CHAPTER 7

PVT System

PVT SYSTEM

Overview

> **⚠ CAUTION**
>
> Because of the critical nature and precision balance incorporated into the PVT system, it is absolutely essential that no attempt at clutch disassembly and/or repair be made without factory authorized special tools and service procedures. Polaris recommends that only authorized service technicians that have attended a Polaris-sponsored service training seminar and understand the proper procedures perform adjustments or repairs.

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 clutch setup and adjustments of existing components must be the primary objective in clutch operation diagnosis.

Drive Spring

The drive spring opposes the shift force generated by the clutch weights, and determines the neutral RPM, engagement RPM, and wether the engine RPM remains flat, rises, or falls during shift out. When changing only the drive spring, installing a spring with a lower pre-load rate will result in a lower engagement RPM speed, while installing a spring with a higher pre-load rate will result in a higher engagement RPM.

Clutch Weight

The clutch weights generate centrifugal force as the drive clutch rotates. The force generated changes in relation to the engine RPM and with specified weight of each clutch weight. When changing only the clutch weights, a lighter weight will result in a higher engagement RPM, lower shifting force, and higher shift out RPM. Installing heavier weights has the opposite effect

Neutral Speed

Engine RPM when the force generated by the clutch weights is less than the pre-load force generated by the drive spring. In this mode, the drive clutch is disengaged.

Engagement RPM

Engine RPM when the force generated by the clutch weights overcomes the drive spring pre-load force and the moveable sheave begins to close or “pinch” the drive belt. The engagement mode continues until no more belt slippage occurs in the drive clutch. Once 100% belt engagement is achieved, the sled will accelerate along the low ratio line until the drive clutch up shift force overcomes the opposing shift force generated by the driven clutch.

Shift Out Over-Rev

Engine RPM that spikes above the desired operating RPM speed. The shift out RPM should come down to the desired operating RPM, but never below, after the driven clutch begins to open.

Shift Out RPM

Engine RPM at which the up shift force generated by the drive clutch overcomes the shift force within the driven clutch. In this mode, the drive clutch will move the belt outwards, and the driven clutch will allow the drive belt to be pulled down into the sheaves.

During WOT operation, the shift out RPM can be seen as the maximum, sustained RPM displayed on the tachometer. The shift out RPM should be the same RPM as the recommended engine operating RPM. If the shift out RPM is above the recommended engine operating RPM, install heavier drive clutch weights. If the shift out RPM is below the recommended engine operating RPM, install lighter drive clutch weights.

The shift out RPM should remain constant during both the upshift and back shift modes.

Driven Spring

A compression spring (Team driven / P2) or torsional spring (Polaris P-85 driven clutch) works in conjunction with the helix, and controls the shift rate of the driven clutch. The spring must provide enough side pressure to grip the belt and prevent slippage during initial acceleration. A higher spring rate will provide more side pressure and quicker back shifting but decreases drive system efficiency. If too much spring tension exists, the driven clutch will exert too much force on the belt and can cause premature belt failure.

Back-Shifting

Back-shifting occurs when the track encounters an increased load (demand for more torque). Back-shifting is a function of a higher shift force within the driven clutch than within the drive clutch. Several factors, including riding style, snowmobile application, helix angles, and vehicle gearing determine how efficient the drive system back-shifts. The desired engine operating RPM should never fall below 200 RPM when the drive system back-shifts.

Final Gearing

The final drive gear ratio plays an important role in how much vehicle load is transmitted back to the helix. A tall gear ratio (lower numerical number) typically results in lower initial vehicle acceleration, but a higher top-end vehicle speed. A lower gear ratio (higher numerical number) typically results in a higher initial vehicle acceleration, but a lower top-end vehicle speed.

Choosing the proper gear ratio is important to overall drive system performance. When deciding on which gear ratio to use, the operator must factor in the decision where the snowmobile will be ridden, what type of riding will be encountered, and the level of performance the operator hopes to achieve.

Gearing a snowmobile too low for extended high-speed runs may cause damage to the drive belt and drive system, while gearing a snowmobile too high for deep-snow, mountain use may cause premature belt and clutch wear.

Typically, it is recommended to gear the snowmobile with a slightly higher ratio than the actual top speed the snowmobile will ever achieve.

1:1 Shift Ratio

A 1:1 shift ratio occurs when the drive clutch and the driven clutch are rotating at the same RPM.

The mathematical vehicle speed for a given gear ratio at a 1:1 shift ratio is represented in the chaincase gearing charts located in the Final Drive Chapter.

Low / High Ratio

Low ratio is the mechanical position when the drive belt is all the way down into the drive clutch, and all the way out on the driven clutch. High ratio represents when the drive belt is all the way out on the drive clutch, and all the way in on the driven clutch.

Driven Helix / Ramp

The helix cam is the primary torque feedback component within the driven clutch, regardless of driven clutch type. The beginning angle of the helix must transmit enough torque feedback to the moveable sheave in order to pinch the drive belt while minimizing belt slip. The flatter or lower the helix angle, the more side force will be exerted on the moveable sheave, while the steeper, or higher the helix angle, the less side force will be exerted on the moveable sheave.

PVT System Fastener Torques

Fastener	Torque	Note
Drive Clutch Bolt (All Carbureted)	50 Ft.Lbs. (68 Nm)	Re-torque after running engine.
Drive Clutch Bolt (All 2007 - Current CFI)	80 Ft.Lbs. (108 Nm)	
Driven Clutch Bolt	17 Ft.Lbs. (23 Nm)	
Team Helix Fasteners	60 - 80 In.Lbs. (7 - 9Nm)	
P2 Cover	12 Ft.Lbs. (16 Nm)	
Team Deflection Jam Nut	110 In.Lbs. (12 Nm)	DO NOT OVER-TORQUE
P2 Deflection Cam	12 Ft.Lbs. (16 Nm)	
P2 SPA Deflection Adjuster Screw Lock Nut	10 Ft.Lbs. (12Nm)	
Spider Flat Clutch Cover Raised Clutch Cover	 200-225 Ft.Lbs. (271-305 Nm) 280-300 Ft.Lbs. (380-407 Nm)	Apply Loctite 242
Spider Jam Nut Flat Clutch Cover Raised Clutch Cover	 225-250 Ft.Lbs. (305-339 Nm) 290-310 Ft.Lbs. (393-420 Nm)	
Drive Clutch Cover	100 In. Lbs. (11 Nm)	
Starter Ring gear	150-180 In.Lbs. (1-1.2 Nm)	Apply Loctite 271 Use cross pattern

GENERAL INFORMATION

Special Tools

Team “12 Cooling Fin Driven Clutch” Offset Alignment Tool	PS-46998
Team “24 Cooling Fin Driven Clutch” / P2 Offset Alignment Tool	PS-47477
Drive Clutch Puller (3/4 - 16 x 7/16): Fuji 340 / 488 / 440 / 550 Fan and Liquid Engines	2872084
Drive Clutch Puller: All engines through 1998 (Excluding Domestic Twins - Fuji 700 / 800 XCR)	2870506
Drive Clutch Puller (3/4 - 16 x 14mm): 2000 - Current Domestic Twins / 1999 - 2003 440 / FS-FST 1999 - 2003 700 - 800 XCR	2872085
Drive Clutch Puller (M14 x 1.5mm): 1997 - 1999 Domestic Twins (Excluding 1999 440 XCR)	2871855
Replacement Handle for ALL Clutch Pullers	5020326
Drive Clutch Holding Wrench	9314177-A
Strap Wrench	PU-45419
Replacement Strap	305085
Drive Clutch Spider Nut Socket	2870338
Drive Clutch Spider Removal/Installation Tool	2870341
Clutch Pin Punch	2870507
Tapered Reamer - 29mm Short Drive-All Fuji Snow Engines (Excluding 800 XCR)	2870576
Tapered Reamer - 29mm Long Drive-755/866 w/original crankshaft / 800XCR / All Domestic Carbureted (Excluding 600 IQ Racer)	PS-48587
Tapered Reamer - 31mm- All 600/700/800 CFI / 755/866 w/large taper crankshaft / 600 IQ Racer	PS-48584
Roller Pin Installation Roller/Bushing Alignment Tool	2870910-A
Drive Clutch Button Removal Tool	2870985
Clutch Bushing Replacement Tool Kit	2871025
Clutch Holding Fixture	2871358-1
Universal Drive/Driven Clutch Compressor (Screw Down Type)	PU-50518
Spring-Loaded Roller Pin Installation Roller/Bushing Alignment Tool	8700221
Drive Clutch Compression Tool (Compresses drive clutch without removing clutch from engine.)	2871173

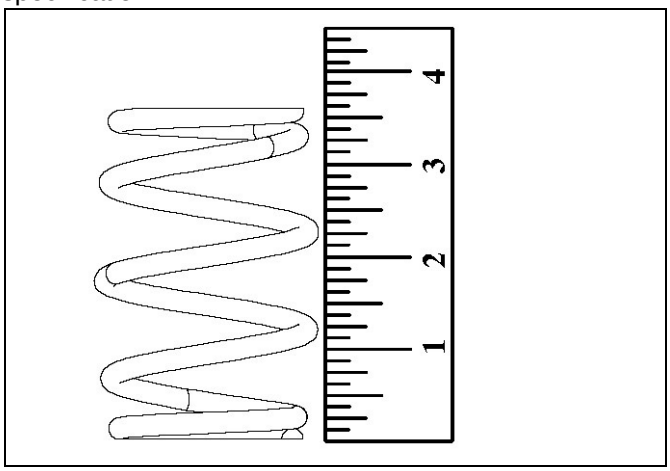
Drive Clutch Springs

PART NUMBER	COLOR	WIRE DIAMETER (inches)	FREE LENGTH +/- .125”	FORCE LBS. @ 2.50” - 1.19” (+/- 12 LBS.)	LOAD RATE (lbs./ inch)
7041080	Blue	.207	3.55	120 - 300	137
7041781	Dark Blue/White	Subs to 7043601.			
7041945	Almond	.218	3.65	140 - 330	145
7041645	Almond/Gold	.207	4.00	150 - 290	107
7041818	Black/White	.218	3.52	140 - 320	137
7041816	Almond/Black	.200	3.75	165 - 310	111
7041922	Almond/Blue	.218	3.75	150 - 310	122
7041988	Almond/Red	.207	4.27	165 - 310	110
7042083	Black/Green	.218	3.38	120 - 340	168
7043601	Black - 3601	.225	3.327	120 - 310	145
7043342	Black - 3342	.218	3.46	140 - 330	145
7043076	Black - 3076	.225	2.67	40 - 340	229
7043120	Black - 3120	.225	2.78	60 - 340	213
7043077	Black - 3077	.255	2.90	80 - 340	198
7043121	Black - 3121	.255	3.05	100 - 340	183
7042287	Black - 2287	.207	3.40	110 - 290	137

NOTE: Springs listed as color - #### will have the last four digits of the part number painted on the spring coil. Tag each spring with the part number and spring force when not in use.

