



POLARIS
The Way Out.



2004 *RANGER* SERVICE MANUAL

Foreword

This manual is designed primarily for use by Polaris *RANGER* 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 2004 Polaris *RANGER*. 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.

2004 *RANGER* Service Manual (PN 9918796)

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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
Loctite, Registered Trademark of the Loctite Corporation
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CHAPTER 1

GENERAL

Specs

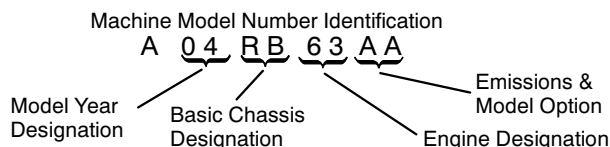
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MODEL IDENTIFICATION

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



Engine Designation Number

42 EH63PFE010 Twin, Air-cooled, OHV 4 Stroke, Electric Start

50 EH42PLE06 Single, L/C, SOHC 4 Stroke, Electric Start

EH50PLE16 Single, L/C, SOHC 4 Stroke, Electric Start

VIN Identification

World Mfg. ID			Vehicle Description							Vehicle Identifier						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
4	X	A	R	F	5	0	A	*	4	P	0	0	0	0	0	0
			Body Style	Powertrain	Engine	Emissions	Check Digit	Model Year	Plant No.	Individual Serial No.						

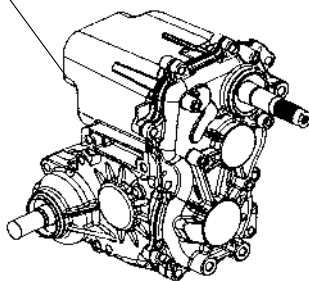
* This could be either a number or a letter

ENGINE SERIAL NUMBER LOCATION

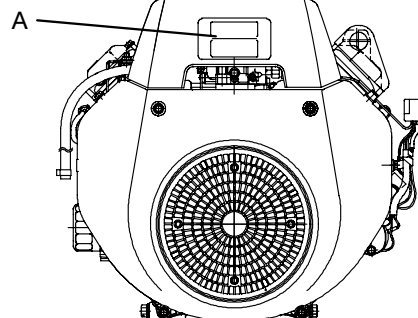
Whenever corresponding about an engine, be sure to refer to the engine model number and serial number. This information can be found on the sticker applied to the flywheel housing on the right side of engine (A).

TRANSMISSION I.D. NUMBER LOCATION

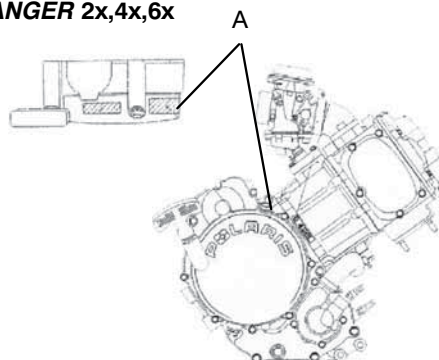
The transmission I.D. number is located on the right side of machine.



RANGER TM



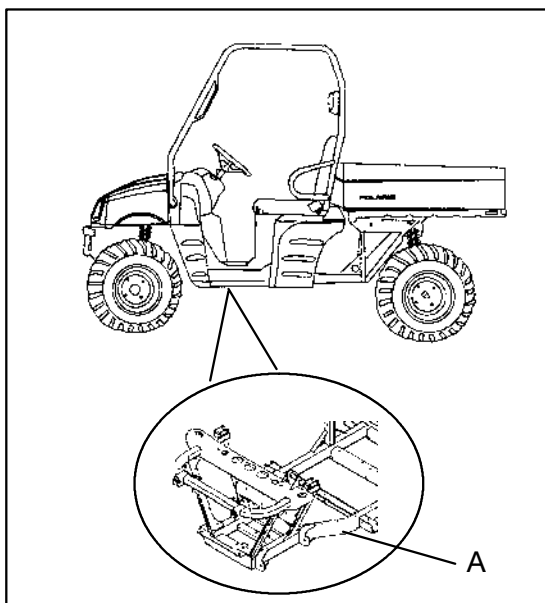
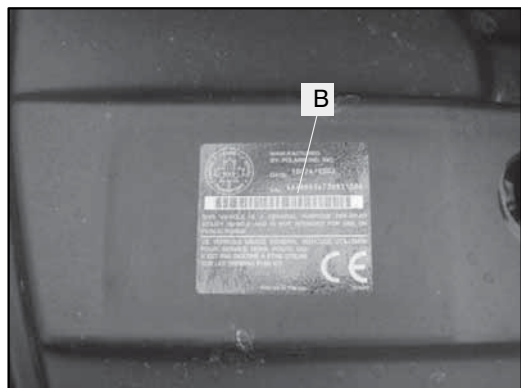
RANGER 2x,4x,6x





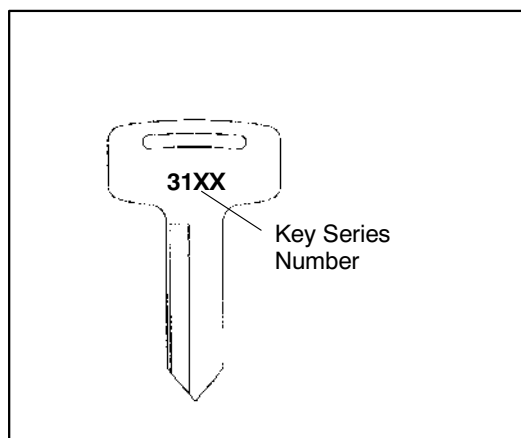
MACHINE MODEL NUMBER AND SERIAL NUMBER LOCATION

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



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.



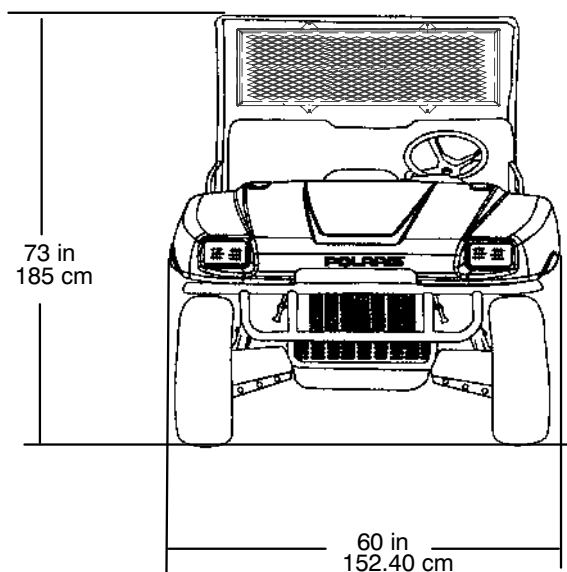
Series #	Part Number
20	4010278
21	4010278
22	4010321
23	4010321
27	4010321
28	4010321
31	4110141
32	4110148
67	4010278
68	4010278



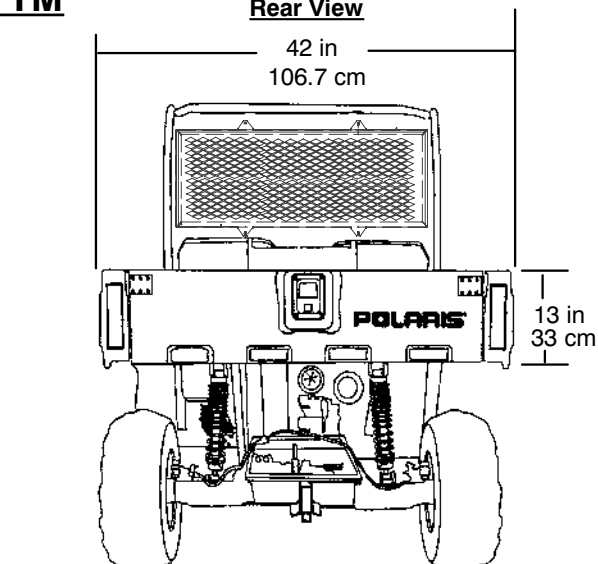


MACHINE DIMENSIONS *RANGER*™

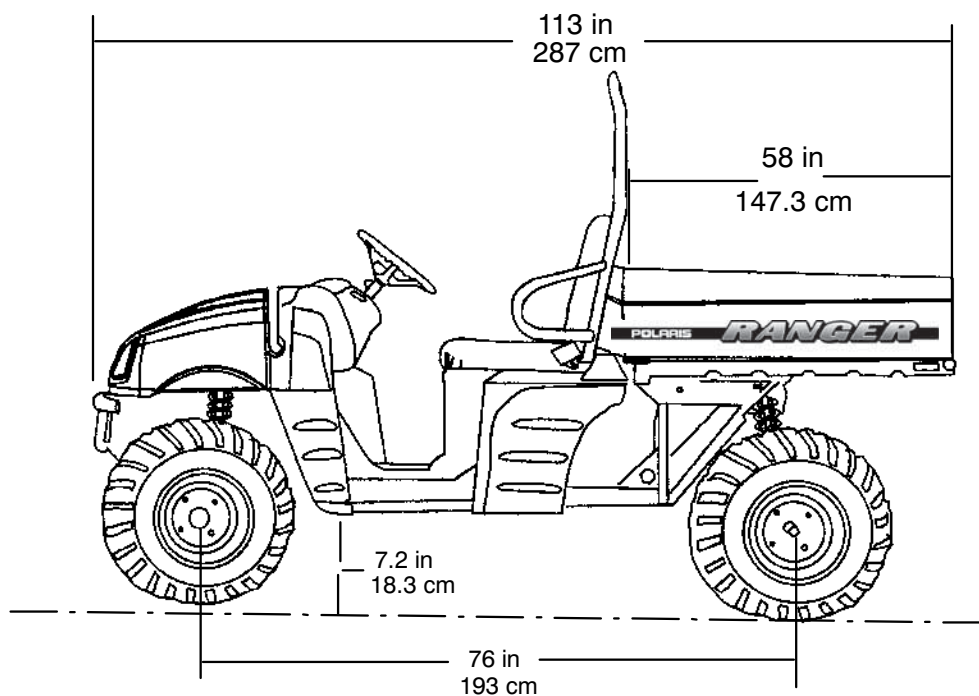
Front View



Rear View

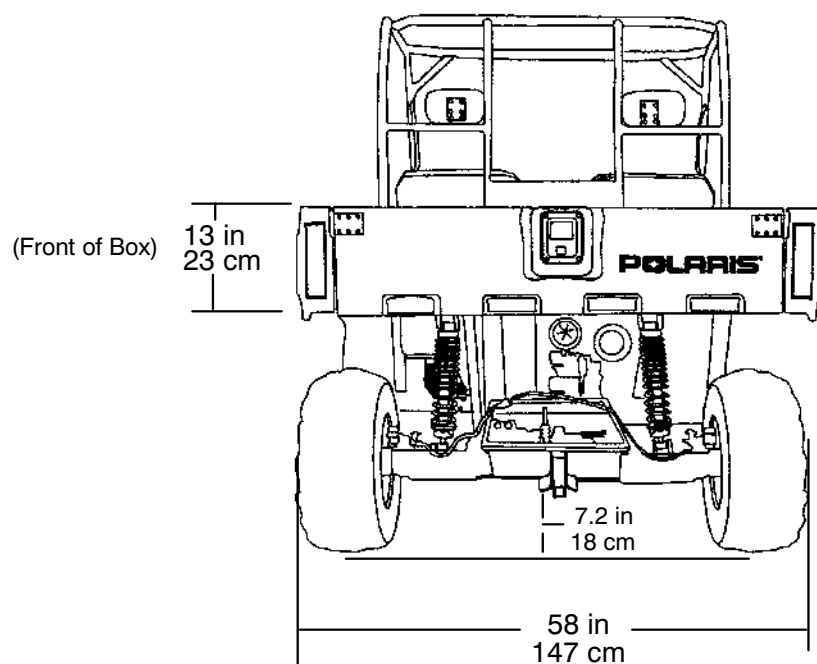
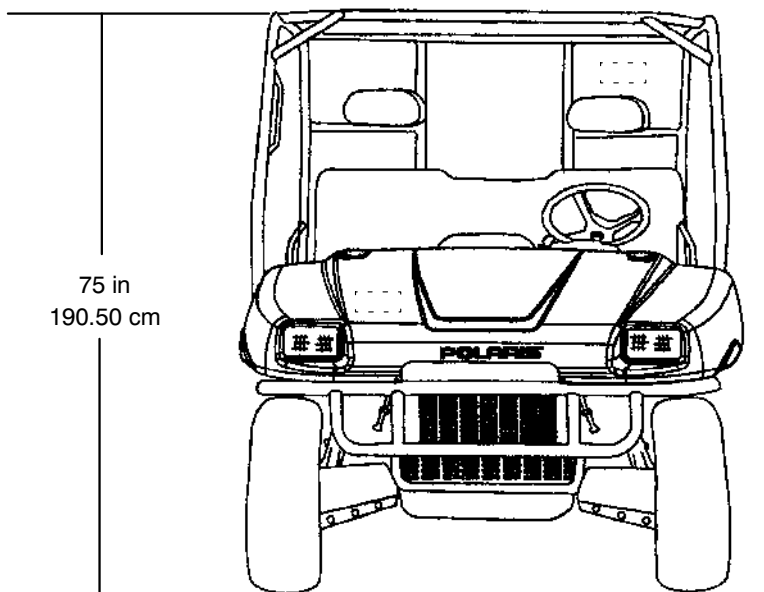


Side View



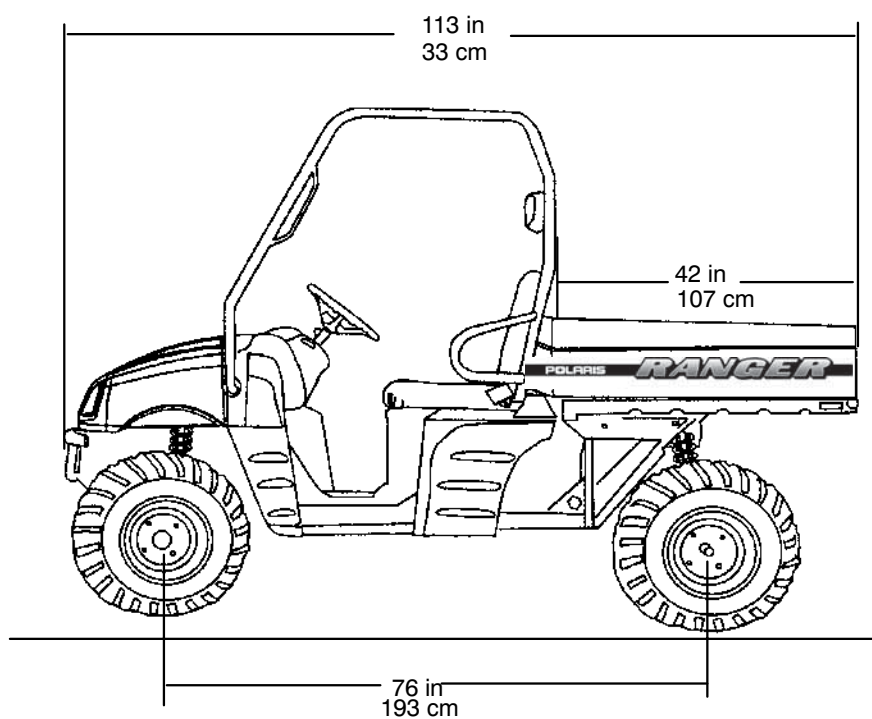
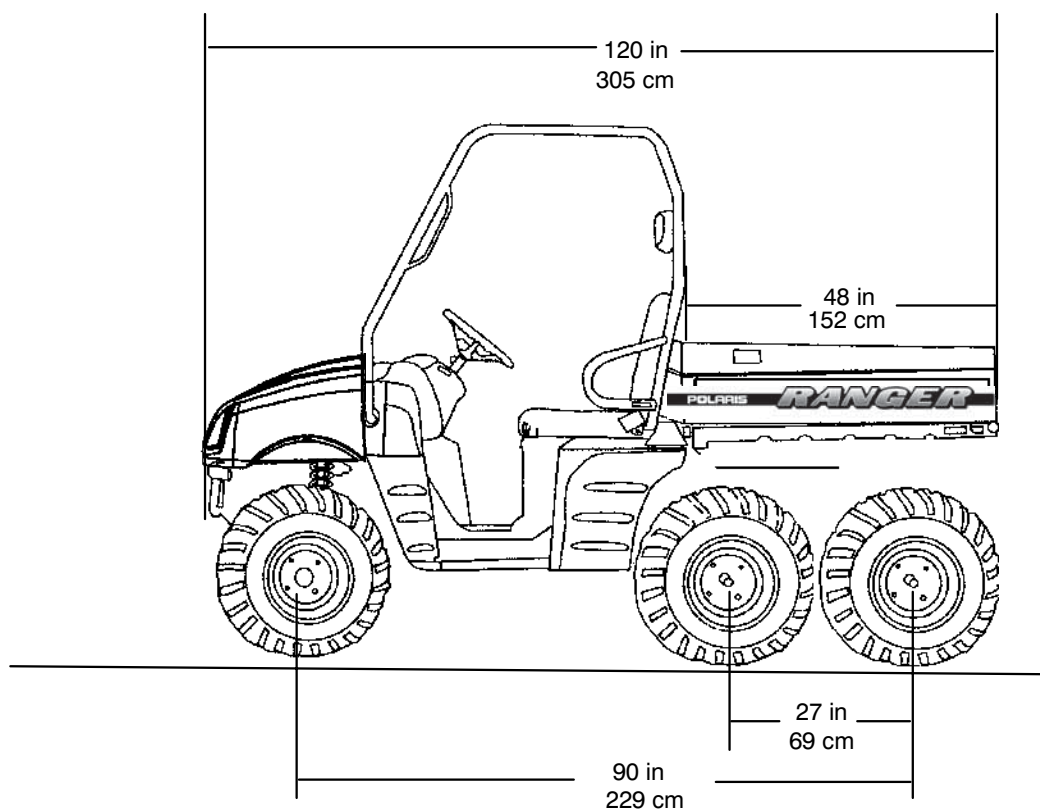


MACHINE DIMENSIONS RANGER 2X,4X,6X



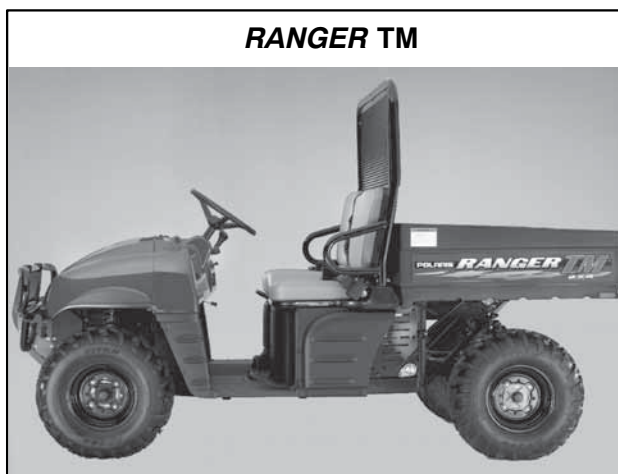


MACHINE DIMENSIONS RANGER 2X,4X,6X



**MODEL: 2004 *RANGER* TM****MODEL NUMBER: . A04RB63AA****ENGINE MODEL: .. EH65DA70**

Category	Dimension / Capacity
Length	113 in./287 cm
Width	60 in./152.4 cm
Height	73 in./185 cm
Wheel Base	76 in./193 cm
Turning Radius	76 in./193 cm
Ground Clearance	7.2 in./183 cm
Dry Weight	1050 lbs./476 kg
Gross Vehicle Weight	2400 Lbs. / 1089 kg
Cargo Box Capacity	750 lbs./340 kg
Vehicle Payload	1250 lbs./567.5 kg (Includes one driver, 2 passengers)
Hitch Towing Capacity	1000 lbs./454 kg
Hitch Tongue Capacity	100 lbs./45.4 kg (Rear box capacity and tongue weight not to exceed 250 lbs/113 kg)

**MODEL: 2004 *RANGER* 2x4****MODEL NUMBER: . A04RB42AA****ENGINE MODEL: .. EH42PLE083**

Category	Dimension / Capacity
Length	113 in./287 cm
Width	60 in./152.4 cm
Height	75 in./190.50 cm
Wheel Base	76 in./193 cm
Ground Clearance	7.2 in./18.25 cm
Dry Weight	1105 lbs./412 kg
Gross Vehicle Weight	2500 Lbs. / 1135 kg
Cargo Box Capacity	850 lbs./385 kg
Vehicle Payload	1500 lbs./681 kg (Includes one driver, 2 passengers)
Hitch Towing Capacity	1400 lbs./523 kg
Hitch Tongue Capacity	150 lbs./68.1 kg (Rear box capacity and tongue weight not to exceed 250 lbs/113 kg)





MODEL: 2004 *RANGER 4X4*

MODEL NUMBER: . A04RB63AA

ENGINE MODEL: .. EH65DA70

Category	Dimension / Capacity
Length	113 in./287 cm
Width	60 in./152.4 cm
Height	75 in./190.50 cm
Wheel Base	76 in./193 cm
Ground Clearance	7.2 in./18.25 cm
Dry Weight	1185 lbs./537 kg
Gross Vehicle Weight	2700 Lbs. / 1226 kg
Cargo Box Capacity	1000 lbs./454 kg
Vehicle Payload	1500 lbs./681 kg (Includes one driver, 2 passengers)
Hitch Towing Capacity	1500 lbs./681 kg
Hitch Tongue Capacity	150 lbs./68.1 kg (Rear box capacity and tongue weight not to exceed 250 lbs/113 kg)

RANGER 4x4



MODEL: 2004 *RANGER 6X6*

MODEL NUMBER: . A04RF50AA

ENGINE MODEL: .. EH50PLE164

Category	Dimension / Capacity
Length	120 in./305 cm
Width	60 in./152.4 cm
Height	51 in./130 cm
Wheel Base	90 in./229 cm
Ground Clearance	7.2 in./18.25 cm
Dry Weight	1410 lbs./526 kg
Gross Vehicle Weight	2900 Lbs. / 1315 kg
Cargo Box Capacity	1000 lbs./454 kg
Vehicle Payload	1500 lbs./681 kg (Includes one driver, 2 passengers)
Towing Capacity	1500 lbs./681 kg
Hitch Tongue Capacity	150 lbs./68.1 kg (Rear box capacity and tongue weight not to exceed 250 lbs/113 kg)

RANGER 6x6





GENERAL INFORMATION

MODEL: **RANGER TM**

MODEL NUMBER: . **A04RB63AA**

ENGINE MODEL: .. **EH63PFE010**

Engine	
Platform	Robin V-Twin, OHV 4 stroke
Engine Model Number	EH63PFE010
Engine Displacement	653cc
Number of Cylinders	2
Bore & Stroke (mm)	80 x 65 mm
Compression Ratio	8.3:1
Engine Idle Speed	1000 ± 100 RPM
Valve Clearance Int./Exh.	0.1 ± 0.015 mm
Thermostat Opening Temperature	N/A
Oil Pressure Warning	Dash Light
Lubrication	Pressurized Wet Sump
Oil Requirements	0W-40
Oil Capacity	1.64 qts. / 1.55L
Exhaust System	2 to 1 canister style
Carburetion	
Carburetor model	27 mm Nikki Down Draft Type (I.D.-610027-861)
Main Jet	132
Pilot (Slow) Jet	60
Jet Needle	N/A
Needle Jet	N/A
Air Screw	0.75 Turns Out (Initial starting point, settings may vary)
Fuel Delivery	Gravity Fuel Pump
Fuel Requirement	87 Octane (minimum)
Fuel Capacity	8.5 gal. / 37.9 L
Electrical	
Alternator Max Output	360 watts @ 3600 RPM
Lights : Main Headlights	Dual Beam 35 watts / 35 watts
Tail	5 watts
Brake	5 watts
Indicator Panel Lights	1 watt (ea.)
Ignition System	Electric Start
Max RPM	3600
Ignition Timing	26.5° ± 2° BTDC @ 3600 RPM
Ignition Coil Clearance	0.3 - 0.5 mm
Spark plug / Gap	NGK BPR5ES/ .035 in./ 0.9 mm
Battery / Model / Amp Hr	Maintenance-Free 30 Amp/12Volt
Circuit Breakers	Harness 20 amp
Starting	Electric - Standard
Instrument Panel Type	Indicator Lights/Hour Meter

Drivetrain	
Transmission Type	Dual Sensing Automatic PVT
Gear Ratio :	High Rev. 4.71:1 6.84:1
Final Drive Ratio	3.70:1
Shift Type	In Line EZ Shift Hi/Low/Reverse
Trans. Oil Requirements	Polaris Gear Drive Fluid
Belt	3211093
Drive Belt Deflection	1.125" / 28.57 mm
Center Distance	14.5" / 368 mm
Clutch Offset	0.5" / 12.7 mm
Springs and Clutches	See Chart on Previous Page
Steering / Suspension	
Front Suspension	MacPherson Strut
Front Travel	4.6 in. / 12 cm
Rear Suspension	Swing Arm w/ Dual Shocks
Rear Travel	4.25 in. / 11 cm
Ground Clearance	5.5 in. / 14 cm
Shock Preload Adjustment Front / Rear	Cam Adjustment 2-2" Twin Tubes
Turning Radius	132 in. / 335.3 cm
Toe Out	1/8-1/4 in. / 3-6.35 mm
Wheels / Brakes	
Wheel Size - Front	25x10-12
Wheel Size - Rear	25x11-12
Recommended Air Pressure F / R	6-10 psi Front 6-10 psi Rear
Brake - Front	Dual Hydraulic Disc
Brake - Rear	Dual Hydraulic Disc
Parking Brake	Foot Actuated (Mechanical)
Brake Fluid	DOT 3 or DOT 4

JETTING CHART

Altitude		AMBIENT TEMPERATURE	
		Below 40°F Below 5°C	+40°F to +80°F +5°C to +28°C
Meters (Feet)	0-1500 (0-5000)	132 (3088426)	132 (3088426)
	above 1500 (above 5000)	124 (3088823)	124 (3088823)

CLUTCH CHART

All Applications	Shift Weight	Drive Spring	Driven Spring
	208 grams (3234176)	Black/Grn (3234184)	Pur/Yel (3234186)

NOTE: The **RANGER TM** contains a different style clutch than the other **RANGER** models. The clutches use the same springs and weights for high elevation.



POLARIS

GENERAL INFORMATION



MODEL: **RANGER 2X4**

MODEL NUMBER: . **A04RB42AA**

ENGINE MODEL: .. **EH42PLE083**

Engine	
Platform	Fuji 4 stroke, Single Cylinder
Engine Model Number	EH42PLE083
Engine Displacement	425cc
Number of Cylinders	1
Bore & Stroke (mm)	87.9 x 70 mm
Compression Ratio	9.2:1
Compression Pressure	70-90 psi
Engine Idle Speed	1200 ± 200 RPM
Valve Clearance Int./Exh.	0.006mm (.006 in.)
Engine Hot Light	Dash Light
Lubrication	Pressurized Dry Sump
Oil Requirements	0W-40
Oil Capacity	2 qts. / 2.1 L
Coolant Capacity	2.25 qts. / 2.4 L
Exhaust System	2 to 1 canister style
Carburetion	
Carburetor model	Mikuni BST 34 CV
Main Jet	135
Pilot Jet	42.5
Jet Needle	4LC38-3
Needle Jet	P-6 (829)
Pilot Screw	2.25 Turns Out (Initial starting point, settings may vary)
Pilot Air Jet	160
Float Height	13 ± 1 mm (0.51 ± 0.40")
Fuel Delivery	Electric Fuel Pump
Fuel Capacity / Requirement	8.5 gal. (32.2 L) 87 Octane (minimum)
Electrical	
Alternator Max Output	250 watts @ 5000 RPM
Lights : Main Headlights	Dual Beam 35 watts / 35 watts
Tail	5 watts
Brake	5 watts
Indicator Panel Lights	1 watt (ea.)
CDI Marking	CU2570
Ignition System	Electric Start (Kokusan)
RPM Limit	6600 RPM
Ignition Timing	30° ± 2° BTDC @ 5000 RPM
Spark plug / Gap	NGK BKR5E/ .036 in./ 0.9 mm
Battery / Model / Amp Hr	Yuasa YB30L-B/ 30 AmpHr./12Volt
Circuit Breakers	Harness 20 amp
Instrument Panel Type	Indicator Lights/Hour Meter
DC Outlet	Standard

Drivetrain	
Transmission Type	Dual Sensing Automatic PVT
Gear Ratio :	High Low Rev.
	3.81:1 8.66:1 5.91:1
Final Drive Ratio	3.70:1
Shift Type	In Line EZ Shift Hi/Low/Reverse
Trans. Oil Requirements	Polaris AGL Gearcase Lube
Belt	3211094
Drive Belt Deflection	1.125" / 28.57 mm
Center Distance	10" / 254.5 mm
Clutch Offset	0.5" / 12.7 mm
Springs and Weights	See Below
Steering / Suspension	
Front Suspension	MacPherson Strut
Front Travel	6.7 in. / 170 mm
Rear Suspension	Swing Arm w/ Dual Shocks
Rear Travel	6.25 in. / 158.75 mm
Ground Clearance	7.2 in. / 180 mm
Shock Preload Adjustment Front / Rear	Cam Adjustment 2-2" Twin Tubes
Turning Radius	132 in. / 335.3 cm
Toe Out	1/8-1/4 in. / 3-6.35 mm
Wheels / Brakes	
Wheel Size - Front	25x10-12
Wheel Size - Rear	25x11-12
Recommended Air Pressure F / R	8-12 psi Front 8-12 psi Rear
Brake - Front	Dual Hydraulic Disc
Brake - Rear	Dual Hydraulic Disc
Parking Brake	Foot Actuated (Mechanical)
Brake Fluid	DOT 3 or DOT 4

JETTING CHART

Altitude		AMBIENT TEMPERATURE	
		Below 40°F Below 5°C	+40°F to +80°F +5°C to +28°C
Meters (Feet)	0-1500 (0-5000)	140 (3130527)	135 (3130563)
	above 1500 (above 5000)	132.5 (3130562)	127.5 (3130560)

CLUTCH CHART

Altitude		Shift Weight	Drive Spring	Second Spring	Driven Helix
Meters (Feet)	0-1500 (0-5000)	10 BH (5630711)	Blu/Grn (7041157)	Black (7041782)	41-37 (5132344)
	1500-3700 (5000-12000)	10 RH (5630709)	Blu/Grn (7041157)	Black (7041782)	41-37 (5132344)



GENERAL INFORMATION

MODEL: **RANGER 4X4**

MODEL NUMBER: . **A04RD50AA**

ENGINE MODEL: .. **EH50PLE164**

Engine	
Platform	Fuji 4 stroke, Single Cylinder
Engine Model Number	EH50PLE164
Engine Displacement	499cc
Number of Cylinders	1
Bore & Stroke (mm)	92 x 75 mm
Compression Ratio	10.2:1
Compression Pressure	70-90 psi
Engine Idle Speed	1200 ± 200 RPM
Valve Clearance Int./Exh.	0.006 mm (.006 in.)
Engine Hot Light	Dash Light
Lubrication	Pressurized Dry Sump
Oil Requirements	0W-40
Oil Capacity	2 qts. / 2.1 L
Coolant Capacity	2.25 qts. / 2.4 L
Exhaust System	2 to 1 canister style
Carburetion	
Carburetor model	Mikuni BST 34 CV
Main Jet	135
Pilot Jet	42.5
Jet Needle	4MB32-3
Needle Jet	P-8M (829)
Pilot Screw	2.5 Turns Out (Initial starting point, settings may vary)
Pilot Air Jet	160
Float Height	13 ± 1 mm (0.51 ± 0.40")
Fuel Delivery	Electric Fuel Pump
Fuel Capacity / Requirement	8.5 gal. (32.2 L) 87 Octane (minimum)
Electrical	
Alternator Max Output	250 watts @ 5000 RPM
Lights : Main Headlights	Dual Beam 35 watts / 35 watts
Tail	5 watts
Brake	5 watts
Indicator Panel Lights	1 watt (ea.)
CDI Marking	CU2570
RPM Limit	6600 RPM
Ignition System	Electric Start (Kokusan)
Ignition Timing	30° ± 2° BTDC @ 5000 RPM
Spark plug / Gap	NGK BKR5E/ .036 in./ 0.9 mm
Battery / Model / Amp Hr	Yuasa YB30L-B 30 AmpHr./12Volt
Circuit Breakers	Harness 20 amp
Instrument Panel Type	Indicator Lights/Hour Meter
DC Outlet	Standard

Drivetrain	
Transmission Type	Dual Sensing Automatic PVT
Gear Ratio :	High 3.83:1 Low 8.71:1 Rev. 5.94:1
Final Drive Ratio	3.70:1
Front Drive Ratio	3.83:1
Shift Type	In Line EZ Shift Hi/Low/Reverse
Trans. Oil Requirements	Polaris AGL Gearcase Lube
Belt	3211094
Drive Belt Deflection	1.125" / 28.57 mm
Center Distance	10" / 254.5 mm
Clutch Offset	0.5" / 12.7 mm
Springs and Weights	See Below
Steering / Suspension	
Front Suspension	MacPherson Strut
Front Travel	6.7 in. / 170 mm
Rear Suspension	Swing Arm w/ Dual Shocks
Rear Travel	6.25 in. / 158.75 mm
Ground Clearance	7.2 in. / 180 mm
Shock Preload Adjustment Front / Rear	Cam Adjustment 2-2" Twin Tubes
Turning Radius	132 in. / 335 cm
Toe Out	1/8-1/4 in. / 3-6.35 mm
Wheels / Brakes	
Wheel Size - Front	25x10-12
Wheel Size - Rear	25x11-12
Recommended Air Pressure F / R	8-12 psi Front 8-12 psi Rear
Brake - Front	Dual Hydraulic Disc
Brake - Rear	Dual Hydraulic Disc
Parking Brake	Foot Actuated (Mechanical)
Brake Fluid	DOT 3 or DOT 4

JETTING CHART

Altitude		AMBIENT TEMPERATURE	
		Below 40°F Below 5°C	+40°F to +80°F +5°C to +28°C
Meters (Feet)	0-1500 (0-5000)	140 (3130527)	135 (3130563)
	above 1500 (above 5000)	132.5 (3130562)	127.5 (3130560)

CLUTCH CHART

Altitude		Shift Weight	Drive Spring	Second Spring	Driven Helix
Meters (Feet)	0-1500 (0-5000)	10 MH (5630513)	Blu/Grn (7041157)	Black (7041782)	40 (5131446)
	1500-3700 (5000-12000)	10 WH (5630710)	Blu/Grn (7041157)	Black (7041782)	40 (5131446)



POLARIS

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GENERAL INFORMATION



MODEL: **RANGER 6X6**

MODEL NUMBER: . **A04RF50AA**

ENGINE MODEL: .. **EH50PLE164**

Engine	
Platform	Fuji 4 stroke, Single Cylinder
Engine Model Number	EH50PLE164
Engine Displacement	499cc
Number of Cylinders	1
Bore & Stroke (mm)	92 x 75 mm
Compression Ratio	10.2:1
Compression Pressure	70-90 psi
Engine Idle Speed	1200 ± 200 RPM
Valve Clearance Int./Exh.	0.006 mm (.006 in.)
Engine Hot Light	Dash Light
Lubrication	Pressurized Dry Sump
Oil Requirements	0W-40
Oil Capacity	2 qts. / 2.1 L
Coolant Capacity	2.25 qts. / 2.4 L
Exhaust System	2 to 1 canister style
Carburetion	
Carburetor model	Mikuni BST 34 CV
Main Jet	142.5
Pilot Jet	42.5
Jet Needle	4MB32-3
Needle Jet	P-8M (829)
Pilot Screw	2.5 Turns Out (Initial starting point, settings may vary)
Pilot Air Jet	160
Float Height	13 ± 1 mm (0.51 ± 0.40")
Fuel Delivery	Electric Fuel Pump
Fuel Capacity / Requirement	8.5 gal. (32.2 L) 87 Octane (minimum)
Electrical	
Alternator Max Output	250 watts @ 5000 RPM
Lights : Main Headlights	Dual Beam 35 watts / 35 watts
Tail	5 watts
Brake	5 watts
Indicator Panel Lights	1 watt (ea.)
CDI Marking	CU2570
RPM Limit	6600 RPM
Ignition System	Electric Start (Kokusan)
Ignition Timing	30° ± 2° BTDC @ 5000 RPM
Spark plug / Gap	NGK BKR5E/ .036 in./ 0.9 mm
Battery / Model / Amp Hr	Yuasa YB30L-B 30 AmpHr./12Volt
Circuit Breakers	Harness 20 amp
Instrument Panel Type	Indicator Lights/Hour Meter
DC Outlet	Standard

Drivetrain	
Transmission Type	Dual Sensing Automatic PVT
Gear Ratio :	High 3.83:1 Low 8.71:1 Rev. 5.94:1
Final Drive Ratio	3.70:1
Front Drive Ratio	3.83:1
Mid Drive Ratio	3.70:1
Shift Type	In Line EZ Shift Hi/Low/Reverse
Trans. Oil Requirements	Polaris AGL Gearcase Lube
Belt	3211094
Drive Belt Deflection	1.125" / 28.57 mm
Center Distance	10" / 254.5 mm
Clutch Offset	0.5" / 12.7 mm
Springs and Weights	See Below
Steering / Suspension	
Front Suspension	MacPherson Strut
Front Travel	6.7 in. / 170 mm
Rear Suspension	Swing Arm w/ Dual Shocks
Rear Travel	6.25 in. / 158.75 mm
Ground Clearance	7.2 in. / 180 mm
Shock Preload Adjustment Front / Rear	Cam Adjustment 2-2" Twin Tubes
Turning Radius	132 in. / 335 cm
Toe Out	1/8-1/4 in. / 3-6.35 mm
Wheels / Brakes	
Wheel Size - Front	25x10-12
Wheel Size - Rear	25x11-12
Recommended Air Pressure F / R	8-12 psi Front 8-12 psi Rear
Brake - Front	Dual Hydraulic Disc
Brake - Rear	Dual Hydraulic Disc
Parking Brake	Foot Actuated (Mechanical)
Brake Fluid	DOT 3 or DOT 4

JETTING CHART		AMBIENT TEMPERATURE	
Altitude		Below 40°F Below 5°C	+40°F to +80°F +5°C to +28°C
Meters (Feet)	0-1500 (0-5000)	140 (3130527)	135 (3130563)
	above 1500 (above 5000)	132.5 (3130562)	127.5 (3130560)

CLUTCH CHART		Shift Weight	Drive Spring	Second Spring	Driven Helix
Altitude					
Meters (Feet)	0-1500 (0-5000)	G (5630514)	Blu/Grn (7041157)	Silver (7041499)	41-37 (5132344)
	1500-3700 (5000-12000)	F (5630515)	Blu/Grn (7041157)	Silver (7041499)	41-37 (5132344)

**PUBLICATION NUMBERS**

Model	Model No.	Owner's Manual PN	Service Manual PN	Parts Manual PN	Parts Micro Fiche PN
<i>RANGER</i> TM	A04RB63AA	9918790	9918796	9918932	9918933
<i>RANGER</i> 2x4, 4x4, 6x6	A04RB42AA, A04RD50AA, A04RD50AB, A04RF50AA	9918790	9918796	9918791	9918792

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

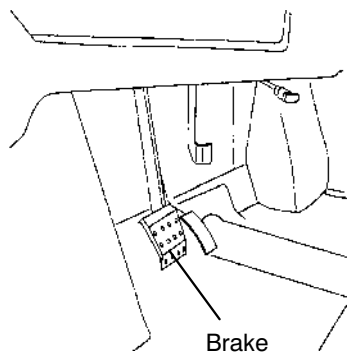
PAINT CODES

PAINTED PART	COLOR DESCRIPTION	DITZLER NUMBER	POLARIS NUMBER
Frame/Cab	Medium Gloss Black	9440 / 8520147	P-067

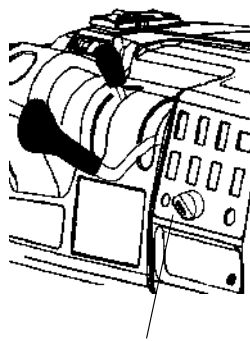
Order direct from Midwest Industrial Coatings (952-942-1840). Mix as directed.

STARTING THE *RANGER*

NOTICE: To start the *RANGER*, the unit must be in neutral to start the machine. The *RANGER* utilizes this safety feature to help prevent any possible injury or accidents that may occur during initial machine start up.

Starting the *RANGER*

1. Press down on the foot brake.



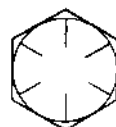
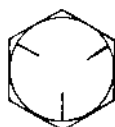
2. Shift to neutral and turn the ignition key to start the vehicle





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 .1382

*To convert Nm to ft. lbs. multiply Nm by .7376.

SPECIFIC TORQUE VALUES OF FASTENERS

Refer to exploded views in the appropriate sectionTorque Conversions

COLD WEATHER KITS FOR 4 CYCLE ATVS

Engine Heater - (PN 2871507)



**SAE TAP DRILL SIZES**

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

METRIC TAP DRILL SIZES

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

DECIMAL EQUIVALENTS

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





GLOSSARY OF TERMS

ABDC: After bottom dead center.

ACV: Alternating current voltage.

Alternator: Electrical generator producing voltage alternating current.

ATDC: After top dead center.

BBDC: Before bottom dead center.

BDC: Bottom dead center.

BTDC: Before top dead center.

CC: Cubic centimeters.

Center Distance: Distance between center of crankshaft and center of driven clutch shaft.

Chain Pitch: Distance between chain link pins (No. 35 = 3/8" or 1 cm). Polaris measures chain length in number of pitches.

CI: Cubic inches.

Clutch Buttons: Plastic bushings which aid rotation of the movable sheave in the drive and driven clutch.

Clutch Offset: Drive and driven clutches are offset so that drive belt will stay nearly straight as it moves along the clutch face.

Clutch Weights: Three levers in the drive clutch which relative to their weight, profile and engine RPM cause the drive clutch to close and grip the drive belt.

Crankshaft Run-Out: Run-out or "bend" of crankshaft measured with a dial indicator while crankshaft is supported between centers on V blocks or resting in crankcase. Measure at various points especially at PTO.

DCV: Direct current voltage.

Dial Bore Gauge: A cylinder measuring instrument which uses a dial indicator. Good for showing taper and out-of-round in the cylinder bore.

Electrical Open: Open circuit. An electrical circuit which isn't complete.

Electrical Short: Short circuit. An electrical circuit which is completed before the current reaches the intended load. (i.e. a bare wire touching the chassis).

End Seals: Rubber seals at each end of the crankshaft.

Engagement RPM: Engine RPM at which the drive clutch engages to make contact with the drive belt.

ft.: Foot/feet.

Foot Pound: Ft. lb. A force of one pound at the end of a lever one foot in length, applied in a rotational direction.

g: Gram. Unit of weight in the metric system.

gal.: Gallon.

ID: Inside diameter.

in.: Inch/inches.

Inch Pound: In. lb. 12 in. lbs. = 1 ft. lb.

kg/cm²: Kilograms per square centimeter.

kg-m: Kilogram meters.

Kilogram/meter: A force of one kilogram at the end of a lever one meter in length, applied in a rotational direction.

l or ltr: Liter.

lbs/in²: Pounds per square inch.

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

m: Meter/meters.

Mag: Magneto.

Magnetic Induction: As a conductor (coil) is moved through a magnetic field, a voltage will be generated in the windings. Mechanical energy is converted to electrical energy in the stator.

mi.: Mile/miles.

mm: Millimeter. Unit of length in the metric system. 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, resulting in energy conversion to heat.

RPM: Revolutions per minute.

Seized Piston: Galling of the sides of a piston. Usually there is a transfer of aluminum from the piston onto the cylinder wall. Possible causes: 1) improper lubrication; 2) excessive temperatures; 3) insufficient piston clearance; 4) stuck piston rings.

Stator Plate: The plate mounted under the flywheel supporting the battery charging coils.

TDC: Top dead center. Piston's most outward travel from crankshaft.

Volt: The unit of measure for electrical pressure of electromotive force. Measured by a voltmeter in parallel with the circuit.

Watt: Unit of electrical power. Watts = amperes x volts.

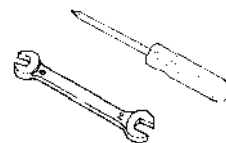
WOT: Wide open throttle.



CHAPTER 2

MAINTENANCE

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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. Change oil immediately if oil level begins to rise.

E Emission Control System Service
(California).

PERIODIC MAINTENANCE - ENGINE					
		Frequency (Whichever comes first)			Remarks
	Item	Hours	Calendar	Miles (Km)	
E►	Engine Oil - Level	25 hrs	6 months	N/A	Check Level Daily; Break In service at 25 hrs.
E	Oil Change/Filter	100 hrs	6 months	N/A	Change oil at 100 hours, more often in cold weather use. Replace with oil change
E►	Air Filter - Main Element	Weekly	Weekly	N/A	Inspect - Replace if necessary
►	Air Box Sediment Tube	-	Daily	N/A	Drain deposits whenever visible
►	Engine Breather Filter	25 hrs	Monthly	N/A	Inspect and replace if necessary
►	Oil Tank Vent Hose	100 hrs	12 months	N/A	Inspect hose routing /hose condition
E■	Valve Clearance	100 hrs	12 months	N/A	Inspect/Adjust
E	Idle Speed	As required	As required	N/A	Adjust
	Choke (Enricher) Cable	50 hrs	6 months	N/A	Inspect -Adjust, Lubricate, Replace if necessary
	Carburetor Float Bowl	50 hrs	6 months	N/A	Drain bowl periodically and prior to storage
	Carburetor Air Intake Ducts/Flange	50 hrs	6 months	N/A	Inspect all ducts for proper sealing/air leaks
E■	Fuel System	100 hrs	12 months	N/A	Check for leaks at tank cap, lines, filter, pump & carburetor. Replace lines every 2 years.
CHASSIS					
		Frequency (Whichever comes first)			Remarks
	Item	Hours	Calendar	Miles (Km)	
E■	Fuel Filter	100 hrs	12 months	N/A	Replace filter annually
	Coolant/Level Inspection (2x,4x,6x)	Daily	Daily	N/A	Replace engine coolant every 2 years
	Coolant Strength / Pressure Test System (2x,4x,6x)	100 hrs	6 months	N/A	Inspect strength seasonally; Pressure test system annually
	Radiator (2x,4x,6x)	100 hrs	12 months	N/A	Inspect / Clean external surface
	Cooling System Hoses (2x,4x,6x)	100 hrs	12 months	N/A	Inspect
	Engine Mounts	100 hrs	12 months	N/A	Inspect
	Drain Recoil Housing (2x,4x,6x)	Weekly	Weekly	N/A	More often if operating in wet environment
	Exhaust Muffler / Pipe	100 hrs	12 months	N/A	
ELECTRICAL					
E	Spark Plug(s)	100 hrs	12 months	N/A	Inspect - Replace if necessary
	Wiring	100 hrs	12 months	N/A	Inspect for abrasion, routing, security





CHASSIS					
		Frequency (Whichever comes first)			
	Item	Hours	Calendar	Miles (Km)	Remarks
	Ignition Timing	100 hrs	12 months	N/A	Inspect
	Battery	25 hrs	Monthly	N/A	Check terminals; Clean; Check fluid level
	Headlight Aim	As required	As required	N/A	Adjust if Necessary
	Headlamp Inspection	Daily	Daily	N/A	Check operation daily; Apply Nyogel™ Grease to connector when lamp is replaced
	Tail Lamp Inspection	Daily	Daily	N/A	Check Operation Daily; Apply Nyogel™ Grease to socket when lamp is replaced
►	General Lubrication	50 hrs	3 months	N/A	Lubricate All Fittings, Pivots, Cables, Etc.
►	Front Gearcase Lubricant (4x,6x)	100 hrs	12 months	N/A	Inspect Monthly; Change Annually
►	Middle Gearcase Lubricant (6x)	100 hrs	12 months	N/A	Inspect Monthly; Change Annually
►	Rear Gearcase Lubricant (All)	100 hrs	12 months	N/A	Inspect Monthly; Change Annually
	Drive Belt	50 hrs	6 months	N/A	Inspect - Adjust, Replace if Necessary
	Clutches (Drive And Driven)	100 hrs	12 months	N/A	Inspect, Clean
►	Transmission Oil Level	25 hrs	Monthly	N/A	Inspect Monthly; Change Annually
	Shift Linkage	50 hrs	6 months	N/A	Inspect, Lubricate, Adjust
■	Steering	50 hrs	6 months	N/A	Inspect Daily, Lubricate
■	Toe Adjustment	As required	As required	N/A	Periodic Inspection, Adjust When Parts are Replaced
►	Front Suspension	50 hrs	6 months	N/A	Inspect - Lubricate
►	Rear Suspension	50 hrs	6 months	N/A	Inspect - Lubricate
	Tires	Pre-ride	Pre-ride	N/A	Inspect Daily, Pre-Ride Inspection Item
■	Brake Fluid	200 hrs	24 months	N/A	Change Every Two Years
►	Brake Fluid Level	Pre-ride	Pre-ride	N/A	Inspect Daily, Pre-Ride Inspection Item
►	Brake Lever Travel	Pre-ride	Pre-ride	N/A	Inspect Daily, Pre-Ride Inspection Item
■	Brake Pad Wear	25 hrs	Monthly	N/A	Inspect Periodically
	Auxiliary Brake Adjustment	As required	As required	N/A	Inspect Deflection Daily; Adjust
	Brake System	Pre-ride	Pre-ride	N/A	Pre-Ride Inspection Item
	Wheels	Pre-ride	Pre-ride	N/A	Pre-Ride Inspection Item
	Frame Nuts, Bolts, Fasteners	Pre-ride	Pre-ride	N/A	Pre-Ride Inspection Item

■ **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. Change oil immediately if oil level begins to rise.

E Emission Control System Service (California).





POLARIS LUBRICANTS, MAINTENANCE AND SERVICE PRODUCTS

Part No.	Description
Engine Lubricant	
2870791	Fogging Oil (12 oz. Aerosol)
2871098	Premium 2 Cycle Engine Oil (Quart) (12 Count)
2871281	Engine Oil (Quart) Premium 4 Synthetic 0W-40 (4-Cycle) (12 Count)
2871844	Engine Oil (Gallon) Premium 4 Synthetic 0W-40 (4-Cycle) (4 Count)
2871567	Engine Oil (16 Gallon) Premium 4 Synthetic 0W-40 (4-Cycle)
Gearcase / Transmission Lubricants	
2873602	AGL Gearcase Lubricant (12 oz. bottle) (12 Count)
2873603	AGL Gearcase Lubricant (1 Gal.) (4 Count)
2871653	ATV Angle Drive Fluid (8 oz.) (12 Count)
2872276	ATV Angle Drive 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)
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)

Part No.	Description
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.



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
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
8700220	Clutch Compression Tool	6
2871025	Clutch Bushing Replacement Tool Kit	6
2872608	Roller Pin Removal Tool	7
8700226	CV Boot Clamp Pliers	7
PV-43568	Fluke™ 77 Digital Multimeter	10
2870630	Timing Light	10
2870836	Battery Hydrometer	10

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

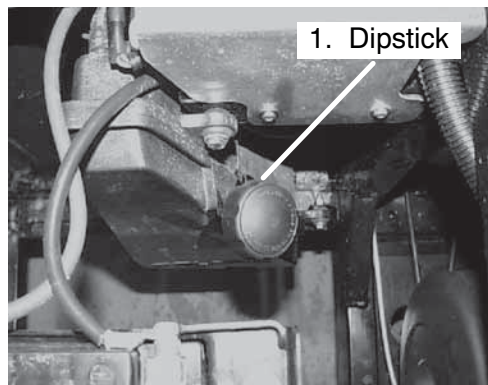
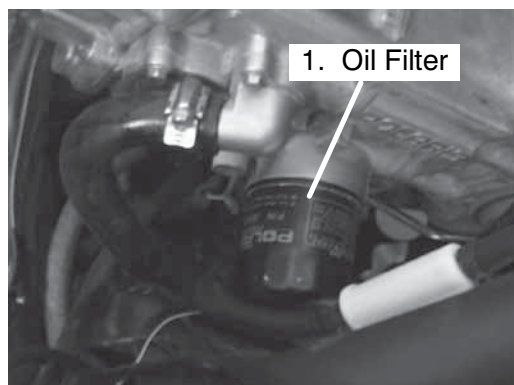




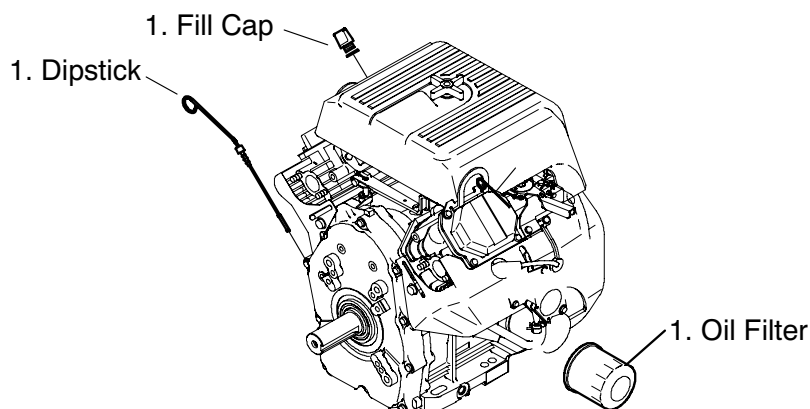
LUBRICATION

Item	Lube Rec.	Method	Frequency*
1. Engine Oil 4-Stroke	Polaris 0W-40 Synthetic (PN 2871281)	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.

RANGER 2x4/4x4/6x6



RANGER TM



* 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)
- ② Annually or 100 hours of operation (refer to Maintenance Schedule for additional information)
- ③ Grease conforming to NLGI No. 2, such as Polaris Premium All Season Grease, Conoco Superlube M or Mobilegrease Special



LUBRICATION, CONT.

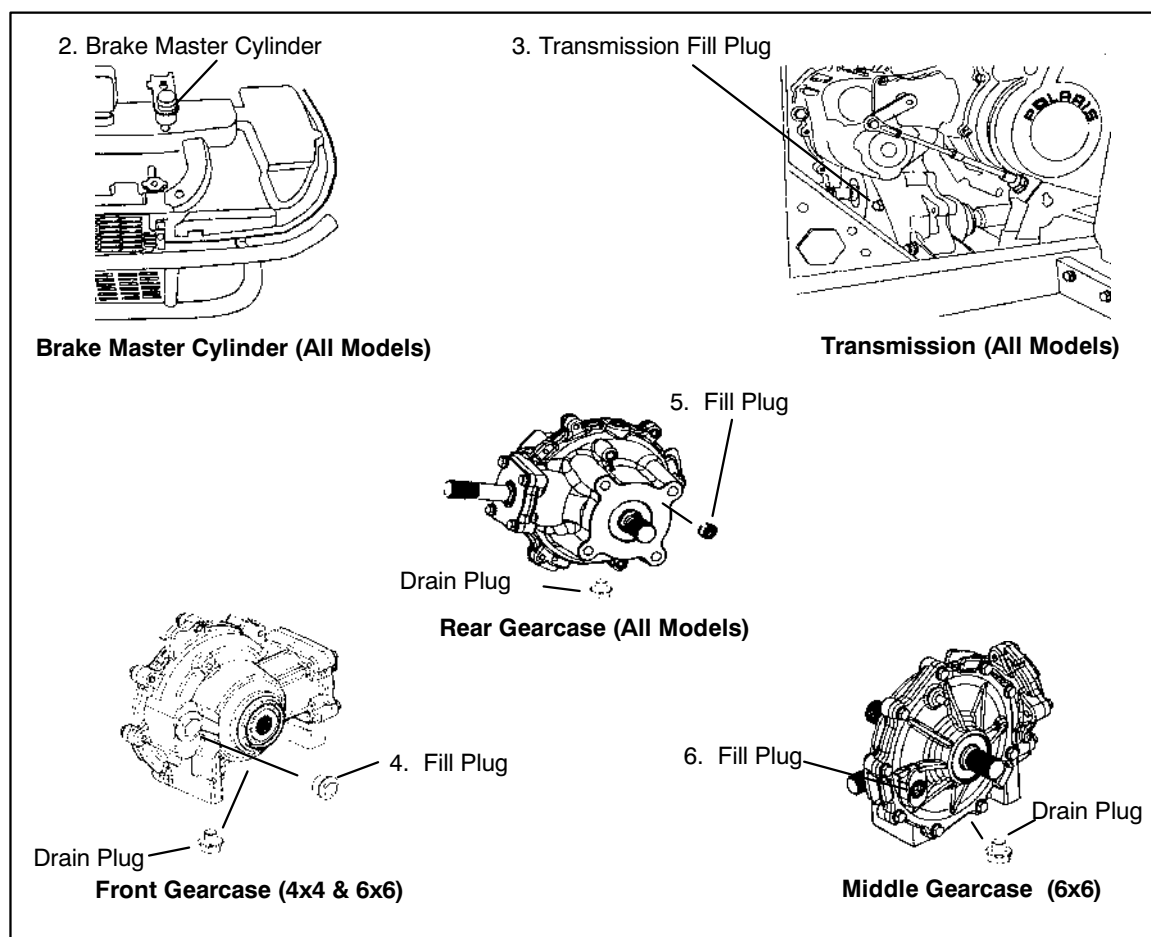
Item	Lube Rec.	Method	Frequency*
2. Brake Fluid	DOT 3 (PN 2870990) or Dot 4	Fill reservoir between MAX and Min lines.	As required. Change fluid every 2 years.
3. Transmission	Polaris AGL Gearcase Lubricant (PN 2873602)	Add lube to bottom of fill plug threads.	Change annually. Change more often if used in severe conditions.
4. Front Gearcase	Polaris Demand Drive Hub Fluid (PN 2871654)	Drain completely. Add lube to specified quantity.	Change annually ^[2]
5. Rear Gearcase	ATV Angle Drive Fluid (PN 2871477)	Drain completely. Add lube to specified quantity.	Change annually ^[2]
6. Middle Gearcase	ATV Angle Drive Fluid (PN 2871477)	Drain completely. Add lube to specified quantity.	Semi-annually ^[1]

* 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)

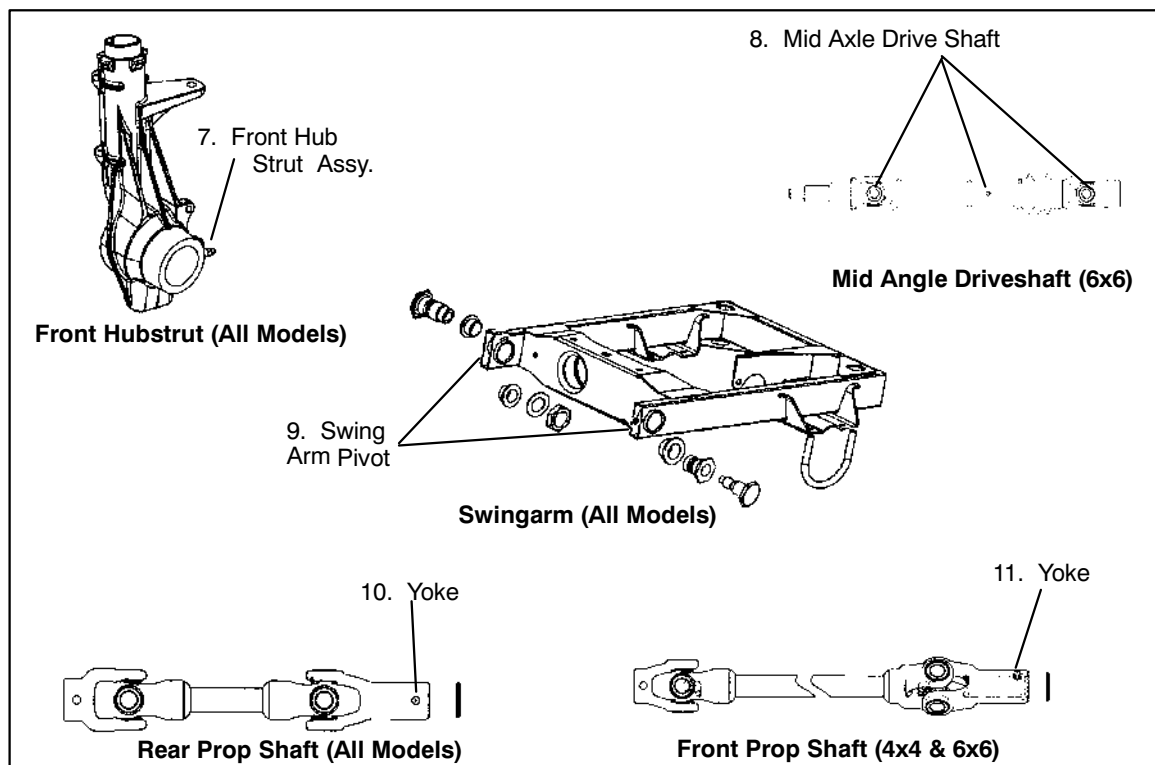
^[2] Annually or 100 hours of operation (refer to Maintenance Schedule for additional information)

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





LUBRICATION, CONT.



Item	Lube Rec.	Method	Frequency*
7. Hubsrut Assembly (Both Sides)	Polaris All Season Grease (PN 2871423)	Locate grease fitting on the underside of the hub-strut assembly and grease with grease gun.	Semi Annually ¹
8. Mid Axle Drive Shaft (Both Drive-shafts) (6x6)	Polaris All Season Grease (PN 2871423)	Locate grease two grease fittings on both ends joints of driveshaft and grease with grease gun. Locate grease fitting in center of driveshaft and grease with grease gun.	Semi Annually ¹
9. Swing Arm Pivot	Polaris All Season Grease (PN 2871423)	Locate grease fitting on inside of the swing arm pivot.	Semi Annually ¹
10. Rear Prop Shaft Yoke	Polaris Premium U-Joint Lube (PN 2871551)	Locate fittings and grease with grease gun.	Semi-annually ¹
11. Front Prop Shaft Yoke (4x4,6x6)	Polaris Premium U-Joint Lube (PN 2871551)	Locate fittings and grease with grease gun.	Semi-annually ¹

* 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)

² Annually or 100 hours of operation (refer to Maintenance Schedule for additional information)

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



FRONT GEARCASE LUBRICATION (4X4, 6X6 MODELS ONLY)

FRONT GEARCASE SPECIFICATIONS

Specified Lubricant:

Premium Demand Drive Hub Fluid
(PN 2871654)

Capacity: 5.0 Oz. (150 ml.)

Drain Plug / Fill Plug Torque:

14 ft. lbs. (19.4 Nm)

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

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

To check the lubricant level:

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

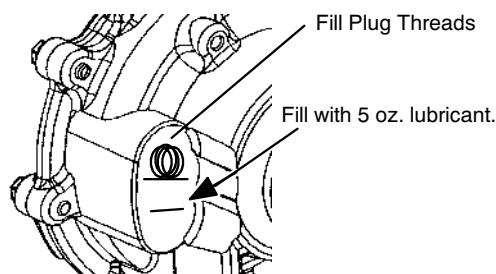
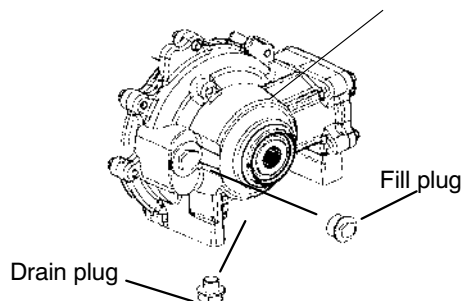
To change front gearcase lubricant:

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

7. Install fill plug. Check for leaks.

FRONT GEARCASE (4X4, 6X6)

Make sure vent is unobstructed



MIDDLE GEARCASE LUBRICATION (6X6 ONLY)

MIDDLE GEARCASE SPECIFICATIONS

Specified Lubricant:

ATV Angle Drive Fluid (PN 2871653)

Capacity: 6.75 Oz. (200 ml.)

Drain Plug / Fill Plug Torque:

14 ft. lbs. (19.4 Nm)

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

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





To check the lubricant level:

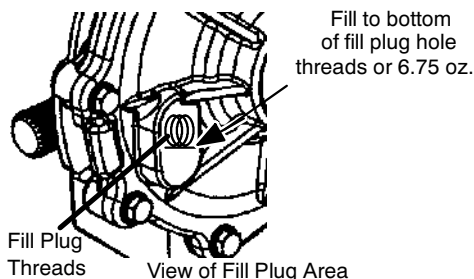
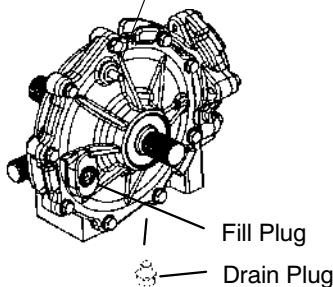
The gearcase must be drained and re-filled with the proper amount of lubricant. Refer to the procedure below.

To change middle gearcase lubricant:

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

MIDDLE GEARCASE (6X6)

Make sure vent is unobstructed



REAR GEARCASE LUBRICATION (ALL MODELS)

REAR GEARCASE SPECIFICATIONS

Specified Lubricant:

ATV Angle Drive Fluid (PN 2871653)

Capacity: 10 Oz. (300 ml.)

Drain Plug / Fill Plug Torque:

14 ft. lbs. (19.4 Nm)

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

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

To check the lubricant level:

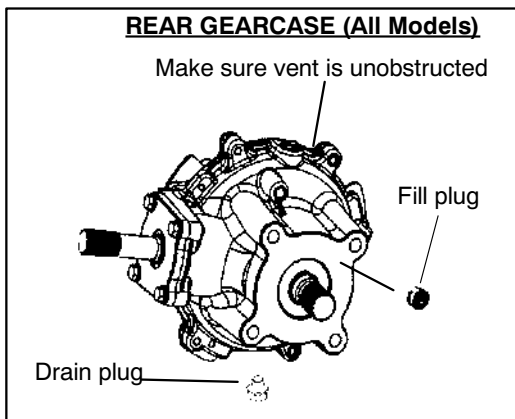
The gearcase must be drained and re-filled with the proper amount of lubricant. Refer to the procedure below.

To change rear gearcase lubricant:

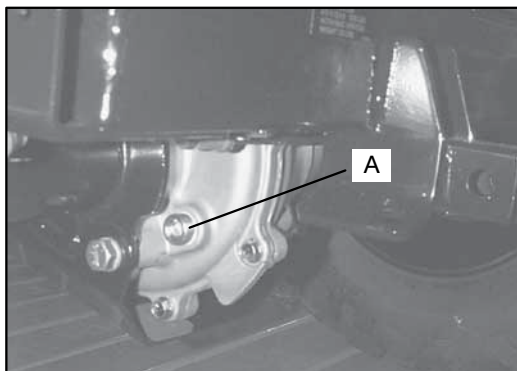
1. With the vehicle on a level surface, remove the fill plug and check the lubricant level. Lubricant should be kept at the specified level, according to the proper gearcase specifications listed.
2. Support the vehicle securely with a jackstand and remove the front tire on the driver's side.
3. Remove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



4. Clean and reinstall drain plug using a new sealing washer.



5. Remove fill plug (A).



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

TRANSMISSION LUBRICATION (ALL MODELS)

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

TRANSMISSION SPECIFICATIONS

Specified Lubricant:

AGL Gearcase Lubricant (PN 2873603) (Gallon) (PN 2873602) (12 oz.)

Approximate Capacity at Change:

4x4 & 6x6: 15.2 oz. (450 ml.)

TM & 2x4: 18.2 oz. (540 ml.)

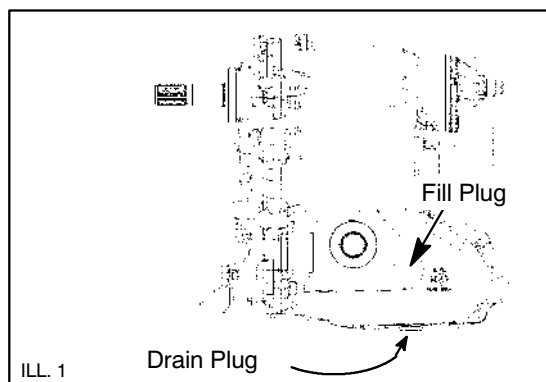
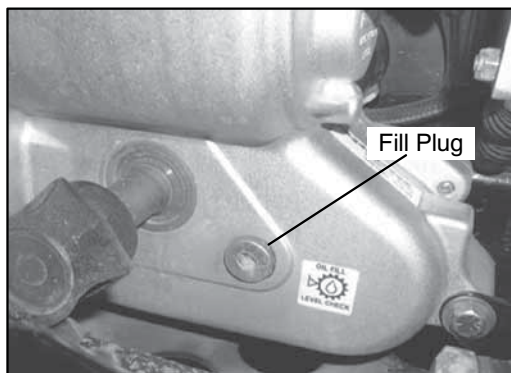
Drain Plug Torque: 14 ft. lbs. (19.4 Nm)

The transmission 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.

To check the level:

1. Remove transmission fill plug and wipe clean.



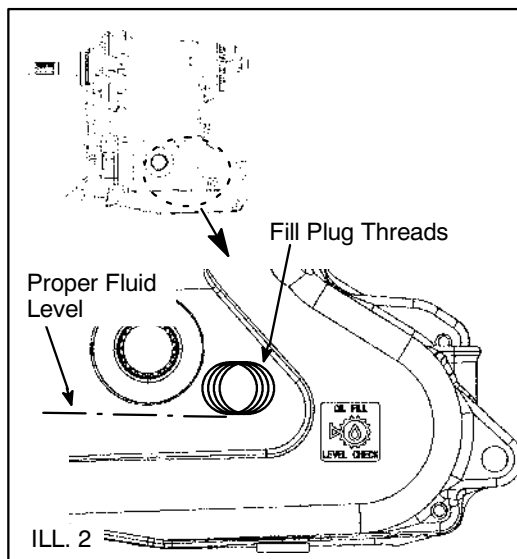
2. To check the level:

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



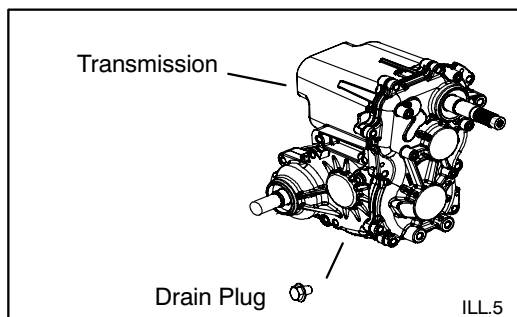


- The fluid should be at the bottom of the fill plug hole threads (see Illustration 2).



To change lubricant:

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



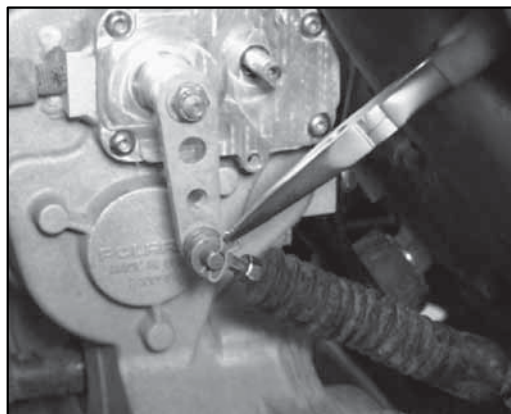
4. After the oil has drained completely, install the drain plug. Torque to 14 ft. lbs. (19 Nm).
5. Add the proper lubricant through the fill plug hole until the oil level is at the bottom of the fill plug threads (see Illustration 2). Do not overfill.
6. Check for leaks.
7. Reinstall skid plate if removed in Step 1.

SHIFT LINKAGE INSPECTION/ADJUSTMENT (ALL MODELS)

Linkage rod adjustment is necessary when symptoms include:

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

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

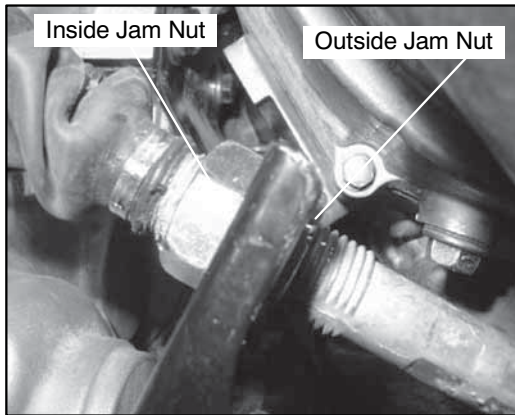


1. Inspect shift linkage cable, clevis pins, and pivot bushings and replace if worn or damaged.
2. Be sure idle speed is adjusted properly.
3. Place gear selector in neutral. Make sure the transmission bell crank is engaged in the neutral position detents.
4. With two wrenches loosen the outside jam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



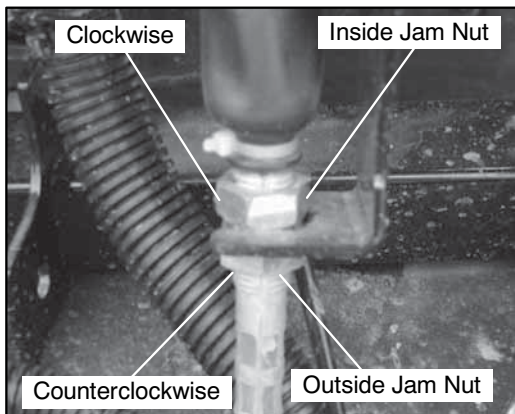


end, also.



Transmission Cable Adjustment

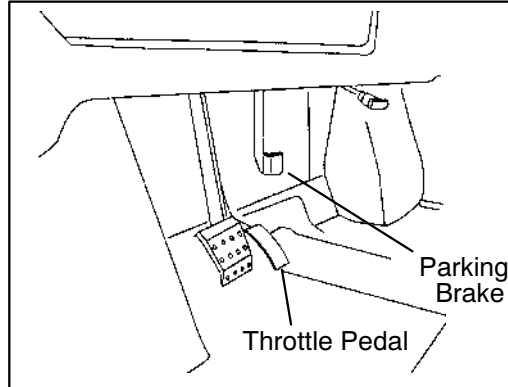
5. After turning the outside jam nut 1 1/2 turns. Hold the outside jam nut with a wrench and tighten the inside jam nut clockwise, until it is tight against the bracket.
6. Repeat Step 4 and Step 5 until the proper adjustment is made for the transmission cable.
7. Use this procedure to loosen or tighten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



Shift Lever Cable Adjustment

THROTTLE PEDAL INSPECTION (ALL MODELS)

Throttle Freeplay



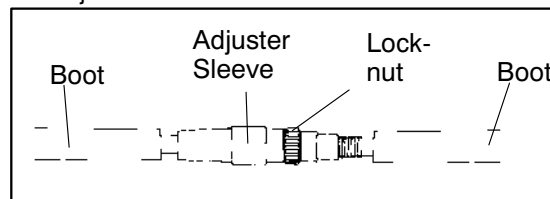
If the throttle pedal has excessive play due to cable stretch or cable misadjustment, it will cause a delay in throttle speed. Also, the throttle may not open fully. If the throttle pedal has no play, the throttle may be hard to control, and the idle speed may be erratic. Check the throttle pedal play periodically in accordance with the Periodic Maintenance Chart and adjust the play if necessary.

Throttle Freeplay Inspection

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

Adjustment

1. Slide the bolts off inline cable adjuster sleeve. Loosen adjuster locknut.
2. Turn adjuster until 1/16, to 1/8, freeplay is achieved pedal. **NOTE:** While adjusting freeplay, it is important you flip the throttle lever back and forth.
3. Tighten locknut and slide boots over cable adjuster until they touch at the mid point of adjuster.

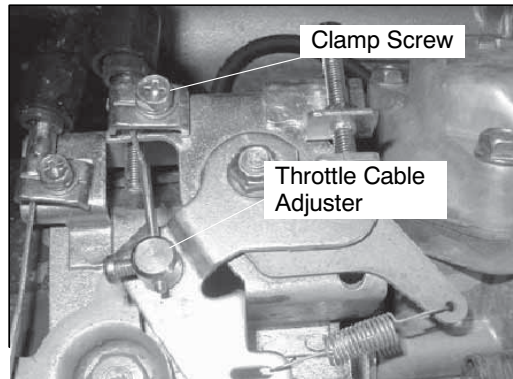
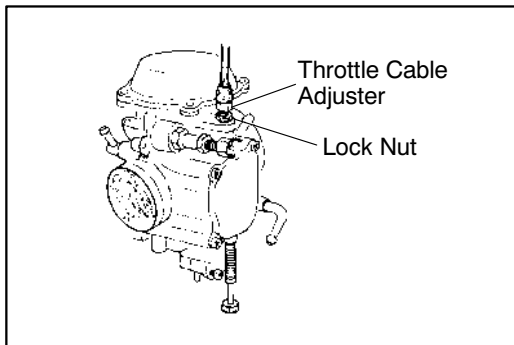




THROTTLE CABLE ADJUSTMENT (RANGER 2X,4X,6X)

NOTE: If the proper freeplay cannot be obtained with the throttle block adjuster, adjust the cable at the carburetor using the following procedure.

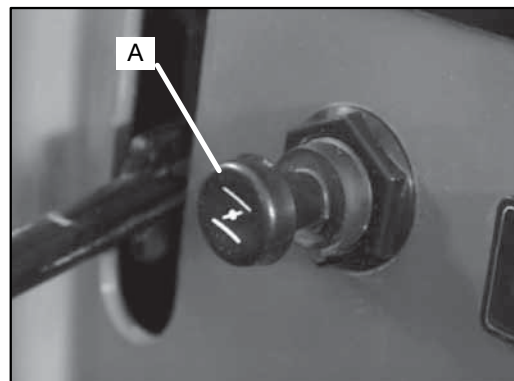
1. Remove seat.
2. Slide boot off throttle cable adjuster and jam nut.
3. Loosen lock nut and turn adjuster until proper throttle lever freeplay is obtained.
4. Tighten locknut and slide boot back over adjuster.
5. Reinstall seat.
6. Check for proper throttle operation and correct freeplay in all handlebar positions.



CHOKE (ENRICHER) ADJUSTMENT (ALL MODELS)

With the choke control pushed in, the choke plunger must be seated on the fuel passage way in the carburetor. If the plunger is not seated on the fuel passage way inside the carburetor (not enough cable freeplay), the engine will flood or run too rich, causing plug fouling and poor performance.

If cable slack is excessive, the choke fuel passage will not open far enough, which may cause cold starting difficulty. Also, the half-choke position used for intermittent applications will not function properly.



1. Locate the boot by the carburetor and pull it back. Loosen the friction nut 1 turn or until choke slides freely. Re-install boot.
2. Push the choke knob (A) in to the full off position.
3. Slide boots off in-line cable adjuster and loosen adjustment locknut.

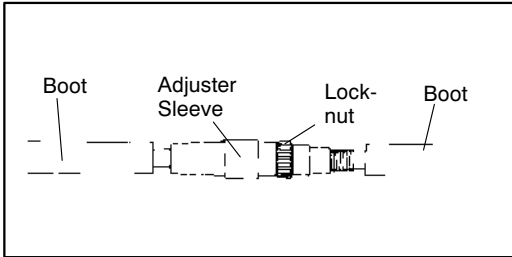
THROTTLE CABLE ADJUSTMENT (RANGER TM)

NOTE: If the proper freeplay cannot be obtained with the throttle block adjuster, adjust the cable at the carburetor using the following procedure.

1. Remove seat.
2. Loosen the clamp screw and the throttle cable adjustment screw.
3. Adjust the cable as needed.
4. Tighten both screws.
5. Reinstall seat.
6. Check for proper throttle operation and correct freeplay in all steering wheel positions.



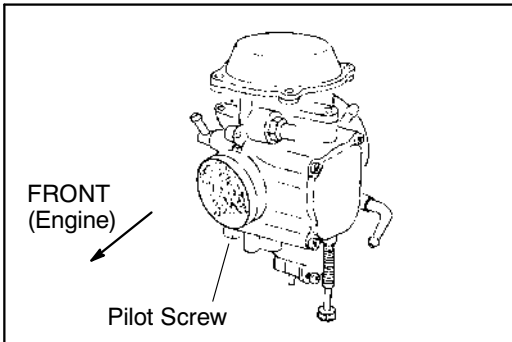
- Turn adjuster until the choke knob pulls out over 1/4".
- Push on the choke knob lightly while turning the adjuster the opposite way.



- Turn the adjuster until the knob contacts the boot.
- Tighten adjuster nut.
- Slide boots back over cable adjuster sleeve until they touch at the middle point of the adjuster.
- Pull back the choke knob boot and tighten the friction nut until the choke will maintain a set position. Re-install boot.

PILOT SCREW ADJUSTMENT **(RANGER 2X,4X,6X)**

- Start engine and warm it up to operating temperature (about 10 minutes).



Pilot Screw Adjustment

Refer to Specifications

- 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.
- Connect an accurate tachometer that will read in increments of + or - 50 RPM such as the PET

2100DX

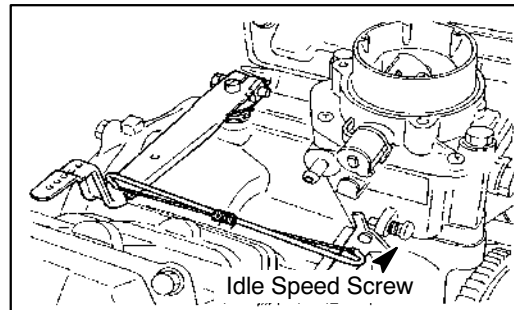
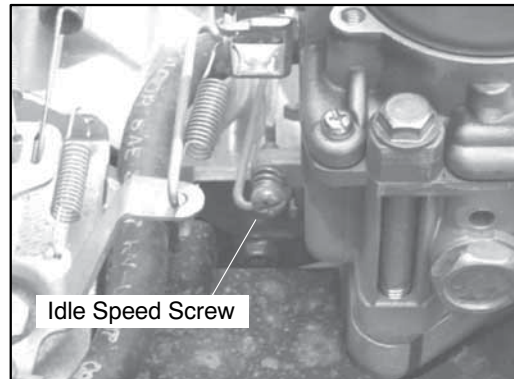
(PN 8712100DX) or the PET 2500 (PN 8712500).

- Set idle speed to 1200 RPM. Always check throttle cable freeplay after adjusting idle speed and adjust if necessary.
- Slowly turn mixture screw clockwise using the pilot screw wrench until engine begins to miss.
- Slowly turn mixture screw counterclockwise until idlespeed increases to maximum RPM. Continue turning counterclockwise until idle RPM begins to drop.
- Center the pilot screw between the points in step 5 and 6.
- Re adjust idle speed if not within specification.

CARBURETOR IDLE SPEED **ADJUSTMENT (RANGER TM)**

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

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





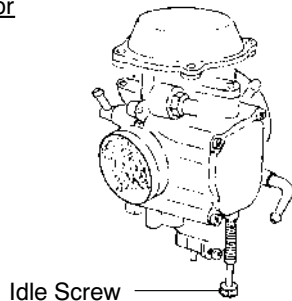
RANGER TM Engine Idle Speed:

1000 ± 100 RPM

IDLE SPEED ADJUSTMENT (RANGER 2X,4X,6X)

1. Start engine and warm it up thoroughly.

CV Carburetor



Idle Screw

RANGER 2x4, 4x4, 6x6 Idle Speed:

1200 ± 200 RPM

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

FUEL SYSTEM (ALL MODELS)

⚠ 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.

VENT LINES

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

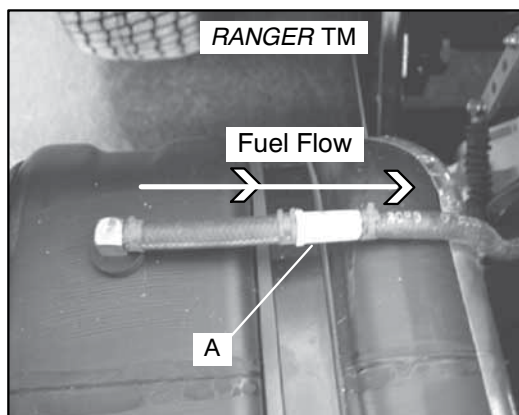
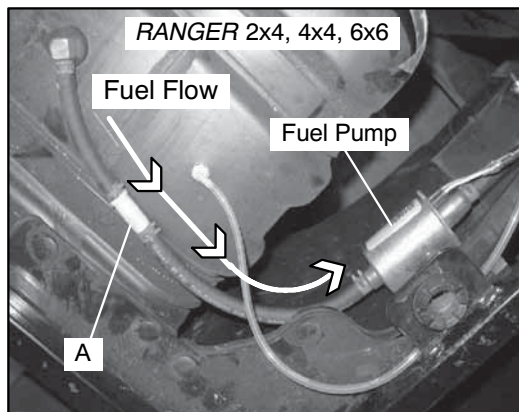
FUEL FILTER

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





1. Remove line clamps at both ends of the filter (A).
2. Remove fuel lines from filter (A).



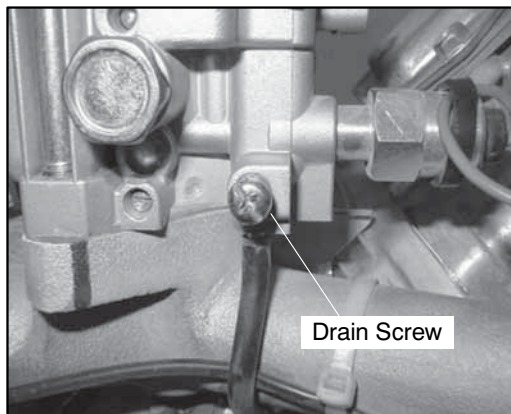
3. Install new filter and clamps onto fuel lines with arrow pointed in direction of fuel flow.
4. Install clamps on fuel line.
5. Start engine and inspect for leaks.

CARBURETOR DRAINING **(RANGER TM)**

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

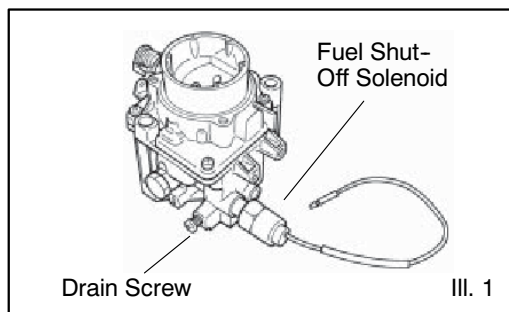
NOTE: The bowl drain screw is located on the right side of the carburetor next to the solenoid valve.

1. The drain screw has a drain line that runs down the side of the engine. Place a clean container beneath the engine.



2. Turn drain screw out two turns and allow fuel in the float bowl and fuel line to drain completely.
3. Inspect the drained fuel for water or sediment.
4. Tighten drain screw.
5. Turn fuel valve to "ON".
6. Start machine and check for leaks.

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



CARBURETOR 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.

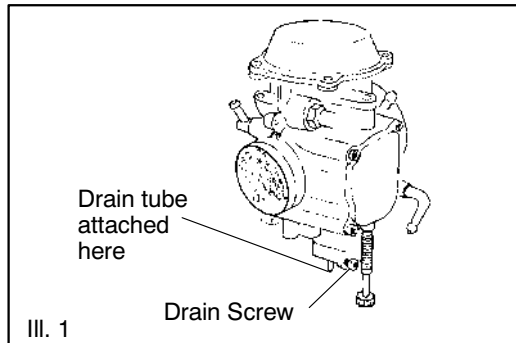
1. Turn fuel valve to the off position.
2. Place a clean container beneath the bowl drain spigot or bowl drain hose.
3. Turn drain screw out two turns and allow fuel in the float bowl and fuel line to drain completely.
4. Inspect the drained fuel for water or sediment.
5. Tighten drain screw.





- Start machine and check for leaks.

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



BATTERY MAINTENANCE (ALL MODELS)

⚠ 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.

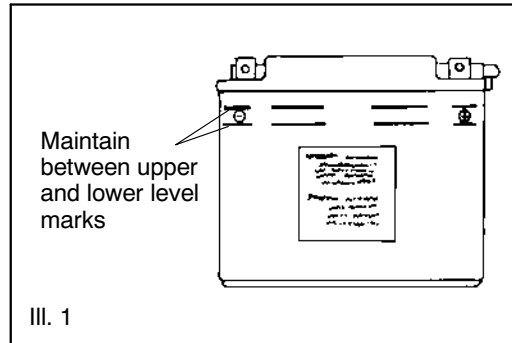
Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries. **KEEP OUT OF REACH OF CHILDREN.**

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)



To remove the battery:

- Disconnect holder strap and remove cover.
- 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.

- Disconnect the vent hose.
- Remove the battery.
- 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.

- Reinstall the battery caps.
- 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.
- 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 Dielectric Grease (PN 2871329).
11. Reinstall battery cover and holder strap.

SPARK PLUG (ALL MODELS)

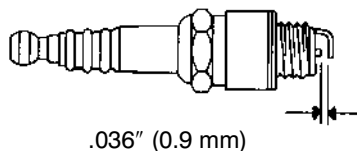
1. Remove spark plug high tension lead. Clean plug area so no dirt and debris can fall into engine when plug is removed.
2. Remove spark plug.
3. Inspect electrodes for wear and carbon buildup. Look for a sharp outer edge with no rounding or erosion of the electrodes.
4. Clean with electrical contact 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.

RANGER 2x4, 4x4, 6x6
Recommended Spark Plug:
NGK BKR5E

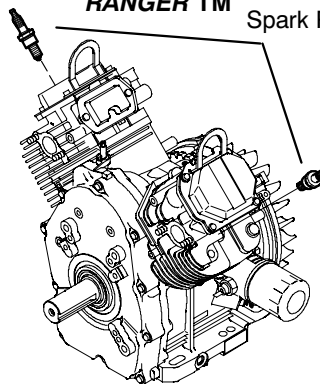
Spark Plug Torque:
14 Ft. Lbs. (19 Nm)

RANGER TM
Recommended Spark Plug:
NGK BP6ES or BPR6ES
NEW Spark Plug Torque:
8.7-10.8 Ft. Lbs. (11.8-1.7 Nm)
USED Spark Plug Torque:
16.6-19.5 Ft. Lbs. (22.5-26.5 Nm)

Spark Plug Gap



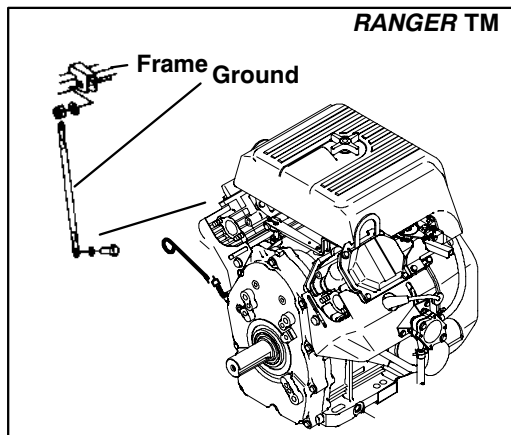
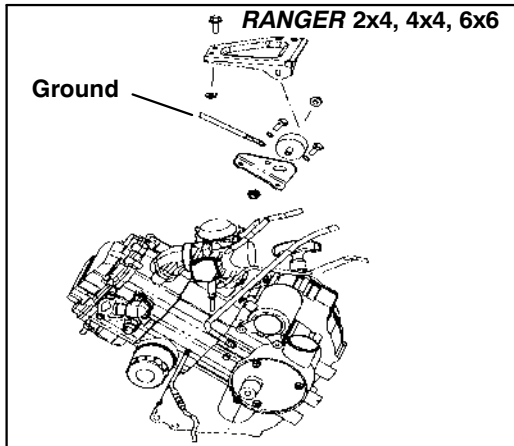
RANGER TM Spark Plugs



ENGINE TO FRAME GROUND (ALL MODELS)

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





LIQUID COOLING SYSTEM OVERVIEW (RANGER 2X,4X,6X)

NOTE: The *RANGER TM* is air cooled, so the coolant and radiator information does not apply to this model.

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.

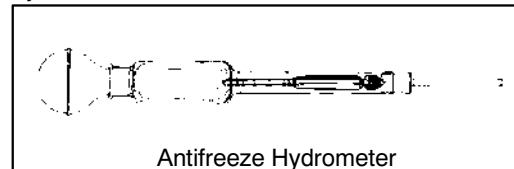
Some coolant level drop on new machines is normal as the system is purging itself of trapped air. Observe coolant levels often during the break-in period.

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 (RANGER 2X,4X,6X)

Test the strength of the coolant using an antifreeze hydrometer.



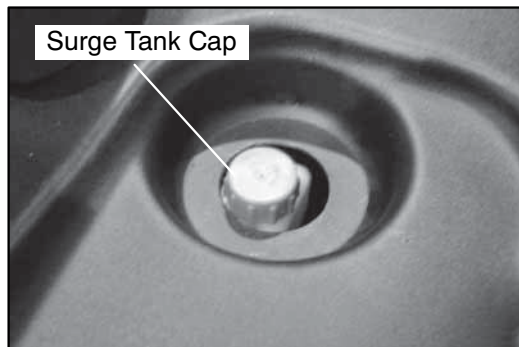
- A 50/50 or 60/40 mixture of antifreeze and distilled water will provide the optimum cooling, corrosion protection, and antifreeze protection.
- Do not use tap water, straight antifreeze, or straight water in the system. Tap water contains minerals and impurities which build up in the system.
- Straight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

Polaris 60/40 Anti-Freeze / Coolant

(PN 2871323)

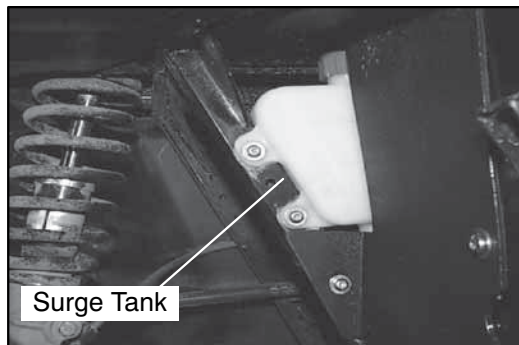
COOLANT LEVEL INSPECTION

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:

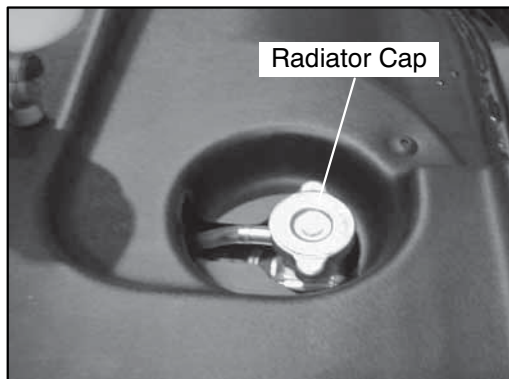
1. Remove reservoir cap. Inner splash cap vent hole must be clear and open.
2. Fill reservoir to upper mark with Polaris Premium 60/40 Anti Freeze / Coolant or 50/50 or 60/40 mixture of antifreeze and distilled water as required for freeze protection in your area.
3. Reinstall cap.



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 (RANGER 2X,4X,6X)

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



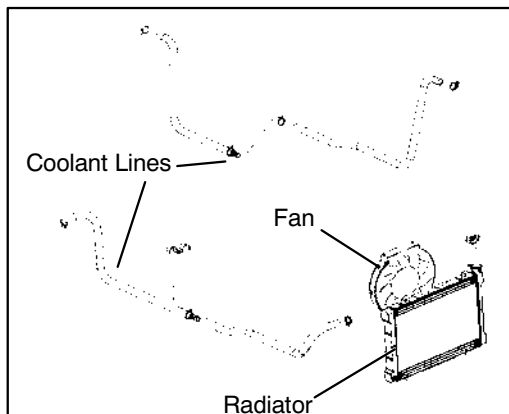
WARNING Never remove the pressure cap when the engine is warm or hot. Escaping steam can cause severe burns. The engine must be cool before removing the pressure cap.

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

To access the radiator pressure cap raise the front hood.

The radiator cap is located on the drivers side.

COOLING SYSTEM HOSES (RANGER 2X,4X,6X)



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



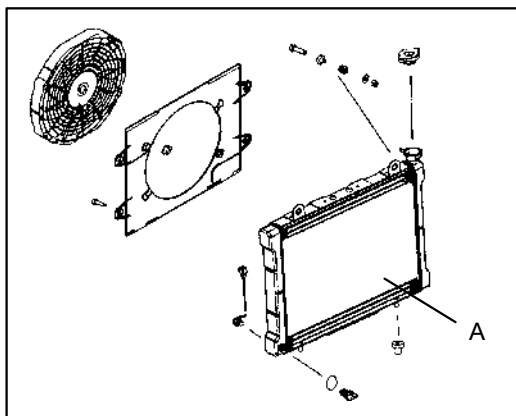


coolant flow. Radiator hose clamp torque is 36 in. lbs. (4 Nm).

COOLING SYSTEM PRESSURE TEST (RANGER 2X,4X,6X)

Refer to Page 3.50 for pressure test procedure.

RADIATOR (RANGER 2X,4X,6X)

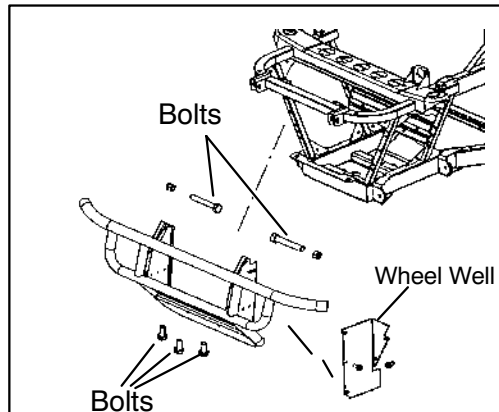


1. Check radiator (A) air passages for restrictions or damage.
2. Carefully straighten any bent radiator fins.
3. Remove any obstructions with compressed air or low pressure water.

COOLANT DRAIN/RADIATOR REMOVAL (RANGER 2X,4X,6X)

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

the frame.



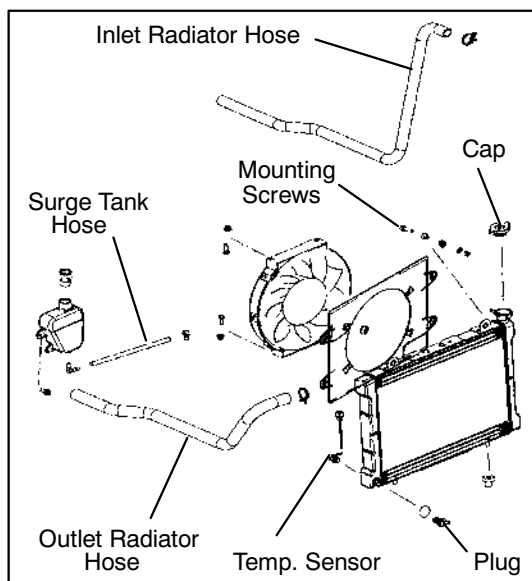
2. Remove two mounting screws that secure the top of the radiator to the frame. Remove the radiator cap. Pull the radiator out of the frame at an angle.

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

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



6. Remove the radiator.

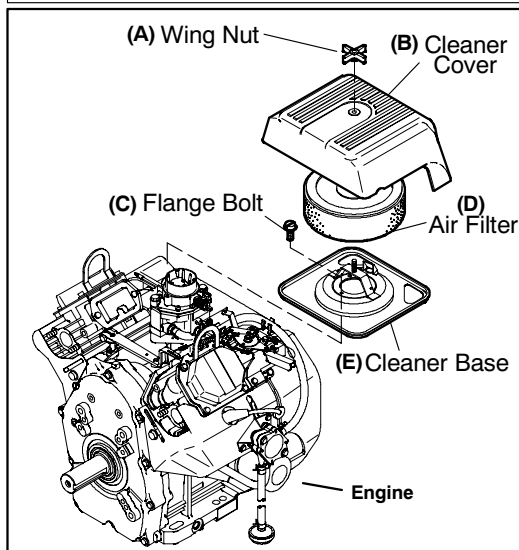
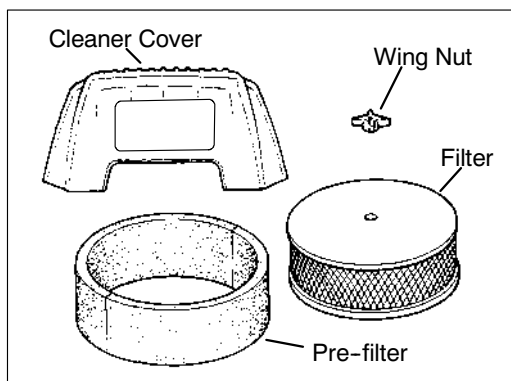


AIR FILTER/ BREATHER **FILTER SERVICE (RANGER** **TM)**

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

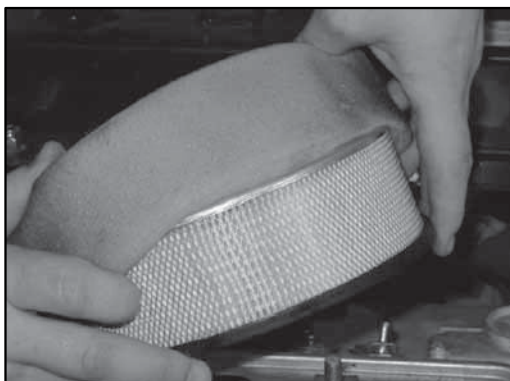
The filter should be inspected periodically before each ride, using the following procedure.

1. Remove the seat.
2. Remove the wing nut (A) located on top of the cleaner cover (B).
3. Remove the cleaner cover (B) and lift the cleaner element (D) from the cleaner base (E).
4. Inspect the pre-filter and filter and replace if necessary. If the filter has been soaked with fuel or oil it must be replaced.



Installation

1. Reinstall the air filter (D) onto the cleaner base (E). Be sure the filter fits tightly t the cleaner base (E).





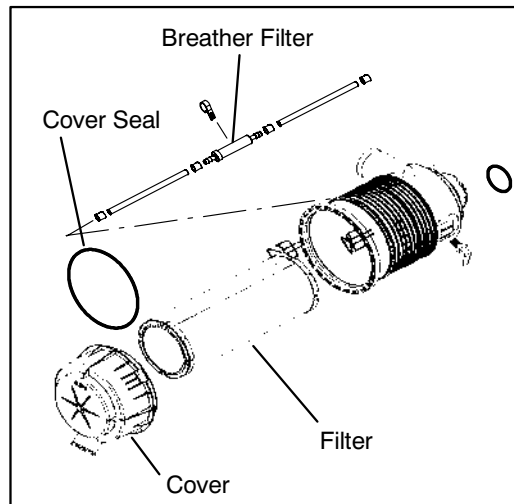
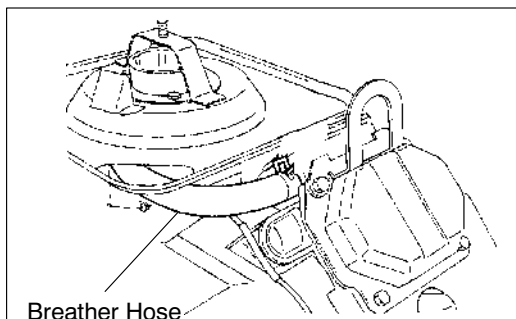
NOTE: Apply a small amount of general purpose grease to the sealing edges of the filter before installing.

2. Install cleaner cover (B) and secure with wing nut (A).

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

BREATHER HOSE (RANGER TM)

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



Installation

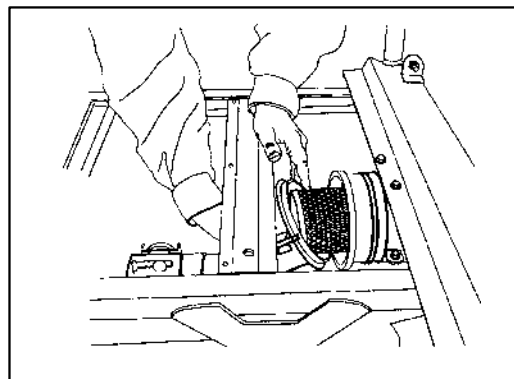
1. Reinstall the filter into the air box container. Be sure the filter fits tightly in the air box.

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

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

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

3. Install air box cover and secure with clips.



AIR FILTER BREATHES SERVICE (RANGER 2X,4X,6X)

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

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

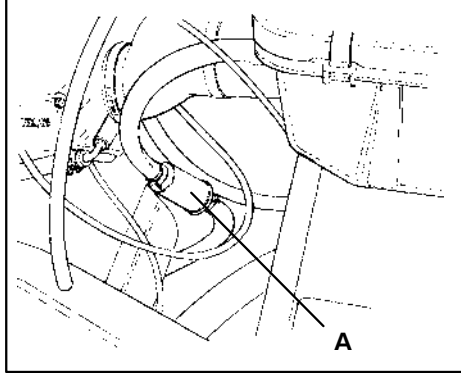
1. Lift the box to access the filter box cover.
2. Remove clips (2) from air box cover and remove cover. Inspect the gasket. It should adhere tightly to the cover and seal all the way around.
3. Remove air filter assembly. Do not clean the main filter, the filter should be replaced.
4. Inspect main element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

BREATHES FILTER INSPECTION (RANGER 2X,4X,6X)

NOTE: The *RANGER TM* does not have a breather filter.



The 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). Follow right hand breather line out of the side of the airbox and locate filter. Blow through gently in direction of arrow on filter to check for clogging. Replace as needed.



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

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

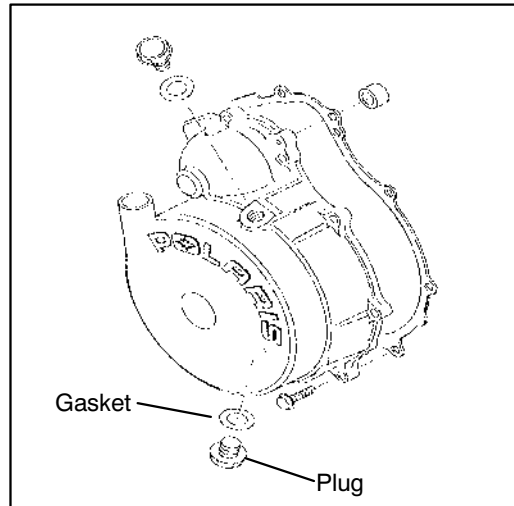
BREATHER HOSE

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

FLYWHEEL HOUSING (RANGER 2X,4X,6X)

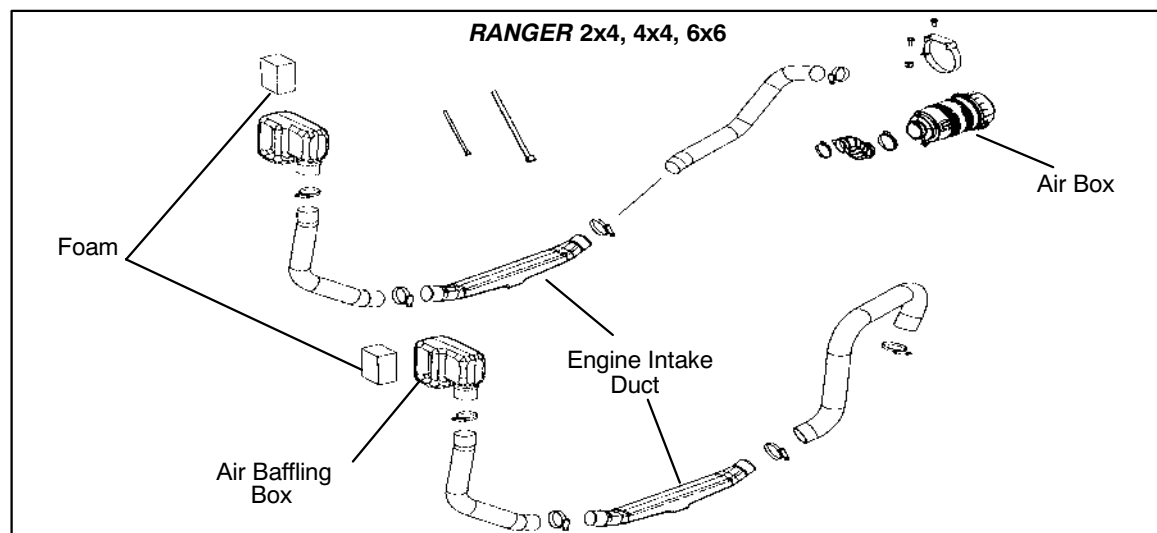
- Drain the housing periodically to remove moisture.
 - Drain the flywheel housing after operating the vehicle in very wet conditions. This should also be done before storing the vehicle. The drain screw is located at the bottom of the flywheel housing. Remove the plug. Reinstall the plug once housing has been drained.
 - After travelling in wet areas the engine housing and starter should always be drained completely by removing the housing.
 - Do not open the crankcase drain unless the engine has ingested water. Some engine oil will be lost if

crankcase drain is opened.





AIR INTAKE INSPECTION



1. Lift the hood.
2. Inspect the foam inserts in the air baffle boxes. If the foam inserts are dirty, clean the foam with a high flash point solvent, followed by hot soapy water.
3. Rinse and dry the foam thoroughly.
4. Inspect the foam for tears or damage. Replace if necessary.
5. Reinstall the foam inserts into the air baffle boxes.

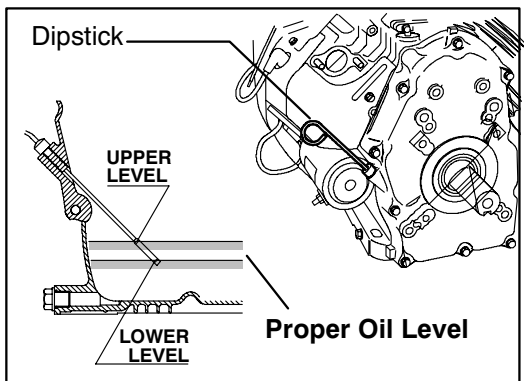
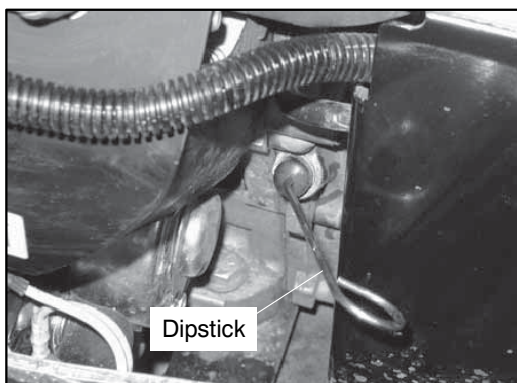


ENGINE OIL LEVEL (RANGER TM)

The EH63 engine is a wet-sump engine.

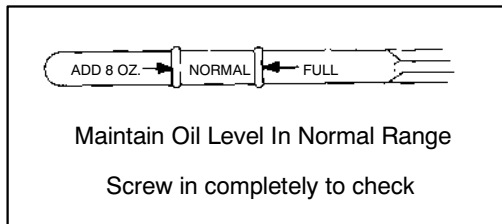
To check the oil level:

1. Set machine on a level surface.
2. Start and run engine for 20-30 seconds.
3. Stop engine, remove the bench seat.
4. The dipstick is located on the front side of the engine (driver side). Remove dipstick and wipe dry with a clean cloth. **NOTE:** If the dipstick is not visible or cannot be reached from the top, remove the plastic front engine cover to access the dipstick.



5. Reinstall dipstick.

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



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

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

OIL AND FILTER CHANGE, RANGER TM

▲ 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.

RECOMMENDED ENGINE OIL:

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

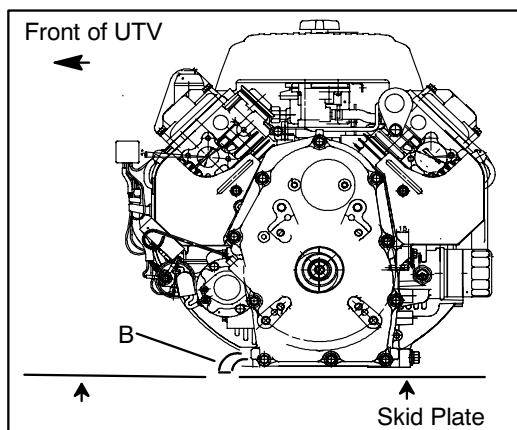
Ambient Temperature Range:
-40° F to 120° F

1. Place vehicle on a level surface.
2. Run engine two to three minutes until warm. Stop engine.
3. Apply parking brake.
4. Clean area around drain plug (B) at bottom of engine.
5. Place a drain pan beneath engine. Access the engine drain plug through the access hole at the

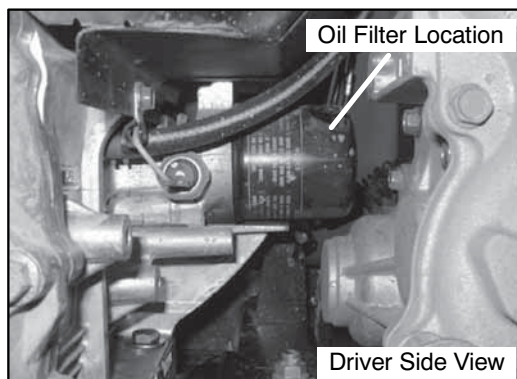




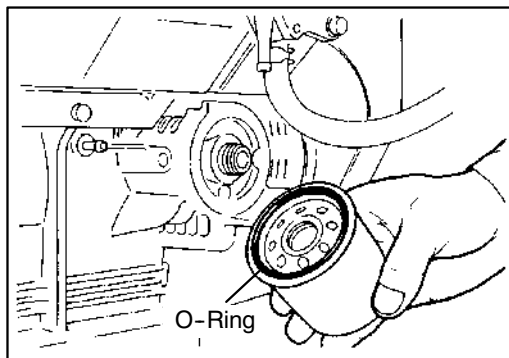
bottom of the skid plate. Use an Allen wrench or socket to remove the the oil drain plug (B).
CAUTION: Oil may be hot. Do not allow hot oil to come into contact with skin as serious burns may result.



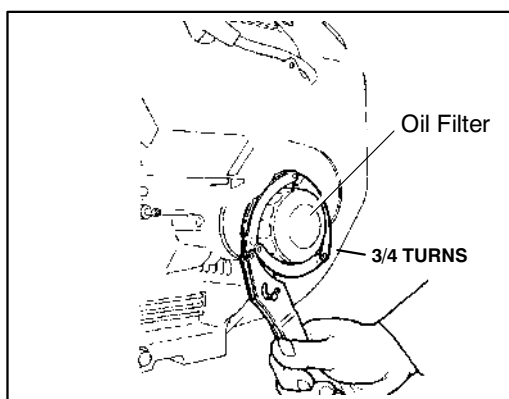
6. Allow oil to drain completely.
7. Reinstall drain plug and washer and torque to 14 ft. lbs. (19 Nm).
8. Place shop towels beneath oil filter. Using an oil filter wrench turn filter counterclockwise to remove.



9. Using a clean dry cloth, clean filter sealing surface on crankcase.
10. Check to make sure the O-ring is in good condition. Lubricate O-ring on new filter with a film of engine oil.

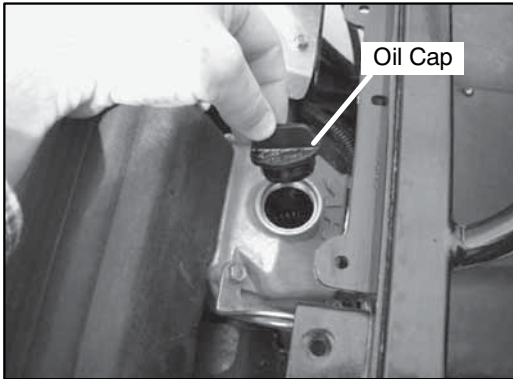


11. Install new filter and turn by hand until filter gasket contacts the sealing surface, then turn and additional 3/4 turn.



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

12. Reinstall drain plug.
13. Remove oil fill cap and fill engine with 1.63 quarts (1.55 l) of Polaris Premium 4 Synthetic 0W-40 Oil (PN 2871281).



14. Place gear selector in neutral and set parking brake.
15. Re-check the oil level on the dipstick and add oil as necessary to bring the level to the upper mark on the dipstick (See previous "Engine Oil Level" section).
16. Dispose of used filter and oil properly.

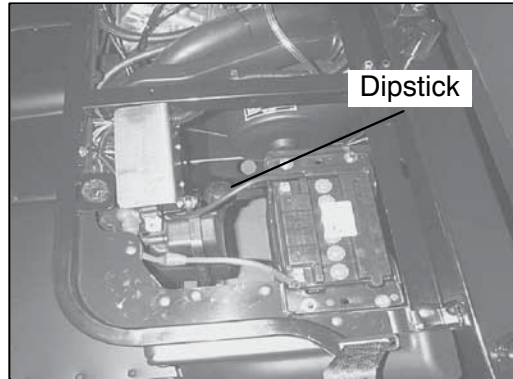
Oil Drain Plug Torque:
14 ft. lbs. (19 Nm)

Oil Filter Torque:
Turn by hand until filter gasket contacts sealing surface, then turn an additional 3/4 turn

ENGINE OIL LEVEL (RANGER 2X,4X,6X)

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. About a cup of oil will remain in the crankcase.
3. Stop engine, remove the bench seat.
4. The oil tank is located on the driver side. Remove dipstick and wipe dry with a clean cloth.



5. Reinstall dipstick, screwing into place.

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



Maintain Oil Level In Normal Range

Screw in completely to check

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

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





OIL AND FILTER CHANGE (RANGER 2X,4X,6X)

▲ WARNING

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

NOTICE:

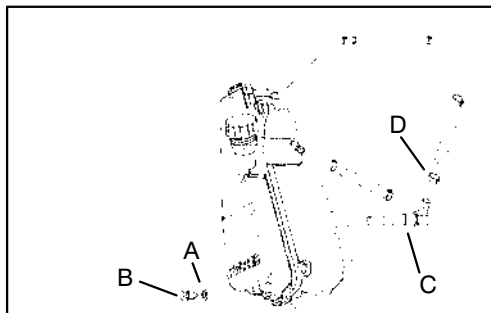
Care must be taken to ensure that fluids are contained. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembly any component containing fluids.

RECOMMENDED ENGINE OIL:

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

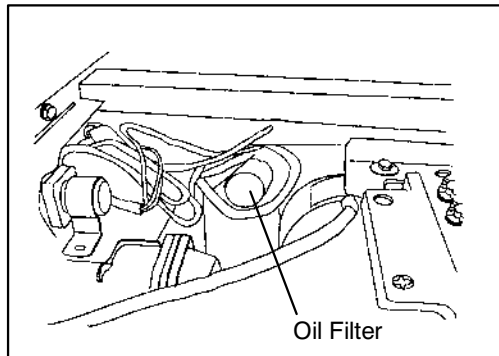
Ambient Temperature Range:
-40° F to 120° F

1. Place vehicle on a level surface.
2. 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).
11. Clean screen thoroughly.
12. Apply Loctite™ 565 Thread Sealant (PN 2871956) to the clean and oil free threads of the fitting.
13. Install the fitting (C) and tighten.
14. Install oil hose on fitting and install clamp.
15. Place shop towels beneath oil filter. Using an Oil Filter Wrench (PV-43527), turn filter counterclockwise to remove.



16. Using a clean dry cloth, clean filter sealing surface on crankcase.
17. Check to make sure the O-ring is in good condition. Lubricate O-ring on new filter with a film of engine oil.
18. Install new filter and turn by hand until filter gasket contacts the sealing surface, then turn and additional 1/2 turn.
19. 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.

20. Reinstall drain plug.
21. Remove dipstick and fill tank with 2 quarts (1.9 l) of Polaris Premium 4 Synthetic Oil (PN 2871281).
22. Place gear selector in neutral and set parking brake.
23. **Prime oil pump using procedure below.** Stop the engine and inspect for leaks.
24. Re-check the oil level on the dipstick and add oil as necessary to bring the level to the upper mark on the dipstick.



25. 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

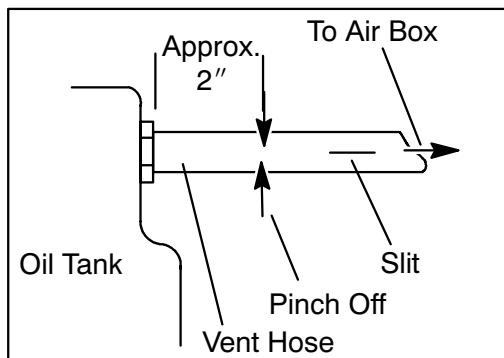
Oil Filter Wrench:
PV-43527

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

OIL PUMP PRIMING PROCEDURE (RANGER 2X,4X,6X)

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 before the vent line's pressure relief slit
2. Run engine for 15-20 seconds.
3. Remove the vent line clamp. The oil pump will now be properly primed and ready for field operation.



VALVE CLEARANCE (RANGER 2X,4X,6X)

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.

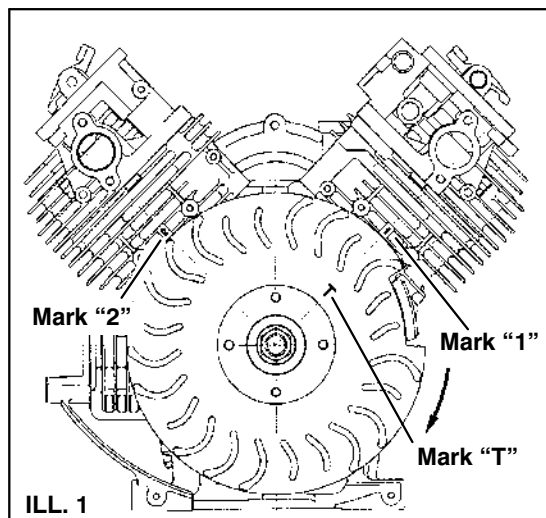
VALVE LASH VERIFICATION (RANGER TM)

NOTE: 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 the flywheel 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.

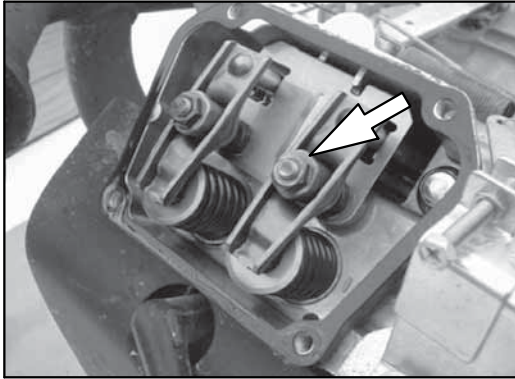
5. Rotate the crankshaft clockwise to the TDC position by matching the "T" of the flywheel with the "1" of the #1 cylinder head.



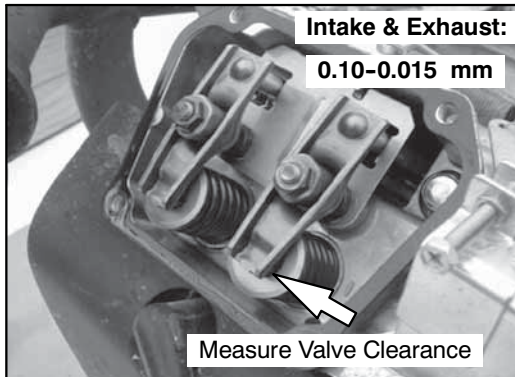


CAUTION: Failure to position the crankshaft at TDC on compression stroke will result in improper valve adjustment.

6. Loosen the rocker arm nut.



7. Use a feeler gauge to measure valve clearance. Valve clearance should be **0.10-0.015 mm**. Now tighten the rocker arm nuts to **7.20-10.10 ft.lbs. (9.8-13.7 Nm)**.
8. Adjust the clearance on the #2 cylinder in the same manner.



9. Rotate the crankshaft several times and be sure to check valve clearance again. Adjust valve clearance if necessary.

INTAKE/EXHAUST VALVE CLEARANCE
0.10 ± 0.015 mm

VALVE CLEARANCE (RANGER 2X,4X,6X)

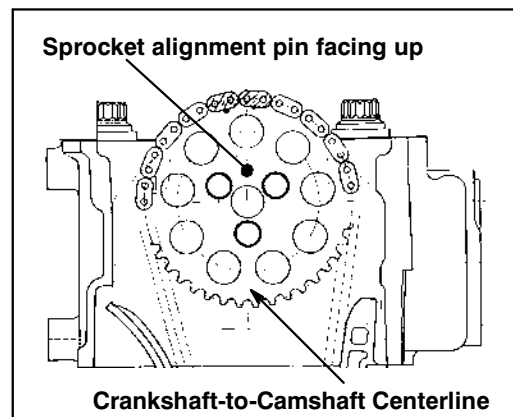
Inspect and adjust valve clearance while the engine is cold and the piston positioned at Top Dead Center (TDC) on compression stroke.

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.

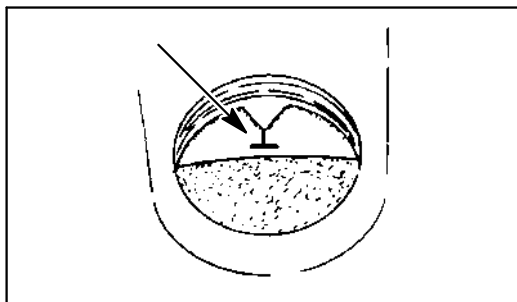
5. Remove timing inspection plug from recoil housing.

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.

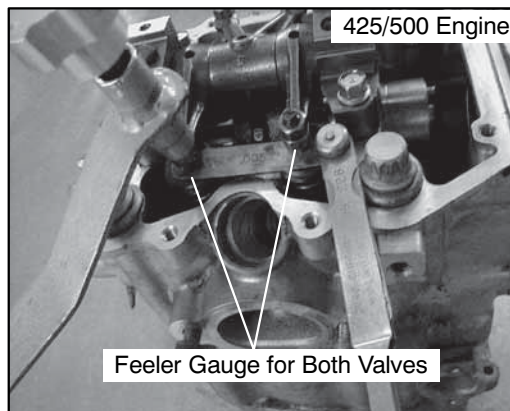
INTAKE VALVE CLEARANCE ADJUSTMENT (RANGER 2X,4X,6X)

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

INTAKE VALVE CLEARANCE

.006" (.15 mm)

EXHAUST VALVE CLEARANCE ADJUSTMENT (RANGER 2X,4X,6X)



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 425/500 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 (ALL MODELS)

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.

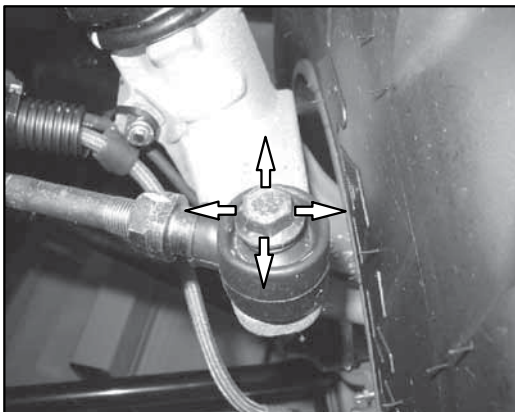
⚠ WARNING

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.

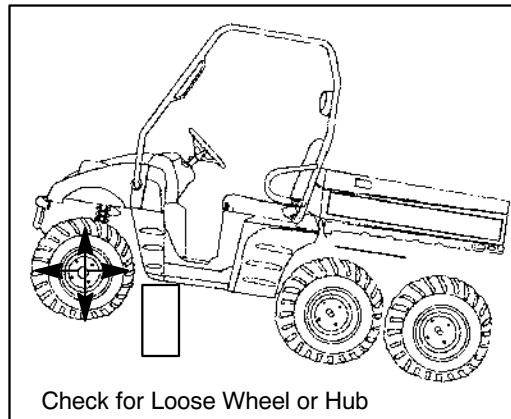
One of two methods can be used to measure toe alignment. The string method and the chalk method. If adjustment is required, refer to following pages for procedure.

TIE ROD END / STEERING INSPECTION (ALL MODELS)

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



- Elevate front end of machine so front wheels are off the ground. Check for any looseness in front hub / wheel assembly by grasping the tire firmly at top and bottom first, and then at front and rear. Try to move the wheel and hub by pushing inward and pulling outward.



- If abnormal movement is detected, inspect the hub and wheel assembly to determine the cause (loose wheel nuts or loose front hub nut).
- Refer to the Body/Steering or Final Drive chapter for more information.

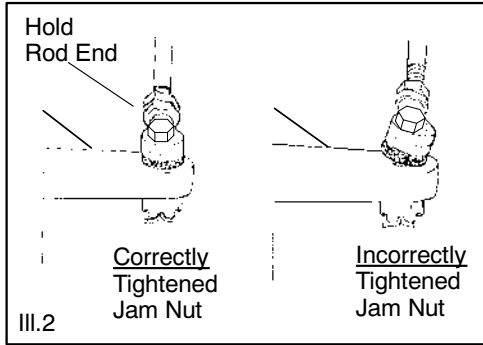
CAMBER AND CASTER (ALL MODELS)

The camber and caster are non-adjustable.

TOE ALIGNMENT ADJUSTMENT (ALL MODELS)

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.



III.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).

EXHAUST PIPE (ALL MODELS)

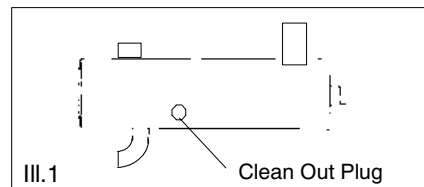
⚠ WARNING

- 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.



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 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 **(ALL MODELS)**

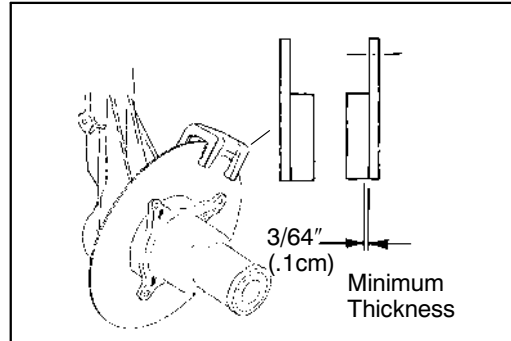
The following checks are recommended to keep the brake system in good operating condition. Service life of brake system components depends on operating conditions. Inspect brakes in accordance with the maintenance schedule and before each ride.



- Keep fluid level in the master cylinder reservoir to the indicated level inside reservoir.
- Use Polaris DOT 3 Brake Fluid (**PN 2870990**) or DOT 4 Brake Fluid.
- Check brake system for fluid leaks.
- Check brake for excessive travel or spongy feel.
- Check friction pads for wear, damage or looseness.
- Check surface condition of the disc.

BRAKE PAD INSPECTION **(ALL MODELS)**

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

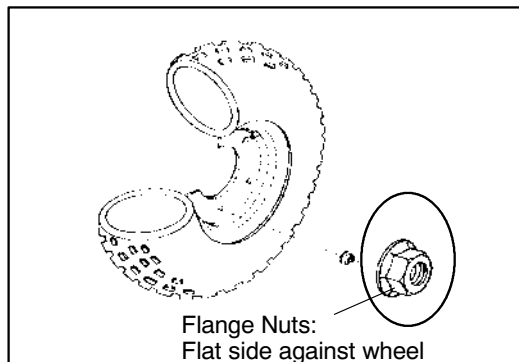
Check brake system hoses and fittings for cracks, deterioration, abrasion, and leaks. Tighten any loose fittings and replace any worn or damaged parts.

WHEEL, HUB, AND SPINDLE **TORQUE TABLE**

Item	Specification
Front Wheel Nuts	35 Ft. Lbs. (47 Nm)
Rear Wheel Nuts	35 Ft. Lbs. (47 Nm)
Front Spindle Nut	40 Ft. Lbs. (55 Nm)
Rear & Center Hub Retaining Nut	110 Ft. Lbs. (150 Nm)



WHEEL REMOVAL FRONT OR REAR (ALL MODELS)



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 (ALL MODELS)

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:

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 (ALL MODELS)

CAUTION:

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

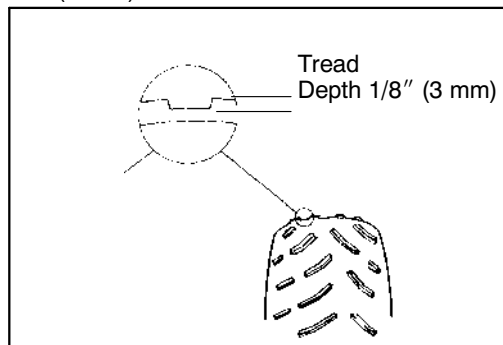
Tire Pressure Inspection (PSI - Cold)	
Front	Center & Rear
10	10

TIRE INSPECTION

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

Tire Tread Depth

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



▲ WARNING

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

Worn tires can cause an accident.

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

FRAME, NUTS, BOLTS, FASTENERS (ALL MODELS)

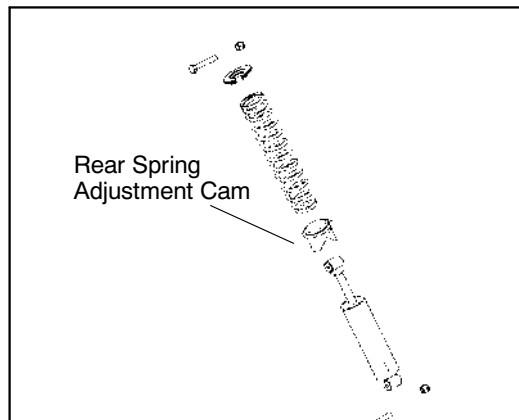
Periodically inspect the torque of all fasteners in accordance with the maintenance schedule. Check that all cotter pins are in place. Refer to specific fastener torques listed in each chapter.

- Check all rear suspension components for wear or damage.





FRONT SUSPENSION (ALL MODELS)

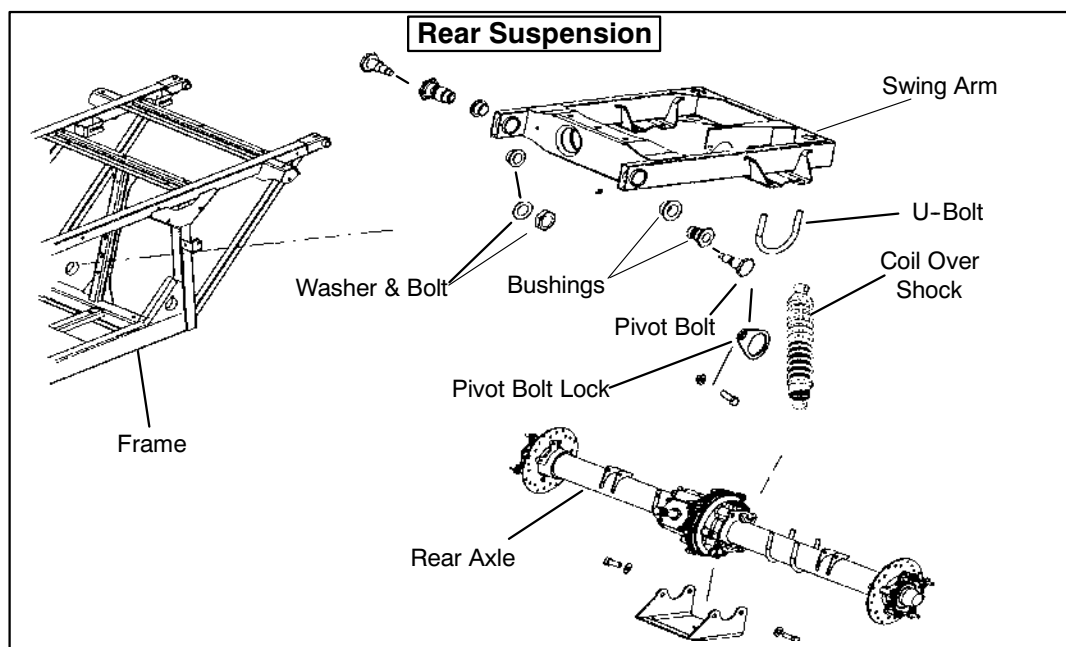


- Compress and release front suspension. Damping should be smooth throughout the range of travel.
- Check all front suspension components for wear or damage.
- Inspect front strut cartridges for leakage.

Shock Spanner Wrench

(PN 2870872)

REAR SUSPENSION (ALL MODELS)



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



CHAPTER 3

ENGINE

<i>RANGER</i> TM Engine (EH63)	3.2-3.44
<i>RANGER</i> 2x4, 4x4, 6x6	3.45-3.98



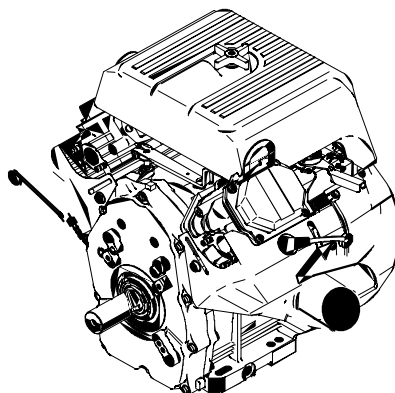


CHAPTER 3

ENGINE

RANGER TM ENGINE

Torque Specifications	3.3
Special Tools	3.3
Cylinder Honing	3.4
Crankshaft Runout Inspection	3.5
Engine Lubrication/Oil Flow	3.6
Engine Component Overview	3.7-3.11
Engine Removal	3.12-3.13
Engine Top End Disassembly	3.14-3.23
Engine Service Data	3.24-3.29
Engine Assembly	3.30-3.41
Engine Installation Notes	3.42
Spark Plug Fouling Checklist	3.42
Troubleshooting	3.42-3.43



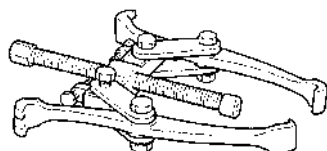


ENGINE TORQUE SPECS

ITEMS		Tightening Torque		
		N-m	Kg-cm	ft-lb.
Breather cover				
Breather cover		2.9 - 4.9	30 - 50	2.2 - 3.6
Carburetor bolts		16.7 - 18.6	170 - 190	12.3 - 13.7
Charge coil		1.5 - 3.4	15 - 35	1.1 - 2.5
Connecting rod cap bolts		22.1 - 27.0	225 - 275	16.3 - 19.9
Cylinder head bolts		33.3 - 41.2	340 - 420	24.6 - 30.4
Flywheel nut		83.3 - 93.1	850 - 950	61.5 - 68.7
Ignition coil		6.9 - 8.8	70 - 90	5.1 - 6.5
Intake manifold bolts		16.7 - 18.6	170 - 190	12.3 - 13.7
Main bearing cover bolts		16.7 - 18.6	170 - 190	12.3 - 13.7
Oil filter		12.3	100 - 150	9
Oil pressure switch		5.9 - 9.8	60 - 100	4.3 - 7.2
Oil relief plug		11.8 - 14.7	150 - 250	10.9 - 18.1
Rocker arm nut		9.8 - 13.7	100 - 140	7.2 - 10.1
Rocker cover		2.9 - 4.9	30 - 50	2.2 - 3.6
Spark plug	New one	11.8 - 14.7	120 - 150	8.7 - 10.9
	Current one	22.5 - 26.5	225 - 275	16.6 - 19.5
Starter motor bolts		16.7 - 18.6	170 - 190	12.3 - 13.7

SPECIAL TOOLS

NOTE: No special tools are required for disassembly and assembly of the EH63 engine. Only a universal flywheel puller is needed to remove the flywheel.



Flywheel Puller





CYLINDER HONE SELECTION/HONING PROCEDURE

CAUTION:

Selecting a hone which will straighten as well as remove material from the cylinder is very important. Using a common spring loaded finger type glaze

breaker for honing is never advised. Polaris recommends using a rigid hone or arbor honing machine which also has the capability of oversizing.

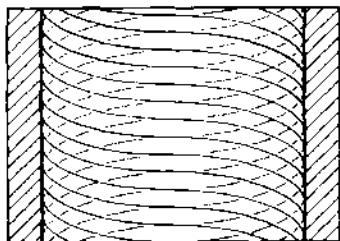
Cylinders may be wet or dry honed depending upon the hone manufacturer's recommendations. Wet honing removes more material faster and leaves a more distinct pattern in the bore.

NOTE: See next page for more information on honing.

HONING TO OVERSIZE

CAUTION: If cylinder wear or damage is excessive, it will be necessary to oversize the cylinder using a new 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.



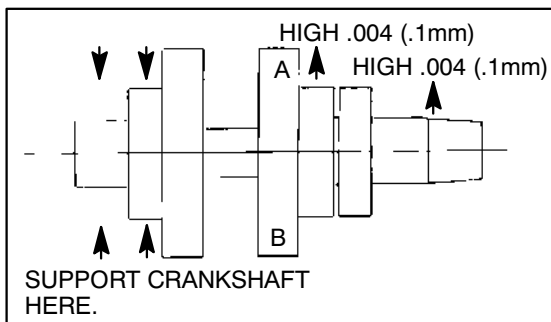


CRANKSHAFT STRAIGHTENING

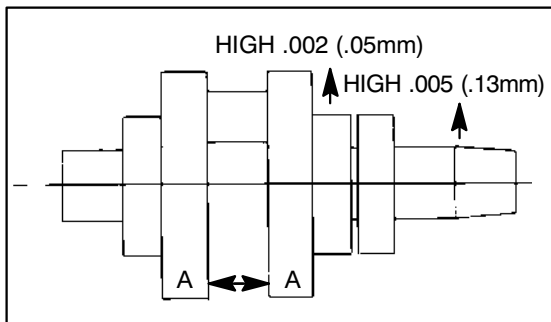
Lubricate the bearings and clamp the crankshaft securely in the Crankshaft Truing Stand (PN 2870569). Refer to the illustrations below.

Crankshaft Truing Stand (PN 2870569)

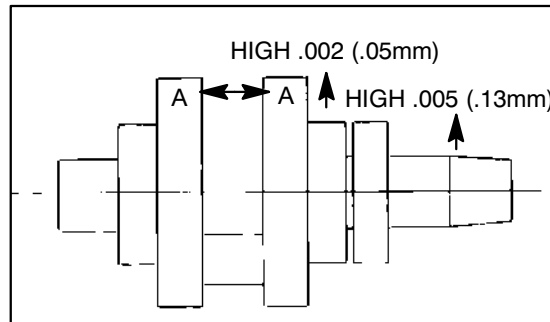
NOTE: The rod pin position in relation to the dial indicator position tells you what action is required to straighten the shaft.



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



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 .006".





