



MODEL B

Lane Machine Manual

REV 12:06

Machine Specifications

17-5400 Kustodian Ion (24VDC) Regular Batteries

17-5400XL Kustodian Ion (24VDC) XL Batteries

Class I - Single Phase

115 Volts, 50/60 Hz, 15 Amps

17-5450 Kustodian Ion (24VDC) Regular Batteries

17-5450XL Kustodian Ion (24VDC) XL Batteries

Class I - Single Phase

230 Volts, 50 Hz, 6 Amps

Dimensions

Width - 55-1/4" (140.34 cm)

Height - 14-1/2" (36.83 cm)

Length - 40-3/4" (103.51 cm)

Regular Weight - 325 pounds (147.4 kg)

XL Weight - 300 pounds (136.1 kg)

Manual Part Number: 158-5400

First Edition

Safety First

This Class I Single Phase lane cleaning/conditioning machine shall be grounded while in use with the cord to protect the operator from electric shock. The machine is provided with a three-conductor cord and a three-contact grounding type attachment plug to fit the proper grounding type receptacle.

The GREEN/YELLOW conductor in the cord is the grounding wire. Never connect this wire to any other terminal than the grounding pin of the attachment plug. If the supply cord is damaged, it must be replaced by a special cord or assembly available from the manufacturer or its service agent.

Machines rated at 115 Volts A.C. are for use on a nominal 120-volt circuit and have a 20A grounding plug (shown on left). Make sure that the machine is connected to an outlet having the same configuration as the plug.



Machines rated at 220-230 Volts A.C. are for use on a nominal 240-volt circuit. The 15A grounding plug is shown on the right. A “Schuko” type adapter for Europe may be provided for this plug.

**Warning of Potential Injury:
Moving Parts – To Reduce The Risk Of Injury, Unplug Before Servicing!**

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

Safety First

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.

It is a HEAVY piece of equipment, and care should be taken when lifting it into the transport position. Use the proper technique to lift 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.

DO NOT operate the machine while standing up in the transport position. There is a **POTENTIAL FOR INJURY** due to moving parts. Be sure to **DISCONNECT** the electrical power source before servicing the machine. Refer all servicing to qualified personnel.

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.

NEVER use any batteries, other than the type supplied with the machine. Mixing battery types or using batteries that are different from what is supplied with the machine may damage the machine and cause serious injury or death to the operator. Use of alternate battery or charger types will void the machine's warranty.

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.

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

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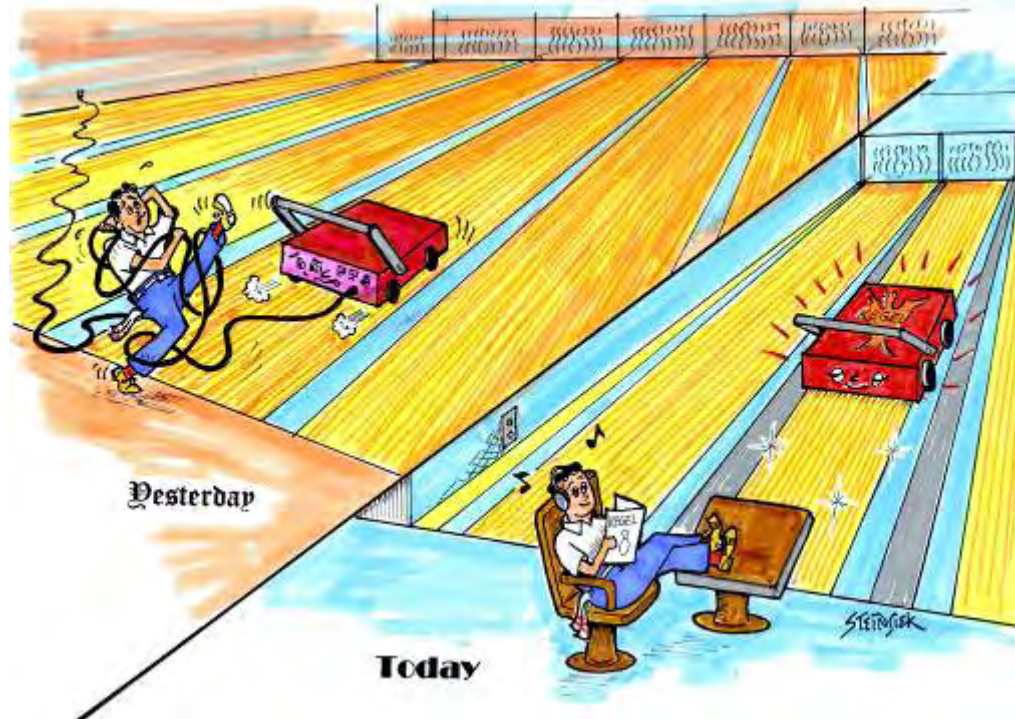
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PREFACE



