Nautilus Step Mill Maintenance Techniques

SM7000 Step Mill

A. Shroud Removal
B. Main Chain Assembly Tensioning
C. Drive Chain Replacement
D. Main Chain Assembly Replacement
E. Upper and Lower Sprocket Replacement
F. Transmission Replacement
G. Alternator Brush Replacement
H. Alternator Replacement
I. Tread Step Cover Replacement

Nautilus Step Mill Maintenance Techniques

A. Shroud Removal

1. The Fastener Removal Tool, shown in Figure 1, is used to remove the plastic rivets attaching the shroud to the frame.

Figure. 1

2. The rivets orientation is indicated on the top with a horizontal line. Align the tool as shown in Figure 2, with the tool edge parallel with the horizontal line. Pry the center portion of the rivet up to unlock the rivet, and then continue until the rivet is removed.

Figure. 2

B. Main Chain Tensioning

1. Remove both the left and right shrouds to gain access to the Main Chain Assemblies. With use, the Main Chains will stretch and sag due to the weight of the steps as shown in Figure 1.

Figure 1. Chain and Step Sag

2. This is especially critical on the right side of the Step Mill as the tread step cover can interfere with the input power causing intermittent loss of power and resistance as shown in Figures 2 and 3.

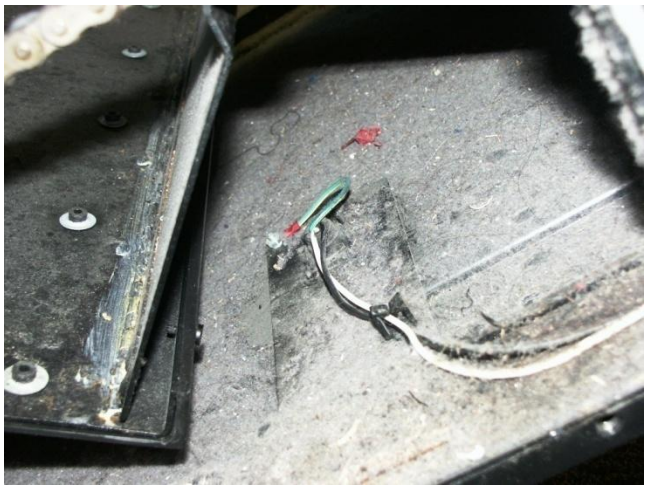

Figure 2. Input Power Wires

Figure 3. Step Interfering with Input Power

3. Before adjusting Main Chain tension, note the number of threads remaining on the chain tensioning set screws located on the pillow blocks as shown in Figure 4. Note the number of threads remaining, for all 4 chain tensioning set screws.

Figure 4. Counting the Set Screw Threads

4. Remove the Drive Belt by rotating the steps and rolling the belt off of the large Transmission pulley.

Figure 5. Drive Belt Removed

5. Loosen the nuts attaching the Pillow Blocks to the frame as shown in Figure 6.

Figure 6.

6. After loosening the pillow blocks, adjust the Chain Tensioning Set screws to remove excess slack from the chain, as shown in Figure 7.

Figure 7.

7. It is preferable to use the bottom Chain Tensioning Set Screws to take up most of the slack, leaving more threads remaining on the top screws. This allows easier Drive Chain removal and replacement. Adjust the set screws so the top left thread remaining count matches the top right thread count, and the bottom left thread remaining thread count matches bottom right thread count. After both left and right Main Chains have been adjusted, make sure the distance between the center of the top and bottom pillow blocks is the same on both the left and right sides as shown in Figure 8.

Figure 8.

7. Using your hand, apply 30 wt. motor oil to both the left and right Main Chain Assemblies. While running your hand on the chain, make sure each link moves freely and does not bind as shown in Figure 9.

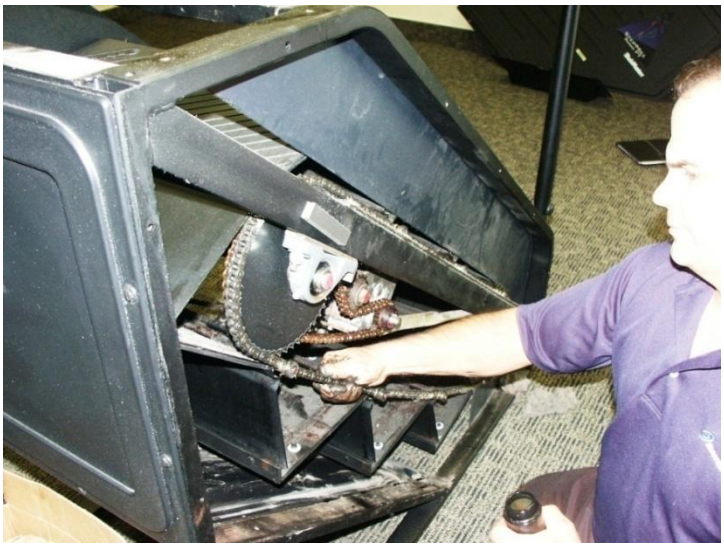

Figure 9.

8. Rotate the steps to ensure that the steps are square to the frame, run true and do not bind as shown in Figure 10.

Figure 10.

9. Re-Install the Drive Belt.

Nautilus Step Mill Maintenance Techniques

C. Drive Chain Replacement

1. Check the Drive Chain tension by inspecting the chain at the Idler Sprocket to make sure the chain does not contact itself as it comes off the bottom of the Transmission sprocket. Figure 1 is only to illustrate the likely point of contact of a stretched chain – all chains will touch if pushed up as shown. If the chain is stretched but not yet touching, have an assistant operate the Step Mill, while you monitor the Drive Chain for contact.