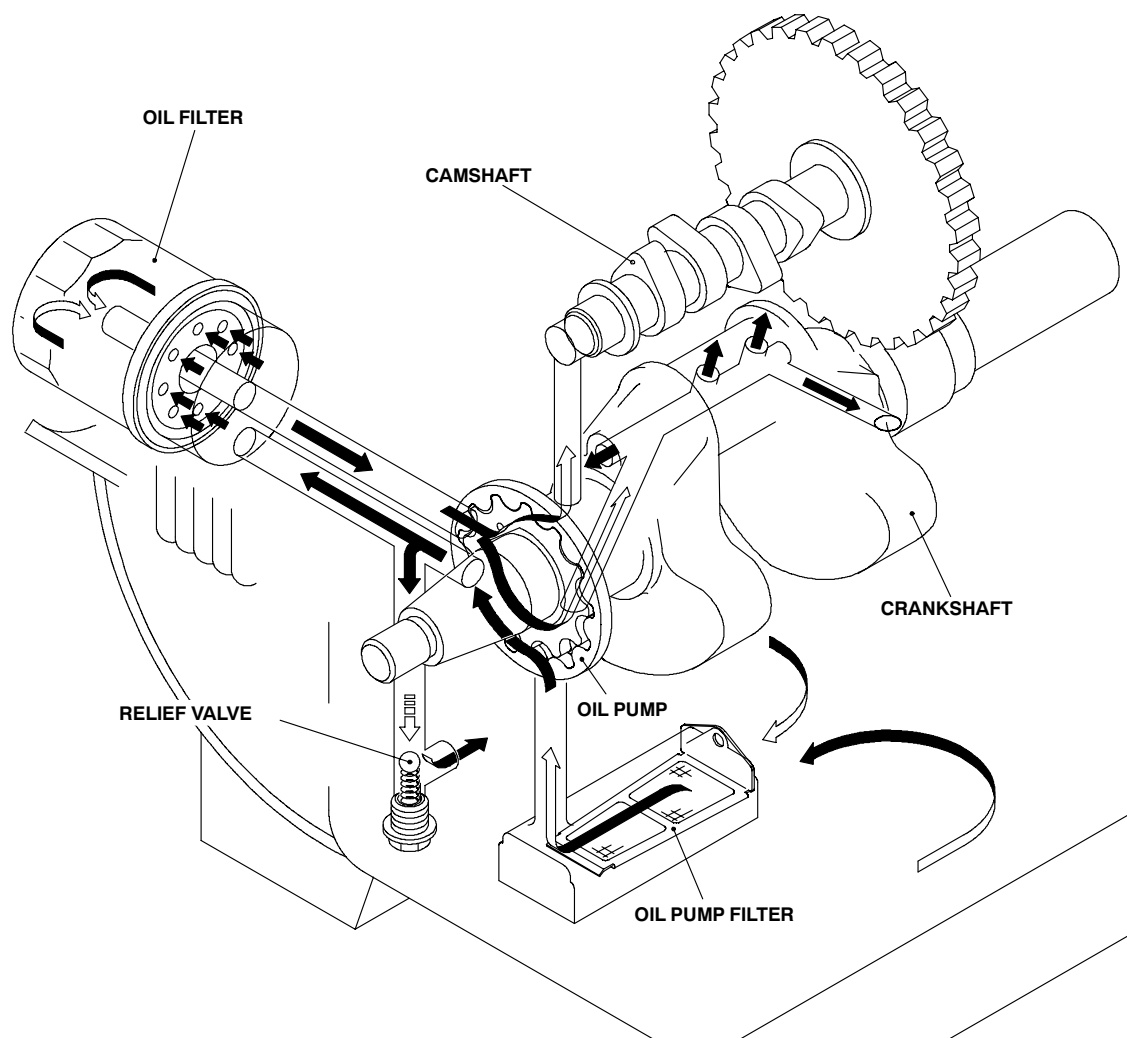
EH63 OIL FLOW DIAGRAM

*The Robin EH63 Engine features a wet sump lubrication system with a large trochoid oil pump and cartridge type filter.

*The large trochoid type oil pump is driven by the crankshaft, and delivers pressurized engine oil to the journal and pin portions of the crankshaft and camshaft.

*The engine oil in the oil pan feeds through the oil pump filter and into the oil pump and the engine oil pressure is adjusted by the relief valve after discharging the oil pump. The oil then runs through the oil filter and is distributed onto the rotating parts such as the journal, pins portion of the crankshaft, and the camshaft. The splashed oil then lubricates all other engine components: cylinder, piston, and cylinder head.

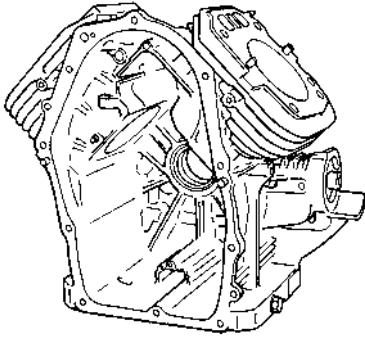
*A bypass valve is incorporated into the cartridge type oil filter, in the case that the oil filter element is clogged, the engine oil is fed through the by-pass valve into the crankcase oil passage.





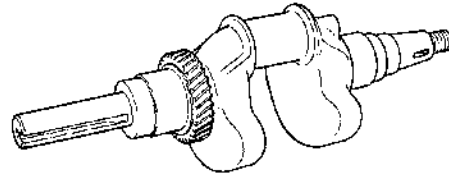
ENGINE COMPONENT OVER VIEW

Cylinder and Crankcase



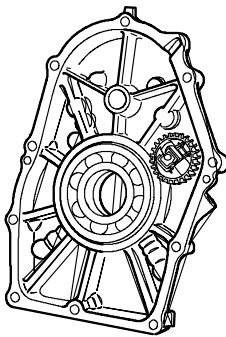
- The twin-cylinder and crankcase is single piece aluminum die-casting.
- The cylinder liner is made of cast iron that is molded into the aluminum housing.
- The bearing cover attaches to the crankcase on the output side.

Crankshaft



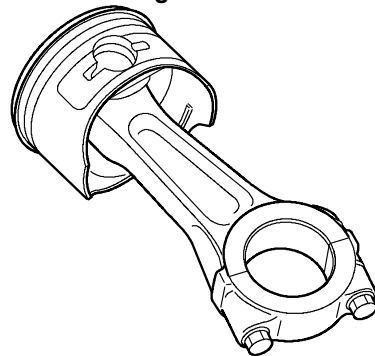
- The crankshaft is forged carbon steel, and the crank pin is induction-hardened.
- The output end of the shaft has a crankshaft gear pressed into position.
- Engine oil passages are provided onto the journal and pin portions of the crankshaft for lubrication.

Main Bearing Cover



- Main bearing cover is die-cast aluminum and mounts on the output shaft side of the crankcase.

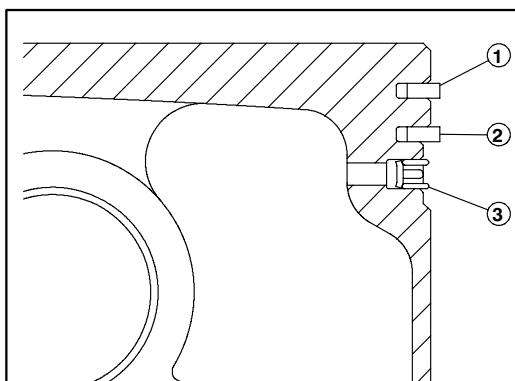
Connecting Rod and Piston



- The connecting rod is forged aluminum alloy, and it's large and small ends function as bearings.
- The piston is an aluminum alloy casting and carries tow compression

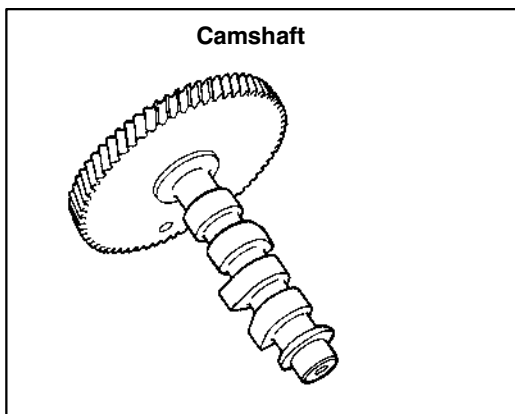


rings and one oil ring.



①	TOP RING	BARREL	
②	SECOND RING	TAPER	
③	OIL RING	COMBINATION RING	

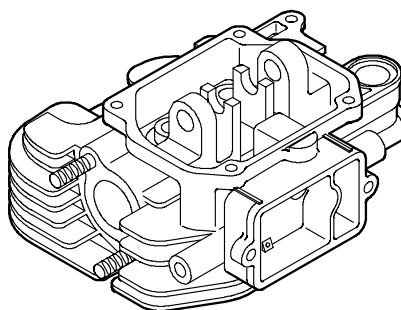
- Piston rings are made of cast iron.
- The profile of the top ring is barrel face and the second ring has a tapered face. The oil ring is designed for better sealing and less oil consumption.



Camshaft

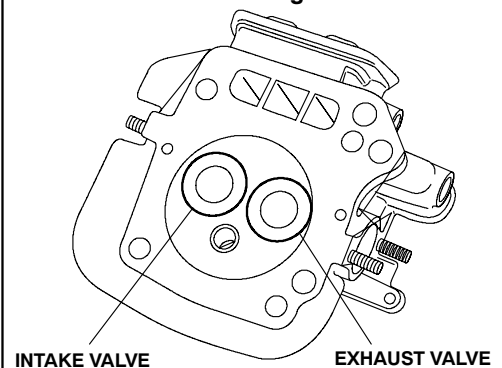
- The camshaft and camshaft gear are cast together as one piece and are made of cast iron.
- Both sides of the camshaft fit into the bearings of the crankcase and main bearing cover.

Cylinder Head



- The cylinder head is die-cast aluminum with a semi-spherical type combustion chamber for the high combustion efficiency.

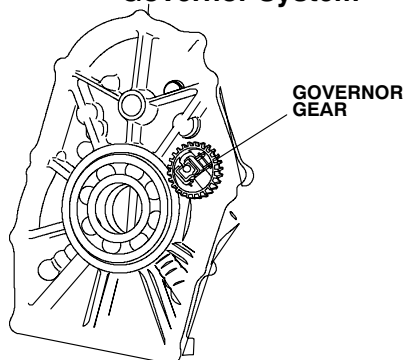
Valve Arrangement



- The intake valve is coated on the flywheel.
- The hard alloy valve seats are molded into the cylinder head and stellite is fused to the exhaust valve face.

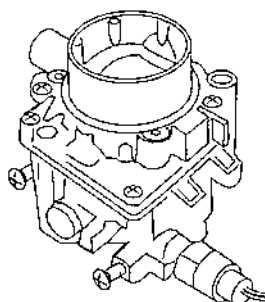


Governor System



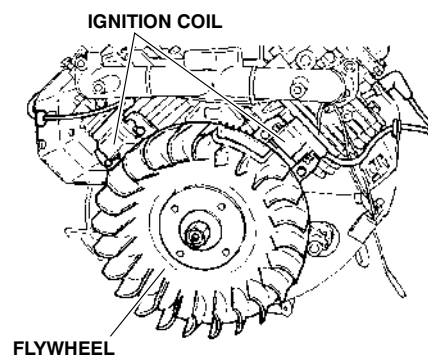
- The governor is a centrifugal flyweight type, which ensures constant operation at the selected speed against load variations.
- The governor gear and governor weights is installed inside the main bearing cover and driven by the crankshaft.

Carburetor



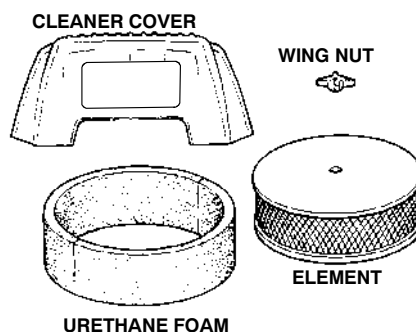
- The EH63 engine is equipped with a down draft carburetor that has a float controlled fuel system and a fixed main jet.
- The fuel cut off solenoid is provided to prevent the engine from running when the key switch is turned off.

Ignition System / Cooling System



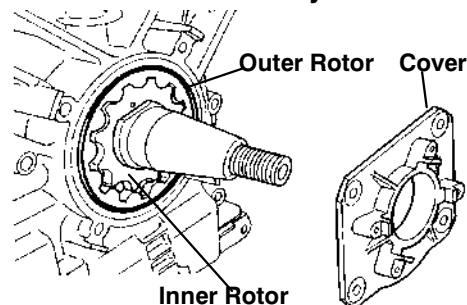
- The ignition system is a transistor controlled magneto ignition system which consists of a flywheel and an ignition coil with a built-in transistor installed into the case.
- The large fins on the flywheel provide sufficient cooling air capacity for the cylinder and cylinder head.

Air Cleaner



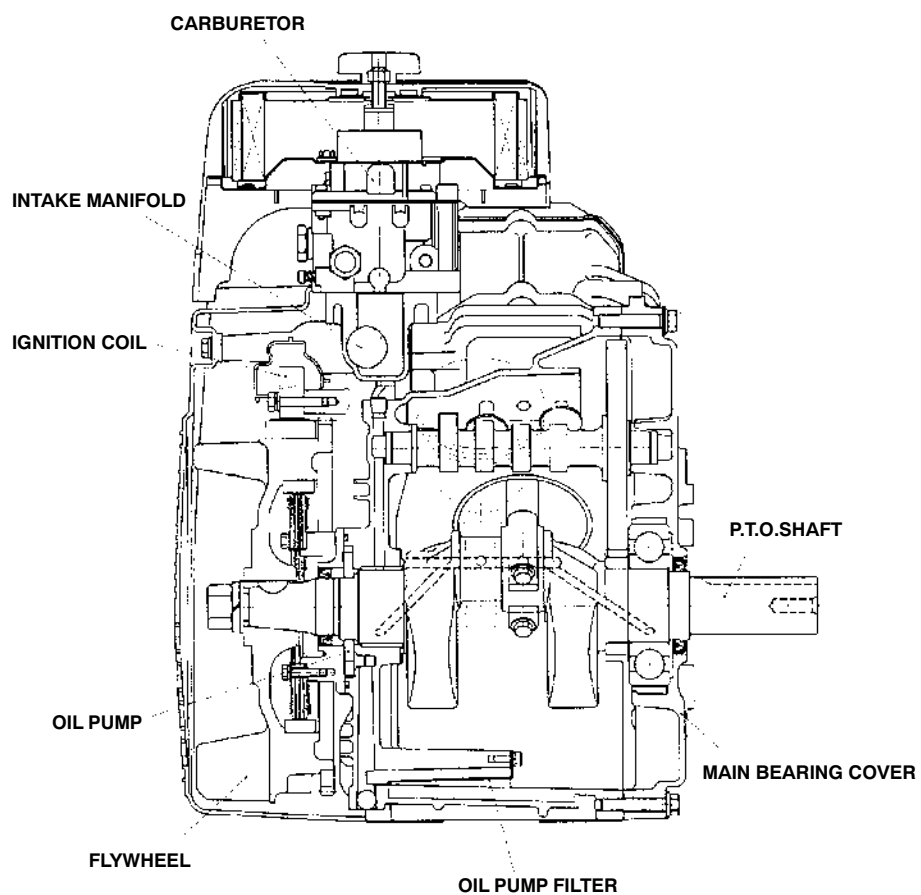
- The air cleaner is a dual element system providing excellent protection. The urethane foam (half wet) filter covers the main dry element.

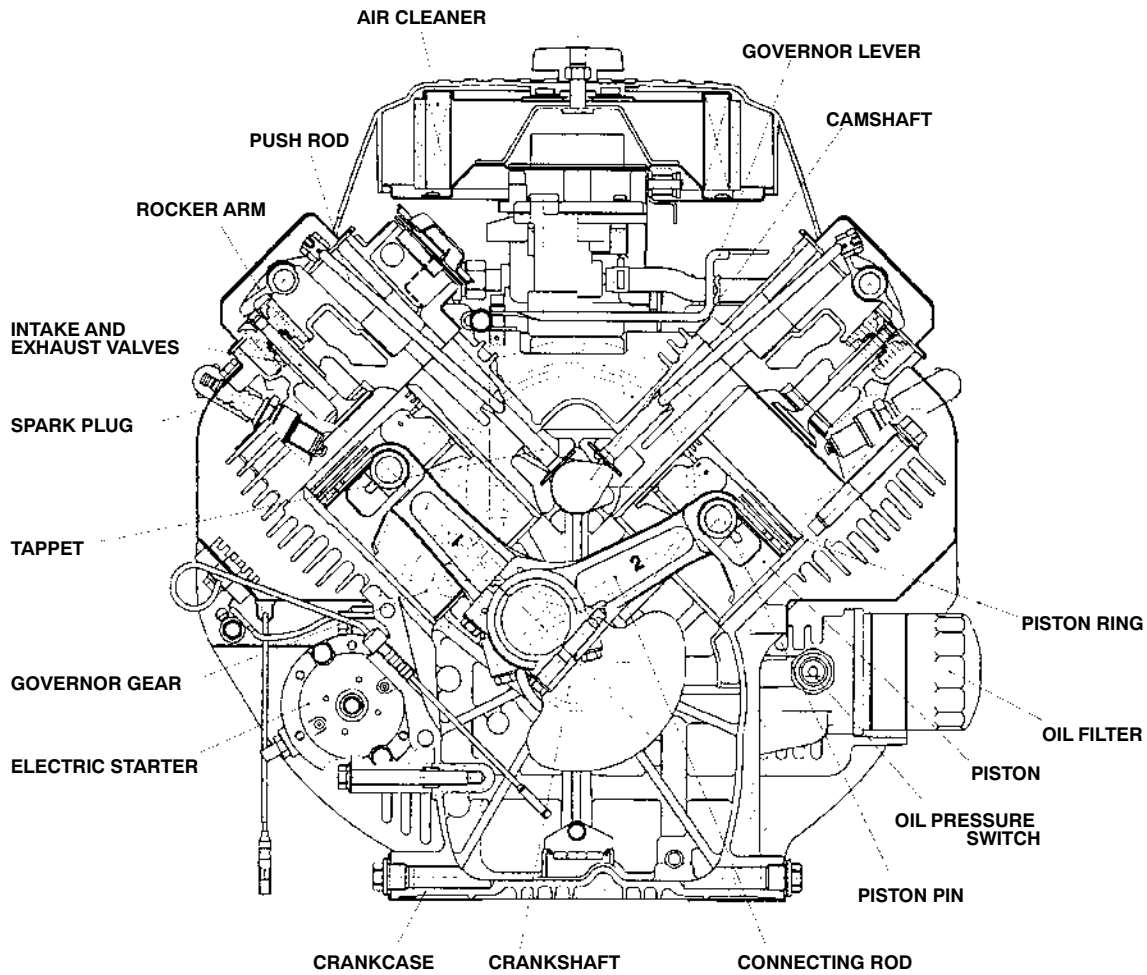
Lubrication System





EH63 SECTIONAL VIEW

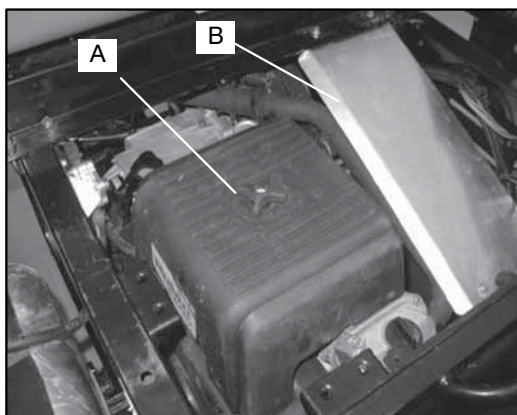


**EH63 SECTIONAL VIEW**

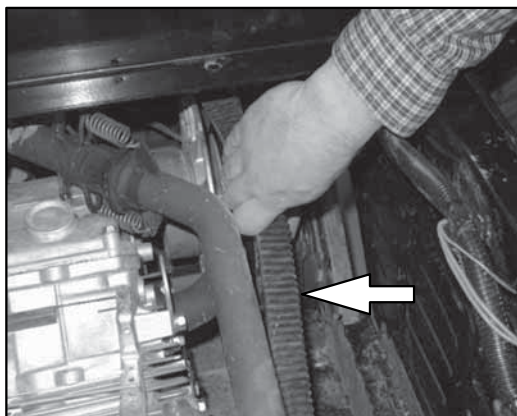


ENGINE REMOVAL

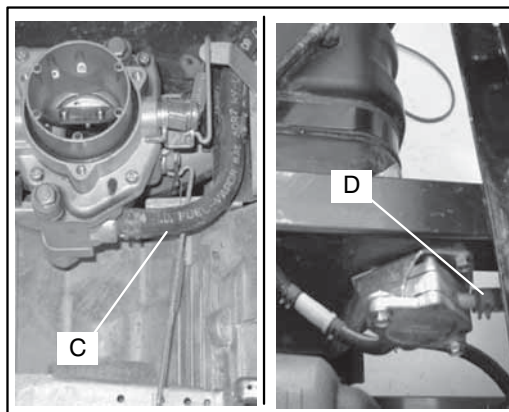
1. Clean the work area, engine, and chassis.
2. Remove the seat, raising the front of the seat and pull forward.
3. Disconnect the battery negative cable.
4. Remove the air cleaner assembly (A) (See "AIR CLEANER REMOVAL" in Ch. 2) and the top PVT cover (B).



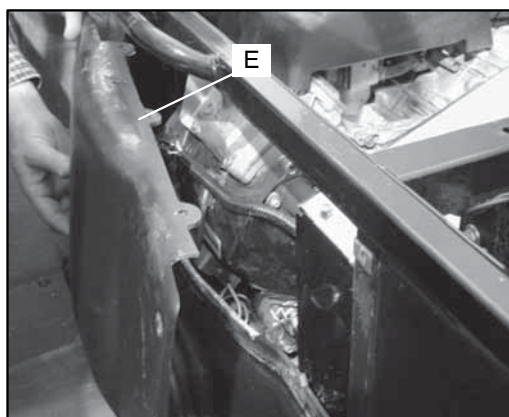
5. Remove the PVT belt and drive clutch (See Chapter 6).



6. Drain the carburetor (See "CARBURETOR DRAINING" in Ch. 2). Remove the fuel line that runs to the carburetor (C) and the pulse line (D).



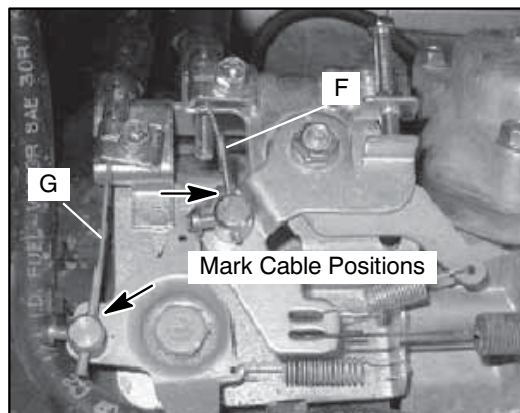
7. Remove the the T25 screws on engine panel cover (E). This will provide easier access to the engine compartment.



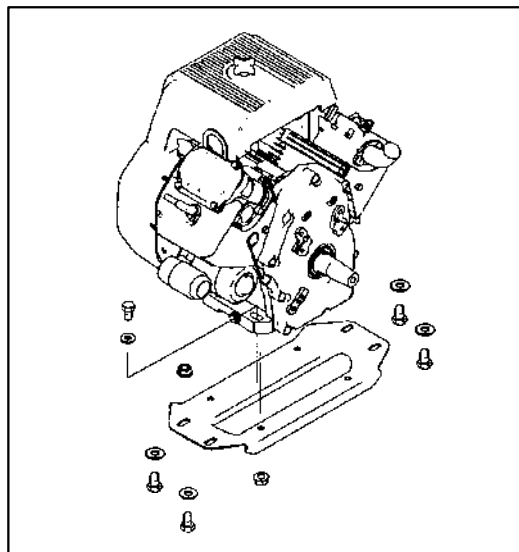
8. Disconnect all engine electrical connectors.



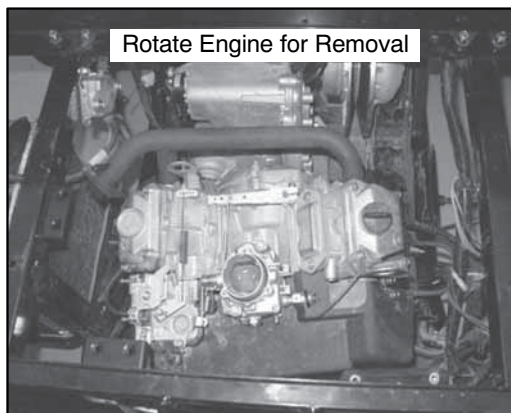
9. Disconnect the throttle cable (F) and choke cable (G). Be sure to mark the position of the cable for ease of reassembly.



10. Remove the exhaust springs from the exhaust to disconnect the exhaust pipe.
11. Remove the four engine mounting bolts. The bolts are accessible through the skid plate under the chassis.



12. After the mounting bolts have been removed, lift and rotate the engine 90 degrees counter-clockwise as shown in the picture.



13. Carefully remove the engine through the top of the seat frame. The approximate dry weight of the engine is **97 lbs. (44 kg)**.

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



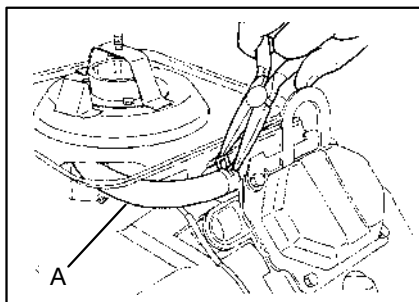


ENGINE DISASSEMBLY

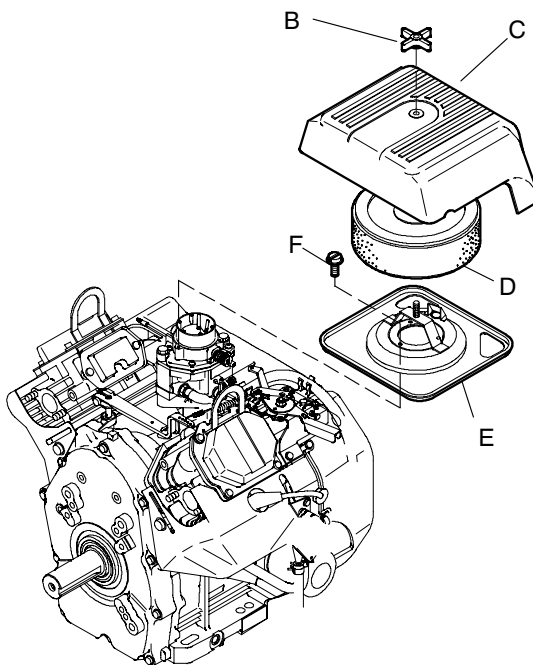
1. With the engine removed from the UTV and oil drained, begin the disassembly procedure. Refer to Chapter 2, "OIL FILTER AND CHANGE", for the oil removal procedure.
2. If not already removed, remove the air cleaner cover and air cleaner. Remove the air cleaner base and breather hose.

3. Remove the blower housing bolts and housing.
4. Remove the two bolts that secure the carburetor. Remove the fuel line and remove the gasket from the intake port. Refer to Chapter 4 for more carburetor information.

STEP 2

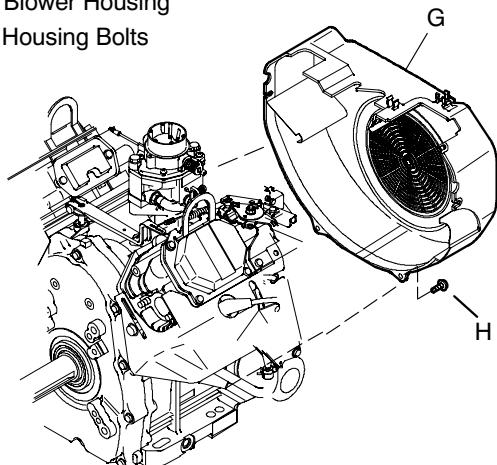


- A. Breather Hose
- B. Wing Nut
- C. Air Cleaner Cover
- D. Air Cleaner
- E. Base
- F. Base Fastener



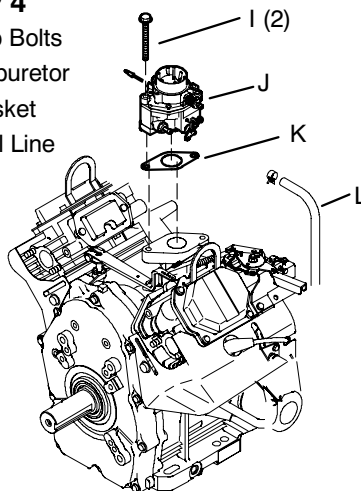
STEP 3

- G. Blower Housing
- H. Housing Bolts



STEP 4

- I. Carb Bolts
- J. Carburetor
- K. Gasket
- L. Fuel Line





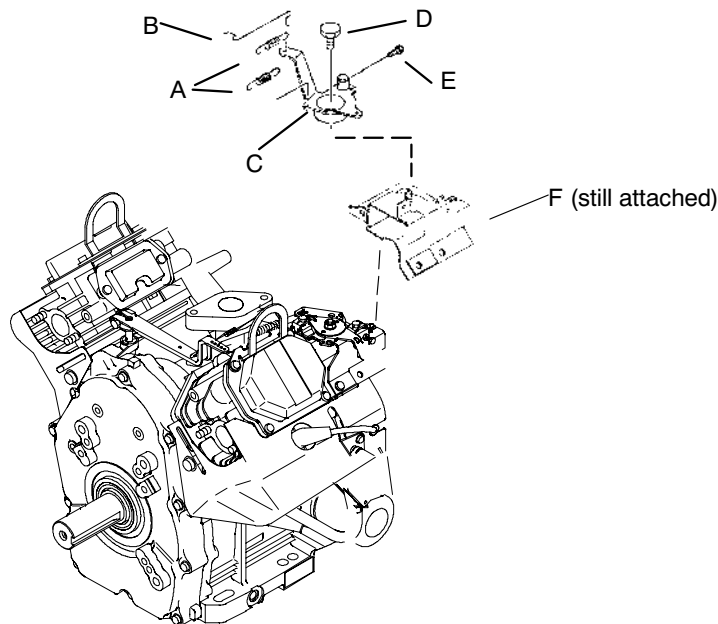
ENGINE DISASSEMBLY

5. Remove the choke lever assembly. See illustration below. Remove the springs and bolts that secure the choke control. Be sure to make note of spring placement for reassembly.

6. Remove the governor lever and speed control lever by removing the nuts and bolts that secure the pieces. Make note of placement of parts for reassembly.
7. Remove the control bracket from the engine.

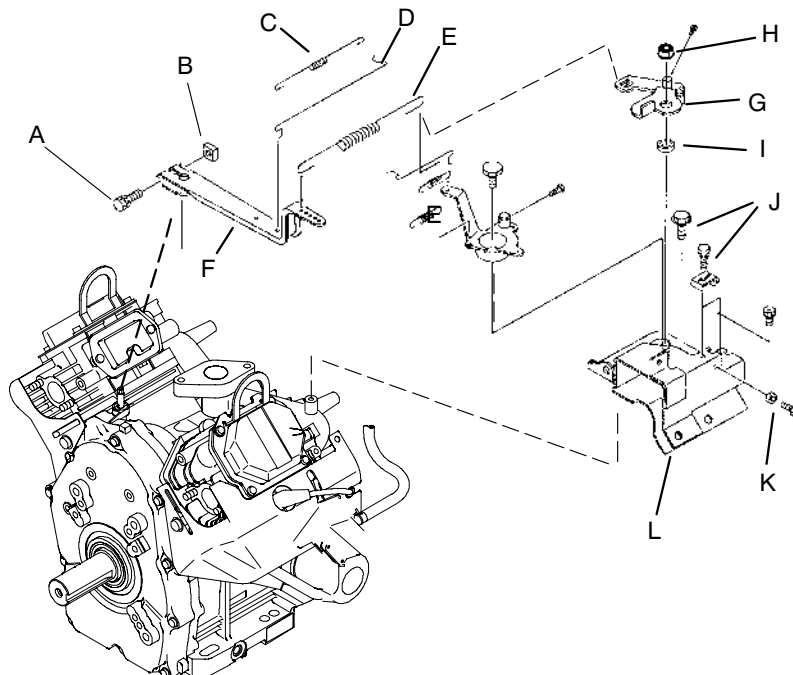
STEP 5

- A. Return Springs
B. Choke Control Rod
C. Choke Control Link
D. Screw
E. Screw
F. Speed Control Bracket



STEP 6 & 7

- A. Bolt & Washer
B. Nut
C. Rod Spring
D. Governor Rod
E. Governor Spring
F. Governor Lever
G. Speed Control Lever
H. Nut
I. Spacer
J. Bolts
K. Nut & Bolt
L. Speed Control Bracket





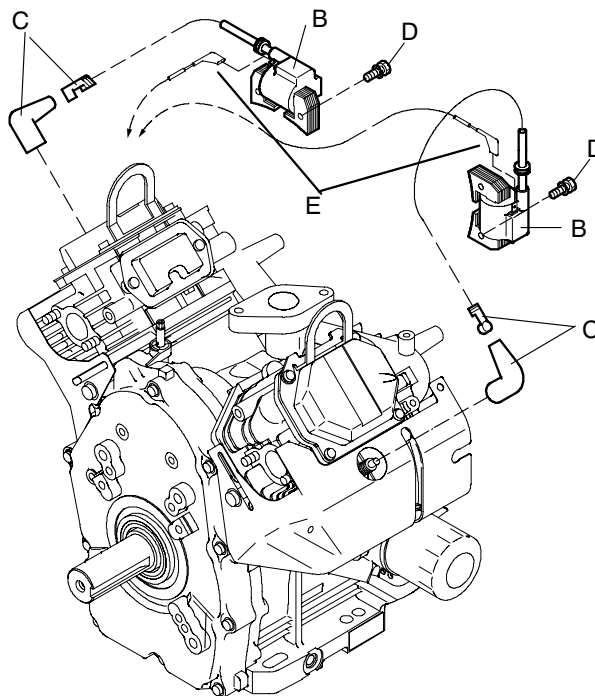
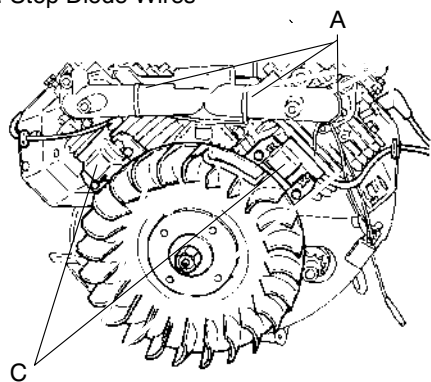
ENGINE DISASSEMBLY

8. Remove the spark plug cap and wires from the spark plug.
9. Remove two bolts that secure each of the ignition coils.
10. Disconnect the stop diode wires from each coil.
11. Cut the bands that secure the stop wire to the intake manifold.

12. Remove the side cylinder baffles (3 bolts each side). Remove the cylinder baffles on the flywheel side. Remove the regulator (F) if needed.
13. Remove the harness (C) and harness clamp (D).
14. Remove the red power wire from the starter solenoid.
15. Remove the starter bolts (E) and remove the starter (G).

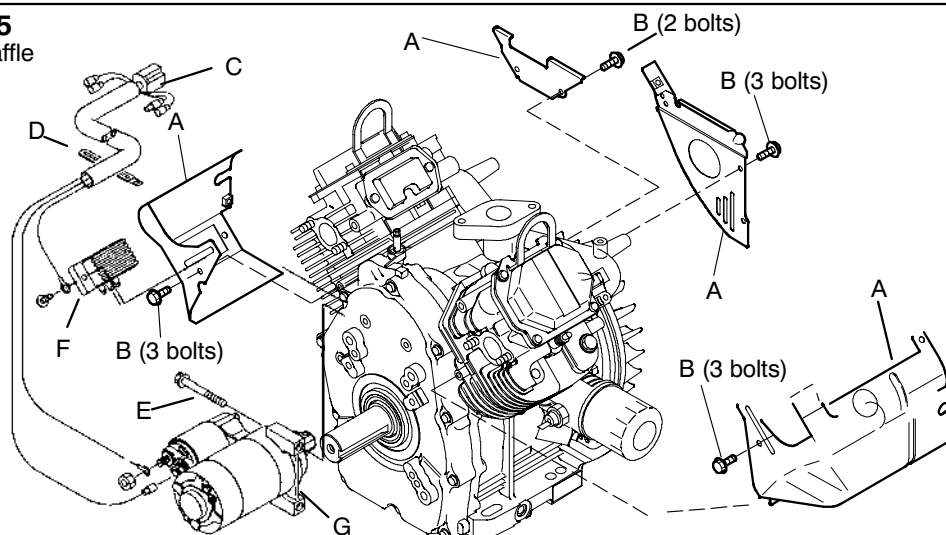
STEP 8 - 11

- A. Bands
- B. Ignition Coils
- C. Spark Plug Cap
- D. Coil Bolts
- E. Stop Diode Wires



STEP 12-15

- A. Cylinder Baffle
- B. Bolts
- C. Harness
- D. Harness Clamp
- E. Starter Bolt
- F. Regulator





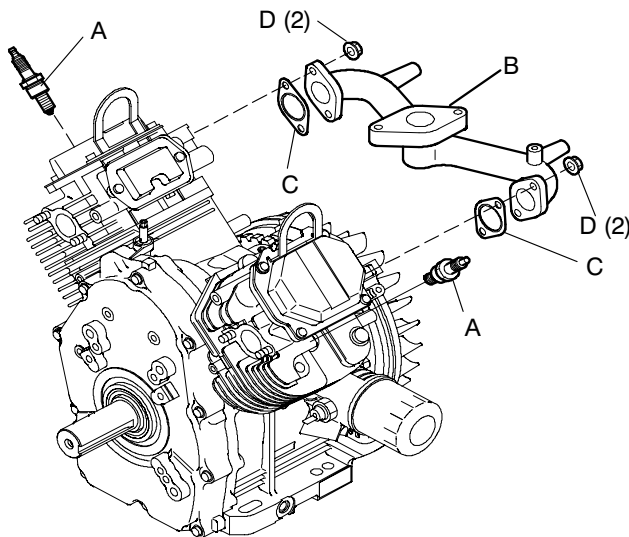
ENGINE DISASSEMBLY

16. Remove the spark plugs from each cylinder.
17. Remove the 4 flange nuts that secure the intake manifold to the engine. Remove the manifold gaskets also.

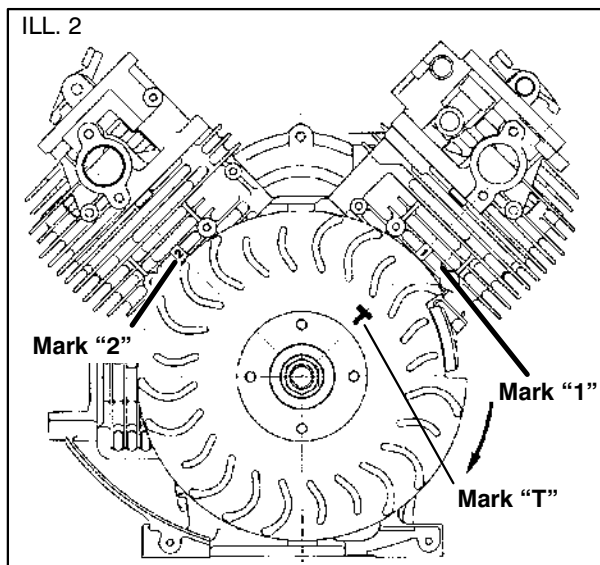
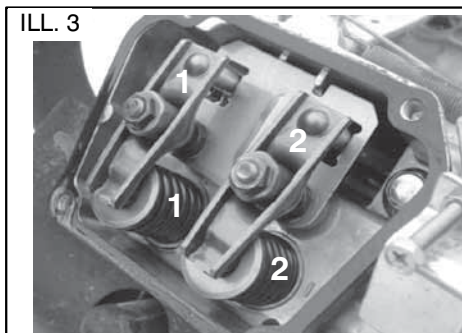
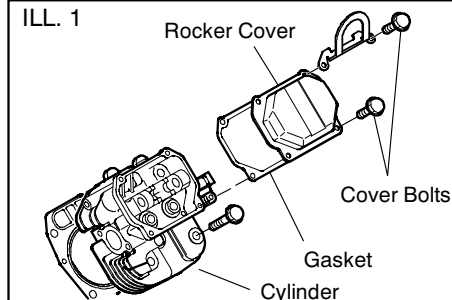
18. Remove the rocker cover bolts and rocker cover (both sides). See Illustration 1 below.
19. Before removing the rocker arms, turn the flywheel to TDC. The "T" on the flywheel should face "1" or "2" on each cylinder head. See Illustration 2 below. Use a white pen to mark the original position of each pushrod, rocker arm, valve spring, and valve for reassembly purposes. See Illustration 3 below.

STEP 16 & 17

- A. Spark Plugs
- B. Intake Manifold
- C. Gasket
- D. Flange Nuts



STEP 18 & 19





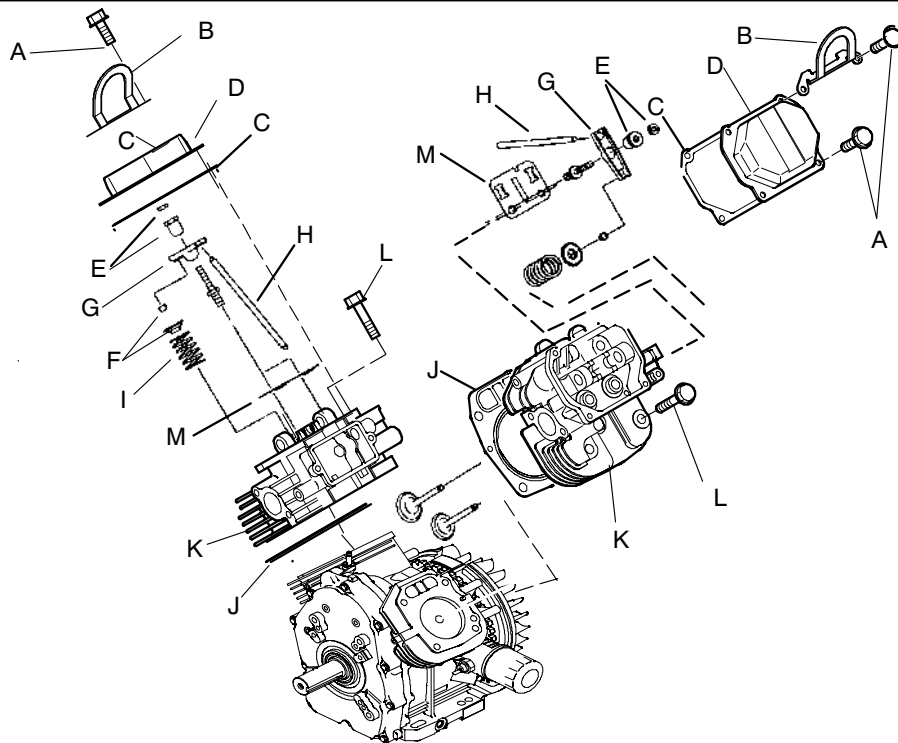
ENGINE DISASSEMBLY

20. Remove the rocker arms, pushrods, cylinder heads and cylinder gaskets. **NOTE:** Remember to mark the components as shown on previous page.
21. With the cylinder head removed, place the cylinder head on a flat surface.
22. Remove the breather cover, gaskets, and breather from the cylinder head.

23. Press down on the valve spring retainers using your hands (as shown) or by using a valve spring removal tool.
24. Carefully remove the spring retainers, spring keepers, springs and washers. Lift the head off of the flat surface and the valves should come out of the cylinder. **NOTE:** Be sure to mark the components as stated previously in this procedure.
25. Inspect all parts thoroughly for wear. Be sure the parts function properly.

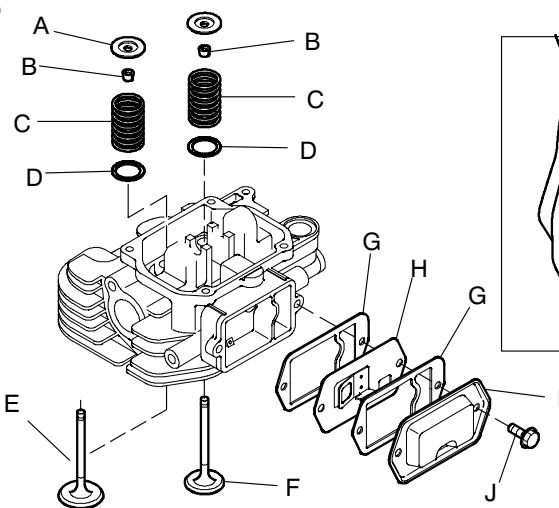
STEP 20

- A. Cover Bolts
- B. Lift Hook
- C. Gasket
- D. Rocker Cover
- E. Nut & Pivot
- F. Spring Retainer
- G. Rocker Arm
- H. Push Rod
- I. Spring
- J. Head Gasket
- K. Cylinder Head
- L. Head Bolt (4)
- M. Guide Plate

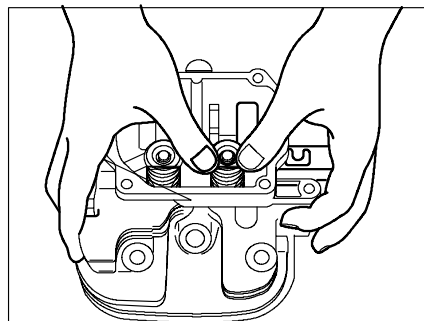


STEPS 21-25

- A. Spring Retainer
- B. Spring Keepers
- C. Valve Spring
- D. Washer
- E. Intake Valve
- F. Exhaust Valve
- G. Gasket
- H. Breather
- I. Breather Cover
- J. Bolts (2 pcs.)



VALVE SPRING REMOVAL





ENGINE DISASSEMBLY

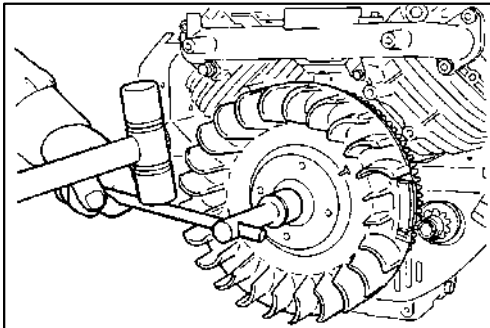
26. Remove the flywheel nut and washer. See below.

27. Use a standard 2-jaw flywheel puller to remove the flywheel. See below.

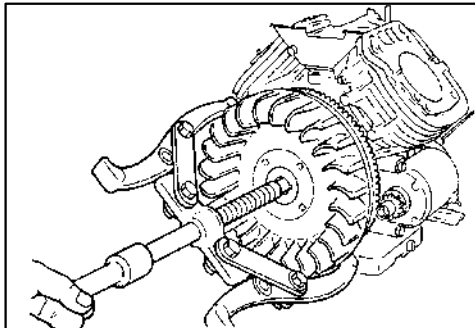
28. Remove the flywheel key. See below.

29. Remove the four bolts that secure the charge coil to the housing.

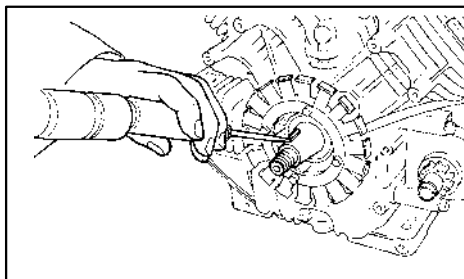
STEP 26



STEP 27

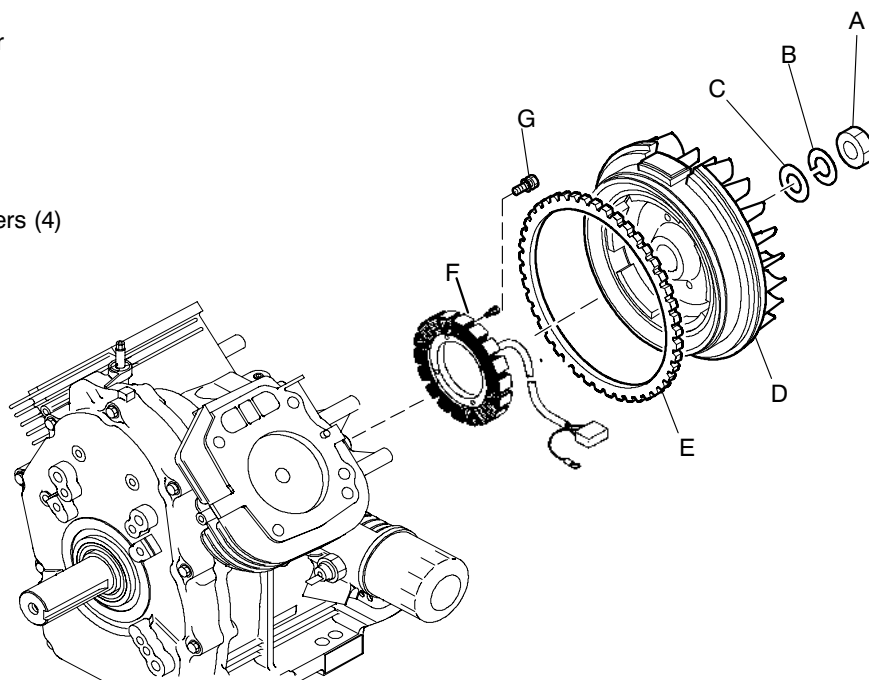


STEP 28



STEP 29

- A. Nut
- B. Spring Washer
- C. Washer
- D. Flywheel
- E. Ring Gear
- F. Stator
- G. Bolts & Washers (4)



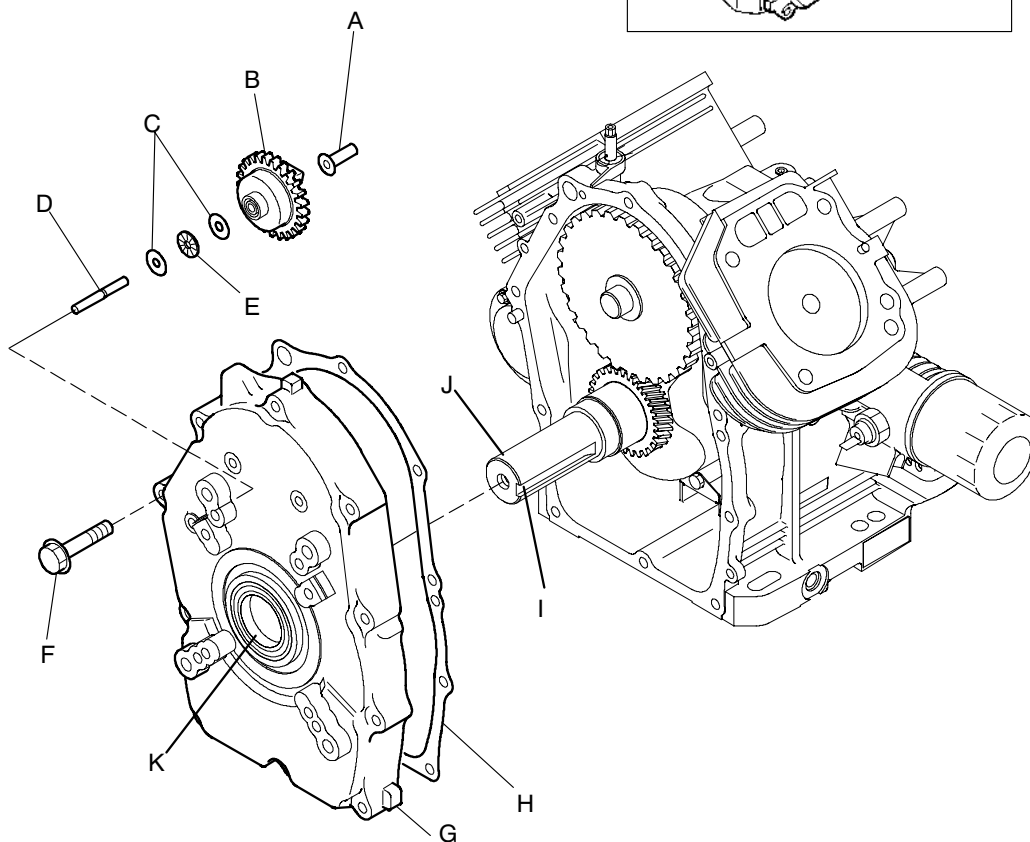


ENGINE DISASSEMBLY

30. Wrap the PTO shaft with polyvinyl tape to protect the oil shaft seal from the edge of the key groove.
31. Remove the eight bolts that secure the cover to the engine.
32. Remove the 2 washers, thrust bearing, and governor gear from the crankcase.
33. Remove the governor gear shaft and gear sleeve if needed. Inspect the components for wear.

Step 30-33

- A. Governor Sleeve
- B. Governor Gear
- C. Washer (2)
- D. Governor Gear Shaft
- E. Thrust Bearing
- F. Bolt (10)
- G. Main Bearing Cover
- H. Gasket
- I. Key Groove
- J. PTO Shaft
- K. Oil Seal

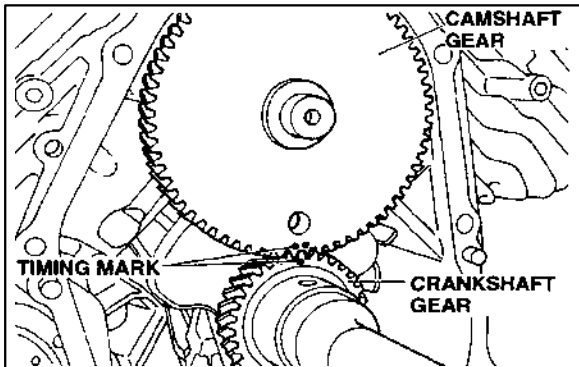




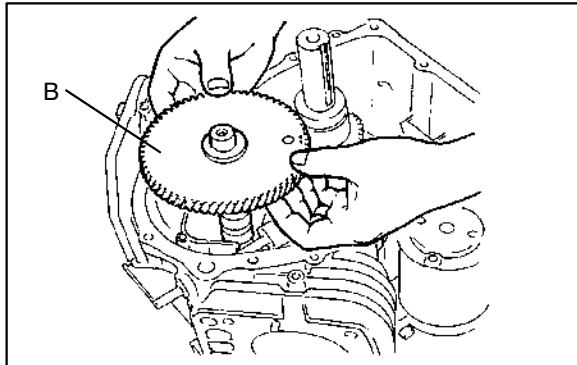
ENGINE DISASSEMBLY

34. Align the timing marks on the crankshaft gear and the camshaft gear.
35. Place the crankcase on its side and remove the camshaft gear.
36. The tappets may slide out of the case while the camshaft gear is removed.
37. Mark the tappets original position in the crankcase using a white marker. This will ensure proper reassembly of the tappets.

Step 34

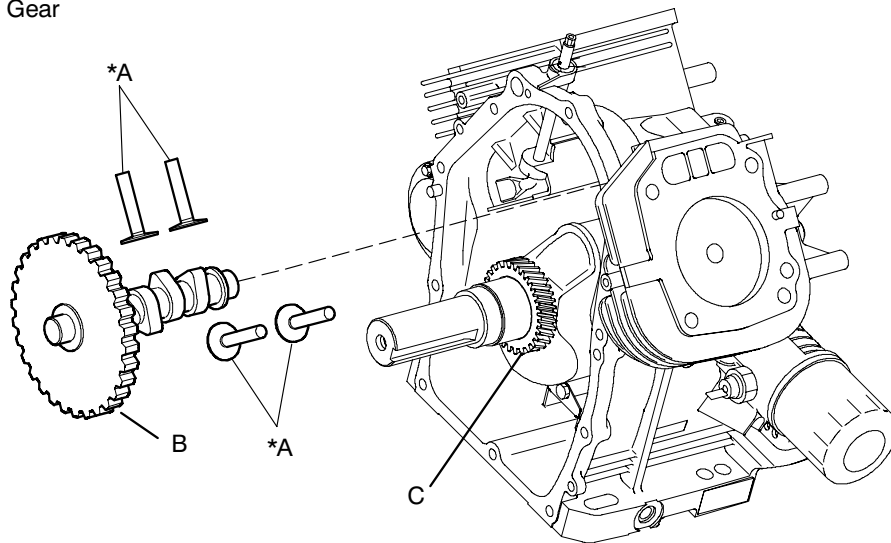


Step 35



Step 36-37

- A. Tappets
- B. Camshaft Gear
- C. Crankshaft Gear



***Mark the Tappets for Reassembly**

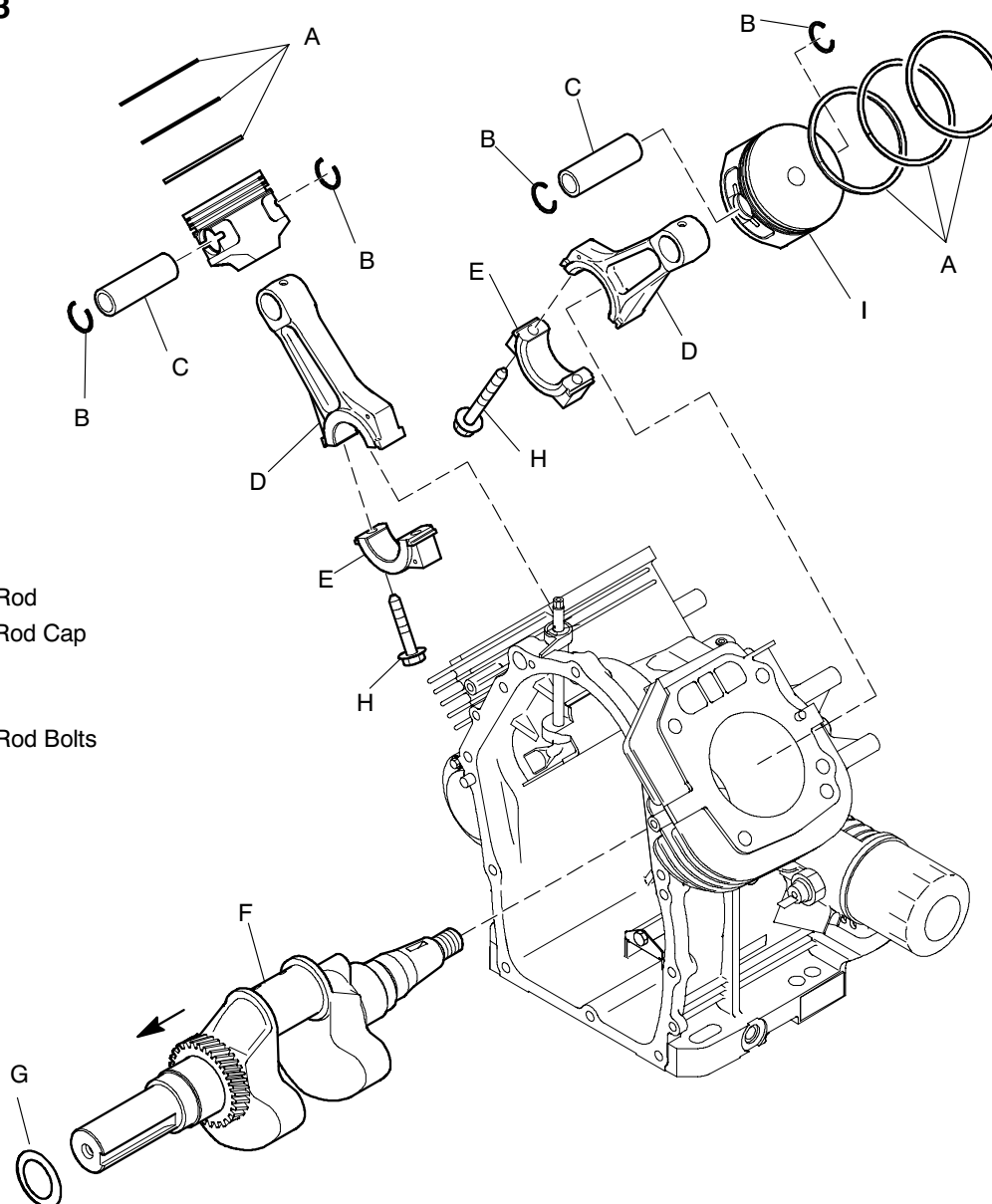




ENGINE DISASSEMBLY

38. Access the connecting rod bolts in the bottom of the crankcase. Remove the connecting rod bolts.
39. Take out the connecting rod cap and carefully push the connecting rod upward.
40. Pull the piston assembly from the top of the crankcase. Perform on both sides.
41. Keep the components of each piston separate or mark the components if necessary for reassembly.
42. To disassemble the piston assembly: remove the c-clip, slide the piston pin out, and remove the connecting rod. Remove piston rings if needed.
43. Pull the crankshaft from the crankcase.

Step 38-43



- A. Piston Rings
- B. C-clips
- C. Piston Pin
- D. Connecting Rod
- E. Connecting Rod Cap
- F. Crankshaft
- G. Spacer
- H. Connecting Rod Bolts
- I. Piston

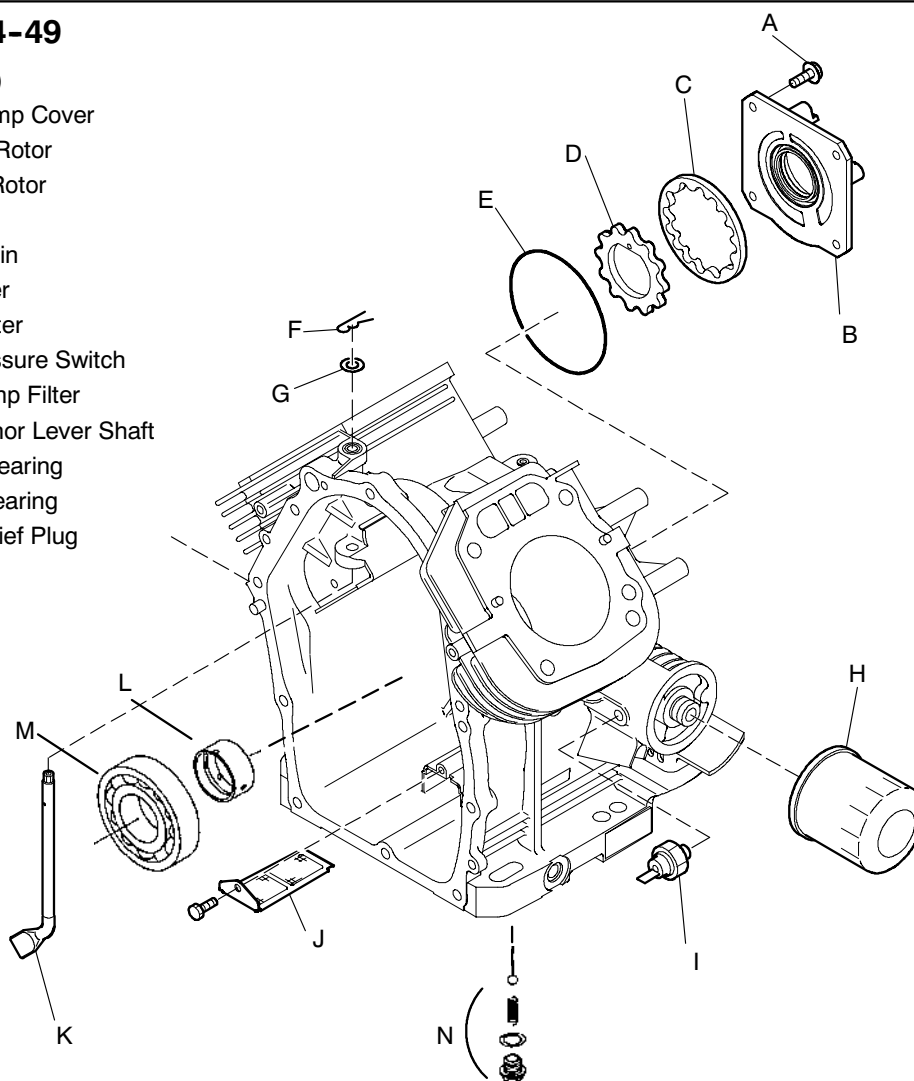


ENGINE DISASSEMBLY

44. Remove the oil filter, if not already removed.
45. Remove the oil pump cover, rotors, and o-ring.
46. Remove the oil pressure switch if needed.
47. Take out the oil pump filter and clean the filter.
48. With the crankcase open, remove the governor lever shaft by removing the snap pin on top of the case.
49. Inspect the ball bearing and main bearing. The ball bearing should rotate smoothly. Replace as needed.
50. Install oil relief plug if previously removed.

Step 44-49

- A. Bolt (4)
- B. Oil Pump Cover
- C. Outer Rotor
- D. Inner Rotor
- E. O-ring
- F. Snap Pin
- G. Washer
- H. Oil Filter
- I. Oil Pressure Switch
- J. Oil Pump Filter
- K. Governor Lever Shaft
- L. Main Bearing
- M. Ball Bearing
- N. Oil Relief Plug





ENGINE SERVICE DATA

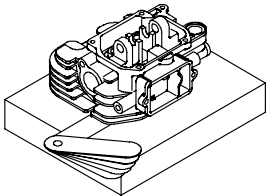
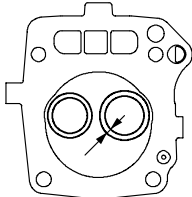
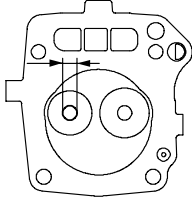
Before reassembling the engine, it is important to inspect the engine and components. With standard engine measuring tools measure and inspect all of the engine components. Follow the table below to obtain the proper specifications.

NOTES FOR ENGINE REASSEMBLY

- Clean all parts thoroughly before reassembly.
- Scrape off all carbon deposits from cylinder head, piston top, and piston ring grooves.
- Replace all seals and apply oil to seals before reassembly.
- Replace all gaskets with new gaskets.
- Replace all keys. Replace nuts and bolts if needed or where specified.
- Torque all nuts and bolts to specification. Refer to the "TORQUE SPECIFICATIONS" table.
- Apply engine oil to all rotating or sliding portions of engine.
- Check and adjust all clearances and end plays as specified in this manual.

ENGINE COMPONENT SPECIFICATIONS TABLE

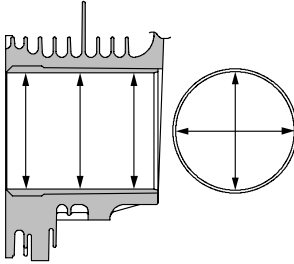
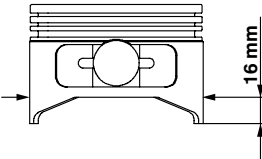
Unit : mm (in)

ITEM		EH63	
		STD	Limit
CYLINDER HEAD * Flatness 		0.05 or less (0.002 or less)	0.1 (0.004)
* Valve seat contact width 	IN. EX.	0.7 - 1.0 (0.028 - 0.039)	2.0 (0.079)
* Valve guide inside dia. 		6.035 - 6.053 (0.2376 - 0.2383)	6.15 (0.242)



**ENGINE SERVICE DATA**

Unit : mm (in)

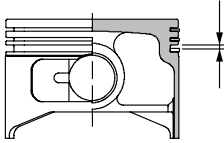
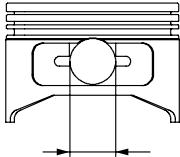
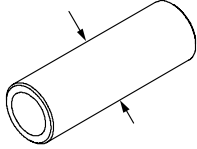
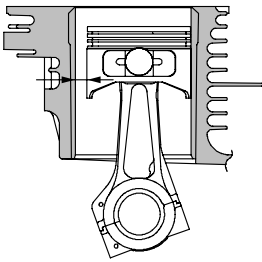
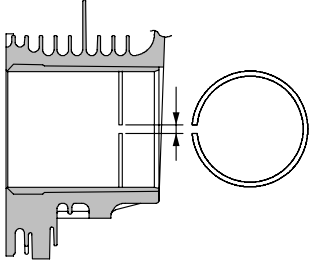
ITEM		EH63	
		STD	Limit
CYLINDER * Inside dia. 	STD	80.000 - 80.019 (3.1496 - 3.1504)	To be rebored when the difference between max. and min. of diameter reached to 0.1 (0.004).
	1 st reboring	80.250 - 80.269 (3.159 - 3.160)	Ditto
	2 st reboring	80.500 - 80.519 (3.169 - 3.170)	-----
	* Roundness after reboring.	0.01 (0.004)	-----
	* Cylindricity after reboring.	0.015 (0.0006)	-----
PISTON * Piston size (At skirt in thrust direction) 	STD	79.968 - 79.988 (3.148 - 3.149)	79.878 (3.145)
	1 st o / s	80.218 - 80.238 (3.158 - 3.159)	80.128 (3.155)
	2nd o / s	80.468 - 80.488 (3.168 - 3.169)	80.378 (3.164)





ENGINE SERVICE DATA

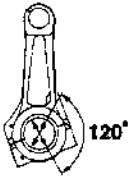
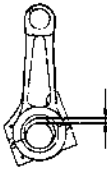
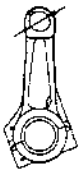
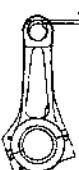
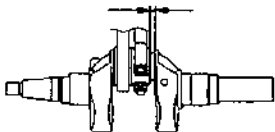
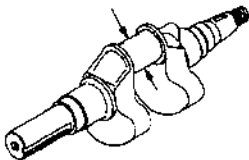
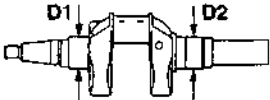
Unit : mm (in)

ITEM		EH63	
		STD	Limit
PISTON * Ring groove side clearance  * Piston pin hole  * Piston pin outside dia.  * Clearance between piston and cylinder at skirt area.  * Piston ring end gap 	Top	0.05 - 0.09 (0.0002 - 0.0035)	0.15 (0.006)
	2nd	0.03 - 0.07 (0.0012 - 0.0028)	0.15 (0.006)
	Oil ring	0.057 - 0.175 (0.0022 - 0.0069)	0.15 (0.006)
		20.989 - 21.002 (0.8263 - 0.8269)	21.035 (0.8281)
		20.991 - 21.000 (0.8264 - 0.8268)	20.960 (0.8251)
		0.012 - 0.051 (0.0005 - 0.0020)	0.25 (0.0098)
	Top 2nd	0.2 - 0.4 (0.0079 - 0.0157)	1.5 (0.0591)
	Oil ring	0.2 - 0.7 (0.0079 - 0.0276)	1.5 (0.0591)



**ENGINE SERVICE DATA**

Unit : mm (in)

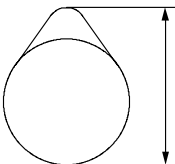
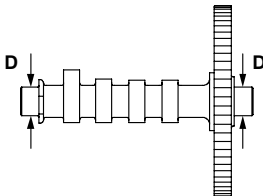
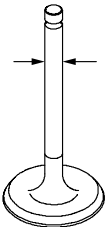
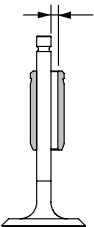
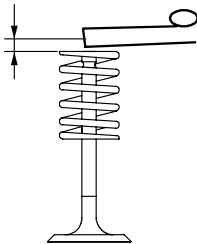
ITEM	EH63	
	STD	Limit
CONNECTING ROD * Big end inside dia. 	39.000 - 39.016 (1.5354 - 1.5361)	39.100 (1.5394)
* Clearance between big end and crankpin 	0.030 - 0.060 (0.0012 - 0.0024)	0.2 (0.0079)
* Small end inside dia. 	21.010 - 21.023 (0.8272 - 0.8277)	21.080 (0.8299)
* Clearance between small end and piston pin 	0.010 - 0.032 (0.0004 - 0.0013)	0.12 (0.0047)
* Big end side clearance 	0.1 - 0.4 (0.0039 - 0.0157)	1.0 (0.0394)
CRANKSHAFT * Crankpin outside dia. 	38.956 - 38.970 (1.5337 - 1.5343)	38.90 (1.5315)
* Journal dia. 	D1 : 44.984 - 45.000 (1.77102 - 1.77165) D2 : 44.986 - 44.997 (1.77110 - 1.77154)	—





ENGINE SERVICE DATA

Unit : mm (in)

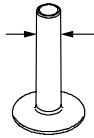
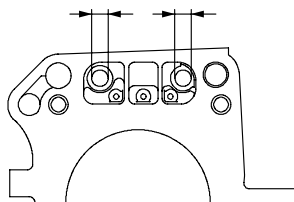
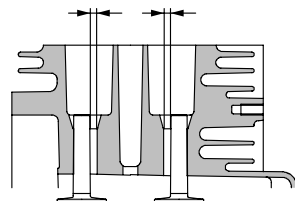
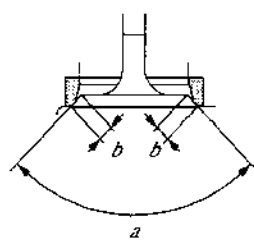
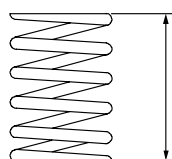
ITEM		EH63	
		STD	Limit
CAMSHAFT * Cam height (IN. and EX.) 		36.1 - 36.3 (1.4213 - 1.4291)	35.95 (1.4154)
* Journal outside dia. "D" type 		19.967 - 19.980 (0.7861 - 0.7866)	19.950 (0.7854)
VALVE * Valve stem outside dia.  *Clearance between valve stem dia. and valve guide.  * Valve clearance 	IN.	5.970 - 5.985 (0.2350 - 0.2356)	5.85 (0.2303)
	EX.	5.960 - 5.975 (0.2346 - 0.2352)	5.85 (0.2303)
	IN.	0.050 - 0.083 (0.0022 - 0.0033)	0.30 (0.0118)
	EX.	0.060 - 0.093 (0.0024 - 0.0037)	0.30 (0.0118)
	IN. / EX. (cold)	0.085 - 0.115 (0.0034 - 0.0045)	





ENGINE SERVICE DATA

Unit : mm (in)

ITEM	EH63	
	STD	Limit
TAPPET * Stem outside dia. 	8.960 - 8.975 (0.3528 - 0.3533)	8.93 (0.3516)
* Guide inside dia. 	9.00 - 9.015 (0.3543 - 0.3549)	9.08 (0.3575)
* Tappet guide clearance 	0.025 - 0.055 (0.0010 - 0.0022)	0.15 (0.0059)
VALVE SEAT ANGLE (IN. EX.) * Valve cutter angle (a) * Valve contact width (b) 	a : 90° b : 0.7 - 1.0 (0.028 - 0.039)	2.0 (0.079)
VALVE SPRING FREE LENGTH 	39.5 (1.5551)	-----



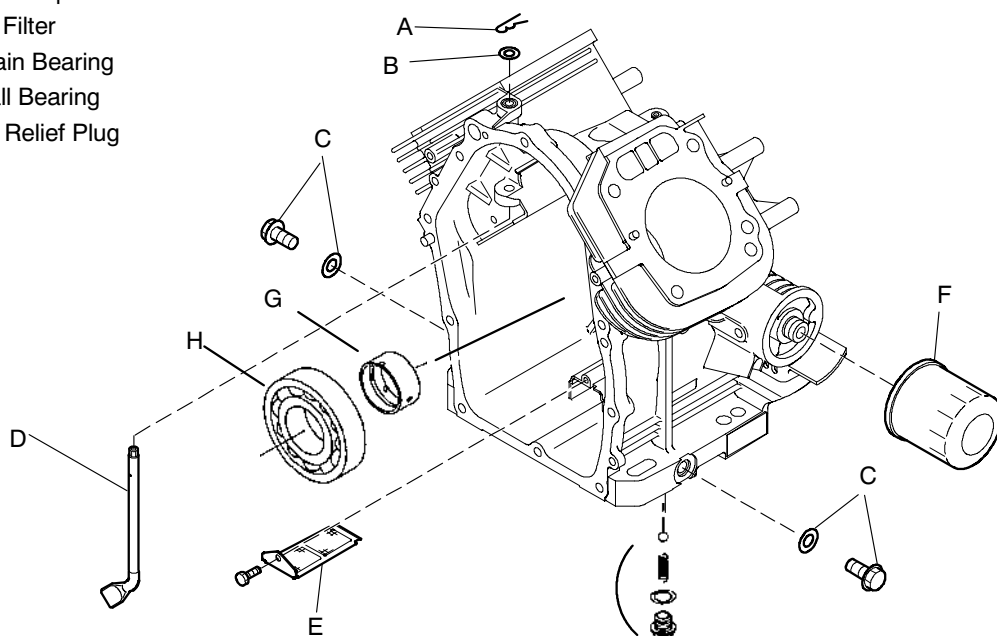


ENGINE ASSEMBLY

1. Install the oil pump filter into the bottom of the crankcase.
2. Install the governor lever shaft into the crankcase. Secure the shaft with the washer and new snap pin.
3. Install the oil drain plug(s) and oil filter. Torque the plug(s) and filter to required torque.
4. Inspect the ball bearing and main bearing and reinstall if previously removed.

Steps 1-4

- A. Snap Pin
- B. Washer
- C. Oil Drain Plug & Washer
- D. Governor Lever
- E. Oil Pump Filter
- F. Oil Filter
- G. Main Bearing
- H. Ball Bearing
- I. Oil Relief Plug





ENGINE ASSEMBLY

Cylinder Head Assembly

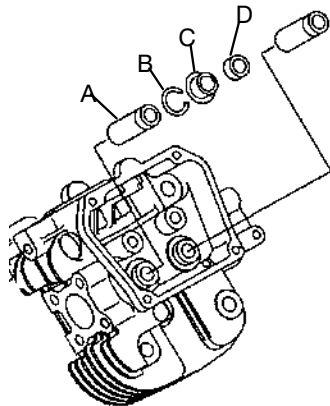
5. Install new valve guides, if required. Check the valve stem clearance to guide clearance. (See Engine Service Data) If the clearance is out of specification replace the valve guide.
6. Install the clip, plate retainer, and valve seal. Apply oil to the components upon assembly.
7. Install the valves into the cylinder head. If the components were previously marked, install in previous order.
8. Place the cylinder head and valves on a flat surface. Install the washer, spring, spring keepers, and spring retainers. Press down on the spring with your fingers or valve spring tool.
9. Install the new breather gaskets, breather, and breather cover. Tighten the bolts to 2.2–3.6 ft. lbs. (2.9–4.9 Nm). **NOTE:** Do not overtighten bolts as gasket damage may occur.

Important Engine Assembly Notes:

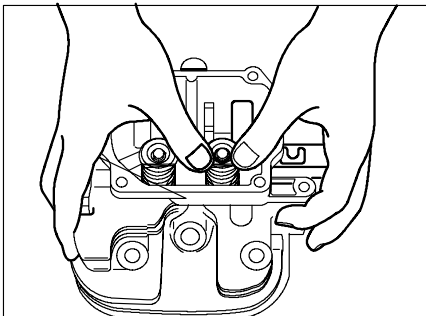
- * Clean valves and wash cylinder head thoroughly
- * Remove carbon and gum deposits from the valves, seats, ports and guides.
- * Inspect valves, valve seats and valve guides.
- * Replace valves that are badly burned, pitted or warped.
- * Valve guides should be replaced when valve stem clearance exceeds specifications.
 - * If exceeds, draw valve guides out and press new guides in.
 - * After replacing valves and guides, lap valves in place until a uniform ring shows around the face of the valve.

Step 5-6

- A. Valve Guide
- B. Clip
- C. Plate Retainer
- D. Seal

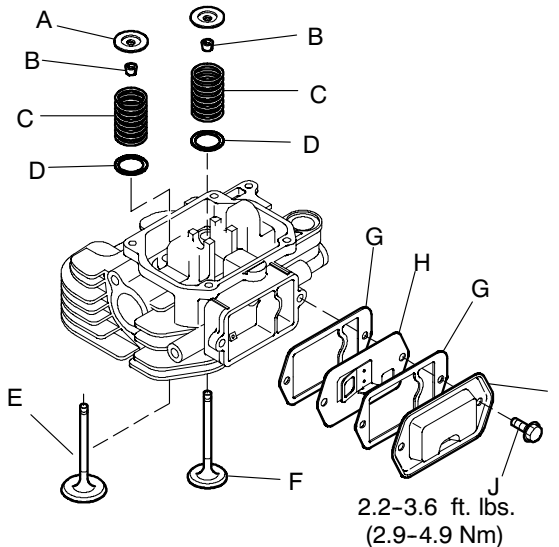


VALVE SPRING INSTALLATION



Step 7-9

- A. Spring Retainer
- B. Spring Keepers
- C. Valve Spring
- D. Washer
- E. Intake Valve
- F. Exhaust Valve
- G. Gasket
- H. Breather
- I. Breather Cover
- J. Bolts (2 pcs.)



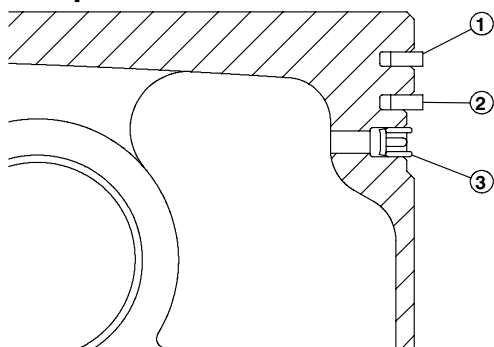


ENGINE ASSEMBLY

Piston and Connecting Rod Assembly

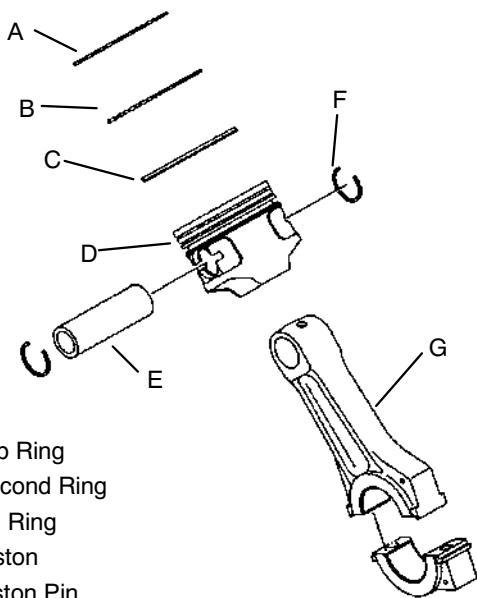
10. Carefully install the oil ring. **NOTE:** For all rings, spread the ring only far enough to slip over the piston and into the correct groove.
11. Install the the second ring. **NOTE:** The punched mark beside the ring end gap faces upward or top side.
12. Install the top ring. The top ring will fit either way.
13. Reassemble the piston to the connecting rod with the piston pin. Apply oil to the connecting rod and piston pin area.
14. Secure the piston pin into place by placing the piston pin clips into the piston pin grooves on each side of the piston pin. Place the piston pin clips in 12 o'clock position.

Step 10-12



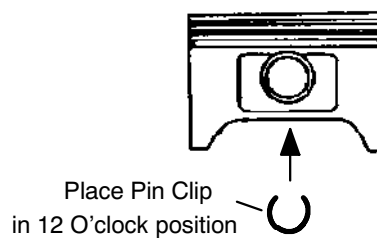
①	TOP RING	BARREL	
②	SECOND RING	TAPER	
③	OIL RING	COMBINATION RING	

Step 13



- A. Top Ring
- B. Second Ring
- C. Oil Ring
- D. Piston
- E. Piston Pin
- F. Connecting Rod
- G. Piston Pin Clip

Step 14



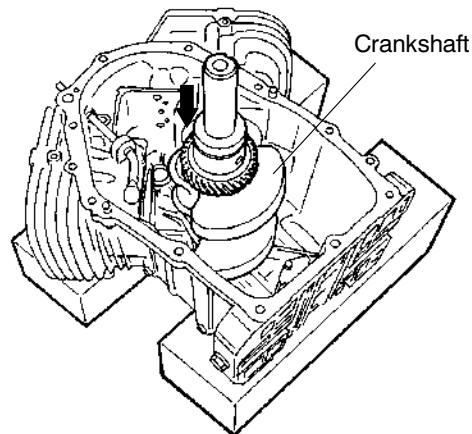


ENGINE ASSEMBLY

CRANKSHAFT & GOVERNOR GEAR

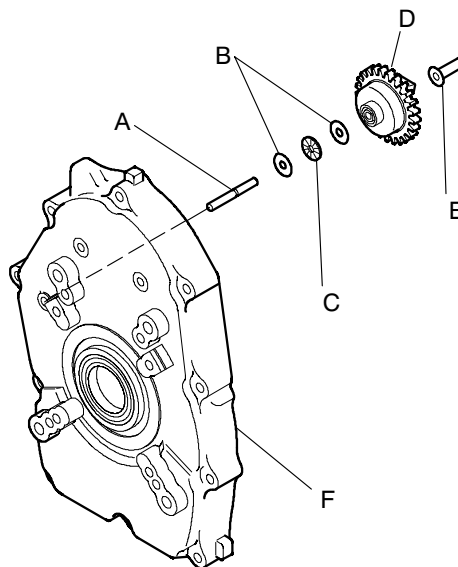
15. Place the crankcase onto a box or wooden blocks. Oil the crankcase bearing.
16. Install the crankshaft into the crankcase.
17. Insert the governor gear shaft into the main bearing cover.
18. Install the washer and thrust bearing onto the governor gear shaft.
19. Insert the governor gear and sleeve onto the governor gear shaft.

Step 15-16



Step 17-19

- A. Governor Gear Shaft
- B. Washers
- C. Thrust Bearing
- D. Governor Gear
- E. Governor Sleeve
- F. Main Bearing Cover



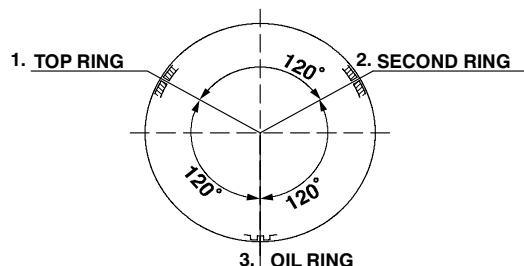
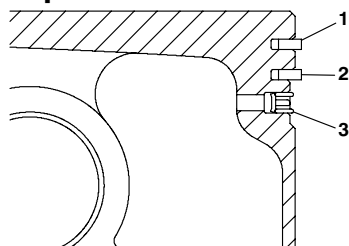


ENGINE ASSEMBLY

Piston & Connecting Rod

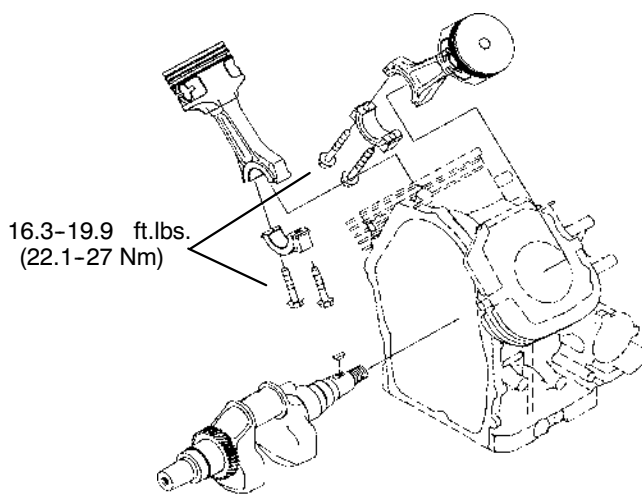
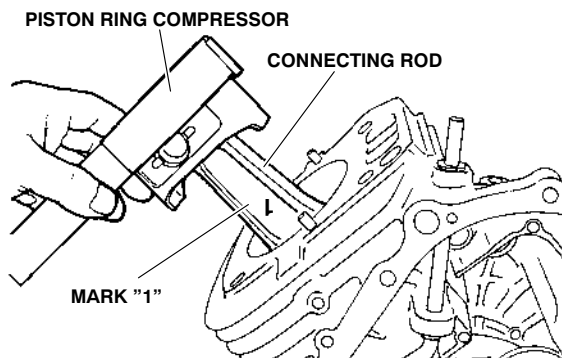
20. Apply oil to the piston rings, connecting rod bearing, and cylinder bore before assembly.
21. Set the gaps of the piston rings every 120°. (See below)
22. Install a piston ring compressor over the piston rings. Install the piston and connecting rod assembly into the cylinder head. **NOTE:** The number on the connecting rod should face the flywheel side during assembly. (See below)
23. Temporarily install the flywheel key and flywheel onto the crankshaft. Turn the crankshaft to BTDC (bottom dead center).
24. With a rubber mallet lightly tap the top of the piston until the large round end of the connecting rod meets the pin portion of the crankshaft.
25. Align the connecting rod cap to the connecting rod by aligning the marks on both ends. Tighten the bolts as specified below.
26. Check for free movement of the piston and connecting rod by turning the crankshaft slowly.

Step 21

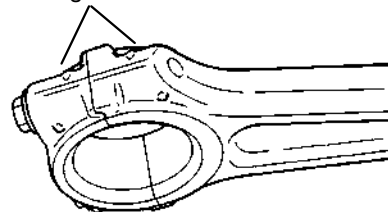


Step 22-26

*The "1" mark of the connecting rod for #1 cylinder and "2" mark for #2 cylinder should be faced to the flywheel side when assembled.



Alignment Marks





ENGINE ASSEMBLY

Tappets & Camshaft

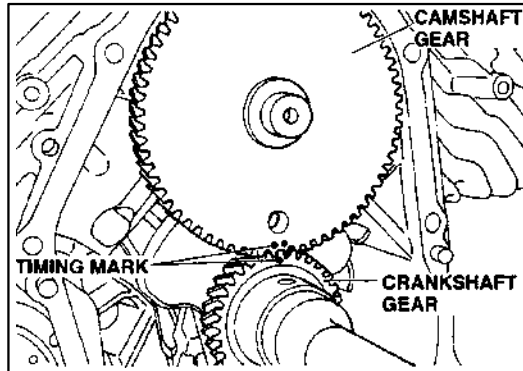
27. Apply oil to the tappets. Install the tappets in their original marked positions. Be sure the tappets are pushed in fully to avoid damage during camshaft installation.

28. Carefully install the camshaft. Align the timing mark of the camshaft with the timing mark on the crankshaft gear. **NOTE: Incorrect alignment will cause damage to the engine!**

29. Measure the end play of the crankshaft and camshaft. Adjust the end play to "0" using the proper spacer.

Step 27-28

NOTE: Be sure to align timing marks on crank gear and camshaft gear.



Step 29

Adjust Crankshaft End Play To "0"

Use equations below to calculate end play.

$$A + 0.36 - B = \text{Spacer (mm) needed}$$

$$\textcircled{1} - \textcircled{2} = \text{Spacer (mm) needed}$$

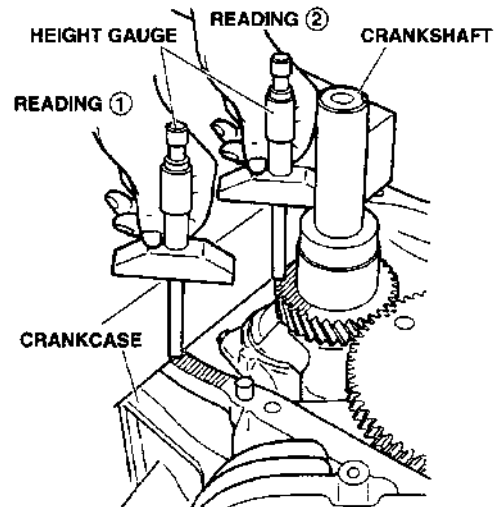
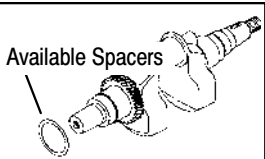
Spacer PN's

3088380 - 0.60

3088381 - 0.80

3088382 - 0.10

Available Spacers

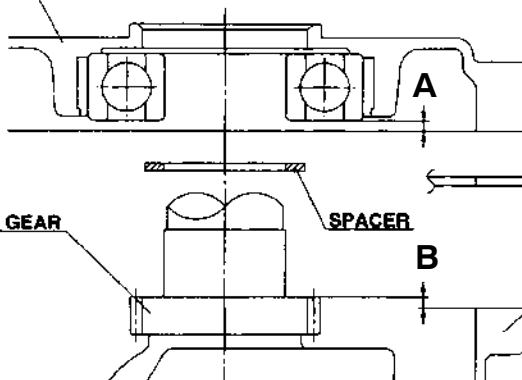


MAIN BEARING COVER

CRANKSHAFT GEAR

SPACER

CRANKCASE



0.36 mm
(THICKNESS WITH
GASKET TIGHTENED)





ENGINE ASSEMBLY

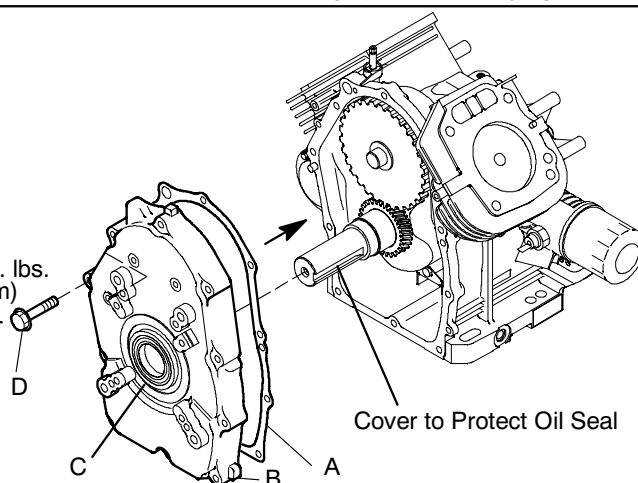
Main Bearing Cover & Oil Pump

30. Before installing the main bearing cover, install an oil seal guide or apply tape to the PTO shaft to avoid damage to the main bearing cover oil seal during installation.
31. Be sure all previously installed parts inside the crankcase are properly torqued and functioning properly before the main bearing cover is installed.
32. Install the main bearing gasket onto the crankcase mating surface. Lubricate the oil seal lip portion and bearings on the main bearing cover.
33. Install the main bearing cover. Be sure the cover mates properly with the governor gear and camshaft properly. A soft mallet may be needed to help seat the cover.
34. Tighten the bolts evenly and torque bolts to 12.3–13.7 ft.lbs. (16.7–18.6 Nm). Rotate crankshaft to be sure all components are turning properly.
35. Apply oil to the inner and outer oil pump rotors. Install the rotors. Be sure the dot on the inside rotor is facing outward.
36. Apply oil to the O-ring and install O-ring.
37. Apply a light coat of oil to the oil pump cover seal. Install the oil pump cover with the arrow marking facing upward. Evenly tighten the bolts.

Step 30–34

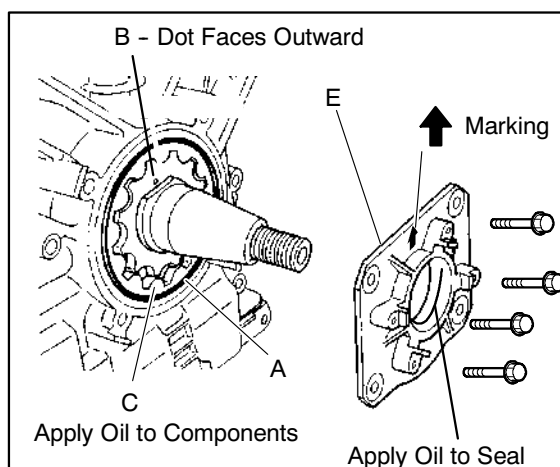
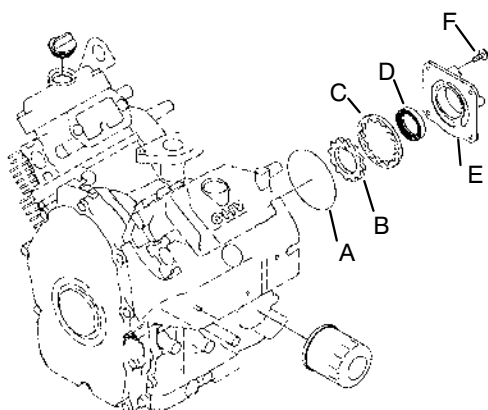
- A. Main Bearing Gasket
- B. Main Bearing Cover
- C. Main Bearing Cover Oil Seal
- D. Bolts

Tighten Bolts Evenly
Torque to: 12.3–13.7 ft. lbs.
(16.7–18.6 Nm)



Step 35–37

- A. O-ring
- B. Inner Rotor
- C. Outer Rotor
- D. Oil Pump Cover Seal
- E. Oil Pump Cover
- F. Bolts

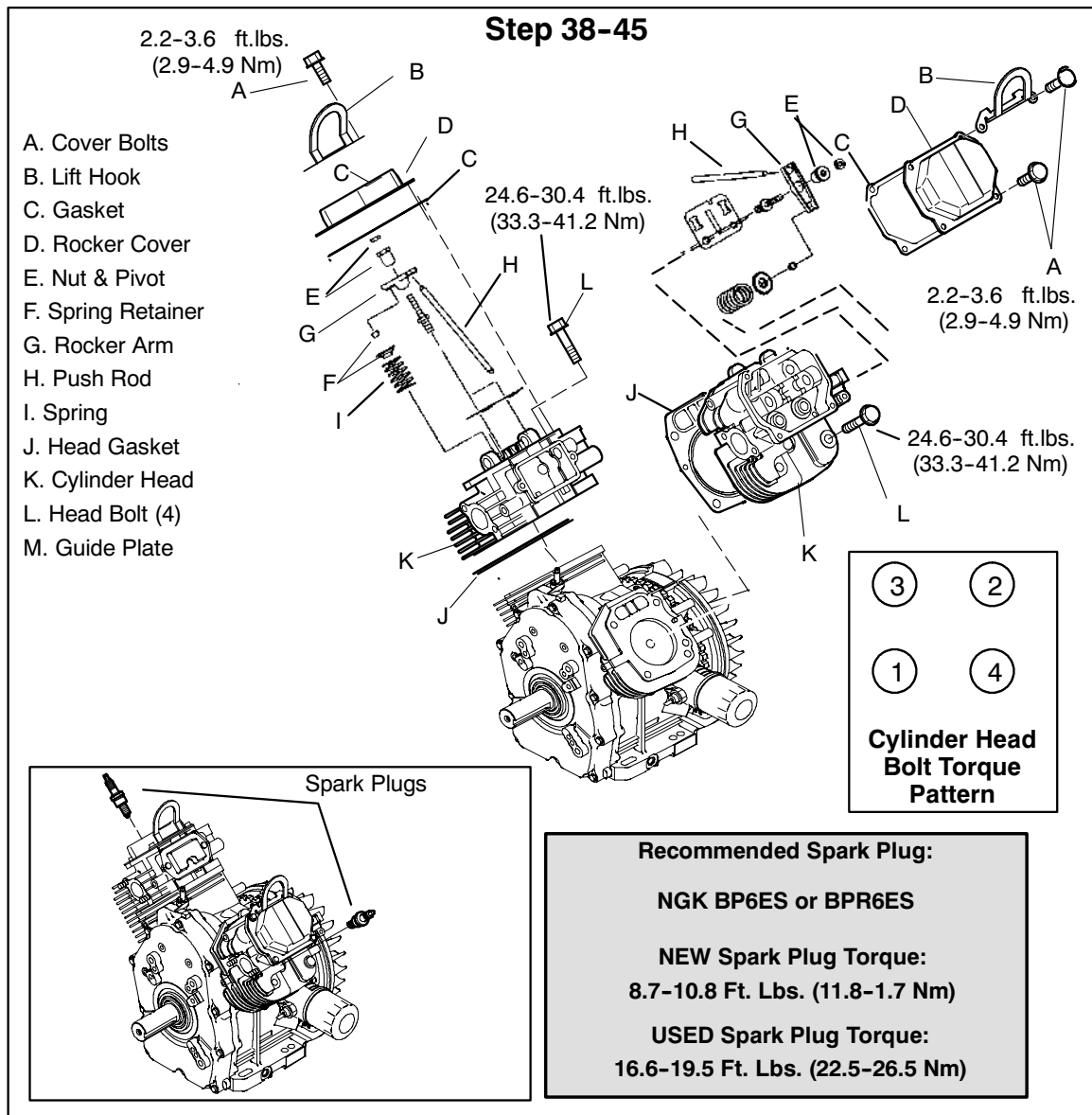




ENGINE ASSEMBLY

Cylinder Head

38. Be sure cylinder and cylinder head areas are clean. Place new cylinder head gasket on cylinder.
39. Install both cylinders. Tighten bolts evenly to 24.6-30.4 ft.lbs. (33.3-41.2 Nm).
40. Rotate the crankshaft to where there is no compression or lift on the tappets.
41. Insert the push rods into the cylinder head.
42. Install the rocker arm, pivot, and nut. Perform on all push rods/rocker arms.
43. Refer to Page 2.19 for proper Valve Adjustment Procedure.
44. Install the rocker covers and new gaskets. Tighten the cover bolts evenly to 2.2-3.6 ft.lbs. (2.9-4.9 Nm).
45. Install the spark plugs into each cylinder head. Torque a NEW plug to: 8.7-10.8 ft.lbs. (11.8-14.7 Nm). Torque used plug to: 16.6-19.5 ft.lbs. (22.5-26.5 Nm).





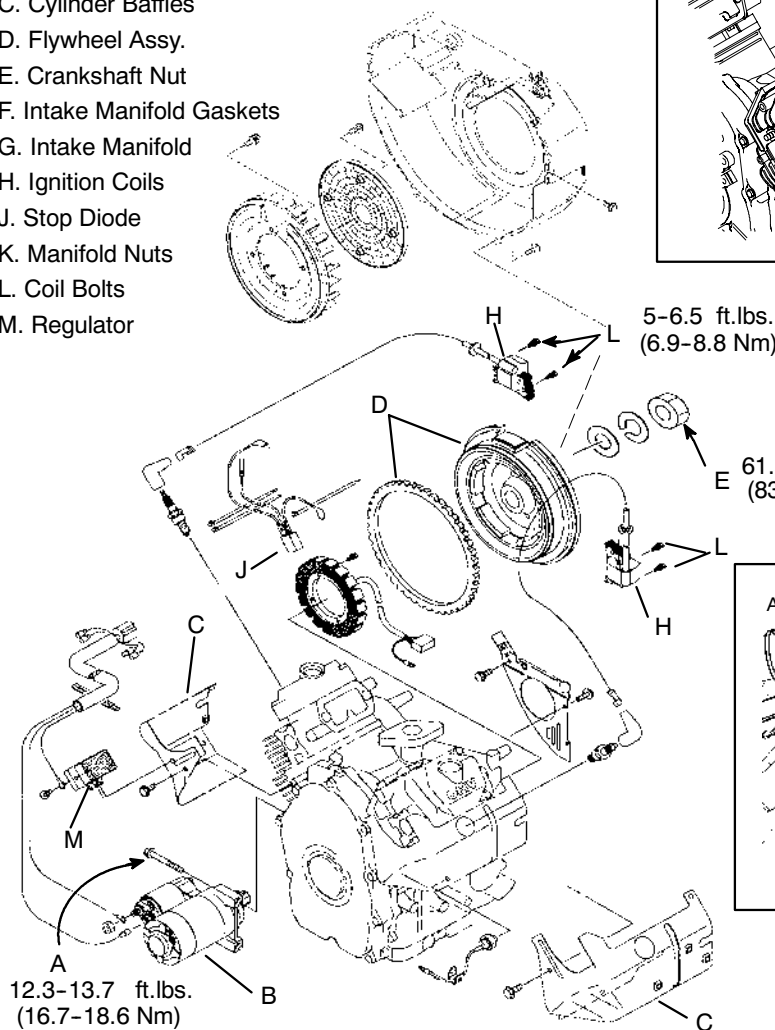
ENGINE ASSEMBLY

Electrical Components

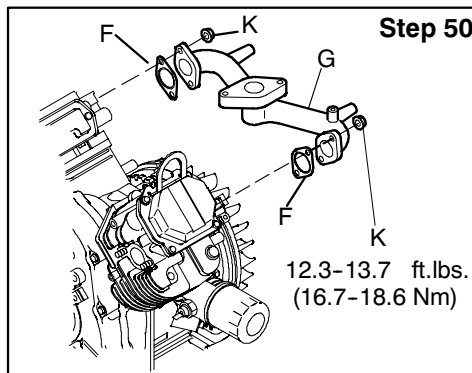
46. Install the starter motor bolts. Tighten the bolts to 12.3–13.7 ft.lbs. (16.7–18.6 Nm).
47. Install the regulator and 4 cylinder baffles. Connect correct wires back to starter.
48. Reinsert the woodruff key into keyway on crankshaft. Wipe off oil and grease from tapered portion of crankshaft and flywheel center hole.
49. Install the flywheel to the crankshaft. Secure with washers and crankshaft nut. Torque crankshaft nut to 61.5–68.7 ft.lbs. (83.3–93.1 Nm).
50. Install the intake manifold gaskets and manifold onto the case. Evenly torque the intake manifold nuts to 12.3–13.7 ft.lbs. (16.7–18.6 Nm).
51. Install the ignition coils to each side of the crankcase.
52. Adjust the air gap using a feeler gauge. Ignition Coil Air Gap: 0.012–0.020 in. (0.3–0.5 mm). Torque the coil bolts to 5–6.5 ft.lbs. (6.9–8.8 Nm).
53. Connect the wiring from the stop diode to the primary terminal of the ignition coil.

Step 46-53

- A. Starter Bolts
- B. Starter Motor
- C. Cylinder Baffles
- D. Flywheel Assy.
- E. Crankshaft Nut
- F. Intake Manifold Gaskets
- G. Intake Manifold
- H. Ignition Coils
- J. Stop Diode
- K. Manifold Nuts
- L. Coil Bolts
- M. Regulator



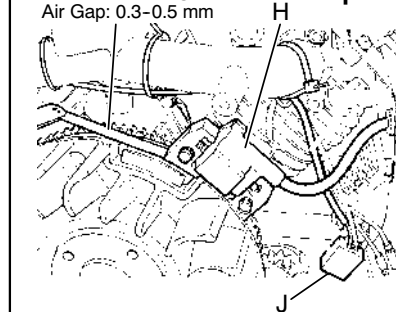
Step 50



Feeler Gauge

Air Gap: 0.3–0.5 mm

Step 52





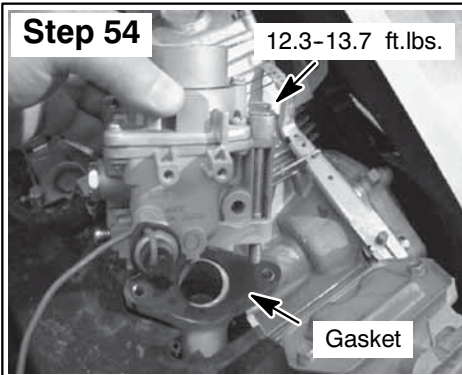
ENGINE ASSEMBLY

Governor/Throttle/Choke Levers

54. Install the carburetor gasket onto the intake manifold. Install the carburetor. Torque bolts to 12.3–13.7 ft.lbs. (16.7–18.6 Nm).
55. Install the governor rod and rod spring between the governor lever and carburetor speed control lever. See illustration on right side below.

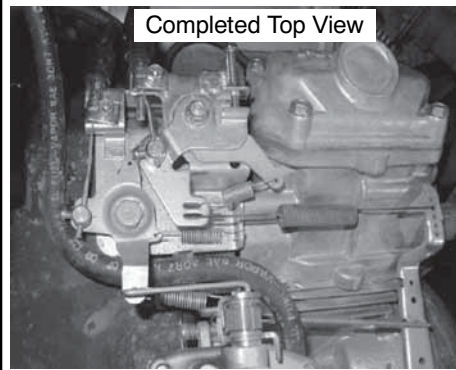
56. Attach the governor lever to the governor lever shaft. Temporarily tighten the governor lever bolt.
57. Install the speed control bracket onto the intake manifold. Attach the speed control lever to the speed control bracket.
58. Attach the choke control link to the speed control bracket. Attach the return springs.

Step 54

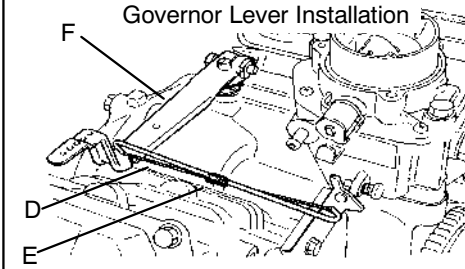


Step 55-58

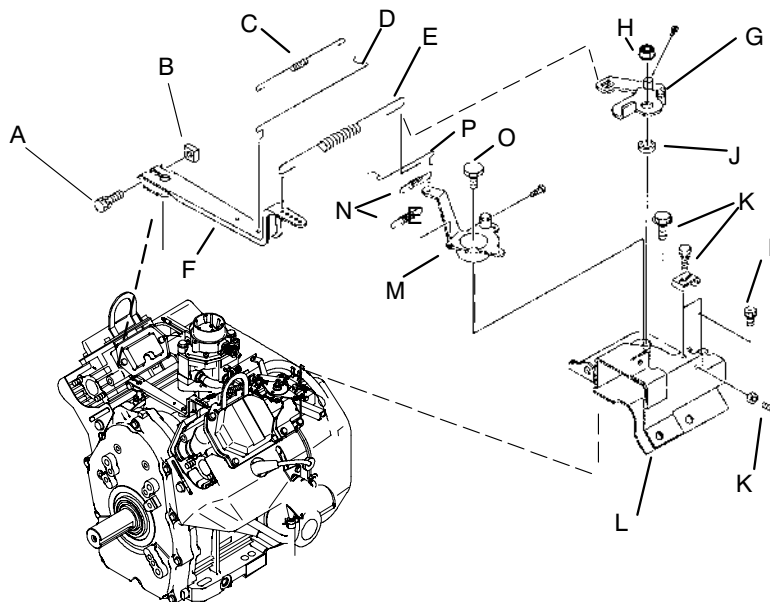
Completed Top View



Governor Lever Installation



- A. Bolt & Washer
B. Nut
C. Rod Spring
D. Governor Rod
E. Governor Spring
F. Governor Lever
G. Speed Control Lever
H. Nut
I. Screw
J. Spacer
K. Nut & Bolt
L. Speed Control Bracket
M. Choke Link
N. Return Springs
O. Screw
P. Choke Control Rod





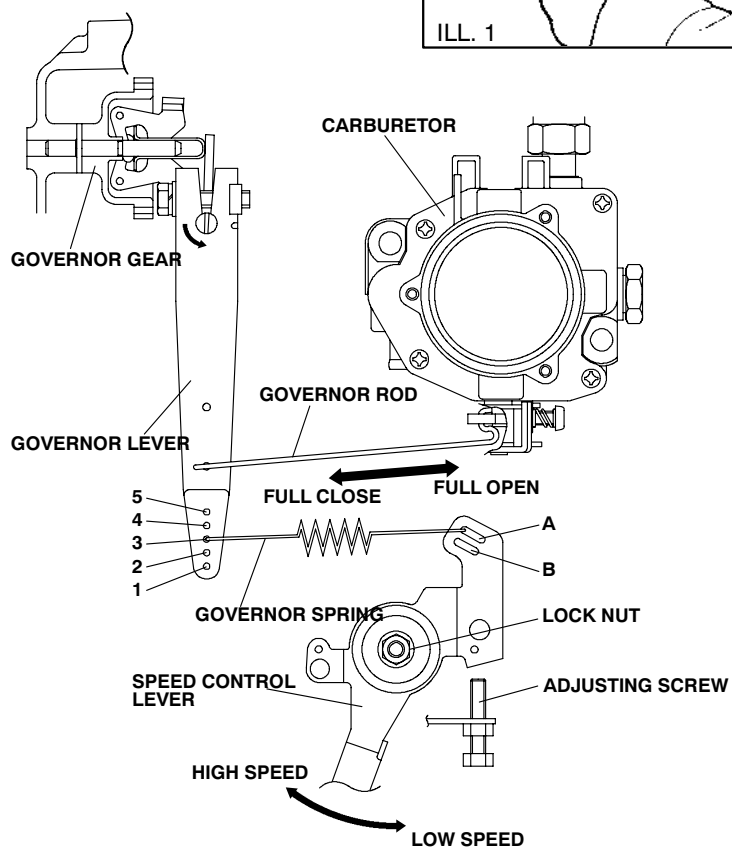
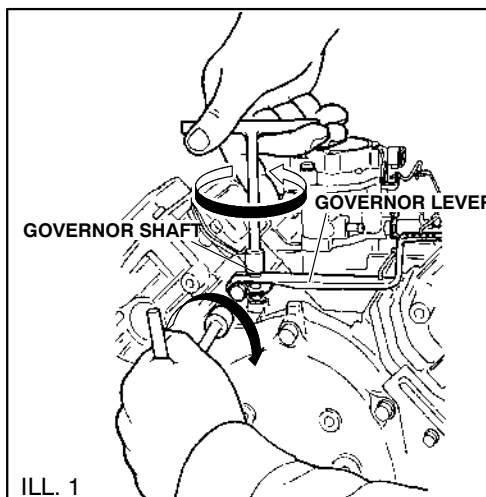
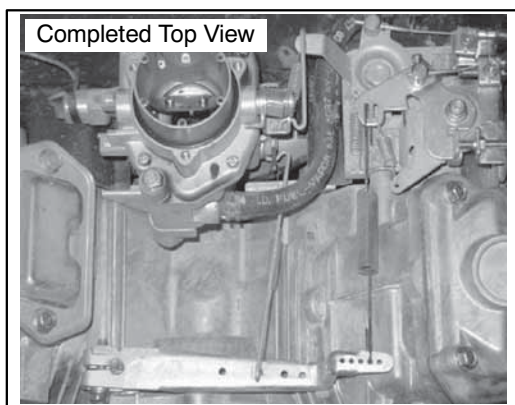
ENGINE ASSEMBLY

Governor/Throttle/Choke Levers

59. Attach the governor spring between the governor lever and speed control lever.
60. Attach the choke control link between the carburetor choke lever and choke control lever.

61. Push the control lever to high speed position and tighten the nut.
62. Attach the choke control link between the carburetor choke lever and choke control lever.
63. Turn the governor shaft counterclockwise all of the way. Tighten the lock bolt to secure the governor lever. See Illustration 1 below.

Step 59-63



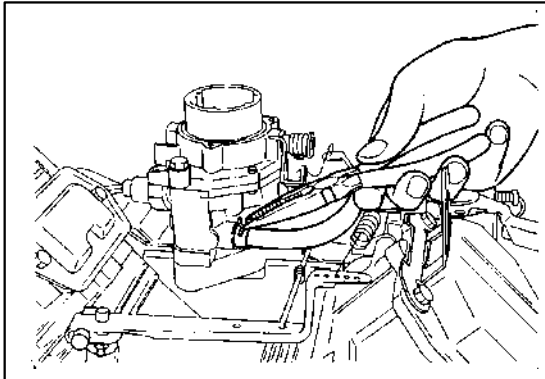


ENGINE ASSEMBLY

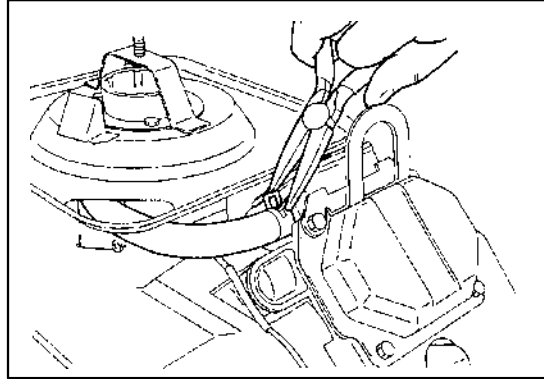
Air Cleaner Install

64. Connect the fuel lines to carburetor.
65. Connect the breather line to the cleaner base.
Attach air cleaner base onto the carburetor.
66. Connect the breather line to the cylinder head.
67. Install new or clean air cleaner and cleaner cover with knob.
68. Install the oil pressure switch (if removed).
Torque the oil pressure switch to 4.3–7.2 ft.lbs. (5.9–9.8 Nm).
69. Install a new oil filter and oil. Refer to Page 2.17 “OIL AND FILTER CHANGE” to complete the oil fill procedure.
70. Reverse the “ENGINE REMOVAL PROCEDURE” on Page 3.14 for engine installation.

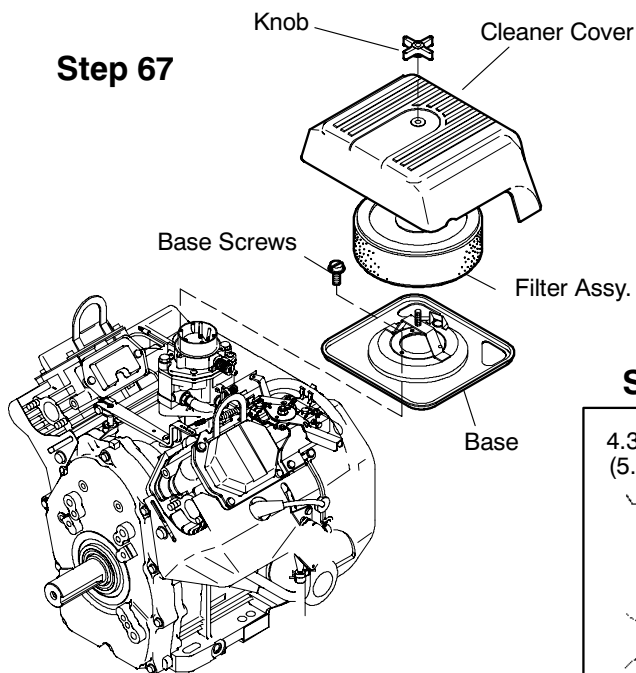
Step 64



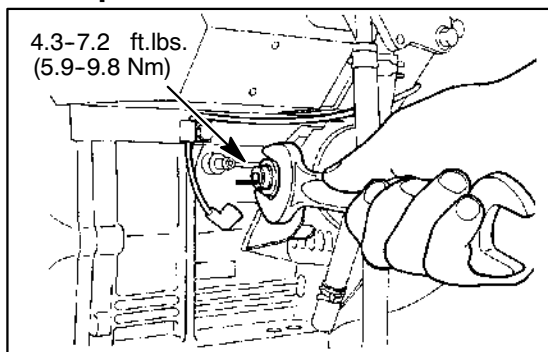
Step 65-66



Step 67



Step 68





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.

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. 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.

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
- Pilot jet worn
- 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 ignition switch)
- 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)
- Fuel shut off solenoid inoperative



**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
- 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
- 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
- Dirty carburetor

Piston Failure - Scoring

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

Excessive Smoke and Carbon Buildup

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

Low Compression

- Decompressor stuck
- Cylinder head gasket leak
- No valve clearance or incorrectly adjusted
- Cylinder or piston worn
- Piston rings worn, leaking, broken, or sticking

- Bent valve or stuck valve
- Valve spring broken or weak
- Valve not seating properly (bent or carbon accumulated on sealing surface)
- Rocker arm sticking

Backfiring

- 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**TROUBLESHOOTING****Overheating**

- Restricted system (mud or debris in cooling fins or restriction to air flow passages)
- Lean mixture (restricted jets, vents, fuel pump or fuel valve)
- Fuel pump output weak
- Restricted radiator (internally or cooling fins)
- Low oil level
- Spark plug incorrect heat range



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CHAPTER 3

ENGINE

RANGER 2x4,4x4,6x6 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)
Hard Metal Oil Line Banjo Fitting	N/A	11-16 ft.lbs. (15-21 Nm)
Oil Hose Fitting	1/8 Pipe Thread	6.5-11 (9-15 Nm)
Oil Pump	6mm	5-6.5 (7-9 Nm)
Oil Pump Case Screw	5mm	1.5-2 (2-3 Nm)
One Way Valve	11mm	14-19 (20-25 Nm)
Recoil Housing	6mm	5-6.5 (7-9 Nm)
Rocker Cover	6mm	7-8 (9-11 Nm)
Rocker Support	8mm	8-10 (11-13 Nm)
Rocker Adjuster Screw	6mm	6-7 (8-10 Nm)
Water Pump Impeller Nut	6mm	5-6.5 (7-9 Nm)

Water Pump Housing Cover	6mm	5-6.5 (7-9 Nm)
Stator Plate	6mm	5-6.5 (7-9 Nm)
Starter Motor	6mm	5-6.5 (7-9 Nm)
Spark Plug	14mm	9-11 (12-15 Nm)

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



**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)			





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)

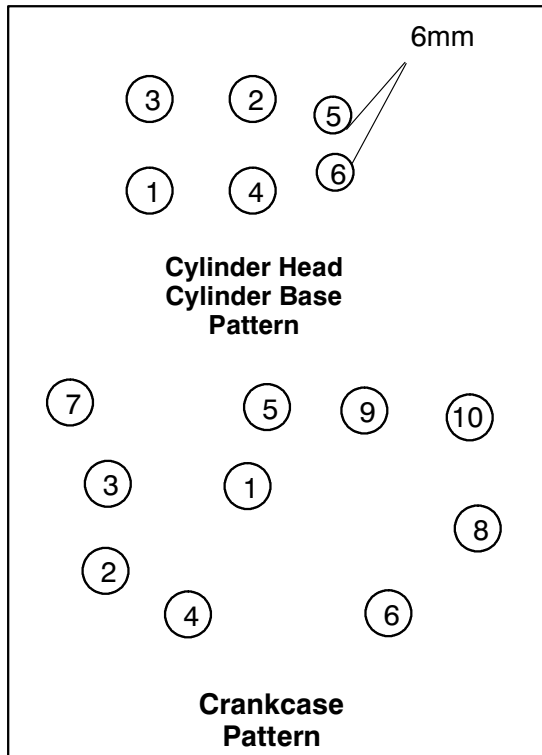
KEY - Std: Standard; OS: Oversize; ID: Inner Diameter;
 OD: Outer Diameter; Mag: Magneto Side; PTO: Power
 Take Off Side





ENGINE FASTENER TORQUE PATTERNS

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



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

PISTON IDENTIFICATION

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

Note 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.





COOLING SYSTEM

WARNING: Never remove radiator cap when engine is warm or hot. The cooling system is under pressure

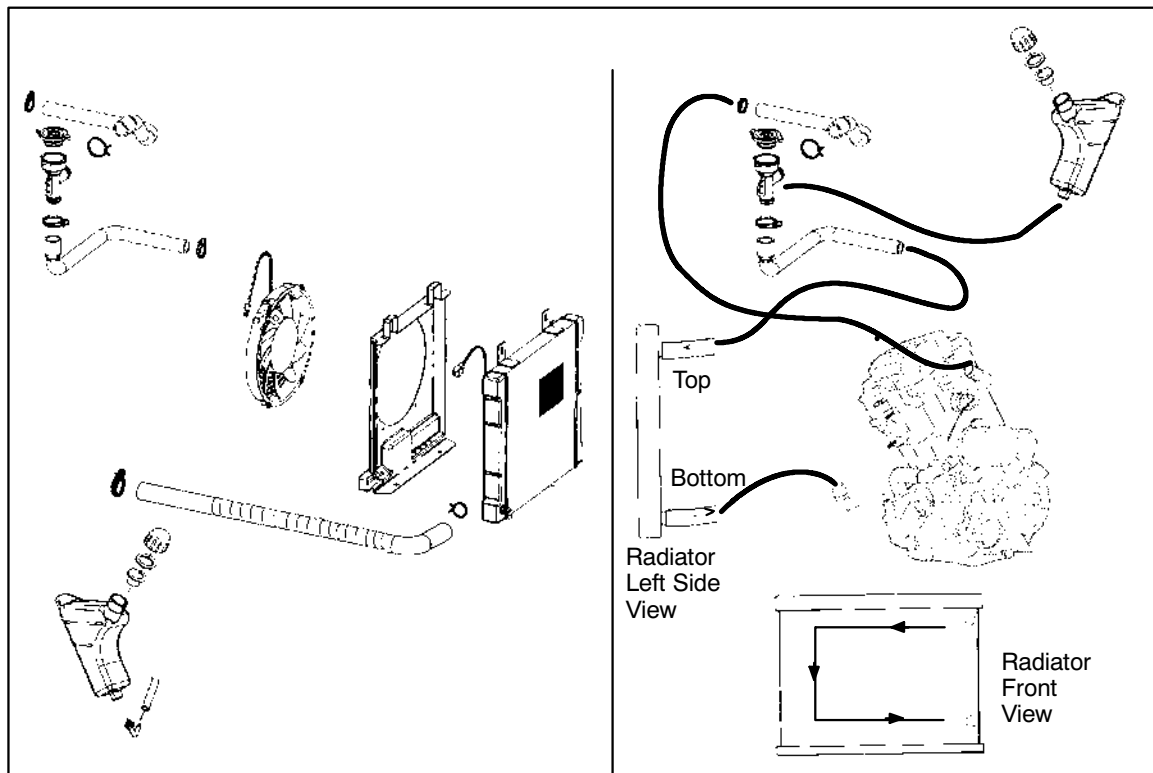
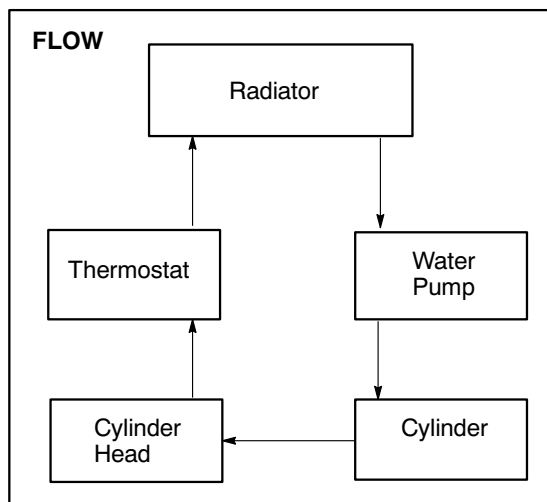
and serious burns may result. Allow the engine and cooling system to cool before servicing.

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.





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.





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. 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.

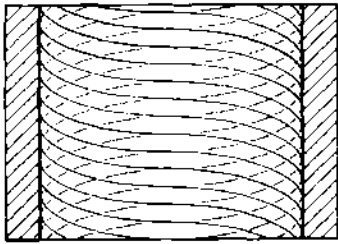




HONING TO OVERSIZE

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

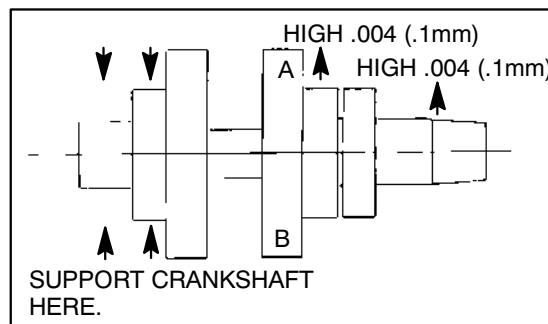
It is very important that the cylinder be thoroughly cleaned after honing to remove all grit material. Wash the cylinder in a solvent, then in hot, soapy water. Pay close attention to areas where the cylinder sleeve meets the aluminum casting (transfer port area). Use electrical contact cleaner if necessary 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.

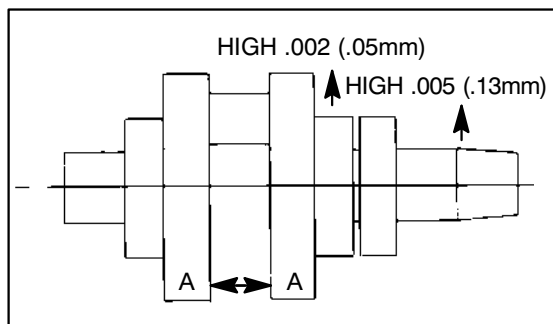
Crankshaft Truing Stand (PN 2870569)

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

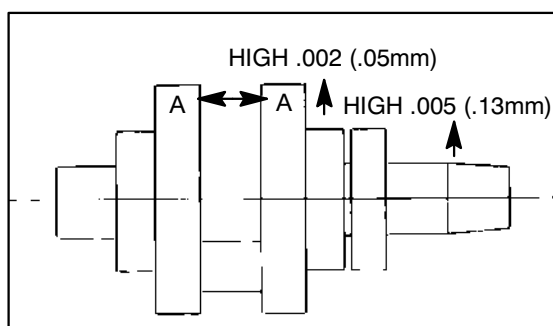


1. To correct a situation like the one shown in the illustration at right, strike the shaft at point A with a brass hammer.





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 - EH42PL/EH50PL

Oil Type Polaris Premium 4 Synthetic
(PN 2871281)

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 - EH42PL/EH50PL

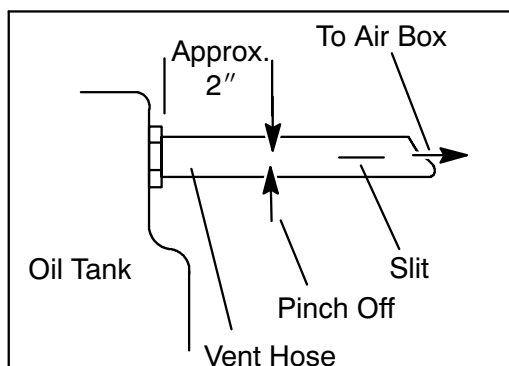
1. Remove blind plug on front left cylinder head.
2. Insert a 1/8 NPT oil pressure gauge adaptor into the cylinder head and attach the gauge.
3. Start engine and allow it to reach operating temperature, monitoring gauge indicator.

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 15-20 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.



OIL FLOW - EH42PL/EH50PL

The chart on Page 3.12 describes the flow of oil through the EH42PL/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.

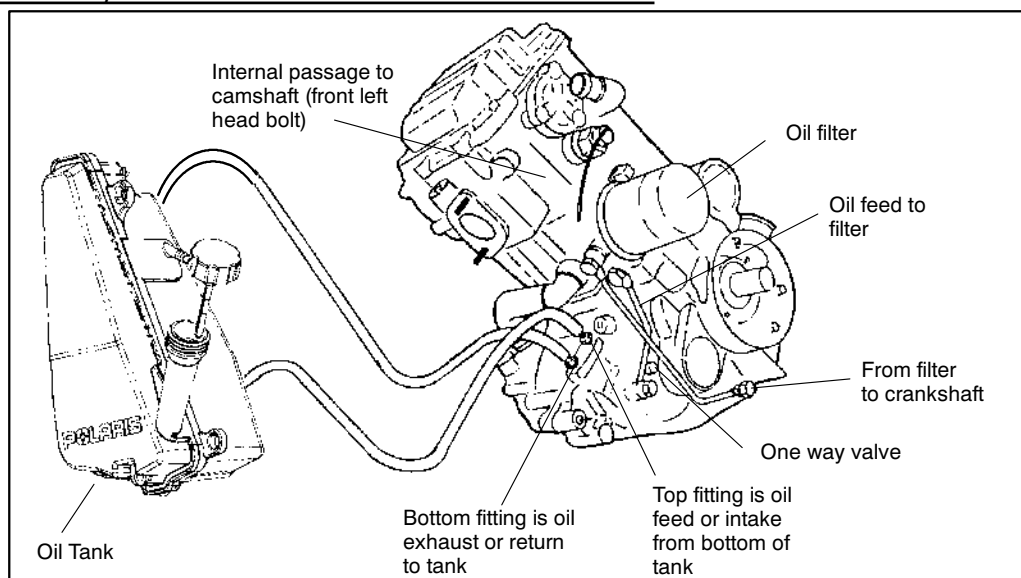
Residual oil from the lubrication of the crankshaft and connecting rod indirectly lubricates the cylinder wall, piston, rings, connecting rod small end bearing, piston pin, oil/water pump drive gears, cam chain and drive sprocket, and Magneto end crankshaft main bearing.

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.

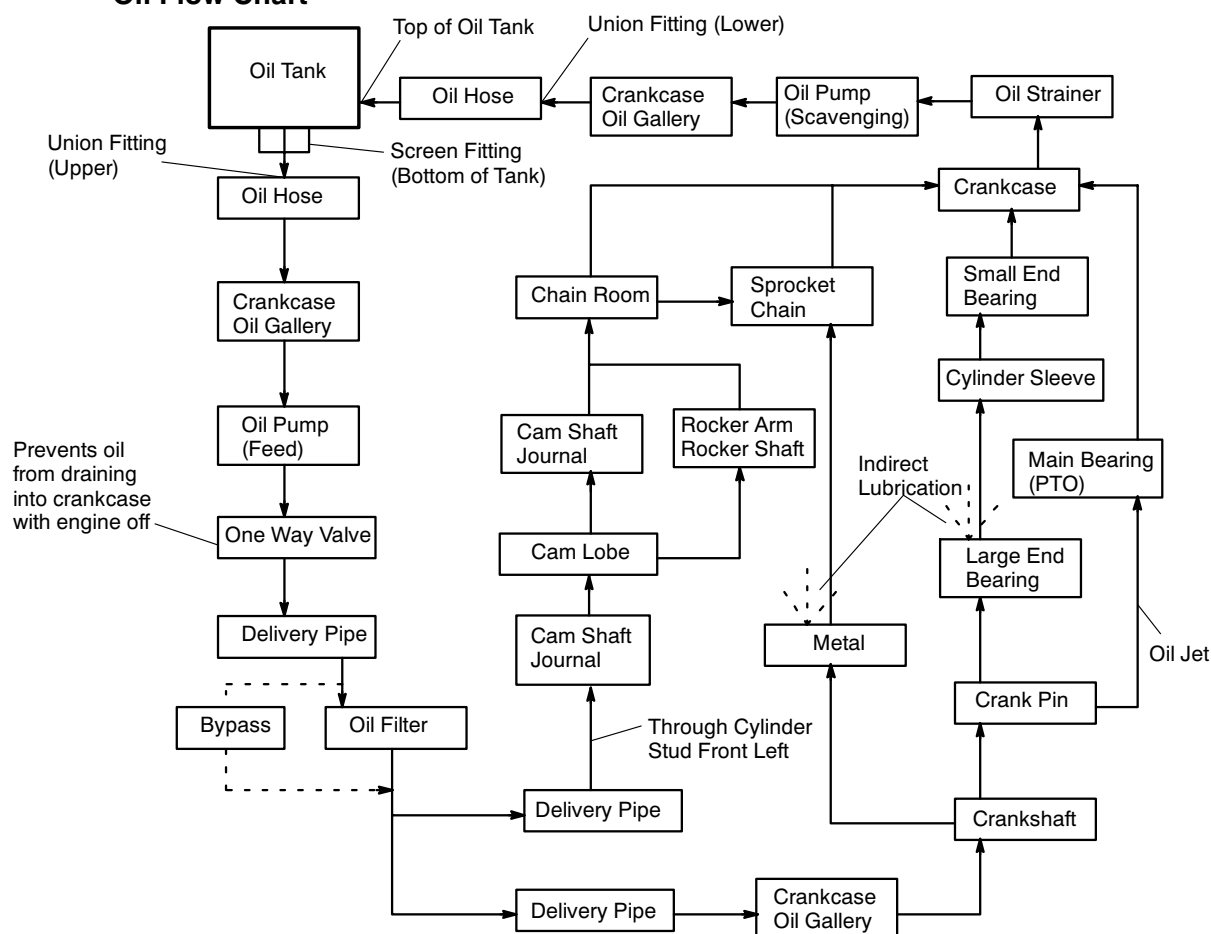




EH42PL/EH50PL OIL FLOW DIAGRAM



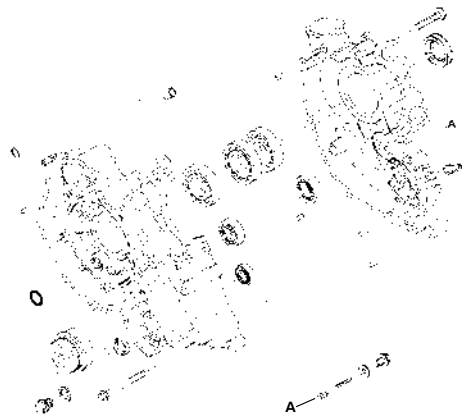
Oil Flow Chart





EH42PL/EH50PL ENGINE EXPLODED VIEW

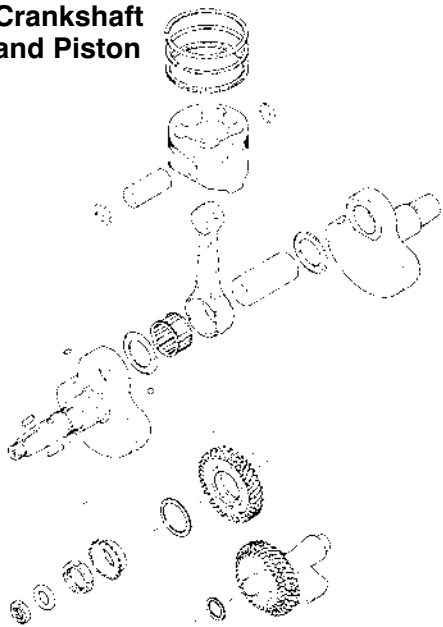
Crankcase



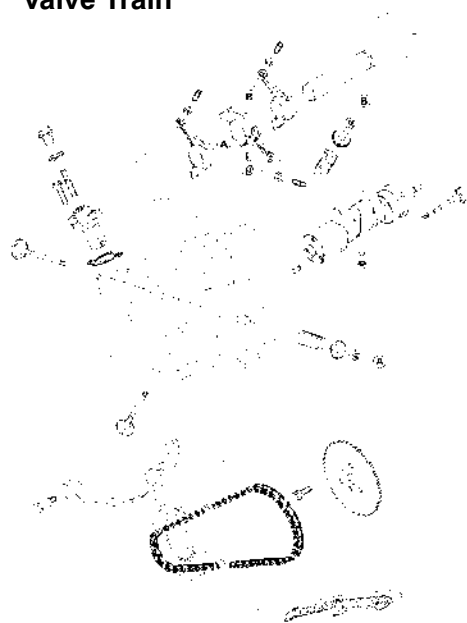
**Cylinder/
Cylinder
Head**



**Crankshaft
and Piston**



Valve Train





ENGINE REMOVAL

REFER TO PAGE 3.51-3.52 FOR

ENGINE REMOVAL / INSTALLATION

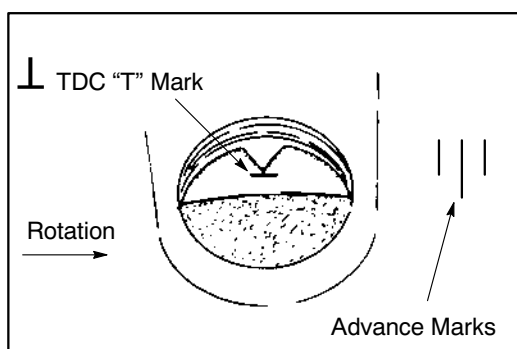
NOTES.

CAM CHAIN

TENSIONER/ROCKER

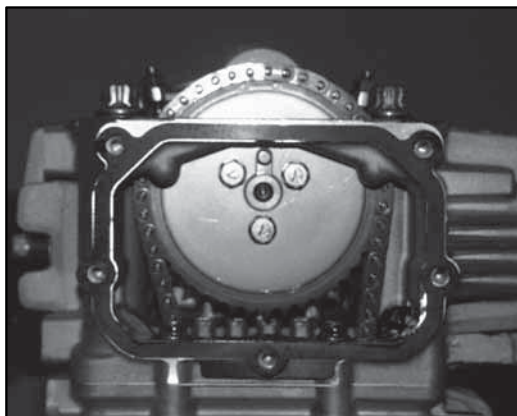
ARM/CAMSHAFT REMOVAL

1. Remove ignition timing inspection plug from recoil housing.



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

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



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

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

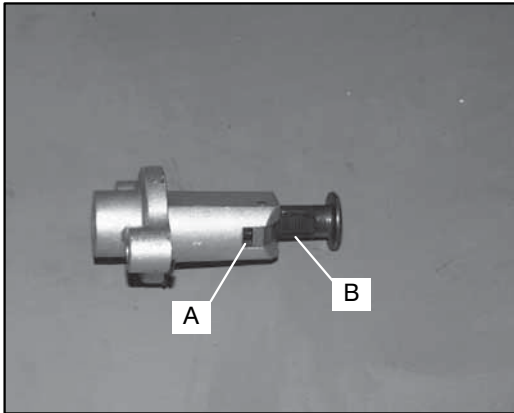


5. Remove cam chain tensioner plug, sealing washer, and spring. **CAUTION:** The plug is under spring tension. Maintain inward pressure while removing.
6. Remove the two 6x25 mm cam chain tensioner flange bolts.
7. Tap lightly on tensioner body with a soft face hammer and remove tensioner.

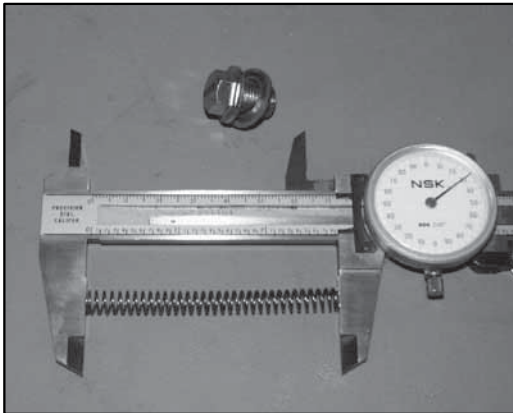




CAM CHAIN TENSIONER INSPECTION



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

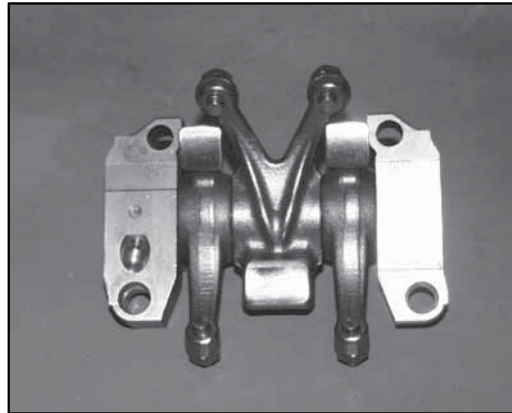


Tensioner Spring Free Length:

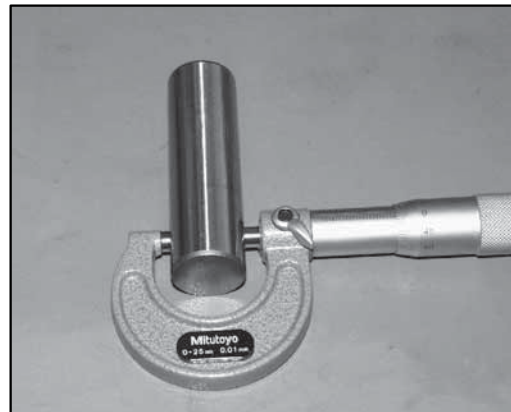
2.320" (5.9 cm)

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.

