

FET-C CONVEYOR SYSTEM

THEORY OF OPERATION

The conveyor system consists of thirty-two (32) individual pallets each containing two (2) squibs (for more information; see Conveyor Pallet section). Each of the nests is individually mounted to the belt with a pin secured by a screw head. The nests can be quickly removed and replaced for maximum throughput and up time.

The conveyor is a two-pulley system. One pulley provides the torque to move the conveyor belt. The other pulley provides proper belt tensioning. The drive pulley is located on the exit side of the machine and is connected to the drive motor by a drive shaft and compression fittings (see figure 2). The compression fittings make a rigid connection of the pulley and the shaft that provides accurate indexing operation. The shaft is mounted to the drive motor through eight (8) M6 bolts. A deep groove radial bearing supports the outboard side of the shaft. The idler pulley has deep groove radial bearings pressed in and rides in a yoke. The yoke is mounted on two shafts and has a 5/8-11 swivel pad bolt that provides proper belt tension. The belt is supported and guided with Ultra High Molecular Weight Polyethylene wear strips. The belt can be adjusted .100 inch (2.5mm) in the Y-axis by moving the three side guide assemblies. The belt is supported by two (2) with Ultra High Molecular Weight Polyethylene wear strips on the return. This provides total support for the conveyor belt during operation.

There are two retroreflective infrared sensors that initialize the conveyor. One is located at the Accept station (PS971) and determines a home nest. A flag on one of the pallets activates the home nest sensor. The other is located near the drive pulley (PS900) and determines the conveyor pulley position to the drive motor encoder (used on the FET-C only). A flag mounted to the drive pulley actuates the pulley position sensor. During initialization, there will be a time when the pulley sense and the home nest sensors are both on (on the FET-CX only the home nest sensor is used). This position determines a unique point. When both of the sensors are on the PLC commands the drive motor to slowly reverse. When the home nest sense turns off there is a software zero set. This becomes the home nest, or initialization, position for the machine.

There are two additional retroreflective infrared sensors to detect the presence of a squib in the nest. One is located to view the position directly after the load station (PS401). The other is located to view the position directly after the accept station (PS403). During initialization or a System Purge the conveyor will index through all nest positions to assure that there are no squibs in the conveyor. If squibs are found in any position the operator interface will display a message to either remove the squib after load or after accept stations.

To index the conveyor, the PLC by issues an index command to the servo drive. The servo drive controller then indexes at a set programmable speed and distance (2", 51mm). The integral encoder mounted on the drive motor provides closed loop feed back and repeatable positioning. When all stations have performed their tasks and out of the way, the PLC issues the index command. After the index is complete the servo drive sends an index complete signal to the PLC. The PLC can then issue signals to perform the next cycle of all stations.