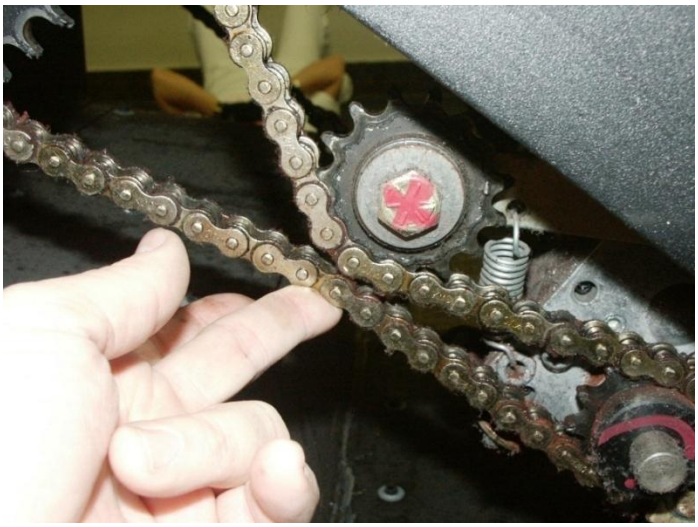

Figure 1. Showing Likely Point of Contact

2. To replace the chain, first locate the Drive Chain Master Link as shown in Figure 2.

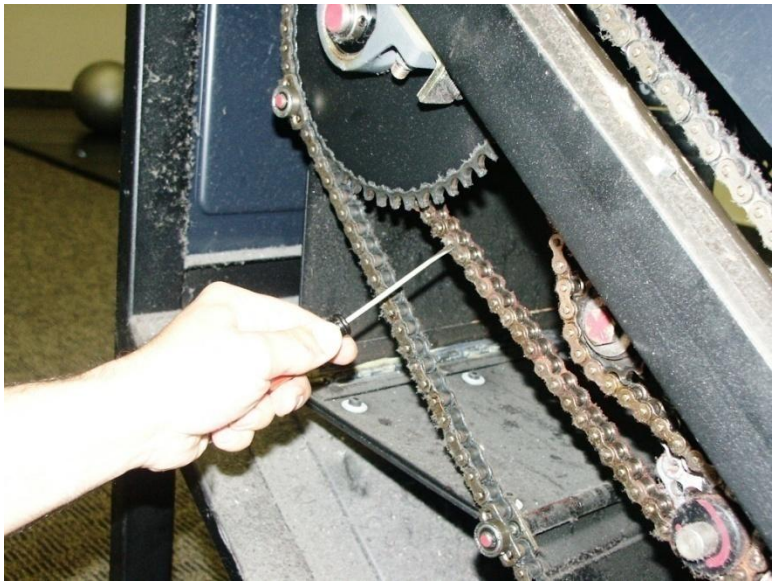

Figure 2. Locating the Master Link

3. Using a small screwdriver, pry the Master Link Clip loose from the Drive Chain links and then remove the Master Link.

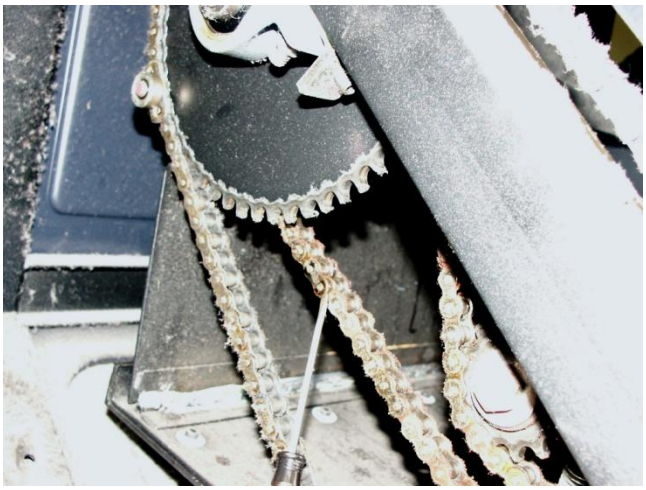

Figure 3. Prying the Clip Loose

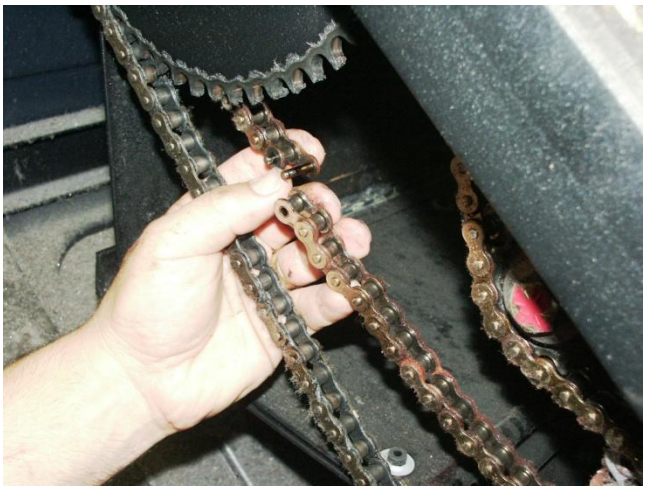

Figure 4. Removing the Master Link

4. Remove the Drive Chain from the Transmission, Idler and Step Sprockets. Inspect the Sprocket teeth for wear as shown in Figure 5 and 5A. Make sure the Idler Sprocket Arm moves freely up and down.

Figure 5. Inspecting the Idler Sprocket

Figure 5A. Sprocket with Excessive Wear - Replace

5. Using 30 weight motor oil, lubricate the chain by forcing oil into the links with your hand as shown in Figure 6. Make sure the chain links move freely and do not bind.