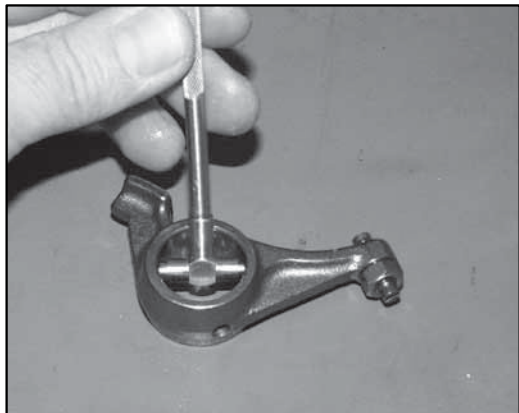
Rocker Shaft O.D.:

.8656-.8661" (21.987-22.0 mm)



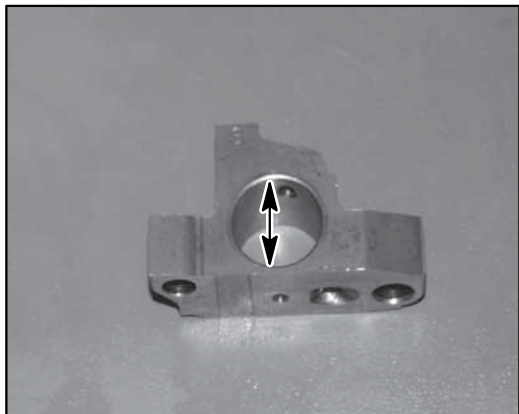


ROCKER ARM/SHAFT INSPECTION, CONT.



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

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

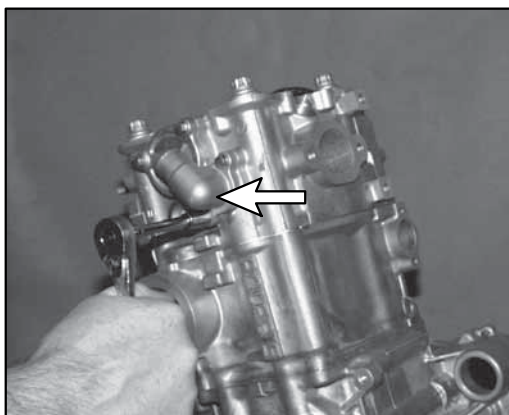


Rocker Shaft Oil Clearance:

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.

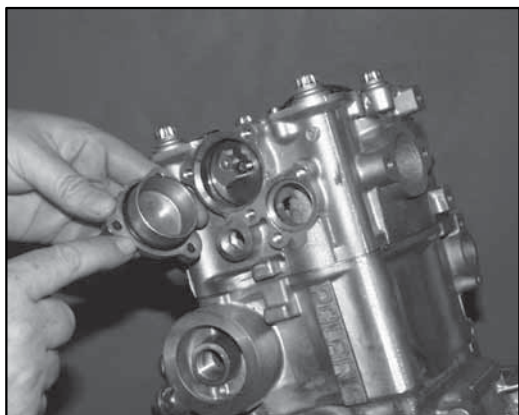
CAMSHAFT REMOVAL



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



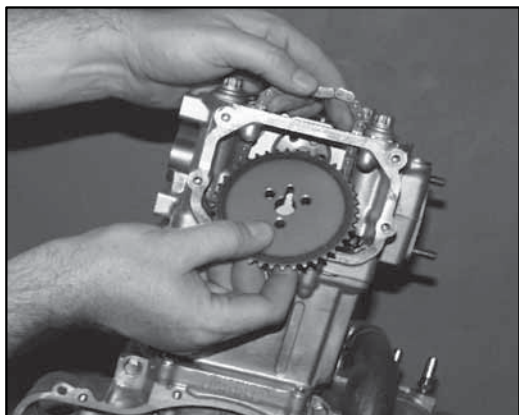
3. Loosen three camshaft sprocket bolts.



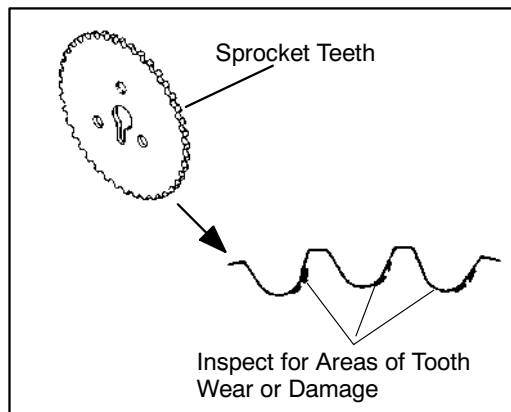
4. Remove camshaft end cap and O-Ring.



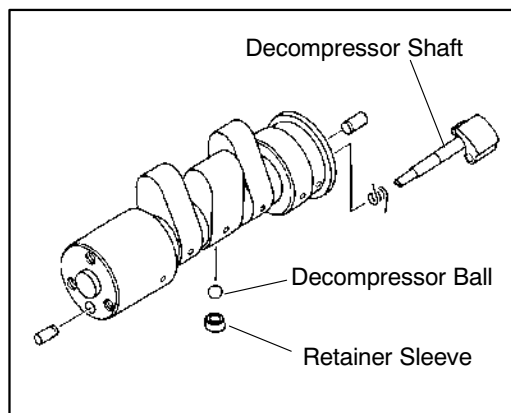
5. Inspect camshaft end cap (thrust face) for wear. Replace if worn or damaged.
6. Place a clean shop towel in the area below cam chain sprocket and remove sprocket retaining bolts.



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



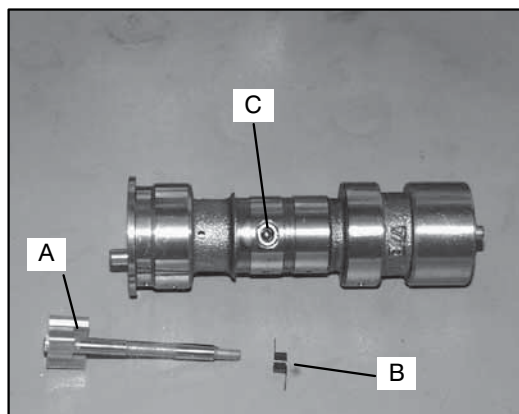
9. Inspect cam sprocket teeth for wear or damage. Replace if necessary.



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

AUTOMATIC COMPRESSION RELEASE REMOVAL/INSPECTION

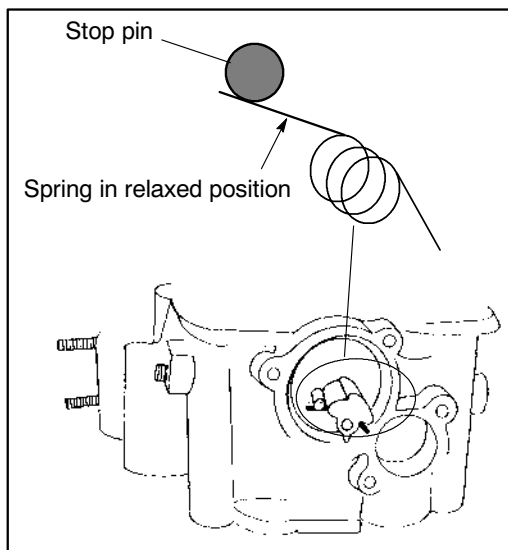
NOTE: The automatic compression release mechanism can be inspected and serviced without removing the camshaft from the cylinder head. The actuator ball in the camshaft is not replaceable. Replace the camshaft as an assembly if the actuator ball is worn or damaged.



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

AUTOMATIC COMPRESSION RELEASE INSTALLATION

1. Slide spring onto shaft.
 2. Apply engine oil to release lever shaft.
- The actuator ball must be held outward to allow installation of the release lever shaft.



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:

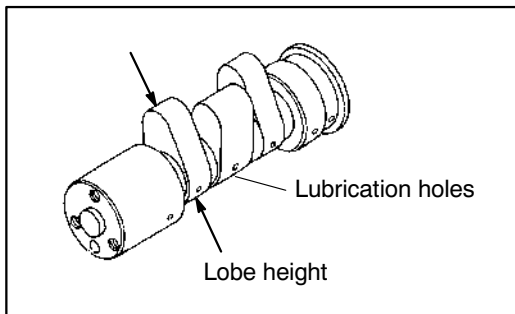
4. Use a small magnet to draw the actuator ball outward, or rotate the engine until the cam lobes face upward and install release lever shaft.
5. Position camshaft as shown at bottom of illustration at right.
6. Place arm of spring under stop pin as shown and push release lever inward until fully seated. *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.



**Camshaft Oil Clearance:**

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

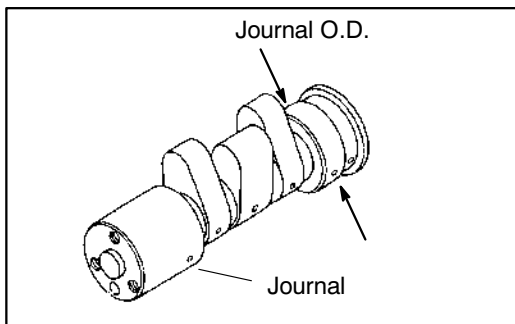
NOTE: Replace camshaft if damaged or if any part is worn past the service limit.

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

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.

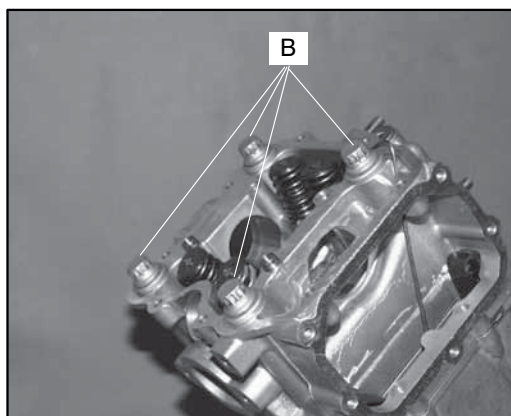
Camshaft Journal I.D.:

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.

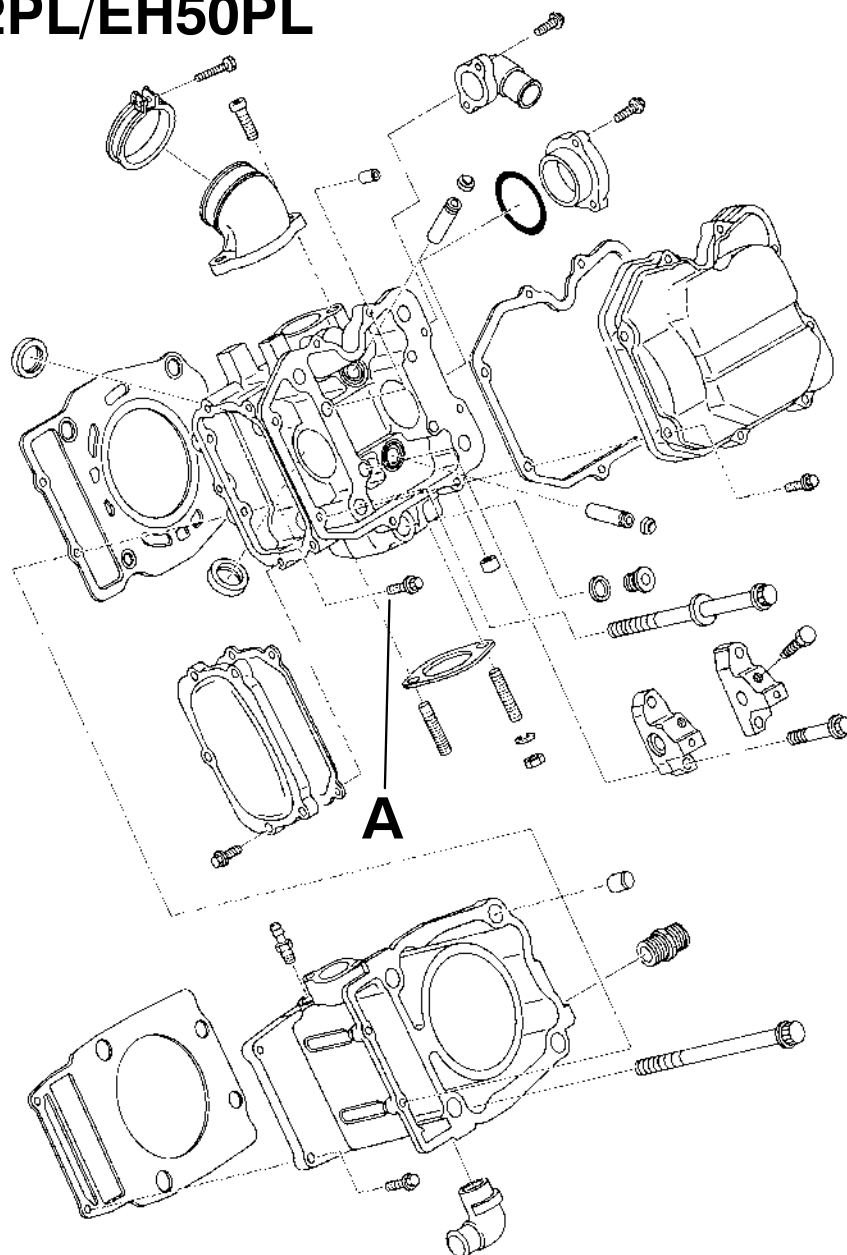
CYLINDER HEAD EXPLODED VIEW, EH42PL/EH50PL

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.



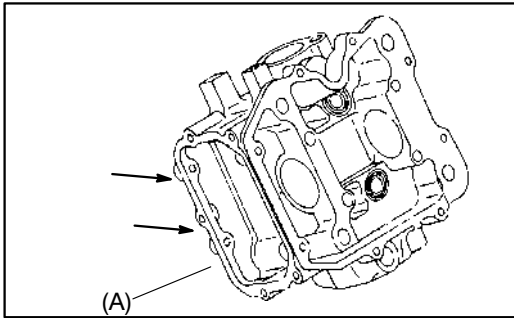
3. Remove bolts (B) and tap cylinder head lightly with a plastic hammer until loose. **CAUTION:** Tap only in reinforced areas or on thick parts of cylinder head casting to avoid damaging the thread.
4. Remove cylinder head and head gasket.



**CYLINDER HEAD EXPLODED VIEW, EH42PL/EH50PL****EH42PL/EH50PL**

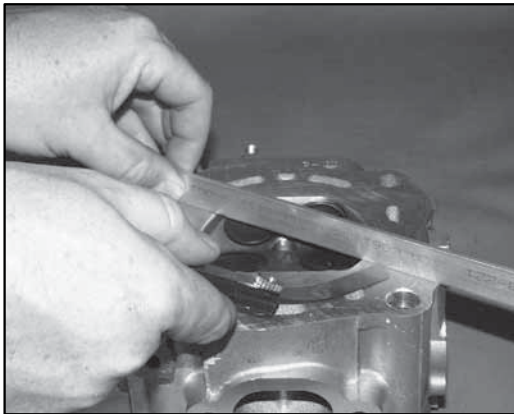


CYLINDER HEAD INSPECTION



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:

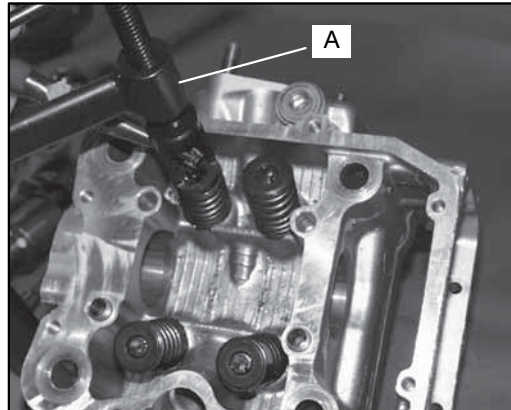
.002" (.05 mm)

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.

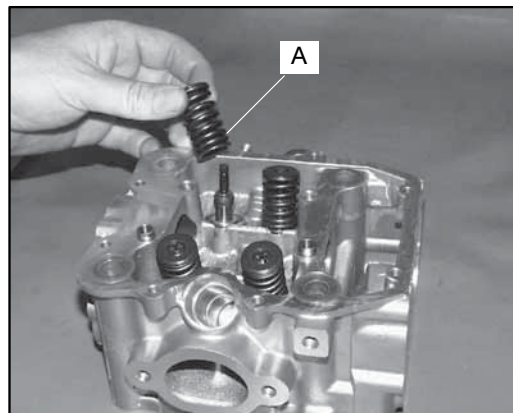
CYLINDER HEAD DISASSEMBLY

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.

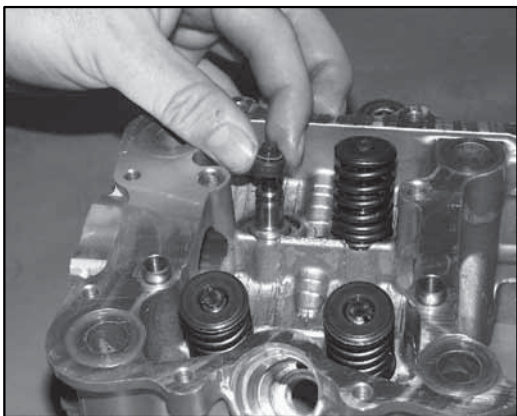
NOTE: The valve springs should be positioned with the tightly wound coils against the cylinder head on progressively wound springs (A).

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





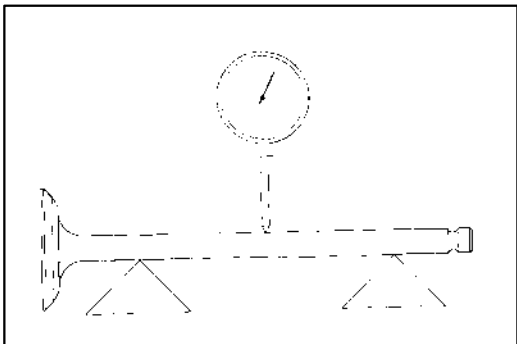
4. Measure free length of spring with a Vernier caliper. Check spring for squareness. Compare to specifications. Replace spring if either measurement is out of specification



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.

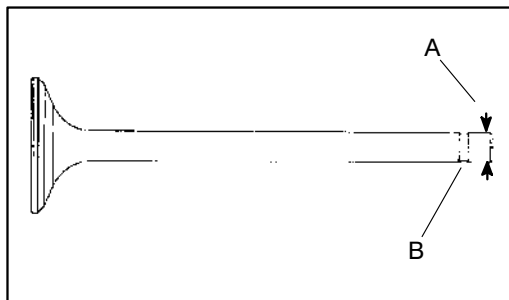
VALVE INSPECTION

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

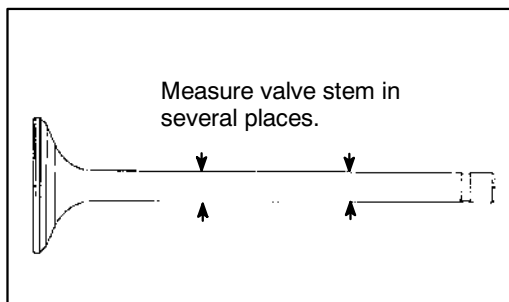


2. Check valve face for runout, pitting, and burnt spots. To check for bent valve stems, mount valve in a drill or use "V" blocks and a dial

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.



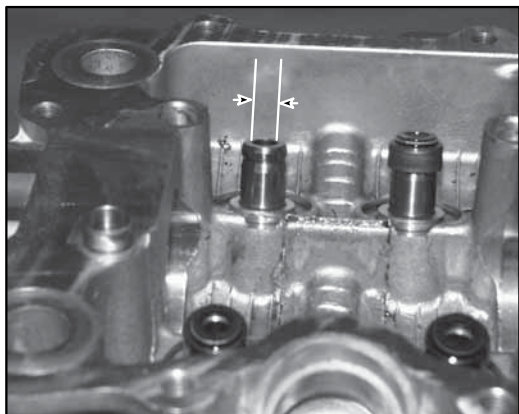
Valve Stem Diameter:

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.



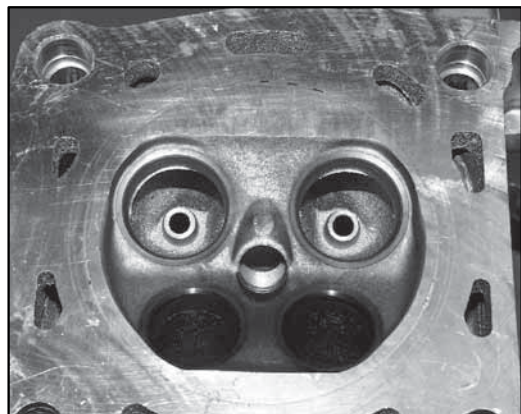


Valve Guide I.D.:
.2362-.2367" (6.0-6.012 mm)

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.

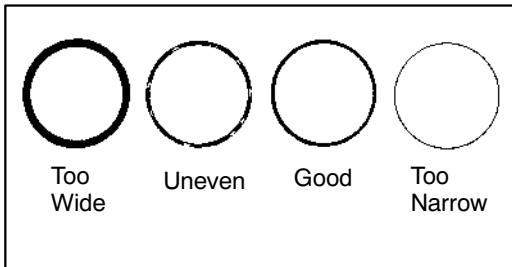
CAUTION: Wear eye protection when performing cylinder head service. Valve guide replacement will require heating of the cylinder head. Wear gloves to prevent burns.

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.

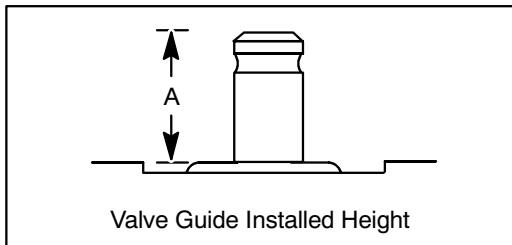
VALVE SEAT RECONDITIONING, CONT.

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.



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.

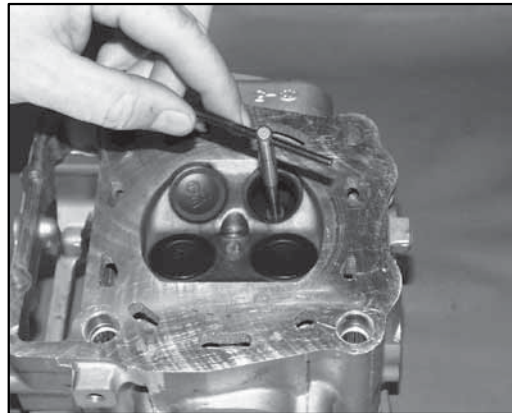
1. When thoroughly heated, place cylinder head on blocks of wood which will allow the old guides to be removed.
2. Using valve guide driver, drive guides out of the cylinder head from the combustion chamber side. Be careful not to damage guide bore or valve seat when removing guides.
3. Place cylinder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



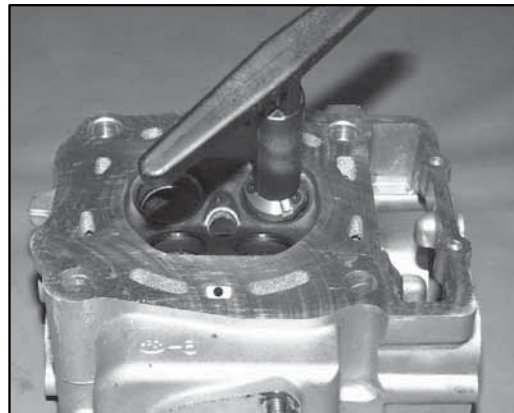
Valve Guide Height:
.689-.709" (17.5-18.0 mm)

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.

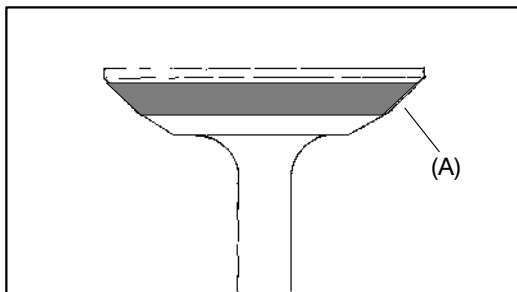


9. Place 46° cutter on the pilot and make a light cut.
10. Inspect the cut area of the seat.
 - If the contact area is less than 75% of the circumference of the seat, rotate the pilot 180° and make another light cut.
 - If the cutter now contacts the uncut portion of the seat, check the pilot. Look for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

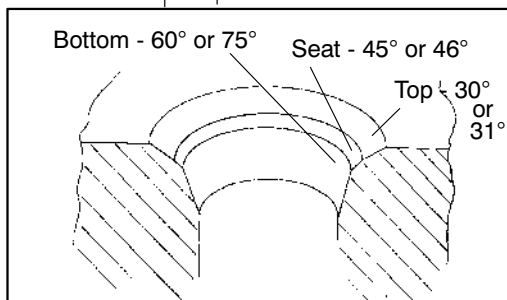
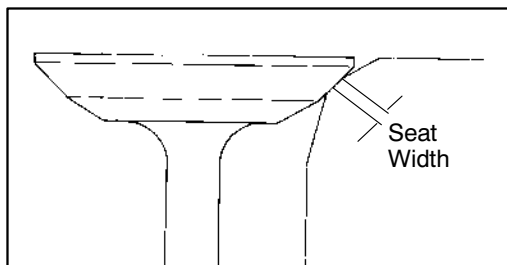




- If the contact area of the cutter is in the same place, the valve guide is distorted from improper installation and must be replaced. Be sure the cylinder head is at the proper temperature and replace the guide.
- If the contact area of the initial cut is greater than 75%, continue to cut the seat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



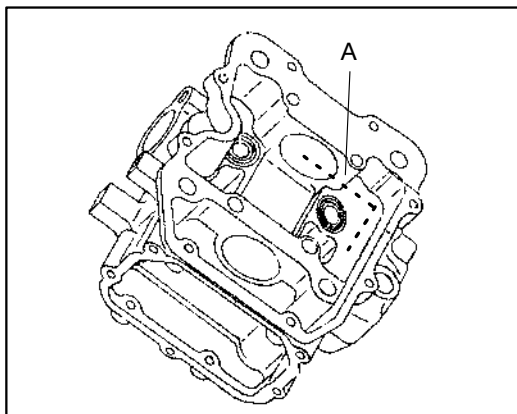
11. To check the contact area of the seat on the valve face, apply a thin coating of Prussian Blue™ paste to the valve seat. If using an interference angle (46°) apply black permanent marker to the entire valve face (A).
12. Insert valve into guide and tap valve lightly into place a few times.
13. Remove 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).



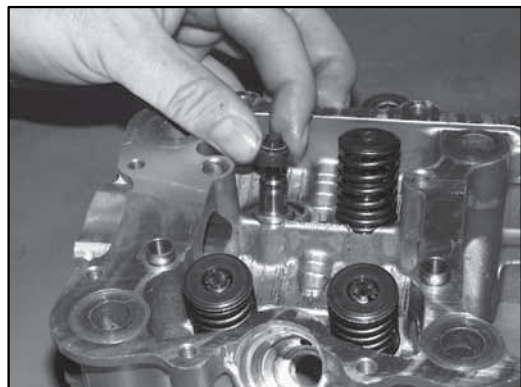


18. Clean cylinder head, valves, and camshaft oil supply passage (A) thoroughly.
19. If oil passage blind plug was removed, apply Crankcase Sealant (PN 2871557) or equivalent sealer to the threads and install, torquing to 8 ft. lbs. (11 Nm). **CAUTION:** Do not allow sealant to enter oil passage.
20.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

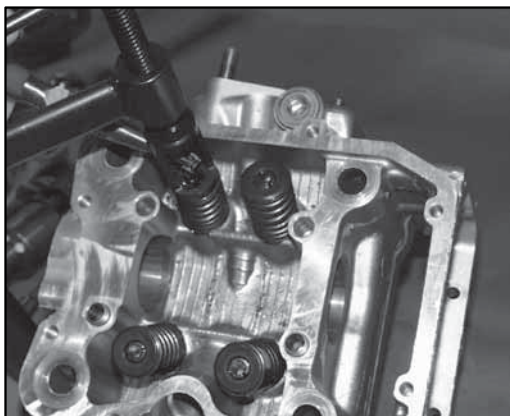
CYLINDER HEAD ASSEMBLY

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.

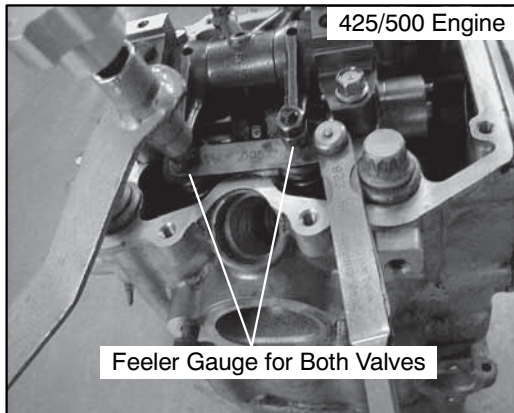
VALVE SEALING TEST

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.





EXHAUST VALVE CLEARANCE ADJUSTMENT

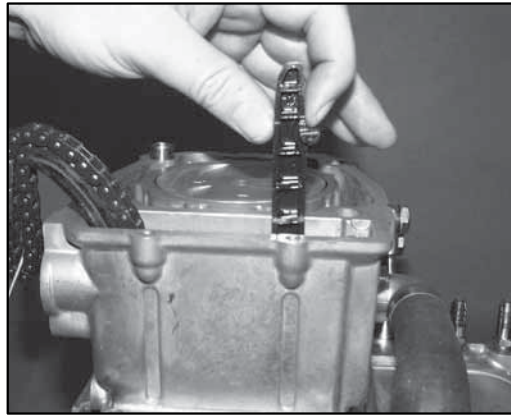


NOTE: The exhaust valves share a common rocker arm, and must be adjusted using two feeler gauges.

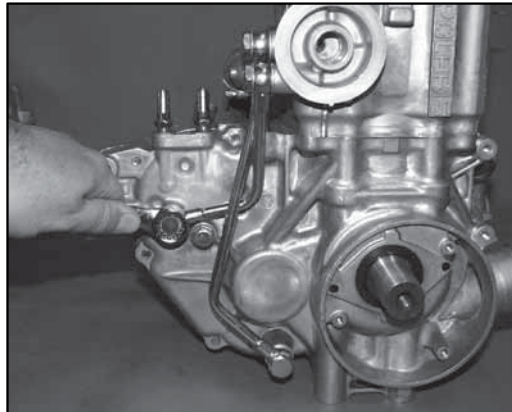
1. Insert .006 feeler gauge(s) between end of exhaust valve stem and adjuster screw(s).
2. Loosen locknut(s) and turn adjuster screw(s) until there is a slight drag on feeler gauge(s). The Valve/Clutch Adjuster Tool (**PA-44689**) can be used to adjust the 425/500 engines valves.
NOTE: Both feeler gauges 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.



1. Remove cam chain guide at front of cylinder.

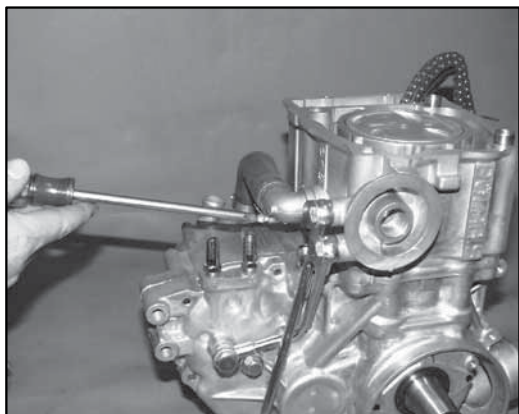


2. Loosen all four oil pipe banjo bolts and then remove the bolts and eight sealing washers. Remove the pipes.

CYLINDER/PISTON REMOVAL AND INSPECTION

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





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



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

NOTE: The bolts are inside the water jacket.



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

PISTON REMOVAL



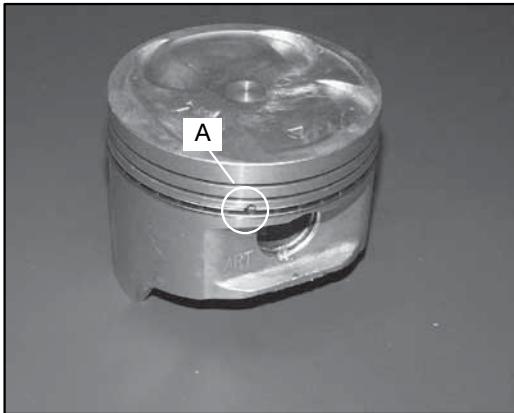
1. Remove circlip. Note piston directional arrow pointing toward the right (Mag) side of engine.
2. Remove piston circlip and push piston pin out of piston. If necessary, heat the crown of the piston *slightly* with a propane torch. **CAUTION:** Do not apply heat to the piston rings. The ring may lose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



3. Remove top compression ring.
***Using a piston ring pliers:** Carefully expand ring and lift it off the piston. **CAUTION:** Do not expand the ring more than the amount necessary to remove it from the piston, or the ring may break.
***By hand:** Placing both thumbs as shown, spread the ring open and push up on the opposite side. Do not



scratch the ring lands.



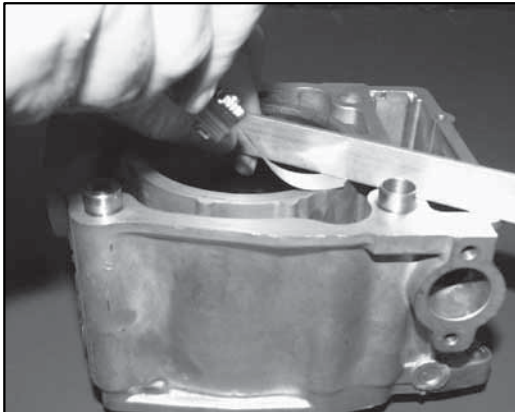
4. Repeat procedure for second ring.

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

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

CYLINDER INSPECTION

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

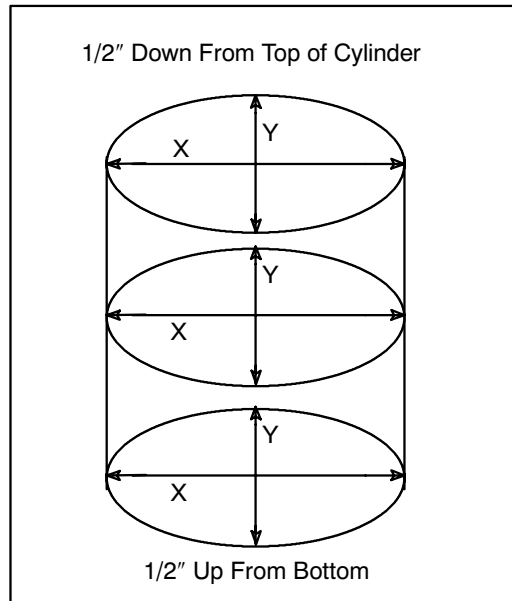


2. Inspect the top of the cylinder for warpage using a straight edge and feeler gauge.

Cylinder Warpage:

.002" (.05 mm)

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



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

Cylinder Taper

Limit: .002 Max.

Cylinder Out of Round

Limit: .002 Max.

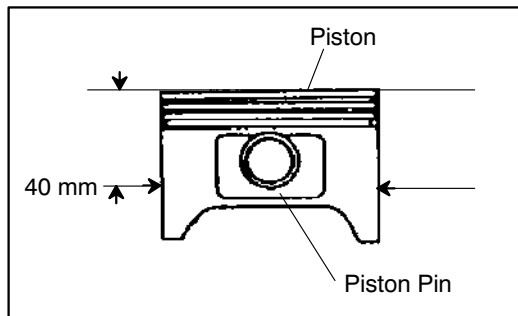
Standard Bore Size:

3.6221-3.6228" (92.00-92.012mm)





PISTON-TO-CYLINDER CLEARANCE



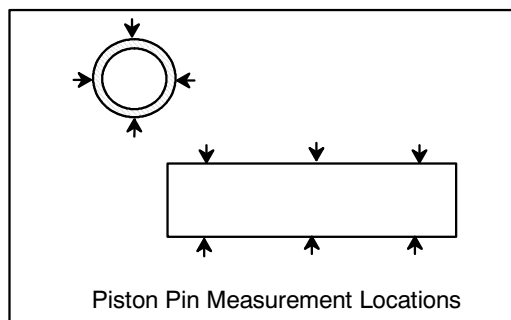
1. Measure piston outside diameter at a point 40 mm down from the top of the piston at a right angle to the direction of the piston pin.
2. Subtract this measurement from the maximum cylinder measurement obtained in Step 5 above.

Piston to Cylinder Clearance

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

Piston O.D.:

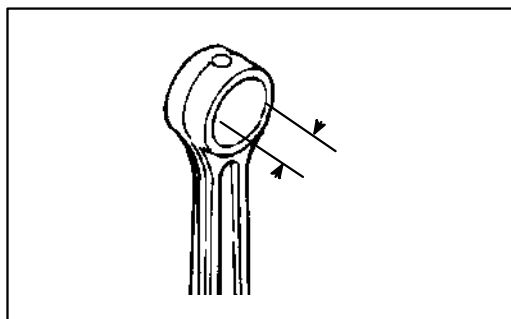
Std: 3.6204-3.6215" (91.970-91.985 mm)



Piston Pin Measurement Locations

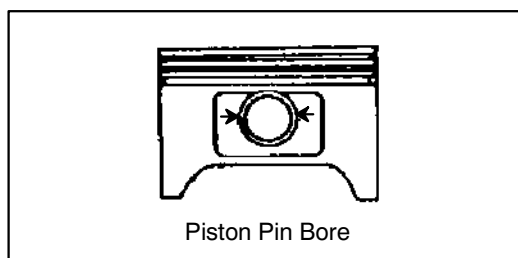
Piston Pin O.D.

.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.

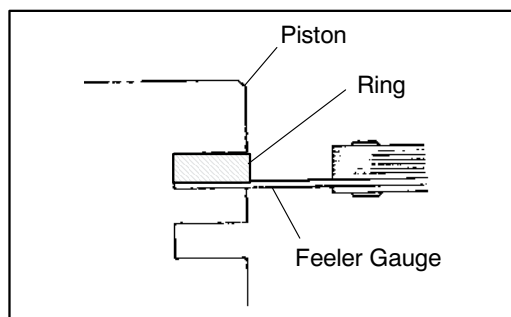
PISTON/ROD INSPECTION



Piston Pin Bore

Piston Pin Bore:

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



1. Measure piston pin bore.

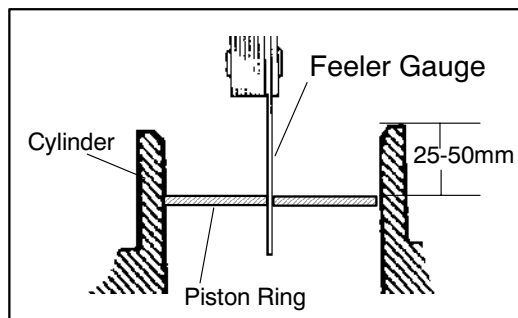


**Piston Ring-to-Groove Clearance****Top Ring Std:** .0016-.0031" (.040-.080 mm)**Limit:** .0059" (15 mm)**Second Ring Std:** .0012-.0028" (.030-.070 mm)**Limit:** .0059" (15 mm)

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.

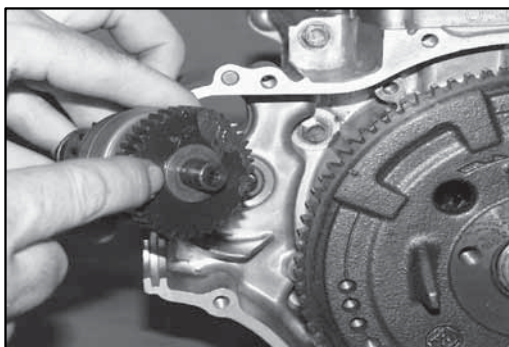
NOTE: Always check piston ring installed gap after re-boring a cylinder or when installing new rings. A re-bored cylinder should always be scrubbed thoroughly with hot soapy water, rinsed, and dried completely. Wipe cylinder bore with an oil rag immediately to remove residue and prevent rust.

CRANKCASE DISASSEMBLY

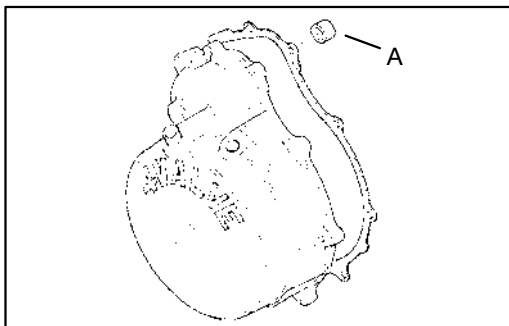
NOTE: The recoil starter, starter motor, starter drive, flywheel, stator, cam chain and sprockets can be serviced with the engine in the frame.

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.





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

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

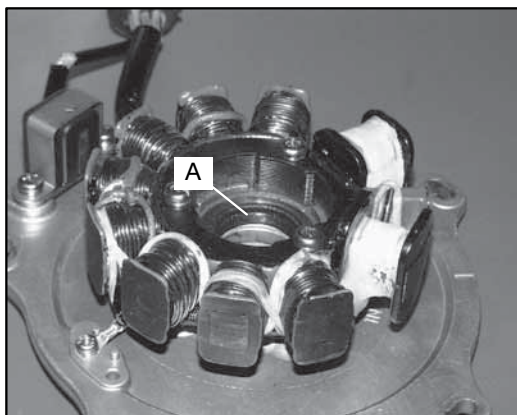
Starter Drive Bushing Clearance:
Std: .0015"-.004" (.038-.102 mm)

Service Limit:
.008" (.203 mm)

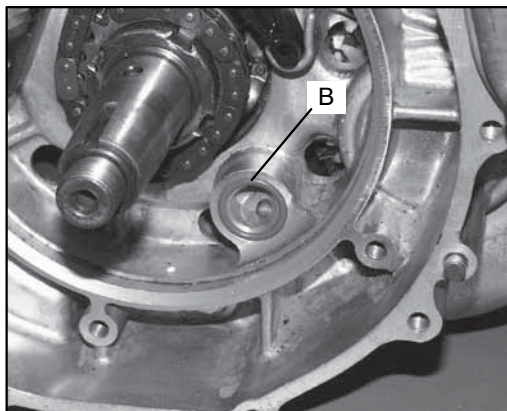
4. Measure the OD of the starter drive shaft on both ends and record.
5. Measure the ID of the bushing in the recoil housing (A) and in the crankcase and record. Measure in two directions 90° apart to determine if bushing is out of round. Calculate bushing clearance. Replace bushing if clearance exceeds 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

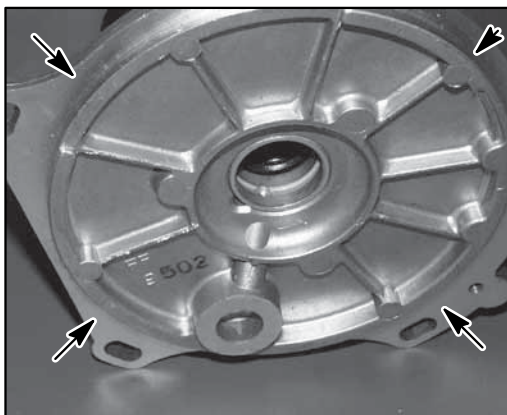
1. Remove flywheel nut and washer.
2. Install Flywheel Puller (PN 2871043) and remove flywheel. **CAUTION:** Do not thread the puller bolts into the flywheel more than 1/4" or stator coils may be damaged.
3. Mark or note position of stator plate on crankcase.
4. Remove bolts and carefully remove stator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



5. Replace crankshaft seal (A).

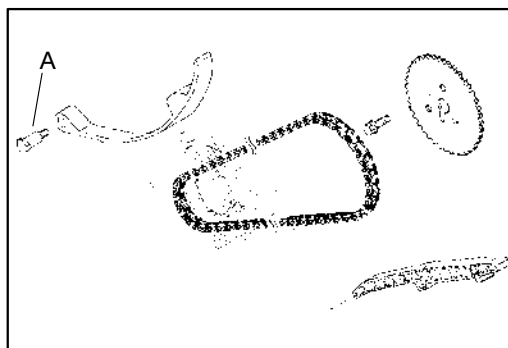


6. Remove oil passage O-Ring (B).



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

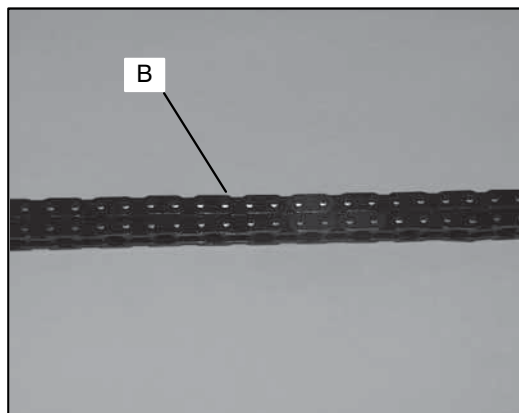
CAM CHAIN/TENSIONER BLADE



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

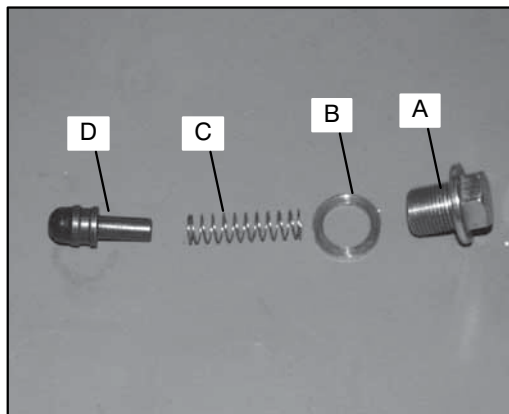


2. Remove blade and inspect for cracks, wear, or damage.



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)



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)

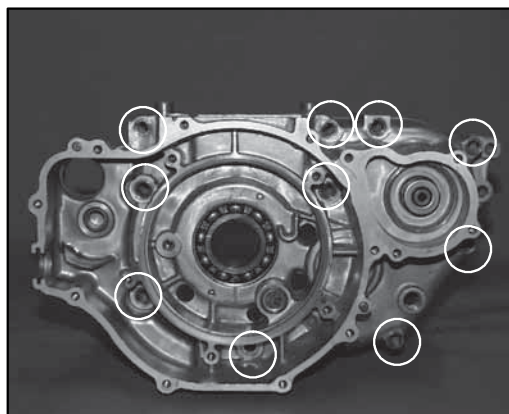
4. Using the special socket, remove the crankshaft slotted nut (A). **NOTE:** The slotted nut is a left hand thread.
5. Remove cam chain drive sprocket (B) and Woodruff key from crankshaft.
6. Inspect sprocket teeth for wear or damage.
7. Inspect Woodruff key for wear.
8. Replace any worn or damaged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

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

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.

CRANKCASE SEPARATION



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

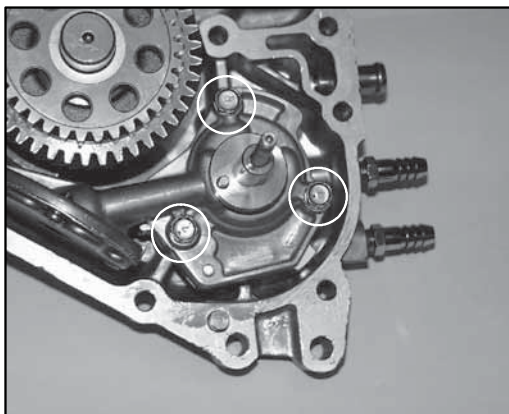




2. Separate crankcase by tapping with a soft faced hammer in reinforced areas.
3. Tap lightly on balancer gear with a brass drift through the hole in the crankcase if necessary, to ensure the balancer shaft stays in the PTO side crankcase. Watch the gap along the crankcase mating surface and separate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

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

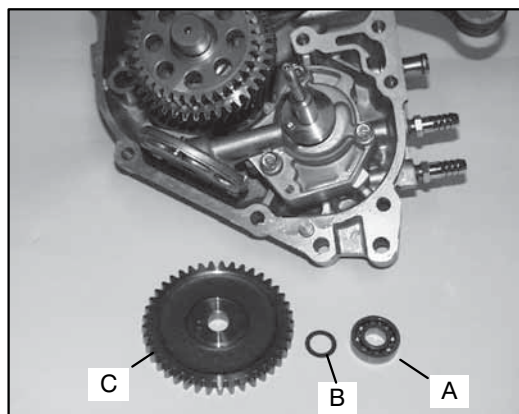
4. Remove the Mag (RH) crankcase from the PTO case.



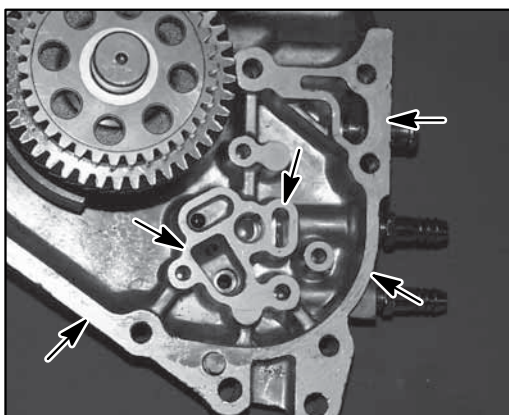
4. Remove three oil pump retaining bolts and pump.

OIL PUMP

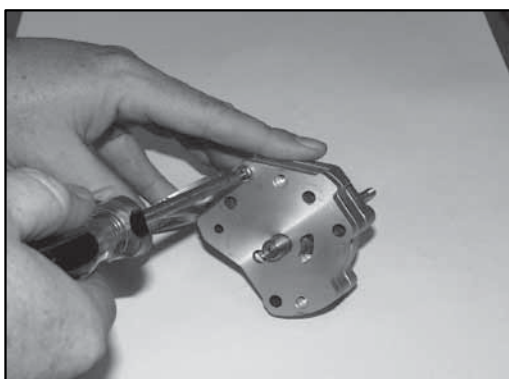
REMOVAL/INSPECTION



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.

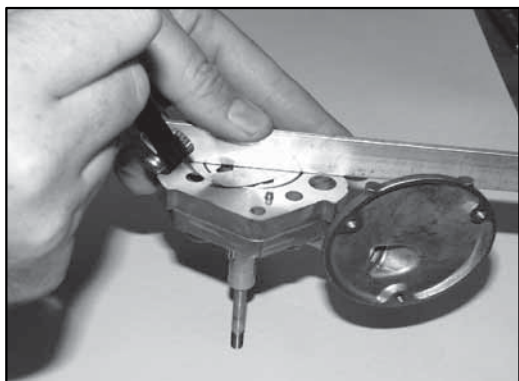


5. Inspect mating surface of crankcase and oil pump. Check for nicks, burrs, or surface irregularities.
6. Remove the three screws and strainer screen from pump.
7. Clean screen thoroughly.





8. Remove pump body screw and feed chamber cover.



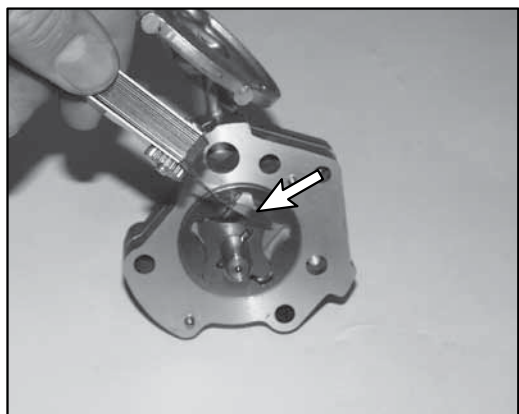
9. Measure pump end clearance using a feeler gauge and straight edge.

Pump End Clearance:

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

Wear Limit: .004 (.1016 mm)

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

**Rotor Tip Clearance:**

Std: .005 (.127 mm)

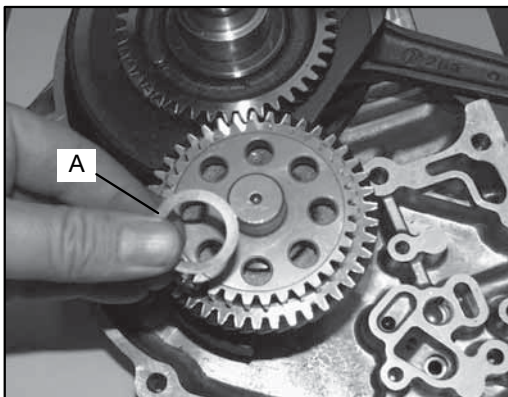
Wear Limit: .008 (.2032 mm)

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**



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



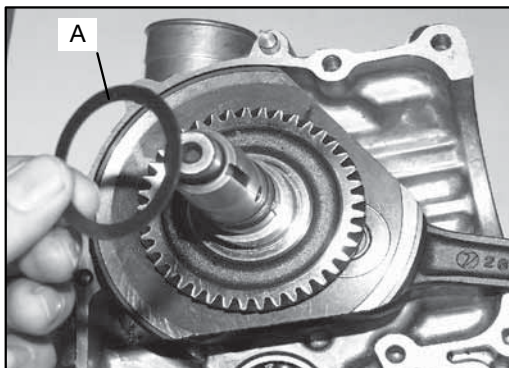
2. Note the alignment dots on the balancer and crankshaft gears, the marks must be aligned during reassembly.



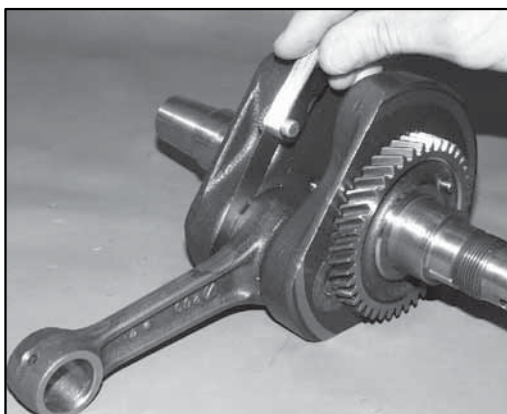
3. Turn the shaft until balancer counter weights clear the crankshaft and remove the balancer shaft from the crankcase.
4. Inspect the balancer drive gear and pump shaft drive gear.
5. Replace the shaft if gear teeth are abnormally worn or damaged.
6. Inspect the balancer shaft bearings.

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)



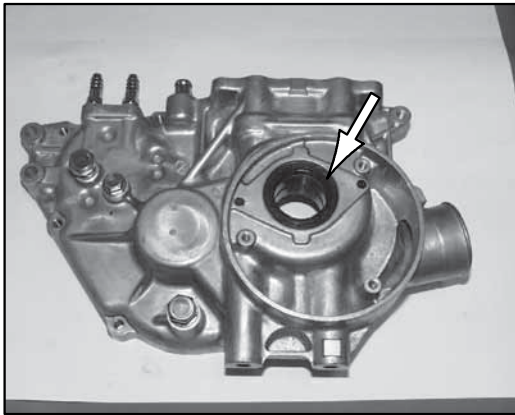
5. Measure the connecting rod big end radial clearance.

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.

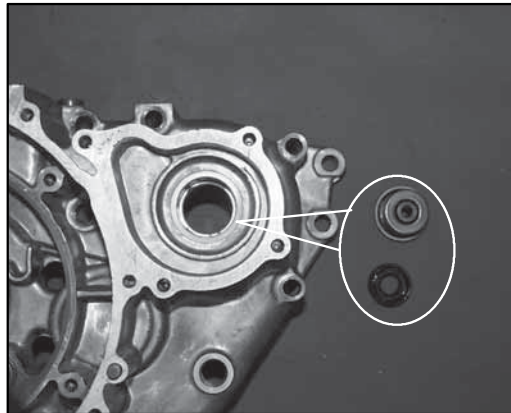
3. Support the crankcase and drive or press the main bearings out of each crankcase.
4. To remove balancer shaft bearings and pump shaft bearing use a blind hole bearing puller.

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.

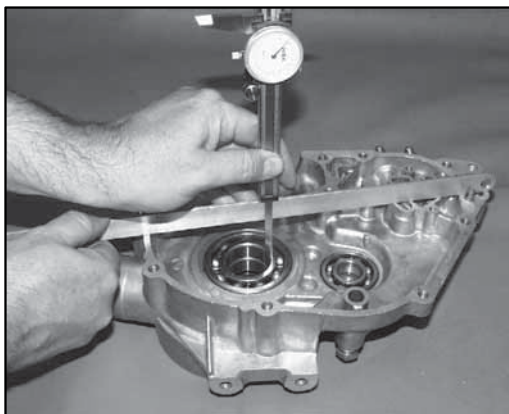




BEARING INSTALLATION

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.



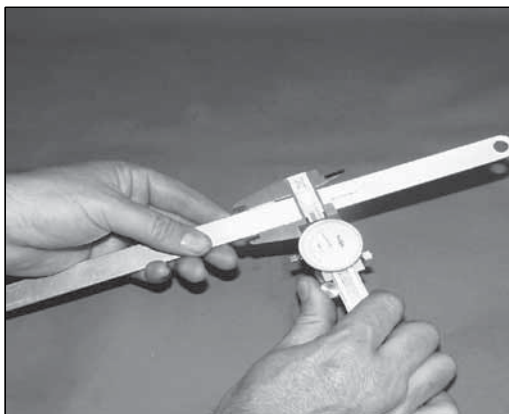
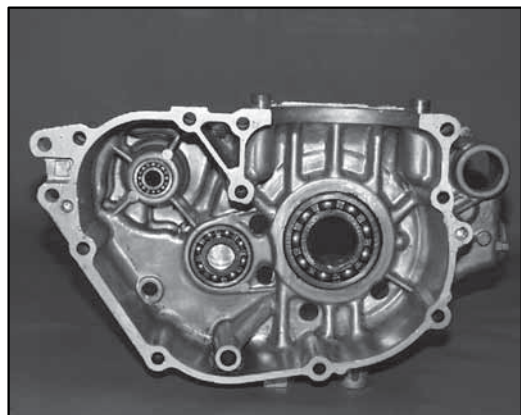
2. Measure the distance from the PTO crankcase mating surface to the main bearing using a dial caliper and a straight edge.

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

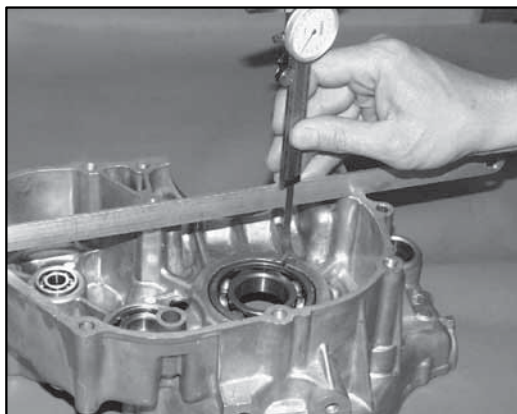


3. Subtract the thickness of the straightedge from the measurement obtained in Step 2 and record.

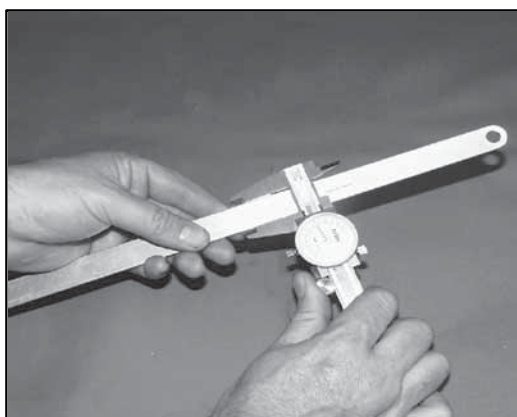
PTO Case Depth _____

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





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

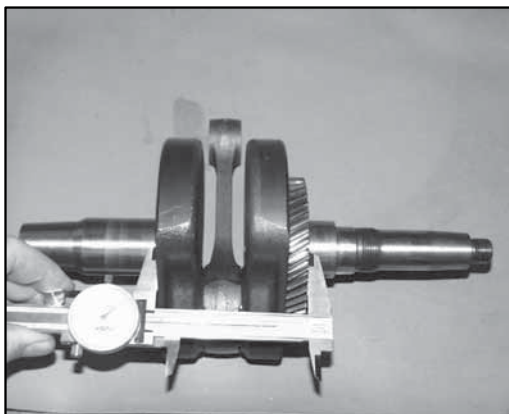


5. Subtract the thickness of the straightedge from the measurement obtained in Step 4 and record.

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:

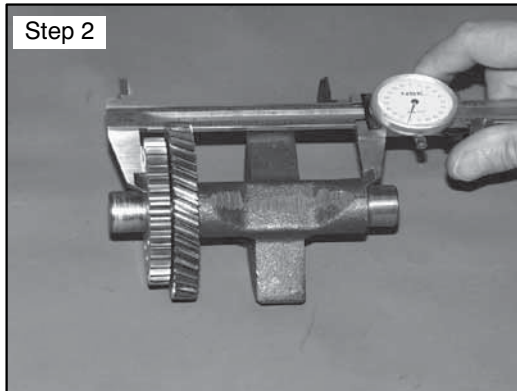
.008"-.016" (.02-.04 cm)





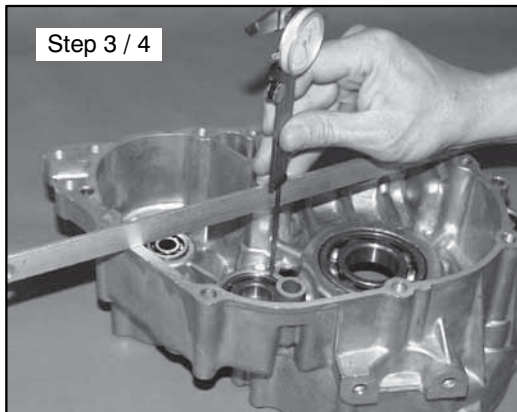
COUNTER BALANCER SHAFT END PLAY ADJUST.

Step 2



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.

Step 3 / 4



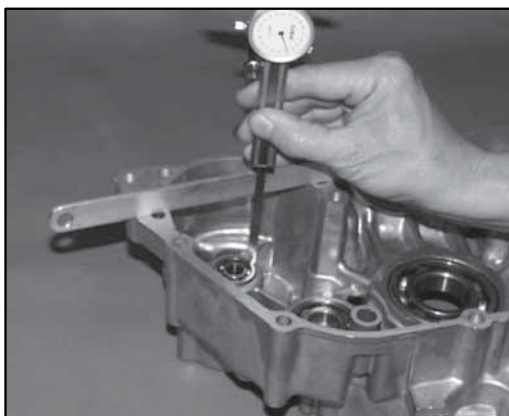
3. Measure the distance from the Mag crankcase mating surface to the balance shaft bearing using a dial caliper and a straight edge. Subtract the thickness of the straightedge and record.
4. Measure the distance from the PTO crankcase mating surface to the bearing using the same method outlined in Step 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:

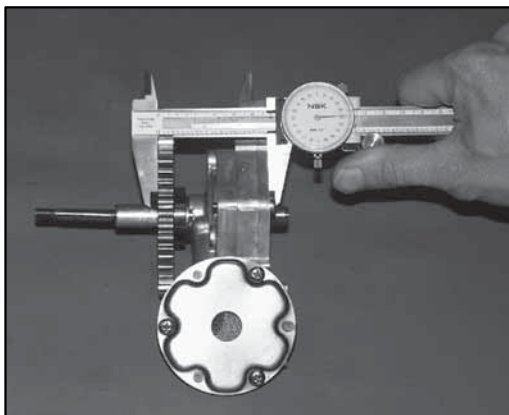
.008"-.016" (.02-.04 cm)

OIL PUMP SHAFT END PLAY ADJUSTMENT

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



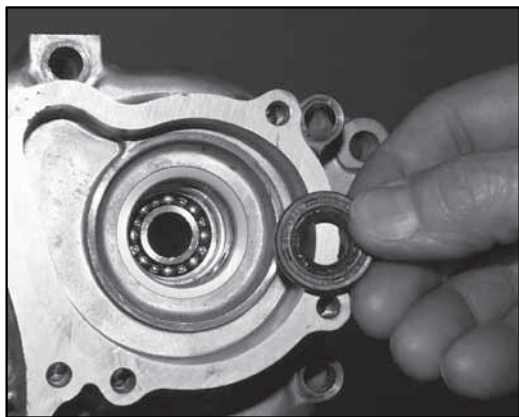
2. Measure the distance from the magneto crankcase mating surface to the bearing using a dial caliper and a straight edge. Subtract the thickness of the straightedge and record.



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.

**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 3.49 to specified torque.

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

**Crankcase Sealant:**

(PN 2871557)

WATER PUMP MECHANICAL SEAL INSTALLATION

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

WATER PUMP MECHANICAL SEAL REMOVAL - ENGINE INSTALLED

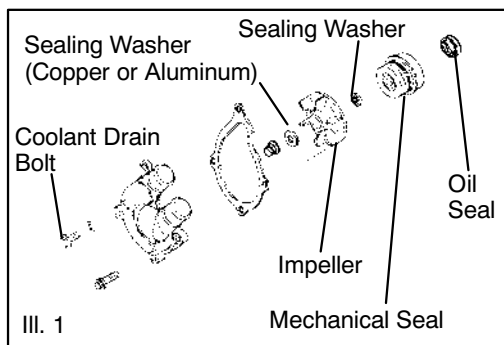
Water Pump Mechanical Seal Puller: (PN 2872105)

Replacement T-Handle: (PN 2872106)

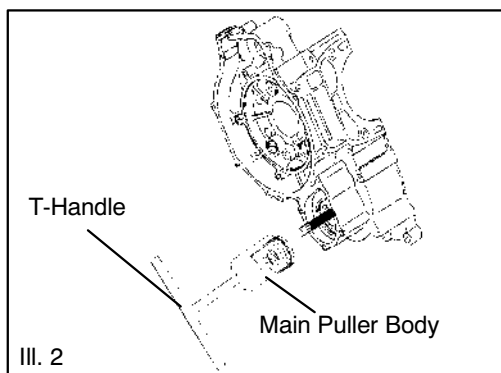
This tool allows a technician to replace the mechanical water pump seal on EH50PL engines without removing the engine and splitting the cases.

CAUTION:

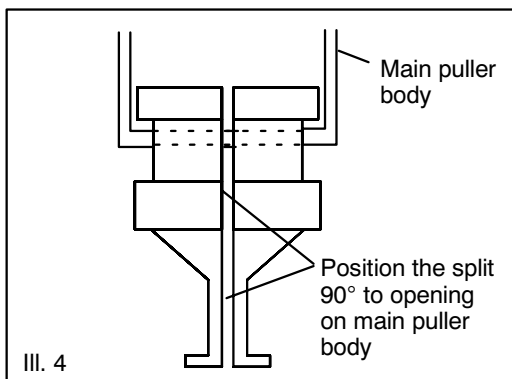
Improper or careless use of this tool or procedure can result in a bent water pump shaft. Pump shaft replacement requires engine removal and crankcase separation. Use caution while performing this procedure. Make sure that the puller is parallel to the shaft at all times. Do not place side loads on the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



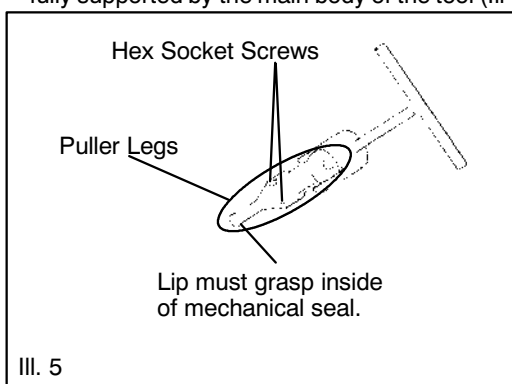
1. After the coolant has been drained, remove the water pump cover, impeller and the sealing washer. (III. 1)



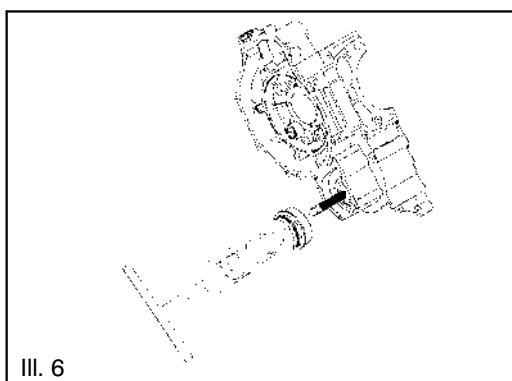
2. Slide the main puller body over the outer portion of the mechanical seal as shown in III. 2 and turn T-Handle clockwise until it contacts water pump shaft. Continue rotating until outer portion of mechanical seal is separated from the metal seal body.
3. Insert the puller legs between the water pump drive shaft and the remaining portion of the mechanical seal. Attach the puller legs to the main puller body. III. 3



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



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



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. III. 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).

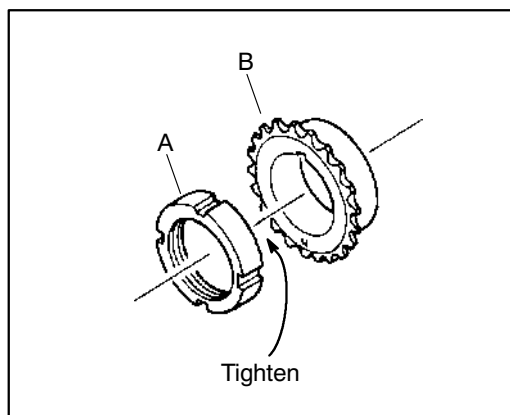
ONE WAY VALVE INSTALLATION

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)





TENSIONER BLADE INSTALLATION

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

Tensioner Blade Mounting Bolt Torque:

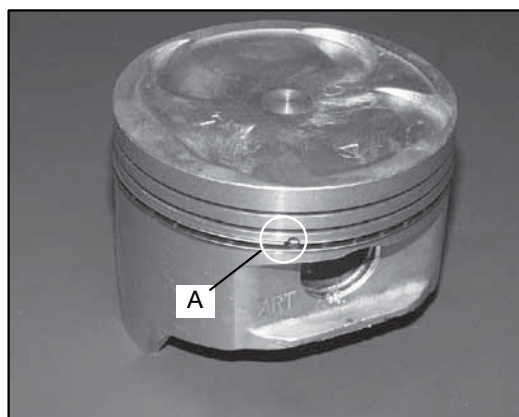
6 ft. lbs. (8 Nm)

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 3.75. If the piston has been in service clean any accumulated carbon from the ring grooves and oil control ring holes.

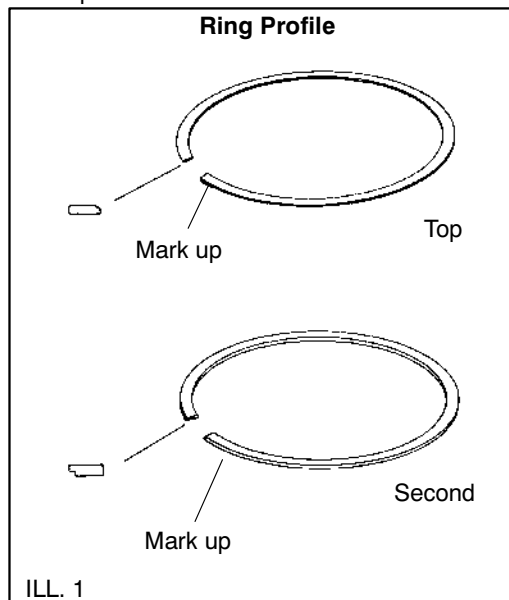
1. Place the oil control ring expander in oil ring groove with the end gap facing forward. The expander has no up or down marking and can be installed either way. The ends should butt squarely together and must not overlap.
2. Install the oil ring top rail.

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).



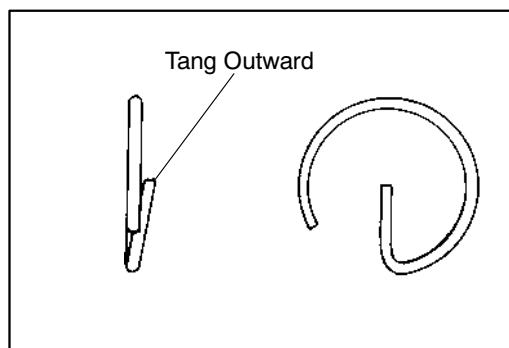
3. Install the bottom rail with the gap at least 30° from the end of the expander on the side opposite the top rail gap. (See ILL. 1).
4. Install the second ring with the "R" mark facing up. Position the end gap toward the rear (intake) side of the piston.

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.



PISTON INSTALLATION

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



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

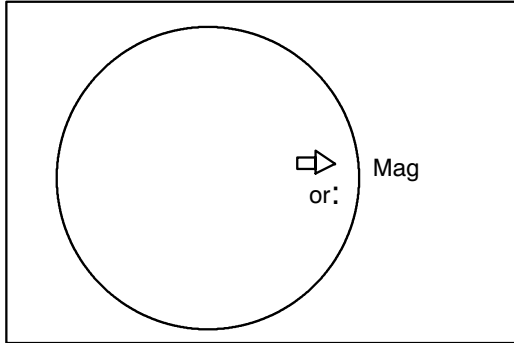
CAUTION: Circlips become deformed during the removal process. Do not re-use old circlips. Do not





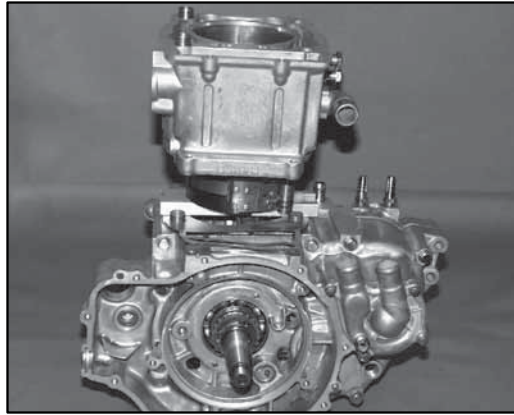
compress the new clip more than necessary upon installation to prevent loss of radial tension. Severe engine damage may result if circlips are re-used or deformed during installation.

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

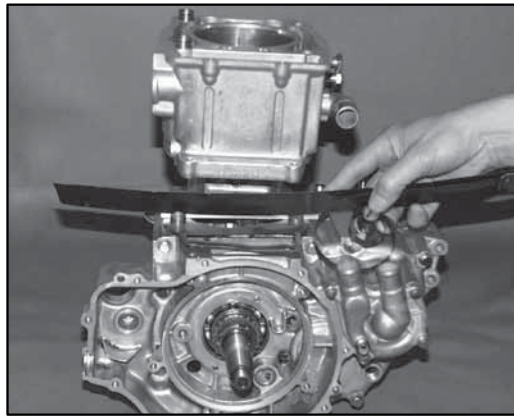


5. Install the piston on the connecting rod with the arrow or : mark facing the magneto (RH) end of the crankshaft. The piston pin should be a push fit in the piston.
6. Install the other circlip with the gap facing up or down and tang outward. (See Caution with Step 3 above). Push the piston pin in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

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.

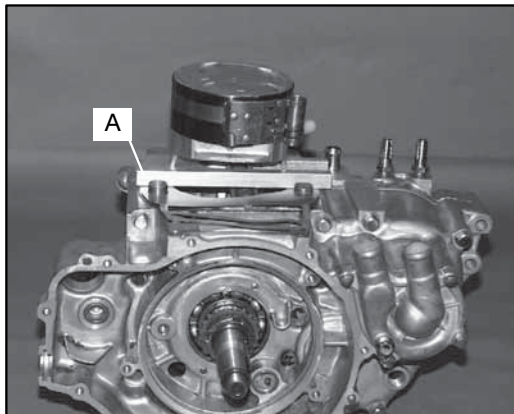


4. Apply clean engine oil liberally to the cylinder bore and tapered area of the sleeve. Install the cylinder with a slight rocking motion until the rings are captive in the sleeve.



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.

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

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





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

Cylinder Bolt Torque:

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

CYLINDER HEAD INSTALLATION

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

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

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

Torque all bolts evenly in a criss cross pattern

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

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

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

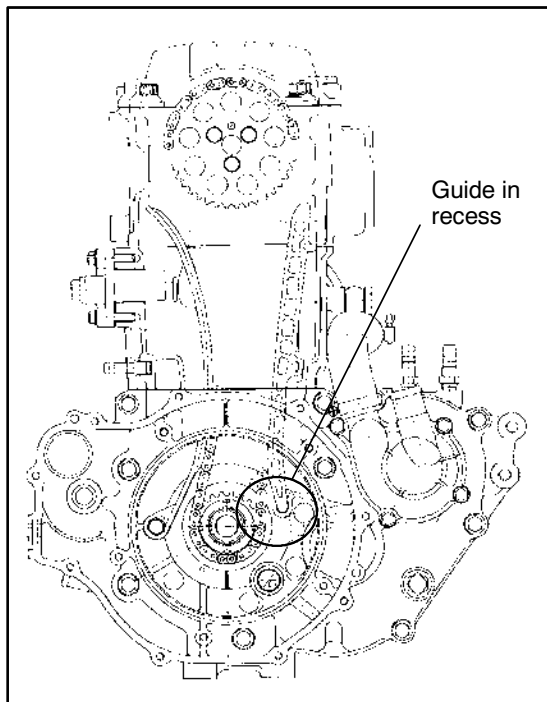
***Loosen bolts again another 180° (1/2 turn)**

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

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

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

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



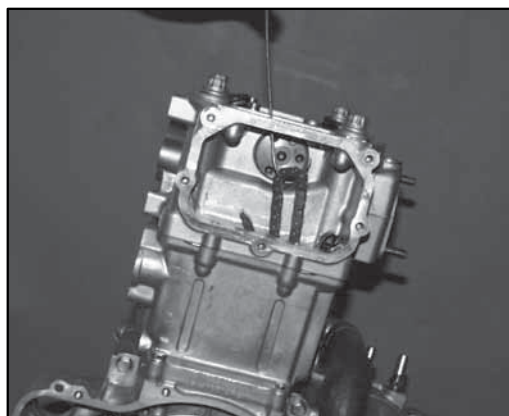
CAM CHAIN/CAMSHAFT INSTALLATION

Install the cam chain over the crankshaft.

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

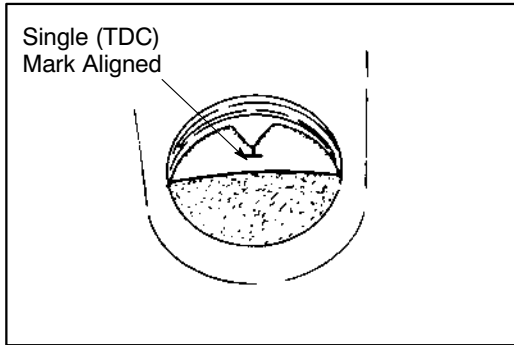
IMPORTANT CAMSHAFT TIMING NOTE: In order to time the camshaft to the crankshaft, the piston must be precisely located at Top Dead Center (TDC).

CAMSHAFT TIMING

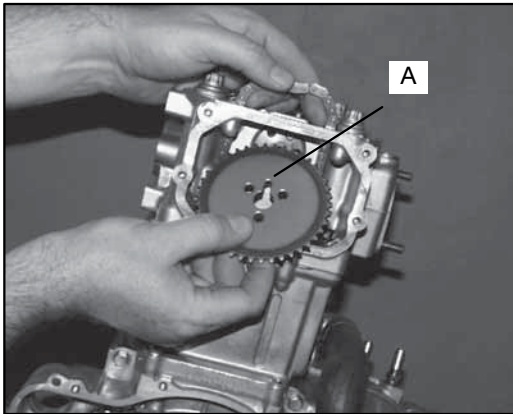




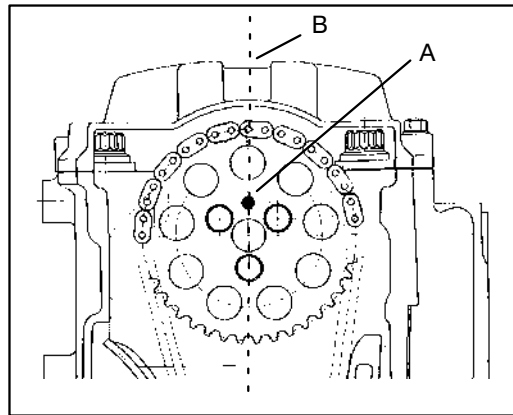
1. Apply Polaris Premium Starter Drive Grease (PN 2871460) to the camshaft main journals and cam lobes. Lubricate automatic compression release mechanism with clean engine oil. (To install the compression release mechanism, refer to Page 3.21).
2. Install the camshaft with the lobes facing downward and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



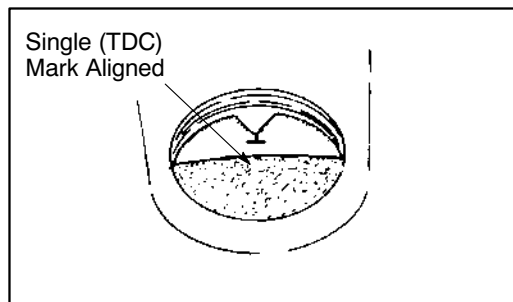
3. Disconnect the wire from the cam chain and rotate the engine to align the single (TDC) timing mark (Top Dead Center) on the flywheel with the notch in the timing inspection window. Be sure to use the *single* TDC mark when installing the cam. Do not use the advance marks. See Ill. on next page.



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.

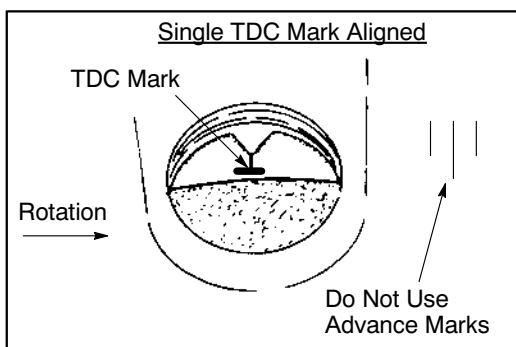
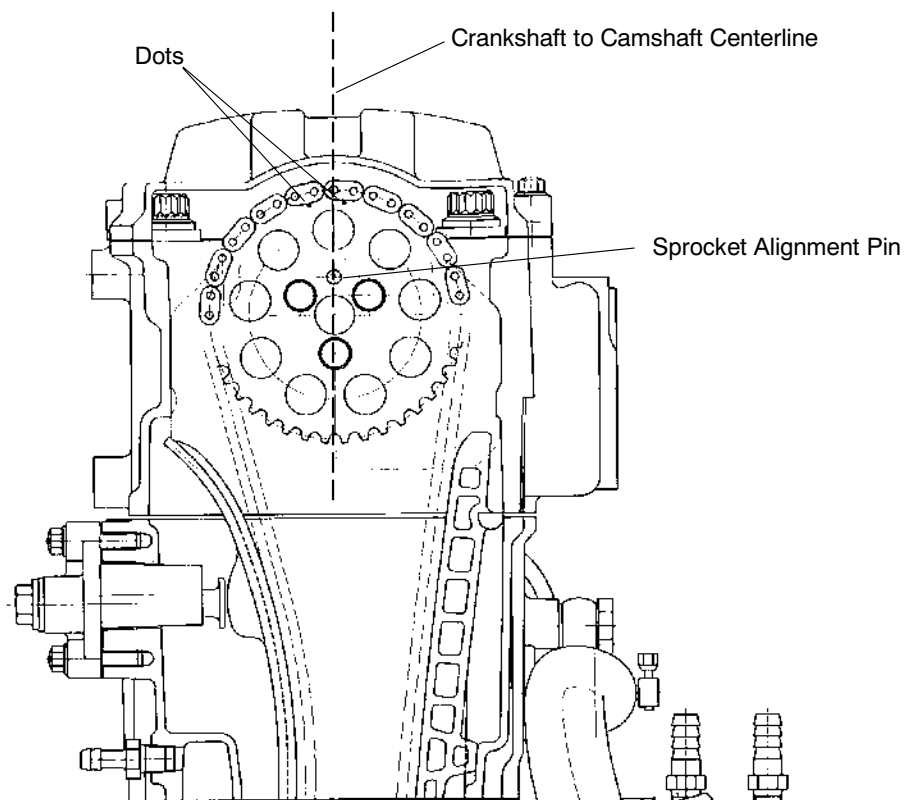
Cam Sprocket Bolt Torque:**6 ft. lbs. (8 Nm)**

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.



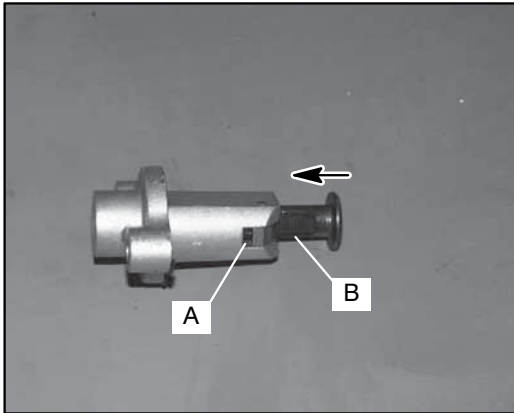


CAMSHAFT TIMING





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)

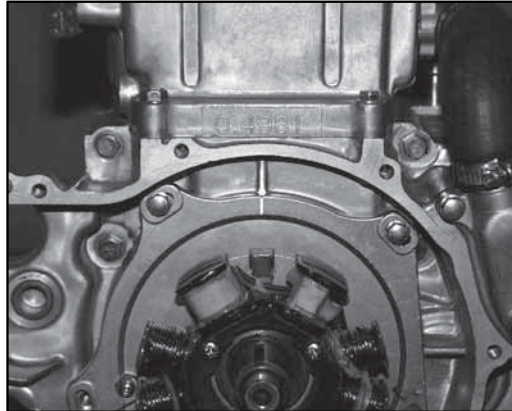
4. Slowly rotate engine two to three revolutions and re-check cam timing.

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



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

Stator Plate Bolt Torque:

5-6.5 ft. lbs. (7-9 Nm)

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

Flywheel

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

Flywheel Nut Torque:

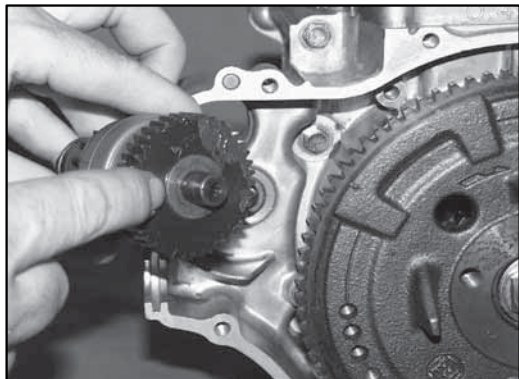
58-72 ft. lbs. (78-98 Nm)



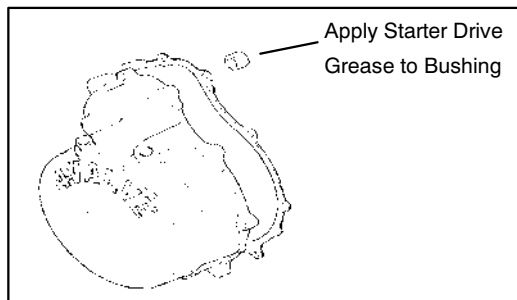


Starter

Drive



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



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

Starter Drive Grease:

(PN 2871460)

ROCKER SHAFT/ROCKER ARM ASSEMBLY INSTALLATION

1. Assemble rocker arms, rocker shaft, and shaft supports.
2. Install and tighten rocker arm shaft locating bolt.
3. Apply starter drive grease to the cam lobes and cam follower surfaces.
4. Rotate the engine until the cam lobes are pointing downward.

5. Be sure the dowel pins are in place and install the rocker shaft assembly.
6. Apply a light film of engine oil to the threads of the bolts and tighten evenly.

Rocker Shaft Support Tower Bolt Torque:

9 ft. lbs. (12 Nm)

Rocker Shaft Locating Bolt Torque:

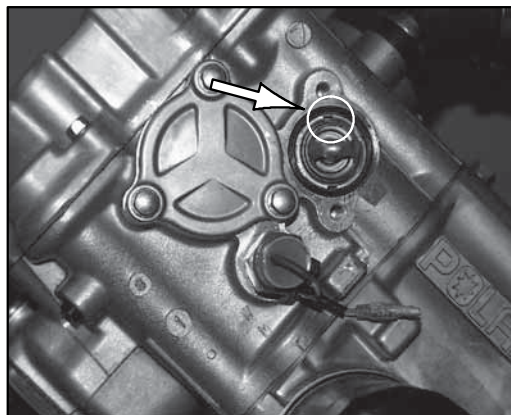
6 ft. lbs. (8 Nm)

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

Rocker Cover Bolt Torque:

6 ft. lbs. (8 Nm)

THERMOSTAT INSTALLATION



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



OIL PIPES

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

Oil Pipe Bolt Torque:

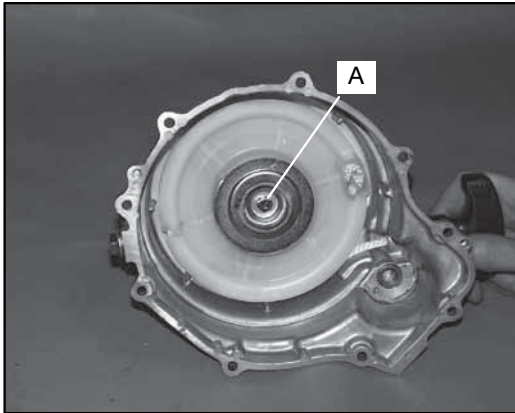
20 ft. lbs. (27 Nm)

RECOIL DISASSEMBLY/INSPECTION

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

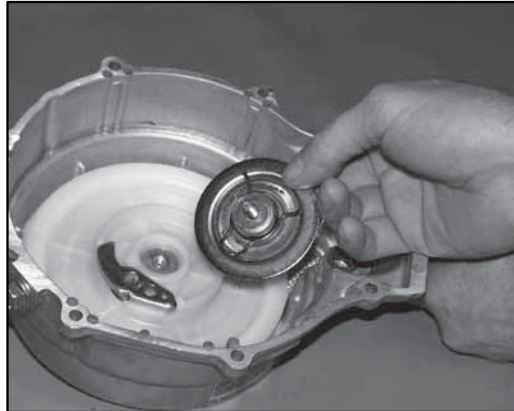
Replace any parts found to be worn or damaged.

REMOVE BOLTS AND RECOIL HOUSING

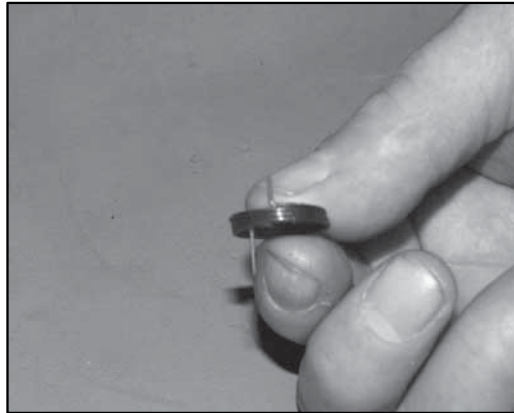


10. Pull recoil rope so it is extended approximately 12-18". Check handle c-ring for proper tension, and the handle for cracks or damage which may allow water or dirt to enter the recoil housing through the rope. **NOTE:** The handle must seal tightly on the recoil housing to prevent water from entering.

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.

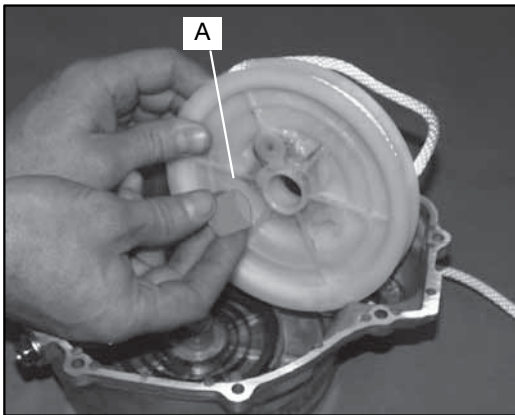


13. Remove ratchet pawl with spring and inspect. Replace spring or ratchet pawl if worn, broken, or damaged.

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.

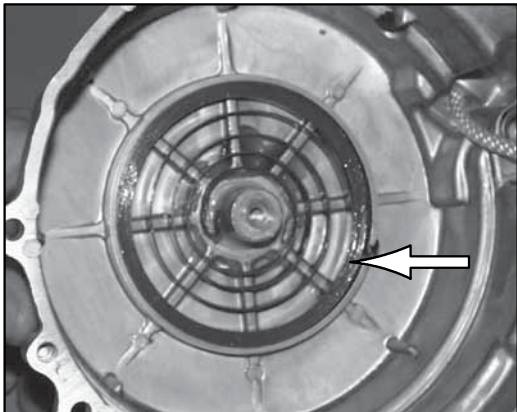




16. Slowly and carefully remove reel from recoil housing making sure the spring remains in the housing. Inspect the reel hub and bushing (A) for wear.
17. Unwind rope and inspect for cuts or abrasions.
18. Inspect drive tab on hub return spring for damage. To remove hub return spring, hold outer coils 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:

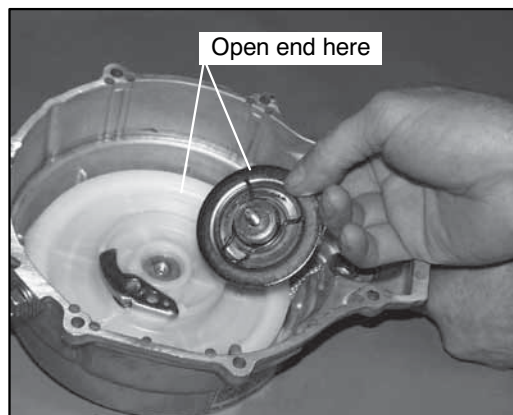
1. Place spring in housing with the end positioned so the spring spirals inward in a counterclockwise direction. See photo at right.
2. Hold spring in place and cut retaining wire.

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.



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





- 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

- 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)

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)





CHAPTER 4

FUEL/CARBURETION

RANGER TM, Nikki 27mm Carburetor 4.2-4.12

RANGER 2x4,4x4,6x6, Mikuni BST 34 Carb . 4.13-4.26



4





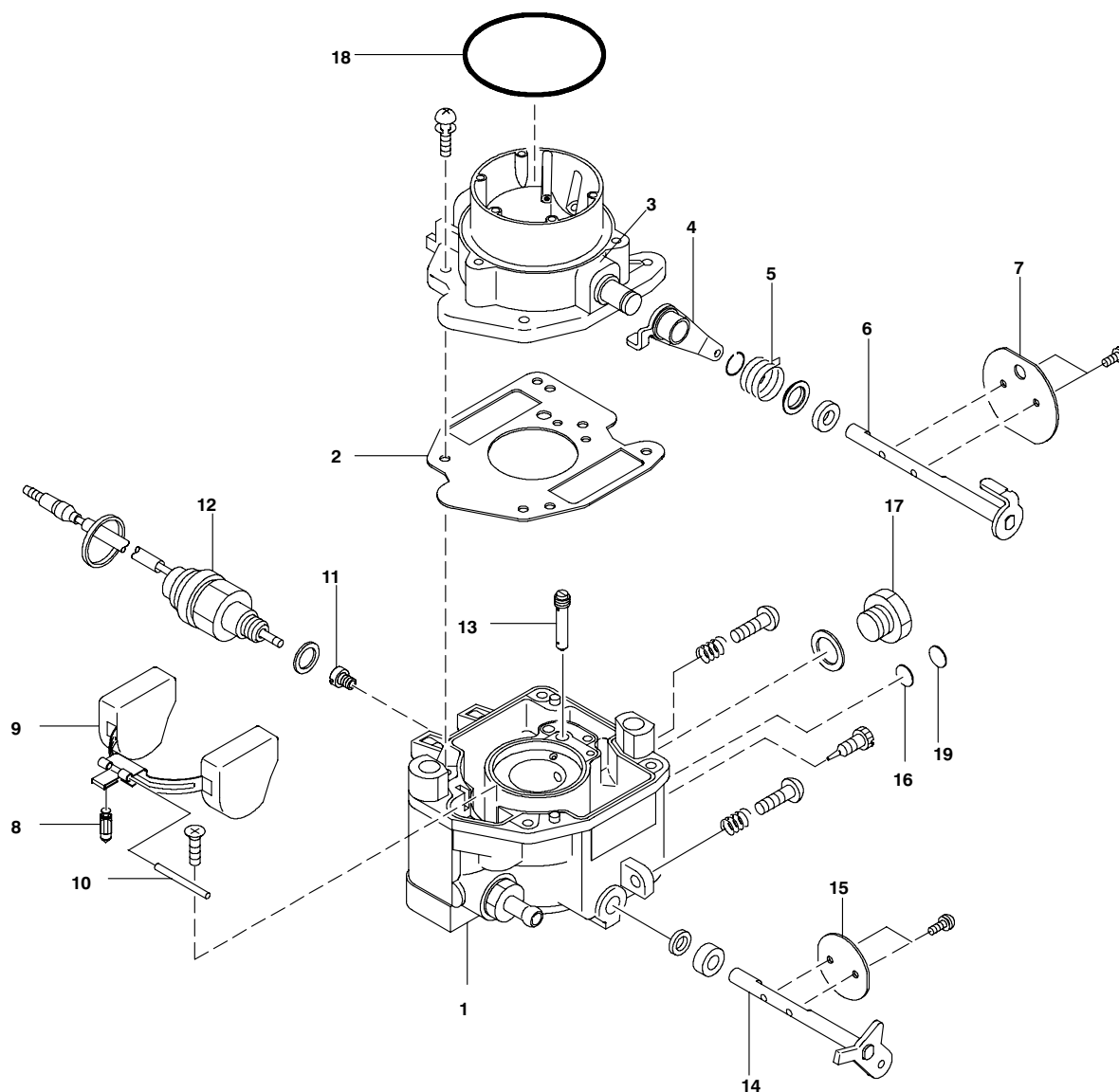
CHAPTER 4

FUEL/CARBURETION

RANGER TM

Exploded View, Nikki 27mm Carburetor	4.3
Fuel Tank Asm. Exploded View	4.4
Special Tool & Jetting Guidelines	4.5
Carburetor Jetting	4.5
Main Jet / Pilot Jet Part Numbers	4.5
Carburetor Operation	4.6
Carburetor Removal	4.7
Disassembly , Carburetor	4.8
Cleaning, Carburetor	4.9
Inspection, Carburetor	4.9
Assembly, Carburetor	4.9
Fuel Level Test	4.10
Fuel Pump Service	4.10-4.11
Fuel Tank Removal / Installation	4.11
Troubleshooting	4.12



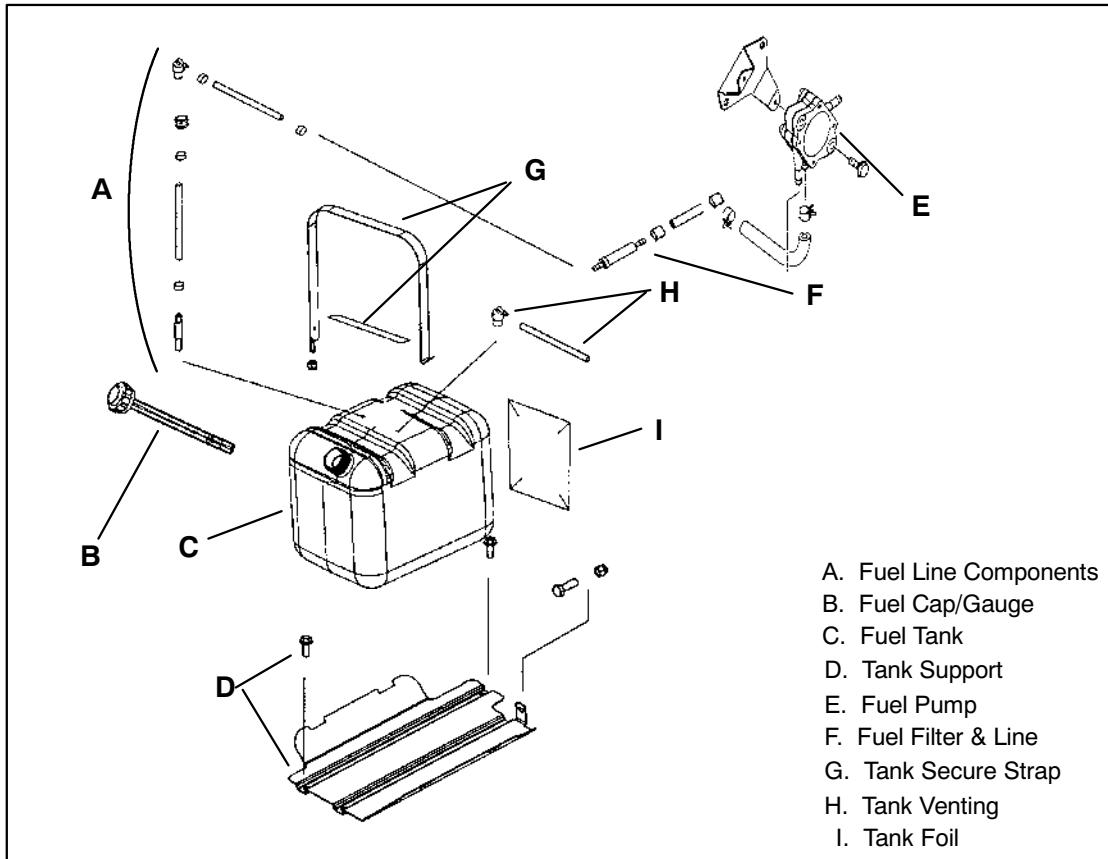
**27 MM NIKKI CARBURETOR EXPLODED VIEW**

- | | |
|----------------------|--------------------------|
| 1. Lower Body | 11. Main Jet |
| 2. Upper Body Gasket | 12. Solenoid Valve |
| 3. Upper Body | 13. Slow Jet |
| 4. Choke Lever Assy. | 14. Throttle Shaft Assy. |
| 5. Choke Spring | 15. Throttle Valve |
| 6. Choke Shaft Assy. | 16. Expansion Plug |
| 7. Choke Valve | 17. Plug |
| 8. Float Valve | 18. O-Ring |
| 9. Float | 19. Anti Tamper Plug |
| 10. Float Pin | |

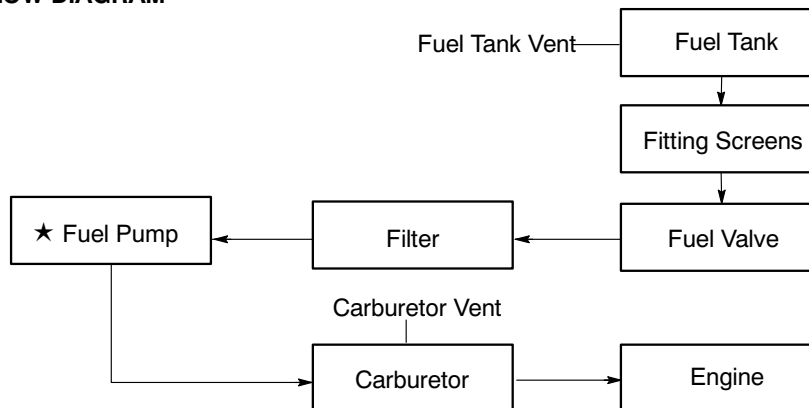




FUEL TANK ASSEMBLY



FUEL FLOW DIAGRAM



★ Located Above Oil Tank



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 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 specifications 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 from the specifications in Chapter 1.
4. Clutching changes may also be required for changes in elevation. Refer to clutching chart in Chapter 1 for recommendations.

NIKKI JET PART NUMBERS

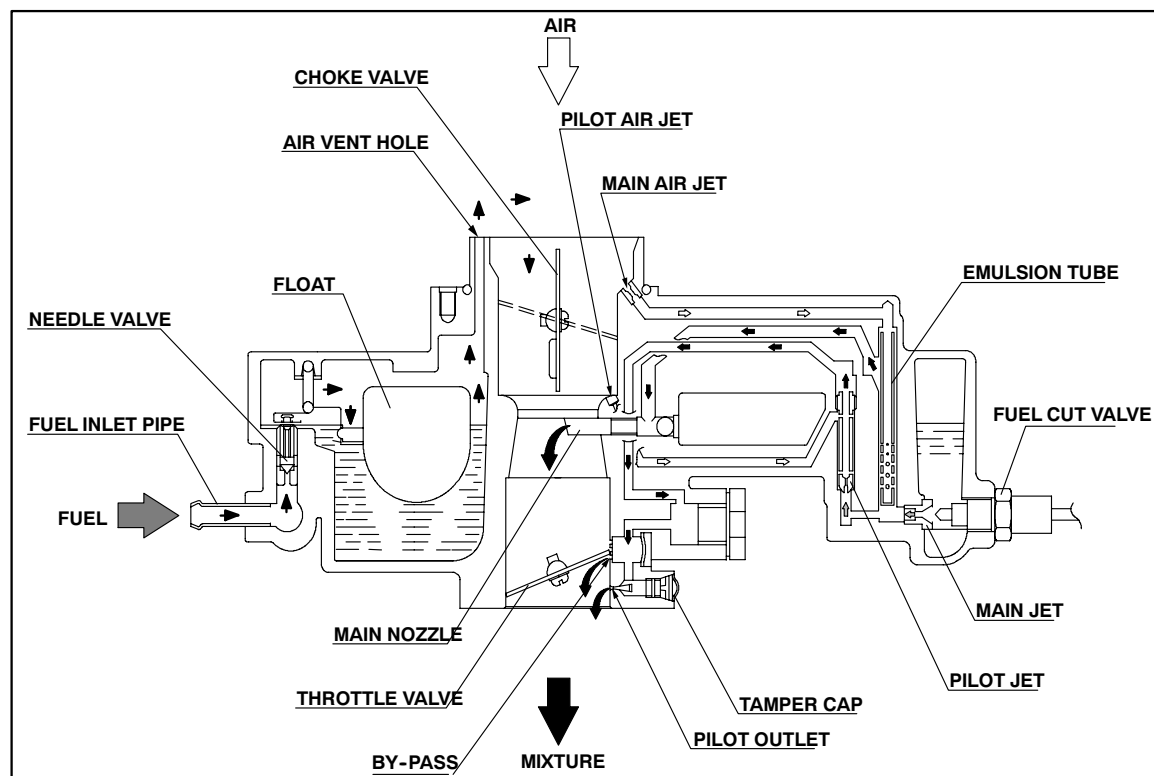
Main Jets		
<u>Altitude</u>	<u>Jet Number</u>	<u>Part Number</u>
0-5000 ft. (0-1500 m)	132	3088426
Above 5000 ft. (Above 1500 m)	124	3088823*

*3088823 is a high altitude jet kit that contains instructions and warning decal





27 MM NIKKI CARB OPERATION



- Float System:** Consists of a float and a needle valve, and maintains a constant fuel level during engine operation. The fuel flows from the fuel tank into the float chamber through needle valve. When the fuel rises to a specific level, the float rises, and when it's buoyancy and fuel pressure are balanced the needle valve closes to shut off the fuel, thereby keeping the fuel at the predetermined level. An air vent hole on top of the float chamber and next to the main air vent sucks fuel vapor into the combustion chamber.
- Pilot System:** The pilot system feeds the fuel to the engine during idling and low speed operation. The fuel is fed through the main jet to the pilot jet, where it is metered, and mixed with the air metered by the pilot air jet.
- Main System:** The main system feeds the fuel to the engine at medium and high-speed operation. The fuel is metered by the main jet and fed to the main nozzle. The air metered by the main air jet is mixed again with the air taken through the air cleaner into an optimum fuel-air mixture, which is supplied to the engine.
- Choke:** The choke is used for easy start when the engine is cold. When the starter is operated with a choke valve fully closed, the negative pressure applied to the main nozzle increases and draws much fuel accordingly; thus easily starting the engine.
- Fuel Cut Off Valve:** The fuel cut off valve, operated with the key switch, is equipped with main system of the carburetor for preventing engine running on and after burning. When the key switch is on, the valve is activated and the plunger is pulled in to open the main jet. When the key switch is off, the power source to the valve is off. The plunger is pushed out by the return spring and stop the fuel flow of main jet.

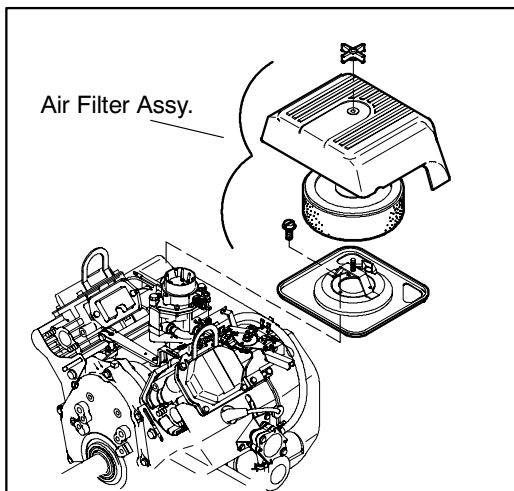


CARBURETOR REMOVAL

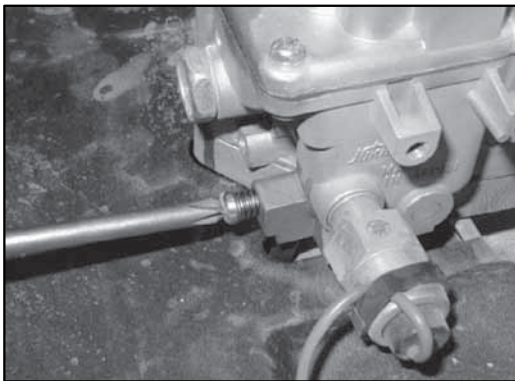
1. Remove the seat.



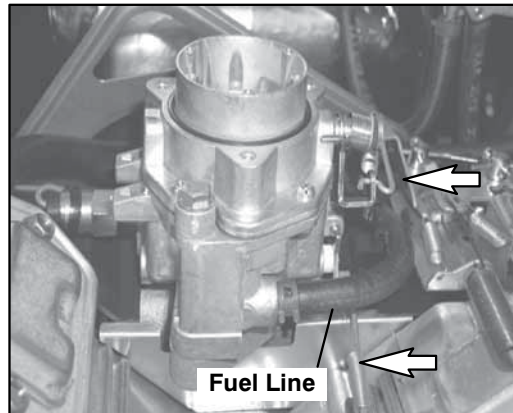
2. Remove the air box assembly.



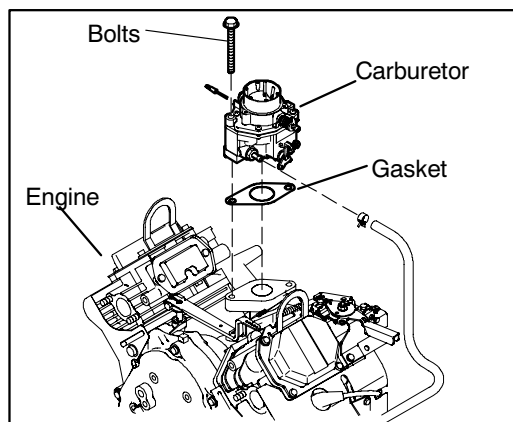
3. Drain the fuel from the carburetor by turning the drain screw counterclockwise. **NOTE:** Dispose of fuel properly.



4. Disconnect the fuel line.
5. Remove the governor rod and rod spring. Remove the throttle plate rod and spring.



6. Remove the 2 bolts that secure the carburetor to the engine. Remove the gasket.



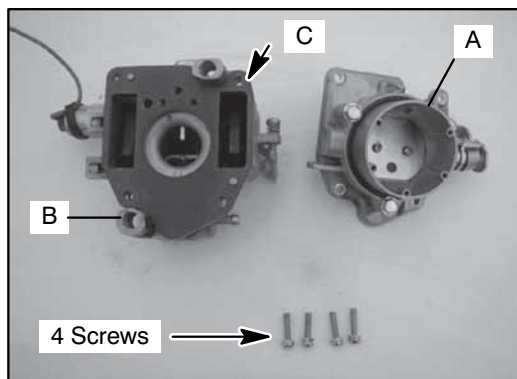
NOTE: Drain and dispose of fuel properly

NOTE: Place a shop towel in carb flange to prevent dirt from entering. Place a shop towel in the engine intake manifold also.

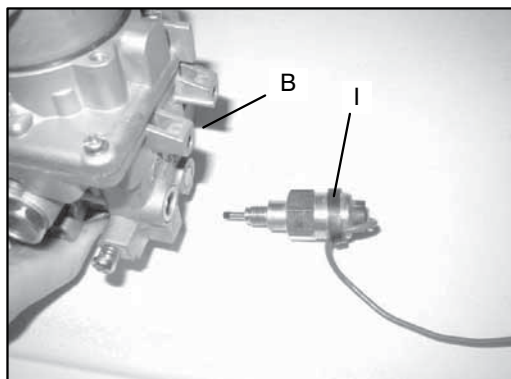


CARBURETOR DISASSEMBLY

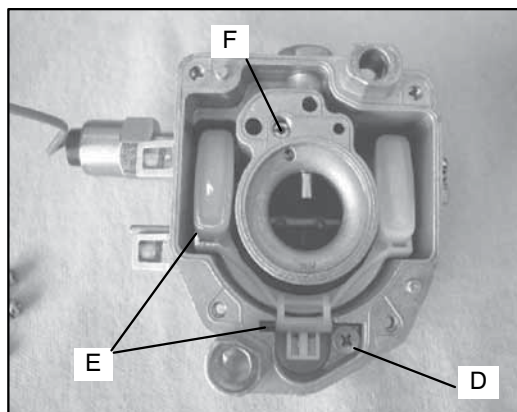
1. Remove the 4 screws and disassemble the upper half (A) from the lower lower half (B). Remove the upper body gasket (C)



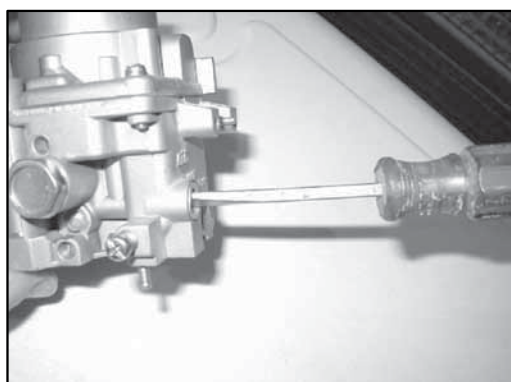
3. Remove the solenoid cut off valve (I) from the lower carb body (B) with a 19 mm wrench. **NOTE:** Do not use a pliers to remove the solenoid or permanent damage may occur.



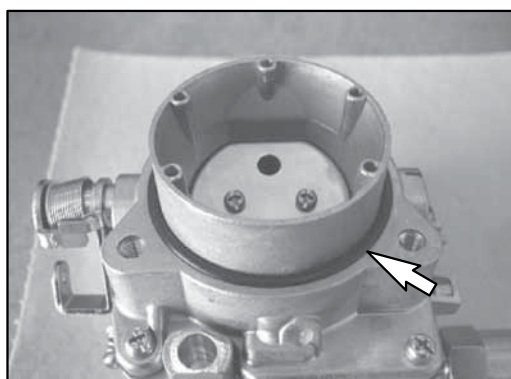
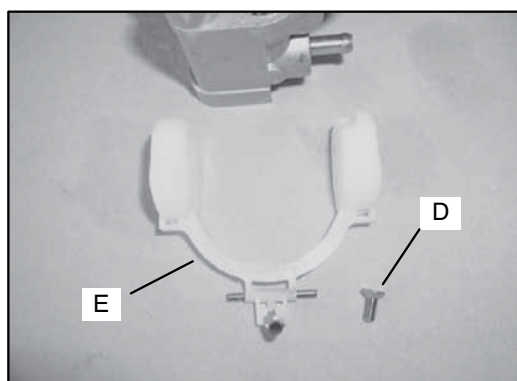
2. Remove the float pin (D) screw to remove the float assembly (E). Remove the slow jet (F), if needed.



4. Remove the main jet with a flat head screw driver.



5. Inspect the O-ring on the intake side of the carburetor, replace if needed.





CARBURETOR CLEANING

⚠ WARNING

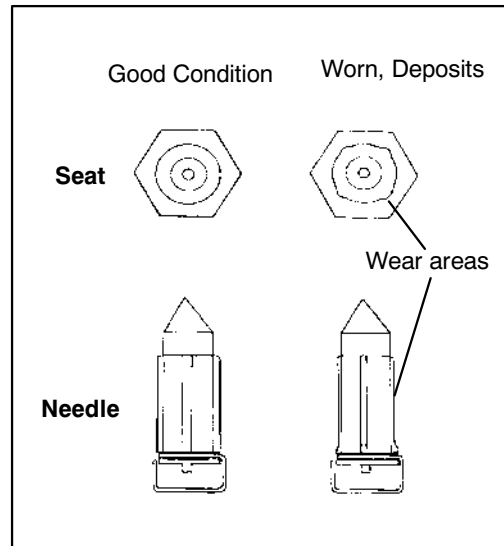
Protect eyes from contact with cleaner. Take appropriate safety measures during these procedures. Safety glasses and chemical resistant gloves are required. Should you get cleaner in your eyes or if you swallow cleaner, seek medical attention immediately.

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.

CARBURETOR INSPECTION

1. 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

1. Reverse the steps in the Carburetor Disassembly section for carburetor reassembly. Be sure to inspect all parts for wear and damage and replace the parts if needed.

FLOAT HEIGHT ADJUSTMENT

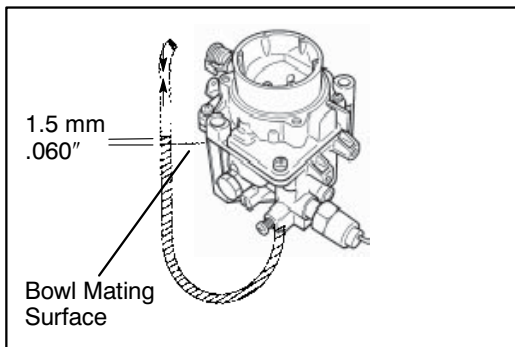
NOTE: The float height is set from the factory. The float height cannot be adjusted, the float assembly is made of plastic and cannot be adjusted.

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 REMOVAL/INSTALLATION

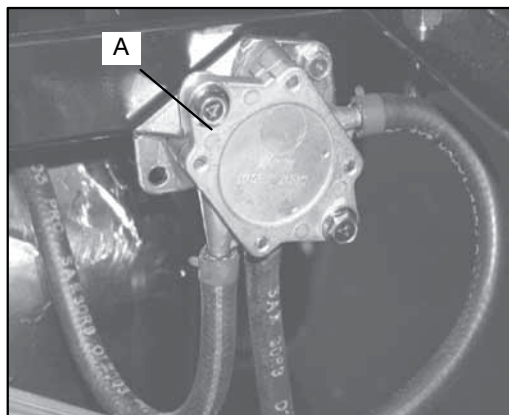
1. Disconnect the negative battery cable.
1. Remove the seat.
2. Disconnect the fuel pump wiring harness.
3. Remove the fuel line clamps and remove the fuel lines from the fuel pump (A).

NOTE: Be sure to catch any fuel that drains out the fuel pump and dispose of fuel properly.

4. Remove the bolts that secure the fuel pump (A) to the frame.
5. To install the fuel pump (A), repeat Step 1 through Step 4 in reverse order.
6. Reverse the removal steps for installation.

CAUTION:

Be careful not to damage fuel pump.



FUEL PUMP DISASSEMBLY

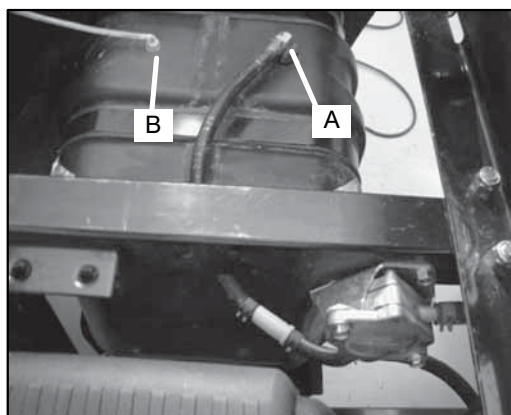
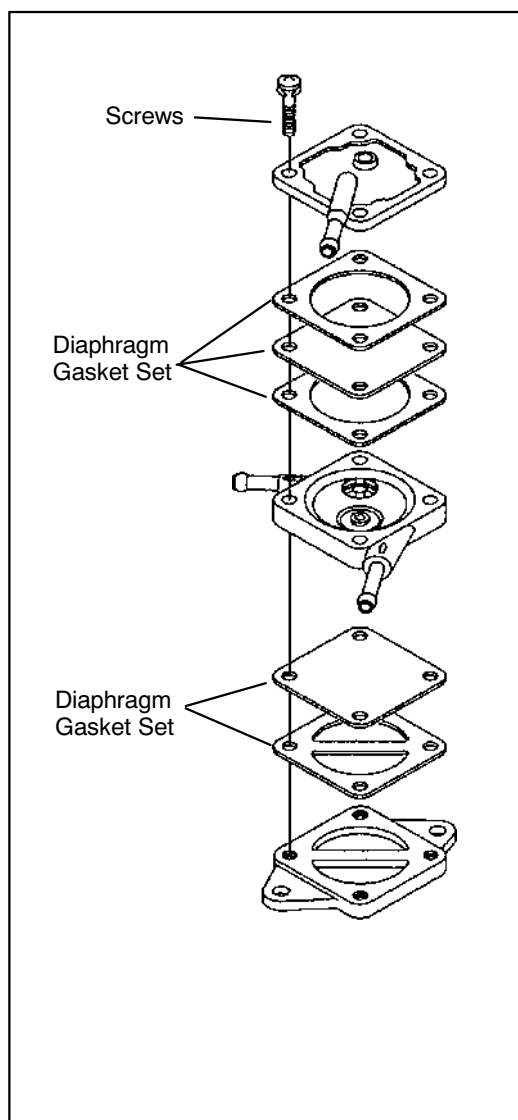
1. Remove the screws from the fuel pump diaphragm cover.
2. Remove the diaphragm cover, gaskets, and diaphragm.

FUEL PUMP INSPECTION/ASSEMBLY

1. Inspect the 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. Reassemble the pump in the reverse order of disassembly.

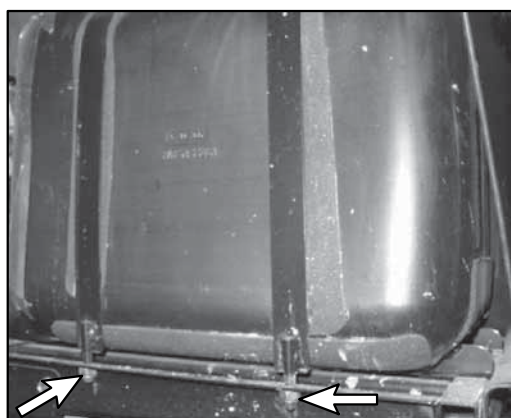


Tighten all screws evenly.



4. Remove the two nuts that secure the tank straps.
5. Pull the straps over the tank. Slide the gas tank out of the tank support.

NOTE: The side panel on the right side of the fuel tank may have to be loosened to ease the removal of the fuel tank.



FUEL TANK **REMOVAL/INSTALLATION**

1. Remove the seat.
2. Disconnect the negative battery cable.
3. Remove the fuel line (A) and remove the tank vent line (B).

NOTE: Mark or tag the hoses for correct installation of the hoses.





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
- 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)
- Jet needle position incorrect
- Incorrect idle screw adjustment
- Fuel cut off solenoid not operating correctly

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
- Float level too high
- Poor fuel quality (old fuel)
- Loose jets
- Worn pilot jet or other carburetor parts
- Dirty carburetor (air bleed passages or jets)
- Fouled spark plug

POOR IDLE

Idle Too High

- 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 mixture screw misadjusted or damaged
- Belt dragging
- Ignition timing incorrect
- Worn pilot 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
- Tight valves
- Ignition timing incorrect
- Belt dragging
- Dirty air cleaner
- Engine worn
- Spark plug fouled
- Worn pilot jet
- Plugged or restricted idle jet



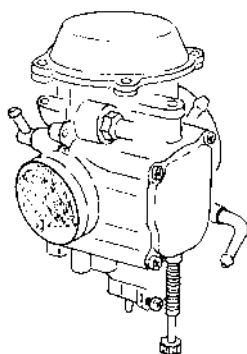


CHAPTER 4

FUEL/CARBURETION

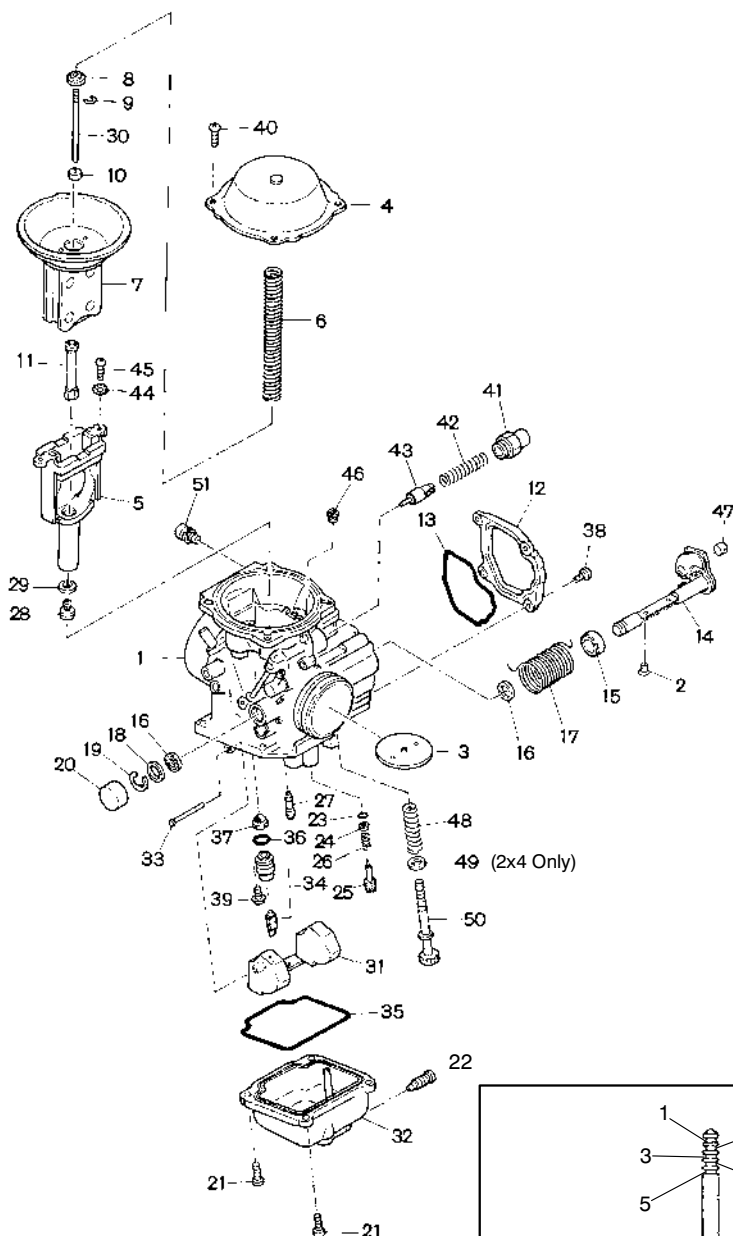
RANGER 2x4, 4x4, 6x6

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Fuel Tank Asm. Exploded View	4.15
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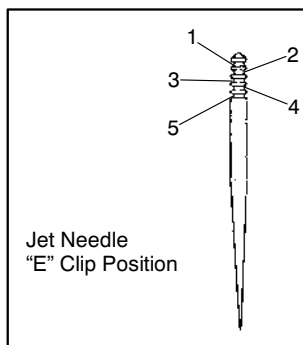




BST 34 CARBURETOR EXPLODED VIEW



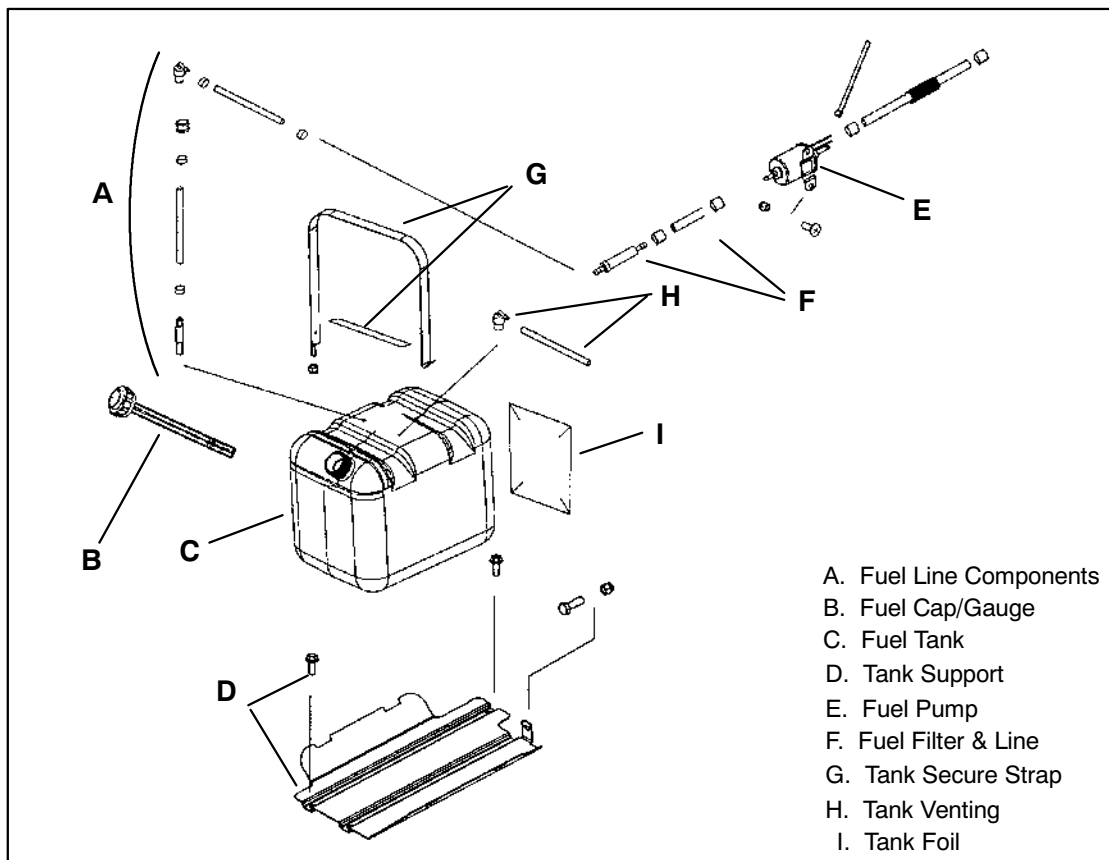
Refer to Page 4.4 for Jet Part Numbers



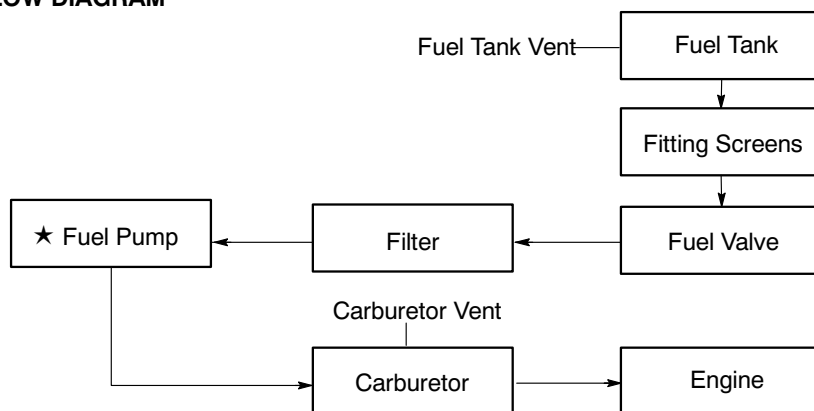
1. Carburetor Assembly
2. Screw
3. Throttle Valve
4. Cover, Diaphragm
5. Jet Block Assembly
6. Spring
7. Diaphragm Assembly
8. Ring
9. "E" Ring
10. Ring
11. Needle Jet
12. Cover
13. O-Ring
14. Throttle Shaft Assembly
15. Ring
16. Seal
17. Spring
18. Packing
19. "E" Ring
20. Cap
21. Screw
22. Drain Screw
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.



FUEL TANK ASSEMBLY



FUEL FLOW DIAGRAM



★ Located Above Oil Tank





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 specifications 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		



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, Bypass 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

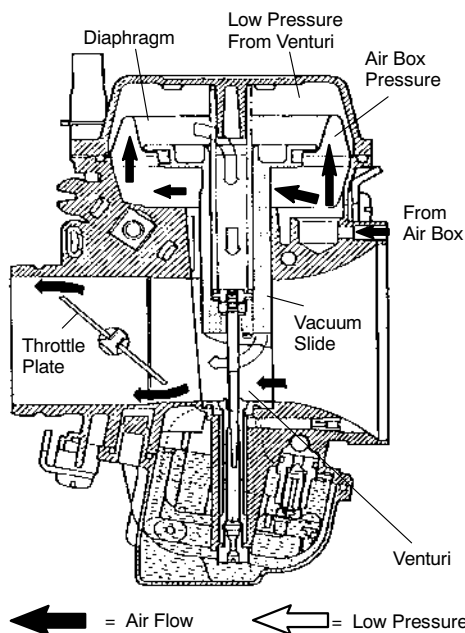
VENT SYSTEMS - CV CARBURETOR

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.

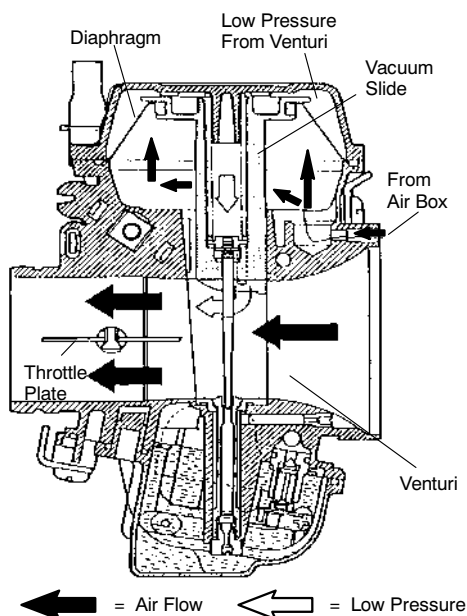
A diaphragm attached to the top of the vacuum slide is sealed to the slide and to the carburetor body forming two chambers. The chamber above the diaphragm is connected to the venturi area by a drilled orifice in the center of the vacuum slide. The chamber below the diaphragm is vented to atmospheric 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.





CARBURETOR OPERATION CONT'D

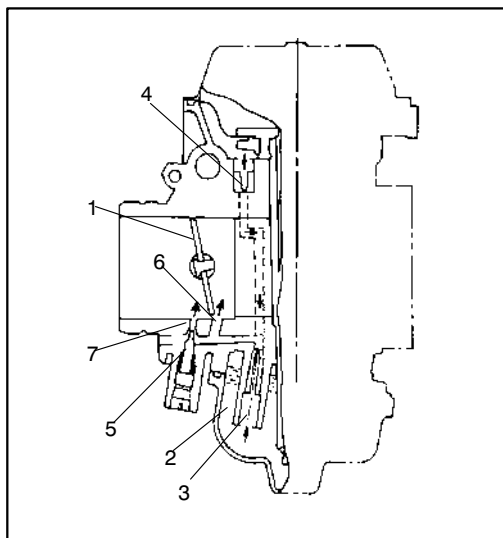
When the throttle plate is opened and engine speed begins to increase, the pressure in the venturi (and therefore in the chamber above the diaphragm) becomes significantly lower than atmospheric. Atmospheric pressure in the chamber below the diaphragm forces the diaphragm upward, raising the slide against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

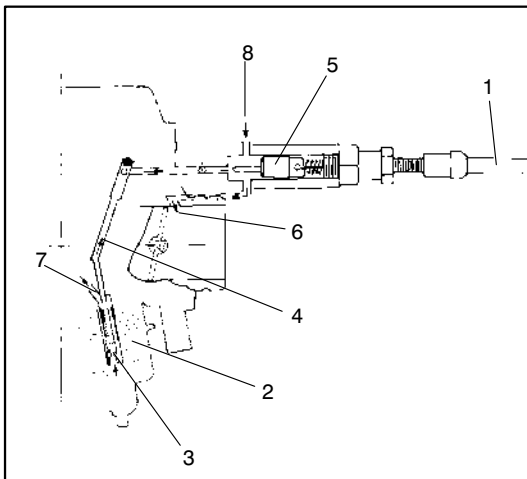
PILOT (IDLE AND SLOW) SYSTEM

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.

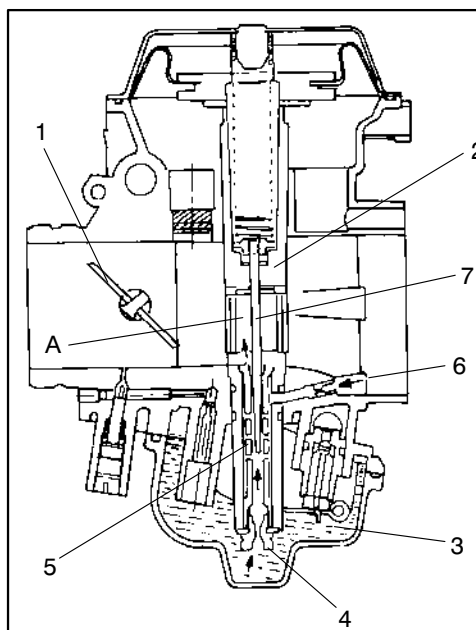
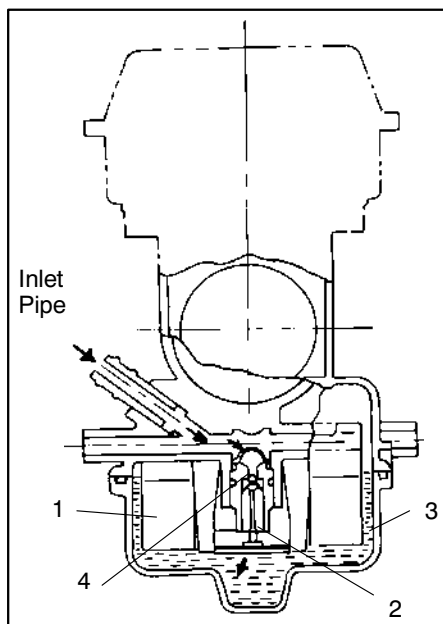


Fuel is drawn into the starter circuit from the float chamber (2) through the starter jet (3). Starter jet meters this fuel, which then flows into starter pipe (4) and mixes with the air (7) coming from the float chamber. The mixture, rich in fuel content, reaches starter plunger and mixes again with 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.



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.



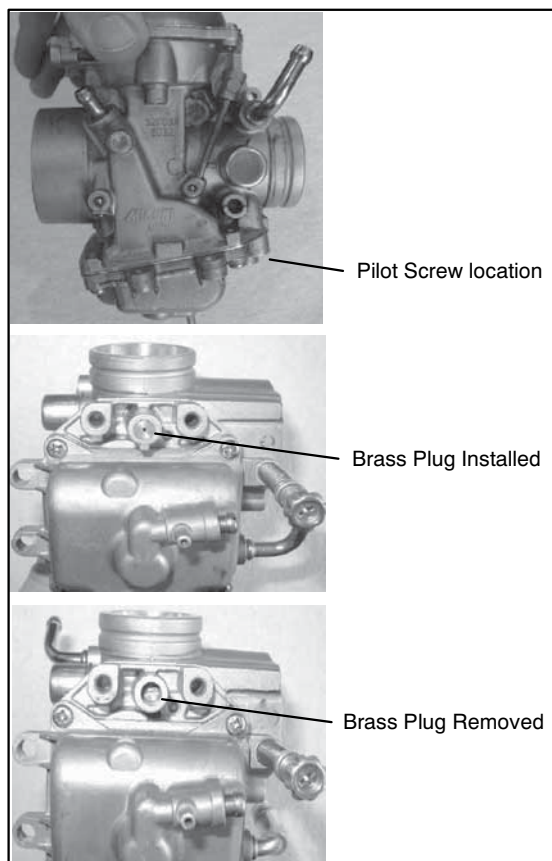


PILOT SCREW

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

CAUTION:

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



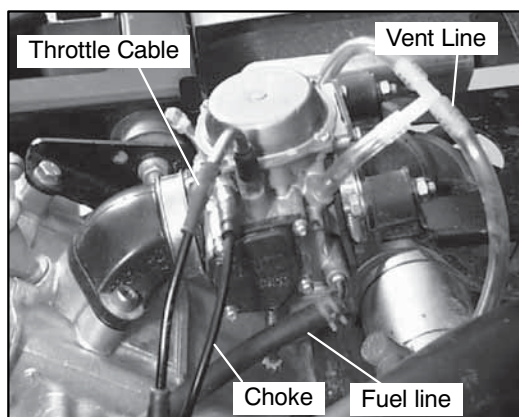


CARBURETOR REMOVAL

1. Remove the seat.

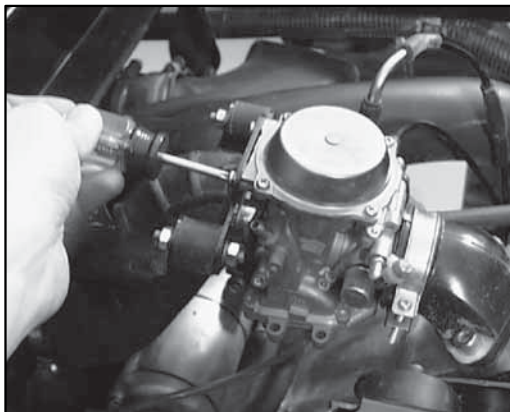


2. Disconnect:
 - Vent lines
 - Drain line
 - Fuel line
 - Throttle cable
 - Choke cable



NOTE: Drain and dispose of fuel properly

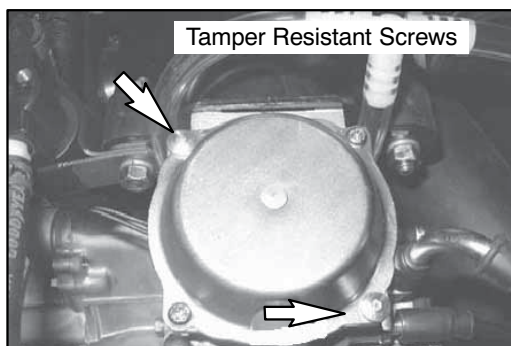
3. Loosen air box carb boot clamp.
4. Loosen carburetor flange clamp at front of carburetor.
5. Remove the carburetor mounting screws from the carburetor bracket.
6. Remove carburetor. Place a shop towel in carb flange to prevent dirt from entering.