The KEGEL Kustodian ION Lane Cleaning and Conditioning Machine represents advanced technology in automated lane care. Clean and consistent bowling conditions are quickly accessed from an on-board keypad linked to an industrial Programmable Logic Controller (PLC).

- The Kustodian ION is a battery operated lane maintenance machine like no other. Cordless operation allows for fewer operating problems and increased customer satisfaction. Extended life batteries are now available to handle larger centers.
- 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.
** Upgrade to the Pocket KOSI PDA if you want the ultimate in convenience. **

**IT IS VERY IMPORTANT THAT THE OPERATOR THOROUGHLY READ & 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 ION. 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.

Disclaimer

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Conformity

Kegel is an ISO 9001 Certified Manufacturer. This lane machine has been independently tested to comply with UL (United States), CSA (Canada), and CE (Europe) standards that apply to the equipment.

For additional copies of this or any other KEGEL product manuals contact:

KEGEL
1951 Longleaf Blvd.
Lake Wales, FL 33859
USA

www.kegel.net
(800) 280-2695 (Toll Free in the U.S.)
(863) 734-0200

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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.

Over the past two decades 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.**

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

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.

Acknowledgment

Special thanks for his contributions to this manual go to Mark Davis, VP of Research & Development for KEGEL. Mark began his career in bowling in 1972 when he started working at Belt Bowl in St. Joseph, MO as a porter. Mark enjoyed his work and soon found mechanical interests. Learning everything he could about pinsetters he advanced to “pin chaser” and went to AMF’s Bowling Technology School. Mark worked as head mechanic from 1974 until 1982 when he joined his brother, John Davis, to start making “The Key” lane cleaning tool.

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. From 1986 to 1989, Mark honed some other lane maintenance skills that included resurfacing bowling lanes and various industry work. A few editorial comments throughout this manual may come from this background.

After Mark’s return to KEGEL, he supervised manufacturing of the Sanction Machine[®] and helped to develop many more machines in the following years. These began in 1990 with the DBA LaneWalker, followed by the innovative LCM, Excel, Arrow, Phoenix, Phoenix-S, Standard, and several Kustodian models. Kegel’s team of engineers continue to research and develop the industry’s leading lane maintenance machines and equipment, marked by the introduction of the battery powered Kustodian ION. We hope you enjoy your machine!



“Wah-lah, I did them the same!”

CHAPTER 1

Installation & Setup

Machine Inspection

It is important to identify all of the parts included with your Kustodian ION Lane Machine and inspect the machine 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 ION Lane Machine** - 17-5400 (115VAC) | 17-5450 (230VAC)
- (2) Funnels - 153-0252 & 153-0052 (Small funnel is in Accessory Kit)
- Accessory Kit
- Operators Manual - 158-5400
- KOSI Software - 154-8748
- Extra Roll of EZ Core Cloth - 153-0047EZ
- Long Power Cord (Kustodian ION)** - 154-8829 (115VAC) | 154-8830 (230VAC)
- Short Power Cord (Battery Charger)** - 158-8425 (115VAC) | 158-8425E (230VAC)
- Chemical Starter Kit (on top of crate) - 154-8866

Date Unpacked: _____

Unpacked by: _____

Machine Serial Number: ION-_____

Register your Lane Machine

It is important to register your Machine with KEGEL in order to receive valuable updates, service bulletins and your Lane Machine's Limited Warranty.

IMPORTANT: Please take a minute and register at: www.kegel.net

Getting Started

Daily Setup and Operation

Moving / Transporting your Lane Machine

You would think that transporting and moving your machine in and out of the lanes 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 easy insertion and removal of 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 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.