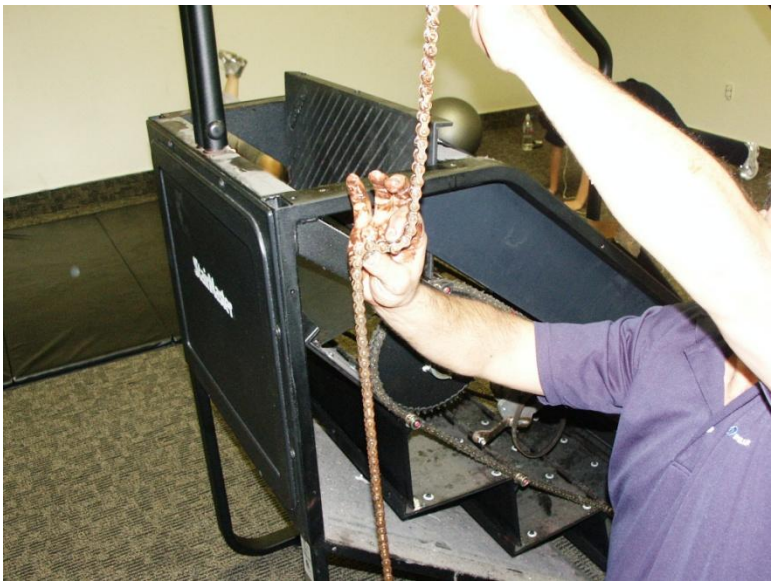

Figure 6. Lubricating the Drive Chain

6. Feed the new chain over the top of the inboard sprocket as shown in Figures 7 and 8.

Figure 7. Feeding Chain Over the Inboard Sprocket

Figure 8. Inboard Sprocket View from the Right Side

7. The Idler Sprocket is forced in the down position with a strong spring. To install the new Drive Chain it is necessary to hold the Idler Sprocket in the up position until the chain is routed over the transmission sprocket and the Master Link is installed. Figures 9 through 15 show a technician using his knee and a lever (hammer) to move, and then hold the Idler Sprocket in the up position, freeing both hands to reattach the Master Link to the Drive Chain.

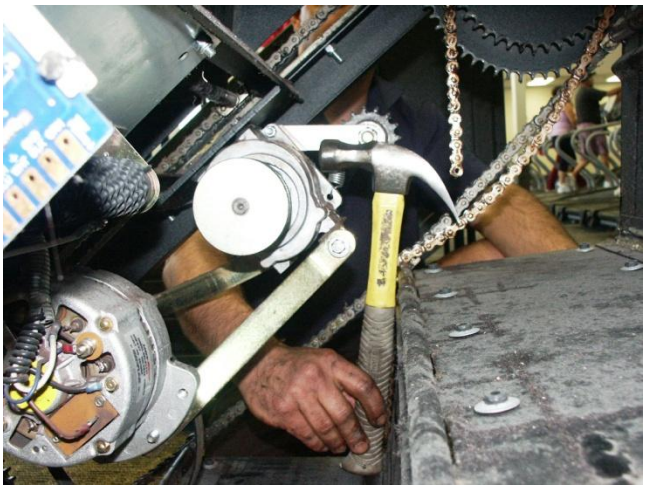

Figure 9. Placing the Hammer Between the Idler and Step

Figure 10. Using Your Knee to Rotate the Steps Up

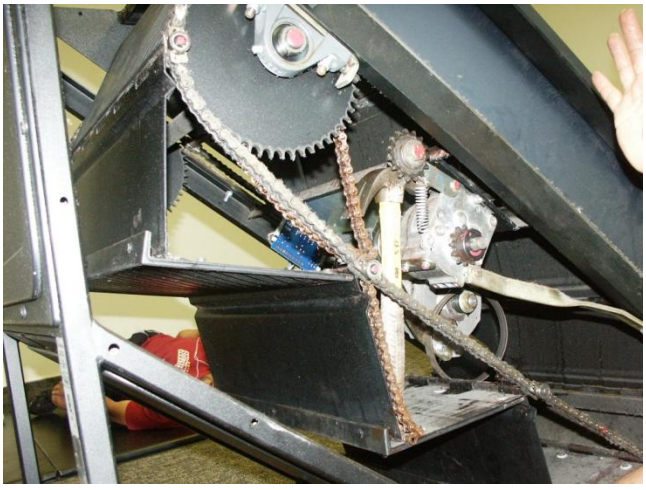

Figure 11. Idler moved to and Held at Max Up Position by Using Your Knee

Figure 12. Re-Installing the Back Section of the Master Link

Figure 13. Using Your Knee, Carefully Rotate the Steps Down, Engaging the Idler Sprocket onto the Drive Chain

Figure 14. Re-install the Master Link Clip, with the Closed End facing Aft – the Direction of Motion

8. Using your knee, rotate the steps to release tension on the hammer, allowing the Idler Sprocket to fully engage the chain. Remove the hammer as shown in Figure 15. The Drive Chain installation is complete.

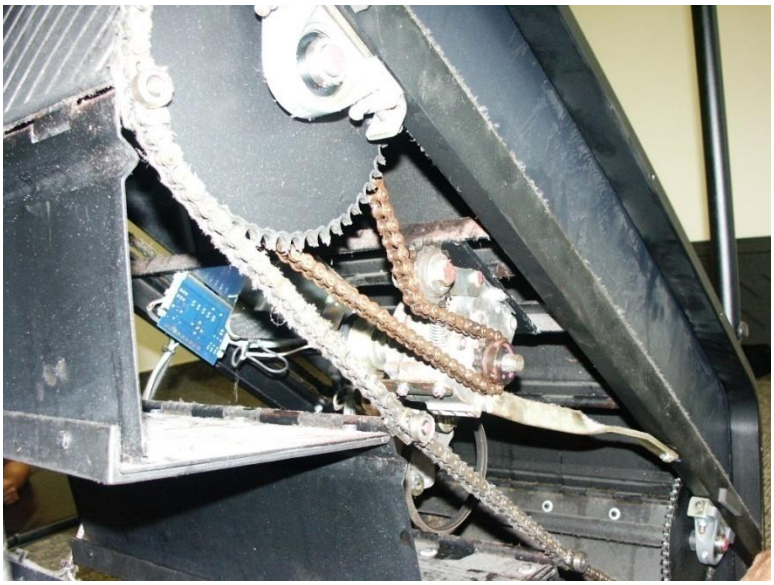

Figure 15. Hammer Removed

Nautilus Step Mill Maintenance Techniques

D. Main Chain Assembly Replacement

1. A Main Chain Assembly may require replacement if;
    a. You cannot adjust for proper tension,
    b. Cannot balance the tension on the left and right hand sides causing the steps to not run true in relation to the frame, or
    c. Some or all of the chain links are frozen and / or binding.
2. Always replace the Main Chain Assemblies in pairs, and always lubricate new chains in 30 weight motor oil before installation.
3. Equally loosen all 4 Main Chain Tension Set Screws.
4. Remove the Drive Belt to reduce Step Mill resistance. Locate the Master Link (usually painted red) on the Main Chain.