CARBURETOR DISASSEMBLY - MIKUNI CV

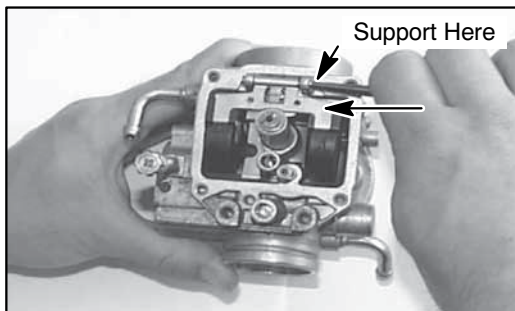
NOTE: 2004 and Series 11 *RANGER* 2x4, 4x4, and 6x6 will have tamper resistant screws on Diaphragm Cover per 2003 CARB standards for LSI (large spark ignition) engines. All *RANGER*'s are classified within LSI. The existence of these tamper resistant screws will require customers to purchase a complete carburetor if they desire to replace jet needle or piston slide.

A main jet change is the only requirement for altitude adjustment of the carburetor. These tamper resistant screws will not prevent anyone from adjusting the main jet size of carburetor when operating at high altitude.



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

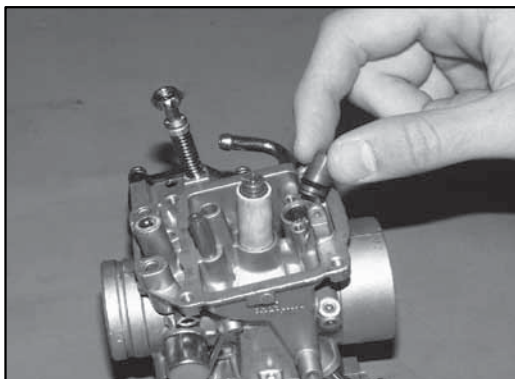




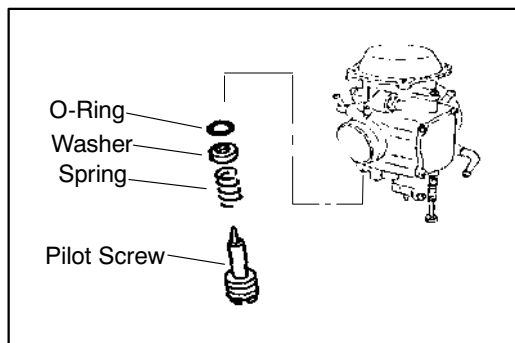
NOTE: Be careful not to damage the float pin tower during the float pin removal. Support the float pin tower while removing the float pin. This helps to prevent the float pin towers from breaking off.

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

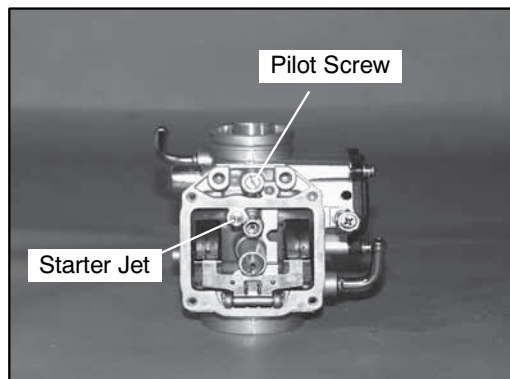
NOTE: Do not use a pliers to remove the seat or permanent damage may occur.



3. 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.

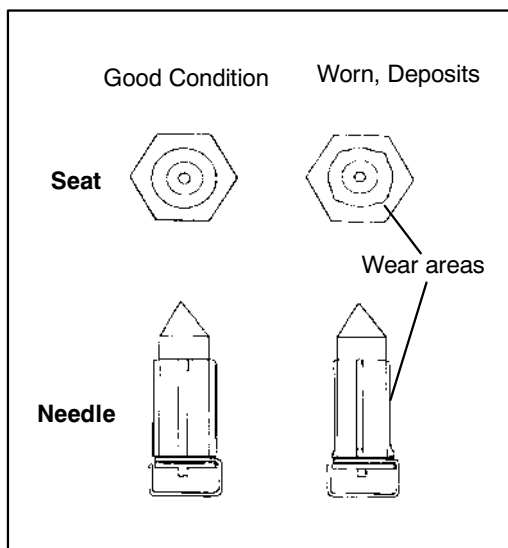
Carburetor cleaners can be extremely caustic. Extended periods of soaking can loosen the adhesive sealer on the passage drill-way plugs. *Do not* soak rubber or plastic components (such as the vacuum slide diaphragm, needle seat screen, or O-Rings in caustic cleaning solutions. Irreparable damage may 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.

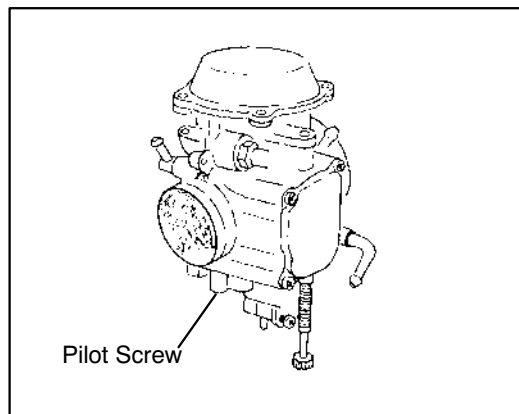


CARBURETOR INSPECTION

1. 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



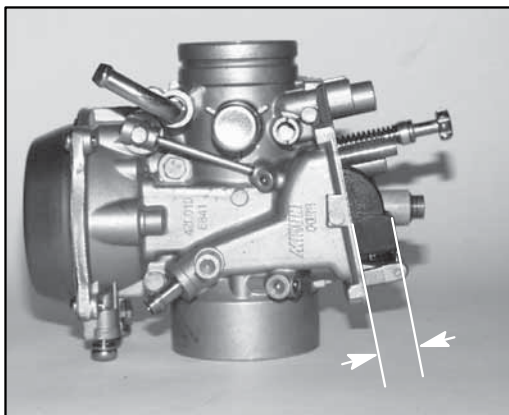
1. Install the pilot mixture screw, spring, washer, and O-ring as an assembly. Lubricate the O-Ring with oil or light grease before installation. **CAUTION:** Do not damage the O-ring during installation. Turn the screw in until it *lightly* contacts the seat. Back out the specified number of turns. **NOTE:** The final pilot (idle) mixture must be adjusted with the engine running. Refer to Page 2.15.

**Pilot Mixture Screw Base Setting
(Set at Factory)**

Refer to Specifications in Chapter 1

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:

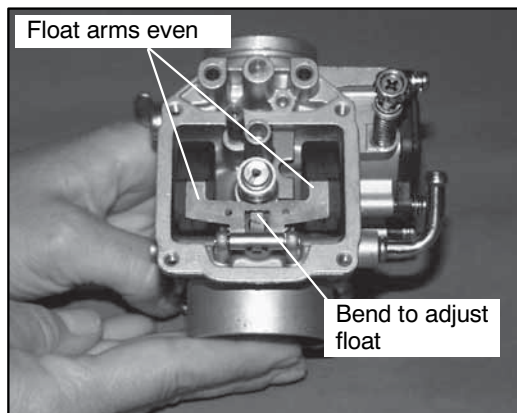
Std: BST 34 13-14 mm (.51-.55 inches)

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.



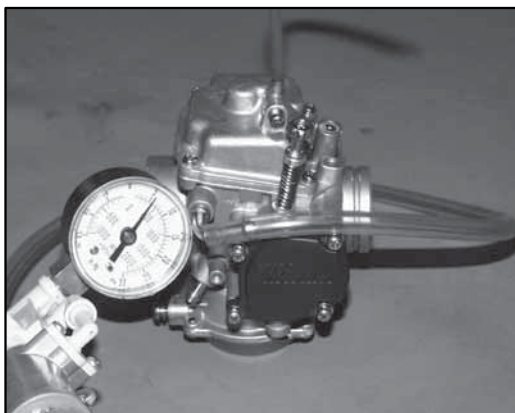


- If adjustment is necessary, bend the tongue slightly. Be sure float measurement is even on left and right side.



NEEDLE AND SEAT LEAKAGE TEST

- 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.

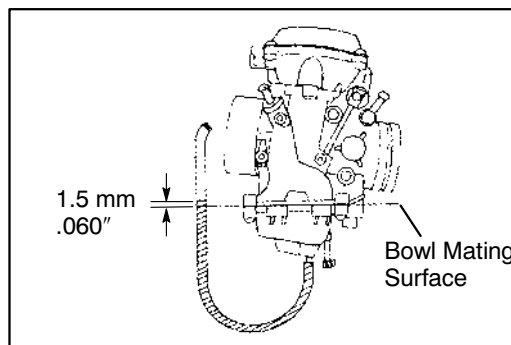


Mity Vac™ (PN 2870975)

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..

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



- 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.

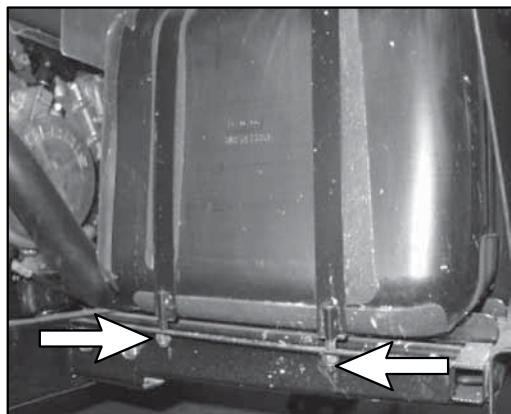
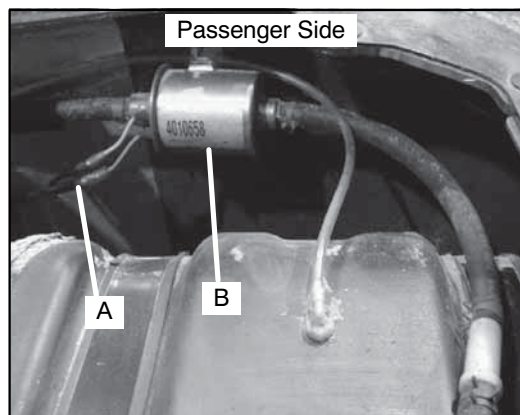
FUEL PUMP REMOVAL/INSTALLATION

- Remove the seat.
- Disconnect the fuel pump wiring harness (A).
- Remove the fuel line clamps and remove the fuel lines from each side of the fuel pump (B).
- Remove two screws that secure the fuel pump (B) to the main floor.
- To install the fuel pump (B), repeat Step 1 through Step 4 in reverse order.

CAUTION:



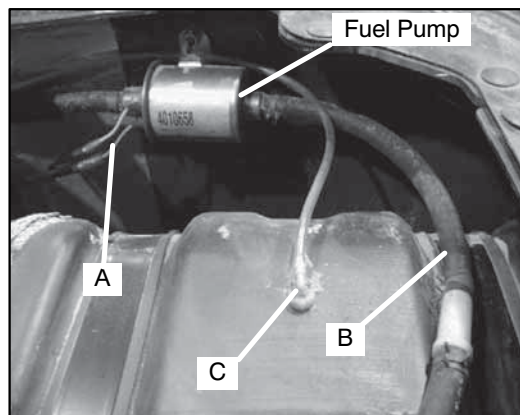
Be careful not to damage fuel pump.



FUEL TANK REMOVAL/INSTALLATION

1. Remove the seat.
2. Disconnect the negative battery cable.
3. Disconnect the fuel pump wiring harness (A).
4. Remove the fuel lines (B) and remove the tank vent line (C).

NOTE: Mark or tag the hoses for correct installation of the hoses.



5. Remove the two nuts that secure the tank straps.
6. Pull the straps over the tank. Slide the gas tank out of the tank support.

NOTE: The side panel on the right side of the fuel tank may have to be loosened to ease the removal of the fuel tank.

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
- 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

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



CHAPTER 5

BODY AND STEERING

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5





TORQUE SPECIFICATIONS

ITEM	TORQUE VALUE ft.lbs. (Nm)
Front A-Arm Attaching Bolt	30 ft. lbs. (41 Nm)
Front A-Arm Ball Joint Stud Nut	25 ft. lbs. (35 Nm)
Handlebar Adjuster Block	10-12 ft. lbs. (14-17 Nm)
Master Cylinder	45-55 in. lbs. (5.2-6.3 Nm)
Rear Shock Bolt (upper)	25 ft. lbs. (34 Nm)
Rear Shock Bolt (lower)	25 ft. lbs. (34 Nm)
Rear Wheel Hub Nut	110 ft. lbs. (150 Nm)
Rear Wheel Nuts	35 ft. lbs. (48 Nm)
Upper/Lower Control Arm Mounting Bolt	30 ft. lbs. (41 Nm)
Upper/Lower Wheel Bearing Carrier Bolt	25 ft. lbs. (35 Nm)
Strut Rod Retaining Nut (Top)	15 ft. lbs. (21 Nm)
Strut Casting Pinch Bolt	15 ft. lbs. (21 Nm)

Tie Rod End Jam Nut	12-14 ft. lbs. (17-19 Nm)
Tie Rod End Castle Nut	40-45 ft. lbs. (54-61 Nm)

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

SPECIAL TOOLS

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

**BODY/PANEL REMOVAL****To Remove:****Perform These Steps:**

- Seat Remove: Pull up on front of seat and then pull forward
- Console Remove: Gear selector handle
Console Screws
Disconnect dash component wires
Steering wheel (1 nut)
Rivets
- Hood Disconnect: Headlights
4 hinge screws
- Cab Remove: Seats
Bolts of front mounts
Bolts for the rear mounts
- Hood Liner Remove: Liner darts
Liner screws
Disconnect wiring harnesses
Remove air baffling boxes
- Front Bumper Remove: Hood
3 front Torx screws from LH and RH wheel well panels
2 top bumper mounting bolts
3 lower bumper mounting bolts
- Cargo Box Place box in the down position
Raise rear of box with assist from dump box shocks
Remove hitch pins from shocks at box
Remove clevis pins
Disconnect light harnesses
Remove (2) screws holding hinge pins
Tap out hinge pins
Lift box off frame with assistance
- Fuel Tank Raise rear box
Disconnect vent and fuel lines (Note locations)
Disconnect electrical connection
Remove tank strap bolts, and tank straps
Lift tank out -through backside of compartment



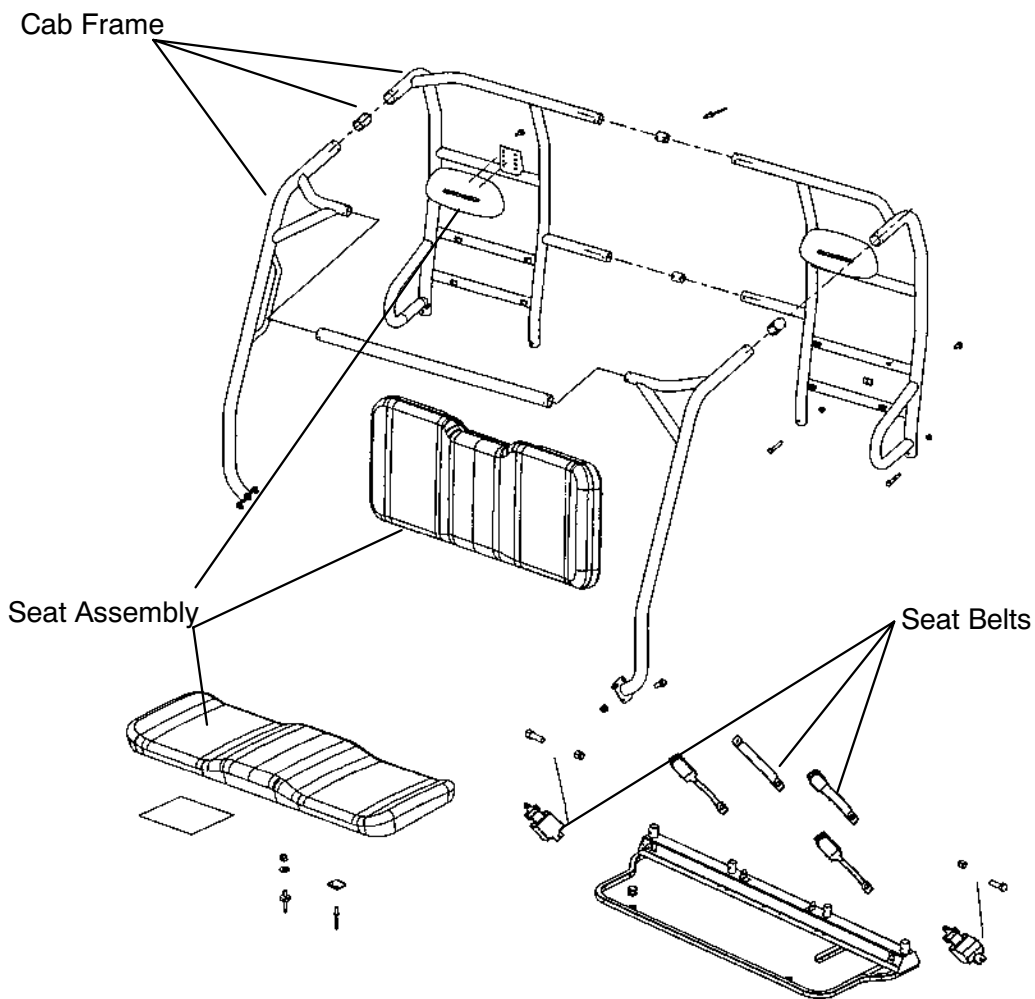


CAB FRAME & SEAT EXPLODED VIEW



RANGER 2x4, 4x4, 6x6

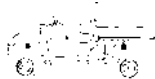
Cab Frame and Seat Assembly



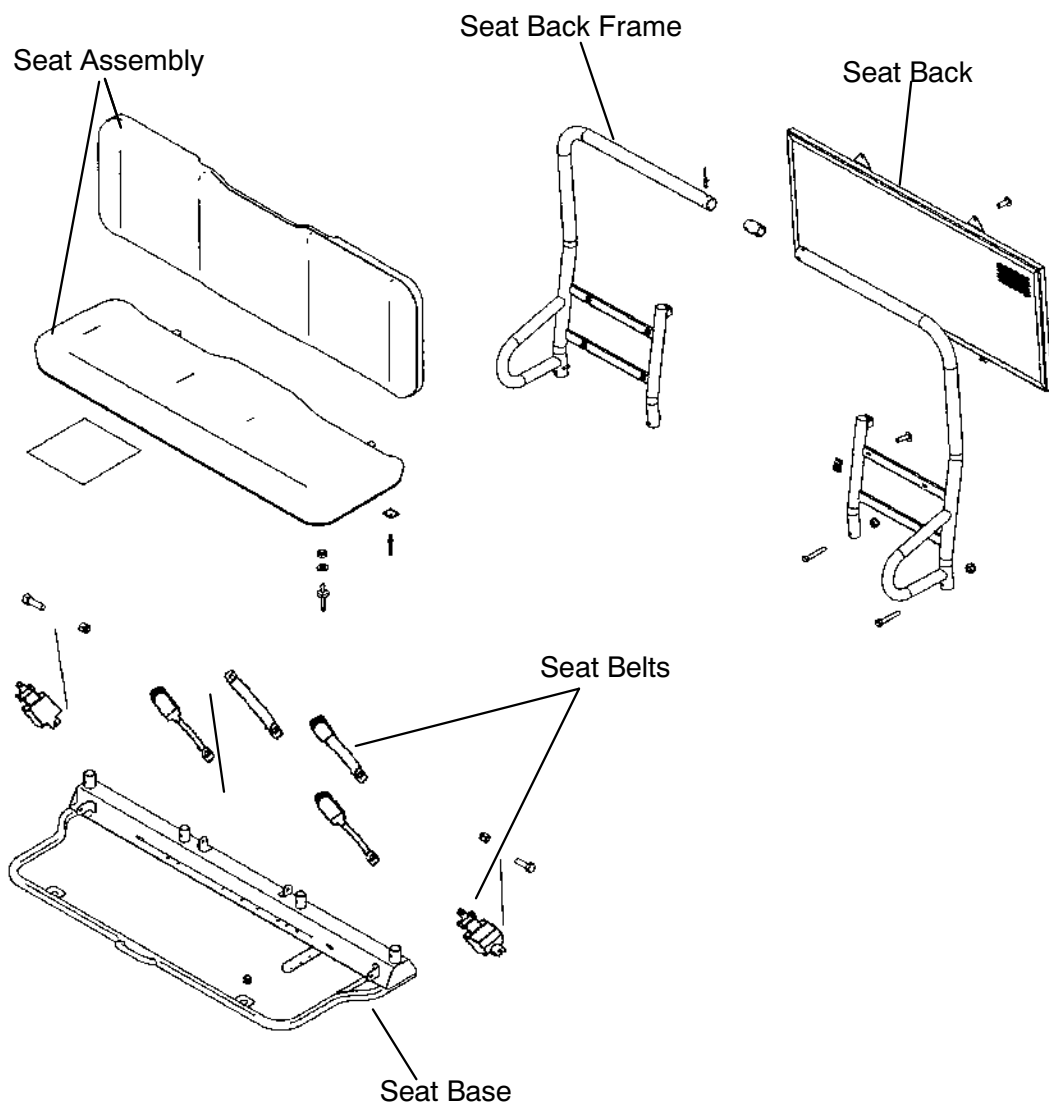


CAB FRAME & SEAT EXPLODED VIEW

RANGER TM



Cab Frame and Seat Assembly



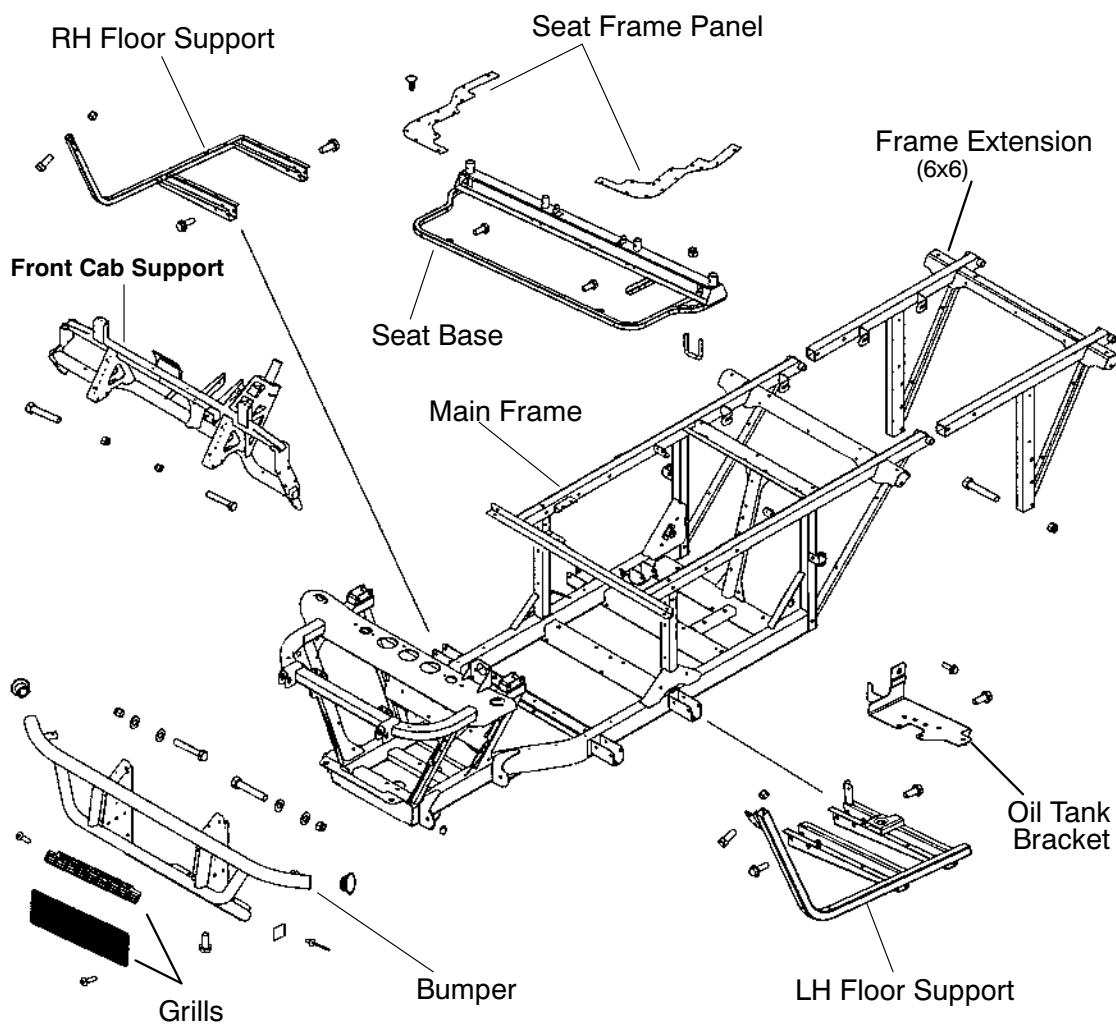


FRAME/BODY ASSEMBLY EXPLODED VIEW



RANGER 2x4, 4x4, 6x6

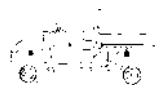
Chassis/Body Assembly



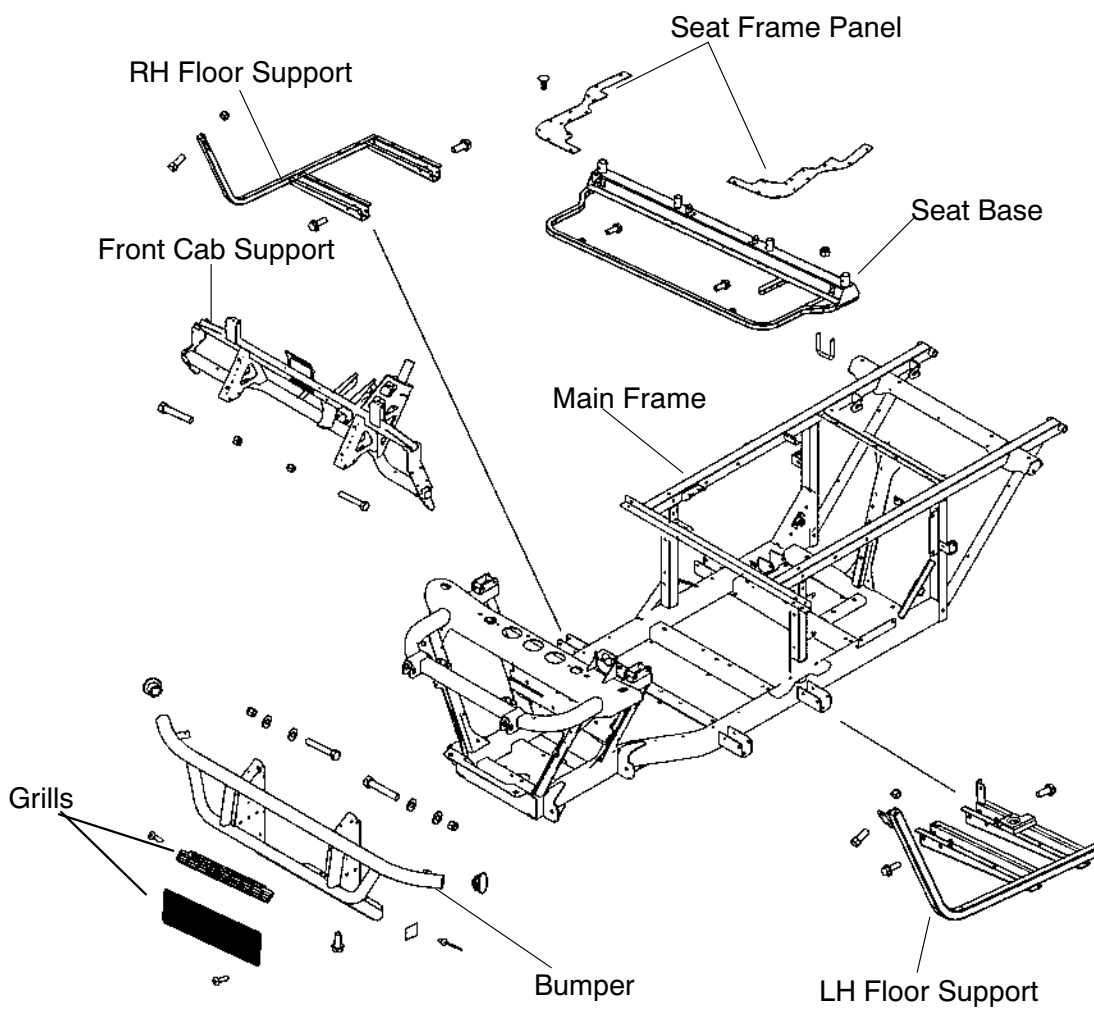


FRAME/BODY ASSEMBLY EXPLODED VIEW

RANGER™



Chassis/Body Assembly

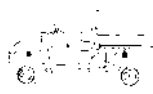




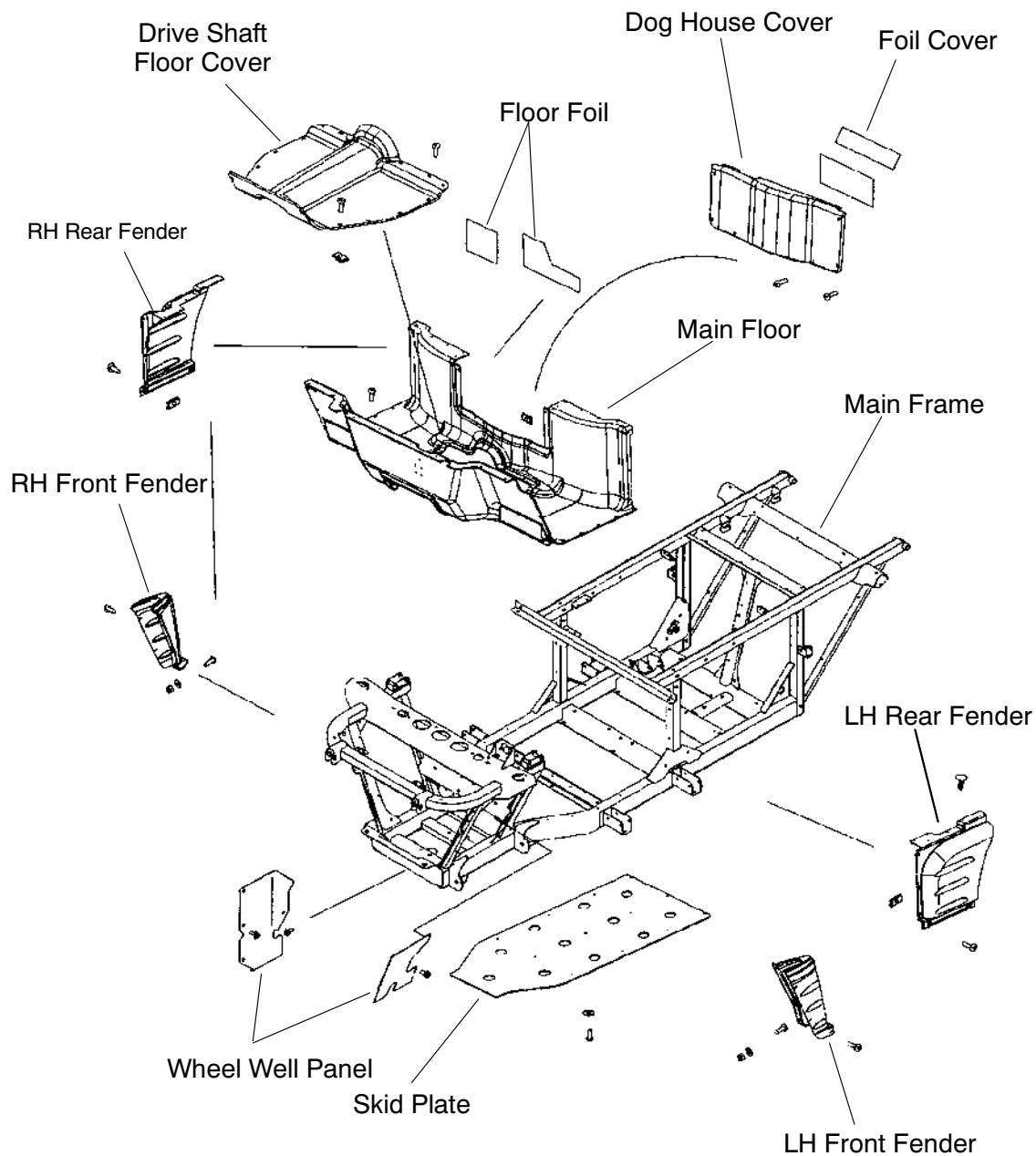
BODY MOLDING EXPLODED VIEW



ALL MODELS



Body Molding



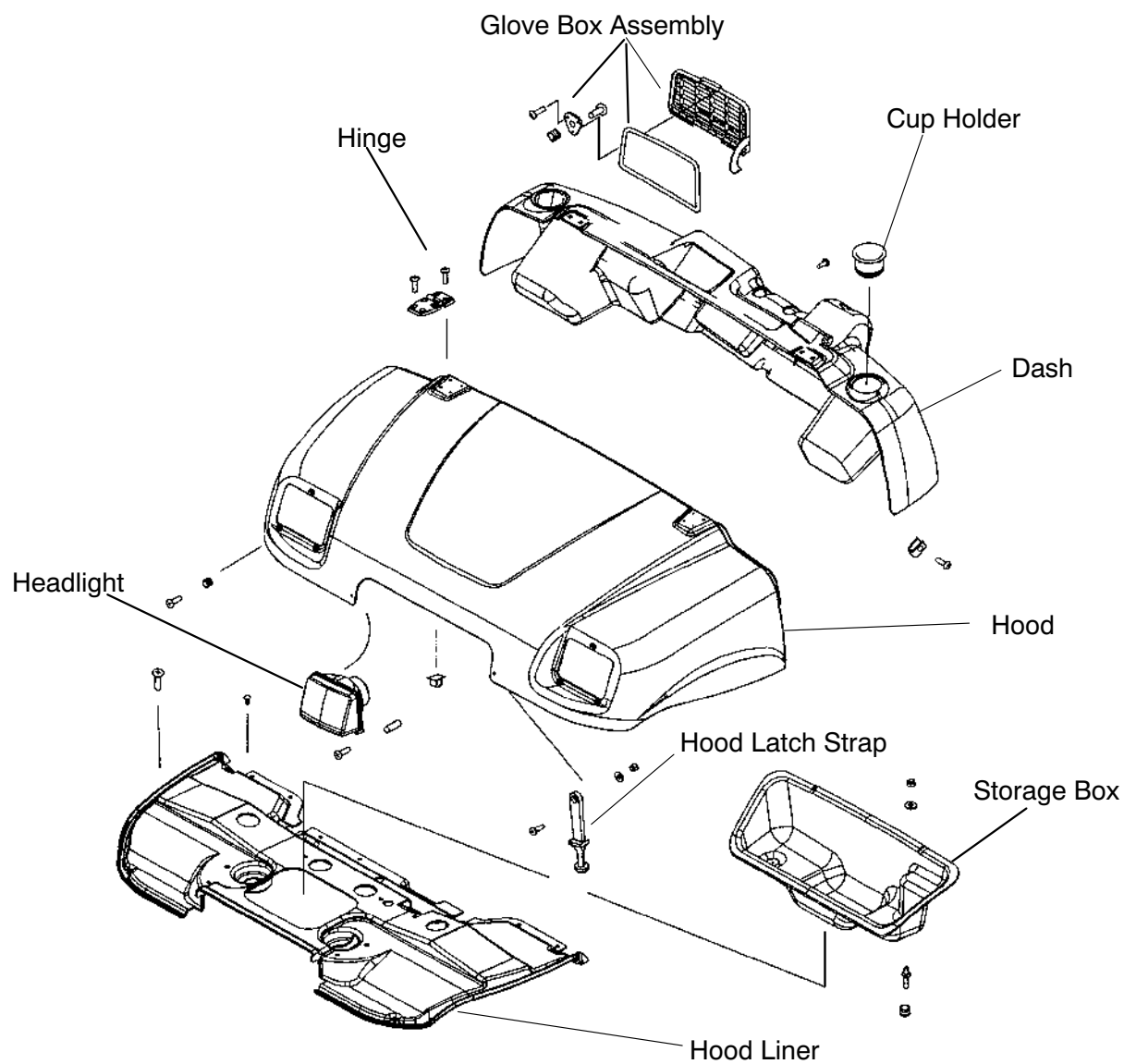


HOOD EXPLODED VIEW



All Models

Front Hood Assembly



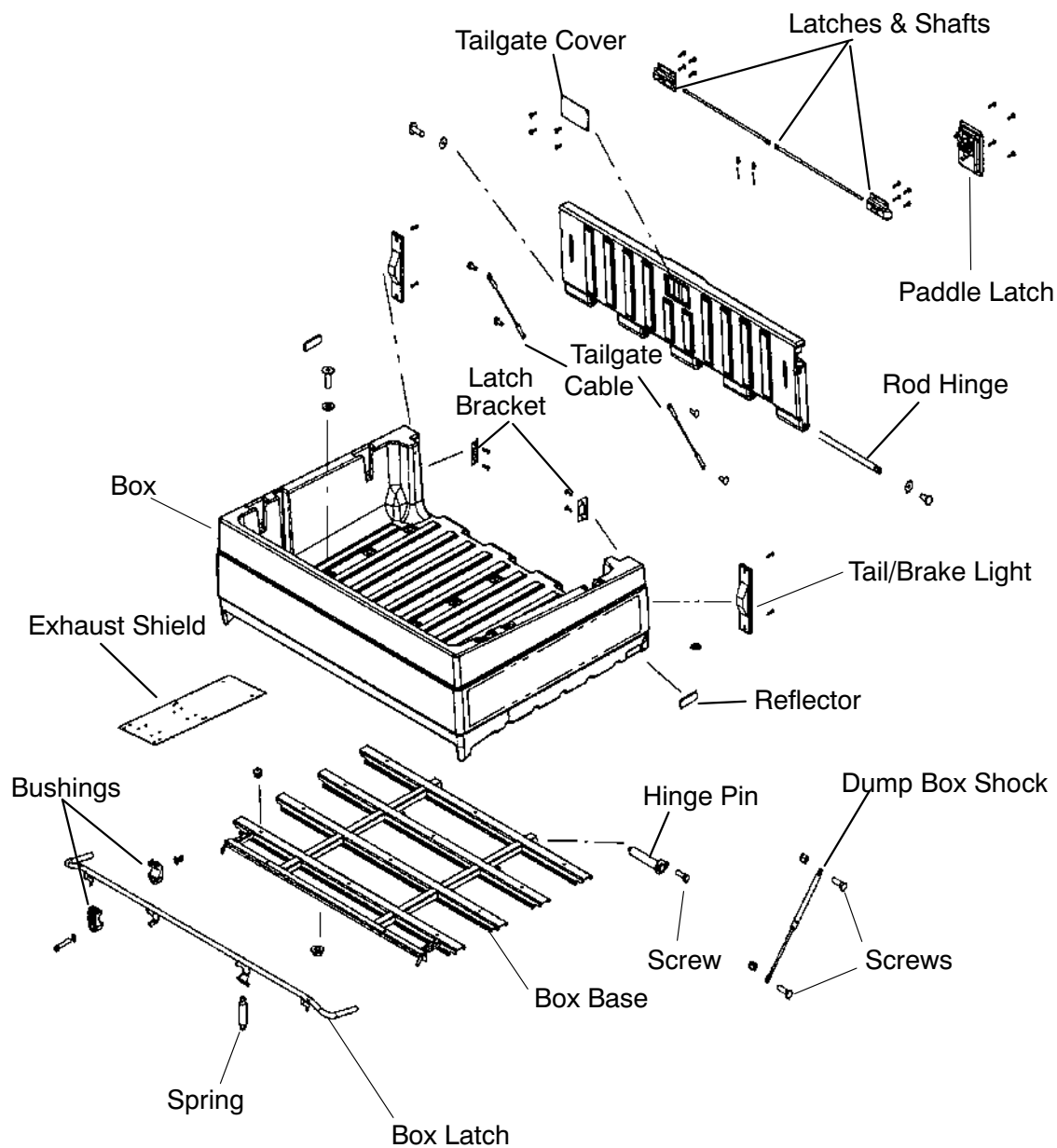


CARGO BOX EXPLODED VIEW



All Models

Cargo Box



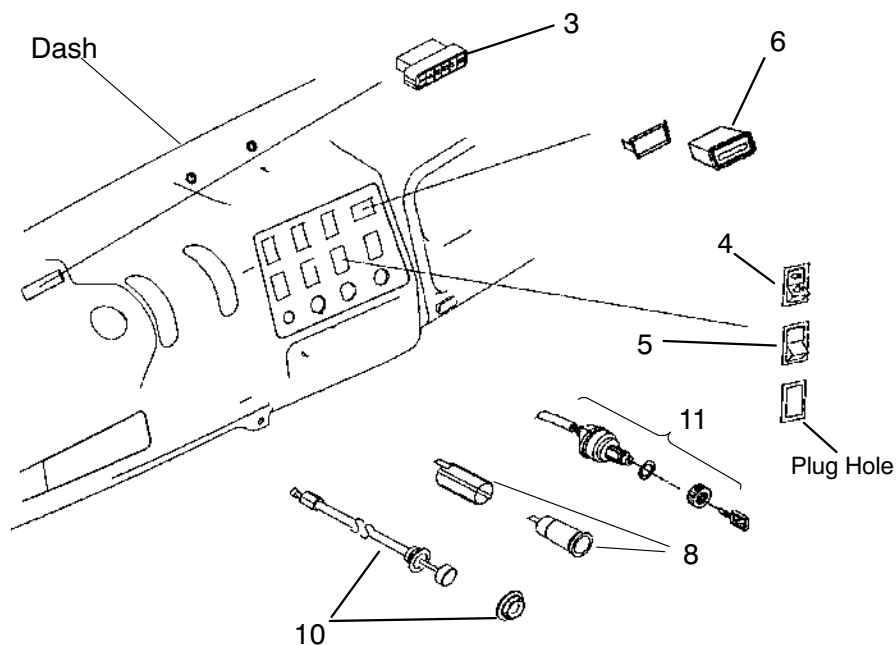
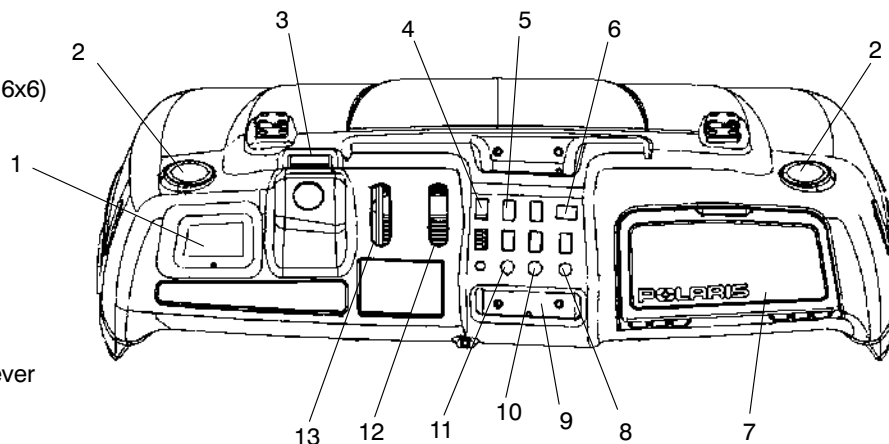


DASH INSTRUMENTS AND CONTROLS



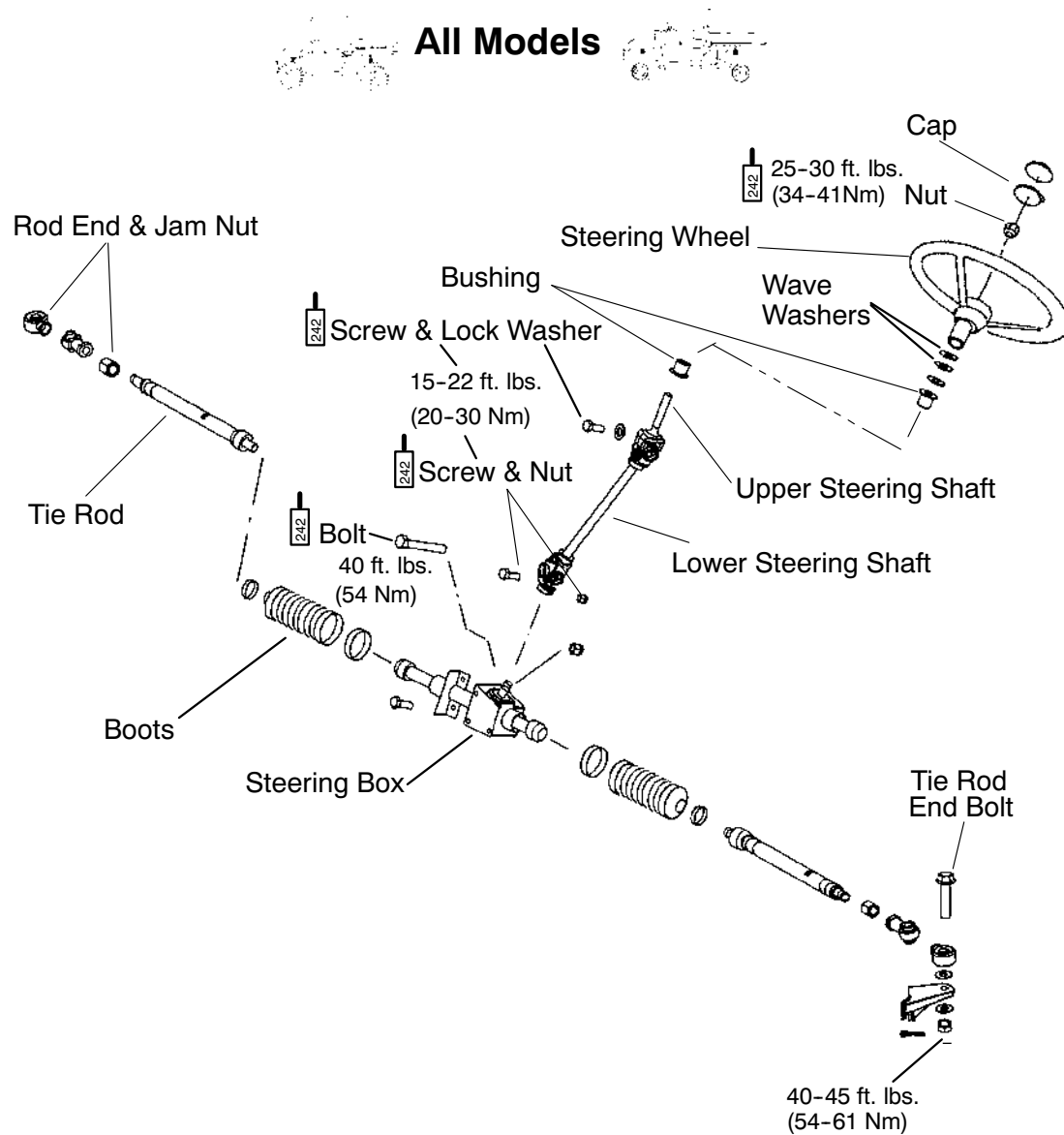
All Models

1. Storage Box
2. Cup Holder
3. Indicator Lights
4. Light Switch
5. AWD Switch (4x4 & 6x6)
6. Hour Meter
7. Glove Box
8. 12V Acc. Plug
9. Storage Tray
10. Choke Knob
11. Ignition Switch
12. Shift Lever
13. Differential Lock Lever (TM, 2x4, & 4x4)





STEERING ASSEMBLY EXPLODED VIEW



242 Apply Loctite™ 242

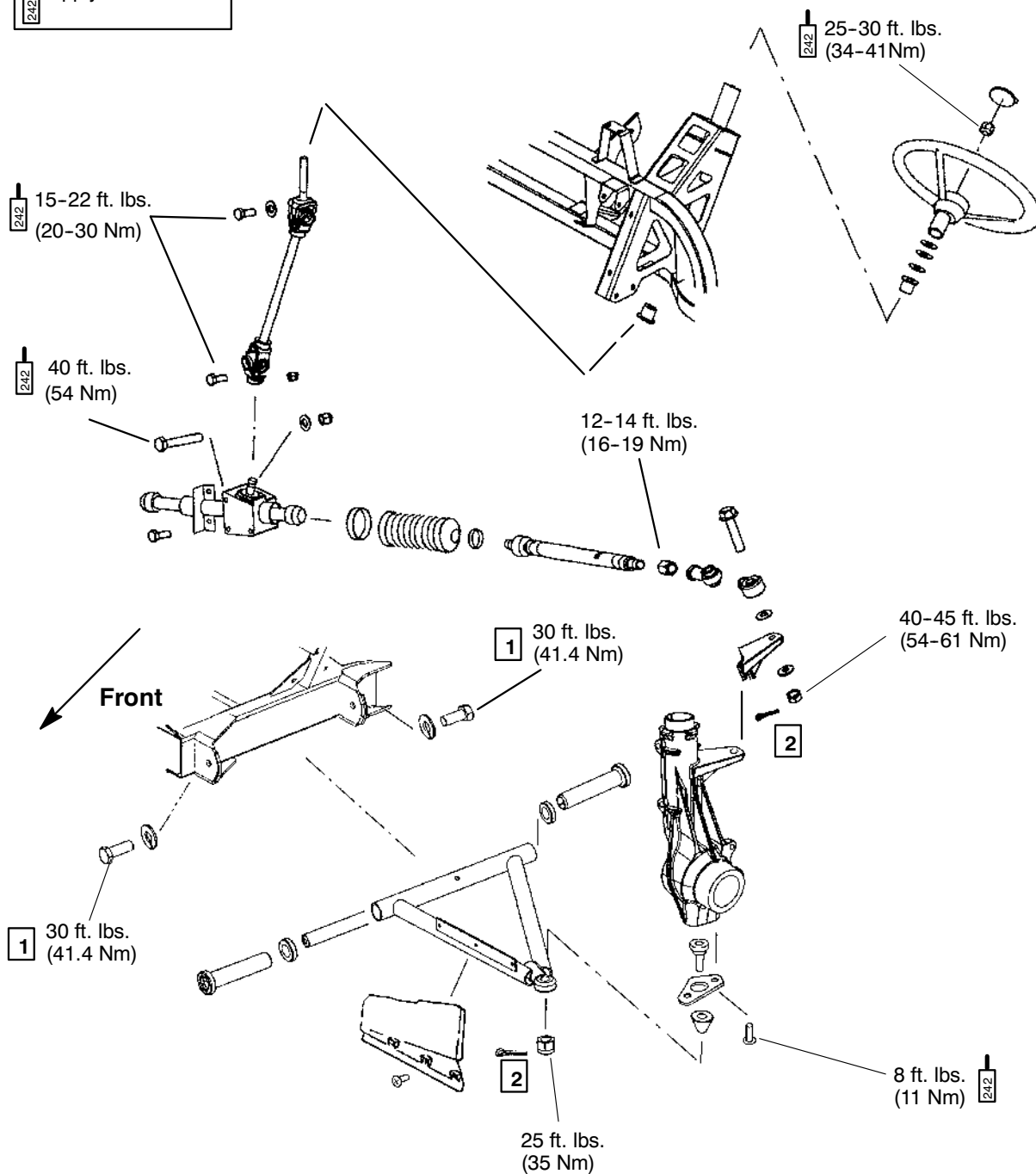
**A-ARM/STRUT ASSEMBLY EXPLODED VIEW (All MODELS)**

1 Always use new bolts upon reassembly

2 Always use new cotter pins upon reassembly.

242 Apply Loctite™ 242

NOTE: To avoid damage to the tie rod ends 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.

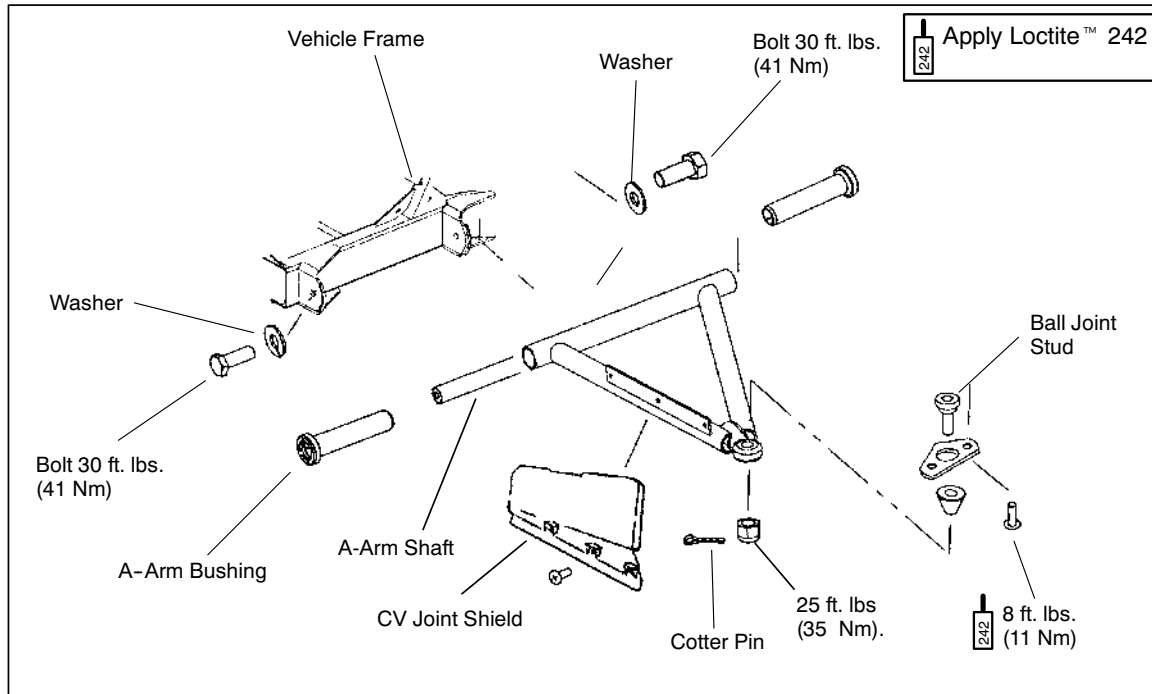




A-ARM REPLACEMENT (ALL MODELS)

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

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



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

⚠ WARNING

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

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

⚠ WARNING

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

A-arm Attaching Bolt Torque:

30 ft. lbs. (41 Nm)

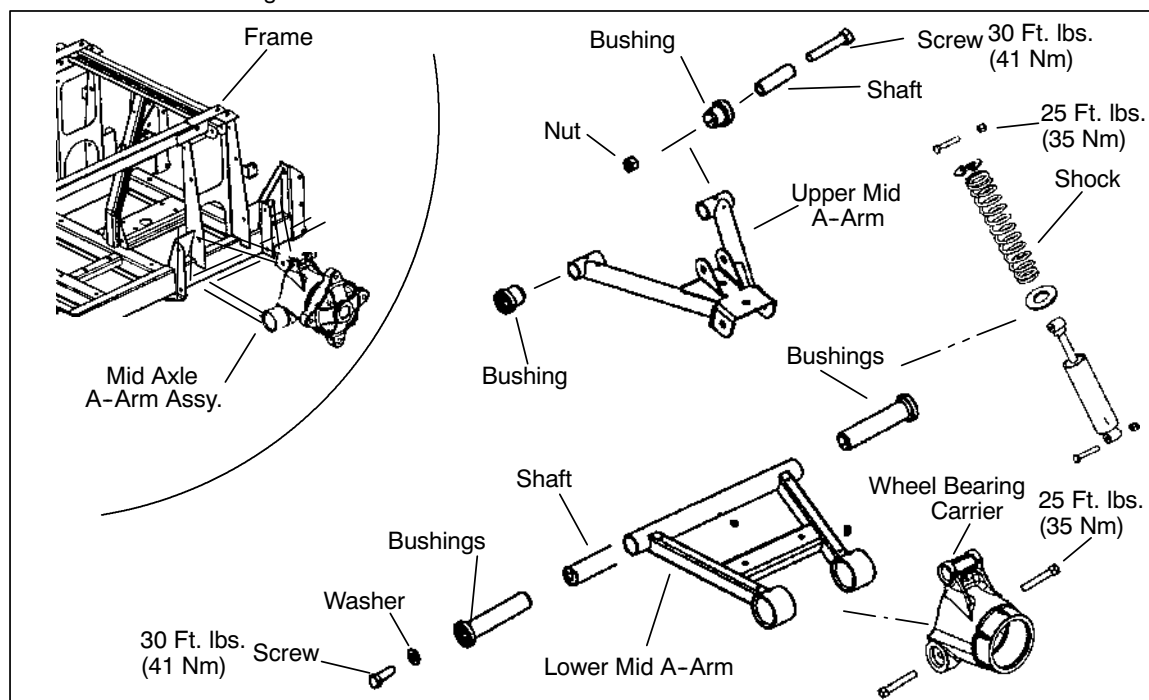
Ball Joint Stud Nut Torque:

25 ft. lbs. (35 Nm)



MID AXLE A-ARM REPLACEMENT (6X6)

1. Elevate and safely support the center of the vehicle with weight removed from center wheel(s).
2. Remove the bolts that secure the shock to the upper and lower mid A-arms.
3. Loosen two bolts on A-arm bushing by alternating each about 1/3 of the way until A-arm can be removed. Perform this procedure on the upper and lower mid A-arms.
4. Examine the A-arm bushing and A-arm shaft. Replace if worn. Discard hardware.
5. Insert A-arm bushings and A-arm shaft into new A-arm.



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

⚠ WARNING

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

8. Attach A-arm to wheel bearing carrier. Torque bolts to 25 ft. lbs. (35 Nm). Install the shock to the upper mid A-arm. Torque bolts to 25 ft. lbs. (35 Nm).
9. Locate grease fitting in center of A-arm tube and pump A-arm full of grease.

⚠ WARNING

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

A-arm Attaching Bolt Torque:

30 ft. lbs. (41 Nm)

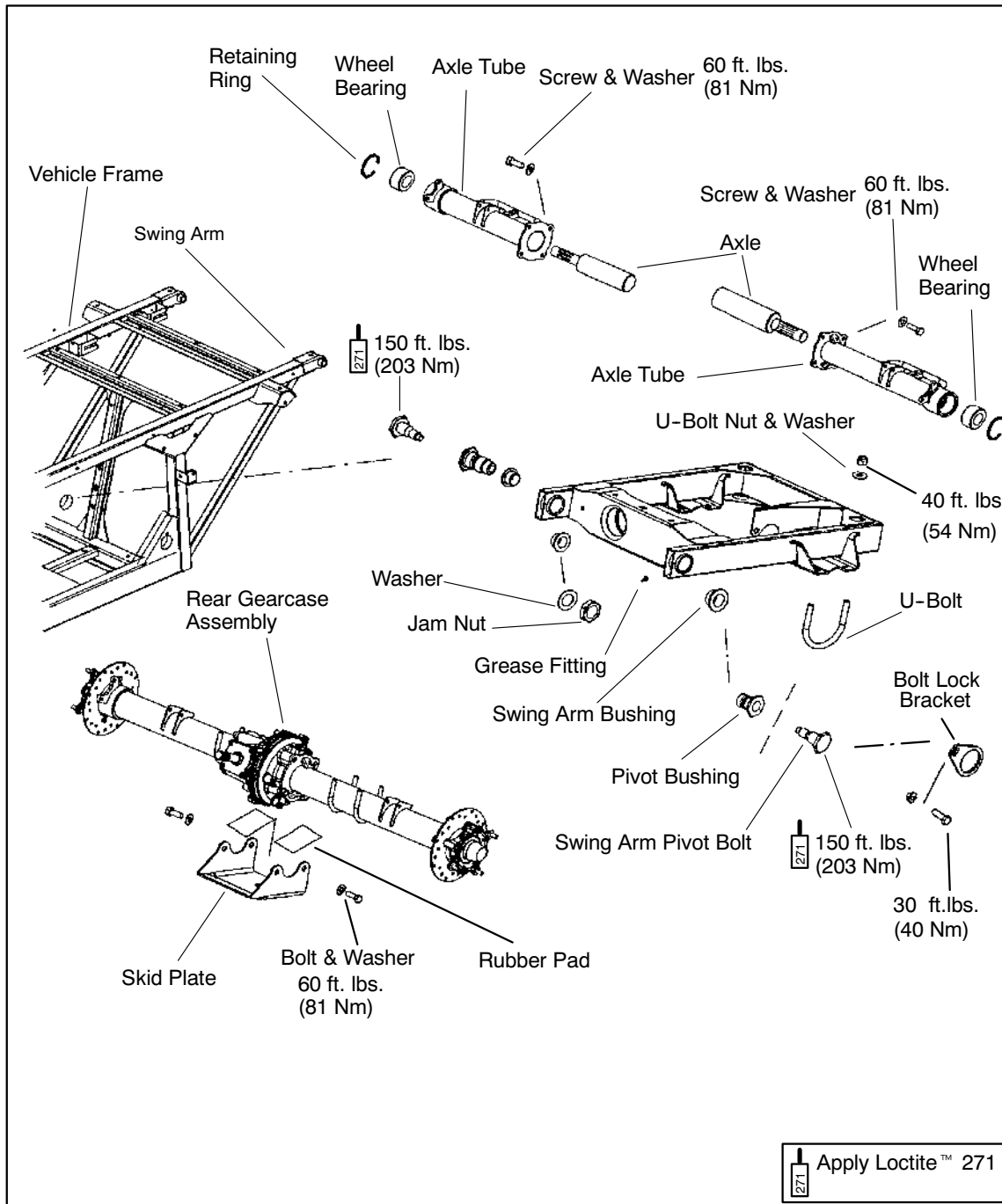
Wheel Bearing Carrier Bolt Torque:

25 ft. lbs. (35 Nm)





REAR DRIVE AXLE AND SWINGARM (ALL MODELS)





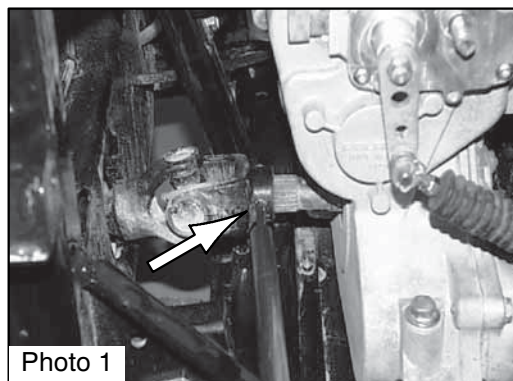
SWING ARM REMOVAL AND INSTALLATION (ALL MODELS)

Swing Arm Removal

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

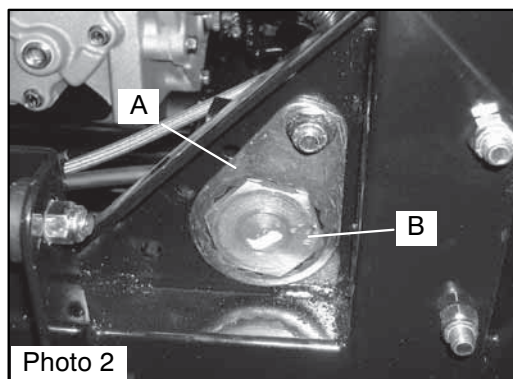
NOTE: The rear axle may be removed to ease the removal of the swing arm. Refer to Chapter 7, REAR AXLE HOUSING REMOVAL/INSPECTION.

3. Support swing arm, remove rear axle shocks.
4. Drive spring pin out of rear propshaft at middle angle drive using the Roll Pin Removal Tool (PN 2872608) (Photo 1).



5. Remove the pivot bolt lock brackets (A), swing arm pivot bolts (B), bolts swing arm bushings, lower swing arm and rear axle. (Photo 2)

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

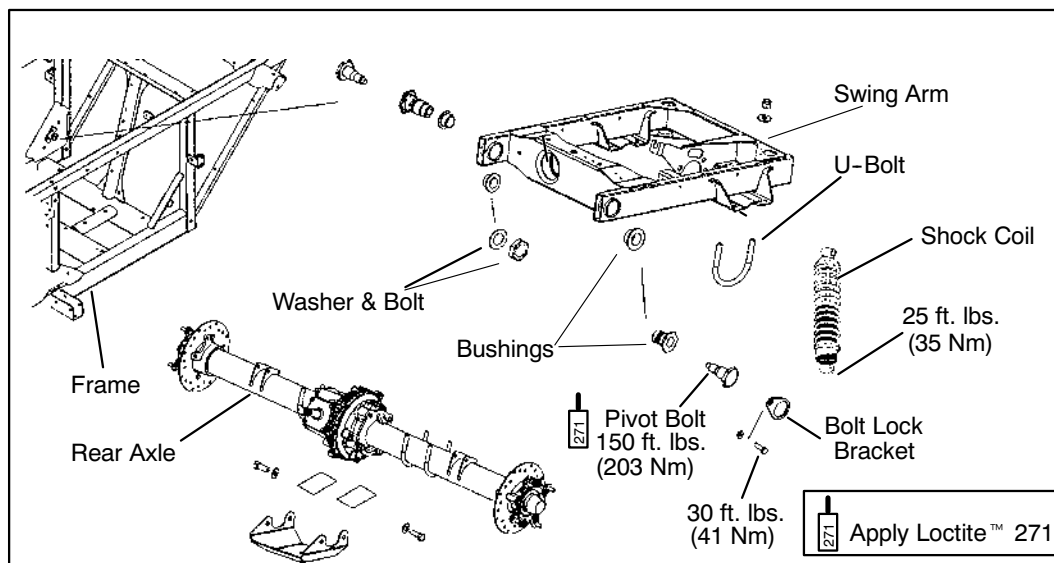


Swing Arm Installation

6. Raise swing arm assembly and align the drive shaft to the rear gearcase splined shaft. (Lube splines)
7. Insert new bushings, check pivot bolts for wear, replace if necessary, torque bolts to 150 ft. lbs (75.9 Nm). Install bolt lock brackets and bolts, torque to 30 ft. lbs. (41 Nm).
8. Install rear coil over shocks onto swing arm, torque bolts to 25 ft. lbs (35 Nm).
9. Install rear wheels, lower machine.
10. Insert new spring pin on rear propshaft.

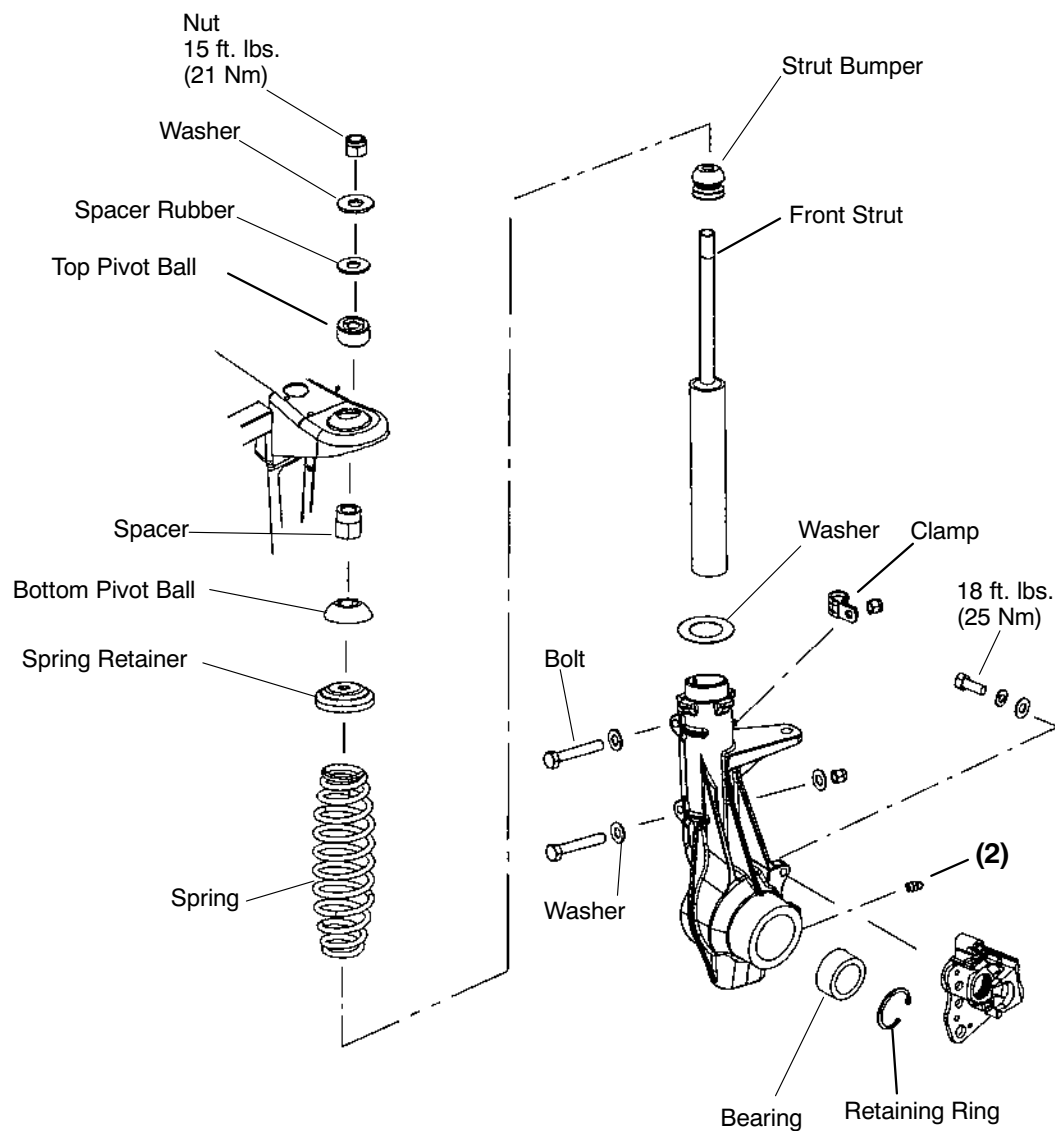
Pivot Bolt and Nut Torque:
150 ft. lbs. (75.9 Nm)

Rear Coil Over Shock Mount Bolt Torque: 25 ft. lbs. (35 Nm)





STRUT ASSEMBLY (ALL MODELS)



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



FRONT STRUT CARTIDGE REPLACEMENT (ALL MODELS)

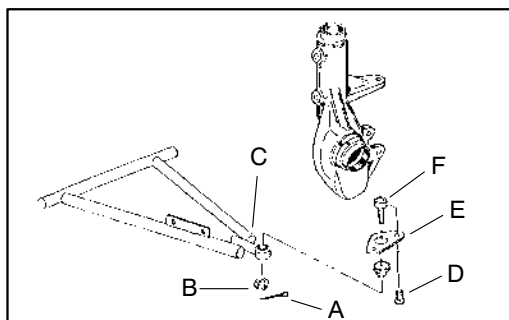
Refer to Illustration on Page 5.18.

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

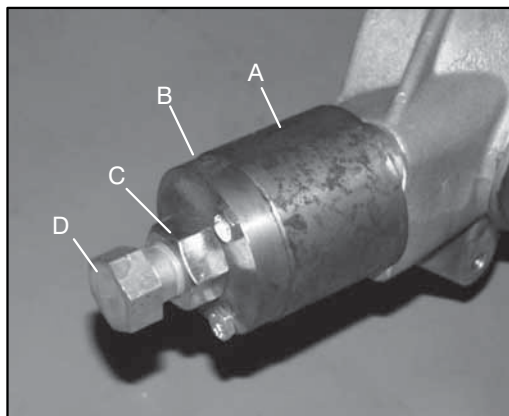
Strut Spring Compressor Tools
(PN 2871573) and (PN 2871574)

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

Strut Rod Nut Torque
15 ft. lbs. (21 Nm)



7. Using ball joint removal / installation tool kit (PN 2870871), remove ball joint (F) from strut housing. Refer to photos at right.
 - Install puller guide (A) with extension cap (B).
 - Apply grease to extension cap and threads of puller bolt to ease removal.
 - Thread bolt (D) with nut (C) onto ball joint stud as shown.
 - Apply heat to ease removal.
 - Hold bolt (D) and turn nut (C) clockwise until ball joint is removed from strut housing.



BALL JOINT REPLACEMENT (ALL MODELS)

REFER TO ILLUSTRATION ON PAGE

5.14.

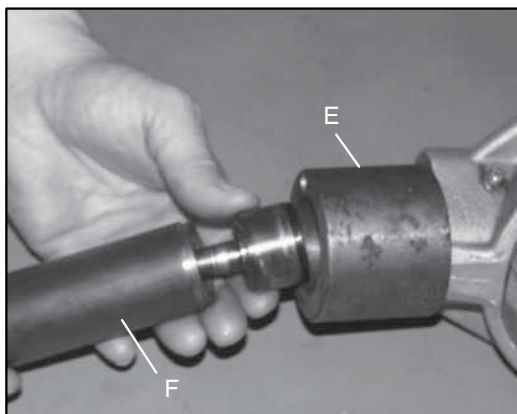
1. Loosen front wheel nuts slightly.
2. Elevate and safely support machine under footrest/frame area.

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

3. Remove wheel nuts and wheels.
4. Remove cotter pin (A) from ball joint castlenut.
5. Remove castle nut (B) and separate A-arm (C) from ball joint stud.
6. Remove screws (D) and ball joint retaining plate (E).

8. To install new ball joint:
 - Remove extension cap and attach puller guide using short bolts provided in the kit.
 - Insert new ball joint (E) into driver (F).
 - Slide ball joint/driver assembly into guide.
 - Apply heat to ease installation.
 - Drive new joint into strut housing until fully seated.

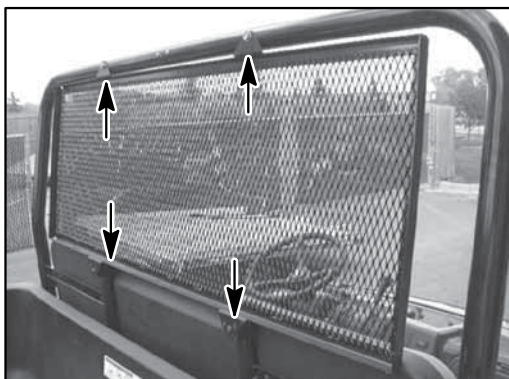




9. Apply Loctite™ 242 (PN 2871949) to threads of retaining plate screws or install new screws with pre-applied locking agent. Torque screws to 8 ft. lbs. (11 Nm).
10. Install A-arm on ball joint and torque castle nut to 25 ft. lbs. (35 Nm).
11. Reinstall cotter pin with open ends toward rear of machine.

SEATBACK SCREEN REMOVAL (RANGER TM)

1. To remove the seat back on the *RANGER* TM, locate the bolts that secure the screen.
2. Remove the two bottom bolts first, then remove the two top bolts. Hold onto the screen while removing the top bolts.



3. Reverse the steps for screen installation.

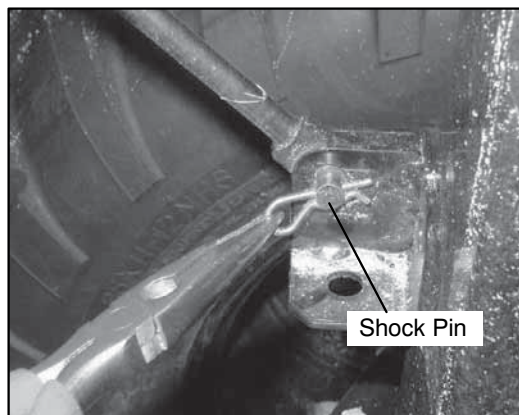


BOX REMOVAL / INSTALLATION (ALL MODELS)

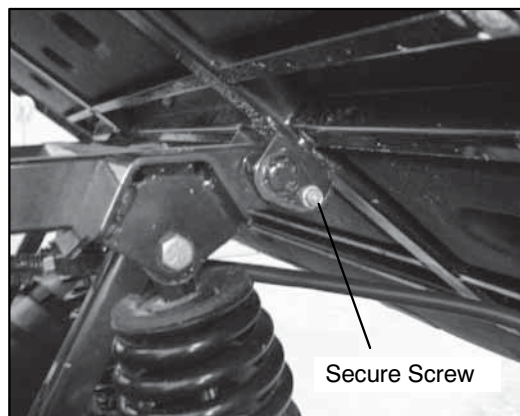
Box Removal

1. Lift the box into the dump position.
2. Remove the box shock pin from the frame (both sides).
3. Remove the shocks from the shock brackets. Let the shocks fully extend.

CAUTION: Safely support the box during the rest of the removal process. The box is not as stable with the shocks removed.



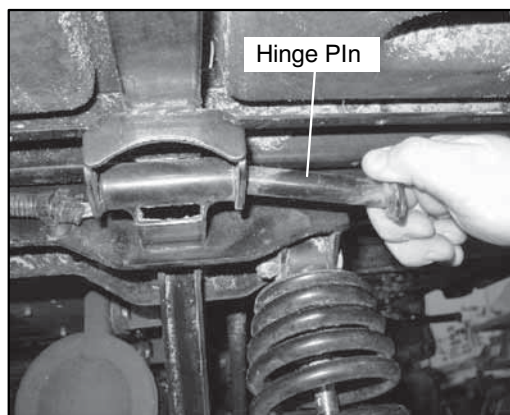
4. Remove the screw that secures the hinge pin to the frame (both sides).



5. Remove the hinge pin (both sides).

CAUTION: Safely support the box during the rest of the removal process. The box is not as stable with the

hinge pins removed.

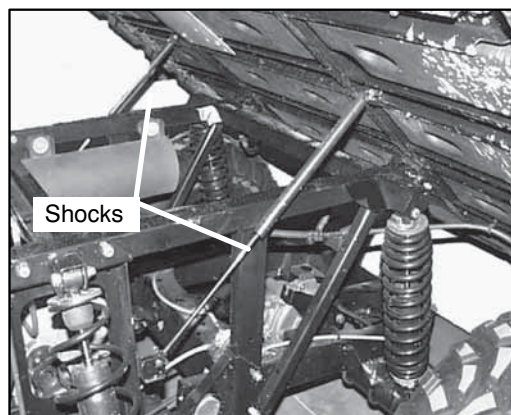


6. With both hinge pins removed, remove the box from the frame. Two people maybe needed to remove the bed from the frame.

CAUTION: Use caution when removing the box. It is recommended to have two people to carefully remove the box from the frame.

Box Installation

1. Place the box onto the frame. Align the hinges of the box with the bracket on the frame.
2. Install the box hinges (both sides).
3. Secure the box hinges with the hinge screws (both sides).
4. With the hinges installed, decompress the box shocks and place them into the shock brackets on the frame (both sides).
5. Secure the box shocks with the shock pin (both sides).



6. Lower the box and secure the latch.





DECAL REPLACEMENT (ALL MODELS)

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

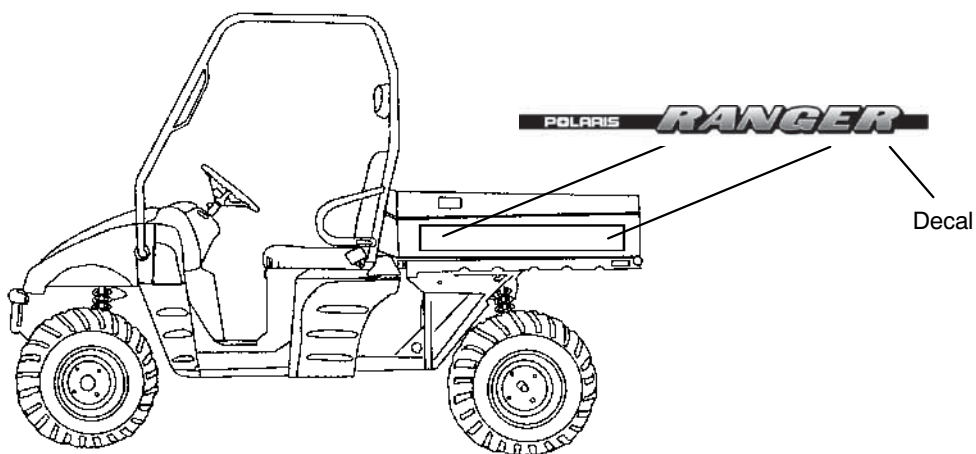
The following procedure involves the use of an open flame. Perform this procedure in a well ventilated

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.

Example of Decal Placement



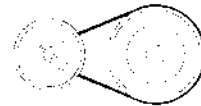
NOTE: Refer to your parts manual for decal part number.



CHAPTER 6

CLUTCHING

PVT System Operation	6.2
Troubleshooting	6.3
<i>RANGER</i> TM PVT SYSTEM	6.4-6.24
<i>RANGER</i> 2X, 4X, 6X PVT SYSTEM	6.25-6.48



6





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.

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 MAINT./INSPECTION

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

1. **Belt Tension, Drive to Driven Clutch Offset, Belt Width.** See these sections later in chapter for each model.
2. **Drive and Driven Clutch Buttons and Bushings, Drive Clutch Shift Weights and Pins, Drive Clutch Spider Rollers and Roller Pins, Drive and Driven Clutch Springs.** See these sections later in chapter for each model.
3. **Sheave Faces.** Clean and inspect for wear.
4. **PVT System Sealing.** For *RANGER 2X, 4X, 6X*: Refer to appropriate illustration below and on the following pages. The PVT system is air cooled by fins on the drive clutch stationary sheave. The fins create a low pressure area in the crankcase casting, drawing air into the system through an intake duct. The opening for this intake duct is located at a high point on the vehicle (location varies by model). The intake duct draws fresh air through a vented cover. All connecting air ducts (as well as the inner and outer covers) must be properly sealed to ensure clean air is being used for cooling the PVT system and also to prevent water and other contaminants from entering the PVT area. This is especially critical on units subjected to frequent water forging.



PVT OVERHEATING/DIAGNOSIS

During routine maintenance or whenever PVT system overheating is evident, it's important to check the inlet and outlet ducting for obstructions. Obstructions to air flow through the ducts will significantly increase PVT system operating temperatures. The vehicle should be operated in

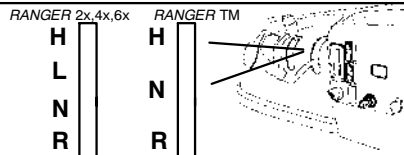
Low (*RANGER* 2X,4X,6X) when pulling or plowing heavy loads, or if extended low speed operation is anticipated. The *RANGER* TM should be operated in high (only forward gear).

Clutch Drive Belt & Cover Related Issues: Diagnosis	
Possible Causes	Solutions/What to do
Loading the vehicle into a truck or tall trailer when in high range.	Shift transmission to Low during loading of the vehicle to prevent belt burning
Starting out going up a steep incline from a stopped position.	When starting out on an incline, use Low, or dismount the vehicle after first applying the park brake and perform the "K" turn.
Driving at low RPM or low ground speed (at approximately 3-7 MPH).	Drive at higher speed or use Low. The use of Low is highly recommended for cooler PVT operating temperatures and longer component life.
Insufficient warm-up of Utility Task Vehicles™ exposed to low ambient temperatures.	Warm engine at least 5 min., then with transmission in neutral, advance throttle to approx. 1/8 throttle in short bursts, 5 to 7 times. The belt will become more flexible and prevent belt burning.
Slow and easy clutch engagement.	Fast, effective use of the throttle for efficient engagement.
Towing/Pushing at low RPM/low ground speed.	Use Low only.
Plowing snow, dirt, etc./utility use.	Use Low only.
Stuck in mud or snow.	Shift the transmission to Low, carefully use fast, aggressive throttle application to engage clutch. WARNING: Excessive throttle may cause loss of control and vehicle overturn.
Climbing over large objects from a stopped position.	Shift the transmission to Low, carefully use fast, aggressive, brief throttle application to engage clutch. WARNING: Excessive throttle may cause loss of control and vehicle overturn.
Belt slippage from water or snow ingestion into the PVT system.	Shift the transmission to neutral. Using the throttle, vary the engine rpm from idle to full throttle. Repeat several times as required. During this procedure, the throttle should not be held at the full position for more than 10 seconds. Clutch seals should be inspected for damage if repeated leaking occurs.
Clutch malfunction.	For inspection of clutch components, please contact your Polaris dealer. Shift transmission to Low during loading of the vehicle to prevent belt burning.
Poor engine performance.	Fouled plugs, foreign material in gas tank, fuel lines, or carburetor. Contact you dealer for further service information.
GENERAL RANGE OPERATION GUIDELINES:	Low: Heavy pulling, basic operational speeds less than 7 MPH, riding through rough terrain (swamps, mountains, ect.), low ground speeds.
	High: High ground speeds, speeds above 7 MPH.

Low Is Primary Drive Gear

Low is the primary driving gear for *RANGER* 2x, 4x, & 6x. High is the only forward gear on the *RANGER* TM and is used for all forward operating applications. *RANGER* 2x,4x,6x - Low should be used in ALL driving applications except for driving on hard packed level surfaces with light loads. In this circumstance, High may be used. Using High for heavy loads, hilly terrain, or in wet, muddy conditions will increase the chance of drive belt burning.

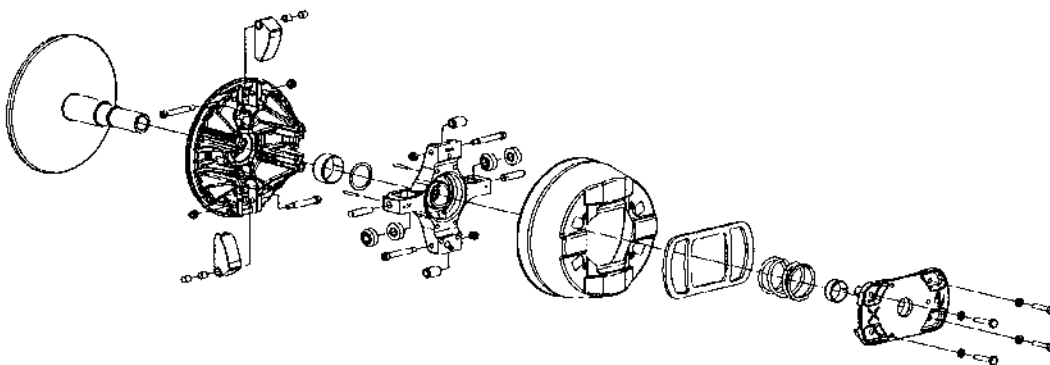
1. Use Low as the primary driving gear for all *RANGERS*, except *RANGER* TM.
2. Use High only on hard packed, level surfaces with light loads.





RANGER TM CLUTCHING SECTION

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SERVICE TOOLS AND SUPPLIES

TOOL DESCRIPTION	PART NUMBER
Drive Clutch Puller	9314177
Driven Clutch Puller	2870913
Roller Pin Tool	2870910
RANGER™ Clutch Alignment Tool	PA-47043

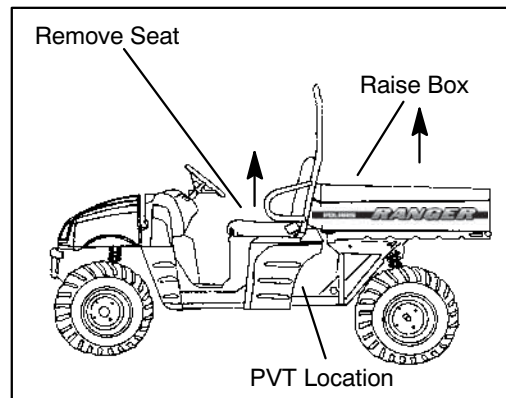
PVT SYSTEM FASTENER TORQUES

ITEM	TORQUE VALUE ft.lbs. (Nm)
Drive Clutch Retaining Bolt	40 ft. lbs. (54 Nm)
Driven Clutch Retaining Bolt	17 ft. lbs. (23 Nm)
Drive Clutch Spider	200 ft. lbs. (271 Nm)
Drive Clutch Cover Plate	12 ft. lbs. (16 Nm)

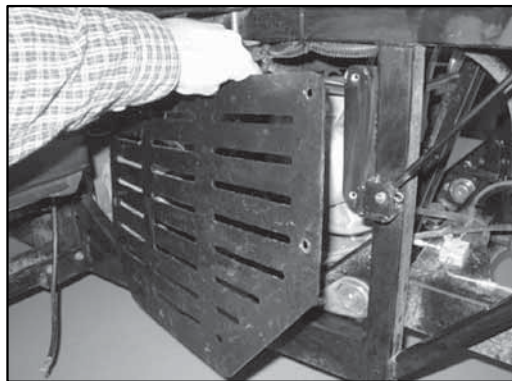
PVT DISASSEMBLY (RANGER™)

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

1. Set the parking brake and block the wheels to prevent any movement. Remove the seat and raise the dump box to help light the PVT cover area.

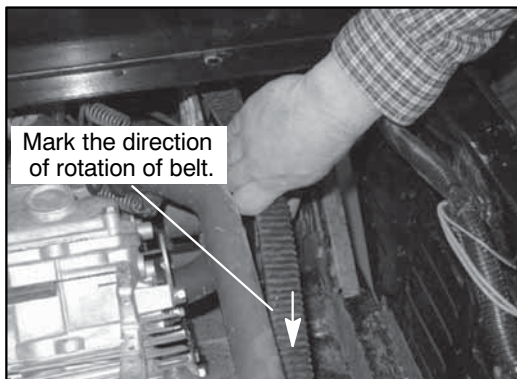


2. Remove clutch exhaust shield located between the engine and battery. Remove the clutch guard from the left side of the machine (T25 screws).

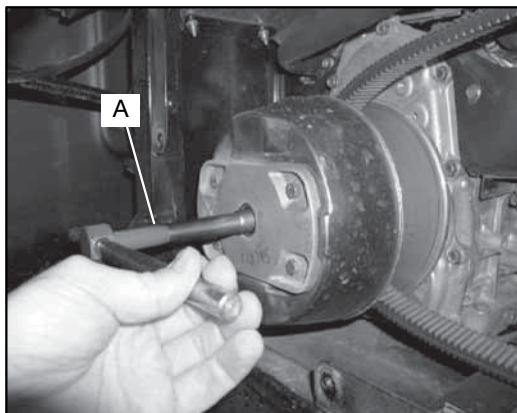


3. Mark the drive belt direction of rotation and remove drive belt. To remove the drive belt, apply brake, pull upward and rearward on belt to open driven clutch sheaves, push down on belt to hold sheaves open, and slip belt over driven clutch outer sheave.

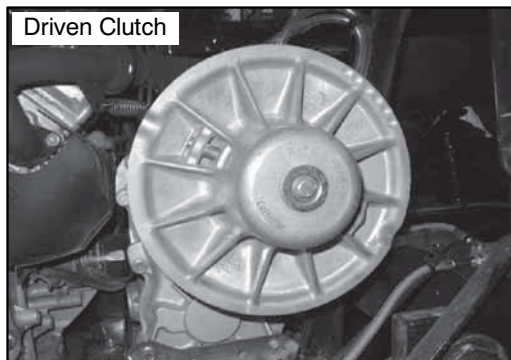
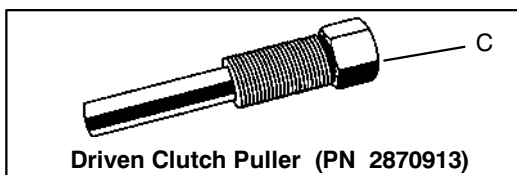




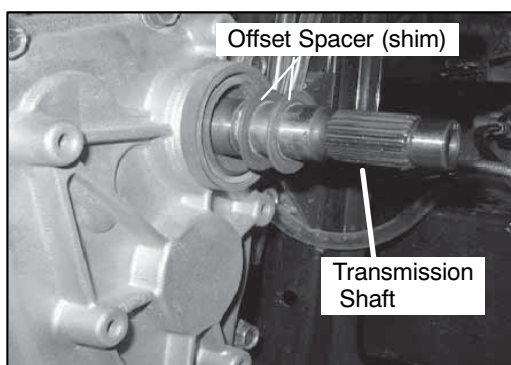
4. Remove the drive clutch bolt.
5. Install the Drive Clutch Puller (PN 2870506) (A).
6. Hold the drive clutch and loosen the drive clutch from the shaft by turning the drive clutch puller tool.



7. Remove driven clutch retaining bolt and driven clutch. Use the Driven Clutch Puller (PN 2870913) if necessary.

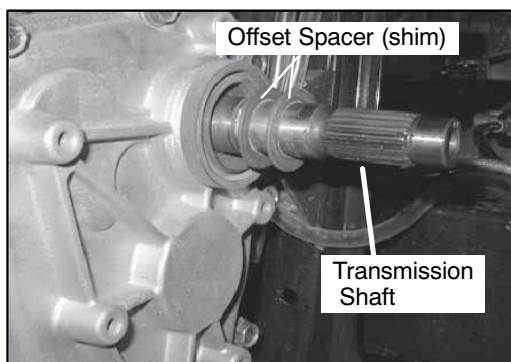


8. Remove driven clutch offset spacers from the transmission input shaft.



PVT ASSEMBLY (RANGER TM)

1. Install clutch offset spacers (shims) on transmission input shaft.

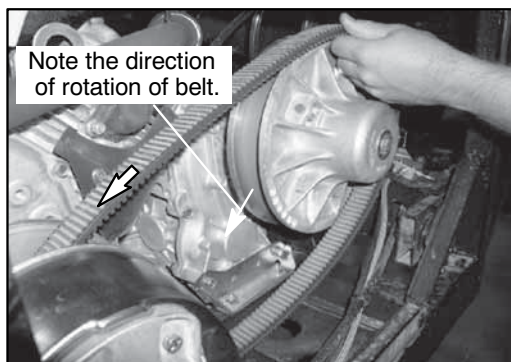
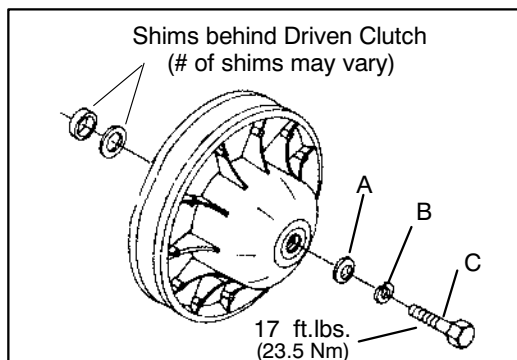


2. Clean splines inside driven clutch and on the transmission input shaft.

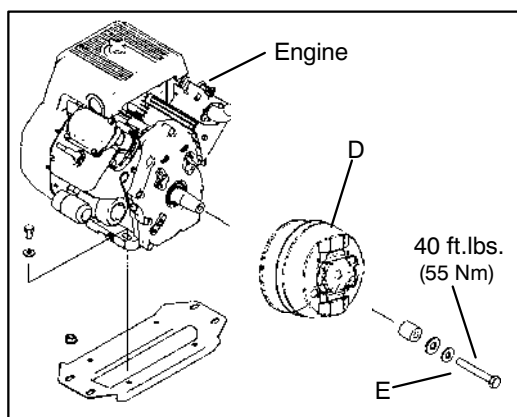




3. Apply a light film of grease to the splines on the shaft.
4. Install the driven clutch onto the transmission shaft. Secure the driven clutch with the washer (A), lock washer (B), and retaining bolt (C). Torque the Driven Clutch Retaining Bolt (C) to 17 ft. lbs. (23.5 Nm).



5. Clean end of taper on crankshaft and the taper bore inside drive clutch.
6. Install drive clutch (D) onto the crankshaft and torque retaining bolt (E) **40 ft.lbs. (55 Nm)**.



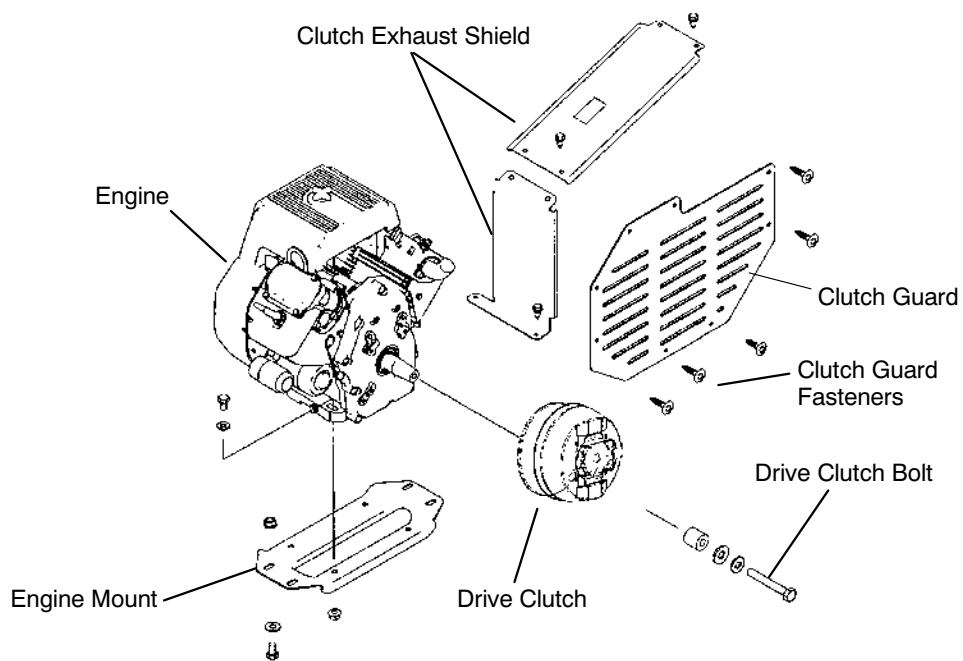
7. Reinstall drive belt:
 - Loop the drive belt over the drive clutch and over the top of the driven clutch.
 - While pushing down on top of belt, turn the back or moveable driven sheave clockwise.
 - The belt then should be able to be pushed down into and between the sheaves.
 - Be sure to note the direction of rotation on the belt for proper installation.





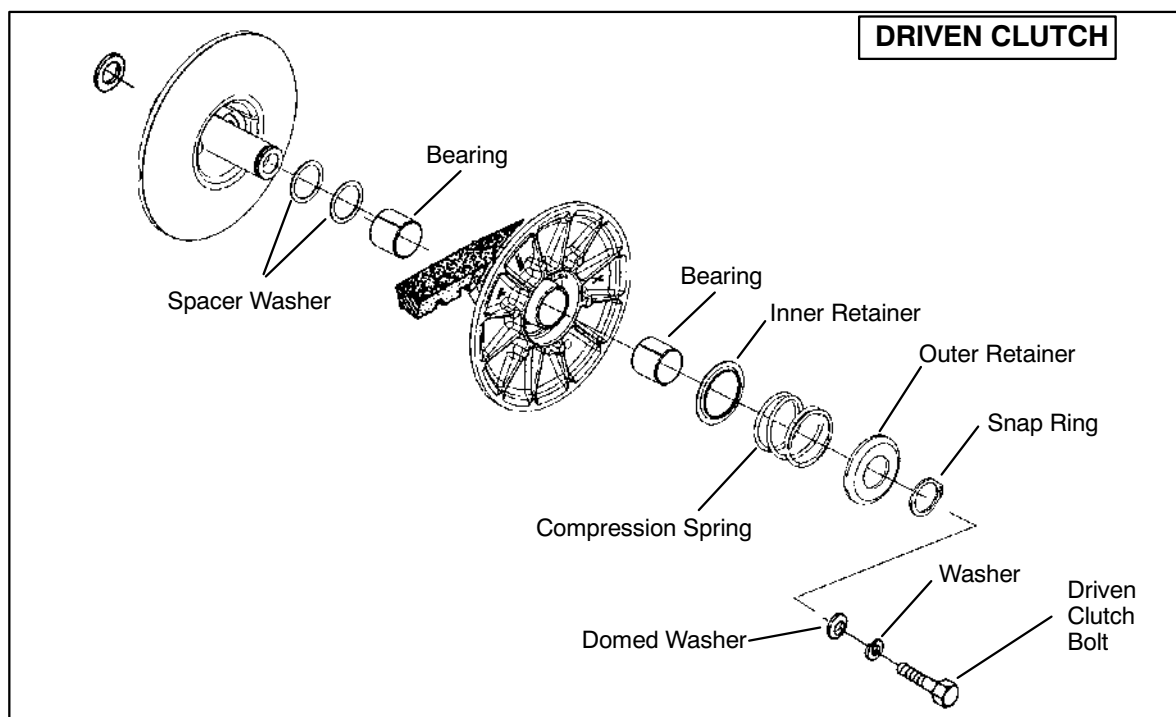
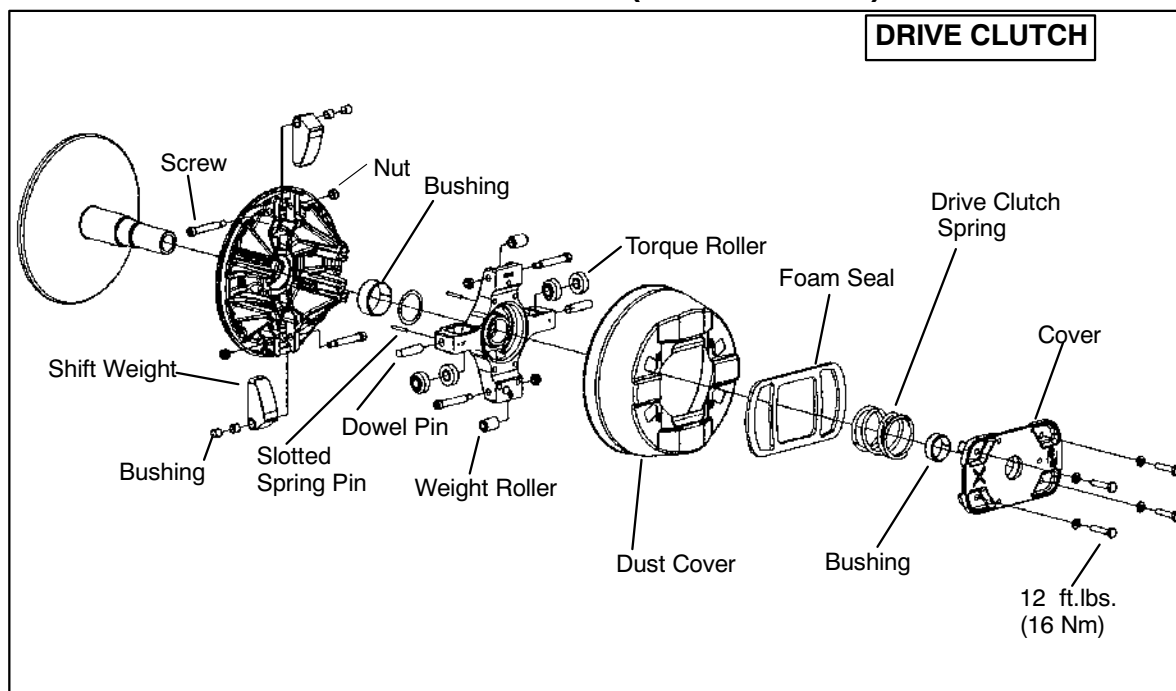
PVT SEALING, GUARD, AND DUCTING COMPONENTS

PVT GUARD COMPONENTS (RANGER TM)





DRIVE CLUTCH EXPLODED VIEW (RANGER TM)





DRIVE CLUTCH SPECIFICATIONS (*RANGER* *TM*)

The drive clutch spring has two primary functions:

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

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

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

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

Check check to see that spring coils are parallel to one another. Distortion of the spring indicates stress fatigue, requiring replacement.



Drive Clutch Spring

Primary (drive) Clutch Spring

PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH ±.125"
3234184	Black/ Green	0.177"	N/A

Secondary (driven) Clutch Spring

PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH ±.125"
3234186	Purple/Yel	0.177"	N/A

SHIFT WEIGHTS (*RANGER* *TM*)

Shown below is the shift weight which has been designed for the PVT system. These shift weights (2) have many factors designed into them for controlling engagement RPM and shifting patterns. Shift weights should not be changed or altered without first having a thorough understanding of their positioning and the effects they may have on belt to sheave clearance, clutch balance and shifting pattern.



PN 3234176
208 grams

DRIVE CLUTCH INSPECTION (*RANGER* *TM*)

⚠ WARNING

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

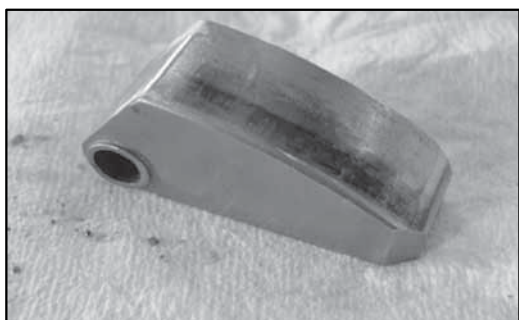
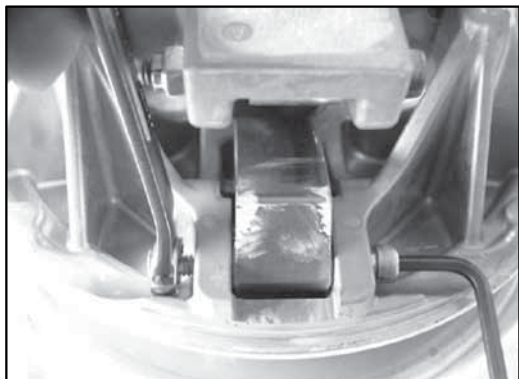
All PVT system maintenance repairs must be performed only by an authorized Polaris service technician who has attended a Polaris sponsored service training seminar and understands the proper procedures as outlined in this manual. **Because of the critical nature and precision balance incorporated into the PVT system, it is absolutely**



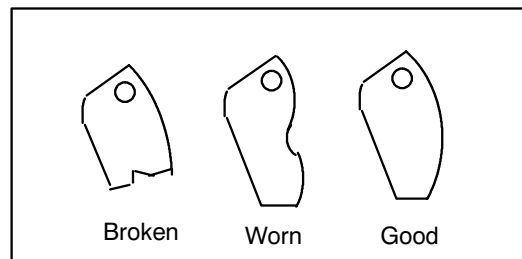


essential that no attempt at disassembly or repair be made without factory authorized special tools and service procedures.

1. Inspect the shift weight, the contact surface of the weight should be smooth and free of dents or gall marks.
2. Remove the shift weight bolts and weights if necessary.



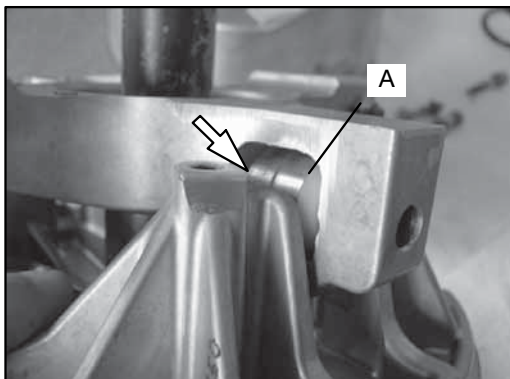
NOTE: A damaged shift weight is usually caused by a damaged or stuck roller in the spider assembly. See "ROLLER, PIN AND THRUST WASHER INSPECTION", Page 6.13.



DRIVE CLUTCH INSPECTION **(RANGER TM)**

TORQUE ROLLER TO TOWER **CLEARANCE INSPECTION**

1. Inspect for any clearance between torque roller (A) to tower. If clearance exists, replace all torque rollers and inspect surface of towers. See "SPIDER REMOVAL" Page 6.12.

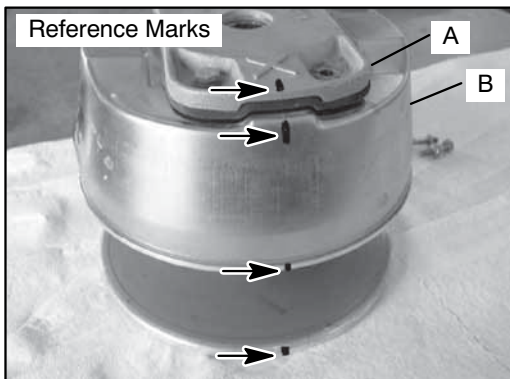


Torque Roller to Tower Clearance:
000 - .001"

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

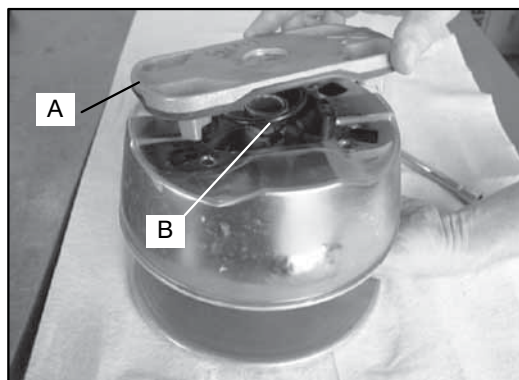
DRIVE CLUTCH **DISASSEMBLY**

1. Make a reference mark on the primary cover (A) and dust cover (B) for reinstallation.

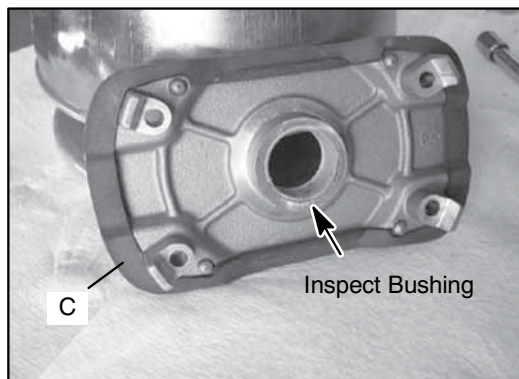




- Remove the four bolts that secure the primary (A) cover to the drive clutch assembly. Remove the spring (B) from the clutch assembly. Inspect the spring, see Page 6.10.



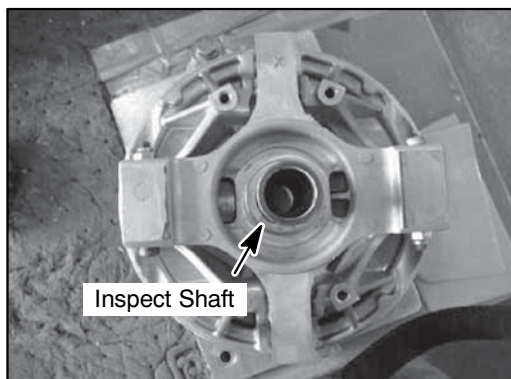
- Inspect the clutch cover gasket (C) for damage or wear, replace cover if needed. Inspect bushing inside the cover, if bushing is worn replace cover.



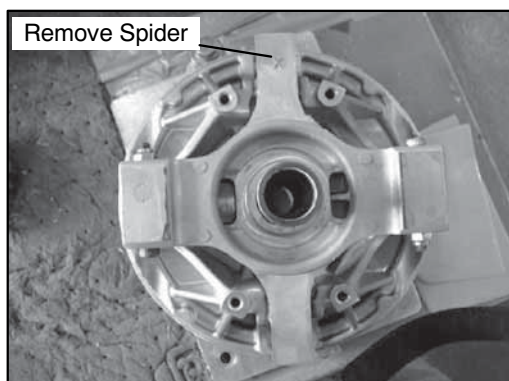
- Use a flat edged tool to carefully pry the dust cover from the drive clutch assembly. Slowly pry in different areas to evenly remove the dust cover.



- Inspect the shaft for wear, galling, nicks, or scratches. Replace clutch assembly if worn or damaged.



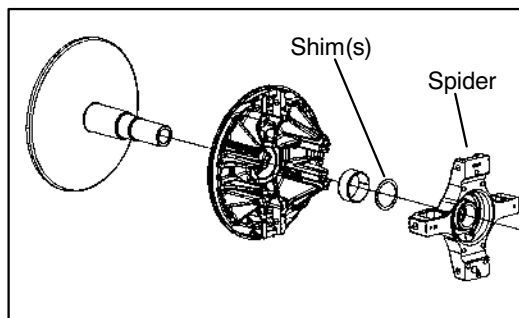
SPIDER REMOVAL (RANGER TM)



- Install clutch in a holding fixture and loosen the spider (counterclockwise).

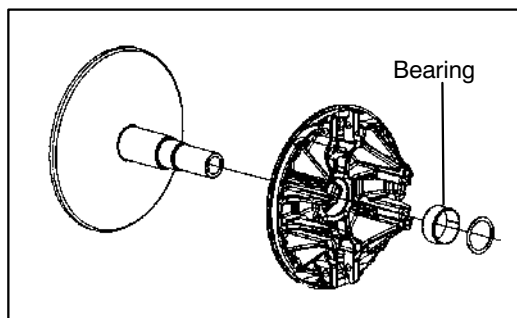


It is important that the same number and thickness of shim(s) are reinstalled beneath the spider during assembly. Be sure to note the number and thickness of washers.



Sheave Bearing Inspection

2. Inspect the bearing in the moveable sheave. If the bearing is worn or pitted, replace the drive clutch.



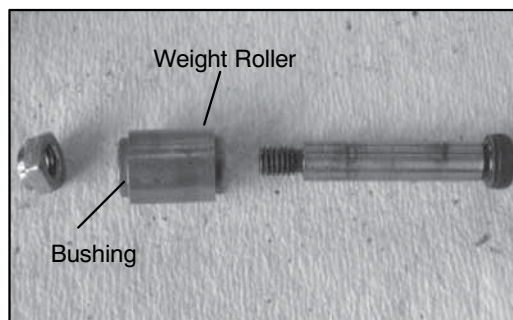
Moveable Sheave Bushing Inspection:

If the bushing is worn, replace the bushing. Refer to parts manual for new bushing.

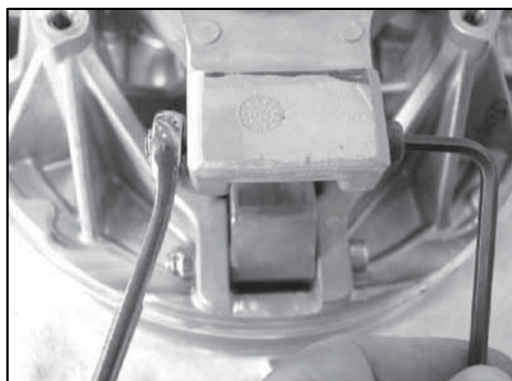
WEIGHT ROLLER AND TORQUE ROLLER INSPECTION (*RANGER TM*)

3. Inspect all weight rollers and torque rollers, and roller pins by pulling a flat metal rod across the weight roller, while the weight roller is installed in the spider. Turn roller with your finger. If you notice resistance, galling, or flat spots, replace weight weight and torque rollers in sets of two. Also inspect to see if roller and bushing are separating. The bushing in the weight roller must

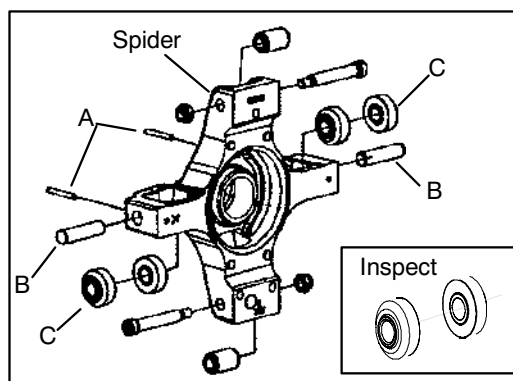
fit tight.



4. Use a wrench and allen wrench to remove the weight roller bolt and nut.



5. To remove the torque rollers, use a pin punch to remove the slotted spring pin (A) from the spider. Then slide the dowel pin (B) and torque rollers (C) out of the spider.

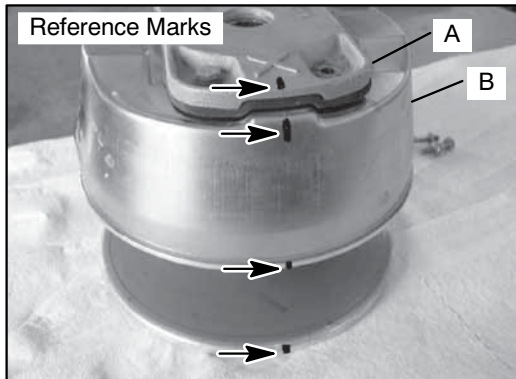


6. With the torque rollers removed, check the torque rollers for wear, denting, or flat spots.



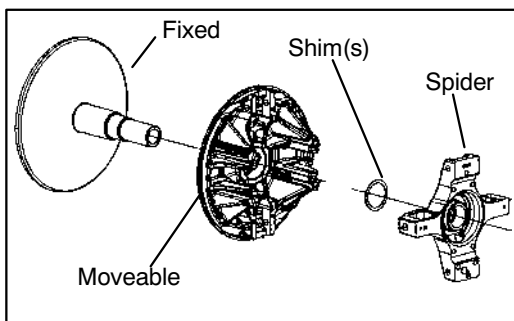


DRIVE CLUTCH ASSEMBLY (RANGER TM)



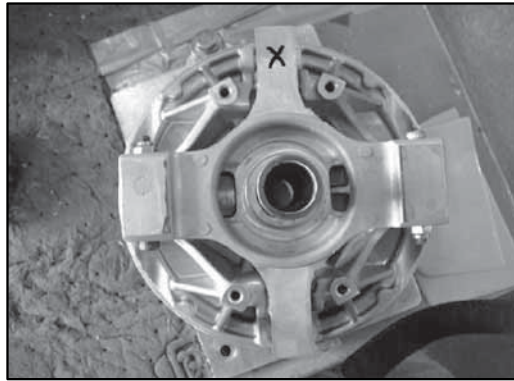
It is important that the same number and thickness of washers are reinstalled beneath the spider during assembly. **Do not apply oil or grease to the bushings.**

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" or mark made on spider, making sure spacer washers are installed underneath spider and positioned properly in recess
 - c) "X", or the marks that were made earlier, on sheaves
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, in moveable sheave.



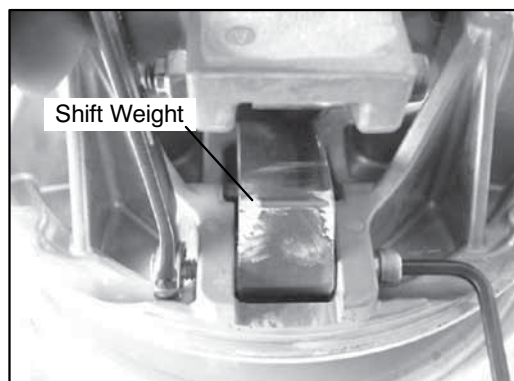
5. Torque spider to 200 ft.lbs. using the holding fixture and spider tool. Torque with smooth motion to avoid damage to the stationary sheave.

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

CAUTION:

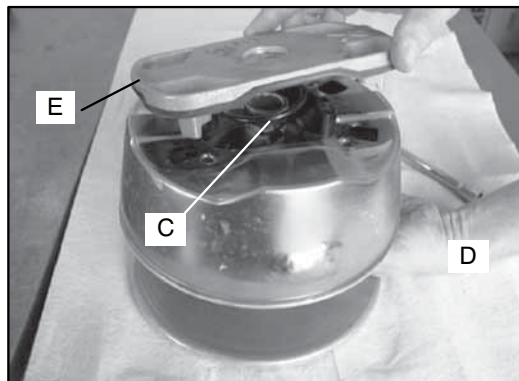
Be sure the spider spacer washers (shims) are fully seated in the recessed area in the spider. Any misalignment will alter clutch balance. Inverting the clutch while initially tightening the spider will help position the washers.

6. Install shift weights using new lock nuts on the bolts.

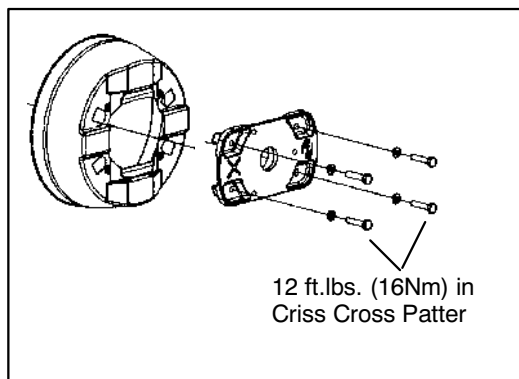


7. Align the "X" or marks and reinstall clutch spring (C), dust cover (D), and primary cover (E).

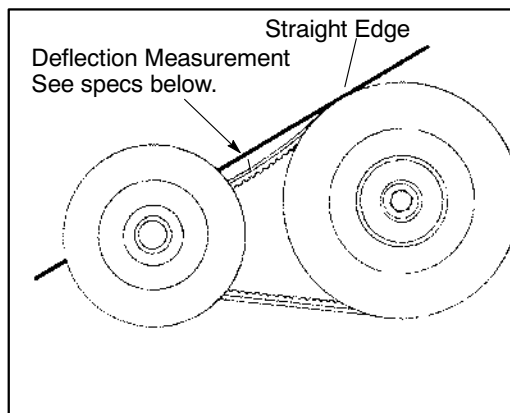




8. Install the primary cover bolts and torque the bolts to 12 ft.lbs. (16 Nm) in a criss cross pattern.



DRIVE BELT TENSION **(RANGER TM)**



RANGER TM

Belt Deflection (Tension):

2.375 ± 0.125" (6.0325 ± 0.3175 cm)

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

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

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 6.18 - 6.19.

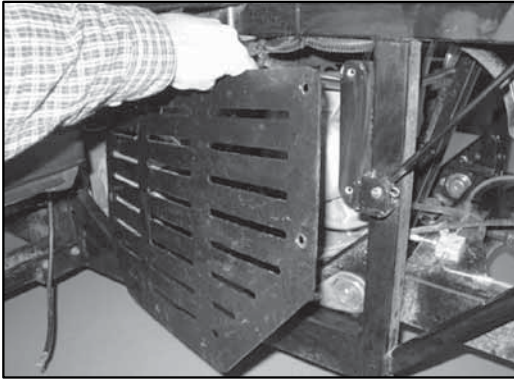
At least one shim must remain between the inner and outer sheave of the driven clutch. If proper belt deflection cannot be obtained, measure drive belt width, length, and center distance of drive and driven clutch, outlined in this section; all have an effect on belt deflection.



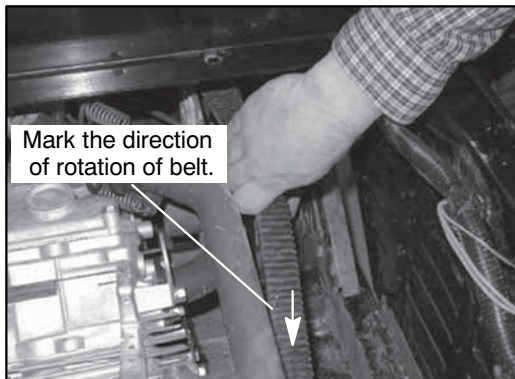


DRIVE BELT REMOVAL/INSPECTION (*RANGER TM*)

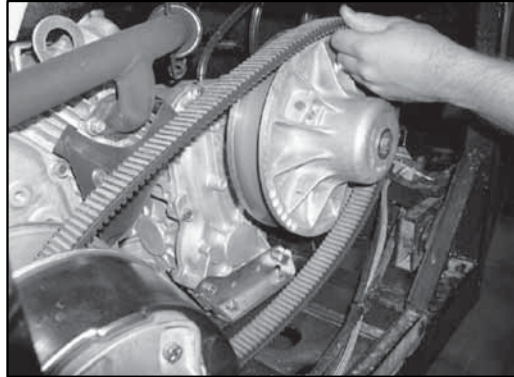
1. Remove the PVT gaurd or remove the seat and aluminum PVT gaurd to access the PVT belt.



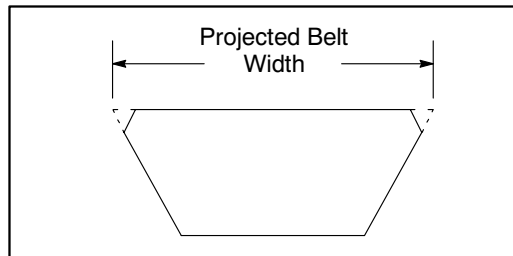
2. Mark drive belt direction of rotation so that it can be installed in the same direction. **NOTE:** Normally numbers are positioned so part numbers are easily read.



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



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



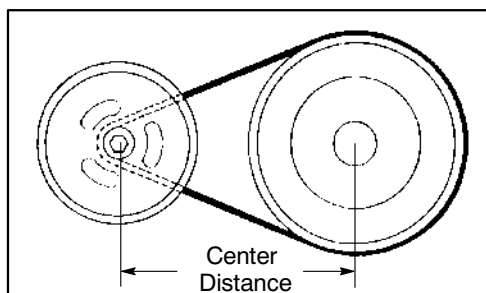
Belt Width:

New 1.355 ± 0.031" (3.44 ± 0.08 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.



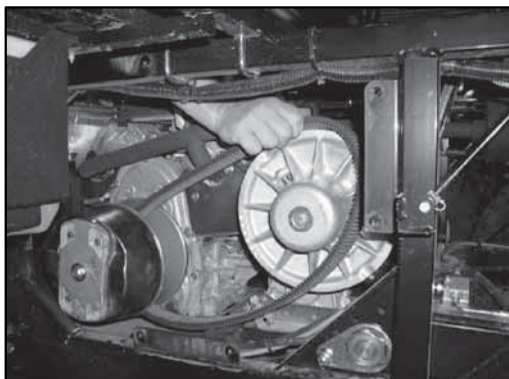
6. Inspect belt for hour glassing (extreme circular wear in at least one spot and on both sides of the belt). Hour glassing occurs when the drive train does not move and the drive clutch engages the belt.



RANGER™
Clutch Center Distance -
14.5" ± 0.1 (368.3 ± 2.54 mm)
Belt Nominal Length - 49.875" ± 0.188
(126.7 cm ± .25 cm)

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

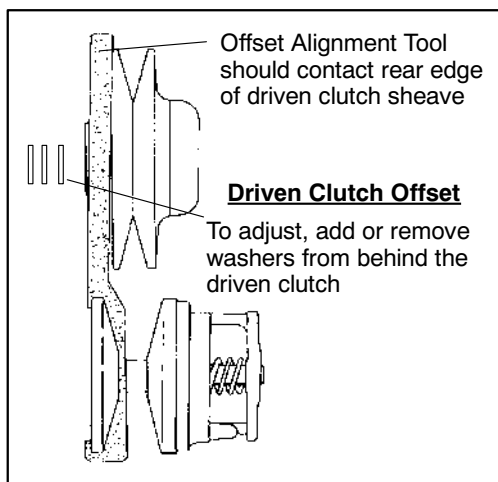
DRIVE BELT INSTALLATION **(RANGER™)**



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.

CLUTCH ALIGNMENT **(RANGER™)**



1. Remove belt and install the Clutch Offset Alignment Tool as shown above. The **RANGER™** uses a different clutch alignment tool than the standard **RANGER** and **ATV** clutch alignment





tool.

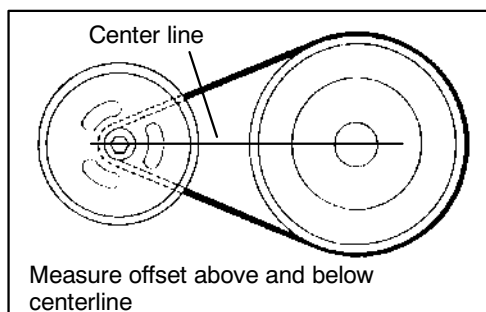
RANGER TM Clutch Alignment Tool
Tool PN: PA-47043

RANGER 2X, 4X, 6X Clutch Alignment
Tool PN: 2870654

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

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

3. Remove drive and driven clutch. See PVT Disassembly, Pages 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.

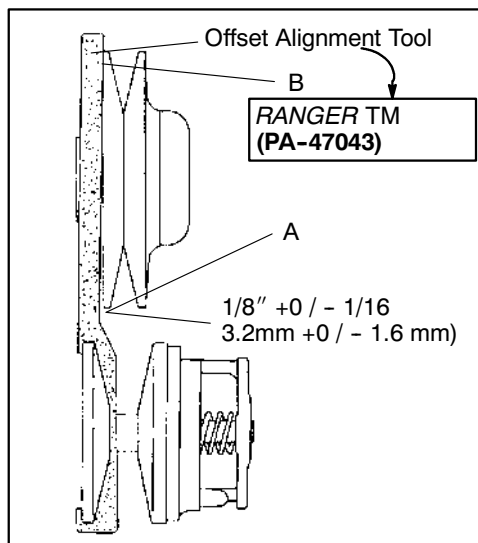


7. Measure belt deflection and measure offset both above and below sheave centerlines. Adjust if necessary.

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

Shim Kit (PN 2200126)

CLUTCH OFFSET (ALL MODELS) (RANGER TM)



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

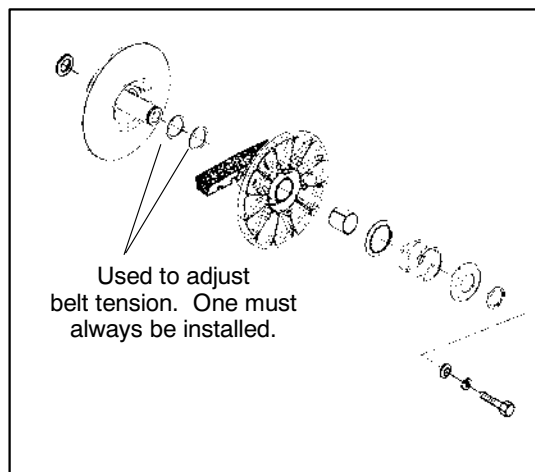
1. Install offset alignment tool as shown.

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

Spacer Washer (PN 7556401)



DRIVEN CLUTCH **DISASSEMBLY/INSPECTION**

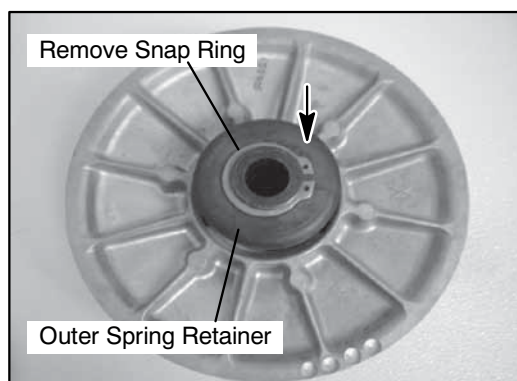
**CAUTION:**

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

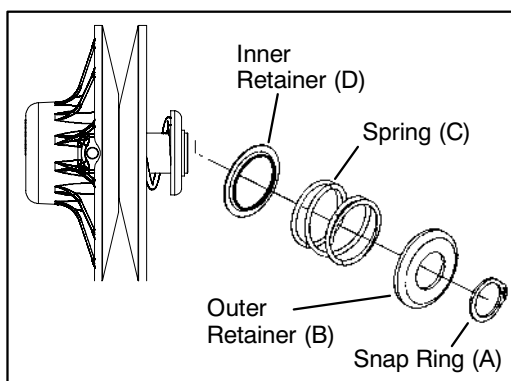
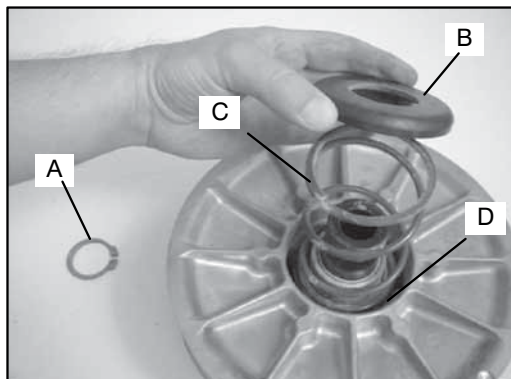
CAUTION:

The snap ring is pressure loaded by the compression ring, use caution when removing the snap ring.

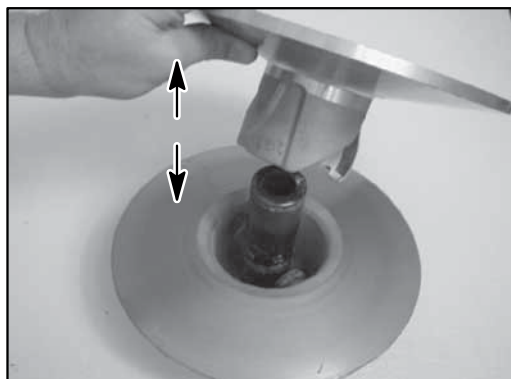
1. Apply and hold downward pressure on the outer spring retainer. Carefully remove the snap ring. Remember the outer spring retainer contains strong spring pressure.



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

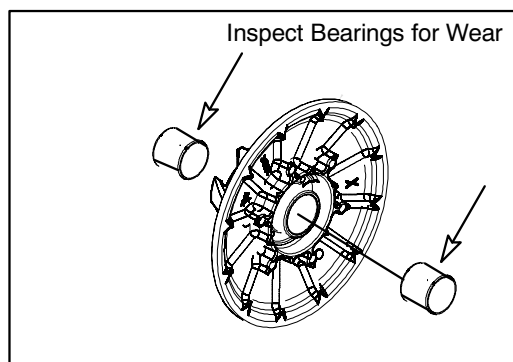
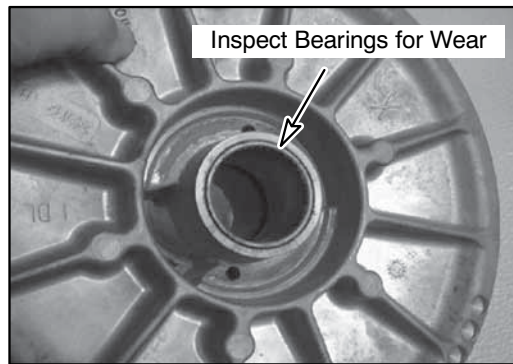


3. Separate the two clutch sheaves.



4. Inspect the helix on the moveable sheave. If the sheave is worn a new driven clutch assembly maybe needed. Make note of the number of spacer washers between the sheaves for reassembly.

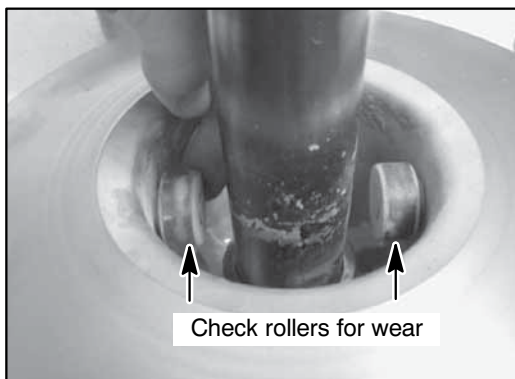




Moveable Sheave Bearing Inspection:

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

5. Check the rollers in the stationary sheave for wear. If the rollers are worn a new driven clutch assembly maybe needed.



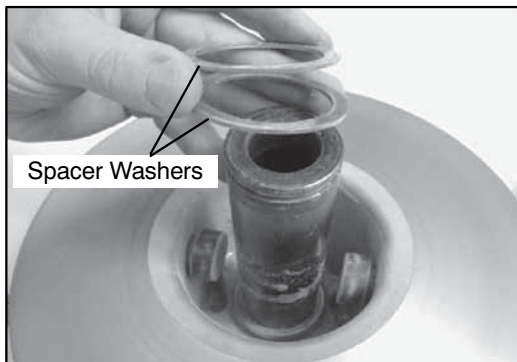
7. Inspect the Teflon™ coating on the moveable sheave bushing.
8. Inspect driven clutch faces for wear or damage.
9. Clean and inspect splines on helix and transmission input shaft.
10. Lube splines with a light film of grease. **Do not lubricate the bearings!**

DRIVEN CLUTCH ASSEMBLY

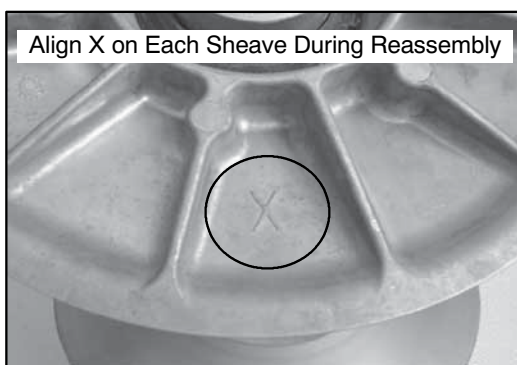
1. Install moveable sheave with spacer washers. **Important:** At least one spacer washer must be installed. Teflon™ bearings are self-lubricating. Do not apply oil or grease to the bearings.

6. Inspect the bearing inside the moveable sheave.



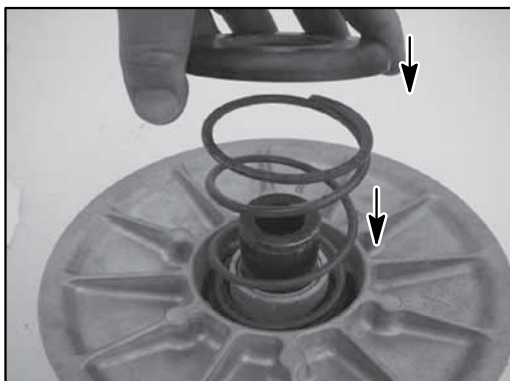


2. Align the **X** mark's on each of the sheaves during reassembly.

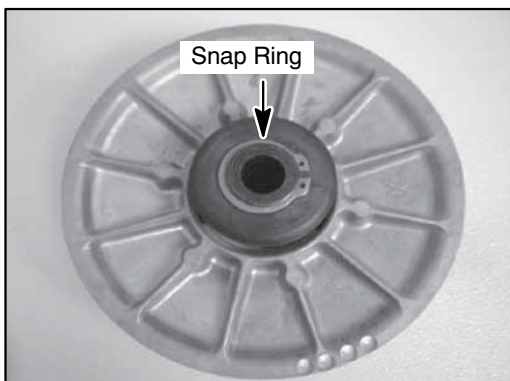


3. Install the inner spring retainer into the moveable clutch sheave. Install spring into inner retainer.

4. Install outer reatainer onto top of spring.



5. Compress the outer retainer and install the snap ring.





TROUBLESHOOTING

Situation	Probable Cause	Remedy
Engine RPM below specified operating range, although engine is properly tuned.	-Wrong or broken drive clutch spring. -Drive clutch shift weight too heavy. -Driven clutch spring broken or installed in wrong helix location.	-Replace with recommended spring. -Install correct shift weight kit to match engine application. -Replace spring; refer to proper installation location.
Erratic engine operating RPM during acceleration or load variations.	-Drive clutch binding. -Belt worn unevenly - thin/burnt spots -Driven clutch malfunction. -Sheave face grooved.	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. - Replace belt a. Replace ramp buttons. b. Inspect movable sheave for excessive bushing clearance/replace. -Replace the clutch.
Engine RPM above specified operating range.	-Incorrect drive clutch spring (too high spring rate). -Drive clutch shift weights incorrect for application (too light). -Drive clutch binding. -Driven clutch binding. -Converter sheaves greasy; belt slippage.	-Install correct recommended spring. -Install correct recommended shift weights. -Disassemble and clean clutch, inspecting shift weights and rollers. Reassemble without the spring and move sheaves through entire range to further determine probable cause. -Disassemble, clean, and inspect driven clutch, noting worn sheave bushing and ramp buttons and helix spring location. -Clean sheaves with denatured alcohol or brake cleaner, install new belt.
Harsh drive clutch engagement.	-Drive belt worn too narrow. -Excessive belt/sheave clearance with new belt.	-Replace belt. -Perform belt/sheave clearance adjustment with shim washers beneath spider.
Drive belt turns over	-Wrong belt for application. -Clutch alignment out of spec. -Engine mount broken or loose.	-Replace with correct belt. -Adjust alignment offset. -Inspect/adjust or replace.
PVT cover overheating (melting)	-Plugged air intake or outlet -Belt slippage due to water, oil, grease, etc., rubbing on cover -Clutches or weight being applied to cover while in operation -High vs. low range	-Clear obstruction. -Inspect system. Clean, repair or replace as necessary. Seal PVT system ducts. -Remove weight. Inform operator. -Instruct operator on guidelines for operation in proper driving range for different terrain as outlined in Owner's Safety and Maintenance Manual.
Water ingestion	-Cover seals or ducts leaking -Operator error	-Find leak and repair as necessary. -Instruct operator on guidelines for operation in wet terrain as outlined in Owner's Safety and Maintenance Manual.





TROUBLESHOOTING

Situation	Probable Cause	Remedy
Belt slippage	-Belt worn out -Water ingestion -Belt contaminated with oil or grease	-Replace belt. -Inspect and seal PVT system. -Inspect and clean.
Belt burnt, thin spots	-Abuse (continued throttle application when vehicle is stationary, excess load) -Dragging brake -Slow, easy clutch engagement	-Caution operator to operate machine within guidelines. -Vehicle operated with park brake on. Inspect brake system. -Fast, effective use of throttle for efficient engagement.
PVT noise	-Belt worn or separated, thin spots, loose belt -Broken or worn clutch components, cover hitting clutches	-Replace belt. -Inspect and repair as necessary.
Engagement erratic or stabby	-Thin spots on belt, worn belt -Drive clutch bushings stick	-Replace belt. Refer to belt burnt troubleshooting and instruct operator. -Inspect and repair clutches.