Machine Sequence of Events - “How it Works”

The machine should be on the approach in down or operating position with the main start screen displayed on the keypad. The machine 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 machine, how the errors work, and what happens as the machine 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 do not open up there will be a duster empty error (**D5**) displayed. The squeegee will move down and stop when the down switch’s normally open contacts close. If the switch contacts do not close there will be a squeegee did not lower error (**SA**) 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 one side to the other (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. After the machine has traveled about 2 feet the vacuum will turn on.
5. Additionally, the second press of the start button will start a clock to record the total amount of run time in the upper right hand corner of the display. The left-hand corner of the display will show the total time the oil valve is on.
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 monitored by the tachometer sensor and is displayed on the bottom left side of 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 brush down error (**B3**).
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 head 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 windup motor will turn on and start to windup the cloth to raise the duster. The duster up switch's normally open contacts will close to turn off the duster windup motor. If the contacts do not close there will be a duster did not wind up (**D6**) error displayed.
12. The machine will then continue the rest of its travel and come to a stop. The squeegee will then lift up and stop when the squeegee up switch's normally open contacts close. If the contacts do not close an **S9** error will be displayed.
13. The machine will then 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 LDS is counting inches traveled and is also monitoring the movement of the machine. If travel is interrupted 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 brush up error (**B4**).
17. The brush will then begin buffing at the end of the pattern as the machine travels in reverse. The oil head will start back up 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, the machine will pause and an **FO** error will be displayed after the machine has stopped at the foul line. The oil will then need to be filled and the **F6** key will need to be pressed to reset the error.

20. If the cleaner float contacts open, the machine will pause and an **FC** error will be displayed after the machine has stopped at the foul line. The cleaner will then need to be filled and the **F6** key will need to be pressed to reset the error. Empty the recovery tank if you fill cleaner tank.
21. The machine can be resumed after all errors except the **SA** squeegee down error. The machine program will need to be zeroed by pressing **F6** and then re-starting the machine.

***NOTE:** If the machine stops and displays the **LOW BATTERY OR E-STOP PRESSED** it will need to be returned to the foul line and plugged in. This message comes up only if the voltage drops below 17 volts (meaning it has a dead battery), the E-Stop is pressed, or there is a loose power connection.*

Basic Steps to Operate Your Kustodian ION

1. Carefully set the machine in the operating (down) position on the approach. It should be completely on the approach, with the cleaning end behind the foul line.
2. Locate the **E-Stop** and rotate the red button to reset and turn the machine on. When the machine is powered ON the menu screen on the keypad will illuminate. The machine is now ready to run.

To operate this machine you need to understand the Machine Sequence of Events. Read previous 2 pages again if you do not fully understand “How it Works”!

3. Position the machine square to the foul line and then press the **Start Button** as you push machine into the lane. The duster and squeegee will lower while you are moving the machine into the lane. Once the machine is seated properly on the lane you can now press the **Start Button** for a second time to finish starting the machine. The machine will now begin operating.
4. **Burning the first pair** - It is necessary to run 2 complete lanes each time you put out a pattern. This is especially true if someone just finished cleaning the oiling system. This step of running warm-up lanes helps to refresh the buffer brush and stabilize the conditioning system. After you have “burned” a pair, then you can start again and condition all of your lanes.

***NOTE:** These two warm-up lanes will allow the Transfer Brush and Buffing Brush to be replenished with oil 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.*

Is it OK not to burn or run any warm-up lanes? Don't we all know the end pairs of any center always get a bad rap, so what's the difference? Everyone has heard the phrase “I don't like to bowl next to the wall” (even if the wall is 8 feet away). The end pairs of any bowling center do tend to be dirtier since there is usually a walkway next to them.

Keypad and Menu

Keypad Button Descriptions

Located under the lid to the right of the conditioning compartment is the computer (PLC) keypad. This keypad is used to enter all programming information. The keypad consists of 6 input keys, two indicator lights, and a two-line Liquid Crystal Display (LCD) where the menu items and prompts appear.



INDICATOR LIGHTS: The red indicator light comes on any time you press any of the 6 keys. The green indicator light comes on when the **NEXT** key is enabled in the Change Program area. The green light will also come on after the Managers Password has been entered correctly (to access the Change Program menu).

MENU / F1: Pressing this key will display and advance the available main menus for the operator. It will also act as a zero button when the machine is operating. When the key is pressed the machine will stop, the program will zero, and the menu will advance to **MANUAL REVERSE**.

