POLARIS®
The Way Out.

2003 SPORTSMAN 400 / 500

SERVICE MANUAL

PN 9918065

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The Way Out.

2003 SPORTSMAN 400/500 SERVICE MANUAL

Foreword

This manual is designed primarily for use by Polaris ATV service technicians in a properly equipped shop. Persons using this manual should have a sound knowledge of mechanical theory, tool use, and shop procedures in order to perform the work safely and correctly. The technician should read the text and be familiar with service procedures before starting the work. Certain procedures require the use of special tools. Use only the proper tools, as specified. Cleanliness of parts and tools as well as the work area is of primary importance.

All references to left and right side of the vehicle are from the operator's perspective when seated in a normal riding position.

This manual includes procedures for maintenance operations, component identification and unit repair, along with service specifications for the 2003 Polaris Sportsman ATVs. A table of contents is placed at the beginning of each chapter, and an alphabetic index is provided at the end of the manual for location of specific page numbers and service information. Keep this manual available for reference in the shop area.

At the time of publication all information contained in this manual was technically correct. However, all materials and specifications are subject to change without notice.

Comments or suggestions about this manual may be directed to: Polaris Sales Inc., Service Publications Department, 2100 Hwy 55 Medina, Minnesota 55340.

2003 Sportsman 400/500 ATV Service Manual (**PN 9918065**)

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UNDERSTANDING SAFETY LABELS AND INSTRUCTIONS

Throughout these instructions, important information is brought to your attention by the following symbols:

The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ DANGER

Failure to follow DANGER instructions will result in severe injury or death to the operator, bystander or person inspecting or servicing the ATV.

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the operator, bystander or person inspecting or servicing the ATV.

CAUTION:

A CAUTION indicates special precautions that must be taken to avoid personal injury, or ATV or property damage.

NOTE:

A NOTE provides key information to clarify instructions.

Trademarks

Polaris acknowledges the following products mentioned in this manual:

FLEXLOC, Registered Trademark of SPS Technologies
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CHAPTER INDEX

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CHAPTER 1
GENERAL INFORMATION

1

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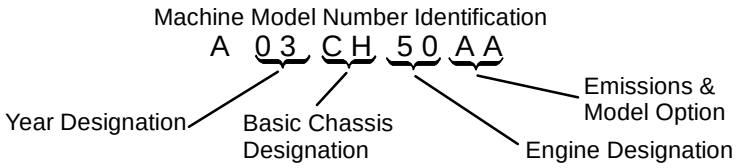
MODEL IDENTIFICATION

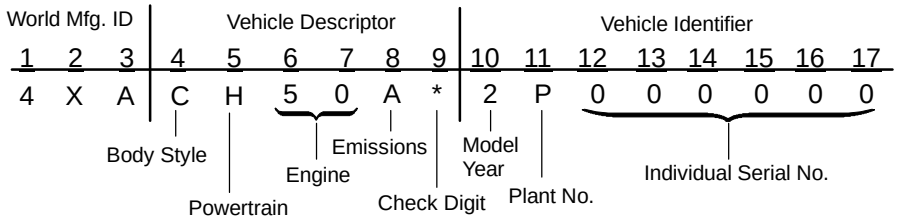
The machine model number must be used with any correspondence regarding warranty or service.



ENGINE DESIGNATION NUMBERS

42 EH42PLE05 . . . . . Single, L/C, SOHC 4 Stroke, Electric Start
50 EH50PLE13 . . . . . Single, L/C, SOHC 4 Stroke, Electric Start

VIN IDENTIFICATION



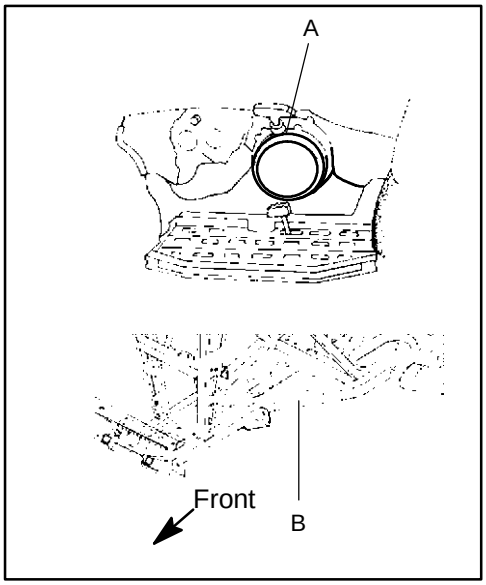
* This could be either a number or a letter

ENGINE SERIAL NUMBER LOCATION

Whenever corresponding about an engine, be sure to refer to the engine model number and serial number. This information can be found on the sticker applied to the recoil housing on the right side of engine.(A) An additional number is stamped on the center top of crankcase beneath the cylinder coolant elbow.

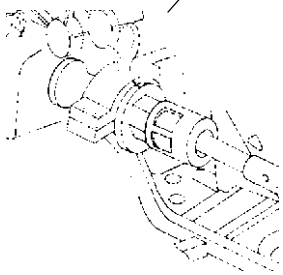
MACHINE MODEL NUMBER AND SERIAL NUMBER LOCATION

The machine model number and serial number are important for vehicle identification. The machine serial number is stamped on the lower left side of the frame tube.(B)



TRANSMISSION I.D. NUMBER LOCATION

The transmission I.D. number is located on top of the transmission snorkel, right side of machine.



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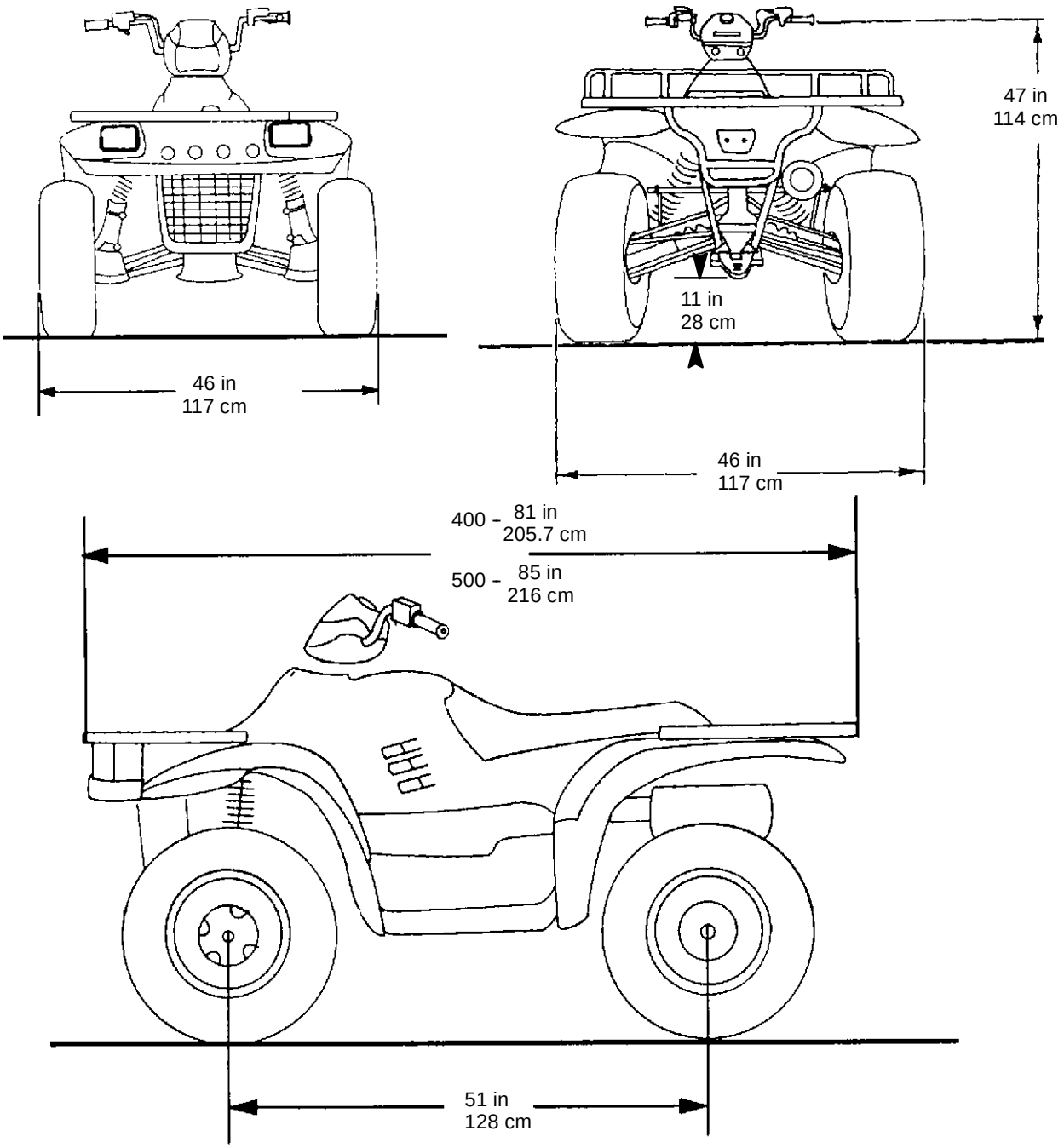
MACHINE DIMENSIONS

SPORTSMAN 400/500



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MODEL: ..... SPORTSMAN 400
MODEL NUMBER: . A03CH42
ENGINE MODEL: .. EH42PLE05

CARBURETION

Type ..... BST 34 Mikuni
Main Jet 167.5
Pilot Jet 40
Jet Needle 4GAC33-3
Needle Jet Q-0 (829)
Throttle Valve ..... #100
Pilot Screw ..... 2 3/4 Turns Out
Pilot Air Jet 160
Valve Seat 1.5
Float Height ..... 13.0mm (.51″)±1mm
Fuel Octane (R+M/2) . 87 Non-Oxygenated or
89 Oxygenated

CLUTCH

Type ..... PVT
Belt 3211069
Belt Width (Projected) ..... 1.188″ (30.18mm)
Side Angle (Overall) ..... 26°
Outside Circumference .... 40.86 ±.12″
Center Distance ..... 10±.12″ (254.5mm)
Clutch Offset ..... 0.5″ (12.7mm)
Secondary Spring ..... Black
Driven Helix ..... 44-36°
Spring Position (Helix) 2
Spring Position (Sheave) .. 2

JETTING CHART

Altitude		AMBIENT TEMPERATURE	
		Below 40°F Below +5°C	+40°F and above +5°C and above
Meters (Feet)	0-1800 (0-6000)	175	167.5
	Above 1800 Above (6000)	165	160

CLUTCH CHART

Altitude		Shift Weight	Clutch Spring	Driven Cluthc Spring	Driven Helix
Meters (Feet)	0-1800 (0-6000)	10BH	Blue/Green	Black	2+2
	1800-3700 (6000-12000)	16	Blue/Green	Black	2+2

ENGINE

Type ..... 4 Cycle, Single Cyl.
Displacement ..... 425 cc
Bore ..... 3.461″ (87.9mm)
Stroke ..... 2.756″ (70mm)
Valve Clearance In/Ex ..... 0.006/0.006″@ TDC on compression
Compression Ratio ..... 9.2/1 Full Stroke
Cooling ..... Liquid
Lubrication Type ..... Dry Sump
Operating RPM±200 ..... 6300 RPM
Idle RPM±200 (lights off) ..... 1200 RPM
Compression Pressure ..... (Std) ±15%

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MODEL: ..... SPORTSMAN 400
MODEL NUMBER: ... A03CH42
ENGINE MODEL: EH42PLE05

ELECTRICAL

Flywheel I.D.	FF95
CDI Marking	CU2557
**Alternator Output	200 Watts / 250 Watts
Ignition Timing	30° BTDC@5000RPM±2°
Spark Plug / Gap	NGK BKR5E / 0.036″ (0.9mm)
Lights: Head	Halogen
High Beam	50watts
Low Beam	27 watts
Tail	8.26 watts
Brake	26.9 watts
Voltage Regulator	LR39
Electric Start	Standard

****Early Build Units Have 200 Watt Altneranto**r

FLUID

	Capacity	Type
Fuel Tank	5.25 gals. (19.9L)	
Injector Oil	N / A	
Coolant	2.25 qts. (2.1L)	PP6*
Transmission	32 oz.	PPS*
Gearcase Oil (Front)	4 oz. (120ml)	80-90 GL5
Gearcase Oil (Center)	N / A	
Gearcase Oil (Rear)	N / A	
Engine Counter Bal.	N / A	
Engine Oil	2 qts. (1.9L)	PP4*
Brake (Hand)		Dot 3
Brake (Foot)		Dot 3
Front Hubs (AWD)	2.5 oz. (75ml)	PDD*
Shift Selector Box	1 oz. (30ml)	PP4*

Lubricant Key
*PP6 Polaris Premium 60/40 Antifreeze/Coolant
*PPS Polaris Premium Synthetic Gear Case Oil
*PP4 Polaris 0W/40 Synthetic Engine Lubricant
*PDD Premium Demand Drive Hub Fluid

SUSPENSION / CHASSIS

Body Style	Gen IV
Front Suspension	MacPherson Strut
Tow Capacity	1225 lbs. (555.6 kg)
Turning Radius	65″ (165.1 cm)
Toe Out	1/8″-1/4″ (3-6.35 mm)
Ground Clearance	11″ (27.94 cm)
Front Vertical Travel	6.7″ (17.02 cm)
Rear Suspension	Progressive Rate Independent
Rear Travel	9.5″ (24.13cm)
Rear Shock	2″ Twin Tube
Shock Adjustment	Cam

TIRES

Tire Size - Front	25 x 8 - 12
Tire Size - Rear	25 x 11 - 12
Tire Size - Center	N / A
Tire Pressure - F/R	5/5 lbs
Total Width	46″ (116.84 cm)
Total Length	81″ (205.74 cm)
Total Height	47″ (119.38 cm)
Wheel Base	50.50″ (128.27 cm)
Weight - Dry	697 lbs. (316.4 kg)

DRIVE TRAIN

Chain Type	Shaft Drive
Gear Reduction-Low	6.69/1
Gear Reduction-Rev	5.17/1
Gear Reduction-High	3.34/1
Front Drive Ratio	2/1
Center Drive Ratio	N / A
Final Drive Ratio	3.16/1
Brake (Hand)	Single Lever, Hyd. Disc
Brake (Auxiliary Foot)	Hydraulic

LOAD CAPACITY

Front Rack (Std)	90 lbs.
Rear Rack (Std)	180 lbs.
Tongue Weight	120 lbs.
Tow Hitch	Std

OPTIONAL SUSPENSION SPRINGS

SPRING TYPE	SOFT	STANDARD	FIRM
Rear Compression Spring	N / A	7041453-067 Standard 100 lb/in.	7041519-067 Option 140 lb/in.
Front Strut Spring	7041238-067 Option 61 lb/in.	7041375-067 Standard 64/113 lb/in.	7041450-067 Option 101 lb/in.

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MODEL: ..... SPORTSMAN 500 H.O.
MODEL NUMBER: . A03CH50
ENGINE MODEL: .. EH50PLE13

CARBURETION

Type . . . . . BST 40 Mikuni
Main Jet 152.5
Pilot Jet 40
Jet Needle 6MGH1–94–3
Needle Jet X-6
Throttle Valve . . . . . #120
Pilot Screw . . . . . 2 Turns Out
Pilot Air Jet 1.3
Valve Seat 1.5
Float Height . . . . . 14.7mm (.58″)±1mm
Fuel Octane (R+M/2) . 87 Non-Oxygenated or 89 Oxygenated

CLUTCH

Type . . . . . PVT
Belt 3211069
Belt Width (Projected) . . . . . 1.188″ (30.18mm)
Side Angle (Overall) . . . . . 26°
Outside Circumference . . . . 40.86 ±.12″
Center Distance . . . . . 10±.12″ (254.5mm)
Clutch Offset . . . . . 0.5″ (12.7mm)
Secondary Spring . . . . . White/Yellow
Driven Helix . . . . . Compound (EBS)
Spring Position (Helix) . . . . N/A
Spring Position (Sheave) . . N/A

JETTING CHART

Altitude		AMBIENT TEMPERATURE	
		Below 40°F Below +5°C	+40°F and above +5°C and above
Meters (Feet)	0-1800 (0-6000)	157.5	152.5
	Above 1800 Above (6000)	150	145

CLUTCH CHART

Altitude		Shift Weight	Clutch Spring	Driven Clutch Spring	Driven Helix*
Meters (Feet)	0-1800 (0-6000)	10WH	Blue/Green	White/Yellow	EBS
	1800-3700 (6000-12000)	16	Blue/Green	White/Yellow	EBS

*EBS require no helix/spring adjustment

ENGINE

Type . . . . . 4 Cycle, Single Cyl.
Displacement . . . . . 499 cc
Bore . . . . . 3.6248″ (92mm)
Stroke . . . . . 2.955″ (75mm)
Valve Clearance In/Ex . . . . . 0.006/0.006″@ TDC on compression
Compression Ratio . . . . . 10/2 Full Stroke
Cooling . . . . . Liquid
Lubrication Type . . . . . Dry Sump
Operating RPM±200 . . . . . 6500 RPM
Idle RPM±200 (lights off) . . . . . 1200 RPM
Compression Pressure . . . . . (Std) ±15%

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MODEL: ..... SPORTSMAN 500 H.O.
MODEL NUMBER: ... A03CH50
ENGINE MODEL: EH50PLE13

ELECTRICAL

Flywheel I.D.	FF97
CDI Marking	CU2574
Alternator Output	250 Watts
Ignition Timing	30° BTDC@5000RPM±2°
Spark Plug / Gap	NGK BKR6E / 0.036″ (0.9mm)
Lights: Head	Halogen
High Beam	50watts
Low Beam	27 watts
Tail	8.26 watts
Brake	26.9 watts
Voltage Regulator	LR39
Electric Start	Standard

FLUID

FLUID	Capacity	Type
Fuel Tank	5.25 gals. (19.9L)	
Injector Oil	N / A	
Coolant	2.25 qts. (2.1L)	PP6*
Transmission	32 oz.	PPS*
Gearcase Oil (Front)	4 oz. (120ml)	80-90 GL5
Gearcase Oil (Center)	N / A	
Gearcase Oil (Rear)	N / A	
Engine Counter Bal.	N / A	
Engine Oil	2 qts. (1.9L)	PP4*
Brake (Hand)		Dot 3
Brake (Foot)		Dot 3
Front Hubs (AWD)	2.5 oz. (75ml)	PDD*
Shift Selector Box	1 oz. (30ml)	PP4*

Lubricant Key
*PP6 Polaris Premium 60/40 Antifreeze/Coolant
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*PDD Premium Demand Drive Hub Fluid

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Body Style	Gen IV
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Ground Clearance	11″ (27.94 cm)
Front Vertical Travel	6.7″ (17.02 cm)
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Rear Travel	9.5″ (24.13 cm)
Rear Shock	2″ Twin Tube
Shock Adjustment	Cam

DRIVE TRAIN

Chain Type	Shaft Drive
Gear Reduction-Low	6.69/1
Gear Reduction-Rev	5.17/1
Gear Reduction-High	3.34/1
Front Drive Ratio	2/1
Center Drive Ratio	N / A
Final Drive Ratio	3.16/1
Brake (Hand)	Single Lever, Hyd. Disc
Brake (Auxiliary Foot)	Hydraulic

TIRES

Tire Size - Front	25 x 8 - 12
Tire Size - Rear	25 x 11 - 12
Tire Size - Center	N / A
Tire Pressure - F/R	5/5 lbs
Total Width	46″ (116.84 cm)
Total Length	85″ (215.9 cm)
Total Height	47″ (119.38 cm)
Wheel Base	50.50″ (128.27 cm)
Weight - Dry	697 lbs. (316.4 kg)

LOAD CAPACITY

Front Rack (Std)	90 lbs.
Rear Rack (Std)	180 lbs.
Tongue Weight	120 lbs.
Tow Hitch	Std

OPTIONAL SUSPENSION SPRINGS

SPRING TYPE	SOFT	STANDARD	FIRM
Rear Compression Spring	N / A	7041453-067 Standard 100 lb/in.	7041519-067 Option 140 lb/in.
Front Strut Spring	7041238-067 Option 61 lb/in.	7041375-067 Standard 64/113 lb/in.	7041450-067 Option 101 lb/in.

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PUBLICATION NUMBERS

Year	Model	Model No.	Owner's Manual PN	Parts Manual PN	Parts Micro Fiche PN
2003	Sportsman 400	A03CH42	**9917492**	**9917537**	**9917538**
2003	Sportsman 500	A03CH50	**9917492**	**9917541**	**9917542**

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

FRAME COLOR - (All) P067 Medium Gloss Black 9440 / 8520147.

Order direct from Midwest Industrial Coatings (952-942-1840). Mix as directed.

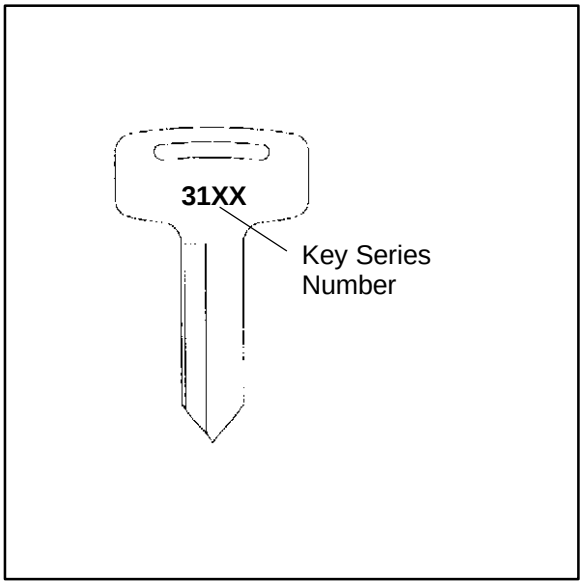
COLD WEATHER KITS FOR 4 CYCLE ATVS

Oil Tank Cover – (**PN 2871874**)

Engine Heater – (**PN 2871507**)

REPLACEMENT KEYS

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



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

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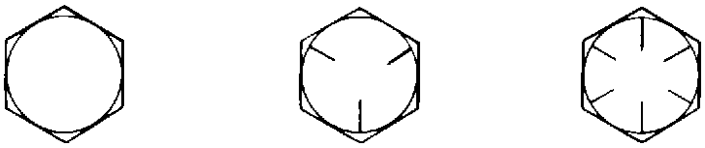
STANDARD TORQUE SPECIFICATIONS

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



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

Metric

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

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

SPECIFIC TORQUE VALUES OF FASTENERS
Refer to exploded views in the appropriate sectionTorque Conversions

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DECIMAL EQUIVALENTS

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

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CONVERSION TABLE

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

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

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SAE TAP DRILL SIZES

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

METRIC TAP DRILL SIZES

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

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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 transmit rotation of the clutch to 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.

Condenser/Capacitor: A storage reservoir for DC voltage.

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.

HP: Horsepower.

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 Side: Always referred to based on normal operating position of the driver.

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GLOSSARY OF TERMS

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. 1mm = 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. Both result in energy conversion to heat.

Right Side: Always referred to based on normal operating position of the driver.

RPM: Revolutions per minute.

Secondary Clutch: Driven clutch on chaincase or jackshaft.

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.

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CHAPTER 2
MAINTENANCE

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PERIODIC MAINTENANCE CHART

Inspection, adjustment and lubrication intervals of important components is listed in the following chart. Maintenance intervals are based upon average riding conditions and a vehicle speed of approximately 10 mph. Inspect, clean, lubricate, adjust or replace parts as necessary. **NOTE:** Inspection may reveal the need for replacement parts. Always use genuine Polaris parts.

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

▶ **Vehicles subjected to severe use (operation in wet or dusty areas, low speed heavy load operation, prolonged idle) should be inspected and serviced more frequently. For engine oil, short trip cold weather riding also constitutes severe use**. Pay special attention to oil level. A rise in oil level in cold weather can indicate moisture collecting in the oil tank (500). Change oil immediately if oil level begins to rise.

E Emission Control System Service (California).

		Frequency (Whichever comes first)			
	Item	**Hours**	**Calendar**	**Miles (Km)**	**Remarks**
E▶	Engine Oil - Level/Change	100 hrs	6 months	1000 (1600)	Check Level Daily; Break In service at 1 month
E	Oil Filter	100 hrs	6 months	1000 (1600)	Replace with oil change
E▶	Air Filter - Foam Pre-Cleaner	Daily	Daily		Inspect-Clean & oil more often in dirty conditions.
E▶	Air Filter - Main Element	Weekly	Weekly		Inspect - Replace if necessary
▶	Air Box Sediment Tube	-	Daily		Drain deposits whenever visible
▶	Engine Breather Filter	20 hrs	Monthly	200 (320)	Inspect and replace if necessary
▶	Oil Tank Vent Hose	100 hrs	12 months	1000 (1600)	Inspect hose routing /hose condition
E■	Valve Clearance	100 hrs	12 months	1000 (1600)	Inspect/Adjust
E	Idle Speed	As required	As required		Adjust
■	Throttle Cable / ETC Switch	50 hrs	6 months	500 (800)	Inspect -Adjust, Lubricate, Replace if necessary
	Choke (Enricher) Cable	50 hrs	6 months	500 (800)	Inspect -Adjust, Lubricate, Replace if necessary
	Carburetor Float Bowl	50 hrs	6 months	500 (800)	Drain bowl periodically and prior to storage
	Carburetor Air Intake Ducts/Flange	50 hrs	6 months	500 (800)	Inspect all ducts for proper sealing/air leaks
E■	Fuel System	100 hrs	12 months	1000 (1600)	Check for leaks at tank cap, lines, fuel valve, filter, pump & carburetor. Replace lines every 2 years.
E■	Fuel Filter	100 hrs	12 months	1000 (1600)	Replace filter annually
	Coolant/Level Inspection	Daily	Daily		Replace engine coolant every 2 years
	Coolant Strength / Pressure Test System	100 hrs	6 months	1000 (1600)	Inspect strength seasonally; Pressure test system annually
	Radiator	100 hrs	12 months	1000 (1600)	Inspect / Clean external surface
	Cooling System Hoses	100 hrs	12 months	1000 (1600)	Inspect
	Engine Mounts	100 hrs	12 months	1000 (1600)	Inspect
	Drain Recoil Housing	Weekly	Weekly		More often if operating in wet environment
	Exhaust Muffler / Pipe	100 hrs	12 months	1000 (1600)	
ELECTRICAL					
E	Spark Plug	100 hrs	12 months	1000 (1600)	Inspect - Replace if necessary
	Wiring	100 hrs	12 months	1000 (1600)	Inspect for abrasion, routing, security
	Ignition Timing	100 hrs	12 months	1000 (1600)	Inspect
	Battery	20 hrs	Monthly	200 (320)	Check terminals; Clean; Check fluid level
	Headlight Aim	As required	As required		Adjust if Necessary

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	Headlamp Inspection	Daily	Daily		Check operation daily; Apply Nyogel™ Grease to connector when lamp is replaced
	Tail Lamp Inspection	Daily	Daily		Check Operation Daily; Apply Nyogel™ Grease to socket when lamp is replaced

CHASSIS					
		Frequency (Whichever comes first)			
	Item	Hours	Calendar	Miles (Km)	Remarks
▶	General Lubrication	50 hrs	3 months	500 (800)	Lubricate All Fittings, Pivots, Cables, Etc.
▶	Front Hubs/Fluid Check	50 hrs	6 months	500 (800)	Check monthly
▶	Front Hubs/Fluid Change	100 hrs	12 months	1000 (1600)	Check monthly
▶	Front Gearcase Lubricant	100 hrs	12 months	1000 (1600)	Inspect Monthly; Change Annually
	Drive Belt	50 hrs	6 months	500 (800)	Inspect - Adjust, Replace if Necessary
	Clutches (Drive And Driven)	100 hrs	12 months	1000 (1600)	Inspect, Clean
▶	Transmission Oil Level	25 hrs	Monthly	250 (400)	Inspect Monthly; Change Annually
	Shift Linkage	50 hrs	6 months	500 (800)	Inspect,Lubricate, Adjust
	Shift Selector Box	200 hrs	24 months	2000 (3200)	Change Lubricant Every Two Years
■	Steering	50 hrs	6 months	500 (800)	Inspect Daily, Lubricate
■	Toe Adjustment	As required	As required		Periodic Inspection, Adjust When Parts are Replaced
▶	Front Suspension	50 hrs	6 months	500 (800)	Inspect - Lubricate
▶	Rear Suspension	50 hrs	6 months	500 (800)	Inspect - Lubricate
	Tires	Pre-ride	Pre-ride		Inspect Daily, Pre-Ride Inspection Item
■	Brake Fluid	200 hrs	24 months	2000 (3200)	Change Every Two Years
▶	Brake Fluid Level	Pre-ride	Pre-ride		Inspect Daily, Pre-Ride Inspection Item
▶	Brake Lever Travel	Pre-ride	Pre-ride		Inspect Daily, Pre-Ride Inspection Item
■	Brake Pad Wear	10 hrs	Monthly	100 (160)	Inspect Periodically
	Auxiliary Brake Adjustment	As required	As required		Inspect Deflection Daily; Adjust
	Brake System	Pre-ride	Pre-ride		Pre-Ride Inspection Item
	Wheels	Pre-ride	Pre-ride		Pre-Ride Inspection Item
	Frame Nuts, Bolts, Fasteners	Pre-ride	Pre-ride		Pre-Ride Inspection Item

PRE-RIDE / DAILY INSPECTION

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

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

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RECOMMENDED LUBRICANTS - QUICK REFERENCE

LUBRICANTS AND MAINTENANCE PRODUCT PART NUMBERS ARE LISTED ON PAGE 2.5

Item	Type	Notes	See Pages
Engine Oil	Polaris Premium 4 Synthetic, 0W–40 (**PN 2871567**)	Add to proper level on dipstick.	2.21–2.22
Transmission	Polaris Synthetic Gear Case Lubricant (**PN 2871478**)	Refer to procedures outlined later in this chapter.	2.9
Front Gear Case	Premium Front Gearcase Fluid (**PN2871653**) or GL5 80-90 Gear Lube	Refer to procedures outlined later in this chapter.	2.9–2.10
Gear Shift Selector Box	Polaris 0W–40 Synthetic Engine Lubricant (**PN 2871281**)	Oil in selector box should be at the center line of the shift selector plungers. Do not overfill or the selector may hydro-lock.	8.4
Coolant Level	Polaris Premium 60/40 Pre-mixed Antifreeze/ Coolant (**PN 2871323**) or a 50/50 mixture high quality antifreeze/coolant and distilled water	Fill reservoir tank to full line. Add if necessary. If reservoir was empty or extremely low, allow engine and cooling system to cool completely and check level in radiator. Fill to top of filler neck.	2.18
Front Hubs	Premium Demand Drive Hub Fluid (**PN 2871654**)	Fill hub at 4:00 or 8:00 position until fluid trickles out. Do not force fluid into hub.	2.27
Brake Fluid	Polaris DOT 3 Brake Fluid (**PN 2870990**)	-Fill to indicated level inside reservoir.	2.28

COLD WEATHER KITS FOR 4 CYCLE ATV'S

Oil Tank Cover – **(PN 2871874)**

Engine Heater – **(PN 2871507)**

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POLARIS LUBRICANTS,MAINTENANCE AND SERVICE PRODUCTS

Part No.	Description
Engine Lubricant	
2870791	Fogging Oil (12 oz. Aerosol)
2871098	Premium 2 Cycle Engine Oil (Quart) (12 Count)
2871281	Engine Oil (Quart) Premium 4 Synthetic 0W-40 (4-Cycle) (12 Count)
2871844	Engine Oil (Gallon) Premium 4 Synthetic 0W-40 (4-Cycle) (4 Count)
2871567	Engine Oil (16 Gallon) Premium 4 Synthetic 0W-40 (4-Cycle)
Gearcase / Transmission Lubricants	
2873603	Premium Synthetic Gearcase Lubricant (1 Gal.) (4 Count)
2873602	Premium Synthetic Gearcase Lubricant (12 oz. bottle) (12 Count)
2871653	Premium Front Gearcase Fluid (8 oz.) (12 Count)
2871653	Premium Front Gearcase Fluid (2.5 Gal) (2 Count)
2870465	Oil Pump for 1 Gallon Jug
2871654	Premium Drive Hub Fluid (8 oz.) (12 Count)
2872277	Premium Drive Hub Fluid (2.5 gal.) (2 Count)
2871653	Angle Drive Fluid (8 oz.)
Grease / Specialized Lubricants	
2871322	Premium All Season Grease (3 oz. cartridge) (24 Count)
2871423	Premium All Season Grease (14 oz. cartridge) (10 Count)
2871460	Starter Drive Grease (12 Count)
2871515	Premium U-Joint Lube (3 oz.) (24 Count)
2871551	Premium U-Joint Lube (14 oz.) (10 Count)
2871312	Grease Gun Kit
2871329	Dielectric Grease (Nyogel™)
Coolant	
2871323	60/40 Coolant (Gallon) (6 Count)
2871534	60/40 Coolant (Quart) (12 Count)
Additives / Sealants / Thread Locking Agents / Misc.	
2870585	Loctite™ Primer N, Aerosol, 25 g
2871956	Loctite™ Thread Sealant 565 (50 ml.) (6 Count)
2871949	Loctite™ Threadlock 242 (50 ml.) (10 Count)
2871950	Loctite™ Threadlock 242 (6 ml.) (12 Count)
2871951	Loctite™ Threadlock 262 (50 ml.) (10 Count)
2871952	Loctite™ Threadlock 262 (6 ml.) (12 Count)
2871953	Loctite™ Threadlock 271 (6 ml.) (12 Count)
2871954	Loctite™ Threadlock 271 (36 ml.) (6 Count)
2870584	Loctite™ 680-Retaining Compound (10 ml.)
2870587	Loctite™ 518 Gasket Eliminator / Flange Sealant (50 ml.) (10 Count)
2872113	Disk Brake Quiet (12 oz.) (12 Count)
2871326	Premium Carbon Clean (12 oz.) (12 Count)
2870652	Fuel Stabilizer (16 oz.) (12 Count)
2871957	Black RTV Silicone Sealer (3 oz. tube) (12 Count)
2871958	Black RTV Silicone Sealer (11 oz. cartridge) (12 Count)
2870990	DOT3 Brake Fluid (12 Count)
2872113	Disc Brake Quiet, Aerosol, (9 oz.) (12 Count)
2871557	Crankcase Sealant, 3-Bond 1215 (5oz.)
2872893	Engine Degreaser (12oz.) (12 Count)

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

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

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SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION	CHAPTER TOOL USED IN
PA-44689	Valve Clutch Adjuster	2
2872105	Water Pump Mechanical Seal Puller	2
8712100 or 8712500	Tachometer	2,10
2200634	Valve Seat Reconditioning Kit	3
2870390	Piston Support Block	3
2871043	Flywheel Puller	3
2871283	Crankshaft/Water Pump Seal Install Kit	3
5131135	Water Pump Install Kit	3
2870569	Crankshaft Truing Stand	5
2872314	Carburetor Float Adjustment Tool	4
2870975	Mity Vac™ Pressure Test Tool	3, 4, 9
2870871	Ball Joint Replacement Tool	5
2870872	Shock Spanner Wrench	2, 5
2870623	Shock Absorber Spring Compression Tool	5
2871572	Strut Rod Wrench	5
2871573	LH Strut Spring Compressor	5
2871574	RH Strut Spring Compressor	5
7052069	Charging Needle	5
2200421	Gas Shock Recharging Kit	5
2871352	Shock Rod Holding Tool	5
2871351	Fox™ Shock IFP Depth Tool	5
2870506	Clutch Puller	6
9314177	Clutch Holding Wrench	6
2871358	Clutch Holding Fixture	6
2870341	Drive Clutch Spider Removal and Install Tool	6
2870654	Clutch Offset Alignment Tool	6
2870913	Driven Clutch Puller	6
2870910	Roller Pin Tool	6
2871226	Clutch Bushing Replacement Tool Kit	6
2870386	Piston Pin Puller	6
2872292	EBS Clutch Alignment Tool	6
2201379	EBS Bushing Replacement Kit	6
8700220	Clutch Compression Tool	6
2871025	Clutch Bushing Replacement Tool Kit	6
2871199	Seal Sleeve Installation Tool Kit	5, 7
2870888	Hilliard Clutch Garter Spring Installation Tool	7
2872608	Roller Pin Removal Tool	7
8700226	CV Boot Clamp Pliers	7
2871701 (Part of **2871702** Kit)	2 1/8 inch Wrench	8
2871697 (Part of **2871702** Kit)	Center Drive Bushing Tool	8
2871695 (Part of **2871702** Kit)	Backlash Setting Tool	8
2871698 (Part of **2871702** Kit)	Rear Output Seal Driver	8
2871699 (Part of **2871702** Kit)	Rear Driveshaft Seal Guide	8
2871282	Bearing Seal Driver (50 mm)	8
PV-43568	Fluke™ 77 Digital Multimeter	10
2870630	Timing Light	10
2870836	Battery Hydrometer	10

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SPECIAL TOOLS, CONT'D

2460761	Hall Sensor Probe Harness	10
2871745	Static Timing Light Harness	10

NOTE: Polaris dealers can order the tools listed above through their Polaris Special Service Tools catalog.

LUBRICATION

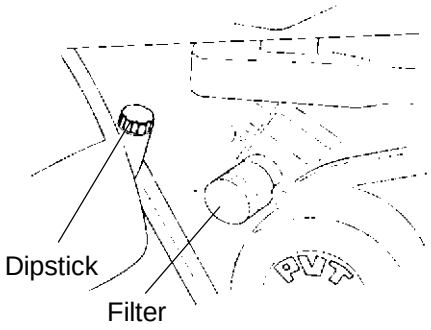
Ill. #	Item	Lube Required	Method	Frequency*
1	**Engine Oil**	Polaris 0W–40 Synthetic (**PN 2871567**)	Add oil to proper level.	Change after 1st month, 6 months or 100 hours thereafter; Change more often (25-50 hours) in extremely dirty conditions, or short trip cold weather operation.
2	**Transmis-sion**	Polaris Synthetic Gear Case Lubricant (**PN 2871478**)	Add lube to FULL level on dipstick.	Change annually [2]
3	**Brake Fluid**	Polaris DOT 3 Brake Fluid (**PN 2870990**)	Fill master cylinder reservoir to indi-cated level inside reservoir.	As required. Change fluid every 2 years.
4	**Front Gear-case Oil**	Premium Front Gear-case Lube (**PN 2871653**)	Add to bottom of fill plug threads.	Change annually [2]

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

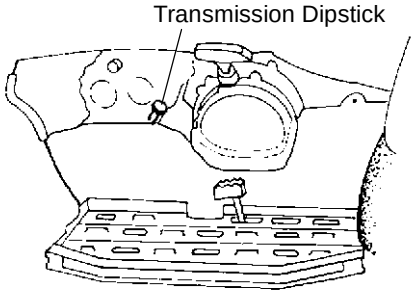
[1] Semi-annually or 50 hours of operation (refer to Maintenance Schedule for additional information)
More often under severe conditions (operating in water or hauling heavy loads)

[2] Annually or 100 hours of operation (refer to Maintenance Schedule for additional information)
More often under severe conditions (operating in water or hauling heavy loads)

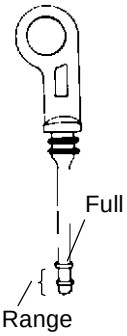
[3] Grease conforming to NLGI No. 2, such as Polaris Premium All Season Grease, Conoco Superlube M or Mobilegrease Special

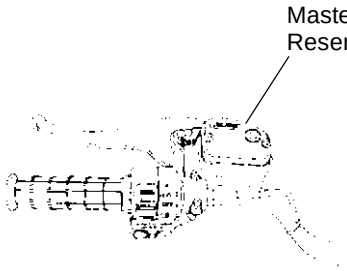


1. Engine Oil and Filter

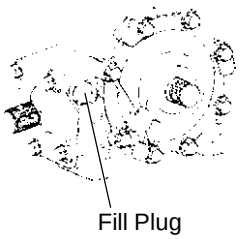


2. Transmission





3. Brake Fluid (Left hand Master Cylinder)



4. Front Gear Case Fill Plug

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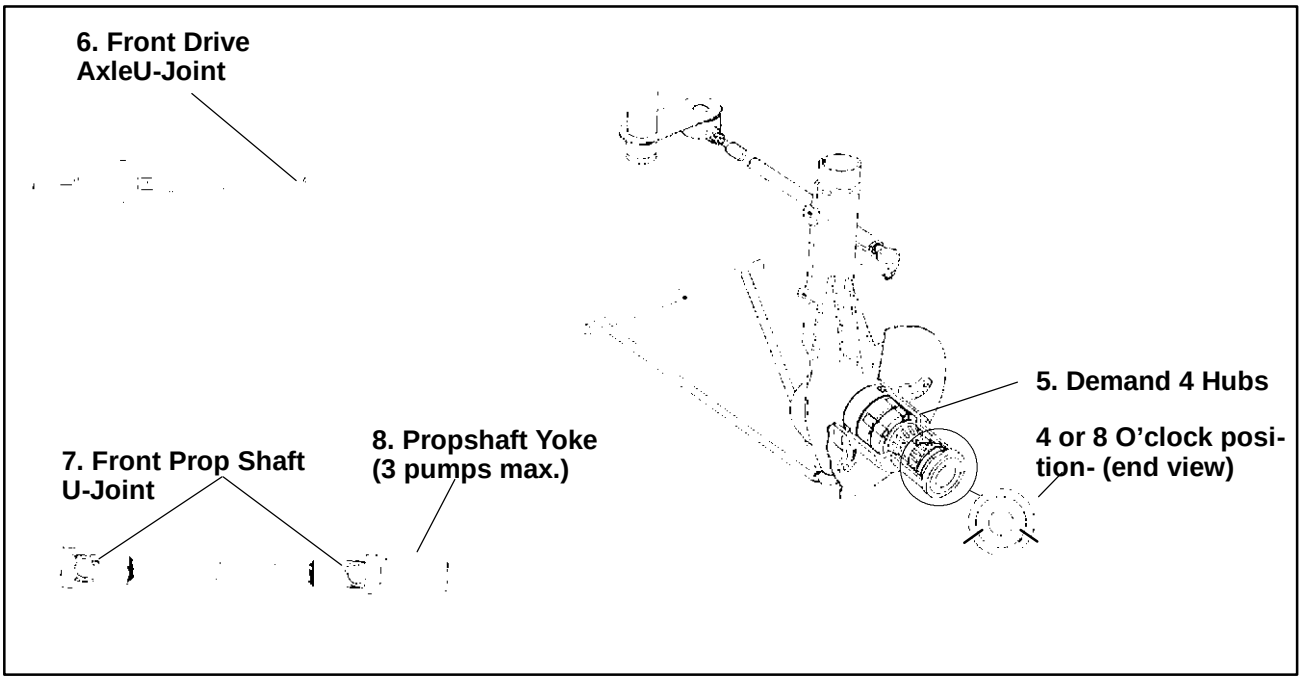
LUBRICATION, CONT.



Ill. #	Item	Lube Required	Method	Frequency*
5	**Demand 4 Hubs - All Wheel Drive**	Polaris Demand Drive Hub Fluid (**PN 2871654**)	Remove filler hole screw in hubs. Rotate wheels to 4 or 8 O'clock position. If lubricant is not visible add until it flows from filler hole. Reinstall screw.	Semi-annually [1]
6	**Front Drive Axle "U" Joints**	Polaris U-Joint Grease [3] (**PN 2871551**)	Locate grease fitting and grease with grease gun.	Semi-annually [1]
7	**U-Joints - Front Prop Shaft**	Premium U-Joint Grease [3] (**PN 2871551**)	Locate Fittings and Grease	Semi-annually [1]
8	**Propshaft Yoke**	Premium U-Joint Grease [3] (**PN 2871551**)	Locate fittings and grease - 3 pumps maximum	Annually [2]

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

[1] Semi-annually or 50 hours of operation (refer to Maintenance Schedule for additional information)
More often under severe conditions (operating in water or hauling heavy loads)

[2] Annually or 100 hours of operation (refer to Maintenance Schedule for additional information)
More often under severe conditions (operating in water or hauling heavy loads)

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

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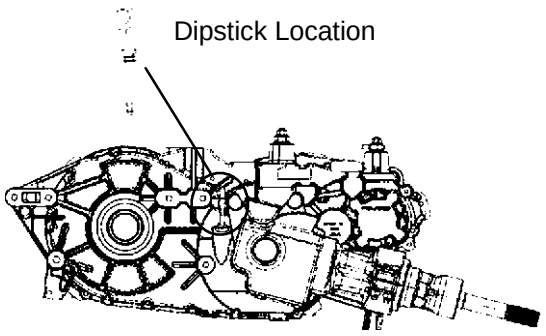
TRANSMISSION LUBRICATION

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

SPORTSMAN 400/500 TRANSMISSION



- Be sure vehicle is level before proceeding.
- Check vent hose to be sure it is routed properly and unobstructed.

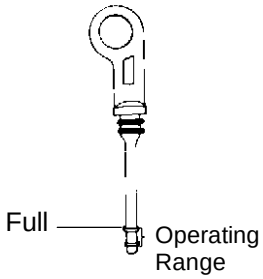
TRANSMISSION SPECIFICATIONS

Specified Lubricant:
Polaris Premium Synthetic Gearcase Lubricant **PN 2871477** (Gallon) **PN 2871478** (12 oz..)

Capacity: . . . . At change: Approx. 20 oz.

Drain Plug:

14 ft. lbs. (19.4 Nm)



To check the level:

1. Remove dipstick and wipe clean.
2. Reinstall dipstick completely, remove and check the level. Add the proper lubricant as required to bring level into operating range as shown.

To change lubricant:

1. Remove skid plate (if necessary).
2. Place a drain pan beneath the transmission oil drain plug area.
3. Remove the drain plug and wipe the magnetic end clean to remove accumulated metallic filings.
4. After the oil has drained completely, install a new sealing washer and install the drain plug. Torque to 14 ft. lbs. (19 Nm).
5. Add the proper lubricant through the dipstick hole until the oil level is between the upper and lower limits. Do not overfill.
6. Check for leaks.
7. Reinstall skid plate if removed in Step 1.

FRONT GEARCASE LUBRICATION

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

- Be sure vehicle is level before proceeding.
- Check vent hose to be sure it is routed properly and unobstructed.
- The correct gearcase lubricant to use is Polaris Premium GL5 80-90 Gear Lube (**PN 2871653**)

FRONT GEARCASE SPECIFICATIONS

Specified Lubricant:
Polaris Front Gearcase Lube **(PN 2871653)** ...Or API GL5 80-90 Gearlube

Capacity: . . . . . 4.0 Oz. (120ml.)

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

To check the level:

1. The front gearcase lubricant level *cannot be checked* with a dipstick or by visual reference. The gearcase must be drained and re-filled with the proper amount of lubricant. Refer to procedure below.

To change lubricant:

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

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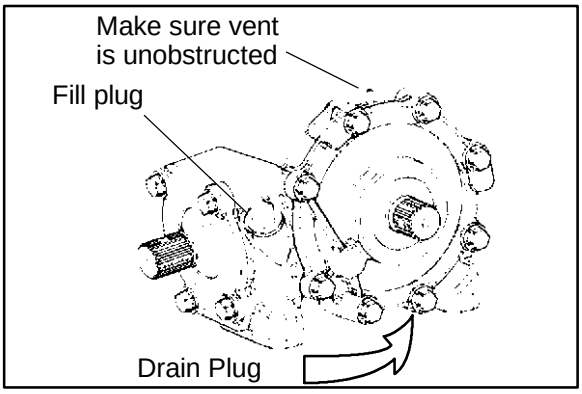
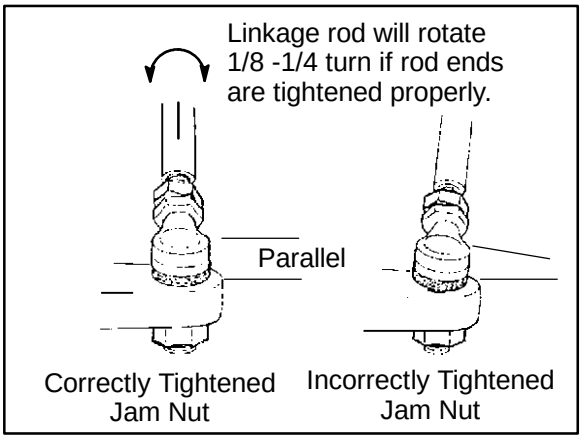
2. Clean and reinstall drain plug using a new sealing washer.
3. Remove fill plug.
4. Add proper amount of lubricant.
5. Install fill plug. Check for leaks.



Drain plug

TRANSMISSION GEARSHIFT LINKAGE ADJUSTMENT, PRELIMINARY INSPECTION



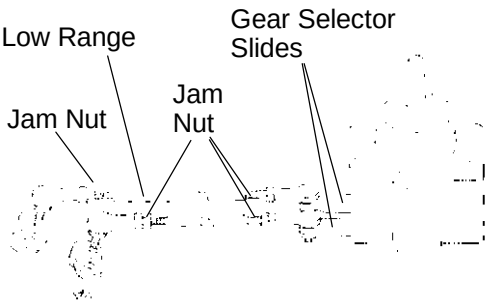
- If shifting problems are encountered, the transmission linkage can be adjusted.
- Tighten shift linkage rod end jam nuts properly after adjustment. You should be able to rotate the linkage rod between 1/8 and 1/4 turn after both jam nuts are tight.
- The transmission shift linkage should be periodically inspected for wear and parts replaced as required to remove excess play from shift linkage.
- Refer to Transmission chapter for more information.

SHIFT LINKAGE ADJUSTMENT

Linkage rod adjustment is necessary when symptoms include:

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

NOTE: When adjusting linkage, always adjust both linkage rods. The adjustment of one rod can prevent proper adjustment of the other rod. Remove necessary components to gain access to shift linkage rod ends (i.e. exhaust heat shield, exhaust pipe, etc.).



NOTE: Rod end orientation, rod ends are both down.

Ill. 1

1. Inspect shift linkage tie rod ends, clevis pins, and pivot bushings and replace if worn or damaged. Lubricate the tie rod ends with a light aerosol lubricant or grease.
2. Loosen all rod end adjuster jam nuts see Ill. 1.
3. Note orientation of tie rod end studs with stud up or down. Remove both rod end studs from transmission bell cranks.
4. Be sure idle speed is adjusted properly.

NOTE: It is important to disconnect *both* rod ends from the transmission bell cranks. If one linkage rod is incorrectly adjusted, it can affect the adjustment of the other rod.

5. Place gear selector in neutral. Make sure the transmission bell cranks are engaged in the

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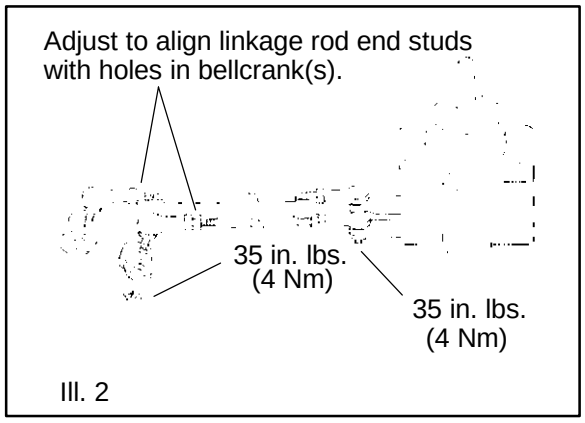
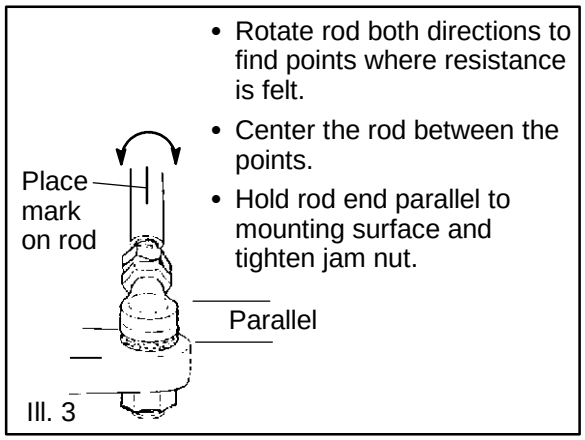
neutral position detents.



Ill. 2

6. Be sure the shift linkage rod ends are firmly attached to the gear selector slides. Adjust the low range (inside) rod so the rod end is centered on the transmission bell crank. Install the lock nut to the rod end and torque to 35 in. lbs. (4 Nm).



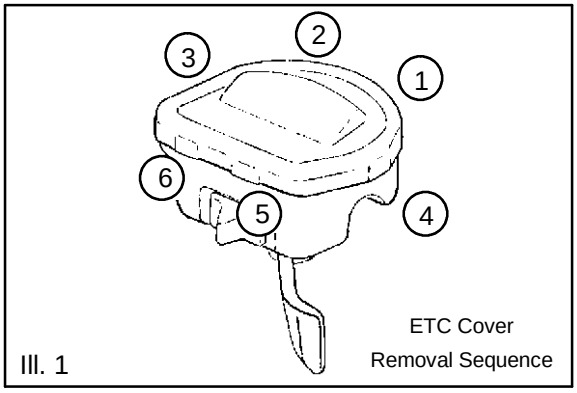
Ill. 3

7. Rotate the linkage rod clockwise until resistance is felt. Mark the rod so revolutions can be easily counted. See Ill. 3 at right.
8. Rotate the linkage rod counterclockwise until the same resistance is felt, counting the revolutions as the rod is turned.
9. Turn the rod clockwise again one half of the revolutions counted in Step 9.
10. Tighten the rod end jam nuts securely while holding the rod end. The jam nuts must be tightened with both front and rear rod ends parallel to each other. If jam nuts are properly tightened, the rod should rotate freely 1/4 turn without binding.
11. Repeat Steps 7-10 for the High/Reverse rod.

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.



Ill. 1

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.

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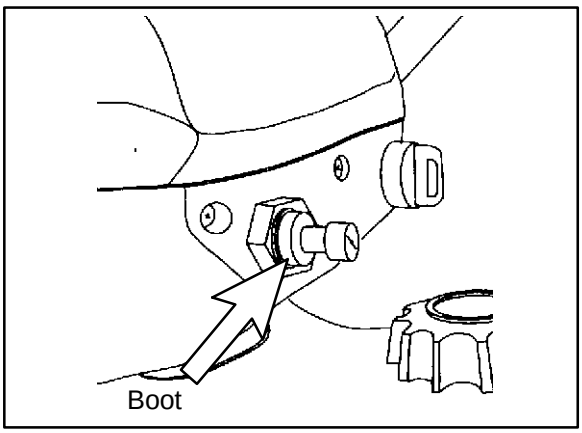
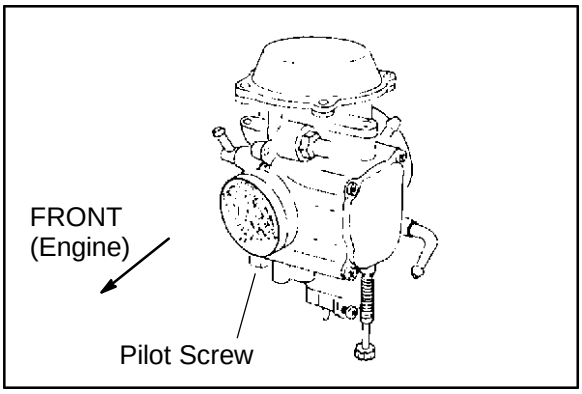
CHOKE (ENRICHER) ADJUSTMENT



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.

PILOT SCREW ADJUSTMENT



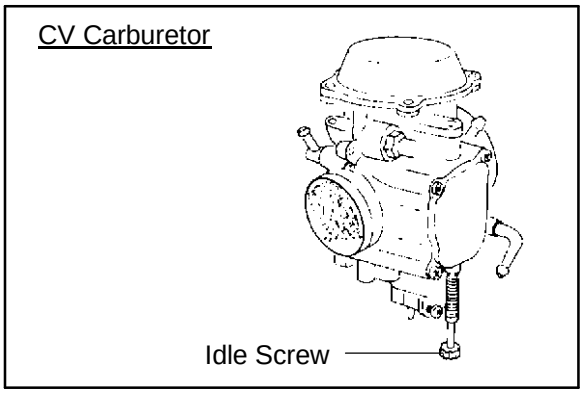
1. Start engine and warm it up to operating temperature (about 10 minutes).
2. Turn pilot screw in (clockwise) until *lightly* seated. Turn screw out the specified number of turns. **NOTE:** Do not tighten the pilot screw forcefully against the seat or the screw and/or seat will be permanently damaged.

Pilot Screw Adjustment:
Sportsman 400 – 2 3/4 Turn Out
Sportsman 500 – 2 Turns Out

3. Connect an accurate tachometer that will read in increments of + or – 50 RPM such as the PET 2100DX (**PN 8712100**DX) or the PET 2500 (**PN 8712500**).
4. Set idle speed to 1200 RPM. Always check throttle cable freeplay after adjusting idle speed and adjust if necessary.
5. Slowly turn mixture screw clockwise using the pilot screw wrench 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. Re adjust idle speed if not within specification.

IDLE SPEED ADJUSTMENT

CV Carburetor



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. (Refer to Ill. at right).

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

Idle Speed:

1200 +/- 200 RPM

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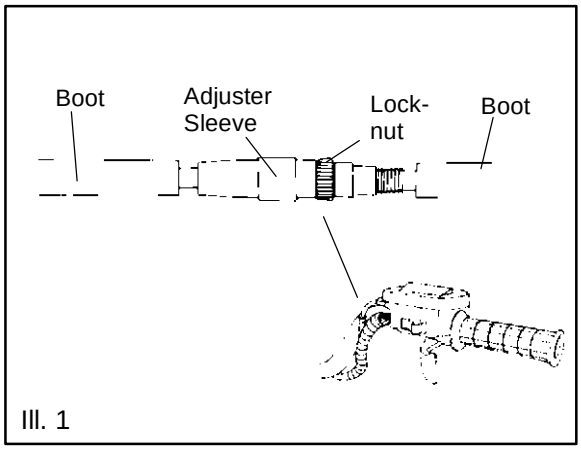
THROTTLE CABLE / ELECTRONIC THROTTLE CONTROL (ETC SWITCH) ADJUSTMENT

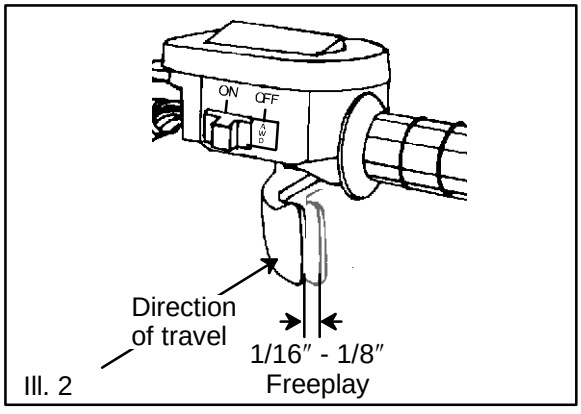
1. Slide boot off throttle cable adjuster and jam nut.
2. Place shift selector in neutral and set parking brake.
3. Start engine and set idle to specified RPM.



Ill. 1

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

4. Loosen lock nut on in-line cable adjuster (Ill. 1).
5. Turn adjuster until 1/16″ to 1/8″ freeplay is achieved at thumb lever. (Ill. 2). After making adjustments, quickly actuate the thumb lever several times and reverify freeplay.



Ill. 2

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.

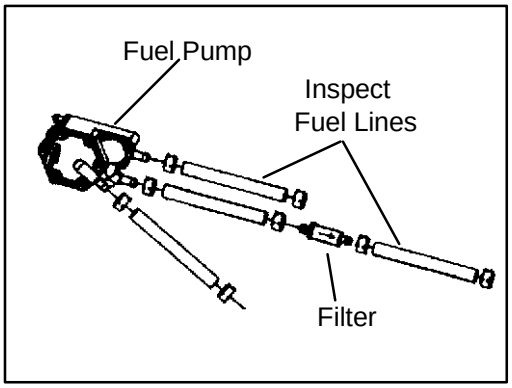
FUEL SYSTEM

⚠ WARNING

Gasoline is extremely flammable and explosive under certain conditions.

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

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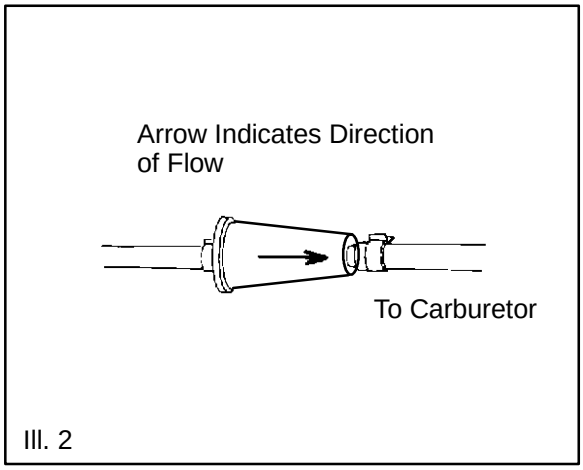
VENT LINES

Check fuel tank, oil tank, carburetor, battery and transmission 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 FILTER

The fuel filter should be replaced in accordance with the Periodic Maintenance Chart or whenever sediment is visible in the filter.



Ill. 2

1. Shut off fuel supply at fuel valve.
2. Remove line clamps at both ends of the filter.
3. Remove fuel lines from filter.
4. Install new filter and clamps onto fuel lines with arrow pointed in direction of fuel flow.
5. Install clamps on fuel line.
6. Turn fuel valve “ON”.
7. Start engine and inspect for leaks.

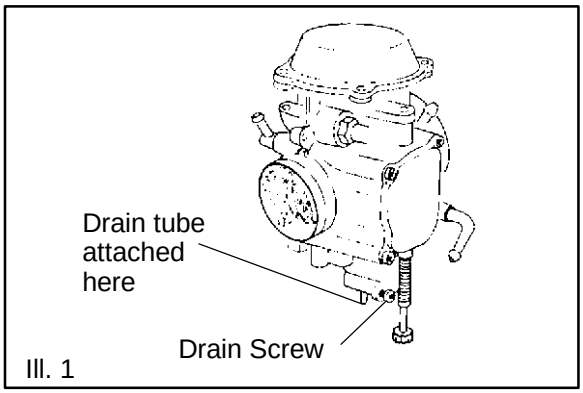
CARBURETOR DRAINING

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

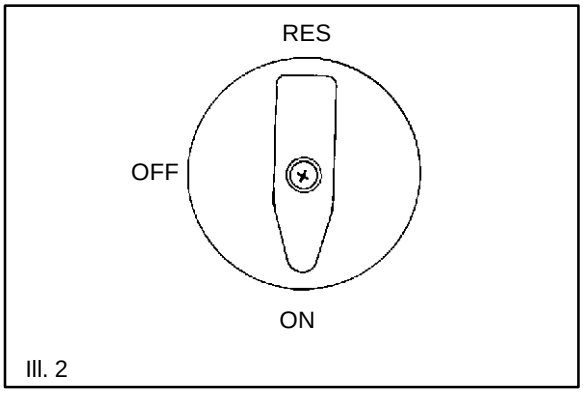
NOTE: The bowl drain screw is located on the bottom left side of the float bowl.

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 check for pinching or blockage, as this will effect engine performance.



Ill. 1



Ill. 2

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COMPRESSION TEST

NOTE: 4-Stroke engines are equipped with an automatic decompressor. Compression readings will vary in proportion to cranking speed during the test. Average compression (measured) is about **50-90 psi** during a compression test.

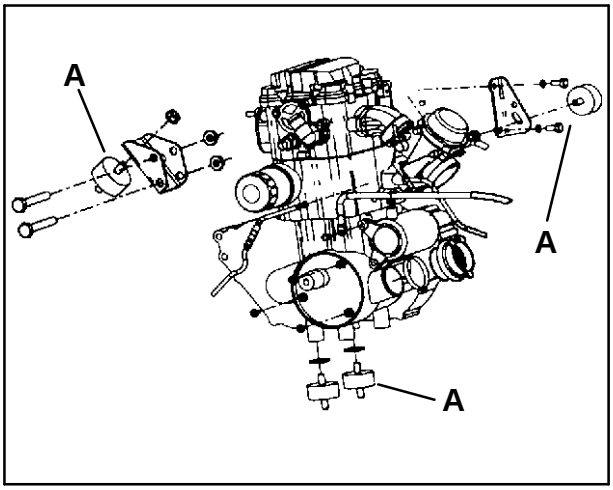
Smooth idle generally indicates good compression. Low engine compression is rarely a factor in running condition problems above idle speed. Abnormally high compression can be caused by a decompressor malfunction, or worn or damaged exhaust cam lobes. Inspect camshaft and automatic decompression mechanism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

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

Cylinder Compression	
Standard	**50-90 PSI**
Cylinder Leakage	
Service Limit	**10 %**
(Inspect for cause if leakage exceeds 10%)	

ENGINE MOUNTS

Inspect rubber engine mounts (A) for cracks or damage. Check engine fasteners and ensure they are tight.



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.

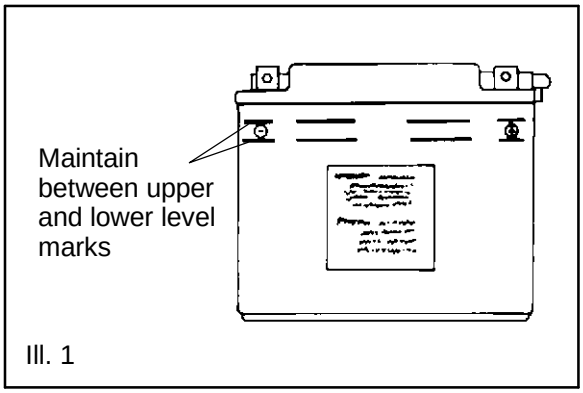
Eyes: Flush with water for 15 minutes and get prompt medical attention.

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.

NOTE: New Batteries: Batteries must be fully charged before use or battery life will be reduced by 10-30% of full potential. Charge battery for 3-5 hours at a current equivalent of 1/10 of the battery's rated amp/hour capacity. Do not use the alternator to charge a new battery. (Refer to Battery Activation and Maintenance video **PN 9917987**)

The battery is located under the left rear fender.

Inspect the battery fluid level. When the electrolyte nears the lower level, remove the battery and **add distilled water only** to the upper level line. (Ill.1)



Ill. 1

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To remove the battery:

1. Disconnect holder strap and remove cover.
2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

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.

3. Disconnect the vent hose.
4. Remove the battery.
5. Remove the filler caps and add *distilled water only* as needed to bring each cell to the proper level. Do not overfill the battery. Fully recharge after filling.

Use only distilled water. Tap water contains minerals which are harmful to a battery.

Do not allow cleaning solution or tap water to enter the battery, as it will shorten the life of the battery.

6. Reinstall the battery caps.
7. 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.
8. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable.
9. Reattach vent hose making sure it is properly routed and not kinked or pinched.
10. Coat terminals and bolt threads with Nyogel™ grease.
11. Reinstall battery cover and holder strap.

SPARK PLUG

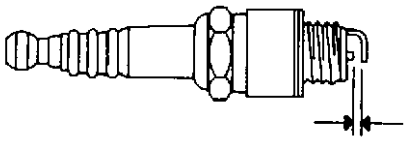
1. Remove spark plug high tension lead. Clean plug area so no dirt and debris can fall into engine when plug is removed.
2. Remove spark plug.
3. Inspect electrodes for wear and carbon buildup. Look for a sharp outer edge with no rounding or erosion of the electrodes.
4. Clean with electrical contact cleaner or a glass bead spark plug cleaner only. **CAUTION:** A wire brush or coated abrasive should not be used.
5. Measure gap with a wire gauge. Refer to specifications for proper spark plug type and gap. Adjust gap if necessary by bending the side electrode carefully. (Ill. 1)
6. If necessary, replace spark plug with proper type. **CAUTION:** Severe engine damage may occur if the incorrect spark plug is used.
7. Apply a small amount of anti-seize compound to the spark plug threads.
8. Install spark plug and torque to specification.

Recommended Spark Plug:

Refer to Specifications

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

Spark Plug Gap



.036″ (0.9 mm)

IGNITION TIMING

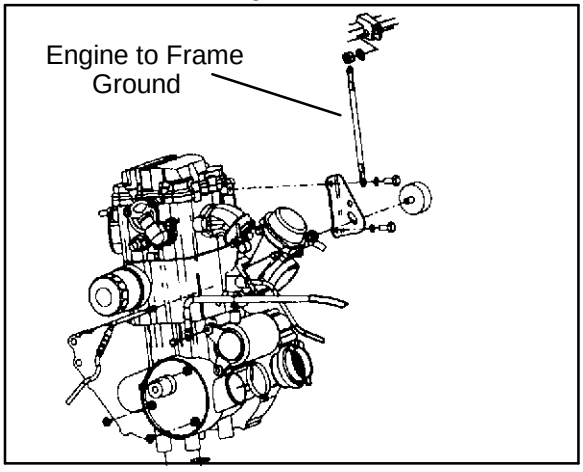
Refer to Chapter 10 for ignition timing procedures.

Ignition Timing 500 Engines:

30°±2° BTDC@5000RPM

Engine-To-Frame Ground

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



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LIQUID COOLING SYSTEM OVERVIEW

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

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

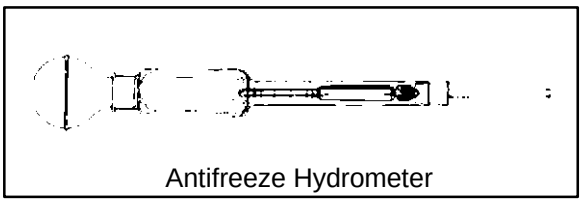
Some coolant level drop on new machines is normal as the system is purging itself of trapped air. Observe coolant levels often during the break-in period.

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

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

COOLANT STRENGTH / TYPE

Test the strength of the coolant using an antifreeze hydrometer.



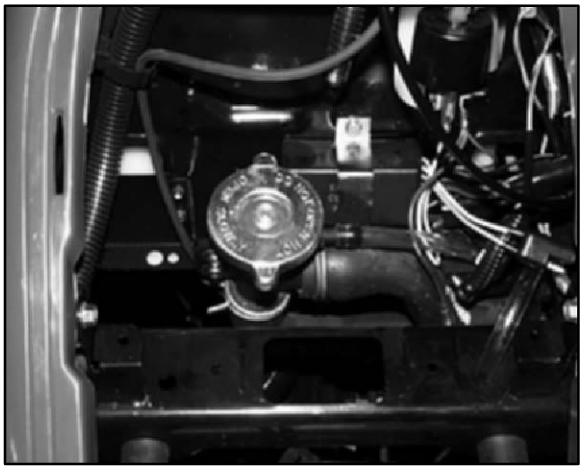
Antifreeze Hydrometer

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

Polaris 60/40 Anti-Freeze / Coolant

(PN 2871323)

COOLING SYSTEM HOSES

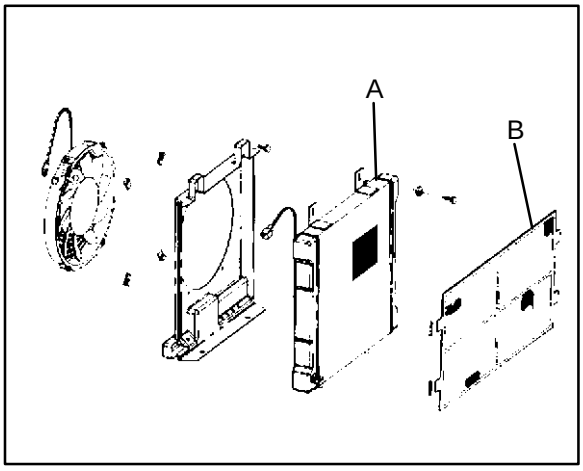


1. Inspect all hoses for cracks, deterioration, abrasion or leaks. Replace if necessary.
2. Check tightness of all hose clamps.

CAUTION:

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

RADIATOR



1. Check radiator (A) air passages for restrictions or damage. Check and clean the radiator screen (B).
2. Carefully straighten any bent radiator fins.
3. Remove any obstructions with compressed air or low pressure water.

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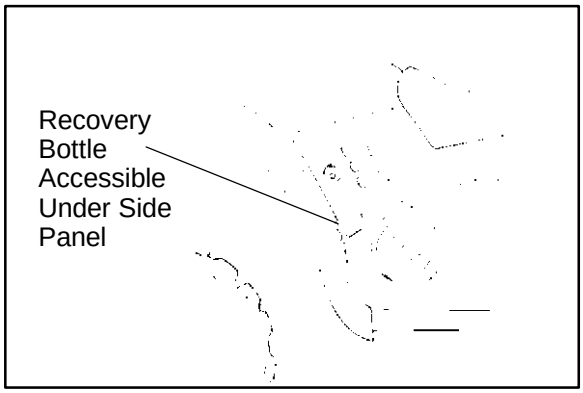
COOLING SYSTEM PRESSURE TEST

Refer to Page 3.5 for pressure test procedure.

COOLANT LEVEL INSPECTION

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



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

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

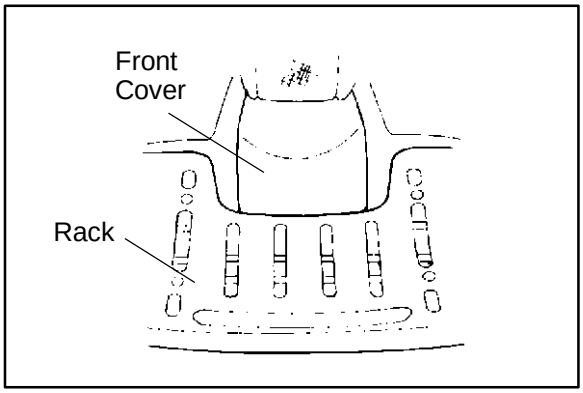
NOTE: If overheating is evident, allow system to cool completely and check coolant level in the radiator and inspect for signs of trapped air in system.

RADIATOR COOLANT LEVEL INSPECTION

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

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

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



To access the radiator pressure cap:

Remove the four screws securing front rack. Turn handle bars full left or right to provide more clearance. Remove front cover by placing your fingers under the front of the cover and pulling upward.

AIR FILTER/PRE-FILTER SERVICE

It is recommended that the air filter and pre filter be replaced annually. 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. Lift up on the rear of the seat.

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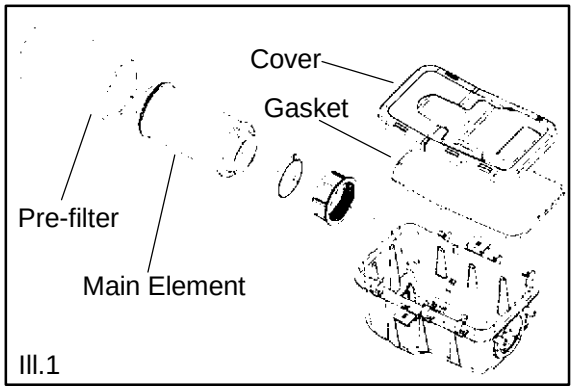
2. Pull the seat back and free of the tabs. **NOTE:** When reinstalling seat, make sure the slots in the seat engage the tabs in the fuel tank.
3. Remove clips (6) from air box cover and remove cover. Inspect the gasket. It should adhere tightly to the cover and seal all the way around.
4. Loosen clamp and remove air filter assembly.



Ill.1

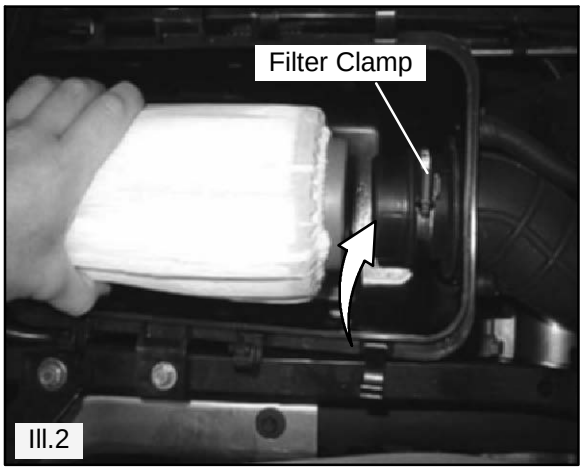
Cleaning:

5. Slip the pre-filter element off of main element. Clean the pre filter with high flash point solvent, followed by hot soapy water.
6. Rinse and dry thoroughly.
7. Inspect element for tears or damage.
8. Apply foam filter oil or clean engine oil and squeeze until excess oil is removed.
9. Inspect main filter and replace if necessary. If the filter has been soaked with fuel or oil it must be replaced.

Installation:

10. Reinstall pre-filter element over main filter. Be sure the element covers entire surface of main filter without folds, creases, or gaps.
11. Reinstall filter on main filter mount. Place filter clamp over the assembly and tighten.

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



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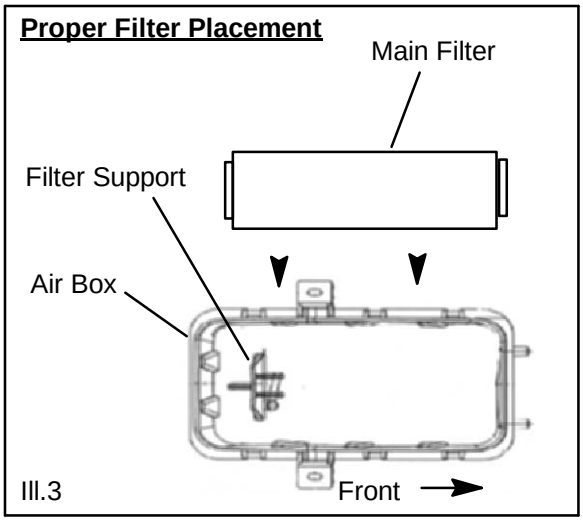

Ill.3

NOTE: The air filter should rest on the filter support. Proper placement of the air filter is important to prevent rattles and air leaks. See Illustration above.

12. Install air box cover and secure with clips.

AIR BOX SEDIMENT TUBE

Periodically check the air box drain tube located toward the rear of the machine. Drain whenever deposits are visible in the clear tube.

1. Remove drain plug from end of sediment tube.
2. Drain tube.

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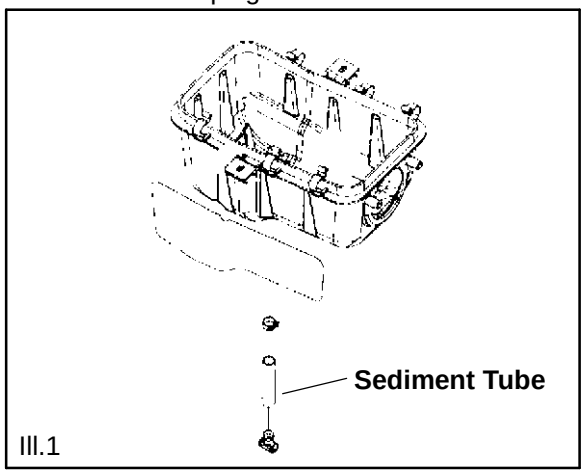
3. Reinstall drain plug.



Ill.1

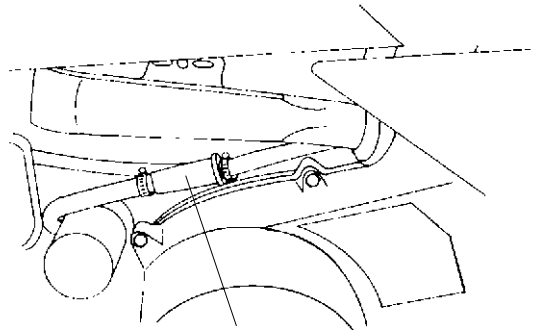
NOTE: The sediment tube will require more frequent service if the vehicle is operated in wet conditions or at high throttle openings for extended periods.

BREATHER FILTER INSPECTION

Four cycle ATV engines are equipped with a breather filter. The in-line filter is similar in appearance to a fuel filter, and is visible on the left side (Location A).

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

Typical Breather Filter Location



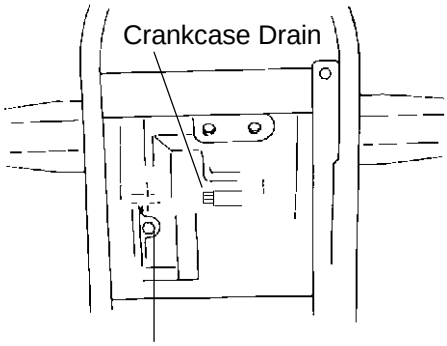
In-Line Breather Filter Location A

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

BREATHER HOSE

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

RECOIL HOUSING



- Drain the housing periodically to remove moisture.
- Drain the recoil housing after operating the ATV in very wet conditions. This should also be done before storing the ATV. The drain screw is located at the bottom of the recoil housing. Remove the screw with a 10 mm wrench. Reinstall screw once housing has been drained.
- **CAUTION:** Make sure the manual start handle is fully seated on the recoil housing, especially when travelling in wet areas. If it is not sealed properly, water may enter the recoil housing and damage components.
- Water will enter the recoil housing if the starter handle is disengaged from the rope guide when under water.
- After travelling in wet areas the recoil housing and starter should always be drained completely by removing the recoil.
- Do not open the crankcase drain unless the engine has ingested water. Some engine oil will be lost if crankcase drain is opened.
- If recoil handle seal has been damaged, the handle shopuld be replaced.

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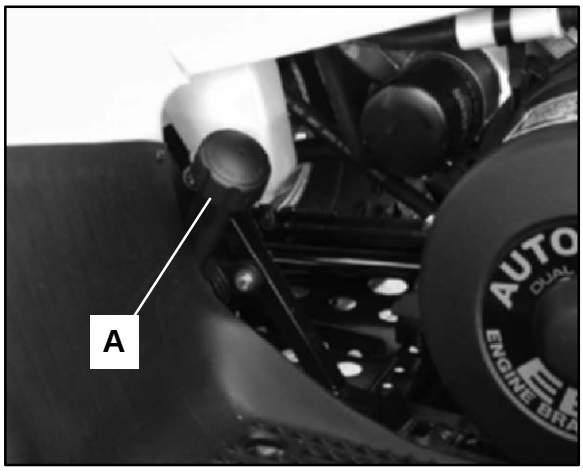
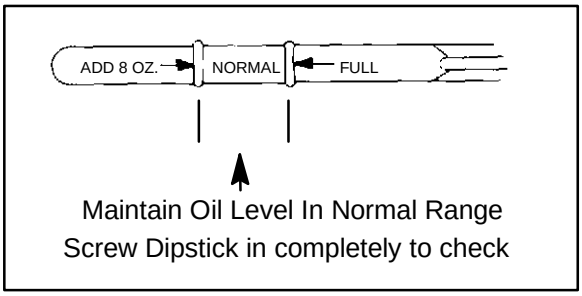
ENGINE OIL LEVEL



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

1. Set machine on a level surface.
2. Start and run engine for 20-30 seconds. This will return oil to its true level in the oil tank.
3. Stop engine, remove dipstick (A) and wipe dry with a clean cloth.
4. Reinstall dipstick, screw the dipstick into place.

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



5. Remove dipstick and check to see that the oil level is in the normal range. The oil should be between the top line and the bottom line on the dipstick. Add oil as indicated by the level on the dipstick. Do not overfill.

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

OIL AND FILTER CHANGE

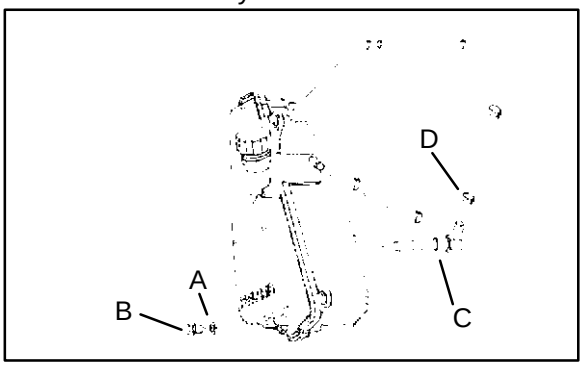
⚠ WARNING

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

NOTICE:

Care must be taken to ensure that fluids are contained. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembly any component containing fluids.

1. Place vehicle on a level surface.
2. Run engine two to three minutes until warm. Stop engine.
3. Clean area around drain plug (B) at bottom of oil tank.
4. Place a drain pan beneath oil tank and remove drain plug. **CAUTION:** Oil may be hot. Do not allow hot oil to come into contact with skin as serious burns may result.



5. Allow oil to drain completely.
6. Replace sealing washer (A) on drain plug. **NOTE:** The sealing surfaces on drain plug and oil tank should be clean and free of burrs, nicks or scratches.
7. Reinstall drain plug and torque to 14 ft. lbs. (19 Nm).
8. Loosen clamp (D).
9. Remove oil hose from screen fitting (C) on bottom of oil tank.
10. Remove screen fitting (C) and clean the screen.
11. Apply Loctite™ Thread Sealant 565 (**PN 2871956**) or an equivalent pipe thread sealant or PTFE sealant tape to clean, oil free threads of fitting.

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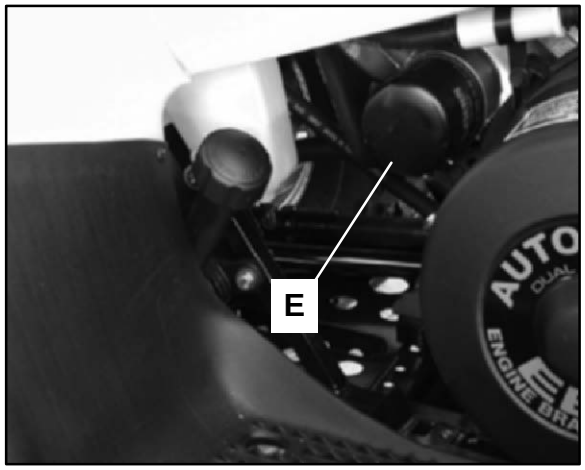
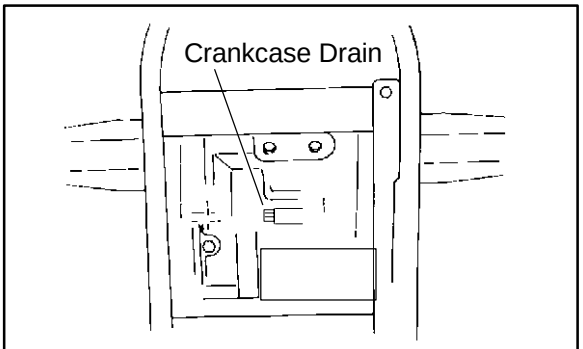
12. Install fitting and torque to 14-17 ft.lbs. (19–23 Nm).
13. Install oil hose on fitting and tighten clamp to 25 in. lbs. (3 Nm).



14. Place shop towels beneath oil filter (E) . Use Oil Filter Wrench (**PV-43527**), turn filter counterclockwise to remove.
15. Using a clean dry cloth, clean filter sealing surface on crankcase.
16. Lubricate O-ring on new filter with a film of engine oil. Check to make sure the O-ring is in good condition.
17. Install new filter and turn by hand until filter gasket contacts the sealing surface, then turn and additional 1/2 turn.



Engine Sump Drain Plug - Bottom View

18. Approximately 1 cup of engine oil will remain in the crankcase. To drain, remove drain plug found on lower right side of crankcase.

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

19. Reinstall drain plug.
20. Remove dipstick and fill tank with 2 quarts (1.9 L) of Polaris Premium 4 Synthetic Oil (**PN 2871844**).
21. Place gear selector in neutral and set parking brake.

NOTE: Clamp or pinch off the vent line 2" from the oil tankas shown below in the Oil Pump Priming Procedure for the 500 engine.

22. Re-check the oil level on the dipstick and add oil as necessary to bring the level to the upper mark on the dipstick.
23. Dispose of used filter and oil properly.

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

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

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

Oil Filter Wrench:
(PV-43527)

Oil Tank Screen Fitting Torque:
14-17 ft. lbs. (19 Nm -23 Nm)

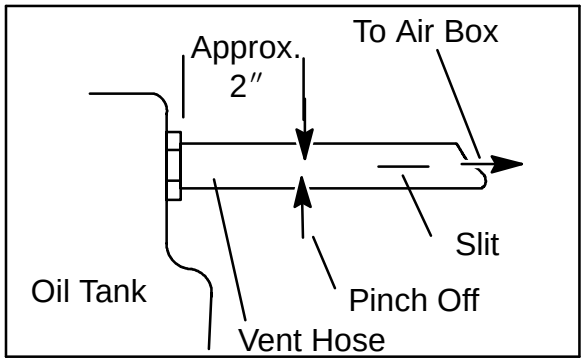
Recommended Engine Oil:

Polaris Premium 4 All Season Synthetic, 0W-40, (PN 2871281)

Ambient Temperature Range:
-40° F to 120° F

OIL PUMP PRIMING PROCEDURE (500)

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



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1. Clamp or pinch off vent line approximately 2″ from oil tank to avoid the end of oil tank vent fitting, and the vent line's pressure relief slit
2. Run engine for 45-60 seconds.
3. Remove the vent line clamp. The oil pump will now be properly primed and ready for field operation.

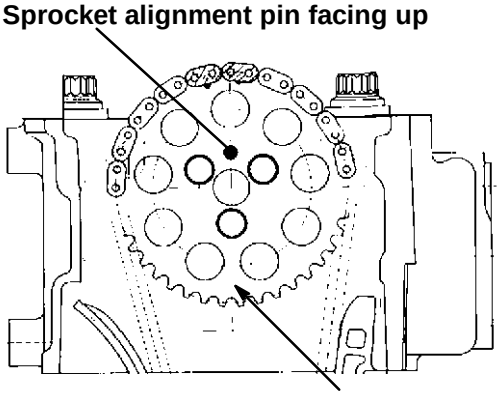
VALVE CLEARANCE

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

1. Remove the seat.
2. Remove body panels and fuel tank as necessary to gain access to valve cover.
3. Remove the spark plug high tension lead and remove the spark plug. **CAUTION:** Place a clean shop towel into the spark plug cavity to prevent dirt from entering.
4. Remove rocker cover bolts, cover and gasket.

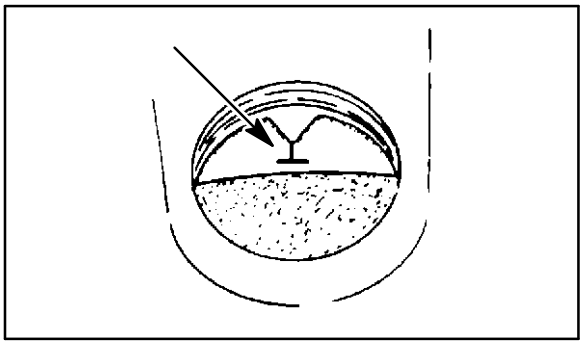
   NOTE: It may be necessary to tap cover lightly with a soft-faced hammer to loosen it from the cylinder head.
5. Remove timing inspection plug from recoil housing.

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



6. Rotate engine slowly with recoil rope, watching the intake valve(s) open and close.

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



7. Verify accurate TDC positioning by observing the "T" mark aligned with the pointer in the timing inspection hole. In this position there should be clearance on all valves.

INTAKE VALVE CLEARANCE ADJUSTMENT

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

INTAKE VALVE CLEARANCE
.006″ (.15 mm)

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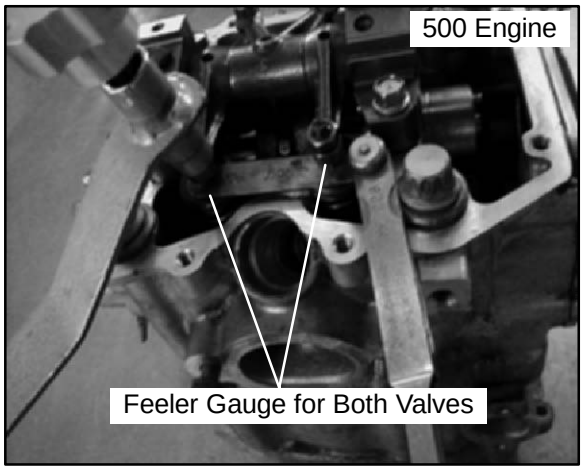
EXHAUST VALVE CLEARANCE ADJUSTMENT



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

1. Insert .006 feeler gauge(s) between end of exhaust valve stem and adjuster screw(s).
2. Loosen locknut(s) and turn adjuster screw(s) until there is a slight drag on feeler gauge(s). The Valve/Clutch Adjuster Tool **(PA-44689)** can be used to adjust the 500 engines valves. **NOTE:** Both feeler gauges should remain inserted during adjustment of each valve.

EXHAUST VALVE CLEARANCE
.006″ (.15 mm)

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

STEERING

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

Replace any worn or damaged steering components. Steering should move freely through entire range of travel without binding. Check routing of all cables, hoses, and wiring to be sure the steering mechanism is not restricted or limited. **NOTE:** Whenever steering components are replaced, check front end alignment. Use only genuine Polaris parts.

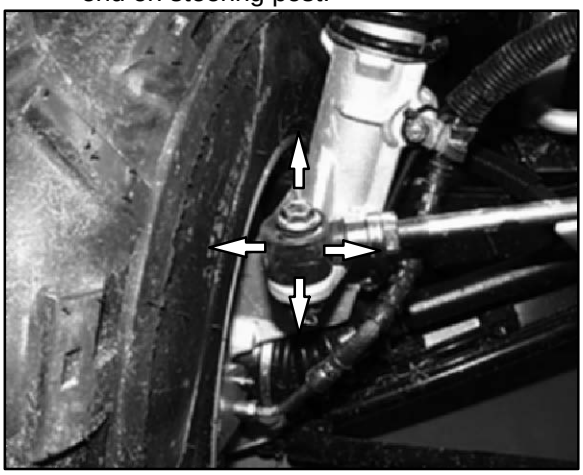
⚠ WARNING

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

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

TIE ROD END / STEERING INSPECTION

- To check for play in the tie rod end, grasp the steering tie rod, pull in all directions feeling for movement.
- Repeat inspection for inner tie rod end on steering post.



- Replace any worn steering components. Steering should move freely through entire range of travel without binding.
- Elevate front end of machine so front wheels are off the ground. Check for any looseness in front hub / wheel assembly by grasping the tire firmly at top and bottom first, and then at front and rear. Try to move the wheel and hub by pushing inward and pulling outward.

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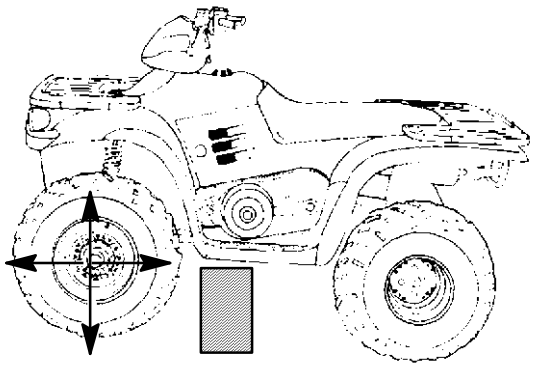
TIE ROD END/STEERING INSPECTION CONT'D

- 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/Steering Chapter 5 or Final Drive Chapter 7 for service procedures.

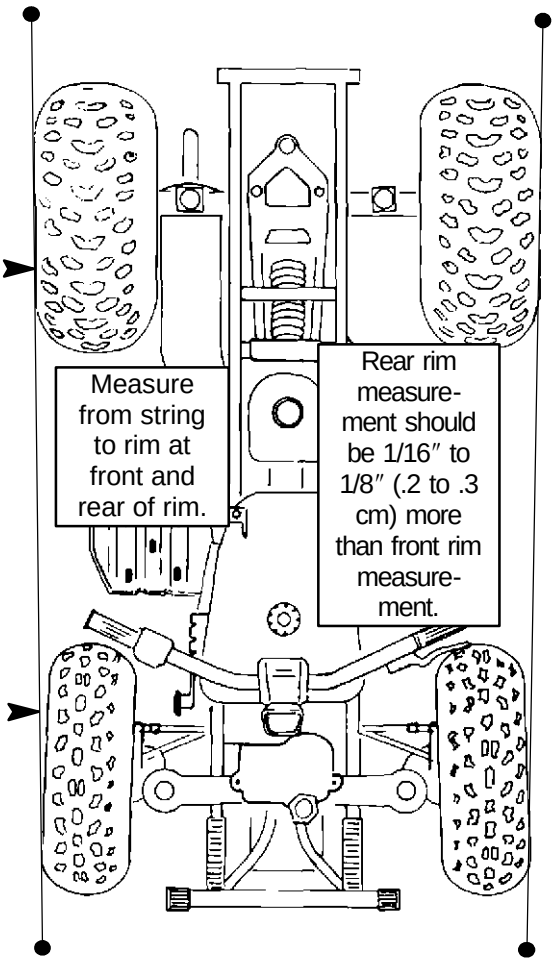
CAMBER AND CASTER

The camber and caster are non-adjustable.

WHEEL ALIGNMENT METHOD 1: STRAIGHTEDGE OR STRING

Be sure to keep handlebars centered. See notes below.

NOTE: String should just touch side surface of rear tire on each side of machine.



NOTE: The steering post arm "frog" can be used as an indicator of whether the handlebars are straight. The frog should always point straight back from the steering post.

WHEEL ALIGNMENT METHOD 2: CHALK

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 arm "frog" can be used as an indicator of whether the handlebars are straight. The frog

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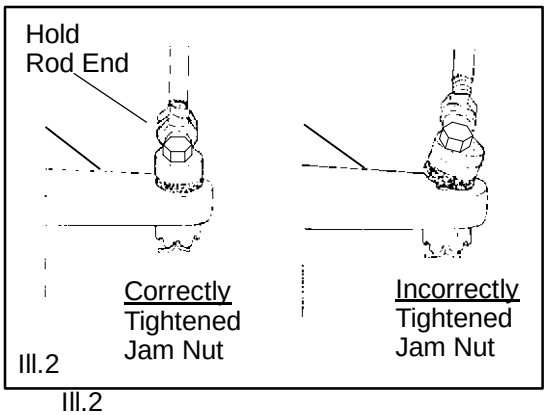
should always point straight back from the steering post.

3. Place a chalk mark on the center line of the front tires approximately 10″ (25.4 cm) from the floor or as close to the hub/axle center line as possible. **NOTE:** It is important that the height of both marks be equally positioned in order to get an accurate measurement.
4. Measure the distance between the marks and record the measurement. Call this measurement "A".
5. Rotate the tires 180° by moving vehicle forward or backward. Position chalk marks facing rearward, even with the hub/axle centerline.
6. Again measure the distance between the marks and record. Call this measurement "B". Subtract measurement "B" from measurement "A". The difference between measurements "A" and "B" is the vehicle toe alignment. The recommended vehicle toe tolerance is 1/8″ to 1/4″ (.3 to .6 cm) toe out. This means the measurement at the front of the tire (A) is 1/8″ to 1/4″ (.3 to .6 cm) wider than the measurement at the rear (B)

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.

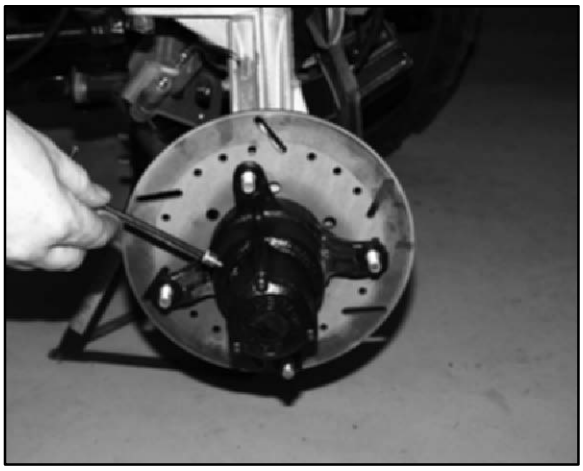


Ill.2

To adjust toe alignment:

- Hold tie rod end to keep it from rotating.
- Loosen jam nuts at both end of the tie rod.
- Shorten or lengthen the tie rod until alignment is as required to achieve the proper toe setting as specified in 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. See illustration 2.
- After alignment is complete, torque jam nuts to 12-14 ft. lbs. (16-19 Nm).

