

*Operation, Maintenance, and Parts Manual*

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**PHOENIX** **LT4**

Combination Lane Machine

December 2012 / 61-900040-000

for the

110V LT4 Lane Machine	61-860334-110
220V LT4 Lane Machine	61-860334-220



**Caution: Read this instruction manual before using the lane machine**



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Section 1







# SAFETY INFORMATION

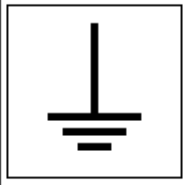

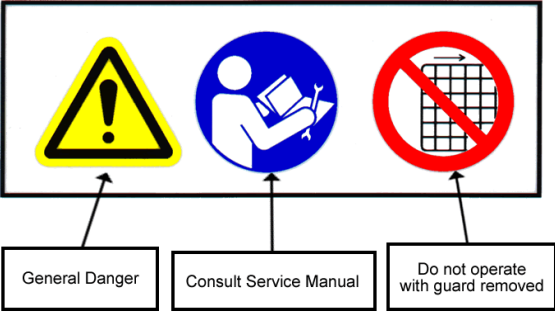
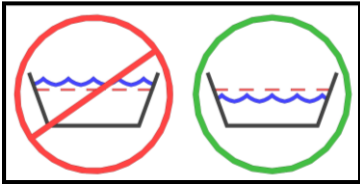
## 1.1 OVERVIEW OF LABEL SYMBOLS

This guide contains information needed to properly operate and maintain the **Phoenix LT4 Lane Machine**. If any terms, concepts, or operations contained in this guide are unclear to the user, consult an experienced professional or Brunswick Customer Response Center at 1-800-YES-BOWL (1-800-937-2695). Additionally, Technical Support can be reached by e-mail at techsupport@brunbowl.com or via fax at 1-231-725-4667.

Table 1- 1 contains safety labels that indicate potential hazards associated with various machine components as well as a brief description of the hazard. This section also contains a number of safety precautions that should be observed when operating and servicing the machine.

Table 1- 1

SINGLE ICON LABELS	DESCRIPTION
	<b>Electric Shock Hazard/Electrocution</b> Part Number 294-115-236
	<b>Heat, Hot Surface, Burn Hazard</b> Part Number 294-115-238
	<b>Hand Crush/Force From Side</b> Part Number 294-115-237
	<b>Hand Entanglement Hazard (chain drive)</b> Part Number 294-115-245
	<b>Hand Entanglement Hazard (notched belt drive)</b> Part Number 294-115-246
	<b>Hand Crush Roller Pinch Point</b> Part Number 252-002-151

	<p><b>Earth (Ground)</b>  <b>Part Number 294-115-256</b></p>
	<p><b>Protected Earth (Ground, Main)</b>  <b>Part Number A-1058</b></p>
<p><b>MULTIPLE ICON LABELS</b></p>	
 <p>General Danger      Consult Service Manual      Do not operate with guard removed</p>	<p><b>Danger, Read Tech Manual, Do Not Operate with Guards Removed</b>  <b>Part Number 294-009-005</b></p>
	<p><b>Do Not Overfill</b>  <b>Part Number 294-115-667</b></p>





## IMPORTANT SAFETY INFORMATION

**WARNING!** The following basic safety-related items must be followed in order to ensure the safe operation of the lane machine. Failure to follow these precautions could result in serious personal injury, damage to the lane machine, or both.

- Read this instruction manual before using this machine.
- This machine is to be operated by authorized and adequately instructed personnel only. Prevent unauthorized use by turning off power, pressing the emergency stop switch and removing the key when the machine is not in use.
- Ensure the pinspotters for the lanes you are conditioning are turned off.
- The only authorized use of this machine is to clean and condition the surface of bowling lanes. **DO NOT** use for any other purpose.
- **DO NOT** use this machine to pick up hazardous dust such as the residue from resurfacing lanes.
- This lane machine is very heavy. If necessary, obtain the assistance of a second person when transferring the machine between the operating and storage positions. Exercise care to prevent the machine from tipping when moving the machine while it is in the upright position.
- **ALWAYS** operate the lane machine on a dedicated and grounded electrical circuit of the proper voltage.
- Inspect the power cord prior to each use. **DO NOT** operate this machine with a damaged power cord or plug.
- **DO NOT** allow the lane machine to run over the power cord.
- Unplug and inspect the power cord for damage if the machine runs over the power cord. Should the power cord become entangled in the machine, unplug the power cord from the bowling center's electrical receptacle before attempting to clear the power cord from the machine.
- **DO NOT** use any other power cord in place of, or in addition to, the one provided. Replacement power cords are available from Brunswick. (see Section 7 - *Parts* of this manual).
- Disconnect the power cord when cleaning, replacing parts, or performing maintenance.
- **DO NOT** operate the lane machine on a lane when someone is working on the lane or in the vicinity of the pinspotter.
- **DO NOT** operate the lane machine with a hood assembly open or removed except when required to make adjustments



## **IMPORTANT SAFETY INFORMATION, cont.**

- DO NOT use flammable or toxic materials in the lane machine. Use only cleaners and conditioners specifically formulated for use by the bowling industry.
- Avoid splashing liquid when filling the cleaner tank and oil tanks. Follow all instructions and precautions on the product label. In case of eye contact, remove any contact lenses and flush with water for 15 minutes.
- DO NOT fill the oil tanks on or near the approach. Conditioner spilled on the approach presents a hazard to the bowler.
- DO NOT store machine upright with a full tank of cleaner. Cleaner may leak out of the tank's air vent hole.
- Turn off the machine if foam or liquid exits from the vacuum exhaust.
- Be aware of the possibility of the machine continuing onto the approach when it returns to the foul line. Stay out of the path of machine travel when the machine is approaching the foul line.
- DO NOT wear loose personal items such as neckties, necklaces, bolo ties, or long hair around rotating machinery.
- Keep hands away from solenoid linkages, gears, chains, and belts. These components can pose a severe pinching hazard.
- Exercise caution whenever the hood is open, removed, or when making adjustments. Some components may become hot during use.
- DO NOT modify the machine's wiring except as specified in Brunswick-supplied publications.
- DO NOT use, clean, or store the machine outdoors and/or in wet conditions.
- Use only brushes supplied with this machine or those supplied by Brunswick for use in this machine.
- Ensure all of the machine's doors are closed and latched before placing the machine in the storage position.
- The possibility exists of a slipping hazard on any wet surface which could come about by operating, moving, or storing the lane machine.
- DO NOT modify any safety apparatus, shield, or electrical components except by a qualified technician for the sole purpose of adjusting and/or repair testing the machine. In completing this function all safety aspects must be restored prior to regular operation



## **IMPORTANT SAFETY INFORMATION, cont.**

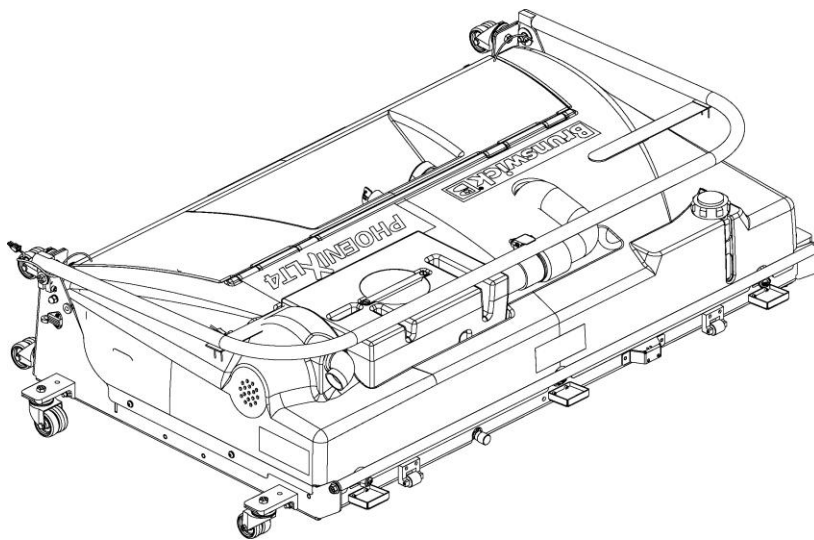
- When not in use, secure the machine to prevent it from falling over and from other unintentional movement.
- During operation, pay attention to other persons in the area, especially children.



## **2.1 INTRODUCTION TO THE PHOENIX LT4 LANE MACHINE**

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The Phoenix LT4 Lane Machine, shown in Figure 2- 1, is a versatile, total lane care machine that performs three operations: cleaning, conditioning, and standalone buffing. The cleaning operation removes dirt and oil from the lane. This can be performed alone or in combination with conditioning. The conditioning operation buffs oil onto the lane surface. This oiled area of the lane is called the pattern. The standalone buffing operation buffs oil that is already on the buffer brush onto the lane and redistributes the oil already on the lane. While the buffing operation is automatically activated with the conditioning operation, it can be performed by independently.



**Figure 2- 1**

### **Cleaning**

The cleaning operation wets the lane by spraying a cleaning solution through the spray nozzles on the front of the machine. The factory-set flow rate and the spraying pattern give gutter-to-gutter coverage without getting overspray<sup>1</sup> into the gutters. The agitator foam under the machine forces the sprayed cleaning solution into the oil already on the lane, forming an emulsion. The emulsified cleaner and oil solution is then picked up by the

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<sup>1</sup> It is important that the nozzles don't overspray the cleaning fluid into the gutters. The excess fluid can build up in the gutter and form a sticky residue that can be transferred to the power cord and bowling balls. Additionally, painted gutters can be damaged by the cleaner fluid. Refer to Section 4.3.4 – *Adjusting the Cleaner Spray*.

machine's floating vacuum head. The floating action allows the vacuum head to conform to changes in the lane surface. The cleaning operation is performed only during the forward segment of the first pass regardless of any second pass settings.

## Conditioning

The conditioning operation (also known as lane conditioning, oiling, or dressing) applies oil by brushing it onto the lane during the forward and reverse passes of the machine. The oil is stored in the oil tank and is applied to the lane via the wicking foams, transfer roller, and buffer brush shown in Figure 2- 2 and Figure 2- 3.

The oil tank has six adjustable segments. Each segment has its own wicking foam and adjustment bar. This allows for the adjustment of each segment independently of the others.

Factory default settings apply less oil on the outer 7 boards on each side of the lane (approximately 7.5 inches or 19 cm). The areas of the lane on boards 8 through 10 (approximately 3.25 inches or 8 cm), known as the track, have slightly more oil applied. The middle 20 boards have a heavy amount of oil applied. This produces a typical oil pattern for most bowlers. All oil patterns may be adjusted to fit the center's needs.

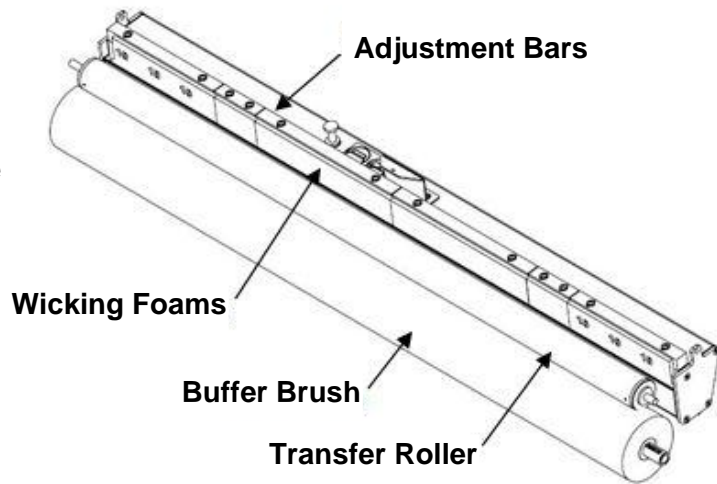


Figure 2- 2

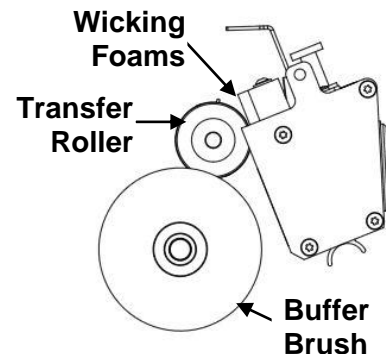


Figure 2- 3

## Buffing

Buffing can be performed with or without applying new oil. It is **NOT** recommended to buff the lane without the application of new oil. It is **NOT** recommended to buff or oil a dirty lane. The buffing only function can also be used to deplete residual oil in the buffer brush by alternating clean only and buff only programs until no oil is visible on the lane after the buff only program. Refer to Section 6 – *Determining the Oil Pattern* for more information.

## Factory Programming

The Phoenix LT4 is capable of performing a single pass (the machine travels down the lane forward and returns in reverse) and double pass (the machine will travel down the lane a second time). If a second pass is used more oil is applied and buffed onto the lane. Each pass is divided into two segments, a forward segment and a reverse segment. On the first pass forward segment, the lane is stripped of any existing oil over its entire length while new oil is applied and buffed out for the distances entered. On the return segment, the lane is buffed and then oiled to the foul line using the same distance settings. If a second pass is used, more oil is buffed onto the lane. No cleaning occurs during a second pass operation.

All programs may be customized to suit the specific needs of the center. The machine comes from the factory with four preprogrammed routines: programs A, B, C, and D. Below is a description of each program.

- Program A is single pass with cleaning, oiling, and buffing. It is typical of what would be applied for recreational or "open" bowlers using mostly house balls supplied by the bowling center.
- Program B is double pass with cleaning, oiling, and buffing. This program lays out a typical league pattern or bowling club pattern for more experienced bowlers using performance bowling balls.
- Program C is double pass with cleaning, oiling, and buffing. This double pass pattern is similar to Program B but applies more oil to the lane. This program is generally used for tournaments and highly competitive leagues or clubs. Typically the majority of the bowlers will be using performance bowling balls.
- Program D is cleaning only single pass. This program can be used to clean the lanes without applying any oil. It is useful for cleaning the lanes prior to a lane inspection or to check the cleaning function of the machine.

Additional information about the factory settings and adjusting them can be found in Section 3.10 – *Cleaning and Conditioning*.

A printout of the specific cross-lane oil pattern produced by the Phoenix LT4 has been included in a yellow envelope. This printout contains important information about the machine's initial settings and should be retained for the center's record.

For more information about oil output and patterns, refer to Section 6 - *Determining the Oiling Pattern*.

## 2.2 UNPACKING THE PHOENIX LT4 LANE MACHINE

After uncrating, inspect the lane machine for any damage that may have occurred in shipping. Any shipping-related damage claims should be filed with the freight carrier. Brunswick is not responsible for damage that occurs during shipment.

Before first using the Phoenix LT4 Lane Machine, ensure all the components were shipped and that they arrived in good condition. It is also important to become familiar with how the machine operates.



### IMPORTANT

The oil transfer roller is wire tied in two places to prevent damage during shipment. The following steps must be completed before using the machine to avoid damage to the machine.

1. Unlatch the hood door and open the compartment door.
2. Cut the two plastic wire ties at each end of the transfer roller as shown in Figure 2- 4 and Figure 2- 5. Then remove the red tag and wire ties.

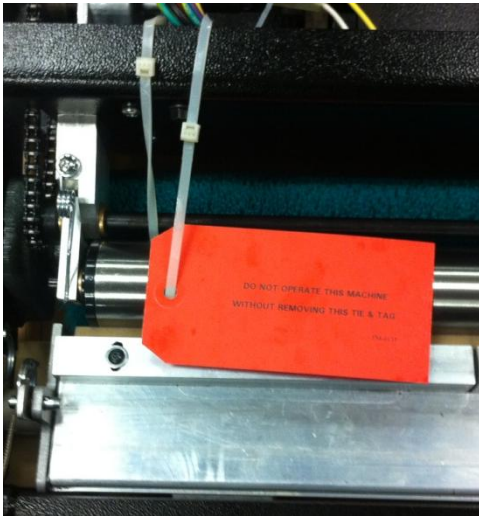


Figure 2- 4



Figure 2- 5

3. If the silver roller (oil transfer roller) does not drop down against the buffer brush, gently push it down to rest it against the buffer brush. Do not force it.
4. Close the hood door and refasten the clasps.



## 2.3 SPECIFICATIONS, DIMENSIONS, AND CAPACITIES

Table 2- 1 below provides the electrical use, machine weight and dimensions, and tank capacities of the Phoenix LT4 Lane Machine.

**Table 2- 1**

Electrical	Single phase, 50/60 Hertz 1860 watts 110 V (US) 15.5 AMP 200 – 240V (other countries) A <sub>μ</sub> 6 A <sub>p</sub> 9.4
Main Power Circuit Breaker on Control Box	20 amp protection (110V), 14 amp protection (220V)
Overcurrent Protection	Each motor and solenoid is individually protected against an overcurrent condition either by a thermal overload protection device or a fuse.  The Machine must be operated on a dedicated and grounded electrical circuit.
Weight (wet)	250 pounds (113 kg)
Machine Dimensions	13.93 inches (35.4 cm) H x 35.6 inches (90.4 cm) L x 55.48 inches (140.9 cm) W
Power Cord	3-conductor, 110V, 12 AWG (US), 220V, 14 AWG (2.5 mm <sup>2</sup> harmonized), 125 feet (38.1 m) L
Cleaner Tank Capacity	1.75 gallons (6.62 liters), enough to clean approximately 16 lanes from the on-approach start position.  <b>Use only cleaners specifically manufactured for use on bowling lanes.</b>
Waste Tank Capacity	Holds waste for up to 16 lanes (~5.75L/1.52gal.) when a defoamer is used.
Oil Tank Capacity	37.5 ounces (1.11 liters), enough to condition up to 24 lanes. Using patterns with higher oil output may reduce the number or lanes covered.  <b>Use only oil products specifically manufactured for use on bowling lanes.</b>
Foams: Standard  Replacement Foam Wicks	Outside - 3-1/2 inches (8.9 cm) H x 7.85 inches (19.9 cm) L Track – 3-1/2 inches (8.9 cm) H x 3 inches (7.6 cm) L Middle - 3-1/2 inches (8.9 cm) H x 10 inches (25.4 cm) L The above represents one side (half) of the oil tank. Identical foams are installed on the other side of the oil tank.  3-1/2 inches (8.9 cm) H x 48 inches (121.9 cm) L

Table 2- 2 below lists the contents of the Phoenix LT4 Lane Machine package.

**Table 2- 2**

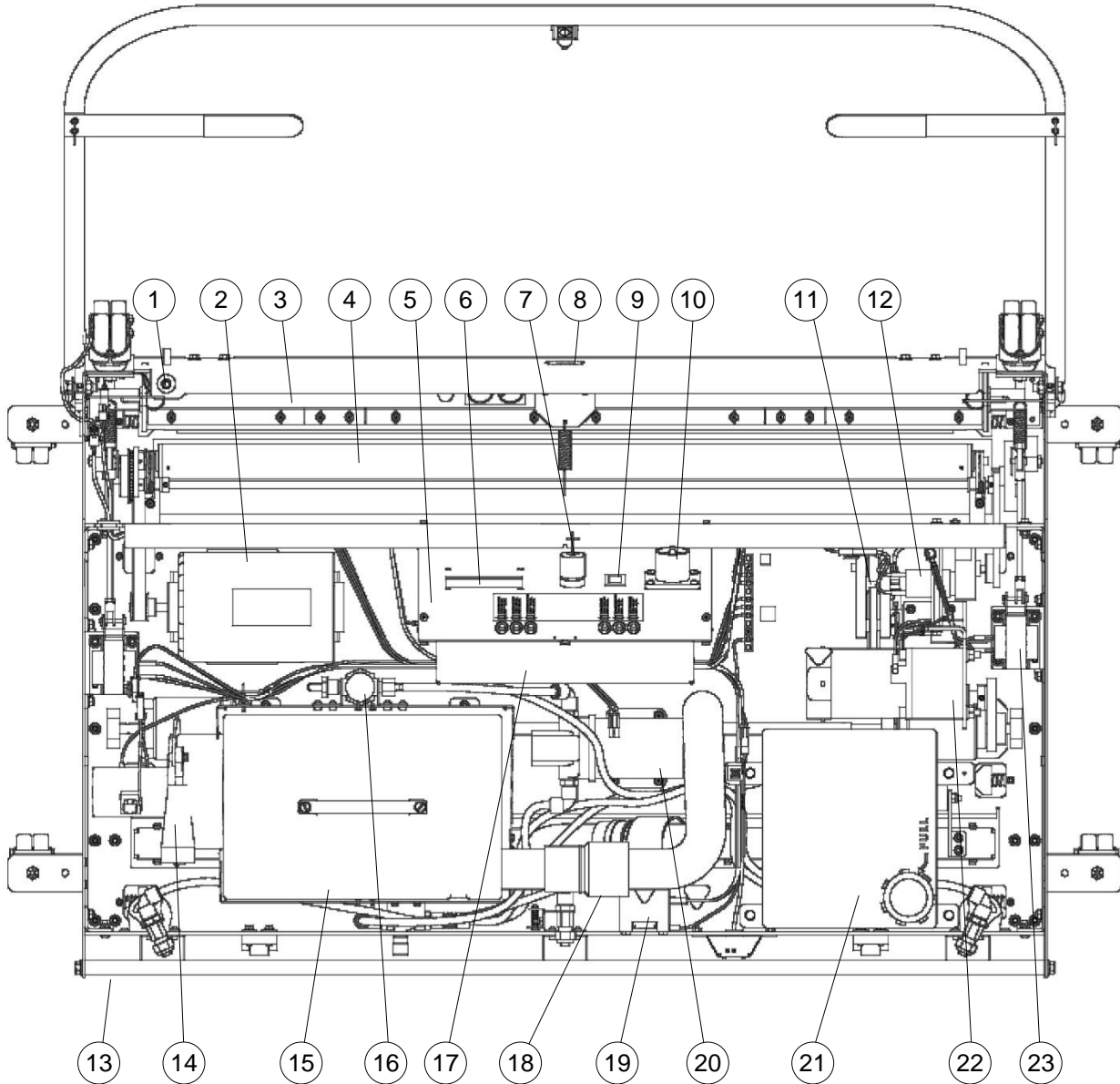
Item	Part Number
Phoenix LT4 Lane Machine	61-860334-110 (110V) 61-860334-220 (220V)
Power Cord	294-002-359 (110V) 294-115-269 (220V)
Large Red Funnel (for cleaning solution)	RP-115
Small Funnel (for oil)	RP-116
Quick Start Information Card	400-294-021
Buffer Pressure Adjusting Tool	RP-43
<ul style="list-style-type: none"> <li>• Defoamer, 1 Gallon (3.78 liter)</li> </ul>	<ul style="list-style-type: none"> <li>• 294-115-161</li> </ul>
Yellow Envelope for 110V Phoenix LT4 <ul style="list-style-type: none"> <li>• Warranty Card</li> <li>• Oil Pattern Printout</li> <li>• 110V, 2A Slow blow fuse 2</li> <li>• 110V, 6.3A Slow blow fuse 2</li> <li>• 110V, 8A Slow blow fuse (4)</li> <li>• 110V, 10A Slow blow fuse (4)</li> <li>• 1/16-inch Hex Wrench</li> <li>• 3/32-inch Hex Wrench</li> <li>• Oil Tank Feeler Gauge (yellow)</li> <li>• Cotter Pin, 1/16 x 1/2 (6)</li> </ul>	<ul style="list-style-type: none"> <li>• 400-294-010</li> <li>• 748-510-600</li> <li>• 748-512-110</li> <li>• 748-901-031</li> <li>• 748-510-400</li> <li>• 294-115-693</li> <li>• 294-115-702</li> <li>• 294-115-694</li> <li>• 01-080</li> </ul>
Yellow Envelope for 220V Phoenix LT4 <ul style="list-style-type: none"> <li>• Warranty Card</li> <li>• Oil Pattern Printout</li> <li>• 220V, 1A Slow blow fuse 2</li> <li>• 220V, 5A Slow blow fuse (4)</li> <li>• 220V, 4A Slow blow fuse (4)</li> <li>• 1/16-inch Hex Wrench</li> <li>• 3/32-inch Hex Wrench</li> <li>• Oil Tank Feeler Gauge (yellow)</li> <li>• Cotter Pin, 1/16 x 1/2 (2)</li> <li>• Bowtie Clips (4)</li> </ul>	<ul style="list-style-type: none"> <li>• 400-294-010</li> <li>• 748-901-111</li> <li>• 748-511-405</li> <li>• 748-510-100</li> <li>• 294-115-693</li> <li>• 294-115-702</li> <li>• 294-115-694</li> <li>• 01-080</li> </ul>

Table 2- 2 Continued

Item	Part Number
Standard Foams (in the machine) <ul style="list-style-type: none"> <li>• Super-High Output (#4), 10 in. (25.4 cm) L x 3½ in. (8.9 cm) H</li> <li>• Medium-Low Output (#10), 7.8 in. (19.9 cm) L x 3½ in. (8.9 cm) H</li> <li>• Medium-High Output (#6), 3 in. (7.6 cm) L x 3½ in. (8.9 cm) H</li> </ul>	Not available in precut lengths
Alternate Foams, 3½ in. (8.9 cm) H x 48 in. (121.9 cm) L (Field cut to size) <ul style="list-style-type: none"> <li>• Super-High Output (#4)</li> <li>• High Output (#5)</li> <li>• Medium-High Output (#6)</li> <li>• Medium Output (#8)</li> <li>• Medium-Low Output (#10)</li> <li>• Low Output (#11)</li> <li>• Extra-Low Output (#12)</li> <li>• Super-Low Output (#13)</li>   <li>• Foam Kit - Contains one 48 in. (121.9 cm) long piece of each of the wicking foams</li> </ul>	<ul style="list-style-type: none"> <li>• 294-115-490</li> <li>• 294-115-488</li> <li>• 294-115-486</li> <li>• 294-115-484</li> <li>• 294-115-482</li> <li>• 294-115-652</li> <li>• 294-115-653</li> <li>• 294-115-654</li>   <li>• 294-115-655</li> </ul>

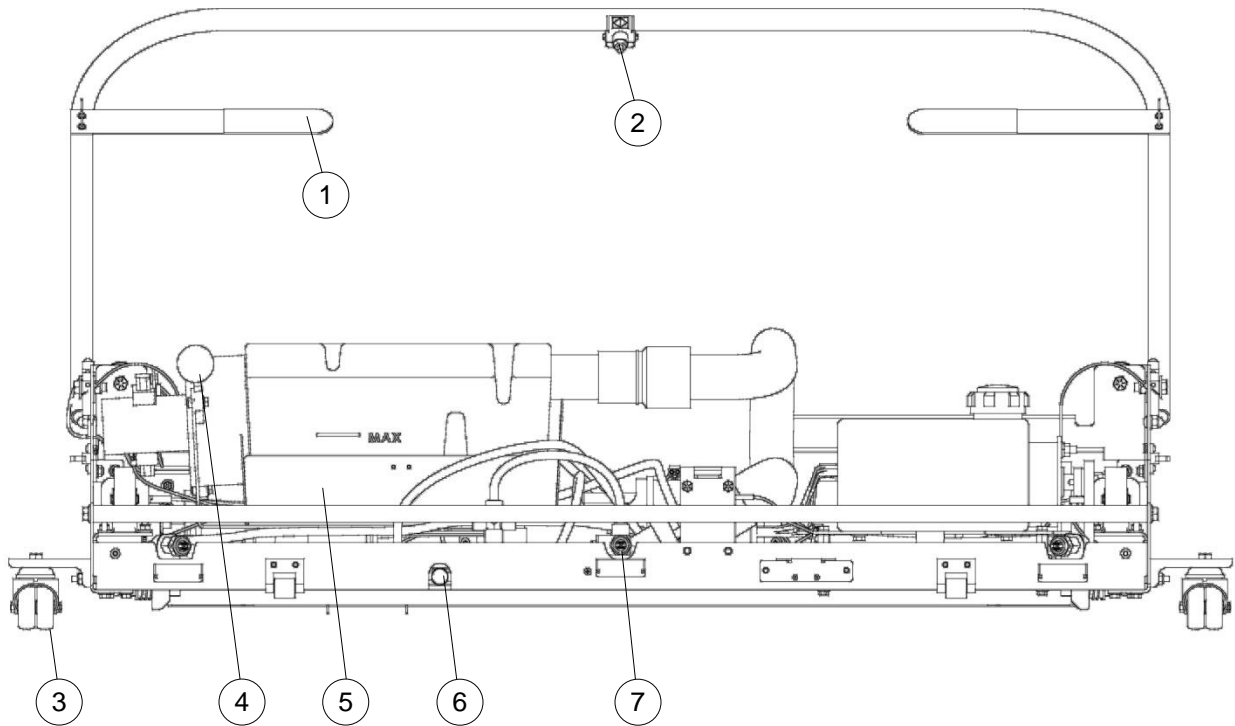
## 2.4 PHOENIX LT4 COMPONENTS OVERVIEW

The following pages contain an overview of the Phoenix LT4 components. The hood has been hidden in these views which are meant to help familiarize the user with the Phoenix LT4. For detailed information about the components and their functions, refer to the Operation, Maintenance, and Parts sections of this manual.

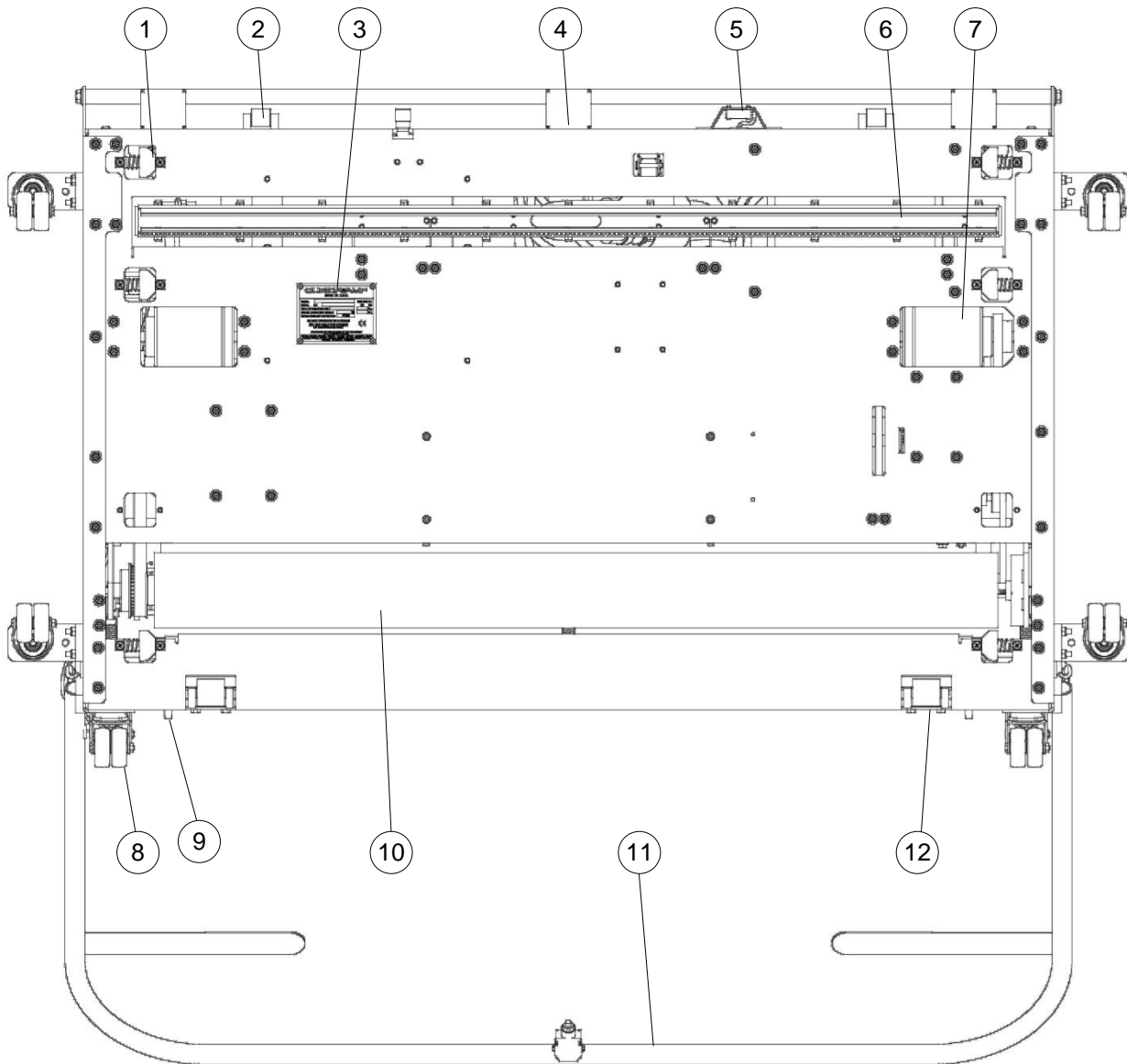


#	DESCRIPTION
1	Oil Compartment E-Stop Switch
2	Buffer Motor
3	Oil Tank
4	Transfer Rollers
5	Control Box
6	Touch Screen
7	E-Stop Switch
8	Oil Tank Sight Glass
9	Power Switch
10	Power Inlet
11	Encoder / Odometer
12	Transfer Roller Motor

#	DESCRIPTION
13	Lift Handle
14	Vacuum Motor
15	Waste Tank
16	In-Line Filter
17	Control Box Guard
18	Vacuum Hose
19	Vacuum Solenoid
20	Cleaner Pump
21	Cleaner Tank
22	Drive Motor
23	Buffer Solenoid



#	DESCRIPTION
1	Power Cord Strap
2	Start Switch
3	Operating Casters
4	Vacuum Motor Exhaust Port
5	Waste Tank Guard
6	Cleaner Flow Control Valve
7	Cleaner Spray Nozzles



#	DESCRIPTION
1	Guide Roller
2	Front Roller
3	Serial / Information Plate
4	Drip Pad
5	End of Lane Sensor
6	Vacuum Head

#	DESCRIPTION
7	Drive Wheel
8	Storage Caster
9	Oil Compartment Latch
10	Buffer Brush
11	Handle
12	Idler Wheel

## Section 3

# OPERATION

---

The Phoenix LT4 Lane Machine is straightforward and easy to operate. The basic steps are:

- Place it on the lane
- Fill the cleaner and oil tanks
- Plug in the machine
- Select the operation
- Press the Start button twice (2<sup>nd</sup> push must be within 5 seconds of 1<sup>st</sup> push)

This section contains the detailed information necessary to use the Phoenix LT4 Lane Machine safely, effectively, and efficiently.

### 3.1 OVERVIEW OF PHOENIX LT4 OPERATION

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#### NOTE

When power is first applied to the machine, the vacuum head solenoid energizes and raises the vacuum head. If at any time during operation the machine is left idle (a cleaning or conditioning cycle is not run) for 5 minutes, the solenoid de-energizes and the vacuum head lowers to the down position. Switch the machine off then back on to reset.

The Phoenix LT4 Lane Machine is separated into the cleaning section and the conditioning section. In the cleaning section, the cleaner pump takes the cleaning solution from the cleaner tank and delivers it to the spray head nozzles. The nozzles atomize the cleaner and direct it onto the lane. The amount of cleaner applied to the lane is controlled by the flow control valve which returns excess cleaner to the cleaner tank. On the lane, the cleaner combines with the lane oil and forms an emulsion which is then stirred up by the agitator foam to increase cleaning efficiency. This emulsion is then removed by the vacuum head and transferred to the waste tank.

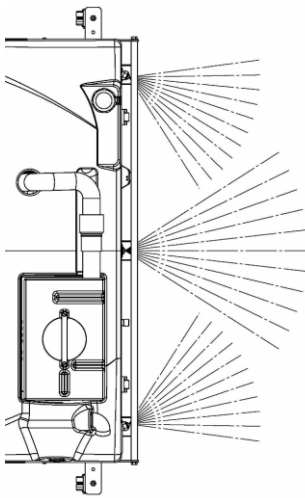
In the conditioning section, the oil transfer roller motor drives the transfer roller which rotates against the wicking foams of the oil tank. The transfer roller picks up oil which is then transferred to the buffer brush where it is applied to the lane surface. When the buffing-only operation is performed, the transfer roller does not turn, therefore the buffer brush does not add any new oil to the lane; it only redistributes the oil that is already on the brush and on the lane. When oiling and buffing have been completed, the buffer solenoids de-energize, and the buffer brush is lifted up off the lane by spring pressure.

The machine is propelled on the lane by the AC drive motor and is equipped with front sensor, guide rollers, and a counter wheel. The guide rollers keep it correctly positioned on the lane. The front optical sensor senses the end of the lane. The counter wheel is a

distance counter that determines the machine's position on the lane. The Phoenix LT4 continuously compares this counter to the factory setting or to the distance entered for an operation so it knows where on the lane to start and stop an operation. When cleaning the lanes, the drive motor propels the machine until the end of the lane is reached, then it reverses direction and propels the machine back to the approach. When only conditioning the lanes (no cleaning) or only buffing the lanes, the drive motor propels the machine until the buffing distance is reached, then it reverses direction and propels the machine back to the approach.

The main components of the cleaning section are:

- The cleaner tank
- The cleaner filter
- The cleaner spray pump
- The spray heads
- Flow control valve
- The vacuum head
- The vacuum head solenoids
- The vacuum motor
- The waste tank



**Figure 3- 1**

The vacuum head contains an agitator foam and a squeegee. When cleaning, the Phoenix LT4 performs the following actions:

1. The spray heads dispense the cleaner over the lane, as shown in Figure 3- 1.
2. The agitator foam mixes the cleaner into the oil on the lane.
3. The emulsified solution is wiped off the lane by the squeegee.
4. The solution is vacuumed from the squeegee through a hose into the waste tank.

The cleaning operation can be performed separately or simultaneously with the conditioning operation. Cleaning occurs only during the forward travel of the first pass of the lane program when activated in the program.

The main components of the conditioning section are:

- Oil tank
- Wicking foams
- Buffer brush & solenoids
- Buffer brush motor
- Oil transfer roller
- Oil transfer roller motor

The Phoenix LT4 Lane Machine uses wicking foams to transport the oil from the oil tank to the transfer roller. The density and contact pressure of the wicking foams control the rate at which oil is moved to the transfer roller. The Phoenix LT4 comes installed with six foams in three densities. The outside foams on each side are #10 (medium-low) output foams and apply oil to the outside 7.8 inches (20 cm) of the lane. The two track foams are #6 (medium-high) output foams and apply oil to the area between the center foams and outside foams. They are 3 inches (7.6 cm) wide. The middle two foams are #4 (super-high) output foams that apply oil to the middle 20 inches (50.8 cm) of the lane.



The oil output can be changed by replacing the installed foams with the alternate wicking foams that were shipped with the machine. For more information about changing the oil output, refer to Section 6 - *Determining the Oiling Pattern*.

### 3.2 THE PHOENIX LT4 LANE MACHINE CONTROLS

The Phoenix LT4 Lane Machine features a touch screen, making it very simple to operate. The control panel, shown in Figure 3- 2, features four main components: the power inlet, power switch, E-STOP Button, and the touch screen.

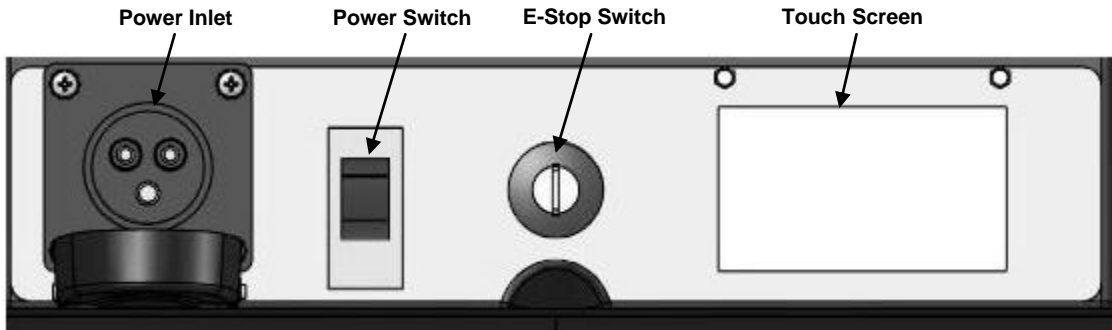


Figure 3- 2

The power inlet is a blue receptacle where the power cable is connected to the machine. The large blue receptacle and its mating connector are designed to fit together in only one way. The machine must only be connected to a grounded 110V or 240V outlet, depending on the machines' voltage rating.

The power switch turns power on and off to the machine. This style switch is also a circuit breaker and provides overcurrent protection (20 amp for 110V, 14 amp for 240V) to the machine. **The power switch does not start any of the machine's operations but it does energize the vacuum solenoid to lift it off of the lane.**

The E-STOP is a large red button that stops all machine operations when it is pressed. **Pressing the E-STOP will not power off the machine** but will display the E-STOP error message, shown in Figure 3- 3, on the screen. After being activated, it must be reset by inserting the key and turning (the button should pop back out) then power cycling the machine before operation can continue. When the E-STOP button is out, a yellow sticker will be visible behind the button. When it is pressed in, no yellow will be visible.

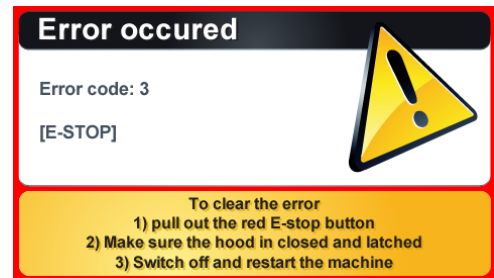


Figure 3- 3

### 3.2.1 The Touch Screen

The controls and information displays on the control dashboard are described below. When the machine is first energized, the touch screen will appear blank momentarily before the Home screen appears. Refer to **Section 3.8 – Preparing for Use** for information on the recommended start-up procedure.

#### The Home Screen

The Home Screen, shown in Figure 3- 4, is the location from which all programming and testing of the Phoenix LT4 is performed.



Figure 3- 4

#### Program Buttons

The Phoenix LT4 has the capability of storing four programs in its memory. These four programs (A, B, C, and D) are listed on the left side of the screen. The names of these programs cannot be changed. When a program is selected for use, it is highlighted in red. In Figure 3- 5, program A is selected for use. To select a different program for use, simply touch the button of the program on the touch screen.



Figure 3- 5

#### Program Information

The information of the currently selected program is displayed in the middle portion of the screen. The three icons across the top represent cleaning, oiling, and buffing respectively from left to right. Table 3- 1 below shows a close up of each icon.

Table 3- 1

Action	Icon
Cleaning	
Oiling	
Buffing	

Displayed in the columns below the cleaning, oiling, and buffing icon is the information for each pass. As shown in Figure 3- 6, the first pass and second pass information is displayed in the two columns below the icons.



Figure 3- 6

The cleaning option is only available on the first pass, cleaning on the second pass would be counter-productive as it would remove the oil which was applied on the first pass. The units displayed under the oiling and buffing icons represent the distances, in feet, from the foul line that this program would oil and buff respectively.

*Example*

*The program shown in Figure 3- 6 would clean the entire lane while applying oil to the first 18 feet of the lane then buffing to 40 feet on the first pass. On the second pass it would apply oil to 9 feet and buff it out to 20 feet.*

**3.2.2 Editing Program Specifications**

**Editing the Pattern Specifications**

The Phoenix LT4 comes with four preprogrammed patterns that will produce a good bowling condition in most bowling centers. The distances of these patterns can be changed to best suit each bowling center. Table 3- 2 shows a close-up of the first and second pass edit buttons which are found on the right side of the screen.

Table 3- 2

Action	Icon
Edit First Pass	
Edit Second Pass	

### First Pass

To edit the first pass, select the program to be changed on the Home screen. In the instance of Figure 3- 7, Program B has been selected as indicated by the ">" next to the program letter "B."



Figure 3- 7

Select the *Edit First Pass* button. The *Edit First Pass* screen is shown in Figure 3- 8. The name of the program will be displayed along with a "1." Any of the operations can be turned on or off by selecting the appropriate icon at the top. Additionally, selecting the "✓" under the cleaning icon and removing it, or setting the oiling/buffing distances to zero will disable the respective operation. Operations that are turned on will be colored green while ones that are not enabled are grayed out.

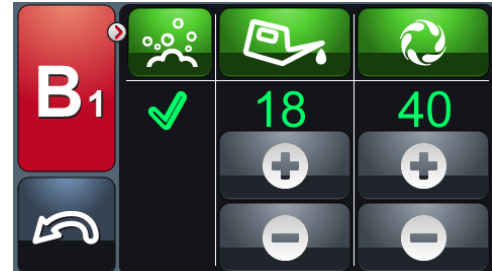


Figure 3- 8

### NOTE

If the oiling or buffing distance (regardless of first or second pass) is disabled, the next time the operation is enabled the machine will use the previously stored distance values for each.

Selecting the "+" under the oiling icon will increase the oiling distance while selecting the "-" will decrease it.

Selecting the "+" under the buffing icon will increase the buffing distance while selecting the "-" will decrease it.

If changing either distance by more than a few feet, it is not necessary to repeatedly select the "+" or "-" buttons. Simply touch and hold the button and the numbers will scroll after a few seconds.

Also, as it not possible to oil without buffing, once the oil distance increases to the point of matching the buffing distance, further increases in the oil distance will automatically increase the buffing distance. Similarly, when the buffing distance decreases to the point of matching the oil distance, further decreases of the buffing distance will automatically decrease the oil distance.

As mentioned previously, the units displayed under the oiling and buffing icons represent the distances, in feet, from the foul line that this program would oil and buff respectively.

When the changes are complete, select the Return button, , at the bottom left corner to save and return to the Home screen.

### NOTE

It is not possible to discard changes or return to the Home screen without saving any changes that were made.

**Second Pass**

To edit the second pass, select the program to be changed on the Home screen. In the instance of Figure 3- 9, Program B has been selected as indicated by the ">" next to the letter "B."

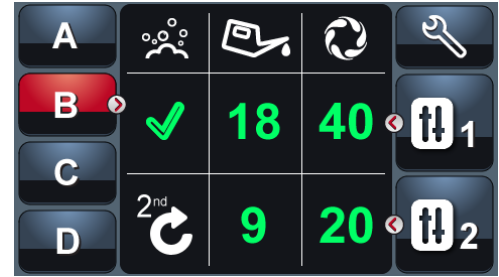


Figure 3- 9

Select the *Edit Second Pass* button. The *Edit Second Pass* screen is shown in Figure 3- 10. The name of the program will be displayed along with a "2." Either of the operations can be turned on or off by selecting the appropriate icon at the top. Additionally, setting the oiling/buffing distances to zero will disable the respective operation. Operations that are turned on will be colored in green while ones that are not enabled are grayed out.

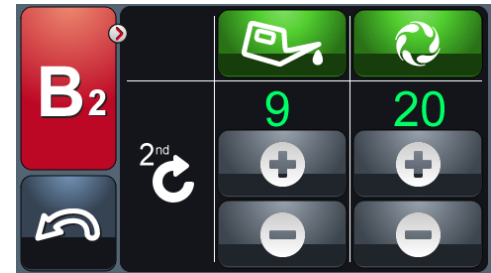


Figure 3- 10

**NOTES**


The cleaning operation is not available for use on the second pass. This would be counter-productive as it would remove the oil that was applied on the first pass.

In Figure 3- 10 the oiling and buffing operations are enabled. They can be disabled by selecting the oil or buffing button or by selecting the "-" button until the values are zero. When the oil operation is selected it will automatically activate the buffing operation.

Selecting the "+" under the oiling icon will increase the oiling distance while selecting the "-" will decrease it.

Selecting the "+" under the buffing icon will increase the buffing distance while selecting the "-" will decrease it.

As mentioned previously, the units displayed under the oiling and buffing icons represent the distances, in feet, from the foul line that this program would oil and buff respectively.

When the changes are complete, select the Return button, , at the bottom left corner to return to the Home screen. Pressing Return automatically saves any changes that were made.

