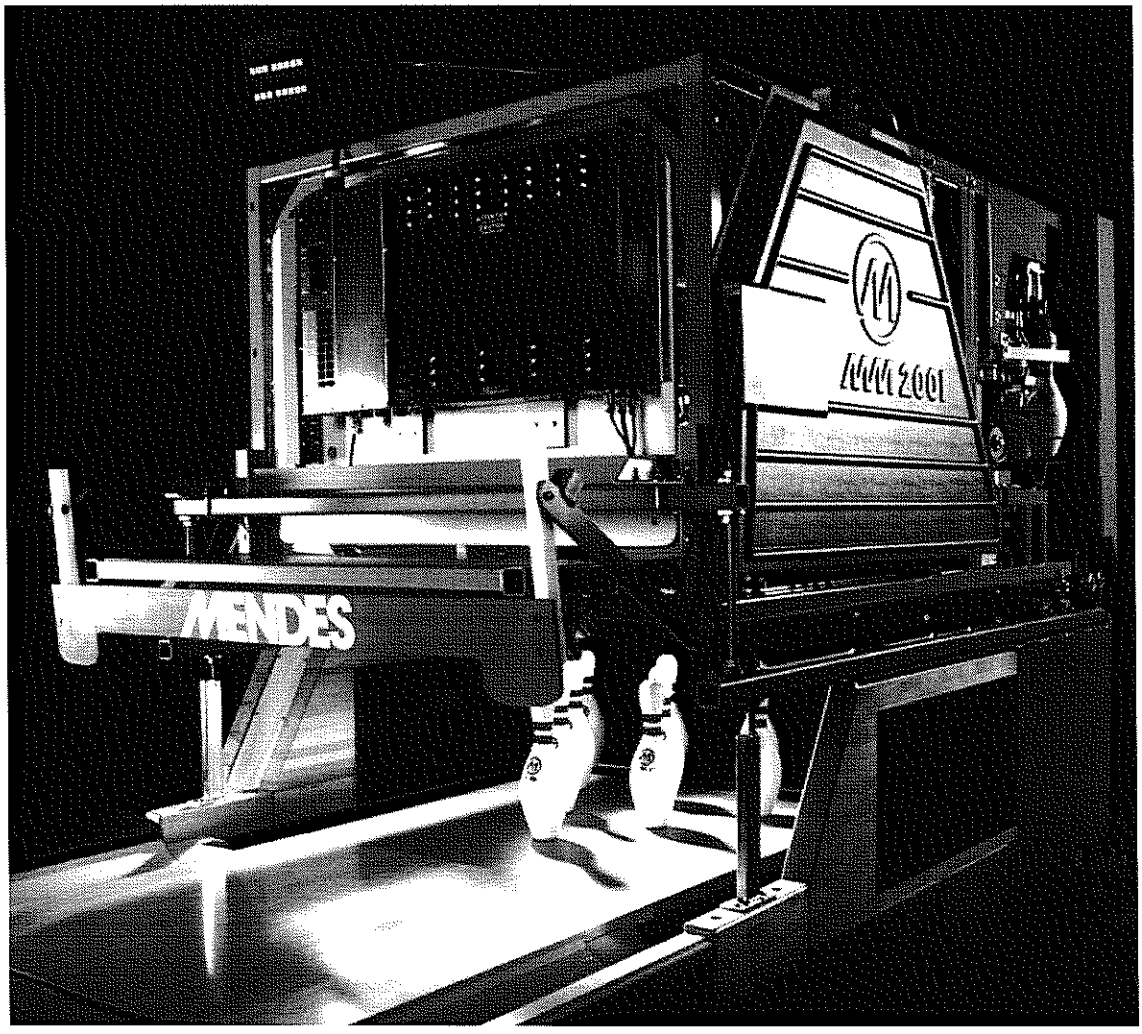
ADJUSTMENTS & MAINTENANCE

3



After reading this chapter you should be able to:

Perform the various adjustments necessary to keep your pinsetters in top condition.

Use the complementary information found in "Chapter 4 - Troubleshooting" to great advantage.

Analyze the importance of and set up a good maintenance program.

The simplicity of the Mendes MM-2201 Pinsetter being its main characteristic, it is very easy to understand its concept. At the same time, it must be understood that pinsetters of any kind require a minimum of maintenance and should operate to standards.

Table 1 - Mechanical Maintenance Schedule

Adjustment Number	Component	Description	Weekly	Monthly	Semi Annually	As Required
1D	Drive Train	Ball Detector		X		
2A	Sweep	Chain Tension		X		
2B	Sweep	Height		X		
2C	Sweep	Parallelism		X		
2D	Sweep	Arc, Right Side		X		
2D	Sweep	Arc, Left Side		X		
2F	Sweep	Drive Chain Tension		X		
2H	Sweep	Up Actuator		X		
2I	Sweep	Double Actuator		X		
2K	Sweep	Torque		X		
3A	Pit	Ball Ready Opto		X		
3B	Pit	Deflector Blocks Replacement				X
4D	Accelerator	Ball Door Torque				X
4E	Accelerator	Ball Door Cam				X
4F	Accelerator	Ball Door Actuator			X	
5A	Elevator	Drive Chain Tension	X			
5B	Elevator	Pin Alignment		X		
5C	Elevator	Right Pin Actuator		X		
5D	Elevator	Left Pin Actuator		X		
5E	Elevator	Right Pin Loader Actuator		X		
5F	Elevator	Left Pin Loader Actuator		X		
5H	Elevator	Movement Opto		X		
6A	Carrousel	Synchronization Opto		X		
6B	Carrousel	Station Synchronization Opto		X		
6C	Carrousel	Pin Detect Opto		X		
6D	Carrousel	Chain Alignment			X	
6E	Carrousel	Cam Alignment			X	
6F	Carrousel	Pin Alignment			X	
6G	Carrousel	Magnet Disengagement Plate		X		
6H	Carrousel	Magnet Guide Rod		X		
6I	Carrousel	Pin Drop Height		X		
7A	Magazine	Solenoid Block		X		
7B	Magazine	Solenoid Bracket		X		
7C	Magazine	Landing Pad Replacement				X
7D	Magazine	Detection Bar Assembly		X		
8A	Drawer	Triangle			X	
8C	Drawer	Out of Spot Pin				X
8D	Drawer	Hook		X		
8F	Drawer	Front Limit Actuator		X		
8G	Drawer	Back Limit Actuator		X		
8H	Drawer	Obstruction Opto		X		
9A	Deck	Wire Length		X		
9B	Deck	Pin Height			X	
9C	Deck	Bumper Height			X	
9D	Deck	Lower Limit Opto		X		
N/A	Belts	Refer to Table 4		X		
N/A	Bolts	Refer to Table 5		X		

Table 2 - Lubrication Schedule

Procedure Number	Component	Description	Bimonthly	Semi Annually	Annually	As Required
1A	Drive Train	Parallel Shaft Gearbox Oil Change				X
2G	Sweep	Attachment Lubrication			X	
2J	Sweep	Clutch Cleaning & Lubrication	X			
3E	Pit	Ball Door Clutch Cleaning & Lubrication	X			
5G	Elevator	Clutch Cleaning & Lubrication	X			
7E	Magazine	Flange Bearings Lubrication	X			
9E	Deck	Pin Centering Dish Fluid		X		
9F	Deck	Motor Reducer Oil Level		X		
9G	Deck	Motor Reducer Oil Change				X
N/A	Chains	Refer to Table 6		X		
N/A	Pulleys	Refer to Table 6	X			

Proper lubrication is essential to a smooth running, trouble-free machine and also prolongs the life of all moving parts. It is very important to perform the lubrication according to the following schedule.

Table 3 - Cleaning Schedule

Part Number	Description	Procedure
303-5210-00	SOLENOID CAM	Clean with a damp cloth.
303-5560-00	SOLENOID BLOCK	Clean with a damp cloth.
303-6610-00	BALL READY REFLECTOR	Clean with a damp cloth.
304-6000-00	PIT CONVEYOR BELT	Clean with a damp cloth.
322-6500-00	METAL KICKBACK ASSEMBLY	Clean the area with a vacuum cleaner.
322-9000-00	BALL ACCELERATOR ASSEMBLY	Clean the area with a vacuum cleaner.
333-6170-00	PIT TABLE ASSEMBLY, RIGHT LANE	Clean the area with a vacuum cleaner.
333-6175-00	PIT TABLE ASSEMBLY, LEFT LANE	Clean the area with a vacuum cleaner.
E-GP1A05	ENCODER OPTICAL SENSOR	Clean with compressed air.
E-VC69105T	CAMERA LENS	Clean with a soft tissue approved for use on optical lenses.
P-1500-16	BALL DETECTOR REFLECTOR	Clean with a damp cloth.
SB-1500-31-B	BALL DETECTOR TRANSMITTER ASSEMBLY	Clean with a damp cloth.
SB-1500-40	BALL READY TRANSMITTER ASSEMBLY	Clean with a damp cloth.
SB-1500-41	DRAWER OBSTRUCTION RECEIVER ASSEMBLY	Clean with a damp cloth.
SB-1500-42	DRAWER OBSTRUCTION TRANSMITTER ASSEMBLY	Clean with a damp cloth.
SB-ECIL-325-FS	OPTICAL SENSOR ASSEMBLY	Clean with compressed air.

Machines must be kept free of dirt, dust and excess of oil. A well cared for machine is a ***clean machine***. A clean machine performs much better and reduces the chance of electronic problems. Table 3 contains the items which should be ***cleaned on a weekly basis***.

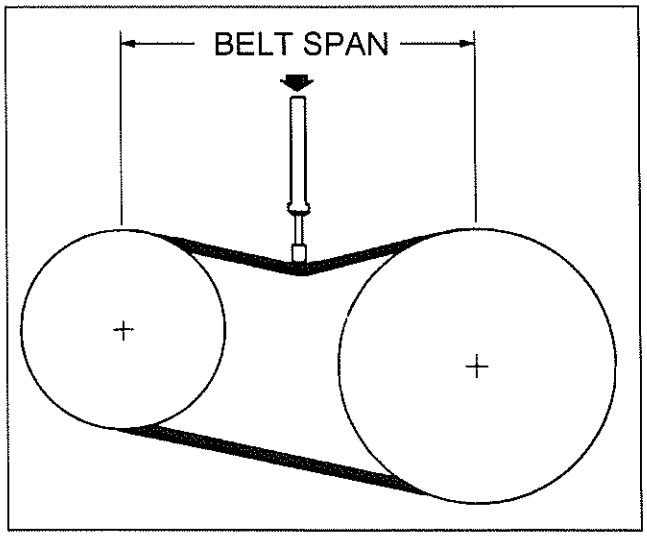
Table 4 - Belt Tension

Part Number	Description	Adjustment Number	Required Recession Depth ± 1/16" (2mm)
304-2000-00	DRIVE TRAIN BELT, 480H075	1B	1/2" (13mm)
304-2000-00	DRIVE TRAIN BELT, 480H075	2E	1/2" (13mm)
304-2020-00	DRIVE TRAIN BELT, 800H075	1C	1/2" (13mm)
304-3000-00	DRAWER BELT, H075	8B	7/8" (22mm)
304-3010-00	DRAWER MOTOR BELT, 255L075	8E	1/4" (6mm)
304-5000-00	CARROUSEL BELT, 4L 500	N/A	automatic
304-6000-00	PIT CONVEYOR BELT	3D	special
304-6050-00	PIT BELT, B107	N/A	automatic
304-6100-00	PIT BELT, B65	3C	1/2" (13mm)
304-6500-00	BALL DOOR BELT, 4L 340	4B	special
304-8000-00	ELEVATOR BELT, 4L 460	N/A	automatic
304-9000-00	ACCELERATOR BELT	4A	5/8" (16mm)
304-9010-00	ACCELERATOR MOTOR BELT, 4L 390	4C	5/8" (16mm)

All belts on the MM-2001 Magnet Pinsetter must be kept at specific tensions in order for the pinsetter to function normally. Most of the belts used are stock timing belts which do not slip, but some V-belts are also used. The general rules of tensioning belts is as follows:

1. Ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
2. Check tension frequently during the first 24-48 hours of operation and at least once every month afterwards.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material which may cause slip.
5. Make drive inspections on a periodic basis, tension belts when slipping. Never apply belt dressing as this will damage the belt and cause early failure.

TENSION MEASUREMENT PROCEDURE



1. Place the Mendes Tension Gauge (part number Z-ME4300) squarely on one belt at the center of the belt span. Apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4.
2. If the recession is greater, you must tighten the belt and if the recession is less, you must loosen the belt.
3. Repeat steps 1 and 2 until the tension is correct.

Table 5 - Bolt Torque

BOLT SIZE	AMERICAN	NEWTON
1/4"	15 FT. LB.	67 N/M
5/16"	19 FT. LB.	85 N/M
3/8"	25 FT. LB.	112 N/M
1/2"	29 FT. LB.	130 N/M

Machines are subject to constant vibration and must be checked frequently for loose nuts and bolts. All bolts on the MM-2201 pinsetters and accessories must be tightened with a torque wrench as indicated in Table 5. Over tightening bolts will simply cause them to break and depending on the function of the bolt, may cause operating headaches.

Also, check and tighten any loose screws on the pinsetters (especially the set screws) as well as any loose bolts on the pit cushions and ball accelerators at regular intervals.

Table 6 - Pulley & Chain Oils

MANUFACTURER	STANDARD SW10 OIL

Oil all pulleys with very small quantities of SW10 motor oil only if judged necessary. Don't forget that any excess oil will only drip into undesired places causing headaches for cleaning.

Oil all chains with very small quantities of SW10 motor oil only if judged necessary.

Drive Train

1A. Parallel Shaft Gearbox Oil Change

Synthetic lubricants are used in the parallel shaft gearbox (302-2300-00) due to its wide temperature range. The gearbox is breatherless and lubricated for life thus eliminating maintenance. In the event that the gearbox needs to be refilled refer to the chart below for the recommended lubricants.

MANUFACTURER	Standard Synthetic Gear Oil
Cofran	Sintogear 125
Mobile Oil Corp.	SHC 629

1B. Drive Belt 304-2000-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belt and if the recession depth is less, you must loosen the belt.

To adjust the tension on the belt, loosen the bolt which holds the tensioner pulley (303-2350-00) in place and move the tensioner pulley in the desired direction. (Figure 1) Re-tighten the bolt and measure the recession depth once again. Repeat until tension is correct.

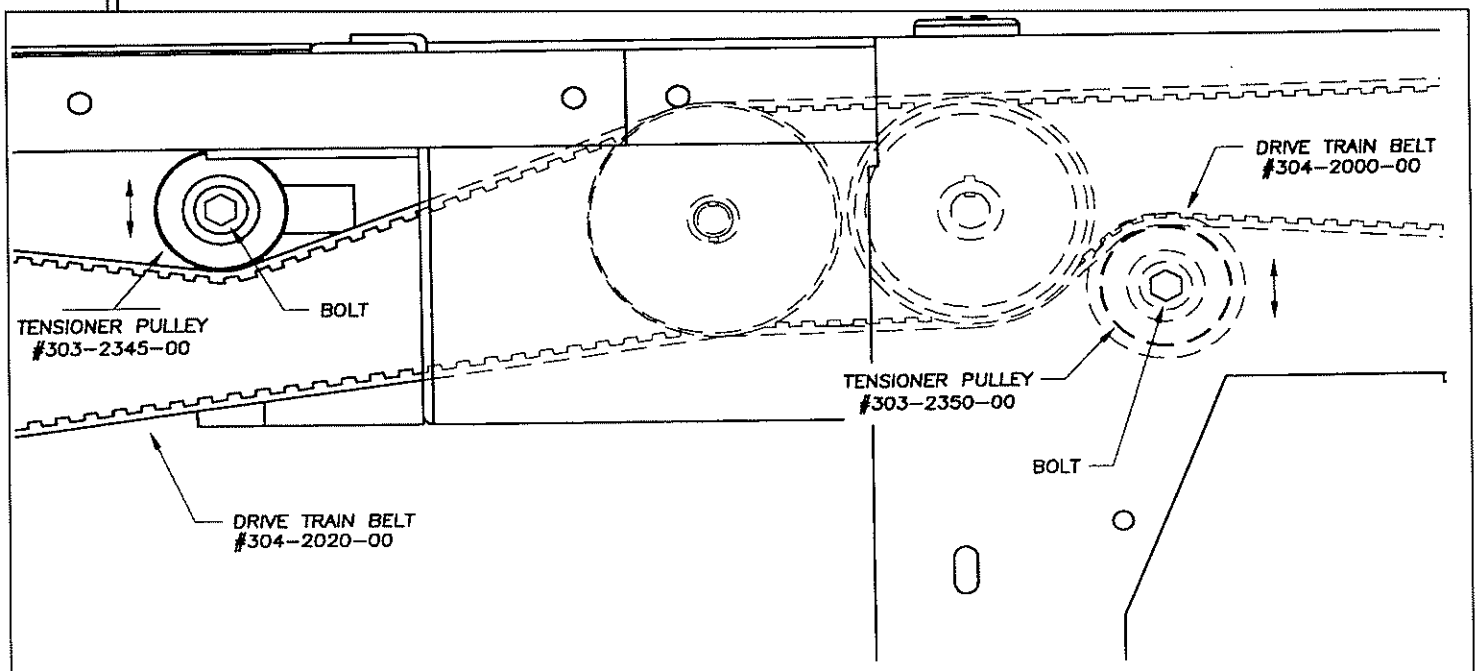


Figure 1

1C. Drive Belt 304-2020-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belt and if the recession depth is less, you must loosen the belt.

To adjust the tension on the belt, loosen the bolt which holds the tensioner pulley (303-2345-00) in place and move the tensioner pulley in the desired direction. (Figure 1) Re-tighten the bolt and measure the recession depth once again. Repeat until tension is correct.

1D. Ball Detector

Although the ball detector is not a mechanical part of the drive train, it is a critical component to the pinsetter's mechanics since all commands to and from the pinsetter start with the detection of a ball.

The ball detector is a simple, very reliable stand alone device but may become misaligned once in a while due to the constant vibration caused by the balls rolling down the lane.

Each ball detector has two LEDs that simplify the adjustment of the unit. The green LED signifies that the unit is perfectly aligned with the reflector while the red LED indicates that the alignment is borderline (usually requiring you to adjust it until the green LED turns on). If neither of the two LEDs are visible on a ball detector, one of four things is possible. The ball detector is completely misaligned, it is defective, the reflector on the opposite side of the lane is soiled or has fallen, or the cable which supplies the necessary voltage to the unit has been cut or disconnected.

To adjust the ball detector:

1. Loosen the screws which hold the ball detector transmitter assembly (SB-1500-31-B) in place;
2. Move the detector assembly up, down, right or left until the green LED appears on the ball detector;
3. Re-tighten the screws.