NEXT / F2: Use this key to advance within a main menu from one menu prompt to the next. It is also used to advance the output number in the Test Output menu.

DOWN ARROW / F3: This button decreases number values in certain menu prompts. Holding the key down will make the numbers decrease faster. This key is also used to change programs when the program override function is enabled.

***NOTE:** The Down Arrow will not work in screens that display a menu prompt requesting you to choose a program number.*

UP ARROW / F4: This button increases number values in certain menu prompts. Holding the key down will make the numbers increase faster. The **Up Arrow** will loop around to 01 when the upper limit is reached. The **Up Arrow** is also a backup start button.

ENTER / F5: This key is used in the Change Program menu for entering data in the oil load screens. The key is also used to enable Program Override and turn outputs **ON** and **OFF** in the Test Output menu.

RESET / F6: This key has four functions.

- Zeros the program like the Menu key, but it does not advance to the next menu
- Used to start the Oil Volume Test
- Resets the Duster Cloth counters
- Used to return back to the Start Screen from any menu prompt (except for the three situations mentioned above).

***NOTE:** The contrast on the display can be controlled with the knob located on the side of the keypad.*

Operator Menu Selections

This is how the menus would look if you laid them out in a complete view. Each of these menus will be explained in detail in another Chapter. The copyright screen is where the program version is located.

* 0000 ION 0000 SPEED 00 PRO# 01	* MANUAL REVERSE PRESS BUTTON	CHANGE PROGRAM CHOOSE -> 01	SYSTEM CONTROL CLEANING	SYSTEM CONTROL DUSTER
		START BRUSH IN INCHES -> 00	LAST SQUIRT DIST IN FEET -> 57	* UNWIND TIME F6 TO RESET 06
		OIL ONLY DUST? 01=YES -> 01	LIFT DUSTER IN INCHES -> 20	
		OIL PATTERN DIST IN FEET -> 40	FORWARD DISTANCE SUBTRACT -> 32	
		01F 2L- 2R X 02 00->02 FT IPS=18	REVERSE DISTANCE SUBTRACT -> 32	
		02F 8L- 8R X 01 02->05 FT IPS=18		
		03F 10L-10R X 03 05->12 FT IPS=18		
		04F 13L-13R X 02 12->17 FT IPS=18		
		05F 2L- 2R X 00 17->24 FT IPS=18		
		06F 2L- 2R X 00 24->33 FT IPS=22		
		07F 2L- 2R X 00 33->40 FT IPS=30		
		01R 2L- 2R X 00 40->35 FT IPS=30		
		02R 15L-15R X 01 35->31 FT IPS=22		
		03R 14L-14R X 02 31->26 FT IPS=18		
		04R 13L-13R X 04 26->16 FT IPS=18		
		05R 11L-11R X 04 16->06 FT IPS=18		
		06R 10L-10R X 02 06->03 FT IPS=10		
		07R 2L- 2R X 00 03->00 FT IPS=10		
		NEXT TO REVIEW * MENU TO EXIT *		

Operator Menu Selections (Continued)

7 DAY PROGRAM PLANNER	TEST OUTPUT #01 PRESS F2-F5 OFF	OIL AND CLEANER VOLUME TEST	* (C) COPYRIGHT KEGEL 2006 1.9
* MONDAY ***** AM--> 01	TEST OUTPUT #02 PRESS F2-F5 000	* OIL VOLUME PRO#01 PRESS F6	
* MONDAY ***** PM--> 01	TEST OUTPUT #03 PRESS F2-F5 000		
* TUESDAY ***** AM--> 01	TEST OUTPUT #04 PRESS F2-F5 000		
* TUESDAY ***** PM--> 01	TEST OUTPUT #05 PRESS F2-F5 000		
* WEDNESDAY ***** AM--> 01	TEST OUTPUT #06 PRESS F2-F5 000		
* WEDNESDAY ***** PM--> 01	TEST OUTPUT #07 PRESS F2-F5 000		
* THURSDAY ***** AM--> 01	TEST OUTPUT #08 PRESS F2-F5 OFF		
* THURSDAY ***** PM--> 01	TEST OUTPUT #09 PRESS F2-F5 OFF		
* FRIDAY ***** AM--> 01	TEST OUTPUT #10 PRESS F2-F5 OFF		
* FRIDAY ***** PM--> 01	TEST OUTPUT #11 PRESS F2-F5 OFF		
* SATURDAY ***** AM--> 01	TEST OUTPUT #12 PRESS F2-F5 OFF		
* SATURDAY ***** PM--> 01	TEST OUTPUT #13 PRESS F2-F5 OFF		
* SUNDAY ***** AM--> 01	TEST OUTPUT #14 PRESS F2-F5 OFF		
* SUNDAY ***** PM--> 01	TEST OUTPUT #15 PRESS F2-F5 OFF		
	TEST OUTPUT #16 PRESS F2-F5 OFF		
	TEST OUTPUT #17 PRESS F2-F5 OFF		