**Example**

From the factory, Program A is a single pass pattern with cleaning, oiling to 14 feet, and buffing to 40 feet. Suppose it is necessary to increase the first pass oil length to 15 feet, decrease buffing distance to 35 feet and add a second pass of oil to 7 feet, buff to 20 feet. Below is the procedure to perform these modifications.



Begin by selecting Program A on the Home screen as shown in Figure 3- 11 and select the Edit First Pass button, .



Figure 3- 11

Lengthen the oil distance to 15 feet using the "+" button in the oiling column. Shorten the buffing distance to 35 feet using the "-" button in the buffing column. When complete, the screen should look like Figure 3- 12. Then select the Return button, ,

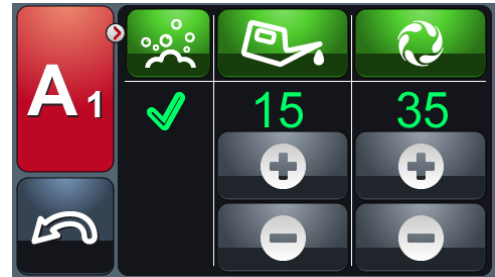




Figure 3- 12

From the Home Screen, select the Edit Second Pass button, . Click the Oiling (or the "+" in the oiling column) and increase the oiling distance to 7 feet. Then click the Buffing button (or the "+" in the buffing column) and increase the distance to 20 feet. When complete, the screen should look like Figure 3- 13. Then select the Return button, ,

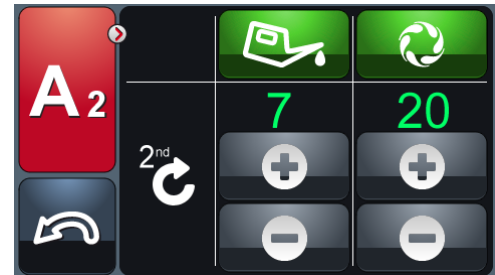


Figure 3- 13

When the modifications are complete, Program A will look like Figure 3- 14 on the Home screen. The updated Program A and the machine are now ready for use.

**NOTE**

Pressing the return button automatically saves the new program parameters.

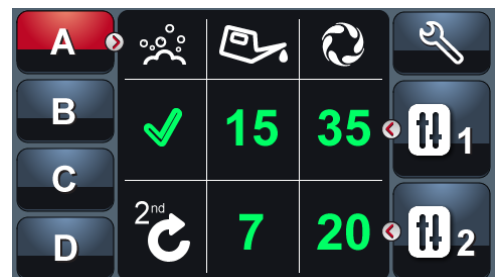


Figure 3- 14

### 3.2.3 The Run Screen

The Run screen appears when the machine is running one of the programs. The program which is being run is displayed in the top left portion of the screen. The distance from the foul line or start position is displayed in the top right portion and the selected operations along the bottom of the screen. An operation that is in process is colored green while one that is not is black. In Figure 3- 15 program A is currently being run, the machine is 16 feet from its starting position and the cleaning and buffing operations are currently being performed.



Figure 3- 15

### 3.2.4 The Test Screen


Selecting the Test screen icon, , in the upper right corner of the Home screen will display the version information of the firmware, graphical user interface (GUI), and the graphic operating system as shown in Figure 3- 16. Additionally, the machine can be reset to factory defaults as well as access the Test Area from this screen.



Figure 3- 16

The Test screen also displays the odometer reading. This is the distance that the machine has traveled in feet. This measurement should be used to determine when it will be necessary to perform preventive maintenance on the machine. Refer to Section 4 for more information on preventive maintenance and the suggested preventive maintenance chart/schedule.

### Factory Defaults

Selecting *Factory Defaults* will reset all programs and settings to the factory default values. The factory default values for the Phoenix LT4 are listed in the Table 3- 3 below.

Table 3- 3

Program	Pass	Cleaning	Oiling	Buffing
A	1 <sup>st</sup>	✓	14	40
	2 <sup>nd</sup>	-	-	-
B	1 <sup>st</sup>	✓	18	40
	2 <sup>nd</sup>	-	9	20
C	1 <sup>st</sup>	✓	25	42
	2 <sup>nd</sup>	-	15	27
D	1 <sup>st</sup>	✓	-	-
	2 <sup>nd</sup>	-	-	-

**NOTE** Machine has been configured at factory for maximum performance and may vary slightly from default values.

A warning message, shown in Figure 3- 17, will appear to confirm that the defaults should be restored. To proceed, select *Reset All*. **Once *Reset All* is selected all customizations will be lost and cannot be recovered. Be sure to note any custom settings that will need to be reused.**



Figure 3- 17

While the machine is resetting, the screen will show display "INIT...", as shown in Figure 3- 18. Once the process is complete, the Home screen will appear and the machine is ready for operation.

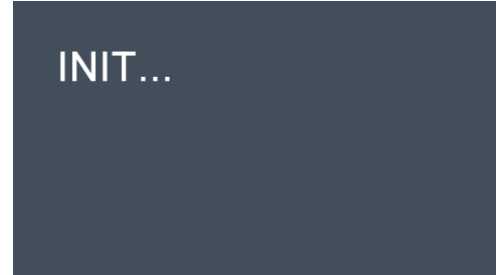


Figure 3- 18

To return to the Test screen without resetting the machine, select the *Back* button.

### 3.2.5 The Test Area

The Test Area is for testing the machine systems. To access it, select *Test Area* from the Test screen. A warning shown in Figure 3- 19 will appear. **Only operators experienced with the Phoenix LT4 Lane Machine should access this screen. Improper use of the test functions can damage the machine as well as cause injury and inconveniences.**

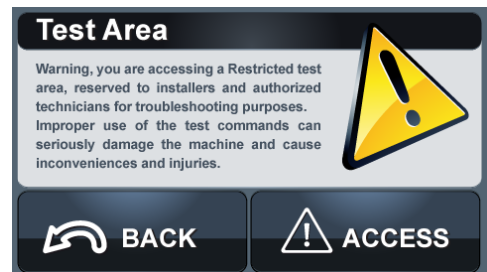


Figure 3- 19

The Test screen is shown in Figure 3- 20. Below is a description of the action each test button initiates.

- Vacuum Solenoid - Touching the Vacuum Solenoid button disengages the vacuum solenoid and will lower the vacuum head to the lane. This tests the operation of the vacuum solenoid. Additionally, it can be used to reset the vacuum solenoid after a machine timeout.
- Cleaner Pump - Turns on the cleaner pump. This is used to test the operation of the cleaner pump, check the cleaner nozzles's flow rate and direction, or prime the cleaning system with cleaner solution. **CAUTION:** Testing the cleaner pump should **ONLY** be performed when the machine is in the operating position on the lane.

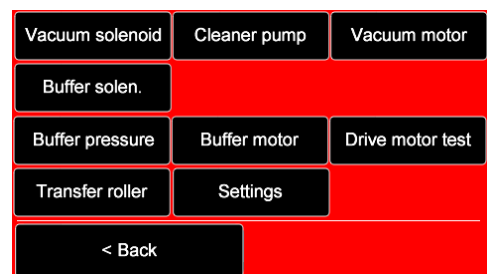


Figure 3- 20



- Vacuum Motor - Pressing the Vacuum Motor button turns on vacuum motor. This can be used to test the operation of the vacuum motor.
- Buffer Solenoid - Touching the Buffer Solenoid button engages both buffer solenoids. An audible click from the buffer solenoid relay inside the control box may also be heard.
- Buffer Pressure - When the Buffer Pressure button is selected, the Buffer Pressure Test screen, shown in Figure 3- 21 will appear while the buffer motor and solenoids are simultaneously engaged. A 45-second timer counts down, allowing ample time to check the buffer brush pressure. Pressing "Cancel" at any time will end the test. This can be used to test the buffer pressure. For more information on testing the buffer brush pressure, see Section 4.2.1.2.

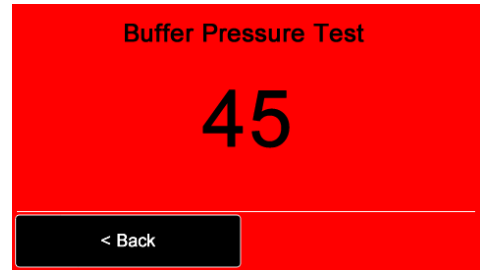


Figure 3- 21

- Buffer Motor - The Buffer Motor button activates the buffer motor. This is used to test the operation of the buffer motor.
- Drive Motor Test - The Drive Motor Test screen, shown in Figure 3- 22, allows for the testing of the drive motor. The up and down arrows correspond to forward and reverse, respectively. **CAUTION:** The machine will move forward or reverse when the arrows are selected. Be sure all persons are clear of the machine to avoid injury. When finished, press the Back button to return to the Test screen.

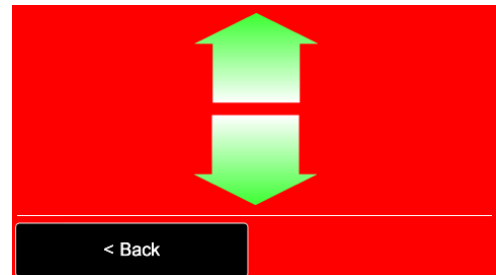


Figure 3- 22

- Transfer Roller - The Transfer Roller button activates the transfer roller motor. This is used to test the operation of the transfer roller motor.
- Settings - The screen shown in Figure 3- 23 appears when the Settings button is selected. **NOTE:** Default settings are shown. Your machine has been configured for maximum performance at factory and settings may vary slightly. These four options control the transfer roller speed, end of lane braking delay, the foul stopping preparation time, and the drive motor braking application time. Each is explained in further detail below. To increase or decrease the value of each, simply select the "+" or "-" to the right of each.

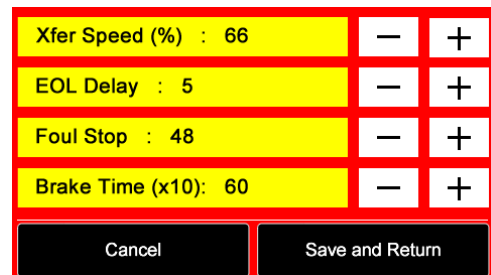


Figure 3- 23

When the necessary changes are complete, select Save and Return to return to the Test Screen. Select Cancel to discard any changes that were made and return to the

Test Screen. **CAUTION:** Changes made in settings affect **ALL** programs and are immediate once saved. Changes should only be made by advanced users.

- Xfer Speed - The Xfer Speed controls the speed of the transfer roller. Increasing it will increase the speed while decreasing it slows it down. Increasing the transfer roller speed increases the amount of oil drawn from the oil tank wick resulting in an increased volume of oil applied to the lane.
- EOL Delay - EOL Delay stands for End of Lane Delay and controls the delay for braking once the optical sensor detects the end of the lane. Increasing it will lengthen the delay while decreasing it will reduce the delay.
- Foul Stop - Foul Stop controls the time, prior to reaching the foul line, that the drive motor turns off. If it is found that the machine is consistently overrunning the foul line on multiple lanes, this value should be increased. Likewise, if the machine is stopping too soon, the value should be decreased.
- Brake Time- This controls the amount of braking applied to the motor to stop the machine. Increasing it will result in more braking while reducing it will decrease the amount of braking applied. **CAUTION:** The brake value should be set high enough to ensure the machine comes to a complete stop before the brake is released. Setting the brake time higher than needed will result in over-braking that can cause the motor to overheat.

### 3.2.6 Error Messages

The Phoenix LT4 Lane Machine has several monitoring features. When unexpected conditions occur, an error message will be displayed on the screen. This section is an overview of the error messages.

#### NOTE

Before manually moving the machine on the lane, always wait for the vacuum head to be lifted off of the lane. Moving the machine without the vacuum head lifted could cause damage to the agitator foam and squeegee.

#### Error Code 1 - Encoder

The Encoder error, shown in Figure 3- 24, will occur if the encoder does not detect that the machine is moving. Generally this occurs when the machine gets stuck due to an anomaly of the lane structure, running over the power cord, or extremely heavy oil conditions on the lane. It could also be the result of a drive

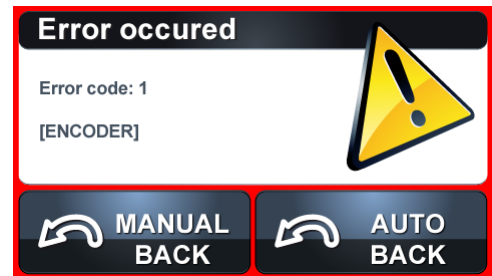


Figure 3- 24

system failure or the failure of the encoder itself. When this error occurs, the machine must be returned to the foul line and the lane reconditioned. Select the Manual Back button to manually return the machine to the foul line. If the machine detects it is being moved, it will automatically select Manual Return.



Figure 3- 25

If Auto Back is selected, the machine will use the last lane distance reading before the error and return itself to the foul line. A screen similar to the one shown in Figure 3- 25 will be displayed when Auto Back is selected.

### Error Code 2 - End of Lane

The End of Lane error, shown in Figure 3- 26, can occur under two circumstances. The first is the detection of the end of the lane outside the normal range of 52 to 65 feet. The second could be loss of signal from the optical sensor either due to a faulty sensor or becoming disconnected from the control box.



Figure 3- 26

### Error Code 3 - E-STOP

When the E-STOP button is depressed (indicated by no yellow showing behind the button) or the cover is lifted or removed, the error message shown in Figure 3- 27 will appear on the screen. When an E-STOP error occurs, all machine operations are stopped and cannot be restarted.

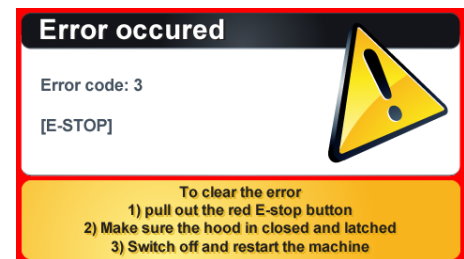


Figure 3- 27

To reset the machine do the following:

If the error was caused by the E-STOP button being depressed, insert the key into the E-STOP switch and turn (the button should pop back out and the yellow sticker behind it should be visible) then turn the power switch off then on.

If the error was caused by opening or removing the cover, close or reinstall the cover and turn the power switch off then on.

### Internal Error

The internal error, shown in Figure 3- 28, occurs if there is an interruption of communication inside the control box between the logic and relay boards. If this error occurs, turn the power switch off then on. If the error is cleared the machine is okay for operation.

If it reoccurs, contact the Brunswick Customer Response Center at 1-800-YES-BOWL (1-800-937-2695). Additionally, Technical Support can be reached by e-mail at techsupport@brunbowl.com or fax at 1-231-725-4667.



Figure 3- 28

### 3.3 PUTTING THE PHOENIX LT4 INTO POSITION

The Phoenix LT4 Lane Machine has two positions: operating and storage. The machine should always be stored on an interior wall (wall not touching the exterior of a building) to maintain consistent temperature. This is done to maintain proper viscosity of conditioner/oil. The machine must be in the operating position, shown in Figure 3- 29, to perform any of its operations.

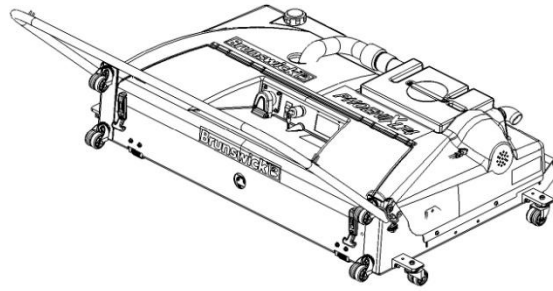


Figure 3- 29

Though the Phoenix LT4 can be moved and temporarily stored in the operating position, the machine must be placed into the storage position, as shown Figure 3- 30, if it is not to be used for more than a few hours. In the operating position, spring pressure acts on the oil tank foams and buffer brush which are necessary for the oiling function of the machine. Over extended periods of inactivity, this pressure can cause permanent deformation of the foams and buffer brush, potentially reducing their functionality. In the storage position, this pressure is relieved by gravity making it safe to store the machine for extended periods of time without risk of damage to these components.

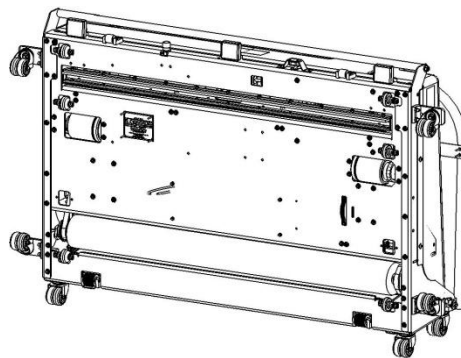
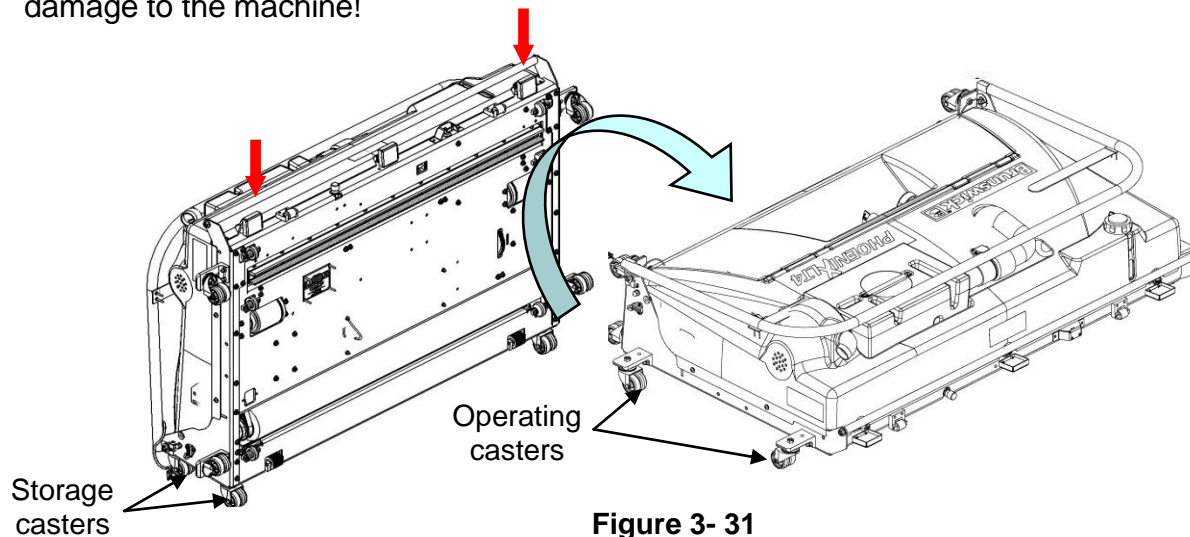


Figure 3- 30

To put the Phoenix LT4 into the operating position from the storage position, stand facing the bottom of the machine and grab the lifting handle with both hands. Slowly lower the machine onto its operating caster wheels, which are shown in Figure 3- 31 on the following page. Do not release the lifting bar until all four wheels are on the approach.

**WARNING:** Dropping the machine onto the floor from its storage position will cause severe damage to the machine!



**Figure 3- 31**

To put the Phoenix LT4 into the storage position from the operating position, first switch off, unplug, remove the power cord, and then fold the handle across the machine. Stand in front of the machine (the side with the spray nozzles) and grab the lifting bar with both hands. Carefully tip the machine up onto its storage casters. Do not release the lifting bar until all four storage casters are on the approach. Use caution to not allow the machine's momentum to take it beyond the upright position.

**NOTE**

**Most of the machine's weight is located at the back/bottom of the machine. This helps keep the machine stable in the storage (upright) position. Although the machine weighs approximately 250 pounds, it is designed so that lifting and lowering the machine between its two positions is relatively easy. Use proper lifting techniques when maneuvering the machine to avoid injury.**

### 3.4 THE HANDLE

The handle, shown in Figure 3- 32 and Figure 3- 33, can be placed in any position from flat against the Phoenix LT4 housing to fully rearward and parallel with the floor. This allows the handle to be put in whatever position is comfortable for the user when operating, moving, or storing the Phoenix LT4.

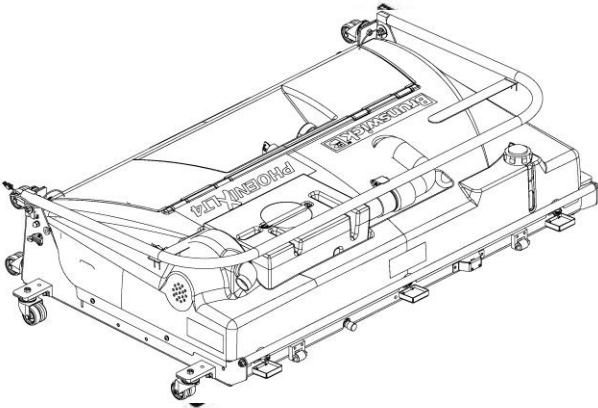


Figure 3- 32

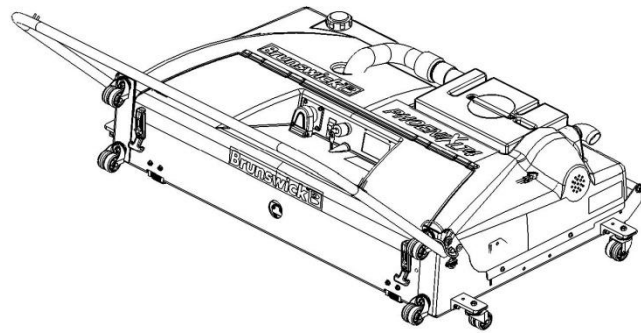


Figure 3- 33

The handle is equipped with adjustable friction hinges which allow it to remain in any position and not fall from its own weight. They also aid in the maneuverability of the machine in the operating position. If the handle is too difficult to pivot or pivots too freely, adjust the socket head hex screws, as shown in Figure 3- 34, at each handle pivot until the proper resistance is obtained. Refer to Section 4.3.8 – *Adjusting the Handle Hinges* for more information on adjusting the friction hinges.

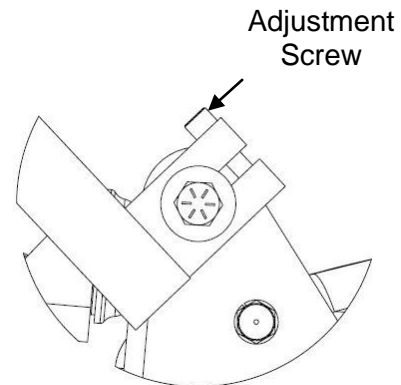
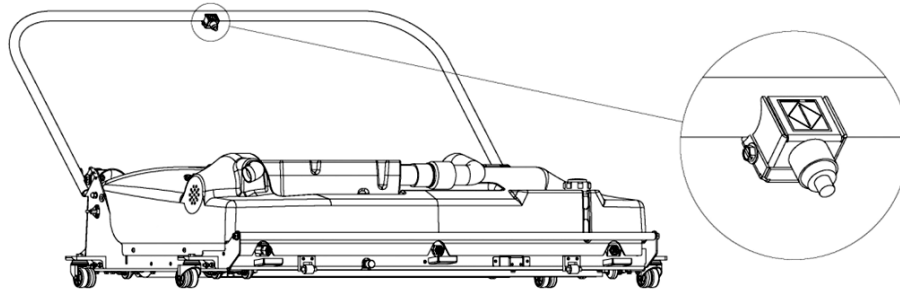


Figure 3- 34

#### SUGGESTION

Before releasing the handle when the Phoenix LT4 starts to move down the lane, it is strongly recommended that it be lowered as the machine is released. This ensures the handle will not contact the underside of the masking unit or pinspotter.

The handle has a START button and hook-and-loop straps. The Start button, which is shown in Figure 3- 35 on the next page, starts the operation of the machine, performing the functions of the selected program. When the start button is pressed the first time, the vacuum head will drop, the vacuum motor will start, and cleaner will start being sprayed onto the lane. For safety, the drive motor will not engage until the Start button has been pressed a second time within 5 seconds of the first push. If 5 seconds passes between the 1<sup>st</sup> press and the 2<sup>nd</sup> press, the 1<sup>st</sup> press of the start button must be done again.

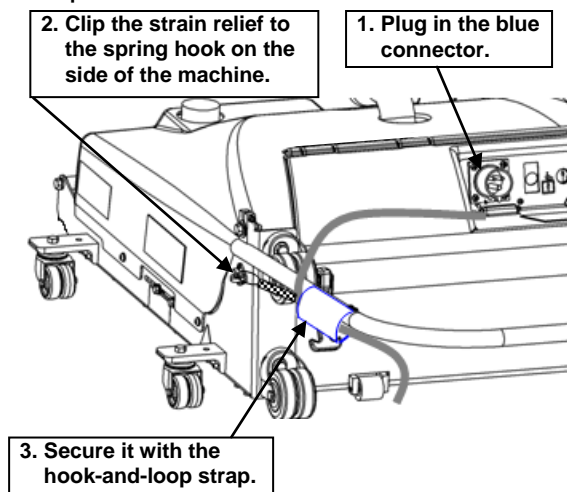


**Figure 3-35**

The hook-and-loop straps hold the power cord up and away from the moving parts of the machine and help prevent it from dragging on the lane as the machine moves (see Figure 3-36). It also relieves stress on the power cord as it is pulled when the machine moves.

The recommended power cord path is:

1. Plug the power cord into the machine.
2. Clip the power cord's strain relief into the hook located on either side of the Phoenix LT4 frame.
3. Run the power cord along handle and secure it with the hook and loop strap.

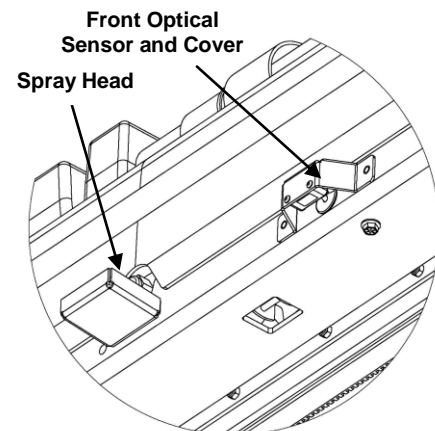


**Figure 3-36**

### 3.5 OPTICAL SENSOR

The Phoenix LT4 Lane Machine is equipped with an optical sensor that detects the end of the lane (EOL). When looking at the front of the machine, the sensor is located to the right of the middle sprayer head and is protected by a metal cover as shown in Figure 3-37.

It is positioned so that it “looks” down on the lane. Information from this sensor is used only when the machine is traveling from the approach to the pin deck. The sensor is continually testing for a change in height. When the sensor detects the end of the lane, it sends a signal to the controller that initiates the braking routine. This prevents the machine from running into the pit.



**Figure 3-37**

## NOTES

- To ensure the power cord does not affect the sensors, it is recommended that the cord be routed as described in Section 3.4 – *The Handle*.
- If the optical sensor causes the machine to lose power, it will not resume its operation on power up, but will return to the home screen. The cleaning and/or oiling program will need to be redone for that lane starting at the foul line. It is always good practice to power up the machine and wait for it to lift the vacuum head before attempting to move the machine manually on the lane. This will prevent contaminating the vacuum head squeegee and agitator foam with untreated lane oil.



### 3.6 CLEANING OPERATION COMPONENTS

The components used in the cleaning operation are shown in Figure 3- 38, Figure 3- 39, and Figure 3- 40 described below in Table 3- 4, Table 3- 5, and Table 3- 6, respectively.

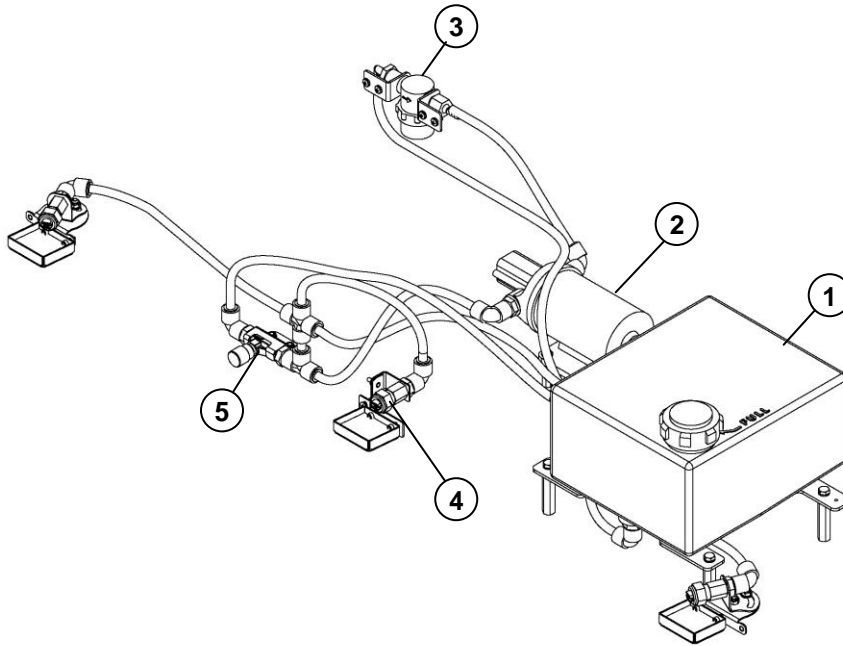


Figure 3- 38

Table 3- 4

ID	Component	Description
1	Cleaner Tank	This tank holds the cleaning solution. It holds enough to clean approximately 16 lanes. When placing the machine in the storage position, <u>ensure the cleaner level is below the level of the cap or cleaner could drip from the cap’s vent hole.</u>
2	Cleaner Pump	This pump transfers cleaner from the cleaner tank to the spray head.
3	Cleaner Filter	Located on the rear of the waste tank mounting bracket in the tubing running from the cleaner tank to the cleaner pump, the filter is designed to strain out any particles that could lodge in the pump or spray nozzles.
4	Spray Heads	The spray heads distribute the cleaner on the lane and can be adjusted for both amount of spray, and direction. Refer to Section 4.3.4 – <i>Adjusting the Cleaner Spray</i> for instructions on clearing clogs and how to change the amount of cleaner dispensed from the spray heads.
5	Cleaner Flow Control Valve	This manually operated valve is used to control the amount of cleaner being supplied to the spray heads. Throttling (closing) the valve increases cleaner flow to the spray heads. Excess cleaner is routed back to the cleaner tank.

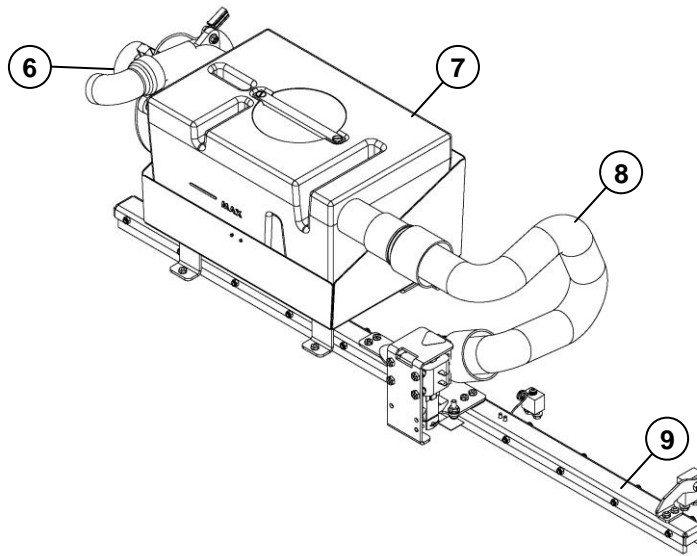


Figure 3- 39

Table 3- 5

ID	Component	Description
6	Vacuum Motor	The combined motor and pump provide the suction power for removing the cleaner and conditioner solution from the lane. The unit contains a replaceable seal (P/N A-8307) that provides an air tight connection between the vacuum pump and waste tank.
7	Waste Tank	<p>This tank is large enough to hold the cleaner, dirt, and oil from the cleaning of approximately 16 lanes.</p> <p>To keep cleaner suds from being sucked into the vacuum pump, pour 1-2 ounces (30-60 ml) of defoamer into the waste tank before use.</p> <p>Empty the waste tank every time the cleaner tank is filled during a lane cleaning session and before storing the machine, though a full waste tank will not leak when the machine is in the storage position.</p> <p>The waste tank also has a line marked “MAX” and it should be emptied once the level of the waste reaches that line.</p>
8	Vacuum Hose	<p>This flexible tube is used to transport the oil/cleaner solution from the vacuum head to the waste tank.</p> <p>The hose slips onto the waste tank inlet tube. This slip fitting makes it easy to take off the hose when removing the waste tank.</p>
9	Vacuum head	The agitator foam and squeegee are attached to the body of the vacuum head. It is held up off the lane by a solenoid except during a cleaning cycle or when power is removed from the machine. The metal tube on the top provides an attachment point for the vacuum hose.

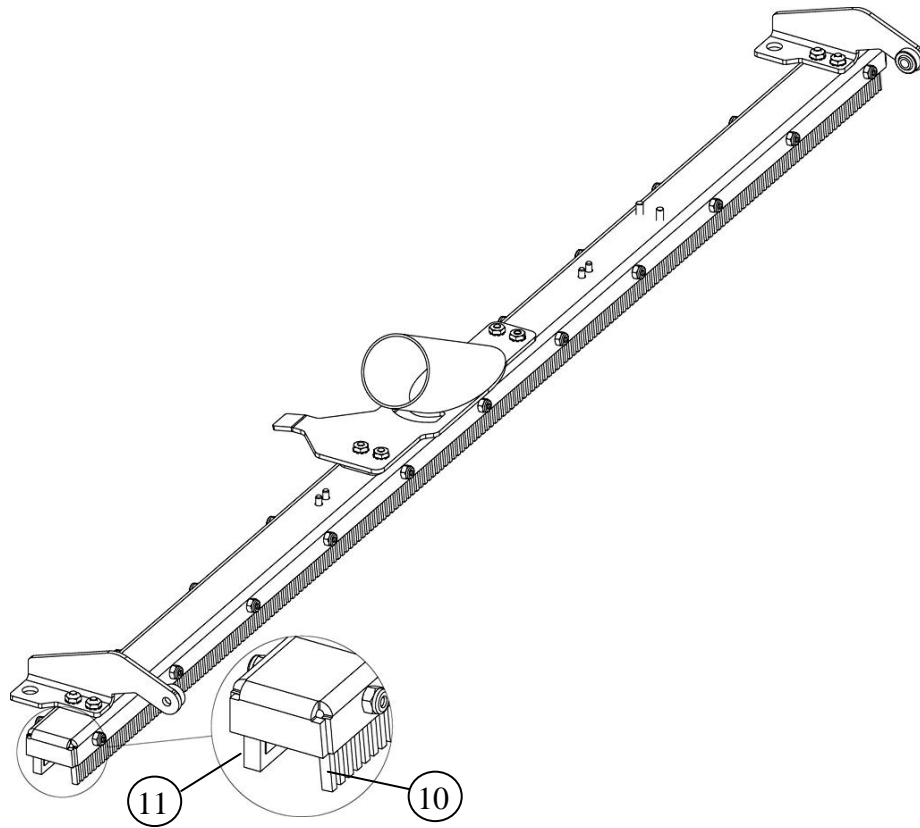


Figure 3- 40

Table 3- 6

ID	Component	Description
10	Rear Squeegee	The squeegee glides along the lane surface, wiping up the emulsified oil/cleaner solution which is then drawn up into the vacuum head by suction.
11	Agitator Foam	This foam strip mixes the cleaner into the oil on the lane to improve cleaning efficiency.

### 3.7 LANE CONDITIONING COMPONENTS

The lane conditioning components are shown in Figure 3- 41, 3- 42, and Figure 3- 43, and described below in Table 3- 7 and Table 3- 8, respectively.

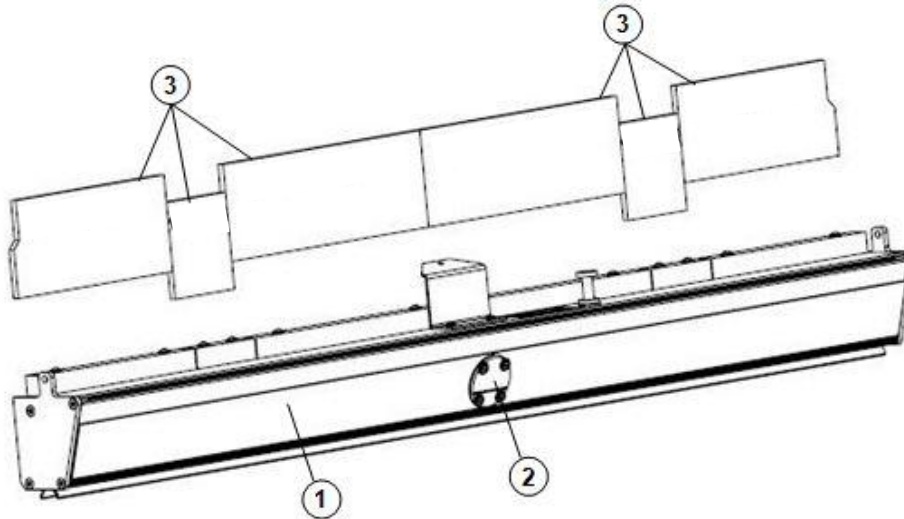


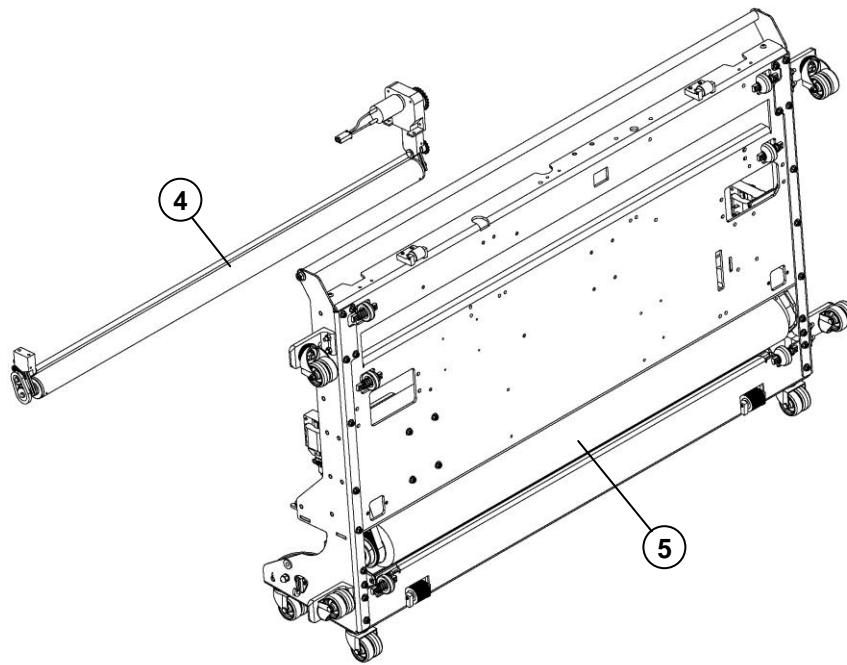
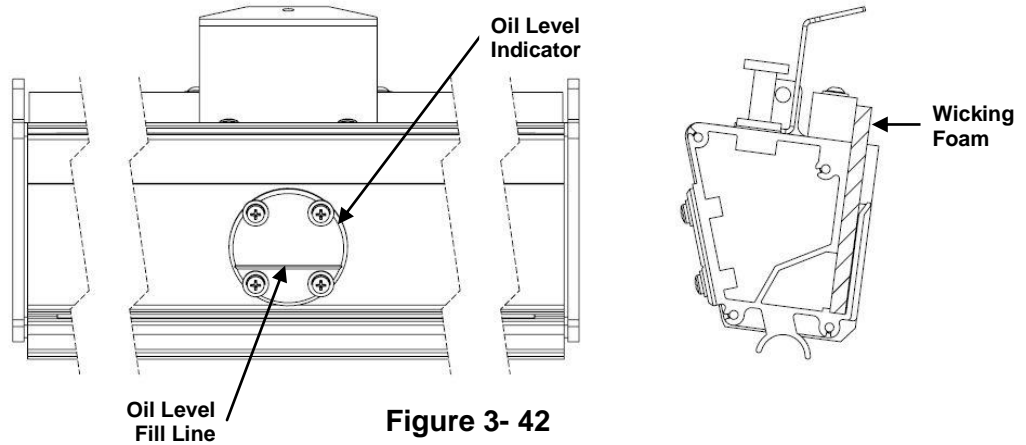
Figure 3- 41

Table 3- 7

ID	Component	Description
1	Oil Tank Assembly	While the oil tank holds enough oil to condition 24 lanes, depending on the pattern, it is advisable to refill when filling the cleaner tank. It should be filled to the maximum oil level observed on the oil tank sight glass before each conditioning session to ensure a consistent amount of oil is kept in the wicking foams.
2	Oil Tank Level Indicator (sight glass)	This indicator shows the level of oil in the oil tank. The line on the sight glass indicates the maximum oil level with the tank in its normal operating position against the transfer roller. Fill the tank in its normal operating position to the bottom of the line.  Add oil to the tank before the oil level drops below the bottom of the sight glass and before every lane conditioning session. This will help keep the oil pattern consistent.
3	Wicking Foams	The wicking foams reside in the oil tank trough where they constantly absorb oil. Capillary action causes the oil to move to the top of the wicking foam where it is picked up by the transfer roller. The different sizes, types, and densities of foam determine the pattern in which the oil is distributed onto the transfer roller. The higher the number stenciled on the foam, the higher the density and the lower the oil output. For more information about oil patterns, refer to Section 6 - <i>Determining The Oiling Pattern</i> .

**IMPORTANT**

Always fill the oil tank slowly to allow the oil level in the indicator, as shown in Figure 3- 42, to adjust to the level in the tank. **Never** fill the oil tank above the mark on the oil tank level indicator or oil will overflow into the machine and onto the lane.



**Figure 3- 43**

**Table 3- 8**

4	Oil Transfer Roller	The oil transfer roller picks up oil from the wicking foams and holds it for pickup by the buffer brush.
5	Buffer Brush	The buffer brush picks up oil from the transfer roller and applies it to the lane.

## 3.8 PREPARING FOR USE

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Before every lane conditioning session, the following steps should be performed to prepare the Phoenix LT4 Lane Machine for use.

1. Check the wicking foams, agitator foam, squeegee, and buffer brush for wear.
2. Move the handle through its full range of motion to ensure it moves easily and is not damaged.
3. Check the fluid levels and fill the cleaner and oil tanks, if necessary.
4. Ensure the waste tank is empty. Check the vacuum connections and add defoamer to the waste tank.

### 3.8.1 Filling and Preparing the Tanks

---

The tanks have been designed to allow cleaning, conditioning, and storing of waste for up to 16 lanes. It is recommended that the cleaner and oil tanks be filled away from the lane. If they are filled on the lanes, position the machine at least 2 feet (60 cm) down the lane from the foul line to ensure that no cleaner or oil is spilled on the approach which, even after it is cleaned up, can adversely affect the bowler's delivery by changing the sliding characteristics of that part of the approach.

Complete the steps below to fill the cleaner and oil tanks, and to prepare the waste tank.



#### **CAUTION**

**DO NOT accidentally put lane oil in the cleaner tank or lane cleaner in the oil tank. Doing so will require extensive cleaning and maintenance of the oiling and cleaning systems.**

#### **3.8.1.1 Adding Cleaner**

The cleaner used must be compatible with the Phoenix LT4 Lane Machine and the center's lanes. Listed below are things that need to be kept in mind when choosing a cleaner and filling the cleaner tank.

1. Use only cleaners that are manufactured for use on bowling lanes.
2. Follow the manufacturer's directions to properly dilute the cleaner. The cleaner dilution ratio may be changed based on water hardness, type and amount of oil on the lanes, and/or cleaning frequency.
3. DO NOT put undiluted cleaner in the cleaner tank.
4. Do not overfill the tank.



#### **CAUTION**

**Avoid splashing the cleaner. Follow all instructions and precautions on the product label. In case of eye contact, immediately remove any contact lenses and flush with water for 15 minutes.**

Follow the steps below to fill the cleaner tank.

1. Remove the cap from the cleaner tank.
2. Insert the **large** red funnel into the tank opening. Leave a small gap to allow air to exit from the tank as it is filled.

**Note:** The large red funnel must have a screen in place. Replace the funnel if the screen is missing or damaged.

3. Pour **diluted** Brunswick Lane Cleaner, or equivalent, into the tank until it is about an inch below the tank inlet.
4. Remove the funnel.
5. Replace the cap.
6. Wipe up any drips or spills that may have occurred.

### **3.8.1.2 Adding Oil**

As with the cleaner, there are things that must be kept in mind when filling the oil tank.

1. Use only oil or lane dressing that is manufactured specifically for use on bowling lanes.
2. Fill the tank while it is in the normal operating position.
3. Do not overfill the tank. The correct level is just to the bottom of the fill line on the sight glass.
4. Pour the oil in slowly. Allow time for the oil to disperse throughout the tank.



**Because bowlers can slip and fall on oil spilled on the approach, DO NOT fill the oil tank on the approach. Fill it 2 to 3 feet down the lane or in an area away from the lanes, such as the service area by the pinspotters.**

**Avoid splashing the oil. Follow all instructions and precautions on the product label.**

Follow the steps below to fill the oil tank.

1. To access the oil tank, open the oil tank compartment door by unlatching the clasps keeping it closed.
2. Remove the plug from the top of the oil tank as shown in Figure 3- 44 on the next page.

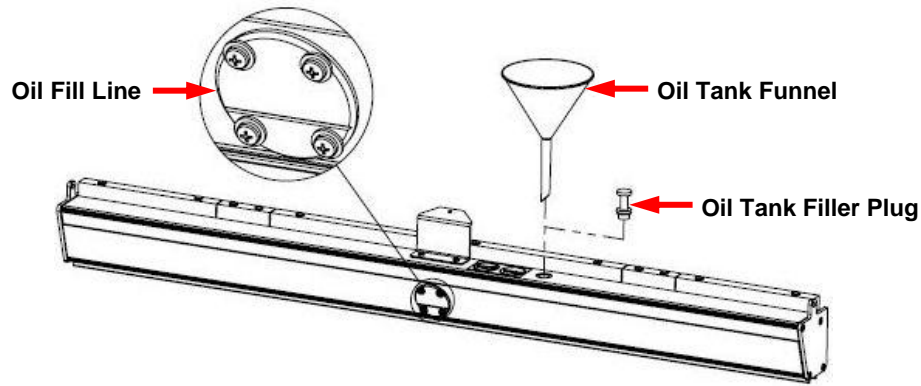


Figure 3- 44

3. Insert the **small** clear funnel into the opening. Leave a small gap to allow air to exit from the tank as it is filled.
4. SLOWLY pour lane oil into the tank until the oil level has reached the oil fill line, as shown in Figure 3- 44. DO NOT OVERFILL!
5. Remove the funnel.
6. Replace the plug.
7. Wipe up any drips or spills that may have occurred.
8. Close the oil tank cover and fasten the clasps.

### 3.8.2 Defoaming the Waste Tank and Checking Hose Connections

As the emulsion of cleaner and oil is vacuumed, air is forced into it. This action produces suds that can get sucked into the vacuum pump and discharged into the machine or back onto the lane. To alleviate this problem, pour 1-2 ounces (30-60 ml) of defoamer into the waste tank before starting a cleaning session. The defoamer should remain effective for the entire cleaning session, even after the waste tank is emptied. If suds are accumulating, pour an additional 1-2 ounces (30-60 ml) of defoamer into the waste tank. The tank must be empty when adding defoamer. After pouring the defoamer in, rotate the tank to coat the walls with the defoamer.

#### CAUTION

**The defoamer, a silicone-based liquid, can damage lane surfaces. Therefore, perform this process away from the lane and approach, and pour the defoamer directly into the waste tank.**

The vacuum hose connections must be tight and the waste tank must be properly seated against the vacuum pump seal to ensure the proper vacuum seal. If there are any leaks in the system, the Phoenix LT4 will not be able to adequately pick up the cleaner/oil emulsion from the lane. Perform the steps below to check the connections and tank placement.