FRONT HUB FLUID LEVEL INSPECTION



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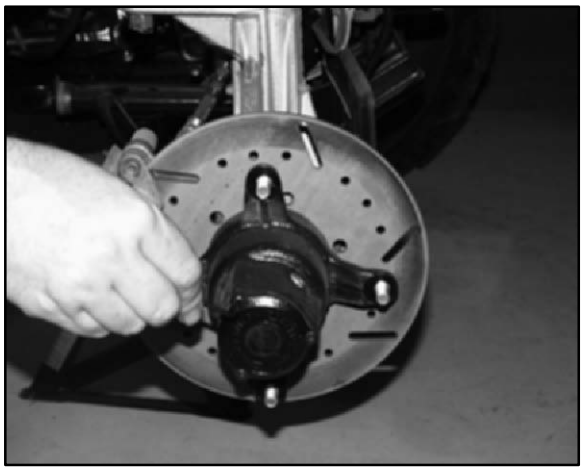
To check front hub fluid: (See next page)

1. Place vehicle on a level surface.
2. Turn wheel until front hub fill/check plug is in either the 4 o'clock or 8 o'clock position.
3. Remove fill/check plug.
4. Add Polaris Demand Drive Hub Fluid if necessary until fluid trickles out. **NOTE:** Do not force the fluid into the hub under pressure or seal damage may occur.
5. Reinstall plug.
6. Repeat procedure for other hub.

FRONT HUB FLUID CHANGE



1. Place a drain pan beneath the hub.
2. Remove check/fill plug.
3. Turn the hub to the 6 o'clock position and drain the fluid
   into the drain pan.
4. Turn wheel until front hub fill/check plug is in either the 4 or 8 o'clock position.
5. Add Polaris Demand Drive Hub Fluid (**PN 2871654**) until fluid trickles out. **NOTE:** Do not force the fluid into the hub under pressure or seal damage may occur.

Polaris Demand Drive Hub Fluid:
(PN 2871654) - 8 oz.
(PN 2872277) - 2.5 gallon

EXHAUST PIPE

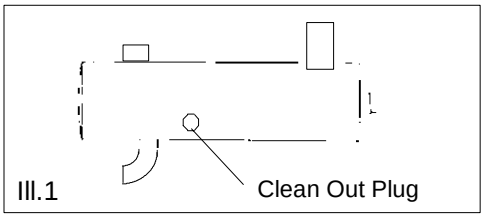
⚠ WARNING

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

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

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

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



Ill.1 Clean Out Plug

2. Place the transmission in neutral and start the engine. Purge accumulated carbon from the system by momentarily revving the engine several times.
3. If some carbon is expelled, cover the exhaust outlet and rap on the pipe around the clean out plugs while revving the engine several more times.
4. If particles are still suspected to be in the muffler, back the machine onto an incline so the rear of the machine is one foot higher than the front. Set the hand brake and block the wheels. Make sure the

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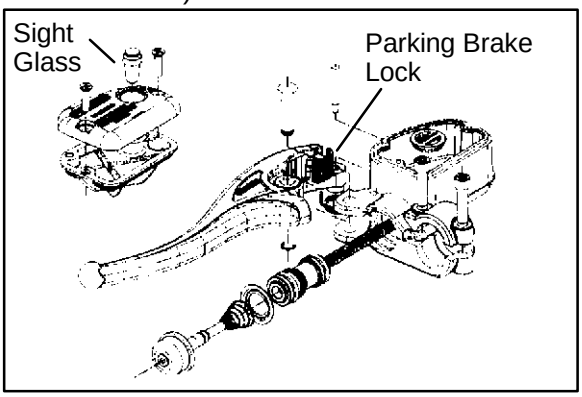
machine is in neutral and repeat Steps 2 and 3. **SEE WARNING**

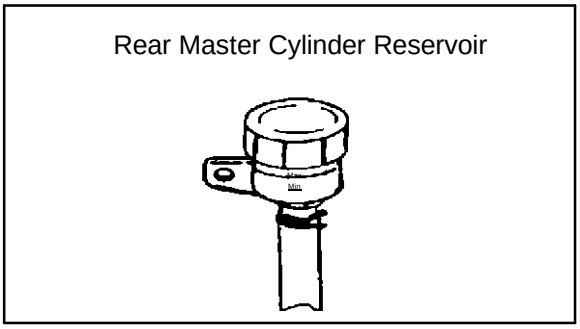
5. If particles are still suspected to be in the muffler, drive the machine onto the incline so the front of the machine is one foot higher than the rear. Set the hand brake and block the wheels. Make sure the machine is in neutral and repeat Steps 2 and 3. **SEE WARNING**
6. Repeat steps 2 through 5 until no more particles are expelled when the engine is revved.
7. Stop the engine and allow the arrestor to cool.
8. Reinstall the clean out plugs.

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 Brake Fluid (**PN 2870990**).

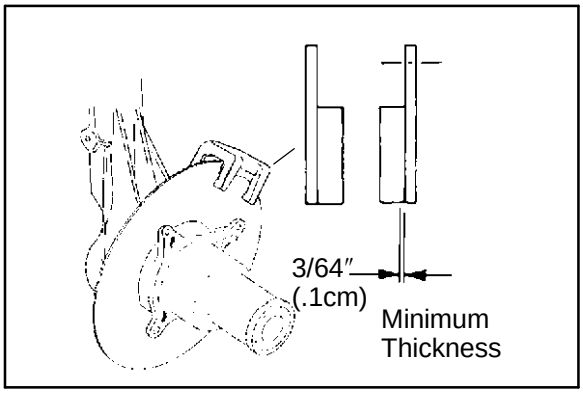




- Check brake system for fluid leaks.
- Check brake for excessive travel or spongy feel.
- Check friction pads for wear, damage or looseness.
- Check surface condition of the disc.

BRAKE PAD INSPECTION

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

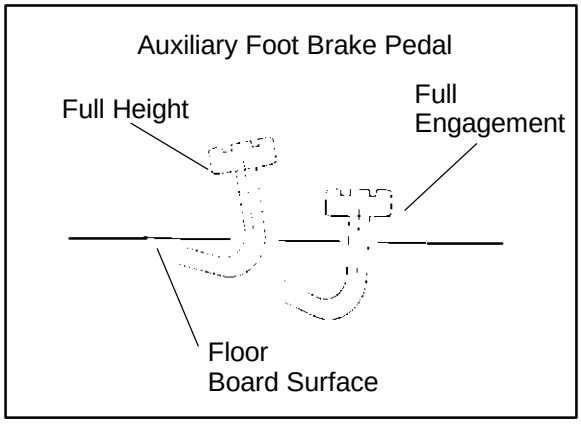


HOSE/FITTING INSPECTION

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

AUXILIARY BRAKE TESTING

The auxiliary brake should be checked for proper function.



1. Support the rear wheels off the ground.
2. While turning the rear wheels by hand, apply the auxiliary foot brake. This brake should not stop the wheels from turning until the lever is half way between its rest position and bottoming on the footrest.

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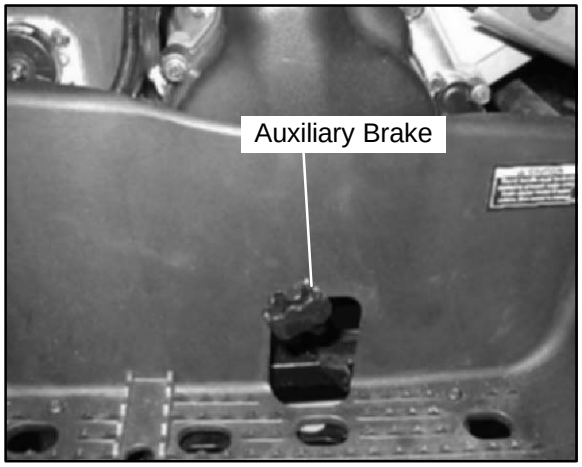
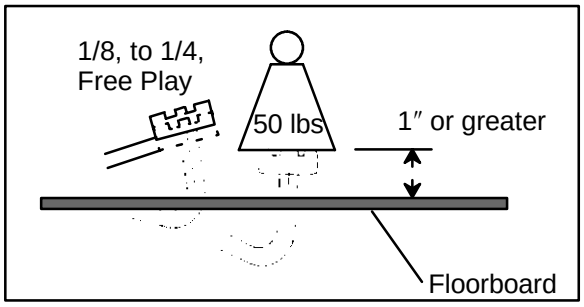
AUXILIARY BRAKE ADJUSTMENT (HYDRAULIC)



Use the following procedure to inspect the hydraulic auxiliary (foot) brake system and adjust or bleed if necessary:

First, check foot brake effectiveness by applying 50 lb. (approx.) downward force on the pedal. The top of the pedal should be at least 1 inch, (25.4mm) above the surface of the footrest.



If less than one inch, two things must be examined:

Free Play:

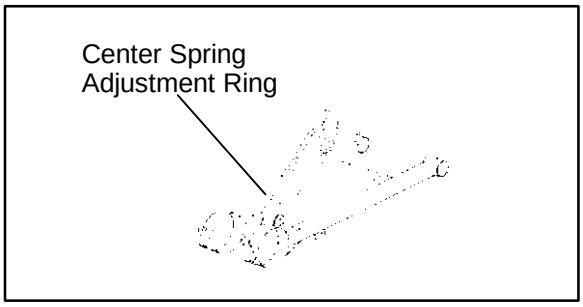
Free play of the brake pedal should be 1/8 - 1/4 inch (3.2 - 6.35 mm).

If free play is excessive, inspect pedal, linkage, and master cylinder 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 Brake Chapter 9.

SUSPENSION SPRING PRELOAD ADJUSTMENT



Operator weight and vehicle loading affect suspensionspringpreloadrequirements.Adjustas necessary.

FRONT SUSPENSION

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

Check all front suspension components for wear or damage.

Inspect front strut cartridges for leakage.

CONTROLS

Check controls for proper operation, positioning andadjustment.

Brake control and switch must be positioned to allow brake lever to travel throughout entire range without contacting switch body.

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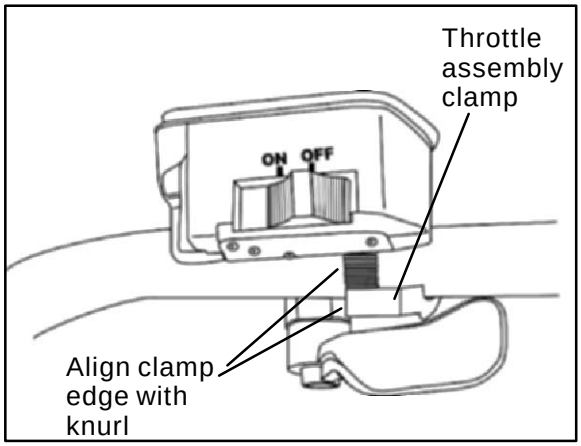


Align throttle control assembly clamp with knurl on handlebar

WHEELS

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

⚠ WARNING

Operating an ATV with worn tires will increase the possibility of the vehicle skidding and possible loss of control.

Worn tires can cause an accident.

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

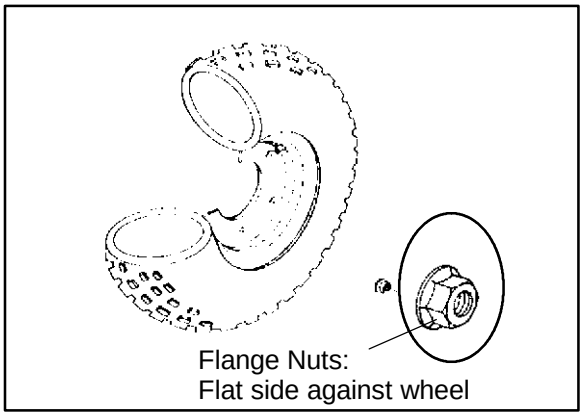
WHEELS

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	20 Ft. Lbs. (27 Nm)
Rear Wheel Nuts	20 Ft. Lbs. (27 Nm)
Front Spindle Nut	Refer to procedure listed in Chapter 7
Rear Hub Retaining Nut	100 Ft. Lbs. (136 Nm)

WHEEL REMOVAL FRONT OR REAR



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 above.

CAUTION:

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

TIRE PRESSURE

CAUTION:

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

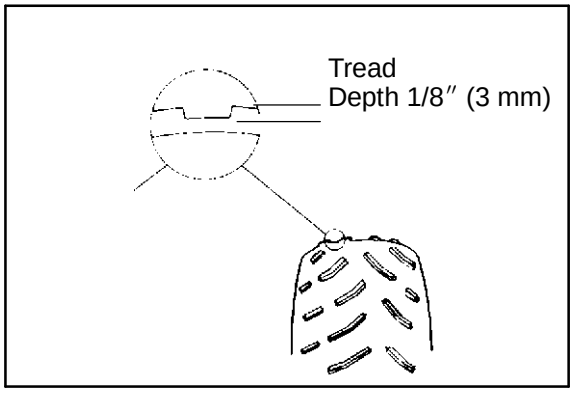
Tire Pressure Inspection (PSI - Cold)	
Front	**Rear**
5	5

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 an ATV with worn tires will increase the possibility of the vehicle skidding easily with possible loss of control.

Worn tires can cause an accident.

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

FRAME, NUTS, BOLTS, 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.

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NOTES

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CHAPTER 3
ENGINE

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TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS		
Fastener	**Size**	**EH42PLE/ EH50PLE Ft. Lbs. (Nm)**
Blind Plug (Oil Pressure)	1/8 PT (28tpi)	6.5-11 (9-15 Nm)
Camshaft Sprocket	6mm	5-6.5 (7-9 Nm)
Camshaft Chain Tensioner Lever	6mm	5-6.5 (7-9 Nm)
Camshaft Chain Tensioner	6mm	5-6.5 (7-9 Nm)
Camshaft Chain Tensioner Cap	11mm	14-19 (20-25 Nm)
Carburetor Adaptor	8mm	12-14 (16-20 Nm)
Crankcase	8mm	14-15 (19-21 Nm)
Crankshaft Slotted Nut (Cam Chain Drive Sprocket)	28mm	35-51 (47-69 Nm)
Cylinder Base Bolts	10mm 6mm	45-49 (61-67 Nm) 6-8 (9-11 Nm)
Cylinder Head Bolts	11mm 6mm	Refer to Engine Assembly for torque procedure
Drive Clutch Bolt	7/16 - 20	40 (55 Nm)
Flywheel	16mm	58-72 (78-98 Nm)
Oil Delivery Pipe	12mm	11-15 (15-21 Nm)
Oil Drain Bolt (Crankcase)	14mm	14-17 (19-23 Nm)
Oil Filter Pipe Fitting	20mm	36-43 (49-59 Nm)
Oil Hose Fitting	1/8 Pipe Thread	6.5-11 (9-15 Nm)
Oil Pump	6mm	5-6.5 (7-9 Nm)
Oil Pump Case Screw	5mm	1.5-2 (2-3 Nm)
One Way Valve	11mm	14-19 (20-25 Nm)
Recoil Housing	6mm	5-6.5 (7-9 Nm)
Rocker Cover	6mm	7-8 (9-11 Nm)
Rocker Support	8mm	8-10 (11-13 Nm)
Rocker Adjuster Screw	6mm	6-7 (8-10 Nm)
Water Pump Impeller Nut	6mm	5-6.5 (7-9 Nm)
Water Pump Housing Cover	6mm	5-6.5 (7-9 Nm)
Stator Plate	6mm	5-6.5 (7-9 Nm)
Starter Motor	6mm	5-6.5 (7-9 Nm)
Spark Plug	14mm	9-11 (12-15 Nm)

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2200634	Valve Seat Reconditioning Kit
2870390	Piston Support Block
2871043	Flywheel Puller
2871283	Crankshaft/Water Pump Seal Install Kit
5131135	Water Pump Install Kit
2870569	Crankshaft Truing Stand
2870975	Mity Vac™ Pressure Test Tool
PV-43527	Oil Filter Wrench

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ENGINE SERVICE DATA

Cylinder Head / Valve				EH42PLE	EH50PLE
Rocker Arm	Rocker arm ID			.8669-.8678″ (22.020-22.041 mm)	.8669-.8678″ (22.020-22.041 mm)
	Rocker shaft OD			.8656-.8661″ (21.987-22.0 mm)	.8656-.8661″ (21.987-22.0 mm)
	Rocker shaft Oil Clearance		Std	.0008-.0021″ (.020-.054 mm)	.0008-.0021″ (.020-.054 mm)
			Limit	.0039″ (.10 mm)	.0039″ (.10 mm)
Camshaft	Cam lobe height	In	Std	1.2884-1.2924″ (32.726-32.826 mm)	1.2884-1.2924″ (32.726-32.826 mm)
			Limit	1.2766″ (32.426 mm)	1.2766″ (32.426 mm)
		Ex	Std	1.2884-1.2924″ (32.726-32.826 mm)	1.2884-1.2924″ (32.726-32.826 mm)
			Limit	1.2766″ (32.426 mm)	1.2766″ (32.426 mm)
	Camshaft journal OD		Mag	1.4935-1.4941″ (37.935-37.950 mm)	1.4935-1.4941″ (37.935-37.950 mm)
			PTO	1.4935-1.4941″ (37.935-37.950 mm)	1.4935-1.4941″ (37.935-37.950 mm)
	Camshaft journal bore ID		Mag	1.4963-1.4970″ (38.005-38.025 mm)	1.4963-1.4970″ (38.005-38.025 mm)
			PTO	1.4963-1.4970″ (38.005-38.025 mm)	1.4963-1.4970″ (38.005-38.025 mm)
	Camshaft Oil clearance		Std	.0022-.0035″ (.055-.090 mm)	.0022-.0035″ (.055-.090 mm)
			Limit	.0039″ (.10 mm)	.0039″ (.10 mm)
Cylinder Head	Surface warpage limit			.0020″ (.05 mm)	.0020″ (.05 mm)
	Standard height			3.870″ (98.3 mm)	3.870″ (98.3 mm)
Valve Seat	Contacting width	In	Std	.028″ (.7 mm)	.028″ (.7 mm)
			Limit	.055″ (1.4 mm)	.055″ (1.4 mm)
		Ex	Std	.039″ (1.0 mm)	.039″ (1.0 mm)
			Limit	.071″ (1.8 mm)	.071″ (1.8 mm)
Valve Guide	Inner diameter			.2362-.2367″ (6.0-6.012 mm)	.2362-.2367″ (6.0-6.012 mm)
	Protrusion above head			.689-.709″ (17.5-18.0 mm)	.689-.709″ (17.5-18.0 mm)
Valve	Margin thickness	In	Std	.039″ (1.0 mm)	.039″ (1.0 mm)
			Limit	.031″ (.8 mm)	.031″ (.8 mm)
		Ex	Std	.047″ (1.2 mm)	.047″ (1.2 mm)
			Limit	.031″ (.8 mm)	.031″ (.8 mm)
Valve	Stem diameter		In	.2343-.2348″ (5.950-5.965 mm)	.2343-.2348″ (5.950-5.965 mm)
			Ex	.2341-.2346″ (5.945-5.960 mm)	.2341-.2346″ (5.945-5.960 mm)
	Stem oil clearance	Std	In	.0014-.0024″ (.035-.062 mm)	.0014-.0024″ (.035-.062 mm)
			Ex	.0016-.0026″ (.040-.067 mm)	.0016-.0026″ (.040-.067 mm)
		Limit		.0059″ (.15 mm)	.0059″ (.15 mm)
	Overall length		In	3.976″ (101.0 mm)	3.976″ (101.0 mm)
			Ex	3.984″ (101.2 mm)	3.984″ (101.2 mm)
Valve Spring	Overall length		Std	1.654″ (42.0 mm)	1.654″ (42.0 mm)
			Limit	1.575″ (40.0 mm)	1.575″ (40.0 mm)
	Squareness			.075″ (1.9 mm)	.075″ (1.9 mm)

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ENGINE SERVICE DATA

Cylinder / Piston / Connecting Rod				EH42PLE	EH50PLE
Cylinder	Surface warpage limit (mating with cylinder head)			.0020″ (.05 mm)	.0020″ (.05 mm)
	Cylinder bore		Std	3.4606-3.614″ (87.900-87.920 mm)	3.6221-3.6228″ (92.00-92.02 mm)
	Taper limit			.0020″ (.050 mm)	.0020″ (.050 mm)
	Out of round limit			.0020″ (.050 mm)	.0020″ (.050 mm)
	Piston clearance		Std	.0006-.0018″ (.015-.045 mm)	.0006-.0018″ (.015-.045 mm)
			Limit	.0024″ (.060 mm)	.0024″ (.060 mm)
	Boring limit			.020″ (.5 mm)	.020″ (.5 mm)
Piston	Outer diameter	Std		3.4596-3.4600″ (87.875-87.885 mm)	3.6204-3.6215″ (91.970-91.985 mm)
		.0098″ (.25 mm) OS		3.4695-3.4699″ (88.125-88.135 mm)	3.6304-3.6310″ (92.21-92.23 mm)
		.0197″ (.50 mm) OS		3.4793-3.4797″ (88.375-88.385 mm)	3.6403-3.6407″ (92.46-92.47 mm)
	Standard inner diameter of piston pin bore			.9055-.9057″ (23.0-23.006 mm)	.9055-.9057″ (23.0-23.006 mm)
Piston Pin	Outer diameter			.9053-.9055″ (22.994-23.0 mm)	.9053-.9055″ (22.994-23.0 mm)
	Standard clearance-piston pin to pin bore			.0002-.0003″ (.004-.008 mm)	.0002-.0003″ (.004-.008 mm)
	Degree of fit			Piston pin must be a push (by hand) fit at 68° F (20° C)	
Piston Ring	Piston ring installed gap	Top ring	Std	.0079-.0138″ (.20-.36 mm)	.0079-.0138″ (.20-.36 mm)
			Limit	.039″ (1.0 mm)	.039″ (1.0 mm)
		Second ring	Std	.0079-.0138″ (.20-.36 mm)	.0079-.0138″ (.20-.36 mm)
			Limit	.039″ (1.0 mm)	.039″ (1.0 mm)
		Oil ring	Std	.0079-.0276″ (.20-.70 mm)	.0079-.0276″ (.20-.70 mm)
			Limit	.059″ (1.5 mm)	.059″ (1.5 mm)
Piston Ring	Standard clearance - piston ring to ring groove	Top ring	Std	.0016-.0031″ (.040-.080 mm)	.0016-.0031″ (.040-.080 mm)
			Limit	.0059″ (.15 mm)	.0059″ (.15 mm)
		Second ring	Std	.0012-.0028″ (.030-.070 mm)	.0012-.0028″ (.030-.070 mm)
			Limit	.0059″ (.15 mm)	.0059″ (.15 mm)
Connecting Rod	Connecting rod small end ID			.9058-.9063″ (23.007-23.020 mm)	.9058-.9063″ (23.007-23.020 mm)
	Connecting rod small end radial clearance		Std	.0003-.0010″ (.007-.026 mm)	.0003-.0010″ (.007-.026 mm)
			Limit	.0020″ (.05 mm)	.0020″ (.05 mm)
	Connecting rod big end side clearance		Std	.0039-.0256″ (.1-.65 mm)	.0039-.0256″ (.1-.65 mm)
			Limit	.0315″ (.80 mm)	.0315″ (.80 mm)
	Connecting rod big end radial clearance		Std	.0004-.0015″ (.011-.038 mm)	.0004-.0015″ (.011-.038 mm)
			Limit	.0020″ (.05 mm)	.0020″ (.05 mm)
Crankshaft	Crankshaft runout limit			.0024″ (.06 mm)	.0024″ (.06 mm)

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

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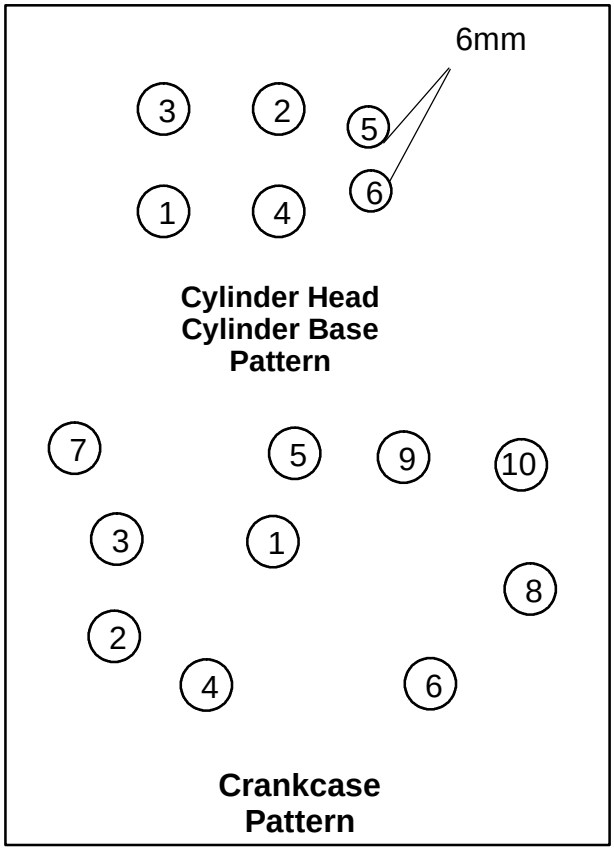
ENGINE FASTENER TORQUE PATTERNS

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



PISTON IDENTIFICATION

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

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

Engine Model No.	Oversize Available* (mm)	Piston Length	Standard Piston Identification
EH50PLE	.25 .50	72 mm	C
EH42PLE	25 .50	66 mm	B

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

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

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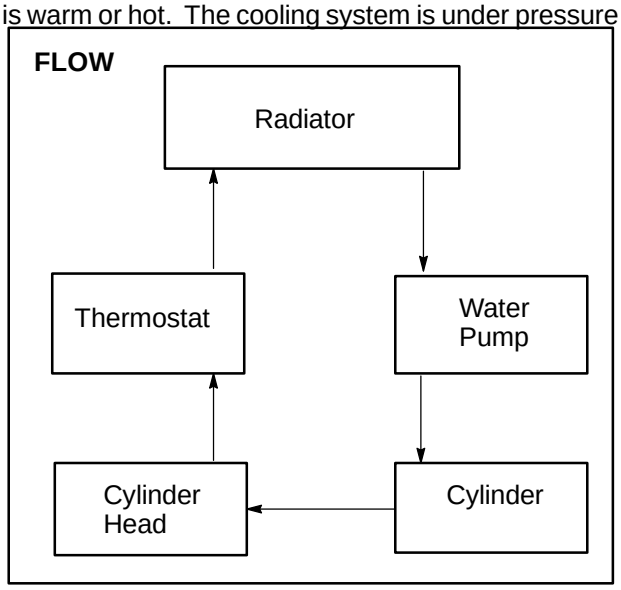
COOLING SYSTEM

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.

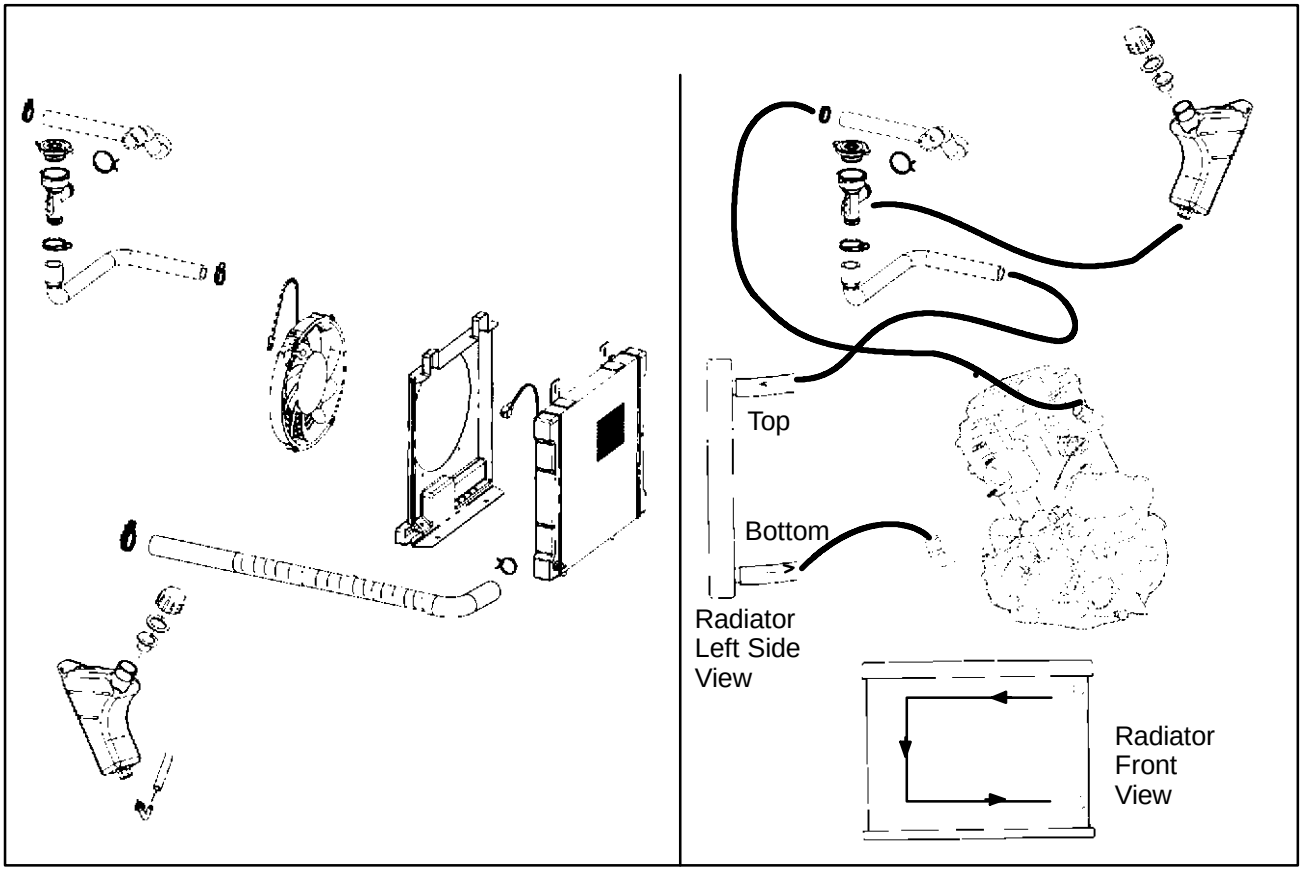


System Pressure Test

1. Remove front cover.
2. Remove recovery bottle hose from coolant filler.
3. 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 lbs.



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RECOMMENDED COOLANT

Use only high quality antifreeze/coolant mixed with *distilled* water in a 50/50 or 60/40 ratio, depending on freeze protection required in your area. **CAUTION:** Using tap water in the cooling system will lead to a buildup of deposits which may restrict coolant flow and reduce heat dissipation, resulting in possible engine damage. Polaris Premium 60/40 Antifreeze/Coolant is recommended for use in all cooling systems, and comes pre-mixed and ready to use.

COOLING SYSTEM SPECIFICATIONS

Fan Switch (Off) Fan Switch (On)	149° F (65° C) ± 8° 180° F (82° C) ± 3°
Hot Light On	221° F (105° C)
System Capacity	2.25 Quarts
Radiator Cap Relief Pressure	13 PSI
Thermostat	Starts opening 176° F (80° C) Open 8mm @ 205° F (96° C)

ACCESSIBLE COMPONENTS

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

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

The following components require engine removal for service:

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

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

ENGINE REMOVAL (TYPICAL)

1. Clean work area.
2. Thoroughly clean the ATV engine and chassis.
3. Disconnect battery negative (-) cable.
4. Remove the following parts as required.
   - Seat
   - Left and Right Side Covers (Refer to Chapter 5)
   - Fuel Tank Cover / Front Cab (Refer to Chapter 5)
   - Fuel Tank (Refer to Chapter 4)
5. Disconnect spark plug high tension lead.
6. Remove springs from exhaust pipe and remove pipe.
7. Drain coolant and engine oil.
8. Remove air pre-cleaner and duct.
9. Remove airbox.
10. Remove carburetor. Insert a shop towel into the carburetor flange to prevent dirt from entering the intake port.
11. Remove center chain guard on chain drive AWD models.
12. Remove center drive and driven sprocket bolts and remove chain and sprockets as an assembly.
13. Refer to PVT System to remove outer clutch cover, drive belt, drive clutch, driven clutch, and inner cover.
14. Starter motor. Note ground cable location. Mark positive (+) cable mounting angle and remove cable.
15. Remove transmission linkage rod(s) from gear selector and secure out of the way.
16. Disconnect coolant temperature sensor wire.
17. Remove engine to chassis ground cable.
18. Remove all engine mount nuts and / or engine mount plates.
19. Remove engine through right side of frame.

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ENGINE INSTALLATION NOTES

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

General Items

1. Install previously removed components using new gaskets, seals, and fasteners where applicable.
2. Perform regular checks on fluid levels, controls, and all important areas on the vehicle as outlined in the daily pre-ride inspection checklist (refer to Chapter 2 or the Owner's Safety and Maintenance Manual).

PVT System

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

Transmission

1. Inspect transmission operation and adjust linkage if necessary. Refer to Chapter 2 and Chapter 8.

Exhaust

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

Bleed Cooling System

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

Engine Break In Period

4 Cycle Engine Break-In Period is defined as the first 10 hours of engine operation, or 2 full tanks of fuel.

1. Use only Polaris Premium 4 All Season synthetic oil, or API certified "SH" oil. Never substitute or mix oil brands. Serious engine damage can result.
2. Use fuel with a minimum octane of 87 (R+M)/2 method.
3. Change break-in oil and filter at 20 hours or 500 miles, whichever comes first.

CYLINDER HONE SELECTION/HONING PROCEDURE

CAUTION:

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

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

NOTE: See next page for more information on honing.

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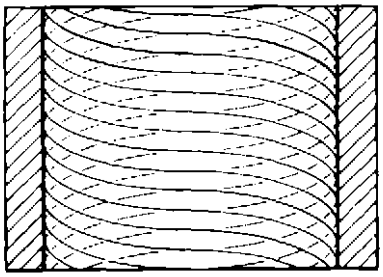
HONING TO OVERSIZE

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

CAUTION: For oversize honing always wet hone using honing oil and a coarse roughing stone. Measure the piston (see piston measurement) and rough hone to the size of the piston. Always leave .002 - .003″ (.05 - .07 mm) for finish honing. Refer to piston-to-cylinder clearance specifications on Page 3.4 before honing. Complete the sizing with fine grit stones to provide the proper cross-hatch finish and required piston clearance.



EXAMPLE OF CROSS HATCH PATTERN

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

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

CLEANING THE CYLINDER AFTER HONING

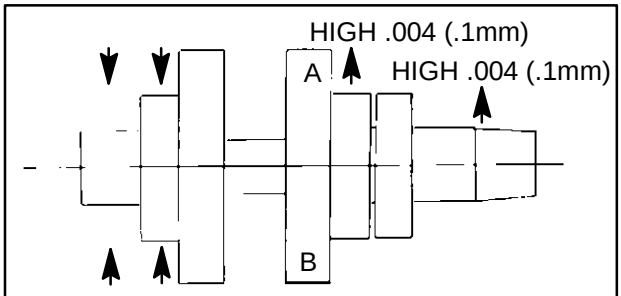
It is very important that the cylinder be thoroughly cleaned after honing to remove all grit material. Wash the cylinder in a solvent, then in hot, soapy water. Pay close attention to areas where the cylinder sleeve meets the aluminum casting (transfer port area). Use electrical contact cleaner if necessary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

CRANKSHAFT STRAIGHTENING

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

Crankshaft Truing Stand
(PN 2870569)

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



SUPPORT CRANKSHAFT HERE.

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

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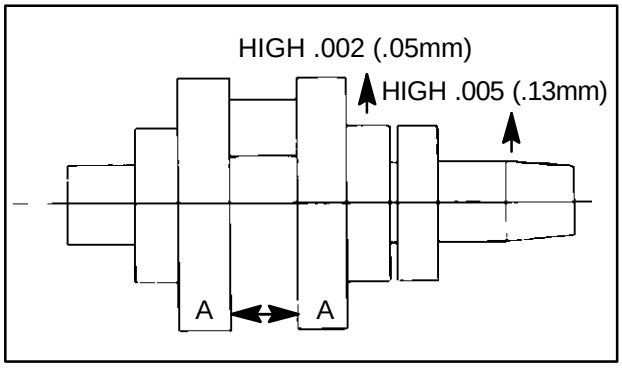
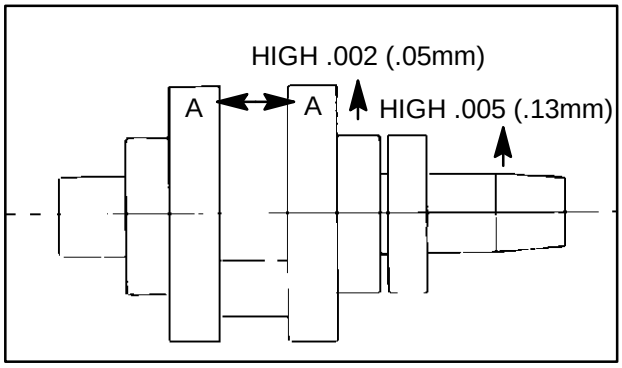


2. To correct a situation like the one shown in the illustration at right, squeeze the crankshaft at point A. (Use tool from alignment kit).



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

NOTE: Maximum allowable runout is .0024″.

ENGINE LUBRICATION - EH50PL

Oil Type . . . . . Polaris Premium 4 Synthetic (**PN 2871281**); or API certified “SH” 5W30 oil

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

Filter . . . . . **PN 3084963**

Filter Wrench . . . . . **(PV-43527)**

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

*Oil Pressure Specification . . . 20 PSI @ 5500 RPM, Polaris 0W-40 Synthetic (Engine Hot)

OIL PRESSURE TEST - EH50PL

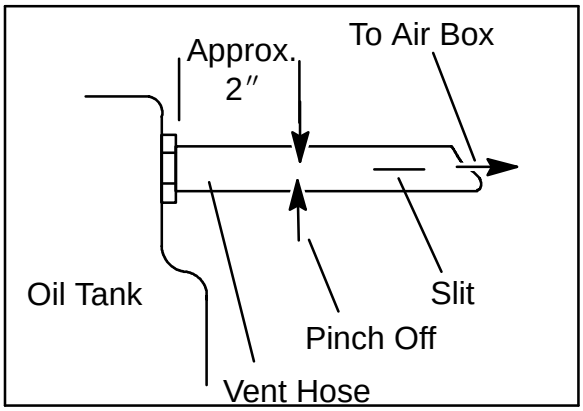
1. Remove blind plug on front left cylinder head.
2. Insert a 1/8 NPT oil pressure gauge adaptor into the cylinder head and attach the gauge.
3. Start engine and allow it to reach operating temperature, monitoring gauge indicator.

NOTE: Use Polaris Premium 4 Synthetic Engine Lubricant (**PN 2871281**).

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

OIL PUMP PRIMING PROCEDURE

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



1. Clamp or pinch off vent line approximately 2″ from oil tank to avoid the end of oil tank vent fitting, and the vent line’s pressure relief slit
2. Run engine for 45-60 seconds.
3. Remove the vent line clamp. **Note:** If the line is bled properly you should hear air release, if you do not hear air the line has not bled. The oil pump will now be properly primed and ready for field operation.

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OIL FLOW – EH50PL

The chart on Page 3.12 describes the flow of oil through the EH50PL engine. Beginning at the oil tank, the oil flows through a screen fitting in the bottom of the tank and into the oil supply hose. The feed side of the oil pump draws oil through the hose and into the crankcase oil gallery, and then pumps the oil through another passage to the one way valve. (When the engine is off, the one way valve closes to prevent oil in the tank from draining into the crankcase.) The oil is pumped through a delivery pipe to the oil filter. If the oil filter is obstructed, a bypass valve contained in the filter allows oil to bypass the filter element.

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

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

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

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

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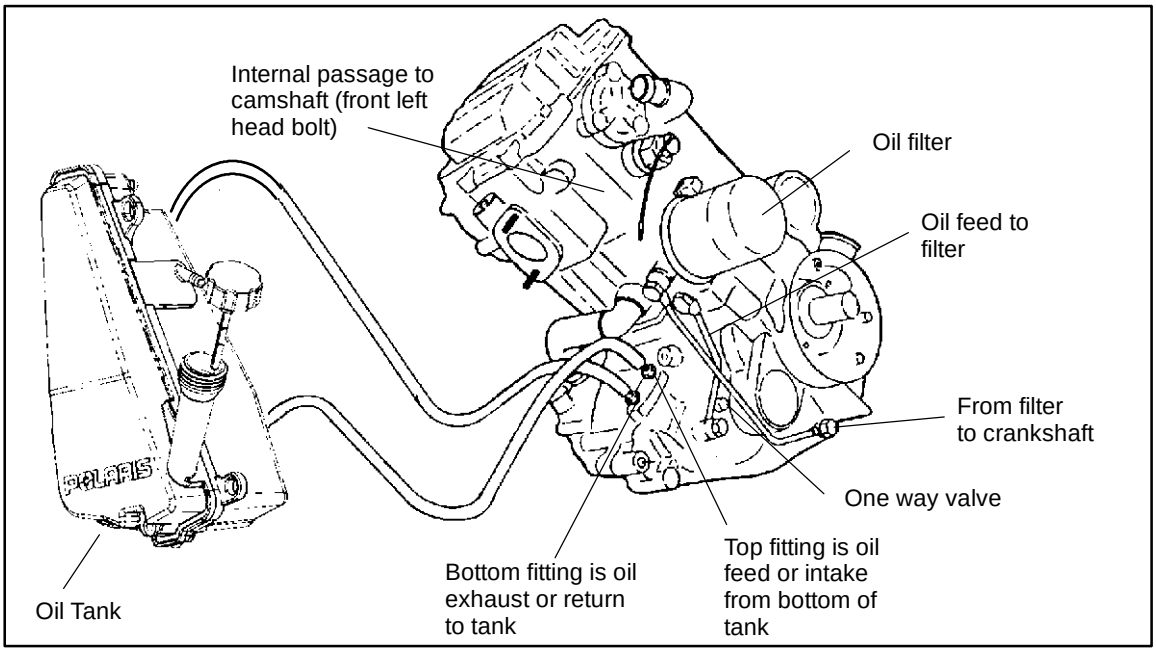
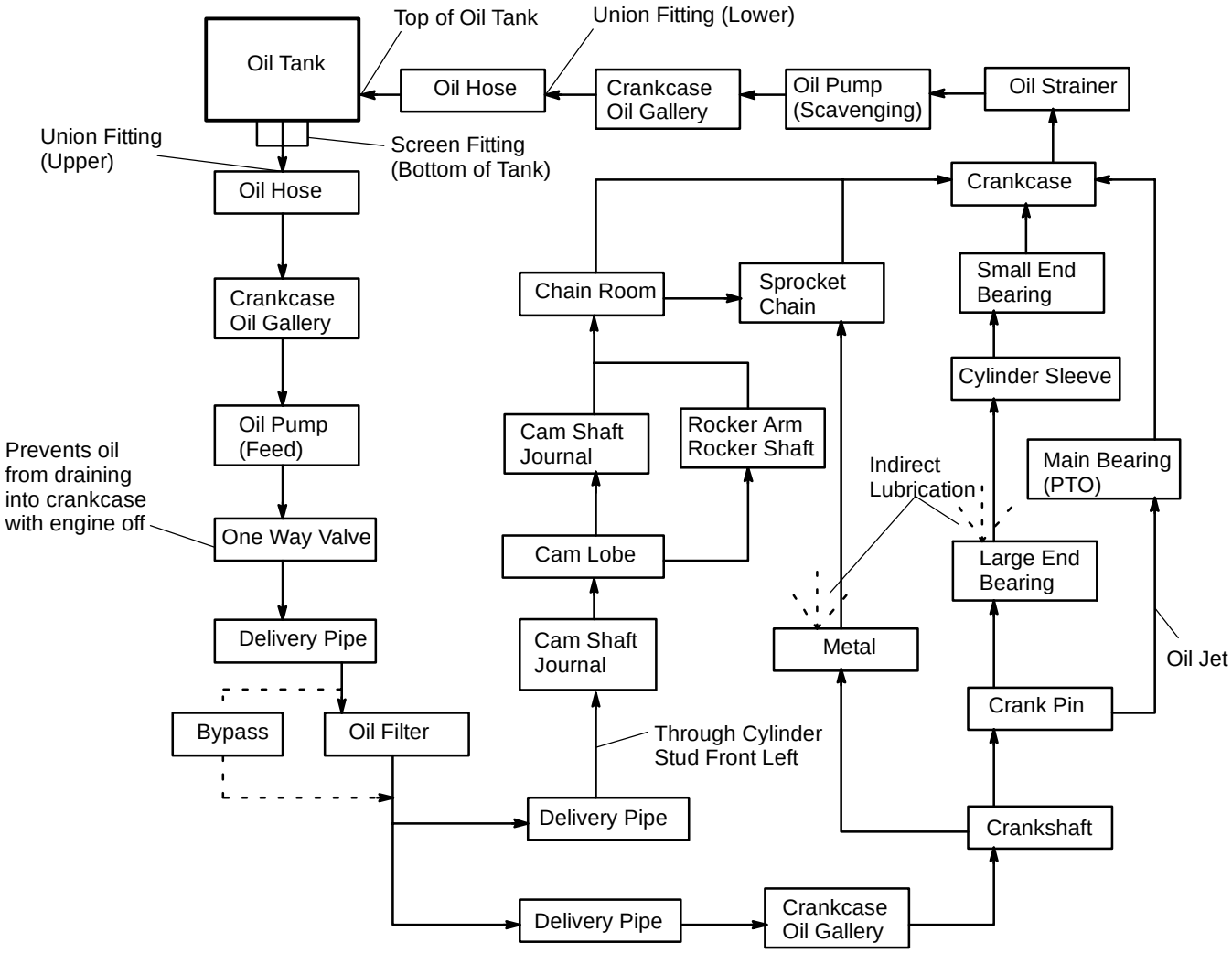
EH50PL OIL FLOW DIAGRAM



EH50PL Oil Flow Chart



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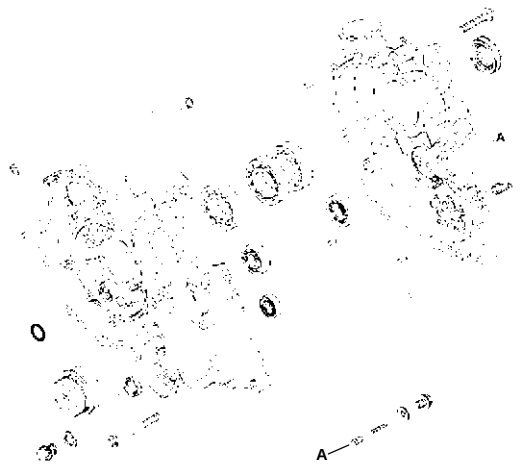
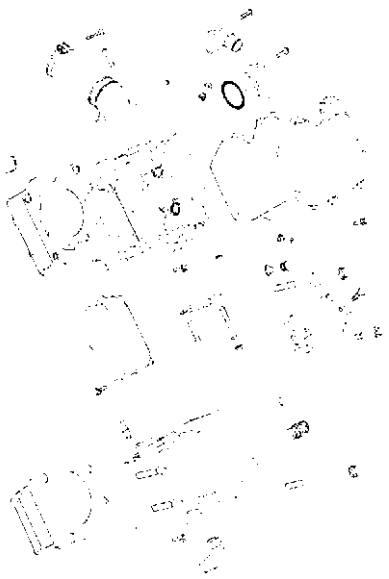
EH50PL ENGINE EXPLODED VIEW

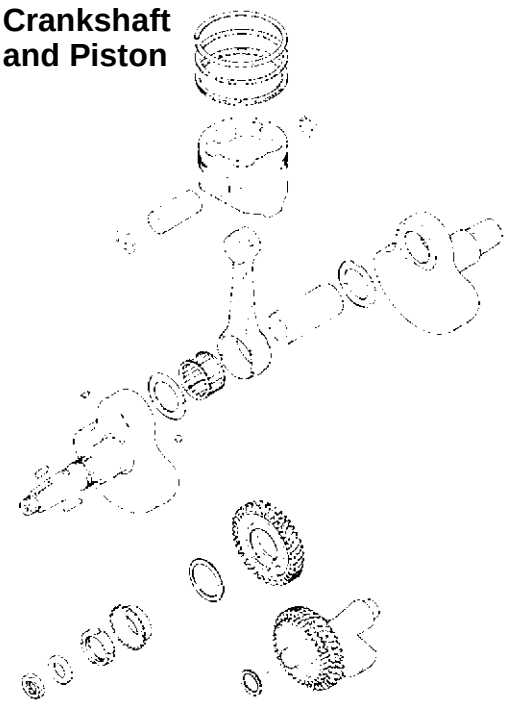
Crankcase



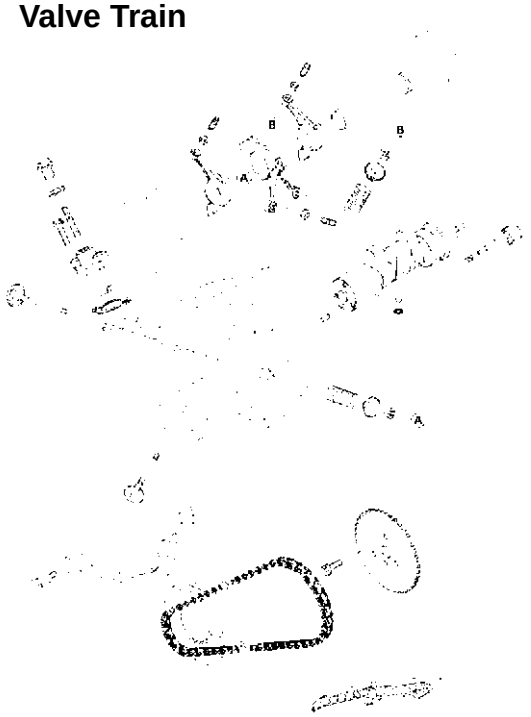
Cylinder/ Cylinder Head



Crankshaft and Piston



Valve Train



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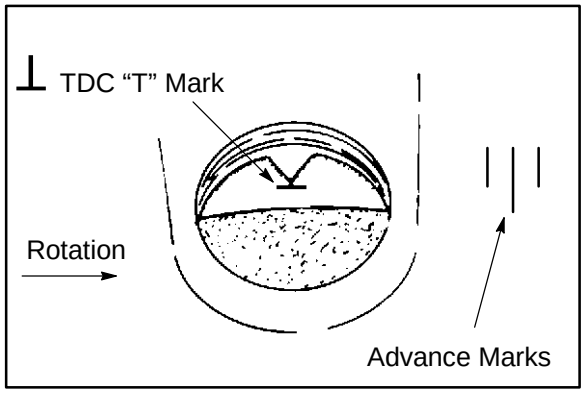
ENGINE REMOVAL

REFER TO PAGE 3.7–3.8 FOR ENGINE REMOVAL / INSTALLATION NOTES.

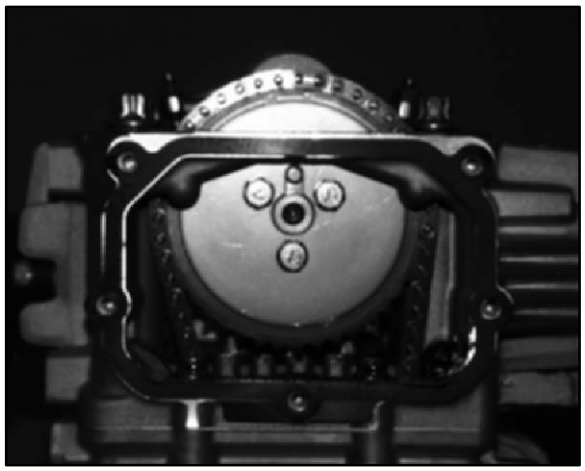
CAM CHAIN TENSIONER/ROCKER ARM/CAMSHAFT REMOVAL

1. Remove ignition timing inspection plug from recoil housing.

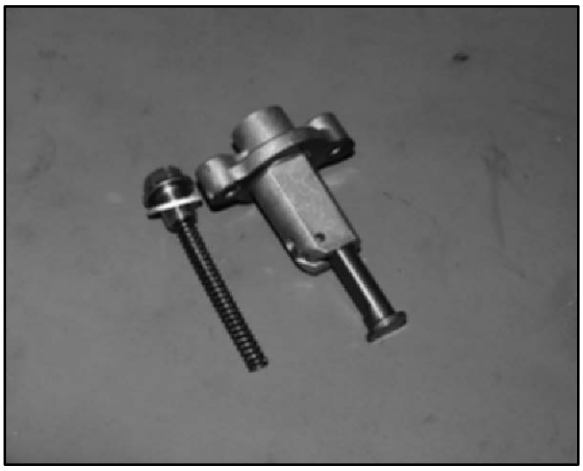


To position crankshaft at Top Dead Center (TDC) on compression stroke:

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



4. Align single (TDC) mark on flywheel with projection in inspection hole, and the cam sprocket pin (facing upward) aligned with the camshaft to crankshaft center line. **NOTE:** The cam lobe should be pointing down and valves should have clearance at this point.



5. Remove cam chain tensioner plug, sealing washer, and spring. **CAUTION:** The plug is under spring tension. Maintain inward pressure while removing.
6. Remove the two 6x25 mm cam chain tensioner flange bolts.
7. Tap lightly on tensioner body with a soft face hammer and remove tensioner.

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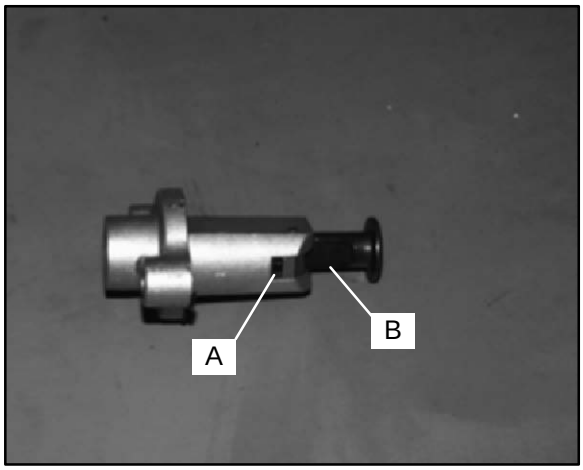
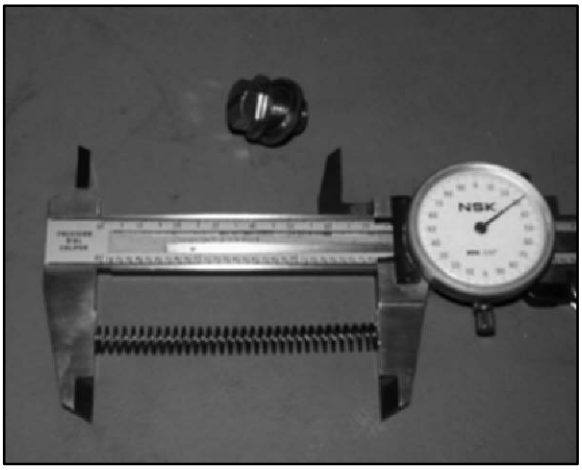
CAM CHAIN TENSIONER INSPECTION



1. Pull cam chain tensioner plunger outward to the end of its travel. Inspect teeth on ratchet pawl (A) and plunger teeth (B) for wear or damage.
2. Push ratchet pawl and hold it. The plunger should move smoothly in and out of the tensioner body.
3. Release ratchet pawl and push inward on plunger. It should remain locked in position and not move inward.



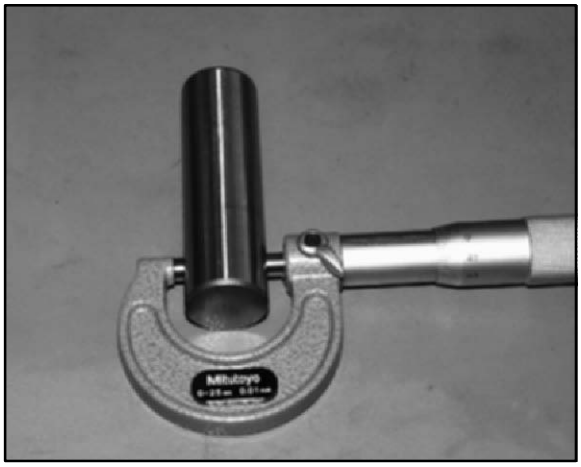
Tensioner Spring Free Length:

2.320″ (5.9 cm)

4. Measure free length of tensioner spring. Replace spring if excessively worn. Compare to specifications.
5. Replace entire tensioner assembly if any part is worn or damaged.

ROCKER ARM/SHAFT INSPECTION

1. Mark or tag rocker arms to keep them in order for assembly.
2. Inspect each rocker arm cam follower surface. If there is any damage or uneven wear, replace the rocker arm. **NOTE:** Always inspect camshaft lobe if rocker arms are worn or damaged.



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

Rocker Shaft O.D.:

.8656-.8661″ (21.987-22.0 mm)

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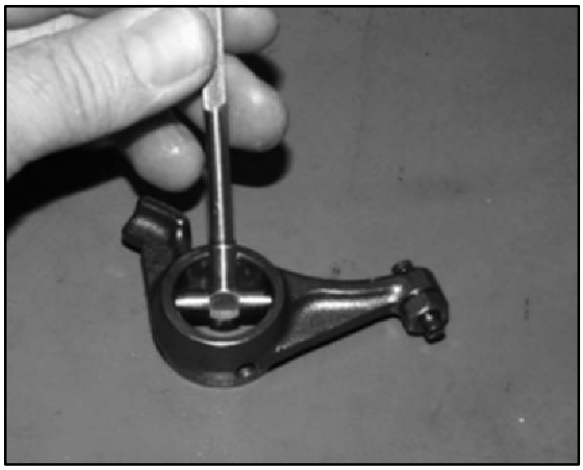
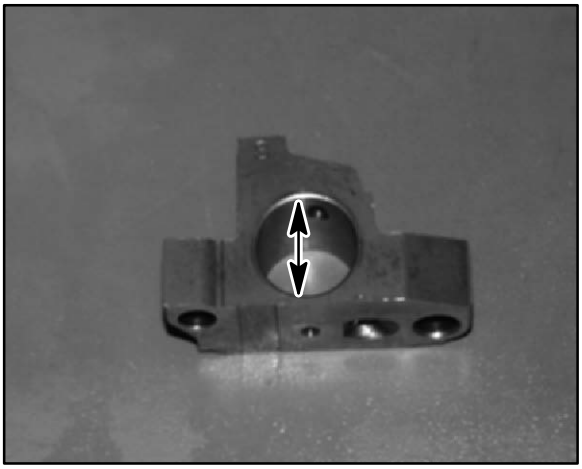
ROCKER ARM/SHAFT INSPECTION, CONT.



Rocker Arm & Support I.D.:

.8669-.8678″ (22.020-22.041 mm)

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

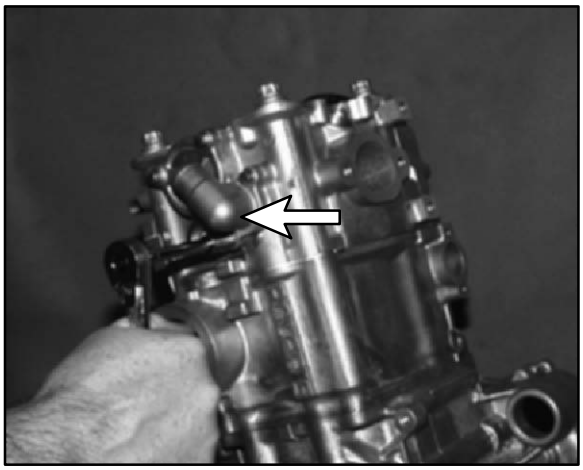


Rocker Shaft Oil Clearance:

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

5. Measure I.D. of both rocker arm shaft supports and visually inspect surface. Compare to specifications.
6. Subtract rocker shaft O.D. from rocker arm & shaft support I.D. This is the oil clearance. Compare to specifications.
7. Inspect rocker adjuster screws for wear, pitting, or damage to threads of the adjuster or locknut. Replace all worn or damaged parts. **NOTE:** The end of the adjuster screw is hardened and cannot be ground or re-faced.

CAMSHAFT REMOVAL



1. Remove thermostat housing.
2. Remove camshaft sprocket inspection cover.

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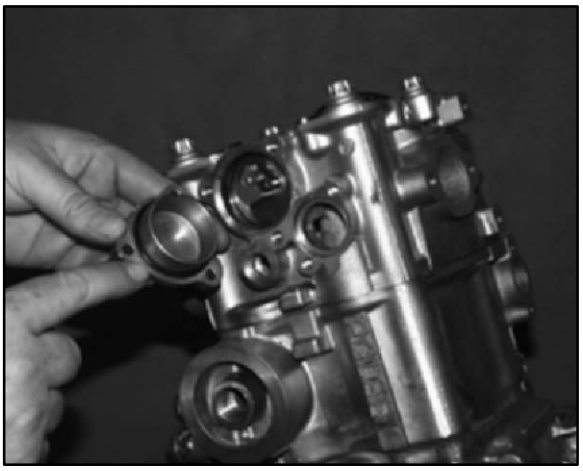
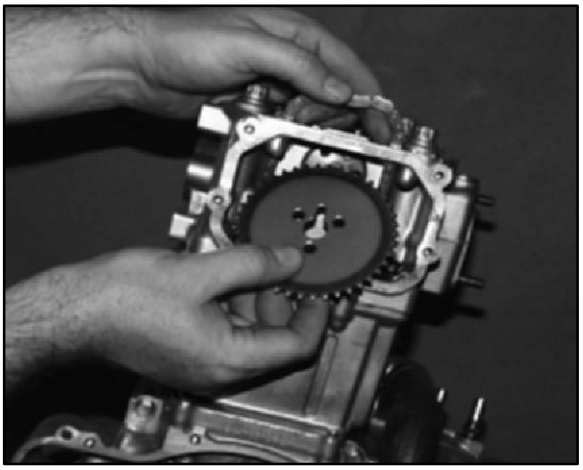
3. Loosen three camshaft sprocket bolts.

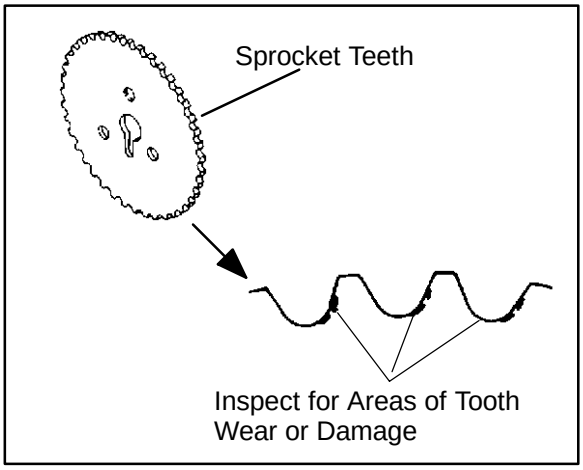


4. Remove camshaft end cap and O-Ring.

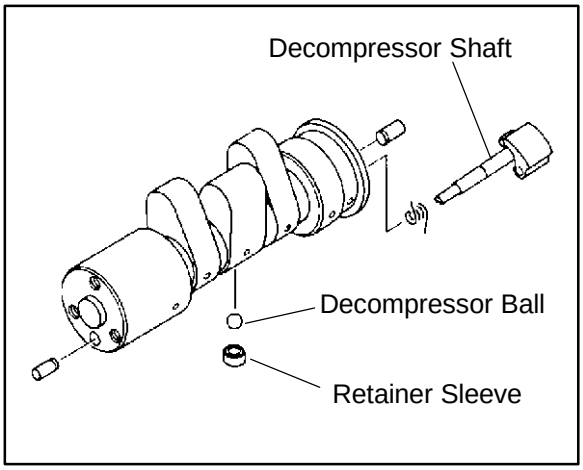
5. Inspect camshaft end cap (thrust face) for wear. Replace if worn or damaged.
6. Place a clean shop towel in the area below cam chain sprocket and remove sprocket retaining bolts.



7. Slide camshaft inward to allow removal of cam sprocket and remove sprocket from camshaft and chain.
8. Secure cam chain with a wire to prevent it from falling into the crankcase.



9. Inspect cam sprocket teeth for wear or damage. Replace if necessary.



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

AUTOMATIC COMPRESSION RELEASE REMOVAL/INSPECTION

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

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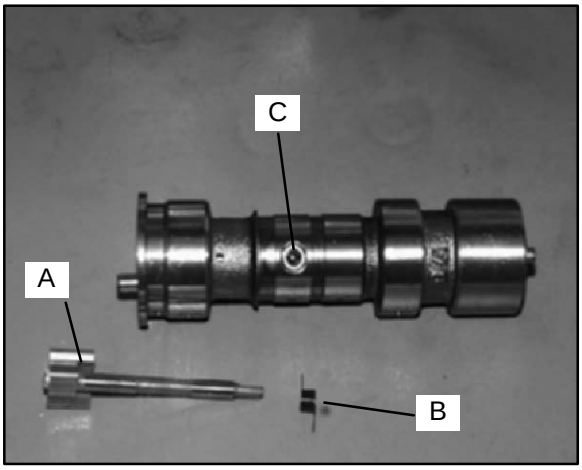
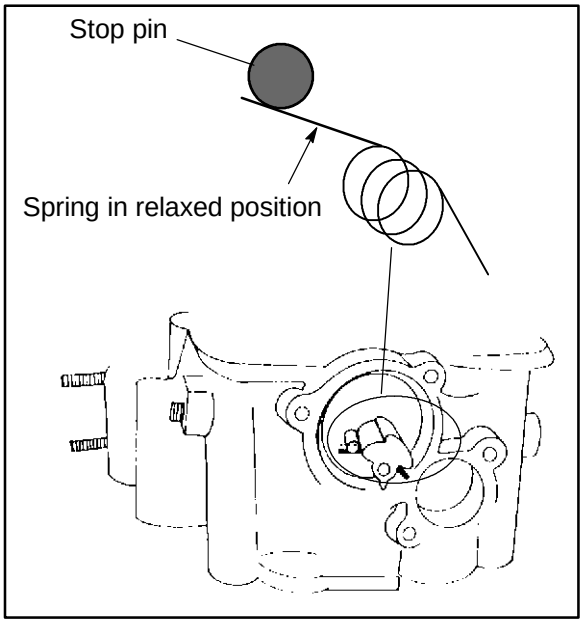


1. Check release lever shaft (A) for smooth operation throughout the entire range of rotation. The spring (B) should hold the shaft weight against the stop pin. In this position, the actuator ball (C) will be held outward in the compression release mode.
2. Remove release lever shaft and return spring.
3. Inspect shaft for wear or galling.
4. Inspect lobe on end of release lever shaft and actuator ball for wear and replace if necessary.

AUTOMATIC COMPRESSION RELEASE INSTALLATION

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

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



If Camshaft Is Removed From Engine:

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

If Camshaft Is Installed In The Engine:

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

CAMSHAFT INSPECTION

1. Visually inspect each cam lobe for wear, chafing or damage.
2. Thoroughly clean the cam shaft, making sure the oil feed holes are not obstructed.

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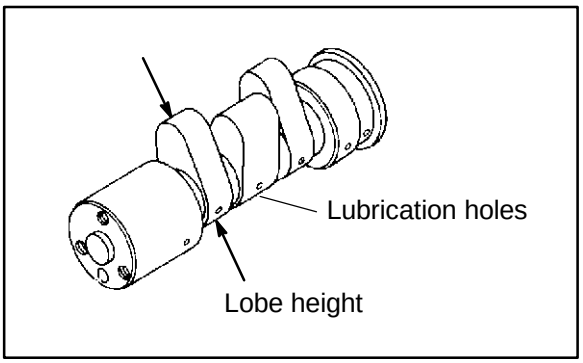
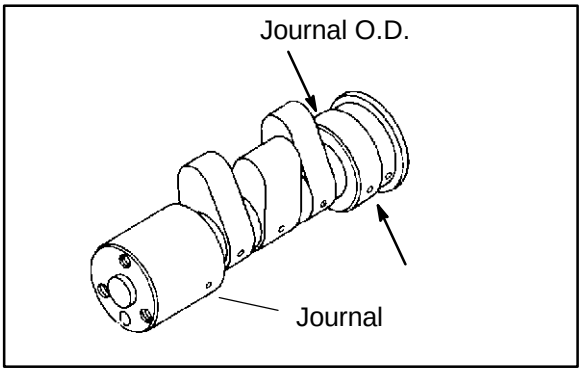


Cam Lobe Height (Intake & Exhaust):

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

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



Camshaft Journal O.D.:

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

4. Measure camshaft journal outside diameter (O.D.)
5. Measure ID of camshaft journal bore.

Camshaft Journal I.D.:

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

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

Camshaft Oil Clearance:

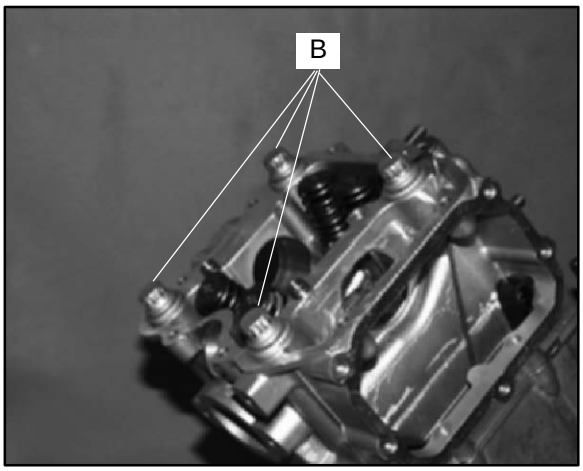
Std: .0022-.0035″ (.055-.090 mm)
Limit: .0039″ (.10 mm)

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

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

CYLINDER HEAD EXPLODED VIEW, EH50PL

1. Remove the two 6mm flange bolts (A) from cylinder head. See next exploded view on next page.
2. Loosen each of the four cylinder head bolts evenly 1/8 turn each time in a criss-cross pattern until loose.



3. Remove bolts (B) and tap cylinder head lightly with a plastic hammer until loose. **CAUTION:** Tap only in reinforced areas or on thick parts of cylinder head casting to avoid damaging the thread.
4. Remove cylinder head and head gasket.

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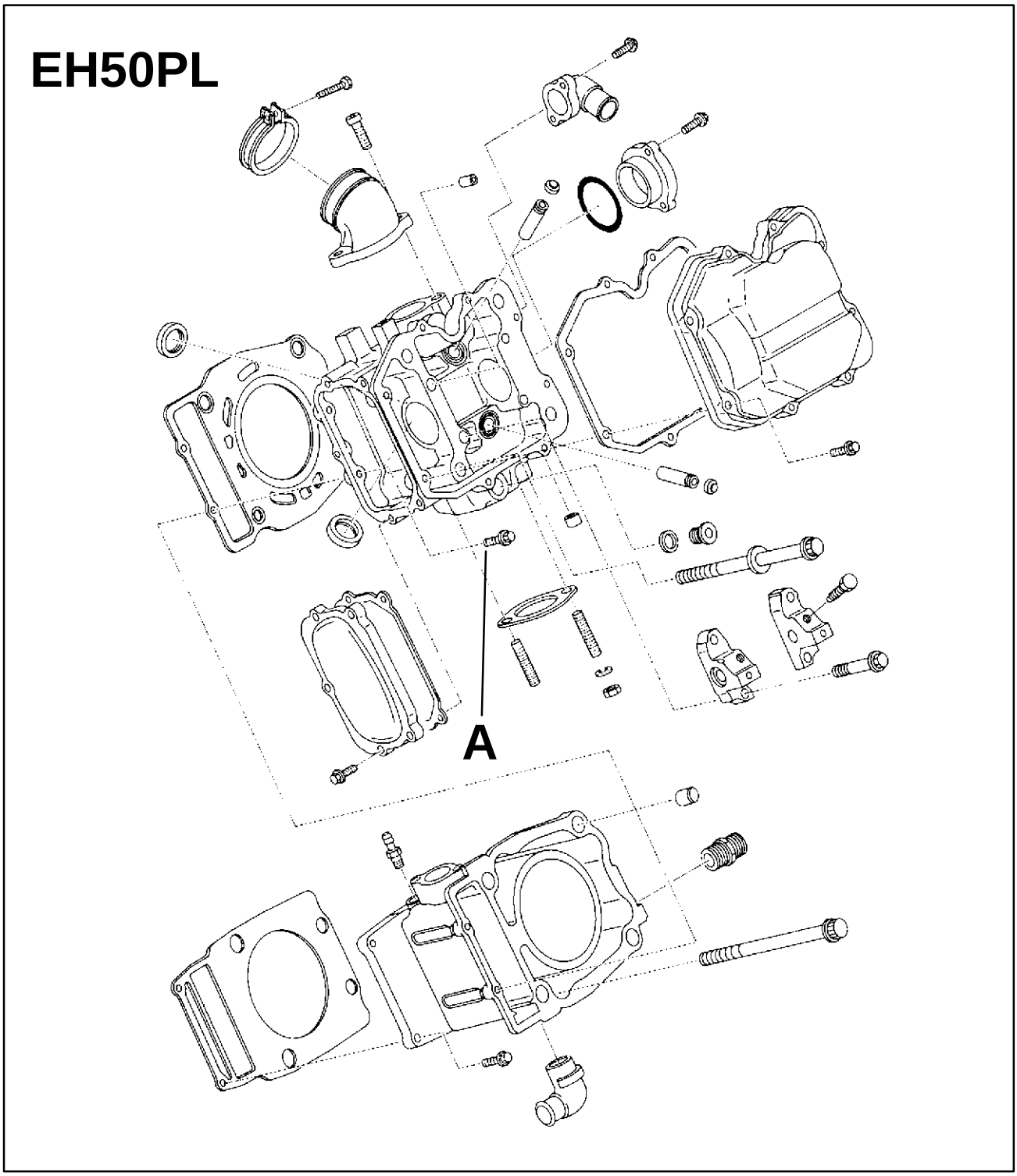
CYLINDER HEAD EXPLODED VIEW, EH50PL



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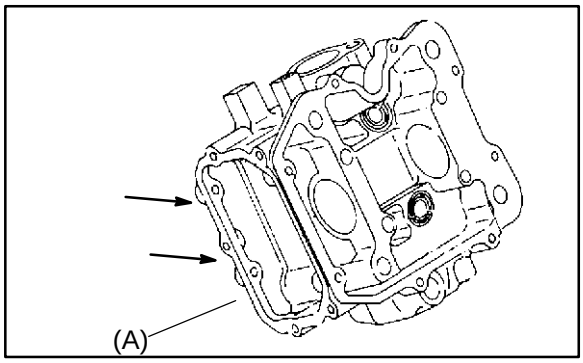
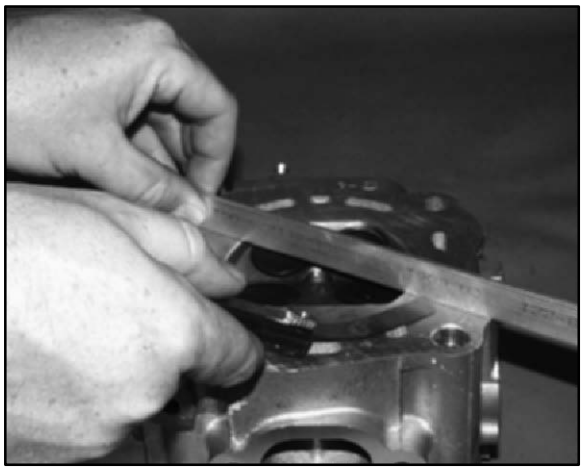
CYLINDER HEAD INSPECTION



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

CYLINDER HEAD WARPAGE



Cylinder Head Warpage Limit:

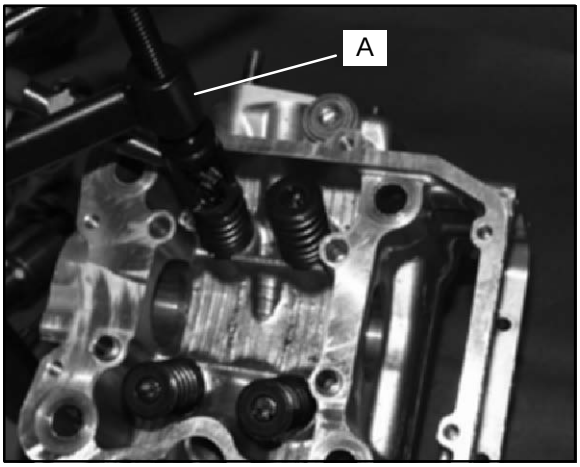
.002″ (.05 mm)

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

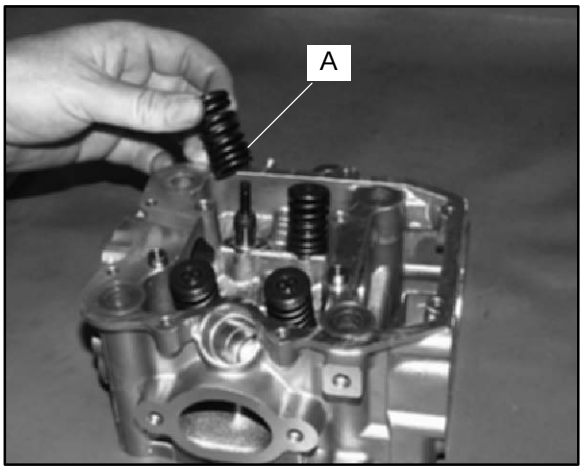
CYLINDER HEAD DISASSEMBLY

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

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



1. Using a valve spring compressor (A), compress the valve spring and remove the ssdplit keeper. **NOTE:** To prevent loss of tension, do not compress the valve spring more than necessary.



2. Remove spring retainer and spring.

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

3. Push valve out, keeping it in order for reassembly in the same guide.
4. Measure free length of spring with a Vernier caliper. Check spring for squareness. Compare

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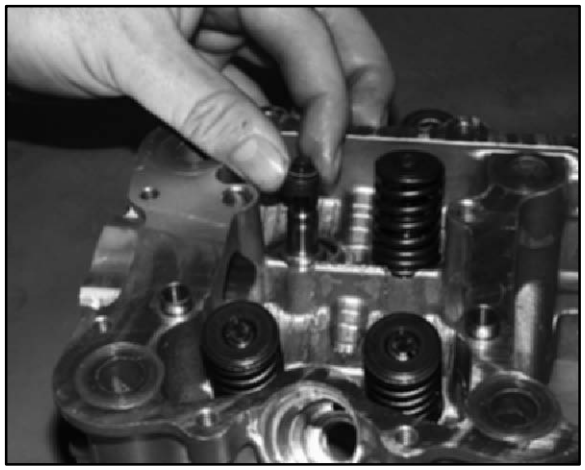
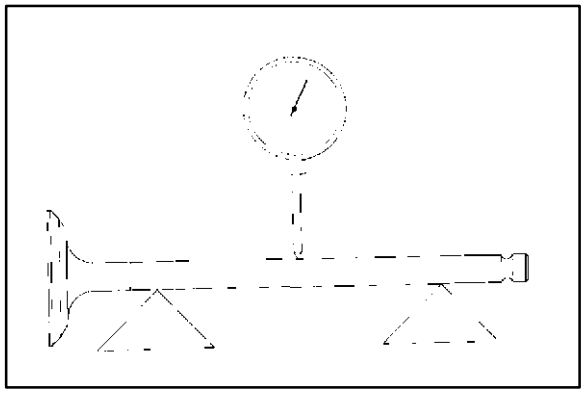
to specifications. Replace spring if either measurement is out of specification



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

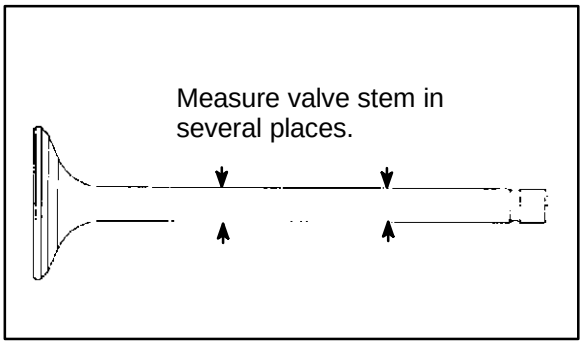
VALVE INSPECTION

1. Remove all carbon from valve with a soft wire wheel.



2. Check valve face for runout, pitting, and burnt spots. To check for bent valve stems, mount valve in a drill or use “V” blocks and a dial indicator.

3. Check end of valve stem for flaring, pitting, wear or damage (A).
4. Inspect split keeper groove for wear or flaring of the keeper seat area (B). **NOTE:** The valves cannot be re-faced or end ground. They must be replaced if worn, bent, or damaged.



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

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

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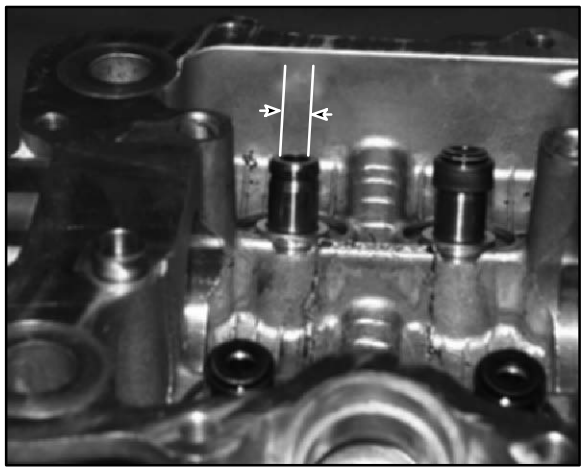

Valve Guide I.D.:
.2362-.2367″ (6.0-6.012 mm)

6. Measure valve guide inside diameter at the top middle and end of the guide using a small hole gauge and a micrometer. Measure in two directions, front to back and side to side.
7. Subtract valve stem measurement to obtain stem to guide clearance. **NOTE:** Be sure to measure each guide and valve combination individually.
8. Replace valve and/or guide if clearance is excessive. Compare to specifications.

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

COMBUSTION CHAMBER

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

VALVE SEAT RECONDITIONING

Valve Seat Inspection

Inspect valve seat in cylinder head for pitting, burnt spots, roughness, and uneven surface. If any of the above conditions exist, the valve seat must be reconditioned. See Valve Seat Reconditioning, Page 3.25. *If the valve seat is cracked the cylinder head must be replaced.*

Cylinder Head Reconditioning

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

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

Valve Guide Removal/Installation

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

VALVE SEAT RECONDITIONING, CONT.

Follow the manufacturers instructions provided with the valve seat cutters in the Valve Seat Reconditioning Kit (**PN 2200634**). Abrasive stone seat reconditioning equipment can also be used. Keep all valves in order with their respective seat.

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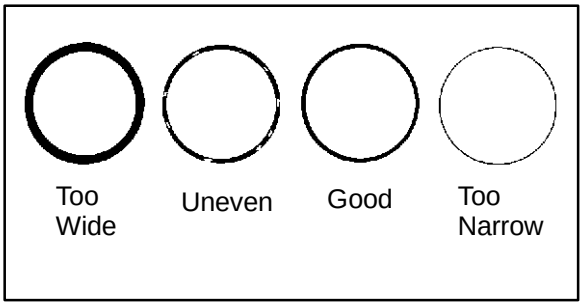
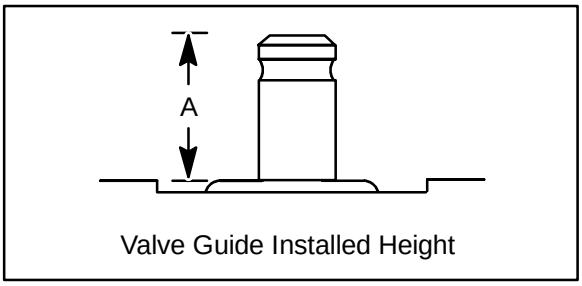


NOTE: Valve seat width and point of contact on the valve face is very important for proper sealing. The valve must contact the valve seat over the entire circumference of the seat, and the seat must be the proper width all the way around. If the seat is uneven, compression leakage will result. If the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

1. When thoroughly heated, place cylinder head on blocks of wood which will allow the old guides to be removed.
2. Using valve guide driver, drive guides out of the cylinder head from the combustion chamber side. Be careful not to damage guide bore or valve seat when removing guides.
3. Place cylinder head on cylinder head table. **NOTE:** Be sure cylinder head is still at 212° F (100° C) before installing new guides.

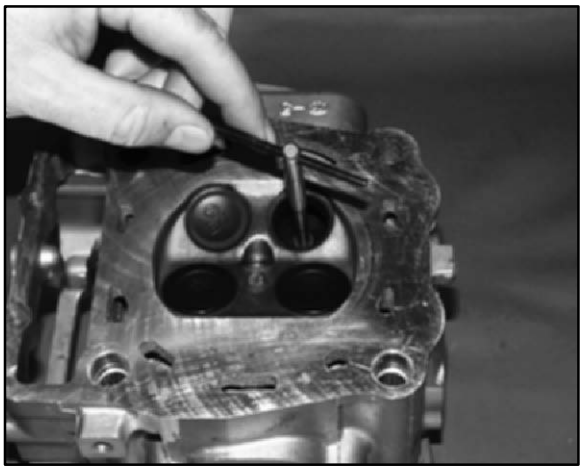


Valve Guide Installed Height

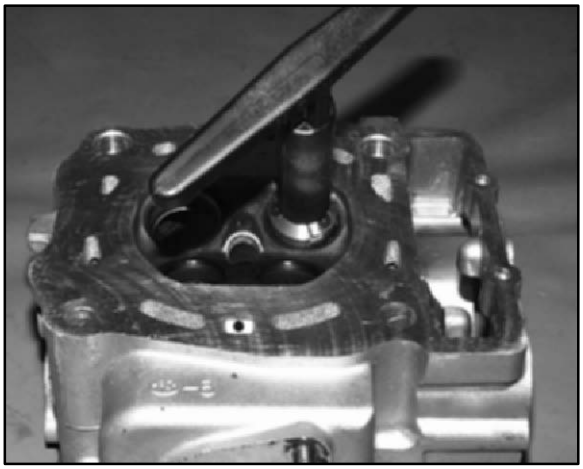
Valve Guide Height:
.689-.709″ (17.5-18.0 mm)

4. Place a new guide in the valve guide installation tool and press guide in to proper depth. Check height of each guide above the cylinder head (A). **NOTE:** The guide can also be driven in to the proper depth. Inspect the guide closely for cracks or damage if a driver is used.

Reaming The Valve Guide



5. Allow cylinder head to cool to room temperature. Apply cutting oil to the reamer. Guides should be reamed from the valve spring side of the cylinder head. Ream each guide to size by turning the reamer clockwise continually. Continue to rotate reamer clockwise during removal of the tool.
6. Clean guides thoroughly with hot soapy water and a nylon brush. Rinse and dry with compressed air. Apply clean engine oil to guides.
7. Install pilot into valve guide.
8. Apply cutting oil to valve seat and cutter.



9. Place 46° cutter on the pilot and make a light cut.
10. Inspect the cut area of the seat.
    - If the contact area is less than 75% of the circumference of the seat, rotate the pilot 180° and make another light cut.
    - If the cutter now contacts the uncut portion of the seat, check the pilot. Look for burrs, nicks, or runout. If the pilot is bent it must be replaced.

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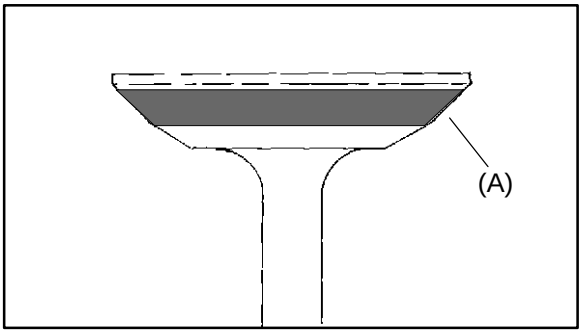
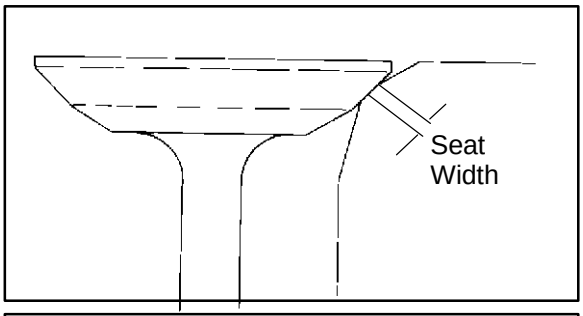
- If the contact area of the cutter is in the same place, the valve guide is distorted from improper installation and must be replaced. Be sure the cylinder head is at the proper temperature and replace the guide.
- If the contact area of the initial cut is greater than 75%, continue to cut the seat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

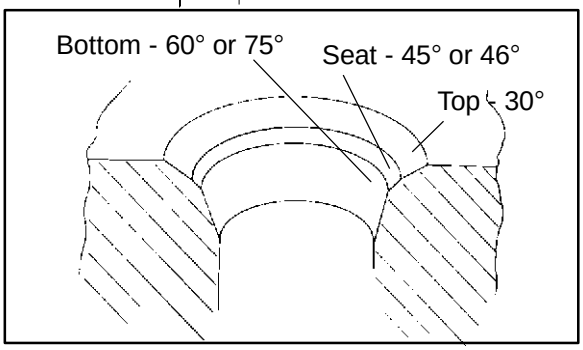


11. To check the contact area of the seat on the valve face, apply a thin coating of Prussian Blue™ paste to the valve seat. If using an interference angle (46°) apply black permanent marker to the entire valve face (A).
12. Insert valve into guide and tap valve lightly into place a few times.
13. Remove valve and check where the Prussian Blue™ indicates seat contact on the valve face. The valve seat should contact the middle of the valve face or slightly above, and must be the proper width.
    - If the indicated seat contact is at the top edge of the valve face and contacts the margin area(B) 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.

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

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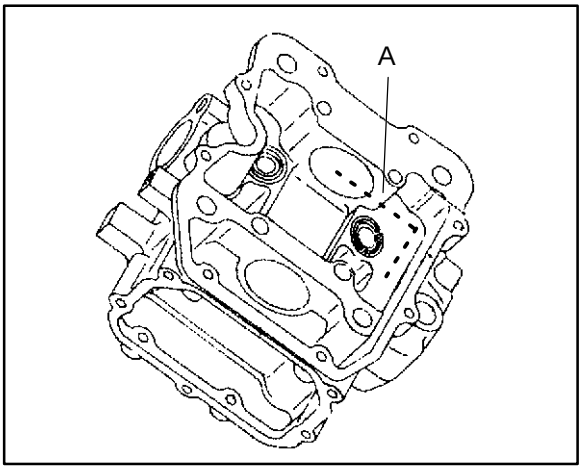
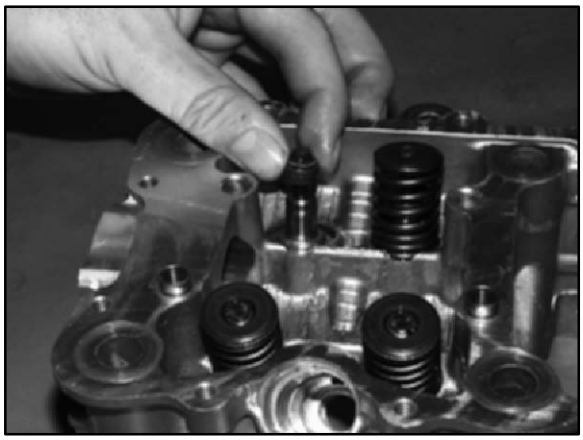


18. Clean cylinder head, valves, and camshaft oil supply passage (A) thoroughly.
19. If oil passage blind plug was removed, apply Crankcase Sealant (**PN 2871557**) or equivalent sealer to the threads and install, torquing to 8 ft. lbs. (11 Nm). **CAUTION:** Do not allow sealant to enter oil passage.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

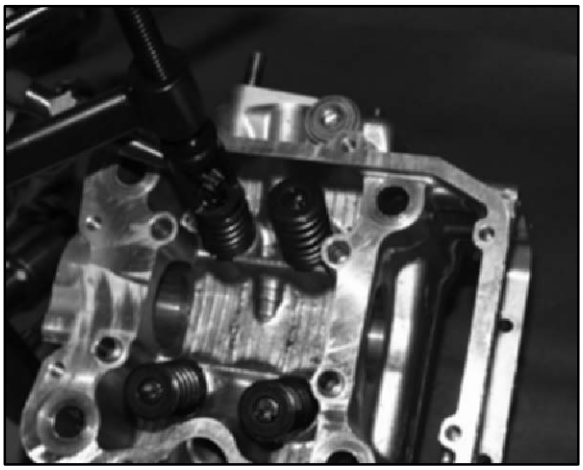
CYLINDER HEAD ASSEMBLY

CAUTION: Wear eye protection during assembly.

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



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



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

VALVE SEALING TEST

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

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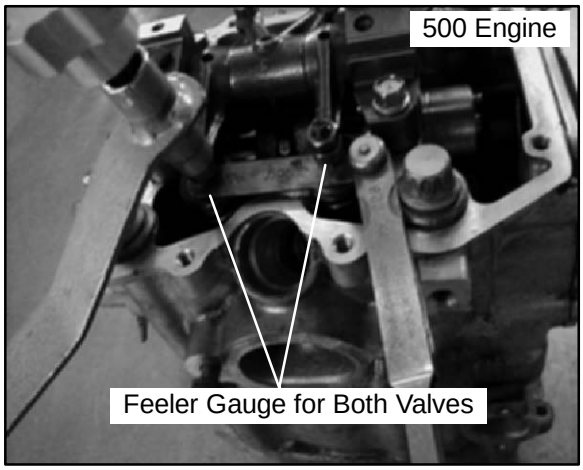
EXHAUST VALVE CLEARANCE ADJUSTMENT



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

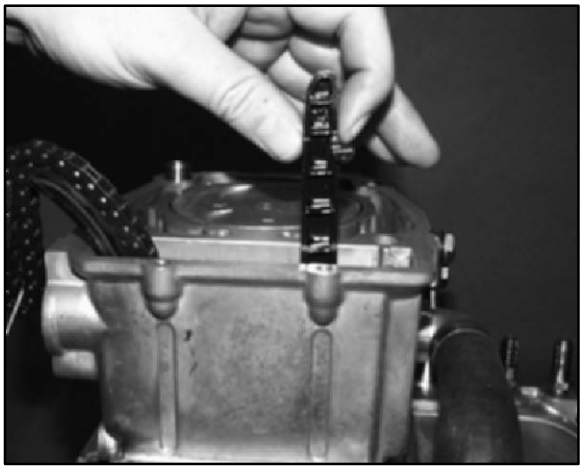
1. Insert .006 feeler gauge(s) between end of exhaust valve stem and adjuster screw(s).
2. Loosen locknut(s) and turn adjuster screw(s) until there is a slight drag on feeler gauge(s). The Valve/Clutch Adjuster Tool **(PA-44689)** can be used to adjust the 500 engines valves. **NOTE:** Both feeler gauges should remain inserted during adjustment of each valve.

EXHAUST VALVE CLEARANCE
.006″ (.15 mm)

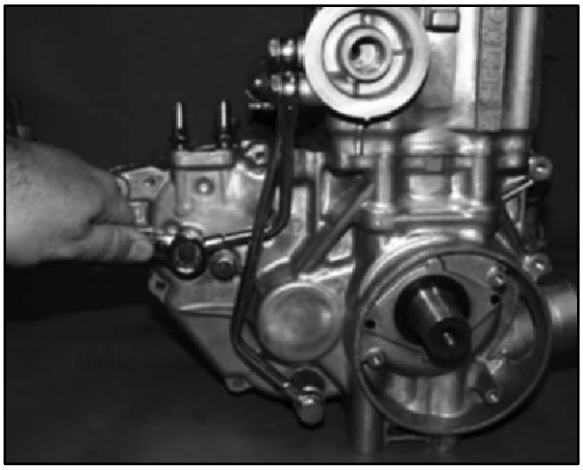
3. When clearance is correct, hold adjuster screw and tighten locknut securely
4. Re-check the valve clearance.
5. Repeat adjustment procedure if necessary until clearance is correct with locknut secured.

CYLINDER/PISTON REMOVAL AND INSPECTION

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



1. Remove cam chain guide at front of cylinder.



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

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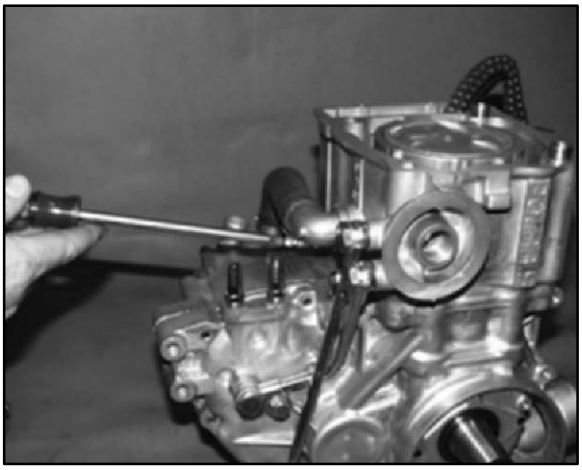


3. Loosen hose clamps and remove coolant inlet hose.
4. Remove the two 6 mm cylinder base bolts.

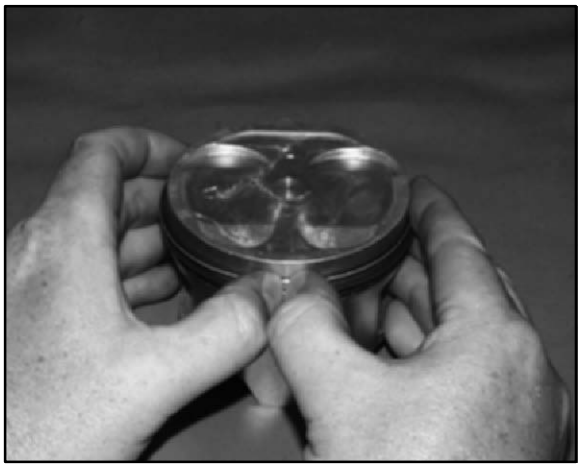
5. Loosen each of the four large cylinder base bolts 1/4 turn at a time in a criss-cross pattern until loose and remove bolts.

NOTE: The bolts are inside the water jacket.

6. Tap cylinder lightly with a plastic hammer in the reinforced areas only until loose.
7. Rock cylinder forward and backward and lift it from the crankcase, supporting piston and connecting rod. Support piston with Piston Support Block **(PN 2870390**).
8. Remove dowel pins from crankcase.

PISTON REMOVAL

1. Remove circlip. Note piston directional arrow pointing toward the right (Mag) side of engine.
2. Remove piston circlip and push piston pin out of piston. If necessary, heat the crown of the piston *slightly* with a propane torch. **CAUTION:** Do not apply heat to the piston rings. The ring may lose radial tension.