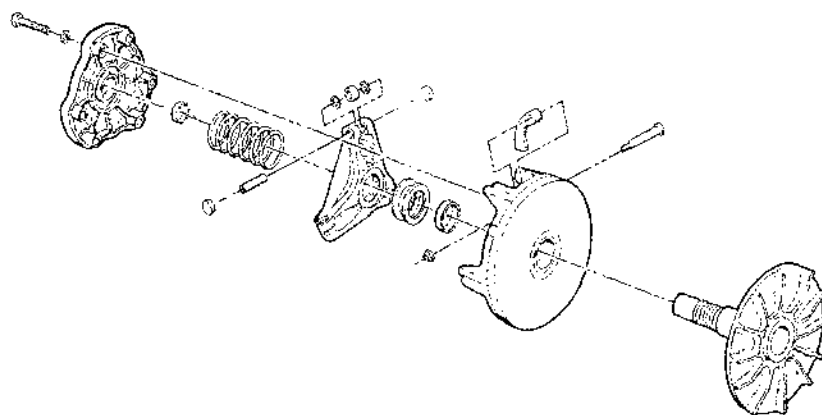
NOTES



This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**RANGER 2X4, 4X4, 6X6 CLUTCHING SECTION**

Service Tools, Supplies & Torques	6.26
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PVT Assembly	6.27-6.28
PVT Sealing and Ducting Components	6.29
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Drive Clutch Spring Specifications	6.31
Shift Weights	6.32
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Driven Clutch Assembly	6.43
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Troubleshooting	6.47





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
Clutch Compression Tool	8700220
Clutch Bushing Replacement Tool Kit	2871025
Standard Clutch Alignment Tool	2870654

SPECIAL SUPPLIES

PART NUMBER

Loctite™ 680	2870584
RTV Silicone Sealer	2870661
Loctite Gasket Remover	2870601

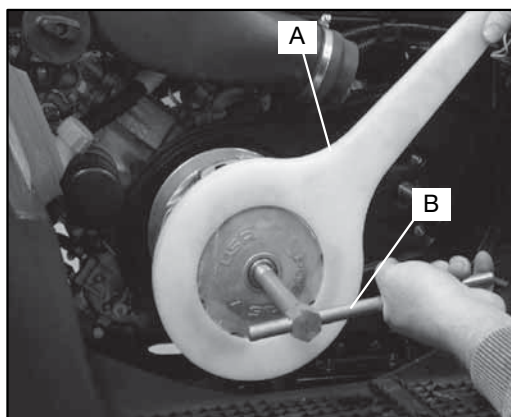
PVT SYSTEM FASTENER TORQUES

ITEM	TORQUE VALUE ft.lbs. (Nm)
Drive Clutch Retaining Bolt	40 ft. lbs. (54 Nm)
Driven Clutch Retaining Bolt	17 ft. lbs. (23 Nm)
PVT Inner Cover Bolts	12 ft. lbs. (16 Nm)
PVT Outer Cover Bolts	45-50 in.lbs (5-5.6 Nm)
Drive Clutch Spider	200 ft. lbs. (271 Nm)
Drive Clutch Spider Lock Nut (Plastic)	15 ft. lbs. (20.3 Nm)
Drive Clutch Cover Plate	90 in. lbs. (10 Nm)

PVT DISASSEMBLY (RANGER 2X,4X,6X)

Some fasteners and procedures will vary. Refer to the appropriate parts manual for proper fasteners and fastener placement. (See Page 6.29).

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 6.29.
5. Mark the drive belt direction of rotation and remove drive belt. See Page 6.37 for drive belt removal.



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

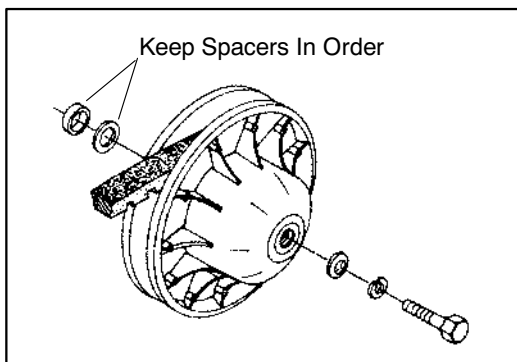
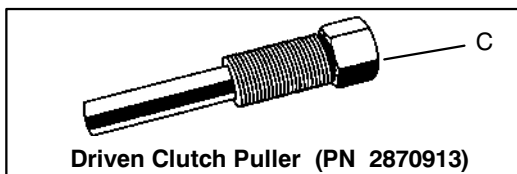
Drive Clutch Puller (PN 2870506)

Drive Clutch Holder (PN 9314177)

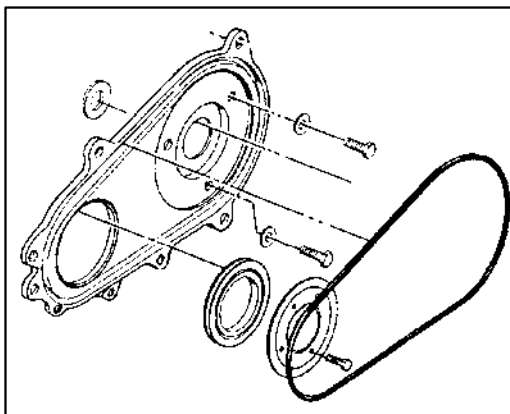




8. Remove driven clutch retaining bolt and driven clutch. Use the Driven Clutch Puller (PN 2870913) if necessary.



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



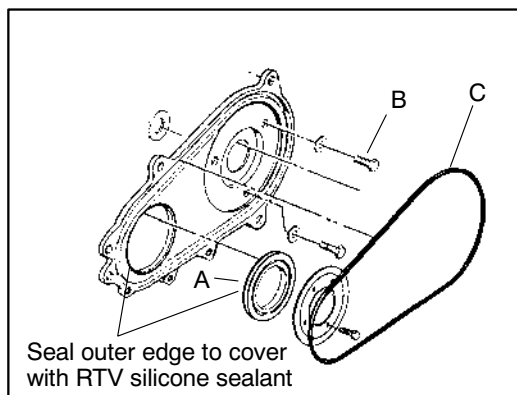
10. Remove screws and retainer plate.
11. Remove inner cover retaining bolts at rear of cover.
12. Remove cover along with foam seal on back of cover or shaft.

PVT ASSEMBLY (RANGER 2X,4X,6X)



1. Inspect PVT inner cover-to-engine seal. Replace if cracked or damaged.
2. Place a new foam seal on transmission input shaft.
3. Apply RTV silicone sealant to outside edge of inner cover-to-engine seal, to ensure a water tight fit between the seal and the cover. Surfaces must be clean to ensure adhesion of silicone sealant.
4. Reinstall cover and tighten rear cover bolts just enough to hold it in place.

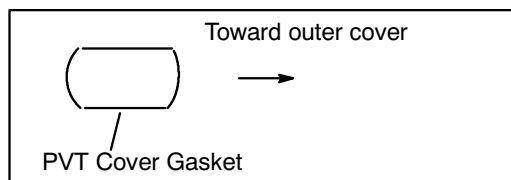




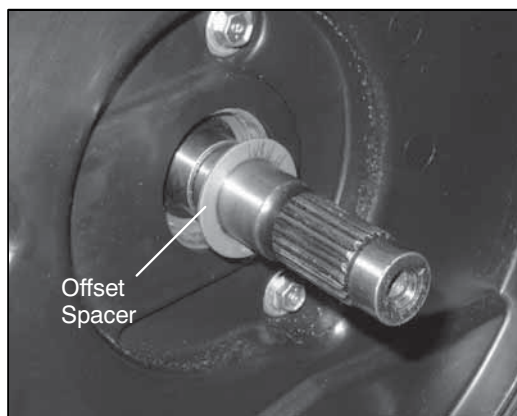
5. Fit lip of inner cover seal (A) to engine. Install seal retainer plate and tighten screws securely.
6. Torque rear inner cover bolts (B) to specification.

Inner Cover Bolt Torque (Rear):
 12 ft. lbs. (16.6 Nm)
Outer Cover Bolt Torque:
 45-50 in.lbs. (5-5.6 Nm)
Driven Clutch Retaining Bolt Torque:
 17 ft. lbs. (23.5 Nm)
Drive Clutch Retaining Bolt Torque:
 40 ft. lbs. (55 Nm)

11. Clean end of taper on crankshaft and the taper bore inside drive clutch.
12. Install drive clutch and torque retaining bolt to specification.
13. Reinstall drive belt noting direction of rotation. If a new belt is installed, install so numbers can be easily read.



14. Replace PVT outer cover rubber gasket with the narrow side out (C).
15. Reinstall PVT outer cover and secure with screws Torque to 45-50 in. lbs. (5-5.6 Nm).
16. Reinstall rear cab assembly and seat.

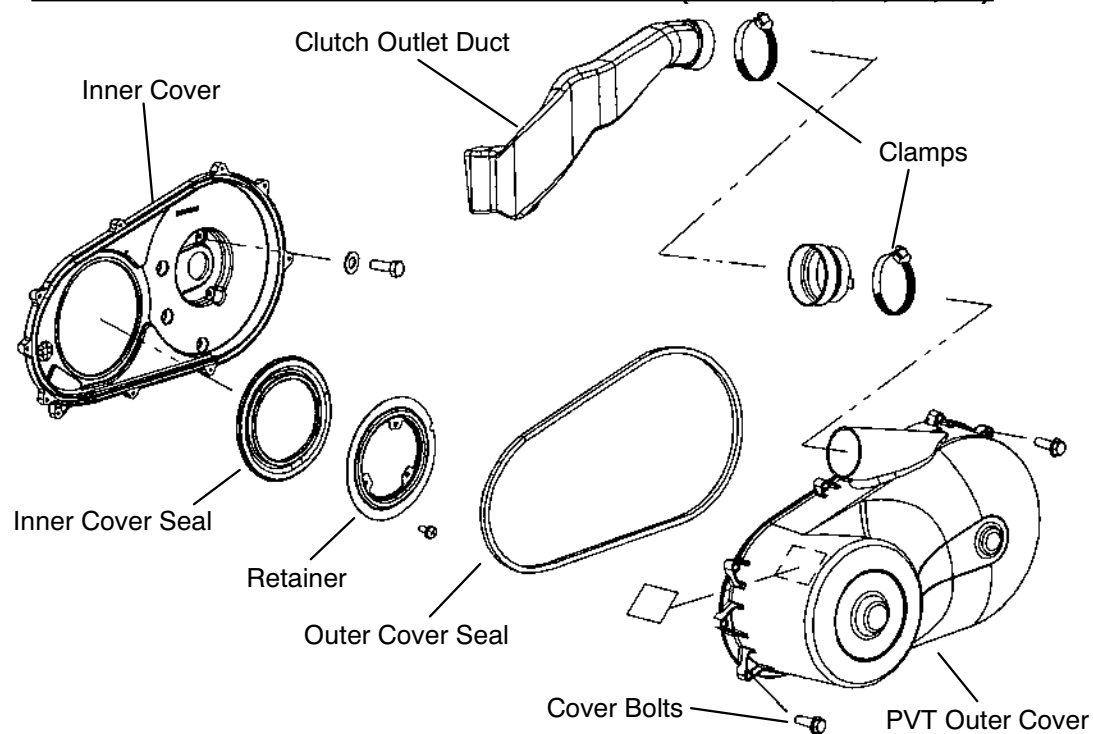


7. Install clutch offset spacers on transmission input shaft.
8. Clean splines inside driven clutch and on the transmission input shaft.
9. Apply a light film of grease to the splines on the shaft.
10. Install the driven clutch, washer, lock washer, and retaining bolt. Torque to specification.



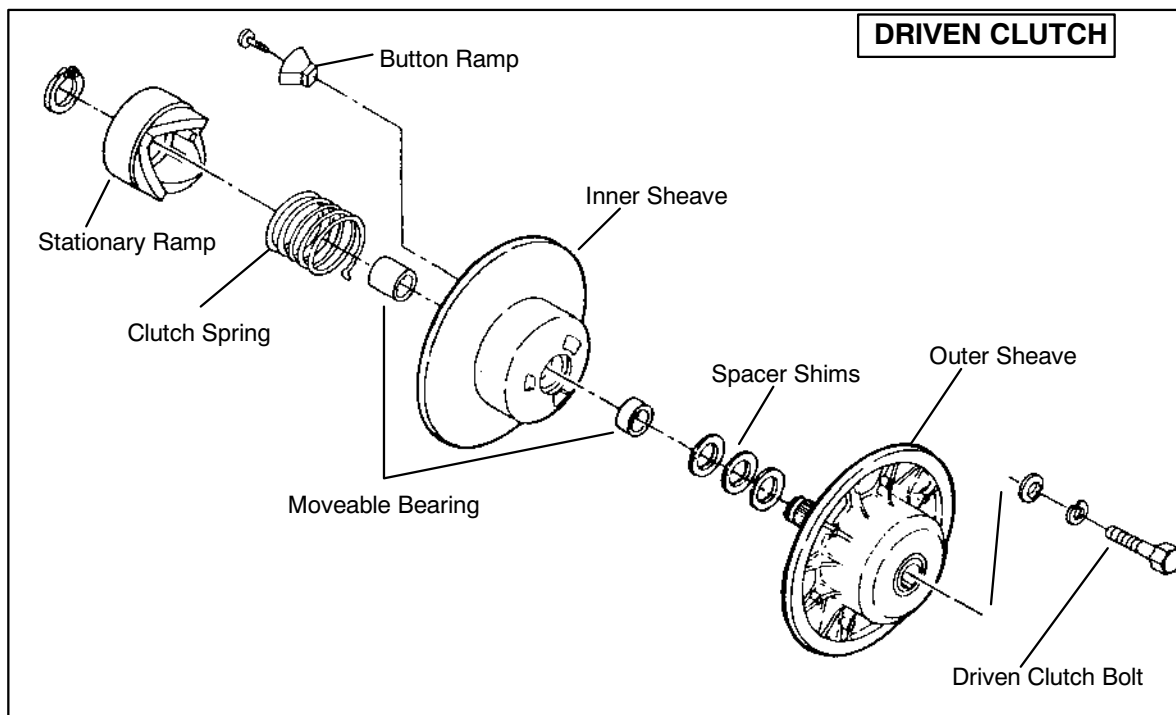
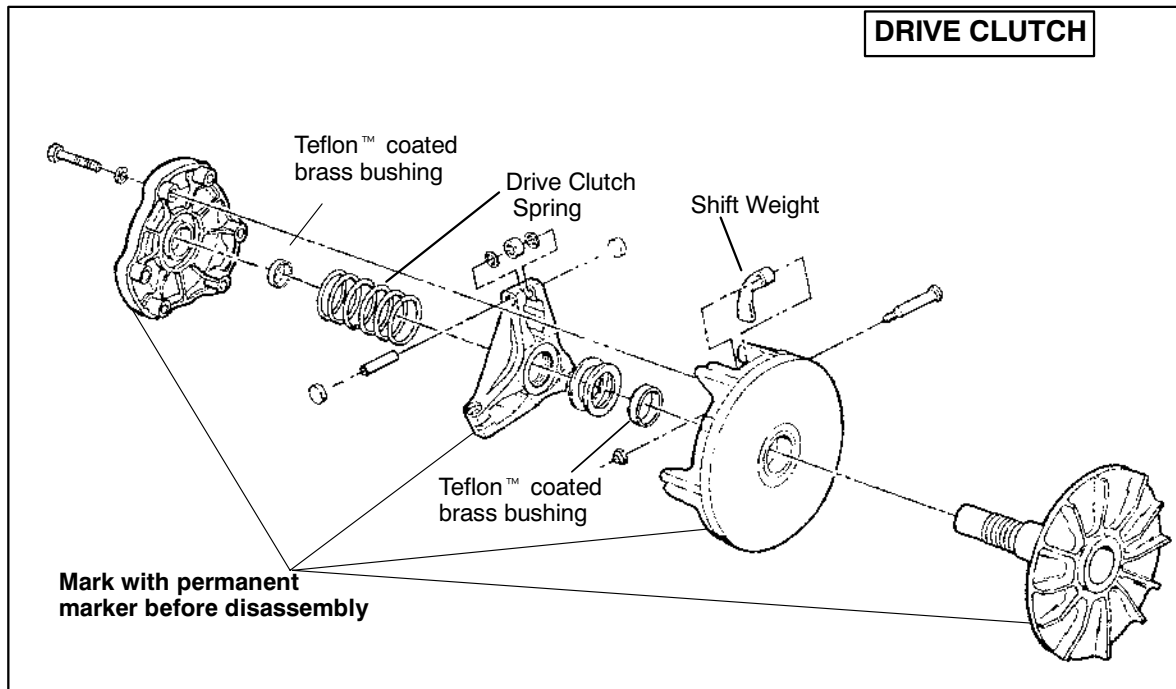
PVT SEALING, GUARD, AND DUCTING COMPONENTS

SEALING AND DUCTING COMPONENTS (*RANGER 2X,4X,6X*)





DRIVE CLUTCH EXPLODED VIEW





DRIVE CLUTCH SPRING SPECIFICATIONS (RANGER 2X,4X,6X)

The drive clutch spring has two primary functions:

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

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

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

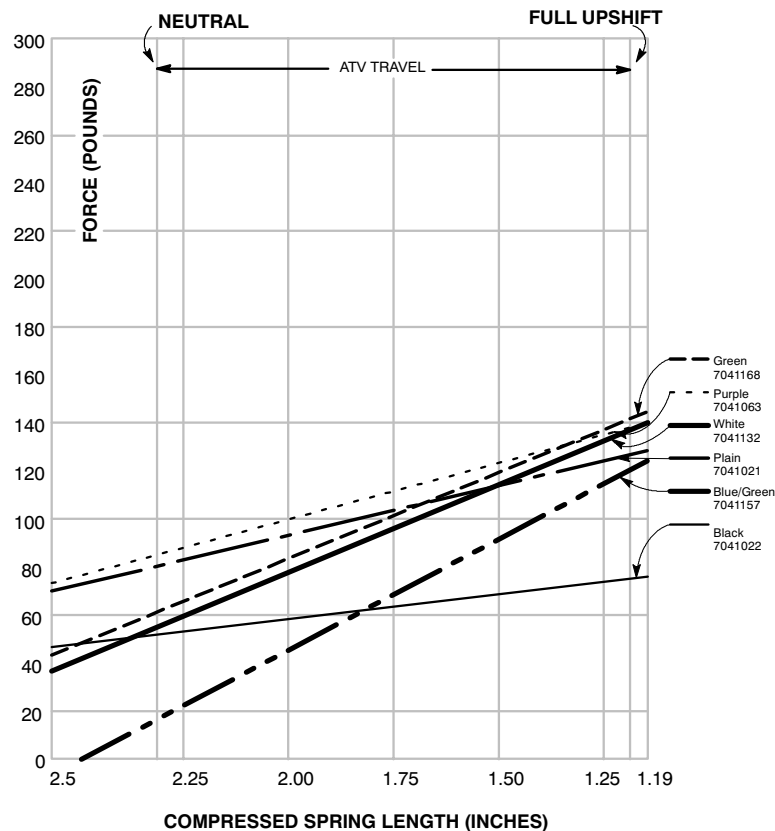
The drive clutch spring is one of the most critical components of the PVT system. It is also one of the easiest to service. Due to the severe stress the spring is subject to during operation, it should always be inspected for tolerance limits during any clutch operation diagnosis or repair.

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

Primary Clutch Springs

Secondary Clutch Springs

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

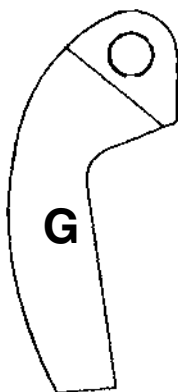




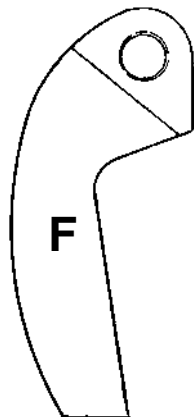
SHIFT WEIGHTS (RANGER 2X,4X,6X)

Shown below are the shift weights which have been designed for, or which may be used in the PVT system. These shift weights have many factors

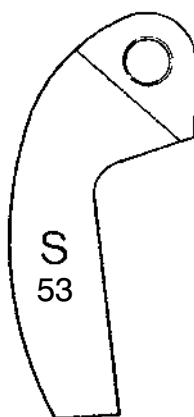
designed into them for controlling engagement RPM and shifting patterns. Shift weights should not be changed or altered without first having a thorough understanding of their positioning and the effects they may have on belt to sheave clearance, clutch balance and shifting pattern.



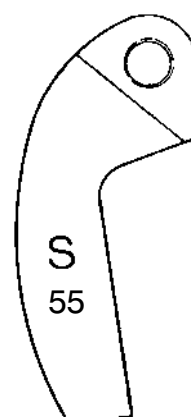
PN 5630514
48 gr



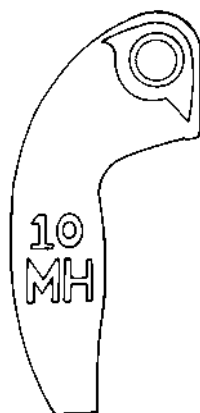
PN 5630515
45 gr



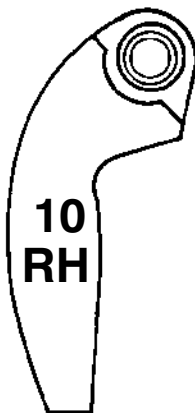
PN 5630095
53 gr



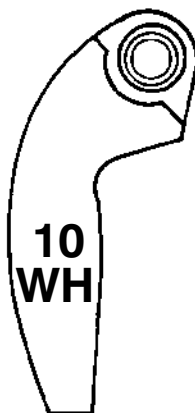
PN 5630509
55 gr



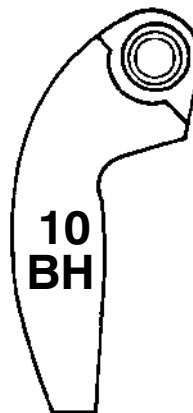
PN 5630513
50.5 gr



PN 5630709
44 gr



PN 5630710
46 gr



PN 5630711
47gr





DRIVE CLUTCH INSPECTION

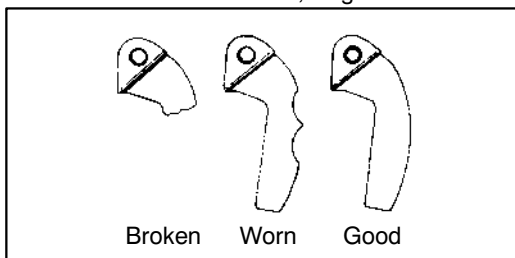
⚠ WARNING

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

All PVT system maintenance repairs must be performed only by an authorized Polaris service technician who has attended a Polaris sponsored service training seminar and understands the proper procedures as outlined in this manual. **Because of the critical nature and precision balance incorporated into the PVT system, it is absolutely essential that no attempt at disassembly or repair be made without factory authorized special tools and service procedures.**



1. Remove shift weight bolts and weights. Inspect as shown. The contact surface of the weight should be smooth and free of dents or gall marks. Inspect the weight pivot bore and pivot bolts for wear or galling. If weights or bolts are worn or broken, replace in sets of three with new bolts. **NOTE:** A damaged shift weight is usually caused by a damaged or stuck roller in the spider assembly. See "ROLLER, PIN AND THRUST WASHER INSPECTION", Page 6.35.



DRIVE CLUTCH INSPECTION

BUTTON TO TOWER CLEARANCE INSPECTION

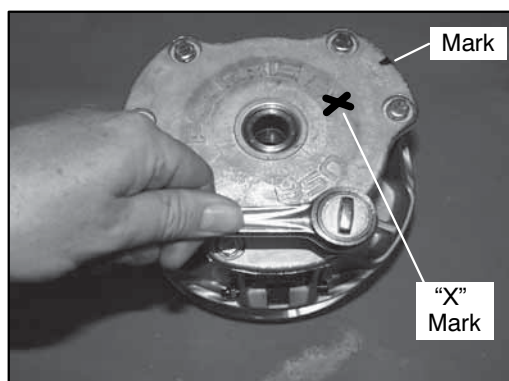
1. Inspect for any clearance between spider button to tower. If clearance exists, replace all buttons and inspect surface of towers. See "SPIDER REMOVAL" Page 6.34.



**Button to Tower Clearance:
000 - .001"**

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

DRIVE CLUTCH DISASSEMBLY

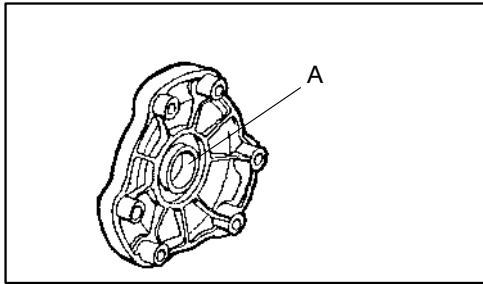


1. Using a permanent marker, mark the cover, spider, moveable and stationary sheaves, and steel post to the stationary sheave for reference. The X's may not have been in alignment before disassembly.





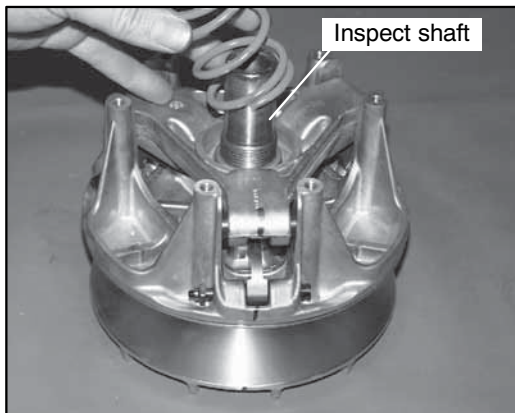
- Remove cover bolts evenly in a cross pattern, and remove cover plate.



Cover Bushing Inspection:

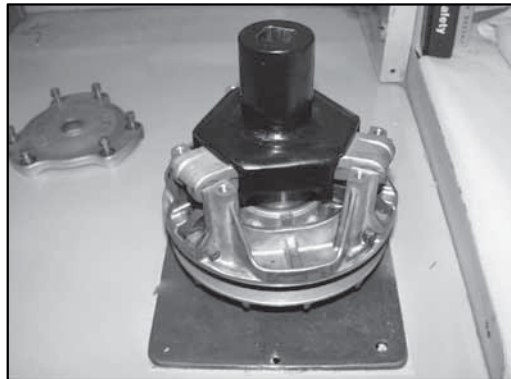
Replace the cover bushing if more brass than Teflon™ is visible on the bushing. Refer to bushing replacement in this chapter.

- Inspect cover bushing (A). The outer cover bushing is manufactured with a Teflon™ coating. Bushing wear is determined by the amount of Teflon™ remaining on the bushing.



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

SPIDER REMOVAL



Clutch Holding Fixture:
(PN 2871358)

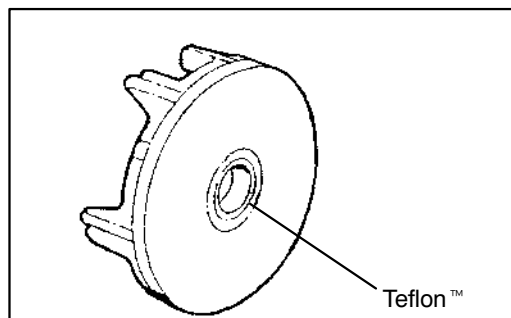
Spider Removal Tool:
(PN 2870341)

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

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

Moveable Sheave Bushing Inspection

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

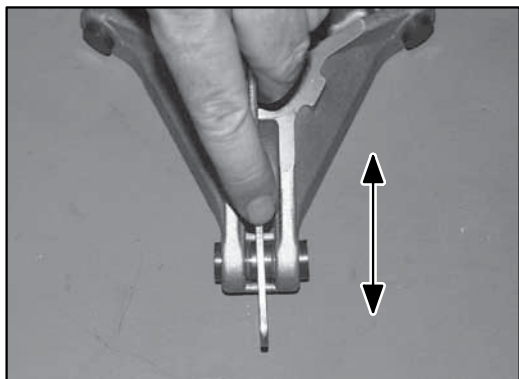


Moveable Sheave Bushing Inspection:

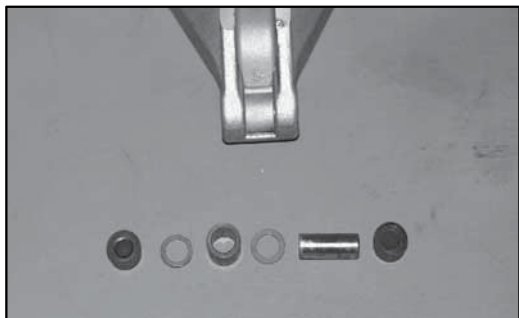
Replace the cover bushing if more brass than Teflon™ is visible on the bushing. Refer to bushing replacement in this chapter.



ROLLER, PIN AND THRUST WASHER INSPECTION



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



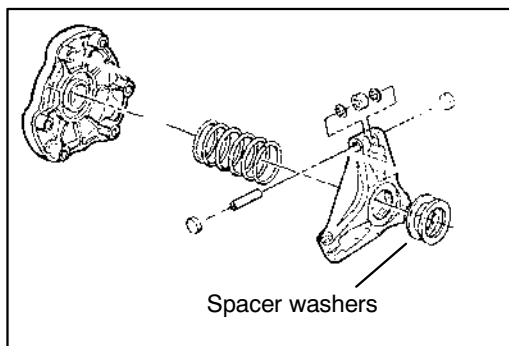
2. Rubber backed buttons can be used in all ATV clutches *if the hollow roller pin is changed to the solid roller pin.* **NOTE:** The rubber side of the button is positioned toward the solid roller pin.

DRIVE CLUTCH ASSEMBLY



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

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) 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



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, in moveable sheave.

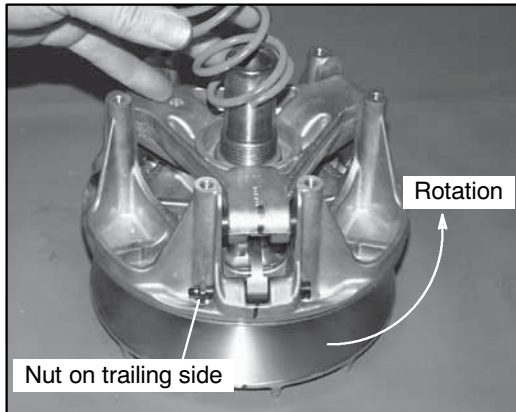




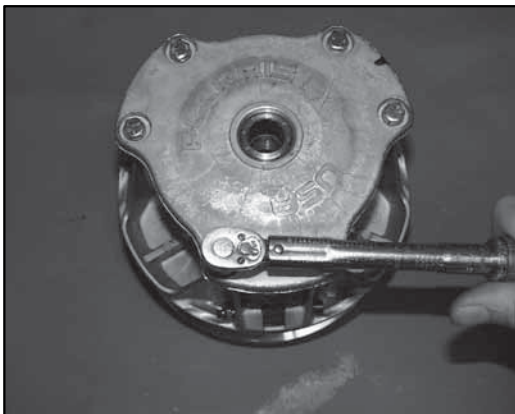
5. Torque spider to specification using the holding fixture and spider tool. Torque with smooth motion to avoid damage to the stationary sheave. Refer to Page 6.26 for torque specification.

CAUTION:

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



6. Install shift weights using new lock nuts on the bolts.
7. Reinstall clutch spring.

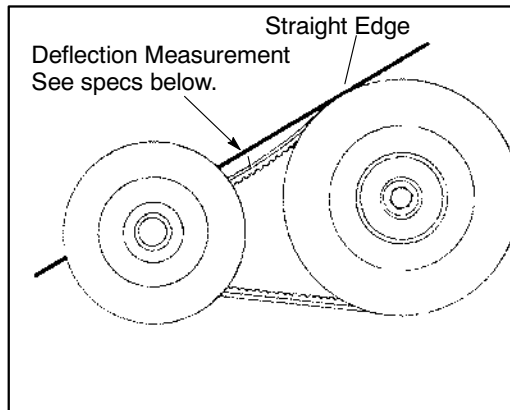


Spider Torque:
200 ft. lbs. (276 Nm)

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

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

DRIVE BELT TENSION



RANGER 2x,4x,6x
Belt Deflection (Tension):
1 1/8" (2.9 cm) - 1 1/4" (3.2 cm)

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

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

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

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

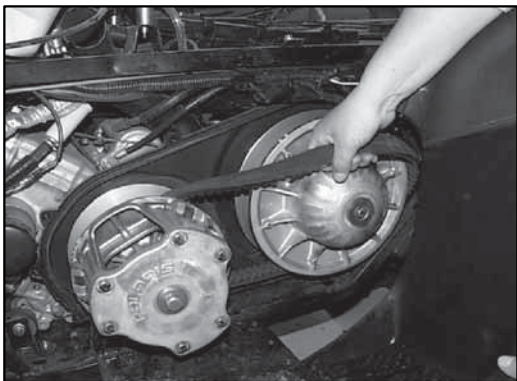
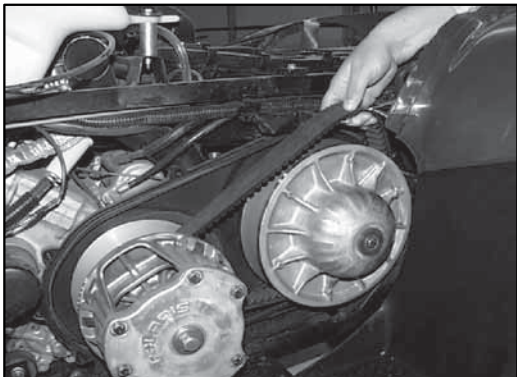
See DRIVEN CLUTCH
DISASSEMBLY/INSPECTION, Pages 6.42.

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.

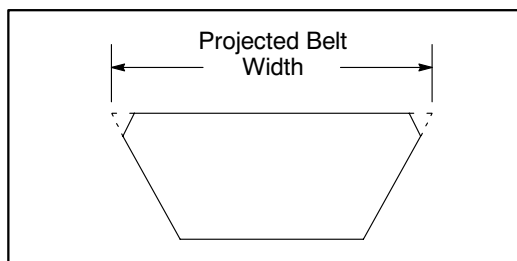


DRIVE BELT REMOVAL/INSPECTION

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



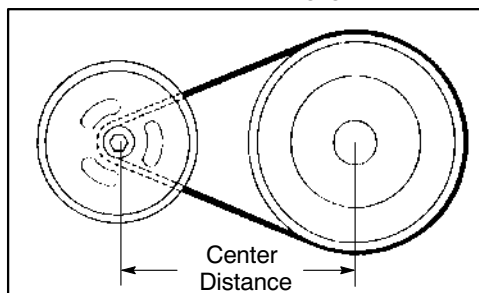
Belt Width:

New 1.174 - 1.188" (2.98-3.02 cm)
Wear Limit 1.125" (2.86 cm)

Belt Width:

New 1.188 ± 0.031" (2.98-3.02 cm)
Wear Limit 1.125" (2.86 cm)

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



RANGER 2X, 4X, 6X

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

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

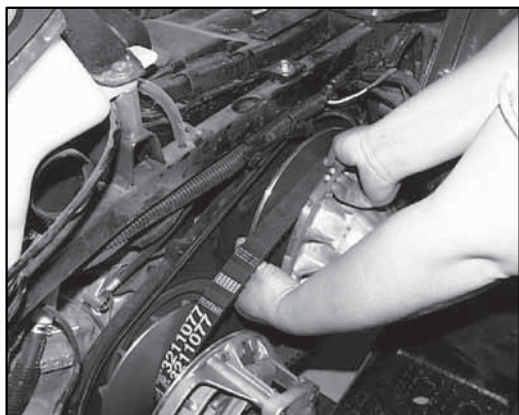




deflection. Belts which measure shorter than nominal length may require driven shimming or a shorter center distance. *Remember, proper belt deflection is the desired goal - not a specific center distance.*

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

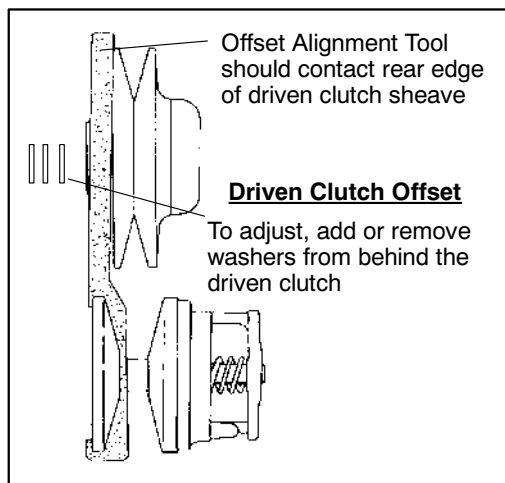
DRIVE BELT INSTALLATION



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.

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

CLUTCH ALIGNMENT



1. Remove belt and install the Clutch Offset Alignment Tool as shown above. The *RANGER*™ uses a different clutch alignment tool than the standard *RANGER* and ATV clutch alignment tool.

***RANGER* 2X, 4X, 6X Clutch Alignment Tool PN: 2870654**

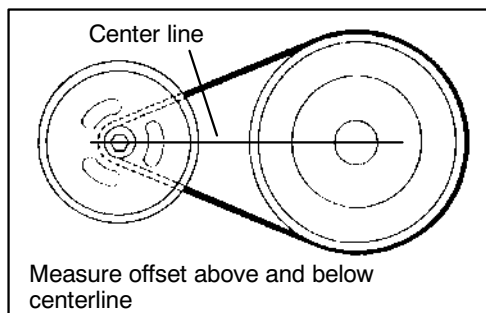
***RANGER*™ Clutch Alignment Tool PN: PP-46969**

2. With tool touching rear of driven clutch inner sheave, the distance at point "A" should be $\frac{1}{8}$ ".

If the distance is greater than $\frac{1}{8}$ " or less than $\frac{1}{16}$ ", clutch alignment must be adjusted as follows:

3. Remove drive and driven clutch. See PVT Disassembly, Pages 6.26.
4. Remove PVT inner cover.
5. Loosen all engine mounts. Move front of engine to the right or left slightly until alignment is correct.
6. Tighten engine mounts and verify alignment is correct.



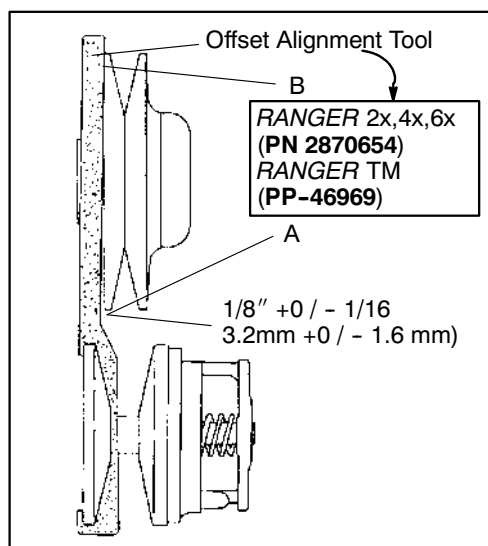


7. Measure belt deflection and measure offset both above and below sheave centerlines. Adjust if necessary.

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

Shim Kit (PN 2200126)

CLUTCH OFFSET (ALL MODELS)



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

1. Install offset alignment tool as shown.
Offset is correct when rear of tool contacts rear of inner sheave with driven clutch pushed completely

inward on shaft and bolt torqued. Adjust offset by adding or removing spacer washers between back of driven clutch and spacer as shown.

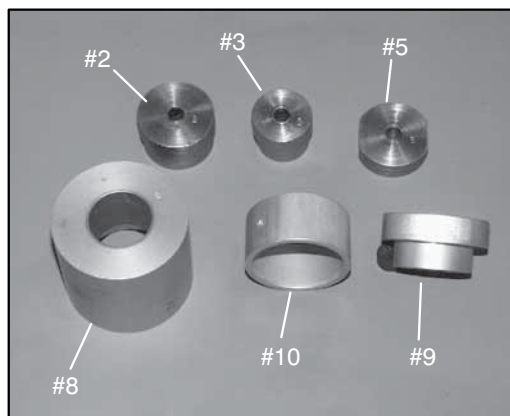
Spacer Washer (PN 7556401)

DRIVE CLUTCH BUSHING SERVICE (ALL MODELS)

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

Stamp	Qty.	Part Description	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 Removal 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

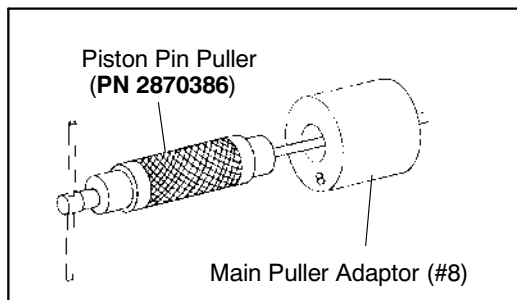




grease puller threads.

Piston Pin Puller (PN 2870386)

- Remove nut from puller rod and set aside.



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



- 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.
- 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



- Turn sheave and puller barrel together counterclockwise on puller rod until bushing is removed.
- Remove nut from puller rod and set aside.
- Pull bushing removal tool and adapter from puller rod. Remove bushing from tool and discard.

DRIVE CLUTCH MOVEABLE SHEAVE - BUSHING INSTALLATION

- Place the Main Puller Adapter (#8) (PN 5020632) onto the puller.
- 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)

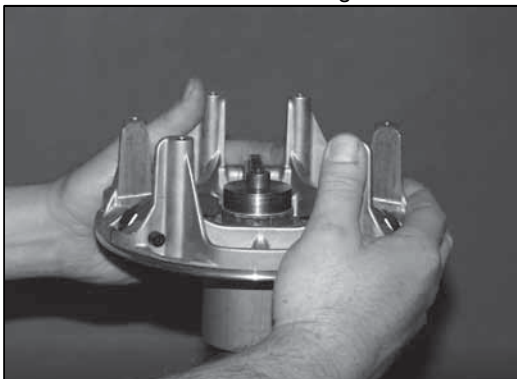
Loctite™ 680 (PN 2870584)

- 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.
- Install nut on puller rod and hand tighten. Turn barrel to apply additional tension if needed.



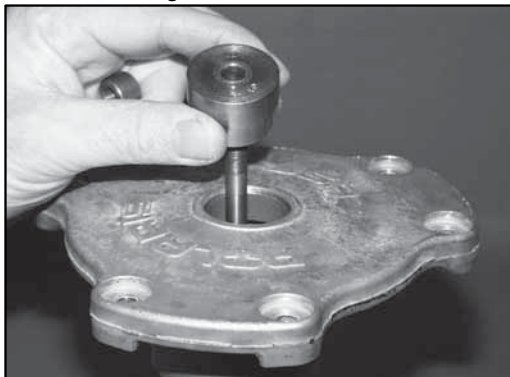


5. Turn sheave and barrel together counterclockwise until bushing is seated.



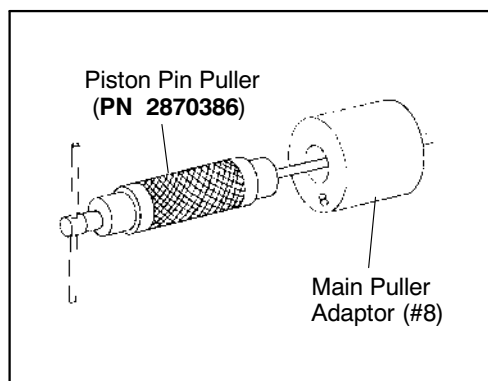
6. Remove nut from puller rod and set aside.
7. Remove sheave from puller.
8. Remove installation tool.

cover bushing.

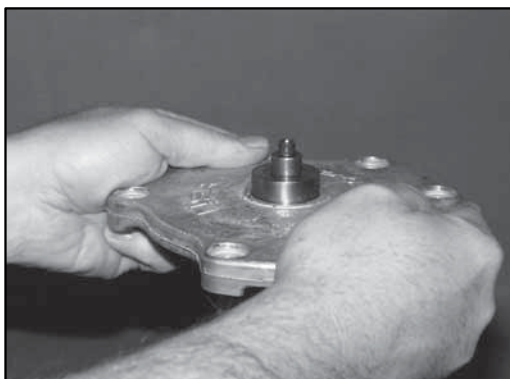


3. With inside of cover toward vise, slide cover onto puller.
4. Install nut onto puller rod and hand tighten. Turn puller barrel to increase tension as needed.

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



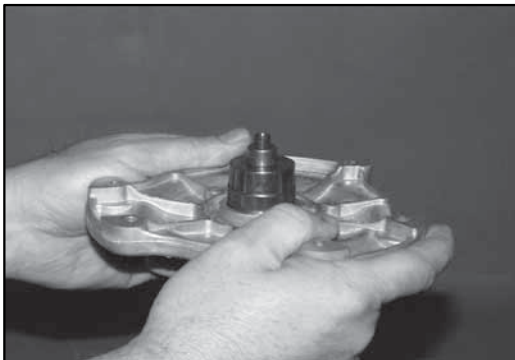
5. Turn clutch cover counterclockwise on puller rod until bushing is removed.
6. Remove nut from puller rod and set aside.
7. Remove bushing and bushing removal tool from puller. Discard bushing.

DRIVE CLUTCH COVER - BUSHING INSTALLATION



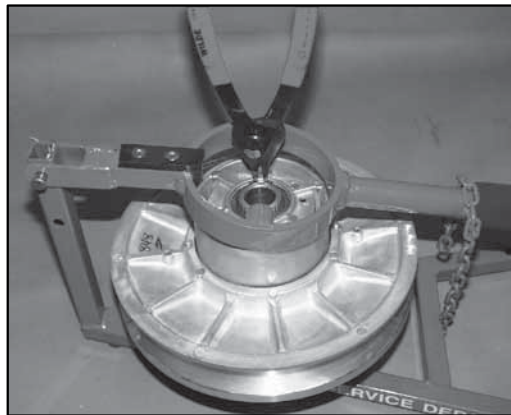


1. Apply Loctite™ 680 (PN 2870584) to the back side of new bushing. Working from inside of cover, insert bushing and bushing installation tool into center of clutch cover.

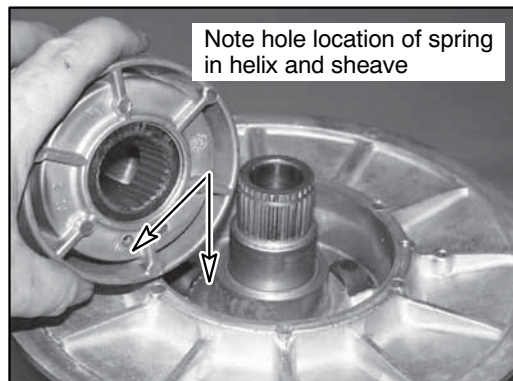


Bushing (PN 3576510)
Loctite™ 680 (PN 2870584)

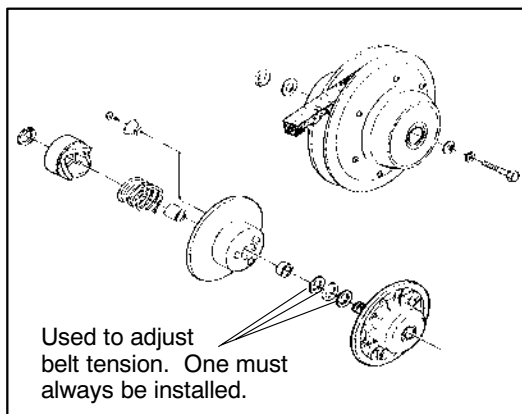
2. With the Main Puller Adapter (#8) (PN 5020632) on the puller, insert cover onto puller rod, placing outside of cover toward vise.
3. Install nut on rod and hand tighten. Turn puller barrel to apply more tension if needed.
4. Turn clutch cover and barrel together counterclockwise on puller rod until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



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.



DRIVEN CLUTCH DISASSEMBLY/INSPECTION



CAUTION:

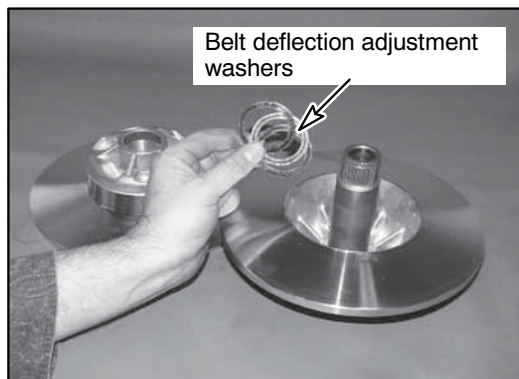
Wear eye protection when removing snap ring to prevent serious personal injury.

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.

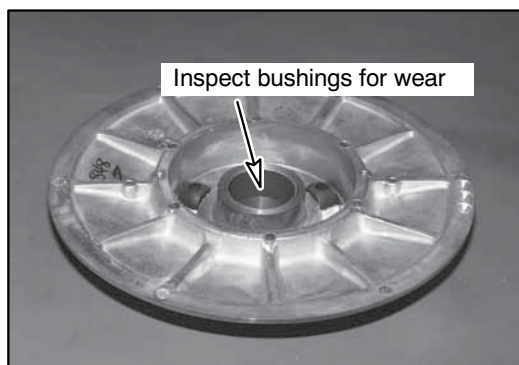




6. Inspect ramp buttons in the moveable sheave and replace if worn. **NOTE:** The ramp buttons are secured by Torx™ screws (T20).



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

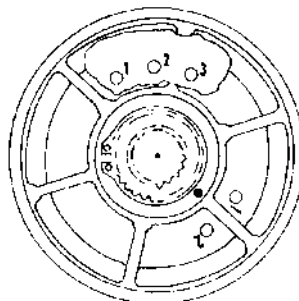


Moveable Sheave Bushing Inspection:

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!**

DRIVEN CLUTCH ASSEMBLY

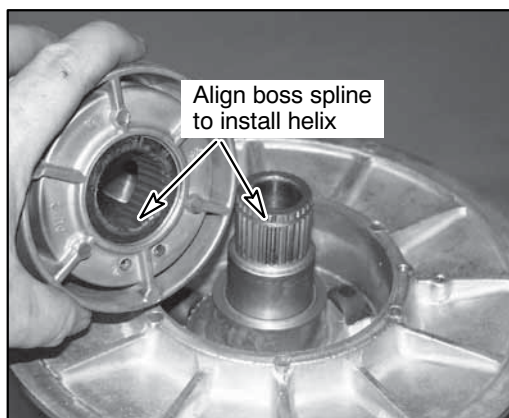


Example:	Helix	Moveable Sheave	Spring Tension
	2 -	1	Heavy
Spring/	2 -	2	
Position	1 -	1	
	2 -	3	
	1 -	2	
	1 -	3	Soft

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

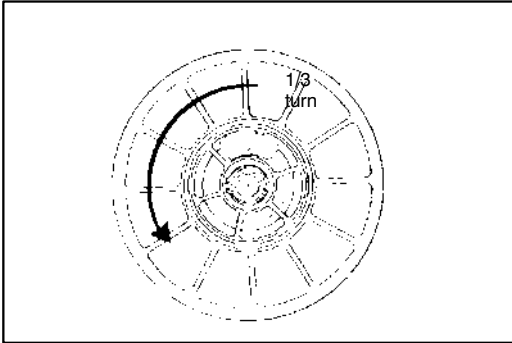
1. Install moveable sheave with spacer washers. **Important:** At least one spacer washer must be installed. Teflon™ bushings are self-lubricating. Do not apply oil or grease to the bushings.
2. Install spring, inserting spring tab into proper hole in moveable sheave.
3. Insert spring tab into proper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



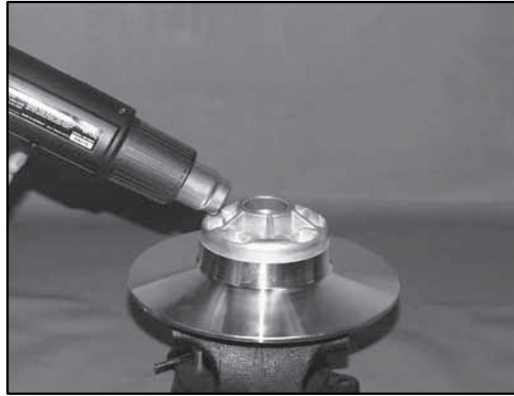


4. Line up boss spline and push helix down until it engages the splines 1/2" to 3/4".



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.

3. Remove ramp buttons from moveable sheave.



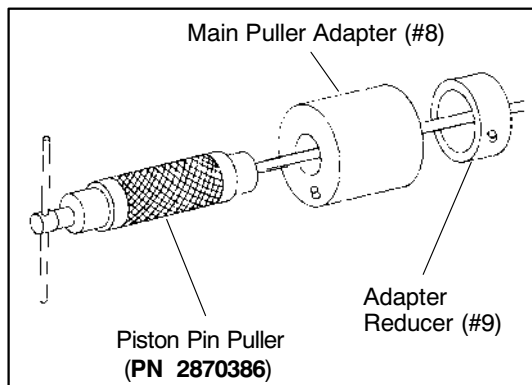
4. Using a hand held propane torch, apply heat directly on bushing until tiny smoke tailings appear.

CAUTION:

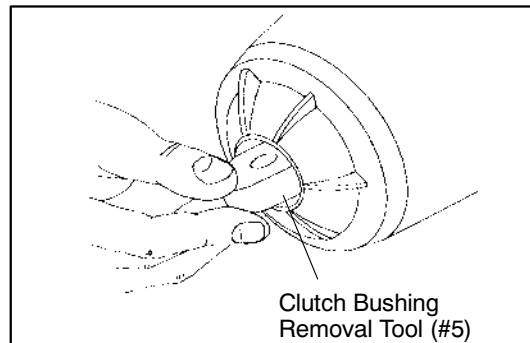
Clutch components will be hot! In order to avoid serious burns, wear heat resistant insulated gloves for the rest of the removal process.

DRIVEN CLUTCH BUSHING SERVICE (ALL MODELS)

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.



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.

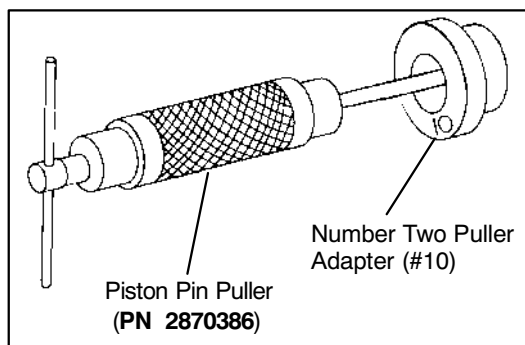


6. Install sheave onto puller.
7. Install nut onto puller rod and tighten by hand. Turn puller barrel for further tension if needed.



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

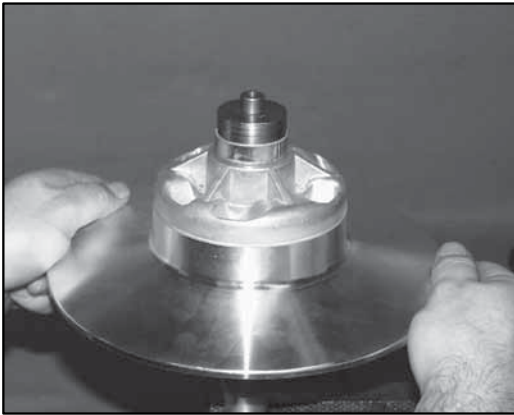


1. Working from the top, insert Number Two Puller Adapter (#10) (PN 5020633) onto the puller. See illustration at above.
2. Start new bushing evenly in moveable sheave. Apply Loctite™ 680 (PN 2870584) to the back side of new bushing.

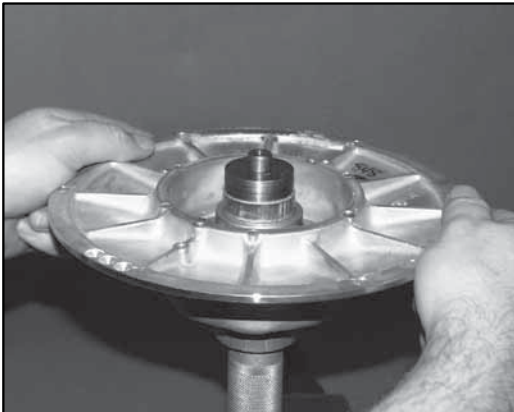


3. Install sheave onto puller with new bushing upward as shown. Install the Number Two Puller Adapter (#10) (PN 5020633).





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.
7. Remove installation tool and clutch sheave from puller.



8. Repeat installation procedure for other moveable bushing.

**TROUBLESHOOTING**

Situation	Probable Cause	Remedy
Engine RPM below specified operating range, although engine is properly tuned.	-Wrong or broken drive clutch spring. -Drive clutch shift weight too heavy. -Driven clutch spring broken or installed in wrong helix location.	-Replace with recommended spring. -Install correct shift weight kit to match engine application. -Replace spring; refer to proper installation location.
Erratic engine operating RPM during acceleration or load variations.	-Drive clutch binding. -Belt worn unevenly - thin/burnt spots -Driven clutch malfunction. -Sheave face grooved.	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. - Replace belt a. Replace ramp buttons. b. Inspect movable sheave for excessive bushing clearance/replace. -Replace the clutch.
Engine RPM above specified operating range.	-Incorrect drive clutch spring (too high spring rate). -Drive clutch shift weights incorrect for application (too light). -Drive clutch binding. -Driven clutch binding. -Converter sheaves greasy; belt slippage.	-Install correct recommended spring. -Install correct recommended shift weights. -Disassemble and clean clutch, inspecting shift weights and rollers. Reassemble without the spring and move sheaves through entire range to further determine probable cause. -Disassemble, clean, and inspect driven clutch, noting worn sheave bushing and ramp buttons and helix spring location. -Clean sheaves with denatured alcohol or brake cleaner, install new belt.
Harsh drive clutch engagement.	-Drive belt worn too narrow. -Excessive belt/sheave clearance with new belt.	-Replace belt. -Perform belt/sheave clearance adjustment with shim washers beneath spider.
Drive belt turns over	-Wrong belt for application. -Clutch alignment out of spec. -Engine mount broken or loose.	-Replace with correct belt. -Adjust alignment offset. -Inspect/adjust or replace.
PVT cover overheating (melting)	-Plugged air intake or outlet -Belt slippage due to water, oil, grease, etc., rubbing on cover -Clutches or weight being applied to cover while in operation -High vs. low range	-Clear obstruction. -Inspect system. Clean, repair or replace as necessary. Seal PVT system ducts. -Remove weight. Inform operator. -Instruct operator on guidelines for operation in proper driving range for different terrain as outlined in Owner's Safety and Maintenance Manual.
Water ingestion	-Cover seals or ducts leaking -Operator error	-Find leak and repair as necessary. -Instruct operator on guidelines for operation in wet terrain as outlined in Owner's Safety and Maintenance Manual.



TROUBLESHOOTING

Situation	Probable Cause	Remedy
Belt slippage	-Belt worn out -Water ingestion -Belt contaminated with oil or grease	-Replace belt. -Inspect and seal PVT system. -Inspect and clean.
Belt burnt, thin spots	-Abuse (continued throttle application when vehicle is stationary, excess load) -Dragging brake -Slow, easy clutch engagement	-Caution operator to operate machine within guidelines. -Vehicle operated with park brake on. Inspect brake system. -Fast, effective use of throttle for efficient engagement.
PVT noise	-Belt worn or separated, thin spots, loose belt -Broken or worn clutch components, cover hitting clutches	-Replace belt. -Inspect and repair as necessary.
Engagement erratic or stabby	-Thin spots on belt, worn belt -Drive clutch bushings stick	-Replace belt. Refer to belt burnt troubleshooting and instruct operator. -Inspect and repair clutches.

NOTES

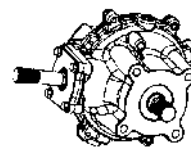
This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.



CHAPTER 7

FINAL DRIVE

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7





SPECIAL TOOLS

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

WHEEL, HUB, AND SPINDLE TORQUE TABLE

Model	Item	Specifica- tion
RANGER TM, 2x4, & 4x4	Front Wheel Nuts	35 Ft. Lbs. (47 Nm)
	Rear Wheel Nuts	35 Ft. Lbs. (47 Nm)
	Front Spindle Nut	40 Ft. Lbs. (55 Nm)
	Rear Hub Retaining Nut	110 Ft. Lbs. (150 Nm)
RANGER 6x6	Front Wheel Nuts	35 Ft. Lbs. (47 Nm)
	Middle Wheel Nut	35 Ft. Lbs. (47 Nm)
	Rear Wheel Nuts	35 Ft. Lbs. (47 Nm)
	Front Spindle Nut	40 Ft. Lbs. (55 Nm)
	Mid Hub Re- taining Nut	110 Ft. Lbs. (150 Nm)
	Rear Hub Retaining Nut	110 Ft. Lbs. (150 Nm)

Refer to exploded views and text for torque values of other fasteners

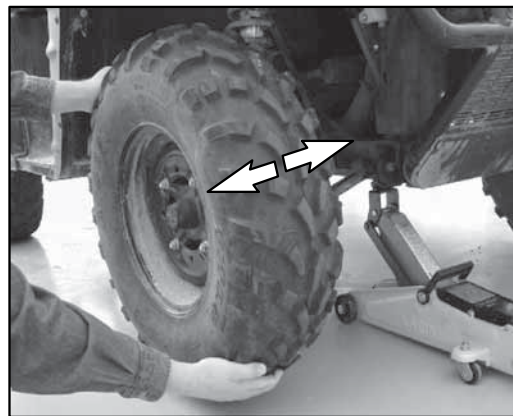
CAUTION: Locking nuts, and bolts with pre-applied locking agent should be replaced if removed. The self-locking properties of the nut or bolt are reduced or destroyed during removal.

FRONT HUB REMOVAL/INSPECTION (TM & 2X4)

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

CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

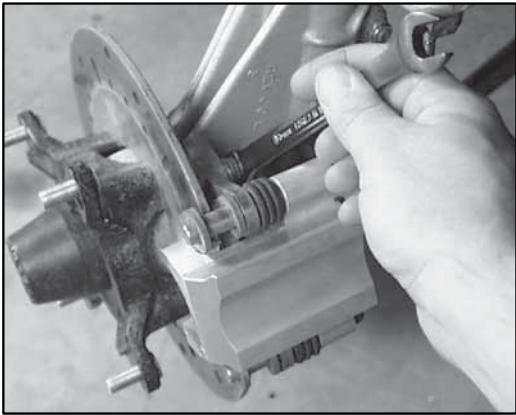
2. Check bearings for side play by grasping the tire / wheel firmly and checking for movement. Grasp the top and bottom of the tire. The tire should rotate smoothly without binding or rough spots.



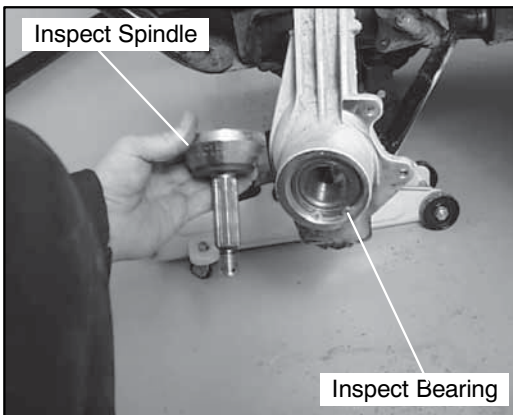
3. Remove wheel nuts and wheel.

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

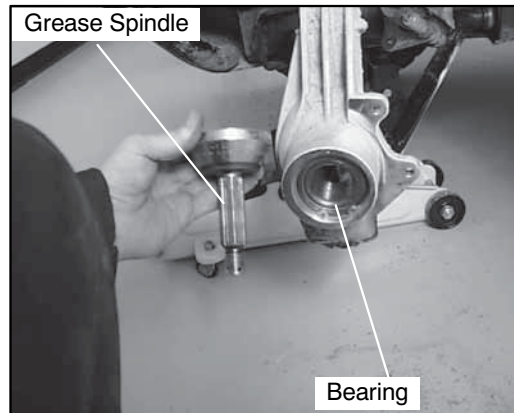




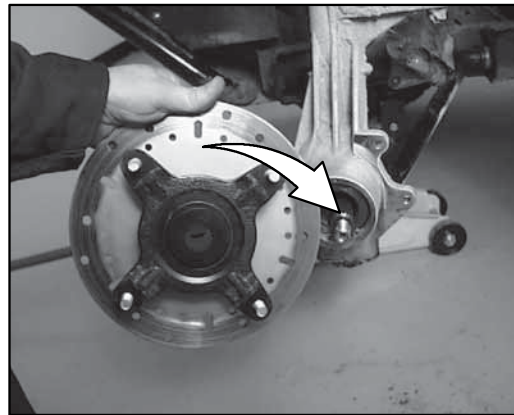
5. Remove hub cap, cotter pin, front spindle nut, and washer.
6. Remove the spindle from the backside of the strut. Rotate each bearing by hand and check for smooth rotation. Visually inspect bearing for moisture, dirt, or corrosion. Replace bearing if moisture, dirt, corrosion, or roughness is evident. Inspect the spindle splines for wear.



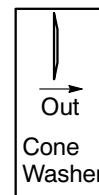
2. Apply grease to spindle.



3. Install spindle through the backside of the hubstrut. Install the hub onto the spindle.



4. Apply grease to washer and install with domed side out.

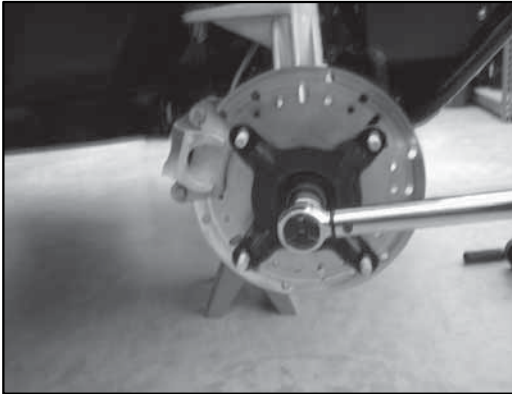


FRONT HUB INSTALLATION **(TM & 2X4)**

1. Inspect the hubstrut bearing surface for wear or damage.



5. Install spindle nut and tighten to specification.

**2 x 4 Spindle Nut Torque:****40 ft. lbs. (55.0 Nm)**

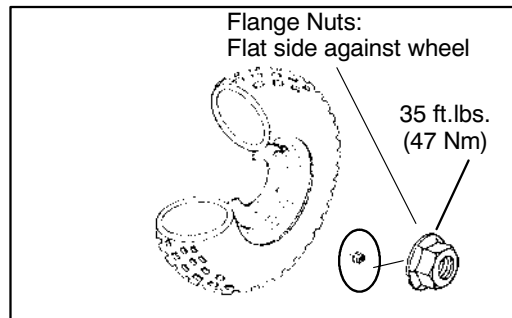
6. Install a new cotter pin. Tighten nut slightly if necessary to align cotter pin holes.
7. Rotate wheel and check for smooth operation. Bend both ends of cotter pin around end of spindle in different directions.
8. Install hub cap.

9. Rotate hub. It should rotate smoothly without binding or rough spots or side play.
10. Install brake caliper using new bolts. Tighten bolts to specified torque.

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

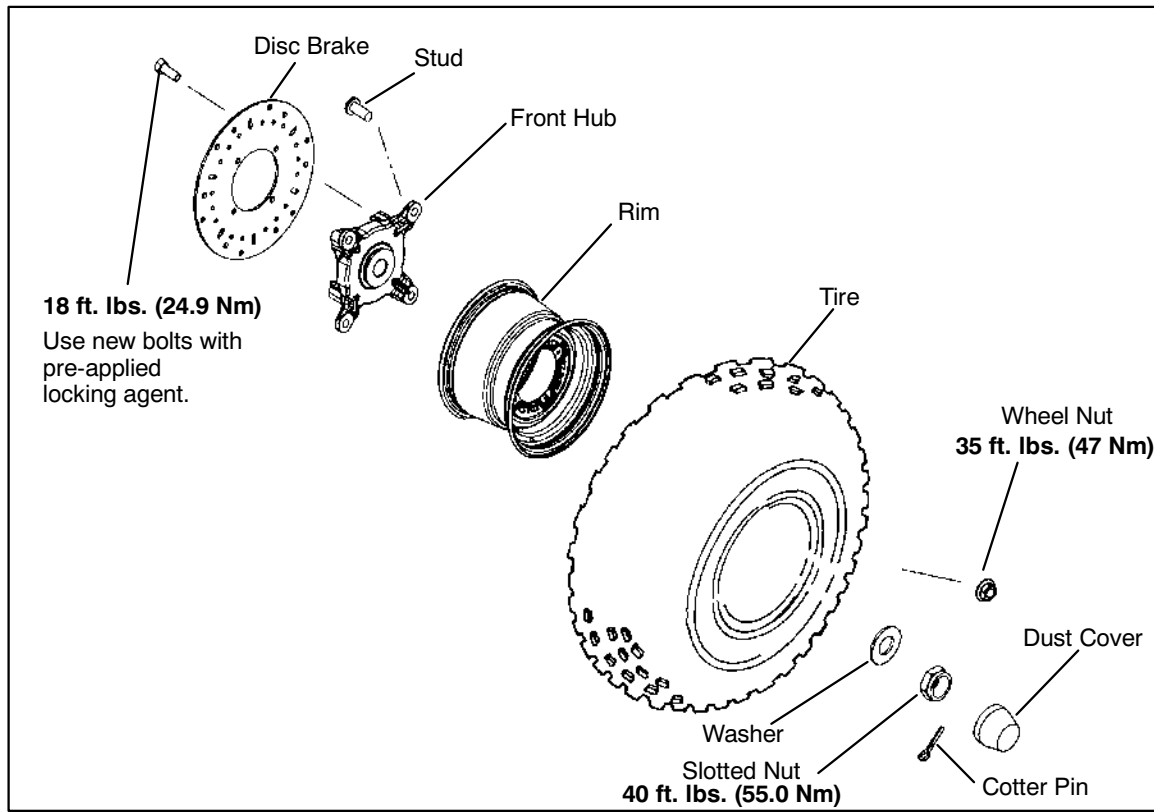
CAUTION: New bolts have a pre-applied locking agent which is destroyed upon removal. Always use new brake caliper mounting bolts upon assembly.

11. Install wheel and wheel nuts and tighten evenly in a cross pattern to 35 ft.lbs. (47 Nm).





FRONT HUB EXPLODED VIEW (TM & 2X4)

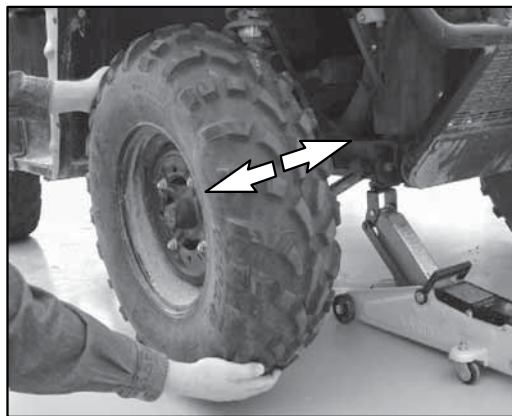


FRONT HUB REMOVAL/INSPECTION (4X4 & 6X6)

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

CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

2. Check bearings for side play by grasping the tire / wheel firmly and checking for movement. Grasp the top and bottom of the tire. The tire should rotate smoothly without binding or rough spots.

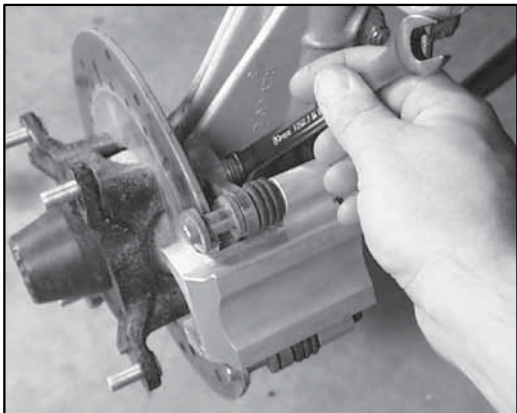




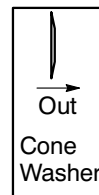
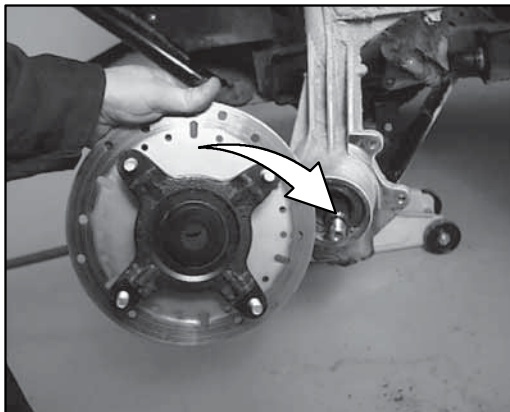
3. Remove wheel nuts and wheel.

4. Remove the two brake caliper attaching bolts.

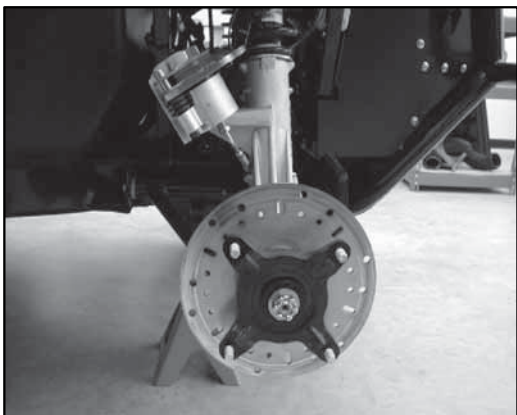
CAUTION: Do not hang the caliper by the brake line. Use wire to hang the caliper to prevent possible damage to the brake line.



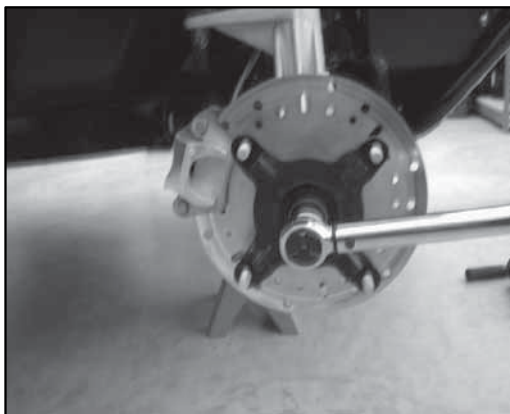
4. Apply grease to washer and install with domed side out.



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



5. Install spindle nut and tighten to specification.



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

6. Install a new cotter pin. Tighten nut slightly if necessary to align cotter pin holes.

7. Rotate wheel and check for smooth operation. Bend both ends of cotter pin around end of spindle in different directions.

8. Install hub cap.

9. Rotate hub. It should rotate smoothly without binding or rough spots or side play.

FRONT HUB INSTALLATION **(4X4 & 6X6)**

1. Inspect the hubstrut bearing surface for wear or damage.

2. Apply grease to spindle.

3. Install spindle through the backside of the hubstrut. Install the hub onto the spindle.



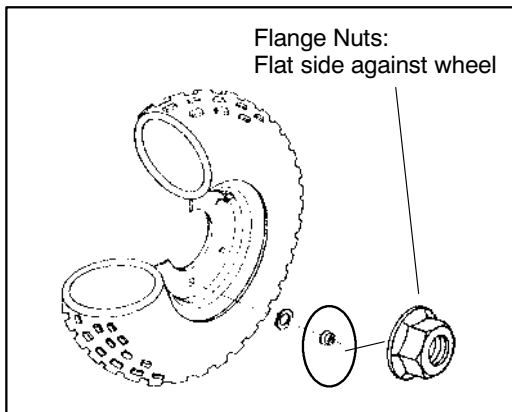


10. Install brake caliper using new bolts. Tighten bolts to specified torque.

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

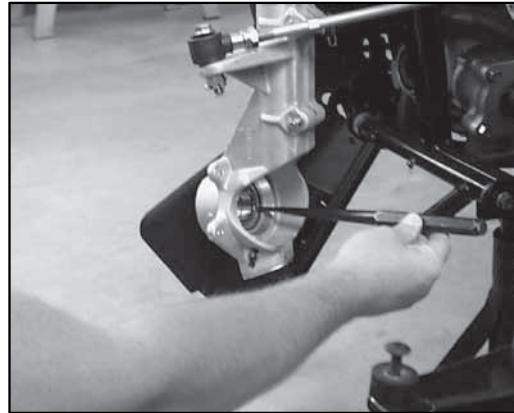
CAUTION: New bolts have a pre-applied locking agent which is destroyed upon removal. Always use new brake caliper mounting bolts upon assembly.

11. Install wheel and wheel nuts and tighten evenly in a cross pattern to specified torque.



Front Wheel Nut Torque
35 ft. lbs. (47 Nm)

2. From the back side, tap on the outer bearing race with a drift punch in the reliefs as shown.
3. Drive bearing out evenly by tapping on outer race only. Once bearing is at bottom of casting, support casting on outer edges so bearing can be removed.



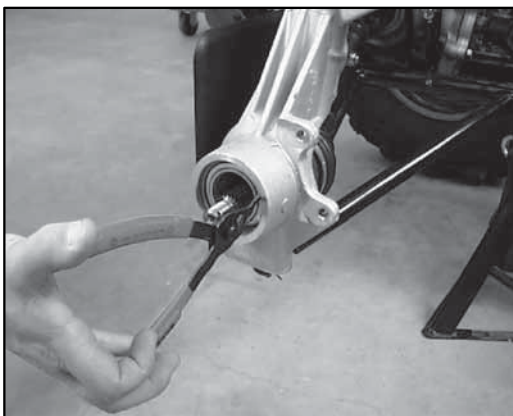
4. Inspect bearing.

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.

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

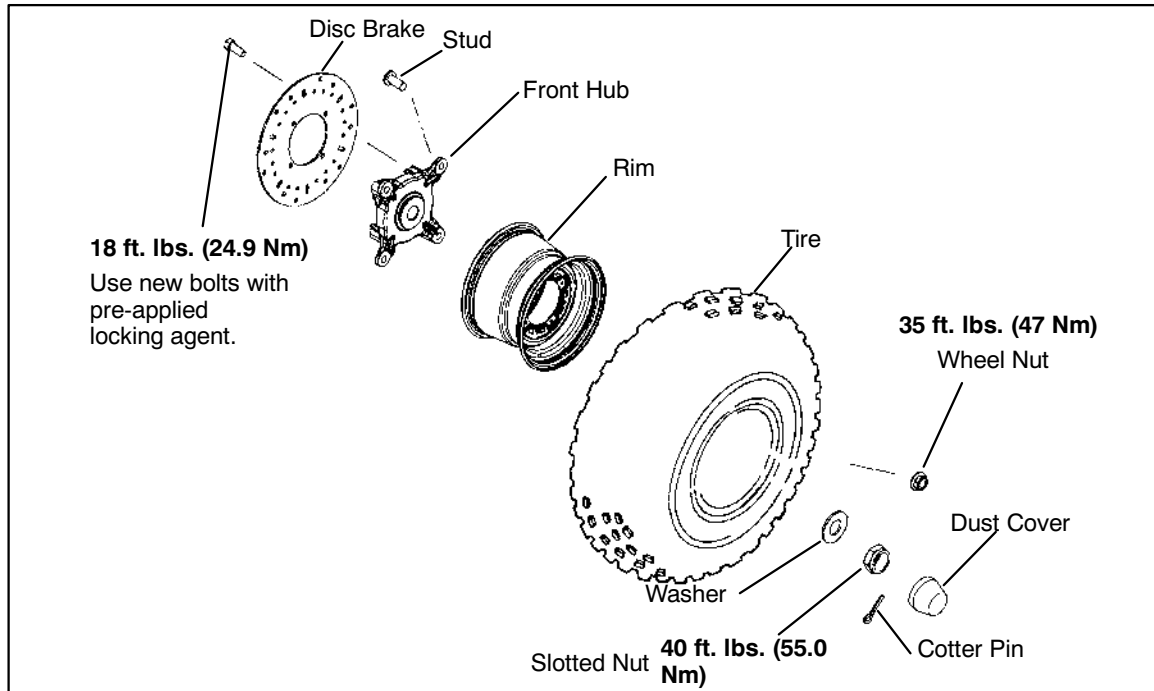
FRONT HUB BEARING REPLACEMENT (4X4 & 6X6)

1. Remove outer snap ring.





FRONT HUB EXPLODED VIEW (4X4 & 6X6)



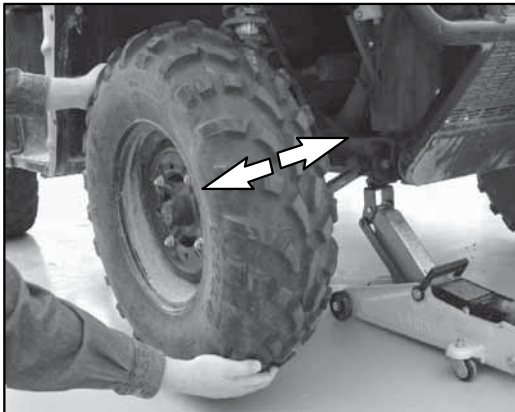


FRONT DRIVE AXLE REMOVAL (4X4 & 6X6)

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

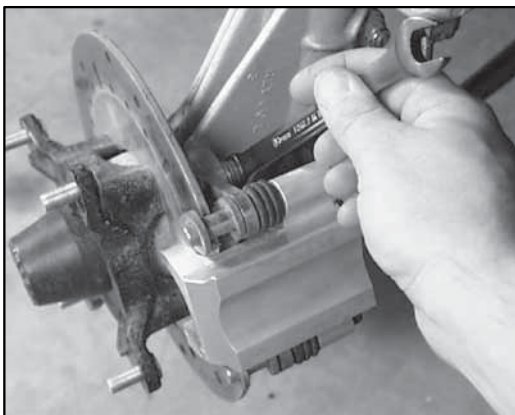
CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

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



3. Remove wheel nuts and wheel.

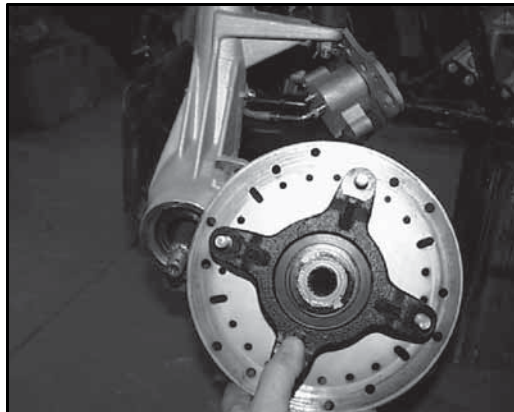
4. Remove the two brake caliper attaching bolts.
CAUTION: Do not hang the caliper by the brake line. Use wire to hang the caliper to prevent possible damage to the brake line.



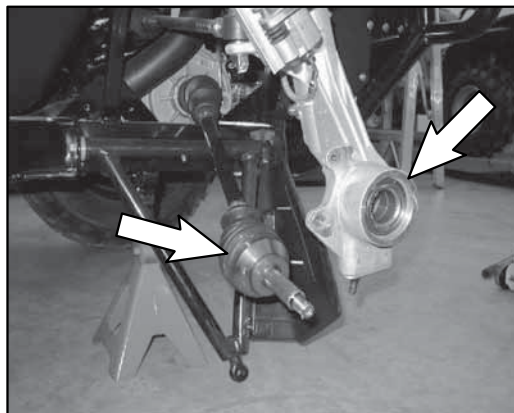
CAUTION:

Serious injury could occur if machine tips or falls.

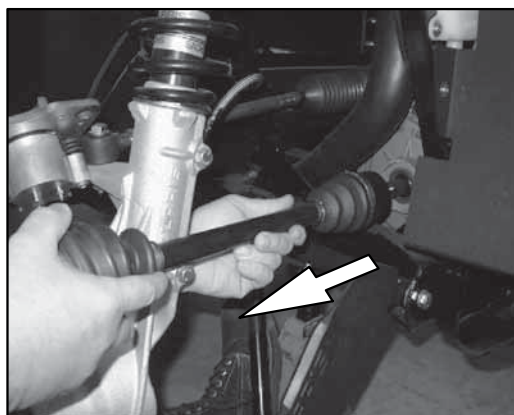
5. Remove wheel.
6. Remove hub.



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

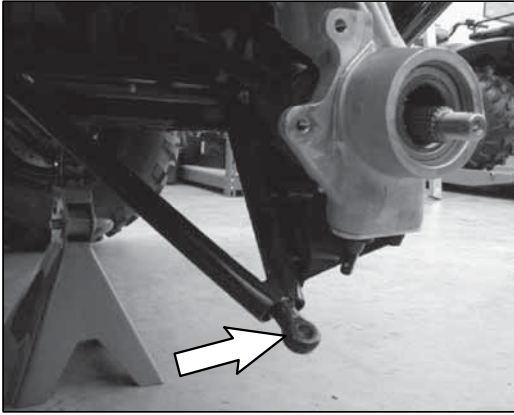


8. Pull strut assembly out while pivoting front drive shaft downward until it clears strut assembly.



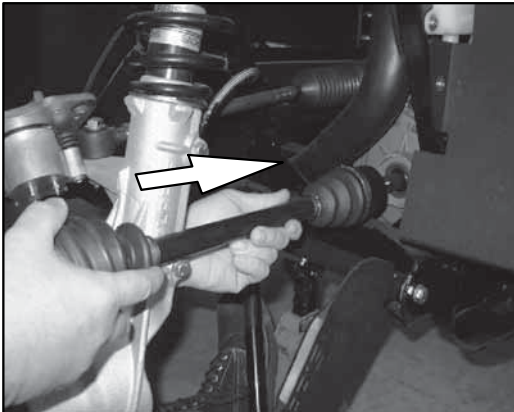
9. With short sharp jerks, remove drive shaft from front gearcase.





FRONT DRIVE AXLE INSTALLATION (4X4 & 6X6)

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



2. Install drive shaft in strut.
3. Install lower ball joint, torque nut to 25 ft. lbs. (34.5 Nm) and install new cotter pin.

4. Install hub and tighten spindle nut to 40 ft. lbs. (55 Nm).

Front Spindle Nut Torque

40 ft. lbs. (55 Nm)

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.

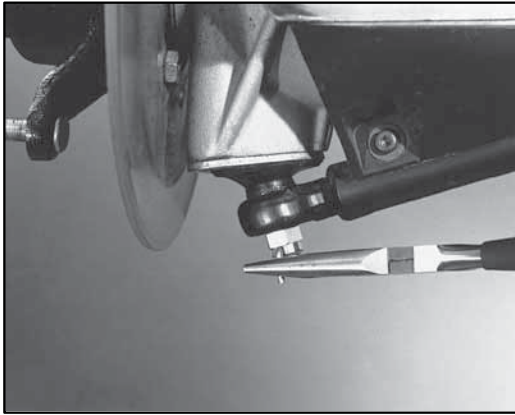
- The complete driveshaft and joint should be handled by getting hold of the interconnecting shaft to avoid disassembly or potential damage to the driveshaft joints.
- Over-angling of joints beyond their capacity could result in boot or joint damage.
- Make sure surface-ground areas and splines of shaft 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 (4X4 & 6X6)

1. Remove wheel, brake caliper and wheel hub. Refer to front hub disassembly Page 7.5 for procedure.
2. Remove cotter pin and castle nut from A-arm ball joint.

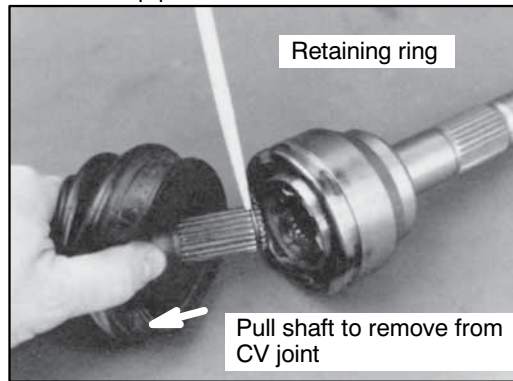


3. Disconnect A-arm from ball joint using a tie rod fork.



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

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



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 the CV boot with clamp.

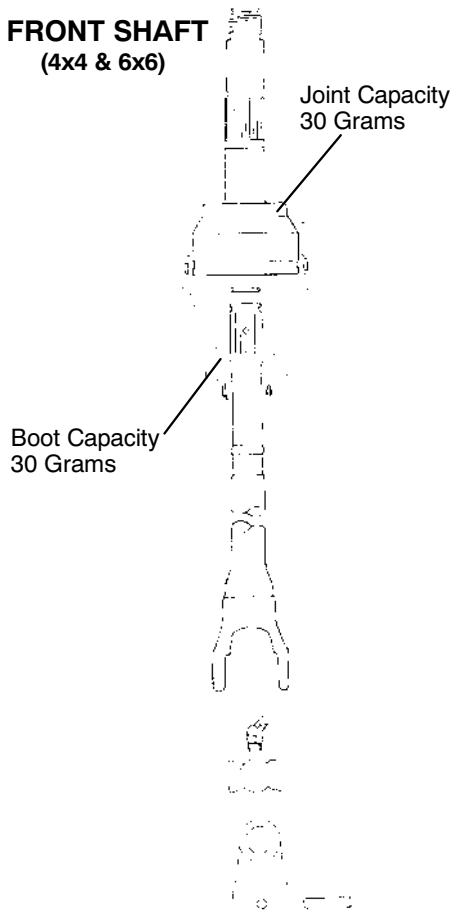
CV Joint Grease - 30g PN 1350046

**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 (4x4 & 6x6)



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

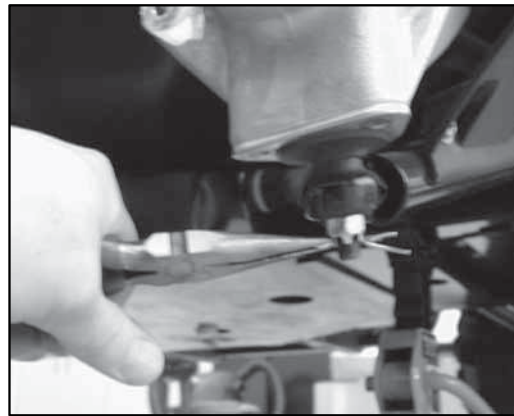
FRONT PROP SHAFT REMOVAL (4X4 & 6X6)

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

CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

2. Remove wheel nuts and wheel.

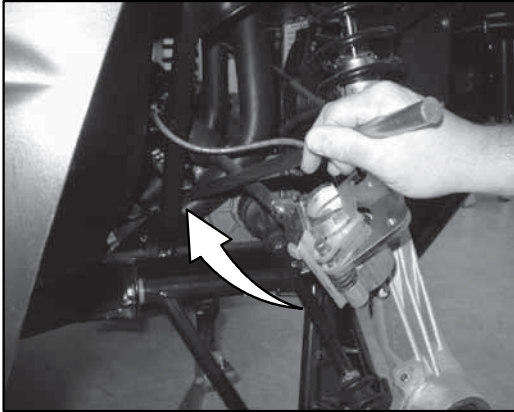
3. Remove cotter pin and nut from lower A-arm ball joint. Remove lower A-arm from ball joint. (See below)



4. Use the Roll Pin Removal Tool (**PN 2872608**), to remove the roll pin from prop shaft at rear of housing. Slide prop shaft back and away from front housing. Pull sharply forward to remove from transmission shaft.

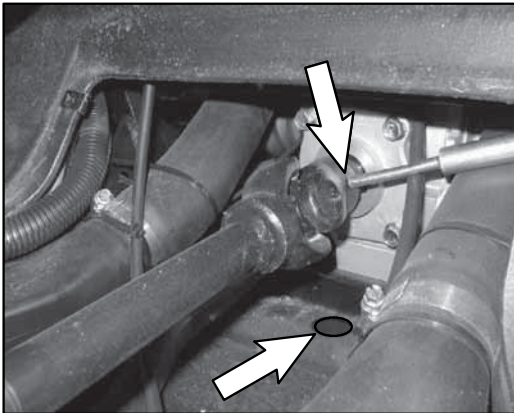
NOTE: The roll pin can also be accessed through the hole in the skid plate shown in the photo below.



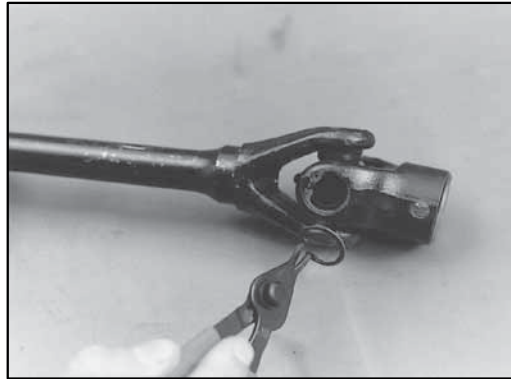


Roll Pin Removal Tool (PN 2872608)

NOTE: Remove the drive shaft floor cover to help align the roll pin removal tool to the roll pin for removal. The drive shaft can be removed through the floor covering.



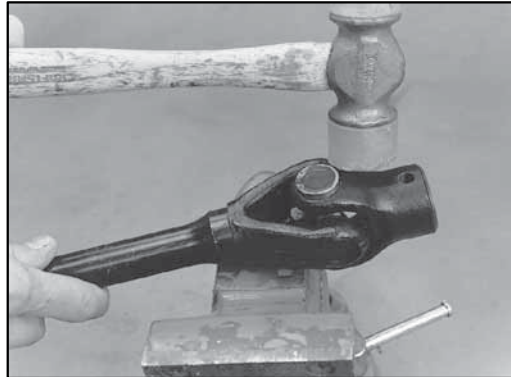
U-JOINT DISASSEMBLY



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.

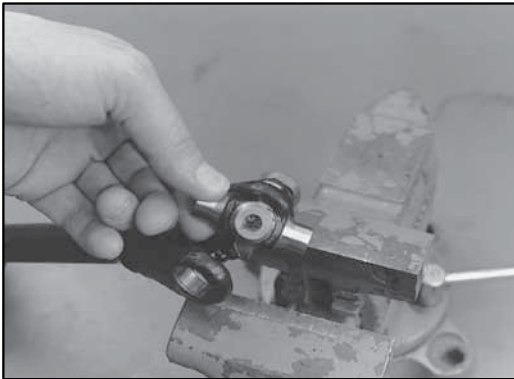




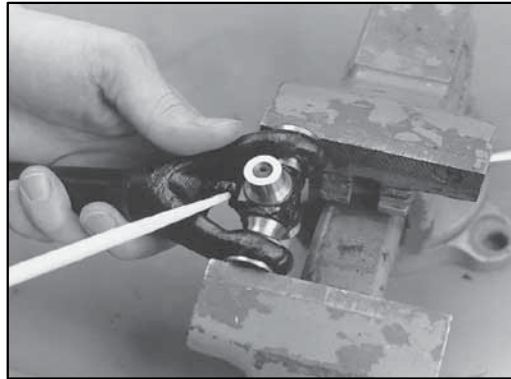
U-JOINT ASSEMBLY



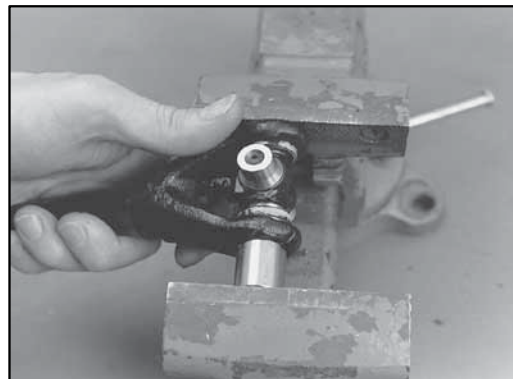
3. Support U-joint in vise as shown and drive inner yoke down to remove remaining bearing caps.



4. Force U-joint cross to one side and lift out of inner yoke.



1. Install new bearing caps in yoke by hand. Carefully install U-joint cross with grease fitting properly positioned inward toward center of shaft. Take care not to dislodge needle bearings upon installation of cross joint. Tighten vise to force bearing caps in.

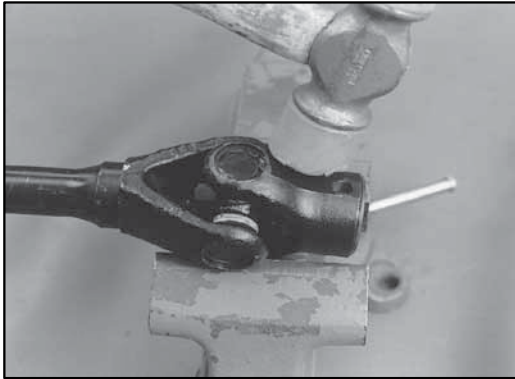


2. Using a suitable arbor, fully seat bearing cap in one side. Continually check for free movement of bearing cross as bearing caps are assembled.
3. Install snap ring to contain bearing cap just installed. Repeat procedure for other side.





4. Install outer yoke, aligning marks made before disassembly.
5. Repeat Steps 1-3 to install bearing caps on outer yoke.



6. Seat all bearing caps against snap rings by supporting cross shaft and tapping on each corner as shown.
7. When installation is complete, yokes must pivot freely in all directions without binding. If the joint is stiff or binding, tap the yoke lightly to center the joint until it pivots freely in all directions.

FRONT GEARCASE OPERATION FOR (4X4 & 6X6 - CENTRALIZED HILLIARD)

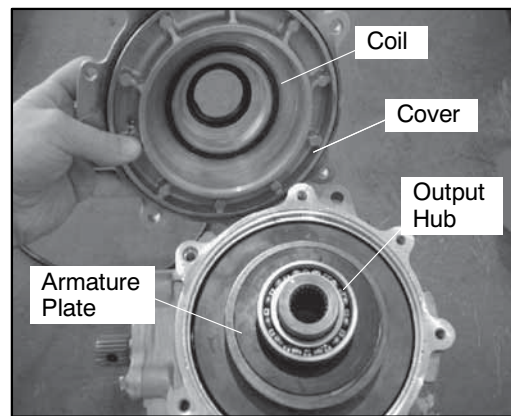
Engaging Front Gearcase: The AWD switch may be turned on or off while the vehicle is moving. Initially, the vehicle's electronic system will not enable the AWD until the engine RPM is below 3100. Once enabled, the AWD remains while the front gearcase

is moving, it will not disengage until the rear wheels regain traction.

Engage the AWD switch before getting into conditions where the front wheel drive may be needed. If the rear wheels are spinning, release the throttle before switching to AWD.

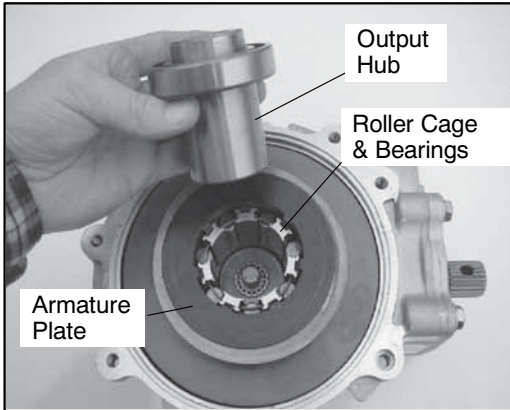
CAUTION: Switching to AWD while the rear wheels are spinning may cause severe drive shaft and gearcase damage. Always switch to AWD while the rear wheels have traction or are at rest.

Normal Operation: With the AWD switch off the vehicle is only driving the rear wheels (2 wheel drive). When the AWD switch is activated it engages the Hilliard and locks both front wheels and we then have, True All Wheel Drive.

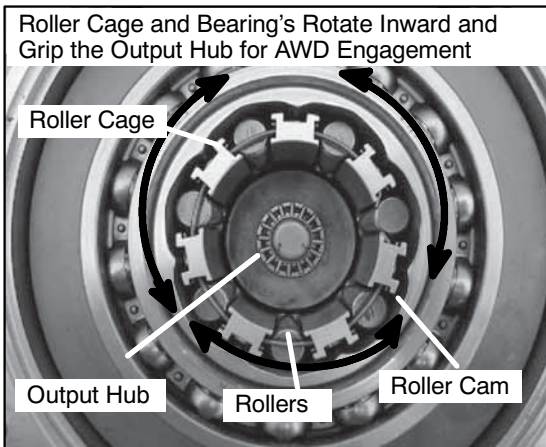


Engagement: When the AWD switch is activated it charges the coil. It then charges an armature plate that is keyed to a roller cage that contains 14 rollers which are forced in by an external cam. The 14 rollers engage themselves to the output hubs that link both front axles. The vehicle now has True All Wheel Drive.

CAUTION: If the rear wheels are spinning, release the throttle before turning the AWD switch on. If AWD is engaged while the wheels are spinning, severe drive shaft and clutch damage could result.



Disengagement: As soon as the front and rear wheels gain traction and are rotating at very close to the same speed the front wheels will overdrive the output hubs and the rollers are forced outward, disengaging AWD. The vehicle is now back to rear wheel drive.



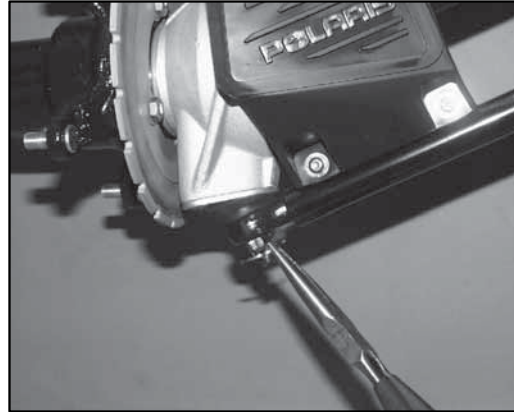
FRONT GEARCASE REMOVAL (4X4 & 6X6)

1. Stop engine, place machine in gear and set parking brake.
2. Loosen right front wheel nuts slightly.
3. Elevate and support machine under footrest/frame area.

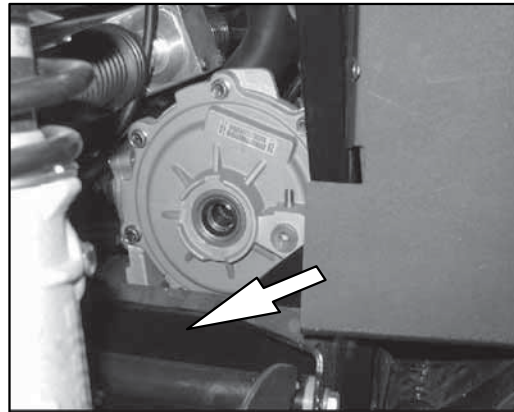
CAUTION: Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing and installing bearings and seals.

4. Remove right wheel nuts and wheel.

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



6. Repeat Step 1 through Step 5 on the opposite side.
7. Pull each axle out from the front gearcase.
8. Remove the roll pin from the front drive shaft. Remove the front drive shaft from the front gearcase splines.
9. Remove bolts securing bottom of gearcase to frame. Remove vent line. Remove gearcase from right side of frame. (See photo)



FRONT GEARCASE DISASSEMBLY/INSPECTION (4X4 & 6X6)

1. Drain and properly dispose of used oil. Remove any metal particles from the drain plug magnet.
2. Remove bolts and output shaft cover.

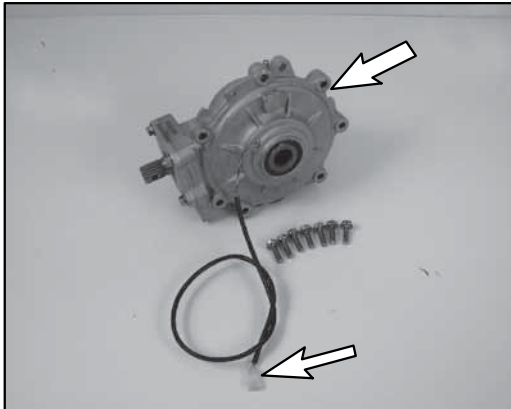
Gearcase Coil Resistance

NOTE: To test the gearcase coils resistance, use the coil harness. The gearcase coils should measure





between **22.8 ohms** and **25.2 ohms**.



**Front Gearcase Coil Resistance:
22.8-25.2 Ohms**

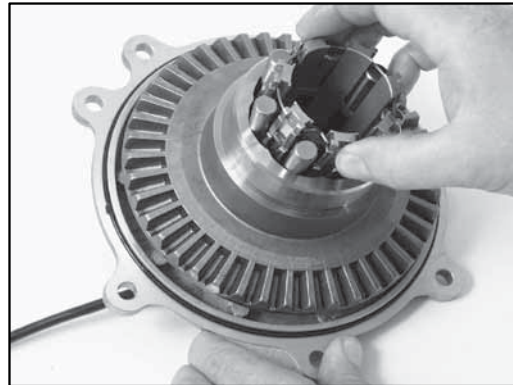
3. Remove output shaft assembly.

NOTE: Be careful not to misplace the thrust bearing located between the two output shafts.

4. Clean all parts and inspect spacers for wear. Inspect ring gear for chipped, broken, or missing teeth.

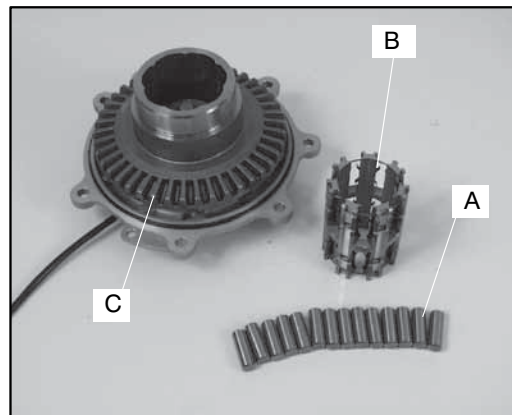


5. Remove the roll cage assembly, rollers, and H-springs.



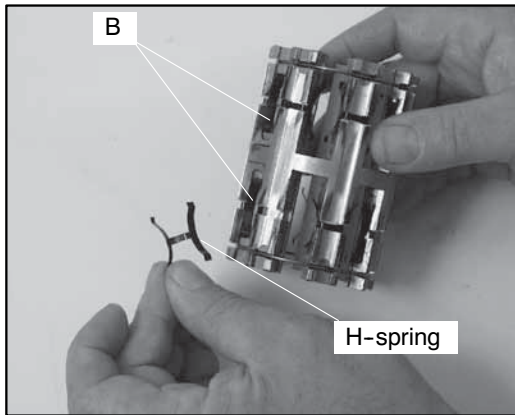
6. Thoroughly clean all parts. Inspect the rollers (A) for nicks and scratches. The rollers must slide up and down freely within the roll cage sliding surfaces (B).

7. Inspect the ring gear (C) for consistent wear patterns. The surfaces should be free of nicks and scratches.

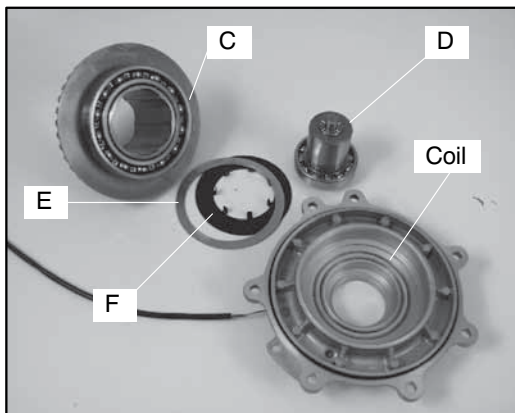


8. Inspect roll cage (B) sliding surface. This surface must be clean and free of nicks, burrs or scratches. Remove and inspect the H-springs.

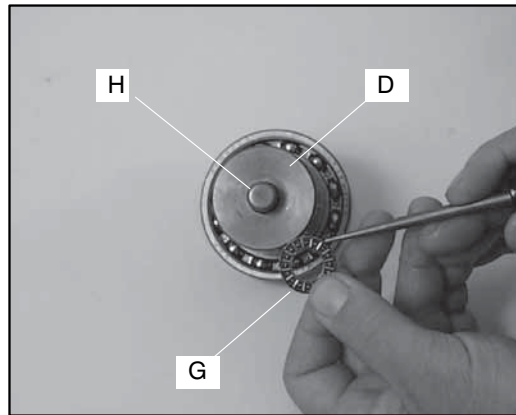




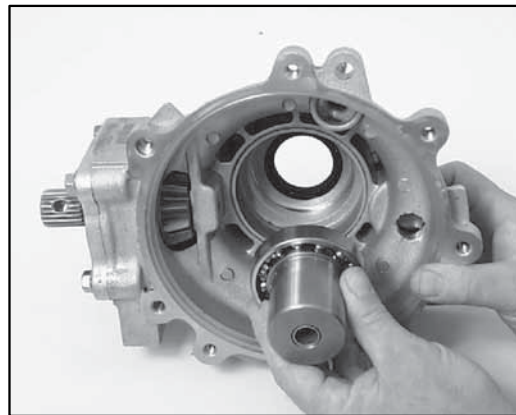
9. Remove the ring gear (C), the output hub (D), the shim (E), and the armature plate (F) from the output cover.
10. Inspect the armature plate (F) for a consistent wear pattern. Uneven wear of the armature plate (F) indicates a warped plate, which may cause intermittent operation.



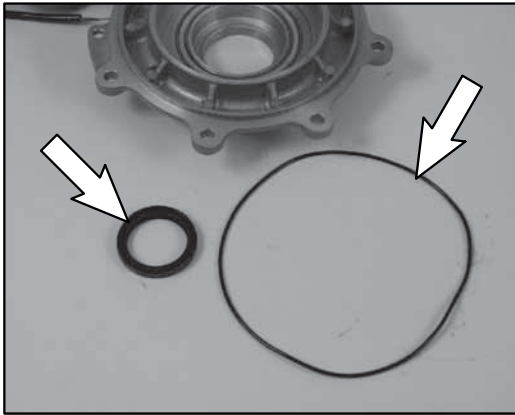
11. Remove the thrust bearing (G) from the output hub (D). Inspect the thrust bearing (G) and the dowel (H).



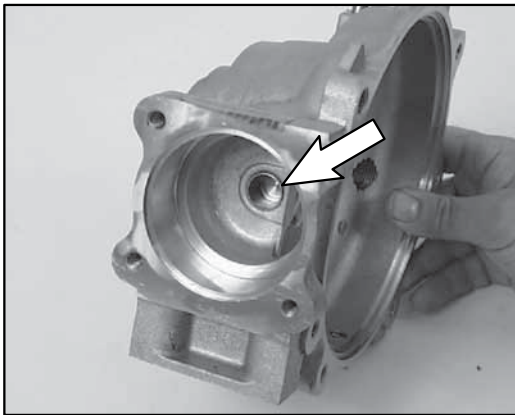
12. Remove the other output hub from the main gearcase.



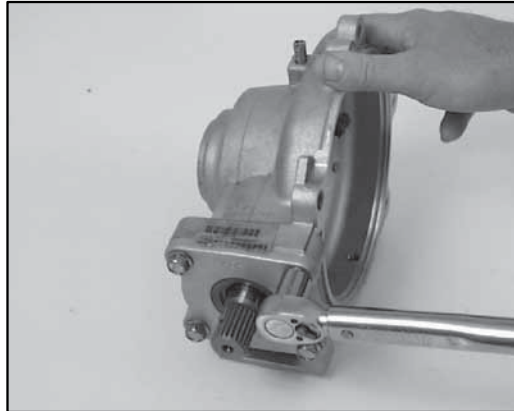
13. Remove the O-ring and seal from the output cover.



14. Remove the input cover, bearing, and the pinion gear. Inspect the pinion gear for chipped, broken, or missing teeth. Inspect the output shaft bushing. Replace as needed. Clean the inside surfaces of both gearcase halves.



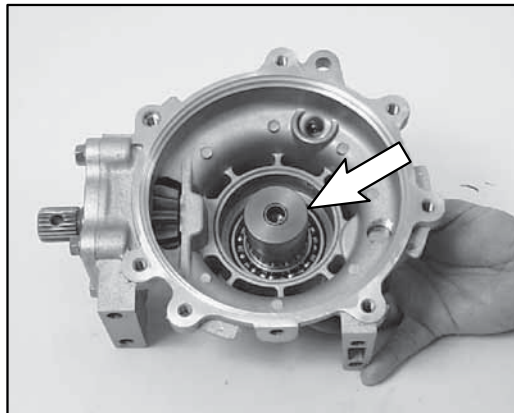
4. Install pinion shaft, bearing, and input cover with new o-ring and torque bolts to 14 ft. lbs (19 Nm).



Cover Bolts Torque

14 ft. lbs. (19 Nm)

5. Install the output hub into the gearcase housing. The output hub should spin freely.



FRONT GEARCASE ASSEMBLY/INSPECTION (4X4 & 6X6)

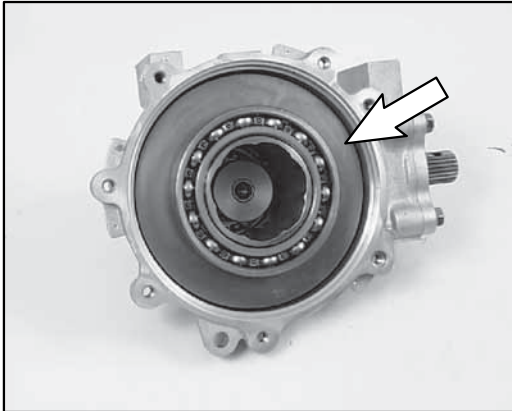
1. Replace all O-rings, seals, and worn components.
2. Press the pinion shaft seal into the pinion cover, until the seal is flush with the sealing surface.
3. Inspect bearings on output and pinion shafts. To replace, press new bearing on to shaft.

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

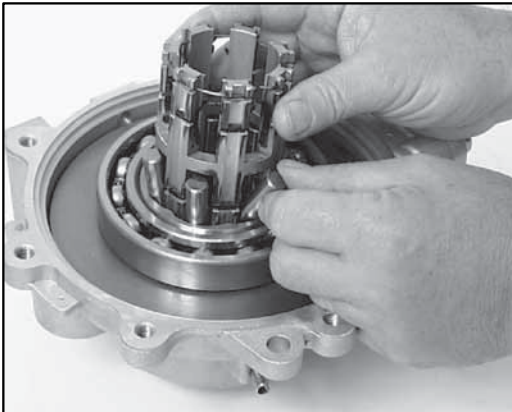




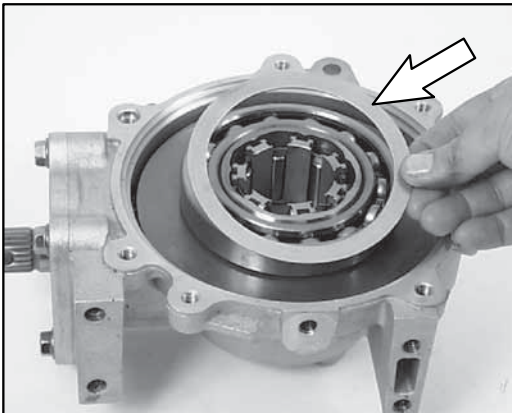
6. Install the ring gear into the gearcase housing.



7. Slide the roll cage into the ring gear. Insert the rollers as the roll cage is installed.

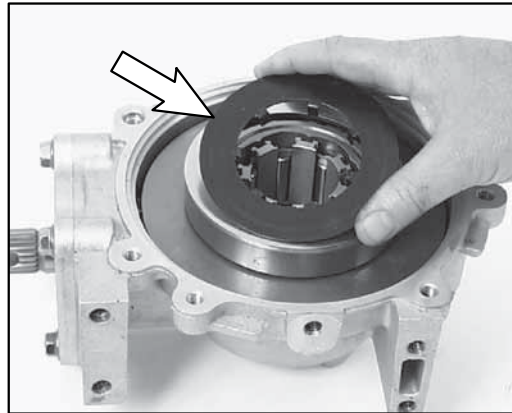


8. Install the shim onto the ring gear.

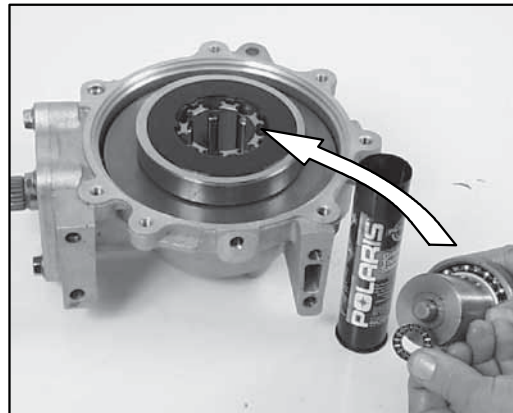


9. Install the armature plate onto the ring gear.

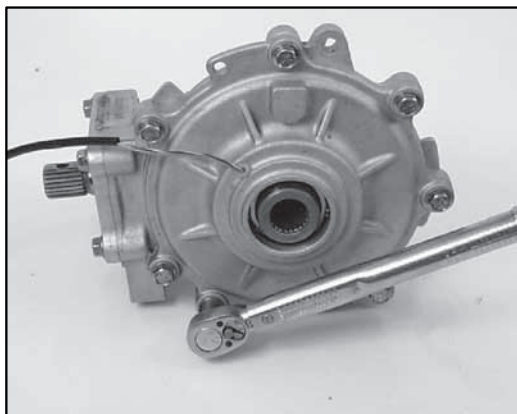
NOTE: Be sure armature plate tabs are placed into the slots on roll cage.



10. Apply grease to the thrust bearing. Insert the thrust bearing onto the output hub. Insert the output hub, dowel, and thrust bearing into the ring gear.

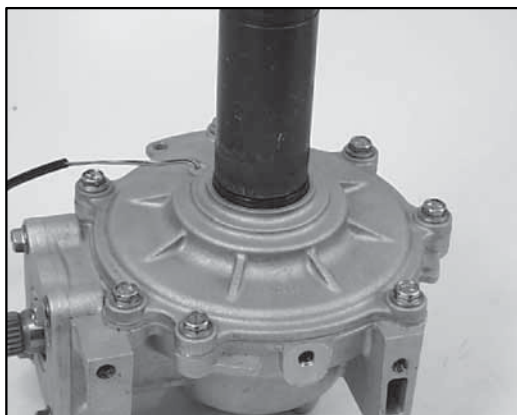


11. Install output cover with new o-ring and torque bolts to 14 ft. lbs. (19 Nm).

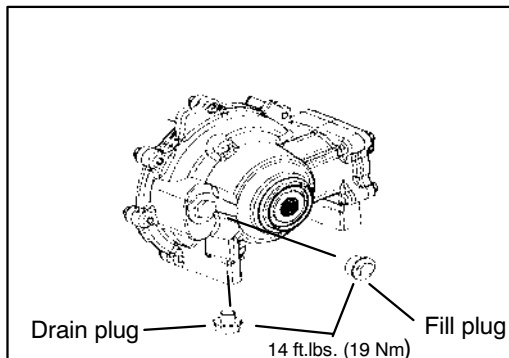


Cover Bolts Torque
14 ft. lbs. (19 Nm)

12. Install new seals into the gearcase housing and gearcase housing cover.



13. Install the drain plug and torque the drain plug to 14 ft.lbs. (19 Nm).
14. Set the gearcase on a level surface. Remove the fill plug and fill the gearcase with 5 oz. (150 ml.) of Premium Drive Hub Fluid (**PN 2871654**). Torque the fill plug to 14 ft. lbs. (19 Nm).



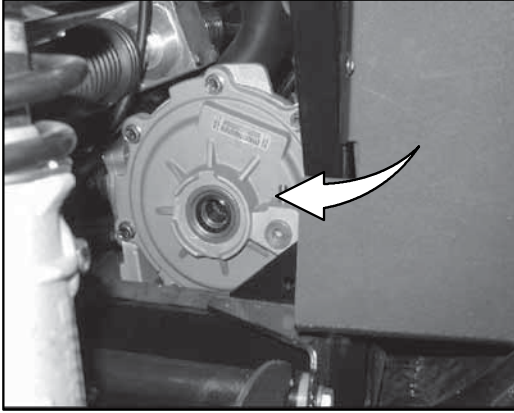
Premium Demand Drive Hub Fluid
(PN 2871654)





FRONT GEARCASE INSTALLATION (4X4 & 6X6)

1. To install gearcase, reverse removal procedure.
2. Make sure the vent opening and vent tube are unobstructed. Install the vent line.



FRONT GEARCASE DIAGNOSIS (4X4 & 6X6)

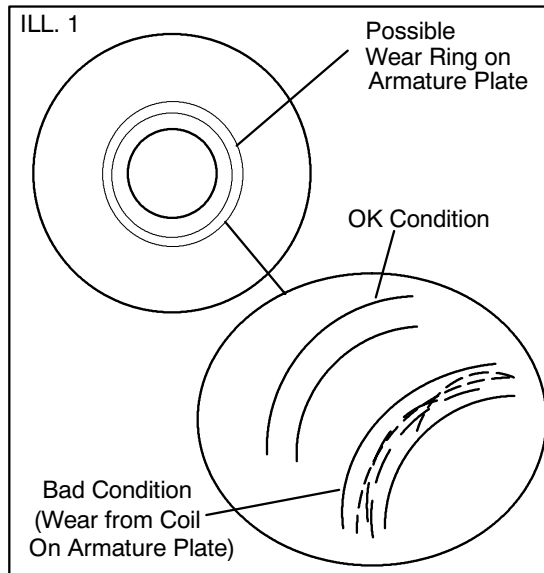
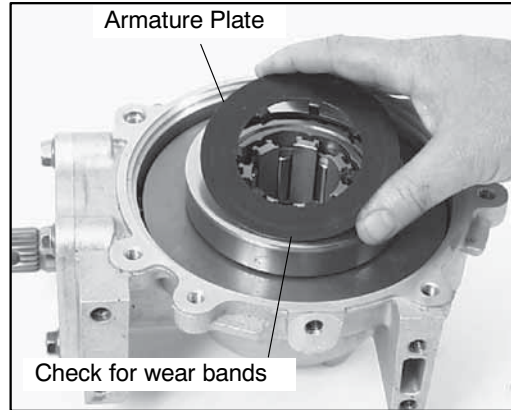
Symptom: AWD Will Not Engage.

1. Check the gearcase coil resistance. To test the gearcase coil resistance, use the coil harness (Grey & Brown/White). The gearcase coils should measure between **22.8 ohms** and **25.2 ohms**.
2. Check the minimum battery voltage at the wire (Grey & Brown/White) that feeds the hub coil wire. There should be a minimum of **11.80-12.0 Volts** present for proper operation.



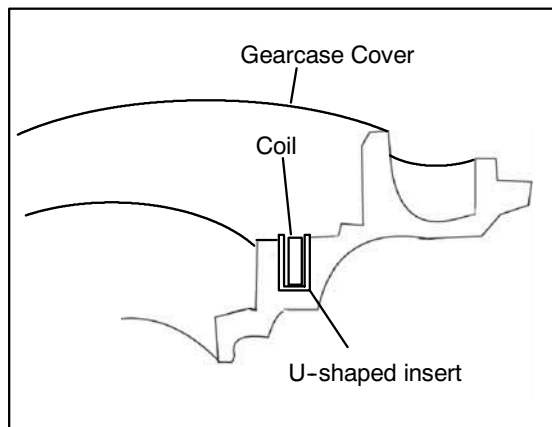
3. Inspect the armature plate for a consistent wear pattern. There should one or two distinct wear

bands (one band inside the other). If only one band of wear is present (or if there is wear between the two bands, inspect the coil area as indicated in Step 4. A band with an interrupted wear mark may indicate a warped plate, which may cause intermittent operation. See ILL. 1.



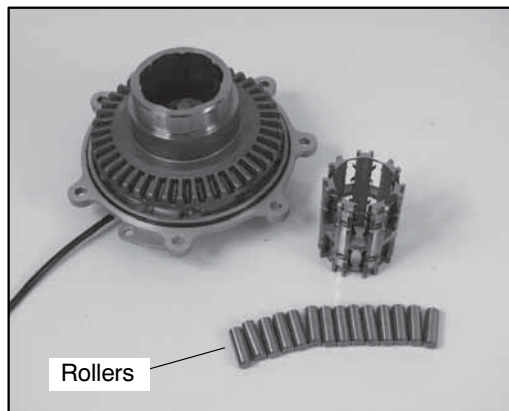
4. Check to make sure the coil is seated in the U-shaped insert that is pressed into the gearcase cover. The top of the coil should be seated below the U-shaped insert. The U-shaped insert controls the pole gap. If the top of the coil is above the surface of the U-shaped insert it raises the armature plate, thereby increasing pole gap. If the pole gap increases the coil will not be strong enough to engage the AWD system. If this is the cause order a new Plate Cover Assembly (PN 3233952). See Illustration next page.

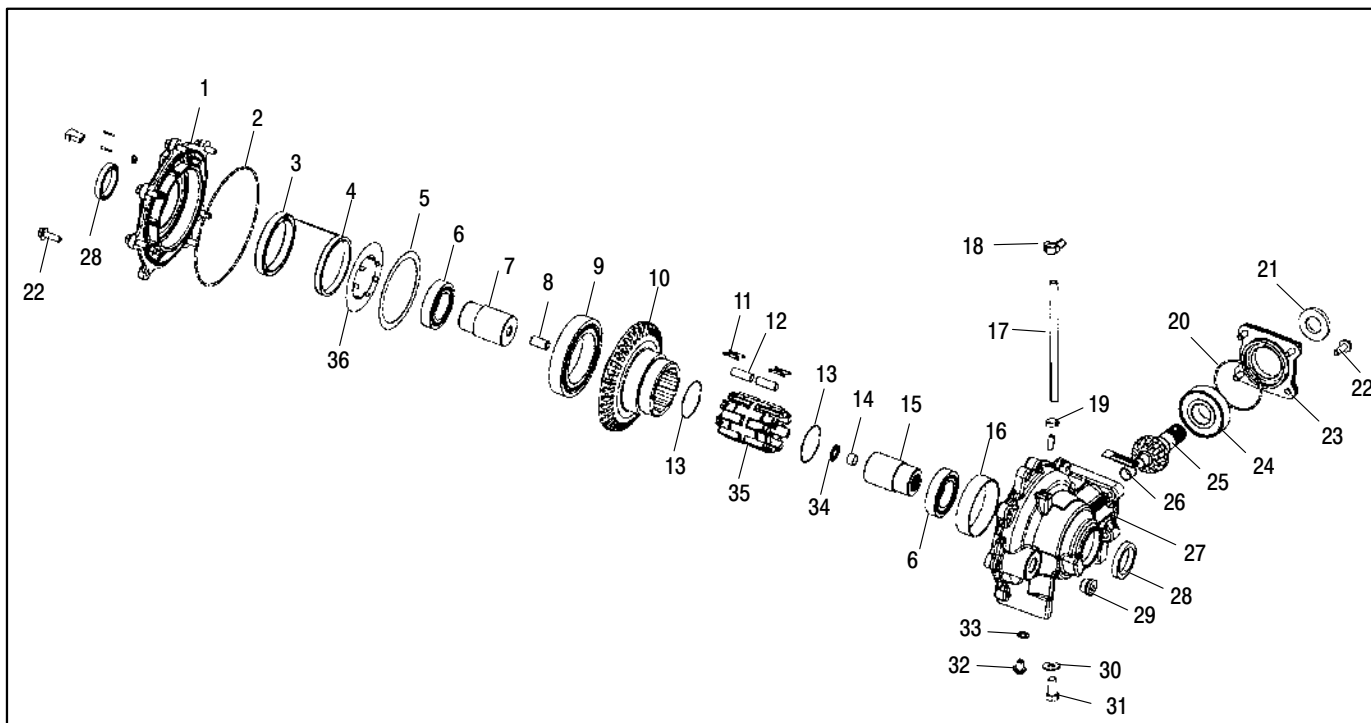




Side Cutaway View of Centralized Hilliard Cover

5. Inspect the rollers for nicks and scratches. The rollers must slide up and down and in and out freely within the roll cage sliding surfaces.



**FRONT GEARCASE EXPLODED VIEW**

Ref.	Qty.	Description	Ref.	Qty.	Description
	1	Asm., Mid Gearcase	20.	1	O-Ring
1.	1	Cover, Output	21.	1	Seal
2.	1	O-Ring	22.	11	Kit, Bolt
3.	1	Insert	23.	1	Cover, Input
4.	1	Coil	24.	1	Bearing, Roller Ball
5.	1	Kit, Shim Set (Incl. Shims)	25.	1	Shaft, Pinion, 11T
6.	2	Bearing, Roller Ball	26.	1	Bushing
7.	1	Hub, Race/Output, Male	27.	1	Gearcase, LH
8.	1	Pin, Dowel	28.	2	Seal, Oil
9.	1	Bearing, Roller Ball	29.	1	Plug, Oil Fill
10.	1	Clutch Housing/Ring Gear	30.	4	Washer, Spring Lock
11.	1	Spring	31.	4	Screw
12.	14	Kit, Roll	32.	1	Plug, Oil Drain
13.	2	Ring, Retaining	33.	1	Washer
14.	1	Bushing	34.	1	Bearing, Needle, Roller Thrust
15.	1	Hub, Race/Output, Female	35.	1	Roll Cage, Aluminum
16.	1	Bushing	36.	1	Plate Armature
17.	AR	Line, Fuel			
18.	1	Clip			
19.	1	Clamp, Hose			



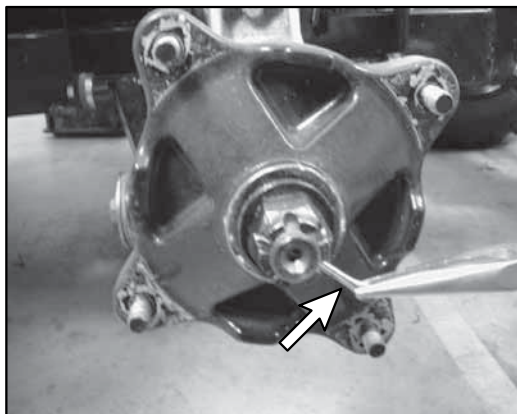


MID DRIVE BEARING CARRIER/HUB REMOVAL (6X6)

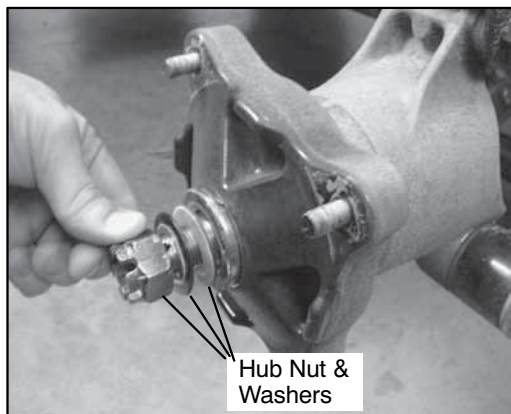
1. Lock the emergency parking brake. Safely raise the center of the machine with a floor jack. Raise the machine just enough to remove the middle wheel.
2. Remove the four wheel nuts and wheel.



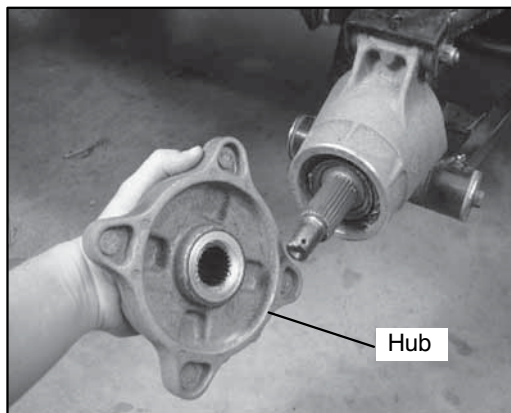
3. Remove the hub cap and cotter pin.



4. Remove the hub nut, domed washer, and flat washer.

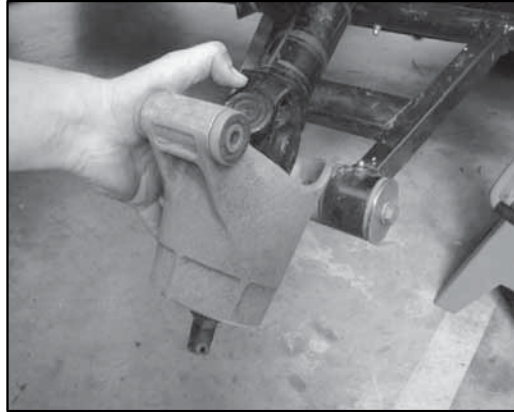
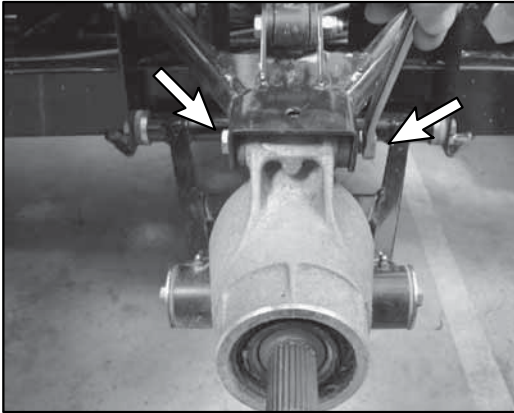


5. Remove the hub from the axle shaft.





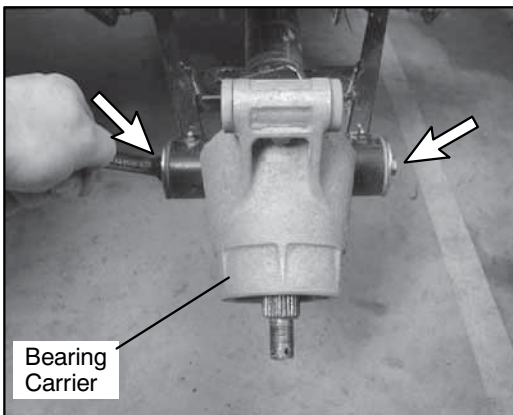
6. Remove the upper control arm bolt.



3. Install and torque both lower control arm bolts.

7. Remove the both lower A-arm bolts.

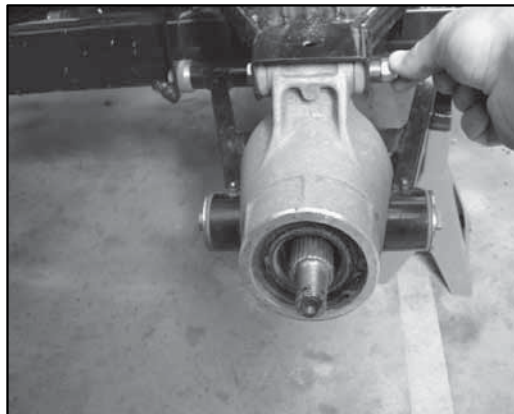
8. Remove the bearing carrier from the A-arm assembly.



Lower Control Arm Bolt Torque:
40 ft. lbs. (54 Nm)

Upper Control Arm Bolt Torque:
40 ft. lbs. (54 Nm)

4. Lift bearing carrier until top aligns with upper control arm. Install and torque upper control arm bolt and torque to specification.



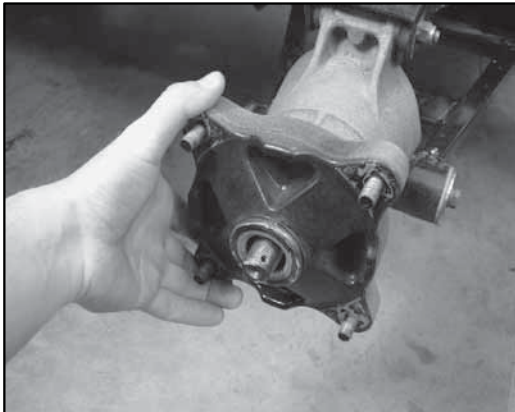
MIDDLE HUB INSTALLATION **(6X6)**

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.





- Pull drive shaft outward and install hub onto driveshaft splines.



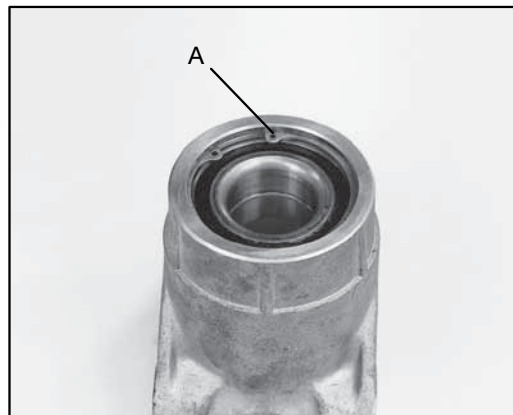
Rear Hub Nut Torque:
110 ft. lbs. (149 Nm)

Rear Wheel Nut Torque
35 ft. lbs. (47 Nm)

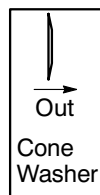
- Install a new cotter pin. Tighten nut slightly to align holes if required.
- Install hub cap.

MID DRIVE BEARING **CARRIER / HUB** **DISASSEMBLY (6X6)**

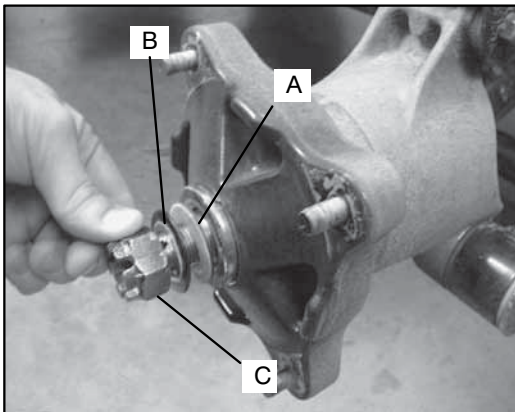
- Remove outer snap ring (A).



- Install the washer (A) and the cone washer (B) with domed side facing outward. (Refer to next photo)



- Install retainer nut (C), wheel and wheel nuts.



- 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.

- Remove jackstand and torque the rear hub nut to 100 ft. lbs. (138 Nm) and wheel nuts to 20 ft. lbs. (27 Nm).





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.

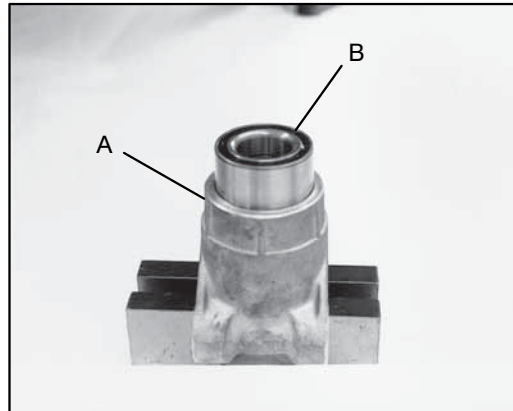
4. Inspect bearing housing for scratches, wear or damage. Replace housing if damaged.

MID DRIVE BEARING CARRIER/HUB ASSEMBLY (6X6)

1. Support bottom of bearing carrier housing. (A) Bearing Carrier Housing; (B) Bearing; (C) Snap Ring



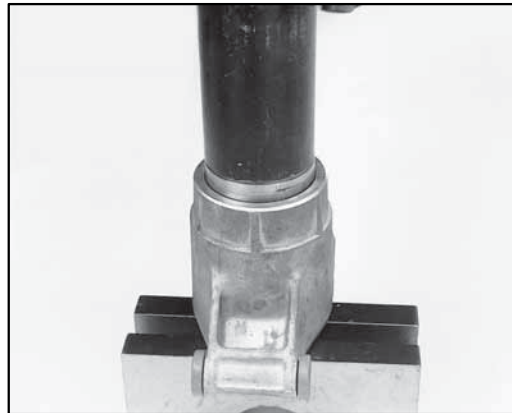
2. Start bearing (B) in housing (A).



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

CAUTION:

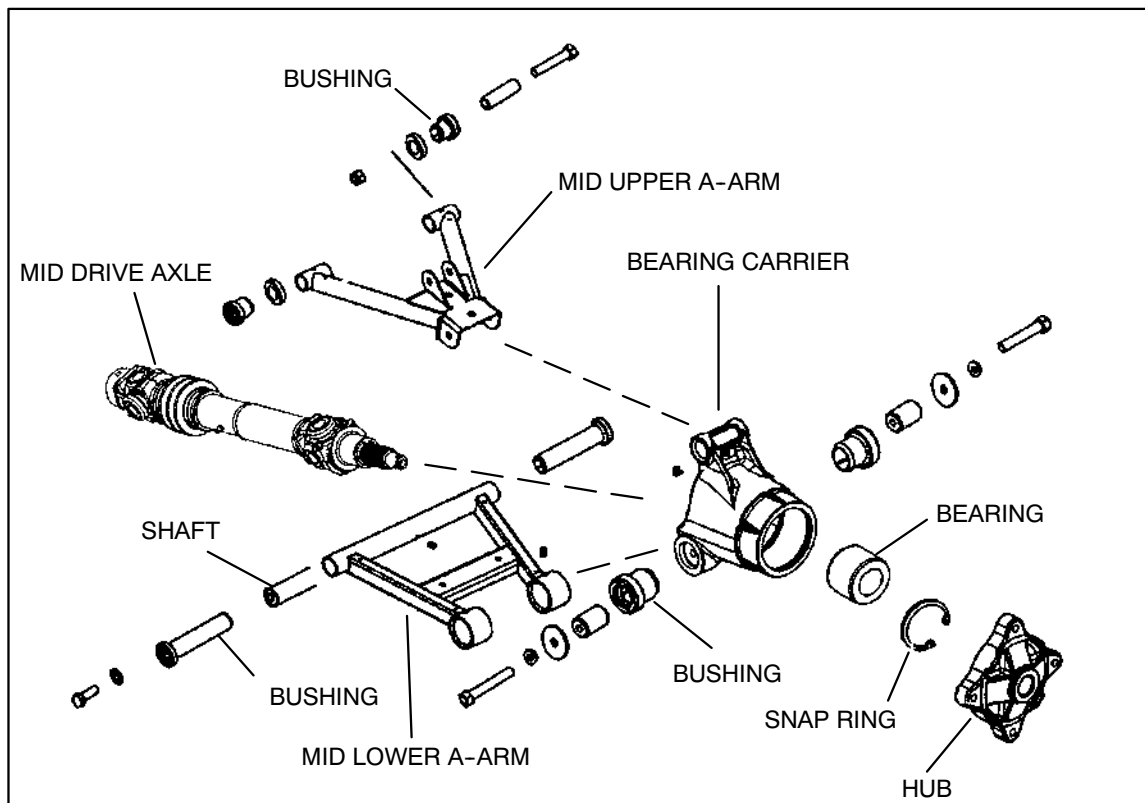
Use an arbor and press only on the outer race, as bearing damage may occur.



4. Install snap ring into groove.



MID DRIVE HUB EXPLODED VIEW (6X6)

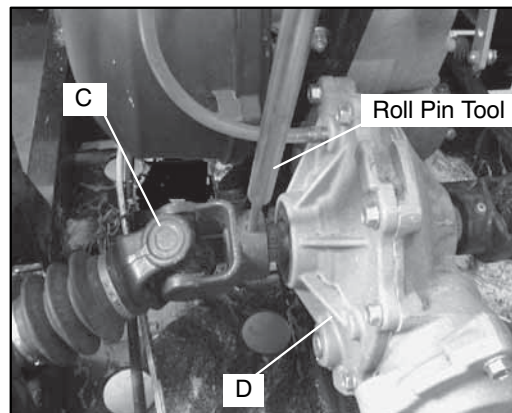
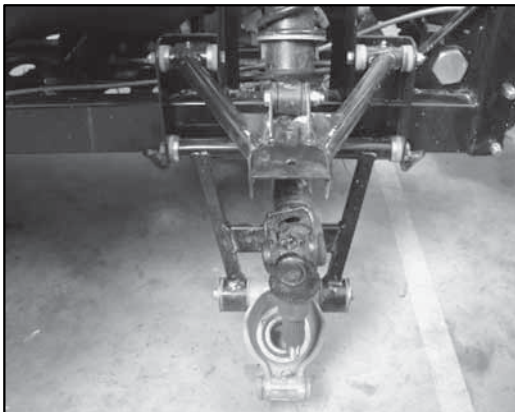


MID DRIVE SHAFT REMOVAL (6X6)

1. Repeat Steps 1-6 in the "MID DRIVE BEARING CARRIER/HUB REMOVAL" section.
2. Slide the middle axle out of the bearing carrier by pulling the bearing carrier assembly outward and down.

spring pin secures the yolk of the middle axle to the middle gearcase (D) output shaft.

NOTE: To ease the removal of the roll pin from the middle axle and middle gearcase output shaft, remove the dump box from the frame. Refer to Chapter 5.