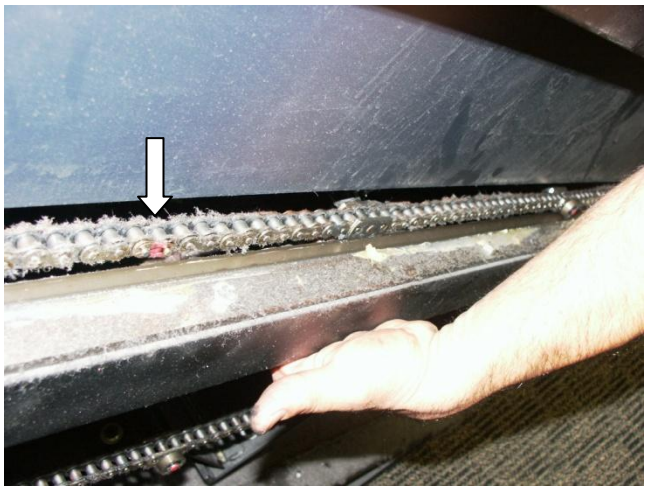

Figure 1. Locating the Master Link

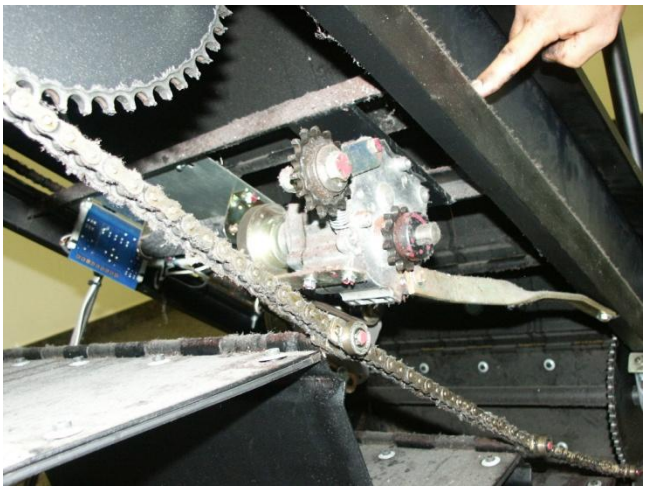

Figure 2. Rotate the Steps so the Master Link is on the Top

5. Remove the Master Link Clip and attach the end of the new chain to the aft end of the Master Link, connecting the new and old chains together.
6. Rotate the steps upwards until the first special link on the new chain is adjacent to the first Step Shaft.
7. Remove the Snap Ring, Flat Washer, and Inboard Flat Washer while sliding the Shaft from the old chain special link.
8. Attach the new chains special link to the Shaft using the hardware just removed from the old chain.

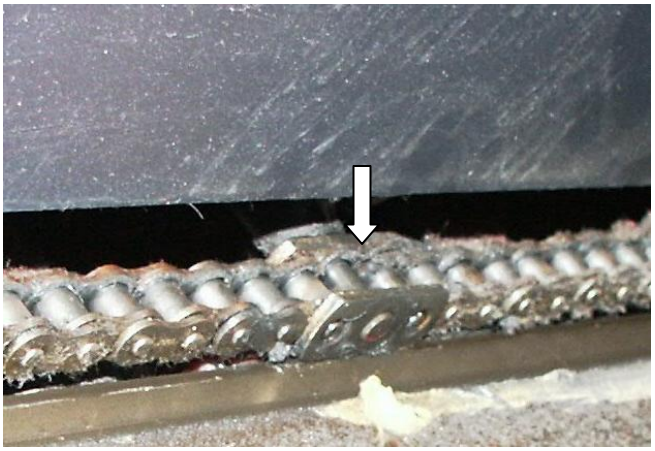

Figure 3. Special Link with Bearing Removed

9. Continue rotating the Steps in the same direction, removing each Step Shaft from the old chain and inserting the shaft into the new chain until all Step Shafts are connected to the new Chain.

10. Insert the Master Link Clip with the closed end facing the direction of movement – or down towards the back of the Step Mill if you are working from the top as shown in Figure 2.

11. Repeat for the other side.

12. Adjust the tension on both the left and right Main Chain Assemblies, check for trueness and re-install the Drive Belt as described in Section B.

Nautilus Step Mill Maintenance Techniques

E. Upper and Lower Sprocket Replacement

1. If an Upper or Lower Sprocket Assembly must be replaced and the Main Chain Assemblies are to be re-used, note the number of threads remaining on all 4 Chain Tensioning Set Screws. After replacing the Sprocket Assembly these settings will be used as a reference when re-tensioning the Main Chain Assemblies.

Figure 1. Counting the Set Screw Threads Remaining

2. The procedure for replacing both the upper and lower sprocket assemblies' is essentially the same, with the following exceptions:
   a. When replacing the Upper Sprocket Assembly, the Drive Chain must be removed
   b. When replacing the Upper Sprocket Assembly, the Step Mill is tipped so the Upper Sprocket is facing down. This removes the weight of the steps and chains from the sprocket so it can be lifted away from the Main Chain Assemblies. **NOTE: Be very careful when tilting the Step Mill – it is very heavy.**

Figure 2. Tilting the Step Mill Forward

Figure 3. Step Mill Lying Top Down

3. When the Sprocket Assembly requires replacement, as a precaution the Pillow Blocks should also be replaced. The following procedure replaces the Pillow Blocks along with the Sprocket Assembly as a complete unit.