Spring Free Length

Measure the drive and driven spring free length with the spring resting on a flat surface. Replace spring if out of specification.



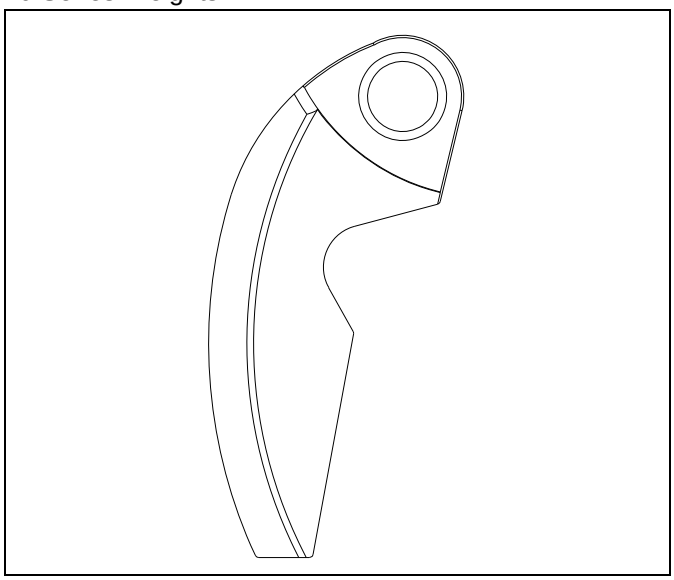
In addition to proper free length, the spring coils should be parallel to one another when placed on a flat surface. Distortion of the spring indicates stress fatigue. Replacement is required.

⚠ 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

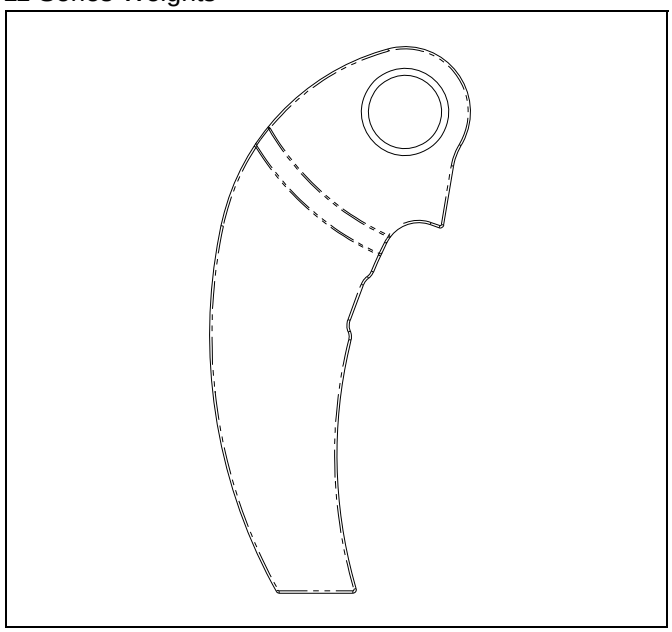
Drive Clutch Weights

10 Series Weights



WEIGHT	GRAMS(+/- 1gr.)	PART NUMBER
10M - R	44	1321530
10M - W	46	1321527
10M - B	47.5	1321529
10M	49.5	1321528
10	51	1321526
10A - L	52.3	1321531
10-54	54	1321685
10A	55	1321589
10-56	56	1321684
10-58	58	1321588
10-60	60	1321587
10-62	62	1321586
10-62M*	61.5	1321614
10-64	64	1321585
10-64M*	63.5	1321615
10-66	66	1321584
10-68	68	1322427
10-70	70	1322414
10-72	72	1322428
10-74	74	1322429
10-76	76	1322585
10-78	78	1322586
* = Features smaller heel. Belt-to-sheave clearance may have to be adjusted.		

11 Series Weights



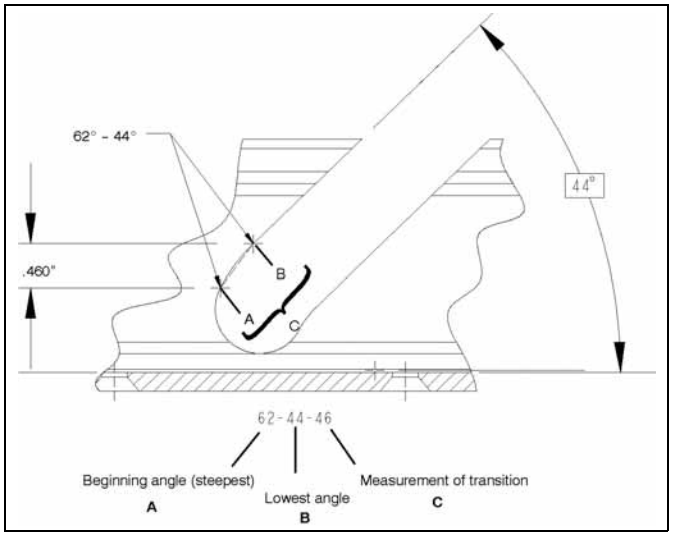
WEIGHT GRAMS(+/- .8gr.)	PART NUMBER
11-40	1322593
11-42	1322592
11-44	1322591
11-46	1322596
11-48	1322590
11-50	1322589
11-52	1322595
11-54	1322866
11-56	1322865
11-58	1322869
11-60	1322863
11-62	1322862
11-64	1322604
11-66	1322559
11-68	1322558
11-70	1322523
11-72	1322524
11-74	1322525
11-76	1322526

NOTE: When compared to 10 series weights, 11 series weights feature more weight distribution at the begining of the shift curve, a more aggressive shift curve, and a larger heel angle. The belt-to-sheave clearance will require adjustment when changing to and from each series of weights.
When cross referencing 10 and 11 series weights, select a 2 gr. lighter 11 series weight (10-66 = 11-64).

PERC Team LWT Driven Helixes (24 Fin)

PART NUMBER	DESCRIPTION
5135401	64 / 42 - .36
5135402	64 / 38 - .25
5135403	56 / 42 - .36
5135503	54 / 38 - .25
5135504	S36
5135772	66 / 44 - .46
5136327	60 / 42 - .36
5136255	S42

Team Ramp Angles



The angles and length of the transition between the first and final angle is stamped on the back of the helix. The first number (A) designates the starting angle of the ramp. The second number (B) designates the finish angle. The last number (C) is the transition distance (in inches) between the starting and finish angles.

CAUTION

Do not install a non-ER helix on a Perc-equipped snowmobile where the engine changes directions.

7

Team Driven Springs

TEAM Driven Springs

PART NUMBER	COLOR	Free Length Inches (cm)	LOAD @ 2.2″(lbs)	LOAD @ 1.1″(lbs)	Rate (Lbs. per inch)
7042181	Black/Yellow	6.0 (15.24)	145	208	56
7043058	Red/Black	4.7 (11.9)	140	240	90
7043059	Red/Green	4.767 (12.1)	120	220	90
7042066	Green/Black	5.60 (14.2)	135	198	56
7043061	Red/Silver	4.95 (12.5)	125	175	45
7043062	Red/Yellow	4.40 (11.2)	100	150	45
7043057	Red/Blue	4.767 (12.1)	140	200	54
7043063	Black/Red	5.14 (13)	155	222	65
7043064	Blue/Black	4.10 (10.4)	123	203	73
7043060	Red/White	4.95 (12.5)	100	200	91
7043069	Red/Pink	3.50 (8.9)	140	260	110
7043363	Black/Purple	4.50 (11.4)	160	240	72
7043252	Black - 160 / 280	3.70 (9.4)	160	280	109
7043253	Black - 180 / 280	4.20 (10.6)	180	280	91
7043254	Black - 140 / 300	3.20 (8.1)	140	300	146
7043255	Black - 160 / 300	3.50 (8.9)	160	300	127
7043256	Black - 180 / 300	3.90 (9.9)	180	300	109

NOTE: Team driven springs listed with a color - ### / ### will have the beginning and ending spring rates painting on the spring coils. Tag each spring with the part number when not in use.

