

## KEGEL KOMFORT BONUS WARRANTY PROGRAM

The KEGEL Komfort Bonus Warranty program provides Sanction Technology™ customers additional protection on costly components after the initial standard Warranty expires. By accepting the KEGEL Komfort Program, the owner will receive an additional two (2) year Warranty by committing to use KEGEL Chemical Products exclusively in their lane machine. This includes Conditioner, Cleaner and Kloth for the first three (3) years of operating the machine. To accept the program, simply check the box on the front of the Warranty card.

In the event that a selected part should fail, a verification process will be initiated with the cooperation of the assigned Distributor to confirm that the requirements of the program have been met. If sufficient documentation cannot be provided, the customer shall be responsible for the cost of the replaced components.

This Warranty program will follow the same guideline as our standard Warranty that accompanies the purchase of a KEGEL lane machine and is exclusive for Sanction Technology™ lane machines.

KEGEL has developed two parts list that are customized to Sanction Technology™ machines according to their operating voltage.

<b>PART DESCRIPTION</b>	<b>AC POWER PART NUMBR 115V / 230V</b>
OIL CONTROL VALVE ASSEMBLY	154-8298
OIL PUMP (FMI)	154-1214
PROXIMITY SENSOR	154-1220
PLC CP1L	164-1230
KEYPAD ASSEMBLY	154-8806
BRUSH / SQUEEGEE LIFT MOTOR ASSEMBLY	153-8207 / 153-8807H
DUSTER MOTOR ASSEMBLY	153-8403 / 153-8803H
CLEANER MOTOR ASSEMBLY	154-8874 / 154-8875
BUFFER MOTOR ASSEMBLY	154-8616A / 154-8616E
OIL PUMP MOTOR ASSEMBLY	154-8604 / 154-8604E
HEAD DRIVE MOTOR ASSEMBLY	154-8232 / 154-8632
DRIVE MOTOR ASSEMBLY (KPLUS)	154-8865
SPEED CONTROL BOARD ONLY (DRIVE)	153-1012 / 153-1812
SPEED CONTROL BOARD ASSEMBLY (CLEANER)	154-8848

# Lane Machine Manual



**REV 5:16**

## **Kustodian Plus Specifications**

17-5100 Kustodian Plus  
Class I - Single Phase  
115 Volts, 60 Hz, 15 Amps

17-5150 Kustodian Plus  
Class I - Single Phase  
230 Volts, 50 Hz, 12 Amps

## **Machine Dimensions**

Width – 55 1/4" (140.34 cm)  
Height - 14" (36.83 cm)  
Length – 40 3/4" (103.51 cm)  
Weight: Kustodian Plus- 309 pounds (140.4 kg)

**Manual Part Number: 154-5100**  
***First Edition***

# Safety First

Machines rated at 115 Volts A.C. are for use on a nominal 120-volt circuit and machines rated at 230 Volts A.C. are for use on a nominal 240-volt circuit.

**Warning of Potential Injury: Moving Parts – To Reduce the Risk of Injury Always Disconnect Power Before Servicing!**

This product is intended for COMMERCIAL USE. To reduce the risk of fire, use only commercially available bowling lane cleaners & conditioners intended for machine application.

**This is a HEAVY piece of equipment, and care should be taken when lifting it into the transport position. Use the proper technique to lift and lower the machine, and get a partner to help lift it up and set it down whenever possible. Make sure to bend at the knees and use a back support or mechanical lift if needed. Kegel does sell an optional piece of equipment that can assist the operator when lifting and lowering the machine. It can be mounted next to the end pairs of lanes to significantly reduce the transitional weight of the machine. Large centers might consider getting one for each end of the center for more convenience.**

**DO NOT** operate the machine while standing up in the transport position. There is a POTENTIAL FOR INJURY due to moving parts. Refer all servicing to qualified personnel. This machine is designed and manufactured for many years of dependable service. To ensure the durability of this equipment please handle it carefully. Do NOT drop or bang the machine around.

Disconnect power BEFORE filling the Supply Tank or the Conditioner Tank. Be careful not to overfill the tanks. Do not allow excess fluid to enter the electrical compartment or come into contact with any electrical components. WIPE UP spills immediately, and make sure all components are dry before applying power to the machine.

Replace fuses with the same type (Slow Blow) and Amp rating as indicated on the original fuse (or refer to the wiring diagram). Failure to do so may result in DAMAGE to the machine.

Please make sure the WARRANTY CARD is filled out and returned immediately. This will allow the manufacturer or distributor to notify you of potential problems and/or offer upgrades to machine as they become available. Register your machine on line at [www.kegel.net](http://www.kegel.net)

***If you need assistance or more information about this equipment please contact Kegel in Lake Wales, Florida USA at (863) 734-0200.***

# More Lanes More Tournaments Worldwide

**KEGEL knows the heart of bowling is within the Sport.**

Without the Sport of Bowling, there is no need for a sanctioning body, no need for equipment specifications and no need for lane specifications.

Without the Sport of Bowling there is no need for experts, no need for instruction and no need for precision.

Without the Sport of Bowling, there is no vehicle for aspiring youth to take up the sport for a lifetime.

**Without the Sport of Bowling...the heart of bowling dies.**





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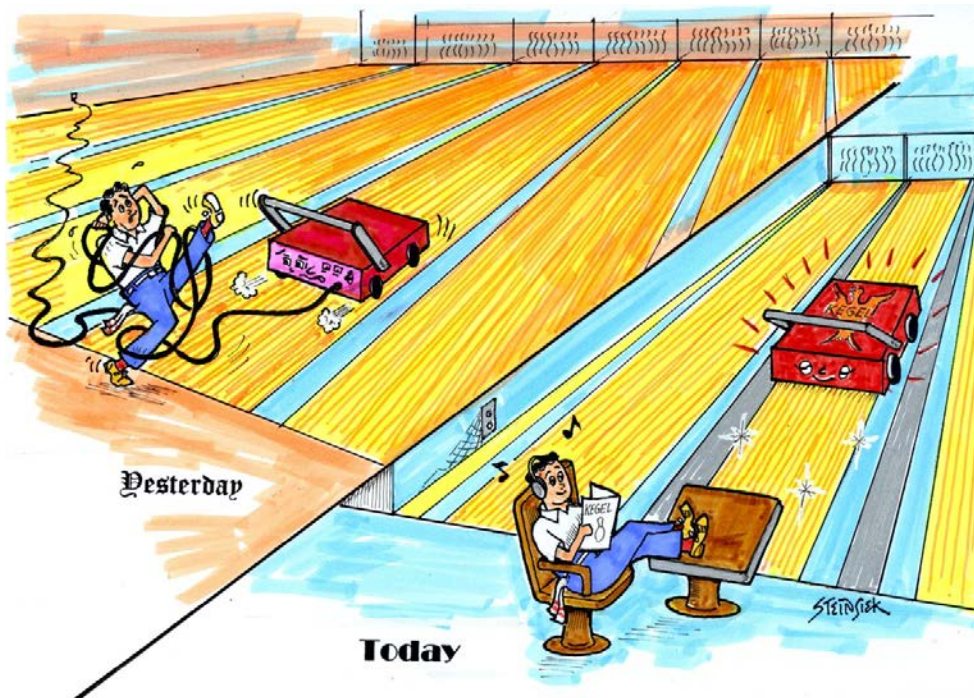
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# PREFACE



**T**he Kegel Kustodian Lane Cleaning and Conditioning Machine represents advanced technology in automated lane care. Clean and consistent bowling conditions are accessed from an on-board touchscreen linked to an industrial Programmable Logic Controller (PLC).

- A patented fluid metering transfer system, along with the vacuum/squeegee cleaning system and duster system, allow the machine to maintain clean and consistent bowling conditions.
- In addition to this manual, Kegel has developed an On-line Support Interface called KOSI. This software is provided free with the machine. KOSI allows the operator to access additional functions that are otherwise not available to the operator through the keypad. KOSI includes programs and instructional videos which should be used as a supplement to this manual.

IT IS VERY IMPORTANT THAT THE OPERATOR THOROUGHLY READ AND UNDERSTAND THIS OPERATING MANUAL BEFORE USING THE MACHINE. WHEN ALL ELSE FAILS...READ THE MANUAL AGAIN OR WATCH TRAINING VIDEOS FOUND IN KOSI.

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## **About This Manual**

This manual was prepared by the engineering, graphics & documentation departments of Kegel to provide detailed information and technical support about this lane machine and its operation. This manual was specially designed to educate the operator and ensure your investment is maintained properly.

## **The Intended User / Operator**

Although every attempt has been made to make this manual easy to understand and use, the operator should have basic electrical, mechanical and technical understanding to operate and maintain the Kustodian. Should you have any questions after reading this manual about proper operation or procedures, please contact Kegel at (863) 734-0200 or via email at [lmc@kegel.net](mailto:lmc@kegel.net) for technical support.

## **Disclaimer**

The identification of individuals, companies and products in this manual is provided for technical informational purposes only and does not constitute endorsement by Kegel of any business entity, service or products. Product brand names mentioned in this manual are trademarks or registered trademarks of their respective holders. Kegel disclaims any and all rights in those marks.

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## **Conformity**

Kegel is an ISO 9001 Certified Manufacturer. This lane machine has been independently tested to comply with applicable standards for the equipment.

## **For additional copies of this or any other Kegel product manuals contact:**

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1951 Longleaf Blvd.  
Lake Wales, FL 33859  
USA

[www.kegel.net](http://www.kegel.net)  
(800) 280-2695 (Toll Free in the U.S.)  
(863) 734-0200

## Kegel Company Background

Kegel was founded in 1981 by John Davis, Linda Davis, and David Jennings. At that time, Kegel had designed a small hand operated cleaning tool named "The Key", which they manufactured in David's garage.

In 1983, Kegel purchased Ridge Lanes in Sebring, Florida and the crew moved south to run the bowling center and start Research & Development of lane maintenance and machines. The Sanction Machine<sup>®</sup> was soon developed and marketed as Kegel's first fluid metering lane machine.

In the following years many more machines were designed, such as the DBA LaneWalker, followed by the innovative LCM, Excel, Arrow, Phoenix, Phoenix-S, Standard, Kustodian, Sanction Walker, Kustodian Plus, Kustodian Ion, and the Kustodian Walker.

Manufacturing – Our core division designs and manufactures the world's best lane conditioning and cleaning machines, replacement parts, and other specialized machinery products.

Kegel Bowling Technologies – This division develops and blends conditioners and cleaners that are used in our lane conditioning machines, as well as other areas in bowling and beyond. Lane Maintenance Central (LMC) – Regarded by many as the best in the industry, LMC provides 24 hour telephone support, educational seminars, workshops, and on-site support to bowling centers and distributors throughout the world. Kegel Training Center – Located on-site, we custom built this 12-lane bowling center for serious bowlers to train to be the best. Kegel is proud to host educational clinics in various forms for bowlers, coaches and pro shop operators. The first of its kind, the Kegel Training Center boasts several original concepts including C.A.T.S. on every lane, adjustable topography lanes, and advanced coaching tools.

Kegel has grown into a worldwide organization with several product divisions, over 100 employees, and a specially designed 72,000 sq. ft. state-of-the-art facility located in Lake Wales, Florida. Kegel has done this with a simple philosophy of **researching the problems that exist in the bowling industry, developing a product or service to solve that problem, and making sure to support the customer with the highest of standards.**





“Wah-lah...I did them the same!”





# CHAPTER 1



## Installation and Setup

### Machine Inspection

It is important to identify all of the parts included with your lane machine and inspect its condition before you begin. Use the following list to make sure all parts are accounted for:

**Fill in the following Check Boxes and Information:**

- Kustodian Plus Lane Machine** - 17-5100 (115V) | 17-5150 (230V)
- (2) Funnels - 153-8252 & 153-0052A (in Accessory Kit)
- Accessory Kit
- Operators Manual – 154-5100
- KOSI PRO Software & PLC Cable - 154-8777
- Extra Roll of EZ Core Cloth - 153-0047EZ
- Maintenance Supplies Starter Kit - 154-8866

**Date Unpacked:** \_\_\_\_\_

**Unpacked by:** \_\_\_\_\_

**Machine Serial Number:** \_\_\_\_\_

### Register your Lane Machine

It is important to register your new Kustodian with Kegel in order to receive valuable updates, service bulletins and your Limited Warranty. Fill out the card or go on-line.

**IMPORTANT: Please take a minute and register at: [www.kegel.net](http://www.kegel.net)**

## Machine Installation Procedures for the Distributor

1. Unpack and inspect machine for shipping damage; make sure all the extra items are included in the shipping crate.
2. Inspect all of the switches and sensors and describe the function of each one:
  - a. Duster Up Switches
  - b. Lane Distance Sensor (LDS);
  - c. Tachometer Sensor (Tach);
  - d. Right & Left Board Edge Sensors;
  - e. Board Counting Sensor;
  - f. Brush and Squeegee Lift Switches;
  - g. Handle Button - explain the functions of this button;
  - h. Oil & Cleaner Floats Switches.
3. Discuss how important it is to have a good transition to the approach. The adapters from gutter to approach must be the same for the machine to come out as straight as possible, it is up to the center to make this happen. Extra dusty approaches are not good.
4. Inspect all the relays and describe their function. Make sure they are seated properly in the socket bases.
5. Show the PLC and how the Inputs light up when a sensor or switch is actuated. Explain the channel designations and which Inputs are 0CH and which are 1CH; Outputs are 100CH and 101CH. This can be confusing for both the Inputs and Outputs since it is not clearly printed this way on the PLC (i.e. 2 connections are labeled 00, but one is 0CH 00 and the other is 1CH 00).
6. Loosen the fasteners for the Main Control Plate to lift it out of the way and show the motors underneath.
7. Open the Splash Guard and describe all of the components behind it.
8. Discuss how the cleaner tank can do up to 50 lanes depending on cleaner volume settings and show how this adjustment is made. The recovery tank holds what the cleaner supply tank dispenses (and it is heavy when full).
9. Explain that the Conditioner Tank can hold up to 60 lanes, depending on pattern volume. Tank also has a quick disconnect to reduce the mess when replacing the oil or cleaning the tank.
10. Stop and take a break...let some of the information sink in and consider getting something to drink. Reassure them that Kegel provides many resources with this information.
11. Point out the KOSI software CD that was provided for their PC. Some may want to install it right away. (The CP1H PLC requires a different cable than the other Omron PLCs.)

12. View all of the menus on the Keypad.

Now that a thorough overview of the machine has been completed, we are ready to run it!

1. When the machine is powered ON the keypad will illuminate. Line the machine up with the lane as if you are ready to operate. When starting the machine on the first lane it is important to position it the correct distance from the foul line. The front bumper should be about 20" to 22" (51 to 56 cm) away from the foul line. This is required so the machine functions will happen at the proper location relative to the foul line of the first lane.
2. Have the operator(s) practice moving the machine and provide tips of what to look for.
3. Using the keypad, perform the starting sequence to run the machine.
4. Watch the machine operate on the lane and monitor the speeds. Make certain they are in the proper range for each speed.
5. As the machine travels to the back end, explain how the brush rotates occasionally past the end of the oil pattern to prevent conditioner build-up on the buffer brush which can leave a "choppy" look at the end of the pattern.
6. When the machine enters the pin deck check to see if the squeegee completely clears the pin deck. Failure to do so will result in a dirty pindeck that will lead to potential out of ranges.
7. Monitor the machine back to the foul line.
8. Watch closely as the machine is pulled from the lane. This is where you can see if the adapters from gutter to the approach will cause any problems with the operation of the machine.
9. After operation, review proper steps to transport, clean, and maintain the machine for its next use. Tell them to read this Operators Manual and show them how the manual is organized to help them find what they are looking for.

## **Daily Setup and Operation**

### **Moving / Transporting your Lane Machine**

You would think that transporting and moving your machine to and from the approach is an easy task, but some places can be difficult. Be careful when moving the machine.

Ramps that are used for moving the machine to and from the approach should also be "machine friendly". These ramps should be no less than 12 feet long with no bump on either end of the transition. Improving these transitions will not only extend the life of your machine, but can make it easier to transport the machine to and from the approach.

The transition from the gutter to the approach should be as smooth as possible for an easy entrance and exit for the lane machine. This will prolong the life of the casters as well as other parts. Better transitions also help in preventing drips of cleaner from falling off the squeegee.

It may seem like a lot of work to improve these areas (and it is in some cases) but it is well worth the time and effort. You should have no problem fitting this project in between pinsetter repair, scoring problems, glow bowl light repair, lane repair, plumbing, electrical work, carpentry and who knows what else...

### **Filling the Conditioner and Cleaner Tanks**

#### **Filling the Conditioner Tank**

1. To fill the conditioner tank, the machine should be in the operating position on the lane. Open the splash guard and remove the cap located on the top of the tank.
2. Insert the funnel assembly provided with the machine. Wrap a rag around the bottom of the funnel to prevent spills from getting in the machine.
3. Fill the tank until the conditioner level in the tank is about 1-1/2" (3.8 cm) from the top edge. Failure to watch the tank level could cause the tank to overflow. This overflow can drain down onto the lane distance sensor or the buffer brush, which will cause an excessive amount of conditioner to be applied to the lane in that area for several lanes. You should place rags beneath the tank to prevent this from happening.

**When finished, be sure to remember to replace the cap.**

**Failure to do so could cause a major spill when the machine  
is lifted up to the transport position.**

## Filling the Cleaner Supply Tank

***Make sure your splash guards are in place prior to filling the tank. This will help protect your electrical components.***

1. To fill the Cleaner Supply Tank, the machine should be in the down or operating position on the lane. Prepare an appropriate mixture of cleaner and water. Open the splash guard and place a rag beneath the tank. Open the tank cap and place a rag around the base of the funnel to prevent foam from over-flowing into the machine.
2. Slowly pour the mixture into the Cleaner Supply Tank using the supplied funnel until the level in the tank is about 1/2" (1.3 cm) below the top of the tank. This will prevent an air pocket from forming and blocking the fluid flowing from the funnel. Replace cap tightly when finished.

***NOTE: Always use the funnel supplied with the machine. This funnel has a plastic filter screen. This screen filters out large debris and trash to prevent this from contaminating the supply tank and cleaning system.***

Not using a funnel with a filter may cause the tank's internal filter to become clogged frequently and reduce the cleaner output, resulting in inadequate cleaning. This may lead to customer complaints, ball calls and an excess of out-of-range pins. When necessary, the supply tank can be removed for cleaning.

Do not spill cleaner on the electrical components. Spills may cause a "short", which may send a false signal to the PLC causing improper operation. A wet switch may also produce a dim LED light on the PLC.

**Any spills or drops of cleaner onto the approach should be wiped up immediately!**

**Any spills on the machine can stain the paint and make the machine ugly.**

**Ugly machines do not run as well as clean, sharp, and highly maintained machines.**

***NOTE: If the lanes are going to be cleaned, make sure the Cleaner Supply Tank is filled, the Recovery Tank is empty, and an adequate supply of Lane Cleaning Cloth is installed before beginning operation. Always empty the recovery tank when filling the supply tank or standing the machine to transport position.***

## Kustodian Plus Sequence of Events - "How it Works"

The following steps detail how the KPlus operates, which is much like the Walker. The unit should be on the approach in down or operating position with the HOME SCREEN displayed on the keypad assembly. The KPlus needs to be in "clean and oil mode" for the following sequence of events to occur. The following sequence will explain how to start the ION, how the errors work, and what happens as the KPlus travels down your lanes.

1. Press the **start** button on the handle one time and the machine will lower the duster cloth which is monitored by the duster up switch. If the switch's normally open contacts malfunction, there will be a **D5** error displayed. The squeegee will move down and stop when the down switch's normally open contacts close. If the switch contacts do not operate properly, there will be either an **SA** error displayed. The oil pump will turn on.
2. Push the machine onto the lane and make sure it is properly seated. If you want to add extra cleaner (pre-soak) to the front of the lane, press the red button on the bottom right side of the handle. If more cleaner is needed, wait for the moving heads to stop and press the button again.
3. Press the **start** button a second time and the moving heads will start and move from left to right or from right to left (the heads move in opposite directions). The cleaner head will start to apply cleaner instantly to the lane and not stop until the last squirt distance has been reached. When the oil head reaches the right board edge proximity sensor, the moving heads will reverse and begin to apply the first stream of oil.
4. The moving heads are now moving in opposite directions, so when the oil head reaches the left board edge proximity sensor, the head motor will reverse and the drive motor will start up. The buffer will then turn on and the machine will begin its forward travel down the lane. When using the factory settings, the buffer motor does not turn on until the rear of the machine is about 3 feet (0.914 meters) past the foul line. Also, the vacuum motor does not turn on until the rear of the machine is about 3 to 4 feet (0.914 to 1.2 meters) past the foul line.
5. Additionally, the second press of the **start** button will start a clock to record the total amount of run time to be displayed on the keypad, the total valve time will also be recorded and displayed.
6. As the machine travels forward down the lane the moving heads will continue to operate applying oil and cleaner. The board counting proximity sensor monitors the motion of the moving heads. If the motion is interrupted, an **H7** error will be displayed.
7. As the machine travels down the lane, the lane distance sensor (LDS) is counting inches traveled and is also monitoring the movement of the machine. If travel is interrupted a

**T1** error will be displayed. The speed of the machine is also being displayed on the screen.

8. As the machine continues to move forward, speeds will change and oil and cleaner will continue to be dispensed to the lane as programmed. As the machine approaches the applied oil distance the oil will turn off and the buffer will continue to buff oil onto the lane.
9. When the oil distance is reached the buffer brush will stop and rise up, then the brush up switch's normally open contacts close. If the contacts do not close there will be a **B4** error displayed. If the brush up switch sticks closed when it should be open it will give a **B5** error.
10. When the oil distance has been reached the machine will shift into high speed and continue to travel toward the pin deck. As the machine approaches the pin deck the last squirt distance will turn off the cleaner pump and the moving heads will park. At the same time the machine will down shift to low speed to reduce its momentum into the pin deck.
11. When the machine enters the pin deck the duster wind-up motor will turn on at its pre-determined distance and start to wind up the cloth (to raise the duster). The duster up switch's normally open contacts will close to turn off the duster wind-up motor. If the contacts do not close there will be a **D6** error displayed.
12. When the machine reaches its travel distance and comes to a stop, the squeegee will proceed to lift up and stop when the squeegee up switch's normally open contacts close. If the contacts do not close, a **S9** error will be displayed.
13. The machine will then start traveling in reverse and stop after moving 4 inches. The squeegee will lower and the machine will go forward again and stop, then lift the squeegee. This function helps to remove drips off the squeegee blades.
14. The machine will now travel in reverse, turn the vacuum off, and run the cleaner pump in reverse for 1 second to help reduce pressure on the cleaner tip.
15. As the machine travels in reverse at high speed the lane distance sensor is counting inches traveled and is also monitoring the movement of the machine. If travel is interrupted, a **T1** or a **T2** error will be displayed.
16. As the machine reaches the oil distance the brush will begin to lower and stop in its down position when the brush down switch's normally open contacts close. If the contacts do not close a **B3** error will be displayed. If the brush down switch sticks closed when it should be open, it will give a **B4** error.
17. The brush will begin buffing at the end of the pattern as the machine travels in reverse. The oil head will start back up again when it reaches the first reverse load distance.

18. As the machine continues to travel in reverse it will be down-shifting to lower speeds. After the machine applies the last reverse load the moving head will park. The machine will continue to the foul line then stop.
19. If the oil float contacts open, a **CODE FO** error will be displayed after the machine has completed its run. The oil will then need to be filled and the machine re-started.
20. If the cleaner float contact is open, a **CODE FC** error will be displayed after the machine has completed its run. The cleaner will then need to be filled and the machine re-started. Always empty the recovery tank when filling the cleaner tank.
21. The machine cannot be resumed if the following errors occur: **OIL & CLEANER FLOAT;** **DUSTER UNWIND;** and **SQUEEGEE DOWN**. In the event one of these errors occurs, the machine will need to be re-started.



## **Basic Steps to Operate your Kustodian Plus**

Carefully set the machine in the operating position on the approach. It should be completely on the approach, with the cleaning end being approximately 6 inches behind the foul line.

Connect the power cord into a suitable outlet. **MAKE SURE THAT THE OUTLET IS SUPPLYING THE CORRECT VOLTAGE AND AMP RATING.** Connecting the power cord into an outlet located toward the center lanes of the establishment will allow more lanes to be cleaned and/or conditioned without changing outlets. Then plug the twistlock connector plug into the machine.

The power cord supplied with the machine will be long enough to clean in excess of 24 lanes without the need to change outlets. (To accomplish cleaning the maximum number of lanes, the cord should be plugged into an outlet at approximately Lane 12. This will allow enough slack in the cord to place it out of the machine's path as it cleans/conditions lanes 1-24.)

When power is applied to the machine the menu screen on the keypad will illuminate. The machine is now ready to run.

If the machine does not appear to have any power after it has been plugged in, check the E-STOP switch to make sure it hasn't been accidentally pressed. Rotate the red button to reset this switch. Power will resume immediately.

## **Keypad Display**

The keypad display is a two line LCD (Liquid Crystal Display). During operation and selection of programs, various prompts, which are simply questions or data requests, will appear in the display, along with possibly some numbers.

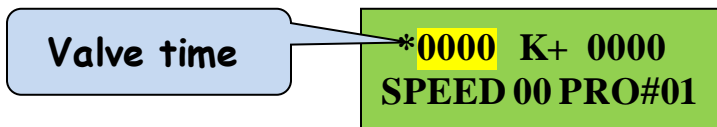
The prompts will request the operator to input or change data or information within the selecting menu. The numbers will display cleaning and/or conditioning program numbers, distances (feet or "counts"), and various settings. What the prompts and numbers mean for each menu is explained under each menu heading in this section.

In some menus there will be only one number in the lower right hand corner. This will be the value of the menu prompt displayed. By using the UP ARROW or DOWN ARROW you can change the value (there is no need to press the enter key). **The value is set when the number is changed.**

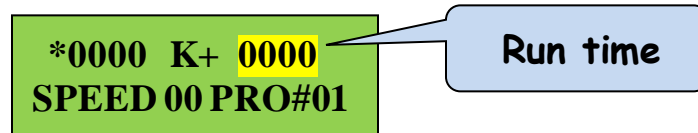
In other menu screens, where multiple variables can be changed, the variable that can be changed will be *blinking*. Pressing the **ENTER** key will advance the blinking value to the next variable. This is used in the CHANGE PROGRAM area.

### Run Screen Information

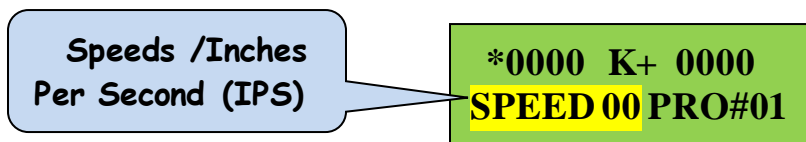
When the machine is powered up the RUN SCREEN will appear first and displays 4 useful pieces of information!



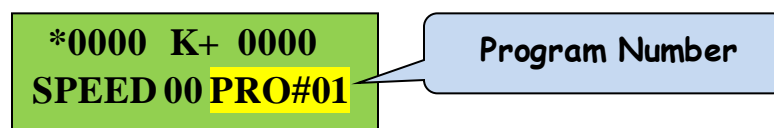
The top left will show the oil valve time, in tenths, if the time shows a steady increase this may indicate lack of lubrication on the oil and cleaner rails.



The top right will be the total time, in tenths, it takes to run one lane, steadily decreasing or increasing values may indicate the need to check machine speed settings.



The lower left displays the speed of the machine as it travels down the lane. Watch this number during operation to see the actual speed of the machine, in inches per second as it operates.



## **Starting Your Machine**

After applying power to the machine, flip the operation Toggle Switch to the desired Mode you wish to run the machine in. This will be Clean Only, Oil Only or Clean and Oil.

To start the machine press the Start Button one time, this will lower the squeegee and unwind duster cloth. The vacuum will also come on (unless the machine is set to oil only).

**NOTE:** If the machine is in OIL ONLY mode it is possible to turn the duster off, therefore nothing happens on the first button push when the duster is turned off.

Push the machine onto the lane, at this moment it is possible to add extra cleaner to the lane. Press the Cleaner Presoak button on the right side of the handle and the oil and cleaner heads will start up and the cleaner head will apply one stream of cleaner. Wait for the cycle to stop to repeat or press the Start Button a second time to start the machine's operation. The speed of the machine will be displayed on the screen, as well as the program number during operation. The total valve time and machine run time will be displayed after each operation.

***NOTE:*** Running two warm-up lanes will allow the Transfer Brush and Buffing Brush to be replenished with conditioner and return to a constant refreshed state. This will help prevent the first lane pair from being different (drier) than the rest. This is critical for league and tournament play conditions. Kegel has recommended this procedure to be done with every machine we have produced.

## **Stock Programs**

The Lane machine has 4 pre-programmed patterns that are downloaded into the PLC. The first three patterns are actual patterns to be used for conditioning and the fourth pattern is used for calibration only. It is recommended NOT to overwrite program 4 as this will be used to calibrate the machine on a daily basis. Below is the pattern name of each program and details of each can be found in the list of Navigation patterns in the following chapter.

- Program 1 - Main Street - Recreation Series pattern
- Program 2 - Middle of the Road – Challenge Series pattern
- Program 3 - Highway to Hell – Sport Series pattern
- Program 4 - Calibration Program – DO NOT OVERWRITE

## **Program Override**

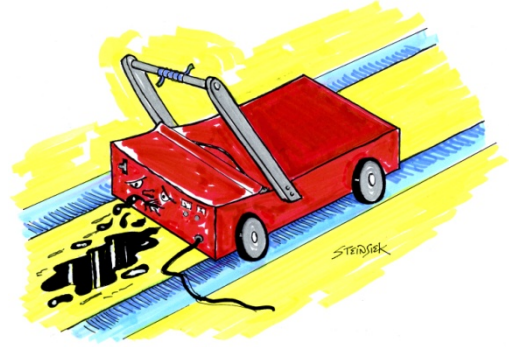
In the RUN SCREEN it is also possible to do a program override. By pressing the F5 key you will enable the override feature. Press the Down arrow to choose the program that is desired, once chosen the machine is ready.

Note: When power is removed from the machine the override feature will be disabled and the machine will return to its original auto programming.

## Keypad and Menus

### Machine Error Messages

The machine is equipped with Error Messages that are displayed on the Keypad in case the machine malfunctions. These messages will indicate the type of operational error that has occurred. Here are some descriptions of how some common causes of these errors may occur.



- CODE T1 - FORWARD TRAVEL
- CODE T2 - REVERSE TRAVEL
- CODE B3 - BRUSH DOWN
- CODE B4 - BRUSH UP
- CODE D5 - DUSTER UNWIND
- CODE D6 - DUSTER WINDUP
- CODE H7 - OIL HEAD TRAVEL
- CODE L8 - OIL HEAD TIMING
- CODE S9 - SQUEEGEE DOWN
- CODE SA - SQUEEGEE UP
- CODE FO - OIL LEVEL LOW
- CODE FC - CLEANER LEVEL LOW

## **Operator Menu Selections**

The machine has a series of menus that are accessed from the RUN SCREEN. By pressing **F1**, which is also the **MENU** key, you will be able to toggle through to view the specific screen you are looking for.

Each of these menus will be explained in detail in the appropriate section of this manual.

- **RUN SCREEN**
- **RETURN TO FOUL LINE**
- **CHANGE PROGRAM SETTINGS**
- **SYSTEM CONTROL CLEANING**
- **SYSTEM CONTROL DUSTER**
- **AUTO PROGRAM SELECT**
- **TEST OUTPUT**
- **PUMP OUTPUT VOLUME TEST**
- **COPYRIGHT**

## **Operating History**

It is a good idea to take that extra step and design an Operating log for mechanics to sign off on. This would be a chart that logs any problems that may have happened, or just to put specific notes that may become useful over time when servicing!

## Maintenance & Storage

### Cleaning Guidelines

We've all heard the saying *"Man, that Lane Machine cost more than my car!"* The fact of the matter is, you can get a pretty nice ride with the money spent on a new Lane machine. So why not treat it like one! Do those things that you would do to your car like the preventive maintenance, washing it, changing the oil and giving it that special attention that it deserves.

Cleaning is the single most important thing the operator can do for this lane machine and it is not hard. Not taking the time to do simple cleaning will result in the downward spiral of your conditioning program. The end result will be a machine that is not reliable, and customers may begin to think they are bowling the Petersen Classic™.

For those who do not know, the Petersen Classic™ is a tournament where the conditions are sometimes worse than bowling in a parking lot. It is the only place on the planet where the lane man gets no grief from the players since no one cares if two lanes play the same.

Keeping your machine clean also helps you find potential problems. Loose fasteners or wires can be found and fixed before they interfere with normal lane maintenance. A good cleaning program is worth a few extra minutes per day.

### Daily Cleaning

- First things first, you should **never transport the machine with waste in the recovery tank!**
- Using a clean cloth, wipe down the power cord as you pull the power cord back.
- The oil compartment should be wiped down completely. Do not clean the Transfer Brush or Buffing Brush excessively unless needed.
- Clean drip pads on each side of the machine in the oil compartment.
- Clean the Drive, Lane Distance and Momentary wheels. Dust and lint should not be allowed to build up.
- Wipe squeegee clean and inspect frequently for wear. Keep an extra set of blades on hand (store them in a dark cool place).

- Wipe down the bottom of the machine (this area collects a lot of dust).
- Wipe off the outside of the machine.

### **Weekly or Monthly Cleaning**

- Use compressed air to remove dust from those hard to reach areas.
- Inspect recovery tank filter.
- Clean lint from Transfer Brush and wipe between both brushes.
- Whenever the Duster cloth is changed, clean the entire cleaning compartment and lube the cleaner head bar.
- Wipe off casters; they should not grow hair.
- Remove large black covers and clean around the motors.
- Inspect the motor end of the vacuum and make sure dust does not build up on the cover for the vacuum motor. Not keeping this clean will shorten the life of the motor.
- Inspect the vacuum housing and investigate if wet.
- Check the power cord ends. Because the power cord is pulled, dragged and tugged on a daily basis, the ends should be removed and wires should be inspected. The wires should be firmly in place.

### **Yearly Cleaning**

Yearly cleaning is when you take the opportunity to do a little extra. Spend the entire day on the machine giving it extra care. Remove key components so you can get to some of those hard to reach areas. Scheduling a day or two would be a good thing.

# Lane Maintenance 101

## Overview

Bowling lane maintenance is more than just pushing a button on a lane machine and applying oil to the surface. It also requires giving attention to the approaches, gutters and capping which all get dusty. Maintaining all of this area on a daily schedule is important to provide the best service to your customers. Your lane machine also benefits from keeping these areas clean. Here are a few suggestions that should be followed to maintain your bowling center.

1. One of the first things that should be done each morning is a walk across the approaches. This is when you find out if the lanes, gutters and approaches were dusted the night before. This is also great time to inspect the approaches for any kind of possible problems that just jump out at you. Very helpful on Saturday and Sunday morning after Rock N' Bowl!
2. Walking the lanes each morning also gives you a chance to see what the left over oil looks like in the applied area and what it looks like on the back-ends as well. It is possible to see many things, from unusual amounts of dirt to possible cleaning problems with the lane machine. Who knows what can be found?
3. Want to earn extra money? You just may find a couple of extra coins while dusting the gutters, caps and division rails each and every day. This greatly reduces the amount of dirt the lane machine pulls into the conditioning compartment. It sounds like a lot of work, but so what, it makes your life easier the more you run the machine. If you want to provide the best conditions it will take time. Also, it's easier to keep up on a day-to-day basis.
4. Dust your approaches no less than three times a day... if not four. Some areas of the country or world will require this just to keep them from looking like they were just plowed and ready for planting.
5. Dusting your lanes between conditioning is another big bonus that seems to be a lost art. High lineage and dusty lanes are a bad combination, especially if your lanes are synthetic. Dust will increase the wear on the surface and reduce the life of your lanes, not including the changes that will result in the way the lanes react and play.
6. The approaches are very important to good customer satisfaction and you should pay close attention to them. Besides frequent dusting, using a rotary buffer will improve the slide consistency and cleanliness of your approaches when done regularly.
7. Keeping your lane machine spotless will help you find problems before they become nightmares.
8. Other areas that affect the cleanliness of your lanes is your pinsetters and ball returns (anything that the bowling ball comes in contact with). Dirt comes from these things, along with grease and oil that is very difficult for the lane machine to clean off the surface.





"The Oily Grail"

# CHAPTER 2

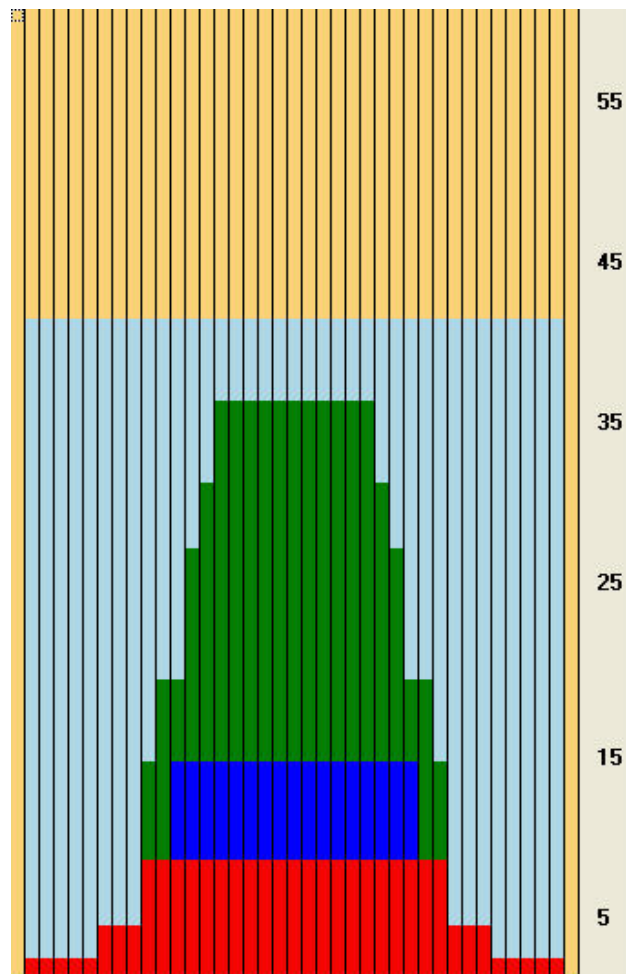


## Conditioning Overview

### How the Conditioner (Oil) is Metered and Controlled

Sanction Technology™ is patented and the only measurable method capable of applying precise amounts of lane conditioner. An explanation of how this is accomplished will help you understand the art form of oil pattern application.

When conditioning a lane, the oil head travels back and forth across the transfer brush applying streams of conditioner. This gives the machine the ability to create patterns like the one below.



The size of the stream can be set to an exact amount or volume. We achieve this exact stream and volume by using a highly accurate fluid metering pump. This pump, running at a constant speed, gives absolute positive displacement of the conditioner. The accuracy of the pump is  $\pm 1\%$  with a continued precision of  $\pm 0.5\%$  after millions of cycles. This is the same pump used in hospital medication dispensers.

The oil head traveling at a constant speed puts down the same amount of oil as it travels across each board. The pump allows us to set the exact amount of conditioner that goes on each and every board within the stream. We measure this amount as the **Volume per Board**.

The pump output is measured in *microliters*. This is a metric measurement for fluid volume. The factory setting for the pump is 50 microliters per board.

To give you a visual perspective of how much conditioner is being applied in 50 microliters, consider that about 20 microliters make up one drop of oil. So each time a stream of oil crosses one board it applies almost 2-1/2 drops of conditioner.

Since this amount of conditioner is too small to measure with the naked eye, we must use a larger number of boards to get an amount we can visibly measure. Factory-set **PATTERN #4** is designed to condition 400 boards. This will give us enough conditioner to determine the amount that is being applied per board. Using a large round number makes the math a little easier to figure.

### **Calibrating the Oil Pump/Volume Test**

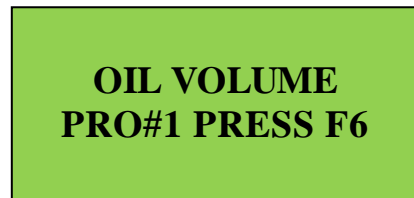
The Kustodian Plus with Sanction<sup>®</sup> Technology allows the conditioner pump to be precisely calibrated before, during, and after use. Press the **MENU** key until the following screen appears: (will **NOT** work in **CLEAN ONLY**)



With this menu you will be able to find out exactly how much oil you are using on each lane in Milliliters or Cubic Centimeters (cc).

You can calculate how much oil is being applied per board for every board on the lane, and how much oil is being pumped out by each revolution of the Metering Pump.

By pressing **NEXT** key, the following menu will appear:



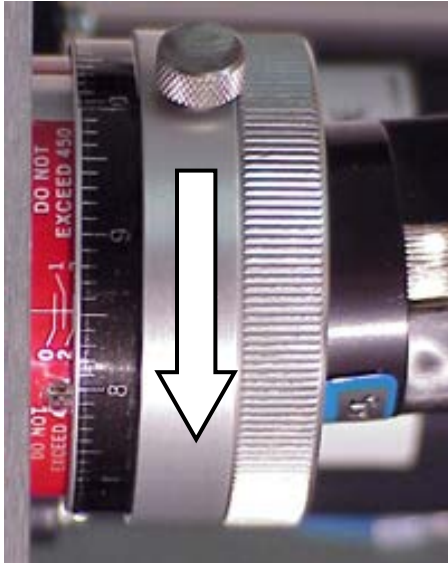
In this menu you can test the exact quantity of oil for both forward and reverse runs. This can be done for any of the 4 programs presently in the memory of the PLC.

Use the **UP ARROW** to change the program to number to **#4**, and the value will be set.

1. Remove the conditioner tip and place into a *perfectly clean* 25 milliliter graduated cylinder and press **F6**.
2. The head will travel back and forth eight times to simulate forward loads. It will pause and then run again for eight loads in reverse. The loads of conditioner are deposited from **2-to-2** four times and **14-to-14** four times for each direction in the graduated cylinder. This is equivalent to a total oil stream of **400 boards**.
3. Remove the tip from the graduated cylinder and read the amount. If the pump is set at 50 microliters, then the output in the cylinder should be 20,000 microliters or **20 milliliters**.

**NOTE:** *There are 1000 microliters (unit of measurement for pump) in 1 milliliter (unit of measurement for graduated cylinder); we divided 20,000 by 1,000 to get 20.*

4. After running the test, the amount in the cylinder should be **20 µl**.
5. If the amount of oil is higher or lower than 20, a pump adjustment is necessary.  
**NOTE:** *Check to make sure the head is moving freely. If it binds up during travel the oil output may be affected.*



Beneath the splash guard on the rear wall of the machine is the Oil pump assembly. The picture shows the calibration ring of the pump. If an adjustment is necessary, turn the dial only about 1/2 microliter.

**NOTE: Direction of the arrow will increase the amount oil dispensed.**

6. Clean out the graduated cylinder using the long felt wick that is provided with the machine. A thorough cleaning is important because any oil left clinging to the sides of the cylinder will give inaccurate readings.

**NOTE:** When felt gets soaked with oil it can be cleaned by squeezing it in a rag or just use strips of rags to clean the graduated cylinder.

7. Keep repeating the test until the amount in the graduated cylinder reads **EXACTLY 20 µl.**

This calibration sets the machine to a standard stream size of **50 microliters per board**. This allows us to "prove" or measure the oil pattern that is programmed into the machine. This value should be entered in the KOSI Advanced Designer screen as the **Oil/Board** value. This will be used for all the pattern volume calculations.

### Proving the Oil Pattern

We will use some generic pattern settings as an example to explain how the math adds up. The numbers below show forward and reverse loads in a hypothetical pattern. From this you can see the boards covered by each load and how many times each different load is being applied.

#### PATTERN STRUCTURE

2 - 2	x	1	(Forward Loads)
10 - 10	x	3	
13 - 13	x	3	

*Zero Loads are ignored going forward and reverse.*

14 - 14	x	2	(Reverse Loads)
13 - 13	x	4	
12 - 12	x	4	
11 - 11	x	2	
2 - 2	x	1	

Each load can quickly be condensed to a total number of boards by referring to the Board Chart found at the end of this section. Using the Board Chart we can determine that a load or stream of oil from **2 - 2 covers 37 boards**.

After converting all the loads the numbers become very simple.

### CONVERTED BOARD QUANTITIES

$$37 \times 1$$

$$21 \times 3$$

$$15 \times 3$$

$$13 \times 2$$

$$15 \times 4$$

$$17 \times 4$$

$$19 \times 2$$

$$37 \times 1$$

When all these loads are multiplied and added together, the result is the total number of boards that are covered by a stream of oil.

### TOTAL PATTERN BOARDS

$$37 \times 1 = 37$$

$$21 \times 3 = 63$$

$$15 \times 3 = 45$$

$$13 \times 2 = 26$$

$$15 \times 4 = 60$$

$$17 \times 4 = 68$$

$$19 \times 2 = 38$$

$$37 \times 1 = 37$$

**374 Total Boards**

In our example, there are 145 boards covered during Forward travel and 229 boards covered during the Reverse travel. This total number (**374**) can be multiplied by the pump setting (**50**  $\mu$ l) to determine the exact amount of oil used when conditioning with this pattern.

374 Boards

x 50 microliters

**18,700** microliters

The total amount is 18,700 microliters. To convert this to milliliters the number has to be divided by 1,000.  $18,700/1,000 = \mathbf{18.7}$  milliliters

The special thing about Sanction Technology is that this total pattern amount can be confirmed by running the pattern and performing a **PATTERN VOLUME TEST**. This step is the most important element in the Process Verification Procedure and you should perform it whenever conditioning lanes for competition. Running the test 3 or 4 times should be enough to convince anyone of the machine's accuracy and repeatability.

**NOTE:** *Any time you run a different program you should calculate the total boards and volume.*

By calculating your program's total oil volume and double-checking the math, you can use the reading you get to check your volume per board adjustment. When the math is correct, it will tell you if the pump needs adjusting. The KOSI software provides a **Total** tab in the Advanced Designer screen that allow you to see the forward, reverse, and total oil volumes and boards crossed so you do not have to do the math.



Having the total output for the program will ensure that the program values are entered correctly. It will also help you understand each change you make. Although it is not information that will be used daily, it is a way of explaining a lane condition in exact terms. These measurements can be written down and duplicated in the future. In other words, it defines a lane condition so that it can be recognized and explained to anyone, much like any other specification of the bowling lane such as its length and width.

**All adjustments to the oil pattern are exact and repeatable with Sanction Technology.**

**Board Chart for Calibrating Oil Pattern (Program) Loads**

This chart shows the total number of boards the head travels across when distributing conditioner. This will make it much easier to determine the amount of oil that is used for your pattern, on paper, before it is measured by the machine during a Calibration Test.

		<b>R I G H T</b>																		
		<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
<b>L E F T</b>	<b>2</b>	<b>37</b>	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19
	<b>3</b>	36	<b>35</b>	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
	<b>4</b>	35	34	<b>33</b>	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
	<b>5</b>	34	33	32	<b>31</b>	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	<b>6</b>	33	32	31	30	<b>29</b>	28	27	26	25	24	23	22	21	20	19	18	17	16	15
	<b>7</b>	32	31	30	29	28	<b>27</b>	26	25	24	23	22	21	20	19	18	17	16	15	14
	<b>8</b>	31	30	29	28	27	26	<b>25</b>	24	23	22	21	20	19	18	17	16	15	14	13
	<b>9</b>	30	29	28	27	26	25	24	<b>23</b>	22	21	20	19	18	17	16	15	14	13	12
	<b>10</b>	29	28	27	26	25	24	23	22	<b>21</b>	20	19	18	17	16	15	14	13	12	11
	<b>11</b>	28	27	26	25	24	23	22	21	20	<b>19</b>	18	17	16	15	14	13	12	11	10
	<b>12</b>	27	26	25	24	23	22	21	20	19	18	<b>17</b>	16	15	14	13	12	11	10	9
	<b>13</b>	26	25	24	23	22	21	20	19	18	17	16	<b>15</b>	14	13	12	11	10	9	8
	<b>14</b>	25	24	23	22	21	20	19	18	17	16	15	14	<b>13</b>	12	11	10	9	8	7
	<b>15</b>	24	23	22	21	20	19	18	17	16	15	14	13	12	<b>11</b>	10	9	8	7	6
	<b>16</b>	23	22	21	20	19	18	17	16	15	14	13	12	11	10	<b>9</b>	8	7	6	5
	<b>17</b>	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	<b>7</b>	6	5	4
	<b>18</b>	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	<b>5</b>	4	3
	<b>19</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	<b>3</b>	*
	<b>20</b>	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	*	*

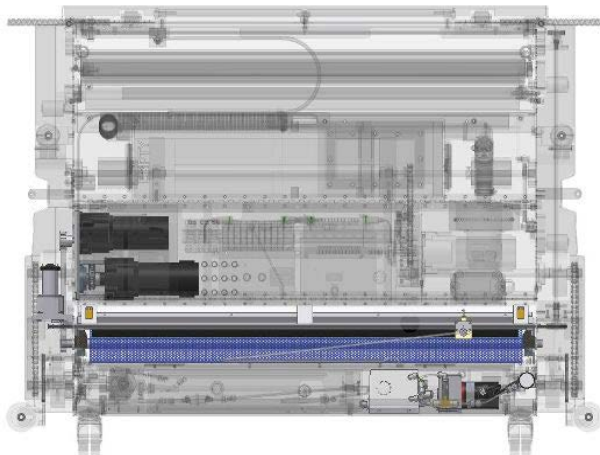
\* Each load of oil should cross at least three boards.





# Conditioning System

## Theory of Operation



This machine uses proven SANCTION TECHNOLOGY® patented by Kegel. This exclusive technology, perfected over the past 2 decades, is the only way to measure the volume of conditioner (oil) that is applied to a bowling lane.

The precision starts with the Fluid Metering Pump. Inside, a ceramic piston and cylinder are precisely milled to perfect clearances. This pump has no valves to impair its operation. The piston revolves and reciprocates during operation for flawless performance.

With the pump rotating at a constant RPM, the conditioner is pumped at an exact flow rate to a three-way valve known as the Oil Pattern Control Valve. The valve in its OFF state routes the conditioner back to the conditioner tank. When turned ON, the valve routes the conditioner to a line connected to the Oil Head.

The OIL HEAD travels back and forth across the transfer system at a constant speed, much like the printer head on a computer printer. The Oil Pattern Control Valve is then turned ON and OFF according to the chosen program. The result is a series of board to board streams of conditioner applied to the transfer system as the machine travels down the lane.