NOTE: The values shown in these tables are sample screens and may not reflect the actual default menu settings for the machine.

For Manual Reverse: Press and hold the **Start Button** to return machine to the foul line.

Machine Error Messages

The machine is equipped with Error Message Codes that are displayed in case the machine malfunctions. These message codes indicate the type of operational error that has occurred. A detailed description of how the errors occur can be located in the troubleshooting area of the appropriate section.

<u>ERROR CODE</u>	<u>DESCRIPTION</u>
T1	FORWARD TRAVEL ERROR
T2	REVERSE TRAVEL ERROR
B3	BRUSH DOWN ERROR
B4	BRUSH UP ERROR
D5	DUSTER UNWIND ERROR
D6	DUSTER WIND-UP ERROR
H7	OIL HEAD TRAVEL ERROR
S9	SQUEEGEE UP ERROR
SA	SQUEEGEE DOWN ERROR
FO	OIL EMPTY ERROR
FC	CLEANER EMPTY ERROR

This is how an error messages will appear:

ERROR MESSAGE

**** CODE T1 ****

When the machine loses battery power or if the **E-STOP** is pressed while operating on the lane, the machine will display this error message when power comes back on.

LOW BATTERY OR E-STOP PRESSED

NOTE: THIS MAY ALSO APPEAR IF THE FUSEABLE LINK HAS BLOWN.

Special Functions

The machine can be programmed to perform some special functions.

Start Brush

**START BRUSH
IN INCHES -> 00**

This prompt will display the current distance from the foul line where the machine should start and stop the buffer motor. This delay in starting the buffer will apply less oil near the foul line. With more open play these days it is important to cut down on the oil near the foul line.

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 a small load such as 19-19 in the first forward screen.

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

Buffer Up Stop Delay

This function has no prompt to be displayed. It can only be adjusted through KOSI or Data Memory (DM529). When set at **0000** the machine will not stop at the end of the pattern. Change the value to **0005** and the machine will pause to raise the buffer brush then continue on. This will create the straight buffer line as it does in the Oil Only Mode. Buffer Advance Drop should be fine-tuned when using this function, it is very easy to see if the buffer starts on the oil line in reverse.

Buffer Advance Drop

This function has no prompt to be displayed. It can only be adjusted through KOSI or Data Memory (DM24). The factory default is **0039**. When adjusting the value lower than 0020 the buffer will drop behind the oil line and when higher than **0039** it will drop in front of the line. High speed will also have an effect on where the buffer drops in relationship with the oil line. If the machine is moving faster it will drop further behind the line and when moving slower, in front of the line.

***NOTE:** Call Tech Support at 863-734-0200 if you have questions on the buffer functions above.*

Oil Only Dust

OIL ONLY DUST?

01=YES -> 01

This prompt will display the current setting of the duster. During OIL ONLY run, the operator has the opportunity to turn the duster off. This should only be used when conditioning on freshly cleaned lanes. The setting of this prompt will be ignored by the PLC if the program is set to clean the lane.

To change this setting, use the **UP** or **DOWN ARROW** to adjust. Setting the value to **01** will turn the duster **ON** for oil only operations.

Lift Duster

LIFT DUSTER

IN INCHES -> 20

The number displayed will refer to the distance from the tail plank where the duster will begin to lift up off of the lane. This feature prevents the cushion roller from dropping off the tail plank when reaching the end of the lane. To change this distance, use the **UP** or **DOWN ARROW** to adjust.