3. Remove top compression ring.

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

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

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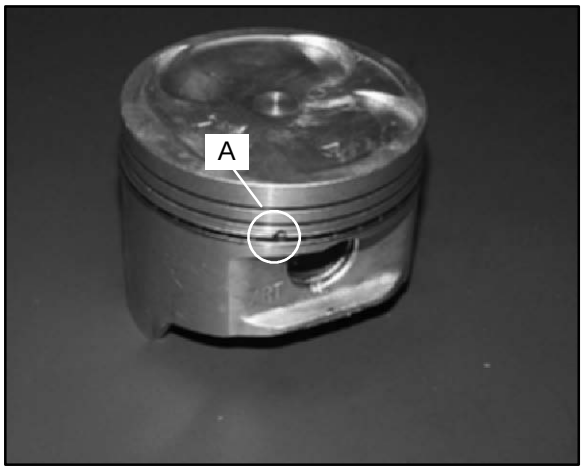
scratch the ring lands.



4. Repeat procedure for second ring.

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

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

CYLINDER INSPECTION

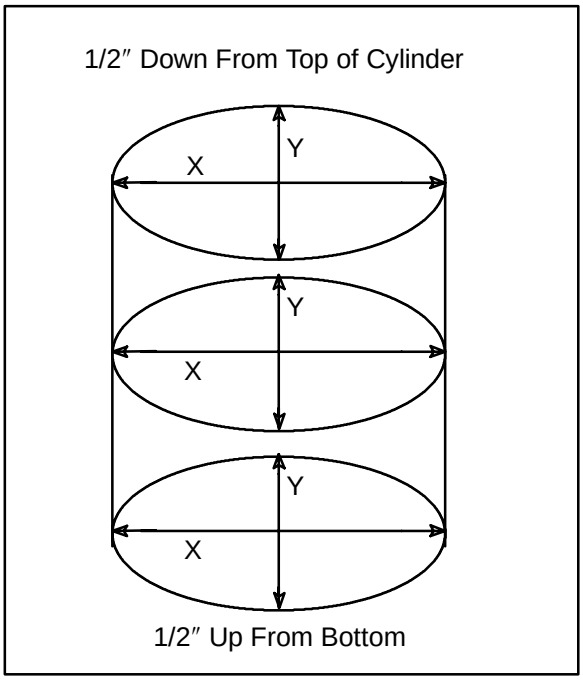
1. Remove all gasket material from the cylinder sealing surfaces.

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

Cylinder Warpage:

.002″ (.05 mm)

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



4. Inspect cylinder for taper and out of round with a telescoping gauge or a dial bore gauge. Measure in two different directions, front to back and side to side, on three different levels (1/2″ down from top, in the middle, and 1/2″ up from bottom).
5. Record measurements. If cylinder is tapered or out of round beyond .002, the cylinder must be re-bored oversize, or replaced.

Cylinder Taper
Limit: .002 Max.
Cylinder Out of Round
Limit: .002 Max.

Standard Bore Size:

3.6221-3.6228″ (92.00-92.012mm)

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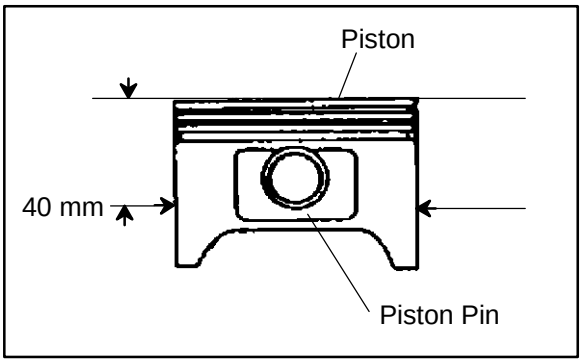
PISTON-TO-CYLINDER CLEARANCE



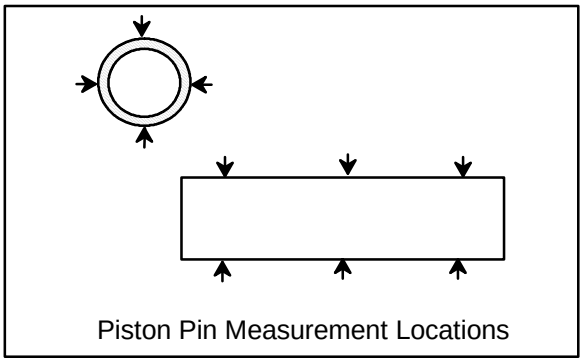
1. Measure piston outside diameter at a point 40 mm down from the top of the piston at a right angle to the direction of the piston pin.
2. Subtract this measurement from the maximum cylinder measurement obtained in Step 5 above.

Piston to Cylinder Clearance

Std: .0006-.0018″ (.015-.045 mm)

Piston O.D.:

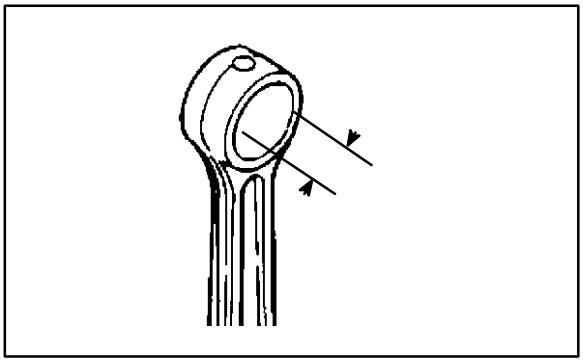
Std: 3.6204-3.6215″ (91.970-91.985 mm)



Piston Pin Measurement Locations

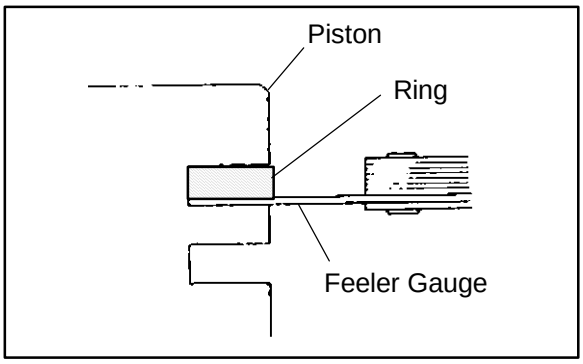
Piston Pin O.D.

.9053-.9055″ (22.994-23.0 mm)

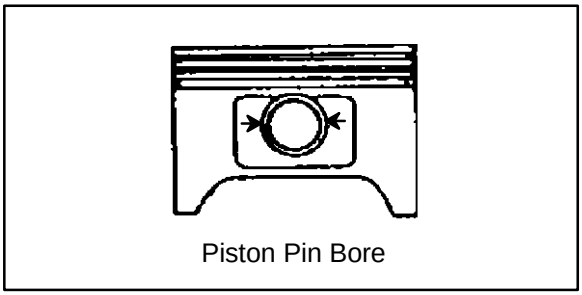


2. Measure piston pin O.D. Replace piston and/or piston pin if out of tolerance.

3. Measure connecting rod small end ID.



PISTON/ROD INSPECTION



Piston Pin Bore

Piston Pin Bore:

.9055-.9057″ (23.0-23.006 mm)

1. Measure piston pin bore.

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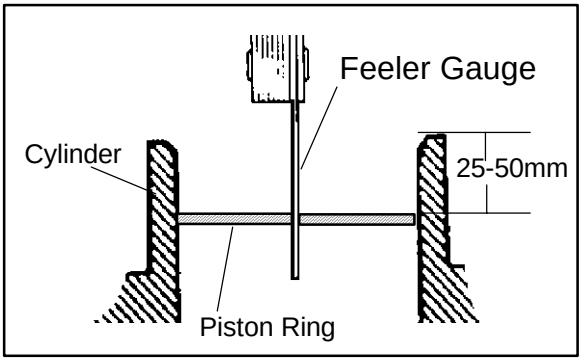
Piston Ring-to-Groove Clearance

Top Ring Std: .0016-.0031″ (.040-.080 mm)
Limit: .0059″ (15 mm)
Second Ring Std: .0012-.0028″ (.030-.070 mm)
Limit: .0059″ (15 mm)

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

PISTON RING INSTALLED GAP

1. Place each piston ring inside cylinder using piston to push ring squarely into place as shown at right.



Piston Ring Installed Gap

Top Ring
Std: .0079-.0138″ (.20-.36 mm)
Limit: .039″ (1.0 mm)
Second Ring
Std: .0079-.0138″ (.20-.36 mm)
Limit: .039″ (1.0 mm)
Oil Ring
Std: .0079-.0276″ (.20-.70 mm)
Limit: .059″ (1.5 mm)

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 gap is within specified range.

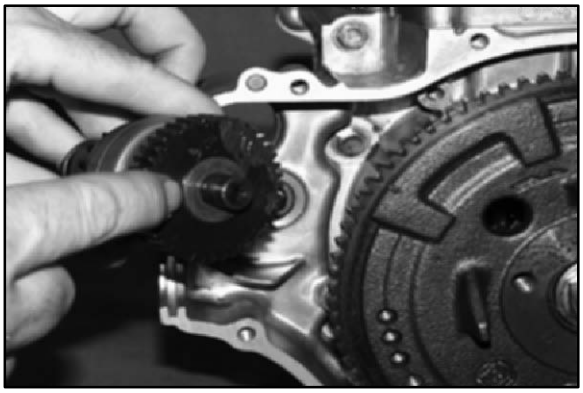
NOTE: Always check piston ring installed gap after re-boring a cylinder or when installing new rings. A re-bored cylinder should always be scrubbed thoroughly with hot soapy water, rinsed, and dried completely. Wipe cylinder bore with an oil rag immediately to remove residue and prevent rust.

CRANKCASE DISASSEMBLY

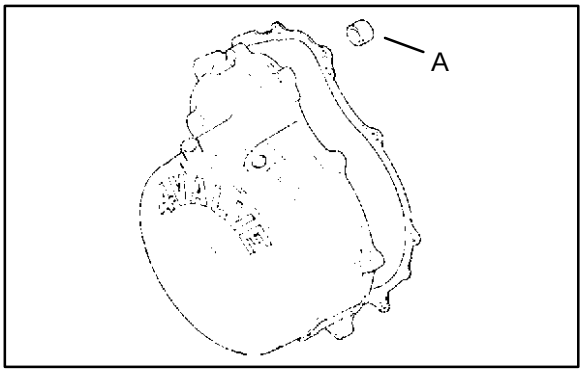
NOTE: The recoil starter, starter motor, starter drive, flywheel, stator, cam chain and sprockets can be serviced with the engine in the frame.

STARTER DRIVE REMOVAL/INSPECTION

1. Remove recoil housing bolts and remove housing.



2. Remove starter drive assembly. Note the thrust washer located at the rear of the drive mechanism.
3. Inspect the thrust washer for wear or damage and replace if necessary.



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

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

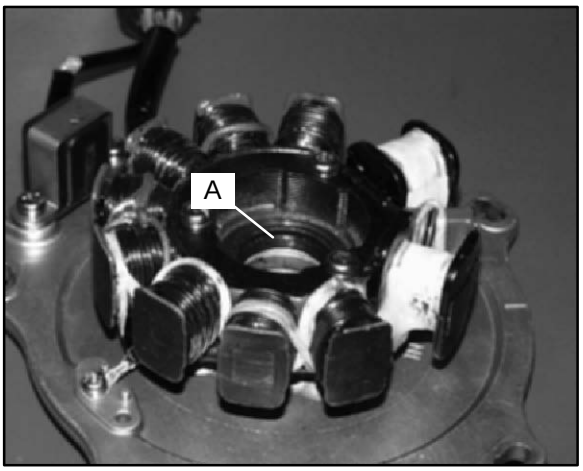
Starter Drive Bushing Clearance:
Std: .0015″-.004″ (.038-.102 mm)

Service Limit:
.008″ (.203 mm)

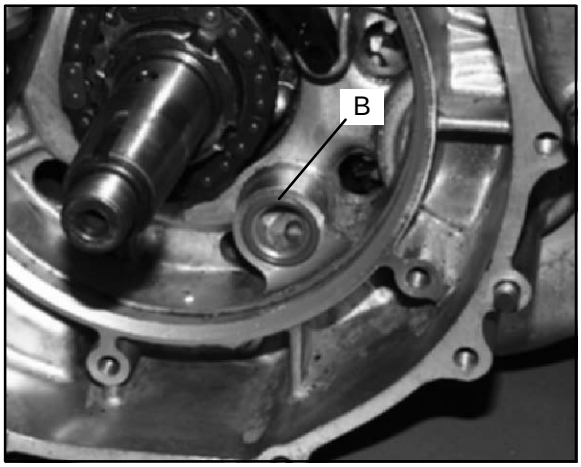
4. Measure the OD of the starter drive shaft on both ends and record.
5. Measure the ID of the bushing in the recoil housing (A) and in the crankcase and record. Measure in two directions 90° apart to determine if bushing is out of round. Calculate bushing clearance. Replace bushing if clearance exceeds the service limit.
6. Inspect gear teeth on starter drive. Replace starter drive if gear teeth are cracked, worn, or broken.

FLYWHEEL/STATOR REMOVAL/INSPECTION

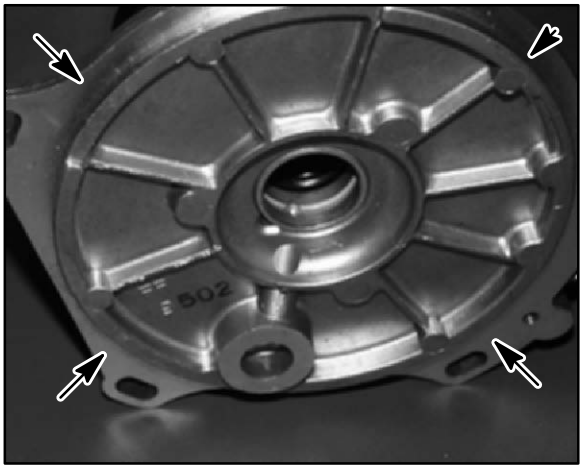
1. Remove flywheel nut and washer.
2. Install Flywheel Puller (**PN 2871043**) and remove flywheel. **CAUTION:** Do not thread the puller bolts into the flywheel more than 1/4″ or stator coils may be damaged.
3. Mark or note position of stator plate on crankcase.
4. Remove bolts and carefully remove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



5. Replace crankshaft seal (A).

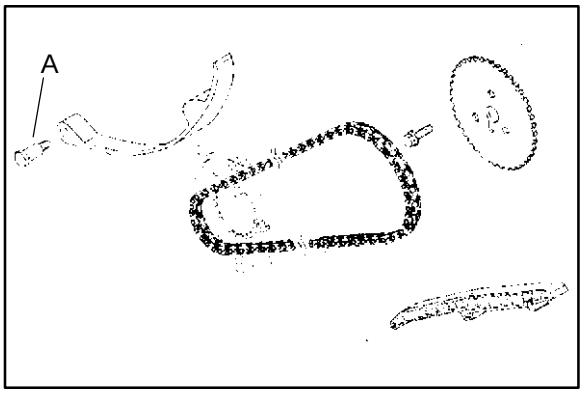


6. Remove oil passage O-Ring (B).



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

CAM CHAIN/TENSIONER BLADE



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

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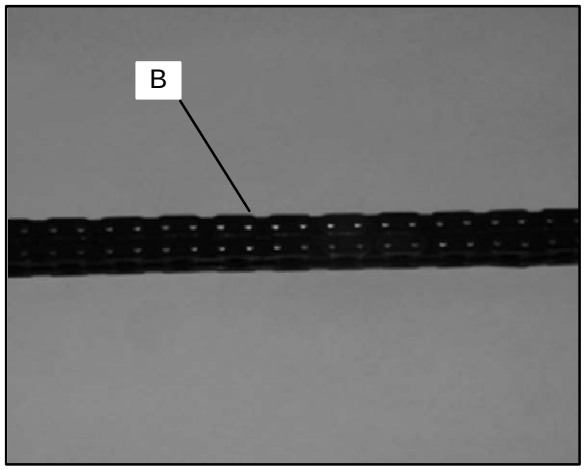
2. Remove blade and inspect for cracks, wear, or damage.



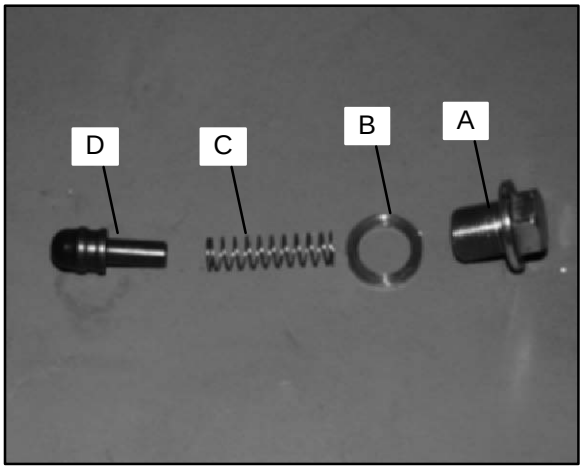
3. Remove cam chain (B). Inspect chain for worn or missing rollers or damage. Stretch chain tight on a flat surface and apply a 10 lb. (4.53 kg) load. Measure length of a 20 pitch section of chain. Replace if worn past service limit.

Chain Service Limit:
5.407″ (13.7 cm)

4. Using the special socket, remove the crankshaft slotted nut (A). **NOTE:** The slotted nut is a left hand thread.
5. Remove cam chain drive sprocket (B) and Woodruff key from crankshaft.
6. Inspect sprocket teeth for wear or damage.
7. Inspect Woodruff key for wear.
8. Replace any worn or damaged parts.

ONE WAY VALVE

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



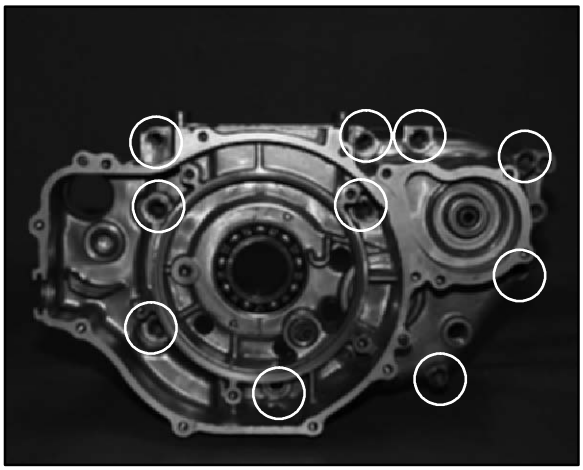
1. Remove cap bolt (A), sealing washer (B), spring (C), and one way valve (D) from PTO side crankcase.
2. Inspect free length of spring and check coils for distortion.

One Way Valve Spring Free Length:

Std: 1.450″ (3.68 cm)

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

CRANKCASE SEPARATION



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

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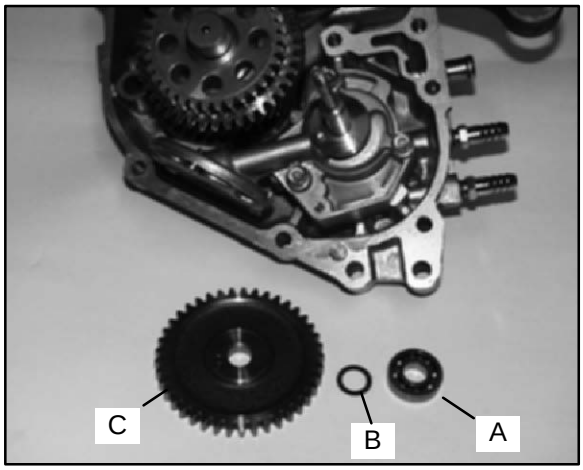
2. Separate crankcase by tapping with a soft faced hammer in reinforced areas.
3. Tap lightly on balancer gear with a brass drift through the hole in the crankcase if necessary, to ensure the balancer shaft stays in the PTO side crankcase. Watch the gap along the crankcase mating surface and separate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

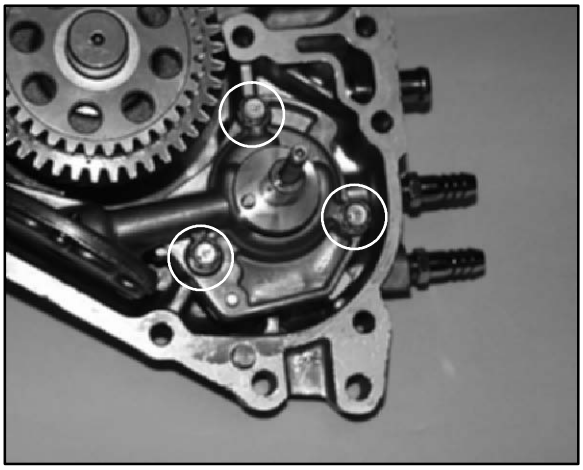
CAUTION: Do not strike the oil pump shaft at an angle or the shaft may bend, causing irreparable damage. Tap only *lightly* on the pump shaft if necessary.

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

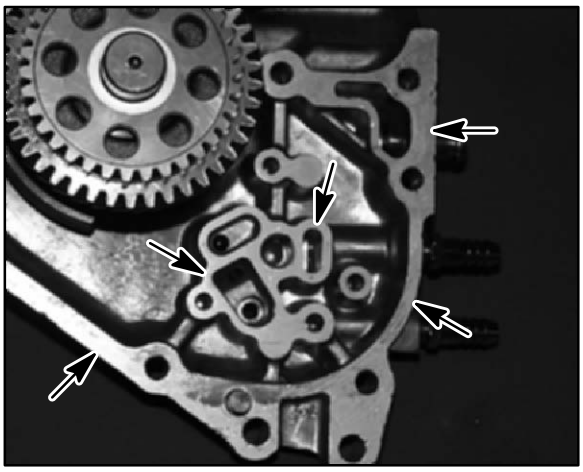
OIL PUMP REMOVAL/INSPECTION



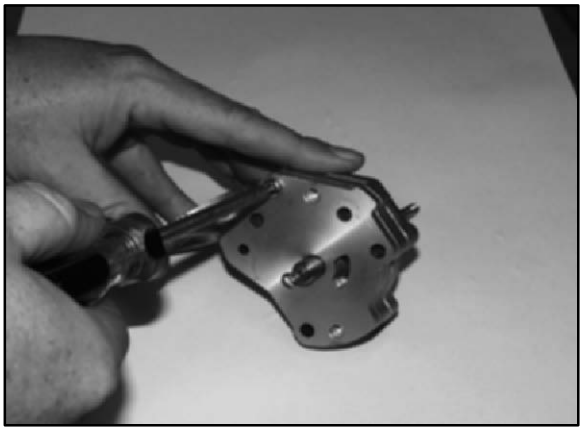
1. Remove pump shaft bearing (A) and thrust washer (B) from pump shaft.
2. Remove (2) bolts holding pump drive gear (C).
3. Inspect drive gear teeth for cracks, damage or excessive wear.



4. Remove three oil pump retaining bolts and pump.



5. Inspect mating surface of crankcase and oil pump. Check for nicks, burrs, or surface irregularities.
6. Remove the three screws and strainer screen from pump.
7. Clean screen thoroughly.



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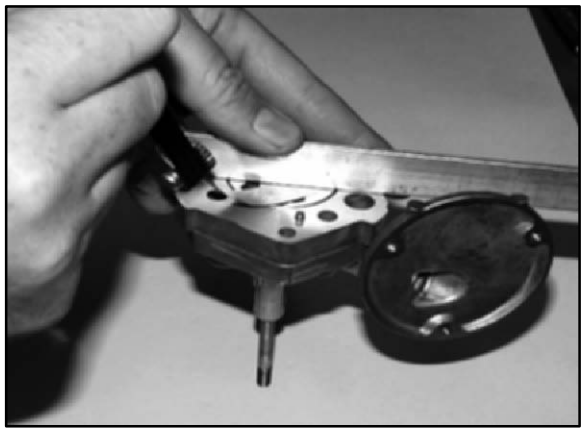
8. Remove pump body screw and feed chamber cover.



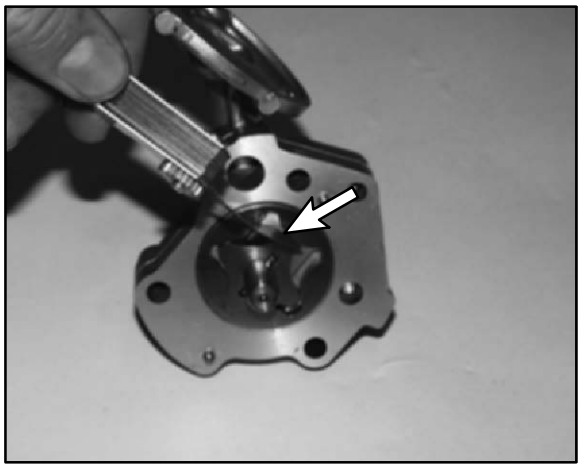
9. Measure pump end clearance using a feeler gauge and straight edge.

Pump End Clearance:

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

Wear Limit: .004 (.1016 mm)

10. Measure clearance between outer feed rotor and pump body with a feeler gauge.



Rotor Tip Clearance:

Std: .005 (.127 mm)

Wear Limit: .008 (.2032 mm)

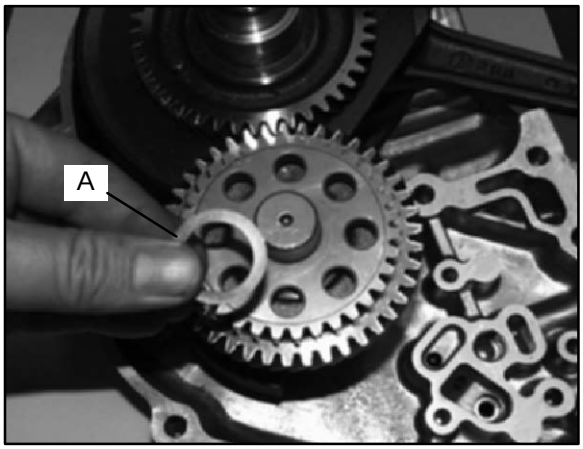
11. Measure rotor tip clearance with a feeler gauge.
12. Remove inner and outer feed rotor and pump chamber body.
13. Repeat measurements for scavenge rotor.
14. Remove inner and outer scavenge rotor and inspect pump shaft for wear.

OIL PUMP ASSEMBLY

1. Clean and dry all parts thoroughly. Apply clean engine oil to all parts. *Do not* use gasket sealer on the pump body mating surfaces or oil passages will become plugged.
2. Install pump shaft and scavenge rotor drive pin.
3. Install outer scavenge rotor, inner scavenge rotor, and scavenge casing.
4. Install outer feed rotor and inner feed rotor drive pin.
5. Install inner feed rotor and feed chamber cover with screw.
6. Tighten screw securely.
7. Install screen on pump body.
8. Install oil pump on crankcase and torque bolts to 6 ft. lbs. (8 Nm).

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

COUNTER BALANCERSHAFT REMOVAL/INSPECTION



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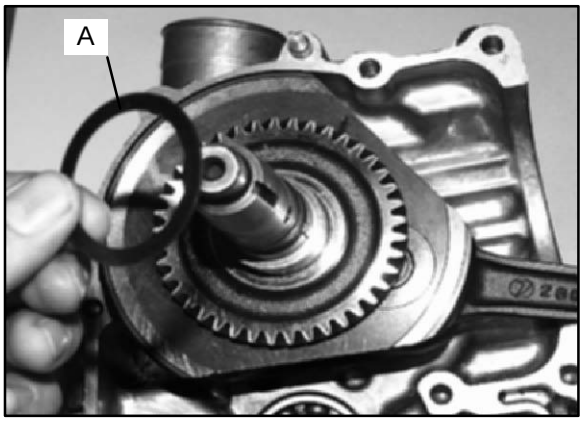
1. Remove the shim washer (A) from the counter balancer shaft.

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

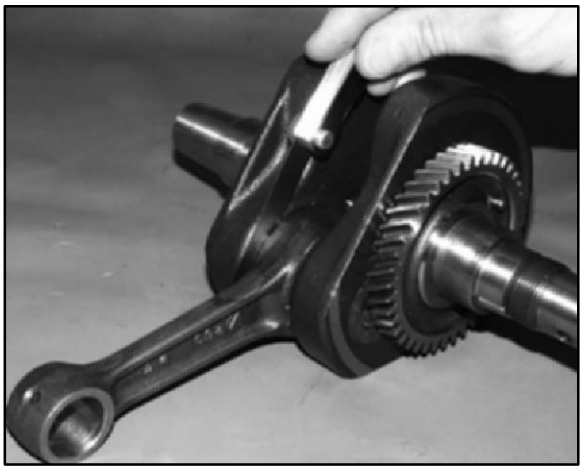
3. Turn the shaft until balancer counter weights clear the crankshaft and remove the balancer shaft from the crankcase.
4. Inspect the balancer drive gear and pump shaft drive gear.
5. Replace the shaft if gear teeth are abnormally worn or damaged.
6. Inspect the balancer shaft bearings.

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

CRANKSHAFT REMOVAL/INSPECTION



1. Remove the shim washer (A) from the crankshaft.
2. Support the PTO side crankcase and crankshaft; press the crankshaft out. Be careful not to damage the crankcase mating surface or connecting rod.



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

Connecting Rod Big End Side Clearance:

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

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

Max Runout: .0024″ (.06 mm)

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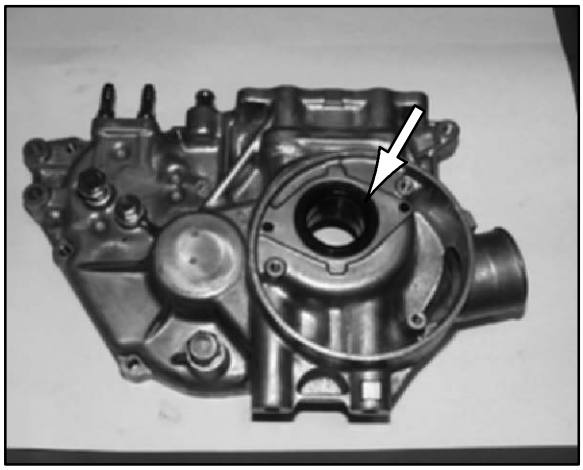
5. Measure the connecting rod big end radial clearance.

Big End Radial Clearance:

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

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

CRANKCASE BEARING INSPECTION



1. Remove the seal from the PTO side crankcase.
2. Inspect the crankshaft main bearings, balancer shaft bearings, and pump shaft bearing.

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

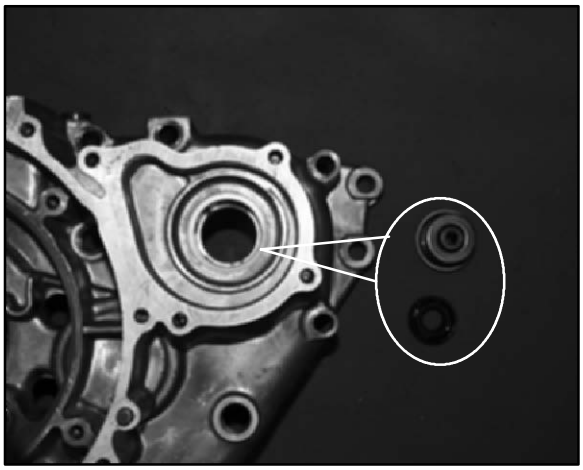
3. Support the crankcase and drive or press the main bearings out of each crankcase.
4. To remove balancer shaft bearings and pump shaft bearing use a blind hole bearing puller.

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

PUMP SHAFT OIL SEAL/ WATER PUMP MECHANICAL SEAL REMOVAL (ENGINE DISASSEMBLED)

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

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



1. Remove the pump shaft bearing from the Magneto (right hand) side crankcase.
2. Pry out the oil seal, noting the direction of installation with the spring side facing IN (toward inside of case).
3. Drive the water pump mechanical seal out of the crankcase from inside to outside. Note: The new mechanical seal must be installed after the crankcases are assembled, using a special tool. See Mechanical Seal Installation.

CRANKCASE INSPECTION

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

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BEARING INSTALLATION

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

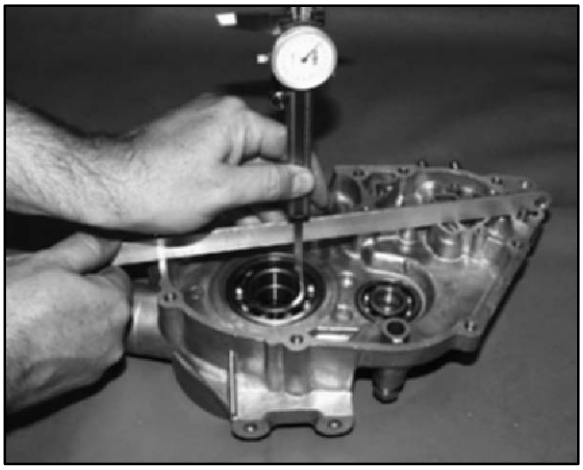
1. Install the bearings so the numbers are visible.
2. Drive or press new bearings into the crankcases, using the proper driver. **CAUTION:** Press only on outer race of bearing to prevent bearing damage.
   - 70 mm (2.755″) driver- For crankshaft main bearings.
   - 46 mm (1.810″) For counter balancer bearings.
   - 28 mm (1.100″) For pump shaft bearing.

END PLAY INSPECTION/ADJUSTMENT

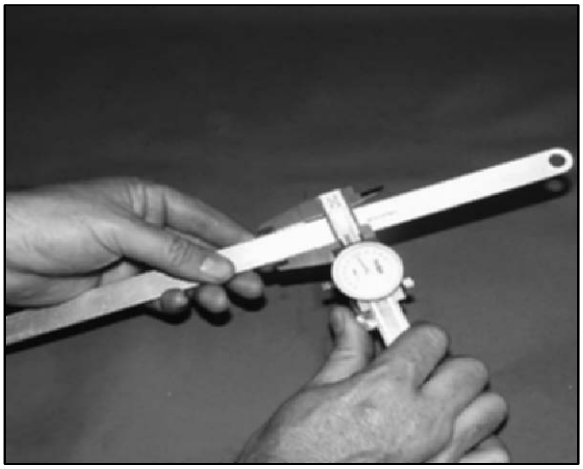
Before reassembling the crankcase,the following steps should be performed to determine the amount of crankshaft, counter balancer shaft, and pump shaft end play. Excessive end play may cause engine noise at idle and slow speeds. Too little play will side load the bearings which may lead to premature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

CRANKSHAFT END PLAY ADJUSTMENT

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



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



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

PTO Case Depth_____

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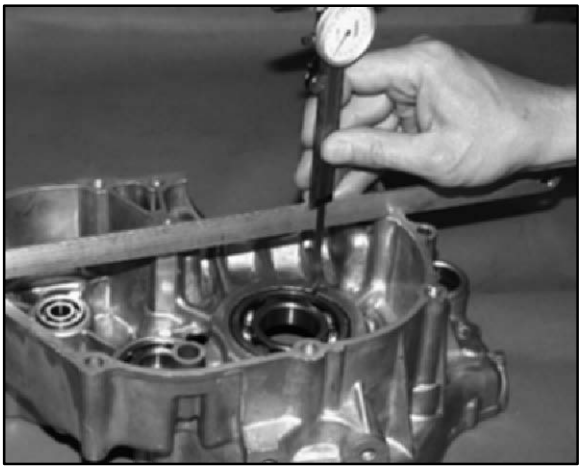
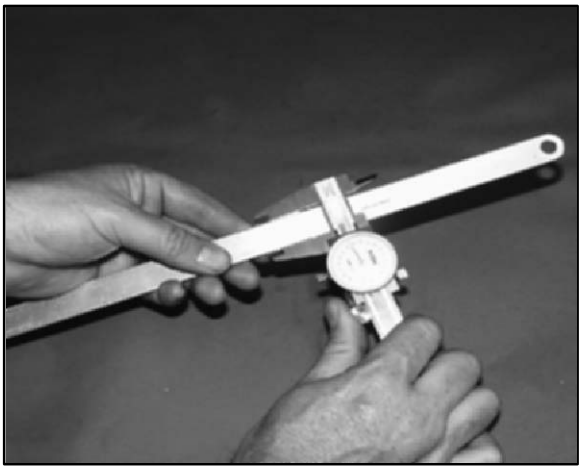


4. Measure the distance from the Magneto crankcase mating surface to the main bearing using the same method and record.

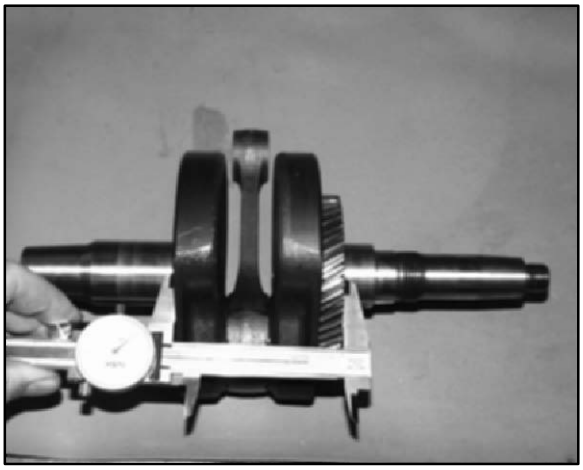


5. Subtract the thickness of the straightedge from the measurement obtained in Step 4 and record.

Mag Case Depth_____

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

Total Case Width_____



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

Crankshaft Width_____

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

Total End Play_____

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

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

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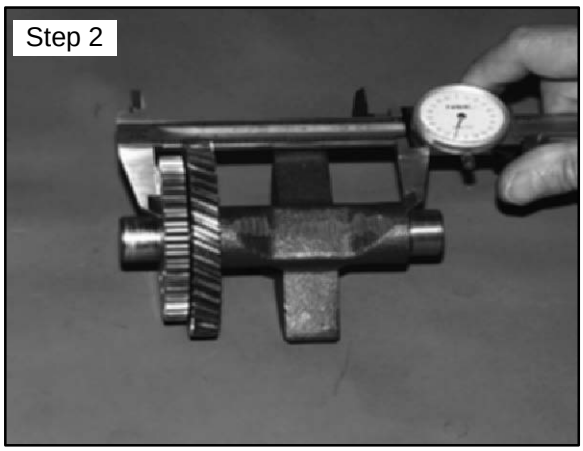
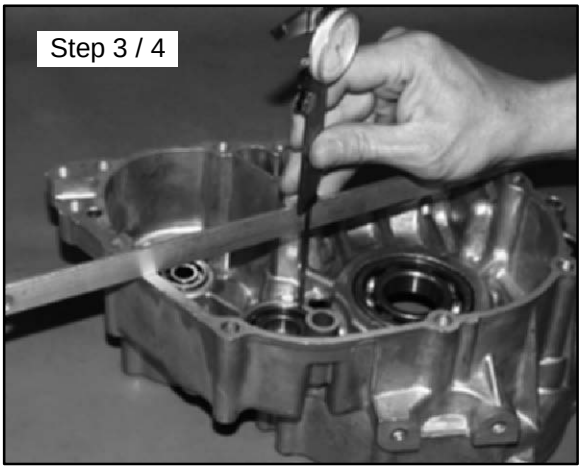
COUNTER BALANCER SHAFT END PLAY ADJUST.



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



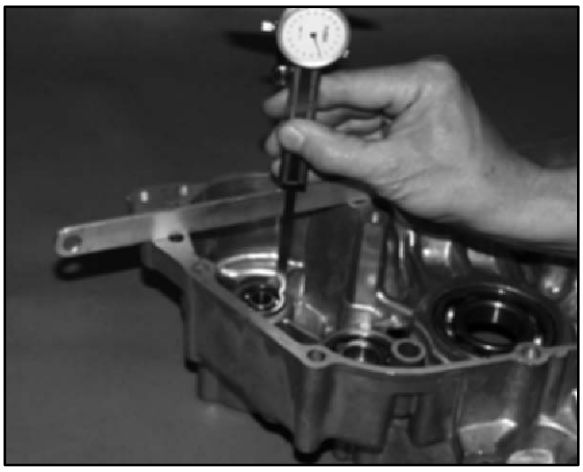
3. Measure the distance from the Mag crankcase mating surface to the balance shaft bearing using a dial caliper and a straight edge. Subtract the thickness of the straightedge and record.
4. Measure the distance from the PTO crankcase mating surface to the bearing using the same method outlined in Step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

Counter Balancer Shaft End Play:

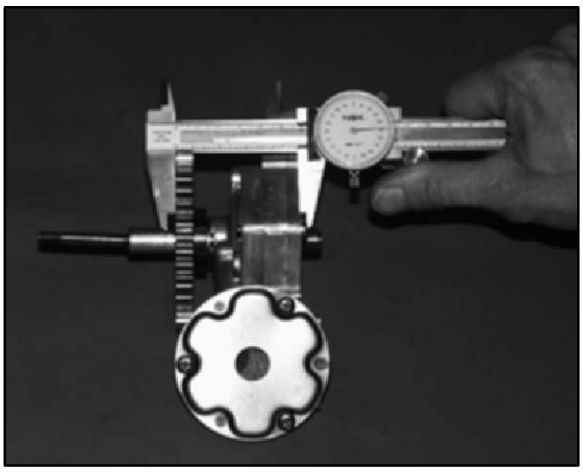
.008″-.016″ (.02-.04 cm)

OIL PUMP SHAFT END PLAY ADJUSTMENT

1. Make sure the pump shaft bearing is firmly seated in the Magneto side crankcase.



2. Measure the distance from the magneto crankcase mating surface to the bearing using a dial caliper and a straight edge. Subtract the thickness of the straightedge and record.



3. Install the gear on the oil pump and measure the width of the pump and gear. Subtract this measurement from the measurement recorded in Step 2.
4. Subtract the thickness of the existing shim from the result of Step 3 to determine if a different shim is needed. See Shaft End Play Spec. next page.

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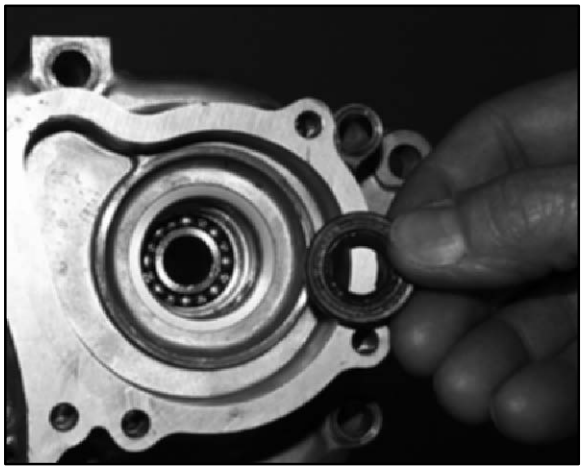
Pump Shaft End Play:

.008″-.016″ (.02-.04 cm)

PUMP SHAFT OIL SEAL INSTALLATION



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

CRANKSHAFT/COUNTER BALANCE/OIL PUMP INSTALLATION

Lubricate all bearings with clean engine oil before assembly.

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

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

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

NOTE: After engine is assembled and machine is readied for field operation, oil pump MUST be primed. Follow oil pump priming procedure on Page 3.10.

Oil Pump Bolt Torque:

6. ft. lbs. (8 Nm)

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

CRANKCASE ASSEMBLY

1. Apply Crankcase Sealant (**PN 2871557**) to the crankcase mating surfaces. Be sure the alignment pins are in place.
2. Set the crankcase in position carefully to avoid damaging the pump shaft seal, and install the magneto end crankshaft installation tool (follow instructions provided with the Crankshaft/Water Pump Installation Kit **(PN 2871283)**. Draw the crankcase halves together by tightening the nut on the tool and tapping lightly in the pump shaft area with a soft faced hammer to maintain alignment. Continually check alignment of the cases during installation, closing the gap equally until the surfaces are tightly seated.
3. Remove the tool.
4. Install the crankcase flange bolts and tighten in 3 steps following the pattern on Page 3.4 to specified torque.

Crankcase Bolt Torque:

14 ft. lbs. (19 Nm)

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Crankcase Sealant:

(PN 2871557)

WATER PUMP MECHANICAL SEAL INSTALLATION

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

WATER PUMP MECHANICAL SEAL REMOVAL - ENGINE INSTALLED

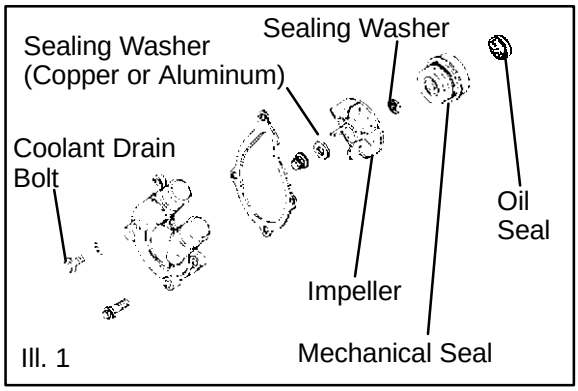
Water Pump Mechanical Seal Puller: (PN 2872105)

Replacement T-Handle: (PN 2872106)

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

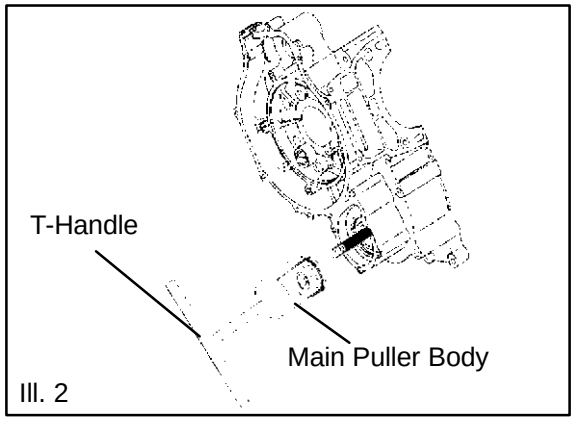
CAUTION:

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



Ill. 1

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



Ill. 2

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

3. nsert 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. Ill. 3

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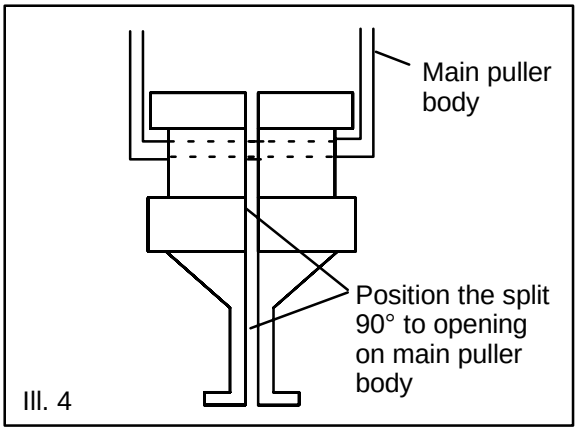
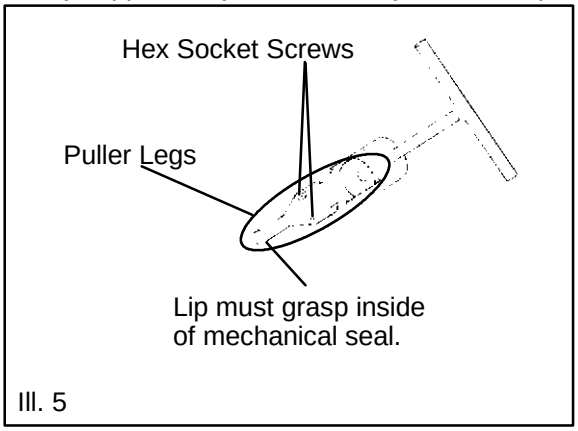


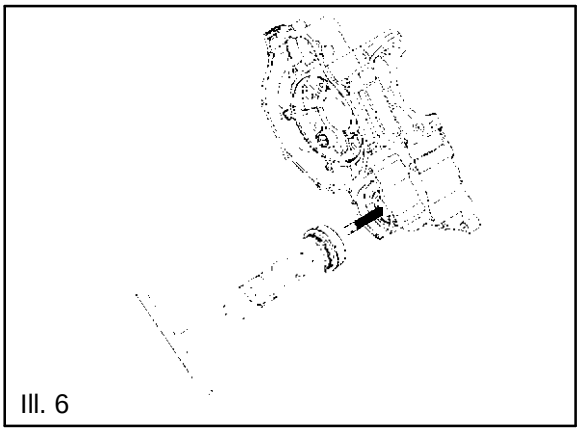
Ill. 4

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



Ill. 5

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


Ill. 6

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

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

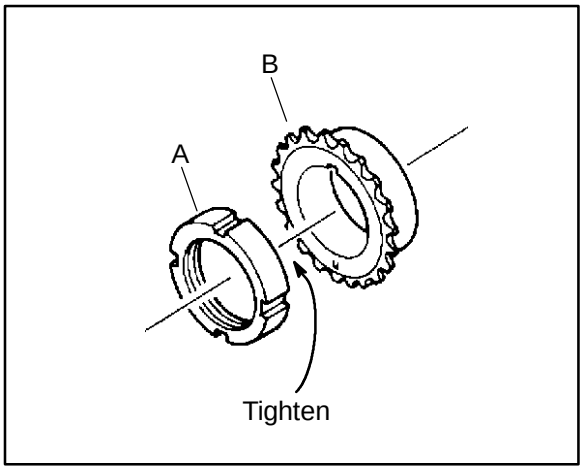
ONE WAY VALVE INSTALLATION

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

One Way Valve Plug Torque:

16 ft. lbs. (22 Nm)

CAM CHAIN DRIVE SPROCKET INSTALLATION



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

Slotted Nut Torque:

35-51 ft. lbs. (4.71-6.86 kg-m)

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TENSIONER BLADE INSTALLATION

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

Tensioner Blade Mounting Bolt Torque:

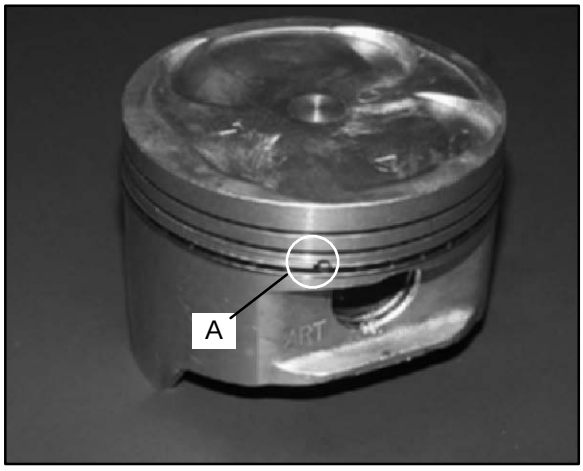
6 ft. lbs. (8 Nm)

PISTON RING INSTALLATION

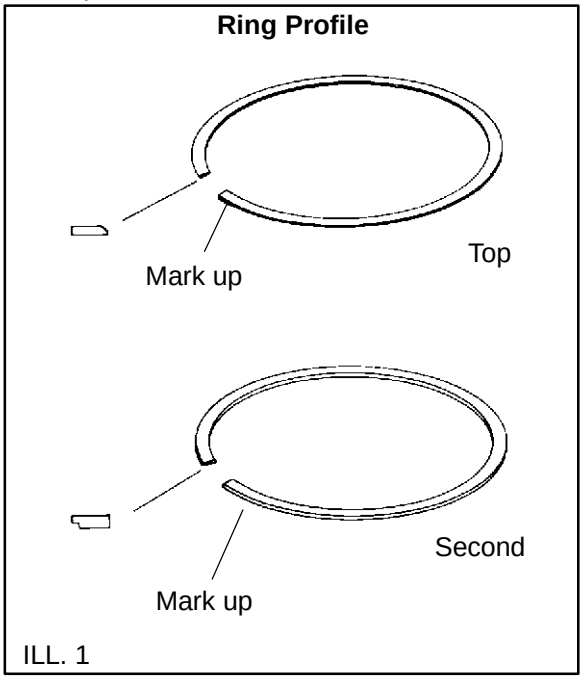
NOTE: Apply clean engine oil to all ring surfaces and ring lands. Always check piston ring installed gap before rings are installed on piston. See Page 3.30. If the piston has been in service clean any accumulated carbon from the ring grooves and oil control ring holes.

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

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



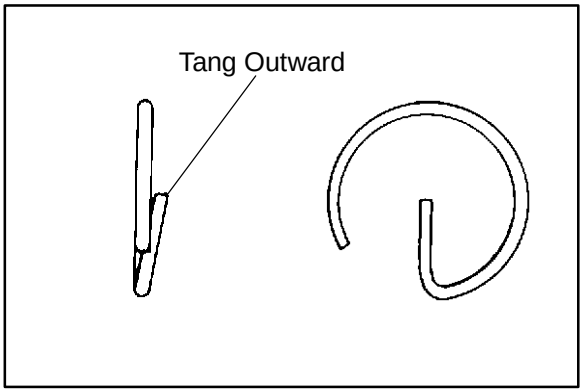
3. Install the bottom rail with the gap at least 30° from the end of the expander on the side opposite the top rail gap.(See ILL. 1).
4. Install the second ring with the "R" mark facing up. Position the end gap toward the rear (intake) side of the piston.
5. Install the top ring (chrome faced) with the "R" mark facing up and the end gap facing forward (toward the exhaust). (See ILL. 1).
6. Check to make sure the rings rotate freely in the groove when compressed.



ILL. 1

PISTON INSTALLATION

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



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

CAUTION: Circlips become deformed during the removal process. Do not re-use old circlips. Do not

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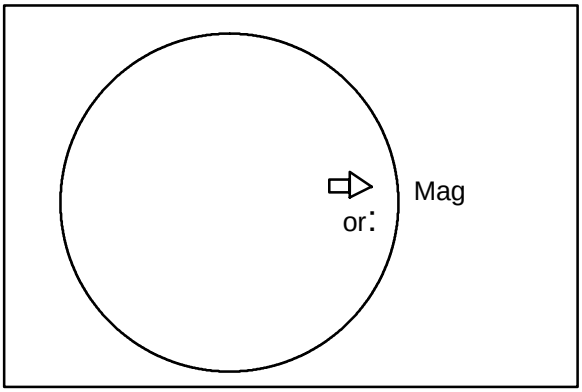
compress the new clip more than necessary upon installation to prevent loss of radial tension. Severe engine damage may result if circlips are re-used or deformed during installation.

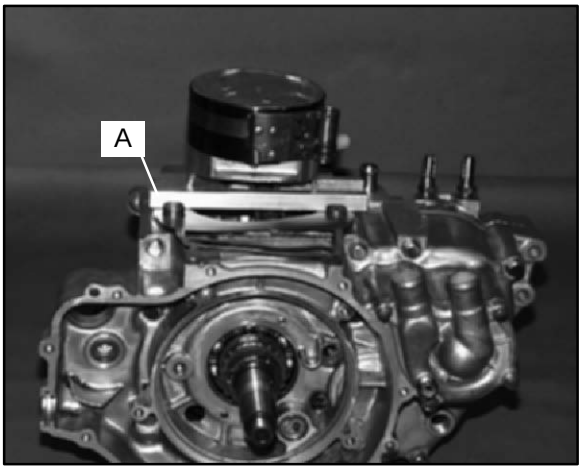
4. Apply clean engine oil to the piston rings, ring lands, piston pin bore, piston pin, and piston skirt. Lubricate the connecting rod (both ends), balancer drive gear, and crankshaft main bearing area.



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

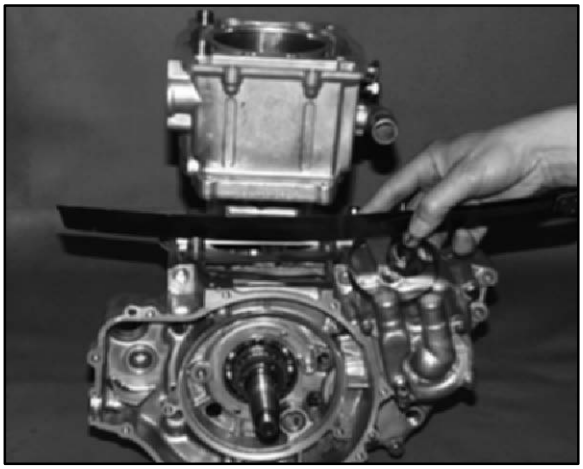
CYLINDER INSTALLATION

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



2. Position the Piston Support Block (**PN 2870390**) (A) beneath the piston skirt to support the piston during cylinder installation.
3. Apply clean engine oil to the ring compressor (Snap On™ PN RCL30) and install the compressor following manufacturers instructions. **CAUTION:** Make sure the oil control ring upper rail tab is positioned properly in the notch of the piston. Verify all ring end gaps are correctly located.

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



5. Remove the ring compressor and support block.
6. Push the cylinder downward until fully seated on the base gasket.
7. Apply a light film of oil to the threads and flange surface of the cylinder mounting bolts.
8. Install all four bolts finger tight. Rotate the engine and position the piston at BDC.

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

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9. Tighten the cylinder bolts in three steps in a criss cross pattern and torque to specifications.
10. Install the two 6 mm bolts.

Cylinder Bolt Torque:

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

CYLINDER HEAD INSTALLATION

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

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

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

Torque all bolts evenly in a criss cross pattern

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

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

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

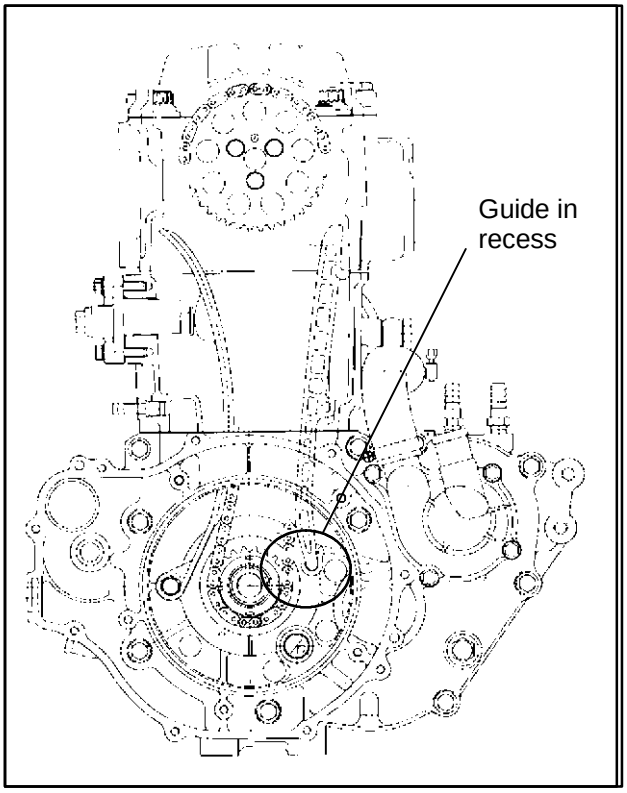
***Loosen bolts again another 180° (1/2 turn)**

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

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

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

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



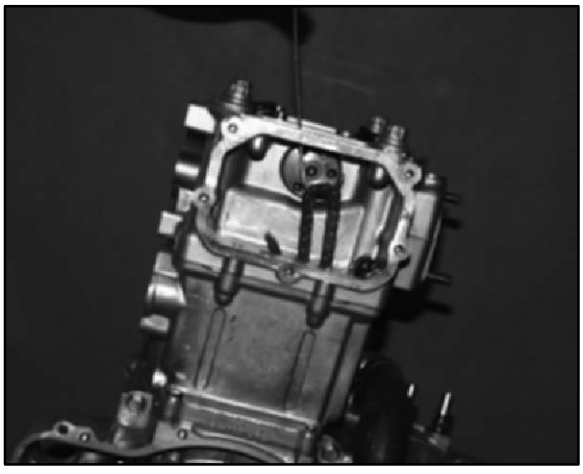
CAM CHAIN/CAMSHAFT INSTALLATION

Install the cam chain over the crankshaft.

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

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

CAMSHAFT TIMING



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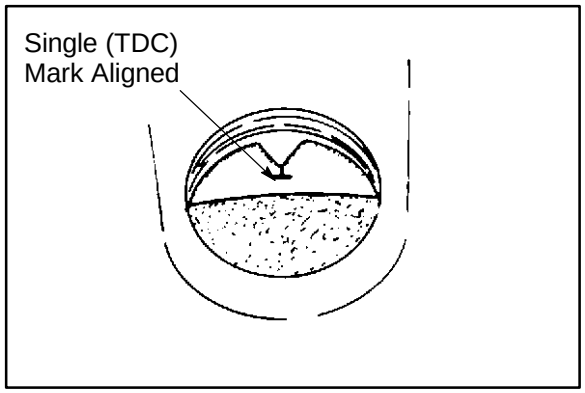
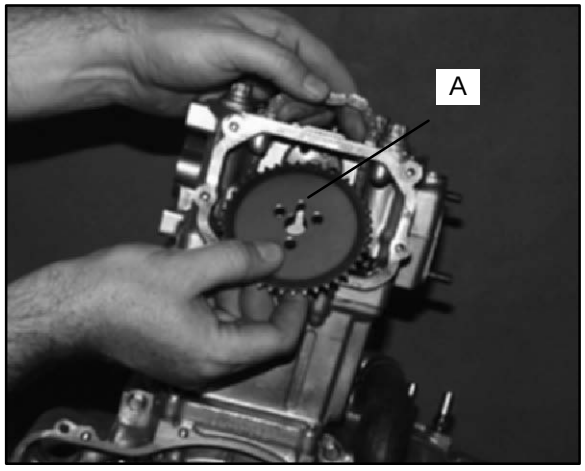
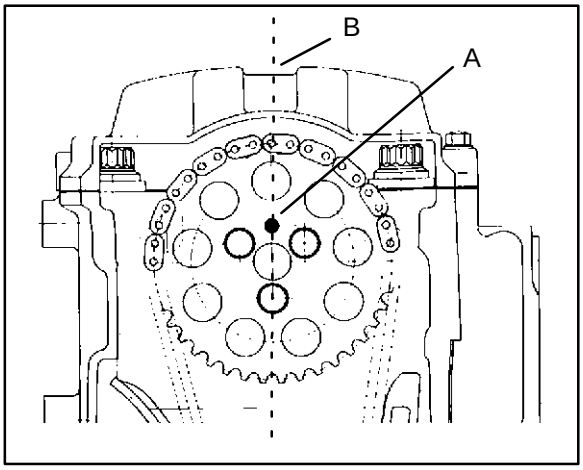
1. Apply Polaris Premium Starter Drive Grease (**PN 2871460**) to the camshaft main journals and cam lobes. Lubricate automatic compression release mechanism with clean engine oil. (To install the compression release mechanism, refer to Page 3.21).
2. Install the camshaft with the lobes facing downward and the sprocket alignment pin facing upward.



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



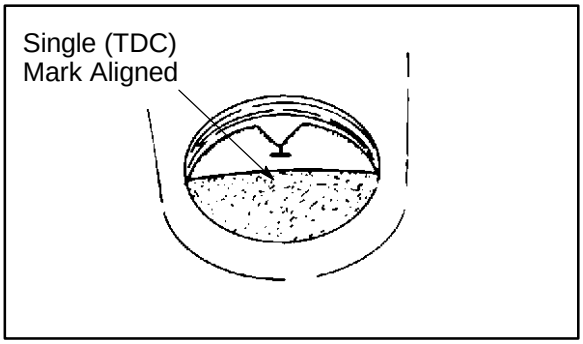
4. Loop the cam chain on the cam sprocket with the dots on the sprocket facing outward and the alignment pin notch facing directly upward.



5. Before positioning the sprocket on the camshaft, check the position of the cam sprocket alignment pin. When the cam is positioned properly, the cam sprocket alignment pin (A) is directly in line with the crankshaft/camshaft centerline (B).
6. Install the sprocket on the camshaft. Apply Loctite™ 242 (**PN 2871949**) to the cam sprocket bolts and torque to specifications.

Cam Sprocket Bolt Torque:

6 ft. lbs. (8 Nm)



7. Verify TDC mark in timing inspection hole and alignment pin is directly in line with crankshaft to camshaft centerline. Refer to Ill. on following page.
8. Apply Crankcase Sealant (**PN 2871557**) to the camshaft end cap and install using a new O-Ring.
9. Check all cam timing marks to verify proper cam timing, and install the cam chain tensioner body with a new gasket.
10. After tensioner installation, rotate engine at least two revolutions and re-check marks/timing.

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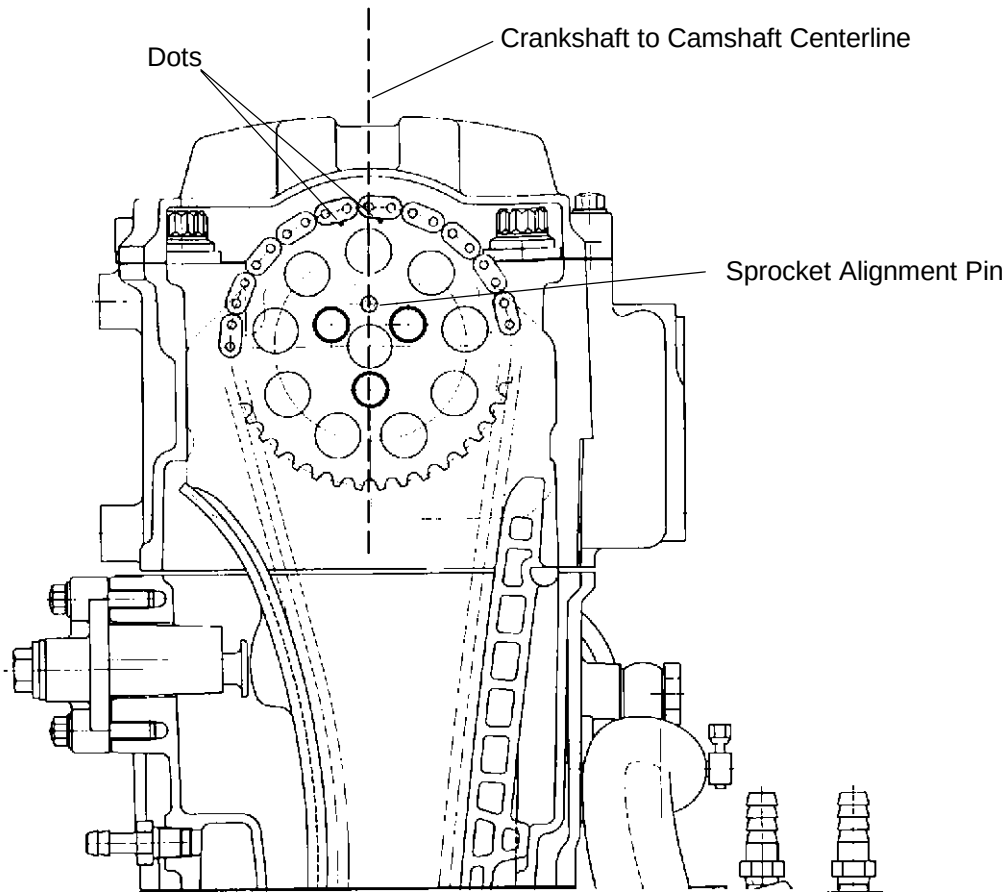
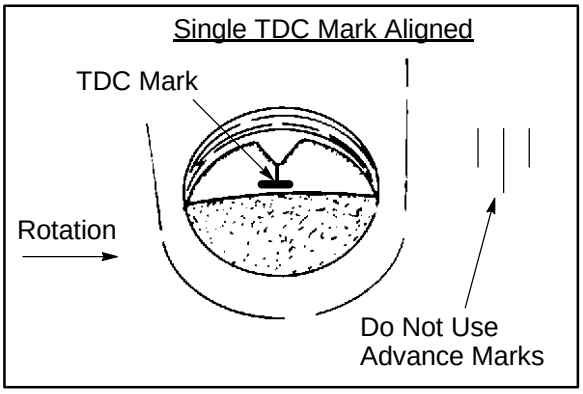
CAMSHAFT TIMING





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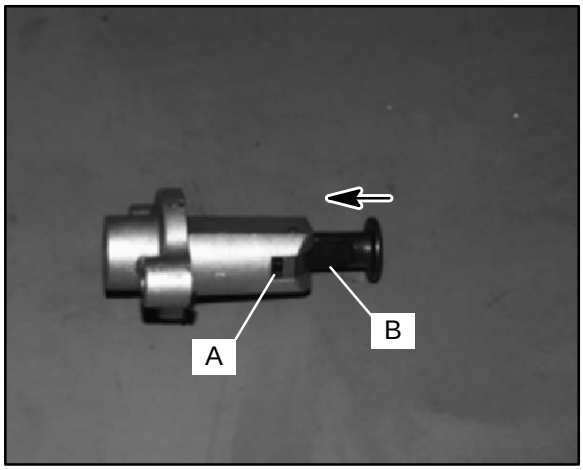
CAM CHAIN TENSIONER INSTALLATION



1. Release the ratchet pawl (A) and push the tensioner plunger (B) all the way into the tensioner body.
2. Install the tensioner body with a new gasket and tighten the bolts.

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

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

Tensioner Plug Torque:
17 ft. lbs. (23 Nm)

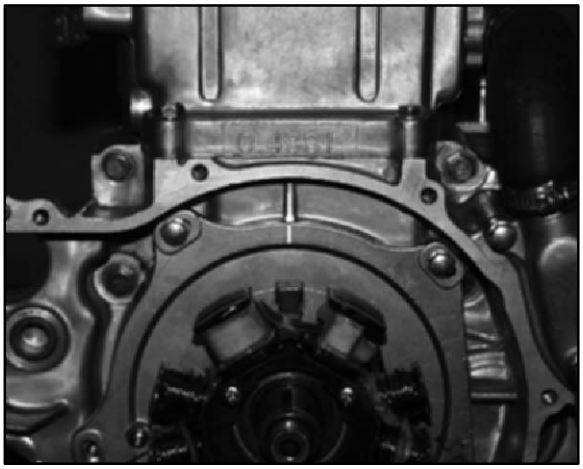
4. Slowly rotate engine two to three revolutions and re-check cam timing.

STATOR, FLYWHEEL AND STARTER DRIVE INSTALLATION

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

Stator

1. Apply a light film of grease to the crankshaft seal. Apply molybdenum disulfide grease or assembly lubricant to the crankshaft bushing.
2. Install a new O-Ring in the oil passage recess in the crankcase.
3. Apply 3 Bond 1215 (**PN 2871557**) or an equivalent sealer to the stator plate outer surface and install a new O-Ring.



4. Install the stator plate being careful not to damage the seal. Align timing reference marks on the plate and crankcase. Be sure the plate is fully seated.
   NOTE: This is a static timing mark. Strobe timing should be performed after start up.
5. Torque bolts evenly to specification.

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

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

Flywheel

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

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

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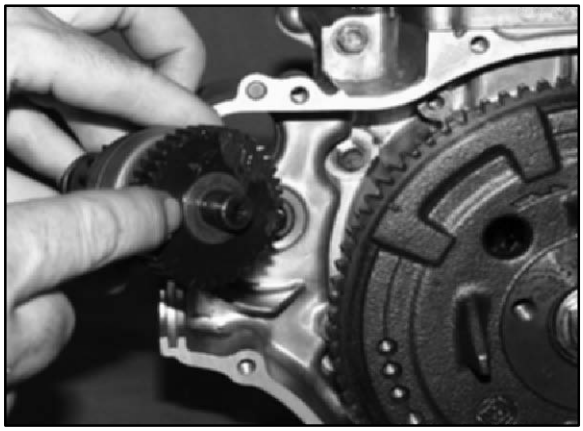
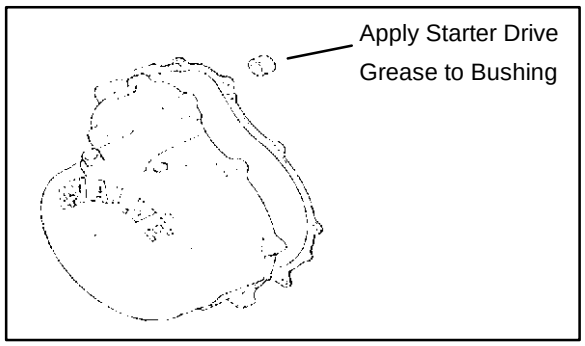
Starter Drive



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



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

Starter Drive Grease:

(PN 2871460)

ROCKER SHAFT/ROCKER ARM ASSEMBLY INSTALLATION

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

Rocker Shaft Support Tower Bolt Torque:

9 ft. lbs. (12 Nm)

Rocker Shaft Locating Bolt Torque:

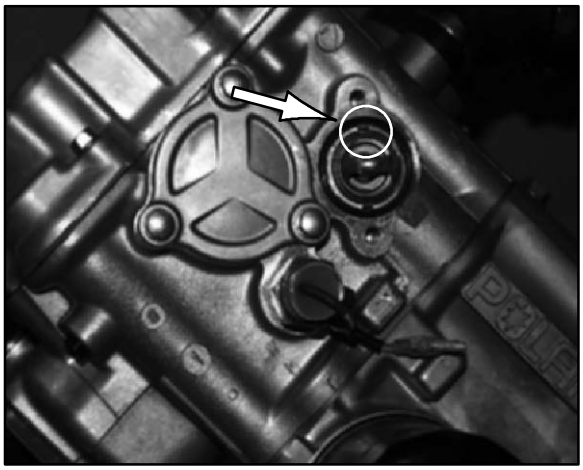
6 ft. lbs. (8 Nm)

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

Rocker Cover Bolt Torque:

6 ft. lbs. (8 Nm)

THERMOSTAT INSTALLATION



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

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OIL PIPES

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

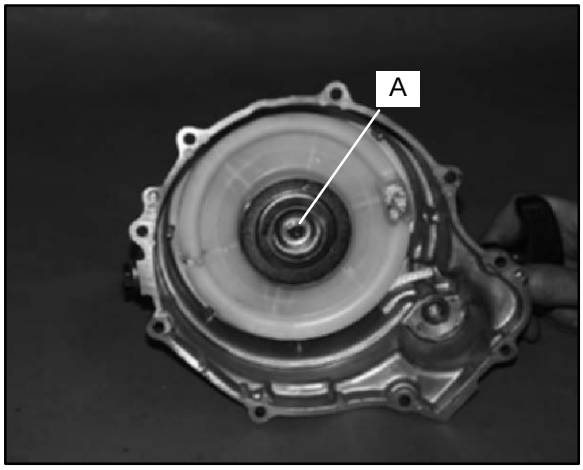
Oil Pipe Bolt Torque:
20 ft. lbs. (27 Nm)

RECOIL DISASSEMBLY/INSPECTION

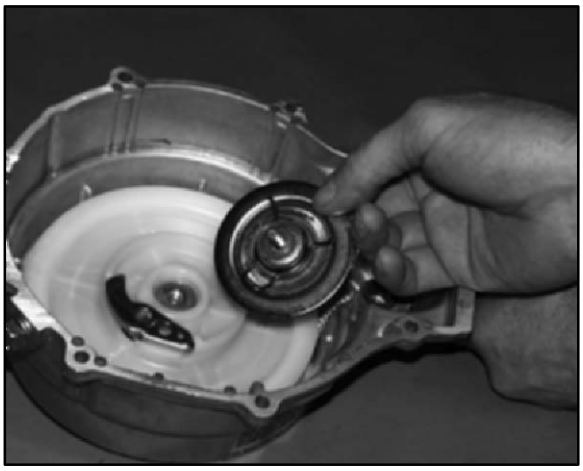
CAUTION: The recoil is under spring tension. A face shield and eye protection is required during this procedure.

Replace any parts found to be worn or damaged.

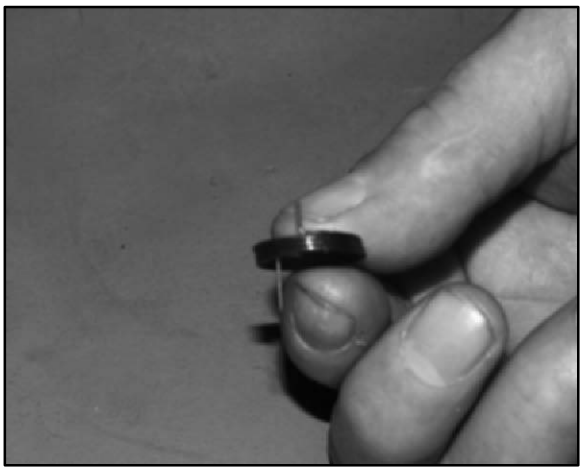
REMOVE BOLTS AND RECOIL HOUSING



10. Pull recoil rope so it is extended approximately 12-18″. Check handle c-ring for proper tension, and the handle for cracks or damage which may allow water or dirt to enter the recoil housing through the rope. **NOTE:** The handle must seal tightly on the recoil housing to prevent water from entering.
11. Remove center bolt from recoil friction plate (A).



12. Inspect plate for wear or damage. Inspect plate friction spring for wear, damage, and proper tension. The spring should fit tightly on friction plate.



13. Remove ratchet pawl with spring and inspect. Replace spring or ratchet pawl if worn, broken, or damaged.

NOTE: Long arm of spring engages reel. Short end against pawl.

14. Hold reel firmly in housing. Pull rope handle until 12-18″ of rope is exposed, and hold reel in place.
15. Place rope in notch on outer edge of reel. Release tension on hub and allow reel to unwind approximately 6-7 turns until spring tension is released.

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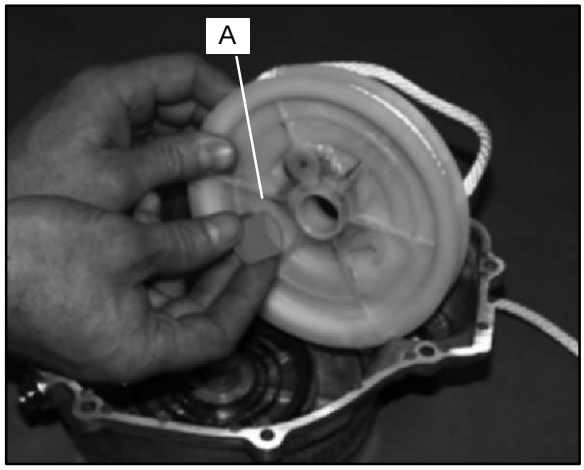
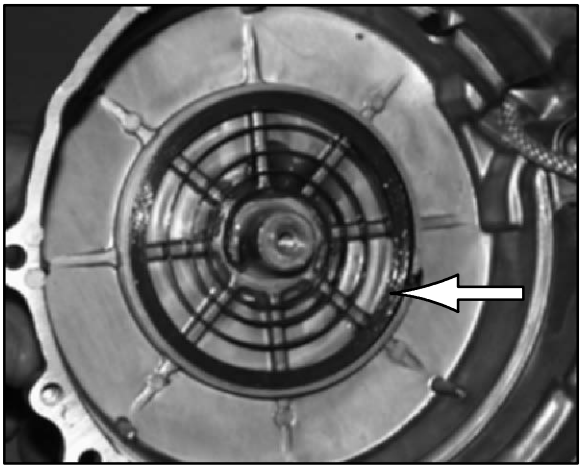


16. Slowly and carefully remove reel from recoil housing making sure the spring remains in the housing. Inspect the reel hub and bushing (A) for wear.
17. Unwind rope and inspect for cuts or abrasions.
18. Inspect drive tab on hub return spring for damage. To remove hub return spring, hold outer coils in place with one hand and slowly remove spring one coil at a time from the inside out.
19. Pull knot out of of recoil reel. Untie knot. Remove rope from reel.

RECOIL ASSEMBLY

CAUTION: Be sure to wear a face shield and eye protection when performing this procedure.



To install a new spring:

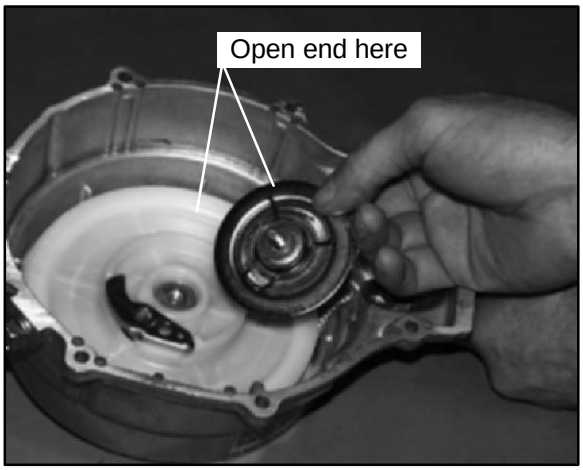
1. Place spring in housing with the end positioned so the spring spirals inward in a counterclockwise direction. See photo at right.
2. Hold spring in place and cut retaining wire.

To reinstall an old spring:

1. Hook outer tab in place in recoil housing and wind spring in a counterclockwise direction one coil at a time while holding the installed coils in place.
2. Lubricate the spring with light lubricant such as Premium All Season Grease (**PN 2871423**).

To complete recoil assembly:

1. Route rope through guide bushing in recoil housing and into reel. Tie a secure knot in end of the rope.
2. Wind rope counterclockwise onto the reel, as viewed from ratchet side of reel.
3. Lock rope into notch on outer edge of reel.
4. Apply a small amount of grease or equivalent to the center post of the housing and the bushing.



5. Install reel into housing making sure the spring drive tab on the reel engages the spring and the reel is fully seated in the housing.
6. Apply downward pressure on the reel and rotate counterclockwise approximately 6-7 turns to pre-wind the spring. Continue rotating counterclockwise until rope on outer edge aligns with rope guide bushing.
7. Release rope from notch and allow reel to rewind completely. If more pre-wind is required, place rope in notch and add additional turns of pre-wind.
8. Install ratchet pawl and return spring, with long leg of spring engaged in reel.
9. Reinstall friction plate. **NOTE:** The friction plate must be positioned with both end tabs of the friction spring opposite the ratchet pawl.
10. Torque friction plate retaining bolt to 5-6 ft. lbs. (7-9 Nm).
11. Reinstall recoil housing using a new gasket. Seal stator wire harness grommet with RTV silicone.

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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 mis-adjusted
- Fuel quality poor (old) or octane too high
- Low compression
- Restricted exhaust
- Weak ignition (loose coil ground, faulty coil, stator, or ETC switch)
- ETC switch mis-adjusted
- Restricted air filter (main or pre-cleaner) or breather system
- Improperly assembled air intake system
- Restricted engine breather system
- Oil contaminated with fuel
- Restricted oil tank vent

TROUBLESHOOTING

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

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- 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

COOLING SYSTEM TROUBLESHOOTING

Overheating

- Low coolant level
- Air in cooling system
- Wrong type of coolant
- Faulty pressure cap or system leaks
- Restricted system (mud or debris in radiator fins or restriction to air flow, passages blocked in radiator, lines, pump, or water jacket)
- Lean mixture (restricted jets, vents, 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)

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CHAPTER 4
FUEL SYSTEM/CARBURETION

4

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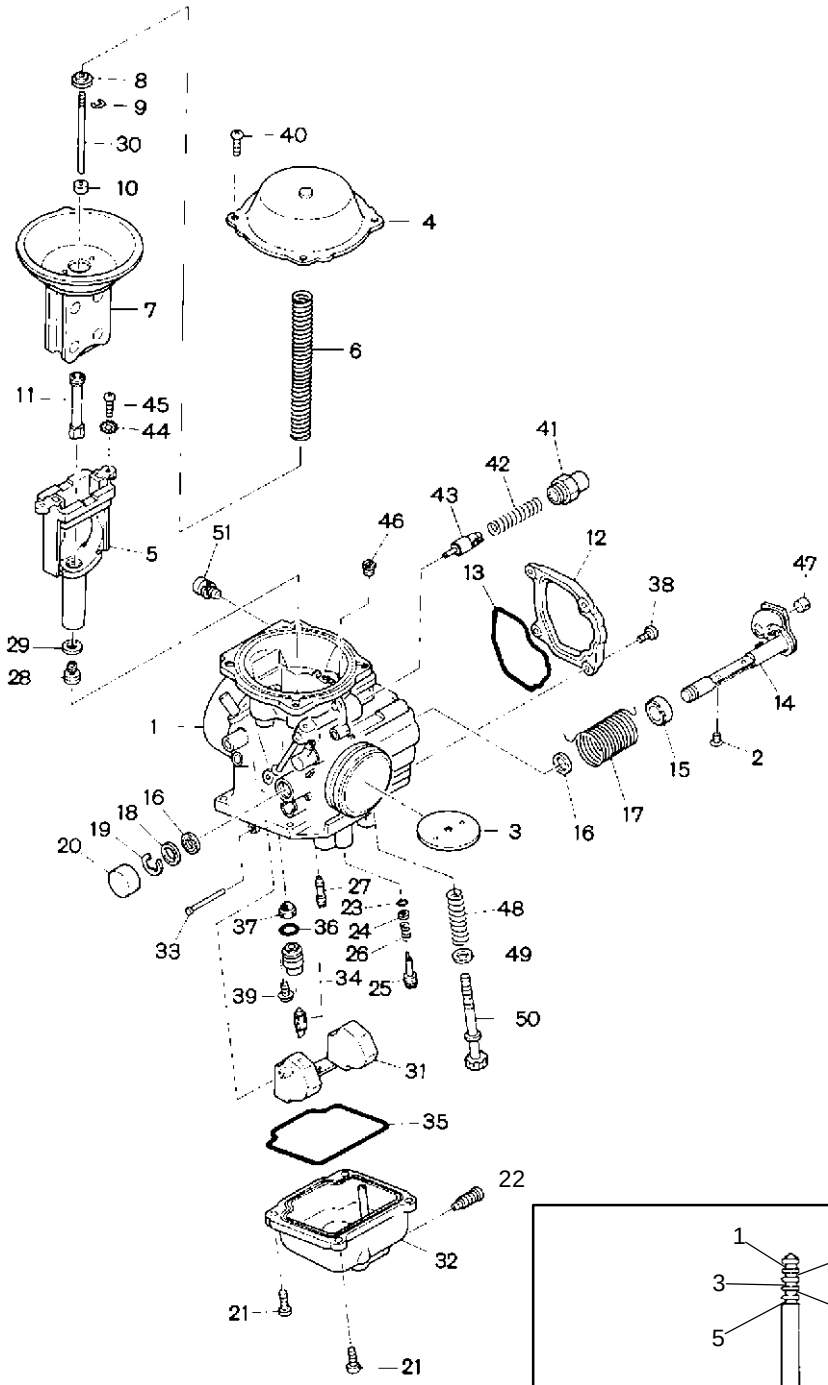
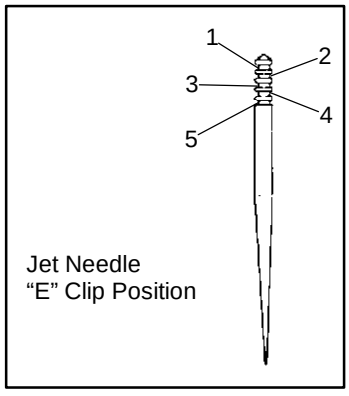
BST 34 CARBURETOR EXPLODED VIEW



Refer to Page 4.4 for Jet Part Numbers



1. Carburetor Assembly
2. Screw
3. Throttle Valve
4. Cover, Diaphragm
5. Jet Block Assembly
6. Spring
7. Diaphragm Assembly
8. Ring
9. "E" Ring
10. Ring
11. Needle Jet
12. Cover
13. O-Ring
14. Throttle Shaft Assembly
15. Ring
16. Seal
17. Spring
18. Packing
19. "E" Ring
20. Cap
21. Screw
22. Drain Screw
23. O-Ring
24. Washer
25. Adjuster
26. Spring
27. Pilot Jet
28. Main Jet
29. Washer
30. Jet Needle
31. Float Assembly
32. Float Body Assembly
33. Float Pin
34. Needle Valve
35. O-Ring
36. O-Ring
37. Filter
38. Screw
39. Screw
40. Screw
41. Guide Holder
42. Spring
43. Plunger Assembly
44. Spring Washer
45. Screw
46. Air Jet
47. Cable Guide
48. Spring
49. Ring
50. Adjust Screw
51. Screw and Washer Assy.

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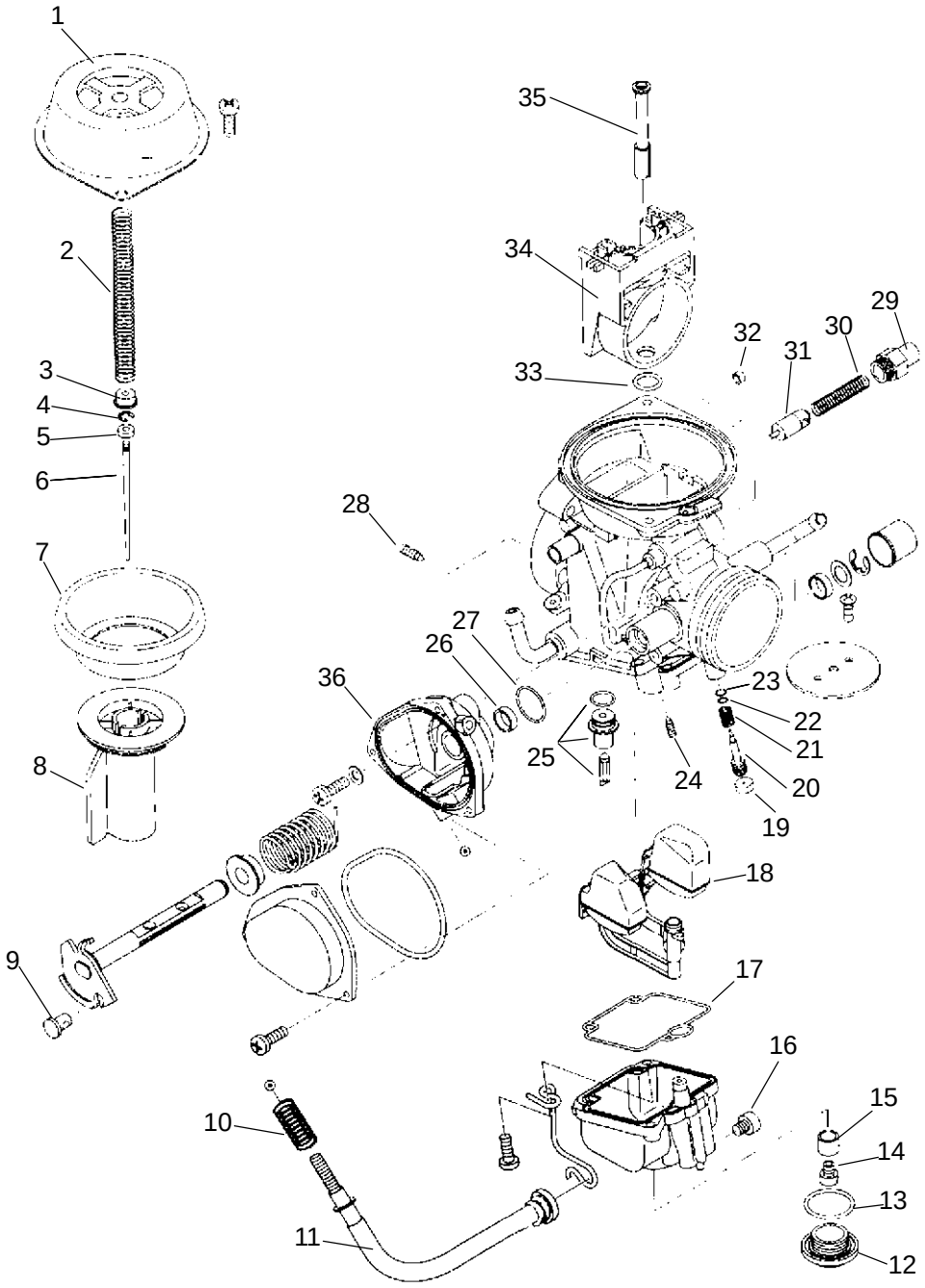
BST 40 CARBURETOR EXPLODED VIEW



1. Cover, Diaphragm
2. Spring
3. Spring Seat
4. “E” Clip
5. Spacer
6. Jet Needle
7. Diaphragm Assembly
8. Throttle Valve
9. Cable Guide
10. Spring
11. Adjuster Cable
12. Drain Plug
13. O-Ring
14. Jet, Main
15. Spacer Ring
16. Drain Screw
17. O-Ring
18. Float Assembly
19. Plug
20. Pilot Screw
21. Spring
22. Washer
23. O-Ring
24. Pilot Jet
25. Valve, Inlet Needle
26. Shaft Seal
27. O-Ring
28. Air Jet
29. Choke Plunger Guide
30. Spring
31. Choke Plunger
32. Cap
33. O-Ring
34. Jet Block Assembly
35. Needle Jet
36. Case

Refer to Page 4.3 for Jet Part Numbers

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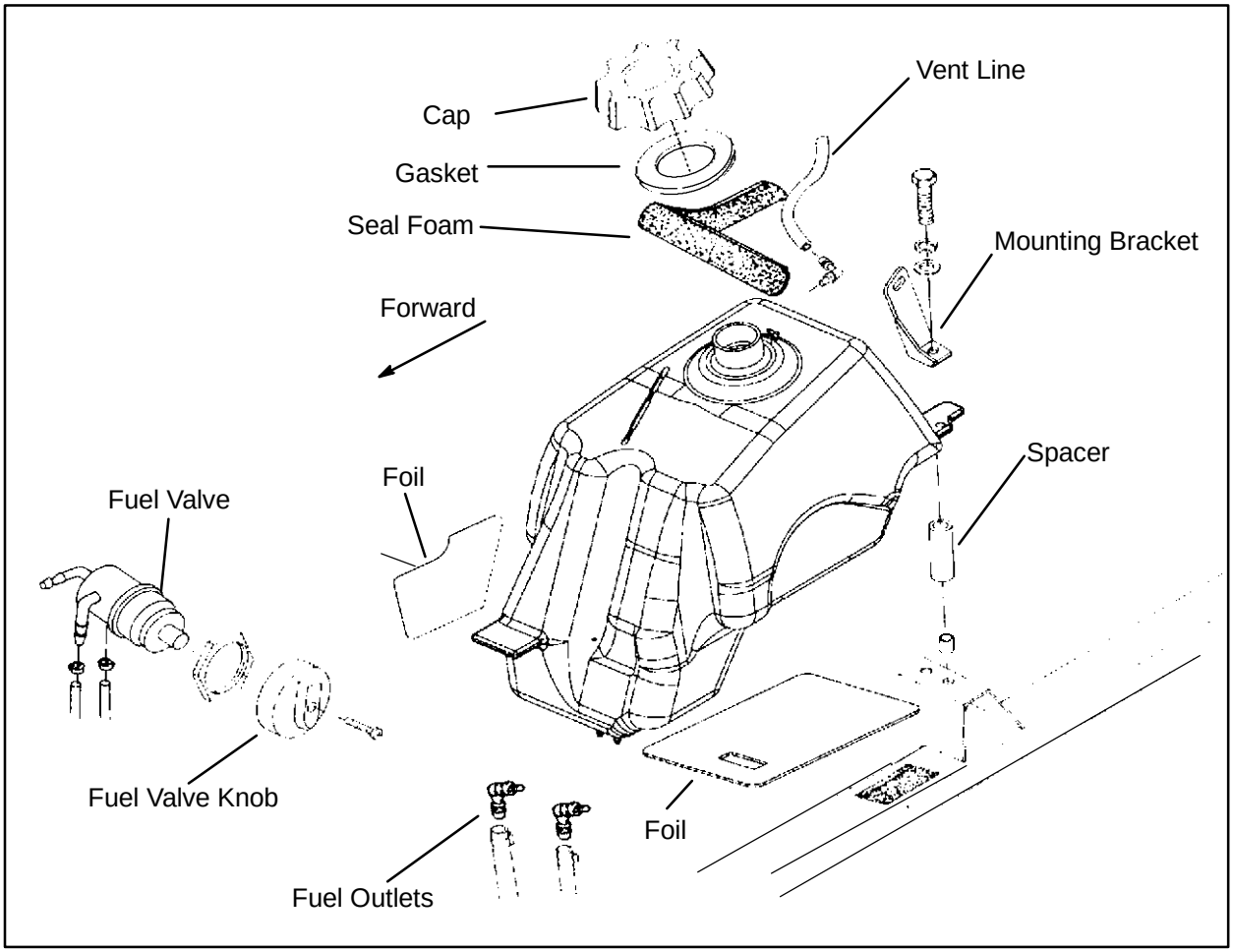
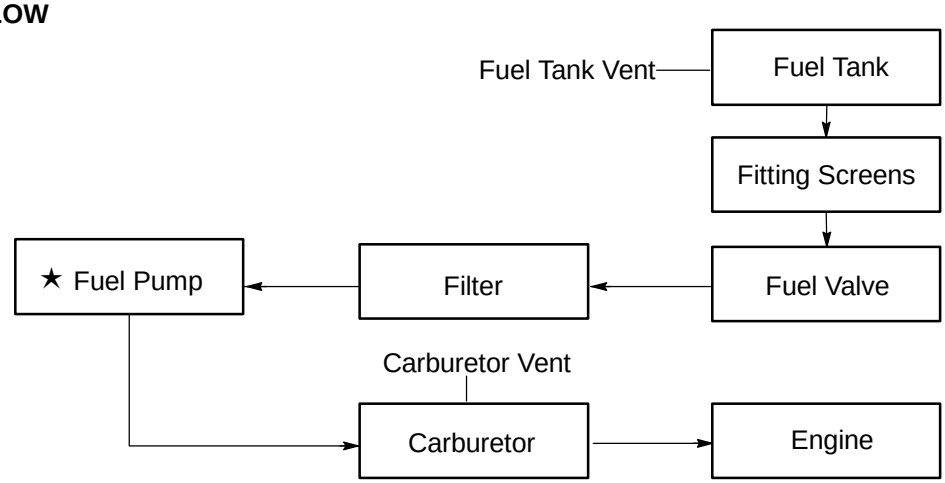
FUEL TANK ASSEMBLY



FUEL FLOW



★ Located Above Oil Tank

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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 between +40 and +80° F (+5° to +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 and PVT 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 on page 1.4 or in the Owner's Safety and Maintenance 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 chart on page 1.4.
4. Clutching changes may also be required for changes in elevation. Refer to clutching chart on page 1.4 for recommendations.

MIKUNI JET PART NUMBERS

Main Jets		Pilot Jets	
Jet Number	Part Number	Jet Number	Part Number
112.5	**3130554**	40.0	**3130624**
115	**3130555**	42.5	**3130526**
117.5	**3130556**		
120	**3130557**		
122.5	**3130558**		
125	**3130559**		
127.5	**3130560**		
130	**3130561**		
132.5	**3130562**		
135	**3130563**		
137.5	**3130564**		
140	**3130527**		
142.5	**3130566**		
145	**3130567**		
147.5	**3130568**		
150	**3130569**		
152.5	**3130570**		
155	**3130571**		
157.5	**3130572**		
160	**3131141**		
162.5	**3131142**		
165	**3131143**		
167.5	**3131144**		
170	**3131145**		

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CV CARBURETOR SYSTEM 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/ Passageways, 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

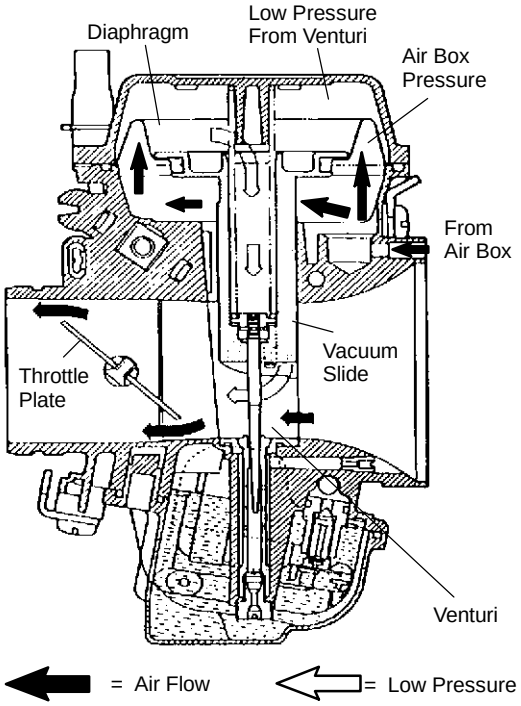
VENT SYSTEMS - CV CARBURETOR

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 CARB 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.