**Anyone who pays attention to the machine's operation  
will really be able to understand lane conditions.  
We use Sanction Technology because all adjustments  
to the oil pattern are exact and repeatable.**

## Change Program Settings

Four (4) factory-preset cleaning and/or conditioning patterns are stored in the computer's memory. These preset programs may be altered in the CHANGE PROGRAM SETTINGS menu. This menu cannot be accessed without entering the Manager's PASSWORD. A combination of the F3, F4, and/or the F5 keys must be used to enter the password.

To see a sample graph and default settings for each of the patterns applied by the programs, please see Section IX in this manual.

To continue within the menu, enter the password using the appropriate sequence of keystrokes. The following prompt will appear:

**CHANGE PROGRAM  
CHOOSE > 01**

To change the program number, use the UP ARROW. The DOWN ARROW does not function in this menu screen. The program number will loop back around to 01 if the UP ARROW is pressed with Program 04 showing.

To continue within this menu, press the **NEXT** key and the following prompt will appear:

**START BRUSH  
IN INCHES - > 30**

This prompt will display the current distance where the machine should start and stop the buffer motor from the foul line. This delay in starting the buffer will apply less oil near the foul line. When the machine is traveling in reverse, the brush will raise off of the lane in the same spot that it turns on going forward.

To change this distance, use the UP or DOWN ARROW to adjust, changing the value sets the data automatically.

When using this feature it is recommended to make adjustments in the oil pattern. An example would be moving the 2-2 loads to the second forward screen and putting small loads such as 19-19's in the first forward screen.

**NOTE:** *There should be a trace of oil on the lane near the foul line to help protect the lane surface.*

To continue within this menu, press the **NEXT** key and the following prompt will appear:

**OIL PATTERN DIST  
IN FEET - > 39**

This prompt will display the current travel distance (buff out in feet) for the program selected. In this case, the machine will travel 40 feet before returning to the foul line (in oil only). To change this distance, use the UP or DOWN ARROW and the value in the lower right corner will reflect the changes.

**DROP BRUSH IN  
REV IN FEET 40**

If you want even MORE control of the mid lane, then this feature is for you! This feature is used to choose where you want the brush to turn on in reverse. The upper limit is the oil distance and the lower limit is where the oil starts in reverse.

When the oil distance is changed, this value will default to that same distance and this feature will need adjusted back to your desired setting.

It is possible to drop the brush after the reverse oil distance has been reached, but this will require a call to Kegel's Lane Maintenance Central for tech support

Any changes made to this value will be accepted by the PLC without the need to press ENTER. Make sure you complete all the programming steps that follow when the pattern distance is changed.

**IMPORTANT NOTE:** If the UP or DOWN arrows are pressed in this screen, then ALL conditioning menus for the forward and reverse loads must have the **ENTER key pressed 4 times** before the NEXT key will advance you to the next load screen. A green LED light above the MENU key will indicate when the NEXT key is enabled. The program will not exit the load screens until you have advanced to the REVIEW or EXIT screen.

If this is correct, press the **NEXT** key. The following prompt will appear:



**01F 2L-2R X 04**  
**00 > 04 FT IPS=10**

**01F** is the menu number for the first load screen for forward oil. There are 15 possible load screens for forward oil.

The next item, **2L- 2R** designates the load (the length of the stream of oil applied to the transfer roller) will run from the 2 board on the left to the 2 board on the right. The next item, **X 04** determines how many 2 to 2's will be applied, in this case it is 4.

On the bottom line the **00->04 FT IPS= 10** says that the machine will travel from 0 ft (the foul line) to 4 ft at 10 inches per second (IPS).

When the screen is first displayed, the left load size designator **2L** will be blinking. This means it is the only one that can be changed.

By pressing the UP ARROW once, the 2L will increment to 3L. When the desired left side load designator is reached, press ENTER and the right side designator 2R will begin blinking (kind of like a digital watch).

**NOTE:** All loads entered into the program must begin on the left side and end on the right side, so the smallest load would cover 3 boards (19L to 19R). However, this limitation can be overcome by downloading the program from KOSI.

The blinking designator indicates the right load limit is ready to be changed. Use the Up or Down Arrow until you reach your desired number, then press ENTER.

Now **04** will begin blinking, Up or Down Arrow this to the number of loads you want and press ENTER.

Two things will now happen: 1)The **IPS** number will begin blinking, and 2)the **distance** it takes for that load screen will re-calculate.

For example, if you increase the load number from 4 to 5 the 00->07 FT will change to 00->10 FT. Since the 18 in IPS=18 is now blinking you now may Up Arrow or Down Arrow the speed.

The speed choices you have for the first screen is 10. When the desired speed is reached press ENTER. This will be entered into memory.

***NOTE:*** *Speed changes should be an even flow from slower to faster, from one screen to the next. Speed changes will control the lengthwise taper of the pattern. They also allow the operator to add-in more loads and still have the last load be within the oil pattern distance.*

The ENTER key will loop you back around to the left side load designator and it will begin blinking again. Also if the speed is changed, the program will re-calculate the area of the lane for that load sequence.

For example, if you have 4 loads at 14 inches per second, the area of the lane for that load sequence is 00->07 feet and you change the speed to 18 inches per second, the area for that load sequence will change to 00->10 ft.

During a Cleaning Only Program, the travel speeds and shift points can be controlled by entering "phantom loads" into these screens. To make the machine shift speeds at a specified point, **set the speed** and then enter loads until the prompt shows the desired footage for the shift point.

**NOTE:** The machine will automatically travel at High Speed (or 30 IPS) after it has reached the Oil Pattern Distance. The pattern distance can be increased up to 55 feet.

ENTER may be pressed as many times as you want. Pressing ENTER simply steps the blinking variable from one to the next. Later in this manual we will refer to this as "Entering Around". But remember, only the variable that is blinking will be changed with either the Up or Down Arrow at any given time.

If the Up or Down Arrow is pressed while in this menu, the ENTER key must be pressed 4 times before the NEXT key will let you into the next load screen.

Now press the **NEXT** key. The following menu prompt will appear:

**02F 9L-9R X 01**  
**04 > 06 FT IPS=14**

The 9L will be blinking. In the previous screen we left with the load area at 00 to 04 feet, the beginning screen in the second screen forward begins with the ending distance of the previous screen. The area for this screen is calculated from the number of loads and the speed.

Any changes to this screen are performed the same way the first changes were entered. Remember, you must press the ENTER key 4 times before you may use the NEXT key to go into the third screen.

Press **NEXT** and the following menu will appear:

**03F 10L-10R X 02**  
**06 > 10 FT IPS=14**

You may now change this screen to anything you want. Remember you must press ENTER 4 times after any changes of load number or speed before you may use NEXT to advance to the next load screen.

Press **NEXT** and the following menu will appear:

**04F 11L-11R X 02**  
**10 > 13 FT IPS=14**

You may now change this fourth load screen to anything you want. Remember you must press ENTER 4 times after any changes of load number or speed before you may use NEXT to advance to the next load screen.

Press **NEXT** and the following menu will appear:

**05F 12L-12R X 02**  
**13 > 19 FT IPS=18**

You may now change this screen to anything you want. Remember you must press ENTER 4 times after any changes of load number or speed before you may use NEXT to advance to the next load screen.

Press **NEXT** and the following menu will appear:

**06F 13L-13R X 01**  
**19 > 21 FT IPS=18**

You may now change this screen to anything you want. Remember you must press ENTER 4 times after any changes of load number or speed before you may use NEXT to advance to the next load screen.

Since the area for this load screen is getting close to the overall oil distance set previously ... there is one more rule.

**Keep in mind that the area for each load is calculated with the ending distance of the previous load screen. This is the starting distance for each successive screen.**

The ending distance is calculated with the number of loads versus the speed that the machine is programmed to travel. This is added to the starting distance for each screen.

When changing the number of loads, the program will not allow you to increment the number so that it takes the ending distance beyond the oil travel distance. It won't let you increase the speed so that it takes you beyond the oil pattern distance either.

After pressing **ENTER** 4 times, press **NEXT** and the following menu will appear:

**07F 2L-2R X 00**  
**21 > 39 FT IPS=26**



The **last load screen forward** must have a value of 00 for the number of loads. This screen will control the Buffer distance. By placing a **00** in this spot it will not activate the oil head since no oil is being asked for. Always end your applied oil at a minimum of 4 feet prior to the end the Oil Program!

When 00 for the number of loads is showing and ENTER is pressed on the speed variable, the next blinking variable will now be the ending distance for that screen.

It is possible to increment it up to the travel distance. When the oil travel distance is reached as the ending distance for the screen you are in, it concludes the oil forward screens. Even though 15 screens are possible, the program will show only those needed to reach the travel distance.

**NOTE:** If you were to go into the screen with the last oil distance to increment the number of loads from 0 to 1, the program will not allow you to increase the number of loads until you "enter around" to the travel distance and decrement it. Use the Down Arrow to change it to something less than the oil pattern distance. You may then enter around to the number of loads and change it.

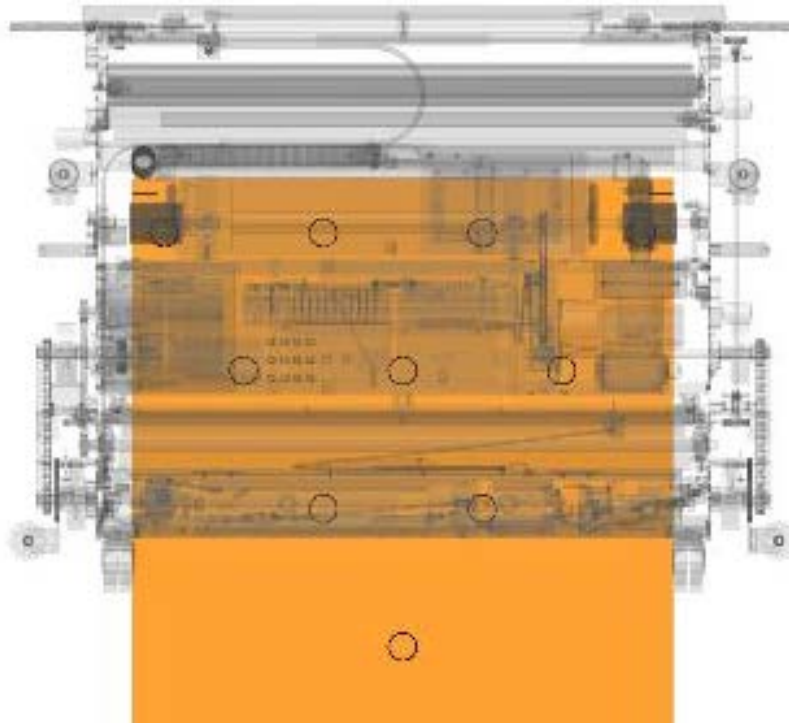
Don't forget you must hit ENTER 4 times after changing any speed or number of loads. If you do this, it will open up another forward screen when you press the NEXT key. The number of loads will be 00 automatically and the ending distance could be anything above the oil travel distance (or even below the starting distance of that screen). Be very careful in this instance. Be sure and enter around and increment the distance up or even down to the oil distance.

If each screen going forward does not flow from the foul line to the travel distance, the machine will not function properly. Overlapping load areas are only possible when opening up new screens previously not used.

It is also possible to make the machine have loads right up to the travel distance. This is not recommended. You should set the program so that it has at least 4 feet of buff only. In other words, you should have it finish loading at least 4 feet before the oil travel distance. The last screen forward must be 0 loads.



After applying the conditioner loads for the forward pass, the machine will continue down the lane (when cleaning) and enter the pindeck area at a speed of 10 inches per second. This slower speed gives the vacuum a better chance to pick-up the cleaner and oil. The machine should clear the tailplank as shown in the diagram below.




During the reverse travel, the machine is set to reverse at 18 inches per second, then shift to high speed after traveling about four and a half feet from the tail plank.

## RETURN OIL SCREENS

When the last screen forward has been entered you may now proceed to the next screen. If no changes are needed to the reverse screens, you will be able to advance through them without pressing the ENTER key four times for each screen.

Press **NEXT** and the following menu will appear:



**01R 2L-2R X 00**  
**39 > 33 FT IPS=26**

Notice the screen number is now 01 again and the F has changed to an **R** (meaning reverse). The area for load screen now starts at the oil travel distance and goes down.

The first screen in reverse must be a buff only (00 loads) for at least the first 1 foot of return travel. The last screen in reverse should be 00 loads for at least 4 feet before the foul line (just like the last screen forward).

**NOTE:** *If the machine does not oil in reverse at all, check the **01R** screen for loads within the first foot of return oil travel. Remove any loads to change the screen to a buff only for at least 1 foot.*

**IMPORTANT NOTE:** If the UP or DOWN arrows are pressed in this screen, then ALL conditioning menus for the reverse loads must have the **ENTER key pressed 4 times** before the NEXT key will advance you to the next load screen. A green LED light above the MENU key will indicate when the NEXT key is enabled. The program will not exit the load screens until you have advanced to the REVIEW or EXIT screen.

To move to the next load, press the ENTER key 4 times (if necessary) and press **NEXT** and the following menu will appear:

**02R 13L-13R X 03**  
**33 > 25 FT IPS=18**

You may now change this screen to anything you want using the procedures described previously.

Press **NEXT** and the following screen will appear:

**03R 12L-12R X 02**  
**25 > 20 FT IPS=18**

You may now change this screen to anything you want using the procedures described previously.

Press **NEXT** and the following screen will appear:

**04R 11L-11R X 04**  
**20 > 12 FT IPS=14**

You may now change this screen to anything you want using the procedures described previously.

Press **NEXT** and the following screen will appear:

**05R 10L-10R X 03**  
**12 > 06 FT IPS=14**

You may now change this screen to anything you want using the procedures described previously.

Remember the last screen in reverse should always end a minimum of **4 feet** before the foul line (or 00 feet). If more than 2 or 3 loads are set for reverse, then end the loads even sooner.

If you don't want the loads to affect the oil pattern on the next lane, then you must pay attention to where the loads end, and how far the machine can travel as it buffs to the foul line.

Press **NEXT** and the following screen will appear:

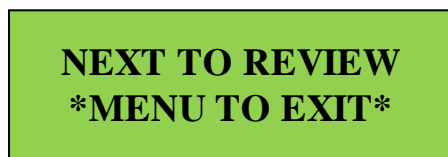


**06R 2L-2R X 00**  
**06 > 00 FT IPS=14**

Since there are no loads, this is the final reverse screen. There are also 15 screens possible in reverse. The reverse oil is typically used to "beef up" the lay down and or skid area in the first 10 to 20 feet of the lane. Do this with several loads at a slower speed.

**NOTE:** When the 15th screen is reached, going forward or reverse, the number of loads is forced to 00. The load area ending distance is forced to the oil distance going Forward, and forced to 00 when going in Reverse.

Press **NEXT** and the following menu will appear:



**NEXT TO REVIEW**  
**\*MENU TO EXIT\***

From this menu prompt it is possible to change Data Memories and adjust the clock (after entering the password). It is recommended that you use KOSI to adjust these settings and always call Kegel Tech Support if this area needs to be accessed.

In this screen you may press NEXT to review the current program settings from the top of the menu, or press MENU to exit the Change Program Settings and go into the another Managers Menu.

## 7 Day Planner Program

From the RUN SCREEN press the F1 MENU key until you get to the following



**7 DAY PROGRAM  
PLANNER**

This feature allows the machine to store specific conditioning programs to be used for each day of the week, within each time period of the day.

The "real time" clock in the machine's PLC keeps track of the time of day and will run the program selected for that specific time period. The time periods are not broken down by the hour, but rather are separated into two time categories, AM and PM.

For example, a conditioning program selected for Monday AM means that operation of the machine any time between 12:01 AM and 12 Noon will apply that selected conditioner program.

To continue within this menu, press the **NEXT** key and the following prompt will appear:



**MONDAY  
AM > 01**

Use the **UP ARROW** to change the program number and the value will be set. The DOWN ARROW does not function in these menu screens, the program number will loop back around to 01 if the UP ARROW is pressed with program 04 showing.

Press the **NEXT** key and the PM time period for Monday will appear:



**MONDAY  
PM > 01**

Once again, use the **UP ARROW** to change the program number and the value will be set.

Advance to the rest of the days of the week with the NEXT key and enter the program numbers that you wish to run for each time period of each day.

A program can be entered for each of the following time periods:

<b>MONDAY AM</b>	<b>MONDAY PM</b>
<b>TUESDAY AM</b>	<b>TUESDAY PM</b>
<b>WEDNESDAY AM</b>	<b>WEDNESDAY PM</b>
<b>THURSDAY AM</b>	<b>THURSDAY PM</b>
<b>FRIDAY AM</b>	<b>FRIDAY PM</b>
<b>SATURDAY AM</b>	<b>SATURDAY PM</b>
<b>SUNDAY AM</b>	<b>SUNDAY PM</b>

**NOTE:** The machine will only run the program set for that day and time. If you wish to override a program press the F5 key in the operating screen and press the down arrow to choose the desired program. When power is removed the machine will change back to its original program that was set into the 7 day program planner

## Adjustments

### **Buffer Brush** (An adjustment video is available in KOSI.)



The buffer brush is made of a long-lasting synthetic bristle, which under normal circumstances can be expected to last approximately 18 months. However, changing this annually before each league season is recommended to ensure consistency throughout the year.

To check the buffer brush adjustment, the brush must first be in the down position. This is done at the **TEST OUTPUT** menu. (Refer to Chapter 5). If the brush is not already down in the "zero" position, go to your Test Outputs to the correct number and place in the down position.

With the brush down, stand the machine to the upright position and hold a level or straight edge across the drive wheels and rear lane distance wheels (shown above). The buffer brush material should extend approximately **3/32"** to **3/16"** (2.38 mm to 4.76 mm) beyond the straight edge for proper adjustment. The buffer brush is factory adjusted prior to being shipped at approximately **1/8"** (3.2 mm).



If an adjustment is needed, determine how much and then place the machine on the approach in the operating position. Open the splash guard and locate the adjusting screws above the lane distance sensor shaft. Loosen the jam nuts on the two adjusting screws, along with the three lane distance shaft pillow blocks.



Turn the adjusting screws until proper adjustment is reached. Each full turn of an adjusting screw is equal to a little less than 1/16" adjustment (1.41 mm). Tighten the jam nuts on the adjusting screws.

Make sure that the Lane Distance Sensor (LDS) pillow blocks are firm against the adjusting screws and then tighten the pillow blocks. Always tighten the center block last.

Once the blocks are secure, check that the LDS shaft turns as freely as possible, and there is a small amount of end play in the shaft. If the shaft does not spin freely, check and make sure the shaft is square throughout the LDS blocks.

**NOTE:** When cleaning the buffing brush, **NEVER** use any type of cleaner on the brush. Use of cleaners will decrease the brush's ability to hold conditioner and greatly affect the lengthwise taper of the conditioner pattern. All that you need to clean the buffer brush is a clean, soft, dry rag.

## **Transfer Brush**

The following steps adjust the transfer brush to the buffer brush.

**Step 1:** Loosen the four #8-32 screws on the right and left side that are used to secure the adjustment (but keep them snug).

**Step 2:** Using an 1/8 inch Allen wrench turn the screw clockwise to raise the transfer brush or counter-clockwise to lower the transfer brush. You want to position the transfer brush so it is just touching the buffer brush, then turn it counter-clockwise to lower the transfer brush into the buffer brush so that when you turn on the buffer motor you have about an **1/8 - 3/16** of an inch (3.2 mm – 4.8 mm) of crush evenly on the top side. Once you get this adjustment, tighten your screws completely.

**Step 3:** Stand the machine up onto the transport casters and check the transfer brush crush to the buffer brush. To check this you will need to manually turn the buffer brush towards you, the bristles on the buffer brush should pull back about **1/8 - 3/16** of an inch. If this is not correct, you will have to return to the top side and make the adjustment the same way you adjusted the crush on the top side, but only loosening up the bottom screw on each side. Moving this may affect the adjustment you made on the top side so you might have to go back and forth from top side to bottom side until you get the **1/8 - 3/16** of an inch of crush on the top and bottom side of the transfer brush.

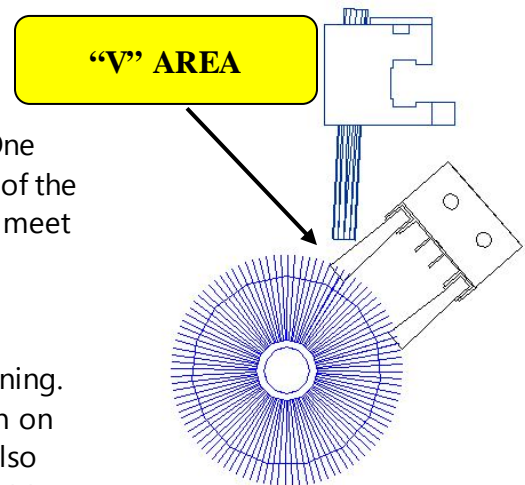
## **Oil Tip**

Correct adjustment of the Oil Tip is very important and is a determining factor in applying a consistent pattern.

There are two adjustments that can be made to the oil tip. One adjustment is the height of the tip. The other is the position of the tip. The point where the Transfer Brush and the Buffer Brush meet will form a "V". The Oil Tip should be as close to this "V" as possible, without actually dispensing oil into the "V" area.

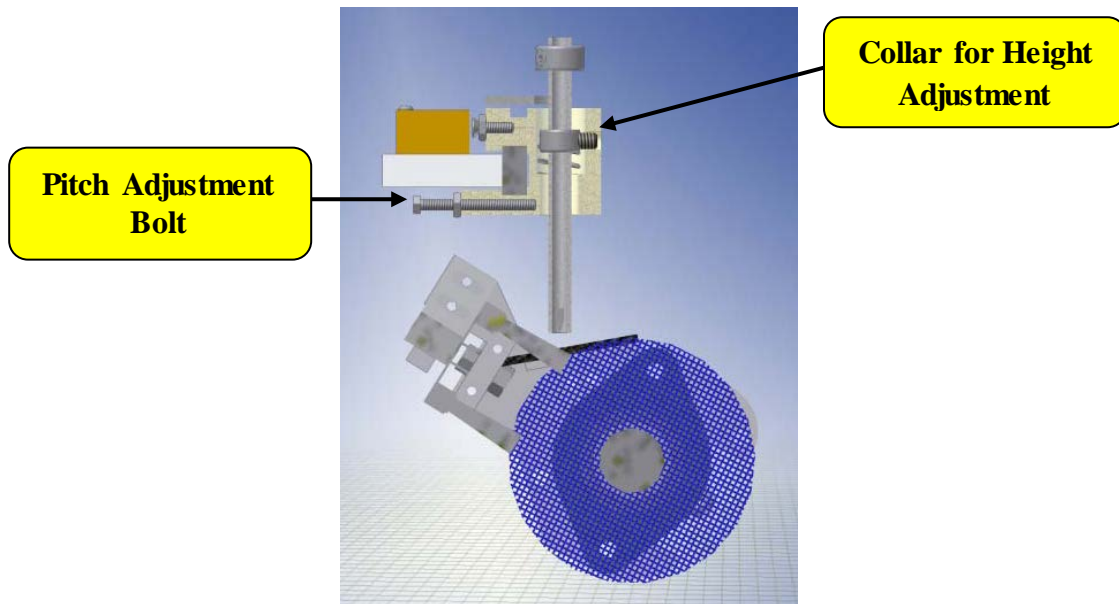
This adjustment should be checked with the buffer brush running. To operate the brush, go to your TEST OUTPUT screen to turn on the motor. After making each position adjustment you will also need to make sure the tip is as close to the drip pads as possible, without touching them.

The oil tip height can be adjusted by loosening the set screw in the tip holder collar and sliding the tip holder up or down. Re-tighten the set screw when desired height is achieved.





The oil tip pitch can be adjusted using the screw and jam nut. Pitch should be set to dispense conditioner on the black transfer brush (very close to the V) not on the blue buffer brush.



**NOTE:** If you notice a zigzag pattern in the oil on the lane, you will need to adjust the Oil Tip position. Adjust the oil tip further up the transfer brush to eliminate this problem (make adjustments in small increments until zigzags disappear).

### **Timing Belts**

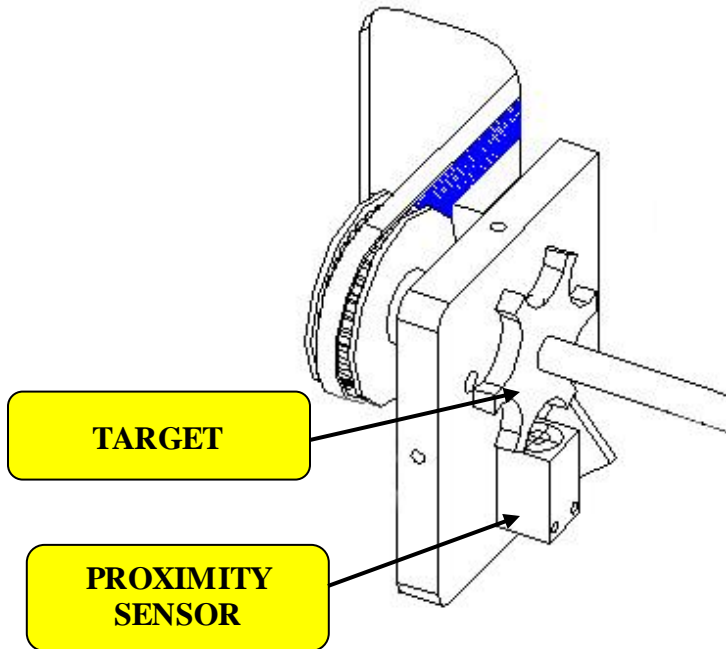
There are 3 timing belts that operate in the conditioning system. Refer to the KOSI videos to see the proper amount of tension required for each belt.

1. **Buffer Belt:** The machine has a belt tension roller that can be positioned to maintain the proper tension. The belt should have a fair amount of tension and should just flex a small amount when pressed on, but not be overly tight. If the belt is too loose it is possible for it to jump cogs and this is not good.
2. **Oil Pump Belt:** It is important to run the oil pump belt on the loose side. Overtightening of this belt will reduce bearing life in the pump and cause premature failure of the oil pump motor. This may also cause oil volume fluctuations. Loosen up the oil pump motor fasteners to change belt tension.
3. **Oil Head Belt:** This belt should run on the tight side. **Unplug the head motor fuse before attempting to work on this belt to disable the braking circuit.**

To adjust head belt tension, loosen the motor up from its mount, adjust to the desired tension and tighten all screws when done. This belt drives the board counting disk and the cleaner assembly making it important that the belt not run loose. A loose belt can cause the machine to lose its oil head timing and the timing that controls the movement of the cleaner head.

Replace fuse when belt tension is correct and fasteners are tight.

**Board Counting Target and Proximity Switch** (An adjustment video is available in KOSI.)



The timing for the oil head is a precise adjustment. **Before making an adjustment, the Head Motor Fuse will need to be removed to disable the braking circuit.**

Remove the plastic cover on the 10-pin side to access the sensor assembly. Once the cover is off you will be able to see the belt tension and head timing assembly. If a timing adjustment is necessary, follow these steps closely to avoid confusion.

1. Move the oil head against the 10-pin side wall.
2. The tension for the head drive belt should be adjusted at this time. Pushing down on the belt, half-way across the head track, you should feel the belt get tight just before it touches the track.

The diagram above shows the board counting target and the board counting proximity sensor.

The gap between the target and the proximity sensor should be  $0.015 (\pm 0.005)$ . The proximity sensor should be mounted square to the plate.

3. The next procedure is to adjust the board counting target by using the indicator lights on the proximity sensors. These lights come on when metal passes by the face of the sensors. The goal is to have the indicator light for the board counting proximity sensor come on when the oil head target is in the middle of both the left and right lane edge sensors (or very close to middle).

**NOTE:** The distance between the metal target on the oil head and the proximity sensor should be a gap of **0.015"**.

4. Move the oil head all the way to the 10-pin side wall (outside of the proximity sensor). Slowly move the head toward the middle of the lane edge proximity sensor. When the board counting sensor light comes on, stop and note the position of the oil head target to the lane edge sensor. Use this same procedure for the 7-pin side.

5. After doing step #5 if you have the board counting sensor indicator light coming on in the same position for both lane edge sensors then the adjustment is good. If not, go to the next step.
6. If on the 10-pin side the board counting sensor comes on too soon and the 7-pin side comes on late, the board counting target will need to be turned in a counter-clockwise direction and vice-versa if they are off in the other direction.

**NOTE:** *When determining the direction to turn the target look at the face of the target for clock direction.*

7. Now it is time to make sure that the board counting target is secured and the head assembly is tight. Place the cover back on the head assembly and re-insert the two mounting screws.

**NOTE:** *The machine's computer has to park the oil head on the right side to ensure the proper starting point for loads of conditioner. When the head goes to the home or zero position it will bump into the side wall and kick back. The clicking sound that is heard is normal and no damage is occurring to the machine.*

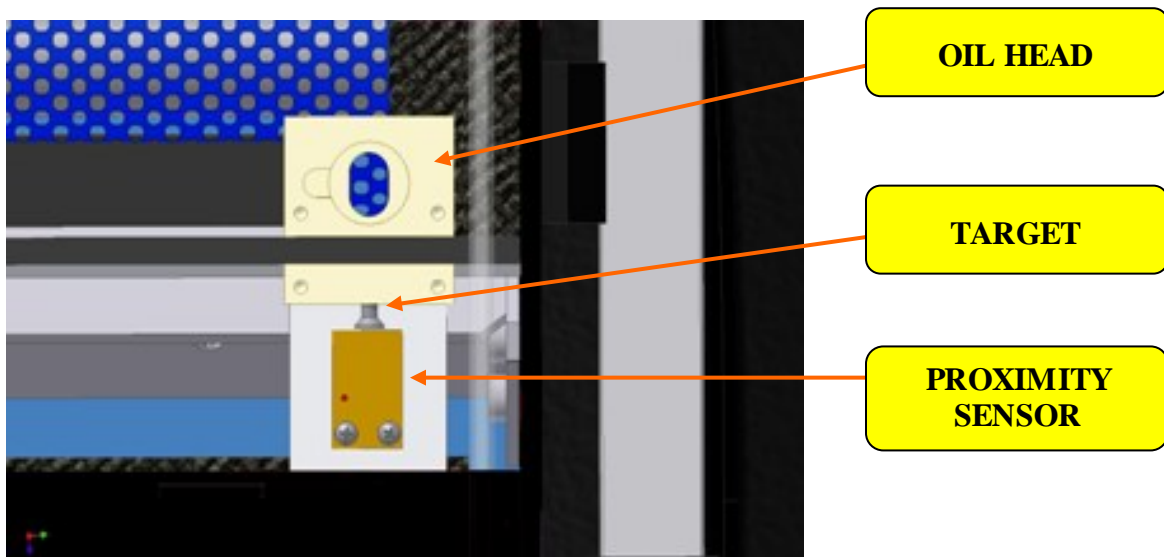
8. Move the oil head all the way to the 10-pin side wall (outside of the proximity sensor). Slowly move the head toward the middle of the lane edge proximity sensor. When the board counting sensor light comes on, stop and note the position of the oil head target to the lane edge sensor. Use this same procedure for the 7-pin side.
9. After doing step #5, if the board counting sensor indicator light is coming on in the same position for both lane edge sensors then the adjustment is good. If not, go to next step.
10. If on the 10-pin side the board counting sensor comes on too soon and the 7-pin side comes on late, the board counting target will need to be turned in a counter-clockwise direction and vice-versa if they are off in the other direction.

**NOTE:** *When determining the direction to turn the target, look at the face of the target for the clockwise rotation. The illustration shows a clockwise adjustment (when the 7-pin sensor light is coming on too soon).*

11. Now it is time to make sure that the board counting target is secured and the head assembly is tight. Place the cover back on the head assembly and re-insert the two mounting screws. Replace the fuse for the motor.

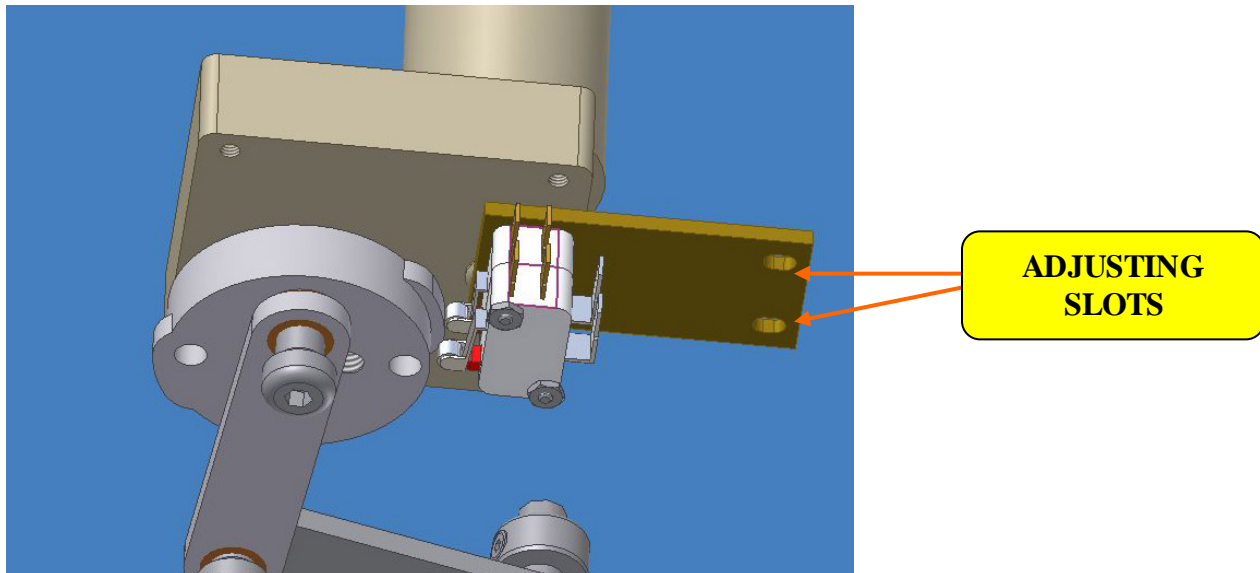
**NOTE:** *The machine's computer has to park the oil head on the right side to ensure the proper starting point for loads of conditioner. When the head goes to the home or zero position it will bump into the side wall and kick back. The clicking sound that is heard is **normal** and no damage is occurring to the machine.*

## Oil Head Target



The moving Oil Head uses a flat head screw as a target for the Board Edge Sensors to “see”. The screw should be adjusted to **0.010”** (0.254 mm) from the face of the proximity sensors. Check both sensors to be certain that the gap is the same. The proximity sensors have a small amount of adjustment so they can also move if necessary.

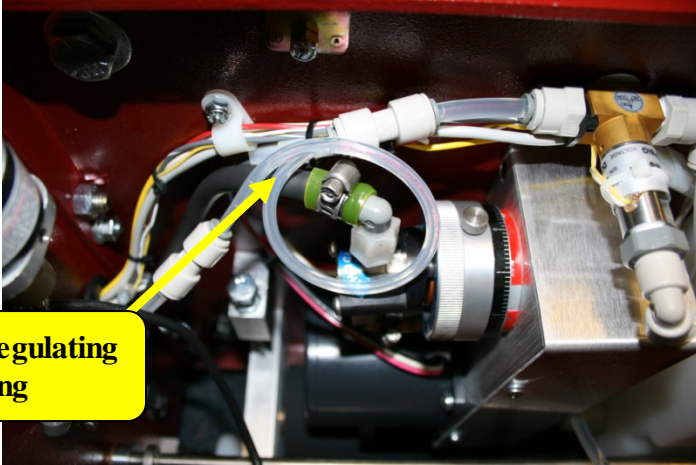
## Brush Lift Switches



The Brush Lift Switches are mounted to a plate that has adjusting slots. The switch plate adjustment should be checked when each switch is on the cam lobe. The switch rollers should not “bottom out” and have only between 0.005” and 0.010” over-travel of the roller (about 0.127 mm to 0.254 mm).

## Pressure Regulator Tubing

A wide range of conditioner viscosity has been tested in the machine to determine the size and length of the pressure regulator tubing that is needed. Keep in mind that these are only **guidelines**; temperature greatly affects viscosity and may change these results. The conditioners (oils) listed below have a viscosity range from about 30-40 cps.



**Pressure Regulating Tubing**

Testing was performed at 72° Fahrenheit with a variety of conditioners with the pump calibration set at 55 µl. Equipment is available to measure the viscosity of any conditioner. A viscosity cup, thermometer, and a stopwatch are valuable tools if you are mixing your own blend of conditioner. Call Kegel for more information on how to obtain this equipment.

The oil pressure for this model machine is a little higher than previous designs due to the 6 different pump speeds available in the machine. The mechanical adjustment of the pump is done at the 55 µl setting at the maximum speed value of 45B0 (this is a hexadecimal value).

<i>Conditioner (Viscosity)</i>	<i>Size (OD)</i>	<i>Length</i>	<i>Pressure</i>
Offense HV (39.1 cps)	3/16"	18"	42psi
Prodigy (29.7 cps)	3/16"	28"	36psi
Defense-S (39.6 cps)	3/16"	18"	42psi
Infinity (35.4 cps)	3/16"	28"	32psi
Navigate (29 cps)	3/16"	28"	36psi
Fire (45.1 cps)	3/16"	14"	41psi
ICE (40.9 cps)	3/16"	18"	42psi

**Note:** When using a conditioner with a higher viscosity than 60, use a 1/4" OD (6.35 mm) piece of tubing that is approximately 3" long (7.62 cm) and connect it between the Tee Fitting and the Oil Control Valve Input Fitting. Store all the elbows, fittings, and lines in a safe place in case you want to switch back to a lighter conditioner. The machine has been tested up to 100 centistokes. The machine ships from the factory with roughly a 28" piece of 3/16" pressure regulator tubing for Prodigy (71 cm long).

To purchase stock tubing for adjusting the regulator lengths order the following part numbers:

**154-0202A** - 1/4" OD Tubing Stock (Inch)

**154-0202B** - 3/16" OD Tubing Stock (Inch)

## Troubleshooting the Conditioning System

Please go over this section if there is any kind of problem with your conditioning system. Reviewing this before calling for Technical Support will help in correcting any problems you may have and allow you to communicate more clearly with a technician on the phone.

### Conditioning Problems Indicated by Error Messages

Problems that display errors are normally corrected easily and happen for definite reasons. Usually, a stuck or out of adjustment switch (and possibly loose or damaged wires) will cause most problems when the machine is old.

**ERROR MESSAGE  
CODE B3**

If an input fails to go off completely and still displays a dim light, the PLC will still consider that as a good input, so look very closely.

Normally, this error occurs when Input 0CH 05 fails to receive a signal within 3.5 seconds of the motor starting.

Here are the possible causes that can produce a BRUSH DOWN ERROR. If the Brush Lift Motor does not run, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #9**. Check for operation by pressing **F5** and the brush should go either up or down, depending on location.

1. The brush lift motor runs but the down switch failed to operate and send a signal to PLC Input 0CH 05.
  - a. Check and inspect the microswitch. Manually operate switch to see if Input 0CH 05 will illuminate.
  - b. Possible broken wire or loose connection in either the yellow 24 VDC wire or the Violet/Yellow Wire that connects to Input 0CH 05.
  - c. This error can also happen if the Brush Up Input 0CH 04 is stuck on.
2. Brush Lift motor does not run when tested in the Output Test. You will need to determine if power is getting to the motor.
  - a. Fuse is blown or fuse holder is bad.
  - b. Brush bearings are causing a bind not allowing free movement up and down.
  - c. Relay came loose in socket or has failed.
  - d. Motor has failed.
  - e. Bad connection to motor, check all power wiring to motor.
  - f. PLC output 11CH 02 failed.

Normally, the Brush Up Error occurs when Input 0CH 04 fails to receive a signal within 3.5 seconds of the motor starting. Below is a list of the possible causes that can produce a BRUSH UP ERROR.

**ERROR MESSAGE  
CODE B4**

Here are the possible causes that can produce a **B4 BRUSH UP ERROR**. If the Brush Lift Motor does not run, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #9**. Check for operation by pressing **F5** and the brush should go either up or down, depending on location.

1. The Brush Lift motor runs but the up switch failed to operate and send the signal to PLC Input 0CH 04.
  - a. Check and inspect microswitch, manually operate switch to see if Input 0CH 04 will illuminate.
  - b. Possible broken wire or loose connection either the yellow 24VDC or the Green/White Wire that connects to Input 0CH 04.
  - c. This error can also happen if the brush down Input 0CH 05 is stuck on.
  
2. Brush Lift motor does not run when tested in the Output Test. You will need to determine if power is getting to the motor.
  - a. Fuse is blown or fuse holder is bad.
  - b. Brush bearings are causing a bind not allowing free movement up and down.
  - c. Relay came loose in socket or has failed.
  - d. Motor has failed.
  - e. Bad connection to motor, check all power wiring to motor.
  - f. PLC output 11CH 02 failed.

**NOTE:** *The brush lift motor (and the squeegee motor) will both time-out in 9 seconds if the position switch the PLC is looking for is not actuated. Before the motor "times-out", the machine should have stopped and displayed an error.*

Normally, this error screen appears when Input 0CH 01 fails to receive a signal within 0.5 seconds of the head motor starting or if there is not a continuous pulsing signal as the motor runs. This makes the machine think that the motor is not running causing the machine to stop.

**ERROR MESSAGE  
CODE H7**

Here are the possible causes that can produce a **H7 OIL HEAD TRAVEL ERROR**. If the Oil Head Motor does not run, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #16**. Check for operation by pressing **F5** on both the Test #16 Right to Left and Test number #17 Left to Right motors.

1. Oil Head Motor runs, but Input 0CH 01 does not operate when oil head is moving or it was interrupted.
  - a. Board counting target has fallen off the shaft.
  - b. Board counting sensor has failed.
  - c. Wire between sensor and PLC is damaged or loose causing an open connection.
  - d. Motor is starting too slow due to lack of lubrication on the oil and cleaner sliding head bars.
  - e. Cleaner belt jumped timing causing the cleaner head to jam against the wall of the machine. A set screw can come loose resulting in this problem.
  
2. Oil Head Motor does not run in one or both directions.
  - a. PLC Output Fuse is blown.
  - b. Motor has failed.
  - c. CR9 Left to Right relay is defective
  - d. CR10 Right to Left relay is defective

**ERROR MESSAGE  
CODE FO**

This error lets you know that the machine is low on conditioner (oil). Simply fill the tank to clear error from the screen, then restart machine.

If this does not clear the error, the float may have a problem. Unplug float and install the jumper plug to by-pass the float (if the jumper is lost a paper clip works well). The jumper plug should be secured properly in the conditioner compartment and the proper repairs should be done as soon as practical.



## **Conditioning System Problems that DO NOT Display Errors**

There are a number of things that can go wrong even if the machine appears to operate correctly. Most of these problems can be caught before the bowlers notice them but only if the operator is paying attention. **Doing a calibration test every day will eliminate many problems from turning into disasters.**

1. Oil Pump fails to run.
  - a. Motor is unplugged or has a damaged or open connection.
  - b. Motor has failed.
  - c. PLC output 10CH 00 failed.
  
2. Buffer fails to run, which will cause serious conditioning problems if the motor works on some of the lanes and fails on others.
  - a. Blown fuse.
  - b. Motor is unplugged or has a damaged or open connection.
  - c. The buffer motor relay failed or is loose in the base.
  - d. Motor has failed.
  - e. Belt is broken.
  
3. Machine oils 2-2 more than programmed or looks as if it is just oiling 2-2 badly (a.k.a. Sport Shot Error).
  - a. Board counting target is loose but not giving errors.
  - b. Gap is too large between the board counting sensor and the target.
  - c. Oil tip insert has come out of the line (Replace with part # 154-6832).
  
4. Machine fails to dispense oil from tip.
  - a. Oil pump motor has failed.
  - b. Pump has failed.
  - c. Pump belt is broken.
  - d. Oil control valve has failed.
  - e. PLC oil control valve output 10CH 00 failed.
  - f. Filter is clogged.
  - g. No oil in tank and the float failed to error machine.
  
5. Conditioner (oil) loads not ending at correct footage.
  - a. Oil Head not running at correct speed; Check Oil and Cleaner Heads for lubrication.
  - b. Machine speeds are not set correctly.
  
6. Oil Valve time has increased.
  - a. Oil Head is not running at correct speed, check oil and cleaner heads for lubrication.
  - b. Board counting target loose.
  - c. Wrong program was run or someone has changed the program (#1 culprit☺).
  - d. Belts are too tight on one or both of the moving heads.
  - e. Shaft bushings need lubricated.

## Maintenance

It is very important to maintain a clean environment in the conditioning compartment. Not doing this will result in oil migrating through the entire machine causing damage to wiring and making a mess of things. The following procedures should be followed in order to keep your machine healthy.

### Daily Maintenance

1. The felt in the compartment must be wiped down and the drip pads on each side of the machine must be wiped off.
2. Wipe around the moving head and check each end of the rail.
3. All surfaces around the oil compartment should be wiped down.
4. Make certain that the moving head bar does not get dry in either the oil or cleaning compartments, but **DO NOT over-oil**, just a film of oil is all that is needed.
5. Remove lint from transfer brush.
6. **DO NOT** wipe down the buffer brush unless some sort of build up is occurring on the ends of the buffer. Build up could be the result of dirty gutters.

***Clean the conditioning compartment every day!!!  
We do not recommend using alcohol to clean the plastic tanks.***

### Monthly Maintenance

1. Remove guards from both sides of machine to clean and inspect motor and sensor shaft.
2. Lightly oil sensor extension shaft and bushings in the cleaning compartment.
3. Inspect buffer belt and its tension.
4. Oil buffer belt idler.
5. Check and inspect sliding head belts.
6. Clean and inspect the compartment that contains the conditioner (oil) tank and pump.
7. Clean between transfer brushes.

### Yearly Maintenance

*If you are a real neat freak you could do things like this:*

1. Remove any component that prevents you from cleaning the machine entirely. If you are doing good daily cleaning you may do this every two years because your machine still looks like new!
2. Replace buffer and sliding head belts with new ones. *(If running 60 lanes or more a day this may not be a bad idea. This all depends on how the machine was treated over the last year.)*
3. Inspect oil pump compartment.
4. Replace buffer brush if needed. If your buffer bristles begin to feel very soft then it is time to replace your brush. The ends of the brush normally go bad first due to dust from the gutters and lane contact.
5. Inspect and clean transfer brush assembly completely.

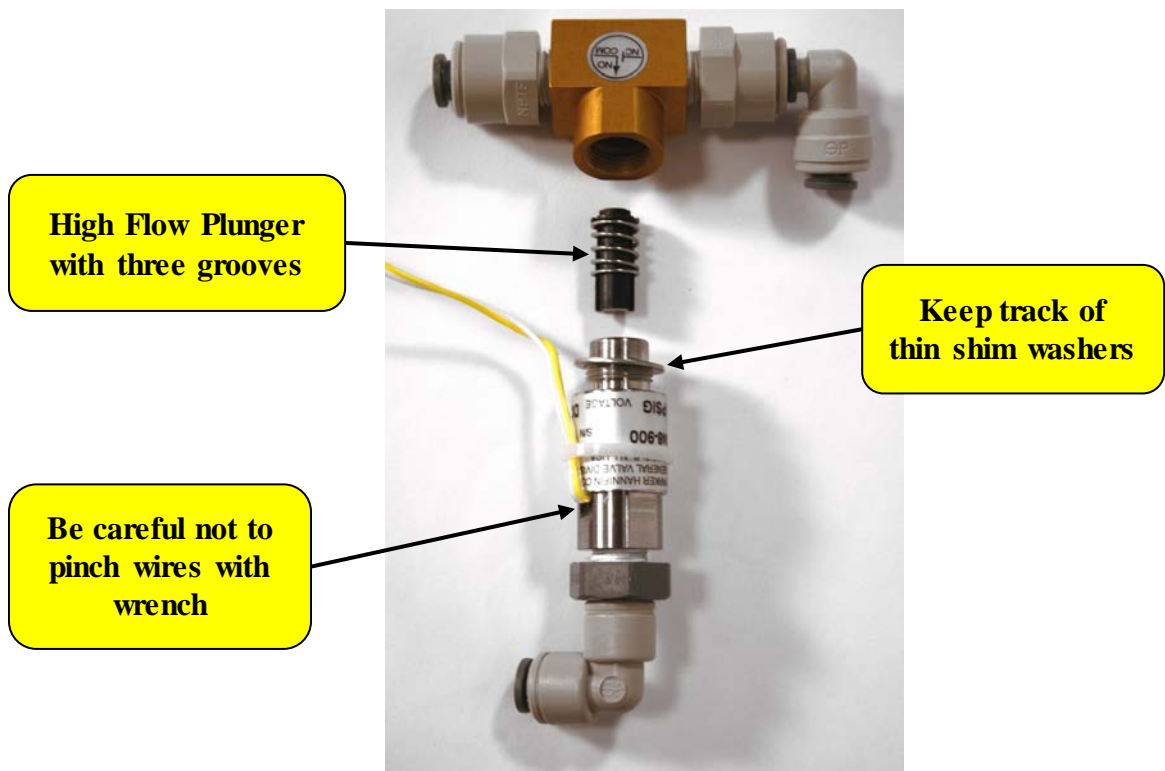
## Procedure for Cleaning Oil Control Valve

The following steps outline the procedure for disassembling the conditioner metering valve. Be careful when removing the oil lines from the fittings since they will leak.

Block off the stem elbows to prevent them from leaking all over the machine (do not split the stem). Open 1/4" lines can be blocked off with a #8 screw.

Keep the oil lines and the valve free from dirt and debris while they are disassembled. Clean up any conditioner spills immediately, the sensors and electronic components do not like oil baths.

1. Disconnect power and place the machine in the operating or down position.
2. Remove the oil assembly from the rear wall.
3. Clean the area around the oil assembly.
4. Use a Phillips screwdriver to remove the two screws holding the valve to the back plate.
5. Remove the two pieces of tubing from the top of the valve. **PUSH IN** on the outer collet to release the tubing or the elbow. Plug the open ends to prevent dirt from entering the lines and to stop the oil from leaking (be careful to not split the elbow).
6. Use a 9/16" open-end wrench to remove the bottom half of the valve. Do not pinch the small wires on the base of the valve. Keep track of the thin shim washer(s) on the valve. Make sure to use the same washer(s) during re-assembly.