Polaris P2 Driven Helixes

PART NUMBER	DESCRIPTION
5136975	38S
5137154	40S
5137155	42S
5137160	44S
5137142	58/40 - .35
5137150	40/38 - .45
5137157	44/38 - .45
5137156	50/40 - .45
5137176	58/42 - .45
5137153	60/40 - .45
5137161	62/40 - .45

Polaris P2 Driven Springs - Team / 2009 550cc P2

PART NUMBER	COLOR	Free Length Inches (cm)	LOAD @ 2.2″(lbs)	LOAD @ 1.1″(lbs)	Rate (Lbs./In.)
7043397	Black	4.4 (11.2)	100	150	45
7043398		4.95 (12.6)	125	175	45
7043151		4.76 (12.1)	140	200	54
7043150		4.2 (10.6)	140	220	65
7043430		4.4 (11.2)	160	240	72
7043152		4.1 (10.4)	120	200	73
7043149		4.7 (11.9)	140	240	90

Polaris P2 Tab Driven Springs

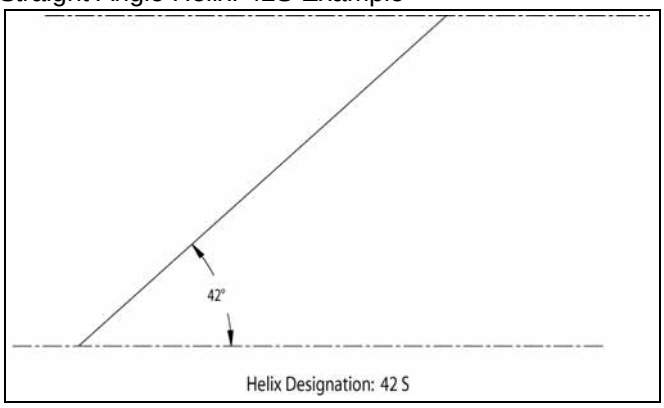
PART NUMBER	COLOR	Free Length* Inches (cm)	LOAD @ 2.4″(lbs)	LOAD @ 1.4″(lbs)	Rate (Lbs./In.)
7043516	Black	4.4 (11.2)	90	135	45
7043517		4.95 (12.6)	115	160	45
7043515		4.77 (12.1)	130	180	54.5
7043495		4.74 (12)	140	200	60.9
7043513		3.85 (9.8)	105	180	73
7043514		4.125 (10.5)	125	200	73
7043496		4.4 (11.2)	145	220	73
7043512		3.74 (9.5)	120	210	91

NOTE: Tag each spring with the part number and spring force when not in use.

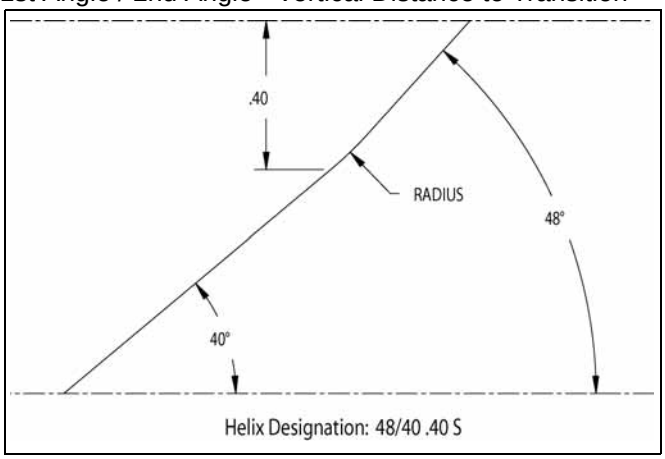
*** = Not including tab.**

P2 Helix Angles

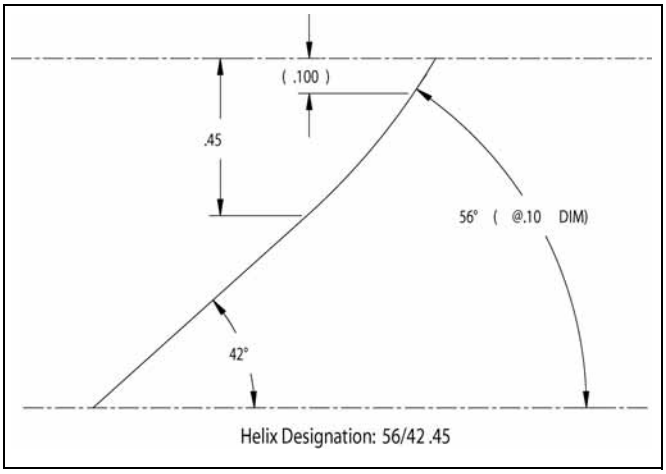
Straight Angle Helix: 42S Example



Dual Straight Angle Helix: 48/40 .40S Example
1st Angle / 2nd Angle - Vertical Distance to Transition



Arc to Straight Angle Helix: 56/42 .45 Example
1st Angle at .100” from Horizontal / 2nd Angle - Vertical Distance to Transition



Drive Belts

Part Number	Projected Width	Overall Side Angle	Center to Center	Outer Circumference	Ride Out	Notes
3211080	1.426 / 36.2	28_	11.5 / 29.2	46.62 / 118.4	Belt cord line should be flush with, or slightly above, the outer circumference of driven clutch sheaves.	Kevlar Cords CVT version of 3211078
3211078	1.438 / 36.5					Standard Compound, Kevlar Cords
3211122	1.46 / 37.1	26_	11.5 / 29.2	46.77 / 118.8		MBL Kevlar Cords Performance replacement for the 3211080 Cut Finish
3211115						MBL High Performance / Mountain Belt PBO Fiber Cords Sanded Finish
3211132		28_	12 / 30.5	47.52 / 120.7		600 IQ Widetrak Belt

Belt dimensions are given in nominal dimensions. There is a +/- variance for all critical dimensions. Clutch set up must be inspected when a new belt is installed.

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.

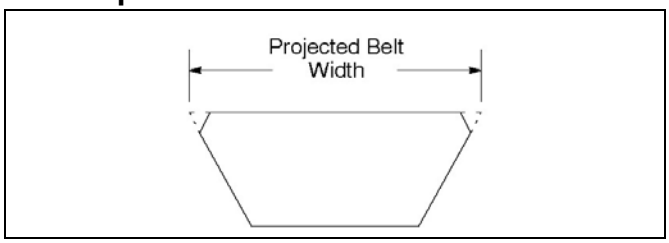
The belt cord line should be flush with, or slightly above, the outer circumference of the driven clutch sheaves. The belt will seat itself in the driven clutch during the break-in period. Adjust the belt ride out after the break-in period by re-adjusting belt deflection.

The break-in period for a new drive belt is 30 miles. During this time, vary the throttle position under 50% and limit full throttle use.

New drive belts that feature a sanded finish should be first washed with warm, soapy water and allowed to air dry prior to use.

Always take time to warm up the belt and driveline prior to operating the snowmobile. Free track and skis from the ground before engaging throttle.

Belt Inspection

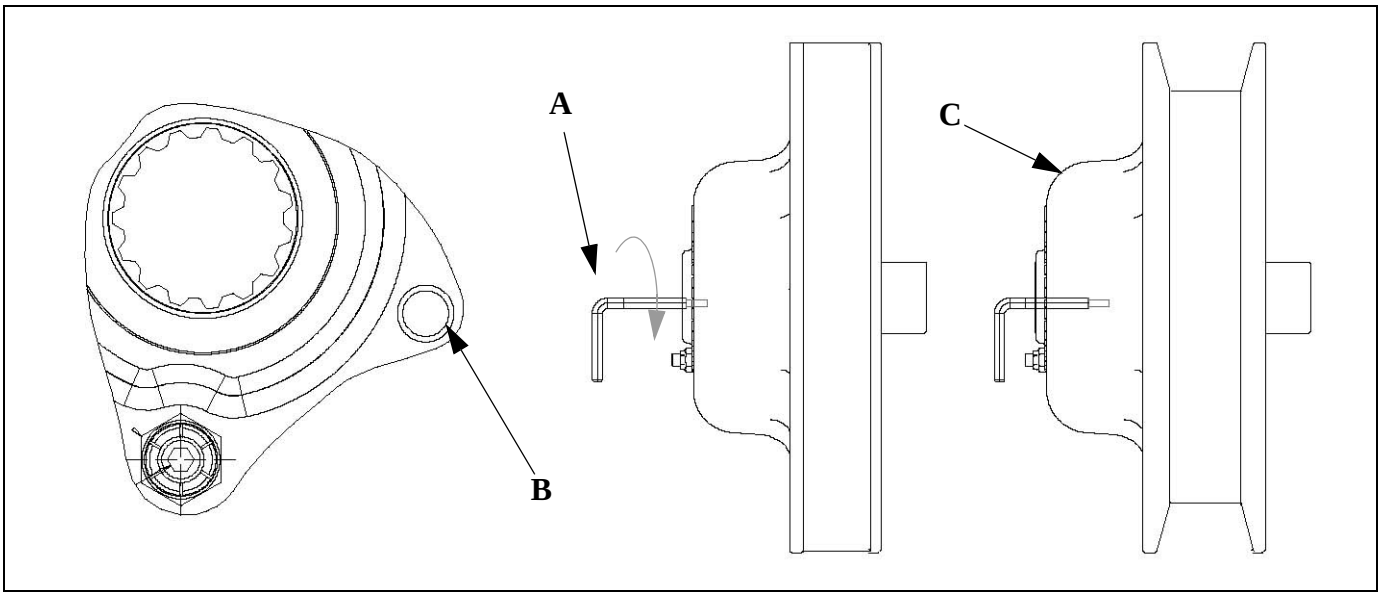


1. Measure the belt width and replace it if it is worn severely. Generally a belt should be replaced if the clutches can no longer be adjusted to provide the proper belt deflection.
   - Project the side profiles and measure from corner to corner.
   - Place a straight edge on each side of the drive belt and measure the distance where the straight edges intersect at the top.
2. Inspect the belt for loose cords. missing cogs, cracks, abrasions, thin spots or excessive wear spots. Replace if necessary.
3. Inspect the belt for hour glassing (extreme circular wear in at least one spot an 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 Diagnostics

POSSIBLE CAUSE	SOLUTION
Driving at or about engagement RPM for extended periods of time in any type of snow condition.	Drive at higher RPM if possible. Gear the machine down. Make sure belt deflection is at 1 1/4” 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 drive away 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 actual vehicle speed and 60 m.p.h. 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 warm-up. 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 carburetors. Make sure no water or ice is present in the 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, or damage on the clutch
Slow, easy belt engagement - easing on the throttle	Use fast, effective throttle to engage the clutch.