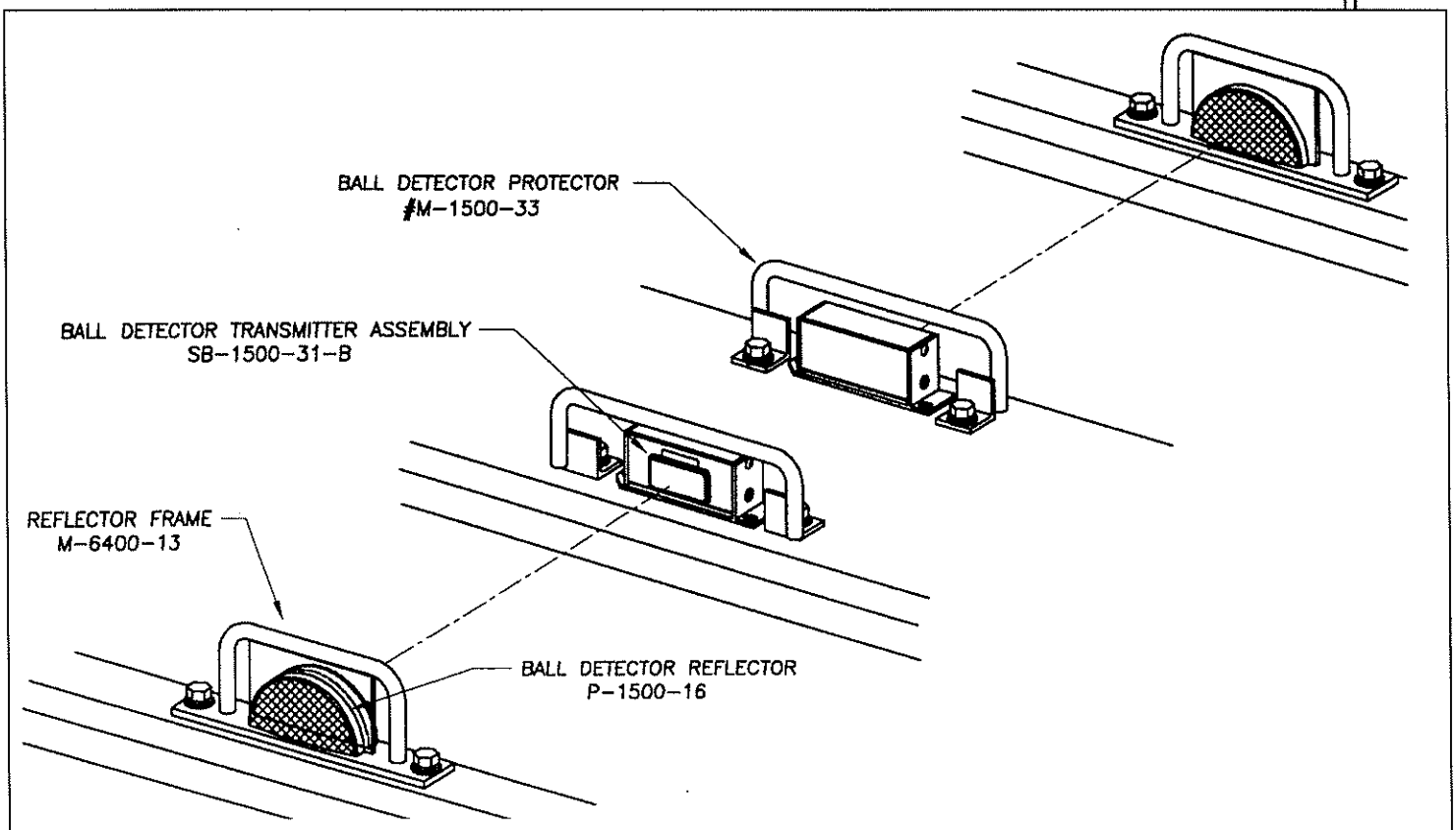


Figure 2

Slide a ½-inch (13mm) square block of wood about 12 inches (305mm) long across the lane where the ball detector is located (*the block of wood should be painted black or covered with black tape*). The green LED should stay on. If the green LED goes out, this means that your signal is bouncing off the lane. If you leave your ball detector like this you will have detection problems due to reflections and shadows.

Drive Train Maintenance Notes

Sweep

There are five identified positions pertaining to the sweep as indicated in the diagram below. Note the position of the ***SWEEP CHAIN ATTACHMENT*** (302-4510-00) when the sweep is in its different positions. The proper positioning of the sweep chain attachment will ensure that the sweep is in its correct position for the necessary adjustment. ***The first four adjustments (2A through 2D) made to the sweep must be carried out as a whole (all adjustments in the order listed) and with the sweep in the appropriate position for each adjustment.*** Failing to place the sweep in its appropriate position before performing an adjustment will result in disastrous consequences with the performance of the MM-2001.

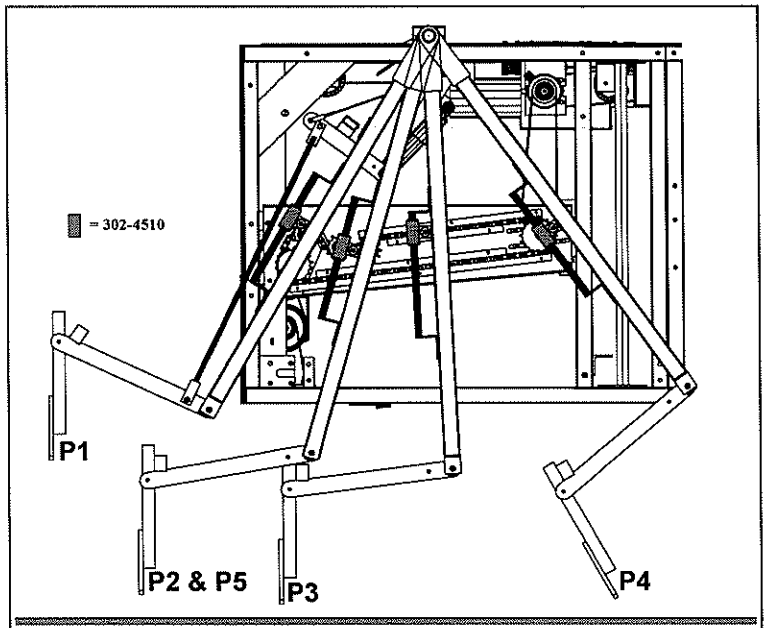


Figure 3 - Sweep Positions

P1	**READY TO BOWL**
P2	**LOWER LIMIT PRIOR TO SWEEPING**
P3	**SWEEPING MOTION**
P4	**BACK LIMIT**
P5	**LOWER LIMIT AFTER SWEEPING**

The first four sweep adjustments (2A through 2D) are made by measuring the distance between the sweep and the lane. Make sure that the distance obtained is equal at both extremities (left and right) of the sweep.

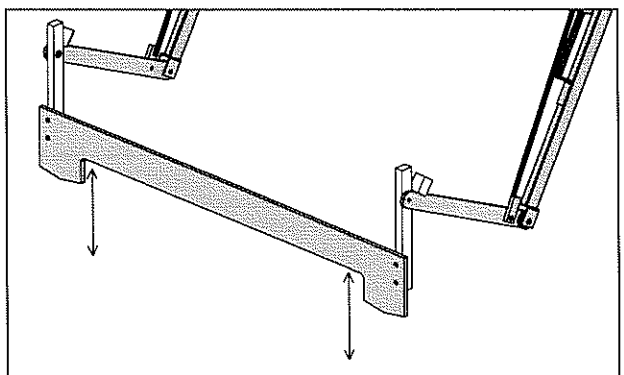


Figure 4 - Sweep Adjustments Measure

2A. Chain Tension

With the sweep in its P1 position, adjust the tension on both chains equally by removing the sweep chain coupling half (302-4225-00) and rotating the bottom chain block (302-4240-00) until the sweep is 20½ inches (520mm) from the lane. (Figure 5)

2B. Height

Lower the sweep to its P2 position and move both adjustment plates (302-4030-00) equally by loosening the 4 bolts (2 on each plate) and sliding the adjustment plate in the direction of the arrows until the sweep is 1¾ inches (45mm) from the lane. Re-tighten the 2 bolts on each side once the desired height is attained. (Figure 6)

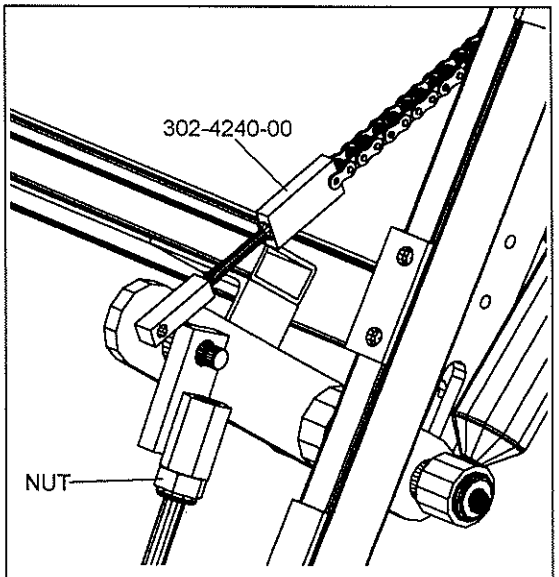


Figure 5

2C. Parallelism

The sweep must always be parallel to the lane and is adjusted during the installation procedure. If the sweep should ever lose its parallelism, it may be adjusted by rotating the adjustment nut until the sweep is parallel to the lane. (Figure 5)

2D. Right & Left Arc

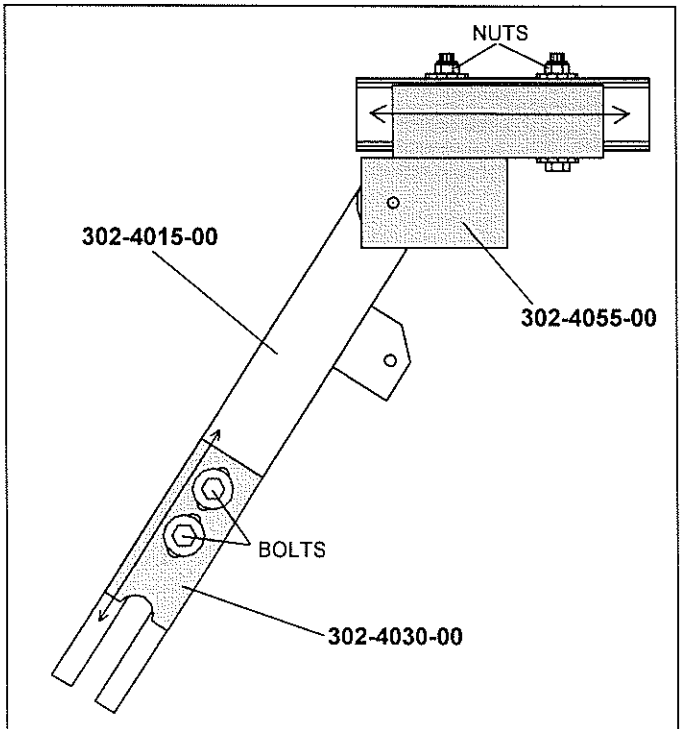


Figure 6

Due to the sweep's arc movement, the right (302-4010-00) and left (302-4015-00) sweep bars must be adjusted in order to keep the sweep parallel to the lane during its sweeping (P3) motion. With the sweep in its P4 position, move the brackets (302-4050-00 & 302-4055-00) equally by loosening the 4 nuts (2 on each bracket) and sliding the brackets from front to back until the sweep is ¾ inch (20mm) from the lane. (Figure 6)

Adjustment 2D has a direct effect on adjustment 2B which should be verified once again after adjustment 2D is completed.

2E. Drive Belt 304-2020-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belt and if the recession depth is less, you must loosen the belt.

To adjust the tension on the belt, loosen the three bolts indicated by **E** in Figure 7 and move the sweep drive channel (302-4400-00) in the direction of the arrows. Re-tighten the three bolts once the correct tension is obtained.

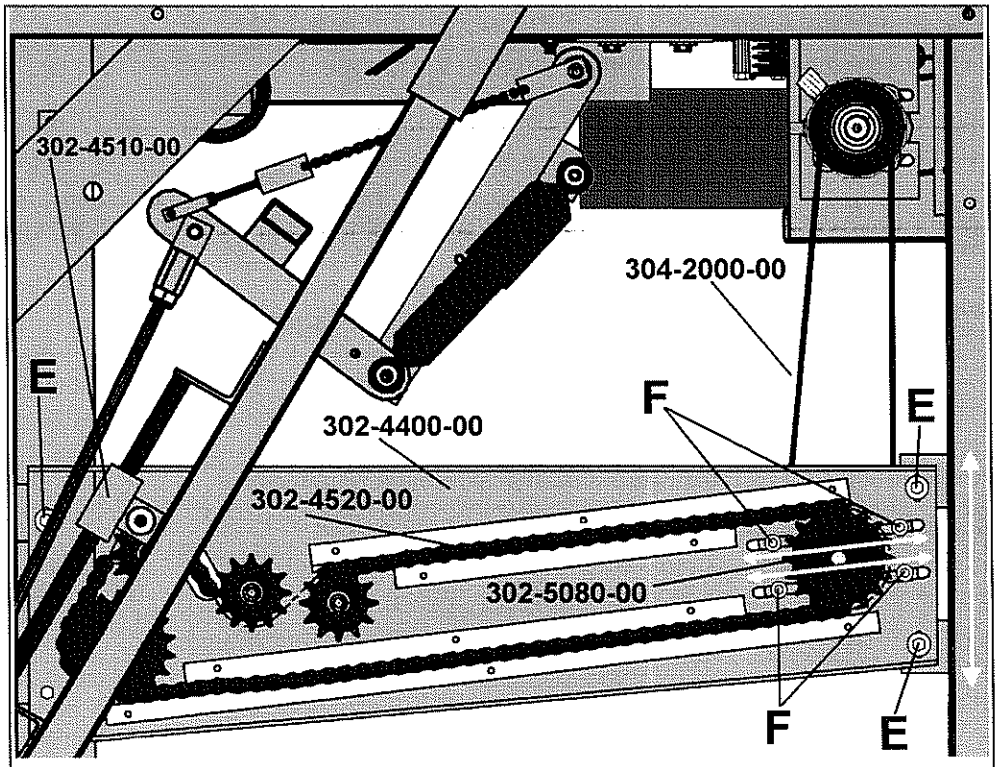


Figure 7

2F. Drive Chain Tension

The sweep chain (302-4520-00) must be kept taut. To adjust the tension on the chain, loosen the four bolts indicated by **F** in Figure 7 and move the shaft sprocket assembly (302-4480-00) in the direction of the arrows by loosening or tightening the adjustment bolt located on the left side of the sweep channel behind the shaft sprocket assembly. Re-tighten the four bolts once the correct tension is obtained.

2G. Sweep Attachment Lubrication

The sweep attachment (302-4510-00) must be greased once a year with a 30/90 grease such as Valvoline 606 or its equivalent. Refer to pages 210-211 in the Parts section of this manual for a close-up view of the sweep attachment itself.

2H. Sweep Up Actuator

The sweep up optical sensor is used to detect the presence of the sweep in its up position. With the sweep in its P1 position, adjust the position of the optical sensor (SB-ECIL-325-FS) or the position of the up actuator (303-4610-00) in order to have both of them perfectly aligned with each one's bottom. (Figure 8) Loosen the hexagon nut to adjust the optical sensor. Loosen the two-inch sweep collar to adjust the up actuator.

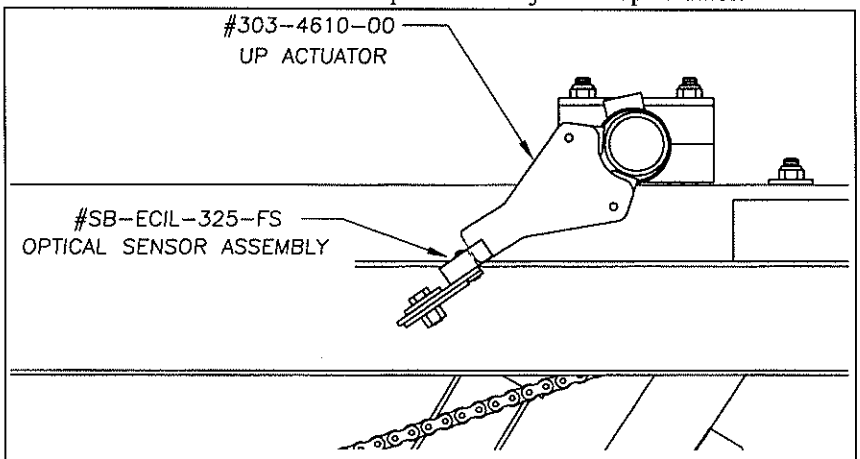


Figure 8

2I. Sweep Double Actuator

The sweep forward and rear optical sensor serves a dual purpose and is equipped with a double actuator. With the sweep in its P1 position, adjust the position of the optical sensor (SB-ECIL-325-FS) or the position of the double actuator (303-4630-00) in order to have both of them aligned as shown in Figure 9. Loosen the hexagon nut to adjust the optical sensor. Loosen the two-inch sweep collar to adjust the double actuator.

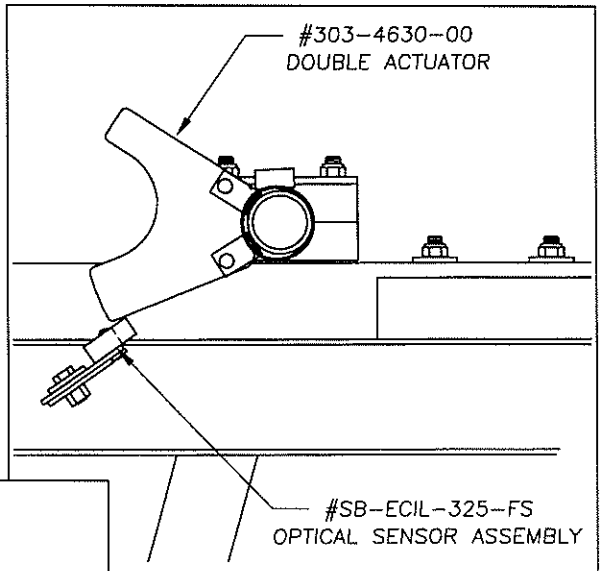


Figure 9

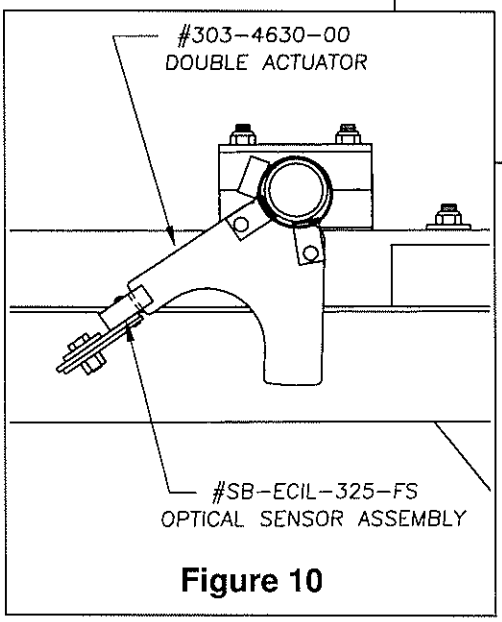


Figure 10

With the sweep in its P4 position, and if the preceding adjustment was carried out correctly, the same optical sensor should be somewhat aligned with the center of the second prong on the double actuator. (Figure 10) The double actuator will not necessarily be perfectly aligned but it should obstruct the optical sensor enough to be able to cut its signal.

2J. Clutch Cleaning & Lubrication

Cleaning and lubrication of the magnetic clutch (301-1400-00) and the timing gear (302-2050-00) must be performed on a bimonthly basis (every two months). To do this, the assembly should be removed from the pinsetter and cleaned. The components should be cleaned with a solvent such as a paint thinner. The components should then be dried using a towel. The shaft (302-2060-00) of the machine where the clutch assembly is normally inserted should also be cleaned with a clean rag while the clutch assembly is out being cleaned as per the above.

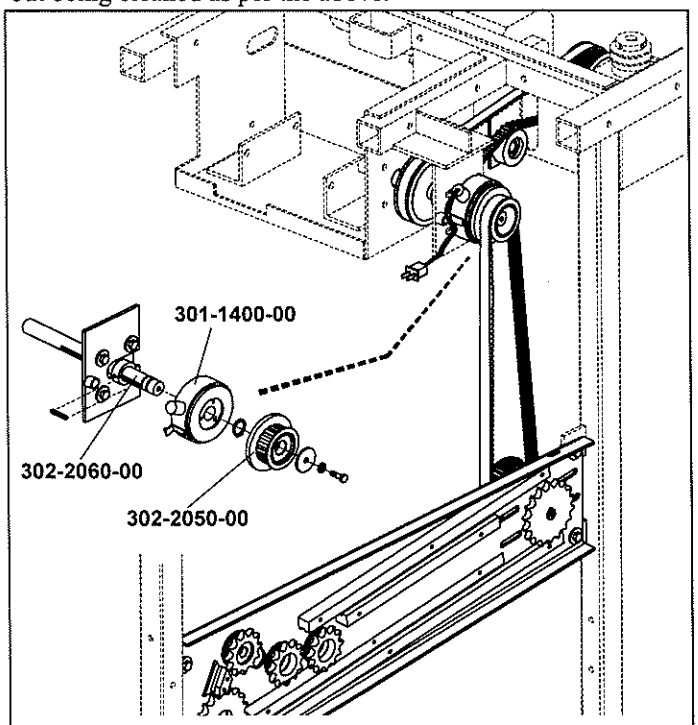
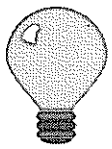


Figure 11

To remove the clutch assembly, you must first remove the timing belt. The tension on the belt must first be removed by loosening the three bolts which hold the sweep drive channel in place as explained in adjustment 2E. The belt will now come off easily. (Figure 11)



The shaft is shown removed in the diagram only for demonstration purposes. It is not necessary to remove the shaft from the pinsetter.

Prior to re-assembly, **lightly** lubricate the shaft with an anti-seize lubricant such as *Loctite Anti-Seize Brush Type No. 76764*, and make sure that the clutch components travel freely on the shaft. Do not apply too much lubricant so as to have it overflow from the shaft to the components' outer surfaces. The clutch's facing must **never** be lubricated. A lubricant is available from Mendes and its affiliated distributors under part number Z-76764.

Following re-assembly of the sweep drive clutch assembly, make sure to re-adjust the tension on the timing belt as explained in adjustment 2E.

Cleaning and lubrication of the magnetic clutch assembly is critical for proper performance. Failure to have a clean, well lubricated clutch will result in unnecessary sweep jams.