7. The top section of the valve should be blown out with a canister of compressed air. Air should flow freely from the bottom through both sides at the top. A few short bursts of canned air in both holes should displace any debris. Alcohol can also be used to remove any build-up of sediment. (Do not use an air compressor to blow out the valve; water in the air lines may be forced into the manifold.)
8. The bottom section contains a plunger and spring. Make sure the three grooves on the sides of the plunger are clean. This part should be cleaned with a cotton swab and alcohol to remove the debris.

**IMPORTANT:** If a valve is found to have only one groove, please call KEGEL for an immediate replacement. All machines should have the "high flow" valves which are machined with three grooves. Please call **(863) 734-0200** if a replacement is needed.

9. Replace the valve body on the head of the valve using the same shim washer(s).
10. Replace the valve on the back plate.
11. Plug the line or elbow back into its proper fitting and clean around all the connections.
12. Return the oil assembly to the machine and plug in the connections.
13. Run the **OIL VOLUME** test once to clear the lines out. Then check the volume of conditioner output for a typical program and adjust the pump if necessary.



KEGEL's Original Mission

By: John Davis

# Oil Patterns

## Why do we Apply Oil to Bowling Lanes?

The primary reason is to protect your investment. The lane surface would get destroyed without at least a light film of lubrication. Another reason is to create better playing conditions for your bowlers. The scoring level is up to you, but the main reason to apply oil is to ensure your lane conditions are the same week to week.

You can get by with small changes in conditions, but when one week the ball hooks off the lane and the next it's a frozen rope off your hand, most bowlers will not see this as a fun challenge; it's really more like an annoyance. It is important to monitor your playing conditions to keep them consistent and provide the best customer service.

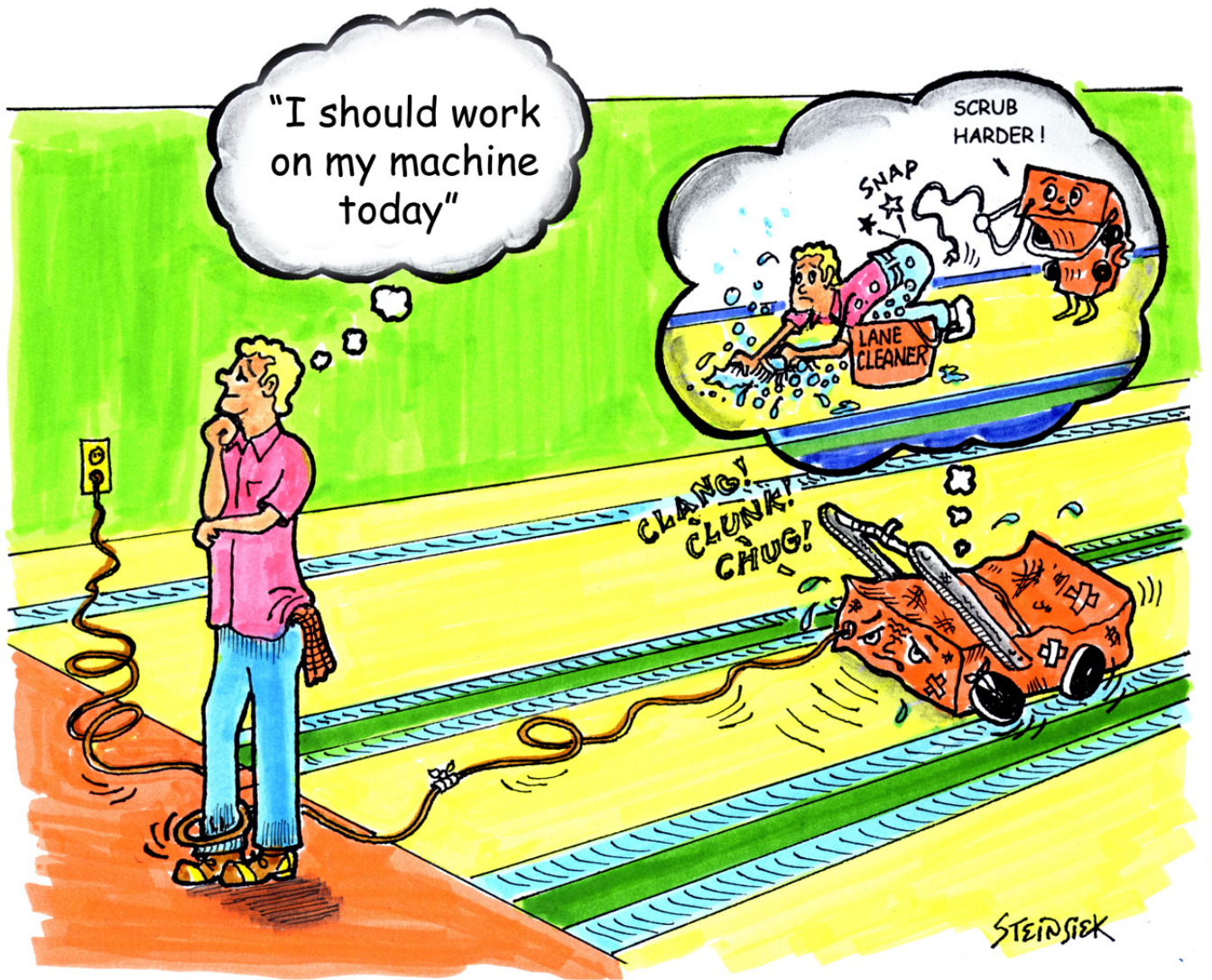
## Troubleshooting Lane Conditions

Troubleshooting lane conditions can be very tricky. You must first think about what you want to accomplish, who the adjustment will affect, and if the machine is calibrated correctly. We suggest reading the following scenarios to see if it is similar to your problem (and to maintain your sanity before making adjustments).

1. First, why do you think there is something wrong with your conditions? Are all of your bowlers complaining, or is it just a few? Are the bowlers right to complain? Don't let bowlers manage your lane maintenance program, you can please some of your bowlers all of the time but you can't please all of them all of the time. Sometimes good personal relations make your customers just as happy as good conditions.
2. Looking for the Holy Grail of lane conditions is something you can't get caught up in either. Bowlers can and will adjust to all kinds of conditions but only if they can bowl on the same thing more than once. Don't make a change for the sake of change. Think before changing the pattern. It is best to prove a change before unleashing it on your bowlers.
3. Never make pattern adjustments before checking the stripping; run your machine in clean only. If your lanes are not coming clean like they should, this could be your only problem. Check your squeegee, cleaner volume, and duster adjustments. Refer to Chapter 3 for the cleaning troubleshooting for solutions to possible problems.
4. Who mixed the cleaner last? Concentration of the cleaner is very important and must stay consistent. At Kegel, we have seen mixed diluted cleaner mistaken as the concentrate. Then it was diluted again making a very, very weak solution. However, mixing cleaner stronger than a 4 to 1 ratio is not good either.

5. When was the last time you checked your oil calibration? Maybe someone adjusted the pump and didn't tell anyone. This should be one of the first things checked along with cleaning. Calibration should be checked regularly [and if there is an oil output problem](#) check the [troubleshooting](#) section for the [conditioning system](#).
6. Now that you don't have a cord to watch out for, walk alongside the machine while it runs; look at the display for speeds and on the way back check the back end for cleanliness. Check to see if the pattern looks uniform across the house. Do this each day and you may be able to stop and correct problems before they happen.
7. A general inspection of the machine should be done whenever there is a concern that something may be wrong. **Just because there were no 300's and 800's shot last night does not mean you should make a change. Bowlers don't always bowl great.**
8. There is always the chance for operator error when it comes to conditioning machines. Always do spot checks on employees that operate the machine to make sure they do the job properly.
9. We hope this does not happen to you...but make sure that the cleaner was not put in the oil or oil in the cleaner tank. Sounds funny, but this happens more than you think and it is no fun to fix.
10. Did someone put the wrong conditioner in the oil tank or use the wrong cleaner? Always make sure that your KEGEL lane machine uses KEGEL products. We have thoroughly tested and established recommendations for all of our lane maintenance chemicals and supplies. It just makes sense to use KEGEL Genuine products.





## Pattern Troubleshooting

Now that you have determined the machine is in perfect working order, here are some tips to common questions about lane conditioning, which should help you make proper adjustments.

**Note:** *Failure to check machine operation before making adjustments can result in the loss of sanity. If it occurs, please call KEGEL at 863-734-0200 and we'll help you get it back.*

**Q:** What should I do if I have too much **carrydown**?

**A:** Shorten the applied oil distance. Too much oil in the middle and at the end of the pattern can cause excessive carrydown. Change only the buff-out distance. Do not shorten the pattern as this only creates more transition and possibly more moves. Make sure the machine is cleaning properly before making any pattern adjustments.

**Q:** What should I do if the **back ends** are too strong?

**A:** Lengthen the pattern to tone down the back end reaction. Tamer back ends provide predictable ball reaction and makes spare shooting much easier. Be aware of potential carrydown problems when the pattern length is increased.

**Q:** What should I do if I do not have enough **hold**?

**A:** The distance of the applied oil on the return pass creates hold. This area is known as the mid-lane (from about 18-32 feet). The mid-lane provides direction to the breakpoint and dictates the score-ability of a pattern. Starting the reverse oil loads farther down the lane will help increase hold.

**Q:** What should I do if the **heads hook**?

**A:** The amount of oil in the lay down area or a lane surface in poor condition can cause the heads to hook. In both instances the lane machine should run slower in the heads. This is better controlled on the return oil due to the direction of travel and the rotation of the buffer brush. Apply oil loads during the return travel that finish closer to the foul line (but not less than 4 feet).

**Q:** What should I do if I have no **swing**?

**A:** The amount of oil on the outside boards or adverse lane topography can affect swing. Reducing the length (or volume) of the applied oil will increase the amount of swing. If this is a topography issue the pattern should be adjusted by reducing the amount of oil on the outside boards to allow the bowlers to play a more direct line to the pocket. This should create more area where ball reaction is concerned.

**Q:** What should I do if the **track** dries up too quickly?

**A:** Many bowling centers do not apply enough oil to the track on both forward and return passes. The volume (in units) at the end of the pattern should be slightly more than the outside boards. Applying oil to the track on the return pass provides longevity and stability. This application of oil can be started further down the lane on the return without drastically affecting the forward oil readings and ball reaction.

**Q:** What should I do if there is no **taper** to my pattern?

**A:** The easiest way to create taper in the pattern is to make adjustments to your drive speeds during the forward loads only. Increasing the drive speed on your forward run should allow the lane condition to taper properly.



# CHAPTER 3

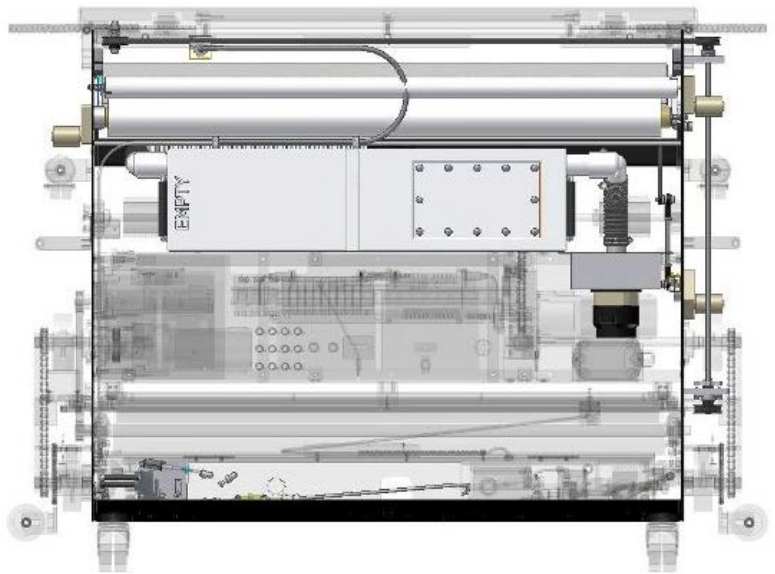


## Cleaning System

### Theory of Operation

The cleaning system is the result of years of experience with automated lane care. The changes that the game has gone through over the years have created the need for improved ways to remove the dirt and conditioners.

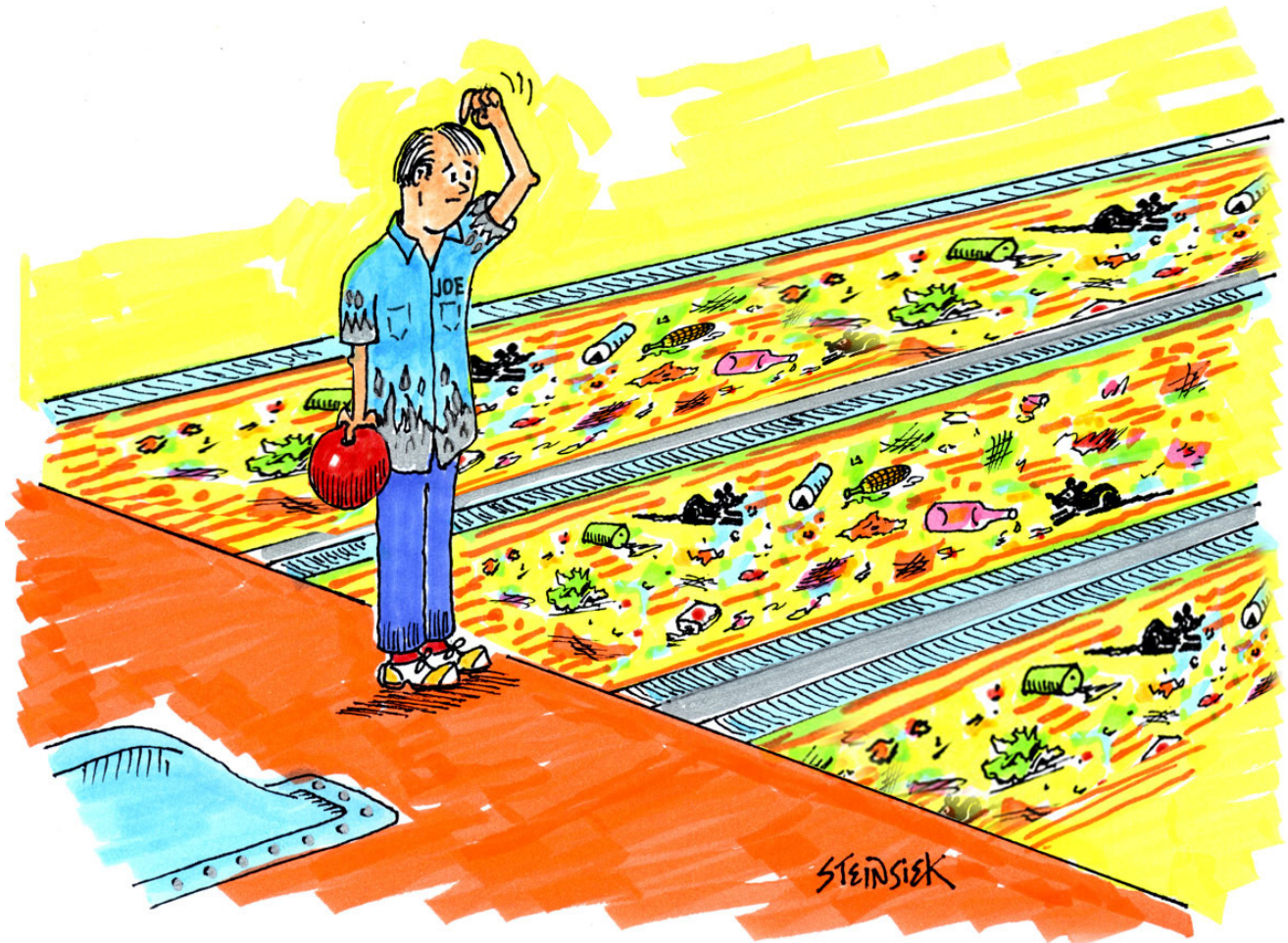
The proper cleaning of your lanes is very important to the consistency of your playing conditions. Various things can cause the machine to not adequately remove the dirt and conditioner from your lanes. In this section we will describe how the machine cleans your lanes and reasons why it may not.



The below sequence is an overview of how the Cleaning System operates.

1. When the machine sequence is started, the cleaner pump will turn on and stay on until the last squirt distance has been reached. The moving head will apply an equal amount of cleaner across the width of the lane as it travels forward.
2. As the machine travels forward, the cleaner will pass underneath the cushion roller and will be wiped onto the surface of the lane. The special texture of the cushion roller wrap prevents the cloth from creating a seal against the surface of the lane and also allows it to follow the crowns and depression of a normal lane.
3. The heavy dirt, along with oil and conditioner, will get trapped in the cloth as it wipes the lane.
4. The front blade of the squeegee then passes over the cleaner and the rear blade seals to the surface of the lane.
5. The vacuum pulls the cleaner, dirt and oil from the squeegee and deposits it into the recovery tank.

## Why do we Clean Lanes?



The reason for cleaning lanes is to protect your investment. Not having a good lane maintenance program will not allow you to achieve the best results. The other reason? It's just good customer service. Another reason would be to have your center create high scoring conditions (but that can also be achieved with poor maintenance).

If you have synthetic lanes there is no room for error. Every scratch will be part of that surface forever and the more you do to prevent it, the longer they will last.

When it comes to wood lanes, I guess you can say there is some room for error. You can always sand and re-coat the surface. Good maintenance for your wood lanes is important in protecting the finish and preventing it from glazing in the ball track. It is impossible to prevent this completely, but it can be slowed down.

## System Control Cleaning

**SYSTEM CONTROL  
CLEANING**

Press the **NEXT** key and the following will appear:

### **Last Squirt Distance**

The number displayed will refer to the distance in feet down the lane at which no more streams of cleaner will be applied. To change this distance, use the UP or DOWN ARROW to adjust. Once the value has been changed, the program accepts the data automatically.

**LAST SQUIRT DIST  
IN FEET - >55**

Press the **NEXT** key and the following will appear:

### **Lift Duster**

The number displayed will refer to the distance from the tail plank the duster will begin to lift off of the lane. To change this distance, use the UP or DOWN ARROW to adjust. Once the value has been changed, the program accepts the data automatically.

**LAST SQUIRT DIST  
IN FEET - >55**

Press the **NEXT** key and the following will appear:

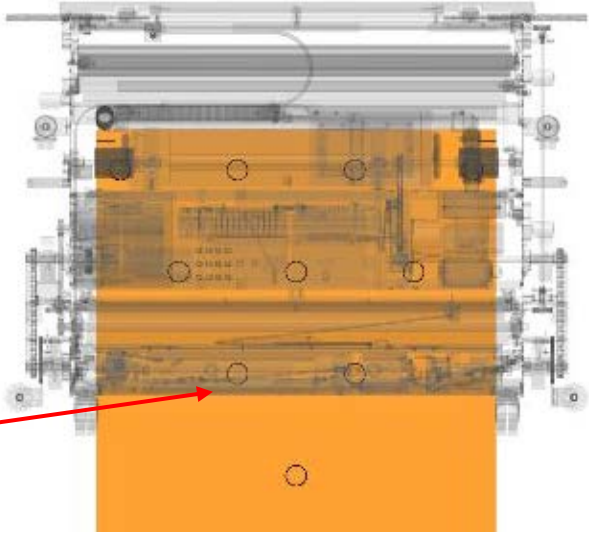
### **Forward Distance Subtract**

This prompt allows the operator to adjust the travel distance to the end of the lane. Increasing the number subtracts more from the distance, so the machine travels shorter. Use the UP or DOWN ARROW to adjust. Any changes to the value set the data automatically.

**FORWARD DISTANCE  
SUBTRACT - > 31**

Press the **NEXT** key and the following will appear:

**Note the position of  
the machine in  
relation to the 2 & 3**



### **Reverse Distance Subtract**

This prompt allows the operator to adjust the travel back to the foul line. Increasing the number subtracts more from the distance, so the machine will stop farther away from the foul line. Use the UP or DOWN ARROW to adjust. The PLC accepts any changes to the data automatically.

**REVERSE DISTANCE  
SUBTRACT - > 31**

## System Control Duster

**SYSTEM CONTROL  
DUSTER 0000**

This menu prompts the operator to run the duster motors to help when installing a new roll of duster cloth. Pressing the handle button will operate the unwind motor first. It will run as long as you hold down the button. Pressing the button the second time will run the wind-up motor. This motor will run until contact is made with the duster up switch, then it automatically stops.

This screen also shows the number of times the machine unwound duster cloth (each lane cycle). This counter resets when the duster unwind time is reset.

Press the **NEXT** key, the following screen will appear:

**UNWIND TIME  
F6 TO RESET 08**

### **Resetting the Duster Cloth**

This screen will display the current unwind time setting for each "ratchet" of cloth. This number will automatically increase as the size of the supply cloth roll decreases. The PRESENT UNWIND TIME will increase by 1/10 (one-tenth) of a second every **35** lanes until the cloth runs out. This value will return to the default setting of 08 when F6 is pressed.

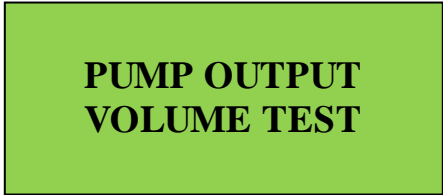
***NOTE: Resetting the DUSTER counter prior to the roll of cloth being empty could reduce the cleaning efficiency of the machine. The cushion roller must be allowed to drop far enough to contact the lane. In this menu, it is possible to correct the present unwind time if one of your pinchers has presented you with this problem.***

The unwind time varies from 08 for a fresh roll to 22 for an almost empty roll. If accidentally reset, use an educated guess on how much of the roll is already used and set your time accordingly. EXAMPLE: If the roll is about half used, then set the time to 15.

The machine will default back to a setting of 08 when a new roll of cloth is installed and the unwind time is reset using the F6 or RESET key.

## Mechanical Adjustments

### **Cleaner Pump Volume Adjustment** (Cleaner Calibration)



The cleaner pump can also be checked in this menu prompt. Remove cleaner tip from the holder and use the 50ml graduated cylinder. Press the presoak button on the handle and the oil and cleaner heads will start up. The Cleaner Head will apply one stream of cleaner then stop. Repeat this test three more times and make note of the volume dispensed. There should be about 20 mils of cleaner. If the machine is stripping satisfactory, you can use this volume as your reference point for future volume checks.

**NOTE: When making changes to the cleaner volume output, always perform this test more than once and note the volume.**

If you are not around 20 mils for cleaner output, an adjustment will need to be made. To add or subtract the amount of cleaner, simply loosen up the set screw fastened to the adjusting knob for your cleaner output that is located in the conditioning compartment. This adjustment knob will speed up or slow down the motor allowing more or less cleaner out the tip.

### **Adjustment of Cleaner Dispensing Tip**

The machine uses a single cleaner dispensing tip that moves back and forth to apply cleaner to the lane surface in front of the duster cloth. Factory adjustment of the tip is flush with the machine panel (diagram shows it lower than normal for illustrative purposes). Loosen the set screw on the collar that is used to lock it in place to move the tip up and down. If tip is adjusted closer to lane, make sure it does not come in contact with the lane surface when machine enters or exits the lane.

**NOTE: The tip height will affect how close to the edge of the lane the cleaner will be applied.**

## **Cleaner Head Timing Belt**

The machine also uses a timing belt to drive the cleaner head back and forth. To check this adjustment, move the oil head to the middle of the machine. When the oil head is in the center the cleaner head should also be in the center.

Before loosening the idler, place a reference mark on the belt and drive pulley. Loosen the idler and shift the belt one cog on the drive pulley in the proper direction. **Do not adjust from the idler end.** Once the belt is moved adjust the belt tension and tighten the idler. Verify that both heads are in the center of the machine after an adjustment is made.

This belt can also be adjusted to shift the cleaner dispensing head to the left or right if the machine tends to favor one side of the lane. *(It is unlikely that you will want to do this and close attention should be given to the guide rollers if you have this problem.)*

## **Momentary Wheel Adjustment**

We like to call this the forgotten adjustment because no one does much with these wheels. To adjust the momentary wheels the machine will have to be stopped on the lane. Once the machine is on the lane, loosen (do not remove) the bolts that hold the momentary wheels to the machine. Slide the momentary wheel housings up or down until the gap between the wheels and the lane is approximately **1/16"** to **1/8"** (1.6 mm to 3.2 mm).

The wheels need to be as close to the lane as possible without touching. For proper adjustment the lanes need to be relatively flat lengthwise. Tighten the bolts in the housing once the desired gap is achieved. Both momentary wheel housings should have the same height adjustment on both sides.

**NOTE:** *When the machine is pushed into the lane if you notice that an area close to the foul line is missed by the squeegee due to a depression (mainly on wood lanes or overlays), you will have to adjust the momentary wheels further up. This will allow the squeegee to touch the lane a little sooner.*

## **Squeegee Blades** (An adjustment video can be viewed in KOSI.)

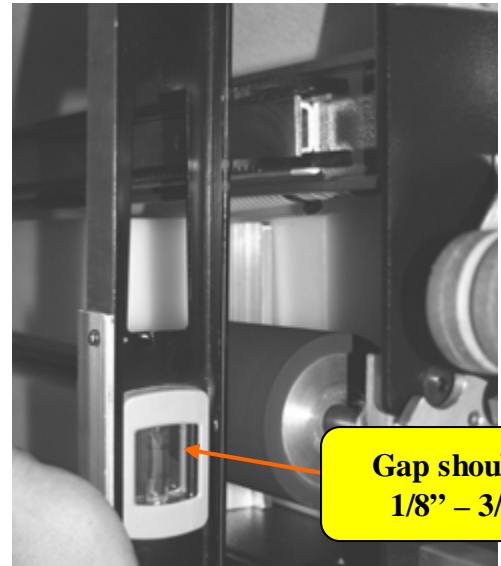
The Squeegee Assembly is adjusted at the factory to ensure proper cleaning. This adjustment should be checked when the machine is installed. The factory "zero" point is measured on the pivot mounts that secure the squeegee to the sides plates. We suggest the gap between the bottom of the side plate and the bottom of the pivot arm should be about **3/16"** (4.76 mm) on both sides of the machine. *Adjustments may vary depending on your lane characteristics.*

To check this **height adjustment** and make changes, the machine should be in the upright or transport position. The squeegee will need to be lowered to the down position. Lower the squeegee by pressing menu until you get to the **TEST OUPUT** screen. Next, press **F2** until you get to test **Output #11**. By pressing **F5** you will be able to raise and lower the squeegee assembly.



With the squeegee down, take a straight edge and place it from the squeegee blade across the drive wheels to the lane distance wheels. The gap between the straight edge and the drive wheels should be about **1/8"** to **3/16"** (3.18 mm to 4.76 mm) on each side.

If the distance is more or less, loosen the bolts (two on each side) that hold the squeegee pivot in place. Move the pivot mount until the squeegee height is correct. This should be done for both the left and the right side. Tighten the bolts after the adjustment is acceptable.



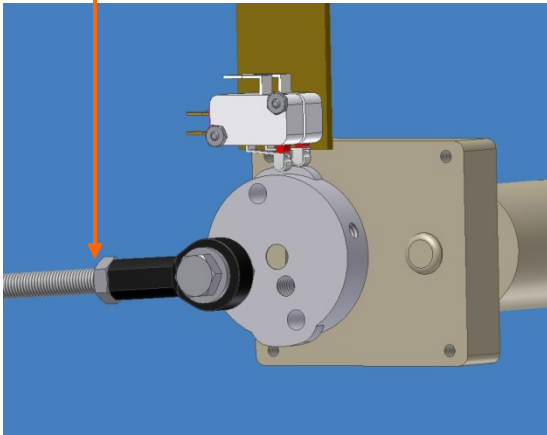
The **tilt** or **pitch** of the squeegee may also need adjustment to ensure that both blades are contacting the lane squarely. If a pitch adjustment is necessary, follow the steps below to make the adjustment. Make sure the squeegee motor does not bind up when making an adjustment. If the link is too short the motor cannot rotate 360°.

1. Locate the squeegee motor on the right side plate of the machine. Mounted to the motor shaft (inside the machine) is a cam. Mounted to the cam is a rod end and rod. This rod lifts and lowers the squeegee (see diagram below).
2. Loosen the jam nut between the rod end and the rod.
3. Remove the bolt that connects the rod end to the cam.
4. Rotate the rod end as needed to increase or decrease the pitch. **DO NOT** make the linkage too short.
5. Re-install and tighten the bolt to connect the rod end to the cam.
6. Re-check the gap between the straight edge and the drive wheels.
7. Tighten the rod end to the rod with the jam nut.
8. Check cleaning to ensure adjustment is adequate.

**NOTE:** Excessive crush on the squeegee will not allow the machine to clean properly and will cause stress on the assembly.



## Pitch Adjustment



## Squeegee Switches

The squeegee switches should have a little over-travel in the lever of about 0.015 (0.381 mm). To adjust, loosen the mounting screws a little (but not too much) so the assembly can be tapped to a fine adjustment using feeler gauges. When the proper adjustment is made you can tighten the screws. If you have no over-travel in the switch while on the cam lobe you will damage the switch (*this is very bad*).

## Maintenance

### **Changing Duster Cloth** (An adjustment video can be viewed in KOSI.)

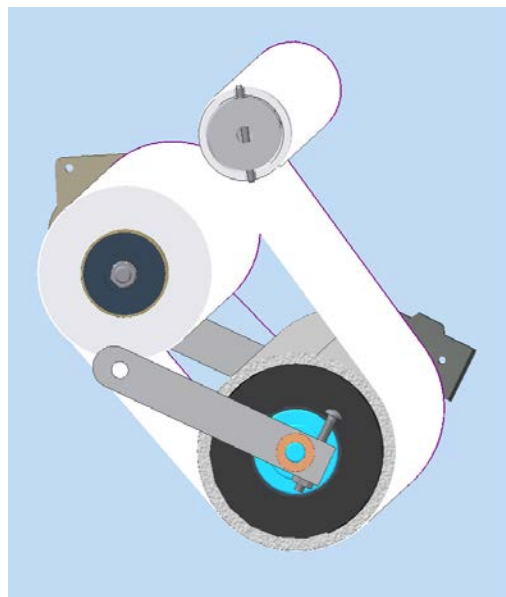
The machine uses a patented Dual Motor Ratcheting (DMR) Cloth system. The duster assembly operates by means of two brake motors. The first unwinds cloth and sets the cushion roller down on the lane surface. The second winds up used cloth onto the used core.

The wind-up motor also lifts the cushion roller off the lane at the end of the run. This dual action simulates that of a ratcheting duster, helping to eliminate dirt lines during a conditioning run. This system also controls cloth usage better and has no clutch mechanism to adjust.

**IMPORTANT! The machine can NOT be operated without Cleaning Cloth installed.**

### **Lane Cleaning Cloth should be loaded into the machine using the following procedure:**

1. Remove the cleaner dispensing tip from the holder and then remove the old cloth (***make sure the spring in the tip holder block doesn't fall out***).
2. **Now take this opportunity to clean and maintain this compartment.** The cloth is now gone so there no reason not to clean the compartment. The cleaner belt should be inspected and the sliding head bar lubricated at this time.
3. Remove the pipe from the old duster core and insert into the new one. Unroll about 3 feet of cloth and then install the new roll into its location.
4. Route the cloth down between the squeegee and the cushion roller. Pull the cloth under the cushion roller and distribute it evenly.
5. Once the cloth is routed under the cushion, pull the excess cloth far enough through to get at least 3 or 4 wraps around the PVC take-up reel or EZ Core. Make sure the cloth is wrapped evenly from side to side around the pipe.
6. Insert the take-up reel into its location and **replace the cleaner dispensing tip.**
7. The button that is located on the side of the handle will advance the duster cloth. Press this button 3 or 4 times to ensure the cloth is set properly in the machine.



### **Cleaner Tank** (An adjustment video can be viewed in KOSI.)

To fill the Cleaner Supply Tank, the machine should be in the down or operating position on a surface that will not be harmed if cleaner is spilled on it. **Always fill both the Cleaner and the conditioner tanks with the center compartment lid shut!**

1. Prepare an appropriate mixture of concentrated cleaner and water.
2. **Press E-Stop** to turn power off, open the splash guard and place a rag under the tank.
3. Open the tank cap, insert the funnel with a rag around the base, and pour the mixture into the Supply Tank using the supplied funnel (with screen filter).
4. Fill the tank until the fluid is about 1/2" (1.3 cm) from the top of the tank. **DO NOT** overfill this tank.
5. Replace the cap.

**NOTE:** *The supply tank on the machine is removable for cleaning when necessary.*

**CAUTION:** Do not spill cleaner inside the machine. Spills may "short" the electronic components and cause the machine to malfunction. A switch contaminated with moisture may also produce a dim INPUT LED on the PLC and drive you crazy. **Any spills or drops of cleaner should be wiped up immediately!**

### **Recovery Tank**

To empty the recovery tank the machine must be in the down or operating position.

1. Disconnect the inlet from the side of the recovery tank and the outlet hose from vacuum motor by removing the PVC elbows. It is best to have a rag in each hand to hold over the fittings to help prevent drips.
2. Remove the tank from machine and dispose of the used cleaner **properly**. Do NOT dump recovery tank in a septic tank or sanitary sewer system. Follow your local environmental regulations for the best method of disposal.
3. When dumping liquid from Recovery Tank, it is important to dump from the end marked EMPTY, or the end that was connected to the squeegee assembly. If liquid accumulates between baffles on the opposite side of tank dirty cleaner may be discharged from the vacuum exhaust and onto the lane until the line is cleared.

**NOTE:** *If you notice a foam build-up in the tank due to soft water conditions at your facility, it will be necessary to purchase a de-foaming agent to add to the dilution mixture.*

4. Transporting the machine with waste in the recovery tank is one of the worst things that an operator can do. It should be strictly forbidden to allow any of your employees to do this. The vacuum will get trashed out and begin to have problems and it will also affect the battery life. Expensive PLC replacement is also possible if you are not lucky enough to clean it and have it still work (after it takes a nasty bath).
5. It is recommended that the inside of the tank be cleaned and the filter material in the tank be replaced periodically. Intervals of Maintenance will vary depending on center size so it is best to inspect the tank filter by looking through the outlet end (where the vacuum is connected) to determine how often it needs to be maintained.

**NOTE:** We suggest swapping recovery tank filters after each cleaning. Order a spare recovery tank filter (Part Number 158-0406).

### **To replace the Filter:**

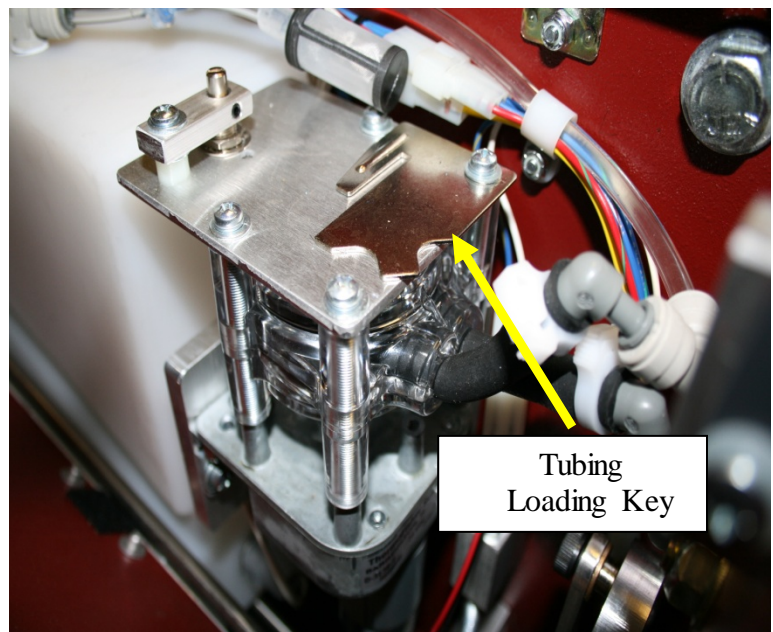
1. Remove the Phillips screws from the cover to access the filter.
2. Remove the filter and replace or clean it.
3. Inspect the gasket and re-fasten the cover to the recovery tank.

### **Pump Tubing Replacement**

It is recommended that the pump tubing be replaced every year. When the cleaner pump's maximum volume output is a problem, follow these instructions to disassemble the pump and replace the tubing. To perform the following steps you will need to use the tubing loading key. This key (see D in diagram) is attached to the top of the cleaner pump assembly with a screw. Replace the key when finished.

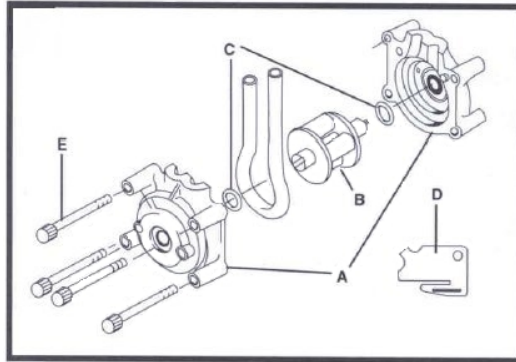
#### **STEPS:**

1. Release both tube fittings from quick disconnects (depress collet and pull tube from quick disconnect fitting).
2. Remove the four screws that attach pump to the mounting plate.
3. Separate the end bells (the pump head valves shown as A in diagram). Hold the end bell containing the rotor (as shown) with tubing retainer grooves pointing down. Remove



old tubing.

4. Place new tubing (which is broken in at the factory before shipping) in the right groove and against the first two rollers. Hold tubing with your thumb. Near the groove, insert smaller prong of loading key between the top of the rotor and tubing. Push key in as far as possible.
5. Push down and turn the key counter-clockwise completely around the rotor. The key will push the tubing uniformly into the end bell assembly. Hold the second end of tubing. Remove the key.



- A. End Bells
- B. Rotor Assembly
- C. Thrust Washer (2)
- D. Tubing Loading Key
- E. Mounting Screws (4)

6. Position the other end bell on top and press the end bells together. Be careful not to pinch the tubing. If end bells do not snap tightly together you need to reload the tubing. If necessary, turn the key in the slot on rotor shaft to adjust tubing.
7. With key in slot on rotor shaft, turn the key to align tang on rotor shaft with slot in motor drive shaft. Point tubing retainer grooves up. Shift the pump head slightly until it snaps on the alignment pins (if present).
8. Replace stem elbows in new tubing if necessary. Make sure elbows are facing correct direction.
9. Re-attach the cleaner pump to mount plate.
10. Press the stems back into quick disconnect fittings.

### **Squeegee Blade Replacement**

The squeegee blades should be flipped every 6 months and changed once a year. Poor cleaning results could occur if the trailing edge is allowed to get dull.

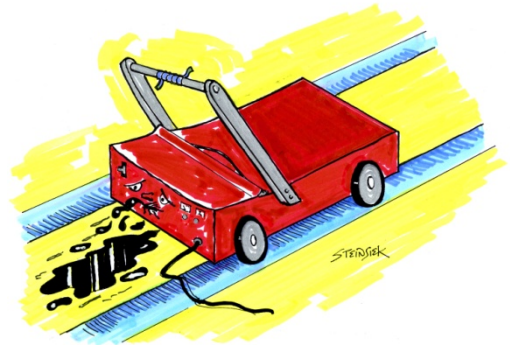
### **General Maintenance**

1. Squeegee should be wiped down after each use.
2. Place a drop of oil on the adjusting link end fittings and the squeegee pivots once every 6 months.

3. Flip squeegee blades every 6 months and replace blades once a year.
4. Change filter in recovery tank once a month or when needed.
5. Check vacuum housing once a week and clean if wet with oil.
6. Check vacuum hose from squeegee head to tank for clogs at least once a year in high lineage centers. We have seen clogs you would not believe, some look like bath tub drains with dirty, hairy clogs the size of dead rats.
7. Check the electrical end of the vacuum once a week for dirt collecting on the cover.

## Troubleshooting the Cleaning System

Please go over this section if there is any kind of problem with your cleaning system. Reviewing this **before** calling for Technical Support may help in correcting any problems you have.



## Cleaning System Problems Indicated by Error Messages

### ERROR MESSAGE CODE D5

Problems that display errors are usually easily corrected and happen for a definite reason. Usually a stuck or out-of-adjustment switch or possible loose or damaged wires will cause most problems.

If an input fails to go off completely and still displays a dim light, the PLC will still consider that as a good input so look closely.

This error normally happens when Duster **Input 0CH 10** fails to open, meaning the input light does not turn off.

Below are a few things that can cause an **UNWIND** error. If the Duster Motor does not run, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #12**. Check for operation by pressing **F5** and the Duster should go either up or down, depending on **location**.

1. Duster cloth is empty. Replace cloth.
2. One or both of the Duster Up Switches are stuck. Check if **Input OCH 10** has an LED light showing on the PLC with the cushion roller adjusting screws off the switches.
3. Duster Unwind Motor has failed.
4. Blown fuse.
5. Duster Unwind relay failed or is loose in socket.
6. Duster motor wire is damaged or there is a loose wire between motor and CR9 relay.
7. Cleaner dumped onto switch causing it to short, but only a dim light is showing on **Input OCH 10**.

**ERROR MESSAGE  
CODE D6**

This error screen normally happens when the duster fails to wind-up the cloth and actuate the duster up switch, failing to turn on **Input OCH 10** on the PLC. If the Duster Motor does not run, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #13**. Check for operation by pressing **F5** and the Duster should go either up or down, depending on **location**.

Below are a few things that can cause a **WINDUP** error.

1. Blown fuse.
2. Duster Wind-up Motor has failed.
3. Duster Up Switches are both broken or out of adjustment.
4. Duster Windup relay failed or is loose in socket base.
5. Duster cloth cardboard core is loose from the plastic hub.
6. Duster hub is slipping on the motor shaft.
7. Duster Wind-up Motor wire (Green/Red) is damaged or there is a loose wire between motor and relay.

**ERROR MESSAGE  
CODE SA**

Normally, this error screen occurs when **Input 1CH 00** fails to receive a signal within 3.5 seconds of the motor starting. If the Squeegee Motor does not run, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #11**. Check for operation by pressing **F5** and the Squeegee should go either up or down, depending on **location**.

1. The Squeegee **motor runs** but the down switch failed to operate and a send signal to PLC **Input 1CH 00**.
  - a. Check and inspect microswitch. Manually operate switch to see if **Input 1CH 00** will illuminate.
  - b. Possible broken wire or loose connection. It will be either the **Yellow** (24 VDC) or the **Black Wire** that connects to **Input 1CH 00**.
  - c. This error can also happen if the squeegee up **Input 1CH 01** is stuck on.
  
2. Squeegee motor does not run when tested in the **Output Test**. You will need to determine if power is getting to the motor.
  - a. Fuse is blown.
  - b. Squeegee linkage is in a bind.
  - c. Relay came loose in socket base or has failed.
  - d. Motor has failed.
  - e. Bad connection to the motor. Check all power wiring to motor.
  - f. PLC **Output 11CH 03** failed.



Normally this error occurs when **Input 1CH 01** fails to receive a signal within 3.5 seconds of motor starting. If the Squeegee Motor does not run, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #11**. Check for operation by pressing **F5** and the Squeegee should go either up or down, depending on **location**.

1. The Squeegee motor runs but the up switch failed to operate and send signal to PLC **Input 1CH 01**.
  - a. Check and inspect microswitch, manually operate switch to see if **Input 1CH 01** will illuminate.
  - b. Possible broken wire or loose connection with either the **Yellow** (24 VDC) or the **Yellow / Green Wire** that connects to **Input 1CH 01**.
  - c. This error can also happen if the squeegee down **Input 1CH 00** is stuck on.
  
2. Squeegee motor does not run when tested in the **Output Test**. You will need to determine if power is getting to the motor.
  - a. Fuse is blown.
  - b. Squeegee linkage is in a bind.
  - c. Relay came loose in socket base or has failed.
  - d. Motor has failed.
  - e. Bad connection to the motor. Check all power wiring to motor.
  - f. PLC Output 11CH 03 failed.



## ERROR MESSAGE CODE FC

Machine is low on cleaner. Fill and restart machine to clear error from the screen.

If this does not clear the error the float may have a problem. Unplug the float and install jumper plug to bypass the float.

The jumper plug should be properly secured in the oil compartment.

## Cleaning System Problems that Do Not Display Errors

There are a number of things that can go wrong when cleaning, but the machine will appear to operate correctly. Most of these problems can be caught before the bowlers notice them but only if the operator is paying attention. **Doing a cleaner test and checking the cleaning system every day will eliminate many problems from turning into disasters.**

1. Cleaner pump fails to run.
  - a. Blown fuse.
  - b. Bad connection at PLC analog connection.
  - c. Loose connection at speed control.
  - d. Speed control has failed.
  
2. Cleaner pump volume low.
  - a. Tubing is starting to wear – probably more than a year old. (See Cleaner Pump Adjustment in this section.)
  - b. Filter is clogged.
  - c. Someone has tampered with the adjustment.
  
3. Machine leaves water on the lane after a test clean in various spots but cleans everywhere else.
  - a. Squeegee not low enough to the lane (#1 cause).
  - b. The lane has bad depressions, possibly more than 1/100<sup>th</sup> of an inch (mostly around screw holes).
  - c. Squeegee has a damaged area.
  - d. Squeegee is worn out and should have been replaced a long time ago.
  - e. Recovery tank is not in machine.

4. Machine leaves oil streaks in various spots, but cleans everywhere else.
  - a. Duster is not touching the lane and may not be unwinding enough cloth.
  - b. Lane has bad depressions.
  
5. Machine leaves streaks that look like squeegee marks.
  - a. Cleaner dilution is weak.
  - b. Someone made a mistake and diluted the diluted cleaner instead of the concentrate, making one very weak solution.
  - c. Duster is not touching the lane and may not be unwinding enough cloth.
  - d. You must not be using Defense-C!
  - e. Lane has not been cleaned in months, just oiled.
  
6. Machine cleans only where it applies cleaner.
  - a. The duster is definitely not touching the lane.
  
7. Machine drips dirty cleaner and oil off the squeegee.
  - a. Rear squeegee blade is not clearing the tail plank. It is very important that the rear squeegee blade clears the pin deck completely.
  - b. The squeegee double wipe function has been turned off.
  - c. Filter in recovery tank is plugged up.
  - d. Vacuum hose is plugged up with hair and all kinds of nasty stuff.
  - e. Vacuum motor is failing.
  
8. Machine pushes cleaner into gutters and excessive amounts into the pinsetter.
  - a. Forgot to put recovery tank in the machine (been there...done that).
  - b. Vacuum hose has come off.
  - c. Real nasty clog in vacuum hose after the squeegee head.
  - d. Applying too much volume while the machine is traveling too fast.
  
9. Machine drips cleaner from tip.
  - a. Check valve has failed or is broken.
  - b. Cleaner line may have a bad connection.
  - c. Machine is not running the pump in reverse at the pin deck.
  
10. Machine is leaking cleaner.
  - a. Tubing in pump failed and needs to be replaced.
  - b. Tubing connector failed or came loose.
  - c. Tank is leaking around fittings.
  - d. Operator over-filled machine and made a mess.

11. Duster cloth hangs down on one side and sometimes touches the lane when the machine exits from of the lane.
  - a. Duster switches are out of adjustment; hitting the switch too soon.
  - b. Duster plug bolt is loose from the side of the machine.
  - c. Duster switch is broken on one side.
  - d. Cushion Roller may be on the large side.
  - e. Duster cloth stretched and needs to be balanced and tightened up.
  - f. Duster motor brake is not holding (or working at all).
  - g. New roll of duster cloth was not checked after installation.
  - h. This machine may need a special adjustment to the program. Please call for Technical Support at 863-734-0200.

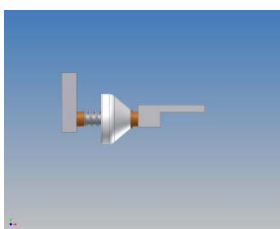
# CHAPTER 4



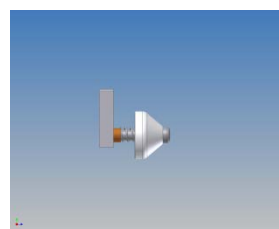
## Drive System

### Adjustments

#### Guide Rollers



Front Guide Wheel Assembly



Rear Guide Wheel Assembly

Adjustment of the guide rollers may be needed if the bowling center has lanes that have been injected or if the gutters are even with the lane surface. In most cases, adjustment to the guide rollers on one side will be all that is required. The guide rollers in the front half of the machine are different than those in the rear half, but the adjustments are the same.

To remove the front guide rollers:

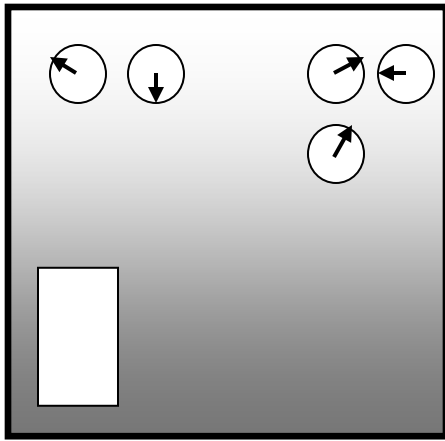
1. Remove the bottom bolt that holds the mounting block to the frame. This provides clearance to remove the shoulder bolt from the mounting block. (*To remove the rear guide roller, you will need to remove the rear approach wheel mounting block completely to remove the shoulder bolt*). One bronze bushing is normally between the roller and the side plate of the machine and one is between the head of the shoulder bolt and the wheel (in the front section of the machine).
2. Place the bronze bushing located toward the side plate between the head of the mounting bolt and the guide roller on one side of the machine (both front and rear rollers). This will give approximately 1/4" additional clearance between the guide rollers as the machine travels on the lane surface.
3. Operate the machine after changing one side. If needed, make adjustments to the wheels on the other side of the machine.

## **Drive Board Adjustments**

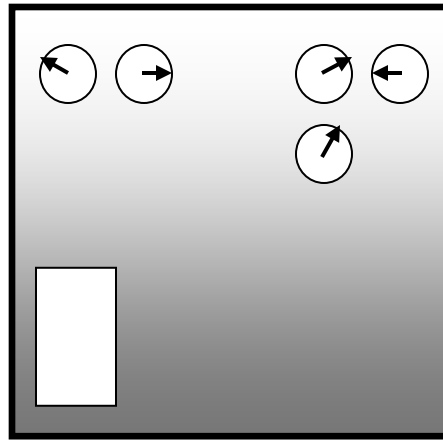
This test is very critical to the Lane Machine. If these speeds are off, then the pattern that you are using is off! The Oil Program asks for specific speeds to be used, if the speeds are not correct then you will have problems such as applying oil all the way to the foul line in reverse.