Drive Belt Removal - Team Driven



NOTE: Turn the key to the "OFF" position and allow the engine to come to a complete stop.

1. Verify the driven clutch is not in reverse. Remove the LH compartment door panel.

⚠ CAUTION

Damage to the driven clutch or L wrench will occur when attempting to open the driven clutch when the driven clutch is in the reverse position.

2. Insert the L wrench, PN 2874857 (A), into the threaded hole (B) located on the driven clutch, and turn it clockwise until the clutch sheaves are in the open position (C).
3. Remove the drive belt.

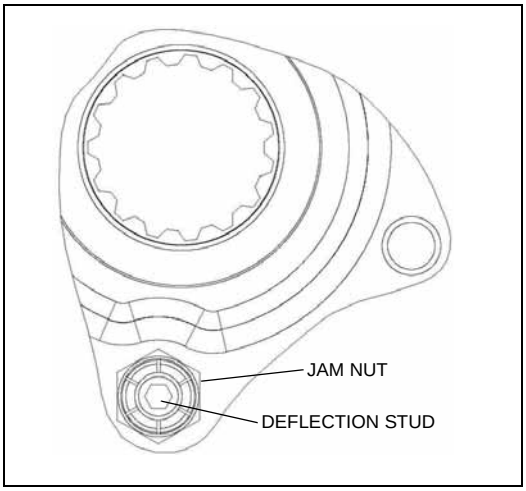
Drive Belt Installation - Team Driven

1. With the L wrench inserted into the threaded hole (B) and the sheaves in the open position, install the drive belt.

NOTE: Install belt so that the numbers can be read correctly on the left side of the machine or in the direction in which the belt was originally installed.

2. Remove the wrench. "Wiggle" the belt to remove slack while removing the wrench.
3. Close the clutch guard.

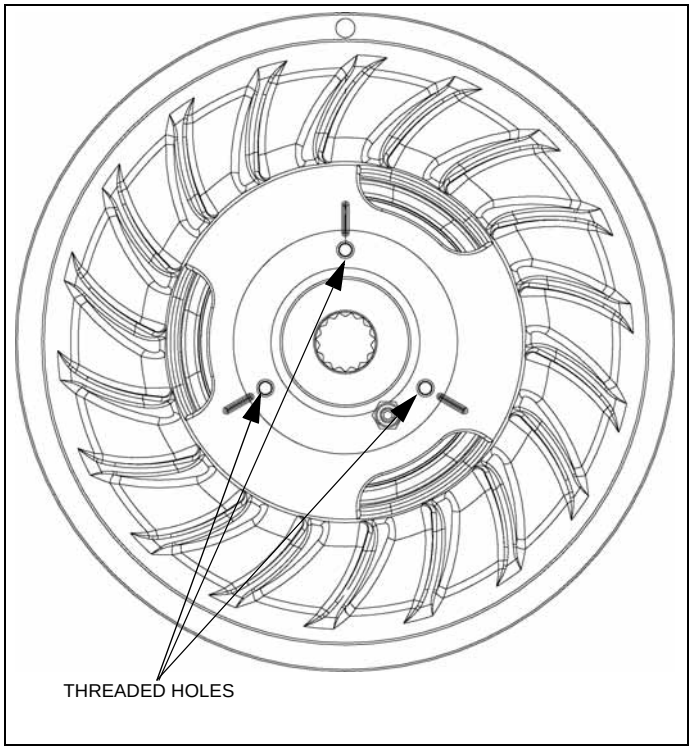
Adjusting Belt Deflection - Team Driven Clutch



1. Loosen the jam nut.
2. Using an 1/8″ Allen head wrench, turn the stud counter-clockwise to decrease belt deflection and clockwise to increase belt deflection.
3. When the proper belt deflection is achieved torque the lock nut to 90 - 110 in-lb. (10 - 12 Nm).

NOTE: The belt deflection should be set so that .09″ to .10″ of the outer cogs are outside of the driven sheaves.

Drive Belt Removal - SPA P2



NOTE: Turn the key to the "OFF" position and allow the engine to come to a complete stop.

1. Verify the driven clutch is not in reverse. Remove the LH compartment door panel.

> **⚠ CAUTION**
>
> Damage to the driven clutch or L wrench will occur when attempting to open the driven clutch when the driven clutch is in the reverse position.

2. Insert the L wrench, PN 2874857, into one of the threaded holes located on the driven clutch. Turn it clockwise until the clutch sheaves are in the open position.
3. Remove the drive belt.

Drive Belt Installation - SPA P2

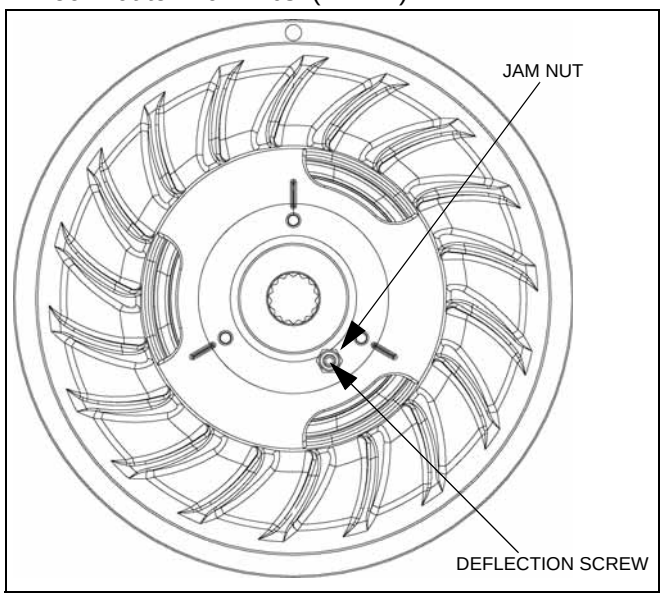
1. With the L wrench inserted into one of the threaded holes and the sheaves in the open position, install the drive belt.

NOTE: Install belt so that the numbers can be read correctly on the left side of the machine or in the direction in which the belt was originally installed.

2. Remove the wrench. "Wiggle" the belt to remove slack while removing the wrench.
3. Close the clutch guard.

Adjusting Belt Deflection - SPA P2

1. Loosen the deflection screw jam nut.
2. Using a 1/8 Allen driver, turn the deflection screw in or out to adjust the distance between the driven clutch sheaves.
3. When the proper belt deflection is achieved torque the lock nut to 110 in. lbs. (12 Nm).



PVT SYSTEM ADJUSTMENTS

Clutch Alignment/Offset

The drive and driven clutches are offest from each other. This offset is controlled by the number and thickness of washers installed on the jackshaft behind the driven clutch.

1. Remove drive belt.
2. Push the driven clutch towards the bulkhead. Install the correct alignment tool depending on the type of driven clutch installed on the snowmobile.

TOOL PART NUMBER	APPLICATION
PS-46998	Standard Team Driven (12 Fin)
PS-47477	Light Weight (LWT) Team Driven / P2

NOTE: The PS-49668 and PS-47477 offset tools are calibrated with the correct alignment angle for their respective driven clutches. Using the wrong offset tool will yield incorrect measurements.

Inspect for broken motor mounts, engine straps or bulkhead damage if the offset tool reveals major mis-alignment.

3. The optimum setup is when the front and rear of the tool touch the driven clutch. No gap should be present in the front, and the rear clearance should not exceed .060" (1.5mm).

NOTE: If the front of the alignment bar does not touch the driven sheave, the maximum clearance cannot exceed .025″ (.64mm).

Offset/Float Adjustment

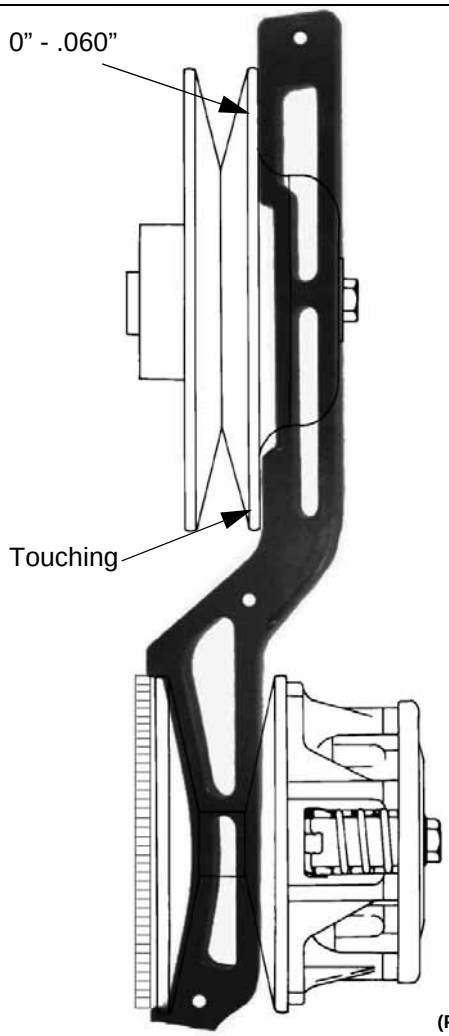
1. Determine direction driven clutch needs to be adjusted.
2. Remove driven clutch retaining bolt, and remove driven clutch.
3. With one 16 GA. bushing installed, add or remove offset washers from behind the driven clutch to set the proper offset.
4. After adjusting the offset, add or remove shim washers from behind the driven clutch bolt and washer to provide a .060" (.1.5mm) driven clutch float on the jackshaft.

Driven Clutch Offset/Shim Washers

Offset Washers
16 GA. Bushing =7556509
.023” = 7555917
.120” = 7555864
Float Washers
.063" = 7555734
.047" = 7555957

⚠ CAUTION

Always verify the driven clutch floats on the jackshaft. The jackshaft bearing will fail from side-loading if the driven clutch is not allowed to float.