2K. Sweep Torque

The sweep's torque may be verified by marking the timing gear and friction disk with a pencil as indicated in Figure 12. Once your mark has been made, perform a few complete sweep cycles through the Magnet 2001 Controller and then verify your marks. If the two marks have remained aligned, the torque is correct. If the two marks have become misaligned, complete the following in order:

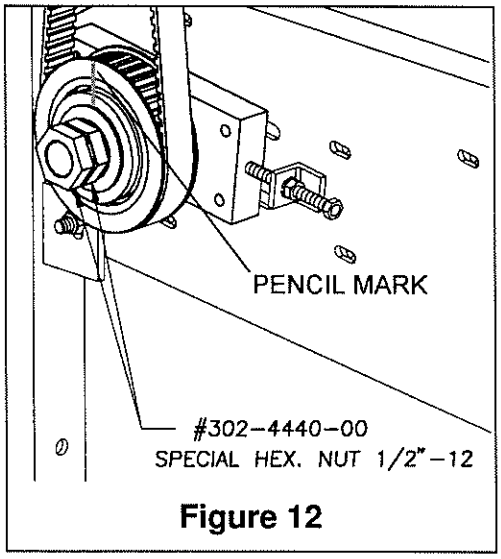


Figure 12

1. erase the pencil marks;
2. loosen the outer half-inch lock nut;
3. tighten the inner half-inch nut ***one-quarter of a turn***;
4. re-tighten the outer lock nut;
5. mark the timing gear and friction disk anew;
6. perform a few sweep cycles through the Magnet 2001 Controller;
7. check the marks again;
8. repeat steps one through seven as necessary until both pencil marks remain aligned.

Sweep Maintenance Notes

Pit

3A. Ball Ready Opto

The ball ready transmitter assembly (SB-1500-40) is used to detect the presence of a ball at the ball door (303-6560-00 or 303-6565-00). The ball cuts the infrared signal between the transmitter and the reflector (303-6610-00). The infrared signal passes through the slot located in the pit cushion frame (302-6150-00) . If the ball ready opto is not properly adjusted, unnecessary "Ball Jams" will occur. When adjusting this sensor, you must take into consideration the fact that the cushion may move back approximately 2 inches (50mm) each time it is hit by a ball.

To adjust the ball ready transmitter assembly, loosen the screws which hold it in place and then move the transmitter up or down and left or right as indicated by the arrows until the green light appears. (Figure 13) **IMPORTANT: Once the green light is obtained, re-tighten the screws and then push the cushion to its rear position and verify the fact that the green light is still ON. If the green light turns OFF and the red light turns ON, raise the angle of the transmitter until the light remains green with the cushion in its rear position.**

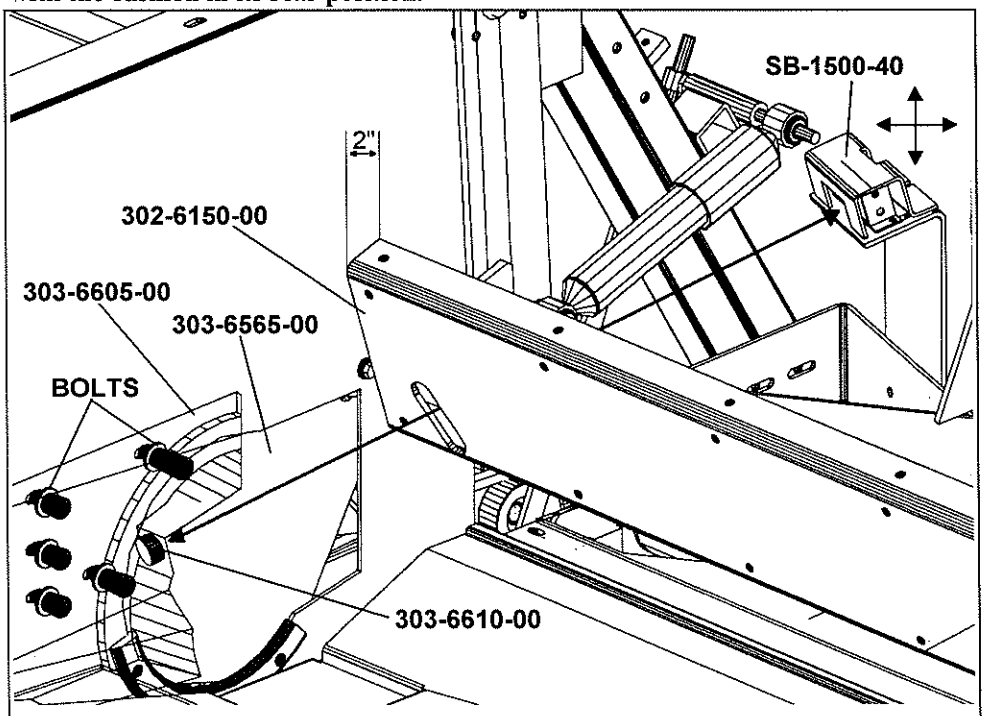


Figure 13

3B. Deflector Blocks Replacement

Although no adjustments exist for the right (303-6600-00) and left (303-6605-00) deflector blocks, it must be noted that if, for whatever reason, the deflector blocks are removed from the kickbacks, the bolts used to hold them in place must be treated with a removable thread locker, such as Loctite 242, prior to their reinstallation. (Figure 13) A removable thread locker is available through Mendes and its affiliated distributors under part number Z-24221.

3C. Drive Belt 304-6100-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belt and if the recession depth is less, you must loosen the belt.

To adjust the tension on the belt, simply loosen both bolts and rotate the tensioner rod (302-2290-00) in the desired direction. Re-tighten the bolts once the appropriate tension is attained. (Figure 14)

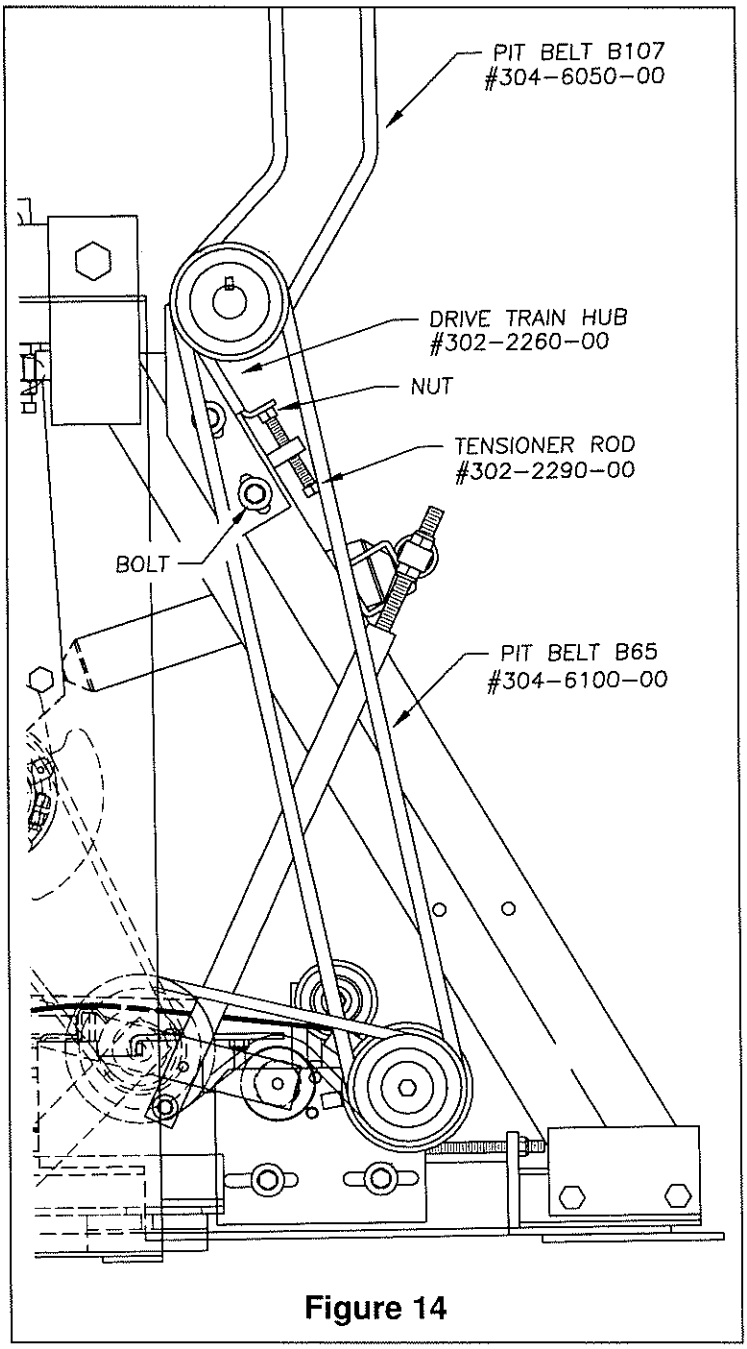
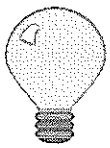


Figure 14



Once adjustment 3C has been carried out correctly, any stoppage with the pit conveyor belt should cause the B65 pit belt (304-6100-00) to slip and not the B107 pit belt (304-6050-00).

3D. Conveyor Belt 304-6000-00 Tension

The pit's conveyor belt must be adjusted using the lightest ball bowled with in the bowling center. (usually 6lbs.) Loosen the bolts which hold the right tension plate (302-6030-00) in place and then with the bowling ball on the conveyor belt, adjust the nut until the ball is level with the ball door's port hole. (Figure 15)

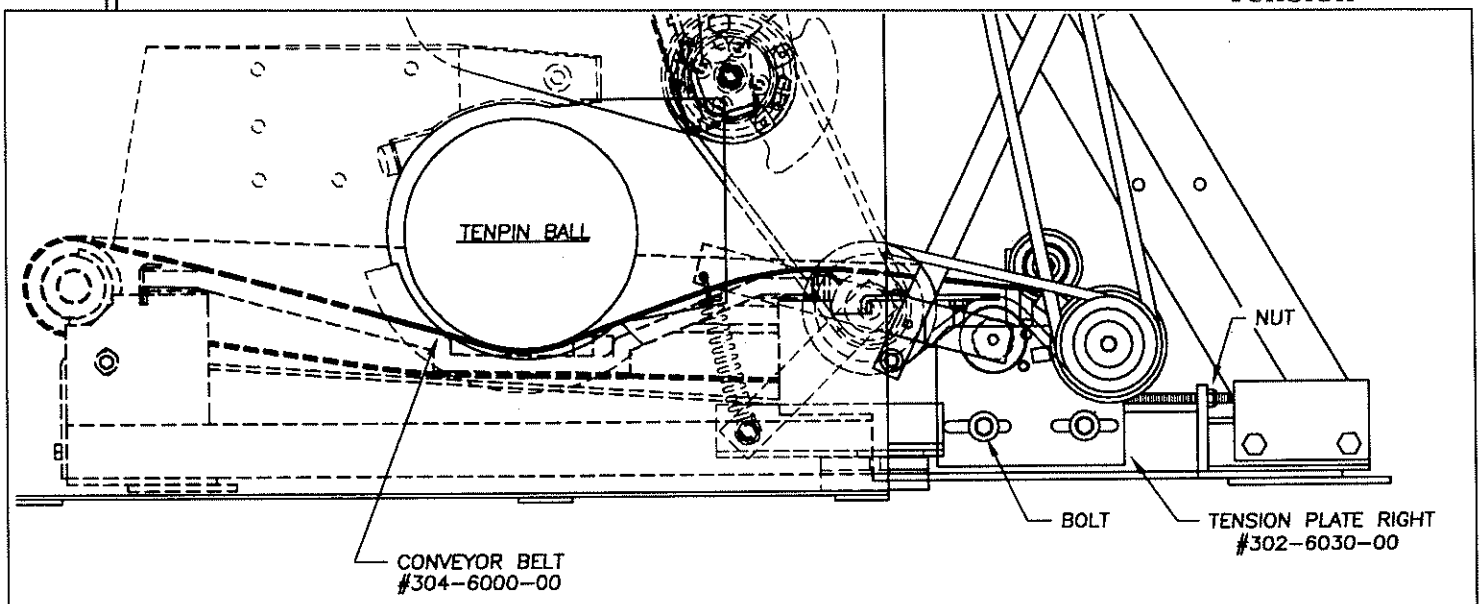


Figure 15

Once the inside of the pit's conveyor belt is adjusted, the outside must be adjusted in order to take up the slack, if any. Loosen the bolts which hold the left tension plate (302-6045-00) in place and then use the nut to adjust the tension on the conveyor belt. An ideal tension will not cause any ripples in the carpet as it rotates. (Figure 16)

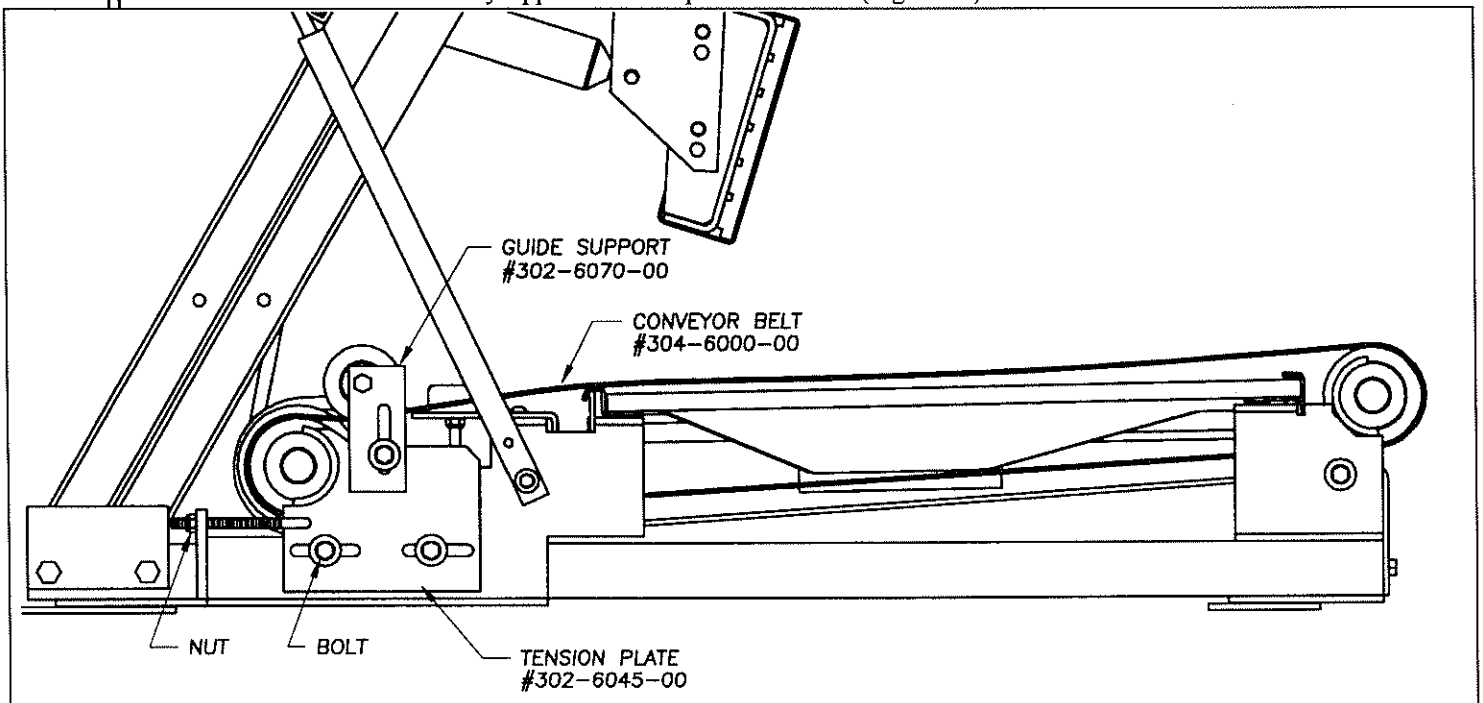


Figure 16

3E. Ball Door Clutch Cleaning & Lubrication

Cleaning and lubrication of the magnetic clutch (301-1400-00) and the pulley (302-2090-00) must be performed on a bimonthly basis (every two months). To do this, the assembly should be **removed** from the pinsetter and cleaned. The components should be cleaned with a solvent such as a paint thinner. The components should then be dried using a towel. The shaft of the conveyor roller (302-6050-00 or 302-6075-00) where the clutch assembly is normally inserted should also be cleaned with a clean rag while the clutch assembly is out being cleaned as per the above.

To remove the clutch assembly, you must first remove the belt. The tension on the belt must first be removed by removing the spring (S-080) as shown in Figure 17. The belt will now come off easily.

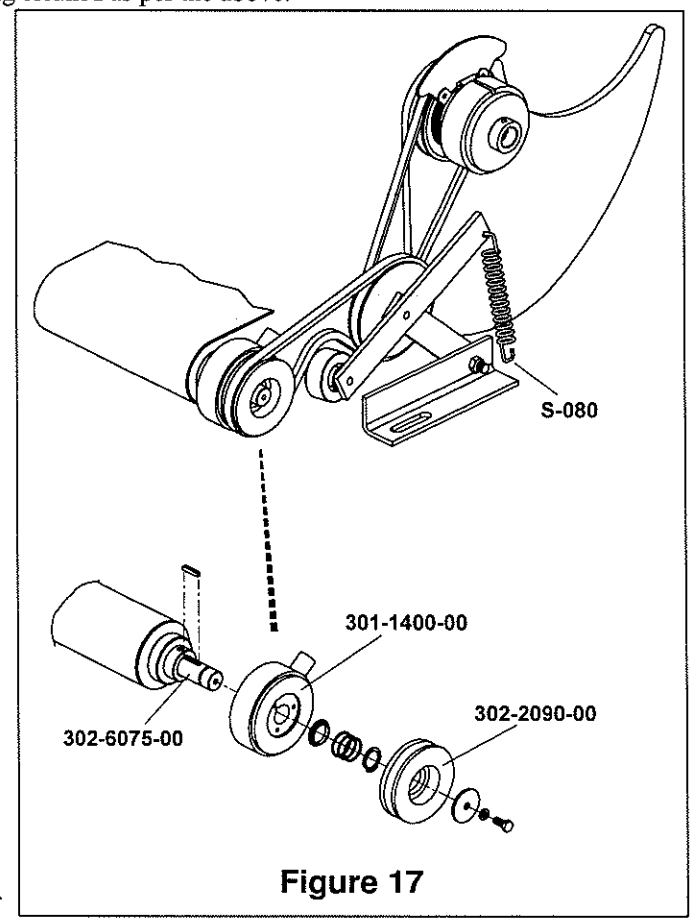


Figure 17

Prior to re-assembly, **lightly** lubricate the shaft with an anti-seize lubricant such as *Loctite Anti-Seize Brush Type No. 76764*, and make sure that the clutch components travel freely on the shaft. Do not apply too much lubricant so as to have it overflow from the shaft to the components' outer surfaces. The clutch's facing must **never** be lubricated. A lubricant is available from Mendes and its affiliated distributors under part number Z-76764.

Following re-assembly of the clutch assembly, make sure to replace the spring in order to re-establish tension on the belt. Cleaning and lubrication of the magnetic clutch assembly is critical for proper performance. Failure to have a clean, well lubricated clutch will result in ball jams.

Pit Maintenance Notes

Ball Accelerator

4A. Belt 304-9000-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belt and if the recession depth is less, you must loosen the belt.