*IMPORTANT: Do the following test on the approach as this will turn on the motor and you really don't want to be chasing your machine down the lane!*

1. To test the Drive speeds, menu to the **TEST OUPUT** screen and press **F2** until you get to test **Output #02**. Test Output #2 is for speed and one and can be checked by pressing **F5**. This will turn the motor on and the speed will be displayed in inches per second in the lower right hand corner.
2. Using a small screwdriver, turn the pot clockwise to increase the speed if needed. The screen should flash evenly between 9-10 for the low speed.
3. Press **NEXT** to advance to the next speed. The motor will stay on as long as you don't press the **ENTER** key. If you do press it, simply press **ENTER** again and it will come back on. Adjust your second speed to 13-14, then advance to the other speeds by pressing **NEXT** and adjust accordingly if needed.
4. If one of the speeds can't be reached, adjust the RANGE trimpot. Turn it clockwise to slow down and counter clockwise to speed up the drive motor. Always go back to Speed 1 and check all the speeds again
5. Once the 6 speeds are set, run the machine on the lane and check each speed to see if it matches the no load adjustments that were just made.
6. If the speeds don't match, it will be necessary to make an adjustment to the Speed Control board. The following steps outline this procedure.
7. Remove power to the machine and remove the four screws that hold the control plate inside the machine
8. Lift the control plate up and locate the DC Speed Control Board. There will be a trimpot on the board labeled **IR**, this is a compensation adjustment. This adjustment is used to equal the load and no load speeds
9. If the machine is traveling faster on the lane, then you will need to turn the trimpot counter-clockwise. If the full-load speeds are slower, turn it clockwise. If the speed difference is not much it will be a very small adjustment.
10. Run machine on the lane and check all 6 drive speeds, repeat the step above if needed.
11. If speeds are set properly, replace screws in control plate and make sure that all plugs are securely fastened.



115v



230V

### SPEED CONTROL BOARD ADJUSTMENTS

## Maintenance

There are a few things that the operator should do to maintain the Drive System. Here are some suggestions that should be done to maintain your machine in proper working order.

1. Keep all of the bushings oiled on the drive shaft (one or two drops is plenty). Do not allow chains to get dry but do not over-oil. There are felt washers to help hold the oil longer next to the bushings. **DO NOT OVER OIL, THEY WILL DRIP FOREVER!**
2. Keep the LDS shaft bushings oiled, one drop of oil every 4 to 6 months is sufficient.
3. Inspect the drive wheels for tightness and free rotation each time you clean the machine.
4. Inspect the drive chain adjustment whenever the wheels are checked or cleaned.
5. Inspect the LDS when cleaning the machine to make sure all parts are tight (it takes just a second).

## Troubleshooting

### Drive System Problems Indicated by Error Messages

#### ERROR MESSAGE CODE T1

Problems that display errors are easily corrected and happen for definite reasons.

Forward and Reverse Travel Errors normally happen when the LDS **Input 0CH 07** fails to go off and on as the lane distance wheels turn. When the motor is turned on an error counter is also activated at the same time. If the LDS does not constantly reset the counter every 2.4 seconds, a travel error will be displayed. We've made a list of a few things that can cause a **Forward or Reverse Travel Error**.

To check your drive speeds, go to the **TEST OUTPUT** screens like you would to check your speeds. Do this on the approach as this will turn on the motor and you really don't want to be chasing your machine down the lane!

1. The drive motor runs but gives a **Forward or Reverse Travel Error**.
  - a. Machine is not seated on the lane, there are high gutters, or the drive wheels are slipping.
  - b. LDS signal has failed or the LDS shaft is binding.
  - c. Wire is loose or broken for the **0CH 07** Input circuit.
  - d. Turn the LDS shaft and see if **Input 0CH 07** is flashing on the PLC as the wheels rotate.
  - e. Machine Acceleration trimpot needs to be adjusted. This problem will show up the most often in the pit when the machine does the squeegee wipe function. There will also be an error code flashing on the speed control board when the ACCEL needs to be adjusted. A clockwise turn of the trimpot will be needed.
  - f. Machine Deceleration trimpot needs to be adjusted. This problem will show up when the machine enters the pit or returns to the foul line in clean only. This is when the machine shifts from high speed to 14 or 10 IPS. There will also be an error code flashing on the speed control board when the DECEL needs to be adjusted. A clockwise turn of the trimpot will be needed.

7. Drive Motor does not run.
  - a. Forward Relay is loose in socket or failed.
  - b. Reverse Relay is loose in socket or failed.
  - c. One of the motor control plugs is loose or unplugged. Check speed control and drive motor plugs.
  - d. Blown fuse.
  - e. Drive Motor or Speed Control has failed.
  - f. Go to the proper menu and check the operation of the relays.
  
8. Machine drives off into pit giving a **Forward Travel Error**.
  - a. DECEL set too slow on drive board.
  - b. Forward Subtract needs to be increased by one or two counts.
  - c. Lane Distance shaft is not turning freely.
  - d. Lane Distance target is loose.
  - e. Lane Distance Proximity Sensor is too far from target.
  - f. Lane Distance Proximity Sensor is damaged.
  - g. Operator needs more training and is starting the machine too far past the foul line.
  - h. Tail plank is missing from pin deck. Check for missing tail planks.

**Q: If there is a definite failure of the Lane Distance Sensor is it possible to use the TACH sensor for the LDS functions?**

**The answer is YES. The operator will have to remove the wire off of Input 0CH 06, which is a Black / Blue wire and put it in place of the White / Pink wire that is on Input 0CH 07.**

**Connect the wire from 0CH 07 to 0CH 06 and remember to reverse the wires when the sensor is repaired or replaced. Exchanging the wires will turn the TACH sensor into a Lane Distance Sensor.**

***NOTE:*** *If the TACH sensor is used as a distance counting sensor it is possible the machine will run short up to as much as a foot of travel so the travel distance will need adjusting.*



## **ERROR MESSAGE CODE T2**

Even though rare it is possible that you may run into a **CODE T2** or **REVERSE TRAVEL ERROR**. To troubleshoot this, you want to follow the same procedures as you would for the Forward Travel error. These are explained in the previous pages.

The LDS Shaft is binding or the machine is not seated on the lane.

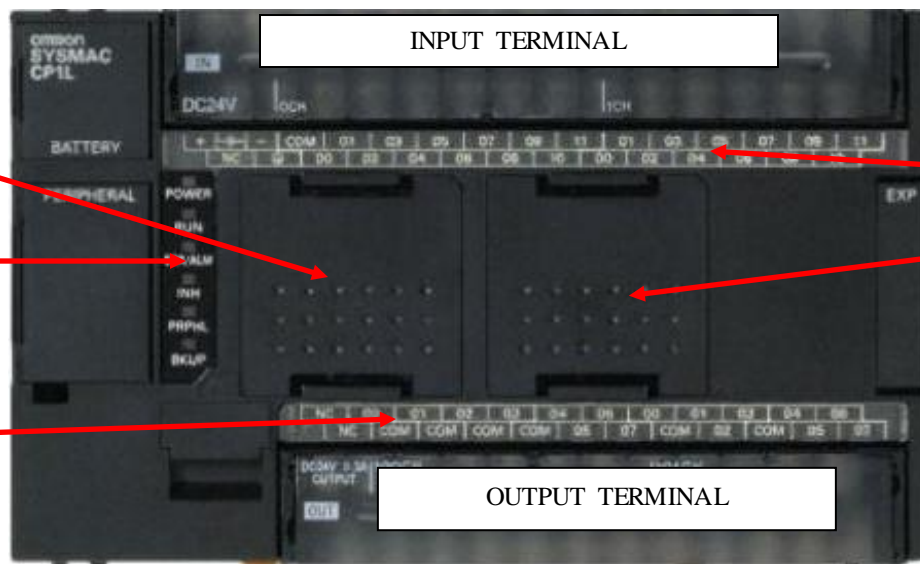
1. Drive Motor or Speed Control failure.
2. Wire is loose or broken for the 0CH #07 Input circuit.
3. Go to the Test Output Menu and Check Output #01 Reverse Drive Relay.
4. Turn the LDS shaft and see if Input 0CH #07 is flashing on the PLC as the wheel rotates.

# CHAPTER 5



## Electrical

### Programmable Logic Controller (PLC)



Indicator	Status	Meaning
PWR (green)	ON	Power is being supplied to the PC.
	OFF	Power isn't being supplied to the PC.
RUN (green)	ON	The PC is operating in RUN or MONITOR mode.
	OFF	The PC is in PROGRAM mode or a fatal error has occurred.
COMM (yellow)	Flashing	Data is being transferred via the Peripheral port or RS-232C port.
	OFF	Data isn't being transferred via the Peripheral port or RS-232C port.
ERR/ALARM (red)	ON	A fatal error has occurred. (PC operation stops.)
	Flashing	A non-fatal error has occurred. (PC operation continues.)
	OFF	Indicates normal operation.

## **PLC Inputs and Testing**

The PLC assembly of the machine has 19 inputs, 17 relay outputs. Inputs accept data from various sensors or switches in the machine and then use that information to control functions of the machine through its outputs. Here is a list of the **INPUT** numbers for the PLC along with their wire color and designations:

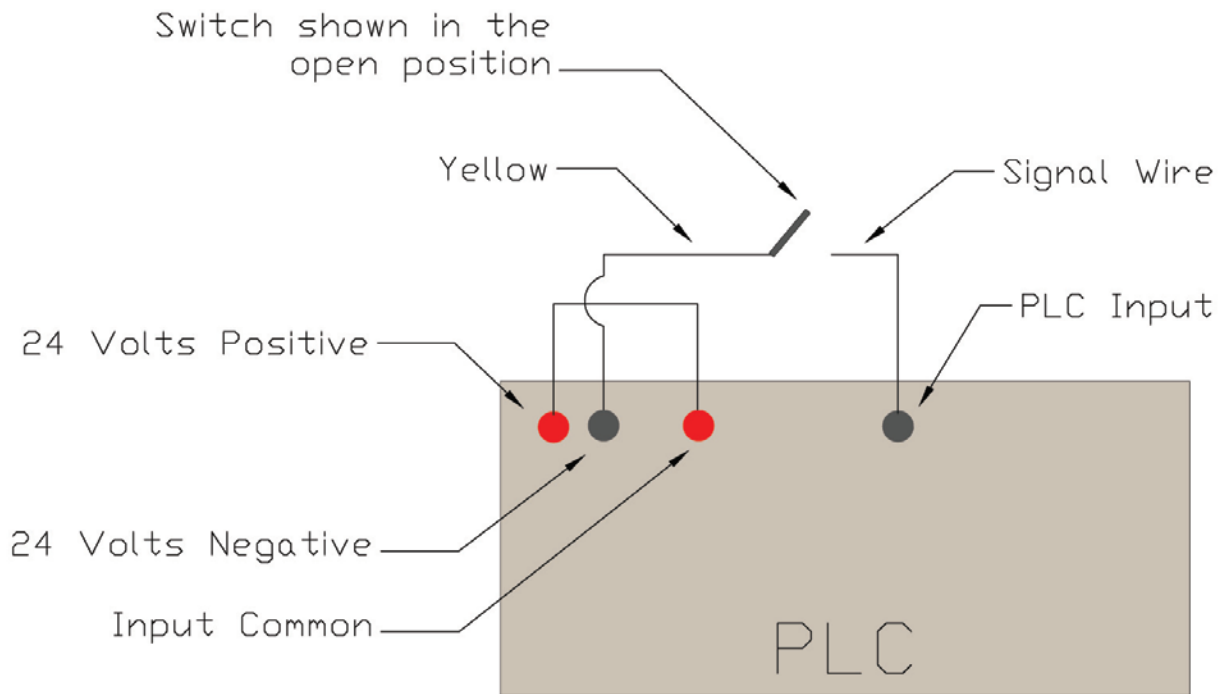
<u>INPUT</u>	<u>DESCRIPTION</u>	<u>WIRE COLOR</u>
0CH 01	BOARD COUNTING PROX SENSOR	RED / WHITE
0CH 02	LEFT OIL HEAD REVERSING PROX SENSOR	RED / ORANGE
0CH 03	RIGHT OIL HEAD REVERSING PROX SENSOR	ORANGE / BLACK
0CH 04	BUFFER BRUSH UP SWITCH	GREEN / WHITE
0CH 05	BUFFER BRUSH DOWN SWITCH	VIOLET / YELLOW
0CH 06	DRIVE SHAFT TACHOMETER PROX SENSOR	BLACK / BLUE
0CH 07	LANE DISTANCE PROXIMITY SENSOR (LDS)	WHITE / PINK
0CH 08	START BUTTON / HANDLE BUTTON	VIOLET
0CH 09	OIL ONLY SWITCH	GRAY/GREEN
0CH 10	DUSTER UP SWITCHES (2)	GREEN / BLACK
0CH 11	CLEAN ONLY SWITCH	GRAY/PINK
1CH 00	SQUEEGEE DOWN SWITCH	BLACK
1CH 01	SQUEEGEE UP SWITCH	YELLOW / GREEN
1CH 02	OIL FLOAT SWITCH	GRAY / WHITE
1CH 03	CLEANER FLOAT SWITCH	GRAY / BLACK
1CH 04	CLEANER PRESOAK BUTTON	WHITE/ORANGE

### **Inputs and Testing Continued...**

Testing inputs is very simple, like the flick of a light switch. To test proximity sensors pass a metal object across the face of any sensor. Lights on both the proximity sensor and PLC Input should light up. To test inputs operated by switches, depress the lever on the switch and the appropriate input should light up.

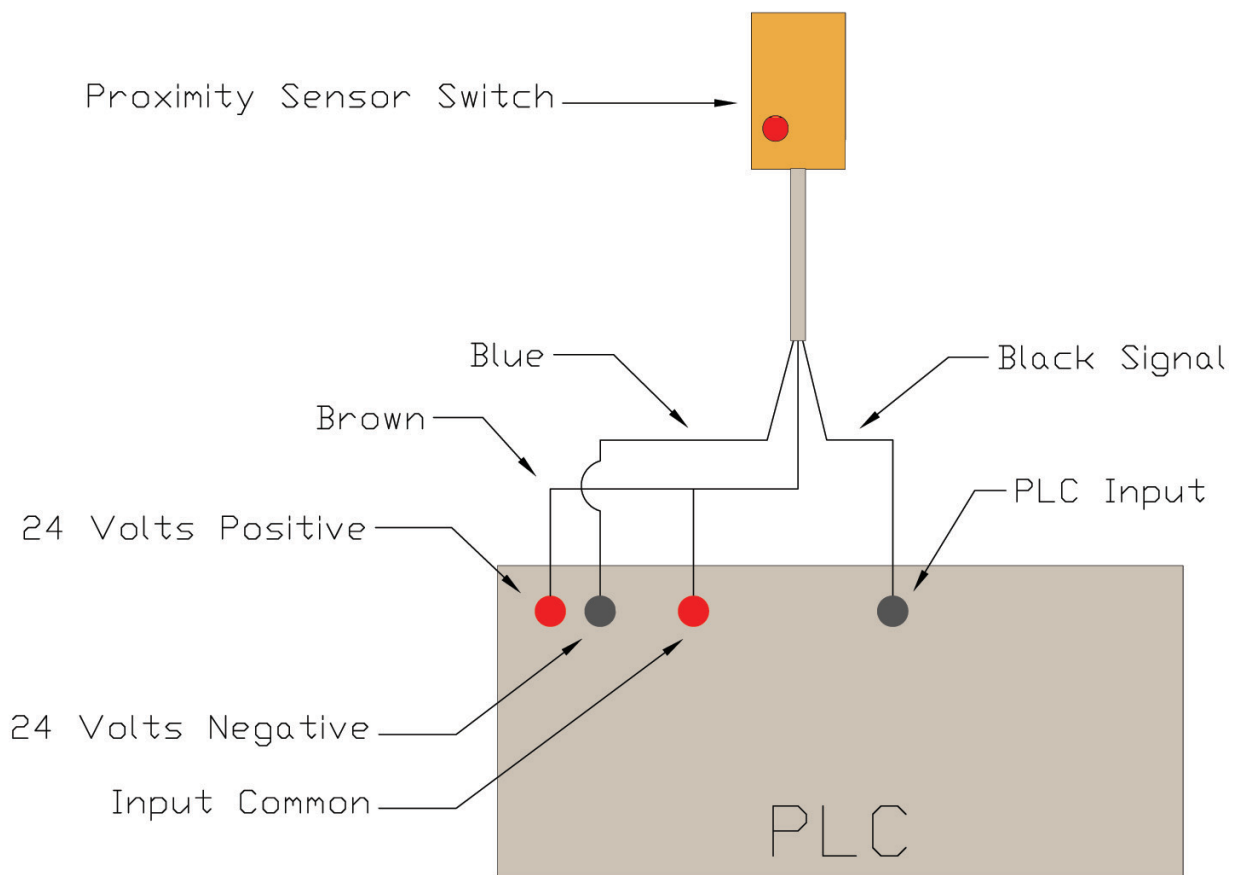
The following wiring drawings will show the simplest way a switch and proximity sensor connect to the PLC.

Below is an example of a typical input circuit using a switch. One side of the switch goes to the PLC Input and the other side of the switch goes to Negative Voltage. The PLC Input Common is supplied with Positive Voltage. The circuit is shown in the open position so there will be no input light on the PLC. The batteries will supply the 24 Volts. **All of the machine switches are wired like this. The only difference is that the wires will pass through plugs and junction blocks.**



### ***Inputs and Testing Continued...***

Below is a wiring example of a typical input circuit using a Proximity Sensor Switch. The Proximity Switch has three wires. Blue will connect to negative, Brown to positive, and Black is the signal which connects to the appropriate PLC Input. The sensor operates when metal passes by the face. An LED light located on the sensor will indicate operation. The batteries will supply the 24 Volts. All of the machine's Proximity Sensor Switches are wired like this; the only difference is that the wires will pass through plugs and junction blocks.



## **PLC Outputs**

Here is a list of the **OUTPUT** numbers for the PLC along with their, wire color, and designations.

<u>OUTPUT</u>	<u>TEST#</u>	<u>DESCRIPTION</u>	<u>WIRE COLOR</u>
100CH 00	08	OIL PROGRAM CONTROL VALVE	ORANGE
100CH 01	02	FORWARD DRIVE (CR1 RELAY)	GREEN/ORANGE
100CH 02	01	REVERSE DRIVE (CR2 RELAY)	YELLOW/VIOLET
100CH 03	03	SR 1 RELAY	WHITE/RED
100CH 04	04	SR 2 RELAY	WHITE/GREEN
100CH 05	05	SR 3 RELAY	BLACK/PINK
100CH 06	06	SR 4 RELAY	YELLOW/ORANGE
100CH 07	10	BUFFER CONTACTOR	YELLOW/BLUE
101CH01	16	OIL HEAD DRIVE	YELLOW/RED
101CH 02	09	BRUSH LIFT MOTOR	WHITE / BLACK
101CH 03	11	SQUEEGEE MOTOR	BLUE / WHITE
101CH 04	12	DUSTER UNWIND	GREEN / BLUE
101CH 05	13	DUSTER WIND-UP	GREEN / RED
101CH 06	15	CLEANER PUMP MOTOR	BLUE/YELLOW
101CH 07	14	VACUUM MOTOR	BLUE / BLACK

## **INPUT / OUTPUT TEST**

To test an output, press the F2 key until you arrive at TEST OUTPUT #1.

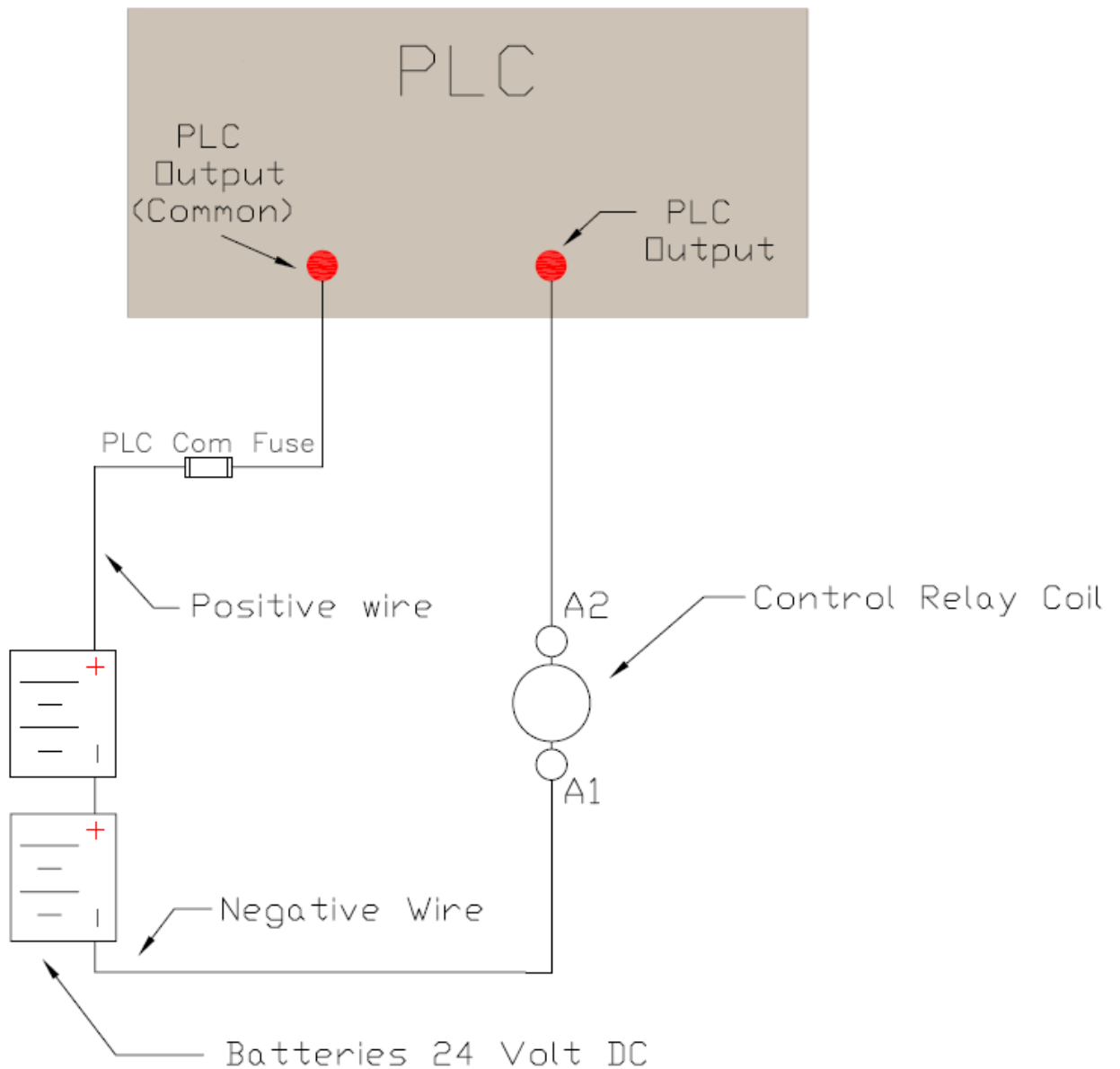
By pressing the F5 key and holding it down, the output will come on and stay on. When the key is released the output will go off.

Press **F2** (NEXT) and you will advance to the next output to be tested. Pressing **F5** (ENTER) in any Test Output screen will turn the output ON. Some outputs are programmed to run only briefly, others will run as long as the F5 key is pressed.

To check inputs, press on one of the two input screens to view. The inputs that are on will change color to yellow. To test an input you will need to physically operate the switch by pressing on it or pass metal by a proximity sensor.

## Testing an Output

Here is an example how the PLC output is wired to the isolation Control Relay. When the PLC output turns on the control relay turns on. The control relay supplies power to the motor or device to protect the PLC from heavy amp load or short circuit conditions. **Only one fuse is used to protect ALL of the PLC outputs commons, so when it fails ALL outputs fail.** The PLC has 6 Output Commons which, for our purposes, are all connected together by jumpers to act as one.



## Fuses / Breakers

Mounted on the control plate are several protective devices for your Kustodian.

- PLC Power Fuse - 0.5A / 115V ~ 500mA / 230V (Input Power / L1)
- PLC Common Fuse - 0.5A / 115V ~ 500mA / 230V(Output Common)
- PLC Relay Fuse – 4A 115V / 230V
- Conditioner Pump Fuse - 0.75A / 115V ~ 315mA / 230V (Oil Pump Motor)
- Drive Motor L1- 4A ceramic
- Drive Motor L2- 4A ceramic
- Cleaner Pump Fuse - 4A / 115V ~ 1.6A / 230V
- Vacuum Fuse / Breaker – 10A ceramic / 115V ~ 8A Breaker for 230V

Do not over-amp fuses. If you can't find the direct replacement you will cause damage to the smaller motors. In addition to fuses and breakers, the PLC program also protects the machine by "timing out" after operating motors for a pre-determined amount of time.

### **Power Cord Maintenance**

If you are experiencing various 'power' related problems, inspect the power cord ends. Because the power cord is pulled, dragged and tugged on a daily basis, the ends should be removed and wires should be inspected. If they look questionable, remove and strip the wires back to expose a new, fresh connection.

Also, if the power cord has been repaired because it's been caught on a gutter cap or bolt for the capping, inspect this portion of the cord carefully!

All of the above problems can rob the machine of amperage causing many problems throughout the machine.



## Control Relays

All of the relay components on the Kustodian Plus are isolated from the PLC. When we say isolated, it means there is a control relay between the PLC and the motor or device. This is to protect the PLC against power spikes from motor amp loads that cause damage to the smaller internal PLC relays. So in the event that something should happen like this, it would be easier to replace the relay rather than replacing the entire PLC!

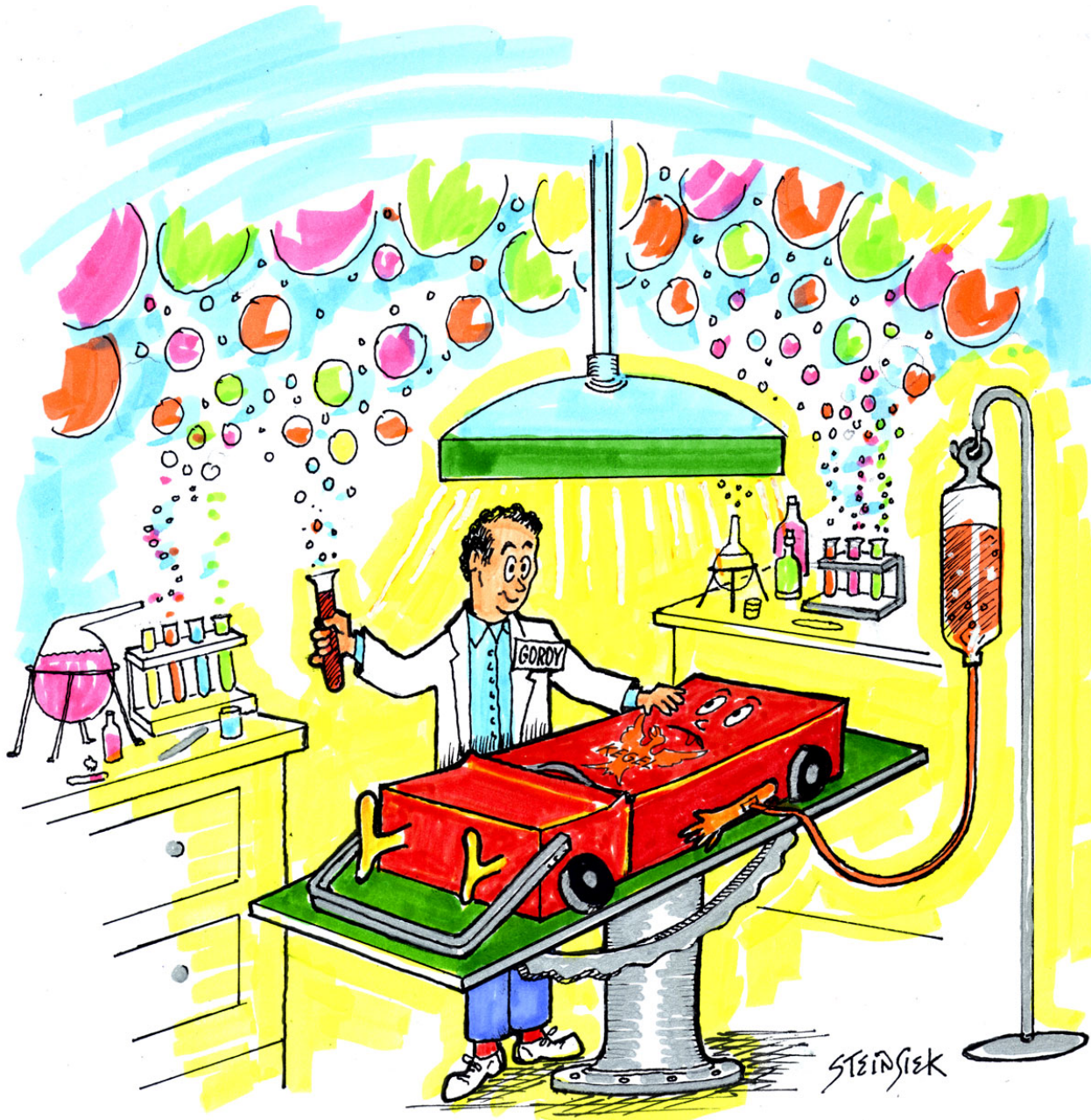


The machine is equipped with 11 replaceable control relays that operate ALL the motors of the machine.

- **CONTROL RELAY 1:** Forward Relay (LY3)
- **CONTROL RELAY 2:** Reverse Relay (LY3)
- **CONTROL RELAY 3:** Brush Lift Motor
- **CONTROL RELAY 4:** Squeegee Lift Motor
- **CONTROL RELAY 5:** Duster Unwind Motor
- **CONTROL RELAY 6:** Duster Wind-up Motor
- **CONTROL RELAY 7:** Cleaner Pump Relay (24VDC)
- **CONTROL RELAY 8:** Vacuum Motor Relay (24VDC)
- **CONTROL RELAY 9:** Left to Right Head Motor Relay (24VDC)
- **CONTROL RELAY 10:** Right to Left Head Motor Relay (24VDC)
- **CONTROL RELAY 11:** Cleaner Pump Speed Control Relay (LY2)

## Troubleshooting

Visit [www.kegel.net](http://www.kegel.net) or call Kegel Tech Support at 863-734-0200. Lane Maintenance Central is here to help any time you call.



# CHAPTER 6



## Mechanical Drawings

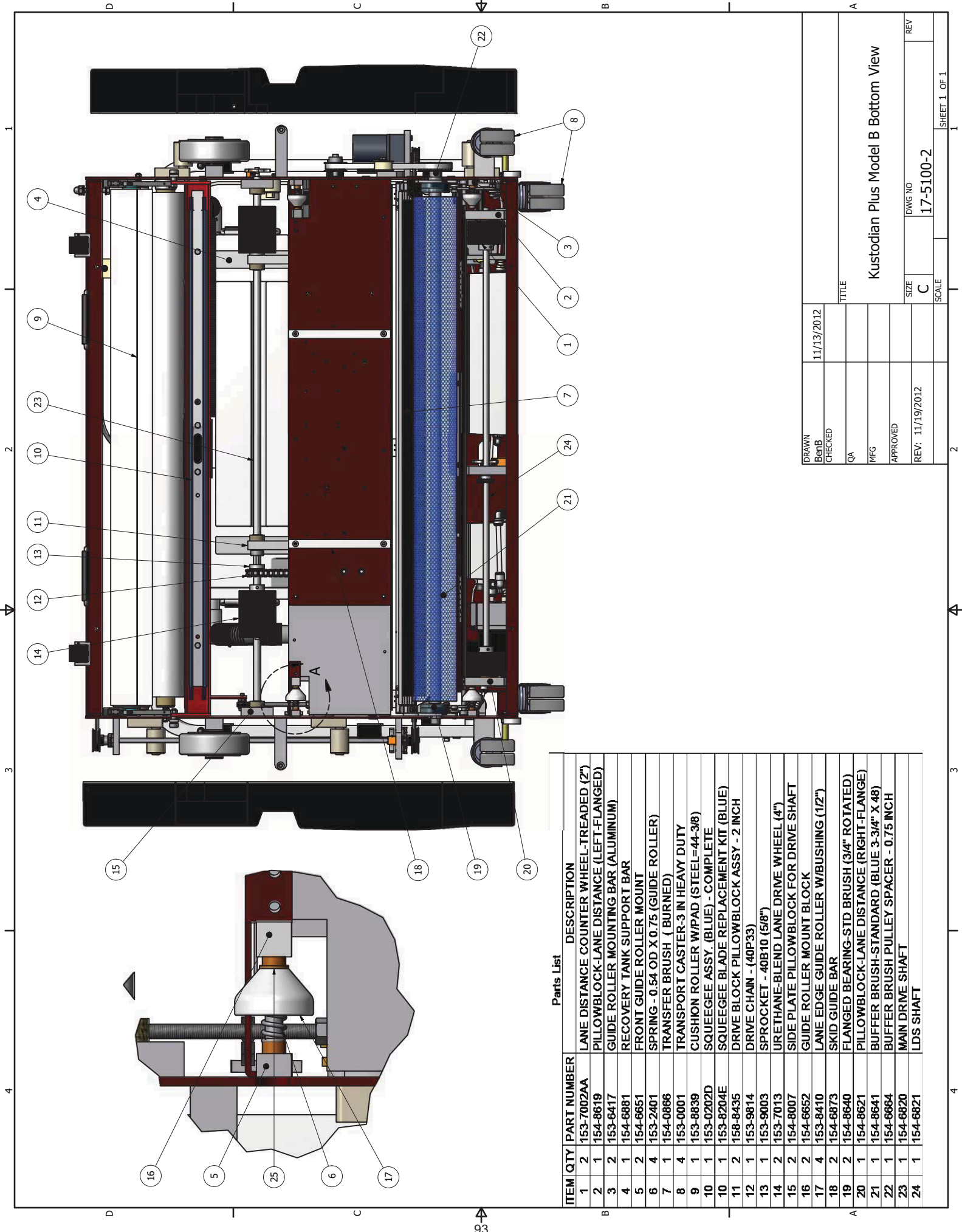
### Machine Descriptions and Part Numbers

The following figures show major systems for the Kustodian Plus and the associated parts:

Figure 1 – Kustodian Plus (Top View).....	92
Figure 2 – Kustodian Plus (Bottom View) .....	93
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Figure 7 – Main Drive Motor Assembly.....	98
Figure 8 – Cleaner Tank Assembly.....	99
Figure 9 – Cleaner Head & Tank Assembly.....	100
Figure 10 – Conditioner Pump & Tank Assembly .....	101
Figure 11 –Buffer and Transfer Brush Assembly .....	102
Figure 12 – Squeegee Assembly .....	103
Figure 13 – Dual Motor Ratcheting Duster Assembly .....	104
Figure 14 – Brush Lift Assembly .....	105
Figure 15 – Vacuum Assembly.....	106
Figure 16 – Splash Guard and Oil Head Assembly .....	107



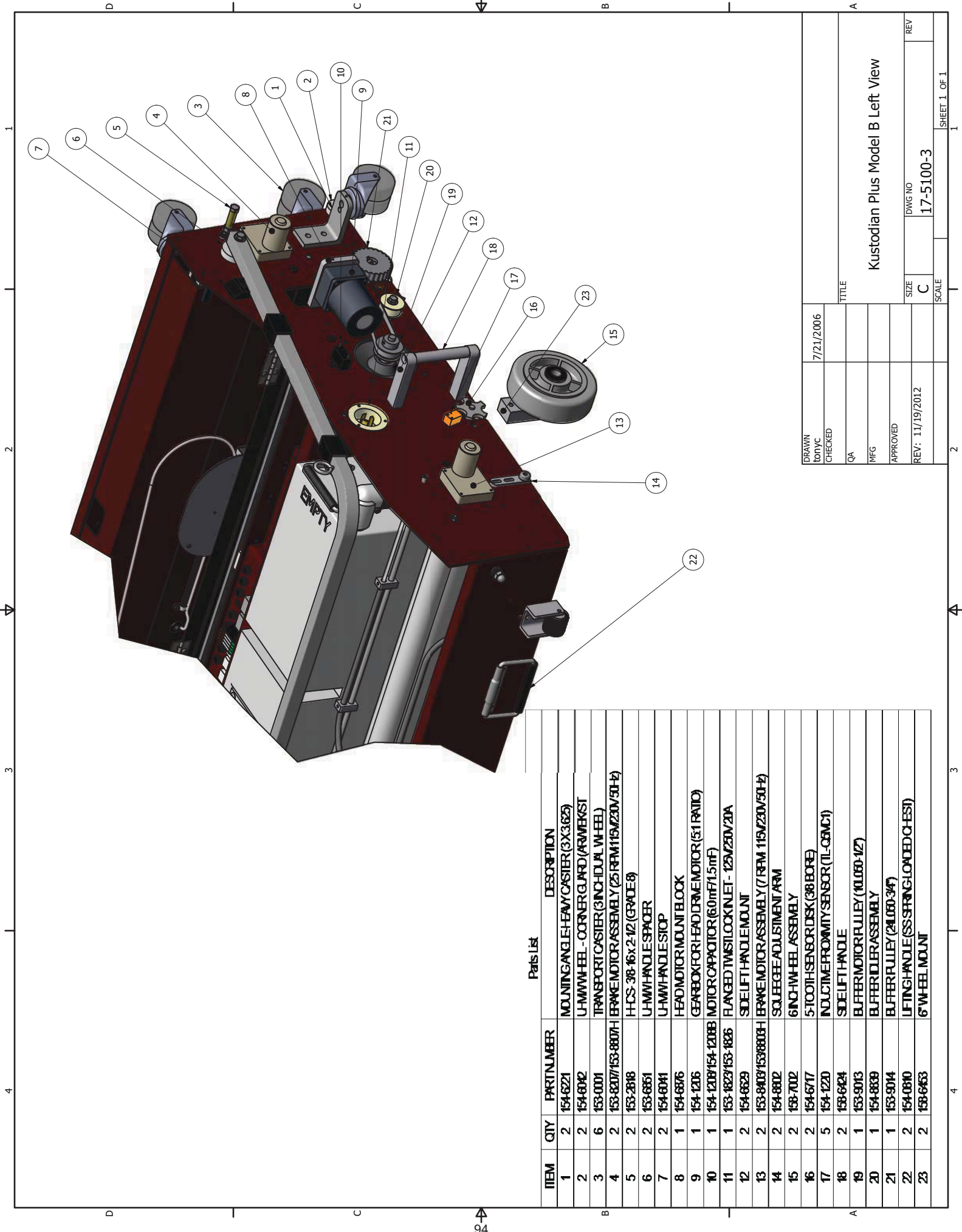




**Parts List**

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	153-7002AA	LANE DISTANCE COUNTER WHEEL-TREADED (2")
2	1	154-8619	PILLOWBLOCK-LANE DISTANCE (LEFT-FLANGED)
3	2	153-8417	GUIDE ROLLER MOUNTING BAR (ALUMINUM)
4	1	154-8881	RECOVERY TANK SUPPORT BAR
5	2	154-8651	FRONT GUIDE ROLLER MOUNT
6	4	153-2401	SPRING - 0.54 OD X 0.75 (GUIDE ROLLER)
7	1	154-0866	TRANSPORT BRUSH ( BURNED)
8	4	153-0001	TRANSPORT CASTER-3 IN HEAVY DUTY
9	1	153-8839	CUSHION ROLLER W/PAD (STEEL=44-3/8)
10	1	153-0202D	SQUEEGEE ASSY. (BLUE) - COMPLETE
11	2	158-8435	DRIVE BLOCK PILLOWBLOCK REPLACEMENT KIT (BLUE)
12	1	153-9814	DRIVE BLOCK PILLOWBLOCK ASSY - 2 INCH
13	1	153-9003	DRIVE CHAIN - (40P33)
14	2	153-7013	SPROCKET - 40B10 (5/8")
15	2	154-8007	URETHANE-BLEND LANE DRIVE WHEEL (4")
16	2	154-8652	SIDE PLATE PILLOWBLOCK FOR DRIVE SHAFT
17	4	153-8410	GUIDE ROLLER MOUNT BLOCK
18	2	154-8873	LANE EDGE GUIDE ROLLER W/BUSHING (1/2")
19	2	154-8640	SKID GUIDE BAR
20	1	154-8640	FLANGED BEARING-STD BRUSH (3/4" ROTATED)
21	1	154-8641	PILLOWBLOCK-LANE DISTANCE (RIGHT-FLANGE)
22	1	154-8664	BUFFER BRUSH-STANDARD (BLUE 3-3/4" X 48)
23	1	154-8820	BUFFER BRUSH PULLEY SPACER - 0.75 INCH
24	1	154-8821	MAIN DRIVE SHAFT
25	1	154-8821	LDS SHAFT

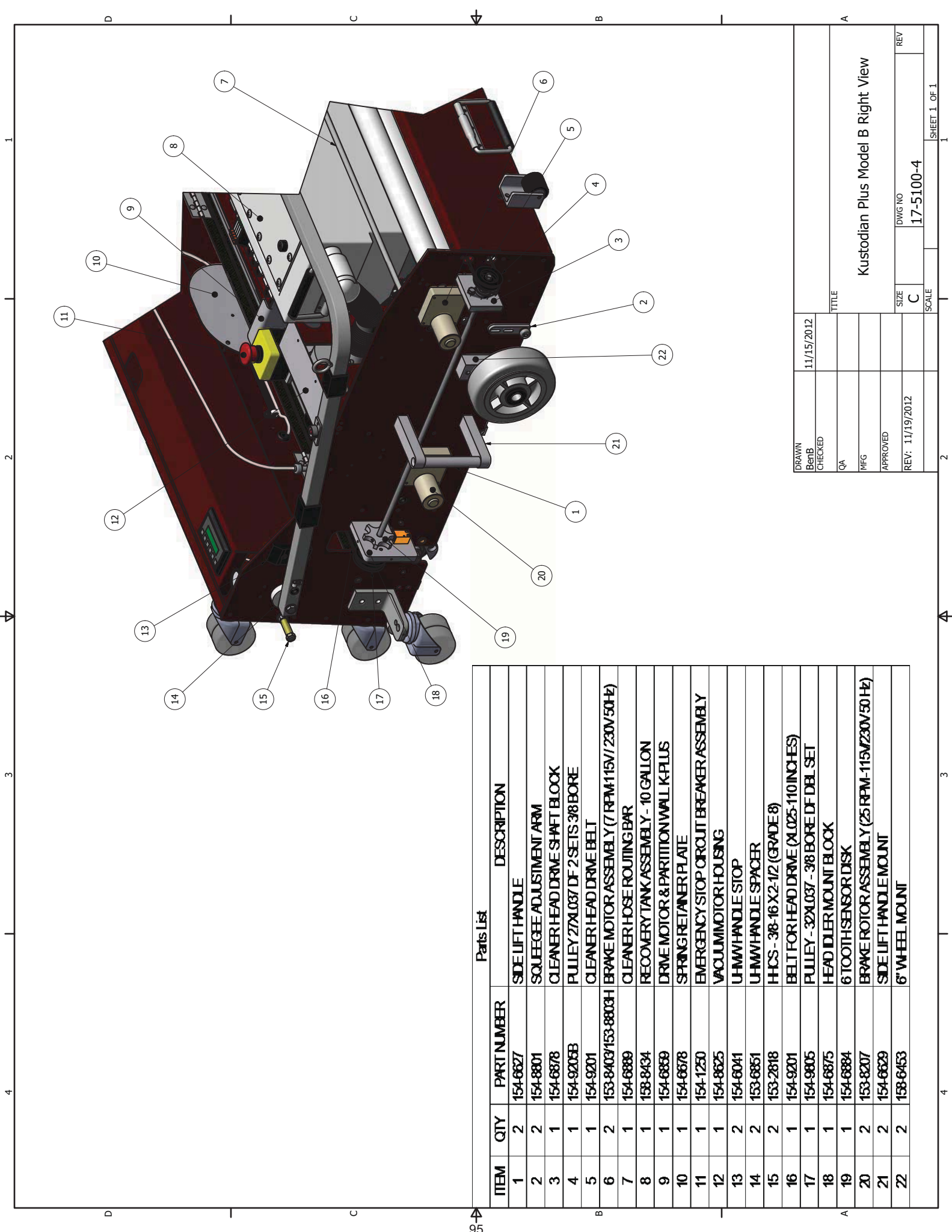
DRAWN	11/13/2012	TITLE	Kustodian Plus Model B Bottom View	
BenB		QA		
CHECKED		MFG		
		APPROVED		
REV	11/19/2012	SIZE	C	DWG NO
		SCALE		17-5100-2
				SHEET 1 OF 1



Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	154-6221	MOUNTING ANGLE HEAVY CASTER (3X3.625)
2	2	154-6042	U-MW WHEEL - CORNER GUARD (ARMERKST)
3	6	153-0001	TRANSPORT CASTER (SINGLE DUAL WHEEL)
4	2	153-8207/153-8807-H	BRAKE MOTOR ASSEMBLY (25 RPM 115/230V 50-Hz)
5	2	153-2818	H-CS 3/8-16x2-1/2 (GRADE 8)
6	2	153-6861	U-MW HANDLE SPACER
7	2	154-6041	U-MW HANDLE STOP
8	1	154-6876	HEAD MOTOR MOUNT BLOCK
9	1	154-1206	GEARBOX FOR HEAD DRIVE MOTOR (5:1 RATIO)
10	1	154-1209/154-1208B	MOTOR CAPACITOR (6.0 mF/1.5 mF)
11	1	153-1823/153-1826	FLANGED TWS LOCK NUT - 125/250V 20A
12	2	154-6829	SIDE LIFT HANDLE MOUNT
13	2	153-8403/153/8803-H	BRAKE MOTOR ASSEMBLY (7 RPM 115/230V 50-Hz)
14	2	154-8802	SQUEEGEE ADJUSTMENT ARM
15	2	158-7002	6 INCH WHEEL ASSEMBLY
16	2	154-6717	5-TOOTH SENSOR DISK (3/8 BORE)
17	5	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-05MCI)
18	2	158-6424	SIDE LIFT HANDLE
19	1	153-9013	BUFFER MOTOR RULLEY (10/60-1/2)
20	1	154-8839	BUFFER RIDER ASSEMBLY
21	1	153-9014	BUFFER RULLEY (24/60-3/4)
22	2	154-0810	LIFTING HANDLE (SS SPRING LOADED C-EST)
23	2	159-6453	6" WHEEL MOUNT

DRAWN	7/21/2006	TITLE	Kustodian Plus Model B Left View	
CHECKED		DATE	SIZE	REV
QA		APPROVED	C	
MFG		REV: 11/19/2012	DWG NO	17-5100-3
SCALE				SHEET 1 OF 1

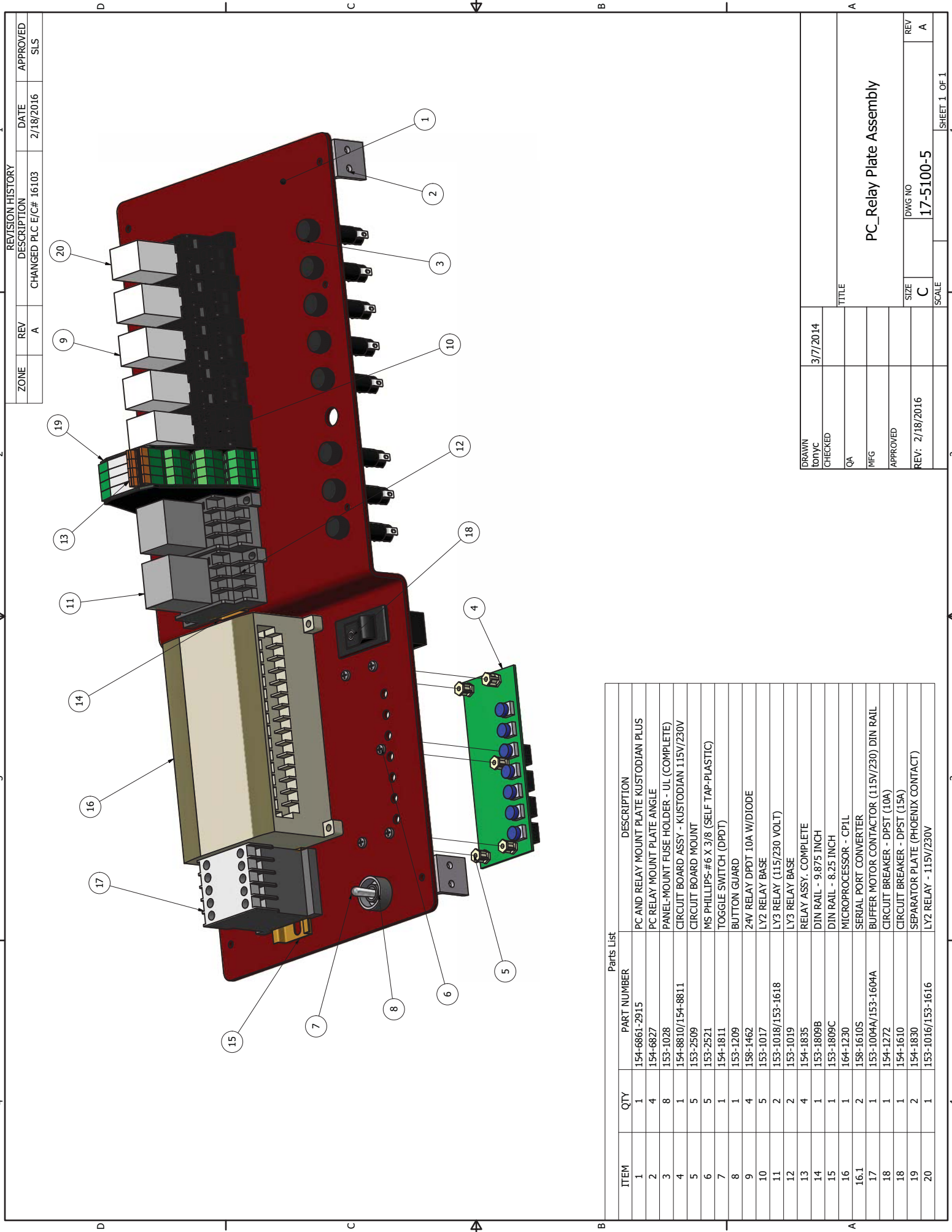


**Parts List**

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	154-6627	SIDE LIFT HANDLE
2	2	154-8801	SQUEEGEE ADJUSTMENT ARM
3	1	154-6878	CLEANER HEAD DRIVE SHAFT BLOCK
4	1	154-9205B	PULLEY 27X.037 DF 2 SETS 3/8 BORE
5	1	154-9201	CLEANER HEAD DRIVE BELT
6	2	153-8403/153-8803H	BRAKE MOTOR ASSEMBLY (7 RPM/115V/ 230V/50 Hz)
7	1	154-6889	CLEANER HOSE ROUTING BAR
8	1	158-8434	RECOVERY TANK ASSEMBLY - 10 GALLON
9	1	154-6859	DRIVE MOTOR & PARTITION WALL K-PLUS
10	1	154-6678	SPRING RETAINER PLATE
11	1	154-1250	EMERGENCY STOP CIRCUIT BREAKER ASSEMBLY
12	1	154-8625	VACUUM MOTOR HOUSING
13	2	154-6041	U-M/W HANDLE STOP
14	2	153-6861	U-M/W HANDLE SPACER
15	2	153-2818	HCS - 3/8-16 X 2-1/2 (GRADE 8)
16	1	154-9201	BELT FOR HEAD DRIVE (X.025-110 INCHES)
17	1	154-9805	PULLEY - 32X.037 - 3/8 BORE DF DBL SET
18	1	154-6875	HEAD IDLER MOUNT BLOCK
19	1	154-6884	6 TOOTH SENSOR DISK
20	2	153-8207	BRAKE ROTOR ASSEMBLY (25 RPM-115M/230V/50 Hz)
21	2	154-6629	SIDE LIFT HANDLE MOUNT
22	2	158-6453	6" WHEEL MOUNT