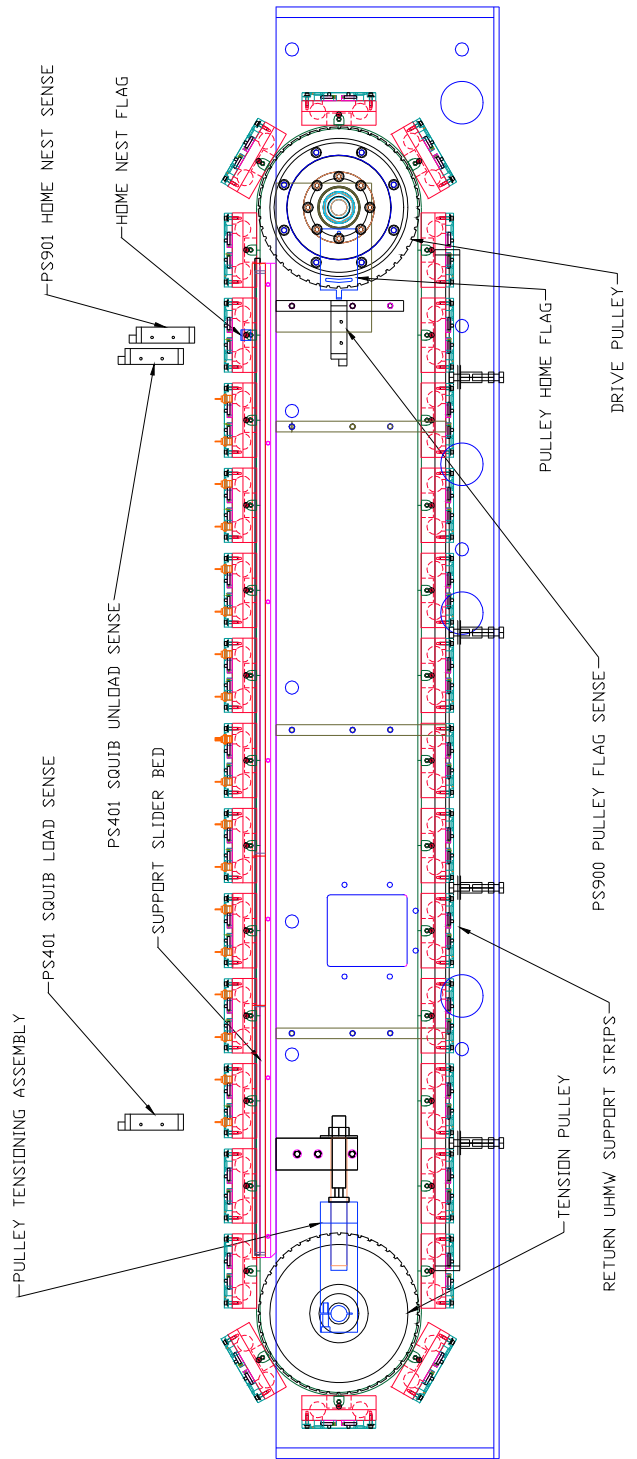


Figure 1 CONVEYOR SYSTEM OVERVIEW

SEQUENCE OF OPERATION

HOMING AND INITIALIZATION

The conveyor must initialize after all major stoppages. The homing process begins when the machine run button is first pushed on the control box. A warning alarm will sound and the conveyor will then begin to move. To properly home the conveyor must simultaneously locate both the pulley flag and the home nest sensors. This may take from one to three (one on the FET-CX) complete belt cycles. Each time the pulley flag input is seen the control system will look for the home nest flag. When both sensors are made the conveyor will stop, reverse and will then move forward while looking for the edge of the nest flag. Once the edge of the nest flag is detected the conveyor motor will move to the next encoder index mark. This is the home position.

Once the conveyor home has been established the conveyor will index for a full revolution of the conveyor belt minus the pallets between the load and accept stations. During this indexing the Load and Accept Station squib present sensors verify that there are no squibs in any of the pallets. If there are squibs there a message will appear on the operator screen indicating the location and requesting removal of that squib. Once the squib has been removed the indexing will continue when the Restart button is pressed. After the entire cycle is completed, the PLC will allow operation of the of the machine.

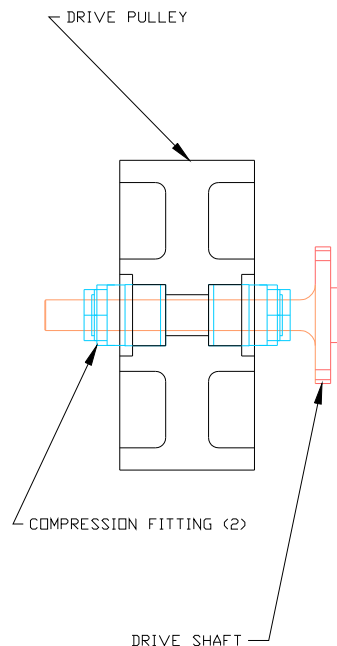


Figure 2 DRIVE PULLEY ASSEMBLY

NORMAL OPERATION

The conveyor system will index two inches (51mm) when issued an Index command from the PLC. In order for the command to be issued there are several conditions that must be met. All stations must be clear of the pallet assembly and all required station activity must be completed. This does not imply that the stations must be in their respective home positions. Enabling the

conveyor system in this manner increases the throughput of the machine by allowing independent action to occur at the various stations.

The load station must have inserted a squib and moved to the gripper up position (sensor HS115). The final electrical test station must have completed the electrical test and moved to the FET up sensor (HS203) position. If a rejected squib is present, the reject station must have gripped the squib and moved to the gripper up sensor (HS209). If a part has successfully passed all testing and is at the Accept Station, the accept gripper must be in the up position as noted by the up sensor (HS305).