To adjust the tension on the belt, simply rotate the tension rod (302-9075-00) in the desired direction (tighten the rod to increase the tension and loosen the rod to decrease tension). (Figure 18)

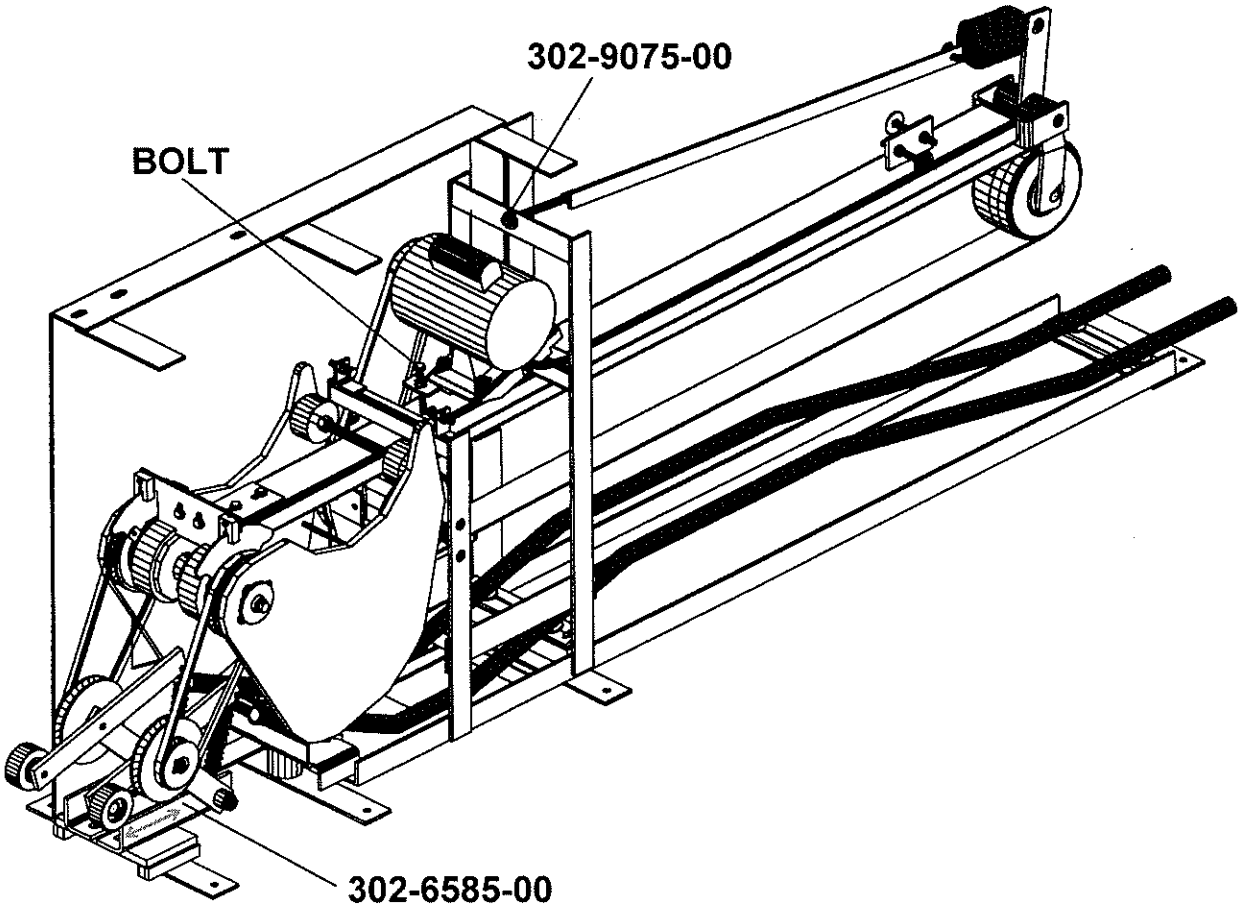


Figure 18

4B. Drive Belt 304-6500-00 Tension

The drive belts used to operate the ball doors are automatically tensioned with their X-form and the spring with which they are mounted. The only thing to check is that the belts do not come in contact with the magnetic clutch situated just below the pulley. If the belts get too close for comfort, adjust the tension as described below.

To adjust the tension on the belt, simply loosen the bolts which hold the tension plates (302-6580-00 and 302-6585-00) in place and then move the tension plates in the direction of the arrows. (Figure 18)

4C. Drive Belt 304-9010-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belt and if the recession depth is less, you must loosen the belt.

To adjust the tension on the belt, simply rotate the adjustment bolt located on the motor support bracket in the desired direction (tighten the bolt to increase the tension and loosen the bolt to decrease tension). (Figure 18)

4D. Ball Door Torque

The torque exerted on the ball door must be sufficient enough to allow for its normal movement but at the same time it should keep the door open when necessary. To adjust the torque, simply rotate the adjustment bolt located on the ball door brake (303-6510-00) in the desired direction Tighten the bolt to increase the tension and loosen the bolt to decrease tension. (Figure 19)

4E. Ball Door Cam

The positioning of the door cam determines the ball door's stopping position. To change the position, loosen the HS 044 pit collar (302-6550-00) which holds the cam in place, move the cam and then re-tighten the bolt. (Figure 19)

4F. Ball Door Actuator

The ball door open optical sensor (SB-ECIL-325-FS) must be laterally aligned so as to have the ball door actuator (303-6535-00) pass through it when it opens. (Figure 19)

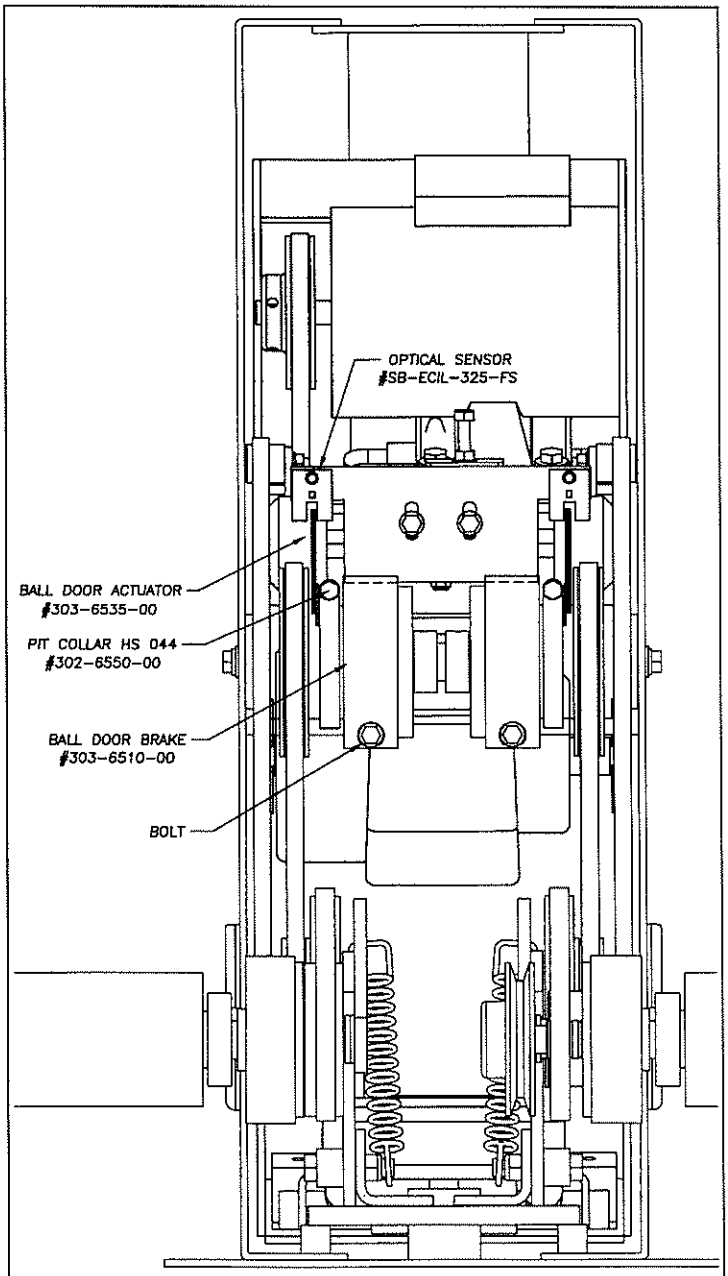


Figure 19 - Rear View

Ball Accelerator Maintenance Notes

Pin Elevator & Carrousel Staging

5A. Drive Chain Tension

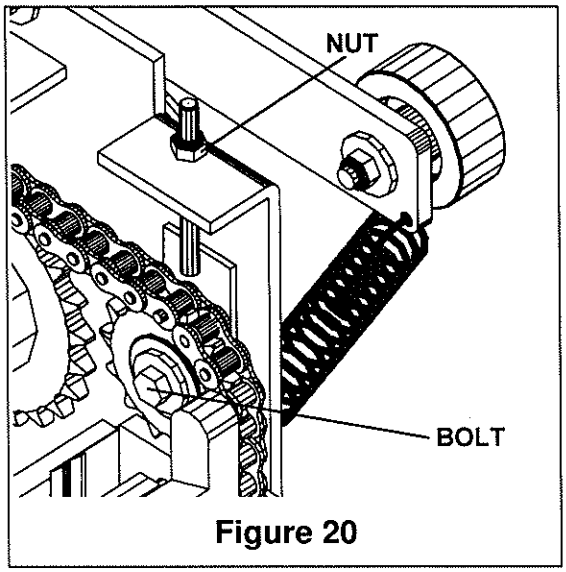


Figure 20

The pin elevator's chains must be adjusted so as to have the chains rotate freely on their sprockets. In order to adjust the tension on the chain, loosen the sprocket's bolt and then rotate the nylock nut in the desired direction. (Figure 20) Once the desired tension has been obtained, re-tighten the sprocket's bolt.

5B. Pin Alignment

The pin alignment bar (304-8200-00) must always be as taut as possible in order for the pin elevator to function correctly. In order to increment the pressure exerted on the pins, remove both metal screws (one on each side) which hold the guide rollers (303-5520-00) and pin alignment bar in place and then remove a section of the pin alignment bar by cutting it. Re-assemble the components. (Figure 21)

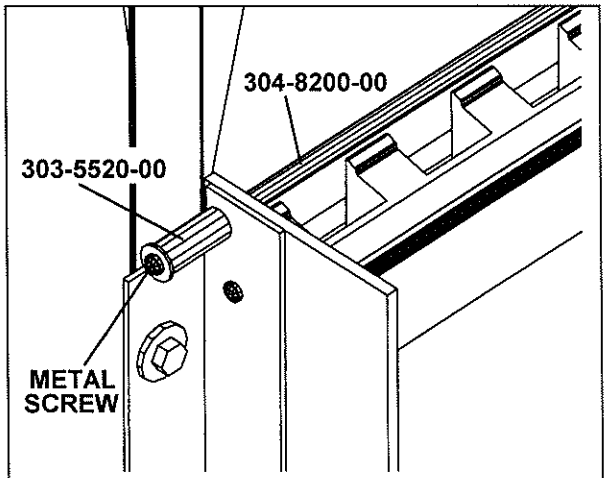


Figure 21

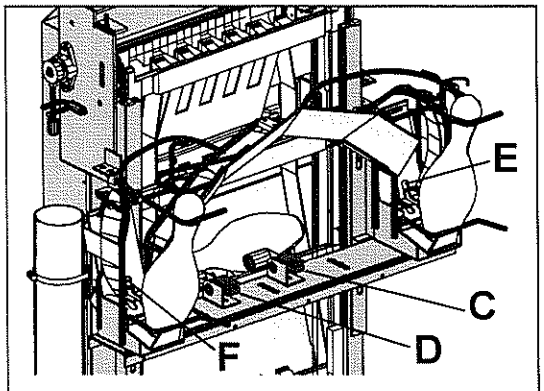


Figure 22 - Pins & Optos

Located on the carrousel staging assembly are four (4) optical sensors which determine the pin elevator's movement. All of these sensors function in a negative manner, which is to say that their actuators are always present in the sensor and are only removed by the presence of a pin.

5C. Right Pin Actuator

The pin elevator right side optical sensor (C in Figure 22) must be adjusted so as to detect a pin riding up the elevator with its head to the left. The pin must activate the right pin actuator (302-8560-00) from all positions (far left, far right and everything in between) without activating the pin elevator left side optical sensor (D in Figure 22).

5D. Left Pin Actuator

The pin elevator left side optical sensor (D in Figure 22) must be aligned so as to detect a pin riding up the elevator with its head to the right. The pin must activate the left pin actuator (302-8560-00) from all positions (far left, far right and everything in between) without activating the pin elevator right optical sensor (C in Figure 22).

The pin elevator optical sensors (C and D in Figure 22) are both adjusted in the same manner. Loosen the bolts which attach the actuator base (302-8550-00) to the carrousel staging frame and then move the base in the direction of the black arrows (Figure 23) until all pins are detected as previously specified. The pressure from the pin is indicated by the gray arrow in Figure 23. Once the adjustment is completed, re-tighten the bolts.

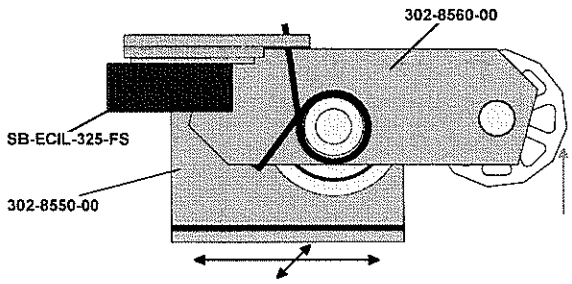


Figure 23 - Side View of Pin Elevator Opto

5E. Right Pin Loader Actuator

The pin loader right side optical sensor (E in Figure 22) must be adjusted so as to have the actuator (302-8550-00) completely removed from the sensor by a pin falling into the carrousel staging assembly as seen in the pin and optos diagram.

5F. Left Pin Loader Actuator

The pin loader left side optical sensor (F in Figure 22) must be adjusted so as to have the actuator (302-8550-00) completely removed from the sensor by a pin falling into the carrousel staging assembly as seen in the pin and optos diagram.

To adjust the pin loader sensors (E and F in Figure 22), Loosen the bolts which attach the actuator base (302-8550-00) to the carrousel staging frame and then move the base in the direction of the black arrows (Figure 24) until all pins are detected as previously specified. The pressure from the pin is indicated by the gray arrow in Figure 24. Once the adjustment is completed, re-tighten the bolts.

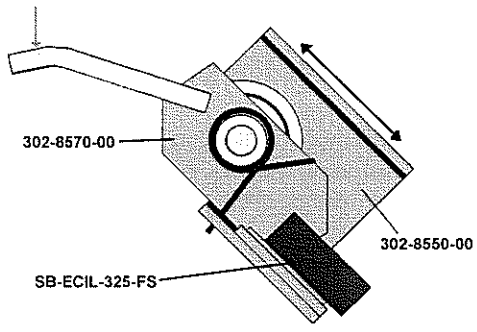


Figure 24 - Side View of Pin Loader Opto

5G. Clutch Cleaning & Lubrication

Cleaning and lubrication of the magnetic clutch (301-1400-00) and the pulley (302-2090-00) must be performed on a bimonthly basis (every two months). To do this, the assembly should be **removed** from the pinsetter and cleaned. The components should be cleaned with a solvent such as a paint thinner. The components should then be dried using a towel. The shaft (302-2080-00) of the machine where the clutch assembly is normally inserted should also be cleaned with a clean rag while the clutch assembly is out being cleaned as per the above.

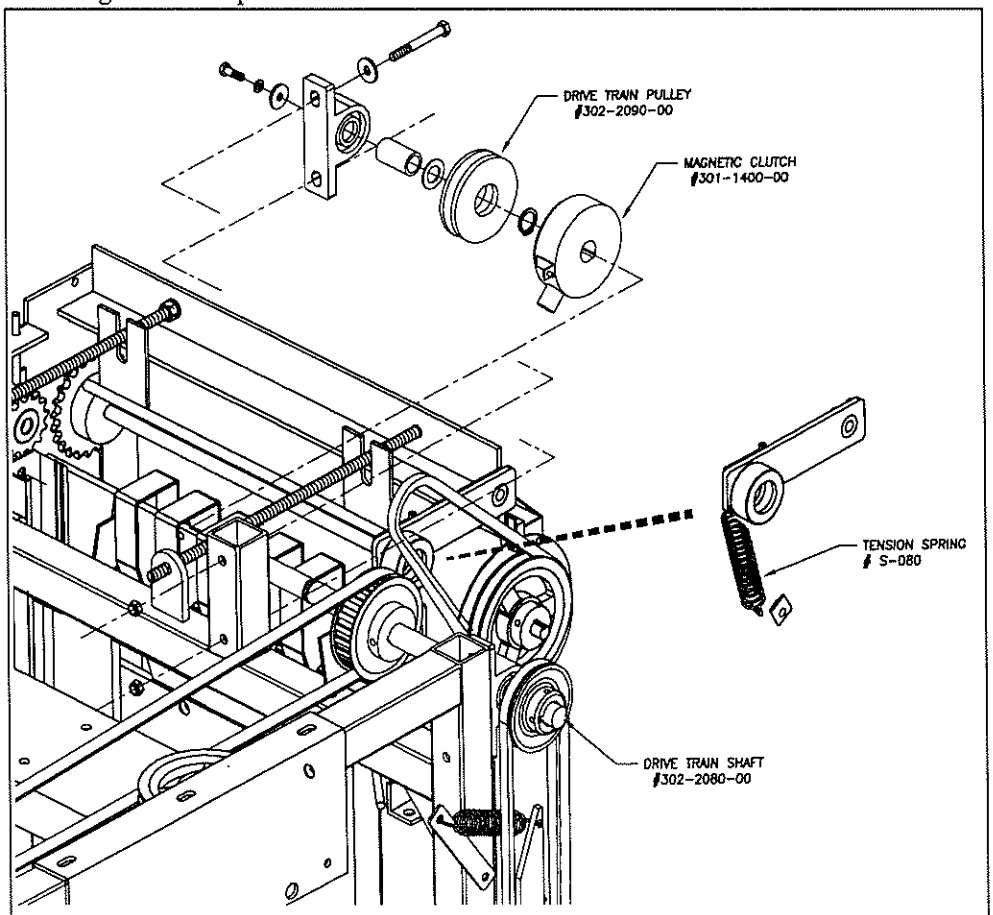


Figure 25 - Pin Elevator Clutch Assembly

To remove the clutch assembly, you must first remove the belt. The tension on the belt must first be removed by removing the spring (S-080) as shown in Figure 25. The belt will now come off easily.

Prior to re-assembly, **lightly** lubricate the shaft with an anti-seize lubricant such as *Loctite Anti-Seize Brush Type No. 76764*, and make sure that the clutch components travel freely on the shaft. Do not apply too much lubricant so as to have it overflow from the shaft to the components' outer surfaces. The clutch's facing must **never** be lubricated. A lubricant is available from Mendes and its affiliated distributors under part number Z-76764.

Following re-assembly of the clutch assembly, make sure to replace the spring in order to re-establish tension on the belt. Cleaning and lubrication of the magnetic clutch assembly is critical for proper performance. Failure to have a clean, well lubricated clutch will result in elevator jams.

5H. Elevator Movement Opto

The elevator movement opto (SB-ECIL-325-FS) keeps the pinsetter's electronics informed of the movement of the elevator so as to be able to shut off the motor in the case of a pin jam. The optical sensor must be kept aligned with the elevator's pulley (302-8230-00) in order to function. To adjust the opto, simply loosen the screws which attach it to the frame and then move it in the necessary direction until it is perfectly aligned with the pulley. Make sure that the pulley does not come in contact with sensor. It must pass freely through the sensor's slot. (Figure 26)

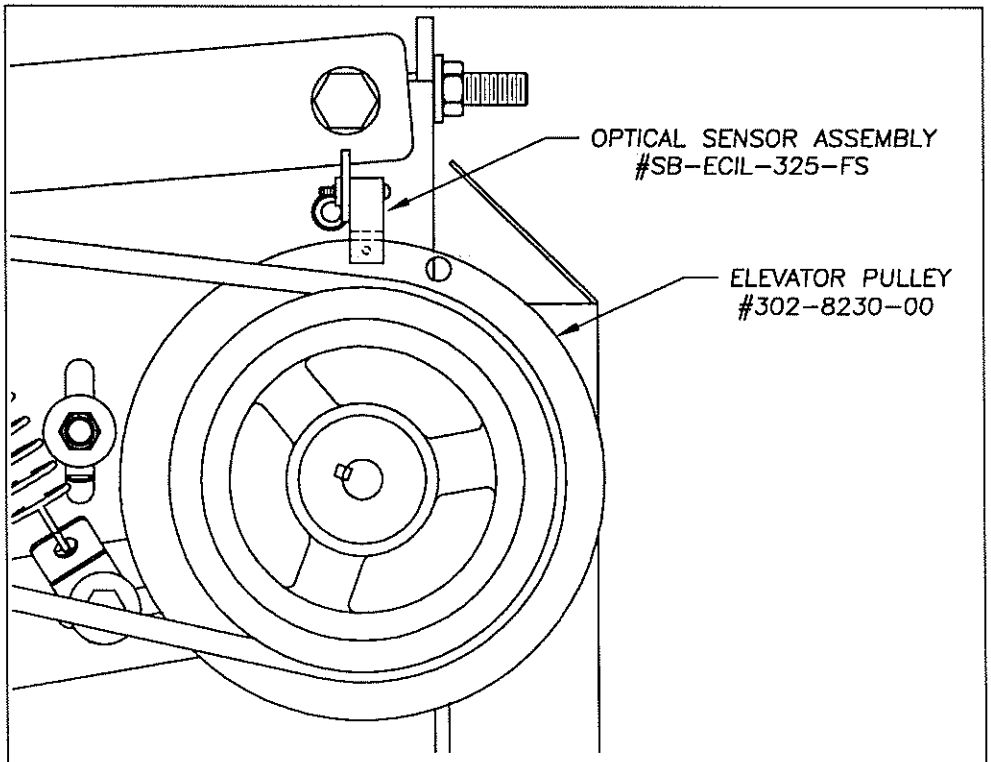


Figure 26

Pin Elevator & Carrousel Staging Maintenance Notes

Carrousel

The carrousel adjustments should always be carried out as a whole since one adjustment usually influences another one directly or indirectly. The order in which the adjustments appear are the order in which they should normally be performed.

