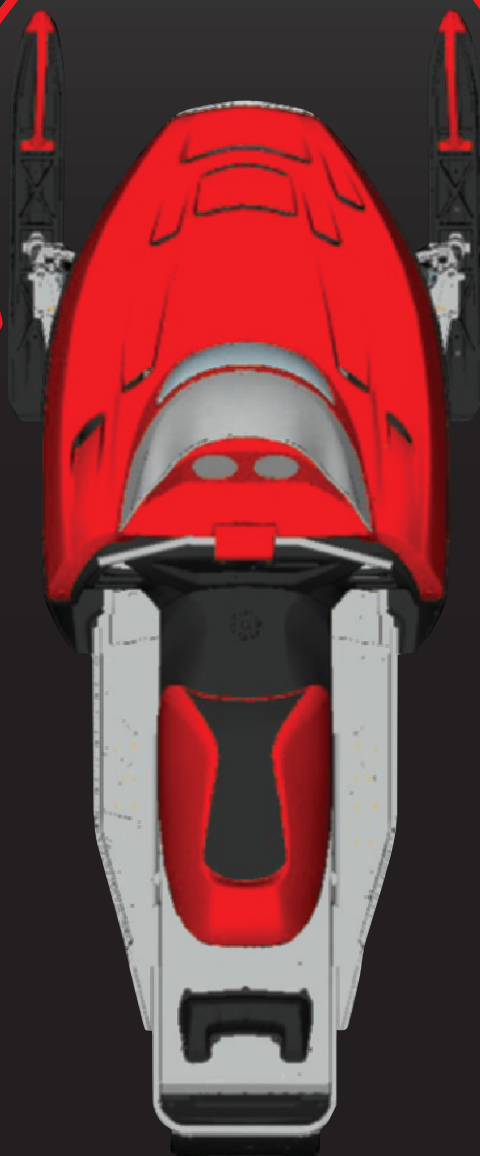


*2003 PRO X*

*SERVICE MANUAL*

**PRO**





**POLARIS®**  
**The Way Out.**



# **HIGH PERFORMANCE SERVICE MANUAL**

## **Foreword**

This manual is designed primarily for use by Polaris snowmobile 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 440 PRO X Fan, 440 PRO X, 600 PRO X, 700 PRO X, 800 PRO X Polaris snowmobiles. 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.

**High Performance Snowmobile Service Manual (PN 9918053)**



## 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 snowmobile.



### **WARNING**

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

### **CAUTION:**

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

### **NOTE:**

A NOTE provides key information to clarify instructions.

## Trademarks

**Polaris acknowledges the following products mentioned in this manual:**

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Willwood, Trademark of the Willwood Corporation  
Walker Evans Racing Shocks, Trademark of the Walker Evans Ent.

## **Foreword**

Welcome to the 2002–2003 Polaris Racing season! Thank you for selecting Polaris as your racing vehicle.

The enclosed technical information, which is based on our past experience, should be reviewed by your team for machine preparation. Do not feel that these suggestions are a must, but use them as a starting point. This information has been outlined with reference to the sections in our 2002 Snowmobile Service Manuals. You will want to refer to them regularly to ensure correct procedures are followed.

The section index enables the user to quickly locate the component unit section desired. A table of contents is placed at the beginning of each chapter to aid the user in locating general areas of information. Keep this manual available for reference.

In order to provide you with the best support possible, Polaris racing, engineering, and testing department personnel must have timely and accurate data from the field. The weekly racing report form is a valuable source of this data. As a part of the Polaris team, your input is highly valued and *never* ignored.

At Polaris, we are committed to your racing effort. We wish you the best of luck in the season ahead!

Please visit our website for updated information throughout the racing season.

When at the home page (<http://www.polarisindustries.com>) click on “Snowmobiles” and then “Racing” for updated information throughout the race season.

## **Race Support Contacts**

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Phone: (715) 355-5157

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Dennis Weinke

Phone: (715) 355-3008

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# **CHAPTER 1**

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## **GENERAL**

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## PRO X Introduction

Polaris' new Pro X models have been designed and tested to endure the toughest of all races. Many hours, days and months of testing have gone into development, and engineering has decided to use a predetermined weight rider and snow cross racing for stock setup. After uncrating your machine, be sure to test ride so setup can be determined for your riding style and characteristics. The following are setup tips for your brand new Pro X snowmobile.

1. Stock suspension setup for the PRO X units is geared to a 170 lb (77.18 kg) pro rider.
2. Stock carburetion, clutching and gearing is for 0-3000 ft. (0-900 m).
3. In this manual, there are numerous optional springs, optional carburetor jets, optional clutch weights, and optional gears to suit your riding preference and location. When changing to optional parts, always test what you have done. Do not be afraid to experiment.
4. Be sure to use good quality traction products and pattern to maximize your traction and safety.

## Break-in

The new PRO X units are high performance snowmobiles, and break-in is a vital step to ensure the performance of your machine will be at its peak.

1. Always break-in any new part for 50-75 miles before using it for racing.
2. Clutch springs and belts need to be broken in to reach their peak in performance.
3. On the 440 Pro X, always use the correct type of fuel for the timing system you are using.
4. Pre mix 20:1 on break in and 32:1 after break in on the 440 Pro X liquid only.
5. Always use the recommended Polaris oil for your snowmobile.
6. Always break-in a new or rebuilt engine to ensure durability.
7. Maintain your exhaust valves frequently to ensure they are operating to their fullest capability.

## Two-Cycle Engine Fuel / Oil ratio chart

To figure out the correct fuel to oil ratio per gallon, you will need to use the formula below:

Example of a Fuel/Oil Ratio of 20:1

$128 \text{ (ounces of fuel in a gallon)} \div 20 \text{ (for the ratio)} = 6.4\text{oz. of oil needed for 1 gallon of fuel.}$

The correct way to mix the oil and fuel together is to have a fuel container 1/2 full of the amount of fuel that you are wanting to mix. Weigh the oil in a plastic cup to the desired weight ratio, and empty it into the fuel container and mix. Then empty the remaining fuel into the container and mix thoroughly once more.

Two-Cycle Engine Fuel / Oil Ratio Chart		
Gallons of Engine Fuel	20:1	32:1
1	6	4
2	13	8
3	19	12
4	26	16
5	32	20
6	38	24

## Trail Set Up

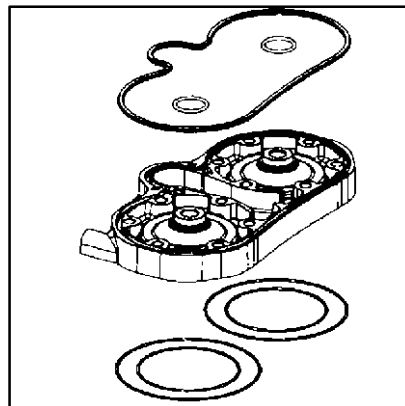
All 2003 440 Pro X Liquid units that are sold for trail use will need to have Head Kit PN 2202188 installed before the customer rides the sled. This Head Kit is designed to run on Premium 92 octane non-oxygenated fuel. **To keep the warranty valid, this Head Kit must be in place on the 440 Pro X Liquids that will be sold for trail use.** The 440 Pro X Liquid comes stock with a high compression head that requires 110 Octane fuel. **If the head is not changed for Premium 92 octane fuel, engine damage will occur. Warranty claims will not be accepted for damage that occurs on trail use 2003 440 Pro X Liquid models if this procedure is not performed.**

**NOTE:** Head assembly PN 2202188 is not legal for ISR sanctioned race use.

### Parts Required: Kit-92 Octane Cylinder Head PN 2202188

All parts required to perform this installation are included with kit **PN 2202188**. Parts included are (1) Head PN 3021343, O-ring PNs 5411199, 5411359, 5411411, Rubber Seal PN 5411465, Thermostat Gasket PN 5830113, and clutch weights for use at 0-3000 ft (3) PN 1321730. **Please follow the instructions, clutching, and jetting recommendations included in the kit. Jets are not included in this kit and are not warrantable.**

Please install this Head Kit PN 2202188 on all 440 Pro X Liquid models that will be used for trail riding.



The installation of this kit must be performed by an authorized Polaris dealer.

## 2003 440 Pro X 92 Octane Jetting Chart

Altitude		AMBIENT TEMPERATURE					
		Below -30°F Below -34°C	-30° to -10°F -34° to -23°C	-10° to +10°F -23° to -12°C	+10° to +30°F -12° to -1°C	+30° to +50°F -1° to +10°C	Above +50°F Above +10°C
Meters (Feet)	0-600 (0-2000)	380 #4	360 #4	350 #3	340 #3	320 #3	310 #2
	600-1200 (2000-4000)	360 #4	340 #3	330 #3	320 #3	300 #2	290 #2
	1200-1800 (4000-6000)	340 #3	320 #3	310 #3	290 #2	280 #2	270 #2
	1800-2400 (6000-8000)	320 #3	300 #3	290 #2	270 #2	260 #2	250 #2
	2400-3000 (8000-10000)	290 #3	280 #2	270 #2	250 #2	240 #2	220 #2
	3000-3700 (10000-12000)	270 #2	260 #2	250 #2	230 #2	220 #2	200 #2

**Publication Numbers**

Model	Model No.	Owner's Manual Supplement	Parts Manual	Parts Microfiche
440 Pro X Fan	S03NX4FS	9917620	9917817	9917818
440 Pro X	S03NX4CS	9917619	9917815	9917816
600 Pro X	S03NX6ES	9917621	9917819	9917820
700 Pro X	S03NX7CS	9917622	9917821	9917822
800 Pro X	S03NX8CS	9917623	9917823	9917824

2003 Snowmobile Owner's Manual (All) - 9917436

**2003 Service Manuals**

<b>2000-2003 120 XC SP</b>	9918046
<b>Trail Sport</b> Super Sport, 340 EDGE, 340 Classic, 500, 440 PRO X FAN	9918048
<b>Touring</b> Wide Trak LX, 340 Touring, Sport Touring, Trail Touring, 500 Classic Touring, 600 Classic Touring, 700 Classic Touring	9918047
<b>Frontier</b> Frontier Classic, Frontier Touring	9918050
<b>Trail Luxury</b> 340 Classic EDGE, 500 Classic, 550 Classic, 600 Classic, 700 Classic	9918049
<b>Deep Snow</b> Trail RMK, 600/700/800 RMK, 700/800 SKS	9918051
<b>Performance</b> 500 XC, 500/600/700/800 XC SP, 800 XCR	9918052
<b>High Performance</b> 440 PRO X FAN, 440, 600, 700, 800 PRO X	9918053
<b>Wallcharts</b>	9918054
<b>Track Poster</b>	9918459





**MODEL:** ..... **440 PRO X Fan**  
**MODEL NUMBER:** . **S03NX4FS**  
**ENGINE MODEL:** .. **EC45PM040**

## ELECTRICAL

Flywheel I.D. .... IG3792  
 CDI Marking ..... CU7235  
 Alternator Output ... 240 Watts @ 4000 RPM  
 Ignition Timing ..... 28° BTDC@3000RPM±1.5°  
                                   9° BTDC@7500RPM±1.5°  
 Spark Plug / Gap ... NGK BR9ES / 0.028" (0.7mm)  
 Lights: Head ..... 2 60 High/55 Low  
         Tail ..... 2@3 watts  
         Brake ..... 18 watts  
 Voltage Regulator .. LR7  
 Electric Start ..... N/A

## CAPACITIES

Fuel Tank ..... 11.8 Gal. (45.4 L)  
 Oil Tank ..... 3.5 Quarts (3.3 L)  
 Coolant ..... N / A  
 Chaincase Oil ..... 8 oz.

## SUSPENSION / CHASSIS

Body Style ..... Pro X  
 Front Suspension .. Pro X  
 IFS Shocks ..... Ryde FX™  
 IFS Spring Rate .... 90/180#/in.  
 Front Spring Preload 2.8" Thread Adjust  
 Front Vertical Travel 9.22" (23.4 cm..)  
 Rear Suspension ... Pro X  
 Rear Travel ..... 13.9" (35.3 cm..)  
 Front Track Shock .. Ryde FX™  
 Spring Rate ..... 190#/in.  
 Rear Track Shock .. Ryde FX™ IFP Clicker  
 Rear Springs ..... .347" / 77°  
 Track Type ..... 15"x121"x.82" (38.1x307.34x2.08cm..)  
 Track Tension ..... 1 1/2" (38mm) slack with 10# (4.54kg) weight 16" (40.64cm..) ahead of rear idler shaft

## CHAINCASE

Sprockets / Chain ... 21:41, 74 P HYVO  
 Reverse ..... Option  
 Brake Pads ..... HayesType 81  
 Chaincase Center Dist. 7.92" (20.12cm.)  
 Driveshaft Sprockets . 2 Drivers  
 Brake Type ..... Polaris HPB

## OPTIONAL REAR TORSION SPRINGS

### 440 Pro X Fan Rear Torsion Springs

SOFT	(STD)	FIRM
.347"(sq.) diameter/77°	.347"(sq.) diameter/77°	.359"(sq.) diameter/77°
L.H. 7042159-067	L.H. 7042101-067	L.H. 7042157-067
R.H. 7042160-067	R.H. 7042102-067	R.H. 7042158-067

**MODEL: ..... 440 PRO X**  
**MODEL NUMBER: . S03NX4CS**  
**ENGINE MODEL: .. S2424-4460PA4C**

## CARBURETION

Type .....	TMX-34 Mikuni
Main Jet .....	290
Pilot Jet .....	35
Jet Needle .....	6GL67-61-3
Needle Jet .....	Q-8 (Fixed)
Cutaway .....	2.5
Air Screw .....	.5 Turns
Valve Seat .....	1.5 Viton
Starter Jet .....	1.5
Fuel Octane w/o Ethanol	110 Oct.minimum
Throttle Gap	
Under Cutaway .....	.098" (2.5 mm)
Exhaust Valve Spring	Red/White

Altitude		AMBIENT TEMPERATURE					
		Below -30°F Below -34°C	-30° to -10°F -34° to -23°C	-10° to +10°F -23° to -12°C	+10° to +30°F -12° to -1°C	+30° to +50°F -1° to +10°C	Above +50°F Above +10°C
Meters (Feet)	0-600 (0-2000)	310 #3	300 #3	290 #3	280 #3	270 #2	260 #2
	600-1200 (2000-4000)	300 #3	280 #3	270 #3	260 #3	250 #2	240 #2
	1200-1800 (4000-6000)	280 #3	270 #3	260 #3	240 #2	230 #2	220 #2
	1800-2400 (6000-8000)	260 #3	250 #3	240 #2	230 #2	210 #2	200 #2
	2400-3000 (8000-10000)	240 #2	230 #2	220 #2	210 #2	200 #2	190 #2
	3000-3700 (10000-12000)	230 #2	210 #2	200 #2	190 #2	180 #2	170 #2

XXX  
#X

- # refers to the clip position from top of jet needle.

## CLUTCH

Type .....	P-85
Belt .....	3211080
Belt Width (Projected) .	1.438" (34.93mm)
Side Angle (Overall) ..	28°
Outside Circumference	46.625" (118.43cm..)
Center Distance .....	11.5" (305mm)
Shift Weights .....	S-51H
Primary Spring .....	Almond/Red
Secondary Spring ....	Red/Blue 140/200
Driven Helix .....	70/44 - .46 (66/44 - .46)

**Production=290 Main jet for 0°F at 0-1000 feet w/110 Octane non-ethanol fuel, the key switch is removed or in the 110 octane position, and the timing curve in position “D”.**

## CLUTCH CHART

Altitude		DRIVE		DRIVEN		
		Shift Weight	Clutch Spring	Clutch Spring	Driven Helix	Chaincase Gearing
Meters (Feet)	0-900 (0-3000)	S-51H	Almond Red	140/200 Red/Blue	70/44 .46	19:43 74P
	900-1800 (3000-6000)	S-49H	Almond Red	140/200 Red/Blue	70/44 .46	19:43 74P
	1800-2700 (6000-9000)	S-47H	Almond Red	140/200 Red/Blue	70/44 .46	19:43 74P
	2700-3600 (9000-12000)	S-45H	Almond Red	140/200 Red/Blue	62/40 .46	19:43 74P

## ENGINE

Type .....	Liquid Cooled Case Reed w/V.E.S.
Displacement .....	438 cc
Bore .....	2.598" (66mm)
Stroke .....	2.520" (64mm)
Piston / Cylinder Clearance ...	0.0023" - 0.0037"(0.06 - 0.095mm)
Service Limit .....	0.0059" (0.15mm)
Piston Marking .....	EK2185/28
Piston Ring Marking .....	3021303
Piston Ring End Gap .....	.012"-.018"(.30-.45mm)
Operating RPM±200 .....	8500 RPM
Idle RPM±200 .....	1500 RPM
Engagement RPM±300 .....	5500 RPM
Cylinder Head Torque .....	20-24 ft.lbs(2.8-3.3 kgm)
Cylinder Base Nut Torque ....	30-34 ft.lbs(4.15-4.7 kgm)
Crankcase Torque (8mm) ....	20-24 ft.lbs(2.8-3.3 kgm)
Crankcase Torque (10mm) ...	N/A
Flywheel Torque .....	90 ft.lbs(12.4 kgm)

**MODEL: ..... 440 PRO X**  
**MODEL NUMBER: . S03NX4CS**  
**ENGINE MODEL: . S2424-4460PA4C**

## ELECTRICAL

Flywheel I.D. ....	4010629	Fuel Tank .....	
CDI Marking .....	4010861	Oil Tank .....	
Alternator Output ...	280 Watts	Coolant .....	
Ignition Timing .....	12° BTDC@1750RPM in “D” Curve	Chaincase Oil ...	
	.with pipe sensor unplugged		
Spark Plug / Gap ...	Champion RN-57YCC / 0.025” (0.64mm)	PN 3070190	
Lights: Head .....	2 60High/55Low		
Tail .....	2@2 watts		
Brake .....	1@17 watts		
Voltage Regulator ..	T1		
Electric Start .....	N/A		

## CAPACITIES

Fuel Tank	5 Gal. (18.9 L)
Oil Tank	N/A ( <b>PRE MIX 32:1</b> )
Coolant	4 Quarts (3.78 L)
Chaincase Oil	9 oz.

## SUSPENSION / CHASSIS

Body Style . . . . .	PRO X	Sprockets / Chain . . .	19:43-74 P HYVO
Front Suspension . .	PRO X	Reverse . . . . .	N/A
IFS Shocks . . . . .	Walker Evans Alum IFP	Brake Pads . . . . .	Hayes Type 81
. . . . .	Comp Adjust w/ Res.	Chaincase Center Dist.	7.92" (20.12cm.)
IFS Spring Rate . . .	74/165#/in.	Driveshaft Sprockets .	2 Drivers-wide
Front Spring Preload	3.75" Thread Adjust	Brake Type . . . . .	Hayes
Front Vertical Travel	9.22" (23.42 cm.)		
Rear Suspension . . .	PRO X		
Rear Travel . . . . .	13.90" (35.31 cm..)		
Front Track Shock . .	Walker Evans Alum IFP		
. . . . .	Comp Adjust w/ Res.		
Spring Rate . . . . .	160#/in.		
Rear Track Shock . .	Walker Evans Alum IFP		
. . . . .	Comp Adjust w/ Res.		
Rear Springs . . . . .	.347" (sq.) / 77°		
Track Type . . . . .	14"x121"x1.625" (35.6 x 307.34 x 4.12cm..)		
Track Tension . . . . .	1 1/2" (38mm) slack with 10# (4.54kg) weight 16" (40.64cm..) ahead of rear idler shaft		

## CHAINCASE

Sprockets / Chain ... 19:43-74 P HYVO  
Reverse ..... N/A  
Brake Pads ..... Hayes Type 81  
Chaincase Center Dist. 7.92" (20.12cm.)  
Driveshaft Sprockets . 2 Drivers-wide  
Brake Type ..... Hayes

## OPTIONAL REAR TORSION SPRINGS

## 440 Pro X Rear Torsion Springs

SOFT	(STD)	FIRM
.347"(sq.) diameter/77°	.347"(sq.) diameter/77°	.359"(sq.) diameter/77°
L.H. 7042159-067	L.H. 7042101-067	L.H. 7042157-067
R.H. 7042160-067	R.H. 7042102-067	R.H. 7042158-067



**MODEL:** ..... **600 PRO X**  
**MODEL NUMBER:** ... **S03NX6ES**  
**ENGINE MODEL:** .... **S2392-6044PA6E**

**ELECTRICAL**

Flywheel I.D. .... 4010677  
 CDI Marking ..... 4010715  
 Alternator Output ... 280 Watts  
 Ignition Timing ..... 24° BTDC@3500RPM±500 RPM  
                                 With TPS unplugged  
                                 0.1350"  
                                 3.430mm  
 Spark Plug / Gap ... Champion RN57YCC / 0.025" (0.64mm)  
 Voltage Regulator .. T1  
 Electric Start ..... N/A  
 Magneto Pulses .... 6

**CAPACITIES**

Fuel Tank ..... 11.8 gallons (44.7 liters)  
 Oil Tank ..... 3.25 quarts (3.1 liters)  
 Coolant ..... 4 quarts (3.8 liters)  
 Chaincase Oil ..... 11 fl. oz.(325cc)/  
                                 w/Reverse13fl.oz (384cc)

**SUSPENSION / CHASSIS**

Body Style ..... PRO X™  
 Front Suspension .. PRO X™  
 IFS Front Shocks ... Alum IFP  
 IFS Spring Rate .... 90/180#/in.  
 Front Spring Preload 2.75" Thread Adjust  
 Front Vertical Travel 9.22" (23.4cm..)  
 Rear Suspension ... PRO X™  
 Rear Axle Travel ... 13.86"(35.2cm..)  
 Front Track Shock .. Ryde FX IFP w/ R/R  
 Spring Rate ..... 160#  
 Rear Track Shock .. Ryde Fx IFP R/R (Preload 1.75")  
 Rear Torsion Springs .359" (sq.) / 77°  
 Track Type ..... 15"x121"x1" (38.1x307.34x2.54cm..)  
 Track Tension ..... 3/8" - 1/2" (1-1.3 cm..) slack with 10# (4.54kg) weight 16" (40.64cm..) ahead of rear idler shaft.  
 Overall Snowmobile Length ..... 110" (279cm..)  
 Overall Snowmobile Height ..... 46" (117cm..)  
 Maximum Snowmobile Width ..... 48" (122cm..)

**CHAINCASE**

Sprockets / Chain ... 23:39-74P HYVO  
 Reverse ..... Option  
 Brake Pads ..... Type 81  
 Chaincase Center Dist.7.92" (20.12cm..)  
 Driveshaft Sprockets . 2 Drivers Wide  
 Brake Type ..... Polaris HPB, Liquid Cooled

**OPTIONAL REAR TORSION SPRINGS**

<b>SOFT</b>	<b>MEDIUM(STD)</b>	<b>FIRM</b>
<b>.347"(Sq.) Diameter x 77°</b>	<b>.359"(Sq.) Diameter x 77°</b>	<b>.405"(Sq.) Diameter x 77°</b>
L.H. 7042101-067	L.H. 7042157-067	L.H.7042240-067
R.H. 7042102-067	R.H. 7042158-067	R.H.7042240-067

MODEL: ..... 700 PRO X  
MODEL NUMBER: . S03NX7CS  
ENGINE MODEL: .. S2378-7070PA7C

## CARBURETION

Type .....	TM40 Mikuni
Main Jet .....	440
Pilot Jet .....	45
Jet Needle .....	J8-9DGN5-57-3
Needle Jet .....	P-8
Cutaway .....	1.5
Fuel Screw .....	2.25 Turns
Valve Seat .....	1.8
Fuel Octane (R+M/2) .	87 Non-Oxygenated 89 Oxygenated
Throttle Gap	
Under Cutaway .....	.0787" (2.0mm)
Starter Jet .....	145
Pilot Air Jet .....	N/A
Air Screw	1.25
Exhaust Valve Spring .	Green/Yellow

Type .....	P-85
Belt .....	3211080
Belt Width (Projected) .	1.438" (36.52mm)
Side Angle (Overall) ..	28°
Outside Circumference	46.625"
Center Distance .....	11.50"
Shift Weights .....	10-62
Primary Spring .....	Black / Green
Secondary Spring ....	Black/Red
Driven Helix .....	Team 62-42/ 46

Altitude		DRIVE		DRIVEN		
		Shift Weight	Clutch Spring	Clutch Spring	Driven Helix	Chaincase Gearing
Meters (Feet)	0-900 (0-3000)	10-62	Black / Green	Black / Red	62-42/.46	25-41 76P HYVO
	900-1800 (3000-6000)	10-60	Black / Green	Black / Red	62-42/.46	25-41 76P HYVO
	1800-2700 (6000-9000)	10-58	Black / Green	Black / Red	62-40/.46	23-39 74P HYVO
	2700-3700 (9000-12000)	10-56	Black / Green	Black / Red	62-40/.46	23-39 74P HYVO

- Production Setting

Type .....	Liquid Cooled Case Reed Twin
Displacement .....	701cc
Bore .....	3.1889" (81mm)
Stroke .....	2.6772" (68mm)
Piston / Cylinder Clearance ...	0.0047" - 0.0060" (0.12 - 0.15mm)
Service Limit .....	0.0060" (0.15mm)
Piston Marking .....	3021307
Piston Ring Marking .....	N/A
Piston Ring End Gap .....	.012mm
Head ccs (Uninstalled) .....	37cc
Head ccs (Installed) .....	29.5 - 30.5cc
Operating RPM±200 .....	8100 RPM
Idle RPM±200 .....	1400 RPM
Engagement RPM±200 .....	3500 RPM
Cylinder Head Torque .....	18-22 ft.lbs. (25-30 Nm)
Cylinder Base Nut Torque ...	30-34 ft.lbs. (41-47 Nm)
Crankcase Torque (8mm) .....	20-24 ft.lbs. (28-33 Nm)
Crankcase Torque (10mm) ...	26-30 ft.lbs. (36-42 Nm)
Flywheel Torque .....	90 ft.lbs. (124 Nm)

Fuel Pump Manuf. ....	N/A
Fuel Pump Mark .....	N/A
Oil Pump Manuf. ....	Mikuni
Oil Pump Mark .....	2540102
Cylinder Head Mark ....	3021342

**MODEL: ..... 700 PRO X**  
**MODEL NUMBER: . S03NX7CS**  
**ENGINE MODEL: .. S2378-7070PA7C**

**ELECTRICAL**

Flywheel I.D. .... 4010677  
 CDI Marking ..... 4010749  
 Alternator Output ... 280 Watts  
 Ignition Timing ..... 18° BTDC@2750RPM±1.5°  
                                     with TPS unplugged.  
                                     0.0815"  
                                     2.0705mm  
 Spark Plug / Gap ... Champion RN57YCC / 0.025" (0.64mm)  
 Voltage Regulator .. T1  
 Electric Start ..... N/A  
 Magneto Pulses .... 6

**CAPACITIES**

Fuel Tank ..... 11.8 gallons (44.7 liters)  
 Oil Tank ..... 3.25 quarts (3.1 liters)  
 Coolant ..... 4 quarts (3.8 liters)  
 Chaincase Oil ..... 11 fl. oz.(325cc)

**SUSPENSION / CHASSIS**

Body Style ..... PRO X  
 Front Suspension .. PRO X  
 IFS Shocks ..... Alum IFP/Threaded  
 IFS Spring Rate .... 90/180#/in.  
 Front Spring Preload 2.75" Thread Adjust  
 Front Vertical Travel 9.22" (23.4cm..)  
 Rear Suspension ... PRO X™  
 Rear Axle Travel ... 13.86"(35.2cm..)  
 Front Track Shock .. Ryde FX IFP w/ R/R (Preload 1.75")  
 Spring Rate ..... 160#  
 Rear Track Shock .. Ryde Fx IFP R/R  
 Rear Torsion Springs .359" (sq.) / 77°  
 Track Type ..... 15"x121"x1" (38.1x307.34x2.54cm..)  
 Track Tension ..... 3/8" - 1/2" (1-1.3 cm..) slack with 10# (4.54kg) weight 16" (40.64cm..) ahead of rear idler shaft.  
 Overall Snowmobile Length ..... 110" (279cm..)  
 Overall Snowmobile Height ..... 46" (117cm..)  
 Maximum Snowmobile Width ..... 48" (122cm..)

**CHAINCASE**

Sprockets / Chain ... 25:41-76 P HYVO  
 Reverse ..... Option  
 Brake Pads ..... Type 81  
 Chaincase Center Dist 7.92" (20.12cm..)  
 Driveshaft Sprockets . 2 Drivers Wide  
 Brake Type ..... Polaris HPB, Liquid Cooled

**OPTIONAL REAR TORSION SPRINGS**

<b>SOFT</b>	<b>MEDIUM(STD)</b>	<b>FIRM</b>
<b>.347"(Sq.) Diameter x 77°</b>	<b>.359"(Sq.) Diameter x 77°</b>	<b>.405"(Sq.) Diameter x 77°</b>
L.H. 7042101-067	L.H. 7042157-067	L.H.7042240-067
R.H. 7042102-067	R.H. 7042158-067	R.H.7042240-067

## GENERAL INFORMATION

MODEL: ..... 800 PRO X  
 MODEL NUMBER: . S03NX8CS  
 ENGINE MODEL: .. S2398-8070PA8C

### JETTING CHART

Altitude		AMBIENT TEMPERATURE					
		Below -30°F Below -34°C	-30° to -10°F -34° to -23°C	-10° to +10°F -23° to -12°C	+10° to +30°F -12° to -1°C	+30° to +50°F -1° to +10°C	Above +50°F Above +10°C
Meters (Feet)	0-600 (0-2000)	490 #5	470 #4	450 #4	430 #4	410 #3	400 #3
	600-1200 (2000-4000)	460 #4	440 #4	420 #4	410 #3	390 #3	370 #3
	1200-1800 (4000-6000)	430 #4	410 #4	400 #3	380 #3	360 #3	340 #3
	1800-2400 (6000-8000)	410 #4	390 #3	370 #3	350 #3	330 #3	320 #2
	2400-3000 (8000-10000)	380 #3	360 #3	340 #3	320 #3	310 #2	290 #2
	3000-3700 (10000-12000)	350 #3	330 #3	320 #3	300 #2	280 #2	260 #2

XXX  
#X

- # refers to the clip position from top of jet needle.

### CLUTCH CHART

Altitude		DRIVE		DRIVEN		
		Shift Weight	Clutch Spring	Clutch Spring	Driven Helix	Chaincase Gearing
Meters (Feet)	0-900 (0-3000)	10-64	Black/Green	Black/Red	62-46/ .46	25-40 76P HYVO
	900-1800 (3000-6000)	10-62	Black/Green	Black/Red	62-46/ .46	25-41 76P HYVO
	1800-2700 (6000-9000)	10-60	Black/Green	Black/Red	62-44/ .46	23-39 74P HYVO
	2700-3700 (9000-12000)	10-58	Black/Green	Black/Red	62-44/ .46	23-39 74P HYVO

- Production Setting

### CARBURETION

Type ..... TM 40 Mikuni  
 Main Jet ..... 450  
 Pilot Jet ..... 45  
 Jet Needle ..... J8-9DGN5-57/4  
 Needle Jet ..... P-8  
 Cutaway ..... 2.0  
 Fuel Screw ..... 1.75 Turns Out  
 Valve Seat ..... 1.8  
 Fuel Octane (R+M/2) . Key Switch Adj.  
   91 Premium  
   89 Regular  
 Throttle Gap  
 Under Cutaway ..... .0787" (2.0mm)  
 Starter Jet ..... 135  
 Pilot Air Jet ..... N/A  
 Air Screw ..... 1.5  
 Exhaust Valve Spring Pink/Yellow

### CLUTCH

Type ..... P-85  
 Belt ..... 3211080  
 Belt Width (Projected) . 1.438" (36.52mm)  
 Side Angle (Overall) . . 28°  
 Outside Circumference 46.625"  
 Center Distance ..... 11.50"  
 Shift Weights ..... 10-64  
 Primary Spring ..... Black/Green  
 Secondary Spring ..... Black/Red  
 Driven Helix ..... Team 62-46/.46

### ENGINE

Type ..... Liquid Cooled Case Reed Twin  
 Displacement ..... 794cc  
 Bore ..... 3.3464" (85mm)  
 Stroke ..... 2.7559" (70mm)  
 Piston / Cylinder Clearance ... 0.006" - 0.0074" (0.15 - 0.188mm)  
 Service Limit ..... 0.0074" (0.188mm)  
 Piston Marking ..... 3021184  
 Piston Ring Marking ..... N/A  
 Piston Ring End Gap ..... 0.016" - 0.022" (0.41 - 0.56mm)  
 Head ccs (Uninstalled) ..... 45.7±0.5cc  
 Head ccs (Installed) ..... 32.2±0.5cc  
 Operating RPM±200 ..... 8000 RPM  
 Idle RPM±200 ..... 1400 RPM  
 Engagement RPM±200 ..... 3800 RPM  
 Cylinder Head Torque ..... 18-22 ft.lbs. (25-30 Nm)  
 Cylinder Base Nut Torque .... 30-34 ft.lbs. (41-47 Nm)  
 Crankcase Torque (10mm) .... 26-30 ft.lbs. (36-41 Nm)  
 Flywheel Torque ..... 90 ft.lbs. (124 Nm)

Fuel Pump Manuf. .... N/A  
 Fuel Pump Mark ..... N/A  
 Oil Pump Manuf. .... Mikuni  
 Oil Pump Mark ..... 2540102  
 Cylinder Head Mark .... 3021324



**MODEL: ..... 800 PRO X**  
**MODEL NUMBER: . S03NX8CS**  
**ENGINE MODEL: .. S2398-8070PA8C**

**ELECTRICAL**

Flywheel I.D. .... 4010677  
 CDI Marking ..... 4010750  
 Alternator Output ... 280 Watts  
 Ignition Timing ..... 29° BTDC@3500RPM  
                               with TPS unplugged  
                               0.2146"  
                               5.4510mm  
 Spark Plug / Gap ... Champion RN57YCC / 0.025" (0.64mm)  
 Voltage Regulator .. T1  
 Electric Start ..... N/A  
 Magneto Pulses .... 6

**CAPACITIES**

Fuel Tank ..... 11.8 gallons (44.7 liters)  
 Oil Tank ..... 3.25 quarts (3.1 liters)  
 Coolant ..... 4 quarts (3.8 liters)  
 Chaincase Oil ..... 11/13 fl. oz.(325cc)

**SUSPENSION / CHASSIS**

Body Style ..... PRO X  
 Front Suspension .. PRO X  
 IFS Shocks ..... Alum IFP/Threaded  
 IFS Spring Rate .... 90/180#/in.  
 Front Spring Preload 2.75" Thread Adjust  
 Front Vertical Travel 9.22" (23.4cm..)  
 Rear Suspension ... PRO X™  
 Rear Axle Travel ... 13.86"(35.2cm..)  
 Front Track Shock .. Ryde FX IFP w/ R/R (Preload 1.75")  
 Spring Rate ..... 160#  
 Rear Track Shock .. Ryde Fx IFP R/R  
 Rear Torsion Springs .359" (sq.) / 77°  
 Track Type ..... 15"x121"x1" (38.1x307.34x2.54cm..)  
 Track Tension ..... 3/8" - 1/2" (1-1.3 cm..) slack with 10# (4.54kg) weight 16" (40.64cm..) ahead of rear idler shaft.  
 Overall Snowmobile Length ..... 110" (279cm..)  
 Overall Snowmobile Height ..... 46" (117cm..)  
 Maximum Snowmobile Width ..... 48" (122cm..)

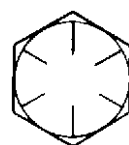
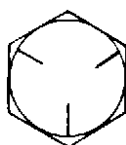
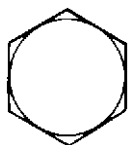
**CHAINCASE**

Sprockets / Chain ... 25:40-76 P HYVO  
 Reverse ..... Option  
 Brake Pads ..... Type 81  
 Chaincase Center Dist 7.92" (20.12cm..)  
 Driveshaft Sprockets . 2 Drivers Wide  
 Brake Type ..... Polaris HPB, Liquid Cooled

**OPTIONAL REAR TORSION SPRINGS**

SOFT	MEDIUM(STD)	FIRM
.347"(Sq.) Diameter x 77°	.359"(Sq.) Diameter x 77°	.405"(Sq.) Diameter x 77°
L.H. 7042101-067	L.H. 7042157-067	L.H.7042240-067
R.H. 7042102-067	R.H. 7042158-067	R.H.7042240-067

## GENERAL INFORMATION



Bolt Size	Threads/In (MM/Thread)	Grade 2	Grade 5	Grade 8
<b><u>Torque in. lbs. (Nm)</u></b>				
#10 -	24 .....	27 (3.1) .....	43 (5.0) .....	60 (6.9)
#10 -	32 .....	31 (3.6) .....	49 (5.6) .....	68 (7.8)
<b><u>Torque ft. lbs. (Nm)*</u></b>				
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)

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

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



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	

## GENERAL INFORMATION

Unit of Measure	Multiplied by	Converts to
ft. lbs.	x 12	= in. lbs.
in. lbs.	x .0833	= ft. lbs.
ft. lbs.	x 1.382	= Nm
in. lbs.	x .0115	= kg-m
Nm	x .7376	= ft.lbs.
kg-m	x 7.233	= ft. lbs.
kg-m	x 86.796	= in. lbs.
kg-m	x 10	= Nm
in.	x 25.4	=mm
mm	x .03937	= in.
in.	x 2.54	= cm..
mile (mi.)	x 1.6	= km
km	x .6214	= mile (mi.)
Ounces (oz)	x 28.35	= Grams (g)
Grams (g)	x 0.035	= Ounces (oz)
lb.	x .454	= kg
kg	x 2.2046	= lb.
Cubic inches (cu in)	x 16.387	= Cubic centimeters (cc)
Cubic centimeters (cc)	x 0.061	= Cubic inches (cu in)
Imperial pints (Imp pt)	x 0.568	= Liters (l)
Liters (l)	x 1.76	= Imperial pints (Imp pt)
Imperial quarts (Imp qt)	x 1.137	= Liters (l)
Liters (l)	x 0.88	= Imperial quarts (Imp qt)
Imperial quarts (Imp qt)	x 1.201	= US quarts (US qt)
US quarts (US qt)	x 0.833	= Imperial quarts (Imp qt)
US quarts (US qt)	x 0.946	= Liters (l)
Liters (l)	x 1.057	= US quarts (US qt)
US gallons (US gal)	x 3.785	=Liters (l)
Liters (l)	x 0.264	= US gallons (US gal)
Pounds - force per square inch (psi)	x 6.895	= Kilopascals (kPa)
Kilopascals (kPa)	x 0.145	= Pounds - force per square inch (psi)
Kilopascals (kPa)	x 0.01	= Kilograms - force per square cm..
Kilograms - force per square cm..	x 98.1	= Kilopascals (kPa)

°C to °F:  $9 (°C + 40) \div 5 - 40 = °F$

°F to °C:  $5 (°F + 40) \div 9 - 40 = °C$

**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

## GENERAL INFORMATION

**ACV:** Alternating current voltage.

**Air Gap Spark Test:** A good check for ignition voltage and general ignition system condition. Spark should arc 3/8" (1 cm..) minimum from end of high tension lead to ground. Several testers are available commercially.

**Alternator:** Electrical generator producing alternating current voltage.

**Bore:** Diameter of cylinder.

**BTDC:** Before Top Dead Center.

**Bump Steer:** When skis toe in and toe out through suspension travel.

**CDI:** Capacitor Discharge Ignition. Ignition system which stores voltage generated by the stator plate exciter coil in a capacitor or condenser (in CDI box). At the proper moment a voltage generated by the stator plate pulser coil closes an electronic switch (thermistor) in the CDI box and allows the voltage in the capacitor to discharge into the primary windings of the ignition coil.

**Center Cylinder:** On three cylinder engines, the cylinder between Mag and PTO ends.

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

**Chain Pitch:** Distance between chain link pins. Polaris measures chain length in number of pitches.

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

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

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

**Coil:** A winding of wire around an iron core which has the ability to generate an electrical current when a magnetic field passes through it.

**Combustion Chamber:** Space between cylinder head and piston dome at TDC.

**Compression:** Reduction in volume or squeezing of a gas.

**Condenser/Capacitor:** A storage reservoir for electricity, used in both E.T. and CDI systems.

**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 lower half of crankcase. Measure at various points especially at PTO. Maximum allowable run-out is .006" (.02 cm..).

**DCV:** Direct current voltage.

**Detonation:** The spontaneous ignition of the unburned fuel/air mixture after normal spark ignition. Piston looks "hammered" through, rough appearance around hole. Possible causes: 1) too high a compression ratio for the fuel octane; 2) low octane fuel; 3) over-advanced ignition timing; 4) lean fuel/air mixture.

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

**Displacement:** The volume of the cylinder displaced by the piston as it travels from BDC to TDC. The formula is:

$$\frac{\text{Bore}^2 \times \text{Stroke} \times 3.1416}{4} = \text{Displacement in CCs}$$

**Effective Compression Ratio:** Compression ratio measured from after the piston closes the exhaust port.

**Electrical Open:** Open circuit. An electrical circuit which isn't complete. (i.e. poor connections or broken wire at hi-lo beam switch resulting in loss of headlights.

**Electrical Short:** Short circuit. An electrical circuit which is completed before the current reaches the intended component. (i.e. a bare wire touching the snowmobile chassis under the seat resulting in loss of taillights and brake lights).

**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.

**E.T. Ignition:** Energy Transfer ignition. Generates primary ignition voltage through electro magnetic induction.



**Flat Head Bolt:** To be used where finished surfaces require a flush fastening unit. Countersunk.

**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.

**Head Volume:** Cylinder head capacity in cc, head removed from engine with spark plug installed.

**Heat Exchanger:** A device used to transfer heat. Mounted under running boards, they dissipate engine heat to the atmosphere.



**Hex Head Bolt:** Standard type of wrench-applied hexagon head, characterized by clean, sharp corners trimmed to close tolerances. Recommended for general commercial applications.

**Hi-Fax:** Trademark of Himont Advanced Materials. The special slide material which fits onto the bottom of the suspension rails.

**High Side:** Sled pushes or tips up.

**High Tension Wire:** The heavy insulated wire which carries the high secondary voltage from the coil to the spark plug.

**Hole Shot:** A term used when machine starts a race from a dead stop.

**Holed Piston:** Piston in which a hole has formed on the dome. Possible causes: 1) detonation; 2) pre-ignition.

**Ignition Coil:** A type of transformer which increases voltage in the primary windings (approx. 200V) to a higher voltage in the secondary windings (approx. 14KV - 32KV) through inductions. Secondary voltage is high enough to arc the air gap at the spark plug.

**Ignition Generating Coil:** Exciter coil, primary charge coil. Stator plate coil which generates primary ignition voltage. CDI system uses one ignition generating coil. Twin cylinder E.T. ignition systems use two ignition generating coils. Coil is mounted at the top of the stator plate.

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

**Kg/cm..2:** Kilograms per square centimeter. Metric equivalent of PSI.

**Keystone Ring:** A piston ring with bevel on upper inside surface.

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

**L Ring:** A wide face piston ring with an "L" shaped cross section. Leg of "L" goes up when installing on piston.

**Labyrinth Seal:** A pressure type center seal identified by series of grooves and lands. Polaris engines use this type of seal to separate the cylinders in the crankcase halves.

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

**Lighting Coil:** Generates voltage for lights, battery charging, etc by electromagnetic induction.

**Loose:** When the rear of the vehicle slides outward in a turn. The track does not grab sufficiently.

**mm:** Millimeter. Unit of length in the metric system. 1mm = .040".

**Mag End:** Flywheel side of engine.

**Magnetic Induction:** As a conductor (coil) is moved through a magnetic field, a voltage will be generated in the windings. This is how mechanical energy in our engines is converted to electrical energy in the lighting coil, ignition generating coils and trigger coil.

**Ohm:** The unit of electrical resistance opposing current flow.



**Oval Head Screw:** Fully specified as "oval countersunk", this head is identical to the standard flat head, but possesses a rounded upper surface for attractiveness of design.

**PTO End:** Power Take Off drive (clutch side).



**Pan Head Screw:** Provides a low, large diameter head, but with characteristically high outer edges along the outer edge of the head where driving action is most effective. Slightly different head contour when supplied with Phillips Recess. See dotted line.

**Piston Clearance:** Total distance between piston and cylinder wall.

**Piston Erosion:** Piston dome melts. Usually occurs at the exhaust port area. Possible causes: 1) lean fuel/air mixture; 2) improper spark plug heat range.



## GENERAL INFORMATION

**Pre-Ignition:** A problem in combustion where the fuel/air mixture is ignited before normal spark ignition. Piston looks melted at area of damage. Possible causes: 1) too hot a spark plug; 2) spark plug not properly torqued; 3) "glowing" piece of head gasket, metal burr or carbon in the combustion chamber; 4) lean fuel/air mixture; 5) Incorrect ignition timing.

**Primary Circuit:** This circuit is responsible for the voltage build up in the primary windings of the coil. Parts of this circuit include the exciter coil, points and condenser, wires from the stator plate to the small primary winding in the ignition coil. In the CDI system the parts include the exciter coil, the trigger coil, the wires from stator plate to CDI box and to the low resistance primary windings in the ignition coil.

**Primary Clutch:** Drive clutch on engine.

**Primary Compression:** Pressure built up in the crankcase of a two stroke engine.

**psi.:** Pounds per square inch.

**Pushing:** When the front of the vehicle does not steer as much as the driver desires. The skis do not grab sufficiently.

**R & R:** Remove and replace.

**RFI:** Radio Frequency Interference. Caused by high voltage from the ignition system. There are special plug caps and spark plugs to help eliminate this problem. Required in Canada.

**RPM:** Revolutions Per Minute.

**Relay Coils:** Electromagnetic device in an EFI system which controls circuit connection with input from another circuit.

**Resistance:** In the mechanical sense, friction or load. In the electrical sense, ohms. Both result in energy conversion to heat.

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



**Round Head Screw:** The familiar head most universally used for general application. Good slot depth, ample underhead bearing surface and finished appearance are characteristic of this head.

**Running Time:** Ignition timing when fully advanced or at specified RPM.

**Secondary Circuit:** This circuit consists of the large secondary coil windings, high tension wire and ground through the spark plug air gap.

**Secondary Clutch:** Driven clutch on chaincase or jackshaft.

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

**Self Steer:** Pulling the machine to the inside of the track.

**Spark Plug Reach:** Length of threaded portion of spark plug. Polaris uses 3/4" (2 cm..) reach plugs.

**Static Timing:** Ignition timing when engine is at zero RPM.

**Stator Plate:** The plate mounted under the flywheel supporting the primary ignition components and lighting coils.

**Stroke:** The maximum movement of the piston from bottom dead center to top dead center. It is characterized by 180° of crankshaft rotation.

**Surge Tank:** The fill tank in the liquid cooling system.

**TDC:** Top Dead Center. Piston's most outward travel from crankshaft.

**Transfer:** The movement of fuel/air from the crankcase to the combustion chamber in a two stroke engine.

**Trigger Coil:** Pulser coil. Generates the voltage for triggering (closing) the thyristor and timing the spark in CDI systems. Small coil mounted at the top of the stator plate next to the ignition generating coil.

**V Regulator:** Voltage regulator. Maintains maximum lighting coil output at approx. 14.5 ACV as engine RPM increases.

**Venturi:** An area of air constriction. A venturi is used in carburetors to speed up air flow which lowers pressure in venturi to below atmospheric pressure, causing fuel to be pushed through jets, etc., and into the venturi to be mixed with air and form a combustible air/fuel mixture.

**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.



## Service

In order to perform service work efficiently and to prevent costly errors, the technician should read the text in this manual, thoroughly familiarizing him/herself with procedures before beginning. Pictures and illustrations have been included with the text as an aid. Notes, cautions and warnings have also been included for clarification of text and safety concerns. However, a knowledge of mechanical theory, tool use and shop procedures is necessary to perform the service work safely and satisfactorily. Use only genuine Polaris service parts.

⚠ Cleanliness of parts and tools as well as the work area is of primary importance. Dirt and foreign matter will act as an abrasive and cause damage to precision parts. Clean the snowmobile before beginning service. Clean new parts before installing.

⚠ Watch for sharp edges which can cause personal injury, particularly in the area of the tunnel. Protect hands with gloves when working with sharp components.

⚠ If difficulty is encountered in removing or installing a component, look to see if a cause for the difficulty can be found. If it is necessary to tap the part into place, use a soft face hammer and tap lightly.

⚠ Some of the fasteners in the snowmobile were installed with locking agents. Use of impact drivers or wrenches will help avoid damage to fasteners.

⚠ Always follow torque specifications as outlined throughout this manual. Incorrect torquing may lead to serious machine damage or, as in the case of steering components, can result in injury or death for the rider(s).

⚠ If a torquing sequence is indicated for nuts, bolts or screws, start all fasteners in their holes and hand tighten. Then, following the method and sequence indicated in this manual, tighten evenly to the specified torque value. When removing nuts, bolts or screws from a part with several fasteners, loosen them all about 1/4 turn before removing them.

⚠ If the condition of any gasket or O-Ring is in question, replace it with a new one. Be sure the mating surfaces around the gasket are clean and smooth in order to avoid leaks.

⚠ Some procedures will require removal of retaining rings or clips. Because removal weakens and deforms these parts, they should always be replaced with new parts. When installing new retaining rings and clips use care not to expand or compress them beyond what is required for installation.

⚠ Because removal damages seals, replace any oil or grease seals removed with new parts.

⚠ Polaris recommends the use of Polaris lubricants and greases, which have been specially formulated for the top performance and best protection of our machines. In some applications, such as the engine, warranty coverage may become void if other brands are substituted.

⚠ Grease should be cleaned from parts and fresh grease applied before reassembly of components. Deteriorating grease loses lubricity and may contain abrasive foreign matter.

⚠ Whenever removing or reinstalling batteries, care should be taken to avoid the possibility of explosion resulting in serious burns. Always disconnect the negative (black) cable first and reconnect it last. Battery electrolyte contains sulfuric acid and is poisonous! Serious burns can result from contact with the 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.

**Tool List**

Tool Part Number	Description
2870338	Drive Clutch Spider Nut Socket
2870426	P-85 CLutch Offset Alignment Tool 5/8"
8700220	Clutch Compression Tool
PS-45909	TEAM Clutch Compression Tool Extensions (To be used with Clutch Compression tool)
2870576	Drive Clutch Bore Tapered Reamer
2870910	Roller Pin Tool
2870974	Jackshaft Installer
2871173	Primary Clutch Compressor
2871296	Jackshaft Installer
2872085	Clutch Puller (3/4-16 x 14mm)
2872401	20mm C-Clip Tool
2872987	Spider Remover/Installer
PS-45259	Gas Fill Tool & Gauge
PS-45259-1	Gas Fill Needles (20 Pack)
PS-45260	Lower Retainer Wrench
PS-45261	IFP Positioning/Extraction Tool
PS-45262	Cylinder Head Wrench
PS-45263	Wear Band Tool
PS-45152	THIN Rear Suspension Wrench
PS-45909	High Performance Driven Clutch Compression Tool
PS-45908	T-Handle Walker Evans IFP Tool
PS-45629	Body Clamps for Walker Evans 1 3/4"
2871358	Clutch Holding Fixture
9314177-A	Clutch Holding Wrench
PS-45484	Rivet Punch (To remove self-piercing rivets)
PS-45678	Shock Shaft Seal Protector (.51 diameter shock shaft)
2201639	Shock Shaft Seal Protector (.498 diameter shock shaft)
2201640	Shock Shaft Seal Protector (.620 diameter shock shaft)
PU-45485	Exhaust Spring Removal Tool
2874522	Walker Evans Racing Shock Oil (5w)

## Recommended Maintenance Products

ENGINE OIL			RETAINING/SEALING PRODUCTS		
Part #	Description	Packaging (size / quantity)	Part #	Description	Packaging (size/quantity)
2871721	Synthetic 2-Cycle Premium Gold	Quarts/ 6	2870652	Fuel Stabilizer	16 oz / 12
2871722	Synthetic 2-Cycle Premium Gold	Gallon / 4	2872280	Fuel Stabilizer	2.5 Gallon / 2
2871723	Synthetic 2-Cycle Premium Gold	16 Gallon Drum	2871329	Nyogel™ Grease	2 oz
2871884	Synthetic 2 Cycle Premium Gold	55 Gallon Drum	2871064	T-9 Metal Protectant	each
2871098	Premium 2-Cycle Oil (TC-W3)	Quart Cans / 12	2870632	Metal Polish	10 oz / each
2871097	Premium 2-Cycle Oil (TC-W3)	Gallon / 6	2871076	Battery Tender™	each
2871240	Premium 2-Cycle Oil (TC-W3)	2.5 Gallon / 2	2870585	Primer N, Aerosol	25 gr / 1
2871566	Premium 2-Cycle Oil (TC-W3)	16 Gallon Drum	2870584	680 Retaining Compound	10cc / each
2871385	Premium 2-Cycle Oil (TC-W3)	30 Gallon Drum	2871949	Threadlock 242	50cc / 10
2871096	Premium 2-Cycle Oil (TC-W3)	55 Gallon Drum	2871950	Threadlock 242	6cc / 12
2872927	VES 2 Cycle Synthetic Oil	Quart	2871951	Threadlock 262	50cc / 10
2872925	VES 2 Cycle Synthetic Oil	Gallon	2871952	Threadlock 262	6cc / 12
2872924	VES 2 Cycle Synthetic Oil	55 Gallon Drum	2871953	Threadlock 271	6cc / 12
2872607	Nature Oil (TC-W3)	Gallon	2871954	Threadlock 271	36cc / 6
2872926	Nature Oil (TC-W3)	55 Gallon Drum	2871955	Instant Adhesive: Prism 401	3cc / 30
MAINTENANCE PRODUCTS			2871956	Pipe Sealant 565	50cc / 6
2872435	Cross Shaft Break-in Lube	8 oz / 12	2871957	Silicone, Black RTV	3 oz tube / 12
2872436	Cross Shaft Break-in Lube	2.5 Gal / 2	2871958	Silicone, Black RTV	11 oz Cartridge/12
2871326	Carbon Clean Plus	12 oz / 12	2871959	Ultra Blue RTV	3.35 oz / 12
2871280	Premium Chaincase Lubricant	Quart / 12	2871960	Ultra Blue RTV	13 oz Cartridge/12
2870464	Premium Chaincase Lubricant	Gallon / 4	2871961	518 Flange Sealant	50cc / 10
2872281	Premium Chaincase Lubricant	2.5 Gallon / 2	CRANKCASE SEALANTS		
2872951	Synthetic Chaincase Lubricant	12 oz.	2871557	3 Bond 1215	5oz
2873105	Synthetic Chaincase Lubricant	Quart	VALUE PACKS		
2873106	Synthetic Chaincase Lubricant	Gallon	2871967	Synthetic Lube Value Pack	4 / Value pack
2872952	Synthetic Chaincase Lubricant	2.5 Gallon	2871593	TC-W3 Lube Value Pack	4 / Value pack
2871323	Premium Antifreeze 60/40 Premix	Gallon / 6	WAX AND POLISH		
2871534	Premium Antifreeze 60/40 Premix	Quart / 12	2871589	Revival/Detailing Kit	6 / Kit
2870995	Premium Gas Shock Oil	Quart / 6	2871966	Restore polish/scuff remover	12 / 12 oz.
2872279	Premium Gas Shock Oil	2.5 Gallon / 2	2871965	Reflect Wax Final Finish	12 / 12 oz.
2870990	Premium Brake Fluid DOT-3	12oz / 12	2871964	Renew vinyl rubber protector	12 / 12 oz.
2870791	Premium Fogging Oil (spray)	12/12 oz	RACING FUELS		
2871517	Premium Fogging Oil (liquid with spout)	Quart / 12	2873019	100 Octane	5 Gallon
2871518	Premium Fogging Oil (liquid)	Gallon / 6	2872980	100 Octane	16 Gallon Drum
2871312	Grease Gun Kit (All Season)	3 oz / 4	2872981	100 Octane	55 Gallon Drum
2871322	Premium All Season Grease	24oz / 10	2873019	110 Octane	5 Gallon
2871423	Premium All Season Grease	14 3 oz /	2872982	110 Octane	16 Gallon Drum
2871460	Premium Starter Grease	2 oz / 12	2872983	110 Octane	55 Gallon Drum
2871592	Barrel Pump (for 16/30/55 gal. drums)	Each			
2871285	Flex Spout (fits gal. and 2.5 gal. jugs)	25			
2870505	Isopropyl	10 oz / 24			



# **CHAPTER 2**

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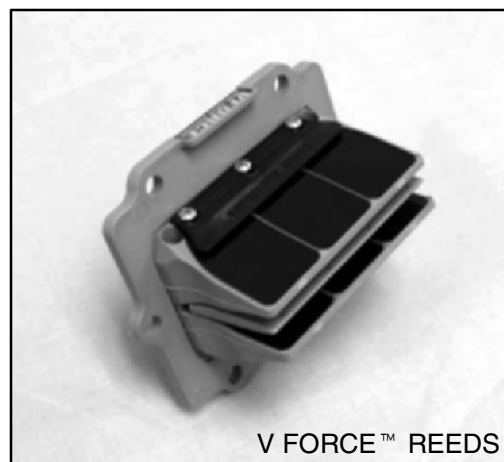
## **ENGINE**

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## Improvements for 2003 440 Pro X

1. V-Force™ Reeds
2. Revised carburetion calibration
3. “Dragon” ignition system



## Pro X Model Specifications

Machine Model	Engine Model	Cyl. Disp. CC's	Bore MM	Bore Inches	Stroke MM	Stroke Inches	No. of Cyl.	Type of Cooling	Fuel Octane (Min.)
440 Pro X Fan	EC45PM040	438	65.5	2.579	65	2.559	2	Fan	87*
440 Pro X	S2423-4460PA4C	438	66	2.598	64	2.520	2	Liquid	110**
600 Pro X	S2392-6044PA6E	593	77.25	3.041	64	2.520	2	Liquid	87*
700 Pro X	S2378-7070PA7C	701	81	3.189	68	2.677	2	Liquid	87*
800 Pro X	S2398-8070P8C	794	85	3.346	70	2.756	2	Liquid	87*

\* Non-oxygenated. Use minimum 89 octane when using oxygenated fuel.

\*\* 110 Octane minimum.

Model	Piston/Cylinder Bore Clearance +.05 mm -.00 mm (MM / Inch )	Engine Operating RPM $\pm 200$	Recommended Idle RPM
440 Pro X Fan	.07-.105 (.0028-.0041")	7750	1600
440 Pro X	.11-.15 (.0044-.0058)	8400	1500
600 Pro X	.11-.14 (.0045-.0055")	8000	1500
700 Pro X	.11 (0.0044")	8100	1400
800 Pro X	.15 (0.006")	8000	1400

When tightening bolts, nuts, or screws, a torque pattern should be followed to insure uniform equal tension is applied to all fasteners. Proper torque application prevents fasteners from loosening or breaking in critical service. It also minimizes wear and eliminates premature or needless repair costs. Following uniform torque application sequence patterns assures optimum performance from precision machined, close tolerance assemblies. On vital engine parts, torquing negligence could be costly.

Torque is a force which tends to produce rotation. The measurement of this force is expressed in units of force and length. There are at present two basic systems of units used to express torque, English and Metric. In the English system, the units of force are the pound or ounce, and the length is the foot or inch.

In the Metric system, the unit of force is expressed in grams (gm) or Newton meters (Nm), and length as centimeters (cm.) or meters (m). The most common units of torque in the English system are ft. lb. and in. lb. In the Metric system, torque is commonly expressed in units of Nm. Multiply foot pounds by 1.382 to obtain Nm.

See page 2.3 for engine torque sequences

Engine	Cylinder Head*	Cylinder Base Nuts	Crankcase 8 mm	Crankcase 10 mm	Flywheel
EC-45	18-19 ft. lbs. (25-26.5 Nm)	24-28 ft. lbs. (33-39 Nm)	17-18 ft. lbs. (22-23 Nm)	23-25 ft. lbs. (32-35 Nm)	60-65 ft. lbs. (83-90 Nm)
S44** SN60-44** SN50**	20-24 ft. lbs. (28 - 33 Nm)	30-34 ft.lbs (42-47 Nm)	20-24 ft.lbs. (28 - 33 Nm)	N/A	90 ft. lbs. (124 Nm)
SN60-70** SN70** SN80**	18-22 ft. lbs. (25 - 30 Nm)	30-34 ft.lbs (42-47 Nm)	20-24 ft.lbs. (28 - 33 Nm)	26-30 Ft lbs (36-42 Nm)	90 ft. lbs. (124 Nm)

\*\*Torque head bolts prior to torquing cylinder base nuts. Apply loctite™ 242.

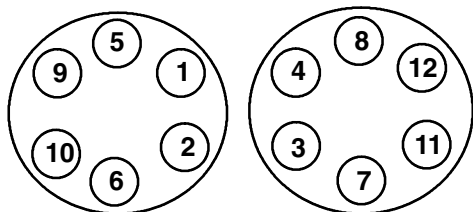
All 6mm Crankcase Bolts . . . . . 108 in. lbs. (12.4 Nm)

All 7/16-14 Engine Mount Strap Bolts . . . . . 44-48 ft. lbs. (60-66 Nm)

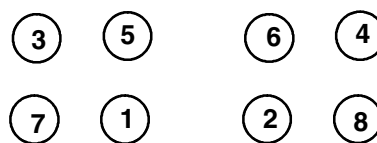
## Spark Plugs

Polaris Part Number	Spark Plug
3070156	NGK BR8ES
3070157	NGK BR7ES
3070160	NGK B7ES
3070161	NGK B8ES
3070162	NGK B9ES
3070163	NGK BR9ES
3070165	Champion RN2C
3070166	Champion RN3C
3070184	Champion RN57YC
3070190	Champion RN57YCC
3070198	NGK BR8EV

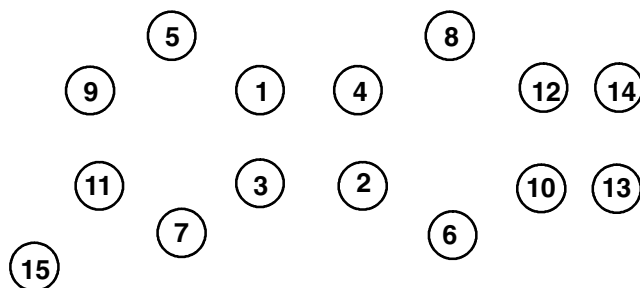




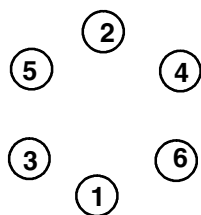
**CYLINDER HEAD**  
440/600 Pro X



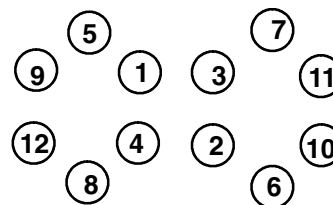
**CYLINDER BASE**  
440/600 Pro X



**CRANKCASE - 440/600 Pro X**

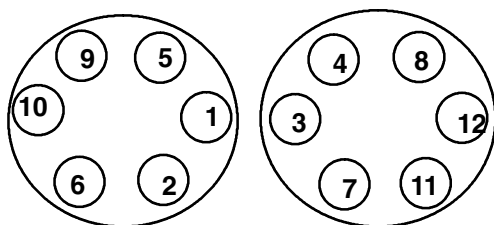


**CYLINDER HEAD - Pro X Fan**



**CRANKCASE - Pro X Fan**

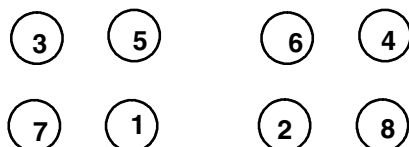
**CYLINDER HEAD**  
Liberty™ 700 / 800



**CYLINDER BASE**  
Liberty™ 700/800



**Liberty™ Crankcase - 700 / 800**



$$R = \frac{(IHV + DISP)}{IHV}$$

$$I = \frac{S}{(DISP \cdot 25.4)}$$

$$DISP = \frac{(PI \cdot B \cdot B \cdot S)}{4}$$

IHV = INSTALLED HEAD VOLUME [CC]  
 DISP = CYLINDER DISPLACEMENT [CC]  
 R = COMPRESSION RATIO  
 S = FULL ENGINE STROKE [CM]  
 I = INCHES PER CC OF IHV  
 B = CYLINDER BORE [CM]  
 PI = 3.1416

Bore = 6.5 cm.

Stroke = 6.0 cm.

IHV = 17.1 cc

$$\text{Displacement} = \frac{\pi}{4} \cdot \text{Bore}^2 \cdot \text{Stroke} \quad (\pi = 3.1416)$$

$$\text{Displacement} = 199.098 \text{ cc}$$

$$R = \frac{IHV + \text{Displacement}}{IHV}$$

$$R = 12.643 \quad \text{Full Stroke Compression Ratio}$$

To calculate the Effective Compression Ratio, substitute the exhaust port height for the stroke in the formulas above:

Exhaust = 2.95 cm.

Exhaust port height 29.5 mm

$$\text{Eff Disp} = \frac{\pi}{4} \cdot \text{Bore}^2 \cdot \text{Stroke} \quad \text{Effective Displacement}$$

$$\text{Eff Disp} = 97.89 \text{ cc}$$

$$\text{Eff Comp} = \frac{IHV + \text{Eff Disp}}{IHV} \quad \text{Effective Compression Ratio}$$

$$\text{Eff Comp} = 6.725$$

In order to increase the Full Stroke Compression Ratio to 13.6, how much material do you need to remove from the cylinder head?

You know that:  $R = \frac{IHV + \text{Displacement}}{IHV}$ , and you want to find out IHV.

Displacement = 199.098 cc, and we want R = 13.6, so then

$$IHV2 = \frac{\text{Displacement}}{(R - 1)}$$

$$IHV2 = 15.801 \text{ cc desired IHV to have 13.6:1 Full Stroke Compression Ratio}$$

**HEAD CC REMOVAL EXAMPLE**

Total number of CCs to remove from the head = Old IHV - Desired IHV

$$\text{Removed CCs} = \text{IHV} - \text{IHV2}$$

$$\text{Removed CCs} = 1.299 \text{ cc}$$

$$I = \frac{\text{Stroke}}{\left( \text{Displacement} \cdot 2.54 \cdot \frac{\text{cm.}}{\text{in}} \right)}$$

Number of inches to remove from the cylinder head to equal 1 cc

$$I = 0.01186 \cdot \frac{\text{in}}{\text{cc}}$$

To find out how much to cut off, multiply the number of CCs you need to remove by the number of inches to remove per CC:

$$\text{Thickness to remove} = I \cdot \text{Removed CCs}$$

$$\text{Thickness to remove} = 0.015 \text{ in}$$

**PORT OPENING DURATION**

Port open = 81.5°      This indicates the degrees after TDC that the exhaust port opens (and also the degrees before TDC that the port closes).

$$\text{Duration closed} = 2 \cdot \text{Port open}$$

$$\text{Duration closed} = 163^\circ$$

$$\text{Total duration} = 360^\circ$$

$$\text{Duration open} = \text{Total duration} - \text{Duration closed}$$

$$\text{Duration open} = 197^\circ$$

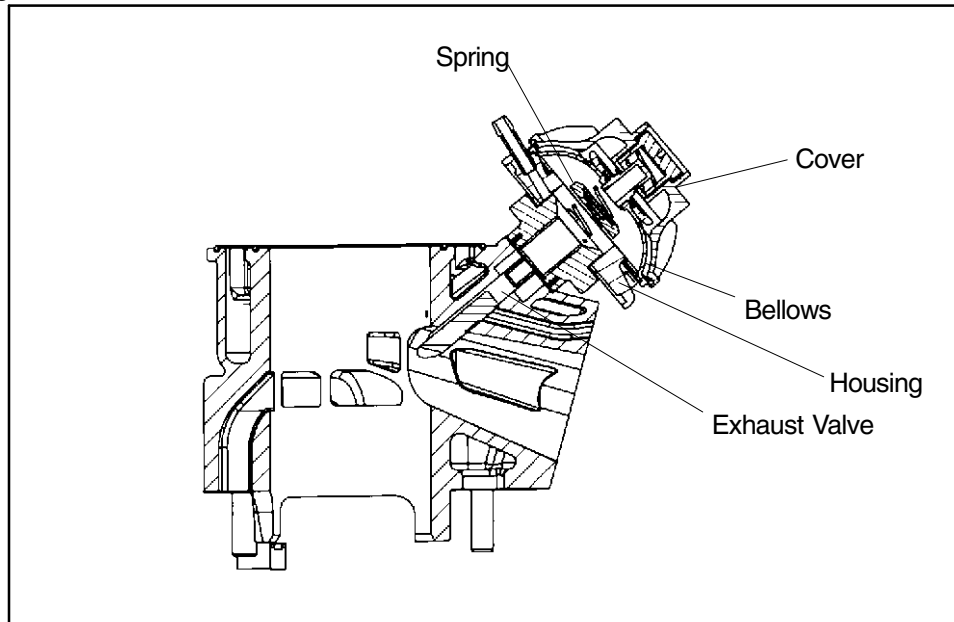
$$\text{Percent open} = \frac{\text{Duration open}}{\text{Total duration}} \cdot 100$$

$$\text{Percent open} = 54.722$$

## Variable Exhaust System (V.E.S.)

Some snowmobiles are equipped with the Polaris *Variable Exhaust System (V.E.S.)*

This unique exhaust valve management system changes the effective exhaust port height in the cylinder to provide maximum horsepower at high RPM without sacrificing fuel economy and engine torque at low to midrange throttle settings.



In order to understand the operation and function of the V.E.S. we must first consider the characteristics of a two stroke engine. The height of the exhaust port in a two stroke engine cylinder has an affect on the total power output of an engine, as well as the RPM at which the power occurs.

Exhaust systems are “tuned” by design to match engine exhaust port configuration and desired power delivery characteristics. Engines with relatively “high” exhaust ports (and exhaust pipe to match) produce more horsepower at high RPM, but only at the expense of low to midrange fuel economy and torque. On the other hand, “low” port engines provide good fuel economy in the midrange and make their power at relatively lower RPM, but will not produce as much peak horsepower for a given displacement range. In general, an engine designed for a racing or high performance snowmobile will have a relatively high exhaust port compared to an engine of the same displacement range designed for touring.

Although the V.E.S. does not in itself increase horsepower, it does allow an engine to be designed for maximum horsepower without the inherent disadvantages of a high exhaust port.

The main components of the V.E.S. are the exhaust valve, valve housing, bellows, return spring, and cover.

A guillotine style exhaust valve is connected to a moveable piston. This piston is attached to a flexible bellows, forming two chambers. The lower chamber is connected to the cylinder by a drilled passageway located just above the exhaust port. The upper chamber is vented to atmospheric pressure. A valve return spring is located in the upper chamber between the piston and cover.

At idle and low speeds, the exhaust valve is held in the “low port” position by the return spring. When throttle is applied (and RPM begins to increase) rising cylinder pressure is applied to the under side of the bellows via the actuation port. This forces the exhaust valve upward against spring pressure. The valve continues to move upward toward the “High Port” position as cylinder pressure, horsepower, and RPM increase.

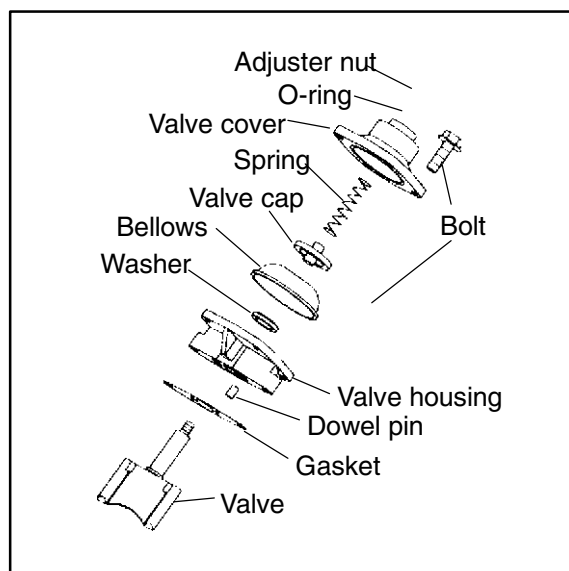
## V.E.S. Maintenance

Due to the simplicity of V.E.S. design, maintenance is limited to a periodic inspection and cleaning of system components. The V.E.S. should be disassembled, inspected, and cleaned (remove carbon deposits) every 1000 to 2000 miles, depending on operating conditions. To ensure maximum performance and minimize required maintenance, Polaris recommends the use of Polaris Synthetic 2 Cycle lubricant only. The use of other lubricants may cause improper function of the valve mechanism, and increase the frequency of required cleaning due to excessive buildup of carbon deposits.

## V.E.S. Removal and Cleaning

Removal and cleaning is covered later in this chapter.

## V.E.S. Troubleshooting

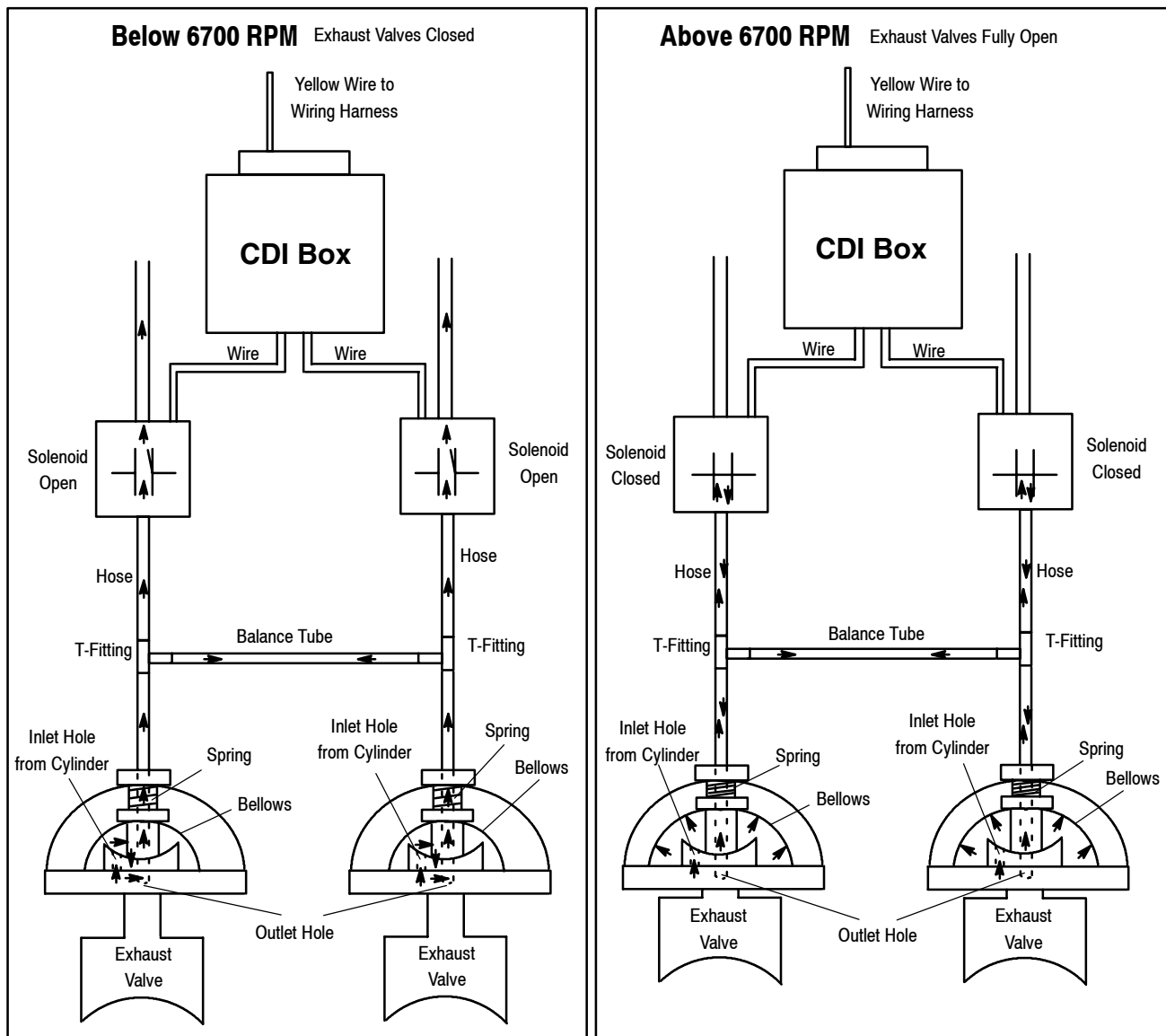


Symptom	Possible Cause	Remedy
Engine will not reach designed operating RPM	Valve not opening or not opening completely: 1. Exhaust valve sticking 2. Cylinder pressure feed port restricted 3. Bellows damaged or not sealing correctly 4. Incorrect spring 5. Problem in clutch setup, drive line, engine, etc.	1. Remove carbon deposits, burrs etc. 2. Clean port 3. Inspect bellows, fastener straps, and gasket and repair as required 4. Inspect 5. Inspect
Poor acceleration; hesitation; High RPM performance is normal or near normal	Valve opening too early: 1. Valve sticking open or partially open 2. Broken, damaged, or incorrect, spring	1. Clean, Inspect 2. Inspect, Replace

## Variable Exhaust System (V.E.S.) - 440 Pro X

### 440 Pro X Variable Exhaust System:

The exhaust valve system on the new 440 Pro X is electronically controlled by solenoids. Pressure from the cylinders is routed through the solenoids to the atmosphere. During this time the exhaust valves are down. When the CDI senses 6700 RPM, it triggers the solenoids to shut off the bypassed air going to the atmosphere. Pressure then builds inside the exhaust valve bellows, causing the valves to fully open. When RPM drops below 6700, the solenoids open to allow air to bypass through to atmosphere and the exhaust valves close.



## Changing the Timing curve

### CAUTION

This engine is jetted for operation at 0 degrees °F and warmer. Re-jetting is required for temperatures colder than 0°F.

The second switch is located on the airbox and has seven optional curves. These seven options are used to match the fuel type and the racing conditions which may vary, depending on the race. The standard position is “D” and should not be moved unless you are a knowledgeable engine tuner.

Position	Timing Effect
A	+3
B	+2
C	+1
D (Standard Position)	0
E	-2
F	-3
G	-4

### Engine Disassembly - 440 Pro X Fan Engine

**NOTE:** Inspect all parts for wear or damage during disassembly. Replace all seals, O-rings, and gaskets with Genuine Polaris parts during assembly.

#### Disassembly

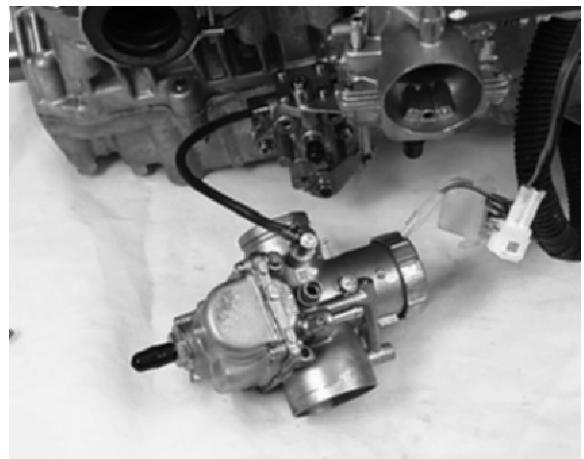
1. Remove coil pack from air box, and disconnect it from the wiring harness.



2. Loosen carburetor clamps and remove each carburetor.



3. Using a pliers, detach the oil lines from the carburetors.





**Disassembly - Continued**

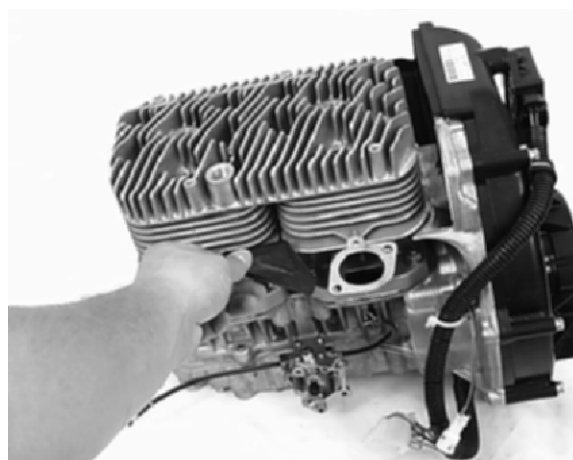
4. Remove the carburetor mounting boots using a allen wrench.



5. Remove both the cylinder head and exhaust side fan shroud s from the engine assembly.



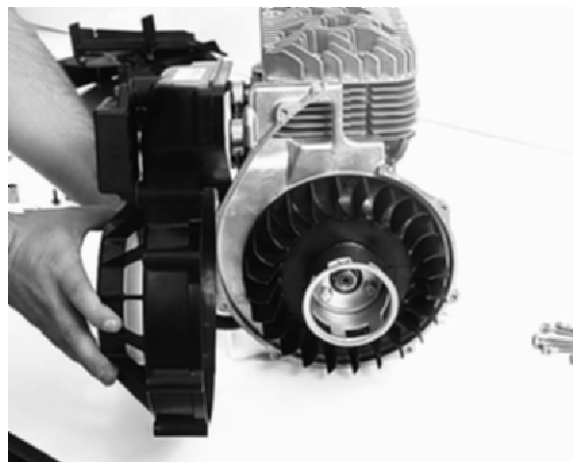
6. After removing the fan shrouds, take note of the vibration dampener located between the two intake ports.



### Disassembly - Continued

7. Remove the CDI module from the flywheel cover.

8. Remove the flywheel cover.



9. Prior to removing the flywheel, insert a piece of nylon rope or cord into a spark plug hole. Rotate the crankshaft counter-clockwise until it will no longer turn over.



**Disassembly - Continued**

10. Remove the recoil cam.



11. Loosen and remove the flywheel nut.



12. Using a flywheel puller, remove the flywheel from the engine. Do not install puller bolts more than 5/16" (7mm) into flywheel threads or stator damage may result.

**Flywheel Puller**

**PN 2871043**



### Disassembly - Continued

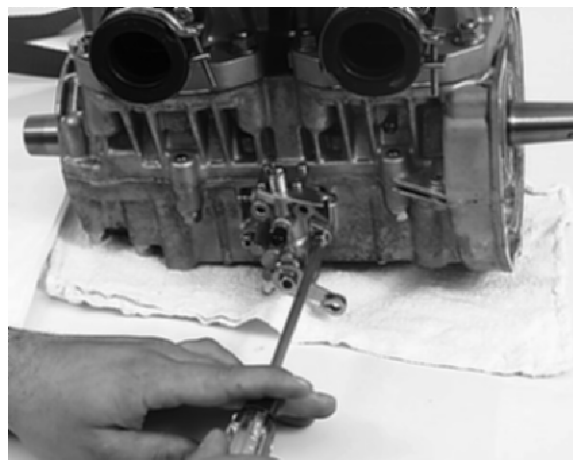
13. Remove the flywheel.



14. The stator plate can be removed without taking off the stator.



15. Remove the oil pump taking note of the o-ring and shim(s).



**Disassembly - Continued**

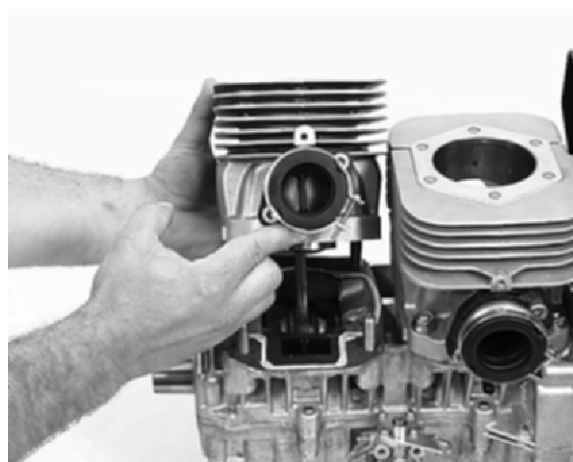
16. Remove the cylinder head.



17. Remove the head gasket. During removal, note that the head gasket is stamped with "EX" and "UP".

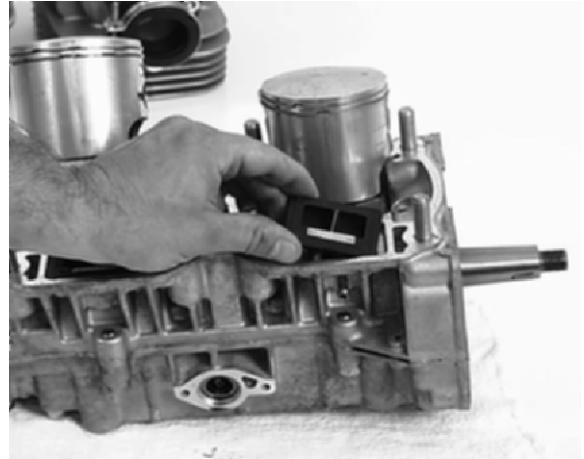


18. Loosen and remove each cylinder.



### Disassembly - Continued

19. Remove the reed valves from the crankcase.



20. Using an awl and piston pin puller, remove the pistons.

**CAUTION:**

Wear eye protection during piston c-clip removal to prevent eye injury.

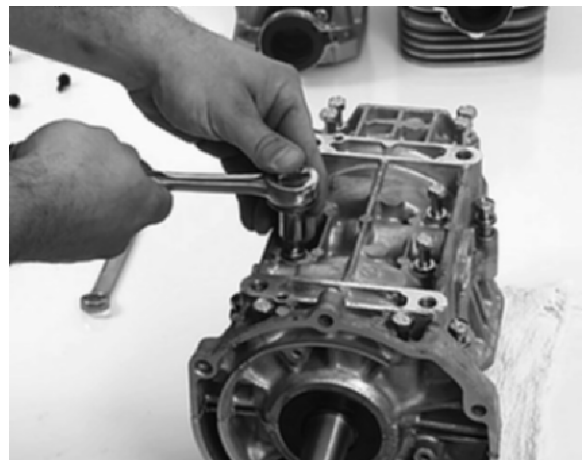
**Piston Pin Puller**

**PN 2870386**



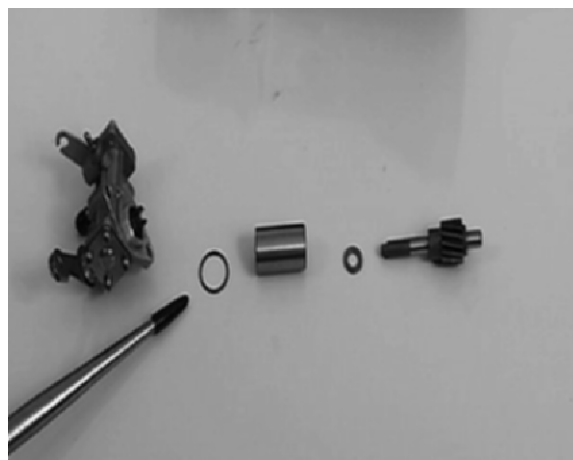
21. Turn crankcase over and remove the crankcase bolts. Turn over and separate the case halves.

22. Refer to General Inspection section for crankshaft inspection and measurement procedures.

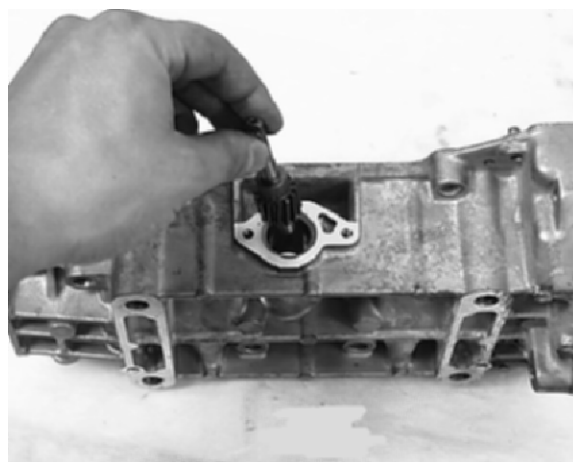


**Engine Assembly**

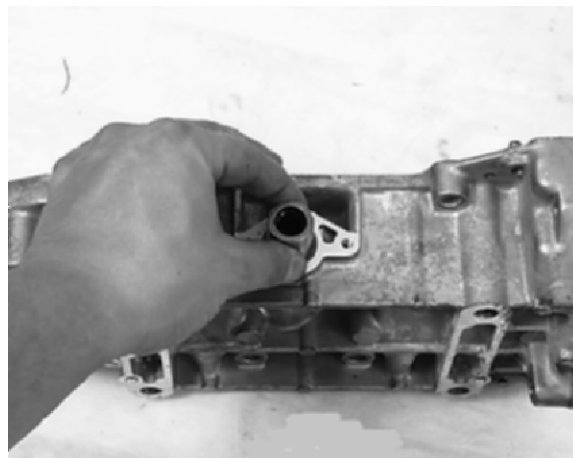
1. Prior to assembly, make sure that you have all of the oil pump shims when the oil pump was removed, and that the shims are installed in the correct order.



2. Insert oil pump drive gear.



3. Insert oil pump driveshaft spacer.



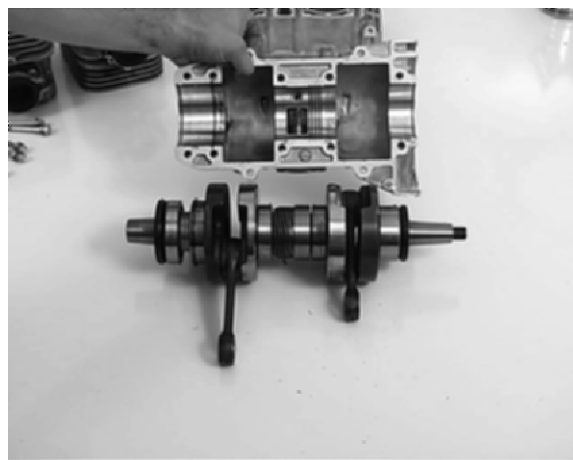
4.

### Engine Assembly - Continued

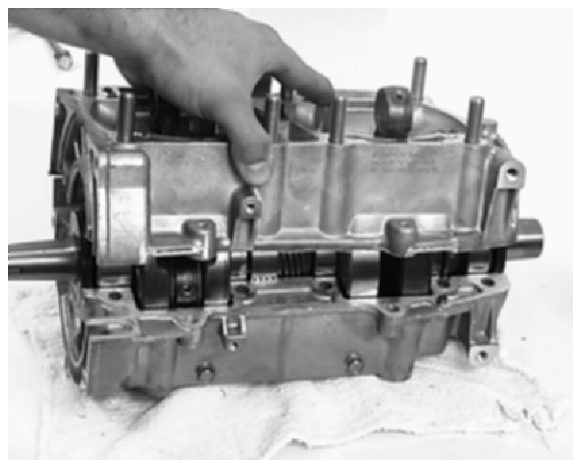
5. Lay crankshaft into the lower case half. Make sure that the crankshaft rotates smoothly and does not bind. Rotate the bearings so that the anti-rotation pins rest in their appropriate galleries.  
**NOTE:** Lubricate the crankseal prior to installation.
6. Apply 3-Bond™ sealer to top half of crankcase. Lubricate oil pump drive gear.

**3-Bond™ 1215**

**PN 2871557 120 Gram Tube**

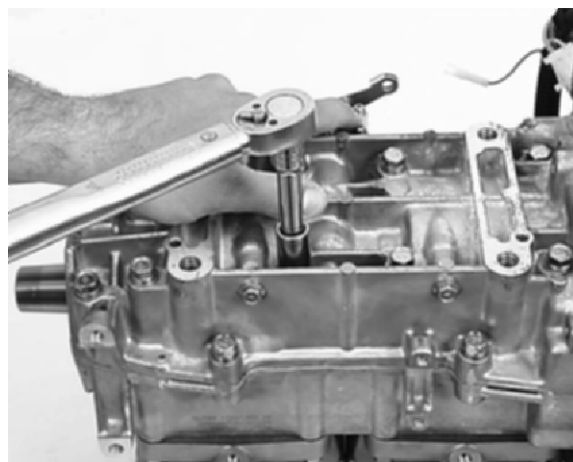


7. Install the upper case half.



8. Turn the crankcase over and torque the case bolts in sequence illustrated in beginning of chapter.

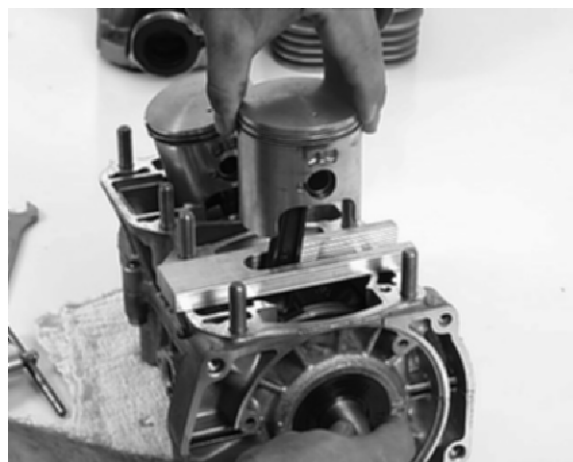
**Crankcase Bolt Torque  
16.6 - 18 ft.lbs. (22 - 25 Nm)**



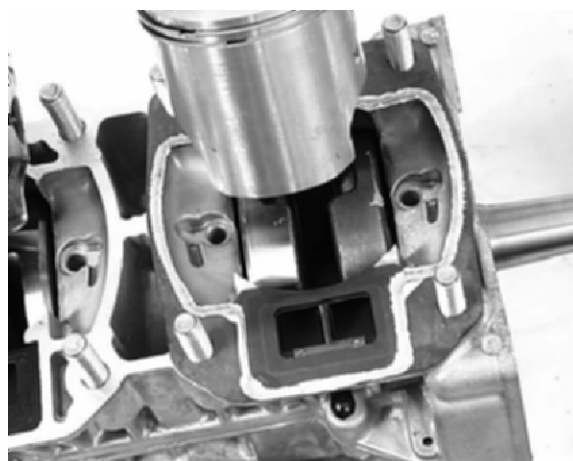


## Engine Assembly - Continued

9. Install pistons with arrow (▶) on piston facing flywheel, with locating pins to intake side. Install C-clips securely in piston groove.  
NOTE: C-Clip should be facing with the open end up.
10. Lubricate rings and pistons with two stroke oil. Install rings with letter, mark, or beveled side facing upward.



11. Install the reed valves in the crankcase. After installing the reed valves, insert the base gaskets.



12. Install each cylinder. Torque cylinder base nuts in sequence illustrated in beginning of chapter.

**Cylinder Base Nut Torque**  
24 - 28 ft.lbs. (33 - 39 Nm)

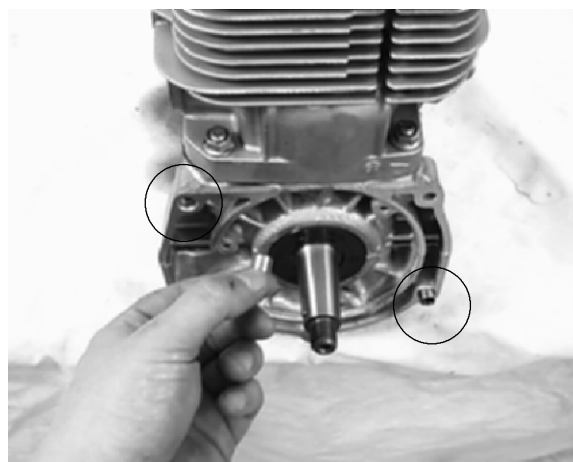


### Engine Assembly - Continued

13. Install the cylinder head gasket with the “EX” on the exhaust side, and “UP” on the intake side of the engine.



14. Insert the dowels into the flywheel housing.  
**NOTE:** Refer to picture for proper installation of alignment dowels.



15. Tighten flywheel housing to crankcase.



**Engine Assembly - Continued**

16. Install the flywheel and insert the lock washer.



17. Torque the flywheel nut. During the procedure, use a flywheel holding wrench to prevent the flywheel from rotating.



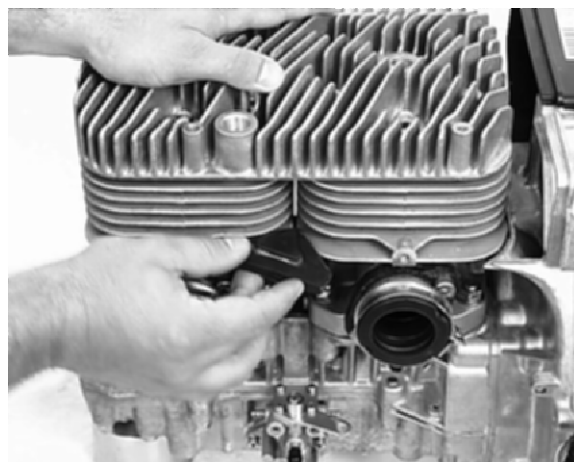
**Flywheel Holding Wrench-  
PN 8700229**

**Flywheel Nut Torque  
60 - 65 ft.lbs. (83 - 90 Nm)**

18. Reinstall the flywheel cover.

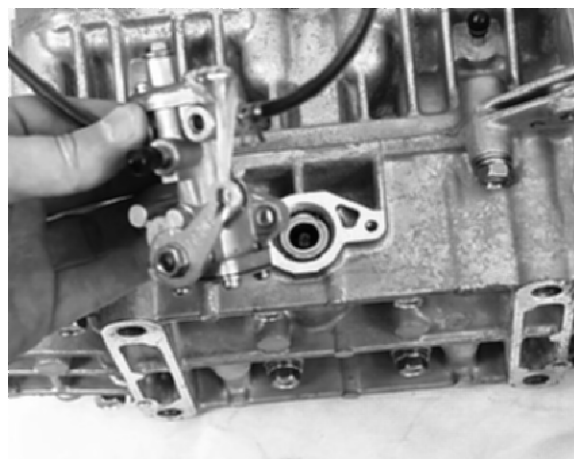
### Engine Assembly - Continued

19. Insert the vibration dampener into the cooling fins between the intake ports. Reinstall the two fan shrouds making sure that they interlock before fastening tightly.

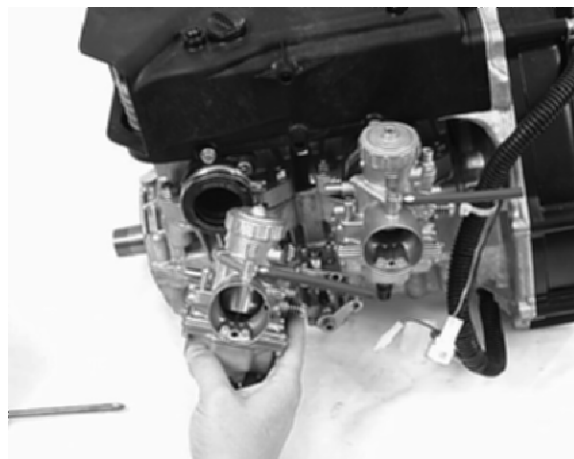


20. Using a new o-ring, reinstall the oil pump.

**Oil Pump Mounting Screw Torque:**  
48 - 72 in.lbs. (5.5 - 8.3 Nm)



21. Install each carburetor and torque the carburetor mounting clamps. Reinstall oil lines on the oil pump.

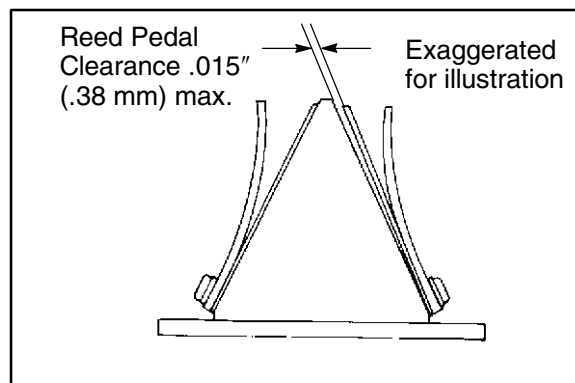


**NOTE:** Inspect all parts for wear or damage during disassembly. Replace all seals, O-rings, and gaskets with Genuine Polaris parts during assembly.

### Disassembly - Liberty™ 440 / 600 Liquid

1. Remove carburetor mount adaptors, reed cages, stuffers, and oil pump. Note position of stator wire guide.

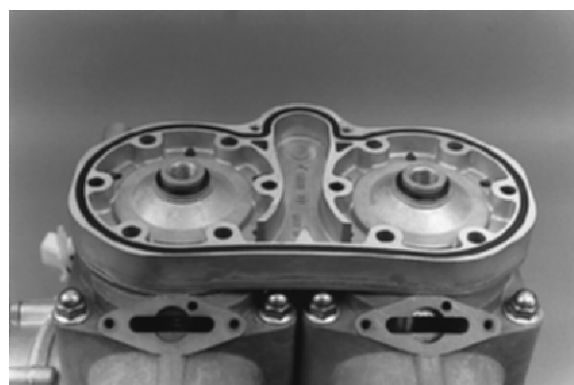
Measure air gap between fiber reed and reed block as shown. The air gap should not exceed .015" (.4 mm). If clearance is excessive DO NOT attempt to reverse the reeds to reduce the air gap. *Always replace them if damaged.* Check each fiber reed for white stress marks or missing material. Replace if necessary.