1. With the hood removed, gently tug on the vacuum hose where it is clamped to the vacuum head. The hose should not be able to move.



2. Firmly push the other end of the vacuum hose onto the waste tank inlet port.
3. Verify the vacuum seal is in full contact with the waste tank. If not see Section 4.3.6 – *Adjusting the Vacuum Motor Position*.

#### NOTE

Whenever the waste tank is placed in the machine, use care to not damage the vacuum pump seal.

### 3.9 CLEANING THE LANE HEAD AREA

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To clean the lane using the Phoenix LT4, place only the front two casters in the gutters and follow the procedure below. Placing only the front two casters in the gutters will allow the machine to clean the first 30 inches (76 cm) of the lane.

To clean the lane head area:

1. Position the machine on the lane with only the front caster wheels in the gutters.
2. Press the POWER switch to ON.
3. Press the START button **once**. The Phoenix LT4 starts spraying the cleaning solution, lowers the vacuum head, and starts the vacuum motor.
4. Push the Phoenix LT4 forward until all four caster wheels are in the gutters and press the start button a second time (within 5 seconds of the first press). The machine will continue on to clean and/or condition the lane.

### 3.10 CLEANING AND CONDITIONING

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#### NOTE

**It is strongly suggested that the lanes be dusted before a conditioning session. Dusting the lanes will prolong the life of the foams, squeegee, and buffer brush, and ensures quality results.**

**Ensure the bumpers, if installed on the center's lanes, are fully retracted before operating the Phoenix LT4 on a lane. Bumper rails that protrude above the lane surface should be repaired or replaced prior to operating the Phoenix LT4.**

#### IMPORTANT!

**Ensure the pinspotters are turned off on the lanes being cleaned or conditioned.**

When the Phoenix LT4 is first energized, the touch screen will momentarily appear blank while the system loads. Once loaded, it will automatically select the last used program on the machine.

For information on programming or changing the factory programming of the Phoenix LT4, refer to Section 3.2 - *The Phoenix LT4 Lane Machine Controls*.

### The Home Screen

The Home screen, shown in Figure 3- 45, is where all the functions of the Phoenix LT4 can be accessed. To clean and/or condition a lane, select the appropriate program by touching one of the program letters on the left side of the screen. The selected program will be colored red, while the others will be black. In Figure 3- 45, program B is the selected routine as indicated by being colored red and the ">" on the program button.



Figure 3- 45

### The Run Screen

The Run screen appears when the machine is running one of the programs. The program which is being run is displayed in the top left portion of the screen. The distance from the foul line or start position is displayed in the top right portion and the selected operations are shown along the bottom of the screen. An operation that is in process will be colored green while one that is not is black. In Figure 3- 46, Program A is currently being run. The machine is 16 feet from its starting position and the cleaning and buffing operations are currently being performed.



Figure 3- 46

### OILING NOTE

The machine is sent with wicking foams that provide the optimal lane conditioning for most centers. This factory-set pattern can be altered by many factors, such as by changing the wicking foam density, the oiling and buffing distances, and the type of oil being used. For information about changing the oil pattern, refer to Section 6 - *Determining the Oiling Pattern*.

### 3.10.1 Cleaning and Conditioning the Lanes

Table 3- 9 below lists the steps that should be performed to clean, oil, and buff a lane. Skip any that do not apply to the operation being performed.

#### Startup Checklist

Table 3- 9

	Move the machine from its storage location to the approach. Lower the machine to the operating position and place on the starting lane.
	Ensure the waste tank is empty. Check the cleaner and oil tank levels. If it is necessary to add cleaner or oil move the machine at least 3 feet (90 cm) down the lane to avoid spillage on the approach. Do not add defoamer to machine while on approach or lanes. Return machine to foul line when complete.
	Plug the power cord into the appropriate electrical outlet.
	Insert the large, blue plug into the power inlet on the machine and secure the cord to the handle.
	Press the POWER switch to ON.
	Select the appropriate program for use.
	<p>Press the START button on the handle <b>once</b>.</p> <p>When the START button is pressed the first time, the Phoenix LT4 performs the following actions:</p> <ul style="list-style-type: none"> <li>• If running a routine that cleans the lanes, the spray head will begin spraying solution onto the lane, the vacuum head drops to the lane, and the vacuum motor starts.</li> <li>• If running a routine that only buffs or oils/buff the lanes, no action is taken.</li> </ul>
	<p>Press the START button on the handle <b>a second time*</b>. The drive motor (and buffer motor if oiling or buffing) starts and the machine begins to move down the lane. If oiling, the transfer roller motor also starts.</p> <p><b>*The START button must be pressed a second time within five seconds of the first push. If it is not pressed again, all operations will be cancelled.</b></p>
	Push the handle down (toward the approach) then release it to allow the machine to travel down the lane.

As the Phoenix LT4 makes its forward and reverse pass on the lane to complete the selected program, it performs the actions shown in Table 3- 10 on the following page. The table separates each action by operation, but the Phoenix LT4 performs the actions simultaneously when multiple operations are selected.

Table 3- 10

CLEANER OPERATION	OIL OPERATION	BUFF OPERATION
<ul style="list-style-type: none"> <li>▶ Sprays cleaner.</li> <li>▶ Turns on the vacuum motor.</li> <li>▶ Vacuum head drops down onto the lane</li> <li>▶ Turns on the drive motor.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Turns on the oil transfer roller motor.</li> <li>▶ Turns on the buffer motor and lowers the brush.</li> <li>▶ Turns on the drive motor.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Turns on the buffer motor and lowers the brush.</li> <li>▶ Turns on the drive motor.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Sprays cleaner continuously until the counter reaches 52 feet from the foul line then stops spraying to avoid spraying pins on the pindeck.</li> <li>▶ Vacuums the entire length of the lane and pin deck.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Brushes oil onto the lane until the counter reaches the specified number of feet from the foul line and then turns off the transfer roller motor.</li> <li>▶ Buffer brushes oil until the specified buffing distance is reached.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Brushes the oil already on the brush and on the lane until the counter reaches the specified number of feet from the foul line and then turns off the buffer motor and retracts the brush.</li> </ul>
<ul style="list-style-type: none"> <li>▶ When the EOL sensor detects the back of the pin deck, it performs the following end of lane actions: <ul style="list-style-type: none"> <li>• Positions the vacuum head beyond the end of the lane, then stops.</li> <li>• Raises then quickly drops the vacuum head twice to shake off excess residue from the agitator and squeegee, then retracts the vacuum head.</li> <li>• Reverses the direction of the drive motor and begins to travel toward the approach.</li> </ul> </li> <li>▶ Continues to run the vacuum motor for 5 feet toward the approach.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Buffer brush is lowered and turned on at buff distance.</li> <li>▶ On the return pass at the programmed number of feet from the foul line, the transfer roller motor is turned on (and if not already in operation the buffer brush motor turns on and the buffer brush is engaged against the lane.)</li> </ul>	<ul style="list-style-type: none"> <li>▶ On the return pass when the counter reaches the programmed number of feet from the foul line, the buffer motor is turned on and the buffer brush is engaged against the lane.</li> <li>▶ Brushes the oil already on the brush and on the lane.</li> </ul> <p><b>Warning:</b> Buffing the lane without oil in the brush can cause wear to brush and burnishing of lane surface.</p>

**Table 3- 110 continued**

<b>CLEANER OPERATION</b>	<b>OIL OPERATION</b>	<b>BUFF OPERATION</b>
Travels toward the approach until the counter wheel counts down to 1 foot from the foul line.	Applies oil until the counter wheel counts down to 1 foot from the foul line.	Brushes the existing oil until the counter wheel counts down to 1 foot from the foul line.
Turns off the drive motor.	<ul style="list-style-type: none"> <li>▶ Turns off the oil transfer roller motor.</li> <li>▶ Turns off the buffer motor and retracts buffer.</li> <li>▶ Turns off the drive motor.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Turns off the buffer motor and retracts buffer.</li> <li>▶ Turns off the drive motor.</li> </ul>
<b>Second Pass:</b> Cleaner system does not operate.	<b>Second Pass:</b> Performs the above steps out to the second pass distance settings.	<b>Second Pass:</b> Performs the above steps out to the second pass distance settings.

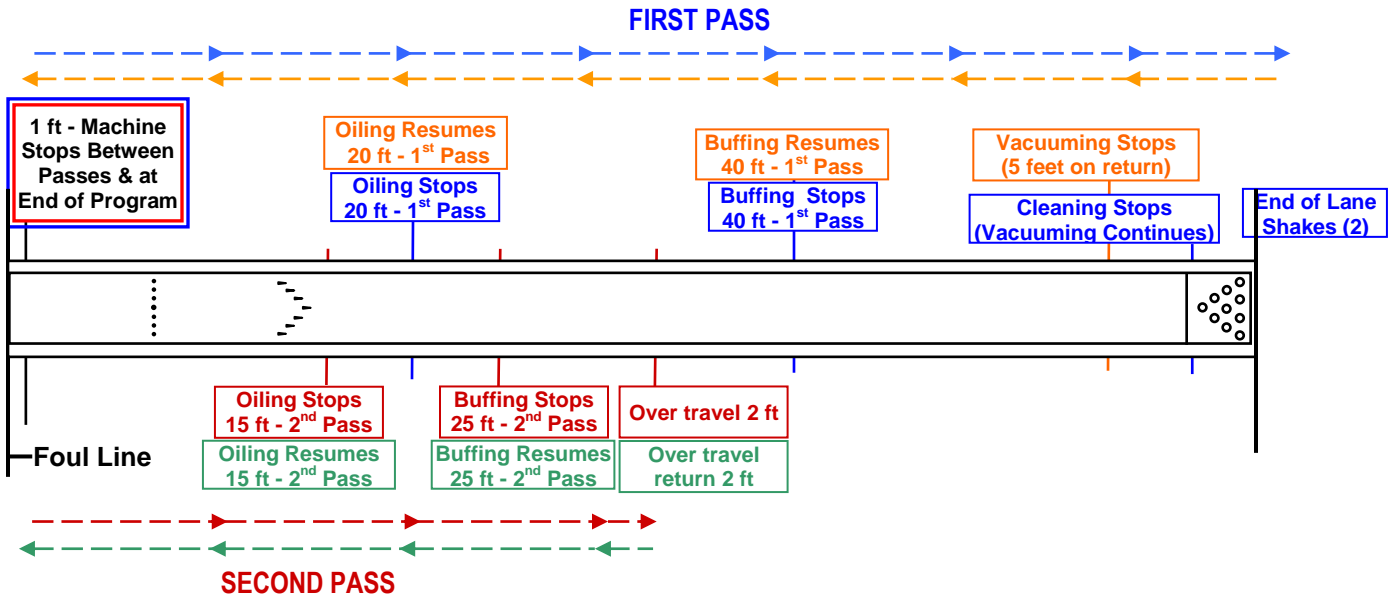
**NOTE**

Though the vacuum, buffer, and drive motors are turned off, the Phoenix LT4 is still powered on. The machine will de-energize the vacuum head solenoids and lower the vacuum head if left idle for more than 5 minutes. Cycle the power switch to reset.

Once the Phoenix LT4 has returned to the approach and turned off the motors for the operations selected, it can be moved to the next lane or press the POWER switch to turn off the machine. For information about storing the Phoenix LT4, refer to Section 4 - *Maintenance and Adjustments*. It is best to power off the machine on the approach. Otherwise, the vacuum head will drop onto the lane. When the machine is pulled onto the approach with the vacuum head down, the squeegee and agitator foam will be dragged through the first 30 inches of oil on the lane.

### 3.10.2 Illustration

The following drawing illustrates where the Phoenix LT4 performs actions when cleaning, oiling for 20 feet, and buffing for 40 feet are enabled on the first pass; and then oiling to 15 feet, and buffing to 25 feet on the second pass. The center's actual settings might be different.



## MAINTENANCE AND ADJUSTMENTS

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By performing the simple, periodic maintenance procedures given in this section, the Phoenix LT4 Lane Machine will be kept in good working order to produce high quality lane conditioning.

In addition to the periodic maintenance procedures, this section also contains information about how to adjust and test the machine's performance and how to replace the parts that wear out from normal use.



**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

### 4.1 PERFORMING AFTER-USE MAINTENANCE

---

After completing a conditioning session, the Phoenix LT4 Lane Machine should be cleaned by performing the maintenance tasks listed below. Performing these tasks will prepare the Phoenix LT4 for the next conditioning session.

#### NOTES

It is recommended that the tasks are performed in the order listed, but they can be performed in any order.

**When cleaning the machine, it is important that oil does not get into the cleaning components of the machine and that cleaning solution does not get into the oiling components of the machine.**

Perform the following tasks with the machine in the **operating** position:

### **Oiling Area**

- Check the oil level and add oil if needed.
- Ensure the cap is in place and securely tightened.
- Check the wicking foams for nicks, tears, and missing pieces along the edge.
- Unlatch the tank oil spring and tilt the tank rearward. With a clean cloth, gently wipe the wicking foams and the front of the oil tank. Reinstall the tank oil spring.

### **Cleaning Area**

- Check the amount of cleaning solution in the cleaner tank and add cleaning solution if needed. Do NOT refill the cleaner tank prior to storing the machine or cleaner could leak out of the vent hole in the cap.
- Ensure the cap is in place and securely tightened.
- Check the foam pads below the spray heads. Rinse and squeeze out excess moisture. Replace the pads as needed.

### **Waste**

- Remove and empty the waste tank. Rinse the waste tank under running water.
- Add 1-2 ounces of defoamer into the tank. Cover the vacuum hose port and swish the defoamer around to coat the inside of the tank. Defoamer will need to be added to the waste tank daily when new, but as the tank becomes "seasoned" it may only need to be added on a weekly basis.
- Check the vacuum seal on the side of the vacuum motor. Replace if it is wrinkled, buckled, or torn.
- Replace the waste tank being careful not to bend or abrade the vacuum pump to waste tank seal.

### **Power Cord**

- Unplug the power cord from the power inlet on the control panel.
- Unplug the power cord from the outlet.
- Coil the power cord around the base of the handle. Coiling in long loops will help keep the cord from twisting.

### **Frame and Exterior Components**

- Wipe the optical sensor lens with a dry, clean, and soft cloth. Do not use any type cleaner on the sensor.
- Wipe the nozzles.
- Wipe the frame.
- Wipe the touch screen with a clean cloth.



Perform the following tasks with the machine in the **storage** position:

### **Cleaning Area**

- With a clean cloth, wipe the agitator foam and squeegee.
- Check the agitator foam and squeegee for nicks, tears, and gaps in their edges.
- Check the squeegee to see if the edges have become hard and for places where it may have permanently warped out of shape.

### **Oiling Area**

- With a clean and dry cloth, wipe the buffer brush bristles. Turn the brush and wipe each exposed section of bristles until all of the bristles have been wiped.
- Check the buffer brush for numerous broken bristles and uneven wear patterns that could indicate the buffer brush pressure is uneven or that the buffer brush pressure is too high.



**Do not use any kind of heating apparatus to dry the brush as it may damage the bristles.**

### **Other Exterior Components**

Wipe down all exterior components with a clean cloth or reuse the cloth that was used to wipe down the cleaning area components.

- Wipe the casters and wheels.
- Wipe the top and sides of the machine.
- Wipe the base plate - starting at the cleaning area and finishing with the oiling/buffing area.

## **4.2 PERFORMING WEEKLY MAINTENANCE**

---

In addition to the maintenance procedures performed after each lane conditioning session, the following tasks should be performed each week. The steps to perform these tasks are given in the following sections.

- Test the machine's performance.
- Clean the cleaner tank and cleaner tank area.
- Clean the waste tank and waste tank area, in-line filter, oil tank area, and the buffer brush.
- Clean the oil tank drip pad located under the oil tank. If saturated with oil, remove to clean with lane cleaner and water.
- Check the inline basket filter located on the back of the waste tank support bracket (Section 4.2.3 – *Cleaning the In-Line Filter*).
- Flip the oil wicks (Section 4.3.2 – *Cleaning the In-Line Filter*).

## 4.2.1 Testing the Phoenix LT4 Lane Machine's Performance

The Phoenix LT4 Lane Machine has been designed and manufactured to perform years of worry-free lane conditioning. However, the cleaning and conditioning operations should be checked to ensure the components are set correctly and that the Phoenix LT4 is performing as expected.

### 4.2.1.1 Checking the Cleaning Function

To ensure the Phoenix LT4 is removing the emulsified cleaning solution from the lanes, pick two or three lanes on which to perform only the cleaning operation. After the Phoenix LT4 has cleaned the lanes, examine them for any remnants.

If any of the emulsified cleaner solution remains on the lanes, check the condition of the squeegee, agitator, and the vacuum seal as described in Section 4.1 - *Performing After-Use Maintenance*. Also refer to Section 5 - *Troubleshooting* for other possible causes and solutions.

#### NOTE

**If a very high volume of conditioner/oil is applied in the head area, the machine may not be able to completely remove all of the oil with a single cleaning operation.**

### 4.2.1.2 Measuring the Buffer Brush Pressure

The pressure put on the lane by the buffer brush must be consistent across the width of the brush to ensure the oil is applied in a consistent amount across the lane. When the Phoenix LT4 Lane Machine leaves the factory, the buffer brush pressure is set for optimal lane conditioning and is tested to ensure the pressure is the same across the brush.

Unless it is determined that a higher setting is needed, the best setting for the buffer brush pressure is a light to mid-range C on the Pressure Adjusting Tool, shown in Figure 4-1. As the bristles on the buffer brush wear and break off through normal wear and tear, the pressure will lessen.

**Even though it is possible to adjust the pressure to remain within the recommended range, brushing efficiency will degrade over time.**

While the life of the buffer brush can be extended by adjusting the buffer brush pressure, replacing the buffer brush will ensure continued optimal performance. Refer to Section 4.3.1 – *Adjusting the Buffer Brush Pressure* and Section 4.4.2 – *Replacing the Buffer Brush*.

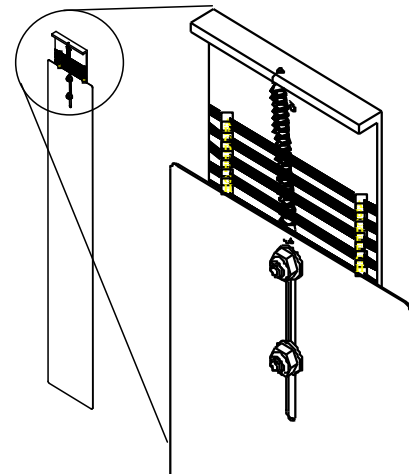


Figure 4- 1

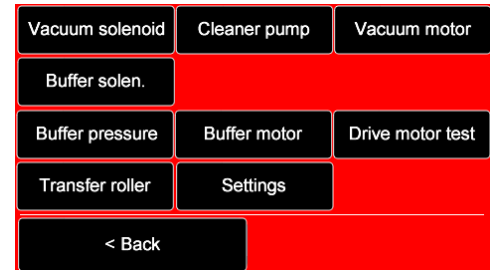
**NOTE**

It is possible for the pressure on one side of the brush to be different from the other side. To ensure the oil application is consistent across the width of the brush, both sides need to be adjusted to the same pressure.

To measure the buffer brush pressure, perform the steps below with the machine in the **operating** position. In order to measure the pressure correctly, the lane and the buffer brush should have oil on them.

<b>Tools Needed:</b>	• Pressure Adjustment Tool, RP-43
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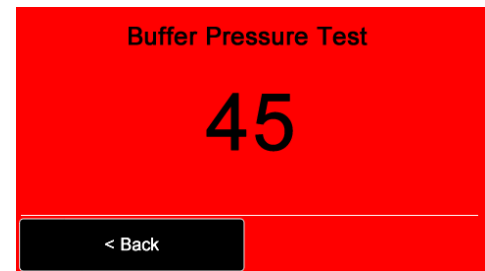
1. Position the Phoenix LT4 about 2 feet down the lane from the foul line.
2. Plug the Phoenix LT4 into a power source.
3. Turn ON the machine's POWER switch.
4. From the Home screen, select the *Test* screen icon and enter the *Test Area* by selecting its



**Figure 4- 2**

button. Touching the Test Area button will display a warning message. **Adjusting the buffer pressure should only be done by experienced operators.**

To proceed to the Test Area, select the Access button. The Buffer Pressure option is located in the third row of the left column as shown in Figure 4- 2.



**Figure 4- 3**

When ready to test the buffer pressure, press the *Buffer Pressure* button. The buffer motor will engage (the drive motor will not start) and run for approximately 45 seconds. A countdown will be displayed on the screen as shown in Figure 4- 3. The test can be stopped at any time by pressing the *Cancel* button located in the bottom left corner of the screen.

5. From the rear of the machine, position the vinyl strip of the Pressure Adjusting Tool under the middle of the buffer brush, with at least 3 inches of the vinyl strip extending beyond the other side of the buffer brush. The engaging of the buffer brush and the tool will be felt.
6. While observing the scale, hold the aluminum plate just off the surface of the lane, and slowly pull the tool away from under the machine.
  - Pull the tool away from the brush in a straight path without lifting the aluminum plate away from the lane.
  - Take the reading while pulling the tool, not as the vinyl strip initially releases from the buffer brush.

7. Take several readings on each side of the machine.
8. If the readings from each side are not between B and C, the pressure must be adjusted. Refer to section 4.3.1 – *Adjusting the Buffer Brush Pressure*.  
  
If the readings are between B and C for all of the areas tested, the pressure does not need to be adjusted.
9. The test can be ended at any time by touching the Cancel button or waiting for the countdown to expire. When the test is complete, press the Back button to return to the Home screen.
10. When testing is complete, turn off the POWER switch and unplug the Phoenix LT4 from the power source.

### 4.2.2 Cleaning the Cleaner Tank Area

To clean the cleaner tank area, wipe the outside of the tank with a cloth that is dampened with the same diluted cleaning solution that is used on the lanes.

### 4.2.3 Cleaning the In-Line Filter

To keep particles out of the cleaner solution delivery system, the Phoenix LT4 has an in-line filter. To check and clean the in-line filter, complete the steps below. Perform these steps with the machine in the **operating** position.

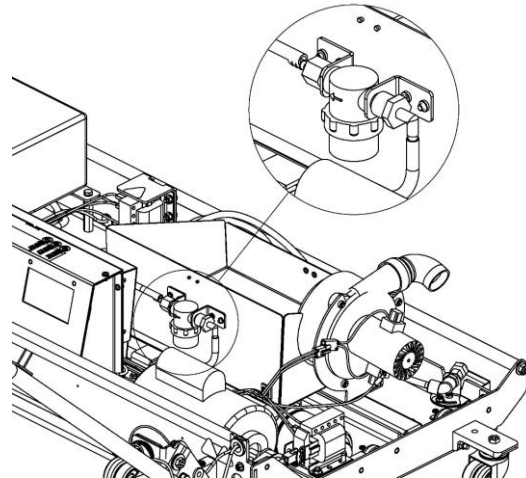


## WARNING

**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

<b>Tools Needed:</b>	Small clamps (2) or locking pliers
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1. Locate the filter, which is attached to the rear of the waste tank support bracket as shown in Figure 4- 4.



**Figure 4- 4**

2. Pinch off the tubing on both sides of the filter assembly. When filter is disassembled, some cleaner will drain from it. **Caution: To prevent spills from occurring, place bowl or cloth beneath the filter to catch all fluid.**
3. Remove the bowl and screen by unscrewing the bottom of the filter assembly. If filter is removed from the support brackets, be sure to pay attention to the flow direction. The arrow should be pointing towards the line that goes into the pump while it receives from cleaner tank.
4. Clean the bowl and screen under running water.
5. Reassemble the screen and bowl.
6. Remove the clamps from the tubing and check for leaks.
7. Wipe up any spills.

#### **4.2.4 Checking the Waste Tank Seal**

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The vacuum pump to waste tank seal plays a critical role in the cleaning function of the Phoenix LT4 and should be inspected weekly. Any nicks or cuts, bent or rolled edges, excessively frayed or abraded areas, or lack of adhesion to the vacuum pump will impede the cleaning function. Refer to Section 4.4.4 – *Replacing the Waste Tank Seal*.

Additionally, any gap between the seal and waste tank will adversely affect cleaning efficiency. If a gap exists, refer to Section 4.3.6 – *Adjusting the Vacuum Motor Position*.

#### **4.2.5 Cleaning the Waste Tank**

---

The waste tank should be rinsed out after each use and it should also be cleaned weekly by completing the steps below. Perform these steps with the machine in the **operating** position.

1. Disconnect the vacuum hose and remove the waste tank from the Phoenix LT4.
2. Pour a few drops of cleaner into the waste tank and add water until the waste tank is about half full.
3. Carefully swish around the solution in the waste tank. Be sure to get the upper corners and around the intake opening.
4. Empty the cleaning solution from the waste tank.
5. Rinse the waste tank under running water until the water runs clear.
6. Reinstall the waste tank in the Phoenix LT4 and reconnect the vacuum hose.

## 4.2.6 Cleaning the Oil Tank Area

Oil will accumulate on the sides and front of the oil tank, in the wicking foam areas, and on the frame below the tank. To clean these areas, complete the steps below. Perform these steps with the machine in the **storage** position away from the lane or the approach. The oil tank can also be removed with the machine in the operating position by first removing the hood. **Rotating the oil tank sight glass downwards will help prevent oil spills that occur due to lateral tipping.**

<b>Tools Needed:</b>	None
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1. Unfasten the clasps of the oil tank compartment and open the compartment door.

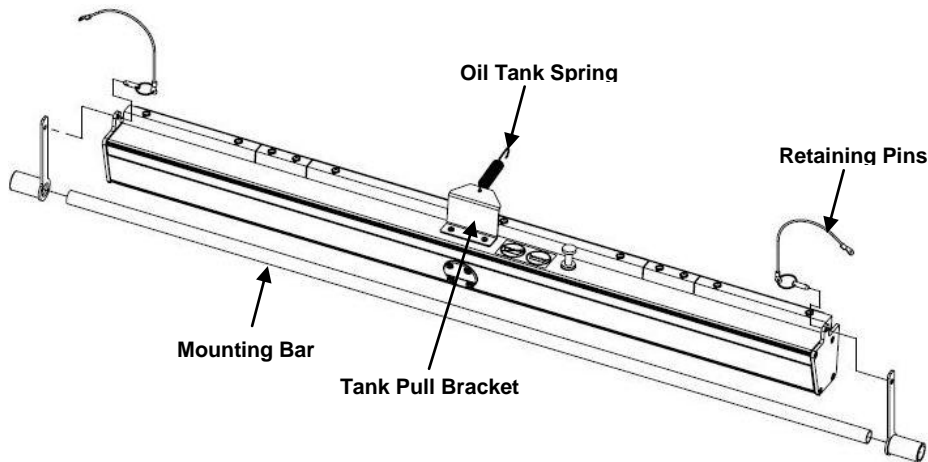


Figure 4- 5

2. Remove the retaining pins from the retaining brackets at each end of the oil tank (see Figure 4- 5).
3. While supporting the tank, unlatch the oil tank spring from the oil tank pull bracket.
4. Lift the tank up and move it away from the mounting bar. Rotate the sight glass side of the oil tank downwards and position the tank to one side as far as it will go so that the other end can clear the hood opening. Remove the tank from the machine.
5. Wipe the oil transfer roller, the wicking foam areas, and the oil tank with a clean, dry cloth.
6. Remove the foam drip pad from the frame area. Rinse the pad with soapy water followed by clean water. Wring the pad out and hang it to dry. When dry, place it back in the machine.
7. Reinstall the oil tank in the machine by reversing the actions specified in steps 2 through 4.
8. Close the oil tank compartment door and refasten the clasps.

## 4.2.7 Cleaning the Buffer Brush

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When the buffer brush bristles get tangled, they can pick up lint or other things too large to be removed from the lane by the vacuum head. Oil will not be applied correctly if the buffer brush has tangles and debris in its bristles. To clean the buffer brush, complete the steps below the machine in the **storage** position.

<b>Tools Needed:</b>	Coarse-toothed comb or stiff-bristled brush (optional)
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1. Wipe the buffer brush with a clean, dry cloth.
2. Turn the buffer brush to expose another section. Repeat until the entire brush has been cleaned.

NEVER wipe the brush with a cloth, comb, or brush that has been dampened with cleaner!

### TIPS

If the bristles have become tangled or matted, use a coarse-toothed comb or stiff-bristled brush to comb through the bristles.

If the buffer brush bristles are in good condition but there is dirt in the brush, it should be removed for cleaning. With the brush removed from the machine, use a coarse-toothed comb or stiff-bristled brush to comb out the dirt. Refer to Section 4.4.2 – *Replacing the Buffer Brush*.

Dusting the lanes before conditioning will help keep the buffer brush clean.


## 4.3 PERFORMING OCCASIONAL MAINTENANCE

At some point it will be necessary to adjust or replace parts as they wear out from normal use. This section contains information about some of the repairs that might need to be performed to the Phoenix LT4.

If a problem that is not described here or in Section 5 - *Troubleshooting* is encountered, contact Brunswick Customer Response Center at 1-800-YES-BOWL (1-800-937-2695). Additionally, Technical Support can be reached by fax at 1-231-725-4667 or e-mail at techsupport@brunbowl.com.

### 4.3.1 Adjusting the Buffer Brush Pressure

For a consistent application of oil across the lane, the buffer brush pressure must be the same across the width of the buffer brush. The best setting for the buffer brush pressure is between B and C on the Buffer Pressure Adjusting Tool.


 **CAUTION** Although increasing the buffer brush pressure can condition low spots on the lane where insufficient oil was being applied, the pressure increase will shorten the life of the buffer brush and put undue strain on the buffer motor. Also, an overall slight reduction in the amount of oil applied to the lane could occur. Weigh the benefits against the detriments before setting the pressure higher than recommended.

#### NOTES

Any adjustments made to one side of the brush will affect the other side. Adjust both sides to the same reading on the Pressure Adjustment Tool. (Too much pressure on one side can cause the machine to drive at an angle on the lane.)

If adjusting the buffer brush still does not yield the desired oiling pattern, refer to Section 6 - *Determining the Oiling Pattern*.

To change the buffer brush position, complete the steps below with the machine in the **operating** position on the lane.

 **WARNING** Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, adjustment, replacement, or repair task.

<b>Tools Needed:</b>	5/32" hex wrench 7/16" wrench Pressure Adjustment Tool, RP-43
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1. While it is not necessary to remove the hood in order to perform this procedure, removing the hood will improve access to the buffer linkages but will require that the hood be reinstalled to check the adjustment. To remove the hood, unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank, remove the cap from the cleaner tank, remove the two screws from each side of the hood as shown in Figure 4- 6, and lift the hood from the frame. Set the screws aside.

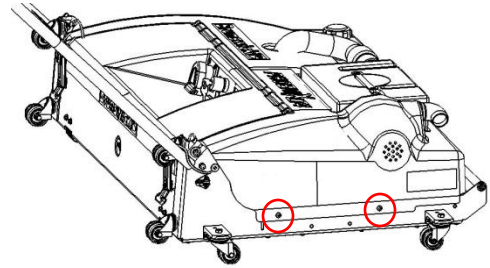


Figure 4- 6

2. On each side of the oil tank, locate, remove, and set aside the clevis pins and bowtie cotters for the buffer brush solenoids as shown in Figure 4- 7. To allow for a more detailed view, all other components have been hidden.

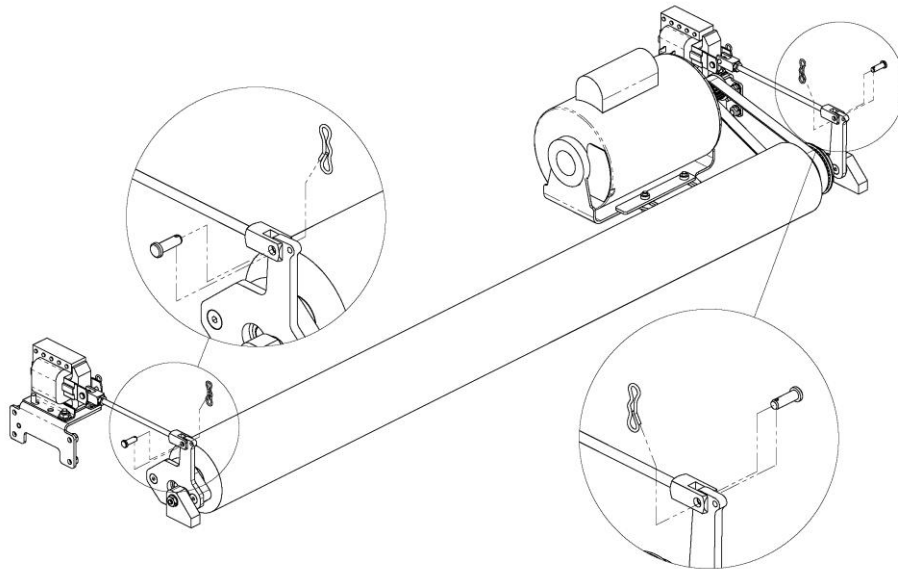


Figure 4- 7

3. Position the linkage as shown in Figure 4- 8 on the next page.
  - To increase the buffer brush pressure, shorten each solenoid connecting rod by turning the clevis clockwise.
  - To decrease the buffer brush pressure, lengthen each solenoid connecting rod by turning the clevis counter-clockwise.

**TIPS**

Make only small incremental adjustments to the buffer brush position and repeat the pressure test after each adjustment until the desired pressure is achieved.

Depending on how much adjustment is needed, the jam nut may need to be loosened to allow for more travel of the linkage.

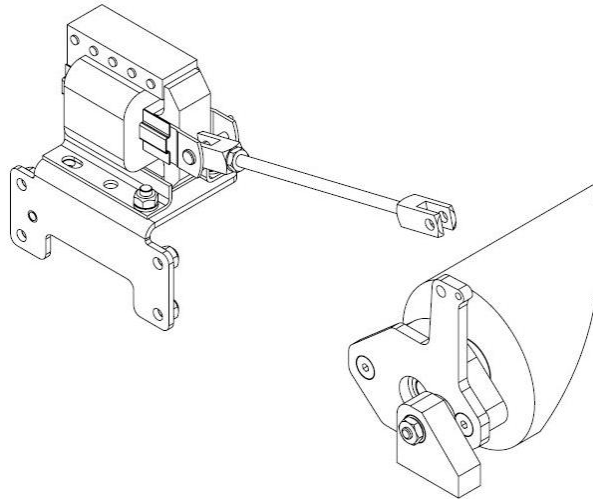


Figure 4- 8

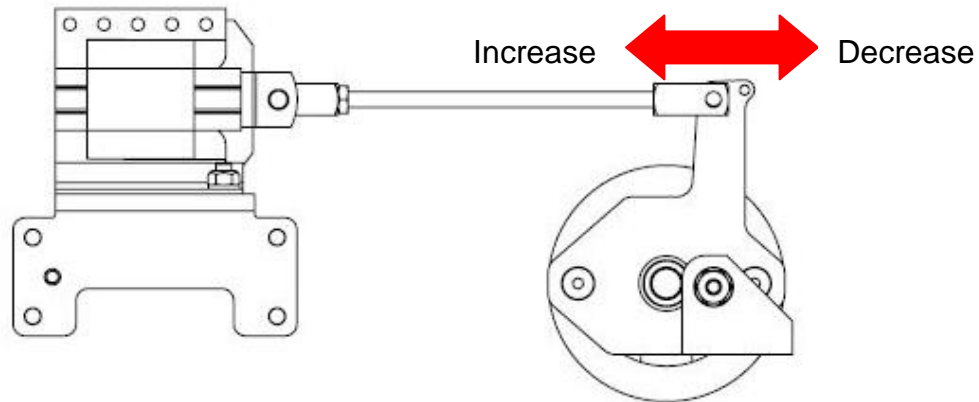


Figure 4- 9

4. Reinstall the clevis pins and bowtie cotters. If the hood was removed, it must be reinstalled prior to testing the buffer pressure. If the hood was not removed, close and latch the oil compartment door.
5. Test the buffer brush pressure by following the procedure described in Section 4.2.1.2 – *Measuring the Buffer Brush Pressure*.
6. Repeat steps 1-5 until desired buffer brush pressure is achieved.
7. When adjustments are complete, re-engage the oil tank spring and reinstall the cleaner tank cap, waste tank, and vacuum hose.

**NOTE** If adjusting the buffer brush pressure without removing the hood, it may be necessary to remove the oil tank. **CAUTION** Removing the oil tank can cause spillages. Never remove the oil tank on the approach. To remove the oil tank, remove the oil tank retaining pins and oil tank retaining spring. Lift the tank and slide to one side towards the open cavity in the hood. Then, lift the opposing end of the oil tank up and out.

### 4.3.2 Rotating the Wicking Foams

Rotating the wicking foams allows for the reuse of the foams while providing a new wicking surface. The wicking foams should be rotated weekly or when waves or streaks appear in the oil pattern.

Perform the following procedure to rotate the wicking foams with the machine in the **storage** or **operating** position in the maintenance area. Performing this procedure in the storage position will help prevent oil from spilling into the machine.

<b>Tools Needed:</b>	Clean, dry cloths
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1. Unfasten the clasps of the oil tank compartment and open the compartment door.
2. Remove the oil tank spring and the two retaining pins on either side of the oil tank as shown in Figure 4- 10 and Figure 4- 11.

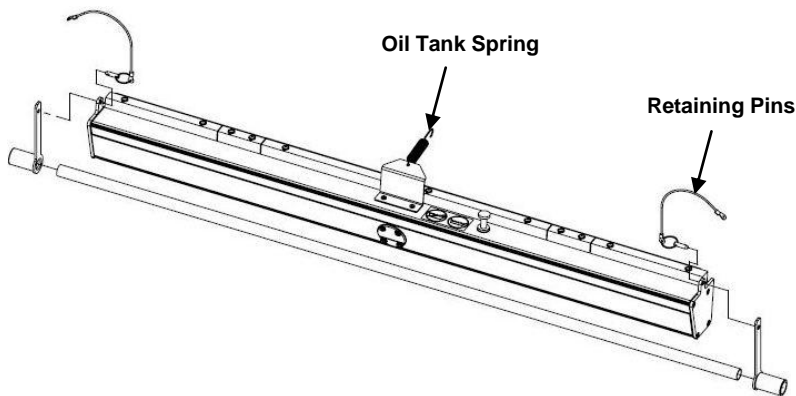


Figure 4- 10

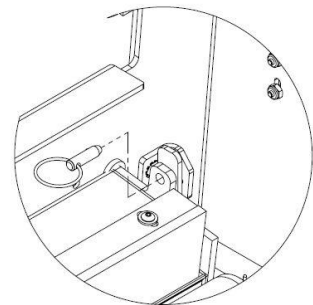
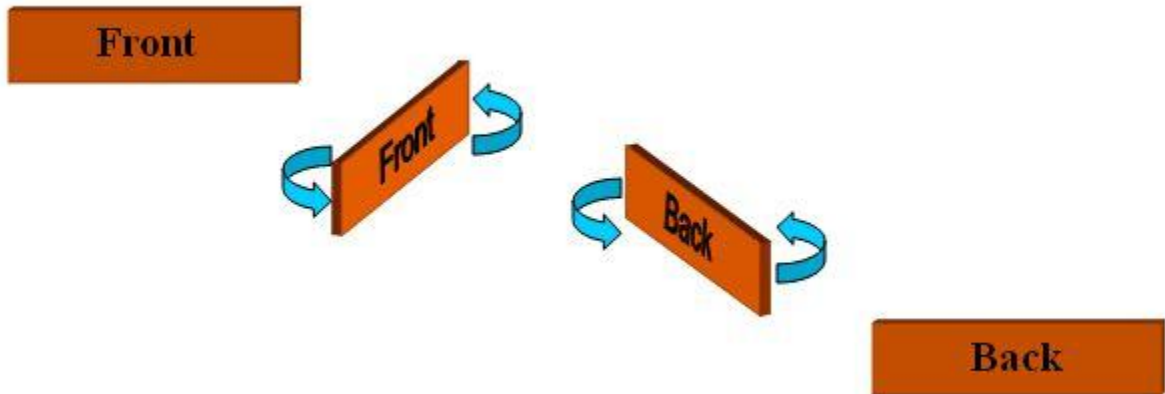


Figure 4- 11

3. Tip the oil tank away from the oil transfer roller to expose the oil transfer roller and wicking foams area.
4. Spread clean, dry cloths over all of the components, leaving only the wicking foams and oil tank tray exposed.
5. Remove a wicking foam from one end of the oil tank and set it aside on a clean surface.
6. Remove the wicking foam from the other end of the oil tank, rotate it end for end, and reinstall it in the opposite end of the tank. The result will be that the front face becomes the back face with the top remaining at the top, as shown in Figure 4- 12. The end wicking foams are notched along their outside edges to prevent drips. When rotating these wicking foams, they must be reinstalled at the opposite end of the oil tank otherwise a gap would exist between the adjacent foams.

7. Install the wicking foam that was removed in Step 5 in the other end of the oil tank. Install it with its unused side facing out.



**Figure 4- 12**

8. Repeat the operation for the remaining wicking foams. They can be reinstalled in their original locations. Ensure the wicking foams line up evenly across the top, with 1½ inches of foam showing above the tray edge, and that they are firmly seated in the oil tray.
9. Wipe up any spills immediately with a clean, dry cloth.
10. Tip the oil tank forward against the oil transfer roller, and latch in place with the oil tank spring. Close and latch the compartment door.

#### **NOTES**

After rotating the wicking foams, ensure they are completely saturated with conditioner before conditioning the lanes.

On the first use after rotating the wicking foams, clean, oil, and buff the first lane twice to ensure the proper amount of oil is applied.

If using a single piece wicking foam, remove entire wicking foam and flip as shown in Figure 4- 12.

### **4.3.3 Lubricating the Chains**

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The drive chain and sprocket along with the oil transfer roller and its' sprocket should be lubricated every 135,000 feet. Use a quality 80- to 90-weight gear oil and be sure to wipe off any excess oil. **DO NOT USE GREASE.** Perform the steps below with the machine in the **operating** position to lubricate the chains and sprockets.

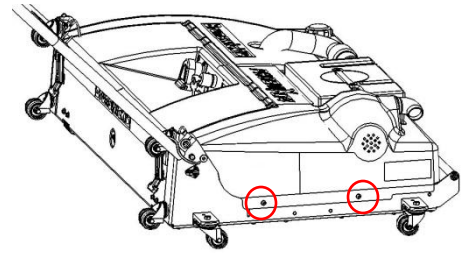
**WARNING**

Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.

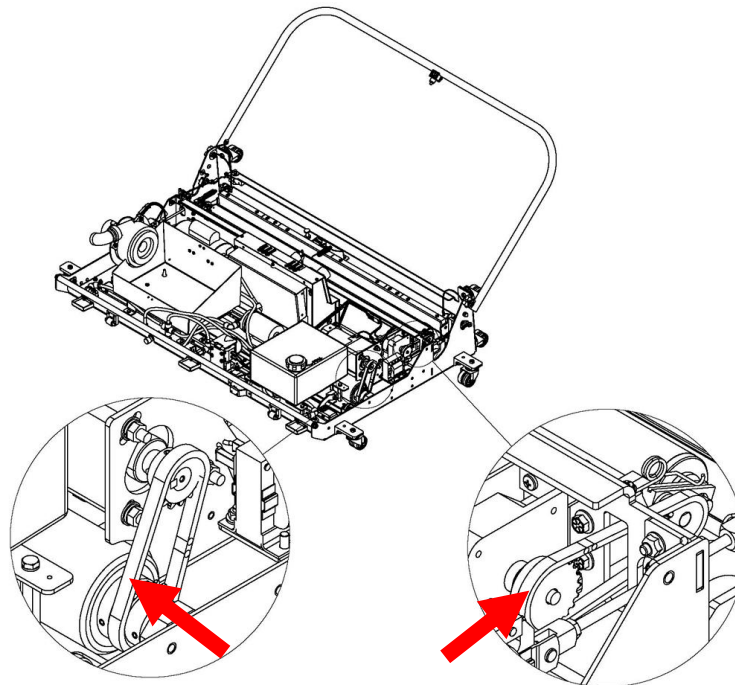
**Tools Needed:**

- Oil can with nozzle dispenser or small, long-handled, stiff-bristled brush
- 5/32-inch hex wrench

1. Unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank, remove the cap from the cleaner tank, remove the two screws from each side of the hood (see Figure 4- 13), and lift the hood from the frame. Set the screws aside.

**Figure 4- 13**

2. Locate the drive chain along the left side of the drive shaft and the oil transfer roller chain at the left rear of the machine, as shown in Figure 4- 14.
3. Apply a small amount of oil to the chain links.
4. Manually move the chains and apply oil until all the links have been lubricated.
5. Wipe off any excess oil.
6. Reinstall the hood, cleaner tank cap, waste tank, and vacuum hose.

**Figure 4- 14**

### 4.3.4 Adjusting the Cleaner Spray

The cleaner spray is critical to the cleaning function of the machine. Two types of adjustments can be made to the sprayer system: flow rate and direction.

The flow rate controls the amount of cleaner fluid being sprayed onto the lane. To ensure that the machine removes all of the existing oil when cleaning the lanes, the lanes must have an adequate amount of cleaner. Too little cleaner will leave conditioner on the lane, while too much cleaner is wasteful and will cause cleaner to be sprayed into the gutters.

The direction in which the cleaner is sprayed is important as well. If the cleaner is sprayed to one side of the lane only, the other will not be cleaned properly. Additionally, if cleaner is over-sprayed into the gutter, painted surfaces can be damaged or it can accumulate on the power cord making it sticky.

#### 4.3.4.1 Adjusting Cleaner Flow Rate

The cleaner flow rate is controlled by the control valve located on the front of the machine (shown in Figure 4- 15). The control valve allows some of the cleaner to flow to the nozzles while sending the rest back to the cleaner tank for recirculation.

Closing the control valve will increase cleaner flow to the nozzles. Opening the control valve will decrease the cleaner flow to the nozzles. The correct setting should allow the machine to clean 16 lanes on a tank of cleaner.

#### NOTE

The majority of centers will not have to change the factory settings. If adjustments are necessary, they should not vary dramatically from the factory settings.

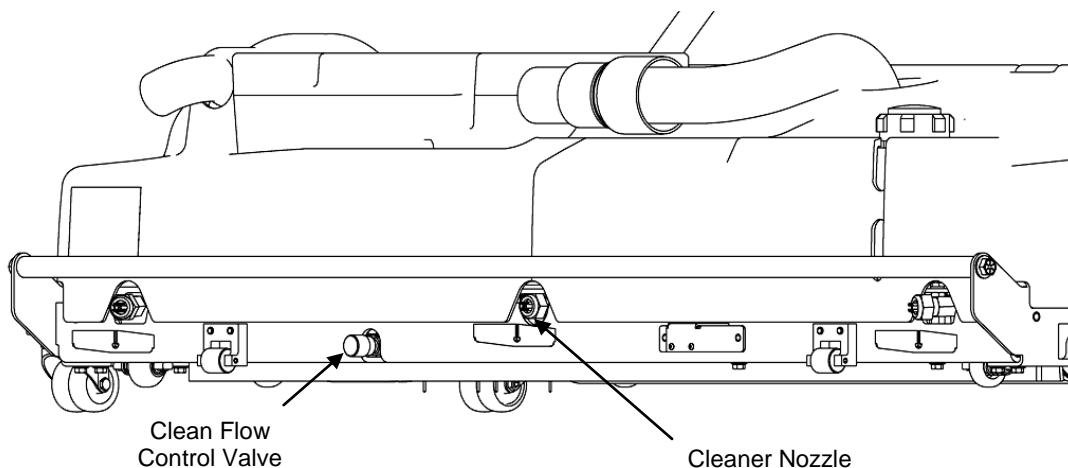
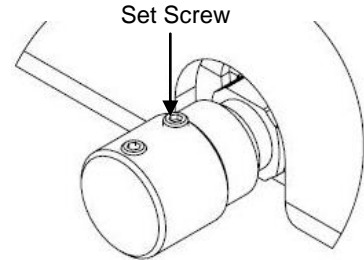


Figure 4- 15

Perform the following steps with the machine in the **operating** position to adjust cleaner flow.

