CHAPTER 7
CLUTCHING (PVT)

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SPECIAL TOOLS AND SUPPLIES

TOOL DESCRIPTION	PART NUMBER
Drive Clutch Puller (Short)	**PA-48595**
Clutch Holding Wrench	**9314177**
Clutch Holding Fixture	**2871358-A**
Drive Clutch Spider Removal and Installation Tool	**2870341**
Roller Pin Tool	**2870910**
Clutch Bushing Replacement Tool Kit	**2871226**
Piston Pin Puller	**2870386**
Clutch Compression Tool	**8700220**
Clutch Bushing Replacement Tool Kit	**2871025**

SPECIAL SUPPLIES	PART NUMBER
Loctite™ 242 Blue	**N/A**
Loctite™ 609 Green	**N/A**
RTV Silicone Sealer	**8560054**

TORQUE SPECIFICATIONS

PVT System Fastener Torques

ITEM	TORQUE VALUE
Drive Clutch Spider	200 ft. lbs. (271 Nm)
Drive Clutch Retaining Bolt	47 ft. lbs. (64 Nm) **Left Hand Thread**
Driven Clutch Retaining Bolt	37 ft. lbs. (50 Nm)
Drive Clutch Cover Bolts	100 in. lbs. (11 Nm)
Inner PVT Cover Screws	6-8 ft. lbs. (8-11 Nm)
Outer PVT Cover Screws	45-50 in. lbs. (5-5.6 Nm)
Drive Clutch Weight Pins	15-25 in. lbs. (2-3 Nm)

PVT SYSTEM OVERVIEW

General Operation

⚠ WARNING

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

The Polaris Variable Transmission (PVT) consists of three major assemblies:

1) The Drive Clutch

2) The Driven Clutch

3) The Drive Belt

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

Drive Clutch Operation

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

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

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Shift Weights

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

Driven Clutch Operation

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

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

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

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

PVT Break-In (Drive Belt / Clutches)

A proper break-in of the clutches and drive belt will ensure a longer life and better performance. Break in the clutches and drive belt by operating at slower speeds during the 10 hour break-in period as recommended (see Chapter 5 “Engine Break-In Period” for break-in example). Pull only light loads. Avoid aggressive acceleration and high speed operation during the break-in period.

Maintenance / Inspection

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

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

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Overheating / Diagnosis

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

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

IMPORTANT: Using High Gear when pulling heavy loads, operating on hilly terrain, or in wet, muddy conditions will increase the chance of drive belt damage.

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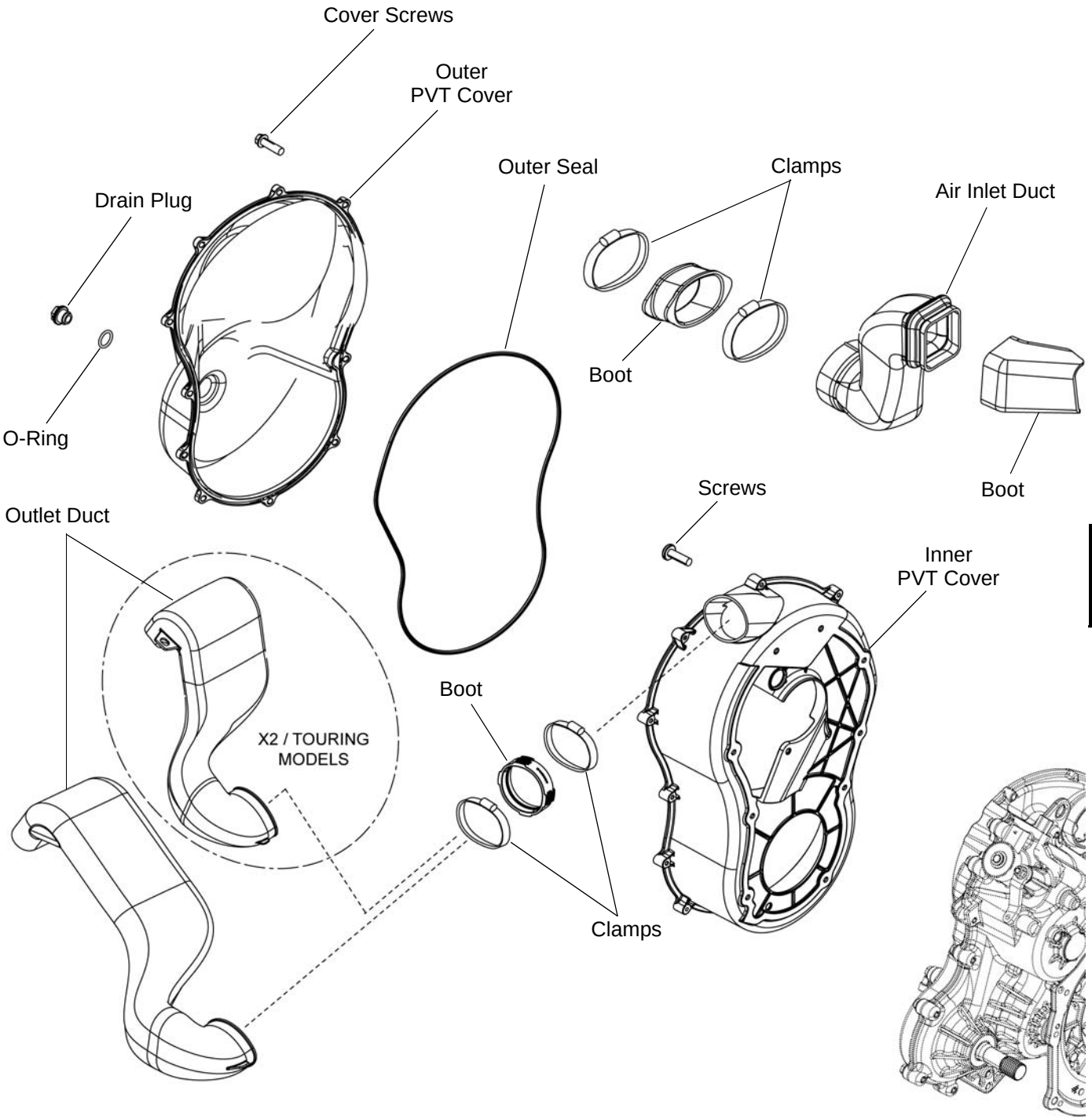
PVT SYSTEM SERVICE

PVT Sealing and Ducting Components



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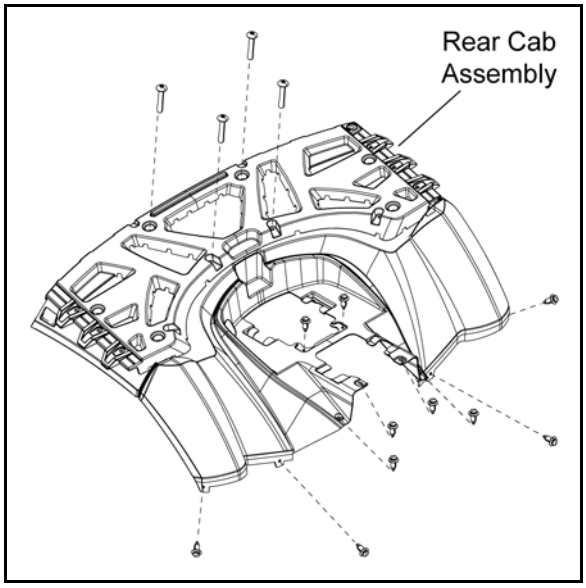
PVT Disassembly (XP Models)

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

1. Remove the seat.

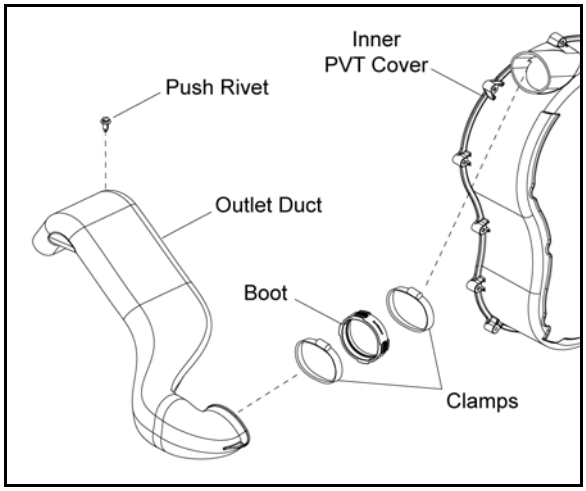
2. Remove the (10) push rivets and (4) Torx-headed screws retaining the rear cab assembly.



3. Remove the tail light bulbs from the tail lamps, disconnect the tail light harnesses from the rear cab, and remove the rear cab to allow access to the PVT system for disassembly.

4. Remove the left rear wheel, lower LH frame support, outer PVT cover and drive belt. Refer to "Belt Removal (XP Models)".

5. Loosen the clamps, remove the push rivet and remove the PVT outlet duct from the inner PVT cover. Remove the duct from the vehicle.



6. With the belt removed, completely remove the retaining bolt and driven clutch.

7. Install the Drive Clutch Holder (PN 9314177) onto the drive clutch.

Drive Clutch Holder (9314177)

8. Remove the drive clutch retaining bolt by turning the bolt in a **clockwise** direction.

NOTE: The drive clutch retaining bolt has left-hand threads. Turn the bolt clockwise to remove it.

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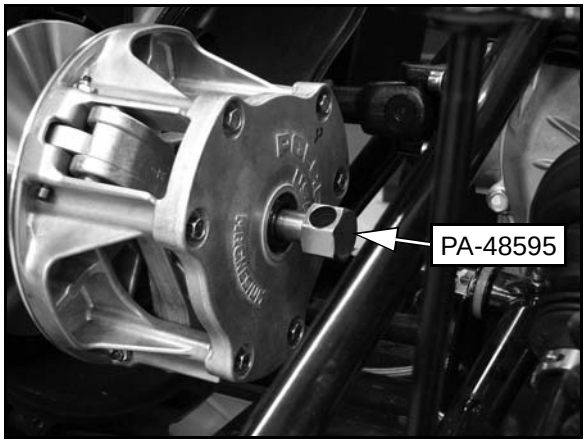
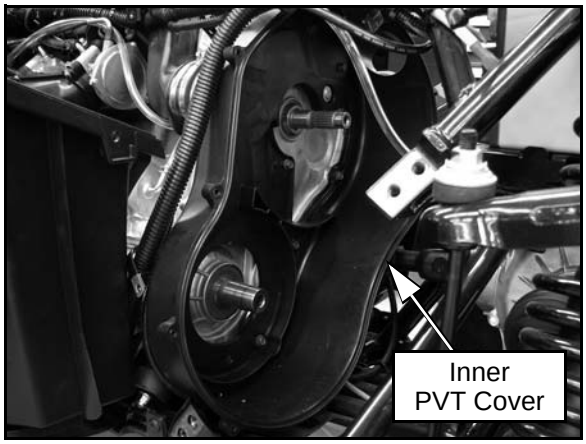
9. Insert the Drive Clutch Puller (PA-48595) into the drive clutch and use it to remove the clutch from the shaft.



Drive Clutch Puller (PA-48595)

10. If removing the inner PVT cover, continue with this procedure.

11. Remove the (10) screws that retain the inner PVT cover to the transmission case and remove the cover.



12. Remove the old silicone material from the inner PVT cover and transmission case using a wire brush. Clean both surfaces thoroughly in preparation for assembly.