2. Remove V.E.S. (if applicable).



3. Remove cylinder head cover and inspect O-rings and sealing surfaces for damage or debris. Use new O-rings upon assembly.



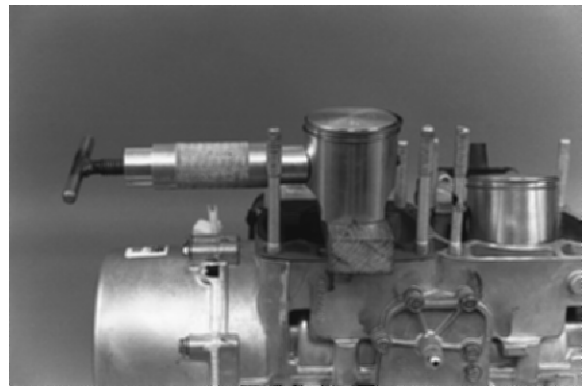
### Disassembly, Cont.

4. Remove cylinder base nuts. Note location of acorn nuts on exhaust side (where applicable).
5. Carefully remove cylinders while supporting pistons and connecting rods to prevent piston damage. Refer to General Inspection Procedures in this chapter.
6. Remove outer piston pin C-clips using a scribe through access slot in piston.

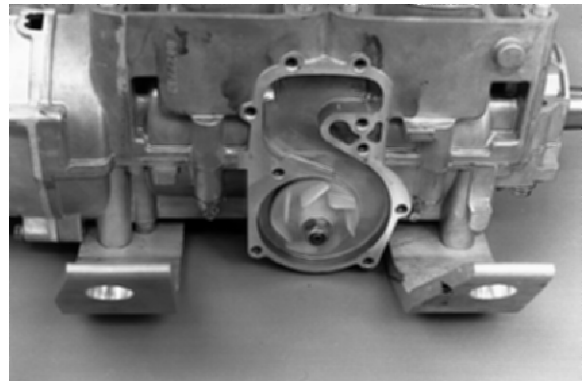


7. Place support block under piston and remove piston pins using pin puller.

<b>Piston Pin Puller</b>	<b>PN 2870386</b>
<b>Support Block</b>	<b>PN 2870390</b>

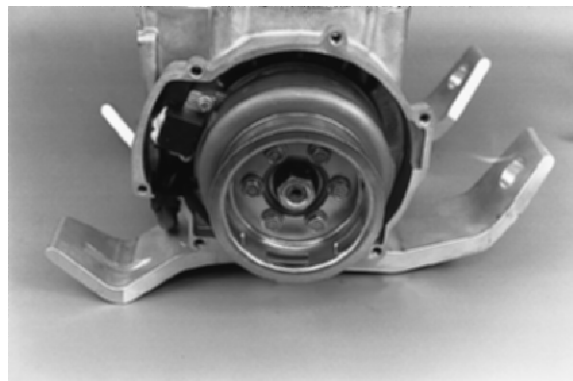


8. Remove water pump cover from front of engine.



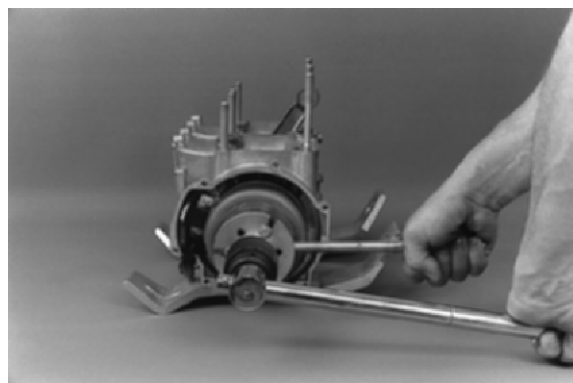
**Disassembly, Cont.**

9. Remove recoil housing and drive hub.

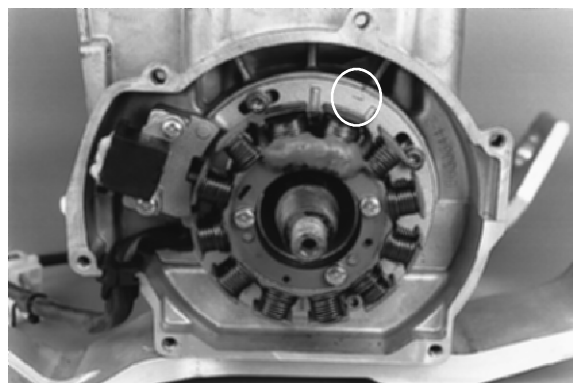


10. Remove flywheel using heavy-duty flywheel puller. Use drive clutch puller T-handle or a wrench to hold puller.

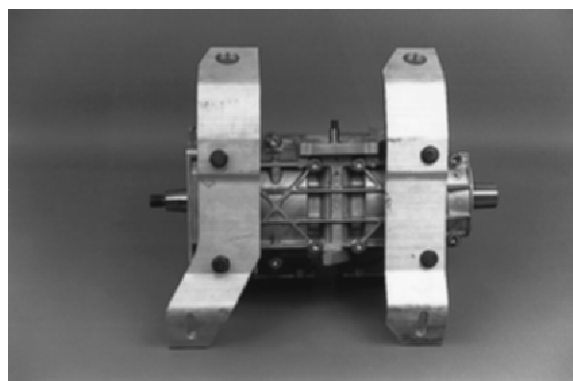
<b>Flywheel Puller</b>	<b>PN 2871043</b>
<b>T-Handle</b>	<b>PN 5020326</b>



11. Before removing stator plate, note where ignition timing marks are located, or scribe additional marks for reference upon reassembly.

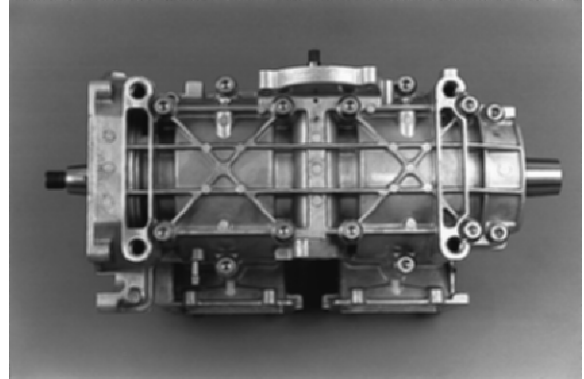


12. Mark or note location of engine mount straps and remove.

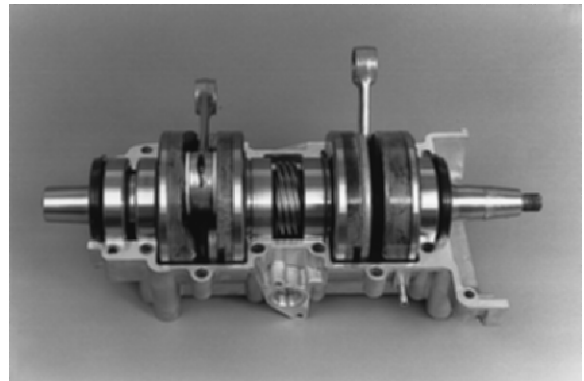


### Disassembly, Cont.

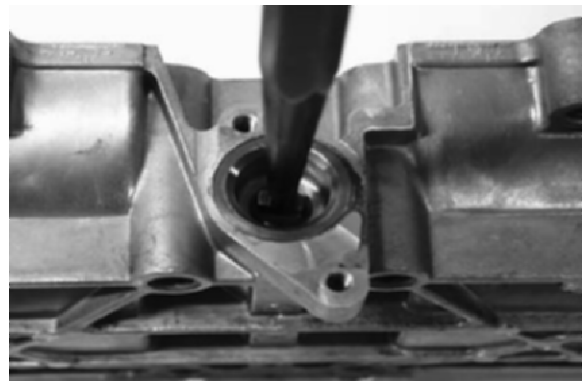
13. Remove bolts and separate case halves. Keep bolts in order for assembly.



14. To prevent damage to snap-ring grooves, lift crankshaft straight upward and out of lower case.



15. Tap out the drive shaft using a center punch and hammer. Locate the center punch in the centering hole on the oil pump end of the shaft. Be careful not to damage the bearing. This will remove the oil seal and the mechanical seal from the crankcase.



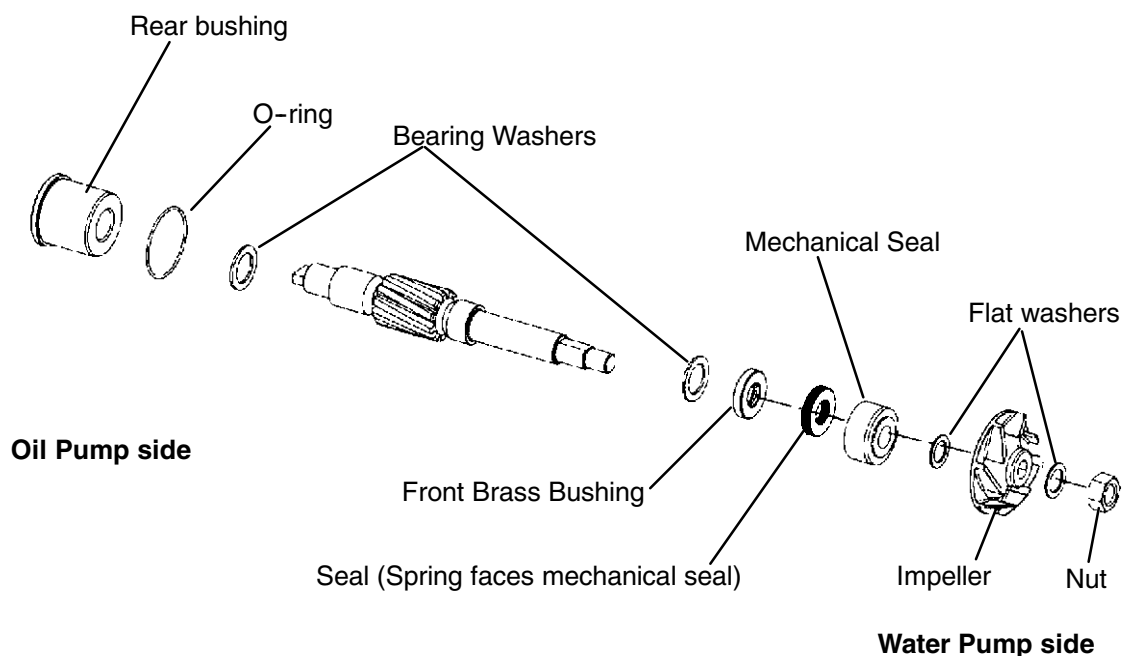
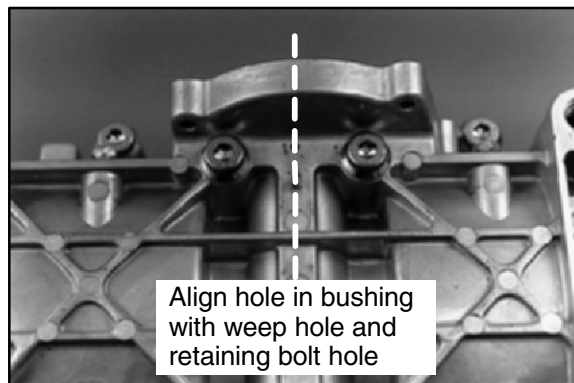


## Assembly

1. Insert bushing into case on oil pump side of case. Press in until firmly seated in case.
2. Install the bearing washer to the oil pump end of the shaft.
  - Lubricate shaft, insert shaft through the case on water pump side into the bushing on oil pump side.
3. Lubricate and install bearing washer and brass bushing onto the shaft on waterpump side.

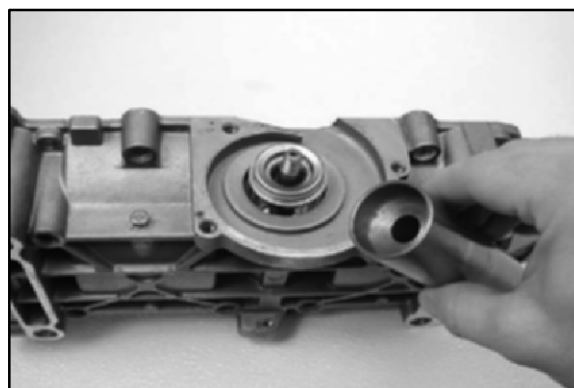
**NOTE:** If front bushing is replaced it may be necessary to drill a retaining pin hole in the new bushing. If there is no hole in the bushing:

- Measure depth of the retaining pin hole in the old bushing.
  - Using the retaining pin hole as a guide, carefully drill a hole in the new bushing to the same depth and diameter as the hole in the old bushing. Be careful not to enlarge the retaining pin hole, or drill too deep.
  - Install new retaining pin.
4. Lubricate and install oil seal with seal lip out (towards you) until it is against the bushing.



5. Lubricate and install new mechanical seal using the Mechanical Seal Guide Tool PN 2872010.
6. Press a new mechanical seal into case until fully seated.

**Mechanical Seal Guide Tool**  
600 PRO X domestic engines 8.4mm:  
PN 2872010

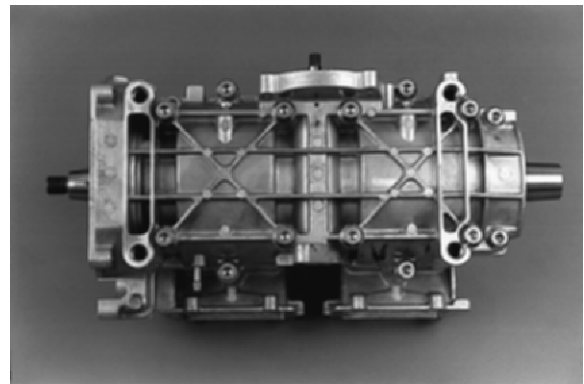
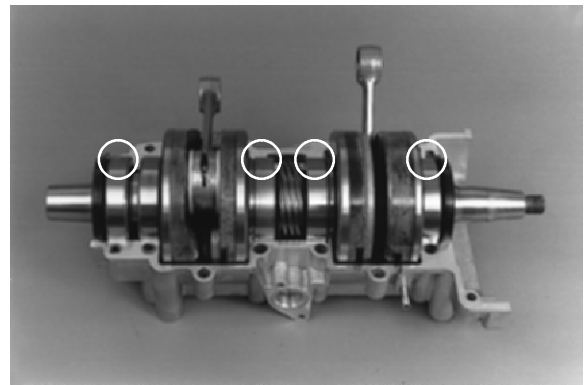


## Assembly, Cont.

7. Lubricate and install new mechanical seal using the Mechanical Seal Guide Tool PN 2872010.
8. Lubricate seal guide and drive or press a new mechanical seal into case until fully seated using the seal press tool.
9. Lubricate all crankshaft bearings with Premium 2-Cycle or Premium Gold Engine Lubricant.
10. Apply 1/3 oz. (10 cc) cross shaft break-in lube to oil pump gears.

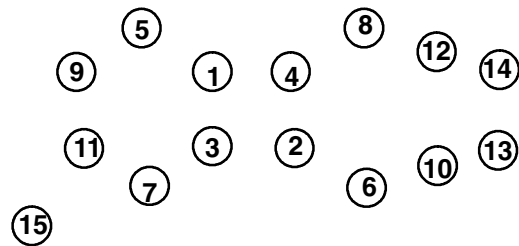
**Oil Pump Cross Shaft  
Break-in Lube:**  
PN 2872435 - 8 oz.  
PN 2872436 - 2.5 Gallon

11. DO NOT insert any grease in the grease zerk located on the PTO end of the crankcase(440 Pro X engine only). Pack the crankcase PTO end cavity with 22 grams of Mobile 1 Synthetic grease.
12. Install seals on crankshaft with spring facing inward (toward crankshaft).
13. Clean and de-grease lower crankcase and install crankshaft assembly, aligning seals and snap ring with grooves in case.
14. Apply a thin coating of 3-Bond 1215 sealant to lower crankcase mating surface.
15. Install upper crankcase on lower crankcase.
16. Apply Loctite 242 to threads of bolts and install. Torque bolts in three steps to specification outlined in beginning of this chapter following the sequence shown at right



**MAG End**

**PTO End**



**Assembly, Cont.**

17. Assemble engine mount straps to crankcase.

**Engine Mount Strap Torque:**

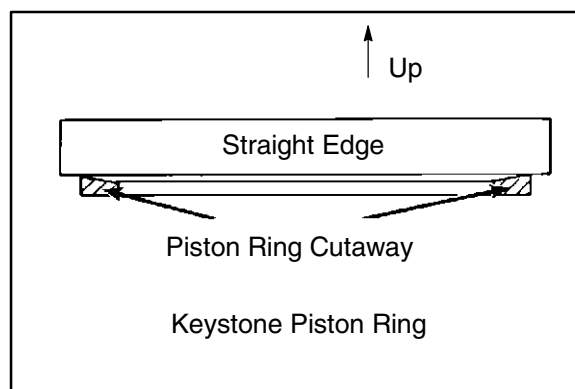
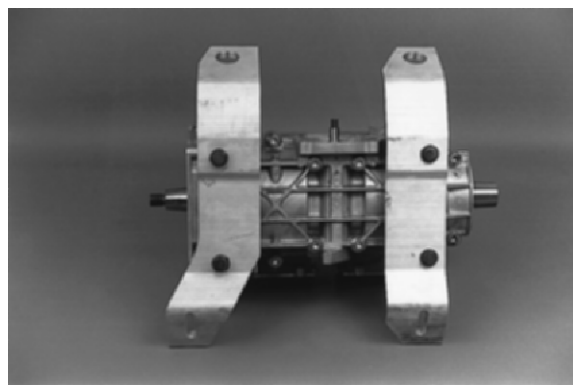
**44-48 ft. lbs. (60-66 Nm)**

18. Lubricate main bearing oil holes with Polaris Premium 2 Cycle or Premium Gold engine oil and rotate crankshaft to distribute oil evenly.
19. Install a new C-clip in both pistons (inside) with gap facing down. Be sure clip is fully seated in groove.
20. Lubricate and install new connecting rod small end bearing in rod.
21. Install piston with arrow facing exhaust (ring locating pins should be facing intake). Warming the piston may help to ease installation of pin.
22. Install remaining C-clip with gap down. Be sure both clips are fully seated in the groove.
23. Install new base gasket. Be sure gasket surface is clean and free of nicks, burrs, or scratches.
24. Lubricate and install piston rings on piston with mark on end of ring facing upward.
25. Place piston support under skirt and lubricate pistons and cylinders thoroughly.
26. Align ring end gaps with locating pins and compress rings. Install cylinder carefully with a gentle front to rear rocking motion. Install cylinder base nuts loosely. Do not tighten them at this time. Repeat Steps 22-25 for other cylinder.

**CAUTION:**

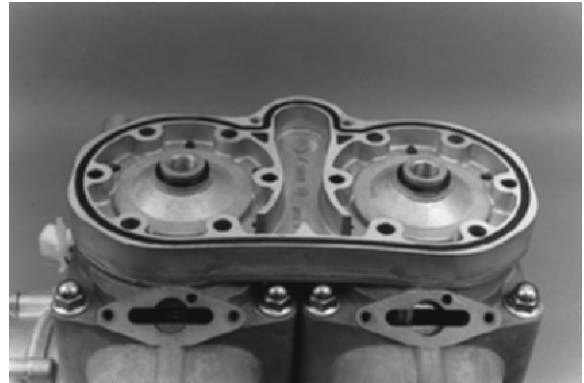
Do not twist or force cylinder during installation.

27. Install new cylinder head O-rings and install cylinder head. Make sure O-rings are properly seated in grooves. Apply a light film of grease to hold O-rings in place if necessary.

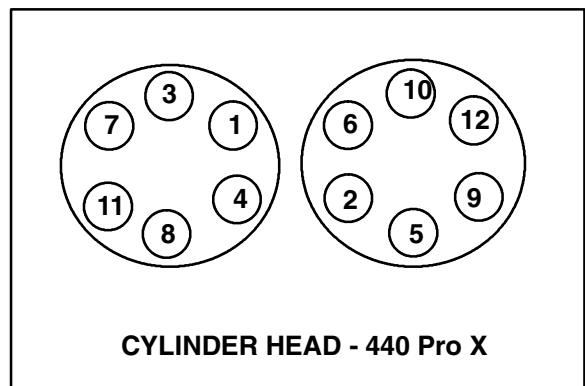


## Assembly, Cont.

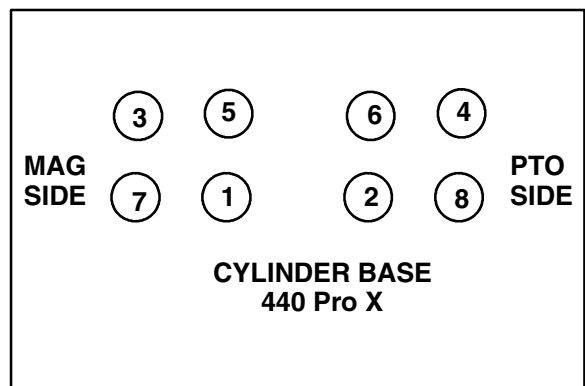
28. Install new cylinder head cover O-rings and install cylinder head cover. Make sure O-rings are properly seated in grooves. Apply a light film of grease to hold O-rings in place if necessary.
29. Loctite 242 to threads of head bolts and install.



30. Torque head bolts to specification outlined on page 2.3 of this chapter.



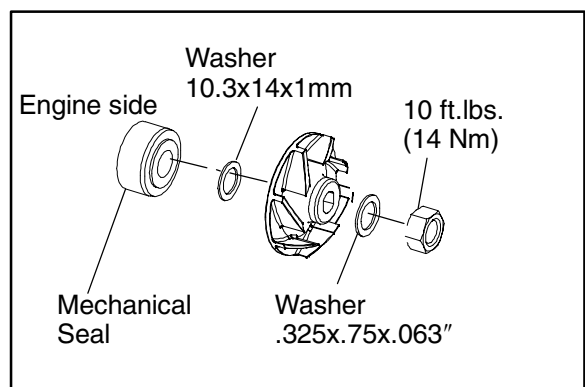
31. Torque cylinder base nuts outlined on page 2.3–2.4 of this chapter.



32. Install washers and water pump impeller as shown and torque nut to 10 ft. lbs. (14 Nm).

**Impeller Nut Torque:**

**10 Ft lbs (14 Nm)**



**Assembly, Cont.**

33. Install water pump cover with new gasket.

**Water Pump Cover Bolt Torque:****9 Ft lbs (12.5 Nm)**

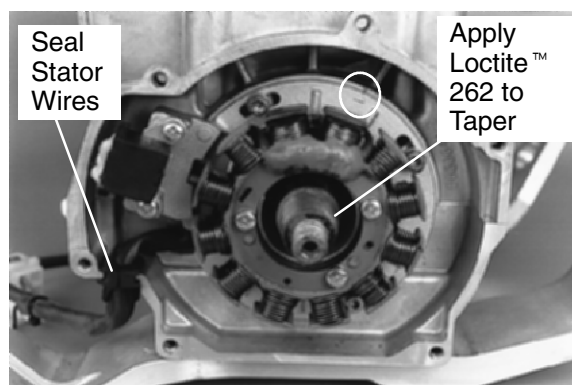
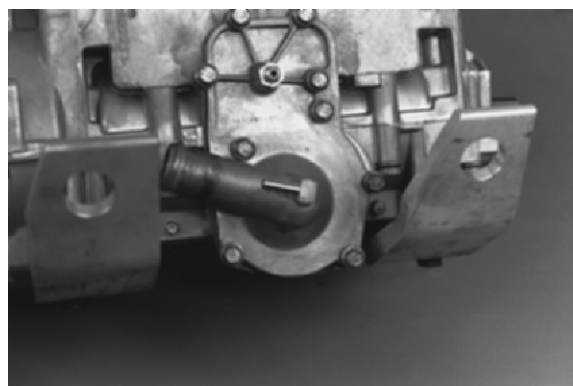
34. Install new exhaust manifold gaskets and manifold.

**Exhaust Manifold Bolt Torque:****16 Ft lbs (22 Nm)**

35. Assemble V.E.S. valve. Refer to V.E.S. procedures on pages 2.36-2.39.
36. Install reed valves, stuffers, and carburetor adaptors. Place stator wire guide on Mag side carburetor adaptor bolt.
37. Install stator assembly, aligning timing marks or marks made upon disassembly. Seal stator wires with high temperature silicone sealant. Install and tighten stator screws to specification.
38. Measure trigger (pulse) coil gap and compare to specification.

**Stator Screw Torque****60 in. lbs. (7 Nm)****Trigger (Pulse) Coil Gap**

**Minimum:** .020" (.5mm )  
**Maximum:** .040" (1.0mm )



### Assembly, Cont.

39. Apply Loctite™ 262 evenly to the flywheel mounting taper on crankshaft. Install woodruff key.
40. Install flywheel. Apply Loctite™ 242 to crankshaft threads. Install washer and nut.
41. Use flywheel holder to hold flywheel and torque nut to specification found in beginning of this chapter.

**Flywheel Holder:**

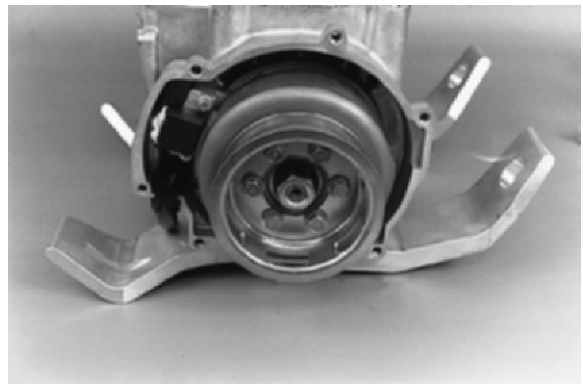
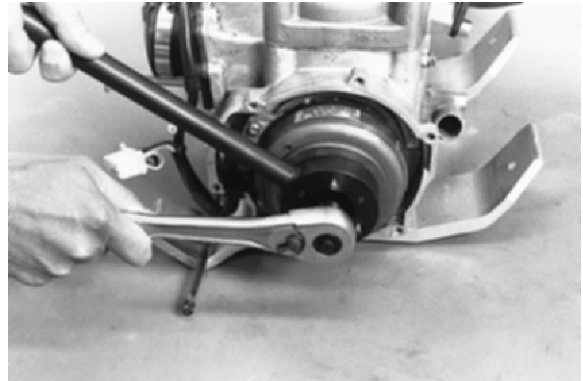
**PN 8700229**

42. Install recoil hub and recoil housing. Torque bolts to specification.

**Recoil Hub and Housing Bolt  
Torque:**

**108 in. lbs. (12.5 Nm)**

43. Install engine in chassis and align clutches.
44. Refer to General Inspection Procedures in this chapter to fill and bleed cooling system and oil pump.

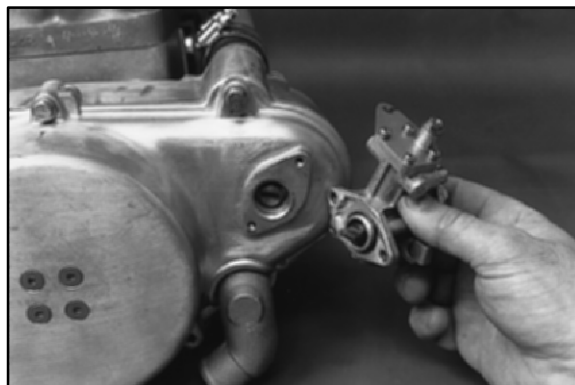


## Liberty™ 700 / 800 Engines

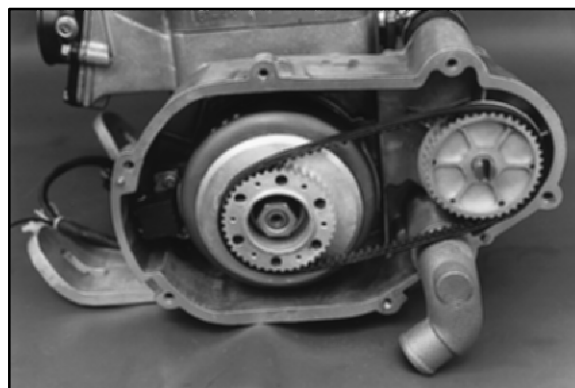
**NOTE:** Inspect all parts for wear or damage during disassembly. It is recommended to replace all seals, O-rings, and gaskets with Genuine Polaris parts during assembly. Refer to General inspection procedures in this chapter.

**Disassembly**

1. Remove the oil pump.

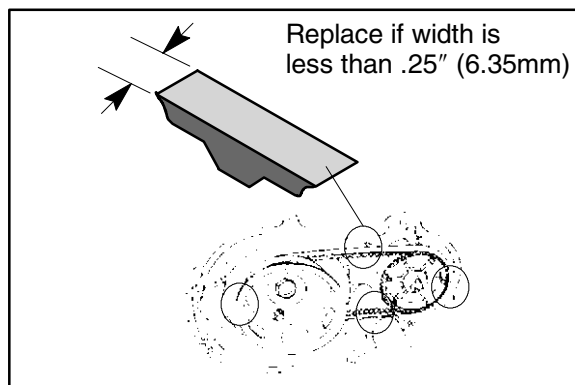


2. Remove the recoil housing and the recoil hub. Inspect waterpump drive belt for missing, cracked, or broken drive cogs.



Measure the belt at 4 different points as shown. Replace if width is less than .250", (6.35mm). Nominal new width is .345", (8.75mm).

3. Remove drive gears and belt.



4. Remove flywheel nut using flywheel holder.

Flywheel Holder: .... PN 8700229



Flywheel Holder:  
PN 8700229

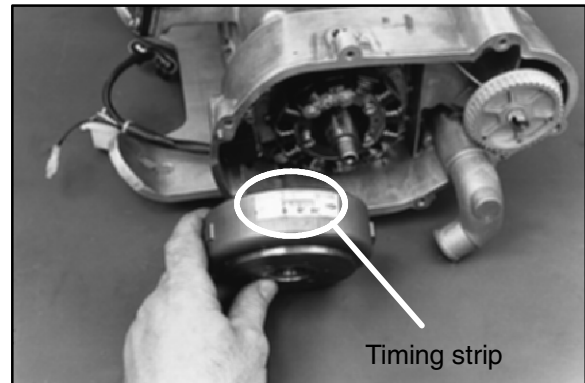
### Disassembly, Cont.

5. Remove flywheel using flywheel puller.

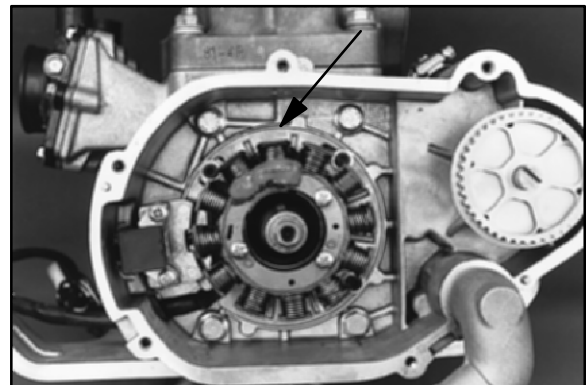
Flywheel Puller: PN 2871043



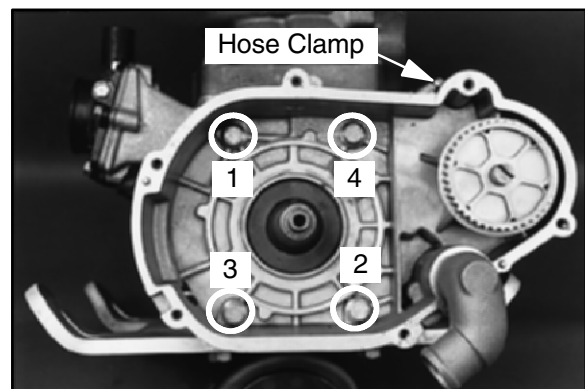
6. Note the ignition timing strip on the flywheel.



7. Before removing stator plate, mark the plate and crankcase for reference upon assembly.



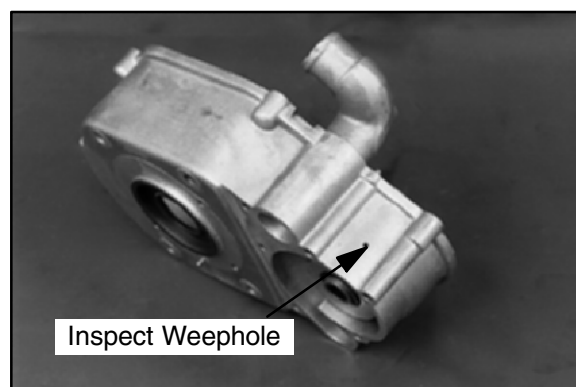
8. Remove bolts holding water pump housing to crankcase. Loosen hose clamp and remove housing.



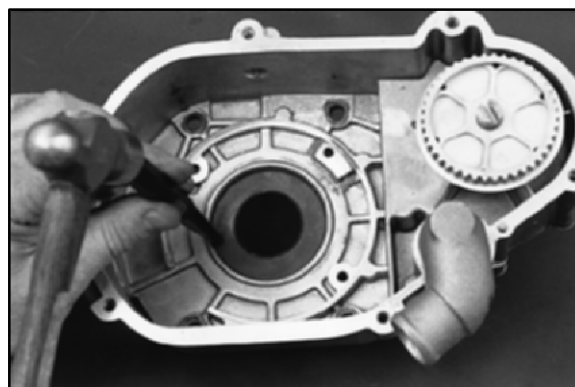


**Disassembly, Cont.**

9. Inspect water pump weep hole for signs of leakage or blockage.



10. Remove crankshaft seal from housing by driving seal to inside of housing. Replace seal if removed.

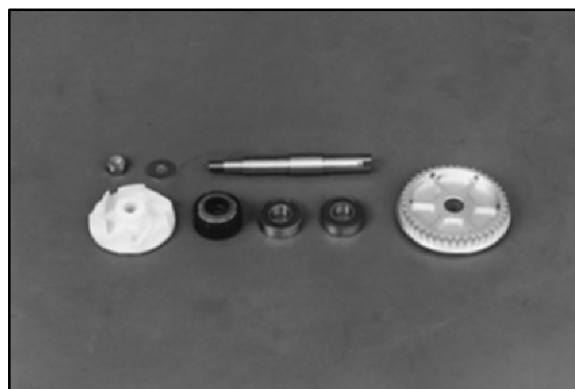


11. Remove water pump cover bolts and then remove impeller nut. Slide shaft out back side.



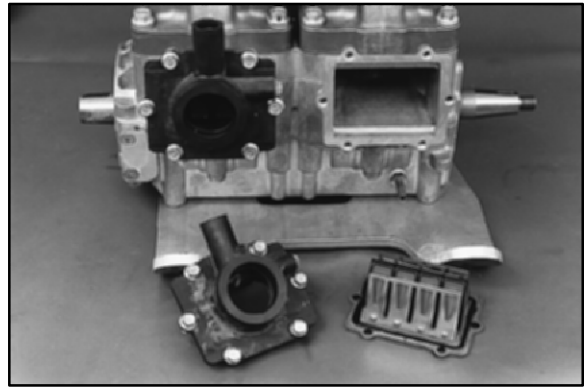
12. Inspect bearings. Replace if necessary. Replace mechanical seal using the special tools listed below. Use the seal press to install a new mechanical seal in cover with spring sleeve toward impeller housing. Install seal guide over end of shaft and apply a light film of grease to seal guide. Carefully install shaft and bearings in cover. Assemble 10x14mm washer, impeller, washer, and nut. **Torque impeller nut to 10 ft.lbs. (14Nm).**

**Water Pump Mechanical Seal Installation**  
Tool - 700/800 domestic engines:  
8.9mm.  
PN 2872389



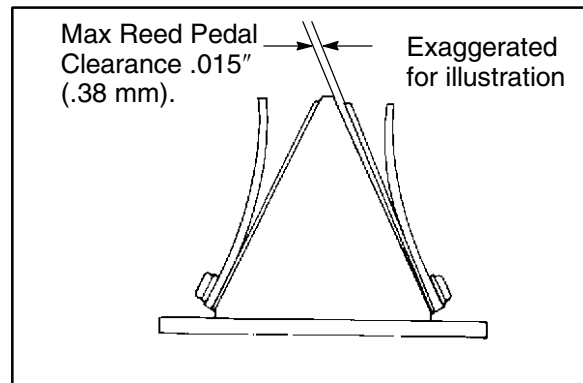
### Disassembly, Cont.

13. Remove reed cover, reed stuffers, and reeds.



### Reed Valve Inspection

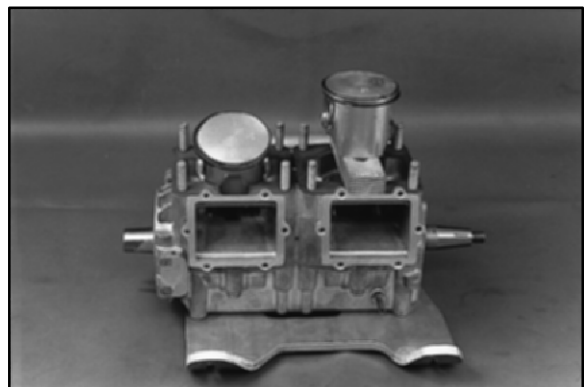
14. Measure air gap between fiber reed and reed block as shown. The air gap should not exceed .015" (.4 mm). If clearance is excessive DO NOT attempt to reverse the reeds to reduce the air gap. *Always replace them if damaged.* Check each fiber reed for white stress marks or missing material. Replace if necessary.



15. Remove V.E.S. assembly. Clean valves as outlined later in this chapter.



16. Remove cylinder head. Note condition and placement of cylinder head O-rings.
17. Loosen cylinder base nuts and remove cylinders.



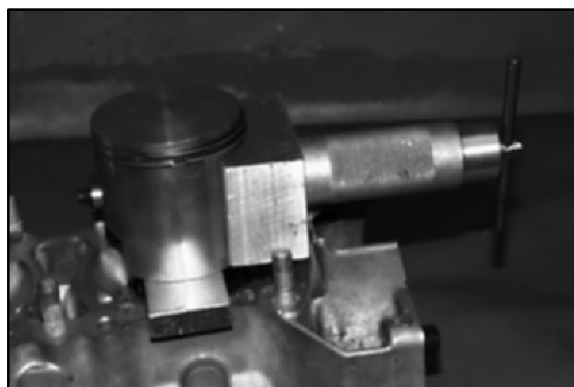
**Disassembly, Cont.**

18. Carefully remove C-clip holding piston pin in place.

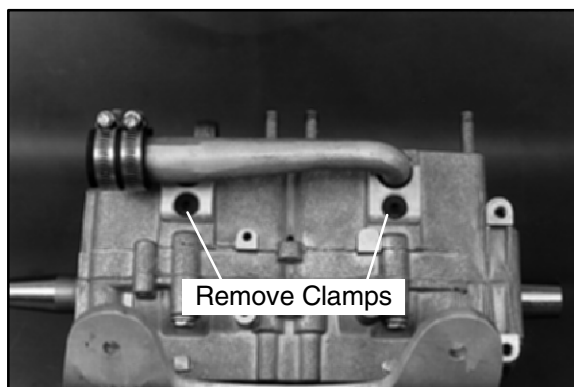


19. Remove piston pin using piston pin puller and adaptor.

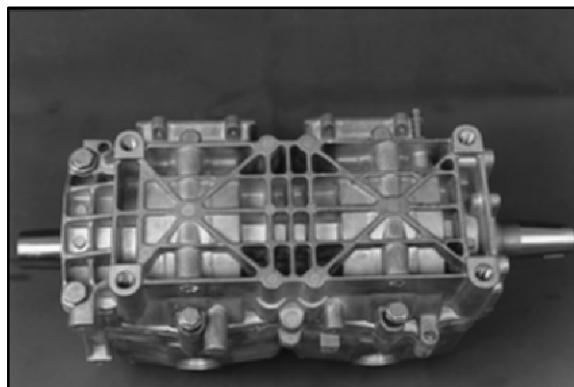
**Piston Pin Puller PN 2870386  
Adaptor PN 5130971**



20. Remove water manifold by removing both retainer brackets.

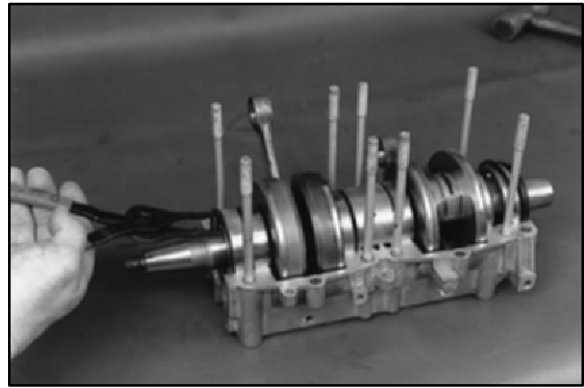


21. Remove bottom crankcase bolts and separate crankcase halves.



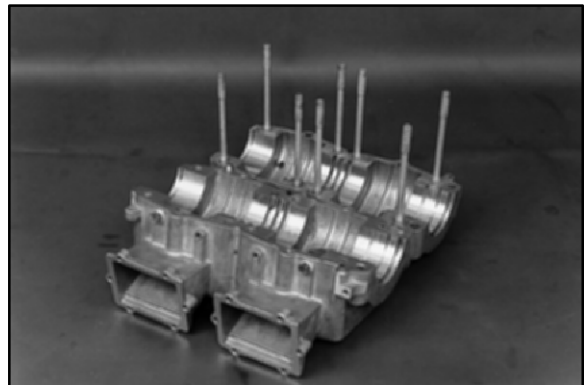
### Disassembly, Cont.

22. Remove snap rings and crankshaft seals.
23. Clean thoroughly to remove all grease, oil, dirt, and old sealant.



### Assembly

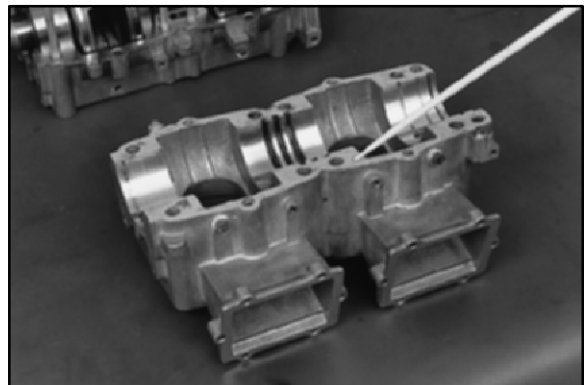
1. Clean all parts with solvent and dry with compressed air.



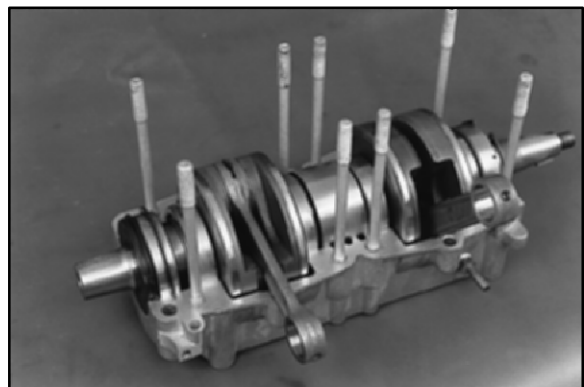
2. Apply 3-Bond™ 1215 sealant to upper crankcase half.

**NOTE:** Use only 3-Bond™ 1215 sealant. Curing time and film thickness are critical for proper bearing clearance.

**3-Bond™ 1215**  
**PN 2871557 120 Gram Tube**



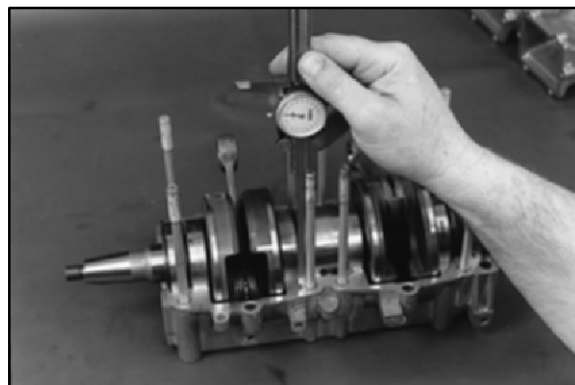
3. Set crankshaft in lower crankcase. Lubricate seal lips with Premium All Season Grease. Make sure seals are positioned properly with lip and spring facing inward toward crankshaft. Install snap rings with gap facing upward toward upper case half.



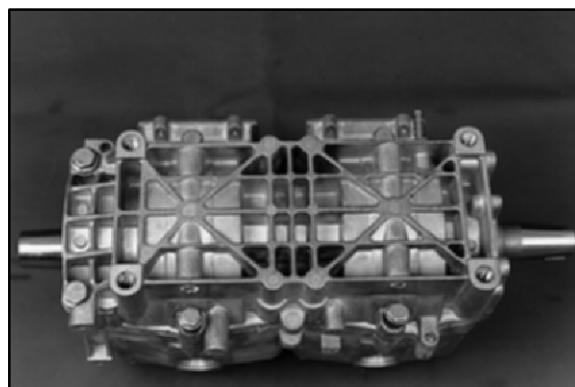
**Assembly, Cont.**

4. If studs were removed or new crankcase installed, apply Loctite™ 242 to threads of studs and screw in until bottomed. Tighten securely.
5. Measure installed length of stud bolt. This is the length necessary to allow cylinder installation.

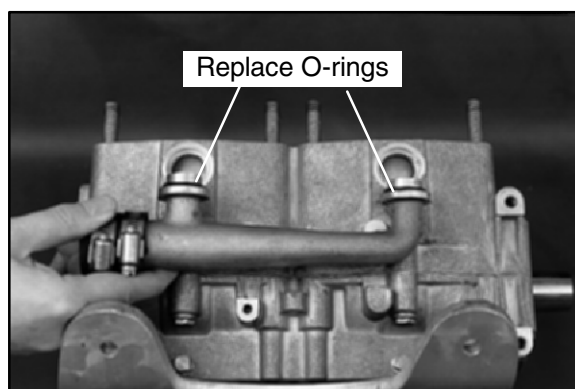
**Lower Crankcase Stud Height  
121-124 mm (4.76-4.88") from crankshaft  
parting line.**



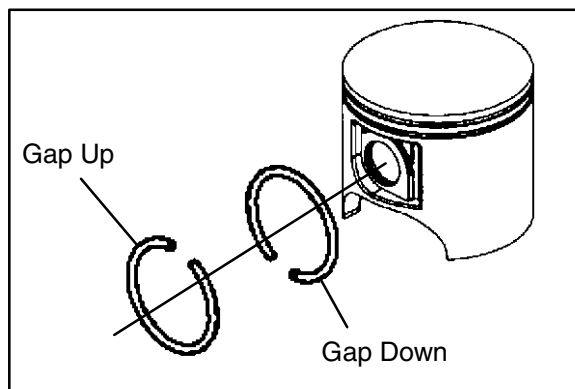
6. Install crankcase halves together. Torque bottom crankcase bolt to specification in the proper sequence found in the beginning of this chapter.



7. Install new O-rings on water manifold. Grease O-rings and install manifold.



8. Lubricate main bearing oil holes with Polaris Premium 2 Cycle or Premium Gold engine oil and rotate crankshaft to distribute oil evenly.
9. Install a new C-clip in both pistons (inside) with gap facing up or down. Be sure clip is fully seated in the piston groove.



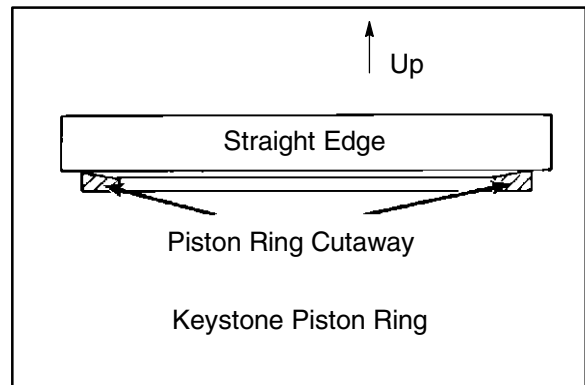
### Assembly, Cont.

10. Lubricate and install new connecting rod small end bearing in rod.
11. Install remaining C-clip with gap up or down. Be sure both clips are fully seated in the groove.

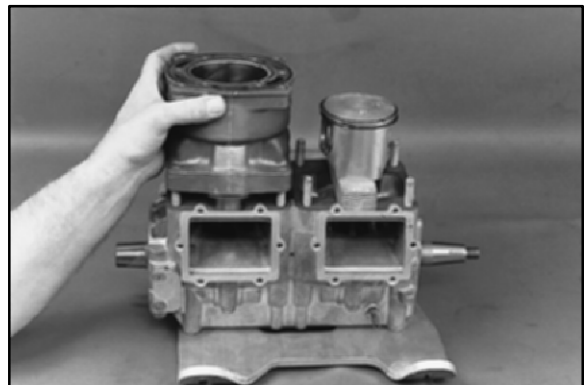
**C-Clip Installation Tool**  
**PN 2872622 - 22mm for Large Block**  
**(700-800 Domestic Engines)**



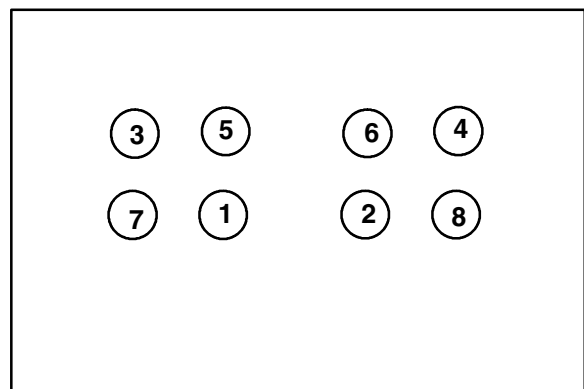
12. Install pistons and rings. Make sure C-clips are firmly seated in grooves. **NOTE:** Keystone ring bevel must be up. Marking near ring end gap faces upward.



13. Lubricate pistons, rings, upper rod bearing, and cylinders with two stroke oil and install cylinders. Align ring end gaps with locating pins and compress rings. Install cylinder carefully with a gentle front to rear rocking motion. Loosely install the cylinder nuts.

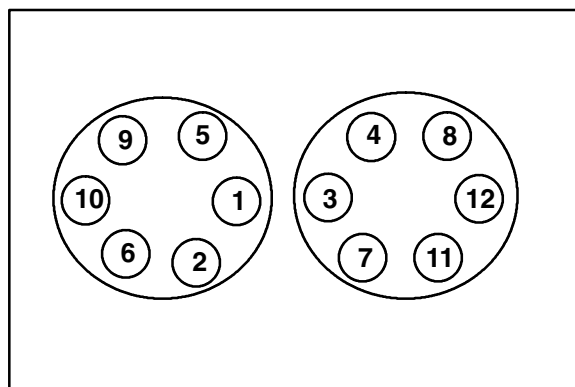


14. Install new cylinder head O-ring and install cylinder head. Make sure O-ring is properly seated in groove.
15. Torque cylinder base bolts in proper sequence. Refer to specifications in the beginning of this chapter.



**Assembly, Cont.**

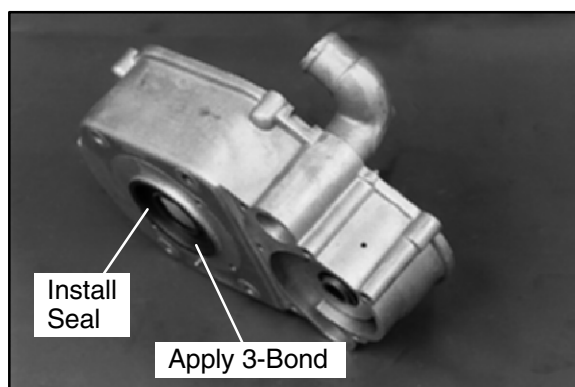
16. Torque head bolts in proper sequence. Refer to specifications in the beginning of this chapter.



17. Reassemble water pump carefully installing seal.

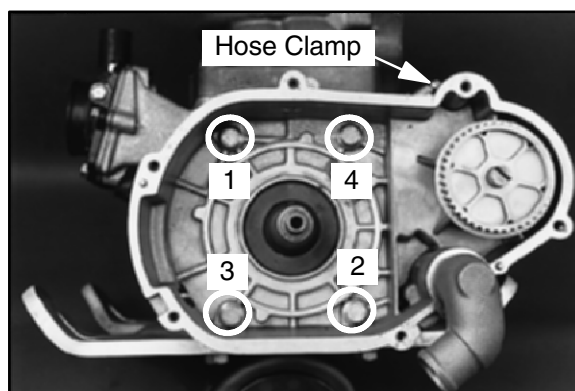


18. Install crankcase seal to ignition/water pump housing from inside toward outside until bottomed on housing. Spring and seal lip must face inward toward crankshaft.



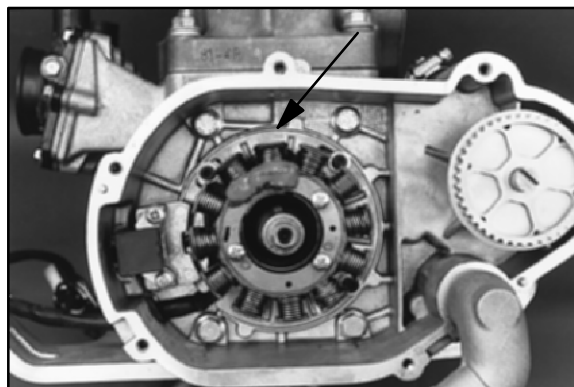
19. Apply 3 Bond™ sealant to pump housing crankcase mating surface and carefully install onto crankcase. Tighten water pump to engine hose clamp and torque bolts to specification.

**Ignition/Water Pump Housing Torque  
22 Ft. lbs (30.4 Nm)**



### Assembly, Cont.

20. Align timing marks and install stator.



21. Install flywheel and torque flywheel nut to 90 ft.lbs (124Nm).

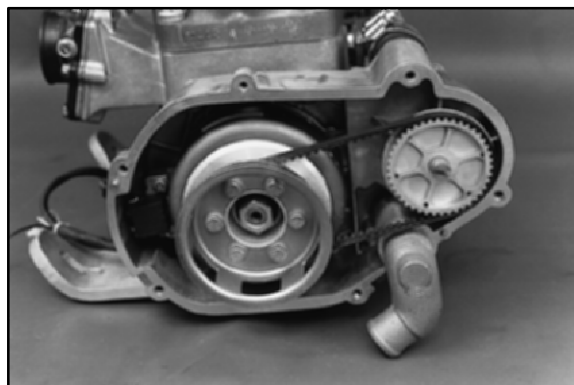
**Flywheel Nut Torque -**  
**90ft. lbs. (124 Nm)**



22. Install water pump belt and recoil hub.

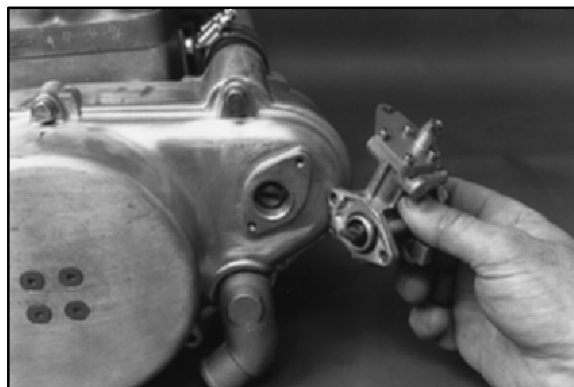
**NOTE:** See domestic twin water pump belt installation in chapter 2, Maintenance, for correct belt installation

**Recoil Hub Bolt Torque -**  
**96-108 in. lbs. (11 - 12.5 Nm)**



23. Install recoil cover and oil pump. Make sure oil pump drive slot mates properly with water pump shaft.

24. Install reed valve, reed stuffer, and reed cover.





## V.E.S. Removal

1. Remove the mounting bolts.

On Domestic Engines remove all four (4) mounting bolts and be ready to catch the spring and cover as you remove the mounting bolts.

**CAUTION:** Valve is spring loaded. Hold cover in position until all bolts are removed.



2. Remove exhaust valve assembly from the cylinder(s).
3. 800 Fuji engines, remove four cover bolts, cover, and return spring.

**CAUTION:** Valve is spring loaded. Hold cover in position until bolts are removed.

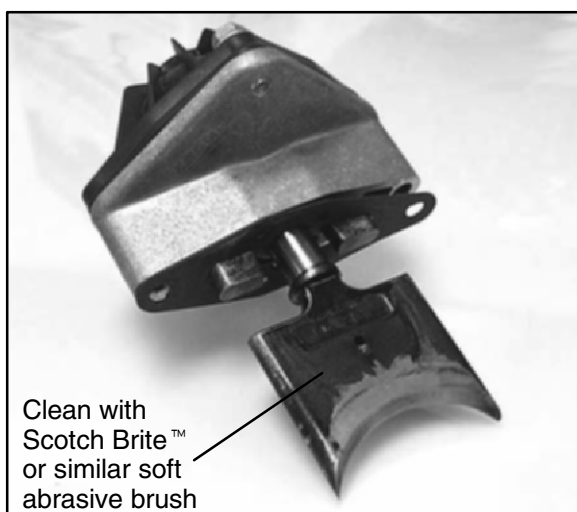
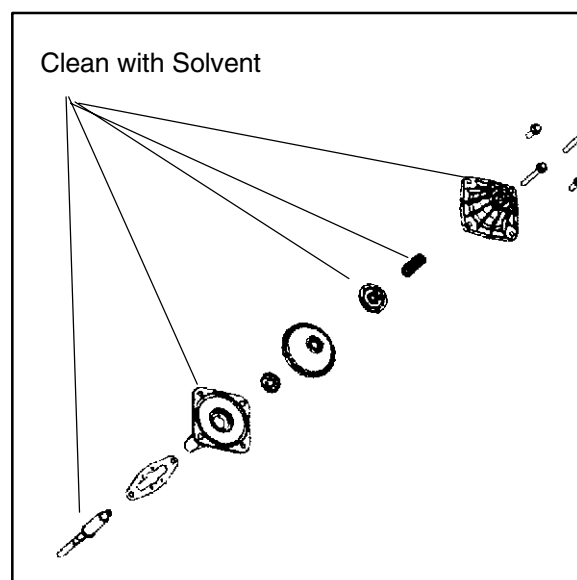
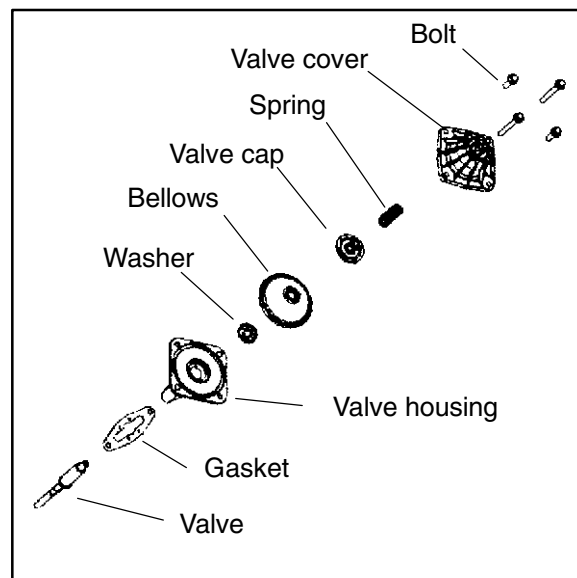
4. If the spring stays in the cover, hold the cover with spring facing toward you. Rotate spring in a counterclockwise direction while pulling outward on the spring. Do not distort the spring upon removal.
5. Insert V.E.S. in a soft jawed vice. Carefully remove exhaust valve cap.

**NOTE:** Top nut is secured to valve with adhesive. Removing top nut may damage threads on valve. If nut will not loosen, apply a small amount of heat to cap. DO NOT OVERHEAT or damage to the bellows will result.



## V.E.S. Disassembly, Cleaning, Inspection

1. Clean O-ring and bellows in warm water and mild detergent. Inspect bellows for holes, distortion or damage. Replace if necessary. Inspect O-ring for damage.
2. Clean all other parts with solvent. Be sure all parts are thoroughly clean.
3. Inspect the actuator port in cylinder and valve housing. Be sure it is clear and not obstructed by debris or carbon.
4. Carbon deposits can be removed from valve with a Scotch Brite™ pad or similar soft abrasive brush.
5. Lubricate exhaust valve with Polaris Premium Gold 2-cycle engine lubricant. Install valve in cylinder and move it through the entire travel range to check for free movement without binding. If the valve sticks anywhere in the travel range, check the valve and valve bore in the cylinder for carbon deposits and clean if necessary. Do not remove anodized coating while cleaning.



**V.E.S. Assembly****V.E.S. Assembly**

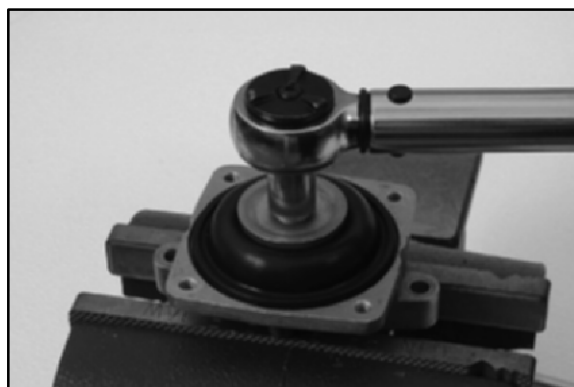
1. Insert exhaust valve into valve housing. Replace housing gasket.

2. Install washer, beveled side out, and bellows.



3. Apply Loctite™ 262 to the threads of valve and install valve cap. Torque to specification.

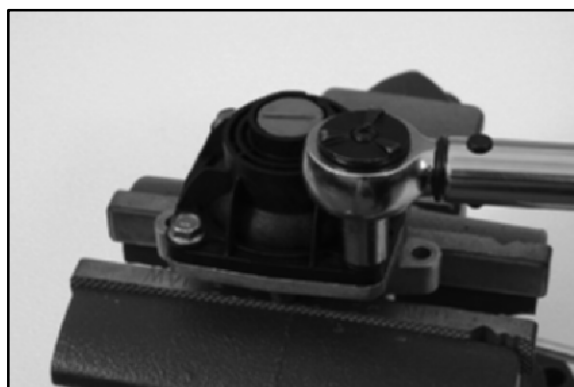
**Valve Cap Torque:**  
**6 Ft lbs (8.3 Nm)**



4. Install spring, valve cover, and adjuster nut. Torque exhaust valve cover bolts to specification.

**Fuji Valve Cover Bolt Torque:**  
**4 Ft lbs (5.5 Nm)**

**Domestic Valve Cover Bolt Torque:**  
**12 ft.lbs(16Nm)**

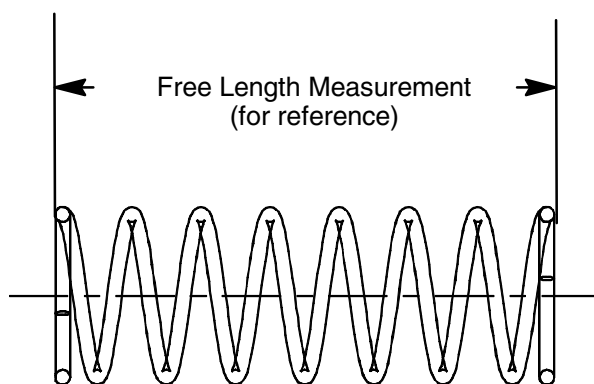


5. Install V.E.S. assembly onto cylinder and torque V.E.S. housing bolts to specification. Domestic Engines utilize two of the cover bolts for mounting to the cylinder. The torque value for these are 12 ft.lbs(16Nm).

## Polaris Variable Exhaust System Springs

PART NUMBER	COLOR	LOAD @ 1.0 In (LBS.)	LOAD @ .630 in (LBS.)	FREE LENGTH (REF)(IN.)	WIRE DIA. (IN.)
7041786-01	RED/WHITE	3.0	4.3	1.854	.041
7041786-02	BLUE/WHITE	4.0	6.0	1.740	.045
7041786-03	GREEN/WHITE	5.0	7.0	1.930	.045
7041786-04	YELLOW/WHITE	5.0	8.0	1.620	.045
7041786-05	ORANGE/WHITE	7.0	9.0	2.300	.046
7041786-06	PINK/WHITE	6.0	8.0	2.110	.046
7041786-07	PURPLE/WHITE	9.0	11.0	2.670	.049
7041786-08	GREEN/YELLOW	8.0	10.0	2.400	.049
7041786-09	RED/YELLOW	3.0	3.7	2.586	.037
7041786-11	PINK/YELLOW	9.0	11.5	2.323	.051
7041704-01	BLUE	4.0	6.0	1.752	.0475
7041704-02	ORANGE	5.5	8.3	1.729	.0475
7041704-03	PINK	4.7	7.1	1.734	.046
7041704-04	PURPLE	3.1	4.7	1.726	.040
7041704-05	YELLOW	2.4	3.6	1.734	.037
7041704-06	WHITE	1.6	2.8	1.537	.036

These springs will change the timing characteristics of the exhaust valve opening. A heavier spring will keep the valve in the closed position longer, while a lighter spring will allow the valve to open sooner. **NOTE:** If making any changes to the valve springs make sure to change all springs so that each valve spring is the same.



## Cylinder Service

Maximum engine performance and easy starting are directly related to the compression of the fuel and air mixture in the combustion chamber. It is important that the cylinder walls are concentric, smooth and perpendicular to the crankshaft center line. All new engines have these characteristics built into them, however, the stresses and heat of operation may cause the bore to distort or score, resulting in loss of compression and power.

### Inspection

A simple way of checking cylinder/piston condition is to remove the exhaust manifold and look into the exhaust port. If there is a considerable amount of blow by (brown or black carbon deposit) under the piston rings, the cylinder should be removed and honed. The piston rings should be replaced also.

The cylinder should always be inspected whenever an engine has been disassembled for repair or any time a loss of power or cylinder cranking compression is noted. A visual inspection after the cylinder head is removed will reveal if the cylinder should be removed for honing. Inspect for any scratches or signs of scoring or brown areas which indicate ring leakage and distortion.

### Cylinder Honing

The cylinder bore must be de-glazed whenever new piston rings are installed\*. A light honing with fine stones removes only a very small amount of material. A proper crosshatch pattern is important to provide a surface that will hold oil, and allow rings to seat properly. If the crosshatch is too steep, oil retention will be reduced. A cross-hatch angle which is too shallow will cause ring vibration, poor sealing, and overheating of the rings due to blow-by and reduced contact with the cylinder wall. Service life of the pistons and rings will be greatly reduced.

\* Except Nicasil

### Cylinder Hone Selection

Selecting a hone which will straighten as well as remove material from the cylinder is very important. Honing a cylinder with a spring loaded glaze breaker is never advised. Polaris recommends using a rigid type hone which also has the capability of oversizing. These hones are manufactured by such companies as Sunnen Products Company of St. Louis, Missouri; and Ammco Tools, Inc., of North Chicago, Illinois.

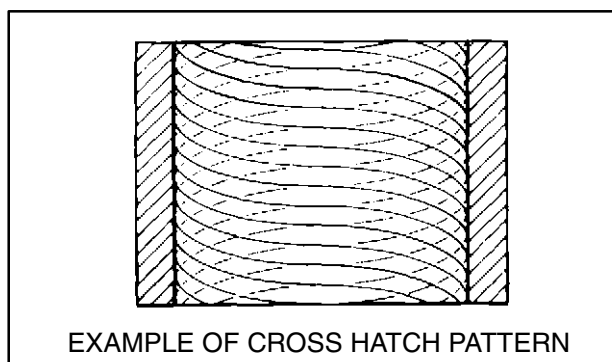
### De-glazing

If cylinder wear or damage is minimal, hone the cylinder lightly with finish stones following the procedure outlined on page 2.48

### Honing To Oversize

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.

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 or slightly larger. Always leave .002 - .003" (.05 - .07 mm) for finish honing. Refer to the Snowmobile Service Manual for piston to cylinder specifications before honing. Complete the sizing with fine grit stones to provide the proper cross-hatch finish and required piston clearance. See procedure on page 2.48.



EXAMPLE OF CROSS HATCH PATTERN

## Honing Procedure

1. Wash cylinder with solvent. Clamp cylinder securely in a soft jawed vise by the exhaust port studs.
2. Place hone in cylinder and tighten stone adjusting knob until stone contacts the cylinder walls (DO NOT OVERTIGHTEN). Cylinders may be wet or dry honed depending on the hone manufacturer's recommendations. Wet honing removes more material faster and leaves a more distinct pattern in the bore. Using a 1/2" (13 mm) drill motor rotating at a speed of 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 to prevent edge loading and always bring the stone approximately 1/2" (1.3 cm.) beyond the bore at the end of each stroke. Release the hone at regular intervals to inspect bore size and finish. Do not "drag" the hone out of the bore.

## Honing Procedure - Nicasil

Ni-Ca-Sil cylinders can be lightly honed if the proper stone is used. Ammco #3955 honing stones (for use with the Ammco 3950 cylinder hone) are suitable and can be ordered through most automotive supply stores or VST. See General Information chapter for tool ordering information.

## Port Chamfering

Remove the sharp edges at the bottom and top of each port whenever boring or honing is performed. Make sure there are no sharp edges.

### IMPORTANT:

## 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 Premium 2 Cycle Lubricant.

## Crankcase Inspection / Bearing Fit

Any time crankshaft bearing failure occurs and the case is to be reused, Polaris recommends checking the bearing fit into the case halves using the following procedure.

1. With case halves cleaned, press a replacement bearing into each of the main bearing journals to determine a basic amount of press fit. **NOTE:** Do a comparison check of all journals by manually forcing the bearing into the bearing seats noting if any are noticeably loose or tight. Normal hand installation will be an indication of the recommended interference fit. If the bearing falls out of the case when the case is inverted, the case should be replaced.

### Crankcase Bearing Interference Fit:

C-3 - .0006" (.015mm) - Crush  
C-4 - .001" (.025mm) - Crush



## Crankshaft Main Bearing Inspection

1. Clean crankshaft thoroughly and oil main and connecting rod bearings with Polaris Premium 2 engine oil. Carefully check each main bearing on the shaft.

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

## Connecting Rod (Big End) Bearing Inspection

1. Measure connecting rod big end side clearance with a feeler gauge. Clearance should be equal on all rods (within .002"). Rotate rod on crankshaft and check for rough spots. Check radial end play in rod by supporting rod against one thrust washer and alternately applying up and down pressure. Replace bearing, pin, and thrust washers if side clearance is excessive or if there is any up and down movement detectable in the big end bearing.

**NOTE:** Specialized equipment and a sound knowledge of crankshaft repair and straightening is required to perform crankshaft work safely and correctly. Crankshaft repair should be performed by trained Polaris service technicians in a properly equipped shop.



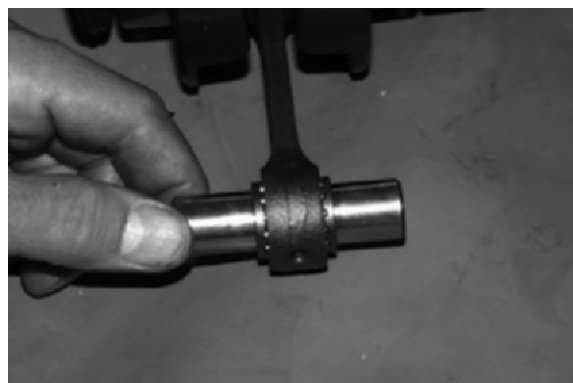
## Piston Pin / Needle Bearing Inspection

1. Clean needle bearing in solvent and dry with compressed air.
2. Inspect needle cage carefully for cracks or shiny spots which indicate wear. Replace needle bearings if worn or cracked, and always replace them if piston damage has occurred.
3. Visually inspect piston pin for damage, discoloration, or wear. Run your fingernail along the length of the pin and replace it if any rough spots, galling or wear is detected.



## Connecting Rod Small End Inspection

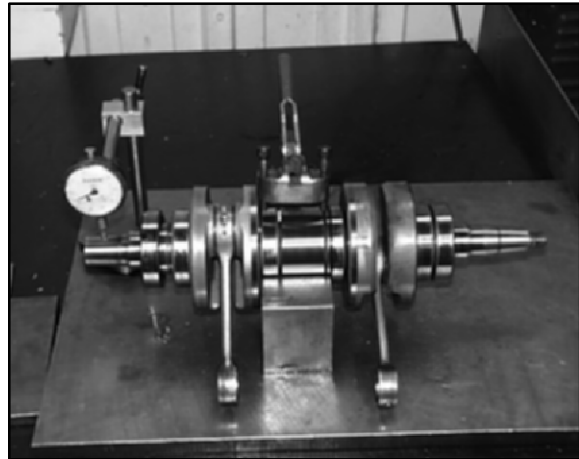
1. Clean small end of connecting rod and inspect inner bore with a magnifying glass. Look for any surface irregularities including pitting, wear, or dents.
2. Run your fingernail around the inside of the rod and check for rough spots, galling, or wear.
3. Oil and install needle bearing and pin in connecting rod. Rotate pin slowly and check for rough spots or any resistance to movement. Slide pin back and forth through bearing while rotating and check for rough spots.
4. With pin and bearing centered in rod, twist ends back and forth in all directions to check for excessive axial play. Pull up and down evenly on both ends of pin to check for radial play. Replace pin and bearing if there is any resistance to rotation or excessive axial or radial movement. If play or roughness is evident with a new pin and bearing, replace the connecting rod.



## Crankshaft Truing

Lubricate the bearings and clamp the crankshaft securely in the holding fixture. On three cylinder crankshafts, straighten one of the ends (Magneto or PTO) and then straighten the center section. Place the center section in the holding fixture and then straighten the remaining end. If truing the crankshaft requires striking with a hammer, always be sure to re-check previously straightened areas to verify truing. Refer to the illustrations below.

**Crankshaft Alignment Fixture  
PN 2870569**

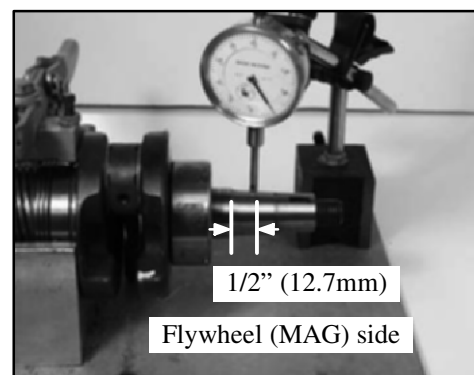


## Crankshaft Runout Inspection

When checking the crankshaft runout, it is important to measure with a dial indicator in the correct position.

When measuring on the flywheel side:

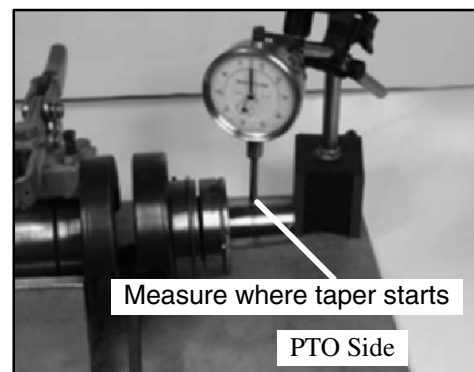
- Measure runout 1/2" (12.7mm) from the bearing flat.



When measuring from the PTO side:

- Measure runout where the taper starts after the bearing flat.

Refer to the illustrations. Acceptable crankshaft runout is .000-.004" (0-.10mm) for all Polaris crankshafts.





## Crankshaft Truing

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

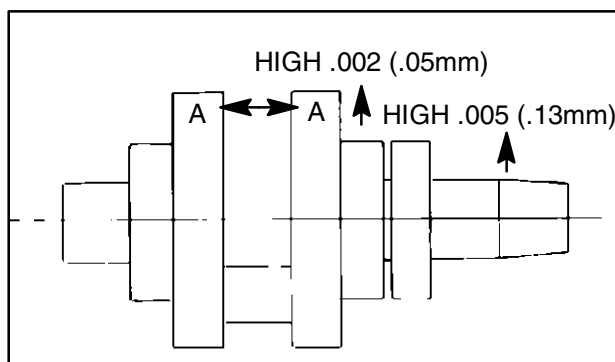
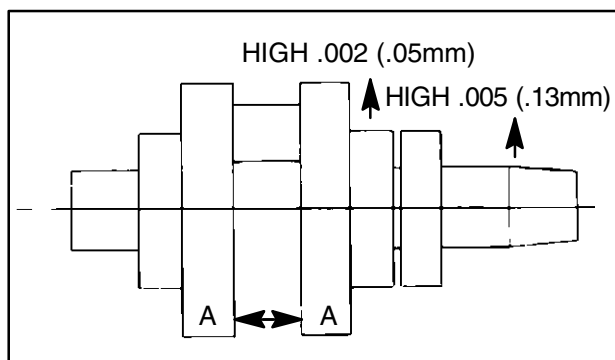
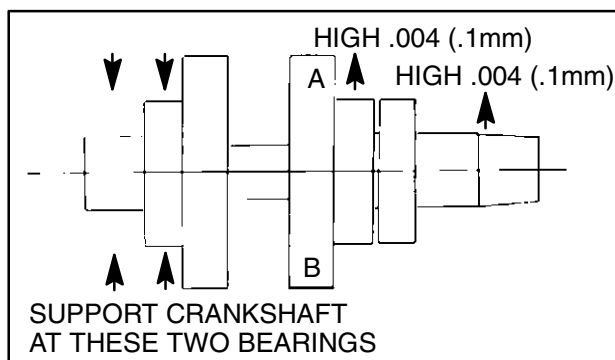
5. To correct a situation like the one shown in the illustration at right, strike the shaft at point A with a brass hammer.

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

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

7. If the crank rod pin location is  $180^\circ$  from the dial indicator (opposite that shown above), it will be necessary to spread the crankshaft at the A position as shown in the illustration at right. When rebuilding and straightening a crankshaft, straightness is of utmost importance. Runout must be as close to zero as possible.

**NOTE:** Maximum allowable runout is .004" (.1 mm).



## Crankshaft Indexing

Polaris crankshafts are pressed together or “indexed” so the connecting rod journal center lines are 180° (twins) or 120° (triples) apart from each other.

It is sometimes necessary to check multi-cylinder crankshafts to verify that one cylinder has not been forced out of position relative to the other cylinder or cylinders. Causes for out-of-index crankshafts include but are not limited to:

- Hydrolock from water or fuel;
- Impact to drive clutch from foreign object or accident;
- Abrupt piston or other mechanical failure;
- Engine lock-up due to drive belt failure;

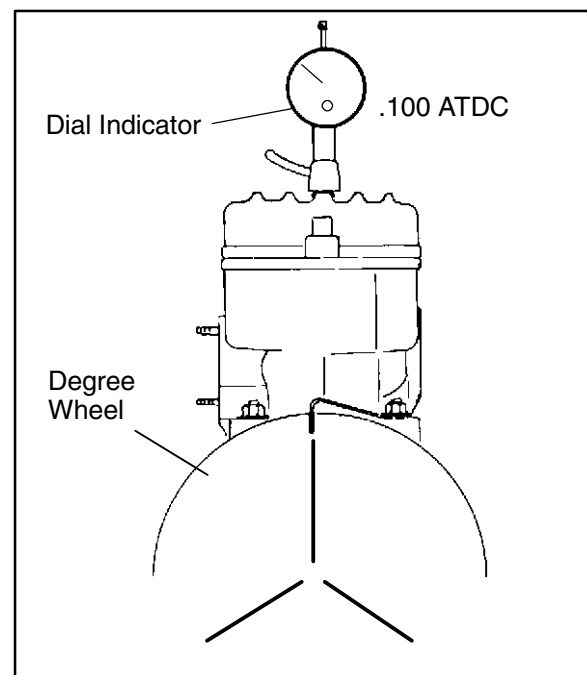
Following is a method of checking:

**CAUTION:**

Disconnect battery ground cable and **all** spark plug high tension leads; ground high tension leads to engine. Disconnect lanyard from engine stop switch before proceeding with the following steps.

1. Securely fasten a degree wheel on the flywheel or PTO end of crankshaft. Use a large degree wheel for more accuracy, and make sure it is mounted concentrically with the crankshaft center line.
2. Sharpen a coat hanger or section of welding rod and anchor it to a convenient spot. Point the sharpened end at the outer perimeter of the degree wheel.
3. Install a dial indicator into the magneto end cylinder spark plug hole (front) (#1). (The ignition timing is referenced by the magneto end.)
4. Rotate the engine to bring the piston to top dead center (TDC) on the cylinder with the indicator installed.
5. Locate TDC as accurately as possible by finding the center of the point where there is no piston movement. “Zero” the dial indicator at this point. Continue to rotate the crankshaft in the normal direction of rotation until the dial indicator reads .100” (2.54mm) after top dead center (ATDC).

**IMPORTANT:** Do not allow the crankshaft to move from this position.



## Crankshaft Indexing (Continued)

6. Bend the pointer or move the degree wheel until the pointer aligns with the 180° or 120° mark on the degree wheel.
7. With the pointer aligned, make sure the degree wheel and pointer are secured and will not move out of position. Re-check accuracy of this location by repeating steps 4. and 5. . The pointer should align with the 180° or 120° mark when the dial indicator reads .100” (2.54mm) ATDC.

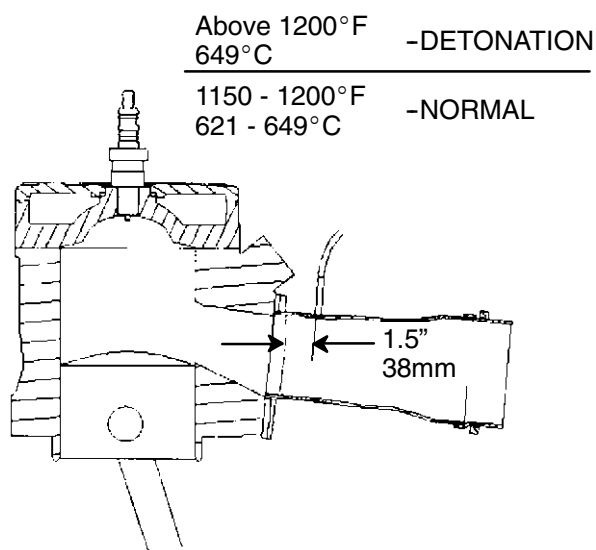
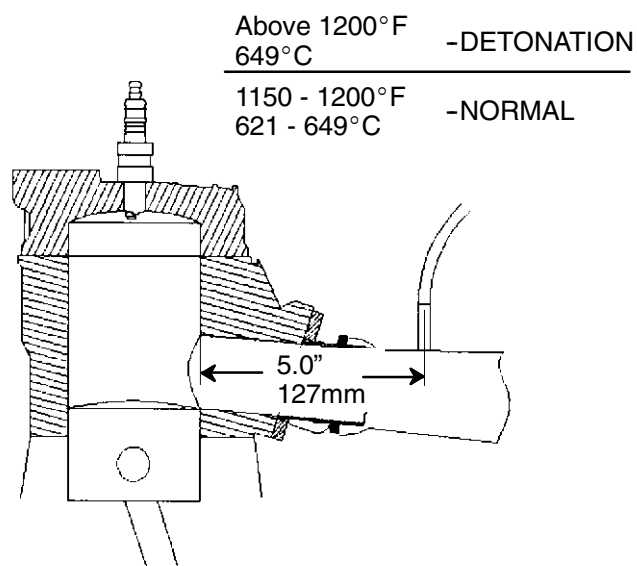
**IMPORTANT:** Do not move the degree wheel or pointer after the initial setting on the mag end cylinder - simply read the wheel and dial indicator.

8. Remove the dial indicator and install in cylinder #2 or center cylinder. Repeat steps 4. and 5. Note the degree wheel indication when the dial indicator reads .100” ATDC. It should be 180° or 120° ( $\pm 2^\circ$ ) from cylinder #1. Repeat procedure on PTO cylinder (#3) where applicable. Cylinder #3 should also be 120° ( $\pm 2^\circ$ ) from cylinder #1.

Symptoms of an out of index crankshaft can include:

- Difficulty calibrating carburetor (repetitive plug fouling on one cylinder with no other cause);
- Unexplained piston failure on one cylinder (i.e. severe detonation, broken ring lands, piston holing);
- Excessive vibration of engine, backfiring, etc.;
- Rough idle, poor top speed.

## Exhaust Gas Temperature

*Exhaust Gas Temperature***Multiple Cylinder Single Pipe****1 Pipe Per Cylinder**

**NOTE:** The temperatures given are approximate and should only be used as an example. You must determine the EGT numbers that are correct for your machine

For more information contact Bill Rader (715) 355-5157

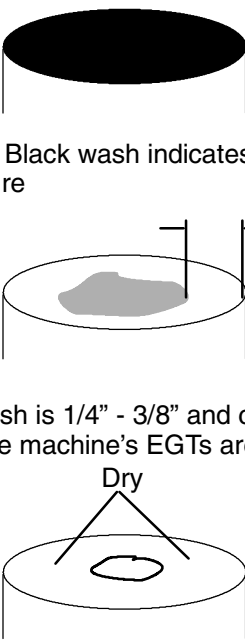
### Piston Wash and Spark Plug color

Changing temperature, barometer, altitude, and fuel supply are just a few of the factors that can affect the day to day performance of your engine. That is why using Exhaust Gas Temperatures (EGTs) are important for maintaining optimum performance.


There are two methods for helping you determine what the EGTs are for your machine. Piston wash and the coloring of your spark plug.

The piston wash is by far the most valuable tool in concluding EGTs, with the spark plug color running a distant second. Use the illustrations below to help you establish the EGTs for your machine.

#### Piston Wash

- 
- ✓ Wet and Black wash indicates too rich a fuel mixture
  - ✓ If the wash is 1/4" - 3/8" and cocoa brown, the machine's EGTs are just right.
  - ✓ A dry, ash colored piston indicates too lean a mixture for the operating conditions.

#### Spark Plug Color

- 
- ✓ If the plug is wet or very dark, the fuel is running too rich.
  - ✓ If the plug is light to cocoa brown, the machine's EGTs are just right.
  - ✓ A ash white plug with speckles indicates too lean a mixture for the operating conditions.

Once the proper jetting is established, you can reference the EGT gauge for your baseline numbers. Then, if there is a rise or fall of 25 degrees, you must jet accordingly to return your EGTs to the baseline numbers.

## Cylinder Head Inspection

1. Inspect each cylinder head for warping. Replace cylinder head if warp exceeds service limit.

### Cylinder Head Warp

Service Limit: .003" (.08mm)



## Cylinder Measurement

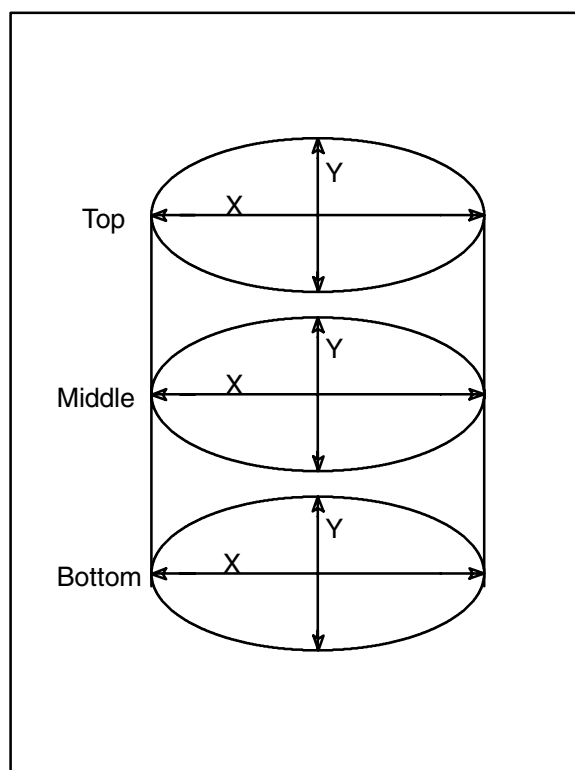
2. Inspect each cylinder for wear, scratches, or damage. If no damage is evident, measure the cylinder for taper and out of round with a telescoping gauge or a dial bore gauge. Measure the bore 1/2" from the top of the cylinder; in line with the piston pin and 90° to the pin to determine if the bore is out of round. Repeat the measurements at the middle and bottom of the cylinder to determine taper or out of round at the bottom. Record all measurements.

### Cylinder Taper

Limit: .002 Max.

### Cylinder Out of Round

Limit: .002 Max.

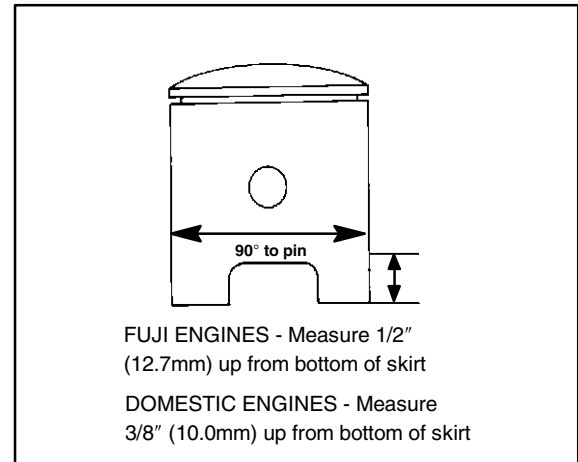


**Piston Inspection/Measurement**

1. Check piston for scoring or cracks in piston crown or pin area. Excessive carbon buildup below the ring lands is an indication of piston, ring or cylinder wear.
2. Measure piston outside diameter at a point 10 mm (3/8") up from the bottom of the skirt at a 90° angle to the direction of the piston pin (domestic engines). For Fuji engines, measure 1/2" (12.7mm) up from the bottom of the piston skirt. Record the measurement for each piston.

**NOTE:** The piston must be measured at this point to provide accurate piston-to-cylinder clearance measurement.

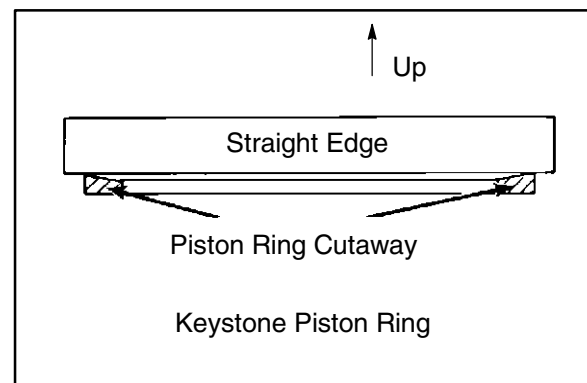
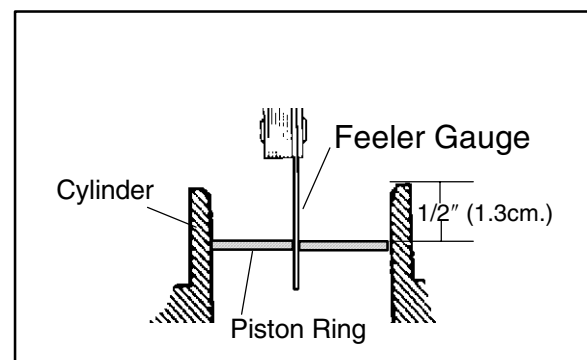
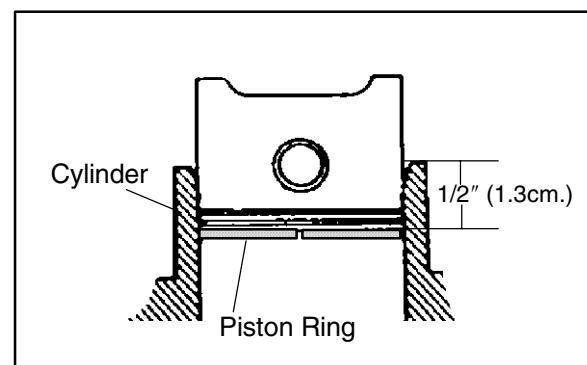
3. Subtract this measurement from the minimum cylinder measurement recorded previously. If clearance exceeds the service limit, the cylinder should be re-bored and new pistons and rings installed.

**Piston Ring Installed Gap**

1. Position ring 1/2" (1.3 cm.) from the top of the cylinder using the piston to push it squarely into place. 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. Replace rings if the installed end gap exceeds the service limit.

**NOTE:** Always check piston ring installed gap after re-boring a cylinder or when installing new rings.

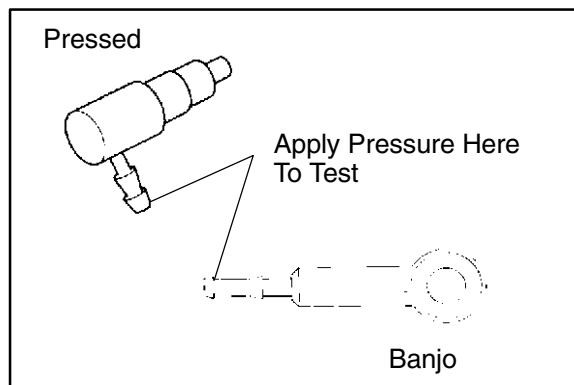


## Oil Pump Operation and Troubleshooting

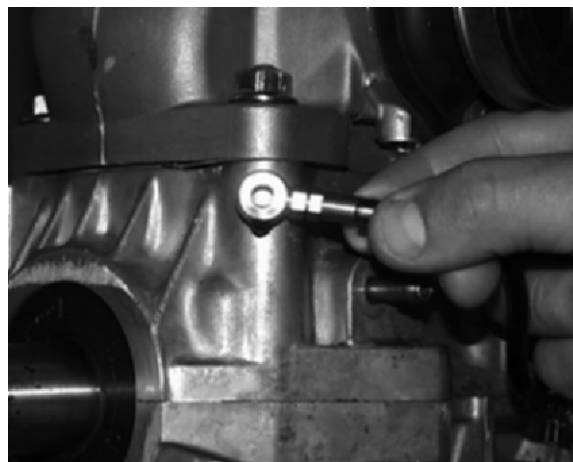
Any time the engine is disassembled or repaired, it is important that the oil supply from the pump to the engine be checked.

**NOTE:** Banjo type or pressed in valves should open with 2 to 7 lbs. of pressure. Perform this test with 40:1 premix in fuel tank.

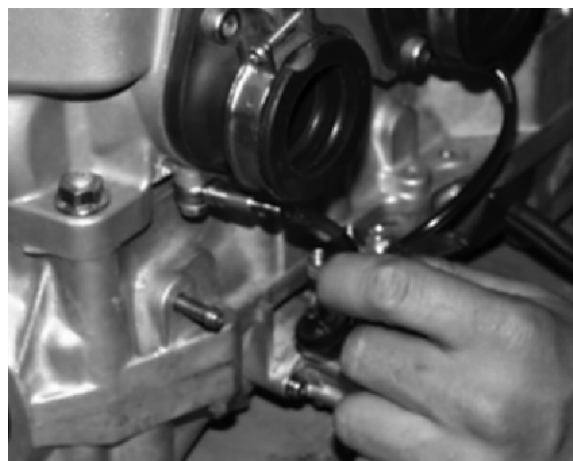
1. With engine in chassis, oil reservoir full, and pump bled, remove two oil feed line banjo bolts (A) from their location on the manifold or carburetors. **NOTE:** Install new sealing washers upon installation on either side of the banjo check valve.
2. Loosely thread only the banjo bolts back into the manifold or carburetors.
3. Place oil feed lines with their check valves away from the clutch area. Start the engine and let it idle at normal idle RPM.



4. Lift oil pump control lever up to its maximum flow position.
5. Drops of oil should be visible from the banjo check valves after the engine is idled one to two minutes, with a drop occurring approximately every few seconds.



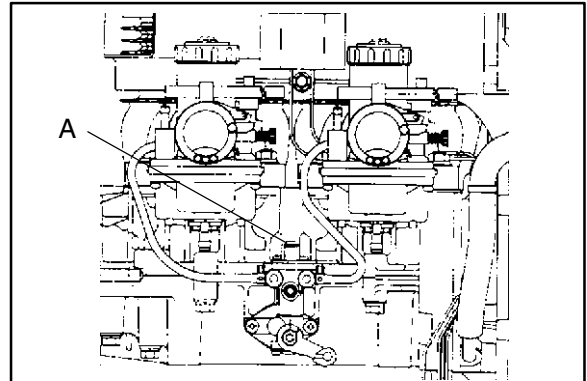
6. If oil does not flow from one of the check valves, remove oil line from check valve and again idle engine. If oil then flows, the check valve is defective and must be replaced.
7. If oil does not flow with check valves removed from their feed lines, the malfunction is one of the following:
  - Inline filter blocked
  - Air not bled from oil pump
  - Feed lines leaking
  - Oil tank vent restricted or kinked
  - Defective pump.



### Oil Pump Bleeding

The oil pump must always be bled following any service to the injector system or engine which allows the loss of oil and subsequent entrapped air during reassembly.

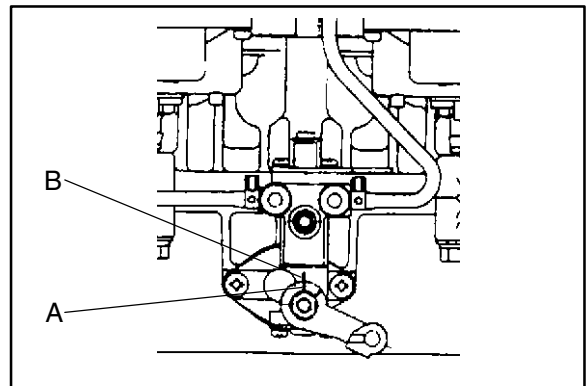
1. Fill oil reservoir with Polaris injector oil.
2. Loosen brass hex head screw (A). After a short time oil should flow from beneath the screw head to indicate the pump is free of air.
3. Tighten bleed screw.



### Oil Pump Adjustment - All Models

After the engine RPM and carburetor adjustments have been made, the oil pump must also be adjusted.

1. With engine shut off and throttle in its idle position, the pump lever index mark (A) must align with the pump housing boss index mark (B).
2. Loosen lock nuts on cable housing sleeve and vary cable housing length as required. **NOTE:** Verify that pump lever is actuated upon initial throttle opening.



### Oil Pump Drive Gear End Play Adjustment

If the oil pump, crankcase, or any other oil pump drive component is replaced, inspect the drive gear end play using the following procedure:

1. Measure distance from oil pump mounting surface to bushing. Call this measurement "A".

**NOTE:** Make sure the bushing is fully seated in the crankcase.

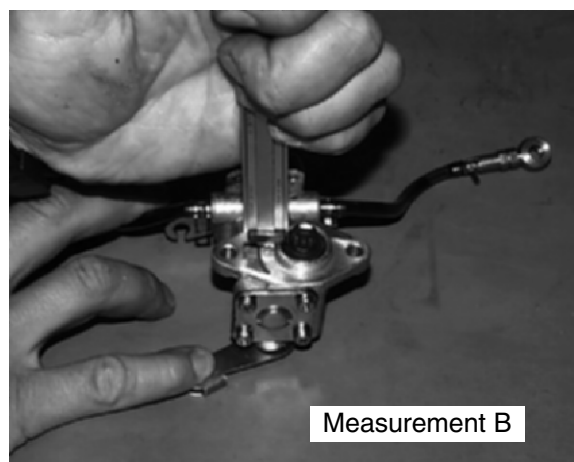
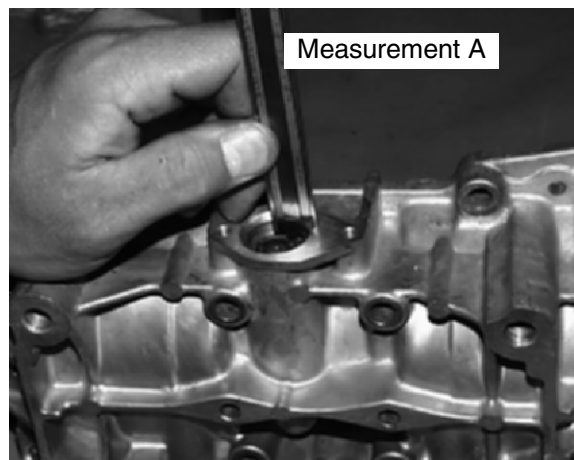


**Oil Pump Drive Gear End Play Adjustment - Fuji**

2. Measure distance from oil pump mounting flange surface to end of seal flange as shown. Call this measurement "B".
3. Subtract measurement "B" from "A" to determine total bushing end play.
4. Measure thickness of existing shims and subtract from total bushing end play determined in step 3.
5. Add or subtract shims as required to provide specified end play.
6. Lightly grease a new O-ring and install it on the pump. Install pump, engaging slot in shaft with drive gear. Apply Loctite™ 242 to bolts and torque evenly to 78 in. lbs. (9 Nm).