<b>Tools Needed:</b>	<ul style="list-style-type: none"> <li>• 1/16" hex wrench</li> </ul>
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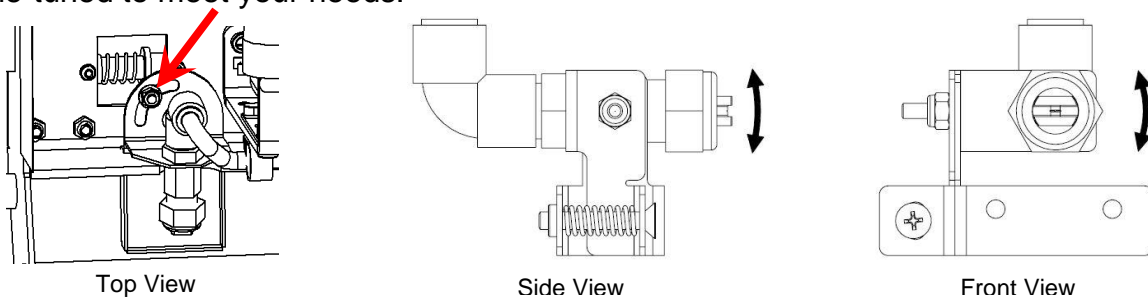
1. The flow valve may be locked into place by a set screw on the knurled knob. If it is, unlock the valve using a 1/16-inch hex wrench as shown in Figure 4-16.
2. OPEN the valve by turning it counter clockwise to DECREASE cleaner spray. CLOSE the valve by turning it clockwise to INCREASE cleaner spray.
3. Lock the valve setting by tightening the smaller set screw to prevent machine vibration from changing the setting.



**Figure 4- 16**

#### **4.3.4.2 Adjusting Cleaner Nozzle Direction**

The PATTERN of cleaner spray is determined by the setting of the spray nozzles. The spray nozzles emit a fan-shaped pattern (the center nozzle has a wide spray pattern while the outside nozzles have narrow spray patterns) that can be adjusted as shown in Figure 4-17. First, all three nozzles can be rotated to spray cleaner in either a more horizontal or more vertical orientation depending on the position of the nozzles. Secondly, the angle of the two outside nozzles can be adjusted to aim the spray more towards the middle of the lane or more towards the outside of the lane, as needed. Third, the center nozzle can be adjusted so that the nozzle points further up or down. Together, the spray pattern can be fine-tuned to meet your needs.



**Figure 4- 17**

The top view of Figure 4- 17 shows that the two outside nozzles can be angled to spray more towards the middle or outside of the lane. The side view shows that the center nozzle can be angled with respect to the lane surface. The front view shows that the nozzles can be rotated with respect to the lane surface. Perform the following procedure to adjust the direction of the spray nozzle with the machine in the **operating** position.



## WARNING

Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.

### Tools Needed:

- 11/32" wrench
- #2 Phillips Screwdriver

To adjust the angle of the middle spray head:

1. Change the nozzle angle by tightening or loosening the adjustment screw through the hole in the front as shown in Figure 4- 18.
  - Tighten the screw to angle the nozzle towards lane surface (downward).
  - Loosen the screw to angle the nozzle away from the lane surface (upward).

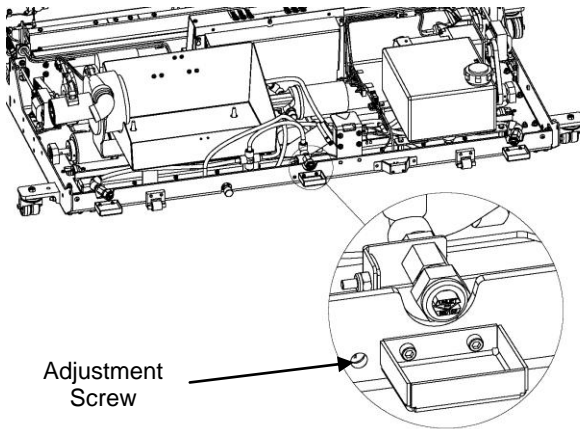


Figure 4- 18

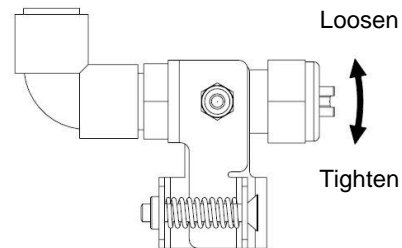


Figure 4- 18 – side view

**Tip:** Make only small incremental adjustments to spray head angle.

2. After each adjustment, test the spray pattern using the *Cleaner Pump* option in the *Test* screen. See Section 3.2.4 – *The Test Screen*.
3. When adjusted correctly, the cleaner will be sprayed across the entire width of the lane with very little, if any, overspray into the gutters. If only one gutter is reached by the spray, the rotation of the nozzle needs to be adjusted.

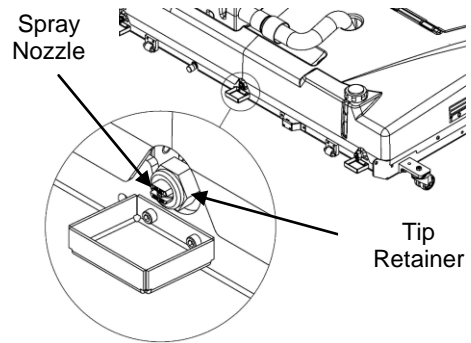


**Tools Needed:**

- 5/16" & 7/8" wrenches

To adjust the rotation of the spray head:

1. Using the 7/8" wrench, hold the tip retainer (collar) that secures the spray nozzle to the body to prevent it from loosening.
2. Use the 5/16" wrench to rotate the nozzle to the desired position.



**Figure 4- 19**

**Tip:** Make only small incremental adjustments to spray head angle.

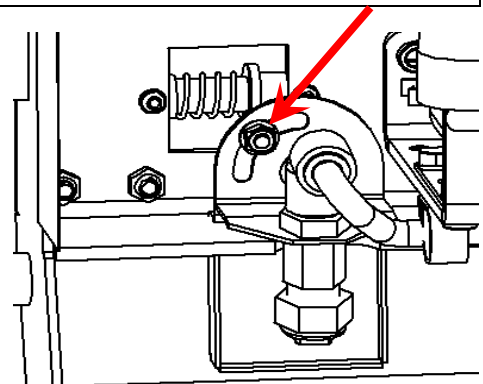
3. Test using the *Cleaner Pump* option in the Test screen. See Section 3.2.4 – *The Test Screen*.
4. When adjustments are complete, reinstall the hood, cleaner tank cap, waste tank, and vacuum hose.

**Tools Needed:**

- 3/8" wrench

To adjust the angle of the outside spray heads:

1. Unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank, remove the cap from the cleaner tank, remove the two screws from each side of the hood, and lift the hood from the frame. Set the screws aside.



**Figure 4- 20**

2. Loosen the lock nut in the spray head's adjustment slot.
3. Angle the spray head to achieve the desired coverage. Be careful not to position the spray heads where cleaner can be sprayed into the gutter.
4. Tighten the lock nut.

**4.3.4.3 Clearing a Clogged Nozzle**

Though the nozzles are designed to minimize clogs and is used in combination with an in-line filter, a clog in a nozzle may still occur. Perform the procedure below with the machine in the **operating** position to clear a clogged nozzle.

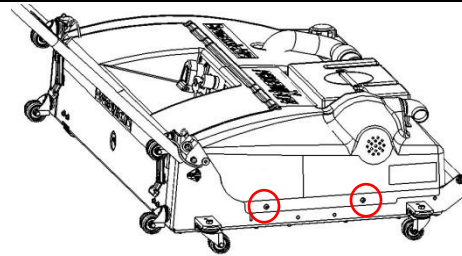


**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

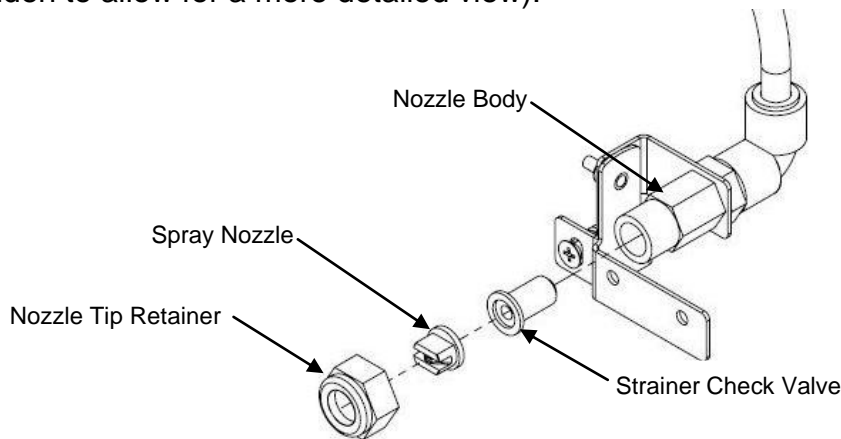
**Tools Needed:**

- 7/8" wrench

1. Unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank, remove the cap from the cleaner tank, remove the two screws from each side of the hood as shown in Figure 4- 211, and lift the hood from the frame. Set the screws aside.

**Figure 4- 20**

2. Disassemble the spray nozzle by unscrewing the nozzle tip from the nozzle body as shown in Figure 4- 222 (some components are hidden to allow for a more detailed view).

**Figure 4- 21**

3. Soak the spray nozzle and strainer check valve in warm water for several minutes then blow air through the end of each.
4. Reassemble the strainer check valve, spray nozzle, and nozzle tip retainer then screw them onto the nozzle body. Before tightening, ensure the spray nozzle is positioned to deposit cleaner spray in the desired direction.
5. Reinstall the hood, cleaner tank cap, waste tank, and vacuum hose.

### 4.3.5 Adjusting the Vacuum Head Height

The vacuum head linkage is designed to allow the vacuum head to float on the lane so that it maintains its cleaning efficiency over the bumps and dips that can form on a lane's surface over time. Correct adjustment of the vacuum head is important. The agitator and squeegee should be well clear of the lane when the vacuum head is retracted while allowing the agitator and squeegee to contact the lane with the correct amount of deflection when extended. If the vacuum head is too high, puddles of cleaner can be left on the lane. If the vacuum head is too low, a hazy film can be left on the lane.

When the machine is turned on, the vacuum head solenoids energize to pull the vacuum head up away from the lane. During a cleaning operation, the solenoids de-energize to

allow the vacuum head to drop down onto the lane surface. This allows the vacuum head to float. Perform the following steps with the machine in the **operating** position on a lane to adjust the vacuum head height.

**NOTE**

The majority of centers will not have to change the factory settings. If adjustments are necessary, they should not vary dramatically from the factory settings.

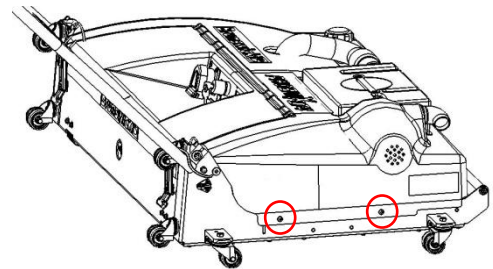


**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, adjustment, replacement, or repair task.**

<b>Tools Needed:</b>	<ul style="list-style-type: none"> <li>• 5/32" hex wrench</li> <li>• Ratchet and 7/16" socket or 7/16" wrench</li> </ul>
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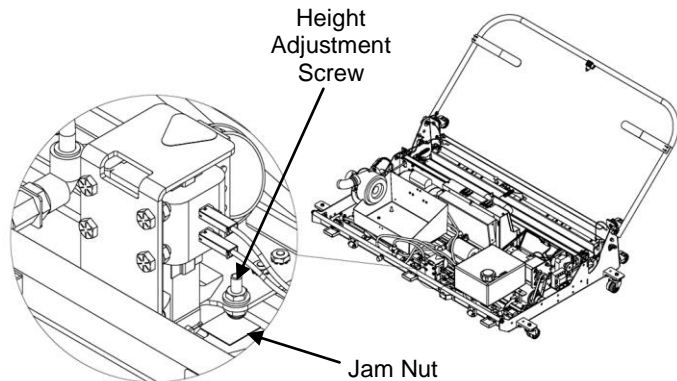
To adjust the vacuum head:

1. Unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank and cleaner tank cap. Then remove the two screws from each side of the hood as shown in Figure 4- 233, and lift the hood from the frame. Set the screws aside.



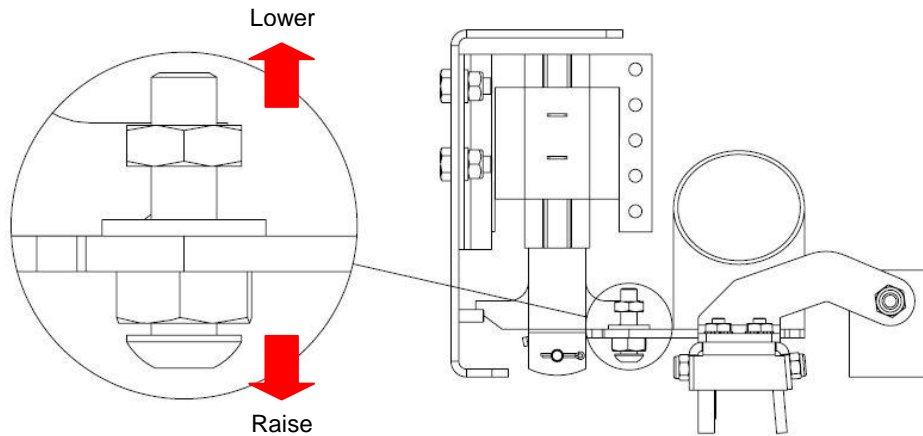
**Figure 4- 22**

2. Loosen the jam nut on the vacuum head height adjustment screw as shown in Figure 4- 244.



**Figure 4- 23**

3. To remove pressure from the vacuum head height adjustment screw, lift the vacuum head off of the lane surface. To raise the vacuum head, rotate the height adjustment screw counterclockwise. To lower the vacuum head, rotate the height adjustment screw clockwise. Make only small incremental adjustments to the height. Refer to Figure 4- 255 on the next page for more information.



**Figure 4- 24**

4. Once the desired height has been achieved, tighten the jam nut and reinstall the hood, vacuum hose, cleaner tank cap, and waste tank.
5. Test run the machine on several lanes using a clean only function to check the position of vacuum head. If further adjustment is needed, repeat steps 1-4.
6. When adjustments are complete, reinstall the hood, cleaner tank cap, waste tank, and vacuum hose.

### 4.3.6 Adjusting the Vacuum Motor Position

The waste tank must be properly seated against the vacuum pump to ensure the proper vacuum seal. If there are any leaks in the system, the Phoenix LT4 will not be able to adequately pick up the cleaner / oil emulsion from the lane.

Perform the steps below with the machine in the **operating** position to adjust the vacuum motor position.



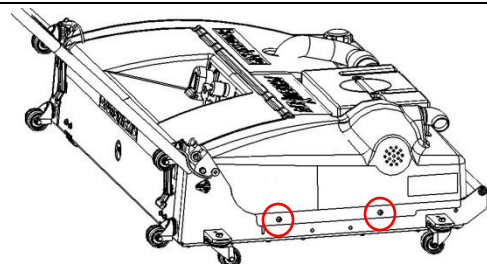
## WARNING

Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.

#### Tools Needed:

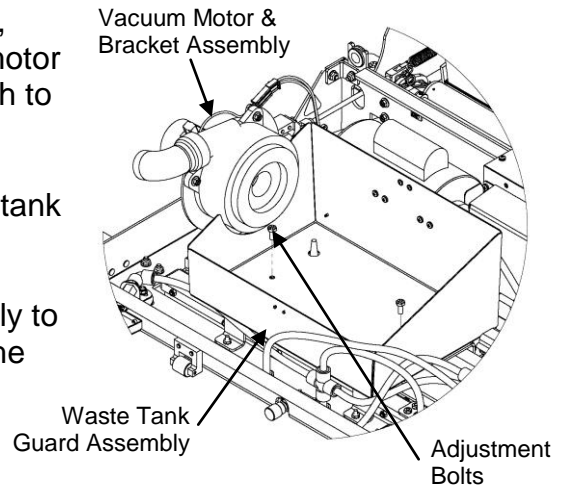
- 5/32" hex wrench
- Ratchet and 7/16" socket or 7/16" wrench

1. Unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank and cleaner tank cap. Then remove the two screws from each side of the hood as shown in Figure 4- 266, and lift the hood from the frame. Set the screws aside.



**Figure 4- 25**

2. Loosen the two bolts, shown in Figure 4- 277, securing the waste tank guard and vacuum motor bracket in place. Only loosen the bolts enough to allow the vacuum motor bracket to move.
3. With the two bolts loosened, place the waste tank into the waste tank guard assembly.
4. Move the vacuum motor and bracket assembly to a position where the seal is compressed by the waste tank.



**Figure 4- 26**

5. While holding the vacuum motor and bracket, remove the waste tank and tighten the two bolts.
6. After securing the motor and bracket in place, remove and reinsert the waste tank into the guard assembly several times. The waste tank should compress the seal enough to ensure a leak free connection. At the same time, the seal should not be pulled off the vacuum motor or abraded when removing or reinserting the waste tank.
7. When adjustments are complete, reinstall the hood, cleaner tank cap, waste tank, and vacuum hose.

### 4.3.7 Adjusting the Optical Sensor

The optical sensor's factory settings should be sufficient for the majority of centers. If the sensor ever needs to be replaced, the behavior of the machine at the end of the lane is erratic, or the center uses an anti-idling plate mounted on the rear of the pindeck, the sensor will need to be adjusted. Unlike all other adjustments, it is necessary to have the Phoenix LT4 powered while adjusting the optical sensor. The two adjustments to the optical sensor are D-L and the sensitivity as shown in Figure 4- 29. The D-L refers to dark detection (normally closed) or light detection (normally open). Sensitivity controls how easy the sensor is to trigger.

Perform the procedure below with the machine powered and in the **operating** position.

<b>Tools Needed:</b>	<ul style="list-style-type: none"> <li>• Small flathead screwdriver</li> </ul>
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1. Position the machine with the sensor ovetop of the lane.

2. Locate the adjustment holes in the protective cover as shown in Figure 4- 28 and 4-29.

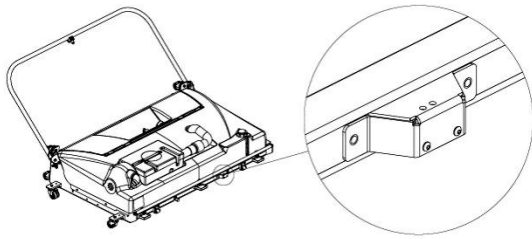


Figure 4- 28

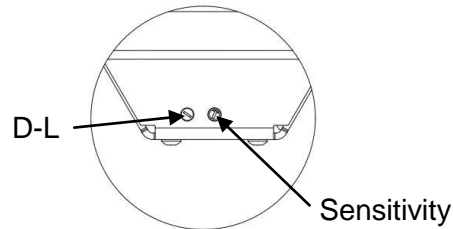


Figure 4- 29

3. Set the sensor for dark detection by turning the D-L adjustment fully clockwise to “L.”
4. Set the sensitivity to its minimum by turning it fully counterclockwise.
5. Increase the sensitivity by turning it clockwise until just when both green and orange status lights turn on.
6. Test by sliding a dark, non-reflective material past the underside of the sensor. While the dark, non-reflective material is underneath the sensor, the orange status light should turn off, leaving only the green status light on.
7. If the desired setting is achieved, adjustments are complete. If not, repeat steps 2 - 4 until desired setting is achieved.

**NOTE** If the lane has an anti-idling plate, it may be necessary to place the machine at the end of the lane with the sensor overtop the anti-idling plate to make adjustments. Ensure the pinspotter is disconnected from power and locked out! To check, physically slide the machine so that the sensor goes from over the pindeck to over the anti-idling plate. While over the anti-idling plate, only the green status light should be on. While over the pindeck/lane, both orange and green status lights should be on.

### 4.3.8 Adjusting the Handle Hinges

The Phoenix LT4 handle can be placed in any position from flat against the Phoenix LT4 housing to parallel with the floor. This allows for the handle to be put in whatever position is most comfortable for the user who is operating, moving, or storing the Phoenix LT4. When adjusted properly, there is enough friction to support the weight of the handle and cord while still allowing for some movement of the handle.

To adjust the friction hinges perform the follow steps with the machine in either the **storage** or **operating** position.

<b>Tools Needed:</b>	• 3/16” hex wrench
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1. Locate the adjustment screw for each of the friction hinges on either side of the handle as shown in Figure 4- 3030.

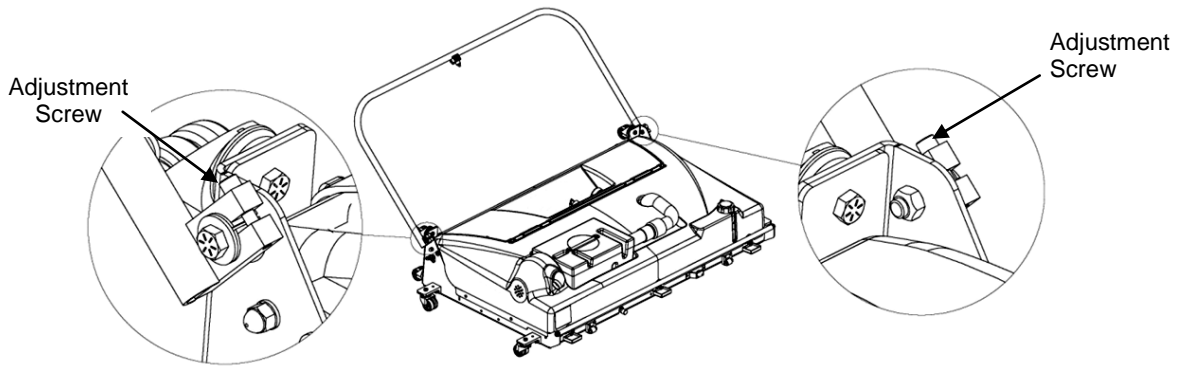


Figure 4- 27

2. Tighten or loosen the adjustment screw to adjust the "hold" of the hinges as shown in Figure 4- 31. Tightening the screw will make the handle harder to move. Loosening it will allow the handle to move more freely.

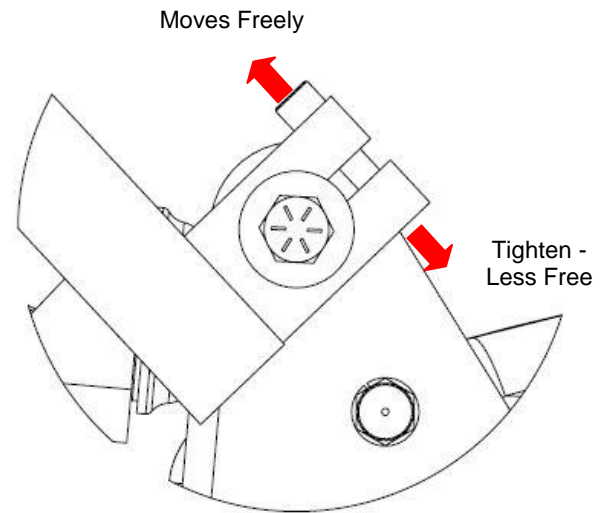


Figure 4- 31

3. Test the hinges in both the storage and operation position to make sure there is enough friction to support the weight of the handle and cord while still allowing for some movement of the handle.

### 4.3.9 Adjusting the Oil Tank Bars

By using different combinations of wicking foams and changing the adjustment bars on the top of the oil tank, a wide variety of oil patterns can be created. The adjustment bars account for a much smaller change in the pattern than the wicking foams and therefore can be used to fine tune the pattern. Fine tuning the adjustment bars requires skill and should only be done by experienced operators.

It is always helpful to run a set of tapes before and after to compare the two patterns. If the center does not have a lane reading machine, use whatever method the center has developed for testing the pattern and compare the results.



**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

To adjust the adjustment bars follow the instructions below with the machine in **operating position**.

<b>Tools Needed:</b>	<ul style="list-style-type: none"><li>• 3/32" hex wrench</li><li>• Oil Tank Feeler Gauge - 294-115-694</li></ul>
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1. Unlatch the oil compartment door latches.
2. With the oil tank bars' screws tightened, insert the feeler gauge in between the wicking foam and oil transfer roller. Slowly withdraw while taking note of the force required. It may be beneficial to compare to the same bar on the other side of the oil tank.
3. If adjustments are required, loosen the bars by unscrewing the screw on either side of the bar. It is not necessary to remove the screw.
4. Adjust the adjustment bars to put more or less pressure on the wicking foam. Moving the bar towards the transfer roller will increase the oil flow to the transfer roller and ultimately the lane. Moving the bar away from the transfer roller will reduce oil flow.
5. Make only small incremental adjustments to the position of the adjustment bars. Repeat the pressure test after each adjustment until the desired pressure is achieved.
6. After adjusting, apply the pattern to a pair of lanes and analyze using a lane reading machine. If center does not have a lane reading machine, use whatever method the center has developed for testing the pattern and compare the results.
7. Repeat steps 2-5 until the desired pattern has been achieved.
8. Close and latch the oil compartment door.

**NOTE**

Total wick pressure is determined by the oil tank spring. Adjusting bar pressure reallocates pressure between the bars but does not increase or decrease total pressure. More bar pressure on one wicking foam increases its oil flow but decreases the flow of the other wicking foams slightly.

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**4.3.10 Adjusting Guide Roller Position**

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The Phoenix LT4 comes with its guide rollers positioned for maximum stability while operating on the lane. In very rare cases, this configuration may not work. The Phoenix LT4 is designed for the rear casters to hit the gutter ramps upon the machine's return to the approach and prevent any contact or damage to the guide rollers. Some centers may have no gutter ramps or different styles of gutter ramps that could affect how this design works. In these cases, the rear guide roller may hit the edge of the approach before the casters come into contact with anything. This could damage the approach or the guide rollers. The base plate has been designed with an opening to allow the position of the rear most guide



rollers to be moved forward if your center has a situation where this problem may occur. To prevent damage to either the machine or the approach, it would be advantageous to move the rear guide rollers to this more forward position on the base plate. The following procedure should be done with the Phoenix LT4 in the **storage** position.



**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

<b>Tools Needed:</b>	<ul style="list-style-type: none"> <li>• #2 Phillips Screwdriver</li> </ul>
----------------------	-----------------------------------------------------------------------------

1. Remove the screws on either side of the rear guide roller
2. Pull off the entire guide roller assembly and position in the more forward guide roller opening.
3. Insert the screws on either side of the rear guide roller to mount in new position.
4. Tighten screws.
5. Repeat steps 1-4 for the other rear guide roller.

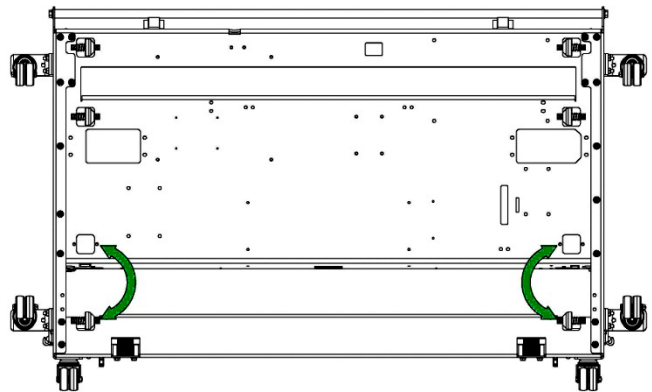


Figure 4- 32

#### 4.3.11 Adjusting the Buffer Brush Drive Belt

The belt connecting the buffer brush motor to the buffer brush is called the buffer brush drive belt. If the tension on this belt is too loose, a chattering sound can occur and the belt can actually jump out of the pulley grooves. This procedure will happen every time the belt, buffer motor, or either of the pulleys needs to be replaced. To adjust the buffer brush drive belt, the machine should be elevated and in the **operating** position.

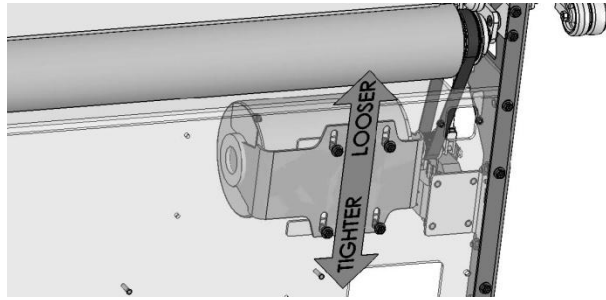


**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

<b>Tools Needed:</b>	<ul style="list-style-type: none"> <li>• Ratchet and 3/8" Socket</li> </ul>
----------------------	-----------------------------------------------------------------------------

1. Elevate the machine so that a ratchet is usable underneath it.
2. Loosen all four screws securing the buffer brush motor to the baseplate just enough to slide the motor along the baseplate.
3. With the buffer brush drive belt on the motor pulley and buffer brush pulley, slide the motor away from the buffer brush to tighten the tension on the belt until snug.

- The belt should just barely give (1/8" or less of movement) under the pressure of being pushed down by one finger (approximately 2-3 lbs. of force).



- Ensure that the buffer motor is parallel with the buffer brush.
- Hold the motor in position while keeping tension on the belt, and tighten all four of the screws.

## 4.4 REPLACING PARTS

The agitator foam, agitator backer, squeegee, buffer brush, and waste tank seal all wear with use and will eventually need to be replaced. This section describes how to replace these parts.

### 4.4.1 Replacing the Agitator Foam or Squeegee

The agitator foam and squeegee are critical to cleaning performance. Each of these components should be checked when performing the after use cleaning procedure. The agitator foam and squeegee should be replaced after 135,000 feet and 540,000 feet of travel respectively. Additionally, if either becomes torn, brittle, or warped, they should be replaced immediately. To replace the agitator foam, squeegee, or both, complete the steps below with the machine in the **storage** position. Always replace the agitator foam and agitator backer together!



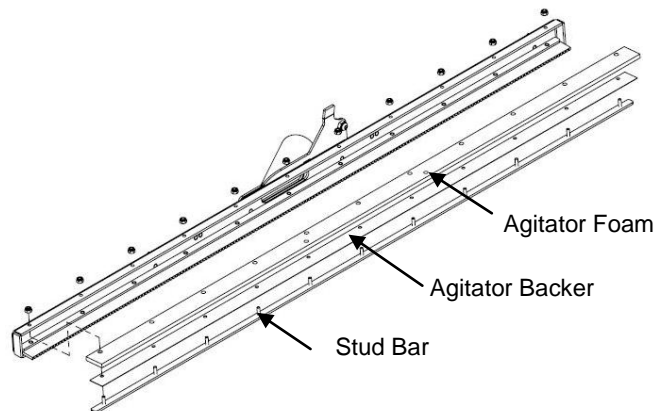
**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

#### Tools Needed:

- #2 Philips screwdriver
- Medium flat blade screwdriver
- 5/32" hex wrenches
- Ratchet, 11/32", 3/8" sockets or wrenches

To replace the agitator foam and agitator backer:

- Remove the 11 nuts as shown in Figure 4- 33. Inspect the stud bar for any damage and replace if necessary.
- Replace the agitator foam and agitator backer then reassemble as shown in Figure 4- 33. Reinstall the 11 nuts to attach the stud bar to the



**Figure 4- 33**

vacuum head. Take care not to drop the nuts into the machine. Reinstall the nuts in the following pattern: one end, opposite end, middle, and then all remaining nuts.

3. Before tightening the nuts, ensure the agitator foam and backer are flat against the vacuum head channel. Tighten or loosen nuts as required to remove waviness from the foam.

**IMPORTANT:** DO NOT OVERTIGHTEN THE NUTS! Tighten them until the nuts are just flush with the studs. To do otherwise will cause the squeegee to deform which will allow residue to remain on the lane.

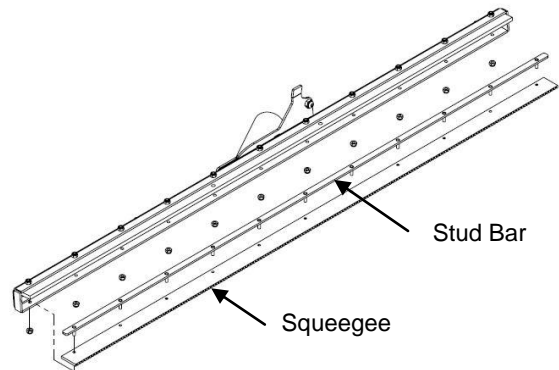
**TIP**

If replacing the squeegee, skip to the squeegee replacement procedure below.

4. Run a clean only pass on a pair of lanes to test the cleaning performance. If any cleaning solution is left on the lane, the vacuum head height needs to be adjusted. Refer to Section 4.3.5 – *Adjusting the Vacuum Head Height* for instructions.

To replace the squeegee:

1. Remove the 11 nuts as shown in Figure 4- 344. Take care not to drop the nuts into the machine. Inspect the stud bar for any damage and replace if necessary.



**Figure 4- 28**

2. Replace the squeegee and reassemble as shown in Figure 4- 344. The **smooth** side of the squeegee should rest against the stud bar.
3. Reinstall the eleven nuts to attach the stud bar to the vacuum head. Reinstall the nuts in the following pattern: one end, opposite end, middle, and then all remaining nuts.
4. Before tightening the nuts, ensure the squeegee is flat against the vacuum head channel. Tighten or loosen nuts as required to remove waviness from the foam.

**IMPORTANT:** DO NOT OVERTIGHTEN THE NUTS! Tighten them until the nuts are just flush with the studs. To do otherwise will cause the squeegee to deform which will allow residue to remain on the lane.

5. Run a clean only pass on a pair of lanes to test the cleaning performance. If any cleaning solution is left on the lane, the vacuum head height needs to be adjusted. Refer to Section 4.3.5 – *Adjusting the Vacuum Head Height* for instructions.

## 4.4.2 Replacing the Buffer Brush

As the buffer brush wears, gets dirty, bristles tangle and break off, it will no longer apply the oil properly. The buffer brush should be replaced every 1,080,000 feet of travel or when adjusting the brush pressure doesn't significantly improve its performance.

### NOTE

The buffer brush can be adjusted to help maintain its performance. As the buffer brush wears, its bristles become thin and tapered and its performance degrades.

**Even though a pressure between B and C on the buffer pressure adjusting tool is achievable, it will not hold as much oil or function as well and should be replaced.**

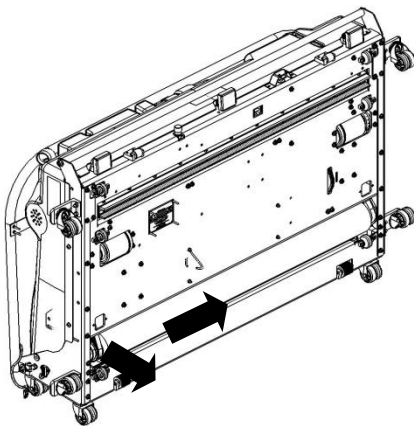


**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

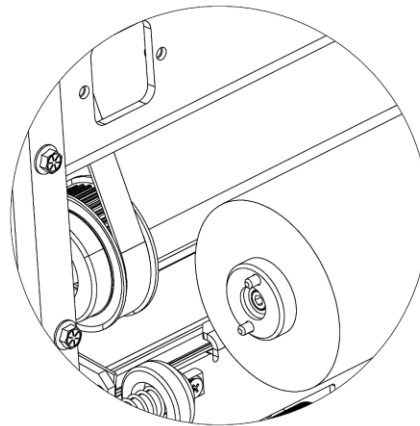
<b>Tools Needed:</b>	None
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Perform the steps below with the machine in the **storage** position to replace the buffer brush.

1. Facing the base plate, hold the machine in place by the frame on the right side and grasp the left end of the buffer brush.
2. Gently slide the buffer brush to the right while slightly pulling the left end out of the machine. Pull out the left end until it is just clear of the slot in the base plate as shown in Figure 4- 355 and Figure 4- 366.



**Figure 4- 30**



**Figure 4- 29**

3. Pull the buffer brush towards the left to release its right side from the machine.
4. Pull the entire buffer brush out from the machine.

5. Lightly grease the spring-loaded end (right hand side) of the new buffer brush using lithium grease. If lithium grease is not available, use 80 to 90 weight gear oil.
6. Insert the right end of the new brush into the sprocket on the right side of the opening.
7. Grasp the left end of the buffer brush and push it gently towards the right while positioning it into its drive sprocket on the left side.

**TIP**

After inserting the right end of the brush into the sprocket, align and insert one of the drive pins, shown in Figure 4- 366, with the drive pulley. Rotate the drive pulley until the other drive pin engages.

8. Release the left side of the buffer brush into its sprocket.
9. After replacing the brush, check and adjust the buffer brush pressure in accordance with Section 4.2.1.2 and Section 4.3.1 respectively.

### 4.4.3 Replacing the Wicking Foams

The wicking foams should be replaced every 180,000 to 270,000 feet of travel. However, if the Phoenix LT4 starts leaving a wavy or streaky oil pattern or the oil output has decreased and rotating the wicking foams does not alleviate the problem, they should be replaced immediately.

Replacement wicking foams of various densities have been included with the lane machine. Each has a number stenciled on it that indicates the foam's density. **Lower number = lower foam density. Lower foam density = higher oil output.**

Table 4- 1 shows the foam density, part number, and output volume of the foams included with the Phoenix LT4.

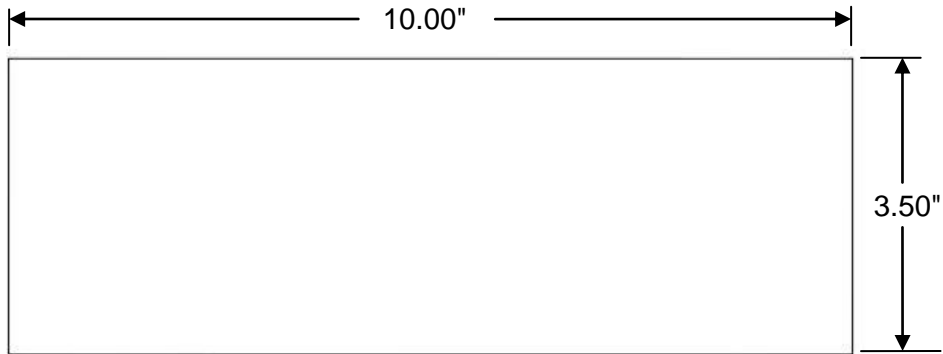
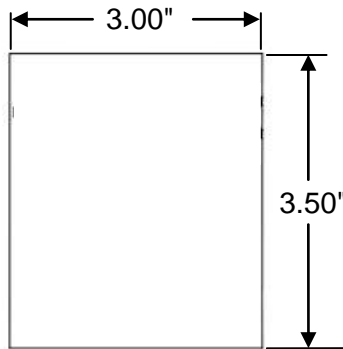
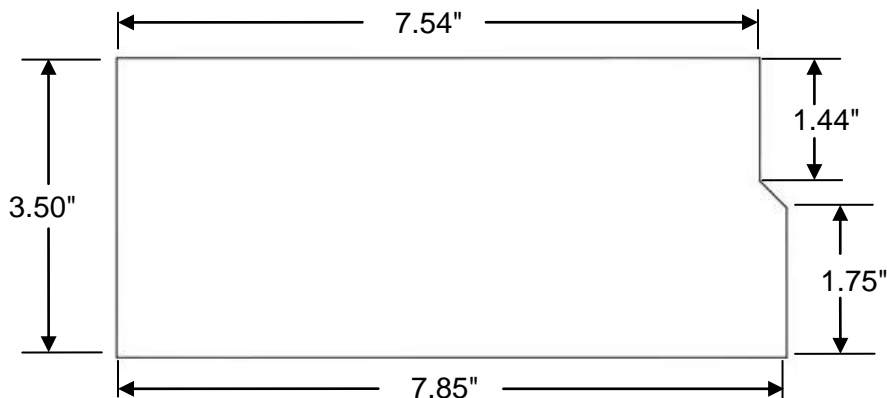
**Table 4- 1**

Foam Density	Part Number	Output
#4	294-115-490	Super-High
#5	294-115-488	High
#6	294-115-486	Medium-High
#8	294-115-484	Medium
#10	294-115-482	Medium-Low
#11	294-115-652	Low
#12	294-115-653	Extra-Low
#13	294-115-654	Super-Low

Cut the foams to the necessary lengths as shown in Figure 4- 317 (center foams), Figure 4- 328 (track foams), and Figure 4- 339 (outside foams) on the following page. The dimensions are the same regardless of wick density. A wicking foam cutting template is available as part number 294-080-201.

**TIP**

When cutting new wicking foams from a section of factory bulk length, cut and discard approximately 1/2" from the factory cut edge. Failure to do so could result in inconsistent oil flow through the wicking foam at the end.

**Figure 4- 317****Figure 4- 328****Figure 4- 339**

The end foams should be profiled like the original factory foams, as shown in Figure 4-339 to prevent dripping. A wick-cutting template (P/N 294-080-201) can be purchased from Brunswick. Different oil patterns can be created by using different foam densities in the oil tank. For more on oil patterns, see Section 6 – *Determining the Oil Pattern*.

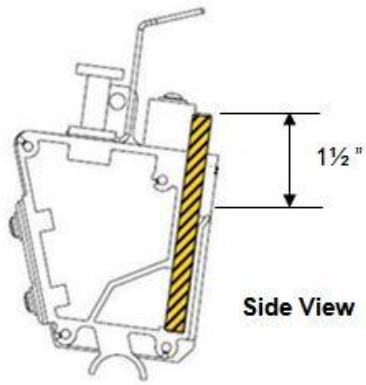


Figure 4- 40

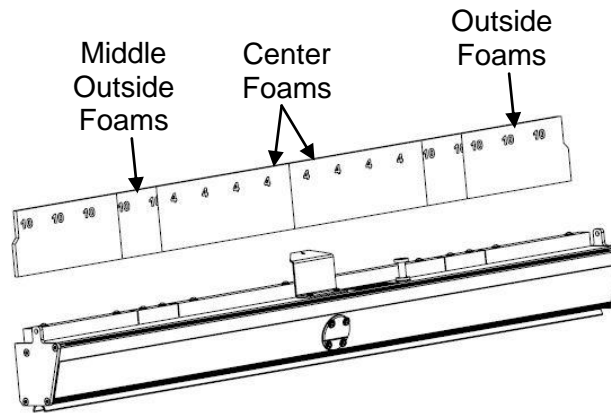


Figure 4- 41

**NOTES**

The Phoenix LT4 cannot be used for approximately 1-2 hours after the wicking foams have been replaced. This waiting period is required to allow the oil to be wicked to the top of the foam. To verify the oil has wicked to the top of the foam, check the color of the wicking foam. The wicking foam will darken as it becomes saturated with oil. The areas that haven't yet wicked oil are easily identifiable by their lighter color. The wicking foams are ready for use when the entire foam is the same color. The machine must be left in operating position for the foams to saturate.

On the first use after replacing the wicking foams, clean, oil, and buff the first lane pair twice to ensure the proper amount of oil is being applied. It would be advantageous to run a set of oil tapes, or using the centers method for testing oil patterns, before and after the change to ensure there are no major differences in the applied pattern.

The wicking foams can be replaced with the oil tank in or out of the machine. The procedure below assumes the oil tank is left in the machine. To replace the wicking foams with the oil tank out of the machine, refer to Section 4.2.6 – *Cleaning the Oil Tank Area* then skip to step 3 of the procedure below.

It is recommended that this procedure be performed in the maintenance area to prevent any spills of lane oil onto the approach.

To replace the wicking foams, perform the steps below with the machine in the **storage** position in the maintenance area.



**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

<b>Tools Needed:</b>	<ul style="list-style-type: none"> <li>• Container for catching oil dripping from wicking foams</li> <li>• Clean, dry cloths</li> </ul>
----------------------	-----------------------------------------------------------------------------------------------------------------------------------------

1. Make sure Phoenix LT4 is in storage position to prevent spillage of oil.

2. Unfasten the clasps over the oiling components at the back of the Phoenix LT4 and open the compartment door.
3. Remove the oil tank spring and the two retaining pins on either side of the oil tank as shown in Figure 4- 42. Tip the oil tank away from the oil transfer roller to expose the wicking foams.
4. Pull out the wicking foams from the oil tank slot and put them in a container to catch the oil.
5. Wipe up any spills immediately with a clean, dry cloth.
6. Insert the new wicking foams so they rest on the bottom of the oil tank slot, as shown in Figure 4- 40. There should be 1½ inches of foam showing above the edge of the oil tank slot.

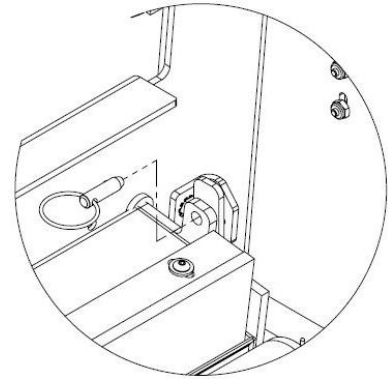


Figure 4- 42

**IMPORTANT**

Ensure that the wicking foam edges firmly abut each other with no gaps at the top, and that the tops of the wicking foams are even.

7. Tip the oil tank against the oil transfer roller, re-latch the oil tank, close the compartment door, and refasten the clasps.
8. Lower the machine into operating position to allow the oil to saturate the wicking foams.

#### 4.4.4 Replacing the Waste Tank Seal

The waste tank seal should be smooth and flat to provide the seal necessary to remove the emulsified cleaner solution from the lane surface. If it is wrinkled, warped, buckled, or has started to pull away from the vacuum pump housing, it must be replaced immediately.

Perform the steps below with the machine in the **operating** position to replace the waste tank seal.

**Tools Needed:**

- Scraper
- Solvent

1. Remove the vacuum hose from the waste tank inlet port.
2. Remove the waste tank from the machine to expose the waste tank seal as shown in Figure 4- 43.

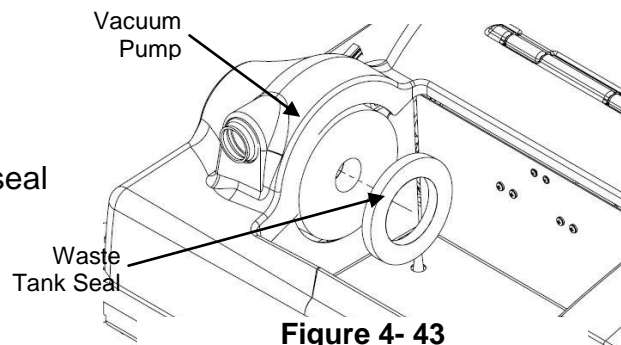


Figure 4- 43



3. Carefully peel the waste tank seal from the vacuum pump.
4. Scrape off any remaining pieces of the seal and any adhesive.



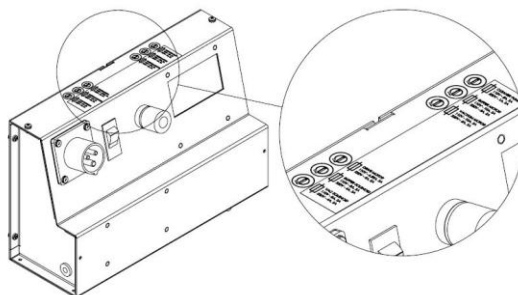
**Some solvents are flammable. Do not use while smoking or near open flames. Solvents can give off harmful vapors. Use in a well ventilated area. Follow the manufacturer's precautions.**

5. Wipe the waste tank seal area with a solvent to remove any remaining residue.
6. Allow the solvent to completely evaporate from the sealing surface. Failing to do so will prevent the new seal from adhering properly.
7. Remove the plastic backing from the new waste tank seal.
8. Center the new seal over the vacuum pump inlet and press firmly.
9. Allow the adhesive 15 to 20 minutes to set before installing the waste tank.
10. Reinstall the waste tank and vacuum hose.
11. Check for gaps in the seal between the waste tank and vacuum pump. Refer to Section 4.3.6 – *Adjusting the Vacuum Motor Position* for instructions on adjusting the vacuum pump motor and bracket.