DRAWN	11/15/2012	TITLE	Kustodian Plus Model B Right View	
BenB				
CHECKED				
QA				
MFG				
APPROVED				
REV: 11/19/2012		SIZE	C	DWG NO
				17-5100-4
		SCALE		SHEET 1 OF 1



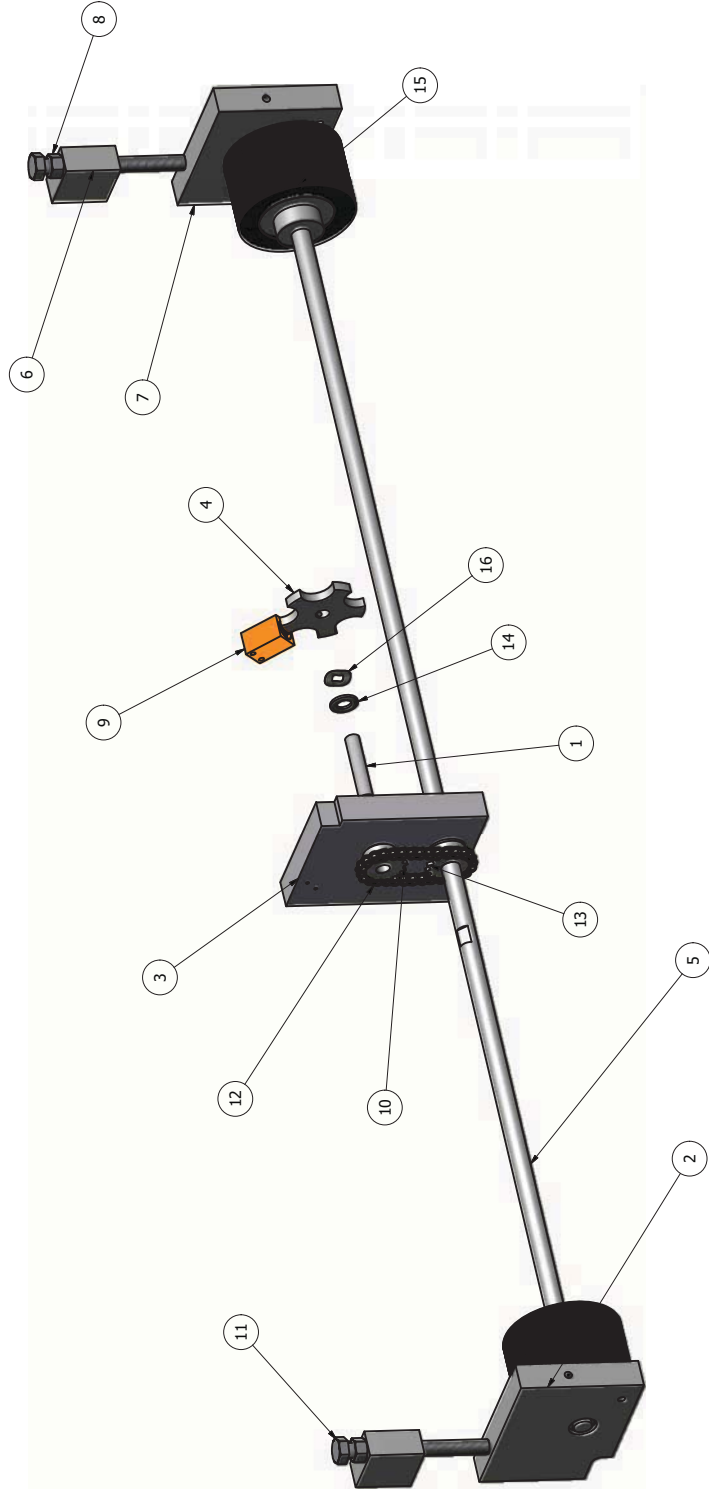


REVISION HISTORY			
ZONE	REV	DESCRIPTION	DATE
	A	CHANGED PLC E/C# 16103	2/18/2016
			APPROVED
			SLS

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-6861-2915	PC AND RELAY MOUNT PLATE KUSTODIAN PLUS
2	4	154-6827	PC RELAY MOUNT PLATE ANGLE
3	8	153-1028	PANEL-MOUNT FUSE HOLDER - UL (COMPLETE)
4	1	154-8810/154-8811	CIRCUIT BOARD ASSY - KUSTODIAN 115V/230V
5	5	153-2509	CIRCUIT BOARD MOUNT
6	5	153-2521	MS PHILLIPS-#6 X 3/8 (SELF TAP-PLASTIC)
7	1	154-1811	TOGGLE SWITCH (DPDT)
8	1	153-1209	BUTTON GUARD
9	4	158-1462	24V RELAY DPDT 10A W/DIODE
10	5	153-1017	LY2 RELAY BASE
11	2	153-1018/153-1618	LY3 RELAY (115V/230 VOLT)
12	2	153-1019	LY3 RELAY BASE
13	4	154-1835	RELAY ASSY. COMPLETE
14	1	153-1809B	DIN RAIL - 9.875 INCH
15	1	153-1809C	DIN RAIL - 8.25 INCH
16	1	164-1230	MICROPROCESSOR - CPIL
16.1	2	158-1610S	SERIAL PORT CONVERTER
17	1	153-1004A/153-1604A	BUFFER MOTOR CONTACTOR (115V/230) DIN RAIL
18	1	154-1272	CIRCUIT BREAKER - DPST (10A)
18	1	154-1610	CIRCUIT BREAKER - DPST (15A)
19	2	154-1830	SEPARATOR PLATE (PHOENIX CONTACT)
20	1	153-1016/153-1616	LY2 RELAY - 115V/230V

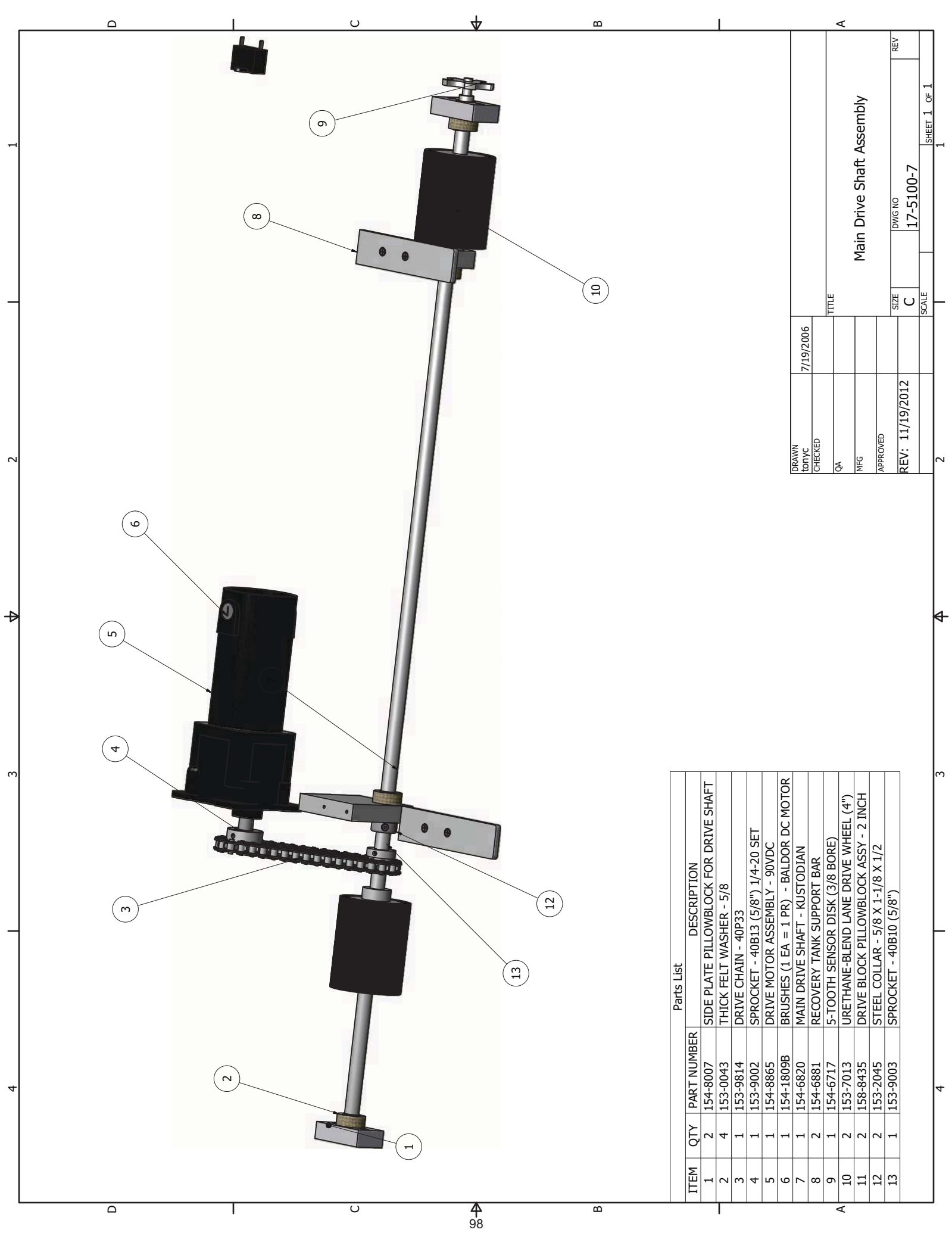
DRAWN	3/7/2014	TITLE	PC_Relay Plate Assembly
CHECKED			
QA			
MFG			
APPROVED			
REV:	2/18/2016	SIZE	C
		DWG NO	17-5100-5
		SCALE	
			SHEET 1 OF 1





ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-6264	SHAFT FOR TIMING DISK (REMOTE SENSOR)
2	1	154-8621	PILLOWBLOCK-LANE DISTANCE (RIGHT-FLANGE)
3	1	154-8320	PB - LANE DISTANCE (CENTER-PLAIN) - 2001
4	1	154-6717	5-TOOTH SENSOR DISK (3/8 BORE) - 2001
5	1	154-6821	LDS SHAFT - KUSTODIAN
6	2	153-6027	LANE DISTANCE ADJUSTMENT BLOCK
7	1	154-8619	PILLOWBLOCK-LANE DISTANCE (LEFT-FLANGED)
8	1	153-2027	JAM NUT - 3/8-16
9	1	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MCL)
10	1	154-9211	LDS AND TACH SENSOR DRIVE CHAIN (25P29)
11	2	153-2234	HHCS - 3/8-16 X 4 (FULL THREAD)
12	1	153-9010	SPROCKET-25B15 (3/8") 1/4-20 SET
13	1	154-9213	SPROCKET-25B15 (1/2") 1/4-20 SET SCREW
14	4	153-2009	NYLON FLAT WASHER (3/8 - 0.060)
15	2	153-7002AA	LANE DISTANCE COUNTER WHEEL - TREADED (2")
16	1	153-2992	TRIPLE WAVE WASHER (.25" DIA)

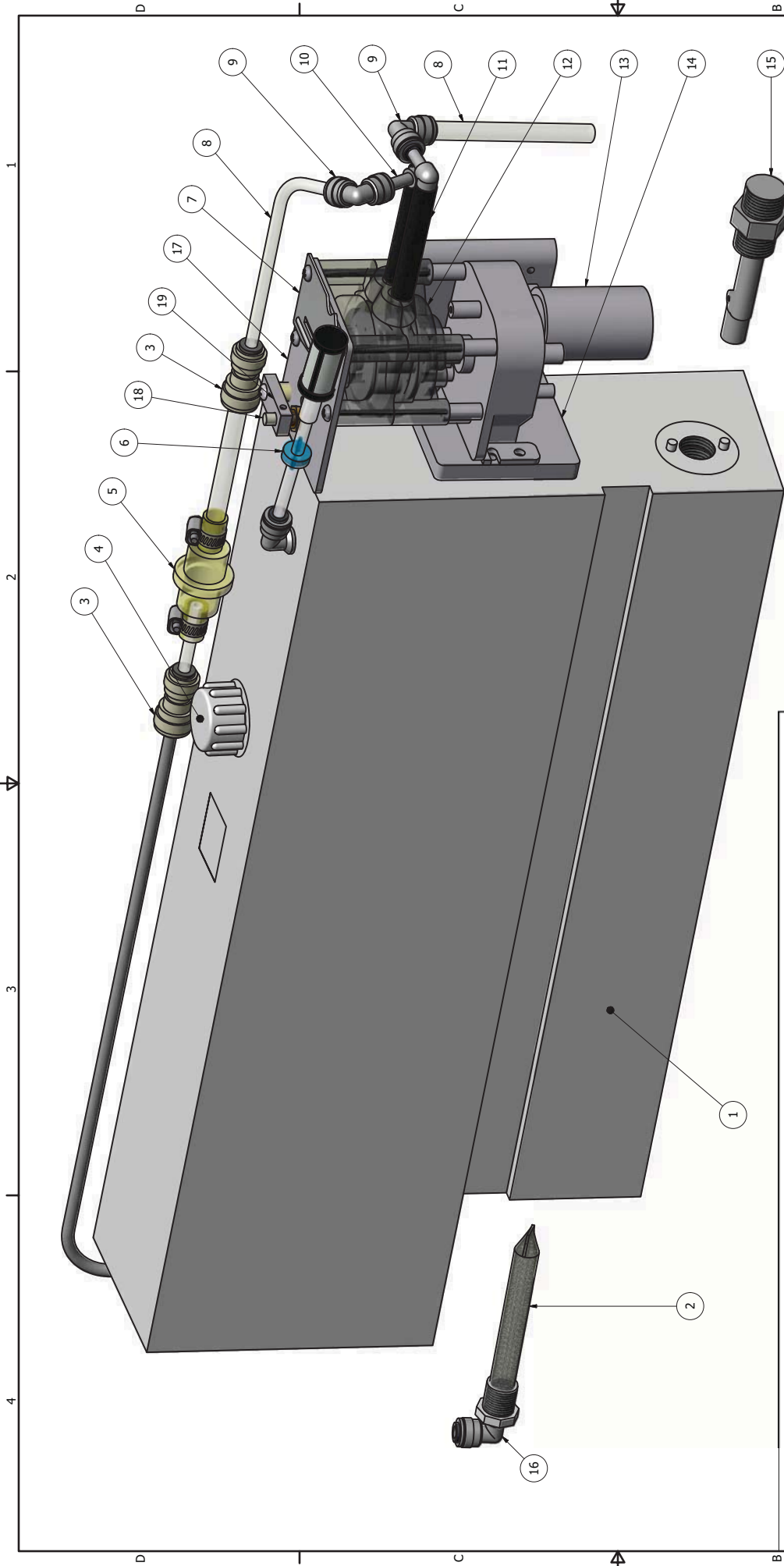
DRAWN	7/20/2006	TITLE	LDS Assembly
CHECKED		QA	
APPROVED		MFG	
SCALE	C	SIZE	
DWG NO	17-5100-6	REV	



Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	154-8007	SIDE PLATE PILLOWBLOCK FOR DRIVE SHAFT
2	4	153-0043	THICK FELT WASHER - 5/8
3	1	153-9814	DRIVE CHAIN - 40P33
4	1	153-9002	SPROCKET - 40B13 (5/8") 1/4-20 SET
5	1	154-8865	DRIVE MOTOR ASSEMBLY - 90VDC
6	1	154-1809B	BRUSHES (1 EA = 1 PR) - BALDOR DC MOTOR
7	1	154-6820	MAIN DRIVE SHAFT - KUSTODIAN
8	2	154-6881	RECOVERY TANK SUPPORT BAR
9	1	154-6717	5-TOOTH SENSOR DISK (3/8 BORE)
10	2	153-7013	URETHANE-BLEND LANE DRIVE WHEEL (4")
11	2	158-8435	DRIVE BLOCK PILLOWBLOCK ASSY - 2 INCH
12	2	153-2045	STEEL COLLAR - 5/8 X 1-1/8 X 1/2
13	1	153-9003	SPROCKET - 40B10 (5/8")

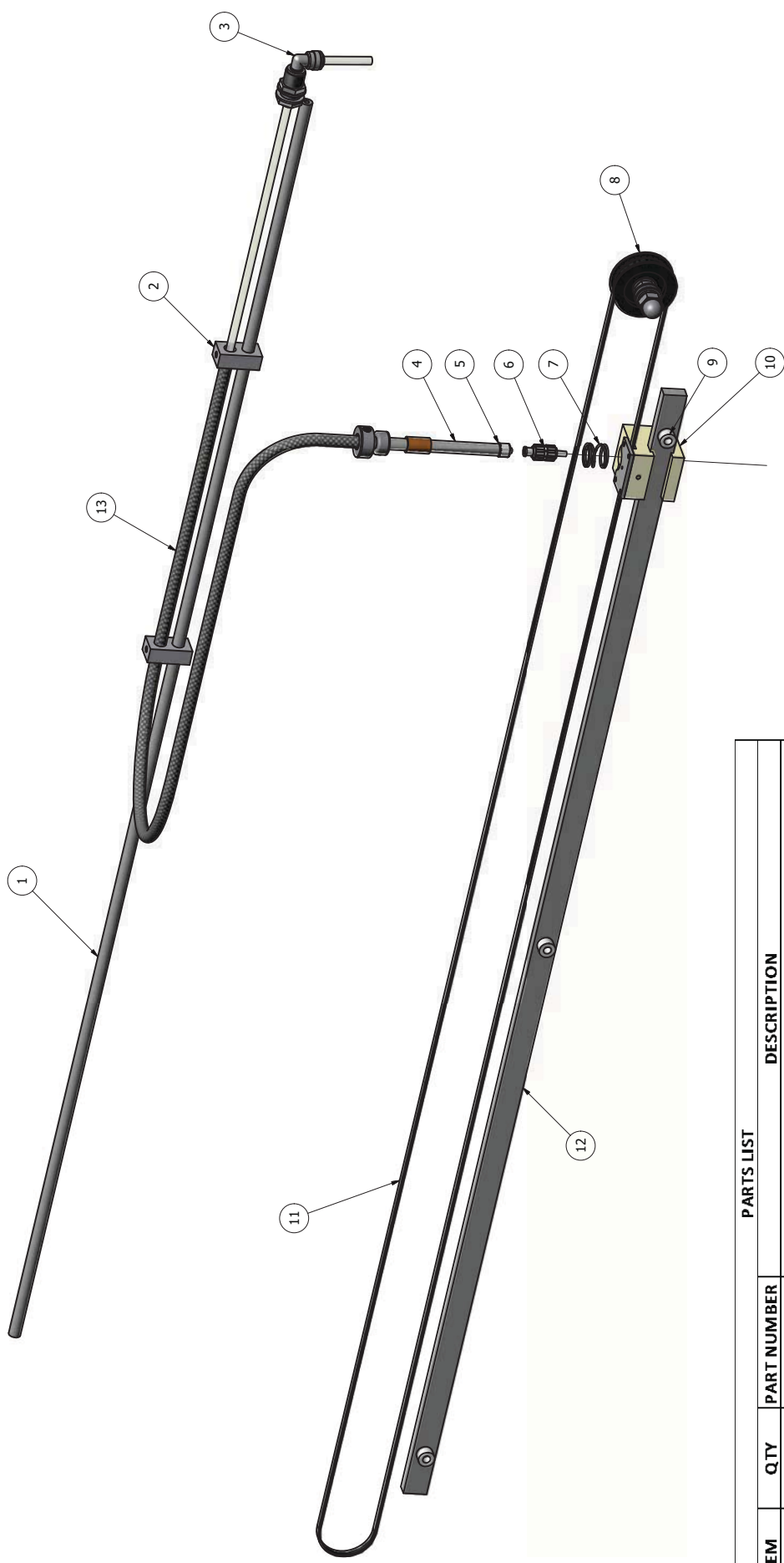
DRAWN lonyc	7/19/2006	TITLE	
CHECKED		Main Drive Shaft Assembly	
QA		SIZE	DWG NO
MFG		C	17-5100-7
APPROVED		REV	
REV: 11/19/2012		SCALE	SHEET 1 OF 1



**PARTS LIST**

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	158-8433C	CLEANER SUPPLY TANK ASSY - 3.25 GAL (COMP)
2	1	154-0212B	FILTER FOR SUPPLY TANK (5" SS) PVC
3	2	154-0244	REDUCER (3/8" TO 1/4")
4	1	154-0832C	CAP FOR POLYETHYLENE TANKS
5	1	154-8867A	INLINE FILTER ASSEMBLY
6	1	154-8817	MANUAL VENT VALVE ASSEMBLY
7	1	N/A	CLEANER PUMP HOSE LOADING TOOL
8	INCH	154-0202A	PENCIL TUBING STOCK - 1/4"OD X 1/8"ID
9	2	154-0243	ELBOW (90 DEGREE) 1/4 X 1/4 GUEST
10	2	154-0227	ELBOW - TUBE TO HOSE BARB (1/4" X 5/16"ID)
11	1	154-0861B	NEOPRENE TUBING FOR PUMP W/ELBOW S
12	1	154-0860A	PUMP - MASTERFLEX (24V-DC)
13	1	158-8404	CLEANER PUMP DRIVE MOTOR
14	1	154-6865	CLEANER PUMP MOUNT ANGLE
15	1	154-8693	CLEANER FLOAT ASSY
16	1	154-0223	ELBOW (90 DEGREE) 1/4" NPT X 1/4" TUBE
17	1	154-6866A	CLEANER PUMP POTENTIOMETER PLATE
18	1	154-8846	POTENTIOMETER ASSEMBLY - SPEED CONTROL (2.5 OHM)
19	1	158-6432	POTENTIOMETER LOCKING BAR

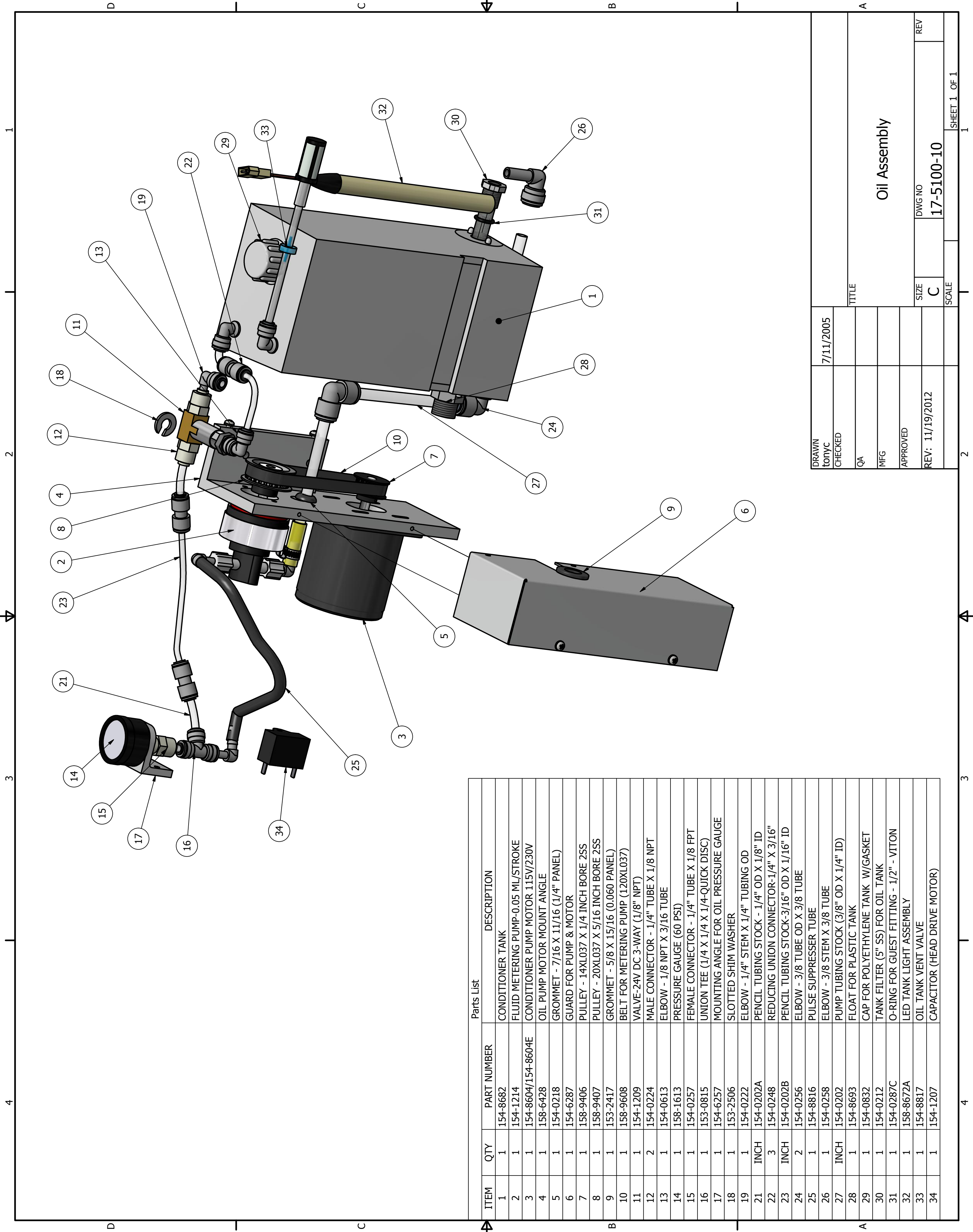
DRAWN	10/29/2012	TITLE	Cleaner Tank Assembly
BRB			
CHECKED			
QA			
MFG			
APPROVED			
REV: 11/19/2012		SIZE	C
		DWG NO	17-5100-8
		SCALE	
		SHEET 1 OF 1	1



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-6889	CLEANER HOSE ROUTING BAR
2	2	154-6888	CLEANER HOSE SPRING MOUNT BLOCK
3	1	154-0222	ELBOW 1/4" STEM X 1/4" TUBING OD
4	1	154-8852	CLEANER HOSE TUBE (4.5 INCH) AND TIP ASSEMBLY
5	1	154-0863	MALE LUER TO HOSE BARB
6	1	164-0012M	CLEANER TIP W/CHECK VALVE
7	1	153-2713	SPRING - OIL TIP RETAINER
8	1	154-9802	PULLEY 27XLO37 DF 2SETS 3/8" BORE
9	3	154-6874	CLEANING HEAD BAR SPACER
10	1	154-6882	CLEANER HEAD
11	1	154-9201	CLEANER HEAD DRIVE BELT
12	1	154-6877	CLEANER HEAD GUIDE BAR
13	1	154-0867	CLEANER HOSE SPRING (3.6")

PARTS LIST

DRAWN	3/7/2014	TITLE	Cleaner Head Assembly
CHECKED		SIZE	C
QA		SCALE	
MFG		DWG NO	17-5100-9
APPROVED		REV	
REV: 11/19/2012			

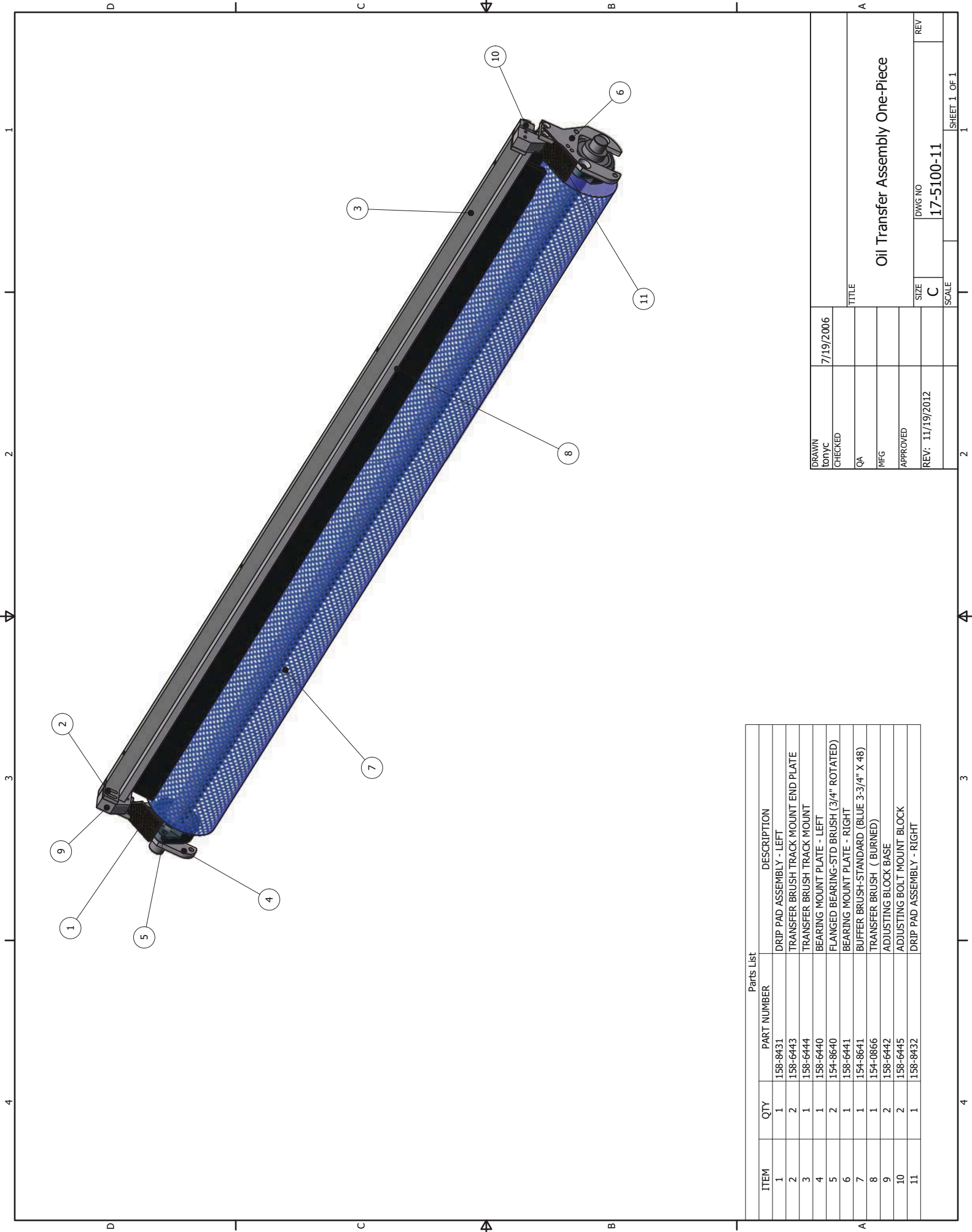


Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-8682	CONDITIONER TANK
2	1	154-1214	FLUID METERING PUMP-0.05 ML/STROKE
3	1	154-8604/154-8604E	CONDITIONER PUMP MOTOR 115V/230V
4	1	158-6428	OIL PUMP MOTOR MOUNT ANGLE
5	1	154-0218	GROMMET - 7/16 X 11/16 (1/4" PANEL)
6	1	154-6287	GUARD FOR PUMP & MOTOR
7	1	158-9406	PULLEY - 14XL037 X 1/4 INCH BORE 2SS
8	1	158-9407	PULLEY - 20XL037 X 5/16 INCH BORE 2SS
9	1	153-2417	GROMMET - 5/8 X 15/16 (0.060 PANEL)
10	1	158-9608	BELT FOR METERING PUMP (120XL037)
11	1	154-1209	VALVE-24V DC 3-WAY (1/8" NPT)
12	2	154-0224	MALE CONNECTOR - 1/4" TUBE X 1/8 NPT
13	1	154-0613	ELBOW - 1/8 NPT X 3/16 TUBE
14	1	158-1613	PRESSURE GAUGE (60 PSI)
15	1	154-0257	FEMALE CONNECTOR - 1/4" TUBE X 1/8 FPT
16	1	153-0815	UNION TEE (1/4 X 1/4 X 1/4-QUICK DISC)
17	1	154-6257	MOUNTING ANGLE FOR OIL PRESSURE GAUGE
18	1	153-2506	SLOTTED SHIM WASHER
19	1	154-0222	ELBOW - 1/4" STEM X 1/4" TUBING OD
21	INCH	154-0202A	PENCIL TUBING STOCK - 1/4" OD X 1/8" ID
22	3	154-0248	REDUCING UNION CONNECTOR-1/4" X 3/16"
23	INCH	154-0202B	PENCIL TUBING STOCK-3/16" OD X 1/16" ID
24	2	154-0256	ELBOW - 3/8 TUBE OD X 3/8 TUBE
25	1	154-8816	PULSE SUPPRESSOR TUBE
26	1	154-0258	ELBOW - 3/8 STEM X 3/8 TUBE
27	INCH	154-0202	PUMP TUBING STOCK (3/8" OD X 1/4" ID)
28	1	154-8693	FLOAT FOR PLASTIC TANK
29	1	154-0832	CAP FOR POLYETHYLENE TANK W/GASKET
30	1	154-0212	TANK FILTER (5" SS) FOR OIL TANK
31	1	154-0287C	O-RING FOR GUEST FITTING - 1/2" - VITON
32	1	158-8672A	LED TANK LIGHT ASSEMBLY
33	1	154-8817	OIL TANK VENT VALVE
34	1	154-1207	CAPACITOR (HEAD DRIVE MOTOR)

DRAWN	7/11/2005	TITLE	
tonyc		Oil Assembly	
CHECKED		SIZE	C
QA		DWG NO	17-5100-10
MFG		REV	
APPROVED		SCALE	
REV: 11/19/2012		SHEET 1 OF 1	





Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	158-8431	DRIP PAD ASSEMBLY - LEFT
2	2	158-6443	TRANSFER BRUSH TRACK MOUNT END PLATE
3	1	158-6444	TRANSFER BRUSH TRACK MOUNT
4	1	158-6440	BEARING MOUNT PLATE - LEFT
5	2	154-8640	FLANGED BEARING-STD BRUSH (3/4" ROTATED)
6	1	158-6441	BEARING MOUNT PLATE - RIGHT
7	1	154-8641	BUFFER BRUSH-STANDARD (BLUE 3-3/4" X 48)
8	1	154-0866	TRANSFER BRUSH ( BURNED)
9	2	158-6442	ADJUSTING BLOCK BASE
10	2	158-6445	ADJUSTING BOLT MOUNT BLOCK
11	1	158-8432	DRIP PAD ASSEMBLY - RIGHT

DRAWN TomyC	7/19/2006	TITLE	
CHECKED		Oil Transfer Assembly One-Piece	
QA		SIZE	DWG NO
MFG		C	17-5100-11
APPROVED		SCALE	REV
REV: 11/19/2012			
			SHEET 1 OF 1





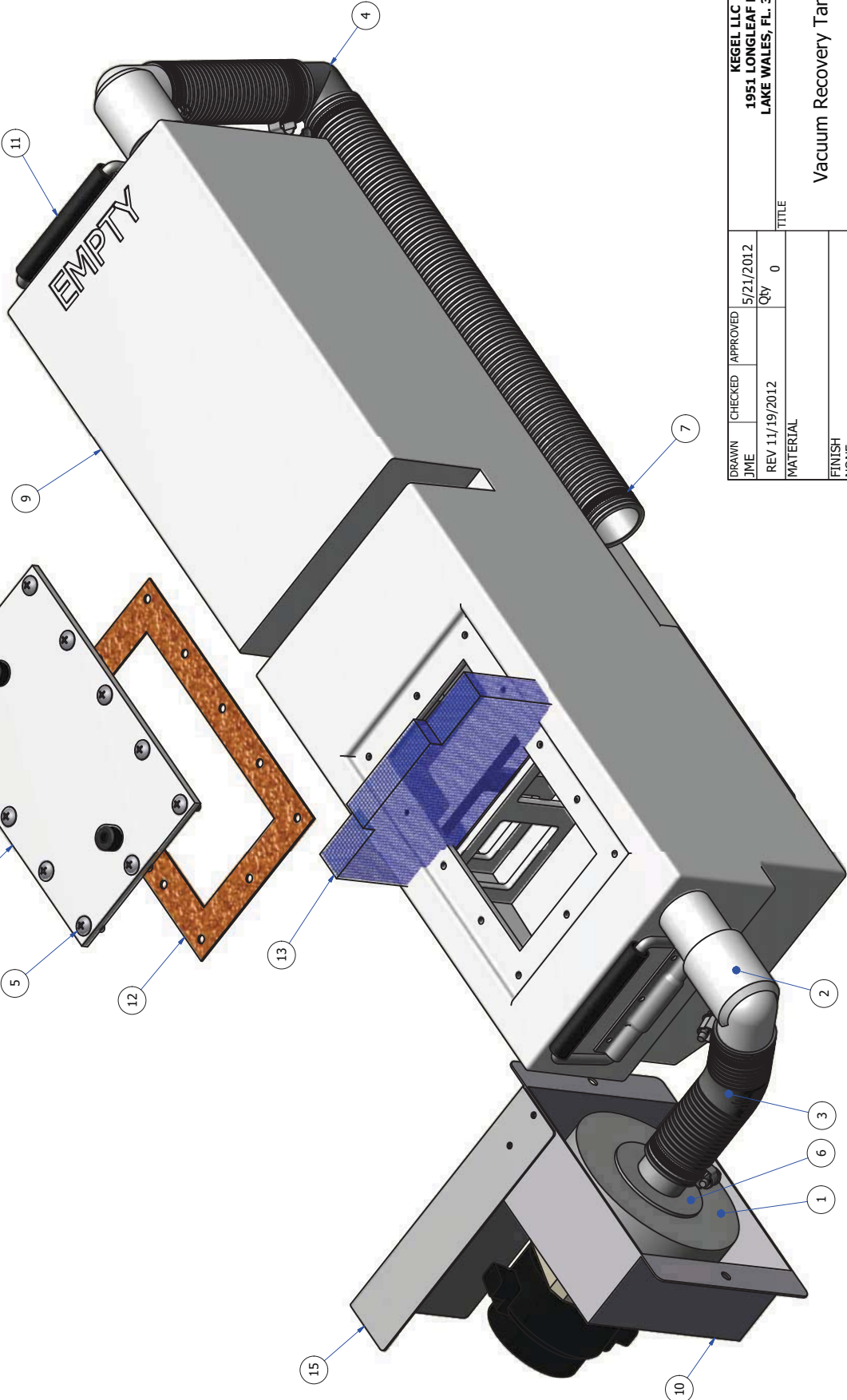




ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-8637	BUFFER BRUSH LIFTING ASSEMBLY
2	1	154-6824	BRUSH CAM SWITCH PLATE
3	1	153-8207	BRAKE MOTOR ASSEMBLY (25 RPM-115 VOLT)
3	1	153-8807H	BRAKE MOTOR ASSEMBLY (25 RPM-230V 50 HZ)
4	1	154-6243	MOTOR CAM-DUAL LOBES (STACKED SWITCHES)
5	6	153-2801	SHOULDER BOLT-3/8 X 3/8 (5/16-18)
6	2	153-2804	COLLAR - 3/8 X 3/4 X 3/8
7	1	154-8638	BUFFER BRUSH LIFTING LINK - LEFT
8	1	154-8639	BUFFER BRUSH LIFTING LINK - RIGHT
9	2	153-1203	MICROSWITCH-WITH ROLLER (SQUEEGEE/BRUSH)
10	2	153-2801A	SHOULDER BOLT-3/8 X 3/8-CUT (5/16-18)
11	1	154-8837	CAM TO BRUSH LIFTING ROD LINK ASSEMBLY

DRAWN tonyc	7/20/2006	TITLE	Brush Lift Assembly
CHECKED		QA	
		MFG	
		APPROVED	
REV: 11/19/2012	SCALE	SIZE	DWG NO
	C		17-5100-14
		REV	

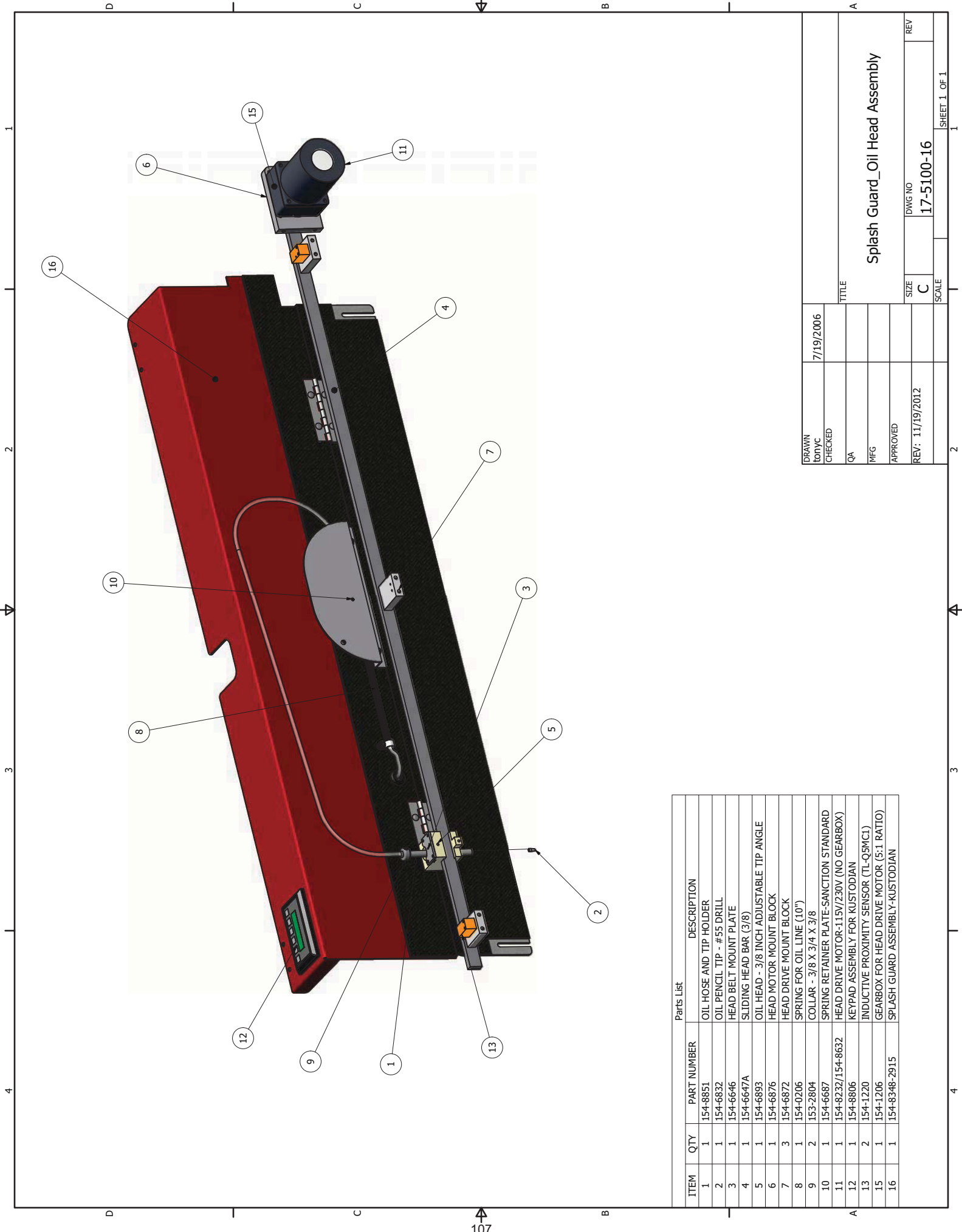
PARTS LIST		QTY	PART NUMBER	DESCRIPTION
1	1	158-8407	ASSEMBLY - VACUUM MOTOR	
1.1	1	158-1421B	BRUSHES - VACUUM MOTOR 24V	
2	2	153-8827T	1-1/4" PVC ELBOW - TANK INLET (NO THREADS)	
3	INCH	154-0260	FLEXIBLE VAC HOSE GREY (1-1/2" ID)	
4	1	154-0607	PVC ELBOW - 1-1/2" BARB X 1-1/2" BARB	
5	12	153-2924	MS PHILLIPS - 1/4"-20 X 3/4" TRUSS HEAD	
6	1	153-6221M	VACUUM HOSE ADAPTER	
7	6	153-2406	HOSE CLAMP (2 INCH)	
8	1	158-6448	REC TANK SUB-FLOOR COVER PLATE - 10 GAL	
9	1	158-8617	RECOVERY TANK ASSEMBLY - 10 GALLON	
10	1	158-8618	VACUUM MOTOR HOUSING	
11	2	154-0810	LIFTING HANDLE (SS SPRING-LOADED CHEST)	
12	1	158-0405	RECOVERY TANK GASKET	
13	1	158-0406	FILTER FOR 10 GALLON RECOVERY TANK	
14	2	154-0066A	BUMPER GUARD - POLYURETHANE (13/32)	
15	1	158-6709	VACUUM MOTOR GUARD	



DRAWN	CHECKED	APPROVED	5/21/2012
JME	REV 11/19/2012		Qty 0
MATERIAL			
FINISH			
NONE			
TOLERANCES:			
3 DECIMALS +/- 0.005			
2 DECIMALS +/- 0.010			
1 DECIMAL +/- 0.030			
SCALE	DOC REV	SIZE	REV
		C	
		DWG NO	17-5100-15
		DATE	09/05/06
SHEET 1 OF 1			

Vacuum Recovery Tank Assembly

KEGEL LLC  
1951 LONGLEAF BLVD  
LAKE WALES, FL. 33859



Parts List

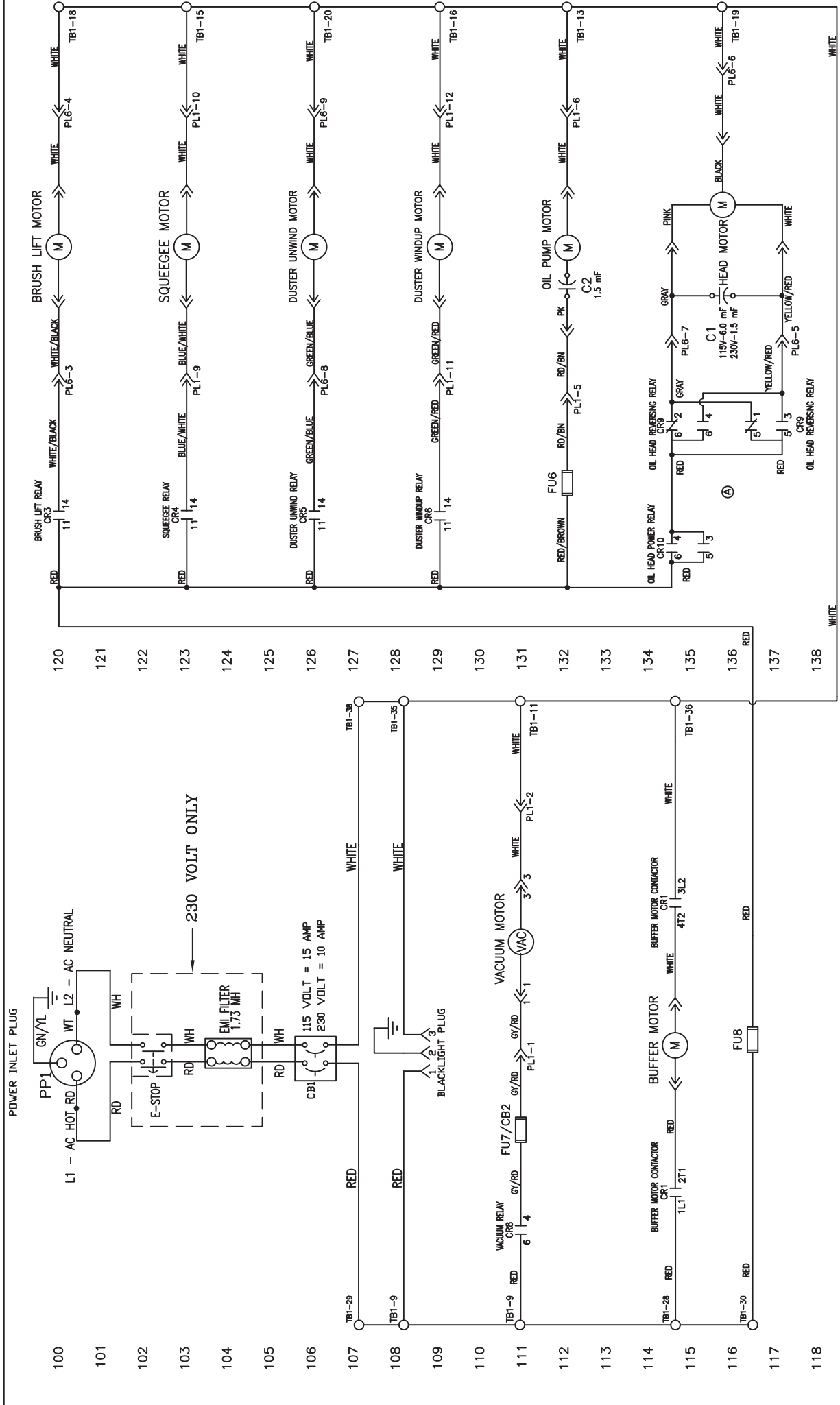
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-8851	OIL HOSE AND TIP HOLDER
2	1	154-6832	OIL PENCIL TIP - #55 DRILL
3	1	154-6646	HEAD BELT MOUNT PLATE
4	1	154-6647A	SLIDING HEAD BAR (3/8)
5	1	154-6893	OIL HEAD - 3/8 INCH ADJUSTABLE TIP ANGLE
6	1	154-6876	HEAD MOTOR MOUNT BLOCK
7	3	154-6872	HEAD DRIVE MOUNT BLOCK
8	1	154-0206	SPRING FOR OIL LINE (10")
9	2	153-2804	COLLAR - 3/8 X 3/4 X 3/8
10	1	154-6687	SPRING RETAINER PLATE-SANCTION STANDARD
11	1	154-8232/154-8632	HEAD DRIVE MOTOR-115V/230V (NO GEARBOX)
12	1	154-8806	KEYPAD ASSEMBLY FOR KUSTODIAN
13	2	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MC1)
15	1	154-1206	GEARBOX FOR HEAD DRIVE MOTOR (5:1 RATIO)
16	1	154-8348-2915	SPLASH GUARD ASSEMBLY-KUSTODIAN

DRAWN	7/19/2006	TITLE	Splash Guard_Oil Head Assembly		
CHECKED		QA	SIZE	DWG NO	REV
		MFG	C	17-5100-16	
		APPROVED	SCALE		SHEET 1 OF 1
REV:	11/19/2012				

## Kustodian Plus Wiring Diagrams

The following diagrams show wiring schematics for this lane machine. If you have any questions please call 863-734-0200 or email [tech@kegel.net](mailto:tech@kegel.net).