The conveyor has a distinct 2-step mode of indexing, called the stutter step. The first movement takes place after a final electrical test has been performed. For this first movement the conveyor will index quickly and then wait while the load station inserts the second squib into a given pallet (the first having been loaded during electrical test). Then there will be a longer interval as the final electrical test is again performed.

If either the reject or accept station fails to correctly remove a squib, the retro reflective sensor (PS403) after accept will sense the part. This will cause the PLC to issue a squib present after accept error. The operator must then manually remove the squib and press restart. The operator should reject the squib to avoid any possibility of mixed parts, although if the squib has been printed it has been tested and is a good part. If no mark is present it is a defective part.

MECHANICAL ADJUSTMENTS

CONVEYOR BELT TENSIONING

The conveyor belt is tensioned at the entrance end of the machine. There is a 5/8-11 swivel pad bolt that pushes the pulley yoke away from the drive side pulley. To tension the belt, release the tension of the lock nut, using a 5/16 hex key in a torque wrench turn the bolt clockwise to tighten and counterclockwise to relieve tension. Proper conveyor belt tension (100 lbs., 445 newtons) is achieved with a torque range of 7-8 in-lb. (79-90 newton-meter). When the proper tension is achieved, lock the bolt in place with the lock nut. DO NOT OVERTIGHTEN.

PROCEDURE

1. TURN THE MACHINE OFF.
2. REMOVE THE FRONT PANEL.
3. LOOSEN THE LOCK NUT (Refer to Figure 3).
4. USING A TORQUE WRENCH (5/16 HEX ADAPTER) TURN THE BOLT CLOCKWISE TO TIGHTEN AND COUNTERCLOCKWISE TO RELIEVE TENSION.
5. TORQUE TO 7-8 IN-LB. (79-90 NEWTON-METER).
6. TIGHTEN THE LOCK NUT.
7. REPLACE FRONT COVER.

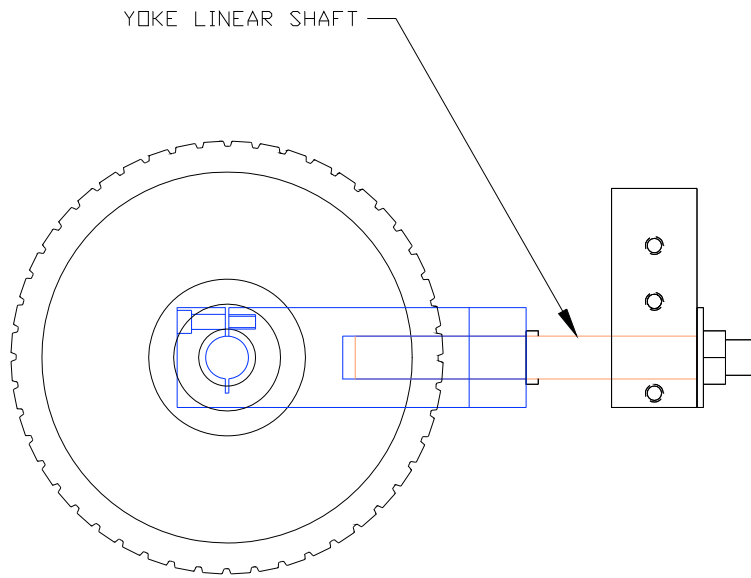
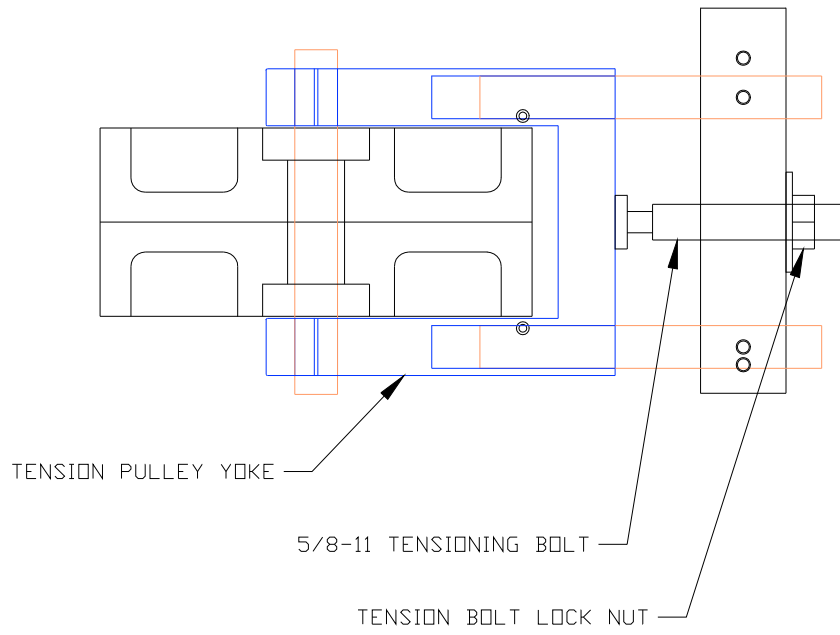