4. Back out the chain tensioning set screws on left and right hand sides as shown in Figure 4. Make the Main Chain Assemblies as loose as possible in order to ease sprocket removal.

Figure 4. Backing Out the Chain Tensioning Set Screws

5. Loosen the Pillow Block nuts as shown in Figure 5.

Figure 5. Loosening the Pillow Block Nuts

13. Pull the Pillow Block away from the frame mounting bolts, and then carefully holding the axel; lift the Sprocket Assembly up and away from the Main Chain Assemblies.

Figure 6. Remove the Pillow Block from the Frame Bolts

14. When installing the new Sprocket Assembly, slide the new Pillow Blocks onto the axel, and drop the assembly into the Main Chains and the Pillow Blocks onto the frame bolts. Face the set screws on the Pillow Block retainer towards the bottom (frame side) of the Pillow Block to gain access with an Allen wrench as shown in Figure 7.

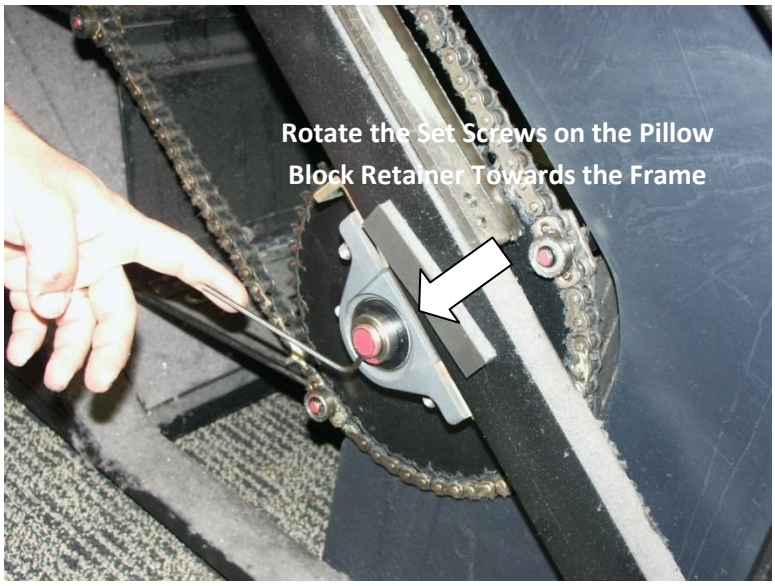

Figure 7. Set Screw Access is From the Frame Side of the Pillow Block

F. Transmission Replacement

1. Remove the Drive Chain following the procedure in Section C. Remove the Drive Belt by rolling the Belt off the Transmission Pulley using your thumb.

2. Loosen the Transmission to Frame mounting bracket at the frame end. Remove the bolt attaching the bracket to the transmission as shown in Figures 1 and 2, being careful to retain all hardware. Move the bracket away from the Transmission.

Figure 1. Loosening Bracket at the Frame End

Figure 2. Removing Bracket from Transmission

3. Loosen the Transmission to Alternator mounting bracket at the Alternator end. Remove the bracket at the transmission end as shown in Figure 3. Move the bracket away from the Transmission.

Figure 3. Removing Bracket from Transmission

4. Better access to the Transmission is gained by removing the step shaft *immediately above* the Transmission. This allows the step to be moved aside to gain access to the Transmission mounting bolts. Shaft removal and mounting bolt access is shown in Figures 4 through 10.

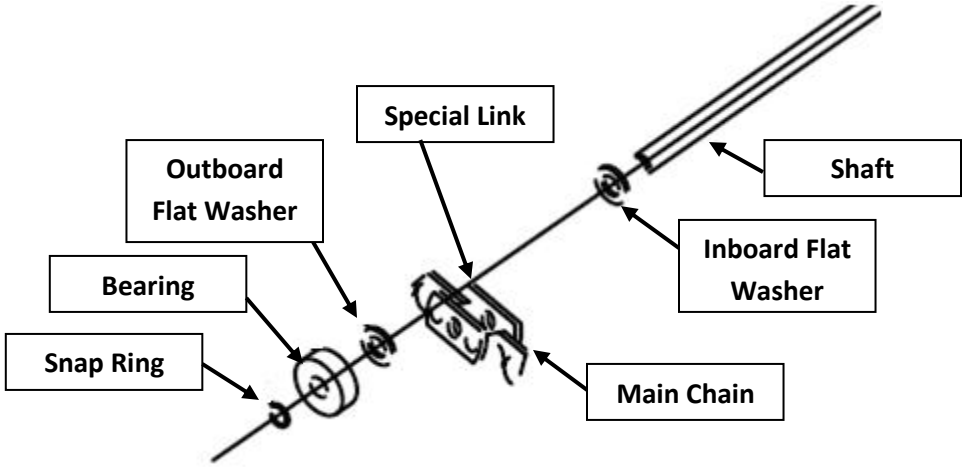

Figure 4. Step Shaft and Attaching Parts

Figure 5. Removing Snap Ring from Left Side of Shaft Above Transmission

Figure 6. Snap Ring, Bearing and Outboard Flat Washer removed

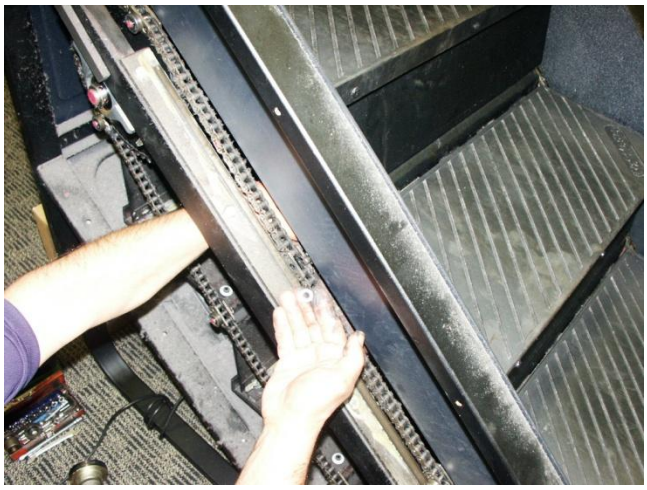

Figure 7. Push the Shaft Through the Chain and Catch the Inboard Flat Washer

Figure 8. Leaving the Attaching Hardware Intact, Pull the Shaft through from the Right Side