(PN: PS-46998 Shown)

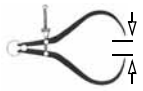
7

Belt-to-Sheave Clearance Adjustment

Belt-to-sheave clearance is an important factor when evaluating drive clutch performance as it controls the starting drive ratio and the position of the drive clutch weights in relation to engine RPM.

If the clearance is too small, the drive belt will drag on the face of the sheaves when the engine is at idle speed.

If the clearance is too large, the belt will slip during initial engagement causing belt burning and low-speed engine bogging.

 = **In. / mm.**
Belt-to-Sheave Clearance Nominal = .020in. (0.508mm) Range = .005 - .035in. (0.127 - 0.89mm)

Belt-to-sheave clearance can adjusted by installing a different drive belt, or by adding or removing shims washers) located under the spider assembly.

To measure belt-to-sheave clearance, follow these steps:

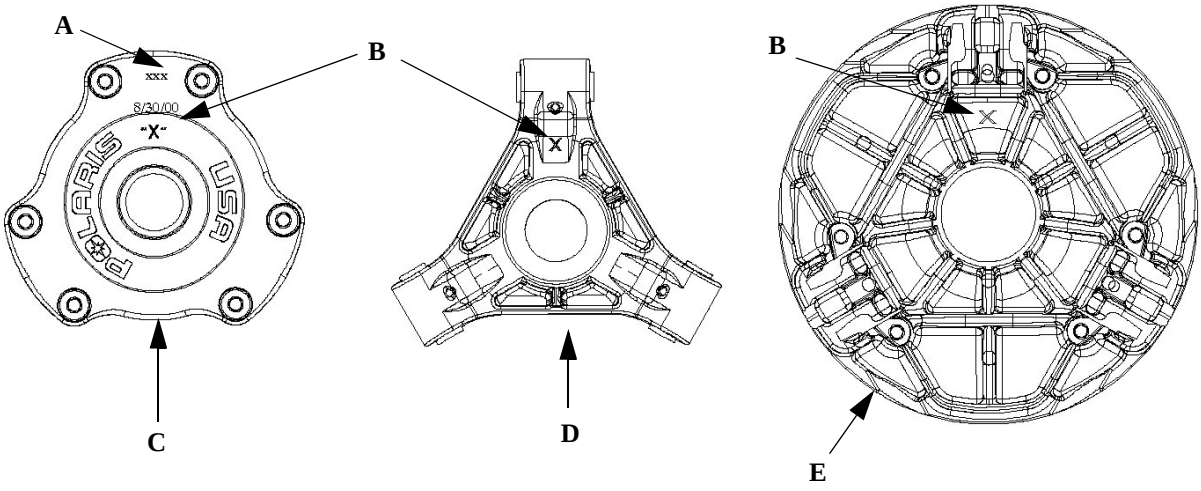
1. Verify the drive clutch sheave faces are clean and the drive belt is in good condition, and not damaged or excessively worn.
2. Push the drive belt tight against one side of the drive clutch sheaves. Measure the opposite side gap using a feeler gauge.
3. A slight very drag should be felt when inserting the feeler gauge between the belt and sheave face.
4. Compare measured gap to the specification.

The distance between the moveable and stationary clutch sheaves and thus the belt-to-sheave clearance is determined by the number and thickness of the washer(s) installed between the spider and clutch spacer.

To increase the clearance, add or install thicker washer(s). To decrease the clearance, remove or install thinner washer(s). Either way, belt-to-sheave clearance adjustment most often requires the spider to be “re-indexed”.

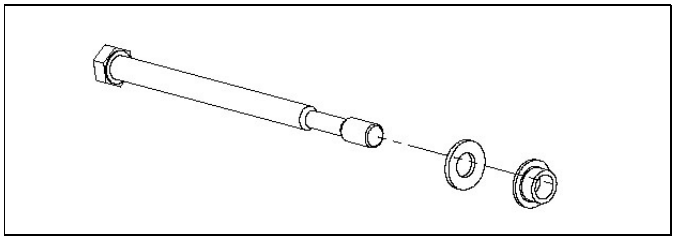
DRIVE CLUTCH

Identification



Every clutch will have the clutch part numbers etched on to the cover (A). The “X" (B) marking is an index mark where the clutch cover (C), clutch spider (D) and the stationary sheave (E) should line up when the clutch is assembled.

Drive Clutch Removal



NOTE: All clutch tools can be found at the beginning of this chapter.

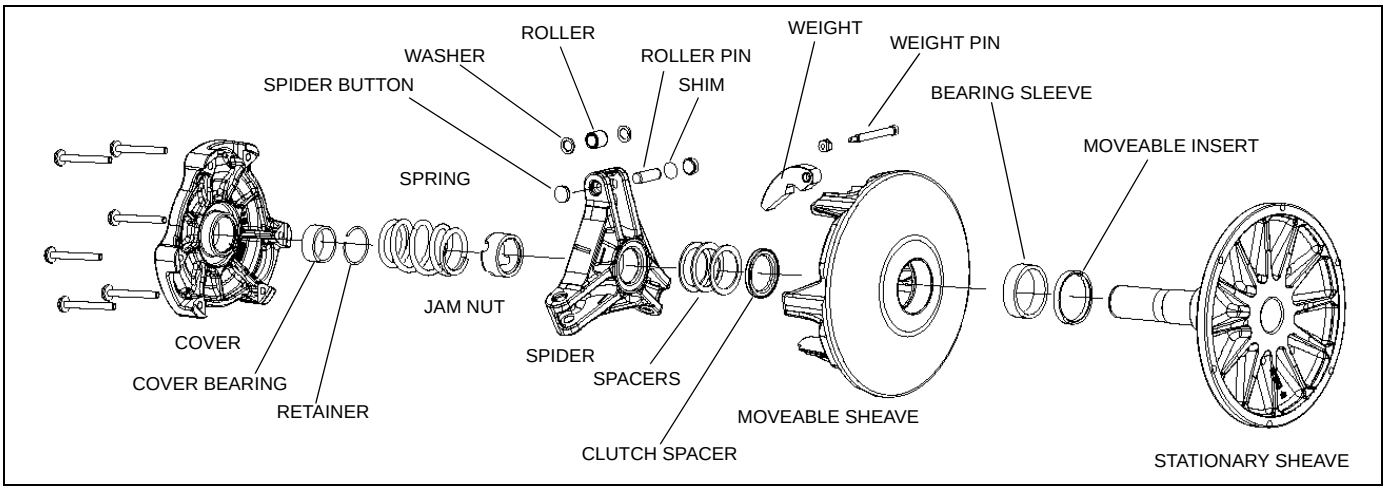
1. Remove the belt.
2. Place the clutch holding tool (PN 9314177-A) on the drive clutch.
3. Remove the drive clutch retaining bolt. Note the placement and number of washers on retaining bolt.
4. Insert the correct clutch puller into the retaining bolt hole.
5. Tighten the puller into the clutch. If the clutch does not come off, strike the clutch puller head with a hammer. If the clutch does not “pop” off, continue to tighten the clutch puller, and repeat this step.

⚠ CAUTION

Do not use an impact wrench to remove or install the clutch bolt or clutch puller. Damage to the clutch and/or crankshaft can occur.

7

Drive Clutch Disassembly



⚠ CAUTION

Wear eye protection when servicing the drive clutch. Sheaves must be marked to provide a reference point for dutch balance and spider indexing. If the sheaves are not marked and the spider washers are changed or misplaced, the clutch may be out of balance and damage to the clutch may result.

⚠ WARNING

Clutch spring is under extreme tension, use caution and wear eye protection when disassembling the clutch.

1. In a straight line, mark/etch the sheaves and the cover with a black marker or a scribe.
2. Place the drive clutch in the clutch compression tool (PN 8700220).
3. Compress the clutch in the compression tool, then secure the chain.
4. Evenly remove the cover fasteners. The cover bushing may be damaged if the cover is side-loaded or mis-aligned.
5. Carefully remove the tension from the compression tool.
6. Remove the cover and inspect the cover bushing. Replace if damaged or worn.

NOTE: Replace the cover bushing if the inside diameter is over 1.40″ (28.95mm)

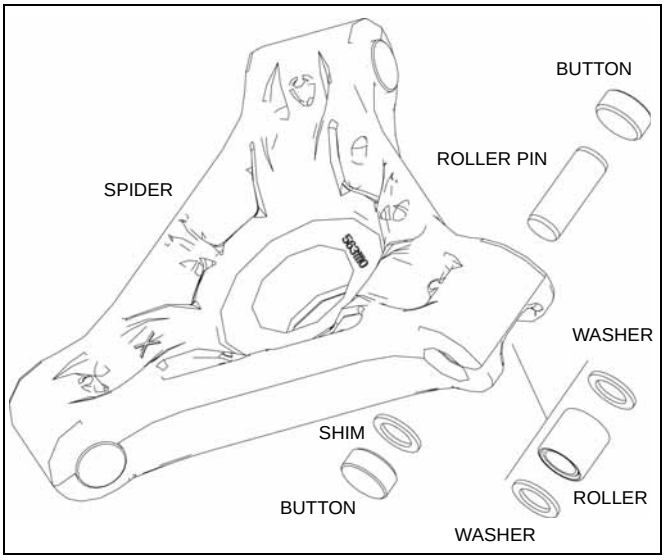
7. Remove the spring.
8. Mount the drive clutch securely in a drive clutch holding fixture (PN 2871358).
9. Remove the jam nut in a counterclockwise direction (standard thread) using the drive clutch spider nut socket (PN 2871358).
10. Install the spider removal tool (PN 2870341), and remove the spider in a counterclockwise direction (standard thread).
11. Measure the total thickness of the spacer washers that are installed on top of the clutch spacer. Record the thickness of these spacer washers.
12. Inspect both sheave surfaces for wear or damage.
13. Inspect the moveable sheave bushing for wear or damage.
14. Remove all three drive clutch weights.
15. Inspect each weight. The surface should be smooth, with no waves or galling. Place pin inside weight to check flyweight bushing and pin surface for wear by rocking the weight back and forth.
16. Inspect all the rollers, bushings and roller pins by pulling a flat metal rod across the roller.
17. Roller can also be inspected by rolling with a finger to feel for flat spots, roughness, or loose bushing.