**Oil Pump Mounting Bolt Torque  
(242 Blue)****78 in. lbs (9 Nm)****Optional Shims:**

PN 3083671 = .006" (.15mm)  
PN 3083672 = .012" (.3mm)  
PN 3083673 = .024" (.6mm)

**End Play****.008 - .016" (.203 - .406 mm)**

### WARNING

Never remove the pressure cap when the engine is warm or hot. If the pressure cap is to be removed, the engine must be cool. Severe personal injury could result from steam or hot liquid. Use of a non-standard pressure cap will not allow the recovery system to function properly. If the cap should need replacement, install the correct Polaris cap with the same pressure rating. Refer to the appropriate parts manual.

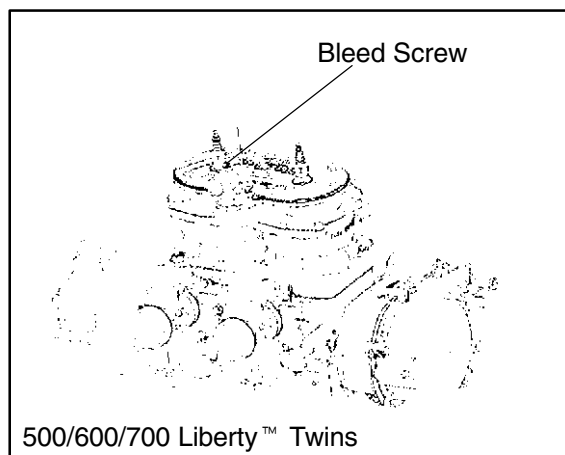
**NOTE:** Always use Polaris premium antifreeze 60/40 premix. Bleed system at specified RPM or air will remain trapped in system, which may result in overheating.

### Filling and Bleeding Procedure

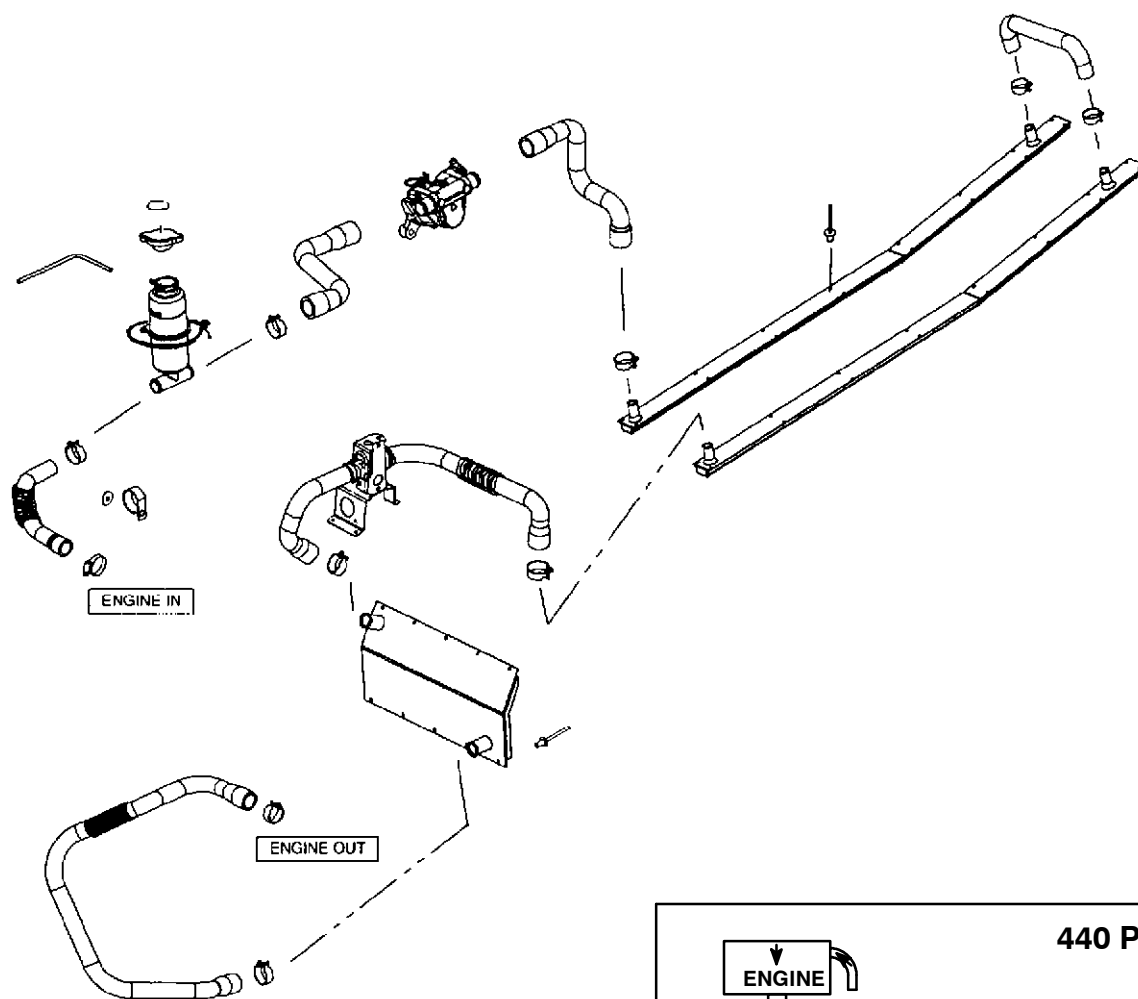
If the cooling system should become low in the reservoir tank and/or filler neck, the system should be bled of any trapped air using one of the following procedures, depending on model.

#### 440/500/600/700 Domestic Twins Bleeding Procedure

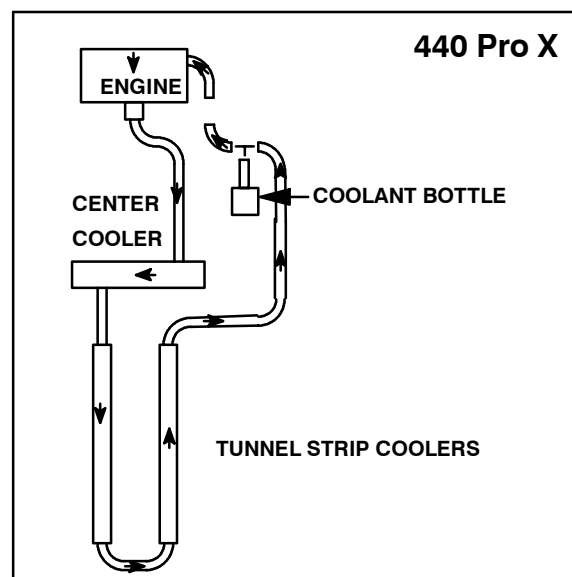
1. Fill cooling system . Leave pressure cap off.
2. With engine running at specified idle speed, loosen bleed screw on thermostat housing.
3. Continue adding antifreeze mixture to reservoir until system is purged of air.
4. Close bleed screw and tighten securely.
5. Fill reservoir bottle until coolant level is between the minimum and maximum fill marks.
6. Replace pressure cap.
7. Start engine and test for leaks.



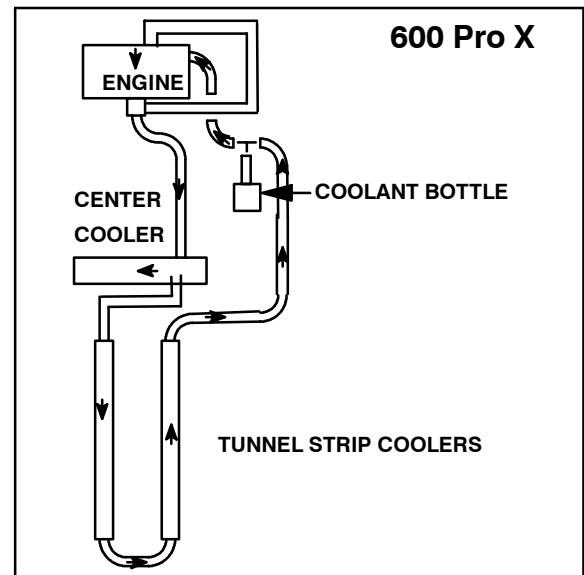
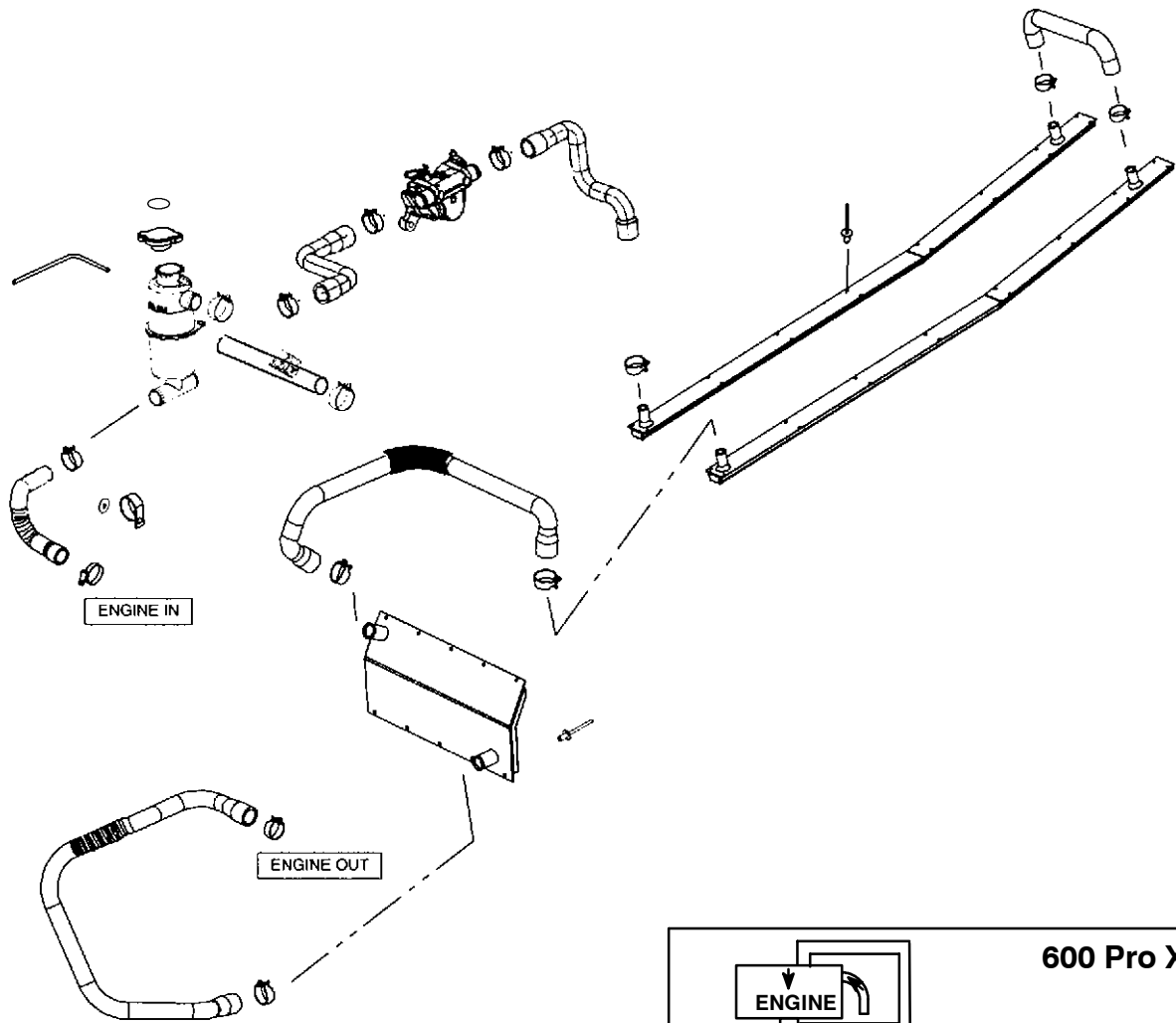
## Cooling System - 440 Pro X



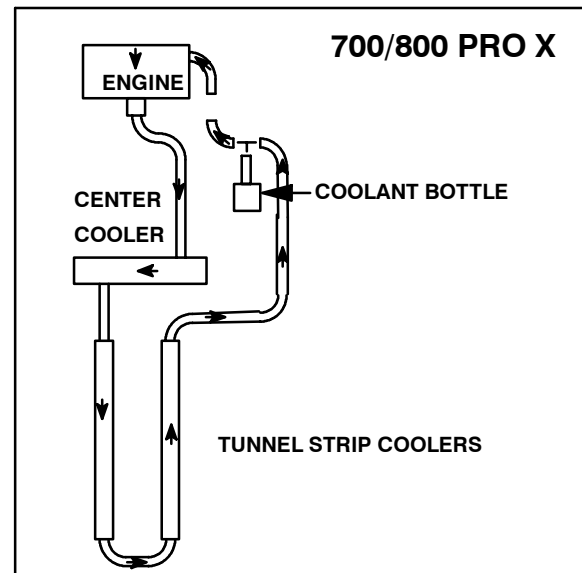
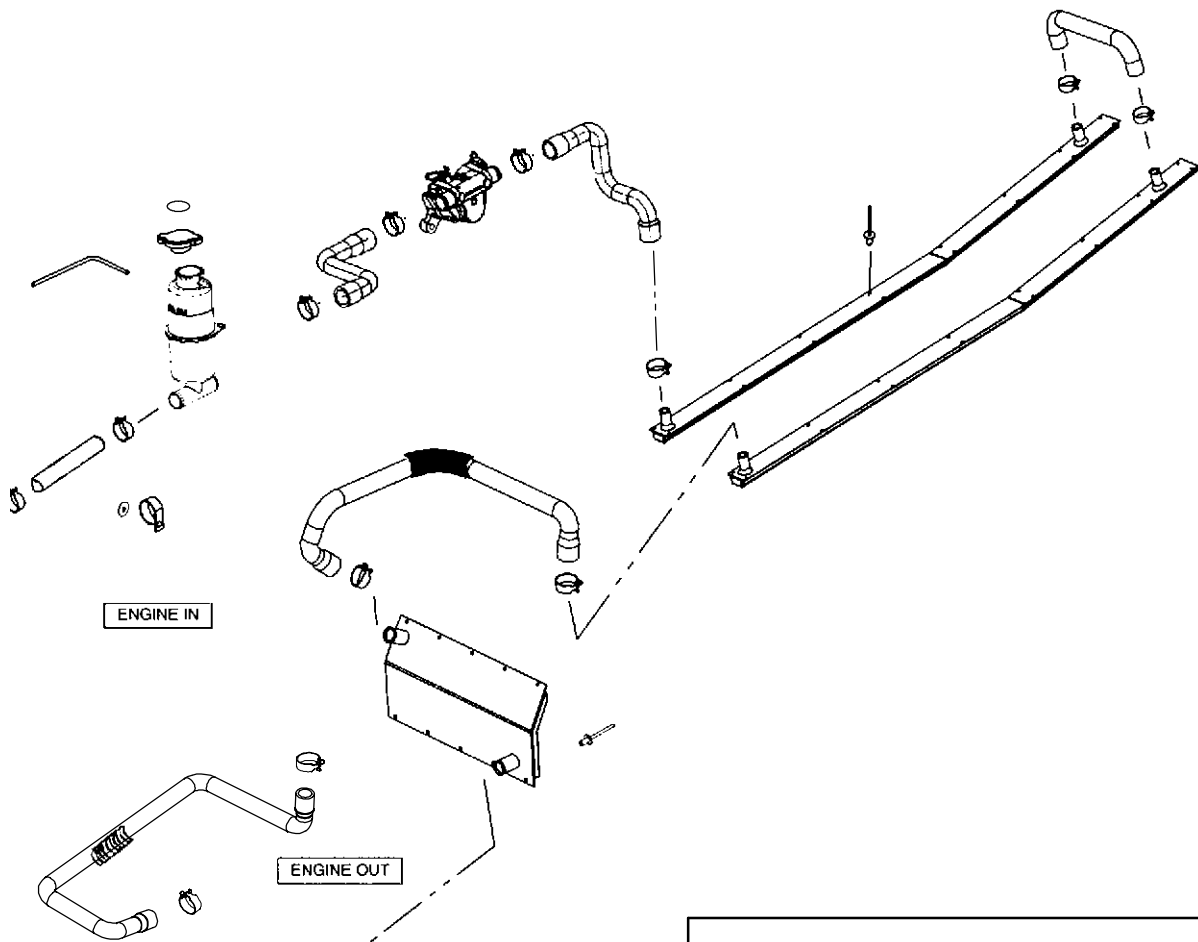
**NOTE:** When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure.



## Cooling System 600 Pro X



## Cooling System 700 / 800 Pro X



**Troubleshooting**

PROBLEM	PROBABLE CAUSE
Will not start/ hard starting	<ul style="list-style-type: none"> <li>-Check ignition switch for run position, moisture contamination</li> <li>-Check auxiliary shut-off switch operation</li> <li>-Check fuel supply</li> <li>-Check wiring from engine to coil(s) or spark plug(s)</li> <li>-Check spark plug(s)</li> <li>-Disconnect engine connector to eliminate any shorts that might be in the system</li> <li>-If starter won't work (electric models), check wires from starter solenoid and battery or check battery and battery cables</li> <li>-Open or broken reed valves</li> </ul>
Low compression	<ul style="list-style-type: none"> <li>-Crankcase plug is out</li> <li>-Head gasket faulty</li> <li>-Poor ring sealing, piston damage</li> </ul>
No spark	<ul style="list-style-type: none"> <li>-Spark plug fouled</li> <li>-Secondary coil bad or wires disconnected</li> <li>-Primary coil shorted or open</li> <li>-Ignition switch shorted, contaminated with moisture</li> <li>-Auxiliary switch shorted or contaminated with moisture</li> </ul>
Engine idles but no acceleration	<ul style="list-style-type: none"> <li>-Restricted fuel flow/air flow</li> <li>-Clogged main jet</li> <li>-Timing</li> <li>-Clutching</li> </ul>
Engine runs but fails to reach maximum RPM	<ul style="list-style-type: none"> <li>-Clogged fuel filter</li> <li>-Incorrect track tension</li> <li>-Incorrect main jet</li> <li>-Throttle slides not fully open</li> <li>-Chain too tight</li> <li>-Clutching</li> <li>-Excessive driveline friction (Hi-Fax overheating)</li> </ul>
Engine runs but fails to idle	<ul style="list-style-type: none"> <li>-Incorrect air mixture setting</li> <li>-Throttle stop screw incorrectly adjusted</li> <li>-Dirt in pilot jet</li> <li>-Low compression</li> <li>-Tight belt</li> <li>-Piston damage</li> <li>-Chokes not seating</li> </ul>
Engine runs, but overloads with fuel	<ul style="list-style-type: none"> <li>-Chokes are not seating</li> <li>-Fuel pump diaphragm is ruptured (caused by engine backfiring)</li> <li>-Carburetor slides are not synchronized</li> <li>-Too large main jet</li> <li>-Needle and seat not seating properly</li> <li>-Incorrect float level</li> <li>-Check reed valve condition</li> </ul>
Carburetion and plug fouling	-If a lot of riding is on trails, and plugs foul and get black when doing so, verify <i>all</i> tune up adjustments: carb sync, oil pump adjustment, pilot screw setting, spark plug type and gap, venting for carbs, proper jetting for altitude and temperature, belt tension, clutch operation. If tune up items are correct, check: float level, jet needle position, jet needle wear, inlet needle and seat wear, etc.
Engine runs but overheats	<ul style="list-style-type: none"> <li>-Coolant level</li> <li>-Incorrect main jet</li> <li>-Incorrect timing</li> <li>-Incorrect spark plug</li> <li>-Water pump belt loose or broken</li> <li>-Cooling restriction</li> <li>-Air in cooling system</li> <li>-Inadequate snow for cooling (ice and/or marginal conditions)</li> </ul>

# **CHAPTER 3**

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## **FUEL/CARBURETION**

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Mikuni VM 34 SS Exploded View .....	3.7
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## Jet Part Numbers

Whenever servicing the carburetor or fuel system, it is important to heed the following warnings.

### 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 or used.
-  Do not overfill the tank. Do not fill the tank neck.
-  If you get gasoline in your eyes or if you swallow gasoline, see your doctor 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. Gasoline powered engine exhaust fumes are poisonous and can cause loss of consciousness and death in a short time.

## Jet Part Numbers

The following chart lists main and pilot jets and the part number of each that are presently available.

### Mikuni

<u>PILOT JET NO.</u>	<u>PART NO.</u>
25 .....	3130064
30 .....	3130065
35 .....	3130066
40 .....	3130067
45 .....	3130068
50 .....	3130629
55 .....	3130070

### Mikuni

<u>HEX HEAD</u>	
<u>MAIN JET NO.</u>	<u>PART NO.</u>
80 .....	3130099
85 .....	3130100
90 .....	3130101
95 .....	3130102
100 .....	3130103
105 .....	3130104
110 .....	3130105
115 .....	3130106
120 .....	3130107
125 .....	3130108
130 .....	3130109
135 .....	3130110
140 .....	3130111
145 .....	3130112
150 .....	3130113
155 .....	3130114
160 .....	3130115
165 .....	3130116
170 .....	3130117
175 .....	3130118
180 .....	3130119
185 .....	3130120
190 .....	3130121
195 .....	3130122
200 .....	3130123
210 .....	3130124
220 .....	3130125
230 .....	3130126
240 .....	3130127

### Mikuni

<u>PILOT JET NO.</u>	<u>PART NO.</u>
60 .....	3130071

### Mikuni

<u>HEX HEAD</u>	
<u>MAIN JET NO.</u>	<u>PART NO.</u>
250 .....	3130128
260 .....	3130129
270 .....	3130130
280 .....	3130131
290 .....	3130132
300 .....	3130133
310 .....	3130134
320 .....	3130135
330 .....	3130136
340 .....	3130137
350 .....	3130138
360 .....	3130139
370 .....	3130290
380 .....	3130140
390 .....	3130480
400 .....	3130141
410 .....	3130599
420 .....	3130142
430 .....	3130143
440 .....	3130144
450 .....	3130145
460 .....	3130146
470 .....	3130147
490 .....	3130148
500 .....	3130149

510N .....	3131400
520N .....	3131401
530N .....	3131402
540N .....	3131408
550N .....	3131409
560N .....	3131410

The "N" series jets have the same flow characteristics as the following.

510N =	540
520N =	580
530N =	600
540N =	620
550N =	660
560N =	700

Do NOT substitute a  
530 Main Jet in place of a 530N .

## Mikuni TM-38/TM-40 Jet Part Numbers

DESCRIPTION	PART NUMBER	DESCRIPTION	PART NUMBER
<b>Jet Needles</b>		<b>Pilot Air Jets Cont.</b>	
Jet Needle J8-9FH04-57	3130794	Pilot Air Jet 1.0	3131257
Jet Needle J8-9EH01-57	3130795	Pilot Air Jet 1.1	3131258
Jet Needle J8-9DH01-54	3130796	Pilot Air Jet 1.2	3131259
Jet Needle J8-9CJB01-50	3130797	Pilot Air Jet 1.3	3131260
Jet Needle J8-8BEY01	3131250	Pilot Air Jet 1.4	3131261
Jet Needle J8-9DFH06-57	3131253	Pilot Air Jet 1.5	3131262
Jet Needle J8-9DFH07-60	3131268	Pilot Air Jet 1.6	3131263
Jet Needle J8-9DFH10-57	3131313	Pilot Air Jet 1.7	3131264
Jet Needle J8-9DGI01-60	3131377	Pilot Air Jet 1.8	3131265
Jet Needle J8-9DGJ02-57	3131378	Pilot Air Jet 1.9	3131266
Jet Needle J8-EFH01-60	3131207	Pilot Air Jet 2.0	3131267
Jet Needle J8-9EFY02-61	3131202	<b>Throttle Valves</b>	
<b>Pilot Air Jets (Short)</b>		Piston Valve 1.5	3130940
Pilot Air Jet 0.5	3130773	Piston Valve 2.0	3130789
Pilot Air Jet 0.6	3130774	Piston Valve 2.5	3130790
Pilot Air Jet 0.7	3130775	Piston Valve 3.0	3130791
Pilot Air Jet 0.8	3130776	Piston Valve 3.5	3130792
Pilot Air Jet 0.9	3130777	Piston Valve 4.0	3130793
Pilot Air Jet 1.0	3130778		
Pilot Air Jet 1.1	3130779		
Pilot Air Jet 1.2	3130780		
Pilot Air Jet 1.3	3130781		
Pilot Air Jet 1.4	3130782		
Pilot Air Jet 1.5	3130783		
Pilot Air Jet 1.6	3130784		
Pilot Air Jet 1.7	3130785		
Pilot Air Jet 1.8	3130786		
Pilot Air Jet 1.9	3130787		
Pilot Air Jet 2.0	3130788	<b>Starter Jets</b>	<b>Part Number</b>
<b>Pilot Air Jets (Long)</b>		Starter Jet 130	3130805
Pilot Air Jet 0.5	3131255	Starter Jet 135	3130767
Pilot Air Jet 0.6	3131249	Starter Jet 140	3130768
Pilot Air Jet 0.7	3131256	Starter Jet 145	3130769
Pilot Air Jet 0.8	3131254	Starter Jet 150	3130770
Pilot Air Jet 0.9	3131203	Starter Jet 155	3130771
		Starter Jet 160	3130772

The part numbers for main jets and pilot jets are the same as Mikuni VM round slide carburetors.

## Jet Part Numbers

### Jet Needle Part Numbers (Mikuni TMX-34)

<u>JET NEEDLE NO.</u>	<u>PART NO.</u>
J8-6GL62 .....	3131107
J8-6GL63 .....	3131108
J8-6GL64 .....	3131109
J8-6GL65 .....	3131110
J8-6GL67 .....	3131462

### Pilot Jet Part Numbers (Mikuni TMX-34)

<u>PILOT JET NO.</u>	<u>PART NO.</u>
#37.5 .....	3131026
#40 .....	3131025
#45 .....	3131023
#50 .....	3131021
#35 .....	3131027
#32.5 .....	3131028
#30 .....	3131029
#27.5 .....	3131030
#25 .....	3131031

### Throttle Valve Cutaway Part Numbers (Mikuni TMX-34)

<u>Throttle Valve No.</u>	<u>PART NO.</u>
1.5 .....	3131041
2.0 .....	3131042
2.5 .....	3131043
3.0 .....	3131044
3.5 .....	3131045
4.0 .....	3131046

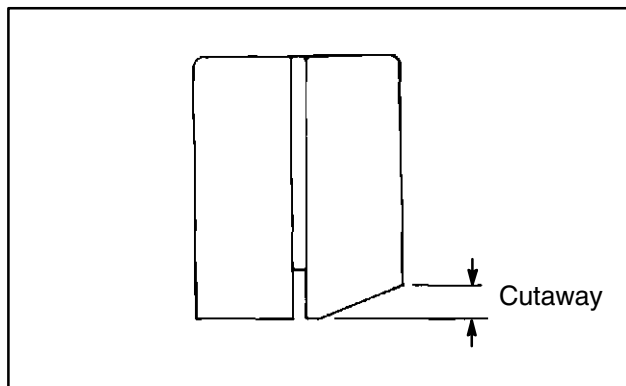
### Main Jet Part Numbers (Mikuni TMX-34)

Main jet part numbers are the same as Mikuni VM carburetors.

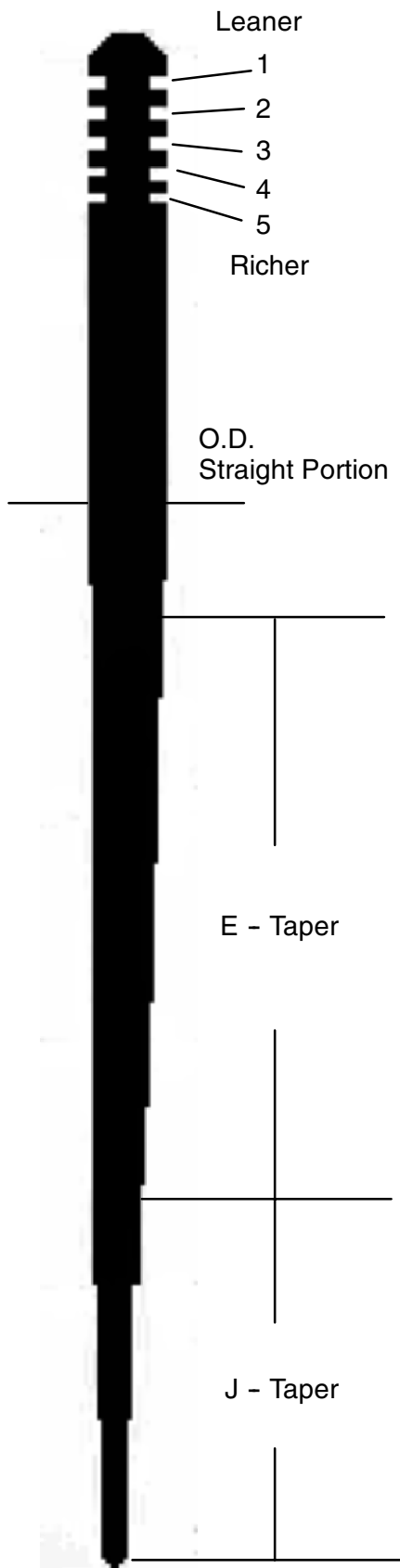
### Throttle Valve

The throttle valve controls the rate of engine air intake by moving up and down inside the main bore. At small throttle openings, air flow control is performed chiefly by the cutaway. By controlling air flow the negative pressure over the needle valve is regulated, in turn varying the fuel flow.

The throttle valves are numbered 1.0, 1.5, 2.0, etc., according to the size of the cutaway. The higher the number, the leaner the gasoline/air mixture.



### Mikuni TM 38 / TM 40 Jet Needle Overview



This needle (example) is a 9DH01-57. The first number is the approximate overall length in 10mm increments of the jet needle. The 9 indicated the needle is approximately 90mm but less than 100mm in length.

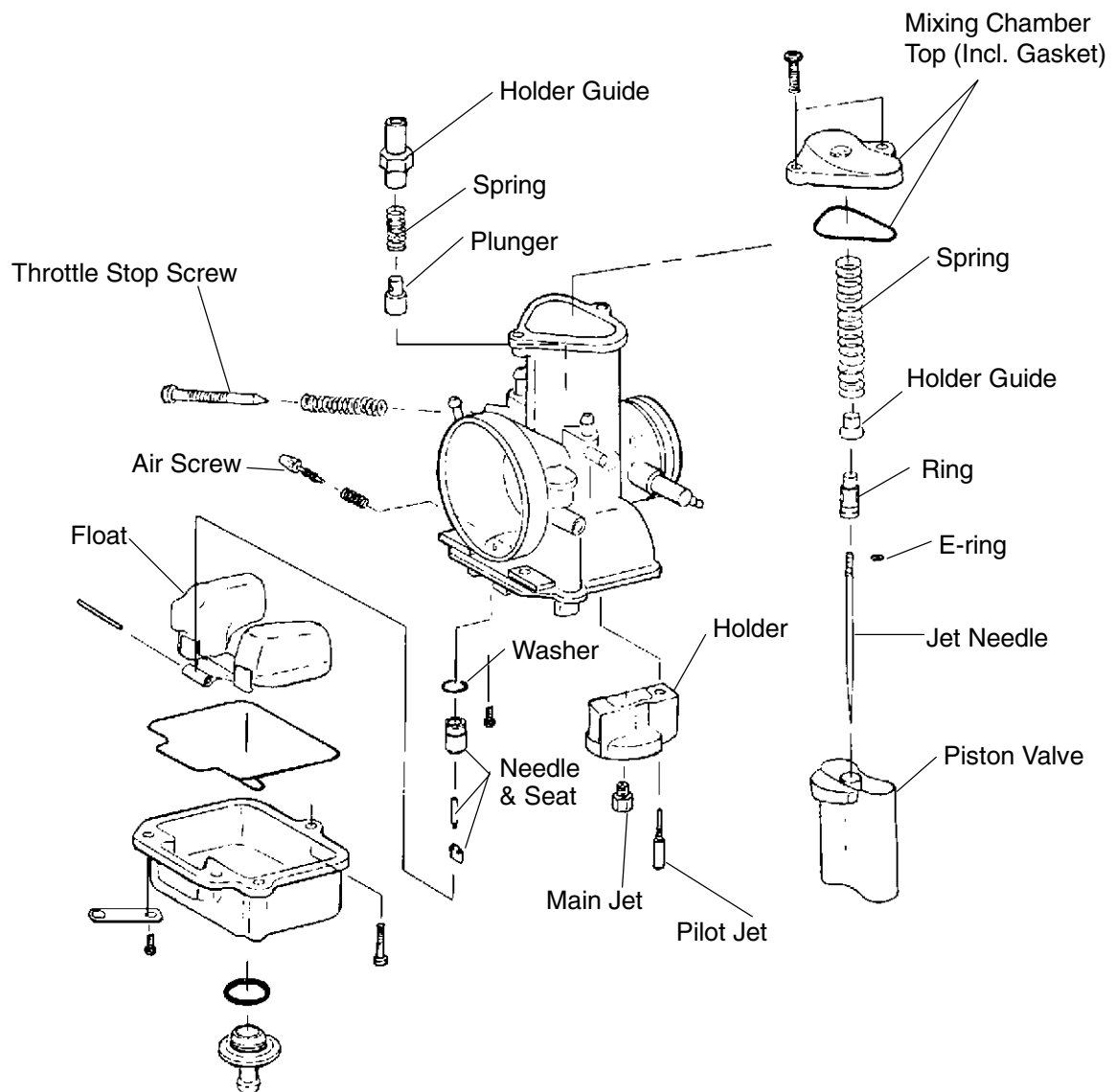
The letters on the jet needle indicate the angle of both tapers. The first letter designates the taper angle of the top section (closest to the grooves) and the second letter designates the angle of the bottom taper. The taper angles are graduated in 15' (15 minute) increments. The jet needle marked 9DH01-57 would have a top taper of 1°0' and a bottom taper of 2°0'.

The number following the letters on the jet needle is the serial number and it varies with individual jet needles.

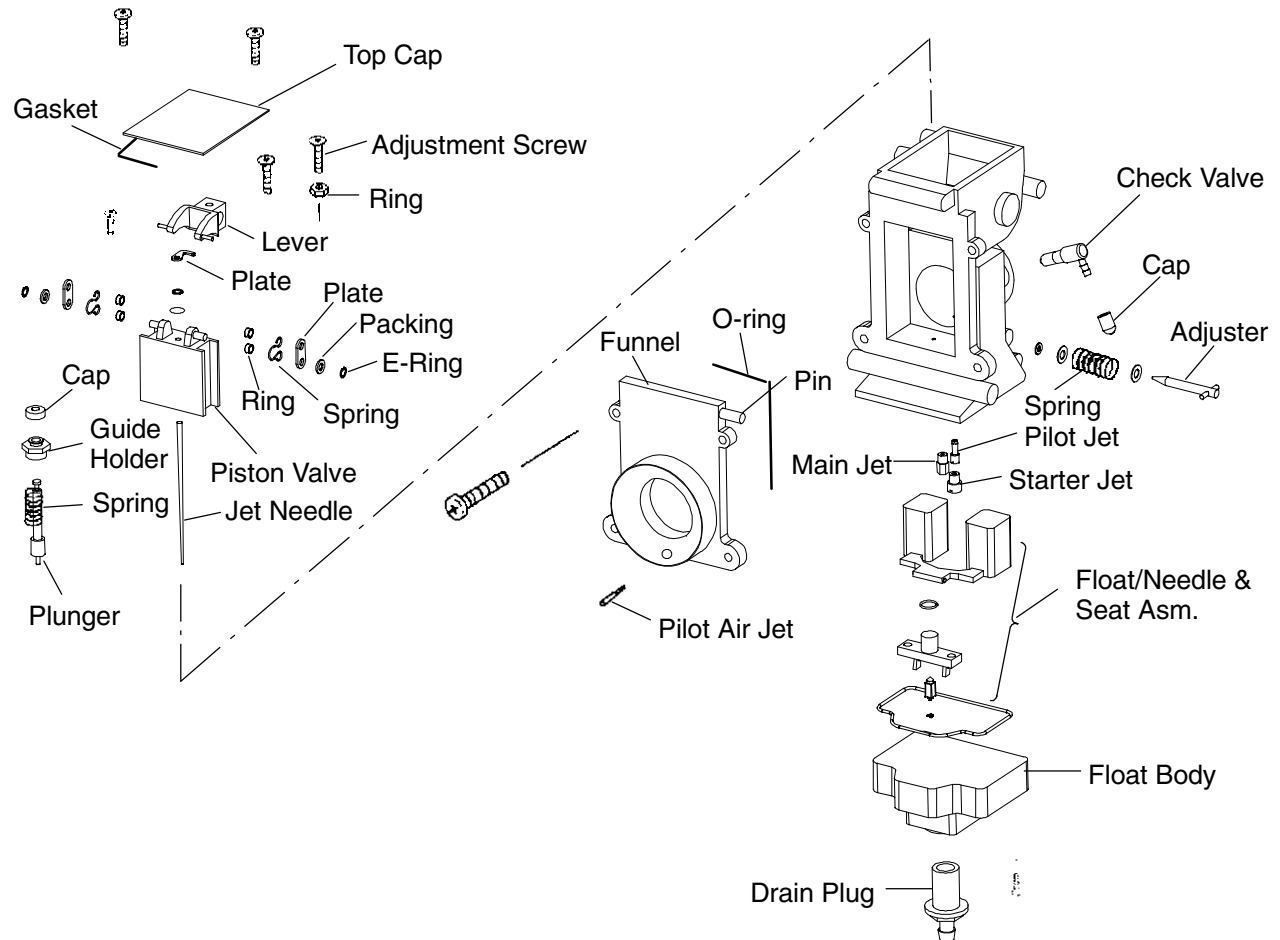
The last number, 57, indicates that the outside diameter is 2.57mm. The smaller the O.D., the richer the mixture.

<b>9</b>	Overall Length in 10mm Increments
<b>D</b>	Taper of top section of needle
<b>H</b>	Taper of bottom section of needle
<b>01</b>	Serial Number
<b>-57</b>	Outside Diameter

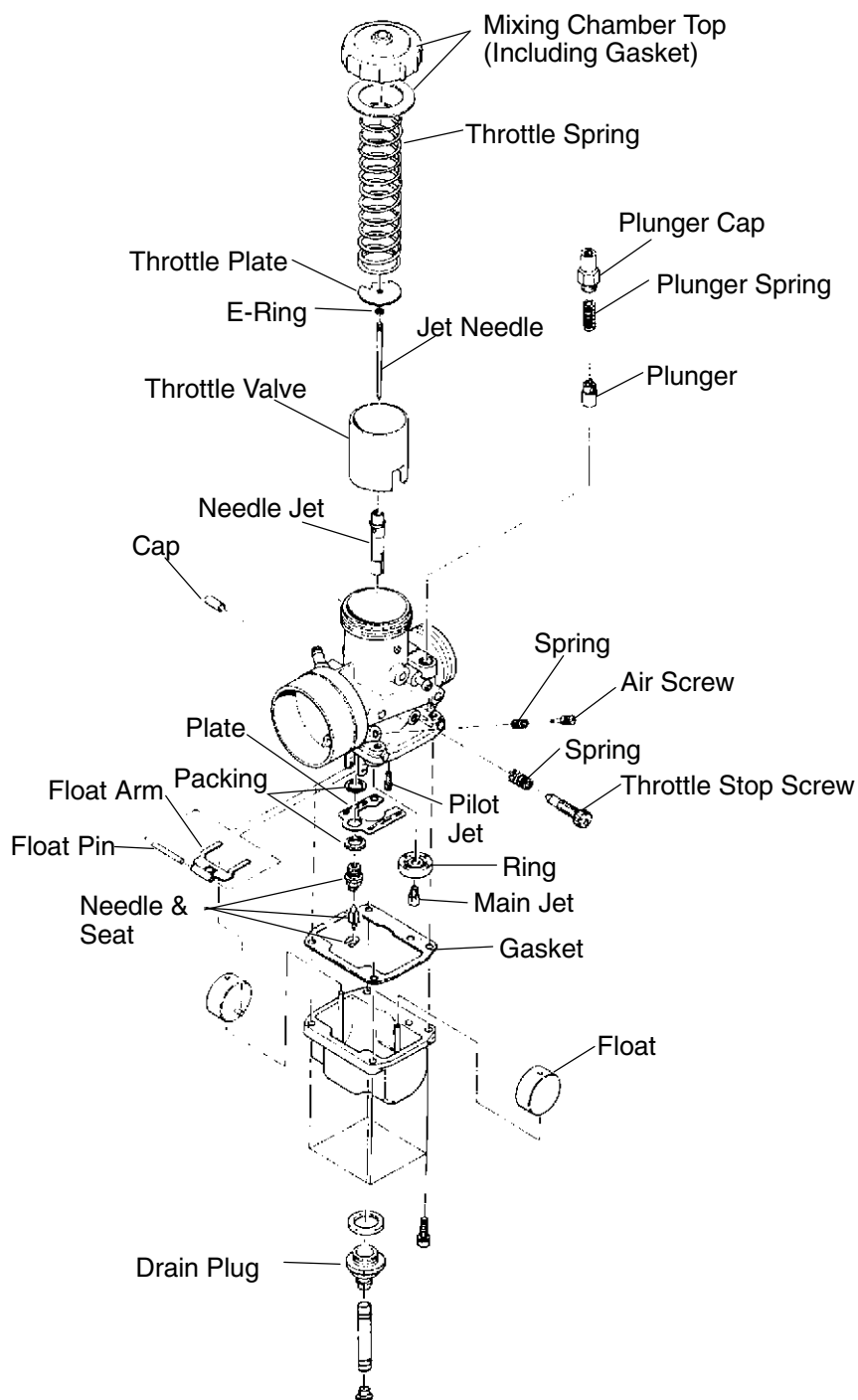
## Exploded View - Mikuni TMX-34



## Exploded View -Mikuni TM-38/TM-40



## Exploded View - VM34SS



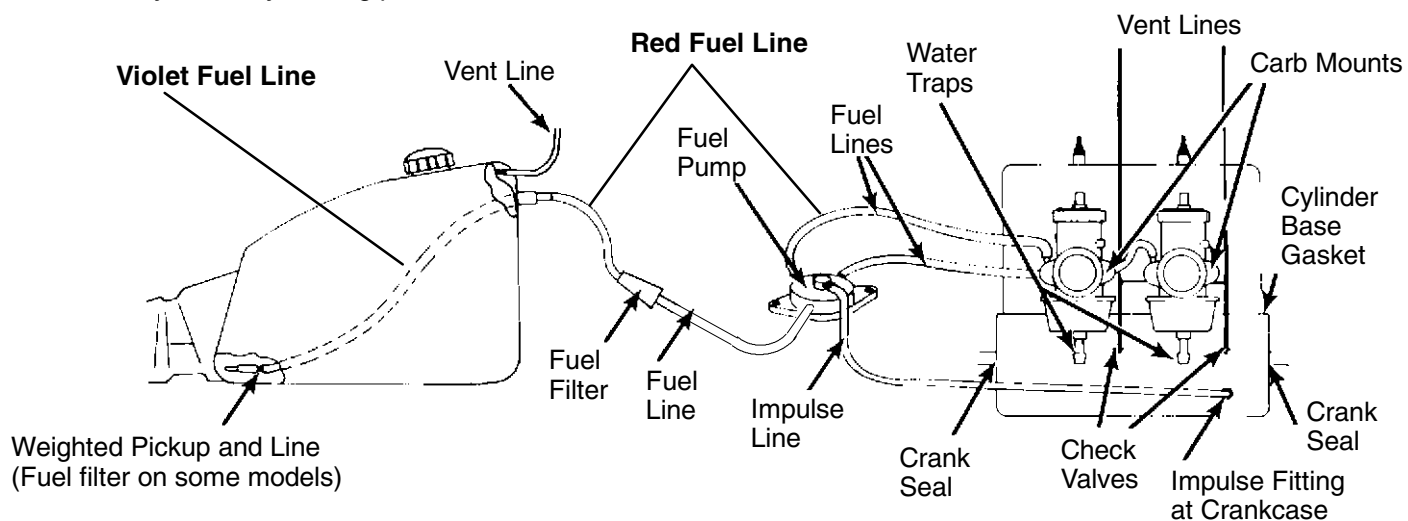
### Fuel Delivery System - Typical

The fuel system contains many components which directly affect fuel mixture and driveability. When performing diagnosis or carburetor maintenance, the entire fuel delivery system should be inspected. The illustration below shows parts of the system requiring periodic maintenance to ensure there is no fuel or air leaks present.

Fuel filters should be replaced at least once per season. More often if any contamination is suspected.

Fuel lines should be replaced every other season. More often if they become brittle or swollen. Fittings should be inspected for cracks or leaks. Do not use pliers or other tools that may damage fuel lines when installing or removing fuel lines.

Test run and check the fuel system for leaks any time parts are replaced. Verify that all lines are routed correctly and away from any moving parts.



**NOTE:** Some models use fuel filters located inside the fuel tank. To inspect/replace filter:

- Remove fuel cap.
- Using a long clean wire, bend into a fish hook shape. Pull the fuel line that is inside of the tank up through the filler hole.
- Inspect filter on end of fuel pick up line. Replace if worn or clogged.

Red fuel line is the exterior line for *outside* the tank. The violet line is the interior line for *inside* the fuel tank. **They cannot be interchanged!**

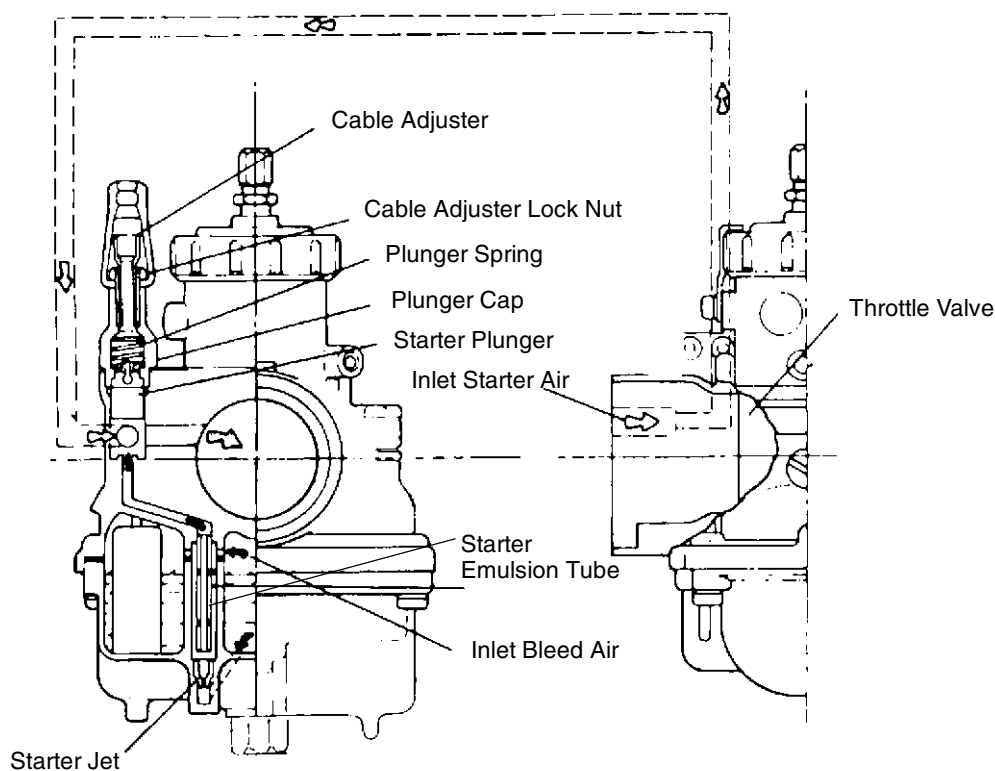
**NOTE: The violet line used inside the tank will fade and turn clear after a relatively short time. This does not affect the function or durability of the line.**

When replacing fuel line, be sure to use the correct color line for inside or outside the fuel tank. Also, be very careful not to bend fuel line to a point of kinking it. If it becomes kinked, it *must* be replaced. Always inspect fuel lines when replacing, or if carbs, carb racks, or fuel pumps are removed from chassis.



**Typical Mikuni Starter System - Closed Throttle**

Mikuni carburetors use a starter enricher system rather than a choke. In this type of carburetor, fuel and air for starting the engine are metered with entirely independent jets. The fuel metered in the starter jet is mixed with air and is broken into tiny particles in the emulsion tube. The mixture then flows into the plunger area, mixes again with air coming from the air intake port for starting and is delivered to the engine through the fuel discharge nozzle in the optimum air/fuel ratio. The starter is opened and closed by means of the starter plunger. The starter type carburetor is constructed to utilize the negative pressure of the inlet pipe, so it is important that the throttle valve is closed when starting the engine.

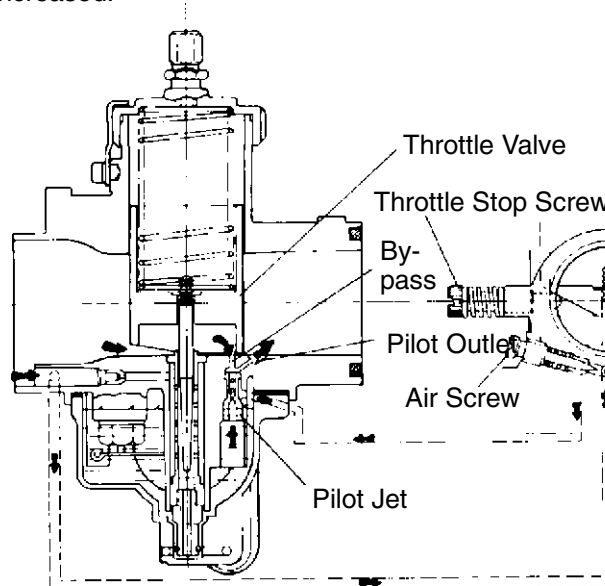


## Pilot System (0-3/8 Throttle)

The pilot system's main function is to meter fuel at idle and low speed driving. Though its main function is to supply fuel at low speed, it does feed fuel continuously throughout the entire operating range.

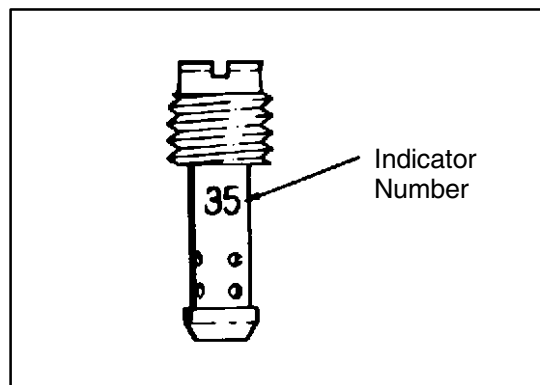
Fuel for the pilot jet is drawn from the float bowl, mixed with air regulated by the air screw, and delivered to the engine through the pilot outlet.

The mixture is regulated to some degree by adjusting the air screw. When the air screw is closed, the fuel mixture is made richer as the amount of air is reduced. When the air screw is opened, the mixture is made more lean as the amount of air is increased.



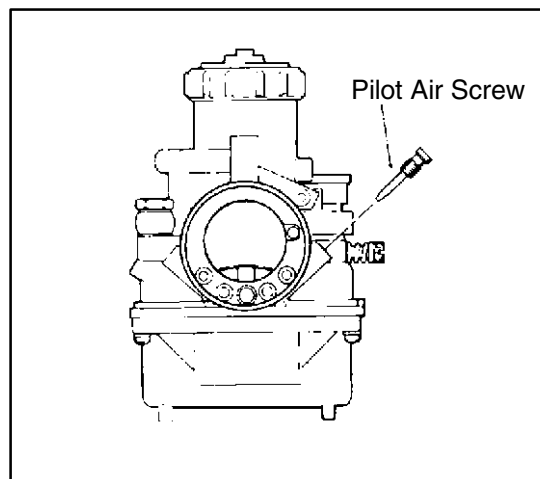
### Pilot Jet

From idling to low speeds, the fuel supply is metered by the pilot jet. There are several air bleed openings in the sides of the pilot jet which reduce the fuel to mist. The number stamped on the jet is an indication of the amount of fuel in cc's which passes through the jet during a one minute interval under a given set of conditions.



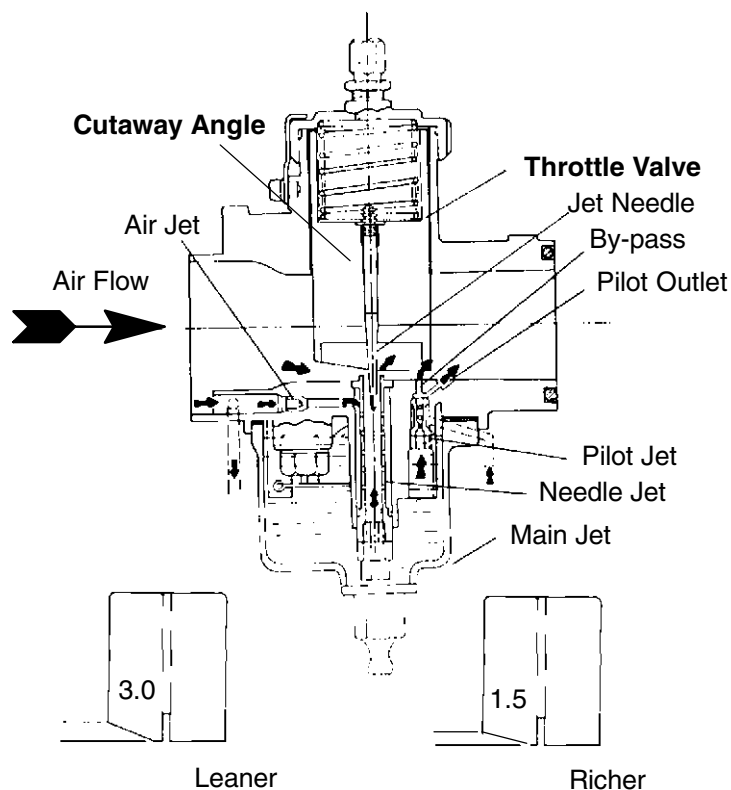
### Pilot Air Screw

The pilot air screw controls the fuel mixture from idle to low speeds. The tapered tip of the air screw projects into the air passage leading to the pilot jet air bleeds. By turning the screw in or out, the cross sectional area of the air passage is varied, in turn varying the pilot jet air supply and changing the mixture ratio.



## Slide Cutaway (1/8-3/8 Throttle)

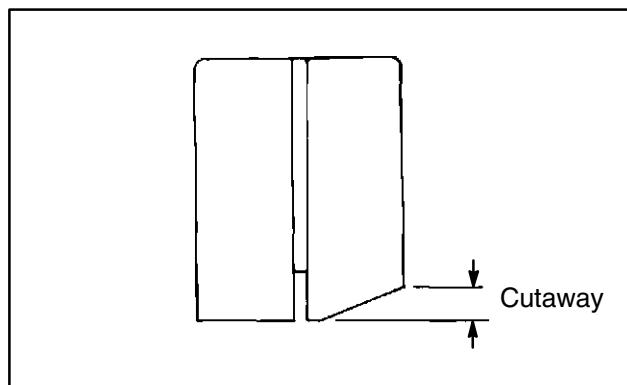
Throttle valve cutaway effect is most noticeable at 1/4 throttle opening. The amount of cutaway is pre-determined for a given engine to maintain a 14:1 air/fuel ratio at part throttle. A steep angle would indicate a fairly lean mixture because there is less resistance to air flow. A flat angle would provide a much richer mixture because there is more resistance to air flow. The venturi shape can be adjusted for each engine's breathing characteristics by using a different valve cutaway angle. A number will be stamped into the bottom of the valve (e.g. 2.5) indicating the size of the cutaway. The higher the number, the steeper the angle. (Leaner mixture).



## Throttle Valve

The throttle valve controls the rate of engine air intake by moving up and down inside the main bore. At small throttle openings, air flow control is performed chiefly by the cutaway. By controlling air flow the negative pressure over the needle valve is regulated, in turn varying the fuel flow.

The throttle valves are numbered 1.0, 1.5, 2.0, etc., according to the size of the cutaway. The higher the number, the leaner the gasoline/air mixture.

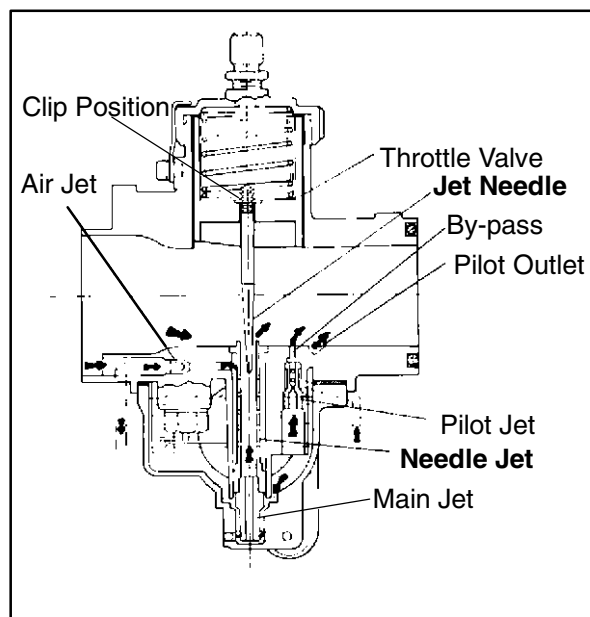


## Jet Needle/Needle Jet (3/8-3/4 Throttle)

The jet needle and needle jet have the most effect between 3/8 and 3/4 throttle opening. Some mixture adjustment can be accomplished by changing the location of the "E" clip on the needle. Moving the clip down raises the needle in the jet passage and richens the mixture. Moving the clip up lowers the needle in the jet passage and leans the mixture. Letter and number codes are stamped into the needle and the jet indicating sizes and tapers (needles only) of each.

### Jet Needle / Needle Jet - Fig. 1

The jet needle tapers off at one end and the clearance between the jet needle and the needle jet increases as the throttle valve opening gets wider. The air/fuel mixture ratio is controlled by the height of the "E" ring inserted into one of the five slots provided in the head of the jet needle. The chart at right shows the variation of fuel flow based on the height of the "E" ring.



### Needle Jet - Fig. 2

The needle jet works in conjunction with the jet needle to regulate fuel flow rate. An air bleed opening in the side of the needle jet brings in air measured by the air jet. This air initiates the mixing and atomizing process inside the needle jet. Mixing is augmented by a projection at the needle jet outlet, called the primary choke. The letter number code stamped on the jet indicates jet inside diameter.

### Throttle Opening vs. Fuel Flow - Fig. 3

In a full throttle condition the cross sectioned area between the jet needle and the needle jet is larger than the cross sectioned area of the main jet. The main jet therefore has greater control over fuel flow.

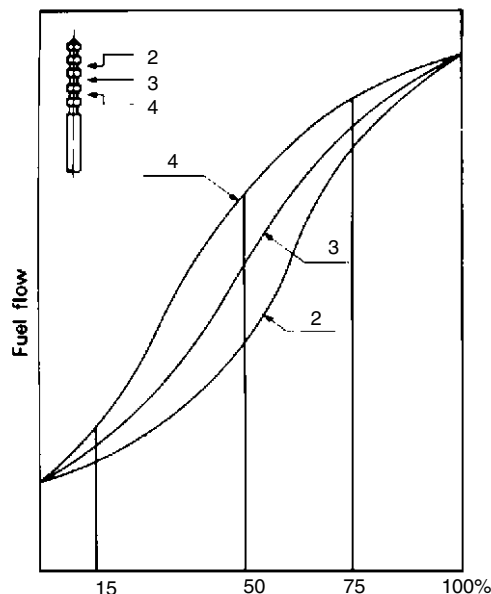
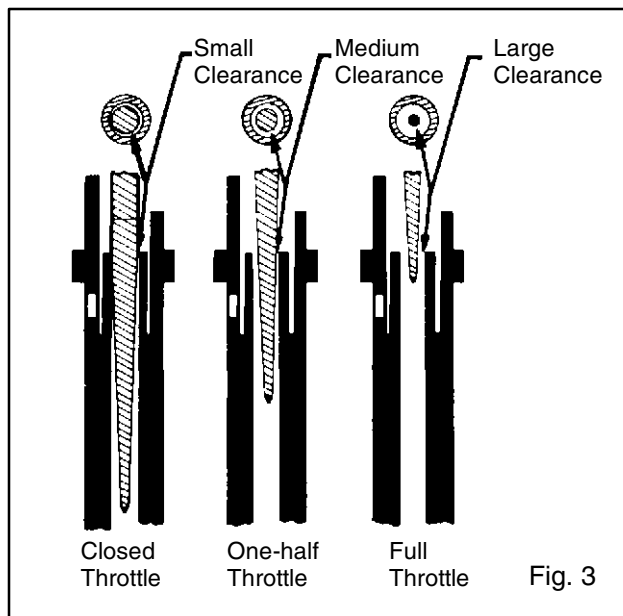


Fig. 1 Throttle Valve Opening

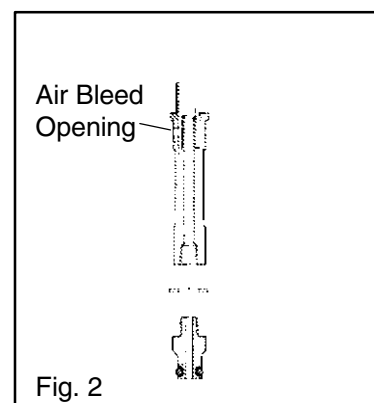
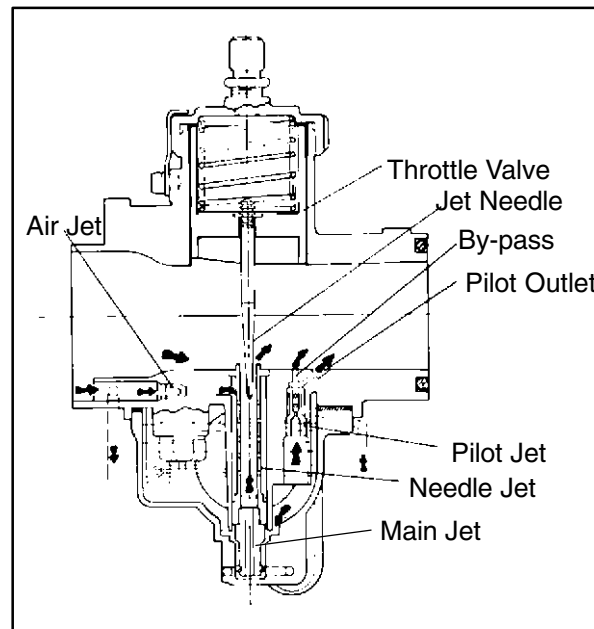


Fig. 2

## Main System (3/4 to Full Throttle)

The main system is designed to deliver fuel between low speed and high speed operation. This system is made up of the jet needle, needle jet, and main jet. The main system begins to take effect as soon as there is enough air flow into the carburetor venturi to draw fuel up through the main jet and needle jet assembly. This system works in conjunction with the needle jet system.

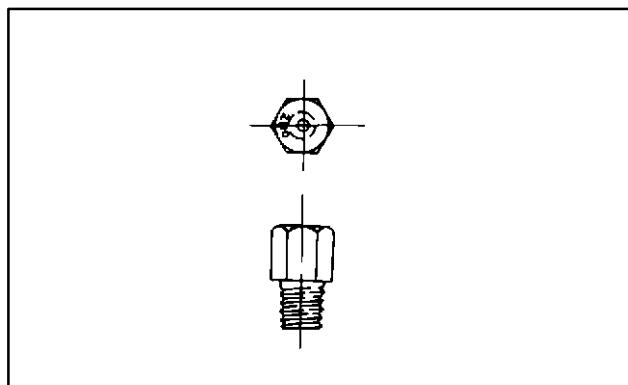
During low speed driving, there is very little clearance between the jet needle and the needle jet; therefore, very little fuel from the main jet can pass between the jet needle and the needle jet. As the throttle valve opening is increased, the tapered jet needle is raised farther out of the needle jet, allowing greater fuel flow. Under full throttle opening, the cross sectioned area of clearance between the jet needle and the needle jet becomes greater than the cross sectioned area of the main jet. Thus the main jet is now controlling the amount of fuel flow.



## Main Jet

When the throttle opening becomes greater and the area between the needle jet and jet needle increases, fuel flow is metered by the main jet. The number on the jet indicates the amount of fuel CCs which will pass through it in one minute under controlled conditions. Larger numbers allow a greater flow, resulting in a richer mixture.

Main jets are screwed directly into the needle jet base.



## 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 has more oxygen. In higher elevations and higher temperatures, the air is less dense.

Carburetors on *most* Polaris models are calibrated for an altitude of 0-3000 ft (0-900 meters) and ambient temperatures between -20° to +10° F (-29° to -12° C). All carburetors must be re-calibrated if operated outside the production temperature and/or altitude range. The main jet installed in production is not correct for all altitudes and/or temperatures.

### CAUTION:

**A main jet that is too small will cause a lean operating condition and may cause serious engine damage. Jet the carburetors carefully for elevation and temperature according to the jetting charts in this manual.**

**NOTE:** It is the owner's responsibility to ensure that the correct jets are installed in the machine for a geographical area. Be very careful when jetting down in warm weather. As the weather turns colder it will be necessary to re-jet upward to prevent engine damage. When selecting the proper main jet *always* use the *lowest* elevation and temperature that is likely to be encountered.

## Function

The function of a carburetor is to produce a combustible air/fuel mixture by breaking fuel into tiny particles in the form of vapor, to mix the fuel with air in a proper ratio, and to deliver the mixture to the engine. A proper ratio means an ideal air/fuel mixture which can burn without leaving an excess of fuel or air. Whether the proper mixture ratio is maintained or not is the key to efficient engine operation.

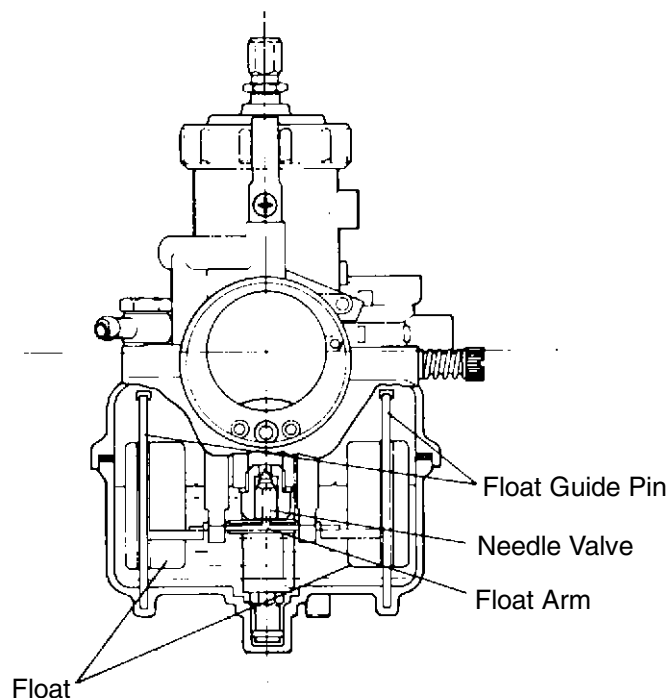
The engine of a vehicle is operated under a wide range of conditions, from idling with the throttle valve remaining almost closed, to full load or maximum output with the throttle valve fully opened. In order to meet the requirements for the proper mixture ratio under these varying conditions, a low speed fuel system, or pilot system, and a main fuel system are provided in Mikuni VM type carburetors.

The Mikuni carburetor has varying operations depending upon varying driving conditions. It is constructed of a float system, pilot system, main system, and starter system or initial starting device.

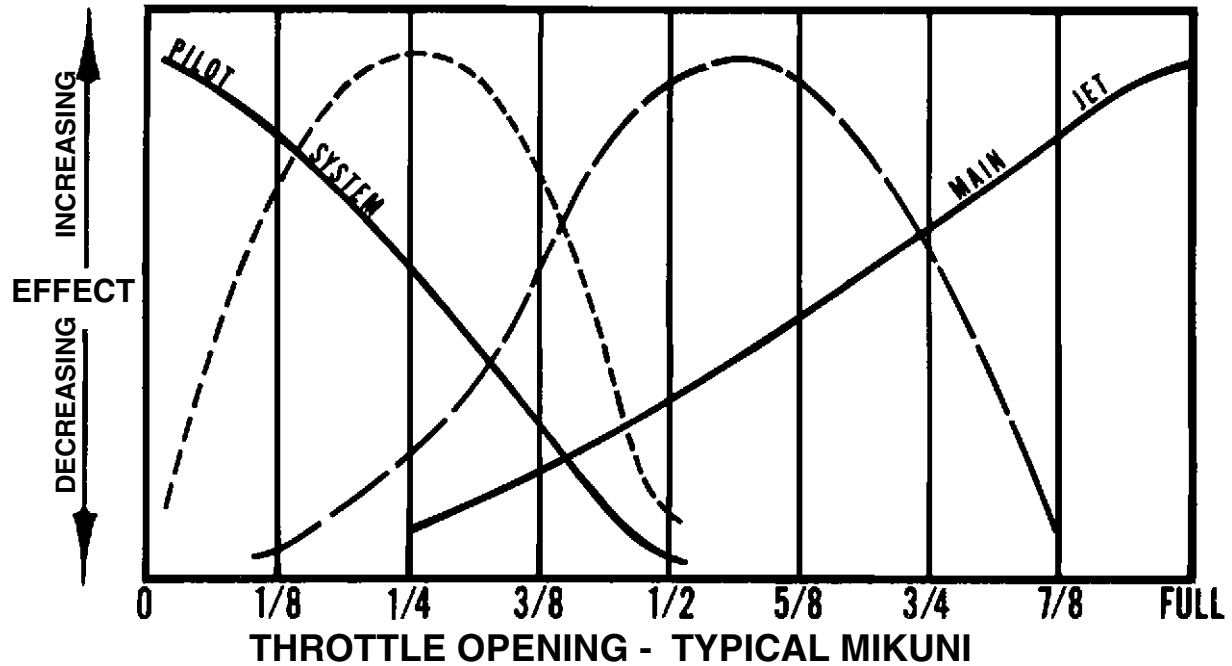
## Float System

The float system is designed to maintain a constant height of gasoline during operation. When the fuel flowing from the fuel pump into the float chamber through the needle valve reaches the constant fuel level, the floats rise. When the buoyancy of the float and the fuel pressure of the fuel pump balance, the needle valve sticks fast to the needle seat, preventing further delivery of gasoline, thereby holding the standard level of gasoline.

The fuel level in the bowl assists in controlling the amount of fuel in the fuel mixture. Too high a level allows more fuel than necessary to leave the nozzle, enriching the mixture. Too low a level results in a leaner mixture, since not enough fuel leaves the nozzle. Therefore, the predetermined fuel level should not be changed arbitrarily.



## Component Effect vs Throttle Opening



----- Throttle Valve Cut-Away  
----- Jet Needle/Needle Jet

Polaris TM-38/TM-40 Mikuni component effect versus throttle opening chart.



### Throttle Synchronization Procedure

1. Remove air box, noting position of throttle cable junction block. Reposition throttle cable and junction block in same position when air box is reinstalled.

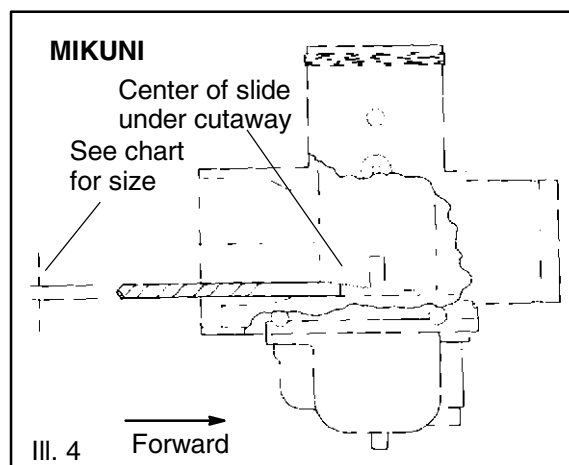
### Throttle Cable Synchronization (Throttle Gap)

2. Referring to specification section in chapter 1, select correct diameter **Throttle Gap** synchronization drill gauge for your engine.
3. Back out idle screws about three turns.
4. Slightly lift throttle slides with throttle lever and insert tool or drill gauge under throttle slide. Allow throttle slides to return.
5. Loosen lock nut and turn throttle cable adjuster (on top of carburetor) in (clockwise) or out (counterclockwise) as required until a slight drag can be felt on the gauge or tool.
6. Securely tighten throttle cable synchronization lock nut.
7. Repeat steps 3 through 5 on remaining carburetor.

### Idle Gap Synchronization

8. Referring to chart in the Specifications section, chapter 1, select correct diameter **Idle Gap** drill gauge for the engine.
9. Slightly lift throttle slides with throttle lever and insert idle gap drill gauge under throttle slide. Allow throttle slides to return.
10. Turn idle adjustment screw in as required until only a slight drag can be felt on the gauge.
11. Repeat steps 8 through 10 for remaining cylinders.
12. Verify proper throttle lever free play and adjust if necessary, by loosening cable adjuster locknuts and turning adjusters out equally until throttle lever freeplay is correct.

**Throttle Free Play -  
0.010 - 0.030" (.25-.76mm)**





## Mikuni TM-38 / TM-40 Carburetor Service

### CAUTION:

Wear eye protection when using compressed air or cleaning solvents. Review all fuel system warnings found on page 3.1 before proceeding.

### Carburetor Removal, Disassembly, and Inspection

1. Remove carburetor rack from engine. Before disassembling, clean outside of carburetor thoroughly with solvent.

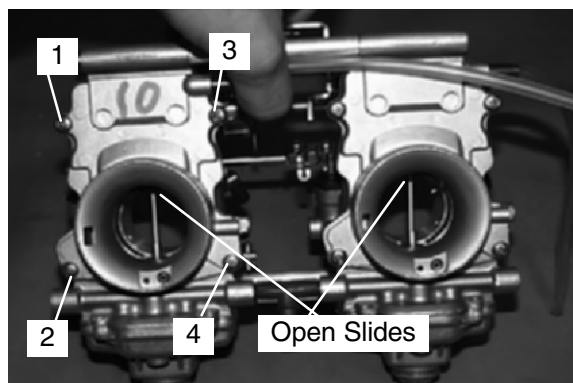
### CAUTION:

Do not use compressed air to dry at this time. The float chamber could become pressurized resulting in damage to the floats or inlet needle and seat. Do not soak carburetors in carb cleaner. Clean only with aerosol cleaner.

2. Remove top caps.



3. Remove four screws on funnel.



4. Turn throttle shaft so slide opens all the way.

**NOTE:** You may have to turn out slide stop screw for slide to move farther up body.

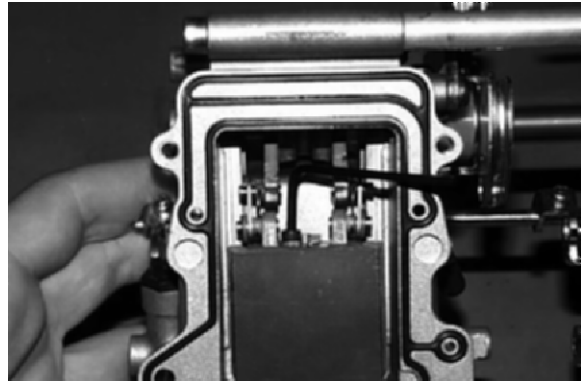
5. With slide fully open, pull funnel out bottom first.



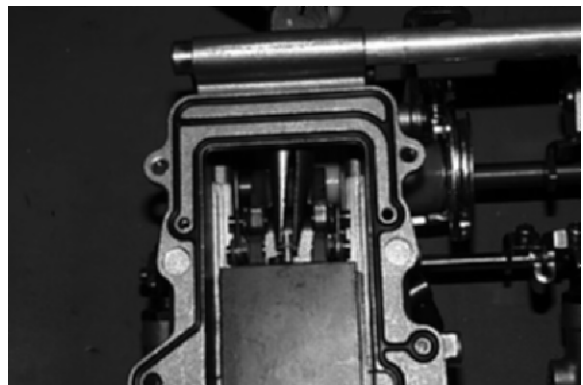
### Mikuni TM-38 / TM-40 Carburetor Service

#### Disassembly Cont.

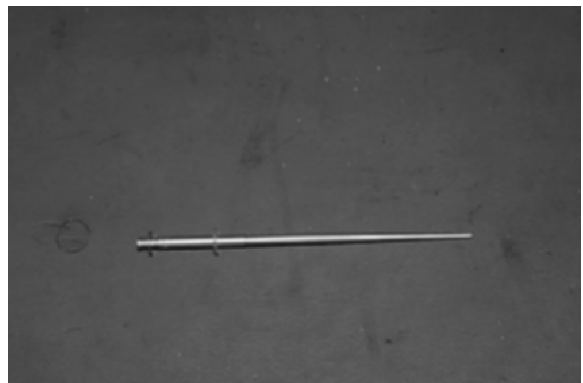
6. From top of carb, loosen allen head screw holding needle in position. Slide holding plate to side.



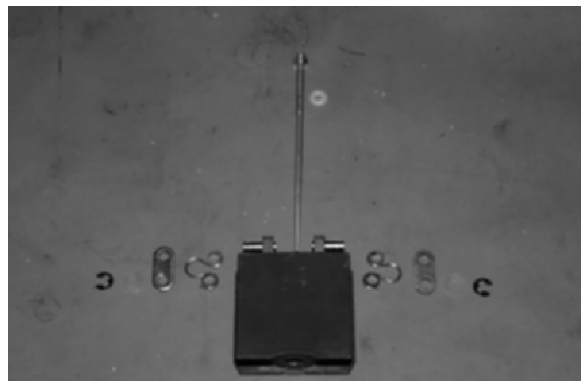
7. Reach into top of carb with a long nose pliers and pull out needle.



8. Inspect needle for wear.



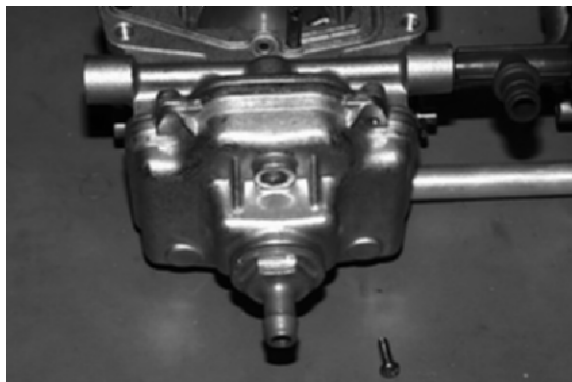
9. Remove E-rings, packing, plate, spring, and rings connecting slide to lever.



## Mikuni TM-38 / TM-40 Carburetor Service

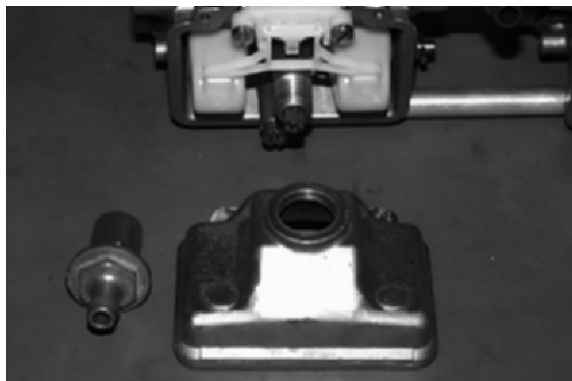
### Carburetor Disassembly Cont.

10. Remove water trap/drain plug (17 mm) and single screw on bottom of carb.

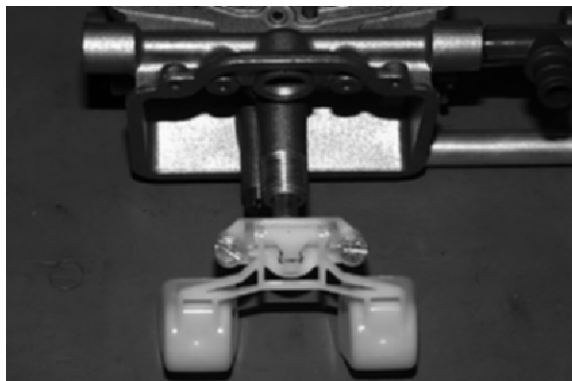


11. Remove float body

**NOTE:** Float body will not come off unless water trap/drain plug, which is threaded and screws into main jet housing, is removed.

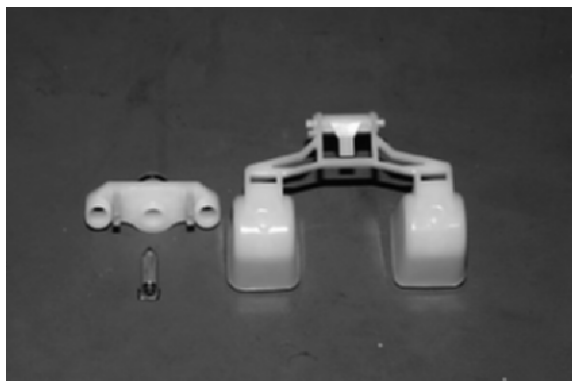


12. Remove 2 screws holding float/needle & seat assembly in position. Remove float/needle & seat assembly.



13. Inspect needle for wear.

**NOTE:** Needles are not available separately. If needle is bad, you must replace float/needle & seat assembly.



### Mikuni TM-38 / TM-40 Carburetor Service

#### Carburetor Disassembly

1. Remove main jet, starter jet, pilot jet, and idle screw.



2. Clean all passages in carburetor body with carburetor cleaner. Dry all passages and jets with compressed air. Replace gaskets and any parts which show wear or damage.



#### Carburetor Assembly

1. Install pilot jet, main jet, starter jet, and idle screw.



2. Install float/needle & seat assembly.



**Mikuni TM-38 / TM-40 Carburetor Service**

3. Place carburetor in an inverted position.
4. Connect pressure tester to fuel inlet fitting. Apply 5 psi pressure and observe for one minute. The needle and seat should hold pressure indefinitely. If the pressure drops, carefully inspect the needle and the needle seat. The needle and seat can be replaced as an assembly (needle and seat comes with float). If the seat surface is damaged replace the carburetor.

**Pressure Tester PN 2870975**



5. Carefully inspect float bowl gasket and replace if necessary. Install float bowl on carburetor.
6. Install float body.
7. Install air adjusting screw.
8. Install throttle slide.
9. Install jet needle.
10. Install funnel.
11. Install carburetors on snowmobile.
12. Synchronize carbs
13. Replace top caps.

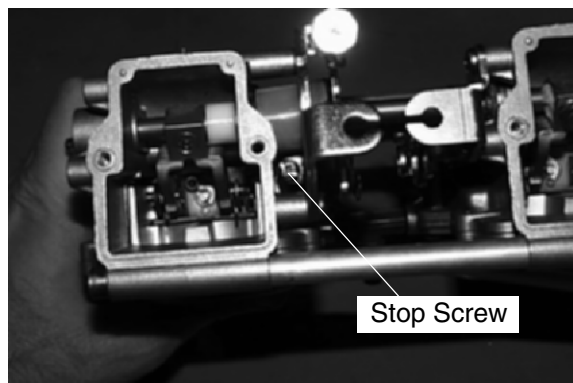
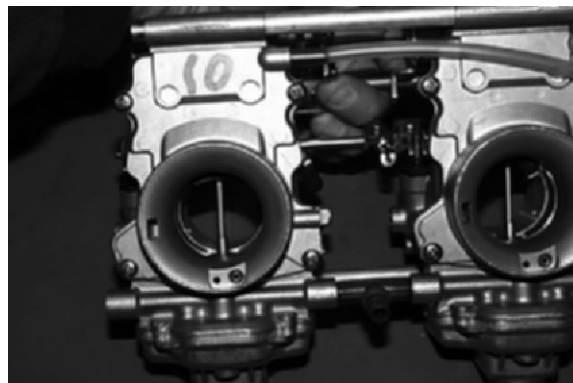


### Adjustments

#### Throttle Synchronization Procedure- Mikuni TM-38 / TM-40 Flatslide Carburetors

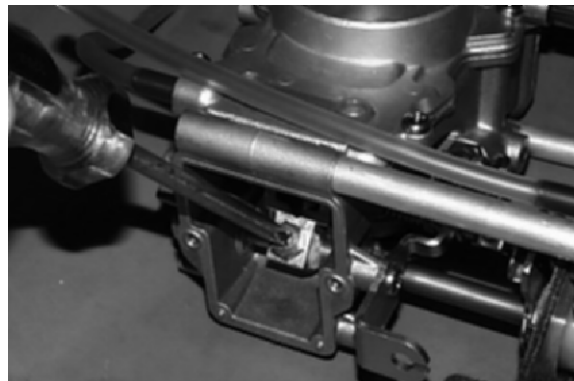
Mikuni TM-38 / TM-40 carburetors are synchronized at wide open throttle without the engine running. The middle carburetor on triples, and the PTO side carburetor on twins have a non-adjustable set screw on the throttle shaft. This carburetor is what the other carb(s) is synchronized to.

1. Remove airbox
2. Remove top caps on all carburetors
3. Hold throttle wide open and view position of carburetor slide on base carburetor. (Middle carb on triples, PTO carb on twins.)
4. With throttle held wide open, turn the slide stop screw with screwdriver until slide is flush with top of carb opening.



**Adjustments****Throttle Synchronization Procedure-  
Mikuni TM-38 / TM-40 Flatslide Carburetors**

5. On remaining carb(s), loosen phillips head screw inside the offset nut.



6. When screw is loose, hold throttle to wide open. Turn offset nut until throttle slide is in same position as base carburetor.



7. Tighten phillips head screw.



8. Replace top caps.



## Mikuni TMX Carburetor Service

### CAUTION:

Wear eye protection when using compressed air or cleaning solvents. Review all fuel system warnings found on page 3.1 before proceeding.

### Carburetor Removal, Disassembly, and Inspection (Typical VM Mikuni)

1. Remove carburetor from engine. Before disassembling, clean outside of carburetor thoroughly with solvent.

### CAUTION:

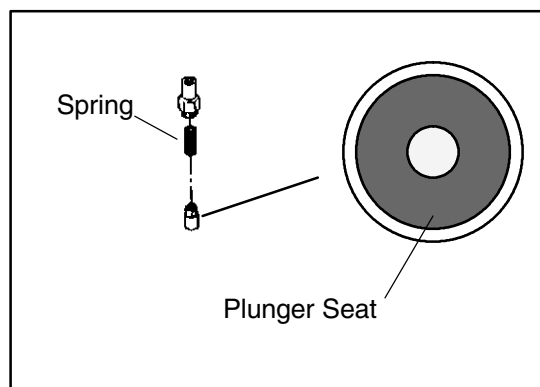
Do not use compressed air to dry at this time. The float chamber could become pressurized resulting in damage to the floats or inlet needle and seat..



2. Remove slide valve. Inspect for nicks or burrs which may cause sticking.
3. Remove jet needle by compressing return spring toward top cap and removing throttle plate which rests on top of needle "E" clip. Note the "E" clip position and inspect needle taper for wear. An indication of wear would be an hourglass shape or polished spots somewhere along the taper.



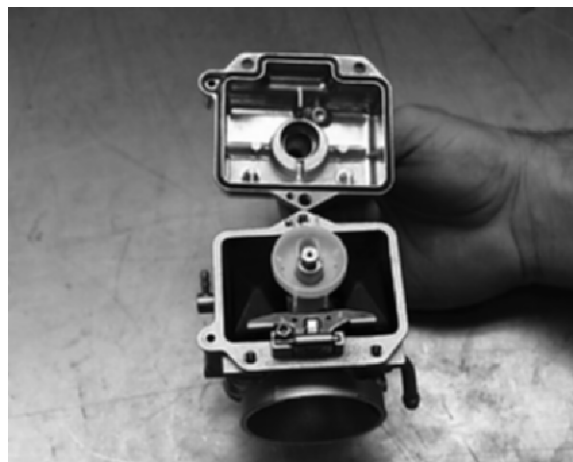
4. Remove enricher (choke) plunger. Check condition of seal on tip of plunger. Any nicks or cuts will cause leakage and a rich fuel condition, usually most evident at idle and low speeds. Inspect the plunger seat for damage or foreign material.
5. Check choke cable movement. Plungers and springs should move back and forth freely, without binding.
6. Check carb bore for nicks or foreign objects.





**Mikuni TMX Carburetor Service****Carburetor Disassembly and Inspection**

1. Remove water trap assembly from float bowl and inspect O-ring, hose and clamp condition. Refer to exploded view corresponding with carburetor being serviced.
2. Inspect enricher (choke) fuel supply passage in bowl for obstruction.



3. Use an automatic center punch to remove float arm pin. Remove inlet needle and seat assembly.
4. Inspect needle for wear and replace sealing washers upon reassembly.

**CAUTION:**

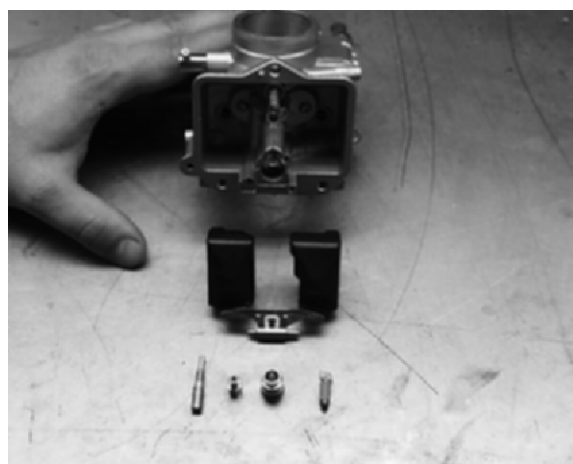
Do not bend float arm during disassembly. Support tower casting when tapping pin out. Do not use excessive force to remove float arm pin. The float pin tower castings are very easily damaged and are not repairable.

5. Remove main jet and washer (or spacer ring) and push needle jet into the slide valve chamber to remove. Clean air bleed hole in needle jet.
6. Remove pilot jet.

**CAUTION:**

Wear eye protection when using compressed air or cleaning solvents. Review all fuel system warnings found on page 3.1 before proceeding.

7. Remove pilot air screw and clean all passages in the carburetor body with carburetor cleaner. Dry all passages and jets with compressed air. Replace gaskets and any parts which show wear or damage.
8. Reassemble carburetor, adjusting float level before installing float bowl.



### Mikuni TMX Carburetor Adjustments

#### Float Level Adjustment

1. Remove float bowl.
2. With carburetor positioned as shown, float arm should be parallel with body. Arms must be parallel to each other.
3. To adjust float arm, bend tang contacting inlet needle.

#### CAUTION:

Never bend the float arm itself.



#### Leak Testing Needle and Seat

1. Be sure float level is adjusted properly.
2. Invert carburetor.
3. Install float chamber and connect pressure tester PN 2870975 to fuel inlet fitting.

**Pressure Tester PN 2870975**

4. Apply approximately 5 PSI pressure and wait for one minute. The needle and seat should hold pressure indefinitely. If the pressure drops rapidly replace the needle and seat assembly and/or sealing washers.



## Adjustments

The amount of air drawn into the cylinders is influenced by such factors as altitude, temperature, humidity, etc. Suppose the amount of air drawn into the cylinders at an elevation of zero is taken as 100 (the temperature and humidity in this case are considered constant). The amount of air in question decreases in proportion to a rise in elevation as shown in Chart A. Reduction in the amount of air drawn into the cylinders changes the air/fuel mixture ratio, resulting in a marked drop in power output.

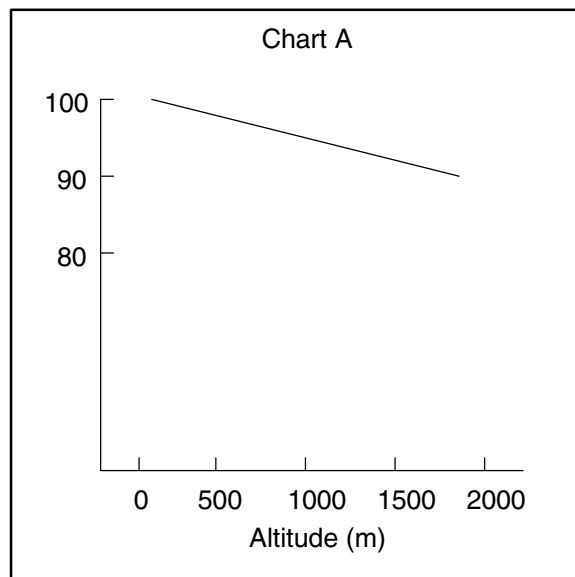
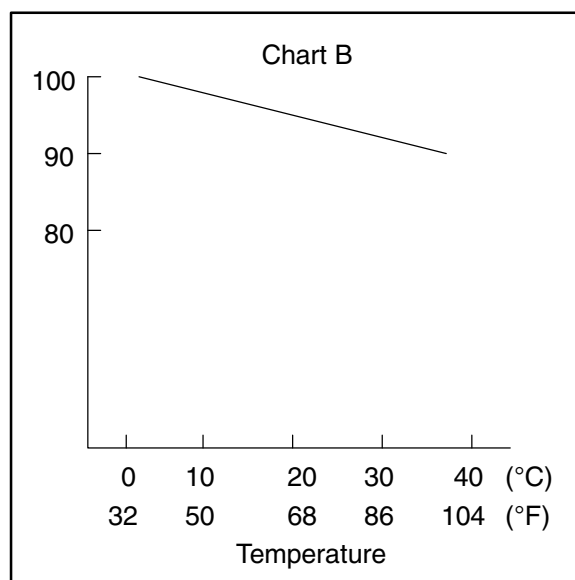
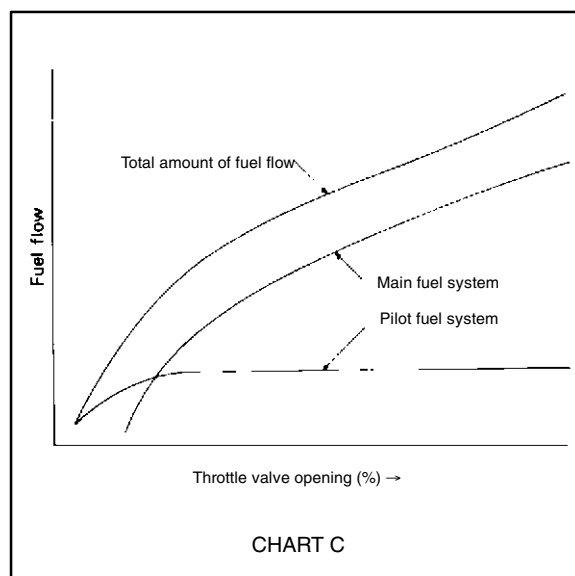


Chart B shows the relationship between a rise in temperature and the amount of air drawn into the cylinders. In this case, the atmospheric pressure (elevation) and the humidity are considered unchanged and the amount of air going into the cylinders at 32° F (0° C) is taken as 100.



On Mikuni carburetors the pilot system and the main system are of independent construction. The fuel flow in these two systems is shown in Chart C.

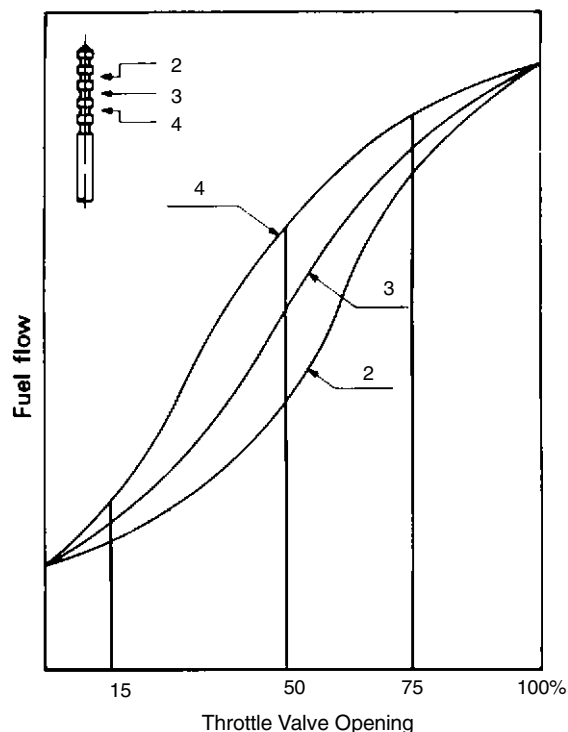


## Adjustments - Jet Needle and Float Level

### Fine Tuning the Mikuni Carburetor

A carburetor with a piston type throttle valve is also called a variable venturi type carburetor. In this type of carburetor, the needle jet and jet needle serve to control a proper air/fuel mixture ratio at the medium throttle valve opening (between 1/4 and 3/4 opening). Having the proper needle jet and jet needle has a major impact on engine performance at partial load.

The jet needle tapers off at one end and the clearance between the jet needle and the needle jet increases as the throttle valve opening gets wider. The air/fuel mixture ratio is controlled by the height of the "E" ring inserted into one of the five slots provided in the head of the jet needle. The chart at right shows the variation of fuel flow based on the height of the "E" ring.



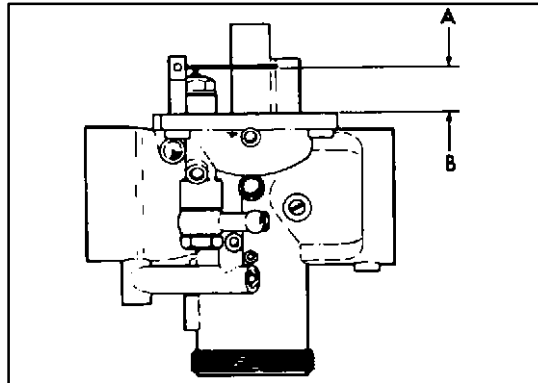
### Float Level Adjustment

1. Remove float bowl.
2. With carburetor in an inverted position, float arm (A) should be parallel with body (B). See illustration at right.
3. To adjust float arm, bend tang contacting inlet needle.

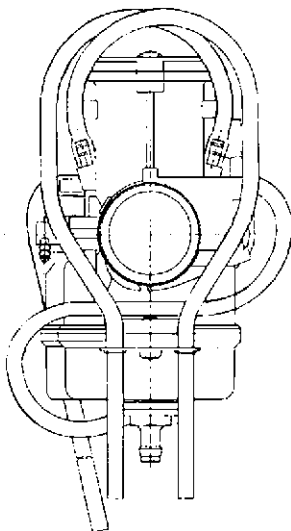
#### CAUTION:

Never bend the float arm itself.

**NOTE:** Mikuni TM-38 carburetor float levels are not adjustable.



### TMX 34 Venting configuration

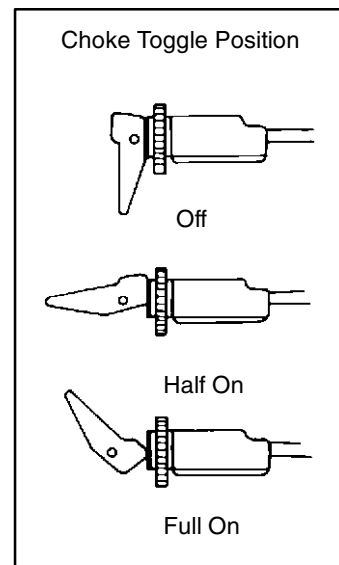


## Adjustments - Choke

With the dash mounted choke control toggle flipped to the full off position, the choke plunger must be seated on the fuel passage way in the carburetor. If the plunger is not seated on the passage way, the engine will flood or run too rich, causing plug fouling and very poor engine performance.

If cable slack is too great there will be excessive toggle free play resulting in hard cold starting. Also, the half on position used for intermittent applications will not function.

If the choke lever assembly becomes damaged, a lever kit is available. This allows replacement of the lever assembly rather than the entire cable assembly. Installation instructions are included with the kit.

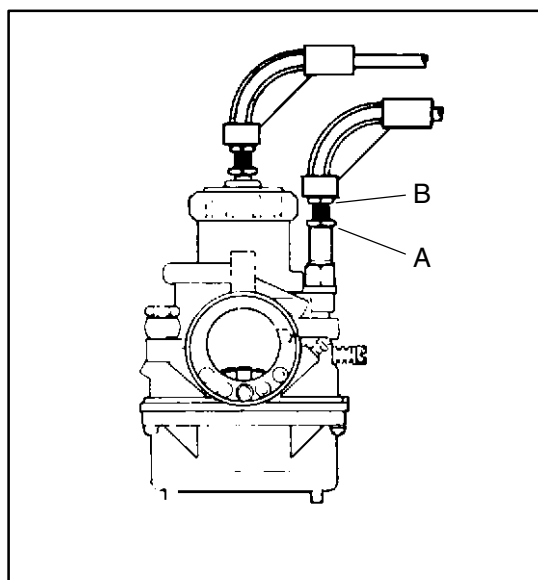
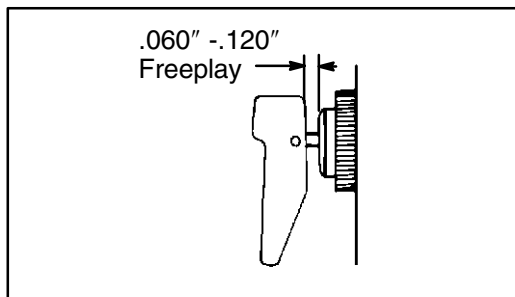


## Adjustment Procedure

1. Flip choke toggle to full off position.
2. Loosen adjustment locknut (A) on carburetor(s).
3. Turn cable sleeve adjusting nut (B) clockwise on carburetor(s) until 1/4" (.6 cm) or more choke toggle free play is evident.
4. Turn cable sleeve adjusting nut counterclockwise on one carburetor until toggle has zero free play, then rotate it clockwise until 1/8"-1/4" (.3-.6 cm) toggle free play is evident.
5. Tighten adjustment locknut (A).
6. Repeat steps 4 and 5 for remaining carburetor(s).