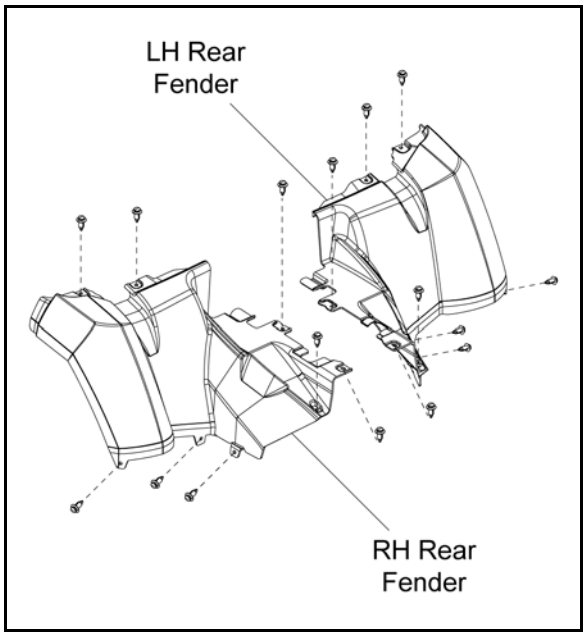
PVT Disassembly (X2 / TOURING Models)

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

1. Remove the driver's seat and rear fenders (X2) or rear cab assembly (TOURING).

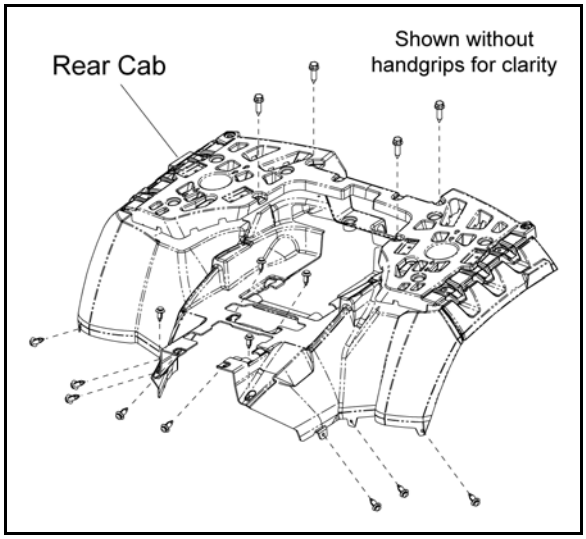
X2 Models

- Tilt the rear cargo box open and remove the seat.
- Remove the (8) push rivets retaining each rear fender.



TOURING Models

- Remove the rear passenger seat.
- Remove the (12) push rivets and (4) bolts retaining the rear cab assembly.



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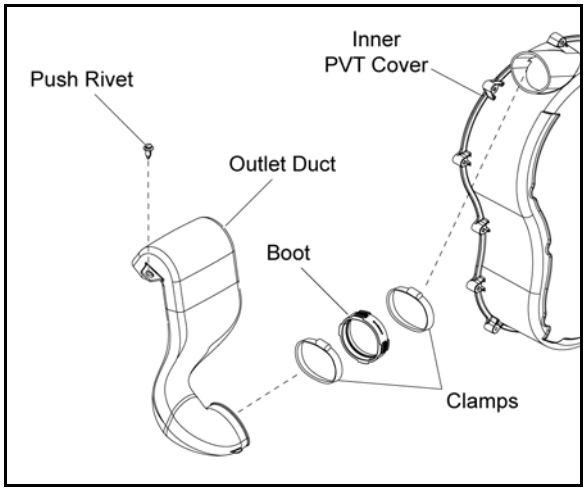
- Remove the tail light bulbs from the tail lamps, disconnect the tail light harnesses from the rear cab, and remove the rear cab to allow access to the PVT system for disassembly.

2. Remove the rear skid plate, outer PVT cover and drive belt. Refer to “Belt Removal (X2 / TOURING Models)”.

3. Loosen the clamps, remove the push rivet and remove the PVT outlet duct from the inner PVT cover.



4. Remove the PVT outlet duct from the vehicle to allow for driven clutch removal. Remove the duct through the bottom of the frame in the same manner as the outer PVT cover.
5. With the belt removed, completely remove the retaining bolt and driven clutch.

6. Install the Drive Clutch Holder (PN 9314177) onto the drive clutch.

Drive Clutch Holder (9314177)

7. Remove the drive clutch retaining bolt by turning the bolt in a **clockwise** direction.

NOTE: The drive clutch retaining bolt has left-hand threads. Turn the bolt clockwise to remove it.

8. Insert the Drive Clutch Puller (PA-48595) into the drive clutch and use it to remove the clutch from the shaft.

Drive Clutch Puller (PA-48595)

9. Remove the drive clutch through the bottom of the frame.

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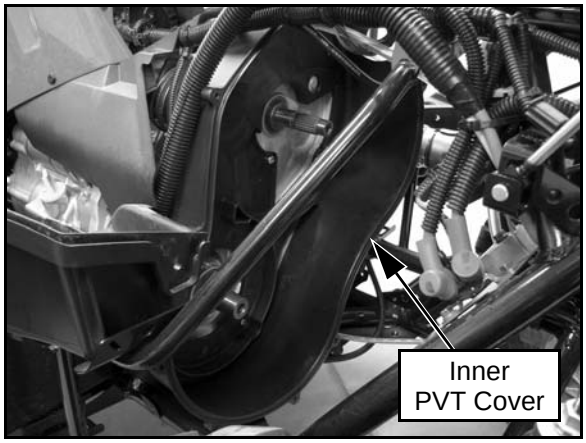
10. Remove the (10) screws that retain the inner PVT cover to the transmission case and remove the cover.



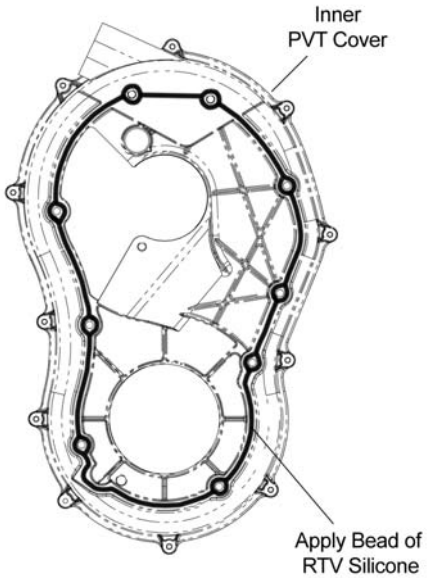
11. Remove the old silicone material from the inner PVT cover and transmission case using a wire brush. Clean both surfaces thoroughly in preparation for assembly.

PVT Assembly

1. Inspect the inner PVT cover. Replace if cracked or damaged. The mating surface must be clean to ensure adhesion of new silicone sealant.

2. Be sure to “flame treat” the inner PVT cover prior to applying silicone to ensure good adhesion. Pass the flame of a propane torch back and forth quickly over the area where the silicone is to be applied (2-3 inches from the flame tip is recommended). Do not hold the torch too close to the surface. Keep the torch moving to prevent damage.

3. Apply RTV silicone sealant to the outside edge of the inner PVT cover to ensure a water tight fit between the cover and the transmission.



4. Install the cover and torque the inner PVT cover screws to specification.

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Inner PVT Cover Screws: **6-8 ft. lbs. (8-11 Nm)**

5. Wipe away any excess silicone sealant.

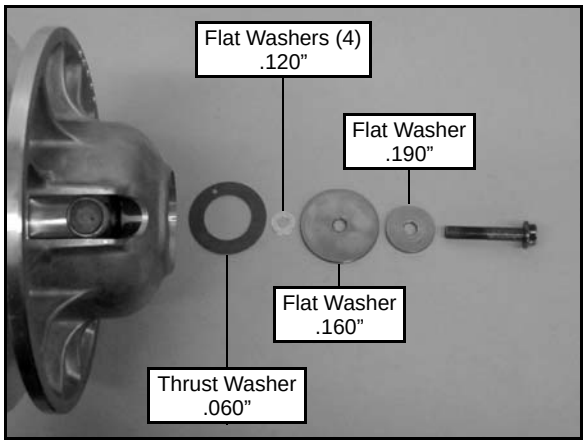
6. Clean end of taper on crankshaft and the taper bore inside drive clutch using a tapered reamer.

7. Install the drive clutch, bushing, washer, lock washer, and the left-hand threaded retaining bolt. Torque retaining bolt to specification.

= T
Drive Clutch Retaining Bolt: **47 ft. lbs. (64 Nm)**

8. Clean the splines on the transmission input shaft and apply a light film of grease to the splines on the shaft.

9. Install the driven clutch, thrust washer, flat washers and retaining bolt in the order shown.



10. Install drive belt noting direction of rotation if the belt is being reused. Refer to “Belt Installation”.

11. Torque the driven clutch retaining bolt to specification

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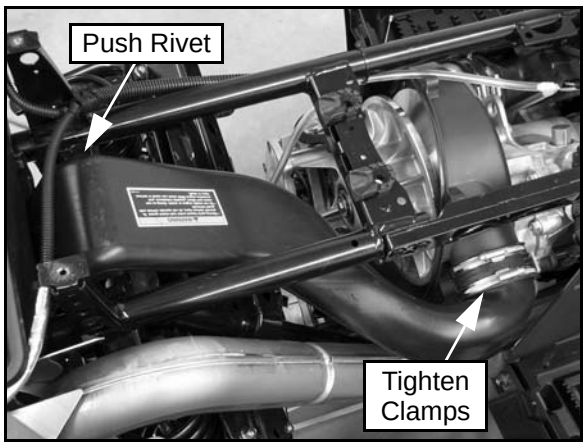
Driven Clutch Retaining Bolt: **37 ft. lbs. (50 Nm)**

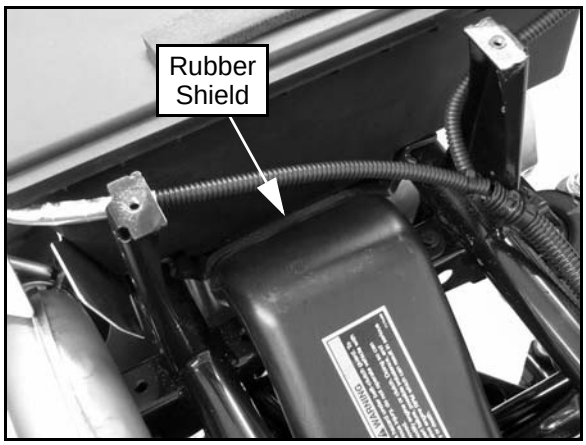
NOTE: While tightening the retaining bolt, stop and rotate the driven clutch counter-clockwise a few times to prevent the belt from binding in the clutch.

XP Models

12. Install the PVT outlet duct and align it with the inner PVT cover. Install the push rivet and tighten the hose clamps to **12-16 in. lbs. (1.4-1.8 Nm)**.



NOTE: Be sure the rubber storage box shield is resting on top of the outlet duct as shown so it does not obstruct air flow.



13. Replace the outer PVT cover seal.

14. Reinstall outer PVT cover and secure with screws. Torque screws to specification.

= T
Outer PVT Cover Screws: **45-50 in. lbs. (5-5.6 Nm)**

15. Reinstall the rear cab, tail light bulbs, and fasteners.

16. Reinstall the lower left-hand frame support and torque bolts to specification.

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Lower Left-Hand Frame Support Bolts: **36 ft. lbs. (49 Nm)**

17. Install the left rear wheel and torque wheel nuts to specification.

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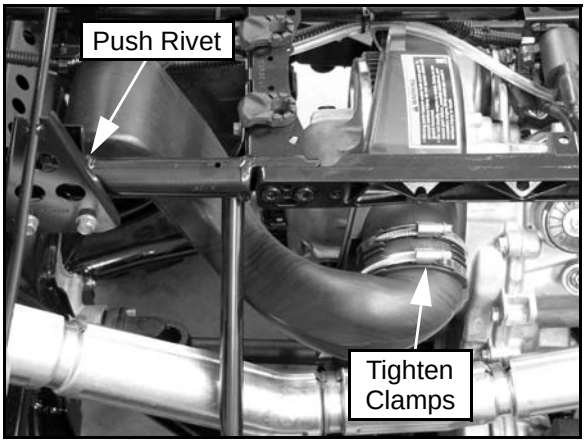
Wheel Nuts: **Steel: 45 ft. lbs. (61 Nm)** **Aluminum: 75 ft. lbs. (102 Nm)**

18. Reinstall the seat, lower the ATV, start the engine and test the operation of the PVT system.

X2 / TOURING Models

19. Install the PVT outlet duct and align it with the inner PVT cover. Install the push rivet and tighten the hose clamps to **12-16 in. lbs. (1.4-1.8 Nm)**.