NOTE: The flyweight bushing is not replaceable. If flyweight bushing is damaged both the flyweight, pin and nut will need to be replaced.

18. Inspect to see if the roller and bushing are separating.
19. Bushing must fit tightly in roller.
20. Replace roller and pin if roller fails to roll smoothly (no flat spots) or if the bushing is loose or worn.

9922854 - 2007-2011 IQ Service Manual

Roller Removal



1. With the spider in a vise start removing the spider buttons by drilling a 0.18" hole in the center of a button on one side of the spider.
2. Place a pin punch through the drilled hole in the button and drive the opposing button and pin out.
3. Remove shims (if any are installed) and note their location.
4. Flip the spider over and tap out the holed button.
5. Perform steps on remaining spider legs.

NOTE: When required, button shims are installed on the trailing (right) side of the spider leg as viewed from the front of spider.

Roller Installation

NOTE: 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 busing could be damaged causing premature wear and roller failure.

1. Drive pin into the spider leg .100" -.125" (0.25 - 0.32cm) beyond the first land of the spider leg.
2. Install one washer on the portion of the pin that is protruding from the spider leg.
3. Place roller in spider leg and center it on the pin.
4. Place a second washer on the other side of the roller.
5. Place the spider on a vise.
6. Install pin centering tool (PN 2870401).
7. Drive the roller pin through the second land of the spider.
8. Repeat process for the other two rollers.

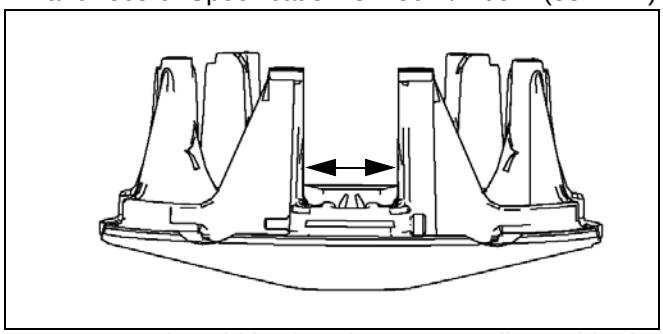
Spider Button Installation

1. A shim kit is available which contains an assortment of shims.

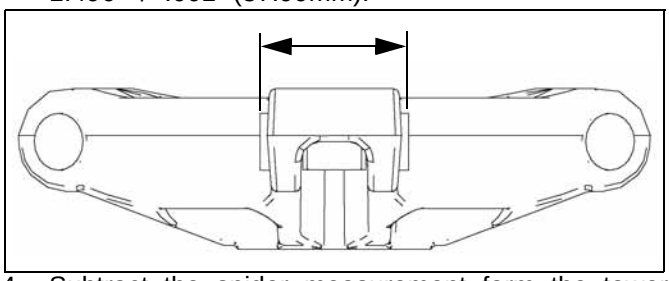
Drive Clutch Shim Kit

PN 2200387

2. Measure the width of the moveable sheave towers and record. Specification is 1.50"+/- .001" (38.1mm).



3. Measure the width of each corresponding spider leg with the buttons installed and record. Specification is 1.496"+/- .001" (37.99mm).



4. Subtract the spider measurement form the tower measurement. The clearance between the spider buttons and the moveable sheave towers is .001" - .002" (.025 - .05mm).
5. Add shims beneath each trailing side spider button to obtain the specified button-to-tower clearance when assembled at each spider leg.

 = In. / mm.
Button-To-Tower Clearance .001" - .002" (.025 - .05mm)

7

Bushing/Insert Replacement

The drive clutch moveable sheave and cover bushings/ insert are replaceable. Bushing/insert removal and installation can be aided using Bushing Removal and Installation Kit.

The kit uses the Piston Pin Puller tool. Each of the adapters and/or tools are marked with an item number. The item number is referenced within the text for identification.

Clutch Bushing Removal / Installation Kit

PN 2871025
Individual Parts:
P-85 Bushing / Insert Tool = 5020627 (Item 1)
Cover Bushing Tool = 5020629 (Item 3)
Main Puller Adapter = 5020632 (Item 8)

Piston Pin Puller Tool

PN 2870386

Moveable Sheave Bushing/Insert Removal and Installation

NOTE: A torch may be required to release the bushing retaining compound.

1. Disassemble the clutch and remove the moveable sheave from the stationary shaft.
2. Install handle end of the piston pin puller securely into a bench vise.
3. Install the main adapter (Item 8) onto the puller.
4. Working from inside of moveable sheave, insert the moveable sheave removal tool (Item 1) into the center of the sheave. Slide sheave onto puller tool with towers facing upwards.
5. Secure puller nut. turn puller barrel to increase tension on the sheave if required.
6. Turn sheave counterclockwise on puller rod until it comes free.
7. Remove the sheave from the puller tool rod.
8. Remove and discard the old bushing and insert.
9. To install a new bushing, place the main adapter (Item 8) onto the puller rod.
10. Apply a thin film of Loctite 648 to the leading edge of the new bushing. Push a new bushing into center of sheave by hand.

NOTE: Verify no retaining compound is deposited on the I.D. of the bushing.

11. Insert installation tool (Item 1) into center of sheave and with the towers pointing toward the vise (down), slide the sheave onto the puller rod.
12. Secure rod nut. turn barrel to apply additional tension against sheave if required.
13. Turn the sheave counterclockwise until bushing is fully seated.
14. Remove the rod nut and installation tool and repeat steps 11 to 13 and install the new insert.

Cover Bushing

NOTE: A torch may be required to release the bushing retaining compound.

1. On covers utilizing a retaining ring, remove the ring using a pick or scribe.
2. Install the main adapter (Item 8) onto the puller tool.
3. From outside of the cover, insert the removal tool (Item 3) into the cover bushing.
4. With the inside of the cover facing the vise, slide the cover onto the puller.
5. Secure the rod nut. Turn the puller barrel to apply tension if required.
6. Turn the clutch cover counterclockwise until the bushing is removed and the cover comes free.
7. Remove the tools and discard the bushing.
8. To install a new cover bushing, apply Loctite 648 to the leading edge of the new bushing. Insert the new bushing and bushing installation tool (Item 3) from the inside of the cover.

NOTE: Verify no retaining compound is deposited on the I.D. of the bushing.

9. With the main adapter (Item 8) installed on the puller, insert the cover onto the puller rod with the outside of the cover facing the vise.
10. Secure the rod nut and tighten the puller barrel to apply more tension if required.
11. Turn the clutch cover counterclockwise on the puller rod until the bushing is fully seated. Remove the tools from the rod and remove cover.
12. Squeeze the ends of the retaining ring and reinstall into the back of the cover.

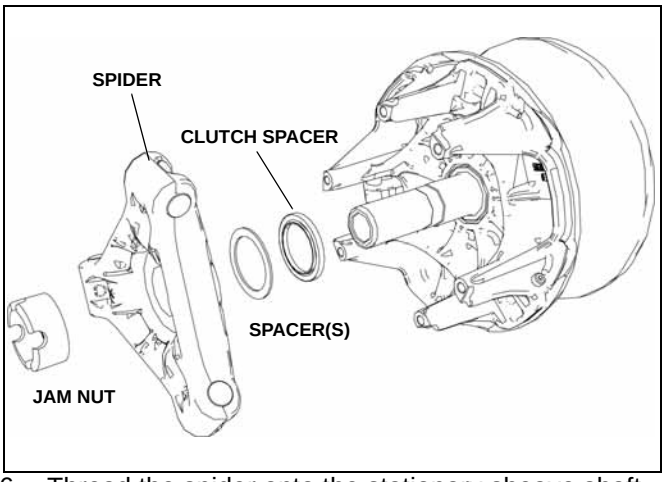
9922854 - 2007-2011 IQ Service Manual

Clutch Assembly

1. Assemble the rollers, bushings and roller pins if they were removed.
2. Install the head of the weight pin so that it is on the leading side of rotation. This will orientate the nut on the trailing side of rotation.
3. Torque weight pin to 30 in-lb. (3Nm).

= T
Weight Pin Torque 20 - 30 In.Lbs. (2.2 - 3.4 Nm)

4. Place the moveable sheave onto the stationary sheave.
5. Place the same number of spacers on top of the stepped spacer onto the shaft of the stationary sheave.



6. Thread the spider onto the stationary sheave shaft.
7. Index the spider. See “Spider Indexing” on page 7.22.
8. Apply Loctite 242 to shaft threads. Do not get Loctite on moveable bushing. Using the spider tool (PN 2870341) torque to specification.

= T
Spider Torque Flat Clutch Cover = 200-225 Ft.Lbs. (271-305Nm) Raised Clutch Cover = 280-300 Ft.Lbs. (380-407 Nm) Apply Loctite 242 to Threads.

9. Apply Loctite 242 to shaft threads. Do not get Loctite on moveable bushing.Install the jam nut onto the shaft and torque it to specification.

= T
Spider Jam Nut Torque Flat Clutch Cover = 225-250 Ft.Lbs. (305-399 Nm) Raised Clutch Cover = 290-310 Ft.Lbs. (393-420 Nm) Apply Loctite 242 to Threads.

10. Place the drive spring on the shaft.
11. Place the cover onto the clutch and torque the cover fasteners to specification.

= T
Cover Fastener Torque 100 In.Lbs. (11 Nm) Use cross pattern.