### Choke Lever Freeplay -

1/8 - 1/4" (.3 - .6 cm)



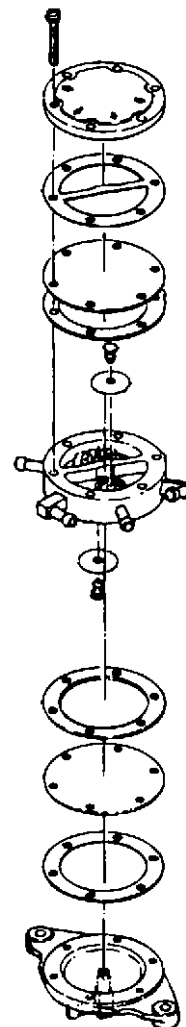
## Fuel Pump - Operation

The fuel pumps on all Polaris engines are basically the same. The differences are in the size and location of the pumps. Pumps may be mounted on the crankcase or on the machine by using an impulse hose.

In the two cycle engine, the pressure in the crankcase changes with the up and down stroke of the piston. The amplitudes of pressure vary according to the RPM and degree of throttle opening. Whether idling or at full throttle, the pressure built up in the crankcase has enough amplitude to operate the pump.

When the piston is on the upstroke, crankcase pressure in that cylinder becomes less positive. The diaphragm in the fuel pump moves toward the engine, causing a negative pressure or suction in the pump chamber. This causes the inlet valve from the fuel supply to open and permits fuel to enter the chamber. This same suction causes the outlet valve (to the carburetor) to close so that fuel cannot return from the carburetor.

When the piston begins its downward stroke, the pressure from the crankcase becomes positive, causing the fuel pump diaphragm to move in the opposite direction and reversing the pressure in the fuel pump chamber. This causes the inlet valve in the pump to close and the outlet valve to open, filling the float bowl in the carburetor. When the float level in the carburetor reaches its standard level, the needle valve will close, preventing more fuel from entering the carburetor, even though the fuel pump continues to try to provide the carburetor with fuel.



## Maintenance

The impulse operated diaphragm fuel pump does not require any specific scheduled maintenance. However, the following procedures should be observed.

### Operation:

- The pump may be checked for operation by removing the fuel supply line from the carburetor and placing it into a container. With the engine idling at approximately 2000 RPM, a steady flow of fuel should be visible.

### Cleaning:

- The pump and impulse line must be disassembled and cleaned of foreign material in the event of piston or other internal engine part failures which produce fragments.

### Inspection:

- The diaphragms and check valves must be carefully examined for cracks, tears, holes, or other damage. If in doubt as to the condition of any internal parts, replace all diaphragms, check valves, and gaskets.

## Troubleshooting

Fuel system diagnosis should follow a specific path, first examining the fuel tank, then the filters, fuel lines, vent lines, fuel pump, impulse hose, air box, exhaust system and finally the carburetors.

The following troubleshooting information assumes that the general mechanical condition of the engine (pistons, rings, bearings, etc.) is good.

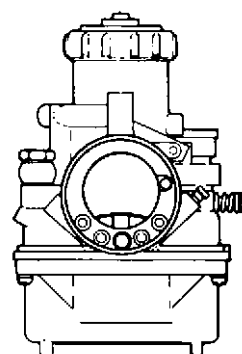
When the fuel/air mixture is diagnosed as improper due to spark plug readings, clean the carburetor and blow its passages clear with compressed air. Use the spark plug firing end condition as a guide for further determination of whether the mixture is too rich or too lean.

Use the throttle lever to determine at what degree of throttle valve opening the problem exists.

CONDITION	SYMPTOMS
Mixture Too Rich	<ul style="list-style-type: none"> <li>-Black spark plug tip</li> <li>-Heavy exhaust smoke</li> <li>-Engine runs worse after warm up</li> <li>-Runs better without air silencer</li> <li>-Combustion chamber has heavy deposits of carbon</li> </ul>
Mixture Too Lean	<ul style="list-style-type: none"> <li>-Spark plug electrodes white</li> <li>-Fluctuation in engine speed</li> <li>-Power loss</li> <li>-Engine overheats</li> <li>-Cylinder scoring</li> <li>-Backfiring - detonation</li> <li>-Throttle diagnostic opening check points</li> </ul>
Poor Fuel Mileage	<ul style="list-style-type: none"> <li>-Incorrect ignition timing</li> <li>-Improper track tension (too tight)</li> <li>-Incorrect carburetor jetting</li> <li>-Fuel leaks (lines, fittings, fuel pump)</li> <li>-Needle and seat leaks</li> <li>-Plugged exhaust</li> <li>-Carburetor vent line problems</li> <li>-Clutching incorrect for conditions</li> </ul>

### Troubleshooting Tips, 0-1/4 Throttle:

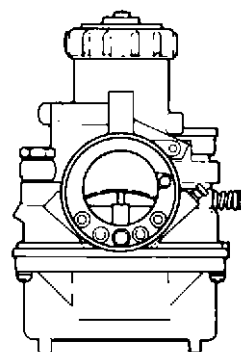
- Pilot air screw mis-adjusted
- Pilot jet of wrong size
- Obstruction of pilot jet
- Pilot jet loose
- Choke plunger not seating (rich)
- Carburetor mounting air leak (lean)
- Crankshaft seal air leak (lean)
- Fuel pump diaphragm damaged (rich)
- Float level incorrect



## Troubleshooting

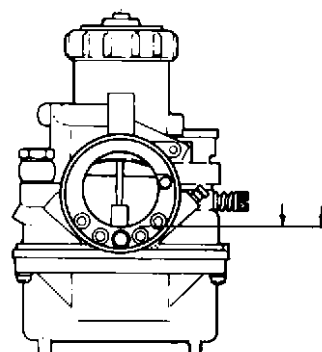
### Troubleshooting Tips, 1/4-3/8 Throttle:

- Obstruction in main jet or needle jet
- Jet needle worn or out of adjustment
- Pilot system malfunction
- Incorrect throttle valve cutaway



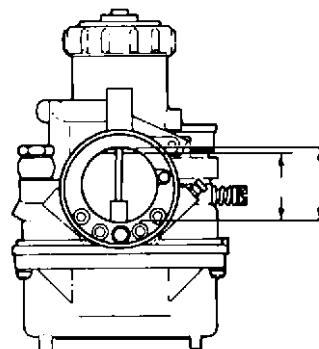
### Troubleshooting Tips, 3/8-3/4 Throttle:

- Main jet incorrect size or clogged (lean)
- Needle jet setter O-ring damaged or loose
- Needle jet/jet needle worn (rich)



### Troubleshooting Tips, Full Throttle:

- Main jet size (rich or lean)
- Fuel filter blocked (lean)
- Fuel vent lines or check valves plugged
- Exhaust system plugged
- Air box restricted
- Fuel pump weak
- Exhaust leaking into engine compartment (rich)
- Water in float bowl (lean)





# **CHAPTER 4**

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# **CLUTCHING**

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## Service Tools

### WARNING

Because of the critical nature and precision balance incorporated into the drive clutch, it is absolutely essential that no attempt at clutch disassembly and/or repair be made without factory authorized tools and service procedures.

### Essential Drive Clutch Tools

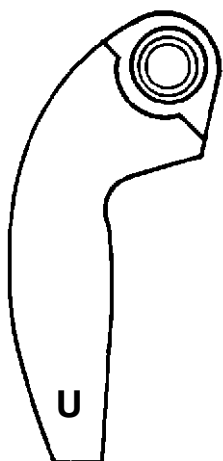
Refer to the Service Tool Catalog (PN 9914681) for photos and descriptions of all tools. A tool catalog update is available through the Polaris parts department. The part number is 9915235.

<u>Description</u>	<u>Part Number</u>
Offset Alignment Tool - 5/8" (1.6 cm) P-85 Clutches . . . . .	2870426
Drive Clutch Puller 14mm (Small Shaft ID) . . . . .	2872085
Strap Wrench . . . . .	2870336
Replacement Strap for 2870336 . . . . .	2870389
Spider Spanner Nut Driver (Jam Nut) . . . . .	2870338
Spider Removal / Installation Tool . . . . .	2870341
Holding Fixture . . . . .	2871358
Holding Fixture Tab . . . . .	5130518
Tapered Reamer . . . . .	2870576
Spider Button Tool . . . . .	2870985
Clutch Bushing Rebuild Tool Kit . . . . .	2871025
P-85 Drive Clutch Compression Tool . . . . .	2870984
Torque Wrench, 250 ft. lb. . . . .	Commercially Available
Torque Wrench, 0-200 in. lb. . . . .	Commercially Available
Clutch Compression Tool . . . . .	8700220
Clutch Holding Wrench . . . . .	9314177
SLP Button Tool . . . . .	8716010
SLP Clutch Sheave Clamp Tool . . . . .	8716020
High Performance Roller Compression Tool . . . . .	PS45909

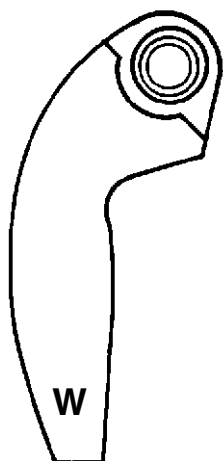
### Pro X Drive Clutch Puller Chart

<b>Model</b>	<b>Clutch Puller Part Number</b>
<b>440 Pro X Fan</b>	<b>2872084</b>
<b>440 Pro X</b>	<b>2872085</b>
<b>600/700/800 Pro X</b>	<b>2872085</b>

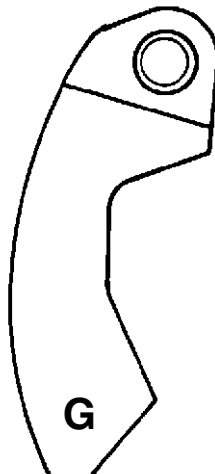
## Drive Clutch Weight Identification - Actual Size



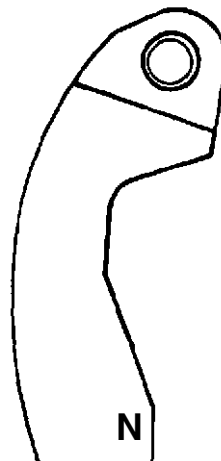
U  
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PN 5630107



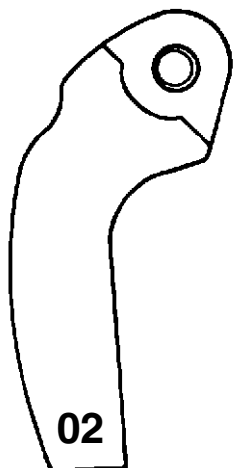
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PN 5630109



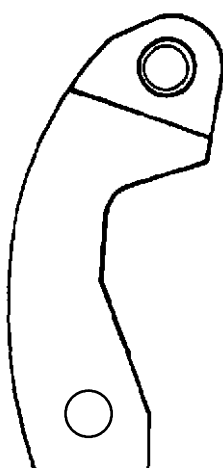
G - (B Modified)  
Gram Weight:  $41.5 \pm 1$   
PN 5630063



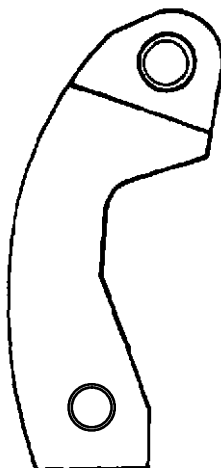
A  
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PN 5630080



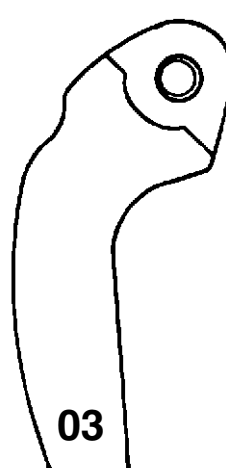
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PN 5630225



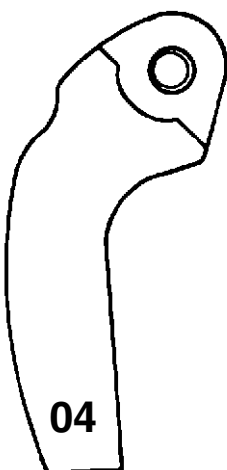
O  
Gram Weight:  $51$   
PN 5610088



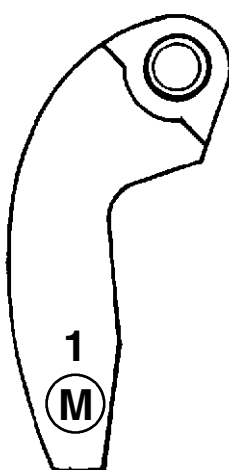
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Gram Weight:  $53 \pm 1$   
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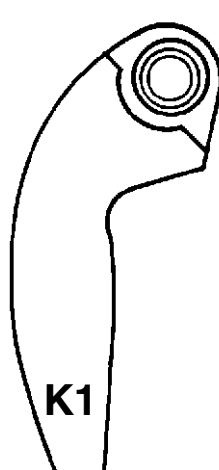
03  
Gram Weight:  $32.5 \pm 1$   
PN 5630227



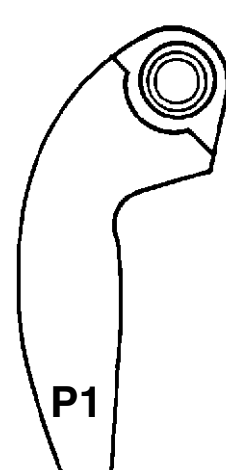
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Gram Weight:  $57.5 \pm 1$   
PN 5630229



M1 (Modified)  
Gram Weight:  $46.0 \pm 1$   
PN 5630301

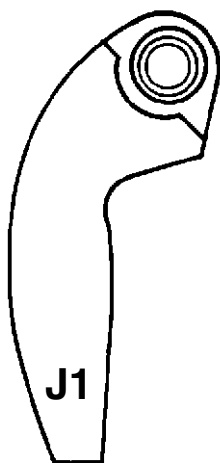


K1  
Gram Weight:  $39 \pm 1$   
PN 5630144

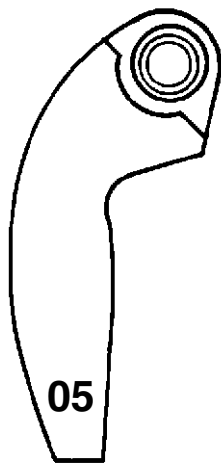


P1  
Gram Weight:  $42 \pm 1$   
PN 5630089

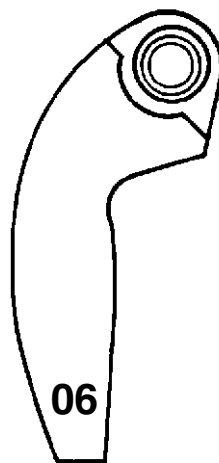
## Drive Clutch Weight Identification - Actual Size



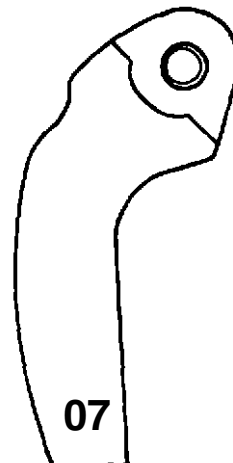
J1  
Gram Weight:  $44 \pm 1$   
PN 5630065



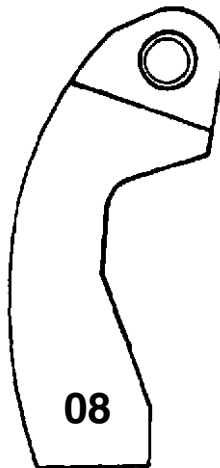
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PN 5630234



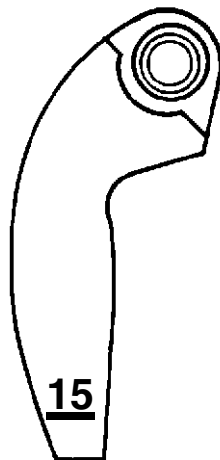
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PN 5630243



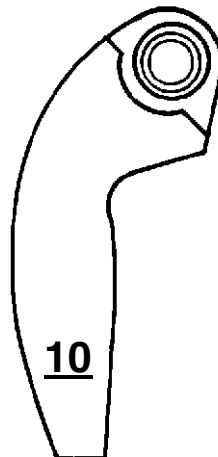
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PN 5630244



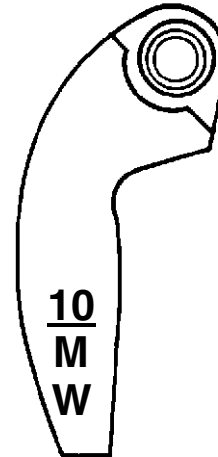
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PN 5630245



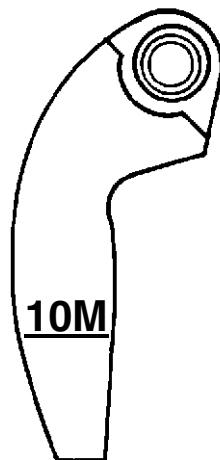
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PN 5630274



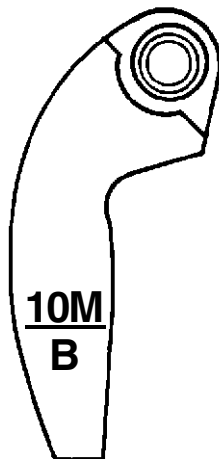
10 Bushed  
Gram Weight:  $51.5 \pm 1$   
PN 1321526



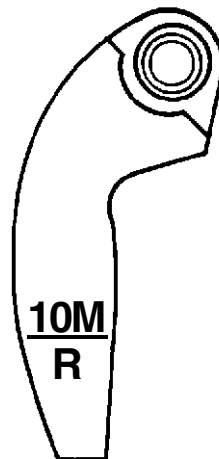
10M-W Bushed  
Gram Weight:  $46 \pm 1$   
PN 1321527



10M Bushed  
Gram Weight:  $49.5 \pm 1$   
PN 1321528

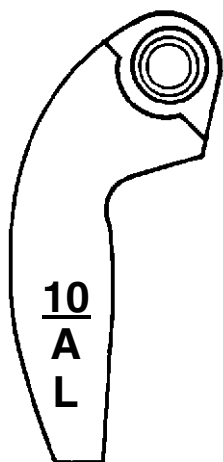


10M Blue Bushed  
Gram Weight:  $47.5 \pm 1$   
PN 1321529

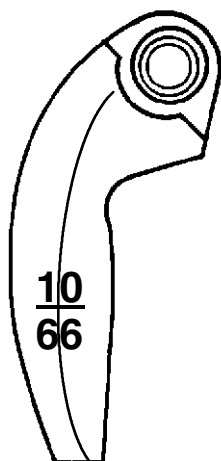


10M Red Bushed  
Gram Weight:  $44 \pm 1$   
PN 1321530

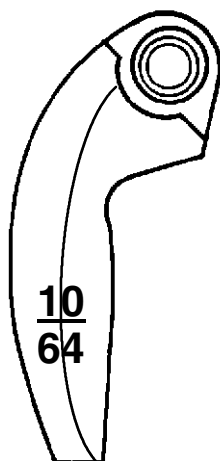
## Drive Clutch Weight Identification - Actual Size



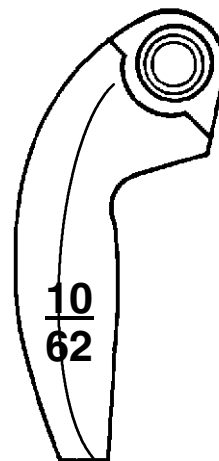
10-AL Bushed  
Gram Weight: 53 ± 1  
PN 1321531



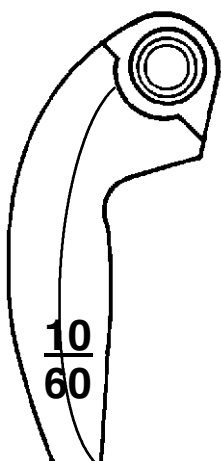
10-66 Bushed  
Gram Weight: 66  
PN 1321584



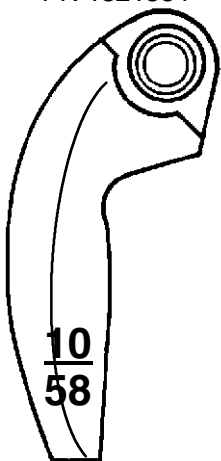
10-64 Bushed  
Gram Weight: 64  
PN 1321585



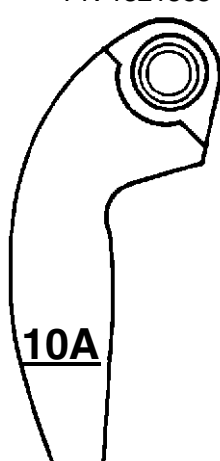
10-62 Bushed  
Gram Weight: 62  
PN 1321586



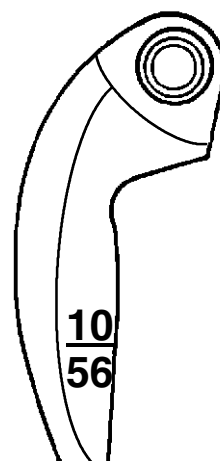
10-60 Bushed  
Gram Weight: 60  
PN 1321587



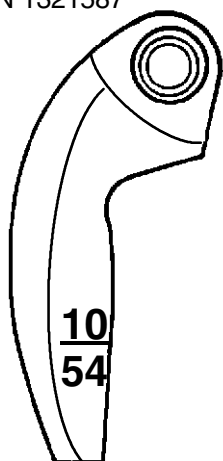
10-58 Bushed  
Gram Weight: 58  
PN 1321588



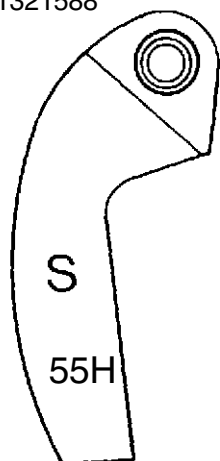
10A Bushed  
Gram Weight: 55  
PN 1321589



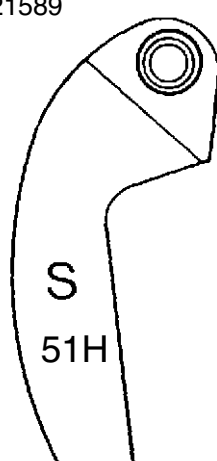
10-56 Bushed  
Gram Weight: 56 ± 1  
PN 1321684



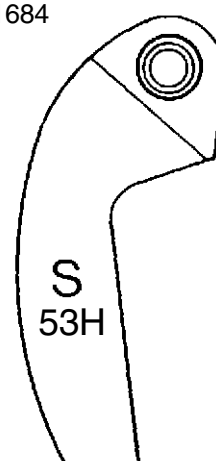
10-54 Bushed  
Gram Weight: 54 ± 1  
PN 1321685



S55H  
Gram Weight: 55 ± 1  
PN 1322004

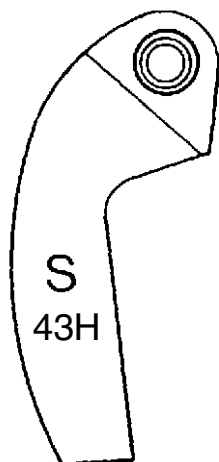


S51H  
Gram Weight: 51 ± 1  
PN 1321731

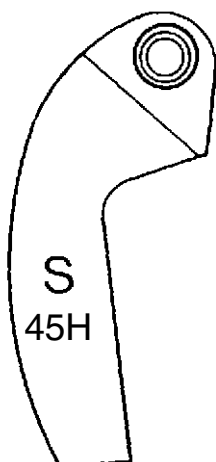


S53H (S55R)  
Gram Weight: 53 ± 1  
PN 1321759

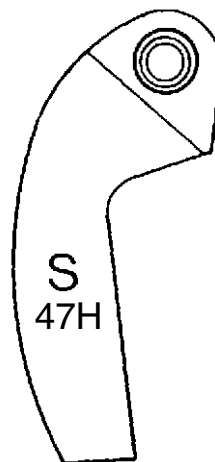
## Drive Clutch Weight Identification - Actual Size



S43H  
Gram Weight:  $43 \pm 1$   
PN 1321849

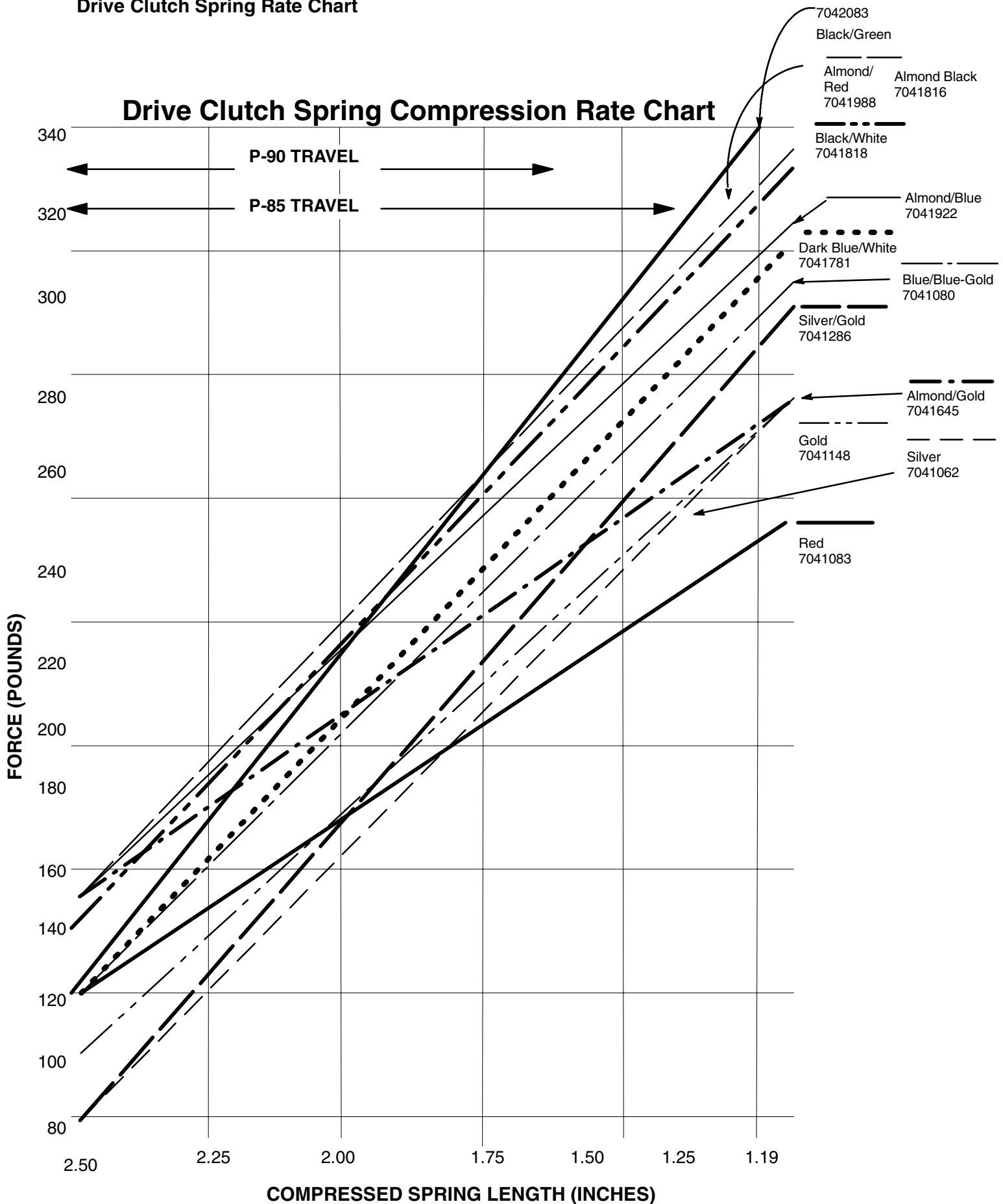


S45H  
Gram Weight:  $45 \pm 1$   
PN 1321850



S47H  
Gram Weight:  $47 \pm 1$   
PN 1321851

## Drive Clutch Spring Rate Chart





## Drive Clutch Spring Data

PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH +/- .125"	Force lbs. @ 2.50"-1.19 (+/- 12lbs.)
7041021	Clear	.157"	4.38"	70-130
7041022	Black	.140"	4.25"	44-77
7041063	Purple	.168"	4.37"	75-135
7041062	Silver	.208"	3.12"	75-243
7041065	Pink	.177"	4.69"	112-200
7041060	Orange	.196"	3.37"	70-199
7041080	Blue/Gold	.207"	3.50"	120-300
7041083	Red	.192"	3.77"	120-245
7041102	Yellow	.192"	2.92"	44-185
7041061	Brown	.200"	3.06"	69-212
7041132	White	.177"	2.92"	34-141
7041168	Green	.177"	3.05"	42-142
7041148	Gold	.207"	3.25"	100-275
7041150	Red/White	.192"	3.59"	100-220
7041286	Silver/Gold	.218"	3.05"	77-240
7041080	Blue	.207"	3.55"	120-300
7041526	Dark Blue	.218"	3.52"	120-310
7041781	Dark Blue/White	.225"	3.52"	120-310
7041566	Almond	.207"	3.65"	140-330
7041645	Almond/Gold	.207"	4.00"	150-290
7041818	Black/White	.218"	3.52"	140-320
7041816	Almond/Black	.200"	3.75"	165-310
7041922	Almond/Blue	.218"	3.75"	150-310
7041988	Almond/Red	.207"	4.29"	165-310
7042083	Black/Green	.218"	3.38"	120-340

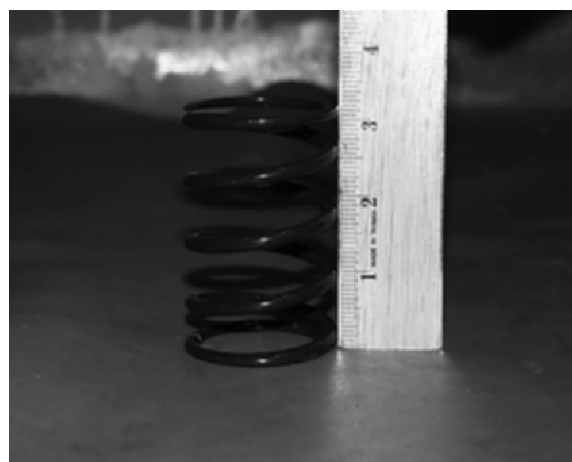
**CAUTION:**

*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.

Maximum efficiency of the variable speed drive system is dependent upon many factors. Included in these are converter offset and alignment, belt tension, belt to sheave clearance, and internal condition of the drive and driven clutch components. One of the most critical and easily serviced parts is the drive clutch spring. Due to the severe stress the spring is subject to during operation, it should always be inspected and checked for tolerance limits during any clutch operation diagnosis or repair.

With the spring resting on a flat surface, measure free length from outer coil surfaces as shown. Refer to the chart above for specific free length measurements and tolerances.

In addition to proper free length, the spring coils should be parallel to one another when placed on a flat surface. Distortion of the spring indicates stress fatigue. Replacement is required.



## CLUTCHING

### Driven Clutch Springs (Polaris Clutch)

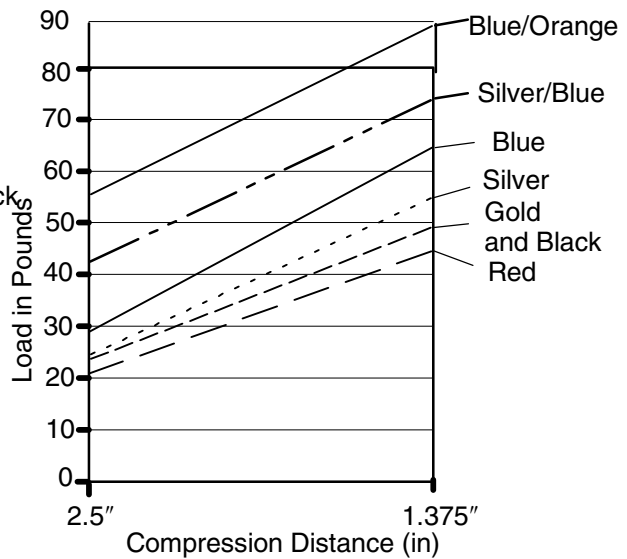
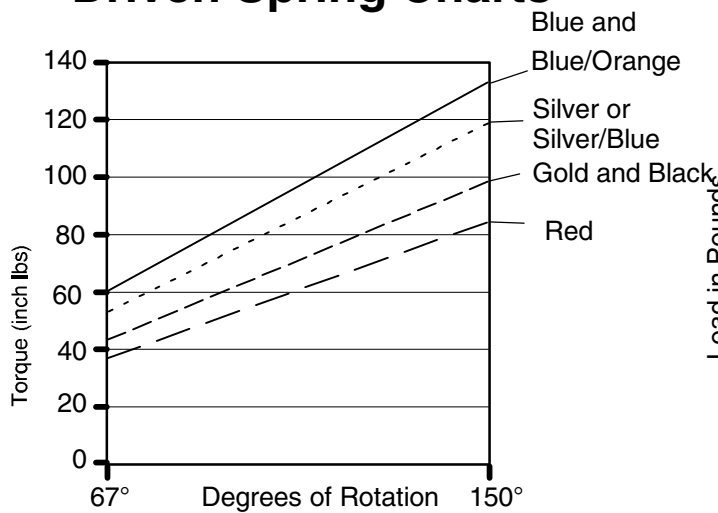
Part Number	Description
7041198	Red
7041782	Black-5 Coil
7041501	Gold-6 Coil
7041296	Blue
7041499	Silver
7041646	Silver/Blue
7042022	Blue/Orange

Soft



Firm

### Driven Spring Charts



### Driven Clutch Spring Data

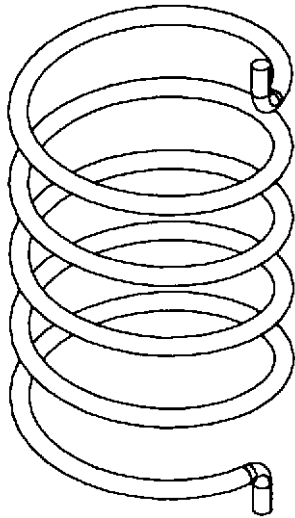
Part Number	Description	Wire Dia.	Free Length	Load at 2.50" (lbs.)	Moment at 67° Rotation (in #s)	Load at 1.375" (lbs.)	Moment at 150° Rotation (in #s)
7041198	Red	0.170	4.00	21	38	45	85
7041296	Blue	0.192	3.43	29	60	64	133
7041499	Silver	0.188	3.45	25	53	54.5	119
7041646	Silver/Blue	0.183	3.45	42	53	75	119
7041782	Black	0.177	3.60	24	44	49	99
7041501	Gold	0.188	3.60	24	44	49	99
7042022	Blue/Orange	0.192	3.50	56	60	90	133

### Effects of Driven Clutch Spring

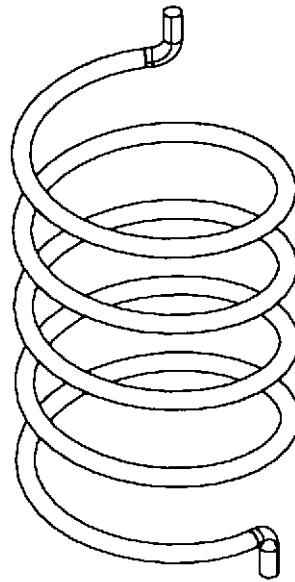
Increases in driven clutch spring preload will raise engine speed before the clutch starts shifting, allowing the clutch to backshift more quickly. Decreases in driven clutch spring preload will result in faster upshift, but will also slow backshift, thereby lowering engine RPM.

It is important to note that engine drive clutch calibration should be used to control engine speed rather than driven clutch spring preload. Lowering RPMs by decreasing driven clutch spring preload will result in belt slippage on acceleration. Increasing RPMs by increasing preload will result in excessive drive belt wear and decreased transmission efficiency.

Refer to the chart on page 4.9 for available driven clutch springs. Experimenting with these springs will allow you to find the most efficient combination of side pressure and back shifting for your application.



Spring tails in line - when installed in clutch preload will cause tails to be offset.



Spring tails offset - when installed in clutch preload will cause tails to be very close to being in line.

### Effects of Driven Clutch Helix Ramp

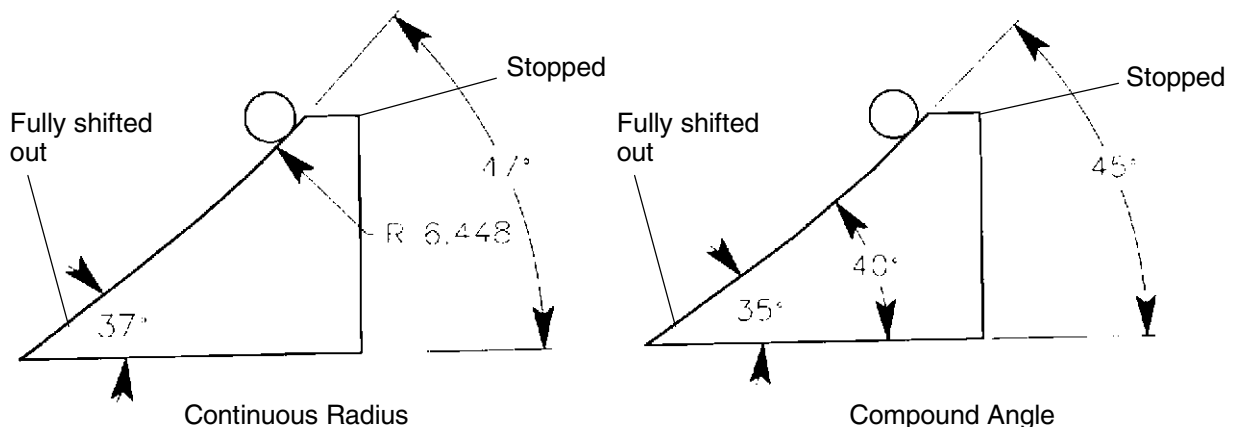
A larger helix angle will allow the clutch to upshift at a lower engine RPM. Less side force will be exerted on the moveable sheave and the clutch will upshift more rapidly. During backshift, a lesser helix angle will backshift more easily and keep engine RPM higher. A larger helix angle will make it harder to downshift and will load the engine, resulting in lower RPMs.

If all other variables are kept constant, a helix change with a lesser angle will result in slower upshift and faster backshift. Engine RPM will remain higher. A helix change with a greater angle will result in faster upshift and slower backshift. Engine RPM will be lower.

The drive clutch controls upshift, while the driven clutch controls backshift through the angle of the helix. The factory helix will work well for most rugged cross country races, while a helix with a lesser angle may work better for high speed ice cross country races.

Because backshifting is not important in drag races, most of these racers experiment with larger helix angles for the fastest possible upshift. Multi-angle helixes are sometimes used by racers who need a good holeshot. A multi-angle helix reduces to a smaller angle as the clutch shift out and RPM is increased to match the HP curve of the engine. This is particularly true of engines with narrower powerbands.

Oval and snowcross racers need a good holeshot and a quicker backshift for good response out of the corners. Helix angles may require a change depending on individual tracks. Depending on performance requirements, continuous radius, compound angle, and straight angle helixes are available. Once again, experimentation is the best method of determining what will work best for your application.



## Helix Angles and Effects (Polaris Clutch)

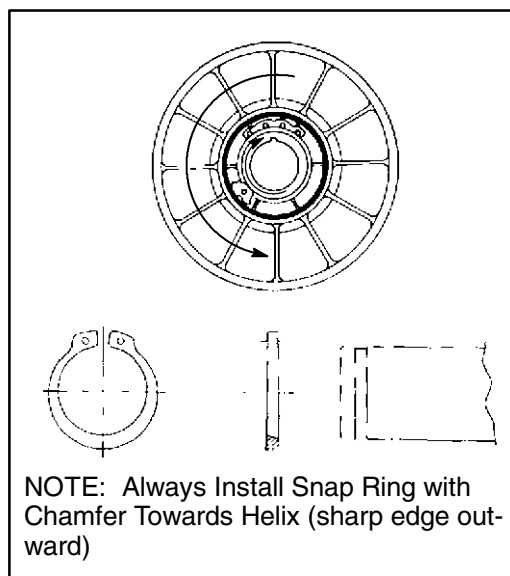
The driven clutch helix was selected for overall performance in relation to the other driven system components. In fine tuning situations requiring a slight adjustment of engine operating RPM or improved backshift, we recommend trying a helix change before changing other components.

The helix spring should always be adjusted within its limits before a helix change is performed. The normal rate of change between helix angle steps is 250 RPM under full throttle. This is approximately the same result as in going from the No. 1 to No. 4 spring position. **NOTE:** Increasing spring tension increases engine RPM. RPM changes may not be evident if other drive or driven clutch components are substandard.

On most models the production helix spring hole location is No. 2. Tension the spring 1/3 turn. Install helix key, thrust washer and snap ring.

Polaris has several helix angles available for the driven clutch. Refer to the chart below for specific angle effects and identification. See NOTE: below.

Description	PN	Degrees	System Type
34	5130896	34	P85
34M*	5130751	34	P85
36	5130895	36	P85
36M*	5130717	36	P85
38	5130723	38	P85
40	5130724	40	P85
42	5130725	42	P85
44	5130726	44	P85
40-36*	5130898	40-36	P85
R1*	5131287	40-32	P85
R2*	5131288	42-32	P85
R3*	5131289	45-32	P85
R4*	5131290	50-32	P85
R5*	5131291	40-34	P85
R6*	5131292	42-34	P85
R7*	5131293	45-34	P85
R8*	5131294	50-34	P85
R9*	5131295	40-36	P85
R10*	5131296	42-36	P85
R11*	5131297	45-36	P85
R32*	5131623	50-34	P85
R12*	5131298	50-36	P85
R49	5133023	52-34	P85
T-1*	5131013	42-36-34	P85
36.5	5130383	36.5	P90
40-38-36	5131161	40-38-36	P90
38-36	5131162	38-36	P90
38-36-34	5131163	38-36-34	P90
34	5131164	34	P90
34	5131164	34	P90



\* **NOTE:** All R-Series, Mod(M), T1, and 40-36 helix ramps are cut 0.060" deeper in the snap ring pocket. These are made so the driven clutch can open far enough for full shift out with wide 1 7/16" belts.

If these helix ramps are used with narrow belts, 2 additional .030" / .8 mm (PN 7556804) washers (for a total of three) must be installed under the snap ring to prevent the belt from touching the inner hub at full shift which can cause belt failure.

Wide belt models use only the existing washer under the snap ring.

**TEAM CLUTCH INFO****Driven Ramp**

RAMP PART NUMBER	DESCRIPTION
5133321	66/44- .46 70/48- .36
5133491	74/48- .46 70/48- .46
5133492	74/48- .46 74/40- .46
5133493	72/44- .46 72/40- .46
5133494	70/44- .46 70/40- .46
5133495	68/44- .46 68/40- .46
5133496	66/48- .46 66/40- .46
5133497	64/44- .46 64/40- .46
5133498	62/44- .46 62/40- .46
5133499	58/44- .46 58/40- .46
5133687	58/44- .46 ER
5133721	66/44- .46 70/48- .46
5133771	58/4/- .46 ER
5133772	62/46- .46 ER
5133773	62/42- .46 ER
5133784	58/40- .46 ER
5133785	62/40- .46 ER
5133786	62/44- .46 ER
5133787	60/48- .46 ER
5133788	60/44- .46 ER
5133789	60/46- .46 ER

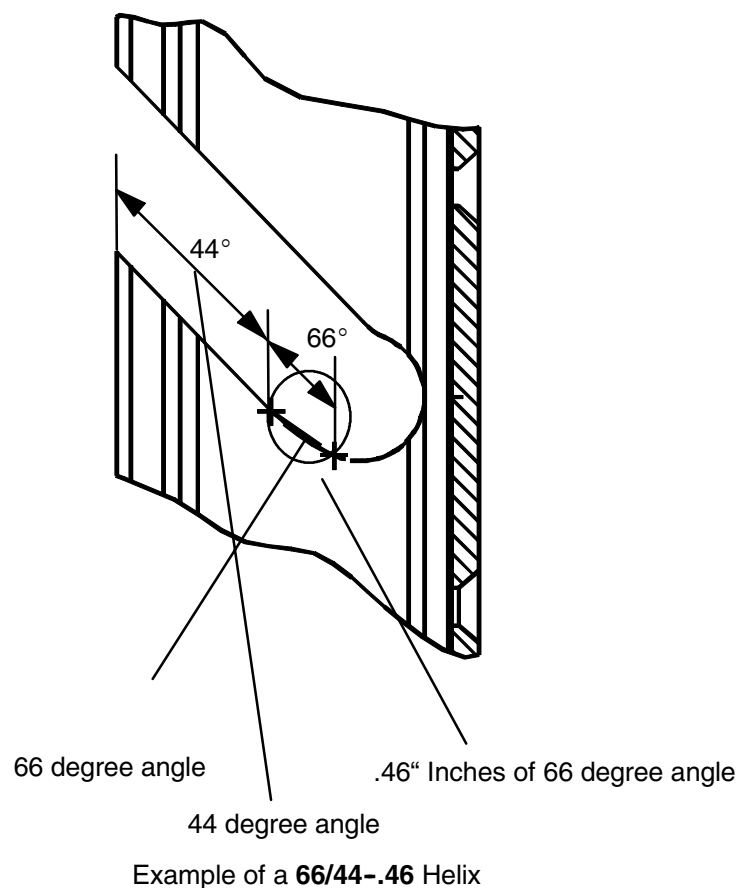
ER notes Ramps for Electric Reverse

**Driven Springs**

PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH +/- .125"	Force lbs. @ 2.20"-1.10" (+/- 6%)
7042137	RED/BLUE	.218	4.767	140-200
7042164	RED/BLACK	.218	4.767	140-200
7042165	RED/GREEN	.218	4.767	120-220
7042166	RED/WHITE	.218	4.950	100-200
7042167	RED/SILVER	.207	4.950	125-175
7042168	RED/YELLOW	.207	4.400	100-150
7042198	BLACK/RED	.218	5.14	155-222

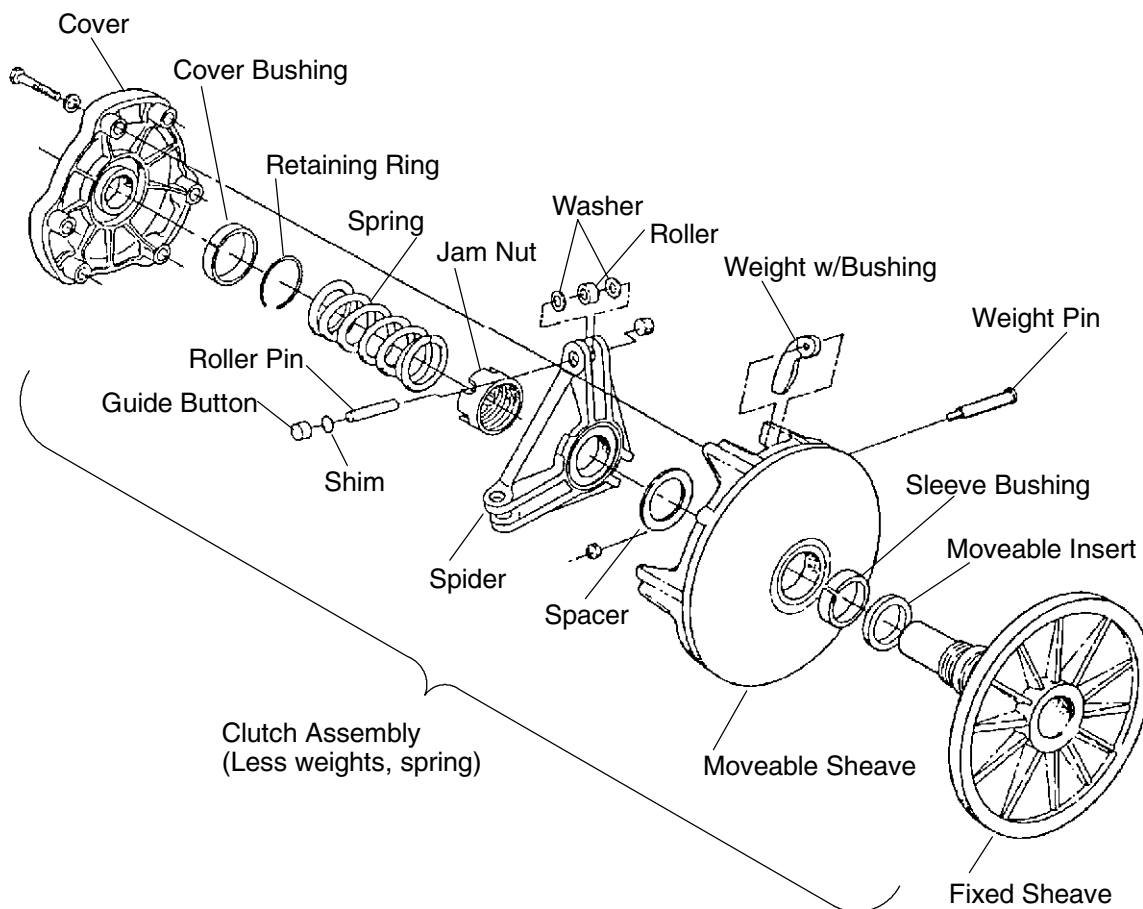
## High Performance Roller Helix explained

The Helix for the High Performance Roller is designated for the angle and length of the angle on the back side of the helix. You will see that the first number designates the steepest angle. The second number designates the lowest angle, and the last number is a measurement of the length of the steepest angle.



### P-85 Drive Clutch Exploded View - Typical

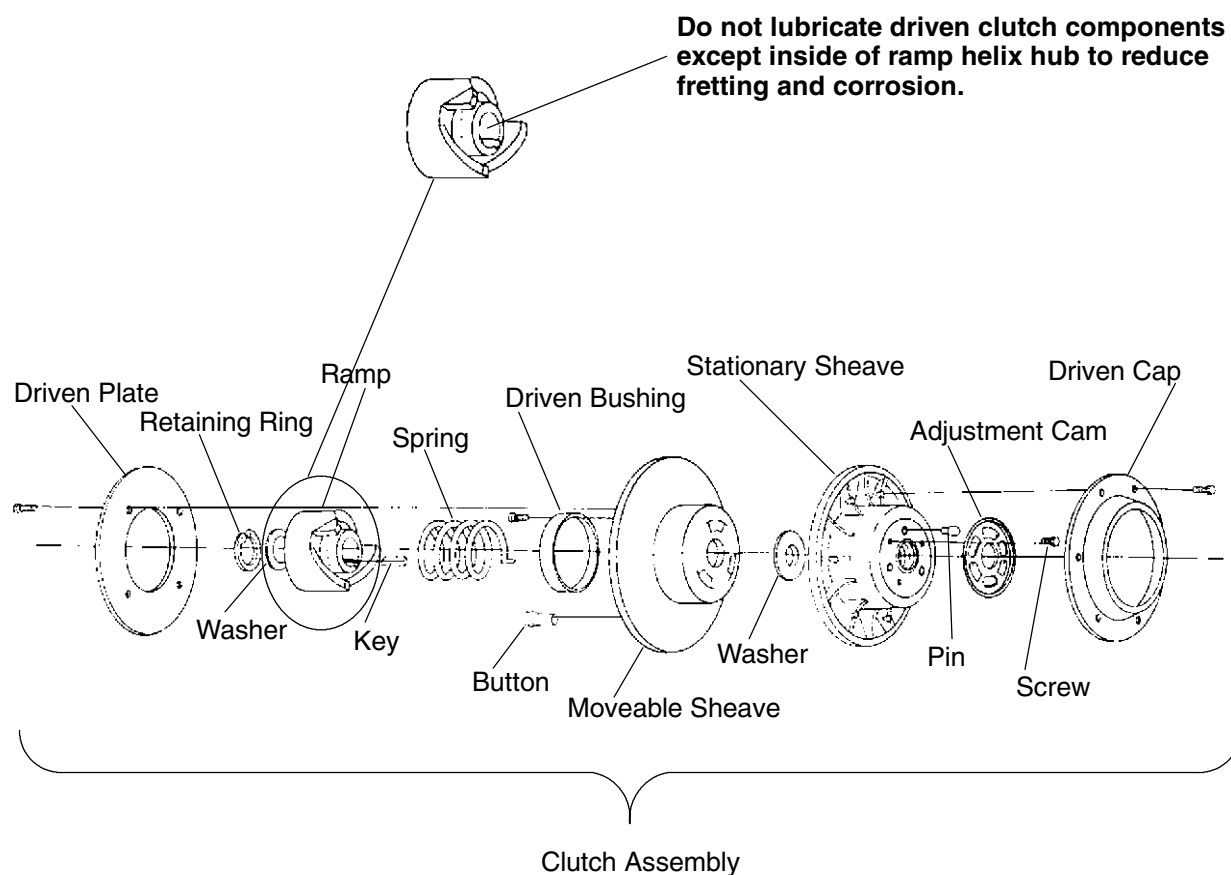
Do not lubricate drive clutch components



Replacement clutches come complete and balanced without clutch weights and clutch spring. The clutch cover, spider, and sheaves cannot be purchased separately as replacement parts.

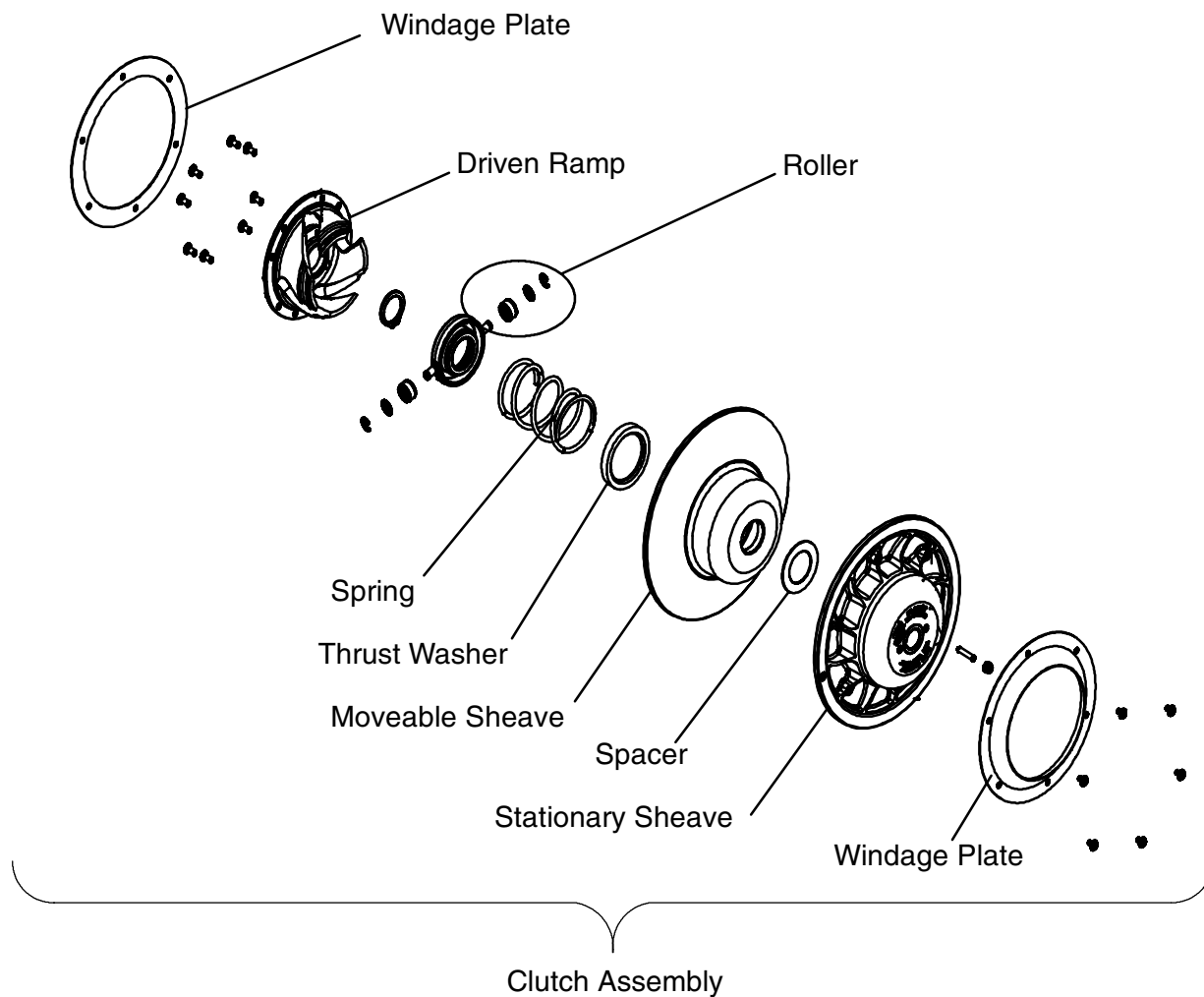


## P-85 Driven Clutch Exploded View - Typical



Replacement driven clutches come without ramp and spring. The moveable and stationary sheaves cannot be ordered as separate service parts.

### Team Roller Clutch Exploded View



Replacement driven clutches come with out ramp. The moveable and stationary sheaves cannot be ordered as separate service parts.

## Operation

The Polaris drive system is a centrifugally actuated variable speed belt drive unit. The drive clutch, driven clutch, and belt make up the torque converter system. Each clutch comes from the factory with the proper internal components installed for its specific engine model. Therefore, modifications or variations of components at random are never recommended. Proper converter setup and adjustments of existing components must be the primary objective in converter operation diagnosis.

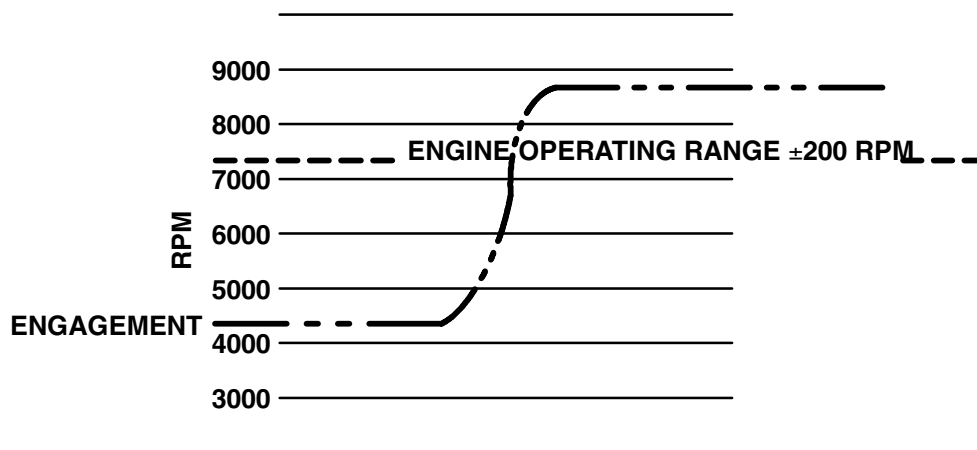
### CAUTION:

All converter 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 drive clutch, it is absolutely essential that no attempt at clutch disassembly and/or repair be made without factory authorized special tools and service procedures. Any unauthorized modifications to clutches, such as adding or removing weights, will void the warranty.

### Relationship Between Drive Clutch Weights And Spring In Maintaining Operating RPM

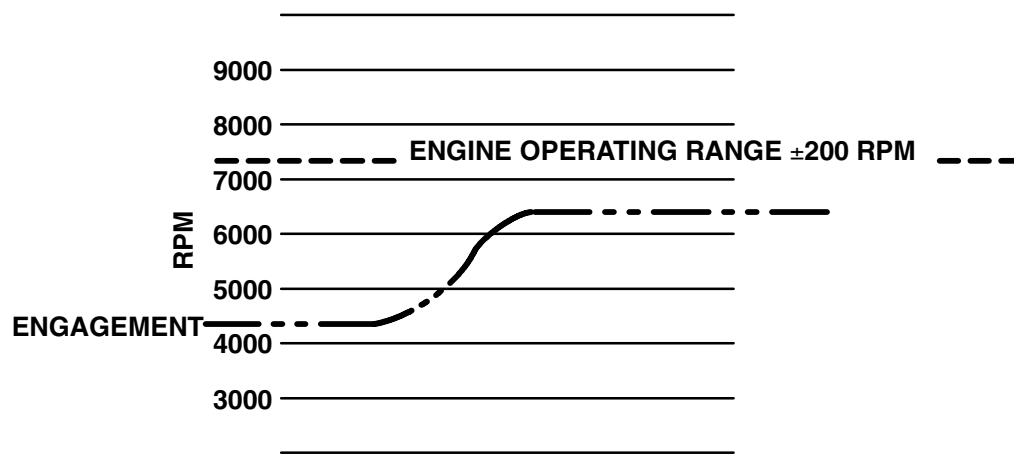
The drive clutch is an RPM and torque sensing unit designed to transfer the maximum amount of horsepower from the engine to the ground. This is accomplished by weights and a spring inside the unit which react to the centrifugal force from the engine RPM.

The spring and weights work in combination. In a properly set up clutch, the maximum desired operating RPM will be reached immediately after clutch engagement, under full throttle conditions. To gain optimum power this RPM should be maintained. As centrifugal force pushes the weights against the rollers, the moveable sheave will force the belt to climb up the drive clutch sheave and increase vehicle speed.

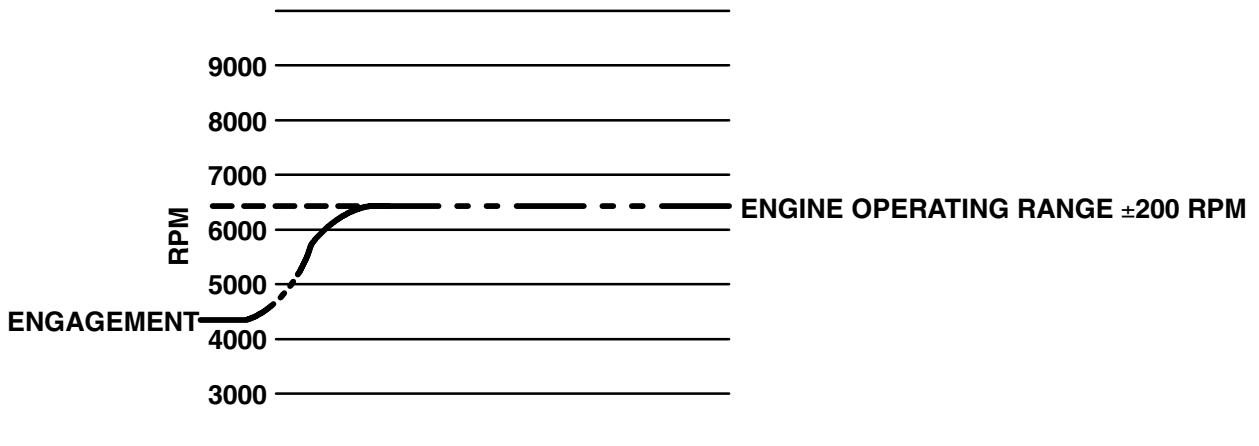


If the weights are too light, or the spring rate too high, the maximum RPM will be too great and the drive belt will not move into high gear at the top of the clutch.

### Operation



If the weights are too heavy, or spring rate too low, the engine RPM will be low and the drive clutch will upshift too fast, keeping the engine out of its power band.



If the weights and spring are matched properly, the engine RPM will go to the desired range and remain there on both upshift and backshift.

## MAINTENANCE

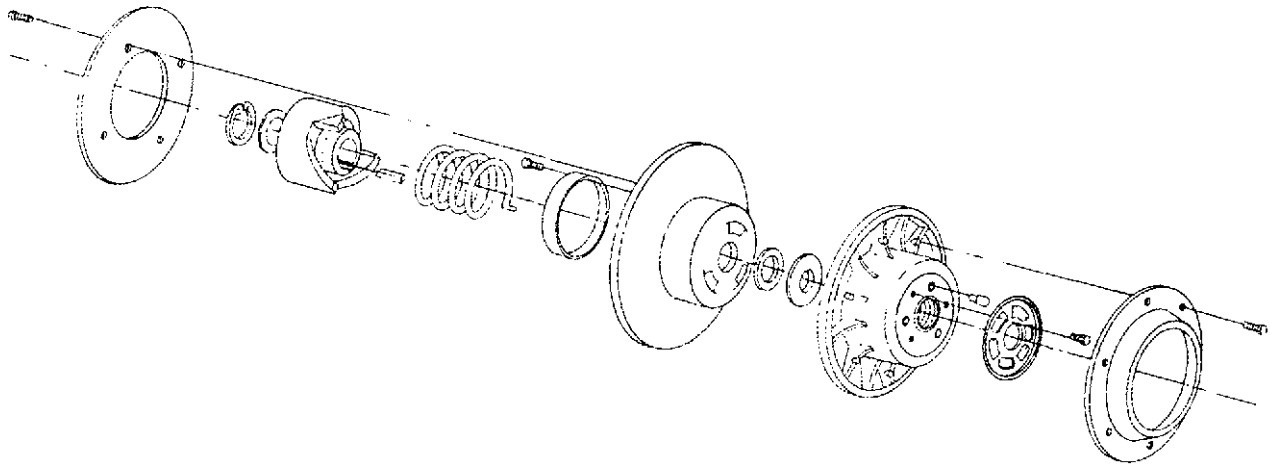
The driven clutch operates in conjunction with the drive clutch. Its function is to maintain drive belt tension preventing slippage, and sense variations in load requirements necessary to maintain optimum engine torque output and load requirements from the track. Output torque is transmitted through the chaincase jackshaft and chaincase to the front drive shaft and track.

When the load on the driven clutch is increased and becomes greater than the torque delivered from the engine, the driven clutch becomes dominant and overrides the drive clutch. The driven clutch downshifts into a ratio which will match the increased load.

Because the driven clutch can sense and shift into the proper ratio, engine RPM will remain within the specified range.

### Driven Clutch Adjustments

The driven clutch has a provision for varying the torque required to change its ratio. It can be readjusted by relocating the spring in the helix which in turn increases or decreases the amount of load required to change the ratio.



**Driven Clutch (Typical P-85)**

### Spider Indexing

**NOTE:** Spider indexing affects clutch balance and belt to sheave clearance. Read procedures carefully before proceeding.

1. Before disassembling drive clutch, mark spider, cover, moveable sheave, and stationary sheave in line with a permanent marker as shown.
2. Disassemble drive clutch as described on page 4.20-4.21. Take care to note the amount and thickness of the shim washers under the spider.
3. Add or remove spider washers as required to achieve desired belt to sheave clearance.
  - For example: If belt to sheave clearance is .020" too large, removing one .020" shim will position the movable sheave closer to the fixed sheave reducing belt to sheave clearance by .020".

**NOTE:** The following washers are available for fine tuning:

**Washers:**

PN 5210754 .050"

PN 5210753 .030"

PN 5210752 .020"

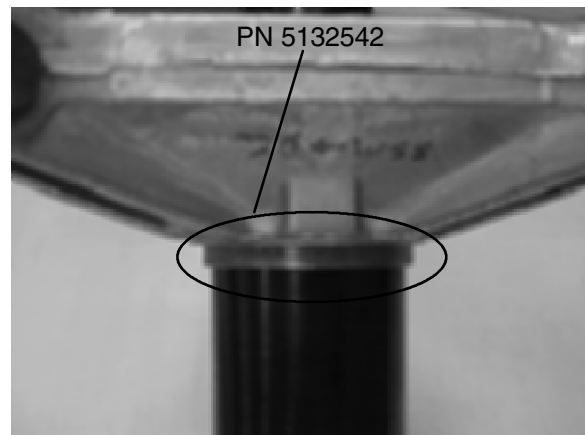
PN 5132542 Stepped washer in addition to one of the above shims for precise shimming

4. Install spider washer(s) and spider aligning Xs. Notice as the spider seat location is changed, the sheave marks made before disassembly no longer align. There are two ways to bring the sheave marks into alignment.
  - Vary the amount and thickness of spacer washers (Washer thickness may vary slightly).
  - Re-index marked spider leg to another tower. This can be done because spider has little effect on overall clutch balance.

Re-indexing the spider 1/3 turn clockwise, or 1 leg, will allow the realignment of the moveable and stationary sheaves as previously marked. For example:

- .020" or .032" washer removed - re-index spider clockwise 1/3 turn
- .050" or .064" washer removed - re-index spider clockwise 1/3 turn
- Two .050" or .064" washers removed - re-index clockwise 2/3 turn

**NOTE:** Alignment marks should be within 1" (25 mm) after final assembly and torquing.



## Removal

1. Hold clutch with strap wrench. Remove drive clutch retaining bolt, grease puller thread and tip lightly and install puller into clutch. Tighten puller with a wrench, or strike t-bar with a hammer until clutch is removed.

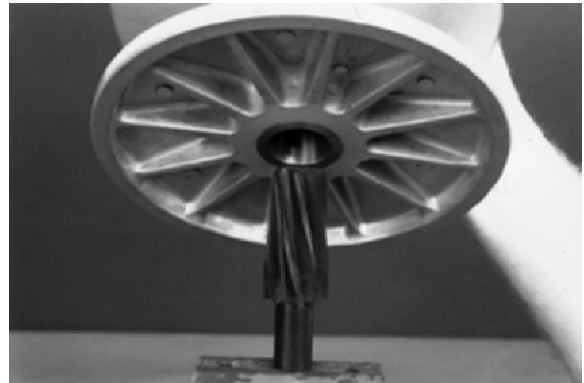
**Strap Wrench PN 2870336**

**Clutch Puller PN 2872085 - 3/4-16x14mm**  
**Clutch Puller XCF: 2872084**



2. Slight galling or scoring of bore taper can usually be corrected using a tapered reamer. Place reamer in a vise and lubricate with cutting oil. Clean clutch taper by manually rotating clutch clockwise. Do not ream taper more than required to remove galling or scoring. Never use power tools to ream taper of drive clutch.

**Tapered Reamer PN 2870576**

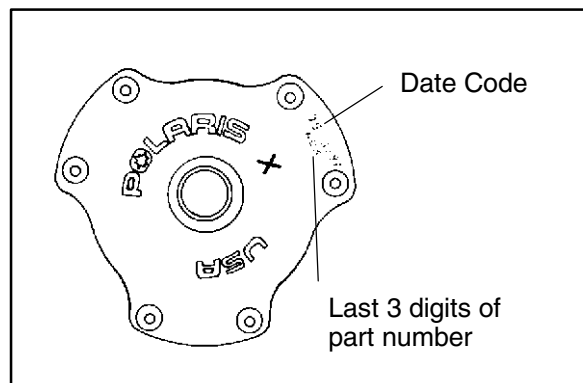


### CAUTION:

Never use an air impact wrench for installing or removing a drive clutch. It will loosen the spider torque value and could cause engine crankshaft damage.

### Identification

This number indicates internal clutch component variation for individual engines. For easy identification, refer to the three numbers behind date code on clutch cover plate. These numbers are the last three digits of the clutch part number.



### Disassembly and Inspection

1. Install drive clutch in clutch compression tool (8700220). Mark both moveable and fixed sheave, cover, and spider with a permanent marker.

#### CAUTION:

Sheaves must be marked to provide a reference point for clutch balance and spider indexing. If the sheaves are not marked, and spider shim washers are changed or misplaced, the clutch will be out of balance and must be replaced. See page 4.28 for indexing procedure.

2. Carefully and evenly remove cover attaching bolts. Do not allow side loading or misalignment of cover or bushing may be damaged. Remember there is spring tension on the cover. Inspect cover bushing for wear. See page NO TAG for inspection and repair procedure.

**Drive Clutch Compression Tool**  
**PN 8700220**

**Drive Clutch Holding Fixture**  
**PN 2871358**

3. Mount drive clutch securely in the holding fixture. On models equipped with a spider jam nut (P-85 Clutches), remove jam nut in a counterclockwise direction (standard thread) using the special tool.

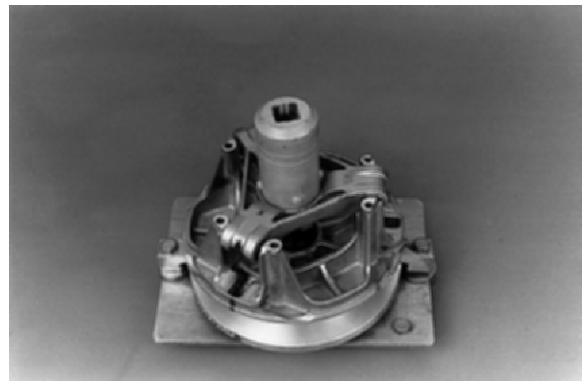
**Spider Spanner (Jam Nut) Tool**

**PN 2870338**

4. Install spider removal tool and remove spider in a counterclockwise direction (standard thread).

**Spider Removal Tool**

**PN 2872987**





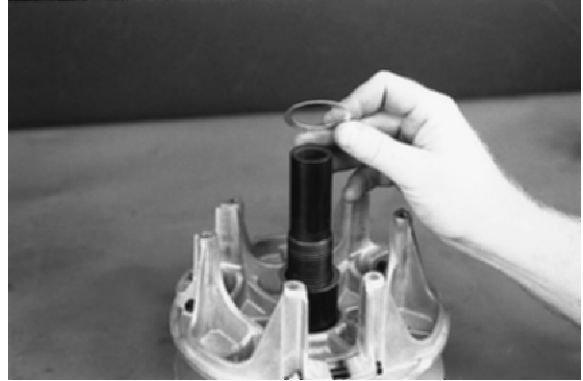
**Disassembly, Cont.**

5. Measure the total thickness of the spacer washers installed beneath spider and record.

**CAUTION:**

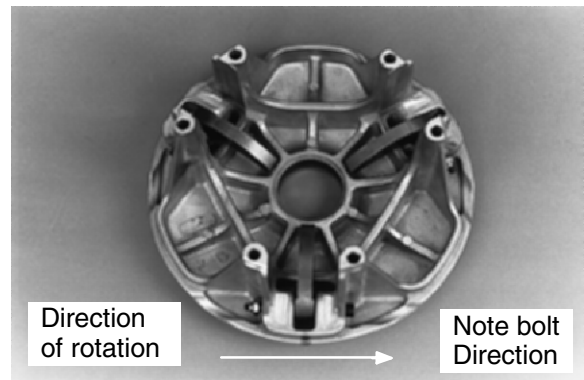
**NOTE:** In order to maintain proper belt-to-sheave clearance and clutch balance, the same washers (or equivalent total thickness) must be reinstalled during assembly. If sheaves are not marked, or if total thickness of existing shim washers under spider is not recorded, clutch will be out of balance when reassembled and must be replaced. Be sure to follow indexing procedure on page 4.28 if belt-to-sheave clearance is being adjusted.

6. Inspect both sheave surfaces for wear or damage. Inspect movable sheave bushing. See page 4.43 for inspection and repair procedure.

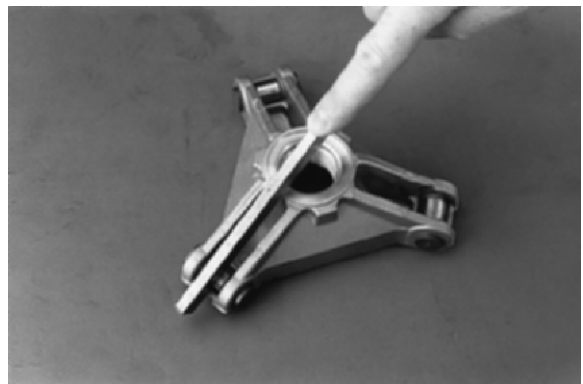


7. Using an 1/8" Allen wrench with a 3/8" combination wrench, remove drive clutch fly weights. Note direction of weight pin with nut on trailing side. Inspect each weight. Surface should be smooth, with no waves or galling. Place bolt inside weight to check flyweight bushing and pin surface for wear.

**NOTE:** The weight bushing is not a service part and both weight and pin must be replaced if worn.



8. Inspect all rollers, bushings and roller pins by pulling a flat metal rod across the roller. Roller can also be inspected by rolling with finger to feel for flat spots, roughness, or loose bushing. Also inspect to see if roller and bushing are separating. Bushing must fit tightly in roller. Replace roller and pin if roller fails to roll smoothly (flat spots) or if bushing is loose.



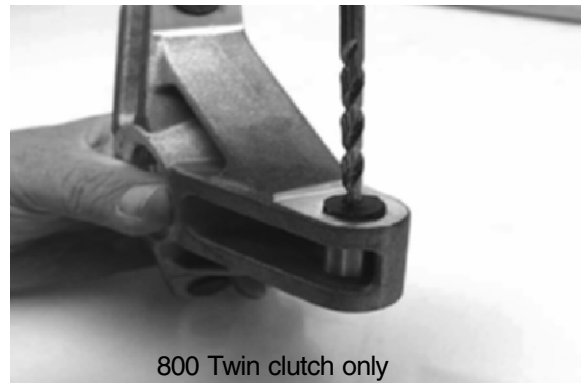
### Spider Roller Removal

1. Remove spider buttons using button removal tool. Remove shims (if any are installed) and note location.  
**NOTE:**The drive clutch spider buttons for the **800 twin** cylinder domestic engines are less exposed than typical. It will not be possible to remove the buttons with the traditional spider button removal tool.

- Using a 5/16" drill bit, drill a hole through the center of the button until the drill bit hits the pin (approximately 3/16" (5 mm).
- Place Clutch Pin Tool PN **2870910** in the 5/16" hole you drilled.
- Using an arbor press, press the pin and opposite button out. Place a 5/16" bolt or rod in the opposite hole to press the button out that you drilled through. Use button **PN 5434188** as your replacement buttons.

2. Place spider on a vise or in an arbor press. Using a pin punch, drive out the roller pin.

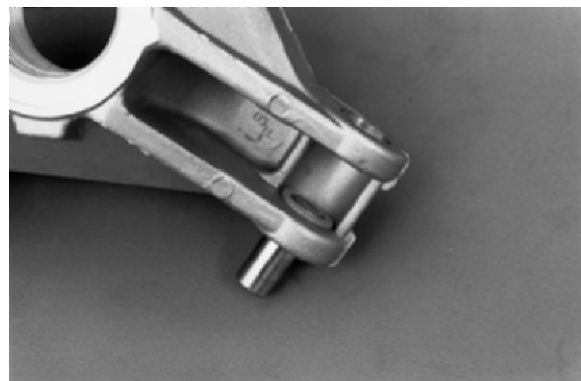
**Spider Button Removal Tools**  
**PN 2870910 (800 Twins)**  
**PN 2870985**



### Roller Installation

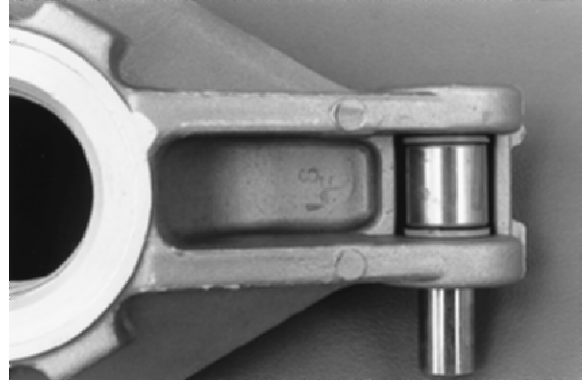
1. Start a replacement roller on each leg, driving a pin in .100"-.125" (.25-.32 cm) beyond the first land of the spider leg (A). Remove any aluminum burrs from pin protruding from spider.

2. Install one washer onto pin.



**Roller Installation, Cont.**

3. Place roller on pin as it protrudes from first land.
4. Place a second washer on other side of roller.



5. Install service tool.

6. Place spider on a vise anvil and drive roller pin through to second land of spider.

**CAUTION:**

Use care to start the pin straight. Aluminum burrs could pass through into the roller bushing causing it to bind and stick. Also use care to make sure the roller remains aligned when the pin is driven through. The roller bushing could be damaged causing premature wear and roller failure.

**Spider Button Shimming**

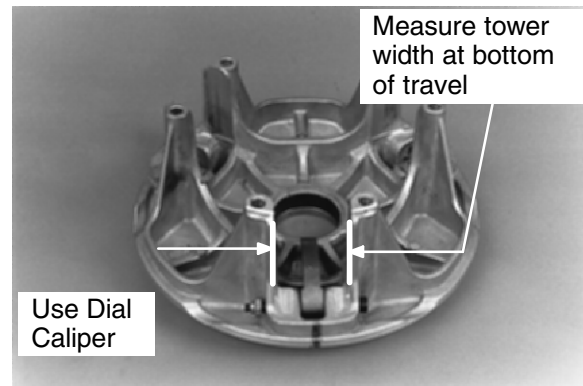
1. Determine how many shims are to be used.

**NOTE:** A shim kit is available which contains an assortment of shims, including .002", .005", and .010".

**Shim Kit PN 2200387**

### Spider Button Shimming, Cont.

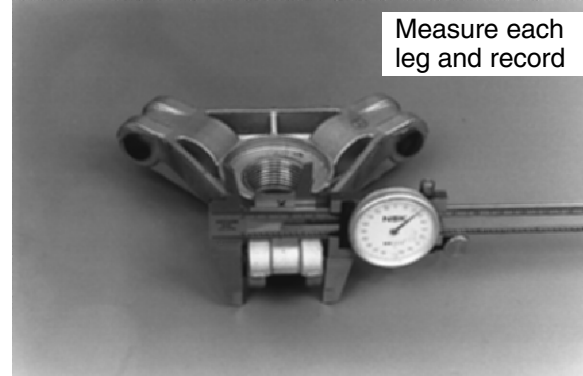
2. Measure the dimension between towers at the lower half of the towers as shown.



3. Install spider buttons using a soft face hammer.



4. Record width of spider buttons on each leg.



5. Add shims beneath trailing side spider button to obtain specified button-to-tower clearance when assembled.

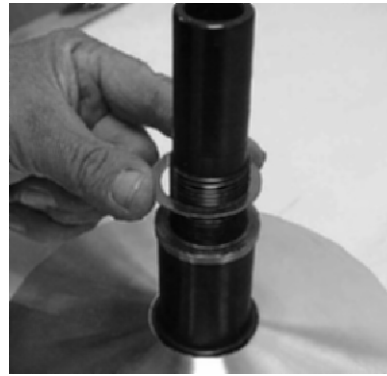
**Button to Tower Clearance -**

**P-85 = .002" (.05 mm)**



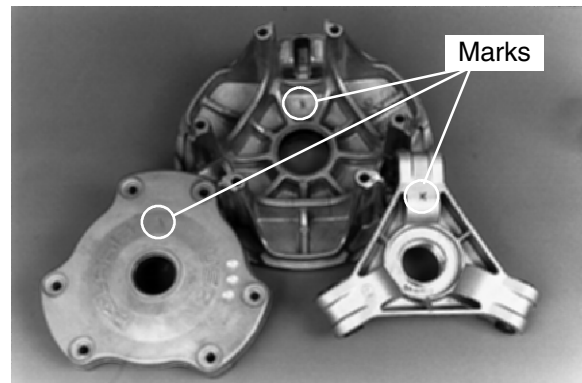
## Drive Clutch Assembly

1. Place the correct number of spacer washers beneath the spider. Spacer PN 5132542 is a stepped washer that can be placed in addition to one of the above shims for precise shimming.



2. Assemble clutch making sure "X" marks on movable sheave and spider, or reference marks made before disassembly are aligned to achieve proper balance.

**NOTE:** If belt to sheave clearance is being changed by adding or removing washers from under the spider, and the sheaves were marked before disassembly, follow indexing procedure on page 4.28.



3. Torque spider to specification.

**Spider Torque - P85 (all except 800 RMK)**  
200 ft. lbs. (276 Nm)

**Spider Removal Tool**  
PN 2872987

**Spider Torque - P85 (800 RMK)**  
230-250 ft. lbs. (318-346 Nm)

**Spider Removal Tool**  
PN 2872987



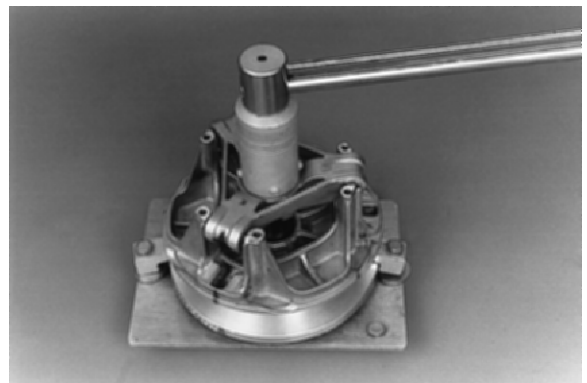
4. Torque jam nut to specification (P-85 Clutches). Install weights with weight pin nut on trailing side. Use new nuts to ensure proper retention. Torque nut to 30 in. lbs.

**Jam Nut Torque - P85 (except 800 RMK)**  
235 ft. lbs. (325 Nm)

**Jam Nut Torque - P85 (800 RMK)**  
200 ft. lbs. (277 Nm)

**Jam Nut Tool** PN 2870338

**Weight Pin Nut Torque**  
30 In. Lbs. (3.4 Nm)



### Assembly, Cont.

5. Install spring and cover. Torque cover bolts evenly to specification.

**CAUTION:** Carefully align bushing with shaft during installation of cover to prevent bushing damage. Maintain alignment by tightening cover bolts evenly and carefully.

**Spider Cover Bolt Torque -**  
**90 in. lbs. (10 Nm)**

### Installation

1. Slight galling or scoring of the bore taper can usually be corrected using a tapered reamer. Place reamer in a vise and lubricate with cutting oil. Clean taper by manually rotating clutch clockwise.

**Tapered Reamer PN 2870576**



2. Check crankshaft taper for galling or scoring. If necessary clean taper evenly with 200 grit emery cloth.



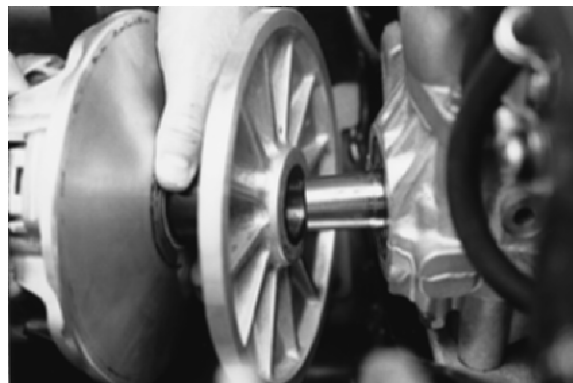
3. Both clutch taper and crankshaft taper should be clean and dry.

**NOTE:** Do not use harsh cleaners which may cause clutch taper to corrode during use. This will cause difficulty when removing clutch in future. Clean clutch taper with lacquer thinner or isopropyl alcohol.

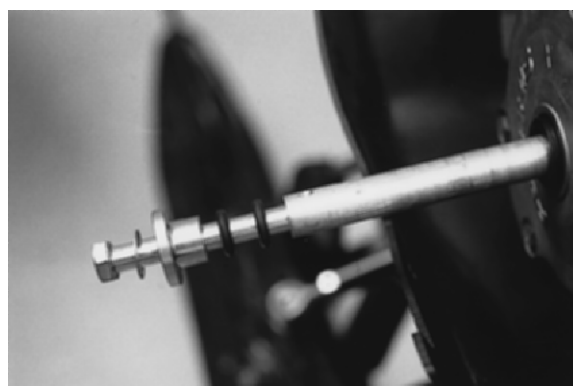


**Installation, Cont.**

4. Slide clutch fully onto crankshaft taper.



5. Install retaining bolt with any spacers, washers or O-rings. See appropriate parts manual for type and placement of retaining bolt components.



6. Torque retaining bolt to specifications. Hold clutch with strap wrench.

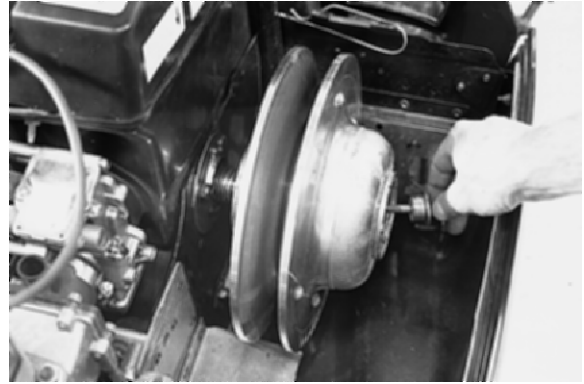
**Drive Clutch Bolt Torque (14mm / 7/16"):  
50 ft lbs. (69 Nm)**

**NOTE:** Re-torque clutch to specification after first period of operation (such as a test ride).

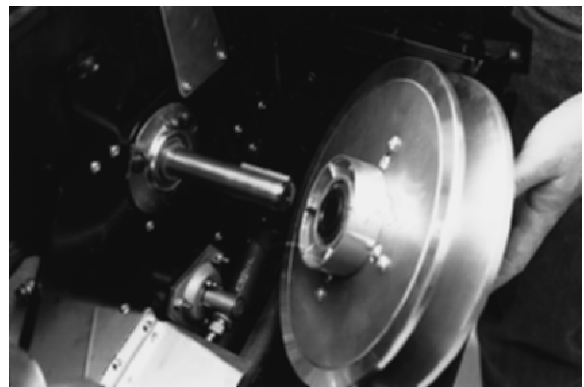


### Driven Clutch Removal

1. Remove driven clutch retaining bolt.



2. Slide driven clutch off jackshaft. It may be necessary to use a puller on some driven clutches. P-85 clutches (externally adjustable) can be removed using a 3-point flywheel or steering wheel puller and the 1/4-20 adjustment bolt holes. Use a suitable spacer on the end of the jackshaft.



3. Inspect jackshaft keyway for wear or damage. New key PN **7721128** (Pro X Fan)  
key PN **7721116** (Pro X 440/600/700/800)

**NOTE:** Notice the number and thickness of shim washers between driven clutch and jackshaft bearing. These must be replaced to maintain proper offset/alignment.



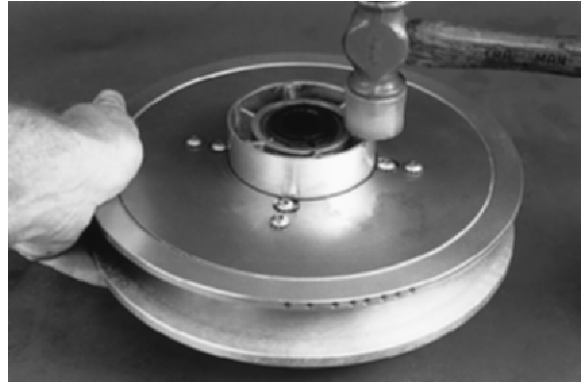


**Disassembly**

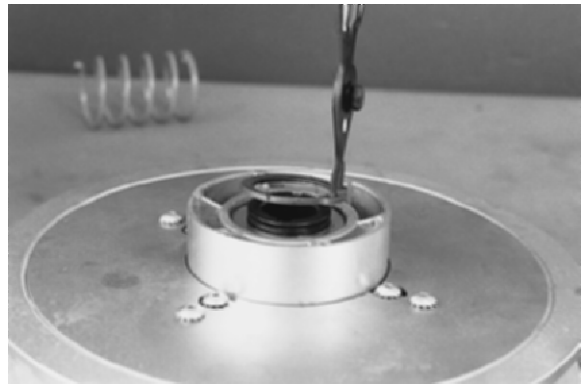
1. Place clutch on bench.

**CAUTION:** Wear eye protection during disassembly and assembly of driven clutch.

**Clutch Compression Tool  
PN 8700220**



2. Hold fixed sheave and turn movable sheave 1/4 turn. Hold movable in place tap helix down with a soft faced hammer. Remove snap ring and washer.



3. Allow sheaves to return and force the helix out. Before removing helix, note driven clutch spring position. Remove helix.

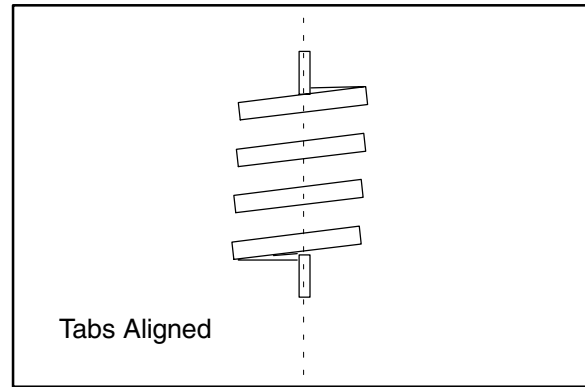


4. Inspect helix ramps and movable buttons for wear or damage. P-85 buttons can be removed by applying heat to the button housing or drill button with an 1/8" drill bit. The ramp buttons should be replaced when worn. See Maintenance section for inspection intervals.



### Disassembly, Cont.

5. Remove driven clutch spring. Both spring tabs should line up. If not spring is fatigued and should be replaced.



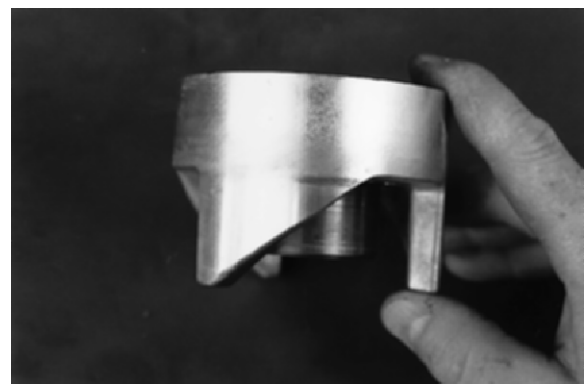
6. Slide moveable sheave off and inspect sheave surfaces for wear or grooving. Note size and number of shim washers between sheaves.



7. Note condition of moveable sheave bushing. Install helix into bushing. It should slide freely without binding. See page 4.47 for bushing replacement.



8. Polish helix with a fine emery cloth to remove any sharp edges or build up which may cause sticking.



## Assembly

1. Install appropriate washer(s) on fixed shaft.

### Optional Thin Adjustment Washer (P-85)

.048" - PN 7555899



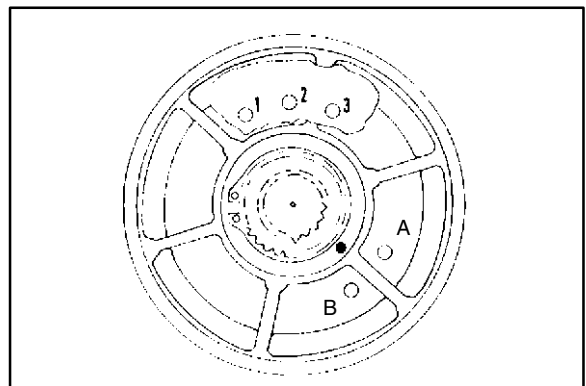
2. Slide moveable sheave on fixed shaft.



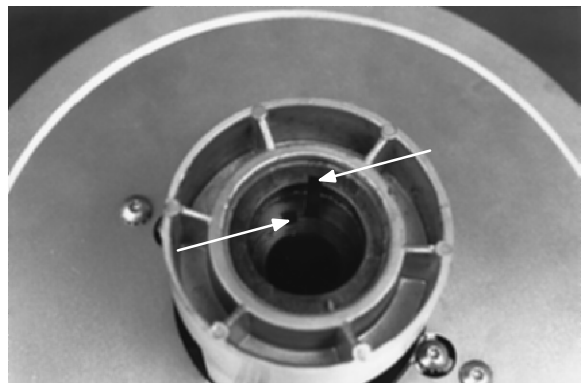
3. Install driven clutch spring. Be sure spring tab is seated in hole in moveable sheave. Refer to specifications in front of this section for driven spring setting.

- **P-85** driven clutches have 1 spring locating hole in the movable sheave and 4 holes in the helix.

**NOTE:** The driven clutch helix/movable assembly has several different spring locations which affect clutch shifting and RPMs. Tighter spring tension will raise engine RPMs during clutch upshift and allow quicker downshift when pulling or negotiating a hill. The lighter tension positions will tend to have a slower downshift and a harder upshift.



4. Align inner keyway between the helix and movable sheave. With the spring in place, slide helix onto shaft .5" (12mm).



### Assembly, Cont.

#### Helix Angles and Effects

The driven clutch helix was selected for overall performance in relation to the other driven system components. In fine tuning situations requiring a slight adjustment of engine operating RPM or improved backshift, we recommend trying a helix change before changing other components.

#### Helix Ramps\*

The helix spring should always be adjusted within its limits before a helix change is performed. The normal rate of change between helix angle steps is 250 RPM under full throttle. This is approximately the same result as in going from the No. 1 to No. 4 spring position (P-85).

**NOTE:** Increasing spring tension increases engine RPM. RPM changes may not be evident if other drive or driven clutch components are substandard.

**\* NOTE:** All R-Series, Mod(M), T1, and 40-36 helix ramps are cut 0.060" deeper in the snap ring pocket. These are made so the driven clutch can open far enough for full shift out with wide 1 7/16" belts. If these helix ramps are used with narrow belts, 2 (two) additional (for a total of three) .030" / .8 mm washers (PN 7556804) should be installed under the snap ring to prevent the belt from touching the inner hub at full shift which can cause belt failure. Wide belt models use only the existing washer under the snap ring.

5. Hold fixed sheave and turn movable sheave 1/4 turn counterclockwise.

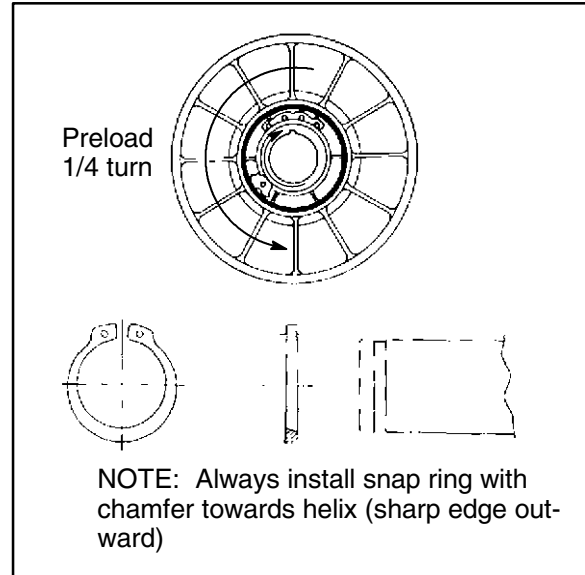
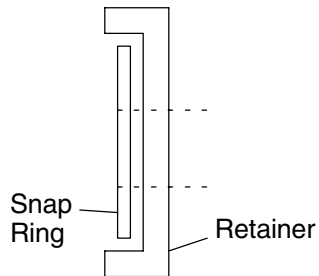


6. Force helix down into place, exposing snap ring groove.

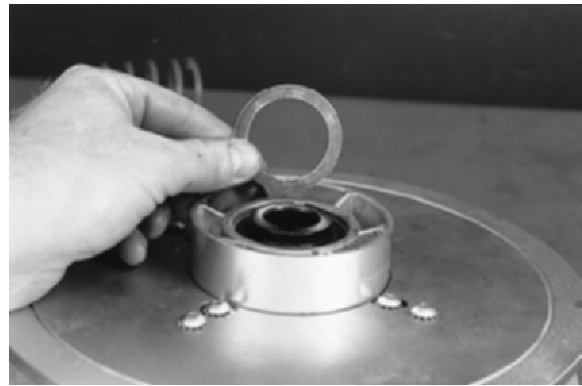


**Assembly, Cont.**

7. Install spacer washer(s), and snap ring. Snap ring should be installed with flat (machined) side up or toward jackshaft bearing.



8. Allow sheaves to close. Test clutch by pre-loading movable sheave 1/4 turn counterclockwise and releasing. Sheave should open and close smoothly with a positive stop. Some helix ramps have more than one washer beneath the snap ring.



### Installation

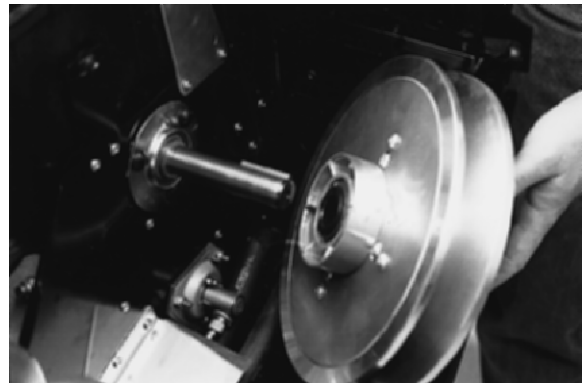
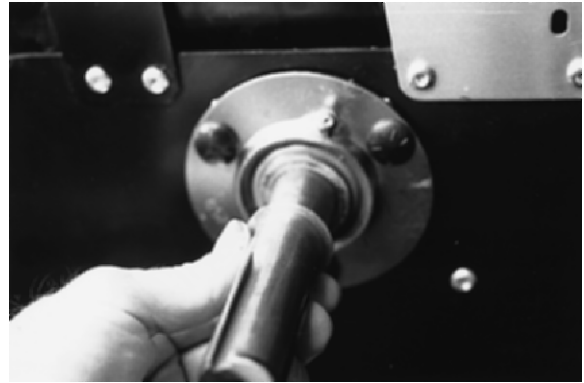
1. Install proper number of spacer washers on jackshaft between clutch and jackshaft bearing.