20. Replace the outer PVT cover seal.

21. Reinstall outer PVT cover and secure with screws. Torque screws to specification.

= T
Outer PVT Cover Screws: **45-50 in. lbs. (5-5.6 Nm)**

22. Reinstall rear skid plate and (6) T40 Torx-headed screws.

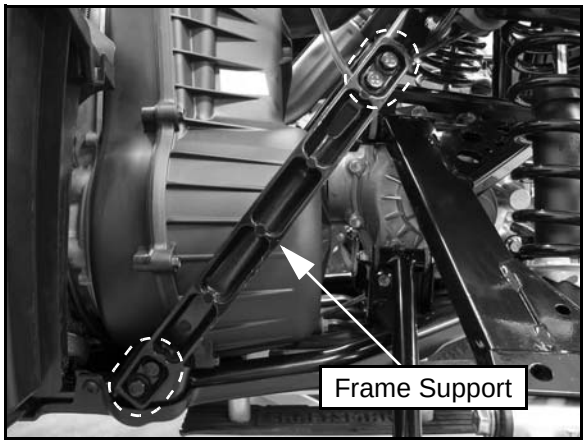
23. Reinstall the rear fenders (X2) or rear cab (TOURING), tail light bulbs, and fasteners.

24. Reinstall the seat(s), start the engine and test the operation of the PVT system.

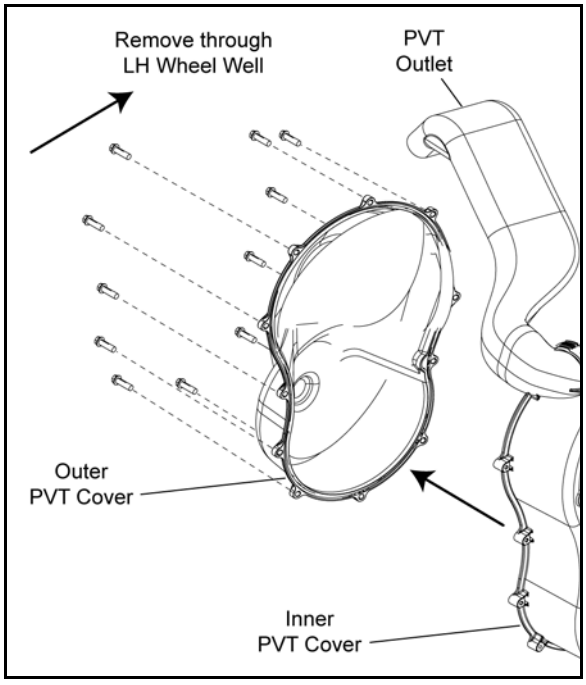
DRIVE BELT

Belt Removal (XP Models)

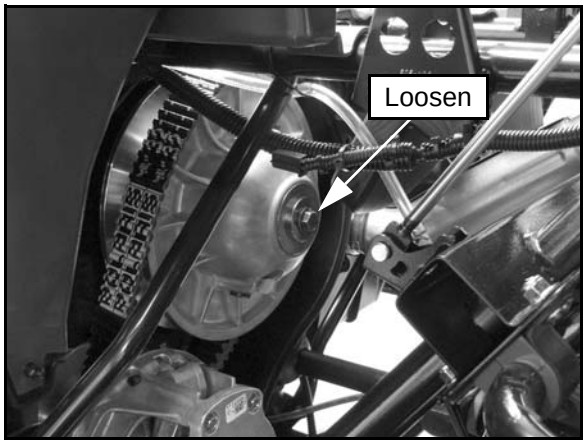
1. Position the vehicle on a level surface and place the transmission in Park.
2. Elevate and safely support the rear of the vehicle.
3. Remove the left rear wheel from the vehicle.
4. Remove the (4) bolts retaining the lower left-hand frame support and remove it from the frame.



5. Remove the seat.
6. Remove the (11) screws retaining the PVT cover.



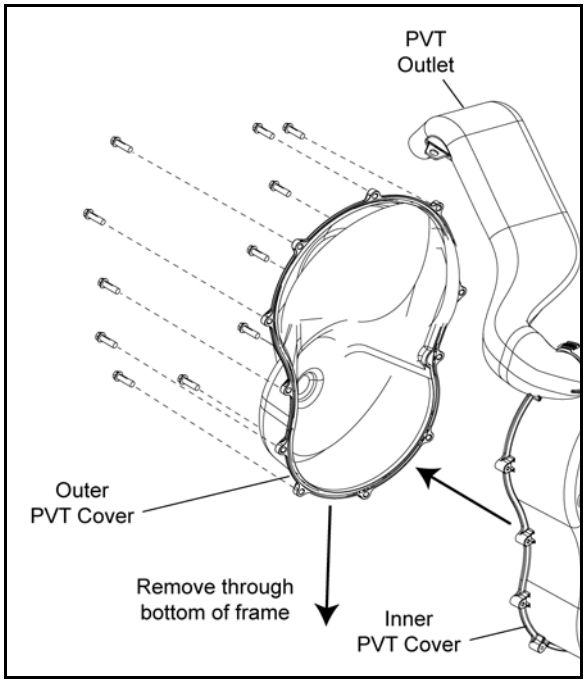
7. Using care, pull the outer PVT cover out the left-hand wheel well.
8. Note the orientation of the drive belt so that it can be installed in the same direction.
9. Loosen the driven clutch retaining bolt to allow the clutch sheaves to open.



10. Walk the belt out of the driven clutch and drive clutch, and remove it from the vehicle.

Belt Removal (X2 / TOURING Models)

1. Position the vehicle on a level surface and place the transmission in Park.
2. Remove the (6) T40 Torx-headed screws retaining the rear skid plate and remove the skid plate from under the vehicle.
3. Remove the driver's seat.
4. Remove the (11) screws retaining the PVT cover.



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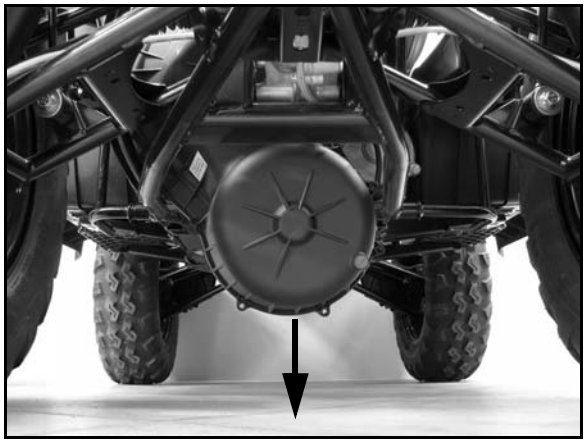
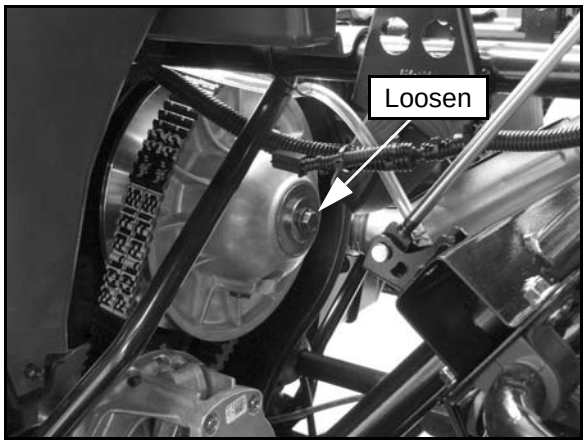
5. Using care, pull the outer PVT cover through the bottom of the frame.



NOTE: Be sure to move the rear brake line out of the way upon removal to prevent from catching it with the outer PVT cover.

6. Note the orientation of the drive belt so that it can be installed in the same direction.

7. Loosen the driven clutch retaining bolt to allow the clutch sheaves to open.



8. Walk the belt out of the driven clutch and drive clutch, and remove it from the vehicle.

Belt Inspection

1. 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.

2. Inspect belt for loose cords, missing cogs, cracks, abrasions, thin spots, or excessive wear. Compare belt measurements with a new drive belt. Replace if necessary.

3. Belts with thin spots, burn marks, etc., should be replaced to eliminate noise, vibration, or erratic PVT operation. See the Troubleshooting Chart at the end of this chapter for possible causes.

Belt Installation

1. Loop the belt over the drive clutch and over top of the driven clutch sheaves.

NOTE: If reusing the drive belt, be sure to reinstall the belt in the same direction as it was removed.

2. Torque the driven clutch retaining bolt to specification.

= T
Driven Clutch Retaining Bolt: **37 ft. lbs. (50 Nm)**

NOTE: While tightening the retaining bolt, stop and rotate the driven clutch counter-clockwise a few times to prevent the belt from binding in the clutch.

3. Replace the outer PVT cover seal.

4. Reinstall outer PVT cover and secure with screws. Torque screws to specification.

= T
Outer PVT Cover Screws: **45-50 in. lbs. (5-5.6 Nm)**

XP Models

5. Reinstall the lower left-hand frame support and torque bolts to specification.

= T
Lower Left-Hand Frame Support Bolts: **36 ft. lbs. (49 Nm)**

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

= T
Wheel Nuts: **Steel: 45 ft. lbs. (61 Nm)** **Aluminum: 75 ft. lbs. (102 Nm)**

7. Install the seat, lower the ATV, start the engine and test the operation of the PVT system.

X2 / TOURING Models

8. Reinstall the rear skid plate and the (6) T40 Torx-headed screws.

9. Install the seat, start the engine and test the operation of the PVT system.

PVT Break-In (Drive Belt / Clutches)

A proper break-in of the clutches and drive belt will ensure a longer life and better performance. Break in the clutches and drive belt by operating at slower speeds during the 10 hour break-in period as recommended (see Chapter 5 “Engine Break-In Period” for break-in example). Pull only light loads. Avoid aggressive acceleration and high speed operation during the break-in period.