Figure 9. Removing the Shaft and Catching Right Side Inboard Flat Washer

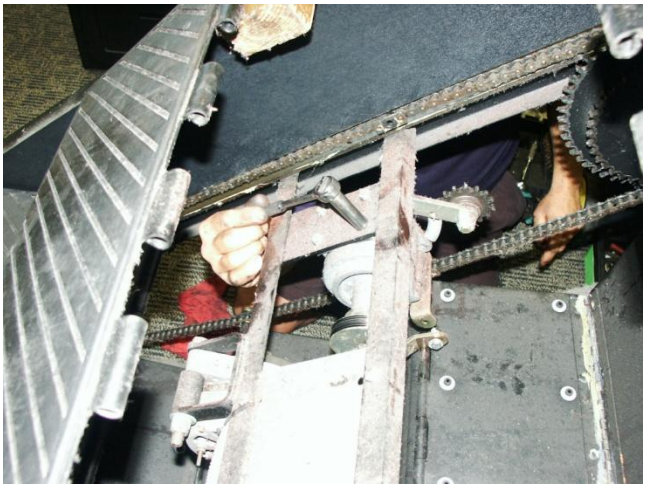

Figure 10. Moving the Steps Aside for Access to the Transmission Mounting Bolts.

5. Remove the four Transmission mounting bolts and remove the Transmission. Retain the rubber mounting pad to reuse on the new transmission.

6. If the replacement Transmission (or Speed Reducer) is P/N SM2001, you must remove all attaching hardware including the Pulley, Idler Arm and Sprocket from the old Transmission and install the parts on the replacement Transmission.

7. Take a minute to look at the old versus new transmissions to ensure that the attaching hardware is installed correctly, see Figures 11 and 12. Parts can be incorrectly installed 180° out.

Figure 11. Comparing the Old Versus New

Figure 12. Comparing the Old Versus New

Figure 13. Hardware Installed on New Transmission

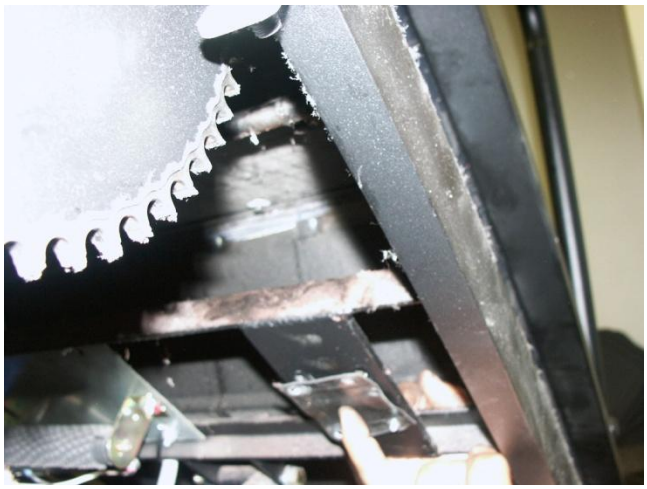

Figure 14. Place Rubber Mounting Pad into Position, Drop Bolts Through Mounting Holes

8. Install the new Transmission using the four mounting bolts. Install the Transmission to Alternator and Transmission to Frame Brackets. Then install the Drive Chain and Drive Belt as described in Section C.

9. Put the Steps back into position and dab a small amount of blue grease into the Shaft housings, re-insert the Step Shaft and re-attach the flat washers, the Left Bearing and the Snap Ring.

Figure 15. Completing the Installation

G. Alternator Brush Replacement

1. The Alternator Brushes can be replaced without removing the Alternator from the Step Mill. Access is gained by removing the right hand shroud.

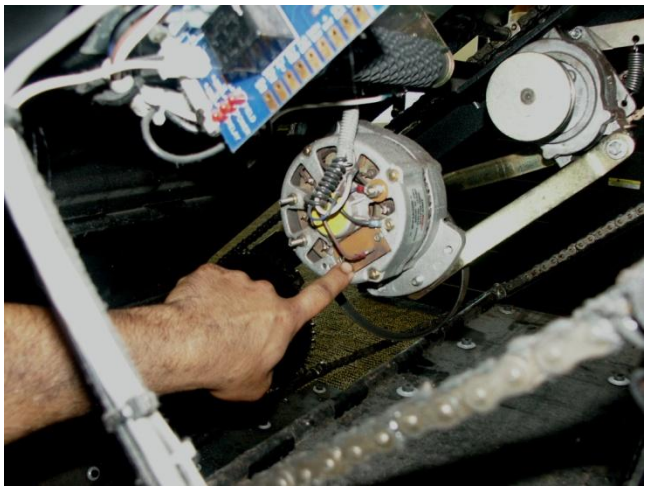

Figure 1. Alternator

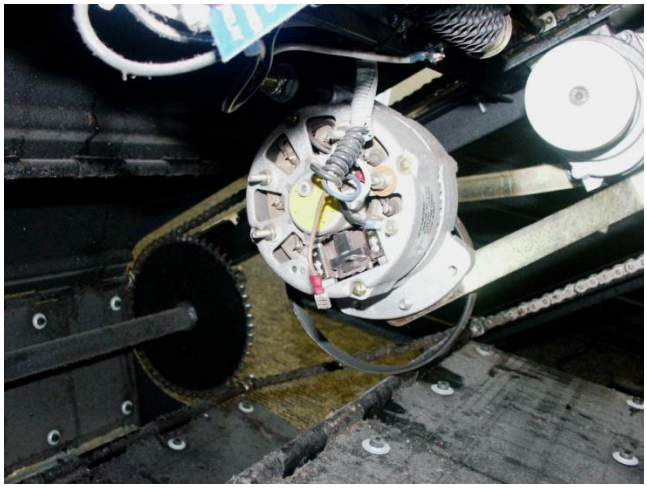

Figure 2. Disconnect the Brown (Field) Wire and Remove the 2 Screws to Remove the Brush Cover