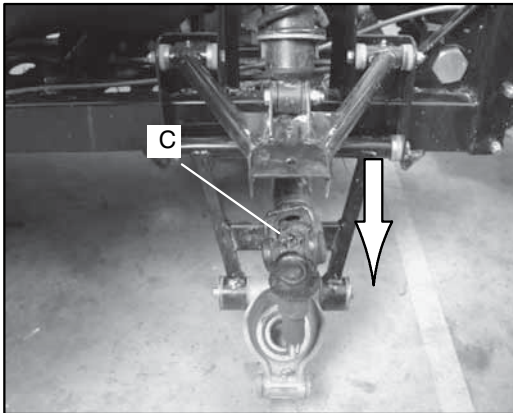


3. Remove the roll pin from the middle axle (C), using the Roll Pin Removal Tool (PN 2872608). The



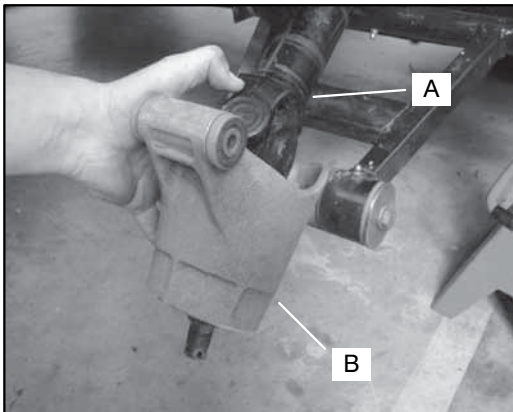


4. Pull the middle axle (C) straight out of the frame.



MID DRIVE SHAFT INSTALLATION (6X6)

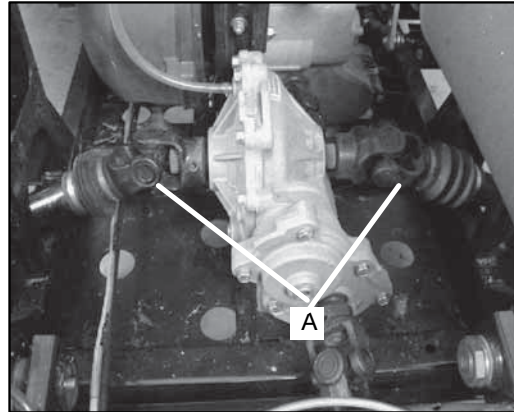
1. Slide the middle axle (A) into the bearing carrier hub (B).



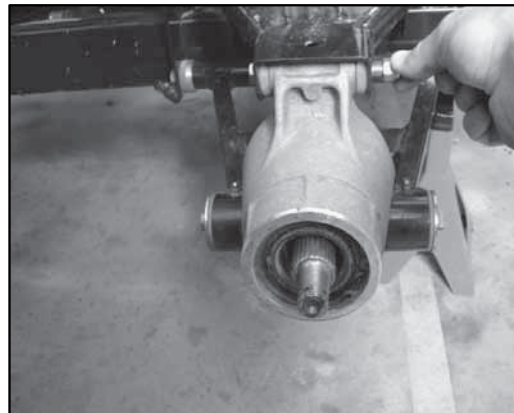
2. Apply Anti-Seize Compound onto the middle gearcase output shaft splines. Reinstall the

middle driveshaft (A) onto the middle gearcase output shaft. Be sure to align the roll pin holes of the middle driveshaft (A) and middle gearcase.

3. Install a new roll pin to secure the middle driveshaft (A) to the middle gearcase.

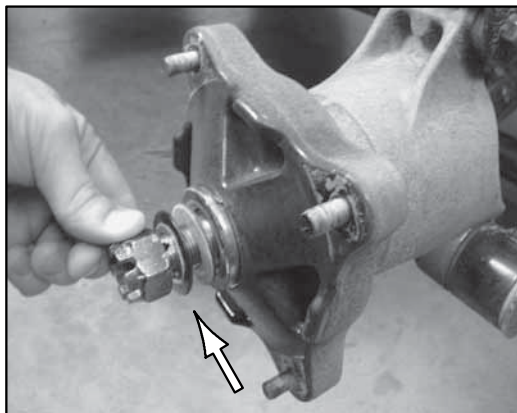


4. Lift bearing carrier into place and install bolt to upper control arm. Torque bolt to 35 ft. lbs. (48 Nm).





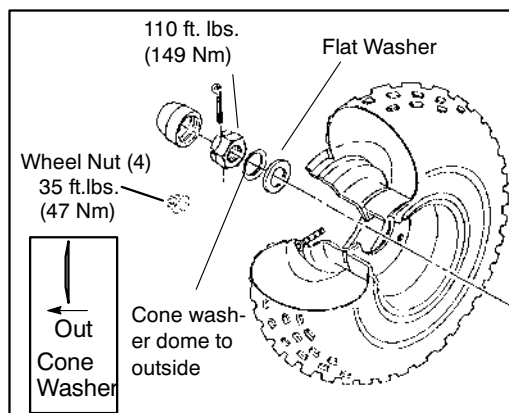
5. Install hub, flat washer, domed washer (domed side out) and nut. Torque center nut to 110 ft. lbs. (149 Nm). Install new cotter pin and hub cap.



Rear Hub Nut Torque:

110 ft. lbs. (149 Nm)

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



Rear Wheel Nut Torque:

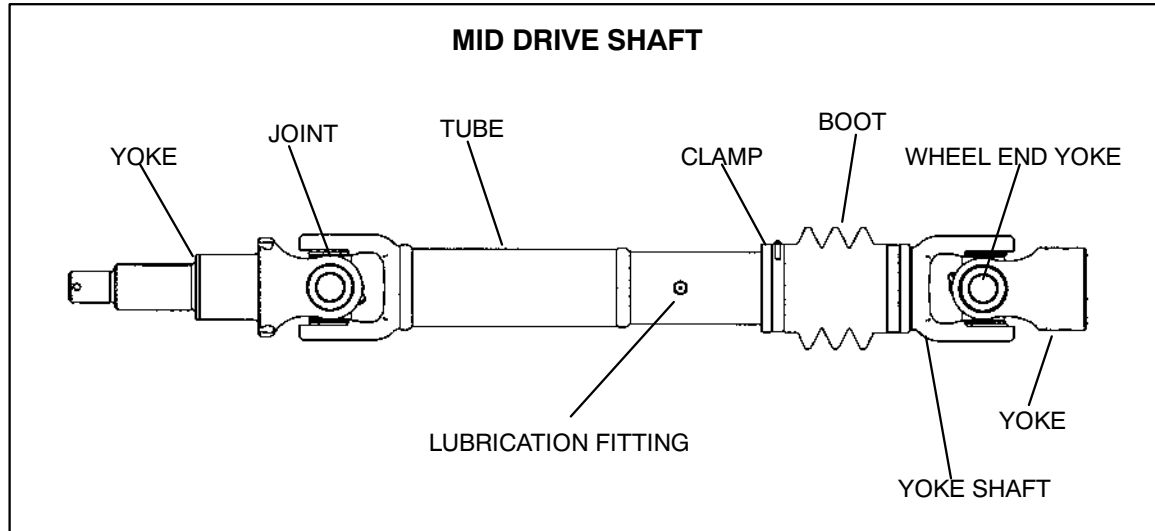
35 ft. lbs. (47 Nm)

7. Grease all fittings thoroughly with Premium U-Joint Lubricant (PN 2871551).





MID DRIVE SHAFT DISASSEMBLY / ASSEMBLY (6X6)



NOTE: Drive shafts must be aligned properly to avoid vibration. Before disassembling the middle driveshaft, be sure to mark the shaft and all U-joints. Take note of the position of the grease fittings to ease assembly.

1. Remove the shaft boot clamp. Separate the middle drive shaft halves.
2. Inspect the inner and outer splines of the shafts.
3. Refer to the U-JOINT DISASSEMBLY section on Page 7.13 for axle U-joint disassembly. When disassembling U-joints, the yoke bore alignment must be inspected. Refer to Page 7.14 for the inspection procedure.

Middle Driveshaft Assembly

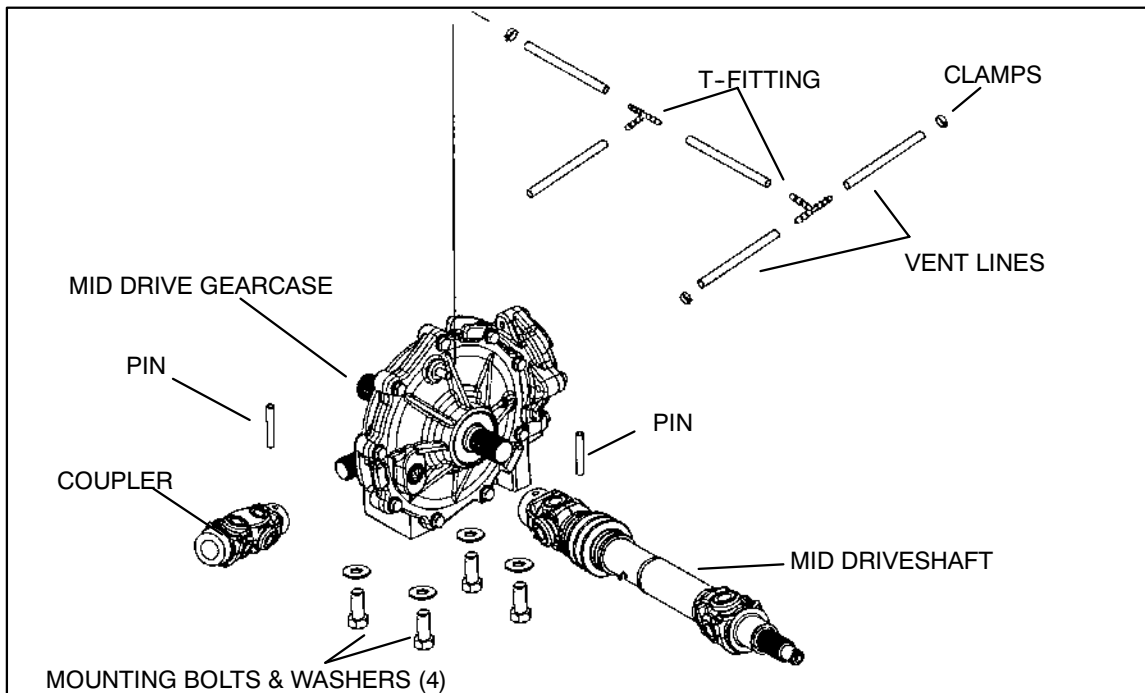
NOTE: When assembling U-joints, be sure to position the grease fittings correctly.

1. Assemble the axle U-joints as described in the U-JOINT ASSEMBLY section Page 7.14. Inspect the yoke bore alignment on all of the yokes. If a yoke is twisted, warped, or misaligned, it must be replaced or pre-mature joint failure will result.
2. Install the drive shaft boot on one of the drive shaft halves.
3. Grease the splines of the shaft with Polaris Premium U-Joint Grease (**PN 2871551**).
4. To prevent driveline vibration, the inner and outer yokes must be aligned properly. Assemble the rear drive shaft, aligning the inner and outer yokes and grease fittings.
5. Install the boot clamps using the Boot Clamp Pliers (**PN 8700226**).
6. Collapse the driveshaft assembly and grease until grease starts to run out of the hole on the end of the shaft.



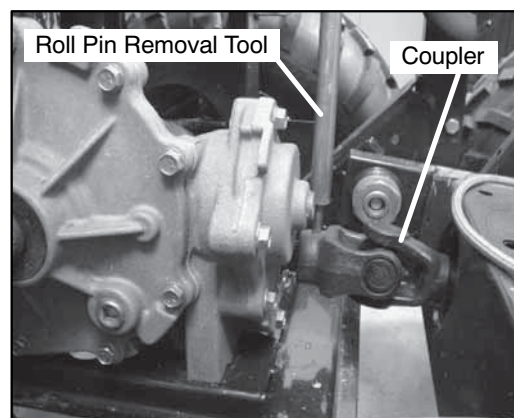
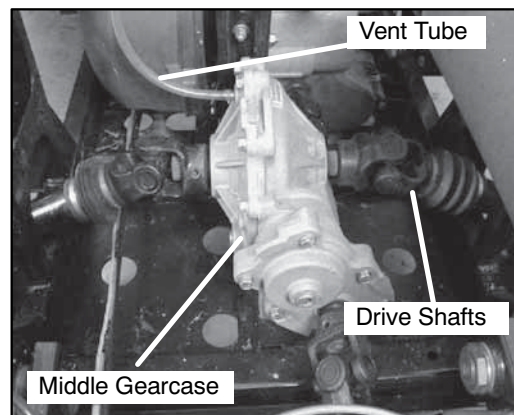


MID DRIVE GEARCASE REMOVAL



NOTE: To ease the removal of the middle axle gearcase, remove the box from the frame. Refer to the Box Removal Procedure in Chapter 5.

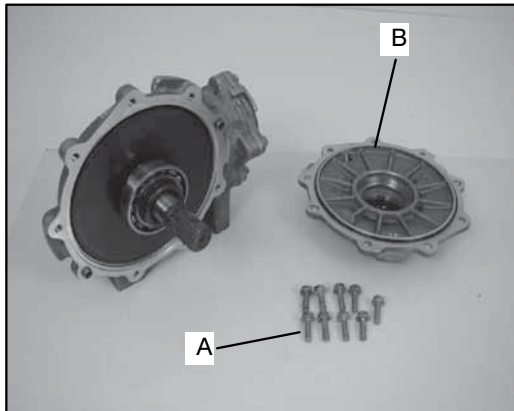
1. Remove the vent line clamp and vent line from the top of the middle drive gearcase.
2. Repeat Steps 1-3 in the MID DRIVESHAFT REMOVAL section on Page 7.29.
3. After the middle axle drive shafts are removed from the middle drive gearcase, remove the coupler (Step 3).
4. Use the Roll Pin Removal Tool (PN 2872608) to remove the roll pin that secures the coupler to the middle drive gearcase.
5. Remove the four bolts and washers that secure the gearcase to the frame. The bolts are accessible through the skid plate on the bottom of the frame.
6. With the drive shaft's and coupler removed from the middle gearcase output shaft, lift the gearcase out of the frame.





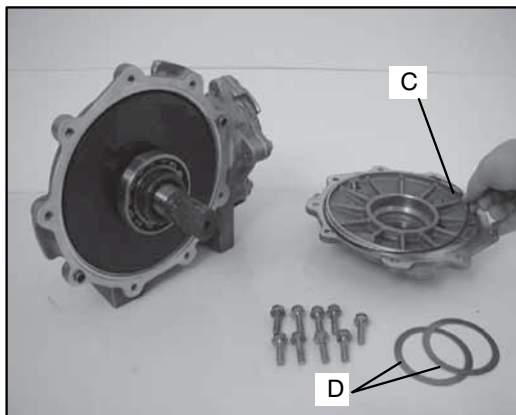
MID DRIVE GEARCASE DISASSEMBLY (6X6)

1. Drain the oil from the mid drive gearcase. Properly dispose of the oil.
2. Remove the output cover bolts (A) and the output cover (B).

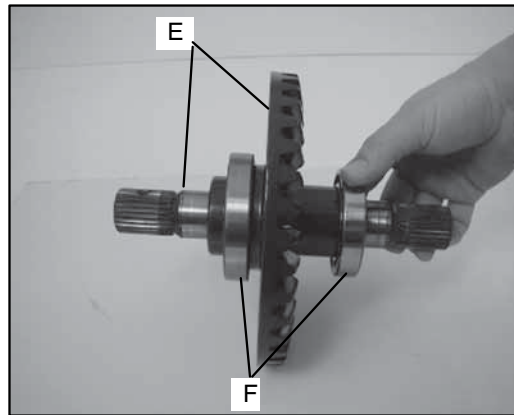


3. Remove the O-ring (C) and two shims (D) from the output cover.

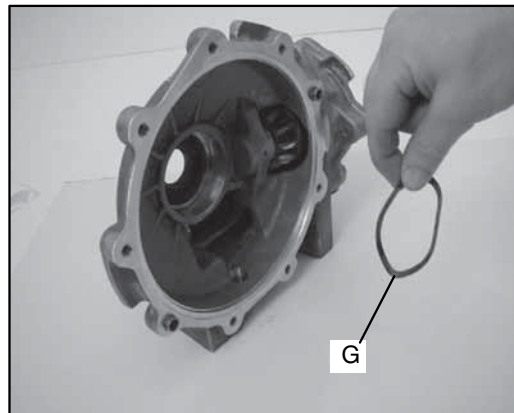
NOTE: The two shims are different of thickness. Be sure to note the placement of the shims as they are removed from the output cover for later installation.



4. Remove the output shaft and ring gear assembly (E) from the gearcase. Inspect the ring gear for abnormal wear, broken, or chipped teeth. Inspect and spin the bearings (F), the bearings should rotate smoothly.

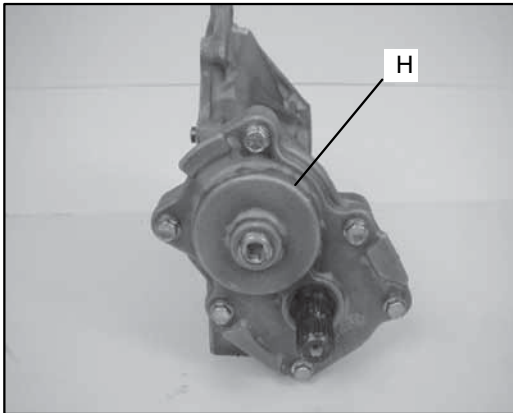


5. Remove the wave spring (G) from the gearcase assembly.

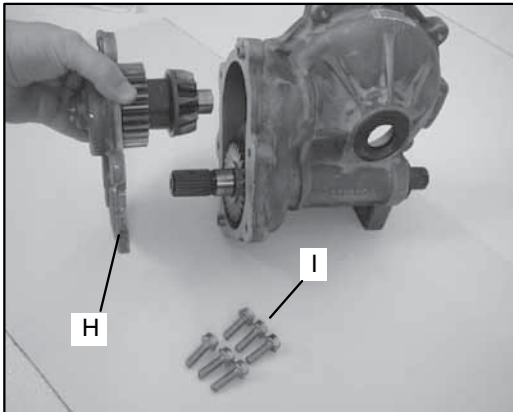




6. Remove the bolts from the input cover (H).

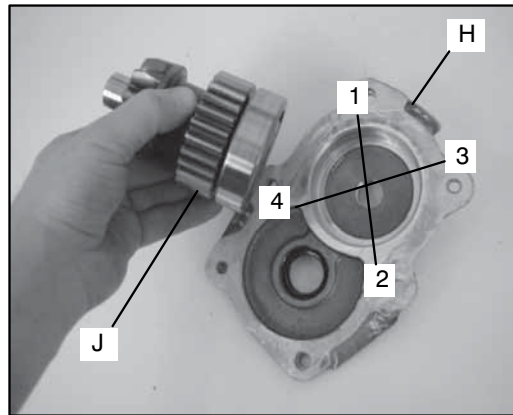


7. Remove the input cover bolts (I). Remove the input cover (H) and pinion gear assembly from the gearcase.

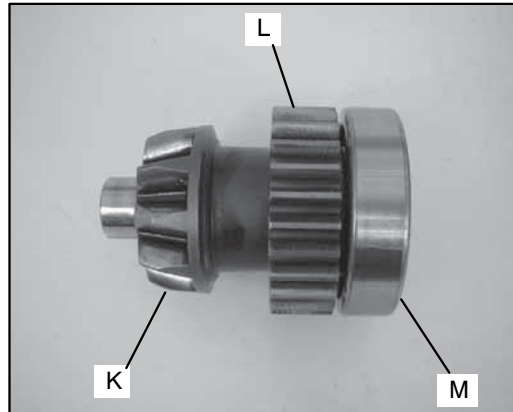


8. Remove the pinion gear (J) assembly from the front cover (H). If the pinion gear does not come loose from the front cover, use the following steps to aid in removal:

- Hold the pinion gear assembly
- Use a rubber mallet to lightly tap around the bearing cup of the front cover
- Tap the front cover in an X pattern (follow the pattern in the photo on the right), until the pinion gear assembly comes loose

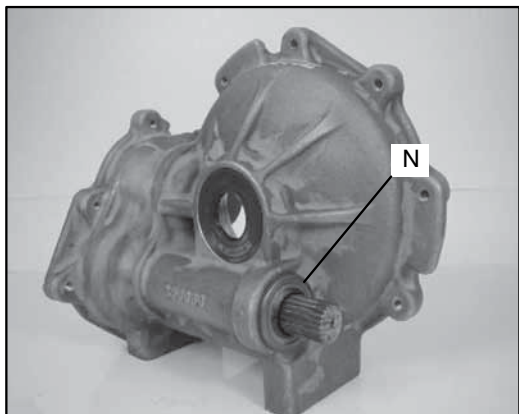


9. Inspect the pinion gear (K) and 26T output gear (L) for nicks or uneven wear. Inspect the bearing (M), the bearing should spin smoothly. Replace the parts as needed.

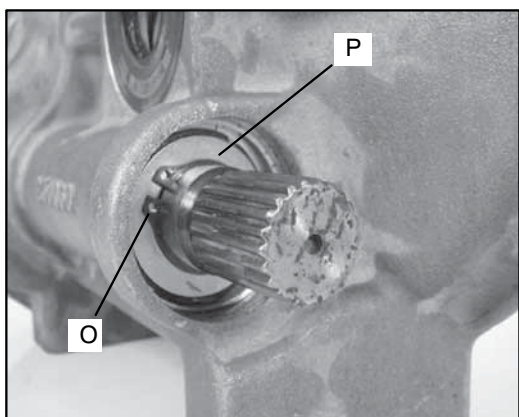


10. Remove the rear output seal (N). See next page.

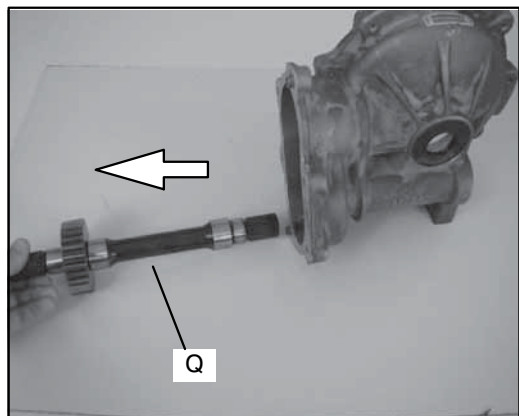




11. Remove the retaining ring (O) and shim (P) from the rear output thru shaft.

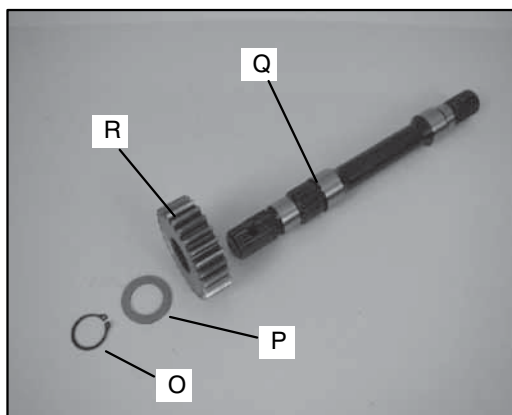


12. Carefully pull the output thru shaft (Q) through the gearcase.

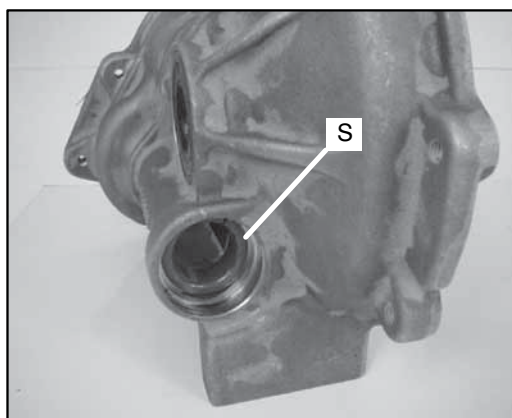
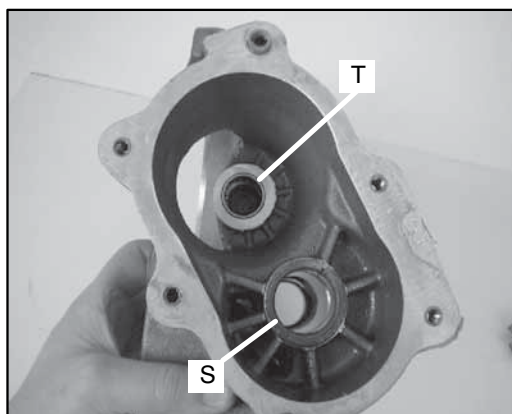


13. Remove the retaining ring (O), shim (P), and input gear (R) from the output thru shaft (Q). Inspect the input gear for abnormal wear, broken, or

chipped teeth.

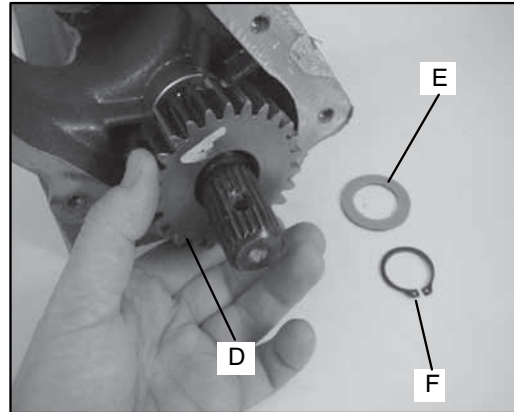
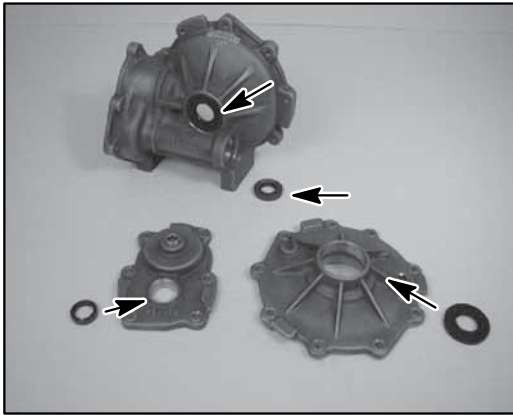


14. Inspect the two flange bearings (S) inside the gearcase. Inspect the pinion shaft bushing (T) for wear that is inside the gearcase.



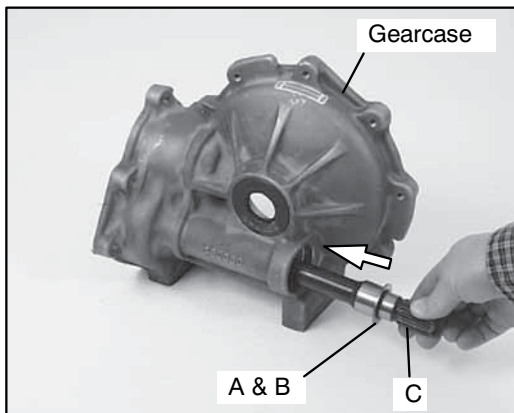
15. Replace all O-ring, seals, and worn components. Replace the seals as shown in the photo.





MID DRIVE GEARCASE ASSEMBLY (6X6)

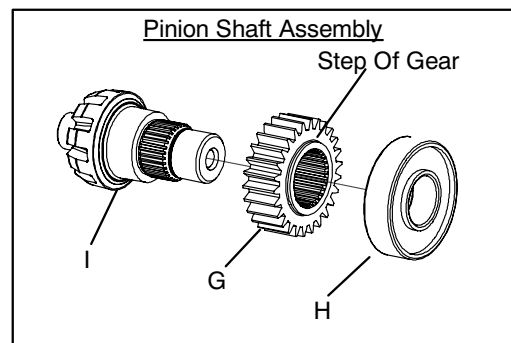
1. Install the shim (A) and a **new** retaining ring (B) onto the output end of the output thru shaft (C). Install the output thru shaft into the gearcase.



2. Install the 26T input gear (D), shim (E), and a **new** retaining ring (F) onto the output thru shaft.

3. Assemble the pinion shaft assembly (if previously disassembled). Install the 26T gear (G) and bearing (H) onto the pinion shaft (I).

NOTE: When replacing the 26T output, be sure the step of the gear is facing towards the bearing (See Below and next page).

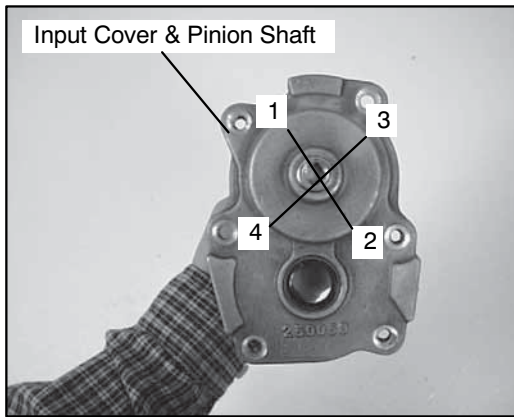




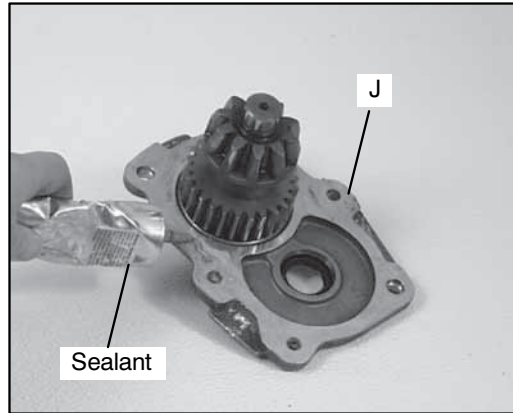
4. Install the pinion shaft assembly into the input cover.

NOTE: Alignment of the pinion shaft bearing into the input cover maybe be difficult. If needed, use the following steps to aid in installation (refer to photo on right):

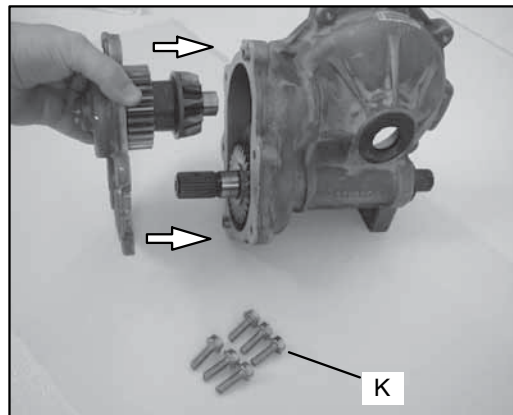
- Hold the pinion gear assembly
- Use a rubber mallet to lightly tap on the front of the input cover, around the bearing cup
- Tap the front cover in an X pattern (follow the pattern in the photo on the right), until the pinion gear assembly comes loose



5. Apply Polaris Crankcase Sealant (**PN 2871557**) to the inside surface of the input cover (J).

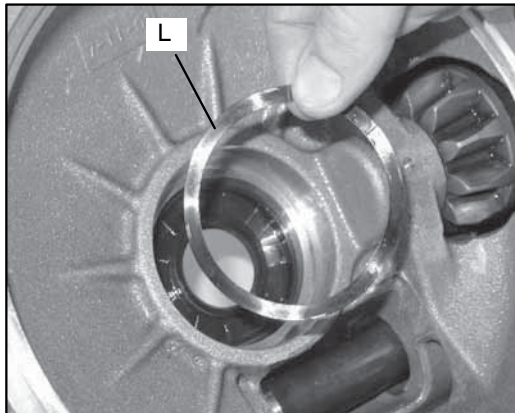


6. Install the pinion shaft assembly and input cover onto the gearcase. Install the input cover bolts (K). Torque the bolts to 18-23 ft. lbs. (24-31 Nm).

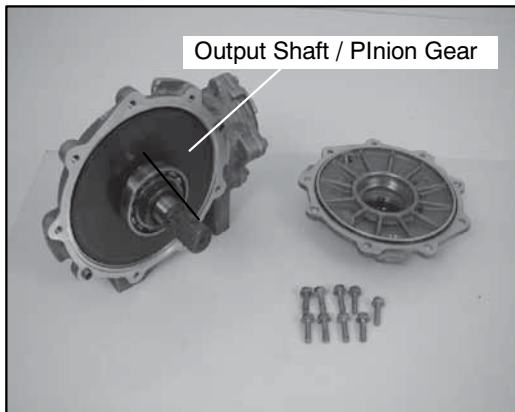




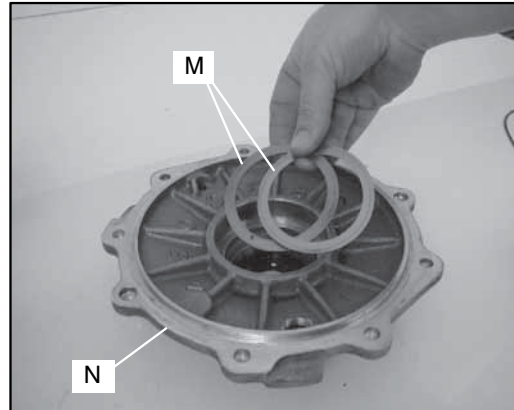
7. Install the wave spring (L) into the gearcase assembly. Be sure the wave spring is fully seated into the bearing cup of the gearcase.



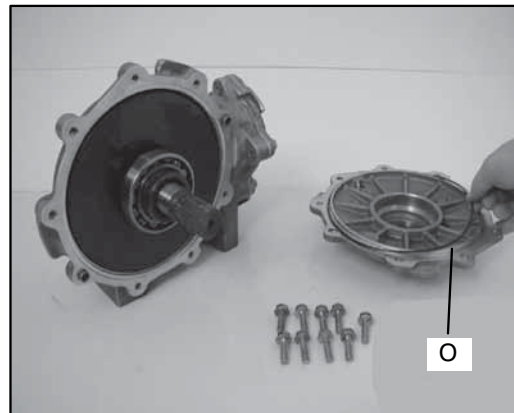
8. Install the output shaft and ring gear into the gearcase. Be sure the 10T input pinion gear and the output pinion gear mesh smoothly.



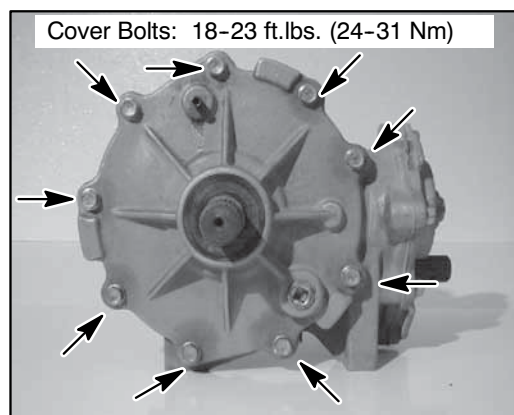
9. Install the shims (M) into the output cover (N). Install the shims in the order that they were removed during the disassembly process.



10. Install a new O-ring (O) onto the output cover.

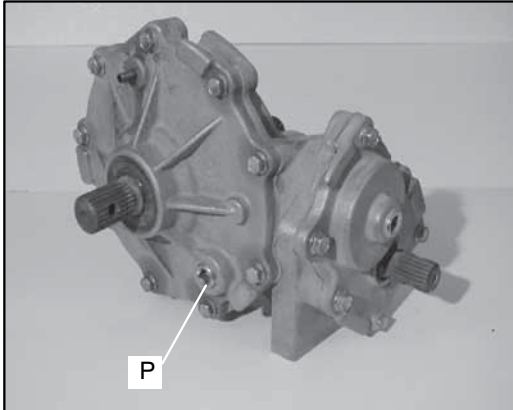


11. Carefully install the output cover onto the gearcase. Install the output cover bolts. Torque the bolts to 18-23 ft. lbs. (24-31 Nm).



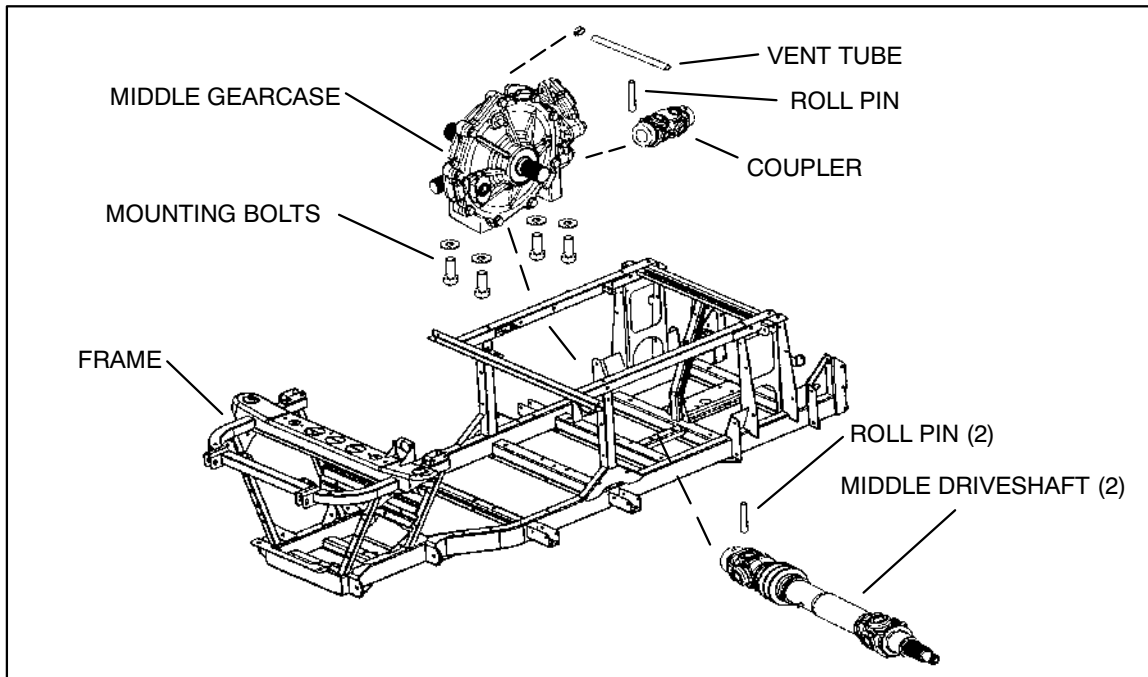
**Input Cover Bolt Torque:****18-23 ft. lbs. (24-31 Nm)**

12. Remove the fill plug (P) and fill the mid gearcase with 6.75 oz. (200 ml) of Polaris Gear Drive Lube (**PN 2871653**). Torque the fill plug to 14 ft. lbs. (19 Nm).

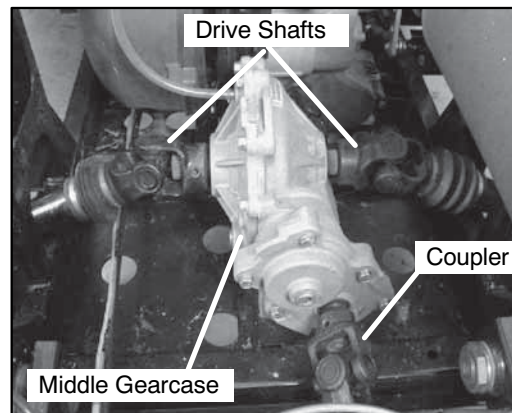
Middle Gearcase Specifications:**Capacity: 6.75 oz. (200 ml)****Specified Lubricant: Polaris Gearcase Lubricant (PN 2871653)****Fill Plug Torque: 14 ft. lbs. (19 Nm)**

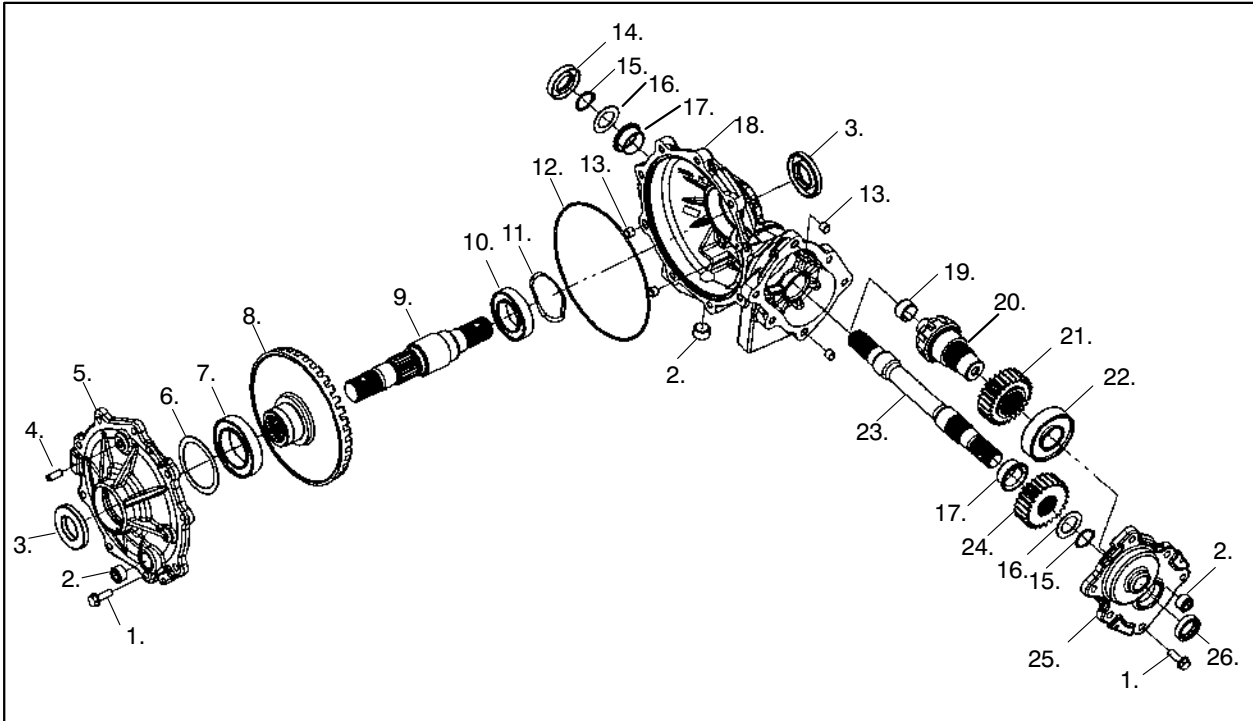


MID DRIVE GEARCASE INSTALLATION (6X6)



1. Place the middle gearcase in the frame assembly.
2. Install the coupler to the middle gearcase, but do not install the new roll pin yet.
3. Install the four middle drive gearcase bolts. Torque the bolts to 30 ft. lbs. (41 Nm) in a cross pattern.
4. Install a new roll pin into the coupler and middle gearcase rear output shaft.
5. Install new roll pins into each of the middle axles and middle gearcase output shafts.
6. Install the vent tube and clamp.
7. Lift bearing carrier into place and install bolt to upper control arm. Torque bolt to 35 ft. lbs. (48 Nm). Refer to the MID DRIVE SHAFT INSTALLATION section on Page 7.28-7.29 for more details.
8. Install hub, flat washer, domed washer (domed side out) and nut. Torque center nut to 110 ft. lbs. (149 Nm). Install new cotter pin and hub cap.
9. Install rear wheel and torque wheel nuts to specification.
10. Grease all fittings thoroughly with Premium U-Joint Lubricant (PN 2871551).



**MID DRIVE GEARCASE EXPLODED VIEW (6X6)**

Ref.	Qty.	Description	Ref.	Qty.	Description
	1	Asm., Mid Gearcase	14.	1	Seal, Triple Lip
1.	15	Screw	15.	2	Ring, Retaining
2.	3	Plug	16.	2	Washer, Thrust
3.	2	Seal	17.	2	Bushing
4.	1	Tube, Vent	18.	1	Gearcase, R11
5.	1	Cover, Output	19.	1	Bushing
6.	1	Shim	20.	1	Pinion, 10T
7.	1	Bearing, Ball	21.	1	Gear, 26T Output
8.	1	Gear, Ring 37T	22.	1	Bearing, Ball
9.	1	Shaft, Output	23.	1	Shaft, Output
10.	1	Bearing, Ball	24.	1	Gear, 26T Input
11.	1	Spring, Wave	25.	1	Cover, Input
12.	1	O-Ring	26.	1	Seal, Triple Lip
13.	4	Pipe, Knock			



REAR HUB INSPECTION (ALL MODELS)

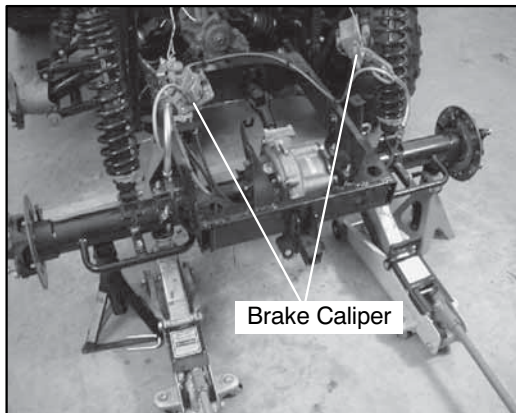
1. Support machine securely with rear wheels elevated.
2. Grasp wheel/hub and check for movement.
3. If movement is detected, inspect hub, hub nut torque and bearing condition and correct as necessary.

REAR DIFFERENTIAL REMOVAL/INSPECTION (ALL MODELS)

1. Jack up vehicle and support on frame and swing are.
2. Remove rear wheels.
3. Remove the brake caliper. Suspend the brake caliper from the frame with wire (both sides).

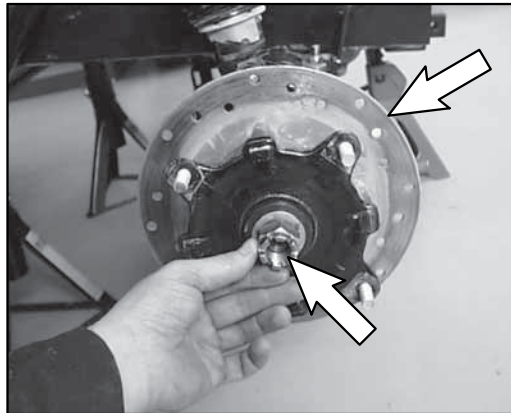
CAUTION:

Serious injury could occur if machine tips or falls.



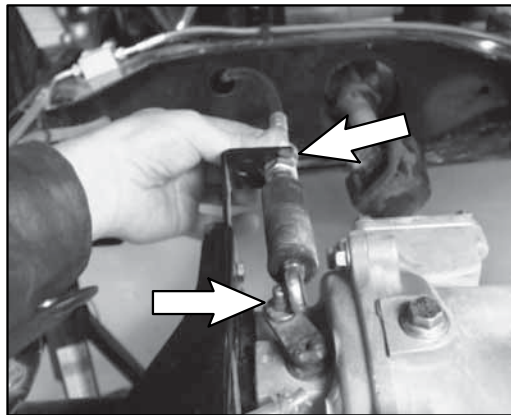
4. Remove the hub cover, cotter pin, spindle nut and washer (both sides).

5. Pull the hub off of the axle.



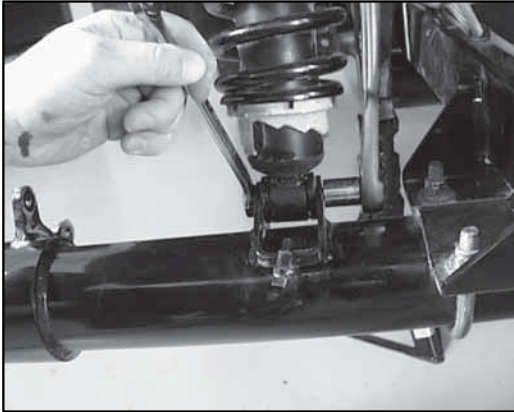
NOTE: ONLY TM, 2x4, and 4x4 models have an actuator on the rear gearcase. Steps 6-8 apply only to the TM, 2x4, and 4x4 models. The 6x6 model does not have the rear gearcase actuator.

6. Remove the cotter pin from the rear gearcase bellcrank. Lift the actuator loose from the bell crank.
7. Loosen the jam nuts that secure the actuator to the bracket. Place the actuator to the side.
8. Remove the hose clamp from the rear gearcase breather hose. Remove the breather hose.

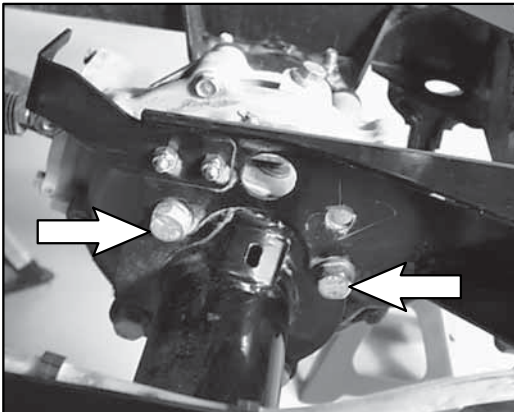




9. Remove the bottom shock bolts and shocks (both sides).

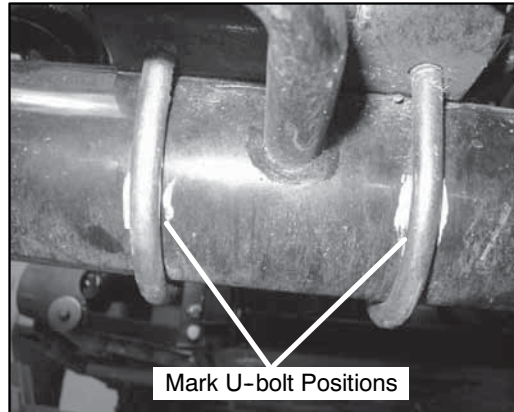


10. Remove the two bolts that secure the rear axle housing to the frame.

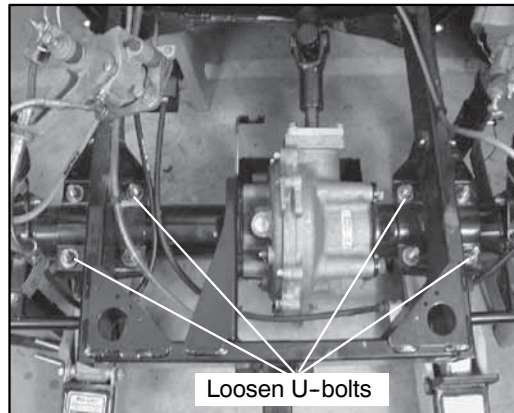


11. Mark the positions of the the four U-bolts that secure the axle to the frame. This will aid with

proper U-bolt and axle placement during reassembly.



12. Loosen the four U-bolts. Loosen each U-bolt nut a few turns at a time, this will reduce stress on all of the U-bolts during U-bolt removal.

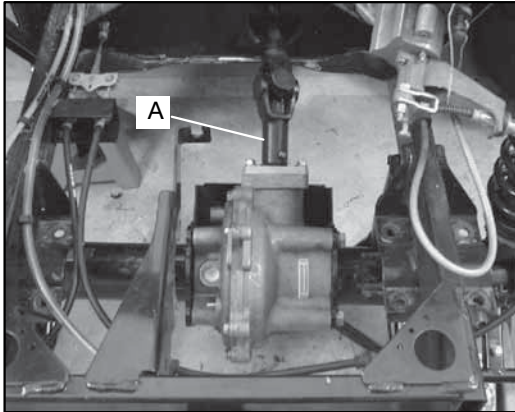




13. With the U-bolts removed, carefully lower the rear axle assembly from the frame. Pull the axle assembly out from the frame.

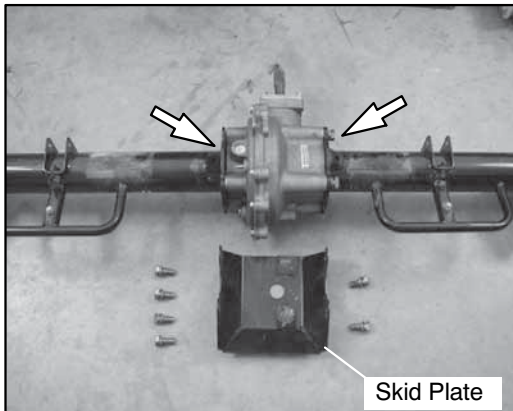
NOTE: The drive shaft yolk slides off of the rear gearcase (A).

NOTE: Use caution when removing the rear axle assembly. Extra jacks maybe needed to lower the rear axle assembly safely.

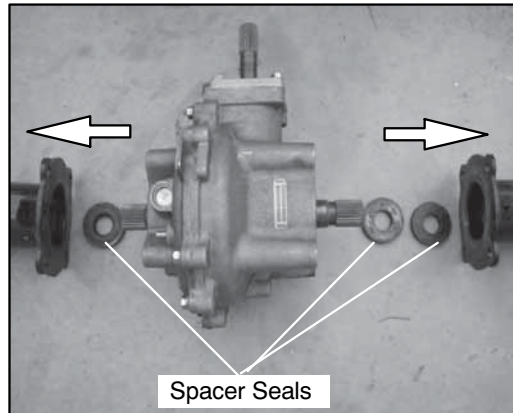


Rear Axle Tube Removal

14. Place the rear axle assembly on a clean surface.
15. Remove the bolts that secure the rear gearcase to the axles.
16. Remove the rear gearcase skid plate.



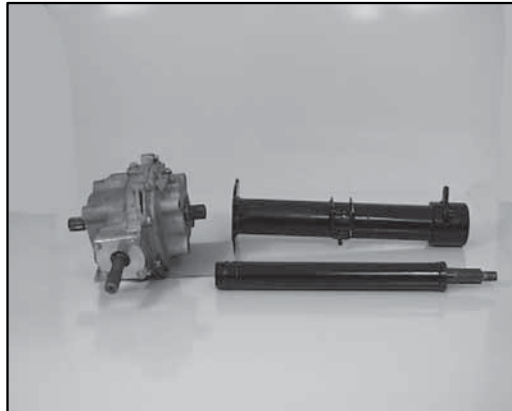
17. Remove the axle and axle tube's from the rear gearcase. Note the placement of the axle spacer seals for placement during reassembly.



18. Slide the axles out of each axle tube.

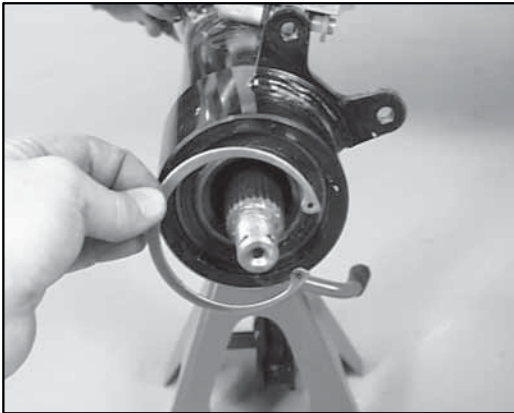
NOTE: Make note of the side each axle was removed.

19. Inspect the splines on the axle ends and the splines on rear gearcase for chips or wear. Replace as needed.

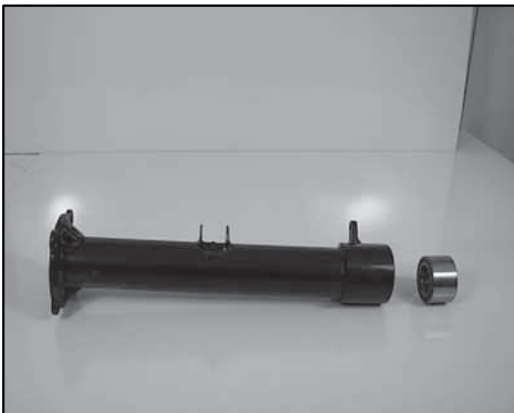


**Bearing Removal/Installation**

20. Remove the retaining ring from the axle tube.



21. Remove the bearings from the axle tube with a bearing puller. Inspect the bearing surface for scoring or nicks. Spin the bearing to check the ball bearings for smoothness. Replace the bearing if needed.



22. Reinstall the bearing using a press.



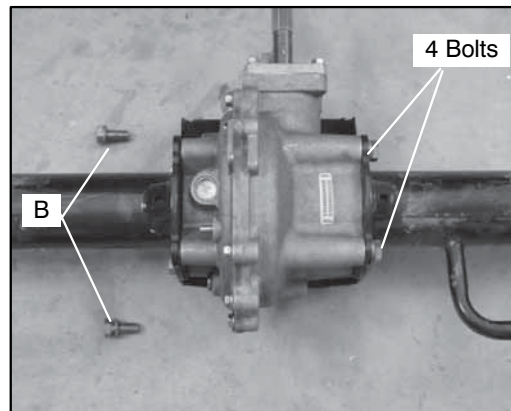
NOTE: The bearing should be properly lubricated before installation.

23. Reinstall the retaining ring.

**REAR DIFFERENTIAL
INSTALLATION (ALL
MODELS)**

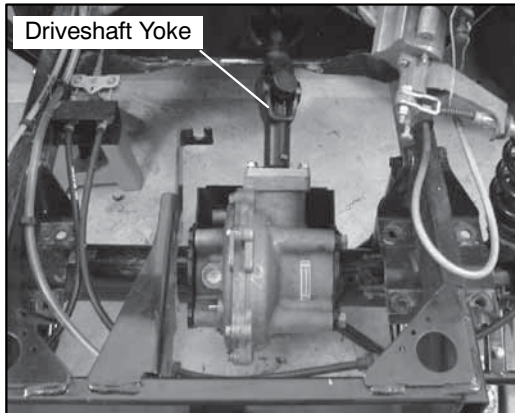
1. Lube the splines of the rear gearcase with anti-seize.
2. Reinstall the axle spacer seals. Reinstall the axle onto the rear gearcase (both sides). Reinstall the axle tube over the axle and attach it to the gearcase.
3. Install and tighten the four bolts onto the right side of the gearcase. Install and tighten the two bottom bolts to the left side of the gearcase. Do not torque the bolts.

NOTE: The two top gearcase to tube bolts (B) on the left side are installed into the frame later in this assembly procedure.





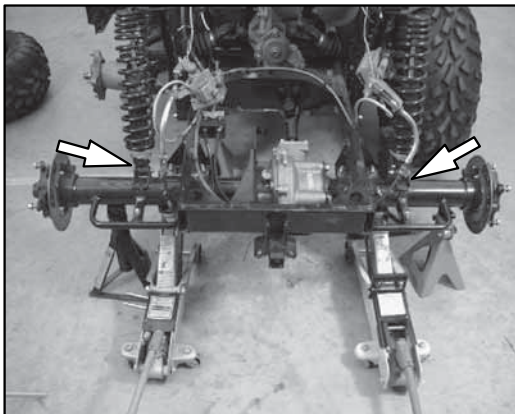
4. Fit the rear axle assembly up to the frame. Slide the rear driveshaft yoke onto the rear gearcase input shaft.



5. Fit the rear axle assembly up to frame. Attach the rear axle assembly to the shocks. Leave the shock bolts finger tight until assembly is complete.

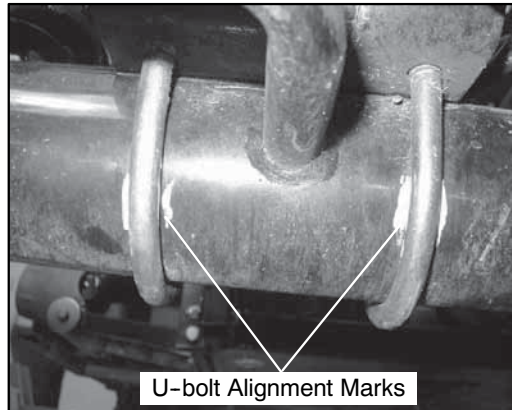
NOTE: Use a jack or another person to assist with the rear axle assembly installation.

NOTE: Use caution when removing the rear axle assembly. Extra jacks may be needed to raise the rear axle assembly safely.

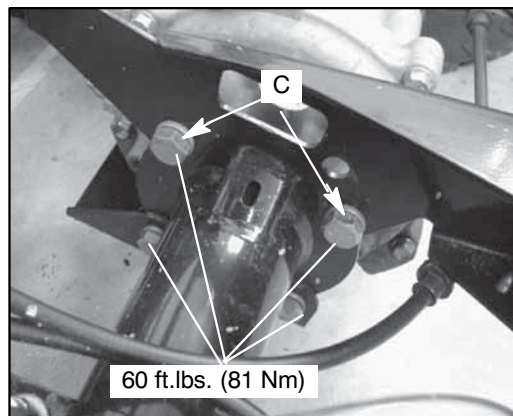


6. Install the four U-bolts. Align the U-bolts with the white marks previously made on the axle tube for proper rear axle alignment.

NOTE: Use a floor jack to help align the rear axle assembly for the U-bolt installation.



7. Install the U-bolt nuts, but do not tighten the nuts.
8. Install the two frame to gearcase bolts (C). Torque the gearcase bolts to 60 ft. lbs. (81 Nm) (Both Sides).

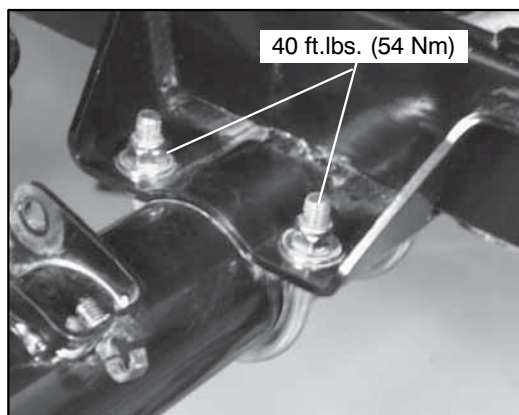


**Axle Tube to Gear Case
Bolt Torque:
60 ft. lbs. (81 Nm)**



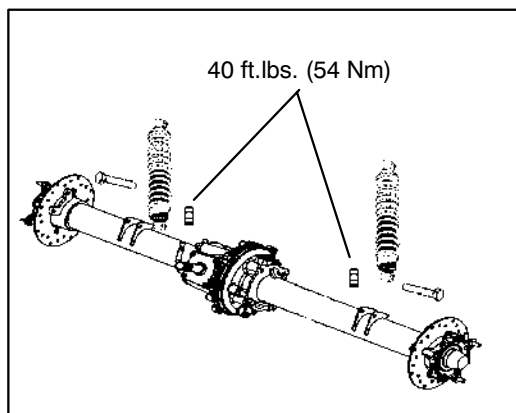


9. Torque the U-bolts nuts to 40 ft.lbs. (54 Nm).



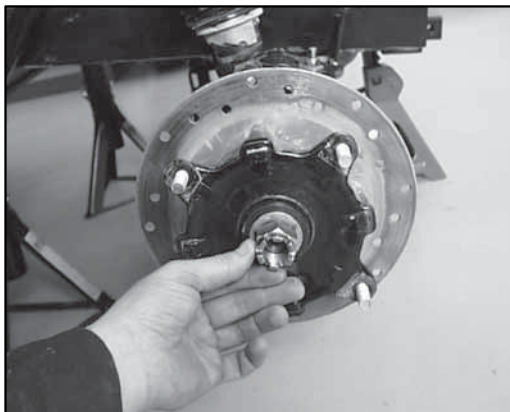
U-Bolt Nut Torque:
40 ft. lbs. (54 Nm)

10. Torque the rear coil over shock bolts to 25 ft. lbs. (35 Nm).

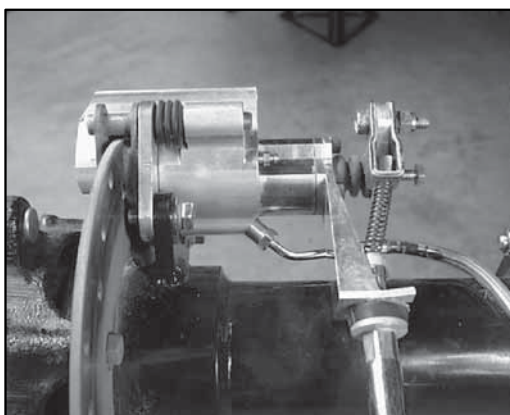


Rear Coil Over Shock Bolt Torque
25 ft. lbs. (35 Nm)

11. Reinstall the vent hose and clamp to the rear gearcase housing.
12. Apply anti-seize to the splines of the axle. Reinstall the hub onto the axle. Reinstall the domed washer, and spindle nut onto the axle.



13. Install the brake caliper. Torque the bolts to 18 ft. lbs. (24.8 Nm).



- 14.

Brake Caliper Torque:
18 ft. lbs. (24.8 Nm)





15. Install the tire and four wheel nuts. Torque the castle nut and the wheel nuts to specifications.



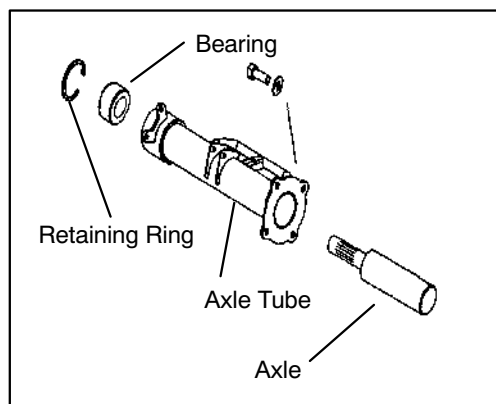
Rear Spindle Nut Torque
110 ft. lbs. (149 Nm)

Rear Wheel Nut Torque
35 ft. lbs. (47 Nm)

16. Install a new cotter pin. Tighten nut slightly to align holes if required. Install the hub cap.

REAR AXLE BEARING REMOVAL/INSTALLATION (ALL MODELS)

1. For rear axle bearing removal, see Page 7.46.

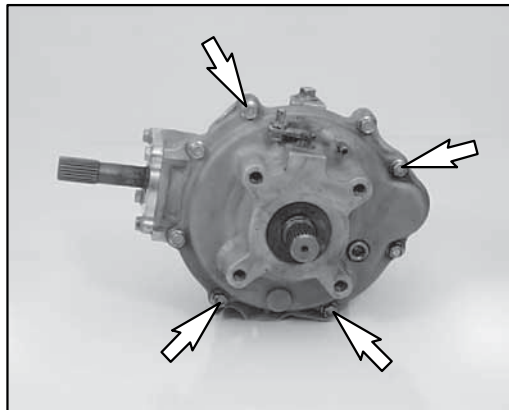


REAR DIFFERENTIAL REMOVAL (ALL MODELS)

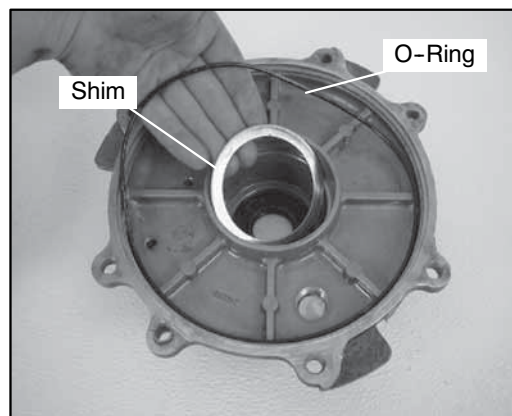
1. Refer to Steps 1–17 in the REAR AXLE HOUSING REMOVAL/INSPECTION section on Page 7.43 for the removal of the rear gearcase.

REAR DIFFERENTIAL DISASSEMBLY (TM, 2X4, & 4X4)

1. Drain and properly dispose of used oil.

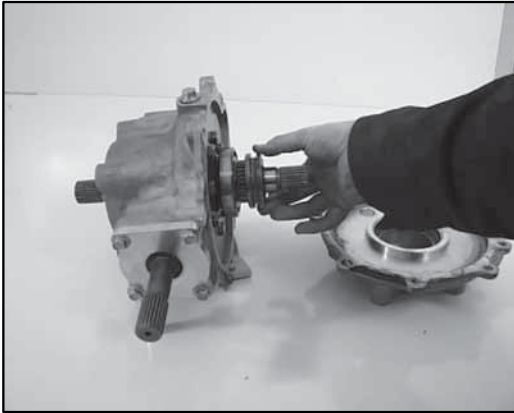


2. Remove the gearcase housing cover bolts and the differential housing cover.
3. Remove the shim and O-ring from the housing cover.

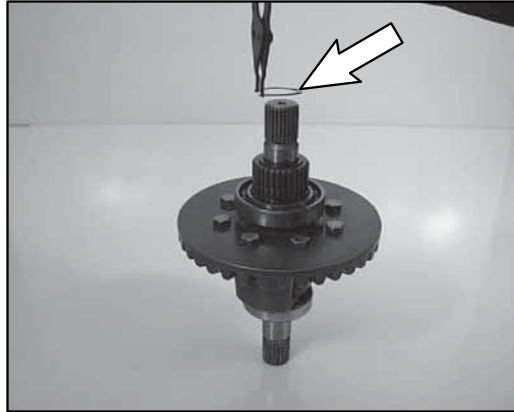




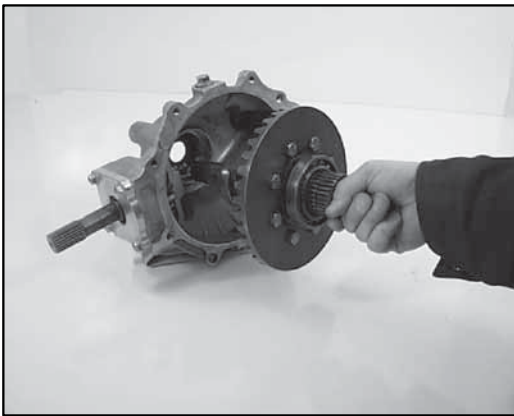
4. Remove the shift dog from the output shaft.



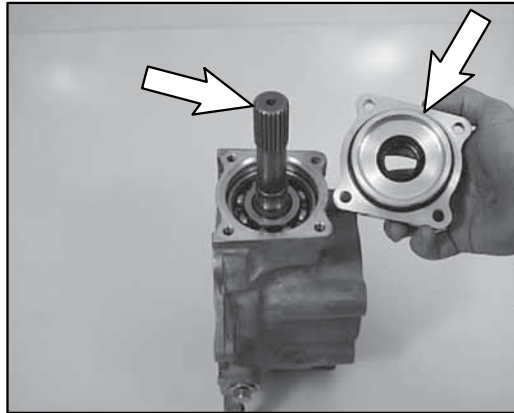
6. Remove retaining ring and the shim from the ring gear.



5. Remove the ring gear from the differential housing cover. Inspect the ring gear for abnormal wear, broken, or chipped teeth.



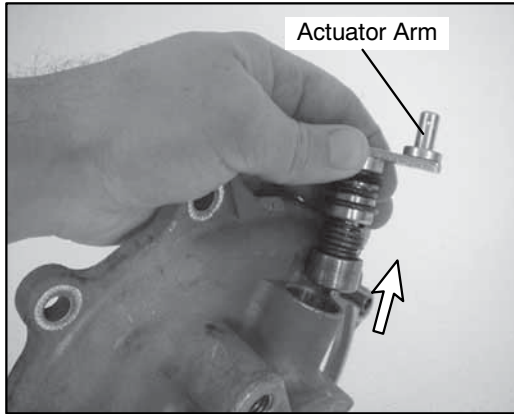
7. Remove the pinion gear cover and the pinion shaft from the differential housing. Inspect the ring gear for abnormal wear, broken, or chipped teeth.





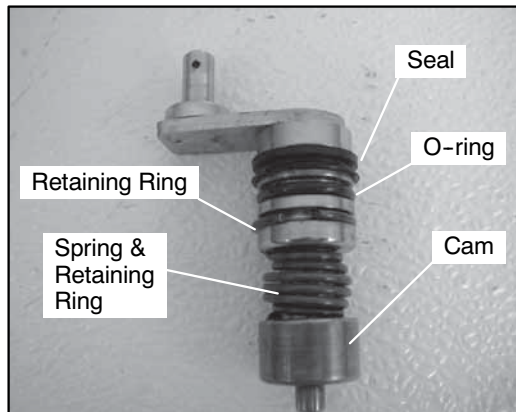
Rear Differential Actuator Removal

- With two small prybars or suitable tools, pry up and outward on the actuator arm. Lift the actuator arm out of the differential cover. A retaining ring secures the actuator assembly in the differential cover.



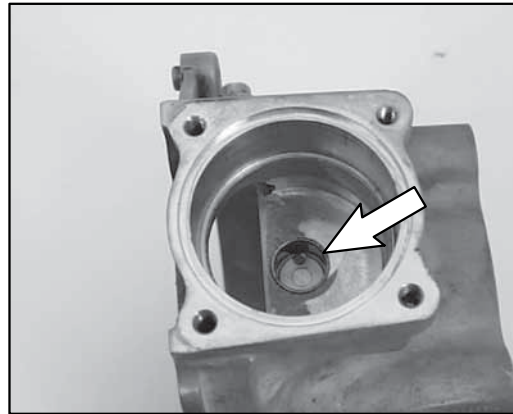
- Inspect the actuator assembly and replace parts as needed. Refer to your parts manual for new parts.

NOTE: The actuator assembly can be taken apart, refer to the exploded view at the end of this section for a parts breakdown.

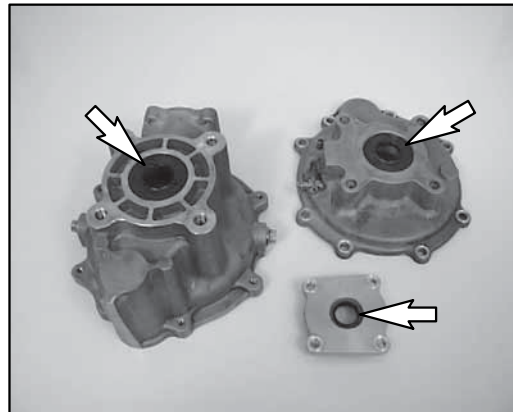


REAR DIFFERENTIAL ASSEMBLY (TM, 2X4, & 4X4)

- Inspect the pinion shaft bushing for wear.

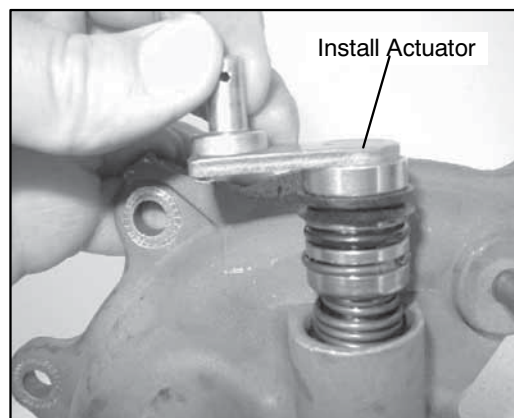
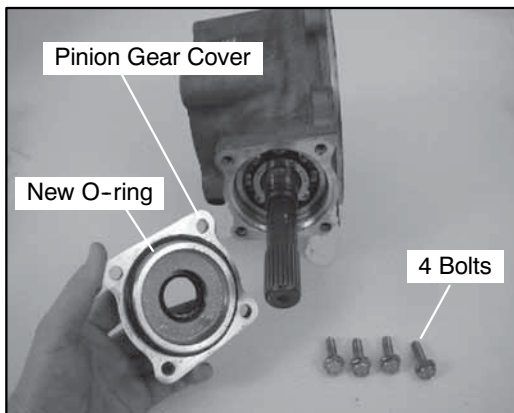
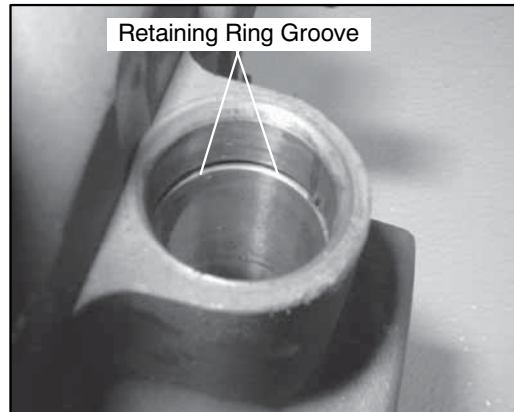


- Replace all O-rings, seals, and worn components.





3. Install the pinion shaft into the differential housing. Install a new O-ring onto the pinion shaft cover. Install the cover and torque the cover bolts to 20 ft. lbs. (27 Nm).



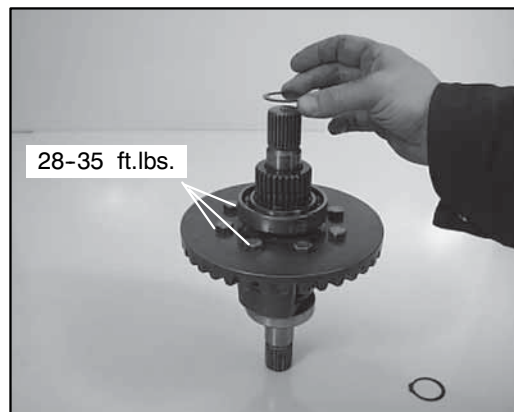
5. Reinstall the the original shims and snap ring onto the output shaft.

NOTE: If disassembling the ring gear from the output shaft be sure to torque the bolts to 28-35 ft.lbs. (38-48 Nm).

Pinion Shaft Cover Bolt Torque:

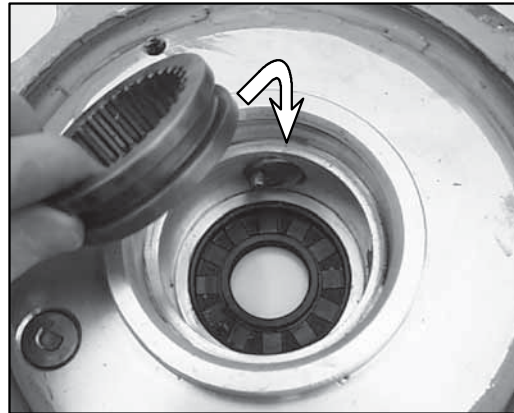
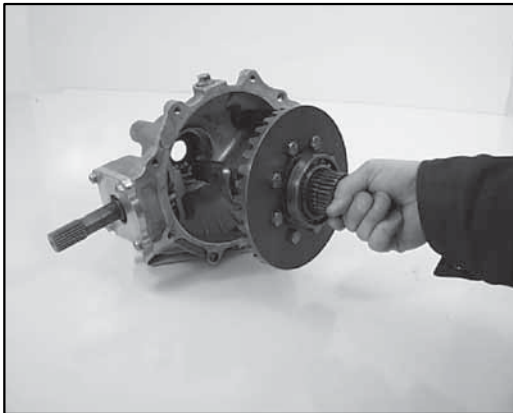
20 ft. lbs. (27 Nm)

4. Install a **NEW** seal, O-ring, and retaining ring onto the actuator if the actuator was removed. Install the actuator into the differential housing. Be sure the retaining ring fully seats into the groove in the differential cover.



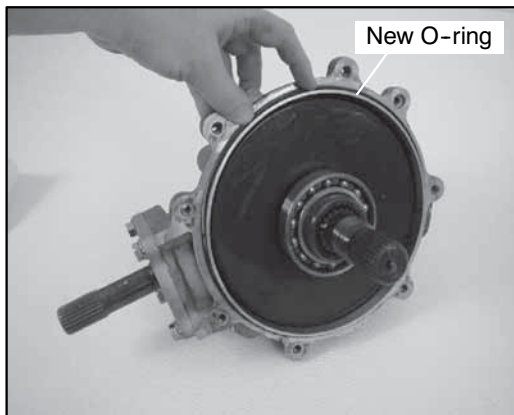


6. Install the ring gear into the differential housing.

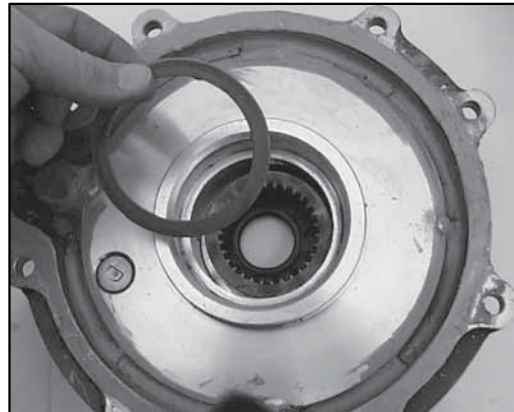


7. Install a new O-ring onto the lip of the gearcase housing.

NOTE: The O-ring is a smaller diameter than the gearcase. Use two hands to work the O-ring onto the gearcase lip.



9. Lubricate the shim with grease and place the shim in the differential housing cover.



8. Install the shift dog into the differential housing cover. The shift lever arm fits into the groove of the shift dog.

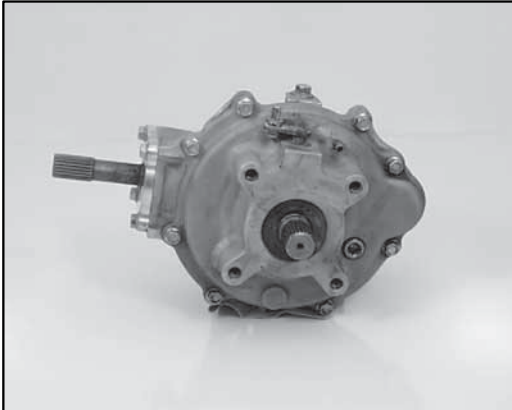
10. Carefully place the differential housing cover onto the gearcase housing. Slide the shift dog over the output shaft.

NOTE: Be sure the shift dog does not slide out of place during assembly of the gearcase halves.



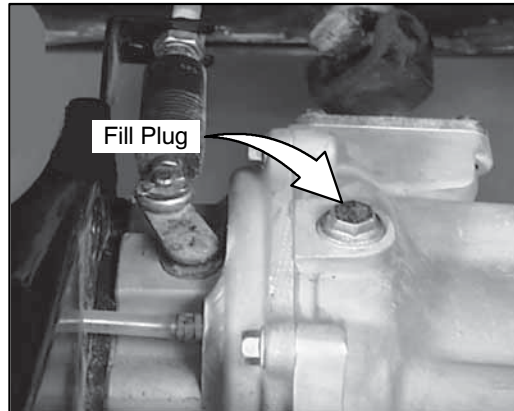


11. Torque the cover bolts to 20 ft. lbs. (27 Nm) in a criss cross pattern.



Cover Bolts Torque
20 ft. lbs. (27 Nm)

correct specs. Check drain plug for proper torque.



Fill Plug Bolt Torque: 14 ft. lbs. (19 Nm)
Rear Gearcase Capacity:
10.0 fl. oz. (300 ml)

REAR DIFFERENTIAL INSTALLATION (TM, 2X4, 4X4)

1. Refer to the REAR AXLE HOUSING INSTALLATION section on Pages 7.46 for the installation of the rear gearcase and axle.
2. Add Polaris Premium Gearcase Lubricant (PN 2871477) to rear gearcase. Refer to Chapter 2 for



This exploded view diagram illustrates the assembly of a mechanical component, likely a pump or motor. The parts are numbered 1 through 41. The assembly sequence generally proceeds from left to right. Key components include a shaft (1), a pulley (2), a bearing (3), a seal (4), a coupling (5), a housing (6), a cover (7), a flange (8), a gasket (9), a cap (10), a nut (11), a bolt (12), a flange (13), a coupling (14), a nut (15), a flange (16), a coupling (17), a nut (18), a flange (19), a coupling (20), a nut (21), a flange (22), a coupling (23), a nut (24), a flange (25), a coupling (26), a nut (27), a flange (28), a coupling (29), a nut (30), a flange (31), a coupling (32), a nut (33), a flange (34), a coupling (35), a nut (36), a flange (37), a coupling (38), a nut (39), a flange (40), a coupling (41), and a nut (42).

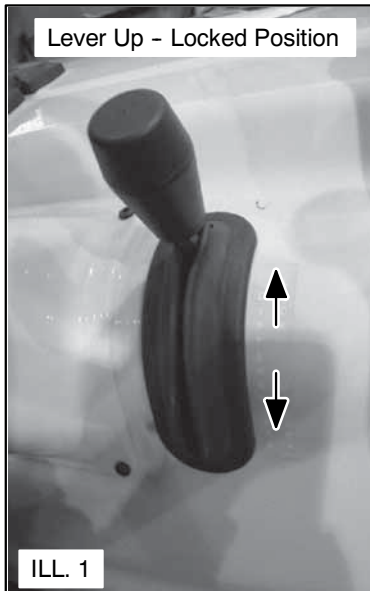
Ref.	Qty.	Description	Ref.	Qty.	Description
	1	Asm., Rear Gearcase	22.	1	Spring, Torsion
1.	1	Seal	23.	1	Washer
2.	1	Cover, Input	24.	1	Pin, Clip
3.	1	O-Ring	25.	1	Seal
4.	1	Bearing, Ball	26.	1	Actuator
5.	1	Pinion, 10T	27.	1	O-Ring
6.	1	Bushing	28.	1	Ring, Retaining
7.	2	Seal	29.	1	Ring, Retaining
8.	1	Case, Front	30.	1	Cover, Output
9.	1	Pipe, Knock	31.	1	Tube, Vent
10.	1	O-Ring	32.	3	Clip
11.	1	Bearing, Ball	33.	AR	Line, Vent
13.	2	Ring, Retaining	34.	1	Clamp, Hose
14.	1	Housing, Differential Lock	35.	2	Plug, Drain
15.	1	Gear, 14T, RH	36.	12	Screw
16.	1	Gear, 14T, LH	37.	1	Dog, Engagement
17.	1	Gear, Ring 37T	38.	AR	Shim
18.	1	Collar, Spined	39.	1	Ring, Retaining
19.	1	Washer, Thrust	40.	8	Screw, Cap
20.	1	Bearing, Ball	41.	2	Pinion, Differential, 10T
21.	1	Actuator, Cam	42.	1	Pin, Differential Pinion



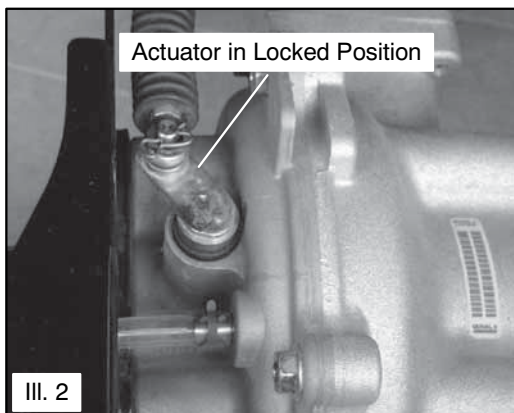
REAR DIFFERENTIAL OPERATION (TM, 2x4, & 4x4)

Differential in Locked Position

1. The rear differential on the can be in a locked position or an unlocked position. To lock the differential push up on the lever on the dash. To unlock the rear differential pull down on the lever. Illustration 1 shows the lever up and the differential in the locked position.

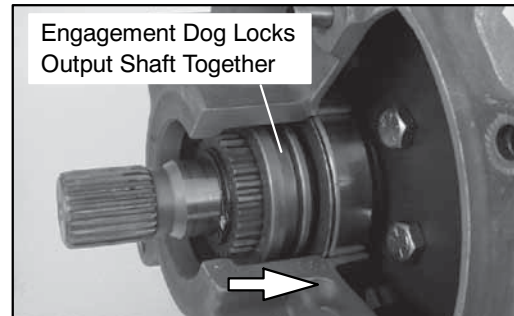


2. Illustration 2 shows the actuator on the rear differential in the locked position.

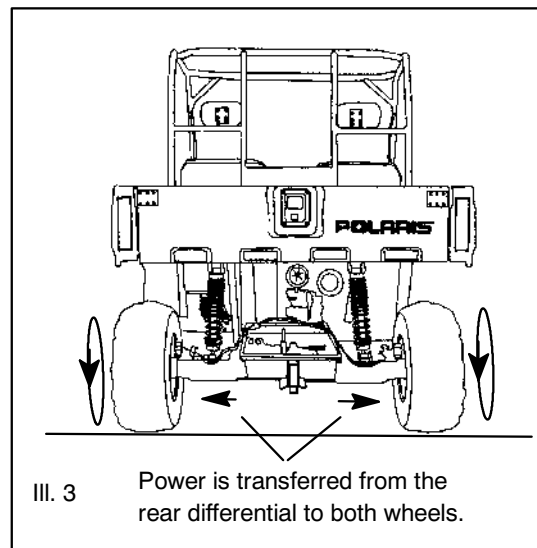


NOTE: The pictures below show a cutaway view of the rear differential for display purposes only.

When the rear differential is in the locked position the actuator has the engagement dog in place so the two output shafts are locked into position to form a single axle.



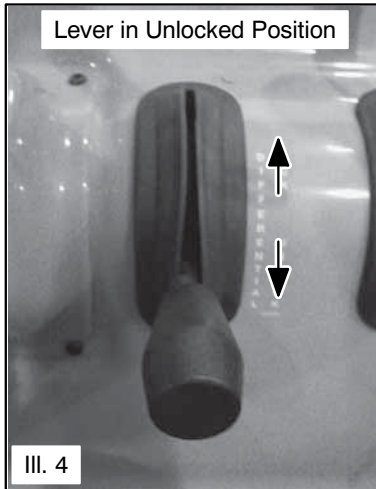
3. Illustration 3 shows the rear differential in the locked position. When the differential is locked power is going to both wheels and acts as a solid axle. **NOTE:** The locked differential is not recommended when driving on turf.



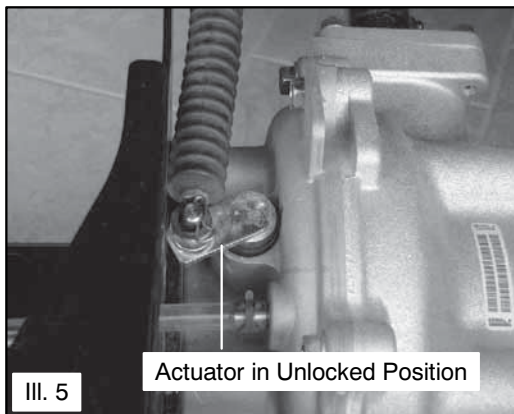


Differential in Unlocked Position

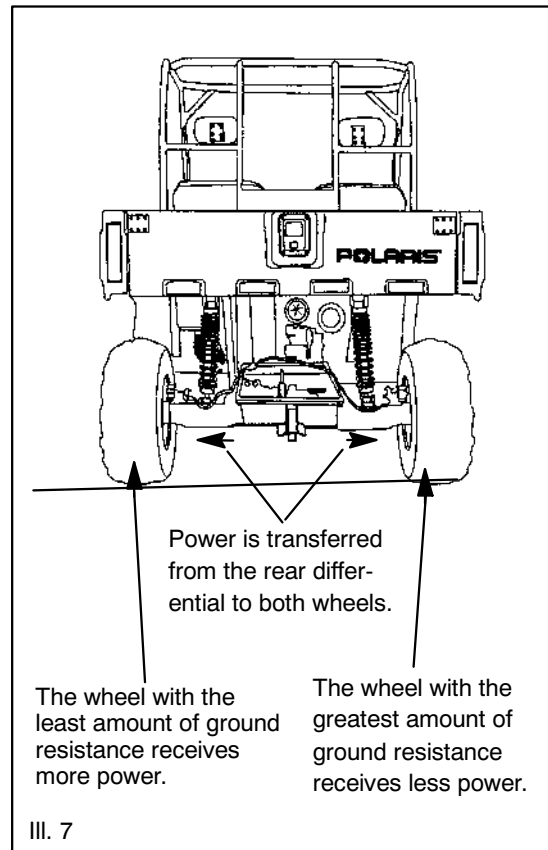
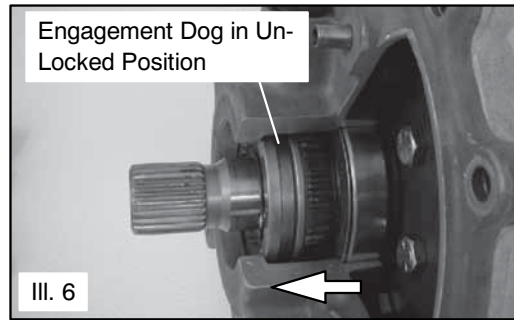
4. Illustration 4 shows the lever down. The rear differential is now in the unlocked position.



5. Illustration 5 shows the actuator on the rear differential in the unlocked position.



6. Illustration 6 - When the rear differential is in the unlocked position the actuator slides the engagement dog into place so the output shafts are unlocked, to form an open differential rear axle assembly. An example of how the limited slip operation works is shown in Illustration 7.



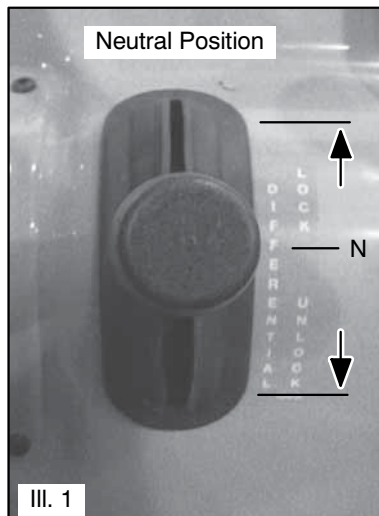


REAR DIFFERENTIAL LINKAGE INSPECTION/ADJUSTMENT (TM, 2X4, & 4X4)

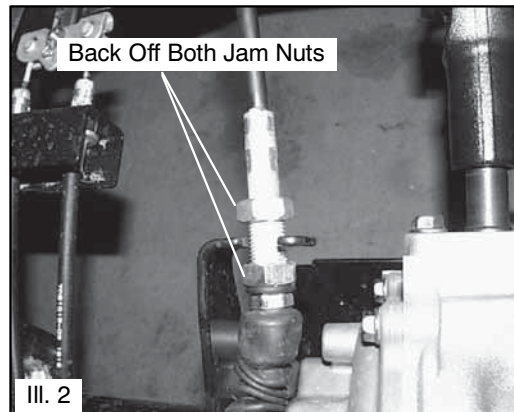
Rear Differential Linkage rod adjustment is necessary when symptoms include:

- The rear differential does not go into the "Locked Position"
- The rear differential does not go into the "Unlocked Position"
- Excessive gear clash (Continuous clicking noise caused by the differential not being properly engaged)
- Differential selector moves out of desired position

1. Inspect linkage cable, clevis pins, and pivot bushings and replace if worn or damaged.
2. Place differential lock lever in a neutral position, centered between the Lock and Unlocked positions (Ill 1).

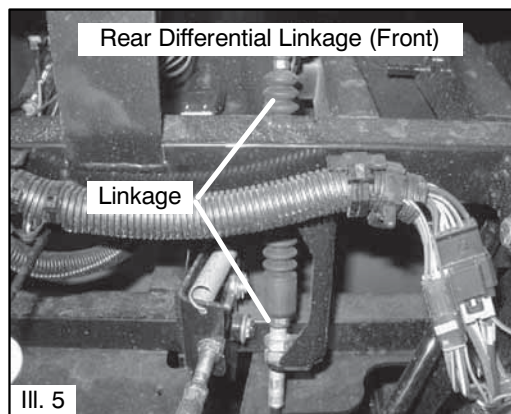
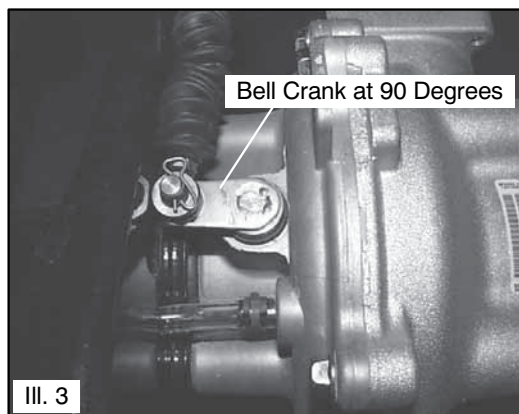


3. With two wrenches loosen the jam nuts and back both of the jam nuts off (Ill. 2).



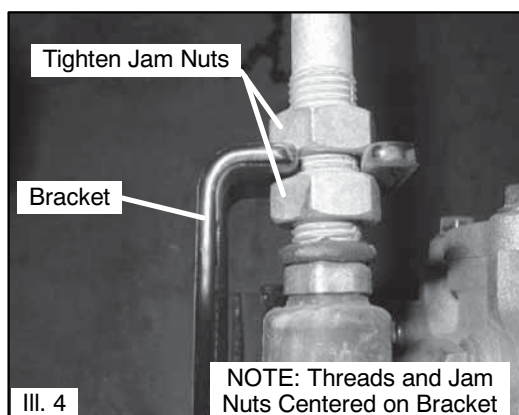
4. Move the rear differential bell crank to 90 degrees (inline with the axle) (Ill. 3).

NOTE: Before you tighten the jam nuts in Step 5, be sure the differential lock lever is in the neutral position (Step1).



5. Hold the bellcrank in the 90 degree position. Hand tighten the jam nuts to the mounting bracket.

NOTE: If replacing the rear differential cable, it is advisable to have the threads and jam nuts centered on the mounting brackets. This will ease any future differential cable adjustments for the user.



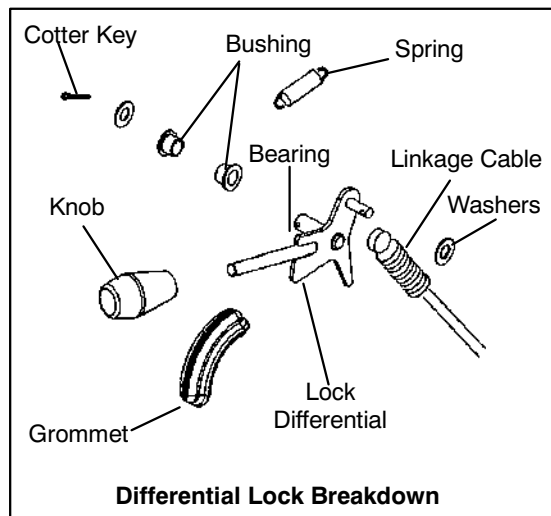
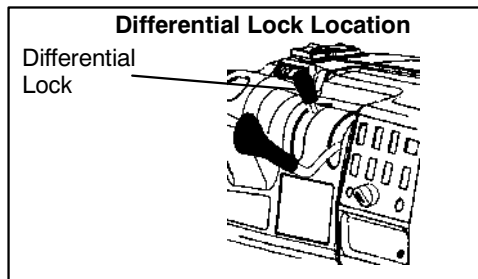
6. If the adjustment of the linkage on the rear differential (Steps 1-5) does not work. Repeat these steps on the linkage located under the front hood. This linkage is closely attached to the rear differential lever.





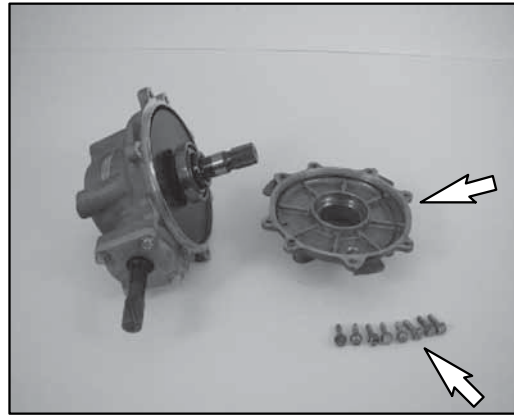
DIFFERENTIAL LOCK LEVER REMOVAL/INSTALLATION **(TM, 2X4, & 4X4)**

1. Disconnect linkage cable from lock differential.
2. Remove the cotter key, washers and bushings that attach lock differential to the cable and frame.
3. Pull off the shifter knob.
4. Lift lock differential out of mounting bracket and away from frame.
5. Repeat the steps above in reverse order for the differential lock lever installation.

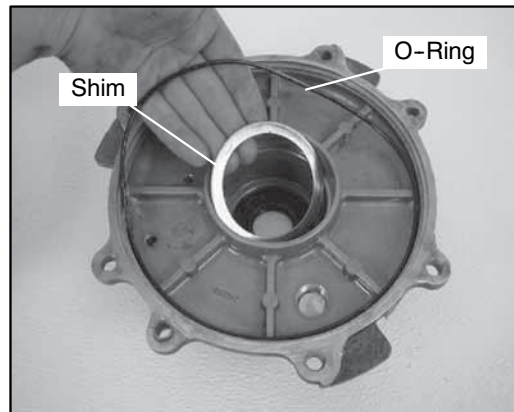


REAR DIFFERENTIAL DISASSEMBLY (6X6)

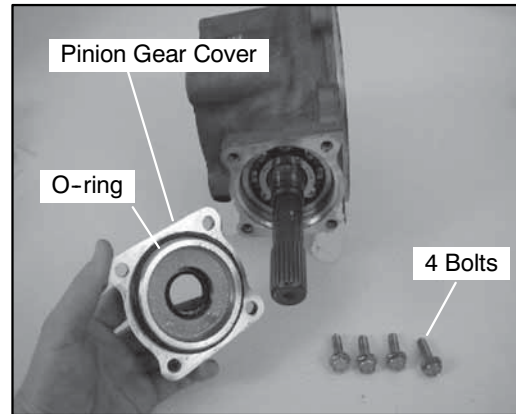
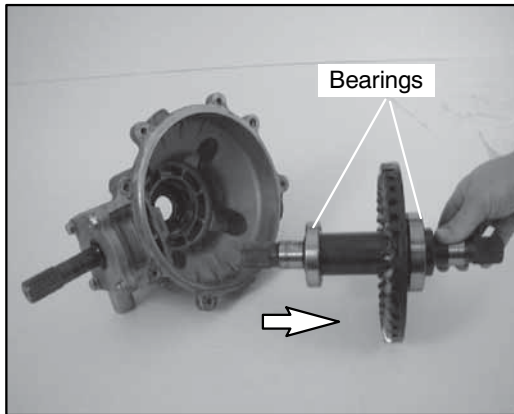
1. Drain and properly dispose of used oil.
2. Remove the differential housing cover bolts and the gearcase housing cover.



3. Remove the shim and O-ring from the differential cover.

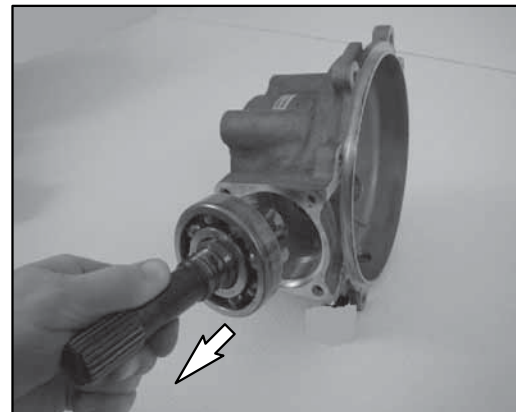
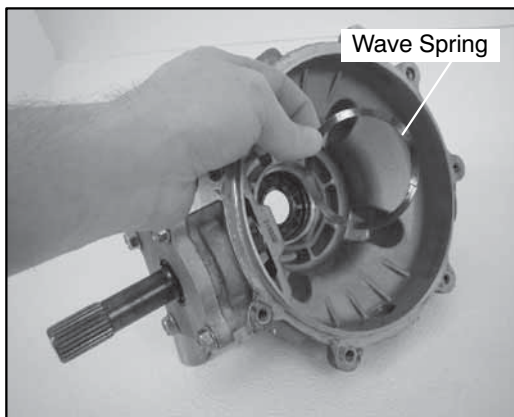


4. Remove the output shaft and ring gear from the differential. Inspect the ring gear for abnormal wear, broken, or chipped teeth. Inspect the bearings for wear. Spin the bearings by hand, the bearings should roll smoothly. Replace the bearings if needed.



5. Remove the wave spring from the differential assembly.

7. Remove the pinion shaft from the differential. Inspect for abnormal wear, broken, or chipped teeth.

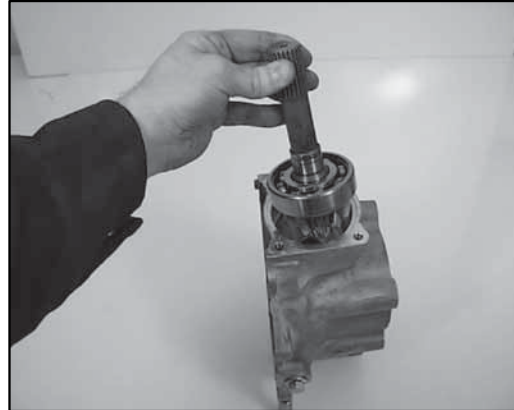
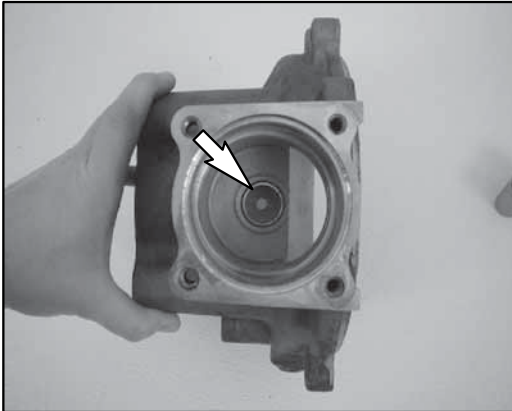


6. Remove the four bolts that secure the pinion gear cover to the differential. Remove the pinion gear cover and O-ring.



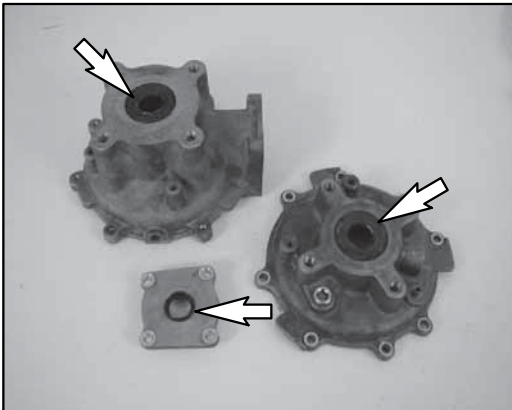


8. Inspect the pinion shaft bushing for wear.

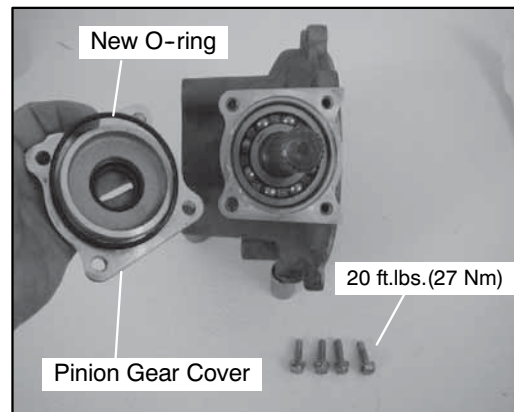


REAR DIFFERENTIAL ASSEMBLY (6X6)

1. Replace all O-rings, seals, and worn components.



3. Replace the pinion shaft cover O-ring and install the cover. Install the four pinion shaft cover bolts and torque the bolts to 20 ft. lbs. (27 Nm).

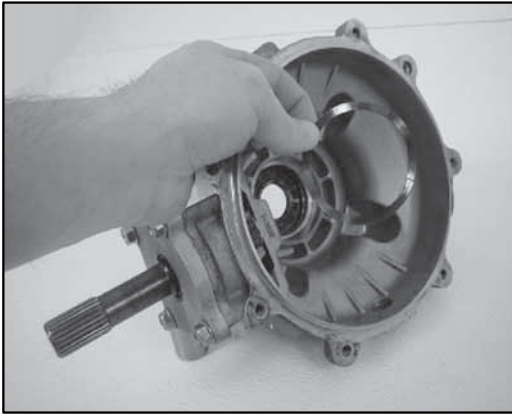


Pinion Shaft Cover Bolt Torque:
20 ft. lbs. (27 Nm)

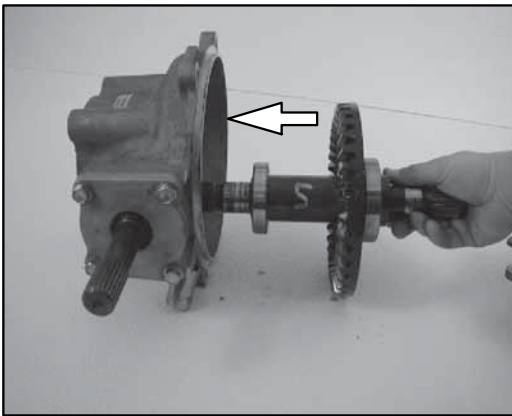
2. Install the pinion shaft into the differential housing.



4. Install the wave spring into the differential assembly. Be sure to properly seat the wave spring into the differential.

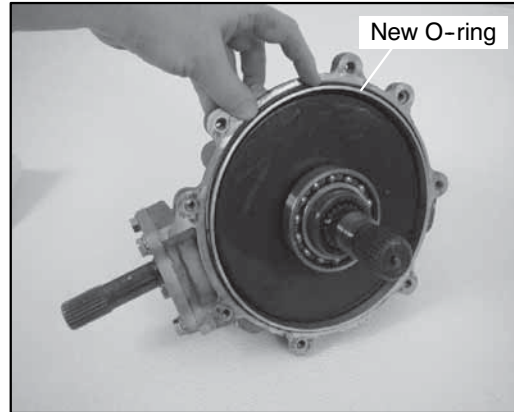


5. Reinstall the the output shaft and ring gear.



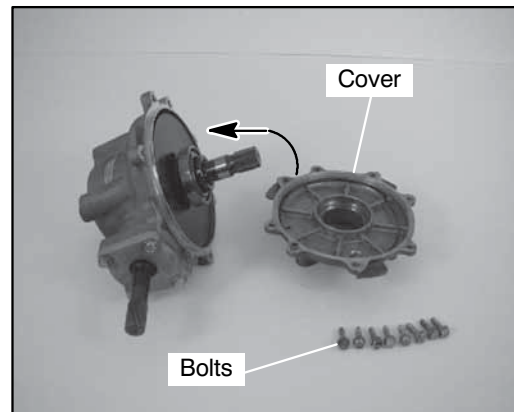
6. Install a new O-ring onto the lip of the gearcase housing.

NOTE: The O-ring is a smaller diameter than the gearcase. Use two hands to work the O-ring onto the gearcase lip.



7. Install the output cover onto the differential assembly.

8. The output cover must be properly aligned and installed straight with the differential when installed. This will ensure that the O-ring is not damaged during output cover installation. This also helps to prevent any gearcase leaks after assembly.



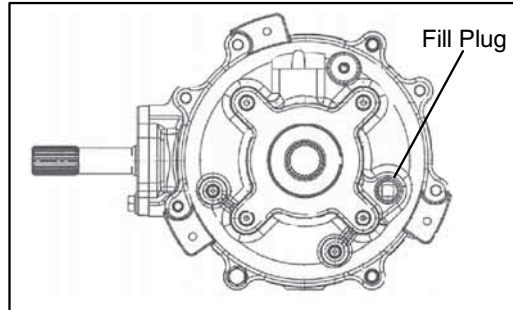


9. Torque the output cover bolts to 20 ft. lbs. (27 Nm).

Output Cover Bolt Torque
20 ft. lbs. (27 Nm)

REAR DIFFERENTIAL INSTALLATION (6X6)

1. Refer to the REAR AXLE HOUSING INSTALLATION section on Pages 7.46 for the installation of the rear gearcase and axle.
2. Add Polaris Premium Synthetic Gearcase Lubricant (**PN 2871447**) to rear gearcase. Torque the drain plug to 14 ft. lbs. (19 Nm).



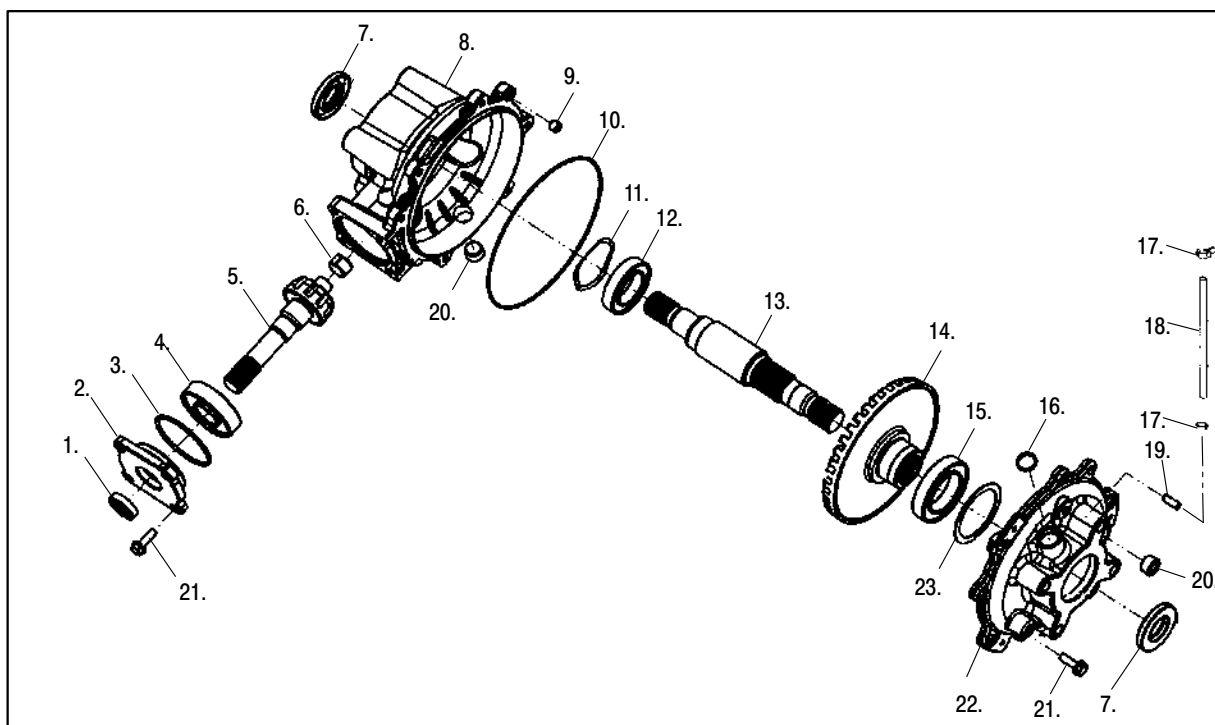
Fill Plug Bolt Torque
14 ft. lbs. (19 Nm)

Rear Gearcase Capacity
10.0 fl. oz. (300 ml)





REAR DIFFERENTIAL EXPLODED VIEW (6X6)



Ref.	Qty.	Description	Ref.	Qty.	Description
	1	Asm., Rear Gearcase	12.	1	Bearing, Ball
1.	1	Seal	13.	1	Shaft, Output
2.	1	Cover, Input	14.	1	Gear, Ring 37T
3.	1	O-Ring	15.	1	Bearing, Ball
4.	1	Bearing, Ball	16.	1	Plug, Expansion
5.	1	Pinion, 10T	17.	3	Clip
6.	1	Bushing	18.	AR	Line, Vent
7.	2	Seal	19.	1	Tube, Vent
8.	1	Case, Front	20.	2	Plug, Drain
9.	1	Pipe, Knock	21.	12	Screw
10.	1	O-Ring	22.	1	Cover, Output
11.	1	Spring, Wave	23.	AR	Shim 2.5





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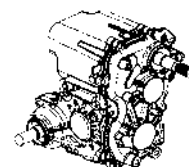


CHAPTER 8

TRANSMISSION

RANGER TM Transmission Info 8.2-8.20

RANGER 2x,4x,6x Transmission Info 8.22-8.44



8



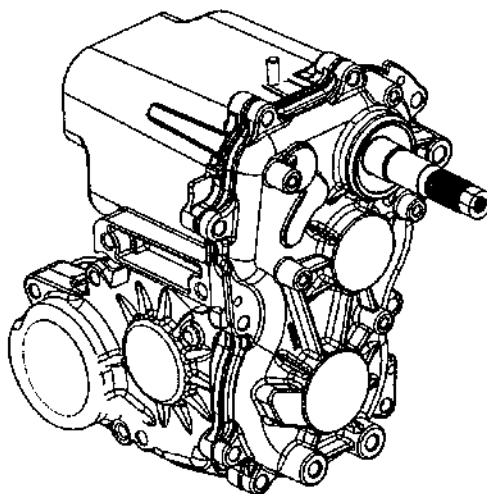


CHAPTER 8

TRANSMISSION

RANGER TM

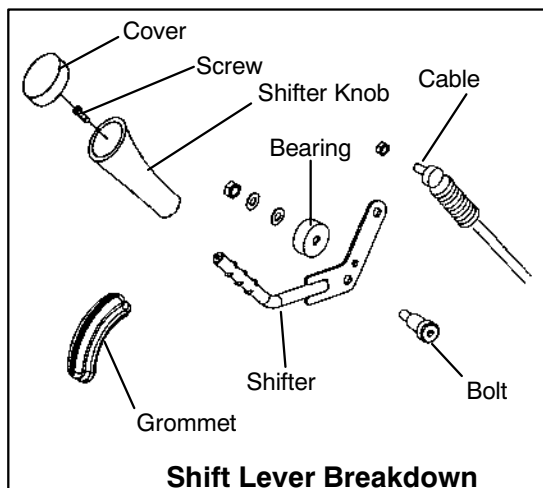
Torque Specifications/Lubrication	8.3
Gear Shift Selector Removal/Installation	8.3
Shift Linkage Adjustment	8.3-8.4
Transmission Removal	8.4-8.5
Transmission Installation	8.6
Transmission Disassembly	8.6-8.12
Transmission Assembly	8.12-8.18
Troubleshooting	8.18
2x4 Transmission, Exploded	8.19-8.20





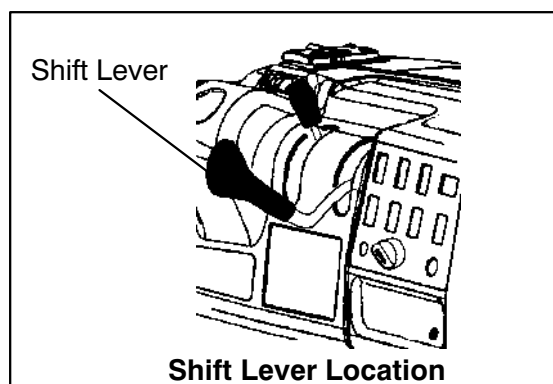
TORQUE SPECIFICATIONS

ITEM	TORQUE VALUE
Transmission Fill Plug	14-18 ft. lbs. (19-24 Nm)
Transmission Drain Plug	14-18 ft. lbs. (19-24 Nm)
Transmission Case Bolts	27-34 ft. lbs. (37-46 Nm)
Bell Crank Nut	12-18 ft. lbs. (16-18 Nm)
Bell Crank Gear Cover	6-12 ft. lbs. (6-16 Nm)
Transmission Mounting Bolts	25 ft. lbs. (35 Nm)
TM Transmission Lubricant / Amount	AGL Gearcase Lube 18.2 oz. (540 ml)



SHIFT LEVER REMOVAL/INSTALLATION

1. Disconnect linkage cable from shifter.
2. Remove one bolt attaching gear selector mount to machine frame.
3. Remove the cover and remove screw. Pull off the shifter knob.
4. Lift gear selector out of mounting bracket and away from frame.
5. Repeat the steps in reverse order to install the gear selector.



SHIFT LINKAGE INSPECTION/ADJUSTMENT

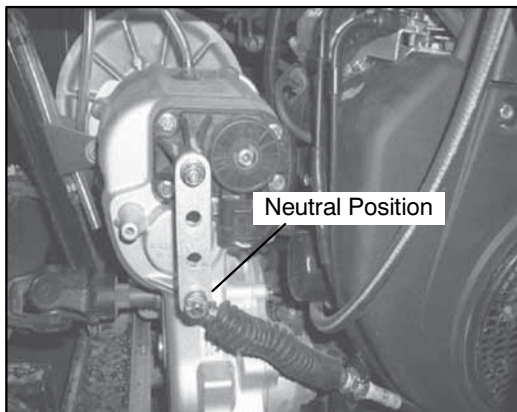
Linkage rod adjustment is necessary when symptoms include:

- No indicator light
- Noise on deceleration
- Inability to engage a gear
- Excessive gear clash (noise)
- Shift selector moving out of desired range

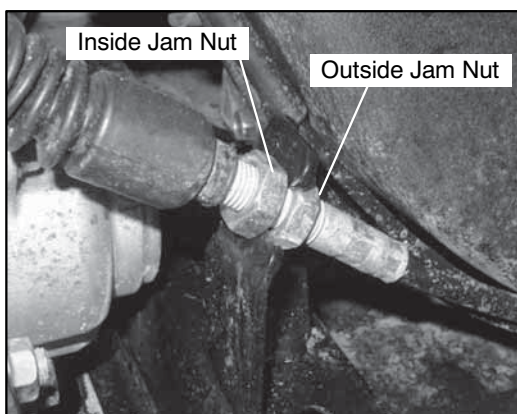
NOTE: Remove necessary components to gain access to shift linkage cable ends (i.e. exhaust heat shield, exhaust pipe, etc.).

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





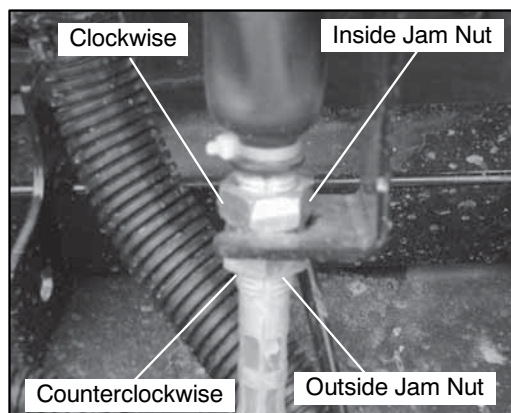
4. With two wrenches loosen the outside jam nut counterclockwise. Turn the outside jam nut 1 1/2 turns. Perform this procedure on the shift lever end, also.



Transmission Cable Adjustment

5. After turning the outside jam nut 1 1/2 turns. Hold the outside jam nut with a wrench and tighten the inside jam nut clockwise, until it is tight against the bracket.
6. Repeat Step 4 and Step 5 until the proper adjustment is made for the transmission cable.

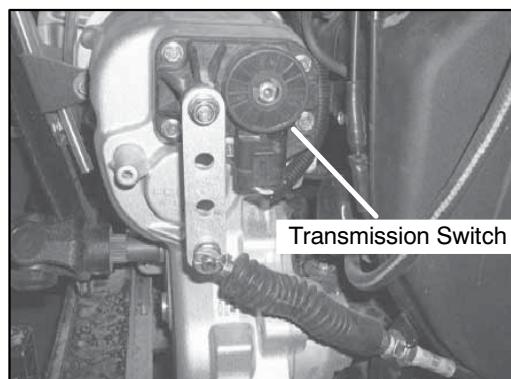
7. Use this procedure to loosen or tighten the shift linkage cable as needed.



Shift Lever Cable Adjustment

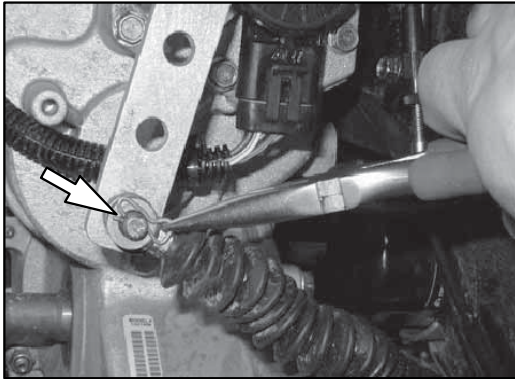
TRANSMISSION REMOVAL

1. Remove the PVT system from the left side of the transmission. See Chapter 6 for more details.
2. Drive roll pin from rear driveshaft yoke.
3. Disconnect the transmission switch.

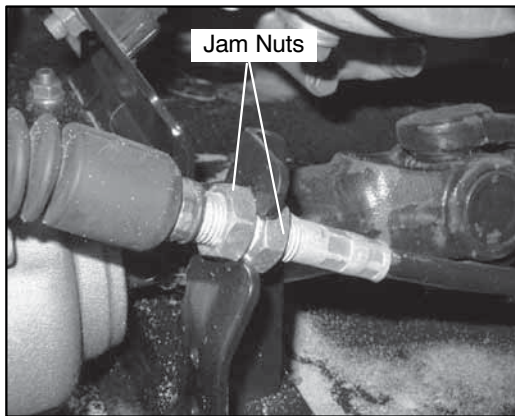




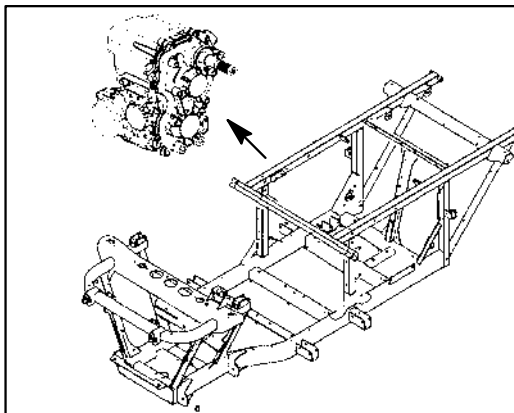
4. Remove the cotter pin from the shift linkage rod. Remove the shift linkage rod and a washer from the bellcrank.



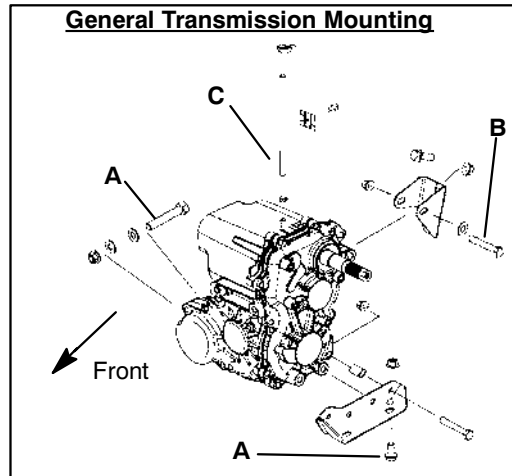
5. Loosen the jam nuts for the transmission cable. Remove the cable from the mounting bracket.



9. Remove transmission from right side of frame.



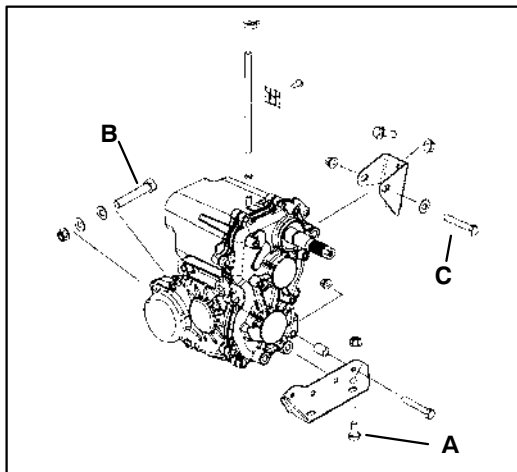
6. Remove the side transmission to frame bolts (A).
7. Remove the rear transmission to frame bolt (B).
8. Disconnect the vent tube (C).





TRANSMISSION INSTALLATION

1. Install transmission on right side of vehicle.
2. Position transmission in frame.
3. Loosely install the rear transmission to frame bolt (C).
4. Loosely install the three side transmission to frame bolts (A & B).
5. Tighten mounting fasteners in order A-C as shown.



Transmission Mounting Bolts Torque:

25 ft. lbs. (34.5 Nm)

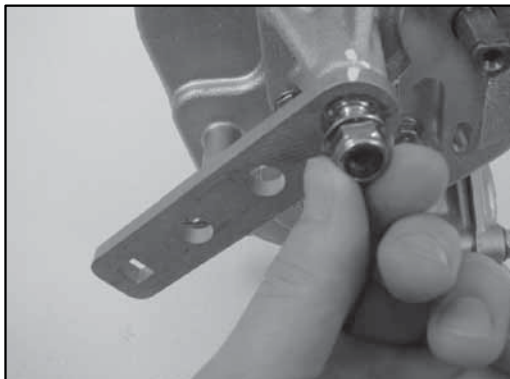
NOTE: Be sure to tighten the side transmission bolts first, this ensures that the transmission is tight against the lower frame and helps to properly align the transmission.

NOTE: Align clutches as outlined in Clutch Chapter 6.

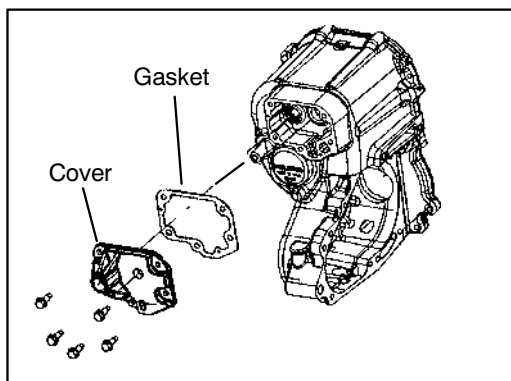
6. Align rear output shaft to rear propshaft yoke and roll pin hole.
7. Slide rear output shaft and into propshaft yoke. Drive the roll pin into the driveshaft yolk.
8. Reinstall the shift linkage rod, the air intake hose, and the vent hose on top of the transmission.

TRANSMISSION DISASSEMBLY

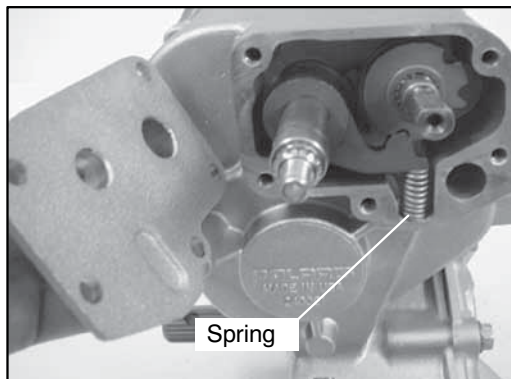
1. Place the bellcrank in neutral position.
2. Remove the nut, and washer that secure the bell crank. Remove the bellcrank.



3. Remove the five bolts that secure the cover. Remove the cover and cover gasket.



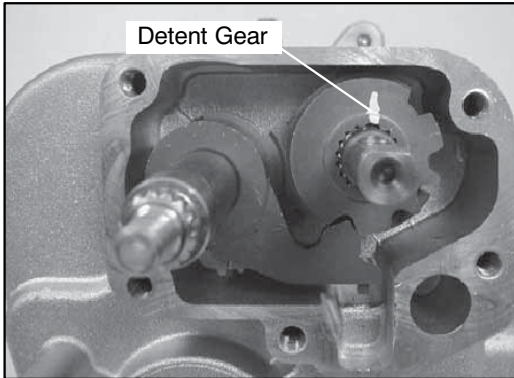
4. Remove the detent spring.



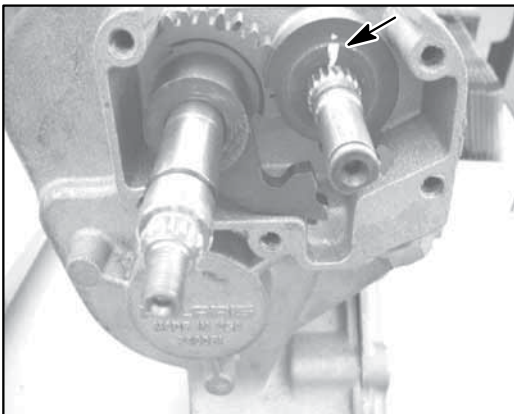


5. Mark the detent gear with a white pen. Remove the detent gear from the case.

NOTE: It may be helpful to place a mark just above the keyed spline.

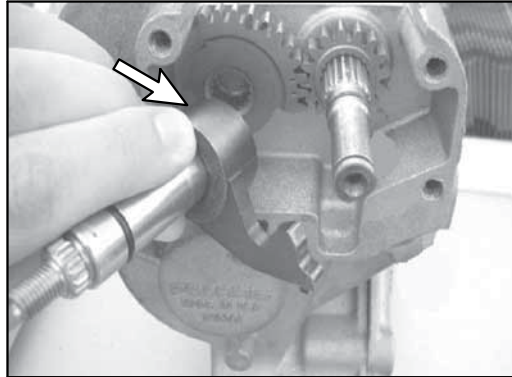


6. Mark the shift lockout disc, this will indicate which side of the disc faces outward during assembly. Remove the shift lockout disc.



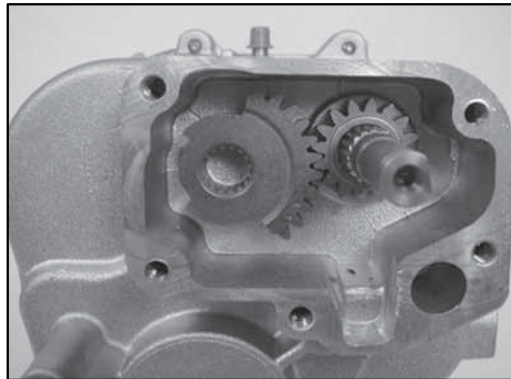
NOTE: It may be helpful to place a mark just above the keyed spline. Note the raised edge on the detent star for later disassembly.

7. Remove the shift shaft and detent lever.

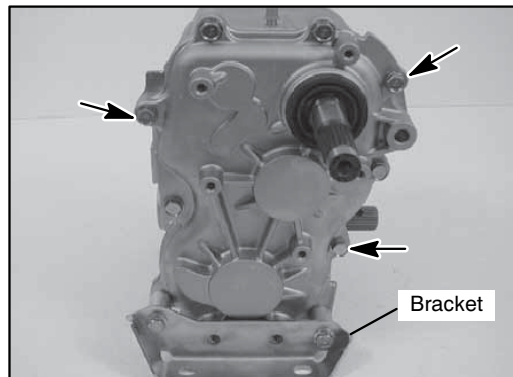


8. Note the timing marks on the shift gears. Remove the shift gears from the case.

NOTE: It may be helpful to accent the timing marks using a white marking pen.

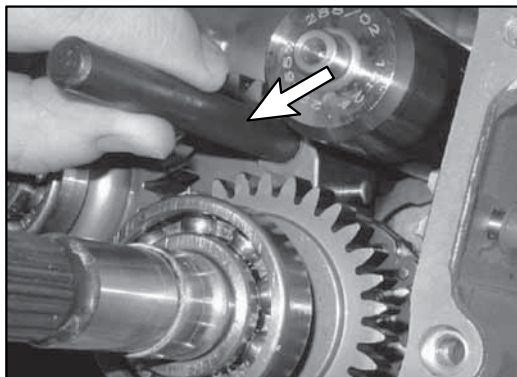


9. Remove the bolts on the LH transmission case cover. Tap the cover off with a soft face hammer if necessary. **NOTE:** Leave bracket attached to the LH cover during removal, only remove if needed.

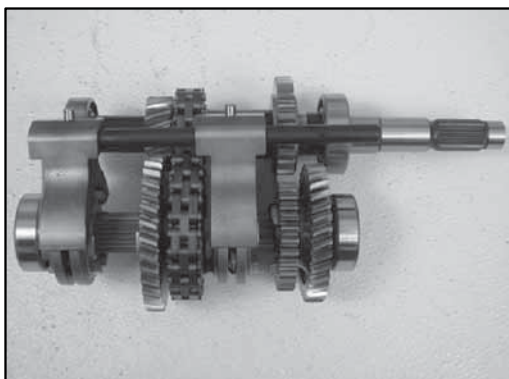




10. Lift shift rail 0.5-1" (12.70-25.40 mm). Then rotate the shift rail/forks and shift drum, so the the forks' pins disengage from the drum.

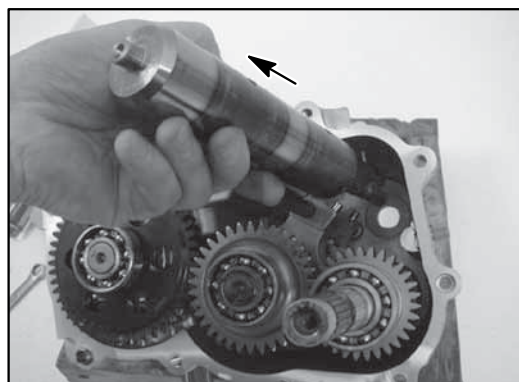


13. Set the upper gear cluster on a flat surface and inspect the components.

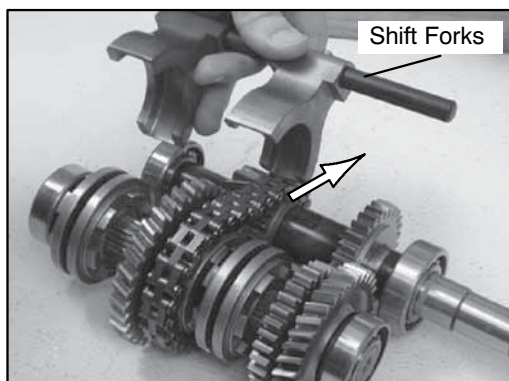


11. Remove the shift drum.

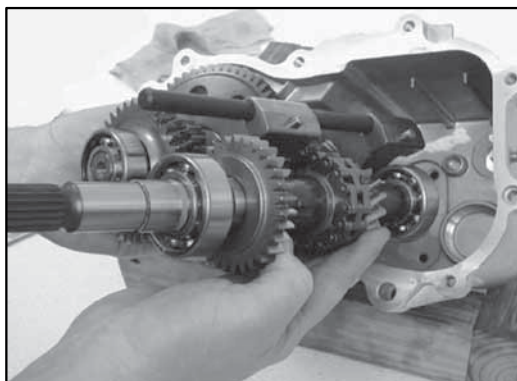
NOTE: You may have to tap the shift drum from the backside of the case to aid in removal.



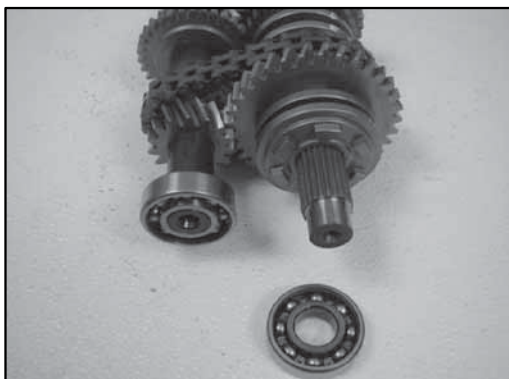
14. Remove the shift forks from the assembly. Note the correct position of each fork.



12. Remove the upper gear cluster and shift forks. You may need to move the assembly back and forth to aid in removal.

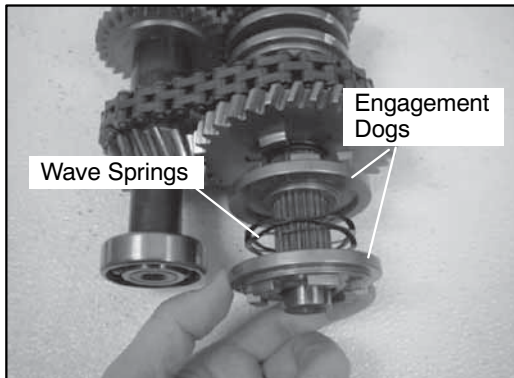


15. Remove the bearing from the reverse shaft with a puller.

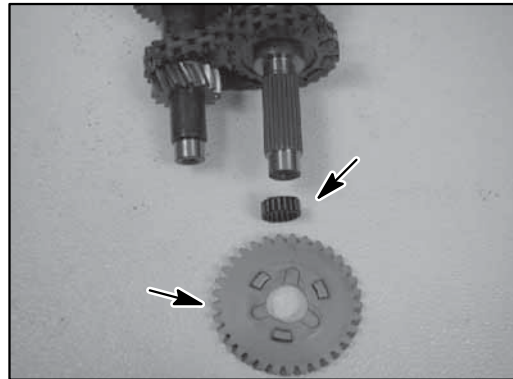




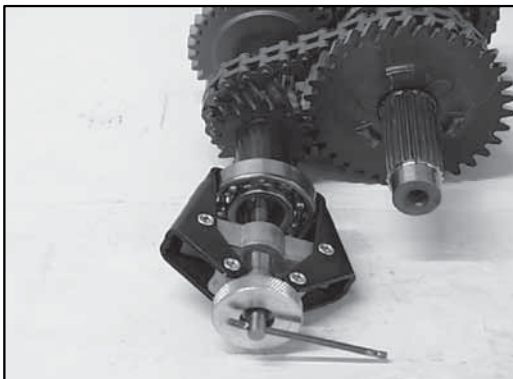
16. Remove the engagement dog. Remove the wave spring and reverse engagement dog.



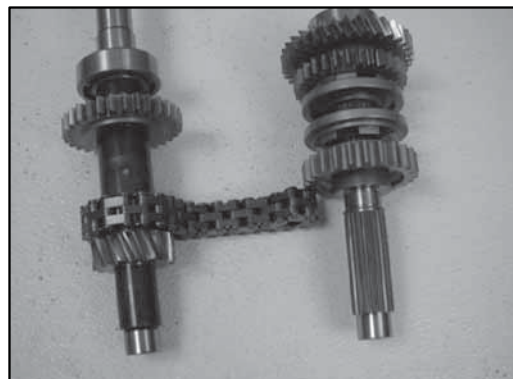
19. Remove low gear and the needle bearing.



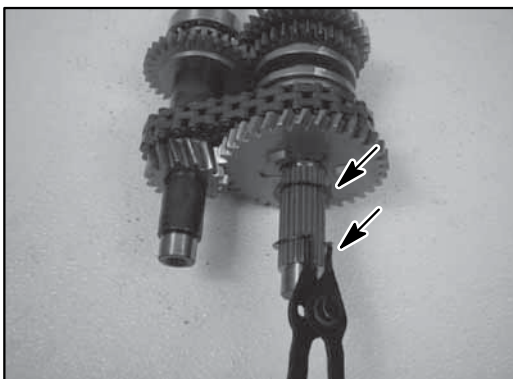
17. Remove the bearing from the input shaft with a puller.



20. Remove the reverse gear shaft and silent chain.



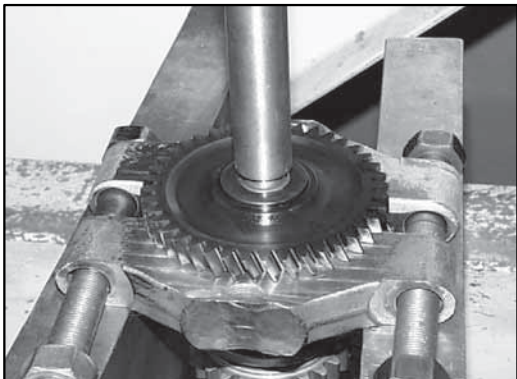
18. Remove the snap ring and washer from the reverse shaft.



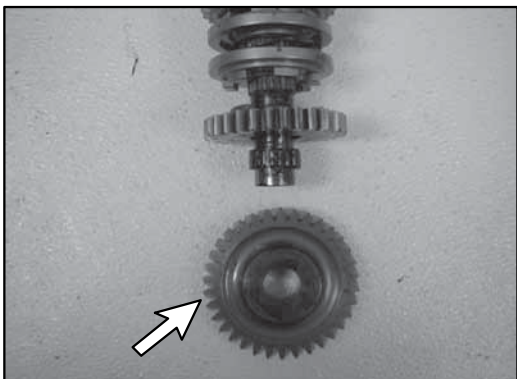
21. Remove the rest of the bearings from the shafts.