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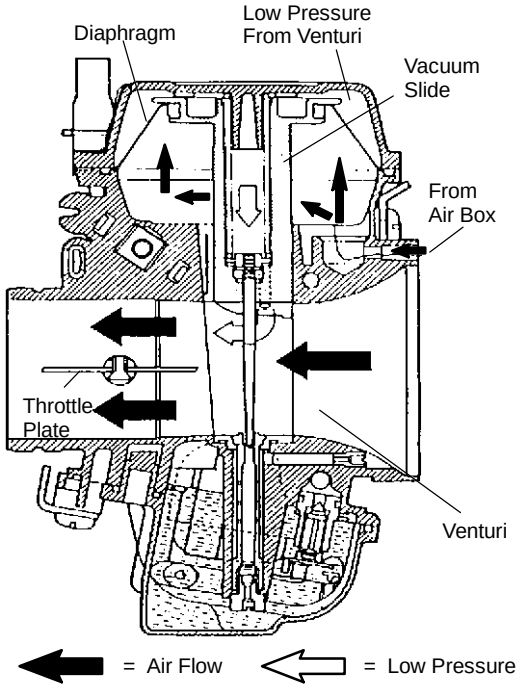
CARBURETOR OPERATION CONT'D

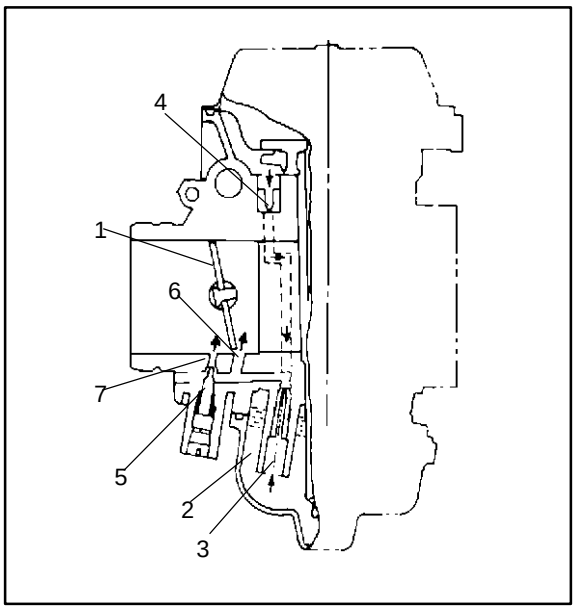
When the throttle plate is opened and engine speed begins to increase, the pressure in the venturi (and therefore in the chamber above the diaphragm) becomes significantly lower than atmospheric. Atmospheric pressure in the chamber below the diaphragm forces the diaphragm upward, raising the slide against 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 Mikuni BST carburetor.

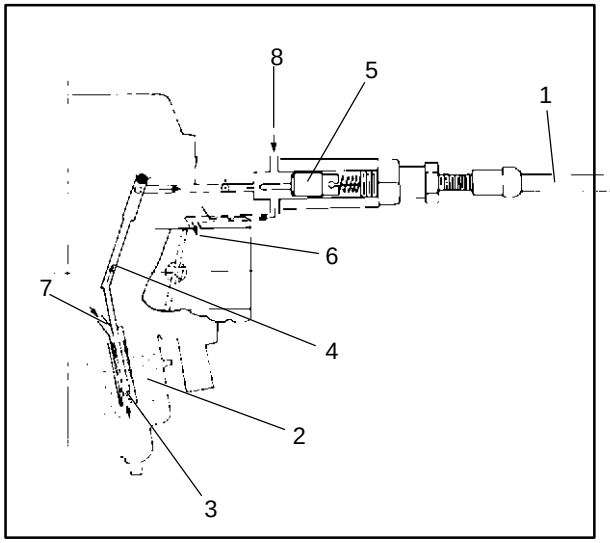
PILOT (IDLE AND SLOW) SYSTEM

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 the main bore.

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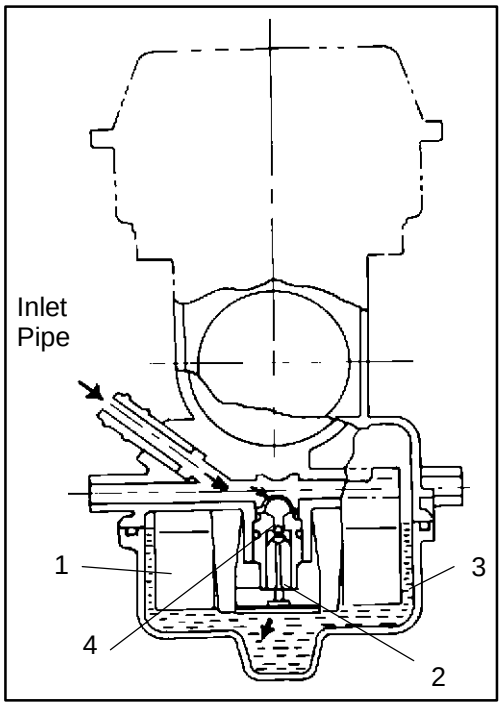
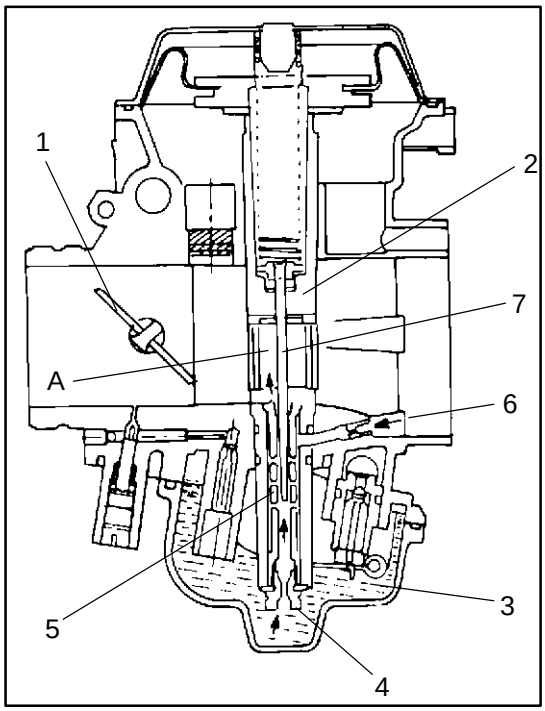
FLOAT SYSTEM

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 admit fuel into the chamber. In this manner, the needle valve admits and shuts off fuel alternately to maintain a practically 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.



CARBURETOR DISASSEMBLY - MIKUNI CV

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.

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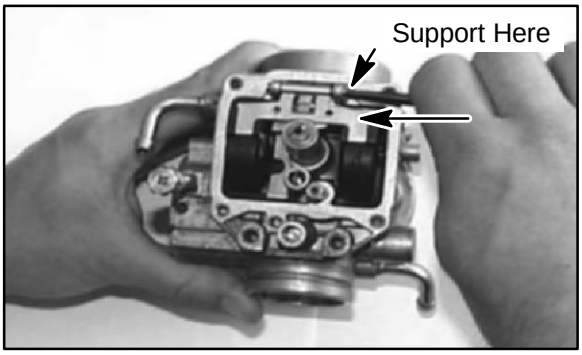
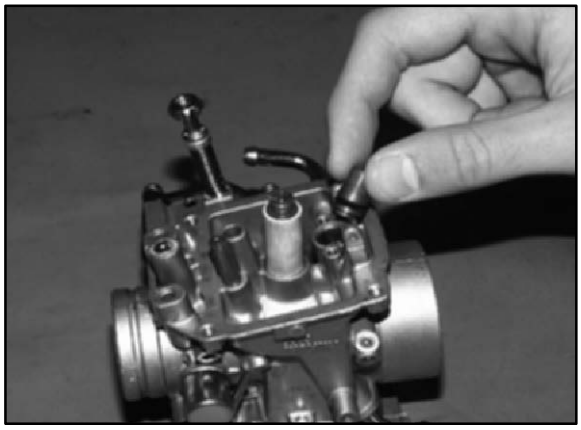
CARBURETOR DISASSEMBLY CONT'D

2. Remove float bowl and carefully remove the pressed float pin.

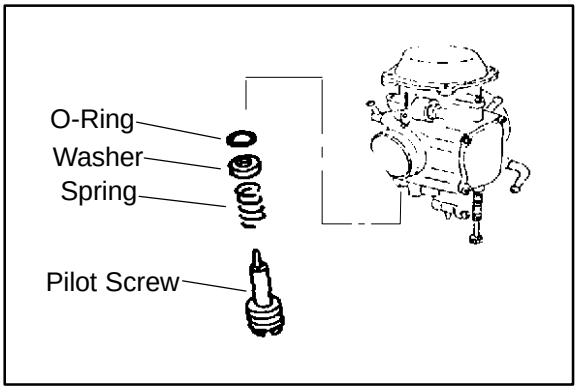


NOTE: Be careful not to damage the float pin tower during the float pin removal. Support the float pin tower while removing the float pin. This helps to prevent the float pin towers from breaking off.

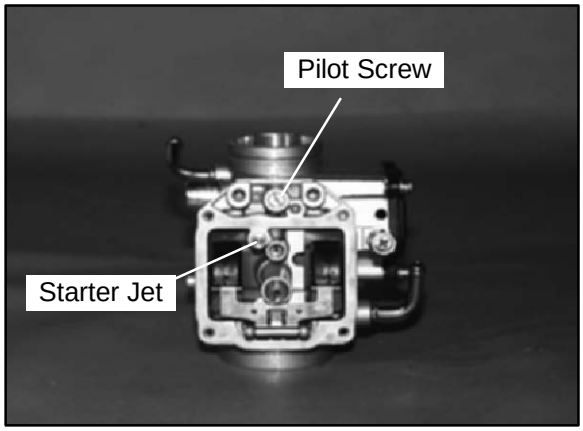
3. Remove inlet needle seat retaining screw along with plate, and carefully remove needle seat. **NOTE:** Do not use a pliers to remove the seat or permanent damage may occur.



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 not removeable. 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. **CAUTION:** 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.

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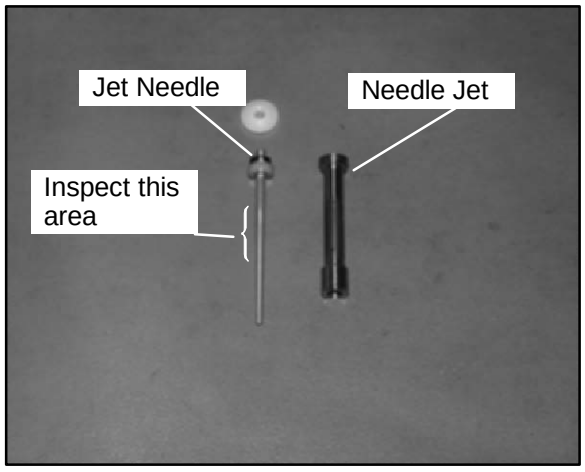
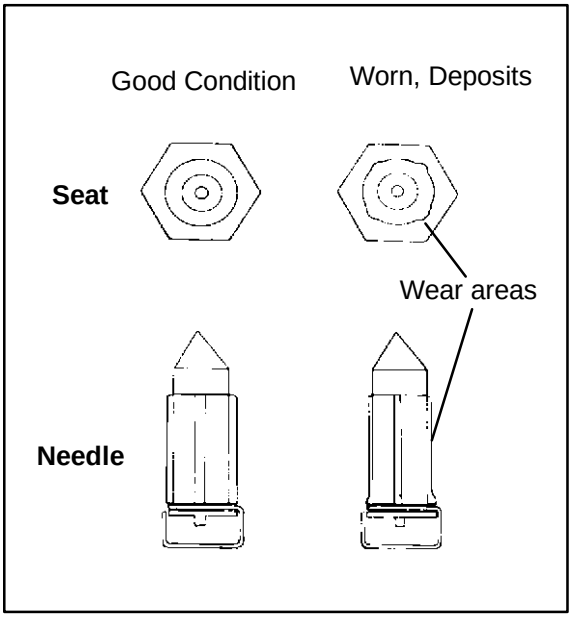
CARBURETOR INSPECTION

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.

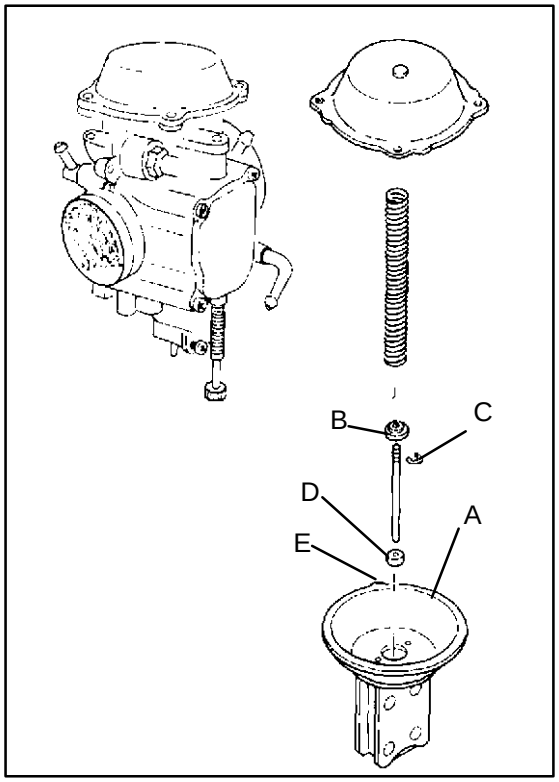


2. Inspect the inlet needle tapered surface for any sign of wear or damage. Be sure the spring loaded pin is free moving and returns freely when pushed. The inlet needle and seat should be pressure tested after assembly.

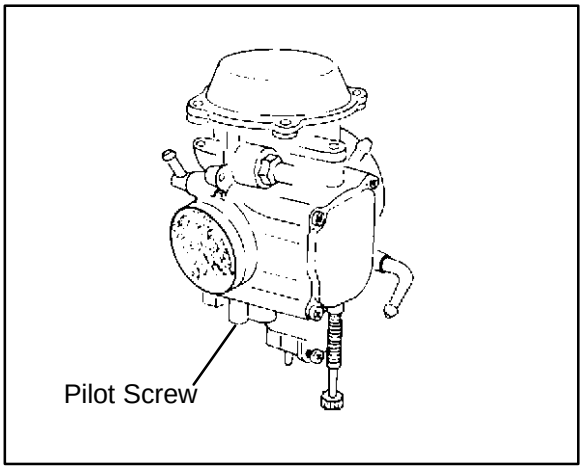


CARBURETOR ASSEMBLY

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.



3. Replace parts in proper order. The spring seat washer (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.
4. Be sure the tab (E) on outer edge of diaphragm is positioned properly in the carburetor body.



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CARBURETOR ASSEMBLY CONT'D

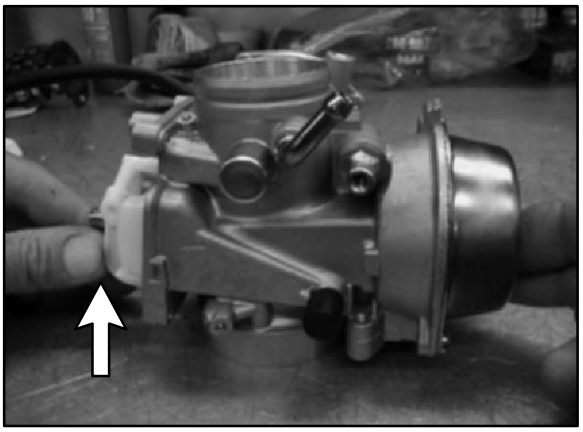
5. Install the pilot mixture screw, spring, washer, and O-ring as an assembly. Lubricate the O-Ring with oil or light grease before installation. **CAUTION:** Do not damage the O-ring during installation. Turn the screw in until it *lightly* contacts the seat. Back out the specified number of turns. NOTE: The final pilot (idle) mixture must be adjusted with the engine running. Refer to Page 2.12.

Pilot Mixture Screw Base Setting (Set at Factory)

Refer to Specifications Page 1.4

FLOAT HEIGHT ADJUSTMENT

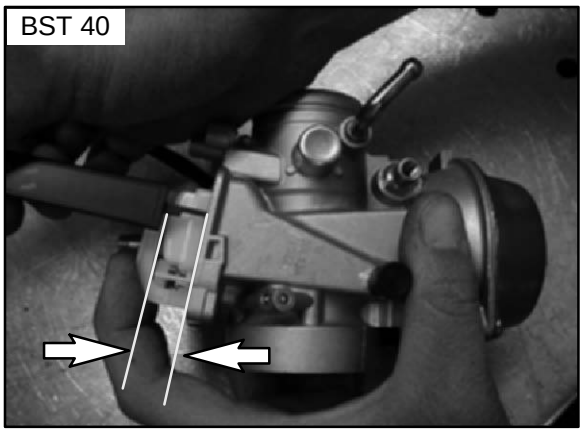
1. Place the carburetor on a level surface as shown at right to remove weight from float arm. In this position, the float tongue will rest lightly on the inlet needle valve pin without compressing the spring.

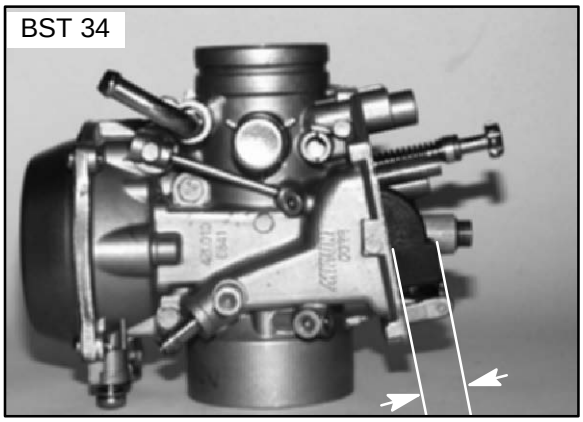


Float Height:

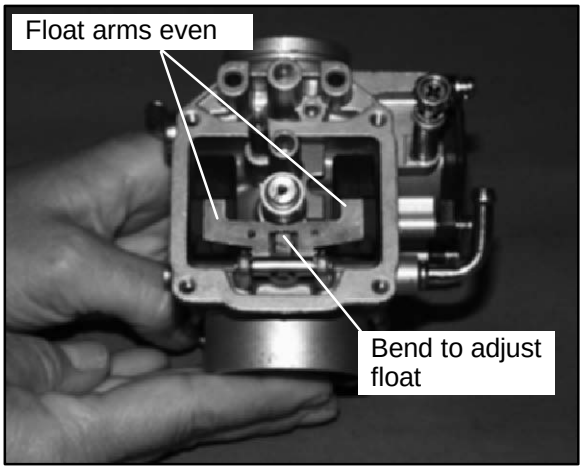
Std: BST 34 13.0mm (.51″) ± 1 mm
BST 40 14.7mm (.58″) ± 1 mm

NOTE: On **BST 40** carburetors, it is important to press in on the float assembly as shown, to fully seat the float assembly.





2. Measure the height from the float bowl mating surface to the top of step in float as shown. Both sides of float should be parallel to each other. The measurement should be made at the mid-point on the 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.
3. If adjustment is necessary, bend the tongue slightly. Be sure float measurement is even on left and right side.



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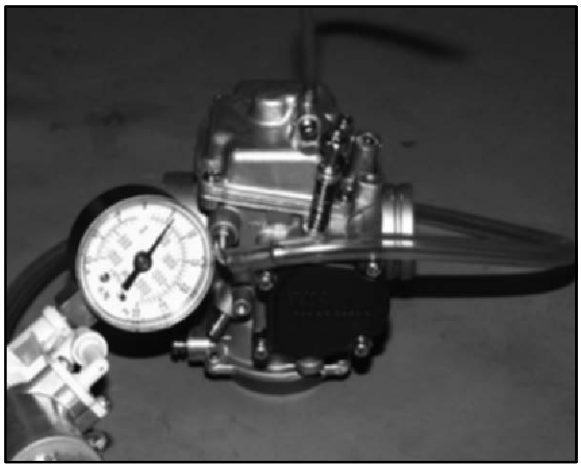
NEEDLE AND SEAT LEAKAGE TEST

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.

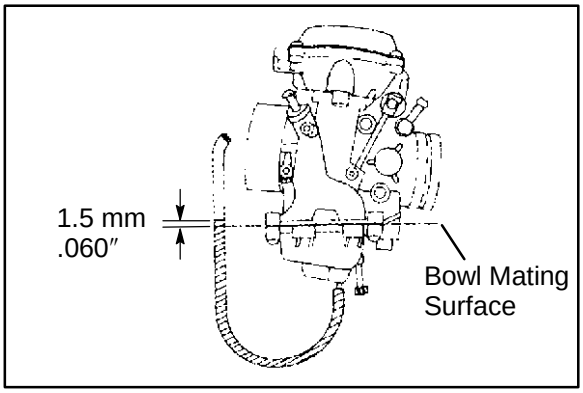


Mity Vac™ (PN 2870975)

FUEL LEVEL

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.

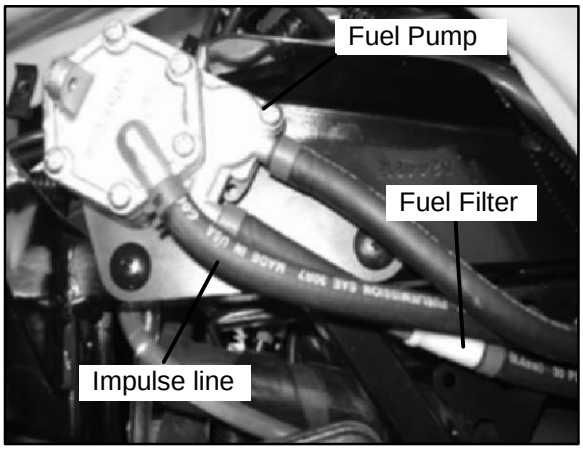
FUEL PUMP

This ATV is equipped with a pressure regulated fuel pump (1-3 PSI). The pump is located under the left front fender of the machine.

To test the fuel pump:

1. Turn fuel off.
2. Disconnect impulse line from pump.
3. Connect Mity-Vac™ (**PN 2870975**) to the impulse line fitting on the pump.
4. 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.



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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.

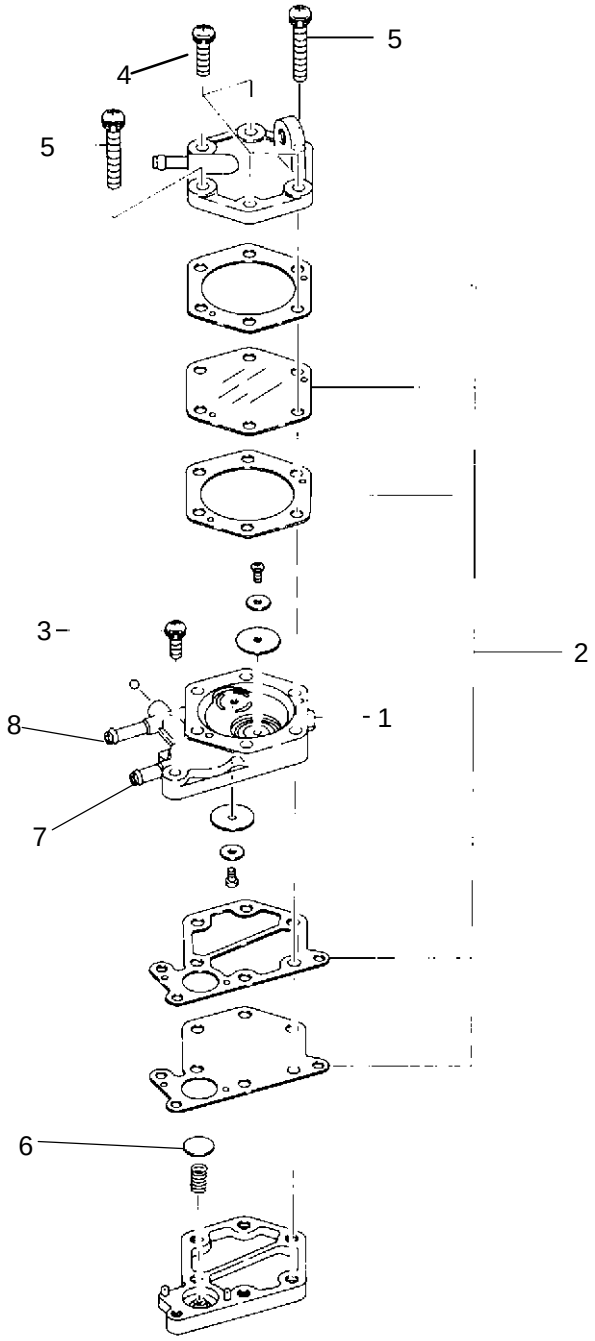
FUEL PUMP INSPECTION/ASSEMBLY

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. **CAUTION:** 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.

FUEL PUMP EXPLODED VIEW

Fuel Pump Exploded View at Right

1. Fuel Pump Assembly
2. Diaphragm, Gasket Set
3. Screw and Washer Assembly
4. Screw and Washer Assembly
5. Screw and Washer Assembly
6. Pressure Regulator
7. Fuel Inlet
8. Fuel Outlet



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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 misadjusted 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

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CHAPTER 5
BODY AND STEERING

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TORQUE SPECIFICATIONS

COMPONENT	FT. LBS. (IN.LBS.)	NM
Front Wheel Nuts	20	27
Front A-Arm Attaching Bolt	30	41
Front A-Arm Ball Joint Stud Nut	25	35
Handlebar Adjuster Block	10-12	14-17
Master Cylinder	(45-55)	5.2-6.3
Rear Shock Bolt (Upper)	30	41
Rear Shock Bolt (Lower)	30	41
Rear Wheel Hub Nut	100	136
Rear Wheel Nuts	20	27
Upper Stabilizer Support Nuts	17	27
Upper Control Arm Mounting Bolt	35	48
Lower Wheel Bearing Carrier Bolt	30	41
Strut Rod Retaining Nut (Top)	15	21
Strut Casting Pinch Bolt	15	21
Tie Rod End Jam Nut	12-14	17-19
Tie Rod End Castle Nut	40–45	54–61
Tie Rod End Attaching Bolt	25-30	35–41

NOTE: Refer to exploded views throughout this chapter for identification and location of components.

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2870871	Ball Joint Replacement Tool
2870872	Shock Spanner Wrench
2870623	Shock Absorber Spring Compression Tool
2871572	Strut Rod Wrench
2871573	LH Strut Spring Compressor
2871574	RH Strut Spring Compressor
7052069	Charging Needle
2200421	Gas Shock Recharging Kit
2871352	Shock Rod Holding Tool
2871199	Seal Sleeve Installation Tool Kit
2870872	Shock Spanner Wrench
2871351	Fox™ Shock IFP Depth Tool

COVER/PANEL REMOVAL

To Remove: **Perform These Steps:**

Seat:

- Pull release lever at the rear of the seat
- Lift and pull seat rearward, disengaging seat from tabs at the rear of the fuel tank

Side Panels (See Page 5.3)

- Remove: Seat
- Disengage tabs at front and rear

Headlight Pod (See Page 5.5)

Front Cover

- Remove: Seat
- Disengage tabs at front and rear
- Lift panel out

Rear Rack

- Remove: Seat
- 2 bolts at rear of rack
- 2 bolts at front of rack

Rear Cab Assembly

- Remove: Seat
- Rear rack
- 1 screw, nut and washer at rear of inner left footrest
- 4 screws at bottom of left rear mudflap
- 1 screw, nut and washer at rear of inner right footrest
- 4 screws at bottom of right rear mudflap
- 4 bolts and flat washers from top of cab assembly, under seat

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- 2 screws at rear bottom of cab assembly near tail light
- Disconnect taillight harness

Front Rack

- Remove: 4 screws, lock washers, and flat washers

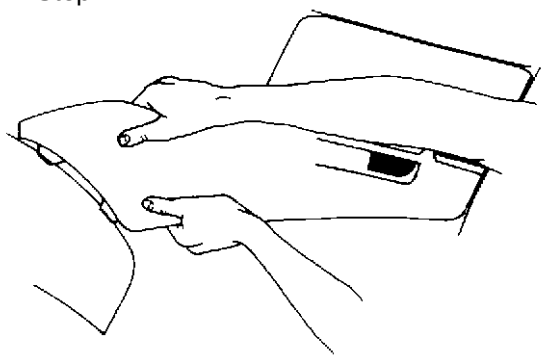
Front Cab Assembly

- Remove: Seat
- Side panels
- 2 screws at rear of cab at fuel tank mount bracket
- Front rack
- Front bumper
- Front cover panel
- 3 screws from bottom left mudflap
- 3 screws from bottom right mudflap
- 1 inner screw from front cab to foot rest on each side
- 2 screws under front panel

SIDE PANEL REMOVAL

Side panel removal may be difficult until the locking tabs and receivers have been snapped and unsnapped a few times.

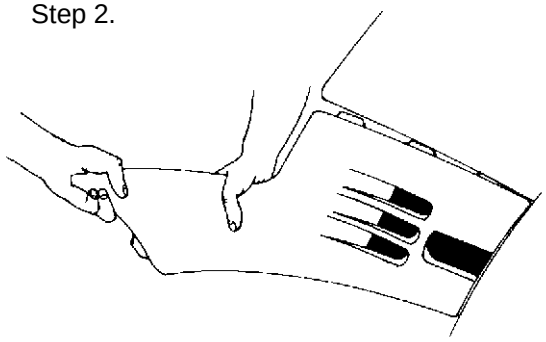
Step 1.



Pull forward and out to disengage two rear tabs.

1. Remove seat. Grasp rear of side panel near rear cab. With a quick and firm motion, pull the panel forward and outward to disengage the two rear tabs.

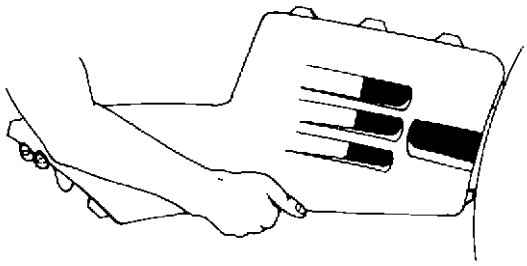
Step 2.



Push down to disengage top rear two tabs.

2. Place hand on top of side panel behind the fuel tank. With a quick and firm motion, push down on the side panel to disengage the top rear two tabs. Then pull up on side panel to disengage front upper and lower tab.

Step 3.



To reinstall, align panel tabs with slots. Push upward and forward until tabs lock.

3. To reinstall side panel, align panel tabs with slots on front cab. Push panel upward and forward until tabs lock. Bend rear of side panel and insert the two tabs into the rear cab.

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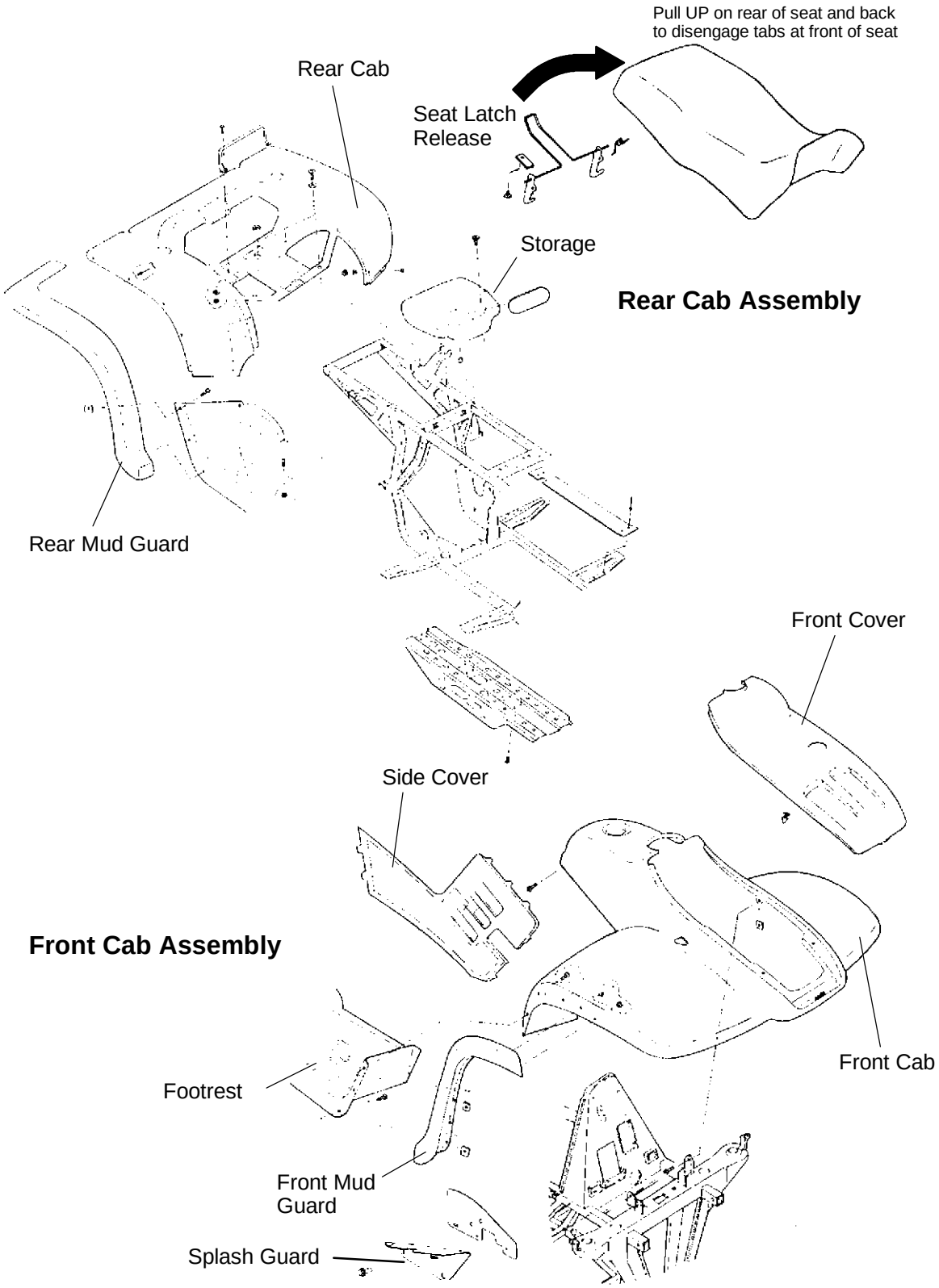
BODY ASSEMBLY EXPLODED VIEW



NOTE: All warning information labels must be in place when body parts are assembled.

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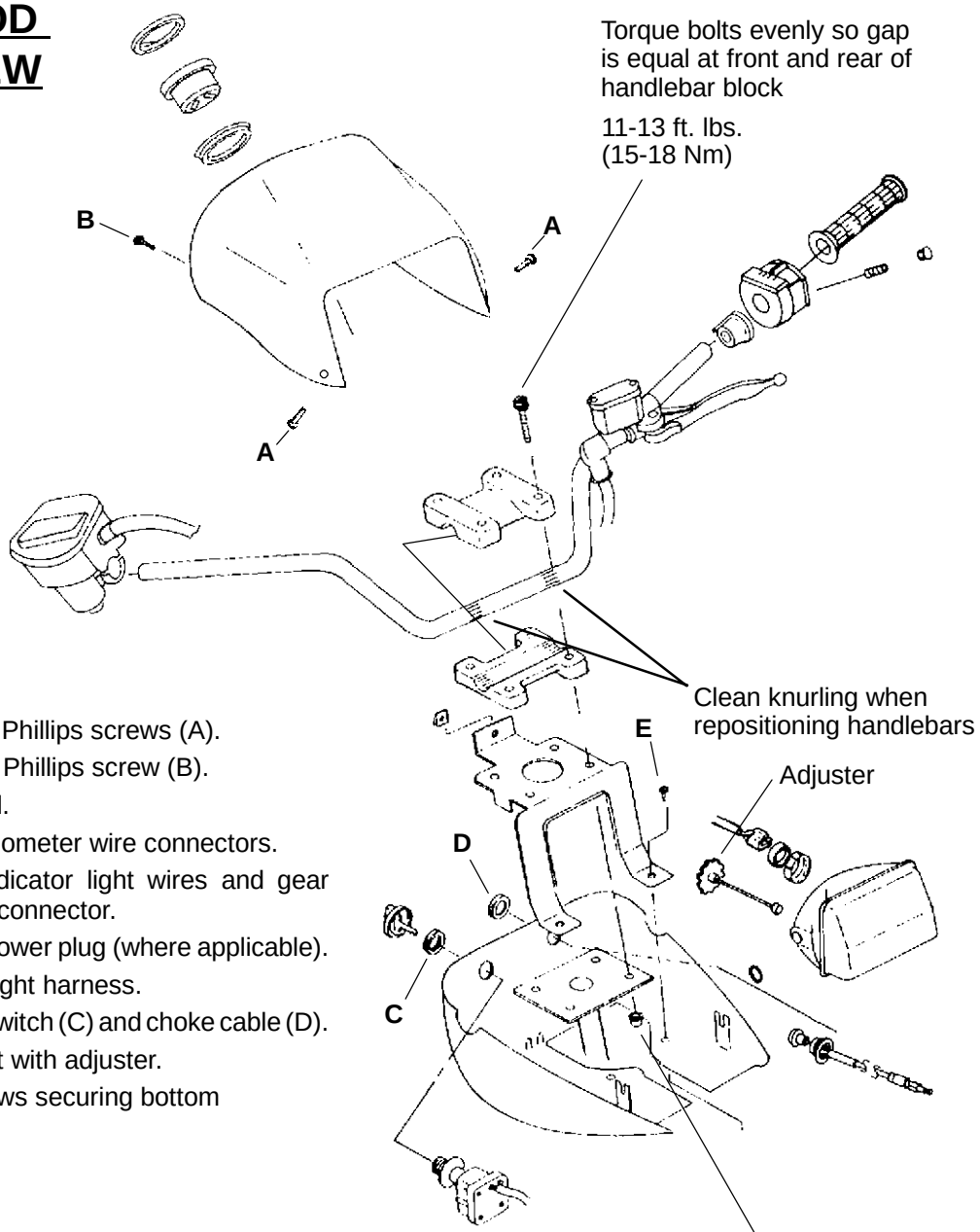
HEADLIGHT POD EXPLODED VIEW



Disassembly

- Remove two side Phillips screws (A).
- Remove one rear Phillips screw (B).
- Lift top half of pod.
- Disconnect speedometer wire connectors.
- Disconnect oil indicator light wires and gear position indicator connector.
- Disconnect 12V power plug (where applicable).
- Disconnect headlight harness.
- Remove ignition switch (C) and choke cable (D).
- Remove headlight with adjuster.
- Remove two screws securing bottom half of pod (E).

Assembly

- Install bottom of pod onto handlebar and secure to brackets.
- Install key switch, choke cable, and headlight.
- Connect 12V power outlet (where applicable)
- Connect headlight.
- Connect speedometer connectors to speedometer.
- Install top of pod onto bottom half, making sure interlocking tabs mate properly.
- Install two side Phillips screws.
- Install one rear Phillips screw.
- To adjust headlight, refer to procedure outlined in Maintenance chapter.
- To apply decals, refer to Page 5.11.

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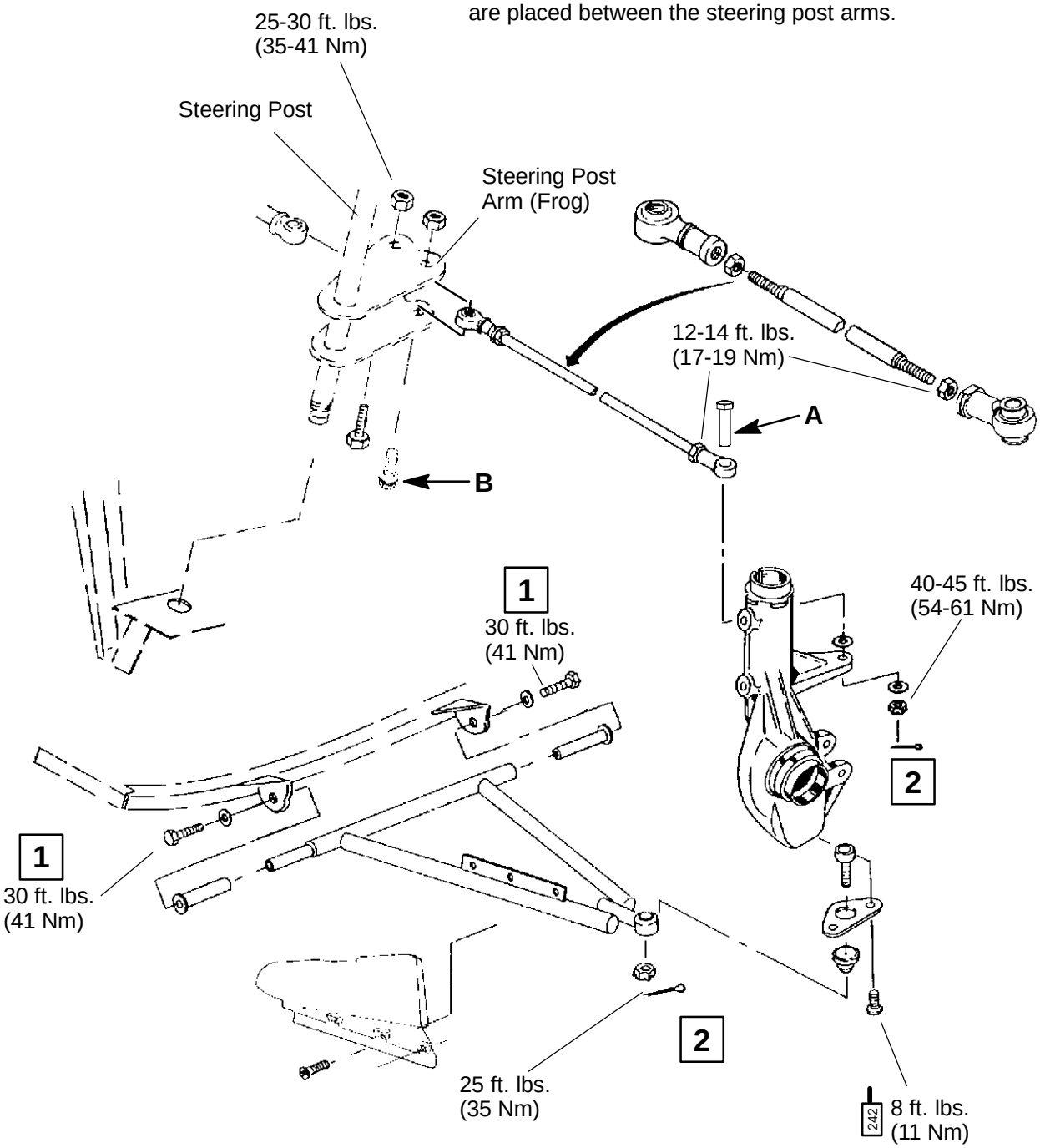
STEERING ASSEMBLY, EXPLODED VIEW

NOTE:
To avoid damage to tie rods and other steering components, be sure to install tie rod end bolts in the proper direction. The steering post arm bolt (B) points up; the rod end bolts (A) point down. Be sure inner rod ends are placed between the steering post arms.



1 Always use new bolts upon reassembly

2 Always use new cotter pins upon reassembly. Install with open end toward rear of machine.

242 Apply Loctite™ 242 to the bolt threads.

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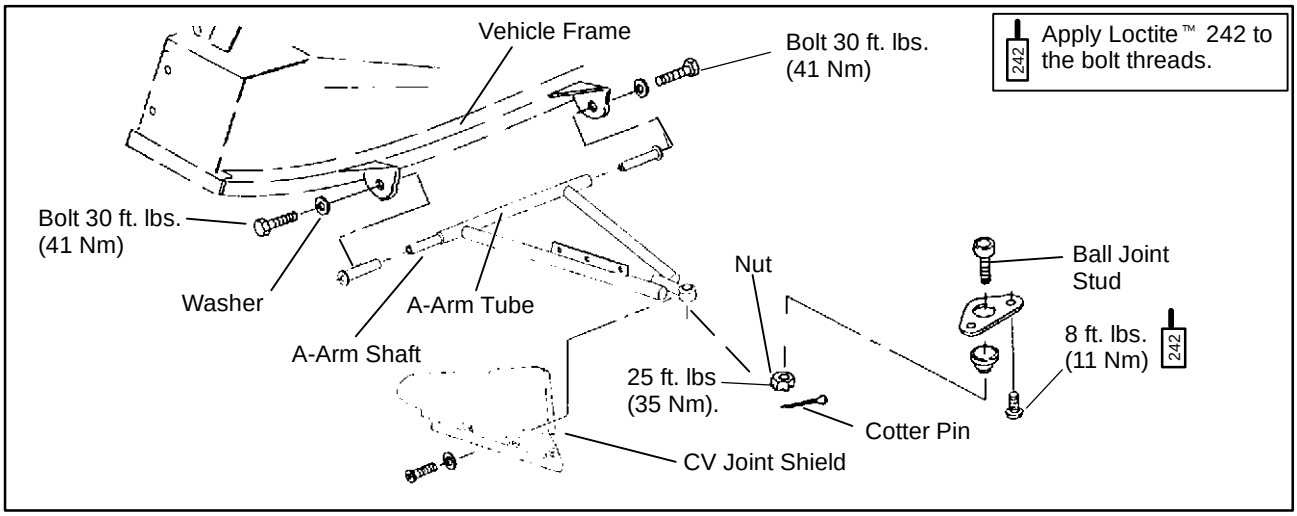
A-ARM REPLACEMENT

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



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

⚠ WARNING

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

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

A-arm Attaching Bolt Torque:

30 ft. lbs. (41 Nm)

Ball Joint Stud Nut Torque:

25 ft. lbs. (35 Nm)

⚠ WARNING

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

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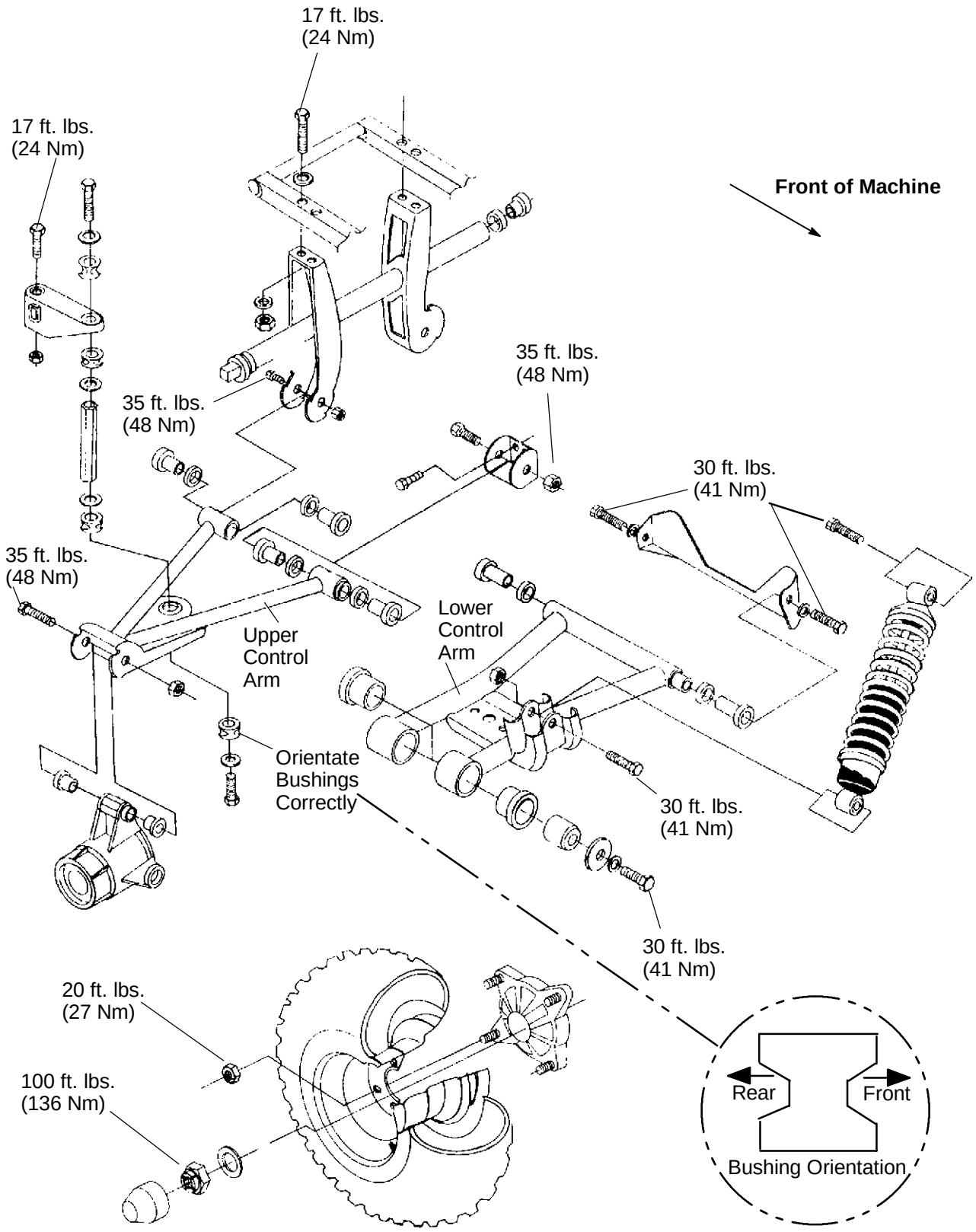
REAR SUSPENSION ASSEMBLY



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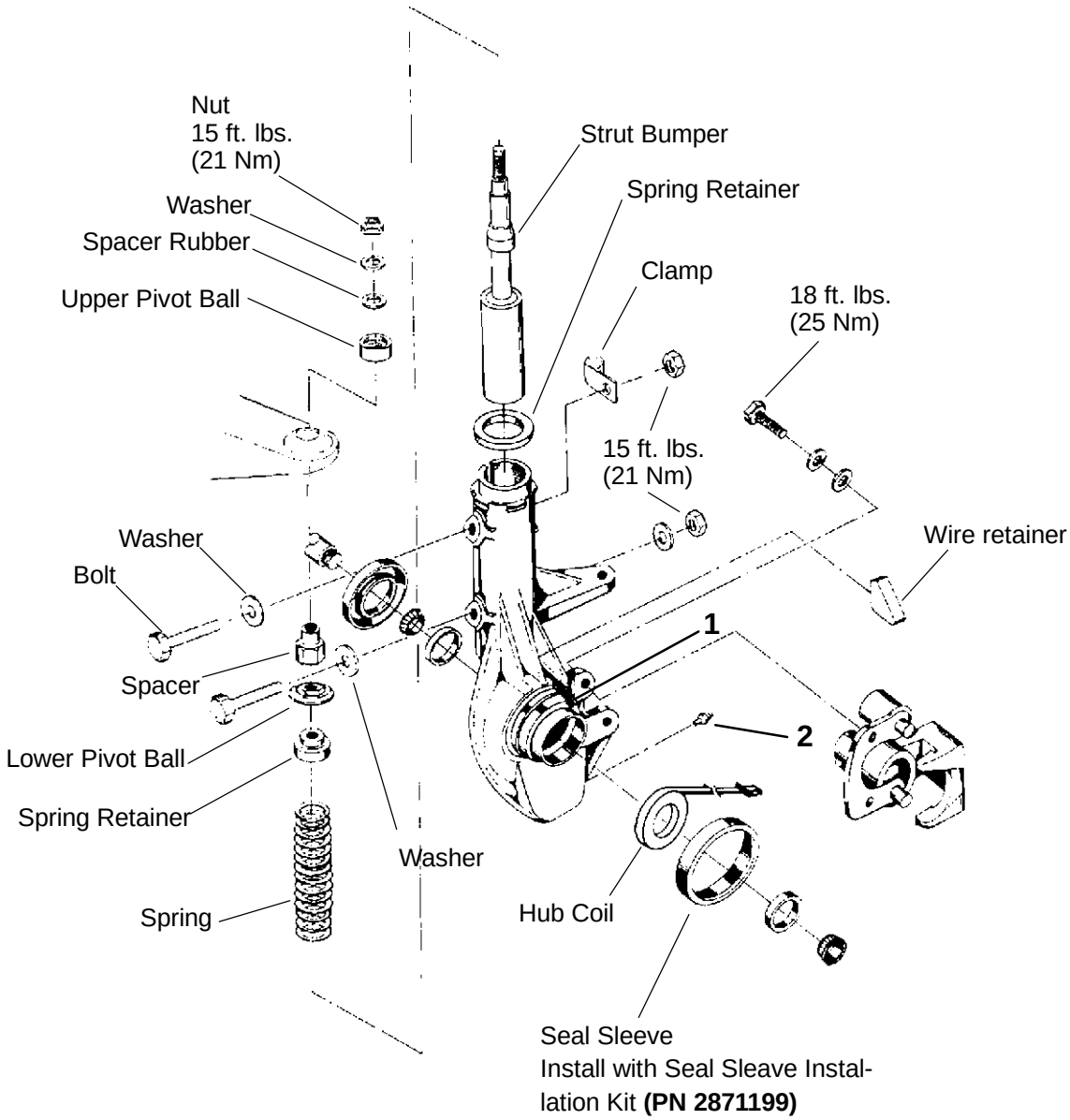
STRUT ASSEMBLY



NOTE: Be sure steel insert notch (1) and strut casting notch are lined up and provide a channel for the magnetic coil wires to lie in. If insert and strut do not match, strut replacement will be necessary.

Grease fitting (2) location. Check lubrication guide for recommended service intervals.

Specified pole gap is 0-.001″ (0-.0254mm)

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FRONT STRUT CARTRIDGE REPLACEMENT

REFER TO ILLUSTRATION ON PAGE 5.8.

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

Strut Rod Wrench (PN 2871572)

Strut Spring Compressor Tools (PN 2871573) and (PN 2871574)

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

Strut Rod Nut Torque

15 ft. lbs. (21 Nm)

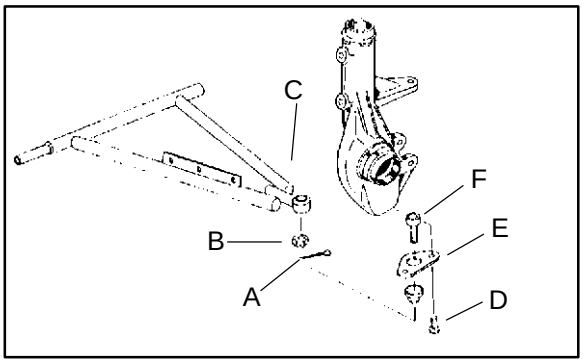
BALL JOINT REPLACEMENT

NOTE: Refer to the illustration on the previous page for this procedure.

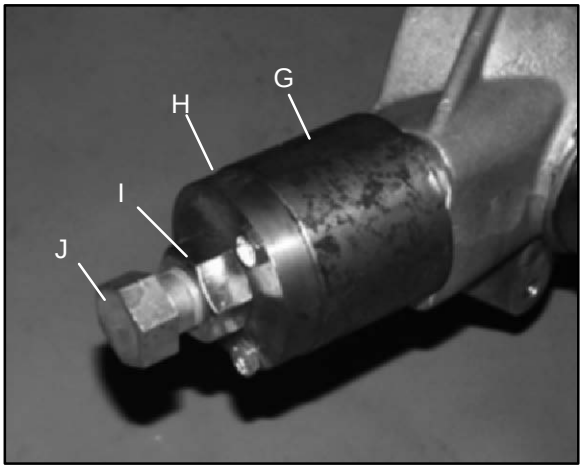
1. Loosen front wheel nuts slightly.
2. Elevate and safely support machine under footrest/frame area.

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

3. Remove wheel nuts and wheels.



4. Remove cotter pin (A) from ball joint castlenut.
5. Remove castle nut (B) and separate A-arm (C) from ball joint stud.
6. Remove screws (D) and ball joint retaining plate plate (E).
7. Use the Ball Joint Replacement Tool (**PN 2870871**), remove ball joint (F) from strut housing. Refer to photos at right.



- Install puller guide (G) with extension cap (H).
- Apply grease to extension cap and threads of puller bolt to ease removal.
- Thread bolt (J) with nut (I) onto ball joint stud as shown.
- Apply heat to ease removal.
- Hold bolt (J) and turn nut (I) clockwise until ball joint is removed from strut housing.

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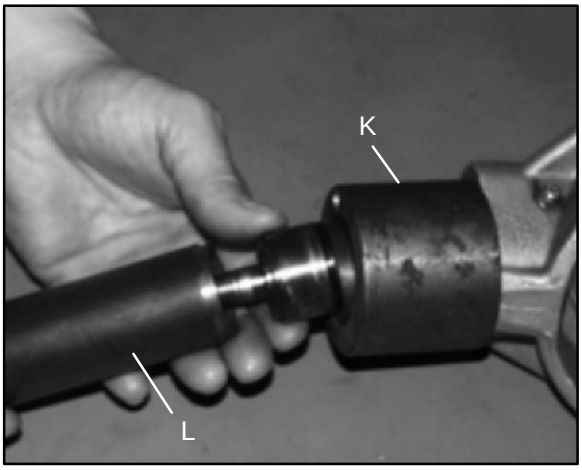


8. **To install new ball joint:**
   - Remove extension cap and attach puller guide using short bolts provided in the kit.
   - Insert new ball joint (K) into driver (L).
   - Slide ball joint/driver assembly into guide.
   - Apply heat to ease installation.
   - Drive new joint into strut housing until fully seated.
9. Apply Loctite™ 242 (**PN 2871949**) to threads of retaining plate screws or install new screws with pre-applied locking agent. Torque screws to 8 ft. lbs. (11 Nm).
10. Install A-arm on ball joint and torque castle nut to 25 ft. lbs. (35 Nm).
11. Reinstall cotter pin with open ends toward rear of machine.

DECAL REPLACEMENT

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

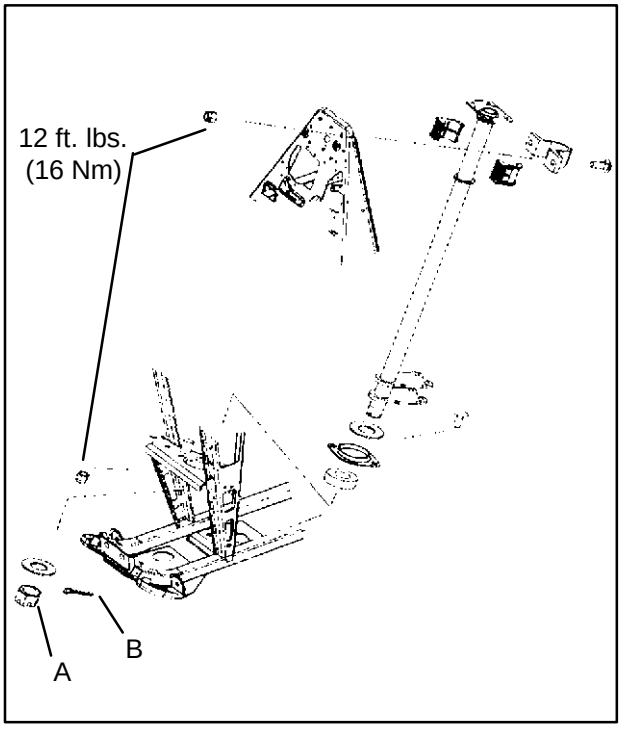
⚠ WARNING

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

To flame treat the decal area:

1. Pass the flame of a propane torch back and forth quickly over the area where the decal is to be applied until the surface appears slightly glossy. This should occur after just a few seconds of flame treating. Do not hold the torch too close to the surface. Keep the torch moving to prevent damage.
2. Apply the decal.

STEERING POST ASSEMBLY



1. Hand tighten steering post slotted nut (A).
2. Align the cotter pin hole on the steering post slotted nut (A).
3. Install the cotter pin (B). Bend both ends of the cotter pin around the slotted nut (A) in opposite directions.
4. Check the steering, the handle bars must move feely and easily from full left to full right without binding.

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NOTES

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CHAPTER 6
PVT SYSTEM

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SPECIAL SERVICE TOOLS AND SUPPLIES

TOOL DESCRIPTION	PART NUMBER
Clutch Puller	**2870506**
Clutch Holding Wrench	**9314177**
Clutch Holding Fixture	**2871358**
Spider Nut Socket	**2870338**
Drive Clutch Spider Removal and Install Tool	**2870341**
Driven Clutch Puller	**2870913**
Roller Pin Tool	**2870910**
Clutch Bushing Replacement Tool Kit	**2871226**
Piston Pin Puller	**2870386**
EBS Clutch Alignment Tool	**2872292**
EBS Bushing Replacement Kit	**2201379**
Clutch Compression Tool	**8700220**
Clutch Bushing Replacement Tool Kit	**2871025**

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

PVT SYSTEM FASTENER TORQUES

Drive Clutch Retaining Bolt . . . 40 ft. lbs. (54 Nm)

Driven Clutch Retaining Bolt . . 17 ft. lbs. (23 Nm)

PVT Inner Cover Bolts . . . . . 12 ft. lbs. (16 Nm)

Drive Clutch Spider EBS Clutch) . . . . . 200 ft. lbs. . . . . (271 Nm)

Drive Clutch Spider Lock Nut (Plastic) . 15 ft. lbs. . . . . (20.3 Nm)

Drive Clutch Cover Plate . . . . . 90 in. lbs. (10 Nm)

PVT OPERATION OVERVIEW

⚠ WARNING

⚠ All PVT maintenance or repairs should be performed only by a certified Polaris Master Service Dealer (MSD) technician who has received the proper training and understands the procedures outlined in this manual. **Because of the critical nature and precision balance incorporated into the PVT components, it is absolutely essential that no disassembly or repair be made without factory authorized special tools and service procedures.**

The Polaris Variable Transmission (PVT) consists of three major assemblies: 1) The Drive Clutch; 2) The Driven Clutch; and 3) The Drive Belt. The internal components of the drive clutch and driven clutch control engagement (initial vehicle movement), clutch upshift and backshift. During the development of a Polaris ATV, the PVT system is matched first to the engine power curve; then to average riding conditions and the vehicle's intended usage. Therefore, modifications or variations of components at random are never recommended. Proper clutch setup and careful inspection of existing components must be the primary objective when troubleshooting and tuning.

DRIVE CLUTCH OPERATION

Drive clutches primarily sense engine RPM. The two major components which control its shifting function are the shift weights and the coil spring. Whenever engine RPM is increased, centrifugal force is created, causing the shift weights to push against rollers on the moveable sheave, which is held open by coil spring preload. When this force becomes higher than the preload in the spring, the outer sheave moves inward and contacts the drive belt. This motion pinches the drive belt between the spinning sheaves and causes it to rotate, which in turn rotates the driven clutch.

At lower RPM, the drive belt rotates low in the drive clutch sheaves. As engine RPM increases, centrifugal force causes the drive belt to be forced upward on drive clutch sheaves.

DRIVEN CLUTCH OPERATION

Driven clutches primarily sense torque, opening and closing according to the forces applied to it from the drive belt and the transmission input shaft. If the torque resistance at the transmission input shaft is greater than the load from the drive belt, the drive belt is kept at the outer diameter of the driven clutch sheaves.

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DRIVEN CLUTCH OPERATION CONT'D

As engine RPM and horsepower increase, the load from the drive belt increases, resulting in the belt rotating *up* toward the outer diameter of the drive clutch sheaves and *downward* into the sheaves of the driven clutch. This action, which increases the driven clutch speed, is called *upshifting*.

Should the throttle setting remain the same and the vehicle is subjected to a heavier load, the drive belt rotates back *up* toward the outer diameter of the driven clutch and *downward* into the sheaves of the drive clutch. This action, which decreases the driven clutch speed, is called *backshifting*.

In situations where loads vary (such as uphill and downhill) and throttle settings are constant, the drive and driven clutches are continually shifting to maintain optimum engine RPM. At full throttle a perfectly matched PVT system should hold engine RPM at the peak of the power curve. This RPM should be maintained during clutch upshift and backshift. In this respect, the PVT system is similar to a power governor. Rather than vary throttle position, as a conventional governor does, the PVT system changes engine load requirements by either upshifting or backshifting.

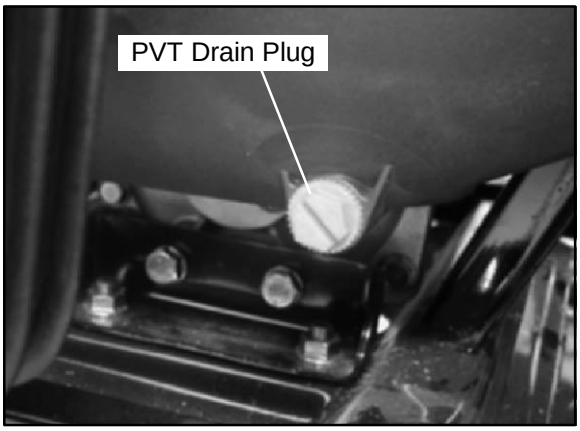
PVT MAINTENANCE/INSPECTION

Under normal operation the PVT system will provide years of trouble free operation. Periodic inspection and maintenance is required to keep the system operating at peak performance. The following list of items should be inspected and maintained to ensure maximum performance and service life of PVT components. Refer to the troubleshooting checklist at the end of this chapter for more information.

1. **Drive to Driven Clutch Offset, Belt Width.** See Page-6.16-6.18
2. **Drive and Driven Clutch Buttons and Bushings, Drive Clutch Shift Weights and Pins, Drive Clutch Spider Rollers and Roller Pins, Drive and Driven Clutch Springs.** See Pages 6.11-6.12
3. **Sheave Faces.** Clean and inspect for wear.
4. **PVT System Sealing.** Refer to appropriate illustrations and photos. The PVT system is air cooled by fins on the drive clutch stationary sheave. The fins create a low pressure area in the crankcase casting, drawing air into the system through an intake duct. The opening for this intake duct is located at a high point on the vehicle (location varies by model). The intake duct draws fresh air through a vented cover. All connecting air ducts, as well as the inner and outer covers, must be properly sealed to ensure clean air is being used for cooling the PVT system. This also will prevent water and other contaminants from entering the PVT area. A sealed PVT is especially critical on units subjected to frequent water forging.

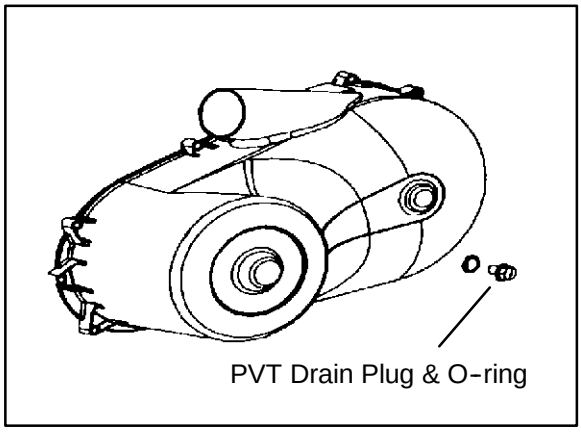
PVT DRYING

NOTE: If operating the ATV through water, be sure to check the PVT cover and other ATV components for water ingestion. The ATV should be checked immediately. Refer to Owner's Manual for Safe Riding Tips.



To drain any water that may be trapped inside the PVT cover, simply remove the PVT drain plug and O-ring located on the bottom of the PVT cover and let the water drain out. The PVT drain plug is shown below.

To further expel water in the PVT cover and to dry out the PVT system, shift the transmission to neutral and rev engine slightly to expel the moisture. This will also air-dry the belt and clutches. Allow engine RPM to settle to idle speed, shift transmission to lowest available range and test for belt slippage. Repeat as needed. Operate ATV in lowest available range for a short period of time until PVT system is dry.



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PVT OVERHEATING/DIANOSIS

During routine maintenance or whenever PVT system overheating is evident, it's important to check the inlet *and* outlet ducting for obstructions. Obstructions to air flow through the ducts will significantly increase PVT system operating temperatures. The ATV should be operated in LOW RANGE when pulling or plowing heavy loads, or if extended low speed operation is anticipated.

GENERAL RANGE OPERATION GUIDELINES:	**Low Range**: Heavy pulling, basic operational speeds less than 7 MPH, riding through rough terrain (swamps, mountains, etc.), low ground speeds.
	High Range: High ground speeds, speeds above 7 MPH.

Diagnosis of Clutch Drive Belt & Cover Related Issues:

Possible Causes	Solutions/What to do
Loading the ATV into a pickup or tall trailer when in high range.	Shift transmission to low range during loading of the ATV to prevent belt burning.
Starting out going up a steep incline.	When starting out on an incline, use low range, or dismount the ATV after first applying the park brake and perform the "K" turn.
Driving at low RPM or low ground speed (at approximately 3–7 MPH).	Drive at higher speed or use Low Range. The use of Low Range is highly recommended for cooler PVT operating temperatures and longer component life.
Insufficient warm–up of ATVs exposed to low ambient temperatures.	Warm engine at least 5 min., then with transmission in neutral, advance throttle to approx. 1/8 throttle in short bursts, 5 to 7 times. The belt will become more flexible and prevent belt burning.
Slow and easy clutch engagement.	Fast, effective use of the throttle for efficient engagement. Continuous operation at the point of engagement (initial vehicle movement) increases PVT temperatures and component wear.
Towing/Pushing at low RPM/low ground speed.	Use Low Range only.
Plowing snow, dirt, etc./utility use.	Use Low Range only.
Stuck in mud or snow.	Shift the transmission to Low Range, carefully use fast, aggressive throttle application to engage clutch. **Warning: Excessive throttle may cause loss of control and vehicle overturn.**
Climbing over large objects from a stopped position.	Shift the transmission to Low Range, carefully use fast, aggressive, throttle application to engage clutch. **Warning: Excessive throttle may cause loss of control and vehicle overturn.**
Belt slippage from water or snow ingestion into the PVT system.	Shift the transmission to neutral. Using the throttle, vary the engine rpm from idle to **3/4 throttle**. Engage transmission in the lowest possible range and test for belt slippage Repeat several times as required. **During this procedure, the throttle should not be held at the full position for more than 10 seconds**. PVT seals should be inspected for damage if repeated leaking occurs.
Clutch malfunction.	Inspection/repair of clutch components should be performed by a certified Polaris MSD techinician.

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PVT DISASSEMBLY

NOTE: Some fasteners and procedures will vary. Refer to the appropriate parts manual for proper fasteners and fastener placement. (See Page 6.8).

1. Remove seat.
2. Remove or loosen rear cab fasteners as necessary to gain access to PVT outer cover.
3. Remove PVT air outlet duct hose.
4. Remove outer cover screws. Refer to Page 6.7.
5. Mark the drive belt direction of rotation and remove drive belt. See Page 6.14 for drive belt removal.
6. Remove drive clutch retaining bolt and remove drive clutch using puller.

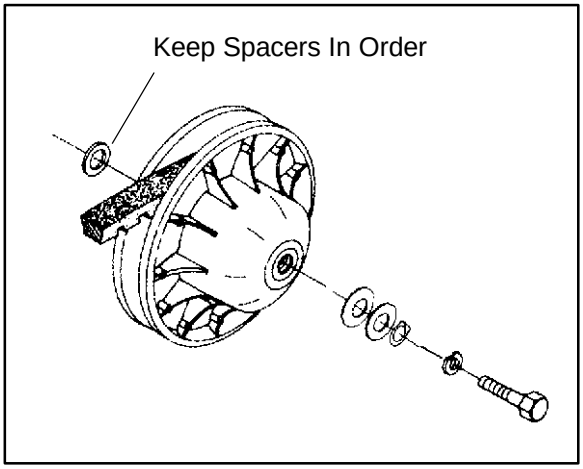
Drive Clutch Puller (PN 2870506)

Clutch Holding Wrench (PN 9314177)

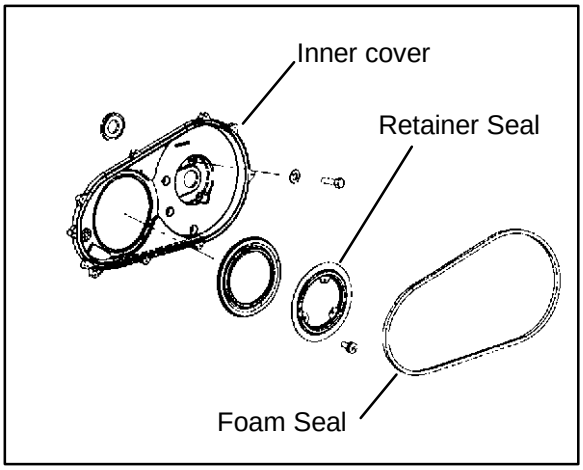
7. Remove driven clutch retaining bolt and driven clutch. Use puller if necessary.

Driven Clutch Puller (PN 2870913)

8. Remove driven clutch offset spacers from the transmission input shaft. NOTE: Remember to keep spacers in order for proper clutch offset on reassembly.



9. Remove cover screws and retainer plate.



10. Remove inner cover retaining bolts at rear of cover.
11. Remove cover along with foam seal on back of cover or shaft.

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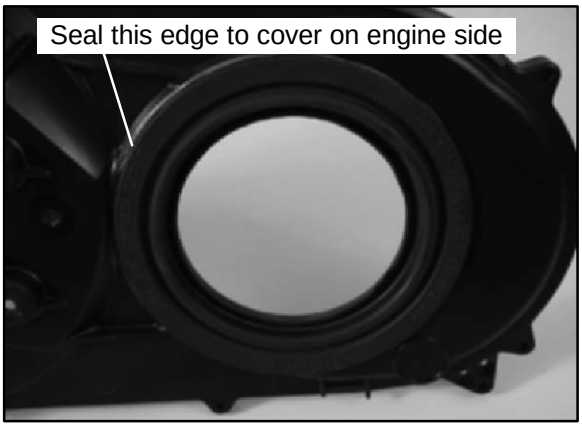
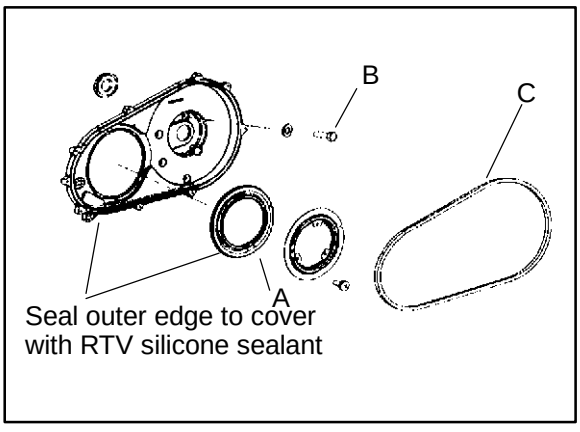
PVT ASSEMBLY/INSPECTION

1. Inspect PVT inner cover-to-engine seal. Replace if cracked or damaged. Align the alignment mark on the cover with the mark on the engine seal.



2. Place a new seal on transmission input shaft.
3. Apply RTV silicone sealant to outside edge of inner cover-to-engine seal, to ensure a water tight fit between the seal and the cover on engine side. Surfaces must be clean to ensure adhesion of silicone sealant.
4. Reinstall cover and tighten rear cover bolts just enough to hold it in place.
5. Fit lip of inner cover seal (A) to engine. Install seal retainer plate and tighten screws securely.
6. Torque rear inner cover bolts (B) to specification.



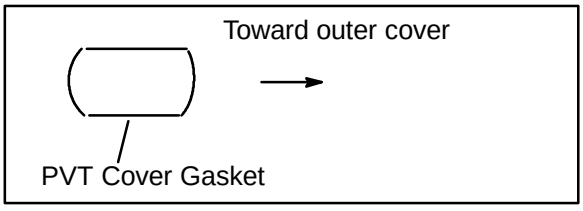
Inner Cover Bolt Torque (Rear):
12 ft. lbs. (16.6 Nm)

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

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

7. Install clutch offset spacer(s) on transmission input shaft.

8. Clean splines inside driven clutch and on the transmission input shaft.
9. Apply a light film of grease to the splines on the shaft.
10. Install the driven clutch, washer, lock washer, and retaining bolt. Torque to specification.
11. Clean end of taper on crankshaft and the taper bore inside drive clutch.
12. Install drive clutch and torque retaining bolt to specification.
13. Reinstall drive belt noting direction of rotation. If a new belt is installed, install so numbers can be easily read.
14. Only replace PVT outer cover rubber gasket if it is damaged. Place the gasket with the narrow side out (C).



15. Reinstall PVT outer cover and secure with screws.
16. Reinstall rear cab assembly, panel and seat.

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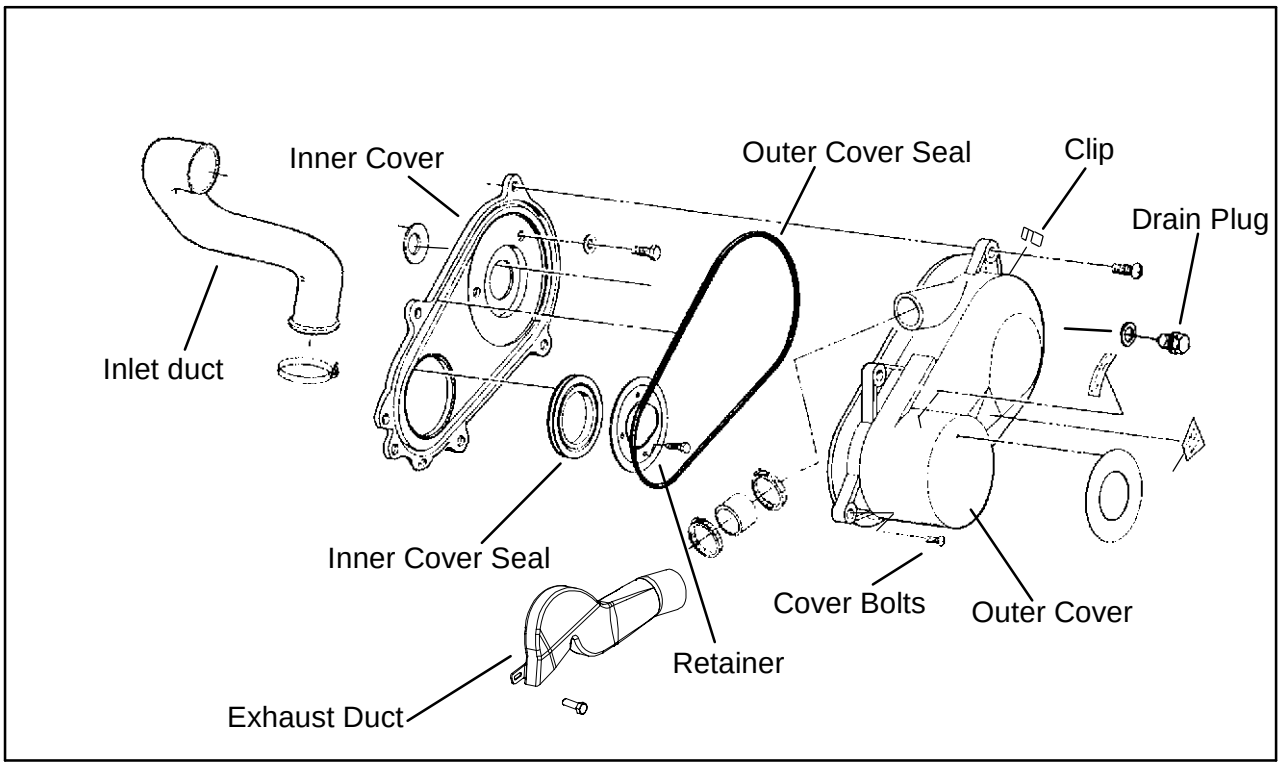
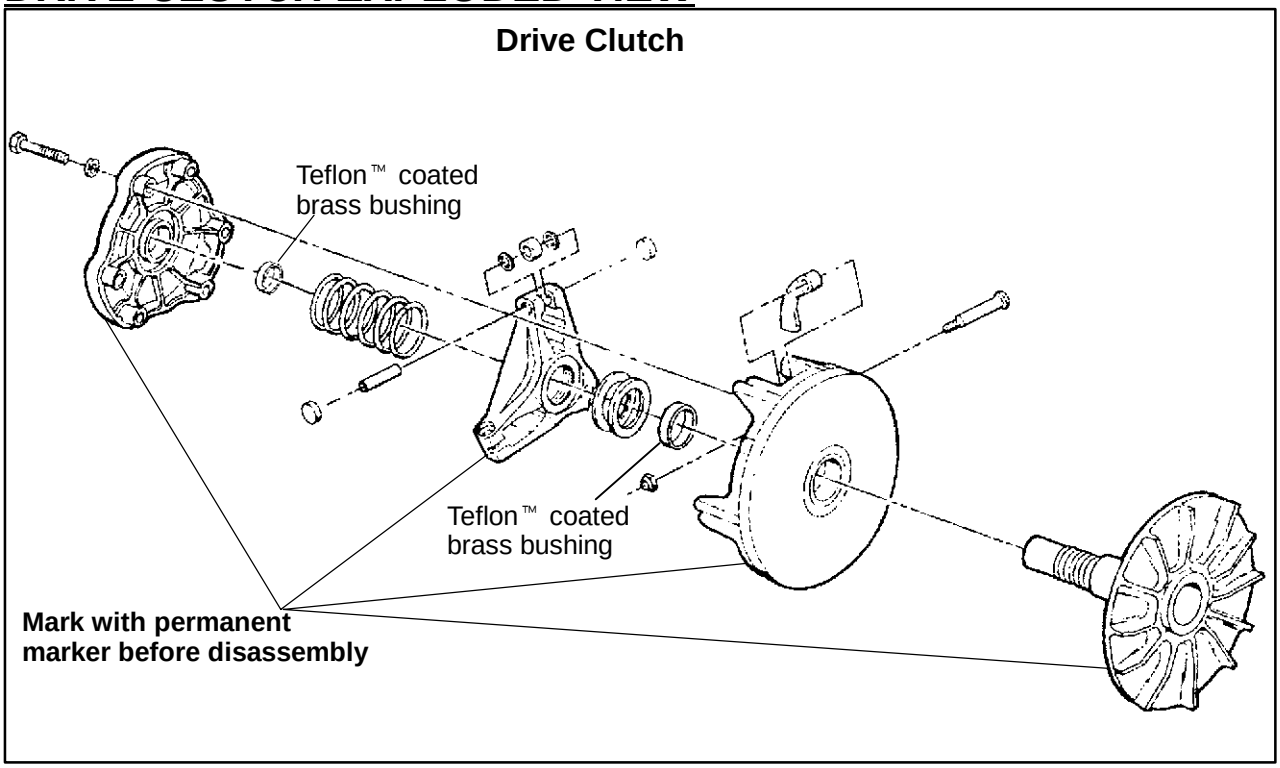
PVT SEALING AND DUCTING COMPONENTS



DRIVE CLUTCH EXPLODED VIEW



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DRIVE CLUTCH SPRING SPECIFICATIONS

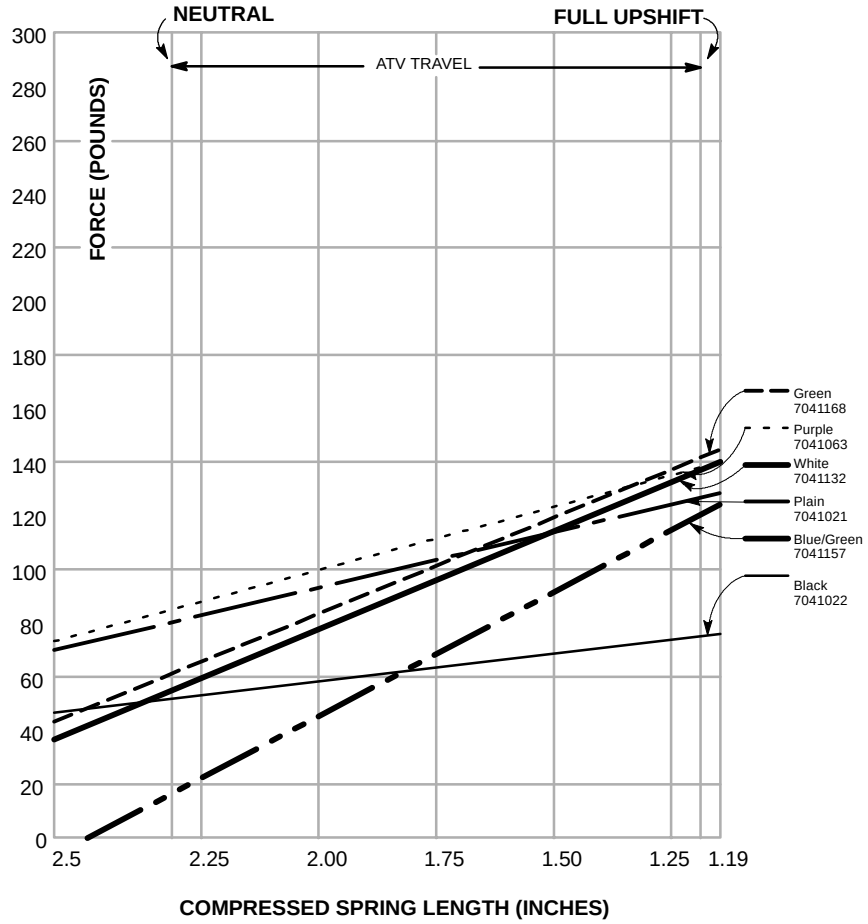
The drive clutch spring has two primary functions:

1. **Controls clutch engagement RPM.** The springs which have a higher rate when the clutch is in neutral will increase clutch engagement RPM.
2. **Controls the rate at which the drive belt moves upward in the drive clutch sheaves.** This is referred to as drive clutch upshift.

The drive clutch spring is one of the most critical components of the PVT system. It is also one of the easiest to service. Due to the severe stress the coil spring is subject to during operation, it should always be inspected for tolerance limits during any clutch diagnosis or repair.

There are other components which control upshift, but the spring is one of the primary components in insuring optimum performance. It is very important that the spring is of correct design and is in good condition.

CAUTION: Never shim a drive clutch spring to increase its compression rate. This may result in complete stacking of the coils and subsequent clutch component failure.



Measuring Spring Length: With the spring resting on a flat surface, measure its free length from the outer coil surfaces as shown. Refer to the spring specification chart for specific free length measurements and tolerances. Also check to see that spring coils are parallel to one another. Distortion of the spring indicates stress fatigue, requiring replacement.

Primary Clutch Springs

PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH ±.125″
7041021	Plain	.157″	4.38″
7041022	Black	.140″	4.25″
7041063	Purple	.168″	4.37″
7041132	White	.177″	2.92″
7041168	Green	.177″	3.05″
7041157	Blue/Green	.177″	2.53″

Secondary Clutch Springs

PART NUMBER	DESCRIPTION
7041198	Red
7041782	Black 5-coil
7041501	Gold 6-coil
7041499	Silver
7041296	Blue
7041646	Silver/Blue

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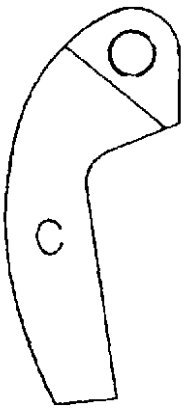
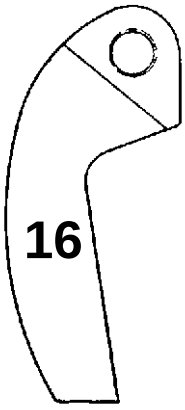
SHIFT WEIGHTS

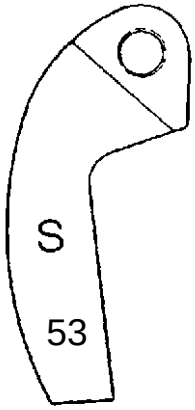
Shown below are optional shift weights which may be used in the PVT system. These shift weights have many different factors designed into them for controlling engagement RPM and shifting patterns. Shift weights should not be changed or altered without first having a thorough understanding the effects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



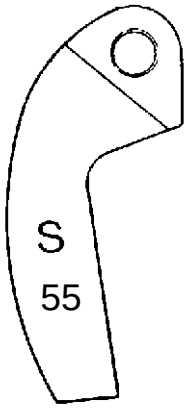
PN 5630418
50 gr



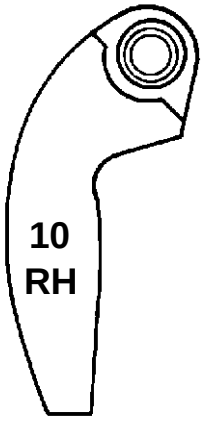
PN 5630279
43 gr



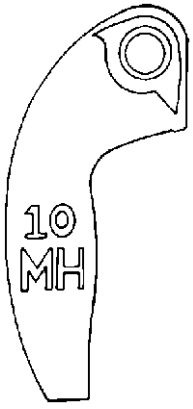
PN 5630095
53 gr



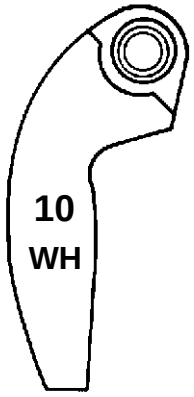
PN 5630509
55 gr



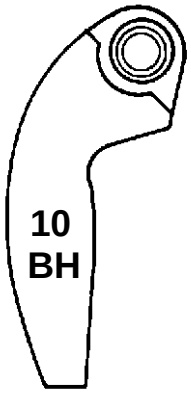
PN 5630709
44 gr



PN 5630513
50.5 gr



PN 5630710
46 gr



PN 5630711
47gr

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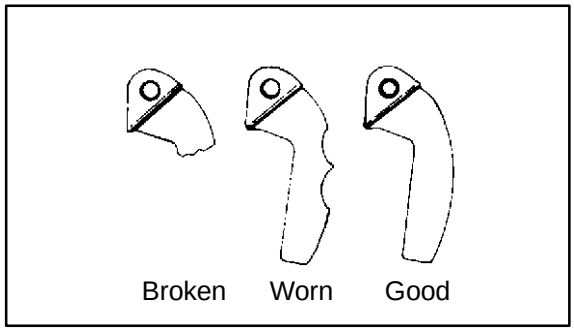
SHIFT WEIGHT INSPECTION

1. Inspect as shown, using a clutch holding tool to compress the moveable sheave. The contact surface of the weight should be smooth and free of dents or gall marks. Remove shift weight bolts and weights.



Inspect the weight pivot bore and pivot bolts for wear or galling. If weights or bolts are worn or broken, replace in sets of three with new bolts. **NOTE:** A damaged shift weight is usually caused by a damaged or stuck roller in the spider assembly. See roller inspection, Page 6.12.

⚠ WARNING

The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly!

All PVT maintenance or repairs should be performed only by a certified Polaris Master Service Dealer (MSD) technician who has received the proper training and understands the procedures outlined in this manual. **Because of the critical nature and precision balance incorporated into the PVT system, it is absolutely essential that no attempt at disassembly or repair be made without factory authorized special tools and service procedures.**

BUTTON TO TOWER CLEARANCE INSPECTION

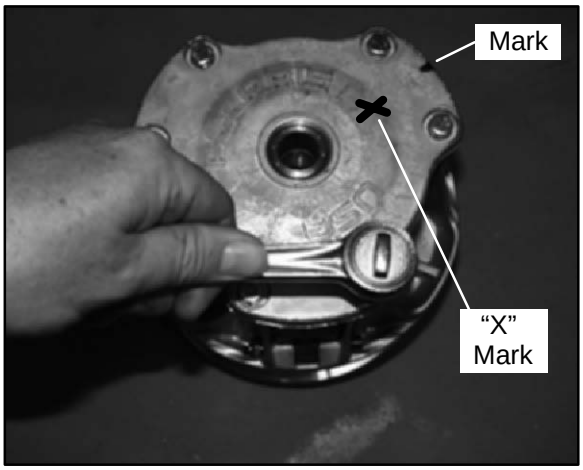
1. Inspect for any clearance between spider button to tower. If clearance exists, replace all buttons and inspect surface of towers. See Spider Removal Page 6.12.

Button to Tower Clearance:
.000 - .001″

2. Inspect sheave surfaces. Replace the *entire clutch as an assembly* if worn, damaged or cracked.

DRIVE CLUTCH DISASSEMBLY

1. Using a permanent marker, mark the cover, spider, and moveable and stationary sheaves for reference, as the previous X's may not have been in alignment before disassembly.



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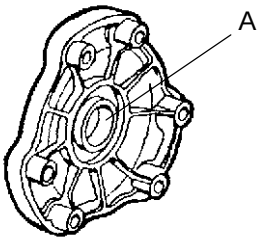
DRIVE CLUTCH DISASSEMBLY CONT'D

2. Remove cover bolts evenly in a cross pattern and remove cover plate.
3. Inspect cover bushing (A). The outer cover bushing is manufactured with a Teflon™ coating. Wear is determined by the amount of Teflon™ remaining on the bushing.

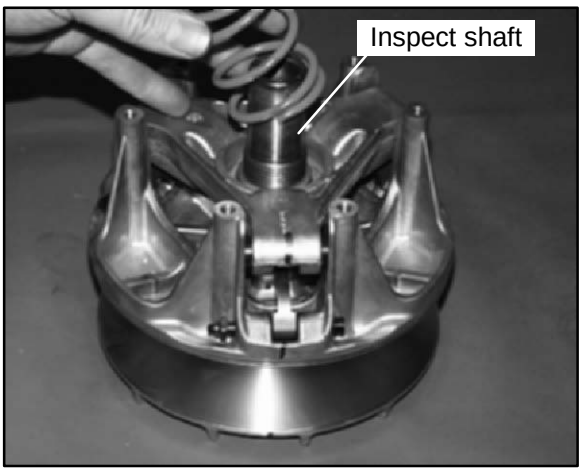
Cover Bushing inspection



Cover Bushing Inspection:

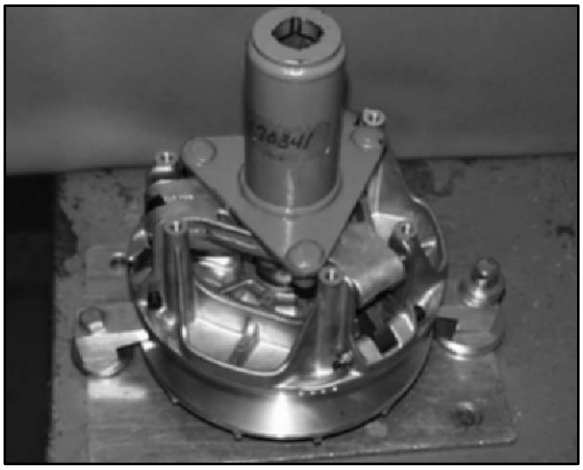
Replace the cover bushing if more brass than Teflon™ is visible on the bushing. Refer to bushing replacement in this chapter.

4. Inspect area on shaft where bushing rides for wear, galling, nicks, or scratches. Replace clutch assembly if worn or damaged.
5. Remove and inspect spring. (See Page 6.8)



SPIDER REMOVAL

1. Remove the limiter nut using the Clutch Spider Nut Socket **(PN 2870338)**. Install clutch in holding fixture and loosen the spider (counterclockwise) using Clutch Spider Install Tool **(PN 2870341)**.

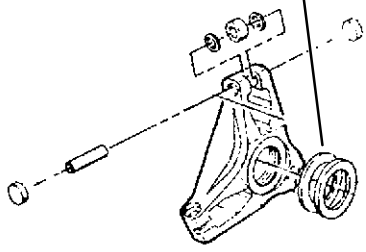


Clutch Holding Fixture:
(PN 2871358)

Spider Removal Tool:
(PN 2870341)

NOTE: It is important that the same number and thickness of washers are reinstalled beneath the spider during assembly. Be sure to note the number and thickness of these washers.

To maintain proper clutch balance and belt-to-sheave clearance, be sure to reinstall original quantity and thickness washers



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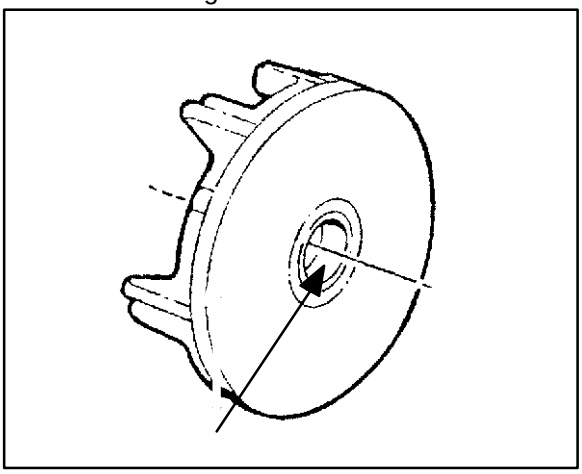
Moveable Sheave Bushing Inspection

2. Inspect the Teflon™ coating on the moveable sheave bushing.

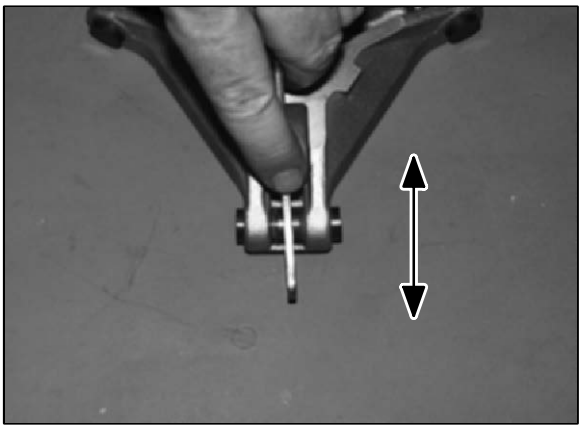


Moveable Sheave Bushing Inspection:

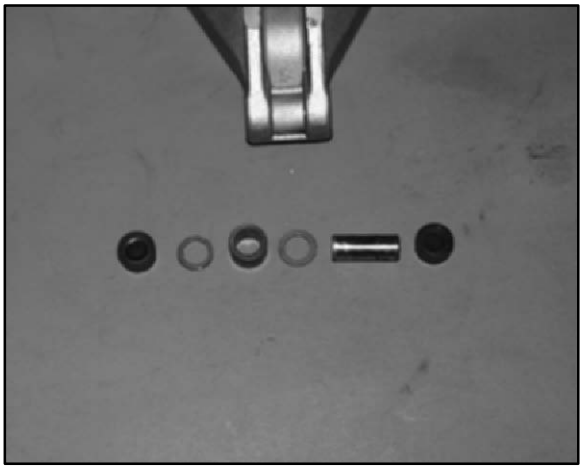
Replace the cover bushing if more brass than Teflon™ is visible on the bushing. Refer to bushing replacement in this chapter.

Roller, Pin and Thrust Washer Inspection

3. Inspect all rollers, bushings and roller pins by pulling a flat metal rod across the roller. Turn roller with your finger. If you notice resistance, galling, or flat spots, replace rollers, pins and thrust washers in sets of three. Also inspect to see if roller and bushing are separating. Bushing must fit tightly in roller. Use the Roller Pin Tool (**PN 2870910**) to replace rollers and pins. Take care not to damage roller bushing or bearing surface of the new pin during installation.



4. Rubber backed buttons can and should be used in all ATV clutches *if the hollow roller pin is changed to a solid roller pin.* **NOTE:** The rubber side of the button is positioned toward the solid roller pin. It is recommended to switch all buttons to the rubber version during service (if needed).



DRIVE CLUTCH REASSEMBLY

NOTE: It is important that the same number and thickness of washers are reinstalled beneath the spider during assembly. The Teflon bushings are self-lubricating. **Do not apply oil or grease to the bushings**.