Figure 3. Inspect the Brushes – Note that the Inboard Brush Normally Wears More than the Outboard Brush

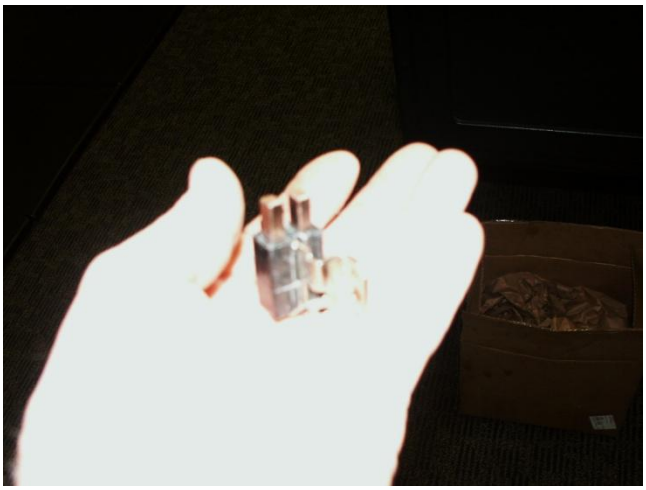

Figure 4. Install New Brushes if Worn More than Half of the New Brush Length as Shown Above

2. Re-Install the Brushes, install the Brush Cover and reattach the brown Field wire.

Nautilus Step Mill Maintenance Techniques

H. Alternator Replacement

1. The Alternator can be replaced after removing the left hand shroud. Remove the Drive Belt and Transmission to Alternator Bracket from the Alternator.

2. Using two wrenches remove the upper Alternator mounting bolt, washers and spacer. As shown in Figure 1.

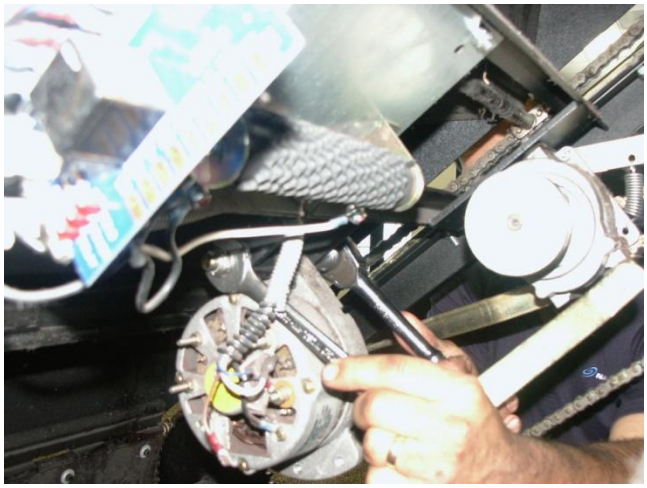

Figure 1. Removing Upper Mounting Bolt and Spacer

Figure 2. Preparing to Disconnect the Alternator Wires

3. Disconnect the brown wire (Field), the blue wire (Tach) and the white wire (B+) from the spade plugs. Unscrew the black (gnd.) wire. Remove the Alternator.

4. Re-Installing the Alternator is the reverse of removal. Re- attach the wires as shown on the yellow label on the back of the Alternator.

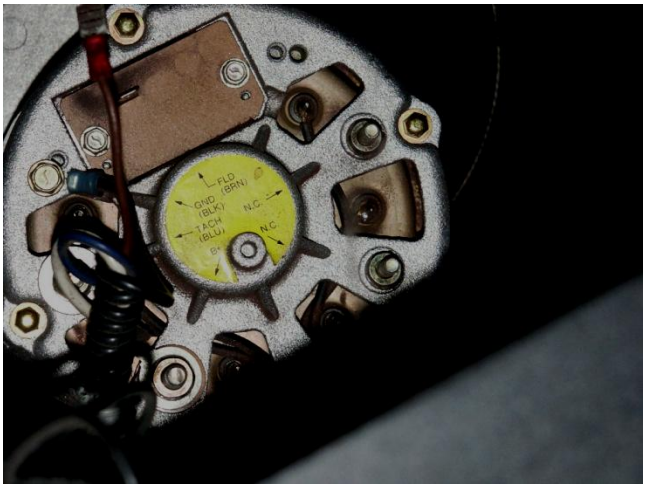

Figure 3. Label Showing Alternator Wire Hook-Ups

5. Install the Alternator into the top mounting bracket using the spacer and bolt. Loosely snug the bolt but do not tighten.

6. Install the Alternator to Transmission mounting bracket, loosely snug but do not tighten.

7. Install the Drive Belt between the Alternator Pulley and Transmission Pulley.

Figure 4. Installing the Alternator Into the Top Bracket

8. As in Section C, we will use a lever (hammer) as a third hand to achieve proper belt tension.

Figure 5. Slide the Lever Between the Alternator and Steps

Figure 6. Using Your Right Foot Gently Rotate the Step Down

9. As you put pressure on the step with your foot the hammer rotates clockwise, providing proper belt tension.

10. Tighten the Alternator to Transmission mounting bracket and upper mounting bolt.

11. Remove the Hammer

Figure 7. Hammer Providing Belt Tension

Nautilus Step Mill Maintenance Techniques

I. Tread Step Cover Replacement

1. The plastic Tread Step Covers are attached with 3 Christmas Tree fasteners on the front of the tread and 10 Flat Push Nuts on the bottom of the step.