Motor Wiring.....	109
Output Wiring.....	110
Input Wiring .....	111
Speed Control.....	112
Terminal Block Layout.....	113
Vacuum Motor Wiring.....	114
Squeegee Motor and Switch.....	115
Speed Tach and LDS Wiring.....	116
Brush Lift Motor and Switch.....	117
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Duster Windup Motor.....	120
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Cleaner Speed Control Wiring.....	124
LED Tank Light Wiring .....	125



REV	LTR	DATE	DESCRIPTION
A		02/25/14	92 PROGRAM WIRING UPDATE E/C# 14130

MATERIAL		DESCRIPTION	
N/A		KEGEL	
N/A		DESCRIPTION	
N/A		MOTOR WIRING SCHEMATIC	
N/A		KUSTODIAN PLUS MODEL B	
N/A		DO NOT SCALE DRAWING	
DATE	06/21/11	SIZE	QTY/MACHINE PART NUMBER
DRAWN BY	SLS	REV DATE	
APPROVED:	HFG	REV	
REV	A	SCALE	N/A
REV	A	SCALE	N/A
REV	A	SCALE	N/A

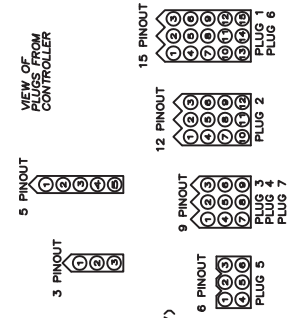
  

REV	DATE	DESCRIPTION
1	01/17/11	ALL 17-51XX MODELS

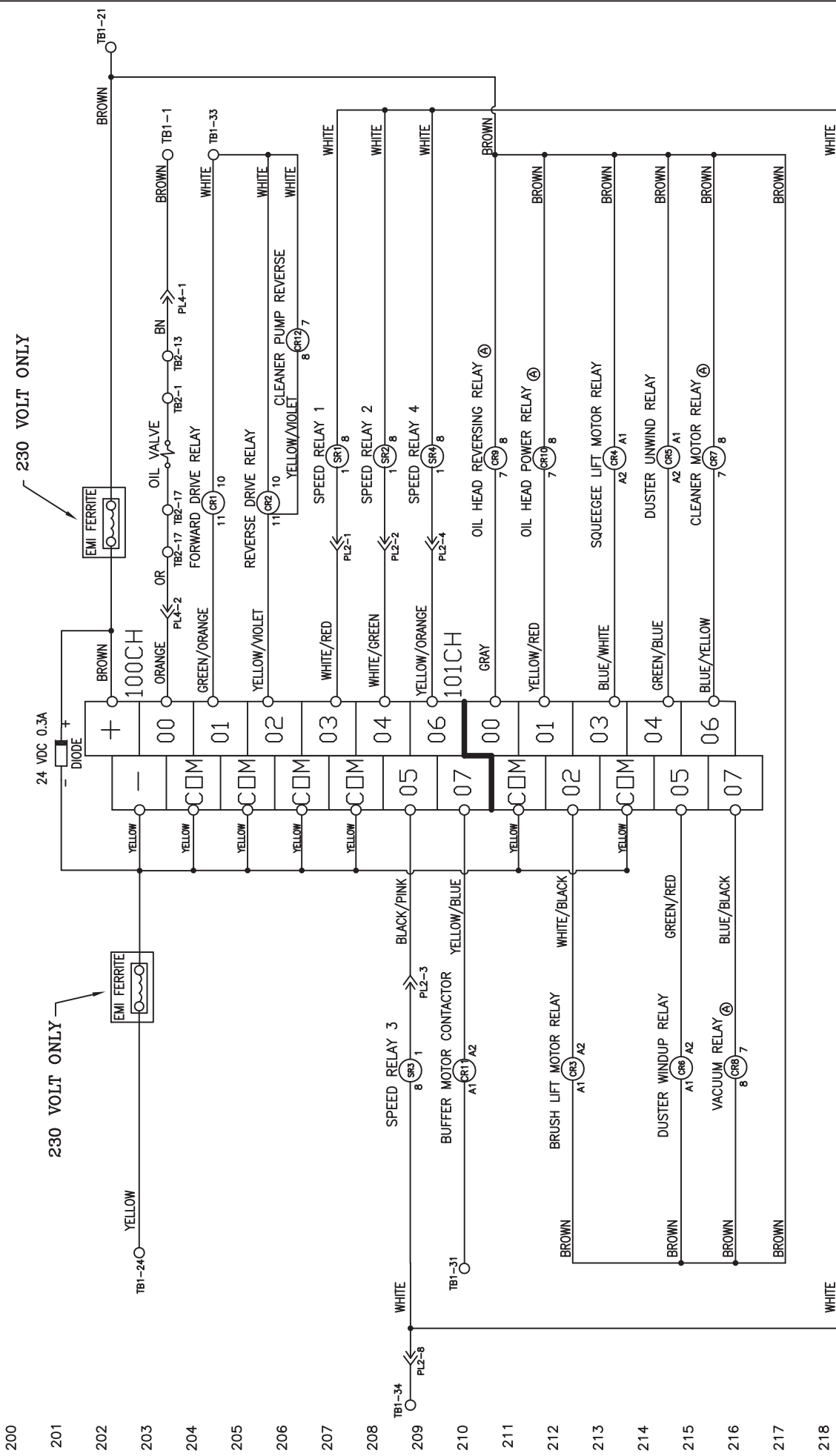
  

1981 LONGLEAF BLVD.  
LAKE WALKER, FL 33869  
(888) 734-0900

- LEGEND**
- PL1 - MAIN PLUG - 10-PIN SIDE (15)
  - PL2 - DRIVE CIRCUIT BOARD PLUG (12)
  - PL3 - DRIVE SPEED BOARD PLUG (9)
  - PL4 - PLC INPUT PLUG - 10-PIN SIDE (9)
  - PL5 - PLC INPUT PLUG - 7-PIN SIDE (6)
  - PL6 - MAIN PLUG - 7-PIN SIDE (15)
  - PL7 - DC CLEANER SPEED BOARD PLUG (9)
  - TB1 - TERMINAL BLOCK 1 (MAIN)
  - TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
  - TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
  - TB4 -
  - TB5 - TERMINAL BLOCK 5 (HANDLE)
  - PP1 - POWER INLET PLUG
  - C1 - HEAD DRIVE MOTOR CAPACITOR
  - C2 - OIL PUMP MOTOR CAPACITOR
  - C81 - CIRCUIT BREAKER (15A-115V)(10A-230V)
  - C82 - VACUUM CIRCUIT BREAKER (8A - 230V)
  - CR1 - FORWARD DRIVE RELAY (LY3)
  - CR2 - REVERSE DRIVE RELAY (LY3)
  - CR3 - BRUSH LIFT MOTOR RELAY
  - CR4 - SQUEEGEE LIFT MOTOR RELAY
  - CR5 - DUSTER UNWIND MOTOR RELAY
  - CR6 - DUSTER WINDUP MOTOR RELAY
  - CR7 - CLEANER MOTOR RELAY (LY2 24VDC)
  - CR8 - VACUUM RELAY (LY2 24VDC)
  - CR9 - OIL HEAD REVERSING RELAY (LY2 24VDC)
  - CR10 - OIL HEAD POWER RELAY (LY2 24VDC)
  - CR11 - BUFFER BRUSH MOTOR RELAY
  - CR12 - CLEANER PUMP REVERSE RELAY
  - SR1 - SPEED RELAY 1 (PCB)
  - SR2 - SPEED RELAY 2 (PCB)
  - SR3 - SPEED RELAY 3 (PCB)
  - SR4 - SPEED RELAY 4 (PCB)
  - FU1 - PLC INPUT POWER (0.5A - 115V) (500mA - 230V)
  - FU2 - PC OUTPUT COMMON (0.5A - 115V) (6.3A - 230V)
  - FU3 - DRIVE MOTOR BOARD L1 (4A - 115V) (4A - 230V)
  - FU4 - DRIVE MOTOR BOARD L2 (4A - 115V) (4A - 230V)
  - FU5 - OIL PUMP MOTOR (0.75A - 115V) (315mA - 230V)
  - FU6 - CLEANER MOTOR (4A - 115V) (1.6A - 230V)
  - FU7 - VACUUM MOTOR (10A - 115V)
  - FU8 - PC RELAY COMMON (4A - 115V) (4A - 230V)



OMRON SYSMAC  
CP1L OUTPUTS



REV	LTR	DATE	DESCRIPTION
A		02/25/14	9Z PROGRAM WIRING UPDATE E/C# 14130
B		02/18/16	CHANGED PLC E/C# 16103

MATERIAL		DESCRIPTION	
N/A		KEGEL	OUTPUT WIRING SCHEMATIC
N/A			KUSTODIAN PLUS MODEL B
N/A			DO NOT SCALE DRAWING
N/A			SIZE QTY/MACHINE PART NUMBER
N/A			C N/A ALL 17-51XX MODELS
N/A			SCALE N/A SHEET 2 OF 17

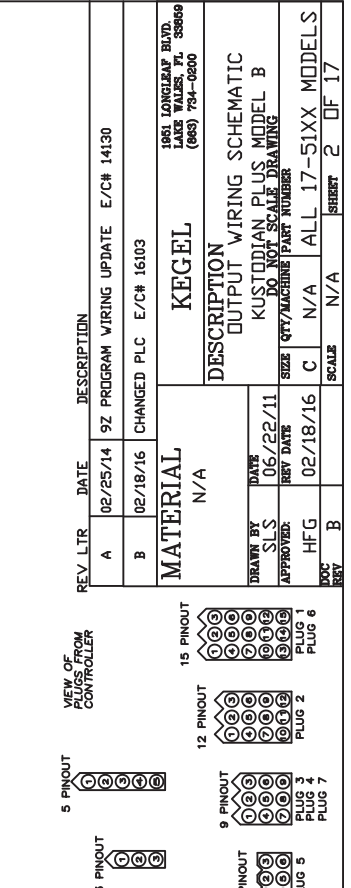
REV	DATE	BY	CHK
A	06/22/11		
B	02/18/16		

1981 LONGLEAF BLVD.  
LAKE WALKER, FL 33869  
(863) 794-0600

- LEGEND**
- PL1 - MAIN PLUG - 10-PIN SIDE (15)
  - PL2 - DRIVE CIRCUIT BOARD PLUG (12)
  - PL3 - DRIVE SPEED BOARD PLUG (9)
  - PL4 - PLC INPUT PLUG - 10-PIN SIDE (9)
  - PL5 - MAIN PLUG - 7-PIN SIDE (6)
  - PL6 - MAIN PLUG - 7-PIN SIDE (15)
  - PL7 - DC CLEANER SPEED BOARD PLUG (9)
  - PL8 - TERMINAL BLOCK 1 (MAIN)
  - PL9 - TERMINAL BLOCK 2 (10-PIN SIDE)
  - PL10 - TERMINAL BLOCK 3 (7-PIN SIDE)
  - PL11 - TERMINAL BLOCK 5 (HANDLE)
  - PL12 - POWER INLET PLUG
  - PL13 - HEAD DRIVE MOTOR CAPACITOR
  - PL14 - OIL PUMP MOTOR CAPACITOR
  - PL15 - CIRCUIT BREAKER (15A-115V)(10A-230V)
  - PL16 - VACUUM CIRCUIT BREAKER (8A - 230V)

- CR1 - FORWARD DRIVE RELAY (LY3)
- CR2 - REVERSE DRIVE RELAY (LY3)
- CR3 - BRUSH LIFT MOTOR RELAY
- CR4 - SQUEEGEE LIFT MOTOR RELAY
- CR5 - DUSTER UNWIND MOTOR RELAY
- CR6 - DUSTER WINDUP MOTOR RELAY
- CR7 - CLEANER MOTOR RELAY (LY2 24VDC)
- CR8 - VACUUM RELAY (LY2 24VDC)
- CR9 - OIL HEAD REVERSING RELAY (LY2 24VDC)
- CR10 - OIL HEAD PUMP MOTOR
- CR11 - BUFFER BRUSH MOTOR REVERSE RELAY
- CR12 - CLEANER PUMP REVERSE RELAY
- CR13 - SPEED RELAY 1 (PCB)
- CR14 - SPEED RELAY 2 (PCB)
- CR15 - SPEED RELAY 3 (PCB)
- CR16 - SPEED RELAY 4 (PCB)
- CR17 - FORWARD DRIVE RELAY (LY3)
- CR18 - REVERSE DRIVE RELAY (LY3)
- CR19 - BRUSH LIFT MOTOR RELAY
- CR20 - SQUEEGEE LIFT MOTOR RELAY
- CR21 - DUSTER UNWIND MOTOR RELAY
- CR22 - DUSTER WINDUP MOTOR RELAY
- CR23 - CLEANER MOTOR RELAY (LY2 24VDC)
- CR24 - VACUUM RELAY (LY2 24VDC)
- CR25 - OIL HEAD REVERSING RELAY (LY2 24VDC)
- CR26 - OIL PUMP MOTOR
- CR27 - BUFFER BRUSH MOTOR REVERSE RELAY
- CR28 - CLEANER PUMP REVERSE RELAY
- CR29 - SPEED RELAY 1 (PCB)
- CR30 - SPEED RELAY 2 (PCB)
- CR31 - SPEED RELAY 3 (PCB)
- CR32 - SPEED RELAY 4 (PCB)



REV	DATE	DESCRIPTION
A	02/25/14	9Z PROGRAM WIRING UPDATE E/C# 14130
B	02/18/16	CHANGED PLC E/C# 16103



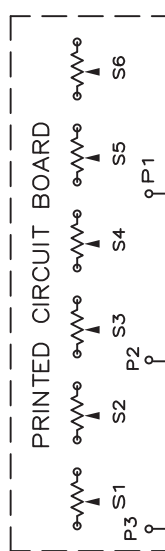


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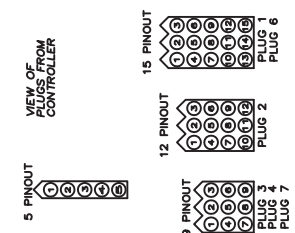
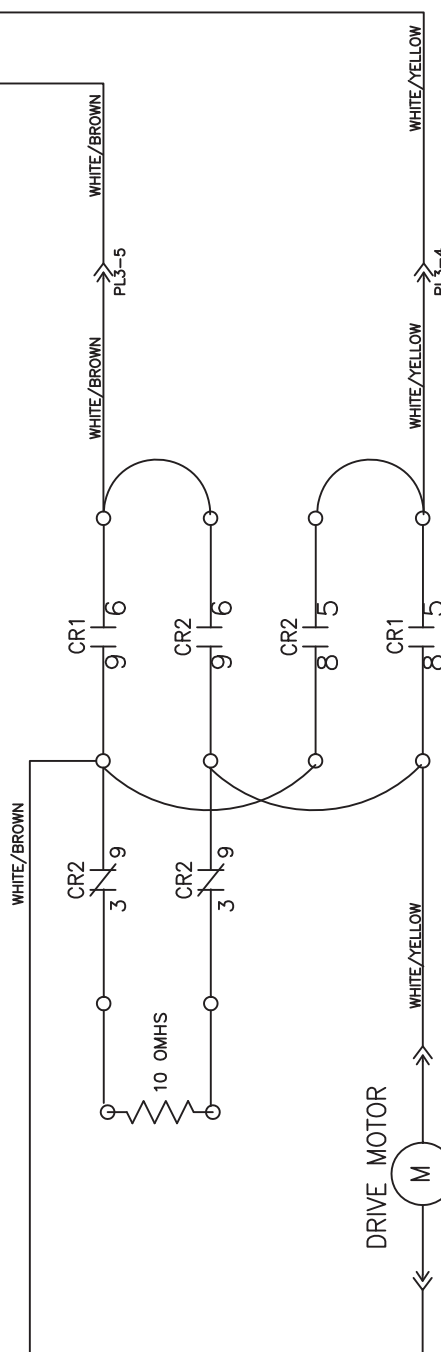
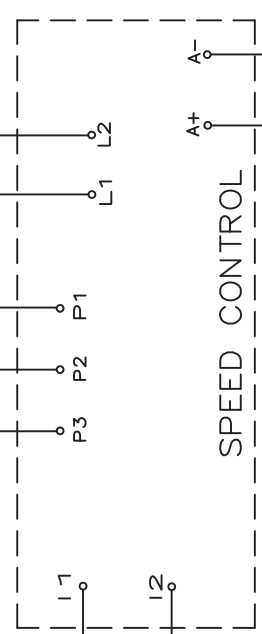
**LEGEND**

- PL1 - MAIN PLUG - 10-PIN SIDE (15)
- PL2 - DRIVE CIRCUIT BOARD PLUG (12)
- PL3 - DRIVE SPEED BOARD PLUG (9)
- PL4 - PLC INPUT PLUG - 10-PIN SIDE (9)
- PL5 - PLC INPUT PLUG - 7-PIN SIDE (6)
- PL6 - MAIN PLUG - 7-PIN SIDE (15)
- PL7 - DC CLEANER SPEED BOARD PLUG (9)
- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
- TB4 - TERMINAL BLOCK 4 (HANDLE)
- PP1 - POWER INLET PLUG
- C1 - HEAD DRIVE MOTOR CAPACITOR
- C2 - DIL PUMP MOTOR CAPACITOR
- CB1 - CIRCUIT BREAKER (15A-115V)(10A-230V)
- CB2 - VACUUM CIRCUIT BREAKER (6A - 230V)
- CR1 - FORWARD DRIVE RELAY (LY3)
- CR2 - REVERSE DRIVE RELAY (LY3)
- CR3 - BRUSH LIFT MOTOR RELAY
- CR4 - SQUEEGEE LIFT MOTOR RELAY
- CR5 - BUUSTER UNWIND MOTOR RELAY
- CR6 - BUUSTER WINDUP MOTOR RELAY
- CR7 - CLEANER MOTOR RELAY (LY2 24VDC)
- CR8 - VACUUM RELAY (LY2 24VDC)
- CR9 - DIL HEAD REVERSING RELAY (LY2 24VDC)
- CR10 - DIL HEAD POWER RELAY (LY2 24VDC)
- CR11 - BUFFER BRUSH MOTOR CONTACTOR
- CR12 - CLEANER PUMP REVERSE RELAY
- SR1 - SPEED RELAY 1 (PCB)
- SR2 - SPEED RELAY 2 (PCB)
- SR3 - SPEED RELAY 3 (PCB)
- SR4 - SPEED RELAY 4 (PCB)



RFI FILTER

230 VOLT ONLY



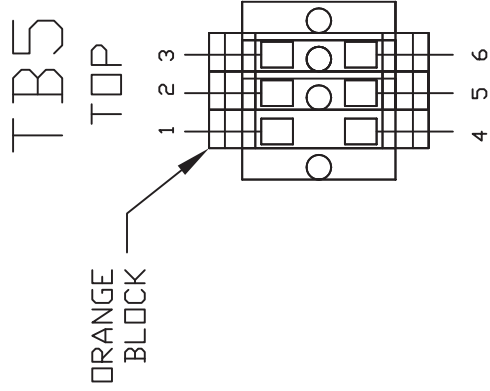
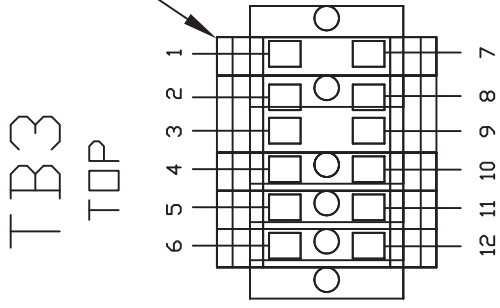
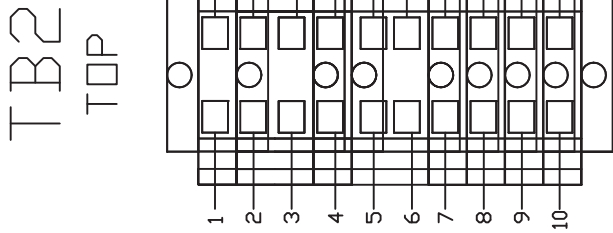
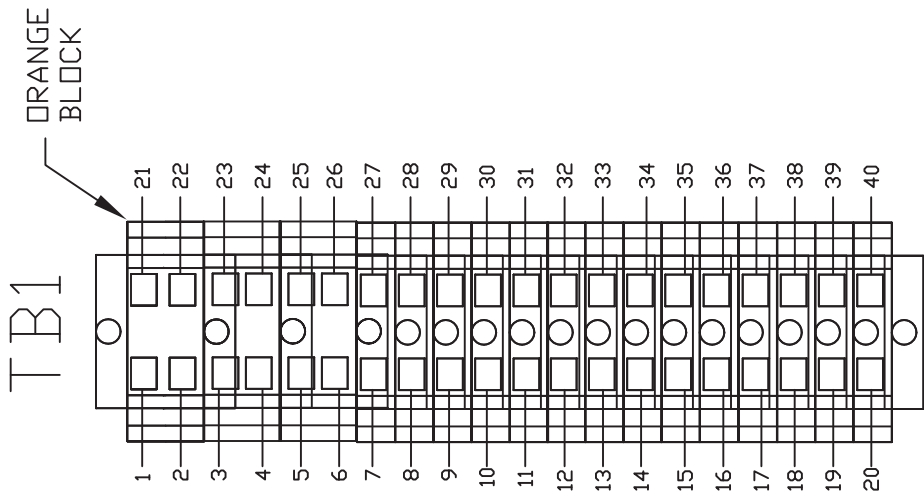
- FU1 - PLC INPUT POWER (0.5A - 115V) (500mA - 230V)
- FU2 - PC OUTPUT COMMON (0.5A - 115V) (6.3A - 230V)
- FU3 - DRIVE MOTOR BOARD L1 (4A - 115V) (4A - 230V)
- FU4 - DRIVE MOTOR BOARD L2 (4A - 115V) (4A - 230V)
- FU5 - DIL PUMP MOTOR (0.75A - 115V) (315mA - 230V)
- FU6 - CLEANER MOTOR (4A - 115V) (1.6A - 230V)
- FU7 - VACUUM MOTOR (10A - 115V)
- FU8 - PC RELAY COMMON (4A - 115V) (4A - 230V)

REV	LTR	DATE	DESCRIPTION
A		02/25/14	9Z PROGRAM WIRING UPDATE E/C# 14130

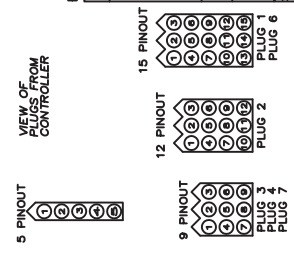
  

MATERIAL	DESCRIPTION
N/A	KEGEL
N/A	SPEED CONTROL SCHEMATIC
N/A	KUSTODIAN PLUS MODEL B
N/A	DO NOT SCALE DRAWING
HFG	SIZE
C	QTY/MACHINE PART NUMBER
N/A	ALL 17-51XX MODELS
A	SCALE
N/A	SHEET
4	OF 17





- LEGEND**
- PL1 - MAIN PLUG - 10-PIN SIDE (15)
  - PL2 - DRIVE CIRCUIT BOARD PLUG (12)
  - PL3 - DRIVE SPEED BOARD PLUG (9)
  - PL4 - PLC INPUT PLUG - 10-PIN SIDE (9)
  - PL5 - PLC INPUT PLUG - 7-PIN SIDE (6)
  - PL6 - MAIN PLUG - 10-PIN SIDE (15)
  - PL7 - DC CLEANER SPEED BOARD PLUG (9)
  - TB1 - TERMINAL BLOCK 1 (MAIN)
  - TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
  - TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
  - TB4 -
  - TB5 - TERMINAL BLOCK 5 (HANDLE)
  - PP1 - POWER INLET PLUG
  - C1 - HEAD DRIVE MOTOR CAPACITOR
  - C2 - DIL PUMP MOTOR CAPACITOR
  - C3 - CIRCUIT BREAKER (15A-115V)(10A-230V)
  - CB1 - CIRCUIT BREAKER (15A-115V)(10A-230V)
  - CB2 - VACUUM CIRCUIT BREAKER (8A - 230V)
  - CR1 - FORWARD DRIVE RELAY (LY3)
  - CR2 - REVERSE DRIVE RELAY (LY3)
  - CR3 - BRUSH LIFT MOTOR RELAY
  - CR4 - SQUEEGEE LIFT MOTOR RELAY
  - CR5 - DUSTER UNWIND MOTOR RELAY
  - CR6 - DUSTER WINDUP MOTOR RELAY
  - CR7 - CLEANER MOTOR RELAY (LY2 24VDC)
  - CR8 - VACUUM RELAY (LY2 24VDC)
  - CR9 - DIL HEAD REVERSE RELAY (LY2 24VDC)
  - CR10 - DIL HEAD PUMP MOTOR CONTACTOR
  - CR11 - BUFFER PUMP REVERSE RELAY
  - SR1 - SPEED RELAY 1 (PCB)
  - SR2 - SPEED RELAY 2 (PCB)
  - SR3 - SPEED RELAY 3 (PCB)
  - SR4 - SPEED RELAY 4 (PCB)
  - FU1 - PLC INPUT POWER
  - FU2 - PC OUTPUT COMMON (4500mA - 230V)
  - FU3 - (0.5A - 115V) (6.5A - 230V)
  - FU4 - DRIVE MOTOR BOARD L1
  - FU5 - DRIVE MOTOR BOARD L2
  - FU6 - (0.75A - 115V) (315mA - 230V)
  - FU7 - CLEANER MOTOR
  - FU8 - (4A - 115V) (1.6A - 230V)
  - FU9 - VACUUM MOTOR
  - FU10 - (0A - 115V)
  - FU11 - PC RELAY COMMON
  - FU12 - (4A - 115V) (4A - 230V)



REV LTR	DATE	DESCRIPTION
A	02/25/14	9Z PROGRAM WIRING UPDATE E/C# 14130

MATERIAL	DESCRIPTION
NA	KEGEL TERMINAL BLOCK LAYOUT
	KUSTODIAN PLUS MODEL B
	DO NOT SCALE DRAWING
DRAWN BY SLS	DATE 06/23/11
APPROVED:	SIZE QTY/MACHINE PART NUMBER
REV	DATE
1	02/25/14
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1981 LONGLEAF BLVD  
LAKE WALKER, FL 33669  
(863) 734-0200

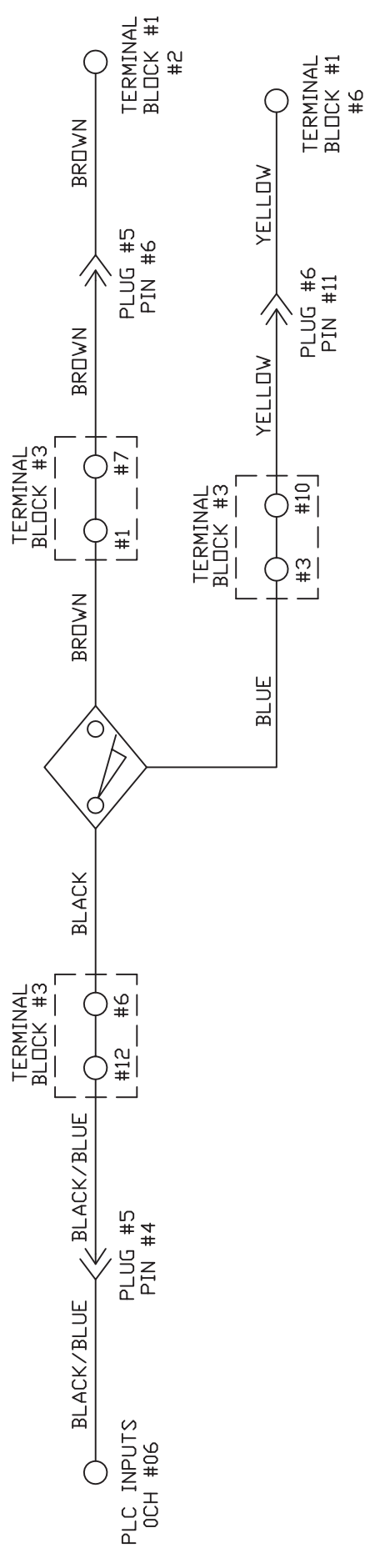




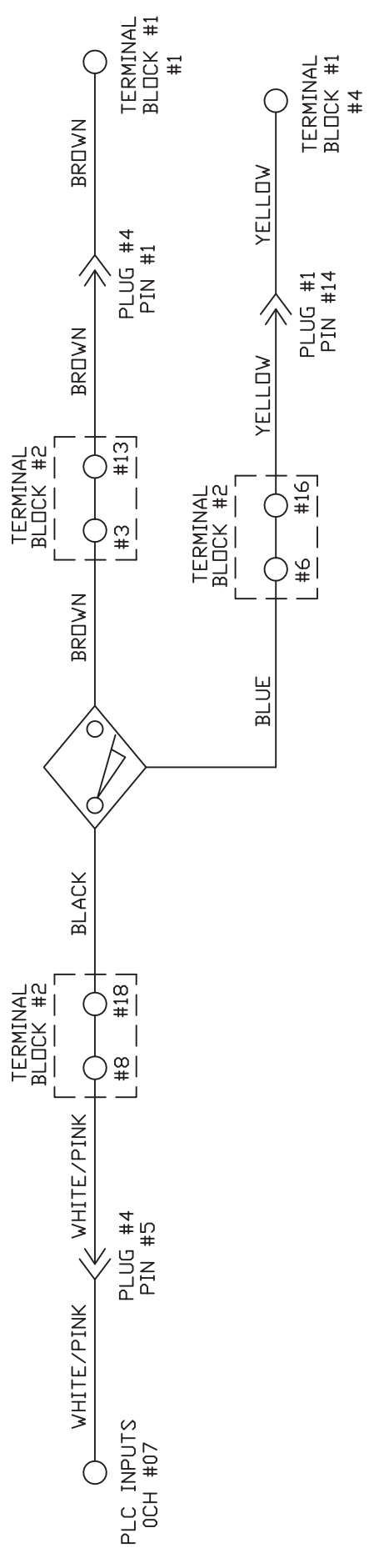
4 3 2 1

REV LTR	DATE	DESCRIPTION

### SPEED TACH PROX



### LANE DISTANCE PROX

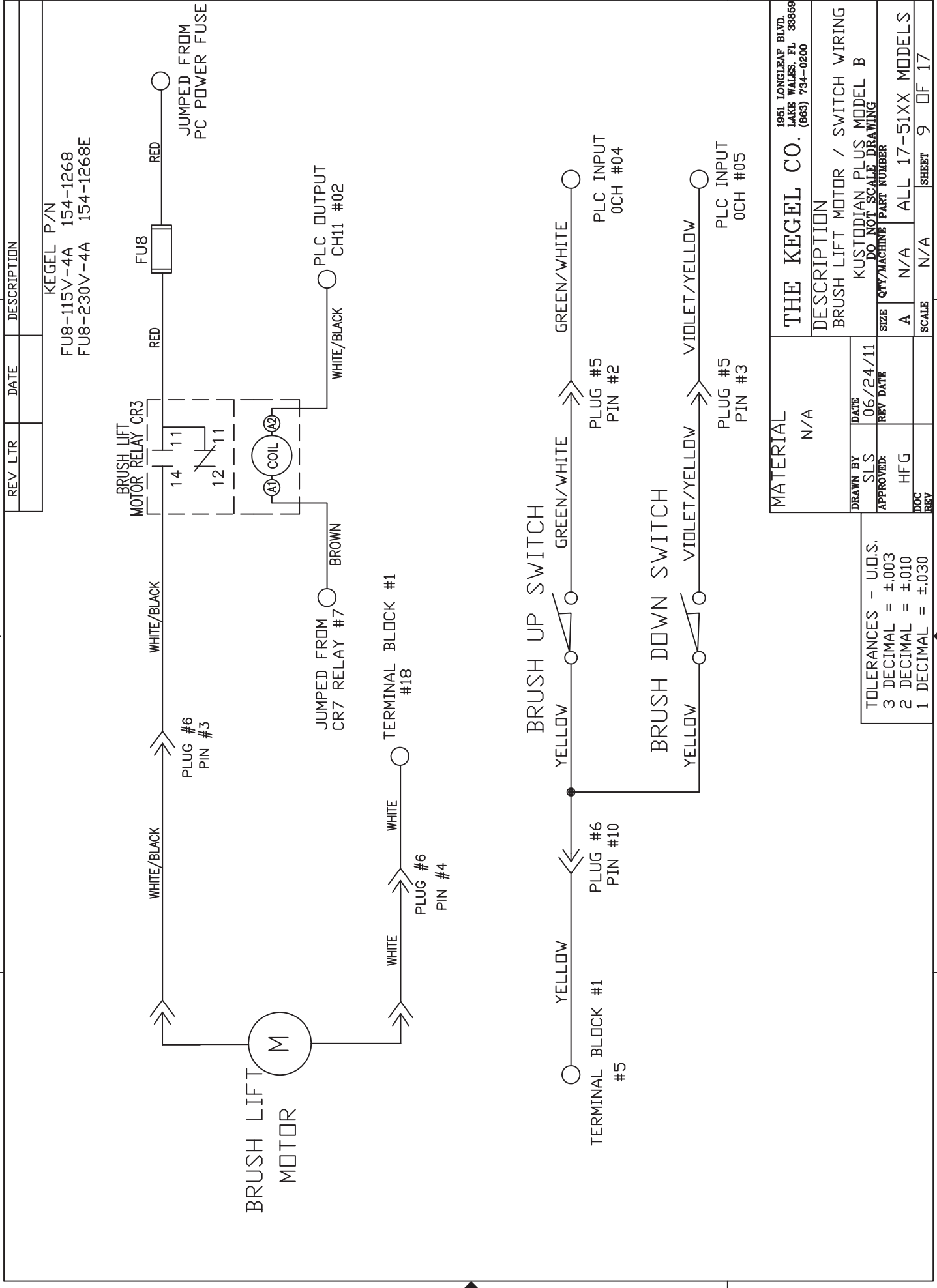


MATERIAL		N/A	
DRAWN BY	DATE	1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
SLS	06/24/11	THE KEGEL CO.	
APPROVED:	REV DATE	DESCRIPTION	
HFG		SPEED TACH / LANE DISTANCE WIRING	
DOC		KUSTODIAN PLUS MODEL B	
REV		DO NOT SCALE DRAWING	
		SIZE	QTY/MACHINE PART NUMBER
		A	N/A
		SCALE	N/A
			ALL 17-51XX MODELS
		SHEET	8 OF 17

TOLERANCES - U.O.S.	
3	DECIMAL = ±.003
2	DECIMAL = ±.010
1	DECIMAL = ±.030

4 3 2 1

4 3 2 1



REV	LTR	DATE	DESCRIPTION

KEGEL P/N  
 FU8-115V-4A 154-1268  
 FU8-230V-4A 154-1268E

MATERIAL	DESCRIPTION
N/A	BRUSH LIFT MOTOR / SWITCH WIRING

DRAWN BY	DATE
SLS	06/24/11

APPROVED:	REV DATE
HFG	

DOC	REV

SIZE	QTY/MACHINE	PART NUMBER
A	N/A	ALL 17-51XX MODELS

SCALE	N/A	SHEET	9	OF	17

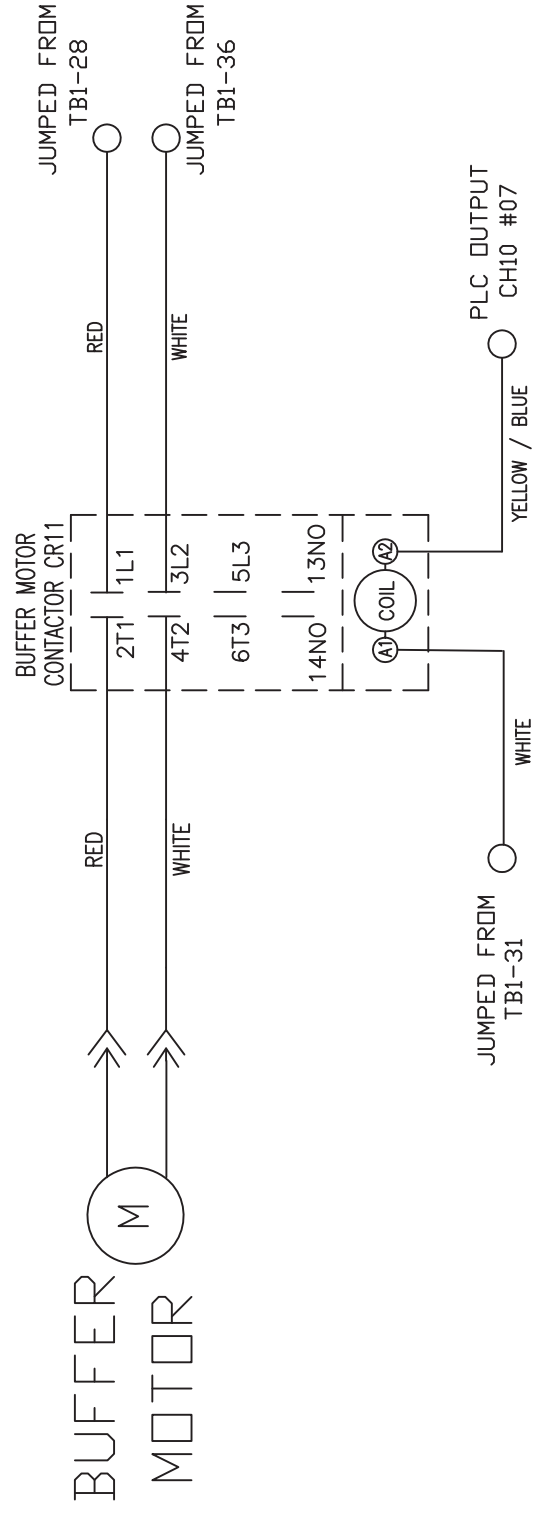
THE KEGEL CO.	
1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	

DESCRIPTION  
 BRUSH LIFT MOTOR / SWITCH WIRING  
 KUSTODIAN PLUS MODEL B  
 DO NOT SCALE DRAWING

TOLERANCES - U.O.S.  
 3 DECIMAL = ±.003  
 2 DECIMAL = ±.010  
 1 DECIMAL = ±.030

4 3 2 1

REV LTR	DATE	DESCRIPTION



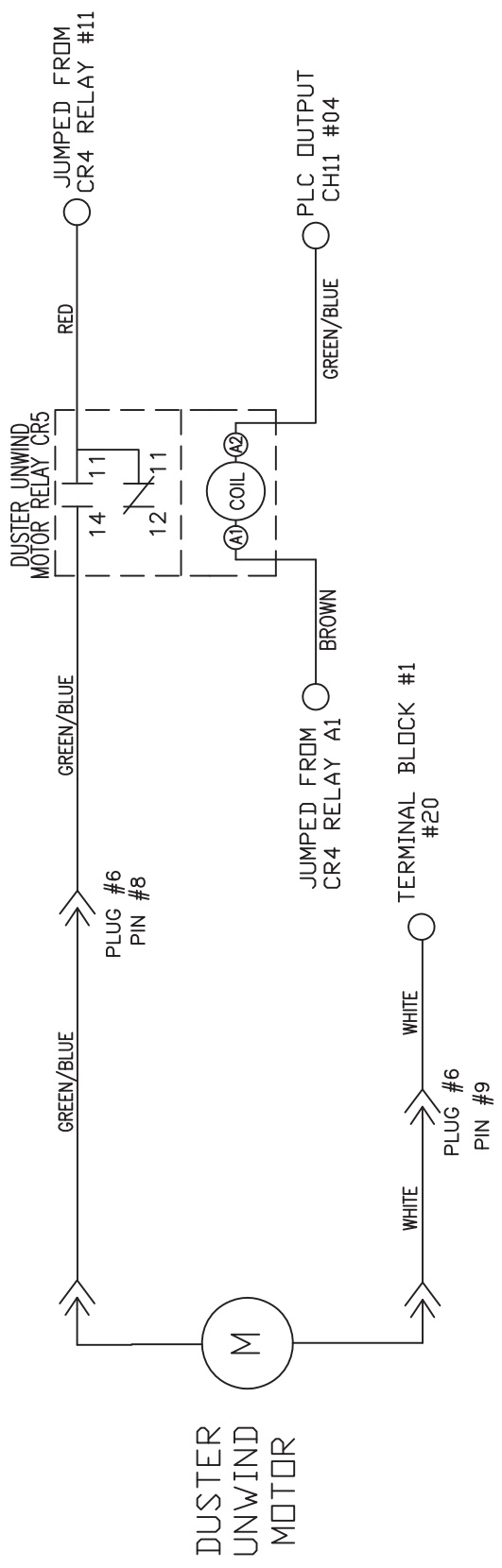
MATERIAL N/A	THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
	DESCRIPTION BUFFER MOTOR WIRING KUSTODIAN PLUS MODEL B DO NOT SCALE DRAWING	
DRAWN BY SLS	DATE 06/24/11	SIZE A
APPROVED: HFG	REV DATE	QTY/MACHINE PART NUMBER N/A
DOC REV	SCALE N/A	ALL 17-51XX MODELS SHEET 10 OF 17

TOLERANCES - U.O.S.	
3	DECIMAL = ±.003
2	DECIMAL = ±.010
1	DECIMAL = ±.030

4 3 2 1

4 3 2 1

D C B A

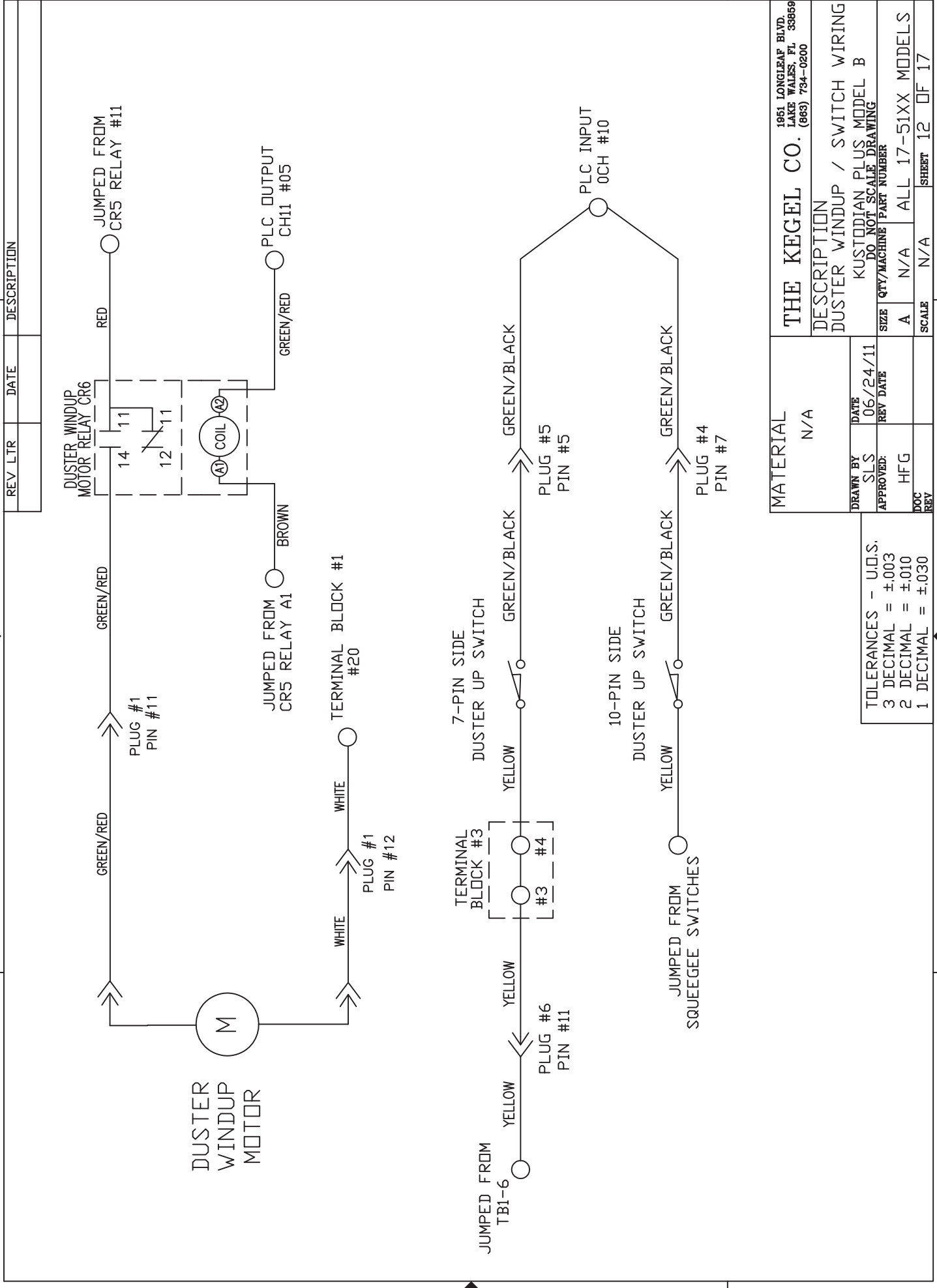


MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (868) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	06/24/11	DUSTER UNWIND MOTOR WIRING	
APPROVED:	REV DATE	KUSTODIAN PLUS MODEL B	
HFG		DO NOT SCALE DRAWING	
DOC	REV	SIZE	QTY/MACHINE   PART NUMBER
		A	N/A
		SCALE	N/A
			ALL 17-51XX MODELS
			SHEET 11 OF 17

TOLERANCES - U.O.S.  
 3 DECIMAL = ±.003  
 2 DECIMAL = ±.010  
 1 DECIMAL = ±.030

4 3 2 1

4 3 2 1



REV	LTR	DATE	DESCRIPTION

MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (868) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	06/24/11	DUSTER WINDUP / SWITCH WIRING	
APPROVED:	REV DATE	KUSTODIAN PLUS MODEL B	
HFG		DO NOT SCALE DRAWING	
DOC		SIZE	QTY/MACHINE PART NUMBER
REV		A	N/A ALL 17-51XX MODELS
		SCALE	N/A
		SHEET 12 OF 17	

TOLERANCES - U.O.S.  
 3 DECIMAL = ±.003  
 2 DECIMAL = ±.010  
 1 DECIMAL = ±.030

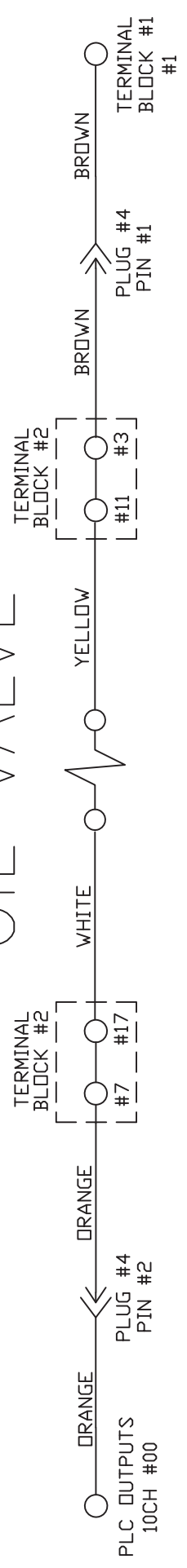
1 2 3 4



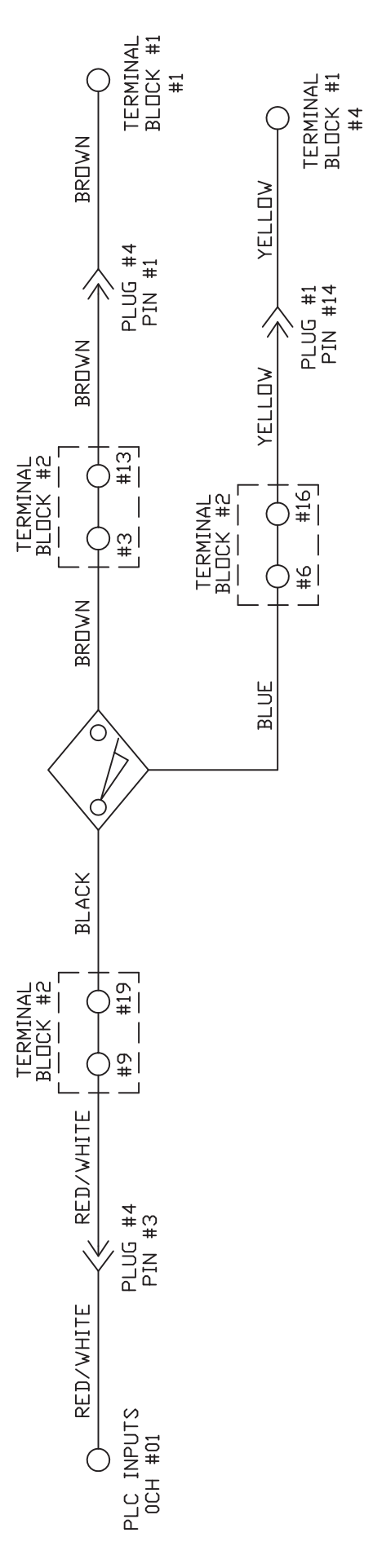
4 3 2 1

REV LTR	DATE	DESCRIPTION

# OIL VALVE



# BOARD PROX



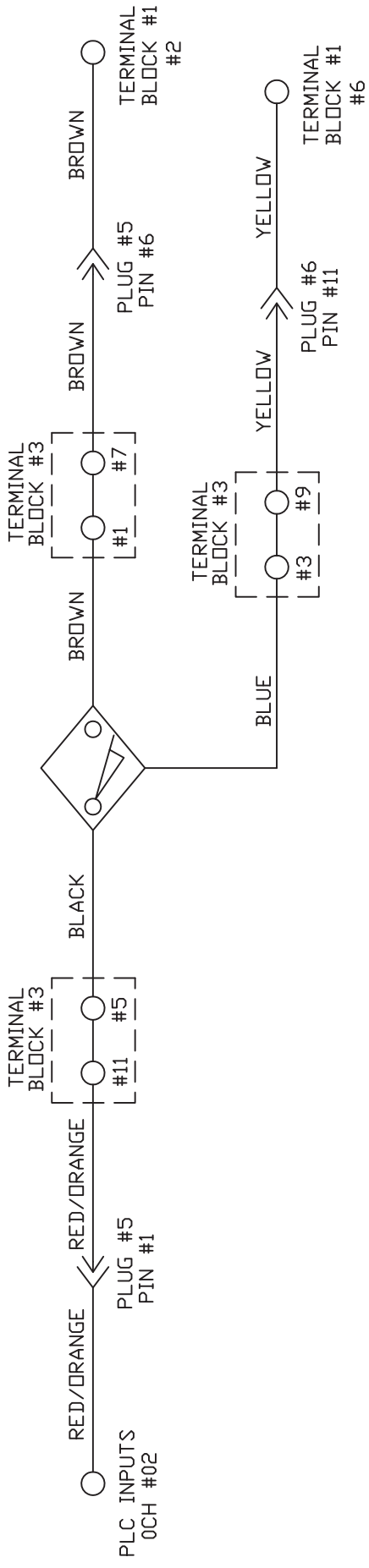
MATERIAL		THE KEGEL CO. (869) 734-0200 1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
DESCRIPTION	OIL VALVE & BOARD PROX WIRING		
DATE	06/24/11		
DRAWN BY	SLS		
APPROVED:	HFG		
REV DATE			
DESCRIPTION	KUSTODIAN PLUS MODEL B DO NOT SCALE DRAWING		
SIZE	A		
QTY/MACHINE	N/A		
SCALE	N/A		
DOC REV	ALL 17-51XX MODELS		
	SHEET 13		OF 17