1. Reassemble drive clutch in the following sequence. Be sure the “X”, or the marks that were made earlier, are aligned during each phase of assembly.

   a) “X”, or the marks that were made earlier on cover

   b) X on spider, making sure spacer washers are installed underneath spider and positioned properly in recess.

   c) “X”, or the marks that were made earlier under weight

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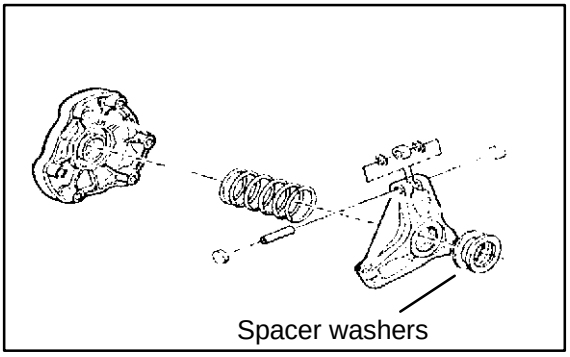
DRIVE CLUTCH REASSEMBLY CONT'D

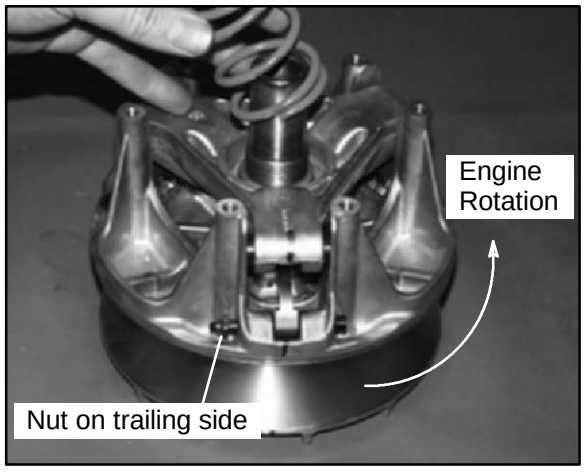
2. Install moveable sheave onto fixed sheave.
3. Install spider spacers. Use same quantity and thickness as were removed.
4. Compress spider buttons for each tower and install spider, making sure that "X", or the marks that were made earlier, on spider aligns with "X", or the marks that were made earlier on the moveable sheave.
5. Torque spider to specification using the holding fixture and spider tool. Torque with smooth motion to avoid damage to the stationary sheave. Refer to Page 6.3 for torque specification.

CAUTION:

Be sure the spider spacer washers are fully seated in the recessed area of the spider. Any misalignment will alter clutch balance. Inverting the clutch while initially tightening the spider will help position the washers.



6. Install limiter nut on top of spider using the Clutch Spider Nut Socket **(PN 2870338)**. Torque to 15 ft. lbs. Reinstall shift weights using new lock nuts on the bolts.
7. Reinstall clutch spring.



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

Spider Torque:
200 ft. lbs. (271 Nm)

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

DRIVE BELT TENSION (NON-EBS)

NOTE:Belt tension is <u>not</u> adjustable on EBS models.

NOTE: Pinch the sheaves lightly together with clamp to prevent the belt from being pushed into the driven sheave.

1. Place a straight edge on top of the belt between drive and driven clutch.
2. Push down on drive belt until it is lightly tensioned.
3. Measure belt deflection as shown in illustration.

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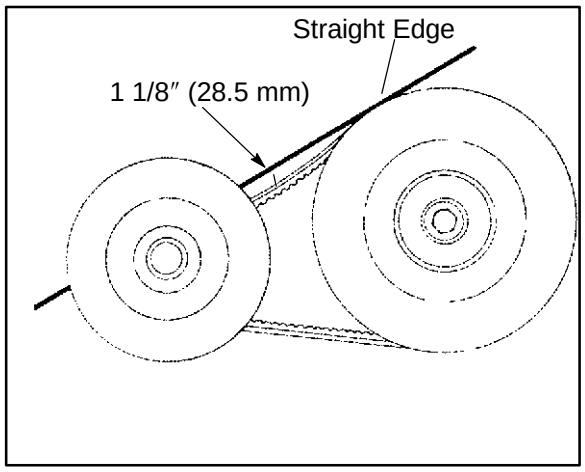

Belt Deflection (Tension):

1 1/8″ (2.9 cm) - 1 1/4″ (3.2 cm)

If belt deflection is out of specification, adjust by removing or adding shims between the driven clutch sheaves.

- Remove shims to decrease belt deflection
- Add shims to increase belt deflection

See Driven Clutch Disassembly/Inspection, Pages 6.19 - 6.20.

NOTE: At least one shim must remain between the inner and outer sheave of the driven clutch. If proper belt deflection cannot be obtained, measure drive belt width, length, and center distance of drive and driven clutch, outlined in this section; all have an effect on belt deflection.

DRIVE BELT REMOVAL/INSPECTION

1. Remove outer PVT cover as described in PVT Disassembly.
2. Mark drive belt direction of rotation so that it can be installed in the same direction. **NOTE:** Normally positioned so part numbers are easily read.
3. To remove drive belt, apply brake, pull upward and rearward on belt to open driven clutch sheaves, pull out and down on belt to slip over the driven clutch outer sheave.

NOTE: When reinstalling the belt with the drive clutch and driven clutch already removed follow these steps:

- Install the driven clutch.
- Install the belt onto the driven clutch.
- Loop the drive clutch through the belt.
- Install the drive clutch onto the crankshaft.

4. Measure belt width and replace if worn. Generally, belts should be replaced if clutches can no longer be adjusted to provide proper belt deflection.
   - The top edges have been trimmed on some drive belts. It will be necessary to project the side profiles and measure from corner to corner.
   - Place a straight edge on each side of the drive belt.
   - Place another straight edge on top of belt.
   - Measure the distance where the side straight edges intersect the top, as

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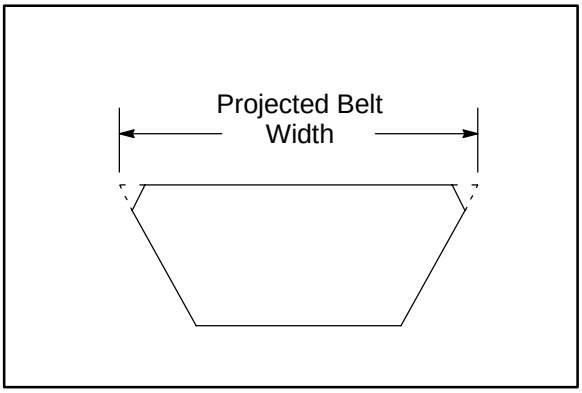
shown in the illustration.

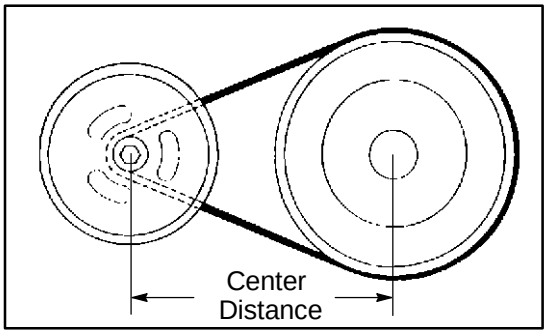


Belt Width:

New 1.174 - 1.188″ (2.98-3.02 cm)

Wear Limit 1.125″ (2.86 cm)

5. Inspect belt for loose cords, missing cogs, cracks, abrasions, thin spots, or excessive wear. Replace if necessary.
6. Inspect belt for hour glassing (extreme circular wear in at least one spot and on both sides of the belt). Hour glassing occurs when the drive train does not move and the drive clutch engages the belt continuously in one spot.
7. Measure belt length with a tape measure around the outer circumference of the belt. Belts which measure longer than nominal length may require driven shimming or engine adjustment for a longer center distance to obtain proper belt deflection. Belts which measure shorter than nominal length may require driven shimming or a shorter center distance. *Remember, proper belt deflection is the desired goal – not a specific center distance.*
8. Replace belt if worn past the service limit. Belts with thin spots, burn marks, etc., should be replaced to eliminate noise, vibration, or erratic PVT operation. See Troubleshooting Chart at the end of this chapter for possible causes.



Clutch Center Distance -
10″ +.1 / -.05 (254 +2.5 / -1.3mm)
Belt Nominal Length - 40.875″± 3/16
(103.8 cm ± .48 cm)

DRIVE BELT INSTALLATION

1. Loop belt over drive and over top of driven sheave.
2. While pushing down on top of belt, turn the back or moveable driven sheave clockwise.

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

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

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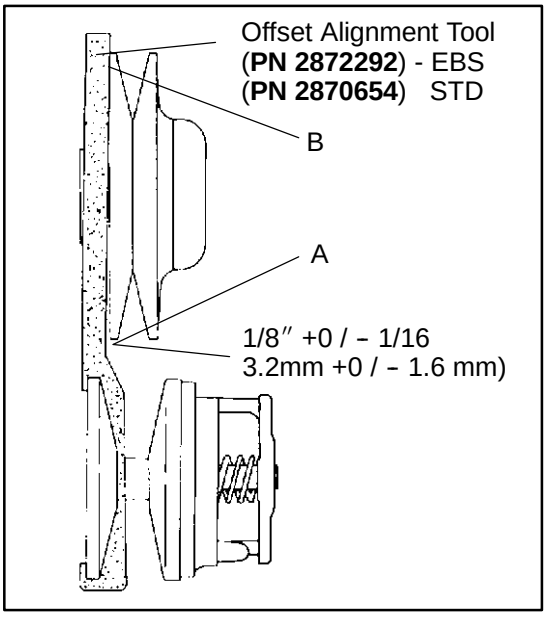
CLUTCH ALIGNMENT

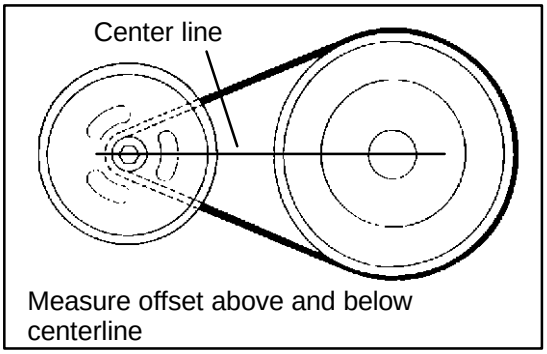
1. Remove belt and install the Clutch Offset Alignment Tool) as shown.



2. With tool touching rear of driven clutch inner sheave, the distance at point “A” should be 1/8″.

NOTE: If the distance is greater than 1/8″ or less than 1/16″, clutch alignment must be adjusted as follows:

3. Remove drive and driven clutch. See PVT Disassembly, Page 6.5.
4. Remove PVT inner cover.
5. Loosen all engine mounts. Move front of engine to the right or left slightly until alignment is correct.
6. Tighten engine mounts and verify alignment is correct.
7. Measure belt deflection and measure offset both **above and below** shaft centerlines. Adjust if necessary.



NOTE: On some models, minor adjustments can be made by adding shims between the frame and front lower left engine mount to increase the distance at point “A”. If a shim is present, it can be removed to decrease the distance at point “A”.

Shim Kit (PN 2200126)

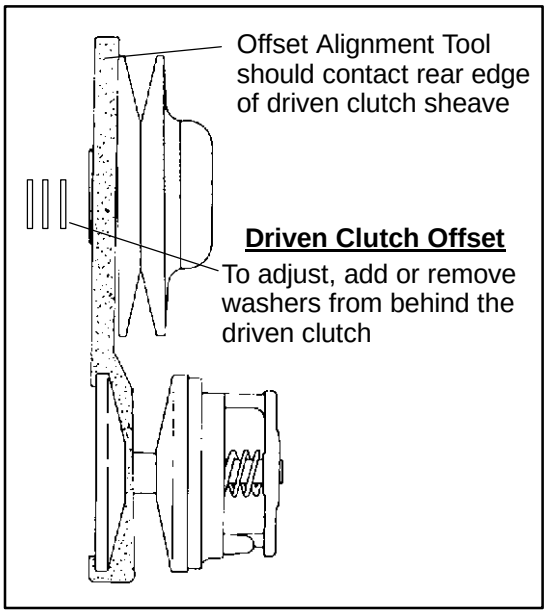
CLUTCH OFFSET

Important: Inspect clutch alignment and center distance before adjusting offset.

Offset is correct when rear of tool contacts rear of inner sheave with driven clutch pushed completely inward on shaft and bolt torqued. Adjust offset by adding or removing spacer washers between back of driven clutch and spacer.

Spacer Washer (PN 7556401)

1. Install offset alignment tool as shown. Remember to measure above and below the shaft centerlines.



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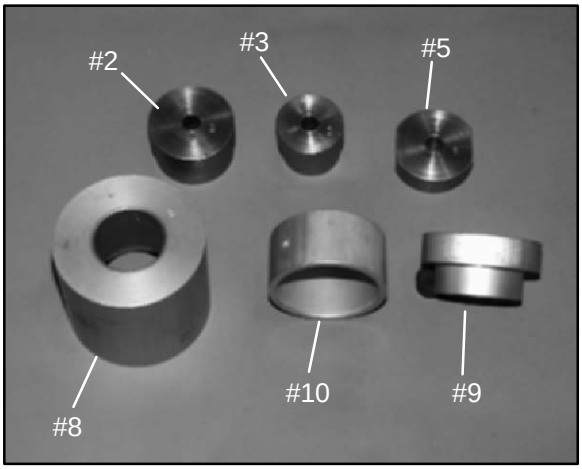
DRIVE CLUTCH BUSHING SERVICE

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

Stamp	Qty.	Part Desciption	Part #
#2	1	P-90 Drive/Driven Cluth Bushing Install Tool	**5020628**
#3	1	Drive Clutch Cover Bushing Removal/ Installation Tool (all clutches)	**5020629**
#5	1	P-90 Driven Clutch Cover Bushing Re-moval Tool	**5020631**
#8	1	Main Puller Adapter	**5020632**
#9	1	Adapter Reducer	**5010279**
#10	1	Number Two Puller Adapter	**5020633**

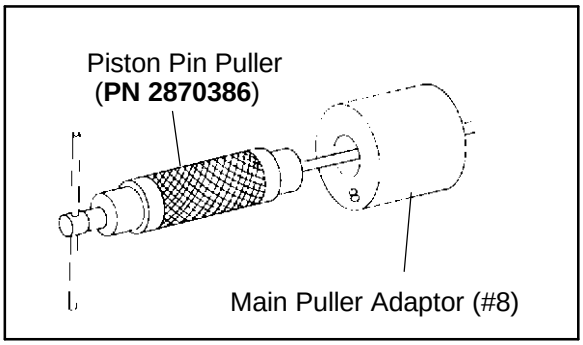
DRIVE CLUTCH MOVEABLE SHEAVE - BUSHING REMOVAL



1. Install handle end of the Piston Pin Puller (**PN 2870386**) securely into bench vise and lightly grease puller threads.

Piston Pin Puller (PN 2870386)

2. Remove nut from puller rod and set aside.



3. Install the Main Puller Adapter (#8) (**PN 5020632**) onto the Piston Pin Puller (**PN 2870386**).

4. Insert the Number Two Adapter (#10) (**PN 5020633**) into the bushing from belt side as shown. With towers pointing toward vise, slide sheave and bushing onto puller rod.
5. Install the nut removed in Step 2 onto end of puller rod and hand tighten. Turn puller barrel to increase tension on sheave if needed. Nut is left hand thread

6. Turn sheave and puller barrel together counterclockwise on puller rod until bushing is removed.
7. Remove nut from puller rod and set aside.

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8. Pull bushing removal tool and adapter from puller rod. Remove bushing from tool and discard.

DRIVE CLUTCH MOVEABLE SHEAVE - BUSHING INSTALLATION

1. Place the Main Puller Adapter (#8) (**PN 5020632**) onto the puller.
2. Apply Loctite™ 680 (**PN 2870584**) to the back side of new bushing. Push bushing into center of sheave on tower side by hand.

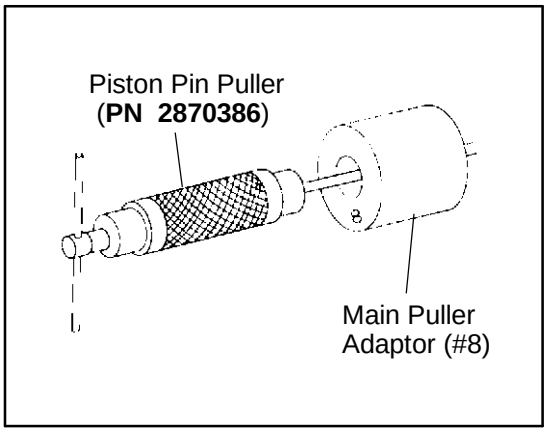
Bushing (PN 3576504)

Loctite™ 680 (PN 2870584)

3. Insert the Clutch Bushing Installation Tool (#2) (**PN 5020628**) into center of sheave and with towers pointing away from vise, slide sheave onto puller rod.
4. Install nut on puller rod and hand tighten. Turn barrel to apply additional tension if needed.
5. Turn sheave and barrel together counterclockwise until bushing is seated.

6. Remove nut from puller rod and set aside.
7. Remove sheave from puller.
8. Remove installation tool.

DRIVE CLUTCH COVER - BUSHING REMOVAL



1. Install the Main Puller Adapter (#8) (**PN 5020632**) onto the Piston Pin Puller (**PN 2870386**).

2. From outside of clutch cover, insert the Drive Cover Bushing Remover (#3) (**PN 5020629**) into cover bushing.

3. With inside of cover toward vise, slide cover onto puller.
4. Install nut onto puller rod and hand tighten. Turn puller barrel to increase tension as needed.

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5. Turn clutch cover counterclockwise on puller rod until bushing is removed.
6. Remove nut from puller rod and set aside.
7. Remove bushing and bushing removal tool from puller. Discard bushing.

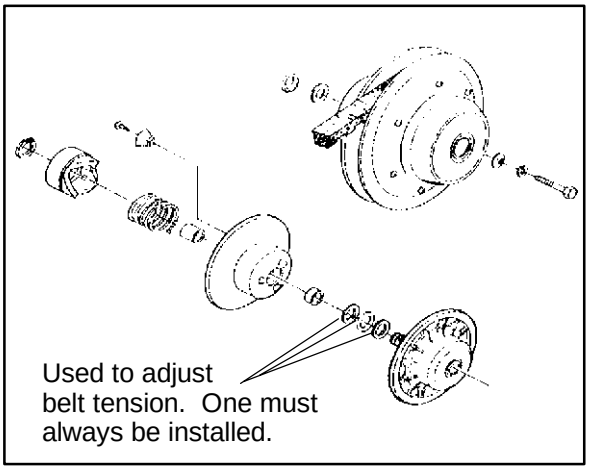
DRIVE CLUTCH COVER - BUSHING INSTALLATION

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

Bushing (PN 3576510)
Loctite™ 680 (PN 2870584)

2. With the Main Puller Adapter (#8) (**PN 5020632**) on the puller, insert cover onto puller rod, placing outside of cover toward vise.
3. Install nut on rod and hand tighten. Turn puller barrel to apply more tension if needed.
4. Turn clutch cover and barrel together counterclockwise on puller rod until bushing is seated.
5. Remove nut from puller rod and take installation tool and clutch cover off rod.

DRIVEN CLUTCH DISASSEMBLY/INSPECTION



CAUTION:

Wear eye protection when removing snap ring to prevent serious personal injury.

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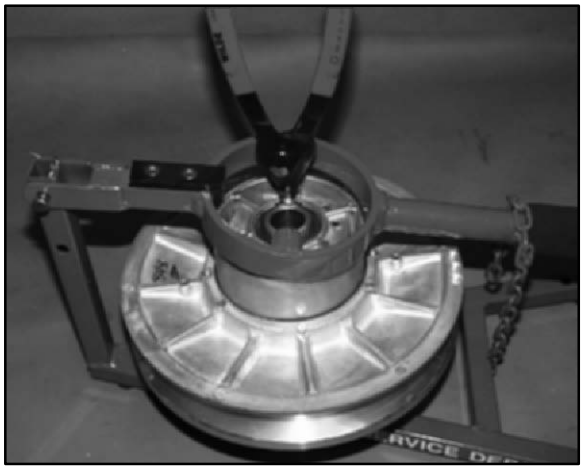
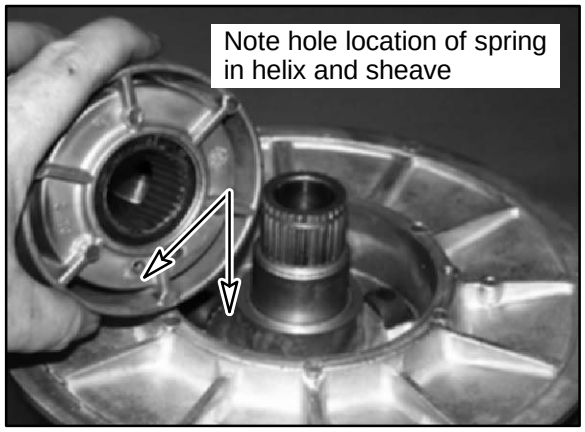
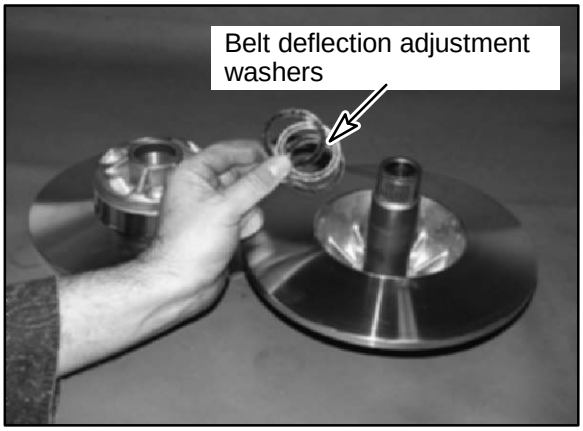


1. Apply and hold downward pressure on the helix, or place driven clutch in the Clutch Compression Tool (**PN 8700220**).
2. Remove snap ring retainer.

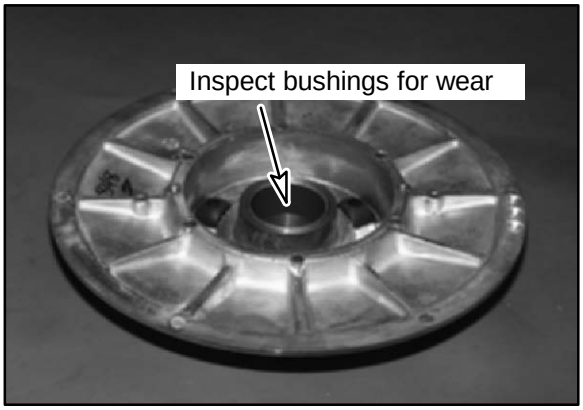


3. Note the location of the spring and remove helix.
4. Note the location of the spring in the moveable sheave, and remove the spring.
5. Check alignment of tabs on spring. Replace the spring if tabs are misaligned or the spring coils are distorted.

6. Inspect ramp buttons in the moveable sheave and replace if worn. **NOTE:** The ramp buttons are secured by Torx™ screws (T20).



7. Remove moveable sheave and note the number of spacer washers. One spacer must remain between the sheaves when adjusting belt deflection.



Moveable Sheave Bushing Inspection:

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

8. Inspect the Teflon™ coating on the moveable sheave bushing.
9. Inspect driven clutch faces for wear or damage.
10. Clean and inspect splines on helix and transmission input shaft.
11. Lube splines with a light film of grease. **Do not lubricate the bushings!**

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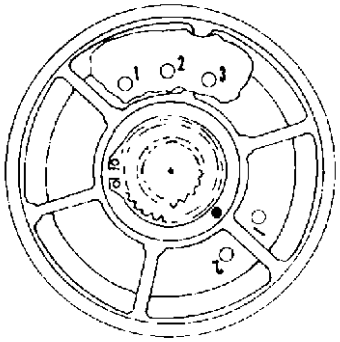
DRIVEN CLUTCH ASSEMBLY

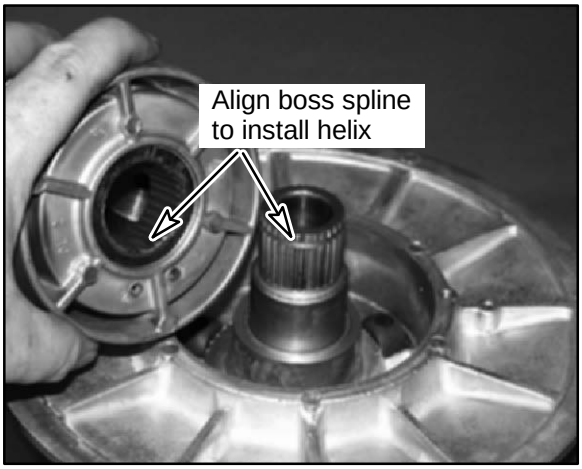


Example:	Helix		Moveable Sheave	Spring Tension
	2	–	1	Heavy
Spring/	2	–	2	
Position	1	–	1	
	2	–	3	
	1	–	2	
	1	–	3	Soft

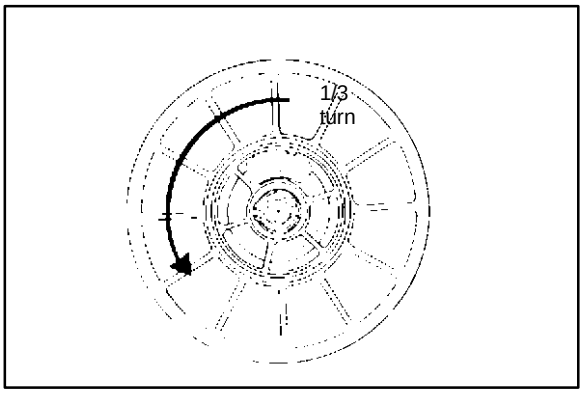
Refer to General Information Chapter 1 for driven clutch spring color and production setting.

1. Install moveable sheave with spacer washers. **Important:** At least one spacer washer must be installed. Teflon™ bushings are self-lubricating. Do not apply oil or grease to the bushings.
2. Install spring, inserting spring tab into proper hole in moveable sheave.
3. Insert spring tab into proper hole in helix. See specifications at the beginning of this section.

The driven clutch, helix/moveable assembly has several different spring locations which affect clutch shifting and RPMs. The greatest amount of spring tension will raise engine RPMs during clutch upshift and allow quicker backshift or downshift when pulling or negotiating a hill, for example. The least amount of tension will create a slower downshift and a harder upshift.



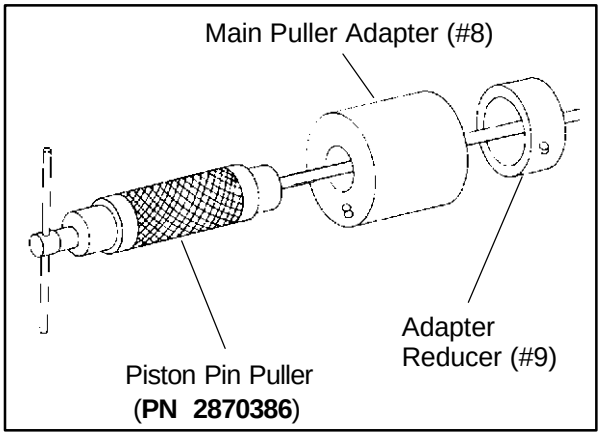
4. Line up boss spline and push helix down until it engages the splines 1/2″ to 3/4″.



5. While holding downward pressure on helix, wind moveable sheave counterclockwise approximately 1/3 turn (120°).
6. Push helix into place and install snap ring.

DRIVEN CLUTCH BUSHING SERVICE

NOTE: Bushings are installed at the factory using Loctite™. In order to remove the bushing it will be necessary to apply heat. A press can be used to remove and install some of the bushings. Be sure to support the sheave or cover as close as possible to the bushing bore when using a press.



1. Install Main Puller Adapter (#8) (**PN 5020632**) onto the Piston Pin Puller (**PN 2870386)**.
2. Insert Adapter Reducer (#9) (**PN 5010279**) onto the puller, sliding it inside the main adapter.

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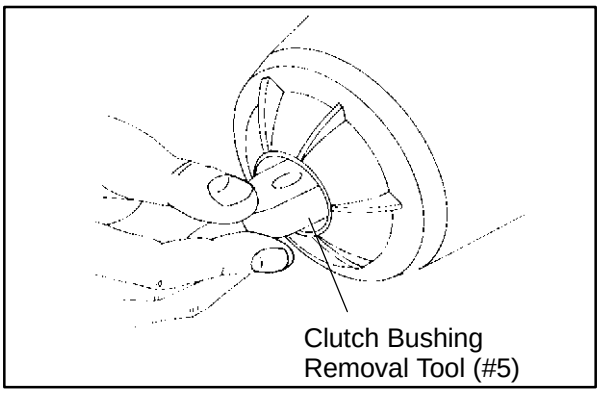
3. Remove ramp buttons from moveable sheave.

4. Using a hand held propane torch, apply heat directly on bushing until tiny smoke tailings appear.

CAUTION:

Clutch components will be hot! In order to avoid serious burns, wear heat resistant insulated gloves for the rest of the removal process.

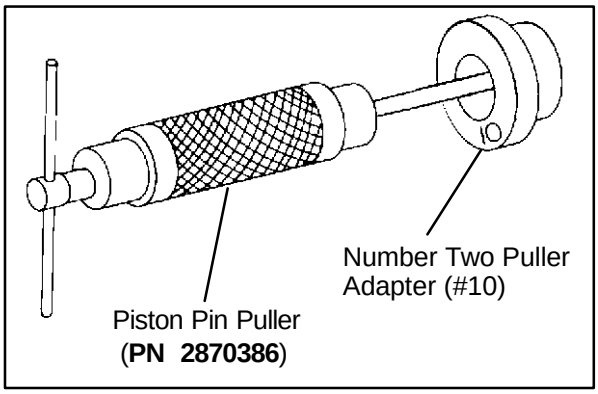


5. Working from the top, install Driven Clutch Bushing Removal Tool (#5) (**PN 5020631**) into the center of clutch sheave with smaller diameter toward bushing to be removed. See illustration.

6. Install sheave onto puller.
7. Install nut onto puller rod and tighten by hand. Turn puller barrel for further tension if needed.

8. Turn clutch sheave counterclockwise until bushing is removed. Repeat Steps 5 - 8 for other bushing.
9. Remove nut from puller rod and set aside.
10. Remove adapters from puller.
11. Remove bushing and removal tool from adapters. Discard bushing.

DRIVEN CLUTCH MOVEABLE SHEAVE - BUSHING INSTALLATION



1. Working from the top, insert Number Two Puller Adapter (#10) (**PN 5020633**) onto the puller. See illustration at above.

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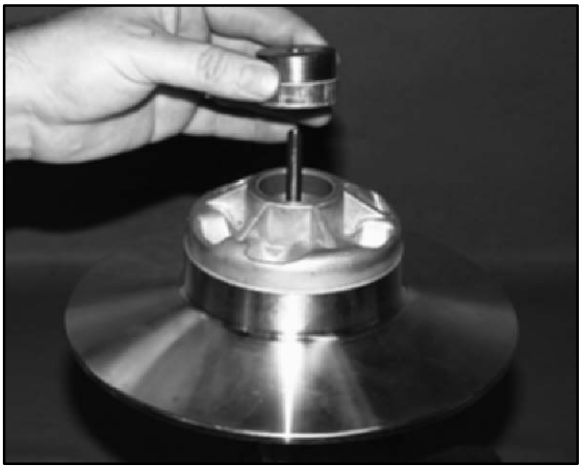
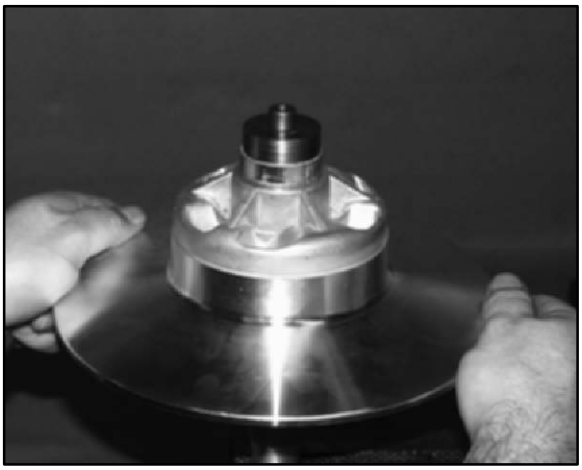
2. Start new bushing evenly in moveable sheave. Apply Loctite™ 680 (**PN 2870584**) to the back side of new bushing.



3. Install sheave onto puller with new bushing upward as shown. Install the Number Two Puller Adapter (#10) (**PN 5020633**).



4. Install nut onto puller rod and hand tighten against installation tool.
5. Turn clutch sheave counterclockwise until bushing is seated.
6. Remove nut from puller rod and set aside.

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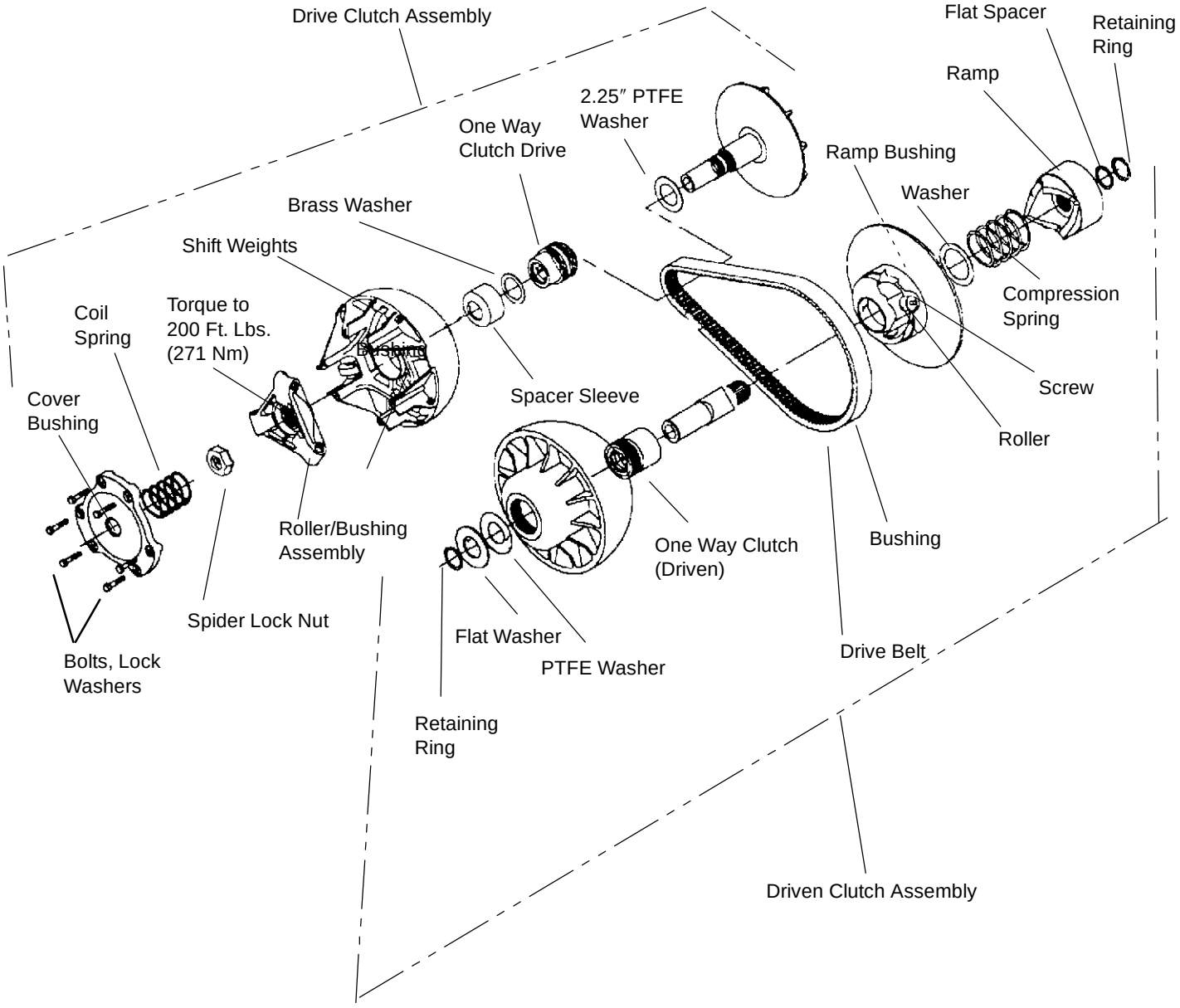
ENGINE BRAKING SYSTEM (EBS) EXPLODED VIEW



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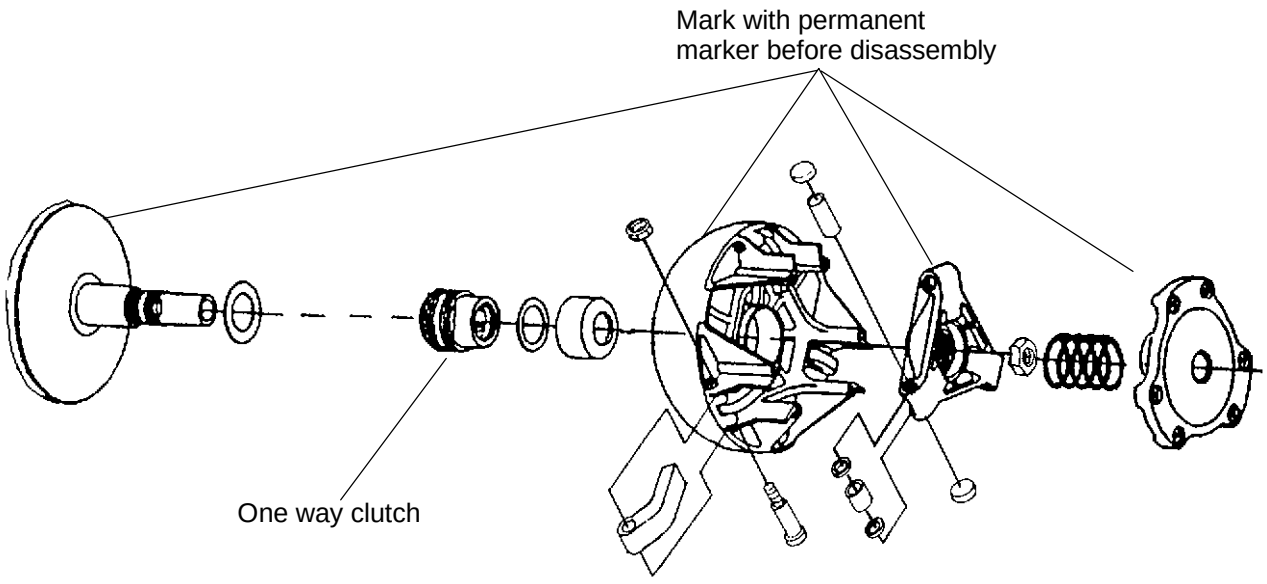
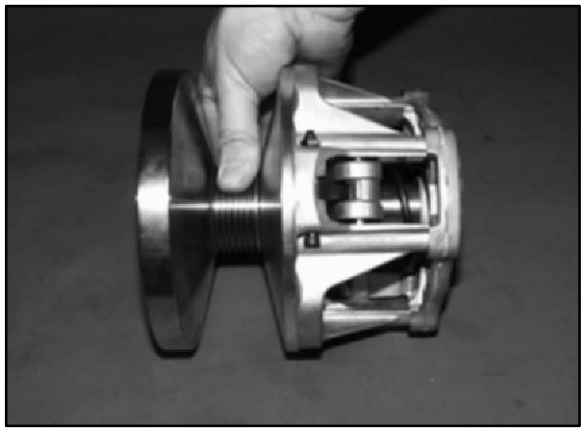
EBS DRIVE CLUTCH EXPLODED VIEW



EBS Drive Clutch

ONE-WAY CLUTCH INSPECTION (DRIVE CLUTCH)

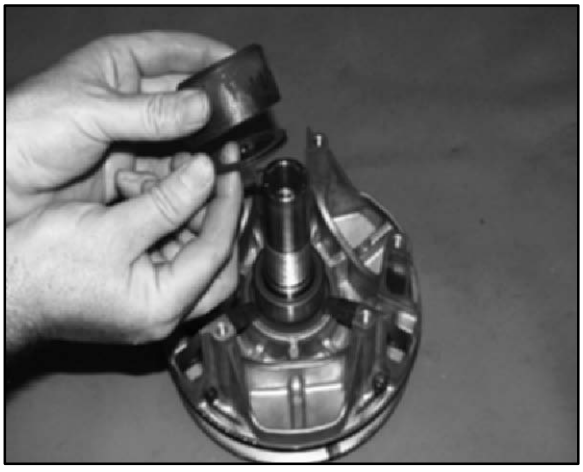
1. Rotate one-way clutch clockwise (as viewed from the cover plate side). The clutch should rotate on the shaft with only slight amount of drag. Verify there is no binding or rough spots. When rotated counterclockwise, the clutch should lock to the shaft without slipping. If problems are noted in either direction, continue with disassembly.



DRIVE CLUTCH INSPECTION

NOTE: Remove cover, spring, and spider following instructions for drive clutch removal, then proceed as follows:

1. Remove moveable sheave spacer sleeve and the brass washer. Visually inspect the washer for damage. Measure the thickness and compare to specification. Replace if worn or damaged.



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Brass Washer Thickness
Standard: .030″ (.76mm)
Service Limit: .025″ (.64mm)

2. Lift one-way clutch off shaft. Replace as an assembly if worn, damaged, or if problems were noted.

3. Inspect surface of shaft for pitting, grooves, or damage. Measure the outside diameter and compare to specifications. Replace the drive clutch assembly if shaft is worn or damaged.

Shaft Diameter
Standard: 1.3745″ - 1.375″
Service Limit: 1.3730″

4. Remove 2 1/2″ PTFE washer from shaft. Visually inspect the washer for damage. Measure the thickness and compare to specification. Replace if worn or damaged.

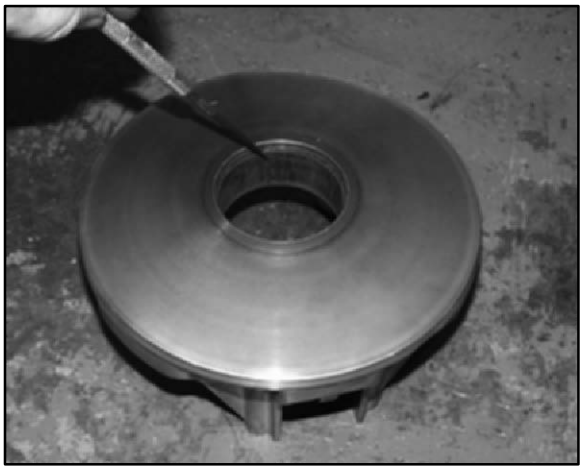
PTFE Washer Thickness
Standard: .030″ (.76mm)
Service Limit: .025″ (.64mm)

MOVEABLE SHEAVE BUSHING INSPECTION

1. Inspect the Teflon™ coating on the moveable sheave bushing. Inspect BOTH sheaves for signs of wear, grooving or cracking. Clean surfaces with a 3M™ pad if needed

Moveable Sheave Bushing Inspection:

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



EBS DRIVEN CLUTCH DISASSEMBLY/INSPECTION -

CAUTION: The driven clutch must be disassembled from the helix end to lessen the chance of damage to seals in the one-way clutch. Review all information below before proceeding.

ONE-WAY CLUTCH PRELIMINARY INSPECTION (DRIVEN)

1. With drive belt removed and transmission in neutral, hold the outer sheave and rotate the inner sheave of the driven clutch (moveable) in a

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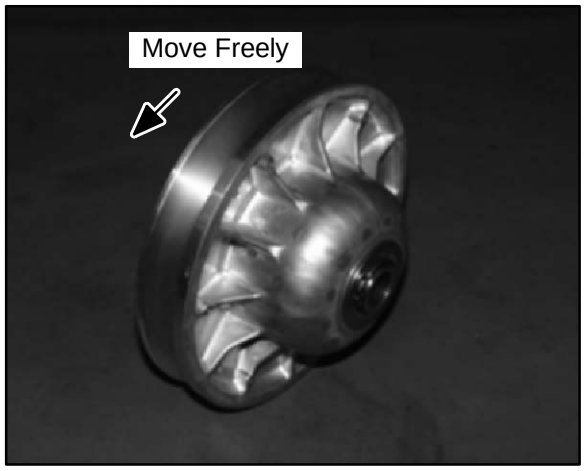
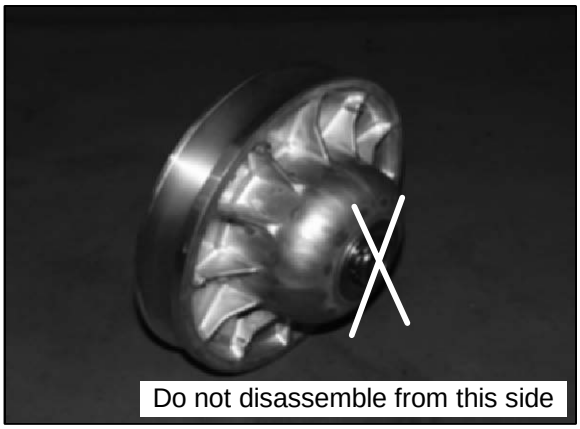
counterclockwise direction as shown at right. The sheave should rotate on the shaft with only a slight amount of drag. There should not be any binding or rough spots.

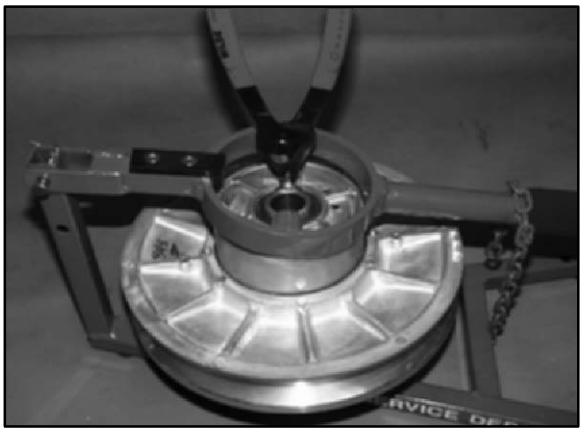


2. When rotated clockwise, the inner (moveable) sheave should lock to the shaft and outer sheave without slipping.

3. Remove driven clutch from the transmission input shaft. Do not disassemble the driven clutch from the outside snap ring. The driven clutch must be disassembled from the helix side or the one-way clutch seals may be damaged.



4. Place the driven assembly into the clutch holder. Push helix inward. Remove snap ring, washer, helix, and spring. NOTE: The spring is a compression spring only and has no torsional wind.



NOTE: Rotating the moveable sheave so that the rollers are not in contact with either helix ramp surfaces will lessen the effort needed to push the helix inward.

5. Remove spring seat washer and inspect for wear or damage. Replace if worn.
6. Inspect surface of rollers for flat spots and wear. Rollers must rotate freely on pins without excessive clearance. Check the roller pin and roller bore for wear and replace if necessary.

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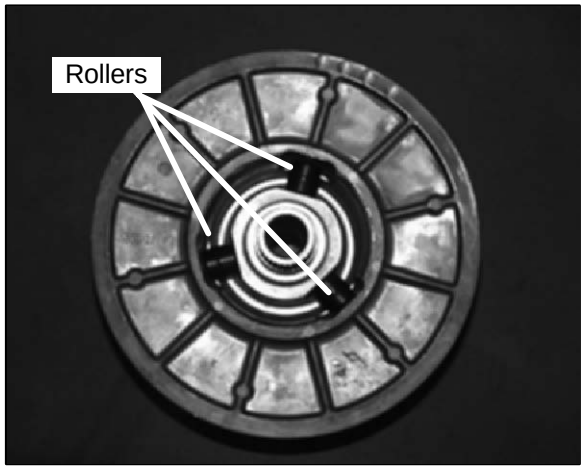
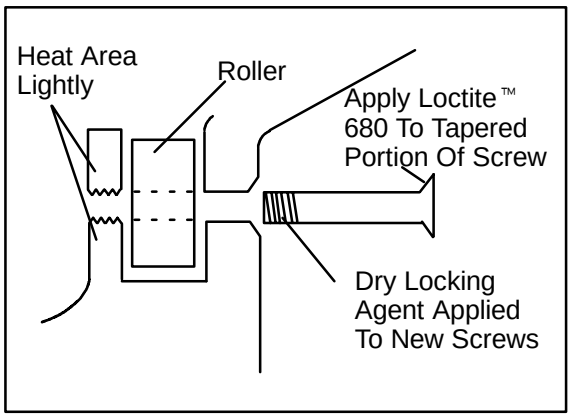


ROLLER PIN DISASSEMBLY

New roller retaining bolts have a dry locking agent applied to the threads. Before attempting to remove the roller pins, heat the threaded area lightly with a propane torch. ***Wear heat resistant gloves during this procedure.*** Use a high quality hexagonal wrench in good condition to avoid screw damage. A small amount of valve grinding compound can be applied to the tip of the hex wrench to ensure a tight fit. Always use new bolts if they are removed for inspection. Apply Loctite™ 680 retaining compound sparingly to the tapered head portion of the roller retaining screws. Do not allow locking agent to contact the inside of the rollers. Do not lubricate the roller or roller pin.



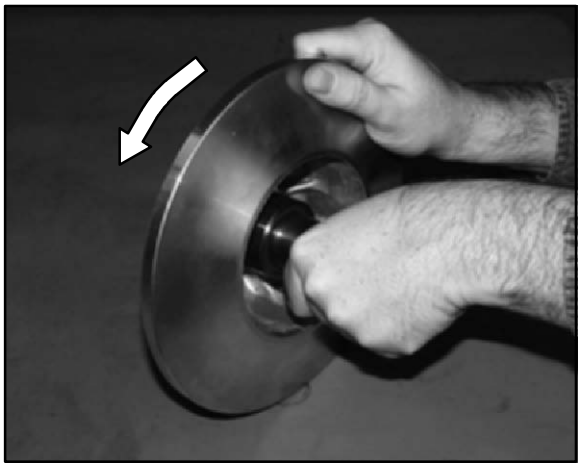
DRIVEN CLUTCH DISASSEMBLY/ INSPECTION CONT'D

7. Inspect moveable sheave bushing for wear. Inspect BOTH sheaves for signs of wear, grooving or cracking. Clean surfaces with a 3M™ pad if needed

Moveable Sheave Bushing Inspection:

Replace the bushing if more brass than Teflon™ is visible on the surface of the bushing.

8. Check for movement of the shaft in the one-way clutch. If the shaft can be moved laterally, or if the one-way clutch does not function properly as described in Step 1 and 2 on Page 6.26, replace driven clutch assembly.



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EBS DRIVE BUSHING SERVICE

EBS CLUTCH BUSHING REMOVAL AND INSTALLATION (Use Tool Kit PN 2201379)

The contents of this kit include:

Item	Qty	Part Description	Part No
A/B	1	EBS Puller Tool	**5132027**
C	1	EBS Puller Nut	**5132501**
D	1	EBS Main Adapter	**5132029**
E	1	EBS Bushing Removal Tool	**5132028**
	1	Instructions	**9915111**

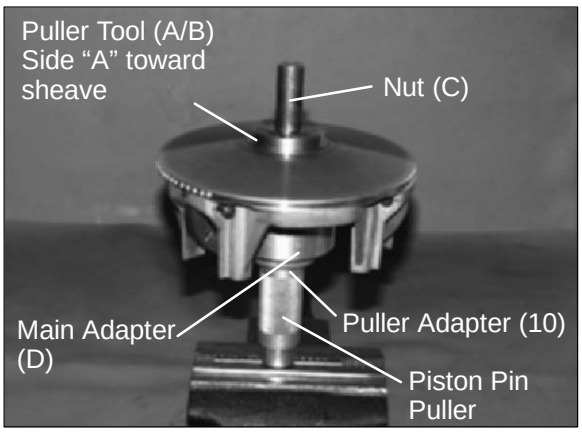
Also required:Clutch Bushing Replacement Tool Kit (PN 2871226) (ATV Clutch Kit) or (PN 2871025) (For all clutches) Piston Pin Puller (PN 2870386)

REMOVAL AND INSTALLATION INSTRUCTIONS

NOTE: Bushings are installed at the factory using Loctite™ 609. In order to remove bushings it will be necessary to apply heat evenly to the area around each bushing. Clean all residual Loctite from bushing bore prior to installing new bushing.

EBS Drive Clutch Moveable Sheave Bushing Removal

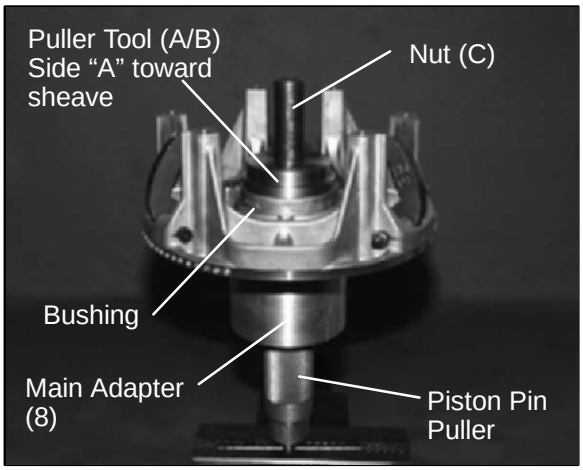
1. Remove clutch as outlined previously in this chapter.
2. Install handle end of Piston Pin Puller (**PN 2870386**) securely into bench vise and lightly grease puller threads.
3. Remove nut from puller rod and set aside.
4. Install puller adapter (Item 10 from kit **PN 2871226**).
5. Install main adapter (Item D) onto puller.



6. With towers pointing toward the vise, slide sheave onto puller rod.
7. Install removal tool (Item A/B) into center of sheave with “A side” toward sheave.
8. Install nut (C) onto end of puller rod and hand tighten. Turn puller barrel to increase tension on sheave if needed. Using a hand held propane torch, apply heat around outside of bushing until tiny smoke tailings appear.
9. Turn sheave counterclockwise on puller rod until it comes free. Lift sheave off puller.
10. Remove nut from puller rod and set aside.
11. Pull bushing removal tool and adapter from puller rod. Remove bushing from tool and discard.

EBS Drive Moveable Bushing Installation

1. Place main adapter (Item 8) on puller.



EBS Drive Clutch Moveable Sheave Bushing Installation

2. Apply Loctite™ 609 evenly to bushing bore inside moveable sheave.
3. Set bushing in place on sheave.
4. Insert installation puller tool (Item A/B) with “A” side down, into center of bushing.
5. With towers pointing upward, slide sheave, bushing and tool onto puller rod.
6. Install nut on puller rod and hand tighten. Turn barrel to apply additional tension if needed.
7. Turn sheave counterclockwise, making sure bushing is drawn straight into bore. Continue until bushing is seated.
8. Remove nut from puller rod and set aside.
9. Remove sheave from puller.
10. Remove installation tool.

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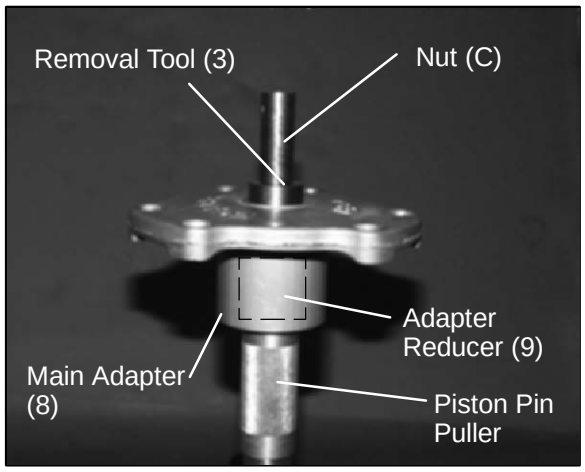
EBS Drive Clutch Cover Bushing Removal

1. Install main adapter (Item 8) on puller.



EBS Drive Clutch Cover Bushing Removal

2. Install adapter reducer (Item 9).
3. From outside of clutch cover, insert removal tool (Item 3) into cover bushing.
4. With inside of cover toward vise, slide cover onto puller.
5. Install nut onto puller rod and hand tighten. Turn puller barrel to increase tension as needed.
6. Turn clutch cover counterclockwise on puller rod until bushing is removed and cover comes free.
7. Remove nut from puller rod and set aside.
8. Remove bushing and bushing removal tool from puller. Discard bushing.

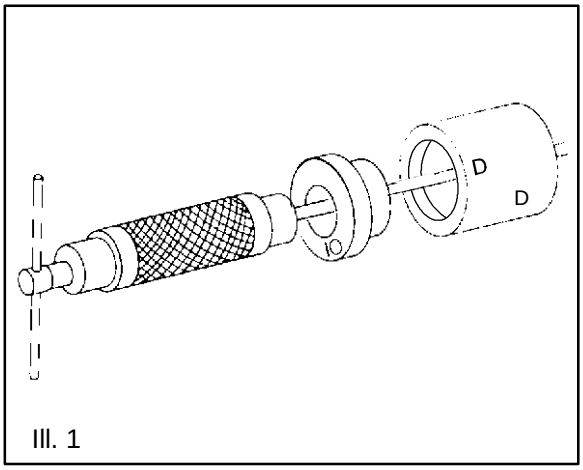
EBS Drive Clutch Cover Bushing Installation

1. Apply Loctite™ 609 evenly to bushing bore in cover.
2. Working from inside of cover, insert new bushing and bushing installation tool into center of clutch cover.
3. With main adapter on puller, insert cover onto puller rod, placing outside of cover toward vise.
4. Install nut on rod and hand tighten. Turn puller barrel to apply more tension if needed.
5. Turn clutch cover counterclockwise on puller rod until bushing is seated.
6. Remove nut from puller rod. Take installation tool and clutch cover off rod.

EBS DRIVEN BUSHING SERVICE

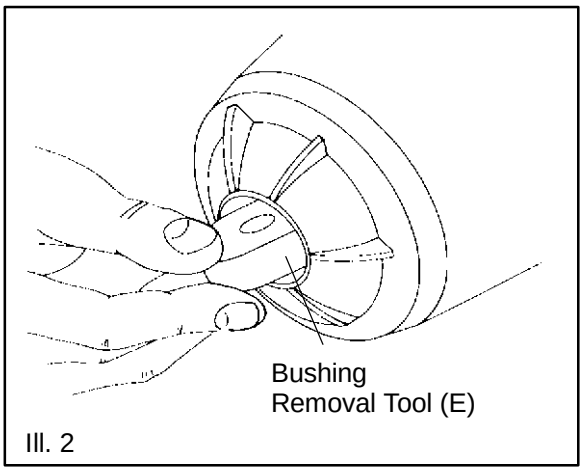
EBS Driven - Bushing Removal

1. Install puller adapter (Item 10) onto puller.



Ill. 1

2. Insert EBS main adapter (Item D) onto puller. See Ill. 1.
3. Install bushing removal tool (Item E) into center of clutch sheave. See Ill. 2.



Ill. 2

4. Install sheave onto puller.
5. Install left hand nut onto puller rod and tighten by hand. Turn puller barrel for further tension if needed.
6. Using a hand held propane torch, apply heat evenly around outside of bushing until tiny smoke tailings appear.

CAUTION: Clutch components will be hot! In order to avoid serious burns, wear insulated gloves during the removal process.

7. Turn clutch sheave counterclockwise until bushing is removed and sheave comes free.

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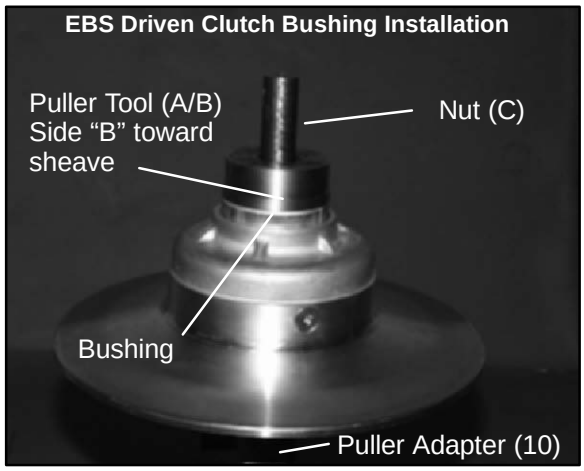
8. Remove nut (C) (left hand thread) from puller rod and set aside.
9. Remove adapters from puller.
10. Remove bushing and removal tool from adapters. Discard bushing.

EBS Driven - Bushing Installation

1. Slide adapter (Item 10) onto puller.



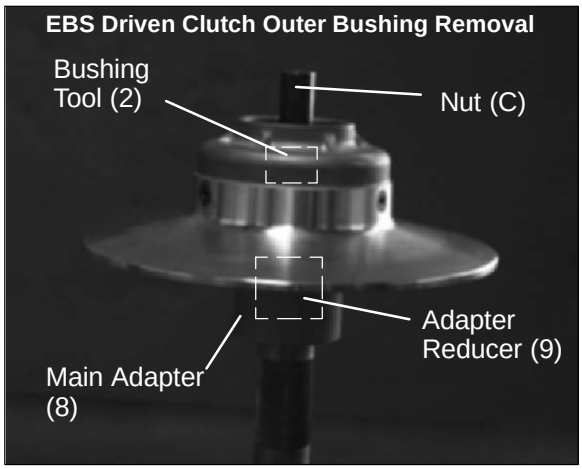
2. Apply Loctite™ 609 evenly to bushing bore inside moveable sheave.
3. Install sheave onto puller (belt surface up).
4. Place new bushing on side B of installation tool (Item A/B) and slide both over puller rod.
5. Install nut (C) onto puller rod and hand tighten against installation tool.
6. Turn clutch sheave counterclockwise until bushing is seated.
7. Remove nut (C) (left hand thread) from puller rod and set aside.
8. Remove installation tool and clutch sheave from puller.

EBS Driven - Backside (Outer) Bushing Removal

1. Install main puller adapter (Item 8) onto puller.
2. Install adapter reducer (Item 9).
3. Using a hand held propane torch, apply heat around outside of bushing until tiny smoke tailings appear.

CAUTION: Clutch components will be hot! In order to avoid serious burns, wear insulated gloves during the removal process.

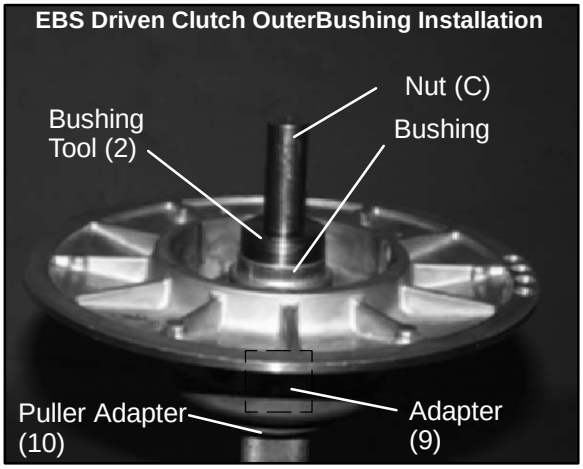
4. Flip sheave over onto puller.
5. Install bushing tool (Item 2).
6. Install left hand nut (C) and spacer onto puller rod and tighten by hand. Turn puller barrel for further tension if needed.
7. Turn clutch sheave counterclockwise until bushing is removed and sheave comes free.
8. Remove nut (C) (left hand thread) from puller rod and set aside.
9. Remove adapters from puller.



10. Remove bushing and removal tool from adapters. Discard bushing.

EBS Driven - Backside (Outer) Bushing Installation

1. Install puller adapter (Item 10) onto puller.
2. Install adapter (Item 9) onto puller.



3. Apply Loctite™ 609 evenly to bushing bore inside moveable sheave.
4. Install sheave face down on puller.
5. Install new bushing on installation tool (Item 2) and install assembly into sheave.
6. Install left hand thread nut (C) onto puller rod and hand tighten against installation tool.
7. Turn clutch sheave counterclockwise, making sure bushing is drawn straight into bore. Continue until bushing is seated. **(Go to next page)**

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8. Remove nut (C) (left hand thread) from puller rod and set aside.
9. Remove installation tool and clutch sheave from puller.

TROUBLESHOOTING

Situation	Probable Cause	Remedy
Engine RPM below specified operating range although engine is properly tuned.	-Wrong or broken drive clutch spring.	-Replace with recommended spring.
	-Drive clutch shift weight too heavy.	-Install correct shift weight kit to match engine application.
	-Driven clutch spring broken or installed wrong .	-Replace spring; refer to proper installation location.
Erratic engine operating RPM during acceleration or load variations.	-Drive clutch binding.	a. Disassemble drive clutch; inspect shift weights for wear and free operation. b. Clean and polish stationary shaft hub; reassemble clutch without spring to determine problem area.
	-Belt worn unevenly - thin/burnt spots	Replace belt
	-Driven clutch malfunction.	a. Replace ramp buttons. b. Inspect movable sheave for excessive bushing clearance/ replace.
	-Sheave face grooved.	-Replace the clutch.
Engine RPM above specified operating range.	-Incorrect drive clutch spring (too high spring rate).	-Install correct recommended spring.
	-Drive clutch shift weights incorrect for application (too light).	-Install correct recommended shift weights.
	-Drive clutch binding.	-Disassemble and clean clutch, inspecting shift weights and rollers. Reassemble without the spring and move sheaves through entire range to further determine probable cause.
	-Driven clutch binding.	-Disassemble, clean, and inspect driven clutch, noting worn sheave bushing and ramp buttons and helix spring location.
	-Converter sheaves greasy; belt slippage.	-Clean sheaves with denatured alcohol or brake cleaner, install new belt.
Harsh drive clutch engagement.	-Drive belt worn too narrow.	-Replace belt.
	-Excessive belt/sheave clearance with new belt.	-Perform belt/sheave clearance adjustment with shim washers beneath spider.
Drive belt turns over	-Wrong belt for application.	-Replace with correct belt.
	-Clutch alignment out of spec.	-Adjust alignment offset.
	-Engine mount broken or loose.	-Inspect/adjust or replace.
PVT cover overheating (melting)	-Plugged air intake or outlet	-Clear obstruction.
	-Belt slippage due to water, oil, grease, etc., rubbing on cover	-Inspect system. Clean , repair or replace as necessary. Seal PVT system ducts.
	-Clutches or weight being applied to cover while in operation	-Remove weight. Inform operator.
	-Use of High vs. low range	-Instruct operator on guidelines for operation in proper driving range for different terrain as outlined in Owner's Safety and Maintenance Manual.
Water ingestion	-Cover seals or ducts leaking	-Find leak and repair as necessary.
	-Operator error	-Instruct operator on guidelines for operation in wet terrain as outlined in Owner's Safety and Maintenance Manual.

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TROUBLESHOOTING

Situation	Probable Cause	Remedy
Belt slippage	-Belt worn out	-Replace belt.
	-Water ingestion	-Inspect and seal PVT system.
	-Belt contaminated with oil or grease	-Inspect and clean.
Belt burnt, thin spots	-Abuse (continued throttle application when vehicle is stationary, excess load)	-Caution operator to operate machine within guidelines.
	-Dragging brake	-Vehicle operated with park brake on. Inspect brake system.
	-Slow, easy clutch engagement	-Instruct firm, effective use of throttle for efficient engagement.
PVT noise	-Belt worn or separated, thin spots, loose belt	-Replace belt.
	-Broken or worn clutch components, cover hitting clutches	-Inspect and repair as necessary.
Engagement erratic or stabby	-Thin spots on belt, worn belt	-Replace belt. Refer to belt burnt troubleshooting and instruct operator.
	-Drive clutch bushings stick	-Inspect and repair clutches.

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NOTES

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CHAPTER 7
FINAL DRIVE

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WHEEL AND HUB TORQUE TABLE

Item	Specification
Front Wheel Nuts	20 Ft. Lbs. (27 Nm)
Middle & Rear Wheel Nuts	50 Ft. Lbs. (68 Nm)
Front Hub Nut	Refer to text for procedure (Pg 7.5)
Rear Hub Retaining Nut	80 Ft. Lbs. (109 Nm)

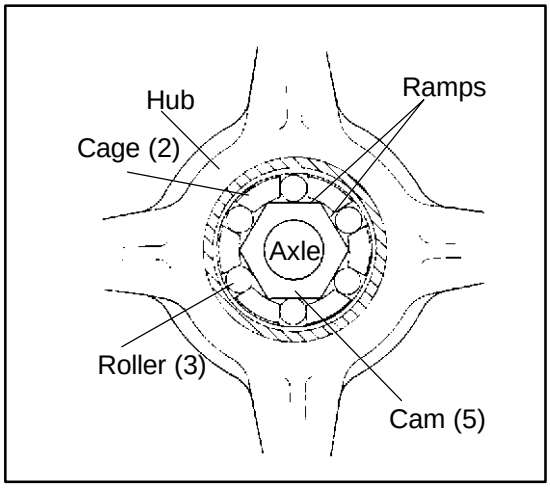
1 Refer to exploded views and text for torque values of other fasteners

CAUTION: Locking nuts, and bolts with preapplied locking agent should be replaced if removed. The self-locking properties of the nut or bolt are reduced or destroyed during removal.

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2871199	Seal Sleeve Installation Tool Kit
2870888	Hilliard Clutch Garter Spring Installation Tool
2872608	Roller Pin Removal Tool
8700226	CV Boot Clamp Pliers
2870772	1 3/4" Straight Wrench

AWD OPERATION OVERVIEW



With the Polaris All Wheel Drive System activated (AWD selected), the machine operates as a 2 wheel drive vehicle until the rear wheels lose traction. If the rear wheels lose traction the front wheel rotational speed will decrease, causing the front drive axle speed to exceed front wheel speed. Restricting the rotation of the drive clutch roller cage (2) (see Electric Hub Operation) will cause the rollers (3) to climb the ramps of the cam (5), and become squeezed between the ramps and the ring in the hub. See Ill. 1.

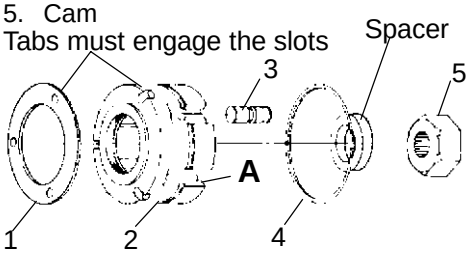
When the hub clutch assembly, wheel hub, and drive axle are engaged, the front wheels will drive and stay engaged until rear wheel traction is regained. When traction is regained, the front wheels will overdrive the hub clutch, pushing the clutch rollers (3) toward the lower part of the cam (5), disengaging the clutch. The rollers are held in place by the spring (4). See Ill. 2. The tension of this spring is critical to AWD hub operation. Always use the correct spring (refer to appropriate parts manual) and use installatiolHilliard Clutch Garter Spring Installation Tool (**PN 2870888**).

⚠ WARNING

It is important that the front and rear axle drive ratio and tire size are not changed. Changing this ratio will cause erratic engagement, which could result in a loss of vehicle control and serious injury or death.

ELECTRIC HUB ENGAGEMENT

1. Armature Plate
2. Roller Cage
3. Roller
4. Garter Spring
5. Cam



Ill. 2

When AWD is selected in a forward gear, current flows through a coil of wire located in the strut housing, creating a magnetic field. An armature plate (1) coupled to the roller cage (2) is attracted to the magnetic field, and resists rotation, creating drag on the drive roller cage assembly. This causes the roller to climb the ramps of the cam, engaging the hub. **NOTE:** In reverse gear the override button must be pushed to deliver power to the wheel coil. Electric hub engagement offers an advantage over mechanical

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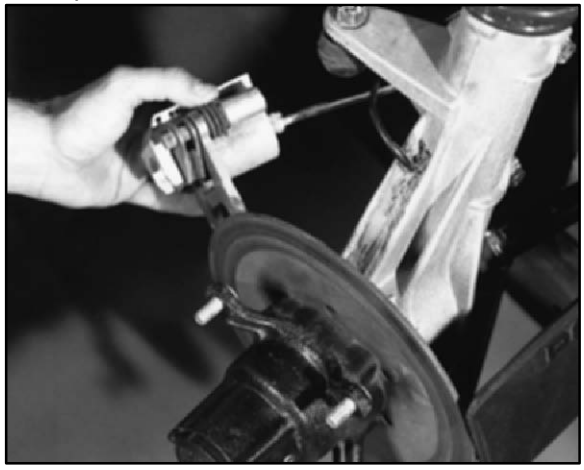
systems. When the AWD button is switched off, the machine will have the steering ease of a 2 wheel drive unit; and with the switch turned on, All wheel drive will be engaged whenever the rear wheels lose traction.

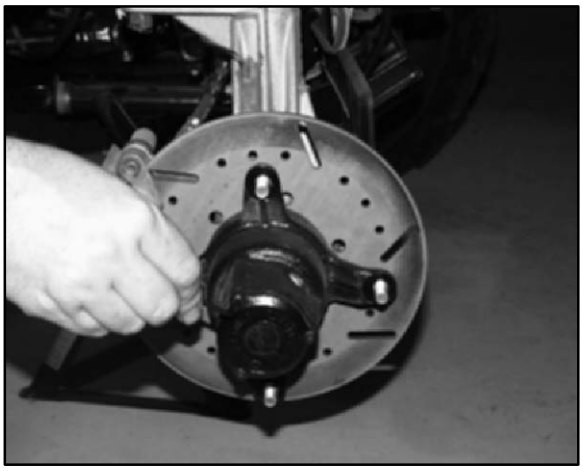
FRONT HUB REMOVAL (AWD)

If an AWD problem is encountered, thoroughly inspect the electrical portion of the system as well as the front hub mechanism. Refer to the electrical chapter.

1. Carefully lift and support the front end of the machine as shown with the jack stands under the front end of the foot rests. **CAUTION:** Make sure the machine is solidly supported before proceeding. Serious injury could occur if the machine tips or falls.
2. Remove the front wheels and thoroughly clean the area around the hub, strut casting, brake caliper and brake disc.



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



4. Place a catch pan beneath the front hub and remove the hub cap.
5. Remove cotter pin and nut.
6. Remove front hub and bearings.

HUB/WHEEL BEARING INSTALLATION

1. Thoroughly inspect the hub internally. If the hub bearing sleeve is damaged or shows signs of movement, the hub assembly must be replaced. When the sleeve is pressed into the hub it should be flush with the outside surface of the hub.
2. Grease hub seal to allow it to slide over roller clutch components.
3. Install wheel hub inner bearing. **NOTE:** All bearings must slide freely onto the spindle. If bearings do not slide freely, wheel bearing torque will be affected.
4. Install wheel hub, outer bearing, washer, and attaching nut. **NOTE:** It is very important that the hub is not moved outward once installed, or the seal on the hub will disengage the armature plate.

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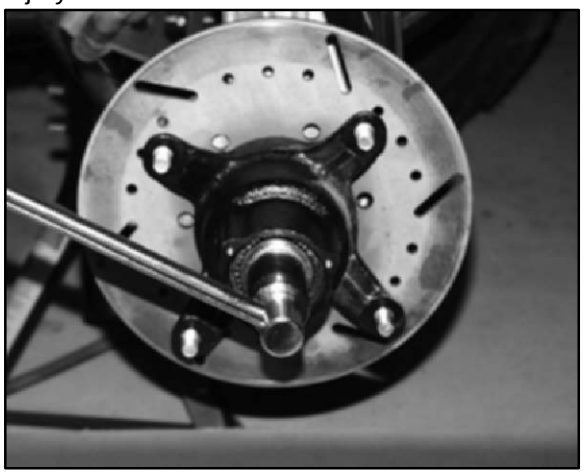
AWD FRONT HUB BEARING ADJUSTMENT

⚠ WARNING

The following bearing adjustments are very important. Incorrect adjustment will increase bearing wear, reduce braking action, and may affect front drive hub engagement, which could result in serious personal injury or death.



1. Torque spindle nut to 160-170 inch lbs. (13 Nm–14Nm) while rotating hub continuously.
2. Back off nut 1/2 turn.
3. Rotate axle several revolutions by raising rear of machine and rotating rear wheels with the machine in gear.
4. Re-torque hub nut to 108-144 inch lbs. (12 –16 Nm).

Front Spindle Nut Torque:
108-144 in. lbs.

Brake Caliper Retaining Bolt Torque:
18 ft. lbs. (25 Nm)

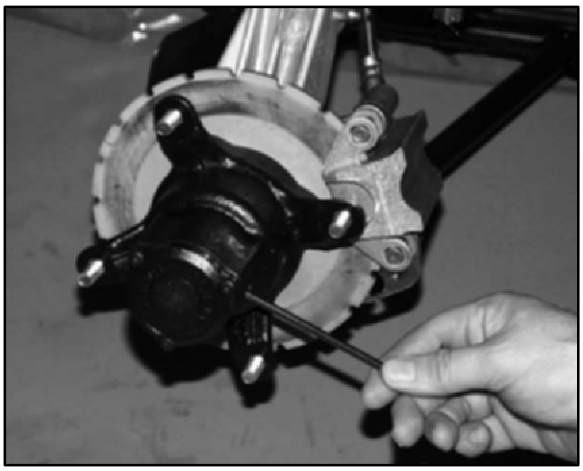
5. Install cotter pin. Bend each leg of cotter pin around castle nut in different directions.

NOTE: If cotter pin hole does not align, tighten slightly to align and install pin. Do not exceed 144 in. lbs. (16 Nm).

6. Reinstall hub cap.
7. Remove fill check plug and rotate hole to either 4:00 or 8:00 position.
8. Fill with Polaris Premium Demand Drive Hub Fluid until fluid trickles out. **NOTE:** Do not force the oil into the hub under pressure. This can cause seal damage and leaks.

Premium Demand Drive Hub Fluid

(PN 2871654) (8 oz.)
(PN 2872277) (2.5 gal.)



9. Reinstall plug.
10. Reinstall brake caliper assembly. Torque retaining bolts to 18 ft. lbs. (25 Nm).
11. Reinstall front wheels. Torque retaining nuts to 15 ft. lbs. (21 Nm).
12. Carefully lower vehicle.
13. Field test vehicle for proper operation of brake system and AWD operation.

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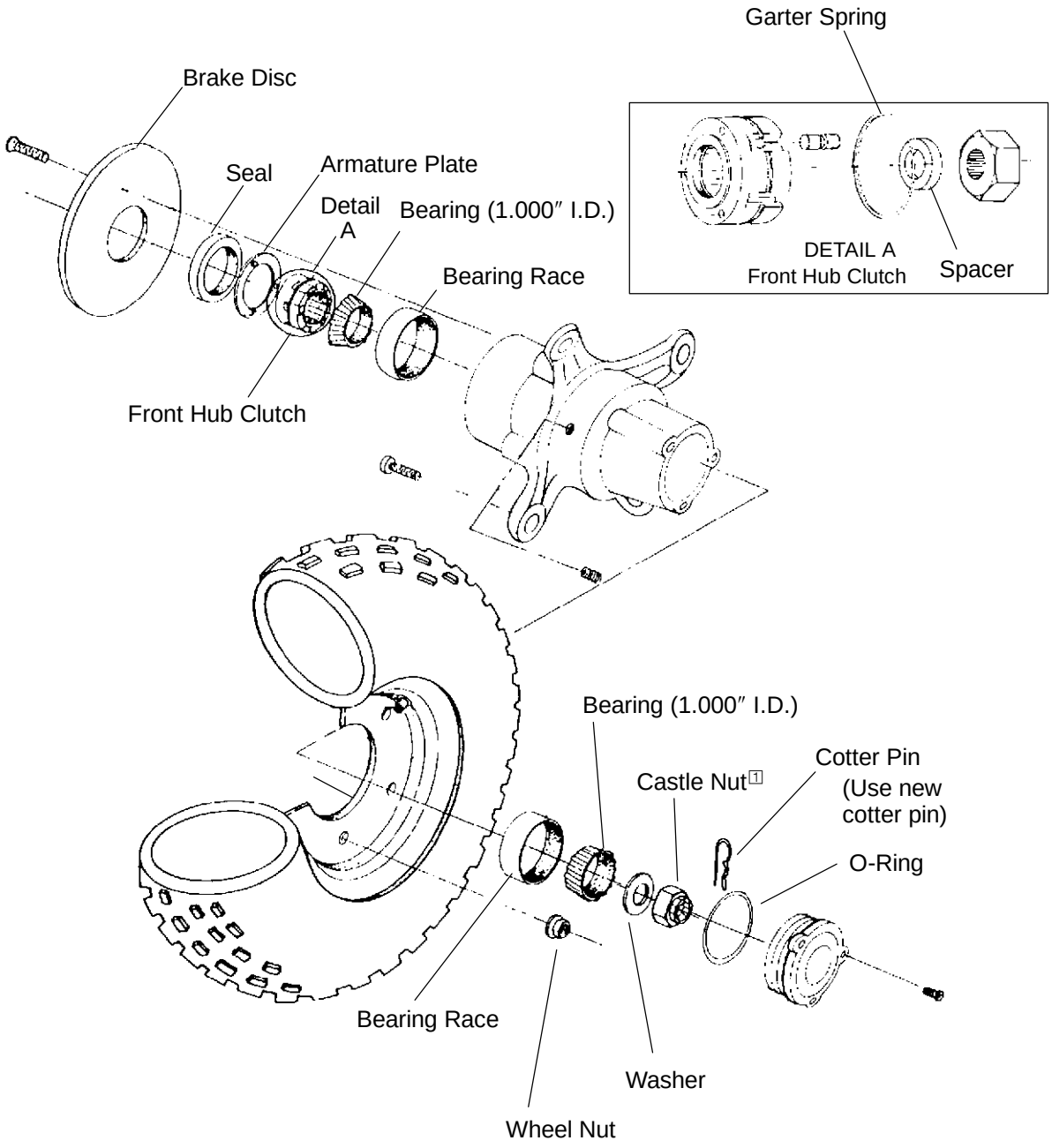
AWD FRONT HUB EXPLODED VIEW



[1] **Refer to text on page 7.7 for more information.**

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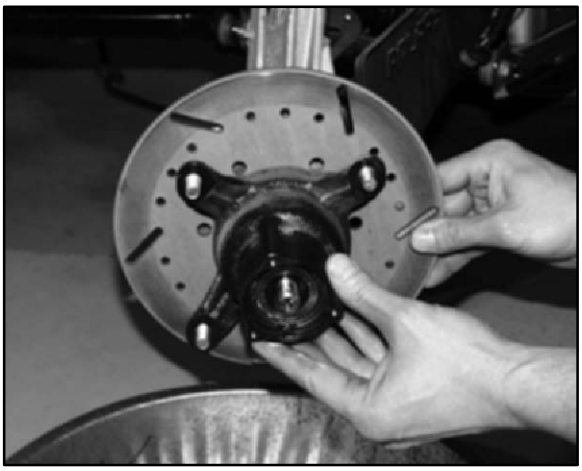
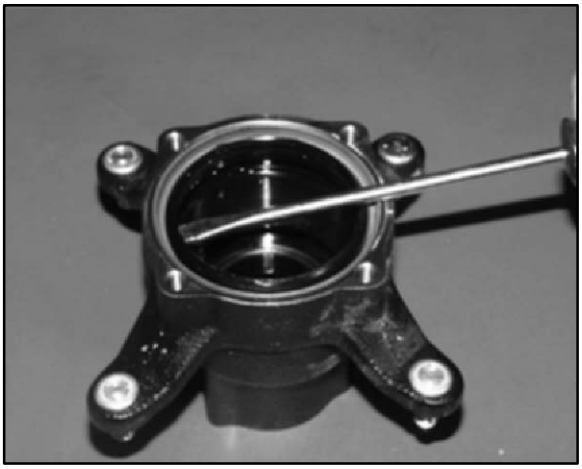
AWD HUB SEAL REPLACEMENT

1. Remove and disassemble front hub. Refer to Page 7.3.



2. Remove brake disc attaching bolts and brake disc.
   NOTE: If the attaching bolts are difficult to remove, it may be helpful to heat the outer surfaces of the hub in the area of the disc mounting bolts, to soften the locking agent.



3. Apply heat to the hub seal area. When the hub becomes too hot to touch, pry out the old seal as shown. Do not damage the surface of the seal cavity. Clean the hub in the seal mating area.

4. With spring side of new seal facing toward hub casting, press it in until flush with brake disc mating surface. **CAUTION:** Do not use a hammer as damage to the seal will result.
5. Thoroughly clean the brake disc with brake cleaner. It is very important that the brake disc be free of any oil or solvents.
6. Reinstall the brake disc using genuine Polaris OEM bolts that have a pre-applied locking agent. Do not substitute bolts or use old ones.
7. Install attaching bolts and torque to 18 ft. lbs. (25 Nm).

MAGNETIC COIL REMOVAL

1. Remove the front drive axle as described later in this chapter.
2. Remove the seal sleeve from the strut casting using a drift punch and hammer, tapping evenly on each side until the sleeve slides off.
3. Remove the existing coil and clean the coil wire channel, coil mount area, and the seal sleeve mounting area of all silicone and foreign matter.
4. Disconnect the coil wires at the connector or terminal board.

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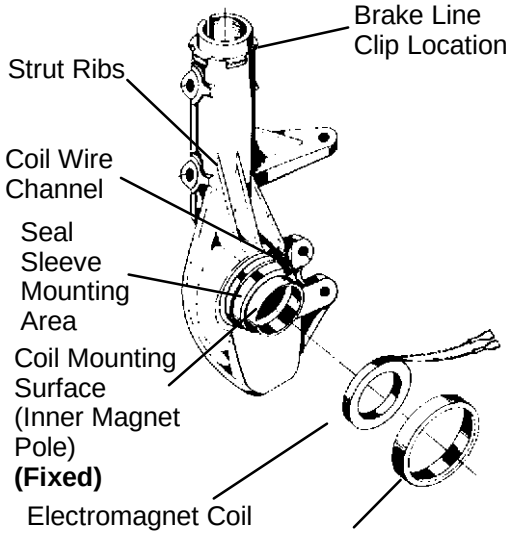
MAGNETIC COIL INSTALLATION



1. Apply 1/4″ (.6 cm) bead of silicone in the coil wire channel.
2. 2. Install the coil to the coil mount surface and press the coil wires into the silicone in the coil wire channel.
3. 3. Apply 1/4″ (.6 cm) bead of Loctite™ Ultra Blue silicone around the seal sleeve mounting area. **NOTE:** This includes applying silicone over the coil lead wires again. Always allow 12 hours' cure time for silicone.
4. 4. Press on the seal sleeve until even with the inner pole. See Page 7.13 for additional information. Once the seal sleeve is properly positioned, a 1/16″ (.16 cm) bead of silicone should remain around the inner edge. Clean off all excess silicone. The seal sleeve area must be free of silicone or the hub seal may leak.

NOTE:

- Always install a new seal sleeve when replacing the coil. Use Seal Sleeve Installation Tool Kit **(PN 2871199**).
- It may be necessary to apply more silicone (or an equivalent fast drying glue) to the wire channel area to properly secure and protect the coil wires.
- Apply 401 Loctite™ to the inside of the strut ribs and press the foam block to contain the coil wires. Make sure the foam block is bonded well to protect the coil wires.

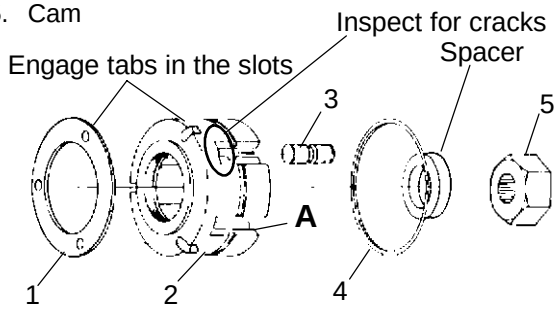
NOTE: Coil wires must be contained in the brake line clip on the back side of the upper strut casting and the wires must be snug against the casting.

5. 6. . Route the wires smoothly and away from any moving parts and secure in place with tie straps.
6. 7. . Assemble front axle and connect hub wires.

HILLIARD CLUTCH DISASSEMBLY/INSPECTION

1. Remove front hub. See Page 7.3.
2. Remove Hilliard clutch assembly.
3. Disassemble the roller clutch and thoroughly clean all parts. **CAUTION:** Do not remove the garter spring. If the spring is removed, it will become over stressed and will require replacement.
4. Inspect roll cage sliding surface (A). This surface must be clean and free of nicks, burrs or scratches. Inspect roller cage (2) carefully for cracks.
5. Inspect rollers (3). The rollers must slide up and down freely within the roller cage sliding surfaces A.
6. Without removing the garter spring, inspect the coils for consistency. If coils are distorted or uneven, cut the old spring with a side cutter to remove it, and replace it.

1. Armature Plate **NOTE:** Armature plate is positioned with tabs in round holes of cage.
2. Roller Cage
3. Roller
4. Garter Spring
5. Cam



7. If garter spring replacement is necessary, *it is very important that the correct installation procedure and special tool be used.* Hold rollers in place on roller cage with a light film of grease. Gently and evenly roll the spring down the Hilliard Clutch Garter Spring Installation Tool (**PN**

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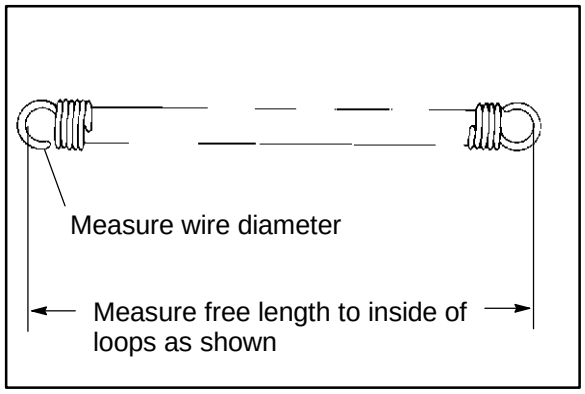
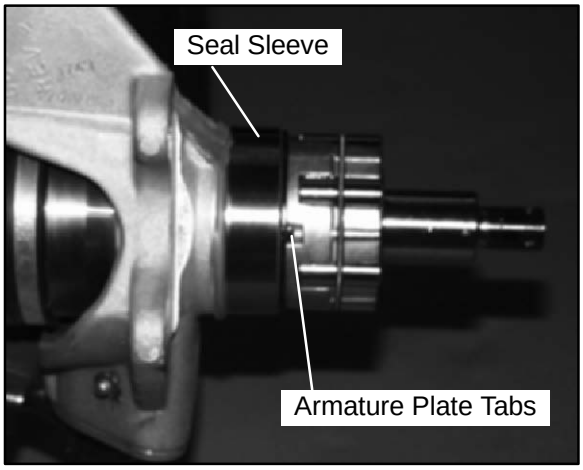
2870888) and into the groove of the rollers and cage. **WARNING:** If this procedure is not followed the spring will be over stressed and lose its tension. Springs with incorrect tension may allow rollers to move outward at high vehicle speeds. If the rollers move outward, the front hub(s) will engage and cause vehicle instability, which could result in serious injury or death.

WARNING: Be sure to use correct garter spring. These springs are very similar in appearance to those used on earlier models. If the old, lighter springs were installed on a machine requiring the heavier spring, the front wheels may engage at high speed, possibly resulting in serious injury or death. **Check springs before installation. Always verify the correct replacement spring part number by referring to the appropriate parts manual.**

8. Current electro-mechanical spring, **(PN 3250032)**; wire diameter .018″ (.46 mm); spring free length end to end inside hooks 6.968″ (177 mm).



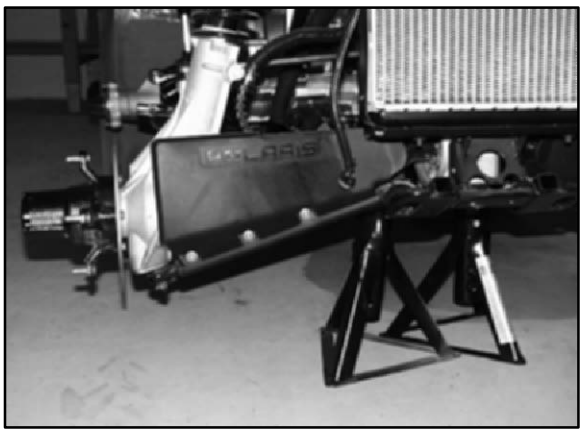
AWD ARMATURE PLATE INSPECTION



1. As the armature plate is engaged, it should contact the outer magnet pole (seal sleeve) and the inner magnet pole. Also, the armature plate must be flat when placed on a flat surface. Bent armature plates should be replaced.
   NOTE: It is not unusual to see a double wear ring on the armature plate; however, the wear rings should be even.
2. Install the roller clutch (Hilliard Clutch) assembly and be sure the armature plate (A) is positioned properly. Also, when installing the hub assembly, be sure the armature plate tabs remain engaged with the roller clutch cage.

CAUTION: After the hub is installed, the slightest movement outward with the hub may cause the armature plate tabs to disengage from the roller clutch cage. If the unit is driven with the armature plate out of position, it will cause roller clutch damage.

AWD FRONT DRIVE AXLE REMOVAL



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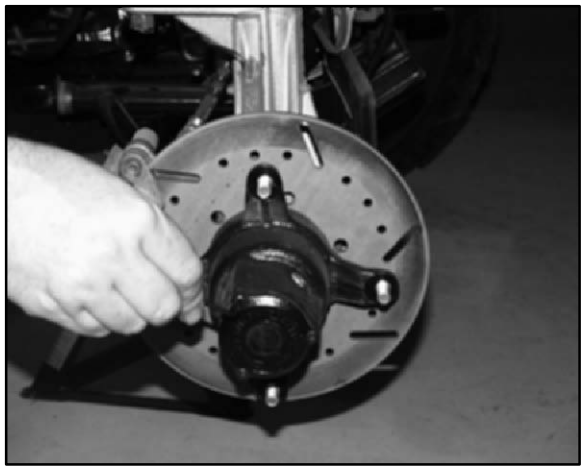
1. Loosen front wheel nuts slightly.
2. Elevate and support machine under footrest/frame area with front wheels elevated.

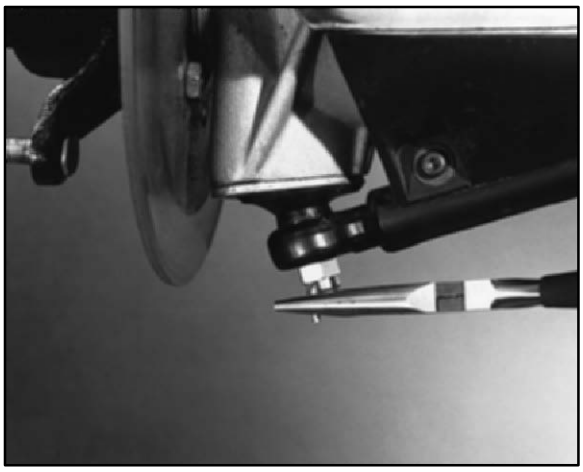
CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing and installing drive axles or component parts.

3. Remove wheel nuts and wheels.

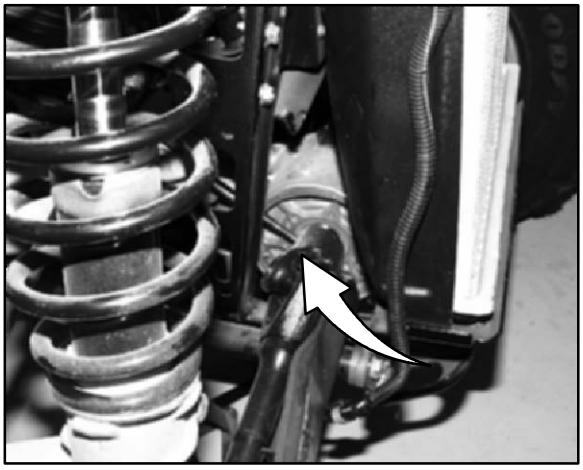


4. Remove hub cap.
5. Remove the two brake caliper attaching bolts. **CAUTION:** Do not hang the caliper by the brake hose. Use wire to hang the caliper to prevent possible damage to the brake line.
6. Place a catch pan beneath the front hub and remove the hub cap.

7. Remove cotter pin and nut.
8. Remove hub, bearings, hilliard assembly, and armature plat



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



10. Using Roll Pin Remover (**PN 2872608**), remove the roll pin at front housing.

Roller Pin Removal Tool (PN 2872608)

11. Remove the spindle and axle assembly from the strut casting bearing by pulling the strut outward as shown. Drive out the old seal, taking care not to damage the tapered roller bearing. Install the new seal until it bottoms against the shoulder in the strut casting.

AWD FRONT DRIVE AXLE INSTALLATION

1. Install spring washer and drive shaft. Align hole in U-joint yoke with hole in eccentric shaft, and install new roll pin.
2. Install new seal in strut casting. Refer to Page 7.13.

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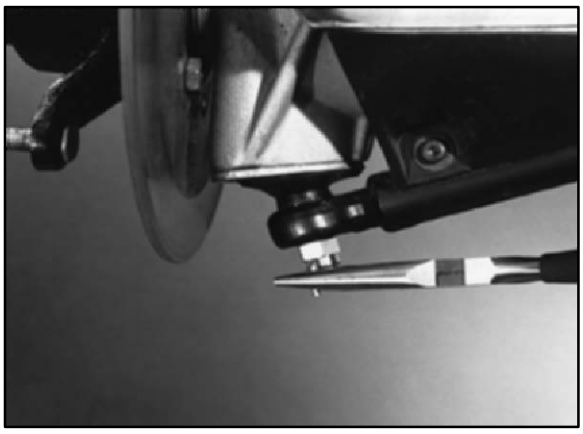
3. Install drive shaft in strut.
4. Install lower ball joint, torque nut to 25 ft. lbs. (34.5 Nm) and install new cotter pin.
5. Follow procedure to install hilliard clutch components and hub as outlined on Page 7.9.
6. Tighten hub nut following procedure on Page 7.5.

DRIVESHAFT AND CV JOINT HANDLING TIPS

Care should be exercised during driveshaft removal or when servicing CV joints. Driveshaft components are precision parts.
Cleanliness and following these instructions is very important to ensure proper shaft function and a normal service life.

- The complete driveshaft and joint should be handled by getting hold of the interconnecting shaft to avoid disassembly or potential damage to the driveshaft joints.
- Over-angling of joints beyond their capacity could result in boot or joint damage.
- Make sure surface-ground areas and splines of shaft are protected during handling to avoid damage.
- Do not allow boots to come into contact with sharp edges or hot engine and exhaust components.
- The driveshaft is not to be used as a lever arm to position other suspension components.
- Never use a hammer or sharp tools to remove or to install boot clamps.
- Be sure joints are thoroughly clean and that the proper amount and type of grease is used to refill when joint boots are replaced and when joints are cleaned. Refer to text for grease capacity of CV joints and CV joint boots.

FRONT DRIVE SHAFT CV JOINT BOOT REPLACEMENT



1. Remove wheel, brake caliper and wheel hub. Refer to front hub disassembly Page 7.3 for procedure.
2. Remove cotter pin and castle nut from A-arm ball joint.
3. Disconnect A-arm from ball joint using a tie rod fork.

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

NOTE: Be careful not to damage the wheel coil wires when positioning the strut. Front Drive Shaft CV Joint Boot Replacement Cont.

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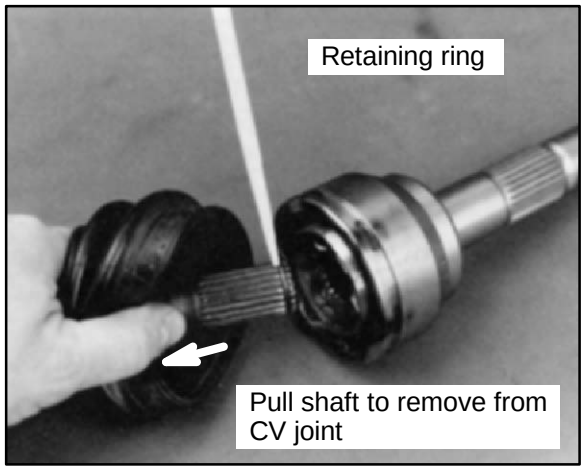
5. Remove clamps from rubber boot using the proper boot clamp pliers.