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DRIVE CLUTCH SERVICE

Spring Specifications

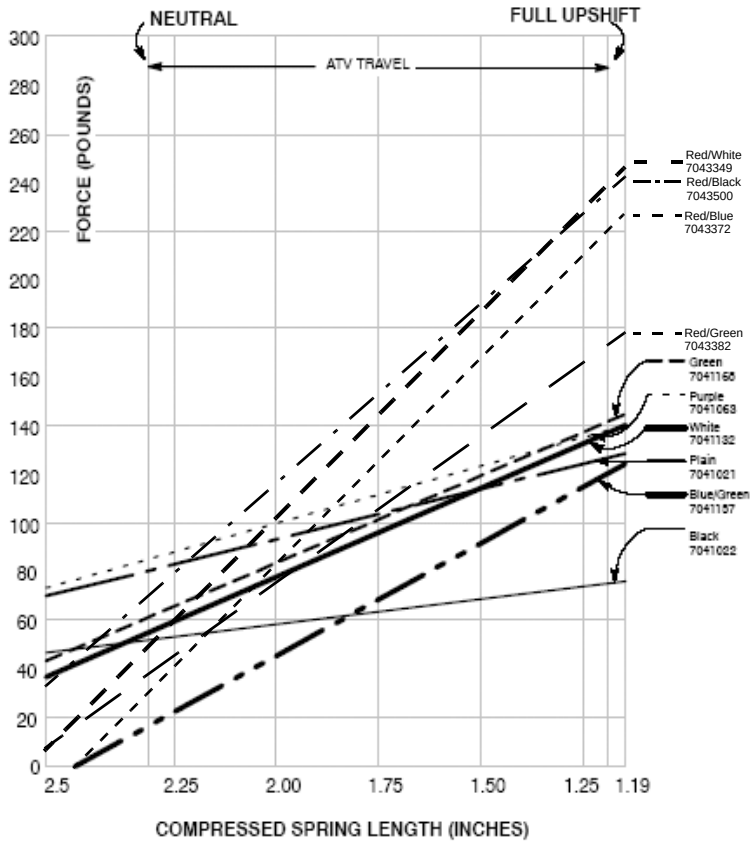
The drive clutch spring has two primary functions:

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

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

⚠ CAUTION

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



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

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

Primary Clutch Springs

PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH ± .125"	PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH ± .125"
7041021	Plain	.157"	4.38"	7041168	Green	.177"	3.05"
7041022	Black	.140"	4.25"	7043349	Red / White	.200"	2.58"
7041063	Purple	.168"	4.37"	7043372	Red / Blue	.187"	2.56"
7041132	White	.177"	2.92"	7043382	Red / Green	.177"	2.63"
7041157	Blue / Green	.177"	2.53"	7043500	Red / Black	.200"	2.82"

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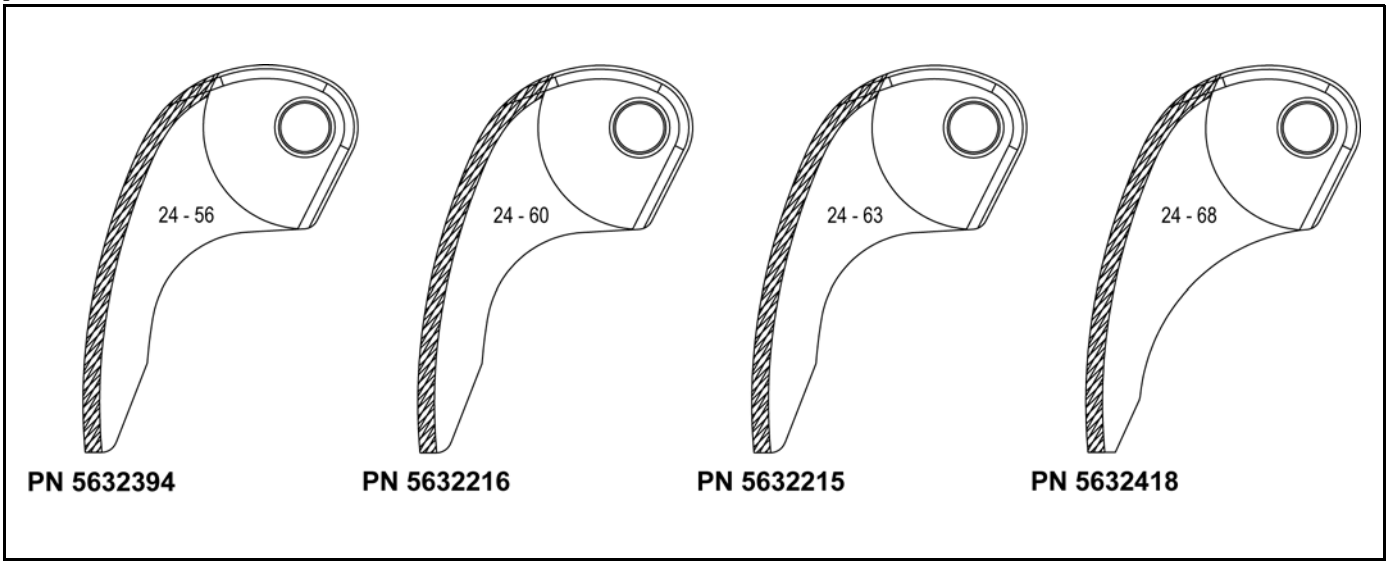
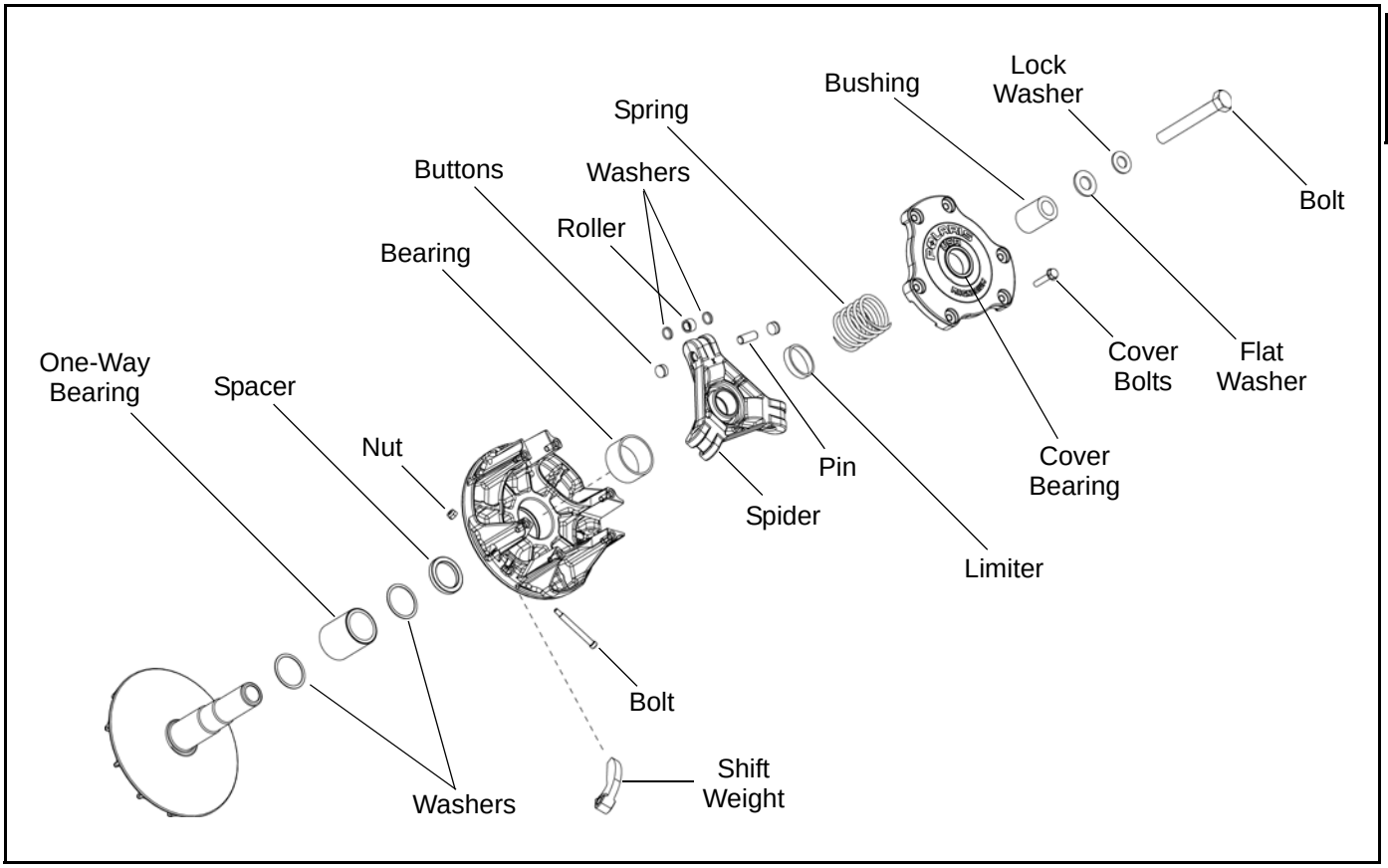
Shift Weights

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



Exploded View



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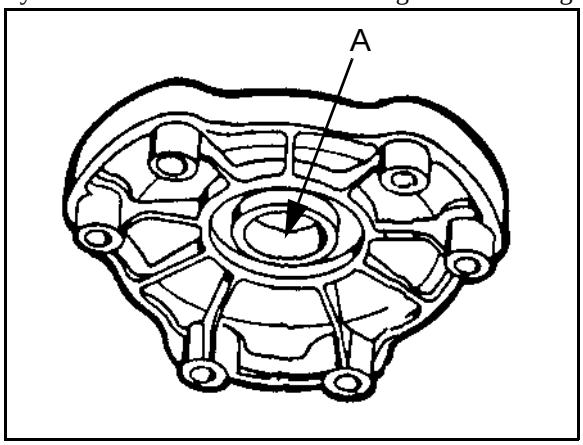
Clutch Disassembly

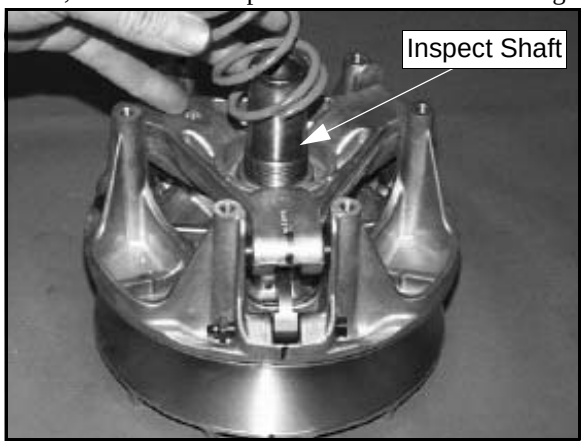
1. Using a permanent marker, mark the cover, spider, and moveable and stationary sheaves for reference, as the cast in X's may not have been in alignment before disassembly.

2. Mark the stationary sheave and clutch shaft to verify the shaft has not turned in the sheave after tightening the spider during clutch assembly.
3. Remove cover bolts evenly in a cross pattern and remove cover plate.
4. Inspect cover bushing (A). The outer cover bushing is manufactured with a Teflon™ coating. Wear is determined by the amount of Teflon™ remaining on the bushing.



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

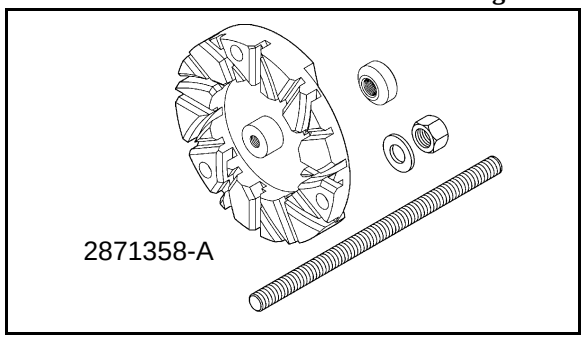
5. Inspect area on shaft where bushing rides for wear, galling, nicks, or scratches. Replace clutch if worn or damaged.



6. Remove and inspect the clutch spring. See "Drive Clutch Spring Specifications" for spring inspection.

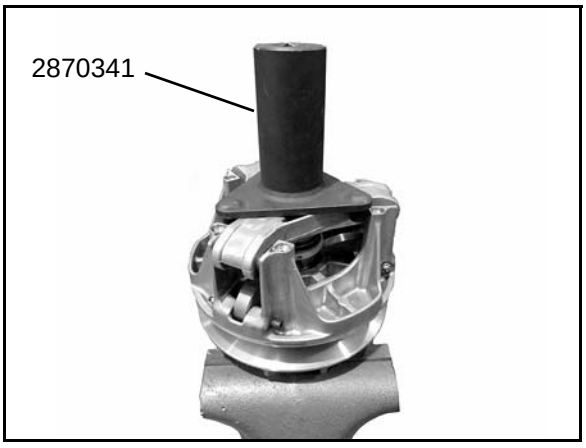
Spider Removal

1. Remove the limiter spacer from the shaft.
2. Install clutch in holding fixture (PN 2871358-A).
   NOTE: This updated holding fixture is required to fit the new drive clutch with a curved rib design.