#### 4.4.5 Replacing Fuses

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The Phoenix LT4 contains six fuses that are used to protect its electrical components. All six fuses are located on top of the control box as shown in Figure 4- 444. Several spare fuses have been included in the yellow envelope that was shipped with the machine.



**Figure 4- 34**

The voltage, current, and part number for each of the fuses is listed in Table 4- 2 on the following page. This information, with exception to the part number, is also present on the top of the control box.

Table 4- 2

Voltage	110 V		220V		
	Label	Current, A	Part Number	Current, A	Part Number
	Cleaner Pump	2	748-610-600	1	748-901-111
	Buffer Motor	10	748-510-400	5	748-511-405
	Vacuum Motor	10	748-510-400	5	748-511-405
	Drive Motor	6.25	748-512-110	4	748-510-100
	Buffer Solenoids	8	748-901-031	4	748-510-100
	Vacuum Head Solenoid	8	748-901-031	4	748-510-100

To replace the fuses, perform the steps below with the machine in the **operating** position.

**Tools Needed:**

- 5/32" hex wrench
- Flat blade screw driver

**WARNING**

Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.

1. Unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank, remove the cap from the cleaner tank, remove the two screws from each side of the hood (see Figure 4- 455), and lift the hood from the frame. Set the screws aside.
2. Remove the fuse holder and fuse by pushing the holder in with the screwdriver while unscrewing it (rotate counterclockwise).
3. Lift the fuse holder and fuse out of the control box.
4. Remove the fuse from fuse holder by pulling it straight out of the holder.

**NOTE**

**Replacement fuses must have the identical voltage, current, and time delay ratings.**

5. Place the new fuse into the fuse holder and insert into the control box.

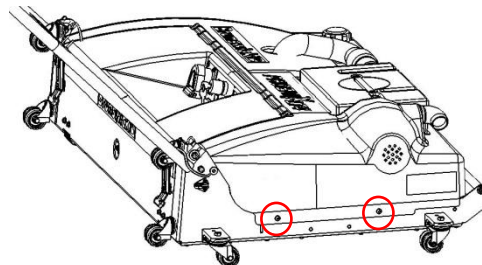


Figure 4- 35

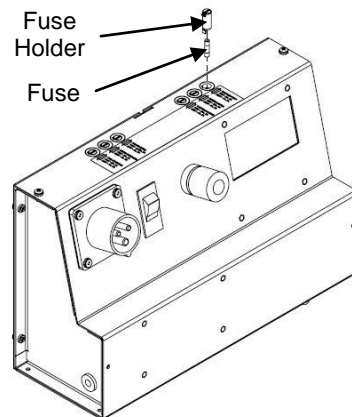


Figure 4- 36

6. Secure the fuse and fuse holder in the control box by pushing it down with the screwdriver and screwing it in (rotate clockwise).
7. Reinstall the hood, vacuum hose, cleaner tank cap, and waste tank.

**TIP**

Fuses shouldn't blow during normal use. If a fuse is blown, check the components in the associated system to ensure none are jammed or otherwise damaged. Blown fuses can be a good indicator that a component may be going bad or is out of adjustment.

### 4.4.6 Replacing the Optical Sensor

The optical sensor stops the Phoenix LT4 at the end of the lane. A faulty optical sensor could cause the machine to stop too soon or not at all. The instructions below tell how to adjust and replace the front sensor.

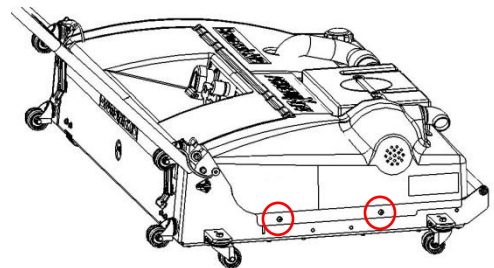
Perform these steps with the machine in the **operating** position.



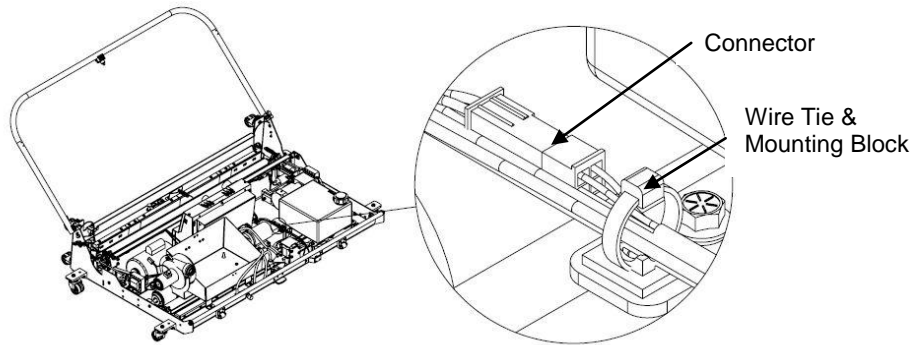
**Always ensure the Phoenix LT4 Lane Machine is disconnected from any power source before starting any maintenance, replacement, or repair task.**

<b>Tools Needed:</b>	<ul style="list-style-type: none"> <li>• 5/32" and 5/64" hex wrenches</li> <li>• Wire cutters and wire tie</li> </ul>
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1. Unlatch the oil compartment door latches, disconnect the vacuum hose and remove the waste tank, remove the cap from the cleaner tank, remove the two screws from each side of the hood (see Figure 4- 477), and lift the hood from the frame. Set the screws aside.
2. Locate the optical sensor cable, connector, and the cable mounting block as shown in Figure 4- 48 on the following page.

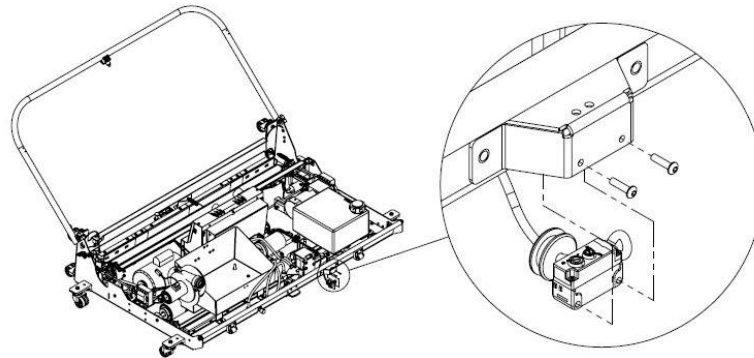


**Figure 4- 437**



**Figure 4- 38**

3. Disconnect the optical sensor cable.
4. Being careful not to cut into any wires, remove the wire tie securing the optical sensor cable to the cable tie anchor.
5. Remove the two screws that attach the optical sensor to its protective cover as shown in Figure 4- 499.



**Figure 4- 39**

6. Remove the grommet from the front panel of the machine and feed the connector end of the sensor cable through it.
7. Feed the connector of the new optical sensor through the grommet and secure the grommet in the hole of the front panel.
8. Secure the optical sensor to the protective cover using the two screws removed earlier.
9. Connect the sensor cable to the control box cable.
10. Secure the optical sensor cable and wires from the vacuum head solenoid to the cable tie anchor with a wire tie.
11. Reinstall the hood, vacuum hose, cleaner tank cap, and waste tank.
12. Refer to Section 4.3.7 – *Adjusting the Optical Sensor*.

## 4.5 UPDATING THE PHOENIX LT4 SOFTWARE

From time to time the Phoenix LT4 firmware may be updated to include new features or correct bugs in the software. In the event that a newer version is available, the software can be upgraded easily. The software version present on the Phoenix LT4 can be identified by selecting the Test screen icon from Home screen. The version information will be displayed as shown in Figure 4-50.

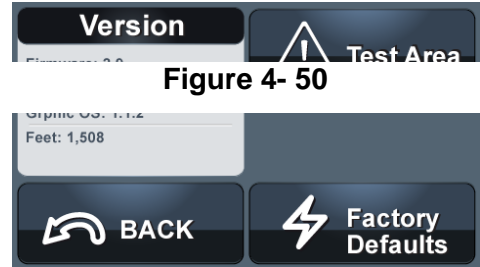


Figure 4- 50



**Software update will overwrite all program and settings. Be sure all program parameters and settings have been copied from the Test area and Programs menu before updating software.**

To update the firmware follow the procedure below with the machine **operating** position.

<b>Tools Needed:</b>	None
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1. **When the software is updated, all customizations will be lost.** Prior to upgrading the machine, be sure to take note of all program specifications along with machine settings such as transfer motor speed, end of lane delay, etc. Refer to Section 3.2.1 – *The Touch Screen* and Section 3.2.5 – *The Test Area* for information on accessing the machine settings.
2. Obtain the latest software by contacting the Brunswick Customer Response Center at 1-800-YES-BOWL (1-800-937-2695). Additionally, Technical Support can be reached by e-mailing [techsupport@brunbowl.com](mailto:techsupport@brunbowl.com) or via fax at 1-231-725-4667.
3. Load the software onto a USB flash drive. Software must be a .upd file and be placed on the USB flash drive at the root/top level (not in a folder).
4. Unlatch the oil compartment door latches and open the cover.
5. Locate the USB port, shown in Figure 4- 51, on the buffer brush motor side of the control box.

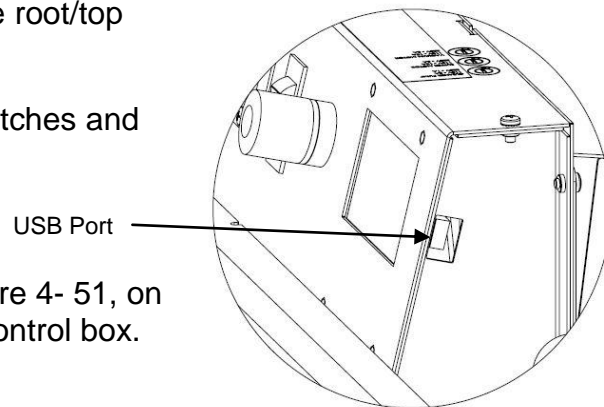
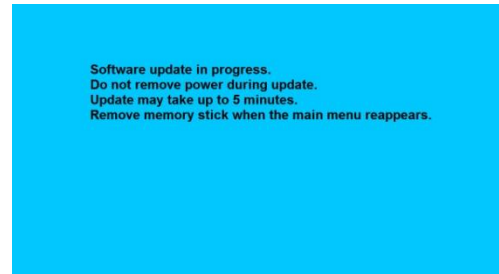


Figure 4- 51

6. Insert the USB flash drive into the USB on the control box then close and latch the oil compartment door.

7. Take note of the time, plug the machine in, and turn the power switch on.

8. A screen similar to the one shown in Figure 4-52 will appear on the screen while the software is updating. There is no status bar or other indication of the progress of the upgrade. An update takes approximately five minutes to install.



**Figure 4- 52**

9. When the update has finished installing, the Home Screen will reappear. Turn the power switch off.

10. Open the oil compartment door, remove the USB flash drive, then close and re-latch the oil compartment door.

11. Turn the machine on and check the Tools screen to ensure that the machine has been updated.

12. Adjust the machines programs and settings to match the settings prior to the upgrade.

## Section 5

# TROUBLESHOOTING

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This section describes some problems that may be encountered when using the Phoenix LT4 Lane Machine, and their solutions. Also included in this section is the procedure to follow if the Phoenix LT4 stops in the middle of an operation.

### 5.1 OPERATIONAL PROBLEMS AND SOLUTIONS

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Problems are grouped into one of three categories:

General Operation	Problems with the machine that are not related to a specific operation.
Cleaning Operation	Problems specific to the cleaning operation.
Conditioning Operation	Problems specific to the oiling and buffing operations.

If a problem cannot be resolved with the solutions contained in this section or a problem not included in this section is encountered, contact the Brunswick Customer Response Center. Their number is given below.

1-800-YES-BOWL (1-800-937-2695)

Additionally, Technical Support can be reached by e-mailing [techsupport@brunbowl.com](mailto:techsupport@brunbowl.com) or by fax at 1-231-725-4667.

#### NOTE

The solutions given in this section should be performed only by experienced operators who are accustomed to working with machines, electrical components, and parts drawings. Do not attempt to repair or adjust the Phoenix LT4 Lane Machine if any of the steps given for a possible solution are not understood.

### 5.1.1 General Operation

PROBLEM	SOLUTION
<p>The machine doesn't turn on/the touch screen doesn't light up.</p>	<p>Ensure that there is power to the outlet (the breaker isn't open or tripped) and that it is of the correct voltage for the machine.</p> <p>Ensure that the power cord is firmly plugged into the outlet and into the power inlet on the machine.</p> <p>Ensure the POWER switch is ON.</p> <p>Ensure the oil tank cover is closed. Check that cover is tight and secure.</p>
<p>Touch screen lights up to main menu, but machine won't start.</p>	<p>Trace the start switch cable out of the left side of the handle base and back to the control box. If the cable is intact, replace the start switch.</p>
<p>The encoder error is displayed</p> <p>For a screen shot of the Encoder error refer to Section 3.2.6 – <i>Error Messages</i></p>	<p>When the encoder does not detect the machine is moving, the encoder error is displayed. Causes of the encoder error include:</p> <ul style="list-style-type: none"> <li>• Obstruction on the lane</li> <li>• Restriction of the power cord</li> <li>• Faulty encoder or connection                             <ul style="list-style-type: none"> <li>○ Ensure cord is securely plugged in to encoder.</li> <li>○ Ensure cord is not damaged.</li> </ul> </li> <li>• Drive motor failure or blown fuse</li> <li>• Misalignment of the machine on the lane</li> </ul>
<p>The machine does not stop at the end of the lane (runs into the pit) or the End of Lane error is displayed</p> <p>For a screen shot of the End of Lane error refer to Section 3.2.6 – <i>Error Messages</i></p>	<p>Ensure that the optical sensor is not dirty or blocked and that the sensor cable is firmly plugged into the control box.</p> <p>Check the EOL delay setting and the brake setting. Refer to "Settings" in Section 3.2.5 – <i>The Test Area</i>.</p> <p>Sensor is not adjusted correctly. Refer to Section 4.3.7 – <i>Adjusting the Optical Sensor</i>.</p>
<p>The E-STOP error is displayed</p> <p>For a screen shot of the E-Stop error refer to Section 3.2.6 – <i>Error Messages</i></p>	<p>If the E-STOP error is displayed, the E-STOP button and the cover's interlock button must both be checked to clear error.</p> <p>If the yellow collar around the E-Stop button is not visible, then the button is depressed. The button must be pulled out and the machine must be turned off and on to clear error.</p> <p>If the machine cover was opened or removed, close or reinstall the machine cover and verify the oil compartment cover is tightly latched. Then turn the machine off and on.</p>




**5.1.1 General Operation**, continued

PROBLEM	SOLUTION
<p>The drive motor continues to run after the machine returns to the approach.</p> <p>The counter wheel didn't count down to zero.</p>	<p>Ensure all four caster wheels are in the gutter before the second press of the start button. Refer to Section 3.9 – <i>Cleaning the Lane Head Area</i>.</p> <p>Ensure that the encoder is plugged in and that both it and the toothed wheel are aligned correctly. Check for free rotation.</p>
<p>The communication error is displayed</p> <p>For a screen shot of the communication error refer to Section 3.2.6 – <i>Error Messages</i></p>	<p>The communication error occurs if there is an interruption of communication inside the control box between the logic and relay boards. If this error occurs, turn the machine off then on. If the error is cleared, the machine is okay for operation.</p> <p>There are no actions the user can take to correct a continuous communications error. Contact the Brunswick Customer Response Center for further assistance.</p>
<p>The machine hesitates or stops while traveling down the lane.</p>	<p>The problem could occur if the bumper rails are too high. If the bumper rails do not fully retract, bumpers must be removed, fixed, or replaced.</p> <p>This could also indicate the counter wheel is not working properly. For example, it may have skidded along the lane failing to count. This can be caused by debris on the lane or by a sticky counter wheel. The encoder connector could be loose either at the control box or the encoder. Check the counter wheel to see if it rotates freely. Disassemble and clean the shaft and check the bearings as necessary.</p> <p>The guide rollers are set at the factory to fit against synthetic lanes. Depending on the center's lanes, the guide rollers can be too tight and stop the machine. Complete the steps below FOR ALL SIX GUIDE ROLLERS to remove the spacer in the guide roller assembly.</p> <ol style="list-style-type: none"> <li>1. With the machine in the <b>storage</b> position, remove the Phillips screw on each end of the guide roller shaft to release the guide roller assembly. Refer to the drawing located in Section 7 - <i>Parts</i>. The guide roller assembly configuration is: a spacer (guide roller washer), a spring, and a guide roller.</li> <li>2. Remove the spacer and reinstall it on the opposite end of the axle.</li> <li>3. Reassemble the guide roller assembly and secure it in place with the two Phillips screws.</li> <li>4. Repeat for the remaining guide rollers.</li> </ol>

**5.1.1 General Operation**, continued

PROBLEM	SOLUTION
<p>The machine does not fit tightly against the sides of the lane or runs crooked/skews down the lane.</p>	<p>The guide rollers are set at the factory to fit synthetic lanes. For wood lanes, the guide roller may need to be adjusted. Depending on the centers lanes, the guide rollers may need to hug the sides of the lane more tightly. To tighten the fit against the lanes, complete the steps below FOR ALL SIX GUIDE ROLLERS to add a spacer in the guide roller assembly.</p> <ol style="list-style-type: none"> <li>1. With the machine in the <b>storage</b> position, remove the Phillips screw on each end of the guide roller shaft to release the guide roller assembly. Refer to the drawing located in Section 7 - <i>Parts</i>. The guide roller assembly configuration is: a spacer (guide roller washer), a spring, and a guide roller.</li> <li>2. Insert another spacer next to the existing spacer.</li> <li>3. Reassemble the guide roller assembly and secure it in place with the two Phillips screws.</li> <li>4. Repeat for the remaining guide rollers.</li> <li>5. Don't pull on the power cord. Make sure to feed slack as the machine runs down the lane toward the pin deck, and take up slack as the machine returns to the foul line to keep the machine from running over the power cord.</li> </ol> <p>The problem could occur if the bumper rails are too high. If the bumper rails do not fully retract, bumpers must be removed, fixed, or replaced.</p> <p>Another possibility is that your pindeck may have missing or broken pieces. Inspect pindeck to verify that nothing is missing or broken. Repair or replace as necessary.</p> <p>If the drive wheel has oil on it, the machine may skew. This is due to the fact that the drive wheel is off-center on the bottom of the machine and if it loses traction, the side the drive wheel is on may slide. Clean drive wheel to ensure it is free from oil.</p>

## 5.1.1 General Operation, continued

PROBLEM	SOLUTION															
<p>The machine hums or buzzes.</p>	<div data-bbox="824 327 1247 443" style="text-align: center;">  <b>WARNING</b> </div> <p data-bbox="623 491 1451 596" style="text-align: center;"><b>Use extreme care when servicing solenoids. The surfaces can be very hot and a severe pinching hazard exists under the hood.</b></p> <p data-bbox="610 644 1409 968">To determine which solenoid might not be fully engaging, select <i>Test Area</i> from the Test Screen. The test area (shown) will be displayed. Press the vacuum solenoid button to disengage the vacuum solenoid. If there is no change in the hum/buzz, press the buffer brush</p> <div data-bbox="993 720 1422 961" style="display: inline-block; border: 1px solid black; background-color: #f00; padding: 5px;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Vacuum solenoid</td> <td style="padding: 2px;">Cleaner pump</td> <td style="padding: 2px;">Vacuum motor</td> </tr> <tr> <td style="padding: 2px;">Buffer solen.</td> <td colspan="2" style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">Buffer pressure</td> <td style="padding: 2px;">Buffer motor</td> <td style="padding: 2px;">Drive motor test</td> </tr> <tr> <td style="padding: 2px;">Transfer roller</td> <td style="padding: 2px;">Settings</td> <td style="padding: 2px;"></td> </tr> <tr> <td colspan="3" style="padding: 2px; text-align: center;">&lt; Back</td> </tr> </table> </div> <p data-bbox="610 974 1435 1115">solenoid button. This will engage the two buffer brush solenoids. By pressing these two buttons and listening for changes in the hum/buzz, one should be able to determine which of the three solenoids is not fully engaging.</p> <p data-bbox="610 1127 1451 1268">The particular solenoid that is not fully engaged can also be found by feeling <b>NEAR</b> the solenoid. A solenoid that is not fully engaging will feel hot. It will also vibrate as it is making the sound.</p> <p data-bbox="610 1281 1463 1497">Solenoids that do not fully engage are usually out of alignment. If a misaligned solenoid is found, turn off power and unplug machine, loosen the adjustment screws, realign the solenoid, tighten the screws, and recheck. Any time the position of a solenoid is adjusted, the vacuum head or buffer brush, as applicable, will need to be checked for adjustment.</p> <p data-bbox="610 1509 1458 1614">It is also possible that oil or debris has gotten on the solenoid shaft and is preventing the solenoid from engaging. Wipe the solenoid shaft with a clean, dry cloth.</p> <p data-bbox="610 1627 1463 1730">If the solenoid continues to buzz or feel hot and adjusting it does not correct the problem, replace it. Refer to Section 7 - <i>Parts</i> for part numbers.</p>	Vacuum solenoid	Cleaner pump	Vacuum motor	Buffer solen.			Buffer pressure	Buffer motor	Drive motor test	Transfer roller	Settings		< Back		
Vacuum solenoid	Cleaner pump	Vacuum motor														
Buffer solen.																
Buffer pressure	Buffer motor	Drive motor test														
Transfer roller	Settings															
< Back																

## 5.1.2 Cleaning Operation

PROBLEM	SOLUTION
<p>The nozzle(s) is not spraying cleaner.</p>	<p>Make sure the cleaning operation is selected.            Ensure there is cleaner in the cleaner tank.            Ensure the cleaner pump is running by pressing the cleaner pump button in the test area. If not, check the cleaner pump fuse. (Refer to Section 4.4.5 – <i>Replacing Fuses.</i>)</p> <ul style="list-style-type: none"> <li>• Check for severely kinked tubing.</li> <li>• Clean the in-line filter. Refer to Section 4.2.3 – <i>Cleaning the In-Line Filter.</i></li> <li>• Check the spray nozzle(s) to see if it is clogged. Refer to Section 4.3.4.3 – <i>Clearing a Clogged Nozzle.</i></li> <li>• Adjust the cleaner flow at the flow control bypass valve to dispense more cleaner by turning it <b>clockwise</b> in small increments until cleaner begins spraying. Refer to the drawing located in Section 4.3.4.1 – <i>Adjusting Cleaner Flow Rate.</i></li> </ul>
<p>The nozzle(s) is spraying erratically.</p>	<p>Check that there is cleaner in the tank, a crimped hose, or a clogged cleaner filter bowl.            The nozzle(s) or check valve/strainer is clogged. Refer to Section 4.3.4.3 – <i>Clearing a Clogged Nozzle.</i>            The tubing has been pushed too far into a quick connector, which can cause a flow restriction. Remove the tubing from the connector, make sure the end is cut cleanly and is not folded under or collapsed, and reconnect.</p>
<p>Foam is coming out the exhaust port of the vacuum motor.</p>	<p>The waste tank needs to be emptied.            The action between the cleaner, oil, and agitator foam creates suds in the waste tank. This foam can be sucked through the vacuum pump. To reduce the amount of suds, pour 1-2 ounces of defoamer into an empty waste tank before the lane cleaning session.            Improper cleaner used. Use a lane cleaner recommended for vacuum stripping.            Cleaner dilution is too strong. Add more water to the mixture to dilute.</p>

## 5.1.2 Cleaning Operation, continued

PROBLEM	SOLUTION
Residue is left on the lane after the Phoenix LT4 passes over it.	<p>Check that the waste tank is seated correctly against the waste tank seal and that the seal is not rolled or damaged. Refer to Section 4.4.4 – <i>Replacing the Waste Tank Seal</i>.</p> <p>Check the squeegee edge to ensure it is not worn, broken, or warped. Ensure that the squeegee edge is making full contact with the lane surface. Replace the squeegee as necessary. Refer to Section 4.4.1 – <i>Replacing the Agitator Foam or Squeegee</i>.</p> <p>Check that the vacuum hose is installed correctly (both ends), and that it has not split. Refer to Section 4.3.5 – <i>Adjusting the Vacuum Head Height</i>.</p>
Cleaner spray in gutters.	<p>This is typically caused by the two outside spray nozzles being aimed more towards the outside of the lane. This can be solved by aiming them more towards the center of the lane. Refer to Section 4.3.4.2 – <i>Adjusting Cleaner Nozzle Direction</i>.</p> <p>Flow pressure may be too high causing the two outside spray nozzles to spray cleaner across the lane to the opposing gutters. Refer to Section 4.3.4.1 – <i>Adjusting Cleaner Flow Rate</i>.</p>
Lane is not being cleaned.	<p>This can be caused by a number of factors:</p> <ul style="list-style-type: none"> <li>• Ensure the cleaning tank has the proper mixture of lane cleaner and water in it.</li> <li>• Ensure spray nozzles and tubes are clear and working properly. Repair/replace as necessary.</li> <li>• Adjust flow rate to apply more cleaner to the lane. Refer to Section 4.3.4.1 – <i>Adjusting Cleaner Flow Rate</i>.</li> <li>• Check agitator foam and squeegee for damage. Repair/replace as necessary. Refer to Section 4.4.1 – <i>Replacing the Agitator Foam or Squeegee</i>.</li> <li>• Verify that the vacuum system/head is working properly.</li> <li>• Check to make sure the waste tank seal is in good working condition and replace as necessary. Refer to Section 4.4.4 – <i>Replacing the Waste Tank Seal</i>.</li> </ul>

### 5.1.3 Conditioning Operation

PROBLEM	SOLUTION
<p>Parts of the oil pattern look like a “washboard” or chattered.</p>	<p>Check the condition of the wicking foams and rotate or replace as needed. Refer to Section 4.3.2 – <i>Rotating the Wicking Foams</i> and/or Section 4.4.3 – <i>Replacing the Wicking Foams</i>.</p> <p>Increase the buffer pressure. Refer to Section 4.3.1 – <i>Adjusting the Buffer Brush Pressure</i>. If changing the buffer pressure does not eliminate the problem, replace the buffer brush.</p> <p>Check that the lane is in USBC or WTBA specification for crowning, depression, and crosswise tilt.</p>
<p>Oil is not being applied to the lane.</p>	<p>Make sure there is oil in the oil tank and that the oil level is above the bottom of the sight glass but not above the fill line.</p> <p>Verify that the oil tank foams are in contact with the transfer roller and that the tank spring is engaged.</p> <p>Check the wicking foams. Rotate or replace them if needed.</p> <p>Check to ensure that the transfer roller motor is operating and turning by pressing the Transfer roller button in the Test Area. Check the electrical connectors and fuse.</p> <p>Verify the transfer roller is turning.</p> <p>Check that the buffer solenoids are working by pressing the Buffer solen. button in the Test Area. If they are not working, trace the wiring back to the control box enclosure to ensure the wiring is intact and the connections have not worked loose. Check the fuse. Refer to Section 4.4.5 – <i>Replacing Fuses</i>. If the solenoids are still not working, replace them. Refer to Section 7 - <i>Parts</i> for part numbers.</p> <p>Verify that the buffer motor is operating by pressing the Buffer motor button in the Test Area. If not, check that the connector is firmly plugged into the control box. Check the fuse. Check that the buffer drive belt has not slipped off or broken. Check the belt tension for sufficient tension.</p> <p>Refer to Section 4.2.1.2 – <i>Measuring the Buffer Brush Pressure</i>.</p>
<p>The amount of oil being applied is less than it used to be.</p>	<p>Ensure the oiling and buffing distances have not been changed.</p> <p>Ensure the oil level is above the bottom of the bull’s-eye.</p> <p>Check if the buffer brush is worn, replace if necessary.</p> <p>Rotate or replace the wicking foams. Refer to Sections 4.3.2 – <i>Rotating the Wicking Foams</i> and 4.4.3 – <i>Replacing the Wicking Foams</i>.</p>

### 5.1.3 Conditioning Operation, continued

PROBLEM	SOLUTION
The machine hums or chatters when it is buffing.	The buffer brush pressure is too high. Reposition the buffer brush to reduce the pressure. Check for sufficient buffer belt tension. Refer to Section 4 – <i>Maintenance and Adjustments</i> for information about adjusting the buffer brush.
The buffer brush doesn't lift off the lane when it has reached the distance at which it should stop buffing.	<p>Check the buffer return springs. The springs should be connected to buffer spring brackets on either of the rear frame corners.</p> <p>Ensure the clevis pin(s) has not come out of the clevis.</p> <p>If the springs no longer have sufficient tension, or if a clevis pin(s) has broken, replace them. Refer to Section 7 - <i>Parts</i> for part numbers.</p>
There are streaks in the oil.	<p>Check the squeegee. The smooth side of the squeegee should be the side that glides along the lane. Reposition the squeegee so that the smooth side faces down on the lane. Additionally, check to make sure the nuts holding the squeegee to the vacuum head aren't too tight. This can cause the squeegee to buckle. If the squeegee is buckled, adjust the tightness of the nuts until smooth.</p> <p>If this problem persists, the squeegee may need to be replaced or the vacuum head height may need to be adjusted. Refer to Section 7 - <i>Parts</i> for part numbers and Section 4.3.5. – <i>Adjusting the Vacuum Head Height</i>.</p>

## 5.2 RECOVERING IF THE PHOENIX LT4 STOPS ON THE LANE

There are five reasons the Phoenix LT4 might unexpectedly stop on the lane:

- The machine became unplugged or lost power.
- The encoder stopped counting or missed too many counts.
- The oil compartment door became unlatched and tripped the interlock switch.
- The guide rollers were too tight against the lane.
- Gutter bumpers are too high and the machine cannot pass the elevated section.

Pressing the EMERGENCY STOP button or opening the cover would also stop the machine.

If the machine stops on the lane, an error will be displayed on the screen. Generally, this error will be either an encoder or the end of lane error (Figure 5- 1 and Figure 5- 2, respectively). Regardless of the error, the machine will need to be returned to the foul line and lane to be reconditioned.



Figure 5- 1

If the Auto Back option is selected, the machine will lift the vacuum head off the lane and run the machine back to the foul line using the drive motor. This option is the preferred method for returning the machine to the foul line.



Figure 5- 2

If there is a drive motor or another failure that prevents the machine from returning itself to the foul line, the Manual Back option should be used. Select the Manual Back button, wait for the vacuum head solenoids to engage, and then pull machine by the handle back to the foul line.

A screen similar to Figure 5- 3 will be displayed when returning the machine to the foul line. The last reading of the odometer is displayed in the upper right portion of the screen; this value will decrease as the machine approaches the foul line.



Figure 5- 3

If it is not possible leave the machine energized while manually returning it to the foul line, pull the machine slowly to avoid damage to the vacuum head.

Once the Phoenix LT4 has returned to the foul line and the problem has been corrected, restart the machine to have it perform the same operation(s) it was performing when it stopped.



## DETERMINING THE OILING PATTERN

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The Phoenix LT4 Lane Machine arrives from the factory preprogrammed with patterns intended for open or recreational, league, and tournament play as well as a cleaning only pattern. Minor adjustments have been made to the machine at the factory to perfect these patterns; therefore, your machine's exact settings may vary slightly from default. These provide a desirable and playable lane oil pattern for most centers. However, there are many factors that can affect lane conditions in a center and these programs may be modified based on the center's needs to yield best results. The factors which can affect lane conditions include but are not limited to:

- Type and physical condition of the lanes
- Environment (temperature and humidity) of the center
- Type and viscosity of the oil being used
- Number of games bowled between each cleaning and oiling session
- Type of bowlers (recreational, organized, professional)

This section discusses the default programs, selecting an appropriate program, how the Phoenix LT4 applies oil, adjusting oil output, and troubleshooting.




Unfortunately, the information in this section cannot address every oiling and buffing situation. Therefore, it is not intended as a full discussion of how to condition lanes. Factoring in the center's bowlers, lanes, environment, and choice of oil, the machine has multiple possible adjustments, such as wicking foams and oiling/buffing distances, that can help achieve the ideal oil pattern. The factory programs will work in the vast majority of centers, without additional adjustments.

### 6.1 DEFAULT PROGRAMS

---

In the following pages, each of the Phoenix LT4's factory programs is explained in detail. Included, is a graphic depiction of the processes the machine will perform on the lane and a typical graph of the oil pattern. A legend for the illustration of the programs is shown in Table 6- 1.

Table 6- 1

Operation	Symbol
Cleaning	
Conditioning	
Buffing	

### 6.1.1 Program A

Program A is a single pass oil pattern that gives novice bowlers a predictable bowling condition. It can be used for recreational or open play. The default specifications for Program A are shown below in Figure 6- 1.

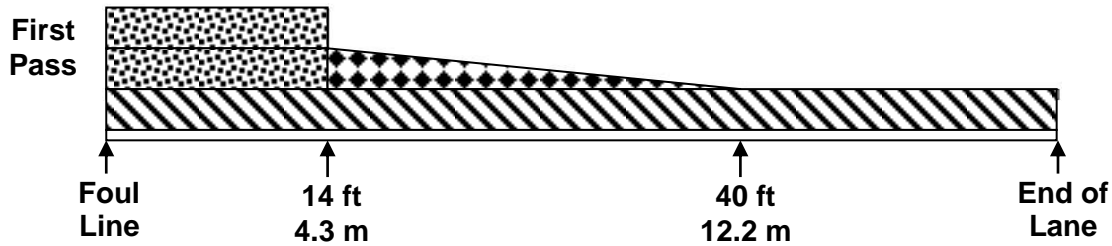


Figure 6- 1

Figure 6- 2 shows a graph of a typical pattern applied to the lane using Program A.

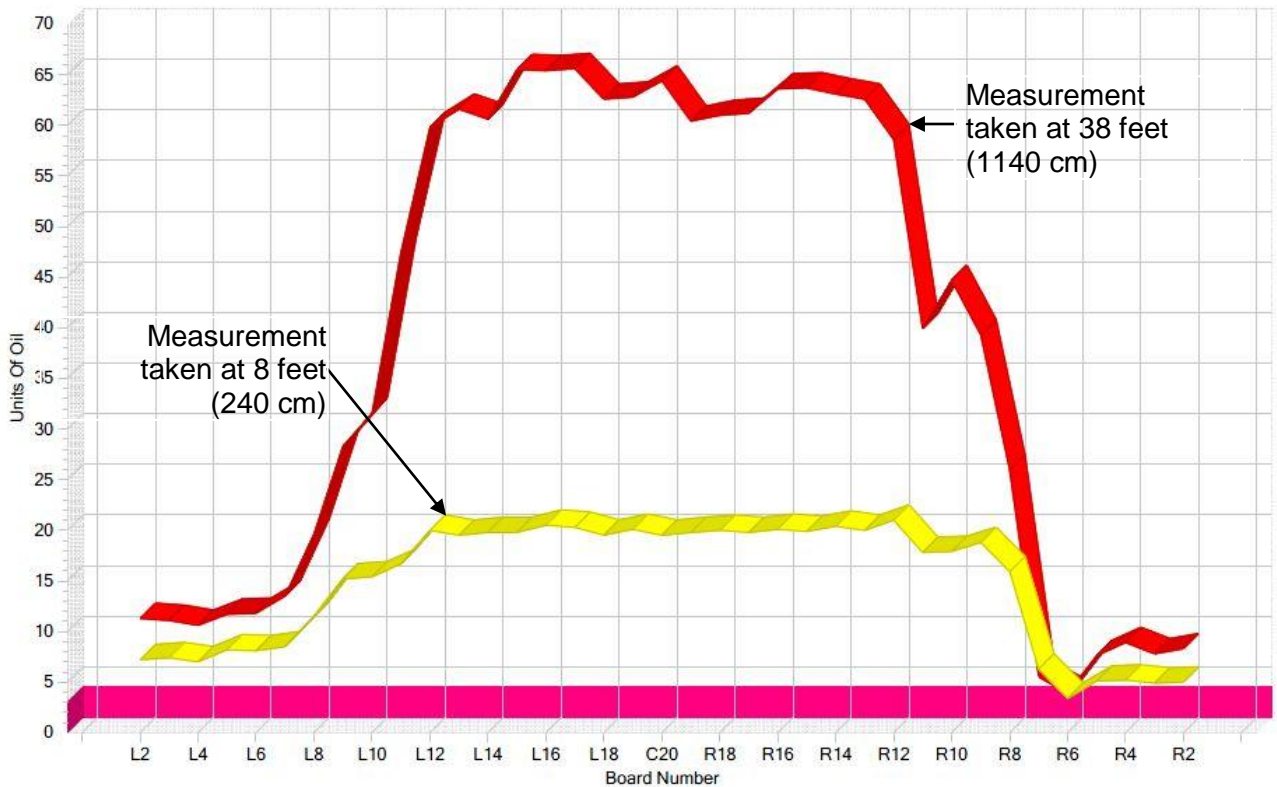


Figure 6- 2

### 6.1.2 Program B

Program B is a double pass oil pattern designed for amateur leagues or clubs whose bowlers may have performance bowling balls. It will protect the lanes from damage due to performance bowling balls while providing a more competitive condition. The specifications for Program B are shown below in Figure 6- 3.

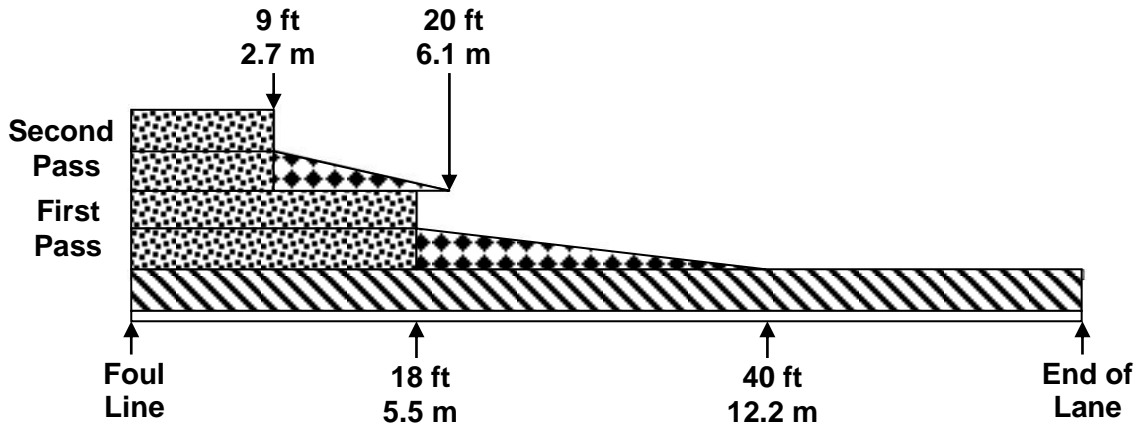


Figure 6- 3

Figure 6- 4 shows a graph of a typical pattern applied to the lane using Program B.

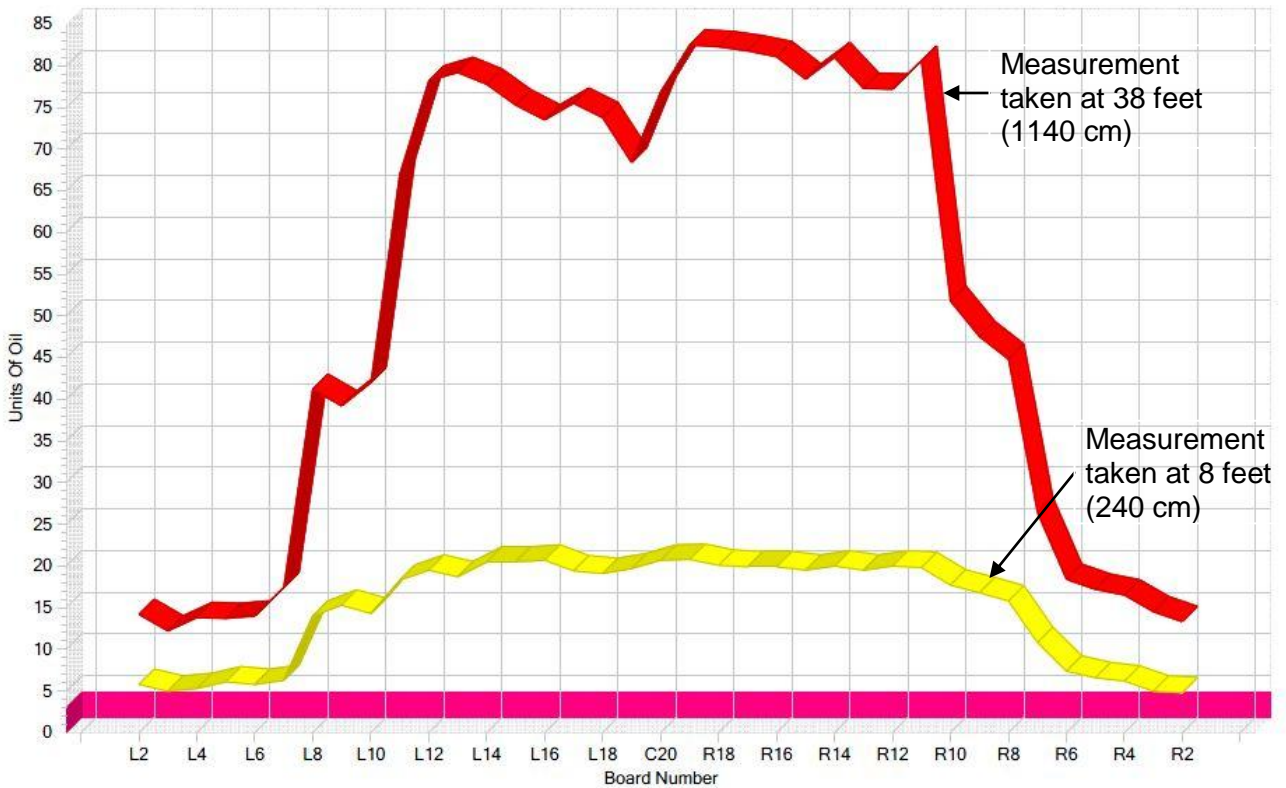


Figure 6- 4

### 6.1.3 Program C

Program C is a double pass oil pattern designed for tournaments and leagues whose bowlers will use high performance bowling balls. Program C will protect the lanes from damage due to performance bowling balls while providing a highly competitive condition. The specifications for Program C are shown below in Figure 6- 3.

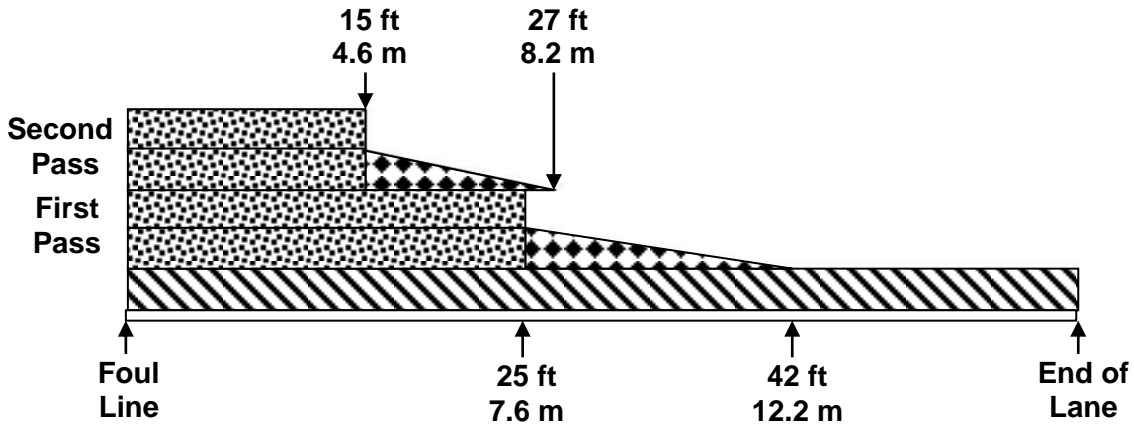


Figure 6- 5

Figure 6- 6 shows a graph of a typical pattern applied to the lane using Program C.

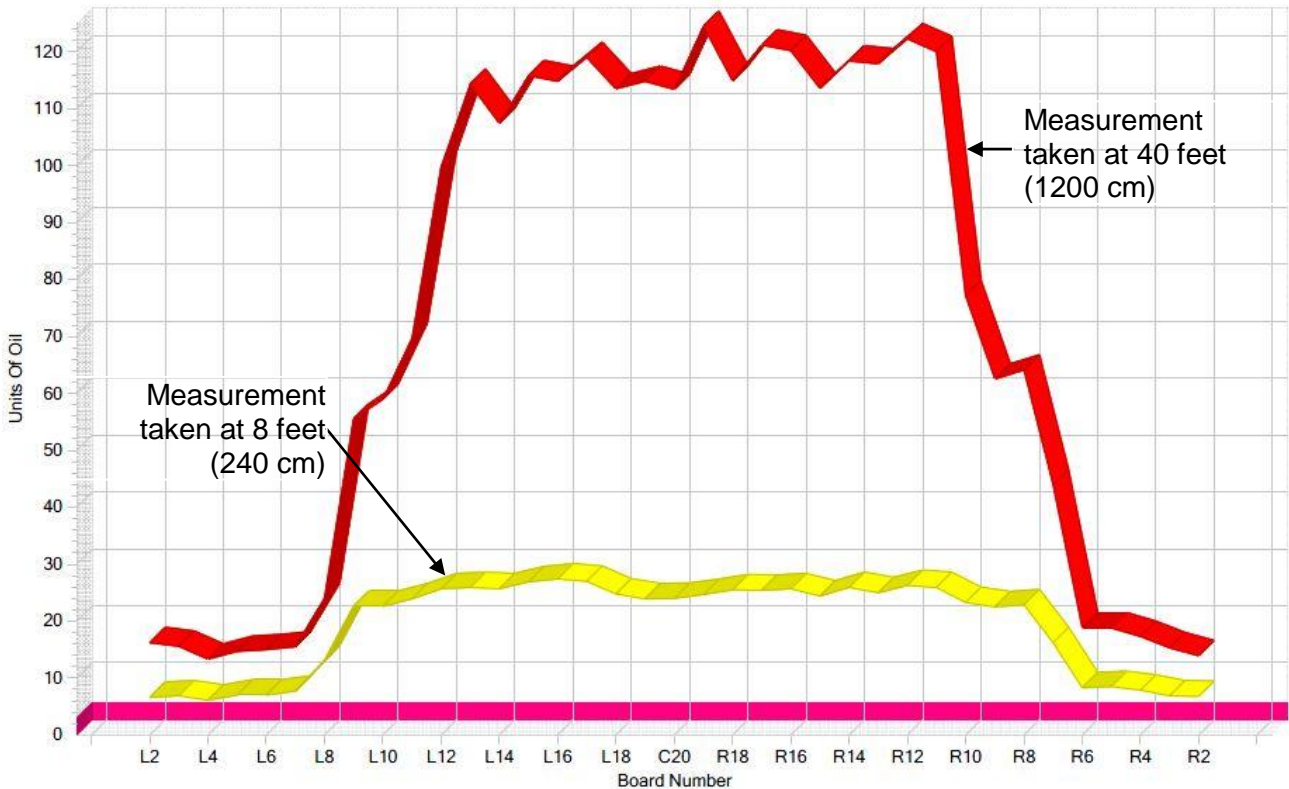


Figure 6- 6

### 6.1.4 Program D

---

Program D is a cleaning only pass as shown in Figure 6- 7. It will not add any oil to the lane and can be used to test the cleaning function of the machine or prepare the lane for inspection.