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

If the ATV has been operated with a damaged boot, the CV joint grease may be contaminated. Inspect the grease carefully for contamination, and clean the joint thoroughly if necessary. Front drive axle CV boot replacement requires 30g of grease. If CV joint is cleaned, an additional 30g of grease is required. Refer to information below.

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

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

9. Slide the new clamp and boot (small end first) over the splined shaft, then slide (tap) the CV joint into the splines of the axle. Install small boot clamp.
10. Add grease through large end of boot.
11. Position large end of boot on CV joint, purge excess air by partially compressing axle into CV bell, lift one edge of boot to let out excess air Secure with clamp.

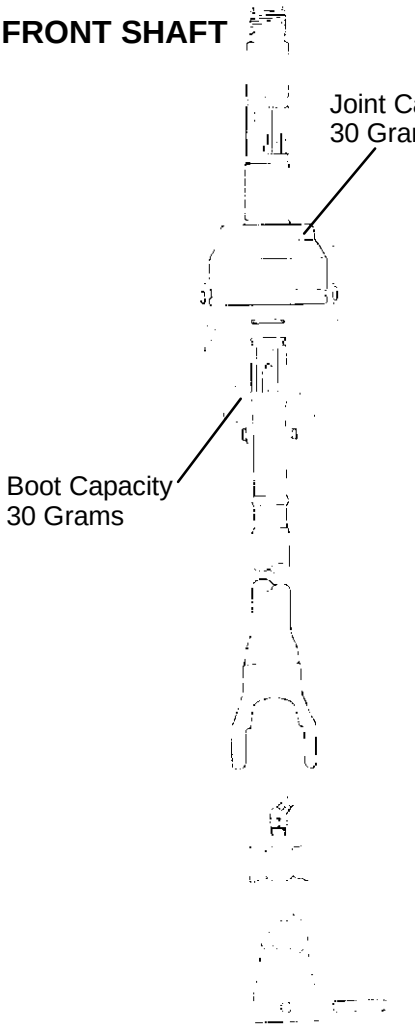
CV Joint Grease - 30g PN 1350046

CV Boot Clamp Pliers:
Earless Type 8700226

Boot Replacement requires 30g

Boot replacement with complete CV joint cleaning requires an additional 30g. (Total 60g)

FRONT SHAFT



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

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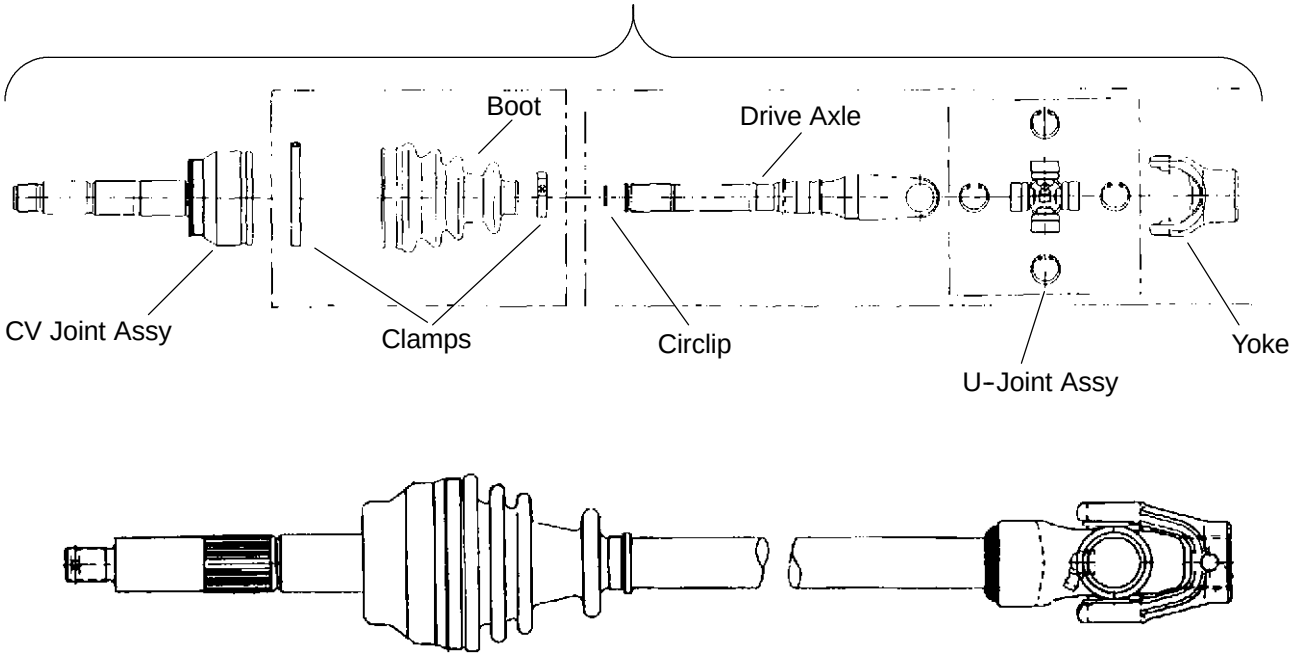
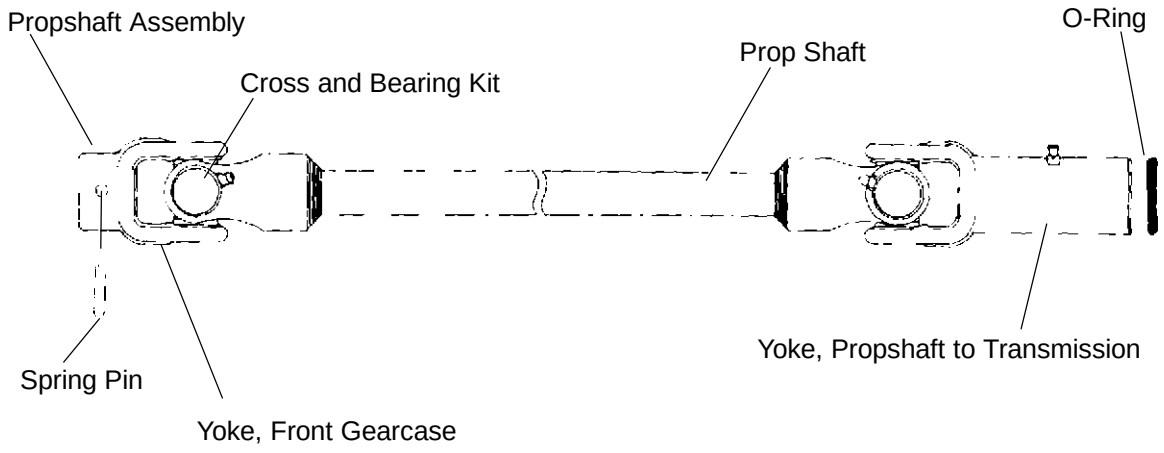
AWD FRONT DRIVE AXLE EXPLODED VIEW

Front Drive Axle Components



Front Prop Shaft Components



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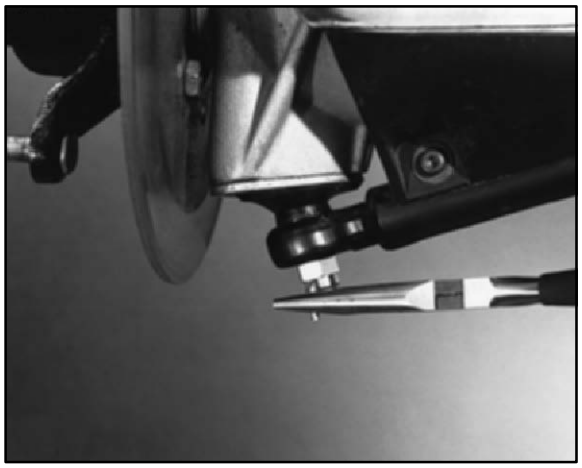
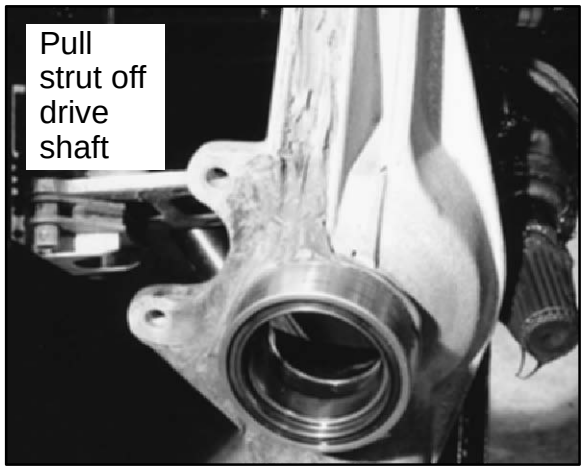
AWD STRUT CASTING FRONT DRIVE AXLE SEAL REPLACEMENT



1. Disassemble front hub. Refer to Page 7.3.
2. Remove the cotter pin and castle nut from the A-arm ball joint. Separate A-arm from ball joint.
3. Remove the spindle and axle assembly from the strut casting bearing by pulling the strut outward as shown. Drive out the old seal, taking care not to damage the tapered roller bearing. Install the new seal until it bottoms against the shoulder in the strut casting.



4. Apply grease to the seal inner lip, reinstall the spindle and axle assembly.
5. Reinstall the A-arm to the ball joint. Torque to 25 ft. lbs. (35 Nm).

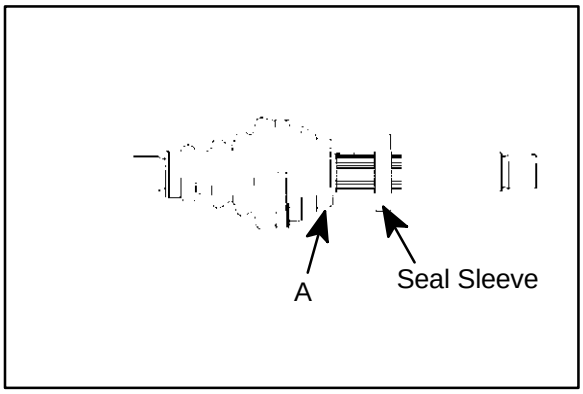
NOTE: If the cotter pin hole does not align at the above torque, tighten slightly until the cotter pin hole aligns and install the pin with open ends *toward rear* of machine.

BEARING REPLACEMENT NOTE FOR FRONT DRIVE AXLE AND FRONT HUB

NOTE: The front axle bearings have a larger I.D. (1.0625″) than the hub bearings (1.000″). Be sure to install the bearings with the larger I.D. in the strut housing, and the bearings with the smaller I.D. in the hub.

SEAL SLEEVE REPLACEMENT

Front Drive Axle Seal Sleeve



1. If front axle sleeves become damaged and leak fluid they are replaceable. Using a hammer and drift punch, remove the seal sleeve by driving it off evenly being careful not to nick or damage the sleeve mounting area (A).
2. Coat the sleeve mounting area (A) with silicone and using extreme care, press the new seal sleeve onto area (A) until it bottoms. Allow 12 hours for silicone to cure.

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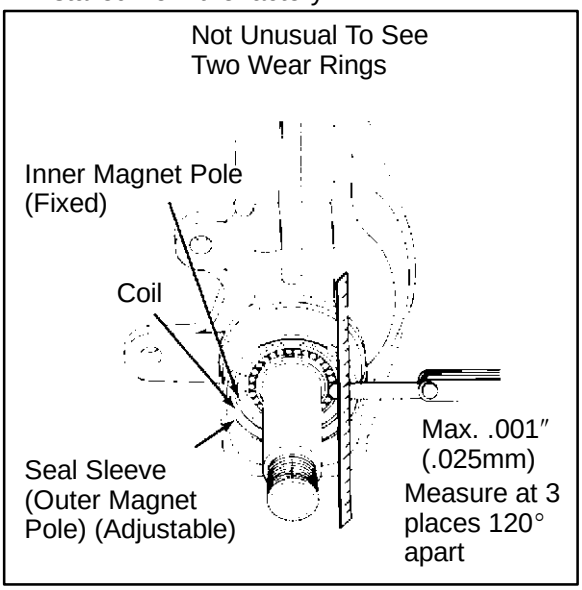
Hub Seal Sleeve Replacement

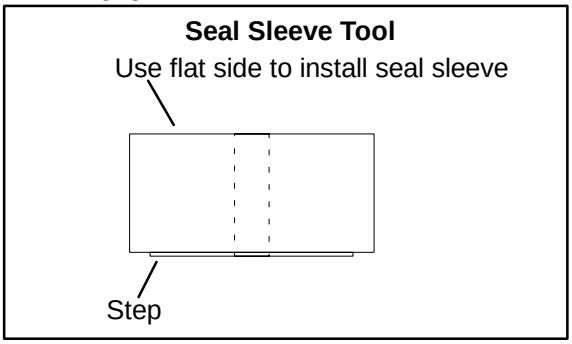
3. New front drive axle CV joint assemblies and drive axle assemblies have the seal sleeve installed from the factory.

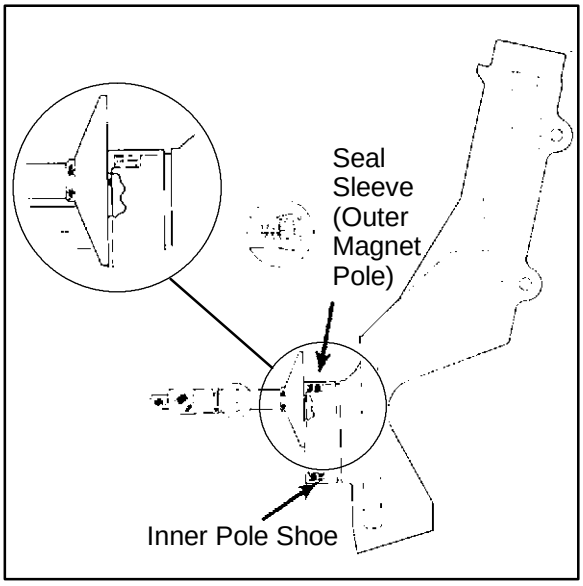


Pole Gap:
.000”-.001” (.00-.025 mm)

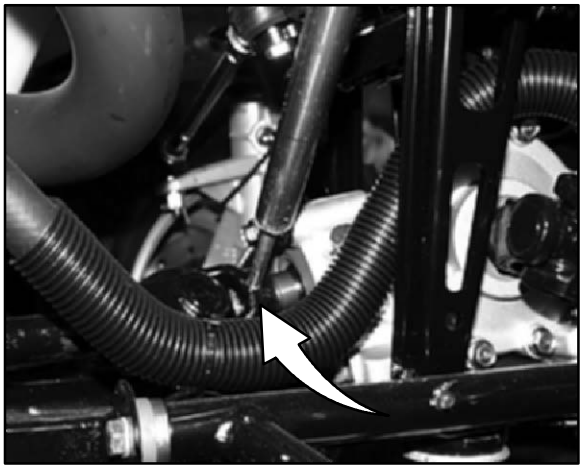
Seal Sleeve Installation Tool Kit: (PN 2871199)

4. The hub seal sleeve must be driven onto the strut casting until flush with the inner magnet pole. Use the flat side (no step) of the Seal Sleeve Installation Tool Kit (**PN 2871199**).
5. To check the gap between the inner and outer poles place a straight edge on the outer pole so that it just intersects with the inner pole. The gap between the straight edge and inner pole should be 0 to .001″ (0-.025mm). This measurement should be checked in three different positions around the pole assemblies. The three measurements must be within .0005″ (.013 mm) of each other. If the gap is excessive, the hub may notengage.





AWD FRONT PROP SHAFT REMOVAL



1. Using Roller Pin Removal Tool **(PN 2872608)**, remove the roll pin from the prop shaft at rear of housing. Slide prop shaft back and away from front housing. Pull sharply forward to remove from transmission shaft.

NOTE: If removing front housing, use roll pin remover to remove the roll pins from both front drive axles.

Roller Pin Remover Tool (PN 2872608)

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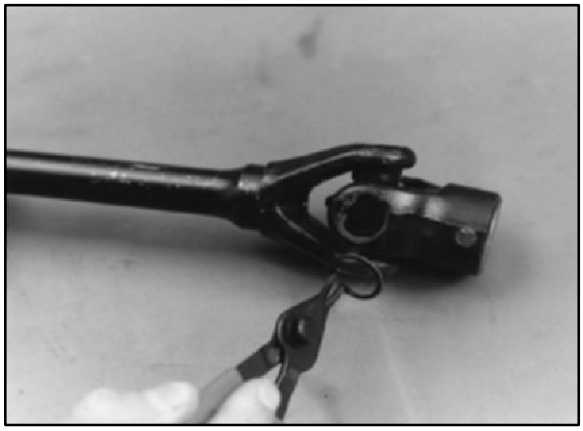
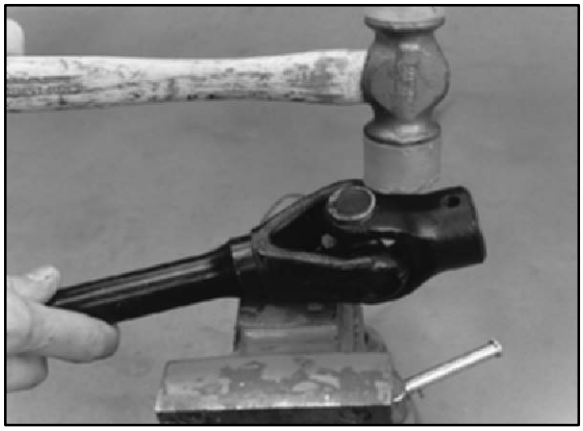
U-JOINT DISASSEMBLY



CAUTION: Always wear eye protection.

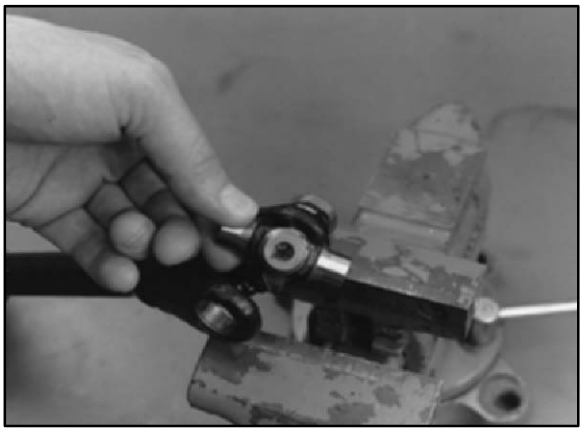
1. Remove internal or external snap ring from all bearing caps.

NOTE: If yoke or bearing is removed, cross bearing must be replaced. Note orientation of grease fitting and mark inner and outer yoke for correct re-positioning during installation.



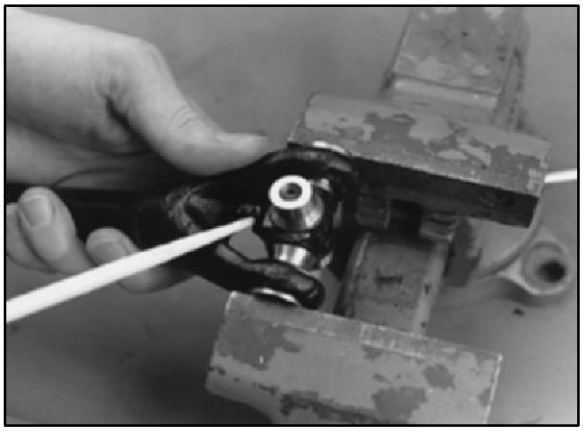
2. Support inner yoke as shown and drive outer yoke down (bearing cap out) with a soft face hammer.

3. Support U-joint in vise as shown and drive inner yoke down to remove remaining bearing caps.

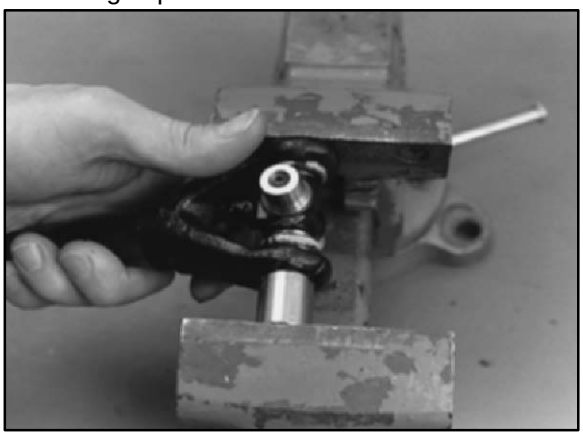


4. Force U-joint cross to one side and lift out of inner yoke.

U-JOINT ASSEMBLY



1. Install new bearing caps in yoke by hand. Carefully install U-joint cross with grease fitting properly positioned inward toward center of shaft. Take care not to dislodge needle bearings upon installation of cross joint. Tighten vise to force bearing caps in.



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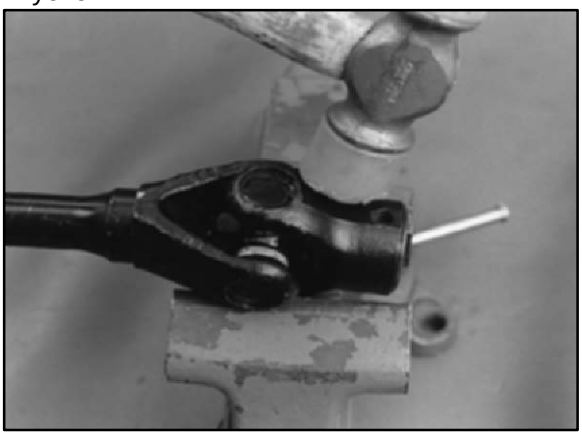
2. Using a suitable arbor, fully seat bearing cap in one side. Continually check for free movement of bearing cross as bearing caps are assembled.
3. Install snap ring to contain bearing cap just installed. Repeat procedure for other side.

4. Install outer yoke, aligning marks made before disassembly.
5. Repeat Steps 1-3 to install bearing caps on outer yoke.



6. Seat all bearing caps against snap rings by supporting cross shaft and tapping on each corner as shown.
7. When installation is complete, yokes must pivot freely in all directions without binding. If the joint is stiff or binding, tap the yoke lightly to center the joint until it pivots freely in all directions.

AWD FRONT HOUSING REMOVAL

1. Stop engine, place machine in gear and set parking brake.
2. Loosen right front wheel nuts slightly.
3. Elevate and support machine under footrest/frame area.

CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing and installing bearings and seals.

4. Remove right wheel nuts and wheel.

5. Remove cotter pin, lower ball joint nut and A-arm from ball joint.
6. Punch spring pins out from both axle splines and front prop shaft.
7. Remove bolts securing bottom of housing to frame. Remove vent line. Remove housing from right side of frame.

FRONT HOUSING DISASSEMBLY

1. Drain and properly dispose of used oil.

2. Remove bolts and output shaft cover.

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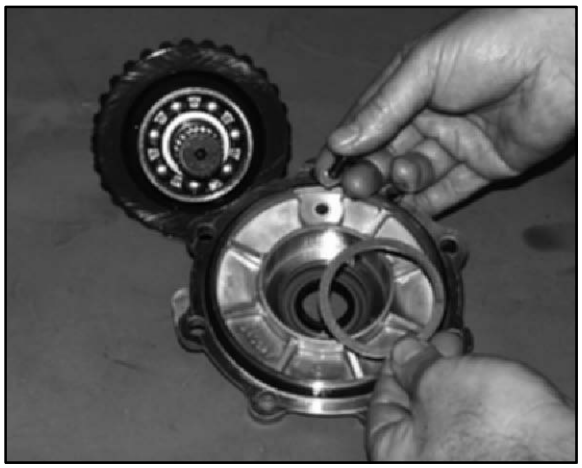
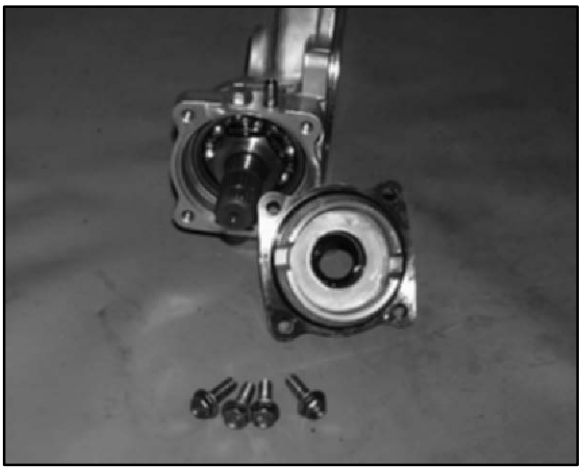
AWD FRONT HOUSING DISASSEMBLY, CONT.



3. Remove output shaft assembly, large shim, and thrust button with its small shim.
4. Clean all parts and inspect spacers for wear. Inspect ring gear for chipped, broken, or missing teeth.



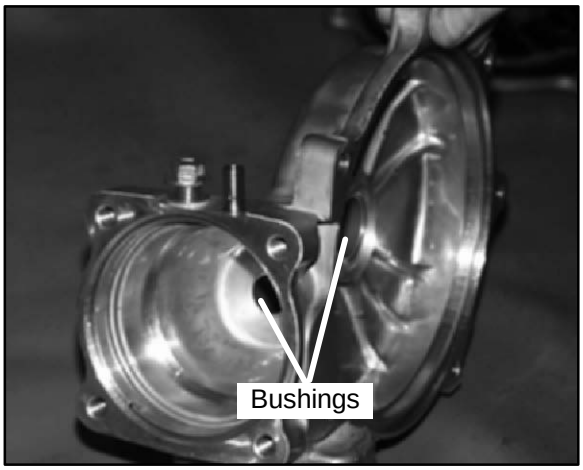
5. Remove pinion cover and O-ring.

6. Unscrew fill plug and remove pinion shaft assembly. Inspect pinion gear for chipped broken or missing teeth.

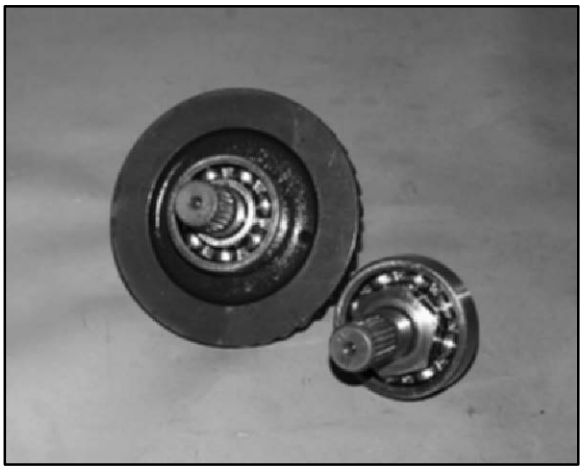
NOTE: Pinion shaft assembly will not clear the fill plug unless it is backed out.

AWD FRONT HOUSING ASSEMBLY

1. Replace all O-rings, seals, and worn components.



2. Press pinion shaft seal into pinion cover until flush with sealing surface.
3. Inspect pinion and output shaft bushings.



4. Inspect bearings on output and pinion shafts. To replace, press new bearing on to shaft.

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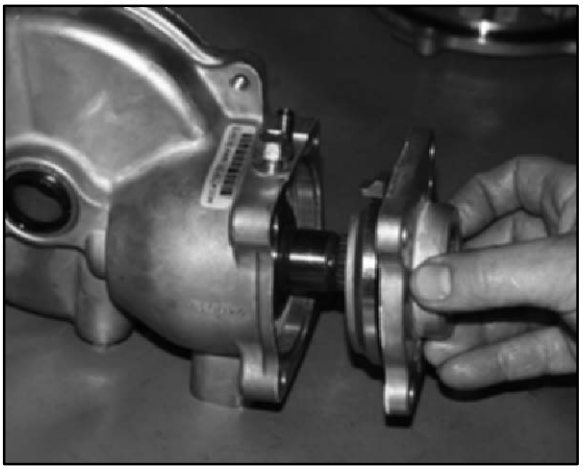
NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement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

5. Clean pinion shaft and lock nut with PrimerN™ and apply red LocTite™ to threads. Tighten lock nut to specification.



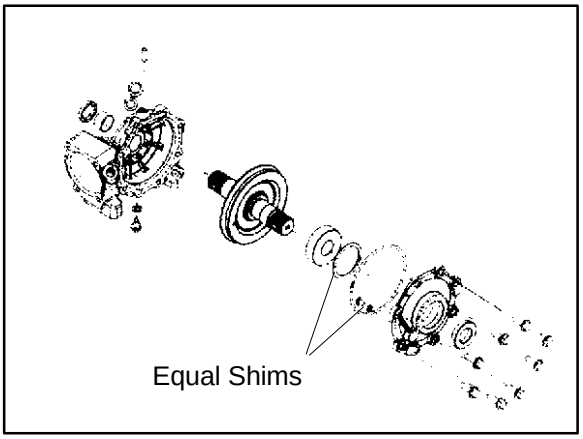
6. Install pinion shaft and pinion cover plate with new o-ring and torque bolts to 14 ft. lbs. (19 Nm).

Pinion Shaft Lock Nut Torque

65 ft. lbs. (89.7 Nm)

Cover Bolts Torque

14 ft. lbs. (19 Nm)



7. Install output shaft assembly.

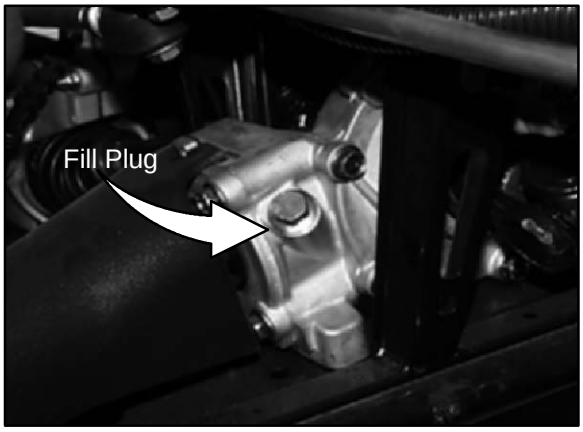
NOTE: The same shim thickness placed behind ring gear bearing must also be put behind the cover button.

8. Install output shaft cover with new o-ring and torque bolts to 14 ft. lbs. (19 Nm).

Cover Bolts Torque

14 ft. lbs. (19 Nm)

FRONT HOUSING INSTALLATION



1. To install housing, reverse removal procedure. Use new roll pins in drive shafts.
2. Add Polaris Premium Front Housing Lubricant or GL5 80-90 gear lube to front housing. Check drain plug for proper torque.

Premium Front Housing Fluid (PN 2871653) (12 oz.)

Front Housing Capacity 4.0 fl. oz. (118 ml)

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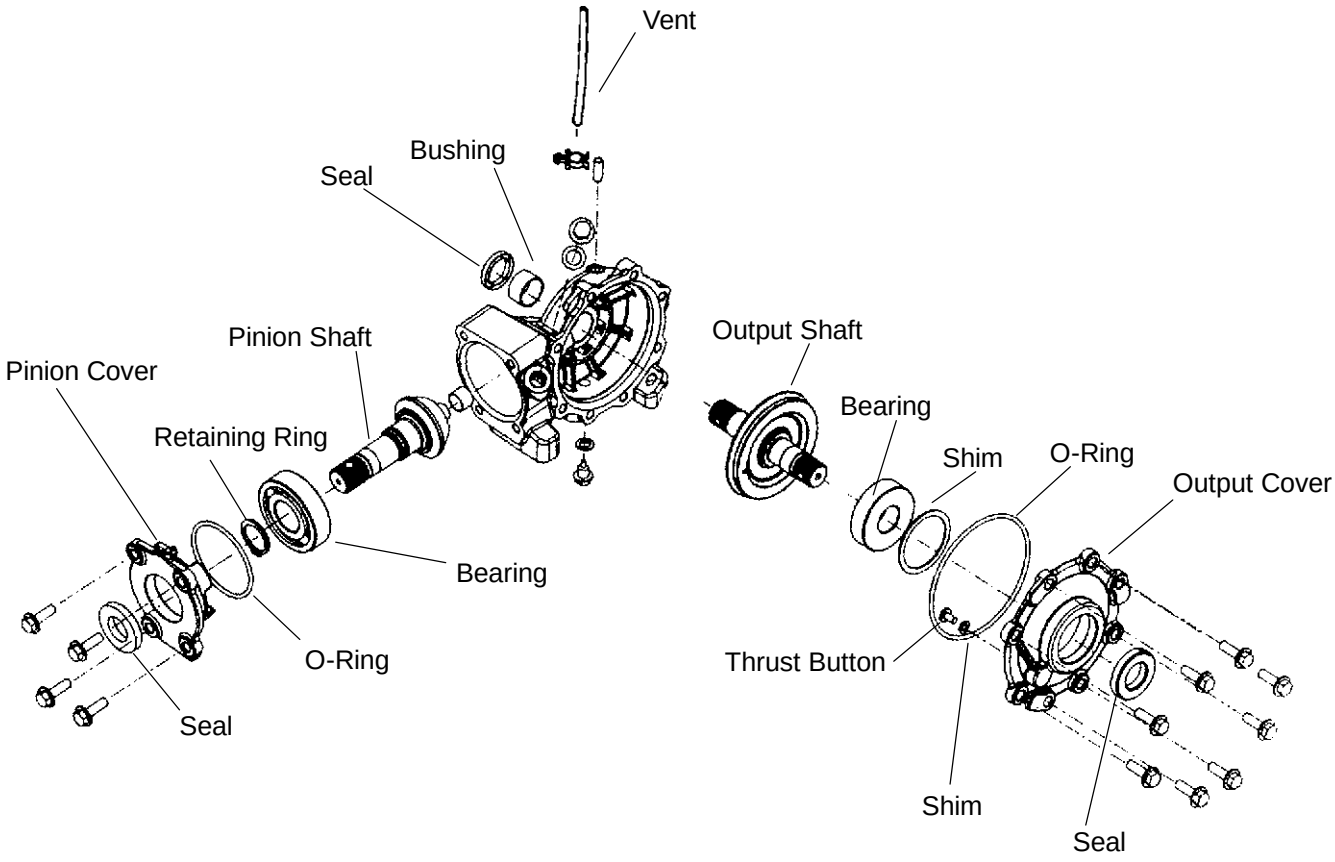
AWD FRONT HOUSING EXPLODED VIEW



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REAR HUB/BEARING CARRIER REMOVAL

1. Lock the parking brake. Remove rear hub cap.
2. Remove cotter pin.

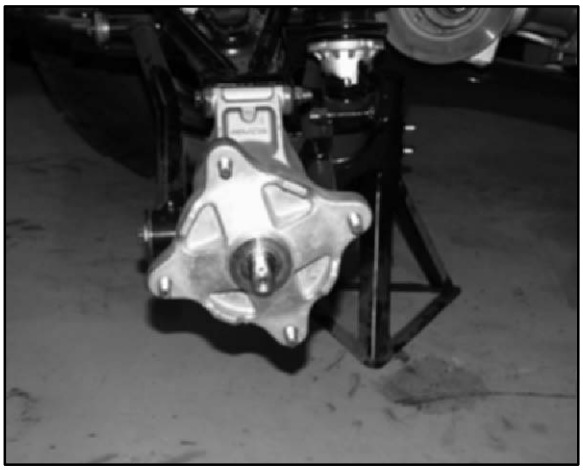
3. Loosen the hub retaining nut.
4. Loosen the wheel nuts.
5. Safely support the rear of the ATV.

CAUTION:

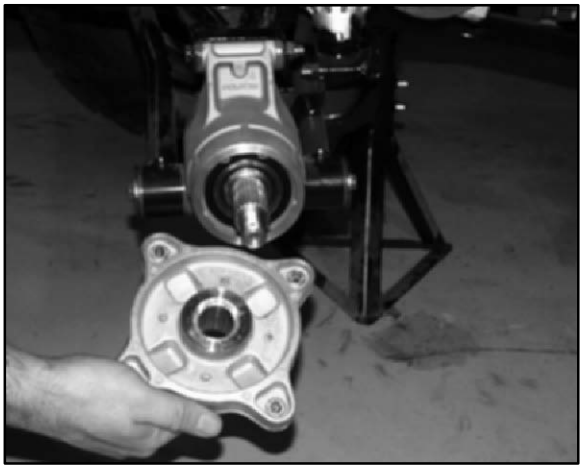
Serious injury could occur if machine tips or falls.

6. Remove hub nut, domed washer and flat washer.

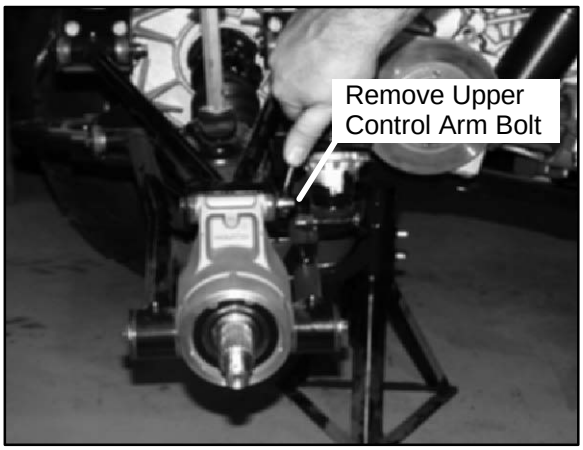
7. Remove wheel nuts and wheel.



8. Remove hub.



9. Remove upper control arm bolt as shown.



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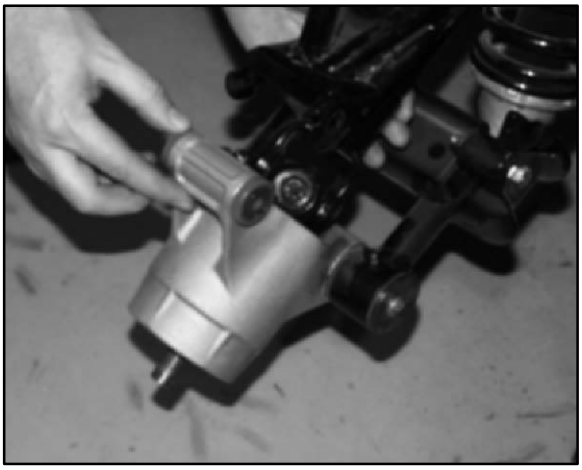
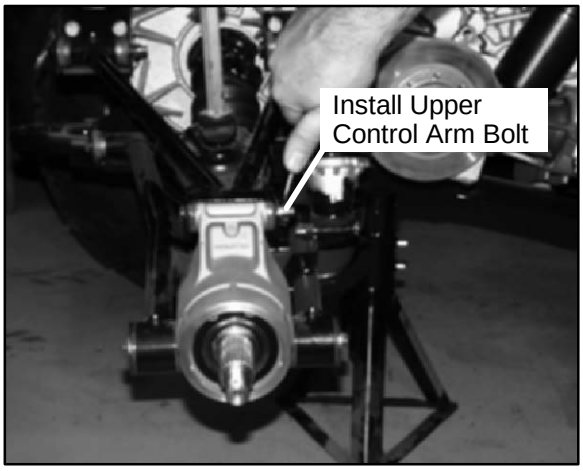
10. Remove both lower control arm bolts.
11. Remove bearing carrier.

REAR HUB INSTALLATION

1. Start 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 and torque both lower control arm bolts.



Lower Control Arm Bolt Torque:
30 ft. lbs. (41 Nm)

Upper Control Arm Bolt Torque:
35 ft. lbs. (48 Nm)

4. Lift bearing carrier until top aligns with upper control arm. Install and torque upper control arm bolt and torque to specification.
5. Pull drive shaft outward and install hub onto driveshaft splines.
6. Install cone washers with domed side facing outward.
7. Install retainer nut, wheel and wheel nuts.
8. Remove jackstand and torque axle nut and wheel nuts.
9. Install a new cotter pin. Tighten nut slightly to align holes if required. Install the hub cap.

Rear Hub Nut Torque:
100 ft. lbs. (138 Nm)

Rear Wheel Nut Torque
20 ft. lbs. (27 Nm)

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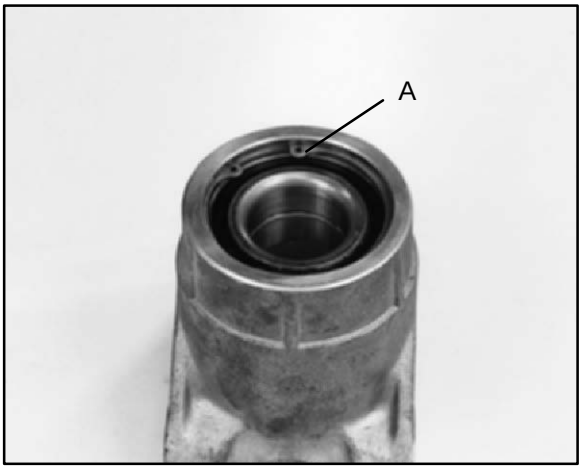
REAR HUB DISASSEMBLY

1. Remove outer snap ring (A).



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

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

3. Inspect bearing.

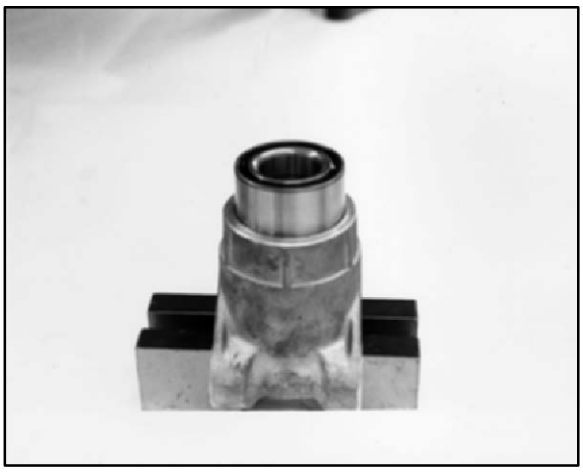
NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement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

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

REAR HUB ASSEMBLY

1. Support bottom of bearing carrier housing.

2. Start bearing in housing.



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

CAUTION:

Use an arbor and press only on the outer race, as bearing damage may occur.

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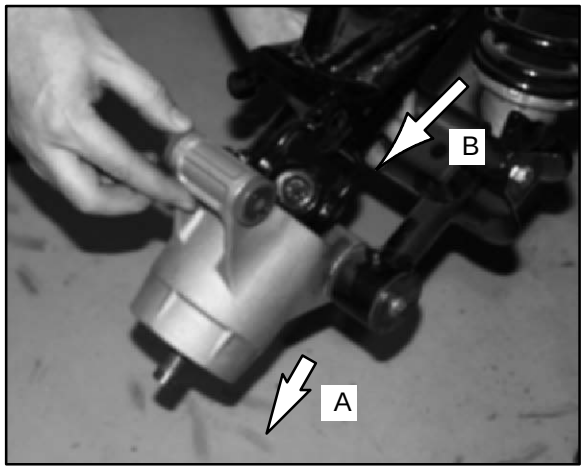
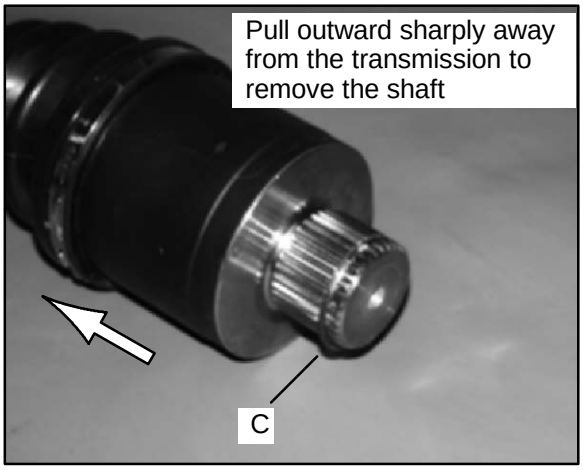
4. Install snap ring into groove.

REAR DRIVE SHAFT REMOVAL

1. Remove rear hub and bearing carrier. (See Pages 7.20 - 7.21, Steps 1- 9).
2. Tip hub outward (A) and remove shaft (B) from hub.



3. Pull sharply outward to remove shaft from transmission. Install a new lock ring (C) upon assembly.



DRIVESHAFT AND CV JOINT HANDLING TIPS

Care should be exercised during driveshaft removal or when servicing CV joints. Driveshaft components are precision parts.
Cleanliness and following these instructions is very important to ensure proper shaft function and a normal service life.

- The complete driveshaft and joint should be handled by getting hold of the interconnecting shaft to avoid disassembly or potential damage to the driveshaft joints.
- Over-angling of joints beyond their capacity could result in boot or joint damage.
- Make sure surface-ground areas and splines of shaft are protected during handling to avoid damage.
- Do not allow boots to come into contact with sharp edges or hot engine and exhaust components.
- The driveshaft is not to be used as a lever arm to position other suspension components.
- Never use a hammer or sharp tools to remove or to install boot clamps.
- Be sure joints are thoroughly clean and that the proper amount and type of grease is used to refill when joint boots are replaced and when joints are cleaned. Refer to text for grease capacity of CV joints and CV joint boots.

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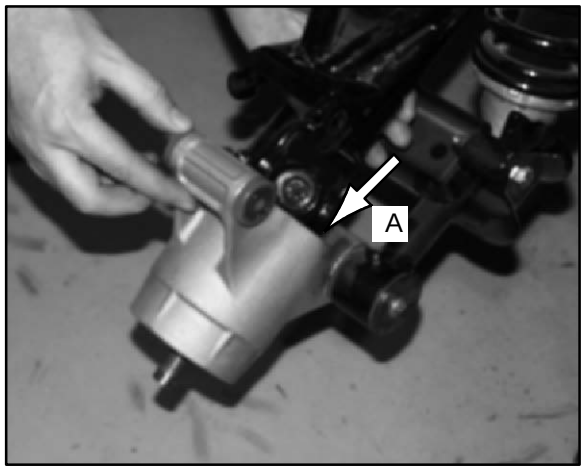
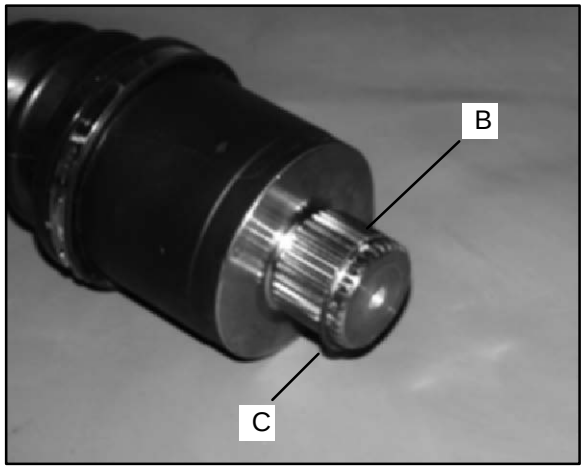
REAR DRIVE SHAFT INSTALLATION

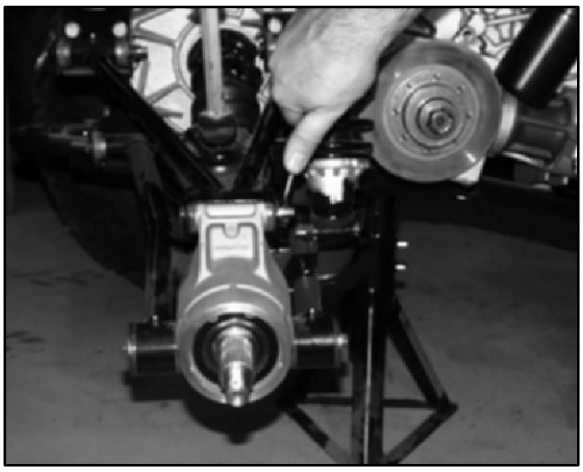
1. Slide shaft assembly into bearing carrier hub (A)



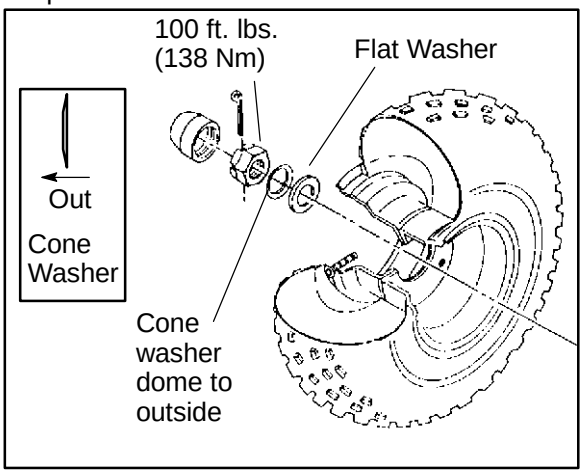
2. Apply anti-seize compound to splines (B) of shaft.
3. Install a new lock ring (C) and install the shaft.



4. Lift bearing carrier into place and install bolt to upper control arm. Torque bolt to 35 ft. lbs. (48 Nm).



5. Install hub, flat washer, domed washer (domed side out) and nut. Torque center nut to 100 ft. lbs. (138 Nm). Install new cotter pin and hub cap.
6. Install rear wheel and torque wheel nuts to specification.



Rear Hub Nut Torque:
100 ft. lbs. (138 Nm)

Rear Wheel Nut Torque:
20 ft. lbs. (27 Nm)

7. Grease all fittings thoroughly with Premium U-Joint Lubricant.

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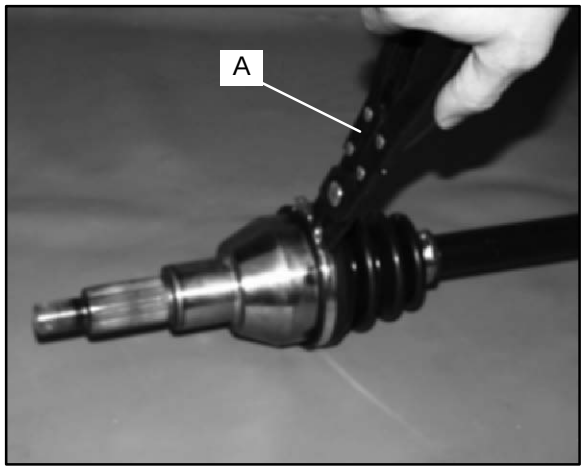
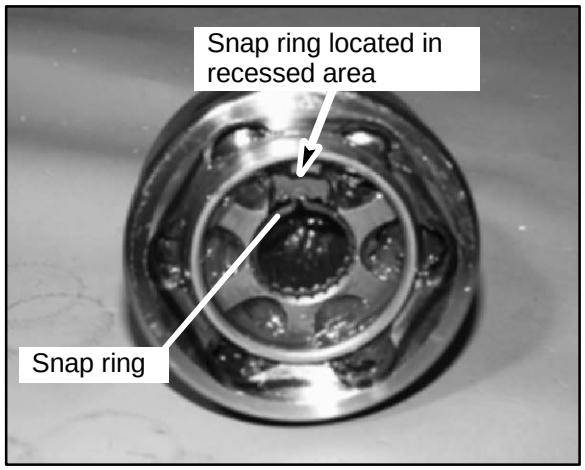
REAR DRIVE SHAFT SERVICE

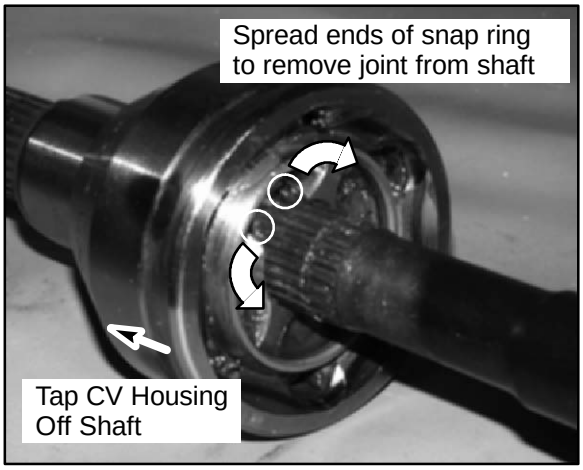
1. Remove clamps from rubber boot(s) using the CV Boot Clamp Pliers (**PN 8700226**) (A).



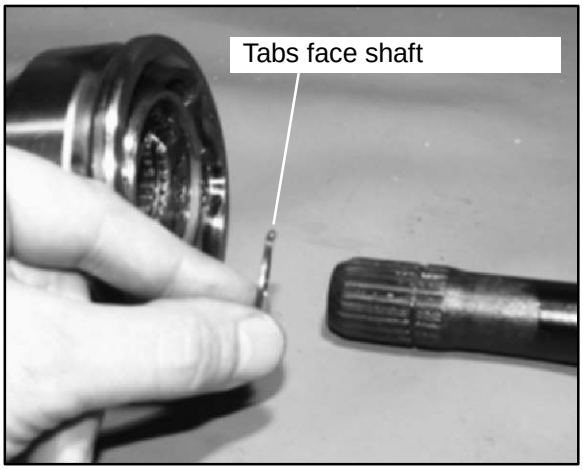
2. **NOTE:** Photo below is shown without shaft for clarity. Wipe grease away from recess in CV joint inner hub to locate snap ring.



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



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



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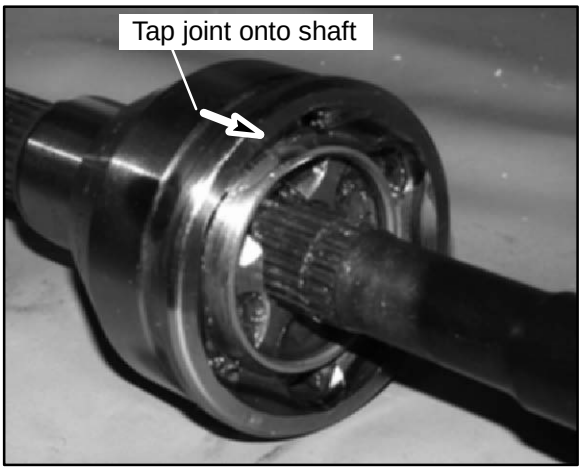
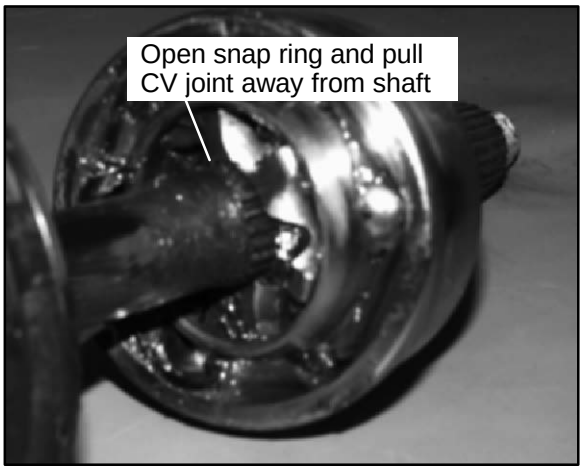
5. Refit CV joint on interconnecting shaft by tapping with a plastic hammer on the joint housing. Take care not to damage threads on the outboard CV joint. The joint is fully assembled when the snap ring is located in the groove on the interconnecting shaft.



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:* 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.



1. Remove CV joint from end of shaft. (See Page 7.25)
2. Remove boot from shaft.

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

(CV JOINT CLEANING / REPLACEMENT)

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.

(Boot Replacement)

4. Add the recommended amount of grease for *CV joint cleaning* to the joint as shown below. Be sure grease penetrates all parts of the joint.

(BOOT INSTALLATION)

5. Fit joint boot and clamps on interconnecting shaft. Make sure small end of boot is fully seated in groove.
6. Position small clamp over small end of boot. Be sure it is seated all the way around in the clamp recess on the boot.

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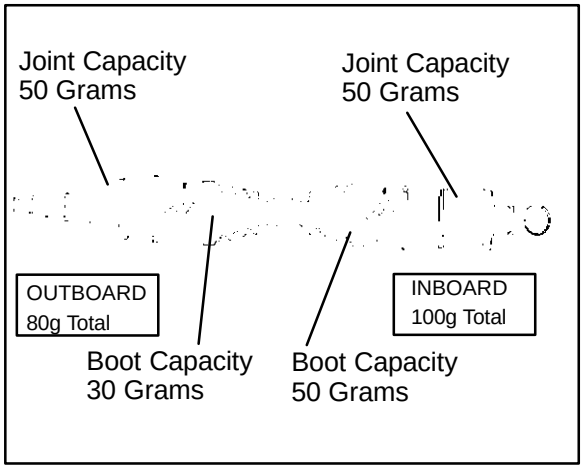
7. Tighten boot clamp using boot clamp pliers.
8. Fill boot with grease supplied with boot service kit and spread remaining grease evenly inside CV joint.
9. Be sure to use only the Constant Velocity Joint grease supplied with boot service kit. IF CV JOINT WAS CLEANED, add the recommended amount of grease to the joint *in addition* to the grease pack supplied with boot kit.

NOTE: CV Joint Grease Capacity:



CV Joint Grease - 30g PN 1350046
50g PN 1350047

Outboard joint - 30g if boot is replaced only. Another 50g (80 total) if joint is cleaned.

Inboard joint - 50g if boot is replaced only. Another 50g (100 total) if joint is cleaned.

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NOTES

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CHAPTER 8
TRANSMISSION SERVICE

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TORQUE SPECIFICATIONS

COMPONENT	FT. LBS. (IN.LBS.)	NM
Transmission Case Bolts	12	16.6
Bell Crank Nut	12	16.6
Transmission Drain Plug	14	19
Transmission Mounting Bolts	25	34.5

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2871701 (Part of **2871702** Kit)	2 1/8 inch Wrench
2871697 (Part of **2871702** Kit)	Center Drive Bushing Tool
2871695 (Part of **2871702** Kit)	Backlash Setting Tool
2871698 (Part of **2871702** Kit)	Rear Output Seal Driver
2871699 (Part of **2871702** Kit)	Rear Driveshaft Seal Guide
2871282	Bearing Seal Driver (50 mm)

LUBRICATION

Refer to maintenance section for transmission lubricant type and capacity.

GEAR SHIFT SELECTOR REMOVAL

NOTE: To change fluid, remove selector box assembly, disassemble, clean, and assemble.

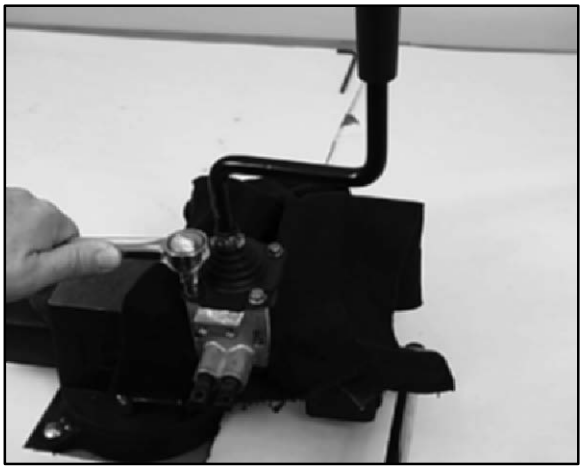
1. Remove parts that interfere with access to shift selector (seat, right side panel, and exhaust heat shield, etc.).
2. Disconnect the two linkage rods from gear shift selector slides.
3. Remove five bolts attaching gear shift selector to the mounting bracket.
4. Lift gear selector out of mounting bracket and away from frame.

GEAR SHIFT SELECTOR DISASSEMBLY

CAUTION:

Wear eye protection during this procedure. Read each step completely before proceeding. Essential parts may be lost or damaged if you do not heed this caution!

1. Clamp gear selector body lightly in a soft jawed vice. Using a cross pattern, loosen each of the four screws holding the gear shift selector cover to the gear shift selector body. Loosen each screw only a few turns, then proceed to another screw.



NOTE: These parts are under pressure from the internal springs.

2. Carefully pull the gear shift selector cover and rod from the gear shift selector body.

3. Set the cover/rod assembly aside.

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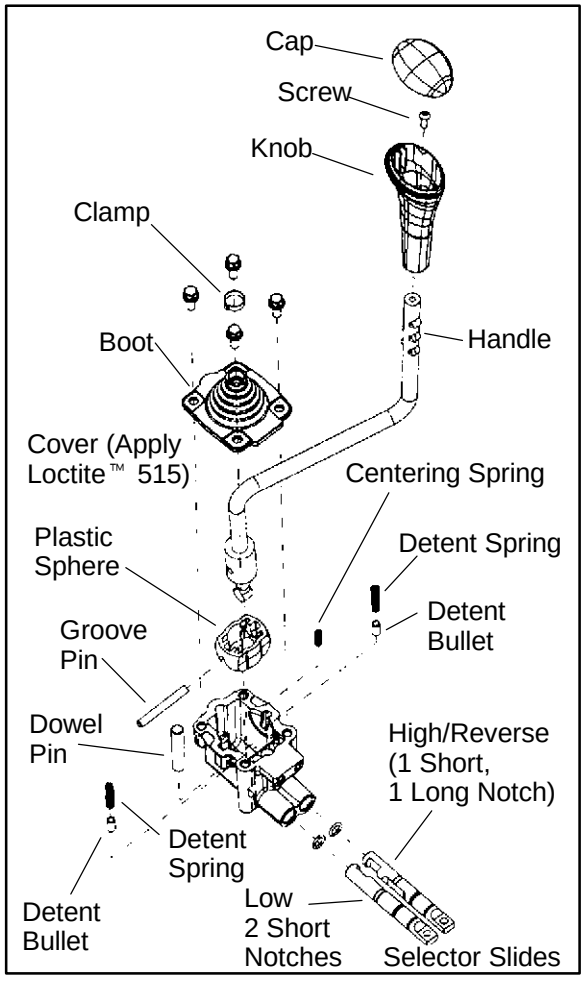
4. Remove the three springs from gear shift selector.
5. Slowly tilt gear shift selector body sideways to drain oil.

NOTE: *Do not* tip gear shift selector body upside down or detent bullets and stop pin may fall out. Check for signs of moisture in the selector body.

7. Remove the two slides, one at a time.

NOTE: The LH (low) slide has two short notches and the RH (high/rev) slide has one short and one long notch. The slides must be replaced in the proper channels.

8. Inspect O-rings for damage. Replace if any damage is found.
9. Flush housing with parts washer fluid or penetrating oil to remove all moisture.
10. Dry all gear shift selector parts and remove any corrosion with a wire brush.



Inspect shift boot closely if moisture is present in selector box.

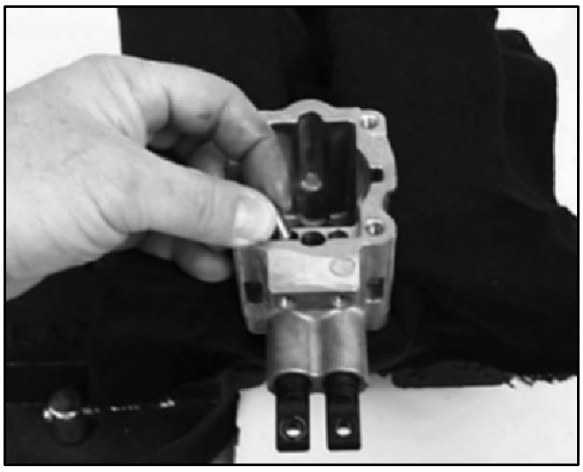
6. Tap gear shift selector body, top down, against a hard, smooth, flat surface to jar the dowel pin and two detent bullets loose. Pull the detent bullets and the dowel pin out of the gear shift selector body.

GEAR SHIFT SELECTOR ASSEMBLY

1. Insert slides into gear shift selector body, taking care not to cut or tear O-rings in the process.

NOTE: The LH slide has two short notches and the RH side has one short and one long notch. The slides must be replaced in the proper channels for the shifter to function properly.

2. Replace detent bullets, dowel pin, and springs by reversing Steps 5 - 7 of Gear Shift Selector Disassembly.



3. Clamp gear shift selector body lightly in a soft jawed vise.

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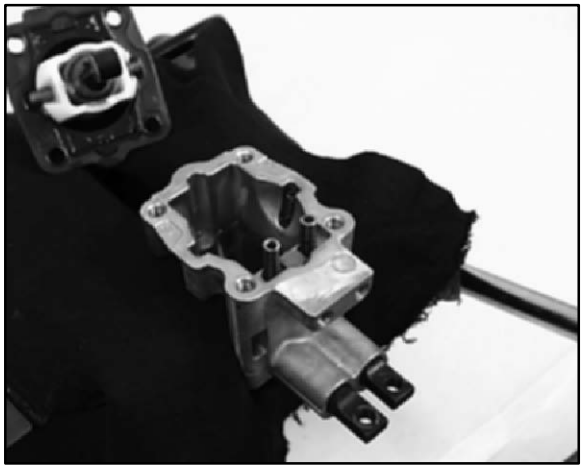
4. Fill selector body with Polaris 0W-40 All Season Synthetic motor oil. The oil level should be at one half the height of the slides (approx. 1 oz.).

Gear Shift Selector Capacity: 1 oz.

Polaris 0W-40 All Season Synthetic Oil
(PN 2871281) - Quart
(PN 2871844) - Gallon

CAUTION: Too much oil could cause the selector to hydrolock. Be sure the selector box is level when adding oil.



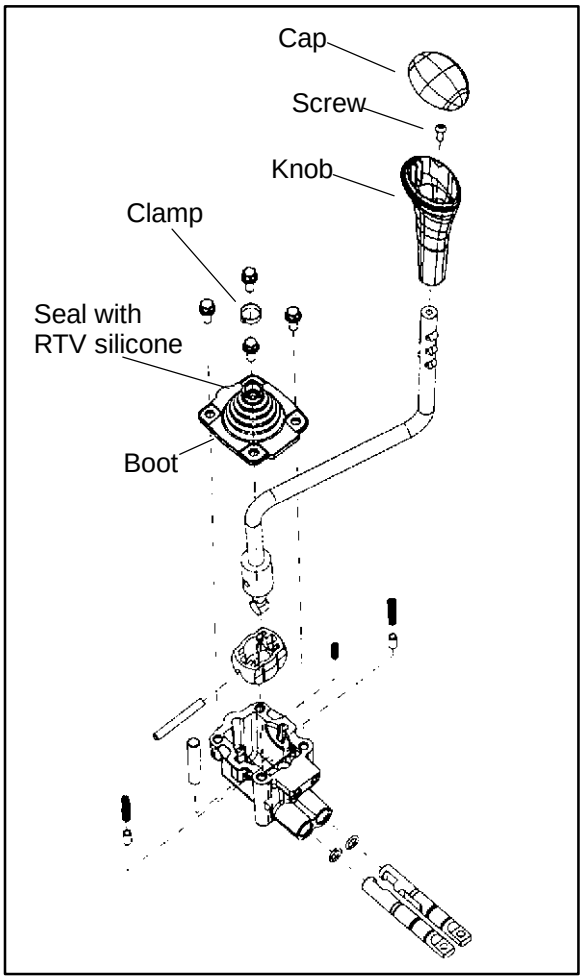
5. Wipe gear selector dry, clean surfaces of cover and selector box with Loctite™ Primer T and place a bead of Loctite™ 518 Gasket Eliminator or Crankcase Sealant (**PN 2871557**) completely around the edge of the gear shift selector body.
6. *Carefully* reattach cover/rod assembly to gear shift selector body. Make sure slides are in neutral, or butterfly may be damaged.
7. Torque cover screws to 12 ft. lbs. (17 Nm).

GEAR SHIFT SELECTOR INSTALLATION

1. Place gear shift selector back into the mounting bracket and replace five bolts.
2. Reconnect linkage rods to gear shift selector slides. Adjust as required. See linkage adjustment procedures.
3. Replace remaining parts.

BOOT REPLACEMENT

NOTE: If moisture is found in the gear shift selector the boot should be replaced.



1. Using a slotted screwdriver, remove cap from gear shift knob.
2. Remove torx screw securing knob to selector rod.
3. Pull selector knob off selector rod.
4. Remove band clamp on rubber boot.
5. Slide boot off selector rod and replace with a new one.
6. Apply RTV silicone to selector rod to seal top of boot.
7. Place band clamp in position and tighten using CV boot clamp pliers.
8. Replace shift knob, securing it to selector rod with screw removed in Step 2.
9. Push shift knob cover back into place. Allow approximately 12 hours for RTV silicone to cure.

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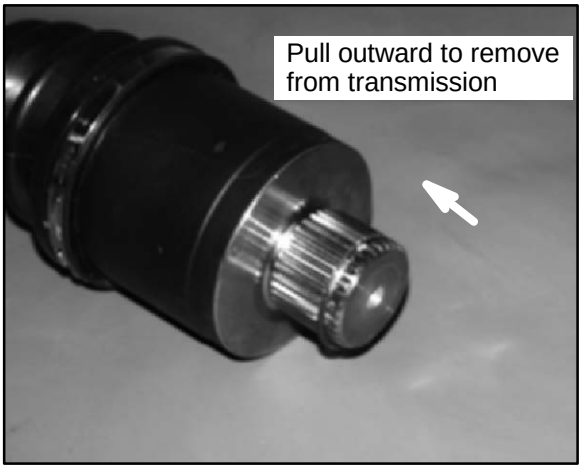
TRANSMISSION REMOVAL

All operations regarding transmission front output housing assembly can be performed with transmission installed in frame.

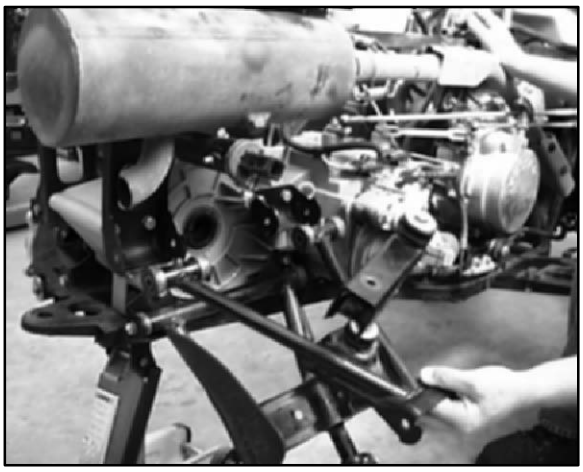
1. Remove the inner PVT cover. Refer to Clutch Chapter.
2. Remove complete airbox assembly and transmission vent line.
3. Loosen rear wheel nuts slightly.
4. Elevate and support machine under footrest/frame area.

CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing and installing bearings and seals.

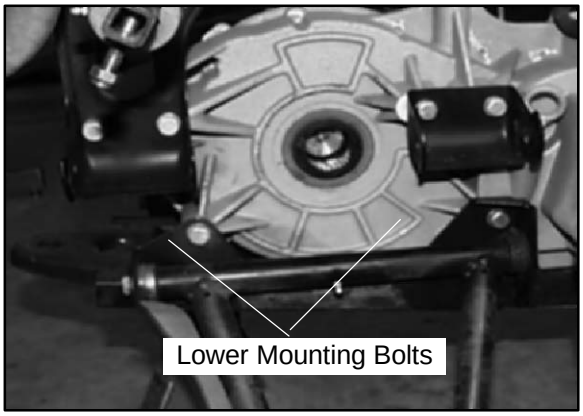
5. Remove wheel nuts and wheels.
6. Disconnect transmission shift linkage rods. Remove right hand shock absorber.
7. Disconnect harness from gear position switches.
8. Remove right rear drive shaft (see Chapter 7).



9. Disconnect the sway bar from both sides. Remove right side upper control arm.



10. Remove left side shock absorber.
11. Remove left rear drive shaft (see Chapter 7).
12. Remove left side upper control arm.
13. Remove both lower transmission mounting bolts from each side.



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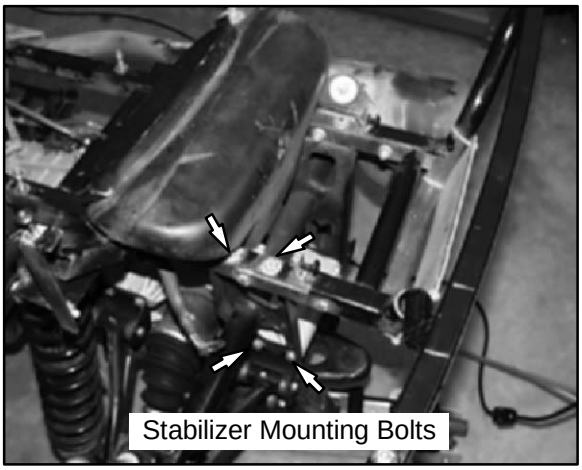
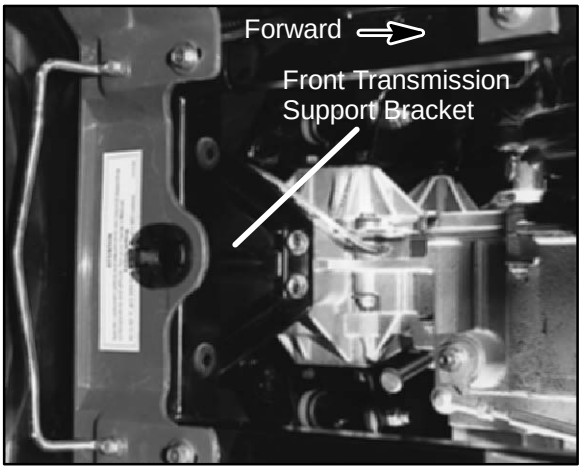
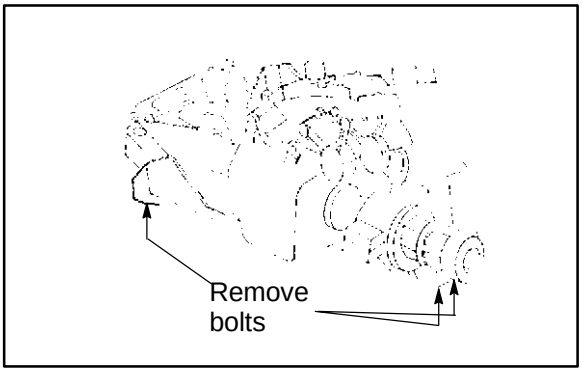
14. Remove all 8 bolts attaching the stabilizer support bracket, and remove support.



15. Remove front support bracket.



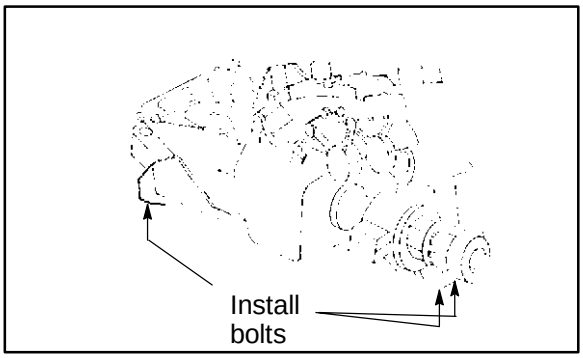
16. Remove bottom transmission bolts as shown in Illustration below.



17. Lift and remove transmission out right side of frame.

TRANSMISSION INSTALLATION

1. Apply Polaris Premium All Season Grease (**PN 2871423**) to splines of front output shaft ,install new O-ring in prop shaft, insert output shaft into prop shaft.
2. Rotate transmission into place from right side of frame.
3. *Loosely* install bottom transmission bolts.



4. Install lower right and left transmission mounting bolts, front transmission bracket, and rear stabilizer support bracket. Tighten transmission bolts securely in the following sequence.
   - Front support bracket upper and lower.
   - Stabilizer bracket upper and lower.
   - Bottom transmission bolts.
   - Lower left and right transmission mounting bolts.

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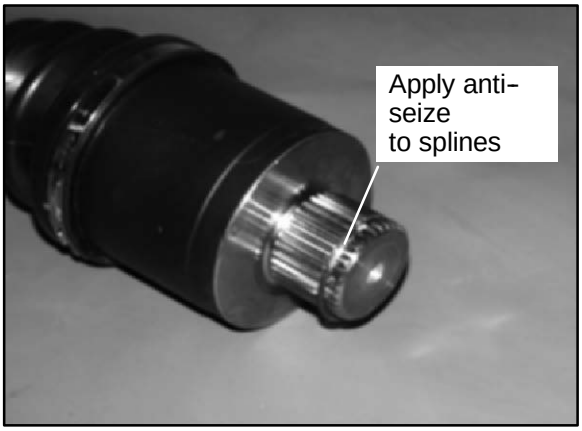
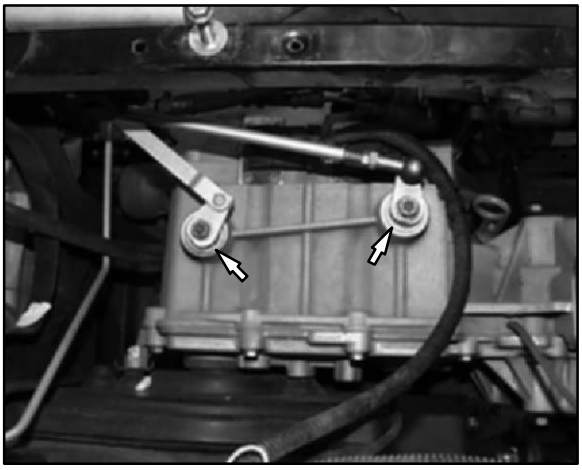
5. Apply anti-seize to splines of rear drive shafts, insert drive shafts into transmission. Install left and right rear upper control arms. Install stabilizer bar arm on stabilizer bar.



6. Install brake disc and washer with domed side out, against nut.
7. Install caliper, auxiliary brake master cylinder, and transmission shift linkage rods. Install left and right hand shock absorbers.



8. Apply brake and torque disc nut to 45 ft. lbs. (61 Nm).
9. Install PVT system. Refer to PVT section for procedure.
10. Install airbox assembly and transmission vent line. Be sure vent line is not kinked or pinched.
11. Add Polaris Premium Synthetic Gearcase Lubricant to the proper level on dipstick. (Approximately 1 quart). Do not overfill.

Premium Synthetic Gear Case Lubricant
(PN 2871478) (12 oz.)
(PN 2871477) (Gallon)

12. Install the rear wheel nuts and torque to specification.

Rear Wheel Retaining Bolt Torque
20 ft. lbs. (27 Nm)

13. Refer to Maintenance Section to adjust transmission linkage.

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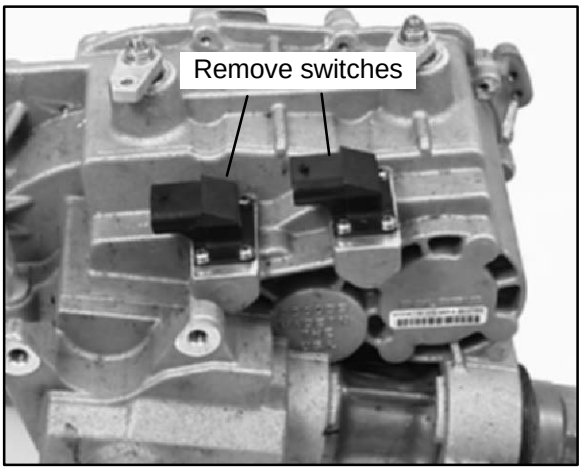
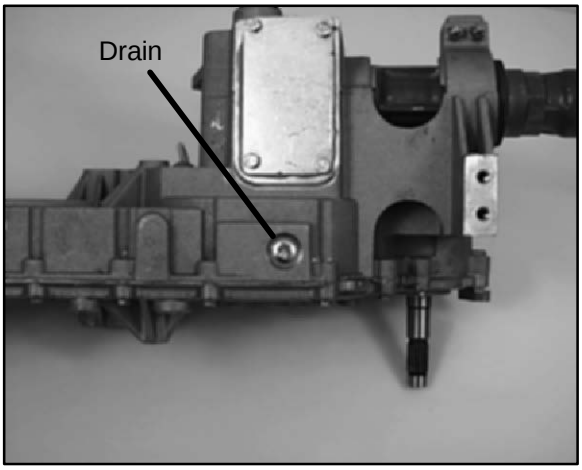
TRANSMISSION DISASSEMBLY

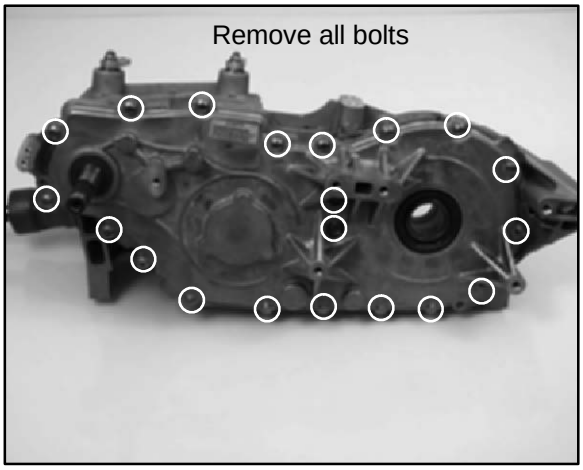
1. Remove gear indicator switches BEFORE disassembly.



2. Drain and properly dispose of transmission oil.



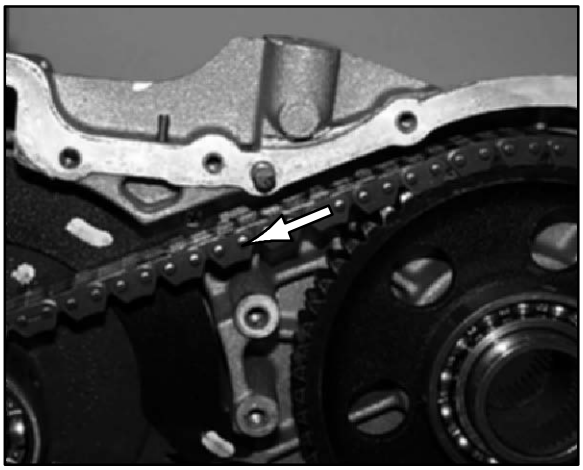
3. Remove all cover bolts. Tap cover with soft face hammer to remove. Note 2 bolts in center of cover.



CAUTION:

Do not pry on case half sealing surfaces.

4. Mark chain rotation direction for assembly. Note location of chain tensioner cam. If fully extended, chain is worn beyond service limit. Replace chain and chain tensioner shoe.



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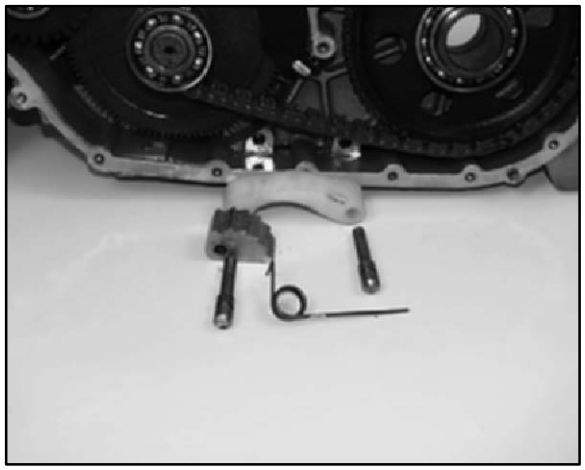
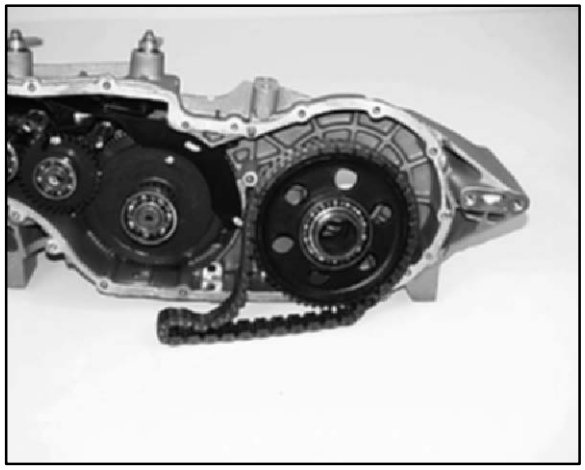
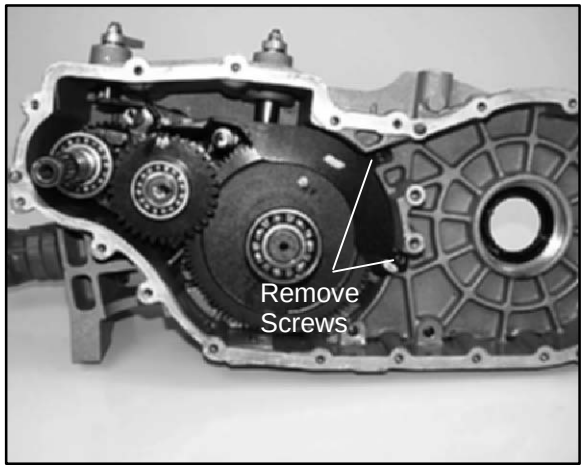
5. Remove chain tensioner along with mounting pins and spring.



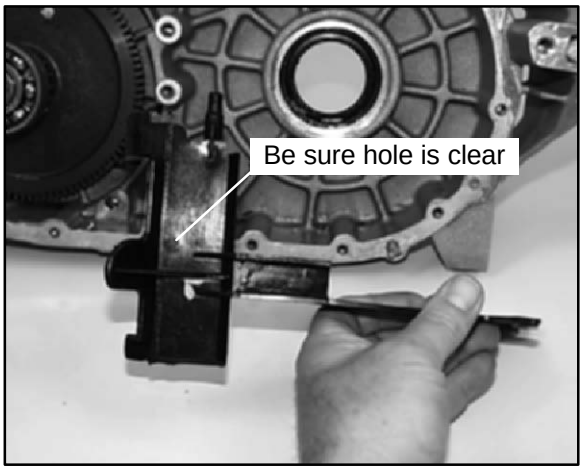
6. Remove rear output gear and chain as an assembly by lifting straight outward.



7. Remove oil deflector.



8. Make sure hole in oil deflector is clear and unobstructed.



9. Using a puller remove Hi/Lo/Reverse (HLR) shaft bearing, and bearing thrust washer.

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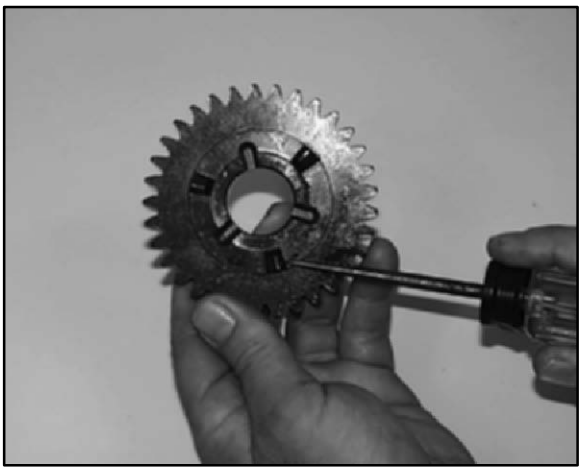
10. Turn transmission so shafts are pointing down. Slide the Low gear in and out until needle bearing slides out of gear and can be removed. Remove needle bearing, low gear, and inner thrust washer.

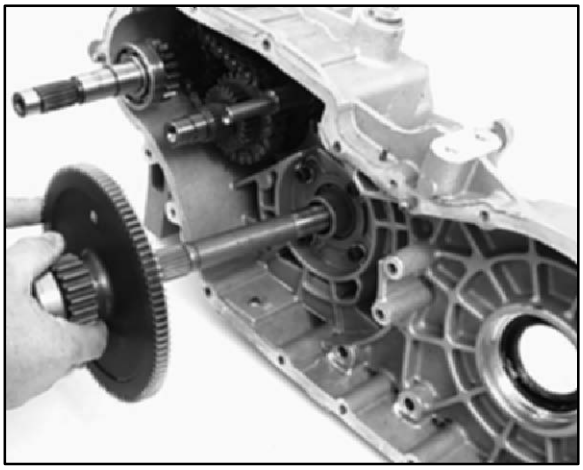
11. Inspect shift dogs for excessive rounding on the leading edges. Replace if worn.



12. Remove low range shift fork and dog. Replace along with mating gear if wear is evident.

13. Inspect face of shift fork for excessive wear, discoloration, or bending.

14. Remove center shaft assembly by tapping on opposite side with a soft face hammer.



15. Remove the remaining gears and shafts as an assembly. Rotate the shift bellcrank with a 1/2

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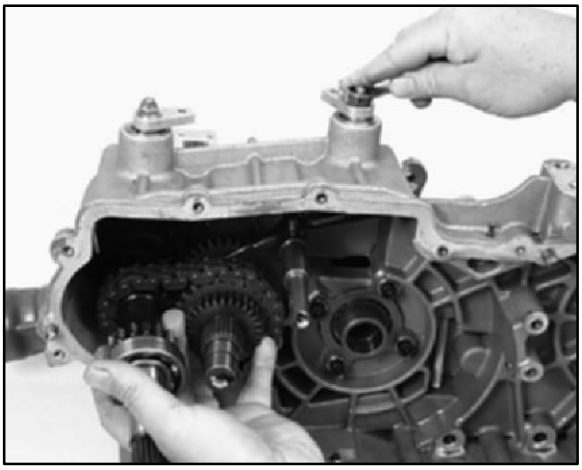
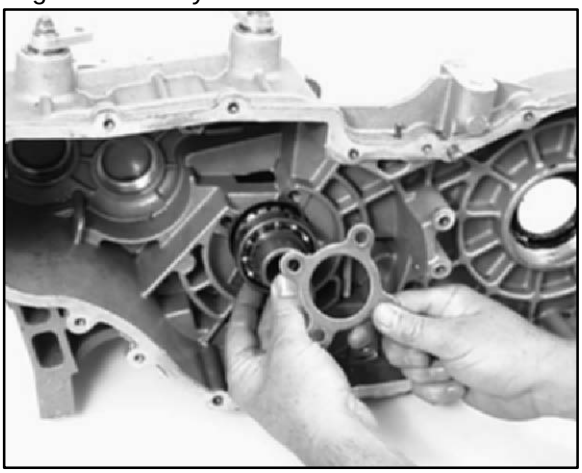
inch wrench to aid in removal.



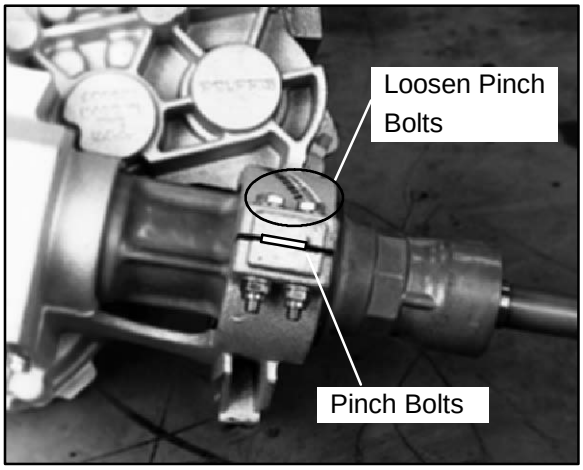
16. Remove pinion gear retaining plate and pinion gear assembly.



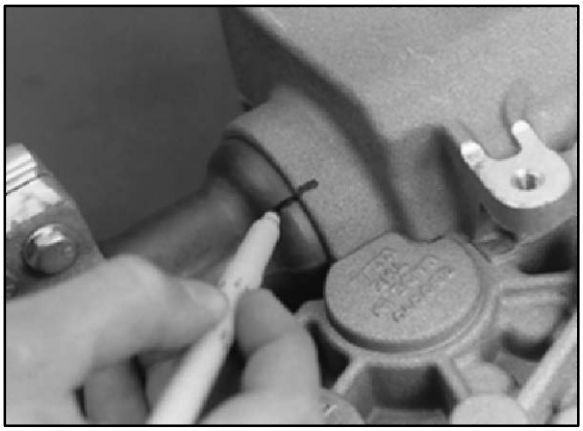
17. Inspect pinion gear for broken, chipped, or worn teeth. Check bearing condition, and snap ring location.

18. Loosen front output housing pinch bolts.

CAUTION: Do not lose pinch plate. Must be used for reassembly or transmission will be damaged.

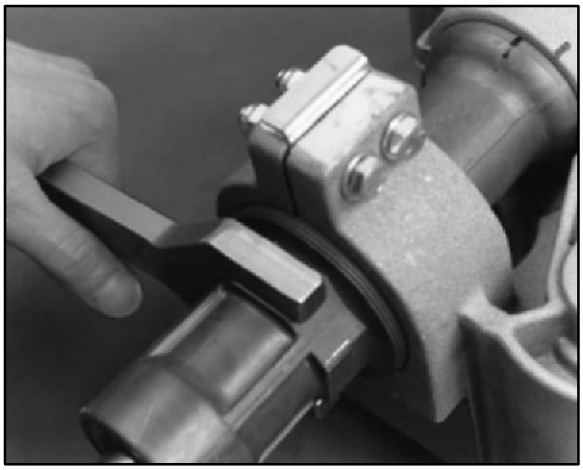


19. Mark housing and casting for reference upon reassembly.



20. Using 2 1/8″ Wrench (**PN 2871701**) unscrew the front drive housing from the transmission casting until O-ring is exposed 1/2″ (13mm).

NOTE: Do not attempt to unscrew the front drive housing completely at this time.



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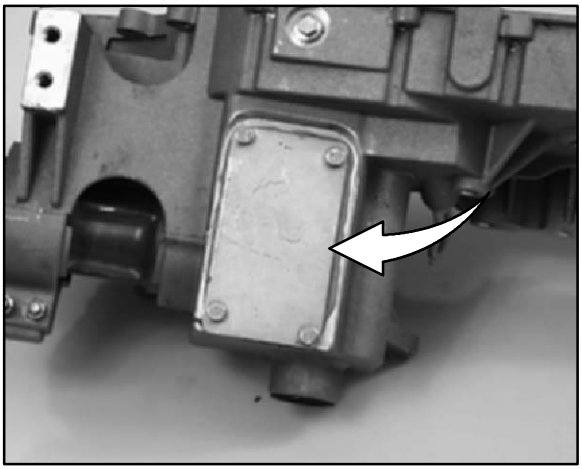
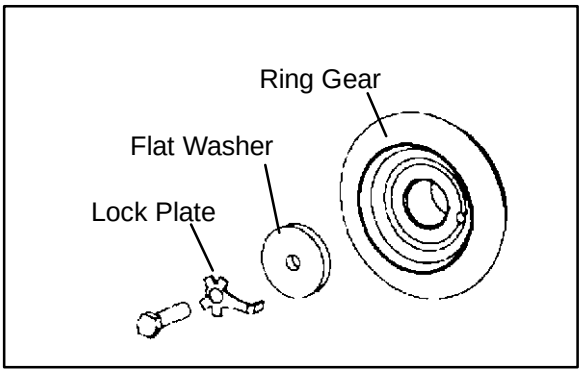
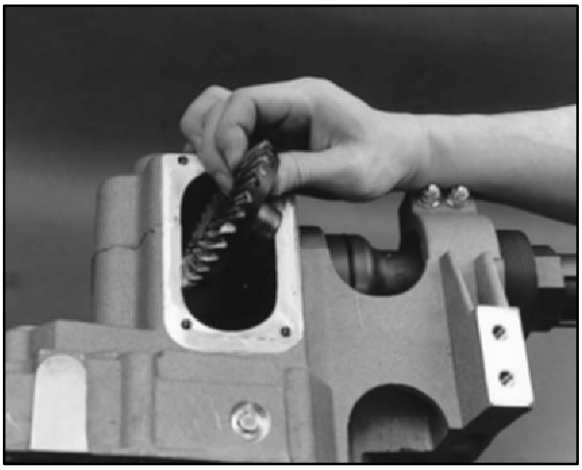
21. Remove bottom access plate.



22. Bend the lock plate tab away from ring gear retaining bolt.
23. Using a strap wrench on splines to hold shaft, remove front output ring gear retaining bolt, lock tab washer, and flat washer.

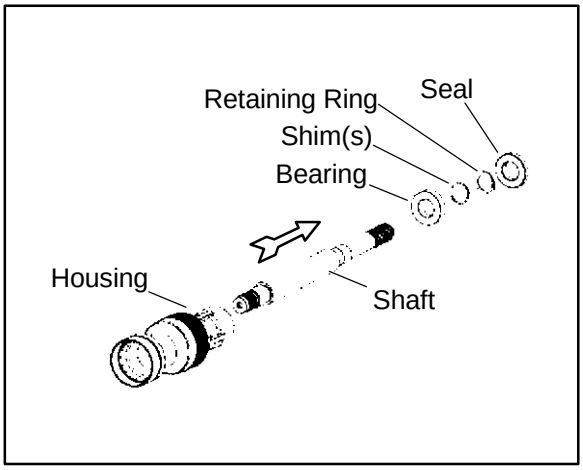


24. Remove front output ring gear. Inspect for broken, chipped, or worn teeth.

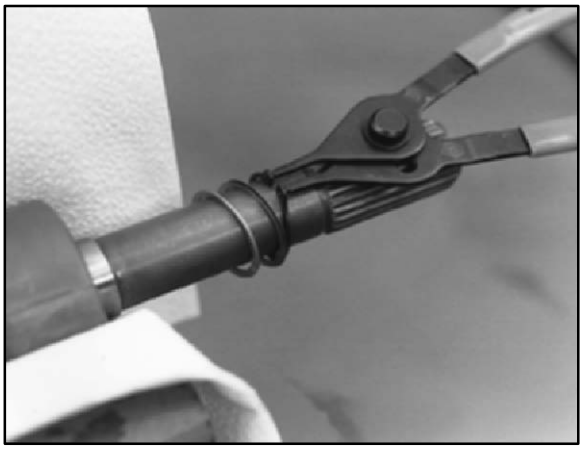


25. Unscrew front drive housing and remove it from case. Apply electrical tape to threads of housing to prevent damage.

26. Using a brass hammer or a press, drive the shaft, bearing, retaining ring, and seal out of the housing from rear to front.



27. Slide seal off shaft and remove snap ring and shims. Record the number of shims and thickness of each for reference.



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1. Inspect center shaft bushing for wear. If necessary, remove with the large end of bushing drive tool.

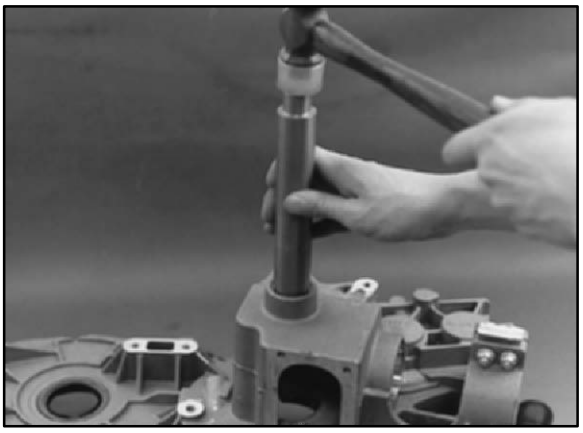
Center Drive Bushing Tool (PN 2871697)

2. Remove all remaining seals from transmission cases and clean all parts thoroughly.

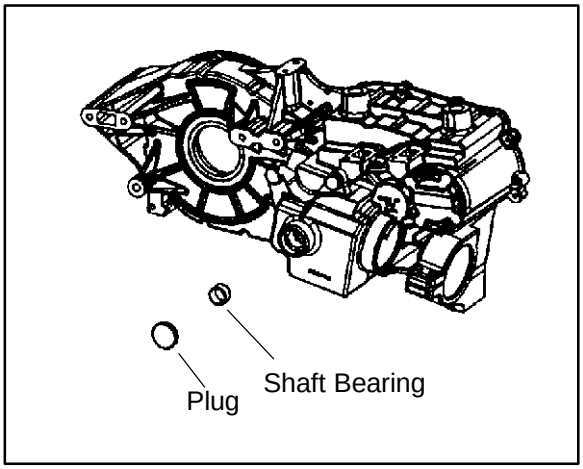
BUSHING INSTALLATION, TRANSMISSION CENTER SHAFT

1. Install center shaft bearing and plug using small end of bushing installation tool.

Center Drive Bushing Tool (PN 2871697)



2. Apply Loctite ™ 243 (blue) to threads of screws and install center shaft cover. Tighten screws securely.



FRONT OUTPUT HOUSING (SNORKEL) ASSEMBLY

1. Bearing is a light press fit on ring gear end of front output shaft. Heat inner bearing on a hot plate or with a heat gun to ease installation. Install bearing on shaft until inner race bottoms on flange of shaft.