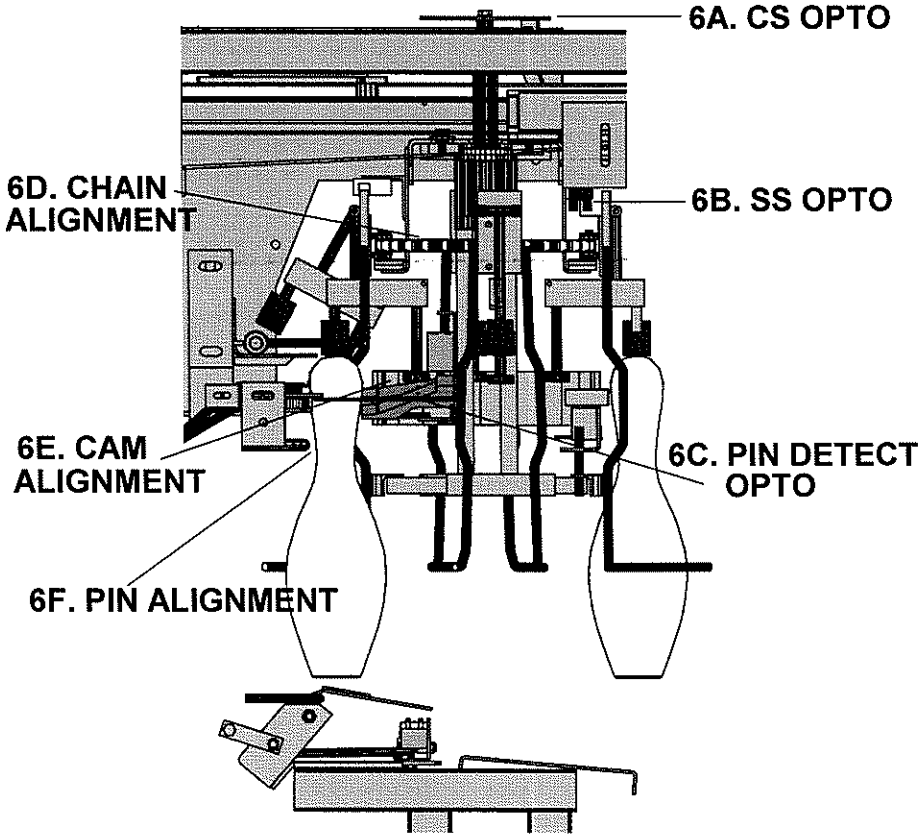


Figure 27 - Carrousel Adjustment Points

6A. Synchronization Opto

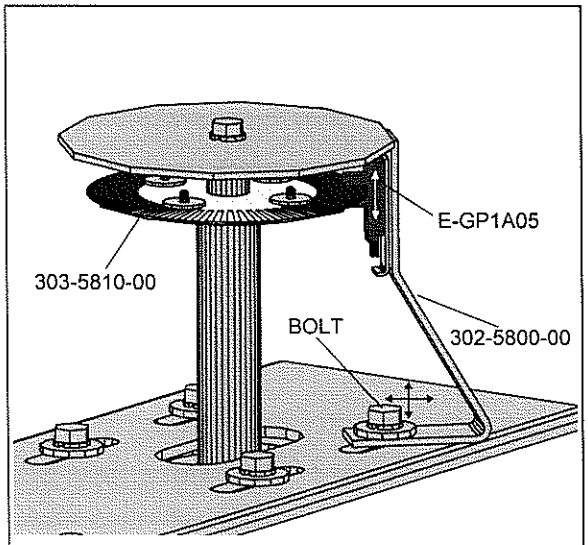


Figure 28

The encoder's optical sensor (E-GP1A05) located on top of the carrousel must be positioned so as to have the encoder (303-5810-00) pass through its center. To adjust the sensor, simply loosen the bolt which holds it in place and move the sensor's mounting plate (302-5800-00) in the direction of the arrows. (Figure 28) Once aligned, re-tighten the bolt.

At this point verify that the encoder does not touch the optical sensor as it rotates. The sensor may be moved up or down as indicated by the white arrows.

6B. Station Synchronization Opto

The SS optical sensor (SB-ECIL-325-FS) keeps the carrousel's station in sync. Its actuator (302-5330-00) must cut the opto's signal at each passage. The sensor is aligned with its actuator by loosening the sensor's screws and moving it in the direction of the arrows. (Figure 29) Re-tighten the screws once aligned.

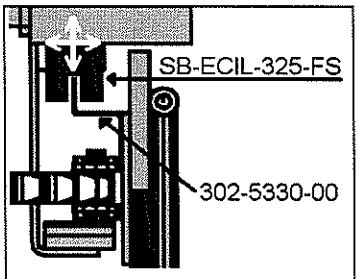


Figure 29

6C. Pin Detect Opto

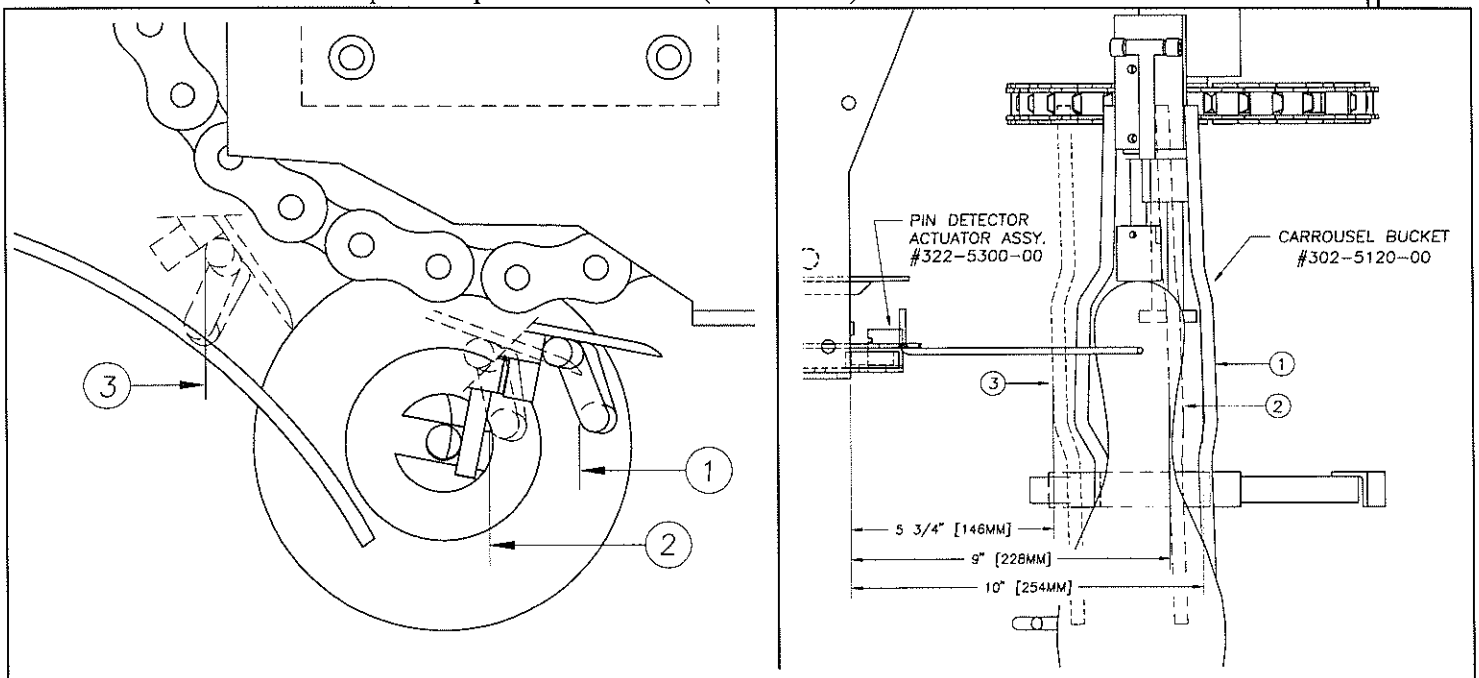
The pin detector actuator assembly (322-5300-00), used to detect the pins as they round the front of the carrousel in their buckets (302-5120-00), must be adjusted so as to have the actuator completely removed from the optical sensor by a passing pin.

This adjustment must be performed in conjunction with the Magnet 2001 Controller. Proceed to Menu 1.1.4.3 which displays the status of each one of the eight optical sensors used to determine the functioning of the carrousel. The information of interest is the **Pd** status which should initially be at **1** since the actuator is obstructing the opto.

Position one of the carrousel buckets with a bowling pin as shown in Figure 30, ***Position 1***. The pin should be as close as possible to the pin detector's arm without touching it. Measure the distance between the carrousel bucket's arm and the frame as indicated. If the measurement is not 10" (254mm), loosen the bolt which holds the detector assembly in place and move the assembly until the required distance is obtained. Re-tighten the bolt.

Proceed to turn the carrousel until it is in the arm is 9" (228mm) from the frame (Figure 30, ***Position 2***) The display on the Magnet 2001 Controller should change from **1** to **0**. Again proceed to turn the carrousel until the arm is 5¾" (146mm) from the frame. (Figure 30, ***Position 3***) The display on the Magnet 2001 Controller should now change from **0** back to **1**.

If the measurements do not coincide with the Magnet 2001 Controller display, the pin detector actuator may have been bent out of shape. Correct the situation if able, otherwise replace the pin detector actuator (302-5310-00).



Top View Figure 30 Side View

6D. Chain Alignment

The carrousel's chain guide supports (303-5010-00) must be adjusted in order to do exactly as their name implies, support the carrousel chain (302-5050-00) in order that it remain centered on the two sprockets on which it rotates. To align the chain with its sprockets, loosen the bolts which hold the mounting plates (302-5010-00) in place and then move the mounting plates in the direction of the arrows until the chain guide supports are as shown in Figure 31. (the carrousel chain is shown by the dotted lines) Re-tighten the bolts once completed.

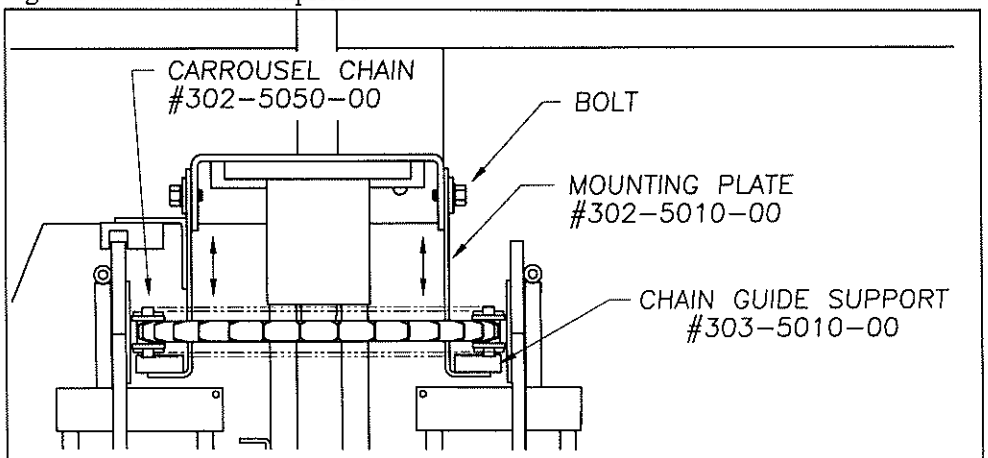


Figure 31

6E. Cam Alignment

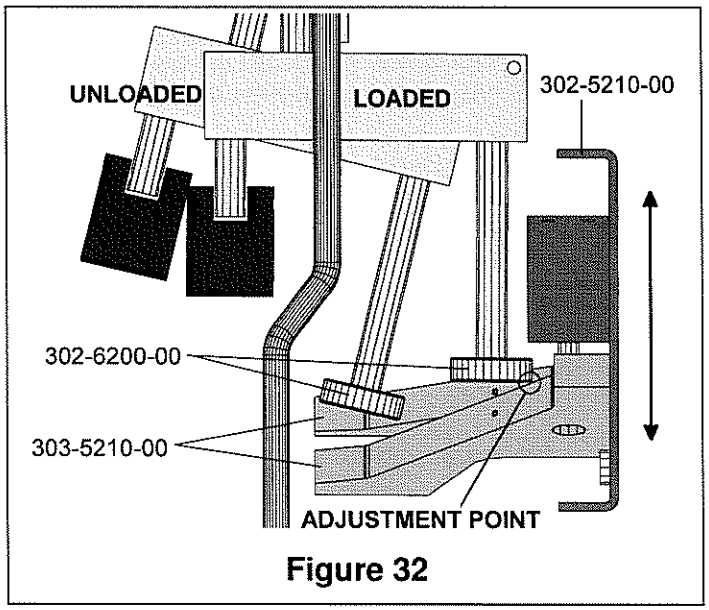


Figure 32

The carrousel's fourteen ball bearings (302-6200-00) located on the magnet assemblies must have the least possible amount of space between themselves and the seven solenoid cams (303-5210-00). When the magnet assemblies are in their loaded positions, verify the spacing at the location marked by the circle for all 14 magnet assemblies. Make the necessary adjustment in conjunction with the ball bearing and cam which are the closest together. To adjust the space between the ball bearings and the cams, loosen the bolts which hold the mounting plate (302-5210-00) in place and then move the mounting plate in the direction of the arrows. (Figure 32) Once the desired space is obtained, re-tighten the bolts.

6F. Pin Alignment

The space between a passing pin and the pin guide (302-5730-00) must be 3/32" (2.4mm). To adjust the space, loosen the bolt which holds the pin guide in place and then move it in the direction of the arrows until the required spacing is obtained. Re-tighten the bolt when done. (Figure 35)

6G. Magnet Disengagement Plate

In order to correctly adjust the magnet disengagement plate (303-5700-00), the #10 template (Z-ME5010) must be used. The template must fit at both ends (left and right) of the magnet disengagement plate as shown in Figure 33. If it doesn't, loosen the bolts which hold the head rest frame (302-5700-00) in place and then move the head rest frame in the direction of the arrows until the template fits perfectly. *You may find it easier to perform this adjustment with two #10 templates.*

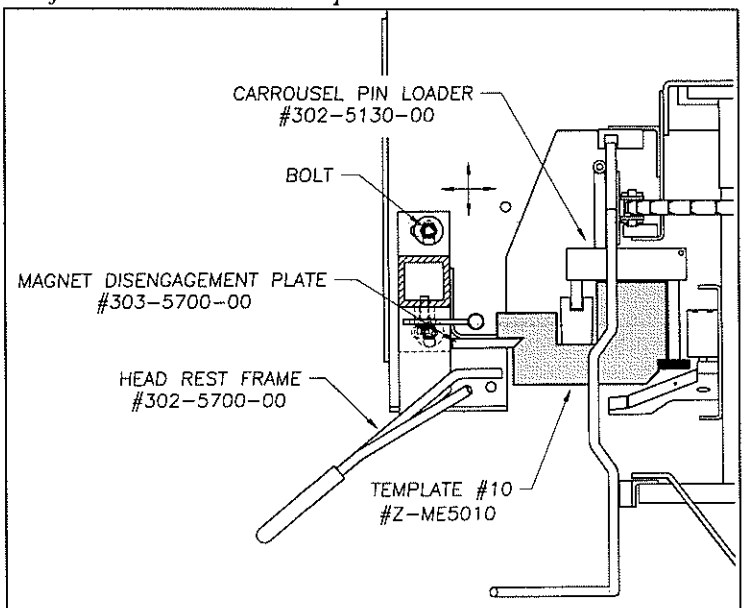


Figure 33

6H. Magnet Guide Rod

In order to correctly adjust the magnet guide rod (302-5710-00), the #20 template (Z-ME5020) must be used. The template must fit at both ends (left and right) of the magnet guide rod as shown in Figure 34. If it doesn't, loosen the bolts which hold the magnet guide rod in place and then move the magnet guide rod in the direction of the arrows until the template fits perfectly. *You may find it easier to perform this adjustment with two #20 templates.*

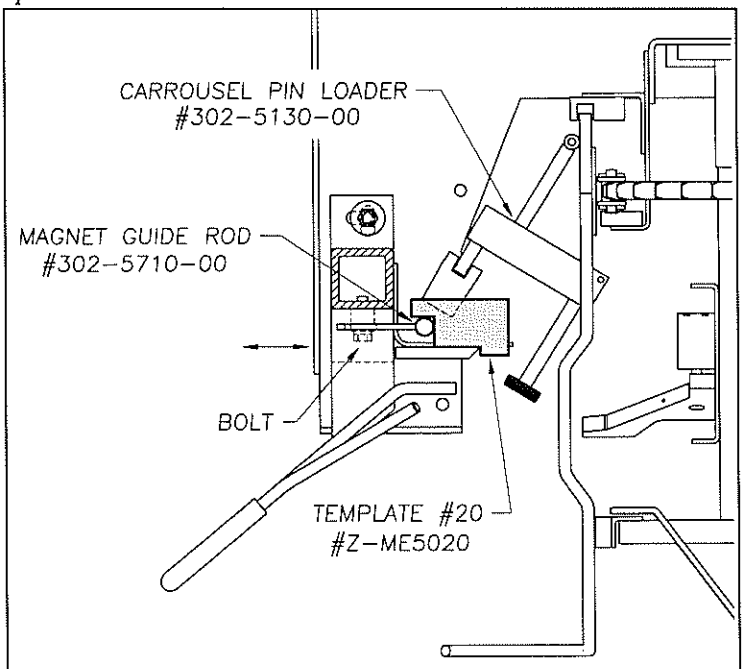


Figure 34

6I. Pin Drop Height

In order to correctly adjust the pin drop height, the #30 template (Z-ME5030) must be used. Position the template on the magazine station assembly (322-5510-00) as shown in Figure 35. There should be a 1/8" (3mm) gap between the template and the bowling pin. If there isn't raise or lower the magazine station assembly by removing the bolts which hold it in place and shimming the height using flat washers (7050-040112-012).