Figure 3 TENSION ASSEMBLY

REMOVAL OF PALLET ASSEMBLY

The conveyor system is designed for rapid replacement of the pallet assembly. Special sections, called profiles, are welded on to the conveyor belt on regular intervals. There is a pocket on the bottom of the nest that accepts the conveyor belt profile. The pocket is very slightly less in width than the profile, providing a small interference. This interference provides a repeatable position of the pallet assembly in the Y-axis. On each of these sections the pallet assembly is mounted with a stepped pivot pin. Correspondingly there is a reduced diameter hole in the rear of the nest. Once the pin is properly inserted through the front nest hole, the conveyor belt profile, and the smaller rear nest hole, a small screw (6-32X.125 BHCS) is used to retain the pin in the nest.

In addition to the interference fit on the width of the conveyor profile, there is a slight interference in the Z-axis (.010", .25mm). The interference provides a repeatable position of the pallet assembly in the Z-axis. Because of this interference, the conveyor belt tension must be relieved prior to removing or replacing a pallet assembly (see conveyor tensioning section).

PROCEDURE

1. PLACE THE MACHINE INTO MAINTENANCE MODE AND JOG THE PALLET TO BE REMOVED TO JUST BEFORE THE LOAD STATION (Figure 5).
2. TURN THE MACHINE OFF.
3. REMOVE THE FRONT PANEL.
4. REMOVE THE TENSION FORM THE BELT AS PER THE TENSIONING INSTRUCTIONS.
5. REMOVE THE NUMBER 6 RETAINING SCREW (Figure 4).
6. REMOVE THE NEST MOUNTING PIN.
7. REMOVE THE NEST
8. REPLACE WITH NEW PALLET ASSEMBLY.
9. ALIGN THE NEST MOUNTING HOLES WITH THE CONVEYOR BELT PROFILE HOLE.
10. PUSH THE NEST MOUNTING PIN THROUGH THE NEST, AND CONVEYOR BELT PROFILE UNTIL FLUSH WITH THE NEST FRONT SURFACE.
11. REPLACE THE RETAINING SCREW.
12. TENSION THE CONVEYOR BELT AS PER TENSIONING INSTRUCTIONS.
13. REPLACE THE FRONT COVER.
14. ADJUST THE INSULATOR ASSEMBLY AS PER INSULATOR