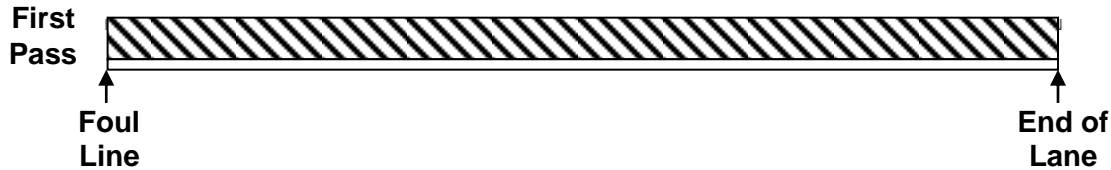


Figure 6- 7

Program D will not add any oil to the lane; therefore no oil graph is needed to represent it.

## 6.2 SELECTING A PROGRAM FOR USE

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The program that best suits the bowling center will be largely dictated by the centers' customers.

Program A should be used when the majority of the customers are recreational bowlers who bowl occasionally and use house balls. If a significant portion of the centers business comes from amateur bowling clubs or leagues whose bowlers use high performance bowling balls, Program B should be used.

In either event, the oil pattern must be examined after a bowling session to ensure there is enough oil to protect the lanes. There should still be oil in the head section of the lane. If no oil is present in the heads, more oil must be applied via higher flowing wicking foams or adding a second pass.

### NOTE

The easiest way to add oil to the lane is to switch programs. If Program A is not providing enough oil, use Program B. If Program B isn't providing the desired amount of oil, use Program C.

The oil pattern can be optimized for the center by using the techniques discussed in this section.

### 6.3 HOW THE PHOENIX LT4 APPLIES OIL

The Phoenix LT4 uses wicking foams to transport the oil from the oil tank onto the oil transfer roller. The oil is moved through the wicking foams by capillary action. The density of the foams determines how much oil is moved in a given amount of time and space.

As the name implies, the oil transfer roller transfers the oil to the buffer brush which applies the oil to the lane surface. Since the oil transfer roller and buffer brush transport the oil from the wicking foams to the surface, the placement of the oil on the lane (oil pattern) is mostly determined by the density of wicking foam selected. The adjustment bars can be used to make minor adjustments to the oil pattern. The components of the conditioning system are shown in Figure 6- 8 and Figure 6- 9.

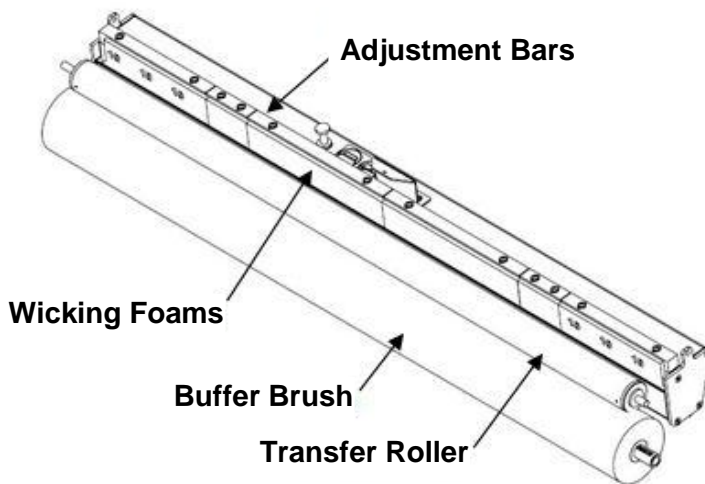


Figure 6- 8

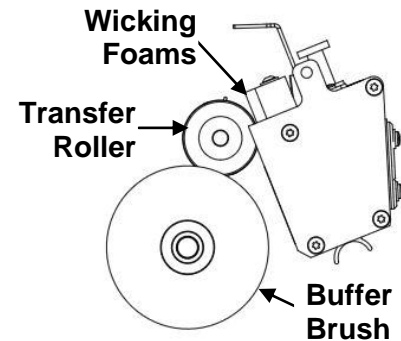


Figure 6- 9

### 6.4 ADJUSTING OIL OUTPUT

While the oil pattern is a major part of bowling, the lane needs to be oiled to protect it from damage caused by bowling balls.

#### IMPORTANT

If the head section of the lane is dry after a bowling session, more oil needs to be added to the lane.

If the Phoenix LT4 is not applying an appropriate amount of oil to the lane, a number of settings can be adjusted. These include adding a second pass, using different density wicking foams, and changing the oil distance.

Before and after making any changes to the oiling programs, it is best to measure the oil pattern with a Computer Lane Monitor®. Many federations and bowling associations will measure the centers oil pattern. If the center does not have a Computer Lane Monitor®,

visually inspect the lane for more or less oil than desired and use the finger smear technique to gauge more or less oil. Refer to Section 6.4.1 - *Finger Smear Technique*.

### **Oiled Area**

Two adjustments can be made to change the amount of oil applied to the lane:

- Adding or removing a second oiling or buffing pass
- Using higher or lower flow wicking foams

The second pass option runs the Phoenix LT4 down the lane a second time. During this transit, more oiling and buffing will occur. The second pass settings are independent of the first pass settings. Instructions for adding a second pass can be found in Section 3.2.2 – *Editing Program Specifications*.

Changing wicking foams allows for the application of more or less oil to the lane without making major changes to the programs or the machine. For information about the wicking foam oil outputs, refer to Section 6.5 - *Creating Oil Output Patterns* or Section 4.4.3 – *Replacing the Wicking Foams*.

### **Buffed Area**

Buffing can provide more oil down the length of the lane without adding more oil in the head area. As mentioned previously, the buffing distance must be at least equal to the oiling distance but it can be greater. Additionally, buffing can take place without adding oil to the lane.

The amount of oil in the buffed area is controlled by several factors which include:

- The buffing distance
- The oiling distance
- The amount of oil applied in the oiled area
- The number of buffing passes
- Oil viscosity

The amount of oil at the end of the oiled area can be increased or decreased by lengthening or shortening the oiling distance. A longer buff-only area will create an area where the amount of oil on the lane gradually decreases (the ball will gradually start to hook past the transition). By eliminating or using a very short buff only zone, a sharp edge can be created (the ball will "snap" or start hooking immediately at the transition). It is important to note that neither the gradual hook nor the "snap" at the transition zone are the "right" answer. The transition zone is a part of the game just like the oil pattern. Instructions for changing the buffing distance can be found in Section 3.2.2 – *Editing Program Specifications*.

If changing the buffing distance does not result in the amount of oil desired in the buffed area, consider changing the oiling distance. A shorter oiling distance will result in less total oil being applied to the buffed area; a longer oiling distance will result in more oil total being

applied in the buffed area. Refer to Section 6.5.4 – *Head to Backend Transition Zone* for information about how the oil is applied in the buffed area. If adjustments to the buffing distance do not yield the desired results, consider changing the wicking foams. It is important to note that the viscosity of the oil also affects the amount of oil applied to the oiled and buffed areas. If a higher or lower oil viscosity is chosen over the type that was shipped with the Phoenix LT4, it will be necessary to experiment in order to find the best configuration for the center

### **6.4.1 Finger Smear Technique**

---

The finger smear technique is a technique used to gauge the amount of oil at any length on the lane, without access to a Computer Lane Monitor®. This will allow for a visual inspection of the lane for more or less oil than desired. Though it is not as accurate as using a Computer Lane Monitor®, this method can be effective.

The finger smear technique is done by choosing a point on the lane for measurement of oil. Here is how it's done:

- Place finger at the very edge of the lane bordering the gutter.
- Push finger forward and downward at approximately a 45° angle, through the oil, toward the center of the lane.
- This motion pushes the oil up at the edges of the line that was made in the oil.
- You should look for the size of oil puddle displaced by the finger motion while also feeling for slight changes in resistance to the motion.
- Areas with more oil will allow for an easier finger slide and more oil to be displaced.
- Areas that are too dry will resist finger motion.

This test is especially good for verifying oil at a point on the lane where, at first glance, there doesn't appear to be any. Some synthetic lanes have a tendency to appear dry when there is a very small amount of oil on them.

## **6.5 CREATING OIL OUTPUT PATTERNS**

---

While lane oil was first used to protect against damage caused by friction between the lanes and the ball, it has evolved into a major component of the game. Often the difference between happy and disgruntled club or league bowlers is the oil pattern they bowl on.

### **6.5.1 Oil Patterns**

---

Different types of oil patterns can be created with the Phoenix LT4 by changing the wicking foams and the adjustment bars on the top of the oil tank. The Phoenix LT4 is shipped with two #10 (medium-low) output foams for the outside 8 inches on both sides of the lane, two #6 (medium-high) foams along the next three inches (the track) on each side of the lane, and two #4 (super-high) output foams (10 inches each) for the middle 20 inches of the lane. Using these foams creates a top-hat style pattern that is used by most bowling centers for league bowling. This pattern applies less oil along the outsides and more down the middle.



While different environmental conditions, such as temperature and humidity, between the factory and bowling center can alter the amount of oil applied, the overall pattern profile should remain approximately the same.

By using wicking foams of various densities along the 42 inch width of the oil tank, the Phoenix LT4 can apply numerous oiling patterns. Mixing and matching wicking foams and varying the adjustment bars will allow for a large number of oil patterns. Refer to Section 4.4.3 – *Replacing the Wicking Foams* and Section 4.3.9 – *Adjusting the Oil Tank Bars*.

### 6.5.2 Wicking Foam Densities

---

The Phoenix LT4 is shipped with six wicking foams made of three different densities. Changing wicking foam types can result in significant changes to the amount of oil being applied to the lane, while adjusting the adjustment bars on the top of the oil tanks will result in smaller changes.

A set of replacement wicking foams of different densities was supplied with the Phoenix LT4 Lane Machine. Each density of wicking foam is printed with a number for easy identification. The higher the number printed on the foam, the higher the foam’s density, and therefore the lower the oil output. Having different density foams as well as having the ability to change the location of each foam type allows for the creation of many different oil patterns.

Table 6- 2 shows the correlation between the number printed on the wicking foam and the comparative oil output along with the part number of each type of foam.

**Table 6- 2**

Output	Foam Density	Part Number
Super-High	#4	294-115-490
High	#5	294-115-488
Medium-High	#6	294-115-486
Medium	#8	294-115-484
Medium-Low	#10	294-115-482
Low	#11	294-115-652
Extra-Low	#12	294-115-653
Super-Low	#13	294-115-654

### 6.5.3 Preparing Custom-Sized Wicking Foams

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Replacement wicking foams come in lengths of 48 inches. When cutting a replacement foam section, try to make the cut as clean and as straight as possible. Using a straight edge as a guide and a new blade in the cutter will help prevent jagged edges and gaps between foam sections and in the pattern. One trick is to slightly overlap two foams keeping their top edges aligned, and make a single cut through both of them. The resulting cut will match perfectly, even if its angle is a little off.

**TIP**

When cutting new wicking foams from a section of factory bulk length, cut and discard approximately 1/2" from the factory cut edge. Failure to do so could result in inconsistent oil flow through the wicking foam at the end.

The proper dimensions of the wicking foams can be found in Section 4.4.3 – *Replacing the Wicking Foams*. Additionally, a wicking foam cutting template is available for order as part number 294-080-201.

The outside wicking foams that were shipped with the machine have a profiled edge to prevent oil drips. When cutting replacement foams; cut the same profile in the new foam.

Before inserting the wicking foams into the machine, align them on a flat surface to ensure the edges and top meet, and that they total 42 inches across. When inserting the wicking foams into the oil tank tray, start at one side and insert the wicking foams across to the other side.

Section 4.4.3 – *Replacing the Wicking Foams* contains the wicking foam replacement procedure as well as the dimensions for each of the foams.

#### 6.5.4 Head to Backend Transition Zone

When the oiling operation is selected, oiling will begin at the foul line and end at the distance specified in the program. The buffer brush can be stopped where oiling ends or it can continue to buff past oiling distance. The difference between the oiling and buffing distances is called the buff-out area. This area can have a major impact on how the bowling ball reacts with the oil pattern.

If the lane is not buffed past the oiling distance, a sharp break between the oiled and dry surfaces is created. If the Phoenix LT4 continues to buff, the remaining oil in the brush will be applied to the lane until the buffer brush runs dry or reaches the end of the buffing area. The amount of oil will gradually decrease in both length and slightly in width as the machine buffs down the lane.

If a top-hat style oiling pattern is being used, the buff-out area will look similar to Figure 6- 10 on this page and Figure 6- 11 on the next.

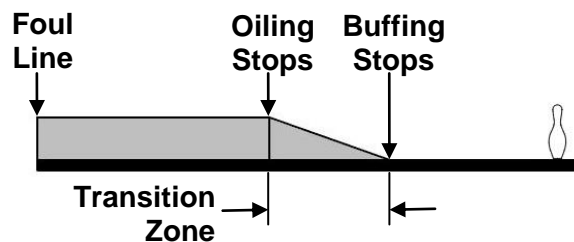
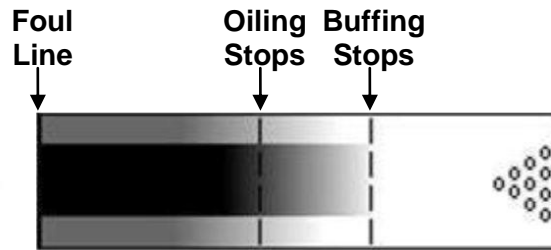


Figure 6- 10



**Figure 6- 11**

This zone provides a gradual change from the oiled surface to the dry surface. When buffing, always maintain at least the minimum amount of oil that satisfies the USBC, WTBA, or other local association (if the center is certified) requirements in the area of the lane to which oil is applied.

The amount of oil the Phoenix LT4 applies to the buffed area of the lane is determined by the amount of oil applied to the oiled area, the oiling distance, and the buffing distance. Generally, the higher the amount of oil and the longer the oiling distance, the more oil that remains in the buffer brush and therefore the more oil that is applied in the buffed area.

Since the amount of oil applied to the buffed area is directly related to the combination of the amount of oil applied in the oiled area and the distance of the oiled area, the only two ways to change the amount of oil in the buffed area — without changing the amount of oil applied to the oiled area — is to change the distance of the oiled area or the buffer brush pressure. Unfortunately, because every lane differs in how it accepts oil, there is no formula for determining how long to set the oiling distance to get a given amount of oil taper in the buffed area. It will be necessary to experiment with different oiling distances to find the right settings for the center.

To briefly summarize this section, the heads should be flooded with oil and the backend should be dry. There should be more oil in the center of the lane than there is on the outside. If the heads are dry after bowling, more oil is needed to protect the lane.

### **6.5.5 Troubleshooting**

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A number of factors can affect the oil pattern and its application to the lane.

Table **6- 3** on the next page contains solutions for a few common problems. Additional information can be found in Section 5.1.3 – *Conditioning Operation*.

If a problem is encountered that is not mentioned in

Table **6- 3** on the next page, Section 5.1.3 – *Conditioning Operation*, or elsewhere in this user manual, contact the Brunswick Customer Response Center at 1-800-YES-BOWL (1-

800-937-2695). Additionally, Technical Support can be reached by e-mail at techsupport@brunbowl.com or via fax at 1-231-725-4667.

Table 6- 3

<p><b>Dry spots in the oiled area (from depressions, undulating lane surfaces, etc.)</b></p>	<p>If there are some dry spots <b>but</b> the rest of the lane has the amount of oil desired, the buffer brush pressure should be increased. This will not affect the amount of oil applied in the rest of the oiled area.</p> <p>If there are some dry spots <b>and</b> the rest of the lane does not have the amount of oil desired, a second pass should be added to the oiling program. If there still is not enough oil being applied, the wicking foams may need to be replaced with higher output foams or increase the transfer roller speed.</p> <p>For information about this, refer to Section 6.5 - <i>Creating Oil Output Patterns</i>. If changing the wicking foams does not eliminate the problem, increase the buffer brush pressure. For information about checking and testing the buffer brush, refer to Section 4 - <i>Maintenance and Adjustments</i>.</p>
<p><b>Washboard or Corrugated Pattern In The Oiled Area</b></p>	<p>This indicates one of four things: the buffer brush pressure is not consistent across the lane, the oil output is too low, the buffer brush pressure needs to be increased, or the buffer brush has been contaminated with grease due to improper storage.</p> <p>Test the buffer brush pressure across the entire width of the brush. The pressure should be at the same point between B and C on the Buffer Pressure Adjustment Tool at each place tested on the buffer brush. If they are not, adjust the buffer brush pressure until the pressure is the same across the width of the brush. For information about measuring the pressure and adjusting the buffer brush pressure, refer to Section 4 - <i>Maintenance and Adjustments</i>. Condition the lane after making the adjustments to see if the problem has been eliminated.</p> <p>If the pressure is the same across the width of the brush and the washboard or corrugated pattern occurs, check the amount of oil applied to the lane. If more oil is desired, replace the wicking foams with higher output foams. For information about this, refer to Section 6.5 - <i>Creating Oil Output Patterns</i>. Condition the lane after changing the wicking foams to see if</p>

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Determining The Oil Pattern

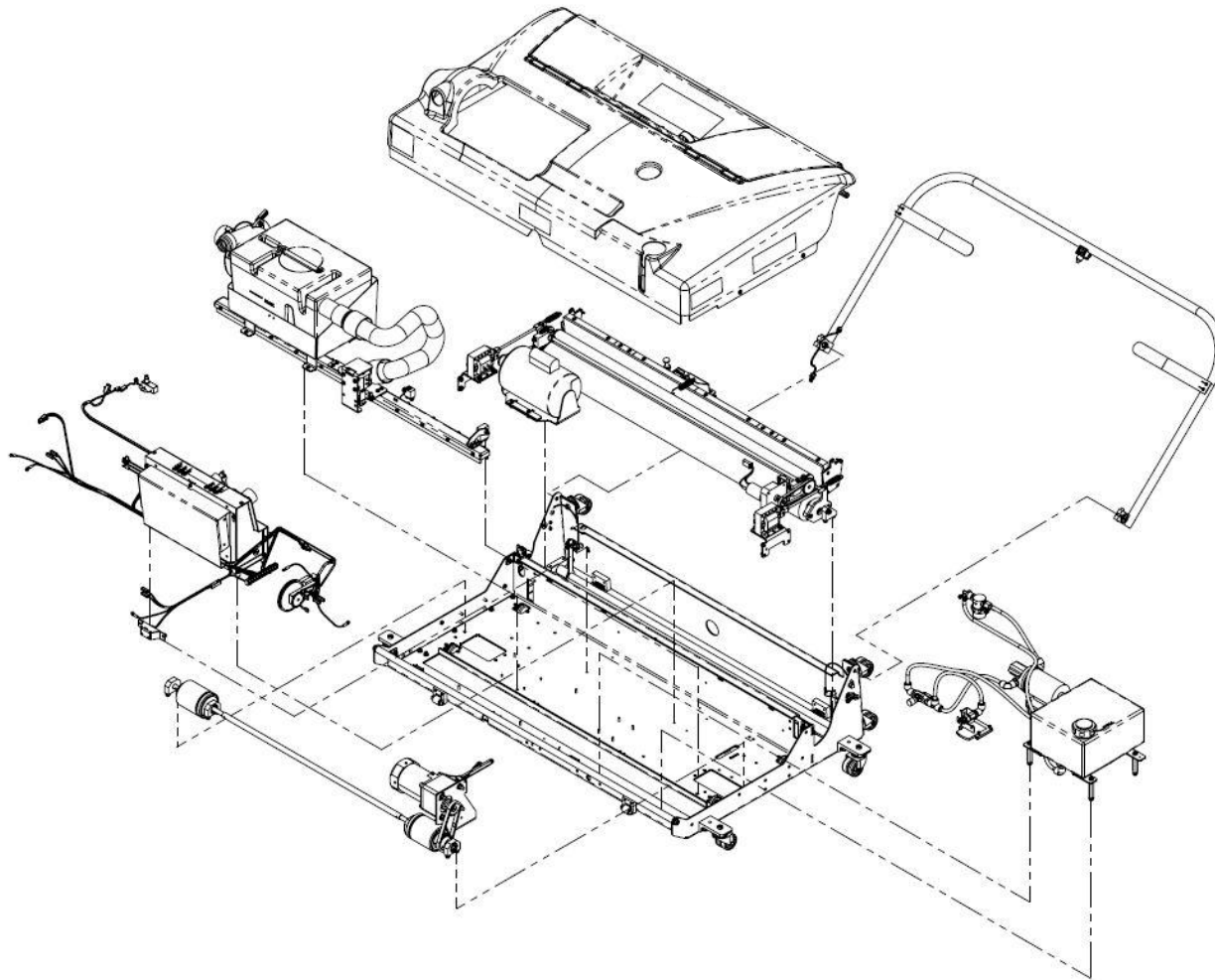
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	<p>their oil output eliminates the problem. If the problem persists, the buffer brush may need to be replaced.</p> <p>If the brush has been contaminated with grease, remove and clean. If issue persists, replace the buffer brush.</p> <p>For more information about the buffer brush, refer to Section 4 - <i>Maintenance and Adjustments</i>.</p>
<b>Washboard or Corrugated Pattern In The Buffed Area</b>	<p>If a washboard or corrugated pattern occurs in both the oiled area and the buffed area, correct the condition in the oiled area first which may also correct the condition in the buffed area.</p> <p>If the washboard or corrugated pattern occurs only in the buffed area, it is caused by too little oil in the brush after applying oil in the oiled area. To correct the condition, increase the buffer brush pressure. Refer to Section 4.3.1 – <i>Adjusting the Buffer Brush Pressure</i>.</p>





**Section 7**  
**PARTS**





This section contains parts drawings as well as wiring diagrams for the Phoenix LT4 Lane Machine. The drawings are shown within functional groupings, as listed on the next page.

Use the drawings in the section for reference when repairing or replacing parts on the machine. Order any replacement parts using the part numbers listed in the adjacent tables. Assemblies listed in **bold** type in the parts lists have exploded view drawings on the pages that follow. The Parts Index, located in the back of this manual, is useful for determining the page number(s) a particular part number is used on.

In order to keep the part descriptions as simple as possible, several abbreviations have been used. These abbreviations include:

- ASM - Assembly
- INC. - Includes
- VAC - Vacuum
- LG - Long

Repairing, replacing, and adjusting machine components should only be done by experienced operators. If a drawing is not clear or does not contain information on a part that needs to be replaced, contact the Brunswick Customer Response Center at 1-800-YES-BOWL (1-800-937-2695). The fax line is 1-231-725-4667 or e-mail to [techsupport@brunbowl.com](mailto:techsupport@brunbowl.com)

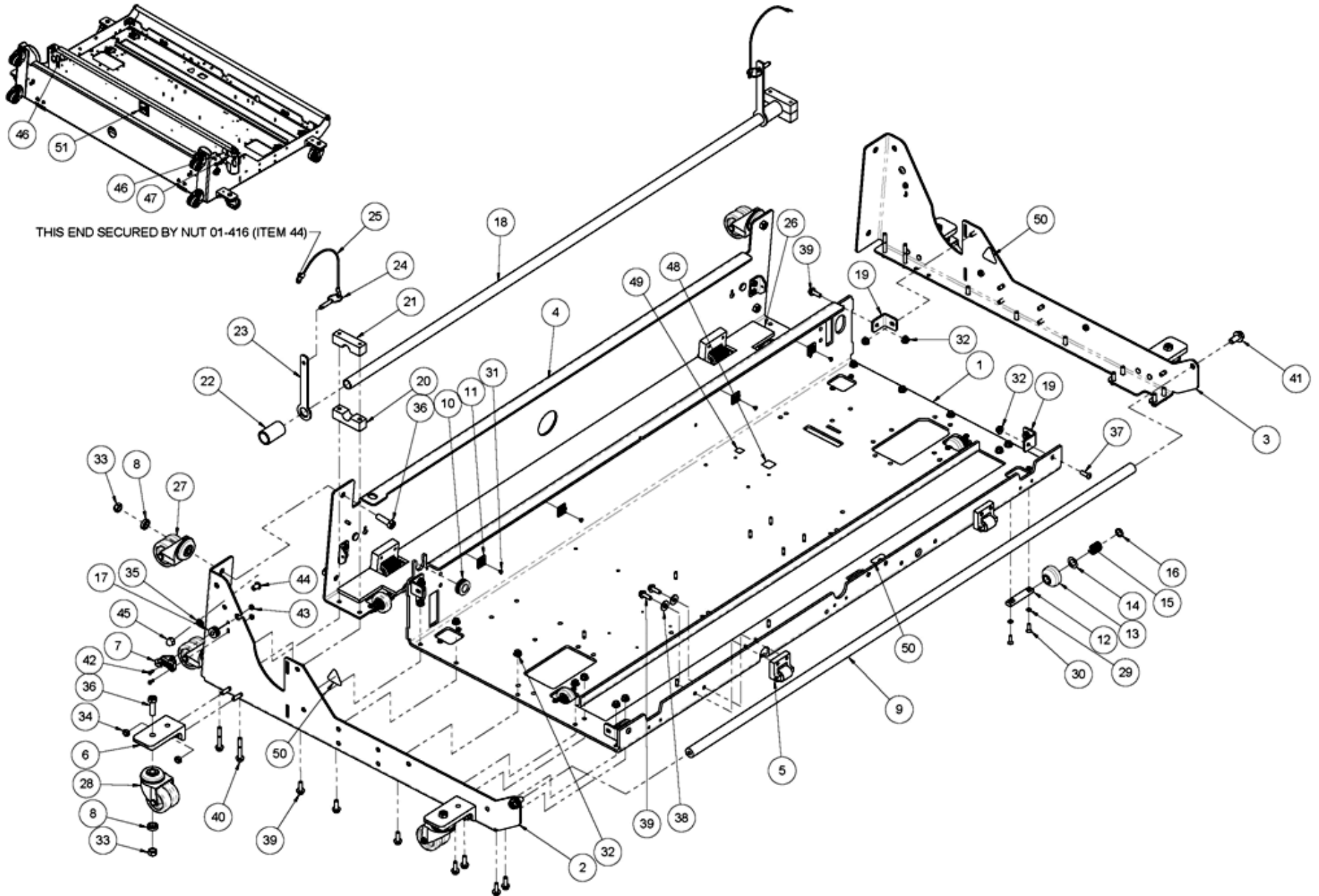
<b>FRAME and BODY</b>
7-6 Base Plate and Side Plates
7-8 Hood Assembly
<b>VACUUM and CLEANER SYSTEMS</b>
7-10 Vacuum System
7-12 Vacuum Head Assembly
7-13 Vacuum Head Solenoid & Bracket Assembly
7-13 Vacuum Head Tensioner Assembly
7-14 Vacuum Hose Assembly
7-14 Vacuum Motor & Bracket Assembly
7-15 Waste Tank & Bracket Assembly
7-16 Cleaner System
7-17 Cleaner Pump Assembly
7-18 Cleaner Filter Assembly
7-18 Flow Control Valve Assembly
7-19 Cleaner Tank & Bracket Assembly
<b>DRIVE SYSTEM</b>
7-22 Drive Assembly
7-23 Drive Shaft Assembly
7-23 Left Hand Drive Shaft End Assembly
7-23 Right Hand Drive Shaft End Assembly
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## **FRAME and BODY**

### Frame Assembly – Base Plate and Side Plates



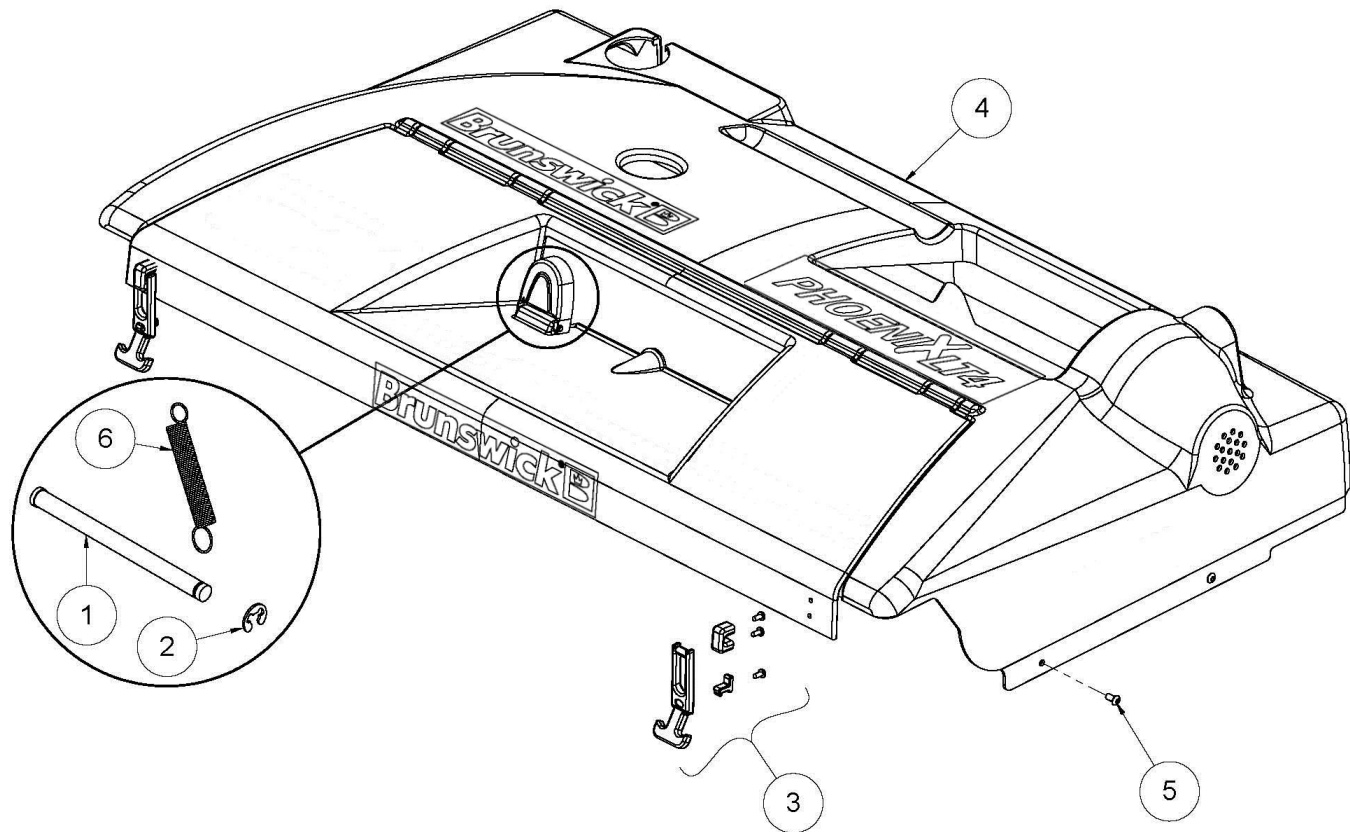
**Frame Assembly – Base Plate and Side Plates**

	<b>NUMBER</b>	<b>DESCRIPTION</b>
1	294-116-001	BASE PLATE ASSEMBLY
2	294-116-003	SIDE PLATE ASSEMBLY, RIGHT HAND
3	294-116-005	SIDE PLATE ASSEMBLY, LEFT HAND
4	294-116-008	REAR PLATE ASSEMBLY
5	SA-3012	DUSTER END PLATE ROLLER
6	294-115-613	CASTER BRACKET, 2-INCH
7	A-2037	POWER CABLE HOOK
8	A-0794	CASTER SPACER
9	294-116-013	LIFT HANDLE
10	711-520-017	GROMMET, 5/8 ID X 7/8OD X 3/16 PANEL
11	02-539	CABLE MOUNTING BLOCK, 3/4 X 3/4
12	294-116-019	GUIDE ROLLER AXLE
13	SA-0244	GUIDE WHEEL ASSEMBLY
14	01-161	PHENOLIC WASHER
15	A-0024	GUIDE ROLLER SPRING
16	A-0025	GUIDE ROLLER WASHER
17	04-078	GROMMET, 5/16 X 3/4 X 1/8, RUBBER
18	294-116-014	OIL TANK SUPPORT TUBE
19	294-116-015	FRAME BRACKET
20	294-116-016	OIL TANK TUBE BLOCK, BOTTOM
21	294-116-017	OIL TANK TUBE BLOCK, TOP
22	294-116-098	OIL TANK SPACER
23	294-115-706	OIL TANK RETAINING BRACKET
24	04-118	PIN QR 0.25 X 0.80 NS
25	04-335	CABLE ASSEMBLY, 8"
26	294-116-018	FOAM OIL TANK DRIP PAD

	<b>NUMBER</b>	<b>DESCRIPTION</b>
27	294-116-011	STORAGE CASTER, 2-INCH
28	294-115-614	OPERATING CASTER, 2-INCH
29	951-638-068	WASHER, EXT. TOOTH COUNTERSUNK, #10
30	01-123	SCREW, PHILLIPS FLAT HEAD, 10-32 X 5/8
31	01-355	SCREW, FLAT HEAD, #6 X 1/4
32	856-149-001	NUT, HEX FLANGE STOVER LOCK, 1/4-20
33	844-065-002	NUT, STOVER LOCK, 3/8-16
34	844-049-002	NUT, STOVER LOCK, 1/4-20
35	951-156-002	WASHER, SPLIT LOCK, 5/16
36	809-865-205	SCREW, HEX 3/8-16 X 1-1/4
37	808-549-120	SCREW, BUTTON HEAD, 1/4-20 X 3/4
38	01-056	WASHER, FLAT, 1/4
39	801-749-121	SCREW, FLANGE HEAD FLEX 1/4-20 X 3/4
40	801-749-281	SCREW, FLANGE HEAD FLEX 1/4-20 X 1-3/4
41	801-765-121	SCREW, FLANGE HEAD FLEX 3/8-16 X 3/4
42	01-001	SCREW, PAN-HEAD PHILLIPS 6-32 X 0.38, ZINC
43	01-416	NUT, 6-32X NYLON LOCKING
44	808-557-082	SCREW, BUTTON HEAD, 5/16-18 X 1/2
45	830-057-002	NUT, ACORN, 5/16-18
46	294-115-245	HAND ENTANGLEMENT-CHAIN DECAL
47	294-115-246	HAND ENTANGLEMENT DECAL
48	294-115-256	GND STICKER IEC 60417-1-5017
49	A-1058	PE GROUND DECAL
50	294-115-237	HAND CRUSH DECAL
51	294-115-723	KEEP LEVEL STICKER

## Hood Assembly – 294-116-215

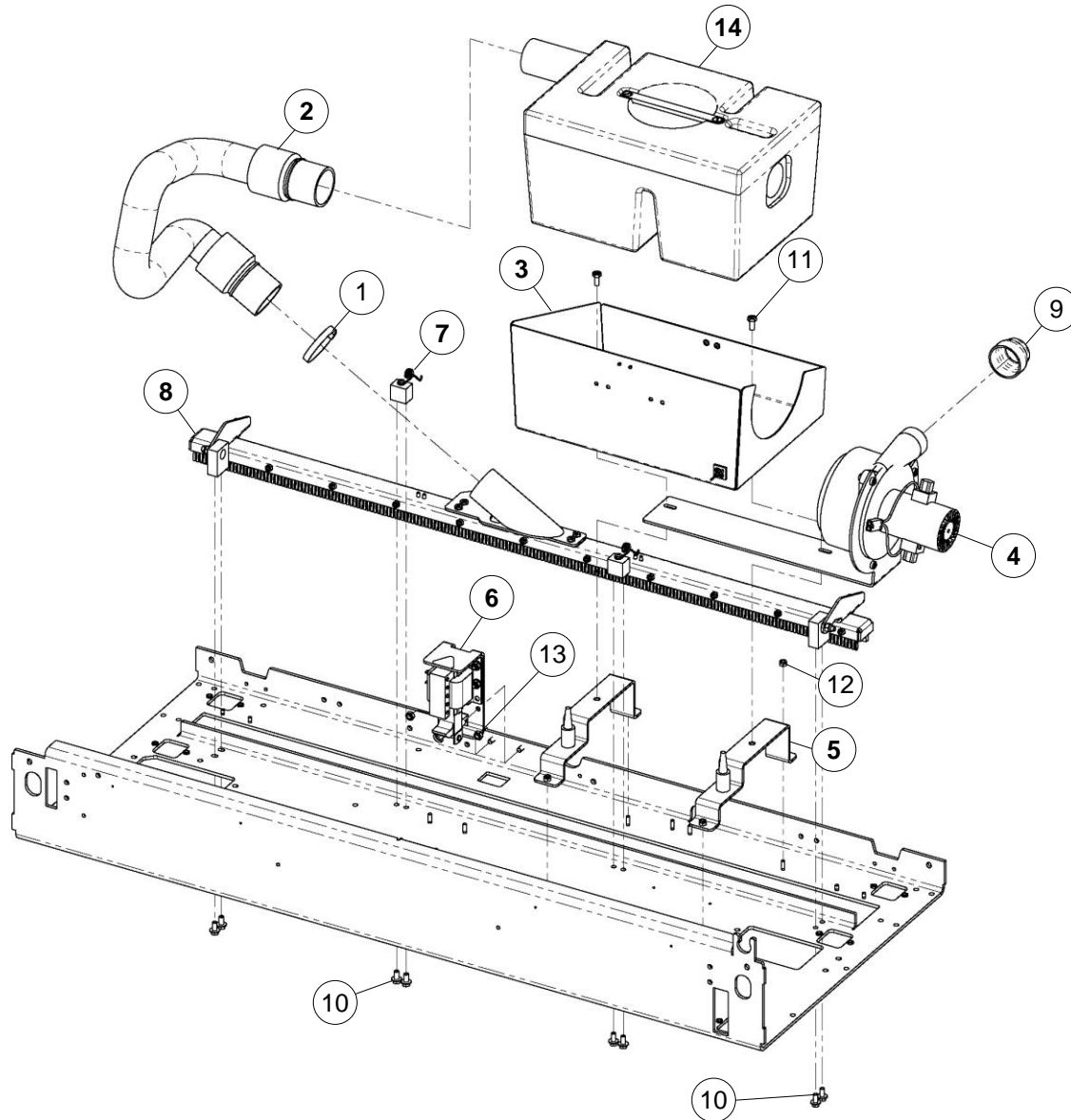
	NUMBER	DESCRIPTION
1	294-115-560	CLEVIS PIN
2	294-115-561	E-CLIP
3	294-115-566	DRAW LATCH ASM
4	294-116-214	HOOD ASM (INCLUDES 1, 2 & 4)
5	808-549-080	SCREW, BUTTON HEAD, 1/4-20 X 1/2
6	A-0113	EXTENSION SPRING



## **VACUUM and CLEANER SYSTEMS**



## Vacuum System



**Vacuum System**

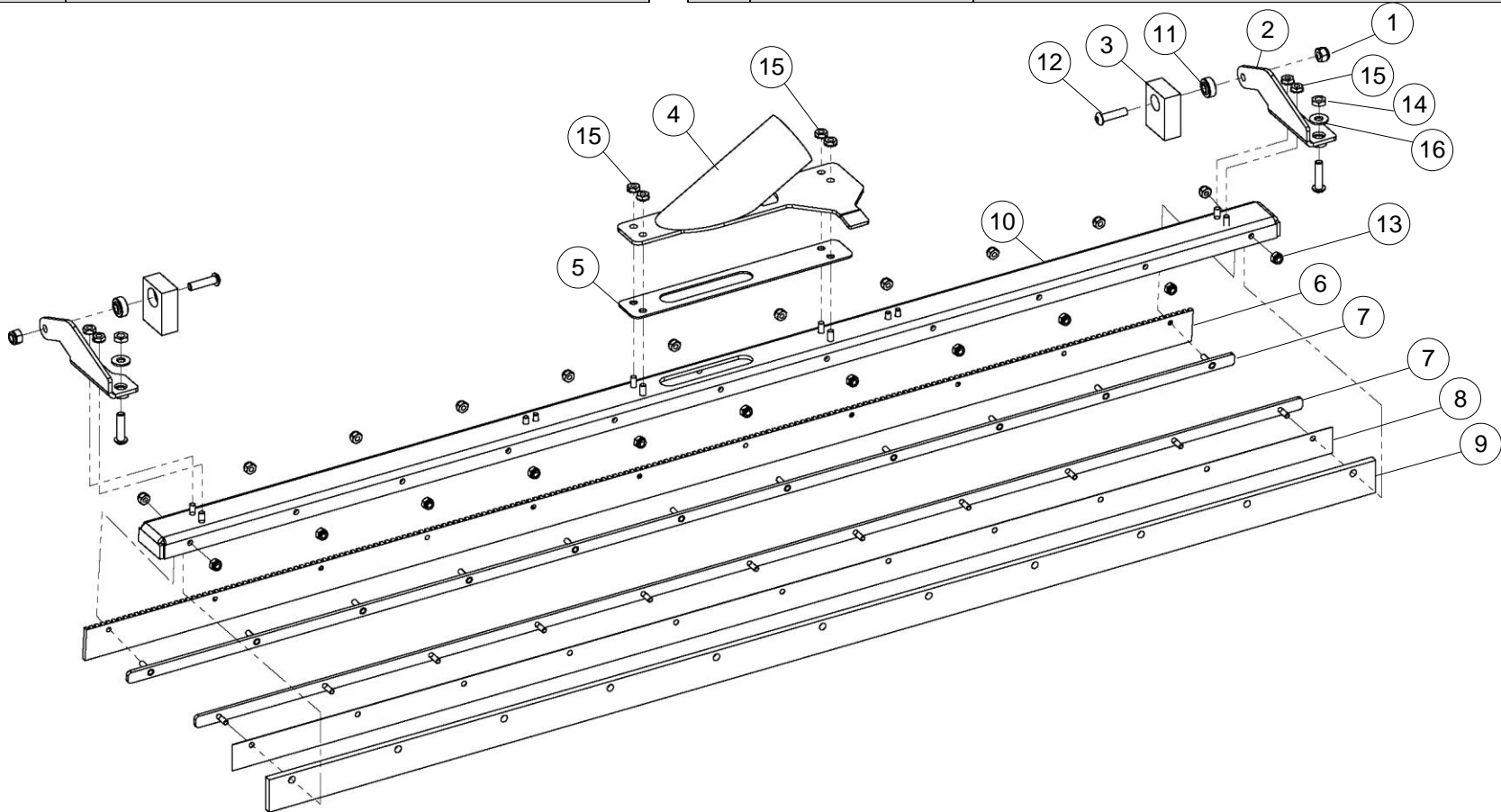
	<b>NUMBER</b>	<b>DESCRIPTION</b>
1	04-120	HOSE CLAMP
2	294-115-113	VAC HOSE ASM
3	294-115-233	WASTE TANK GUARD ASM
4	294-116-031 294-116-032	VAC MOTOR & BRACKET ASM, 110V VAC MOTOR & BRACKET ASM, 220V
5	294-116-043	TANK SUPPORT ASM
6	294-116-125 294-116-124	VAC SOLENOID ASM, 110V VAC SOLENOID ASM, 220V
7	294-116-128	VAC HEAD TENSIONER ASM

	<b>NUMBER</b>	<b>DESCRIPTION</b>
8	294-116-147	VAC HEAD ASM
9	294-116-148	EXHAUST DIVERTER
10	801-749-081	SCREW, FLANGE HEAD HEX, 1/4-20 X 1/2
11	809-849-100	SCREW, HEX, 1/4-20 X 5/8
12	843-140-002	NUT, KEPS, 10-32
13	844-049-002	NUT, STOVER LOCK, 1/4-20
14	SA-1129	WASTE TANK ASM

## Vacuum Head Assembly - 294-116-147

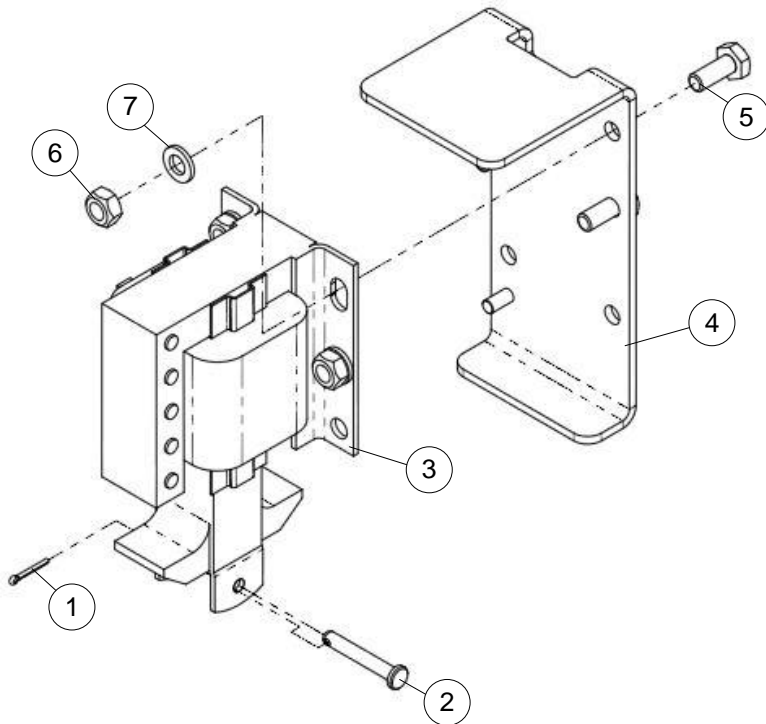
	NUMBER	DESCRIPTION
1	01-051	NUT, NYLON LOCK, 1/4-20
2	294-116-129	ARM, VAC HEAD
3	294-116-132	PIVOT BLOCK, VAC HEAD
4	294-116-135	HORN WELDMENT, VAC HEAD
5	294-116-136	GASKET, VAC HEAD
6	294-116-137	SQUEEGEE
7	294-116-139	STUD BAR, VAC HEAD
8	294-116-141	AGITATOR FOAM SHIM

	NUMBER	DESCRIPTION
9	294-116-142	AGITATOR FOAM
10	294-116-146	VAC HEAD BAR
11	702-108-000	BEARING, SPHERICAL, 1/4 X 21/32 X 1/4
12	808-549-160	SCREW, BUTTON HEAD, 1/4-20 X 1
13	832-133-008	NUT, NYLON LOCK, 8-32
14	835-549-008	NUT, HEX JAM, 1/4-20
15	843-140-002	NUT, KEPS, 10-32
16	948-753-101	WASHER, FLAT, 1/4



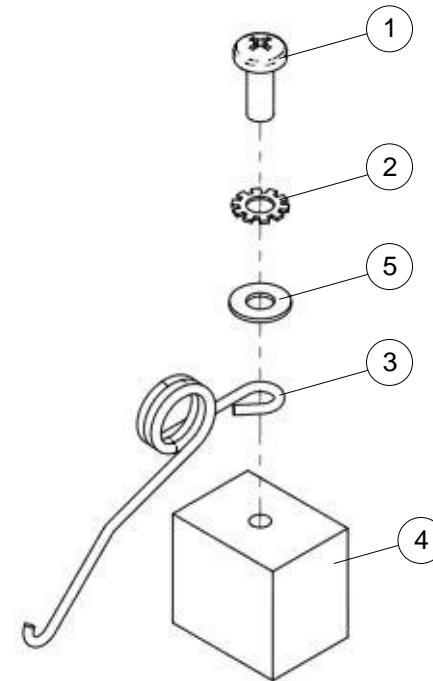
### Vacuum Head Solenoid & Bracket Assembly

	NUMBER	DESCRIPTION
1	01-080	PIN, COTTER, 1/16 X 1/2 LG
2	01-495	PIN, CLEVIS, 3/16 X 1-1/4 LG
3	294-002-033 294-002-274	SOLENOID, 110V, 60 HZ, LEFT HAND SOLENOID, 220V, 50HZ, LEFT HAND
4	294-116-123	VAC SOLENOID BRACKET ASM
5	809-849-100	SCREW, HEX, 1/4-20 X 5/8
6	844-049-002	NUT, STOVER LOCK, 1/4-20
7	945-548-000	WASHER, FLAT, 1/4