TOLERANCES - U.O.S.	
3	DECIMAL = ±.003
2	DECIMAL = ±.010
1	DECIMAL = ±.030

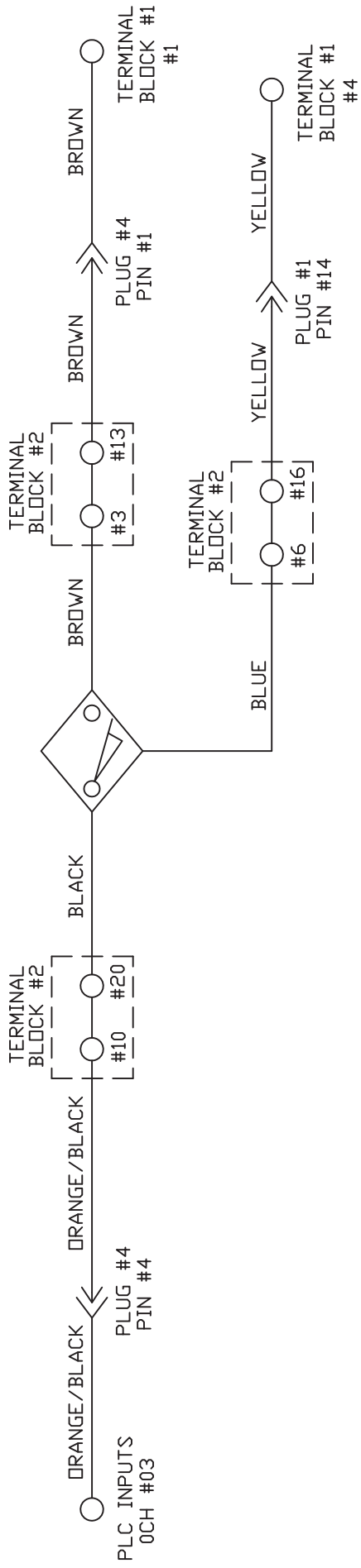
4 3 2 1

4 | 3 | 2 | 1

### L-R HEAD PROX



### R-L HEAD PROX



REV LTR	DATE	DESCRIPTION

MATERIAL N/A		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
DESCRIPTION L-R & R-L PROX WIRING			
KUSTODIAN PLUS MODEL B DO NOT SCALE DRAWING			
DRAWN BY SLS	DATE 06/24/11	SIZE A	QTY/MACHINE PART NUMBER N/A
APPROVED: HFG	REV DATE	SCALE N/A	SHEET 14 OF 17
DOC REV			

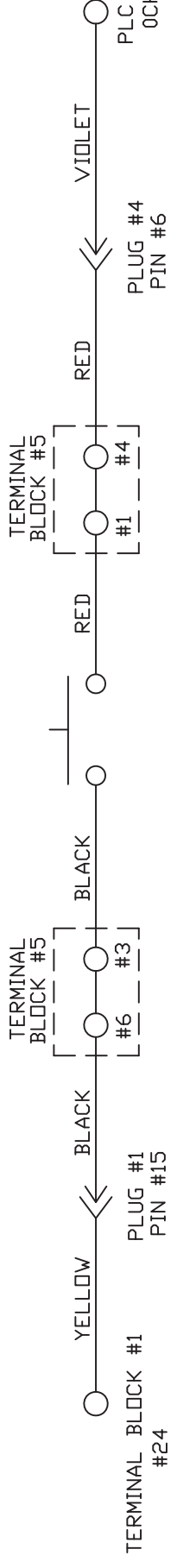
TOLERANCES - U.O.S.  
3 DECIMAL = ±.003  
2 DECIMAL = ±.010  
1 DECIMAL = ±.030

4 | 3 | 2 | 1

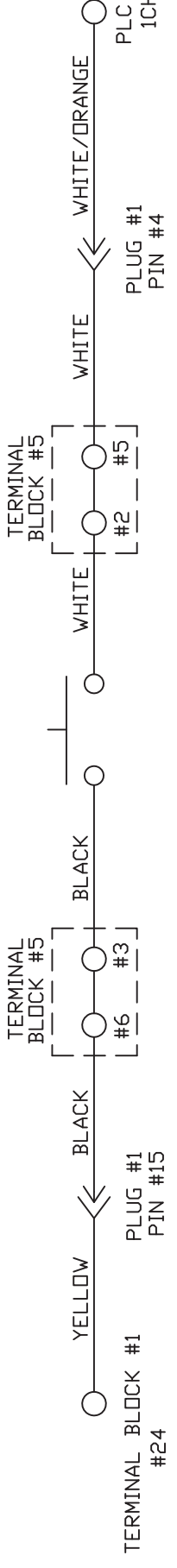
4 3 2 1

REV LTR	DATE	DESCRIPTION

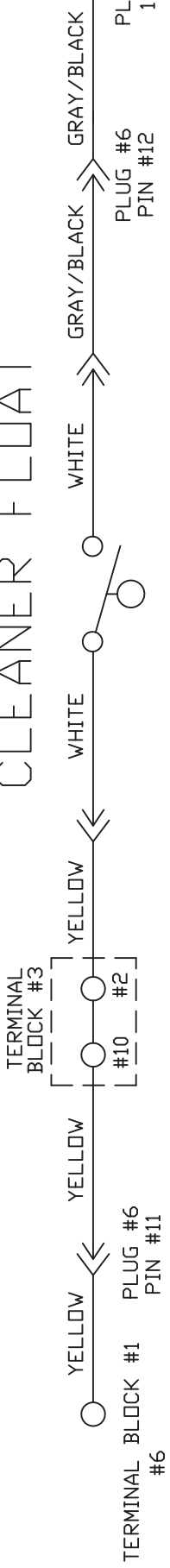
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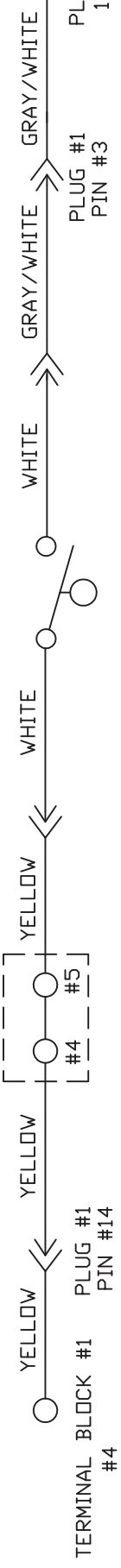
# PRESOAK BUTTON



# CLEANER FLOAT



# OIL FLOAT



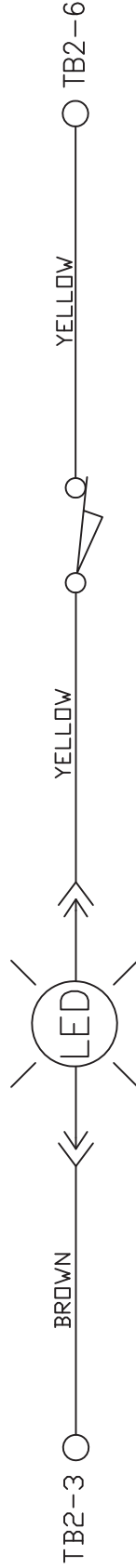
MATERIAL N/A		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
DRAWN BY SLS	DATE 06/27/11	THE KEGEL CO. (869) 734-0200	
APPROVED: HFG	REV DATE	DESCRIPTION START BUTTON, PRESOAK BUTTON, CLEANER FLOAT & OIL FLOAT DO NOT SCALE DRAWING	
DOC REV	SIZE A	QTY/MACHINE N/A	PART NUMBER ALL 17-51XX MODELS
	SCALE N/A		SHEET 15 OF 17

TOLERANCES - U.O.S.	
3	DECIMAL = ±.003
2	DECIMAL = ±.010
1	DECIMAL = ±.030

4 3 2 1



# LED TANK LIGHT SWITCH



MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
DRAWN BY SLS		DESCRIPTION LED TANK LIGHT WIRING	
DATE 06/27/11		KUSTODIAN PLUS MODEL B DO NOT SCALE DRAWING	
APPROVED: HFG		SIZE A	QTY/MACHINE N/A
DOC REV		SCALE N/A	ALL 17-51XX MODELS SHEET 17 OF 17

TOLERANCES - U.D.S.	
3	DECIMAL = ±.003
2	DECIMAL = ±.010
1	DECIMAL = ±.030

## Attaching Parts List

The following pages will help you find fasteners and other attaching parts to help you maintain your lane machine. If you require help finding a part please call (800) 280-2695 or (863) 734-0200.

Visit [www.kegel.net](http://www.kegel.net) for the latest upgrades, parts lists and more. Parts are subject to change.

## ATTACHING PARTS LIST

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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
1	1	154-8348-2915	SPLASH GUARD ASSEMBLY	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2603	HHCS - 1/4-20 X 3/4	2
1	2	154-1250A	EMERGENCY STOP CIRCUIT BREAKER ASSEMBLY	1
		ATTACHING PARTS		
		153-2001	FLAT WASHER - #6	2
		153-2018	LOCKNUT - 6-32 (NYLOK)	2
		153-2084	MS PHILLIPS - 6-32 X 1	2
		154-1251A	BREAKER FOR E-STOP	2
1	3	154-8806	KEYPAD ASSY	1
		ATTACHING PARTS		
		154-0801	KEYBOARD DECAL - KUSTODIAN	1
1	4	158-1613	PRESSURE GAUGE (0-60 PSI) - 1-1/2 DIA	1
		USE TEFLON TAPE		
		ATTACHING PARTS		
		154-0257	FEMALE CONNECTOR - 1/4" TUBE x 1/8 FPT	1
1	5	154-6221	MOUNTING ANGLE - HEAVY CASTER (3x3.625)	2
		ATTACHING PARTS		
		153-2006	FLAT WASHER - 3/8	4
		153-2016	LOCK WASHER - 3/8	2
		153-2025	HEX NUT - 3/8-16	2
		153-2067	HHCS - 3/8-16 x 1-1/4	2
1	6	154-8893	LANE TO LANE HANDLE ASSEMBLY	1
		ATTACHING PARTS		
		153-2006	FLAT WASHER - 3/8	4
		153-2027	JAM NUT - 3/8-16	2
		153-2815	HHCS - 3/8-16 X 2-1/4 (GRADE 8)	2
		153-6851	UHMW HANDLE SPACER	2
		153-2021A	LOCKNUT - 3/8-16 (STOVER)	1
1	7	154-8805	VACUUM MOTOR ASSEMBLY	1
		154-8805E	VACUUM MOTOR ASSEMBLY	1
		ATTACHING PARTS		
		153-2830	HEX HEAD SELF TAP #10 X 5/8 SCREW	4
1	8	154-8625	VACUUM MOTOR HOUSING - ALUMINUM	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	4
		153-2014	LOCK WASHER - 1/4	2
		153-2023	HEX NUT - 1/4-20	2
		153-2052	HHCS - 1/4-20 X 7/8	2
1	9	153-8403	BRAKE MOTOR ASSEMBLY (7RPM - 115V)	2
		153-8803H	BRAKE MOTOR ASSEMBLY (7RPM - 230V 50Hz)	2
		ATTACHING PARTS		
		153-2604	MS FLAT PHILLIPS - 10-32 X 1/2	2
		153-2091	MS PHILLIPS - 10-32 X 3/4	6
		153-2003	FLAT WASHER - #10	6
		153-2013	LOCK WASHER - #10	6
1	10	153-8824	PVC TAKE-UP REEL ASSEMBLY (44 3/4)	1
1	11	153-6029	MOMENTARY WHEEL HOUSING	2
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	4
		153-2015	LOCK WASHER - 5/16	2
		153-2024	HEX NUT - 5/16-18	2
		153-2061	HHCS - 5/16-18x1	2
1	12	153-6437	PUSH BUTTON MOUNTING PLATE	1
		ATTACHING PARTS		
		153-2013	#10 LOCK WASHER	2
		153-2086A	MS PHILLIPS - 8-32 X 3/8	2

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
1	13	158-6418	GUARD - LEFT SIDE (MOLDED)	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	5
		153-2010	LOCK WASHER - #10	5
		153-2086	MS PHILLIPS - 8-32 X 5/8	3
		153-2087	MS PHILLIPS - 8-32 X 3/4	2
1	14	158-6419	GUARD - RIGHT SIDE (MOLDED)	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	5
		153-2010	LOCK WASHER - #10	5
		153-2086	MS PHILLIPS - 8-32 X 5/8	2
		153-2087	MS PHILLIPS - 8-32 X 3/4	3
1	15	158-8434	RECOVERY TANK ASSEMBLY - 10 GALLON	1
1	16	153-8311	MOMENTARY WHEEL ASSEMBLY (URETHANE)	2
		ATTACHING PARTS		
		153-2049	SET SCREW - 8-32 X 3/16	1
		153-6006	MOMENTARY LANE ROLLER SHAFT	1
1	17	154-1603	MICROSWITCH - WITHOUT ROLLER (LARGE)	
		ATTACHING PARTS		
		153-2084	MS PHILLIPS - 6-32 X 1	2
		153-2018	LOCKNUT - 6-32 (NYLOK)	2
1	18	154-8616A	BUFFER MOTOR ASSEMBLY (115V-AC ONLY)	1 on 115V
1	18	154-8616E	BUFFER MOTOR ASSEMBLY (230V-AC ONLY)	1 on 230V
		ATTACHING PARTS		
		154-9615	BUFFER BELT	1
		153-2006	FLAT WASHER - 3/8	4
		153-2016	LOCK WASHER - 3/8	4
		153-2066	HHCS - 3/8-16 X 1	4
1	19	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MC1)	5
		ATTACHING PARTS		
		153-2216A	MS PHILLIPS - 4-40 X 7/8	2
1	20	154-6872	HEAD DRIVE MOUNT BAR	3
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2052	HHCS - 1/4-20 X 7/8	2
1	21	154-6357	LATCH FOR SPLASH GUARD	1
		ATTACHING PARTS		
		153-2003	FLAT WASHER - #10	1
		153-2207	MS PHILLIPS - 10-24 X 1-1/4	1
		153-2208	LOCKNUT - 10-24 (NYLOK)	1
		153-2510	NYLON WASHER - 1/4 (0.060)	1
1	22	154-6356	MOUNT BLOCK FOR LATCH	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	2
		153-2013	LOCK WASHER - #10	2
		153-2087	MS PHILLIPS - 8-32 X 3/4	2
2	1	153-7002AA	LANE DISTANCE COUNTER WHEEL-TREADED (2")	2
		ATTACHING PARTS		
		153-2050	SET SCREW - 1/4-28 X 3/8	2
2	2	154-8619	PILLOWBLOCK-LANE DISTANCE (LEFT-FLANGED)	1
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2
		153-2602	HHCS - 5/16-18 X 3/4	2
2	3	153-6417	GUIDE ROLLER MOUNT BLOCK	2
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2



ATTACHING PARTS LIST

Rev 11:12

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		153-2061	HHCS - 5/16-18 X 1	2
2	4	154-6881	RECOVERY TANK SUPPORT BAR	2
		ATTACHING PARTS		
		153-2806	FLAT HEAD PHILLIPS - 8-32 X 5/8	2
2	5	154-6651	FRONT GUIDE ROLLER MOUNT	2
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2023	HEX NUT - 1/4-20	2
		153-2052A	BHSS - 1/4-20 X 7/8	2
2	6	153-2401	SPRING - 0.54 OD X 0.75 (GUIDE ROLLER)	4
2	7	154-0866	TRANSFER BRUSH ASSEMBLY	1
2	8	153-0001	TRANSPORT CASTER - 3" HEAVY DUTY (3/8")	6
		ATTACHING PARTS		
		153-2006	FLAT WASHER - 3/8	2
		153-2016	LOCK WASHER - 3/8	1
		153-2025	HEX NUT - 3/8-16	1
		153-2067	HHCS - 3/8-16 X 1-1/4	1
2	9	153-8839	CUSHION ROLLER W/PAD (STEEL=44-3/8)	1
2	10	153-0202D	COMPLETE SQUEEGEE ASSEMBLY (2-PIECE BLUE)	1
		153-8204E	SQUEEGEE BLADE REPLACEMENT KIT (BLUE)	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2023	HEX NUT - 1/4-20	2
2	11	158-8435	DRIVE BLOCK PILLOWBLOCK ASSY - 2 INCH	2
		ATTACHING PARTS		
		153-2006	FLAT WASHER - 3/8	2
		153-2016	LOCK WASHER - 3/8	2
		153-2066	HHCS - 3/8-16x1	2
2	12	153-9814	DRIVE CHAIN - (40P33)	1
		ATTACHING PARTS		
		153-9047	40 MASTER LINK	1
2	13	153-9003	SPROCKET	1
2	14	153-7013	URETHANE BLEND LANE DRIVE WHEEL (4")	2
		ATTACHING PARTS		
		153-2819	SET SCREW - 5/16-24 X 3/8 (W/ KNURL)	2
2	15	154-8007	SIDE PLATE PILLOWBLOCK FOR DRIVE SHAFT	2
		ATTACHING PARTS		
		153-2006	FLAT WASHER - 3/8	6
		153-2015	LOCK WASHER - 3/8	4
		153-2024	HEX NUT - 3/8-16	4
		153-2068	HHCS - 3/8-16 X 1-1/2	2
		153-2805A	FHSS - 3/8-16 X 1-1/2	2
2	16	154-6652	GUIDE ROLLER MOUNT BLOCK	2
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2
		153-2061	HHCS - 5/16-18 X 1	2
2	17	153-8410	LANE EDGE GUIDE ROLLER W/BUSHING (1/2")	4
2	18	154-6873	SKID GUIDES	2
		ATTACHING PARTS		
		153-2034	ALUMINUM RIVET (0.187 X 0.450 X 0.375)	2
		153-2035	BLIND RIVET WASHER - 3/16	2
2	19	154-8640	FLANGED BEARING FOR BUFFER BRUSH (3/4" ROTATED)	2

ATTACHING PARTS LIST

Rev 11:12

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		<i>ATTACHING PARTS</i>		
		153-2009	NYLON FLAT WASHER (3/8 - 0.060)	1
		153-2801	SHOULDER BOLT - 3/8 X 3/8 (5/16-18) BRUSH LIFT	1
<b>2</b>	<b>20</b>	<b>154-8621</b>	<b>PILLOWBLOCK - LANE DISTANCE (RIGHT FLANGE)</b>	<b>1</b>
		<i>ATTACHING PARTS</i>		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2
		153-2602	HHCS - 5/16-18 X 3/4	2
<b>2</b>	<b>21</b>	<b>154-8641</b>	<b>BUFFER BRUSH (BLUE 3-3/4" x 48)</b>	<b>1</b>
		<i>ATTACHING PARTS</i>		
		153-2707	SHCS - 5/16-24 x 3/4	1
		153-2711	FENDER WASHER - 5/16	1
		154-8640	FLANGED BEARING FOR BUFFER BRUSH (3/4" ROTATED)	2
<b>2</b>	<b>22</b>	<b>154-6664</b>	<b>BUFFER BRUSH PULLEY SPACER</b>	<b>1</b>
<b>2</b>	<b>23</b>	<b>154-6820</b>	<b>MAIN DRIVE SHAFT</b>	<b>1</b>
<b>2</b>	<b>24</b>	<b>154-6821</b>	<b>LDS SHAFT</b>	<b>1</b>
		<i>ATTACHING PARTS</i>		
<b>3</b>	<b>1</b>	<b>154-6221</b>	<b>MOUNTING ANGLE - HEAVY DUTY CASTER (3 x 3.625)</b>	<b>2</b>
		<i>ATTACHING PARTS</i>		
		153-2006	FLAT WASHER - 3/8	4
		153-2016	LOCK WASHER - 3/8	2
		153-2025	HEX NUT - 3/8-16	2
		153-2067	HHCS - 3/8-16 x 1-1/4	2
<b>3</b>	<b>2</b>	<b>154-6042</b>	<b>UHMW WHEEL - CORNER GUARD</b>	<b>2</b>
		<i>ATTACHING PARTS</i>		
		153-2004	FLAT WASHER - 1/4	2
		153-2020A	LOCKNUT - 1/4-20 (STOVER)	1
		153-2023	HEX NUT - 1/4-20	1
		153-2053	HHCS - 1/4-20 x 1	1
<b>3</b>	<b>3</b>	<b>153-0001</b>	<b>TRANSPORT CASTER (3" DUAL WHEEL)</b>	<b>6</b>
		<i>ATTACHING PARTS</i>		
		153-2007	FLAT WASHER - 1/2	2
		153-2017	LOCK WASHER - 1/2	1
		153-2026	HEX NUT - 1/2-13	1
		153-2073A	HHCS - 1/2-13 x 1-1/2	1
<b>3</b>	<b>4</b>	<b>153-8207</b>	<b>BRAKE MOTOR ASSEMBLY (25 RPM - 115V)</b>	<b>2 on 115v</b>
		<b>153-8807H</b>	<b>BRAKE MOTOR ASSEMBLY (25 RPM - 230V 50 Hz)</b>	<b>2 on 230v</b>
		<i>ATTACHING PARTS</i>		
		153-2604	MS FLAT PHILLIPS - 10-32 x 1/2	1
		153-2091	MS PHILLIPS - 10-32 X 3/4	3
		153-2003	FLAT WASHER - #10	3
		153-2013	LOCK WASHER - #10	3
<b>3</b>	<b>5</b>	<b>153-2818</b>	<b>HHCS - 3/8-16 x 2-1/2 (GRADE 8)</b>	<b>2</b>
		<i>ATTACHING PARTS</i>		
		153-2006	FLAT WASHER - 3/8	2
		153-2016	LOCK WASHER - 3/8	1
		153-2025	HEX NUT - 3/8-16	1
		153-2027	JAM NUT - 3/8-16	1
		154-0204STK	TYGON TUBING (YELLOW)	INCH
<b>3</b>	<b>6</b>	<b>153-6851</b>	<b>UHMW HANDLE SPACER</b>	<b>2</b>
<b>3</b>	<b>7</b>	<b>154-6041</b>	<b>UHMW HANDLE STOP</b>	<b>2</b>
		<i>ATTACHING PARTS</i>		
		153-2004	FLAT WASHER - 1/4	4
		153-2014	LOCK WASHER - 1/4	2
		153-2023	HEX NUT - 1/4-20	2
		153-2053A	BHSS - 1/4-20 x 1	2
<b>3</b>	<b>8</b>	<b>154-6876</b>	<b>HEAD MOTOR MOUNT BLOCK</b>	<b>1</b>
		<i>ATTACHING PARTS</i>		

## ATTACHING PARTS LIST

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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2052	HHCS - 1/4-20 X 7/8	2
3	9	154-1206	GEARBOX FOR HEAD DRIVE MOTOR (5:1 RATIO)	1
3	10	154-1208	MOTOR CAPACITOR (6.0 Mf)	1
3	10	154-1208B	MOTOR CAPACITOR (1.5 Mf)	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	1
		153-2019	LOCKNUT - 8-32 (NYLOK)	1
		153-2087	MS PHILLIPS - 8-32 X 3/4	1
3	11	153-1823	FLANGED TWISTLOCK INLET - 125V/20A	1
3	11	153-1826	FLANGED TWISTLOCK INLET - 250V/20A	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	3
		153-2019	LOCKNUT - 8-32 (NYLOK)	3
		153-2086	MS PHILLIPS - 8-32 X 5/8	3
3	12	154-6629	SIDE LIFT HANDLE MOUNT	2
		ATTACHING PARTS		
		153-2052	BHSS - 1/4-20 X 7/8	2
		153-2014	LOCK WASHER - 1/4	2
3	13	153-8403	BRAKE MOTOR ASSEMBLY (7 RPM - 115V)	1
3	13	153-8803H	BRAKE MOTOR ASSEMBLY (7 RPM - 230V 50Hz)	1
		ATTACHING PARTS		
		153-2091	MS PHILLIPS - 10-32 X 3/4	4
		153-2003	FLAT WASHER - #10	4
		153-2013	LOCK WASHER - #10	4
3	14	154-8802	SQUEEGEE ADJUSTMENT ARM	2
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2023	HEX NUT - 1/4-20	2
		153-2079	FHMS - 1/4-20 X 1	2
		153-2403	COUNTERSUNK LOCK WASHER - 1/4	2
3	15	153-7002	6" WHEEL ASSEMBLY	2
		ATTACHING PARTS		
		153-2833	WHEEL AXEL - SHOULDER BOLT	2
3	16	154-6717	5 - TOOTH SENSOR DISK - ALUMINUM (3/8 BORE)	1
		ATTACHING PARTS		
		153-2201	SET SCREW - 10-32 X 3/8	1
3	17	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MC1)	4
		FOR ATTACHING PARTS SEE FIG. 1:21		
3	18	154-6627	SIDE LIFT HANDLE	2
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2
		153-2061	HHCS - 5/16-18 X 1	2
3	19	153-9013	BUFFER MOTOR PULLEY (10L050 - 1/2")	1
3	20	154-8839	BUFFER IDLER ASSEMBLY	1
		ATTACHING PARTS		
		153-2739	SHOULDER BOLT - 3/8 X 1 (5/16 THREAD)	2
		154-6841	BELT IDLER MOUNT BAR	1
3	21	153-9014	BUFFER PULLEY (24L050-3/4")	1
		ATTACHING PARTS		
		153-2051	SET SCREW - 1/4-20 X 1/2	1
		153-2005	FLAT WASHER 5/16	3
		153-2531	NYLON WASHER - 3/8 (0.030)	2
		153-2707	SHCS - 51-24 X 3/4	1
		153-2711	FENDER WASHER - 5/16	1

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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		158-9608	SPACER - BUSHING 3/4 ID X 1 OD X 3/4 - PLAIN	1
		153-2099	KEYSTOCK - 3/16 X 1/2	1
3	22	154-0810	<b>LIFTING HANDLE (SS SPRING-LOADED CHEST)</b>	2
		ATTACHING PARTS		
		153-2003	FLAT WASHER - # 10	3
		153-2208	LOCK NUT - 10-24 NYLOK	3
		153-2301	MS PHILLIPS - 10-24 X 5/8	3
3	23	158-6453	<b>6" WHEEL MOUNT</b>	2
		ATTACHING PARTS		
		153-2006	FLAT WASHER - 3/8	2
		153-2016	LOCK WASHER - 3/8	2
		153-2067	HHCS - 3/8-16 X 1-1/4	2
4	1	154-6627	<b>SIDE LIFT HANDLE</b>	2
		FOR ATTACHING PARTS SEE FIG. 3:18		
4	2	154-8801	<b>SQUEEGEE ADJUSTMENT ARM</b>	2
		FOR ATTACHING PARTS SEE FIG. 3:14		
4	3	154-6878	<b>CLEANER HEAD DRIVE SHAFT BLOCK</b>	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2603	HHCS - 1/4-20 X 3/4	2
4	4	154-9802	<b>PULLEY (27XL 3/8" BORE W/DBL SET)</b>	1
		ATTACHING PARTS		
		154-6879	HHCS - 1/4-20 X 3/4	1
4	5	154-9201	<b>BELT FOR CLEANER HEAD DRIVE</b>	1
4	6	153-8403	<b>BRAKE MOTOR ASSEMBLY (7 RPM - 115V)</b>	1
4	6	153-8803H	<b>BRAKE MOTOR ASSEMBLY (7 RPM - 230V 50Hz)</b>	1
		FOR ATTACHING PARTS SEE FIG. 3:13		
4	7	154-6889	<b>CLEANER HOSE ROUTING BAR</b>	1
		ATTACHING PARTS		
		153-2003	FLAT WASHER - #10	2
		153-2013	LOCK WASHER - #10	2
		123-2301	MS PHILLIPS - 10-24 X 5/8	2
4	8	158-8434	<b>RECOVERY TANK ASSEMBLY - 10 GALLON</b>	1
4	9	154-6859	<b>DRIVE MOTOR &amp; PARTITION WALL KUSTO PLUS</b>	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	4
		153-2014	LOCK WASHER - 1/4	4
		153-2023	HEX NUT - 1/4-20	4
		153-2079	FHMS - 1/4-20 X 1	4
4	10	154-6687	<b>SPRING RETAINER PLATE</b>	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	4
		153-2019	LOCKNUT - 8-32 (NYLOK)	2
		153-2086	MS PHILLIPS - 8-32 X 5/8	2
4	11	154-1250	<b>EMERGENCY STOP CIRCUIT BREAKER ASSEMBLY</b>	1
		FOR ATTACHING PARTS SEE FIG. 1:2		
4	12	154-8625	<b>VACUUM MOTOR HOUSING - ALUMINUM</b>	1
		FOR ATTACHING PARTS SEE FIG. 1:8		
4	13	154-6041	<b>UHMW HANDLE STOP</b>	2
		FOR ATTACHING PARTS SEE FIG. 3:7		
4	14	153-6851	<b>UHMW HANDLE SPACER</b>	2
4	15	153-2818	<b>HHCS - 3/8-16 x 2-1/2 (GRADE 8)</b>	2
		FOR ATTACHING PARTS SEE FIG. 3:5		

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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
4	16	154-9201	BELT FOR CONDITIONER HEAD DRIVE (XL025 - 9 FT)	1
4	17	154-9805	PULLEY - 32XL037 - 33/8 BORE W/ DBL SET	1
		ATTACHING PARTS		
		154-6879	CLEANER HEAD DRIVE SHAFT	1
4	18	154-6875	HEAD IDLER MOUNT BLOCK	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2052	HHCS - 1/4-20 X 7/8	2
4	19	154-6884	6 TOOTH SENSOR DISK	1
		ATTACHING PARTS		
		154-6879	CLEANER HEAD DRIVE SHAFT	1
4	20	153-8207	BRAKE MOTOR ASSEMBLY (25 RPM - 115V)	2 on 115v
4	20	153-8807H	BRAKE MOTOR ASSEMBLY (25 RPM - 230V 50 Hz)	2 on 230v
		FOR ATTACHING PARTS SEE FIG. 3:4		
4	21	154-6629	SIDE LIFT HANDLE MOUNT	1
		ATTACHING PARTS		
		153-2052	BHSS - 1/4-20 X 7/8	2
		153-2014	LOCK WASHER - 1/4	2
4	22	154-6629	SIDE LIFT HANDLE MOUNT	2
		ATTACHING PARTS		
		153-2052	BHSS - 1/4-20 X 7/8	2
		153-2014	LOCK WASHER - 1/4	2
5	1	154-6861-2915	PC/RELAY MOUNT PLATE	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	4
		153-2013	LOCK WASHER - #10	4
		153-2087	MS PHILLIPS - 8-32 X 3/4	4
5	2	154-6827	PC RELAY MOUNT PLATE ANGLE	4
5	3	153-1028	PANEL-MOUNT FUSE HOLDER - UL (COMPLETE)	8 on 115V
5	3	153-1028E	PANEL-MOUNT FUSE HOLDER - IEC (COMPLETE)	8 on 230V
5	4	154-8810	CIRCUIT BOARD ASSEMBLY (115V)	1
5	4	154-8811	CIRCUIT BOARD ASSEMBLY (230V)	1
		ATTACHING PARTS		
		153-2509	CIRCUIT BOARD MOUNT	5
		153-2521	MS PHILLIPS-#6 X 3/8 (SELF TAP-PLASTIC)	5
5	5	153-2509	CIRCUIT BOARD MOUNT	5
5	6	153-2521	MS PHILLIPS-#6 X 3/8 (SELF TAP-PLASTIC)	5
5	7	153-1009	TOGGLE SWITCH (DPDT)	1
		ATTACHING PARTS		
		153-1209	BUTTON GUARD	1
5	8	153-1209	BUTTON GUARD	1
5	9	153-1016D	LY2 RELAY (24VDC)	4
		ATTACHING PARTS		
		153-1020	RELAY CLAMPS	1 PR
5	10	153-1017	LY2 RELAY BASE	8
5	11	153-1018	LY3 RELAY (115V)	2
		153-1618	LY3 RELAY (230V)	2
		ATTACHING PARTS		
		153-1020	RELAY CLAMPS	1 PR
5	12	153-1019	LY3 RELAY BASE	2

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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
5	13	154-1835	RELAY ASSEMBLY - COMPLETE (W/RELAY)	4
5	14	153-1809B	DIN RAIL (9-7/8")	1
		ATTACHING PARTS		
		153-2034	ALUMINUM RIVET - 0.187 X 0.450 X 0.375)	2
		153-2035	BLIND RIVET WASHER - 3/16	2
5	15	153-1809C	DIN RAIL (8-1/4")	1
		FOR ATTACHING PARTS SEE FIG. 5:14		
5	16	154-1801	MICROPROCESSOR - CPM2A	1
5	17	153-1004A	BUFFER MOTOR CONTACTOR (115 VOLT)	1 on 115V
5	17	153-1604A	BUFFER MOTOR CONTACTOR (230 VOLT)	1 on 230V
5	18	154-1610	CIRCUIT BREAKER - DPST (15A - 115 VOLT)	1 on 115V
5	18	154-1272	CIRCUIT BREAKER - DPST (10A - 230 VOLT)	1 on 230V
5	19	154-1830	RELAY BASE SEPARATOR PLATE	2
5	20	153-1016	LY2 RELAY (115V)	1
5	20	153-1616	LY2 RELAY (230V)	1
		ATTACHING PARTS		
		153-1020	RELAY CLAMPS	1 PR
6	1	154-6264	SHAFT FOR TIMING DISK (REMOTE SENSOR)	1
6	2	154-8621	PILLOWBLOCK - LANE DISTANCE (RIGHT FLANGE)	1
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2
		153-2602	HHCS - 5/16-18 X 3/4	2
6	3	154-8320	PILLOWBLOCK - LANE DISTANCE SHAFT (CENTER-PLAIN)	1
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2
		153-2602	HHCS - 5/16-18 X 3/4	2
6	4	154-6717	5-TOOTH SENSOR DISK - ALUMINUM (3/8 BORE)	1
		ATTACHING PARTS		
		153-2201	SET SCREW - 10-32 X 3/8	1
6	5	154-6821	LDS SHAFT	1
6	6	153-6027	LANE DISTANCE ADJUSTMENT BLOCK	2
		ATTACHING PARTS		
		153-2005	FLAT WASHER - 5/16	2
		153-2015	LOCK WASHER - 5/16	2
		153-2602	HHCS - 5/16-18 X 3/4	2
6	7	154-8619	PILLOWBLOCK-LANE DISTANCE (LEFT-FLANGED)	1
		FOR ATTACHING PARTS SEE FIG. 6:2		
6	8	153-2027	JAM NUT - 3/8-16	2
6	9	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MC1)	2
		FOR ATTACHING PARTS SEE FIG. 1:21		
6	10	154-9211	LDS AND TACH SENSOR DRIVE CHAIN (25P29)	1
		ATTACHING PARTS		
		153-9045	25 MASTER LINK	1
6	11	153-2234	HHCS - 3/8-16 X 4 (FULL THREAD)	2
6	12	153-9010	SPROCKET - 25B15 (TRANSFER DRIVE & LDS - 3/8")	1
6	13	154-9213	SPROCKET - 25B15 (TACH AND LDS DRIVE 1/2" BORE)	1
6	14	153-2009	NYLON FLAT WASHER (3/8 - 0.060)	4

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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
6	15	153-7002AA	LANE DISTANCE COUNTER WHEEL-TREADED (2")	2
6	16	153-2992	TRIPLE WAVE WASHER	1
7	1	154-8007	SIDE PLATE PILLOWBLOCK FOR DRIVE SHAFT <i>FOR ATTACHING PARTS SEE FIG. 2:15</i>	2
7	2	153-0043	THICK FELT WASHER - 5/8	4
7	3	153-9814	DRIVE CHAIN - (40P33)	1
			<i>ATTACHING PARTS</i>	
		153-9047	#40 MASTER LINK	1
7	4	153-9002	SPROCKET - 40B13 (5/8")	1
7	5	154-8865	BALDOR DC DRIVE MOTOR ASSEMBLY	1
			<i>ATTACHING PARTS</i>	
		153-2004	FLAT WASHER - 1/4	4
		153-2014	LOCK WASHER - 1/4	4
		153-2052	HHCS - 1/4-20 X 7/8	4
7	6	154-1809B	BRUSHES - DRIVE MOTOR (SOLD AS PAIR)	PAIR
7	7	154-6820	MAIN DRIVE SHAFT	1
7	8	154-6881	RECOVERY TANK SUPPORT BAR <i>FOR ATTACHING PARTS SEE FIG. 2:4</i>	2
7	9	154-6717	5 - TOOTH SENSOR DISK - ALUMINUM (3/8 BORE) <i>FOR ATTACHING PARTS SEE FIG. 3:16</i>	1
7	10	153-7013	URETHANE BLEND LANE DRIVE WHEEL (4") <i>FOR ATTACHING PARTS SEE FIG. 2:14</i>	2
7	11	158-8435	DRIVE BLOCK PILLOWBLOCK ASSY - 2 INCH <i>FOR ATTACHING PARTS SEE FIG. 2:11</i>	2
7	12	153-2045	STEEL COLLAR - 5/8 X 1-1/8 X 1/2	2
7	13	153-9003	SPROCKET	1
8	1	158-8433	CLEANER SUPPLY TANK ASSY - 3.25 GALLON	1
8	1	158-8433C	CLEANER SUPPLY TANK ASSY-3.25 GAL (COMP)	1
			<i>ATTACHING PARTS</i>	
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2603	HHCS - 1/4-20 X 3/4	2
8	2	154-0212B	FILTER FOR SUPPLY TANK (5" SS) PVC	1
8	3	154-0244	REDUCER (3/8 " TO 1/4")	1
8	4	154-0832	CAP FOR POLYETHYLENE TANK W/ GASKET	1
			<i>ATTACHING PARTS</i>	
		154-0832C	CAP FOR POLYETHYLENE TANK	1
		154-0832G	GASKET FOR CAP (154-0832C)	1
8	5	154-0255	IN-LINE FILTER (1/4 BARB X 1/4 BARB)	1
8	5	154-8867A	IN-LINE FILTER ASSEMBLY - KPLUS AND ION	1
8	6	154-8817	MANUAL VENT VALVE ASSEMBLY FOR TANK	1
8	7	N/A	CLEANER PUMP TUBE LOADING TOOL	1
8	8	154-0202A	PENCIL TUBING STOCK - 1/4" OD X 1/8" ID	
8	9	154-0243	ELBOW (90 DEGREE 1/4 X 1/4 GUEST)	2
8	10	154-0227	ELOBW TUBE TO HOSE BARB (1/4" X 5/16" ID)	2

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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
8	11	154-0861B	NORPRENE TUBING FOR PUMP W/ ELBOWS	1
8	12	154-0860A	CLEANER PUMP - 24VDC	1
8	13	158-8404	ASSEMBLY - CLEANER PUMP MOTOR - 24VDC	1
		158-8404C	ASSEMBLY - CLEANER PUMP COMPLETE - 24VDC	1
		ATTACHING PARTS		
		153-2002	FLAT WASHER - #8	4
		153-2013	LOCK WASHER - #10	4
		153-2927	MS - PHILLIPS - 8-32 X 2-3/4 (PAN HEAD)	4
8	14	154-6865	CLEANER PUMP MOUNT ANGLE	1
		ATTACHING PARTS		
		153-2003	FLAT WASHER - #10	4
		153-2013	LOCK WASHER - #10	4
		153-2091	MS PHILLIPS - 10-32 X 3/4	4
8	15	154-8693	CLEANER FLOAT ASSY	1
8	16	154-0223	ELOBW (90 DEGREE) 1/4" NPT X 1/4" TUBE	1
8	17	154-6866A	CLEANER PUMP POTENTIOMETER PLATE	1
8	18	154-8846	CLEANER PUMP POTENTIOMETER ASSY - (2.5K)	1
9	1	154-6889	CLEANER HOSE ROUTING BAR	1
		ATTACHING PARTS		
		153-2091	MS PHILLIPS - 10-32 X 3/4	2
		153-2013	LOCK WASHER	2
		153-2003	FLAT WASHER	2
9	2	154-6888	CLEANER HOSE SPRING MOUNT BLOCK	2
		ATTACHING PARTS		
		153-2051A	SET SCREW - 1/4-20 X 1/4	4
9	3	154-0222	ELBOW - 1/4" STEM X 1/4" TUBING OD	1
9	4	154-8852	CLEANER HOSE TUBE AND TIP ASSEMBLY	1
9	5	154-0863	MALE LUER TO HOSE BARB	1
9	6	164-0012M	CLEANER TIP W/ CHECK VALVE	1
9	7	153-2713	SPRING OIL TIP RETAINER	1
9	8	154-9802	PULLEY - 28XL037 - 1/2 BORE NO SET SCREW	1
9	9	154-6874	CLEANING HEAD BAR SPACER	3
9	10	154-6882	CLEANER HEAD	1
9	11	154-9201	CLEANER HEAD TIMING BELT	1
9	12	154-6877	CLEANER HEAD GUIDE BAR	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	3
		153-2014	LOCK WASHER - 1/4	3
		153-2053	HHCS - 1/4-20 X 1	3
		154-6874	CLEANING HEAD BAR SPACER	3
9	13	154-0867	CLEANER HOSE SPRING 36"	1
10	1	154-6725	CONDITIONER TANK (NO FITTINGS)	1
		154-8682	CONDITIONER TANK (COMPLETE)	1
		ATTACHING PARTS		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2603	HHCS - 1/4-20 X 3/4	2
10	2	154-1214	FLUID METERING PUMP - 0.05 ml/STROKE	1
		ATTACHING PARTS		



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FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		153-2013	LOCK WASHER - #10	2
		153-2086	MS PHILLIPS - 8-32 X 5/8	2
10	3	154-8604	MOTOR FOR METERING PUMP 115V (#4)	1 on 115V
10	3	154-8604E	MOTOR FOR METERING PUMP 230V	1 on 230V
		ATTACHING PARTS		
		153-2013	LOCK WASHER - #10	4
		153-2091	MS PHILLIPS - 10-32 X 3/4	4
10	4	154-6223A	MOUNTING ANGLE - PUMP & MOTOR	1
		ATTACHING PARTS		
		153-2602	HHCS - 5/16-18 X 3/4	2
10	5	154-0218	GROMMET - 7/16 X 11/16 (1/4" PANEL)	1
10	6	154-6287	GUARD FOR PUMP & MOTOR	1
		ATTACHING PARTS		
		153-2013	LOCK WASHER - #10	2
		153-2086A	MS PHILLIPS - 8-32 X 3/8	2
10	7	154-9208	PULLEY - METERING PUMP (12XL-5/16)	1
10	8	154-9607	PULLEY (24XL 5/16" BORE W/SET) 60Hz	1
10	8	154-9614	PULLEY (30XL 5/16" BORE W/SET) 50Hz	1
10	9	153-2417	GROMMET - 5/8 X 15/16 (0.060 PANEL)	1
10	10	154-9202A	BELT FOR METERING PUMP (130XL037) 115V	1 on 115V
10	10	154-9215	BELT FOR METERING PUMP (140XL037) 230V	1 on 230V
10	11	154-1209	VALVE-24V DC 3-WAY (1/8" NPT)	1
		ATTACHING PARTS		
		153-2523	FHMS PHILLIPS - 4-40 X 3/8	2
10	12	154-0224	MALE CONNECTOR - 1/4" TUBE x 1/8 NPT	2
10	13	154-0613	ELBOW - 1/8 NPT X 3/16 TUBE	1
10	14	158-1613	PRESSURE GAUGE (0-60 PSI) - 1-1/2 DIA	1
		FOR ATTACHING PARTS SEE: FIG 1:4		
10	15	154-0257	FEMALE CONNECTOR - 1/4" TUBE X 1/8 FPT	1
10	16	153-0815	UNION TEE (1/4 X 1/4 X 1/4 - QUICK DISCONNECT)	1
10	17	154-6257	MOUNTING ANGLE FOR OIL PRESSURE GAUGE	1
		ATTACHING PARTS		
		153-2087	MS PHILLIPS - 8-32 X 3/4	2
		153-2002	FLAT WASHER - #8	4
		153-2019	LOCKNUT - 8-32 (NYLOK)	2
10	18	153-2506	SLOTTED SHIM WASHER-3/8 (FOR VALVES)	1
10	19	154-0222	ELBOW - 1/4" STEM X 1/4" TUBING OD	1
10	21	154-0202A	PENCIL TUBING STOCK - 1/4" OD X 1/8" ID	INCH
10	22	154-0248	REDUCING UNION CONNECTOR-1/4" X 3/16"	3
10	23	154-0202B	PENCIL TUBING STOCK-3/16" OD X 1/16" ID	INCH
10	24	154-0256	ELBOW - 3/8 TUBE OD x 3/8 TUBE	1
10	25	154-0225	ELBOW - 3/8 TUBE OD X 1/4 NPT	1
10	26	154-0258	ELBOW - 3/8 STEM X 3/8 TUBE	1
10	27	154-0202	PUMP TUBING STOCK - (3/8 OD X 1/4 ID)	INCH
10	28	154-8693	FLOAT FOR PLASTIC TANK	1

## ATTACHING PARTS LIST

Rev 11:12

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
10	29	154-0832	CAP FOR POLYETHYLENE TANK W/ GASKET	1
		ATTACHING PARTS		
		154-0832C	CAP FOR POLYETHYLENE TANK	1
		154-0832G	GASKET FOR CAP (154-0832C)	1
10	30	154-0212	TANK FILTER (5" SS) FOR OIL TANK	1
10	31	154-0287C	O-RING FOR GUEST FITTING - 1/2 VITON	1
10	32	158-8672A	LED TANK LIGHT ASSEMBLY	1
10	33	154-8817	OIL TANK VENT VALVE	1
10	34	154-1207	CAPACITOR	1
11	1	158-8431	ASSY - DRIP PAD 1PC TRANSFER SYSTEM -LFT	1
		ATTACHING PARTS		
		153-2723	FHMS PHILLIPS - 4-40 X 3/8	2
11	2	158-6443	BRUSH TRACK MOUNT END PLATE	2
		ATTACHING PARTS		
		153-2003	FLAT WASHER - #10	2
		153-2013	LOCK WASHER - #10	2
		153-2091	MS PHILLIPS - 10-32 X 3/4	2
		153-2742	FHMS- 1/4-20 X 1/2	1
11	3	158-6444	BRUSH TRACK MOUNT	1
		ATTACHING PARTS		
		153-2019	LOCKNUT - 8-32 (NYLOK)	4
		153-2501	FLAT HEAD PHILLIPS - 8-32 X 1-1/2	4
11	4	158-6440	BEARING MOUNT PLATE - LEFT	1
		ATTACHING PARTS		
		153-2813	MS FLAT PHILLIPS - 10-32 X 3/4	2
11	5	154-8640	FLANGED BEARING-STD BRUSH (3/4" ROTATED)	2
		ATTACHING PARTS		
		153-2802	FHSS - 5/16-18 X 5/8	2
11	6	158-6441	BEARING MOUNT PLATE - RIGHT	1
		ATTACHING PARTS		
		153-2813	MS FLAT PHILLIPS - 10-32 X 3/4	2
11	7	154-8641	BUFFER BRUSH (BLUE 3-3/4" x 48)	1
		FOR ATTACHING PARTS SEE FIG. 2:21		
11	8	154-0866	TRANSFER BRUSH ASSEMBLY	1
		ATTACHING PARTS		
		153-2019	LOCKNUT - 8-32 (NYLOK)	4
		153-2501	FLAT HEAD PHILLIPS - 8-32 X 1-1/2	4
11	9	158-6442	ADJUSTING BLOCK BASE	2
		ATTACHING PARTS		
		153-2003	FLAT WASHER - #10	2
		153-2013	LOCK WASHER - #10	2
		153-2091	MS PHILLIPS - 10-32 X 3/4	2
11	10	158-6445	ADJUSTING BOLT MOUNT BLOCK	2
		ATTACHING PARTS		
		153-2003	FLAT WASHER - #10	2
		153-2013	LOCK WASHER - #10	2
		153-2091	MS PHILLIPS - 10-32 X 3/4	2
		153-2020	LOCKNUT - 1/4-20 (NYLOK)	2
		153-2932	SET SCREW - 1/4-20 X 1-3/4	1
11	11	158-8432	ASSY - DRIP PAD 1PC TRANSFER SYSTEM -RT	1
		ATTACHING PARTS		
		153-2723	FHMS PHILLIPS - 4-40 X 3/8	2
12	1	153-8207	BRAKE MOTOR ASSEMBLY (25 RPM - 115V)	2 on 115v
12	1	153-8807H	BRAKE MOTOR ASSEMBLY (25 RPM - 230V 50 Hz)	2 on 230v