#### Inspect Jackshaft Bearing

Excessive vibration or abnormal drive belt wear can be caused by a worn bearing or jackshaft on the driven clutch side. To inspect bearing fit, watch the bearing area closely as you try to force the jackshaft up and down. If movement is detected, disassemble to determine which parts are worn. Replace the jackshaft if the new bearing is loose on the shaft. The bearing should be greased at 1000 mile (1600 km) intervals and before storage.

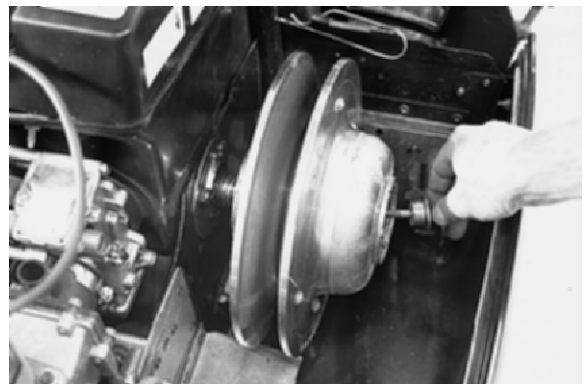
**NOTE:** Spacer washers between driven clutch and jackshaft bearing set the offset. Refer to adjustment procedure on page 4.40 to adjust offset between the drive and driven clutch.

2. Lightly grease jackshaft keyway or spline. With square key in place slide clutch onto jackshaft.



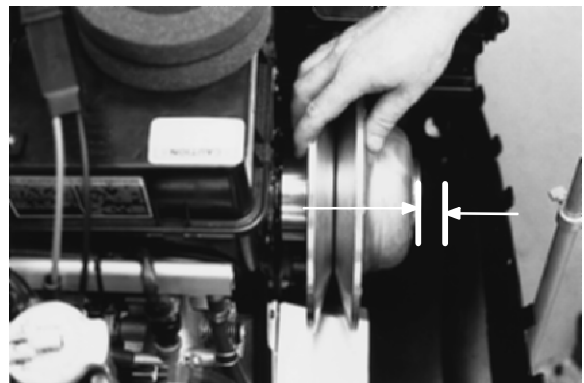
3. Install spacer, bolt and washer to hold driven clutch in place.

**Driven Clutch Retaining Bolt Torque-**  
**15 ft. lbs. (21 Nm)**



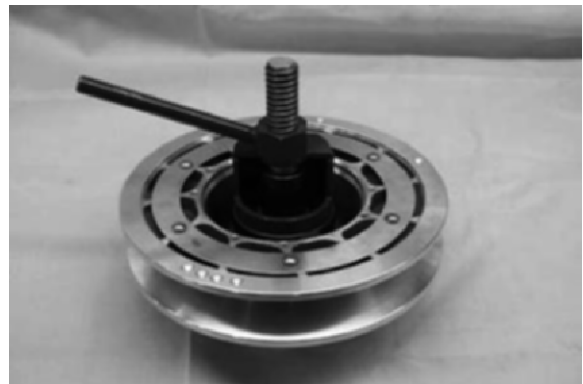
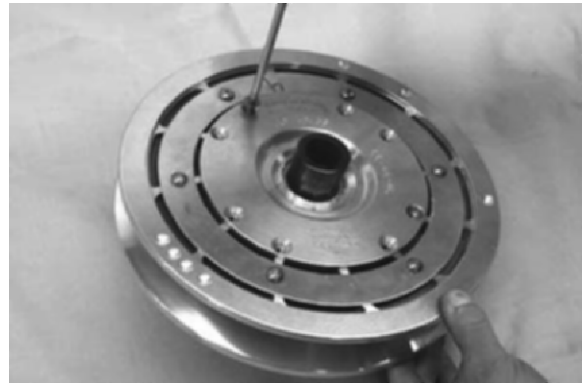
4. P-85 driven clutches should float from side to side (.040-.080" (1-2 mm)). Without a slight free float, jackshaft bearings could be side loaded, causing premature bearing failure.

**Driven Clutch Torque/Float**  
**P-85 - .040-.100" (1-2.54 mm)**



## High Performance Roller Clutch Maintenance/Adjustment

1. Remove clutch from vehicle.
2. Remove the screws that hold the helix in place.
3. Pull and twist upward to remove the helix from the clutch. **Note:** If changing helix angles move the helix 90° to the desired combination and reinstall holding screws.
4. Place the roller tool PN **PS45909** through the clutch shaft and twist handle down to compress the spring.
5. Once you have tension on the roller assembly, remove the snap ring from the groove through the opening of the roller tool. Leave the snap ring loose.

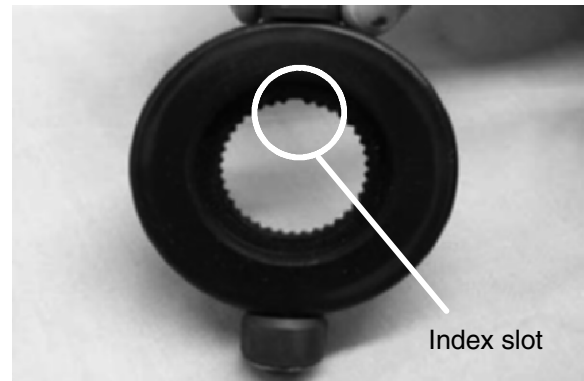


### High Performance Roller Maintenance (cont.)

6. Remove the holding tool and remove the roller assembly.



7. Note the index slot for the roller assembly for installation.



8. Inspect spring for length. Inspect roller assembly for wear. Inspect shaft for nicks or burrs.



9. Reassemble in reverse order.



## Drive Belt

Part No.	Belt Width* (Projected)	Side Angle Overall*	Center to Center*	Outer Circum- ference*	Notes
3211058	1.250" (31.75mm)	28°	11.03"	43.313"	340 Touring and 340 Deluxe, P-90 system
3211059	1.250" (31.75mm)	28°	12.00"	45.125"	P-90 system
3211060	1.250" (31.75mm)	28°		45.605"	P-90 system
3211042	1.375" (34.93mm)	32°	12.00"	47.250"	Service part from older P-85 systems (96-prior)
3211045	1.375" (34.93mm)	32°	12.00"	47.125"	Close tolerance version of 3211042
3211061	1.375" (34.93mm)	32°	12.00"	47.188"	CVT compound version of 3211045
3211065	1.438" (36.53mm)	28°	12.50"	48.375"	CVT Double Cog - big block domestic belt
3211073	1.438" (36.52mm)	28°	12.50"	48.375"	Double cog - standard compound version of 3211065
3211070	1.375" (34.93mm)	28°	12.00"	47.250"	Standard on many lower horsepower P-85 drive system snowmobiles (97-current)
3211067	1.375" (34.93mm)	28°	12.00"	47.250"	Double cog standard compound version of 3211070
3211066	1.375" (34.93mm)	28°	12.00"	47.250"	CVT double cog version of 3211070
3211074	1.438" (36.52mm)	28°	12.00"	47.625"	Double cog standard compound
3211075	1.438" (36.52mm)	28°	12.00"	47.625"	CVT compound version of 3211074
3211078	1.438" (36.52mm)	28°	11.50"	46.625"	Double cog, standard compound, EDGE
3211080	1.438" (36.52mm)	28°	11.50"	46.625"	CVT compound version of 3211078
3211086	1.438" (36.52mm)	28°	11.50"	46.500"	Double cog, std comp., close tolerance EDGE
3211087	1.438" (36.52mm)	28°	11.50"	46.500"	CVT compound version of 3211086

\*± **Belt dimensions given are nominal dimensions.** There is a ± variance for all critical dimensions. Clutch set-up must be inspected when a new belt is installed and, If necessary, clutch set-up must be adjusted.

The drive belt is an important component of the converter system. In order to achieve maximum efficiency from the converter, drive belt tension (deflection), clutch offset, and alignment must be adjusted properly.

#### General Belt Selection Guidelines

**NOTE:** Refer to appropriate parts manual for proper belt. Production belt is recommended unless tuning for a specific application.

#### CVT

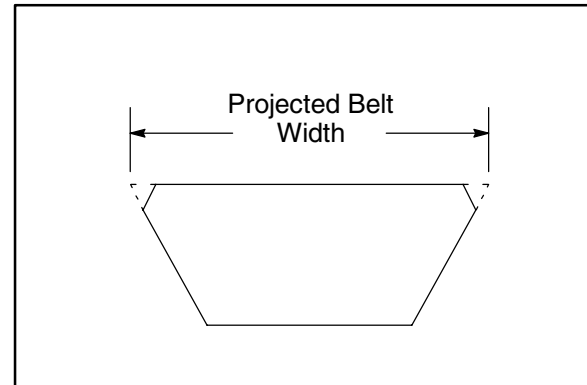
- Increased service life for high horsepower and extended high speed running
- Need 1-2 grams heavier drive clutch weight
- Good for prolonged high speed running.
- Good for aggressive riders

#### Standard Compound

- More aggressive at low speeds
- Reduced heat and drive clutch sheave wear
- Used for short, higher horsepower runs (Drag Racing)
- Good trail belt for lower horsepower engines.

## Drive Belt Inspection

1. Measure belt width and replace if worn severely. Generally, belt should be replaced if clutches can no longer be adjusted to provide proper belt deflection.
  - The top edges have been trimmed on some drive belts. It will be necessary to project the side profiles and measure from corner to corner.
  - Place a straight edge on each side of the drive belt.
  - Place another straight edge on top of belt.
  - Measure the distance where the side straight edges intersect the top, as shown in the illustration at right.
2. Inspect belt for loose cords, missing cogs, cracks, abrasions, thin spots, or excessive wear. Replace if necessary.
3. Inspect belt for hour glassing (extreme circular wear in at least one spot and on both sides of the belt). Hour glassing occurs when the drive train does not move and the drive clutch engages the belt.

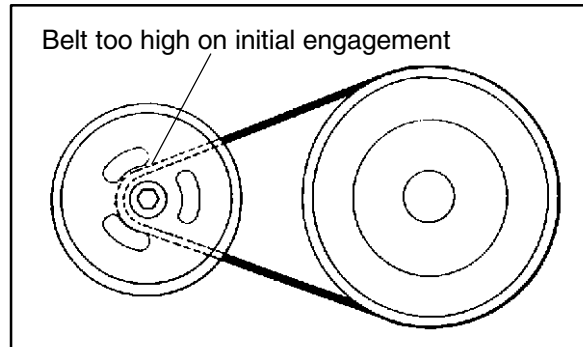


## Belt Wear / Burn Diagnosis

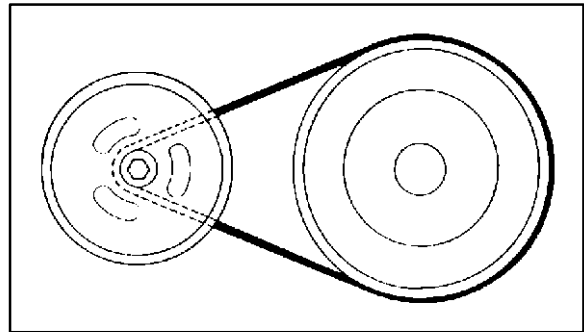
Belt Wear / Burn Diagnosis	
Possible Cause Of Wear Or Burning	Solution
Driving at or about engagement RPM for extended periods in all types of conditions	Drive at higher RPM if possible. Gear the machine down. Make sure belt deflection is at 1.25" to achieve optimum starting ratio
Cold weather startups	Be patient. Warm up engine at least 5 minutes or until it readily responds to throttle input. For the quickest most efficient driveaway in extreme cold weather, take drive belt off machine and bring it in to a warm environment. Break skis and track loose from the snow. Engage throttle aggressively for short durations for initial cold drive-away
Towing another machine at or about engagement RPM	When possible, do not go in deep snow when towing another machine. Use fast, effective throttle to engage the clutch. Not all machines are intended for pulling heavy loads or other machines.
Spinning track while vehicle is stuck (high RPM, low vehicle speed, high ambient temp. Example: 8000 RPM, 10mph vehicle speed, 60 mph indicated on speedometer.	Lower the gear ratio. Remove windage plates from driven clutch. If possible, move to better snow conditions and reduce RPM. Avoid riding in very high ambient temperatures.
Ice and snow piled up between track and tunnel overnight or after stopping for a long period of time (enough to re-freeze the snow).	Break loose snow and ice under tunnel. Allow longer than normal warmup. Allow belt to warm sufficiently and increase grip ability on clutch sheaves. Use fast, effective throttle when engaging clutch.
Poor running engine (Bog, Miss, Backfire, etc.)	Maintain good state of tune including throttle and choke synchronization. Check for fouled spark plug(s). Check for foreign material in carbs. Make sure no water or ice in fuel tank, lines, or carburetors.
Loading machine on trailer	Use caution when loading machine. Carbide skags may gouge into trailer and prevent drive train from spinning freely. Use enough speed to drive completely onto trailer. If machine cannot be driven completely onto trailer, it may need to be pulled or pushed to avoid belt wear / burning.
Clutch malfunction	Check for correct clutch components.
Slow, easy belt engagement - easing on the throttle	Use fast, effective throttle to engage the clutch.

## Belt Deflection

**Too much belt deflection** - If the belt is too long or the center distance too short, the initial starting ratio will be too high, resulting in performance loss. This is due to the belt rising too high in the drive clutch sheaves upon engagement.



**Not enough belt deflection (belt too tight)** - If the drive belt is too short or the center distance too long, the ratio will again be incorrect. In addition, the machine may creep when the engine idles, causing damage to the internal face of the drive belt.



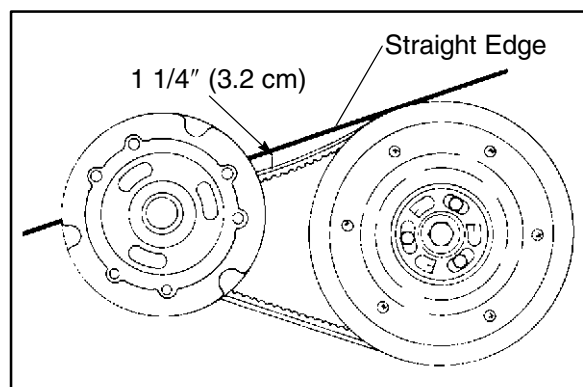
## Measuring Belt Deflection

**IMPORTANT NOTE:** Do not apply excessive pressure to force belt into driven sheaves. This will result in an improper measurement. If belt deflection cannot be adjusted within specification using methods below, inspect center distance and compare to specifications on page 5.30.

1. Measure belt deflection with both clutches at rest and in their full neutral position.
2. Place a straight edge on the belt and apply downward pressure while measuring at the point shown.

**Belt Deflection -**

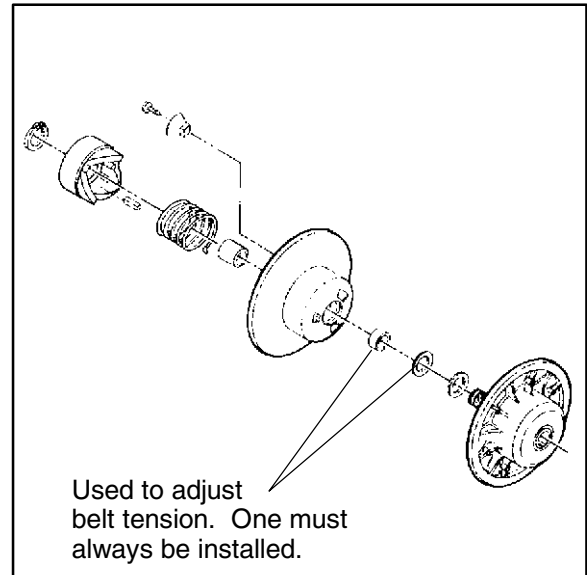
**1 1/4" (3.2 cm)**



### Adjusting Belt Deflection

Belt deflection can be adjusted without removing the clutch from the jackshaft.

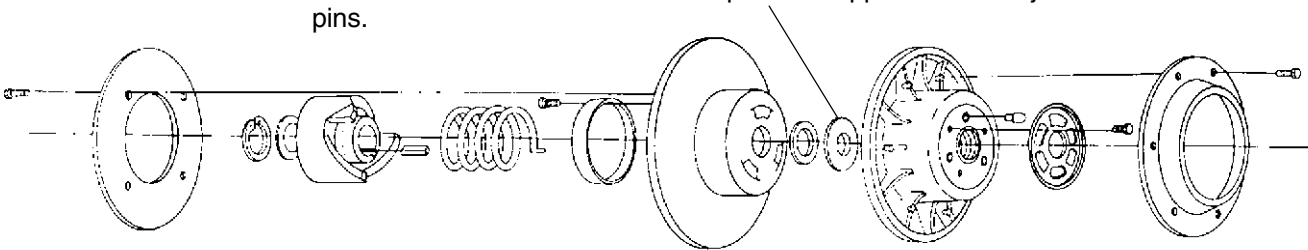
1. Pull belt into driven clutch to slightly open sheaves.
2. Loosen three bolts on adjustment cam.
3. Turn cam counterclockwise to reduce distance between sheaves. *Do not* rotate past #1 position.
4. Torque bolts to specification.



#### Optional Thin Adjustment Washer (P-85)

.048" - PN 7555899

Production washer is usually .075" thick with other .020 or .030 washers as required. May use optional, thinner (.048") washer PN 7555899 if required to obtain proper sheave width. Either the .075" or .048" washer must be installed in this location to provide support for the adjustment pins.



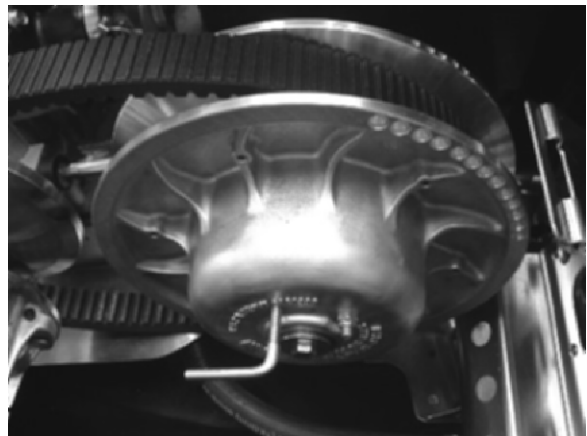
### Adjusting Belt Deflection on the High Performance Roller

1. To adjust the sheaves, loosen the 7/16" jam nut on the belt width adjuster.
2. Using a 1/8" Allen wrench, adjust the threaded set screw as needed. NOTE: Turn the set screw in (clockwise) to increase the distance between the sheaves and out (counter clockwise) to decrease the distance.
3. Tighten the jam nut after the belt adjustment has been made.



### Belt Removal on High Performance Roller

1. Thread the belt installation tool "L-wrench" into the open hole next to the belt width adjuster bolt.
2. Thread the tool into the hole until the sheaves separate enough to remove the drive belt.

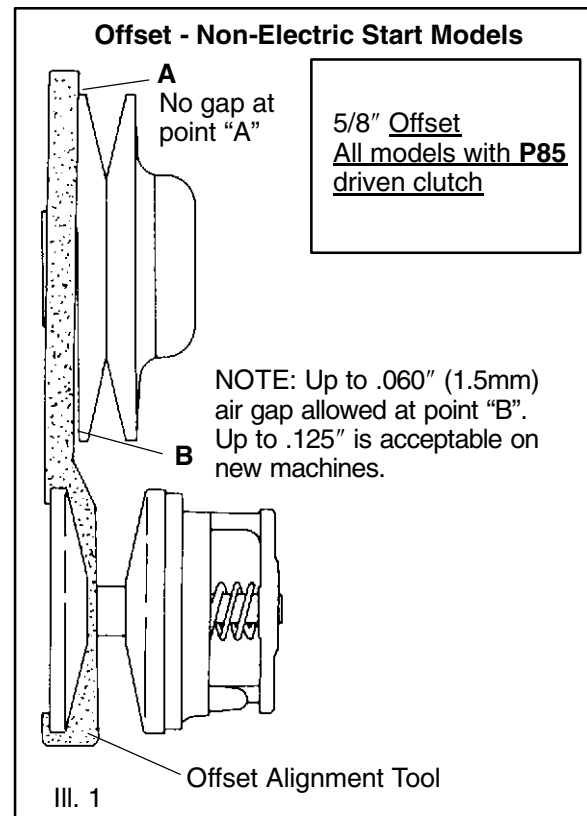


### Clutch Offset Inspection (ALL)

**NOTE:** Proper offset aligns the fixed sheaves of both clutch assemblies. This allows the clutches to be aligned throughout the shift range.

1. Remove drive belt. Belt deflection adjustments affect offset. Set belt deflection first.
2. Install proper alignment tool, depending on type of clutch, as shown in Ill. 1.
3. Rear of driven clutch moveable sheave should just contact tool when clutch is pushed inward on jackshaft.

**Clutch Alignment (Tools) -  
P85 - 5/8" Offset (PN 2870426)**



### Clutch Offset Adjustment

1. Determine direction driven clutch needs to be adjusted. (Refer to Clutch Offset Inspection procedure above).
2. Remove driven clutch retaining bolt, and remove driven clutch.
3. Add or take out washers on jackshaft between the driven clutch and jackshaft bearing to achieve proper offset.
4. Most models require the driven clutch to float on the jackshaft. After adjusting offset, add or remove shim washers from the retaining bolt to provide a .040"-.100" (1-2.4mm) of float on jackshaft. This will prevent side loads on the jackshaft bearing.

**Driven Clutch Bolt Torque -  
15 ft. lbs. (21 Nm)**

## Clutch Alignment Inspection

**NOTE:** Drive clutches are purposely misaligned slightly forward to compensate for the engine shifting on it's mounts. Under load, the engine will pull back slightly so both clutches are in alignment.

1. After clutch offset has been verified, inspect alignment.
2. Install proper alignment tool, depending on type of clutch, as shown in Ill. 1 page.
3. There should be a .060" - .090" (1.5 - 2.25 mm) gap between front of driven clutch and tool, with the tool just touching at the rear. Up to .125" (3.1 mm) gap is acceptable in the front on new machines.

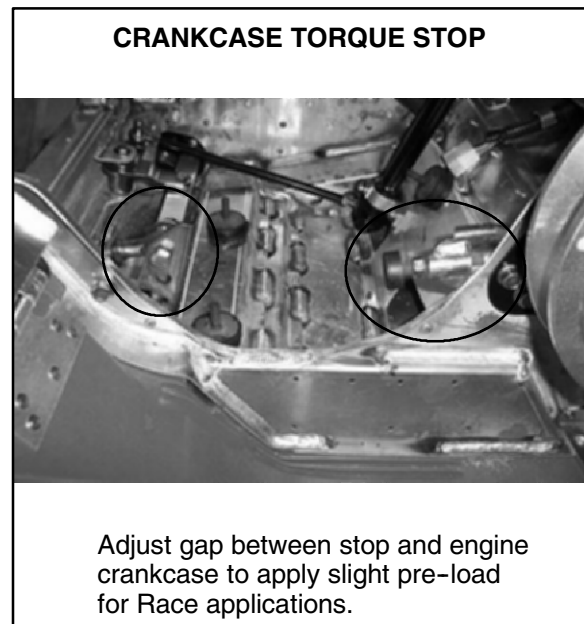
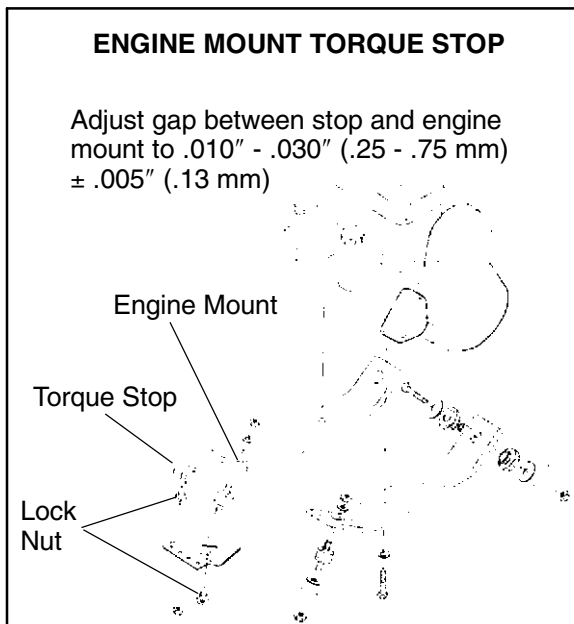
## Clutch Alignment Adjustment

1. Loosen all 4 engine mounting bolts.
2. Adjust engine torque stop until clutches are in proper alignment.
3. Tighten engine mounts securely.
4. Recheck both clutch offset and alignment.
5. Verify proper torque stop adjustment.

## Torque Stop Adjustment

**NOTE:** There are two types of torque stops currently used. Refer to the illustrations below for adjustment of each type.

1. After aligning clutches, adjust torque stop by loosening lock nut and rotating stop to proper clearance as shown. Hold torque stop and tighten jam nut to 15-17 ft. lbs. (21-23.5 Nm).



### Belt to Sheave Clearance Inspection

**NOTE:** The distance between the belt and the moveable sheave on the drive clutch is very important. This distance controls the starting ratio (lowest starting ratio is most preferable) and the position of the clutch weight to engine RPM. The distance between the belt and moveable sheave should be as close to .020" (.5 mm) as possible without creating a drag on the belt, when positioned around the hub at the bottom of the sheaves.

1. Force belt to one side of drive clutch. **NOTE:** Measure total belt to sheave clearance with a new belt.
2. Install feeler gage between other sheave and belt.

**Belt to Sheave Clearance -**  
**.020"  $\pm$ .015" (.5 mm  $\pm$ .4mm)**

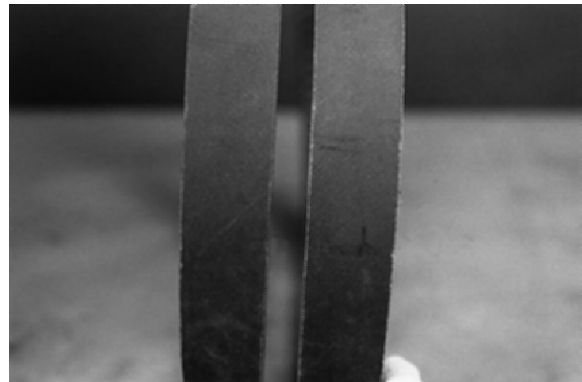
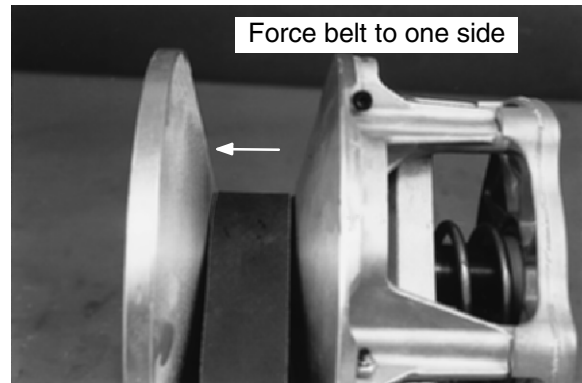
### Belt to Sheave Clearance Adjustment

Belt to sheave clearance can be adjusted in two ways.

1. Try several new belts to achieve proper clearance.
2. Can add or remove shims from under the spider to increase or decrease belt to sheave clearance. See Spider indexing on page 4.28.

**NOTE:** Spider indexing affects clutch balance and belt to sheave clearance. Read procedures carefully before proceeding.

**NOTE:** Belts with various widths will also affect belt deflection since they will fit differently in the driven clutch. Deflection should be checked per procedure on page 4.38.





## 800 TWIN WIDE ROLLER SPIDER REBUILD KIT KIT PN 2202376

### Application

Polaris snowmobiles with a wide roller spider

Before you begin, read these instructions and check to be sure all parts and tools are accounted for. Please retain these installation instructions for future reference and parts ordering information.

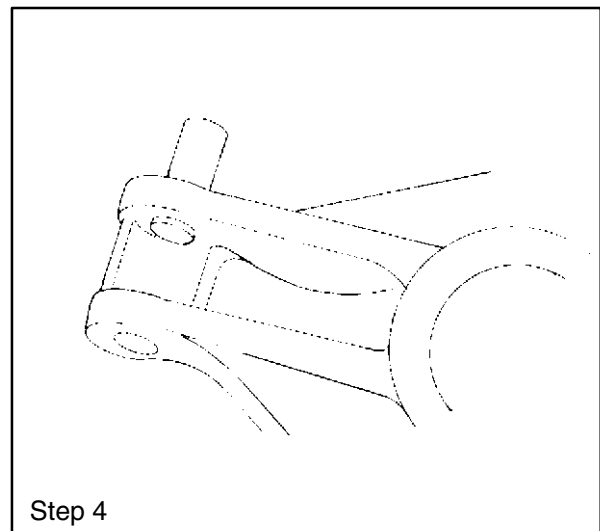
### Kit components:

<u>Qty.</u>	<u>Part Description</u>	<u>Part No.</u>
6	Button Guide	5434188
3	Shift Weight Roller	1321622
3	Weight Pin	7515105
3	Clutch Button Shim (.010)	5211304
3	Clutch Button Shim (.005)	5211305
6	Clutch Button Shim (.002)	5211306
9	Multi-lube Washer	5430945
3	Spider Roller Pin	5133054
1	Instruction	9918273

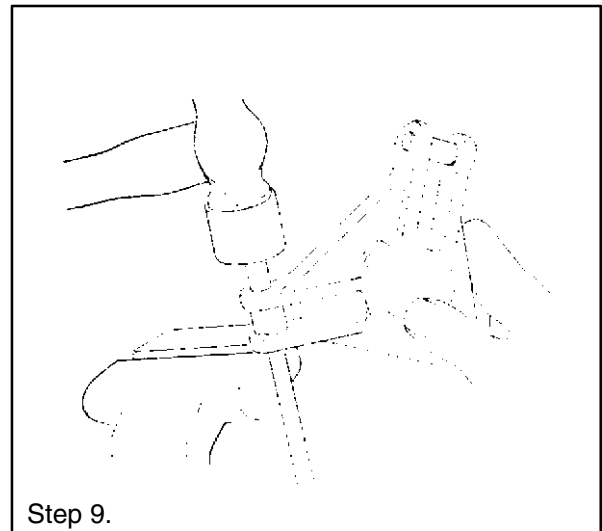
**IMPORTANT:** Perform all items correctly and completely.

## INSTALLATION INSTRUCTIONS

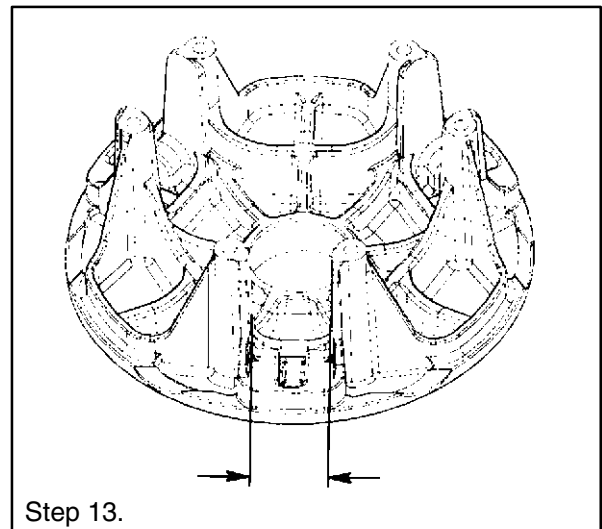
1. Remove and disassemble the drive clutch.
2. Drill a .18" hole in the center of the spider button. Remove any shims and note their locations.
3. Place the spider in a vise or arbor press. Place a pin punch through the spider button hole and drive the opposite button and pin out. Flip the spider over and tap out the holed button.
4. Start a replacement roller pin on each leg, driving the pin about .100" - .125" beyond the first land of the spider leg. This will enable you to locate the first washer and position the roller to attain alignment until the pin is flush at the second land.
5. Install one washer on the pin.
6. Install the roller (PN 1321622).
7. Place second washer on other side of roller.
8. Install the spider assembly tool (PN 8700221 or 2870910).



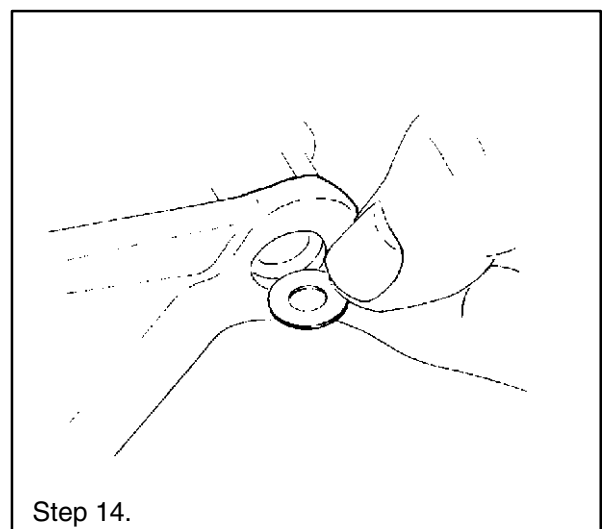
9. Place the spider on the vise anvil and drive the roller pin through to the second land of the spider.  
**NOTE:** Care must be taken to ensure that the pin is started straight. Aluminum burrs could pass through into the roller bushing causing it to bind and stick. Care must also be taken to ensure that the roller remains aligned when the pin is driven through. Roller bushing could be damaged causing premature wear and roller failure.
10. Center the pin in the spider lands.
11. Install new buttons into the spider.
12. Assemble the moveable sheave and spider to the stationary sheave but do not tighten yet.
13. Mark each leg of the spider and each tower with an A, B, or C. With the moveable sheave open (neutral position), insert the appropriate feeler gauge between a button and a tower and leave it in place (note the size of the feeler gauge used). Measure and record the reading at the other 2 legs.  
**NOTE:** Measurement must be taken at the bottom of the tower (neutral position).
14. Install the required amount of shims to achieve .000" (zero) clearance. **NOTE:** All shims are to be installed on the *drive* side of the spider legs.  
**NOTE:** Moveable must not bind in any position when cycled up or down. Refer to *Snowmobile Repair Manual* for general procedures.
15. Install weights with drive head of weight pin leading and nut trailing. Torque nuts to 30 in. lbs.
16. Assemble the clutch completely. Torque the spider to 200 ft. lbs (27.6 kg-m). Torque the jam nut to 235 ft. lbs (32.4 kg-m). Torque the cover plate bolts to 90 in. lbs. (1.04 kg-m).
17. If the clutch taper bore is rough or appears to have spun on the crankshaft, the bore taper should be trued using the tapered reamer (PN 2870576). Place the reamer in a vise, lubricating with cutting oil, and clean up the taper by manually rotating the clutch clockwise.
18. Position the clutch on the engine crankshaft. Install the retaining bushing and bolt. Using the strap wrench (PN 2870336) to hold the clutch, torque the retaining (7/16") bolt to 40-45 ft. lbs (5.5-6.2 kg-m) or 14mm bolt to 50 ft. lbs. **NOTE:** Never use an air impact wrench for installing or removing a drive clutch. This could cause the spider torque value to be reduced and/or engine crankshaft damage.



Step 9.



Step 13.



Step 14.

SYMPTOMS	PROBABLE CAUSE	REMEDY
Harsh drive clutch engagement	<ul style="list-style-type: none"> <li>-Drive belt worn too narrow</li> <li>-Excessive belt to sheave clearance with new belt (high performance version without detent shift weight)</li> </ul>	<ul style="list-style-type: none"> <li>-Replace</li> <li>-Perform belt to sheave clearance adjustment with shim washers beneath spider</li> </ul>
Drive belt turn over	<ul style="list-style-type: none"> <li>-Wrong belt for application</li> <li>-Clutch alignment out of spec</li> <li>-Engine mount broken or loose</li> <li>-Driven clutch sheaves have excessive runout, are bent or damaged</li> </ul>	<ul style="list-style-type: none"> <li>-Replace</li> <li>-Adjust alignment offset</li> <li>-Inspect, adjust or replace</li> <li>-Measurement should be taken .25" in from outer circumference on sheave face. Maximum allowable tolerance is .015" (.6 mm).</li> </ul>
Noise in drive system	<ul style="list-style-type: none"> <li>-Broken drive clutch components</li> <li>-Excessive drive clutch button - tower clearance</li> <li>-Bearing failure/ chaincase, jackshaft or front drive shaft</li> <li>-Drive chain loose or worn, sprocket teeth broken</li> <li>-Driven clutch bushing worn excessively or spring broken</li> <li>-Drive chain adjustment too tight/too loose</li> <li>-Drive belt surface flat spots</li> </ul>	<ul style="list-style-type: none"> <li>-Inspect/replace</li> <li>-Install new buttons or shim out existing buttons</li> <li>-Inspect/replace</li> <li>-Inspect/adjust or replace</li> <li>-Inspect/replace</li> <li>-Inspect/replace</li> <li>Inspect/adjust</li> <li>Inspect/replace</li> </ul>
<p>Over rev during initial acceleration or during heavy pulling at low ground speeds.</p> <p>Engine bogs after engagement.</p>	<ul style="list-style-type: none"> <li>-Spider roller position remaining in detent</li> <li>-Improper driven clutch setup</li> <li>-Worn belt</li> <li>-Excessive belt deflection</li> <li>-Improper offset/alignment</li> <li>-Broken or misadjusted torque stop</li> <li>-Broken motor mount</li> <li>-Jackshaft bearing seizure</li> </ul>	<ul style="list-style-type: none"> <li>-Add spider shim washers</li> <li>-Add driven washers</li> <li>-Reduce gear ratio (chaincase models)</li> <li>-Replace</li> <li>-Subtract driven clutch washers</li> <li>-Inspect/adjust</li> <li>-Inspect/adjust/replace</li> <li>-Inspect/replace</li> <li>-Replace</li> </ul>

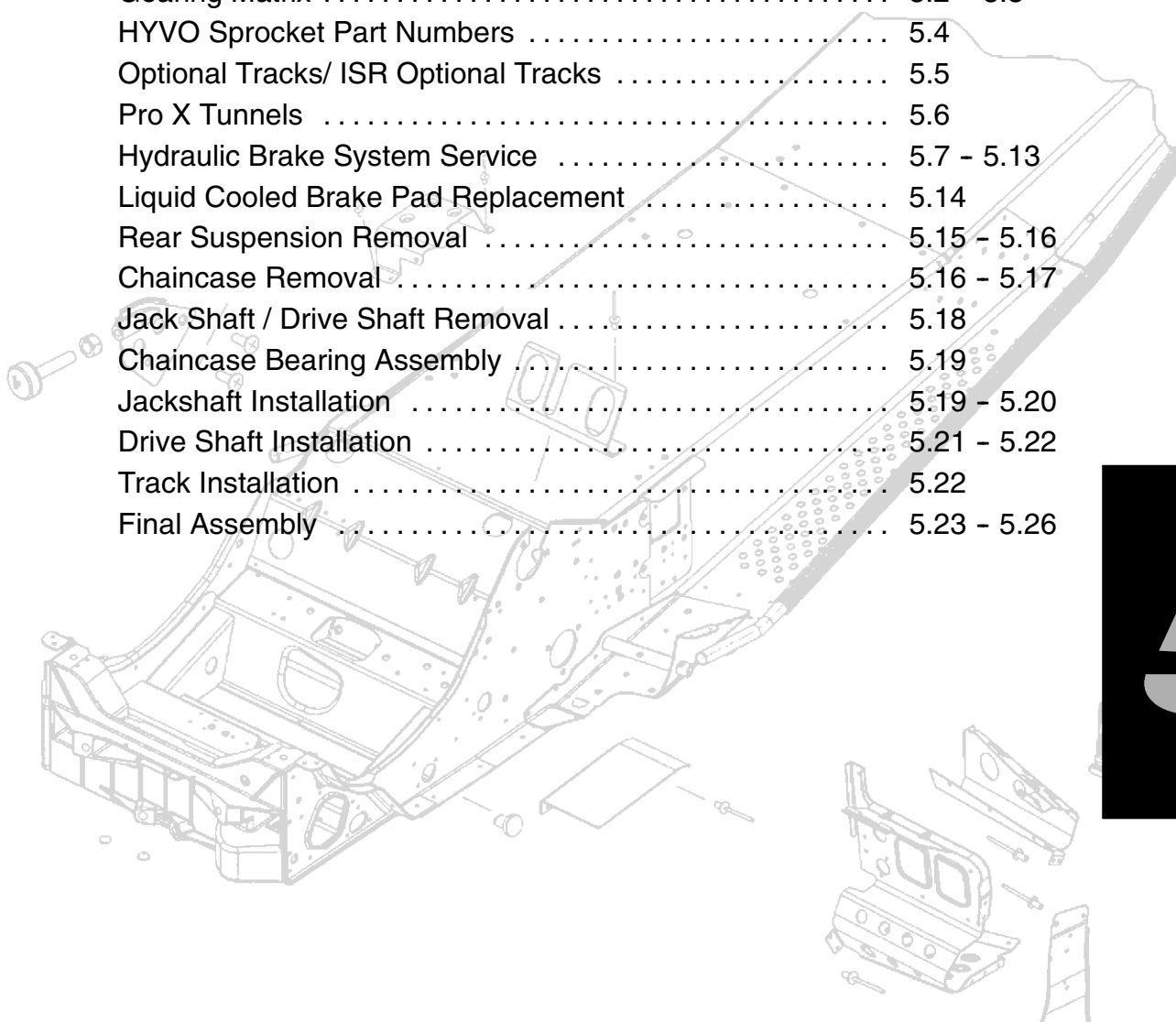
SYMPTOMS	PROBABLE CAUSE	REMEDY
Engine RPM below specified operating range, although engine is properly tuned	a) Wrong or broken drive clutch spring b) Drive clutch shift weight too heavy c) Driven clutch spring broken or installed in wrong helix location d) Drive belt too long e) Improper driven clutch setup	a) Replace with recommended spring b) Install correct shift weight kit to match engine application c) Replace spring; refer to proper installation location d) Install new belt and/or adjust belt tension e) Install correct parts and/or adjust to match engine application and machine use
Erratic engine operating RPM during acceleration or load variations	Drive clutch binding or driven clutch malfunction  Converter sheaves greasy; belt slippage	-Disassemble drive clutch; inspect shift weights for wear and free operation Clean clutches; install new belt -Clean and polish stationary shaft hub; reassemble clutch without spring to determine problem area -Replace ramp buttons -Inspect moveable sheave for excessive bushing clearance/replace
Engine RPM above specified operating range	a) Incorrect drive clutch spring (too high spring rate) b) Drive clutch shift weights incorrect for application (too light) c) Drive clutch binding d) Driven clutch binding e) Converter sheaves greasy; belt slippage f) Improper driven clutch setup	a) Install proper spring b) Install proper shift weights c) Disassemble and clean clutch, inspecting shift weights and buttons. Reassemble without the spring to determine probable cause. d) Disassemble, clean and inspect driven clutch, noting worn sheave bushing and ramp buttons and helix spring location e) Clean clutches; install new belt f) Install correct parts and/or adjust to match engine application and machine use
Burnt Belts / Premature Wear Also see Belt Wear / Burning Diagnosis Chart on page 4.39	a) Wrong or broken drive clutch spring b) Drive clutch shift weight too heavy c) Driven clutch spring broken or installed in wrong helix location d) Drive belt too long e) Converter sheaves greasy; belt slippage. f) Improper driven clutch setup	a) Replace with recommended spring b) Install correct shift weight kit to match engine application c) Replace spring; refer to proper installation location d) Install new belt and/or adjust belt tension e) Clean clutches; install new belt f) Install correct parts and/or adjust to match engine application and machine use

# **CHAPTER 5**

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## **CHASSIS/FINAL DRIVE**

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HYVO Sprocket Part Numbers .....	5.4
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Pro X Tunnels .....	5.6
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Track Installation .....	5.22
Final Assembly .....	5.23 - 5.26

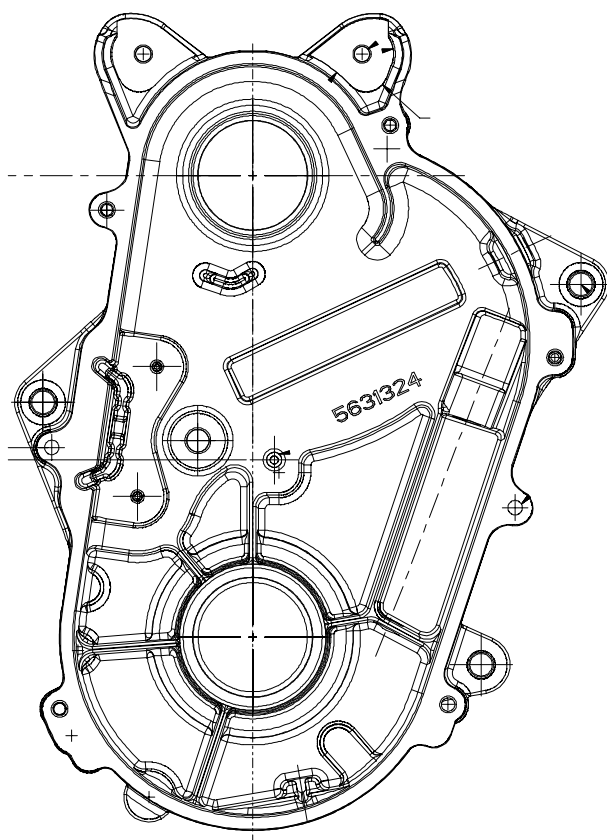




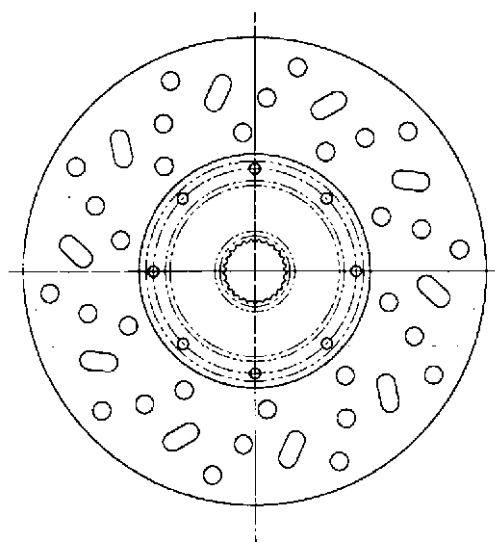
**440 Pro X Bulkhead / Tunnel and Chassis changes**



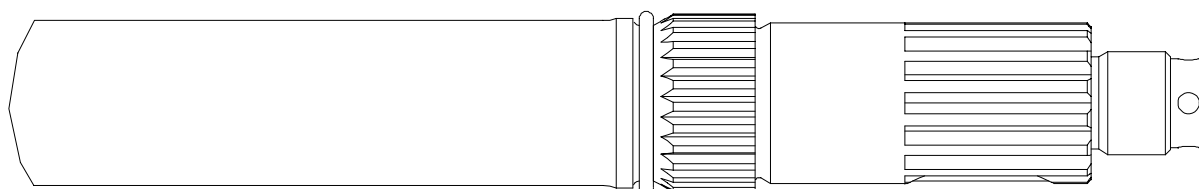
**New Seat Design**



**Chaincase Improvements**



**New Brake Rotor**



**New Stronger Hollow Jackshaft**

## 5.2

[illegible]

NR - Not Recommended, chain will not fit



NR - Not Recommended, chain will not fit

## **HYVO™ Sprocket Part Numbers**

### **Top Sprockets For 3/4" HYVO™ Drive Systems**

17T	2900001
18T	2900002
19T	2900003
20T	2900004
21T	2900005
22T	2900006
23T	2900007
24T	2900008
25T	2900009

### **HYVO™ Drive Chain**

<b>Chain Length (Pitch)</b>	<b>Part Number</b>
66P	3224071
68P	3224070
70P	3224069
72P	3221110
74P	3221109
76P	3221108

### **Bottom Sprockets For 3/4" HYVO™ Drive Systems**

<b>Standard Bottom Sprockets</b>		<b>Reverse Sprockets</b>	
37T	2900010	39T	1341243
38T	2900011	40T	1341227
39T	2900012	41T	1341228
40T	2900013		
41T	2900014	<b>Lightweight Cut Metal Gears</b>	
42T	2900015	37T Lightweight	2900144
43T	2900016	38T Lightweight	2900147
		39T Lightweight	2900142
		40T Lightweight	2900141
		41T Lightweight	2900140
		42T Lightweight	2900139
		43T Lightweight	2900138

**NOTE:** Only Cut Metal Gears are recommended for Racing applications

## Optional Tracks

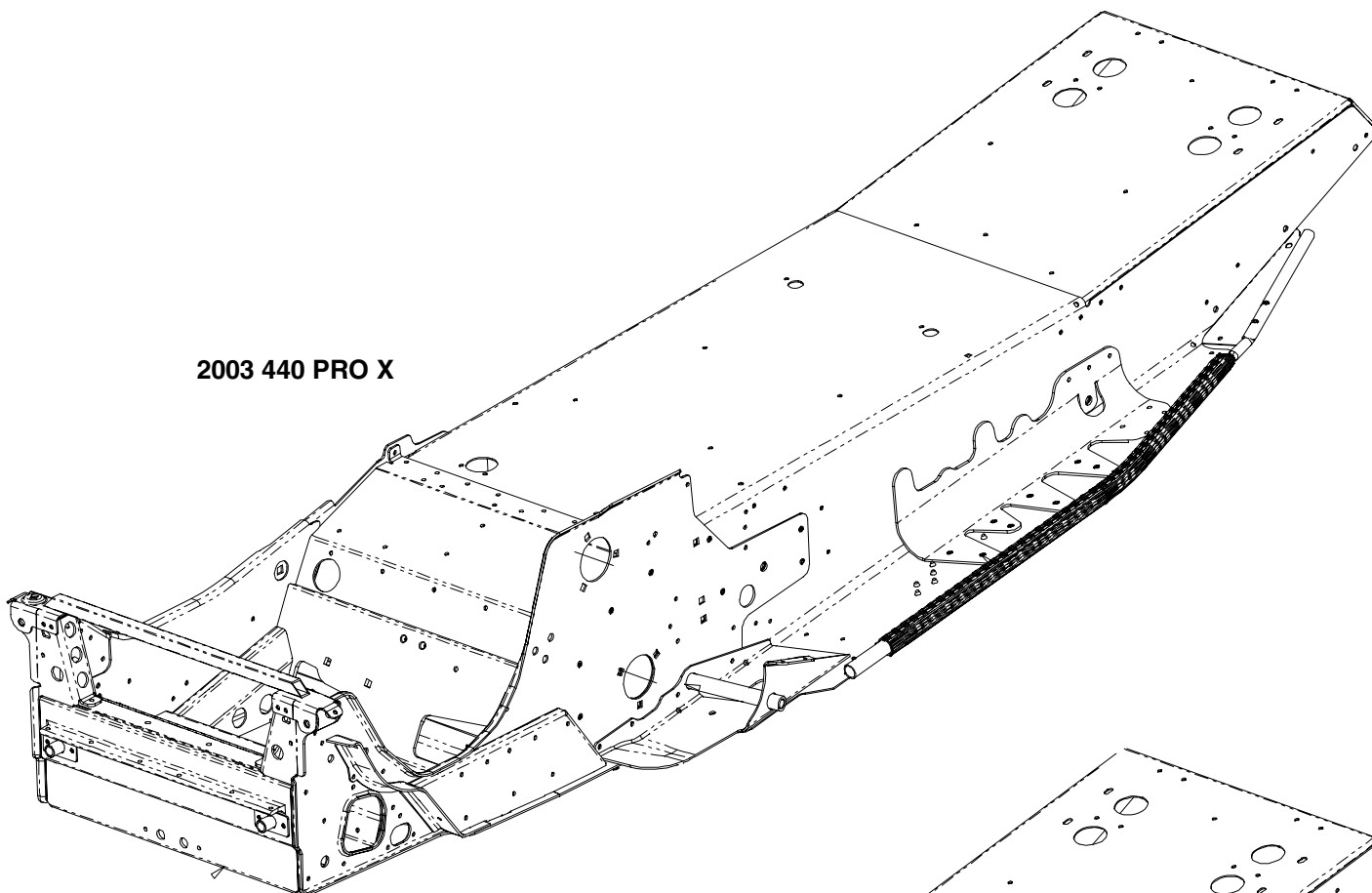
Part Number	Length x Width	Pattern/Lug Height
2900019	121 x 15"	1.5" Deep Lug (Notched)
2900018	121 x 15"	1.75" Deep Lug (Notched)
2900017	121 x 15"	2" Deep Lug (Notched)
5411825	121 x 15"	1" Mod Lightning
2872087	121 x 15"	1.25" (Notched)
5411994	121 x 15"	1" Shock Wave
5412197	121 x 14"	1.375" Shockwave ( Pro X only)

## ISR Optional Tracks

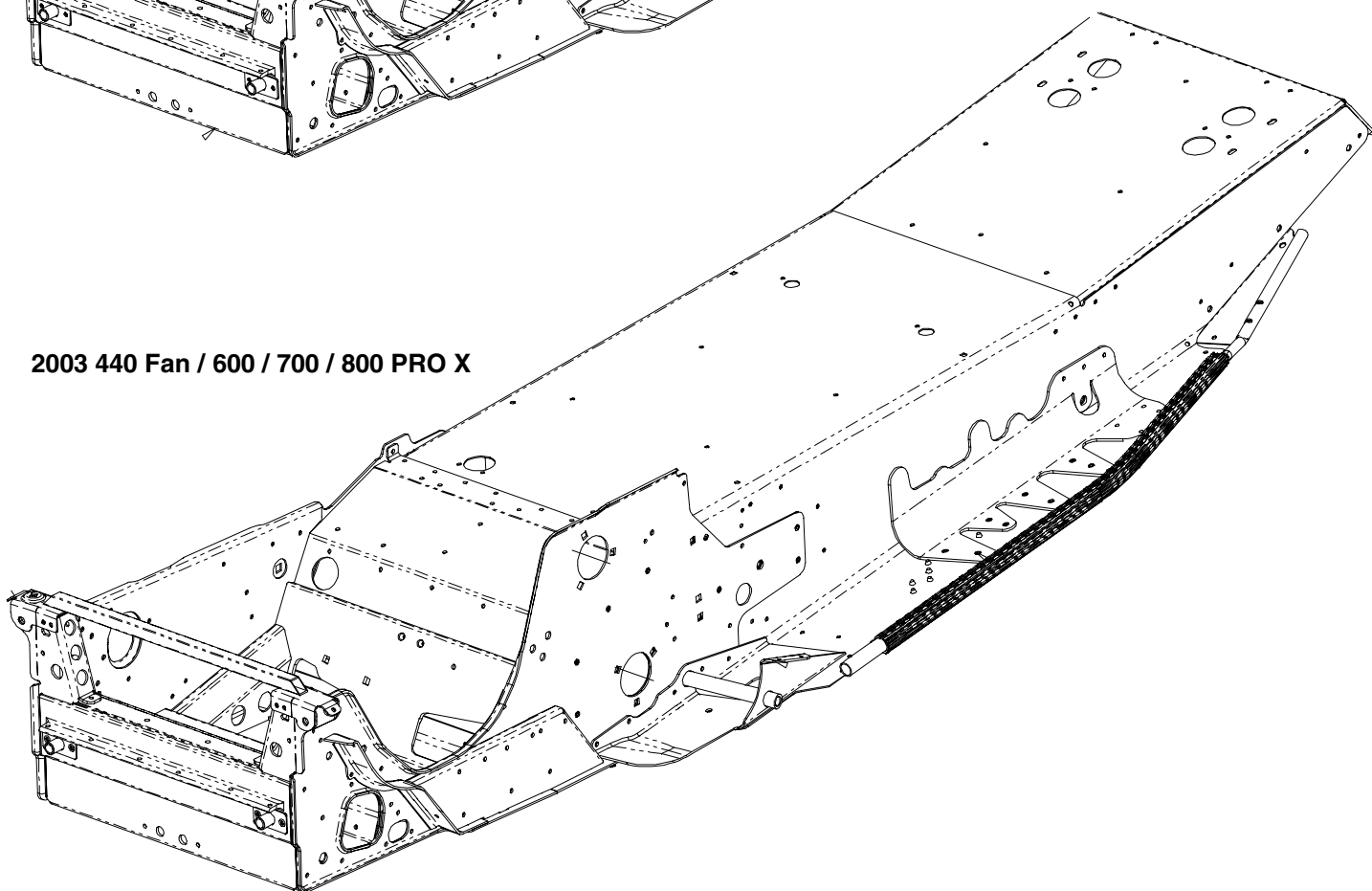
MODEL	OEM TRACK P/N	LUG HEIGHT	OPTIONAL TRACK P/N	LUG HEIGHT
440 Pro X Fan	5411379	.820"	5412197	1.375"
440 Pro X Lqd	5412329	1.625"	5412197	1.375"
600 Pro X	5411994	1.00"	5412329	1.625"
700 Pro X	5411994	1.00"	5412329	1.625"
800 Pro X	5411994	1.00"	5412329	1.625"
500 XC SP	5411994	1.00"	5412329	1.625"
600 XC SP	5411994	1.00"	5412329	1.625"
700 XC SP	5411994	1.00"	5412329	1.625"
800 XC SP	5411994	1.00"	5412329	1.625"
500 XC SP M-10	5411963	1.250"	5412329	1.625"
600 XC SP M-10	5411963	1.250"	5412329	1.625"
700 XC SP M-10	5411963	1.250"	5412329	1.625"
800 XC SP M-10	5411963	1.250"	5412329	1.625"
340 EDGE	5412193	.820"	5412197	1.375"

### Pro X Tunnels

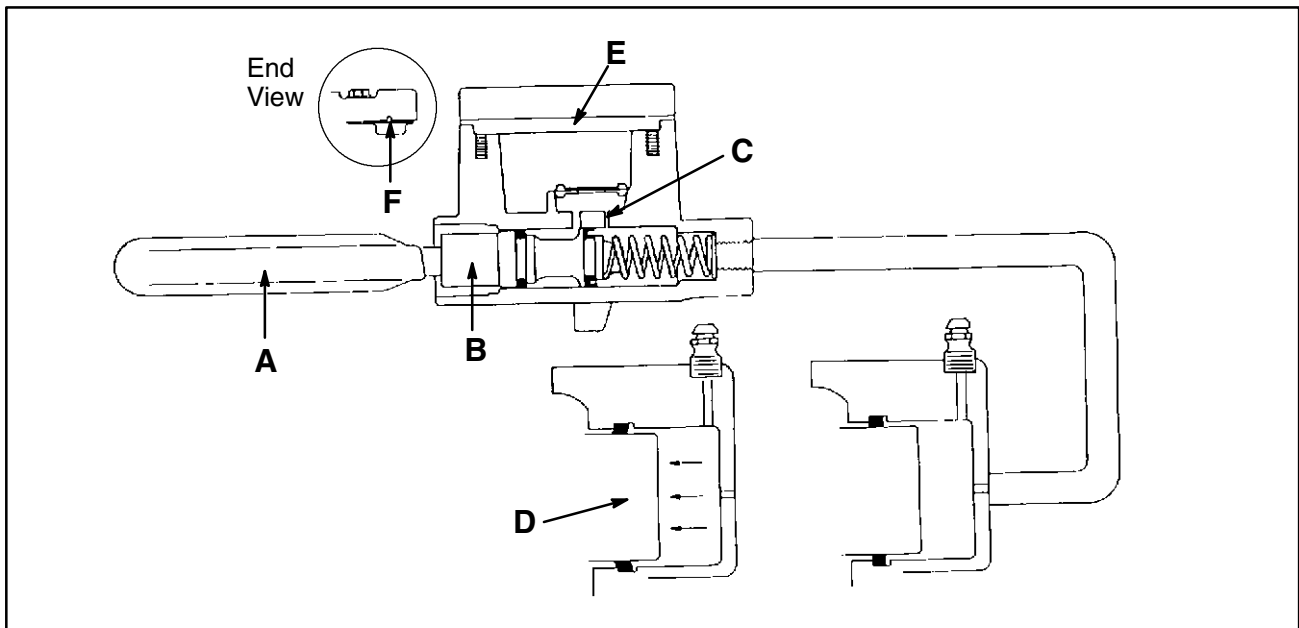
2003 440 PRO X



2003 440 Fan / 600 / 700 / 800 PRO X



## Hydraulic Brake System Operation



The Polaris snowmobile hydraulic brake system consists of the following components or assemblies: brake lever, master cylinder, hydraulic hose, brake caliper (slave cylinder), brake pads, and a brake disc which is secured to the drive line.

When the hand activated brake lever (A) is applied, it contacts a piston (B) within the master cylinder. As the master cylinder piston moves inward it closes a small opening called a 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, moves the caliper in its floating bracket and pulls the stationary pad into the brake disc. As the lever pressure is increased, the braking effect is increased.

The friction applied to the brake pads will cause the pads to wear. As the pads wear, the piston within the caliper self-adjusts and moves further outward.

Brake fluid level is critical to proper system operation. A low fluid level allows air to enter the system causing the brakes to feel spongy.

### Compensating Port

Located within the master cylinder is a small compensating port (C) which is opened and closed by the master cylinder piston assembly. The port is open when the brake lever is released and the piston is outward. As the temperature within the hydraulic system changes, this port compensates for fluid expansion caused by heat, or contraction caused by cooling. 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 the brake fluid to expand. Master cylinder reservoirs should be filled to the top of the fluid level mark on the inside of the reservoir, 1/4" - 5/16" (.6 - .8 cm) below lip of reservoir opening.

### WARNING

Never overfill the reservoir. This could alter brake function, resulting in system component damage or severe personal injury or death.

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. Be sure the vent is open and allowed to function. If the reservoir is overfilled or the diaphragm vent is plugged, the expanding fluid may build pressure in the brake system and lead to brake failure.

### Brake Bleeding - Fluid Change

#### Brake Bleeding - Fluid Change

This procedure should be used to change fluid or bleed brakes during regular maintenance, or after complete brake service. Brake fluid may damage painted or plastic surfaces. Take care not to spill, and wipe up any spills immediately. Cover parts to avoid damage.

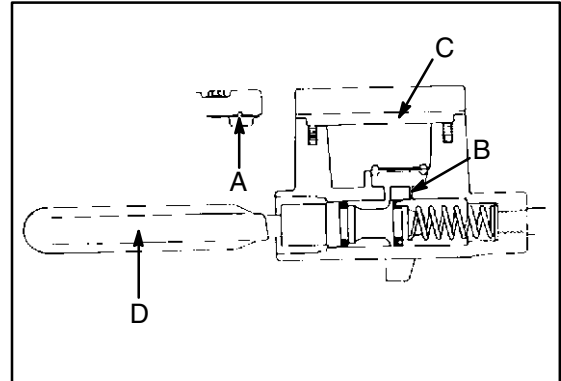
1. Clean reservoir cover thoroughly.
2. Remove screws, cover, and diaphragm from reservoir.
3. Inspect vent slots (A) in cover and remove any debris or blockage.
4. If changing fluid, remove fluid from reservoir with a Mity Vac™ pump or similar tool.

**NOTE:** Do not remove brake lever when reservoir fluid level is low.

**Mity Vac™ PN 2870975**

5. Add brake fluid to within 1/4-5/16" (.6-.8 cm) of reservoir top.

**Reservoir Cover Screw Torque -  
15-18 in. lb. (1.7-2 Nm)**



**Polaris DOT 3 Brake Fluid  
PN 2870990**

**Polaris DOT 3 High Temp Fluid  
(for Racing applications)  
PN 2873717**

6. Install a box end wrench on caliper bleeder screw fitting. Attach a clean, clear hose to fitting and place the other end in a clean container. Be sure the hose fits tightly on fitting.

**NOTE:** Fluid may be forced from compensation port (B) when brake lever is pumped. Place diaphragm (C) in reservoir to prevent spills. Do not install cover.

7. *Slowly* pump lever (D) until pressure builds and holds.
8. While maintaining lever pressure, open bleeder screw. Close bleeder screw and release brake lever. Do not release lever before bleeder screw is tight or air may be drawn into caliper.
9. Repeat procedure until clean fluid appears in bleeder hose and all air has been purged. Add fluid as necessary to maintain level in reservoir.

#### **CAUTION:**

Maintain at least 1/2" (1.27 cm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

10. Tighten bleeder screw securely and remove bleeder hose.
11. Add brake fluid to the proper level.
12. Install diaphragm, cover, and screws. Tighten screws to specification.

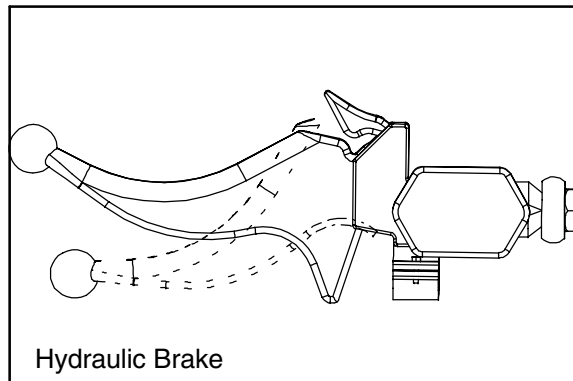
**Brake Bleeding - System Rebuild****Brake Bleeding - Fluid Change, Cont.**

13. Field test machine before putting into service. Check for proper braking action and lever reserve. With lever firmly applied, lever reserve should be no less than 1/2" (1.3 cm) from handlebar.

**Brake Lever Reserve Limit**

**Not less than 1/2" (1.3 cm)  
from handlebar**

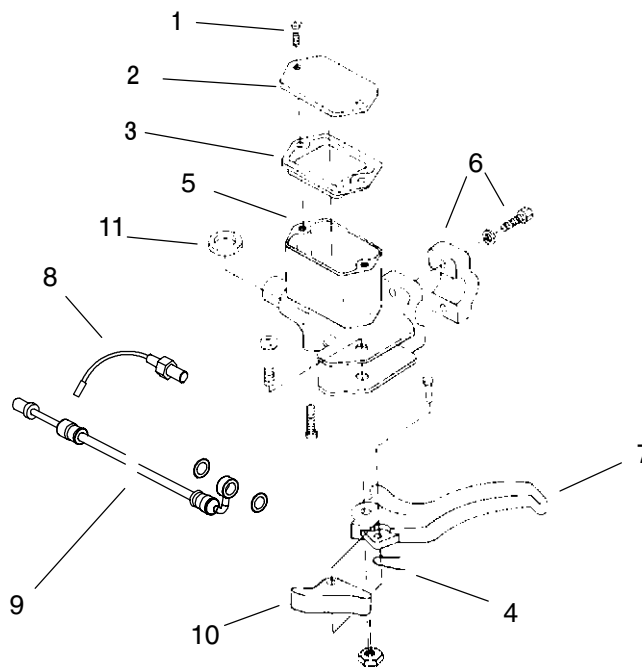
14. Check brake system for fluid leaks.



### Brake System

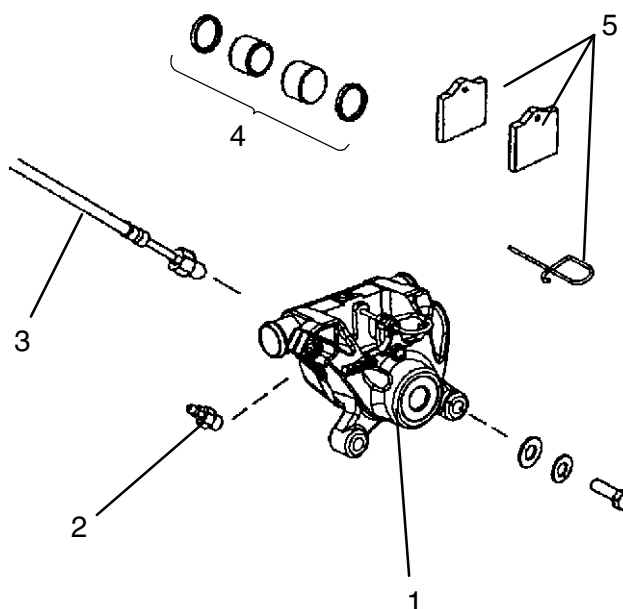
#### Wilwood™ Master Cylinder

1. Cover Screws
2. Cover
3. Cover Gasket
4. Parking Lever Spring
5. Master Cylinder
6. Screw
7. Lever
8. Pressure Switch
9. Brake Line
10. Park Brake Lever
11. Reservoir Ring



#### Hayes™

1. Brake Caliper
2. Kit Bleeder Replacement
3. Brake Line
4. Piston, Seal, Caliper Kit
5. Brake Pads and Pin





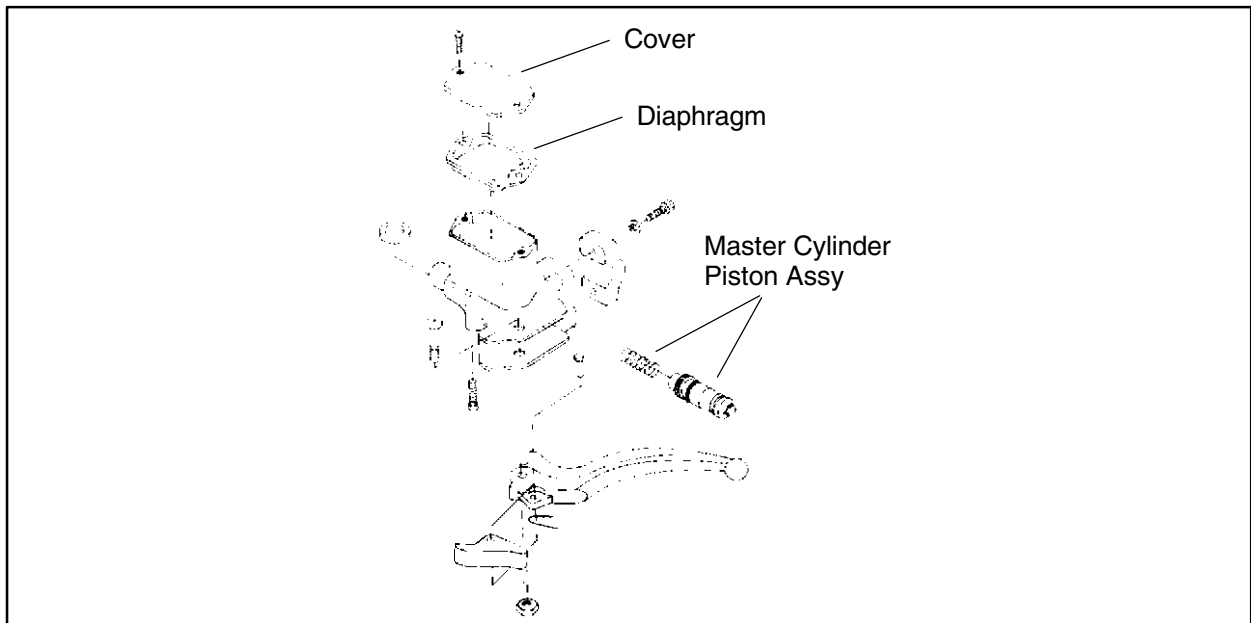
**Step by Step instructions for Wilwood Master Cylinder Removal and Inspection.****Disassembly**

1. Clean master cylinder and reservoir assembly. Make sure you have a clean work area to disassemble brake components.
2. Place a shop towel under brake line connection at master cylinder. Loosen banjo bolt; remove bolt and sealing washers.

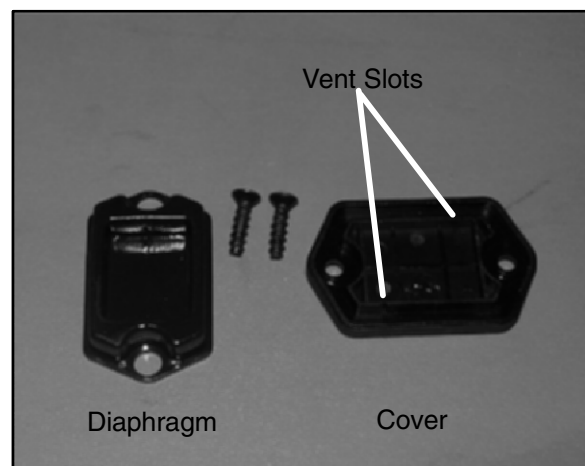
**CAUTION:**

Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

3. Remove master cylinder from handlebars.

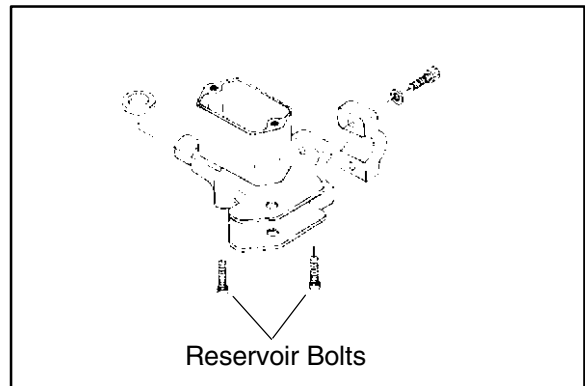


4. Remove cover and diaphragm from master cylinder and dispose of the fluid properly.
5. Be sure vents in cover are clean and unobstructed.
6. Remove brake lever.

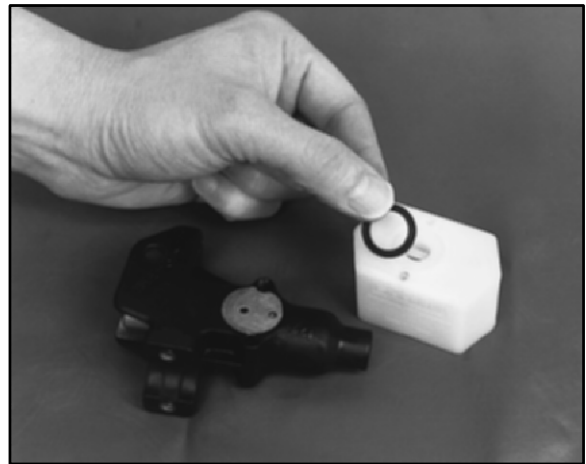


### Disassembly (cont.)

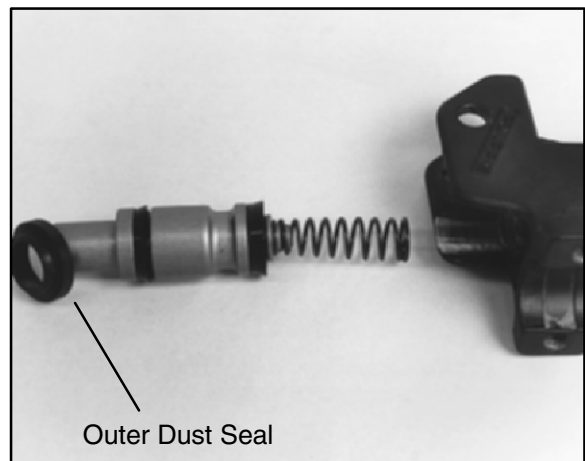
7. Remove reservoir screws and reservoir.



8. Inspect reservoir seal and replace if worn or damaged. Clean surfaces of the reservoir and master cylinder body. Be sure compensating (A) and supply (B) ports are clean before reassembly.



9. Remove outer dust seal. Be ready to catch piston assembly. **NOTE:** The return spring may force piston out when dust seal has been removed.



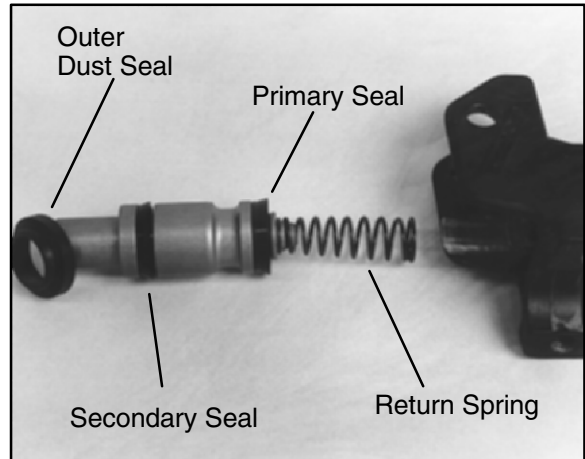
10. Remove piston assembly and return spring from master cylinder. Replace piston assembly and spring.

**Inspection**

1. Clean the master cylinder assembly with clean Dot 3 brake fluid, brake parts cleaner, or denatured alcohol. Dry thoroughly. Inspect the bore for nicks, scratches or wear. Replace if damage is evident or if worn.
2. Inspect parking brake for wear. If teeth or locking cam are worn, replace lever.

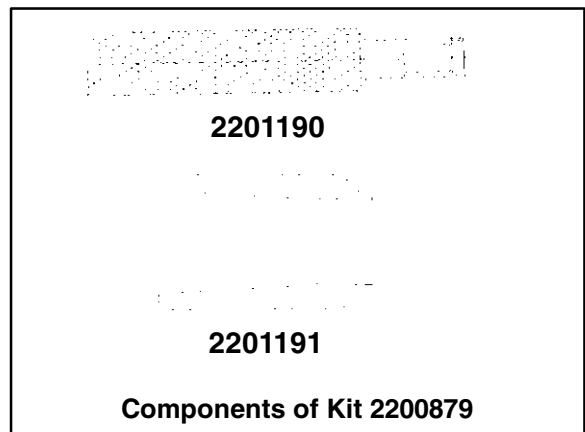
**Assembly**

1. Install new primary and secondary seals on the piston.



2. Select the appropriate master cylinder piston installation tool and insert into master cylinder bore. A typical installation tool is shown at right.

**Type IV Master Cylinder (Hand Brake)**  
**.750 (19mm)**  
**Installation Tool #2200879**



3. Dip piston in clean DOT 3 brake fluid, attach spring to piston, and install assembly into installation tool.

**CAUTION:**

Do not attempt to install the piston without the required installation tool. Do not allow the lip of the seals to turn inside out or fold.

4. Push the piston assembly through the installation tool sleeve using the plunger handle (included with installation tool kit). Continue pushing until plunger is solid against installation tool. Both tools can now be removed.
5. Hold piston assembly inward, and install a new dust seal. Be sure dust seal is completely seated in the groove.  
**NOTE:** The Piston assembly should spring back against the seal when compressed.
6. Install reservoir with new seal. Be careful to install and torque screws evenly.
7. Apply a light film of grease to the lever bolt. Install lever and tighten bolt securely.
8. Install parking brake lever assembly.



### Liquid Cooled Brake System

#### Liquid Cooled Brake Pad Replacement

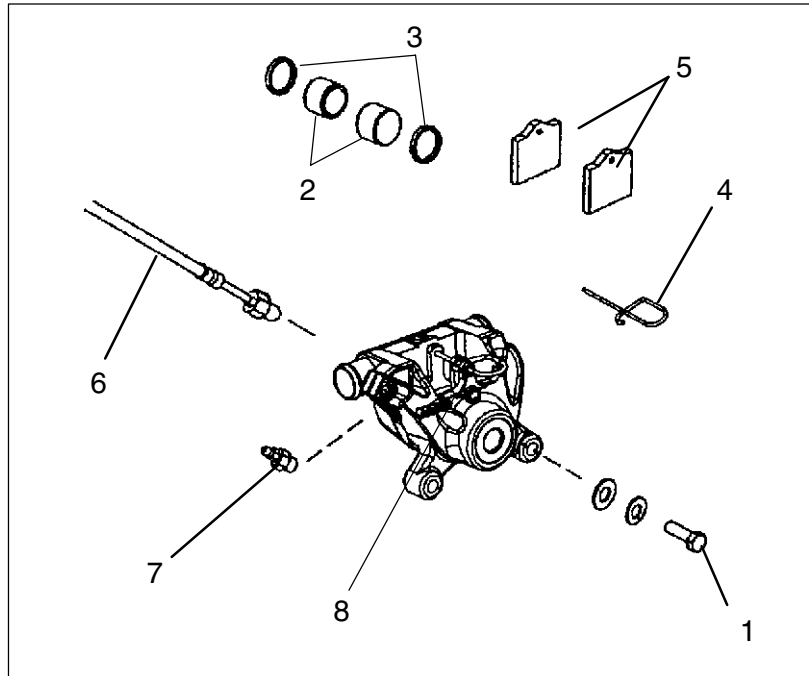
1. Carrier Bracket Attaching Bolts
2. Pistons
3. Piston Seals
4. Spring Clip
5. Brake Pads
6. Brake Line
7. Bleeder Screw
8. Caliper (Liquid Cooled)

#### WARNING

The rider's safety depends on correct installation. Follow procedures carefully.

#### CAUTION:

Protect eyes from brake fluid.



1. Remove spring clip.
2. Place new pads with friction material facing each other into housing.
3. If pads do not slide easily over the disc the piston is not compressed far enough into the caliper.
4. Hold pads in place and replace spring clip through the pad ears.
5. Actuate brake several times to set brake pads to proper operating position.
6. Check for proper fluid level in master cylinder and replace cover. Torque to specification.
7. Bleed brake system as outlined earlier in this chapter.
8. Field test at low speeds before putting into regular service.

#### Master Cylinder Fluid Level

1/4" - 5/16" (.6 - .8 cm) below  
top of master cylinder

#### Reservoir Cover Screw Torque -

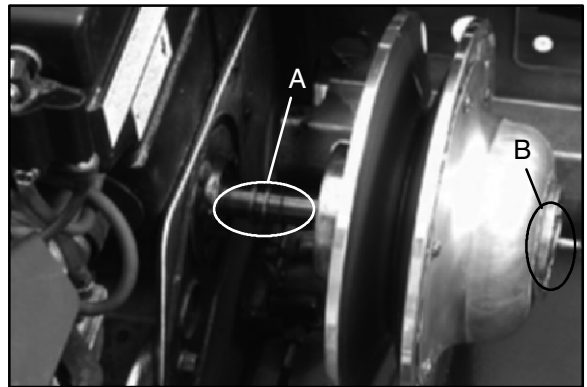
15-18 in. lb. (1.7-2 Nm)

## Rear Suspension Removal

The Type 3 drive system is used on all models except the WideTrak. This system consists of a right side mounted chaincase with right side mounted brake assembly.

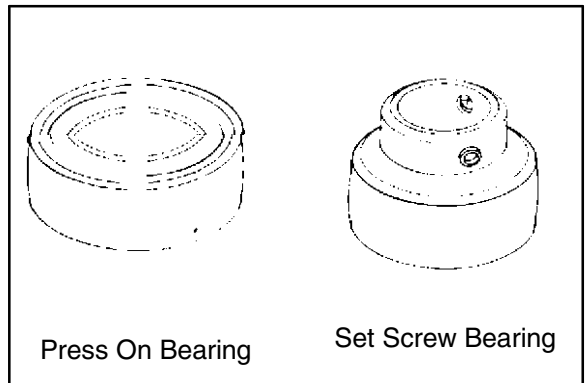
1. Turn OFF Fuel Valve and drain all the fuel from the fuel tank into an approved container.
2. Mark hood hinges for ease of alignment when reassembling.
3. Remove hood (to prevent damage), air silencer, exhaust system and battery, if so equipped.
4. Place drip pan under chaincase and remove drain plug. Dispose of used chaincase oil properly.
5. Remove drive belt and driven clutch.

**Note position of washers for controlling drive to driven offset (A) and washers to control clutch free floating (B).**

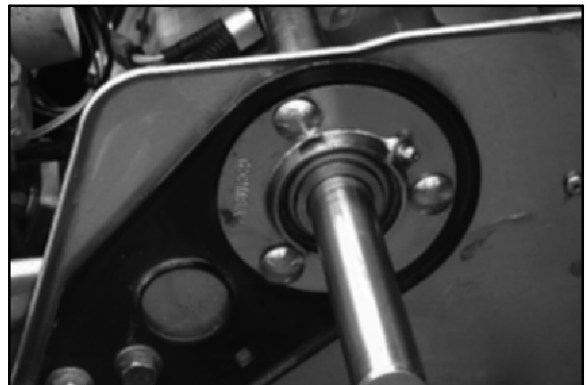


6. Remove air box (if needed) and loosen jackshaft bearing lock set screws (if equipped).

**NOTE:** Some models are equipped with set screw or Skwez-loc™ style jackshaft bearings. Some models are equipped with press-fit bearings which have no locking device.



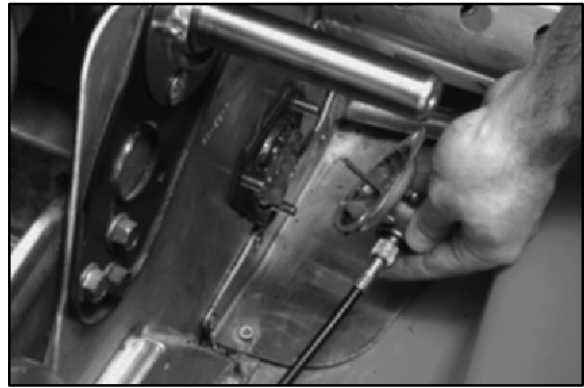
7. Remove two upper flange attaching bolts.



### Rear Suspension Removal, Cont.

8. Remove three bolts, nuts, and washers securing angle drive and bearing flangettes. Remove and discard adaptor key.
9. Remove four suspension mounting bolts.
10. Place a protective mat on floor and tip machine onto left side.
11. Remove rear suspension by pulling rear of track outward and sliding suspension forward. Lift out rear of suspension first.

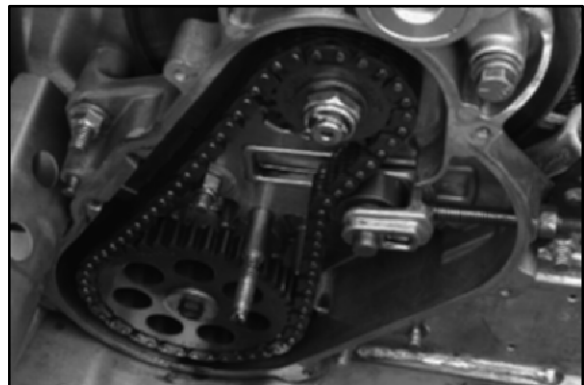
**NOTE:** Unhook the rear torsion springs to relieve pressure on the torque arm for ease of removal. Loosen rear shaft bolts and adjuster bolts, slide rear shaft forward for ease of removal.



### Chaincase Removal

1. Support rear of machine.
2. Remove third jackshaft flangette attaching bolt. Tip machine back to upright and support rear with jack-stand.
3. Drain Chaincase and remove chaincase cover attaching bolts and remove cover.
4. Remove cotter pin and nut.
5. Loosen chain adjustment bolt and remove chain tensioner assembly.
6. Remove bottom sprocket attaching bolt, chain and sprockets.
7. Remove two bolts securing caliper carrier bracket to chaincase.

**NOTE:** Inspect brake pad condition and replace if worn to less than 1/2 the original thickness. See Brake Pad Replacement in this chapter.

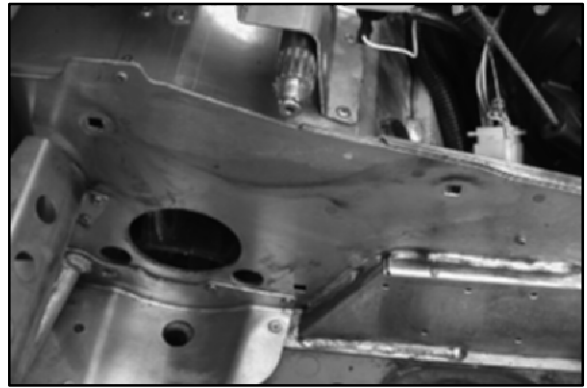


**Chaincase Removal, Cont.**

8. Remove three (PRO X has four) chaincase to bulkhead attaching nuts and bolts. The front bolt is a through bolt, rear and bottom bolts are carriage bolts.

**NOTE:** On some machines it may be necessary to remove the rear exhaust bracket prior to lifting chaincase or removing drive shaft assembly.

9. Remove O-Ring, seal sleeve and brake disc by tapping on jackshaft end with a soft face hammer.
10. Remove chaincase.

**Chaincase Bearing Removal**

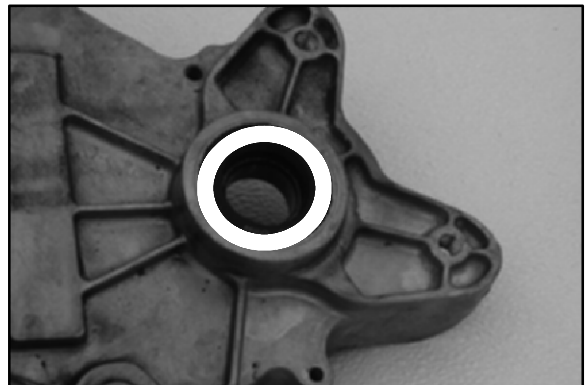
1. Remove bearing retaining snap rings.



2. Pry out old seal from back side of chaincase.



3. Press out old bearing from side shown (seal side). If bearing appears tight, use heat to expand chaincase bore. Always press bearing toward snap ring side of chaincase when removing. Inspect chaincase for any damage and replace if required.



### Jackshaft Removal

1. Remove jackshaft.

**NOTE:** On models with pressed bearing on jackshaft, shaft will have to be brought through bulkhead slot in order to remove from unit.

2. Inspect drive shaft and jackshaft in bearing contact area. If diameter is .001" (.025 mm) less than non-contact area, shafts should be replaced.

#### Jackshaft and Driveshaft Service Limit -

.001" (.025 mm)

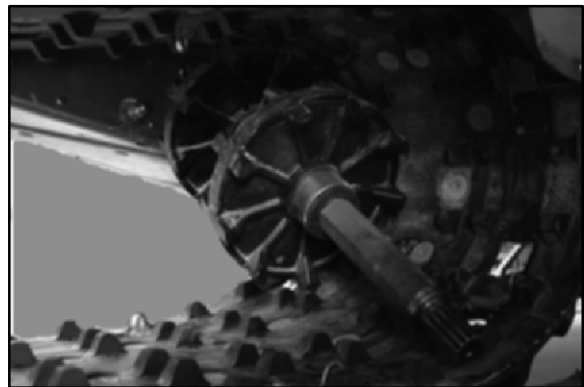
### Driveshaft Removal

1. Support the rear of the machine.

2. Remove driveshaft by pushing through bearing hole on the bulkhead, then pulling driveshaft toward you.
3. After drive shaft has been removed, inspect condition of drive sprockets and replace if required.

**NOTE:** On models with pressed bearings on drive shaft:

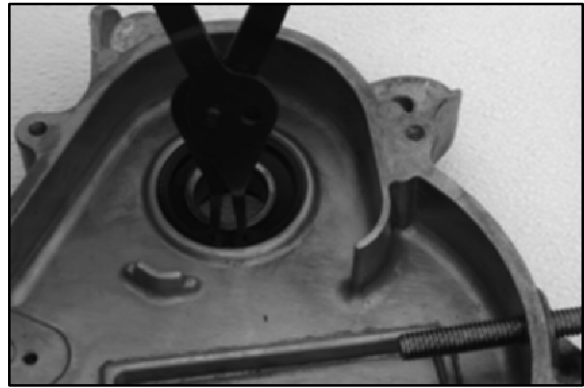
- If bearings are loose internally or rough they should be replaced.
- If bearings are loose on the shaft the shaft must be replaced.





### Chaincase Bearing Assembly

1. Apply Loctite 680 to outer race of new bearing and press into position. Press on outer race only, or bearing damage may result.
2. Reinstall snap rings.



3. Press new seals in until outer edge is flush with chaincase shoulder. New seals must be installed from outside of case with lip side in.
4. Install chaincase.

**NOTE:** Do not tighten chaincase bolts at this time.



### Jackshaft Installation

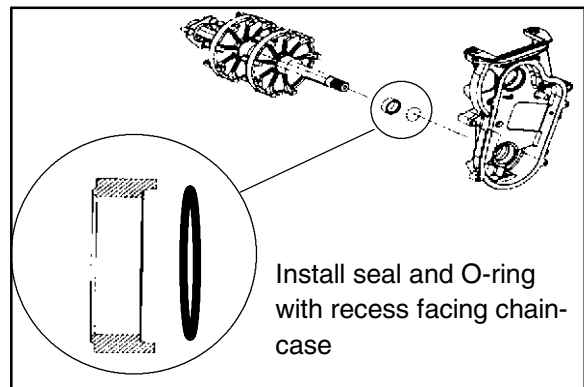
1. Replace seal sleeves and O-Rings with new and grease.
2. Install jackshaft installation tool on the threads of the jackshaft

#### Jackshaft Installation Tool

PN 2870974 - 13 Tooth Jackshafts  
PN 2871296 - 15 Tooth Jackshafts



3. Line up bushing, o-ring and brake disc on splined shaft.



### Jackshaft Installation, Cont.

4. Insert jackshaft through bearing in chaincase
5. Install jackshaft alignment tool and secure with castle nut and flat washer. Tighten jackshaft nut securely to ensure positive bearing and jackshaft seating to chaincase.

**NOTE:** Use of a standard nut and flat washer for this alignment process will simplify the process as well as preserve the locking features of the lock nut for reassembly.

#### Jackshaft Alignment Tool

PN 2870399 - 13 Tooth Jackshafts  
PN 2871535 - 15 Tooth Jackshafts

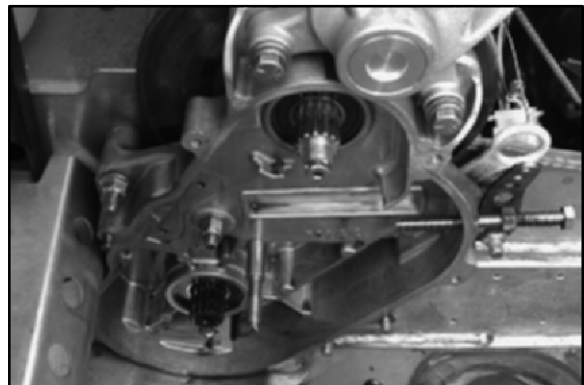
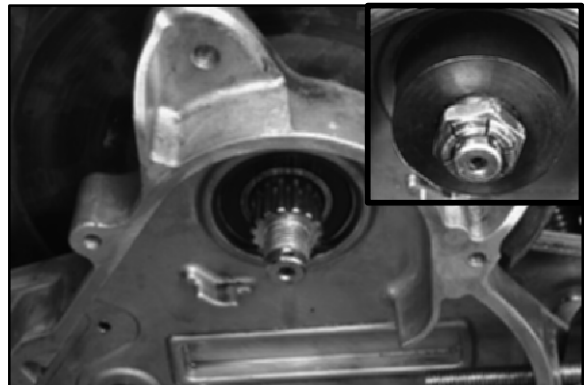
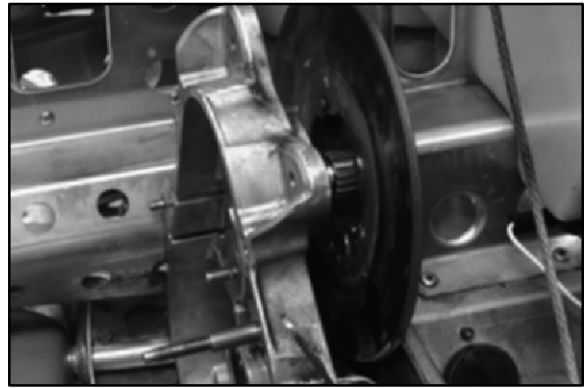
6. If shaft is not centered, tap shaft with a soft faced hammer until centered. This will align the upper chaincase bearing in the chaincase bore.
7. Once correct jackshaft alignment has been achieved, install lock nuts on chaincase mounting bolts and torque to specification. Remove alignment tool from chaincase.
8. Install jackshaft flangette gasket and bolts. Align grease hole in bearing with hole or fitting in flangette to ensure greasability. Torque nuts to specification. *Do not* lock set screws on retainer ring (if so equipped).

#### Chaincase Mounting Bolt Torque -

28-30 ft. lbs. (38.6 - 41.4 Nm)

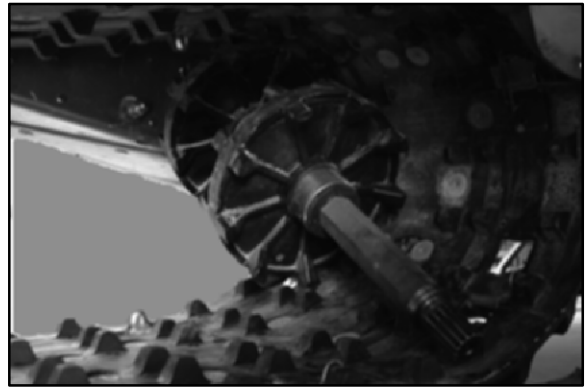
#### Flangette Nut Torque -

15 - 17 ft. lbs. (20.7 - 23.5 Nm)

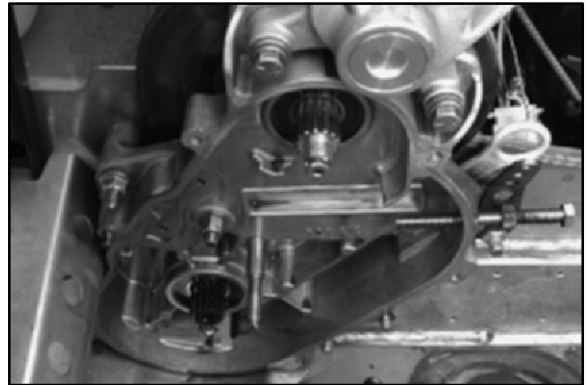


**Driveshaft Installation**

1. Set track into machine making note of correct direction of travel. Most tracks have an arrow pointing which direction the track turns.
2. Insert driveshaft through bearing hole in bulkhead. Place inner driveshaft bearing flange bolts in the bulkhead.
3. Insert chaincase side of driveshaft through bottom chaincase bearing.

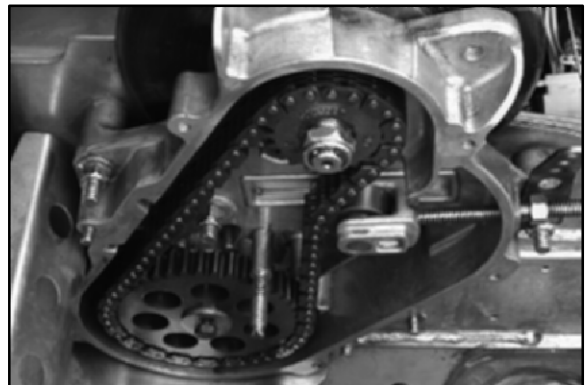


4. Replace speedometer key with a new one and install angle drive. Torque nuts to specification.

**Speedometer Angle Drive  
Mounting Nut Torque -****15 - 17 ft. lbs. (20.7 - 23.5 Nm)**

5. Link together the upper and lower chaincase sprockets with the chain. Install both the upper and lower sprockets and chain at the same time. Finger tighten the top sprocket nut and turn in bottom sprocket bolt until snug.

**NOTE:** On Hyvo™ sprockets, the beveled side goes toward the chaincase bearing.



### Driveshaft Installation, Cont.

6. Install chain tensioner. Finger tighten adjustment bolt.
7. Install brake caliper assembly in chaincase.

#### CAUTION:

On models with hydraulic brakes, make sure caliper piston is fully retracted into caliper to prevent brake binding from preload of pads. On models equipped with mechanical brakes make sure cam is fully retracted.

8. Torque caliper mounting bolts to specification.

**Caliper Mounting Bolt Torque -**  
**28 - 30 ft. lbs. (38.6 - 41.4 Nm)**



### Track Installation

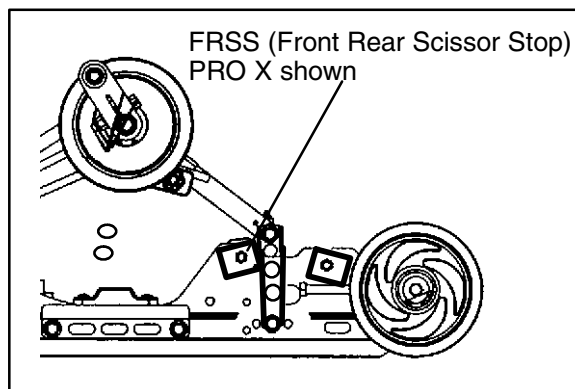
1. Tip machine back onto left side. Insert suspension, into the track.
2. Install Torsion springs back onto the spring retainers.
3. Move the suspension back and forth until front torque arm mounting bolts can be started. Tighten finger tight.
4. Rotate the suspension until the rear mount bolts can be installed in the same manner as the front.

**NOTE:** For ease of installation, turn the front rear scissor stops (FRSS) to low position. This allows the rear torque arm to move forward more to line up holes.

#### CAUTION:

Make sure the suspension does not over center when installing suspension, keep the Front Rear Scissor Stop in contact with the Front Scissor stop.