NOTE: Do not allow side loading or mis-alignment of the cover or the bushing may become damaged.

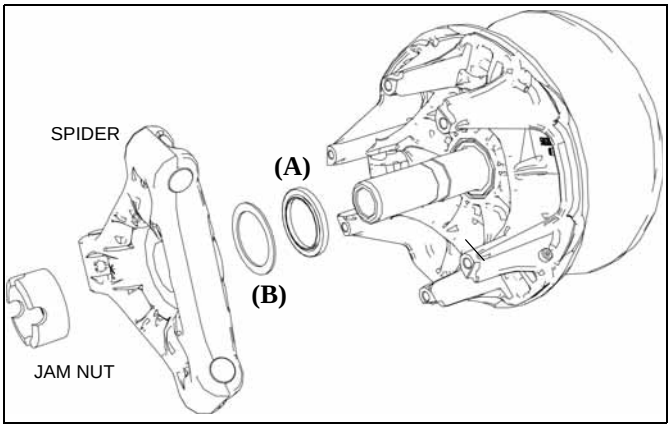
Spider Indexing

NOTE: Spider indexing effects belt to sheave clearance and clutch balance. Please read all procedures before proceeding.

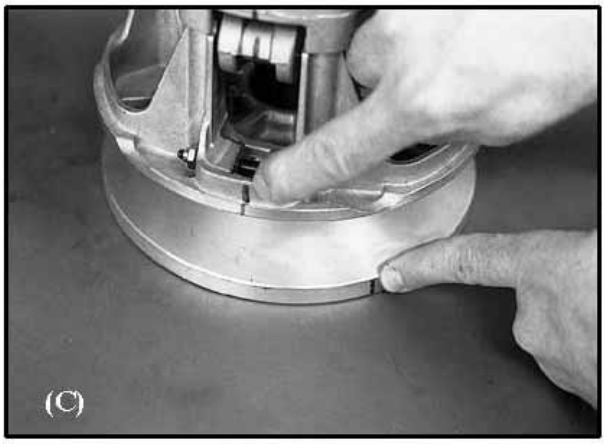
1. Remove and disassemble clutch
2. Add or remove spider washers as required to achieve desired belt-to-sheave clearance. Make sure that the stepped washer (A) is on the bottom of the spacer stack (B). For example: If belt to sheave clearance is .020″ too large, removing one .020″ shim will position the movable sheave closer to the fixed sheave reducing belt to sheave clearance by .020″.

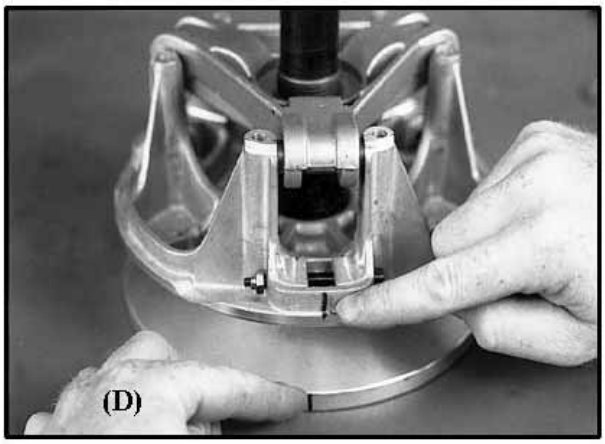
NOTE: Install the clutch spacer (stepped washer) with the lip facing the spider.

3. Place the correct number of spacer washers (B) between the spider and clutch spacer (A). The following washers are available for fine tuning:
   - 5210752 - .020″ (.51mm)
   - 5242981 - .025″ (.63mm)
   - 5210753 - .032″ (.81mm)
   - 5210754 - .050″ (1.27mm)



4. Install spider washer(s) and spider aligning the “X” with the moveable sheave’s “X”. Notice as the spider seat location is changed, the sheave marks made before disassembly no longer align (C). 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 (D). For EXAMPLE: 0.020" or 0.032" (0.5 - 0.8mm) washer removed - re-index spider clockwise 1/3 turn.

NOTE: Alignment marks on the sheaves should be with in 1" (25.4mm) after final assembly and torquing. When assembling a new clutch with all of the same components, it is not uncommon for the marks not to line up.

Drive Clutch Installation

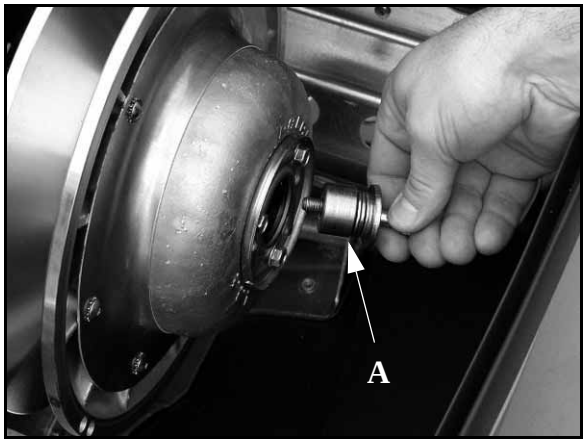
NOTE: Always clean the clutch taper before re-installing clutch on engine.

1. Place the specified clutch taper reamer in a vise and lubricate the cutting edges with cutting oil. Clean the clutch taper by manually rotating the clutch clockwise on the reamer one or two revolutions. Only use the weight of the clutch and do not push down on the clutch while turning.
2. Check crankshaft taper for galling or scoring. If necessary clean the taper evenly with 200 grit emery cloth.
3. The clutch taper and the crankshaft taper should be clean and dry. Do not use harsh cleaners which may cause clutch taper to corrode, or damage the crank seal.
4. Clean clutch taper with lacquer thinner or isopropyl alcohol.
5. Slide clutch onto crankshaft taper.
6. Install the retaining bolt with all spacers and washers or o-rings that were on the bolt when it was removed.
7. Hold the clutch with the holding wrench PN 931417-A.
8. Torque bolt to specification.
9. Run engine then re-torque the retaining bolt to specification.

= T
Drive Clutch Bolt Torque All Carbureted Engines = 50 Ft.Lbs. (68 Nm) All 2007 - Current CFI Engines = 80 Ft.Lbs. (108 Nm) Re-torque after running engine.

DRIVEN CLUTCH

Driven Clutch Removal

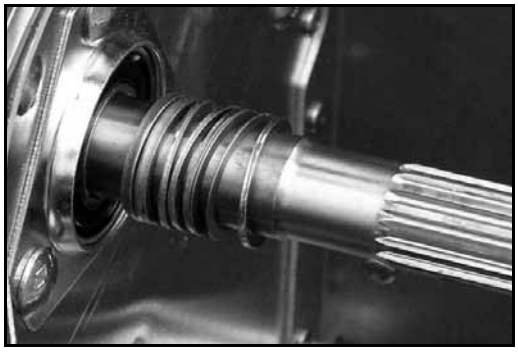


1. Remove the drive belt.
2. Apply and lock the parking brake.
3. Remove the driven clutch bolt and washers (A).

NOTE: Count the number and location of the spacer washers located on the fastener and behind the clutch.

4. Slide the driven clutch off the jackshaft.
5. Inspect the splines and replace jackshaft if damage is found.

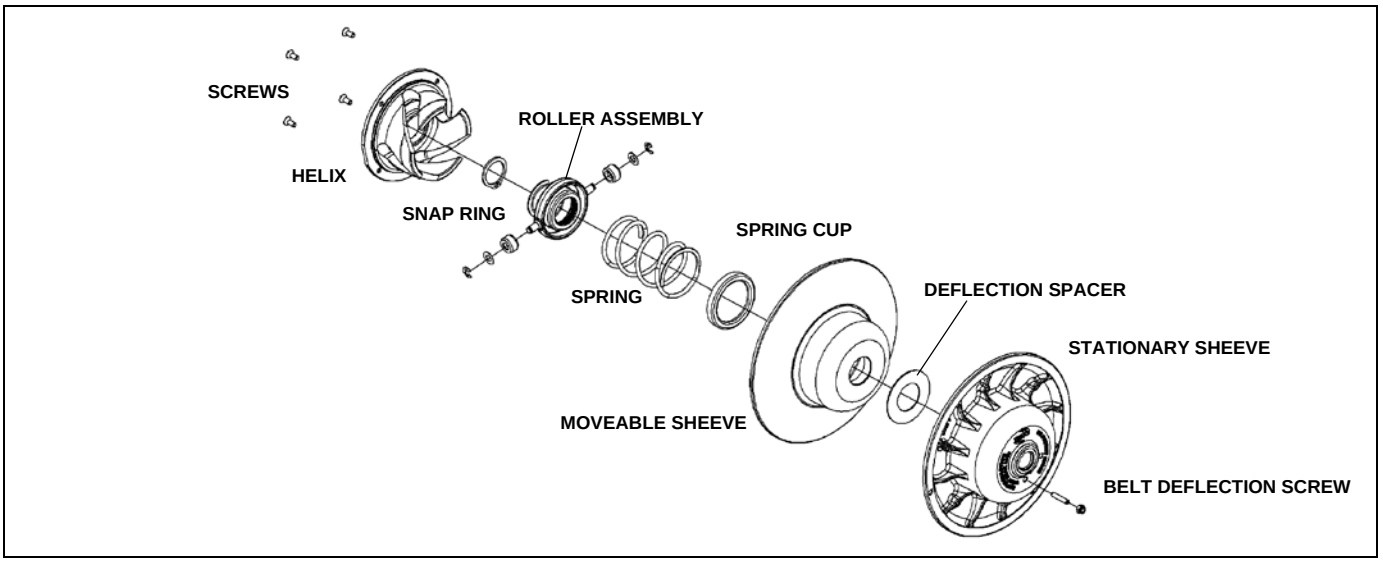
Driven Clutch Installation



1. Install the driven clutch bolt with the same amount of washers at removal.
2. Torque the bolt to specification.
3. Check for correct belt deflection, and the clutch floats on the shaft.