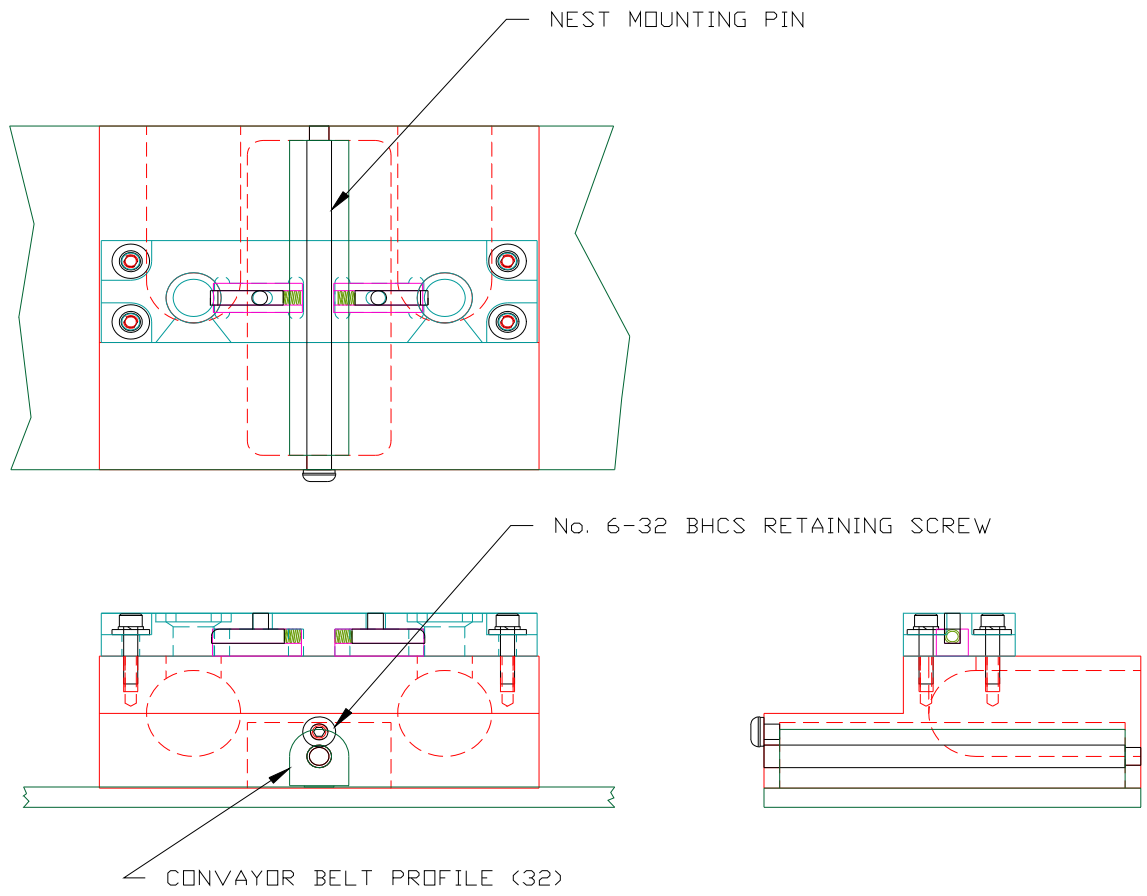


Figure 4 PALLET ASSEMBLY OVERVIEW

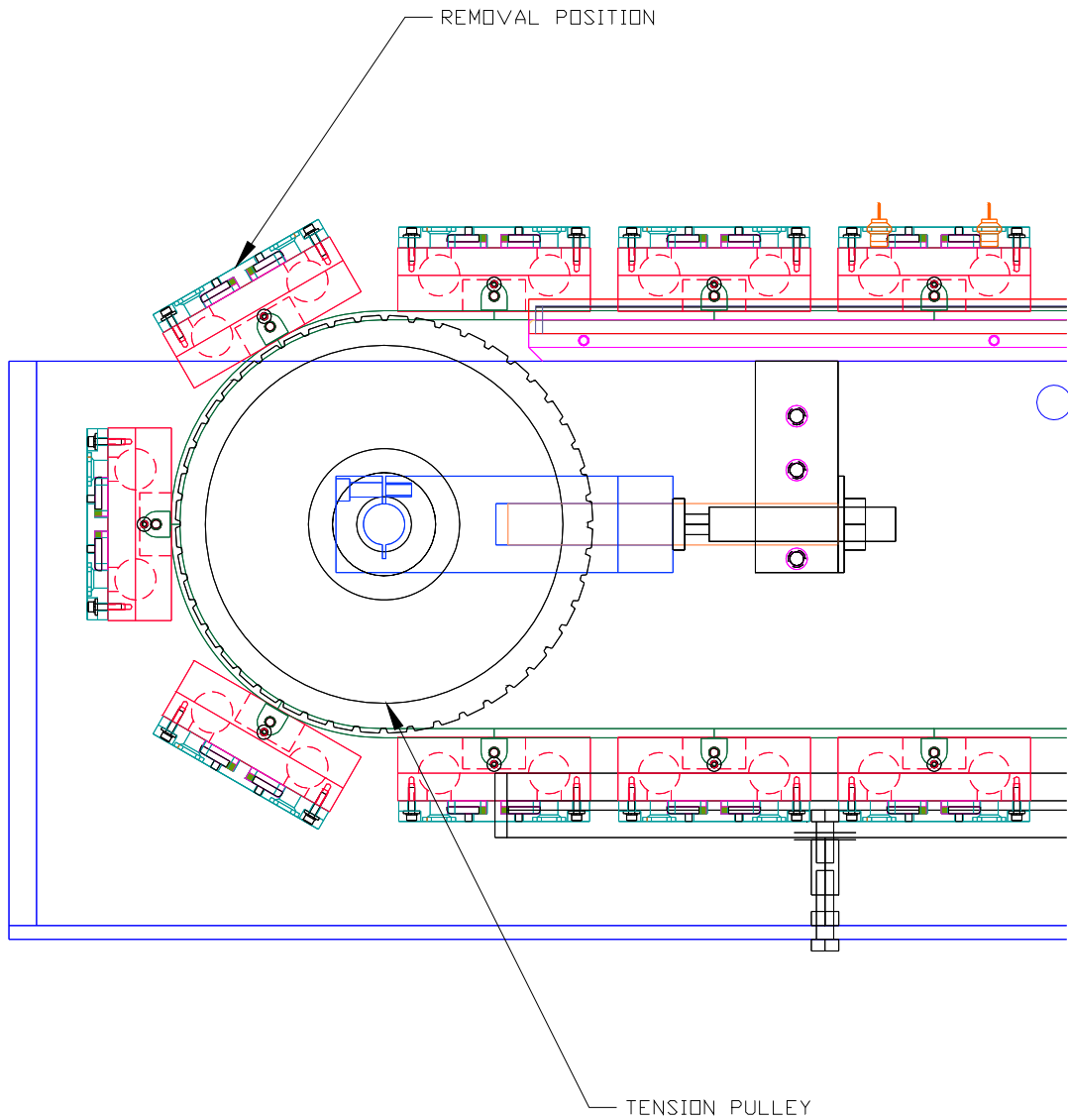


Figure 5 PALLET REMOVAL/REPLACEMENT POSITION

PERIODIC MAINTENANCE

MAINTAIN A MAINTENANCE LOGBOOK LISTING ALL WORK DONE ON THE EQUIPMENT.

DAILY

CLEAN THE MACHINE WITH A MILD, NON-ABRASIVE CLEANING SOLUTION. DO NOT USE SOLVENTS ON PLASTIC PARTS. DO NOT CLEAN THE PALLETS AND/OR NESTS WITH A WATER-BASED SOLUTION, ELECTRICAL CONDUCTIVITY IS CRITICAL.

VISUALLY MONITOR ALL PALLETS FOR WEAR AND/OR MISSING PARTS.

CHECK THE ALIGNMENT OF THE VIBRATORY FEED BOWL TO THE PICKUP BLOCK.

INSPECT THE POSITION OF THE MARK ON A SAMPLE INITIATOR AND CORRECT AS NECESSARY.

ADJUST THE VIBRATORY FEED BOWL AND OUTFEED TRACK CONTROLS FOR THE BEST FEED RATE AND LOWEST NOISE LEVEL.

INSPECT ALL COVERS FOR PROPER FIT AND FUNCTION.