5. Torque suspension mounting bolts to specification.
6. Return front rear scissor stops (FRSS) to original position.
7. Align track (outlined in suspension section) and tighten adjuster and rear shaft bolts to specification.

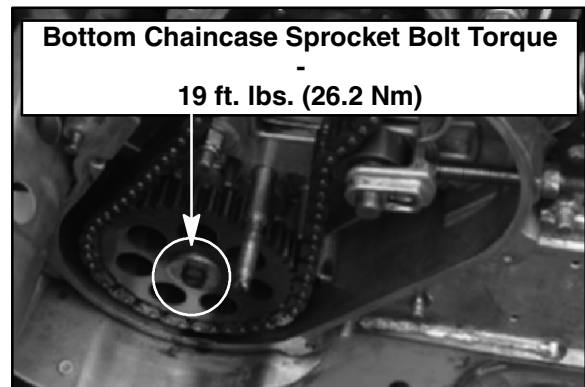


**Final Assembly**

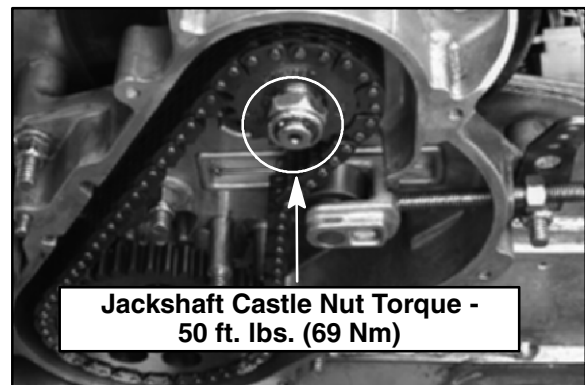
1. Check speedometer cable routing.
2. Grease angle drive and bearing with Polaris grease.



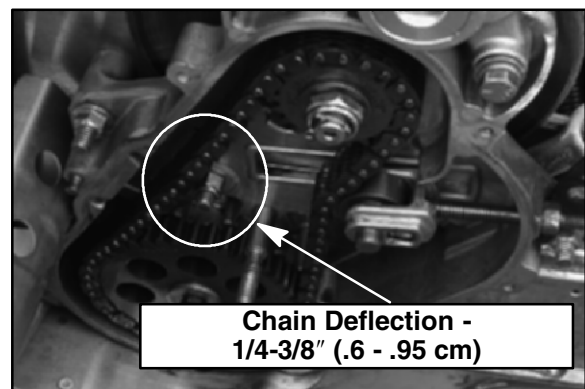
3. Torque bottom chaincase sprocket bolt to specification.



4. Torque jackshaft nut to specification. On models with castle nut, if cotter pin does not align, tighten nut until it does. Apply brake to hold jackshaft while torquing.



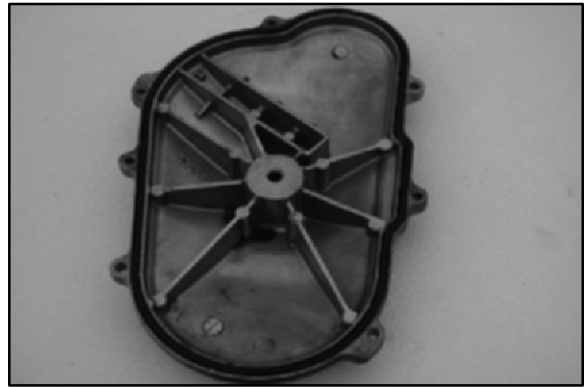
5. There should be approximately 1/4-3/8" (.6-.95 cm) total deflection on the chain. Turn adjuster bolt until correct chain deflection is obtained and lock the locknut.



### Final Assembly, Cont.

6. Install chaincase cover gasket in chaincase. Install chaincase cover and torque cover bolts to specification.

**Chaincase Cover Bolt Torque -**  
**8 - 10 ft. lbs. (11 - 14 Nm)**

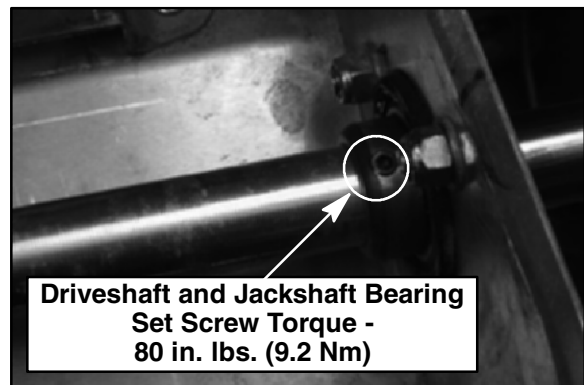


7. Add 9 oz. (11 oz. on models equipped with reverse) of Polaris chaincase oil to the chaincase. Verify proper level with dipstick.

**Polaris Synthetic Gearcase Lube**  
**PN 2871477 (Gallon)**  
**PN 2871478 (12 ounces)**



8. Torque jackshaft bearing set screws to specification (if so equipped).



9. Lubricate bearings with Polaris Premium All Season grease.

**Polaris Premium All Season Grease**  
**PN 2871423**



**Final Assembly, Cont.**

10. Reinstall clutch offset washers on jackshaft and install driven clutch. Using the clutch alignment tool adjust driven clutch to achieve proper offset. See Clutch Offset Adjustment in this manual.

**Clutch Alignment Tool**

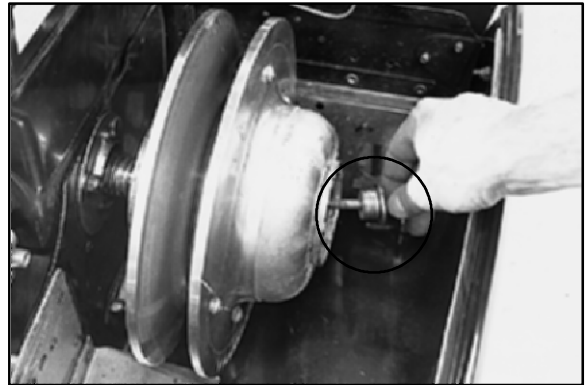
P90 - PN 2870914  
P85 - PN 2870426



**P90 Offset 21/32": P90 Electric Start Offset:  
1.28" (straight edge)**

**P85 Offset 5/8": P85 Electric Start Off-set:  
1" (straight edge)**

11. With proper offset achieved, the driven clutch must float on the jackshaft. This is done by adding or subtracting spacer washers (PN 7555734) to the clutch retaining bolt. When properly adjusted, the driven clutch will have .020 - .100" (.5 - 2.5 mm) float.

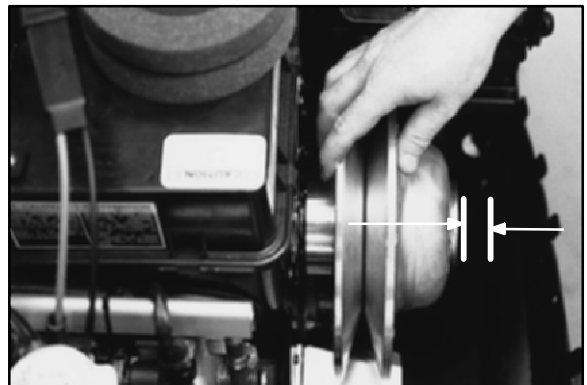
**CAUTION:**

Incorrect float can cause jackshaft bearings to be side loaded, resulting in premature bearing failure.

12. Torque driven clutch retaining bolt to specification.

**Driven Clutch Retaining Bolt Torque**

**12 ft. lbs. (16.6 Nm)**



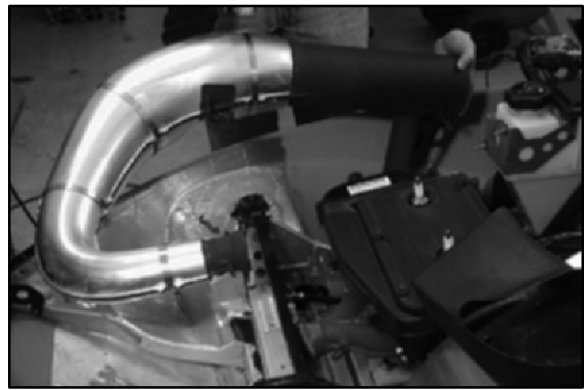
13. Reinstall air box, adjusting box properly.  
14. Reinstall battery (if so equipped). Always attach ground cable last to prevent sparks.



### Final Assembly, Cont.

15. Replace exhaust system.
16. Install hood, (if removed) aligning with marks made during disassembly. Ensure proper hood closure and readjust if necessary.

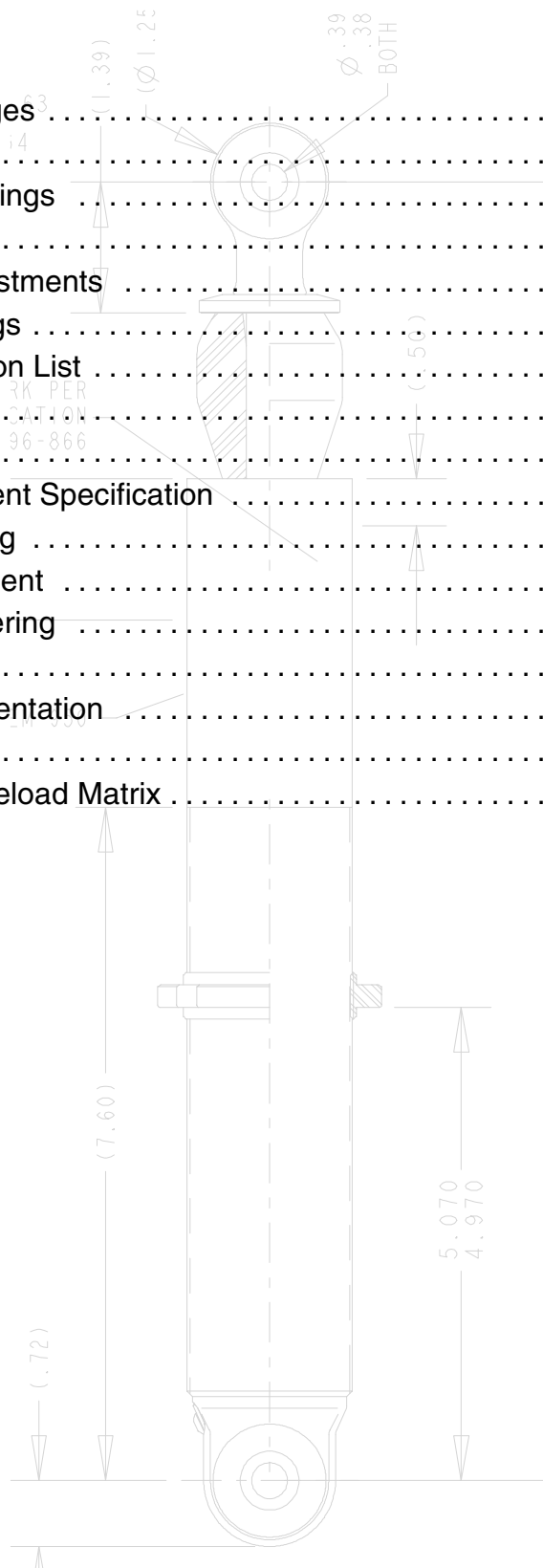
**Hood Bolt Torque -  
8-10 ft. lbs. (11-14 Nm)**



17. Test ride the unit to ensure all components are functioning properly before putting into service.

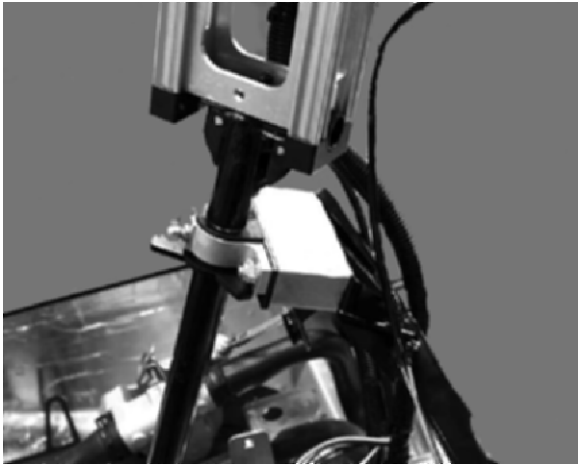


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The following is a list of some improvements to the 2003 440 PRO X.



**Steering Post moved forward 2' form 2003**



**Walker Evans Compression Adjustable  
IFS Shocks**



**Improved Steering Geometry**



**New Steering Bushing**

- ▶ Improved Steering Rack
- ▶ Revised Spring Rates
- ▶ Dual Rate IFS Springs

**Spring Data**

Spring Part #	Length (in)	Wire Diameter (in)	# Of Coils	Active Coils	Outside Diameter (in)	Solid Length (in)	Spring Rate (lb/in)
7041203	2.21	0.060	20.70	18.70	0.367	1.280	38.6
7041204	13.00	0.438	11.00	9.00	3.590	5.250	190
7041253	7.50	0.331	10.00	8.00	2.532	3.310	200-240
7041261	10.25	0.312	13.00	11.00	2.600	4.750	105
7041351	11.88	0.331	13.00	11.00	3.200	4.300	75-125
7041396	11.88	0.283	13.35	11.35	2.820	4.000	50
7041398	11.88	0.312	12.72	10.72	2.880	4.000	75
7041404	11.88	0.343	13.00	11.00	3.100	4.300	90-150
7041405	11.88	0.306	13.40	11.40	2.820	4.100	65
7041508	6.25	0.343	6.70	4.70	3.160	2.400	190
7041509	6.18	0.343	8.38	6.38	3.160	2.880	140-240
7041510	6.25	0.362	8.52	6.52	3.200	3.100	165-245
7041512	5.25	0.263	5.30	3.30	3.160	1.500	85
7041514	5.25	0.297	7.00	5.00	3.100	2.150	100-180
7041527	11.00	0.306	18.46	16.46	2.500	5.650	70-180
7041528	11.30	0.306	17.57	15.57	2.530	5.380	74-160
7041529	11.30	0.283	19.39	17.39	2.500	5.490	50-140
7041530	10.50	0.283	14.42	12.42	2.500	4.080	70-105
7041531	10.50	0.283	14.42	12.42	2.500	4.080	70-110
7041549	10.75	0.331	9.17	7.17	2.750	3.030	140
7041550	10.75	0.306	8.29	6.29	2.750	2.540	120
7041551	10.75	0.306	9.55	7.55	2.750	2.920	100
7041552	10.75	0.283	9.09	7.09	2.750	2.570	80
7041553	11.33	0.283	11.46	9.46	2.750	3.240	60
7041554	10.75	0.283	9.09	7.09	2.750	2.570	80
7041561	7.50	0.261	10.10	8.10	2.500	2.800	85
7041569	10.50	0.263	11.80	9.80	2.530	3.200	60
7041570	10.50	0.281	11.70	9.70	2.540	3.300	80
7041571	10.50	0.263	10.40	8.40	2.530	3.200	90
7041573	10.00	0.331	9.28	7.28	2.910	3.070	160
7041574	10.25	0.331	10.32	8.32	2.910	3.420	140
7041575	11.42	0.331	10.36	8.36	2.870	3.430	120
7041576	10.80	0.306	9.55	7.55	2.860	2.920	100
7041591	12.25	0.306	12.79	10.79	2.750	3.920	80
7041598	9.33	0.312	9.71	7.71	2.894	2.570	105
7041613	11.88	0.295	14.01	12.01	2.620	4.130	75
7041668	4.00	0.219	6.94	4.94	2.340	1.520	70
7041669	4.00	0.218	6.27	4.27	2.330	1.360	80
7041670	4.00	0.225	6.28	4.28	2.350	1.420	90
7041671	9.00	0.331	11.71	9.71	2.560	3.870	160
7041672	9.00	0.331	10.63	8.63	2.560	3.520	180
7041673	9.00	0.362	12.72	10.72	2.620	4.610	200
7041674	9.00	0.362	12.72	10.72	2.620	4.610	220
7041677	9.00	0.306	10.43	8.43	2.520	3.190	140
7041678	7.00	0.262	8.65	6.65	2.430	2.260	100
7041679	7.00	0.262	7.54	5.54	2.430	1.970	120
7041680	7.00	0.295	9.35	7.35	2.490	2.750	140
7041681	7.00	0.295	8.43	6.43	2.490	2.480	160
7041683	11.88	0.312	12.12	10.12	2.870	3.780	80



## Spring Data Continued

Spring Part #	Length (in)	Wire Diameter (in)	# Of Coils	Active Coils	Outside Diameter (in)	Solid Length (in)	Spring Rate (lb/in)
7041698	4.00	0.225	5.84	3.84	2.350	1.310	100
7041699	4.00	0.235	5.75	3.75	2.370	1.350	120
7041701	9.00	0.295	10.57	8.57	2.490	3.120	120
7041790	13.00	0.421	10.84	8.84	3.500	6.125	175
7041792	7.50	0.362	8.98	6.98	2.800	3.170	250
7041796	13.00	0.406	9.99	7.99	3.630	6.125	150
7041797	7.50	0.343	9.26	7.26	2.750	3.170	200
7041820	4.00	0.250	5.98	3.98	2.430	1.500	140
7041821	4.00	0.262	5.91	3.91	2.490	1.550	160
7041822	7.50	0.343	8.75	6.75	2.720	3.250	225
7041823	7.50	0.375	8.82	6.82	2.870	3.250	275
7041824	13.00	0.421	12.81	10.81	3.630	6.125	130
7041825	13.00	0.438	12.72	10.72	3.400	6.125	190
7041826	7.00	0.306	9.19	7.19	2.540	3.250	160
7041827	7.00	0.312	8.85	N/A	2.540	3.250	180
7041828	7.00	0.331	9.61	7.61	2.590	3.250	200
7041829	7.00	0.331	8.92	6.92	2.590	3.250	220
7041830	6.00	0.250	8.50	6.50	2.430	2.500	85
7041831	6.00	0.262	8.57	6.57	2.450	2.500	100
7041832	6.00	0.281	8.82	6.82	2.510	2.500	120
7041833	6.00	0.281	8.04	6.04	2.490	2.500	140
7041834	9.00	0.362	7.39	5.39	3.240	4.500	200
7041835	9.00	0.375	7.74	5.73	3.230	4.500	220
7041836	9.00	0.393	7.82	5.82	3.330	4.500	240
7041837	9.00	0.406	7.32	5.32	3.490	4.500	260
7041870	7.50	0.331	6.77	4.77	3.000	3.250	190
7041887	2.20	0.125	4.15	2.15	1.640	N/A	59
7041914	7.57	0.331	9.62	7.62	2.900	3.180	160
7041915	2.25	0.207	4.74	2.74	2.340	0.980	100
7041916	2.25	0.218	4.21	2.21	2.370	0.920	150
7041917	2.25	0.235	4.03	2.03	2.390	0.950	215
7041927	13.00	0.295	16.15	14.15	2.540	4.770	68-160
7041937	10.13	0.331	15.20	13.20	2.650	N/A	100-200
7041950	11.57	0.331	13.80	11.80	3.125	4.570	68-160
7042048	2.60	0.243	4.28	N/A	2.400	1.040	220
7042049	2.60	0.262	4.54	N/A	2.430	1.190	260
7042051	12.00	0.362	12.50	N/A	3.000	5.000	130
7042052	12.00	0.331	10.25	8.25	3.000	5.000	110
7042053	12.00	0.362	10.94	8.94	3.000	5.000	150
7042055	2.50	0.235	4.47	N/A	2.380	1.050	180
7042074	10.65	0.343	11.63	9.63	3.200	3.980	90-180
7042090	10.50	0.000	N/A	N/A	0.000	N/A	155
7042091	7.00	0.312	N/A	N/A	2.540	3.000	160
7042092	10.50	N/A	N/A	N/A	0.000	4.250	195
7042103	5.00	0.262	N/A	N/A	2.380	1.550	160
7042105	5.00	0.262	N/A	N/A	2.380	1.650	80
7042122	10.50	0.362	N/A	N/A	2.640	4.250	175
7042187	12.55	0.343	13.76	11.76	3.181	4.720	74-165

\*All springs shipped as service parts are black. You must add a suffix of "-067" to spring part number when ordering.

## MAXIMUM SPRING PRELOAD MATRIX

BOLD type indicates Production setting

SLED	POSITION	RATE	SPRING #	FREE LENGTH	SOLID LENGTH	SHOCK #	TRAVEL	SPRING PRELOAD	MAX PRE-LOAD	PRELOAD DIMENTION
440 PRO X	IFS	74/165	7042187	12.55"	4.72"	7042180	6.27"	14 Turns	21.8 Turns	3.75"
	IFS	175	7042122	10.5"	4.25"	7042180	6.27"	17 Turns	36.8 Turns	1.75"
	IFS	120	7041699	4.00"	1.35"	7042180	6.27"			
	IFS	155	7042090	10.5"	4.25"	7042180	6.27"			
		100	7041698	4.00"	1.31"	7042180	6.27"	17 Turns	37.4 Turns	1.75"
	IFS	195	7042092	10.5"	4.25"	7042180	6.27"			
		140	7041820	4.00"	1.50"	7042180	6.27"	17 Turns	34.7 Turns	1.75"
	F/T	160	7042091	7.00"	3.00"	7042178	3.76"	2 Turns	3.4 Turns	2.88"
	F/T	140	7041680	7.00"	2.75"	7042178	3.76"	2 Turns	6.9 Turns	2.88"
	F/T	180	7041827	7.00"	3.25"	7042178	3.76"	2 Turns	1.3 Turns	2.88"

SLED	POSITION	RATE	SPRING #	FREE LENGTH	SOLID LENGTH	SHOCK #	TRAVEL	SPRING PRELOAD	MAX PRE-LOAD	PRELOAD DIMENTION
440 PRO X FAN	IFS	90/180	7042195	13.00"	5.07"	7042183	6.27"	2 Turns	23.2 Turns	2.50"
	IFS	110	7042052	12.00"	5.00"	7042183	6.27"	1 Turn	20.8 Turns	2.75"
	IFS	130	7042051	12.00"	5.00"	7042183	6.27"	1 Turn	20.8 Turns	2.75"
	IFS	150	7042053	12.00"	5.00"	7042183	6.27"	1 Turn	20.8 Turns	2.75"
	F/T	190	7041870	7.50"	3.25"	7042205	3.74"	3 Turns	8.2 Turns	2.38"
	F/T	181	7041712	7.50"	3.00"	7042205	3.74"	3 Turns	12.2 Turns	2.38"
	F/T	200	7041797	7.50"	3.17"	7042205	3.74"	4 Turns	9.4 Turns	2.38"

SLED	POSITION	RATE	SPRING #	FREE LENGTH	SOLID LENGTH	SHOCK #	TRAVEL	SPRING PRELOAD	MAX PRE-LOAD	PRELOAD DIMENTION
600/700/800 PRO X	IFS	90/180	7042195	13.00"	5.07"	7042215	5.70"	2 Turns	31.5 Turns	2.00"
	IFS	110	7042052	12.00"	5.00"	7042215	5.70"	1 Turn	20.8 Turns	2.75"
	IFS	130	7042051	12.00"	5.00"	7042215	5.70"	2 Turns	20.8 Turns	2.75"
	IFS	150	7042053	12.00"	5.00"	7042215	5.70"	3 Turns	20.8 Turns	2.75"
	F/T	160	7041671	9.00"	3.87"	7042214	3.75"	2 Turns	19.3 Turns	1.75"
	F/T	190	7041870	7.50"	3.25"	7042124	3.75"	3 Turns	8 Turns	2.38"
	F/T	181	7041712	7.50"	3.00"	7042124	3.75"	3 Turns	12 Turns	2.38"
	F/T	200	7041797	7.50"	3.17"	7042124	3.75"	3 Turns	9.3 Turns	2.38"

## OPTIONAL IFS SPRINGS

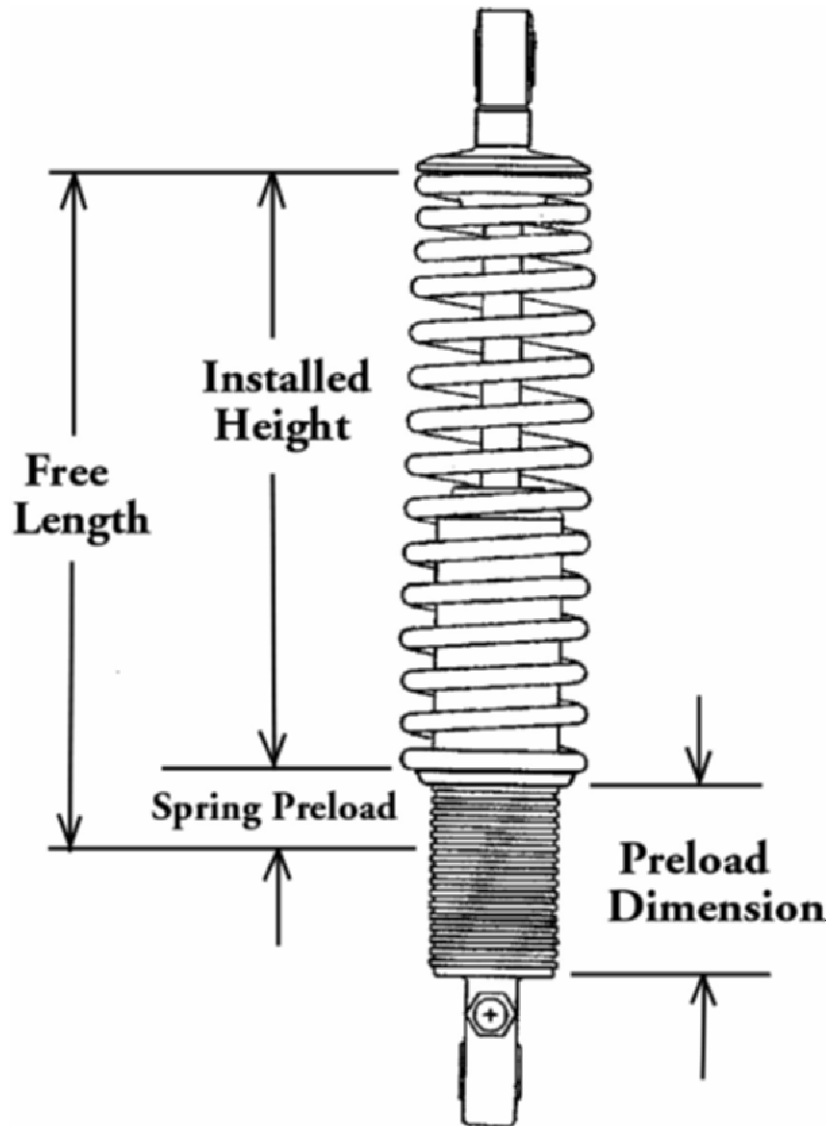
- 7042090 10.5" x 195#/in
- 7042092 10.5" x 155 #/in
- 7041698 4.0" x 100 #/in
- 7041820 4.0" x 140 #/in
- 5133304 1" Transition spacer

## Front Track Shock (F/T)

- 7041680 7.0" x 140 #/in
- 7041827 7.0" x 180 #/in
- 7041712 7.5" x 181 #/in
- 7041797 7.5" x 200 #/in

## TORSION page 1.7

- 7042159/60 Soft-half step
- 7042157/58 Firm-half step
- 7041627/28 Soft-full step
- 7041631/32 Firm-full step

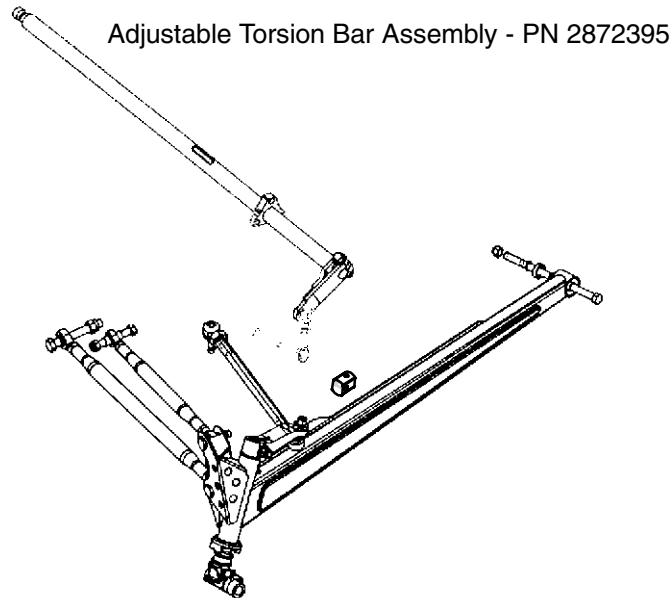


### Torsion Bars Kits - 440 Pro X Fan, 440/600/700/800 Pro X, (42.5" max. width)

Description	Part Number
1/2	STD
5/8	2900183
9/16	2900184

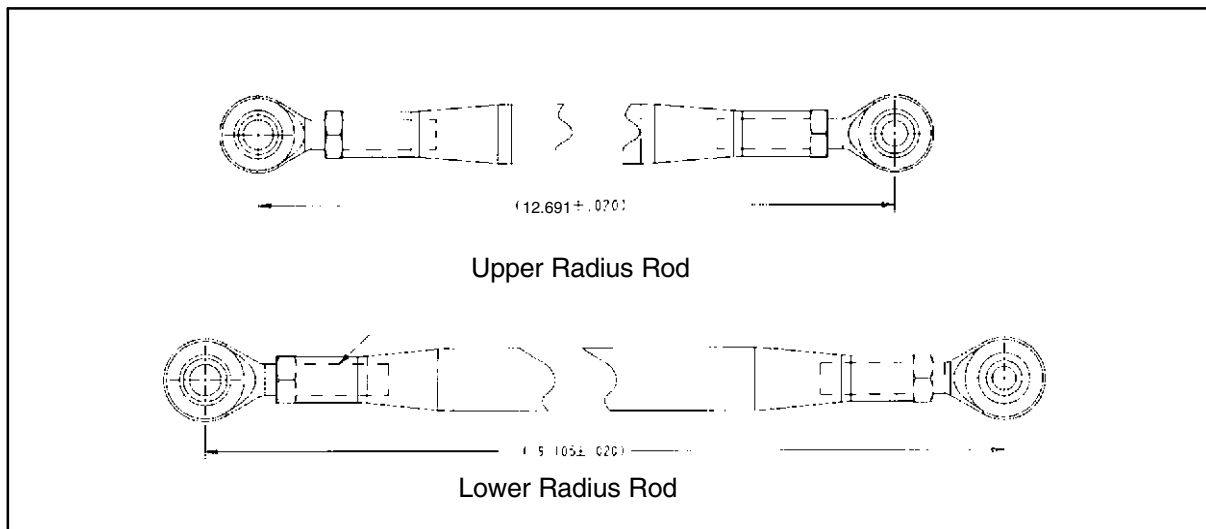
### Adjustable Torsion Bar Assembly

This assembly comes complete with all the necessary hardware to install. Slide in the aluminum block and then attach the torsion bar assembly. Let the glide block center it self at normal ride height, then mark the glide housing and drill through top and bottom. Insert bolt and torque to the correct amount.



### Pro X Radius Rods

440/600/700/800 Pro X, radius rods have both inner and outer rod ends for adjustability. When radius rods are installed, remove shocks and move the front suspension through its range of motion to make sure there is no binding in the rod ends.

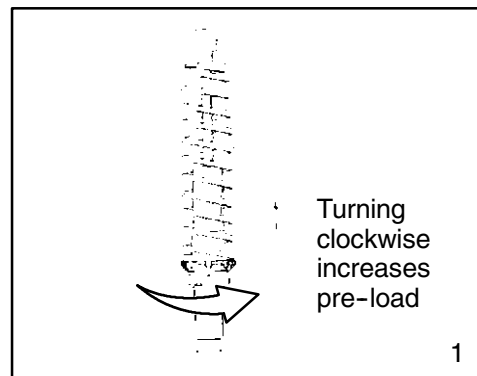




## Front Suspension Setup and Adjustments

Spring pre-load is one of the adjustment options which affects ride. Preload is the amount of pressure at which the spring is held. The longer the installed length of the spring, the less the amount of pre-load; the shorter the installed length of the spring, the more the amount of pre-load. An increase in IFS shock spring pre-load will result in an increase in ski pressure.

To adjust front spring pre-load on threaded adjust models, grasp the spring and turn in a clockwise direction (as viewed from the top of the shock) to increase the pre-load. Turn in a counter-clockwise direction to decrease pre-load. (illustration 1)



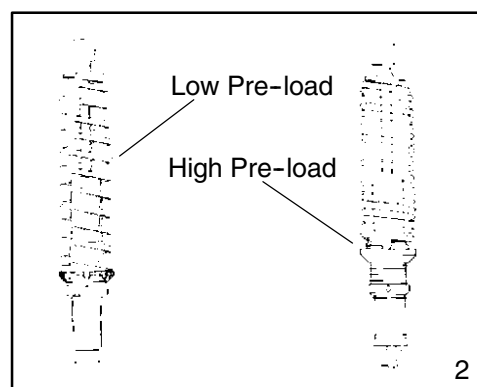
In the illustration 2, high pre-load and low pre-load positions are depicted.

When adjusting, be sure springs on both the left and right sides of the machine are at the same adjustment.

### CAUTION:

Increasing IFS spring pre-load too far can result in shock and bulkhead damage due to "coil binding".

To determine if your machine is using full travel, push the shock jounce bumper down as far as it will go on the shock rod and test ride the machine. (See Illustration 3)



## SPRING RATE

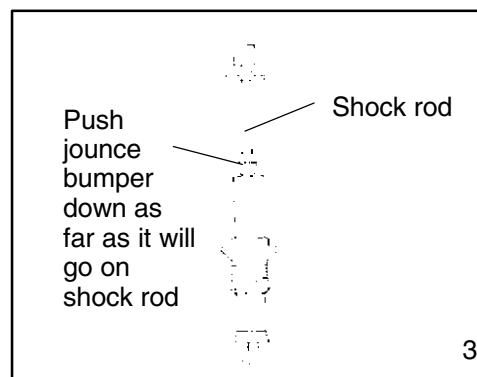
The correct spring rate will allow full travel of the shock with occasional LIGHT bottoming.

If full travel is not being used you can:

- Decrease clicker position (if applicable)
- Install a lighter spring rate
- Revalve shock (if applicable)

If hard bottoming occurs:

- Increase clicker position (if applicable)
- Install a heavier spring rate
- Revalve shock (if applicable)

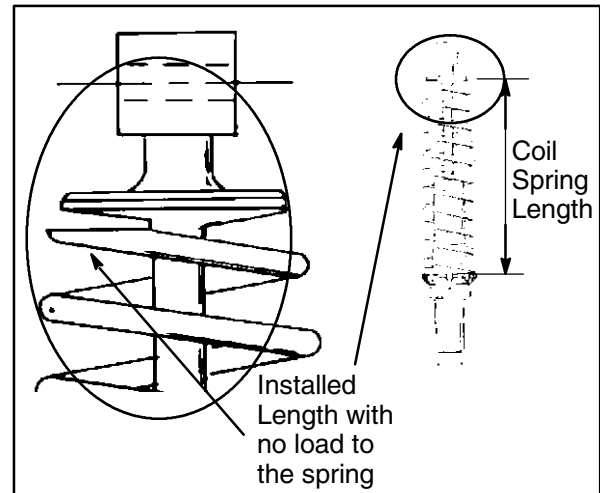


### Springs

Two types of springs are employed in Polaris suspensions, coil springs and torsion springs. Following is some of the terminology used when referring to coil springs.

- **Free length** - the length of a coil spring with no load applied to the spring.
- **Installed length** - the length of the spring between the spring retainers. If the installed length of the spring is less than the free length, it will be pre-loaded.

**NOTE:** All springs must have pre-load or damage to the retainers and shock may occur.



- **Spring rate** - the amount of force required to compress a coil spring one inch. For example, if 100 pounds of force is required to compress a spring 1 inch, the spring rate would be 100 #/in.
- **Straight rate spring** - the spring requires the same amount of force to compress the last one inch of travel as the first one inch of travel. For example, if a 100 #/in. spring requires 100 pounds of force to compress it one inch, 300 pounds of force would compress it three inches, 400 pounds of force would compress it three inches, and so on. Thus if you had a 5 inch 100#/in spring, the amount of force to fully compress this spring would be 500 lbs of force.
- **Progressively wound spring** - the rate of the spring increases as it is compressed. For example, a 100/200 #/in. rate spring requires 100 pounds of force to compress the first one inch, but requires 200 additional pounds to compress the last one inch. For example if you had a 9 inch 100/200 #/in spring the required force to fully compress this spring would be 1000 lbs of force
- **Dual Rate Springs** - When a bump is encountered by the suspension, the force of the bump compresses the spring. If the force were 450 pounds, a 100 #/in. spring would compress 4.5 inches. A 150 #/in. spring would only compress 3 inches. If the suspension had 4 inches of spring travel the 100 #/in. spring would bottom out, while the 150 #/in. spring would have one inch of travel remaining.

## Dual Rate Springs

During initial compression of dual rate springs (two separate springs stacked on top of each other, both springs will compress resulting in an initial spring rate that is a combination of both springs, yet less than either of the individual springs. The chart at right shows the initial combined spring rate using two individual spring rates. The initial spring rate is based on the formula below. For example, if you stack a 150 lb/in. spring in combination with a 225 lb/in. spring, the chart will give you an initial spring rate of 90 lb/in.

As the springs compress, there is a point where the small spring compresses to solid, or the spring retainer contacts the transition spacers. This point is called the transition point. Any compression of the springs after this point is reached will result in a spring rate equal to the spring rate of the long spring. This is true because the smaller spring is no longer being compressed.

$$\text{Initial Rate} = \frac{(\text{Spring Rate \#1}) \times (\text{Spring Rate \#2})}{(\text{Spring Rate \#1}) + (\text{Spring Rate \#2})}$$

Example:

$$\frac{(150 \text{ lb/in}) \times (225 \text{ lb/in})}{(150 \text{ lb/in}) + (225 \text{ lb/in})} =$$

$$\frac{33750}{375} = 90 \text{ lb/in. initial spring rate}$$

Dual Rate Spring Matrix

	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	225	230	235	240	250	255	260	270	275	280	290	300				
K2	50	25.0	27.3	29.2	30.8	31.5	32.1	33.3	34.4	35.3	36.1	36.8	37.5	38.1	38.8	39.9	39.1	39.6	40.0	40.4	40.6	40.7	40.9	41.1	41.2	41.4	41.7	41.8	41.9	42.2	42.3	280		
K1	70	29.3	30.0	32.3	34.3	35.2	36.0	37.5	38.8	40.0	41.1	42.0	42.9	43.6	44.3	44.7	45.0	45.8	46.2	46.7	46.9	47.1	47.4	47.6	47.8	48.0	48.4	48.6	48.9	49.3	49.4	49.7	50.0	
80	27.2	32.3	35.0	37.3	38.4	39.4	41.2	42.8	44.2	45.5	46.7	47.7	48.7	49.6	50.4	51.2	51.9	52.5	53.1	53.4	53.7	54.0	54.7	54.9	55.2	55.6	55.8	56.0	56.2	56.4	56.8	57.0		
90	30.8	34.3	37.3	40.0	41.2	42.4	44.4	46.3	48.0	49.5	50.9	52.2	53.3	54.4	54.9	55.4	56.3	57.1	57.9	58.3	58.7	59.0	59.4	59.6	60.0	60.6	60.9	61.2	61.7	62.0	62.2	62.7	63.2	
95	31.5	35.2	38.4	41.2	42.5	43.7	45.9	47.9	49.8	51.4	52.9	54.3	55.5	56.7	57.2	57.7	58.7	59.6	60.5	60.9	61.3	61.7	62.1	62.4	62.8	63.4	63.8	64.1	64.6	64.9	65.2	65.7	66.2	
98	32.1	36.0	39.4	42.4	43.7	45.0	47.4	49.5	51.4	53.2	54.8	56.3	57.5	58.8	59.4	60.0	61.1	62.1	63.0	63.4	63.9	64.3	64.7	65.1	65.5	66.2	66.5	66.9	67.5	67.8	68.1	68.7	69.2	
100	33.3	37.5	41.2	44.4	45.9	47.4	50.0	52.4	54.5	56.5	58.3	60.0	61.5	63.0	63.8	64.3	65.6	66.7	67.7	68.3	68.9	69.4	69.7	70.1	70.6	71.4	71.8	72.2	73.0	73.3	73.7	74.4	75.0	
110	34.4	38.8	42.6	46.3	47.9	49.5	52.4	55.0	57.4	59.6	61.6	63.7	65.2	66.8	67.5	68.2	69.5	71.0	72.2	72.8	73.3	73.9	74.4	74.9	75.4	76.4	76.8	77.3	78.2	78.6	79.0	79.8	80.5	
120	35.3	40.0	44.2	48.0	49.8	51.4	54.5	57.4	60.0	62.4	64.6	66.7	68.6	70.3	71.2	72.0	73.5	75.0	76.4	77.0	77.8	78.3	78.9	79.4	80.0	81.1	81.6	82.1	83.1	83.5	84.0	84.9	85.7	
130	36.1	41.1	45.5	49.5	51.4	53.2	56.5	59.8	62.4	65.0	67.4	69.6	71.7	73.7	74.6	75.5	77.2	78.8	80.3	81.1	81.7	82.4	83.1	83.7	84.4	85.5	86.1	86.7	87.8	88.3	88.8	89.8	90.7	
140	36.8	42.0	46.7	50.9	52.9	54.8	58.3	61.6	64.8	67.4	70.0	72.4	74.7	76.8	77.8	78.8	80.8	82.4	84.0	84.8	85.6	86.3	87.0	87.8	88.9	90.4	91.0	92.2	92.8	93.3	94.4	95.5	96.5	
150	37.5	42.9	47.7	52.2	54.3	56.3	60.0	63.5	66.7	69.6	72.4	75.0	77.4	79.7	80.8	81.8	83.8	85.7	87.5	88.4	89.2	90.0	90.8	91.6	92.5	93.6	94.4	95.1	96.4	97.1	97.7	98.9	100.0	
160	38.1	43.8	48.7	53.3	55.5	57.6	61.5	65.2	68.6	71.1	73.7	76.7	77.4	80.0	82.4	83.6	84.7	86.9	88.9	90.8	91.7	92.6	93.5	94.4	95.2	96.0	97.8	98.3	99.0	100.5	101.1	101.8	103.1	104.3
170	38.6	44.3	49.6	54.4	56.7	58.8	63.0	66.8	70.3	73.7	76.7	78.7	79.7	82.4	85.0	86.2	87.4	89.7	91.9	93.9	94.9	95.9	96.8	97.8	98.8	99.5	101.2	102.0	102.8	104.3	105.1	105.8	107.2	108.5
180	39.1	45.0	50.4	55.4	57.7	60.0	64.3	68.3	72.0	75.5	78.8	81.8	84.7	87.4	88.7	90.0	92.4	94.7	96.9	98.0	100.0	101.0	101.9	102.9	104.7	105.5	106.4	108.0	108.8	109.6	111.1	112.5	115.5	
190	39.6	45.8	51.2	56.3	58.7	61.1	65.5	69.7	73.5	77.2	80.6	83.6	86.6	89.7	91.1	92.4	95.0	97.4	99.8	100.8	102.0	103.0	104.0	105.1	106.0	108.0	108.8	110.8	111.5	112.4	113.2	114.8	116.3	
200	40.0	46.2	51.9	57.1	59.6	62.1	66.7	71.0	75.0	78.8	82.4	85.7	88.9	91.9	93.3	94.7	97.4	100.2	103.8	106.8	105.6	107.0	108.0	109.1	111.1	112.1	113.0	114.9	115.6	116.7	118.4	120.0	123.5	
210	40.4	46.7	52.5	57.9	60.5	63.0	67.7	72.2	76.4	80.3	84.0	87.5	90.8	93.9	95.3	96.9	102.4	105.0	108.2	107.4	108.6	109.8	110.9	112.1	113.2	115.2	116.2	118.1	119.1	120.0	121.8	125.5	129.5	
220	40.7	47.1	53.1	58.4	61.3	63.9	68.8	73.3	77.6	81.7	85.6	89.2	92.8	96.9	97.5	99.0	102.0	104.0	107.0	106.7	107.8	111.0	111.2	112.4	113.6	114.8	117.0	118.1	119.8	122.2	125.2	128.9	132.5	
230	41.1	47.6	53.7	59.1	62.1	64.7	69.7	74.4	78.9	83.1	87.0	90.8	94.4	97.8	99.4	101.0	104.0	107.0	106.8	111.1	112.4	113.7	115.0	116.4	117.8	119.8	120.9	122.2	125.2	128.9	132.5	136.9	140.2	
240	41.4	48.0	54.2	60.0	62.8	65.5	70.8	75.4	80.0	84.3	88.4	92.3	96.0	96.5	101.2	102.9	106.0	108.1	112.0	113.4	114.6	116.1	117.4	118.7	120.0	122.4	123.8	124.8	127.1	128.2	129.2	131.3	135.3	
250	41.7	48.4	54.7	60.6	63.4	66.2	71.4	76.4	81.1	85.5	89.7	93.8	97.8	101.2	102.9	104.7	108.0	111.1	114.1	115.6	117.0	118.4	119.8	121.1	122.4	125.0	126.2	127.5	129.8	131.0	132.1	134.3	138.4	
260	41.9	48.8	55.2	61.1	64.1	66.9	72.2	77.3	82.1	86.7	91.1	95.1	98.0	102.8	104.6	106.4	109.8	113.0	116.2	117.7	119.2	120.6	122.0	123.4	124.8	127.5	128.7	130.0	132.5	134.8	137.1	139.3	143.5	
270	42.2	49.1	55.6	61.7	64.6	67.5	73.0	78.2	83.1	87.8	92.2	96.4	100.5	104.5	106.8	110.2	113.4	116.7	119.9	121.2	122.5	123.8	125.1	126.4	129.2	130.5	131.8	133.5	135.5	137.5	139.6	142.1	146.5	
280	42.4	49.4	56.0	62.2	65.2	68.1	73.7	79.0	84.0	88.6	93.3	97.7	101.4	105.4	108.5	111.7	114.9	118.2	121.4	122.7	124.0	125.3	126.6	128.0	130.3	131.6	133.2	135.2	137.2	139.3	141.8	146.3	150.9	

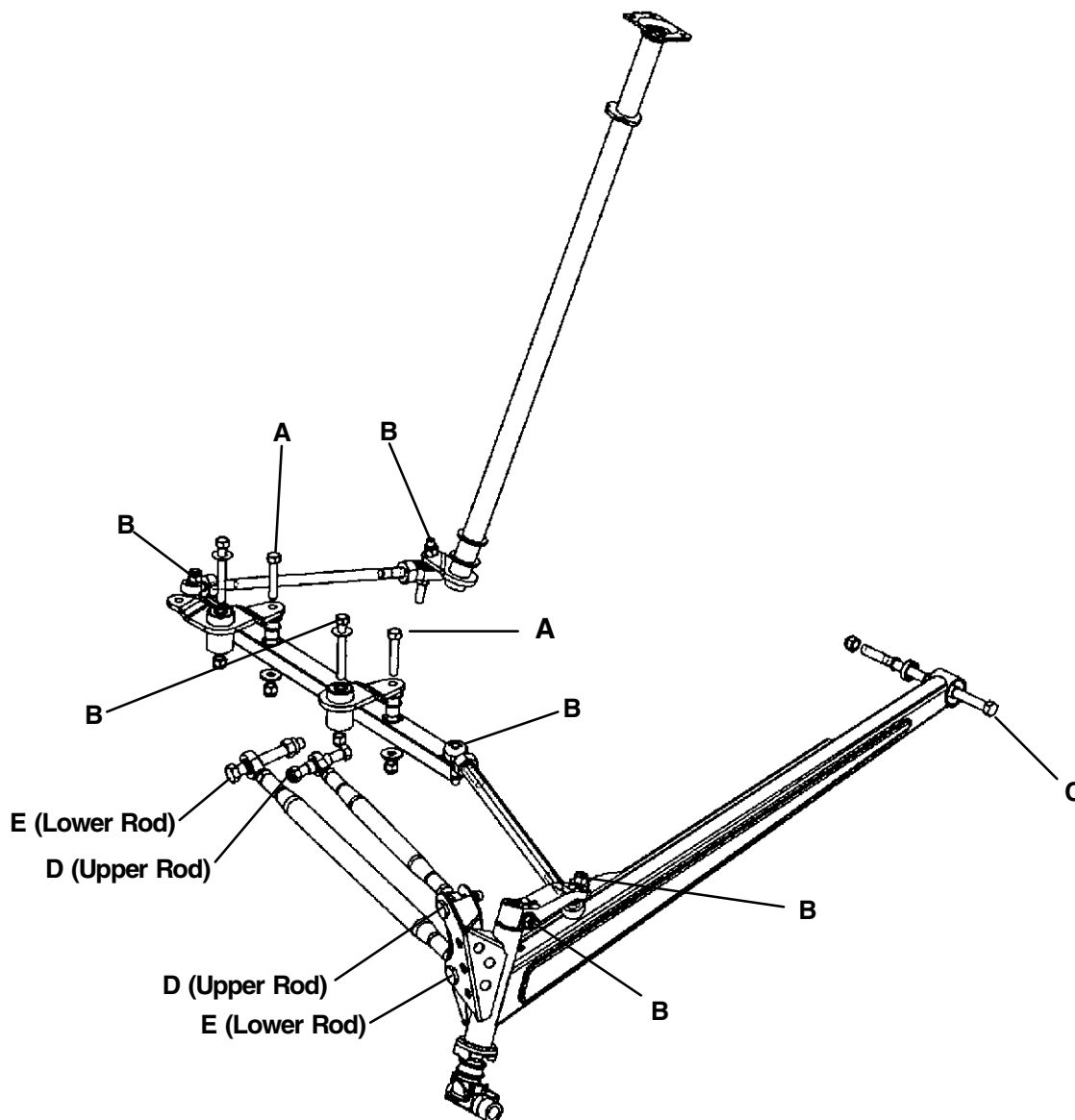
Formula: Initial Rate = (K1\*K2)/(K1+K2)

### Torque Application List

Due to the special grade bolts and nuts required for specific applications, observe the following torque values in the areas specified. Refer to exploded views for torque values and orientation of components and fasteners.

#### 440 Pro X Fan, 440 / 600 / 700 / 800 EDGE Pro X

Illustration depicts proper orientation of rod ends and bolts on steering components.



#### Torque Specifications

A	16-20 ft lbs(22-28Nm)
B	28-30 ft.lbs (38-41 Nm)
C	35-40 ft.lbs (47-54 Nm)
D	55-65 ft.lbs (61-90Nm)
E	90-100 ft.lbs (124-138 Nm)

◆ Replace locking fasteners if removed.

Apply Premium All Season Grease, PN2871322 (3oz.), to all grease zerks located on suspension assemblies.

## Inspection

Prior to performing steering alignment, inspect all steering and suspension components for wear or damage and replace parts as necessary. Refer to steering assembly exploded views in this chapter for identification of components and torque values of fasteners. While disassembling, make notes of what direction a bolt goes through a part, what type of nut is used in an application, in which direction do the steering arms go on - weld up or weld down, etc.

Some of the fasteners used in the IFS are special and cannot be purchased at a hardware store. Always use genuine Polaris parts and hardware when replacing front end components. Review steering adjustment guidelines on page 6.14 before making adjustments.

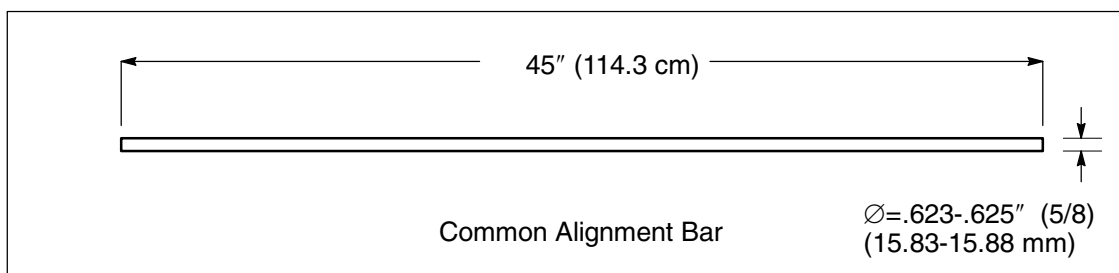
The following components must be inspected before each event.

**NOTE:** Always follow rod end engagement guidelines found later in this chapter. Maximum setup width must be checked whenever front suspension components are adjusted or replaced.

- ☐ Tie rods and tie rod ends
- ☐ Radius rods and radius rod ends
- ☐ Torsion bar and bushings / linkage (where applicable)
- ☐ Handlebars and steering post assembly
- ☐ Spindles and bushings
- ☐ Trailing arms and bushings
- ☐ Skis and skags
- ☐ Bell crank / Pitman arm / Idler arm
- ☐ Steering arms
- ☐ Shock absorbers, shock mounts, springs
- ☐ All related fasteners - check torque. Refer to steering exploded views at the beginning of this section.
- ☐ Grease all fittings.

## Alignment Bar Specifications

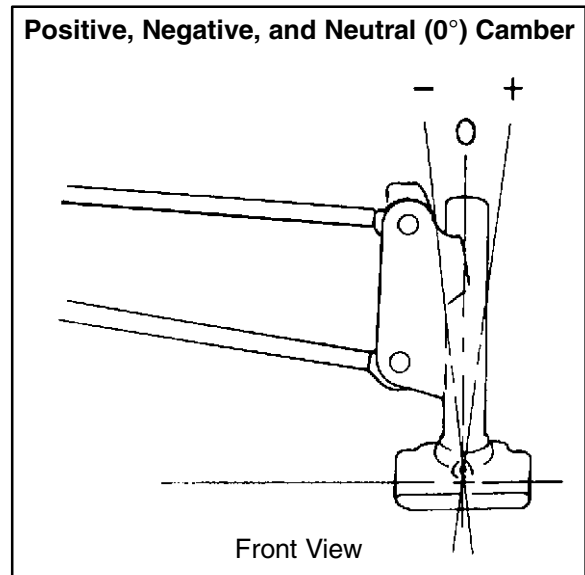
<b>Material:</b>	<b>C-1018 Steel</b>
<b>Diameter:</b>	<b>.623" - .625" (5/8") (15.82 - 15.87 mm)</b>
<b>Length:</b>	<b>45" (114.3 cm)</b>



### Camber Definition - All IFS

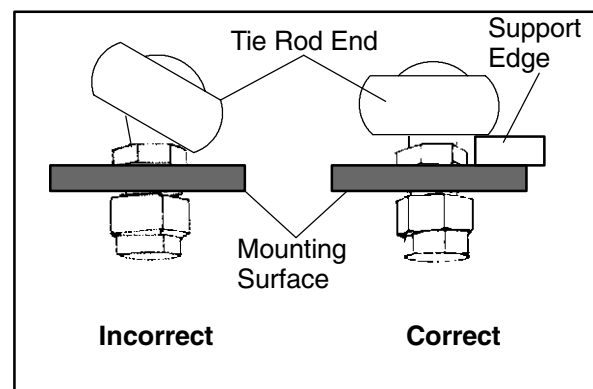
The following definitions of camber use automotive terminology to describe positive and negative positions. Refer to the illustration at right.

- 0 (Neutral) Camber - Spindle is 90° (perpendicular) to ground
- + (Positive) Camber - Spindle bottom is canted inward toward chassis
- - (Negative) Camber - Spindle bottom is canted outward from chassis



### Radius Rod and Tie Rod End Torque Procedure

Radius rod and tie rod ends must be parallel to their respective mounting surface after tightening jam nut as shown at right. Hold tie rod or radius rod and tighten jam nut. If possible, support the edge of the rod end as shown to keep it from rotating out of position until jam nut is tight. When tie rod ends are properly tightened, the tie rod should rotate freely approximately 1/8 turn.



### Rod End Engagement Guidelines - All IFS

**Tie Rod Or Radius Rod End Must Engage Rod A Minimum Of 2x Thread Diameter When Adjustment Is Complete**

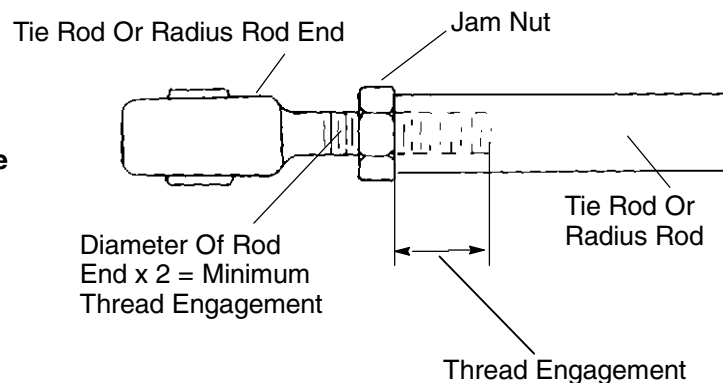
**EXAMPLE**

**7/16" Rod End x 2 = 7/8"**

**Minimum Thread Engagement = 7/8"**

**11mm x 2 = 22mm**

**Minimum Thread Engagement = 22mm**



## 2003 PRO X IFS Steering Alignment Specifications

The following information is to be used for 2003 Pro X Polaris Snowmobile front suspension setup. The data in the following table is based on the 2003 Pro X Polaris factory settings. **Maximum Width and Camber measurements are to be taken with the front end elevated and shocks at full extension. Toe alignment is measured at ride height.**

Suspension Type	Maximum Setup Width ± .025" (6mm)	Camber	Toe Out (At Ride Height)
<b>42.5" Pro X</b> Pro X Fan (Ryde FX shock) 440 Pro X (Walker Evans)	41.60"	1.75" ±.31"	1/8" - 1/4"  TOE OUT  At Normal Ride Height
<b>42.5" Pro X</b> Pro X 600 / 700 / 800	41.72"	.53" ±.31	1/8" - 3/8"  TOE OUT  At Normal Ride Height

**WIDTH NOTE:** Width is measured in inches from the center of the spindles near the grease fitting for the ski mount bolt located at the base of the spindle. The tolerance on this measurement is  $\pm 1/4"$ .

**TOE ADJUSTMENT NOTE:** Toe is measured in inches with the machine on the ground and resting at normal ride height - not full rebound. Measure at a point 10" (254mm) forward of the ski mount bolt and 10" behind the ski mount bolt, preferably on the centerline of carbide skags. Note: Measurements to points on the skis may be inaccurate.

**NOTE:** *Camber* measurement is taken in inches from top of alignment bar to the top of ski mount hole in the spindle (bushing removed).

## STEERING / FRONT SUSPENSION

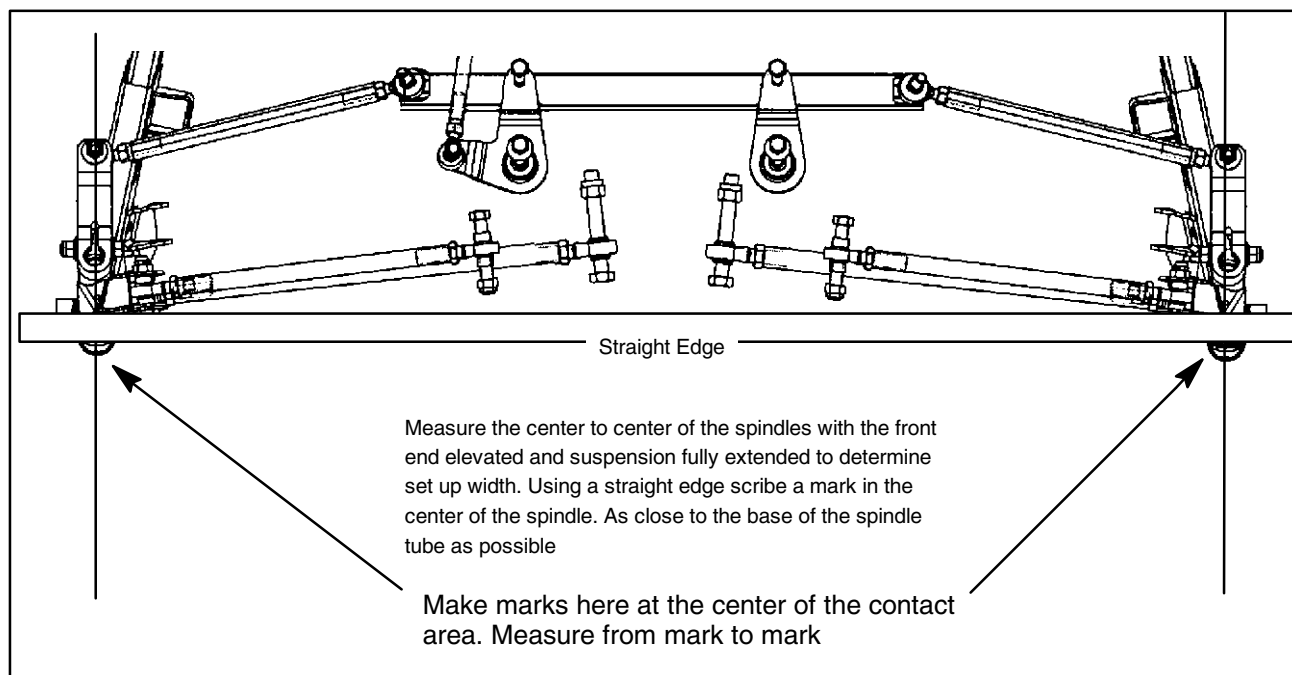
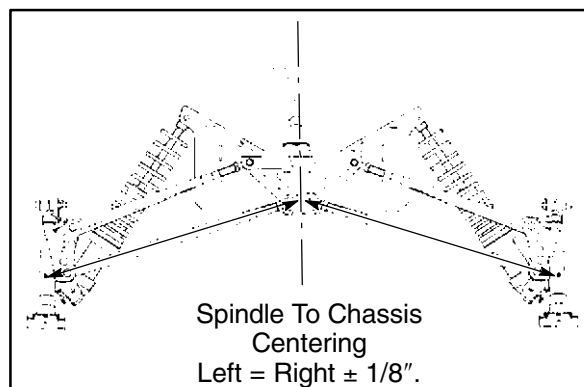
Prior to performing steering alignment, the suspension should be inspected for damage or wear and replacement parts installed as required. See inspection on page 6.11.

### ⚠ WARNING

A maximum set up width is listed in the chart on page 6.15. Maximum set up width is the maximum allowable distance between ski spindle centers with front end of vehicle off the ground and suspension fully extended. The Maximum Set Up Width specifications are maximum width measurements, and are critical to ensure adequate torsion bar engagement with the trailing arm. If the suspension is set too wide, **the torsion bar may disengage from trailing arm**. Do not attempt to set the suspension wider than the specified Maximum Set Up Width.

### Spindle Centering / Set Up Width / Camber Adjustment

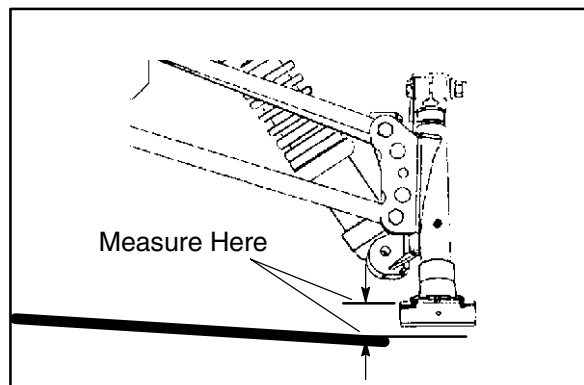
1. Make sure the track is properly aligned. Refer to Maintenance Chapter for procedure. This will be used as a reference point for final toe out measurement.
2. Support the front of the machine 1-2" (2.5-5.1 cm) with the skis off the floor.
3. Remove skis and ski pivot bushings.
4. Disconnect adjustable torsion bar linkage where applicable.
5. Measure spindle to chassis centering as shown and record measurement. Both spindles should be an equal distance  $\pm 1/8"$  (3 mm) from the center of the chassis after adjusting camber, width. This measurement is controlled by adjusting radius rod length.
6. Measure set up width and record. This measurement is controlled by adjusting radius rod length, and must not exceed the Maximum Setup Width listed in the appropriate table (at the front of this section) after all steering adjustments are complete. See illustration below for procedure.  
**NOTE:** Camber / Width / and Centering are dimension that depend on each other. Each one should be checked after any changes made.



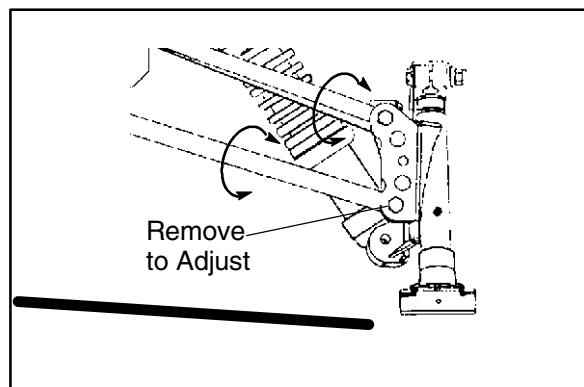


## Camber Adjustment

1. Determine which spindle requires the greatest amount of correction by installing the alignment bar through one side to the opposite spindle. Remove the bar and install it through the other side to the opposite spindle. Measure from the top of the bar to the top of the hole. Turn the upper and lower radius rods (like a turn buckle) to achieve the appropriate camber width.  
**NOTE:** Camber / Width / and Centering are dimensions that depend on each other. Each one should be checked after any changes.



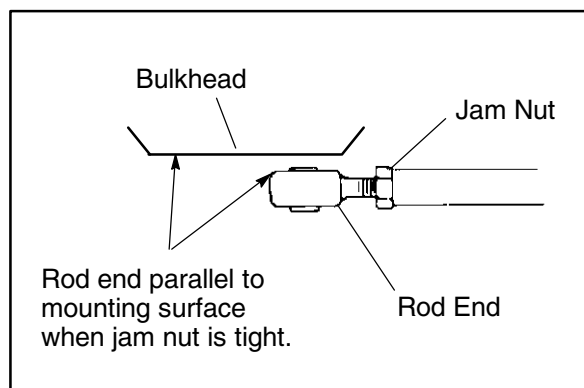
2. Using a 3/8" (1 cm) drive 11/16" (1.7 cm) crow foot wrench and 20" (51 cm) long 3/8" (1 cm) drive extension, loosen the radius rod end jam nut. Remove the lower radius rod bolt from the spindle requiring the most camber correction. Adjust the opposite side next.
3. To adjust camber, change lower radius rod length until alignment bar measurement is within specified range for each spindle. Refer to charts on page 6.15 for camber specifications. On models with neutral camber (0) the bar should slide freely through both spindles ( $\pm$  tolerance).



### CAUTION:

Radius rod ends must remain parallel to the bulkhead after rod end jam nuts are tightened to specified torque. See illustration at right.

4. Tighten all jam nuts. Torque radius rod attaching bolts to specification.



### WARNING

After camber adjustment is complete, be sure to measure set up width outlined on page 6.16 and compare to specifications. Do not attempt to set suspension wider than the specified maximum set up width. If set up width exceeds maximum, adjust upper and lower radius rods equally to maintain camber adjustment.

#### Radius Rod End Jam Nut Torque -

8-14 ft. lbs. (11-19 Nm)

#### Radius Rod Attaching Bolt Torque -

3/8" (outer) 28-30 ft. lbs. (38.6-41.4 Nm)

7/16" (inner top) 35-40 ft. lbs.

(48-55 Nm)

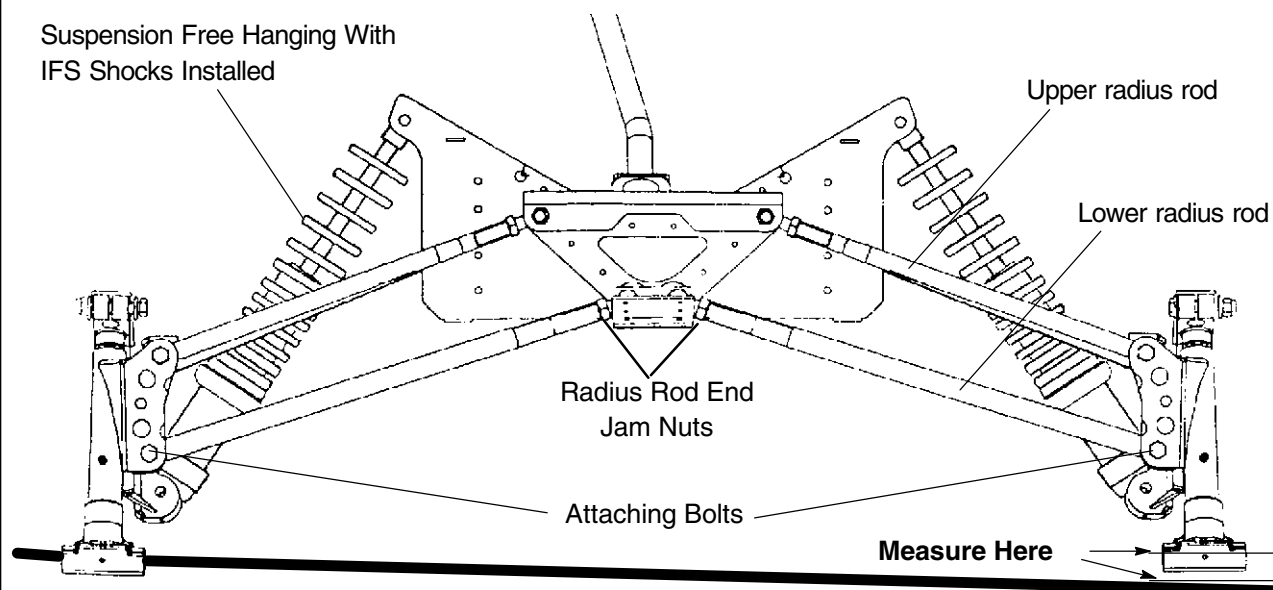
1/2" (inner bottom) 40-50 ft. lbs.

(55-69 Nm)

## CAMBER INSPECTION

### All Models - Elevate Front End - Shocks Installed

Typical CRC Shown - Style varies by model



Refer to specifications for:

- IFS type
- Specified amount of camber

☐ To adjust, lengthen or shorten appropriate lower radius rod until top of bar is within specified camber distance. Measurement should be taken from *top of alignment bar to top of ski pivot bushing hole in spindle (bushing removed)*. Radius rod must be re-attached to trailing arm before measuring.

## CAMBER - ACCEPTABLE RANGE

**NOTE:** Measure from top of bar to the top of the hole.

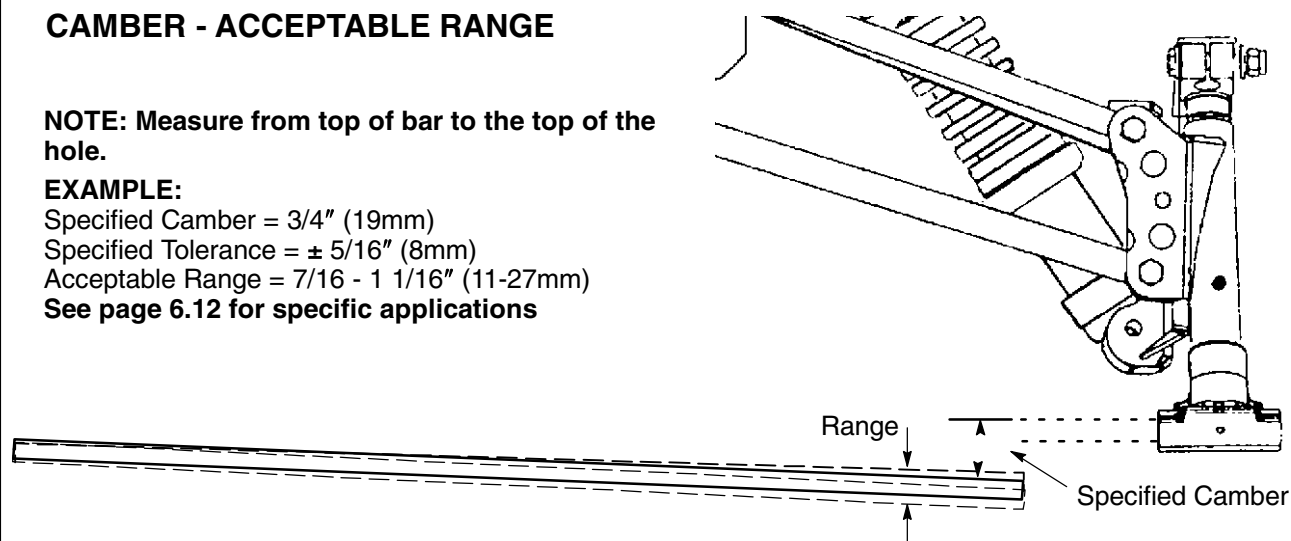
### **EXAMPLE:**

Specified Camber =  $3/4"$  (19mm)

Specified Tolerance =  $\pm 5/16"$  (8mm)

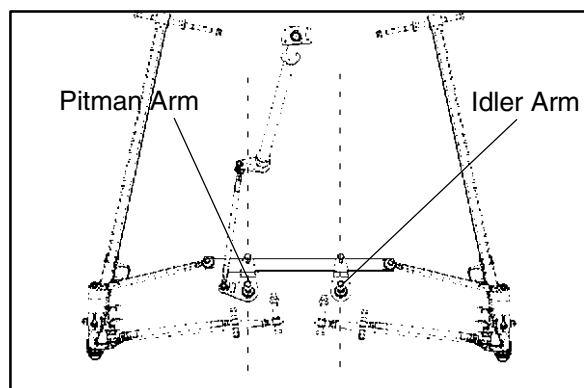
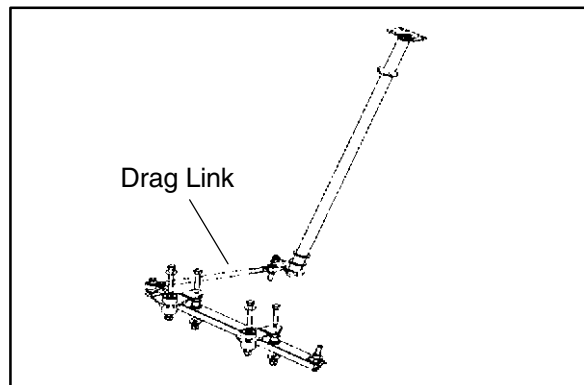
Acceptable Range =  $7/16 - 1\ 1/16"$  (11-27mm)

See page 6.12 for specific applications



**Handlebar Centering Adjustment**

1. Remove the outer rod ends from the steering arms. Center the steering rack and lock down
  2. Center the handlebars by adjusting the drag link length. Tighten the drag link jam nuts.
  3. Lubricate ski pivot bushings with Polaris Premium All Season Grease and install in spindle. Torque ski bolts to specification. Install new cotter pin in castle nut.
- 
4. Perform Toe Adjustment on page 6.18.
  5. Reinstall the L.H and R.H tie rods and tighten the rod end jam nuts



## Toe Adjustment, All Models

Toe adjustment on all models must be performed with the vehicle weight on the suspension, at Normal Ride Height.

1. Make sure the track is properly aligned. This will be used as a reference point for toe out measurement.

2. To obtain normal ride height of the front suspension, lift the front end 3–5" with the front bumper. Slightly compress the front bumper several times, working the suspension and front skis until an average is obtained.

**NOTE:** To prevent carbide skags from grabbing, make sure the surface under the skis will allow full side-to-side movement. Avoid rough concrete, asphalt, or carpet which may cause carbide skags to grab or catch and restrict movement.

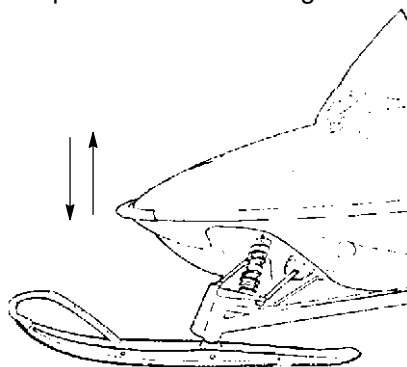
**Radius Rod End Jam Nut Torque -**  
**8-14 ft. lbs. (11-19 Nm)**

**SERVICE HINT:** Before final measurement is taken, skis should be pushed together lightly at the tips to remove play in the steering components. This will help achieve accurate measurement. If a strap is used be sure it is not *too tight* or it will alter measurement (this is most important on models with composite skis).

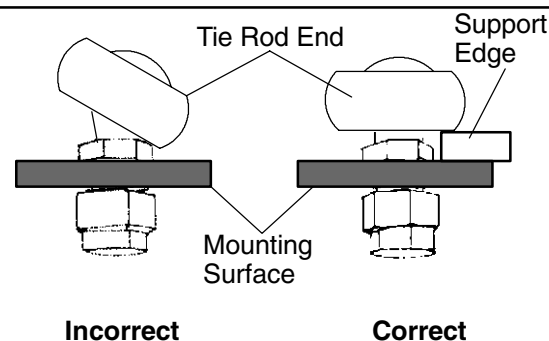
## Toe Alignment: All Models

Measurement "A" should be  $\frac{1}{8}$ " -  $\frac{1}{4}$ " (3.17 - 6.35 mm) greater than measurement "B" at normal ride height.

Lift 3-5" (7.6-12.7 cm) and work suspension to find average



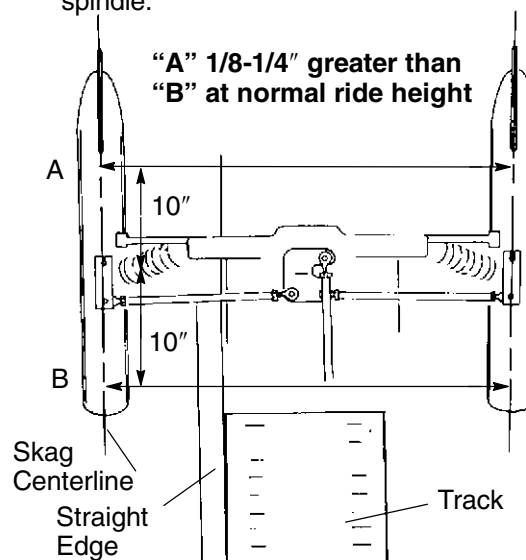
**Toe Adjustment  
Normal Ride Height**



**Incorrect**

**Correct**

**NOTE:** Measurements A&B should be taken 10" (254 mm) from center of ski spindle.

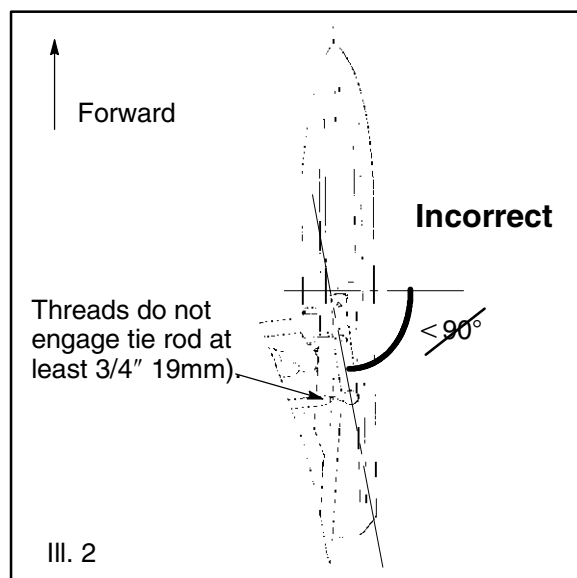
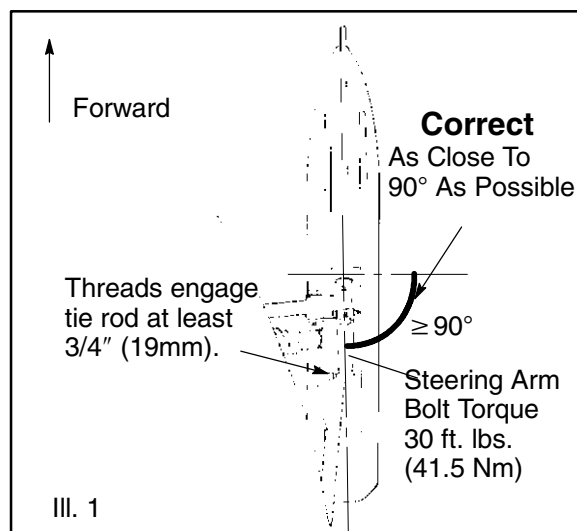


## STEERING ARM ORIENTATION FOR 440 Pro X Fan, 440 / 600 / 700 / 800 Pro X

### ⚠ WARNING

Steering arm orientation is important to ensure proper steering tie rod end thread engagement and steering performance. Always mark steering arms and spindles before removal for reference upon reassembly. When installing new parts or after steering arm installation, refer to the illustrations and text below. Always verify proper steering operation after completing adjustments or repairs.

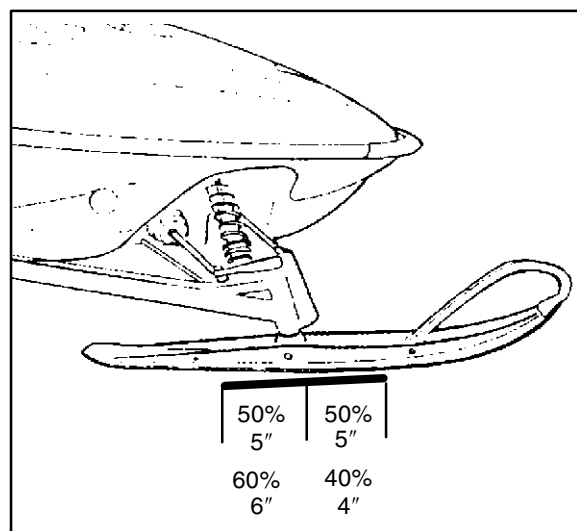
1. The steering arms on each spindle should be parallel to slightly inward in relation to each ski. When correctly installed (III. 1) the centerline of the ski and centerline of the ski bolt hole in the spindle will form (approximately) a 90° angle or slightly greater.
2. If the steering arm is installed incorrectly the threads of the steering tie rod end will not engage the tie rod sufficiently, and the angle formed between ski and ski bolt centerlines is considerably less than 90° as shown at right.
3. Reinstall torsion bar linkage (where applicable). Torque attaching bolts to specification.



### Carbide to Ski Placement

A good starting point for placement of carbide is 50/50 (50% forward and 50% behind the ski mounting bolt). This can be varied depending on the aggressiveness of the carbide and the strength of the driver. Make sure the leading edge of the carbide has a small chamfer.

More carbide trailing will cause the machine to track straighter, but steering effort will increase.



## STEERING / FRONT SUSPENSION

Arvin™ (IFP) IFS SHOCKS							
Shock PN	Extended Length (in)	Collapsed Length (in)	Stroke (in)	Shock Rod (in)	IFP Depth (in)	Shaft Part #	PSI
7042215	17.32	13.38	5.70	.62	6.21	1700189	200
7042183	18.00	13.48	6.27	.50	6.95	1700158	200

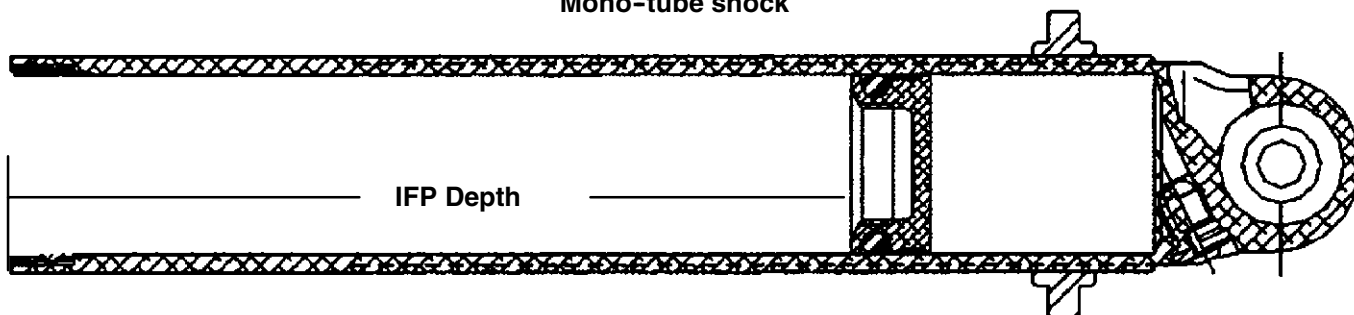
Walker Evans Racing Shocks (IFP) IFS SHOCK							
Shock PN	Extended Length (in)	Collapsed Length (in)	Stroke (in)	Shock Rod (in)	IFP Depth (in)	Shaft Part #	PSI
7042180	18.00	11.738	6.27	.625	2.00	1800102	200

\* Jounce Bumper Removed

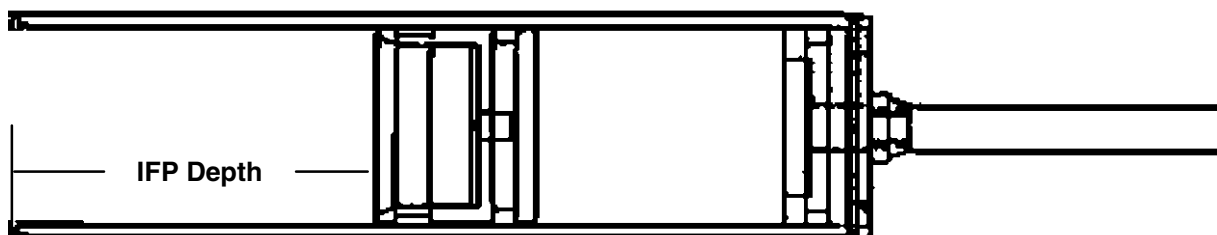
Measure IFP depth from lip of the piston as shown using the IFP depth tool (for Ryde FX use PN PS-45261) or a dial caliper.

### SEE CHAPTER 7 FOR REBUILDING STEPS

Mono-tube shock



Remote Reservoir shock

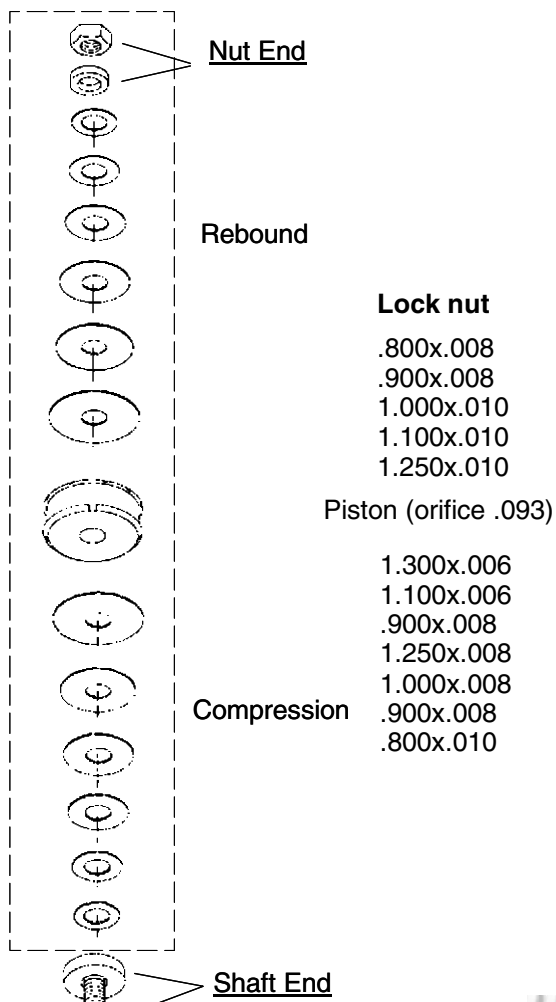


## 440 Pro X Fan IFS Shock (Ryde FX) P/N 7042183

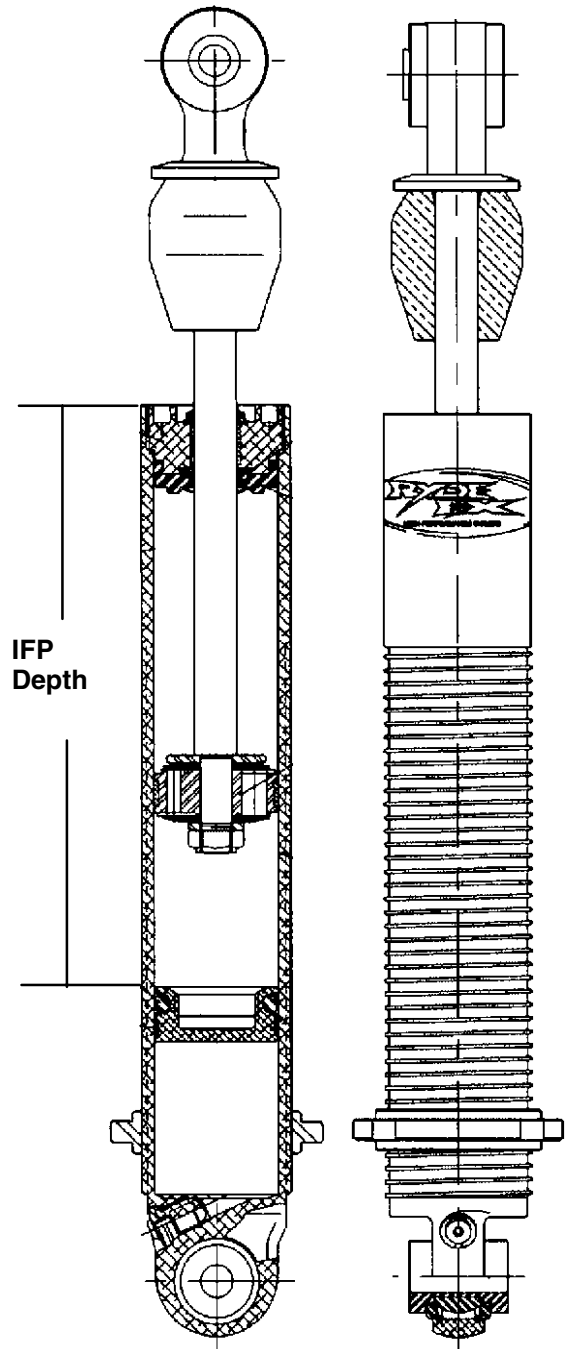
### Ryde FX Shock - PN 7042183 Shock Design Details (Inches)

Travel .....	6.27
Extended Length .....	18.00
Compressed Length ..	11.73
IFP Depth .....	6.27
Nitrogen .....	200 psi
Oil Capacity .....	170 cc

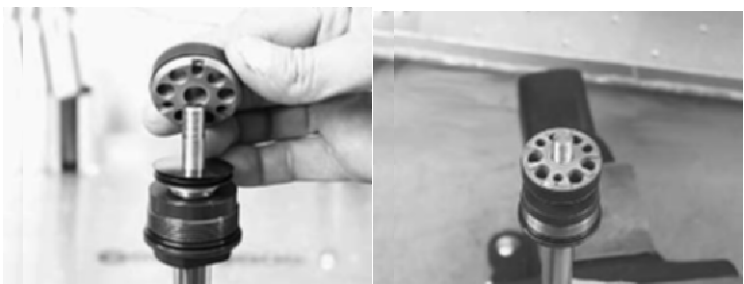
#### Valving



Stack shown as placed on the shock rod with rod in a vice.



#### PISTON ORIENTATION



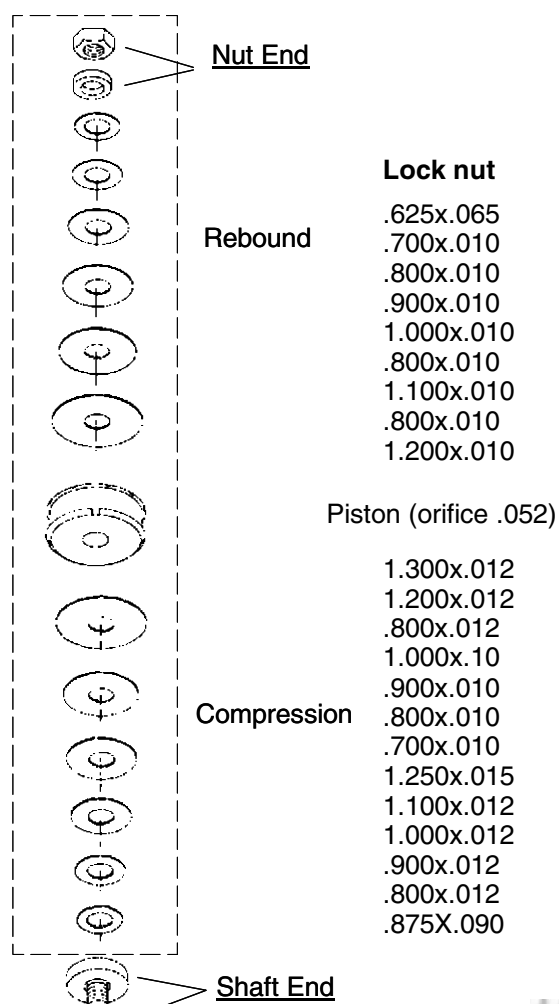
## 440 Pro X IFS Shock (Walker Evans Racing Shock) P/N 7042180

### Ryde FX Shock - PN 7042180

#### Shock Design Details (Inches)

Travel .....	6.27
Extended Length .....	18.00
Compressed Length ..	11.738
IFP Depth .....	2.00
Nitrogen .....	200 psi
Oil Capacity .....	235 cc

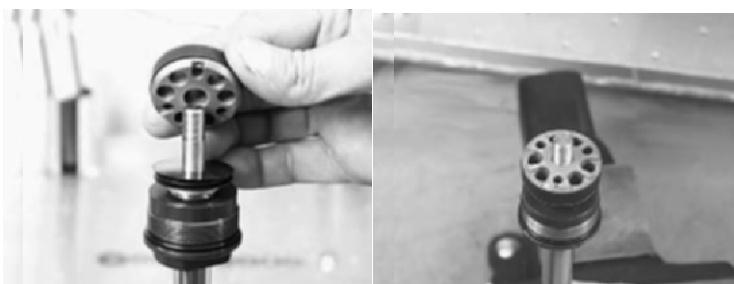
### Valving



Stack shown as placed on the shock rod with rod in a vice.

IFP Depth

### PISTON ORIENTATION



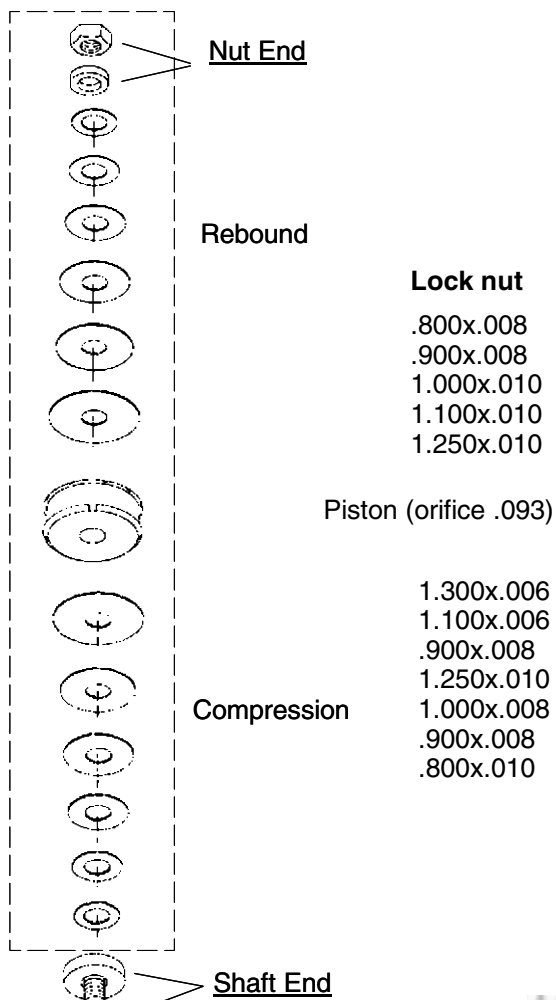


## 600/700/800 Pro X IFS shock (Ryde FX) P/N 7042215

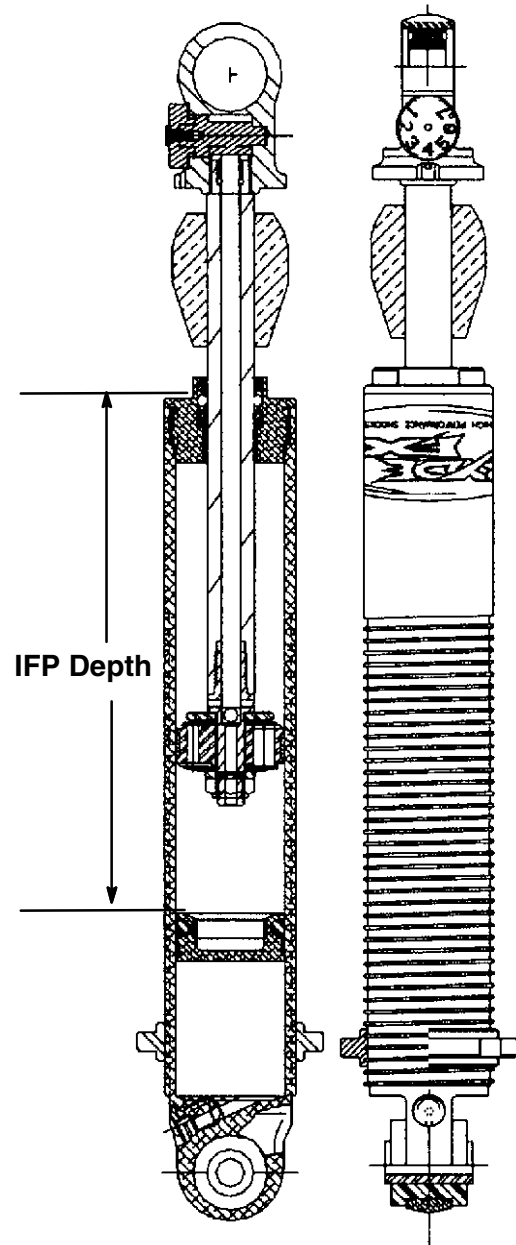
### Ryde FX Shock - PN 7042215 Shock Design Details (Inches)

Travel .....	6.21
Extended Length .....	17.32
Compressed Length ..	11.62
IFP Depth .....	6.21
Nitrogen .....	200 psi
Oil Capacity .....	148 cc

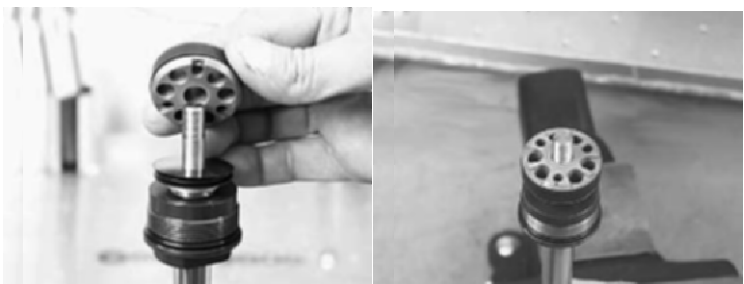
### Valving



Stack shown as placed on the shock rod with rod in a vice.