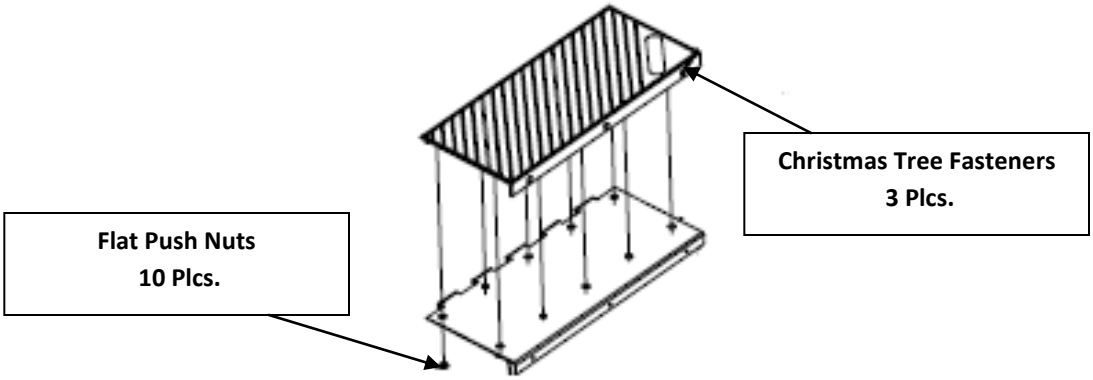

Figure 1. Tread Step Cover

2. Rotate the Step with the tread that you are going to replace, to the lowest horizontal position on the Step Mill as shown in Figure 2.

Figure 2. Tread Step Cover to be Replaced

3. We will remove the Step Shaft from the step with the cover to be replaced, allowing us to flip the step over and use the floor as a work space which supports the step as we replace the Tread Step Cover.

4. Remove the Christmas Tree Fasteners using the Fastener Removal Tool as shown in Figure 3.

Figure 3. Removing the Christmas Tree fasteners

Figure 3. Removing the Snap Ring, Bearing and Flat Washers from the Step Shaft

Figure 4. Removing the Step Shaft

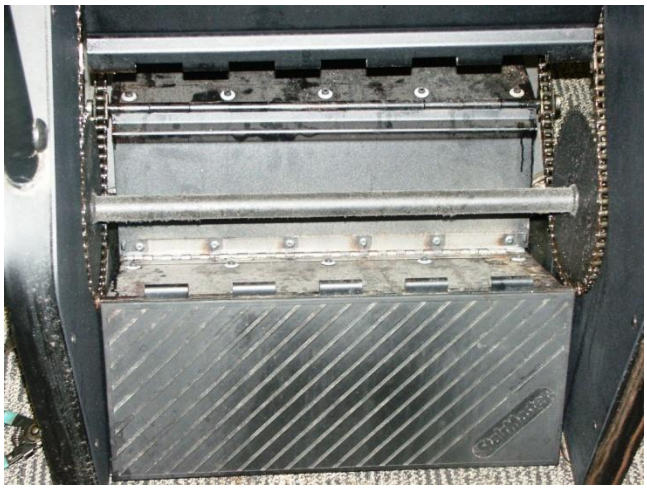

Figure 5. Step Freed from Step Shaft

Figure 6. Laying the Step onto the Floor Work Surface

Figure 7. Ready to Replace the Tread Step Cover

Figure 8. Removing the Old Cover

5. Using a long screw driver, pry the cover loose from the step by popping off the Flat Push Nuts. Discard the old cover and push nuts as shown in Figure 8.

6. Install the new Tread Cover by inserting the tabs on the bottom of the cover into the holes in the step. Press-on new Flat Push Nuts using a ½" socket and hammer, using the floor to support the step as you force the push nuts over the tabs as shown in Figure 9.

Figure 9. Installing New Push Nuts

7. After the all push nuts are installed, lubricate each of the Shaft housings with a small amount of blue grease as shown in Figure 10.

Figure 10. Lubricating the Shaft Housings

Figure 11. Lubricating the Shaft Housings

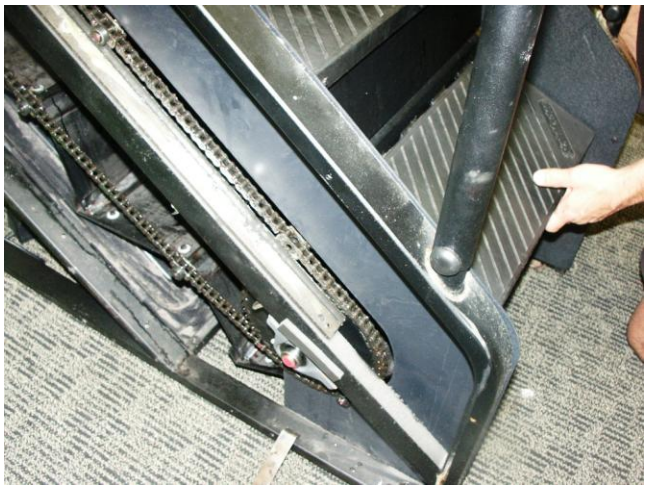

Figure 12. Reinstalling the Step Shaft

8. Lift the step into position as shown in Figure 11 and slide the Step Shaft into the shaft housing and through the special link as shown in Figure 12.

Figure 13. Reinstalling the Bearing and Snap Ring

9. Reinstall the Flat Washers, the Bearing and the Snap Ring. Insert the 3 Christmas Tree Fasteners at the front of the tread using your thumb.

10. Repeat the steps for replacing additional Tread Step Covers.