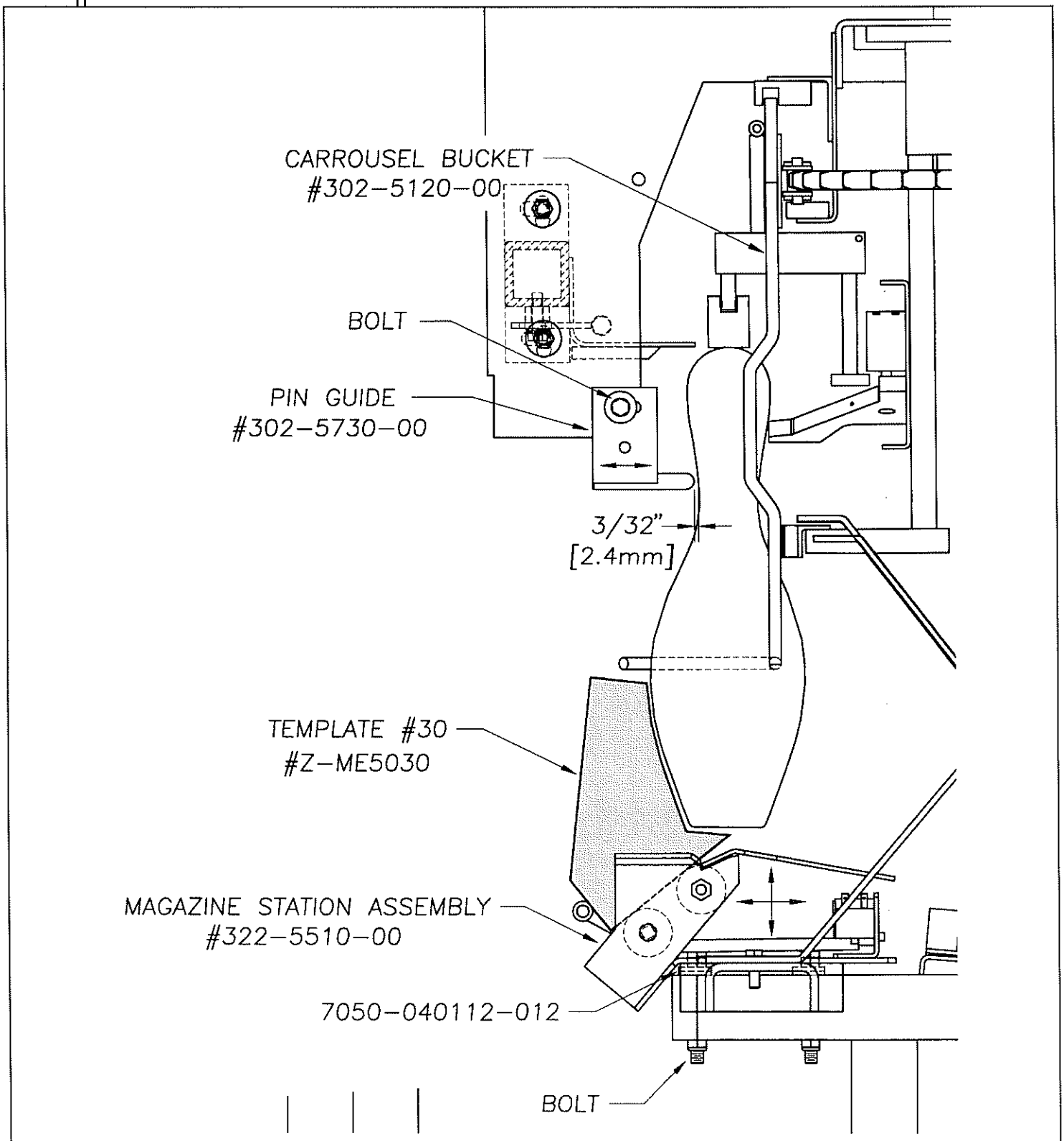


Figure 35

Carrousel Maintenance Notes

Magazine

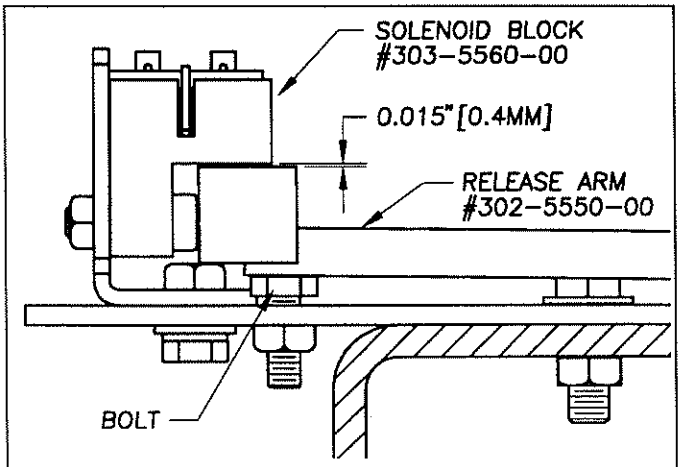


Figure 36

7A. Solenoid Block

Without the magazine station's solenoid being activated, the distance between the bottom of the solenoid block (303-5560-00) and the top of the release arm (302-5550-00) toe must be kept at 0.015" (0.4mm). Rotate the bolt located beneath the release arm until the correct distance is obtained. (Figure 36)

7B. Solenoid Bracket

With the magazine station's solenoid activated, the distance between the side of the solenoid block (303-5560-00) and the side of the release arm (302-5550-00) must be kept at 1/16" (2mm). Move the solenoid bracket (302-5560-00) in the direction of the arrows to obtain the required distance. (Figure 37)

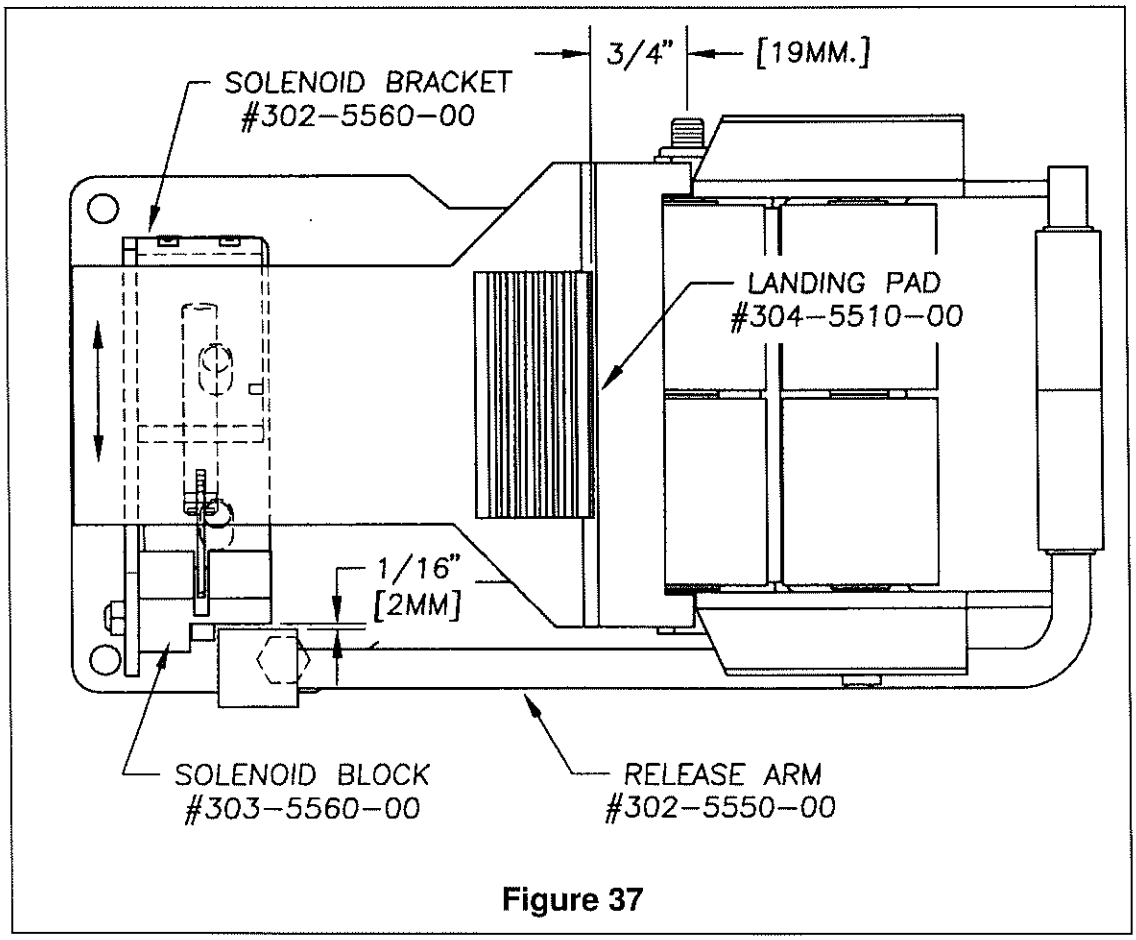


Figure 37

7C. Landing Pad Replacement

The landing pad (304-5510-00) is glued to the station. When replacing the landing pads, clean the metal surface with an acetone solvent before gluing the new pad in place. Place the new landing pad 3/4" (19mm) from the center of the first row of guide rollers as indicated in Figure 37.

7D. Detection Bar Assembly

When pins are in the magazine, their heads must be centered on the detection bar assembly (SB-308-5700) at a distance of 3/16" (5mm). To adjust this distance, loosen the bolts which hold the detection bar assembly in place and move it in the desired direction as shown by the arrows until the necessary distance is obtained. Re-tighten the bolts. (Figure 38)

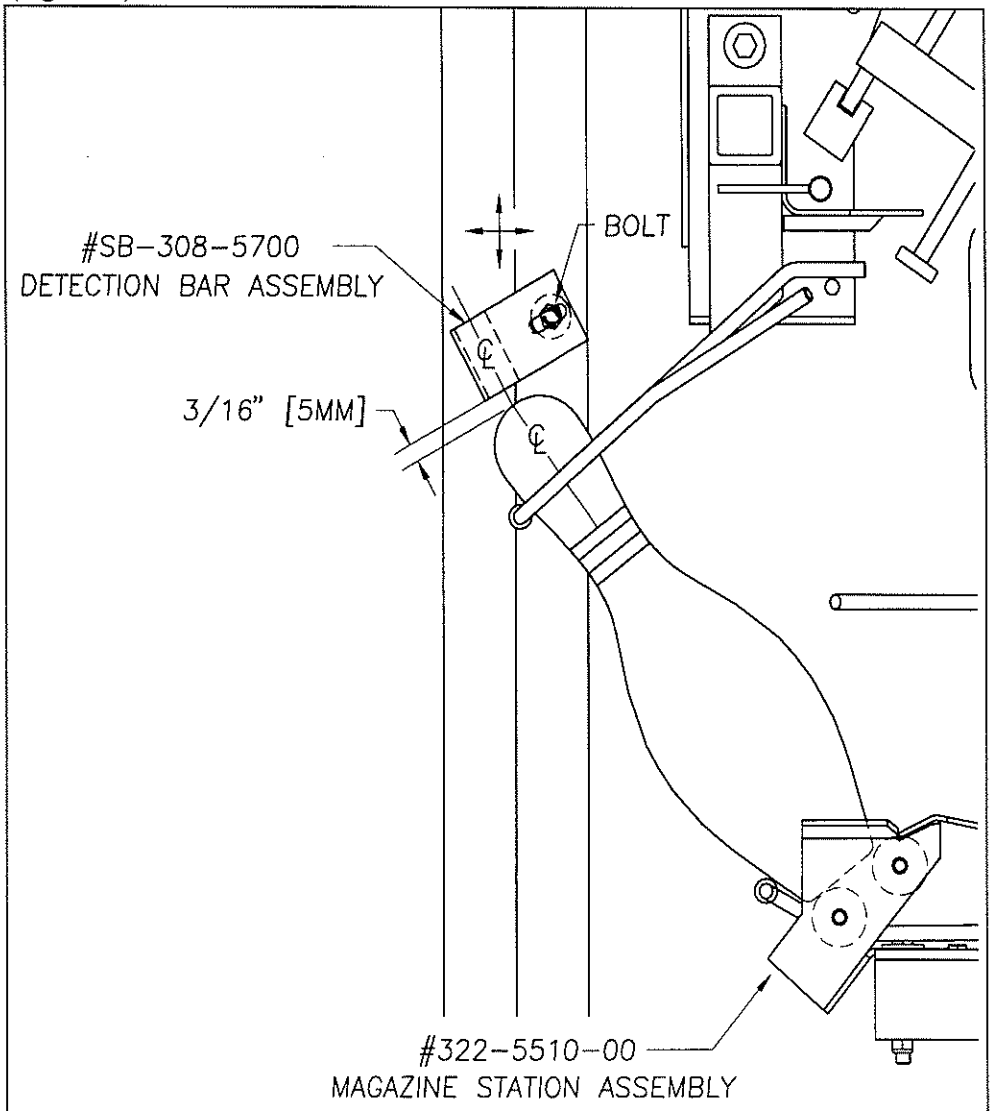


Figure 38

7E. Flange Bearings Lubrication

The magazine stations' flange bearings (302-5520-00) must allow the release arm (302-5550-00) to open and close without the slightest restriction. To allow this, the flange bearings must be oiled with very small quantities of SW10 motor oil on a bimonthly basis (every two months) only if judged necessary. Don't forget that any excess oil will only drip into undesired places causing headaches for cleaning.

Refer to pages 252-253 in the Parts section of this manual for the flange bearings' location. Don't forget to check each one of the seven stations.

Magazine Maintenance Notes

Drawer

8A. Triangle

The drawer's triangle is formed with rows of tubular metal with pin cups bolted to them. The tubulars must always be kept parallel to each other in order to maintain a perfect triangle.

The drawer needs to be completely adjusted if your pinsetter experiences a lot of "Drawer Troubles" or if pins are set out of spot in a de-formed triangle. Steps 1 through 7 must be carried out in order when performing a complete triangle adjustment.

If the drawer suddenly becomes de-calibrated after a drawer obstruction, steps 2, 3 and 6 need only be performed.

1. Join the drawer's two main components by using two large "C"clamps as shown in Figure 39.

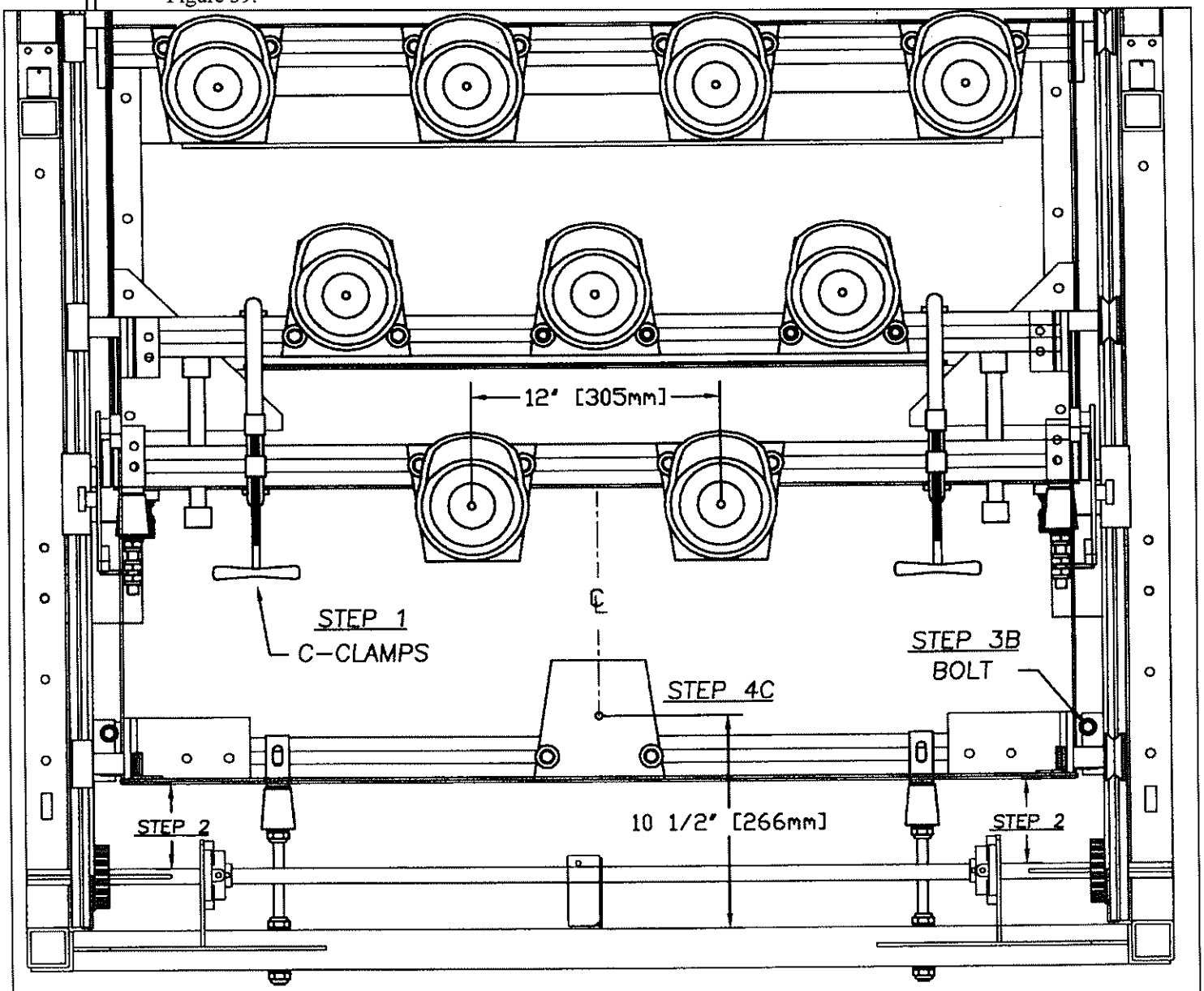


Figure 39

2. Measure the distance from the front of the drawer to the drive shaft at both extremities as indicated in Figure 39 to ensure that they are parallel to each other. If they are parallel go to step 4, otherwise complete step 3.

3. Remove the tension on the drawer's belt. To do so loosen the four bolts which hold the left (302-3035-00) and right (302-3030-00) tension plates in place and also by loosening the two nuts as indicated in Figure 40. Remove the two bolts which hold the mounting plate (302-3360-00 in place as shown in Figure 40. Do not remove the mounting plate since doing so will cause the drawer belt to be separated.

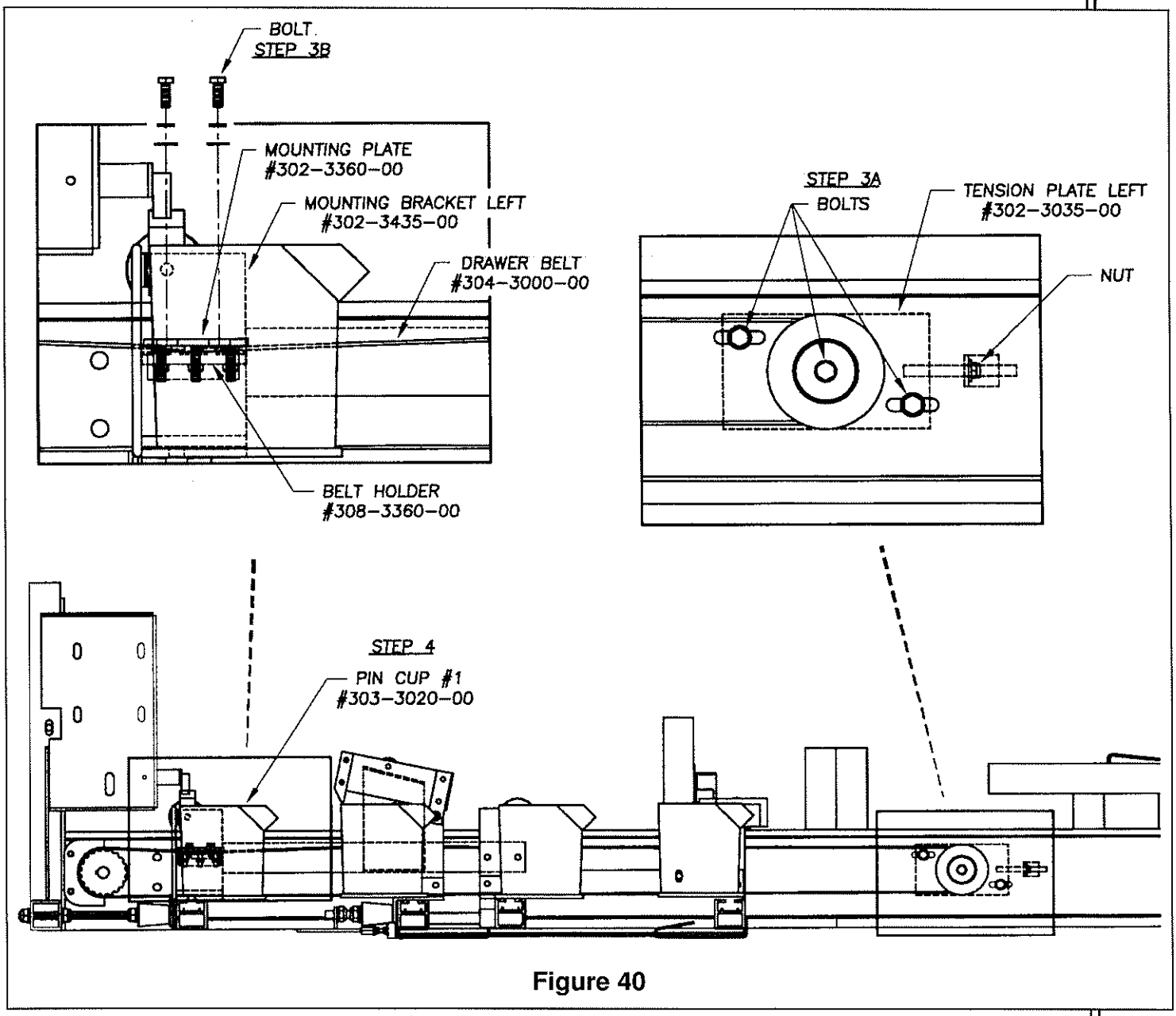


Figure 40

4. Remove pin cup #1 (303-3020-00) and use the bumper pads (304-1560-00 shown in Figure 41) located on both sides of the drawer to position the drawer's frame assembly 10½ inches (266mm) from the frame as indicated in Figure 39.