### PISTON ORIENTATION





# ***CHAPTER 7***

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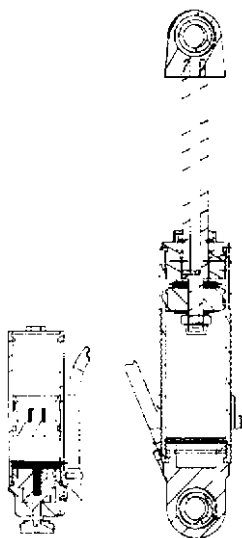
## ***REAR SUSPENSION***

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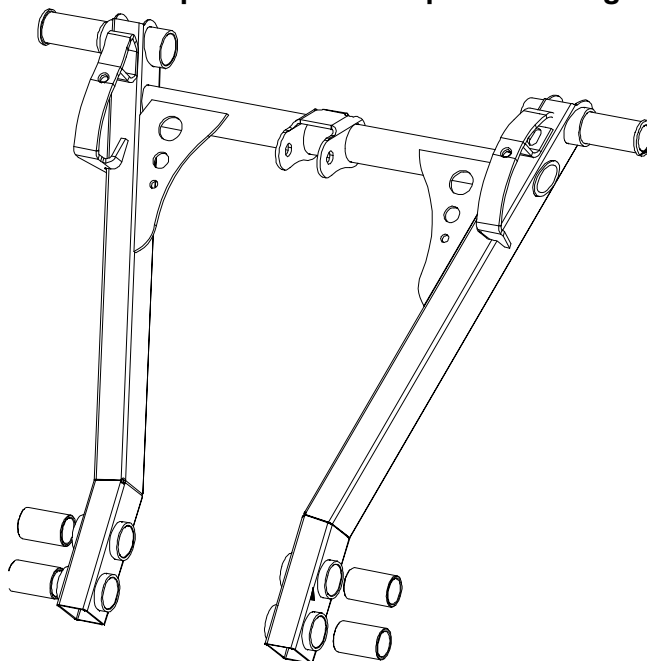


## Pro X Rear Suspension Improvements

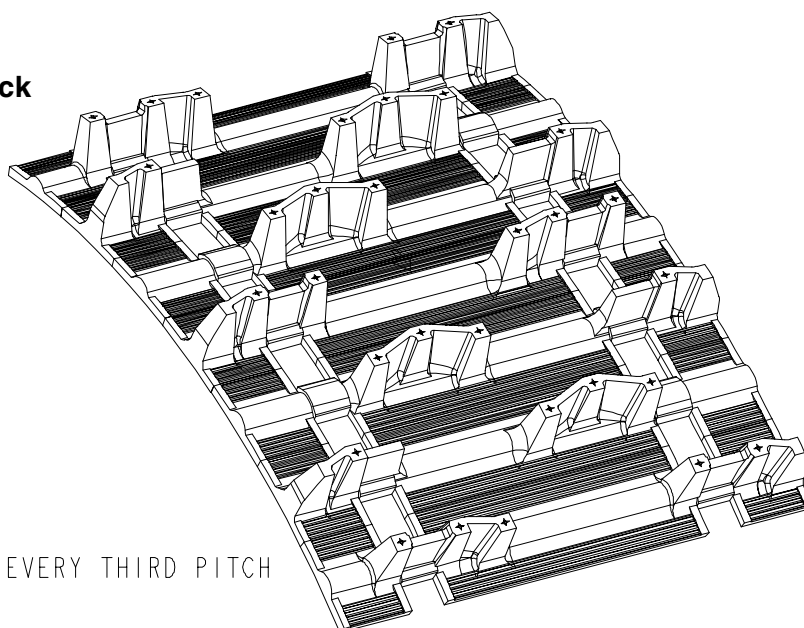
### ■ Walker Evans Racing Shocks



### Improved Front Torque Arm design



### New 1 5/8" "SNO X" Pattern Track



#### NOTES:

PATTERN:	SNO-X
TRACK LENGTH:	121"
TRACK WIDTH:	14"
TREAD HEIGHT:	1.625"

CLIP:	GUIDE EVERY THIRD PITCH
-------	-------------------------

## REAR SUSPENSION/TRACK/TRACTION

### Suspension Torque Specifications

3/8" suspension mounting bolts .....	35 - 40 ft. lbs. (48 - 55 Nm)
7/16" suspension mounting bolts (PRO X) .....	55 - 60 ft. lbs. (76 - 83 Nm)
Shock rod bolts (do not over torque) (PRO X) .....	25 ft. lbs. (34.6 Nm)
Xtra-10 and Edge Rear Track Shock Upper Pivot Torque .....	25 ft.lbs (34.6 Nm)

Shock rod bolts (do not over torque) ..... 35 ft. lbs. (48.4 Nm)

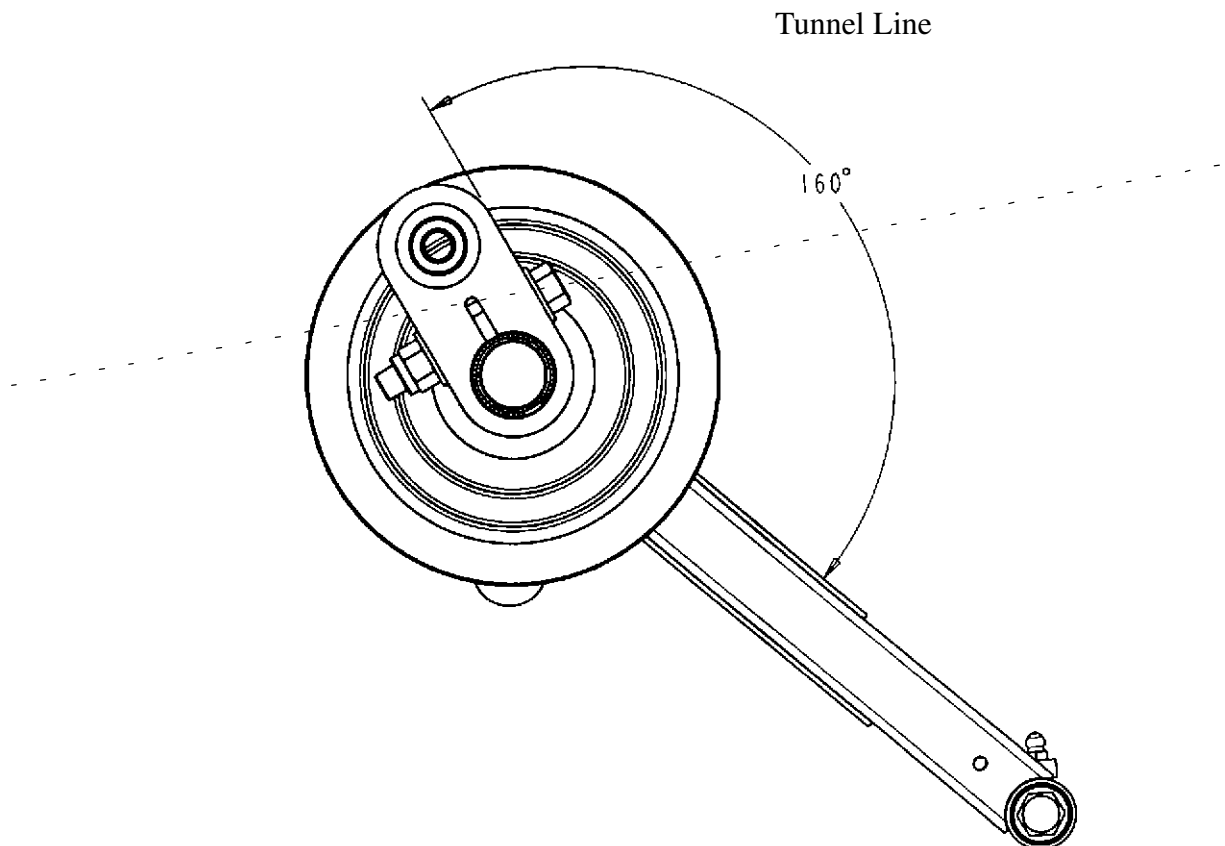
\* Shock rods must pivot freely after torquing

### Rear Suspension Specifications

Model	Rear Suspension	Front Track Shock PN	Front Track Shock (Type)	Front Track Shock Spring PN*	Front Track Shock Spring Rate (lb./in.)	Rear Track Shock PN	Rear Track Shock Desc.	Torsion Spring Part Number* Left / Right	Torsion Spring Diameter / Angle (Rear Shock Spring Rate)	
Pro X Fan	Pro X	7042205	Ryde FX IFP	7041870	190#/in	7042184	Ryde FX IFP res	7042101/7042102	.347(sq.)	77°
440 Pro X	Pro X	7042178	Walker Evans IFP res	7041671	160#/in	7042179	Walker Evans IFP res	7042101/7042102	.347(sq.)	77°
600/700/800 Pro X	Pro X	7042214	Ryde FX IFP res	7041671	160#/in	7042213	Ryde FX IFP res	7042157/7042158	.359(sq.)	77°

\*All springs shipped as service parts are black. You must add a suffix of "-067" to spring part number when ordering

### Rear only Xtra Travel Arm orientation



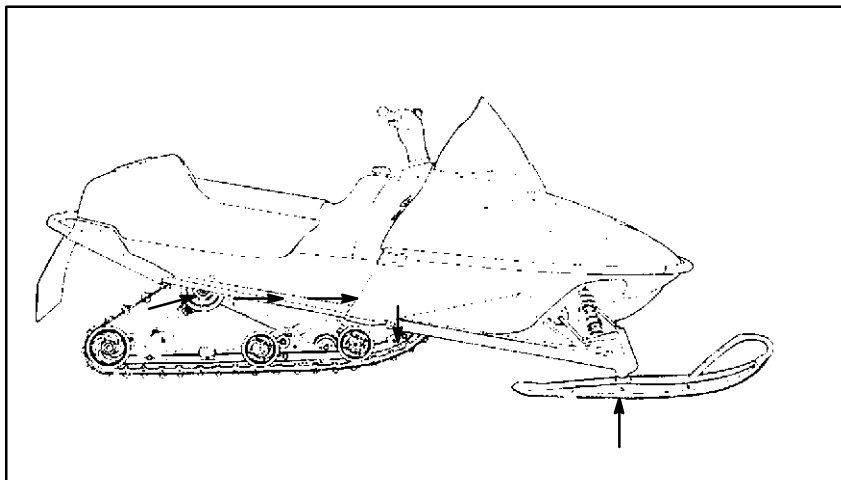
### Rear Suspension Operation

The primary function of the rear suspension is to provide a comfortable ride in all types of riding conditions. It separates the rider from the ground, while allowing for complete vehicle control. The rear suspension also must provide weight transfer and maintain track tension.

The rear suspension has many adjustable features for fine tuning to achieve optimum comfort. The suspension can be adjusted to suit rider preference and deliver excellent performance for a given set of conditions. It should be noted, however, that suspension adjustments involve a compromise or trade off. A machine set up to perform well in the moguls would not suit the preference of a groomed trail rider.

### Weight Transfer

The shifting of weight from the skis to the track is called weight transfer. As engine torque is applied to the drive axle the torque is transferred to the track, pulling it forward. This energy also tries to pull the suspension forward. The front torque arm reacts to this force by pushing down on the front of the track, in effect applying more weight to the front of the track and reducing the weight on the skis. It is important to note that energy used to lift the front of the machine is not available to push the vehicle forward.



Changing the angle of the front torque arm changes the suspension's reaction to the force. Adjusting the length of the limiter strap will change the front torque arm angle. Shortening the strap limits the extension of the front of the suspension; reducing the angle of the torque arm and increasing ski pressure during acceleration. Lengthening the strap allows the front of the suspension to extend further; increasing the angle of the torque arm and decreasing ski pressure during acceleration. Limiter strap adjustment has a great affect on weight transfer. Limiter straps only affect ski pressure during acceleration.

Front track shock spring preload also affects weight transfer. A stiffer spring and/or more preload on the spring transfers more weight to the track. A softer spring and/or less preload keeps more weight on the skis. Keep your riding application in mind when choosing springs and setting spring preload. Soft springs/preload will increase ski pressure, but may bottom out. Stiff springs/preload will provide more track pressure (reduced ski pressure), but may result in a less comfortable ride.

During acceleration, the rear of the suspension will compress and the IFS will extend, pivoting the machine about the front torque arm. Because of this pivoting effect, rear spring and spring preload also have some effect on weight transfer. Softer rear springs, or less preload, allow more weight transfer to the track and reduce ski pressure. Stiffer rear springs, or increased preload, allow less weight transfer to the track and increase ski pressure. The main function of the rear torque arm is to support the weight of the vehicle and rider, as well as to provide enough travel to absorb bumps and jumps.

Shock valving also has an effect on weight transfer. Refer to shock tuning information in this chapter. Scissor stops also affect weight transfer. See scissor stop information in this chapter.

### Springs

Two types of springs are employed in Polaris suspensions, coil springs and torsion springs. Following is some of the terminology used when referring to coil springs.

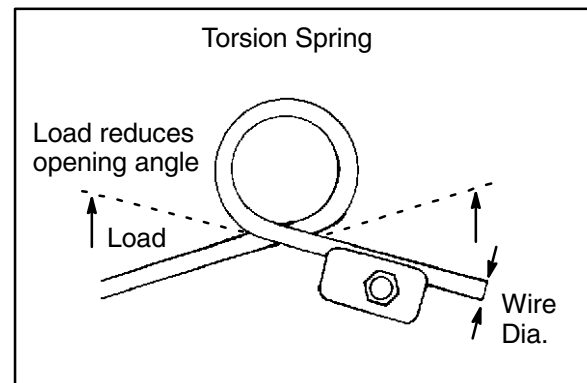
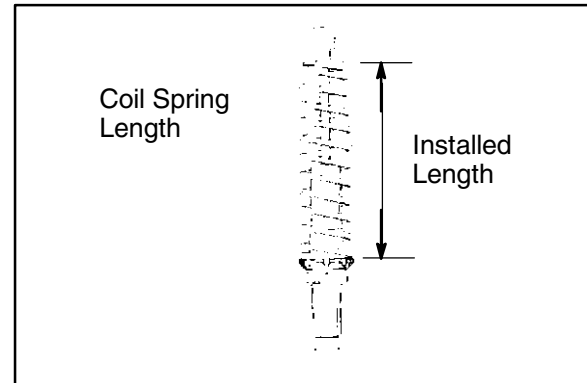
- *Free length* - the length of a coil spring with no load applied to the spring
- *Installed length* - the length of the spring between the spring retainers. If the installed length of the spring is less than the free length, it will be pre-loaded.

**NOTE:** All springs must have preload or damage to the retainers and shock may occur.

- *Spring rate* - the amount of force required to compress a coil spring one inch. For example, if 150 pounds of force are required to compress a spring 1 inch, the spring rate would be 150 #/in.
- *Straight rate spring* - the spring requires the same amount of force to compress the last one inch of travel as the first one inch of travel. For example, if a 150 #/in. spring requires 150 pounds of force to compress it one inch, 300 pounds of force would compress it two inches, 450 pounds of force would compress it three inches, etc.
- *Progressively wound spring* - the rate of the spring increases as it is compressed. For example, a 100/200 #/in. rate spring requires 100 pounds of force to compress the first one inch, but requires 200 additional pounds to compress the last one inch.
- *Dual Rate Springs* - See page 6.8 for dual spring rate information.

When a bump is encountered by the suspension, the force of the bump compresses the spring. If the force were 450 pounds, a 100 #/in. spring would compress 4.5 inches. A 150 #/in. spring would only compress 3 inches. If the suspension had 4 inches of spring travel the 100 #/in. spring would bottom out, while the 150 #/in. spring would have one inch of travel remaining.

Torsion springs are much like coil springs, although shaped differently. The rate of the torsion spring is controlled by the free opening angle, the installed opening angle, the wire diameter of the spring, and the number of coils.





## Rear Suspension Tuning

Many factors influence the overall handling characteristics of snowmobile suspensions. Rider weight, riding style, course conditions, and the condition of suspension components are some of the things that you have to consider when tuning a suspension.

On new machines, or whenever new suspension parts are installed, the sled should be ridden for at least one tank of fuel to allow moving parts in the shocks and suspension to wear in.

- **Front Suspension:** The front suspension should sag (unloaded) about 1" (measured at the front bumper) with the weight of the sled. Use stiffer or softer springs as needed to keep from bottoming too hard, and to ensure the entire range of travel is used. HINT: Sliding the jounce bumper all the way down the shock rod will show how much travel is being used.

## Rear Suspension Tuning

To begin suspension tuning, check the condition of shocks and other suspension parts.

- Inspect and grease all suspension parts, making sure they pivot freely. All suspension components should be greased prior to adjusting the suspension. Regular maintenance greasing should be done with no weight on the component to allow grease to reach important contact areas.
- **Loaded Sag:** Set the preload on the rear springs for the correct sag. There should be 1 1/2" of sag on the rear suspension when the rider on the snowmobile, measured at the rear bumper (4" at rear of tunnel edge on Edge models). Bounce on the suspension a couple of times to overcome any "suction" and settle the sled to an accurate reference point. The rider should have their weight placed correctly on the machine. Adjust spring preload to achieve the 1 1/2" sag dimension on X-Tra 10 or 4" on all EDGE and PRO X models.
- **Unloaded (Free) Sag:** When the rider gets off the machine, the suspension should return to 1/2" of sag. If the sag is less than 1/2" stiffer springs may be needed. If it is greater than 1/2" softer springs may be needed. This may seem backwards at first, but if the spring is too soft, the preload must be greatly increased to prevent excess loaded sag. This shows up in the form of less unloaded sag. Therefore, a stiffer spring is required. If the spring is too stiff, the preload will have to be backed off, and unloaded sag will be excessive. This is a very important step because the proper spring will also help ensure correct weight transfer.

## Shock Tuning

The shocks work in two directions. Compression damping prevents the shock from bottoming hard while rebound damping keeps the shock from springing back too fast. On Indy Select shocks, the compression damping can be changed by turning the adjuster screw. Refer to shock section in this chapter for adjustment. **NOTE:** When we refer to high and low speed, we are referring to the speed of the shock shaft or valve, *not* vehicle speed.

## Rebuildable Shocks

Begin by taking the shocks apart, inspecting all parts for damage, and changing the oil. Even new shocks should get an oil change after break in to clean break-in material from the shocks and valve body.

If oil is low, inspect seal cap O-Ring and seals for damage. If air or foam is evident in the oil, the O-Ring in the floating piston must be replaced. After changing the oil reassemble shocks, making sure oil level, floating piston depth (IFP), and nitrogen pressure are correct.

The use of nitrogen in Walker Evans Racing Shocks and Ryde FX™ shocks provides consistent damping at extreme temperatures. Don't overcharge the shocks. Excess nitrogen pressure may cause seal "suction" and prevent proper shock action. If too much oil is added, or if the IFP depth is set incorrectly (too low) shock travel will be limited, and shock damage could result.

### Shock Valving

To check high speed rebound, drive over a series of fairly large moguls. Gradually increase the speed until you reach 70% to 80% of maximum vehicle speed or the maximum safe speed for the vehicle over those bumps. (The reason for limiting speed is that it is difficult to feel what the shocks are doing when you are driving at full speed.)

Ideal high speed rebound is achieved when your suspension keeps returning fast enough to have full travel as you hit the next bump. If the first bump feels good, but each bump after that gets worse until the machine starts bouncing around, you need less high speed rebound damping in the shocks that are bouncing.

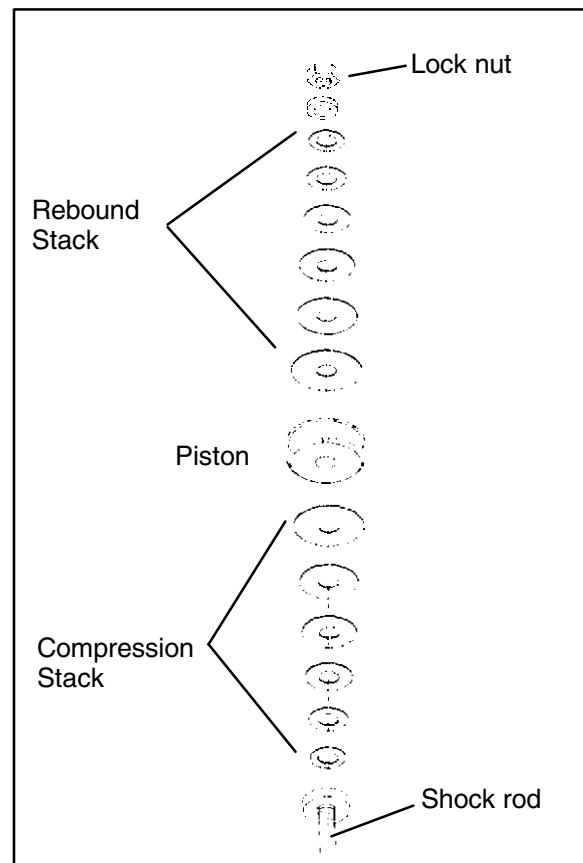
After you've determined your high speed rebound valving needs, drive over one large rounded bump to make sure you have enough rebound control to keep the sled from kicking up after you hit the bump.

To check the high speed compression damping, you will need to find a hard, square edged bump. Again, try to hit the bump at less than full speed so you can feel what each shock is doing. The ideal compression valving prevents bottoming, but is not too harsh. When you hit the bump, if your suspension falls through and bottoms, you need more damping. If the sled bounces when you first contact the bump, you need less damping.

### Valving

After you have determined what adjustments are needed you can revalve the shocks to work best for you. Always remember to record where you start (and what you change) on a shock valving data sheet. Keep notes on conditions so you can reference the sheets throughout the season. Make copies of the sheets and include them in this manual.

The shocks operate by having oil flow through the valving piston and bend the washers to get on the other side of the piston. The washers on the shaft side of the piston are compression valves. The washers on the nut side control rebound.



## Shock Valving

The valving piston has six large compression holes and three smaller rebound holes. The smallest hole, called the low speed hole, controls low speed rebound damping. It also has about a 25% effect on low speed compression. This hole is usually between .050" and .100" in diameter. You can drill the piston with numbered drill bits to get any size you want. Blank pistons are also available.

The rest of the valving is controlled by the valving washers. These washers are available in various thicknesses and diameters to achieve the proper amount of stiffness.

Following is an example of available valving washer sizes.

### Washer Diameters

.700"  
.800"  
.900"  
1.000"  
1.100"  
1.250"  
1.300"  
1.450"  
1.600"

### Washer Thicknesses

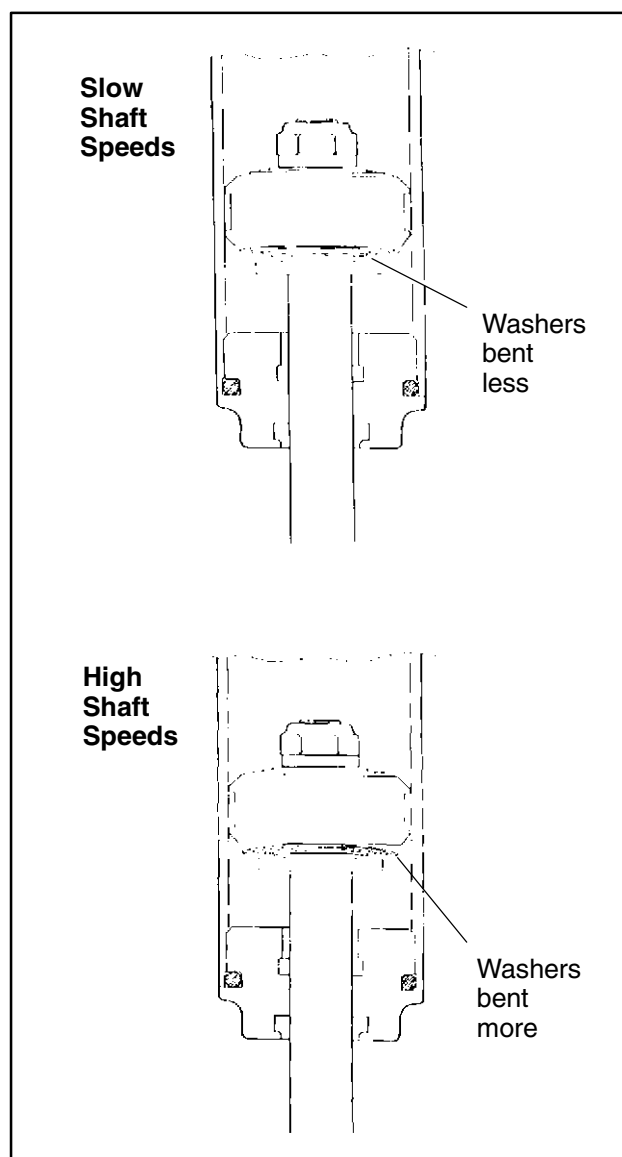
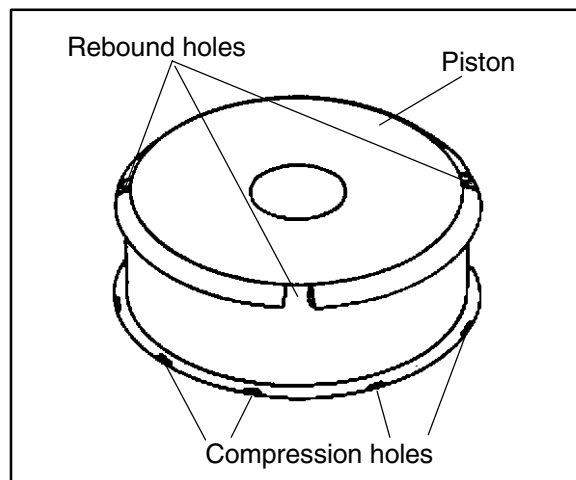
.006"  
.008"  
.010"  
.012"  
.015"

Use thicker, larger diameter washers to make the shock stiffer. The rebound stack must start out with a washer that is at least 1.250" in diameter. The compression stack must start out with a washer that is 1.300" in diameter. At slower shaft speeds, only the washers closest to the piston will bend and allow oil through.

At fast shaft speeds the washers bend further, so the washers further from the piston are helping control the oil flow.

In summary, the washers closest to the piston control low speed valving, and the washers furthest away affect high speed valving. In the rebound stack, the washer next to the piston is more a medium speed valve because of the oil flowing through the low speed hole.

It takes a lot of time and practice to see which valves control the way your suspension feels. Sometimes it's good to make a big change to see how the shock will react, and then end up somewhere in between.



**NOTE:** For every 1" of travel limiter spacers added to the shock, decrease the IFP depth by .115".

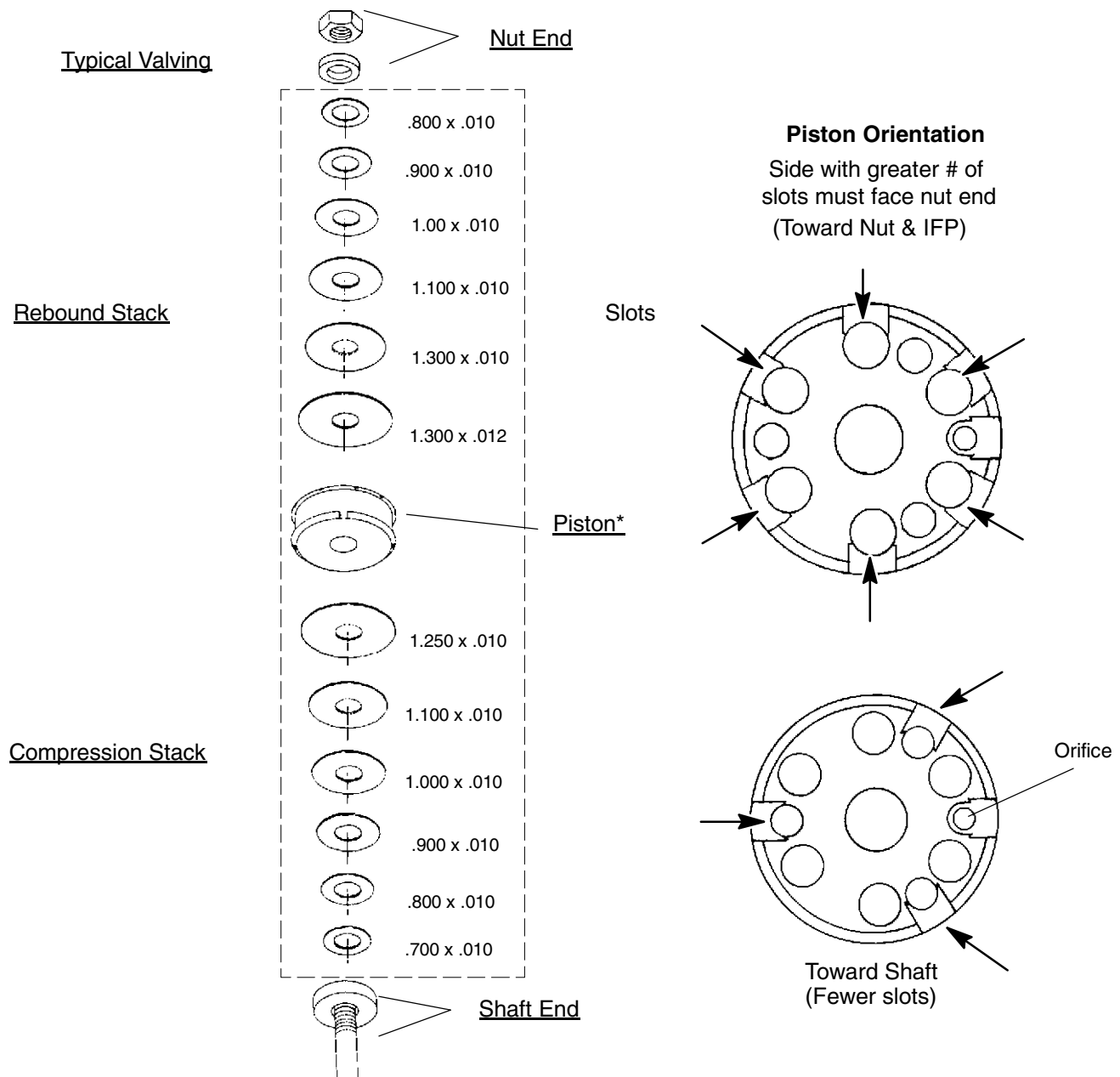
**NOTE:** For every .25" of travel limiter spacers added to the shock, decrease the IFP depth by .029".

### Shock Valving Arrangement

Shown below is an example of how valving stacks are arranged. The following diagrams will have the compression and rebound stacks listed as if the shock rod is in a vise and the nut end is facing upward.

Parts in box are an example of standard valving.

\* Note direction of valve piston before disassembly. The side with the greater number of slots should face the IFP (nut end of the shaft).



Changing oil on Shocks is recommended annually and should be included when performing end of season storage preparation. This oil change is necessary to avoid any chance of corrosion which could be caused by moisture contamination. For competition use, shocks should be disassembled, inspected and serviced more frequently.

**REAR SUSPENSION SHOCKS Front Shock Specifications**

<b>Ryde FX™ FRONT TRACK SHOCKS</b>						
Shock PN	Extended Length (in)	Collapsed Length (in)	Travel (in)	IFP Depth (in)	Shaft Part # (in)	PSI
7042205	11.98	8.24	3.74	Emulsion	1700214	300
7042214	11.99	8.24	3.75	1.50	N/A	200

<b>Walker Evans Racing Shocks FRONT TRACK SHOCKS</b>						
Shock PN	Extended Length (in)	Collapsed Length (in)	Travel (in)	IFP Depth (in)	Shaft Part # (in)	PSI
7042178	12.00	8.23	3.76	2.00	1800015	200

**REAR SUSPENSION SHOCKS Rear Track Shock Specifications**

<b>Ryde FX™ REAR TRACK SHOCKS</b>						
Shock PN	Extended Length (in)	Collapsed Length (in)	Travel (in)	IFP Depth (in)	Shaft Part # (in)	PSI
7042184	14.943	9.593	5.35	2.10	1700183	200
7042213	14.943	9.593	5.35	1.50	1700014	200

<b>Walker Evans Racing Shocks REAR TRACK SHOCKS</b>						
Shock PN	Extended Length (in)	Collapsed Length (in)	Travel (in)	IFP Depth (in)	Shaft Part # (in)	PSI
7042179	15.00	9.65	5.35	2.00	1800010	200

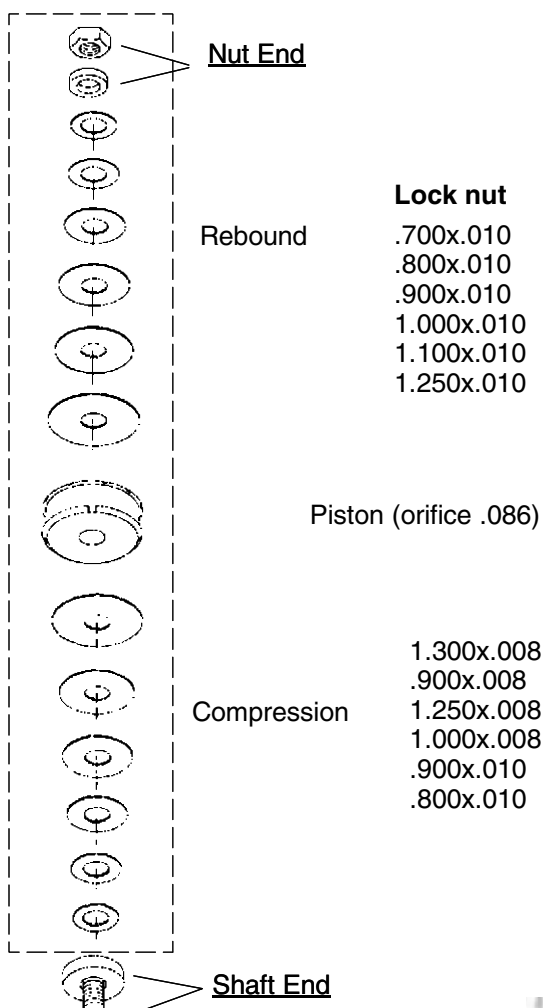
## Front Track Shock - 440 Pro X Fan - Ryde FX P/N 7042205

### Walker Evans Racing Shock - PN 7042205

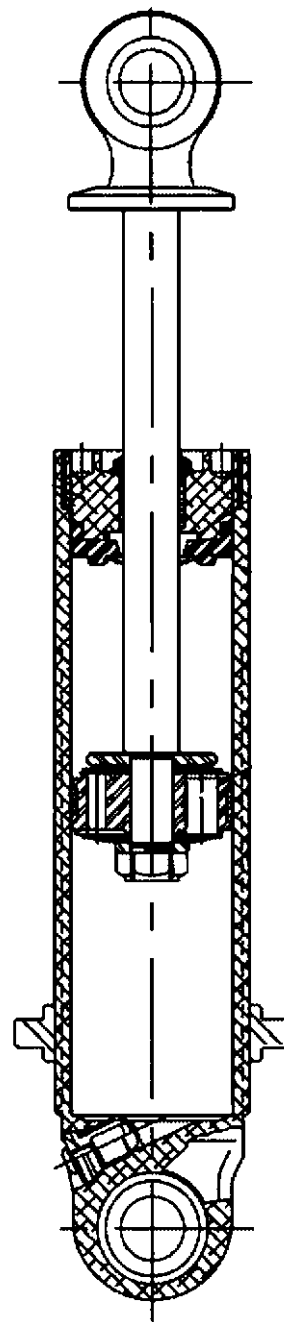
#### Shock Design Details (Inches)

Travel .....	3.74
Extended Length .....	11.98
Compressed Length ..	8.24
IFP Depth .....	N/A
Nitrogen .....	300 psi
Oil Capacity .....	100-110 cc
Hose Length .....	N/A

#### Valving



Stack shown as placed on the shock rod with rod in a vice.



#### PISTON ORIENTATION



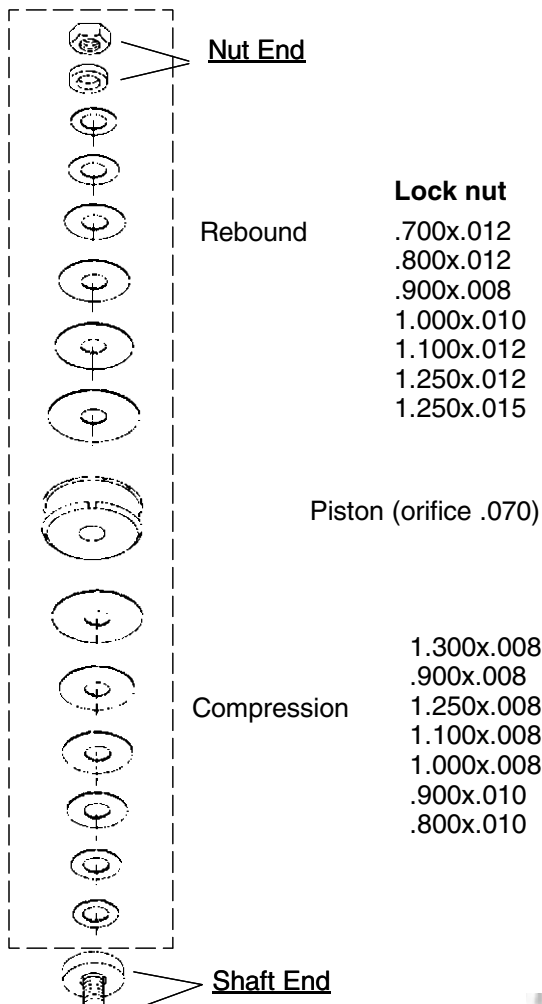
## Rear Track Shock - 440 Pro X Fan - Ryde FX P/N 7042184

### Walker Evans Racing Shock - PN 7042184

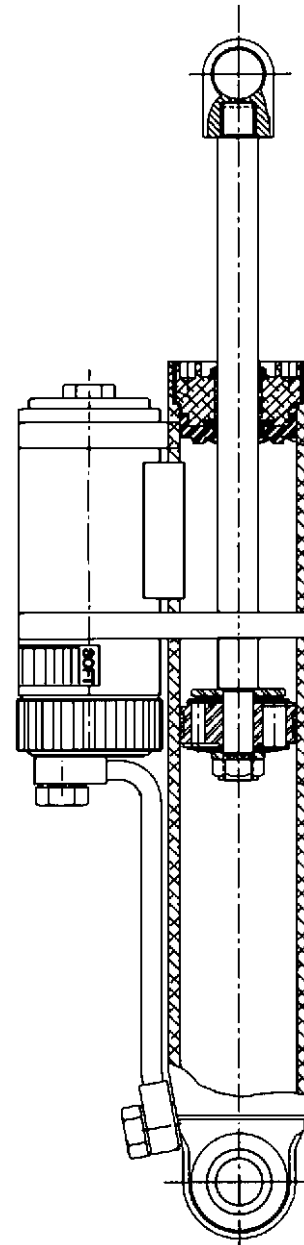
#### Shock Design Details (Inches)

Travel .....	5.35
Extended Length .....	14.493
Compressed Length ..	9.593
IFP Depth .....	2.10
Nitrogen .....	200 psi
Oil Capacity .....	164 cc
Hose Length .....	N/A

#### Valving



Stack shown as placed on the shock rod with rod in a vice.



#### PISTON ORIENTATION



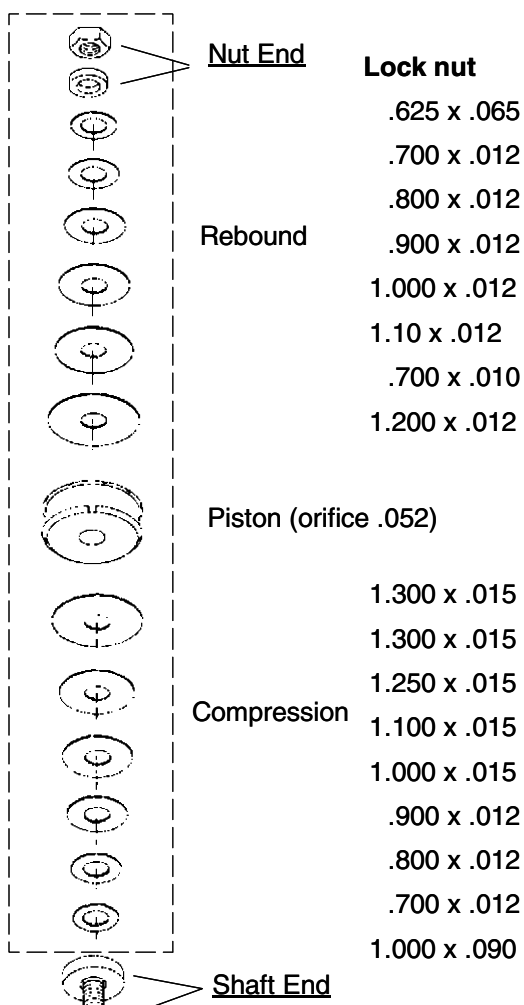
### Front Track Shock - 440 Pro X - Walker Evans Racing P/N 7042178

#### Walker Evans Racing Shock - PN 7042178

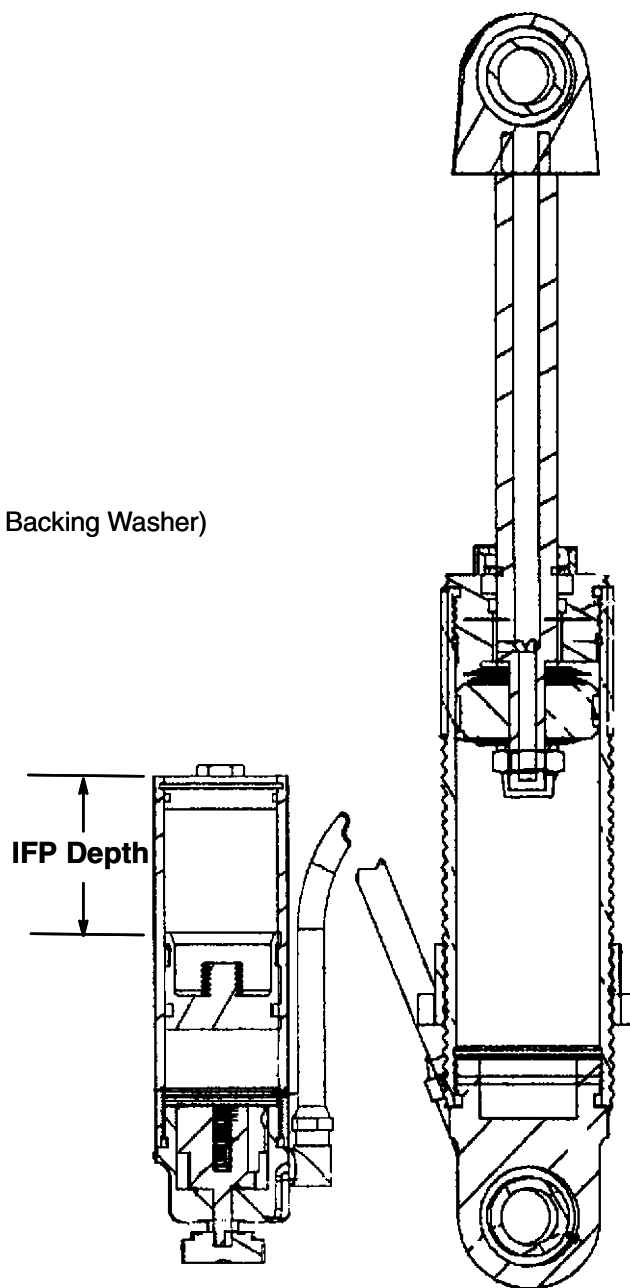
##### Shock Design Details (Inches)

Travel .....	3.76
Extended Length .....	12.00
Compressed Length ..	8.23
IFP Depth .....	2.0
Nitrogen .....	200 psi
Oil Capacity .....	170 cc
Hose Length .....	29.0

#### Valving



Stack shown as placed on the shock rod with rod in a vice.



#### PISTON ORIENTATION





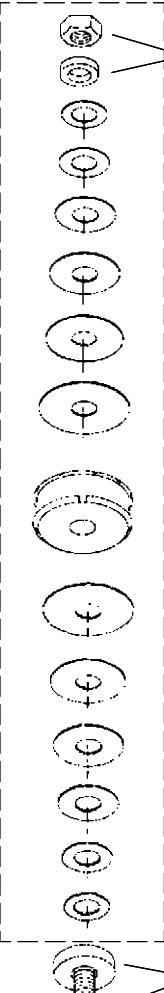
## Rear Track Shock - 440 Pro X - Walker Evans Racing P/N 7042179

### Walker Evans Racing Shock - PN 7042179

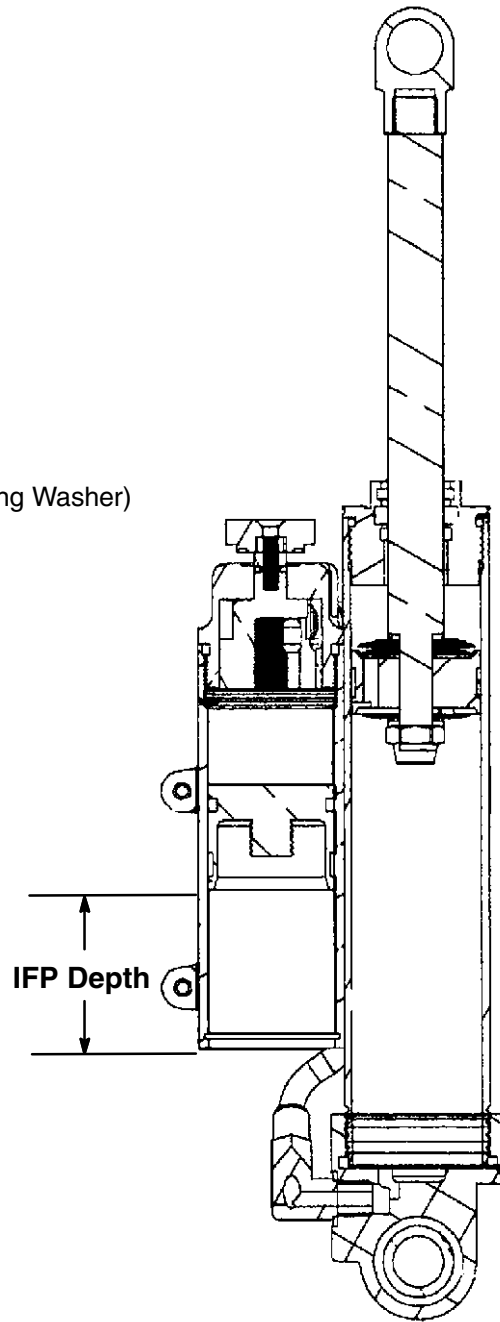
#### Shock Design Details (Inches)

Travel .....	6.27
Extended Length .....	18.00
Compressed Length ..	11.738
IFP Depth .....	2.0
Nitrogen .....	200 psi
Oil Capacity .....	235 cc
Hose Length .....	7.0

#### Valving

	<b>Nut End</b>	<b>Lock nut</b>
		.625 x .065 (Nut Backing Washer)
		.700 x .010
		.800 x .010
	<b>Rebound</b>	.900 x .010
		1.000 x .010
		.800 x .010
		1.10 x .010
	<b>Piston (orifice .052)</b>	.800 x .010
		1.200 x .010
		.800 x .012
		1.100 x .010
		1.000 x .010
		.900 x .010
		.800 x .010
		.700 x .010
		1.250 x .015
		1.100 x .012
	<b>Compression</b>	1.000 x .012
		.900 x .012
		.800 x .012
		.875 x .090
	<b>Shaft End</b>	

Stack shown as placed on the shock rod with rod in a vice.



#### PISTON ORIENTATION



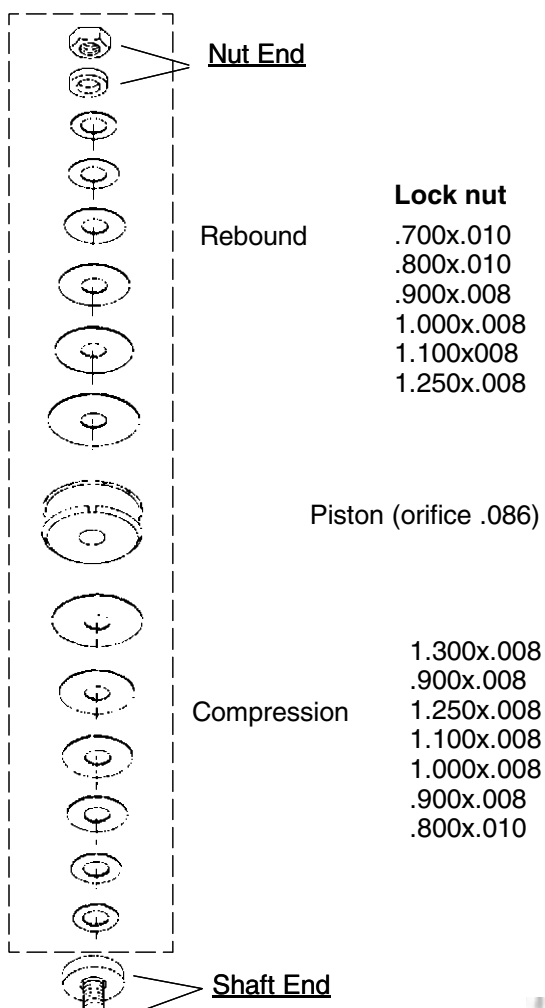
## Front Track Shock - 600/700/800 Pro X - Ryde FX P/N 7042214

### Walker Evans Racing Shock - PN 7042214

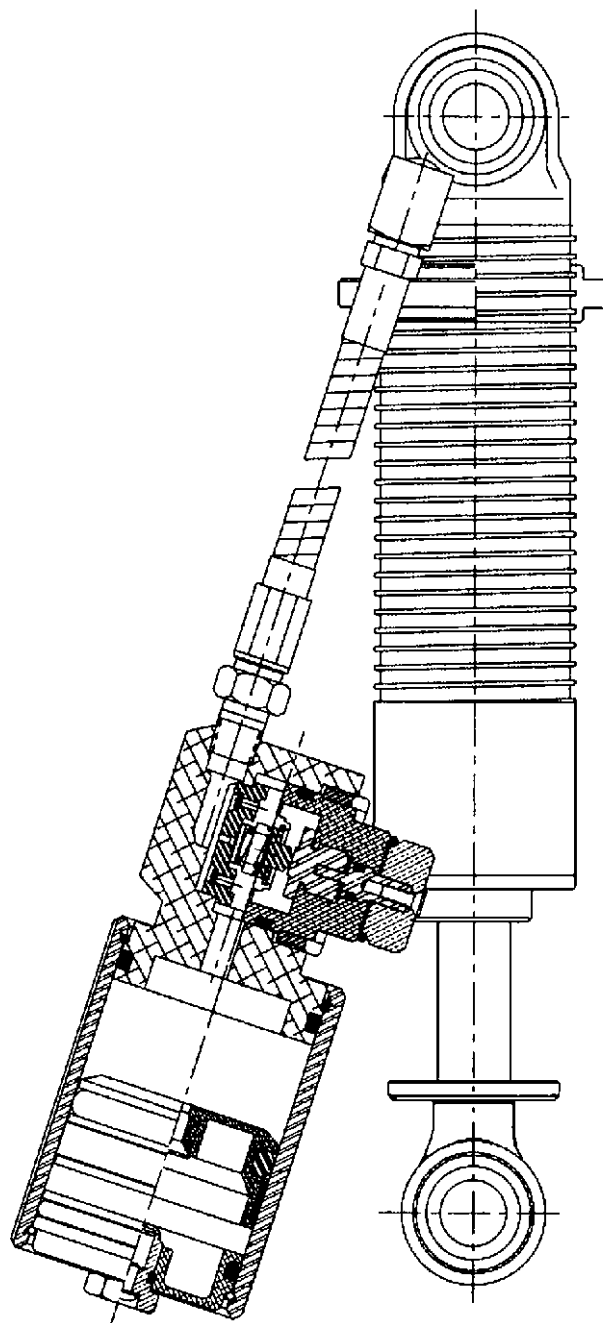
#### Shock Design Details (Inches)

Travel .....	3.75
Extended Length .....	11.99
Compressed Length ..	8.24
IFP Depth .....	1.50
Nitrogen .....	200 psi
Oil Capacity .....	136 cc
Hose Length .....	24

#### Valving



Stack shown as placed on the shock rod with rod in a vice.



#### PISTON ORIENTATION



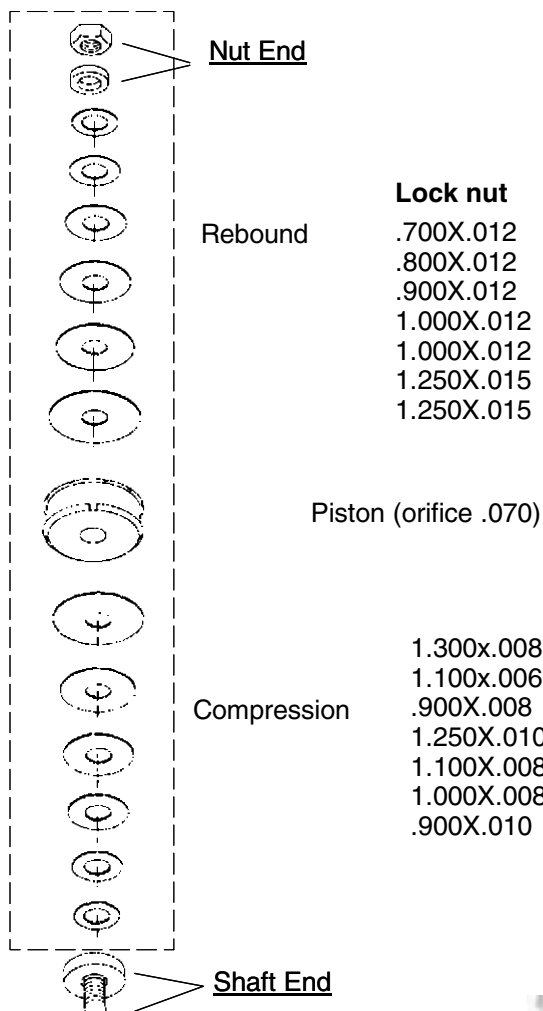
## Rear Track Shock - 600/700/800 Pro X - Ryde FX P/N 7042213

### Walker Evans Racing Shock - PN 7042213

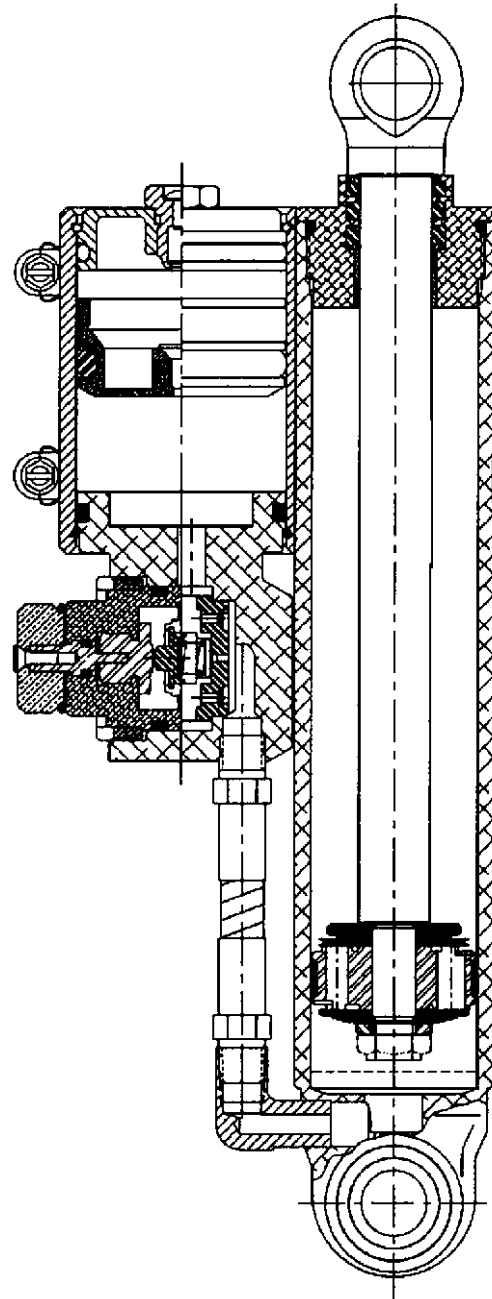
#### Shock Design Details (Inches)

Travel .....	5.35
Extended Length .....	14.493
Compressed Length ..	9.593
IFP Depth .....	1.50
Nitrogen .....	200 psi
Oil Capacity .....	172 cc
Hose Length .....	N/A

#### Valving



Stack shown as placed on the shock rod with rod in a vice.



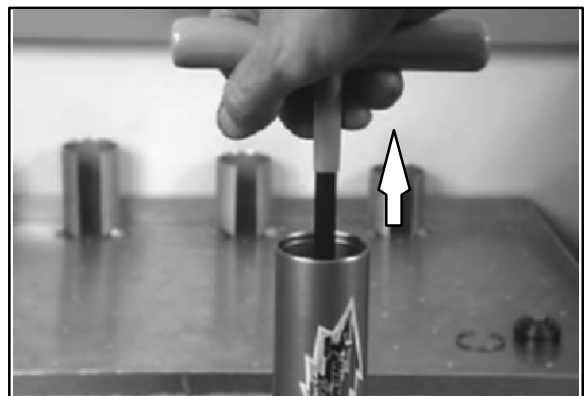
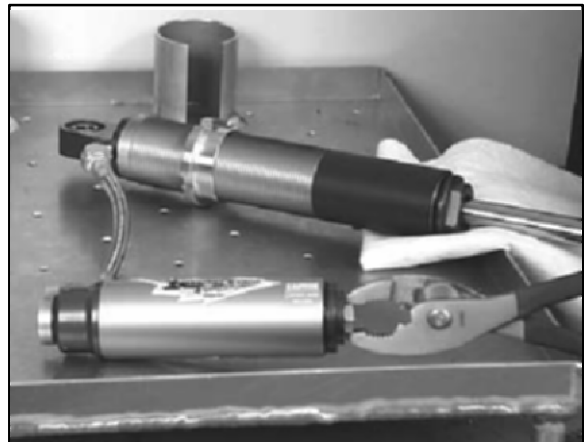
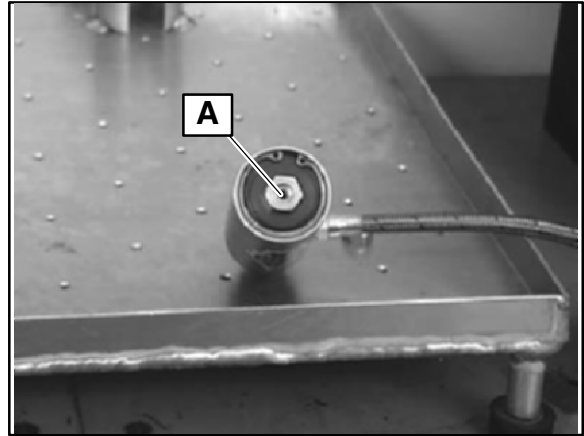
#### PISTON ORIENTATION



### Walker Evans Racing Shocks Rear Shock Maintenance (IFS Shock Shown)

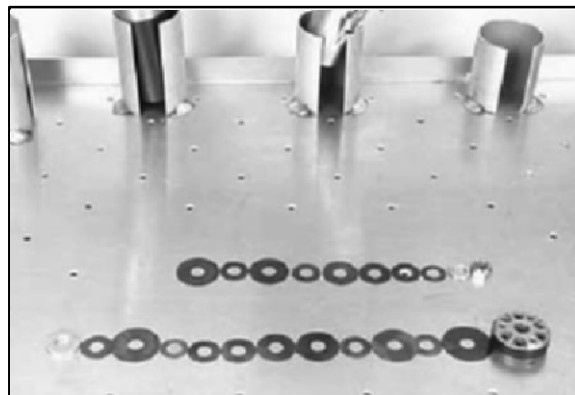
#### Disassembly

1. Remove shock from vehicle and clean thoroughly.
2. Remove button head hex screw (A) from reservoir end cap.
3. Insert safety needle carefully and depress the center of the Schrader valve to de-pressurize.
4. Press the end cap into reservoir so snap ring can be removed.
5. Remove the snap ring from the end of the reservoir.
6. Grasp the end cap with a pliers and pull cap straight out.
7. Place shock in the vise by the lower eyelet. Loosen and remove the cylinder head (bearing cap) from the shock.
8. With the cylinder head removed pour out old shock oil.  
**NOTE:** You can insert the IFP tool (PS-45908) and cycle the IFP through a few strokes to purge the shock oil from the reservoir.
9. Remove the IFP from the reservoir with the IFP tool.
10. Clean and inspect **ALL** parts, replace worn out parts if needed.



### Valve Stack Maintenance

11. Place shock rod in the vise by the upper eyelet.
12. Remove the lock nut from the shock rod.
13. Place the valve stack on a clean shop towel.  
**NOTE:** Make sure to place the valve stack on a shop towel in the order that you remove them. This will help when assembling them back on the shock rod.
14. Inspect the valves for kinks, waves, pits, or foreign material.
15. Inspect the piston wear band for scratches or nicks, and replace if needed.



### Shock Assembly

16. Secure the piston rod in the vise with the threads up as shown and secure it by the shock mounting eye.
17. Place the compression valve washers on the rod in the reverse order of disassembly.

**NOTE:** Special attention should be paid to the orientation of the valve piston, and the order of the compression and rebound discs (shims) in the stack, ensuring that they are in the correct position upon assembly. Refer to appropriate valve stack and piston orientation illustration on page 7.12 (front track shock) or 7.13 (rear track shock) prior to assembly.



18. Place a NEW lock nut (PN 1800031) on the piston rod. Torque to 14 ft.lbs.(19 Nm).

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



### Filling, Bleeding, & Charging

19. Secure the shock body by its lower mount in vise. The use of soft jaws is recommended to prevent damage or marks to the shock.
20. Set the compression damping adjustment knob to "1".

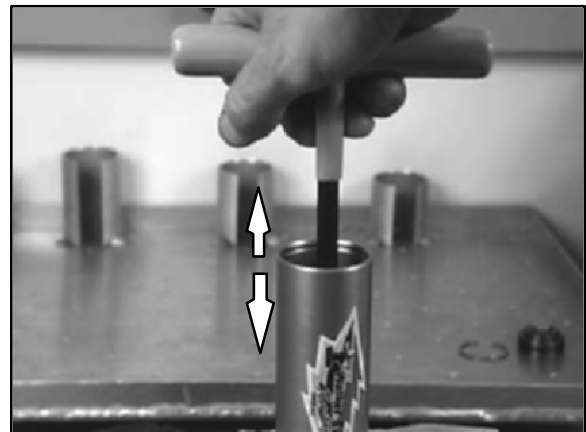


### Walker Evans Racing Shocks Rear Shock Maintenance (Cont.)

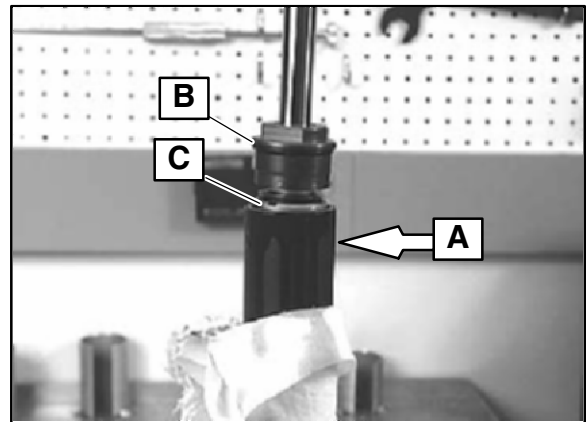
21. Fill the shock body **and the reservoir** 1/2 full of Walker Evans 5w shock oil (PN 2874522).
22. Apply a thin film of oil to the IFP O-ring and floating wear band.
23. Compress the wear band as you install the IFP and Allow as much air as possible to escape as you install the piston.
24. Screw the IFP tool onto the floating piston.

#### IFP TOOL PN PS45908

25. Hold the reservoir as low as possible and slowly cycle the IFP up and down to purge air out through the main shock cylinder. Be sure to bottom out the piston in the reservoir body. Allow time for bubbles to dissipate and repeat the process until all air is removed.
26. Set the IFP to the proper depth. Refer to illustrations for the shock you are working on.
27. Fill the shock body to a level just below the threads (A).



28. With the cylinder head assembly (B) pushed down against the valve piston (C), dip the piston assembly in shock oil.
29. Carefully, insert the piston rod and valve assembly into the cylinder; slightly oscillating the piston rod to allow piston to enter shock body bore and purge air. Slight up and down movement may be required to allow all air to pass through piston assembly.
30. Slowly push the piston rod and assembly into shock body until the threads can be engaged.  
**NOTE:** During installation, some shock oil will overflow. Wrap a shop cloth around shock body to catch possible oil overflow. Fast installation of the piston rod and assembly may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed.
31. Tighten the cylinder head on the shock body securely.
32. Check to be sure IFP is still at the specified depth.
33. Install reservoir end cap and install snap ring. Charge shock to 200 PSI. Clean shock of oil residue and check for leaks.
34. Install button screw in reservoir cap.



**Walker Evans Racing Shocks Valve Part Numbers. Ryde FX Part umberes on page 7.28**

<b>PART NUMBER</b>	<b>SIZE</b>
1800050	.065x.625
1800051	.006x.700
1800052	.010x.700
1800053	.010x.800
1800054	.010x.900
1800055	.010x1.000
1800056	.010x1.100
1800057	.010x1.200
1800058	.010x1.300
1800059	.012x.700
1800060	.012x.800
1800061	.012x.900
1800062	.012x1.000
1800063	.012x1.100
1800064	.012x1.200
1800065	.012x1.300
1800066	.015x.700
1800067	.015x.800
1800068	.015x.900
1800069	.015x1.000
1800070	.015x1.100
1800071	.015x1.250
1800072	.015x1.300
1800075	.006x.800
1800076	.006x.900
1800077	.006x1.000
1800078	.006x1.100
1800079	.006x1.200
1800080	.006x1.300
1800081	.008x.700
1800082	.008x.800
1800083	.008x.900
1800084	.008x1.000
1800085	.008x1.100
1800086	.008x1.200
1800087	.008x1.250
1800088	.008x1.300
1800089	.012x1.250
1800090	.025x1.000
1800091	.025x1.100
1800092	.025x1.200
1800093	.025x1.300

### Ryde FX™ Shock Maintenance

Procedures for the proper disassembly and assembly of Ryde FX gas charged IFP and emulsion mono-tube shock absorbers.

**WARNING:** Before servicing a gas shock it is important that all the gas pressure be discharged from the unit. Refer to the instructions listed below for the proper procedure of discharging the gas pressure from a shock. Protective eyewear should be worn to avoid risk of injury while servicing Ryde FX gas charged mono-tube shocks.

Remove the shock from the vehicle.

- If shock incorporates spring; remove spring and collateral retainers.

**NOTE:** Before unscrewing pre-load springs, measure the compressed length of the installed spring and mark position for reinstallation. (PICTURE 1)

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

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

**WARNING:** When using compressed air to dry components, protective eyewear should be worn to avoid risk of injury.

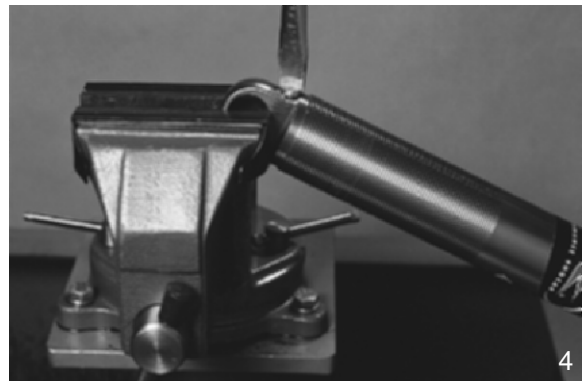
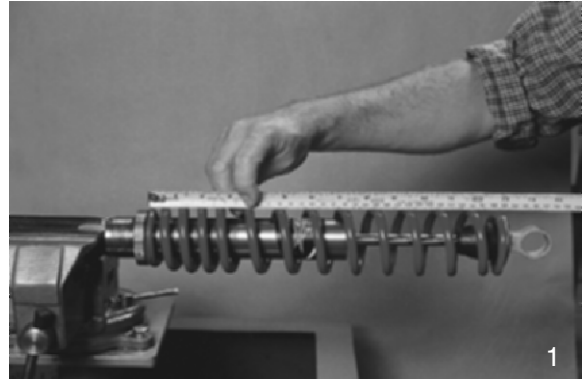
Remove bearing, sleeve and/or bushings from lower shock mount eyelet. Secure the lower mount of the shock in a vise. The use of soft jaws is recommended to prevent damage or marks to the shock. (PICTURE 2)

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

Remove the small button head screw from the pressure valve assembly. (PICTURE 3)

Depressurizing shock:

A) Internal Floating Piston Shocks (P/N: 7041990): Using a slotted screwdriver, loosen the pressure valve assembly counter-clockwise two full revolutions allowing the gas pressure to fully escape past the pressure valve assembly O-ring. (PICTURE 4)



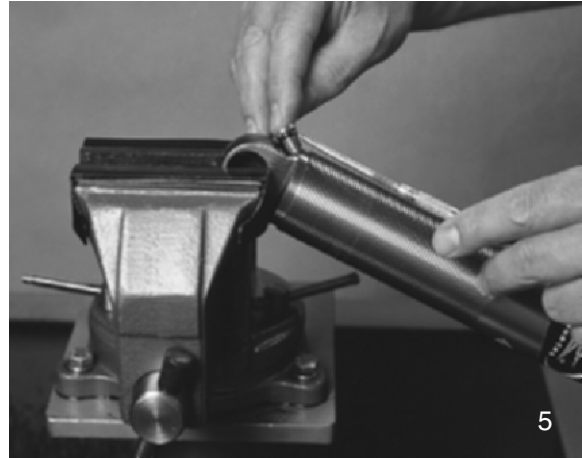


B) Emulsion Shocks: With the shock inverted and the piston rod fully extended, secure the lower mount of the shock in a vise. Allow a couple of minutes for the gas pressure to separate from the oil and rise to the top. Using a rag as a shield to prevent spraying gas and oil; place rag over top the pressure valve assembly and slowly loosen the valve assembly with slotted screw driver three full revolutions, allowing all the gas pressure to escape past the pressure valve assembly O-ring.

**WARNING:** Nitrogen gas is under extreme pressure. Use caution when releasing nitrogen gas from shock. Protective eyewear should be worn to avoid risk of injury.

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

Using a slotted screwdriver, remove the pressure valve assembly from the lower end mount. Account for an O-ring. (PICTURE 5)



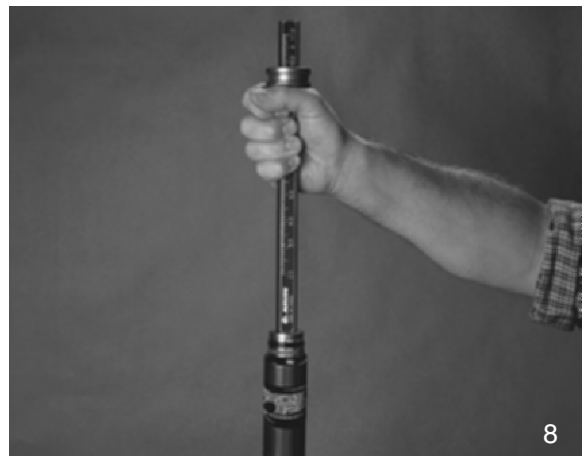
Using an adjustable face spanner, fully loosen and remove cylinder head assembly. (PICTURES 6 , 7)

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



Using the I.F.P extraction tool thread the tool into the I.F.P and pull upwards, removing the I.F.P from the shock body. Account for wear band and an O-ring. (PICTURE 8) Note: Not applicable for emulsion shock P/N 7041992

Clean the inside of the shock body using clean parts-cleaning solvent and blow dry using compressed air.



## REAR SUSPENSION/TRACK/TRACTION

Place the shock piston rod upper mount in bench vise, begin piston and valve removal. Arrange parts removed in the sequence of disassembly. The piston should have the flat slots facing the nut end (as highlighted in black). (PICTURE 9)

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

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

### ASSEMBLY:

Place the piston rod upper mount into the vise. Reassemble damper rod assembly in the reverse order of disassembly. Special attention should be paid the order of the Rebound and Compression disc (shim) stacks, ensuring that they are in the same order prior to disassembly. Tighten the lock nut to 15–20 ft-lb of torque. (PICTURE 10)

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

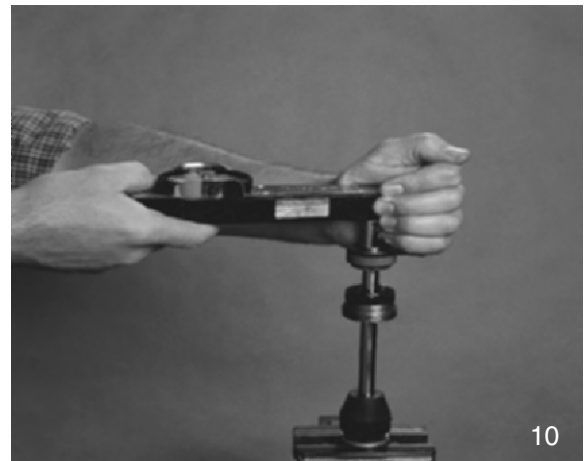
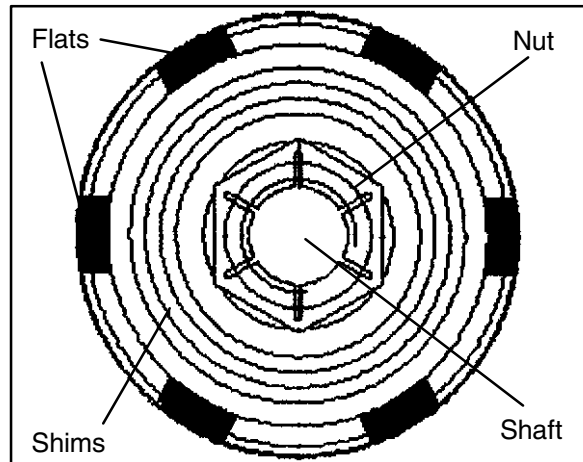
Secure the shock body by its lower mount in vise. The use of soft jaws is recommend to prevent damage or marks to the shock. (PICTURE 11)

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

**Note:** Points 3 through to 5 are not applicable for emulsion shocks (P/N: 7041992) Proceed to point #15

Thread the positioning head onto the I.F.P locator tool and adjust the top of the value indicator to the appropriate measurement. (PICTURE 12)

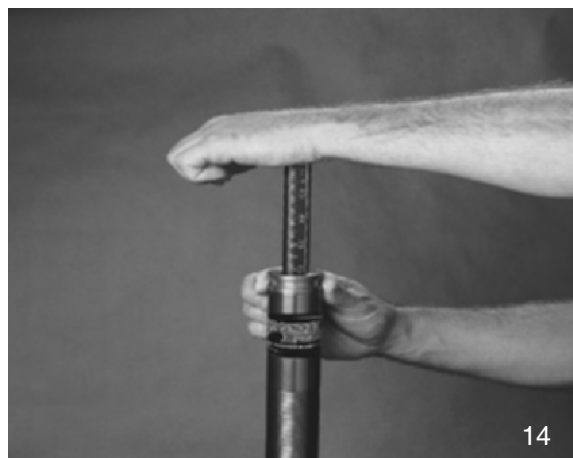
**NOTE:** Depending on which shock absorber is being worked on, adjust the piston location tool to the specified depth indicated in the shock specification charts.



Apply a thin film of oil onto the floating wear band and O-ring and install the floating piston into the top of the shock body, positioning it below the counterbore. (PICTURE 13)



Using the tool as a handle, push the floating piston down into the shock body, being careful not to damage I.F.P wear band and O-ring, until the valve indicator knob comes in contact with the shock body. The piston should now be located correctly. (PICTURE 14)



Apply of light film of grease to the pressure valve port counter bore through 360°, where the pressure valve assembly O-ring meets.

Screw the pressure valve assembly into the valve port by hand with a slotted head screwdriver; and tighten to 100-110 in.lb of torque. (PICTURE 15)



Fill the shock body with shock oil:

A) Internal Floating Piston Shocks: Fill the shock body with shock oil to the bottom of the thread within the cylinder. (PICTURE 16)

B) Emulsion Shocks: Fill shock body with 110cc of oil. This will allow for the required air space to properly gas charge the shock with nitrogen gas.

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



## REAR SUSPENSION/TRACK/TRACTION

With the cylinder head assembly pushed down against the piston, carefully, insert the piston rod and assembly into the cylinder; Slightly oscillating the piston rod to allow piston to enter shock body bore. A light coating of oil on the piston wear band will ease installation. (PICTURE 17)

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

NOTE: During installation, some shock oil will overflow. Wrap a shop cloth around shock body to catch possible oil overflow. Fast installation of the piston rod and assembly may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed

Using an open face spanner wrench tighten cylinder head securely into the shock cylinder. (PICTURE 18)

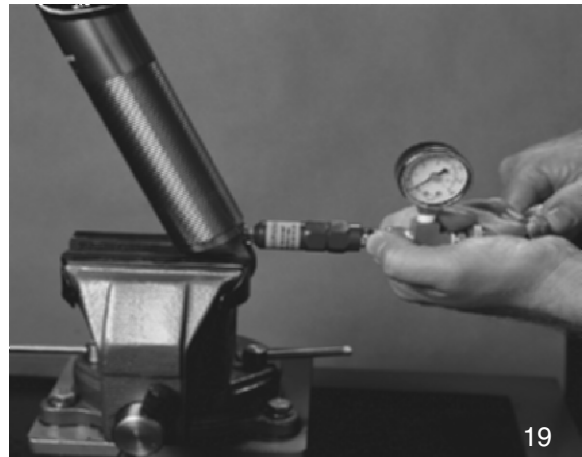
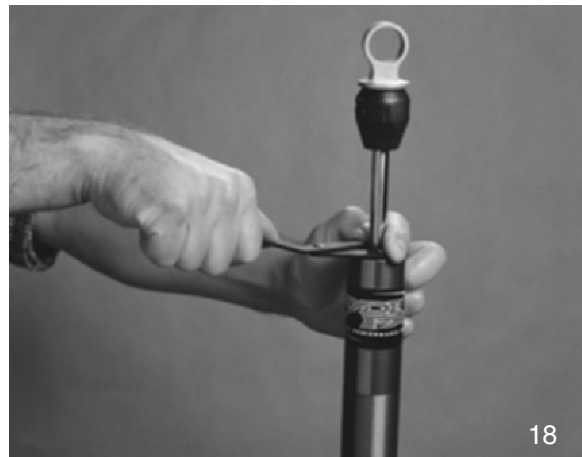
Pressurize the shock, through the pressure valve, with nitrogen gas to the specified pressure. (PICTURE 19)

If using Ryde FX inflation tool Refer to Procedures for use of replaceable inflation needle instruction manual found in the Ryde FX inflation tool case.

NOTE: After being compressed, the piston rod should fully extend from the shock body once the shock has been pressurized.

Install the small button head screw in the pressure valve assembly and tighten securely. (PICTURE 20)

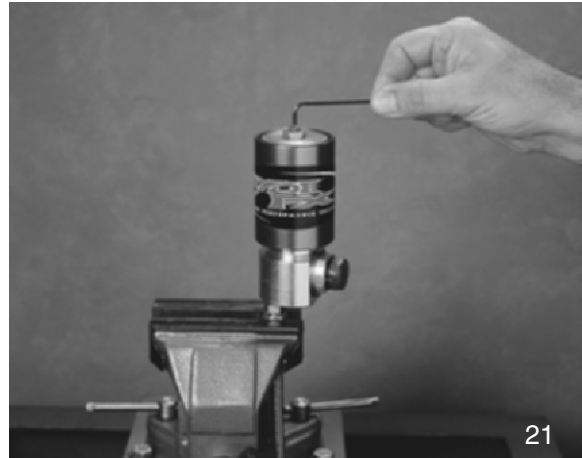
Reinstall sleeve and bushings in lower shock mount.



Procedures for the proper disassembly and assembly of the adjustable compression clicker

**WARNING:** Before servicing a gas shock it is important that all the gas pressure be discharged from the unit. Refer to the instructions listed below for the proper procedure of discharging the gas pressure from a shock. Protective eyewear should be worn to avoid risk of injury while servicing Ryde FX gas charged mono-tube shocks.

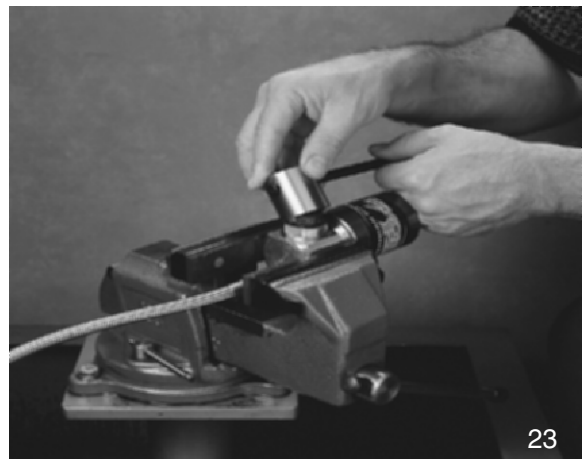
Remove small button head screw from the pressure valve assembly found on the bottom of the reservoir. (Picture 21)



Discharge all the gas pressure from the shock: If using Ryde FX inflation tool Refer to Procedures for use of replaceable inflation Needle instruction manual found in Ryde FX Inflation Tool case. If inflation tool incorporates ball valve, open valve fully and allow all the gas pressure to be released from the shock. (PICTURE 22)

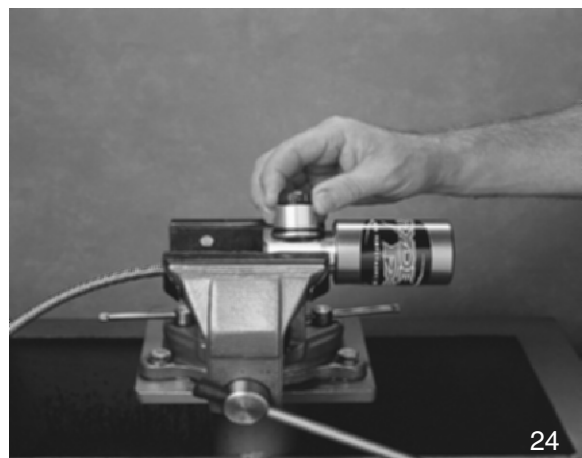


Using the collar socket, loosen and remove the compression assembly collar. (Picture 23)



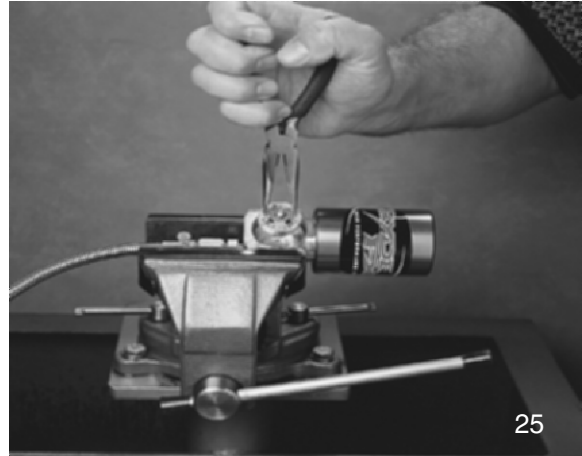
Paying special attention to the position of the pin (relative to the reservoir) remove clicker assembly (Picture 24)

**NOTE:** Inspect O-ring for nicks, cuts or cracks. Replacement is recommended should any of these signs be present.



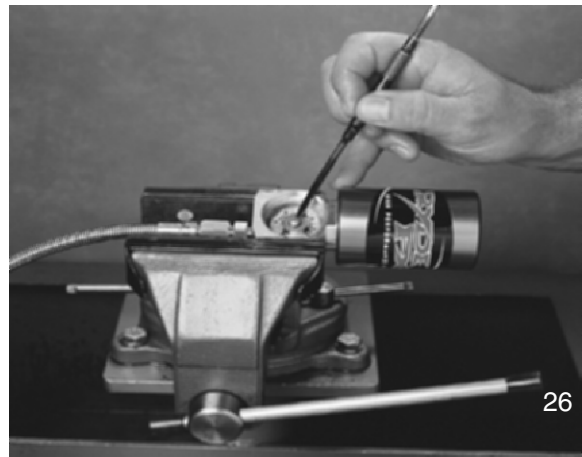
## REAR SUSPENSION/TRACK/TRACTION

Remove the compression head from the clicker assembly housing by grasping the compression pin with pliers and pulling straight out. (Picture 25)

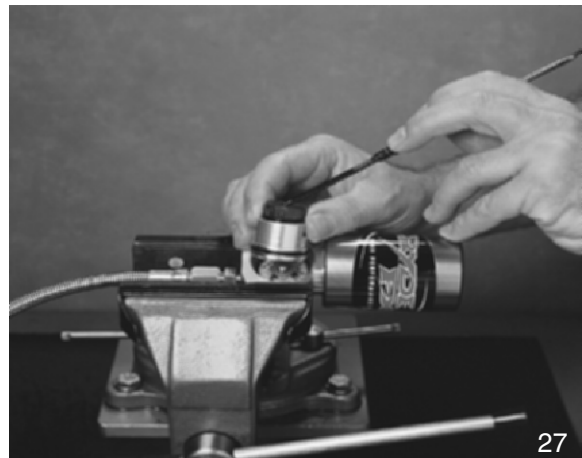


ASSEMBLY: Install the compression head into the clicker assembly housing, making sure the compression pin is facing up. (Picture 26)

Fill compression housing with approximately 10cc of shock fluid.



Set the compression clicker to the zero 0 position. (Picture 27)



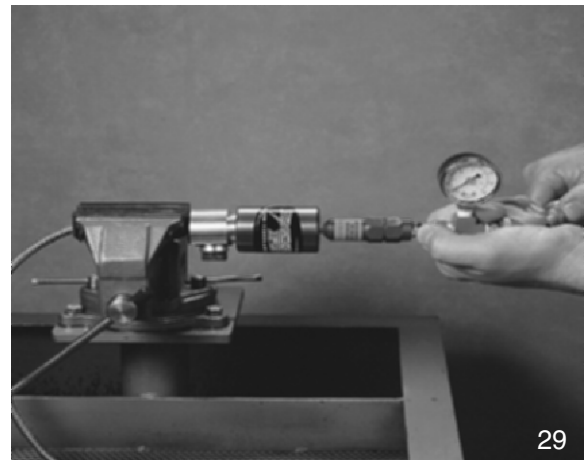
Pushing firmly down, reinstall clicker assembly into housing. Special attention should be given to ensure the pin is positioned in the same location as it was prior to removal. (Picture 28)



Pressurize the shock reservoir, through the pressure valve, with nitrogen gas to the specified pressure. (PICTURE 29)

If using Ryde FX inflation tool Refer to Procedures for use of replaceable inflation Needle instruction manual found in Ryde FX Inflation Tool case.

NOTE: - Depending on which shock absorber is being worked on, adjust the gas pressure the specified value indicated in the shock specification chart located (TBD) service manual.



After being compressed ,the piston rod should be fully extended from the shock body once the shock has been pressurized.

Install the small button head screw in the pressure valve assembly and tighten securely. (PICTURE 30)



## **REAR SUSPENSION/TRACK/TRACTION**

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**Ryde FX Valve Washer Part Numbers Walker Evans Part Numbers on pg 7.19.**

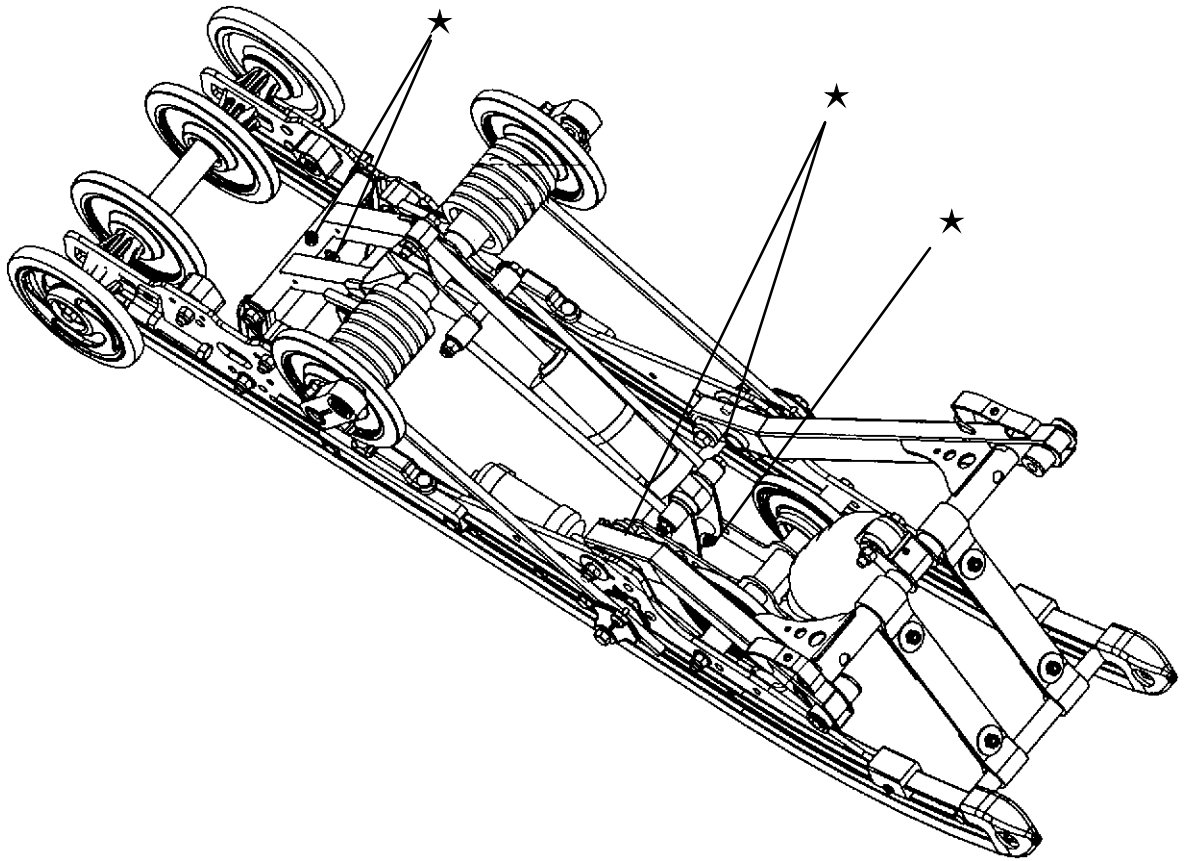
Polaris #	Thickness	Diameter
1700080	0.004 .	.700
1700081	0.006 .	.700
1700082	0.008 .	.700
1700083	0.010 .	.700
1700084	0.012 .	.700
1700085	0.015 .	.700
1700086	0.004 .	.800
1700087	0.006 .	.800
1700088	0.008 .	.800
1700089	0.010 .	.800
1700090	0.012 .	.800
1700091	0.015 .	.800
1700092	0.004 .	.900
1700093	0.006 .	.900
1700094	0.008 .	.900
1700095	0.010 .	.900
1700096	0.012 .	.900
1700120	0.015 .	.900
1700121	0.006 .	1.000
1700122	0.008 .	1.000
1700126	0.010 .	1.000
1700127	0.012 .	1.000
1700128	0.015 .	1.000
1700129	0.006 .	1.100
1700130	0.008 .	1.100
1700131	0.010 .	1.100
1700132	0.012 .	1.100
1700133	0.015 .	1.100
1700134	0.006 .	1.250
1700135	0.008 .	1.250
1700136	0.010 .	1.250
1700137	0.012 .	1.250
1700138	0.015 .	1.250
1700139	0.006 .	1.300
1700140	0.008 .	1.300
1700141	0.010 .	1.300
1700142	0.012 .	1.300
1700143	0.015 .	1.300

Tool Part numbers:	Gas Fill Tool and Gauge (Incl. 5 needles)	PS45259
	Gas Fill Needles replacement pack	PS45259-1
	Gas Fill Gauge (replacement)	PS45259-2
	Lower Retainer Wrench	PS45260
	IFP Positioning / Extraction tool	PS45261
	Cylinder Head Wrench	PS45262
	Wear Band Tool	PS45263
	Arvin Shock Body Holder	PS45629

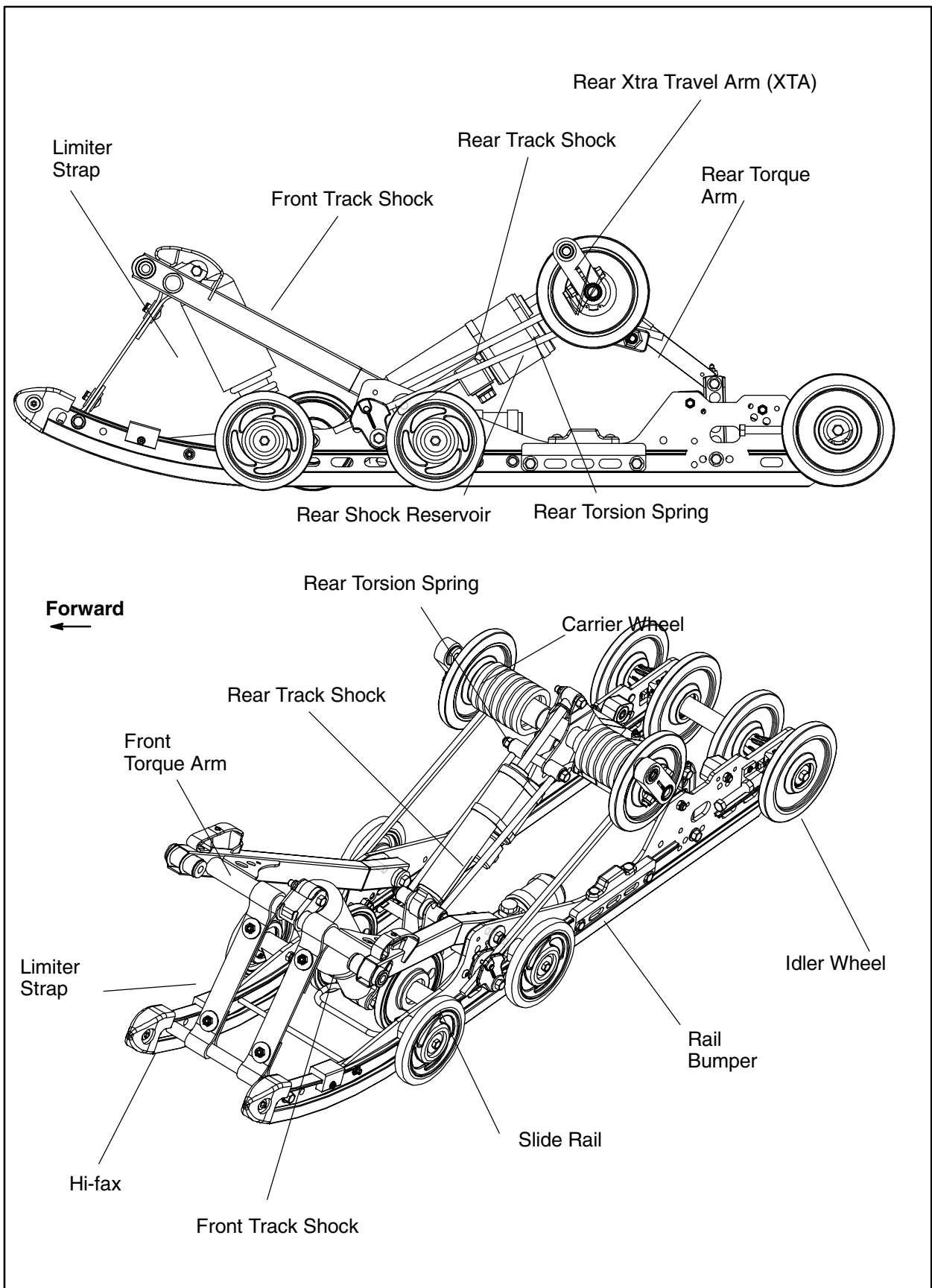




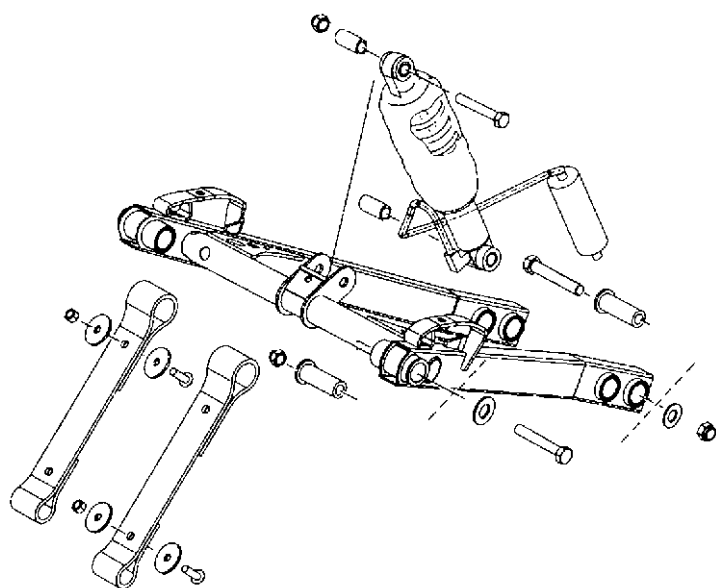
**Suspension Lubrication**



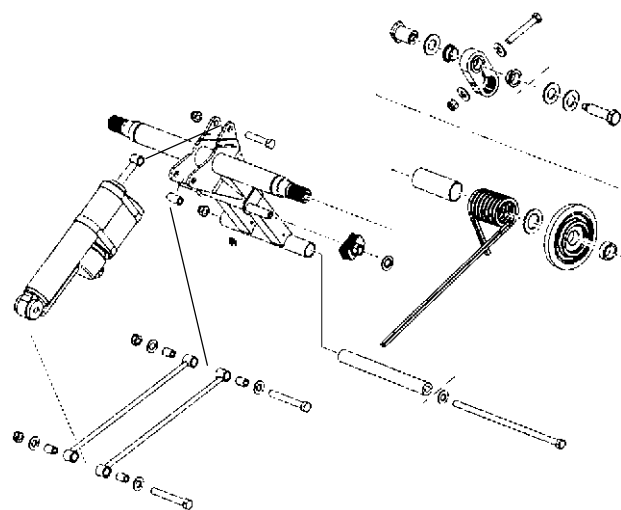
### Rear Suspension Components - Pro X



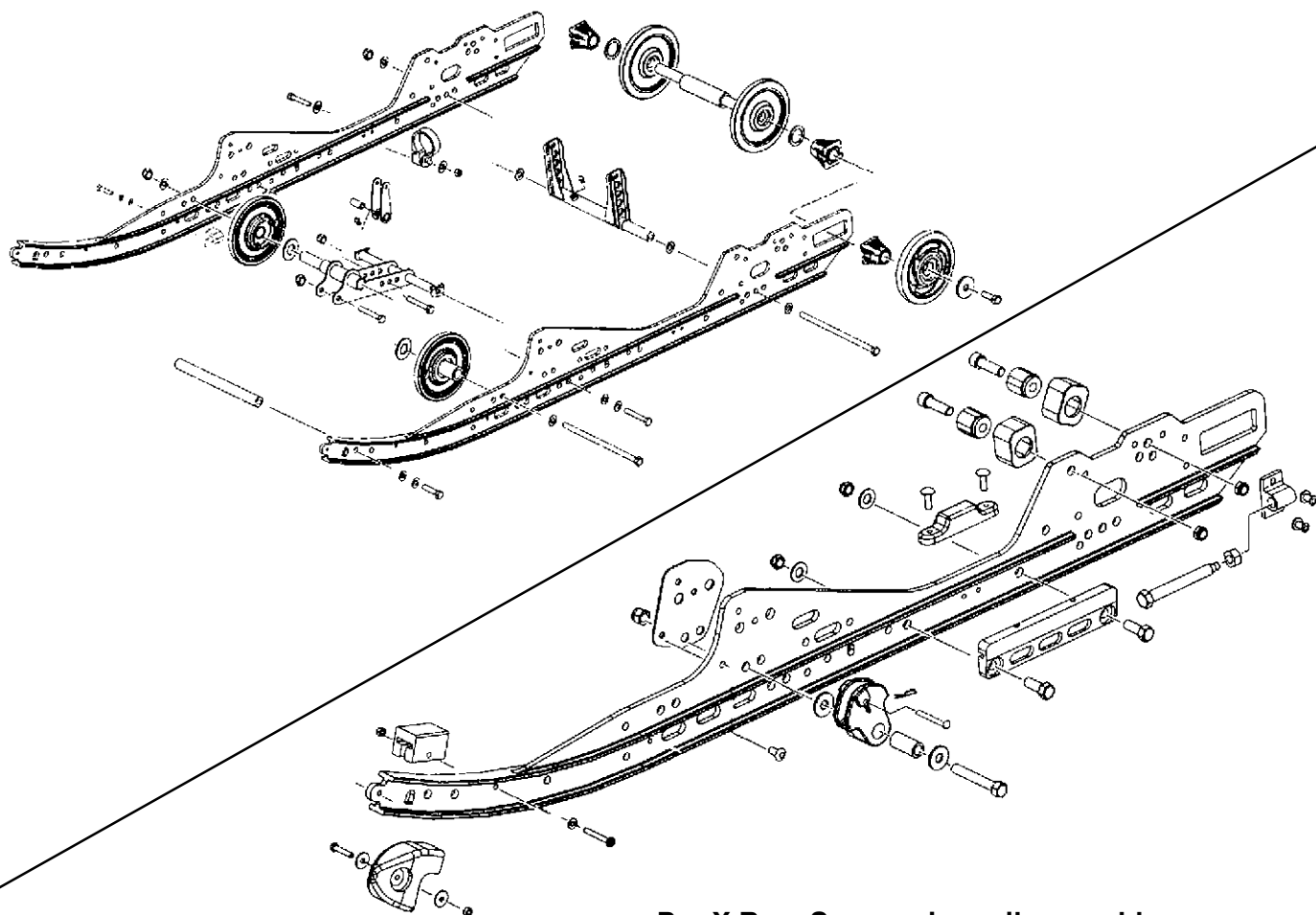
**Rear Suspension Exploded View - Pro X Style**



**Pro X Front Torque Arm**



**Pro X Rear Torque Arm**



**Pro X Rear Suspension rail assembly**

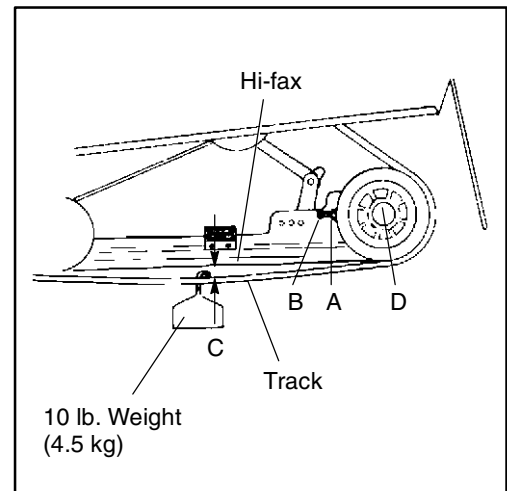
### Track Tension

Tension adjustments should be made only after the track is warmed up and limber. Always inspect track alignment after track tension adjustment.