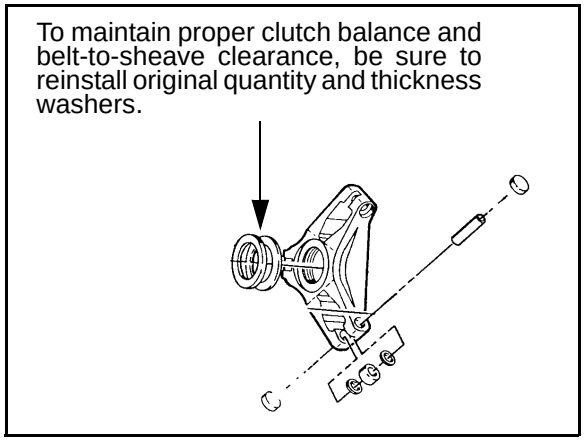


3. Loosen the spider (clockwise) using Clutch Spider Removal Tool (PN 2870341).

IMPORTANT: The clutch shaft has <u>left-hand threads</u>. Be sure to turn the Spider Removal Tool in a <u>clockwise direction</u> to remove.

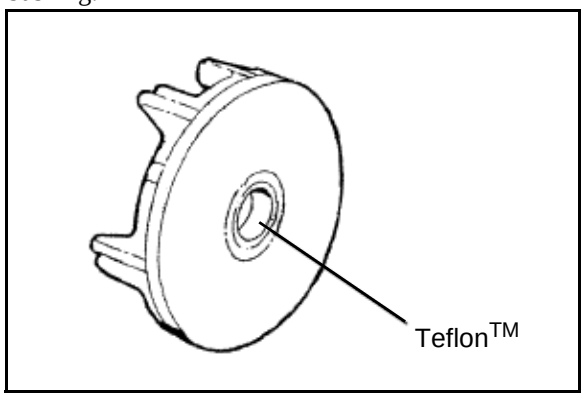


NOTE: It is important that the same number and thickness of washers are reinstalled beneath the spider during assembly. Be sure to note the number and thickness of these washers.



Moveable Sheave Bushing Inspection

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

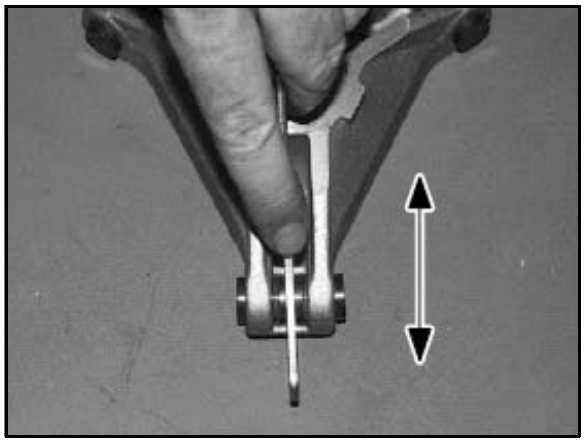


Moveable Sheave Bushing Inspection:

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

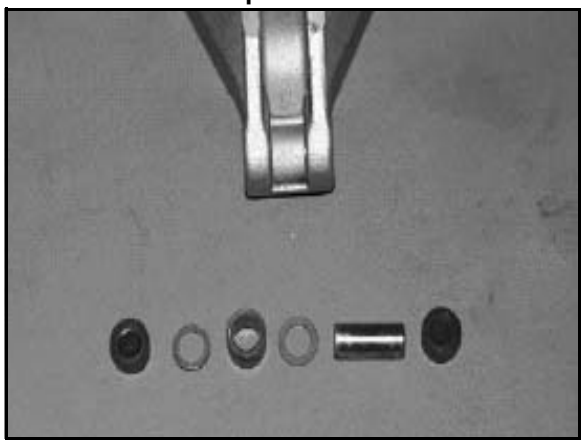
Roller, Pin, and Thrust Washer Inspection

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



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

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



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Button To Tower Clearance Inspection

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

Button to Tower Clearance: 000-.005”

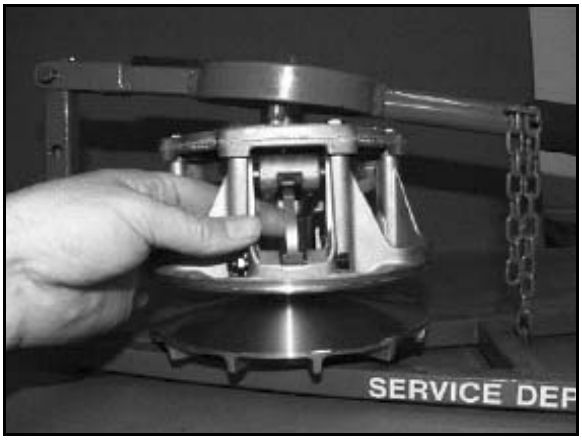
2. Inspect sheave surfaces. Replace the entire clutch if worn, damaged or cracked.

Shift Weight Inspection

WARNING

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

1. If clutch is not disassembled, inspect as shown, using a clutch holding tool to compress the moveable sheave. The contact surface of the weight should be smooth and free of dents or gall marks.



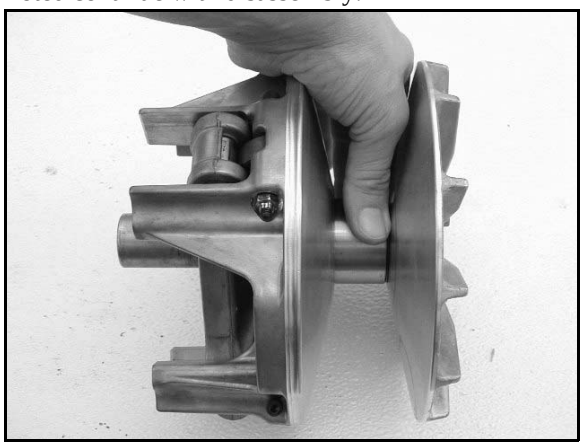
2. Remove shift weight bolts and weights. Inspect the contact surface of the weight. The surface should be smooth and free of dents or gall marks. Inspect the weight pivot bore and pivot bolts for wear or galling. If weights or bolts are worn or broken, replace in sets of three with new bolts.

NOTE: A damaged shift weight is usually caused by a damaged or stuck roller in the spider assembly. See “Roller, Pin and Thrust Washer Inspection”.

Bearing Inspection

1. Rotate the clutch bearing in both clockwise and counter-clockwise directions. The one-way bearing should rotate counter-clockwise (when viewed from cover plate side) with only a slight amount of drag. When rotated clockwise the one-way bearing should lock to the shaft without slipping.

2. Verify there is no binding or rough spots. If problems are noted continue with disassembly.

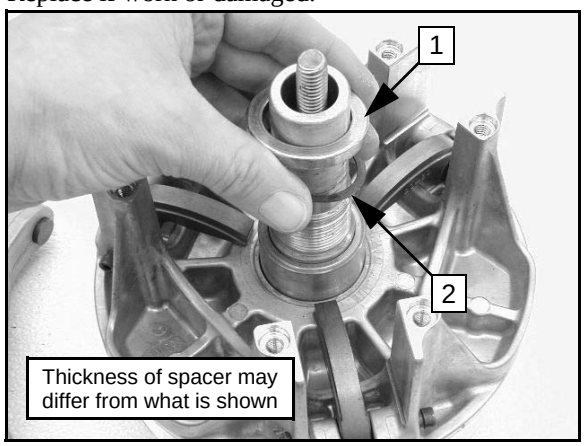


Clutch Inspection

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

1. Remove the moveable sheave spacer sleeve (1) and the thrust washer (2). Visually inspect the washer for damage.

2. Measure the thickness and compare to specification. Replace if worn or damaged.

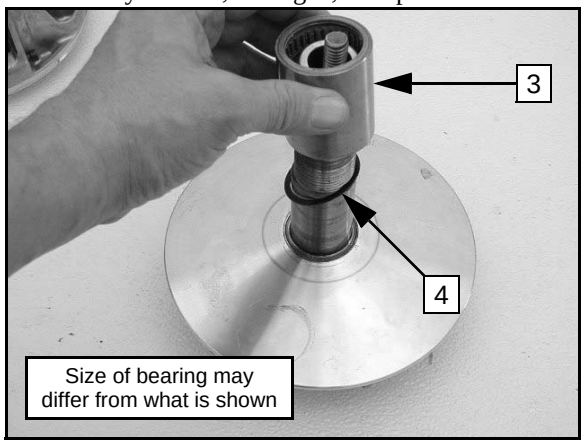


= In. / mm.

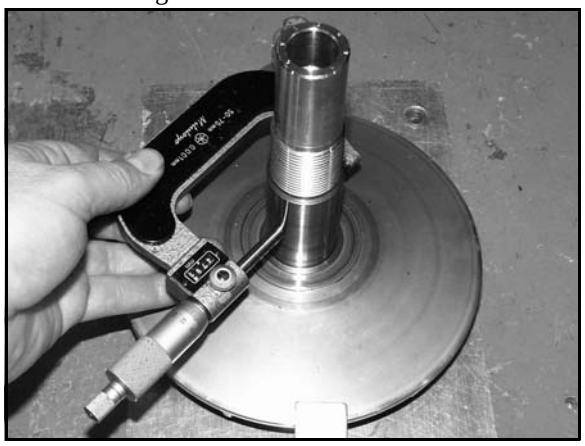
Thrust Washer Thickness
Standard: .030” (.76 mm)
Service Limit: .025” (.64 mm)

3. Remove the moveable clutch sheave.

4. Lift bearing (3) and thrust washer (4) off shaft. Replace as an assembly if worn, damaged, or if problems were noted.



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



= In. / mm.

Shaft Diameter:
Standard: 1.3745 - 1.375 (34.91 - 34.93 mm)
Service Limit: 1.373” (34.87 mm)

6. Visually inspect PTFE thrust washer for damage. Measure the thickness and compare to specification. Replace if worn or damaged.

= In. / mm.

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

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Moveable Sheave Bushing Inspection

Inspect the Teflon™ coating (arrow) on the moveable sheave bushing. Inspect both sheaves for signs of wear, grooving or cracking. De-glaze sheave surfaces with a 3M™ Scotch-Brite Pad if needed.

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

Bushing Service

IMPORTANT: Special Tools Required

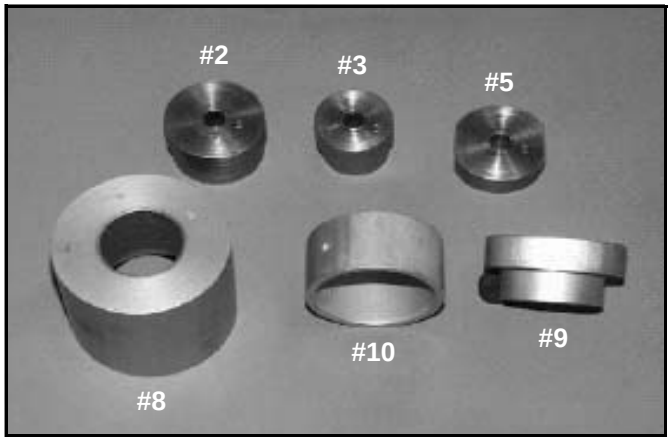
EBS Clutch Bushing Tool Kit - 2201379

Item	Qty.	Part Description	Part #
A, B	1	EBS Puller Tool	5132027
C	1	EBS Puller Nut	5132501
D	1	EBS Main Adapter	5132029
E	1	EBS Bushing Removal Tool	5132028
--	1	Instructions	9915111

Additional Special Tools

Qty.	Part Description	Part #
1	Clutch Bushing Replacement Tool Kit	2871226
1	Piston Pin Puller	2870386

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



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

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

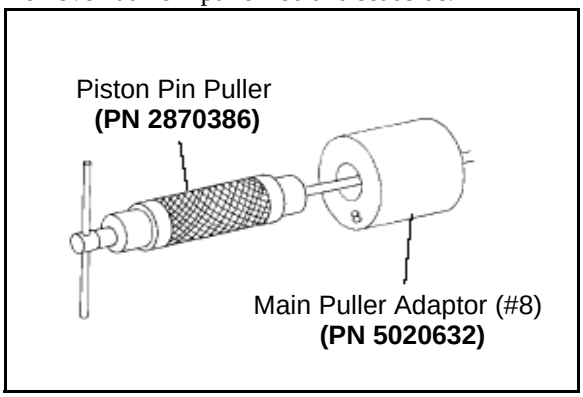
> **⚠ CAUTION**
>
> Clutch components will be hot! In order to avoid serious burns, wear insulated gloves during the removal process.