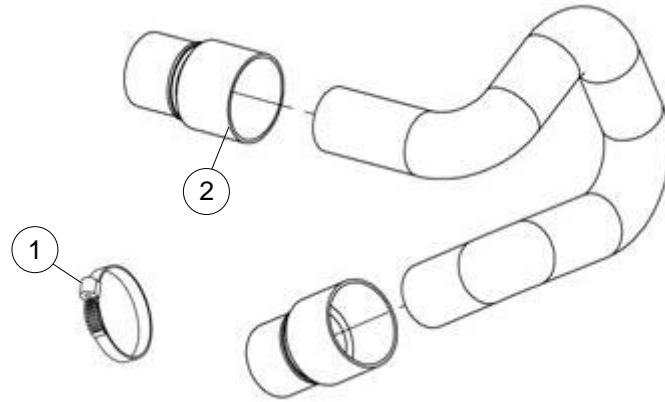
### Vacuum Head Tensioner Assembly – 294-116-128

	NUMBER	DESCRIPTION
1	01-021	SCREW, PAN HEAD, 10-32 X 1/2
2	01-033	WASHER, EXT TOOTH LOCK, #10
3	294-116-126	SPRING
4	294-116-127	VAC HEAD SPRING BLOCK
5	948-545-072	WASHER, MACHINE, #10



### Vacuum Hose Assembly & Clamp

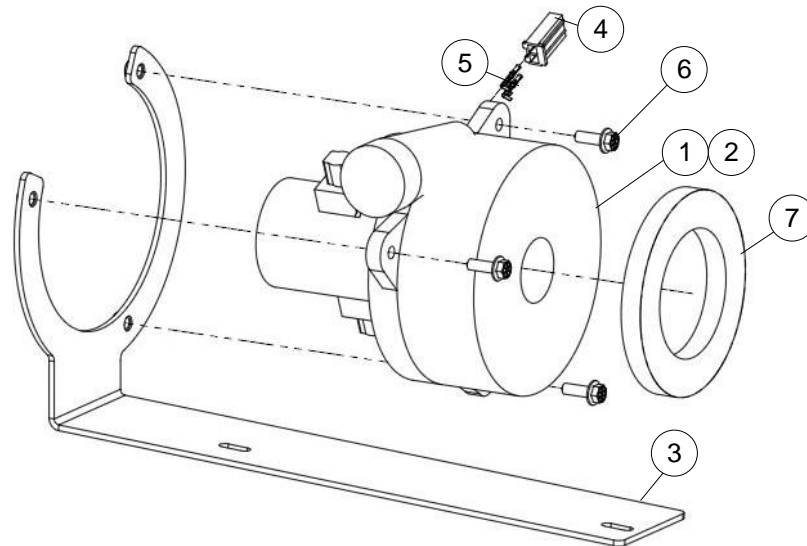
	NUMBER	DESCRIPTION
1	04-120	HOSE CLAMP
2	04-150	SLIP ADAPATER



### Vacuum Motor & Bracket Assembly

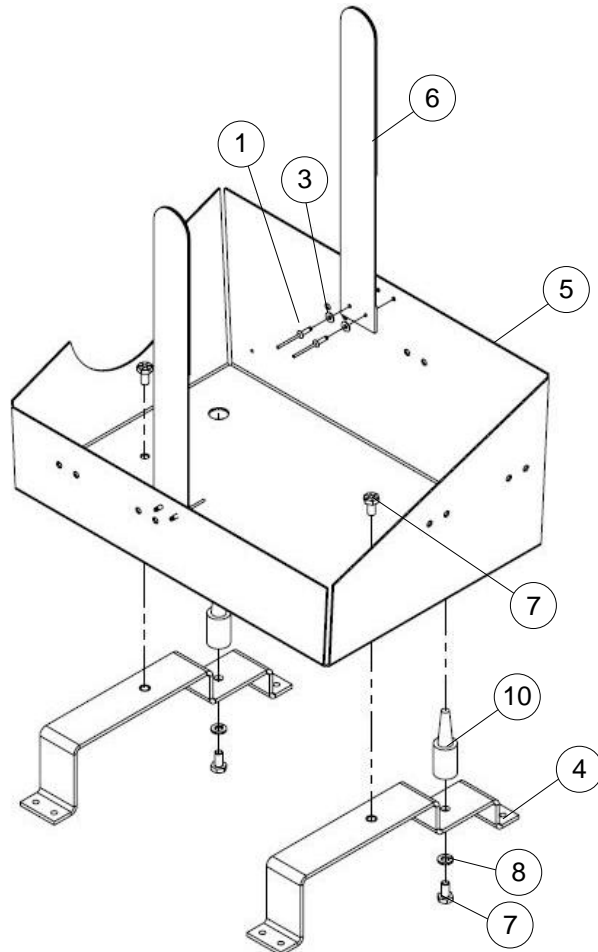
	NUMBER	DESCRIPTION
1a	02-214	VAC MOTOR, 110V
1b	02-255	VAC MOTOR, 220V
2a	294-116-047	VAC MOTOR ASM, 110V (INC. 1a,4,5 & 6)
2b	294-116-046	VAC MOTOR ASM, 220V (INC. 1b,4,5 & 6)
3	294-116-117	VAC MOTOR BRACKET ASM
4	746-013-498	CONNECTOR, 2 POSITION

	NUMBER	DESCRIPTION
5	760-019-223	CRIMP TERMINAL, FEMALE, 14-20 AWG
6	801-749-121	SCREW, FLANGE HEAD HEX, 1/4-20 X 3/4
7	A-8307	WASTE TANK SEAL, 1/2 THICK

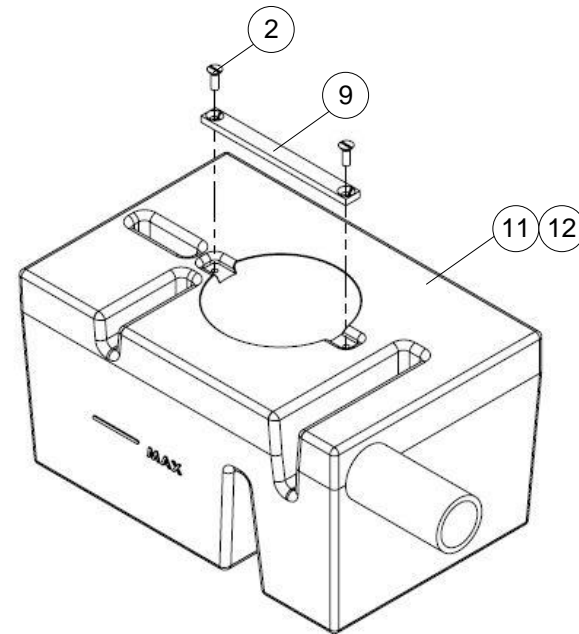


## Waste Tank & Bracket Assembly

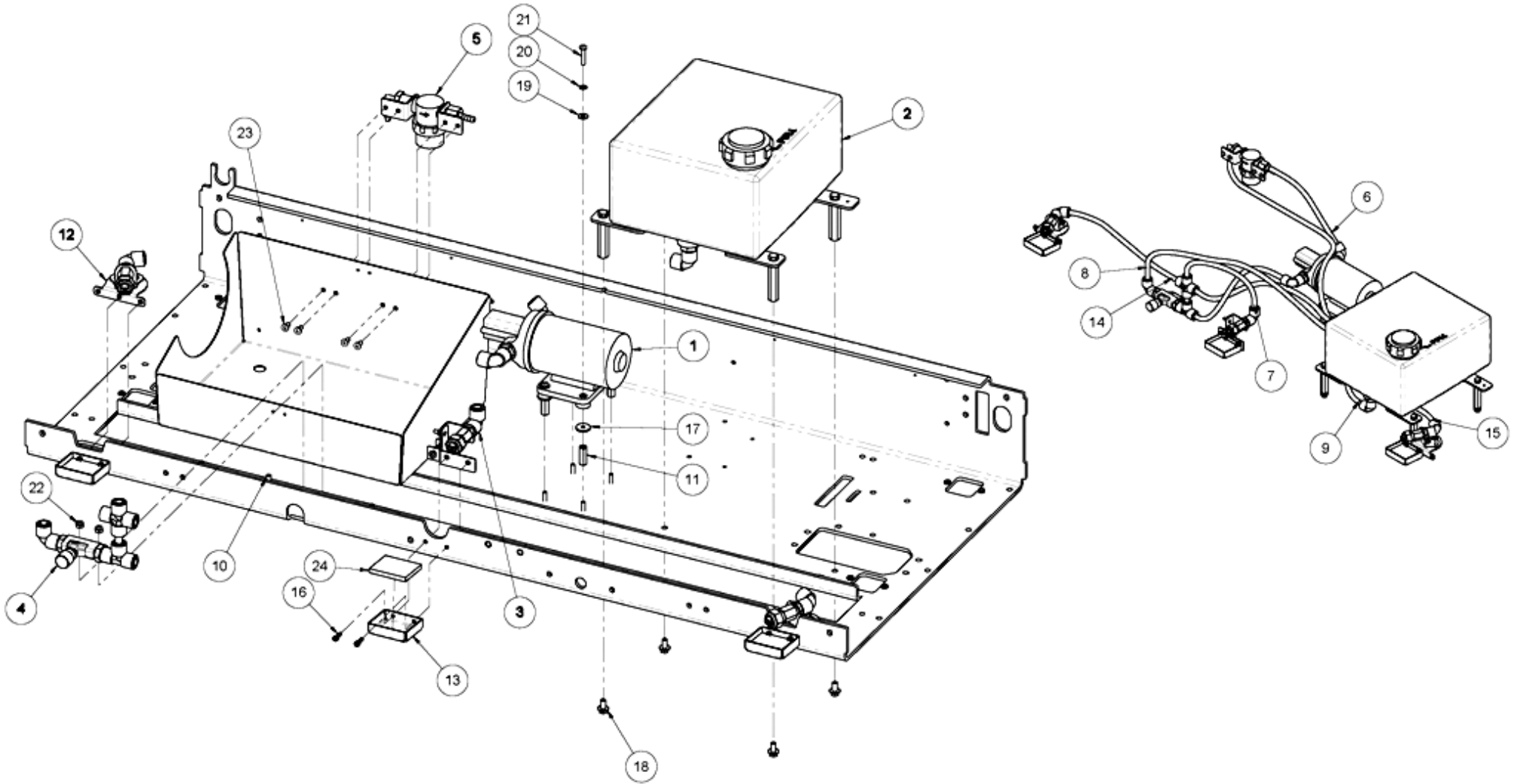
	NUMBER	DESCRIPTION
1	01-089	RIVET, 1/8 DIA X 3/8 LG, ALUMINUM
2	01-148	SCREW, FLAT HEAD MACHINE, 1/4-20 X 3/4
3	01-303	WASHER, FLAT, 1/8 X 11/32 X 1/32
4	294-115-040	WASTE TANK SUPPORT BRACKET
5	294-115-227	WASTE TANK GUARD
6	294-115-247	STRAP, EXPRESS WASTE TANK



	NUMBER	DESCRIPTION
7	809-849-085	SCREW, HEX, 1/4-20 X 1/2
8	951-148-008	WASHER, SPLIT LOCK, 1/4
9	A-8308	WASTE TANK HANDLE
10	A-8331	WASTE TANK LOCATING PIN
11	C-8341	POLYETHYLENE TANK
12	SA-1129	WASTE TANK ASM (INCLUDES 2,9, & 11)



### Cleaner System



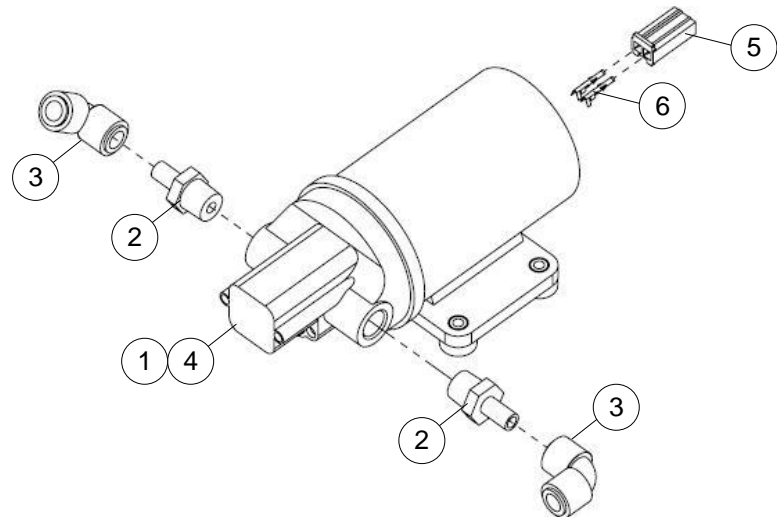
## Cleaner System

	NUMBER	DESCRIPTION
1	294-116-049 294-116-048	CLEANER PUMP & FITTINGS, 110V CLEANER PUMP & FITTINGS, 220V
2	294-116-105	CLEANER TANK & BRACKET ASM
3	294-116-113	SWIVEL NOZZLE ASM
4	294-116-151	FLOW CONTROL NOZZLE ASM
5	294-115-673	FILTER ASM
6	294-116-152	TYGOTHANE TUBE, 9 IN
7	294-116-153	TYGOTHANE TUBE, 12 IN
8	294-116-154	TYGOTHANE TUBE, 35 IN
9	294-116-155	TYGOTHANE TUBE, 37 IN
10	294-115-733	TUBE SUPPORT
11	722-502-091	SPACER, FEMALE HEX, 10-32 X 3/8 X 1
12	294-116-234	SIDE NOZZLE ASM

	NUMBER	DESCRIPTION
13	294-115-650	DRIP TRAY
14	294-116-238	TYGOTHANE TUBE, 16 IN
15	294-116-239	TYGOTHANE TUBE, 31 IN
16	810-240-088	SCREW, SOCKET-HEAD CAP 10-32 X 0.50, STAINLESS STEEL
17	7150-019075-009	WASHER, FLAT, 3/16 X 3/4 X 3/32, ALUMINUM
18	801-749-081	SCREW, FLANGE HEAD HEX, 1/4-20 X 1/2
19	01-030	WASHER, FLAT, #10 SAE, ZINC
20	01-033	WASHER, EXTERNAL TOOTH LOCK, #10 ANSI, ZINC
21	01-024	SCREW, PAN-HEAD PHILLIPS MACHINE 10-32 X 1.00, ZINC
22	832-040-008	NUT, NYLON LOCK, 10-32
23	01-019	SCREW, PAN-HEAD PHILLIPS MACHINE 10-32 X 0.38 ZINC
24	294-115-554	DRIP TRAY FOAM

## Cleaner Pump Assembly

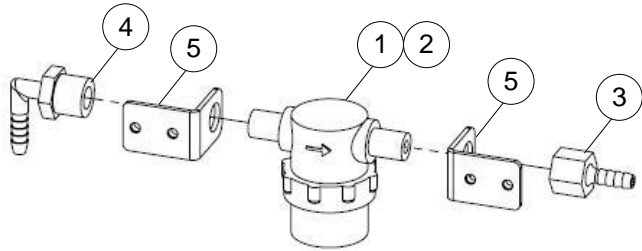
	NUMBER	DESCRIPTION
1a	02-206	CLEANER PUMP, 110V
1b	294-115-287	CLEANER PUMP, 220V
2	294-115-072	STEM ADAPTER, 3/8 MPT X 3/8
3	294-115-073	UNION ELBOW, 3/8 X 3/8
4	294-115-729 294-115-730	CLEANER PUMP ASM, 110V (INC. 1a, 5, & 6) CLEANER PUMP ASM, 220V (INC. 1b, 5, & 6)
5	746-013-498	CONNECTOR, 2 POSITION
6	760-019-223	CRIMP TERMINAL, FEMALE, 14-20 AWG



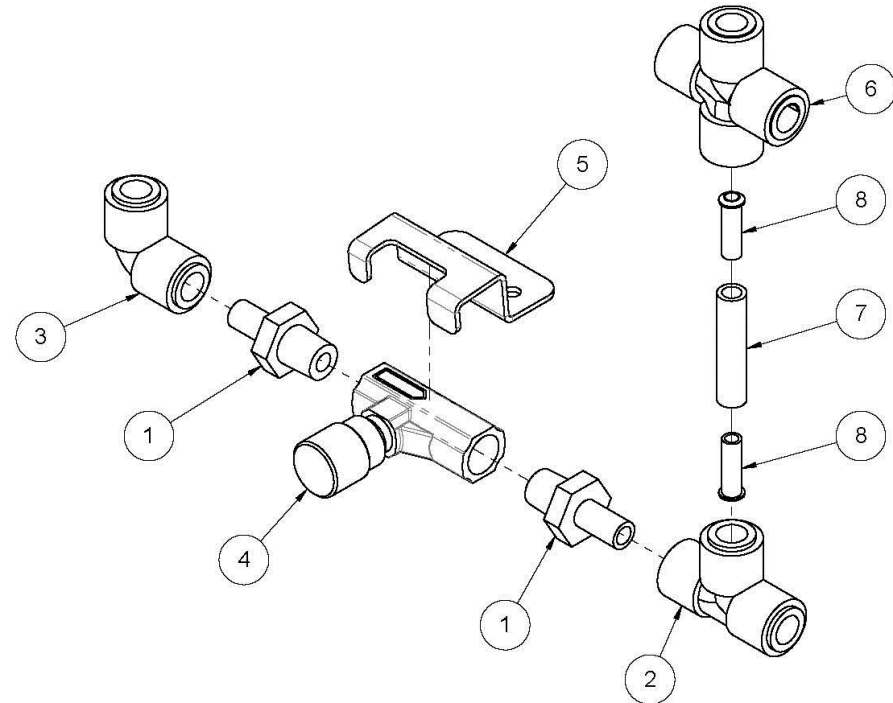


**Cleaner Filter Assembly- 294-115-673**

	NUMBER	DESCRIPTION
1	04-322	FILTER BOWL
2	04-322-1	MESH SCREEN FILTER (NOT SHOWN)
3	04-398	BAREB FITTING, 1/4 NPT X 1/4
4	294-115-455	BARED FITTING, 90°, 1/4 FEMALE X 1/4
5	294-115-675	FILTER MOUNTING BRACKET ASM

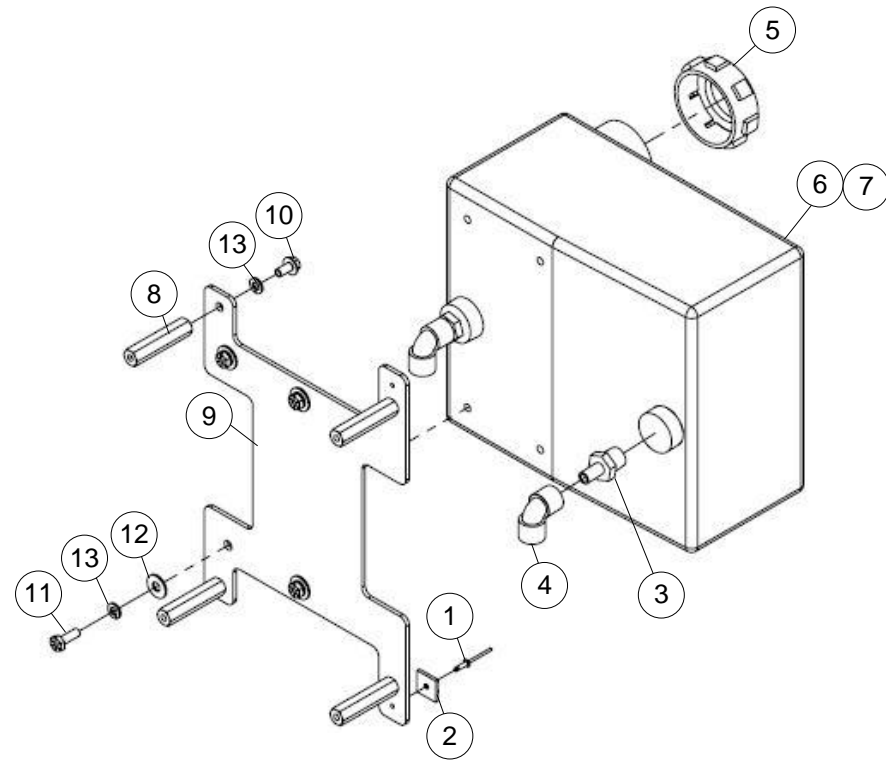
**Flow Control Valve Assembly - 294-116-151**

	NUMBER	DESCRIPTION
1	294-115-071	STEM ADAPTER, 1/4 MPT X 3/8
2	294-115-074	UNION TEE, 3/8 X 3/8
3	294-115-073	UNION ELBOW, 3/8 X 3/8
4	294-115-636	FLOW CONTROL VALVE
5	294-116-149	FLOW CONTROL VALE BRACKET
6	294-115-076	UNION CROSS (4X) 3/8
7	294-116-237	TYGOTHANE TUBE, 1.75 IN
8	294-115-733	TUBE SUPPORT



**294-116-105 - Cleaner Tank & Bracket Assembly**

	NUMBER	DESCRIPTION
1	01-089	RIVET, 1/8 DIA X 3/8 LG, ALUMINUM
2	02-539	CABLE MOUNTING BLOCK, 3/4 X 3/4
3	294-115-072	STEM ADAPTER, 3/8 MPT X 3/8
4	294-115-073	UNION ELBOW, 3/8 X 3/8
5	294-115-092	CLEANER TANK CAP
6	294-115-525	CLEANER SUPPLY TANK
7	294-115-638	CLEANER TANK ASM (INCLUDES 2,3,4 & 5)
8	294-116-106	STANDOFF, CLEANER TANK
9	294-116-112	CLEANER TANK SUPPORT BRACKET
10	801-749-081	SCREW, FLANGE HEAD HEX, 1/4-20 X 1/2
11	809-849-125	SCREW, HEX, 1/4-20 X 3/4
12	945-056-122	WASHER, FLAT, 1/4
13	951-148-008	WASHER, SPLIT LOCK, 1/4



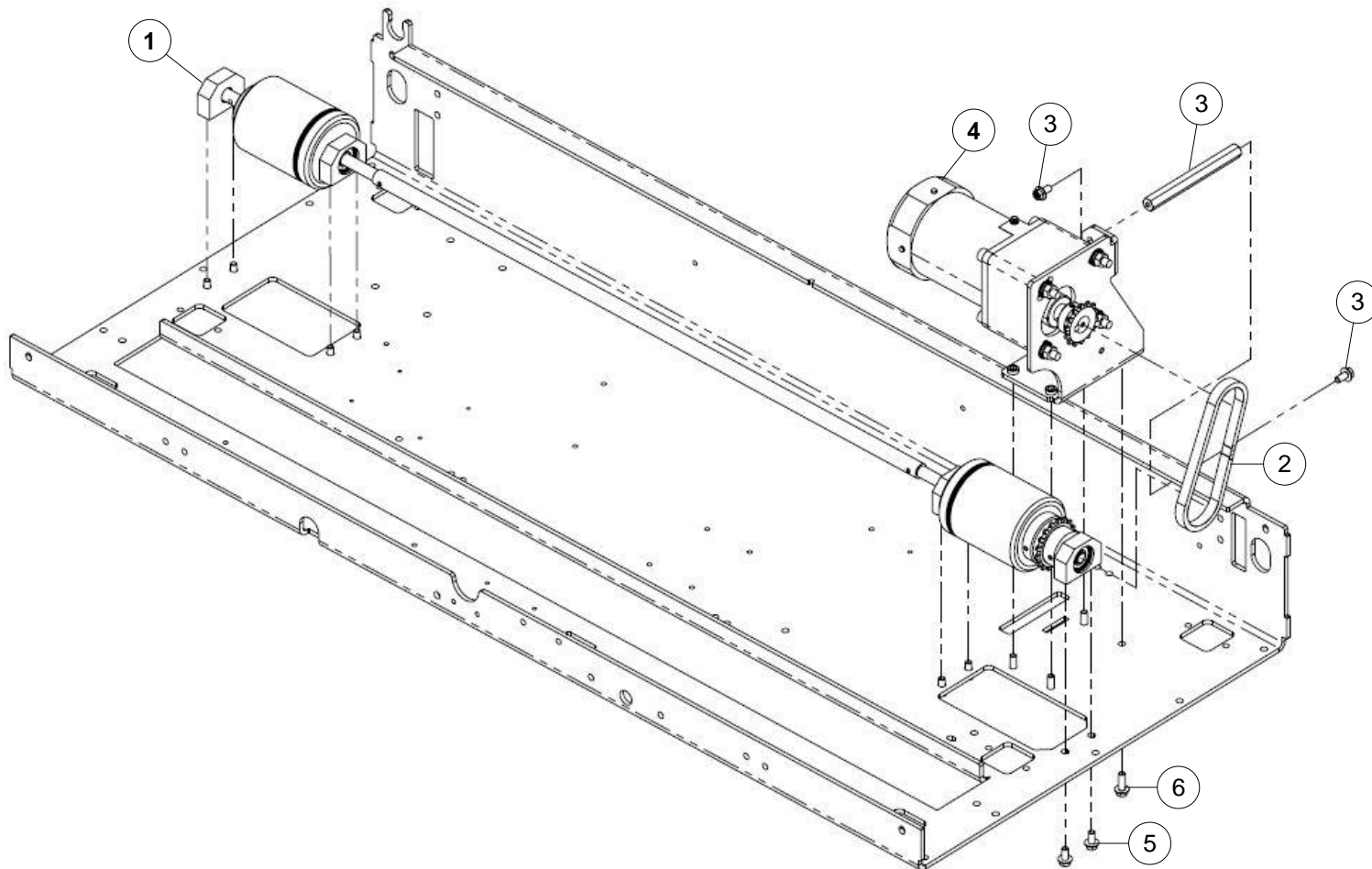
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## **DRIVE SYSTEM**

## Drive Assembly

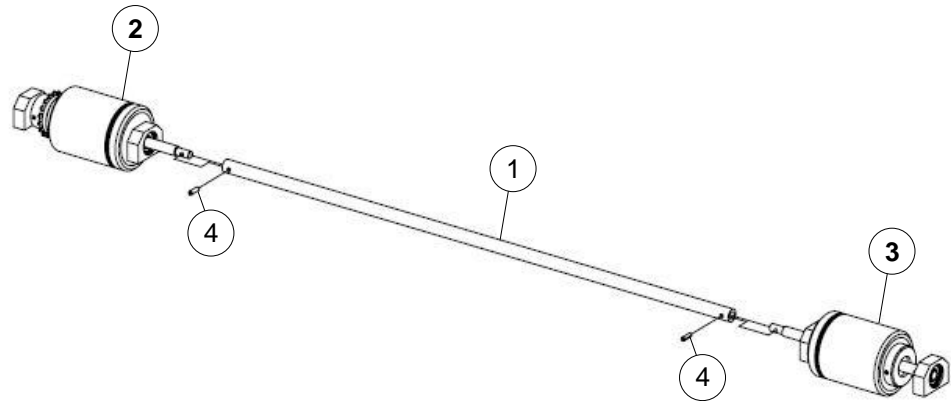
	NUMBER	DESCRIPTION
1	294-116-030	DRIVE SHAFT ASM
2	294-116-036	DRIVE CHAIN
3	294-116-044	STANDOFF, DRIVE MOTOR

	NUMBER	DESCRIPTION
4	294-116-045 294-116-039	DRIVE MOTOR ASM, 110V DRIVE MOTOR ASM, 220V
5	801-749-081	SCREW, FLANGE HEAD HEX, 1/4-20 X 1/2
6	801-749-121	SCREW, FLANGE HEAD HEX, 1/4-20 X 3/4



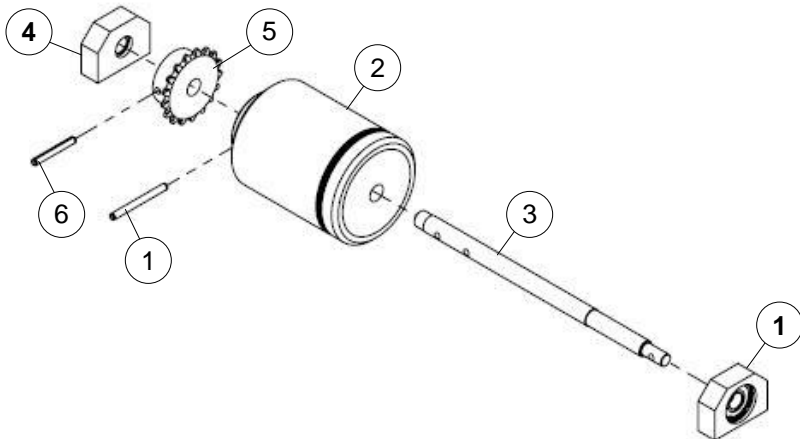
### Drive Shaft Assembly - 294-116-030

	NUMBER	DESCRIPTION
1	294-116-027	DRIVE SHAFT SLEEVE
2	294-116-028	LEFT HAND DRIVE SHAFT END
3	294-116-029	RIGHT HAND DRIVE SHAFT END
4	913-437-100	PIN, ROLL, 3/16 X 5/8 LG



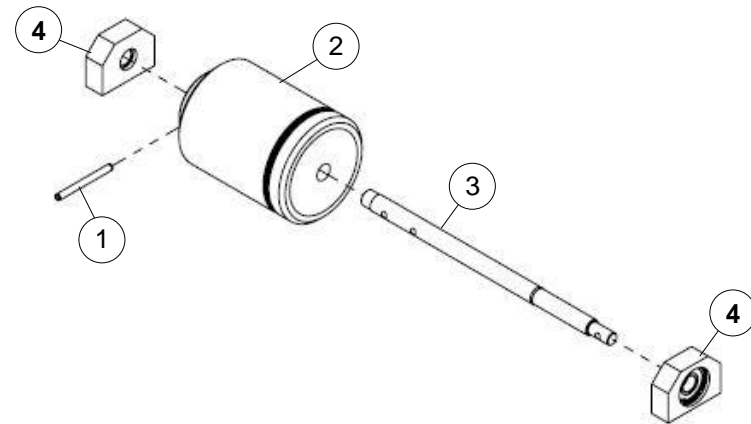
### Left Hand Drive Shaft End -294-116-028

	NUMBER	DESCRIPTION
1	01-087	PIN, ROLL, 3/16 X 2 LG
2	294-115-404	DRIVE WHEEL
3	294-116-026	DRIVE SHAFT END
4	294-116-034	DRIVE SHAFT BEARING BLOCK ASM
5	294-116-035	SPROCKET, #35 CHAIN, 17T
6	913-437-240	PIN, ROLL, 3/16 X 1-1/2 LG



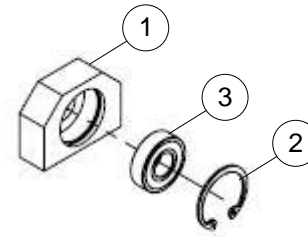
### Right Hand Drive Shaft End - 294-119-029

	NUMBER	DESCRIPTION
1	01-087	PIN, ROLL, 3/16 X 2 LG
2	294-115-404	DRIVE WHEEL
3	294-116-026	DRIVE SHAFT END
4	294-116-034	DRIVE SHAFT BEARING BLOCK ASM

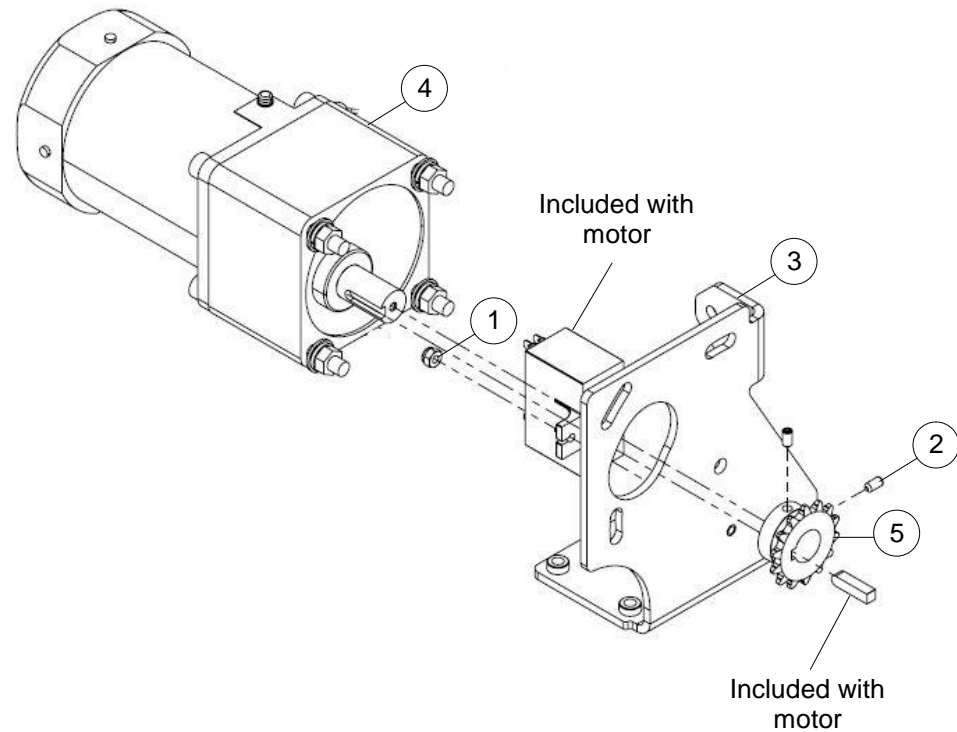


**Drive Shaft Bearing Block Assembly - 294-116-034**

	NUMBER	DESCRIPTION
1	294-012-131	RETAINING RING, BEARING BLOCK
2	294-116-033	BEARING BLOCK, DRIVE SHAFT
3	701-035-040	BEARING, 12 mm X 28 mm X 8 mm

**Drive Motor Assembly**

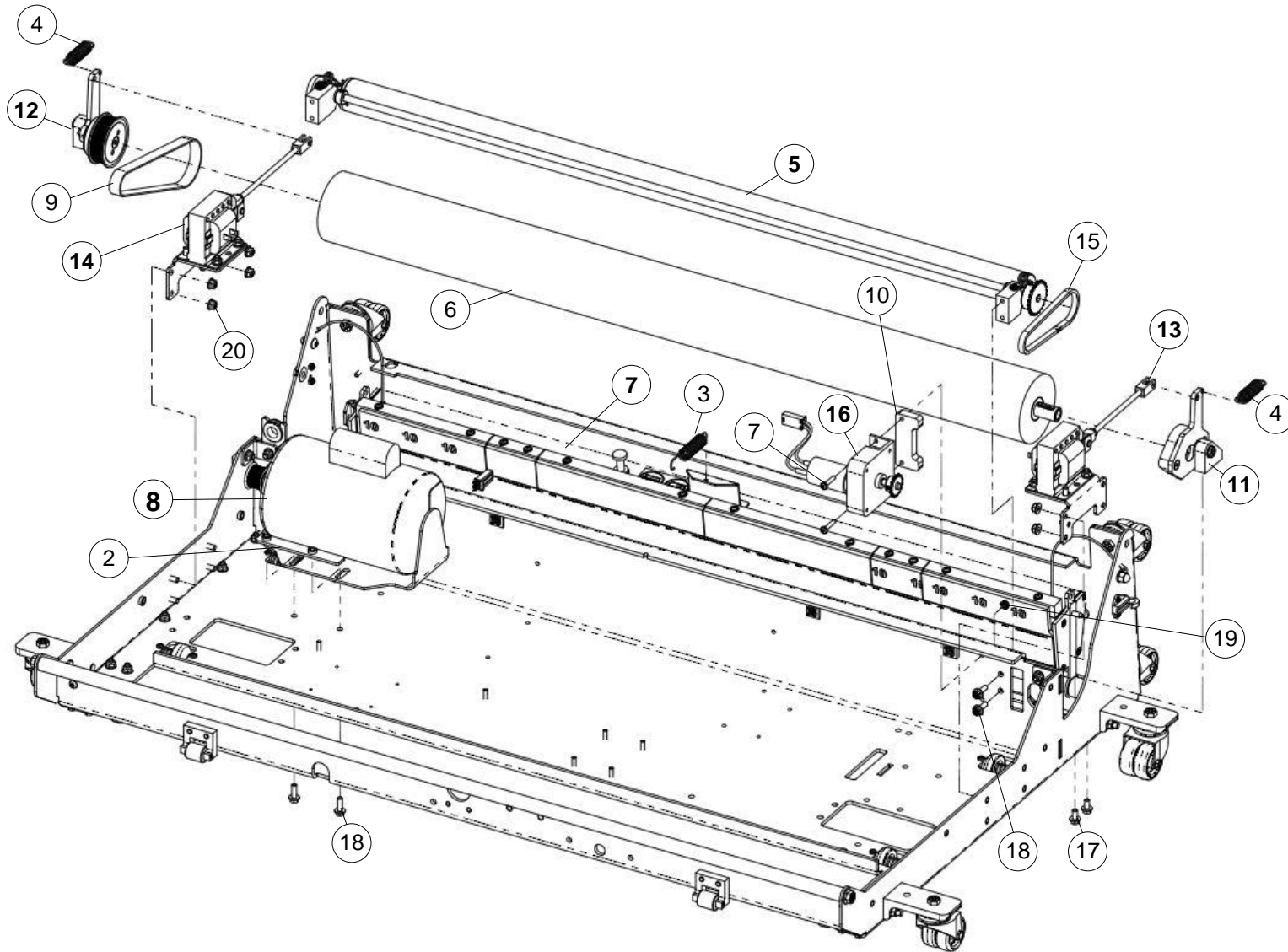
	NUMBER	DESCRIPTION
1	01-014	NUT, NYLON LOCK, 8-32
2	01-098	SCREW, SET, CUP POINT 10-32
3	294-116-038	DRIVE MOTOR BRACKET ASM
4	294-116-041 294-116-040	INLINE DRIVE MOTOR, 110V INLINE DRIVE MOTOR, 220V
5	294-116-042	SPROCKET, #35, 14T



## **OILING and BUFFING SYSTEM**



## Oiling & Buffing System



## Oiling & Buffing System

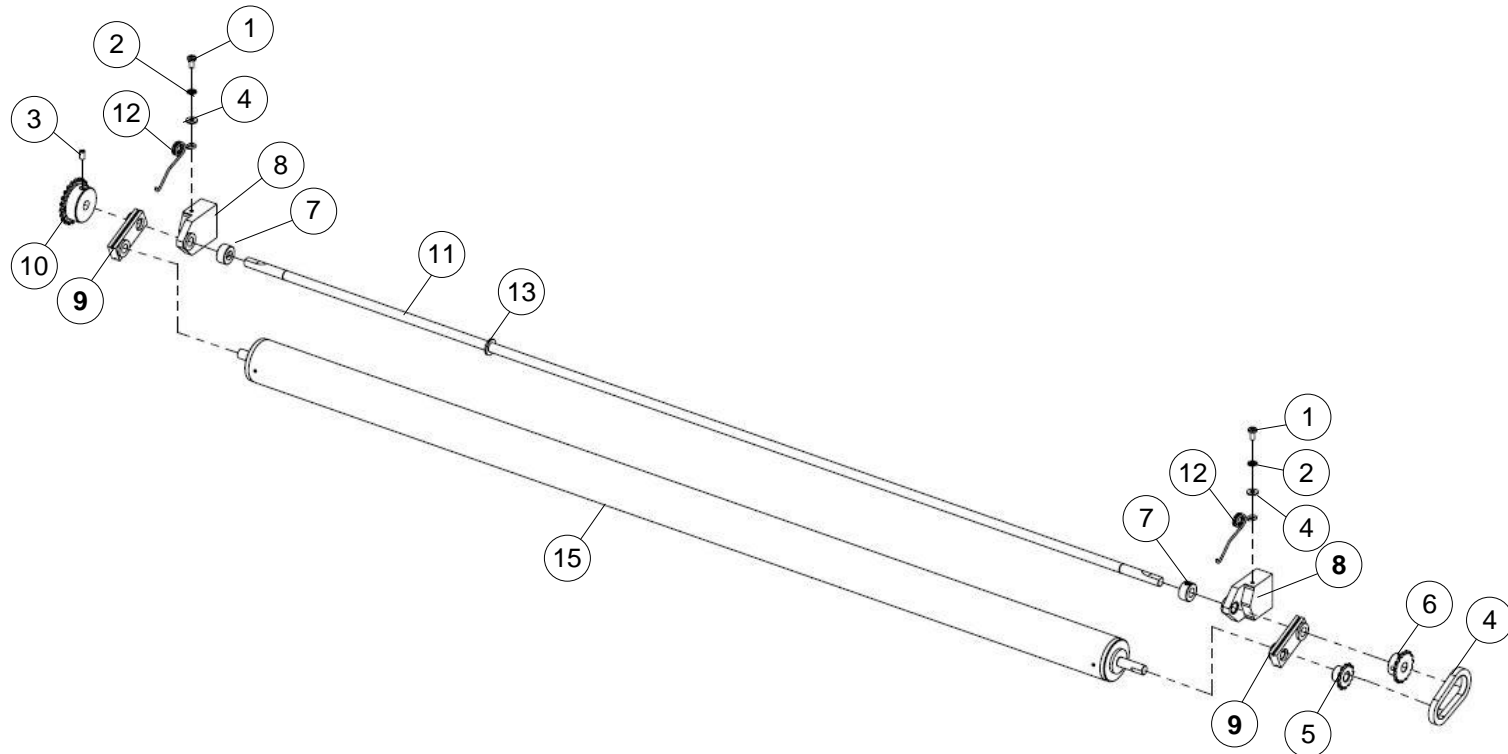
	NUMBER	DESCRIPTION
1	01-024	SCREW, PAN HEAD, 10-32 X 1
2	294-116-025	BUFFER MOTOR NUT PLATE
3	294-116-054	OIL TANK SPRING
4	294-116-055	BUFFER RETURN SPRING
5	<b>294-116-062</b>	<b>TRANSFER ROLLER DRIVE ASM</b>
6	294-116-065	BUFFER BRUSH
7	<b>294-116-068</b>	<b>OIL TANK ASM</b>
8	<b>294-116-071</b> <b>294-116-070</b>	<b>BUFFER MOTOR ASM, 110V</b> <b>BUFFER MOTOR ASM, 220V</b>
9	294-116-082	BUFFER BELT
10	294-116-083	TRANSFER MOTOR SHIM

	NUMBER	DESCRIPTION
11	<b>294-116-090</b>	<b>LEFT HAND BUFFER MOUNTING ASM</b>
12	<b>294-116-093</b>	<b>RIGHT HAND BUFFER MOUNTING ASM</b>
13	<b>294-116-095</b> <b>294-116-094</b>	<b>LEFT HAND BUFFER SOLENOID ASM, 110V</b> <b>LEFT HAND BUFFER SOLENOID ASM, 220V</b>
14	<b>294-116-097</b> <b>294-116-096</b>	<b>RIGHT HAND BUFFER SOLENOID ASM, 110V</b> <b>RIGHT HAND BUFFER SOLENOID ASM, 220V</b>
15	294-116-099	TRANSFER CHAIN
16	<b>294-116-150</b>	<b>TRANSFER MOTOR ASM</b>
17	801-749-081	SCREW, FLANGE HEAD HEX, 1/4-20 X 1/2
18	801-749-121	SCREW, FLANGE HEAD HEX, 1/4-20 X 3/4
19	843-140-002	NUT, KEPS, 10-32
20	856-149-001	NUT, HEX FLANGE STOVER LOCK, 1/4-20

## Transfer Roller Drive Assembly - 294-116-062

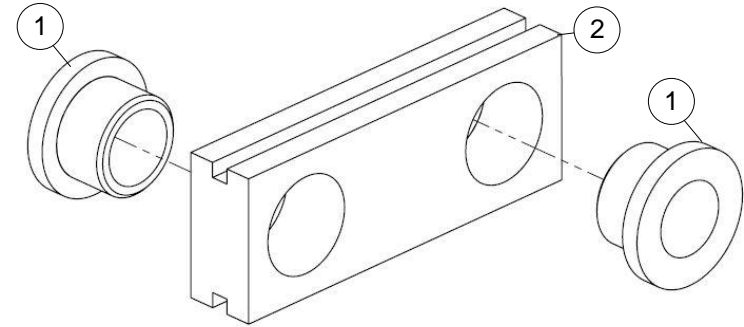
	NUMBER	DESCRIPTION
1	01-009	SCREW, PAN HEAD, 8-32 X 3/8
2	01-016	WASHER, EXT TOOTH LOCK, #8
3	01-098	SCREW, SET, CUP POINT 10-32
4	01-109	WASHER, FLAT, #8
5	03-001	SPROCKET, #25 CHAIN, 12T
6	03-007	SPROCKET, #25 CHAIN, 15T
7	04-015	SET SCREW COLLAR
8	294-116-057	ROLLER SHAFT SUPPORT ASM

	NUMBER	DESCRIPTION
9	294-116-059	TRANSFER ROLLER SUPPORT ASM
10	294-116-060	SPROCKET, #25 CHAIN, 22T
11	294-116-061	TRANSFER ROLLER DRIVE SHAFT
12	294-116-126	SPRING
13	A-0036	WASHER, TRANSFER ROLLER DRIVE
14	A-0071	CHAIN, TRANSFER ROLLER DRIVE
15	SA-0296	TRANSFER ROLLER ASM



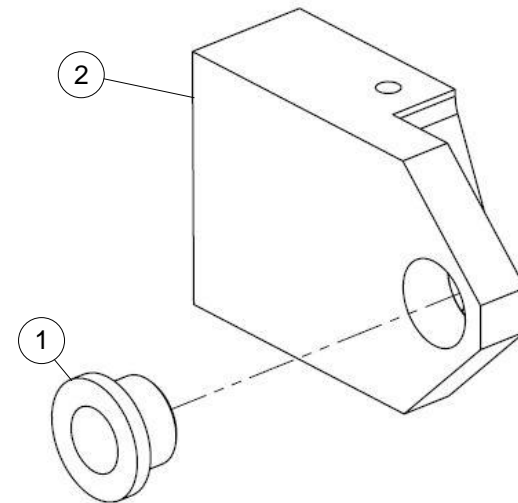
**Transfer Roller Support Assembly - 294-116-059**

	NUMBER	DESCRIPTION
1	04-017	BUSHING, FLANGED, 3/8 X 1/2 X 3/8
2	294-116-058	TRANSFER ROLLER SUPPORT ARM



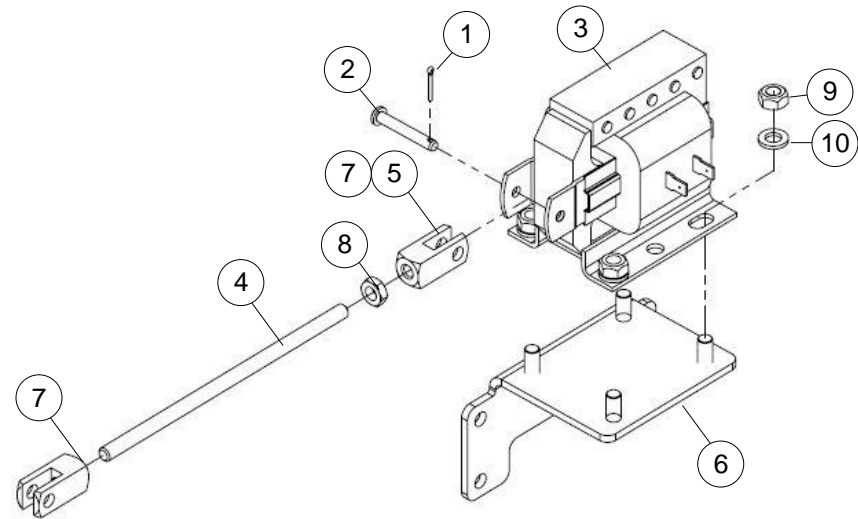
**Roller Shaft Support Assembly - 294-116-057**