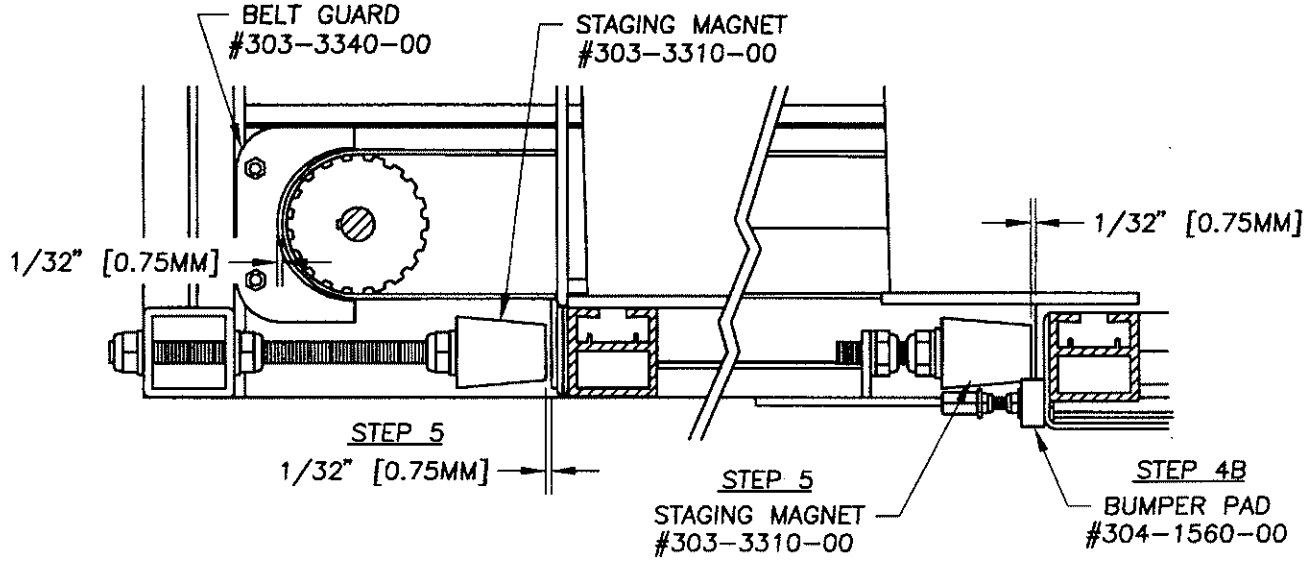


Figure 41

5. Adjust the four staging magnets (303-3310-00) to obtain a space of 1/32" (0.75mm) as indicated in Figure 41.
6. If Step 3 was completed, re-assemble the drawer belt and its mounting plate jumping the number of notches in the required direction in order to maintain the drawer's parallelism and then re-tension the drawer's belt. Check the drive belt tension as described in adjustment 8B.
7. Replace pin cup #1 and remove the two "C" clamps.

8B. Drive Belt 304-3000-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belt and if the recession is less, you must loosen the belt. loosen the left (302-3035-00) and/or right (302-3030-00) tension plate and then use the nut to increase or decrease tension. (Figure 40)

8C. Out of Spot Pin

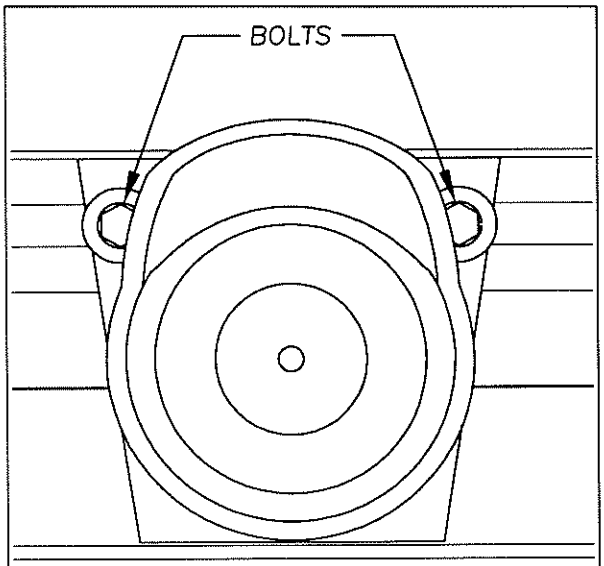


Figure 42 - Top View

If only one pin is constantly set out-of-spot and no drawer troubles are signaled through the Magnet 2001 Controller, it is probably just a case of relocating the pin cup on its tubular bar. This adjustment only effects the left and right positioning of the pin.

To relocate a pin cup, simply loosen the bolts which hold it in place as indicated in Figure 42 and then move it in the desired direction. Once completed, re-tighten the bolts.

When tightening the bolts, be sure to respect the 25 FT. LB. (112 N/M) torque. Failure to do so may result in breaking a bolt which will mean dismantling the complete drawer in order to replace it.

8D. Drawer Hook

Completely close the drawer (push to the rear) and check the space between the plastic hook (303-3320-00) and the pulley shoulder (302-3350-00). The necessary spacing is 1/16" (2mm). To adjust the space, loosen the bolts which hold the hook plate (302-3320-00) in place and then re-tighten them when the spacing is correct. (Figure 43)

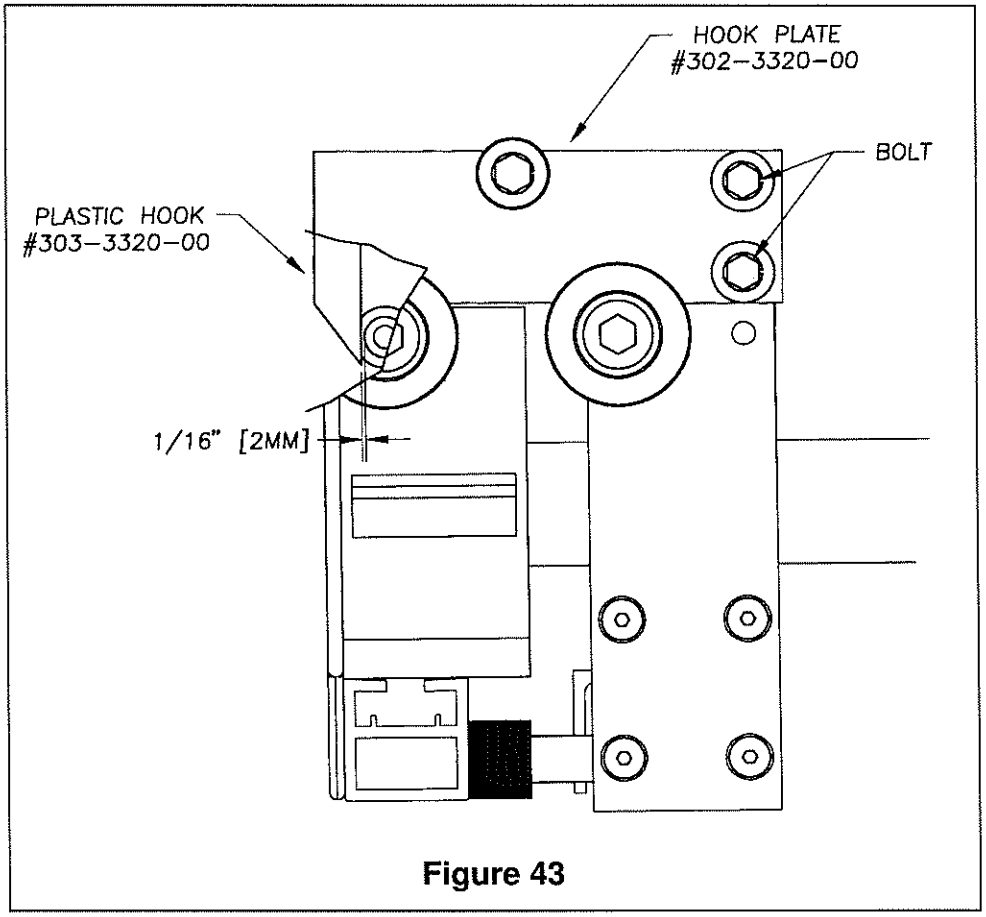


Figure 43

8E. Drive Belt 304-3010-00 Tension

Using the belt tension tool (Z-ME4300) apply a force of 5lbs (2.25kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4 on page 72. If the recession depth is greater, you must tighten the belts and if the recession is less, you must loosen the belts.

To adjust the tension on the belts, loosen the bolts which hold the motor in place and then use the nut at the top to increase or decrease tension. (Figure 44)

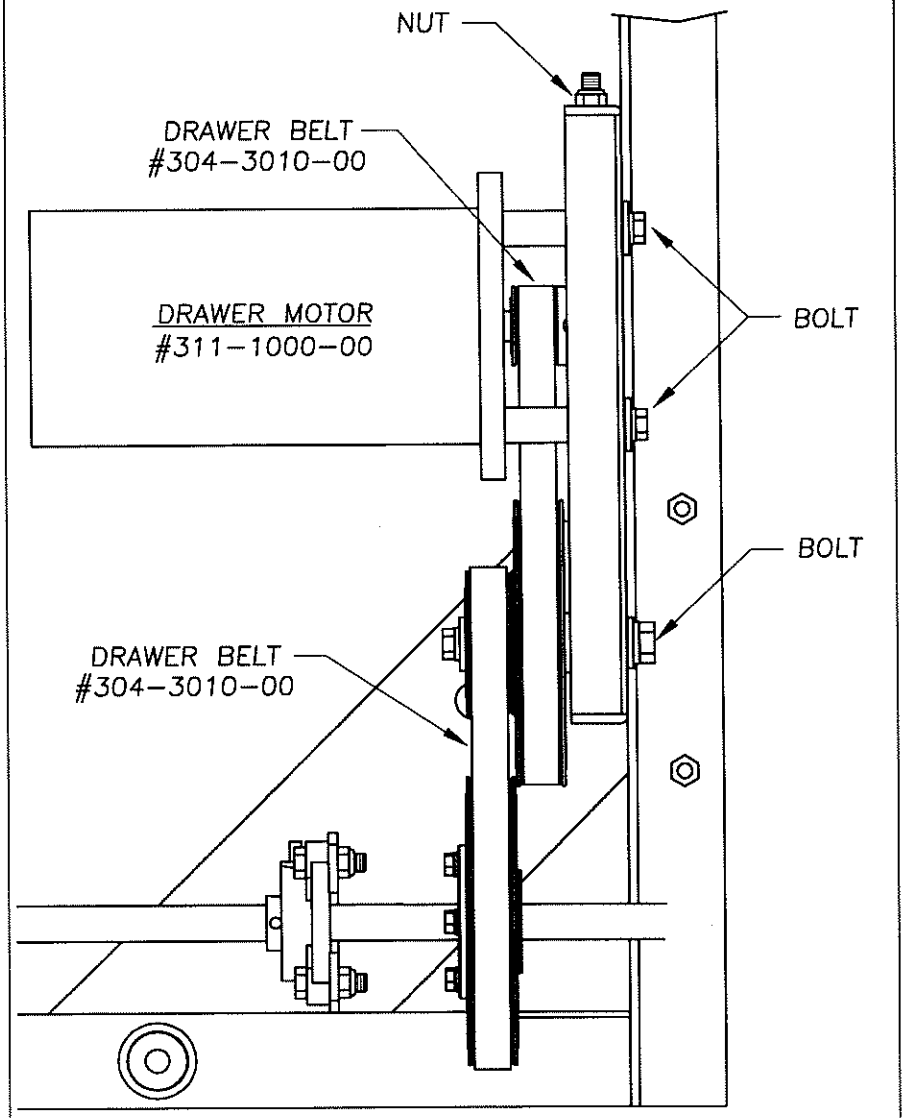


Figure 44

8F. Front Limit Actuator

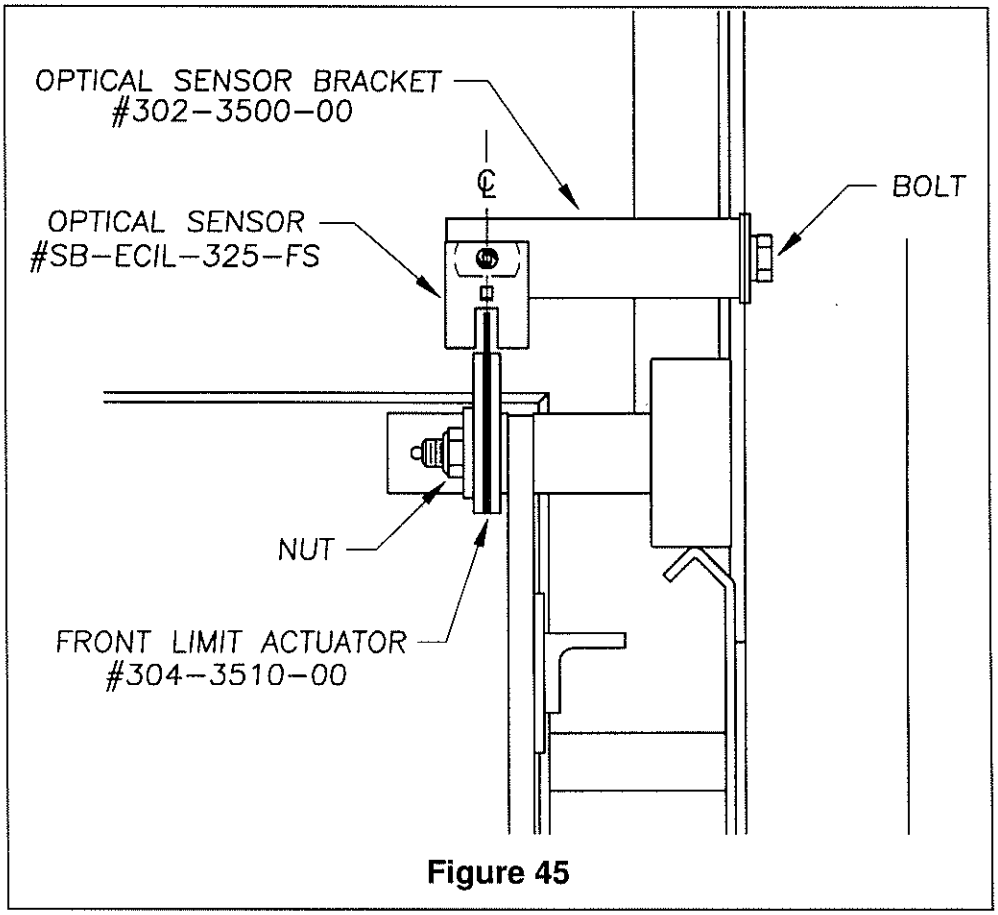


Figure 45

The drawer's front limit optical sensor must be kept centered with its actuator (304-3510-00). The front of the actuator must also be kept flush with the front of the optical sensor when the drawer is its front position. Place the drawer in its front position, loosen either the nut which holds the actuator or the bolt which holds the bracket (302-3500-00) and adjust the two until perfectly aligned. (Figure 45 and Figure 46)

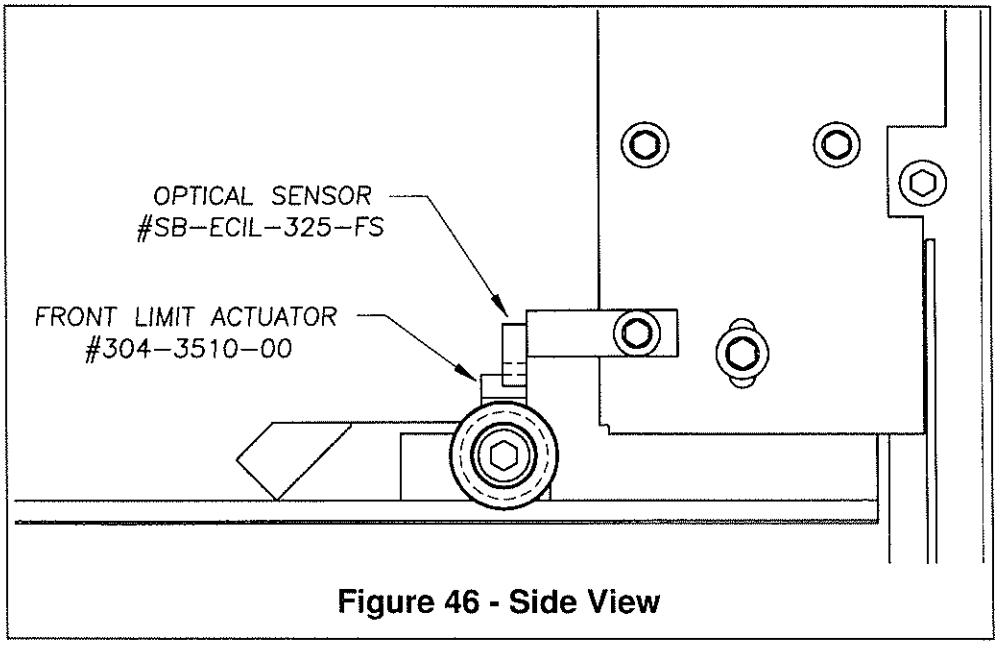


Figure 46 - Side View

8G. Back Limit Actuator

The drawer's back limit optical sensor must be kept centered with its actuator (304-3530-00). Place the drawer in its rear position, loosen either the nut which holds the actuator or the bolt (7016-410632-100) which holds the sensor and adjust the two until perfectly aligned. (Figure 47)

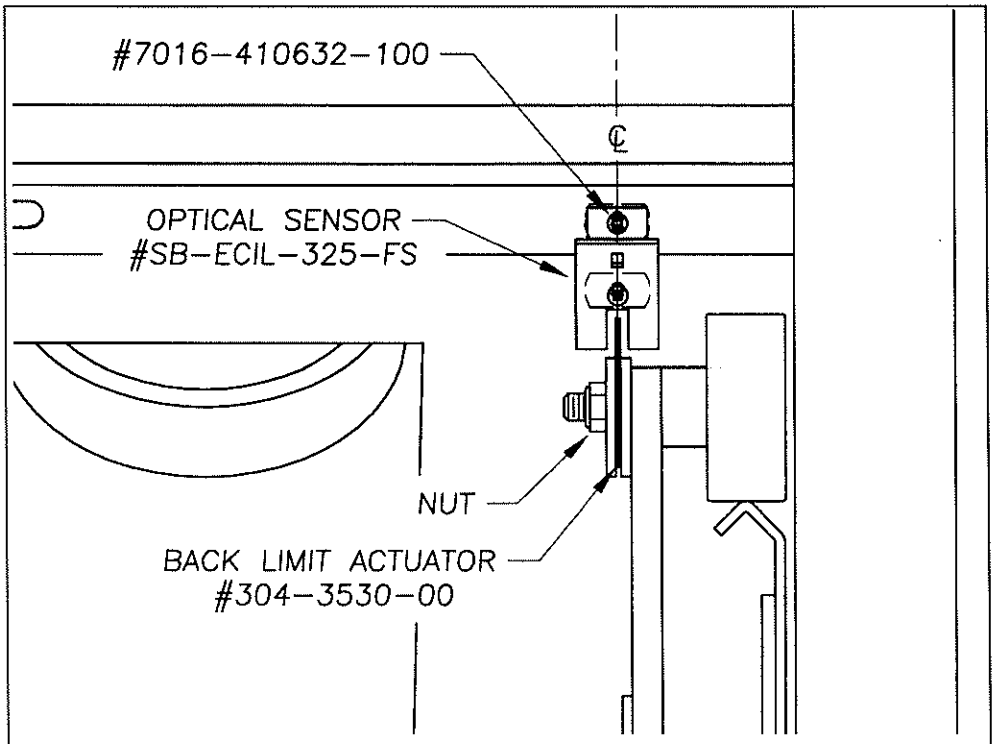


Figure 47

8H. Drawer Obstruction Opto

The drawer obstruction transmitter (SB-1500-42) and receiver (SB-1500-41) must be perfectly aligned in order to avoid unnecessary stoppages. The infrared light beam should be aligned in a manner to have the LEDs on both assemblies green. (Figure 48) If both LEDs aren't green, loosen the screws which hold one of the assemblies in place and move it until perfectly aligned. (both LEDs green)