Moveable Sheave - Bushing Removal

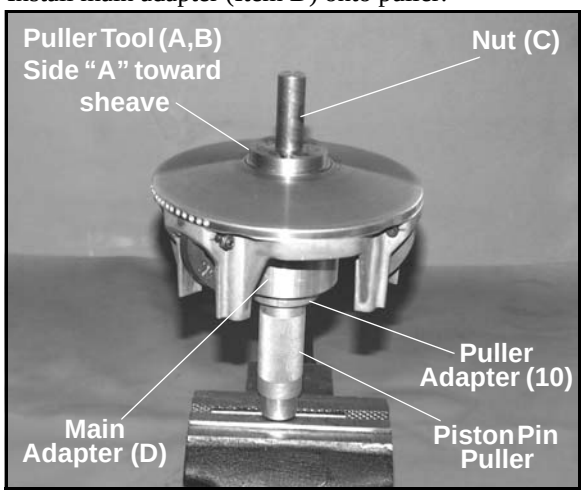
1. Remove clutch as outlined previously in this chapter.
2. Install handle end of the Piston Pin Puller **(PN 2870386)** securely into bench vise and lightly grease puller threads.

Piston Pin Puller (PN 2870386)

3. Remove nut from puller rod and set aside.



4. Install puller adapter (Item 10 from kit **PN 2871226**).
5. Install main adapter (Item D) onto puller.



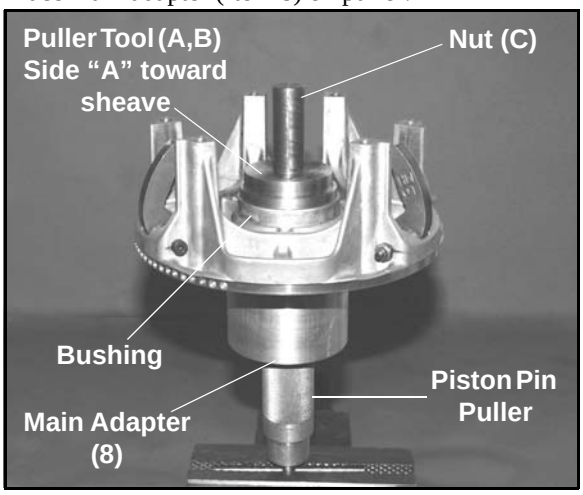
6. With towers pointing toward the vise, slide sheave onto puller rod.
7. Install removal tool (Item A, B) into center of sheave with "A side" toward sheave.

NOTE: Use Bushing Tool PA-47336.

8. Install nut (C) onto end of puller rod and hand tighten. Turn puller barrel to increase tension on sheave if needed. Using a hand held propane torch, apply heat around outside of bushing until tiny smoke tailings appear.
9. Turn sheave counterclockwise on puller rod until it comes free. Lift sheave off puller.
10. Remove nut from puller rod and set aside.
11. Pull bushing removal tool and adapter from puller rod. Remove bushing from tool and discard.

Drive Clutch Bushing Installation

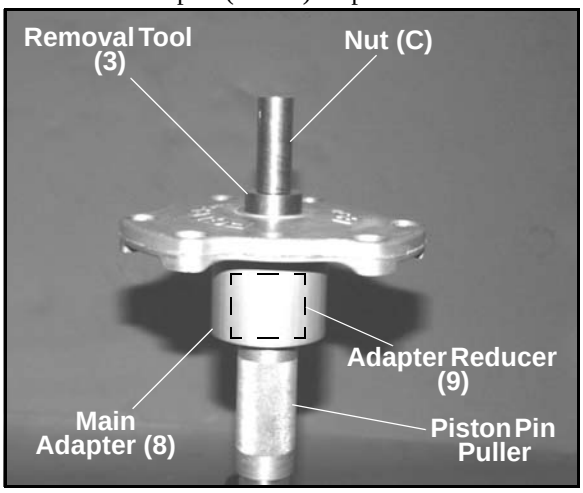
1. Place main adapter (Item 8) on puller.



2. Apply Loctite™ 609 evenly to bushing bore inside moveable sheave.
3. Set bushing in place on sheave.
4. Insert installation puller tool (Item A/B) with "A" side down, into center of bushing.
   NOTE: Some models use **Bushing Tool PA-47336**.
5. With towers pointing upward, slide sheave, bushing and tool onto puller rod.
6. Install nut on puller rod and hand tighten. Turn barrel to apply additional tension if needed.
7. Turn sheave counterclockwise, making sure bushing is drawn straight into bore. Continue until bushing is seated.
8. Remove nut from puller rod and set aside.
9. Remove sheave from puller.
10. Remove installation tool.

Cover Bushing Removal

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



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

Cover Bushing Installation

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

Clutch Assembly

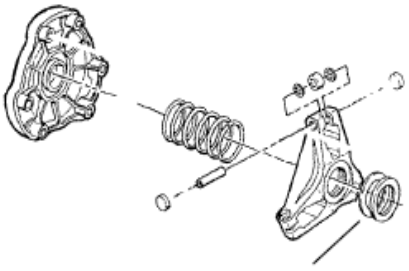
NOTE: It is important that the same number and thickness of washers are reinstalled beneath the spider during assembly. The Teflon bushings are self-lubricating.

⚠ CAUTION

Do not apply oil or grease to the bushings.

Reassemble the drive clutch in the sequence provided below. Be sure the "X", or the marks that were made earlier are aligned during each phase of assembly.

1. Install moveable sheave onto fixed sheave.
2. Install spider spacers. Use same quantity and thickness as were removed.



Spacer washers

3. Compress spider buttons for each tower and install spider, making sure that "X", or the marks that were made earlier, on spider aligns with "X", or the marks that were made earlier, in moveable sheave.
4. Torque the spider **(counter-clockwise)** to specification using the holding fixture and spider tool. Torque with smooth motion to avoid damage to the stationary sheave.

IMPORTANT: The clutch shaft has <u>left-hand threads</u>. Be sure to turn the Spider Removal Tool in a <u>counter-clockwise direction</u> to reinstall.

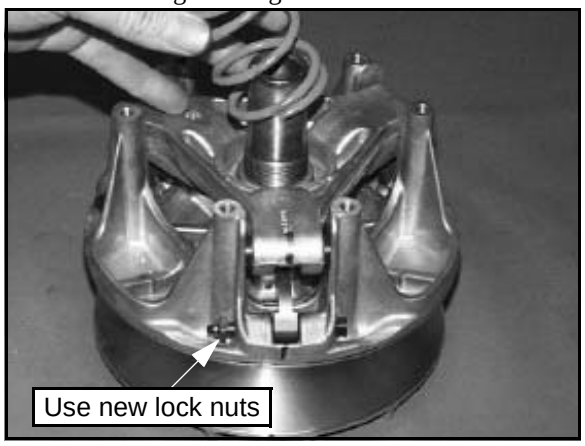
= T

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

⚠ CAUTION

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

5. Install the limiter spacer over the shaft and on top of spider.
6. Install shift weights using new lock nuts on the bolts.



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

= T

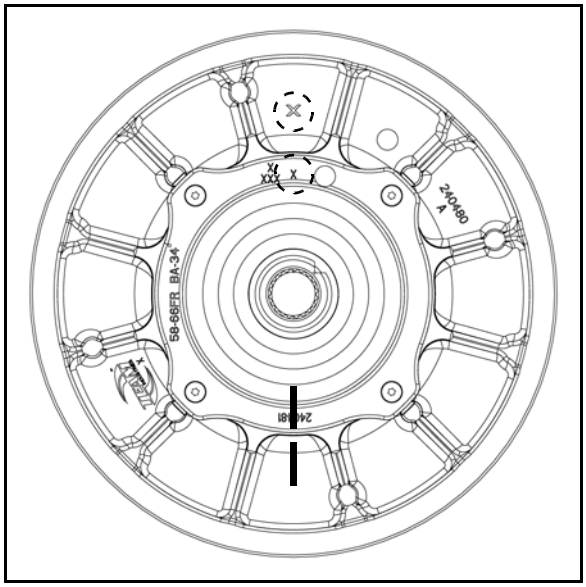
Cover Bolt Torque:
100 in. lbs. (11 Nm)

DRIVEN CLUTCH SERVICE

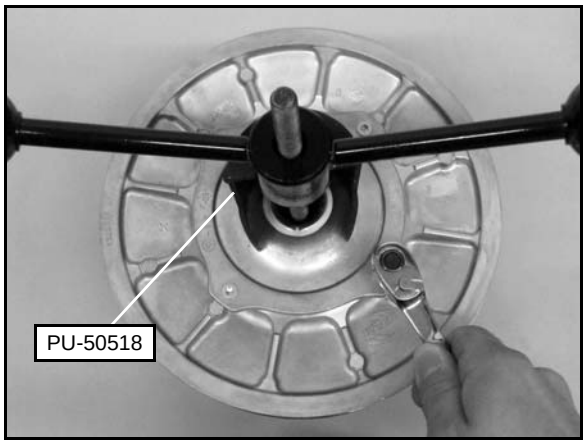
Clutch Disassembly

1. Remove driven clutch from the transmission input shaft (see “PVT Disassembly”)

2. It is important to mark the position of the cam (helix) and sheave before disassembly or use the “X” marks on the components for reference. This will aid in reassembly and helps maintain clutch balance after reassembly.



3. Place the driven clutch into the Clutch Compression Tool **PU-50518**. Spin the tool down until it touches the cam (helix).

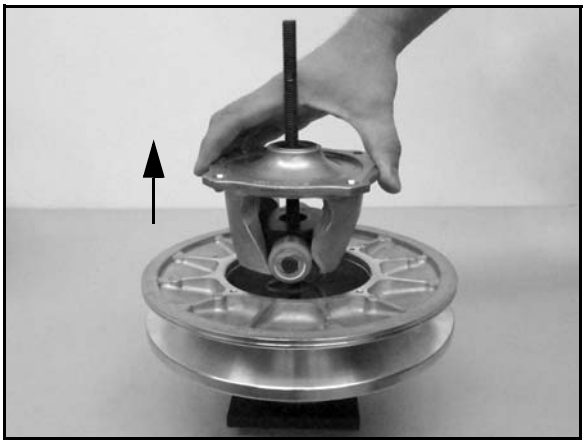


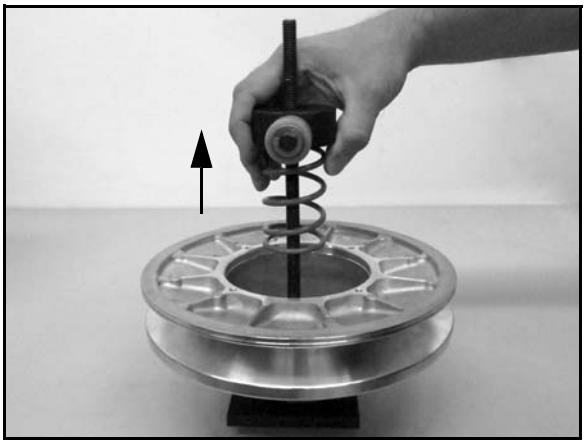
Driven Clutch Compression Tool: PU-50518

4. Using a T25 Torx driver, remove the four screws that secure the cam (helix) assembly.

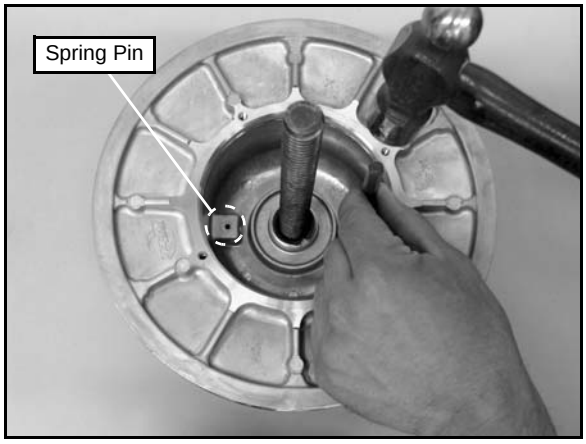
5. Turn the compression tool handle counter-clockwise to relieve spring pressure and allow the cam (helix) to move out from the moveable sheave.