REMOVE ALL INITIATORS FROM REJECT AND ACCEPTANCE BINS AT THE END OF THE DAY AFTER THE LAST LOT.

WEEKLY

PERFORM ALL DAILY CHECKS.

CLEAN THE VIBRATORY FEED BOWL AND OUTFEED TRACK.

CLEAN THE INSULATION RESISTANCE CONTACT WITHIN EACH PALLET WITH A SWAB AND ALCOHOL.

CLEAN MARKING INK OVERSPRAY AND ANY CONTAMINANTS FROM ALL PALLETS.

INSPECT THE WIRING AND PNEUMATIC LINES TO EACH STATION FOR SIGNS OF BINDING OR WEAR.

TEST COVER INTERLOCKS AND EMO BUTTONS FOR PROPER FUNCTION.

INSPECT THE ELECTRICAL TEST STATION AND CONTACTS FOR SIGNS OF WEAR.

MONTHLY

PERFORM ALL DAILY AND WEEKLY CHECKS.

EXAMINE THE AIR FILTER FOR WATER AND DRAIN AS NECESSARY.

EXAMINE THE CONVEYOR BELT FOR SIGNS OF WEAR.

EXAMINE THE REJECT/X-RAY LINEAR MOTOR FOR SIGNS OF WEAR, PROPER TENSION.

VERIFY THE POSITIONING OF ALL PICKUP/SETDOWN GRIPPERS.