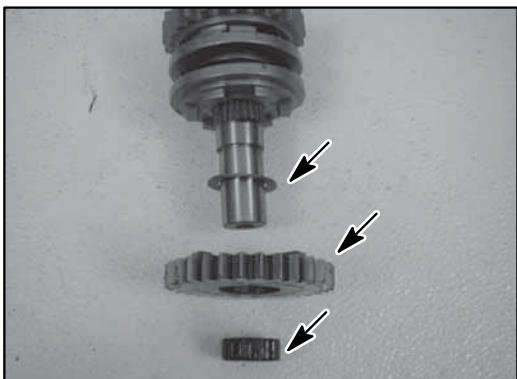
22. Use a press to remove the gear from the shaft.



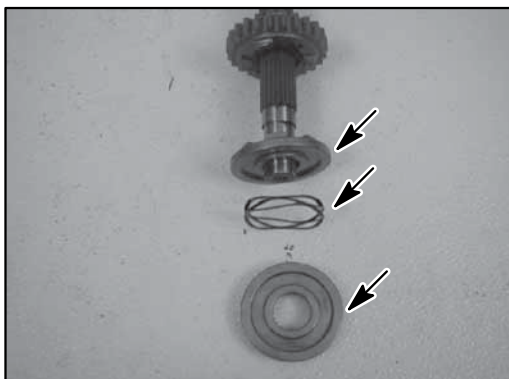
23. Make note of the direction of the gear and hub location.



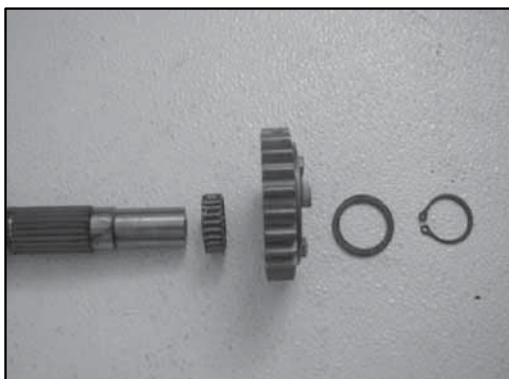
24. Remove the gear, split needle bearing, and washer from the reverse shaft.



25. Slide off the shift dogs and wave springs.



26. Remove the snap ring, washer, gear, and split needle bearing.

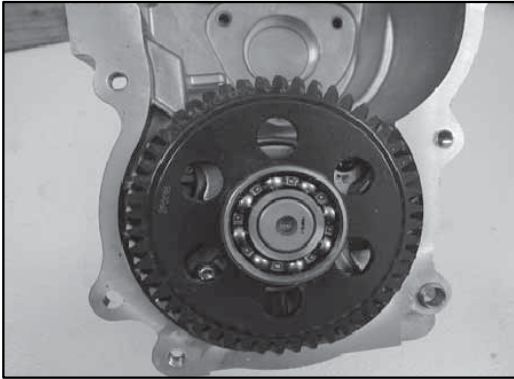


27. Inspect the input shaft for wear cracks chips for broken teeth.

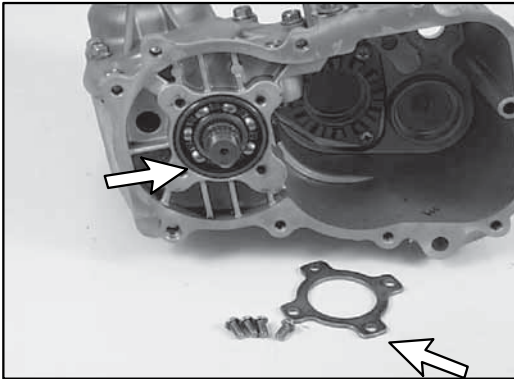




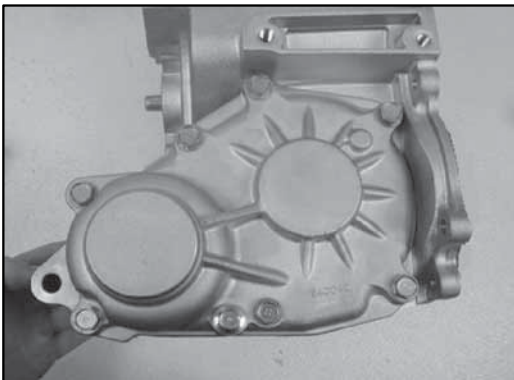
28. Remove bearing and the helical gear.



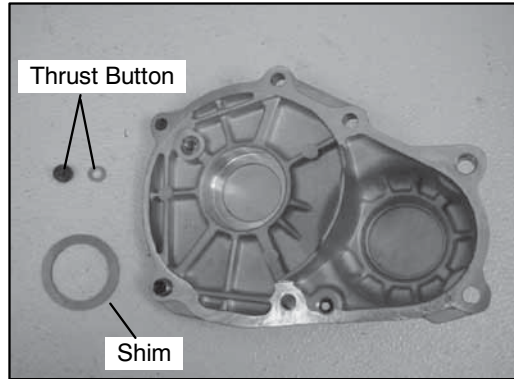
29. Remove the pinion shaft retainer plate and the pinion shaft.



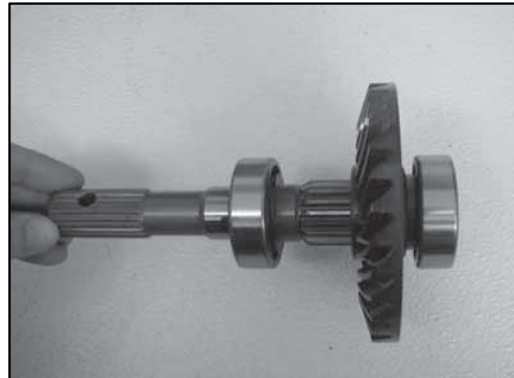
30. Remove the front housing cover screws.



31. Remove the front housing cover, shim, thrust button, and thrust button shim.



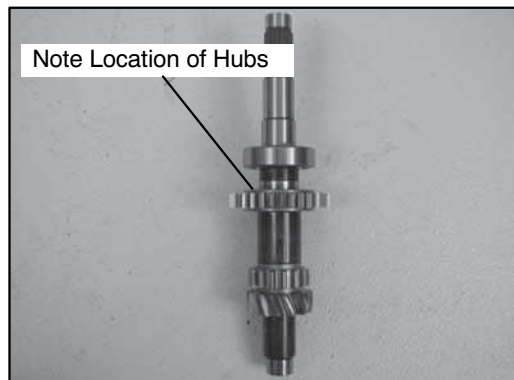
32. Remove the rear output shaft from the case.



33. Clean all components in a parts washer and inspect for wear.

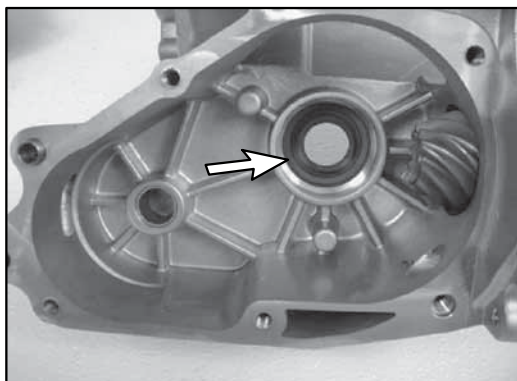
34. Inspect engagement dogs of gears and replace if edges are rounded.

35. Inspect gear teeth for wear, cracks, chips or broken teeth. Note the location of the hubs on the gear.



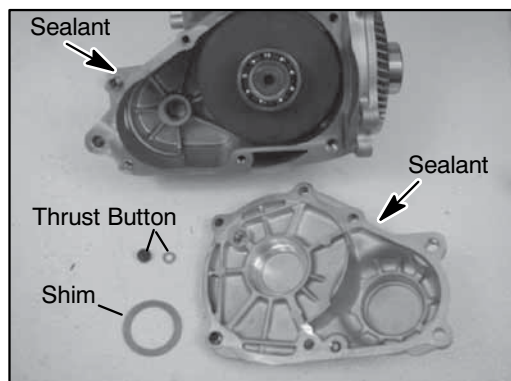


36. Remove seals from transmission case.



IMPORTANT: New seals should be installed after the transmission is completely assembled.

37. Inspect bearings for smooth operation. Check for excessive play between inner and outer race.



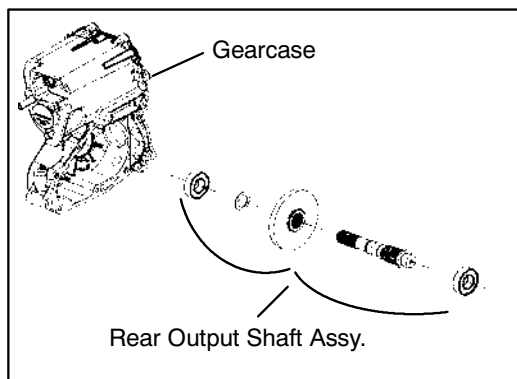
Crankcase Sealant
(PN 2871557)

3. Reinstall the thrust button shim, thrust button, and other shims into the cover. Reinstall cover and torque bolts in a criss-cross pattern in 3 steps to 27-34 ft. lbs. (36.50-46 Nm).

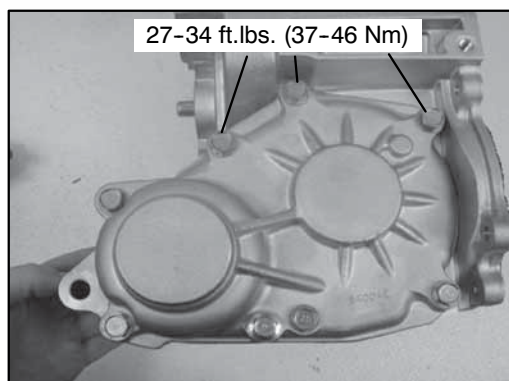
NOTE: Make sure that the case locating pins (knock pipes) are in place.

TRANSMISSION ASSEMBLY

1. Install rear output shaft into the gearcase.



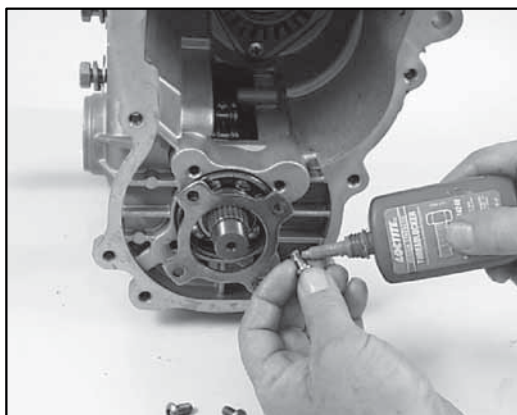
2. Before installing the cover make sure the sealing surfaces are clean and dry, and shafts are fully seated in the transmission case. Apply Polaris Crankcase Sealant (PN 2871557) to the mating surfaces.



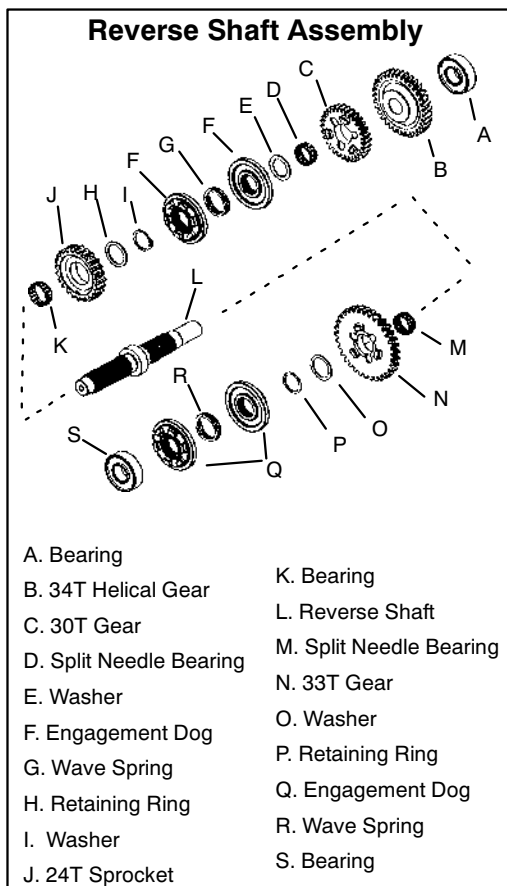
Front Cover Bolt Torque:
27-34 ft. lbs. (37-46 Nm)



4. Apply grease to the seal lips. Apply electricians tape or somehow cover the splines of the shaft to protect the seal lips during installation. Install new rear output shaft seal.
5. Install pinion shaft with bearing.
6. Install retainer plate with flat side toward bearing.
7. Apply Loctite™ 262 (Red) (PN 2871951) to screw threads and torque screws to 6-12 ft. lbs. (8-16 Nm).



**Pinion Retainer Plate
Bolt Torque:
6-12 ft. lbs. (8-16 Nm)**

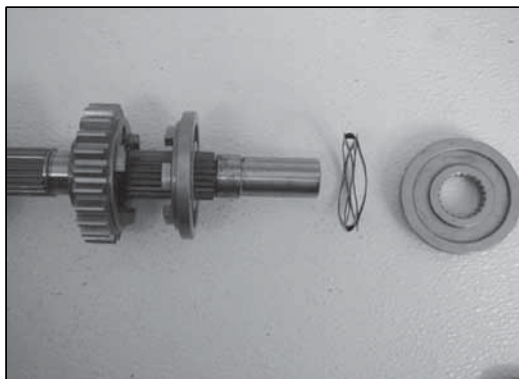


8. Install a new needle bearing, the 24T reverse sprocket, washer, and a new snap ring.
9. Install a new snap ring at this time. When installing the new snap ring, open the the snap ring just far enough to go over the shaft, to avoid stressing the snap ring. If the snap ring is overstressed it could come off the shaft and cause internal damage to the transmission.

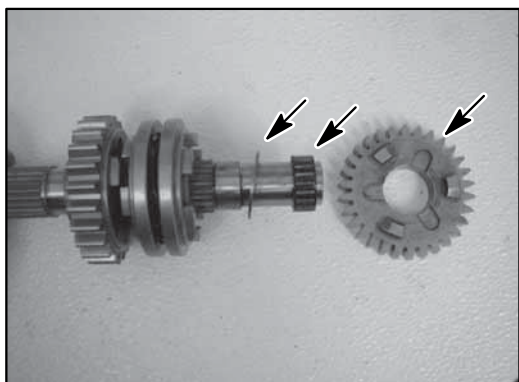




10. Install the shift dogs and wave spring.



11. Install the washer, a new needle bearing and the high gear (30T gear). Install the press fit gear (34T helical) and ball bearing.



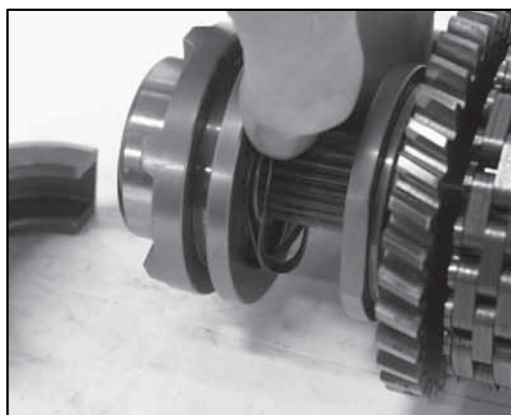
12. Slide the reverse shaft assembly through the silent chain.



13. Install a new split needle bearing, the low gear (33T), the thrust washer and the snap ring. Use of a new snap ring is recommended.

14. Install the engagement dogs, wave springs, and bearing.

15. Install the ball bearing onto the end of the input shaft.



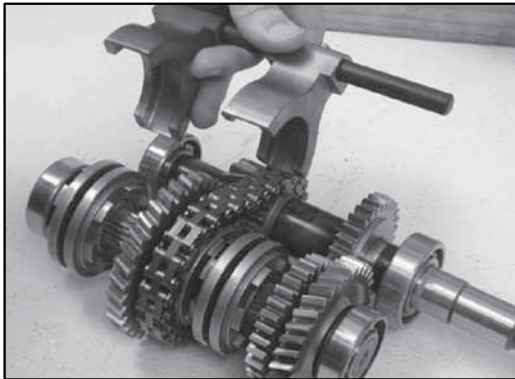
16. As the engagement dogs are installed onto the shaft, place the wave springs into the spring groove.



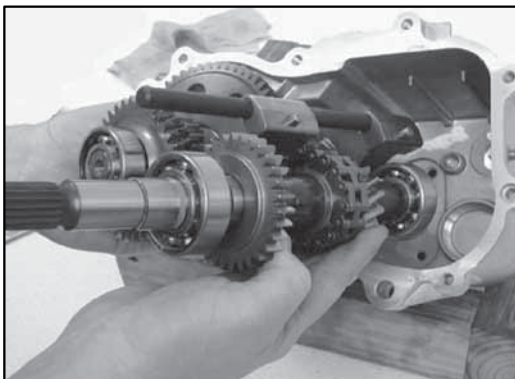
17. Install the shift forks. Keep the spring in place while the fork is being installed on the shaft and while placing the shafts into the case.

NOTE: Use caution when installing the fork, the spring can easily fall out.

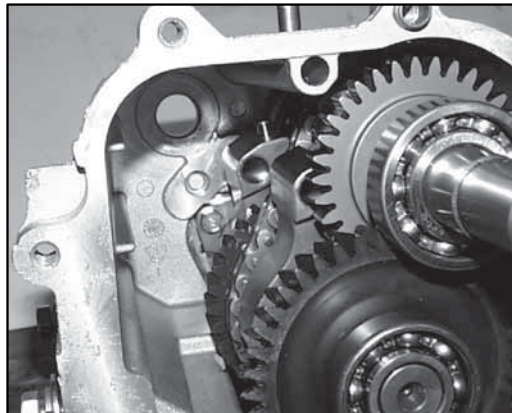
NOTE: Installing the shift rail will aid in keeping the shift forks, shift dogs, and the springs in place.



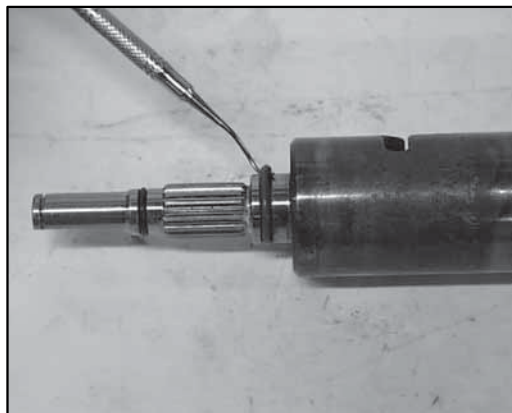
18. Carefully install the shaft assembly and gear cluster as a unit into their respective bearing case recesses. Tap with a soft face hammer to seat shaft assemblies.



19. Position the shift forks up and so the the pins point toward the 9 o'clock position, before installing the shift drum assembly.



20. Replace and grease the O-ring's on the shift drum before installation.

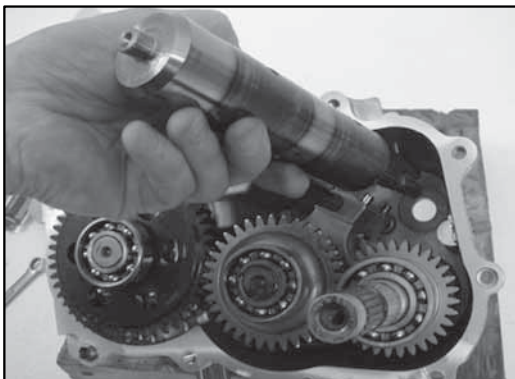


21. Install the shift drum into the case.

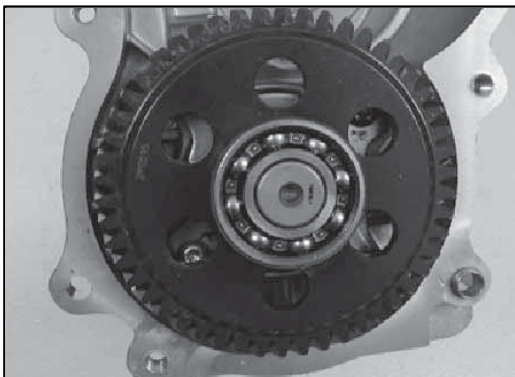
NOTE: Make sure shift shaft pins are properly positioned in the slot on selector arms.



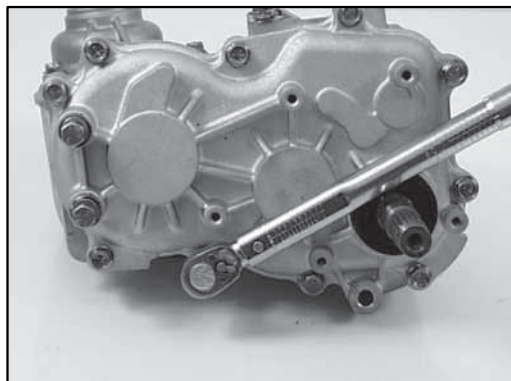
22. Lift the shift rail slightly and rotate the rail/fork assembly so it meshes with the tracks on the shift drum. Be sure the wave springs are properly in place and that the shift rail is seated into the pocket on the backside of the case.



23. Install the helical gear and bearing onto the pinion shaft.

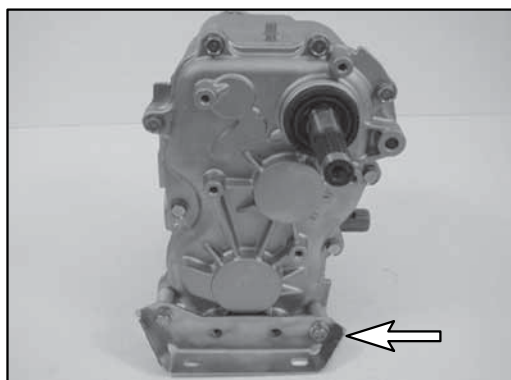


24. Clean the mating surfaces of the case and cover. Apply Crankcase Sealant (PN 2871557) to the mating surfaces. Be sure the locating pins (knock pipes) are in place. Reinstall cover and torque bolts in a criss-cross pattern in 3 steps to 27-34 ft. lbs. (36.50-46 Nm).

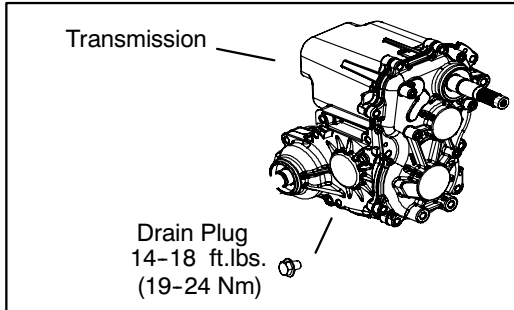


Front Cover Bolt Torque:
27-34 ft. lbs. (36.50-46 Nm)

25. Install the transmission mounting bracket, if previously removed.



26. Grease the seal lips of the input shaft seal. Apply electricians tape or somehow cover the splines of the shaft to protect the seal lips during installation. Install new input shaft seal.
27. Install drain plug with a new sealing washer. Torque drain plug to 14-18 ft. lbs. (19-24 Nm).

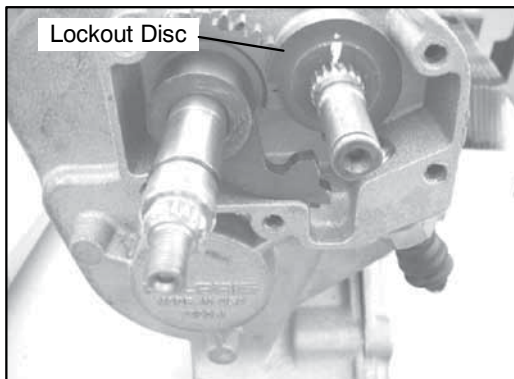


Drain Plug Torque:
14-18 ft. lbs. (19-24 Nm)

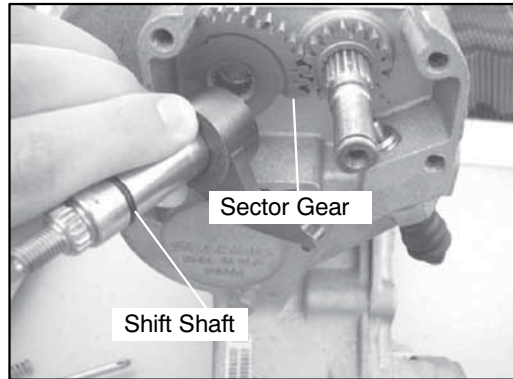
28. Place a small amount of grease (**PN 2871551**) into the pocket before installing the sector gear. Install the shift gear (16T) on the shift drum shaft. Install the sector gear in the bushing pocket on the left side. Aligning the timing marks on the gears.

NOTE: Note the location of the skip tooth on the splines. Apply a light coating of grease on the gear teeth.

29. Install the lockout disc with the raised edge facing outward. Use the white marks that were previously applied for reference.

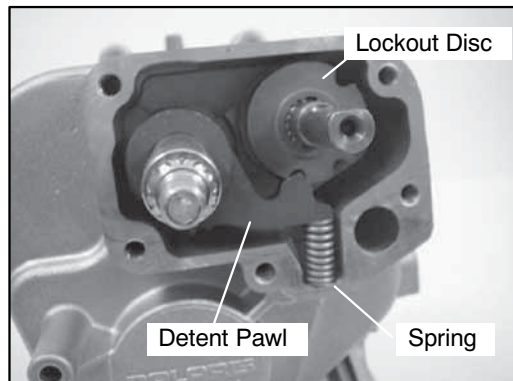


30. Install the shift shaft.



NOTE: Note the location of the skip tooth on the splines. Apply a light coating of grease on the gear teeth.

31. Install the lockout disc. Install the detent pawl and spring. Install a new O-ring onto the shift shaft after the detent pawl is assembled to the shaft. Place a small amount of grease on the small O-ring on the shift shaft and on the detent star. Grease the o-ring on the end of the shift drum.

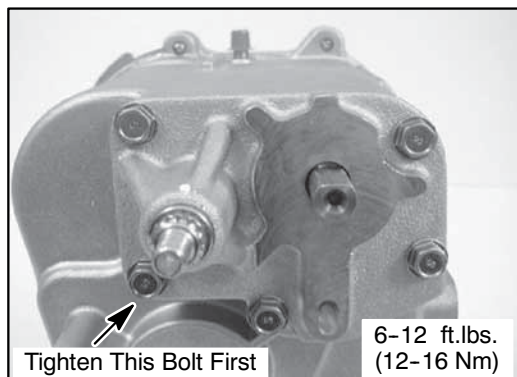


32. Apply Crankcase Sealant (**PN 2871557**) onto the cover and case mating surfaces. Install the cover and hand tighten all of the bolts. Tighten the bolt indicated in the picture below first and torque the





bolt to 6-12 ft. lbs. (12-16 Nm). This helps to align the cover and shaft to ensure smoother shifting.

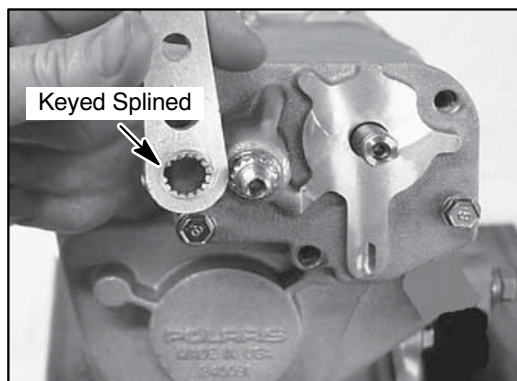


33. Torque the remaining bolts to 6-12 ft.lbs. (12-16 Nm).

Cover Bolt Torque:

6-12 ft. lbs. (12-16 Nm)

34. Install a new bellcrank onto the shift shaft. Note the keyed spline on the bellcrank and shaft. Install the washer and nut. Torque the bellcrank nut to 12-18 ft. lbs. (16-24 Nm).

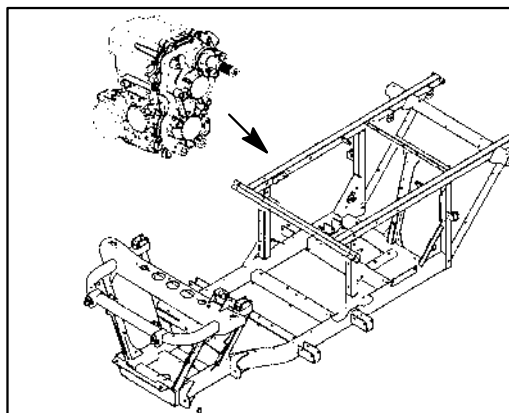


Bellcrank Nut Torque:

12-18 ft. lbs. (16-24 Nm)

35. Install transmission and add Polaris Premium Synthetic Gear Case Lubricant (PN 2871477) in the recommended amount. Refer to

Maintenance Chapter 2.



TROUBLESHOOTING CHECKLIST

Check the following items when shifting difficulty is encountered.

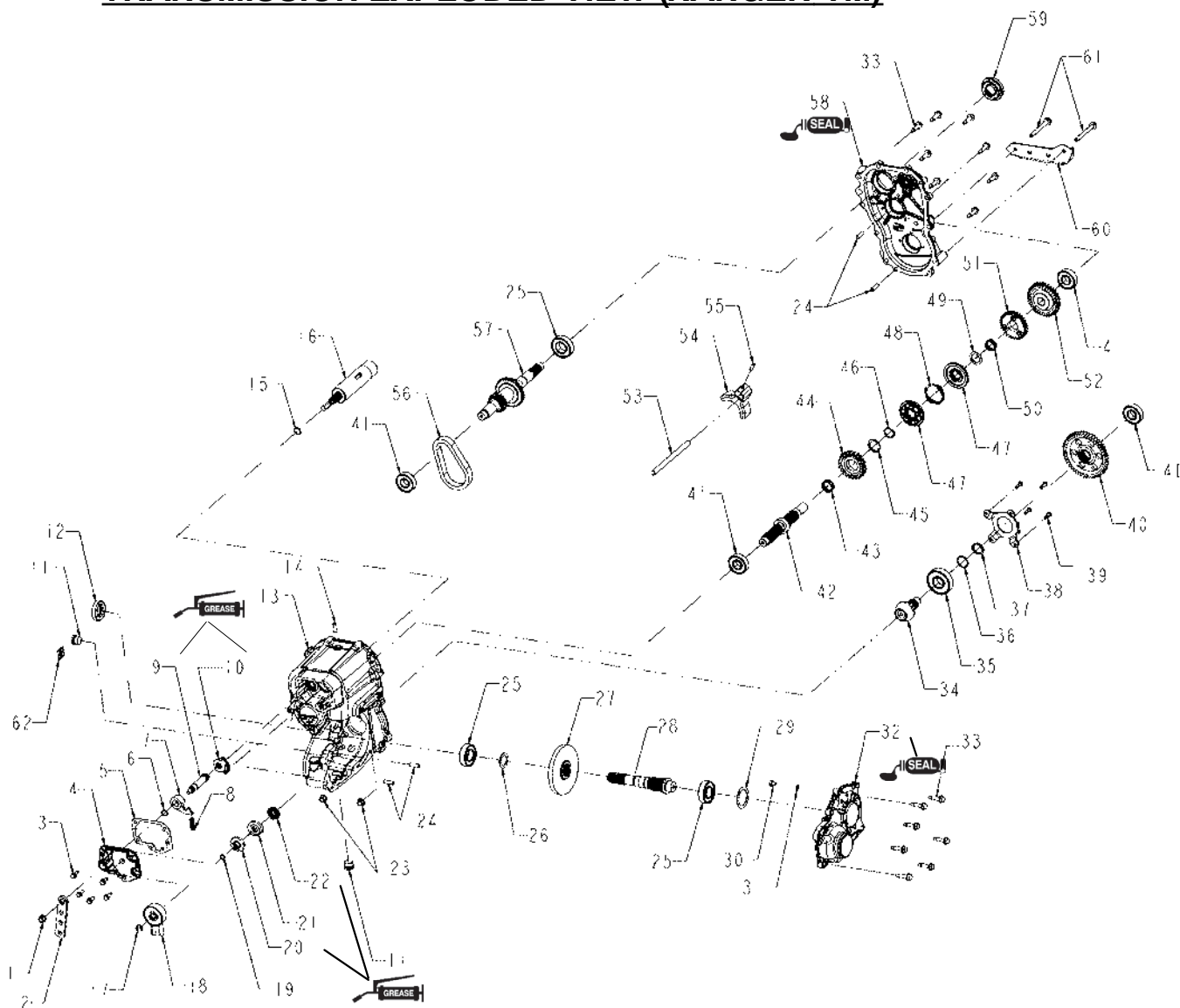
- Idle speed adjustment
- PVT alignment
- Transmission oil type/quality
- Transmission torque stop adjustment (where applicable)
- Engine torque stop adjustment (where applicable)
- Drive belt deflection
- Loose fasteners on rod ends
- Loose fasteners on selector box
- Worn rod ends, clevis pins, or pivot arm bushings
- Linkage rod adjustment and rod end positioning
- Shift selector rail travel
- *Worn, broken or damaged internal transmission components

***NOTE:** To determine if shifting difficulty or problem is caused by an internal transmission problem, isolate the transmission by disconnecting linkage rod from transmission bellcrank. Manually select each gear range at the transmission bellcrank, and test ride vehicle. If it functions properly, the problem is outside the transmission.

If transmission problem remains, disassemble transmission and inspect all gear dogs for wear (rounding), damage. Inspect all bearings, circlips, thrust washers and shafts for wear.



TRANSMISSION EXPLODED VIEW (RANGER TM)



TORQUE SPECIFICATIONS

Item	Torque
1	12-18 ft.lbs. (16-24 Nm)
3	7-9 ft.lbs. (9.5-12 Nm)
23	15-19 ft.lbs. (20-26 Nm)
33	27-34 ft.lbs. (37-46 Nm)
39	6-12 ft.lbs. (8-16 Nm)

FOR REASSEMBLY



Apply White Lithium Based Grease.



Apply Polaris Crankcase Sealant



Apply Loctite™ 262 to the bolt threads.





TRANSMISSION EXPLODED VIEW, CONT.

Ref.	Qty.	Description	Ref.	Qty.	Description
			35.	1	Ball Bearing
1.	1	Nut	36.	1	Spacer
2.	1	Shift Drum Bellcrank	37.	1	Spacer
3.	5	Sector Cover Screws	38.	1	Retaining Ring
4.	1	Sector Cover	39.	4	Torx Screws
5.	1	Sector Cover Gasket	40.	1	50T Helical Gear
6.	1	O-ring	41.	4	Ball Bearing
7.	1	Detent Pawl	42.	1	Reverse Shaft
8.	1	Compression Spring	43.	1	Needle Cage Bearing
9.	1	Shift Shaft	44.	1	24T Sprocket
10.	1	31T Sector Gear	45.	1	Washer
11.	2	Hollow Hex Plug	46.	1	External Retaining Ring
12.	1	Triple Lip Seal	47.	2	Engagement Dog
13.	1	Gearcase	48.	1	Wave Spring
14.	1	Vent Tube	49.	1	Washer
15.	1	O-ring	50.	1	Needle Cage Bearing
16.	1	Shift Drum	51.	1	31T Gear
17.	1	External Retaining Ring	52.	1	34T Helical Gear
18.	1	6-Pin Switch	53.	1	Shift Shaft Rail
19.	1	O-ring	54.	1	Shift Fork
20.	1	Detent Star	55.	1	Dowel Pin
21.	1	Lockout Disc	56.	1	Silent Chain
22.	1	16T Sector Gear	57.	1	Input Shaft
23.	2	Lock Nut	58.	1	LH Main Cover
24.	4	Dowel Pin	59.	1	Dual Lip Seal
25.	3	Ball Bearing	60.	1	Transmission Mount Bracket
26.	1	Thrust Washer	61.	2	Screw
27.	1	31T Spiral Gear	62.	1	Label
28.	1	Output Shaft			
29.	1	Shim			
30.	1	Thrust Button			
31.	1	Shim			
32.	1	Output Cover			
33.	15	Screw			
34.	1	10T Spiral Pinion Shaft			

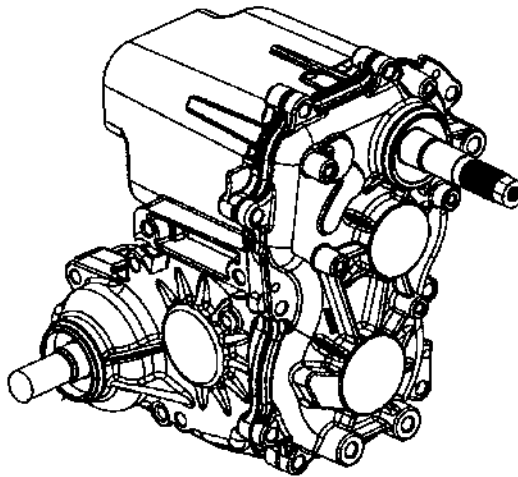


CHAPTER 8

TRANSMISSION

RANGER 2X4, 4X4, 6X6

Torque Specifications/Lubrication	8.22
Gear Shift Selector Removal/Installation	8.22
Shift Linkage Adjustment	8.22-8.23
Transmission Removal	8.23-8.25
Transmission Installation	8.26
Transmission Disassembly	8.27-8.33
Transmission Assembly	8.34-8.39
Troubleshooting	8.39
2x4 Transmission, Exploded	8.40-8.41
4x4 & 6x6 Transmission, Exploded	8.42-8.43



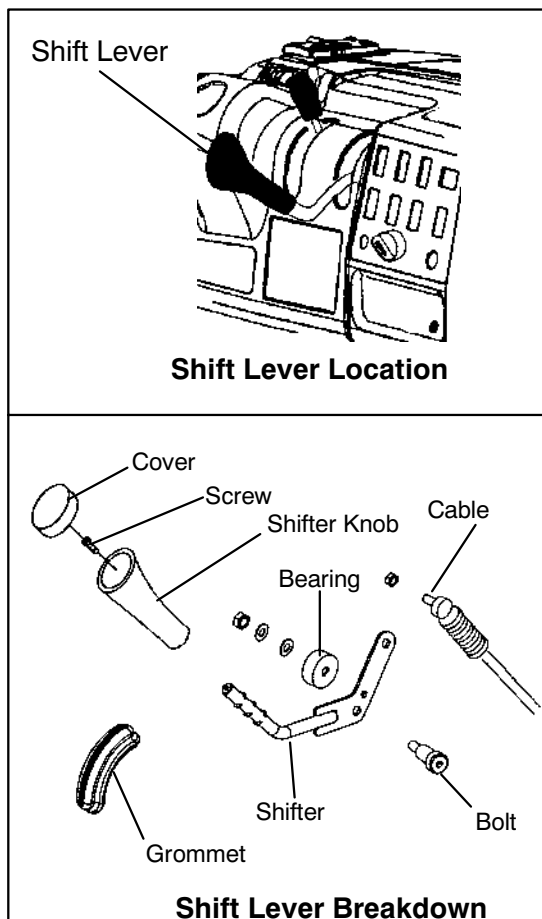


TORQUE SPECIFICATIONS

ITEM	TORQUE VALUE
Transmission Fill Plug	14-18 ft. lbs. (19-24 Nm)
Transmission Drain Plug	14-18 ft. lbs. (19-24 Nm)
Transmission Case Bolts	27-34 ft. lbs. (37-46 Nm)
Bell Crank Nut	21-18 ft. lbs. (16-18 Nm)
Bell Crank Gear Cover	6-12 ft. lbs. (6-16 Nm)
Transmission Mounting Bolts	25 ft. lbs. (35 Nm)
2x4 Transmission Lubricant / Amount	AGL Gearcase Lube 18.2 oz. (540 ml)
4x4, 6x6 Transmission Lubricant / Amount	AGL Gearcase Lube 15.2 oz. (450 ml)

SHIFT LEVER REMOVAL/INSTALLATION

1. Disconnect linkage cable from shifter.
2. Remove one bolt attaching gear selector mount to machine frame.
3. Remove the cover and remove screw. Pull off the shifter knob.
4. Lift gear selector out of mounting bracket and away from frame.
5. Repeat the steps in reverse order to install the gear selector.



SHIFT LINKAGE INSPECTION/ADJUSTMENT

Linkage rod adjustment is necessary when symptoms include:

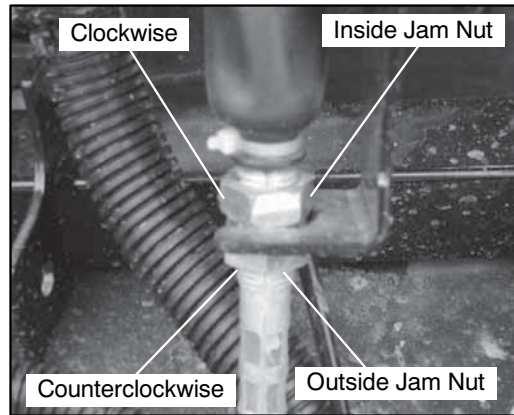
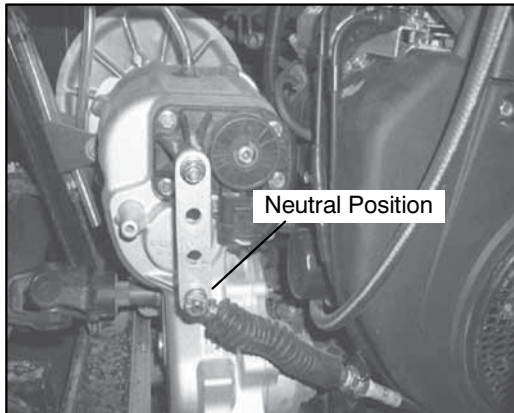
- No All Wheel Drive light
- Noise on deceleration
- Inability to engage a gear
- Excessive gear clash (noise)
- Shift selectors moving out of desired range

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

1. Inspect shift linkage cable, clevis pins, and pivot bushings and replace if worn or damaged.
2. Be sure idle speed is adjusted properly.

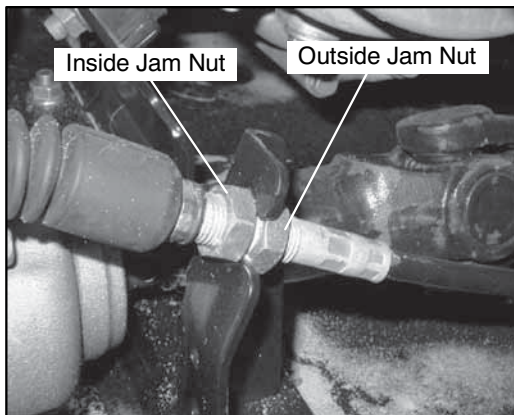


- Place gear selector in neutral. Make sure the transmission bell crank is engaged in the neutral position detents.



Shift Lever Cable Adjustment

- With two wrenches loosen the outside jam nut counterclockwise. Turn the outside jam nut 1 1/2 turns. Perform this procedure on the shift lever end, also.



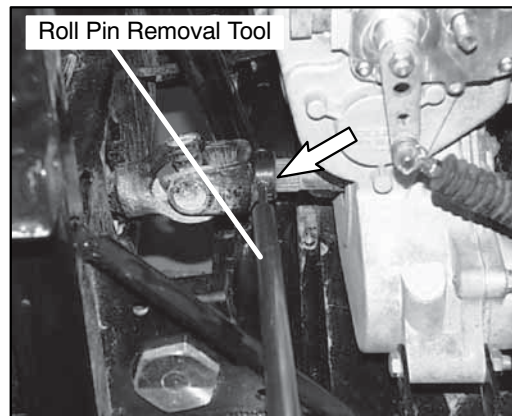
Transmission Cable Adjustment

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

TRANSMISSION REMOVAL

- Remove the PVT system from the left side of the transmission.
- Drive roll pin from rear driveshaft yoke.

NOTE: On the 4x4 & 6x6 transmission the front output shaft yolk slides off during the transmission removal.

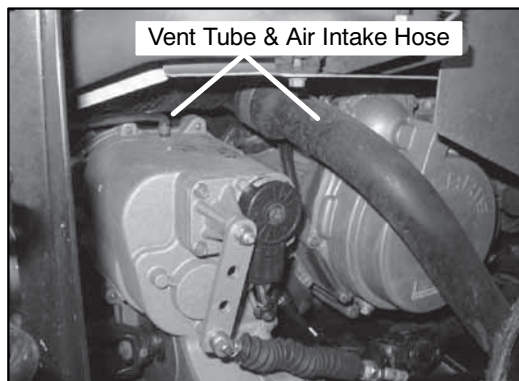


Roll Pin Removal Tool (PN 2872608)

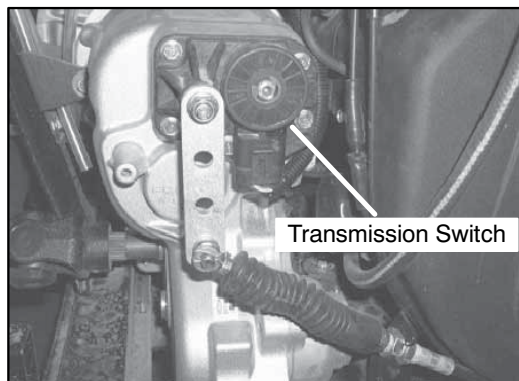




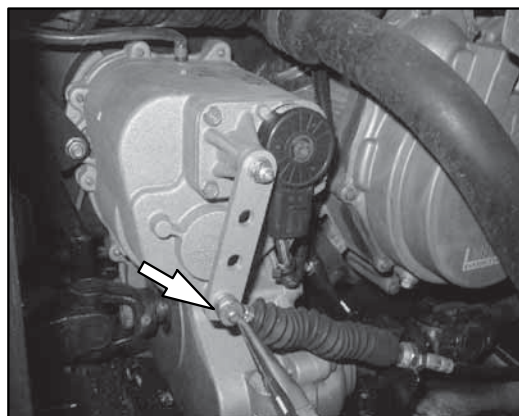
3. Remove the air intake hose from the air box that is located above the transmission. Place the hose to the side, this eases the transmission removal. Remove the vent hose from the top of the transmission.



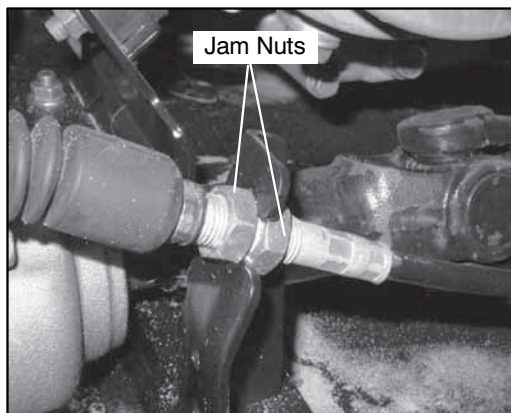
4. Disconnect the transmission switch.



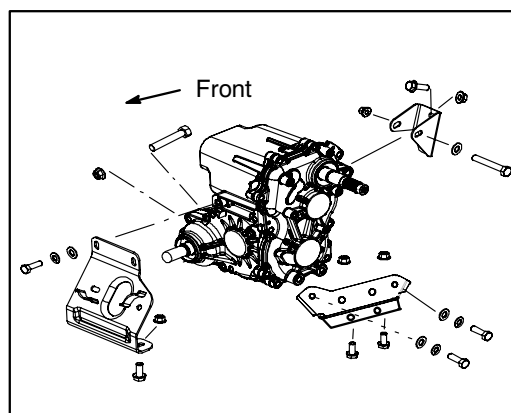
5. Remove the cotter pin from the shift linkage rod. Remove the shift linkage rod and a washer from the bellcrank.



6. Loosen the jam nuts for the transmission cable. Remove the cable from the mounting bracket.



7. Remove the mounting bolts from the transmission mounting on both sides of the transmission.

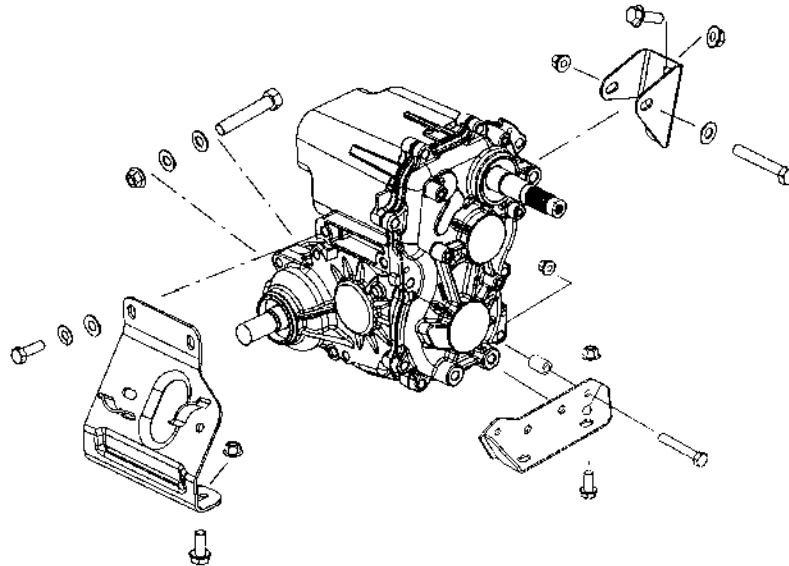




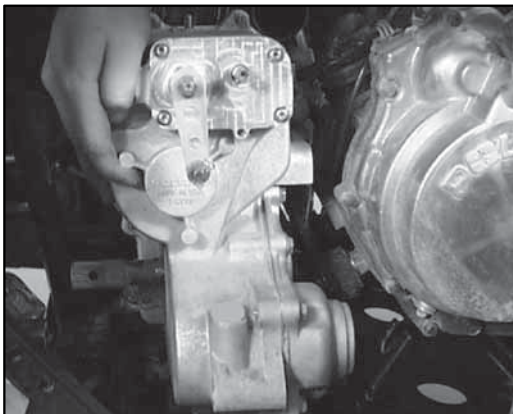
8. Remove the four bottom transmission to frame bolts.
9. Remove the rear transmission to frame bolt.
10. Remove front transmission-to-engine mount bolt.

General Transmission Mounting

Front



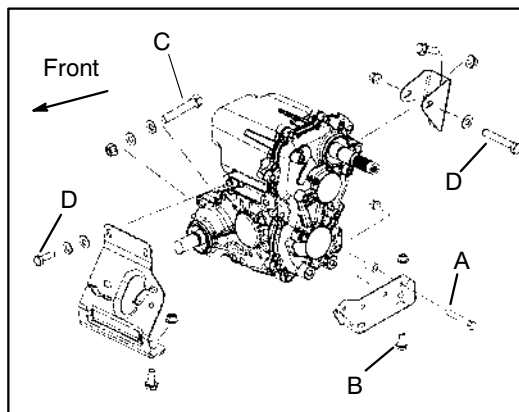
11. Remove transmission from right side of frame.





TRANSMISSION INSTALLATION

1. Install transmission from right side of vehicle.
2. Position transmission in frame.
3. Loosely install the front transmission to frame bolts.
4. Loosely install the rear transmission to frame bolt.
5. Loosely install the three bottom transmission to frame bolts.
6. Tighten mounting fasteners in order A-D as shown.



Transmission Mounting Bolts Torque

25 ft. lbs. (34.5 Nm)

NOTE: Be sure to tighten the lower transmission bolts first, this ensures that the transmission is tight against the lower frame and helps to properly align the transmission.

NOTE: Align clutches as outlined in Clutch Chapter 6.

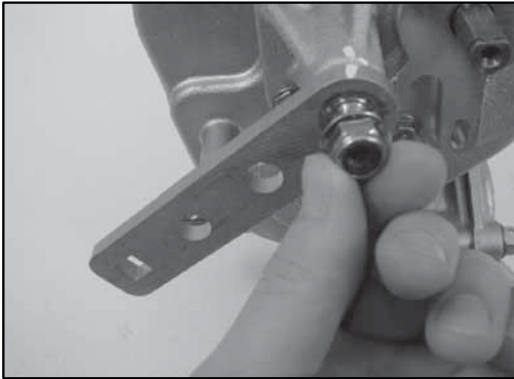
7. Align the front input shaft to the front propshaft yoke on the vehicle.
8. Align rear output shaft to rear propshaft yoke and roll pin hole.
9. Slide rear output shaft and into propshaft yoke. Drive the roll pin into the driveshaft yolk.
10. Reinstall the shift linkage rod, the air intake hose, and the vent hose on top of the transmission.



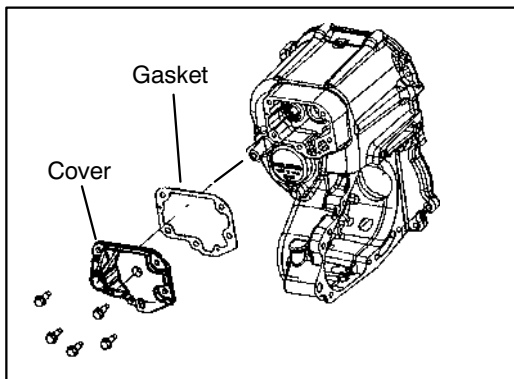
TRANSMISSION DISASSEMBLY

NOTE: The following disassembly procedure shows the 4x4 transmission disassembly. Follow the same procedure for the 2x4 and 6x6 transmission disassembly. The transmissions are very similar. Refer to the exploded views at the end of this chapter.

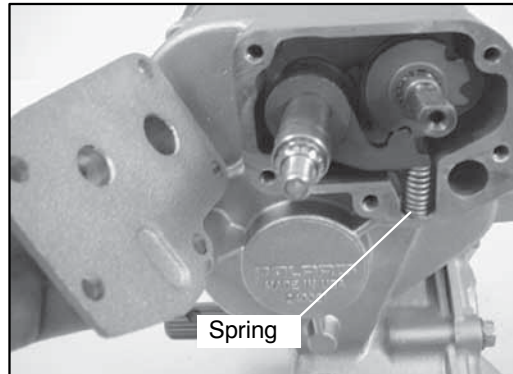
1. Place the bellcrank in neutral position.
2. Remove the nut, and washer that secure the bell crank. Remove the bellcrank.



3. Remove the five bolts that secure the cover. Remove the cover and cover gasket.

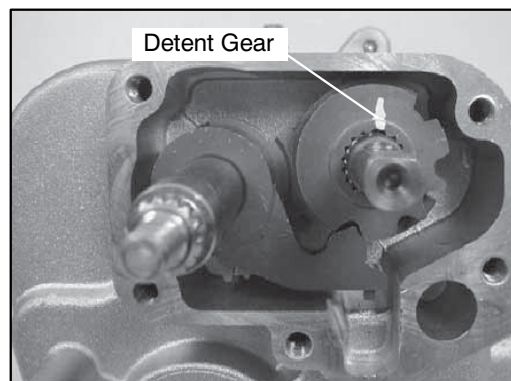


4. Remove the detent spring.



5. Mark the detent gear with a white pen. Remove the detent gear from the case.

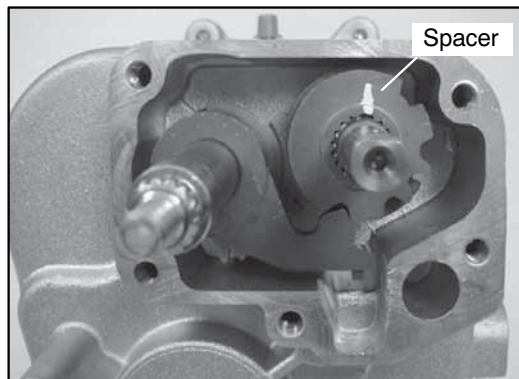
NOTE: It may be helpful to place a mark just above the keyed spline.



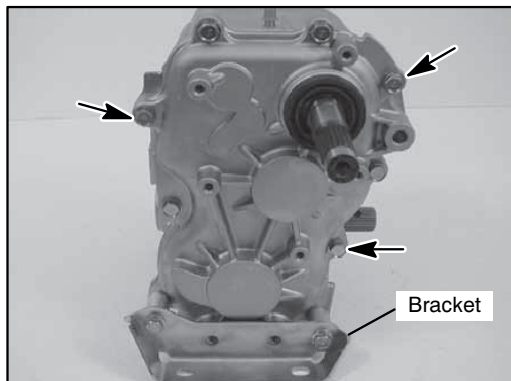
6. Mark the spacer, this will indicate which side of the disc faces outward during assembly. Remove the spacer.

NOTE: It may be helpful to place a mark just above the keyed spline. Note the raised edge on the detent.



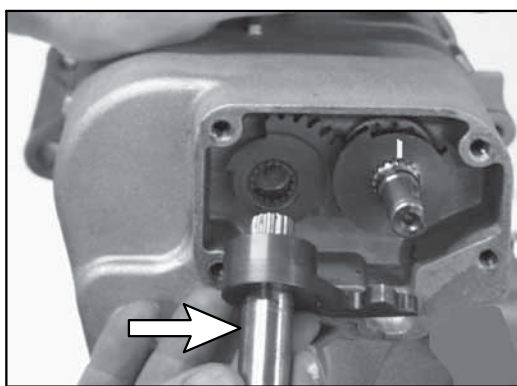


7. Remove the shift shaft and detent lever.



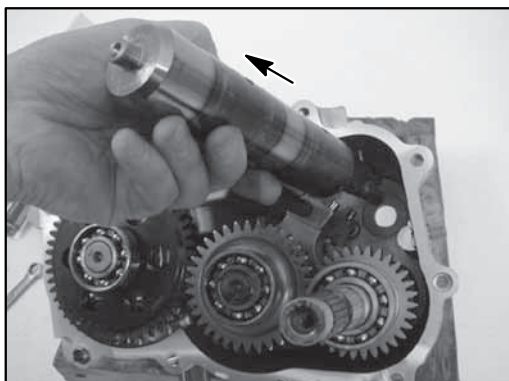
10. Remove the shift drum.

NOTE: You may have to tap the shift drum from the backside of the case to aid in removal.

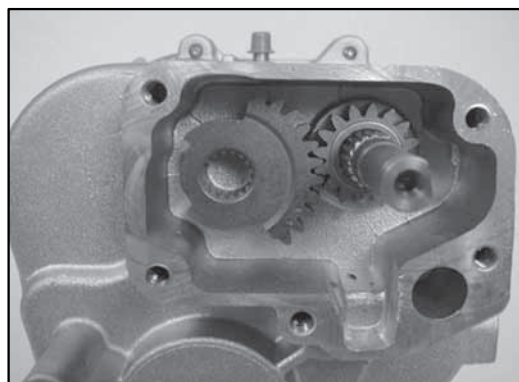


8. Note the timing marks on the shift gears. Remove the shift gears from the case.

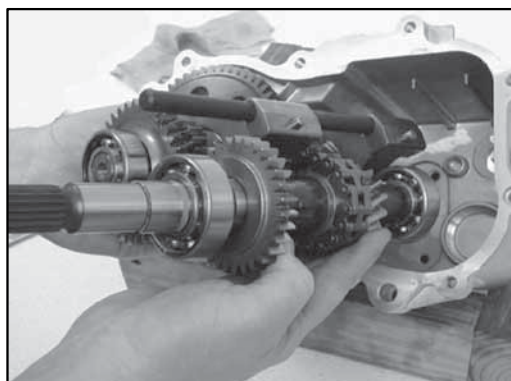
NOTE: It may be helpful to accent the timing marks using a white marking pen.



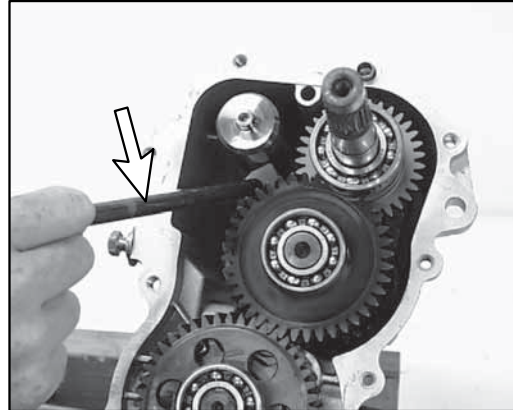
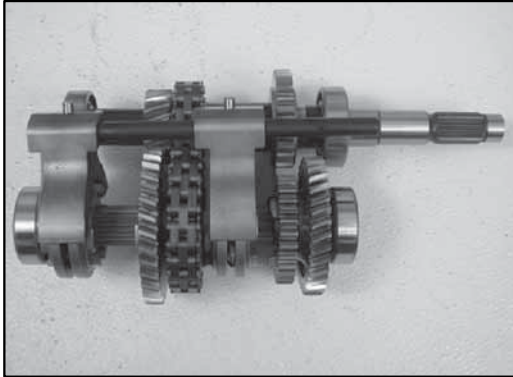
11. Remove the upper gear cluster and shift forks. You may need to move the assembly back and forth to aid in removal.



9. Remove the bolts on the LH transmission case cover. Tap the cover off with a soft face hammer if necessary. **NOTE:** Leave bracket attached to the LH cover during removal, only remove if needed.



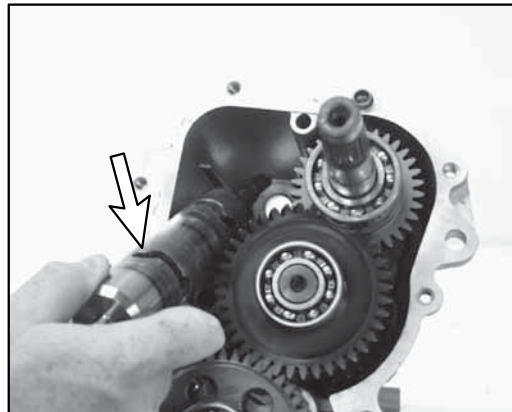
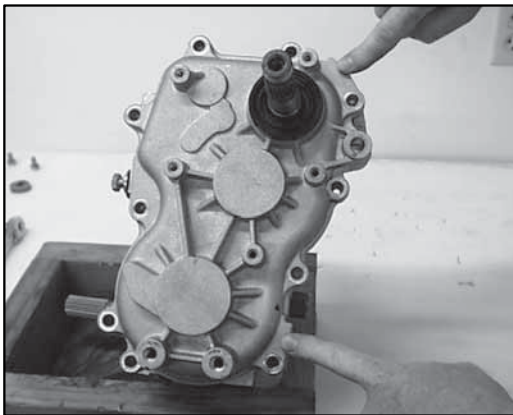
12. Set the upper gear cluster on a flat surface and inspect the components.



13. Remove the bolts on the LH transmission case. Tap the cover off with a soft face hammer if necessary.

15. Remove the shift drum.

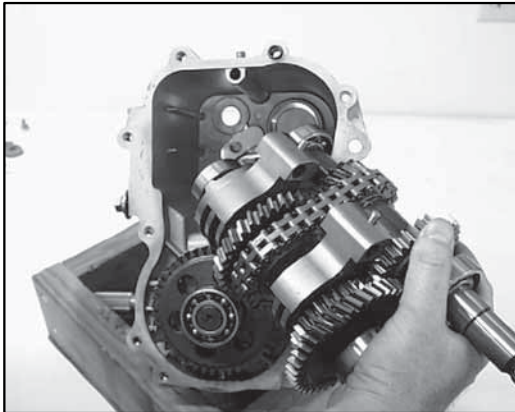
NOTE: You may have to tap the shift drum from the backside of the case to aid in removal.



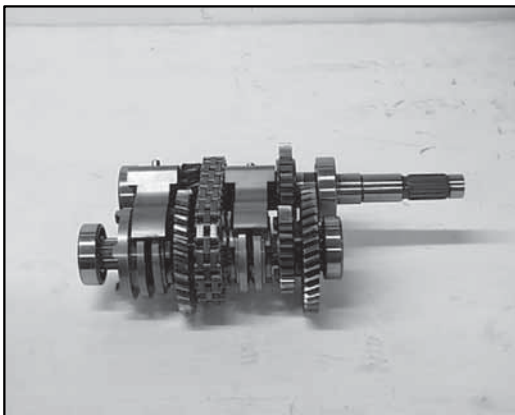
14. Lift shift rail 0.5-1" (12.70-25.40 mm). Then rotate the shift rail/forks and shift drum, so the the forks' pins disengage from the drum.

16. Remove the upper gear cluster and shift forks. You may need to move the assembly back and forth to aid in removal.



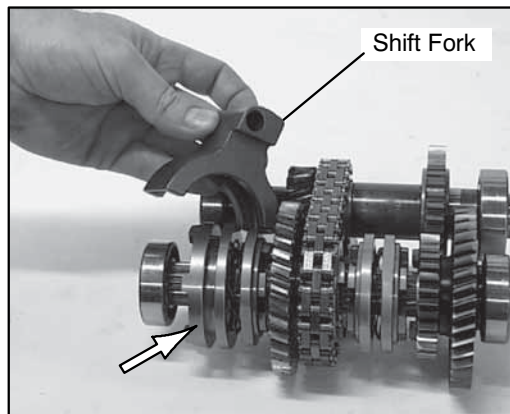


17. Set the upper gear cluster on a flat surface and inspect the components.

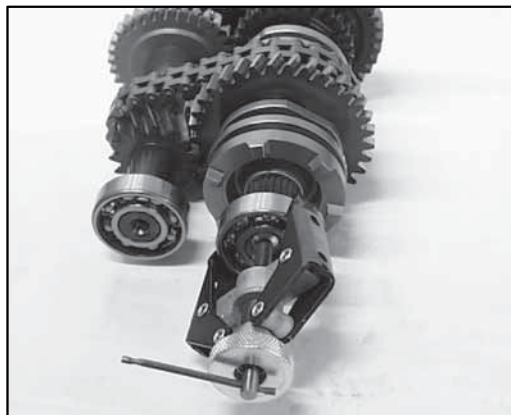


18. Remove the shift forks from the assembly. Note the correct position of each fork.

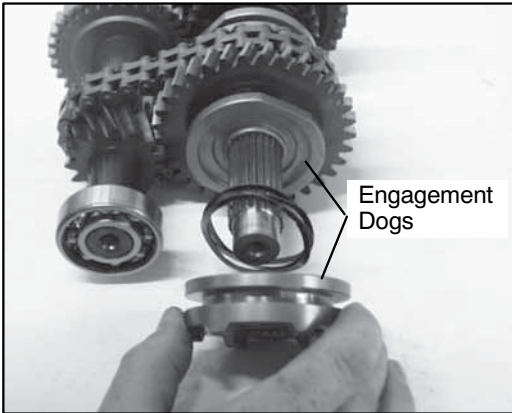
NOTE: The picture on the right depicts a transmission with a “park dog” on the end of the shaft instead of a regular “shift dog”. The transmission will have a regular shift dog in the location indicated by the arrow in the photo.



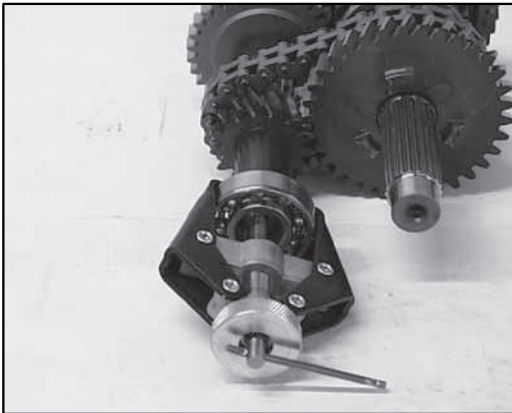
19. Remove the bearing from the reverse shaft with a puller.



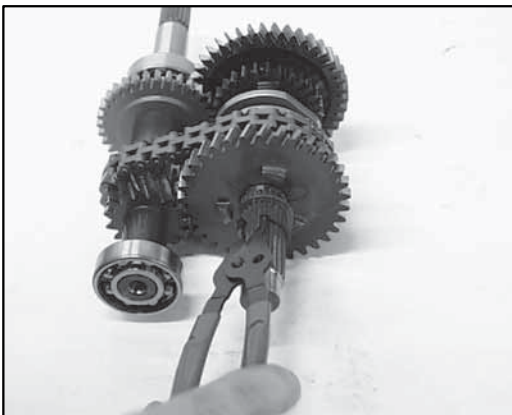
20. Remove the park lock engagement dog. Remove the wave spring and reverse engagement dog.



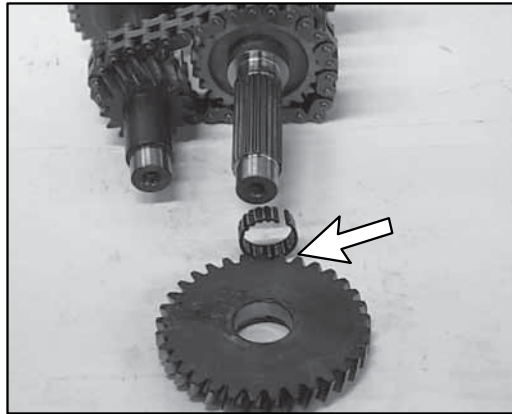
21. Remove the bearing from the input shaft with a puller.



22. Remove the snap ring and washer from the reverse shaft.

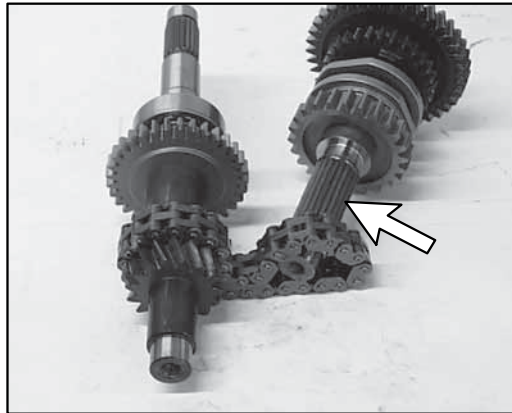


23. Remove low gear (33T) and the needle bearing.



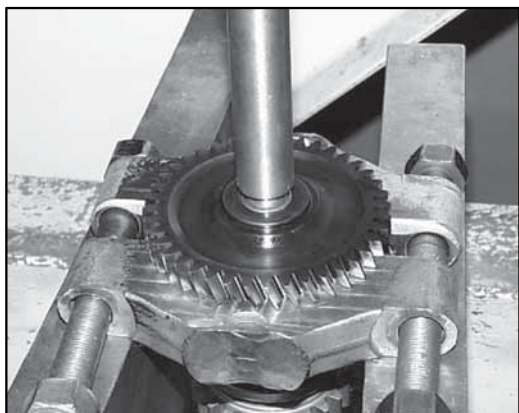
24. Remove the reverse gear shaft.

25. Remove the rest of the bearings from the shafts.

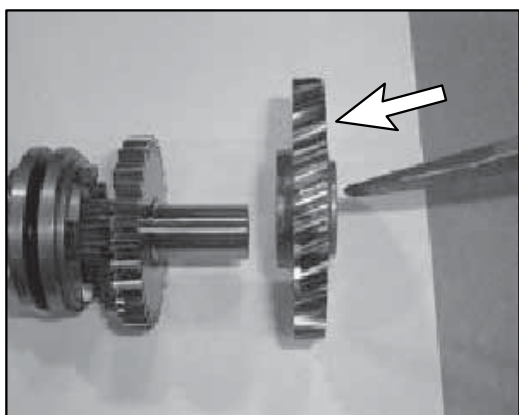




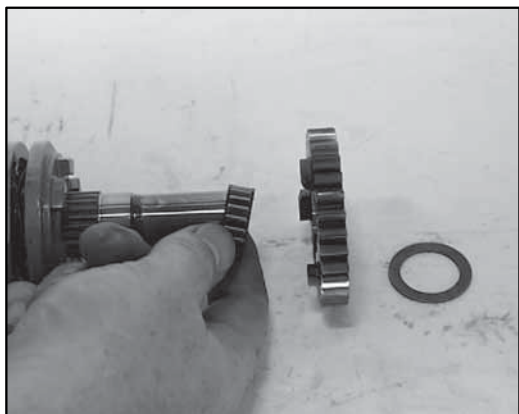
26. Use a press to remove the gear from the shaft.



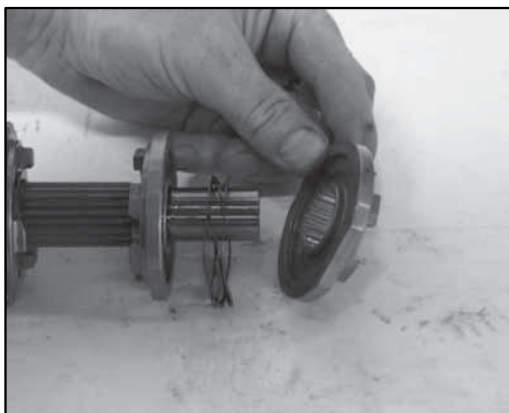
27. Make note of the direction of the gear and hub location.



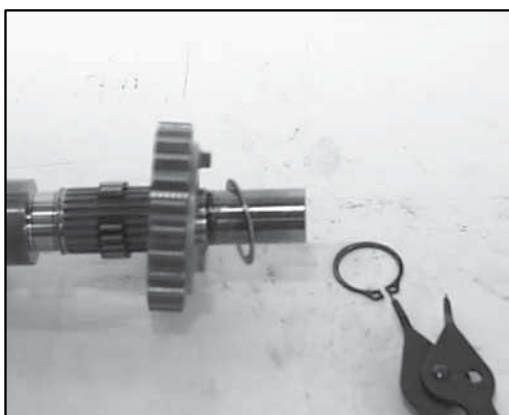
28. Remove the gear, split bearing, and washer from the reverse shaft.



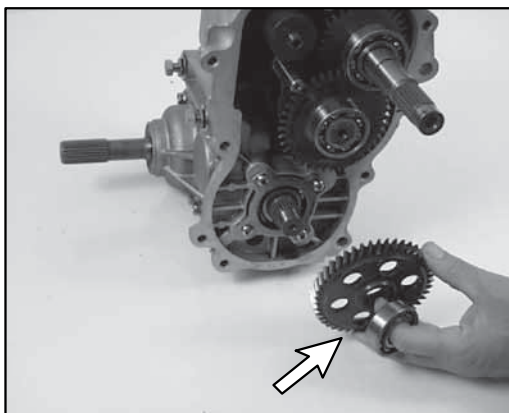
29. Slide off the shift dogs and wave springs.



30. Remove the snap ring, washer, gear, and split bearing.

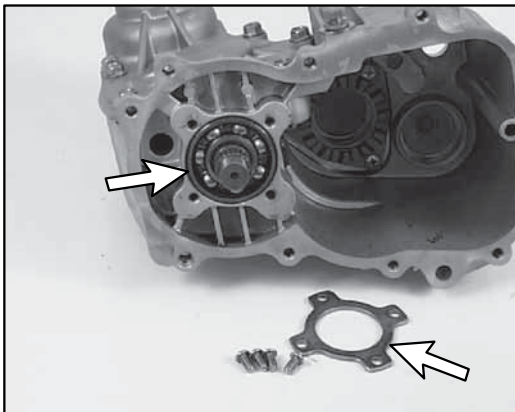


31. Remove bearing and the helical gear.

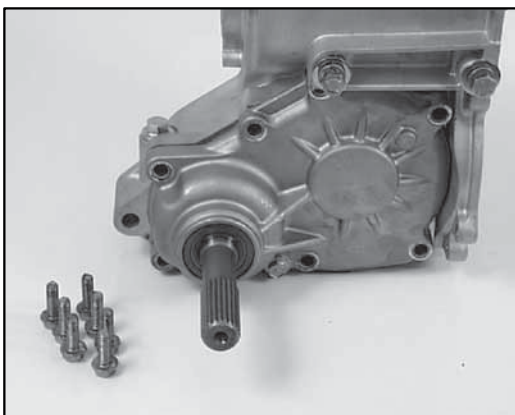




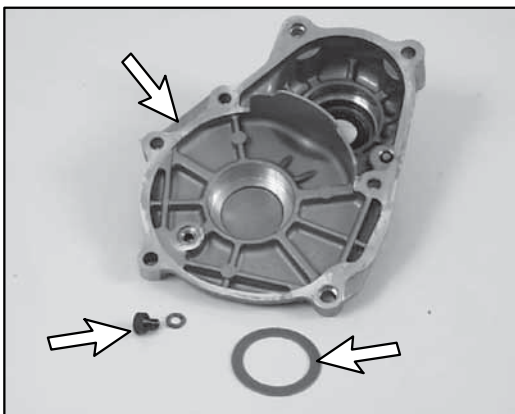
32. Remove the pinion shaft retainer plate and the pinion shaft.



33. Remove the front housing cover screws.



34. Remove the front housing cover, shim, thrust button, and thrust button shim.



35. Remove the shafts as an assembly.

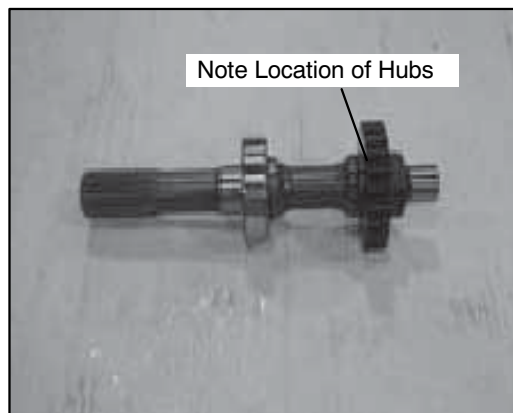


36. Remove the silent chain from the assembly for shaft inspection.

37. Clean all components in a parts washer and inspect for wear.

38. Inspect engagement dogs of gears and replace if edges are rounded.

39. Inspect gear teeth for wear, cracks, chips or broken teeth. Note the location of the hubs on the gear.



40. Remove seals from transmission case.

IMPORTANT: New seals should be installed after the transmission is completely assembled.

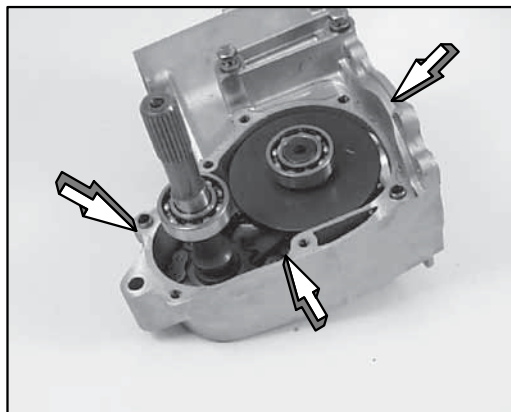
41. Inspect bearings for smooth operation. Check for excessive play between inner and outer race.





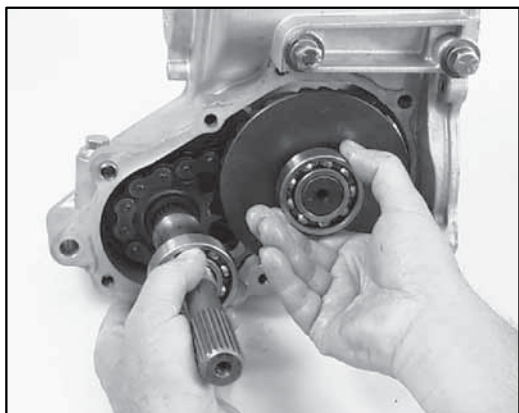
TRANSMISSION ASSEMBLY

1. Reinstall the chain onto the front output shaft and rear output shaft.



Crankcase Sealant
(PN 2871557)

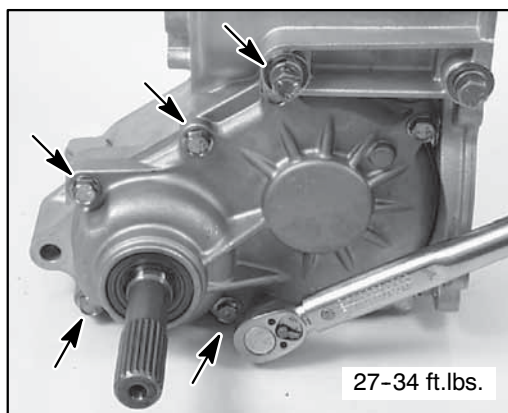
2. Install front and rear output shafts into the case.



3. Before installing the cover make sure the sealing surfaces are clean and dry, and shafts are fully seated in the transmission case. Apply Polaris Crankcase Sealant to the mating surfaces.

4. Reinstall the thrust button shim, thrust button, and other shims into the cover. Reinstall cover and torque bolts in a criss-cross pattern in 3 steps to 27-34 ft. lbs. (36.50-46 Nm).

NOTE: Make sure that the case locating pins (knock pipes) are in place.

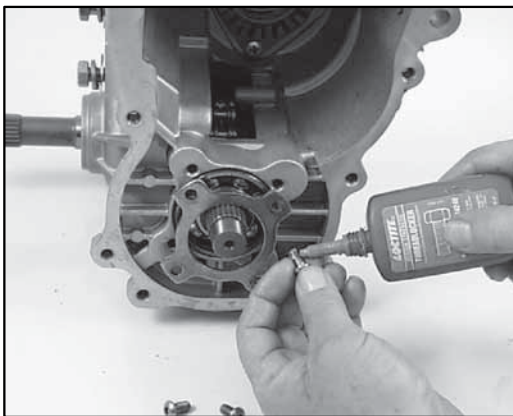




Front Cover Bolt Torque:

27-34 ft. lbs. (36.50-46 Nm)

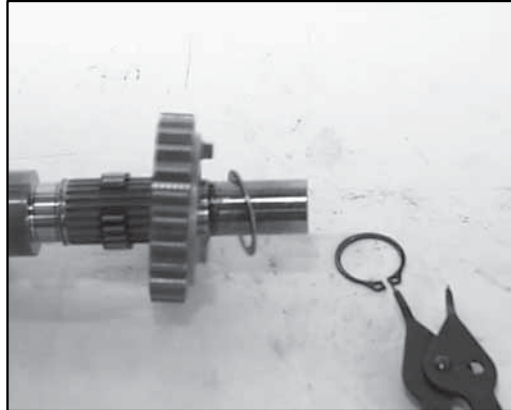
5. Apply grease to the seal lips. Apply electricians tape or somehow cover the splines of the shaft to protect the seal lips during installation. Install new front and rear output shaft seals.
6. Install pinion shaft with bearing.
7. Install retainer plate with flat side toward bearing.
8. Apply Loctite™ 262 (Red) (PN 2871951) to screw threads and torque screws to 6-12 ft. lbs. (8-16 Nm).



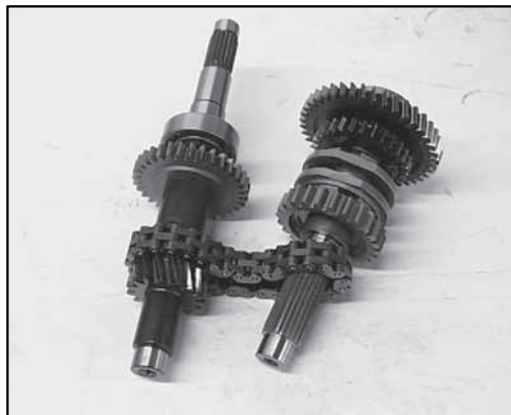
Pinion Retainer Plate Bolt Torque:

6-12 ft. lbs. (8-16 Nm)

9. Install a new needle bearing, the 24T reverse sprocket, washer, and a new snap ring. Install the shift dogs and wave spring. Install the washer, a new needle bearing and the high gear. Install the press fit gear and ball bearing.
10. Install a new snap ring at this time. When installing the new snap ring, open the the snap ring just far enough to go over the shaft, to avoid stressing the snap ring. If the snap ring is overstressed it could come off the shaft and cause internal damage to the transmission.

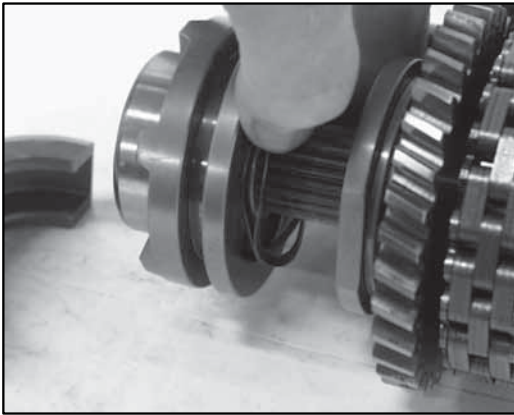


11. Slide the reverse shaft assembly through the silent chain.



12. Install a new needle bearing, the low gear, the thrust washer and the snap ring. Use of a new snap ring is recommended.
13. Install the engagement dogs, wave springs, and bearing.
14. Install the ball bearing onto the end of the input shaft.

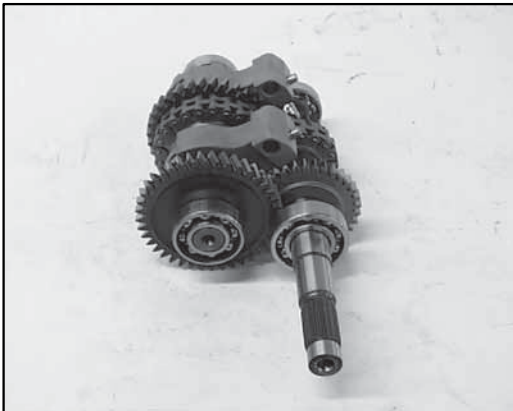




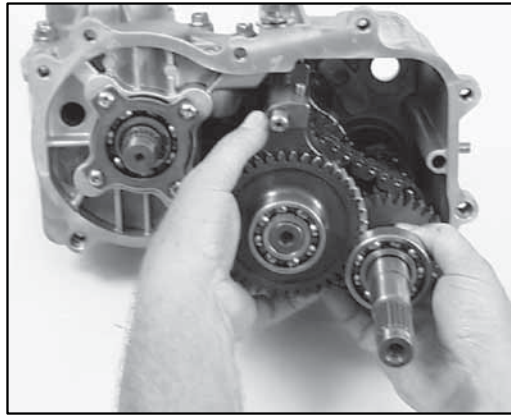
15. As the engagement dogs are installed onto the shaft, place the wave springs into the spring groove. Keep the spring in place while the fork is being installed on the shaft and while placing the shafts into the case.

NOTE: Use caution when installing the fork, the spring can easily fall out.

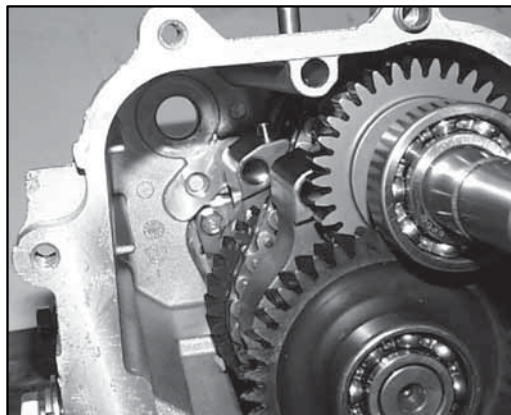
NOTE: Installing the shift rail will aid in keeping the shift forks, shift dogs, and the springs in place.



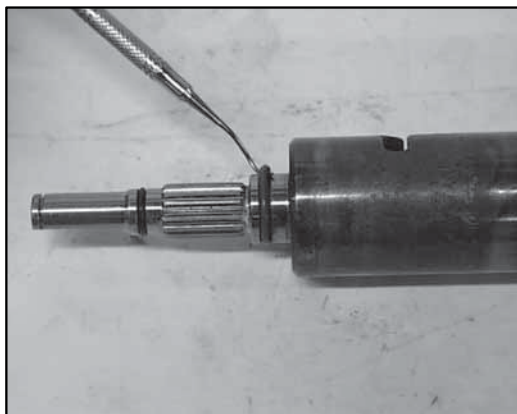
16. Carefully install the shaft assembly and gear cluster as a unit into their respective bearing case recesses. Tap with a soft face hammer to seat shaft assemblies.



17. Position the shift forks up and so the the pins point toward the 9 o'clock position, before installing the shift drum assembly.



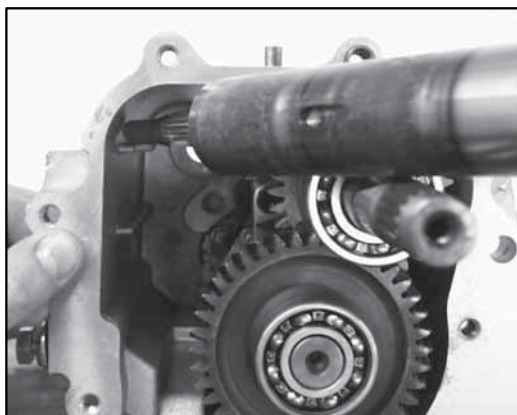
18. Replace and grease the O-ring's on the shift drum before installation.



19. Install the shift drum into the case.

NOTE: Make sure shift shaft pins are properly positioned in the slot on selector arms.

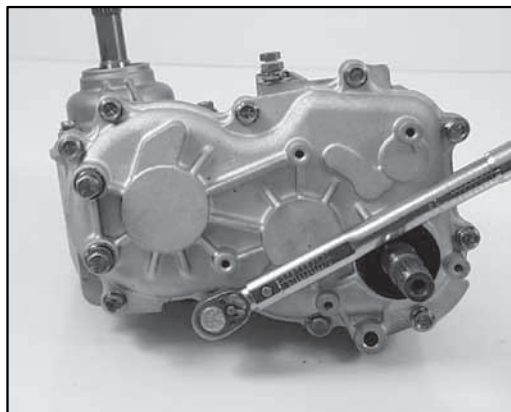
20. Lift the shift rail slightly and rotate the rail/fork assembly so it meshes with the tracks on the shift drum. Be sure the wave springs are properly in place and that the shift rail is seated into the pocket on the backside of the case.



21. Install the helical gear and bearing onto the pinion shaft.

22. Clean the mating surfaces of the case and cover. Apply Crankcase Sealant (**PN 2871557**) to the mating surfaces. Be sure the locating pins (knock pipes) are in place. Reinstall cover and torque bolts in a criss-cross pattern in 3 steps to 27-34 ft. lbs. (36.50-46 Nm).

23. Reinstall the mounting bracket if previously removed.

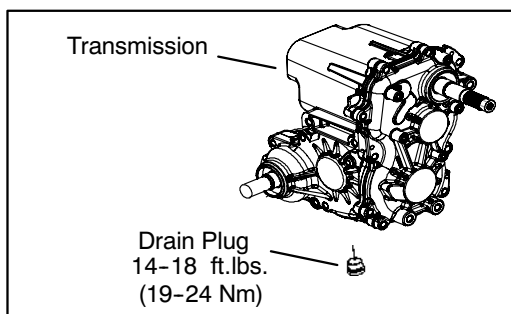


Front Cover Bolt Torque:

27-34 ft. lbs. (36.50-46 Nm)

24. Grease the seal lips of the input shaft seal. Apply electricians tape or somehow cover the splines of the shaft to protect the seal lips during installation. Install new input shaft seal.

25. Install drain plug with a new sealing washer. Torque drain plug to 14-18 ft. lbs. (19-24 Nm).



Drain Plug Torque:

14-18 ft. lbs. (19-24 Nm)

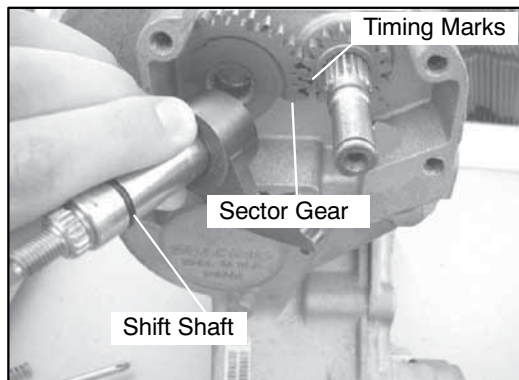
26. Place a small amount of grease (**PN 2871551**) into the pocket before installing the sector gear. Install the shift gear (16T) on the shift drum shaft. Install the sector gear in the bushing pocket on the left side. Aligning the timing marks on the gears.



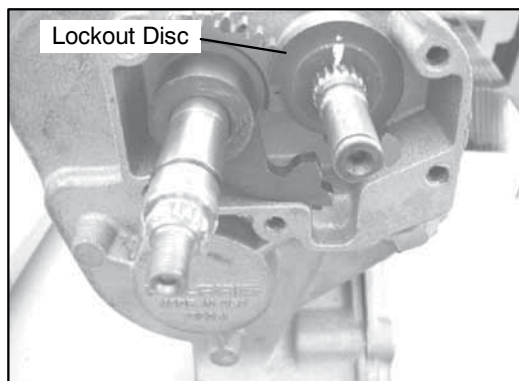


NOTE: Note the location of the skip tooth on the splines. Apply a light coating of grease on the gear teeth.

27. Install the shift shaft.

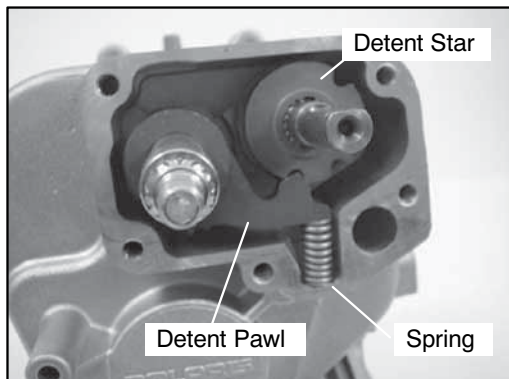


28. Install the lockout disc with the raised edge facing outward. Use the white marks that were previously applied for reference.

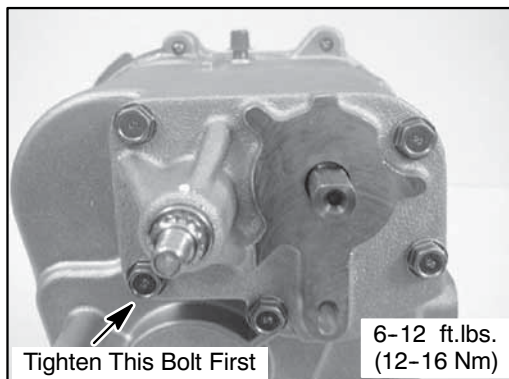


29. Install the detent star with the raised edge facing outward. Note the keyed spline on the end of the shaft.

30. Install the detent pawl spring. Install a new o-ring onto the shift shaft after the detent pawl is assembled to the shaft. Place a small amount of grease on the small O-ring on the shift shaft and on the detent star. Grease the o-ring on the end of the shift drum.



31. Install the sector cover gasket. Install the cover and hand tighten all of the bolts. Tighten the bolt indicated in the picture below first and torque the bolt to 6-12 ft. lbs. (12-16 Nm). This helps to align the cover and shaft to ensure smoother shifting.



32. Torque the remaining bolts to 6-12 ft.lbs. (12-16 Nm).

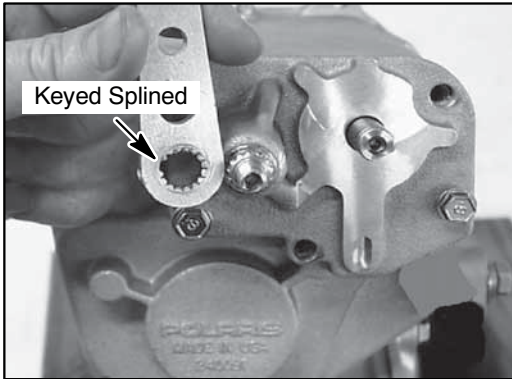
Cover Bolt Torque:

6-12 ft. lbs. (12-16 Nm)

33. Install a new bellcrank onto the shift shaft. Note the keyed spline on the bellcrank and shaft.

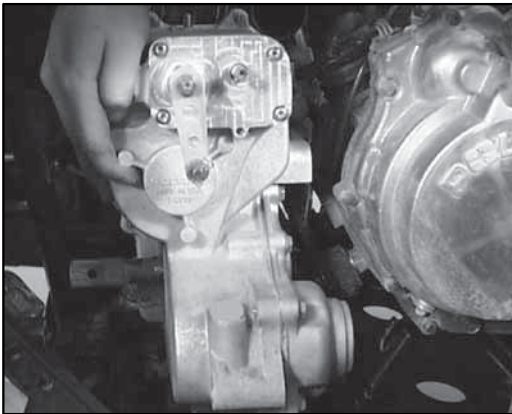


Install the washer and nut. Torque the bellcrank nut to 12-18 ft. lbs. (16-24 Nm).



Bellcrank Nut Torque:
12-18 ft. lbs. (16-24 Nm)

34. Install transmission and add Polaris AGL Gear Case Lubricant (PN 2872602) in the recommended amount. Refer to Maintenance Chapter 2.



TROUBLESHOOTING **CHECKLIST**

Check the following items when shifting difficulty is encountered.

- Idle speed adjustment
- PVT alignment
- Transmission oil type/quality
- Transmission torque stop adjustment (where applicable)
- Engine torque stop adjustment (where applicable)
- Drive belt deflection
- Loose fasteners on rod ends
- Loose fasteners on selector box
- Worn rod ends, clevis pins, or pivot arm bushings
- Linkage rod adjustment and rod end positioning
- Shift selector rail travel
- *Worn, broken or damaged internal transmission components

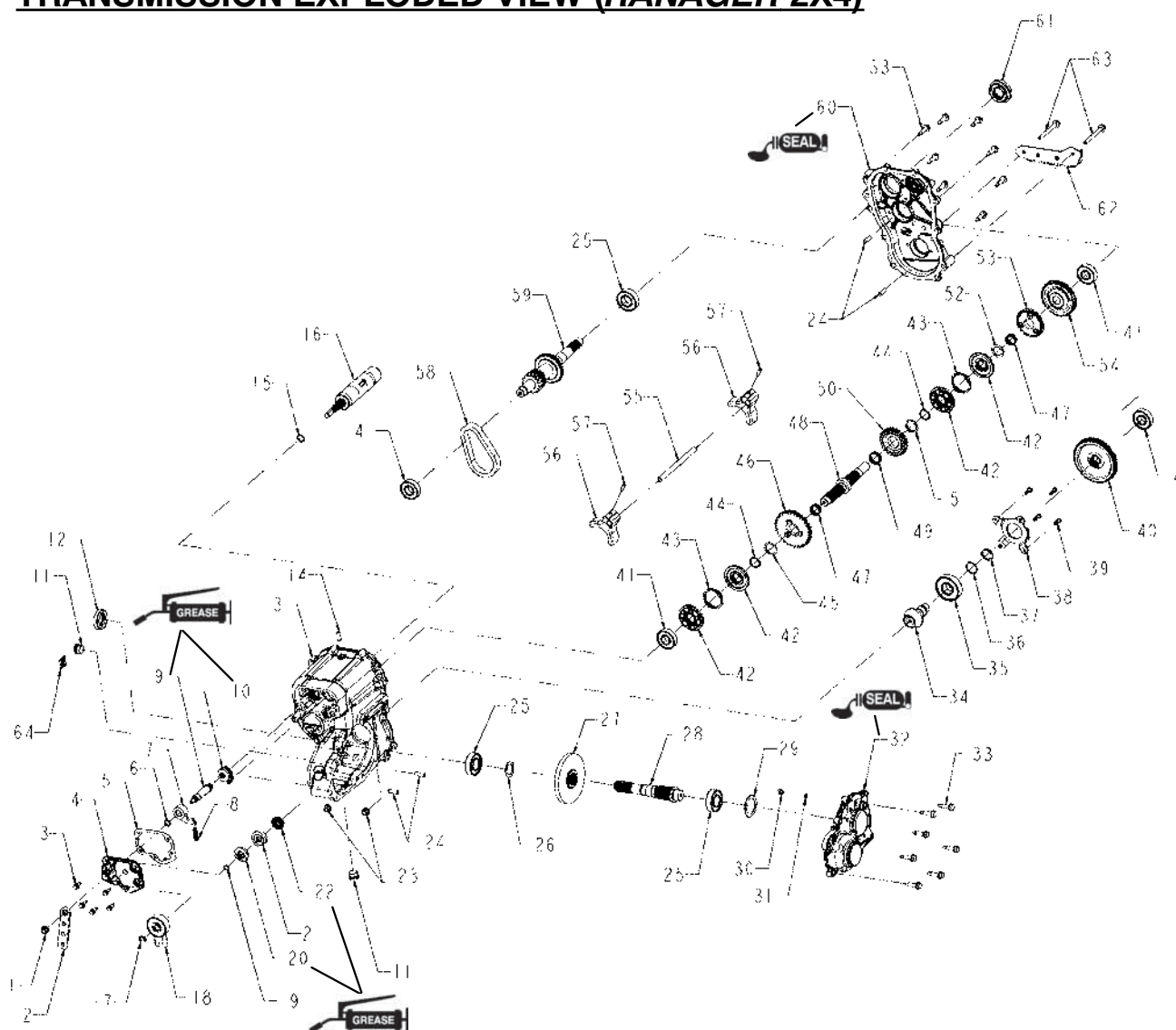
***NOTE:** To determine if shifting difficulty or problem is caused by an internal transmission problem, isolate the transmission by disconnecting linkage rod from transmission bellcrank. Manually select each gear range at the transmission bellcrank, and test ride vehicle. If it functions properly, the problem is outside the transmission.

If transmission problem remains, disassemble transmission and inspect all gear dogs for wear (rounding), damage. Inspect all bearings, circlips, thrust washers and shafts for wear.





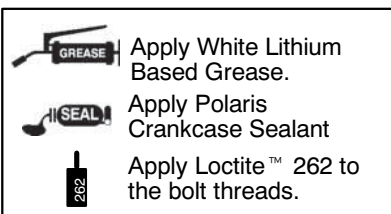
TRANSMISSION EXPLODED VIEW (RANGER 2X4)



TORQUE SPECIFICATIONS

Item	Torque
1	12-18 ft.lbs. (16-24 Nm)
3	7-9 ft.lbs. (9.5-12 Nm)
23	15-19 ft.lbs. (20-26 Nm)
33	27-34 ft.lbs. (37-46 Nm)
39	6-12 ft.lbs. (8-16 Nm)

FOR REASSEMBLY





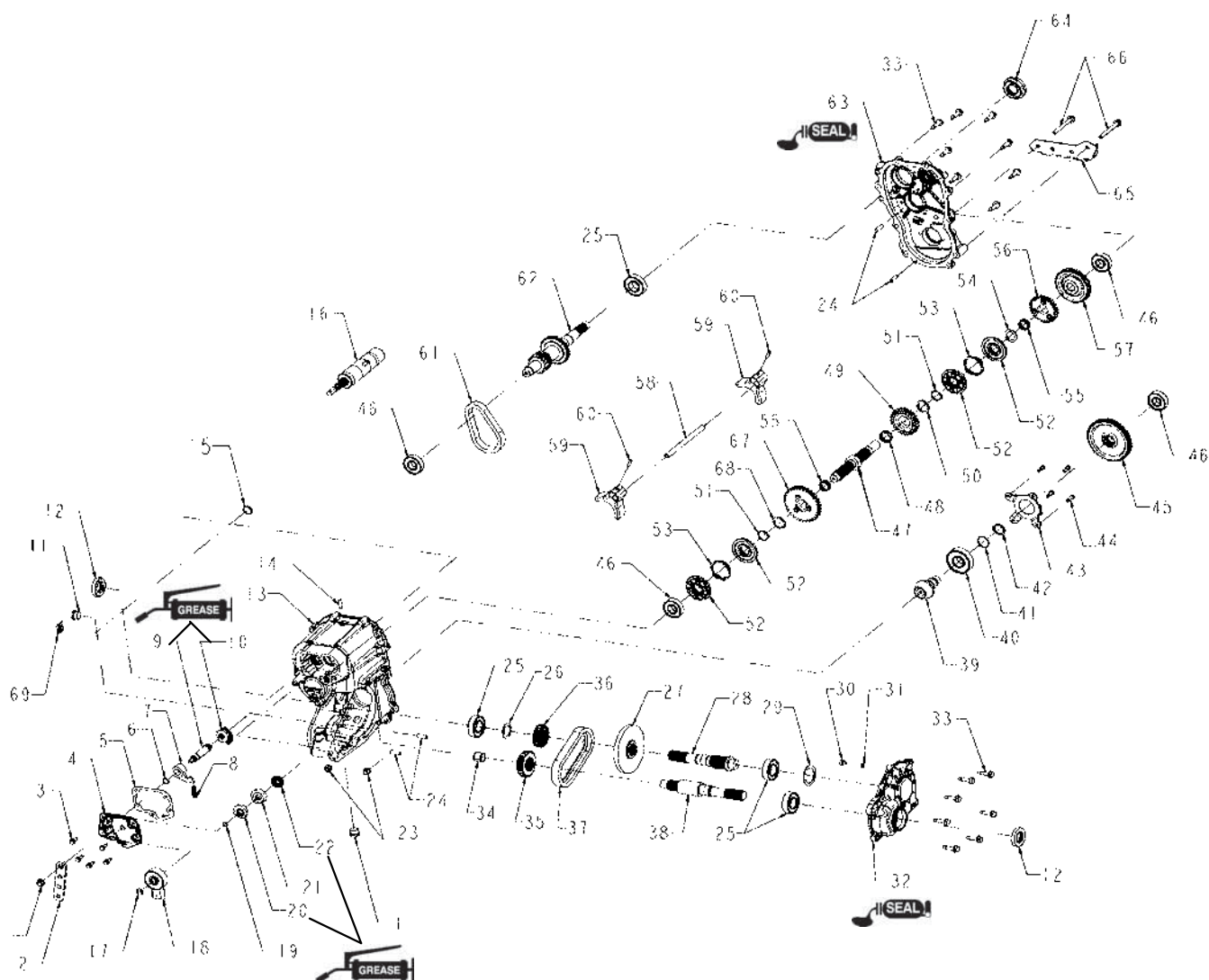
TRANSMISSION EXPLODED VIEW (RANGER 2X4), CONT.

Ref.	Qty.	Description	Ref.	Qty.	Description
	1	Asm., 2x4 Transmission	35.	1	Ball Bearing
1.	1	Nut	36.	1	Spacer
2.	1	Shift Drum Bellcrank	37.	1	Retaining Ring
3.	5	Sector Cover Screws	38.	1	Bearing Center Drive Cover
4.	1	Sector Cover	39.	4	Torx Screws
5.	1	Sector Cover Gasket	40.	1	60T Helical Gear
6.	1	O-ring	41.	4	Ball Bearing
7.	1	Detent Pawl	42.	4	6-Face Engagement Dog
8.	1	Compression Spring	43.	2	Wave Spring
9.	1	Shift Shaft	44.	2	Retaining Ring
10.	1	31T Sector Gear	45.	1	Washer
11.	2	Hollow Hex Plug	46.	1	33T 6 Face Gear
12.	1	Triple Lip Seal	47.	2	Needle Cage Bearing
13.	1	Gearcase	48.	1	Reverse Shaft
14.	1	Vent Tube	49.	1	Needle Cage Bearing
15.	1	O-ring	50.	1	24T 6 Face Sprocket
16.	1	Shift Drum	51.	1	Washer
17.	1	External Retaining Ring	52.	1	Washer
18.	1	6-Pin Switch	53.	1	30T 6 Face Gear
19.	1	O-ring	54.	1	47T Mid Output Gear
20.	1	Detent Star	55.	1	Shift Shaft Rail
21.	1	Lockout Disc	56.	2	Shift Fork
22.	1	16T Sector Gear	57.	2	Dowel Pin
23.	2	Lock Nut	58.	1	Silent Chain
24.	4	Dowel Pin	59.	1	Input Shaft
25.	3	Ball Bearing	60.	1	LH Main Cover
26.	1	Thrust Washer	61.	1	Dual Lip Seal
27.	1	31T Spiral Gear	62.	1	Transmission Mount Bracket
28.	1	Output Shaft	63.	2	Hex Screw
29.	1	Shim	64.	1	Label
30.	1	Thrust Button			
31.	1	Shim			
32.	1	Output Cover			
33.	15	Screw			
34.	1	10T Spiral Pinion Shaft			





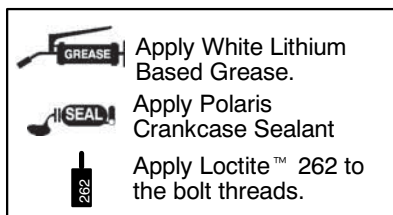
TRANSMISSION EXPLODED VIEW (RANGER 4X4 & 6X6)



TORQUE SPECIFICATIONS

Item	Torque
1	12-18 ft.lbs. (16-24 Nm)
3	7-9 ft.lbs. (9.5-12 Nm)
23	15-19 ft.lbs. (20-26 Nm)
33	27-34 ft.lbs. (37-46 Nm)
39	6-12 ft.lbs. (8-16 Nm)

FOR REASSEMBLY





TRANSMISSION EXPLODED VIEW (RANGER 4X4 & 6X6), CONT.

Ref.	Qty.	Description	Ref.	Qty.	Description
			35.	1	22T Sprocket
1.	1	Nut	36.	1	19T Sprocket
2.	1	Shift Drum Bellcrank	37.	1	Silent Chain
3.	5	Sector Cover Screws	38.	1	Front Main Output Shaft
4.	1	Sector Cover	39.	1	10T Spiral Pinion Shaft
5.	1	Sector Cover Gasket	40.	1	Ball Bearing
6.	1	O-ring	41.	1	Spacer
7.	1	Detent Pawl	42.	1	Retaining Ring
8.	1	Compression Spring	43.	1	Bearing Center Drive Cover
9.	1	Shift Shaft	44.	4	Torx Screws
10.	1	31T Sector Gear	45.	1	60T Mid Output Helical Gear
11.	2	Hollow Hex Plug	46.	4	Ball Bearing
12.	2	Triple Lip Seal	47.	1	Reverse Shaft
13.	1	Gearcase	48.	1	Needle Cage Bearing
14.	1	Vent Tube	49.	1	24T 6 Face Sprocket
15.	1	O-ring	50.	1	Washer
16.	1	Shift Drum	51.	2	External Retaining Ring
17.	1	External Retaining Ring	52.	4	6 Face Engagement Dog
18.	1	6-Pin Switch	53.	2	Wave Spring
19.	1	O-ring	54.	1	Washer
20.	1	Detent Star	55.	2	Needle Cage Bearing
21.	1	Lockout Disc	56.	1	30T 6 Face Gear
22.	1	16T Sector Gear	57.	1	47T Mid Output Helical Gear
23.	2	Lock Nut	58.	1	Shift Shaft Rail
24.	4	Dowel Pin	59.	2	Shift Fork
25.	4	Ball Bearing	60.	2	Dowel Pin
26.	1	Thrust Washer	61.	1	Silent Chain
27.	1	31T Spiral Gear	62.	1	Input Shaft Assy.
28.	1	Output Shaft	63.	1	LH Main Cover
29.	1	Shim	64.	1	Dual Lip Seal
30.	1	Thrust Button	65.	1	Transmission Mount Bracket
31.	1	Shim	66.	2	Hex Screw
32.	1	Output Cover	67.	1	33T 6 Face Gear
33.	15	Screw	68.	1	Washer
34.	1	Plain Bearing	69.	1	Label



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CHAPTER 9

BRAKES

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9



SPECIFICATIONS

Front Brake Caliper		
Item	Standard	Service Limit
Brake Pad Thickness	.298 ± .007" / 7.56 ± .178 mm	.180" (4.6 mm)
Brake Disc Thickness	.150 -.165" (3.810 - 4.19mm)	.140" (3.56mm)
Brake Disc Runout	-	.010" (.254mm)

Rear Axle Brake Caliper		
Item	Standard	Service Limit
Brake Pad Thickness	.298 ± .007" / 7.56 ± .178 mm	.180" (4.6 mm)
Brake Disc Thickness	.150-.165" (3.81-4.19mm)	.140" (3.56mm)
Brake Disc Runout	-	.010" (.254mm)

TORQUE SPECIFICATIONS

Item	Torque ft.lbs.	Torque Nm
Front / Rear Caliper Mounting Bolts	18.0	24
Output Shaft Caliper Mounting Bolts	15.0	21
Brake Line Banjo Bolt	15.0	21
Front Brake Disc	18.0	25
Master Cylinder Mounting Bolts	17	23

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2870975	Mity Vac™ Pressure Test Tool





BRAKE SYSTEM SERVICE

NOTES

Disc brake systems are light weight, low maintenance, and perform well in the conditions ATVs routinely encounter. There are a few things to remember when replacing disc brake pads or performing brake system service to ensure proper system function and maximum pad service life.

- Optional pads are available to suit conditions in your area. Select a pad to fit riding style and environment.
- Do not over-fill the master cylinder fluid reservoir.
- Make sure the brake lever and pedal returns freely and completely.
- Adjust stop pin on front caliper after pad service.
- Check and adjust master cylinder reservoir fluid level after pad service.
- Make sure atmospheric vent on reservoir is unobstructed.
- Test for brake drag after any brake system service and investigate cause if brake drag is evident.
- Make sure caliper moves freely on guide pins (where applicable).
- Inspect caliper piston seals for foreign material that could prevent caliper pistons from returning freely.
- Perform a brake burnishing procedure after installing new pads to maximize service life.

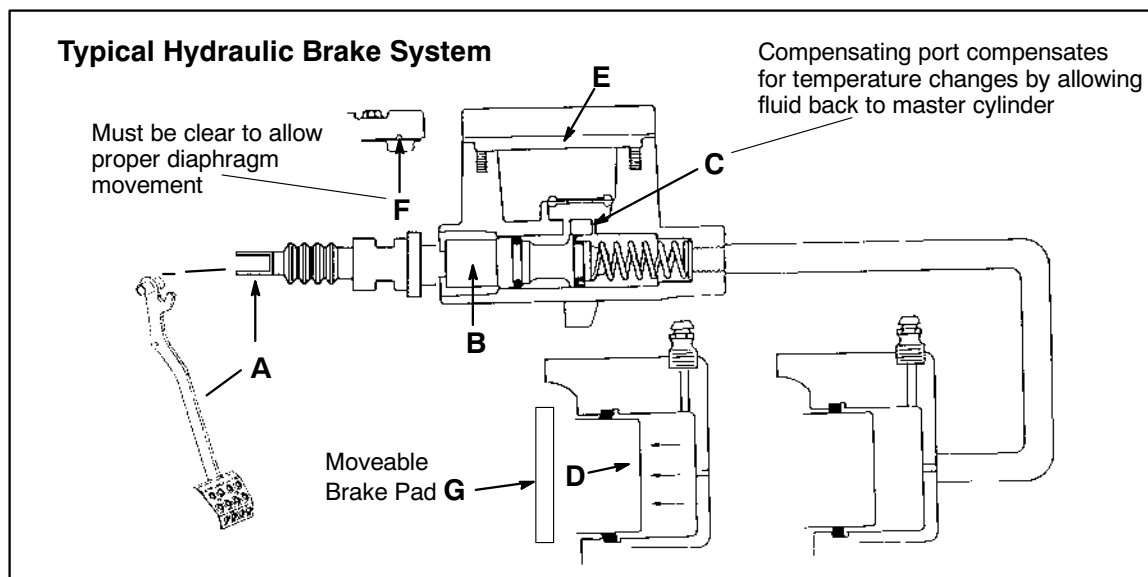
BRAKE NOISE TROUBLESHOOTING

Dirt or dust buildup on the brake pads and disc is the most common cause of brake noise (squeal caused by vibration). If cleaning does not reduce the occurrence of brake noise, Permatex™ Disc Brake Quiet (PN 2872113) can be applied to the back of the pads. Follow directions on the package. This will keep pads in contact with caliper piston(s) to reduce the chance of squeaks caused by dirt or dust.

Brake Noise Troubleshooting	
Possible Cause	Remedy
Dirt, dust, or imbedded material on pads or disc	Spray disc and pads with CRC Brakeleen™ or an equivalent non-flammable aerosol brake cleaner. Remove pads and/or disc hub to clean imbedded material from disc or pads.
<u>Pad(s) dragging on disc (noise or premature pad wear)</u> Improper adjustment Insufficient lever or pedal clearance Master cylinder reservoir overfilled Master cylinder compensating port restricted Master cylinder piston not returning completely Caliper piston(s) not returning Operator error (riding the brake / park brake applied)	Adjust pad stop (front calipers) Check position of controls & switches. Set to proper level Clean compensating port Inspect. Repair as necessary Clean piston(s) seal Educate operator
Loose wheel hub or bearings	Check wheel and hub for abnormal movement.
Brake disc warped or excessively worn	Replace disc
Brake disc misaligned or loose	Inspect and repair as necessary
Noise is from other source (axle, hub, disc or wheel)	If noise does not change when brake is applied check other sources. Inspect and repair as necessary
Wrong pad for conditions	Change to a softer or harder pad



HYDRAULIC BRAKE SYSTEM OPERATION



The Polaris brake system consists of the following components or assemblies: brake pedal; master cylinder; hydraulic hose; brake calipers (slave cylinder); brake pads; and brake discs, which are secured to the drive line.

When the foot activated brake lever (A) is applied it contacts a piston (B) within the master cylinder. As the master cylinder piston moves inward it closes a small opening (compensating port) (C) within the cylinder and starts to build pressure within the brake system. As the pressure within the system is increased, the piston (D) located in the brake caliper moves outward and applies pressure to the moveable brake pad. This pad contacts the brake disc and moves the caliper in its floating bracket, pulling the stationary side pad into the brake disc. The resulting friction reduces brake disc and vehicle speed. As the lever pressure is increased, the braking affect is also increased.

The friction applied to the brake pads will cause the pads to wear. As these pads wear, the piston within the caliper moves further outward and becomes self adjusting. Fluid from the reservoir fills the additional area created when the caliper piston moves outward.

Brake fluid level is critical to proper system operation. Too little fluid will allow air to enter the system and cause the brakes to feel spongy. Too much fluid could cause brakes to drag due to fluid expansion.

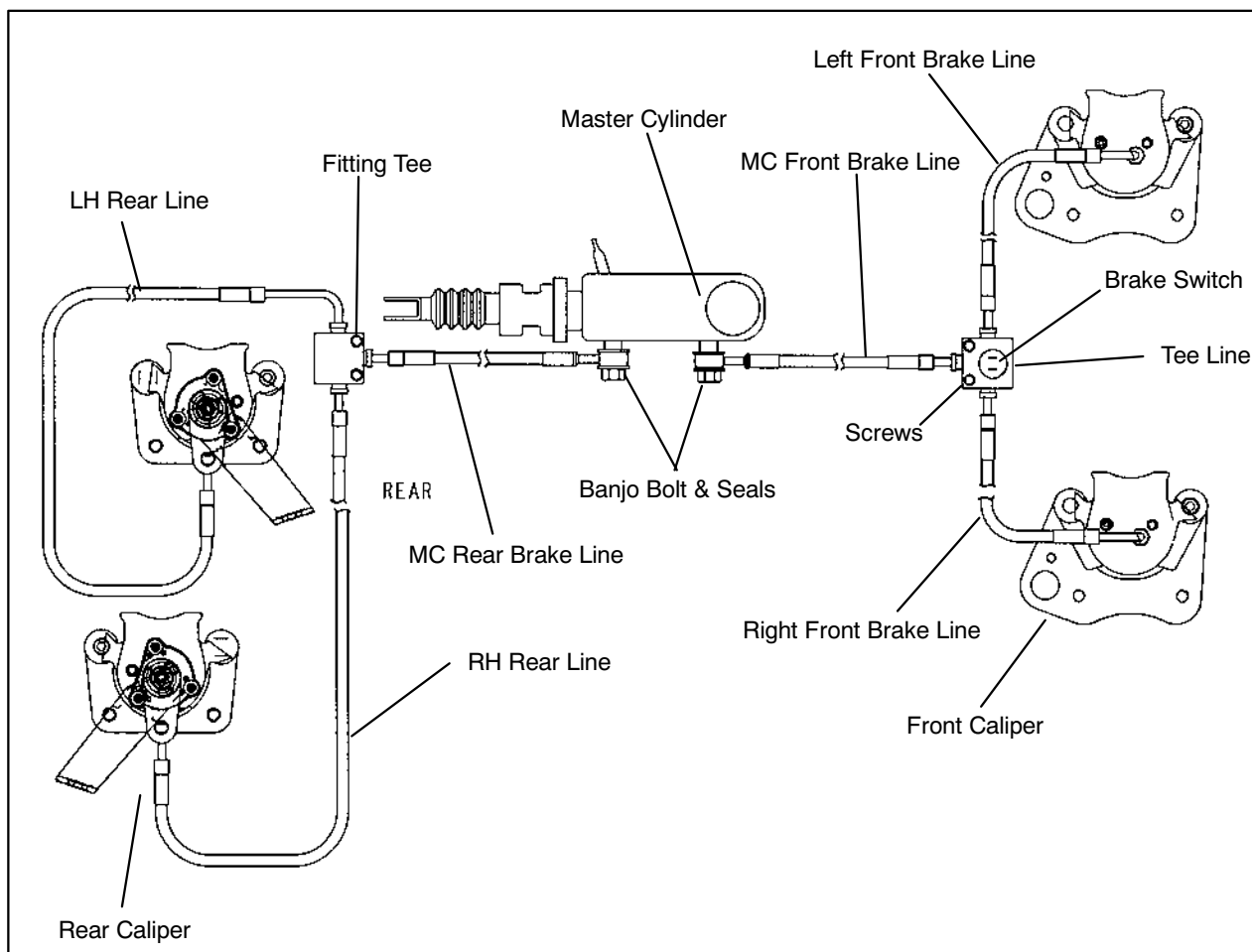
Located within the master cylinder is the compensating port (C) which is opened and closed by the master cylinder piston assembly. The port is open when the lever is released and the master cylinder piston is outward. As the temperature within the hydraulic system changes, this port compensates for fluid expansion (heated fluid) or contraction (cooled fluid). During system service, be sure this port is open. Due to the high temperatures created within the system during heavy braking, it is very important that the master cylinder reservoir have adequate space to allow for fluid expansion. **Never overfill the reservoir!** Do not fill the reservoir past the MAX LEVEL line!

This system also incorporates a diaphragm (E) as part of the cover gasket; and a vent port (F) located between the gasket and the cover. The combination diaphragm and vent allow for the air above the fluid to equalize pressure as the fluid expands or contracts. Make sure the vent is open and allowed to function. If the reservoir is over filled or the diaphragm vent is plugged the expanding fluid may build pressure in the brake system leading to brake failure.

When servicing Polaris brake systems use only Polaris DOT 3 Brake Fluid (**PN 2870990**) or DOT 4 Brake Fluid. Polaris brake fluid is sold in 5.5 oz. bottles. **WARNING:** Once a bottle is opened, use what is necessary and discard the rest in accordance with local laws. Do not store or use a partial bottle of brake fluid. Brake fluid is hygroscopic, meaning it rapidly absorbs moisture. This causes the boiling temperature of the brake fluid to drop, which can lead to early brake fade and the possibility of serious injury.



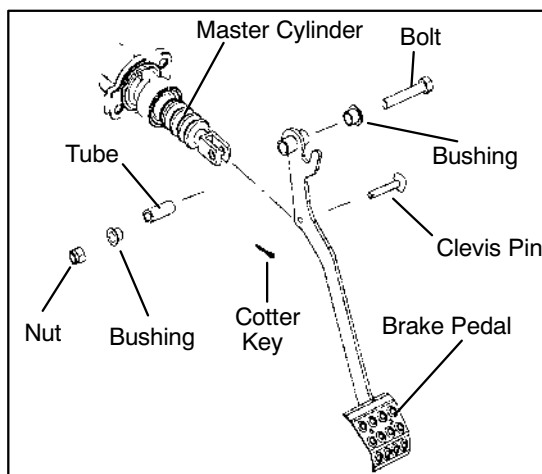
BRAKE SYSTEM EXPLODED VIEW



FRONT BRAKE PEDAL REMOVAL / INSTALL

1. Open the hood. Locate the master cylinder.
2. Remove the nut, bushing, tube, and bolt from the brake pedal.
3. Remove the clevis pin and cotter key from the master cylinder to remove the brake pedal.
4. Reverse Steps 1-3 for foot brake installation. After installing the foot brake check pedal freeplay. Pedal freeplay should not exceed .090" (2.286 mm).

Brake Pedal Freeplay:
.090" (2.286 mm)





BRAKE BLEEDING-FLUID CHANGE

NOTE: When bleeding the brakes or replacing the fluid always start with the furthest caliper from the master cylinder.

CAUTION:

Always wear safety glasses.

CAUTION:

Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

This procedure should be used to change fluid or bleed brakes during regular maintenance.

1. Clean reservoir cover thoroughly.
2. Remove cover from reservoir.



3. If changing fluid, remove old fluid from reservoir with a Mity Vac™ pump or similar tool.

Mity Vac™ (PN 2870975)

4. Add brake fluid to the indicated MAX level of reservoir.

**Polaris DOT 3 Brake Fluid (PN 2870990)
Or
DOT 4 Brake Fluid**

5. Begin bleeding procedure with the caliper that is farthest from the master cylinder. Install a box end wrench on caliper bleeder screw. Attach a clean, clear hose to fitting and place the other end in a clean container. Be sure the hose fits tightly on fitting.
6. *Slowly* pump foot pedal until pressure builds and holds.
7. Hold brake pedal on to maintain pedal pressure, and open bleeder screw. Close bleeder screw and release foot pedal.

NOTE: Do not release foot pedal before bleeder screw is tight or air may be drawn into master cylinder.

8. Repeat procedure until clean fluid appears in bleeder hose and all air has been purged. Add fluid as necessary to maintain level in reservoir.

CAUTION:

Maintain at least 1/2" (1.27 cm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

9. Tighten bleeder screw securely and remove bleeder hose.
10. Repeat procedure Step 5 through Step 9 for the remaining calipers.
11. Add brake fluid to MAX level inside reservoir.



Master Cylinder Fluid Level

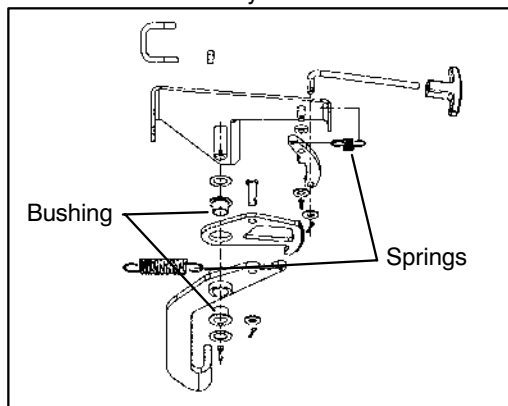
**Between the MIN line and the
MAX line of reservoir.**



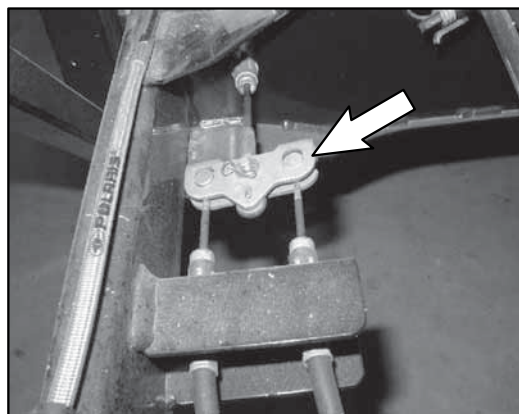
12. Install master cylinder reservoir cover.
13. Field test machine at low speed before putting into service. Check for proper braking action and pedal reserve. With pedal firmly applied, pedal reserve should be no less than 1/2" (1.3 cm).
14. Check brake system for fluid leaks.

PARKING BRAKE AND BRAKE LINE INSPECTION

1. Inspect the springs and bushings on the parking brake lever assembly.

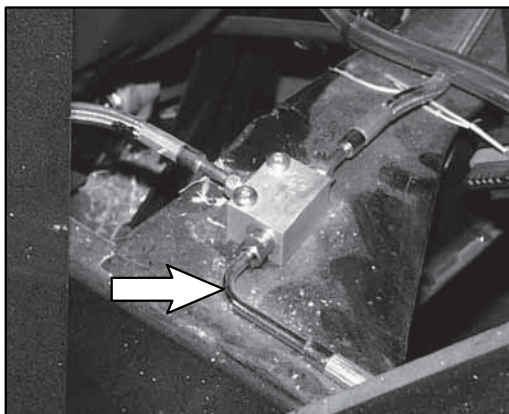


2. Inspect the parking brake cable at the equalizer assembly and at the brake lever on the brake caliper.



3. Inspect the brake lines and brake line connections for possible leaks or loose lines.

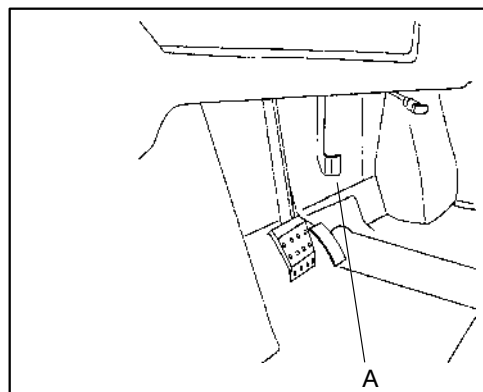
NOTE: Inspect the connections at the master cylinder, brake calipers, and brake valves.



PARKING BRAKE ADJUSTMENT

Parking Brake Inspection

1. Push the parking brake (A) down with your foot.



2. After 8 to 12 clicks of lever travel, the vehicle should not roll while parked.
3. If the vehicle moves, adjustment is necessary
4. Adjust the parking brake where the cable attaches to the lever assembly on the rear brake caliper.

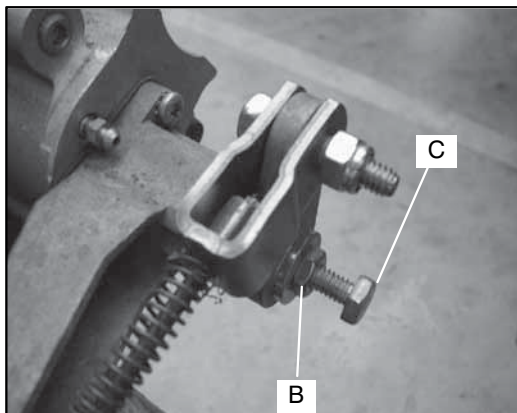
Parking Brake Adjustment

1. Place the vehicle in neutral on a flat level surface.



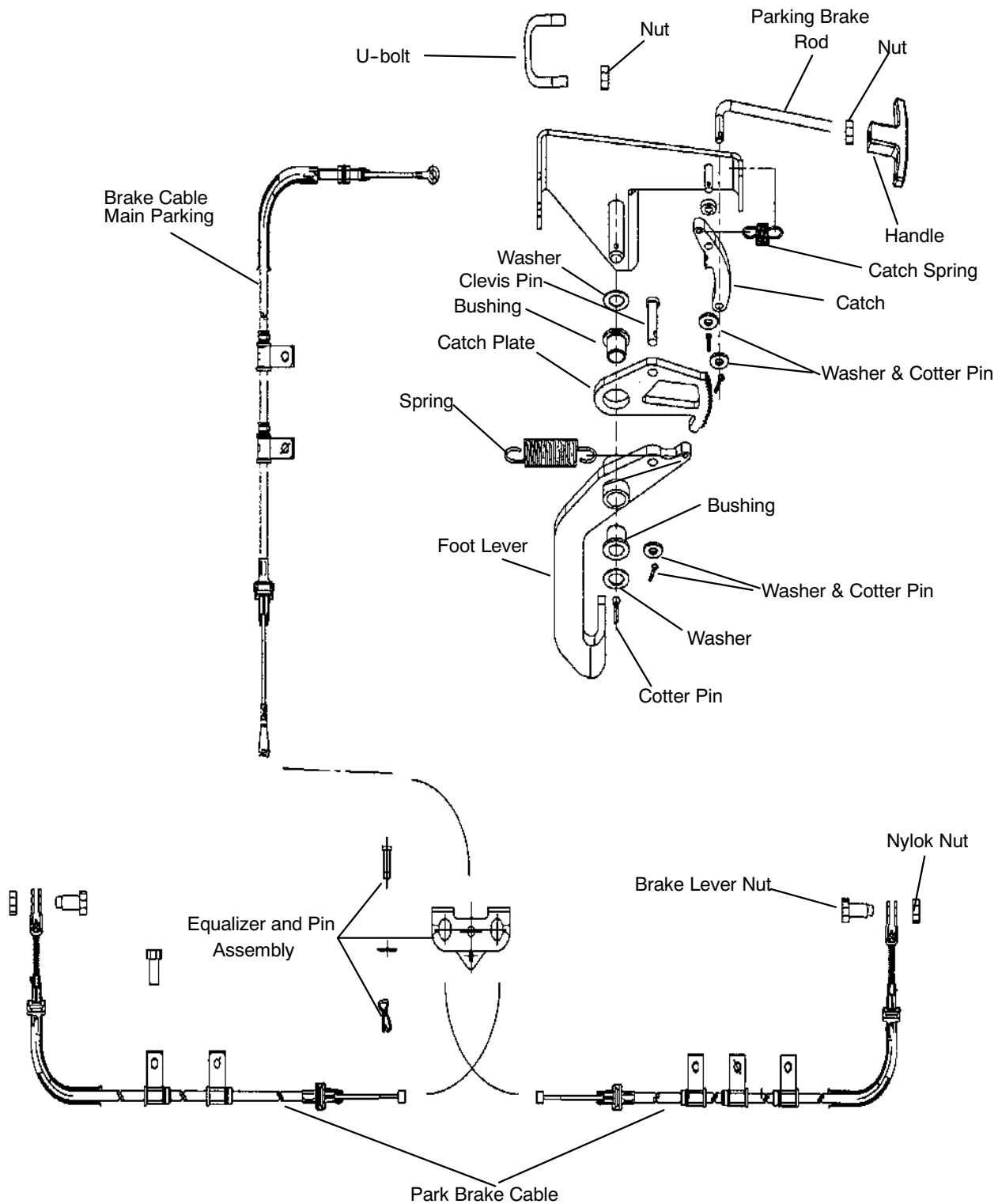


2. Carefully lift the rear of the vehicle off the ground and stabilize on jack stands.
3. Loosen the jam nut (B) on the rear caliper adjustment bolt (C).
4. Tighten the adjustment bolt (C) until the rear tire will not rotate.
5. Back the adjustment bolt (C) out 1/4 turn.
6. Tighten the jam nut (B) while holding the adjustment nut (C) in place.
7. Repeat this procedure on the other rear tire.
8. The parking brake may have to be adjusted to prevent pad wear. The bolt and the jam nut on the rear brake caliper can be adjusted as needed.





PARKING BRAKE LOCK EXPLODED VIEW



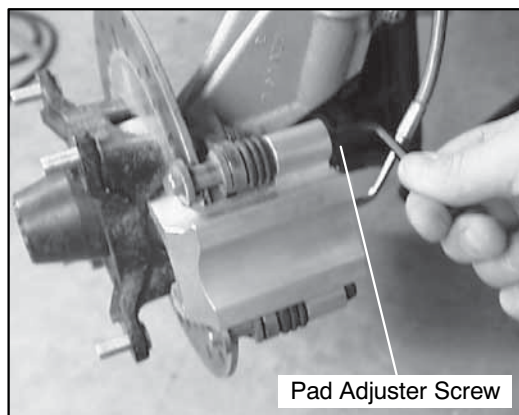


FRONT PAD REMOVAL

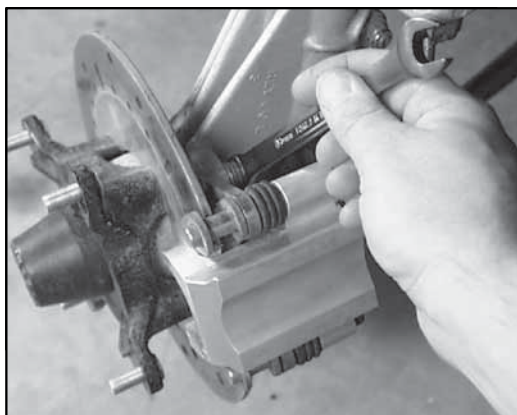
1. Elevate and support front of machine.

CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

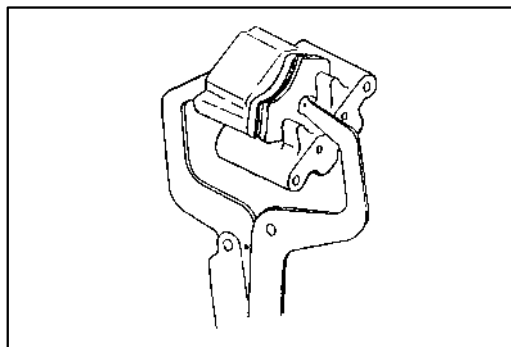


2. Remove the front wheel. Loosen pad adjuster screw 2-3 turns.
3. Remove caliper from mounting bracket.

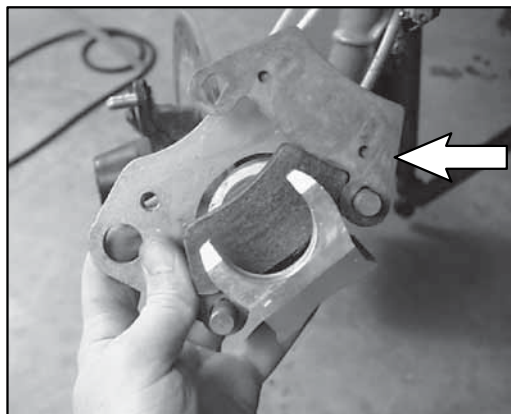


4. Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed.

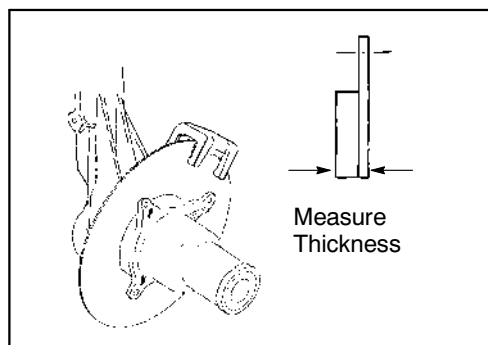
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.



5. Push upper pad retainer pin inward and slip outer brake pad past edge. Remove inner pad.



6. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.

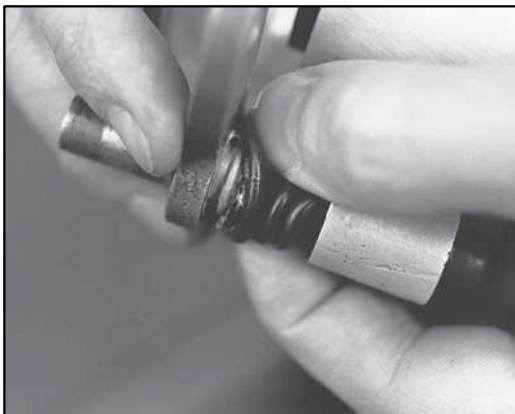




Front Brake Pad Thickness:
New: 298" (7.56 mm) $\pm$.007" (.178 mm)
Service Limit: .180" / 4.6 mm

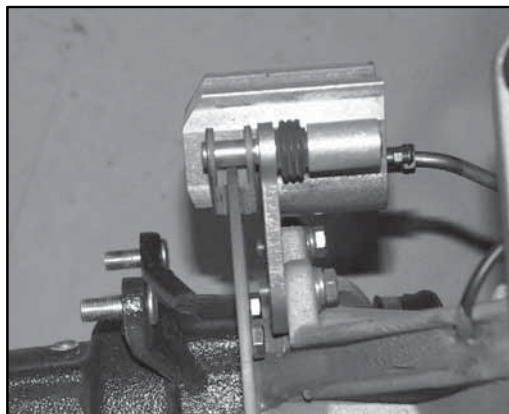
FRONT PAD ASSEMBLY

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.



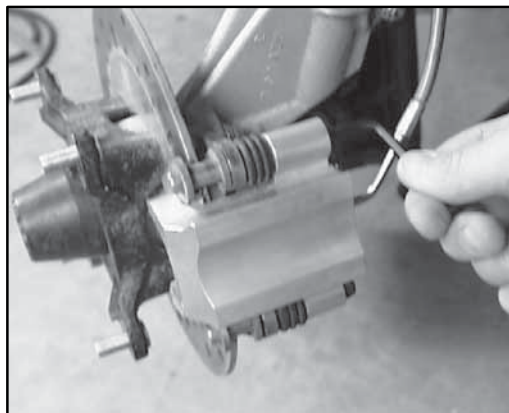
Front Caliper Mounting Bolts

Torque 18 ft. lbs. (25 Nm)

4. Slowly pump the brake pedal until pressure has been built up. Maintain at least 1/2" (12.7 mm) of brake fluid in the reservoir to prevent air from entering the brake system.

PAD ADJUSTMENT

1. Install the adjuster screw and turn clockwise until stationary pad contacts disc, then back off 1/2 turn (counterclockwise).



2. Be sure fluid level in reservoir is up to MAX line inside reservoir and install reservoir cap.





Master Cylinder Fluid
Up to MAX line inside reservoir

3. Install wheels and torque wheel nuts.
4. It is recommended that a burnishing procedure be performed after installation of new brake pads to

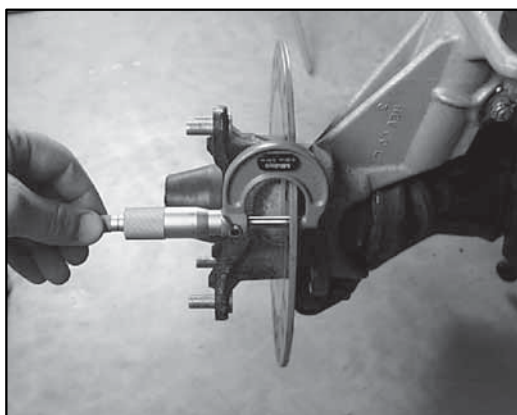
extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.

Front Wheel Nut Torque:

20 ft. lbs. (27 Nm)

FRONT DISC INSPECTION

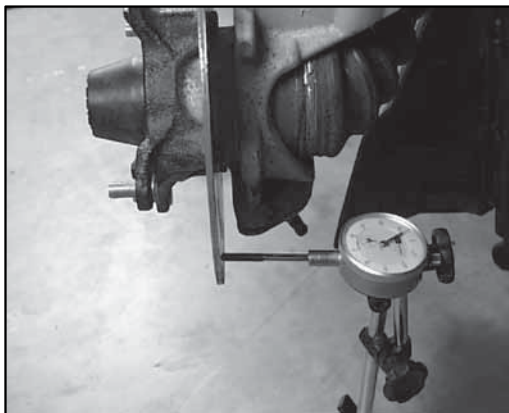
1. Visually inspect the brake disc for nicks, scratches, or damage.
2. Measure the disc thickness at 8 different points around the pad contact surface using a 0-1" micrometer. Replace disc if worn beyond service limit.



Brake Disc Thickness
New .150-.165" (3.81-4.19 mm)
Service Limit .140" / 3.56 mm

Brake Disc Thickness Variance
Service Limit .002" (.051 mm)
difference between measurements.