	NUMBER	DESCRIPTION
1	04-017	BUSHING, FLANGED, 3/8 X 1/2 X 3/8
2	294-116-056	ROLLER SHAFT SUPPORT ARM



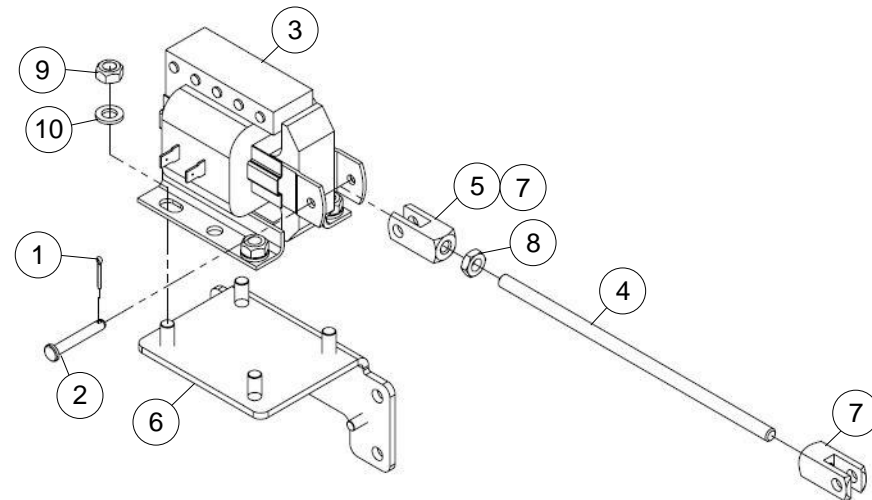
## Left Hand Buffer Solenoid Assembly

	NUMBER	DESCRIPTION
1	01-080	PIN, COTTER, 1/16 X 1/2 LG
2	01-495	PIN, CLEVIS, 3/16 X 1-1/4 LG
3	294-002-032 294-002-275	SOLENOID, 110V, 60HZ, RIGHT HAND SOLENOID, 220V, 50HZ, RIGHT HAND
4	294-116-074	BUFFER ROD, LEFT HAND
5	294-116-075	BUFFER LINKAGE, LEFT HAND (INC. 4, 7, & 8)
6	294-116-078	BUFFER SOLENOID BRACKET ASM
7	706-903-000	ROD END CLEVIS
8	835-550-002	NUT, JAM, 1/4-28
9	844-049-002	NUT, STOVER LOCK, 1/4-20
10	945-548-000	WASHER, FLAT, 1/4



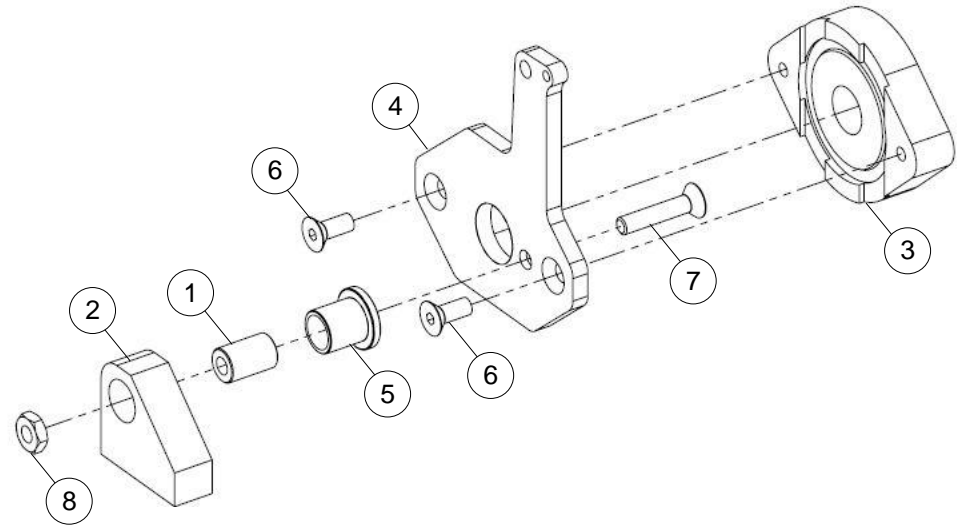
## Right Hand Buffer Solenoid Assembly

	NUMBER	DESCRIPTION
1	01-080	PIN, COTTER, 1/16 X 1/2 LG
2	01-495	PIN, CLEVIS, 3/16 X 1-1/4 LG
3	294-002-033 294-002-274	SOLENOID, 110V, 60HZ, LEFT HAND SOLENOID, 220V, 50HZ, LEFT HAND
4	294-116-072	BUFFER ROD, RIGHT HAND
5	294-116-073	BUFFER LINKAGE, RIGHT HAND (INC. 4, 7, & 8)
6	294-116-078	BUFFER SOLENOID BRACKET ASM
7	706-903-000	ROD END CLEVIS
8	835-550-002	NUT, JAM, 1/4-28
9	844-049-002	NUT, STOVER LOCK, 1/4-20
10	945-548-000	WASHER, FLAT, 1/4

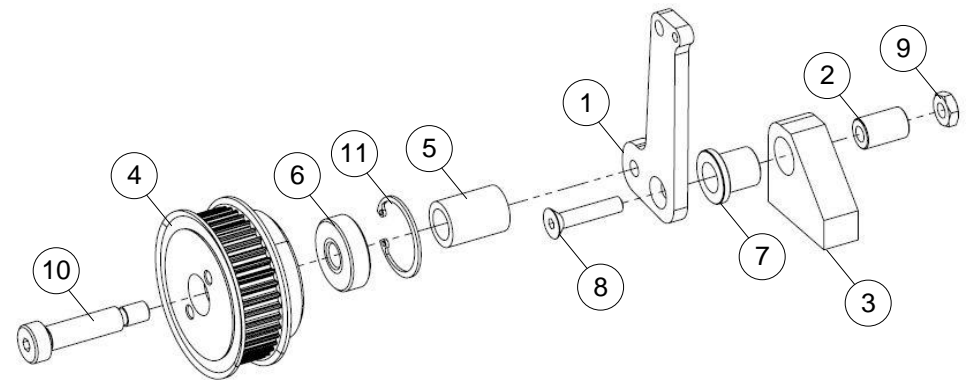


**Left Hand Buffer Mounting Assembly - 294-116-090**

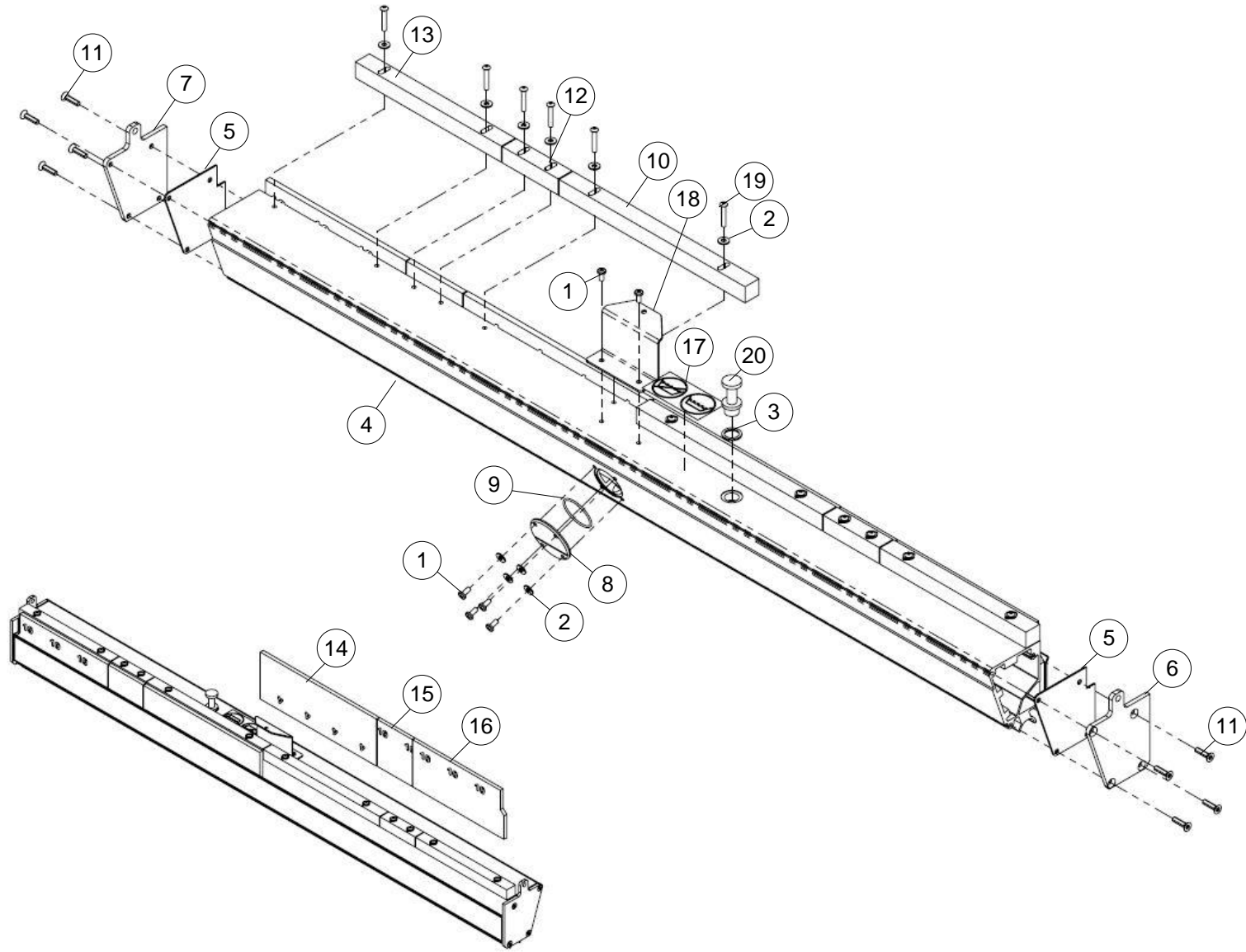
	NUMBER	DESCRIPTION
1	294-116-085	BUFFER PIVOT SHAFT
2	294-116-086	BUFFER PIVOT MOUNTING BLOCK
3	294-116-088	SWIVEL END BEARING
4	294-116-089	LEFT HAND BUFFER ARM
5	701-406-108	BUSHING, FLANGED, 1/2 X 5/8 X 3/4 X 1/8
6	808-849-100	SCREW, FLAT HEAD, 1/4-20 X 5/8
7	808-849-280	SCREW, FLAT HEAD, 1/4-20 X 1-3/4
8	836-549-008	NUT, HEAVY JAM, 1/4-20

**Right Hand Buffer Mounting Assembly - 294-116-093**

	NUMBER	DESCRIPTION
1	294-116-084	RIGHT HAND BUFFER ARM
2	294-116-085	BUFFER PIVOT SHAFT
3	294-116-086	BUFFER PIVOT MOUNTING BLOCK
4	294-116-091	BRUSH PULLEY
5	294-116-092	BUFFER PULLEY COLLAR
6	701-013-040	BEARING, 10 mm X 30 mm X 9 mm
7	701-406-108	BUSHING, FLANGED, 1/2 X 5/8 X 3/4 X 1/8
8	808-849-280	SCREW, FLAT HEAD, 1/4-20 X 1-3/4
9	836-549-008	NUT, HEAVY JAM, 1/4-20
10	880-110-350	SCREW, HEX SHOULDER, 10 mm X 35 mm
11	919-019-050	SNAP RING, INTERNAL, 1.319 X .050



## Oil Tank Assembly



## Oil Tank Assembly

	NUMBER	DESCRIPTION
1	01-009	SCREW, PAN HEAD, 8-32 X 3/8
2	01-109	WASHER, FLAT, #8
3	04-093	RUBBER DIPSTICK SEAL
4	294-115-508	OIL TANK
5	294-115-509	OIL TANK GASKET
6	294-115-510	OIL TANK CAP, RIGHT HAND
7	294-115-511	OIL TANK CAP, LEFT HAND
8	294-115-512	SIGHT GLASS DISK
9	294-115-513	SIGHT GLASS O-RING
10	294-115-515	ADJUSTMENT BAR, 10-INCH

	NUMBER	DESCRIPTION
11	294-115-516	SCREW, THREAD FORMING, 10-24 X 3/4
12	294-115-530	ADJUSTMENT BAR, 3-INCH
13	294-115-531	ADJUSTMENT BAR, 7-INCH
14	294-115-551	WICK, FOAM, SHO
15	294-115-553	WICK, FOAM, LO
16	294-115-665	WICK, FOAM, MLO
17	294-115-667	OVERFILL STICKER
18	294-116-067	OIL TANK PULL BRACKET
19	808-533-167	SCREW, BUTTON HEAD, 8-32 X 1
20	A-0330	OIL TANK PLUG

## Replacement Wicking Foams

NUMBER	OIL OUTPUT	STENCIL #	LENGTH
294-115-654	SUPER LOW	13	48"
294-115-653	EXTRA LOW	12	48"
294-115-652	LOW	11	48"
294-115-482	MEDIUM LOW	10	48"
294-115-484	MEDIUM	8	48"
294-115-486	MEDIUM HIGH	6	48"
294-115-488	HIGH	5	48"
294-115-490	SUPER HIGH	4	48"



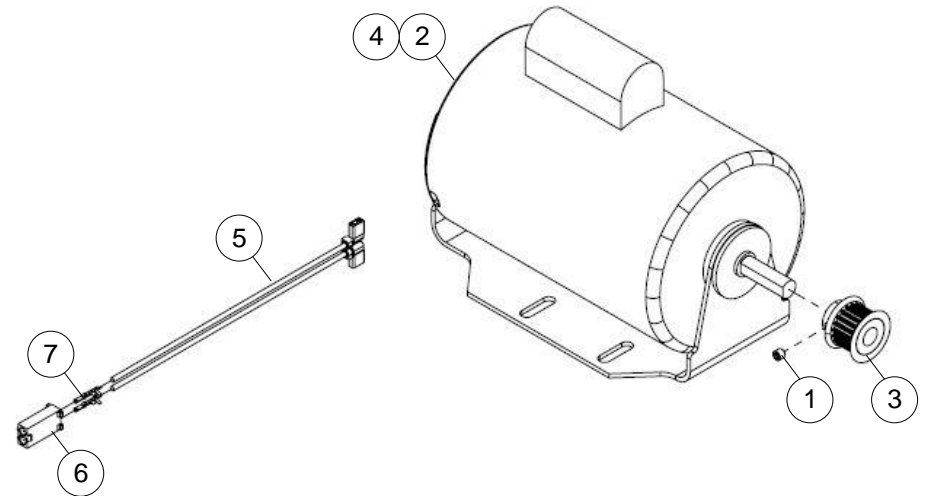
## Buffer Motor Assembly

	NUMBER	DESCRIPTION
1	01-041	SCREW, SET, CUP POINT 1/4-20 X 1/4
2	294-002-268	BUFFER MOTOR
3	294-116-069	BUFFER MOTOR PULLEY
4	294-116-071 294-116-070	BUFFER MOTOR ASM, 110V (INC. 2,3,4, & 5) BUFFER MOTOR ASM, 220V (INC. 2,3,4, & 5)
5	294-116-079	BUFFER MOTOR PIGTAIL (INC. 4 & 5)
6	746-013-498	CONNECTOR, 2 POSITION
7	760-019-223	CRIMP TERMINAL, FEMALE, 14-20 AWG

The buffer motor must be wired for either 110V or 220V use. Remove motor endcap cover for wiring access. For both 110V and 220V operation, connect pigtail blue wire to L1 and pigtail black wire to L2 then follow the instructions below.

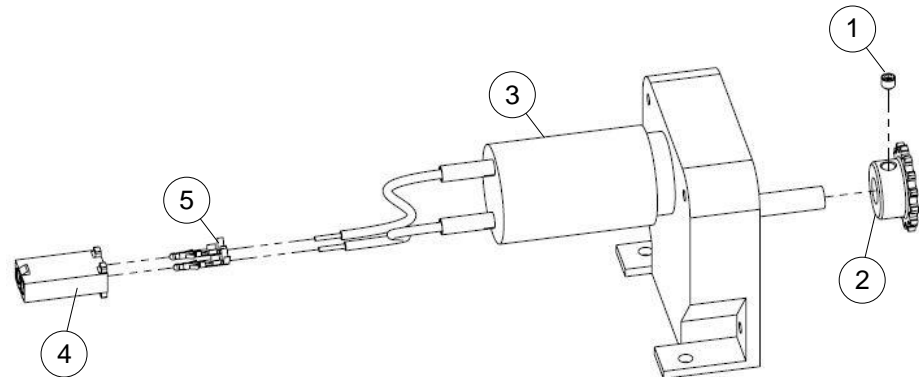
**For 110V operation connect:** the red wire to the #2 terminal and the black wire to the #4 terminal.

**For 220V operation connect:** the red wire to the #2 terminal, white wire to the #3 terminal, black wire to the #4 terminal, and blue to the #5 terminal.



## Transfer Roller Motor Assembly - 294-116-150

	NUMBER	DESCRIPTION
1	01-029	SCREW, SET, CUP POINT 10-32 X 3/16
2	294-001-006	SPROCKET, #25 CHAIN, 25T
3	294-116-023	TRANSFER MOTOR ASM (INC. 4 & 5)
4	746-013-498	CONNECTOR, 2 POSITION
5	760-010-219	CRIMP TERMINAL, MALE, 14-20 AWG

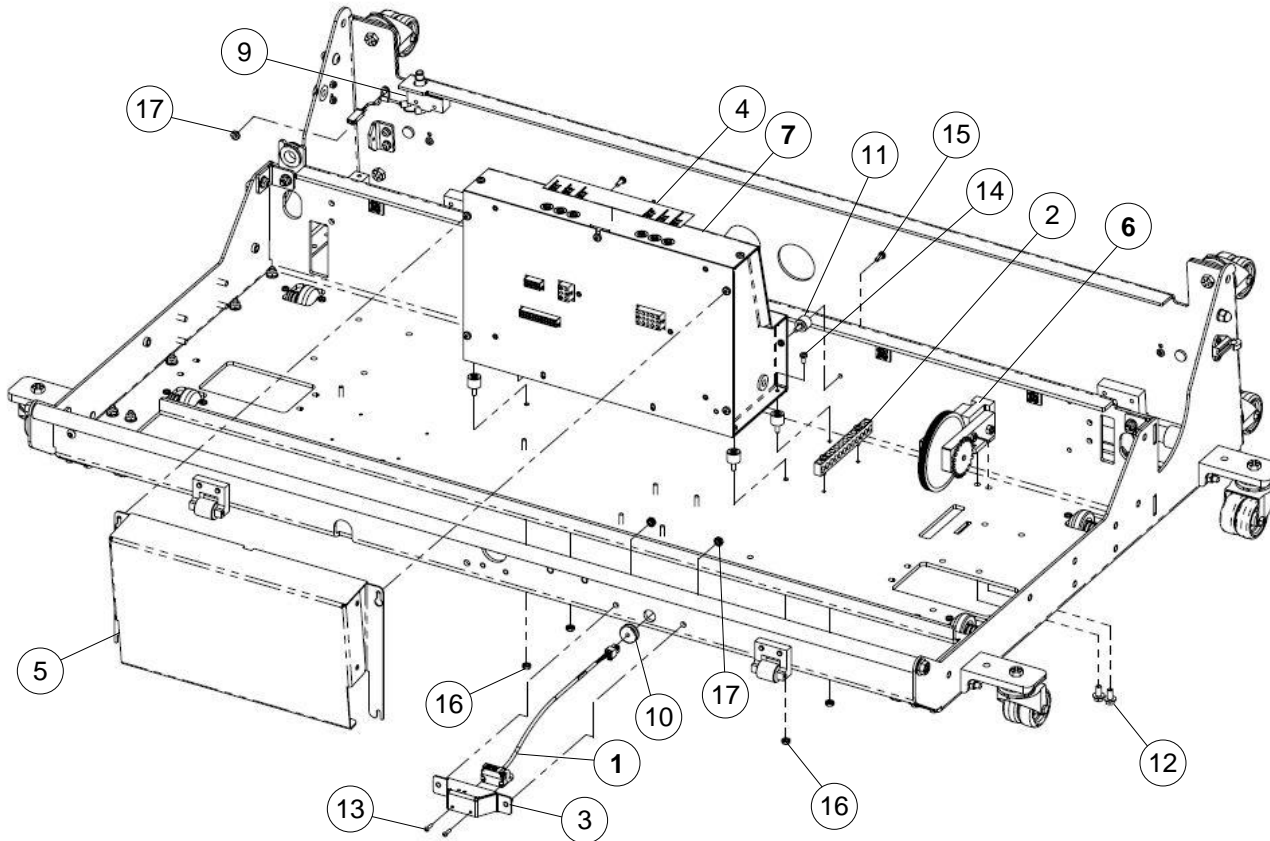


## **CONTROL SYSTEM**

## Control System Components

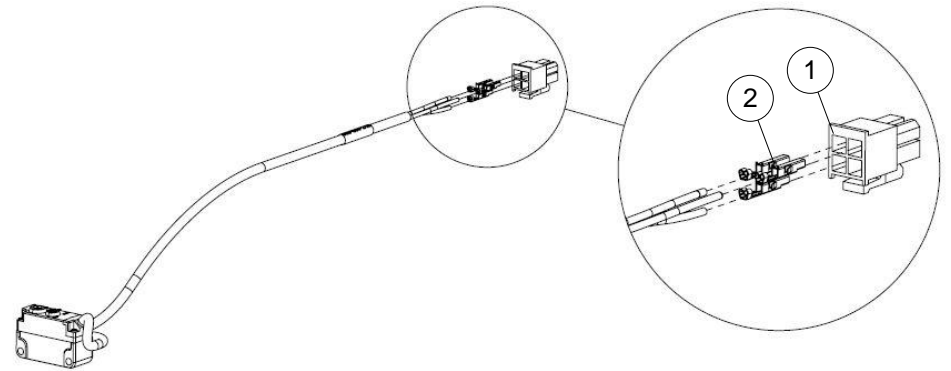
	NUMBER	DESCRIPTION
1	088-000-245	OPTICAL SENSOR ASM
2	294-115-677	GROUND BAR ASM
3	294-116-053	OPTICAL SENSOR BRACKET
4	294-116-076	CONTROL BOX FUSE DECAL
5	294-116-158	CONTROL BOX GUARD ASM
6	294-116-169	COUNTER WHEEL & ENCODER ASM
7	294-116-195 294-116-194	CONTROL BOX ASM, 110V CONTROL BOX ASM, 220V
8	294-116-199 294-116-198	WIRING HARNESS, 110V (NOT SHOWN) WIRING HARNESS, 220V (NOT SHOWN)
9	294-116-202	INTERLOCK SWITCH ASM

	NUMBER	DESCRIPTION
10	711-501-001	GROMMET, 3/16 X 5/8 X 3/16, RUBBER
11	721-510-029	VIBRATION MOUNT, 8-32 X 1/2, MALE-FEMALE
12	801-749-081	SCREW, FLANGE HEAD HEX, 1/4-20 X 1/2
13	808-503-121	SCREW, BUTTON HEAD, M3-.5 X 12 mm
14	818-233-062	SCREW, PAN HEAD, 8-32 X 3/8
15	818-233-082	SCREW, PAN HEAD, 8-32 X 1/2
16	843-133-002	NUT, KEPS, 8-32
17	843-140-002	NUT, KEPS, 10-32

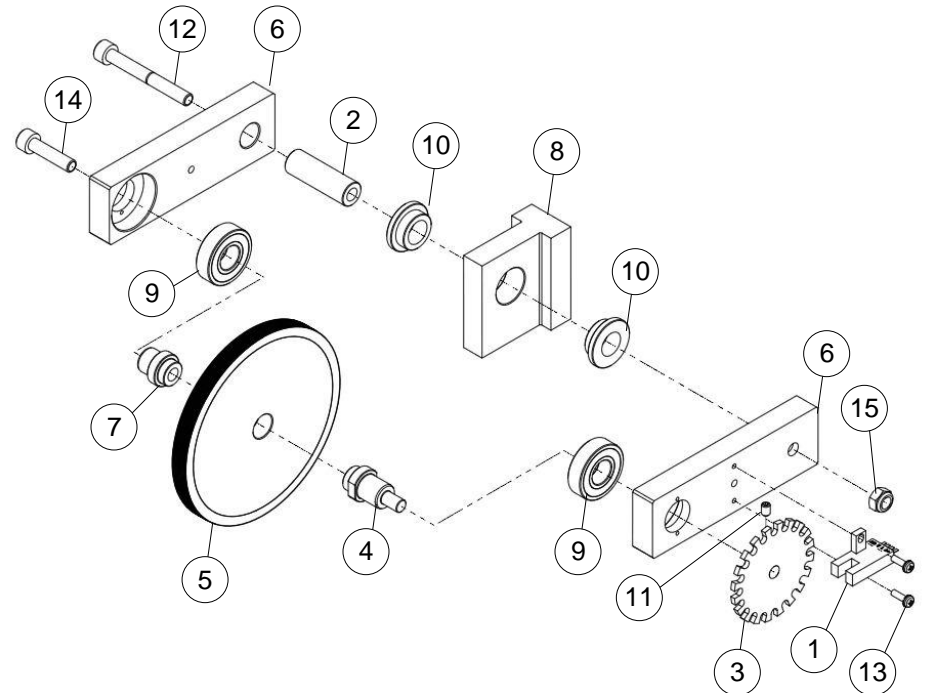


**Optical Sensor Assembly - 088-000-245**

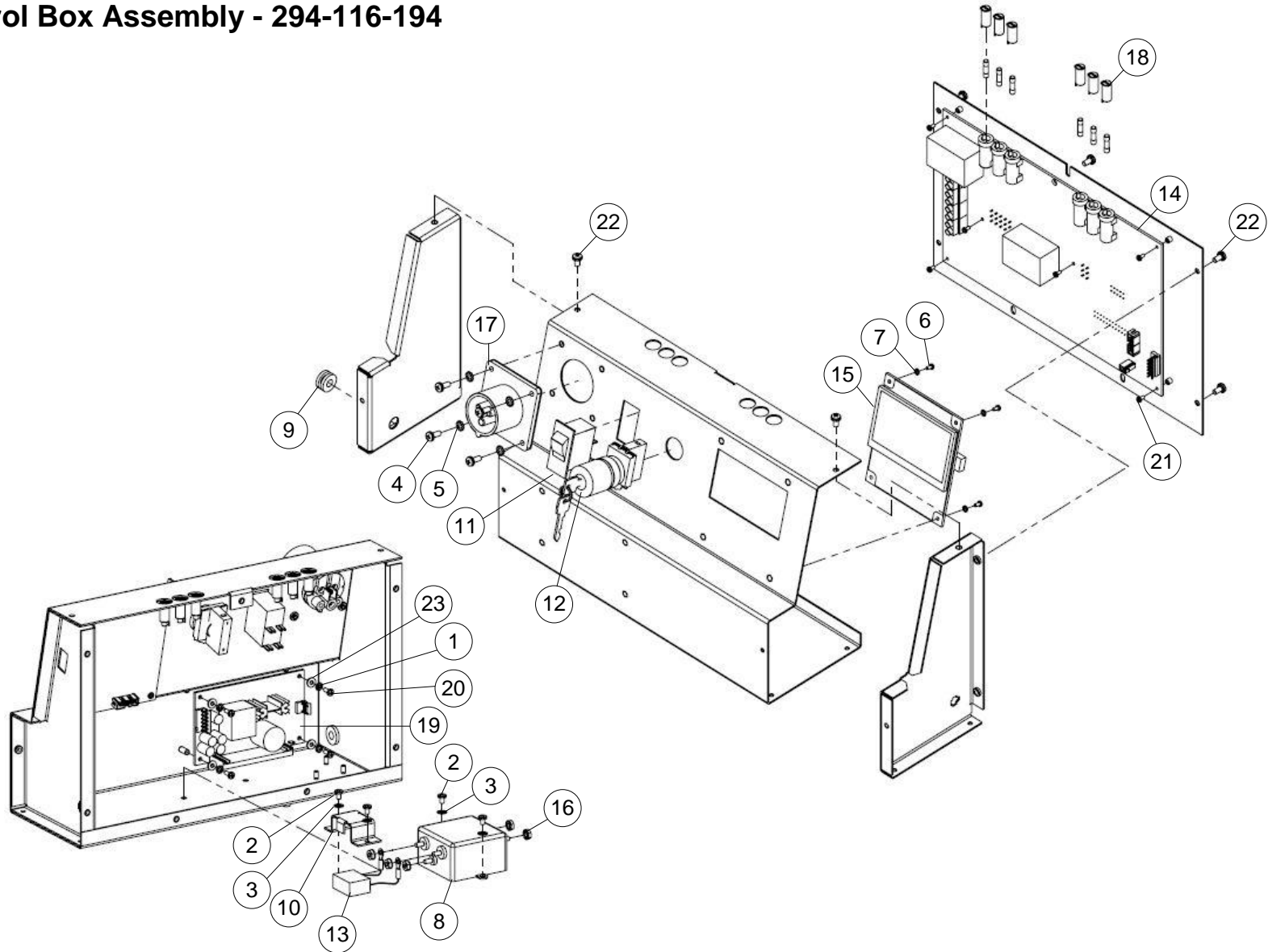
	NUMBER	DESCRIPTION
1	745-020-328	CONNECTOR, 4 POSITION
2	760-010-234	CRIMP TERMINAL, 18-24 AWG

**Counter Wheel Assembly**

	NUMBER	DESCRIPTION
1	294-115-046	ENCODER
2	294-116-145	ENCODER SHAFT
3	294-116-162	TOOTH COUNTER WHEEL
4	294-116-163	COUNTER SHAFT, WHEEL
5	294-116-164	COUNTER WHEEL
6	294-116-165	COUNTER ARM
7	294-116-166	COUNTER SHAFT, MOUNT
8	294-116-167	COUNTER MOUNTING BRACKET
9	701-035-040	BEARING, 12 mm X 28 mm X 8 mm
10	701-415-001	BUSHING, FLANGED, 12 mm X 18 mm X 8 mm X 3 mm
11	807-104-061	SCREW, SET, CUP POINT, M4-.7 X 6 mm
12	810-206-501	SCREW, SOCKET HEAD, M6-1 X 50 mm
13	817-921-060	SCREW, PAN HEAD, 4-40 X 3/8
14	860-006-251	SCREW, SOCKET HEAD, M6-1 X 25 mm
15	872-062-017	NUT, NYLON LOCK, M6-1



**110V Control Box Assembly - 294-116-195**  
**220V Control Box Assembly - 294-116-194**



	NUMBER	DESCRIPTION
1	01-005	WASHER, EXT TOOTH LOCK, #6
2	01-008	SCREW, PAN HEAD, 8-32 X 1/4
3	01-016	WASHER, EXT TOOTH LOCK, #8
4	01-021	SCREW, PAN HEAD, 10-32 X 1/2
5	01-033	WASHER, EXT TOOTH LOCK, #10
6	01-135	SCREW, PAN HEAD, 4-40 X 1/4
7	01-402	WASHER, EXT TOOTH LOCK, #4
8	02-040	RFI POWER LINE FILTER
9	04-078	GROMMET, 5/16 X 3/4 X 1/8, RUBBER
10	294-002-150	CAPACITOR BRACKET
11	743-504-010	CIRCUIT BREAKER, 110V 20 AMP
	294-002-214	CIRCUIT BREAKER, 220V 14 AMP
12	294-115-678	LOCKING E-STOP ASM

	NUMBER	DESCRIPTION
13	294-116-144	CAPACITOR ASM
14	294-116-181	RELAY BOARD ASM
15	294-116-183	DISPLAY BOARD ASM
16	7038-000832-000	NUT, KEPS, 8-32
17	746-023-450	POWER INLET
18	748-730-003	FUSE CAP
19	770-046-257	POWER SUPPLY, 45 WATT
20	813-227-062	SCREW, PAN HEAD, 6-32 X 3/8
21	818-221-042	SCREW, PAN HEAD, 4-40 X 1/4
22	818-240-062	SCREW, PAN HEAD, 10-32 X 3/8
23	948-631-062	WASHER, FLAT, #6

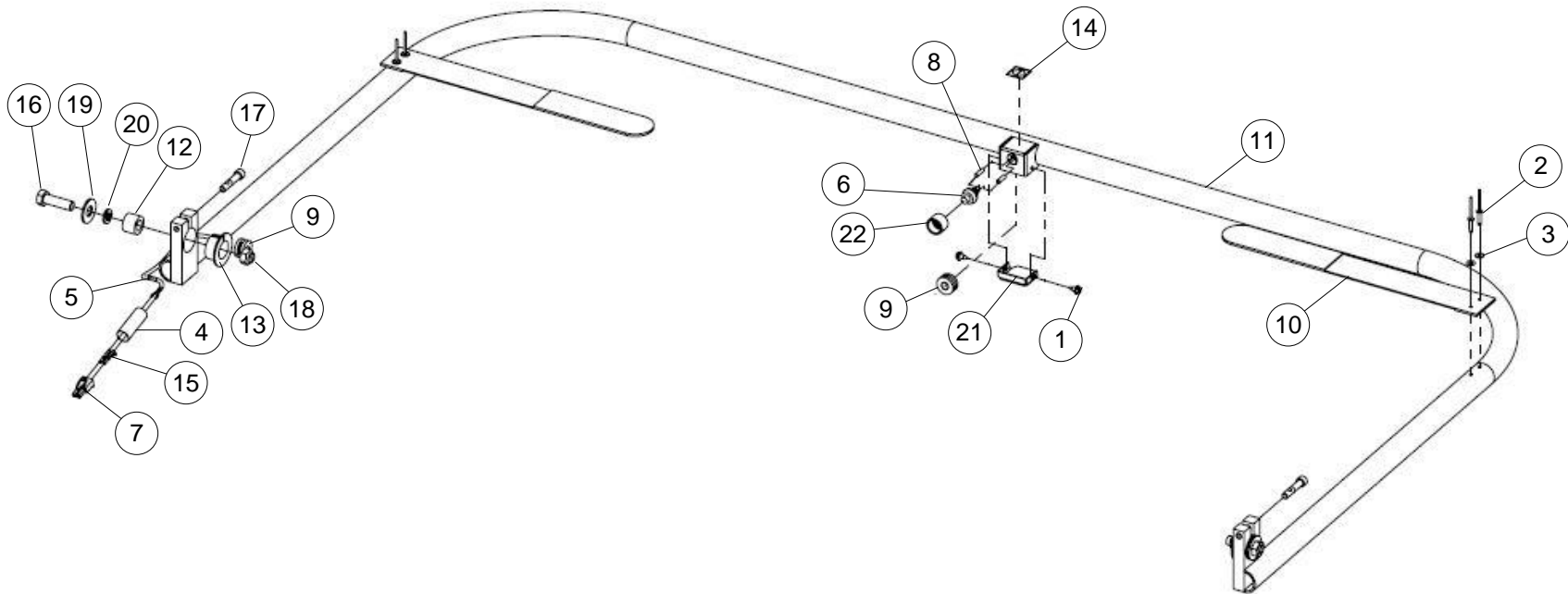
## Replacement Fuses

Voltage	110 V		220V	
	Current, A	Part Number	Current, A	Part Number
Cleaner Pump	2	748-510-600	1	748-901-111
Buffer Motor	10	748-510-400	5	748-511-405
Vacuum Motor	10	748-510-400	5	748-511-405
Drive Motor	6.25	748-512-110	4	748-510-100
Buffer Solenoids	8	748-901-031	4	748-510-100
Vacuum Head Solenoid	8	748-901-031	4	748-510-100

**Handle Assembly - 294-115-555**

	NUMBER	DESCRIPTION
1	01-058	SCREW, HEX HEAD THREAD FORMING, #8 X 3/8
2	01-130	RIVET, 1/8 DIA X 1/2 LG, ALUMINUM
3	01-303	WASHER, FLAT, 1/8 X 7/16 X 1/32
4	02-208	HEAT SHRINK TUBING, 1/2 DIA
5	02-307	CABLE, 2 CONDUCTOR, 22 AWG, SHIELDED
6	02-335	SWITCH
7	02-336	CONNECTOR, 2 POSITION
8	02-563	HEAT SHRINK TUBING, 1/8 DIA
9	04-078	GROMMET, 5/16 X 3/4 X 1/8, RUBBER
10	04-397	HANDLE STRAP
11	294-115-030	HANDLE WELDMENT

	NUMBER	DESCRIPTION
12	294-115-082	HANDLE PIVOT BOSS
13	294-115-695	FLANGED TENSION BUSHING
14	294-115-709	START STICKER
15	760-019-226	CONTACT TERMINAL, FEMALE, 18-24 AWG
16	809-865-205	SCREW, HEX, 3/8-16 X 1-1/4
17	810-349-200	SCREW, SOCKET HEAD, 1/4-20 X 1-1/4, PATCH
18	844-065-002	NUT, STOVER LOCK, 3/8-16
19	947-367-141	WASHER, FLAT, 3/8
20	951-156-002	WASHER, SPLIT LOCK, 5/16
21	A-0448	HANDLE SWITCH BOX COVER
22	A-1028	START SWITCH COVER

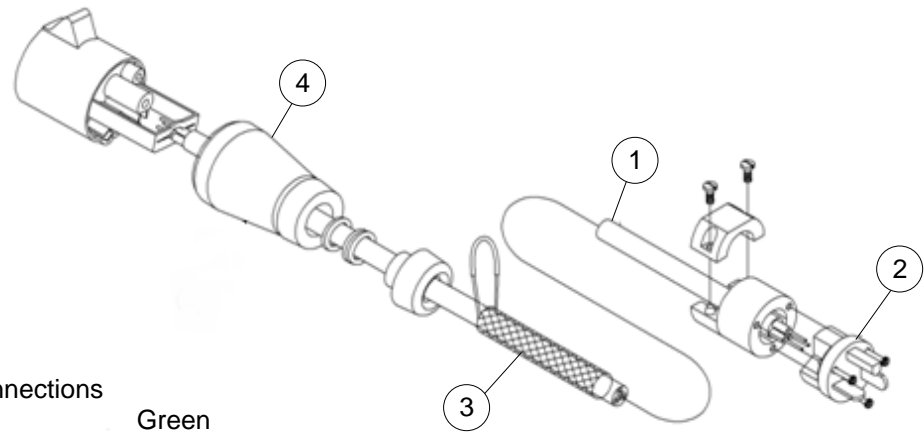


## **MISCELLANEOUS**

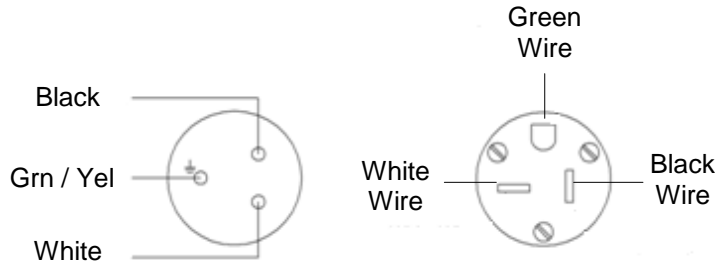


### 294-002-359 110V Power Cord Assembly

	NUMBER	DESCRIPTION
1	02-238	WIRE, 12/3, TYPE SJTO
2	02-397	125V, 20A, MALE PLUG
3	04-443	SUPPORT GRIP, SINGLE EYE, SINGLE WEAVE
4	294-002-219	CONNECTOR BODY

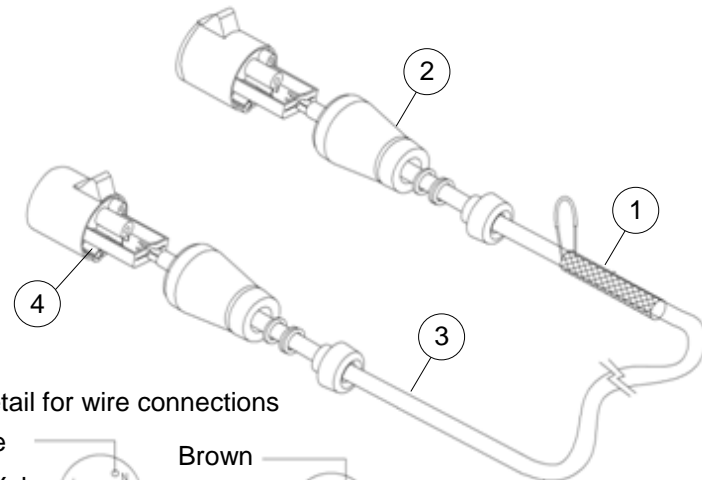


Detail for wire connections

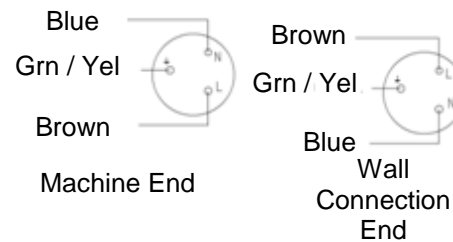


### 294-115-269 220V Power Cord Assembly

	NUMBER	DESCRIPTION
1	04-443	SUPPORT GRIP, SINGLE EYE, SINGLE WEAVE
2	294-002-219	CONNECTOR BODY
3	294-002-249	HAMONIZED POWER CORD
4	294-115-344	PLUG BODY

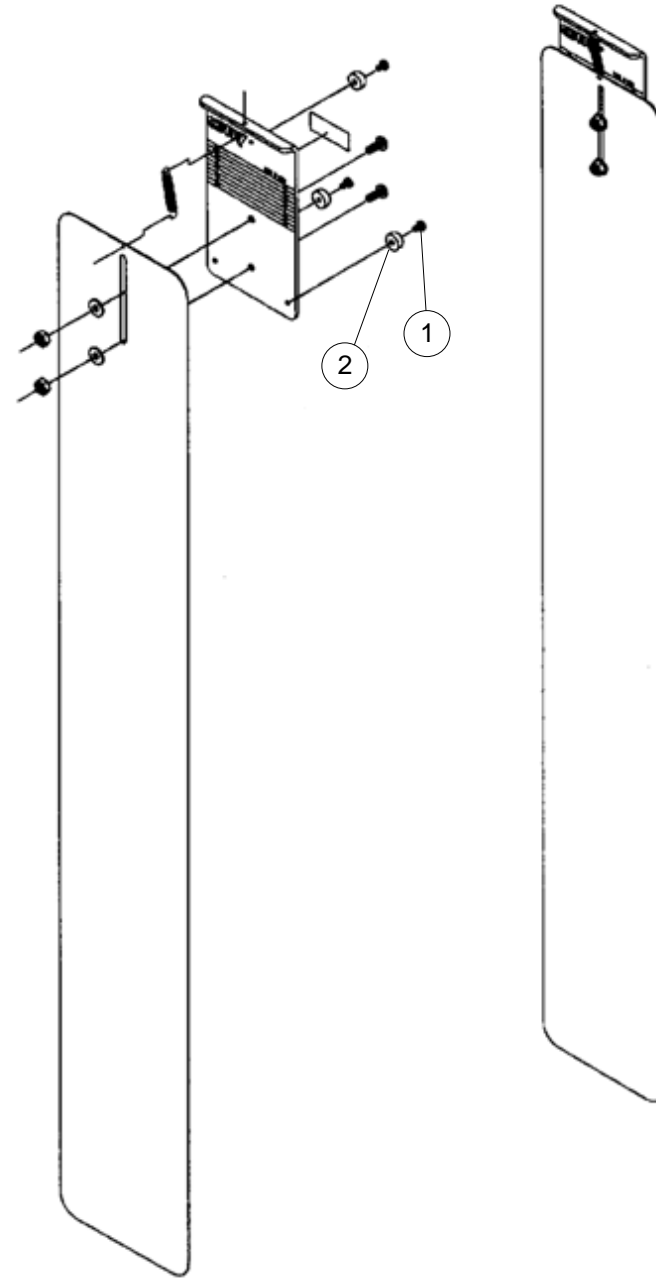


Detail for wire connections

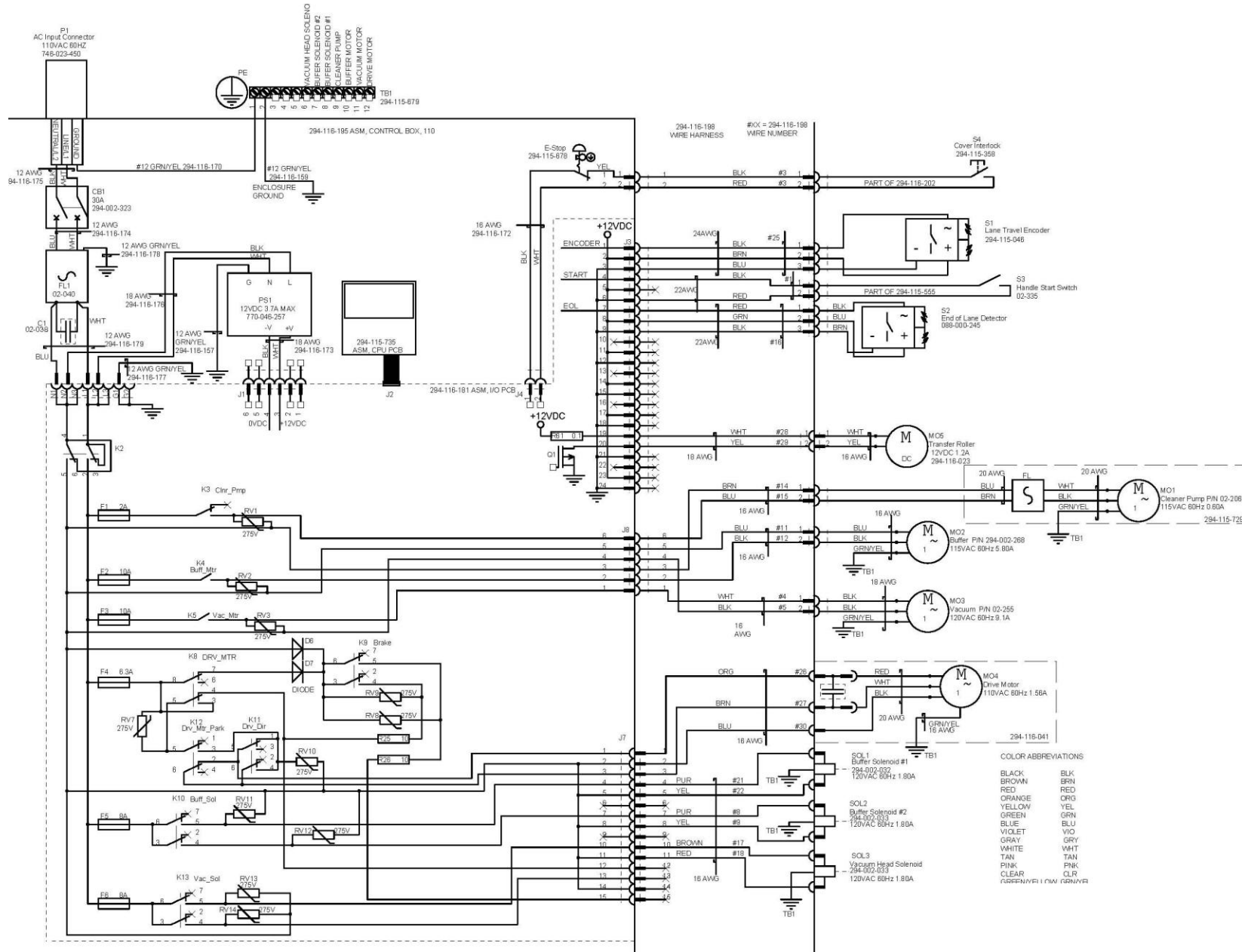


**RP-43 Buffer Pressure Adjusting Tool**

	NUMBER	DESCRIPTION
1	01-108	SCREW, PAN HEAD, 6-32 X 1/4
2	04-403	RECESSED BUMPER



## Wiring Diagram 110V Lane Machine – P/N 400-294-020





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Phoenix LT4 Lane Machine Operation, Maintenance, and Parts Manual

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