= T
Driven Clutch Bolt Torque 17 Ft.Lbs. (23 Nm)

Team LWT Components



= T
Helix Fasteners = 60 - 80 In.Lbs. (7 - 9 Nm) Driven Clutch Retaining Fastener = 17 Ft.Lbs. (23 Nm)

Disassembly and Assembly Process

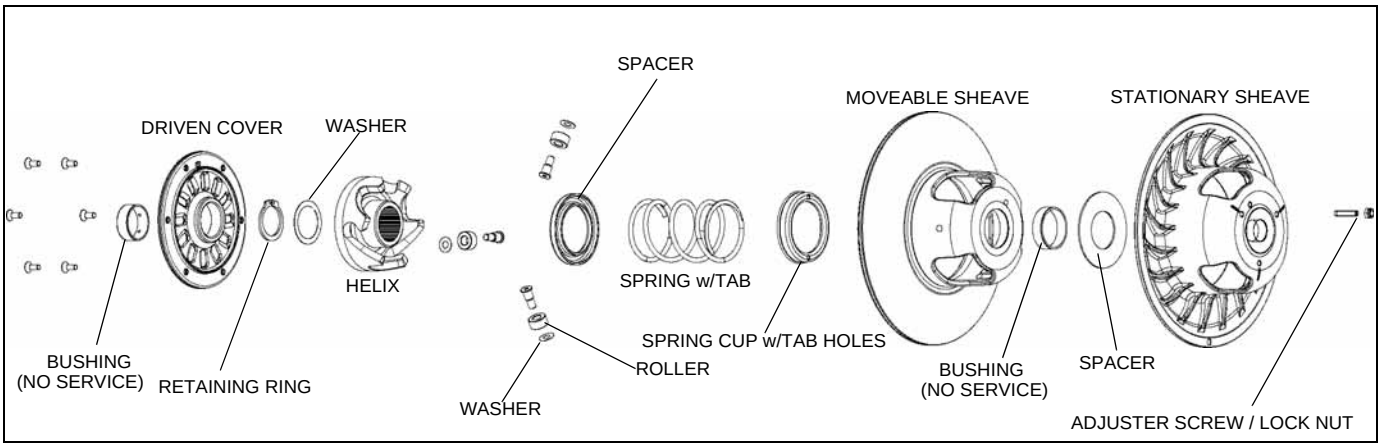
1. Remove the screws from the helix, then carefully pry the helix out of the moveable sheave, or gently tap shaft on a block of wood.
2. Install the clutch in the clutch compressor fixture, PN 8700220. Install the extensions, PN PS-45909.

CAUTION
Driven spring under pressure. Wear eye protection when removing snap ring and helix.

3. Wearing eye protection, carefully compress the roller assembly to gain access to the snap ring. Remove the snap ring.
4. Slowly release the fixture arm to remove the roller assembly and spring. Disassemble the clutch sheaves.
5. Inspect the sheaves for abnormal wear. Clean sheave faces with a Scotch Brite pad and a solution of warm, soapy water.
6. Inspect spring, spring cup, spacer and rollers for wear and replace as required.
7. To assemble the clutch, slide the components back on to the stationary sheave shaft.
8. Align the notch in the roller assembly with row of double splines on the shaft. Slowly compress the spring and roller assembly down on to the shaft. Install the snap ring making sure it is fully seated in the groove.
9. Install the helix by aligning the rollers with the ramps. Push the helix down into the sheave while keeping the screws holes aligned.
10. Install and torque helix fasteners to 60 - 80 in. lbs. (7 - 9 Nm).

9922854 - 2007-2011 IQ Service Manual

Polaris SPA-P2 Driven Clutch Components

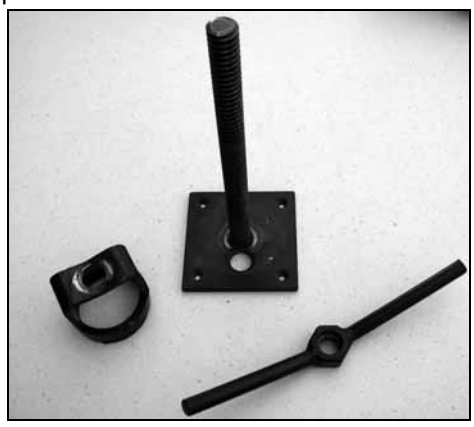


= T
Driven Cover Screws = 12 Ft.Lbs. (16Nm)
Deflection Adjuster Screw Lock Nut = 10 Ft.Lbs. (12Nm)
Driven Clutch Retaining Fastener = 17 Ft.Lbs. (23 Nm)
Roller Fasteners = 110 In.Lbs. (12.5 Nm)

NOTE: Single Point Adjuster (SPA) P2 driven clutches feature different components than what is used on early P2-equipped 2009 EDGE vehicles.

Disassembly and Assembly Process

1. Remove the driven cover screws and cover. Note the "X" in the cover and moveable sheave are in alignment.
2. Install the clutch into a screw-down clutch compression fixture. Screw-down clutch compressors are commercially available through after-market companies such as Team Industries Inc.



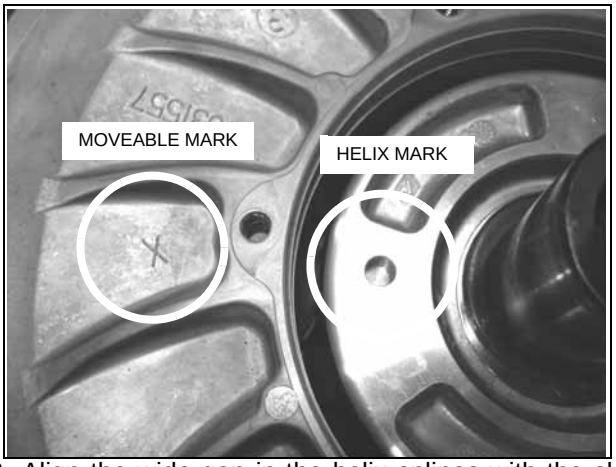
NOTE: The 8700220 clutch compressor and PS-45909 extensions will not work on a P2 driven clutch.

3. Remove the snap ring. Verify the washer is not lodged inside the snap ring groove.

CAUTION
Driven spring under pressure. Wear eye protection when removing snap ring and helix.

4. Unscrew the compressor to remove the helix, spring cups and spring. Note the orientation of the spring spacer, spring cup, and tabbed spring. Disassemble the clutch sheaves.
5. Inspect the helix, cup/spacer, spring, bushings, rollers, and clutch sheaves for damage.
6. The cover and sheave bushings are not serviceable. If bushings are severely worn or binding, clutch assembly replacement is required.
7. Clean the sheaves with a Scotch Brite pad and a solution of warm, soapy water.
8. Inspect the rollers for abnormal wear and replace as required. Install new rollers with the ejector pin marks on the rollers facing center of sheave (visible).
9. Install the sheave spacer, and then the moveable sheave.
10. Next, install the metal spring cup, spring, and then spring spacer. Make sure the spring tab is in one of the spring cup holes, and engaged in the moveable sheave hole.
11. Slide the helix down the stationary shaft.

12. Align the helix alignment hole with the “X” on the moveable sheave.



13. Align the wide gap in the helix splines with the skip tooth in the stationary sheave shaft.
14. Visually verify the rollers are positioned underneath each corresponding helix ramp.
15. Compress the helix down into the sheave. Install the washer and snap ring. Verify the snap ring is fully seated in the groove with the sharp edge upward.
16. Carefully release the clutch compressor.
17. Align the two “X” marks and install the cover. Torque fasteners to specification.

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P2 Cover Fastener Torque 12 Ft.Lbs. (16 Nm)

PVT SYSTEM TROUBLESHOOTING

Drive Belt

- Verify specified drive belt is installed on vehicle.
- Drive belts have different width, angle and length measurements. Reference: “Drive Belts” section for specifications.
- Installing a non-specified drive belt often requires drive clutch spacer adjustments to achieve correct belt-to-sheave clearance.
- Install drive belt so part number can be read from left-side of vehcile. Always install belt using the same orientation as it was before removal.
- **PREMATURE WEAR:** Ensure correct belt is installed. Inspect belt-to-sheave clearance, deflection, and clutch alignment.
  Adjust gearing for rider type. Verify correct clutch weight/spring package is installed.
  Change riding habbits/style.
- **OPERATING RPM DROP:** Drive belts used on snowmobiles operated at high speeds/loads (mountain use) for extended periods of time should be inspected for glazzing at 1,000 mile intervals.
- **CORD POP-OUT:** Inspect drive/driven clutch alignment, motor mounts, and deflection. Set driven clutch float.
- Remove belt during off-season storage period.

Drive Clutch

- **PREMATURE WEAR:**
  Verify correct clutch weight/spring package is installed.
  Inspect spider rollers/bushings for damage and uneven wear.
  Inspect sheave faces for premature wear. De-glaze faces with 1500-2000 grit sand paper.
- **OPERATING RPM DROP:**
  Replace drive clutch spring and retest.
  Inspect spider rollers/bushings.
  Inspect/adjust belt-to-sheave clearance.
  Inspect moveable/cover bushings.
- **SURGING/BOGGING:**
  Inspect/adjust clutch alignment and belt deflection.
  Inspect drive clutch weights for wear.

Driven Clutch

- **PREMATURE WEAR:**
  Verify correct clutch helix/spring is installed.
  Inspect rollers/bushings for damage and uneven wear.
  Inspect sheave faces for premature wear. De-glaze faces with 1500-2000 grit sand paper.
  Verify driven clutch floats on jackshaft.
- **OPERATING RPM DROP:**
  Replace spring and retest.
  Inspect spider rollers/bushings.
  Inspect moveable/cover bushings.

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