6. Remove the cam (helix), spider and compression spring from the clutch.

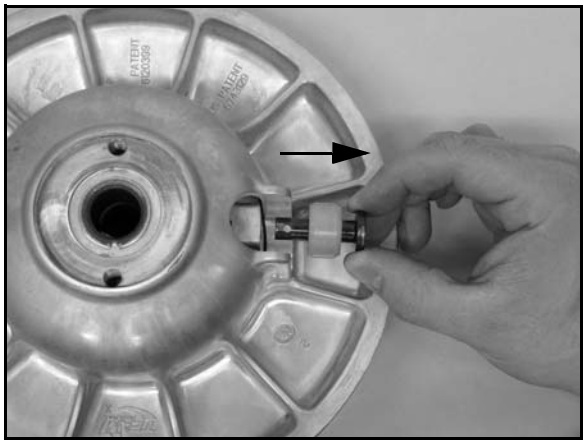




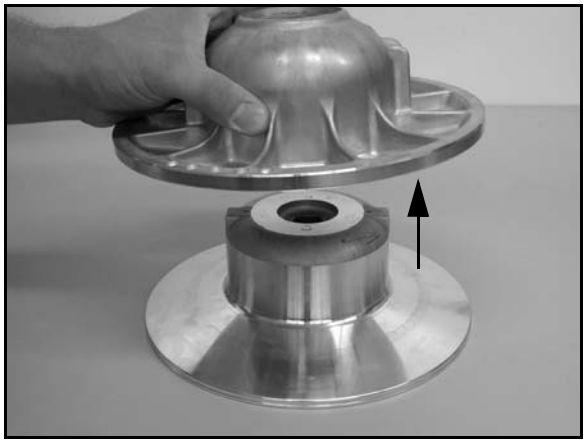
7. In order to disassemble the clutch sheaves, the roller pins must be removed. Using a pin punch and hammer, tap the spring pins out of the moveable sheave as shown.



8. Once the spring pins are removed, turn the clutch over and remove the roller pins and outer clutch rollers as shown.

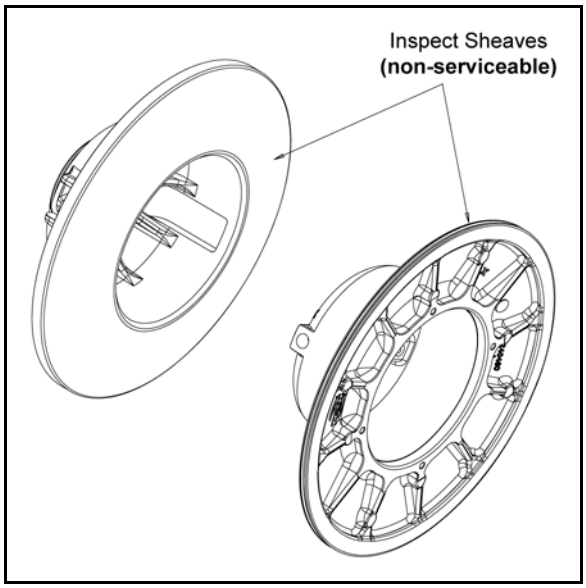


9. Lift the stationary sheave off the moveable sheave.



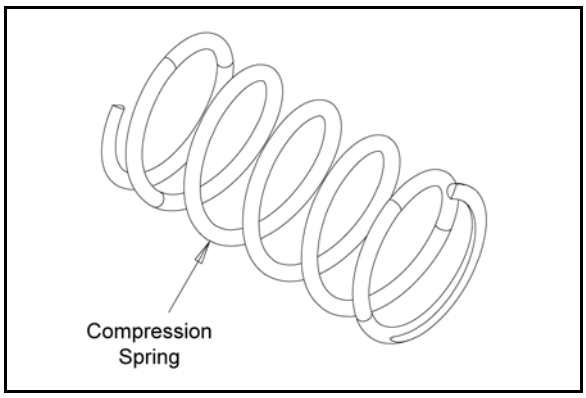
Clutch Inspection

1. Clean the sheaves and inspect each of them for damage.

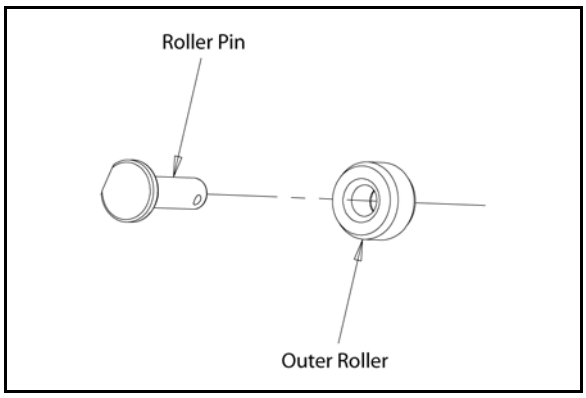


NOTE: If either clutch sheave is damaged, the entire driven clutch assembly must be replaced.

2. Inspect the compression spring for cracks or other damage.



3. If removed, inspect the outer clutch rollers and roller pins for excessive wear or damage. Replace as needed.



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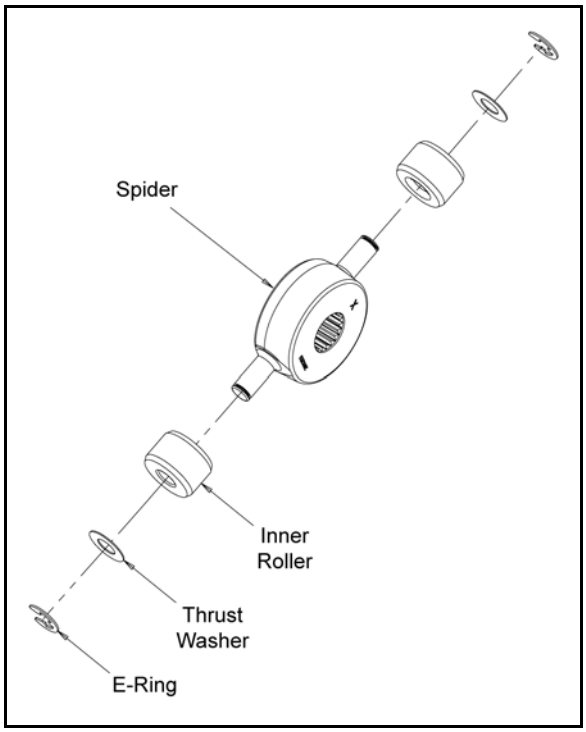
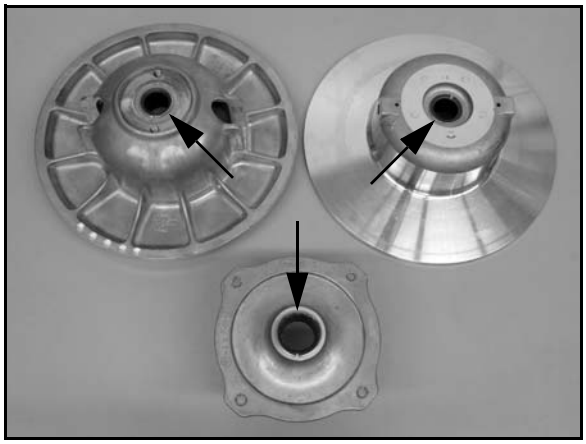
4. Remove the E-rings and thrust washers from each end of the spider assembly. Remove and inspect the inner clutch rollers for excessive wear or damage. Replace components as needed. Use new E-rings upon assembly.



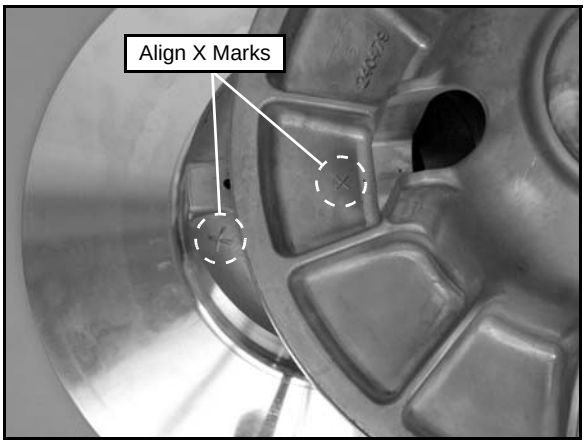
5. Inspect the flanged bearings in the clutch sheaves and cam (helix). If bearings are damaged or have an excessive amount of wear, the entire component must be replaced.



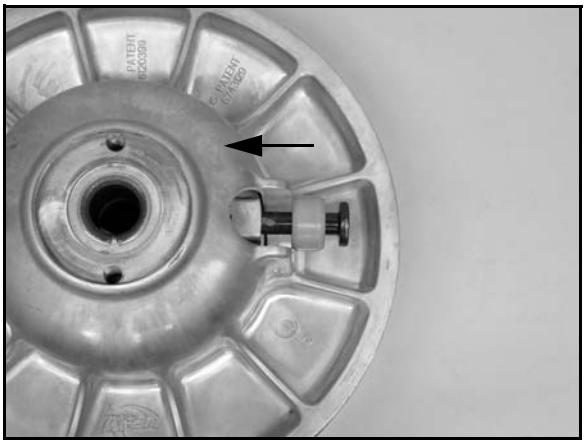
NOTE: The flanged bearings are not serviceable. If either clutch sheave bearing requires replacement, the entire driven clutch assembly must be replaced. Refer to the Polaris Electronic Parts catalog for specific parts availability.

Clutch Assembly

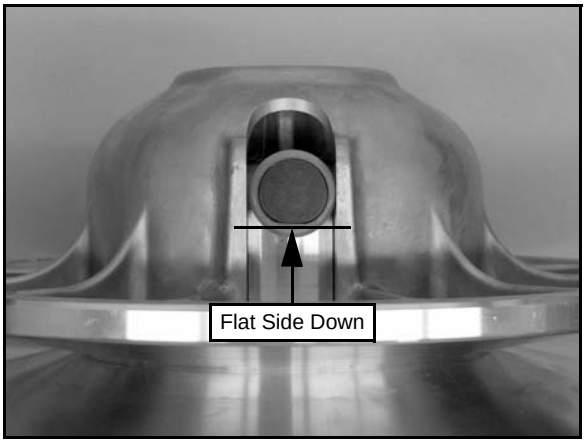
1. Line up the "X" on the moveable sheave with the "X" on the stationary sheave and place the sheaves together.



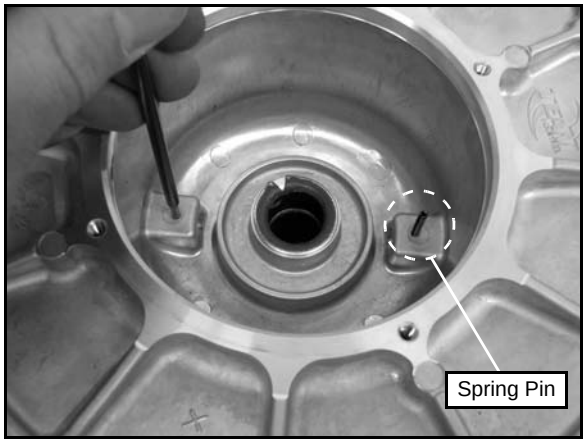
2. Install the outer clutch roller and roller pin on both sides of the moveable sheave.