ATTACHING PARTS LIST

Rev 11:12

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		<i>FOR ATTACHING PARTS SEE: FIG 3:4</i>		
12	2	154-6243	MOTOR CAM - DUAL LOBES	1
		<i>ATTACHING PARTS</i>		
		153-2051	SET SCREW - 1/4-20 X 1/2	1
12	3	154-8802	SQUEEGEE ADJUSTMENT ARM	2
		<i>ATTACHING PARTS</i>		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2023	HEX NUT - 1/4-20	2
		153-2079	FHMS - 1/4-20 X 1	2
		153-2403	COUNTERSUNK LOCK WASHER - 1/4	2
12	4	154-6824	BRUSH CAM SWITCH PLATE	1
		<i>ATTACHING PARTS</i>		
		153-2002	FLAT WASHER - #8	4
		153-2019	LOCKNUT - 8-32 (NYLOK)	2
		153-2086	MS PHILLIPS - 8-32 X 5/8	2
		<i>FOR ATTACHING PARTS SEE: FIG 9:2</i>		
12	5	154-6339-2915	SQUEEGEE MOUNT ANGLE - KUSTODIAN	1
		<i>ATTACHING PARTS</i>		
		153-2027A	JAM NUT - 5/16-18	2
		153-2009	NYLON FLAT WASHER (3/8 - 0.060)	2
		153-2303	SHOULDER BOLT-3/8 X 5/8 (5/16-18)	2
12	6	153-0211	SQUEEGEE ROD END WITH FITTING (ON MOTOR)	2
		<i>ATTACHING PARTS</i>		
		153-2214	JAM NUT - 5/16-24	2
		154-0031	5/16-24 ALLTHREAD STOCK	INCH
12	7	154-0031	5/16-24 ALLTHREAD STOCK	INCH
12	8	153-1203	MICROSWITCH W/ROLLER	2
		<i>ATTACHING PARTS</i>		
		153-2505	MS PHILLIPS - 4-40 X 1	2
12	9	153-2062	HHCS - 5/16-18 X 1-1/4	2
12	10	153-0202D	SQUEEGEE ASSEMBLY - BLUE	1
12	10	153-8204E	SQUEEGEE BLADE REPLACEMENT KIT (BLUE)	1
		<i>FOR ATTACHING PARTS SEE: FIG 2:13</i>		
12	11	154-6677A	SQUEEGEE HOSE ADAPTER - NYLON	1
		<i>ATTACHING PARTS</i>		
		<i>USE SILICON WHEN ATTACHING</i>		
		153-2004	FLAT WASHER - 1/4	2
		153-2014	LOCK WASHER - 1/4	2
		153-2023	HEX NUT - 1/4-20	2
		153-2052A	BHSS - 1/4-20 X 7/8	2
12	12	154-6827	PC RELAY MOUNT PLATE ANGLE	1
		<i>ATTACHING PARTS</i>		
		153-2004	FLAT WASHER - 1/4	1
		153-2014	LOCK WASHER - 1/4	1
		153-2023	HEX NUT - 1/4-20	1
13	1	153-6850	UHMW DUSTER PLUG FOR CARDBOARD CORE	1
		<i>ATTACHING PARTS</i>		
		153-2005	FLAT WASHER - 5/16	1
		153-2020A	LOCKNUT - 1/4-20 (STOVER)	1
		153-2535	SHOULDER BOLT - 5/16 X 2-1/4 (1/4-20) DUSTER PLUG	1
		153-2808	SPRING - 0.42 OD X 1.25 (DUSTER PLUG)	1
13	2	153-6853	UHMW DUSTER PLUG FOR PVC TAKE-UP REEL	1
13	3	153-8839	CUSHION ROLLER W/PAD (STEEL=44-3/8)	1
13	4	153-8202B	DUSTER SOLID DRIVE HUB (PVC - 1/4-28)	1
		<i>ATTACHING PARTS</i>		

## ATTACHING PARTS LIST

Rev 11:12

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		153-2050	SET SCREW - 1/4-28 X 3/8	1
13	5	153-8201B	DUSTER DRIVE HUB ASSEMBLY (1/4-28) <i>FOR ATTACHING PARTS SEE: FIG 13:4</i>	1
13	6	153-8420	CUSHION ROLLER PIVOT ARM ASSEMBLY <i>ATTACHING PARTS</i>	2
		153-2005	FLAT WASHER - 5/16	1
		153-2020A	LOCKNUT 1/4-20 STOVER	1
		153-2408	SHOULDER BOLT - 5/16 X 1/2 1/4-20 THREADS	1
		153-2414	HEX NUT 8-32	1
		153-2090	MS PHILLIPS - 8-32 x 1-1/2	1
13	7	154-1603	MICROSWITCH - WITHOUT ROLLER (LARGE) <i>FOR ATTACHING PARTS SEE: FIG 1:17</i>	2
13	8	153-0047EZ	CLOTH - EZ EXTRUDED REUSABLE CORE	CASE
13	9	153-0429	DMR DUSTER ROLL SUPPORT PIPE (40 INCH)	1
13	10	153-8824	PVC TAKE-UP REEL ASSEMBLY (1/4-28)	1
13	11	153-8403	BRAKE MOTOR ASSEMBLY (7RPM - 115V)	2
13	11	153-8808H	BRAKE MOTOR ASSEMBLY (7RPM - 230V 50Hz) <i>ATTACHING PARTS</i>	2
		153-2091	MS PHILLIPS - 10-32 x 3/4	4
		153-2013	LOCK WASHER #10	4
		153-2003	FLAT WASHER #10	4
13	12	153-2807	SHOULDER BOLT-5/16 X 2 (1/4-20)	2
13	13	153-2808	SPRING - 0.42 OD x 1.25 (DUSTER PLUG)	2
13	14	153-2020A	LOCKNUT - 1/4-20 (STOVER)	2
14	1	154-8637	BUFFER BRUSH LIFTING ASSEMBLY <i>ATTACHING PARTS</i>	1
		153-2804	COLLAR - 3/8 X 3/4 X 3/8	2
14	2	154-6824	BRUSH CAM SWITCH PLATE <i>ATTACHING PARTS</i>	1
		153-2002	FLAT WASHER - #8	4
		153-2019	LOCKNUT - 8-32 (NYLOK)	2
		153-2086	MS PHILLIPS - 8-32 X 5/8	2
14	3	153-8207	BRAKE MOTOR ASSEMBLY (25 RPM-115 VOLT)	1
14	3	153-8807H	BRAKE MOTOR ASSEMBLY (25 RPM-230V 50 Hz) <i>FOR ATTACHING PARTS SEE FIG. 3:4</i>	1
14	4	154-6243	MOTOR CAM - DUAL LOBES (FOR STACKED SWITCHES) <i>ATTACHING PARTS</i>	1
		153-2051	SET SCREW - 1/4-20 X 1/2	1
14	5	153-2801	SHOULDER BOLT - 3/8 X 3/8 (5/16-18) BRUSH LIFT <i>ATTACHING PARTS</i>	1
		153-2027A	JAM NUT - 5/16-18	1
14	6	153-2804	COLLAR - 3/8 X 3/4 X 3/8	2
14	7	154-8638	BUFFER BRUSH LIFTING LINK - LEFT <i>ATTACHING PARTS</i>	1
		153-2027A	JAM NUT - 5/16-18	3
		153-2801	SHOULDER BOLT - 3/8 X 3/8 (5/16-18) BRUSH LIFT	2
		153-9803	FLANGED BUSHING (3/8 X 1/2 X 1/4)	15
14	8	154-8639	BUFFER BRUSH LIFTING LINK - RIGHT <i>FOR ATTACHING PARTS SEE FIG. 13:7</i>	1
14	9	153-1203	MICROSWITCH - WITH ROLLER (SQUEEGEE & BRUSH) <i>ATTACHING PARTS</i>	2
		153-2505	MS PHILLIPS - 4-40 X 1	2

ATTACHING PARTS LIST

Rev 11:12

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
14	10	153-2801A	SHOULDER BOLT-3/8 X 3/8-CUT (5/16-18)	2
14	11	154-8837	CAM TO BRUSH LIFTING ROD LINK ASSEMBLY	1
		ATTACHING PARTS		
		153-2027A	JAM NUT - 5/16-18	1
		153-2801	SHOULDER BOLT - 3/8 X 3/8 (5/16-18) BRUSH LIFT	2
15	1	154-8805	VACUUM MOTOR ASSEMBLY - 115V	1
15	1	154-8805E	VACUUM MOTOR ASSEMBLY - 230V	1
		ATTACHING PARTS		
		153-2830	HEX HEAD SELF TAP #10 X 5/8 SCREW	4
		153-0204B	VACUUM MOTOR BRUSHES	PAIR
15	2	153-8827T	1-1/4" PVC ELBOW FOR TANK INLET (NO THREADS)	2
15	3	154-0260	FLEXIBLE VACUUM HOSE STOCK (1-1/2" ID)	INCH
15	4	154-0607	PVC ELBOW - 1-1/2 BARB X 1-1/2 BARB	1
15	5	153-2924	MS PHILLIPS - 1/4-20 X 3/4 TRUSS HEAD	12
15	6	153-6221M	VACUUM WALL ADAPTER	1
		USE SILICON WHEN ATTACHING		
15	7	153-2406	HOSE CLAMP (1-1/2")	6
15	8	158-6448	REC TANK SUB-FLOOR COVER PLATE - 10 GAL	1
		ATTACHING PARTS		
		153-2924	MS PHILLIPS - 1/4-20 X 3/4 TRUSS HEAD	12
15	9	158-8434	RECOVERY TANK ASSEMBLY - 10 GALLON	1
15	10	158-8618	VACUUM MOTOR HOUSING	1
15	11	154-0810	LIFTING HANDLE (SS SPRING LOADED)	2
15	12	158-0405	RECOVERY TANK GASKET	1
15	13	158-0406	FILTER FOR 10 GALLON RECOVERY TANK	1
15	14	154-0006A	BUMPER GUARD - POLYURETHANE (13/32)	2
15	15	158-6709	VACUUM MOTOR GUARD	1
16	1	154-8851	CLEANER HOSE AND TIP HOLDER	1
16	2	154-6832	OIL PENCIL TIP	1
16	3	154-6646	HEAD BELT MOUNT PLATE	1
		ATTACHING PARTS		
		153-2081	MS PHILLIPS - 6-32 x 1/2	4
		153-2504	MS PHILLIPS - 4-40 x 3/8	1
16	4	154-6647A	SLIDING HEAD BAR	1
		ATTACHING PARTS		
		153-2702	FHMS - 1/4-20 X 1 SELF-LOCKING	3
16	5	154-6893	OIL HEAD - ADJUSTABLE TIP ANGLE	1
		ATTACHING PARTS		
		153-2928	MS - PHILLIPS - 8-32 X 1-3/4 (PAN HEAD)	1
		153-2507	FHMS PHILLIPS - 8-32 X 3/4	1
		153-2414	HEX NUT - 8-32	2
16	6	154-6876	HEAD MOTOR MOUNT BLOCK	1
		FOR ATTACHING PARTS SEE: FIG 3:8		
16	7	154-6872	HEAD DRIVE MOUNT BLOCK	3
		FOR ATTACHING PARTS SEE: FIG 1:20		
16	8	154-0206	SPRING FOR OIL LINE (10")	1

## ATTACHING PARTS LIST

Rev 11:12

FIGURE NUMBER	INDEX NUMBER	PART NUMBER	PART NAME & DESCRIPTION	QUANTITY NEEDED
		<i>ATTACHING PARTS</i>		
		153-1049E	WIRE HARNESS CLAMP - 3/8	1
		153-2002	FLAT WASHER - #8	1
		153-2019	LOCKNUT - 8-32 (NYLOK)	1
		153-2086	MS PHILLIPS - 8-32 X 5/8	1
16	9	153-2804	COLLAR - 3/8 X 3/4 X 3/8	2
16	10	154-6687	SPRING RETAINER PLATE	1
		<i>FOR ATTACHING PARTS SEE: FIG 4:10</i>		
16	11	154-8232	HEAD DRIVE MOTOR-115V ST (NO GEARBOX)	1
		154-8632	HEAD DRIVE MOTOR-230V STD (NO GEARBOX)	1
		<i>ATTACHING PARTS</i>		
		154-1206	GEARBOX FOR HEAD DRIVE MOTOR (5:1 RATIO)	1
16	12	154-8806	KEYPAD ASSY	1
		<i>FOR ATTACHING PARTS SEE: FIG 1:3</i>		
16	13	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MC1)	4
		<i>FOR ATTACHING PARTS SEE: FIG 1:19</i>		
16	15	154-1206	GEARBOX FOR HEAD DRIVE MOTOR (5:1 RATIO)	1
		<i>ATTACHING PARTS</i>		
		154-8232	HEAD DRIVE MOTOR-115V ST (NO GEARBOX)	1
		154-8632	HEAD DRIVE MOTOR-230V STD (NO GEARBOX)	1
16	16	154-8348-2915	SPLASH GUARD ASSEMBLY	1
		<i>FOR ATTACHING PARTS SEE: FIG 1:1</i>		





**“Take care of your lane machine and it will take care of you”**





# CHAPTER 7

## Navigation Patterns

### Navigation Pattern Settings

We realize everyone is searching for some kind of direction when it comes to lane patterns so the Kegel “Navigation Patterns” were created to help proprietors give bowlers the stepping stones needed to improve, compete, and reach their full potential.

Until now, there have not been many pattern choices or a level of difficulty between ‘House’ and ‘USBC Sport Bowling’ patterns. USBC’s Sport Bowling is a good description of difficulty, but the definition of a ‘House’ shot only means what bowling has given to it. To beginners who are just starting to bowl that description means nothing. With that in mind, Kegel has created a series of patterns called the Kegel “Navigation Patterns”.

All of the Navigation Patterns are grouped and separated by three levels of difficulty: **Sport**; **Challenge**; and **Recreation**. The Recreation Series of patterns will be at a ratio of 5:1 or greater; the Challenge Series patterns will be between 3:1 to 4.9:1; and all Sport Series patterns will be USBC Sport Bowling compliant, which adhere to a ratio of 3:1 or less.

The Navigation Patterns will be available in Kegel’s Pattern Library on [www.kegel.net](http://www.kegel.net) and they are available to view and download for free. Kegel’s award winning technical support department, Lane Maintenance Central, will also be available for questions and to assist in setting up these patterns in your bowling center for your customers.

Go to <http://www.kegel.net/patternlibrary/default.asp> for additional patterns.



### **BOURBON STREET 6240**

Kegel's reverse drop function is used for this pattern which provides more shots up front while also making the shot more open downlane.

So just like the famous street in New Orleans, once the shot's start flowing, you can really let loose and have a good time when playing on Kegel's Bourbon Street.

#### **Latitude Ratio Coordinates**

22' 6.2 to 1

38' 6.7 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 5.0 to 1

Inside Taper 4.0 to 1

#### **Pattern Distance**

40 Feet

#### **Pattern Volume**

Forward 15.60 mL

Reverse 7.85 mL

Total 23.45 mL



# KEGEL NAVIGATION PATTERNS

## RECREATION SERIES



### BOURBON STREET 6240

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50  $\mu$ L

Pattern Distance: 40 feet

Reverse Drop Brush: 32 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01F	2	2	3	14.00	0.00	1.90	37	111	5550	
02F	9	9	1	18.00	3.90	6.40	23	23	1150	
03F	10	10	3	18.00	6.40	14.00	21	63	3150	
04F	11	11	3	18.00	14.00	21.60	19	57	2850	
05F	13	13	3	18.00	21.60	29.20	15	45	2250	
06F	14	14	1	22.00	29.20	32.30	13	13	650	
07F	2	2	0	22.00	32.30	34.00	0	0	0	
08F	2	2	0	26.00	34.00	40.00	0	0	0	
09F										
Forward Buff Screens: 2			Forward # Boards Crossed   Volume mL					312	15.60	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01R	2	2	0	30.00		30.00				
02R	14	14	1	22.00	30.00	26.90	13	13	650	
03R	13	13	3	18.00	26.90	19.30	15	45	2250	
04R	11	11	3	18.00	19.30	11.70	19	57	2850	
05R	10	10	2	14.00	11.70	7.80	21	42	2100	
06R	2	2	0	10.00	7.80	0.00	0	0	0	
07R										
08R										
09R										
Reverse # Boards Crossed   Volume mL								157	7.85	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>469</b>	<b>23.45</b>	





### **EASY STREET 7938**

Because of the medium distance of this pattern, it is favorable to many different styles and ball choices. Bowlers with higher rev rates can easily swing the ball and bowlers with lower rev rates can play more direct. This pattern is just like walking down EASY STREET with no worries on a nice summer day.

#### **Latitude Ratio Coordinates**

22' 7.9 to 1

36' 5.2 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 2.4 to 1

Inside Taper 3.9 to 1

#### **Pattern Distance**

38 Feet

#### **Pattern Volume**

Forward 7.25 mL

Reverse 11.45 mL

Total 18.70 mL



# KEGEL NAVIGATION PATTERNS

## RECREATION SERIES



### EASY STREET 7938

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50  $\mu$ L

Pattern Distance: 38 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01F	2	2	1	14.00	0.00	0.00	37	37	1850	
02F	10	10	3	18.00	0.00	7.60	21	63	3150	
03F	13	13	3	18.00	7.60	15.20	15	45	2250	
04F	2	2	0	18.00	15.20	24.00				
05F	2	2	0	22.00	24.00	33.00				
06F	2	2	0	30.00	33.00	38.00				
07F										
08F										
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					145	7.25	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01R	2	2	0	30.00		33.00				
02R	14	14	2	18.00	33.00	27.90	13	26	1300	
03R	13	13	4	18.00	27.90	17.70	15	60	3000	
04R	12	12	4	14.00	17.70	9.80	17	68	3400	
05R	11	11	2	10.00	9.80	7.00	19	38	1900	
06R	2	2	1	10.00	7.00	5.60	37	37	1850	
07R	2	2	0	10.00	5.60	0.00				
08R										
09R										
Reverse # Boards Crossed   Volume mL								229	11.45	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>374</b>	<b>18.70</b>	





### **HIGH STREET 8144**

At 44 feet in length, the oil line is very high and extends far down lane giving hold area like no other pattern in the series. Players will have to target along the highest point of oil much longer to prosper on the HIGH STREET.

#### **Latitude Ratio Coordinates**

22' 8.1 to 1  
42' 5.5 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 2.9 to 1  
Inside Taper 1.8 to 1

#### **Pattern Distance**

44 Feet

#### **Pattern Volume**

Forward 10.85 mL  
Reverse 10.25 mL  
Total 21.10 mL





# KEGEL NAVIGATION PATTERNS

## RECREATION SERIES



### HIGH STREET 8144

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50  $\mu$ L

Pattern Distance: 44 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01F	2	2	2	18.00	0.00	2.50	37	74	3700	
02F	9	9	2	18.00	2.50	7.60	23	46	2300	
03F	10	10	3	18.00	7.60	15.20	21	63	3150	
04F	12	12	2	18.00	15.20	20.30	17	34	1700	
05F	2	2	0	18.00	20.30	24.00				
06F	2	2	0	22.00	24.00	33.00				
07F	2	2	0	30.00	33.00	44.00				
08F										
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					217	10.85	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01R	2	2	0	30.00		35.00				
02R	14	14	3	18.00	35.00	27.40	13	39	1950	
03R	13	13	4	18.00	27.40	17.20	15	60	3000	
04R	12	12	4	14.00	17.20	9.30	17	68	3400	
05R	11	11	2	10.00	9.30	6.50	19	38	1900	
06R	2	2	0	10.00	6.50	0.00				
07R										
08R										
09R										
Reverse # Boards Crossed   Volume mL								205	10.25	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>422</b>	<b>21.10</b>	





### **MAIN STREET 7241**

This 41 foot pattern is typical of the many house shots used across the USA. Using a slight blend, the MAIN STREET is a pattern that enables many different styles to score while socializing and hanging out with friends.

#### **Latitude Ratio Coordinates**

22' 7.2 to 1  
39' 4.7 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 2.7 to 1  
Inside Taper 1.9 to 1

#### **Pattern Distance**

41 Feet

#### **Pattern Volume**

Forward 8.55 mL  
Reverse 10.75 mL  
Total 19.30 mL





# KEGEL NAVIGATION PATTERNS

## RECREATION SERIES



### MAIN STREET 7241

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50  $\mu$ L

Pattern Distance: 41 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01F	2	2	2	18.00	0.00	2.50	37	74	3700	
02F	8	8	1	18.00	2.50	5.00	25	25	1250	
03F	10	10	2	18.00	5.00	10.10	21	42	2100	
04F	13	13	2	18.00	10.10	15.20	15	30	1500	
05F	2	2	0	18.00	15.20	24.00				
06F	2	2	0	22.00	24.00	33.00				
07F	2	2	0	30.00	33.00	41.00				
08F										
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					171	8.55	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01R	2	2	0	30.00		35.00				
02R	15	15	1	22.00	35.00	31.90	11	11	550	
03R	14	14	2	18.00	31.90	26.80	13	26	1300	
04R	13	13	4	18.00	26.80	16.60	15	60	3000	
05R	11	11	4	14.00	16.60	8.70	19	76	3800	
06R	10	10	2	10.00	8.70	5.90	21	42	2100	
07R	2	2	0	10.00	5.90	0.00				
08R										
09R										
Reverse # Boards Crossed   Volume mL								215	10.75	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>386</b>	<b>19.30</b>	





### **STONE STREET 9642**

Like Wall Street, the area to play this pattern is very defined but its prime location is just outside a couple boards from its travel companion.

Some might refer to this pattern as a "Stone Wall" since it fits into USBC's Red pattern category.

#### **Latitude Ratio Coordinates**

22' 9.6 to 1  
40' 4.1 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 1.7 to 1  
Inside Taper 3.7 to 1

#### **Pattern Distance**

42 Feet

#### **Pattern Volume**

Forward 11.50 mL  
Reverse 11.65 mL  
Total 23.15 mL



# KEGEL NAVIGATION PATTERNS

## RECREATION SERIES



### STONE STREET 9642

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50  $\mu$ L

Pattern Distance: 42 feet

Reverse Drop Brush: 42 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01F	2	2	2	14.00	0.00	1.90	37	74	3700	
02F	9	9	1	14.00	1.90	3.80	23	23	1150	
03F	10	10	2	18.00	3.80	8.90	21	42	2100	
04F	11	11	3	18.00	8.90	16.50	19	57	2850	
05F	12	12	2	18.00	16.50	21.60	17	34	1700	
06F	2	2	0	18.00	21.60	34.00	0	0	0	
07F	2	2	0	26.00	34.00	38.00	0	0	0	
08F	2	2	0	30.00	38.00	42.00	0		0	
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					230	11.50	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01R	2	2	0	30.00		35.00				
02R	12	12	1	18.00	35.00	32.50	17	17	850	
03R	11	11	2	18.00	32.50	27.40	19	38	1900	
04R	10	10	4	18.00	27.40	17.20	21	84	4200	
05R	9	9	3	18.00	17.20	9.60	23	69	3450	
06R	8	8	1	14.00	9.60	7.70	25	25	1250	
07R	2	2	0	10.00	7.70	0.00	0	0	0	
08R										
09R										
Reverse # Boards Crossed   Volume mL								233	11.65	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>463</b>	<b>23.15</b>	





### **WALL STREET 7240**

Unlike WALL STREET of today, this 40 foot pattern yields no surprises and is defined heavily at the 10th board. To be successful on the WALL STREET, we advise you to place your position near the big dot and bowl over the second arrow so your scores will flourish!

#### **Latitude Ratio Coordinates**

22' 7.2 to 1

38' 5.2 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 2.8 to 1

Inside Taper 2.1 to 1

#### **Pattern Distance**

40 Feet

#### **Pattern Volume**

Forward 8.80 mL

Reverse 10.90 mL

Total 19.70 mL



# KEGEL NAVIGATION PATTERNS

## RECREATION SERIES



### WALL STREET 7240

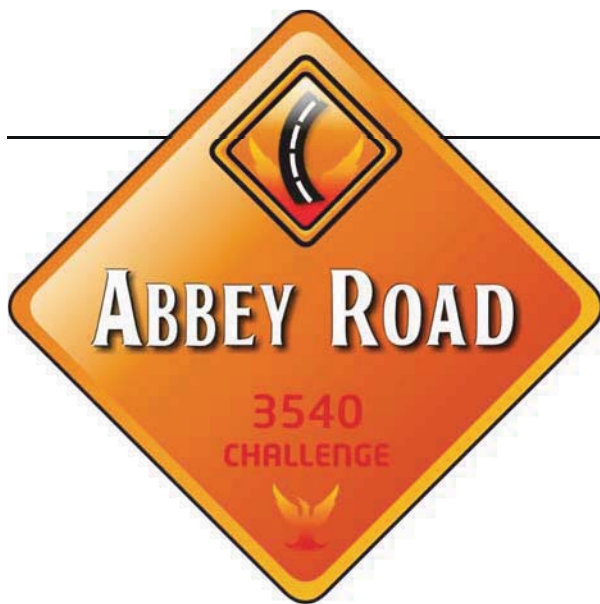
#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 40 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	1	18.00	0.00	0.00	37	37	1850	
02F	10	10	3	18.00	0.00	7.60	21	63	3150	
03F	10	10	2	18.00	7.60	12.70	21	42	2100	
04F	12	12	2	18.00	12.70	17.80	17	34	1700	
05F	2	2	0	18.00	17.80	24.00				
06F	2	2	0	22.00	24.00	32.00				
07F	2	2	0	30.00	32.00	40.00				
08F										
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					176	8.80	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		34.00				
02R	11	11	4	22.00	34.00	21.60	19	76	3800	
03R	10	10	5	18.00	21.60	8.90	21	105	5250	
04R	2	2	1	14.00	8.90	7.00	37	37	1850	
05R	2	2	0	14.00	7.00	0.00				
06R										
07R										
08R										
09R										
Reverse # Boards Crossed   Volume mL								218	10.90	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>394</b>	<b>19.70</b>	





### ABBEY ROAD 3540

Like the goal of the famous album, this pattern is designed more like the way things used to be; back to the basics. Players should try different lines across the Abbey Road and watch out for traffic to find their best way to the scoring side.

For some it may be on the corner while for others towards the middle, but like the last line the Beatles ever sang... *"in the end the score you take is equal to the score you make."*

#### **Latitude Ratio Coordinates**

22' 3.5 to 1

38' 3.1 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 5.1 to 1

Inside Taper 4.0 to 1

#### **Pattern Distance**

40 Feet

#### **Pattern Volume**

Forward 16.60 mL

Reverse 7.60 mL

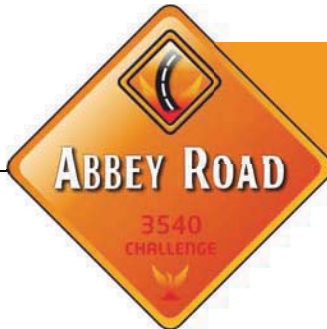
Total 24.20 mL





# KEGEL NAVIGATION PATTERNS

## CHALLENGE SERIES



### ABBEY ROAD 3540

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50  $\mu$ L

Pattern Distance: 40 feet

Reverse Drop Brush: 34 feet

Forward Settings									
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)
01F	2	2	2	14.00	0.00	1.90	37	74	3700
02F	4	4	1	14.00	1.90	3.80	33	33	1650
03F	5	5	1	14.00	3.80	5.70	31	31	1550
04F	6	6	1	14.00	5.70	7.60	29	29	1450
05F	7	7	1	14.00	7.60	9.50	27	27	1350
06F	9	9	2	14.00	9.50	13.40	23	46	2300
07F	11	11	2	18.00	13.40	18.50	19	38	1900
08F	13	13	2	18.00	18.50	23.60	15	30	1500
09F	14	14	1	18.00	23.60	26.10	13	13	650
10F	15	15	1	18.00	26.10	28.60	11	11	550
11F	2	2	0	18.00	28.60	31.00	0	0	0
12F	2	2	0	26.00	31.00	40.00	0	0	0
Forward Buff Screens: 2			Forward # Boards Crossed   Volume mL					332	16.60
Reverse Settings									
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)
01R	2	2	0	30.00		22.00	0	0	0
02R	12	12	1	18.00	22.00	19.50	17	17	850
03R	10	10	1	18.00	19.50	17.00	21	21	1050
04R	8	8	1	18.00	17.00	14.50	25	25	1250
05R	7	7	1	18.00	14.50	12.00	27	27	1350
06R	6	6	1	14.00	12.00	10.10	29	29	1450
07R	4	4	1	14.00	10.10	8.20	33	33	1650
08R	2	2	0	14.00	8.20	0.00	0	0	0
Reverse # Boards Crossed   Volume mL							152	7.60	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>							<b>484</b>	<b>24.20</b>	





### **BEATEN PATH 4531**

This 41 foot pattern is much like the MIDDLE ROAD but two feet longer. Because of this added length, the options of attack will be a little more limited and the pattern will usually play where the most worn or highest friction part of the lane surface is. The players who excel in reading the lanes will easily find the BEATEN PATH and make this pattern look relatively easy. If you veer too far off the BEATEN PATH, it will play more difficult.

#### **Latitude Ratio Coordinates**

22' 4.5 to 1

39' 3.1 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 3.6 to 1

Inside Taper 3.3 to 1

#### **Pattern Distance**

41 Feet

#### **Pattern Volume**

Forward 12.05 mL

Reverse 12.20 mL

Total 24.25 mL





# KEGEL NAVIGATION PATTERNS

## CHALLENGE SERIES



### BEATEN PATH 4541

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 41 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	2	10.00	0.00	1.40	37	74	3700	
02F	8	8	1	14.00	1.40	3.30	25	25	1250	
03F	10	9	2	14.00	3.30	7.20	22	44	2200	
04F	12	10	3	14.00	7.20	13.10	19	57	2850	
05F	14	12	2	14.00	13.10	17.00	15	30	1500	
06F	16	14	1	18.00	17.00	19.50	11	11	550	
07F	2	2	0	18.00	19.50	27.00				
08F	2	2	0	22.00	27.00	34.00				
09F	2	2	0	26.00	34.00	41.00				
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					241	12.05	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		32.00				
02R	15	13	1	22.00	32.00	28.90	13	13	650	
03R	13	12	2	18.00	28.90	23.80	16	32	1600	
04R	11	11	2	18.00	23.80	18.70	19	38	1900	
05R	9	9	1	18.00	18.70	16.20	23	23	1150	
06R	7	7	1	14.00	16.20	14.30	27	27	1350	
07R	2	2	3	14.00	14.30	8.40	37	111	5550	
08R	2	2	0	14.00	8.40	0.00				
09R										
			Reverse # Boards Crossed   Volume mL					244	12.20	
			<b>Forward plus Reverse Boards Crossed   Volume mL</b>					<b>485</b>	<b>24.25</b>	





### **BROADWAY 4537**

This 37 foot pattern is named after the wide open street in Manhattan called BROADWAY, which ironically originates at a park called Bowling Green. BROADWAY was originally translated from the Dutch name of 'Breede weg' because of its location in New Amsterdam. Because of the medium short length of this pattern and light volume of conditioner towards the outside portion of the lane, players can arrive to the pocket on the BROADWAY from multiple directions.

#### **Latitude Ratio Coordinates**

22' 4.5 to 1  
35' 3.5 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 3.1 to 1  
Inside Taper 2.5 to 1

#### **Pattern Distance**

37 Feet

#### **Pattern Volume**

Forward 11.00 mL  
Reverse 12.25 mL  
Total 23.25 mL



# KEGEL NAVIGATION PATTERNS

## CHALLENGE SERIES



### BROADWAY 4537

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 37 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	4	4	1	14.00	0.00	0.00	33	33	1650	
02F	5	5	1	14.00	0.00	1.90	31	31	1550	
03F	7	7	2	14.00	1.90	5.80	27	54	2700	
04F	9	9	2	14.00	5.80	9.70	23	46	2300	
05F	11	10	2	18.00	9.70	14.80	20	40	2000	
06F	13	12	1	18.00	14.80	17.30	16	16	800	
07F	2	2	0	18.00	17.30	24.00				
08F	2	2	0	22.00	24.00	31.00				
09F	2	2	0	26.00	31.00	37.00				
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					220	11.00	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		31.00				
02R	12	11	1	22.00	31.00	27.90	18	18	900	
03R	10	9	1	18.00	27.90	25.40	22	22	1100	
04R	8	8	3	18.00	25.40	17.80	25	75	3750	
05R	7	7	1	14.00	17.80	15.90	27	27	1350	
06R	6	6	1	14.00	15.90	14.00	29	29	1450	
07R	2	2	2	14.00	14.00	10.10	37	74	3700	
08R	2	2	0	14.00	10.10	0.00				
09R										
Reverse # Boards Crossed   Volume mL								245	12.25	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>465</b>	<b>23.25</b>	





### MIDDLE ROAD 4239

In political terms, this pattern is centrism in nature because the characteristics lie between the extremes of having to play too far to the right or too far to the left. The MIDDLE ROAD is a 39 foot pattern that is moderately challenging; it's not too easy and it's not too tough. The best mindset and line for this pattern is usually somewhere near the middle of the road.

#### Latitude Ratio Coordinates

22' 4.2 to 1

37' 3.2 to 1

#### Longitude Ratio Coordinates

Outside Taper 4.0 to 1

Inside Taper 2.9 to 1

#### Pattern Distance

39 Feet

#### Pattern Volume

Forward 11.90 mL

Reverse 10.95 mL

Total 22.85 mL



# KEGEL NAVIGATION PATTERNS

## CHALLENGE SERIES



### MIDDLE ROAD 4239

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 39 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	2	14.00	0.00	1.90	37	74	3700	
02F	6	6	1	14.00	1.90	3.80	29	29	1450	
03F	8	8	1	14.00	3.80	5.70	25	25	1250	
04F	10	10	3	14.00	5.70	11.60	21	63	3150	
05F	12	12	2	18.00	11.60	16.70	17	34	1700	
06F	14	14	1	18.00	16.70	19.20	13	13	650	
07F	2	2	0	18.00	19.20	26.00				
08F	2	2	0	22.00	26.00	32.00				
09F	2	2	0	30.00	32.00	39.00				
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					238	11.90	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		32.00				
02R	13	13	2	22.00	32.00	25.80	15	30	1500	
03R	11	11	2	18.00	25.80	20.70	19	38	1900	
04R	9	9	1	18.00	20.70	18.20	23	23	1150	
05R	7	7	2	18.00	18.20	13.10	27	54	2700	
06R	2	2	2	18.00	13.10	8.00	37	74	3700	
07R	2	2	0	14.00	8.00	0.00				
08R										
09R										
Reverse # Boards Crossed   Volume mL								219	10.95	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>457</b>	<b>22.85</b>	







### **ROUTE 66 4345**

As one the longest roads in America, so is this pattern in the series. At 45 feet in length, and as with most long oil patterns, the optimum line is usually one that is closer to the pocket or more towards the inside portion of the lane. The greatest slope of conditioner on the ROUTE 66 is from the 11th board to the 16th board so players should target along this route. Outside of that slope, the pattern is flat so there will be very little room for error. 🎵 If you get hip to this tip, take that bowling center trip to get your kicks on ROUTE 66! 🎵

#### **Latitude Ratio Coordinates**

22' 4.3 to 1

43' 2.6 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 3.4 to 1

Inside Taper 3.2 to 1

#### **Pattern Distance**

45 Feet

#### **Pattern Volume**

Forward 10.30 mL

Reverse 13.00 mL

Total 23.30 mL



# KEGEL NAVIGATION PATTERNS

## CHALLENGE SERIES



### ROUTE 66 4345

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 45 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	3	14.00	0.00	3.90	37	111	5550	
02F	12	12	1	14.00	3.90	5.80	17	17	850	
03F	13	13	2	18.00	5.80	10.90	15	30	1500	
04F	14	14	2	18.00	10.90	16.00	13	26	1300	
05F	15	15	2	18.00	16.00	21.10	11	22	1100	
06F	2	2	0	18.00	21.10	26.00				
07F	2	2	0	26.00	26.00	36.00				
08F	2	2	0	30.00	36.00	45.00				
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					206	10.30	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		36.00				
02R	14	14	2	22.00	36.00	29.80	13	26	1300	
03R	13	13	2	18.00	29.80	24.70	15	30	1500	
04R	12	12	2	18.00	24.70	19.60	17	34	1700	
05R	11	11	2	14.00	19.60	15.70	19	38	1900	
06R	10	10	1	14.00	15.70	13.80	21	21	1050	
07R	2	2	3	14.00	13.80	7.90	37	111	5550	
08R	2	2	0	14.00	7.90	0.00				
09R										
Reverse # Boards Crossed   Volume mL								260	13.00	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>466</b>	<b>23.30</b>	





### SUNSET STRIP 3240

Using Kegel's reverse drop brush function, this pattern places oil on the lane in four board strips.

Some lanes may allow certain styles to play the outside strip while others may find the middle or inside strip the best.

With a great performance and a little luck, you too can be a star on the Sunset Strip!

#### **Latitude Ratio Coordinates**

22' 3.2 to 1

38' 2.6 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 4.6 to 1

Inside Taper 4.3 to 1

#### **Pattern Distance**

40 Feet

#### **Pattern Volume**

Forward 15.95 mL

Reverse 8.75mL

Total 24.70 mL





# KEGEL NAVIGATION PATTERNS

## CHALLENGE SERIES



### SUNSET STRIP 3240

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50  $\mu$ L

Pattern Distance: 40 feet

Reverse Drop Brush: 32 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01F	2	2	2	14.00	0.00	1.90	37	74	3700	
02F	5	5	3	18.00	1.90	9.50	31	93	4650	
03F	9	9	4	18.00	9.50	19.70	23	92	4600	
04F	13	13	4	18.00	19.70	29.90	15	60	3000	
05F	2	2	0	18.00	29.90	33.00	0	0	0	
06F	2	2	0	22.00	33.00	40.00	0	0	0	
07F										
08F										
09F										
Forward Buff Screens: 2			Forward # Boards Crossed   Volume mL					319	15.95	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil ( $\mu$ L)	
01R	2	2	0	30.00		21.00	0	0	0	
02R	13	13	2	14.00	21.00	17.10	15	30	1500	
03R	9	9	2	14.00	17.10	13.20	23	46	2300	
04R	5	5	2	14.00	13.20	9.30	31	62	3100	
05R	2	2	1	10.00	9.30	7.90	37	37	1850	
06R	2	2	0	10.00	7.90	0.00	0	0	0	
07R										
08R										
09R										
Reverse # Boards Crossed   Volume mL								175	8.75	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>494</b>	<b>24.70</b>	





### AUTOBAHN 2542

Using Kegel's reverse drop brush function, the amount of applied conditioner is increased in the midlane but less is at the end of the pattern.

This makes the Autobahn more about speed control and keeping your path straighter through the front part of the 'drive'; a term used for bowling lanes in the early 1900's.

On some 'drives', faster speeds may be best while other 'drives' may require a little less speed to navigate the corner without crashing through the breakpoint.

#### **Latitude Ratio Coordinates**

22' 2.5 to 1

40' 2.0 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 4.6 to 1

Inside Taper 4.0 to 1

#### **Pattern Distance**

42 Feet

#### **Pattern Volume**

Forward 18.70 mL

Reverse 7.15 mL

Total 25.85 mL



# KEGEL NAVIGATION PATTERNS

## SPORT SERIES



### AUTOBAHN 2542

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 42 feet

Reverse Drop Brush: 33'

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	5	14.00	0.00	7.90	37	185	9250	
02F	6	6	1	14.00	7.90	9.80	29	29	1450	
03F	9	9	2	14.00	9.80	13.70	23	46	2300	
04F	9	9	2	18.00	13.70	18.80	23	46	2300	
05F	12	12	4	18.00	18.80	29.00	17	68	3400	
06F	2	2	0	18.00	29.00	34.00	0	0	0	
07F	2	2	0	22.00	34.00	42.00	0	0	0	
08F										
09F										
Forward Buff Screens: 2			Forward # Boards Crossed   Volume mL					374	18.70	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		32.00	0	0	0	
02R	12	12	1	18.00	21.00	18.50	17	17	850	
03R	9	9	1	18.00	18.50	16.00	23	23	1150	
04R	6	6	1	18.00	16.00	13.50	29	29	1450	
05R	2	2	2	18.00	13.50	8.40	37	74	3700	
06R	2	2	0	14.00	8.40	0.00	0	0	0	
07R										
08R										
09R										
Reverse # Boards Crossed   Volume mL								143	7.15	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>517</b>	<b>25.85</b>	





### **BOARDWALK 2435**

Based upon the 2000 PBA Indianapolis Open pattern which was created by Kegel, this pattern is designed to play towards the edge board. Because of the relatively short 35 foot length of the BOARDWALK, players will need to control the excessive change of direction of the bowling ball as it enters the 25 feet of dry backend. Since lanes do have many topographical differences, on some lanes the BOARDWALK will require a more direct route to the pocket while other lane characteristics may allow players to swing the ball to the edge board. Like all wooden walkways, this pattern can provide great excitement but stray too far off the BOARDWALK and you'll find yourself in the moat!

#### **Latitude Ratio Coordinates**

22' 2.4 to 1  
33' 2.1 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 2.5 to 1  
Inside Taper 2.3 to 1

#### **Pattern Distance**

35 Feet

#### **Pattern Volume**

Forward 10.55 mL  
Reverse 13.35 mL  
Total 23.90 mL



# KEGEL NAVIGATION PATTERNS

## SPORT SERIES



### BOARDWALK 2435

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 35 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	1	14.00	0.00	0.00	37	37	1850	
02F	5	5	2	14.00	0.00	3.90	31	62	3100	
03F	6	6	2	18.00	3.90	9.00	29	58	2900	
04F	7	7	2	18.00	9.00	14.10	27	54	2700	
05F	2	2	0	22.00	14.10	26.00				
06F	2	2	0	26.00	26.00	35.00				
07F										
08F										
09F										
Forward Buff Screens: 2		Forward # Boards Crossed   Volume mL						211	10.55	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		28.00				
02R	8	8	1	18.00	28.00	25.50	25	25	1250	
03R	7	7	2	18.00	25.50	20.40	27	54	2700	
04R	6	6	2	14.00	20.40	16.50	29	58	2900	
05R	5	5	2	14.00	16.50	12.60	31	62	3100	
06R	4	4	1	14.00	12.60	10.70	33	33	1650	
07R	3	3	1	14.00	10.70	8.80	35	35	1750	
08R	2	2	0	14.00	8.80	0.00				
09R										
		Reverse # Boards Crossed   Volume mL						267	13.35	
		<b>Forward plus Reverse Boards Crossed   Volume mL</b>						<b>478</b>	<b>23.90</b>	







### DEAD MAN'S CURVE 3043

This 43 foot pattern has more out of bounds than most patterns because of the increased application of conditioner on the forward pass. With a slight increase slope of oil from the tenth board to the fourteenth board on the return pass, the goal of the player is to target along those boards of extra conditioner without swinging the ball too much towards the outside part of the lane. Players who try to excessively curve the ball with too much speed will find DEAD MAN'S CURVE hazardous to their score.

#### **Latitude Ratio Coordinates**

22' 3.0 to 1

41' 2.4 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 4.2 to 1

Inside Taper 3.5 to 1

#### **Pattern Distance**

43 Feet

#### **Pattern Volume**

Forward 13.85 mL

Reverse 10.40 mL

Total 24.25 mL



# KEGEL NAVIGATION PATTERNS

## SPORT SERIES



### DEAD MAN'S CURVE 3043

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 43 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	5	14.00	0.00	7.90	37	185	9250	
02F	11	11	1	14.00	7.90	9.80	19	19	950	
03F	12	12	2	14.00	9.80	13.70	17	34	1700	
04F	14	14	3	18.00	13.70	21.30	13	39	1950	
05F	2	2	0	18.00	21.30	26.00				
06F	2	2	0	22.00	26.00	33.00				
07F	2	2	0	26.00	33.00	43.00				
08F										
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					277	13.85	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		32.00				
02R	15	15	1	26.00	32.00	28.40	11	11	550	
03R	13	13	2	22.00	28.40	22.20	15	30	1500	
04R	12	12	2	18.00	22.20	17.10	17	34	1700	
05R	11	11	2	18.00	17.10	12.00	19	38	1900	
06R	10	10	1	14.00	12.00	10.10	21	21	1050	
07R	2	2	2	14.00	10.10	6.20	37	74	3700	
08R	2	2	0	10.00	6.20	0.00				
09R										
Reverse # Boards Crossed   Volume mL								208	10.40	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>485</b>	<b>24.25</b>	





### HIGHWAY TO HELL 2340

This 40 foot pattern is the flattest of the group and therefore can be the most difficult. With an increased amount of conditioner outside, the HIGHWAY TO HELL is a low latitude ratio pattern with very little left to right shape to help guide the bowling ball towards the pocket. Each player will have to decide and make sense of their ball reaction to decide what is best for them to find their way down the HIGHWAY TO HELL!

#### **Latitude Ratio Coordinates**

22' 2.3 to 1

38' 1.9 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 4.0 to 1

Inside Taper 3.5 to 1

#### **Pattern Distance**

40 Feet

#### **Pattern Volume**

Forward 10.75 mL

Reverse 14.55 mL

Total 25.30 mL





# KEGEL NAVIGATION PATTERNS

## SPORT SERIES



### HIGHWAY TO HELL 2340

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 40 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	4	14.00	0.00	5.90	37	148	7400	
02F	7	7	1	14.00	5.90	7.80	27	27	1350	
03F	9	9	1	14.00	7.80	9.70	23	23	1150	
04F	12	12	1	18.00	9.70	12.20	17	17	850	
05F	2	2	0	18.00	12.20	26.00				
06F	2	2	0	26.00	26.00	40.00				
07F										
08F										
09F										
Forward Buff Screens: 2		Forward # Boards Crossed   Volume mL						215	10.75	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		30.00				
02R	14	14	1	18.00	30.00	27.50	13	13	650	
03R	12	12	2	18.00	27.50	22.40	17	34	1700	
04R	10	10	2	14.00	22.40	18.50	21	42	2100	
05R	8	8	1	14.00	18.50	16.60	25	25	1250	
06R	6	6	1	14.00	16.60	14.70	29	29	1450	
07R	2	2	2	14.00	14.70	10.80	37	74	3700	
08R	2	2	2	10.00	10.80	8.00	37	74	3700	
09R	2	2	0	10.00	8.00	0.00				
		Reverse # Boards Crossed   Volume mL						291	14.55	
		<b>Forward plus Reverse Boards Crossed   Volume mL</b>						<b>506</b>	<b>25.30</b>	





### TURNPIKE 2441

With the conditioner being applied in a flat manner on the forward travel, and with a little shape created on the journey back towards the foul line, this makes the last third of this pattern very flat.

So when bowling on the Turnpike, you better pay strict attention to your direction or you will pay a hefty toll!

#### **Latitude Ratio Coordinates**

22' 2.4 to 1  
39' 1.1 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 3.0 to 1  
Inside Taper 5.3 to 1

#### **Pattern Distance**

41 Feet

#### **Pattern Volume**

Forward 11.10 mL  
Reverse 14.20 mL  
Total 25.30 mL



# KEGEL NAVIGATION PATTERNS

## SPORT SERIES



### TURNPIKE 2441

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 41 feet

Reverse Drop Brush: 41 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	6	18.00	0.00	12.70	37	222	11100	
02F	2	2	0	18.00	12.70	31.00	0	0	0	
03F	2	2	0	26.00	31.00	36.00	0	0	0	
04F	2	2	0	30.00	36.00	41.00	0	0	0	
05F										
06F										
07F										
08F										
09F										
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					222	11.10	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		32.00				
02R	12	12	2	18.00	32.00	26.90	17	34	1700	
03R	11	11	2	18.00	26.90	21.80	19	38	1900	
04R	10	10	2	14.00	21.80	17.90	21	42	2100	
05R	9	9	2	14.00	17.90	14.00	23	46	2300	
06R	8	8	2	14.00	14.00	10.10	25	50	2500	
07R	2	2	2	14.00	10.10	6.20	37	74	3700	
08R	2	2	0	10.00	6.20	0.00				
09R										
Reverse # Boards Crossed   Volume mL								284	14.20	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>506</b>	<b>25.30</b>	





### WINDING ROAD 2839

This oil pattern uses a distance of 39 feet with very little downlane help to guide the ball into the pocket. Because of the lower ratios towards the end of pattern, the greatest factor on how the WINDING ROAD will play is the lane surface and how the bowlers breakdown the pattern. The WINDING ROAD could play more inside or it could play more outside but the player who figures it out will straighten out the WINDING ROAD!

#### **Latitude Ratio Coordinates**

22' 2.8 to 1  
37' 2.4 to 1

#### **Longitude Ratio Coordinates**

Outside Taper 4.2 to 1  
Inside Taper 3.5 to 1

#### **Pattern Distance**

39 Feet

#### **Pattern Volume**

Forward 12.10 mL  
Reverse 10.35 mL  
Total 22.45 mL



# KEGEL NAVIGATION PATTERNS

## SPORT SERIES



### WINDING ROAD 2839

#### Kegel Sanction Technology™ Lane Machine Settings

Oil per Board (Pump Setting): 50 µL

Pattern Distance: 39 feet

Forward Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01F	2	2	3	14.00	0.00	3.90	37	111	5550	
02F	6	6	1	14.00	3.90	5.80	29	29	1450	
03F	9	8	1	14.00	5.80	7.70	24	24	1200	
04F	10	9	2	14.00	7.70	11.60	22	44	2200	
05F	12	11	1	18.00	11.60	14.10	18	18	900	
06F	13	12	1	18.00	14.10	16.60	16	16	800	
07F	2	2	0	18.00	16.60	24.00				
08F	2	2	0	22.00	24.00	35.00				
09F	2	2	0	30.00	35.00	39.00				
Forward Buff Screens: 3			Forward # Boards Crossed   Volume mL					242	12.10	
Reverse Settings										
Screen #	Left End of Stream	Right End of Stream	# Loads or Streams	Travel Speed (in/sec)	Beginning Distance of Load (feet)	Ending Distance of Load (feet)	# Boards Crossed per Load	Total Boards Crossed	Total Volume of Oil (µL)	
01R	2	2	0	30.00		29.00				
02R	14	13	1	22.00	29.00	25.90	14	14	700	
03R	11	10	2	18.00	25.90	20.80	20	40	2000	
04R	8	8	2	18.00	20.80	15.70	25	50	2500	
05R	6	6	1	18.00	15.70	13.20	29	29	1450	
06R	2	2	2	14.00	13.20	9.30	37	74	3700	
07R	2	2	0	14.00	9.30	0.00				
08R										
09R										
Reverse # Boards Crossed   Volume mL								207	10.35	
<b>Forward plus Reverse Boards Crossed   Volume mL</b>								<b>449</b>	<b>22.45</b>	