CAUTION: Do not use a torch - bearing damage may result.

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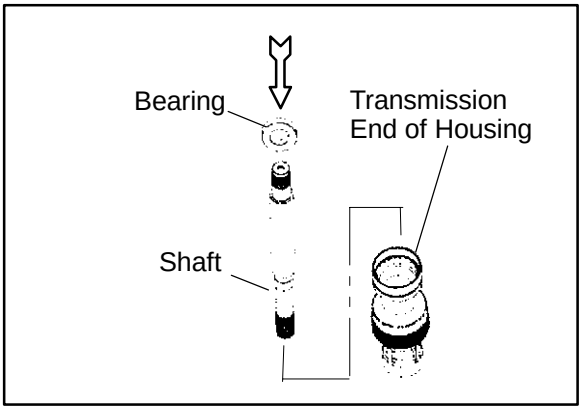
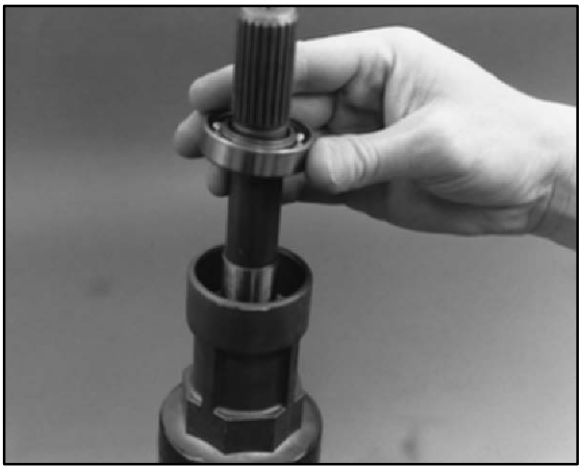
2. Install shaft with bearing in front output housing.

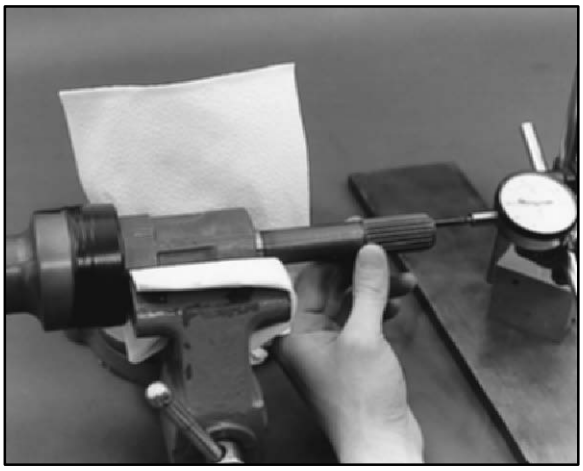


3. Turn housing, shaft, and bearing assembly over and install front bearing until fully seated.



4. Front output shaft end play must be measured and adjusted if shaft or housing was replaced.
   To measure end play:
   Install snap ring on shaft without shims in place. Clamp housing lightly in soft jawed vise.

5. Set up a dial indicator to measure shaft end play.



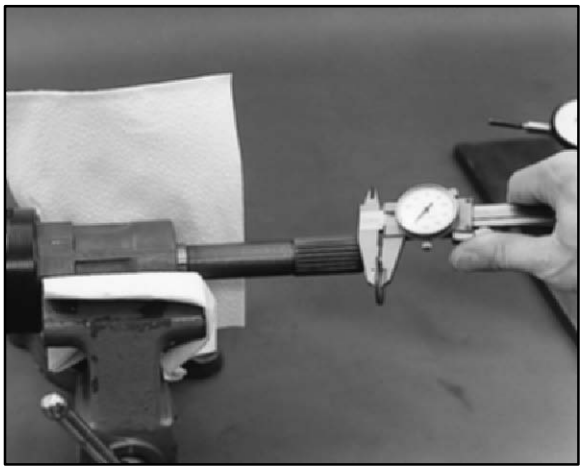
FRONT OUTPUT HOUSING (SNORKEL) INSTALLATION

6. Measured end play will be between .030″ -.070″. Shims must be added between bearing and circlip to reduce end play. To calculate proper end play, subtract total shim thickness from end play measured in Step 8. Add or subtract shims as required to obtain specified end play (.000-.003″). Remove snap ring, install shims, reinstall snap ring. It may be necessary to tap snap ring into place.

NOTE: Shaft should rotate freely when finished. Confirm end play measurement with dial indicator. *Do not* install front housing seal until backlash is adjusted.

Final Installed Shaft End Play

.000″ - .003″ (0mm - .075mm)



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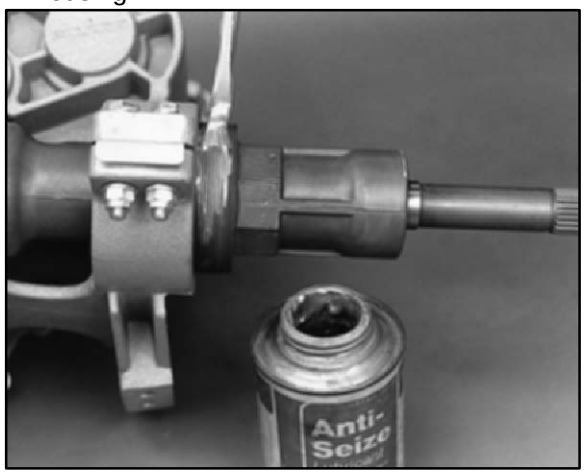
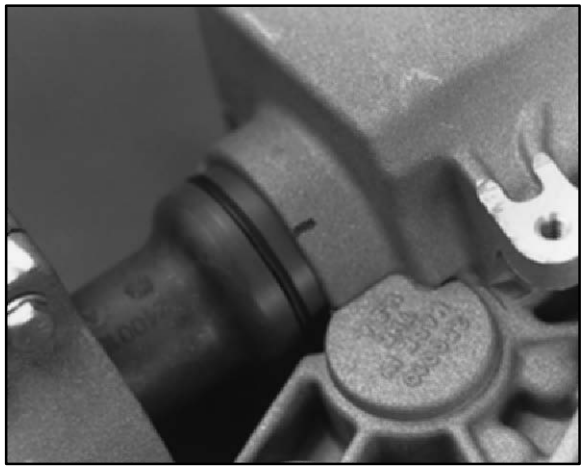
7. Remove electrical tape and apply anti-seize compound to the threads of the front output housing.

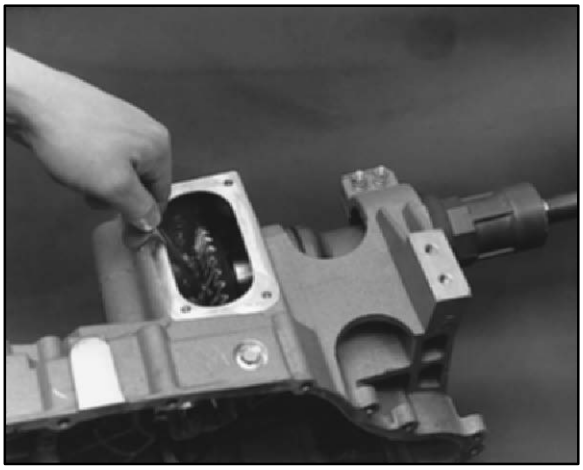


8. Screw in housing until O-ring is approximately 1/4″ (8mm) from transmission housing.



9. Install front output ring gear, washer, and retaining bolt with a new lock plate. Hold shaft with strap wrench and tighten retaining bolt. Clean threads of bolt and shaft with Loctite™ Primer N. Apply Loctite™ 242 (**PN 2871949**) to retaining bolt threads. Torque bolt to specification and bend lock plate against hexagonal portion of bolt.

Ring Gear Retaining Bolt
17 - 20 ft. lbs. (24-27 Nm)
Apply Loctite™ 242 (PN 2871949)



10. Install pinion gear assembly and retaining plate. Use Loctite™ Primer N on threads and housing. Apply Loctite™ 242 (**PN 2871949**) to bolts and torque to specification.

Pinion Gear Retainer Screws:
17 - 20 ft. lbs. (24-27 Nm)
Apply Loctite™ 242 (PN 2871949)

FRONT OUTPUT HOUSING (SNORKEL) BACKLASH ADJUSTMENT

11. Lubricate front housing O-ring thoroughly with Polaris All Season grease. Continue to screw front housing in, making sure O-ring enters housing without damage. Be sure ring and pinion gear teeth mesh properly.

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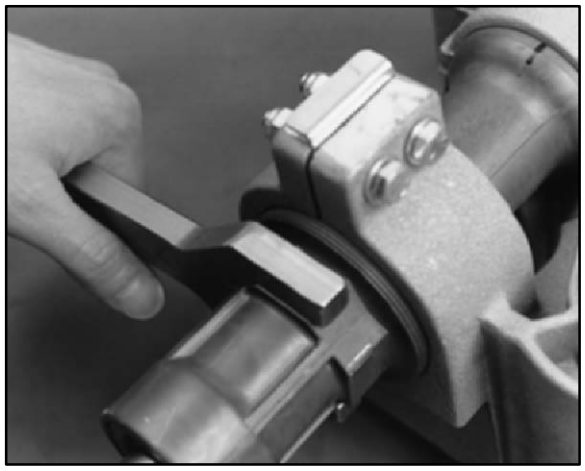
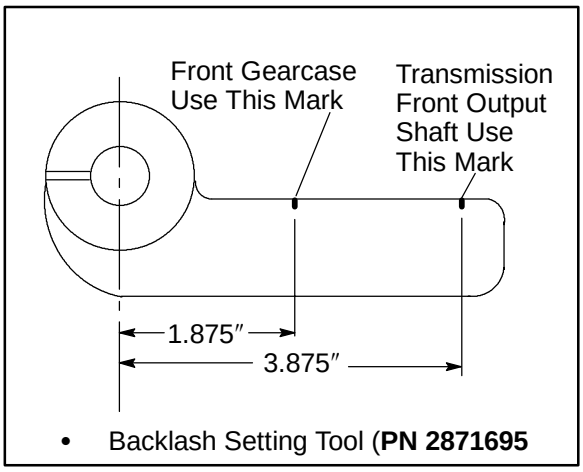
12. Rotate front shaft while slowly turning housing inward. As gear backlash is reduced to zero, the shaft will begin to bind. At this point back off 1/4 turn.



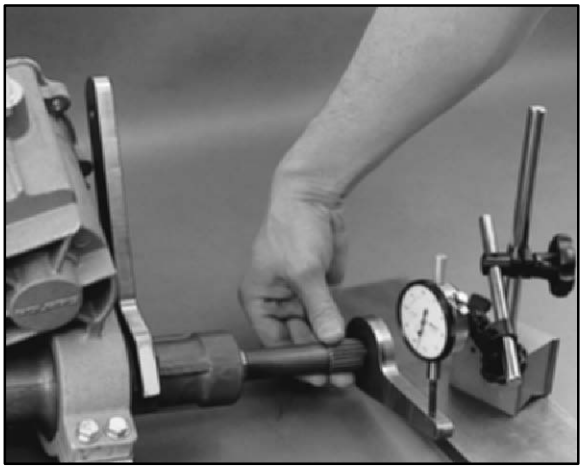
TRANSMISSION OUTPUT GEAR BACKLASH INSPECTION/ ADJUSTMENT

13. The following steps must be performed to obtain proper front output gear backlash adjustment:
    - The pinion gear must be held securely.
    - Do not lubricate the gear teeth until backlash adjustment is complete. Both Gears should be free of grease and oil.
    - Perform adjustment with front output housing seal removed and end play properly adjusted.
    - Measure backlash using the Backlash Setting Tool (**PN 2871695**). The measurement point is 3.875″ (98.43mm) from shaft centerline.
    - Set backlash at .008″ - .014″ (.20 -.36mm).
    - Check backlash in several locations of ring gear.



- Backlash Setting Tool (**PN 2871695**

14. Install the Backlash Setting Tool (**PN 2871695**) on shaft as shown. With pinion gear held stationary, rotate output shaft back and forth, reading the total movement of dial indicator. The dial indicator must be positioned as shown at the proper distance (aligned with outermost mark on tool, and 90° to the tool surface), or indicated backlash will be inaccurate.
    - To reduce backlash, rotate housing clockwise as viewed from front of housing.
    - To increase backlash, rotate housing counterclockwise.



15. Torque pinch bolts to specification. Be sure pinch plate (A) is installed. Verify backlash measurement.

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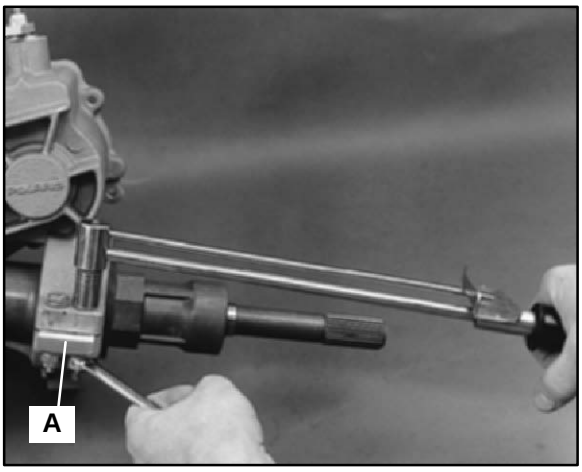
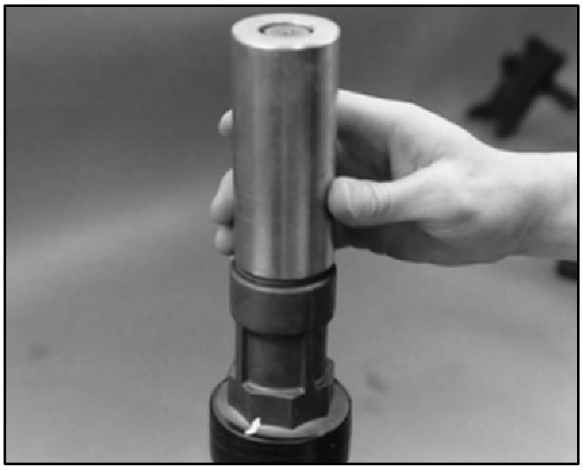
TRANSMISSION ASSEMBLY, CONT.

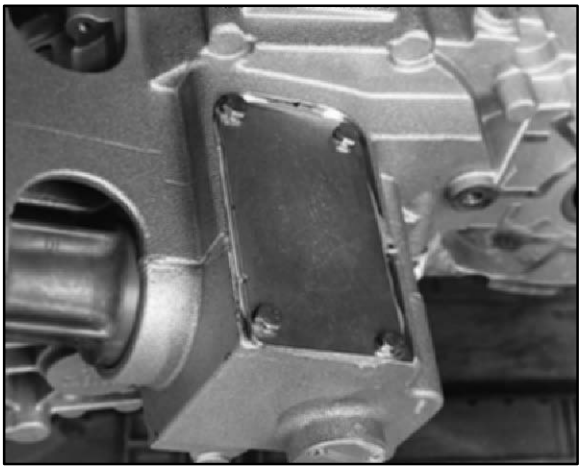




16. Make sure surface of access plate and transmission are clean and free of oil and grease. Apply Crankcase Sealant (**PN 2871557**) to mating surface of transmission case. Install access plate with notch to front as shown, torque screws to specification.

Access Plate Screws:

8 - 10 ft. lbs. (11-14 Nm)



17. Using the Magnum crankshaft installation tool, lubricate and carefully install the front seal until flush with housing.

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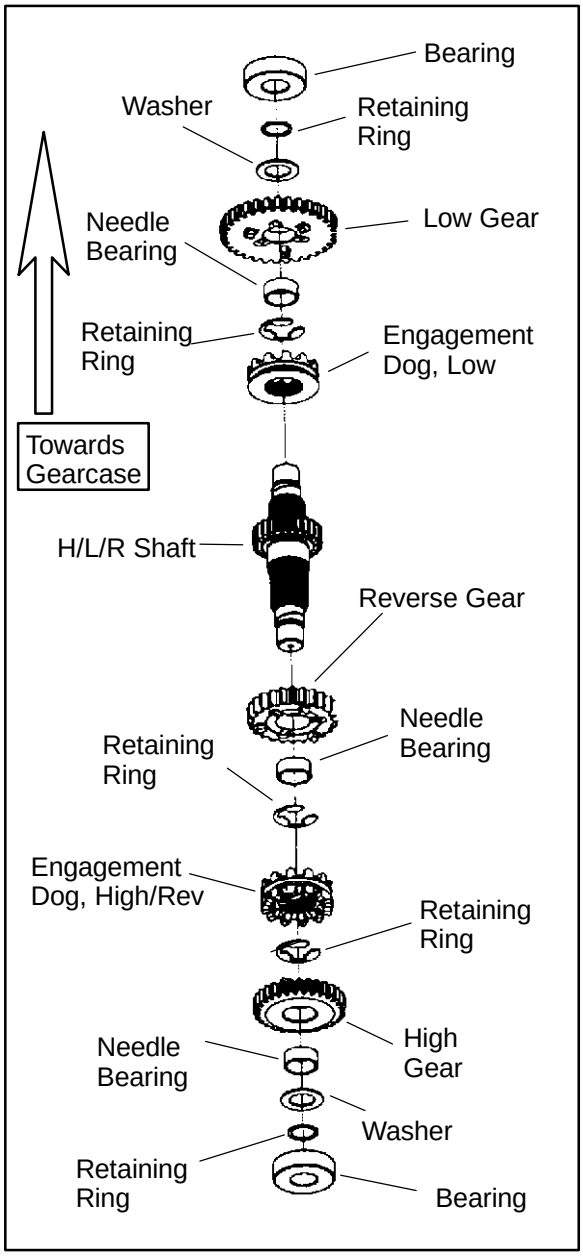
18. Assemble Hi/Low/Reverse shaft as shown. Machined (flat) side of retainer should face direction of thrust. Sliding high/reverse engagement dog is symmetrical and can be installed either way. The low gear dog must face low gear.

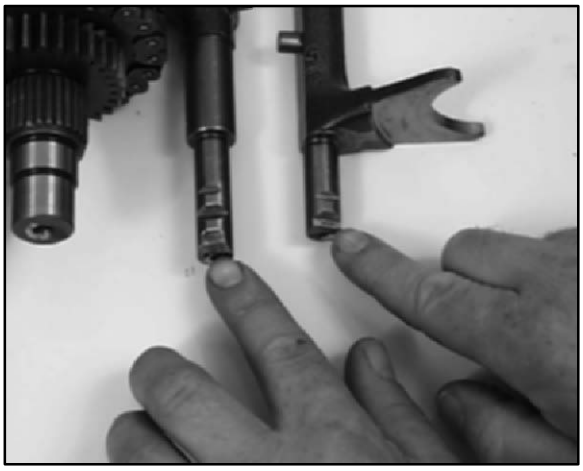


19. Stretch silent cluster chain tight on a flat surface and measure the length of 8 pitches in a minimum of three places on chain. Replace chain if measurement is longer than 3.0904″.

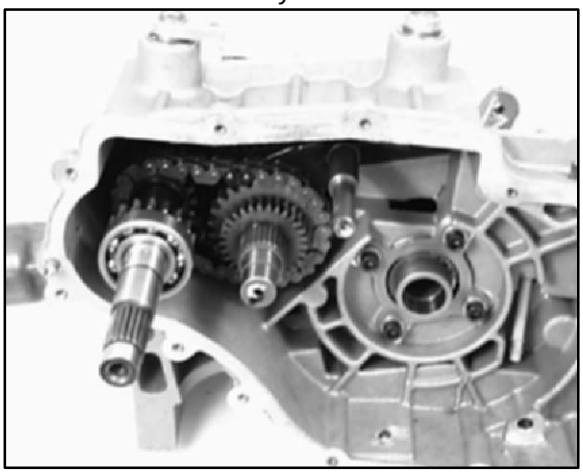
Chain Stretch Limit
8 pitch length = 3.0904″ Maximum

20. Assemble the input shaft and Hi/Low/Reverse gear cluster as shown.

21. The two shift forks can be easily identified by the indentations. Low/Neutral shaft has 2 detents, and Hi/Neutral/Reverse has 3 detents.



22. Install Hi/Reverse cluster in transmission as an assembly. If necessary use a soft face hammer to install shafts until fully seated.



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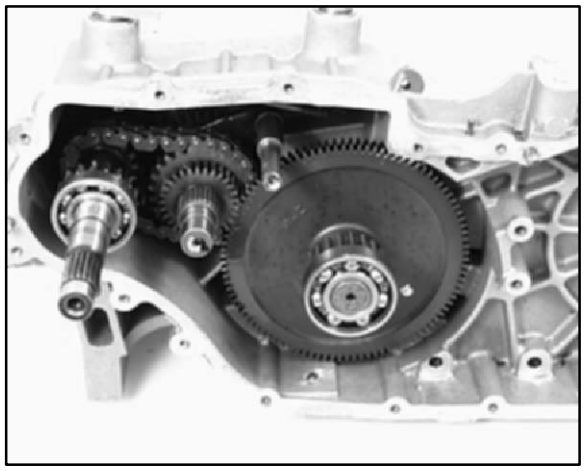
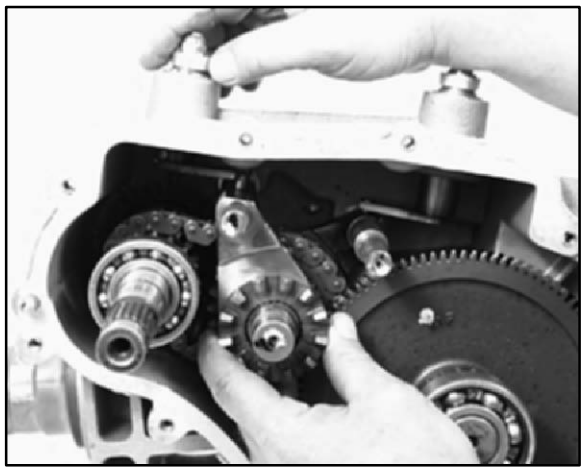
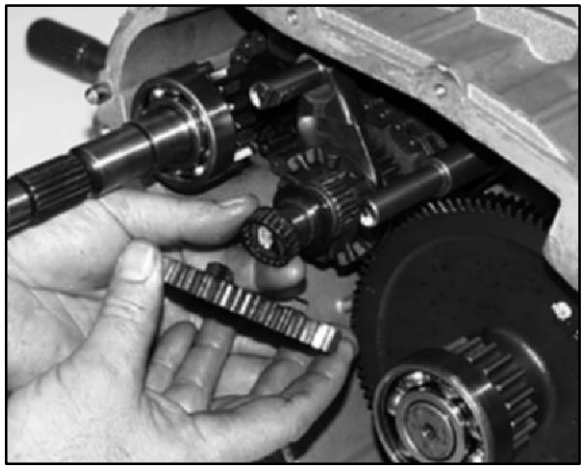
23. Install center shaft assembly.



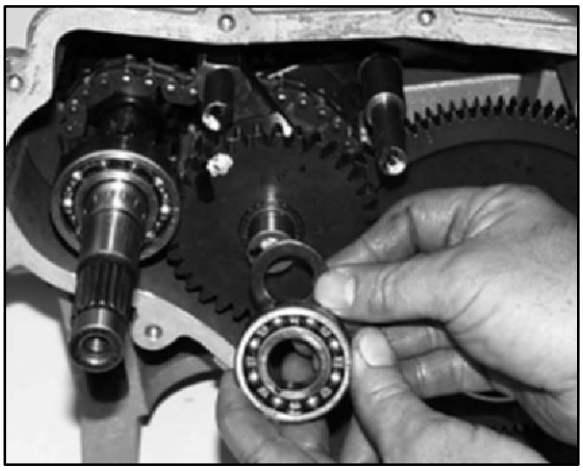
24. Install Low shift fork with sliding dog in place. Dogs must be positioned outward (toward you). Slide the shift dog over the spline and the low range shift shaft.



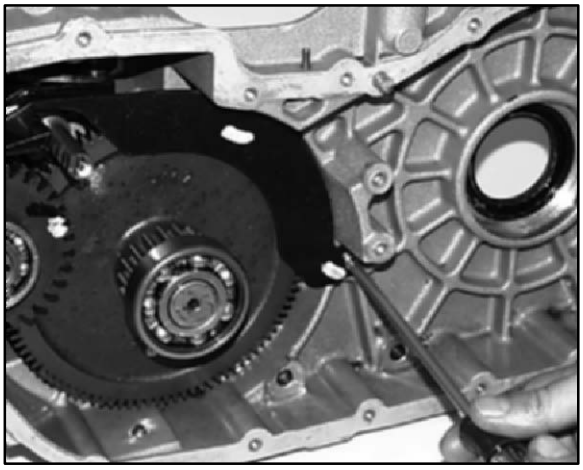
25. Lubricate and install inner thrust washer, low gear, and needle bearing.



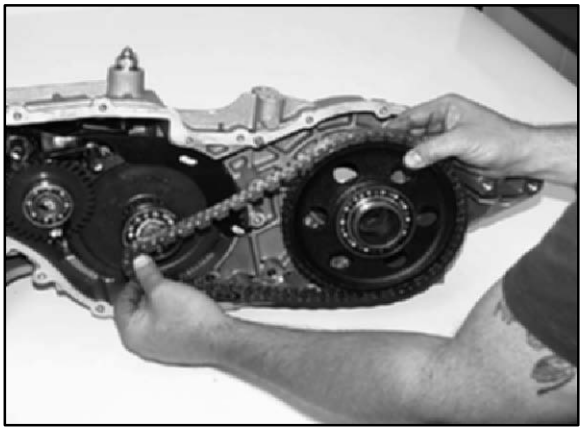
26. Install outer thrust washer and bearing.



27. Install plastic oil deflector. Apply Loctite™ 242 (**PN 2871949**) to screw threads. Be sure deflector pin seats into case.
28. Do not over-tighten deflector screws, or deflector may crack.



29. Install drive gear with chain.
30. Install chain tensioner. Refer to Illustration on following page.



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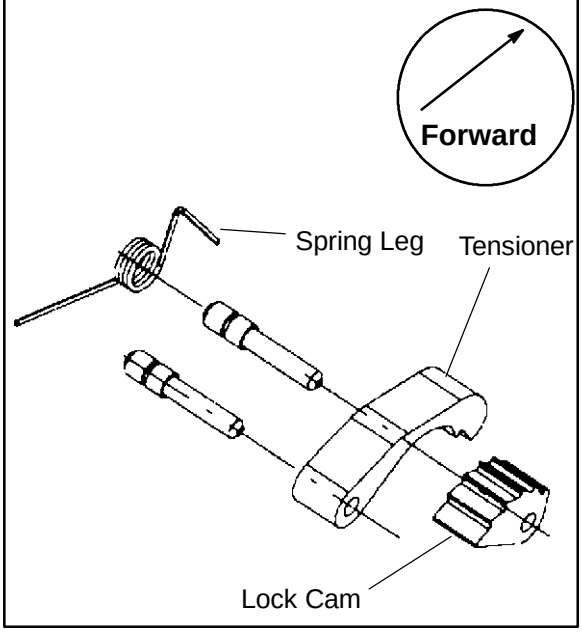
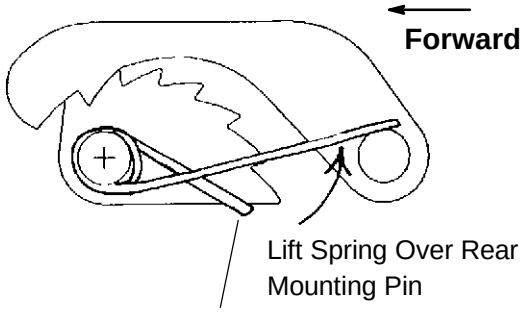
31. **Tensioner Installation:**

- Place the tensioner cam on the front spacer and tensioner shoe on the rear spacer.
- Insert the pins through the cam and through the shoe.
- Place the spring over the front pin and hook the spring leg under the cam.
- Lift the leg of the spring up and over the rear pin. The tensioner cam will lift the shoe and tension chain.

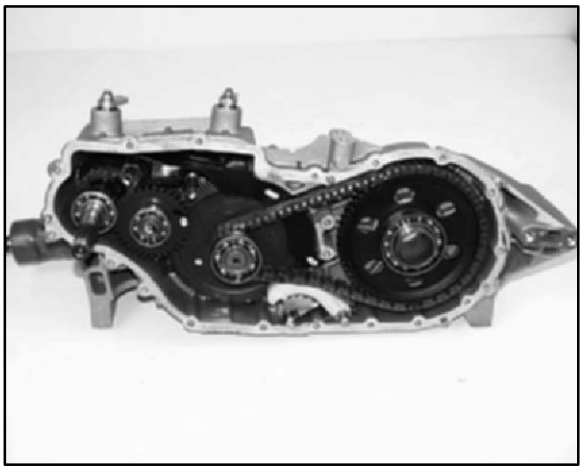
Tensioner Assembly - Top View



View From Left Side of Transmission

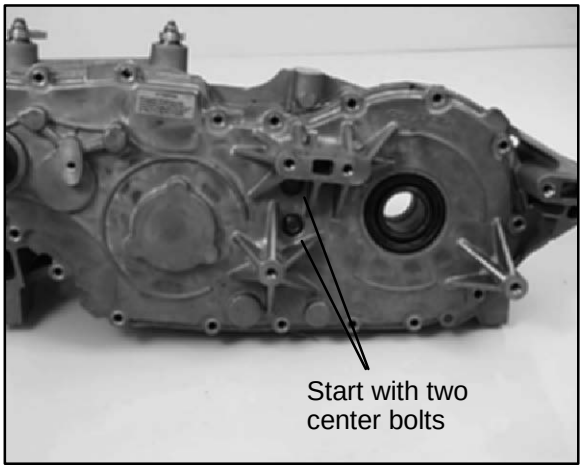


32. Pre-lubricate all bearings with Polaris Premium Synthetic GearCase Lubricant **(PN 2871477**) before installing cover.
33. Place the bellcranks in neutral so shift fork shafts will engage into the spring loaded detents of case cover.



34. Be sure sealing surfaces of cover and transmission case are clean. Apply Crankcase Sealant (**PN 2871557**) to surface of case and install cover bolts. Torque to specification in three steps, following a cross pattern. Start with the center (2) bolts.

Torque 5/16 bolts (2)
17 - 20 ft. lbs. (23.5 - 27.7 Nm)
Torque 1/4 bolts
8 - 10 ft. lbs. (11 - 11.4 Nm)



35. Install seal installation tool in drive gear as shown. Lubricate new seal with grease and slide onto tool. Drive seal into place using large end of slide hammer. Repeat procedure for other side.

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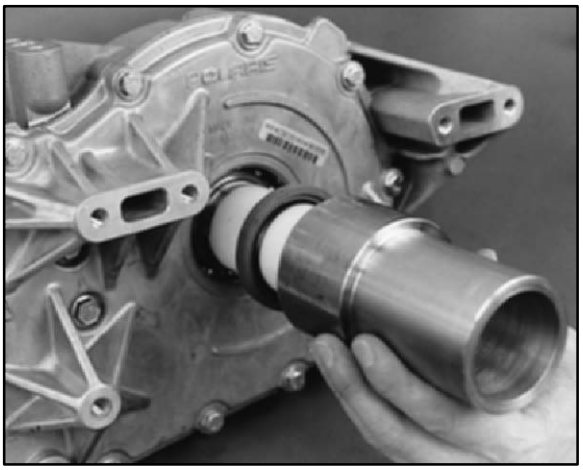
Seal Installation Tool

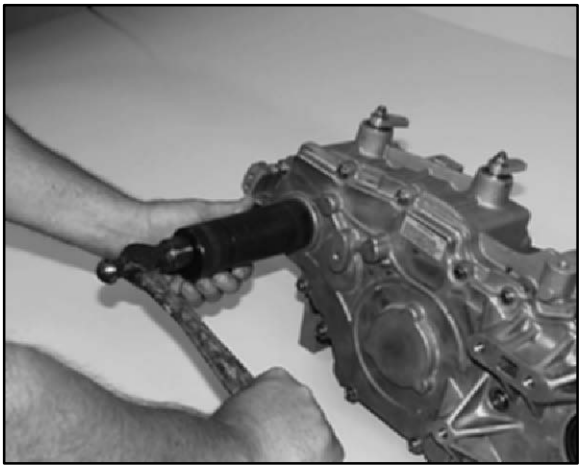
Rear Output Seal Driver (PN 2871698)
Rear Driveshaft Seal Guide (PN 2871699)



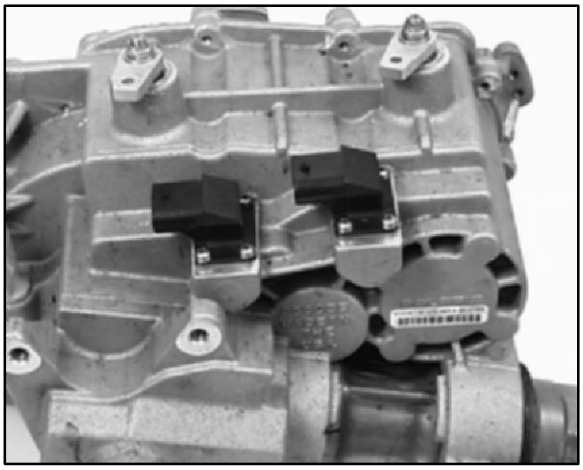
36. Apply grease to the lip of a new input shaft seal. Install the seal, being careful to work the lip of the seal over the step in the shaft before using the Bearing Seal Driver (**PN 2871282**). Install the seal flush with transmission housing.

Bearing Seal Driver:

(PN 2871282)



37. Install gear indicator switches. Apply Loctite™ 242 (**PN 2871949**) to threads of switch screws and torque to 13-16 in. lbs. (1.5-1.9 Nm).



TROUBLESHOOTING CHECKLIST

Check the following items when shifting difficulty is encountered.

- Idle speed adjustment
- Transmission oil type/quality
- Transmission torque stop adjustment
- Engine torque stop adjustment
- Drive belt deflection
- Loose fasteners on rod ends
- Loose fasteners on selector box
- Worn rod ends, clevis pins, or pivot arm bushings
- Linkage rod adjustment and rod end positioning
- Shift selector rail travel
- *Worn, broken or damaged internal transmission components

NOTE: To determine if shifting difficulty or problem is caused by an internal transmission problem, isolate the transmission by disconnecting linkage rods from transmission bellcranks. Manually select each gear range at the transmission bellcrank, and test ride vehicle. If it functions properly, the problem is outside the transmission.

NOTE: If transmission problem remains, disassemble transmission and inspect all gear dogs for wear (rounding), damage. Inspect all bearings for wear.

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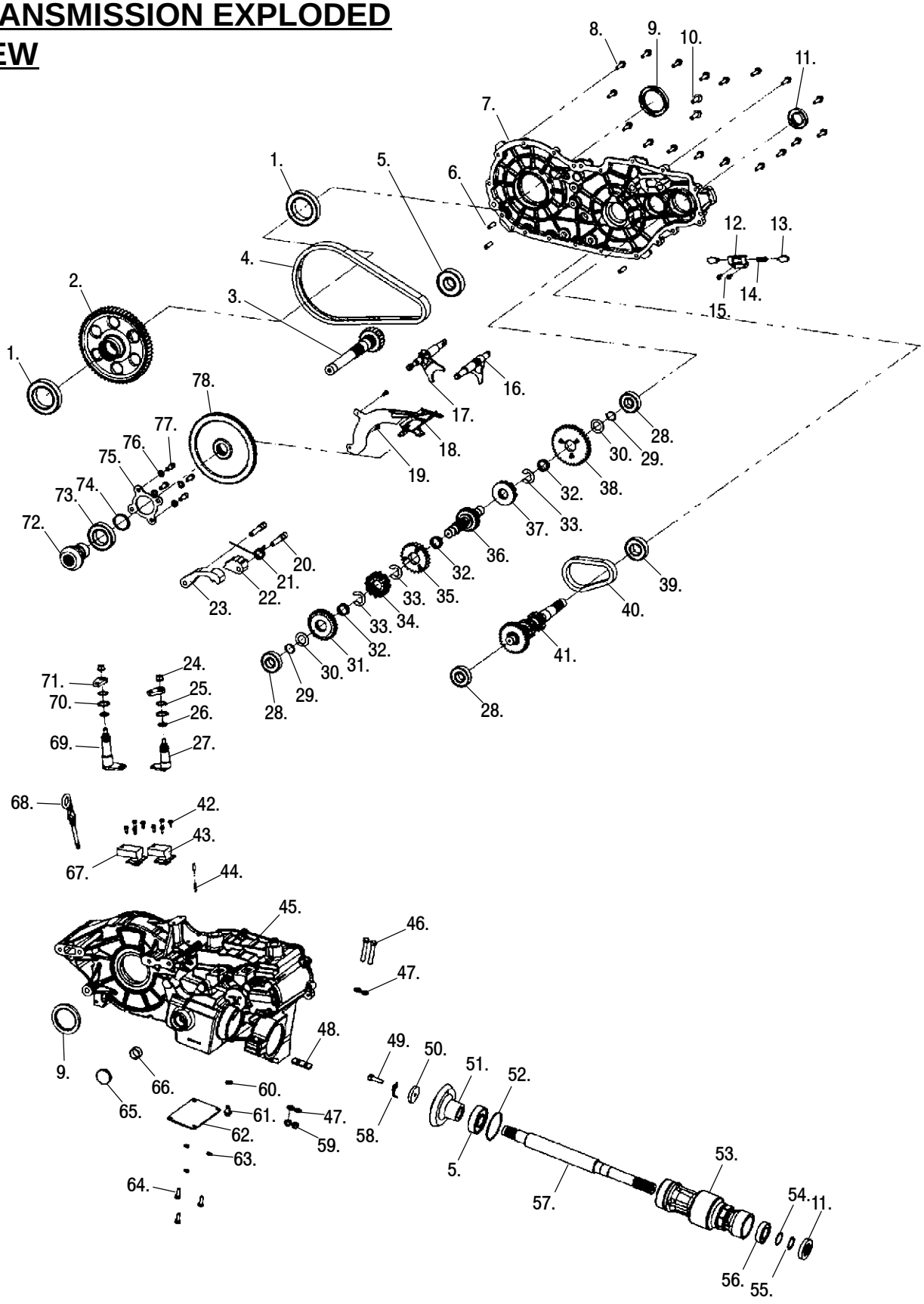
TRANSMISSION EXPLODED VIEW



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TRANSMISSION EXPLODED VIEW CONT.

Item	Qty	Description
1.	2	Bearing, Ball
2.	1	Shaft, 60T
3.	1	Shaft, Center
4.	1	Chain, Silent
5.	2	Bearing, Ball
6.	3	Pin, Dowel
7.	1	Gearcase, LH
8.	18	Screw
9.	2	Seal, Triple Lip
10.	2	Screw
11.	2	Seal, Triple Lip
12.	1	Bracket
13.	2	Pin, Interlock
14.	1	Spring
15.	2	Screw
16.	1	Fork, Shift, Spring Loaded, Low
17.	1	Fork, Shift, High/Rev.
18.	1	Deflector, Oil
19.	2	Screw
20.	2	Pin
21.	1	Spring, Torsion
22.	1	Cam, Chain Tensioner
23.	1	Shoe, Chain Tensioner
24.	2	Nut, Lock
25.	2	Ring, Retaining
26.	2	O-Ring
27.	1	Shaft, Shift
28.	3	Bearing, Ball
29.	2	Ring, Retaining
30.	2	Washer, Thrust
31.	1	Gear, 30T
32.	3	Bearing, Needle
33.	3	Ring, Retaining
34.	1	Dog, Engagement, Low
35.	1	Sprocket, 24T
36.	1	Shaft, Reverse, 29T
37.	1	Dog, Engagement, Low
38.	1	Gear, 36T
39.	1	Bearing, Ball
40.	1	Chain, Silent
41.	1	Shaft, Input
42.	8	Screw
43.	1	Switch, 2 Position
44.	1	Vent, Tube
45.	1	Gearcase, RH
46.	2	Screw
47.	4	Washer
48.	1	Spacer
49.	1	Screw
50.	1	Washer, Steel
51.	1	Gear, 31T
52.	1	O-Ring
53.	1	Tube, Snorkel
54.	1	Spacer
55.	1	Ring, Retaining
56.	1	Bearing, Ball
57.	1	Shaft, Drive
58.	1	Bolt, Lock
59.	2	Nut, Lock
60.	1	Washer
61.	1	Plug
62.	1	Plate, Cover
63.	4	Washer, Lock
64.	4	Screw
65.	1	Plug
66.	1	Bearing
67.	1	Switch, 3 Position
68.	1	Dipstick
69.	1	Shaft, Shift, Low
70.	2	Washer, Thrust
71.	2	Bellcrank, HLR
72.	1	Pinion, 16T
73.	1	Bearing, Ball
74.	1	Ring, Retaining
75.	1	Cover, Bearing
76.	4	Washer, Lock
77.	4	Screw
78.	1	Gear, 100T

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NOTES

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CHAPTER 9
BRAKES

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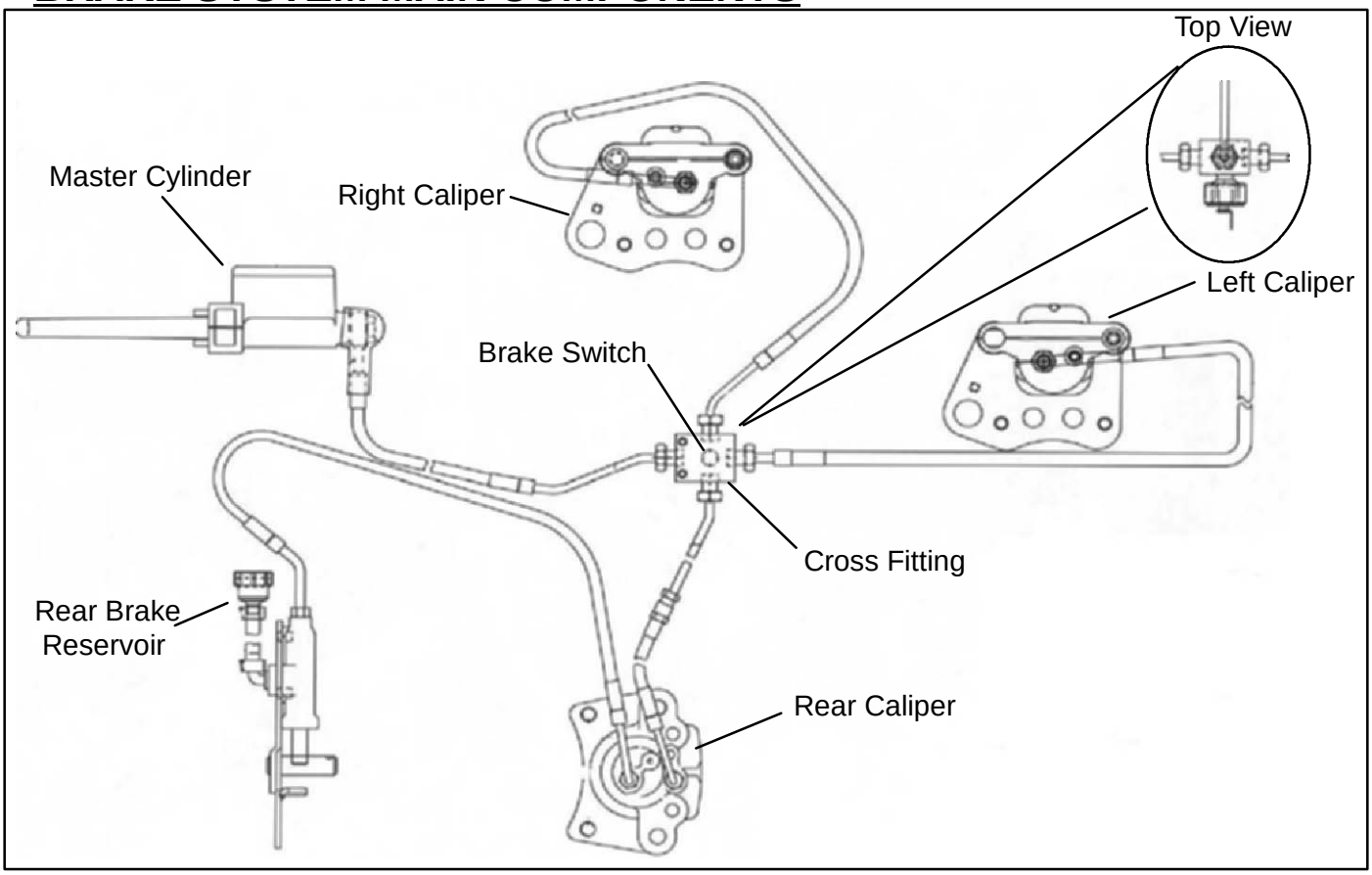
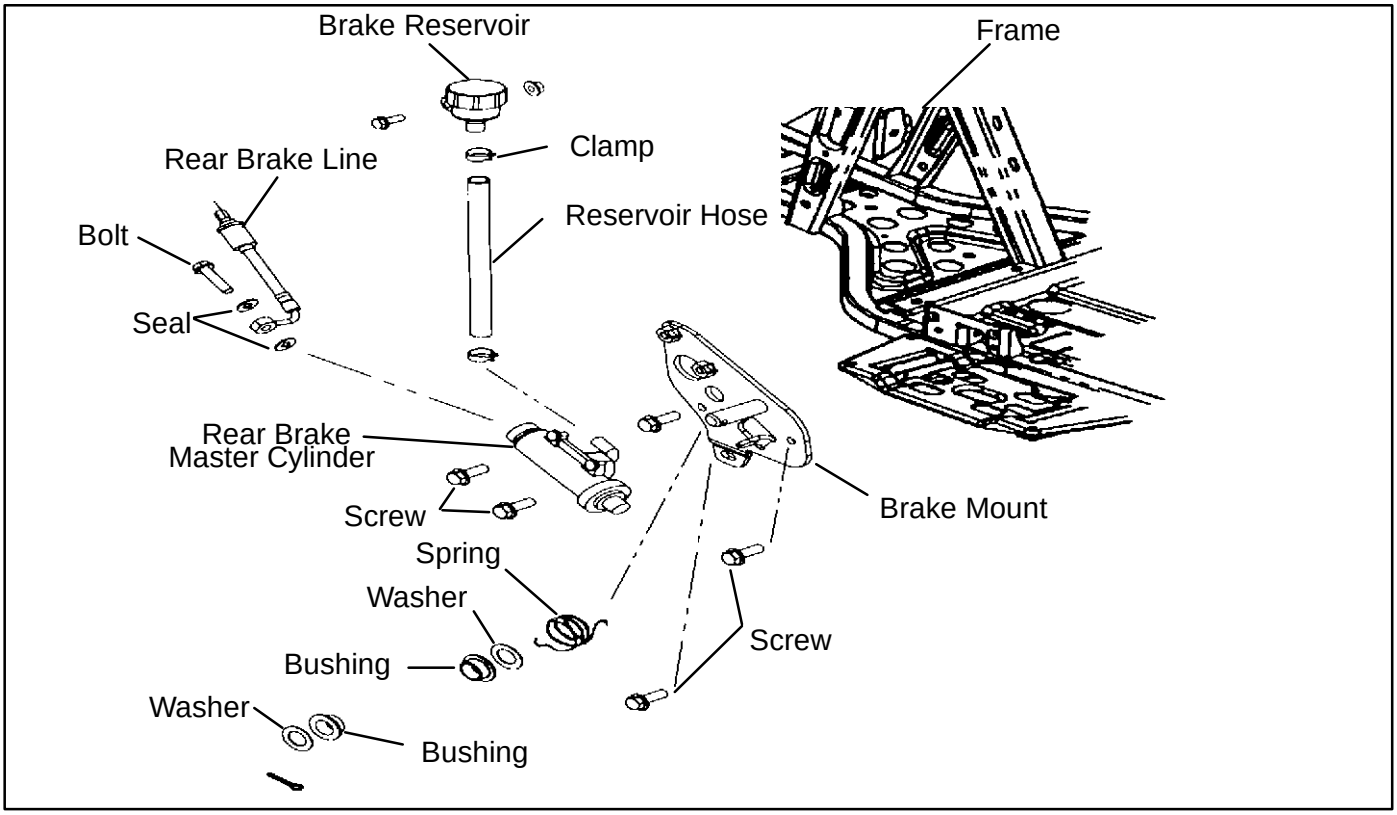
BRAKE SYSTEM MAIN COMPONENTS



REAR AUXILIARY MASTER CYLINDER



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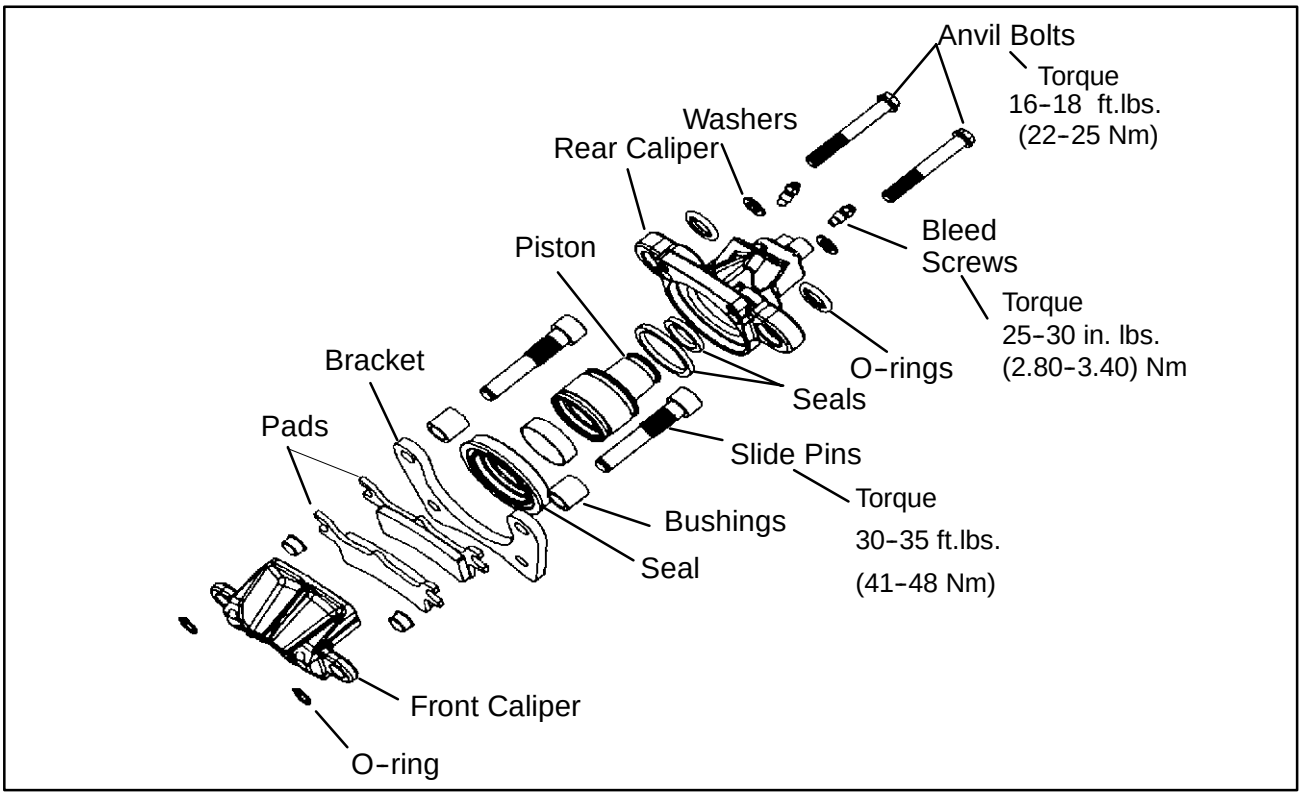
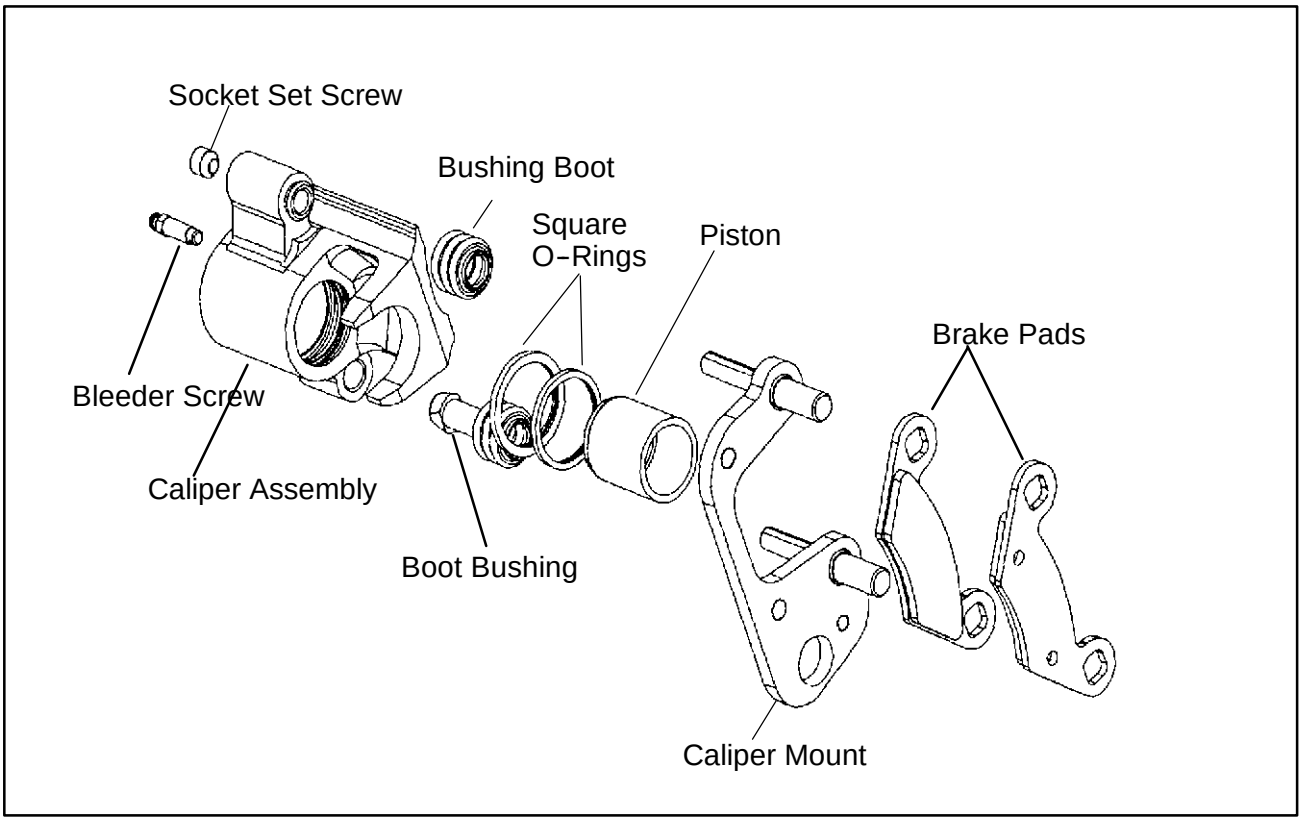
REAR BRAKE CALIPER EXPLODED VIEW



FRONT BRAKE CALIPER EXPLODED VIEW



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SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2870975	Mity Vac™ Pressure Test Tool

SPECIFICATIONS

Front Brake Caliper		
Item	**Standard**	**Service Limit**
Brake Pad Thickness	.298″ / 7.6mm	.180″ / 4.6mm
Brake Disc Thickness	.150-.164″ / 3.810-4.166mm	.140″ / 3.556mm
Brake Disc Thickness Variance Between Measurements	-	.002″ / .051mm
Brake Disc Runout	-	.005″ / .50mm

Rear Axle Brake Caliper		
Item	**Standard**	**Service Limit**
Brake Pad Thickness	.318″ / 7.6mm	.180″ / 4.6mm
Brake Disc Thickness	.177-.187″ /4.496-4.750mm	.167″ / 4.242mm
Brake Disc Thickness Variance Between Measurements	-	.002″ / .051mm
Brake Disc Runout	-	.005″ / .25mm

Master Cylinder I.D. - Front	.750″
Master Cylinder I.D. - Aux. Rear	.500″

TORQUE SPECIFICATIONS

Item	Torque (ft. lbs. except where noted*)	Torque (Nm)
Front Caliper Mounting Bolts	16.0	22
Output Shaft Caliper Mounting Bolts	15.0	21
Master Cylinder Mounting Bolts	*25 in. lbs.	3.0
Master Cylinder Reservoir Cover Bolt	*45 in. lbs.	5.0
Brake Line Banjo Bolt	15.0	21
Front Brake Disc	18.0	25
Front Wheel Mounting Nuts	20.0	28

NOTE: Refer to the tightening procedures in this chapter when torquing the bolts. Some special procedures are used when torquing certain bolts and fasteners.

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BRAKE SYSTEM SERVICE NOTES

Polaris disc brake systems are light weight, low maintenance and perform well in the conditions ATVs routinely encounter. However, 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.

- Perform a brake burnishing procedure after installing new pads to maximize service life.
- Optional pads are available to suit conditions in your area. Select a pad to fit riding style and environment.
- Do not over-fill the master cylinder fluid reservoir.
- Make sure the brake lever and pedal returns freely and completely.
- Adjust stop pin on front caliper after pad service.
- Check and adjust master cylinder reservoir fluid level after pad service.
- Make sure atmospheric vent on reservoir is unobstructed.
- Test for brake drag after any brake system service and investigate cause if brake drag is evident.
- Make sure caliper moves freely on guide pins (where applicable).
- Inspect caliper piston seals for foreign material that could prevent caliper pistons from returning freely.

BRAKE NOISE TROUBLESHOOTING

Dirt or dust buildup on the brake pads and disc is the most common cause of brake noise (squeal caused by vibration). If cleaning does not reduce the occurrence of brake noise, Permatex™ Disc Brake Quiet (**PN 2872113**) can be applied to the back of the pads. Follow directions on the package. This will keep pads in contact with caliper piston(s) to reduce the chance of squeaks caused by dirt or dust.

Brake Noise Troubleshooting	
Possible Cause	**Remedy**
Dirt, dust, or imbedded material on pads or disc	Spray disc and pads with CRC Brake Kleen™ or equivalent non-flammable aerosol brake cleaner. Remove pads and/or disc hub to clean imbedded material from disc or pads.
Pad(s) dragging on disc (noise or premature pad wear) Improper adjustment Insufficient lever or pedal clearance Master cylinder reservoir overfilled Master cylinder compensating port restricted Master cylinder piston not returning completely Caliper piston(s) not returning Operator error (riding the brake / park brake applied)	Adjust pad stop (front calipers) Check position of controls & switches. Set to proper level Clean compensating port Inspect. Repair as necessary Clean piston(s) seal Educate operator
Loose wheel hub or bearings	Check wheel and hub for abnormal movement.
Brake disc warped or excessively worn	Replace disc
Brake disc misaligned or loose	Inspect and repair as necessary
Noise is from other source (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

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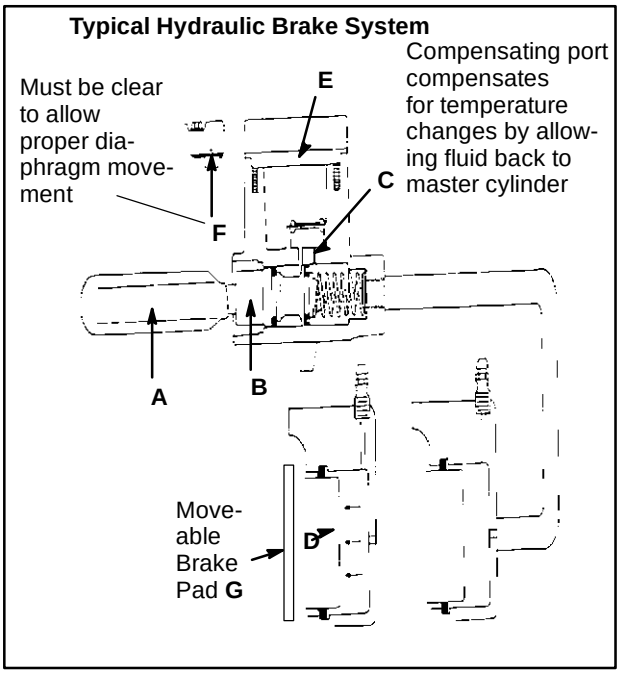
HYDRAULIC BRAKE SYSTEM OPERATION OVERVIEW

Typical Hydraulic Brake System



The Polaris disc 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 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 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 Brake Fluid (**PN 2870990**).

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 the possible loss of control.

HYDRAULIC CALIPER BLEEDING

This caliper is a single piston design. The caliper pistons are “T”-shaped, which allows both hand and foot brake to use the same caliper piston, but remain separated by seals. The hand brake system applies hydraulic pressure to both front calipers and only the *outer* diameter of the rear caliper pistons. The auxiliary (foot) brake applies pressure to the inner portion of the rear caliper pistons. Because the hand and foot brake hydraulic systems are separate, there are also two bleed screws – one for the outer fluid chamber (hand brake), and one for the inner fluid chamber (foot brake). The basic procedure for bleeding the brake system is the same as outlined on page 9.7 - 9.8, however, each system must be bled separately.

Hydraulic Auxiliary Brake inspection and adjustment is outlined in Chapter 2 beginning on Page 2.28.

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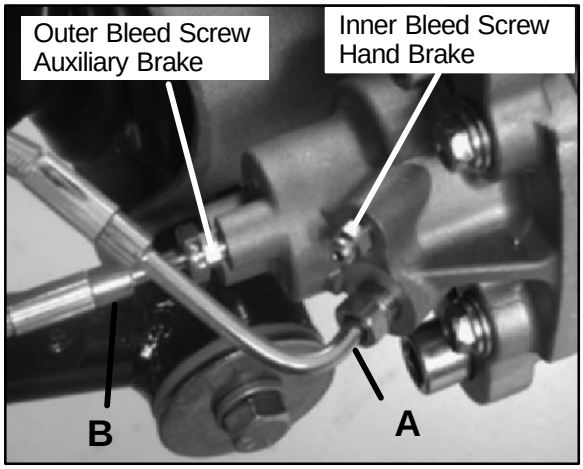
NOTE: Uppermost (inner) bleed screw and brake line (A) is for hand brake system. Lower (outer) bleed screw and brake line (B) is for auxiliary (foot) brake system.



BRAKE BLEEDING - FLUID CHANGE

NOTE: When bleeding the brakes or replacing the fluid, always start with the caliper farthest from the master cylinder.

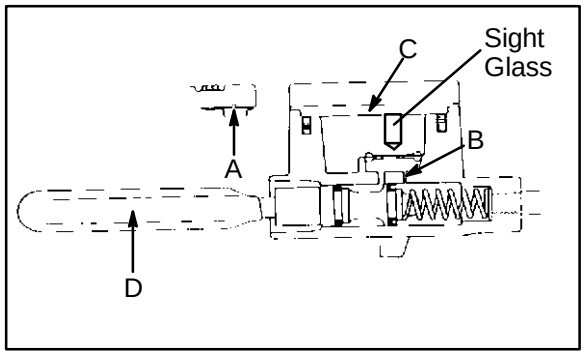
CAUTION:

Always wear safety glasses during these procedures. Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

NOTE: Do not remove brake lever when reservoir fluid level is low.

This procedure should be used to change fluid or bleed brakes during regular maintenance.

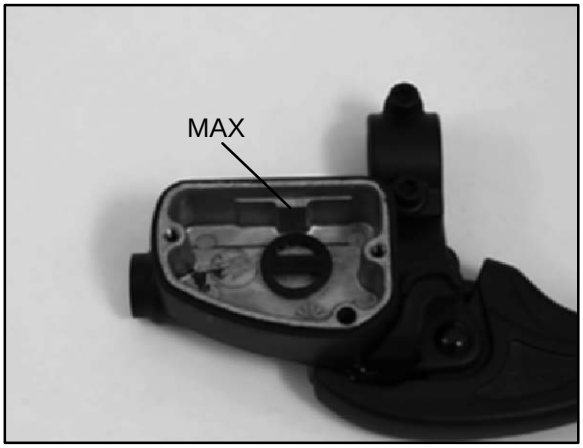
1. Clean reservoir cover thoroughly.
2. Remove screws, cover and diaphragm (C) from reservoir.
3. Inspect vent slots (A) in cover and remove any debris or blockage.



4. If changing fluid, remove old fluid from reservoir with a Mity Vac™ pump or similar tool.

Mity Vac™ (PN 2870975)

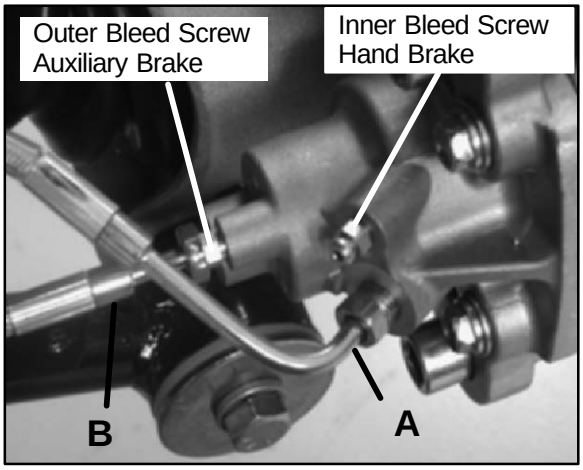
5. Add brake fluid to the indicated MAX level inside reservoir.



Polaris DOT 3 Brake Fluid

(PN 2870990)

6. Begin bleeding procedure with the caliper that is farthest from the master cylinder. Install a box end wrench on caliper bleeder screw. Attach a clean, clear hose to fitting and place the other end in a clean container. Be sure the hose fits tightly on fitting. (E) is Auxiliary Brake Line, (F) is Hand Brake Line.



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BRAKE BLEEDING CONT'D

NOTE: Fluid may be forced from supply port (B) when brake lever is pumped. Place diaphragm (C) in reservoir to prevent spills. Do not install cover. See Illustration above.

7. *Slowly* pump brake lever (D) 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.

Bleeder Screw Torque

25–30 in.lbs. (2.80 –3.40 Nm)

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 the bleeder screw to 25–30 in.lbs. (2.80 –3.40 Nm).
11. Repeat procedure Steps 5-9 for the remaining caliper(s).
12. Add Polaris Dot 3 Brake Fluid (**PN 2870990**) to MAX level inside reservoir.

Master Cylinder Fluid Level:

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. Tighten screws to specification.

Reservoir Cover Torque -

5 in. lbs. (.6 Nm)

14. 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.
15. 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.

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2. Place a shop towel under brake line connection at master cylinder. Loosen banjo bolt; remove bolt and sealing washers.

CAUTION:

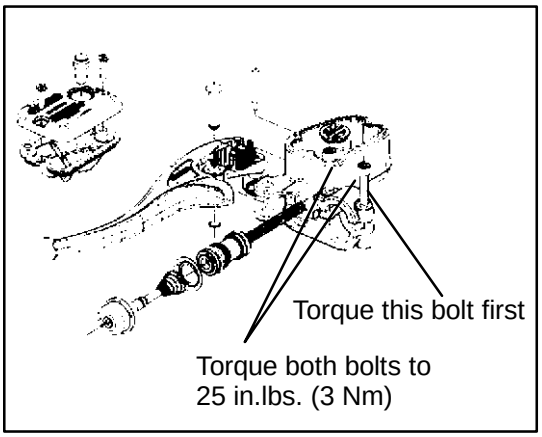
Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

3. Remove master cylinder from handlebars.
4. Hold brake upright and continue to remove master cylinder. Cover brake line to avoid spillage.

MASTER CYLINDER INSTALLATION

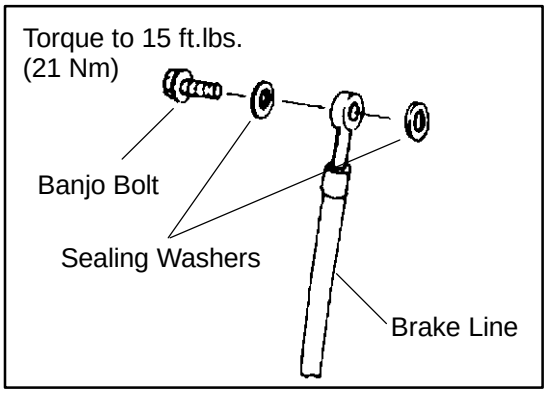
Notice: When replacing the brake master cylinder assembly or master cylinder parts, use the correct parts. There are different brake master cylinders for the different Polaris ATV models. Refer to your parts manual or guide for the correct parts. ***This master cylinder is not servicable and is replaced as a unit.***

1. Install master cylinder on handlebars. Torque mounting bolts to 25 in. lbs. (3 Nm). Torque the inside bolt first as indicated in the illustration to the right.



NOTE: To speed up the brake bleeding procedure, the master cylinder can be purged of air before brake line is attached. Fill with DOT3 Brake Fluid (**PN 2870990**) 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 line and torque banjo bolt to specification.



Master Cylinder Mounting Bolt
Torque 25 in. lbs. (3 Nm)

Brake Line Banjo Bolt Torque
15 ft. lbs. (21 Nm)

3. Fill reservoir with DOT3 Brake Fluid (**PN 2870990**).

Polaris DOT 3 Brake Fluid

(PN 2870990)

4. Follow bleeding procedure on Pages 9.7-9.8. Check all connections for leaks and repair if necessary.

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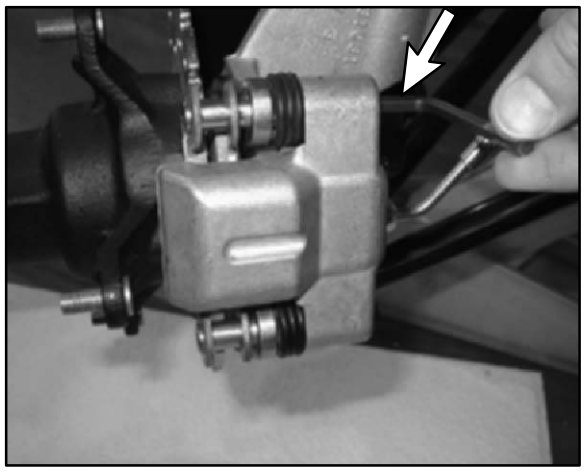
FRONT PAD REMOVAL

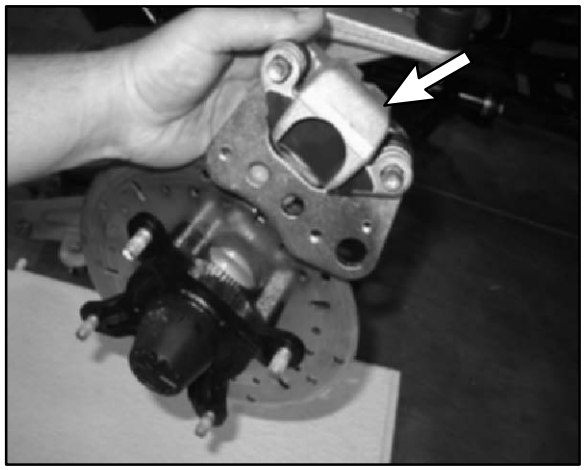
1. Elevate and support front of machine.



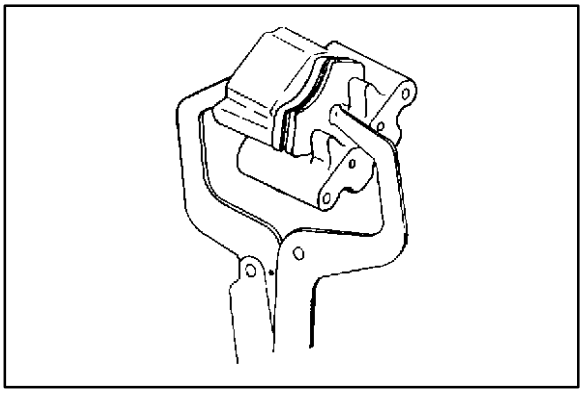
CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

2. Remove the front wheel. Loosen pad adjuster screw 2-3 turns.
3. Remove caliper from mounting bracket.

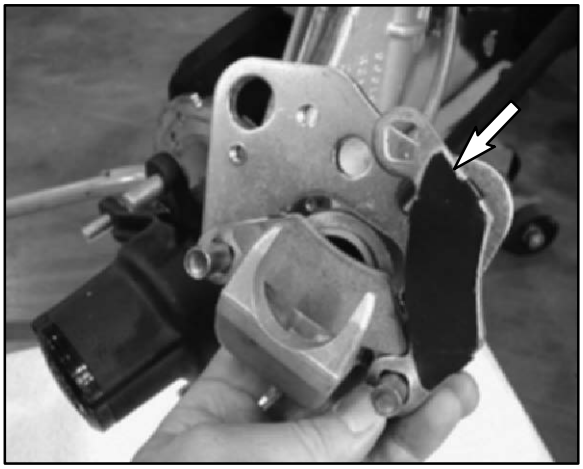


4. Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed.



NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

5. Push 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.

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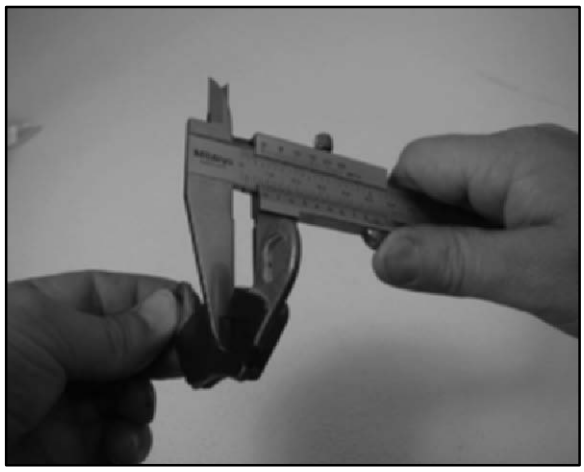
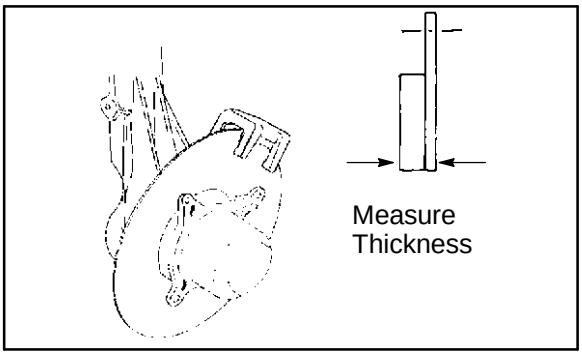




Front Brake Pad Thickness
New298″/7.6 mm
Service Limit .180″ / 4.0 mm

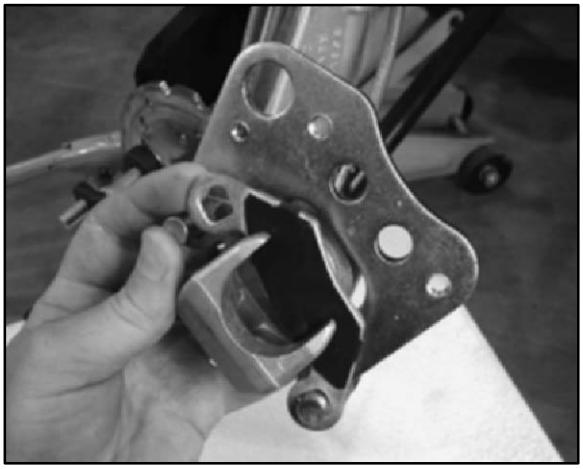
FRONT PAD ASSEMBLY

1. Lubricate mounting bracket pins with a light film of Polaris Premium All Season Grease, and install rubber dust boots.

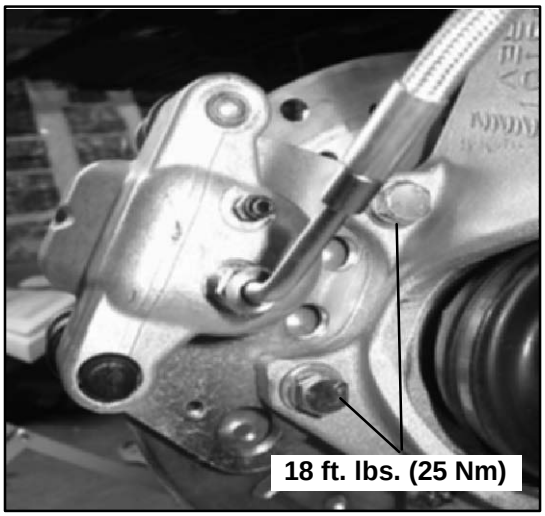
Polaris Premium All Season Grease

(PN 2871423)

2. Compress mounting bracket and make sure dust boots are fully seated. Install pads with friction material facing each other. Be sure pads and disc are free of dirt or grease.



3. Install caliper on hub strut, and torque mounting bolts.



Front Caliper Mounting Bolts

Torque: 18 ft. lbs. (25Nm)

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.

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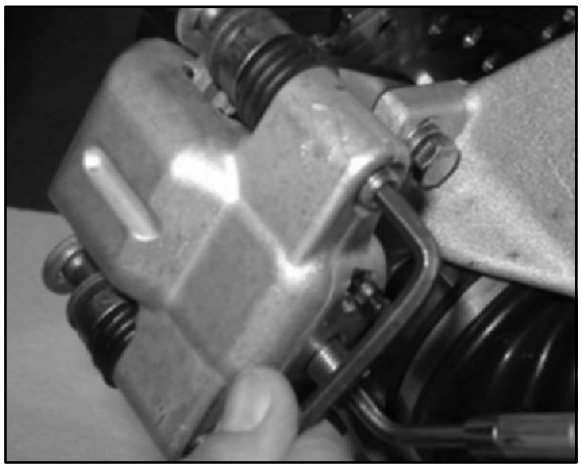
5. Install the adjuster screw and turn clockwise until stationary pad contacts disc, then back off 1/2 turn (counterclockwise).



6. Verify fluid level in reservoir is up to MAX line inside reservoir and install reservoir cap.

Master Cylinder Fluid
Up to MAX line inside reservoir

7. Install wheels and torque wheel nuts.

Front Wheel Nut Torque

20 ft. lbs. (27 Nm)

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 warpage may result. Repeat this procedure 10 times.

FRONT DISC INSPECTION

1. Visually inspect the brake disc for nicks, scratches, or damage.
2. Measure the disc thickness at eight different points around the pad contact surface using a 0-1″ micrometer. Replace disc if worn beyond service limit.

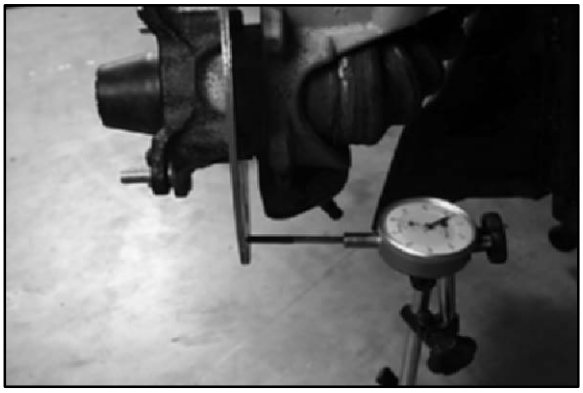
Brake Disc Thickness

New .150-.164″ (3.810-4.166 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 .005″ (.127 mm)

FRONT BRAKE DISC REMOVAL / REPLACEMENT

NOTE: To reduce the possibility of warpage, try removing the brake disc mounting bolts before applying heat to the bolts.

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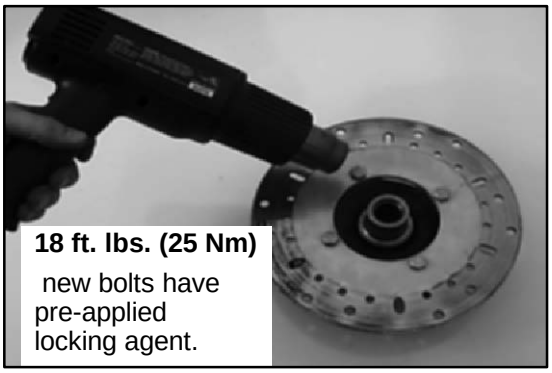
1. Apply heat to the hub in the area of the brake disc mounting bolts to soften the bolt locking agent.



2. Remove bolts and disc.
3. Clean mating surface of disc and hub.
4. Install disc on hub.
5. Install new bolts and tighten to specified torque.

Front Brake Disc Mounting Bolt Torque
18 ft. lbs. (25 Nm)

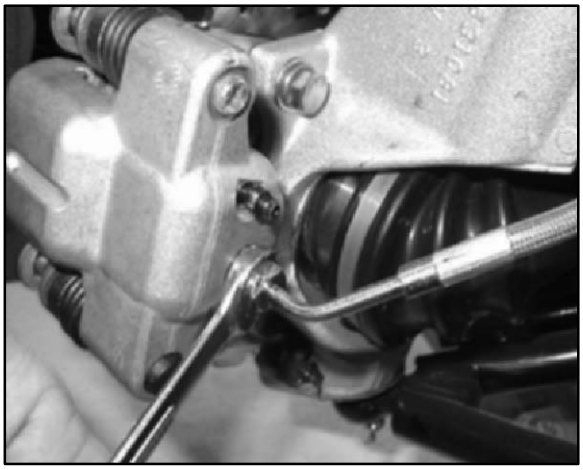
CAUTION: Always use new brake disc mounting bolts. The bolts have a pre-applied locking agent which is destroyed upon removal.

FRONT CALIPER REMOVAL

CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

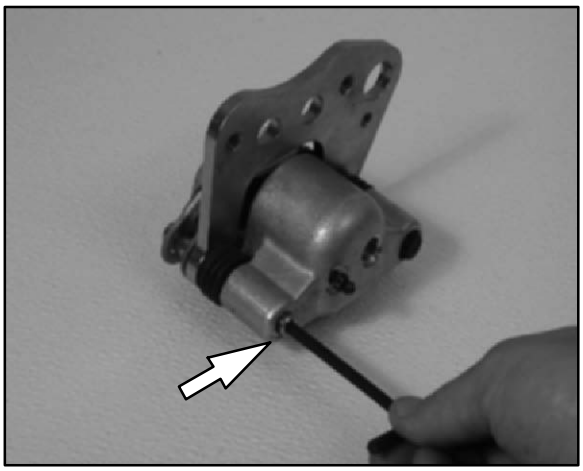
1. Remove brake pads. See Page 9.10.
2. Using a line wrench, loosen and remove brake line to caliper. Place a container under caliper to catch fluid draining from brake line.



3. Remove brake caliper and drain fluid into container. Do not reuse brake fluid.

FRONT CALIPER DISASSEMBLY

1. Remove brake pad adjuster screw.



2. Push upper pad retainer pin inward and slip brake pads past edge.

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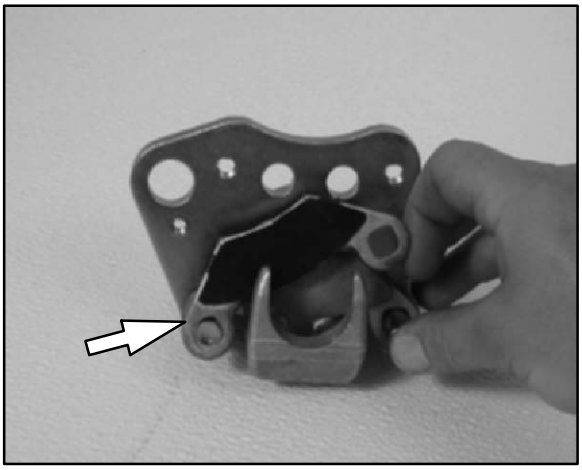
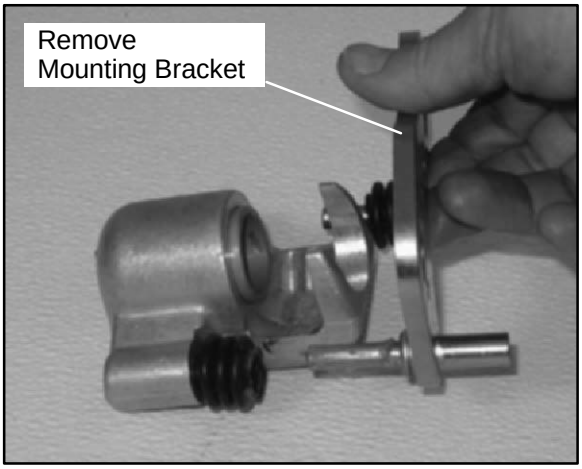
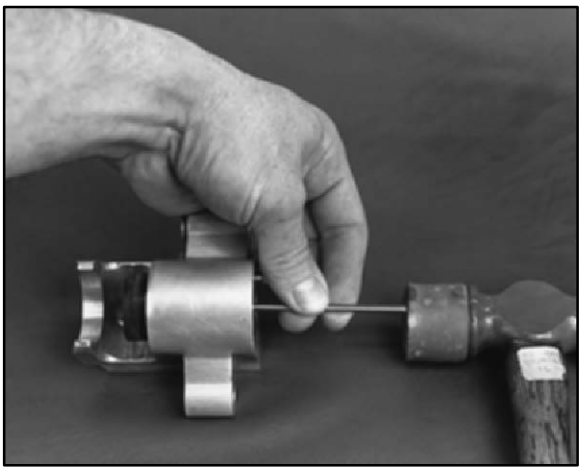


3. Remove mounting bracket, pin assembly and dust boot.

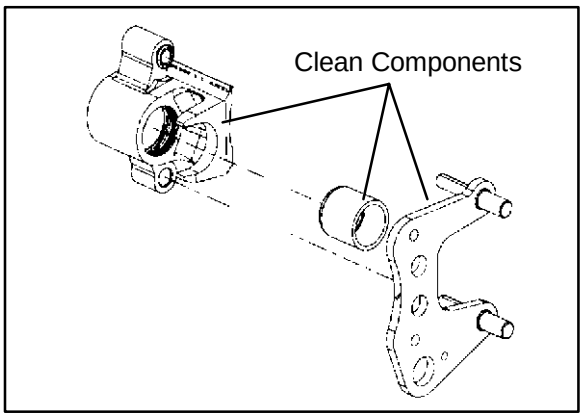


4. Remove piston, dust seal and piston seal.



5. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.

NOTE: Be sure to clean seal grooves in caliper body.



FRONT CALIPER INSPECTION

1. Inspect caliper body for nicks, scratches or wear. Measure bore size and compare to specifications. Replace if damage is evident or if worn beyond service limit.

Front Caliper Piston Bore I.D.

Std. 1.191-1.192″ (30.25-30.28 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.

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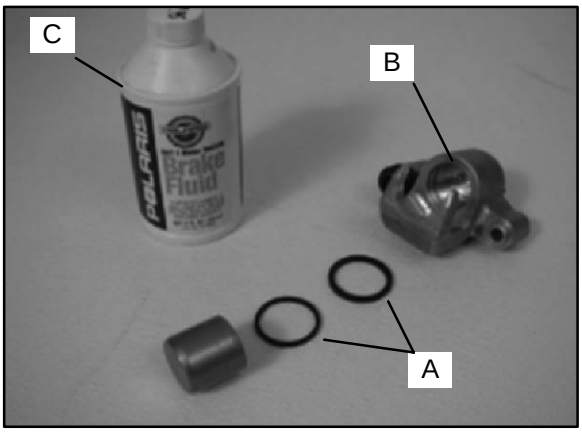
3. Inspect the brake disc and pads as outlined for brake pad replacement this section. See Pages 9.10–9.11.

FRONT 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.

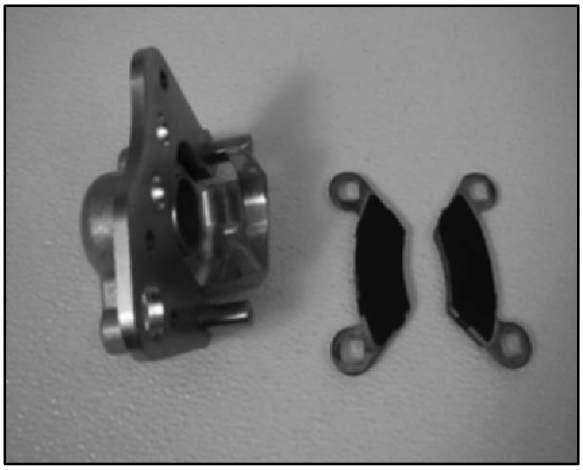


2. Coat piston with clean Polaris DOT 3 Brake Fluid (**PN 2870990**) (C). Install piston (D) with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance.
3. Lubricate the mounting bracket pins with Polaris Premium All Season Grease, and install the rubber dust seal boots.

Polaris Premium All Season Grease

(PN 2871423)

4. Compress the mounting bracket and make sure the dust seals are fully seated. Install the pads as shown on Page 9.10. Clean the disc and pads with brake parts cleaner or denatured alcohol to remove any dirt, oil or grease.



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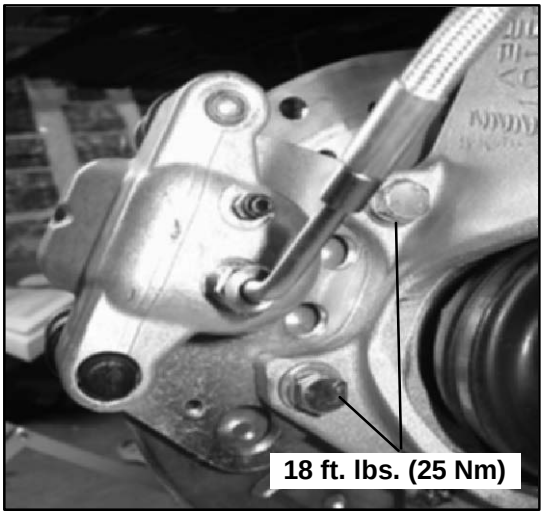
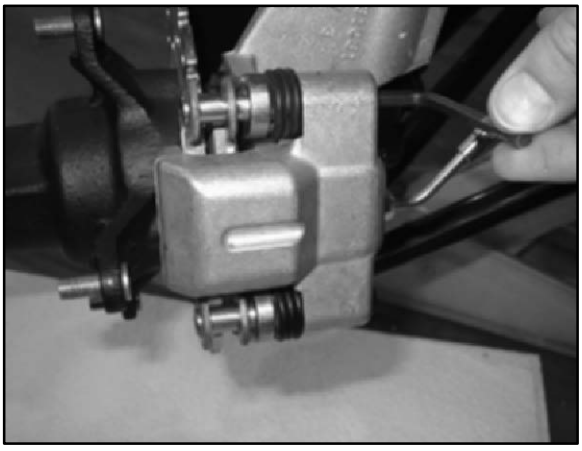
FRONT CALIPER INSTALLATION

1. Install caliper on hub strut, and torque mounting bolts.



Front Caliper Mounting Bolt Torque
18 ft. lbs. (25 Nm)

2. Install brake line and tighten securely with a line wrench.
3. Install the adjuster screw and turn until stationary pad contacts disc, then back off 1/2 turn.



4. Follow brake bleeding procedure outlined on Pages 9.7-9.8.
5. Install wheels and torque wheel nuts to specification.

Front Wheel Nut Torque
20 ft. lbs. (27 Nm).

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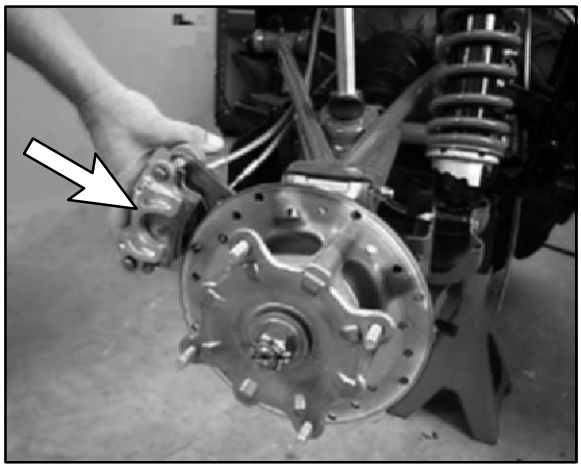
BRAKE BURNISHING PROCEDURE

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 warpage may result. Repeat this procedure 10 times.

REAR BRAKE PAD REMOVAL

1. Support the machine. Remove the rear tire.



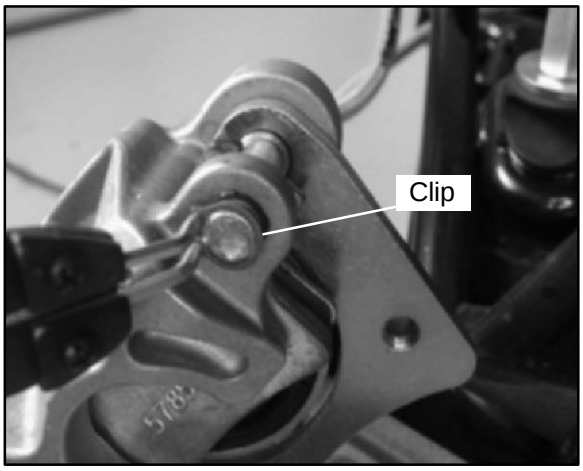
2. Remove caliper mounting bolts and lift caliper off of disc.

NOTE: When removing caliper, be careful not to damage brake line. Support caliper so as not to kink or bend brake line.

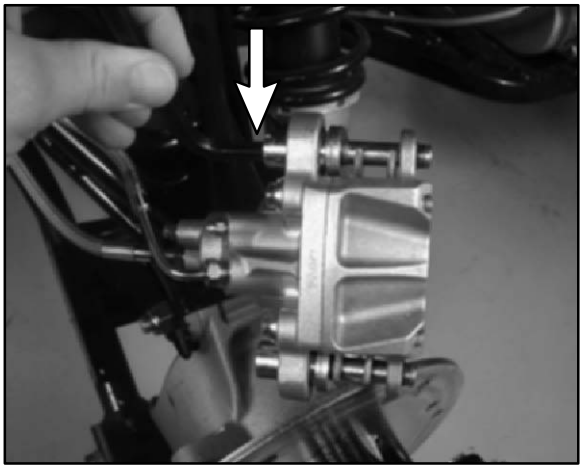
3. Push caliper pistons into caliper bore slowly with pads installed.

NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

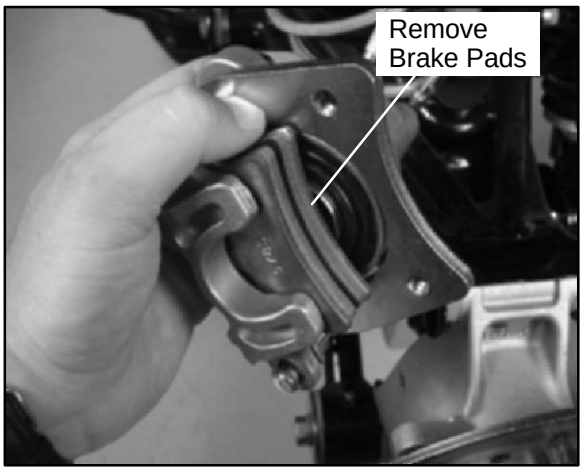
4. Remove the clip from the slide bolt.



5. Remove a slide bolt with a hex wrench.



6. Remove the brake pads from the caliper.



7. Clean the caliper with brake cleaner or alcohol.

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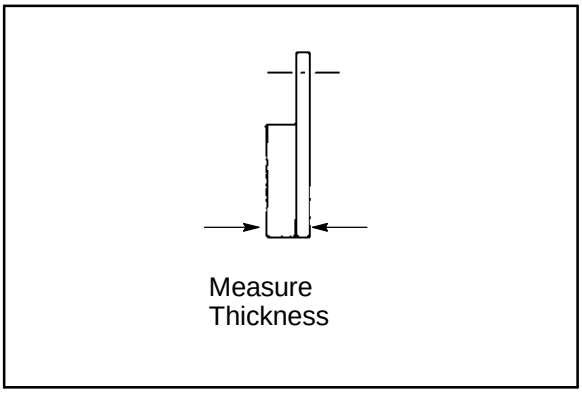
REAR BRAKE PAD REMOVAL CONT'D

8. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.

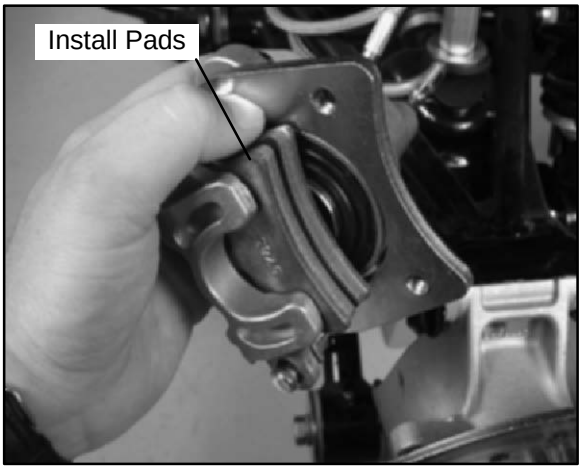


Rear Brake Pad Thickness
New: .318″ (8.0 mm)

Service Limit: .180″ (4.6 mm)

REAR BRAKE PAD INSTALLATION

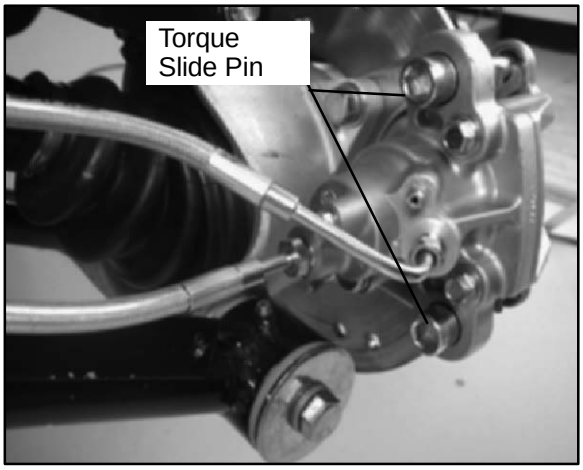
1. Install new brake pads in caliper body.



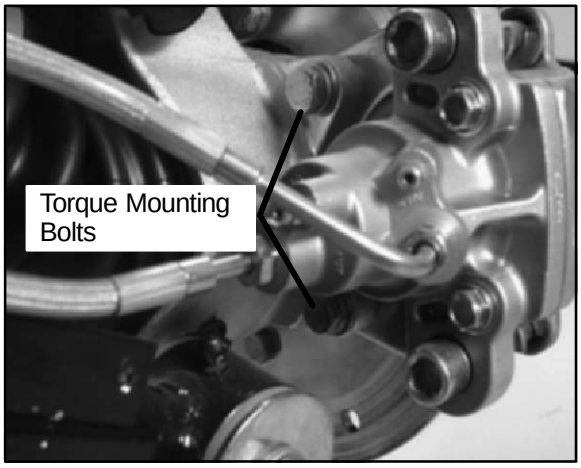
2. Tighten the slide pin with a hex wrench.
3. Install the slide bolt snap ring. Torque the slide pin to 30–35 ft. lbs. (41 Nm–48 Nm).

Caliper Slide Pin Torque:

30–35 ft. lbs. (41 Nm–48 Nm)



4. Install caliper and torque the mounting bolts.



Rear Brake Caliper

Torque: 18 ft. lbs. (25 Nm)

5. 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 master cylinder.
6. It is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.