1. Turn the machine off.
2. Lift the rear of the machine and safely support it off the ground.
3. Place a 10 lb. (4.5 kg) downward pressure on the track at a point approximately 16" (40.6 cm.) ahead of the center of the rear idler wheel (D).
4. Check for  $1\frac{1}{4}$  -  $1\frac{1}{2}$ " (3.175 - 3.81 cm.) slack between the inside of the track clip and the Hi-Fax (C). **NOTE:** Measure at the point where the weight is hanging.

If the track needs adjustment:

5. Loosen rear idler shaft bolts (D) on both sides of the machine.
6. Loosen track adjusting bolt locknuts (A).
7. Tighten or loosen the track adjusting bolts (B) evenly as necessary to obtain proper track tension.
8. Tighten idler shaft bolts and adjuster bolt locknuts.



### Track Tension Data

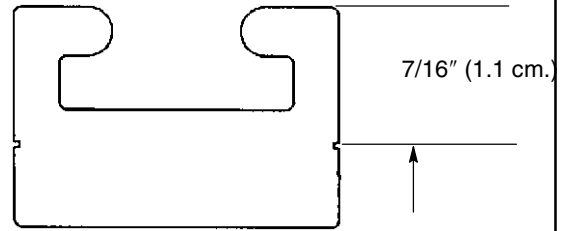
Suspension (Refer to Chapter 1 for type)	Weight	Measurement Location	Measurement
Pro X 121"	10 lbs. (4.54 kg)	16" ahead of rear idler shaft	$1\frac{1}{4}$ - $1\frac{1}{2}$ " (3.175 - 3.81 cm.)

**Hi-Fax Inspection / Replacement****Hi-Fax Replacement - All Models**

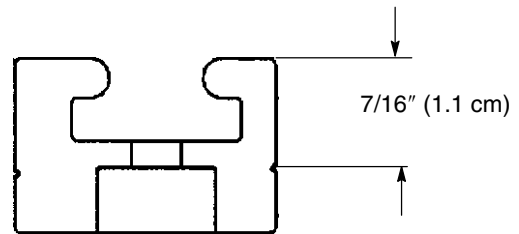
Hi-Fax replacement on all Polaris models is similar. When any area of the Hi-Fax is worn to 1/8" (.3 cm.), it should be replaced. This will save wear on other vital components.

The slide rail is designed to operate in conditions with adequate snow cover to provide sufficient lubrication. Excessive wear may be due to improper alignment, improper track adjustment or machine operation on surfaces without snow.

Replace Hi-Fax when worn to 7/16" (1.11 cm.) on PRO X suspensions.

**Suggested Hi Fax Wear Limit:****Pro X - 7/16" (1.1cm.)****Hi Fax Wear Limit**

440 Pro X PN 5521577-309  
440 Pro X Fan / 600 Pro X  
PN 5521603-309



Wide Hi-Fax for Ice Racing  
5521587-309

### XTRA Lite Wide Hi-Fax

Xtra Lite wide hi-fax is available for ice racing applications. The part number is **5521587-309** for 2003 Pro X suspensions. Install with the wide side to the outside of the snowmobile. These hi-fax are made with a wear mark on the outside. When the hi-fax is wore to the wear mark line, replace the hi-fax.

### Hi-Fax Removal

1. Remove suspension from machine.

**NOTE:** Some models may allow Hi Fax to be removed by sliding it through track windows with the suspension mounted in the machine.

2. Remove front Hi-Fax retaining bolt.

### Hi Fax Replacement

3. Use a block of wood or drift punch and a hammer to drive Hi-Fax rearward off the slide rail.
4. With Hi-Fax material at room temperature, install new Hi-Fax by reversing steps 1 - 3.

### Rubber Track Clip Replacement

1. Install replacement clip and clipping tool.

**NOTE:** For ease of operation, the tool may be placed in a vise.

2. Tighten drive bolt against forming die until clip is formed.

**Track Guide Clip Installation Tool**  
**PN 2871041**

**Track Clip Removal Tool**  
**PN 2871337**

## **Traction**

The amount of traction required varies depending upon the type of riding and the snowmobile's horsepower.

Studs are designed specifically for each riding category. They're made in various lengths, shapes, and materials. Improperly applied studs can cause poor traction and premature wear. Studs which are too long can cause damage to the tunnel and heat exchangers.

Stud points fall into two categories: conical and scoopers. Conical studs (or picks) penetrate into the ground for increased traction. Scoopers use a flat surface to hold more ground for traction. Generally, a penetrating point is used for hard ground surfaces and ice. Scoopers are used on softer surfaces.

Material contributes more to stud life and cost than to functionality. Carbide is the most durable and lasts much longer than steel. Studs should be installed no closer than 3/4" from the edges of the track. Avoid the center of the track because there is poor support in this area. The track's center belt controls acceleration. The two smaller outside track belts contribute to acceleration, and have the largest affect on cornering. The following chart is a guideline for the quantity of studs to install.

<b>Horsepower</b>	<b>Snowcross/ Cross Country</b>	<b>Drag</b>
50-60 HP	96 Studs	96 Studs
60-75 HP	96 Studs	120 Studs
75-100 HP	120 Studs	144 Studs
100-125 HP	144 Studs	168 Studs
120-130 HP	168 Studs	192 Studs
125-150 HP	192 Studs	240 Studs
130-170 HP	240 Studs	240 Studs

- Be sure to check allowable clearance between the track and tunnel or heat exchangers, factoring in suspension travel.
- Do not place studs under the tunnel protector strips (directly above slide rails on underside of tunnel). Tunnel protectors are vital components and must not be subjected to stud damage.
- V-shaped stud patterns with the least repetition work best. Studs should cover as many different lines in the ice as possible.
- Studs closest to the slide rails provide the most effectiveness, because the weight of the sled is concentrated in this area.

**ALWAYS REFER TO YOUR ISR ON RACE AFFILIATE FOR STUD RULES PRIOR TO STUDDING YOUR TRACK.**

## Stud Installation

1. Mark the stud pattern on the track.
2. Drill stud holes with a 1/4" (7mm) hollow-core drill bit. Make sure the drill is sharp for a clean hole.
3. Spin the non-cutting portion of the drill shank in the hole at high speed to melt the cords together, or melt them with a 1/4-9/32" heated probe. This will prolong track life.

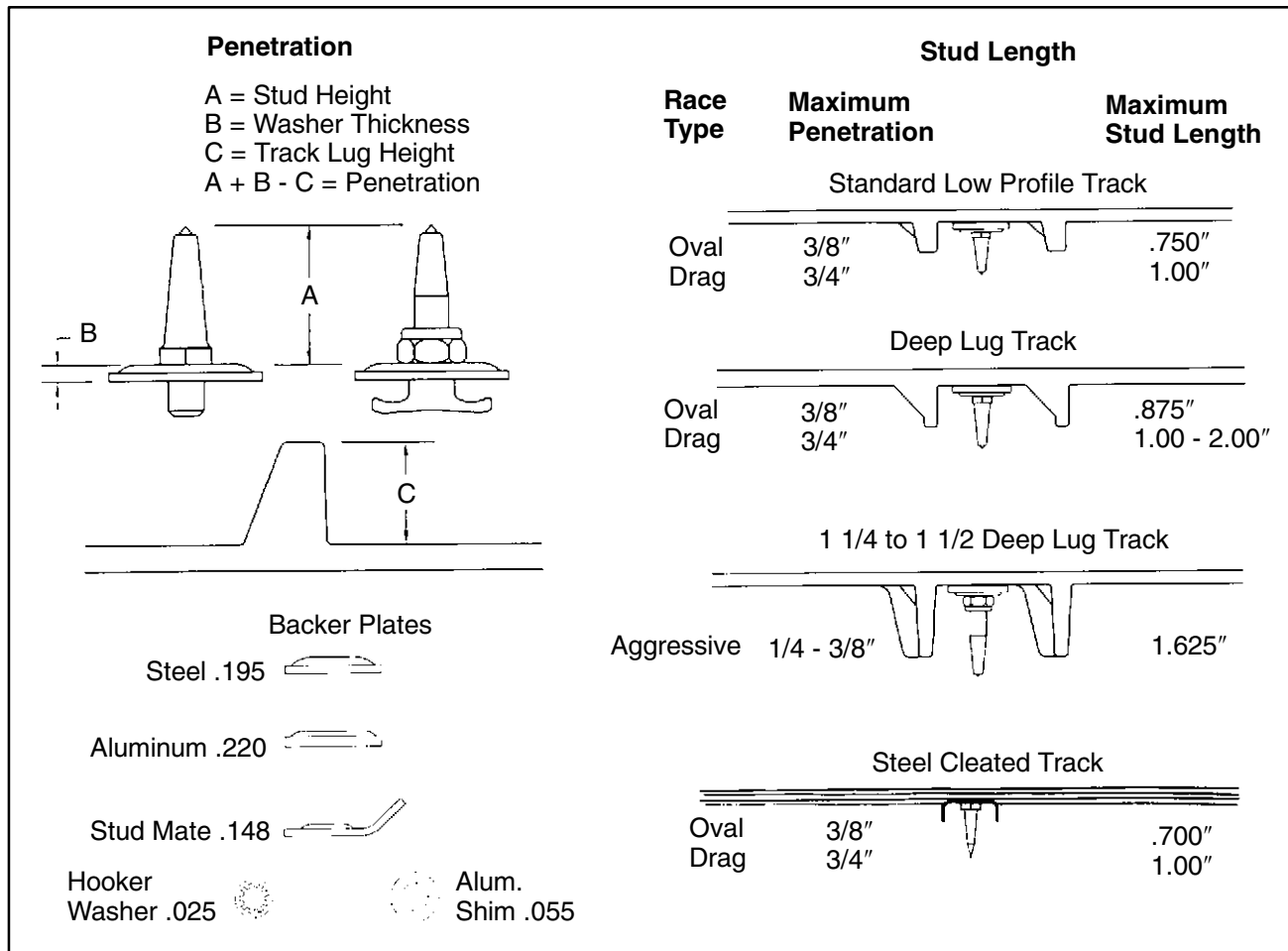
## T-nut Studs

1. Push a T-nut tool through the hole from the outside of the track.
2. With the barrel end of the T-nut toward the track, spin a T-nut onto the tool. Pull the T-nut into the track until the head is flush with the track.
3. Remove the tool and put a drop of Loctite™ 262 or 271 on the nut threads and stud threads.
4. Secure the T-nut, slide a support washer onto the stud, and screw the stud into the T-nut
5. Torque to 80-100 in. lbs. and let dry for 24 hours at room temperature.
6. Check for loose studs after each event.

## Push Through Studs

1. Push stud through track hole from inside track. Hand tighten domed support plate and Nyloc nut on the exposed stud.
2. Tighten with a socket on the nut and a 5.32" allen wrench on the stud head. Tighten nut until the domed washer bottoms out on the stud shoulder. If tightened beyond this point, the threads will be stripped.
3. Inspect for loose nuts after each event.

Refer to the diagrams below for stud length recommendations.





## Traction

### ⚠ WARNING

A proper balance of traction products on the skis and track must be maintained to obtain proper vehicle control on hard packed snow and ice. Loss of control can result in severe personal injury or death.

Track studding will enhance braking control on hard packed snow or ice, but extreme caution is still required on such surfaces. Use extra caution when track studding is employed as steering ability may be reduced on hard packed snow or ice. The addition of carbide skags (if not already installed) is recommended with studded tracks to aid in maintaining proper vehicle steering and control. Proper balance must be maintained between the number of studs and the length and sharpness of carbide on skags.

If you are adding studs to the track of a machine it will probably be advisable to add carbide skags or change to more aggressive skags in order to maintain proper vehicle control while turning on hard packed snow or ice. If the machine is equipped with carbide skags or if you are adding them or changing to more aggressive skags than standard equipment, it may also be necessary to add track studs in order to maintain proper vehicle control while turning on hard packed snow or ice.

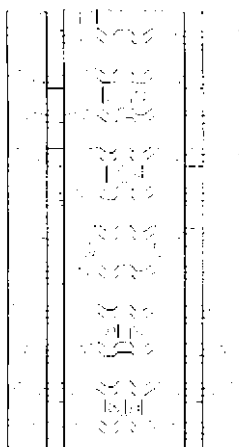
As a rule of thumb, the more studs, the longer and sharper the carbide on the skags should be. The recommendations in the chart should be used as guidelines in achieving a proper balance of ski and track traction products on Polaris snowmobiles.

Typical pattern placement  
as viewed from inside track.



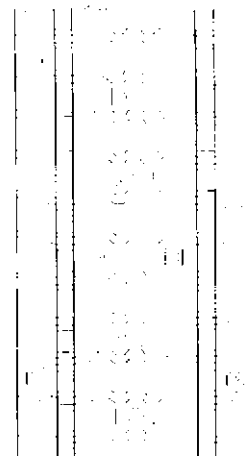
Track  
Rotation  
↓

48 Studs 121"  
53 Studs 133"

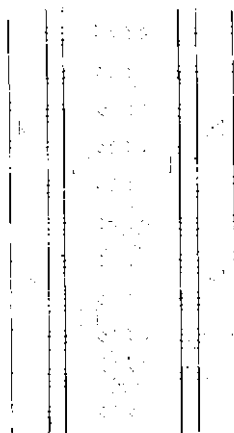


Track  
Rotation  
↓

72 Studs 121"  
80 Studs 133"

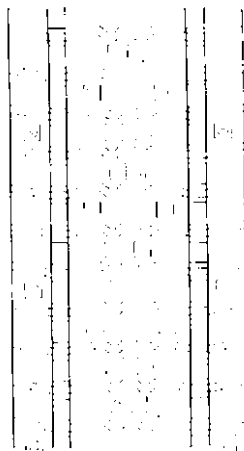


96 Studs 121"  
106 Studs 133"



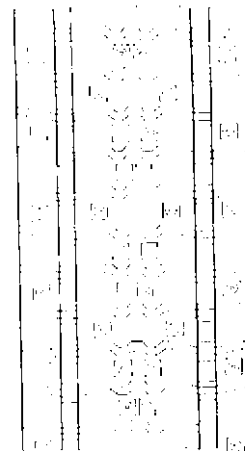
Track  
Rotation  
↓

120 Studs 121"  
132 Studs 133"



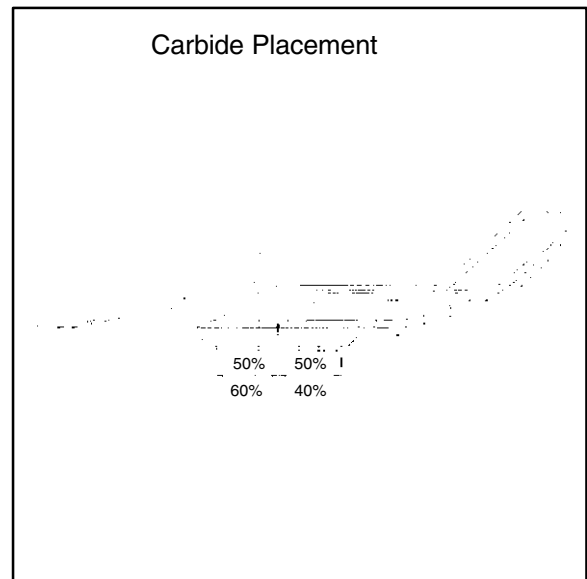
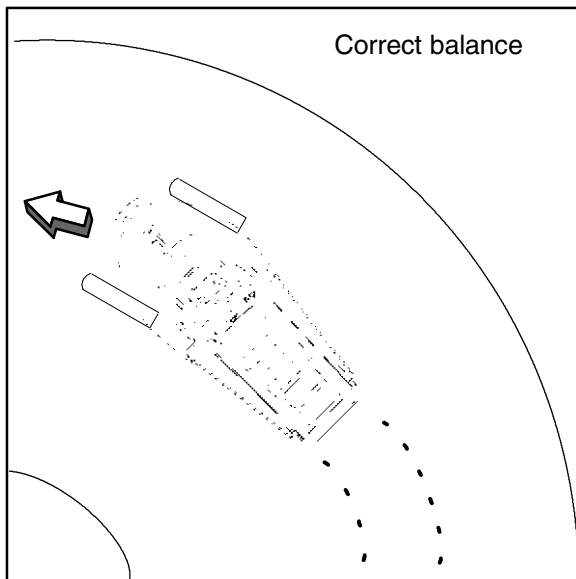
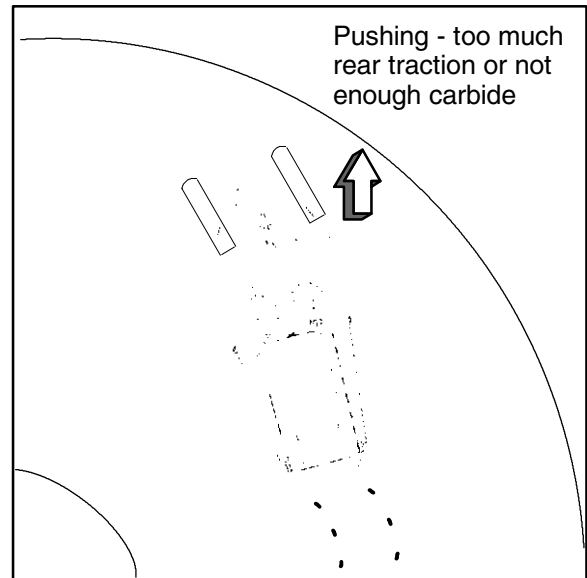
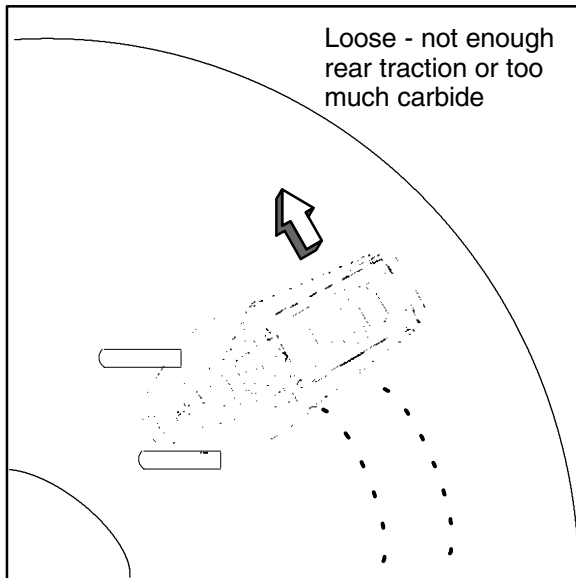
Track  
Rotation  
↓

144 Studs 121"



### Traction

Too few studs will allow the track to spin, resulting in excessive wear or damage to the studs. A loose condition can result from too many dull studs. Front end pushing can result from too many sharp studs. After studs are installed, it's important to install carbide skags to ensure maximum steering control. See the diagrams below.



# **CHAPTER 8**

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# **ELECTRICAL**

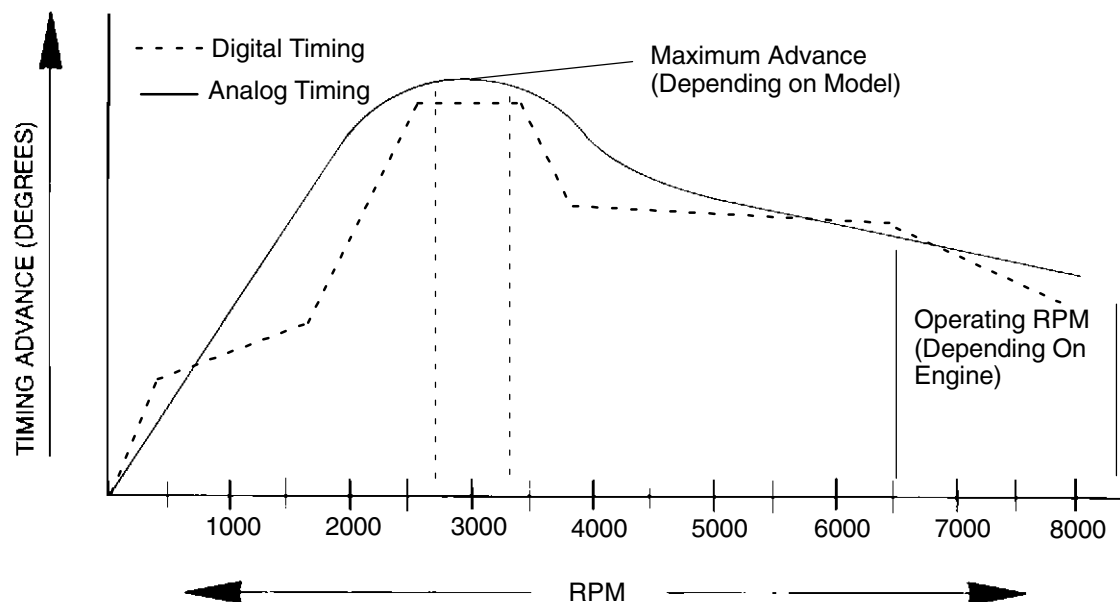
Engine Electrical .....	8.1
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440/600 Pro X Ignition .....	8.4
700/800 Pro X Ignition .....	8.5
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Alternators .....	8.11
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## Engine Electrical

Machine Model	Alternator Wattage	Spark Plug		Plug Gap MM/inches	CDI Box Identification Number	Fly-wheel ID #
		NGK	Champion			
440 Pro X Fan	240	BR9ES	RN2C	0.7/.028	CU7227	IG3792
440 Pro X	280	TBA	RN57YCC	0.7/.028	4010624	4010624
600 Pro X	280	TBA	RN57YCC	0.7/.028	4010689	4010629

### Ignition Timing



**NOTE:** Always verify timing of engine at room temperature only (68° F / 20° C, no engine warm up) and at the proper RPM.

To obtain the best ignition timing accuracy and reduce the chance of error, the ignition timing specification is given at a "flat" portion of the advance curve. This flat portion on the curve is where the ignition timing is specified. Ignition timing must be checked at the specified RPM, or inaccurate timing will result. Refer to timing specifications at the beginning of this chapter.

### Dial Indicating The Timing Marks

Due to differences between engines, it is necessary to dial indicate the timing marks on all engines before attempting to adjust the ignition timing. To indicate the marks:

1. Remove the mag (RH) cylinder spark plug and install the dial indicator.
2. Rotate the crankshaft by hand while observing the dial indicator. As the piston touches the indicator plunger, the dial will begin to rotate. Find the point where the pointer stops rotating and reverses direction. This will be TDC (Top Dead Center).
3. While holding the crankshaft with the piston at TDC, zero the indicator by rotating the bezel until the 0 on the dial and the pointer align.
4. Rotate the crankshaft opposite the direction of rotation about .250 BTDC (2 1/2 pointer revolutions).
5. Determine the correct ignition timing position from the ignition data charts and rotate the crankshaft in the normal direction of rotation to that position. (**Example:** If engine timing is .150 BTDC, the crankshaft must be rotated in the normal direction of rotation so that the dial indicator pointer does one complete revolution and stops on 50. This should be 1 1/2 pointer revolutions before top center, or .150 BTDC).
6. While holding the crankshaft at the correct timing position, mark the flywheel (with chalk or a white marker) directly in-line with the stationary pointer (or line) on the fan or recoil housing through the timing inspection window.

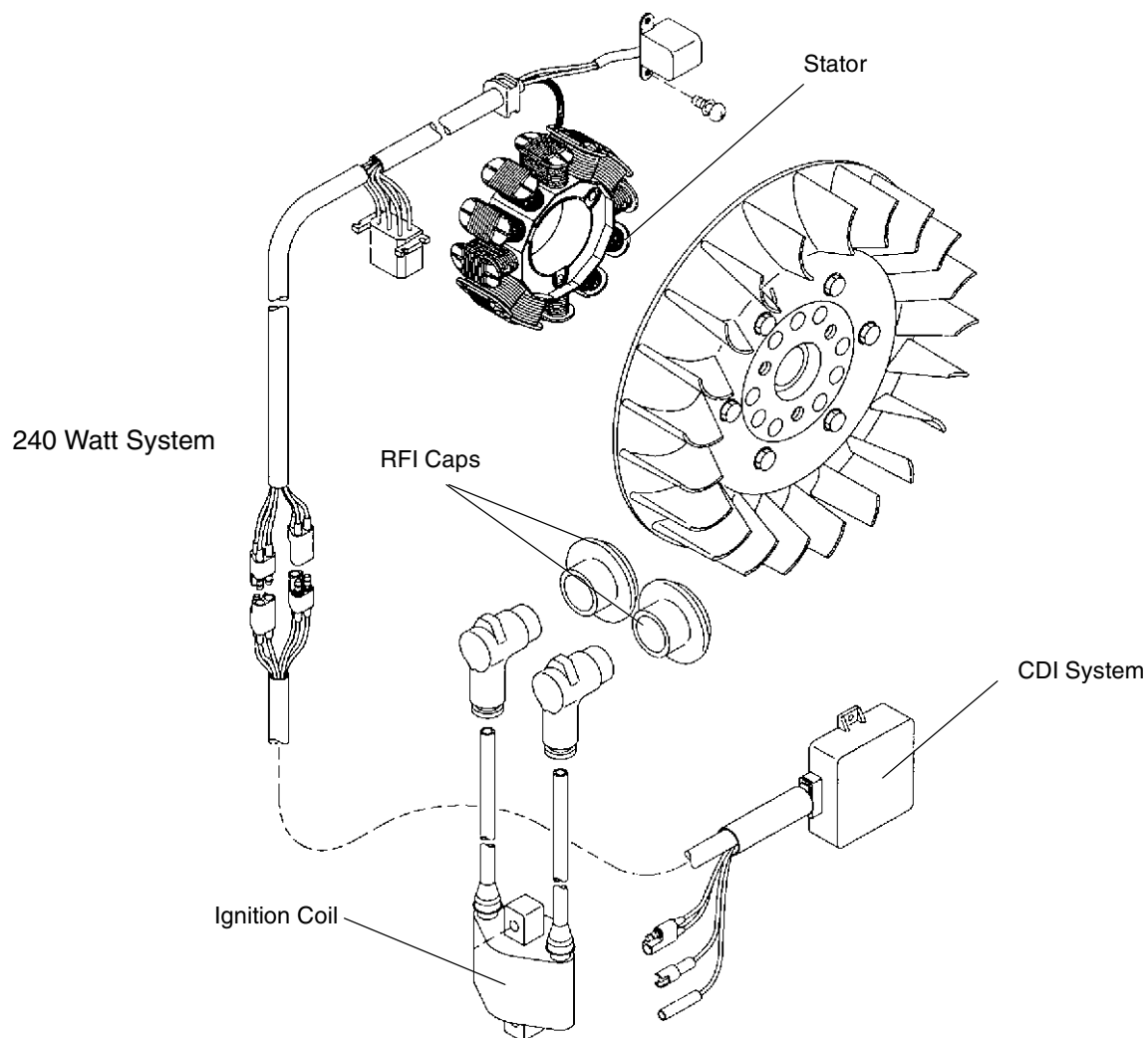
## Conversion Chart - Degrees to Piston Position - B.T.D.C.

If the ignition timing specification is listed in degrees only, convert to either inches or mm BTDC and use a dial indicator to verify timing marks. **NOTE:** Due to differing rod lengths and engine strokes, consult the engine model list for correct engine.

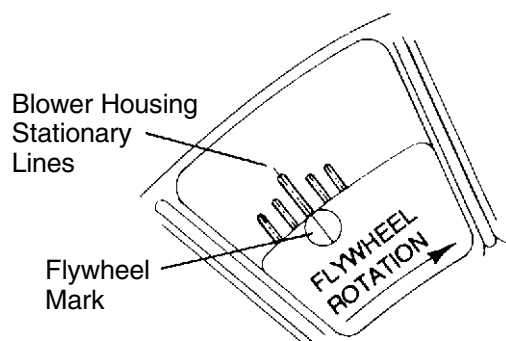
DEG. BTDC	EC40PL EC44-2PM EC44-3PM EC45PL EC50PL EC58PL EC60PL EC65PL		EC45PM EC55PM		EC59PL EC68PL EC70PL EC79PL EC80PL		EC34-2PM		EC25PF EC25PS EC44PT EC44PQ EC44PM		Domestic 440 Domestic 500 Domestic 600 (with V.E.S.)		Domestic 630 (without V.E.S.) Domestic 700		Domestic 800	
	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES
1	0.0058	0.0002	0.0063	0.0002	0.0062	0.0002	0.0054	0.0002	0.0057	0.0002	0.0061	0.0002	0.0065	0.0003	0.0067	0.0003
2	0.0232	0.0009	0.0252	0.0010	0.0249	0.0010	0.0215	0.0008	0.0228	0.0009	0.0244	0.0010	0.0259	0.0010	0.0268	0.0011
3	0.0521	0.0021	0.0566	0.0022	0.0561	0.0022	0.0484	0.0019	0.0514	0.0020	0.0548	0.0022	0.0582	0.0023	0.0603	0.0024
4	0.0826	0.0036	0.1006	0.0040	0.0997	0.0039	0.0860	0.0034	0.0913	0.0036	0.0974	0.0038	0.1035	0.0041	0.1072	0.0042
5	0.1447	0.0057	0.1571	0.0062	0.1558	0.0061	0.1343	0.0053	0.1426	0.0056	0.1522	0.0060	0.1617	0.0064	0.1674	0.0066
6	0.2083	0.0082	0.2261	0.0089	0.2242	0.0088	0.1933	0.0076	0.2053	0.0081	0.2190	0.0086	0.2327	0.0092	0.2410	0.0095
7	0.2833	0.0112	0.3078	0.0121	0.3050	0.0120	0.2630	0.0104	0.2793	0.0110	0.2979	0.0117	0.3166	0.0125	0.3278	0.0129
8	0.3698	0.0146	0.4016	0.0158	0.3981	0.0157	0.3432	0.0135	0.3646	0.0144	0.3889	0.0153	0.4132	0.0163	0.4279	0.0168
9	0.4677	0.0184	0.5079	0.0200	0.5036	0.0198	0.4341	0.0171	0.4612	0.0182	0.4919	0.0194	0.5226	0.0206	0.5412	0.0213
10	0.5770	0.0227	0.6265	0.0247	0.6212	0.0245	0.5355	0.0211	0.5689	0.0224	0.6068	0.0239	0.6448	0.0254	0.6876	0.0263
11	0.6976	0.0275	0.7575	0.0298	0.7510	0.0296	0.6474	0.0255	0.6878	0.0271	0.7336	0.0289	0.7795	0.0307	0.8071	0.0318
12	0.8294	0.0327	0.9006	0.0355	0.8930	0.0352	0.7696	0.0303	0.8178	0.0322	0.8723	0.0343	0.9268	0.0365	0.9597	0.0378
13	0.9724	0.0383	1.0559	0.0416	1.0470	0.0412	0.9025	0.0355	0.9598	0.0377	1.0227	0.0403	1.0867	0.0428	1.1251	0.0443
14	1.1265	0.0444	1.2232	0.0482	1.2129	0.0478	1.0456	0.0412	1.1108	0.0437	1.1849	0.0466	1.2589	0.0490	1.3035	0.0513
15	1.2917	0.0509	1.4026	0.0552	1.3908	0.0548	1.1989	0.0472	1.2737	0.0501	1.3586	0.0535	1.4435	0.0568	1.4940	0.0588
16	1.4678	0.0578	1.5938	0.0627	1.5804	0.0622	1.3624	0.0536	1.4474	0.0570	1.5439	0.0608	1.6404	0.0646	1.6984	0.0669
17	1.6548	0.0652	1.7969	0.0707	1.7818	0.0701	1.5359	0.0605	1.6269	0.0642	1.7406	0.0685	1.8494	0.0728	1.9149	0.0754
18	1.8526	0.0729	2.0117	0.0792	1.9948	0.0785	1.7196	0.0677	1.8206	0.0719	1.9487	0.0767	2.0705	0.0815	2.1438	0.0844
19	2.0611	0.0811	2.2380	0.0881	2.2193	0.0874	1.9130	0.0753	2.0326	0.0800	2.1681	0.0854	2.3036	0.0907	2.3851	0.0939
20	2.2802	0.0898	2.4759	0.0975	2.4552	0.0967	2.1163	0.0833	2.2487	0.0885	2.3966	0.0944	2.5485	0.1003	2.6386	0.1039
21	2.5098	0.0988	2.7252	0.1073	2.7024	0.1064	2.3294	0.0917	2.4752	0.0974	2.6402	0.1039	2.8052	0.1104	2.9043	0.1143
22	2.7497	0.1083	2.9857	0.1175	2.9608	0.1166	2.5521	0.1005	2.7119	0.1068	2.8927	0.1139	3.0735	0.1210	3.1820	0.1253
23	3.0000	0.1181	3.2574	0.1282	3.2303	0.1272	2.7843	0.1086	2.9587	0.1155	3.1500	0.1243	3.3532	0.1320	3.4717	0.1367
24	3.2603	0.1284	3.5401	0.1394	3.5107	0.1382	3.0260	0.1191	3.2156	0.1266	3.4300	0.1350	3.6444	0.1435	3.7730	0.1485
25	3.5307	0.1390	3.8336	0.1509	3.8019	0.1497	3.2769	0.1290	3.4824	0.1371	3.7146	0.1462	3.9467	0.1554	4.0860	0.1609
26	3.8110	0.1500	4.1379	0.1629	4.1038	0.1616	3.5370	0.1393	3.7590	0.1480	4.0096	0.1579	4.2802	0.1677	4.4104	0.1736
27	4.1010	0.1615	4.4528	0.1753	4.4161	0.1739	3.8062	0.1498	4.0452	0.1593	4.3149	0.1699	4.5846	0.1805	4.7462	0.1869
28	4.4007	0.1733	4.7782	0.1881	4.7389	0.1866	4.0843	0.1608	4.3410	0.1709	4.6303	0.1823	4.9197	0.1937	5.0931	0.2005
29	4.7068	0.1854	5.1138	0.2013	5.0719	0.1997	4.3712	0.1721	4.6461	0.1829	4.9558	0.1951	5.2655	0.2073	5.4510	0.2146
30	5.0282	0.1980	5.4595	0.2149	5.4149	0.2132	4.6667	0.1837	4.9604	0.1953	5.2911	0.2063	5.6218	0.2213	5.8197	0.2291
31	5.3559	0.2109	5.8152	0.2289	5.7679	0.2271	4.9708	0.1957	5.2839	0.2080	5.6361	0.2219	5.9884	0.2358	6.1991	0.2441
32	5.6926	0.2241	6.1807	0.2433	6.1306	0.2414	5.2832	0.2080	5.6163	0.2211	5.9907	0.2359	6.3651	0.2506	6.5889	0.2594
33	6.0381	0.2377	6.5559	0.2581	6.5028	0.2560	5.6039	0.2206	5.9575	0.2345	6.3546	0.2502	6.7518	0.2658	6.9891	0.2752
34	6.3924	0.2517	6.9405	0.2732	6.8845	0.2710	5.9326	0.2336	6.3073	0.2483	6.7278	0.2649	7.1482	0.2814	7.3993	0.2913
35	6.7552	0.2660	7.3343	0.2888	7.2754	0.2864	6.2663	0.2468	6.6656	0.2624	7.1099	0.2799	7.5543	0.2974	7.8195	0.3079
36	7.1263	0.2806	7.7372	0.3046	7.6753	0.3022	6.6138	0.2604	7.0322	0.2769	7.5010	0.2953	7.9698	0.3138	8.2494	0.3248
37	7.5057	0.2955	8.1491	0.3208	8.0840	0.3183	6.9658	0.2742	7.4069	0.2916	7.9007	0.3111	8.3945	0.3305	8.6888	0.3421
38	7.8931	0.3108	8.5696	0.3374	8.5015	0.3347	7.3253	0.2884	7.7896	0.3067	8.3089	0.3271	8.8282	0.3476	9.1375	0.3597
39	8.2883	0.3263	8.9988	0.3543	8.9274	0.3515	7.6920	0.3028	8.1801	0.3221	8.7254	0.3435	9.2708	0.3650	9.5954	0.3778
40	8.6912	0.3422	9.4360	0.3715	9.3616	0.3686	8.0659	0.3176	8.5782	0.3377	9.1501	0.3602	9.7220	0.3828	10.0622	0.3951

## Twin Cylinder Fan CDI Ignition - Exploded View - Timing

## 440 Pro X Fan



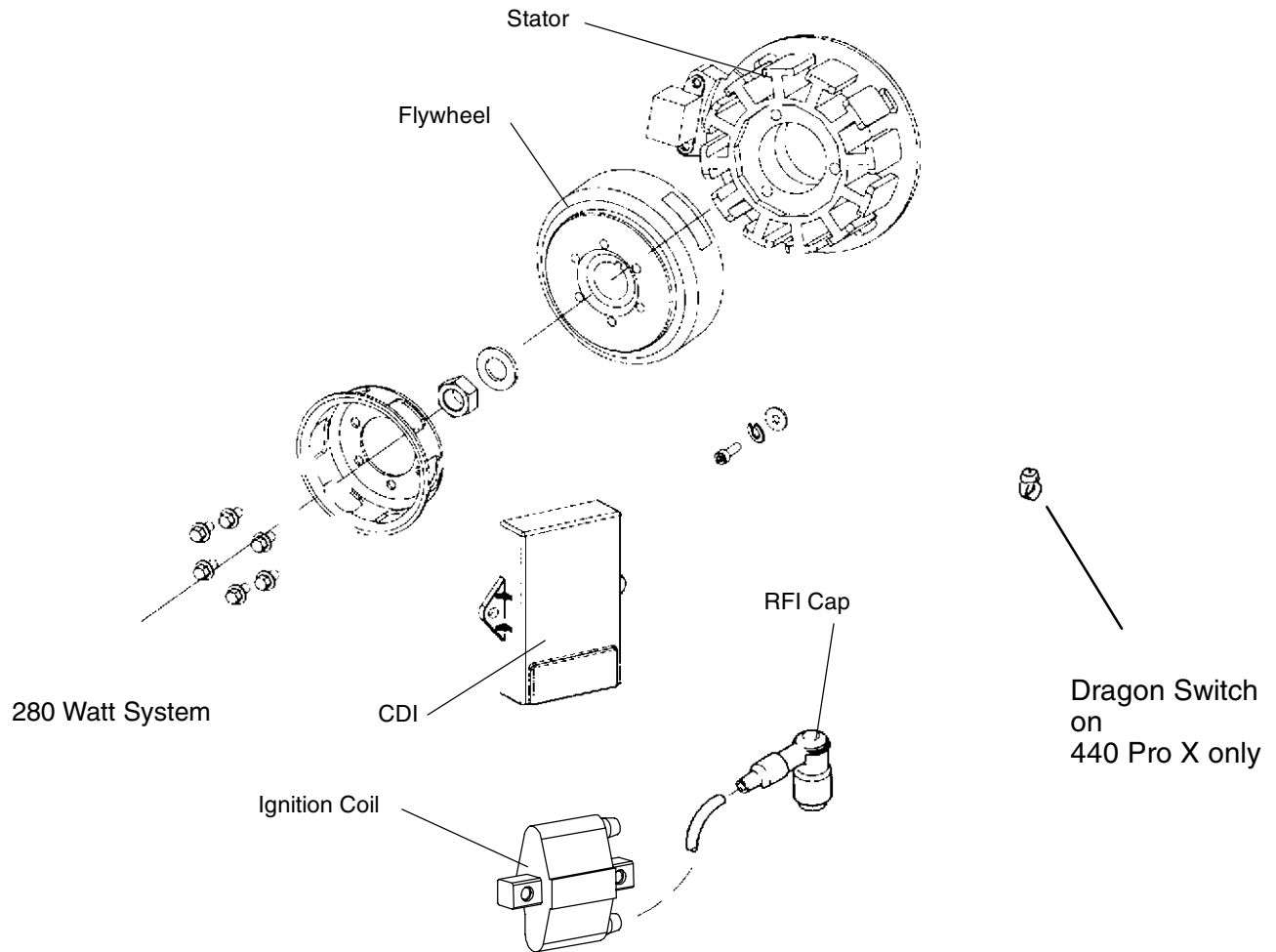
**NOTE:** Always verify timing of engine at room temperature only (68° F / 20° C, no engine warm up) and at the proper RPM.



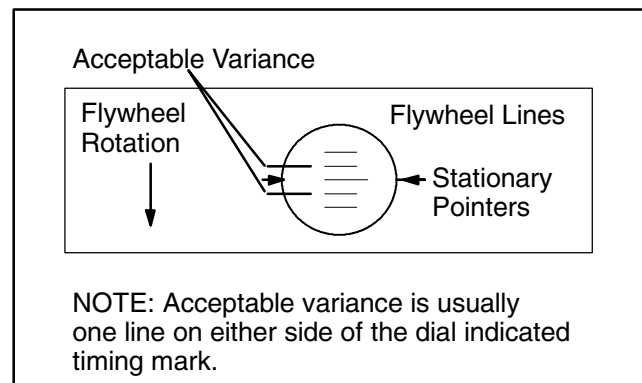
**NOTE:** Acceptable variance is usually one line on either side of the dial indicated blower housing stationary line.

## Exploded View - Timing

### 440/600 Pro X

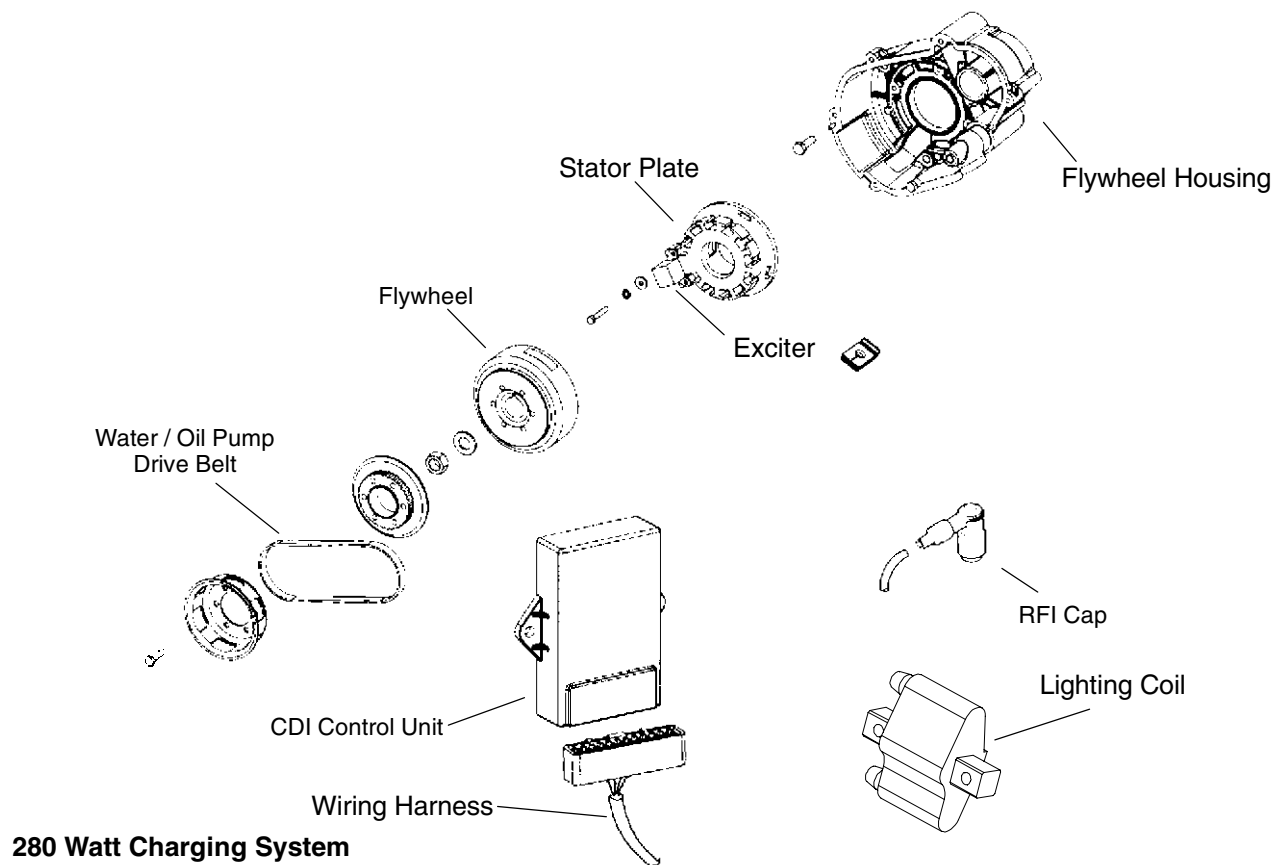


**NOTE:** Always verify timing of engine at room temperature only (68° F / 20° C, no engine warm up) and at the proper RPM.

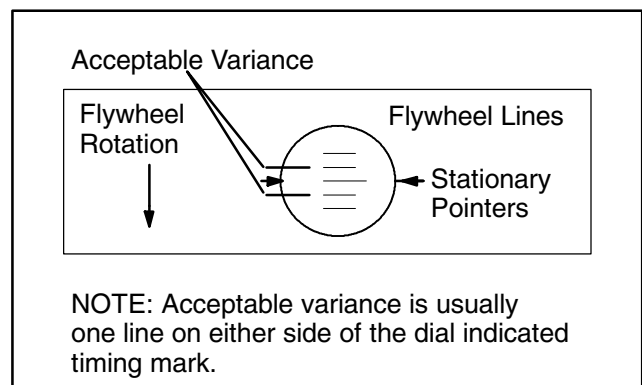




## 700 / 800 Pro X



**NOTE:** Always verify timing of engine at room temperature only (68° F/20° C).

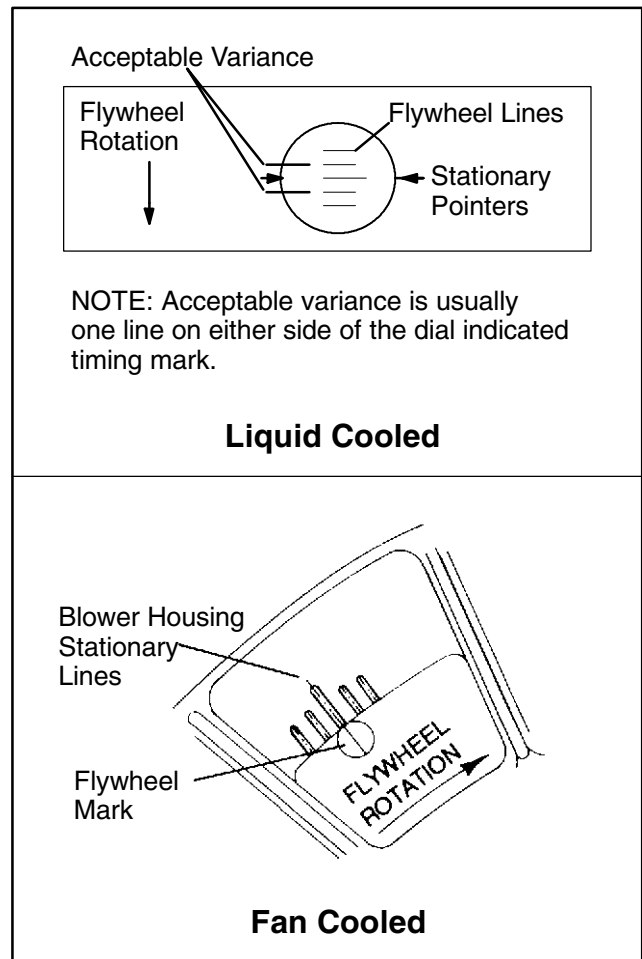


## CDI Ignition Timing

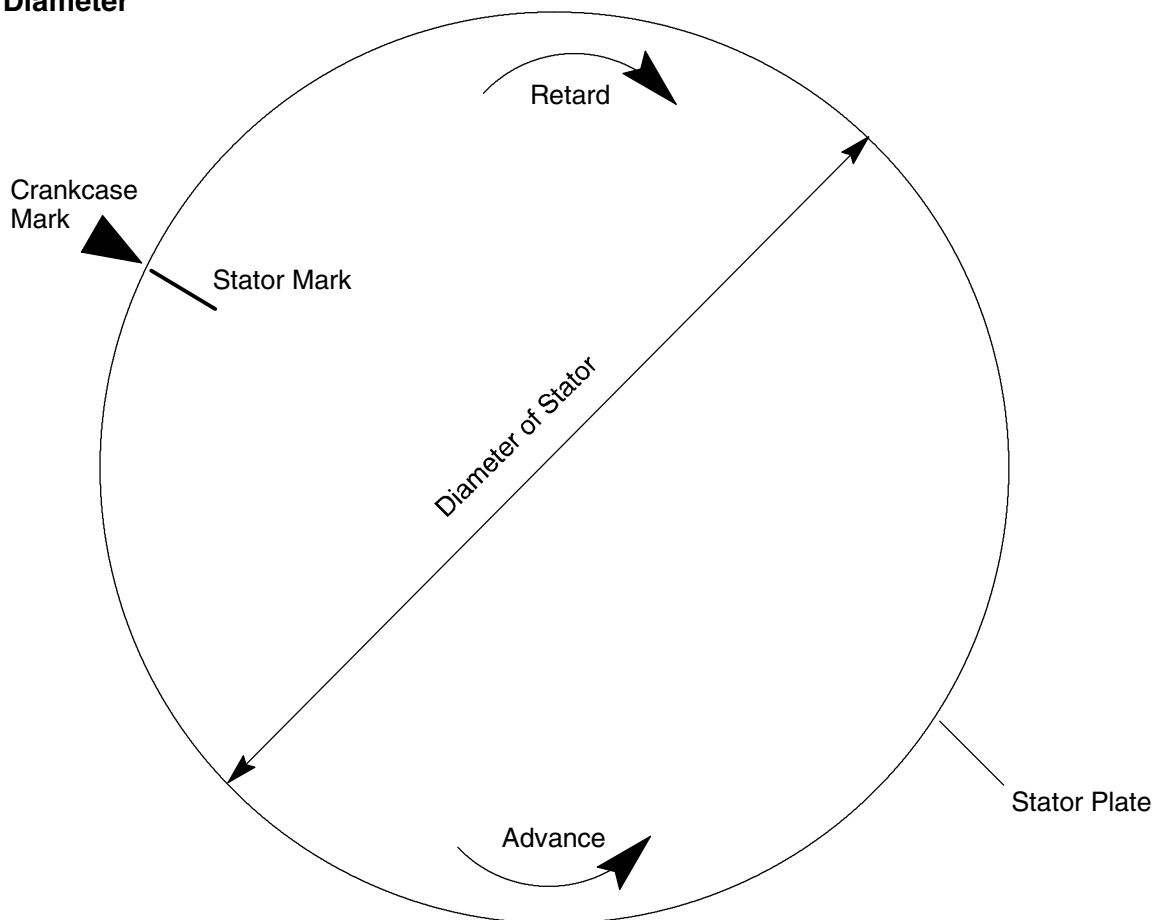
### Timing Procedure - All Models

**NOTE:** Always verify timing of engine at room temperature only (68° F / 20° C, no engine warm up) and at the proper RPM.

1. Refer to the timing specification charts at the beginning of this section to determine the proper ignition timing for the engine you are working on.
  2. Use a dial indicator to place the piston in the proper timing position and mark the flywheel at this point.
  3. Connect an accurate tachometer and a good quality timing light to the engine according to manufacturer's instructions. *Disconnect the TPS (Throttle Position Sensor) connector from carburetor.*
  4. Start engine and increase RPM to the point specified in the timing specifications in Chapter 1. Hold the throttle to maintain specified timing RPM.
  5. Point the timing light at the timing inspection hole.
  6. With your head positioned so there is a straight line between your eye, the stationary pointer and the crankshaft center line, note the relative position between the marked flywheel line and the stationary pointer. If the stationary pointer is aligned with the mark made in Step 2, (or within the acceptable  $\pm$  variance) the timing is correct.
  7. If the pointer is outside the variance, the stator will have to be rotated either with crankshaft rotation (to retard the timing) or *against* rotation to advance it.
- NOTE:** Rotate stator plate approximately the same distance as the marks must move.
- NOTE:** In most cases, the recoil starter housing, recoil drive hub, and flywheel must be removed to loosen the stator bolts and change the timing. On some engines, the stator plate retaining screws can be accessed through the flywheel.
8. Torque stator plate screws and flywheel nut to specified torque. Apply Loctite 262 (red) to crankshaft flywheel taper if required. Refer to the Specifications section for torque specifications and flywheel installation procedure for engine type.



## Stator Diameter



The formula for determining stator movement per degree of timing:

$$\frac{\text{Diameter of stator} \times 3.1416}{360^\circ} = \text{thousandths of stator movement per degree of timing}$$

Example:  $\frac{4.000 \times 3.1416}{360^\circ} = .035''$  of stator movement per one degree of stator movement

## Ignition System Testing

Ignition system components can be individually tested by measuring their internal resistance and insulation to ground. These checks **must** be done with a digital volt/ohm meter. Compare the readings obtained to the values listed on the chart. Actual values may vary up to  $\pm 10\%$  between like components. Any readings outside the span should be considered questionable.

**NOTE:** The stator coils can be checked without removing them from the engine. Simply disconnect the connector plug in the stator-to-CDI wire and check the resistance values between the wire colors. Consult the stator schematics shown at the end of this section.

For specific information, consult the wiring diagrams at the end of this section.

**NOTE:** Secondary coils can also be dynamically tested with a coil power tester. Consult the tester operation manual for specific operating instructions.

## Multimeter Usage

The easiest and most accurate method for testing modern electrical components is with a digital multimeter. Any good quality multimeter will work. However, due to ease of operation and durability, Polaris recommends the Fluke Model 73 (PN 2870659), or Tektronix DMM155. See photo at right. This instrument will provide a digital readout of the measured value of the test being performed.

Listed below are the dial symbols, their meaning and what the dial setting can be used for.

Off = Instrument Off

### **V~ = Volts AC - measuring alternator output**

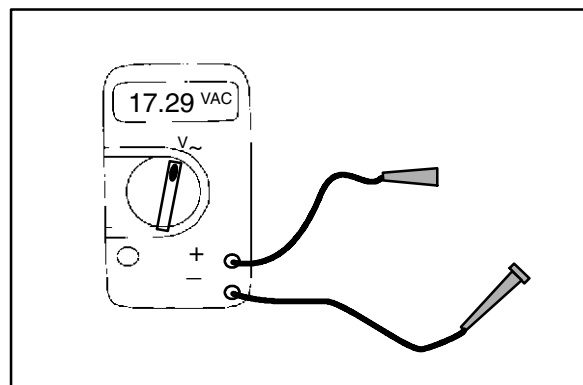
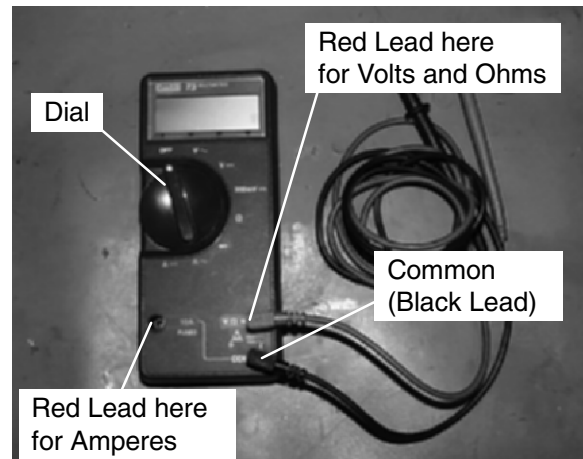
Used to measure AC voltage in an electrical system. AC voltage is produced from every coil on the stator plate when a magnet is passed by it.

#### Test Method

1. Connect black lead to Com (-) meter terminal.
2. Connect red lead to VΩ (+) meter terminal.
3. Turn selector dial to V~ setting.
4. Connect test leads parallel with test component. The polarity of the leads is not important.

#### Usage

- Test unregulated voltage output of a stator coil
- Test regulated voltage to the lights and handwarmers



### **V --- = Volts DC - measuring battery voltage, volt drop, etc.**

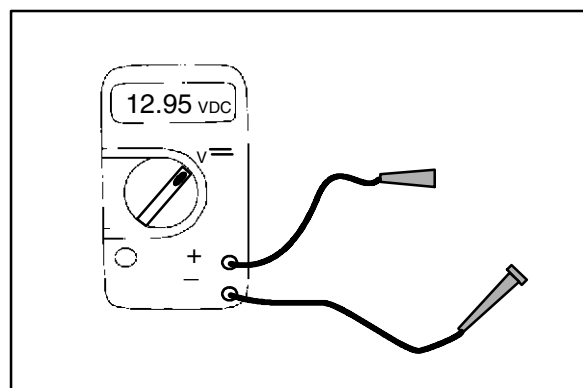
Used to measure DC voltage produced by a battery or rectifier.

#### Test Method

1. Connect black lead to Com (-) meter terminal
2. Connect red lead to VΩ (+) meter terminal.
3. Turn selector dial to V --- setting.
4. Connect test leads parallel with test component. Observe polarity.

#### Usage

- Test battery voltage
- Test DC regulator
- Test voltage drop for bad connections
- Test supply voltage to electric fuel gauge



## Multimeter Usage

$\Omega$  = Ohms, resistance - measuring component resistance values - testing coils, wiring, etc.

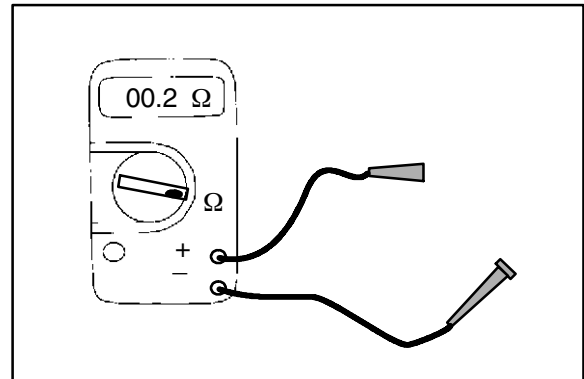
Used to test resistance to the flow of electricity in a circuit or component. A reading of OL means an open circuit or infinite resistance. Sometimes the leads themselves will have some resistance. Touch the leads together and subtract this resistance from the component reading to achieve the actual reading.

### Test Method

1. Connect black lead to Com (-) meter terminal
2. Connect red lead to  $V\Omega$  (+) meter terminal.
3. Turn selector dial to  $\Omega$  setting.
4. Isolate test component from the rest of the electrical circuit by disconnecting wires from harness.
5. Connect test leads to the circuit to be tested.

### Usage

- Testing coil resistance
- Testing switch operation
- Testing wire continuity



**A~ = Amps AC - used to test lighting coil output**

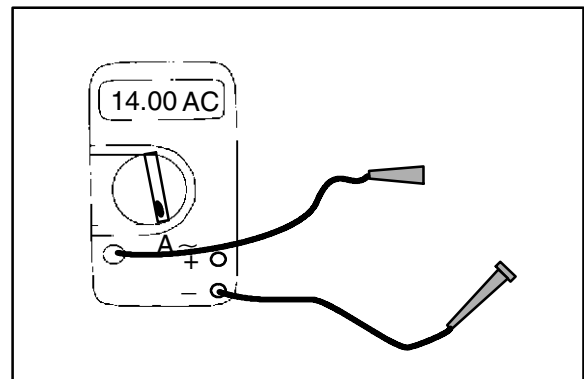
Used to test the power of an alternator coil.

### Test Method

1. Connect black lead to Com (-) meter terminal
2. Connect red lead to 10A (+) meter terminal.
3. Disconnect engine harness from system.
4. Connect across the specified coil wires.
5. Start engine and let it idle.
6. Readings should be above 5 Amps at any RPM. **NOTE:** It is not necessary to increase RPM. The reading can be obtained at idle.

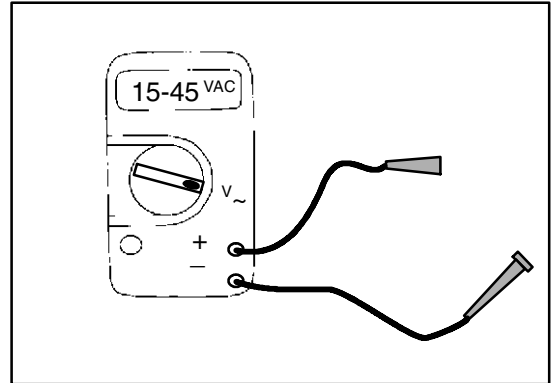
### Usage

- Testing stator coil power output.



### Unregulated Voltage - continued

7. Turn the multimeter dial to the Volts AC (V~) position.
8. Disconnect the alternator to main harness connector at engine.
9. Connect one of the tester leads to the yellow alternator wire and the other lead to the brown alternator wire.  
**NOTE:** On floating alternators, the yellow/red stator wire should connect to the brown stator wire. If it does not, the system will not have a ground and will not operate.
10. Start the engine. While observing the voltage reading, increase the engine speed to about 3000 RPM. Readings of between 15 and 45 VAC are considered normal.



### Short Circuit Current (AC Amp Test)

1. Turn multimeter dial to A~.
2. Connect red lead to 10A terminal.
3. Connect black lead to Com (-) meter terminal.
4. Disconnect lighting/charge coil wires from system. Connect meter leads to coil wires leading to stator coils.
5. Start and idle engine. Readings should be above 5 amps. Refer to Amps AC on page 8.9.

### Regulated Voltage

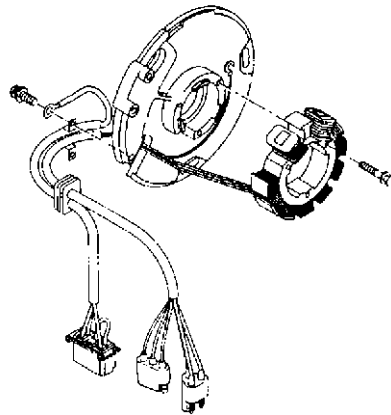
1. Connect the alternator to main harness connector.
2. Insert one of the tester leads along the side of the yellow regulator wire connector between the insulation and the terminal.
3. Ground the other tester lead.
4. Start engine and observe headlight output. Increase engine RPM. If the headlights seem dim above 3500 RPM, let the engine return to idle and disconnect the yellow wire from the regulator. Carefully observe the voltage reading. *Do not* allow voltage to increase above 14.0 volts.
5. Slowly increase RPM. Voltage above 12 volts at 2500 - 3000 and a bright headlight, indicates a good lighting coil. Voltage below 10 volts at 3000 indicates excessive system loads, poor flywheel magnets, lighting coil problems, or wires harness problems. Check for partially grounded (shorted) yellow wire.
6. Reconnect the yellow regulator wire and increase the RPM. If the headlight was bright with the regulator disconnected and dim when connected at the same RPM, the regulator or regulator ground is at fault.

## Alternators

The 6 pulse alternator system is the number of AC sine waves created by the alternator in one revolution of the crankshaft. For example, in a 6 pulse system, the alternator will create 6 pulses, or 6 complete AC sine waves, in one crankshaft revolution. The tachometer reads these sine waves, therefore giving you accurate RPM readings. A 3 pulse tachometer cannot be used on a 6 pulse system. If this is done, the tachometer will read double RPM. Refer to the following text for applications.

### Polaris Snowmobiles:

All Polaris Domestic twin cylinder engines .....	6 pulse
Fuji 3 cylinder engine .....	6 pulse
Fuji Fan Cooled EC45/55PM .....	6 pulse



6-Pulse

### Tachometers:

Tachometers for snowmobiles will have an identification marking on the back side. For example: The tachometer for a 600 RMK will have "6 pulse" (or 6P) written on it.

**Exhaust System Temperature sender - 440 Pro X****Temp sender**

The temp sender that is on the 440 Pro X will read the exhaust temperature and adjust the timing according to the temperature range.

**To Test the sensor:**

Unplug sensor. At room temperature the temperature sender will have a HIGH resistance (may read Open Line (OL)) depending on your meter.

As the pipe gets hotter, the resistance keeps lowering resulting in optimum timing for a given RPM and pipe temperature,

If the sender resistance is not responding to pipe heat the sensor may need to be replaced.

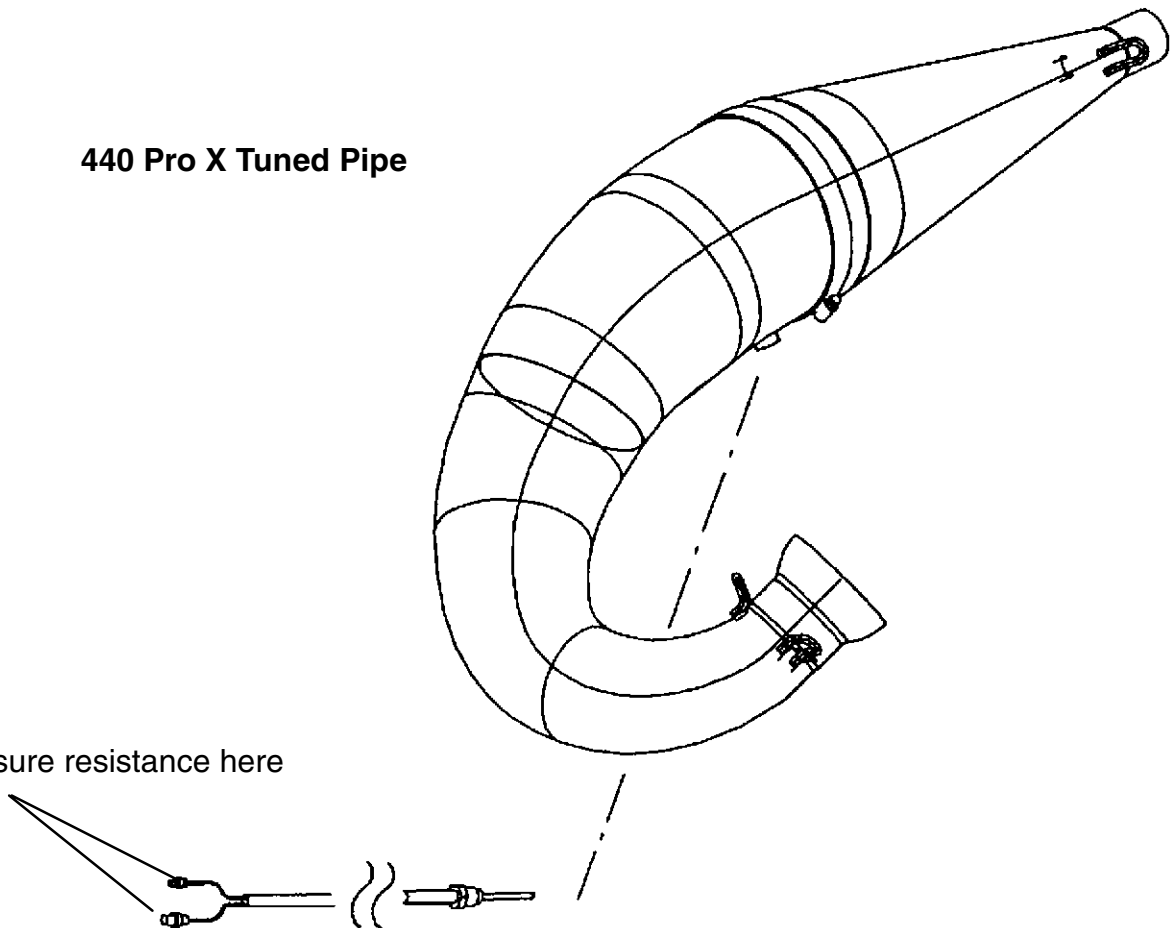
LOW PIPE TEMP = HIGH RESISTANCE

MEDIUM PIPE TEMP = MEDIUM RESISTANCE

HIGH PIPE TEMP = LOW RESISTANCE

**440 Pro X Tuned Pipe**

Measure resistance here



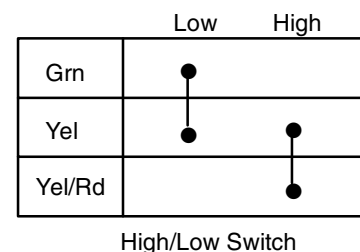


### Headlight Bulb Filament Continuity Test

1. Turn the Multitester dial to the ohms ( $\Omega$ ) position.
2. Disconnect the wire harness from the headlight bulb.
3. Viewing the back of the bulb with the terminal blades at the 9, 12 and 3 o'clock position, connect the black multitester lead to the 9 o'clock blade.
4. Touch the red tester lead to the 12 o'clock terminal and then to the 3 o'clock terminal, noting the resistance value of each. A reading of between 2 and 5 ohms is good. An open reading indicates a bad element.

### Hi/Lo Beam Switch Testing

1. Set the multitester dial to the ohms ( $\Omega$ ) position.
2. If the Hi/Lo switch has not been removed from the machine, disconnect the switch to harness plug-in connector.
3. With the Hi/Lo switch in the *Lo beam* position, check the resistance between the yellow and the green switch wires. The reading should be less than .4 ohms.
4. Turn the Hi/Lo switch to the *Hi beam* position and the multitester should indicate an open circuit (OL) reading.
5. Move one of the tester leads from the green to the red switch wire. The multitester should now read less than .4 ohms.
6. Turn the Hi/Lo Switch back to the *Lo beam* position and the meter should again read an open circuit (OL).



### Seat Harness Troubleshooting

1. Remove the taillight lens.
2. Remove the two taillight bulbs and the brakelight bulb.
3. Separate the seat harness from the main harness by unplugging the connector at the right rear of the tank.
4. With the multitester dial set on ohms ( $\Omega$ ) connect either meter test lead to the brown seat harness wire.
5. Touch the other tester lead to first the yellow wire and then the orange wire. Observe the readings. Readings other than an open circuit (O.L.) indicate a shorted harness or bulb socket. **NOTE:** The bulb socket tangs sometimes short to ground with the bulb removed.
6. Check between the yellow and orange wires in the same manner to check for a short between the brake and running lights. If damaged wiring is found, remove the seat.
7. Tip the seat over and remove the right side seat cover staples. Locate and repair the harness problem.
8. Reinstall the staples and re-check the seat harness.

## Ignition Switch Testing (Non-Electric Start)

1. Set the multimeter dial to the ohms ( $\Omega$ ) position. Connect one of the tester leads to either of the switch terminals and the other tester lead to the other switch terminal.
2. With the switch off, the reading should be less than .4 ohms. With the switch on, the reading must be an open circuit (OL).
3. Check the resistance between each of the switch terminals and the switch body. With the switch still in the on position, there must be an open circuit (OL) reading. Readings other than those listed indicate a defective switch.

	Off	On
Blk		●
Brn		●

Ignition Switch

## Ignition Switch Testing (Electric Start Models)

**NOTE:** Refer to the appropriate model and year wiring diagram for ignition switch wire colors and connections.

1. Disconnect wires. Set the multimeter dial to the ohms ( $\Omega$ ) position.
2. With the key in the off position, check the resistance between the G (Ground, brown) terminal and the M (Mag, black) terminal. This reading must be less than .4 ohms.
3. Turn the key to the on position. The multimeter should now read an open circuit (OL).
4. Move the tester lead from the G terminal to the switch housing and re-check the reading. It should also be an open circuit (OL).
5. Place one of the tester leads on the B (Battery, red) terminal and the other tester lead on the S (Starter, blue) terminal. With the key in the on position, there must be an open circuit (OL) reading.
6. Turn the key to the start position. The reading should be less than .4 ohms. Readings other than the ones listed indicate a defective switch.

	Off	On	Start
Brn		●	
Blk		●	
R			●
R/W			●

Ignition Switch - Electric Start

## Coolant High Temperature Indicator Testing

### Lamp Circuit Test

1. Remove wire from temperature sensing switch located under thermostat housing.
2. With engine idling, ground wire to engine. The temperature warning lamp on the console should light. If not, replace the lamp assembly or inspect wiring for shorts or open circuit.

### Temp Light Temperature Sensor Test

The temperature/warning switch is normally open.

1. Set the multimeter on the ohms ( $\Omega$ ) scale.
2. Disconnect the lamp wire.
3. Connect one test probe to the switch terminal and the other to engine ground. The meter should show an open circuit (OL). This indicates a normally open switch. If the switch were heated to approximately 205° F, the contact in the switch would close and the reading would be less than .4 ohms.

#### **CAUTION:**

If attempting to heat the sensor to close the contacts, heat only in a water bath. Never subject the sensor to an open flame to attempt to close the contacts as sensor damage will result.

## Polaris DRAGON™ Ignition Operation

Your 2003 Polaris 440 Pro-X snowmobile is equipped with an ignition-system feature which improves competition performance by increasing exhaust-system temperature. The Dragon™ ignition system provides maximum "holeshot" performance for racing applications.

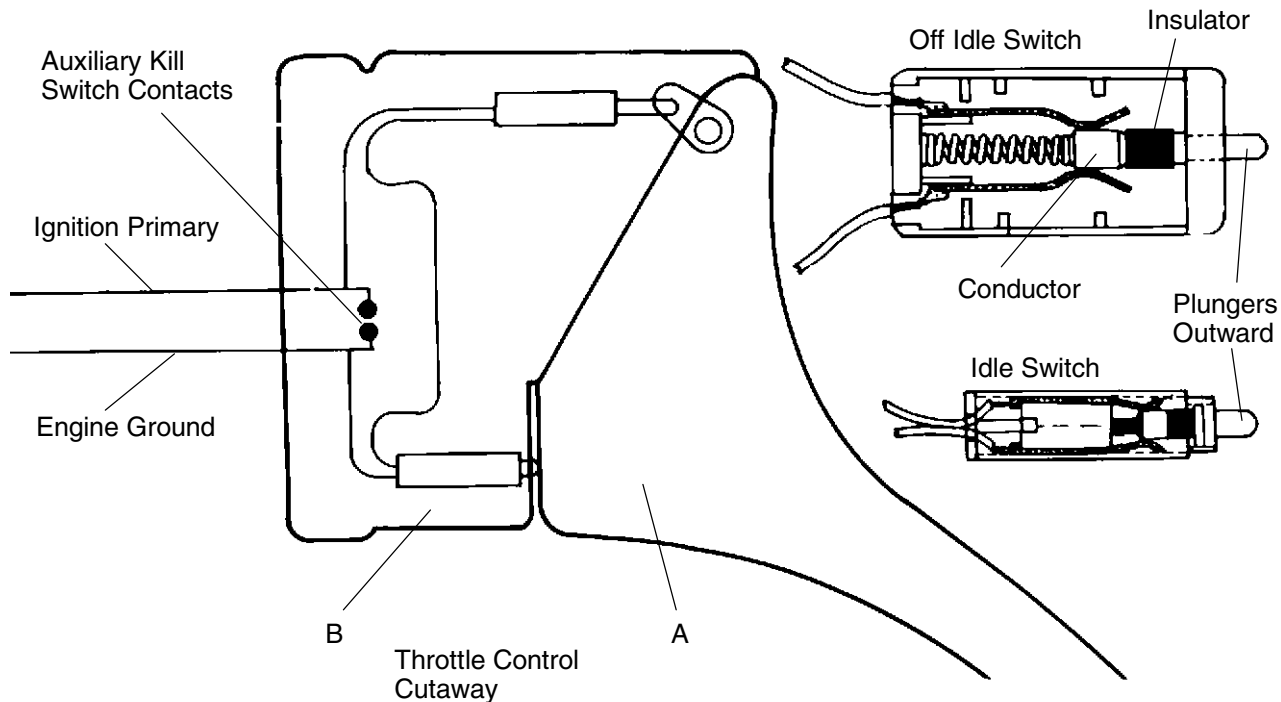
**WARNING:** Dragon mode increases the exhaust-system temperature and causes engine misfire and backfire. Flammable materials and vapors can be ignited resulting in fire and explosion which may cause serious injury, death, or property damage. Read Owner's Manual. Always follow all instructions and warnings.

Additional information regarding Dragon mode operation:

- The Dragon™ ignition system is intended for competition use only.
- There is no benefit to using Dragon mode for normal trail riding.
- Unnecessary, extended, or excessive use of Dragon mode can result in severe engine damage which is excluded from Polaris Warranty coverage.
- Dragon™ mode usually heats up the exhaust system within 5 to 20 seconds, depending upon the initial temperature of the exhaust system.
- Two different sounds may be heard when using Dragon™ mode. One sound is an erratic misfire heard when the exhaust system is heating up. The other sound is a consistent misfire (with a slight rise in engine RPM) when the exhaust system is at target operating temperature.
- Dragon™ mode keeps the engine speed to between 4500 and 5100 RPM.
- Be sure that the clutch engages at 5300 RPM or above to prevent forward creep of the vehicle. See your dealer if clutch needs to be adjusted.

To use Dragon™ mode at the start of a race:

1. Warm up the engine and track using the procedure in the Owner's Manual.
2. When staged at the starting line, depress and hold the Dragon (horn) button.
3. Slowly advance the throttle to the wide-open position while keeping the button depressed.
4. Release the button when the start flag drops.
5. The vehicle will launch forward at wide-open throttle.

**Speed Control Assurance Operation**

The speed control assurance consists of two series connected switches. If one or both switch plungers are positioned inward, the circuit is open and the engine will run.

At idle, with the throttle lever properly adjusted, the bottom switch circuit is open and the plunger is inward. The top switch circuit is closed, and the plunger is outward. The speed control circuit is open, allowing the engine to run.

As the throttle lever is actuated to an off idle position, the top switch circuit is opened (plunger in) and the bottom switch circuit is closed (plunger out). The speed control circuit is still open, allowing the engine to run.

In the event the carburetor or controls malfunction and allow the throttle cable to become slack, the circuit will close (both switch plungers out), grounding the ignition system and causing the engine to stop.

**Speed Control Assurance Adjustment**

Throttle lever free play must always provide a specified clearance between throttle lever (A) and throttle block (B). This clearance is controlled by the throttle cable sleeve(s) and the idle speed screw(s).

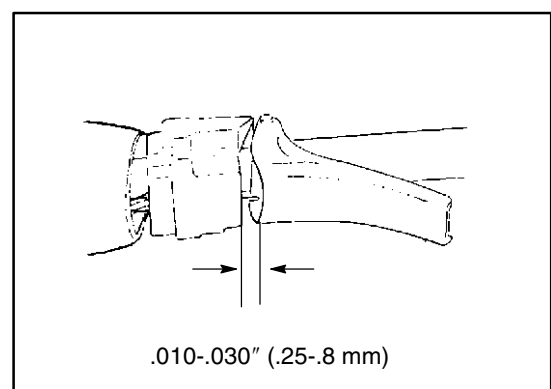
**Throttle Lever Freeplay -****Regular Throttle - .010 - .030" (.25 - .8 mm)**

If the idle speed screw(s) is adjusted inward and the cable sleeve(s) is not adjusted to take up the throttle lever to throttle block clearance, the engine may misfire or kill upon initial throttle opening.

**CAUTION:**

After any idle speed adjustments are made, the throttle lever to throttle block clearance and oil pump adjustment must be checked and adjusted.

**NOTE:** When adjustments are made on models which have more than one carburetor, refer to Section 6, Carburetion, for proper carburetor synchronization adjustments.



## **Speed Control Assurance Testing**

1. Set the multimeter in the ohms ( $\Omega$ ) position.
2. Disconnect the switch harness from the main wire harness.
3. Connect the two multimeter leads to the two switch wires.

### **Test 1 - Open Circuit - Run**

With the auxiliary shut-off switch in the **ON** position, the multimeter should read an open circuit (OL). As the throttle lever is moved from idle to off idle, the tester should continue to read an open circuit. If the tester fluctuates and the throttle lever to throttle block clearance is adjusted properly, the switch assembly must be replaced.

### **Test 2 - Closed Circuit - Kill**

The two speed control switches must make a complete circuit to kill the engine. To check the switches, pull the throttle lever out away from the throttle block. With the switch plungers outward and the auxiliary shut-off switch in the **ON** position, the multimeter must read less than .4 ohms resistance. Inspect wires and repair if damaged, or replace switch assembly.

### **Test 3 - Auxiliary Shut-Off**

The multimeter should read less than .4 ohms in the **OFF** position and an open circuit in the the **ON** position. Inspect wires and repair if damaged, or replace switch assembly.

## **Speed Control Assurance Replacement**

Auxiliary shut-off and speed control assurance switches are connected and replaced as a unit from the back side of the throttle block.

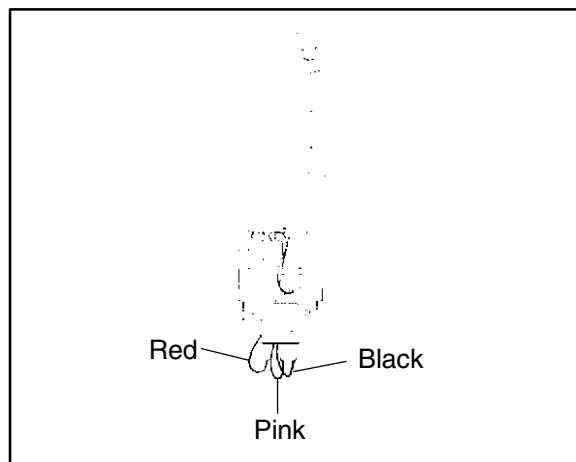
1. Remove the handlebar pad and/or throttle block backing plate.
2. Slide out the auxiliary shut-off portion of the switch.
3. Remove the two screws securing the two speed control assurance switches.
4. Remove the switches noting their placement in the throttle block.
5. Replace the assembly and check its operation.

### TPS (Throttle Position Sensor)

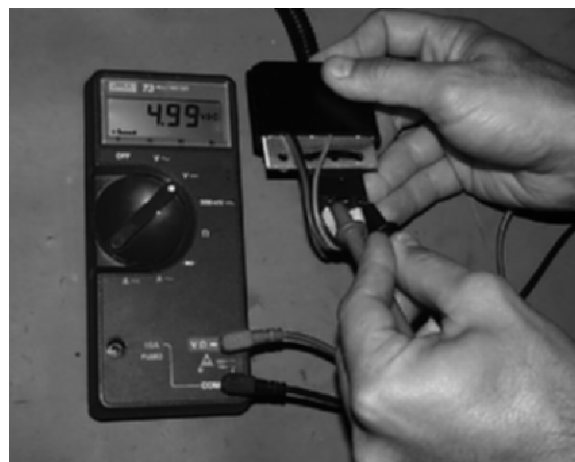
Some Polaris snowmobiles are manufactured with Throttle Position Sensors (TPS). The TPS comes set from the factory and should not need adjustment. However, upon removal of the TPS, you must mark the TPS position on the carburetor and replace it in the exact same position as removal. Polaris has developed a TPS test kit for aid in setting the Throttle Position Sensor to specification.

#### TPS Testing

1. Illustration at right shows the TPS sensor kit PN 2201519.



2. Make sure your 9 volt battery is in good condition by inserting the black volt meter probe from your Fluke™ meter in the black terminal and the red probe into the pink terminal. Voltage should read 4.99 to 5.01 volts. If not, try a new 9 volt battery.



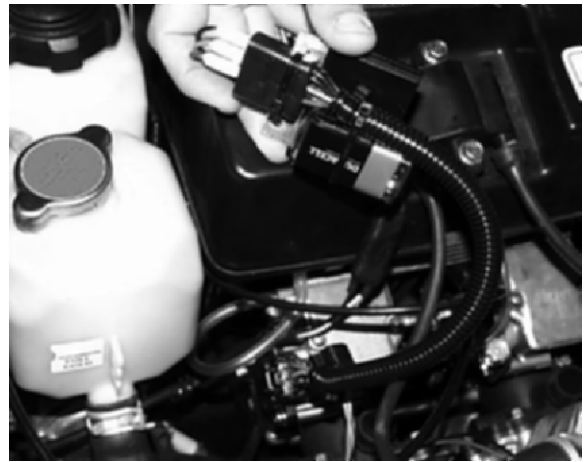
3. Remove the connector from the TPS.



## TPS (Throttle Position Sensor)

### TPS Testing - Continued

4. Install test harness connector on TPS.



5. Insert red voltmeter lead into yellow terminal, and black lead to black terminal. Slowly open throttle and check for smooth voltage change.

**NOTE:** The fluke meter will change scales and show O.L. momentarily when throttle is opening.



6. Voltage at yellow terminal should be 4.0 volts *at Wide Open Throttle* for domestic engines, If not, the TPS must be adjusted.

**TPS Volts at Wide Open Throttle -  
Polaris Domestic Engines:**

**4.0 - 4.2 Volts**

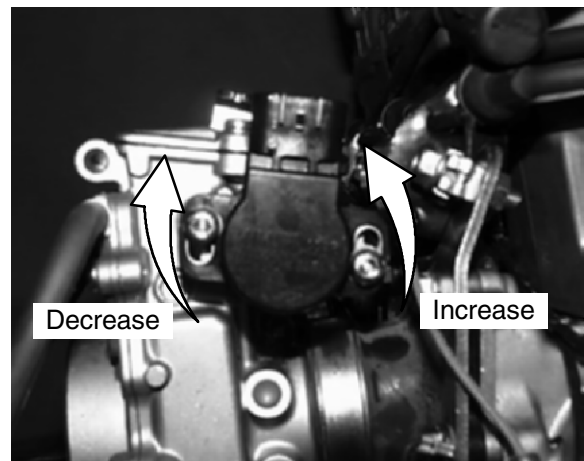


### TPS Adjustment

1. Loosen the two screws that hold the TPS on the carburetors using a Torx™ T25 bit with tamper resistant hole in bit.



2. Turn the TPS **clockwise** to decrease voltage, or **counterclockwise** to increase voltage.



3. When the TPS is set to the desired voltage, tighten the holding screws and verify voltage is 4.0 -4.2 volts *at Wide Open Throttle* for Polaris domestic engines.





**TPS Adjustment - Continued**

4. When the TPS is set and voltage is verified, remove the tester and re-install the snowmobile TPS harness.



5. When storing the TPS tester, remove the red terminal of the tester and insert it in the blank terminal of the harness.



**Condition: No Spark**

Disconnect the single black (black/white) wire from the CDI Module to the ignition kill circuit. Does it have a spark? Yes→ No↓	Check the ignition switch, wire harness, throttle safety switches and kill switch for proper adjustment or short to ground. Repair or replace as necessary.
Disconnect the stator to CDI module wires. Test the resistance values of the stator. Are the resistance values within specs?  Yes→ No↓	All except 3 cylinders: If the parts of the ignition system under the flywheel check OK, the only remaining component is the coil/CDI module assembly. Replace the module with another with the same CU number. (See ignition data) All 3 cylinders: Disconnect and check the secondary ignition coil resistances. Refer to the resistance values listed on IVa-10. If the coil resistance values are within specs, replace the CDI module.
Isolate which component's resistance is not within specs. Remove the flywheel and stator. Recheck the resistances; look for pinched or bare harness wires; or replace the stator.	

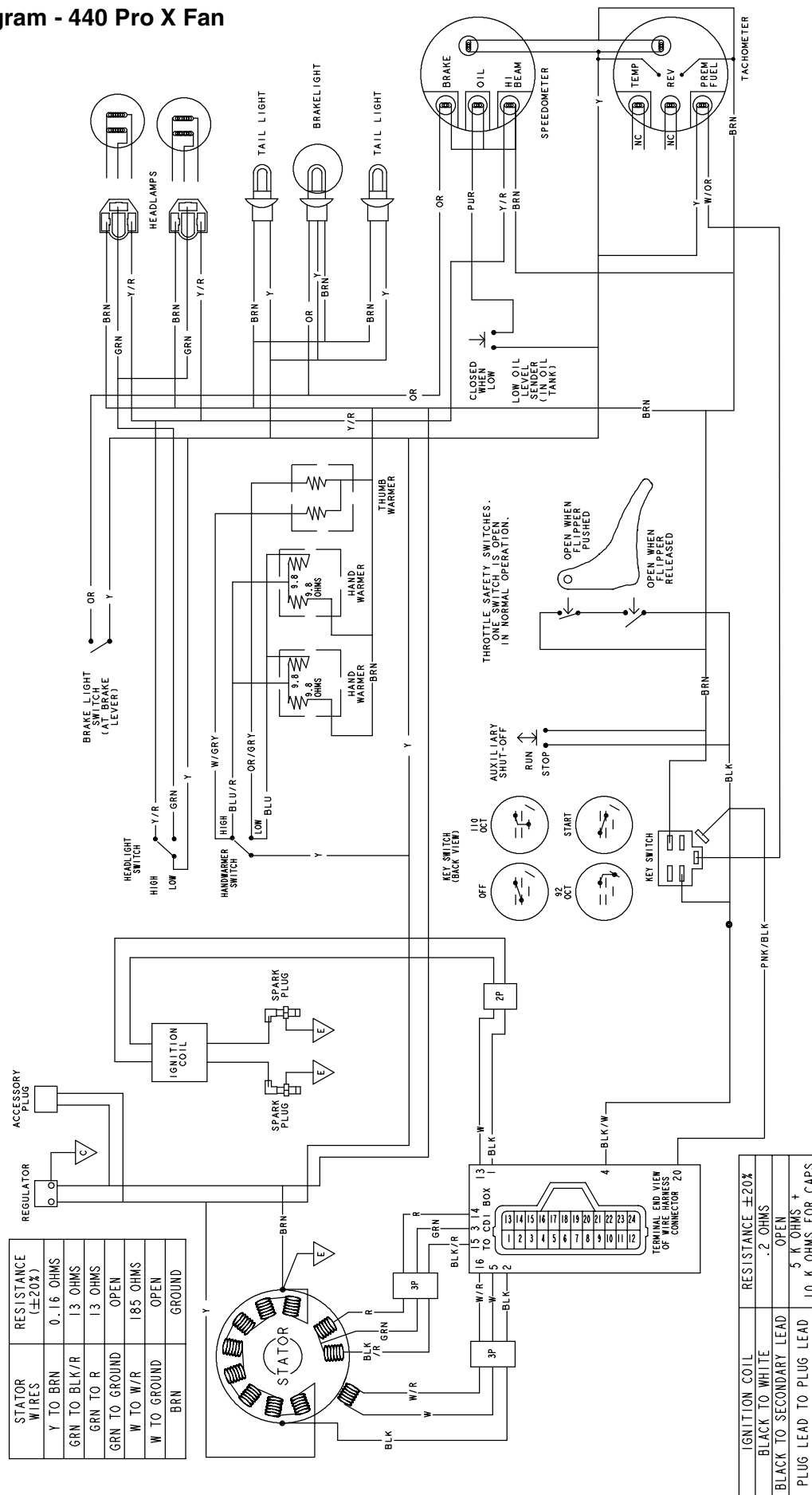
**Condition: Incorrect Advance/Retard**

Follow the engine timing procedure for checking running timing at 3000 RPM. Is the timing within limits? No→ Yes↓	Adjust the ignition timing by rotating the stator plate to correct the timing. (Continue on with left column.)
Remove the ignition kill circuit by disconnecting the single black wire between the CDI module and the machine harness. Is the timing now correct?  Yes→ No↓	Check the ignition switch, throttle safety switches, kill switch and harness for damage which can cause intermittent shorting problems. Correct the problem.
Verify the correct CDI module by comparing the code on the box to the information listed in the ignition data section of chapter one. Is it the right module?  No→ Yes↓	Replace the module with the correct part and readjust the ignition timing.
Check the resistance of the coils under the flywheel. Are they within limits?  No→ Yes↓	Check the wiring connecting the coils and/or replace the coils as necessary.
Replace the CDI module.	

**Timing Light PN 2870630**

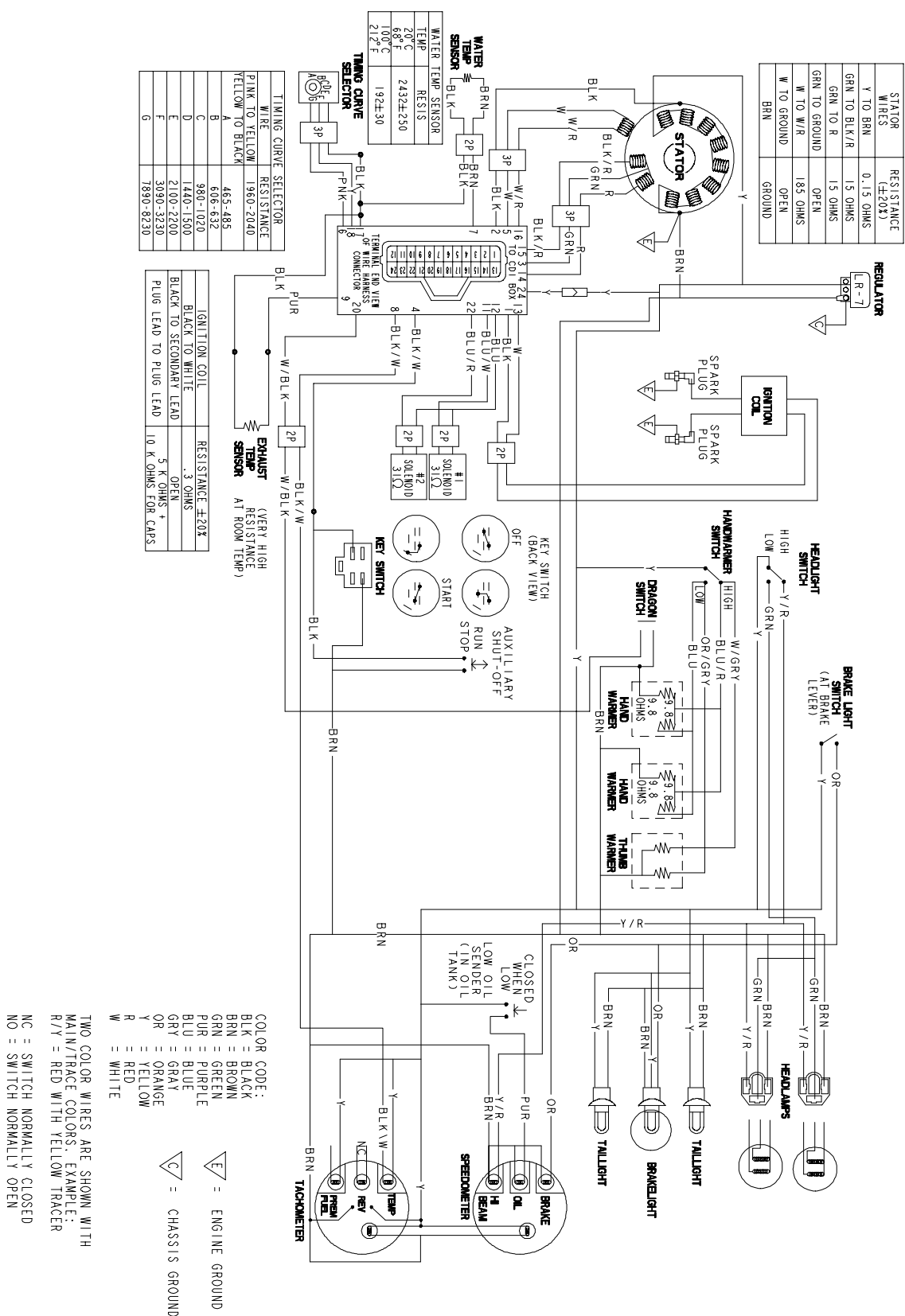
## Wiring Diagram - 440 Pro X Fan

## 03 440 PRO-X FAN



## Wiring Diagram - 440 Pro X

2003 440 PRO-X

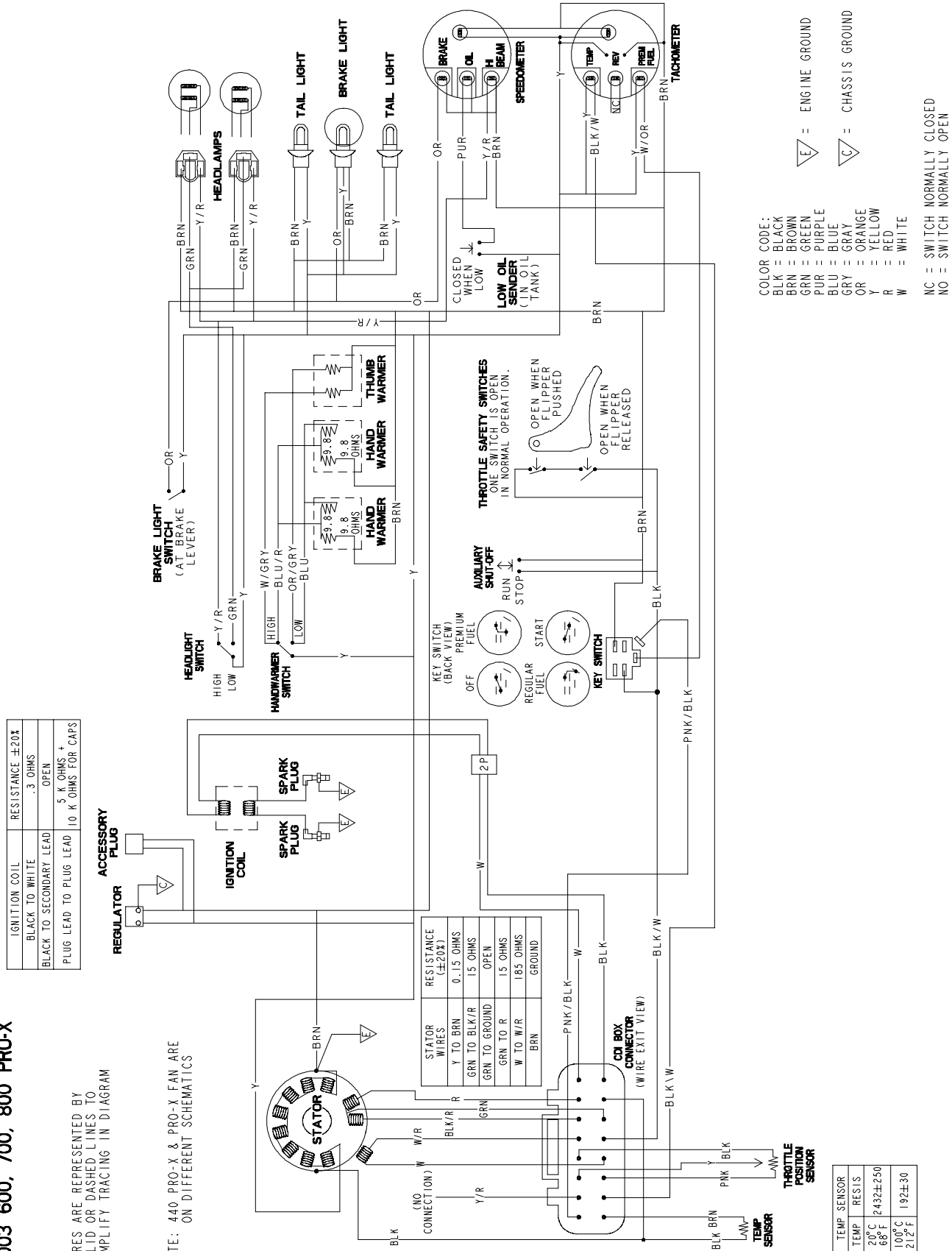


## Wiring Diagram - 600/700/800 Pro X

2003 600, 700, 800 PRO-X

WIRES ARE REPRESENTED BY  
SOLID OR DASHED LINES TO  
SIMPLIFY TRACING IN DIAGRAM

NOTE: 440 PRO-X & PRO-X FAN ARE  
ON DIFFERENT SCHEMATICS





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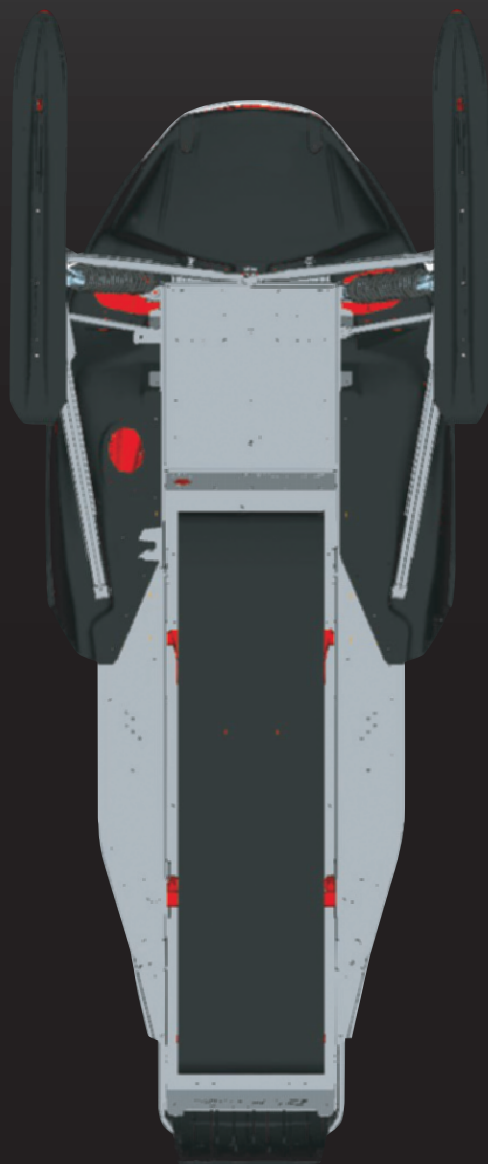
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