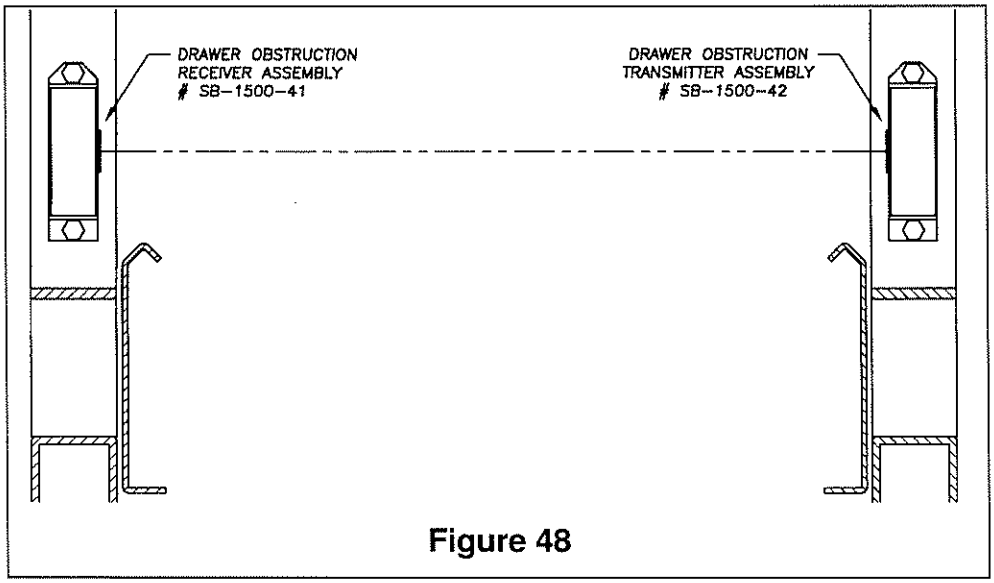


Figure 48

Drawer Maintenance Notes

Deck

9A. Wire Length

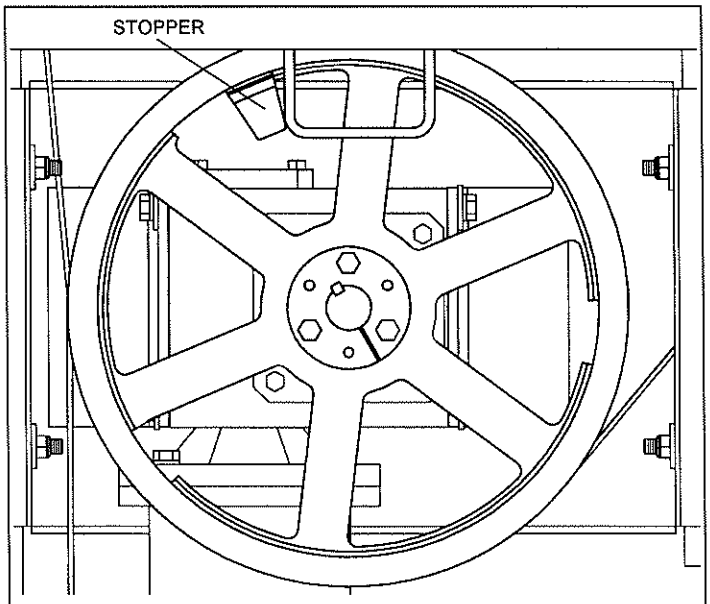


Figure 49 - Deck Pulley (Top View)

Using the manual deck crank (part number Z-ME4100), raise the deck to its maximum height and then check that the 14" (355mm) pulley has stopped rotating due to its stopper and not due to the deck wires being too tight. This may be seen by looking at the 14" pulley from the top of the pinsetter. (Figure 49)

If the pulley has **not** stopped due to its stopper, loosen the nylock nut(s) (7036-002520-000) which hold the deck wires in place until you can manually crank the deck all the way to the stopper. (Figure 50) There are three such nylock nuts. (one for each deck wire)

Once the pulley is held in place with the stopper, adjust the two side deck wires in the same manner as explained in the previous step until a ½" (13mm) gap is obtained between the deck column guide (303-1540-00) and the deck column's top. (Figure 51)

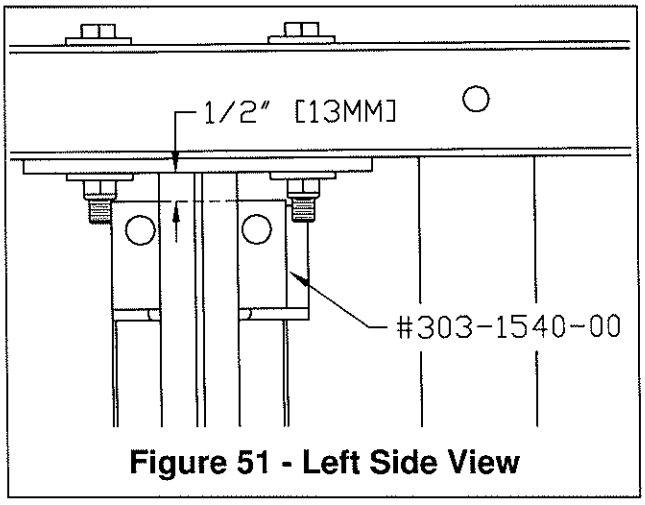


Figure 51 - Left Side View

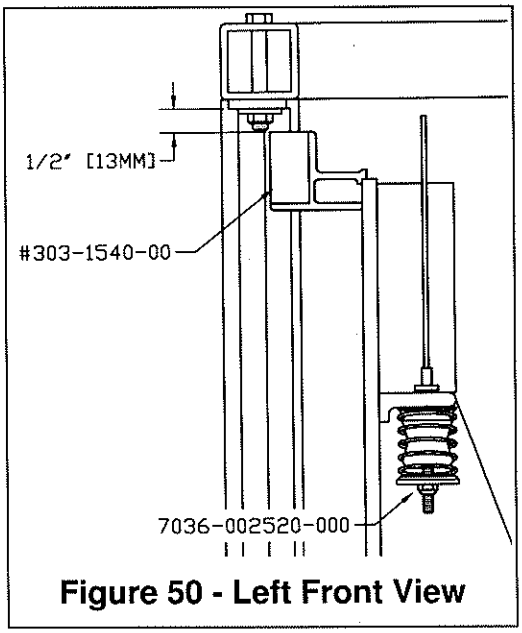


Figure 50 - Left Front View

With the deck in its upper position, check the deck's upper limit optical sensor to ensure that it is flush with the actuator. (Figure 52) If necessary, lower or raise the optical sensor by loosening the hexagon nut (7034-003118-000) in order to align it with the actuator (302-1610-00). Also make sure that the actuator is at a 90° angle with the deck's column. Failure to do so will cause the optical sensor to deteriorate due to friction caused by the actuator.

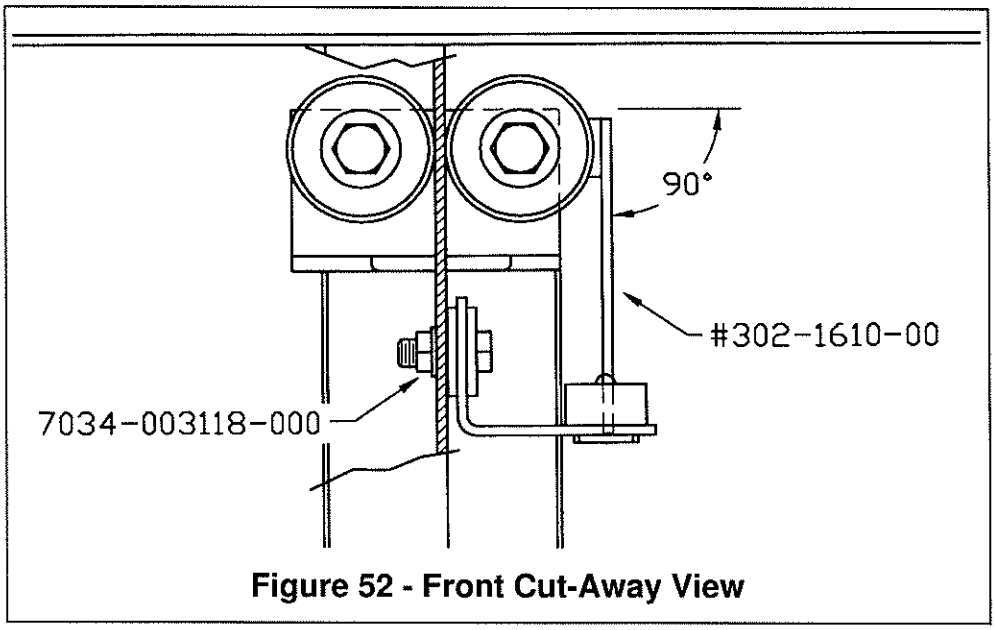


Figure 52 - Front Cut-Away View

9B. Pin Height

Perform adjustment 9A before attempting this adjustment.

Suspend pin numbers 1, 7 and 10 from their respective positions in the deck. Using the manual deck crank (part number Z-ME4100), lower the deck until the base of the lowest pin is 0.020" (0.5mm) from the lane's pin deck. (Figure 53)

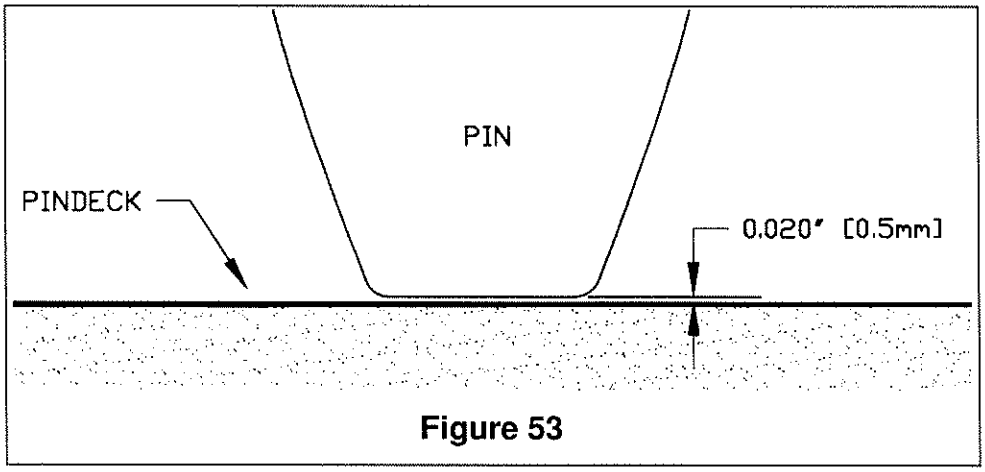


Figure 53

Place the deck parallel to the pin deck by adjusting the deck wires, as explained in 9A, of the two remaining pins which are not yet at 0.20" from the lane's pin deck.

Example: pin #7 is the lowest pin. Once pin # 7 is 0.20" from the pin deck, adjust the deck's right side wire (pin #10) until pin #10 is also 0.20" from the pin deck. Once pin # 10 is 0.20" from the pin deck, adjust the deck's front wire (pin #1) until pin #1 is also 0.20" from the pin deck.

9C. Bumper Height

Perform adjustment 9B before attempting this adjustment.

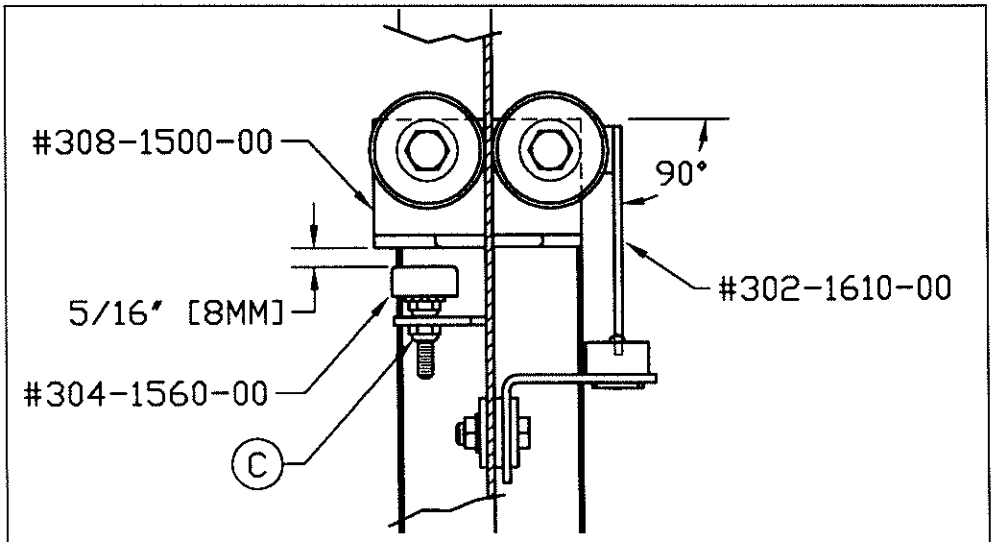


Figure 54 - Front Bumper (Cut-Away View)

With all three pins 0.20" from the pin deck, the distance between each bumper (304-1560-00) and the deck frame (308-1500-00) must be adjusted to 5/16" (8mm) . Loosen the lock nut **(C)** which holds the bumper in place, then screw or unscrew the bumper itself until the necessary distance is obtained. Re-tighten the lock nut. (Figure 54 and Figure 55)

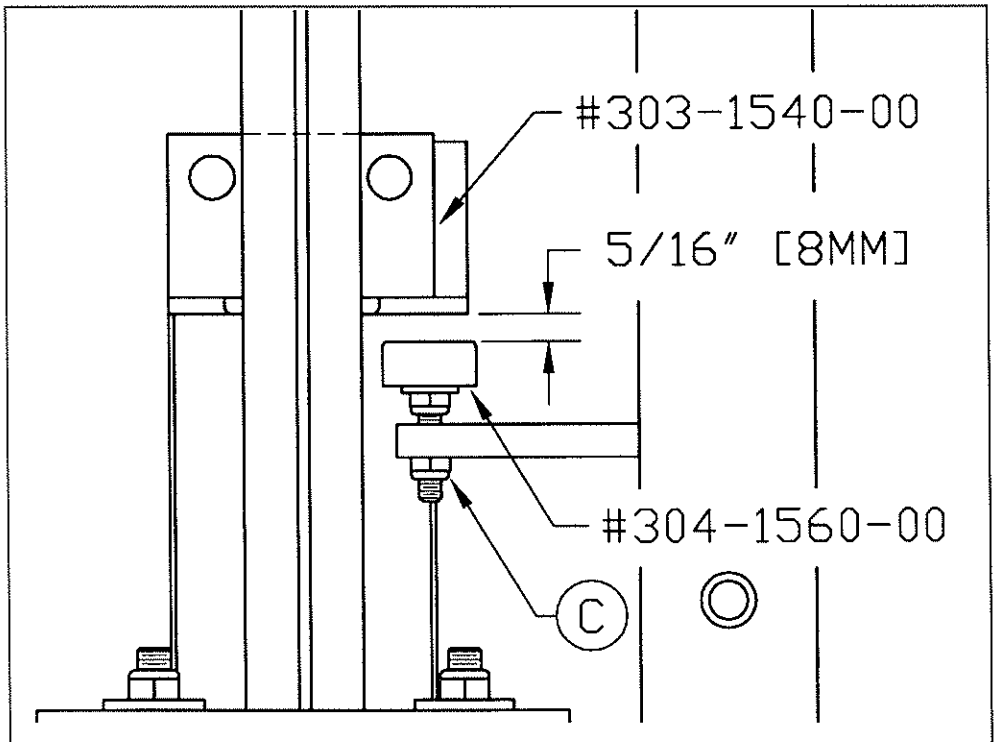


Figure 55 - Left Side Bumper

9D. Lower Limit Opto

Perform adjustment 9C before attempting this adjustment.

Using the manual deck crank (part number Z-ME4100), lower the deck until it rests on the bumpers which were adjusted in 9C. Check the deck's lower limit optical sensor to ensure that it is flush with the actuator's bottom. If necessary, lower or raise the optical sensor by loosening the hexagon nut (**D**) in order to align it with the actuator (302-1610-00). (Figure 56) Perform a deck calibration through the Magnet 2001 Controller once the opto has been adjusted.

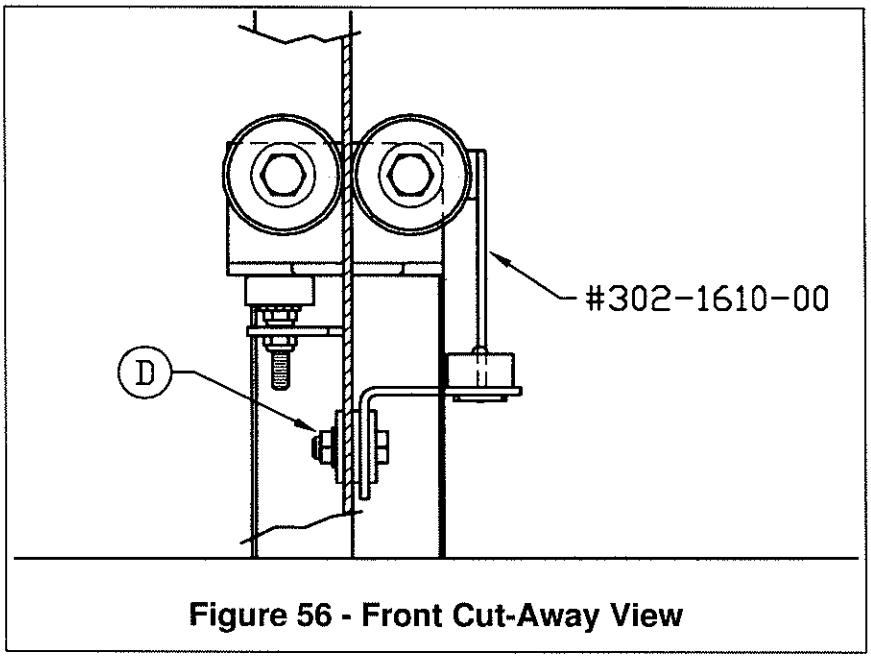


Figure 56 - Front Cut-Away View

9E. Pin Centering Dish Fluid

The pin centering dish (302-1500-00) contains a mixture of water (60%) and anti-freeze (40%). The correct amount of liquid is crucial to the pinsetter's well functioning. Each dish contains **30.5** ounces (900ml) of the mixture.

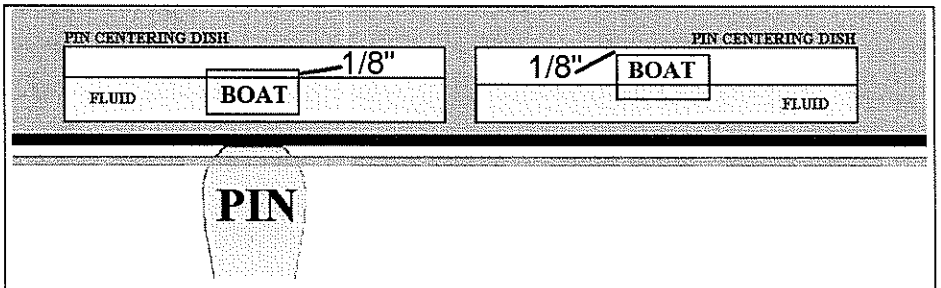


Figure 57

You may visually check the quantity of deck fluid by looking at the boat. When the boat is at the bottom of the pin centering dish (pin is present), the boat must clear the liquid by approximately 1/8" (3mm). When the boat is at the top of the pin centering dish (no pin), the boat must clear the dish cover by approximately 1/8" (3mm). Use the filler pump (Z-V538) supplied with your spare parts kit to add or remove fluid. (Figure 57)

Table 7 - Recommended Deck Fluid (dilute with water, 40/60)

Manufacturer	Anti-Freeze
Exxon Co. USA	
Gulf Oil Co.	
Mobile Oil Corp.	
Shell Oil Co.	
Texaco	

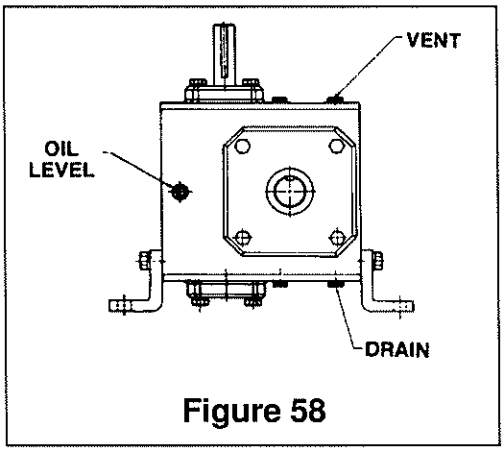


Figure 58

9F. Motor Reducer Oil Level

Check the oil level of the deck motor reducer (302-1000-00) on a semi-annual basis. If the oil level is low, add lubrication through the filler plug until it comes out the oil level plug. (Figure 58)

At this time, also inspect the vent plug located on the deck motor reducer to ensure it is clean and operating well.

The precision-made gears and bearings in the deck motor reducer require high-grade lubricants to maintain trouble-free performance. For best results use lubricants listed in Table 8 or order the lubricant from Mendes under part number Z-TK680

Table 8 - Deck Motor Reducer Recommended Lubricants

Manufacturer	Lubricant
Amoco Oil Co.	Cylinder Oil #680
Chevron USA, Inc.	Cylinder Oil #680X
Exxon Co. USA	Cylesstic TK-680
Gulf Oil Co.	Senate 680D
Mobile Oil Corp.	Extra Hecia Super
Shell Oil Co.	Valvata Oil J680
Sun Oil Co.	Gear Oil 8C
Texaco	650T Cylinder Oil
Union Oil Co. of California	Worm Gear Lube 140

Do not overfill the deck motor reducer with oil, or failure could result in damage to pinsetter or personal injury.

9G. Motor Reducer Oil Change

Change the oil in the deck motor reducer every two years. Reducer's full capacity is 26 ounces.

Deck Maintenance Notes

pages 116 through 136 reserved for future publications...