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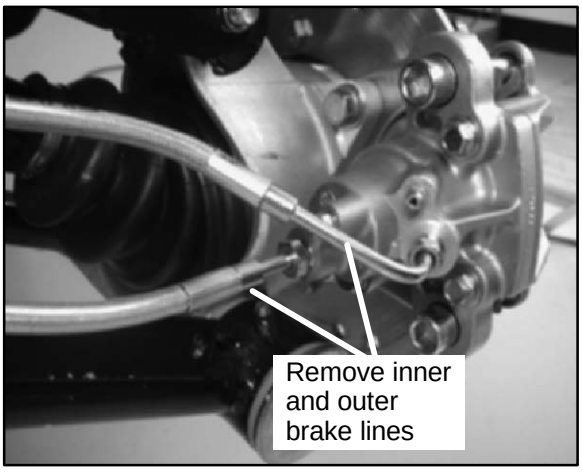
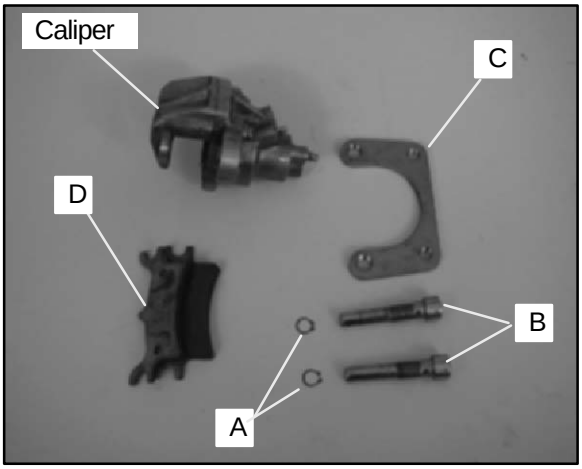
REAR CALIPER REMOVAL/INSPECTION

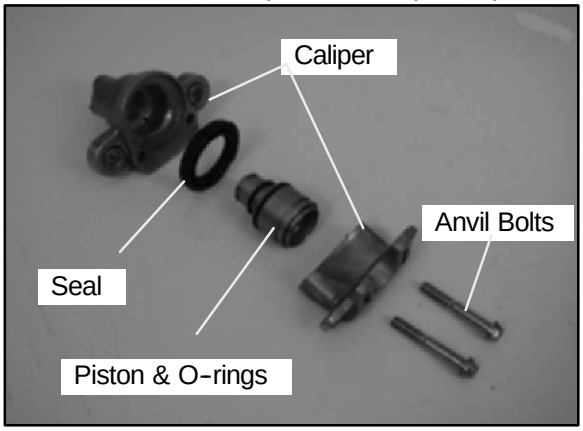
1. Clean caliper area before removal.
2. Using a flare nut wrench, remove hand brake (inner) and auxiliary brake (outer) lines. Place a container to catch brake fluid draining from brake lines.



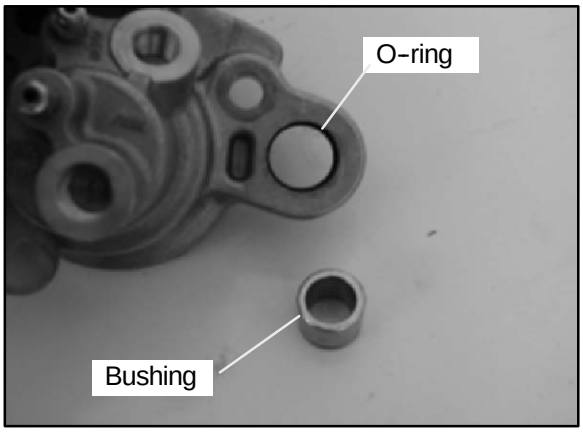
3. Remove the two caliper bolts and the caliper.
4. Remove the slide bolt snap rings (A), the slide pins(B), the bracket pad (C), and the brake pads (D).



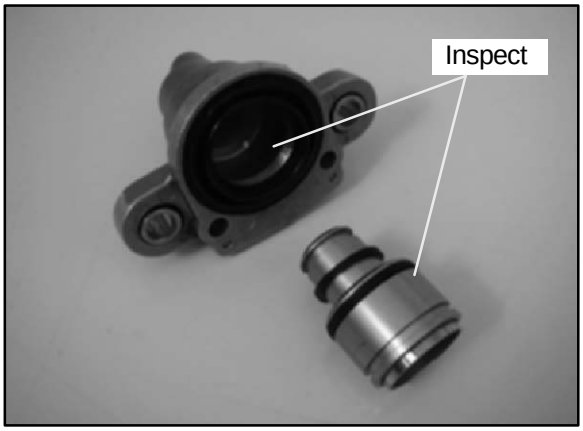
5. Remove the anvil bolts and separate caliper halves and remove pistons with piston pliers.



6. Remove seals and O-rings. Clean the O-ring grooves.
7. Clean disc, caliper body, and pistons with brake cleaner or alcohol.
8. Remove the slide bolt bushings. Inspect the bushings and O-rings and replace if necessary.



9. Inspect caliper piston bore for scratches, severe corrosion, or galling and replace if necessary.



10. Inspect surface of caliper piston for nicks, scratches, or damage and replace if necessary.

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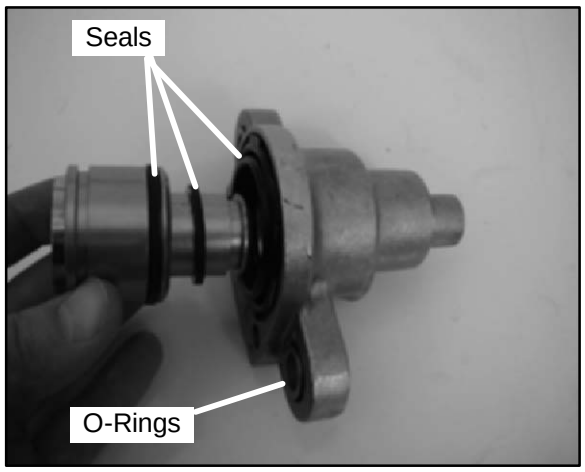
REAR CALIPER ASSEMBLY

1. Install new O-rings in the slide bolt bushing holes. Be sure O-ring and seal grooves are thoroughly cleaned of all residue, or piston may bind in bore. Apply brake fluid to piston seals and install carefully with a twisting motion to ease assembly until fully seated.

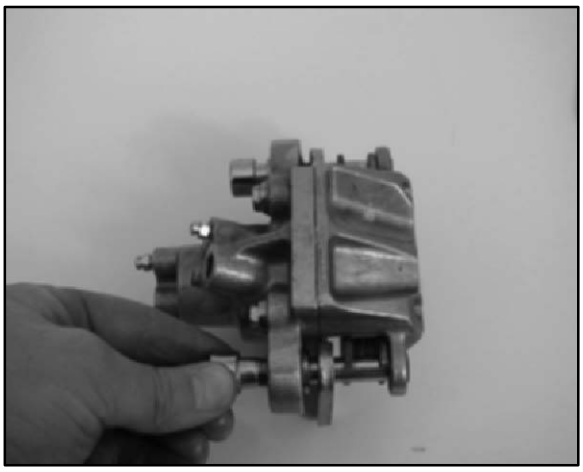


2. Carefully assemble caliper body, making sure O-rings are properly positioned in groove. Tighten the caliper anvil bolts and then torque the anvil bolts evenly to 16–18 ft. lbs. (22–25 Nm).

Caliper Anvil Bolt Torque:

16–18 ft. lbs. (22 Nm–25 Nm)

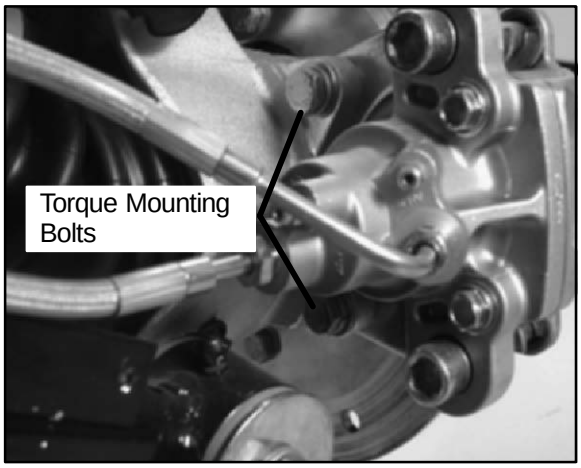
3. Install brake pads in caliper body with friction material facing each other. Install the slide pins and the slide pin retaining ring. Torque the slide pins to 30–35 ft.lbs. (41–48 Nm).



Caliper Slide Pin Torque:

30–35 ft. lbs. (41 Nm–48 Nm)

4. Install caliper and torque mounting bolts to 18 ft.lbs (25 Nm).



Caliper Mounting Bolt Torque

18 ft. lbs. (25 Nm)

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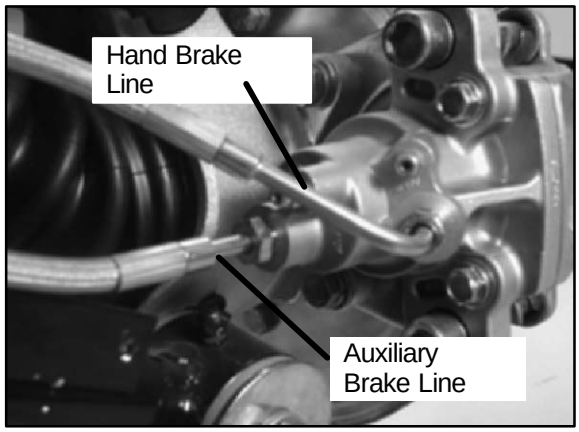
5. Install brake lines and tighten to specified torque.



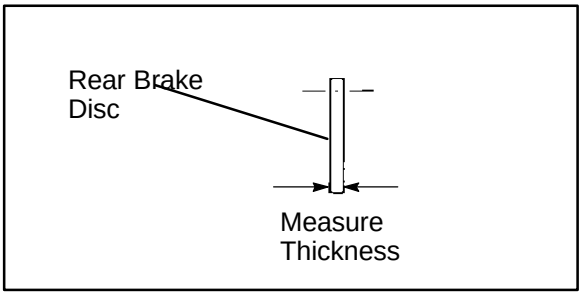
Banjo Bolt Torque

15 ft. lbs. (21 Nm)

6. Follow bleeding procedure outlined on Pages 9.6-9.7 of this section and refer to system overview and illustrations on Pages 9.2–9.3.
7. Field test unit for proper braking action before putting into service. Inspect for fluid leaks and firm brakes. Make sure the brake is not dragging when lever is released. If the brake drags, re-check assembly and installation.

REAR BRAKE 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 .177-.187″ (4.496-4.750 mm)
Service Limit .167″ (4.242 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 .005″ (.127 mm)

TROUBLESHOOTING

Brakes Squeal

- Dirty/contaminated friction pads
- Improper alignment
- Worn disc
- Worn disc splines

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.

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CHAPTER 10
ELECTRICAL

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SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
PV-43568	Fluke™ 77 Digital Multimeter
2870630	Timing Light
2870836	Battery Hydrometer
2460761	Hall Sensor Probe Harness
2871745	Static Timing Light Harness

WIRING SCHEMATIC SERVICE NOTES

NOTE: ***There are two different electrical configurations for the 2003 Sportsman 400. Two different wiring configurations were used. Refer to the right hand corner of the foldout wiring schematics in the back of the book to note the differences.***

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 under10 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.

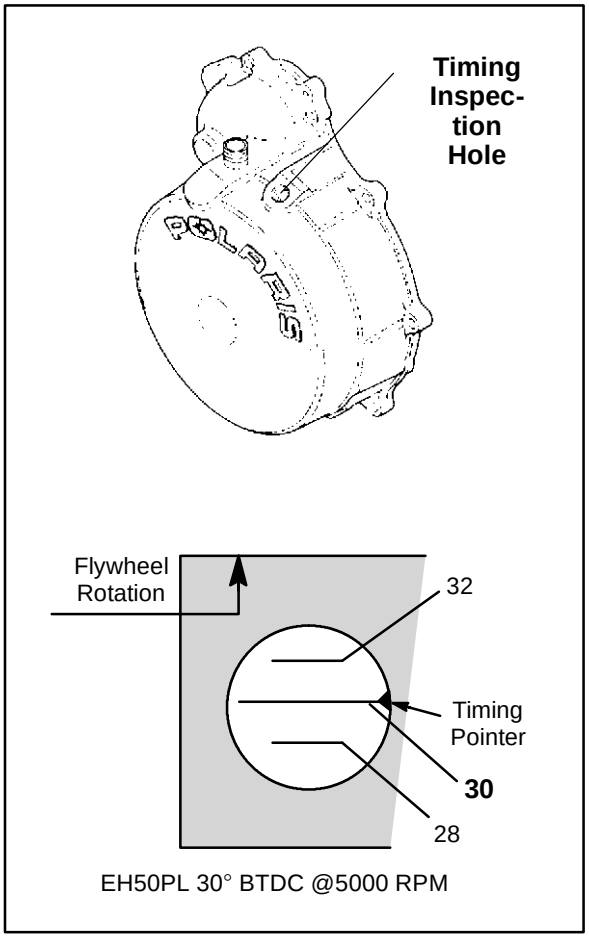
TIMING CHECK PROCEDURE

1. The ignition timing check hole is in the starter recoil/magneto housing. Remove the check plug.

NOTE: NOTE: The ignition timing marks are stamped on the outside of the flywheel. Ignition timing must be inspected with the engine at room temperature (68°F / 20° C).

2. With the transmission in neutral, start the engine and set engine speed to 5000 ± 200 RPM.
3. Direct the timing light at the ignition timing check hole and check the ignition timing. **NOTE:** Do not allow the engine to warm up. The timing will retard approximately 2° when the engine is warm.

If the ignition timing is not within the specified range, adjust the stator plate position as described below.



EH50PL 30° BTDC @5000 RPM

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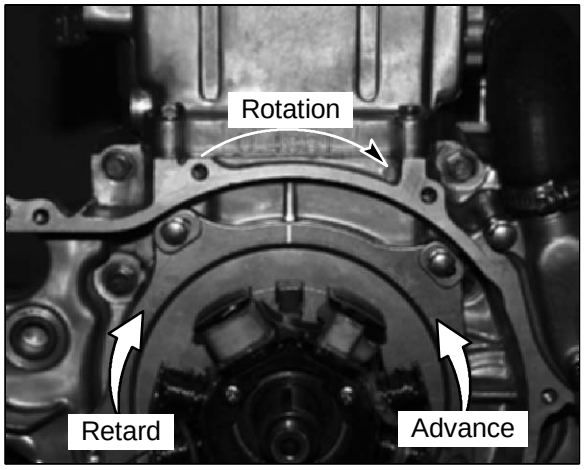
Stator Adjustment

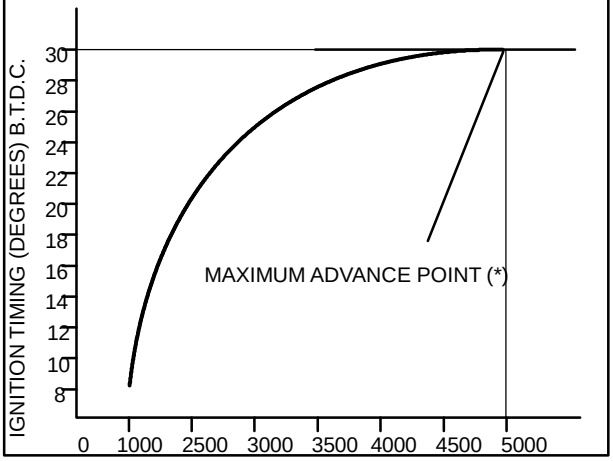
1. Remove the magneto housing.
2. Remove the flywheel.
3. Loosen the stator plate screws and adjust the stator plate position. **NOTE:** Moving the stator plate clockwise retards (delays) the ignition timing. Moving the plate counterclockwise advances it.



TYPICAL IGNITION TIMING CURVE * ACTUAL ADVANCE POINT

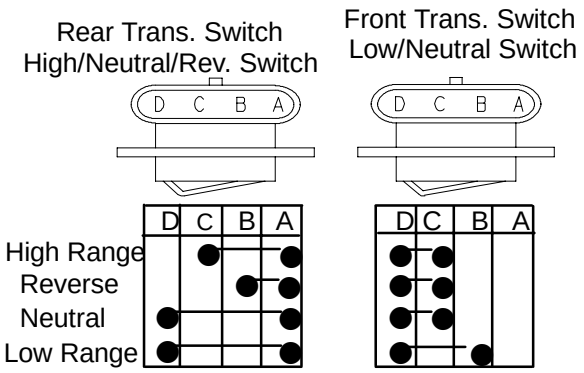
MAY VARY BY SEVERAL HUNDRED RPM ABOVE OR BELOW 5000 .

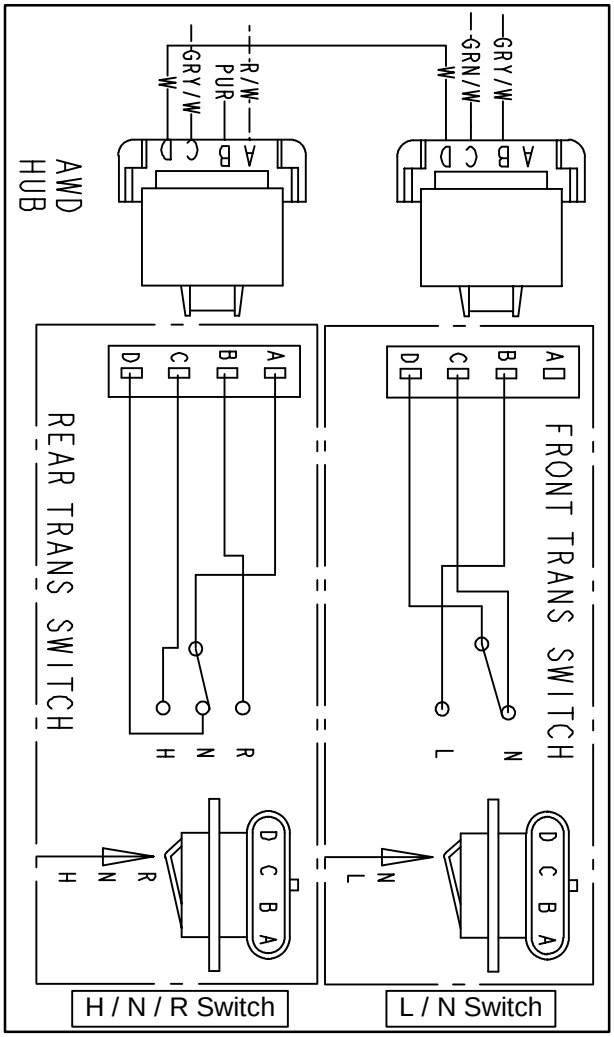
USE THE POINT OF MAXIMUM ADVANCE WHEN CHECKING IGNITION TIMIN



GEAR POSITION INDICATOR SWITCH TEST

Switch Continuity Table





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INSTRUMENT CLUSTER TROUBLESHOOTING

Introduction
The Polaris ATV Instrument Cluster is powered by battery voltage (12 VDC) and requires inputs from the engine RPM, transmission gear, and wheel speed sensor for proper operation. Two harnesses plug into the cluster head; one from the wheel sensor, and one from the vehicle main harness. A non-serviceable internal memory battery maintains odometer and hour meter data when the machine is not running. The illumination lamp inside the gauge is non-serviceable and is designed to last for the life of the unit. In addition to the ground speed in Miles Per Hour (MPH), Kilometers Per Hour (KPH), odometer, and trip odometer, the electronic speedometer provides the following functions: (See Illustration)

1. Hour meter
2. Programmable Service Interval
3. Gear Indicator
4. High Engine Coolant Temperature
5. Low Oil Pressure
6. High/Low Battery Voltage

Vehicle Speed and Odometer
An electronic wheel speed sensor located on the right front brake caliper bracket senses vehicle speed. The speedometer head does not differentiate between forward and reverse wheel rotation. Static Timing Light Harness **(PN 2871745)**, with the Hall Sensor Probe Harness **(PN 2460761)**, can be used to quickly test the sensor.

Hour Meter (Engine Run Time)
Logs the total hours the engine has been in operation.

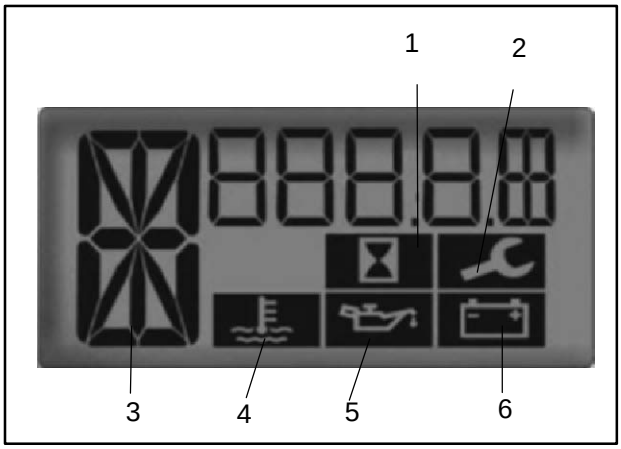
Programmable Service Interval
The purpose of the programmable service interval is to provide the consumer and their dealer with a convenient way to schedule routine maintenance. When the ATV leaves the factory, this feature is turned "OFF". You must enable this feature if you intend to use it to track maintenance requirements.

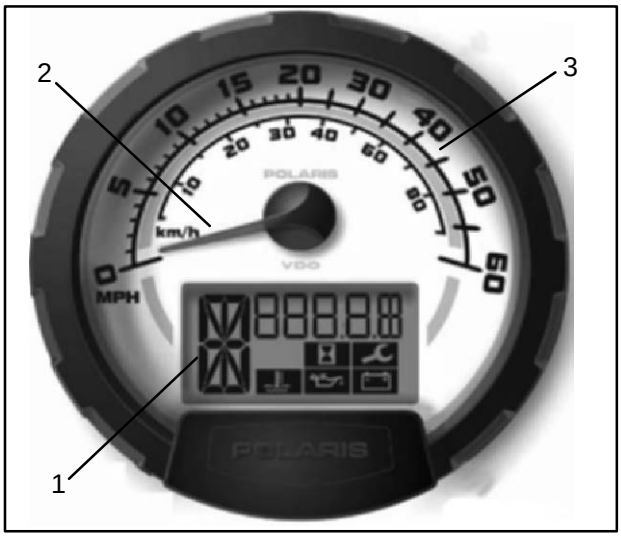
Low Oil Pressure
Indicates that the engines is operating on low oil pressure or that the engine is running low on oil.

High Engine Coolant Temperature
Indicates the engine is overheating. Refer to **Chapter 3 "Cooling System Troubleshooting"** for help with diagnosis of overheating.

High/Low Battery Voltage
Indicates that the battery is nearing full discharge, or that a failed battery or voltage regulator is causing an excessively high voltage on the DC bus.

Diagnostic Mode
Refer to Page 10.6 on how to operate the diagnostic mode.





1. Rider Information Center

2. Speedometer Needle – In addition to depicting vehicle speed, this needle will flash to indicate a fault condition.

3. Speedometer graph depicting both miles per hour and kilometers per hour.

Programmable Service Interval
To enable the programmable service interval function, scroll to the Programmable Service Interval (P.S.I.) mode, which is initially indicated by the "wrench" icon and the word "OFF".

1. Press and hold the mode/reverse override button until the wrench icon begins flashing. When the wrench icon begins to flash, release the button.

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PROGRAM SERVICE INTERVAL CONT'D

2. Begin entering the next service hour total by releasing and pressing the mode/reverse override button. Each time the mode/reverse override button is pressed and released the service interval time is increased by an hour. **NOTE**: Continuing to hold down the mode button will add to the hour total faster.

3. When the desired hour total has been reached, stop pressing the mode/reverse override button and wait for the wrench icon to quit flashing. Once the wrench icon quits flashing the service hours are set. If you scroll past the intended number, hold the button down until the count turns over to "0". At this point you can re-attempt to set the number.

4. The P.S.I. then counts down from this total per hours of engine operation.

5. When the number reaches "0", the wrench icon will flash for five seconds during vehicle start up to remind the driver that the next scheduled service is due. To turn the P.S.I. off, toggle to the service interval mode and press the mode/reverse override button for approximately seven seconds until the word "OFF" appears in the Rider Information Center.

Diagnostic Mode

Warning Indications Displayed on Rider Information Center

Warning Indication	Warning Explanation
"E"	Most of the time this error message indicates that you are between gears. It can also indicate that the transmission switch is broken.
"StAtr"	"Stator" – is displayed when the gauge senses ground speed but no engine rpm for at least 10 seconds. May indicate a failing stator or wiring problem.
"hdLbr"	"Handlebar" – is displayed when the mode/override button is stuck in for more than ten seconds in any mode except Programmable Service Interval or Diagnostic modes.

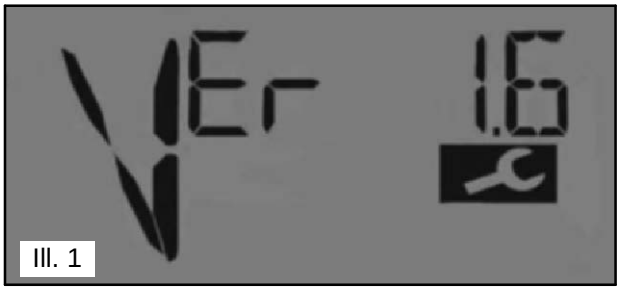
NOTE: The gauge will shut itself off if the voltage on the DC bus is too excessive. This is usually the result of an open battery condition. The gauge is designed to survive such an event.

NOTE: If the gauge will not indicate what gear it is in and will not allow AWD operation, AWD can still be enabled by holding in the mode/override button.

To enter the diagnostics mode:

1. Turn the key switch off and wait 10 seconds.
2. Set the park brake and shift the transmission to neutral.
3. Hold the mode/reverse override button as you turn the key switch on.

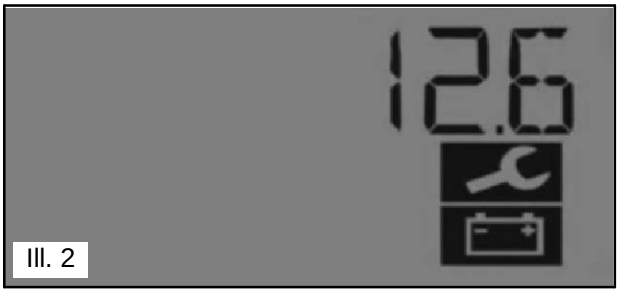
The initial screen displayed looks similar to Ill. 1 and is referring to the software version currently installed in your instrument cluster. This information is only briefly displayed.



Ill. 1

Use the mode/reverse override button to toggle through the diagnostic screens.

The first screen indicates battery voltage. Refer to Ill. 2.



Ill. 2

Screen three (Ill. 4) is the tachometer for setting idle speed. This mode is not operational while in motion.

Ill. 4

NOTE: As long as you are in the diagnostic mode, the wrench icon will remain lit.

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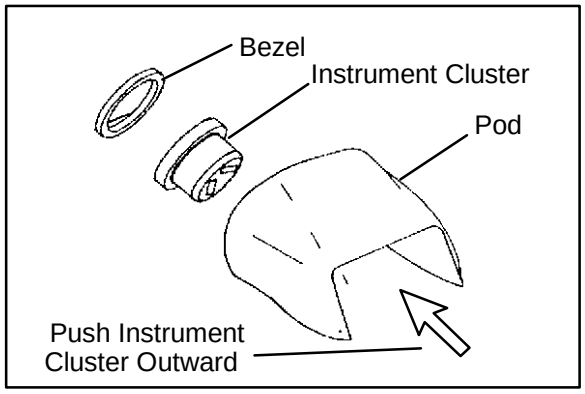
To leave the diagnostic mode, either shift the machine out of neutral or turn the key switch off and on.

NOTE: Any movement of the tires will trigger the speedometer out of the diagnostic mode.

SPEEDOMETER REMOVAL

1. Remove the headlight pod cover and disconnect the wire connectors from the instrument cluster.

2. Push the instrument cluster out from the backside of the pod, while securely holding the pod.



NOTE: Do not remove the rubber grommet in the pod. Only remove the rubber grommet if necessary.

SPEEDOMETER INSTALLATION

1. Spray a soap and water mixture onto the outer surface area of the instrument cluster. This will help the instrument cluster slide into the pod assembly more easily.

2. Be sure the rubber grommet inside the pod is fully installed and that the indexing key is in the headlight pod keyway.
3. Hold the pod assembly securely and insert the instrument cluster into the pod assembly. Twist the instrument cluster gently in a clockwise motion to properly seat the instrument cluster into the pod assembly. Apply pressure on the bezel while pressing down on the instrument cluster.

NOTE: Be sure the key on the instrument cluster housing is aligned with the keyway in the rubber grommet, to ensure proper alignment.

NOTE: Do not allow alcohol or petroleum products to come in contact with the instrument cluster lens.

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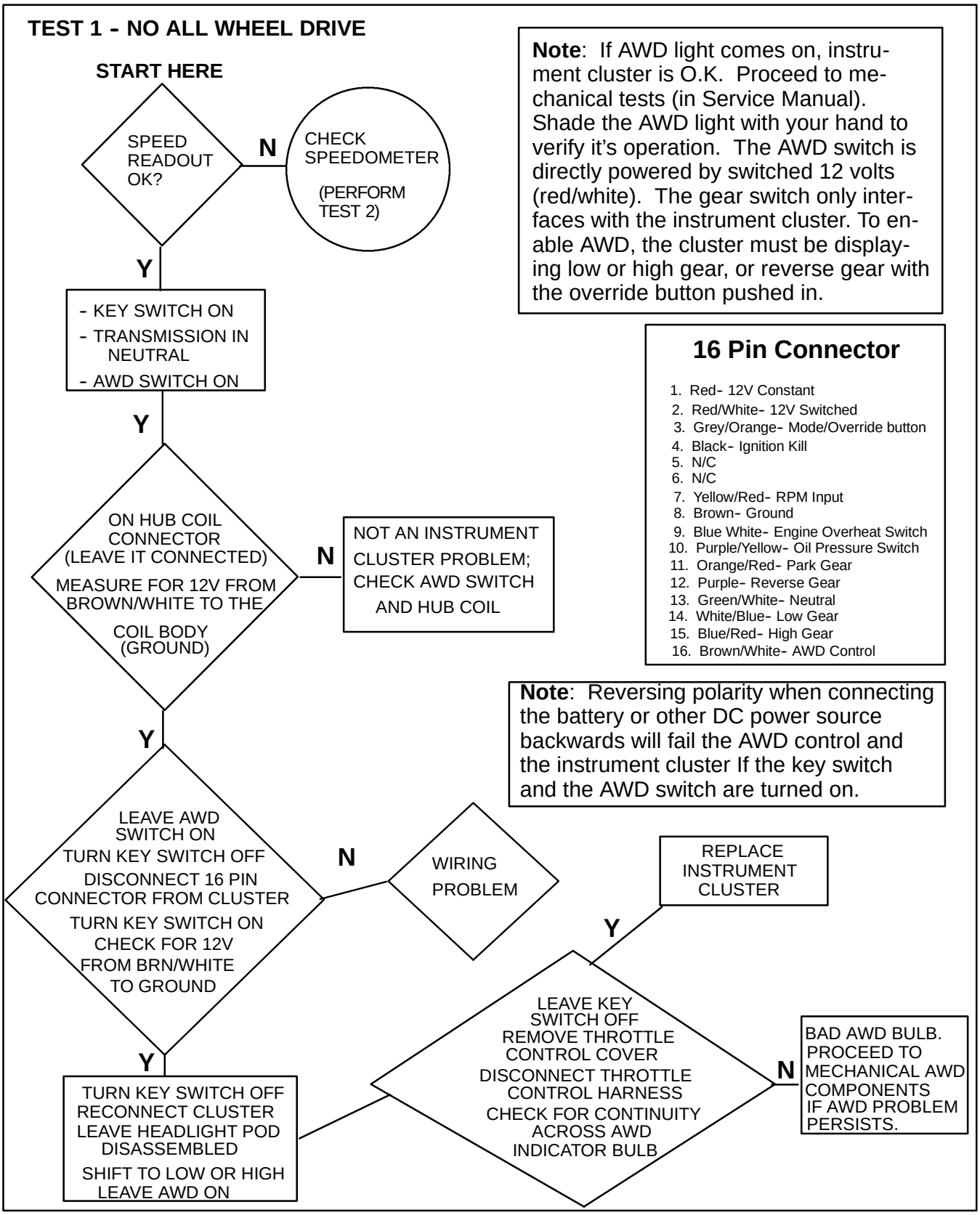
SPEEDOMETER TROUBLESHOOTING



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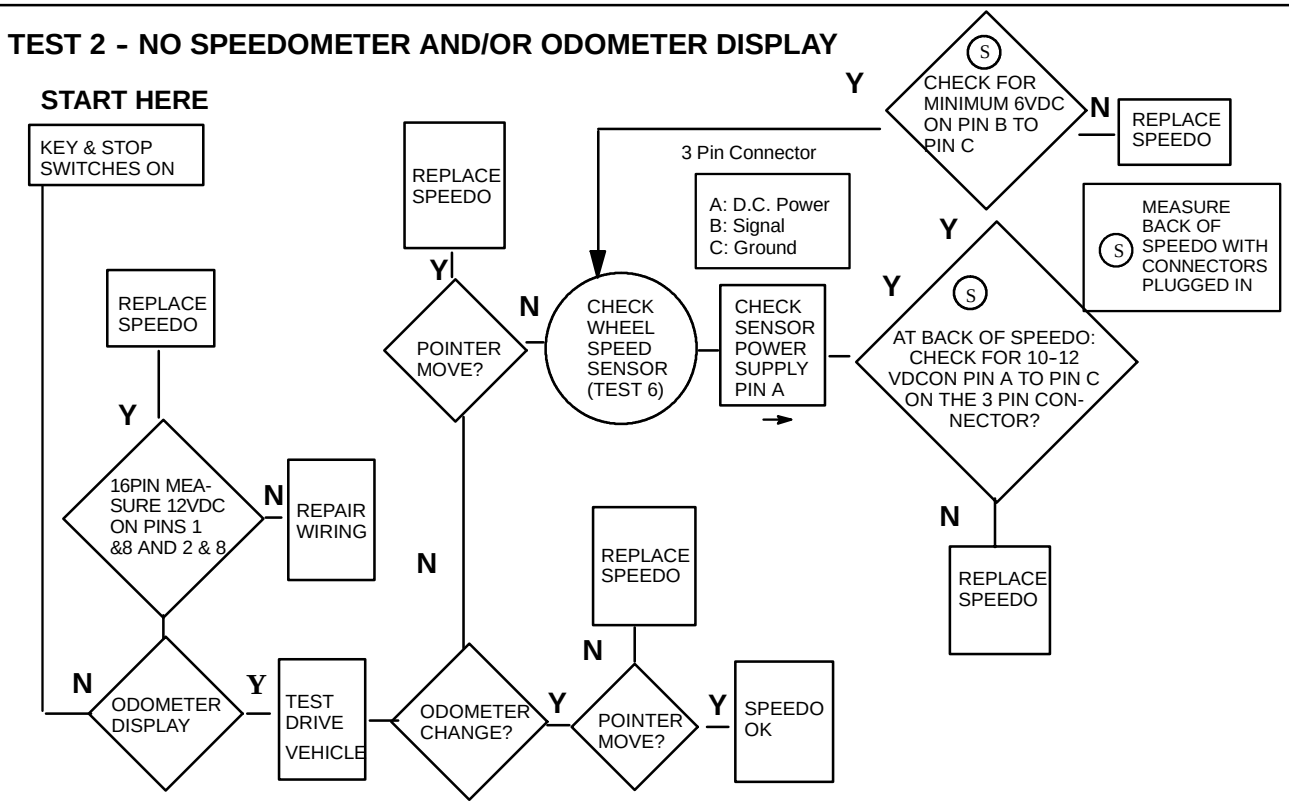
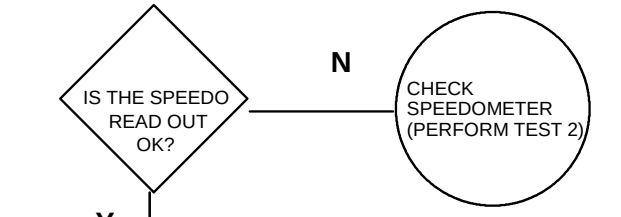
SPEEDOMETER TROUBLESHOOTING

TEST 2 - NO SPEEDOMETER AND/OR ODOMETER DISPLAY



TEST 3 - NO REVERSE SPEED LIMIT

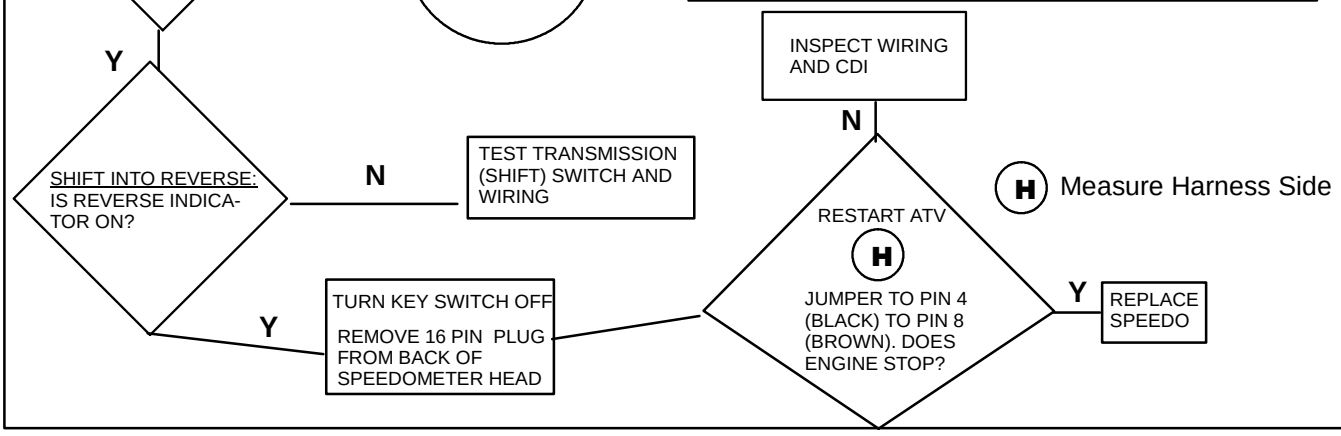
(VEHICLE EXCEEDS 7-9 MPH IN REVERSE)



16 Pin Connector

1. Red- 12V Constant
2. Red/White- 12V Switched
3. Grey/Orange- Mode/Override button
4. Black- Ignition Kill
5. N/C
6. N/C
7. Yellow/Red- RPM Input
8. Brown- Ground
9. Blue White- Engine Overheat Switch
10. Purple/Yellow- Oil Pressure Switch
11. Orange/Red- Park Gear
12. Purple- Reverse Gear
13. Green/White- Neutral
14. White/Blue- Low Gear
15. Blue/Red- High Gear
16. Brown/White- AWD Control

NOTE: Mode/Override button provides a grounding (sinking) input to the instrument cluster.



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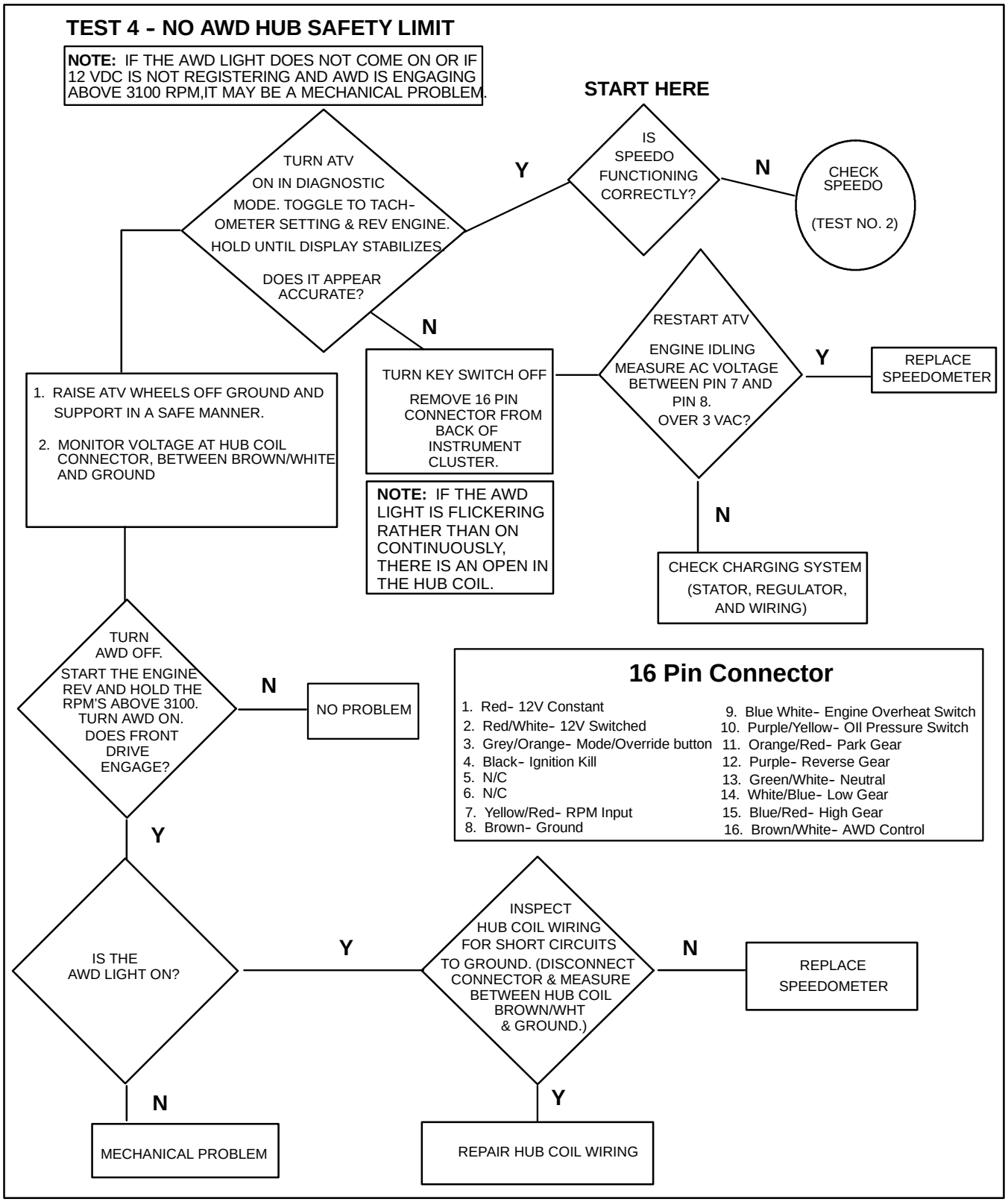
SPEEDOMETER TROUBLESHOOTING



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SPEEDOMETER TROUBLESHOOTING

TEST 5 REVERSE SPEED LIMITER ACTIVATED IN FORWARD GEAR

(Engine loses spark when vehicle speed is above 7-9 mph.)

START HERE

INSTRUMENT CLUSTER FUNCTION OK?

CHECK SPEEDOMETER (PERFORM TEST 2)

Y

SHIFT TO LOW OR HIGH GEARS. IS REVERSE INDICATOR LIGHT ON OR GEAR ON?

DOES THE LETTER "E" APPEAR?

N

Y

TEST TRANSMISSION SWITCH CHECK RELATED WIRING

TURN KEY SWITCH OFF
REMOVE 16 PIN PLUG FROM BACK OF INSTRUMENT CLUSTER
RESTART ATV AND TEST DRIVE

CHECK FUEL & IGNITION SYSTEMS

Y

PROBLEM REMAINS?

N

REPLACE SPEEDOMETER

NOTE: OVERRIDE SWITCH PLAYS NO ROLE IN REVERSE GEAR OUTPUT ON THE ATV.

16 Pin Connector

1. Red- 12V Constant
2. Red/White- 12V Switched
3. Grey/Orange- Mode/Override button
4. Black- Ignition Kill
5. N/C
6. N/C
7. Yellow/Red- RPM Input
8. Brown- Ground
9. Blue White- Engine Overheat Switch
10. Purple/Yellow- Oil Pressure Switch
11. Orange/Red- Park Gear
12. Purple- Reverse Gear
13. Green/White- Neutral
14. White/Blue- Low Gear
15. Blue/Red- High Gear
16. Brown/White- AWD Control

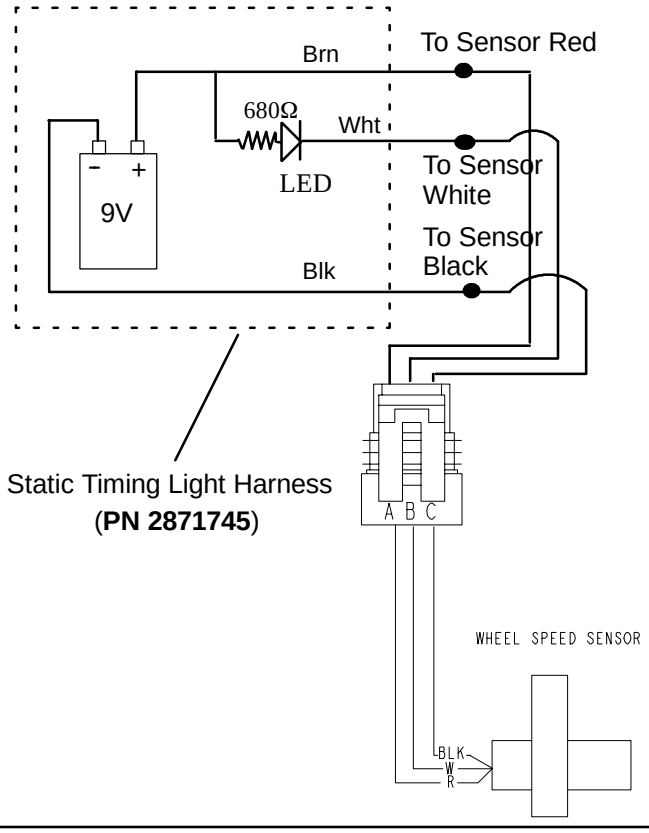
TEST 6 WHEEL SPEED SENSOR

Tools Required:

- Static Timing Light Harness **(PN 2871745)**
- Hall Sensor Probe Harness **(PN 2460761)** or equivalent jumper wires.

To test wheel speed sensor:

1. Disconnect 3 Pin connector from speedometer.
2. Connect wires from test light to sensor 3 Pin connector as shown at right, using the Hall Sensor Probe Harness **(PN 2460761)** or jumper leads.
3. Elevate front right side of vehicle until tire is off the ground.
4. Slowly turn right front wheel while observing the test light.
5. If light flashes, sensor is O.K. Be sure connections are good and 9 volt battery is in good condition.



Static Timing Light Harness (**PN 2871745**)

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SPEEDOMETER TROUBLESHOOTING CONT'D

TEST 7 -- RESET SPEEDOMETER

If the key switch or engine stop switch is turned off with the vehicle in motion, the speedometer indicator needle may stick, indicating the speed at which the vehicle was traveling when the speedometer lost power. For example: If the ATV was traveling 30 mph when the engine stop switch is turned off, speedo may indicate 30 mph until reset:

1. Operate vehicle at a speed greater than indicated on speedometer (past point where needle is stuck). Needle should return to normal operation.
2. In the above example, the ATV speed would have to exceed 30 mph to reset.

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 sensor on the cylinder head. In normal operating conditions, the temperature sensor is non-conductive (open). If engine coolant reaches the specified temperature, the sensor 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 (megohms).

Hot Light On	221° F (105° C)

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.***

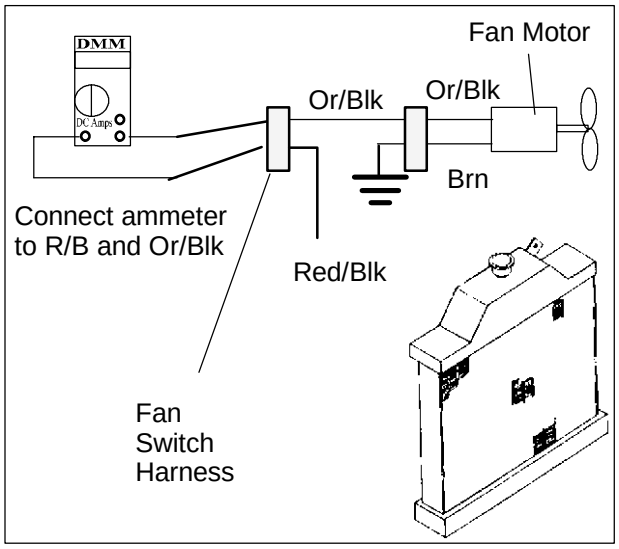
NOTE: The fan switch may not function or operation may be delayed if coolant level is low or if air is trapped in the cooling system. Be sure cooling system is full and purged of air. Refer to Maintenance Chapter 2 for cooling system information.

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 Testing this section). Repair or replace as necessary.

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. Disconnect the harness from the fan switch.
2. Connect a DC ammeter in between the fan switch harness wires as shown.
3. Be sure fan blade is free to rotate.
4. Turn ignition key and engine stop switch to "ON" position. Read the current draw on ammeter with fan running.

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5. If the fan motor draws more than 6.5 Amps, replace the motor.

Fan Motor Current Draw:

Should Be Less Than 6.5 Amps

FAN CONTROL SWITCH OPERATION TEST

1. Place switch in a water bath and submerse it to the base of the threads. Do not allow threads to contact container or inaccurate reading will result.
2. Heat the coolant 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 Part Number	**Continuity (On)**	**No Continuity (Off)**
4010161	180° F (82° C) ± 3°F	149° F (65° C) ± 8°F

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

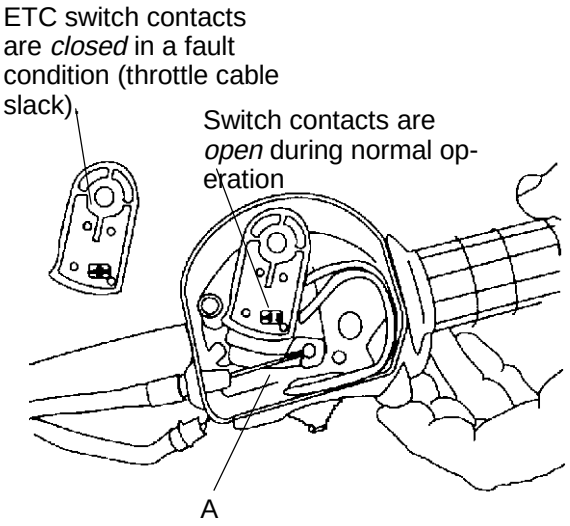
Remove throttle block cover by carefully releasing all tabs around edge of cover.

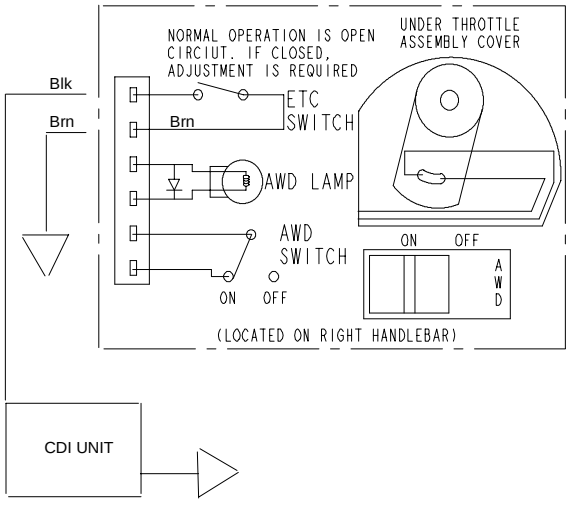
Place transmission in neutral and apply parking brake.

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)





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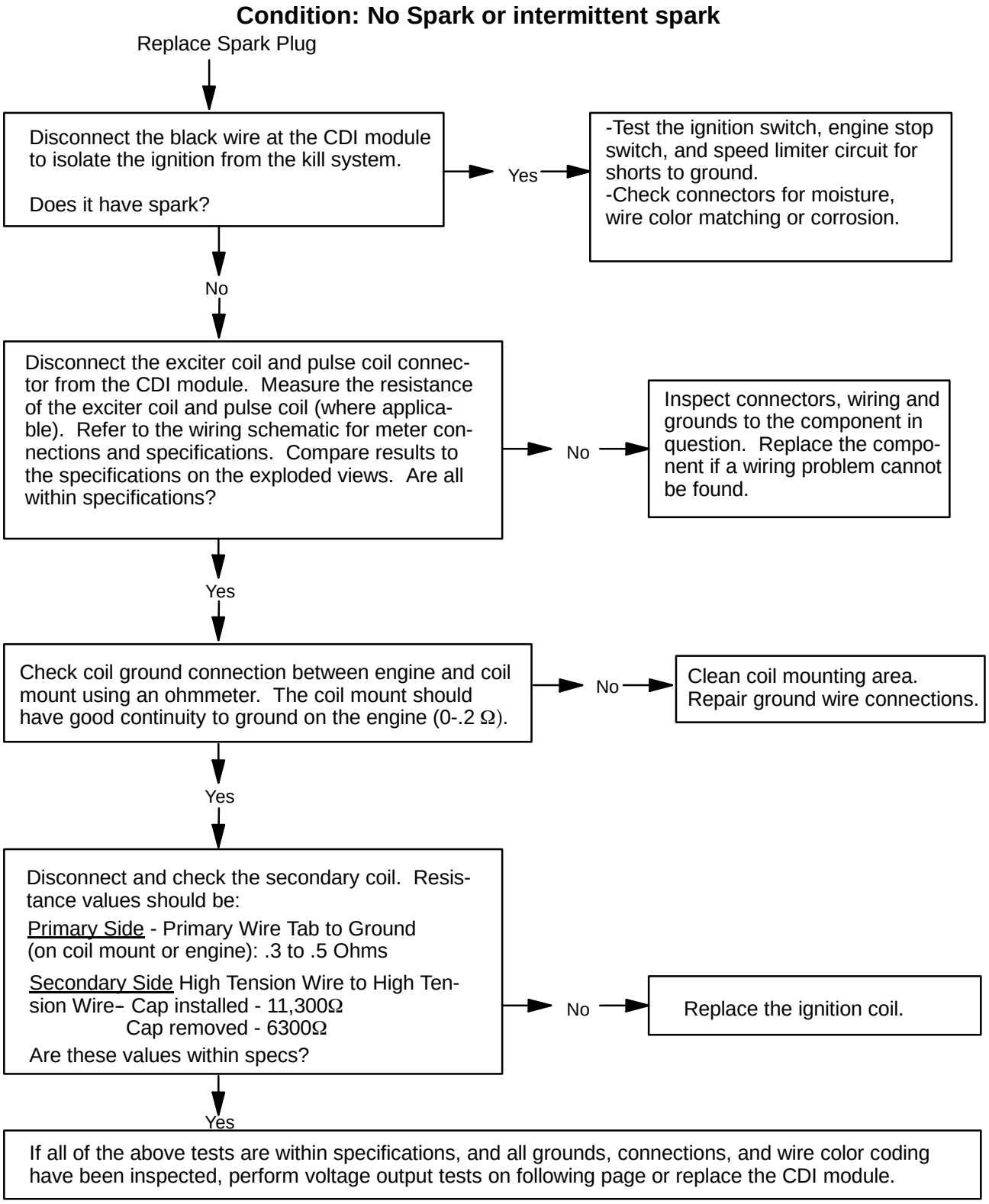
IGNITION SYSTEM TESTING FLOW CHART

Whenever troubleshooting an electrical problem, 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.



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IGNITION SYSTEM TROUBLESHOOTING

No Spark, Weak or Intermittent Spark

- 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
- Wire harness or connections wet, corroded
- 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
- Trigger coil air gap too wide (where applicable) - should be .016-.040″ (.4-1.0 mm)
- Excessive crankshaft runout on magneto (RH) end - should not exceed .0024″
- Faulty CDI module

CDI OUTPUT TEST USING PEAK READING ADAPTOR

Re-connect all CDI wires to stator wires. Disconnect CDI module wire from ignition coil primary terminal. Connect one meter lead to engine ground and the other to the ignition coil primary wire leading from the CDI module. Crank engine and check output of CDI wire to coil (130 DCV). Reconnect coil wire to CDI.

Output w/ Peak output tester
130 DCV
Average Output w/ Digital Voltmeter 20 DCV

CDI CRANKING OUTPUT TEST WITH PEAK READING VOLTMETER

The following peak voltage tests will measure the amount of output directly from each component. A peak reading voltmeter must be used to perform the tests. A variety of peak reading adaptors are commercially available for use with the Fluke ™ 77 Digital Multitester (**PV-43568**) and other digital VOMs which will allow peak voltage tests to be performed accurately. Follow the directions provided with the adaptor. All measurements are indicated in DC Volts. Readings obtained without a peak reading adaptor will be significantly different.

Disconnect the stator connectors from the CDI module. Test output from exciter coil, pulse (trigger) coil, and compare to the chart. The following measurements are obtained when cranking the engine with the electric starter, spark plug installed. The starter system must be in good condition and the battery fully charged.

250 Watt 4 Stroke

Coil	Connect Meter Wires To:	Reading (With Peak Reading Volt meter)
Exciter 1	Black/Red and Red	34 DCV
Pulse (Trigger)	White/Red and White	3.3 DCV

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.

Refer to Illustration 1 on the next page.

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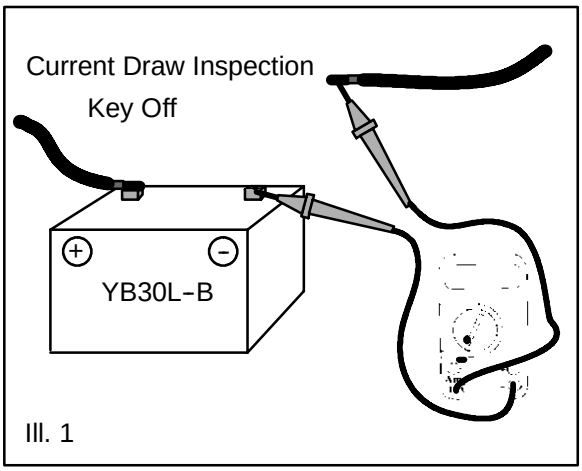

Ill. 1

Current Draw - Key Off:
Maximum of .01 DCA (10 mA)

CHARGING SYSTEM "BREAK EVEN" TEST

CAUTION: ***Do not allow the battery cable or ammeter to become disconnected with the engine running. Follow the steps below as outlined to reduce the chance of damage to electrical components.***

WARNING: Never start the engine with the ammeter connected in series. Damage to the meter or meter fuse will result. Do not run test for extended period of time. Do not run test with high amperage accessories.

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.

1. Connect a tachometer according to manufacturer's instructions.
2. With the negative cable still connected to the battery, connect one meter lead (set to DC amps) to the battery post and the other to the negative battery cable
3. With engine off and the key and kill switch in the ON position, the ammeter should read negative amps (battery discharge). Reverse meter leads if a positive reading is indicated.
4. Shift transmission into neutral and start the engine. *With the engine running at idle, disconnect the negative cable from the battery post without disturbing the meter leads.* 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 load off, the "break even" point should occur at approximately 1500 RPM or lower.
8. 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 OUTPUT TEST (AC AMP)

This test measures AC amperage from the alternator.

CAUTION: This test simulates a "full load" on the alternator at idle. Do not increase idle RPM or perform this test longer than required to obtain a reading. The alternator stator windings may overheat. 3-5 seconds is acceptable.

To Calculate Available Alternator Output

$$I = \frac{P}{E} \qquad \frac{200W}{12V} = 16.7 \text{ Amps} \qquad \frac{250W}{12V} = 20.8 \text{ Amps}$$

I = Current in Amps
P = Power in Watts
E = Electromotive Force (Volts)

1. Maximum alternator output will be indicated on the meter. DO NOT increase engine RPM above idle.
2. Place the red lead on the tester in the 10A jack.
3. Turn the selector dial to the AC amps (A) position.
4. Connect the meter leads to the Yellow and Yellow/Red wires leading from the alternator.
5. Start the engine and let it idle. Reading should be a minimum of 7A/AC at idle.

Alternator Current Output:
Minimum of 7 AC Amps at Idle

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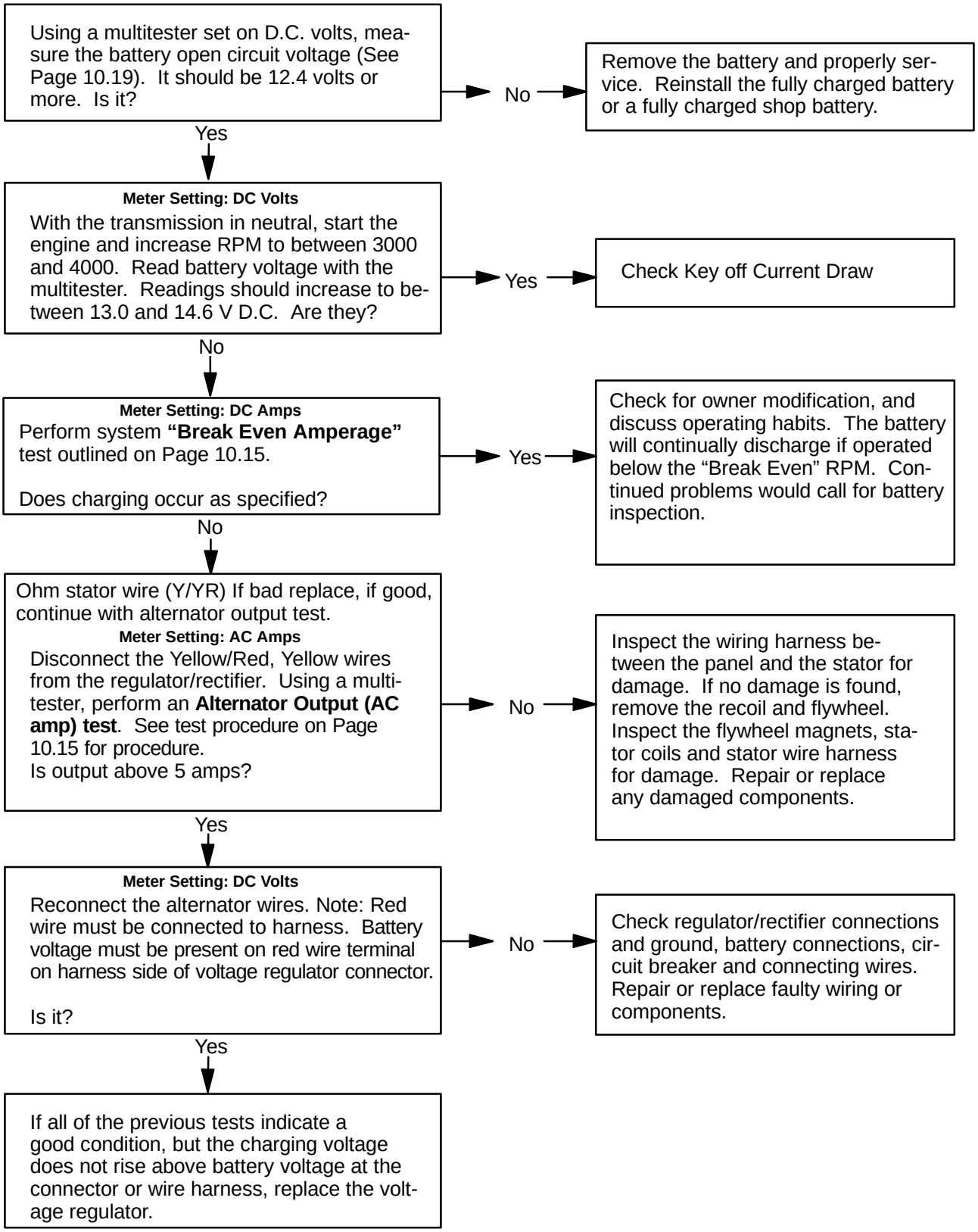
CHARGING SYSTEM TESTING FLOW CHART

Whenever charging system problems are suspected, proceed with the following system check.



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INITIAL BATTERY ACTIVATION

⚠WARNING

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

External: Flush with water.

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

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

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

WARNING: The gases given off by a battery are explosive. Any spark or open flame near a battery can cause an explosion which will spray battery acid on anyone close to it. If battery acid gets on anyone, wash the affected area with large quantities of cool water and seek immediate medical attention.

To ensure maximum service life and performance from a new battery, perform the following steps. **NOTE:** Do not service the battery unless it will be put into regular service within 30 days. After initial service, **add only distilled water** to the battery. Never add electrolyte after a battery has been in service.

NOTE: **New Battery:** Battery must be fully charged before use or battery life will be significantly reduced 10-30% of the battery's full potential.

To activate a new battery:

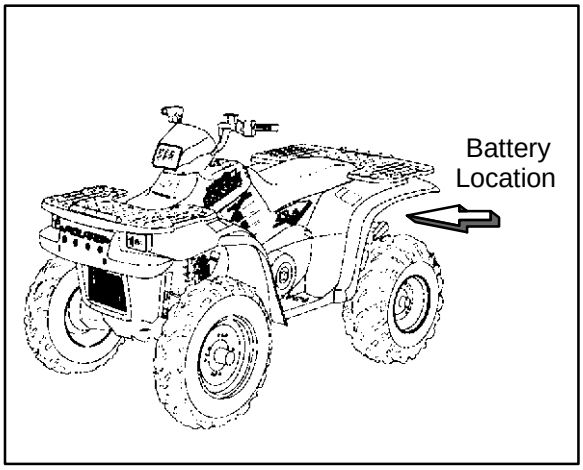
1. Remove vent plug from vent fitting. Remove cell caps.
2. Fill battery with electrolyte to upper level marks on case.
3. Set battery aside to allow for acid absorption and stabilization for 30 minutes.
4. Add electrolyte to bring level back to upper level mark on case. **NOTE:** This is the last time that electrolyte should be added. If the level becomes low after this point, add only distilled water.
5. Charge battery at 1/10 of its amp/hour rating. Examples: 1/10 of 9 amp battery = .9 amp; 1/10 of 14 amp battery = 1.4 amp; 1/10 of 18 amp battery = 1.8 amp (recommended charging rates).
6. Check specific gravity of each cell with a hydrometer to assure each has a reading of 1.270 or higher.

BATTERY TERMINALS/TERMINAL BOLTS

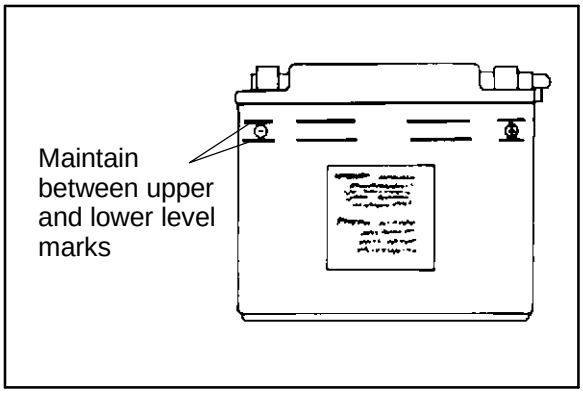
Use Polaris corrosion resistant Nyogel™ grease (**PN 2871329**) on battery bolts. See Battery Installation on Page 10.18.

BATTERY INSPECTION/REMOVAL

The battery is located under the left rear fender.



Inspect the battery fluid level. When the battery fluid nears the lower level, remove the battery and fill with distilled water to the upper level line. To remove the battery:



1. Disconnect holder strap and remove cover.

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2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

CAUTION

Whenever removing or reinstalling the battery, disconnect the negative (black) cable first and reinstall the negative cable last!

3. Remove the battery.
4. Remove the filler caps and add ***distilled water only*** as needed to bring each cell to the proper level. Do not overfill the battery.

Refill using only distilled water. Tap water contains minerals which are harmful to a battery.

Do not allow cleaning solution or tap water inside the battery. Battery life may be reduced.

5. Reinstall the battery caps.

BATTERY INSTALLATION

1. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse well with clean water and dry thoroughly.
2. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable. Coat terminals and bolt threads with Nyogel™ Grease **(PN 2871329)**.
3. Install clear battery vent tube from vehicle to battery vent. **WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and cause an explosion. The vent tube should be routed away from frame and body to prevent contact with electrolyte. Avoid skin contact with electrolyte, as severe burns could result. If electrolyte contacts the vehicle frame, corrosion will occur.
4. Route the cables correctly.
5. Reinstall the holder strap.

BATTERY TESTING

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.

Following are three tests which can easily be made on a battery to determine its condition: OCV Test, Specific Gravity Test and Load Test.

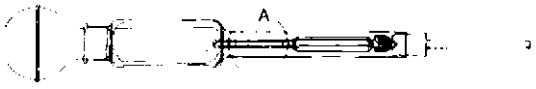
OCV - OPEN CIRCUIT VOLTAGE TEST

Battery voltage should be checked with a digital multitester. Readings of 12.6 volts or less require further battery testing and charging. See charts and Load Test on below.

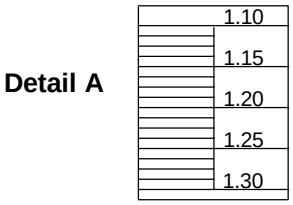
NOTE: Lead-acid batteries should be kept at or near a full charge as possible. Electrolyte level should be kept between the low and full marks. If the battery is stored or used in a partially charged condition, or with low electrolyte levels, hard crystal sulfation will form on the plates, reducing the efficiency and service life of the battery.

SPECIFIC GRAVITY TEST

A tool such as a Battery Hydrometer (**PN 2870836**) can be used to measure electrolyte strength or specific gravity. As the battery goes through the charge/discharge cycle, the electrolyte goes from a heavy (more acidic) state at full charge to a light (more water) state when discharged. The hydrometer can measure state of charge and differences between cells in a multi-cell battery. Readings of 1.270 or greater should be observed in a fully charged battery. Differences of more than .025 between the lowest and highest cell readings indicate a need to replace the battery.



Battery Hydrometer **(PN 2870836)**



OPEN CIRCUIT VOLTAGE		
State of charge	Conventional Lead-acid	YuMicron™ Type
100% Charged	12.60V	12.70V
75% Charged	12.40V	12.50V
50% Charged	12.10V	12.20V
25% Charged	11.90V	12.0V
0% Charged	less than 11.80V	less than 11.9V

Contiued on next page

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SPECIFIC GRAVITY		
State of charge*	Conventional lead-acid	YuMicron™ Type
100% Charged	1.265	1.275
75% Charged	1.210	1.225
50% Charged	1.160	1.175
25% Charged	1.120	1.135
0% Charged	less than 1.100	less than 1.115

* At 80°F

NOTE: Subtract .01 from the specific gravity reading at 40° F.

LOAD TEST

CAUTION: ***To prevent shock or component damage, remove spark plug high tension leads and connect securely to engine ground before proceeding.***

NOTE: This test can only be performed on machines with electric starters. This test cannot be performed with an engine or starting system that is not working properly.

A battery may indicate a full charge condition in the OCV test and the specific gravity test, but still may not have the storage capacity necessary to properly function in the electrical system. For this reason, a battery capacity or load test should be conducted whenever poor battery performance is encountered. To perform this test, hook a multitester to the battery in the same manner as was done in the OCV test. The reading should be 12.6 volts or greater. Engage the starter and observe the battery voltage while cranking the engine. Continue the test for 15 seconds. During cranking the observed voltage should not drop below 9.5 volts. If the beginning voltage is 12.6 volts or higher and the cranking voltage drops below 9.5 volts during the test, replace the battery.

OFF SEASON STORAGE

To prevent battery damage during extended periods of non-use, the following basic battery maintenance items must be performed:

- Remove the battery from the machine and wash the case and battery tray with a mild solution of baking soda and water. Rinse with lots of fresh water after cleaning. **NOTE:** Do not get any of the baking soda into the battery or the acid will be neutralized.
- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- Make sure that the electrolyte is at the proper level. Add distilled water if necessary.
- Charge at a rate no greater than 1/10 of the battery's amp/hr capacity until the electrolyte's specific gravity reaches 1.270 or greater.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

NOTE: Stored batteries lose their charge at the rate of 1% per day. Recharge to full capacity every 30 to 60 days during a non-use period. If the battery is stored during the winter months, electrolyte will freeze at higher temperatures as the battery discharges. The chart below indicates freezing points by specific gravity.

Electrolyte Freezing Points	
Specific Gravity of Electrolyte	Freezing Point
1.265	-75° F
1.225	-35° F
1.200	-17° F
1.150	+5° F
1.100	+18° F
1.050	+27° F

CHARGING PROCEDURE

1. Remove the battery from the ATV to prevent damage from leaking or spilled acid during charging.
2. Charge the battery with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the specific gravity to 1.270 or greater.
3. Install battery in vehicle with positive terminal toward the front. Coat threads of battery bolt with a corrosion resistant Nyogel™ grease.

Nyogel™ Grease

(PN 2871329)

4. Connect battery cables.

⚠ WARNING

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

5. After connecting the battery cables, install the cover on the battery and attach the hold down strap.

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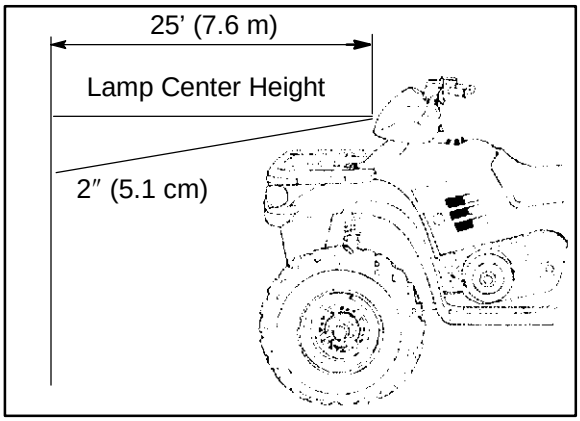
6. Install clear battery vent tube from vehicle to battery vent. **WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and cause an explosion. Vent should be routed away from frame and body to prevent contact with electrolyte. Avoid skin contact with electrolyte, as severe burns could result. If electrolyte contacts the vehicle frame, corrosion will occur.
7. Route cables so they are tucked away in front and behind battery.

HIGH BEAM HEADLIGHT ADJUSTMENT

The headlight beam can be adjusted to any position desired by turning the adjusting knob located on the bottom right side of the headlight pod.

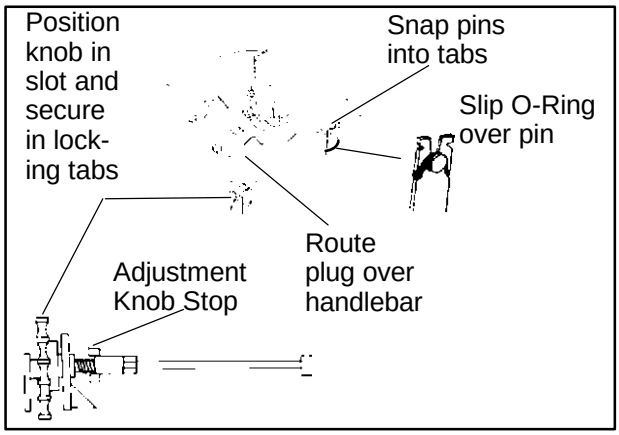
1. Place the vehicle on a level surface with the headlight approximately 25' (7.6 m) from a wall.



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. Adjust beam to desired position .

HIGH BEAM HEADLIGHT LAMP REPLACEMENT

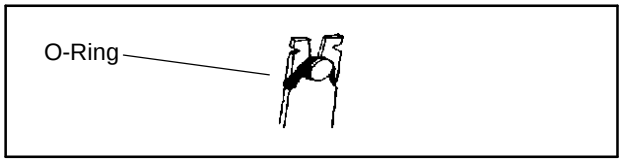
CAUTION: Do not service while headlight is hot. Serious burns may result. Protect lamp during install.



1. Remove three Phillips screws on the headlight pod.
2. Lift pod cover up.
3. Unplug headlamp from wiring harness.
4. Remove rubber shield from headlamp housing.
5. Push in and turn plastic retainer counter clockwise and remove.
6. Carefully remove headlamp bulb from housing.
7. Reverse procedure to install new headlamp bulb.

HEADLIGHT HOUSING REPLACEMENT

1. Remove three Phillips screws on the headlight pod.
2. Lift pod cover up. Unplug speedometer from harness. Unplug indicator lights from harness and remove pod cover.
3. Unplug headlamp from wiring harness.
4. Remove O-Ring from headlight pivot pins.



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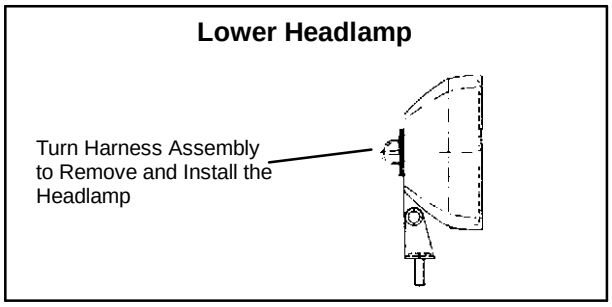
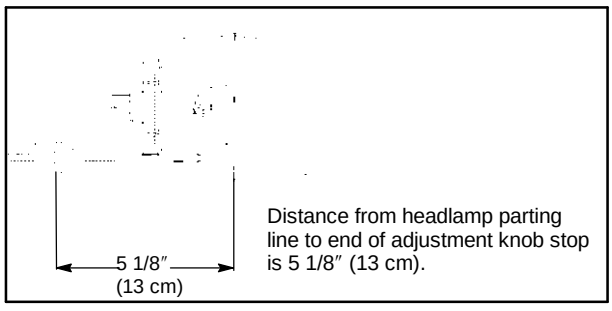
LOWER HEADLAMP REMOVAL/INSTALLATION



1. Turn the back of the headlight harness in a clockwise direction.
2. Pull the harness assembly out from the headlight assembly.
3. Remove the headlamp and replace with a new headlamp.
4. Install the new headlamp and harness assembly into the headlight assembly. Turn the headlight harness counterclockwise to secure the headlamp into place.

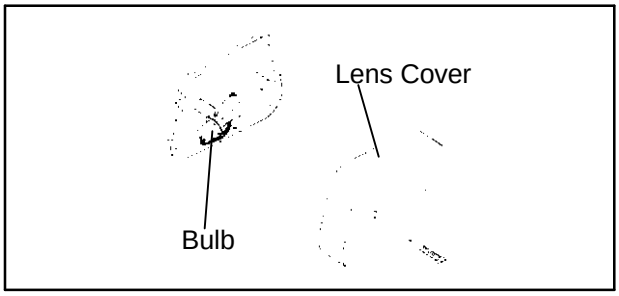
HEADLIGHT HOUSING REPLACMENT CONT'D

5. Pull headlight housing up to release from locking tabs.
6. Lift adjusting knob up to remove from locking tabs.
7. Carefully pull assembly up and out of pod.
8. Reverse steps to install new housing and reassemble pod.
9. Adjust headlight aim by turning adjusting knob.



TAILLIGHT/BRAKELIGHT LAMP REPLACEMENT

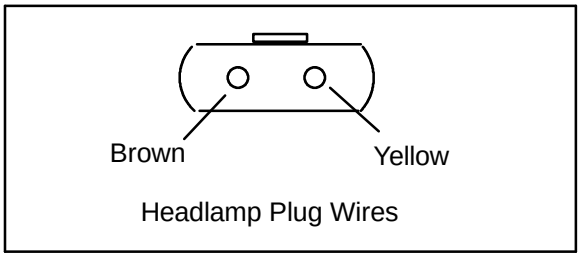
If the taillight/brakelight does not work the lamp may need to be replaced.



1. From the rear of the taillight remove two screws holding lens cover in place and remove lens cover.
2. Remove lamp and replace it with recommended lamp. Apply Nyogel™ Grease **(PN 2871329)**.
3. Reinstall the lens cover removed in step 1.
4. Test the taillight/brakelight to see it is working.

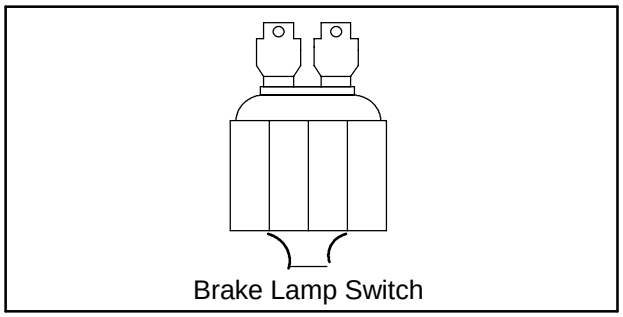
HEADLAMP SWITCH

Remove the headlight pod cover. Probe the headlamp plug wires (Brown and Yellow) at back of connector. Turn headlight on.



BRAKE LIGHT SWITCH

1. Remove the front cover.



2. Disconnect wire harness from switch.
3. Connect an ohmmeter across switch contacts. Reading should be infinite (∞).
4. Apply brake at handlebar lever and check for continuity between switch contacts. Replace

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switch if there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure.

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 starter solenoid or starter motor.
- Engine problem - seized or binding (Can engine be rotated easily with recoil starter?)

Starter Motor Turns Over Slowly

- Battery discharged - low specific gravity
- Excessive circuit resistance - poor connections (see Voltage Drop Test below)
- 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
- Faulty starter drive gears or starter motor gear
- Faulty flywheel gear or loose flywheel

VOLTAGE DROP TEST

The Voltage Drop Test is used to test for bad connections. When performing the test, you are testing the amount of voltage drop through the connection. A poor or corroded connection will appear as a high voltage reading. Voltage shown on the meter when testing connections should not exceed .1 VDC per connection or component.

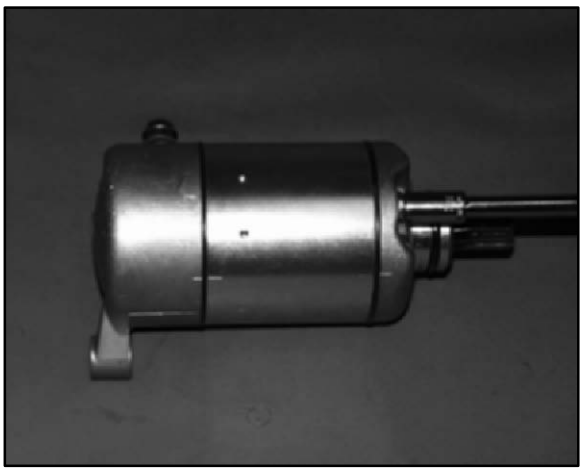
To perform the test, place the meter on DC volts and place the meter leads across the connection to be tested. Refer to the chart on 10.27 to perform voltage drop tests on the starter system.

Voltage should not exceed .1 DC volts per connection

STARTER MOTOR DISASSEMBLY

NOTE: Use only electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

1. Note the alignment marks on both ends of the starter motor casing. These marks must align during reassembly.



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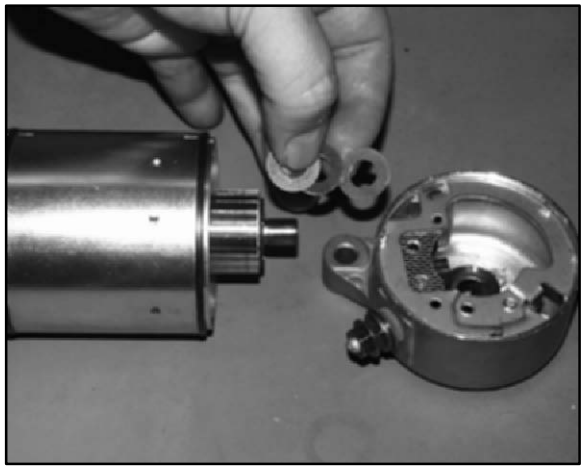
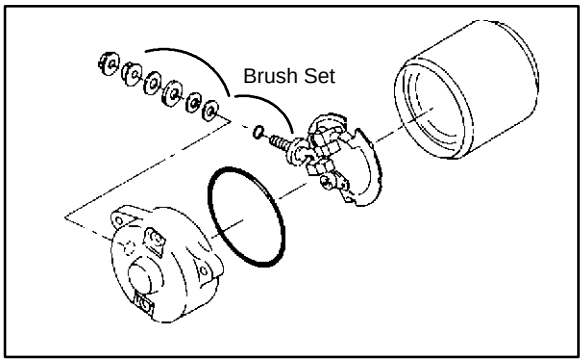
2. Remove the two bolts, washers, and sealing O-Rings. Inspect O-Rings and replace if damaged.

3. Remove brush terminal end of housing while holding other two sections together.

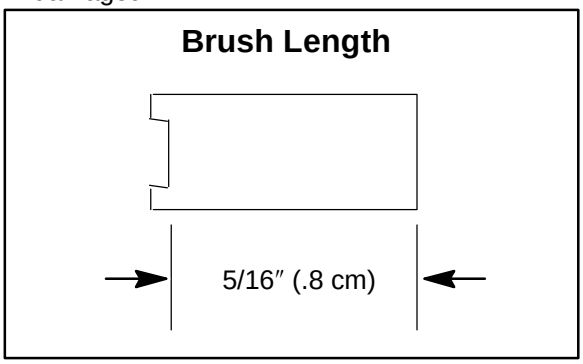


4. Remove shims from armature shaft. **NOTE:** All shims must be replaced during reassembly.

BRUSH INSPECTION/REPLACEMENT



1. Using a digital multitester, measure the resistance between the cable terminal and the insulated brush. The reading should be .3 ohms or less. Measure the resistance between the cable terminal and brush housing. Make sure the brush is not touching the case. The reading should be infinite.
2. Remove nut, flat washer, large phenolic washer, two small phenolic washers, and O-Ring from brush terminal. Inspect the O-Ring and replace if damaged.



Brush Length Service Limit: 5/16″ (.8 cm)

3. Remove brush plate and brushes. Measure length of brushes and replace if worn past the service limit. Replace springs if they are discolored or have inadequate tension.
4. Inspect surface of commutator for wear or discoloration. See Steps 3-6 of armature testing on Page 10.24.

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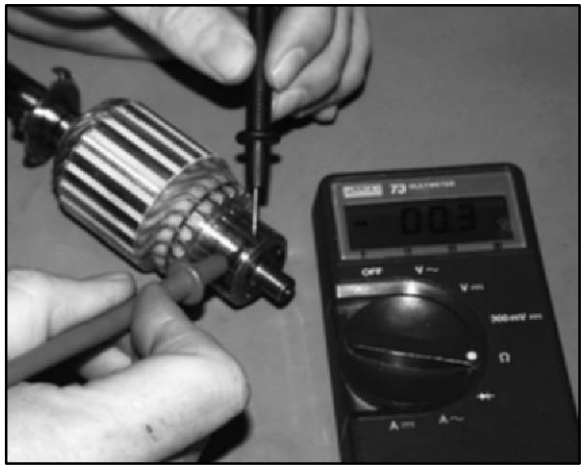
5. Install a new carbon brush assembly in the brush housing. **NOTE:** Be sure that the terminal bolt insulating washer is properly seated in the housing, and the tab on the brush plate engages the notch in the brush plate housing.
6. Place a wrap of electrical tape on the threads of the terminal bolt to prevent O-Ring damage during reinstallation.
7. Install the O-Ring over the bolt. Make sure the O-ring is fully seated.

8. Remove the electrical tape and reinstall the two small phenolic washers, the large phenolic washer, flat washer, and nut.

ARMATURE TESTING

1. Remove armature from starter casing. Note order of shims on drive end for reassembly.
2. Inspect surface of commutator. Replace if excessively worn or damaged.



3. Using a digital multitester, measure the resistance between each of the commutator segments. The reading should be .3 ohms or less.

4. Measure the resistance between each commutator segment and the armature shaft. The reading should be infinite (no continuity).
5. Check commutator bars for discoloration. Bars discolored in pairs indicate shorted coils, requiring replacement of the starter motor.
6. Place armature in a growler. Turn growler on and position a hacksaw blade or feeler gauge lengthwise 1/8″ (.3 cm) above armature coil laminates. Rotate armature 360°. If hacksaw blade is drawn to armature on any pole, the armature is shorted and must be replaced.

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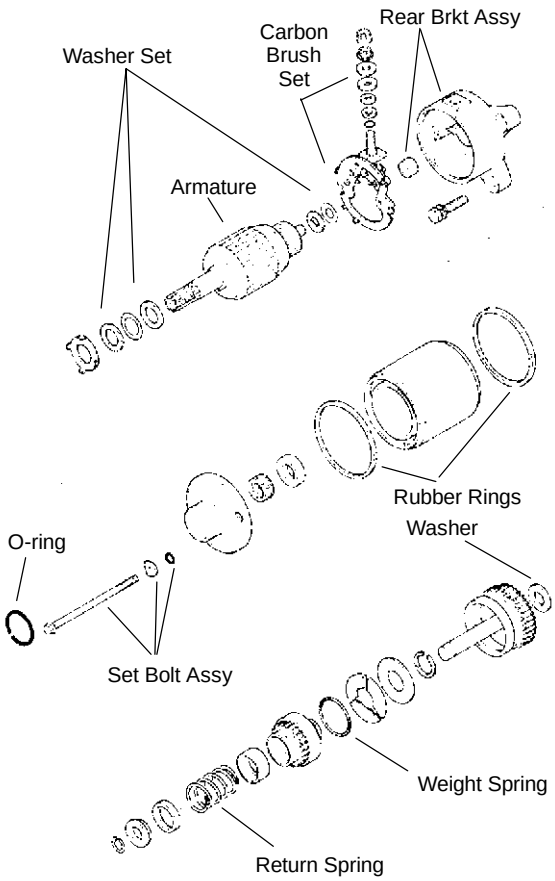
STARTER ASSEMBLY

1. Place armature in field magnet casing.
2. 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.
3. 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.
4. Install O-Ring on other end of field magnet casing. Make sure it is in good condition and not twisted on the case.
5. Align casing marks and install housing, pushing back brushes while installing shaft in bushing.
6. Reinstall starter motor housing bolts. Make sure O-Rings are in good condition and seated in groove.
7. Inspect permanent magnets in starter housing. Make sure they are not cracked or separated from housing.

CAUTION: Use care when handling starter housing. Do not drop or strike the housing as magnet damage is possible. If magnets are damaged, starter must be replaced.

Starter Motor Exploded View



STARTER DRIVE

Pinion Gear - Anti Kick-out Shoe, Garter Spring Replacement

If the garter spring is damaged, the overrun clutch may fail to return properly. The replacement spring is **(PN 7042039)**. Use either of the following methods to remove and install a new garter spring.

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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.

With the tester on the VDC position, place the tester's black lead on the battery negative and the red lead on the battery positive.

Reading should be 12.4 V D. C. or greater.

→ No → Remove battery and properly service. Install fully charged shop battery to continue test.

Yes

Disconnect White/Red engagement coil wire from the starter solenoid. Connect tester black wire to battery ground. Connect red tester lead to White/Red harness wire at solenoid. Turn on ignition switch and depress the starter button. Tester should read battery voltage.

→ No → Check voltage on both sides of circuit breaker, ignition switch/engine stop switch and starter button. The voltage on both sides should be the same. **NOTE:** The ignition switch and engine stop switch must be on and the key switch turned to "Start". Replace the defective component.

Yes → Test starter solenoid coil by connecting an ohmmeter between the solenoid red wire and the solenoid mounting plate. Resistance should be 3.4Ω. Check solenoid ground path by measuring resistance between mounting plate and battery negative terminal (-).

Voltage Drop Testing

See Page 10.23 for instructions.

Reconnect the solenoid. Connect the tester black lead to the battery positive and the red lead to the solenoid end of the battery-to-solenoid wire. Depress starter button. Reading should be less than .1 V D.C.

→ No → Clean the battery-to-solenoid cable ends or replace the cable.

Yes

Connect the black tester lead to solenoid end of battery-to-solenoid cable. Connect red tester lead to solenoid end of solenoid-to-starter cable. Depress starter button. Reading should be less than .1 V D.C.

→ No → Replace the starter solenoid.

Yes

Connect the black tester lead to the solenoid end of the solenoid-to-starter cable. Connect the red tester lead to the starter end of the same cable. Depress the starter button. The reading should be less than .1 V D.C.

→ No → Clean the solenoid-to-starter cable ends or replace the cable.

Yes

If all of these indicate a good condition, yet the starter still fails to turn, the starter must be removed for static testing and inspection.

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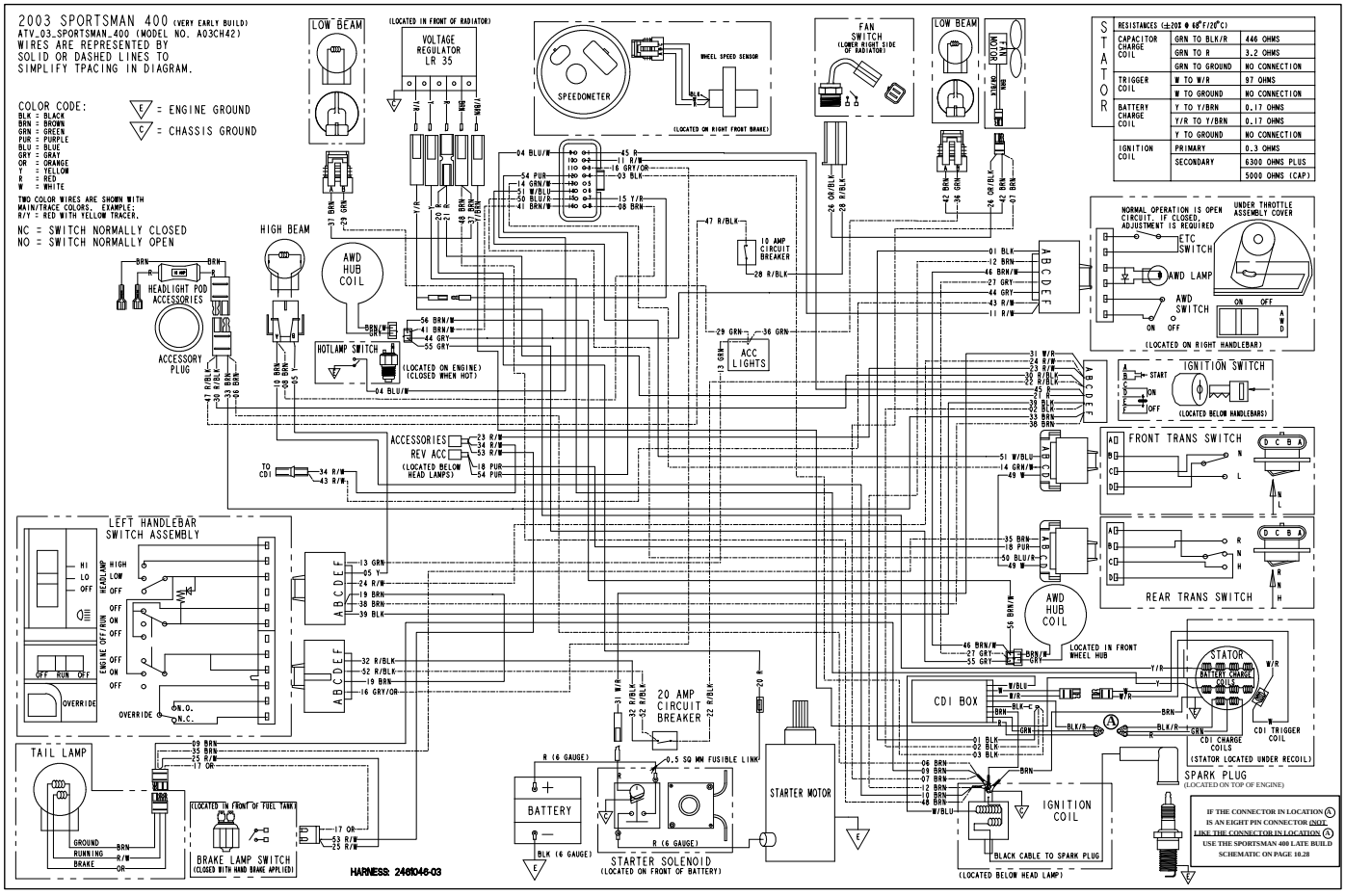

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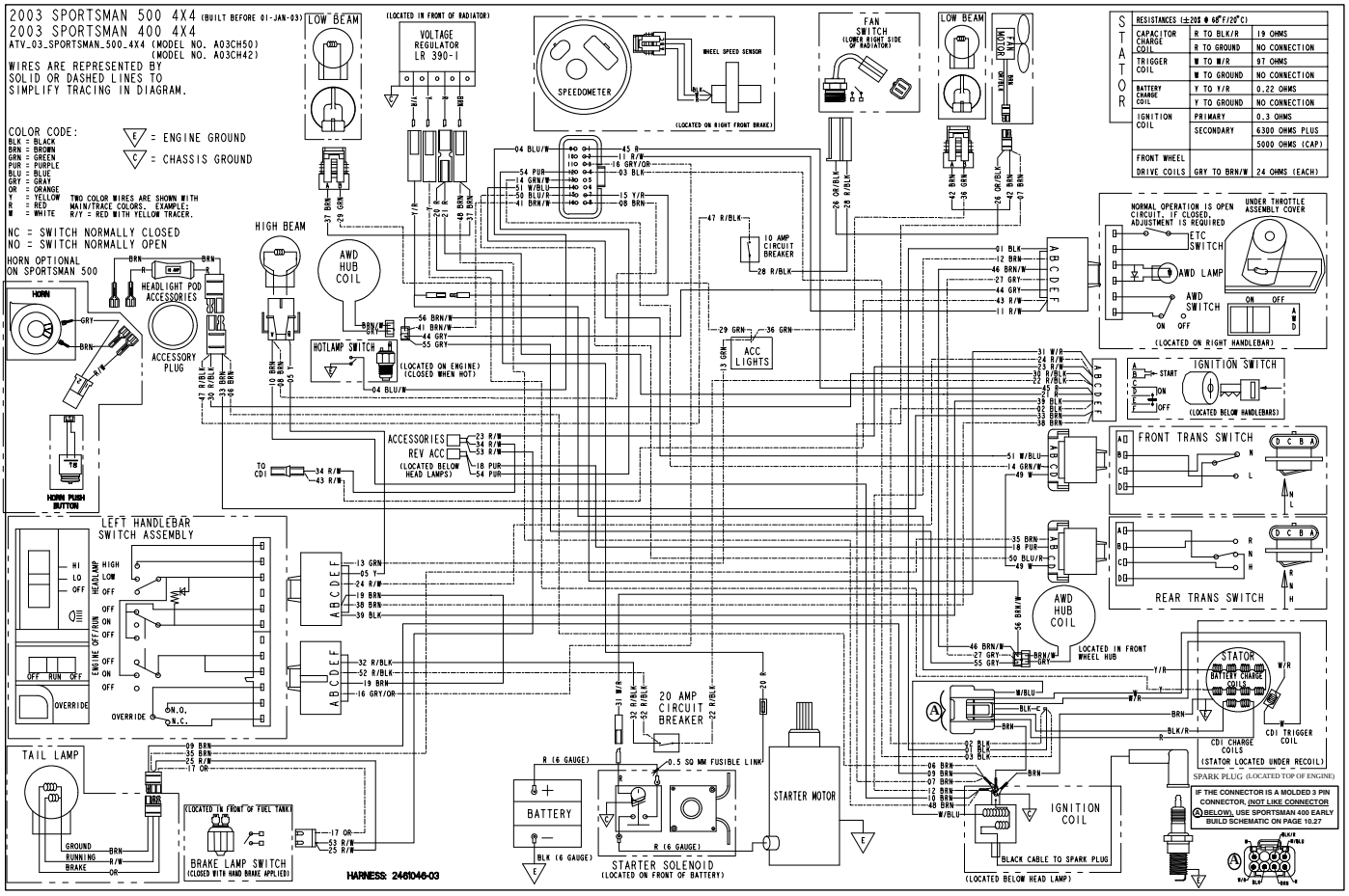
WIRING DIAGRAM 2003 SPORTSMAN 400 (LATE BUILD) / 500



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