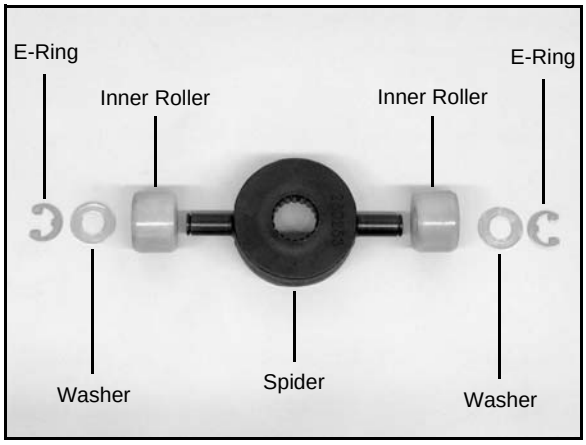
3. Press the roller pin into the moveable sheave on each side with the flat side of the roller pin facing down as shown.



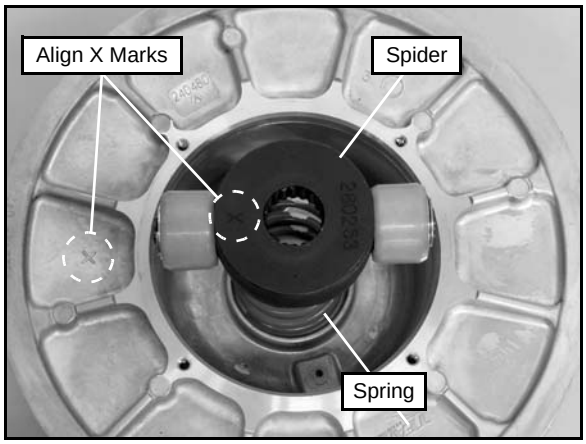
4. Install new spring pins to secure the roller pins in the moveable sheave. Tap the spring pins in until they are flush with sheave surface.



5. Install the inner clutch rollers, thrust washers and E-rings onto the spider if previously disassembled.

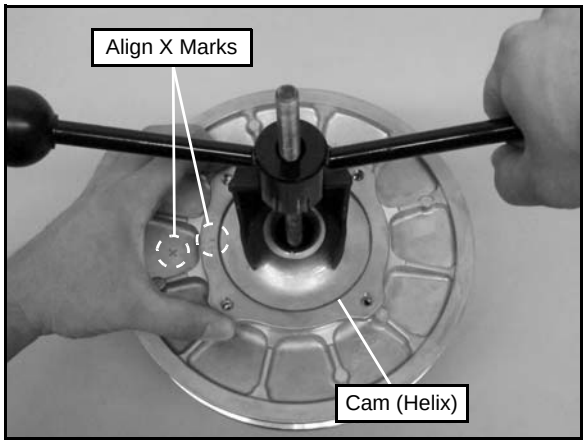


6. Install the compression spring and spider assembly into the moveable sheave. Align the "X" mark on the spider with the "X" mark on the moveable sheave as shown.



7. Install the cam (helix) on top of the spider. Align the "X" mark on the cam (helix) with the "X" mark on the moveable sheave.

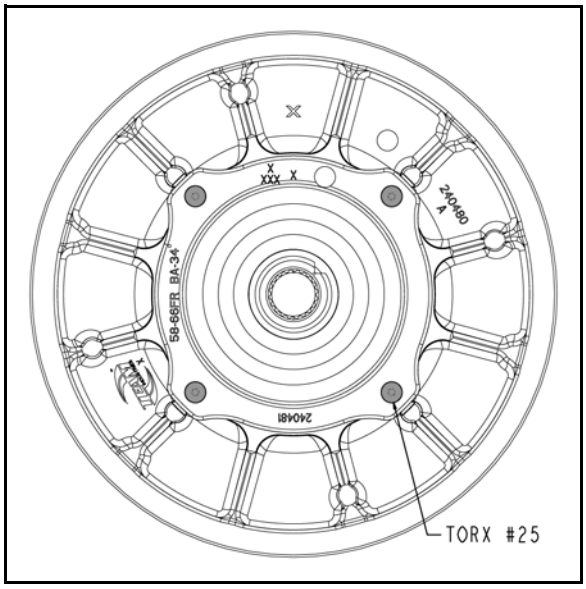
8. Place the clutch assembly onto the Clutch Compression Tool **PU-50518**. Turn the compression tool handle clockwise to overcome spring pressure and force the cam (helix) into the moveable sheave.



NOTE: Be sure the "X" mark on the cam (helix) is aligned with the "X" mark on the moveable sheave.

9. Replace the (4) T25 Torx screws (thread-locking agent applied) or apply Loctite™ 242 to the existing screws.

10. Use a T25 Torx driver to install the four screws and torque them to specification.



= T
T25 Torx Screws: **47 in. lbs. (5.3 Nm)**

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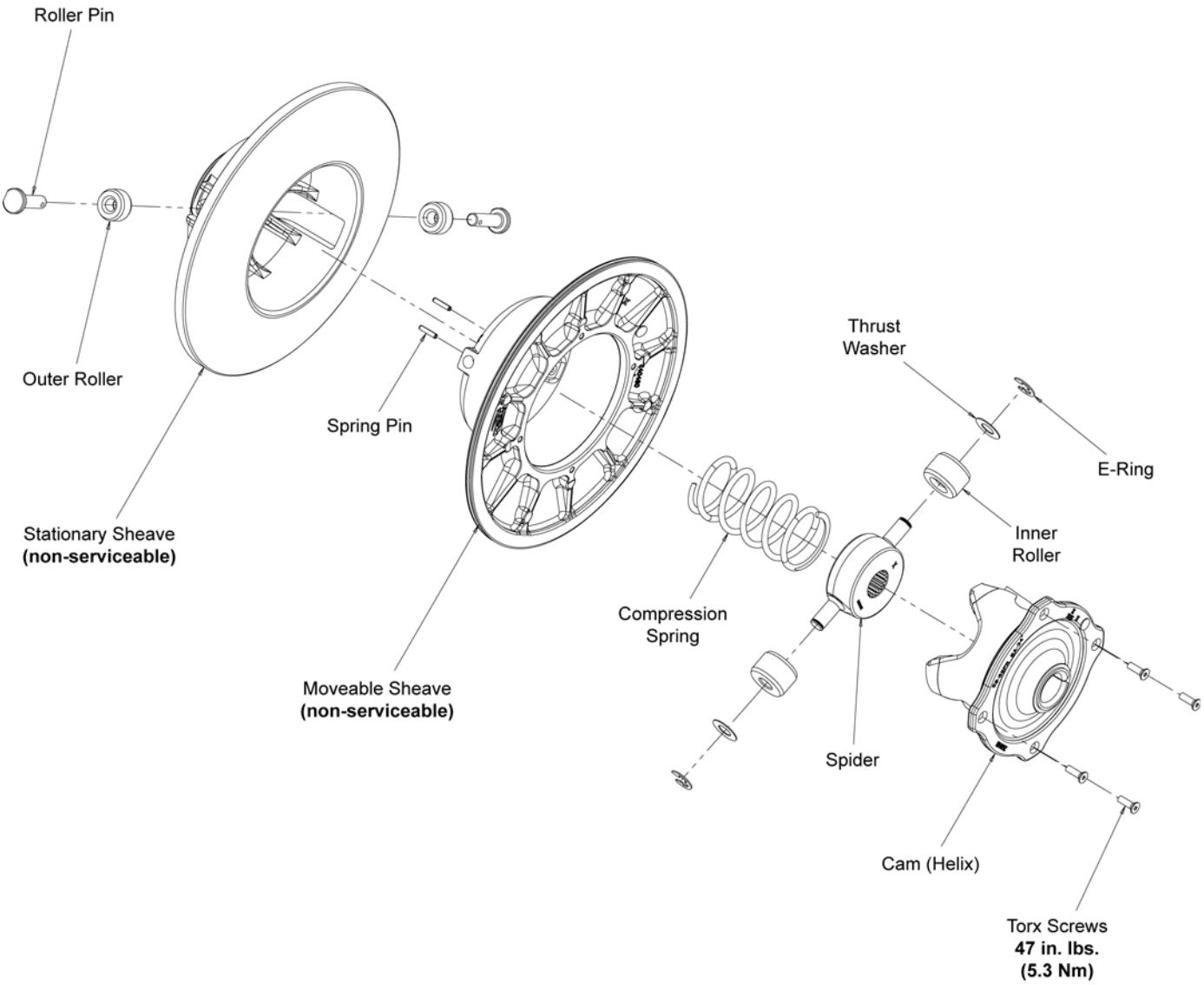
Exploded View



TROUBLESHOOTING

Situation	Probable Cause	Remedy
Engine RPM below specified operating range, although engine is properly tuned	-Wrong or broken drive clutch spring	-Replace with recommended spring
	-Drive clutch shift weight too heavy	-Install correct shift weight kit to match engine application
	-Driven clutch spring broken or installed in wrong helix location	-Replace spring; refer to proper installation location
Erratic engine operating RPM during acceleration or load variations	-Drive clutch binding	A. Disassemble drive clutch; inspect shift weights for wear and free operation. B. Clean and polish stationary shaft hub; reassemble clutch without spring to determine problem area
	-Belt worn unevenly - thin / burnt spots	Replace belt
	-Driven clutch malfunction	Inspect movable sheave for excessive bushing clearance
	-Sheave face grooved	-Replace the clutch
Engine RPM above specified operating range	-Incorrect drive clutch spring (too high spring rate)	-Install correct recommended spring
	-Drive clutch shift weights incorrect for application (too light)	-Install correct recommended shift weights
	-Drive clutch binding	-Disassemble and clean clutch, inspecting shift weights and rollers. Reassemble without the spring and move sheaves through entire range to further determine probable cause
	-Driven clutch binding	-Disassemble, clean, and inspect driven clutch
	-Clutch sheaves greasy; belt slipage	-Clean sheaves with denatured alcohol or brake cleaner, install new belt
Harsh drive clutch engagement	-Drive belt worn too narrow	-Replace belt
	-Excessive belt / sheave clearance with new belt	-Perform belt / sheave clearance adjustment with shim washers beneath spider
Drive belt turns over	-Wrong belt for application	-Replace with correct belt
Belt burnt, thin spots	-Abuse (continued throttle application when vehicle is stationary, excess load)	-Caution operator to operate machine within guidelines
	-Dragging brake	-Vehicle operated with parking brake on. Inspect brake system
	-Slow, easy clutch engagement	-Fast, effective use of throttle for efficient engagement

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Troubleshooting, Continued.....

Situation	Probable Cause	Remedy
PVT cover overheating (melting)	-Plugged air intake or outlet	-Clear obstruction
	-Belt slippage due to water, oil, grease, etc., rubbing on cover	-Inspect system. Clean , repair or replace as necessary. Seal PVT system ducts
	-High vs. low range	-Instruct operator on guidelines for operation in proper driving range for different terrain as outlined in Owner's Safety and Maintenance Manual
Water ingestion	-Cover seal or ducts leaking	-Find leak and repair as necessary
	-Operator error	-Instruct operator on guidelines for operation in wet terrain as outlined in Owner's Safety and Maintenance Manual
Belt slippage	-Belt worn out	-Replace belt
	-Water ingestion	-Inspect and seal PVT system
	-Belt contaminated with oil or grease	-Inspect and clean
PVT noise	-Belt worn or separated, thin spots, loose belt	-Replace belt
	-Broken or worn clutch components, cover hitting clutches	-Inspect and repair as necessary
Engagement erratic or stabby	-Thin spots on belt, worn belt	-Replace belt. Refer to belt burnt troubleshooting and instruct operator
	-Drive clutch bushings stick	-Inspect and repair clutches

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