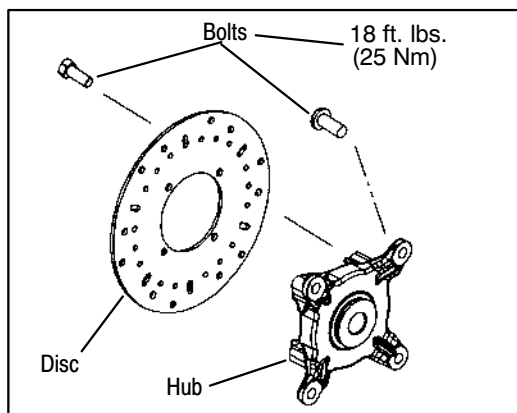
3. Mount dial indicator as shown to measure disc runout. Slowly rotate the disc and read total runout on the dial indicator. Replace the disc if runout exceeds specifications.



Brake Disc Runout
Service Limit .010" (.254 mm)

FRONT BRAKE DISC REMOVAL / REPLACEMENT

1. Remove bolts and disc.



2. Clean mating surface of disc and hub.
3. Install disc on hub.
4. Install new bolts and tighten to specified torque.

CAUTION: Always use new brake disc mounting bolts. The bolts have a pre-applied locking agent which is destroyed upon removal.

Front Brake Disc Mounting Bolt Torque:

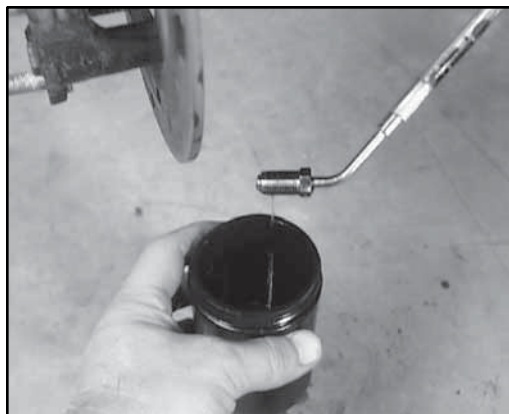
18 ft. lbs. (25 Nm)

Front Caliper Removal

CAUTION:

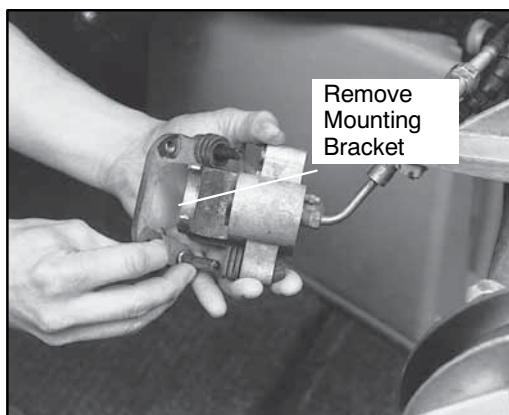
Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

1. Remove brake pads. See Page 9.10–9.11.
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.



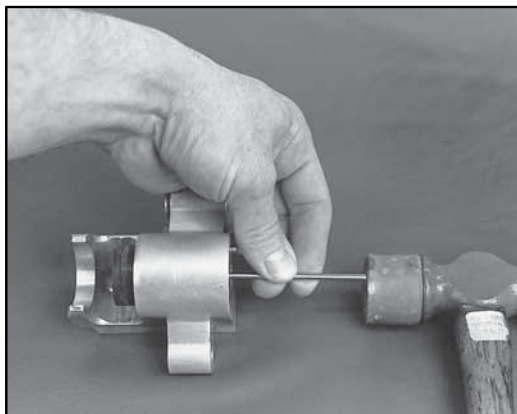
FRONT CALIPER DISASSEMBLY

1. Remove brake pad adjuster screw.
2. Push upper pad retainer pin inward and slip brake pads past edge.
3. Remove mounting bracket, pin assembly and dust boot.



4. Remove piston, dust seal, and piston seal from the caliper body.



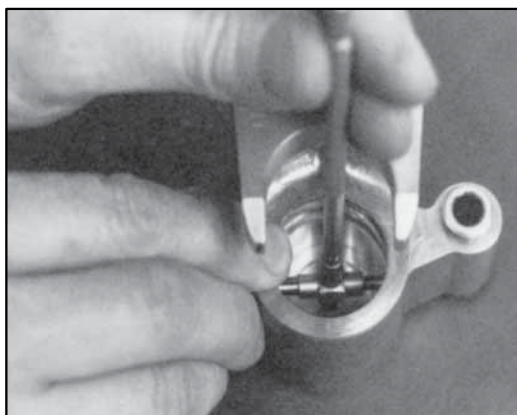


5. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.

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. 1.5050-1.5040" (3.227-30.202 mm)
Service Limit 1.5060" (38.252 mm)

2. Inspect piston for nicks, scratches, wear or damage. Measure diameter and replace if damaged or worn beyond service limit.

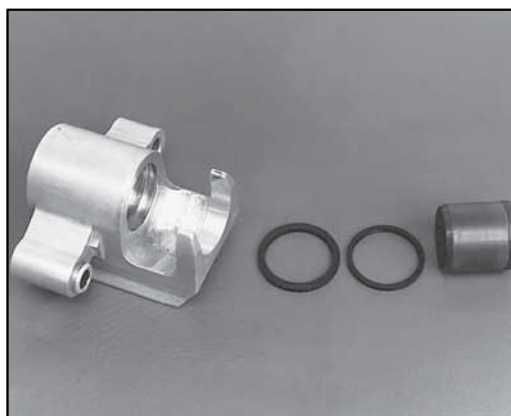
Front Caliper Piston O.D.

Std. 1.4985-1.5000" (38.062-38.10 mm)
Service Limit 1.4980" (38.049 mm)

3. Inspect the brake disc and pads as outlined for brake pad replacement this section. See page 9.11-9.12.

FRONT CALIPER ASSEMBLY

1. Install new O-rings in the caliper body. Be sure that the grooves are clean and free of residue or brakes may drag.

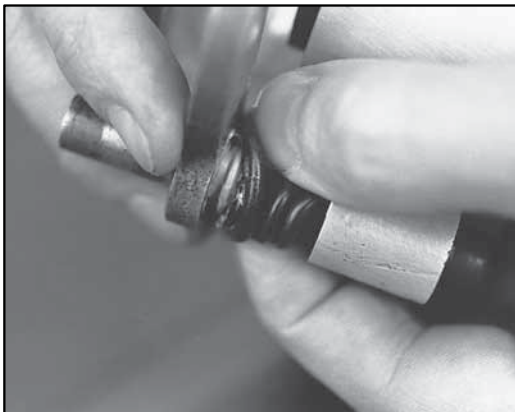


2. Coat the piston with clean DOT 3 Brake Fluid (PN 2870990) or DOT 4 Brake Fluid. Install piston with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance.





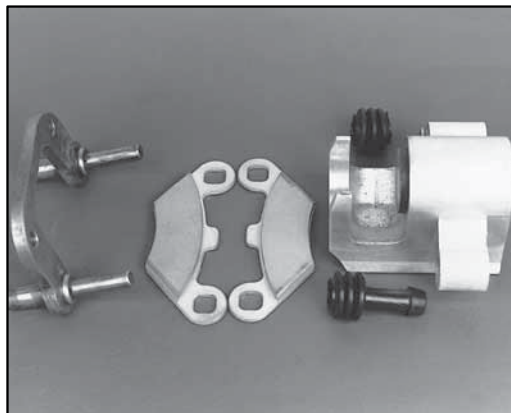
- Lubricate the mounting bracket pins with Polaris Premium All Season Grease, and install the rubber dust seal boots.



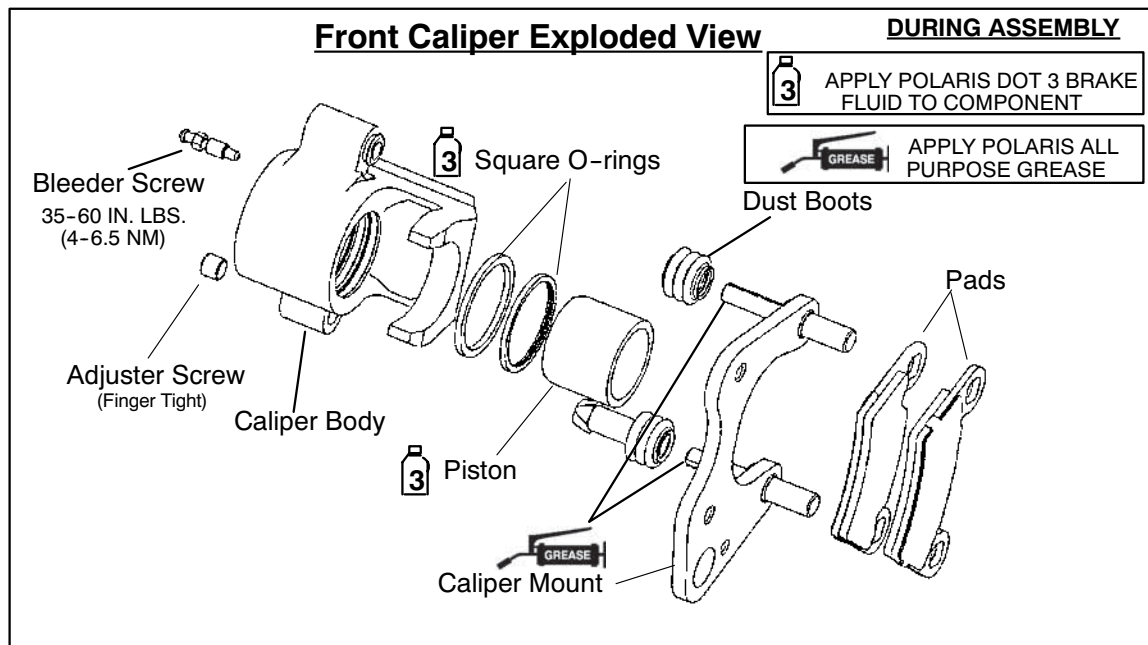
Polaris Premium All Season Grease

(PN 2871423)

- Compress the mounting bracket and make sure the dust seals are fully seated. Install the pads as shown on Page 9.11-9.12. Clean the disc and pads with brake parts cleaner or denatured alcohol to remove any dirt, oil or grease.



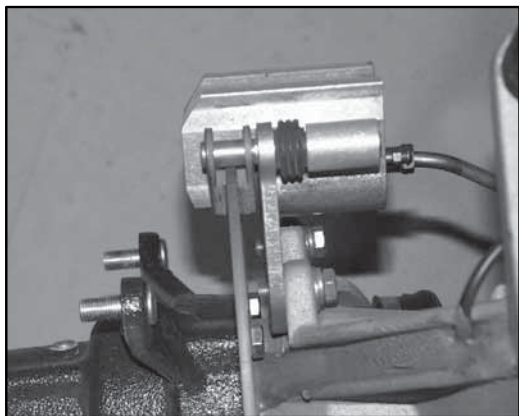
FRONT BRAKE CALIPER EXPLODED VIEW





FRONT CALIPER INSTALLATION

1. Install caliper on hub strut, and torque mounting bolts.

**Rear Caliper Mounting Bolt Torque:****18 ft. lbs. (25 Nm)**

2. Install brake line and tighten securely with a flare nut wrench.
3. Install the adjuster screw and turn until stationary pad contacts disc, then back off 1/2 turn.



4. Follow brake bleeding procedure outlined on Pages 9.6-9.7.
5. Install wheels and torque wheel nuts to specification.

Front Wheel Nut Torque:**35 ft. lbs. (47 Nm).**

NOTE: If new brake pads are installed, it is recommended that a burnishing procedure be performed to extend pad service life and reduce noise. Start machine and slowly increase speed to 15 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.

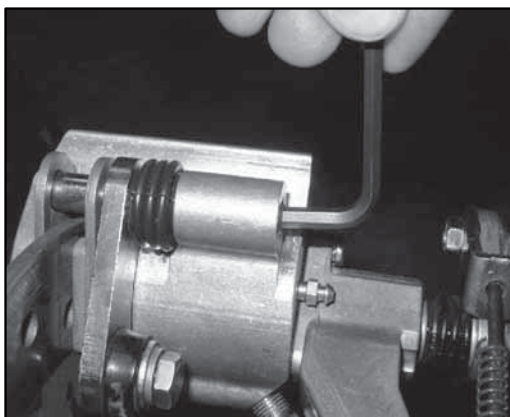
REAR BRAKE PAD REMOVAL

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 rear wheel. Loosen pad adjuster screw 2-3 turns.



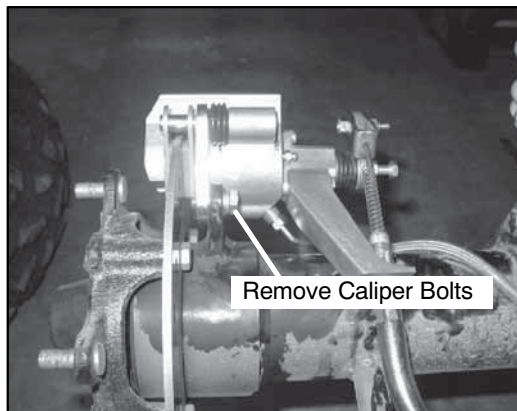
3. Clean caliper area before removal.
4. Remove caliper mounting bolts and lift caliper off of disc.

NOTE: When removing caliper, be careful not to damage brake line. Support caliper so as not to kink





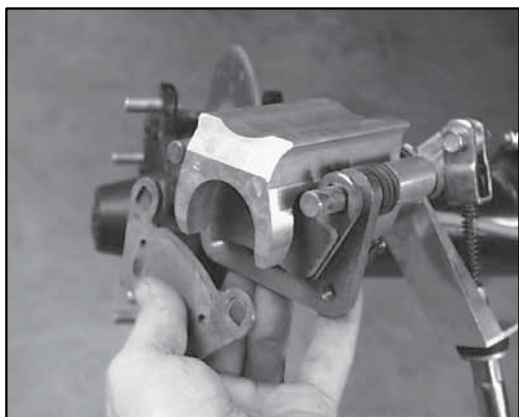
or bend brake line.



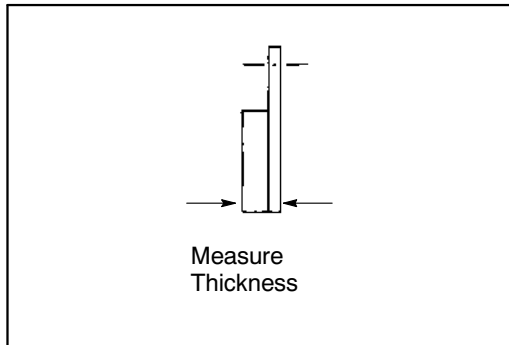
5. Push caliper piston into caliper bore slowly with pads installed.

NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

6. Remove the brake pads.



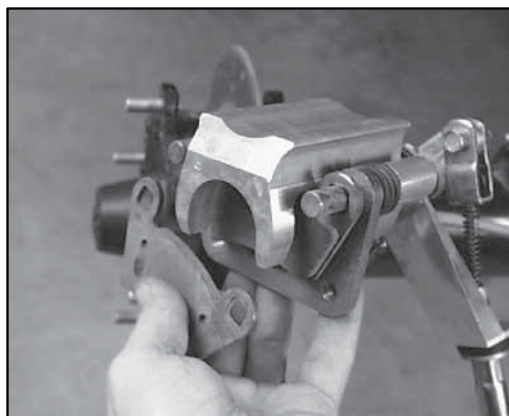
7. Clean pad retainer pins with a wire brush.
8. Clean the caliper with brake cleaner or alcohol.
9. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.



Rear Brake Pad Thickness
New .298 ± .007" (7.56 ± .178 mm)
Service Limit .180" (4.6 mm)

REAR BRAKE PAD INSTALLATION

1. Install new pads in caliper body.



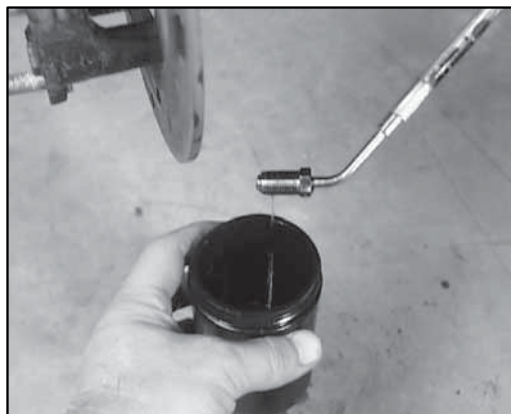
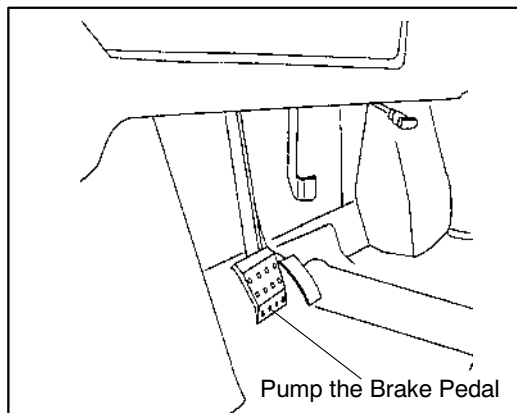


2. Install caliper and torque mounting bolts.

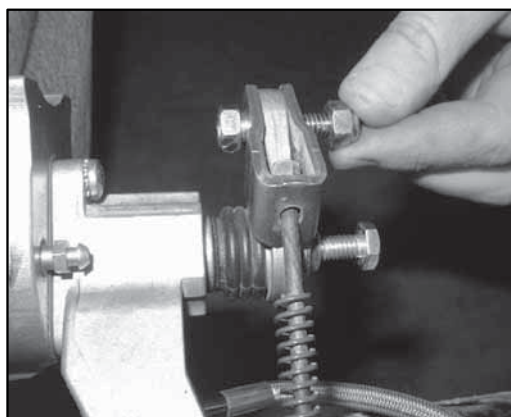
Rear Brake Caliper Mounting Bolt:

Torque 18 ft. lbs. (24 Nm)

3. Slowly pump the brake pedal until pressure has been built up. Maintain at least 1/2" (12.7 mm) of brake fluid in the reservoir to prevent air from entering the master cylinder.



3. Remove the parking brake cable nut and bolt.



4. It is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 15 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.

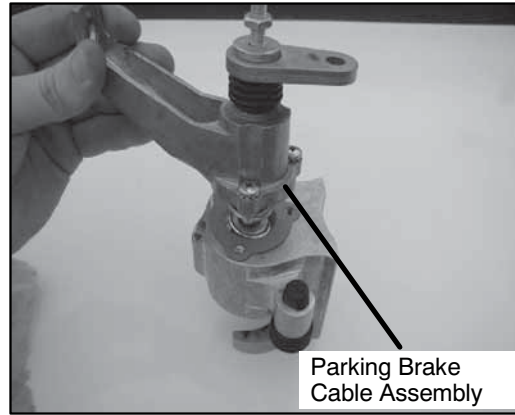
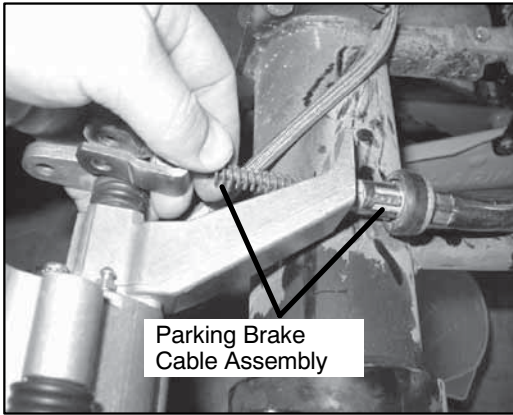
4. Remove the parking brake cable assembly from the brake caliper assembly.

REAR 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. Safely support the rear of the machine.
2. Using a flare nut wrench, remove the brake line. Place a container to catch brake fluid draining from brake lines.

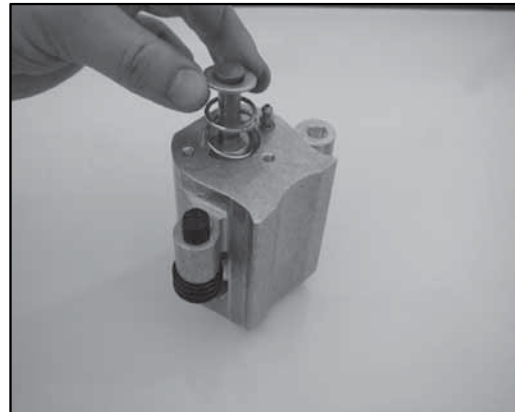
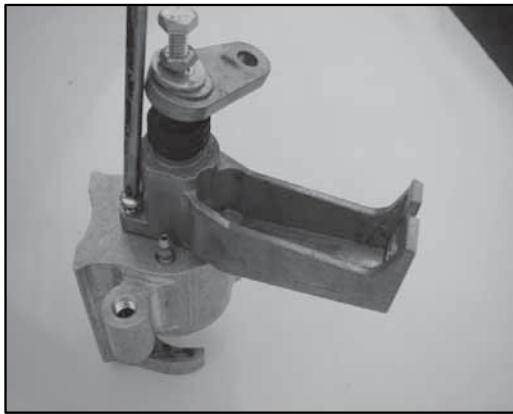


5. Remove the two brake caliper assembly attaching bolts.
6. Clean disc, caliper body, and pistons with brake cleaner or alcohol.

3. Lift the plunger, washer, and compression spring from the caliper body. Inspect components and replace if needed.

REAR CALIPER DISASSEMBLY / INSPECTION

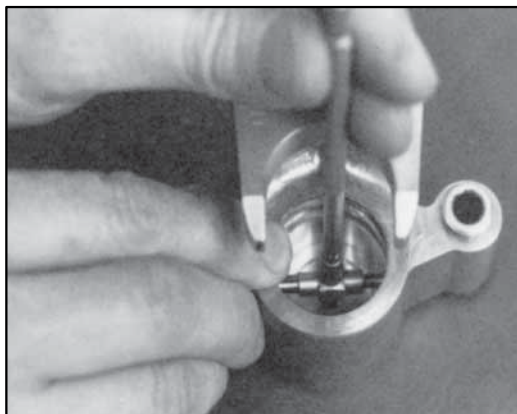
1. Loosen three screws on the parking brake cable assembly.



2. Lift the parking brake cable assembly from the caliper.

4. Remove the piston from the caliper. Inspect the caliper piston for nicks scratches or damage and replace if necessary.
5. Inspect caliper body for nicks, scratches or wear. Measure bore size and compare to specifications. Replace if damage is evident or if worn beyond service limit.

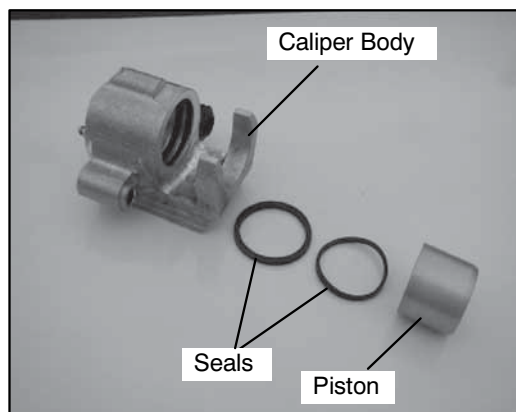


**Rear Caliper Piston Bore I.D.**

Std. 1.2550-1.2540" (31.877-31.852 mm)
Service Limit 1.256" (31.902 mm)

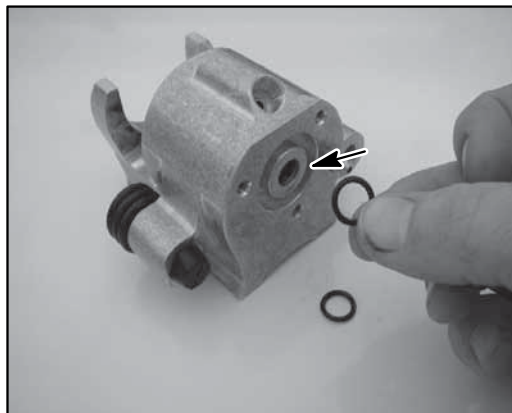
REAR CALIPER ASSEMBLY/INSTALLATION

1. Install new O-rings in the piston hole of the caliper body. Be sure grooves are clean and free of residue or brakes may drag.

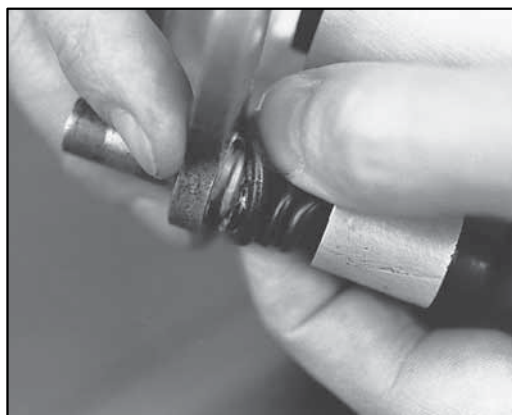


2. Coat piston with clean DOT 3 Brake Fluid (**PN 2870990**) or DOT 4 Brake Fluid. Install piston with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance.

3. Install two new O-rings in the plunger hole of the caliper assembly. Be sure grooves are clean and free of residue.



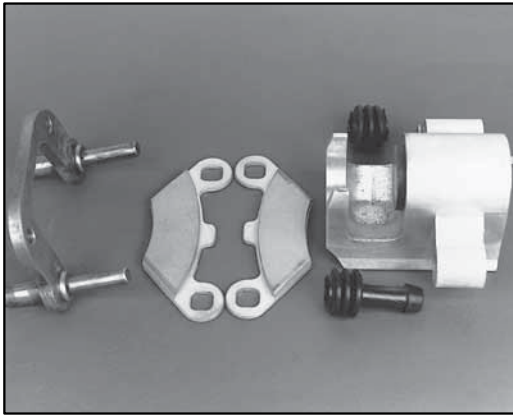
4. Lubricate the mounting bracket pins with Polaris Premium All Season Grease, and install the rubber dust seal boots.

**Polaris Premium All Season Grease**

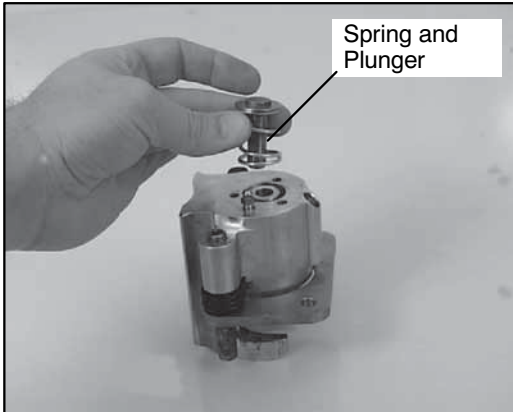
(PN 2871423)

5. Compress the mounting bracket and make sure the dust seals are fully seated. Install the pads as shown on Page 9.17. Clean the disc and pads with brake parts cleaner or denatured alcohol to remove any dirt, oil or grease.

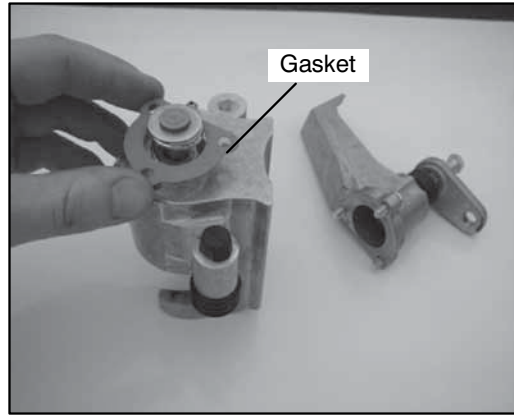




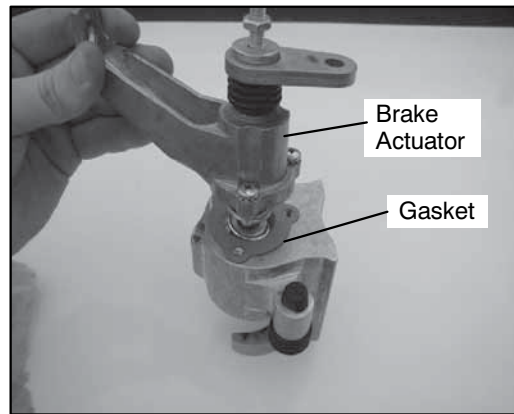
6. Install the spring , washer, and plunger into the caliper assembly.



7. Install the gasket onto the caliper body. Align the gasket with the three holes in the caliper body.

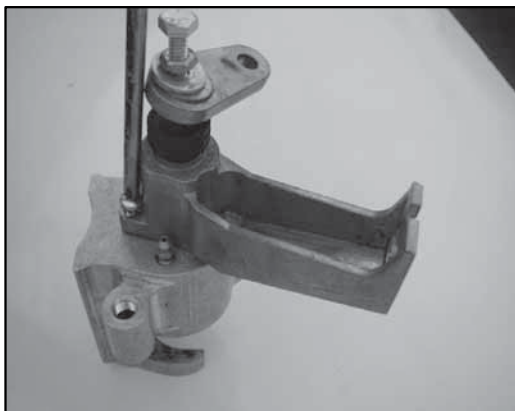


8. Install the emergency brake actuator onto the caliper body. Be sure the gasket holes line up with the caliper body holes and emergency brake actuator holes, to ensure no damage is done to the gasket.

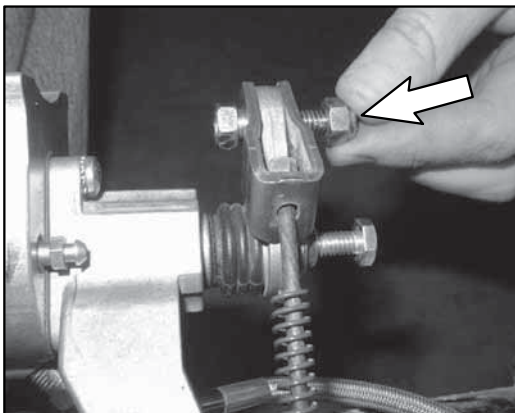




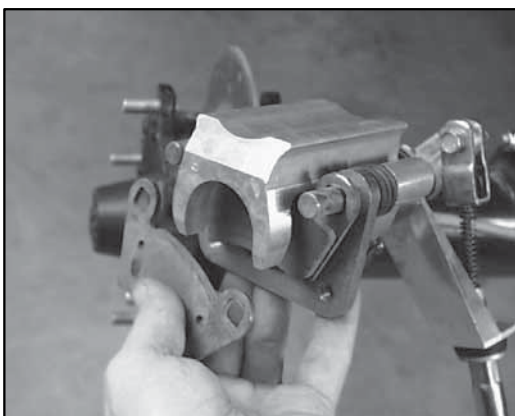
9. Tighten the screws on the caliper assembly.



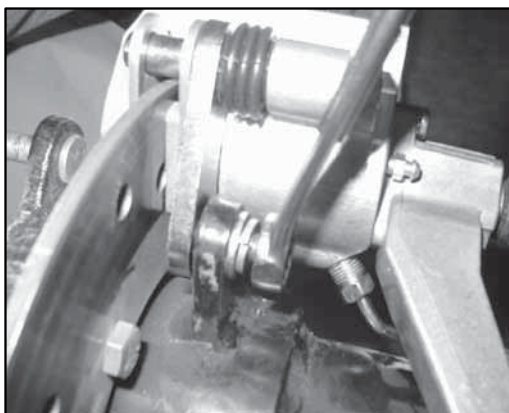
10. Reinstall the emergency brake cable and assembly onto the brake caliper. Secure the emergency brake cable with the nut and bolt.



11. Install brake pads in caliper body with friction material facing each other.



12. Install caliper and torque mounting bolts. Install brake lines and tighten with a flare nut wrench.



Caliper Mounting Bolt Torque:

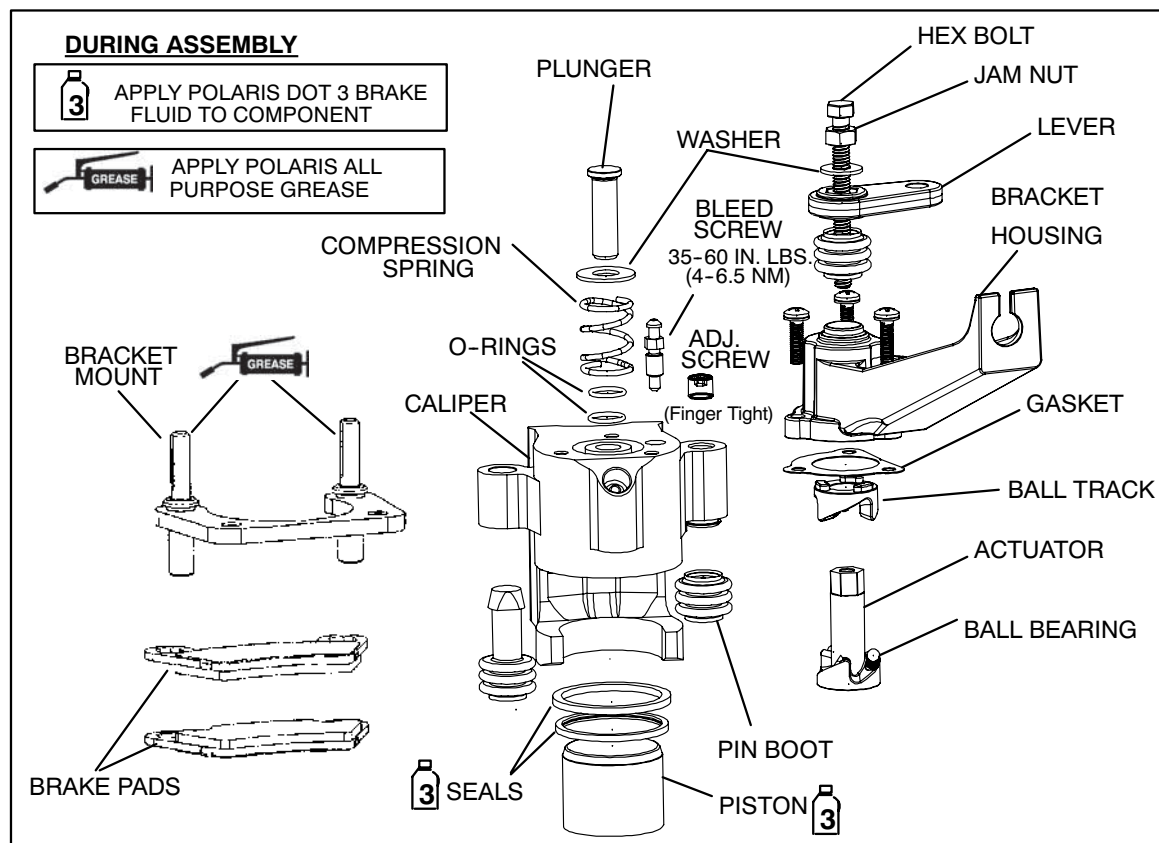
18 ft. lbs. (24 Nm)

13. Follow bleeding procedure outlined on Pages 9.6-9.7 of this section and refer to system overview and illustration on Page 9.5.
14. 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.





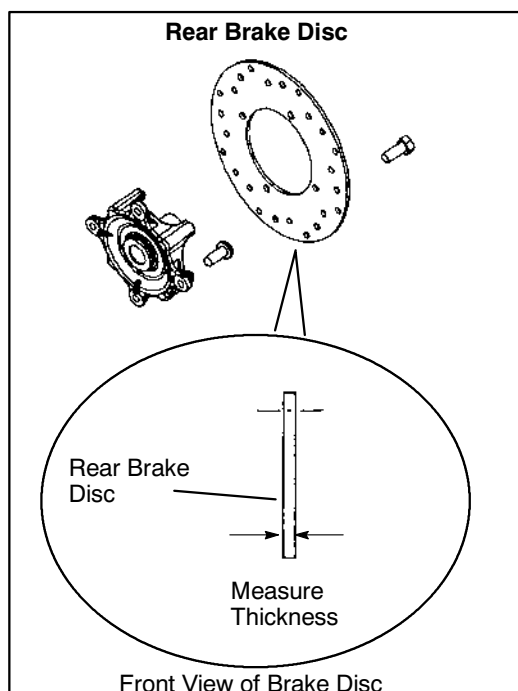
REAR BRAKE CALIPER EXPLODED VIEW



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 .150-.165" (3.81-4.19 mm)****Service Limit .140" (3.56 mm)****Brake Disc Thickness Variance****Service Limit .002" (.051 mm)
difference between measurements**

3. Mount dial indicator and measure disc runout. Replace the disc if runout exceeds specifications.

Brake Disc Runout**Service Limit .010" (.254 mm)**

4. Install brake line and tighten with a flare nut wrench.
5. Follow bleeding procedure outlined on Pages 9.6-9.7 of this section.

6. Field test unit for proper braking action before putting into service. Inspect for fluid leaks and firm brakes. Make sure the brake is not dragging when pedal is released. If the brake drags, re-check assembly and installation.

7. Dirty/contaminated friction pads

8. Improper alignment

9. Worn disc

10. Worn disc splines

TROUBLESHOOTING

Brakes Squeal

Poor Brake Performance

- Air in system
- Water in system (brake fluid contaminated)
- Caliper/disc misaligned
- Caliper dirty or damaged
- Brake line damaged or lining ruptured
- Worn disc and/or friction pads
- Incorrectly adjusted stationary pad
- Worn or damaged master cylinder or components

Pedal Vibration

- Disc damaged
- Disc worn (runout or thickness variance exceeds service limit)

Caliper Overheats (Brakes Drag)

- Compensating port plugged
- Pad clearance set incorrectly
- Parking brake lever incorrectly adjusted
- Brake pedal binding or unable to return fully
- Parking brake left on
- Residue build up under caliper seals
- Operator riding brakes

Brakes Lock

- Alignment of caliper to disc
- Caliper pistons sticking
- Improper assembly of brake system components





CHAPTER 10

ELECTRICAL

RANGER TM 10.2-10.10

RANGER 2X4, 4X4, 6X6 10.11-10.26

ELECTRICAL SERVICE ITEMS - ALL 10.27-10.38



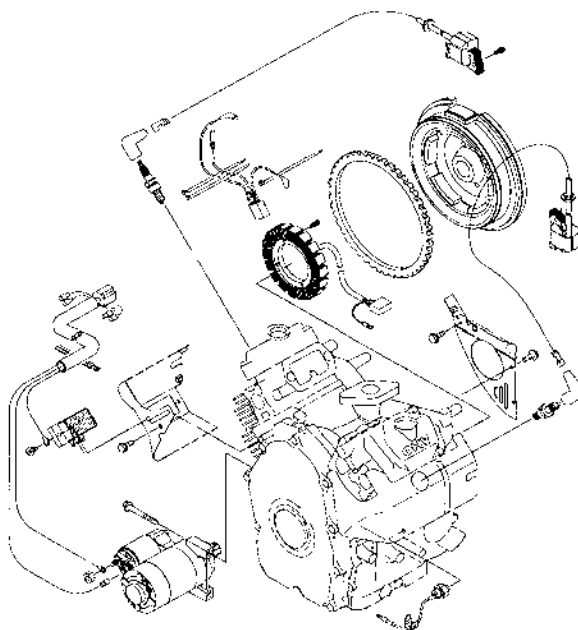
10





RANGER TM

Special Tools/ Electrical Notes	10.3
ECM Logic Box Operation	10.4
Ignition Coil Air Gap	10.4
Ignition System Troubleshooting	10.5
Charging System Testing	10.5-10.7
Starter System Troubleshooting	10.8
Starter Motor Service	10.8-10.10
Starter Assembly Expoded View	10.9





SPECIAL TOOLS

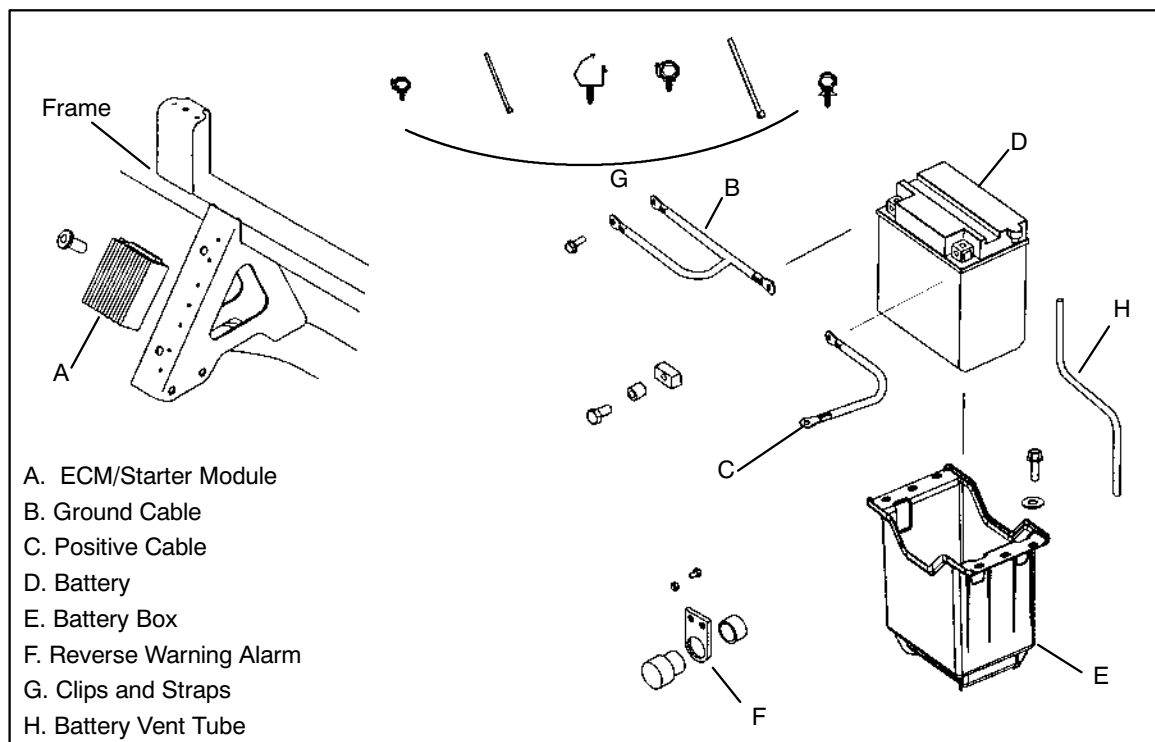
PART NUMBER	TOOL DESCRIPTION
PV-43568	Fluke™ 77 Digital Multimeter
2870630	Timing Light
2870836	Battery Hydrometer

ELECTRICAL SERVICE NOTES

Keep the following notes in mind when diagnosing an electrical problem.

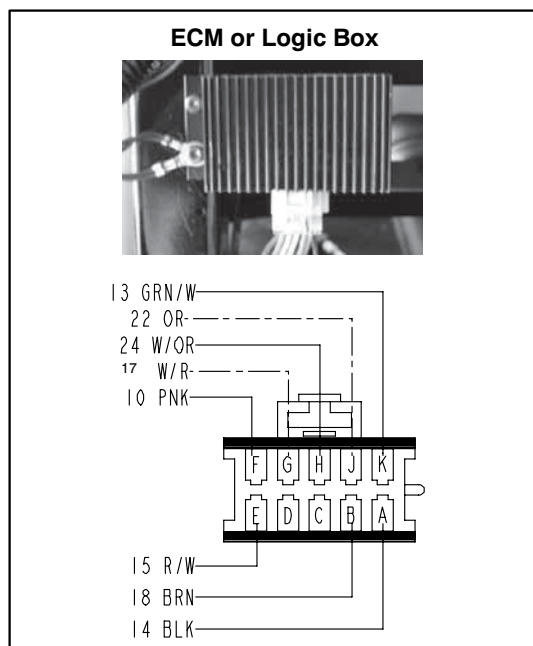
- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a resistance value under 10 Ohms, remember to subtract meter lead resistance from the reading. Connect the leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.
- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10A jack for current readings). Refer to the Owner's manual included with your meter for more information.
- Voltage, amperage, and resistance values included in this manual are obtained with a Fluke™ 77 Digital Multimeter (PV-43568). This meter is used for when diagnosing electrical problems. Readings obtained with other meters may differ.
- Pay attention to the prefix on the multimeter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate the component to be tested. Disconnect it from the wiring harness or power supply.

ELECTRICAL COMPONENTS IDENTIFICATION





ECM (LOGIC BOX) OPERATION



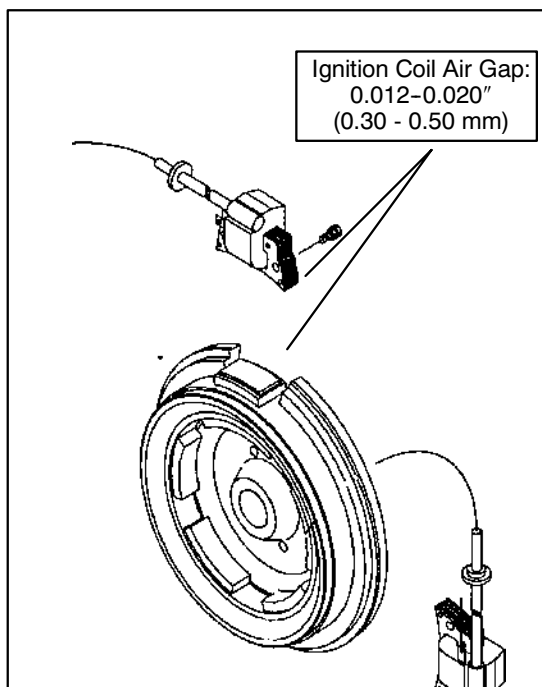
The ECM (logic box) provides a starter inter-lock and engine on power. The ECM senses the engine state via Black Wire (Pin A). If electrical pulses exist in the Black Wire the ECM recognizes that the engine is running. If the engine is running the ECM will not allow the starter to engage. If the engine is running, the Pink Wire (Pin F) is engaged to power the hour meter.

One of the two other conditions must be met for the starter to engage. Either the Green/White (Pin K) or the Orange (PIN J) inputs must be turned on (pulled to ground). Once the starter output is energized, it will remain energized until the input from the White Orange (PIN H) wire from the starter switch is removed.

NOTE: When power is applied to the unit through the Red/White (PIN E) input the Pink (Pin F) output will energize for a short period of time even if the engine is not running.

Wire Color	Pin	Description
Black	A	Provides signal to ECM that contain pulses that indicate when engine is running or cranking
Brown	B	Return to Battery Negative
	C,D	Not Used
Red/White	E	Run Signal. At +12 V when the ignition switch is on and RUN/OFF switch is RUN
Pink	F	Provides +12V When engine is running or cranking.
White/Red	G	Output to engine starter
White/Orange	H	Input from starter switch
Orange	J	Input from brake switch. Grounded when brake is engaged.
Green/White	K	Input from transmission Neutral switch. Grounded when transmission is in neutral.

IGNITION COIL AIR GAP





IGNITION SYSTEM TROUBLESHOOTING

No Spark, Weak or Intermittent Spark

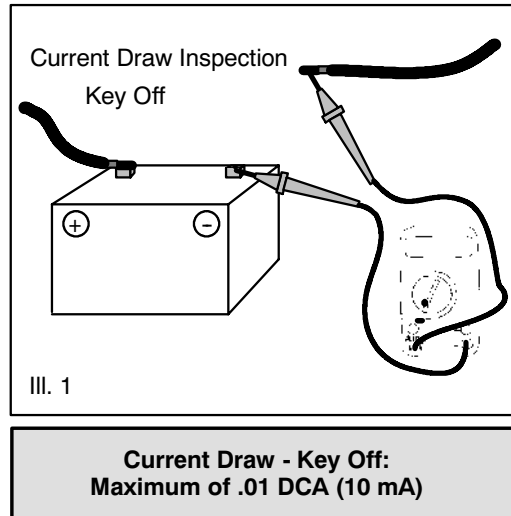
- Spark plug gap incorrect
- Fouled spark plug
- Faulty spark plug cap or poor connection to high tension lead
- Related wiring loose, disconnected, shorted, or corroded
- Engine Stop switch or ignition switch faulty
- Wire harness or connections wet, corroded
- Poor ignition coil ground (e.g. coil mount loose or corroded)
- 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 .012-.020" (.4-1.0 mm)
- Faulty ECM (logic box) module

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.



CHARGING SYSTEM TEST

CAUTION: *Do not allow the battery cables to become disconnected with the engine running. Follow the steps below as outlined to reduce the chance of damage to electrical components.*

WARNING: Never start the engine with the meter connected in series. The carburetor stop solenoid will cease to function, stopping the engine.

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 tach manufacturer's instructions.
2. Connect one meter lead (set to DC Volts) to the positive battery post and the other to the negative battery post.
3. Shift transmission into neutral and start the engine. With the engine running at idle (900 RPM), observe meter reading. The meter should read nominal battery voltage.
4. Increase RPM gradually. Normal charging is indicated by the meter reading gradually rising with a corresponding increase in RPM. Maximum charging voltage is achieved when the meter reads at least 14.2 VDC @ 1450 (lights off) or 14.2 VDC @ 1600 (lights on)
5. With lights and other electrical load off, the average battery point should occur at approximately 14.2 VDC @ 1400 RPM.





6. Turn the lights on and engage parking brake lock to keep brake light on.
7. Repeat test, observing ammeter and tachometer. With lights on, the "maximum charge point" should occur at approximately 14.2 VDC @ 1600 RPM.
8. Failure of the charging system to steadily maintain the maximum charging voltage indicates a problem with one or more components.

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 winding may overheat. 3-5 seconds is acceptable.

To Calculate Available Alternator Output

$$I = \frac{P}{E} \quad \frac{200W}{12V} = 16.7 \text{ Amps}$$

$$\frac{250W}{12V} = 20.8 \text{ Amps}$$

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 position.
4. Connect the meter leads to the two black wires leading from the alternator.
5. Start the engine and let it idle. Reading should be a minimum of 5A/AC at 1200 RPM.

**Alternator Current Output:
Minimum of 5 AC Amps at 1200 RPM**

IGNITION SYSTEM DIAGNOSIS

NO SPARK CONDITION BOTH CYLINDERS

Disconnect Black/White Wire to Stop Diode

Disconnect Each Black to Each Magneto Coil

Check for Corrosion of Electrical Connections

Check Magneto Coil Air Gap

Check Between Magneto Coil and Flywheel for Foreign Debris Build-up

NO SPARK CONDITION ONE CYLINDER

Disconnect Black wire at Magneto Coil

Test Coil Primary

Test Coil Secondary

Test Plug Cap

Check for Corrosion of Electrical Connections

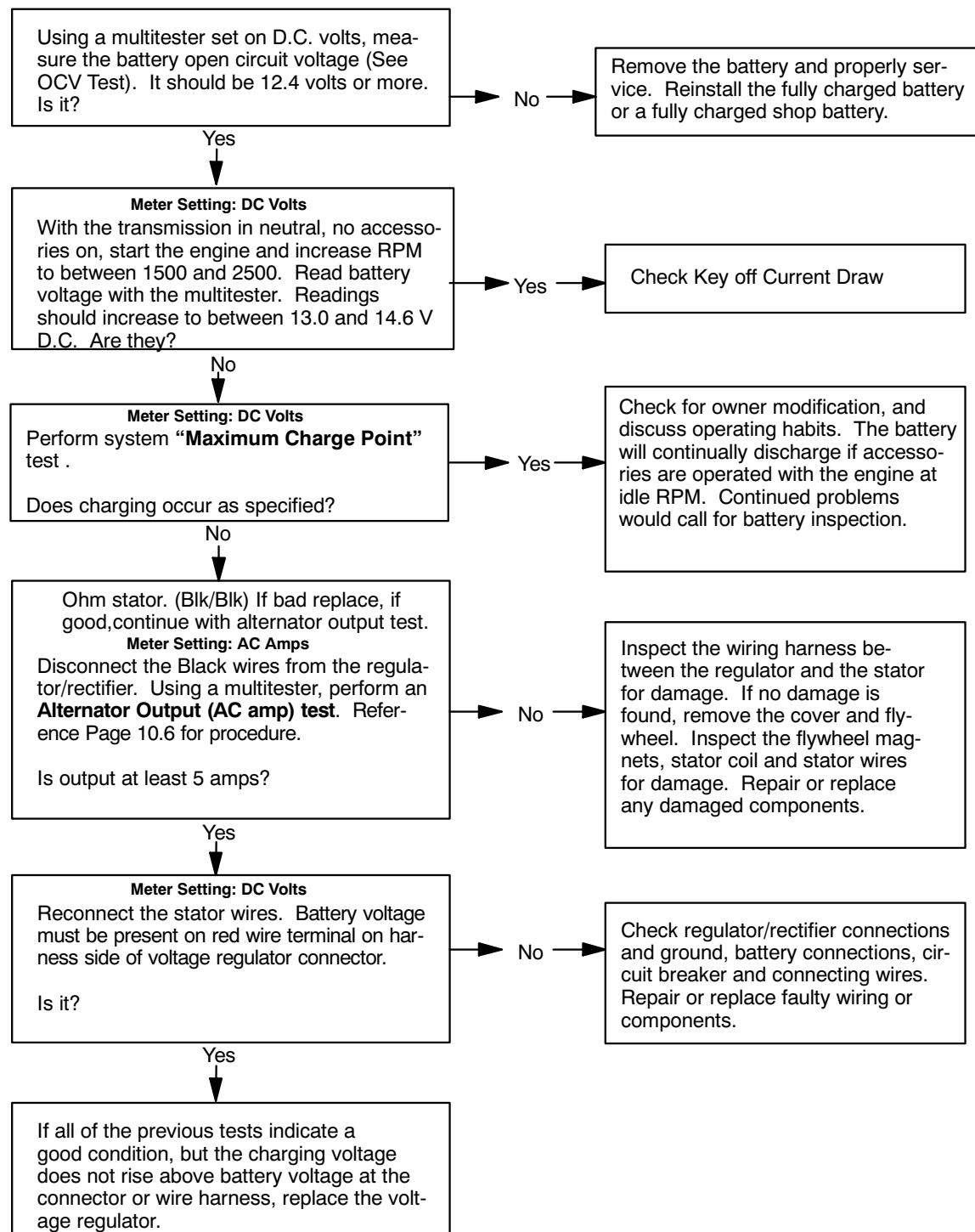
Check Between Magneto Coil and Flywheel for Foreign Debris Build-up





CHARGING SYSTEM TESTING FLOW CHART

Whenever charging system problems are suspected, proceed with the following system check.





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

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 10.12 to perform voltage drop tests on the starter system.

**Voltage should not exceed
.1 DC volts per connection**

VOLTAGE DROP TEST

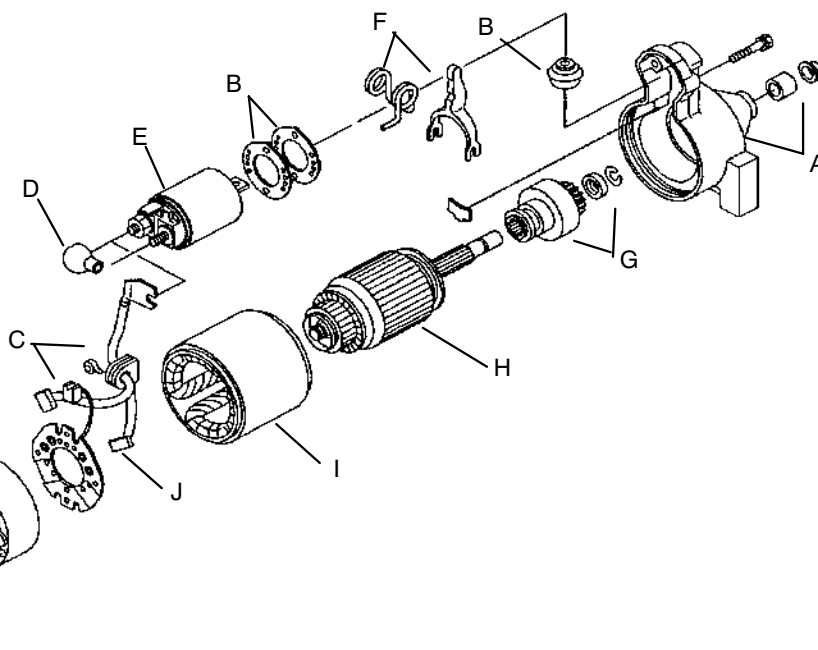
The Voltage Drop Test is used to test for bad connections. When performing the test, you are testing the amount of voltage drop through the connection. A poor or corroded connection will appear as a high voltage reading. Voltage shown on the meter when testing connections should not exceed .1 VDC per connection or component.





STARTER MOTOR DISASSEMBLY

- A. Gearcase Assy.
- B. Dust Cover Kit
- C. Brush Assy.
- D. Rubber Cap
- E. Magnetic Switch
- F. Shift Lever
- G. Pinion Assy.
- H. Armature
- I. Yoke
- J. Brush Set
- K. Thrust Kit

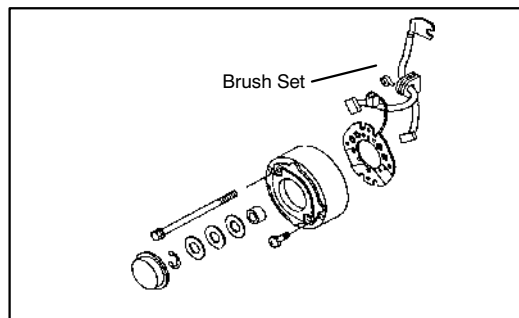


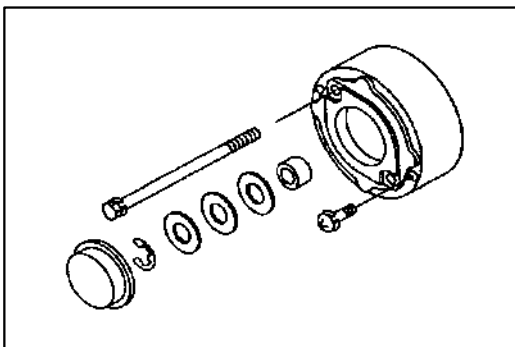
NOTE: Use only electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

1. Remove the two bolts, thrust washers, shims, and sealing O-Rings. Inspect O-Rings and replace if damaged. **NOTE:** All shims must be replaced during reassembly.
2. Remove brush terminal end of housing while holding other two sections together.
3. Remove the armature and pinion.

1. Using a digital multimeter, 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.
3. Remove brush plate and brushes. 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 10.23.
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.

BRUSH INSPECTION/REPLACEMENT

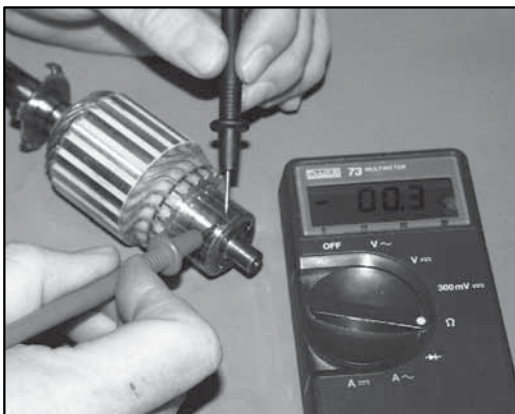




8. Remove the electrical tape and reinstall the two small phenolic washers, the large phenolic washer, flat washer, and nut.

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.

STARTER ASSEMBLY

1. Place armature in field magnet casing.
2. Install the thrust washers onto armature.
3. Be sure the brush assembly properly fits inside the cover.
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.





RANGER 2x4, 4x4, 6x6

Special Tools/Service Notes	10.12
Timing Check Procedure	10.13
Coolant Sensor Tests	10.13-10.14
Fan Motor Tests	10.14
Fan Control Switch Test	10.14
Flywheel I.D.	10.15
Alternator Components	10.16
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Ignition System Troubleshooting	10.18
CDI Output Tests	10.18
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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

ELECTRICAL SERVICE NOTES

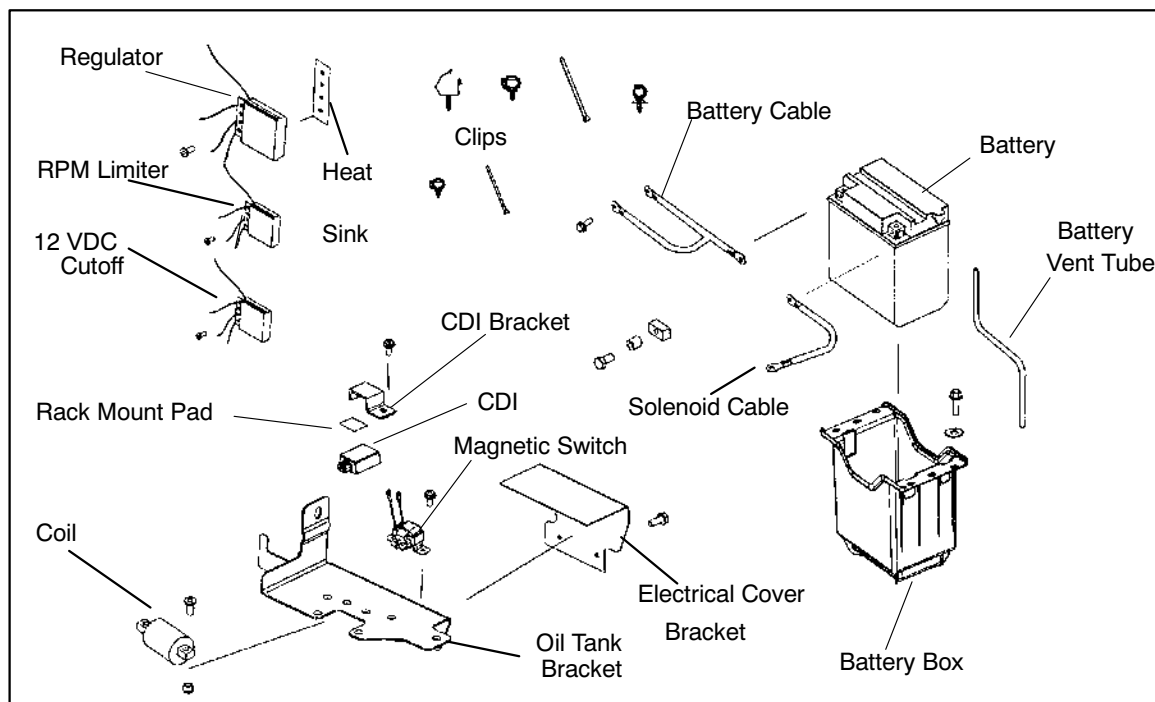
Keep the following notes in mind when diagnosing an electrical problem.

- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a resistance value under 10

Ohms, remember to subtract meter lead resistance from the reading. Connect the leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.

- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10A jack for current readings). Refer to the Owner's manual included with your meter for more information.
- Voltage, amperage, and resistance values included in this manual are obtained with a Fluke™ 77 Digital Multimeter (PV-43568). This meter is used for when diagnosing electrical problems. Readings obtained with other meters may differ.
- Pay attention to the prefix on the multimeter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate the component to be tested. Disconnect it from the wiring harness or power supply.

ELECTRICAL COMPONENTS IDENTIFICATION





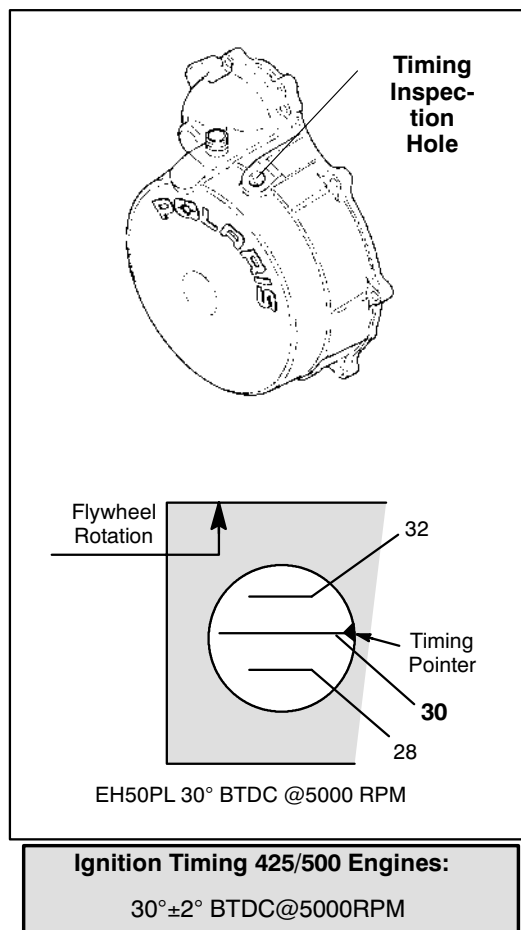
TIMING CHECK PROCEDURE

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).

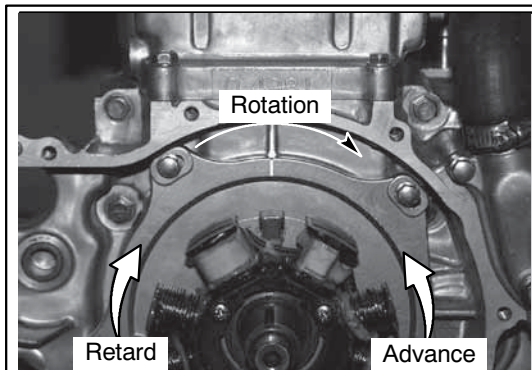
2. With the transmission in neutral, start the engine and set engine speed to 5000 ± 200 RPM.
3. Direct the timing light at the ignition timing check hole and check the ignition timing. **NOTE:** Do not allow the engine to warm up. The timing will retard approximately 2° when the engine is warm.

If the ignition timing is not within the specified range, adjust the stator plate position as described below.



Stator Adjustment

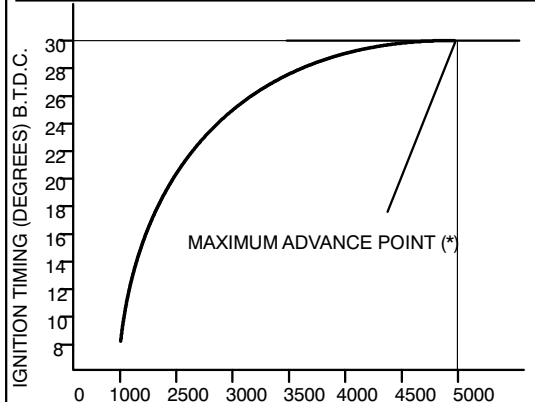
1. Remove the magneto housing.
2. Remove the flywheel.
3. Loosen the stator plate screws and adjust the stator plate position. **NOTE:** Moving the stator plate clockwise retards (delays) the ignition timing. Moving the plate counterclockwise advances it.



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 TIMING



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.

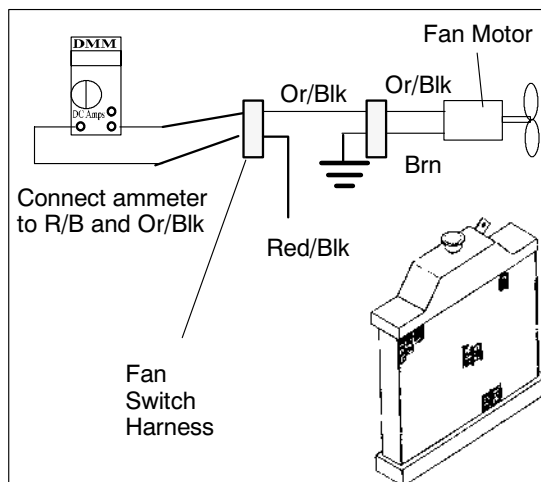
NOTE: The fan switch may not function or operation may be delayed if coolant level is low or if air is trapped in the cooling system. Be sure cooling system is full and purged of air. Refer to Maintenance Chapter 2 for cooling system information.

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.
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 submerge 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.

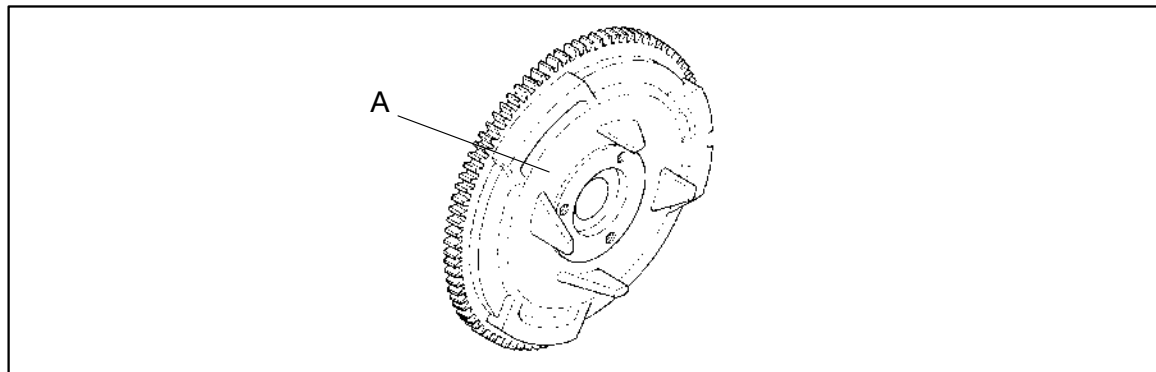
REFER TO PARTS MANUAL FOR FAN SWITCH APPLICATION

Fan Switch Operation	Continuity (On)	No Continuity (Off)
Temperature	180° F (82° C) ± 3°F	149° F (65° C) ± 8°F





FLYWHEEL IDENTIFICATION



Flywheel Identification Stamp Location

The flywheel can be identified by the stamp mark in location A. Refer to "I.D." location in chart below. Do not use the cast mark to determine flywheel application.

Engine Application	Type	Cast	Stamp	Comment	I.D. Stamp
EH500PLE	N/A	N/A	N/A	240W	N/A
EH425PLE	N/A	N/A	N/A	240W	N/A

DC / CDI IGNITION

The engine has incorporated into its design a DC/ CDI ignition system.

Some of the advantages of DC ignition are:

- Stronger, more consistent spark at low rpm for better performance
- Easier starts
- Simpler component design for ease of trouble shooting and maintenance

Operation Overview:

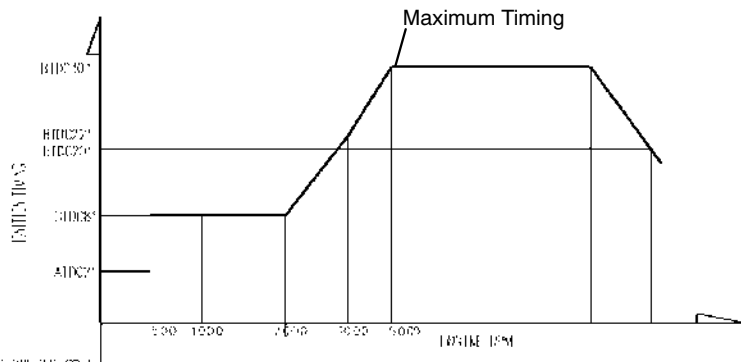
The DC/CDI system relies on battery power for ignition. Instead of generating DC voltage via magnetic induction, a 12 volt DC current is supplied directly to the CDI unit from the battery.

At the CDI, 12 volt DC current charges an internal capacitor to build up the initial ignition charge. A small A/C signal from the Trigger (Pulse) coil closes a thyristor (located in the CDI) at a point pre-determined in the crankshaft rotation by magnets on the flywheel's outer diameter. This signal releases the electrical charge which saturates the coil for ignition. DC/CDI systems have the ability to ignite with as little as 6 volts of power.

NOTICE: Do not remove the wiring harness from the CDI box while the key switch is on or while the engine is running. Damage to the CDI box may occur!

NOTE:

DC/CDI systems and components are not interchangeable with any other system.

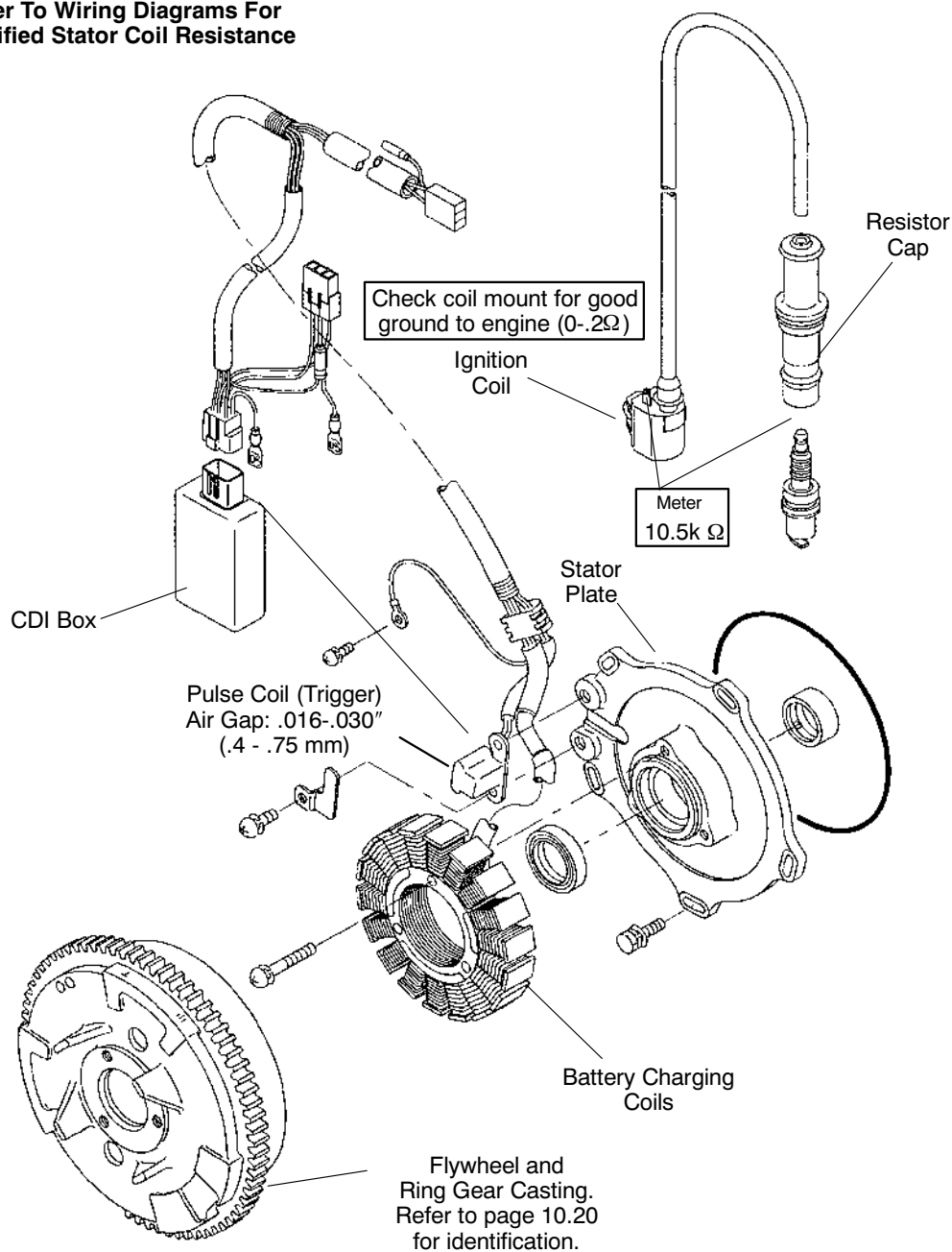




COMPONENTS OF 240 WATT ALTERNATOR

NOTE: CDI boxes may look the same but have different internal circuitry. Be sure to always use the correct CDI box part number.

Refer To Wiring Diagrams For Specified Stator Coil Resistance

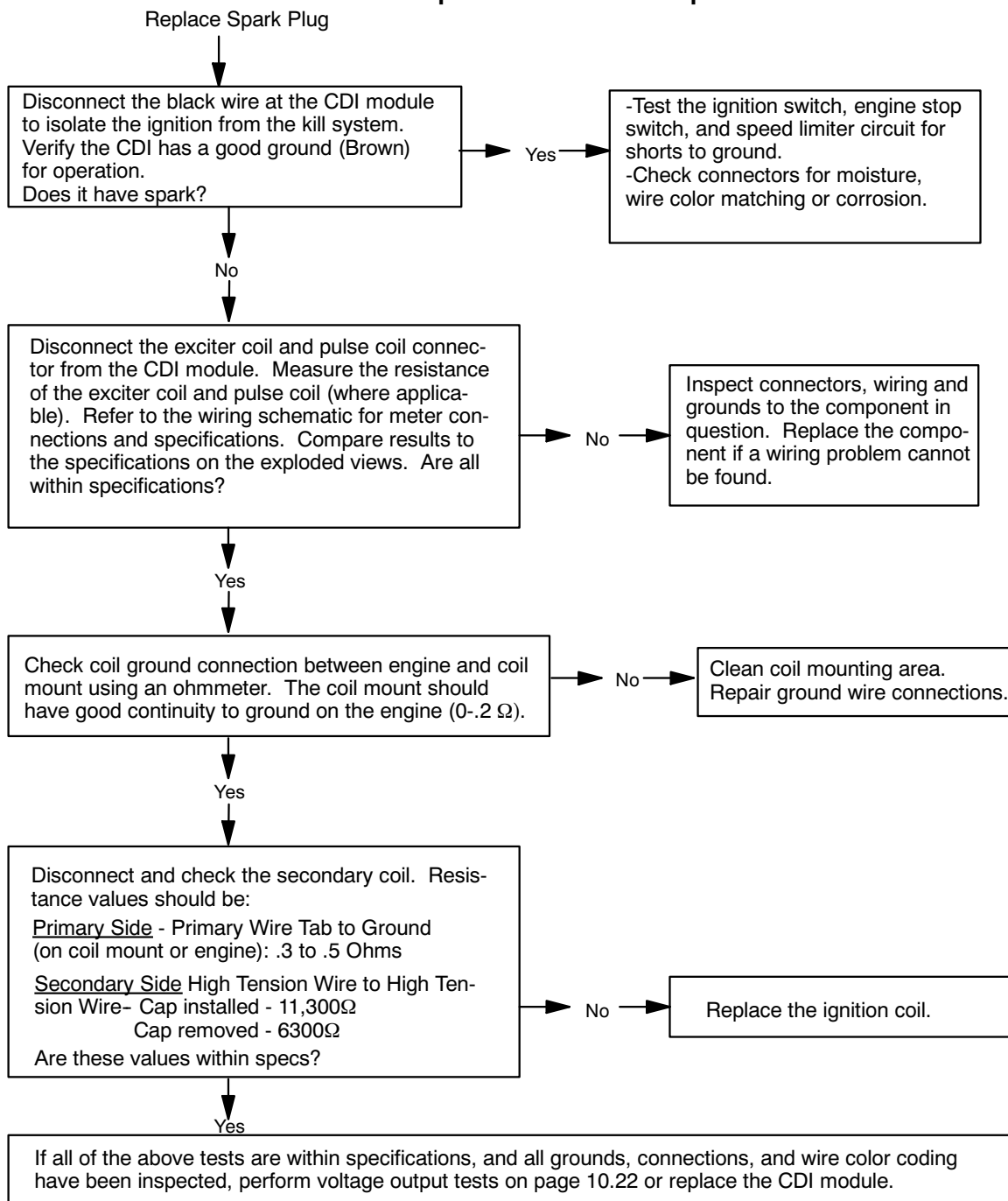




IGNITION SYSTEM TESTING FLOW CHART

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.

Condition: No Spark or intermittent spark





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.

240 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

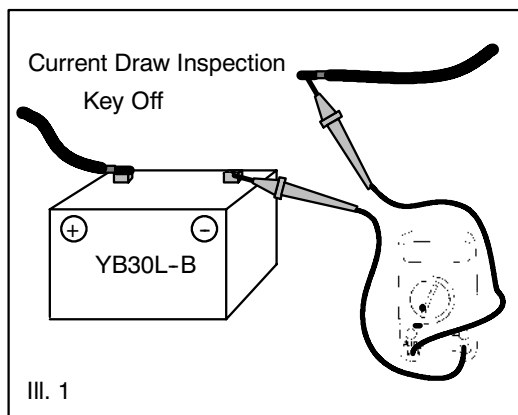
CURRENT DRAW - KEY OFF

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.





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

$$I = \frac{P}{E} \quad \frac{200W}{12V} = 16.7 \text{ Amps}$$
$$\frac{250W}{12V} = 20.8 \text{ Amps}$$

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 $\square$) 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.

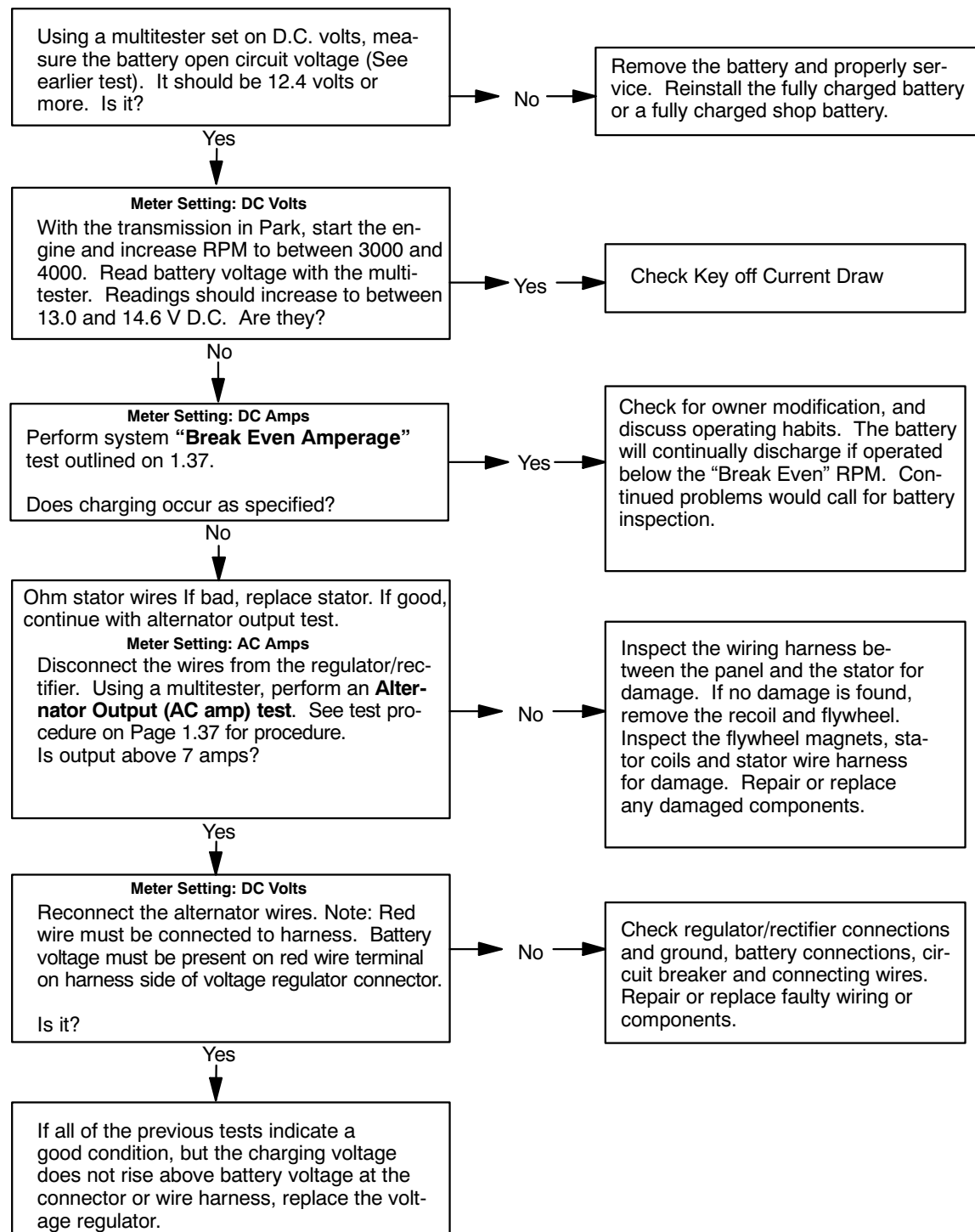
Alternator Current Output:
Minimum of 7 AC Amps at Idle





CHARGING SYSTEM TESTING FLOW CHART

Whenever charging system problems are suspected, proceed with the following system check after verifying that all wires are in good condition, connected and not kinked or pinched.





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.

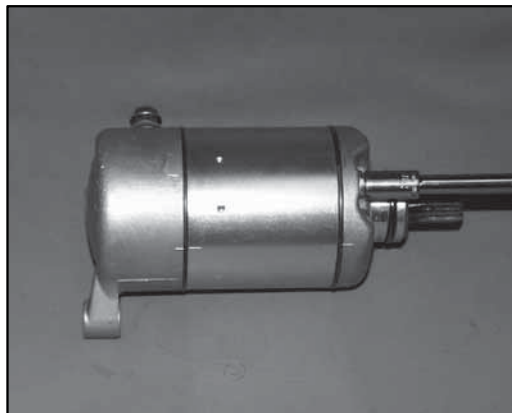
To perform the test, place the meter on DC volts and place the meter leads across the connection to be tested. Refer to the chart on 10.27 to perform voltage drop tests on the starter system.

**Voltage should not exceed
.1 DC volts per connection**

STARTER MOTOR DISASSEMBLY

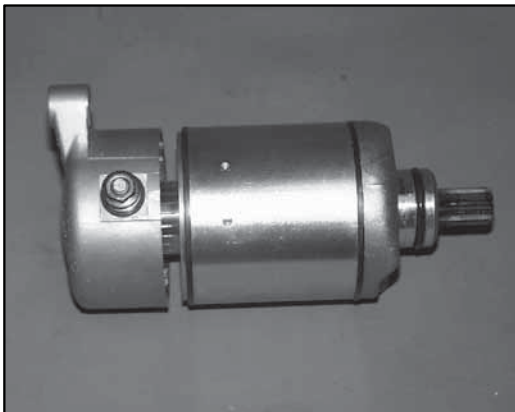
NOTE: Use only electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

1. Note the alignment marks on both ends of the starter motor casing. These marks must align during reassembly.

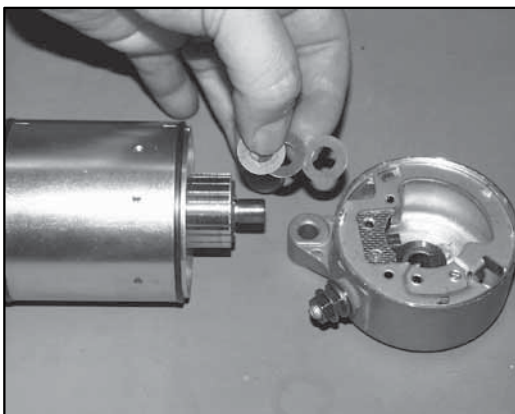




- Remove the two bolts, washers, and sealing O-Rings. Inspect O-Rings and replace if damaged.

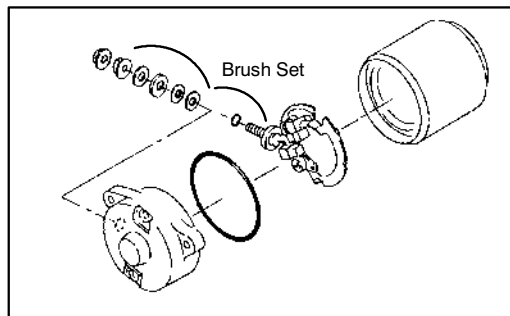


- Remove brush terminal end of housing while holding other two sections together.



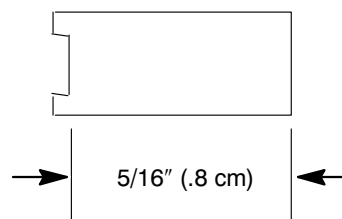
- Remove shims from armature shaft. **NOTE:** All shims must be replaced during reassembly.

BRUSH INSPECTION/REPLACEMENT



- Using a digital multimeter, 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.
- 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

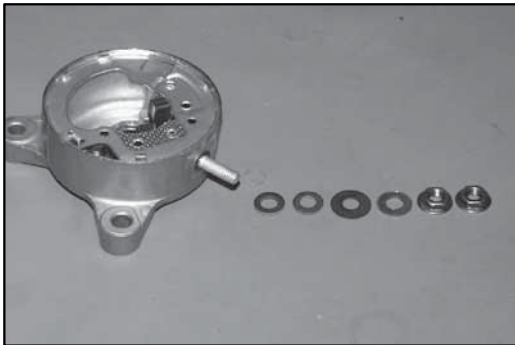


Brush Length Service Limit:
5/16" (.8 cm)

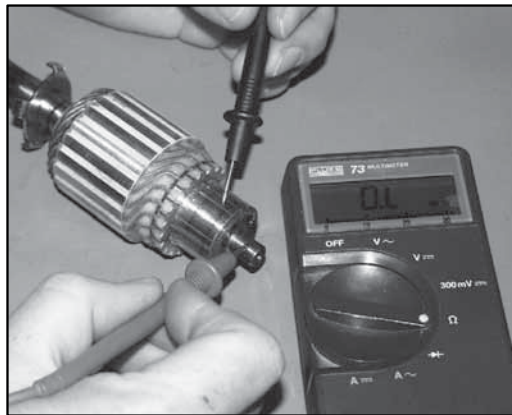
- Remove brush plate and brushes. Measure length of brushes and replace if worn past the service limit. Replace springs if they are discolored or have inadequate tension.
- Inspect surface of commutator for wear or discoloration. See Steps 3-6 of armature testing on Page 10.23.



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.



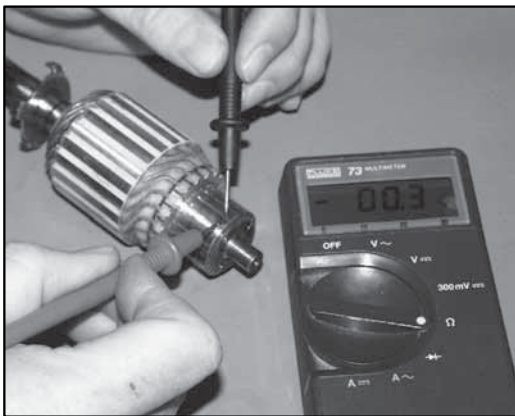
8. Remove the electrical tape and reinstall the two small phenolic washers, the large phenolic washer, flat washer, and nut.



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.

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.





STARTER ASSEMBLY



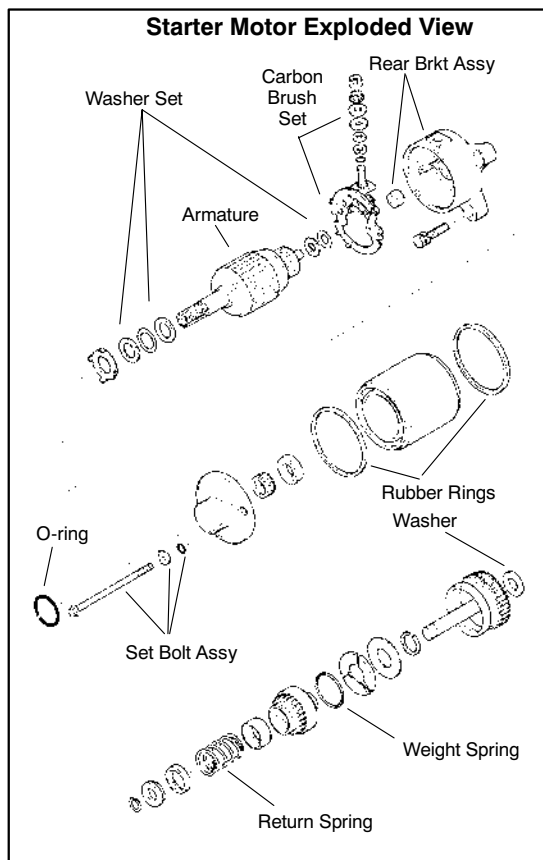
1. Place armature in field magnet casing.
2. Place shims on drive end of armature shaft with phenolic washer outermost on shaft. Engage tabs of stationary washer in drive end housing, holding it in place with a light film of grease.
3. Install case sealing O-Ring. Make sure O-Ring is in good condition 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 DRIVE

Pinion Gear - Anti Kick-out Shoe, Garter Spring Replacement

If the garter spring is damaged, the overrun clutch may fail to return properly. The replacement spring is (PN 7042039). Use either of the following methods to remove and install a new garter spring.



1. Screw the overrun clutch out to the engaged position on the pinion shaft assembly. Use a small piece of wire with the end bent in a hook and pick the old spring out of its channel. Slide it off the end of the shaft. Slide the new spring over the overrun clutch and into the spring groove. Make sure that the spring is positioned between the shoe alignment pins and the back flange of the anti kick-out shoes.
2. Remove the lock ring, end washer, spring retainers and clutch return spring. Screw the overrun clutch off the end of the pinion shaft. Remove the old spring and install a new one. Lightly grease the pinion shaft and reinstall the clutch, spring, retainers, end washer and lock ring in the reverse order. Make sure the end washer is positioned properly so that it will hold the lock ring in its groove.

Polaris Premium Starter Drive Grease

(PN 2871460)

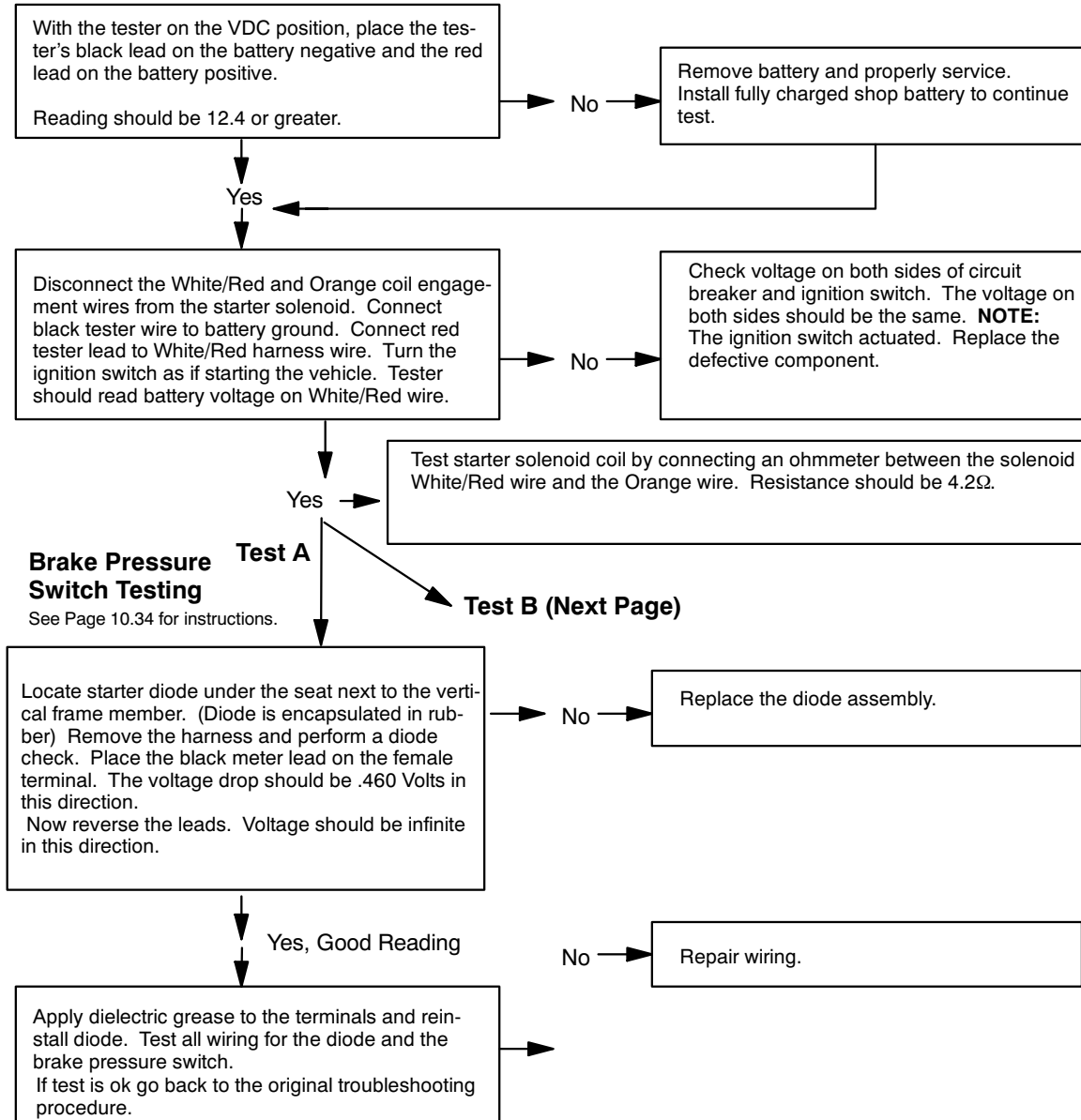




STARTER SYSTEM TEST FLOW CHART

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 multimeter must be used for this test.

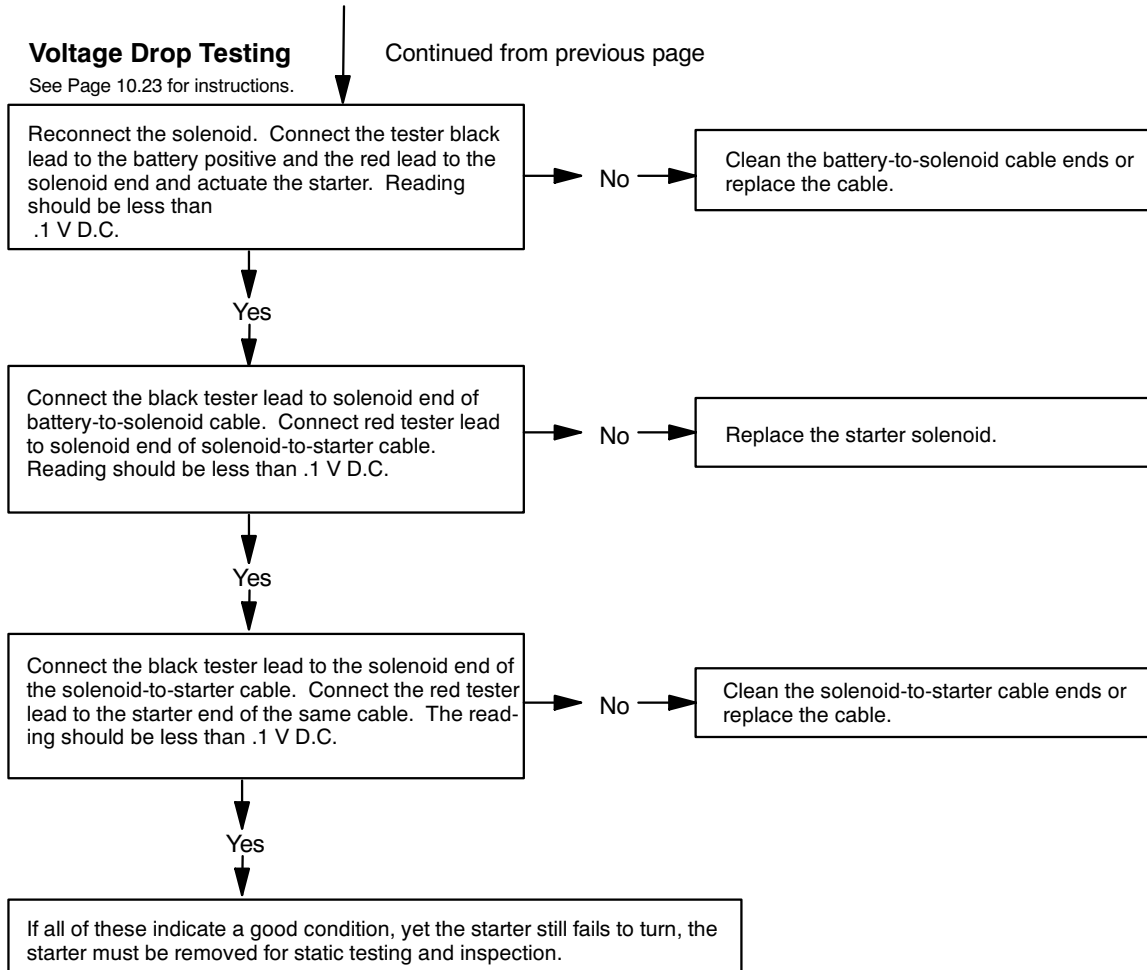
NOTE: The footbrake must be compressed for the starter circuit to engage.





STARTER SYSTEM TEST FLOW CHART, CON'T

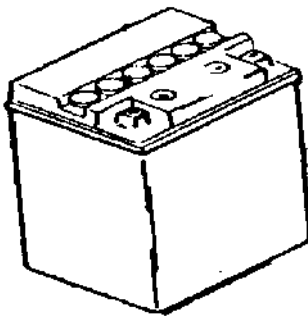
Test B (from previous page)





ELECTRICAL SERVICE ITEMS - ALL

Battery Activation/Service	10.28-10.34
Head Light/Brake Light Lamp Service	10.35
Brake Light Switch	10.36
Gear Indicator Light Circuit Operation	10.36
Indicator Lamp Replacement	10.37
Electric Box Lift Diagnosis (If Equipped)	10.38

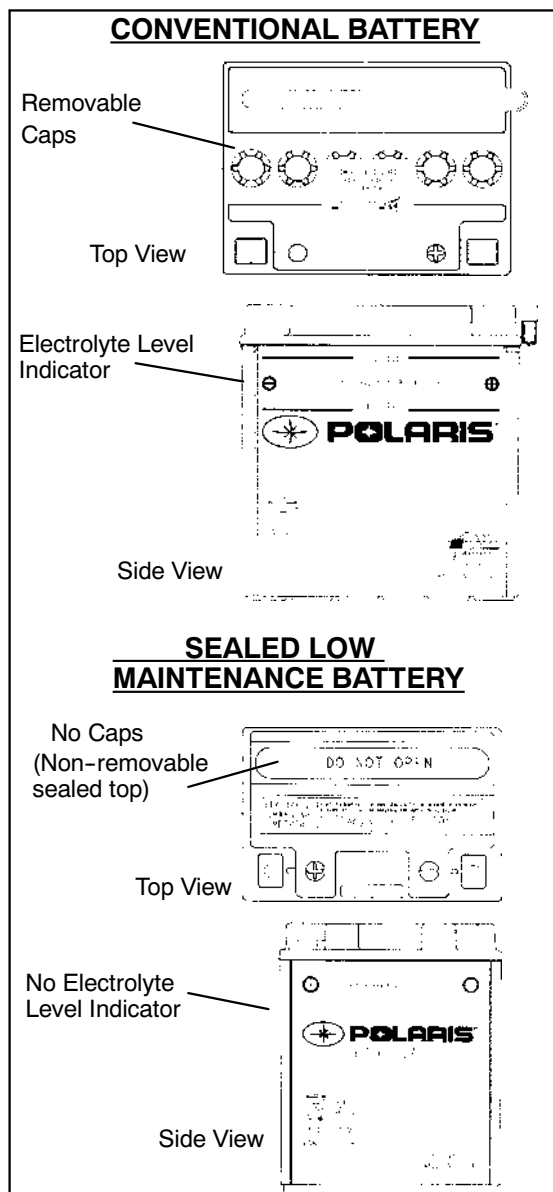




BATTERY IDENTIFICATION

NOTICE: It is important to identify what type of battery you have installed in your *RANGER*. Different types of batteries require different service procedures. Proper servicing and upkeep of your battery is very important for maintaining long battery life.

Your *RANGER* may have a Conventional Battery or a Sealed Low Maintenance Battery. To identify which type of battery your *RANGER* has, refer to the illustration below and follow the correct service and charging procedures that follow in the manual.



BATTERY ACTIVATION (CONVENTIONAL)

⚠ WARNING

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

External: Flush with water.

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

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

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

WARNING: The gases given off by a battery are explosive. Any spark or open flame near a battery can cause an explosion which will spray battery acid on anyone close to it. Should there be contact with battery acid, wash the affected area with large quantities of cool water and seek immediate medical attention.

To ensure maximum service life and performance from a new battery, perform the following steps.

NOTE: Do not service the battery unless it will be put into regular service within 30 days. After initial service, **add only distilled water** to the battery. Never add electrolyte after a battery has been in service.

NOTE: New Battery: Battery must be fully charged before use or battery life will be significantly reduced 10-30% of the battery's full potential.

To activate a new battery:

1. Remove vent plug from vent fitting. Remove cell caps.
2. Fill battery with electrolyte to upper level marks on case.
3. Set battery aside to allow for acid absorption and stabilization for 30 minutes.
4. Add electrolyte to bring level back to upper level mark on case. **NOTE:** This is the last time that electrolyte should be added. If the level becomes low after this point, add only distilled water.





5. Charge battery at 1/10 of its amp/hour rating. Examples: 1/10 of 9 amp battery = .9 amp; 1/10 of 14 amp battery = 1.4 amp; 1/10 of 18 amp battery = 1.8 amp (recommended charging rates).
6. Check specific gravity of each cell with a hydrometer to assure each has a reading of 1.270 or higher.

BATTERY

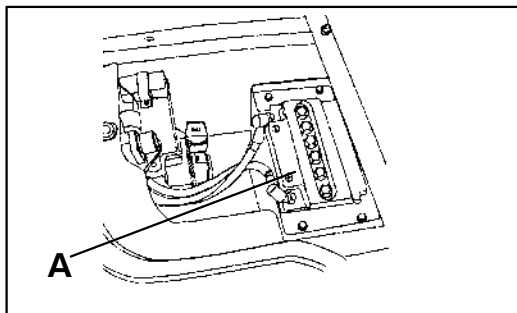
TERMINALS/TERMINAL BOLTS

Use Polaris corrosion resistant Nyogel™ grease (PN 2871329) on battery bolts. See Battery Installation on Page NO TAG.

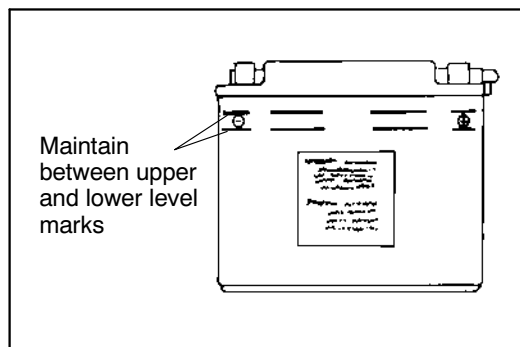
CONVENTIONAL BATTERY

INSPECTION/REMOVAL

The battery is located under the seat (A).



Inspect the battery fluid level. When the battery fluid nears the lower level, remove the battery and fill with distilled water only to the upper level line. To remove the battery:



1. Disconnect holder strap and remove covers.

2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

CAUTION

Whenever removing or reinstalling the battery, disconnect the negative (black) cable first and reinstall the negative cable last!

3. Remove the battery.
4. Remove the filler caps and add **distilled water only** as needed to bring each cell to the proper level. Do not overfill the battery.



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



Do not allow cleaning solution or tap water inside the battery. Battery life may be reduced.

5. Reinstall the battery caps.

CONVENTIONAL BATTERY

INSTALLATION

1. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse well with clean water and dry thoroughly.
2. Route the cables correctly.
3. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable. Coat terminals and bolt threads with Nyogel™ Grease (PN 2871329).
4. Install clear battery vent tube from vehicle to battery vent. **WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and cause an explosion. The vent tube should be routed away from frame and body to prevent contact with electrolyte. Avoid skin contact with electrolyte, as severe burns could result. If electrolyte contacts the vehicle frame, corrosion will occur.
5. Reinstall the holder strap.

CONVENTIONAL BATTERY

TESTING

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.





Following are three tests which can easily be made on a battery to determine its condition: OCV Test, Specific Gravity Test and Load Test.

CONVENTIONAL BATTERY OCV - OPEN CIRCUIT VOLTAGE TEST

Battery voltage should be checked with a digital multimeter. Readings of 12.6 volts or less require further battery testing and charging. See charts and Load Test on below.

NOTE: Lead-acid batteries should be kept at or near a full charge as possible. Electrolyte level should be kept between the low and full marks. If the battery is stored or used in a partially charged condition, or with low electrolyte levels, hard crystal sulfation will form on the plates, reducing the efficiency and service life of the battery.

OPEN CIRCUIT VOLTAGE		
State of charge	Conventional Lead-acid	YuMicon™ 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

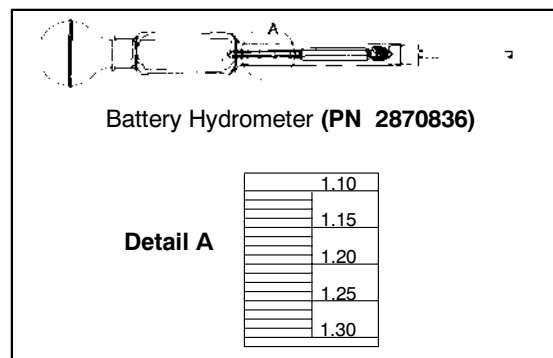
SPECIFIC GRAVITY		
State of charge*	Conventional lead-acid	YuMicon™ Type
100% Charged	1.265	1.275
75% Charged	1.210	1.225
50% Charged	1.160	1.175
25% Charged	1.120	1.135
0% Charged	less than 1.100	less than 1.115

* At 80°F

NOTE: Subtract .01 from the specific gravity reading at 40° F.

CONVENTIONAL 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.



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 multimeter to the battery in the same manner as was done in the OCV test. The reading should be 12.6 volts or greater. Engage the starter and observe the battery voltage while cranking the engine. Continue the test for 15 seconds. During cranking the observed voltage should not drop below 9.5 volts. If the beginning voltage is 12.6 volts or higher and the cranking voltage drops below 9.5 volts during the test, replace the battery.

OFF SEASON STORAGE

To prevent battery damage during extended periods of non-use, the following basic battery maintenance items must be performed:

- Remove the battery from the machine and wash the case and battery tray with a mild solution of baking soda





and water. Rinse with lots of fresh water after cleaning. **NOTE:** Do not get any of the baking soda into the battery or the acid will be neutralized.

- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- Make sure that the electrolyte is at the proper level. Add distilled water if necessary.
- Charge at a rate no greater than 1/10 of the battery's amp/hr capacity until the electrolyte's specific gravity reaches 1.270 or greater.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

NOTE: Recharge to full capacity every 30 to 60 days during a non-use period. If the battery is stored during the winter months, electrolyte will freeze at higher temperatures as the battery discharges. The chart below indicates freezing points by specific gravity.

Electrolyte Freezing Points	
Specific Gravity of Electrolyte	Freezing Point
1.265	-75° F
1.225	-35° F
1.200	-17° F
1.150	+5° F
1.100	+18° F
1.050	+27° F

CHARGING PROCEDURE

1. Remove the battery 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 dielectric grease.

Dielectric 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.
6. Install clear battery vent tube from vehicle to battery vent. **WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and cause an explosion. Vent should be routed away from frame and body to prevent contact with electrolyte. Avoid skin contact with electrolyte, as severe burns could result. If electrolyte contacts the vehicle frame, corrosion will occur.
7. Route cables so they are tucked away in front and behind battery.

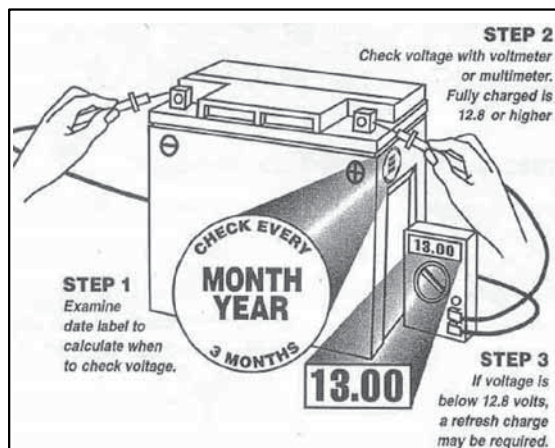
LOW MAINTENANCE BATTERY

NOTE: All Low Maintenance batteries are fully charged and tested at the factory before installation. Expected shelf life varies on storage conditions. As a general rule before placing the battery into service, check the battery condition and charge accordingly.

Battery Check:

1. Check the date label on the side of the battery to calculate when to check voltage. The battery should be checked every 3 months.
2. Check the voltage with a voltmeter or multimeter. **A fully charged battery should be 12.8 V or higher.**
3. If the voltage is below 12.8 V, the battery will need to be recharged.





New Batteries: Batteries must be fully charged before use or battery life can be reduced by 10-30% of full potential. Charge battery for 3-5 hours using a variable rate charger. Do not use the alternator to charge a new battery. A high rate battery charger can cause battery damage.

Low Maintenance batteries are permanently sealed at the time of manufacture. The use of lead-calcium and AGM technology instead of lead-antimony allows the battery acid to be fully absorbed. For this reason, a Low Maintenance battery case is dark and the cell caps are not removable, since there is no need to check electrolyte level.

NEVER attempt to add electrolyte or water to a Low Maintenance battery. Doing so will damage the case and shorten the life of the battery. Refer to the Battery Activation and Maintenance Video (PN 9917987) for proper instruction on servicing Low Maintenance batteries.

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

NEVER attempt to add electrolyte or water to a Low Maintenance battery. Doing so will damage the case and shorten the life of the battery. Refer to the Battery Maintenance Video (PN 9917987) for proper instruction on servicing Low Maintenance batteries.

To service a Low Maintenance battery:

1. Remove battery from the vehicle
2. Test battery with a voltage meter or load tester to determine battery condition. This will determine the length of time required to charge the battery to full capacity. Refer to capacity table.
3. Charge battery using a variable rate charger.

LOW MAINTENANCE BATTERY CHARGING

If battery voltage is 12.8 V or less, the battery may need recharging. When using an automatic charger, refer to the charger manufacturer's instructions for recharging. When using a constant current charger, use the following guidelines for recharging.

NOTE: Always verify battery condition before and 1-2 hours after the end of charging.

WARNING: An overheated battery could explode, causing severe injury or death. Always watch charging times carefully. Stop charging if the battery becomes very warm to the touch. Allow it to cool before resuming charging.

Battery Charging Reference Table

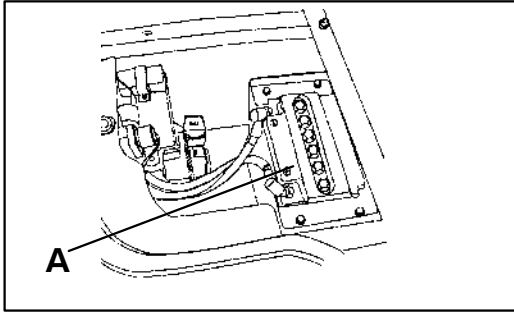
State of Charge	Voltage	Action	Charge Time (*See note below)
100%	12.8-13 V	None, check voltage at 3 mos. after manufacture date	None Required
75-100%	12.5-12.8 V	May need slight charge	3-6 hours
50-75%	12.0-12.5 V	Needs Charge	5-11 hours
25-50%	11.5-12.0 V	Needs Charge	At least 13 hours, verify state of charge
0-25%	11.5 V or less	Needs Charge	At least 20 hours





LOW MAINTENANCE BATTERY INSPECTION/ REMOVAL

The battery is located under the seat (A).



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



CAUTION

Whenever removing or reinstalling the battery, disconnect the negative (black) cable first and reinstall the negative cable last!

3. Remove the battery.

LOW MAINTENANCE BATTERY INSTALLATION

1. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse well with clean water and dry thoroughly.
2. Route the cables correctly.
3. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable. Coat terminals and bolt threads with Nyogel™ Grease (PN 2871329).
4. Reinstall the holder strap.

LOW MAINTENANCE 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.

LOW MAINTENANCE BATTERY - OCV - OPEN CIRCUIT VOLTAGE TEST

Battery voltage should be checked with a digital multimeter. Readings of 12.8 volts or less require further battery testing and charging. See charts and Load Test.

NOTE: Lead-acid batteries should be kept at or near a full charge as possible. If the battery is stored or used in a partially charged condition, or with low electrolyte levels, hard crystal sulfation will form on the plates, reducing the efficiency and service life of the battery.

NOTE: Use a voltmeter or multimeter to test battery voltage.

OPEN CIRCUIT VOLTAGE		
State of charge	Maintenance Free	YuMicron™ Type
100%	13.0V	12.70V
75% Charged	12.80V	12.50V
50% Charged	12.50V	12.20V
25% Charged	12.20V	12.0V
0% Charged	less than 12.0V	less than 11.9V

* At 80°F

NOTE: Subtract .01 from the specific gravity reading at 40° F.

LOW MAINTENANCE BATTERY 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 multimeter 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.

LOW MAINTENANCE BATTERY OFF-SEASON STORAGE

To prevent battery damage during extended periods of non-use, the following basic battery maintenance items must be performed:

- Remove the battery from the machine and wash the case and battery tray with a mild solution of baking soda and water. Rinse with lots of fresh water after cleaning.
- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- Make sure that the electrolyte is at the proper level.
- 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

LOW MAINTENANCE BATTERY 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 variable rate charging output. 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 (PN 2871329).
4. Route cables so they are tucked away in front and behind battery.
5. Connect battery cables.

⚠ WARNING

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

6. After connecting the battery cables, install the cover on the battery and attach the hold down strap.

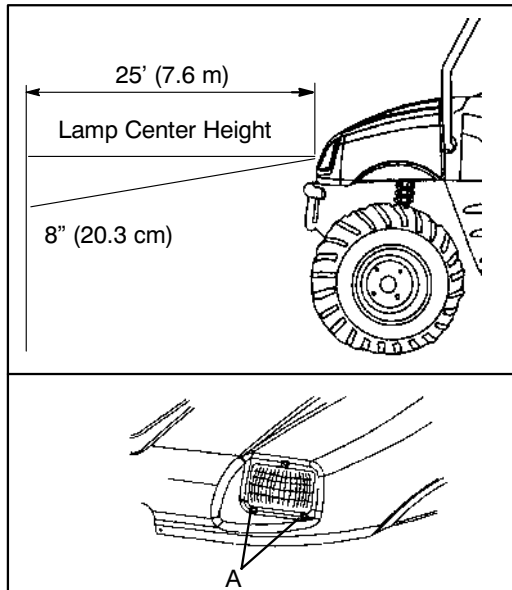




HIGH BEAM HEADLIGHT ADJUSTMENT

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 in 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.

- Turn the right screw clockwise to adjust to the left.
- Turn the left screw clockwise to adjust to the right.
- Turn the bottom screw clockwise to adjust up.

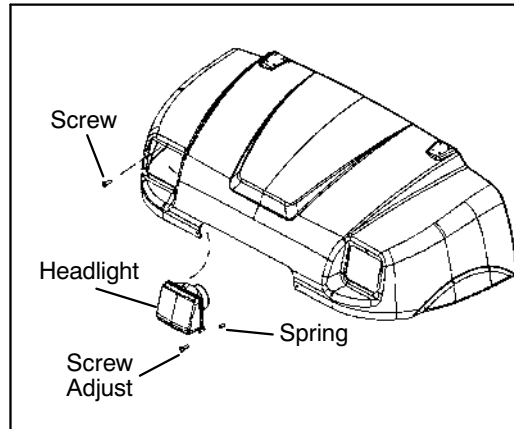


WARNING: Due to the nature of light utility vehicles and where they are operated, headlight lenses become dirty. Frequent washing is necessary to maintain lighting quality. Riding with poor lighting can result in severe injury or death.

5. Adjust beam to desired position.

HEADLIGHT HOUSING REPLACEMENT

1. Open the hood.
2. Disconnect wire harness to headlamp.
3. Remove screws and spring.
4. Remove headlight.
5. Insert new bulb and reverse steps.



TAILLIGHT/BRAKELIGHT LAMP REPLACEMENT

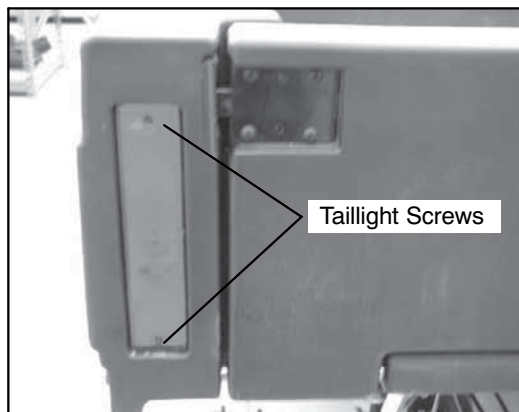
If the taillight/brakelight does not work the lamp may need to be replaced.

1. From the rear of the taillight remove two screws holding lens cover in place and remove lens cover.
2. Remove lamp by turning the rubber base 1/4 turn and pulling the bulb out. Replace it with recommended lamp. Apply Dielectric Grease (PN 2871329).



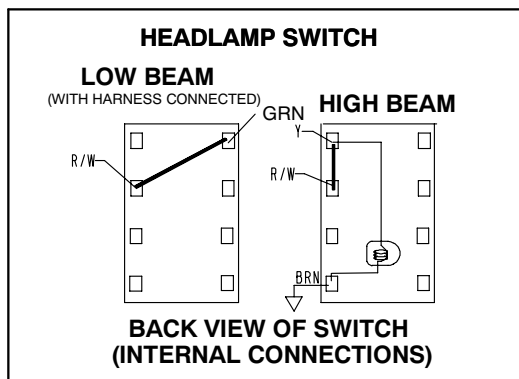


3. Reinstall the lens cover removed in step 1.
4. Test the taillight/brakelight to see it is working.



HEADLAMP SWITCH

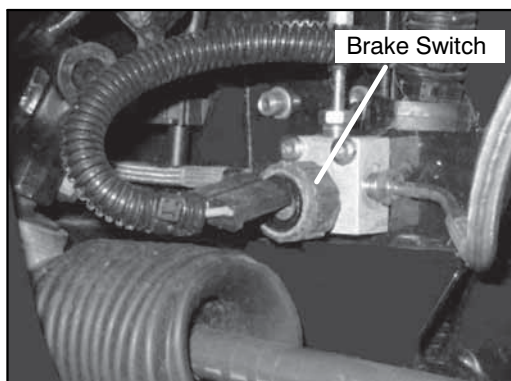
1. Lift the front hood.
2. The wires are located on the backside of the instrument panel.
3. Disconnect the headlamp switch harness (Brown, Green, and Yellow), by depressing the connector lock and pulling on the connector. Do not pull on the wiring.
4. Test the switch connections and compare to the illustration. The internal headlight switch connections are shown in the illustration to the right.



BRAKE LIGHT SWITCH

1. Turn the steering wheel to the right and look behind the front left tire for the brake junction block. The brake pressure switch is installed into

this block.



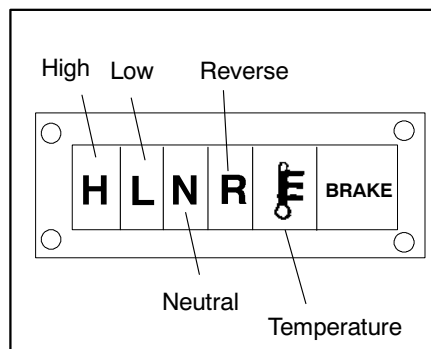
2. Disconnect wire harness from switch.
3. Connect an ohmmeter across switch contacts. Reading should be infinite (∞).
4. Apply foot brake and check for continuity between switch contacts. If there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure, first clean the switch contacts and re-test. Replace switch if necessary.

GEAR INDICATOR LIGHT CIRCUIT OPERATION

The transmission switch provides the ground path for the indicator lamps located on the dashboard. For example, when neutral is selected, Green/White wire connected to ground throughout the switch and the neutral lamp is illuminated.

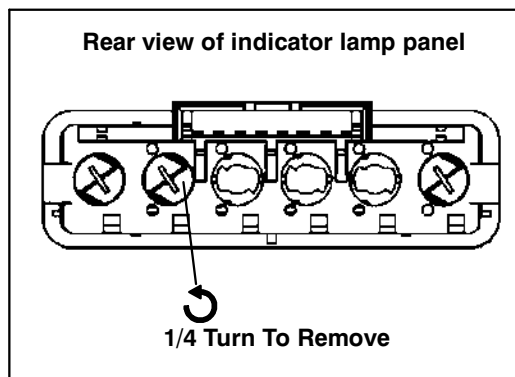
If the light does not illuminate when neutral is selected, check the bulb. If the bulb is good, check the wiring, transmission switch, and lamp socket source voltage. Perform the same test for all four gear indicators. Refer to the wire diagram for wire colors.





INDICATOR LAMP REPLACEMENT

1. Disconnect indicator light harness from the panel by lifting the retaining latch.
2. To remove defective lamp: Use a small screwdriver and turn lamp holder a quarter turn, pull the bulb assembly out with a needle nose pliers or equivalent. Replace with a new bulb assembly.

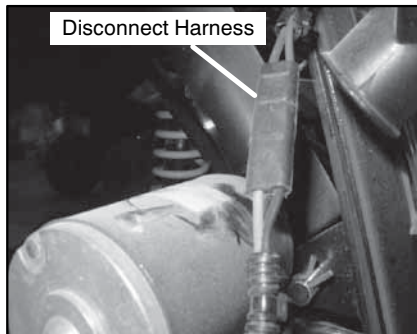




ELECTRIC BOX LIFT ACTUATOR DIAGNOSIS (IF EQUIPPED)

1. Disconnect the wiring harness to the box lift actuator.

2. Connect a multimeter across the box lift actuator harness connection.



3. Actuate the box lift switch in both directions. Verify that there is 12 Volts reaching the box lift actuator. Follow the diagram below for diagnosis.

YES

YES - (12 Volts at actuator)

NO

(Not 12 Volts at actuator)
Lift the UTV hood. Locate the box lift switch. Check for 12 Volts between the RED/BLACK wire terminal on the back of the switch and the BROWN wire terminal.

NO

YES

(Not 12 Volts between wires)
On the main connector behind the dashboard, measure for 12 Volts between RED/BLACK wire terminal and ground.

(12 Volts between wires)
Check the switch. Check the wires between the switch and the actuator motor.

NO

YES

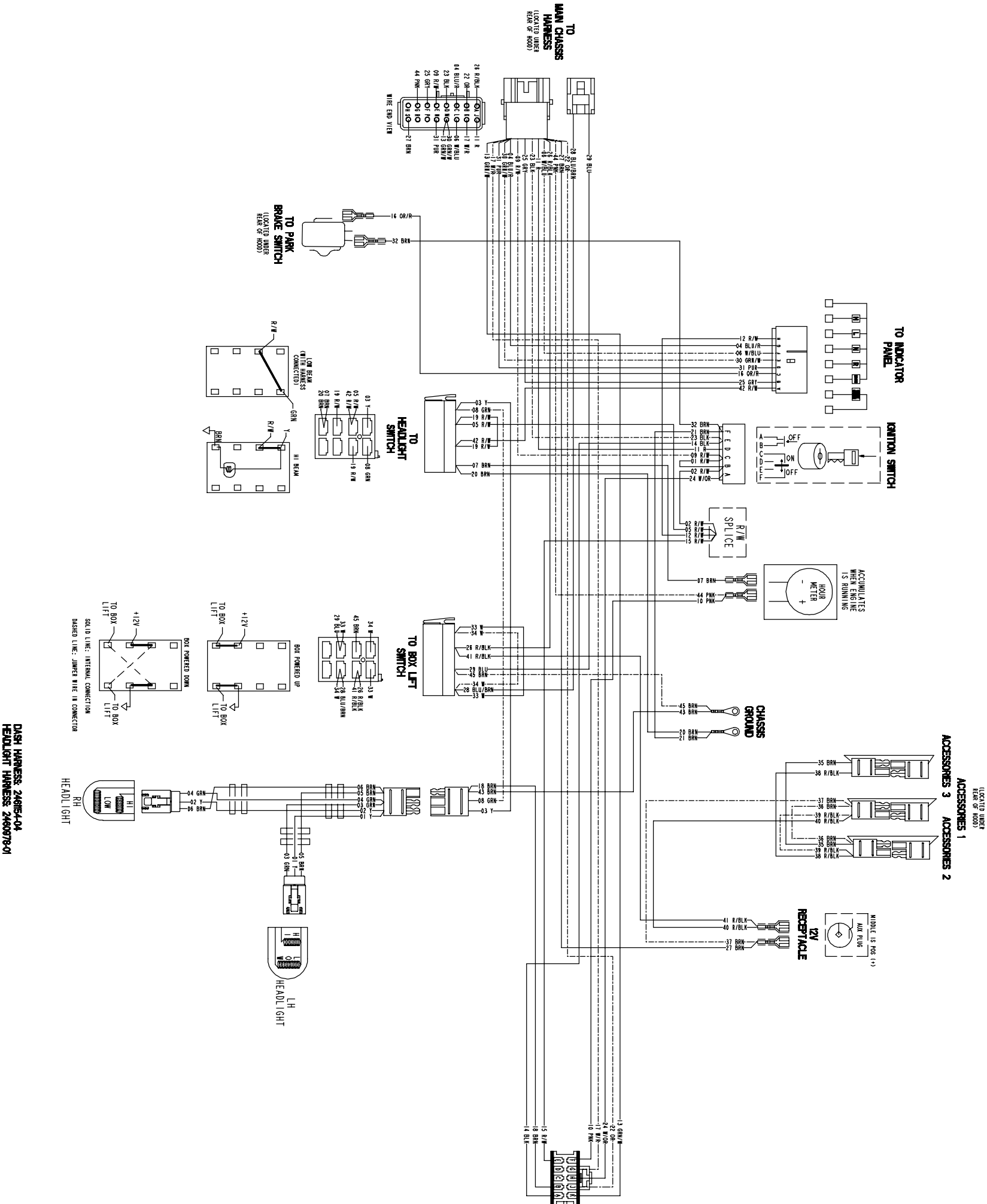
(Not 12 Volts between wires)
Test the accessory and wiring circuit breaker located under the seat. (Refer to Wiring Schematic)
Test the wiring between the main connector and the circuit breaker.

(12 Volts between wires)
Test wiring between the main connector and the circuit breaker.





WIRING DIAGRAM 2004 *RANGER* TM



ACCESSORIES 1
ACCESSORIES 2
ACCESSORIES 3

RANGER TM (Pg. 1 OF 1)

Wires are represented by solid or dashed lines to simplify tracing in diagram

- COLOR CODE:
BLK = BLACK
BRN = BROWN
GRN = GREEN
PUR = PURPLE
BLU = BLUE
GRY = GRAY
OR = ORANGE
Y = YELLOW
R = RED
W = WHITE
- ⏏ ENGINE GROUND
⏏ CHASSIS GROUND

TWO COLOR WIRES ARE SHOWN WITH MAIN/TRACE COLORS. EXAMPLE:
R/Y = RED WITH YELLOW TRACER
NC = SWITCH NORMALLY CLOSED
NO = SWITCH NORMALLY OPEN

1. RED/WHITE IS POWER TO ECM. BROWN IS GROUND.
2. ECM WILL CONNECT WHITE/ORANGE (START FROM KEY) TO WHITE/RED (START SOLENOID) IF GREEN/WHITE IS LOW VOLTAGE (TRANSMISSION IN NEUTRAL) OR ORANGE IS LOW VOLTAGE (BRAKE ON).
3. ECM WILL NOT ALLOW POWER TO START SOLENOID IF AC SIGNAL ON BLACK (ENGINE RUNNING).
4. ECM ALLOWS POWER TO PINK IF AC ON BLACK.

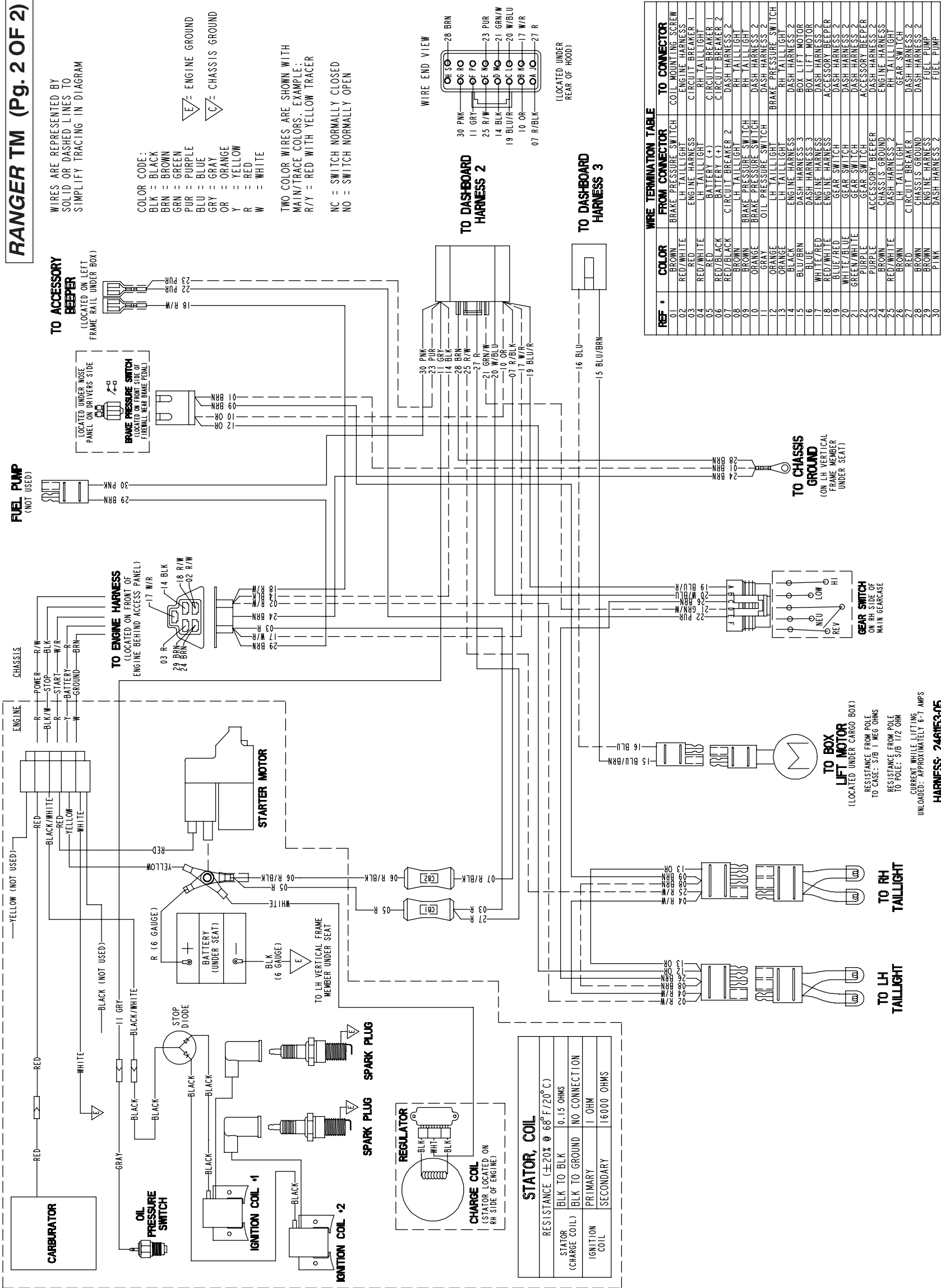
REF #	COLOR	FROM CONNECTION	TO CONNECTION
01	RED/WHITE	IGNITION SWITCH	IGNITION SWITCH
02	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
03	YELLOW	HEADLIGHT SWITCH	HEADLIGHT HARNESS
04	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
05	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
06	WHITE/BLUE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
07	BROWN	HEADLIGHT SWITCH	HEADLIGHT HARNESS
08	BROWN	HEADLIGHT SWITCH	HEADLIGHT HARNESS
09	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
10	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
11	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
12	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
13	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
14	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
15	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
16	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
17	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
18	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
19	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
20	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
21	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
22	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
23	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
24	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
25	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
26	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
27	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
28	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
29	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
30	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
31	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
32	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
33	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
34	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
35	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
36	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
37	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
38	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
39	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
40	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
41	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
42	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
43	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
44	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS
45	RED/WHITE	HEADLIGHT SWITCH	HEADLIGHT HARNESS

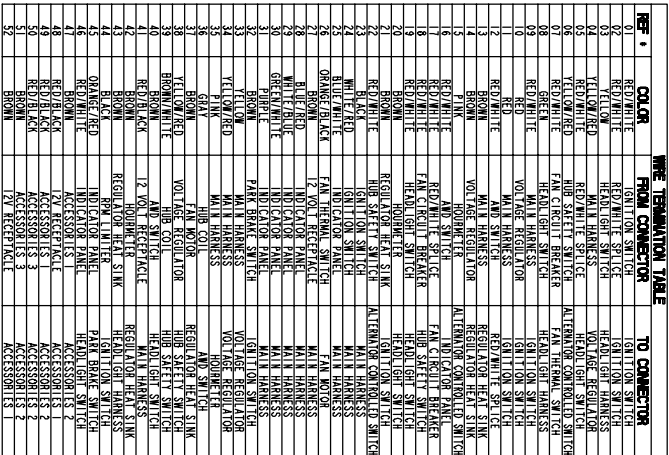
DASH HARNESS 246164-04
HEADLIGHT HARNESS 246078-01



WIRING DIAGRAM 2004 *RANGER* TM

RANGER TM (Pg. 2 OF 2)





10.42

ATV_04_RANGER_2X4_4X4_6X6_CHASSIS
2X4 (MODEL NO: A04RB42AA)
4X4 (MODEL NO: A04RD50AA)
6X6 (MODEL NO: A04RF50AA)

WIRES ARE REPRESENTED BY
SOLID OR DASHED LINES TO
SIMPLIFY TRACING IN DIAGRAM

COLOR CODE:

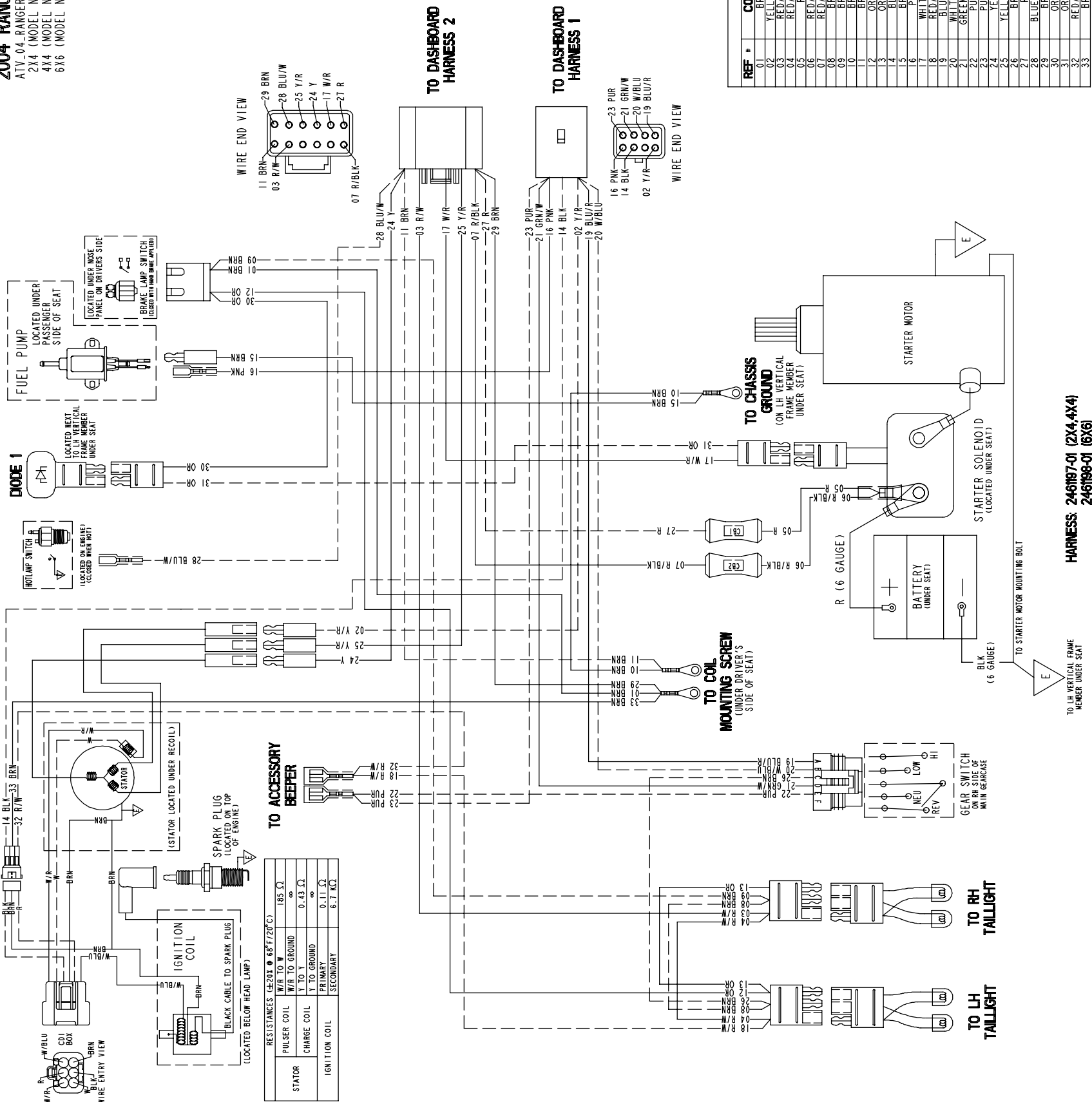
BLK	=	BLACK
BRN	=	BROWN
GRN	=	GREEN
PUR	=	PURPLE
BLU	=	BLUE
GRY	=	GRAY
OR	=	ORANGE
Y	=	YELLOW
R	=	RED
W	=	WHITE

 ENGINE GROUND

 CHASSIS GROUND

TWO COLOR WIRES ARE SHOWN WITH
MAIN/TRACE COLORS. EXAMPLE:
R/Y = RED WITH YELLOW TRACER

NC = SWITCH NORMALLY CLOSED
NO = SWITCH NORMALLY OPEN



REF #	COLOR	WIRE TERMINATION TABLE	FROM CONNECTOR	TO CONNECTOR
01	BROWN	BRK/ PRESSURE SWITCH	COIL MOUNTING SCREW	
02	YELLOW/RED	DASH HARNSS	STARTER SOLENOID (+)	
03	RED/WHITE	DASH HARNSS	STARTER SOLENOID (-)	
04	RED/WHITE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
05	RED	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
06	RED/BLACK	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
07	RED/BLACK	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
08	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
09	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
10	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
11	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
12	ORANGE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
13	ORANGE	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
14	BLACK	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
15	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
16	PINK	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
17	WHITE/RED	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
18	RED/WHITE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
19	BLUE/RED	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
20	WHITE/BLUE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
21	GREEN/WHITE	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
22	PURPLE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
23	PURPLE	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
24	YELLOW	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
25	YELLOW/RED	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
26	RED	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
27	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
28	BLUE/WHITE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
29	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
30	ORANGE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
31	ORANGE	COIL MOUNTING SCREW	STARTER SOLENOID (-)	
32	RED/WHITE	COIL MOUNTING SCREW	STARTER SOLENOID (+)	
33	BROWN	COIL MOUNTING SCREW	STARTER SOLENOID (-)	

HARNESSES: 2461197-01 (2X4,4X4)
2461198-01 (6X6)

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