***NOTE:** Every time a value is changed, the program saves the data automatically.*

Program Override

In the **Run Screen** it is also possible to override the pre-selected program. 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.*

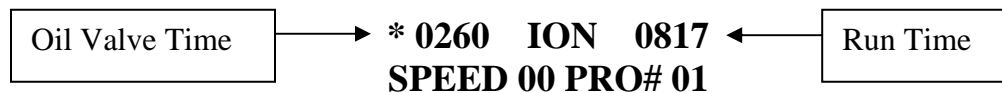
Oil Valve Time and Machine Run Time

The Oil Valve Time and Machine Run Time is not something you adjust, but something you can monitor.

The valve time displayed is the total time the oil valve is turned on for each lane. If your valve time is 260 and you notice it change to 280 this may indicate the oil head is slowing down and the head bar may need to be lubricated. It can also mean someone has changed the oil pattern program. The recorded valve time will fluctuate just a few counts, but not more than 2 or 3.

The machine run time is the time it takes to run one lane in tenths of seconds. This time should also be monitored and will indicate if the drive speeds are changing or if someone has changed the oil pattern program. 0817 is 81.7 seconds.

The valve time is on the top left hand side of the screen and run time is on the top right.



Maintenance, Recharging & Storage

Cleaning Guidelines

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

1. First things first, you should **never transport the machine with waste in the recovery tank!**
2. The oil compartment should be wiped down completely. Do not clean the Transfer Brush or Buffing Brush excessively, unless needed.
3. Clean drip pads on each side of the machine in the oil compartment.
4. Clean the Drive, Lane Distance, and Momentary wheels if full of lint.
5. Wipe squeegee clean and inspect frequently for wear. Keep an extra set of blades on hand (store them in a dark cool place).
6. Wipe down the bottom of the machine (this area collects a lot of dust).
7. Wipe off the outside of the machine.

Weekly or Monthly Cleaning

1. Use compressed air to remove dust from those hard to reach areas.
2. Inspect recovery tank filter.
3. Clean lint from Transfer Brush and wipe between both brushes.
4. Whenever the duster cloth is changed clean entire cleaning compartment.
5. Wipe off casters; they should not grow hair.
6. Remove large black covers and clean around the motors.
7. 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.
8. Inspect the vacuum housing and investigate if wet.

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.

Storage

The machine should be stored in a safe and warm environment and as close to the lanes as possible. Some centers build dog houses for their machine next to the approach or behind the pinsetters. If possible, the machine should be stored where all of its related Kegel products are kept (i.e. cloth, conditioner, cleaner, and whatever else you use to keep it clean and maintained).

***NOTE:** This is also where the machine will be charging its batteries so there should be a reliable power receptacle in this location. It would be best if the receptacle is a dedicated circuit with a power indicating light.*

Recharging

To recharge your ION plug it into a standard wall receptacle (power source). Always put the machine on charge when not in use. The charging voltage should be monitored each day when put away for charging. **Refer to Chapter 5 for more detailed information on charging.**

***NOTE:** If your lane machine came with Odyssey Batteries, and this is the FIRST TIME you have charged the batteries, make sure the IQ4 is plugged into the charger (see Chapter 5).*

Things You Can Do with No Cord Attached!



Now that there is no cord to manage you have the freedom to do many things you couldn't do with previous lane machines. In the past, you had to hold the cord whenever operating the lane machine. If it takes you 45 to 60 minutes to condition your lanes, you virtually gain that time to do other things. So here are a few recommendations:

1. More attention can be given to the approaches and the area just past the foul line.
2. Dusting the approaches is much easier without a cord lying around.
3. Adjust foul lights. This is always an on-going task.
4. Inspect power lifts. Not much fun when these things go down.
5. Socialize with the customers. Now you can do it and not worry about the machine running over the cord when you turn your head.
6. Watch the machine do its job. Make sure it is conditioning (oiling) and cleaning properly because it's not much fun when the bowlers know before you do.
7. Get your ball out and bowl while you condition and check the lanes out. It is always nice to know the strike-ability of the lanes.
8. It is much easier to have that morning cup of coffee when conditioning now.
9. Inspect the entire lane area as you condition. You are now able to stroll all over the place.
10. Think of how to make the transition better at the foul line (only if it's bad). This is very important because you do not want to damage your new cordless machine due to poor transitions.

**What you do with this extra time is up to you, but one thing is certain...
we think you will enjoy the freedom of a Kustodian ION.**

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.
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. Dust 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"

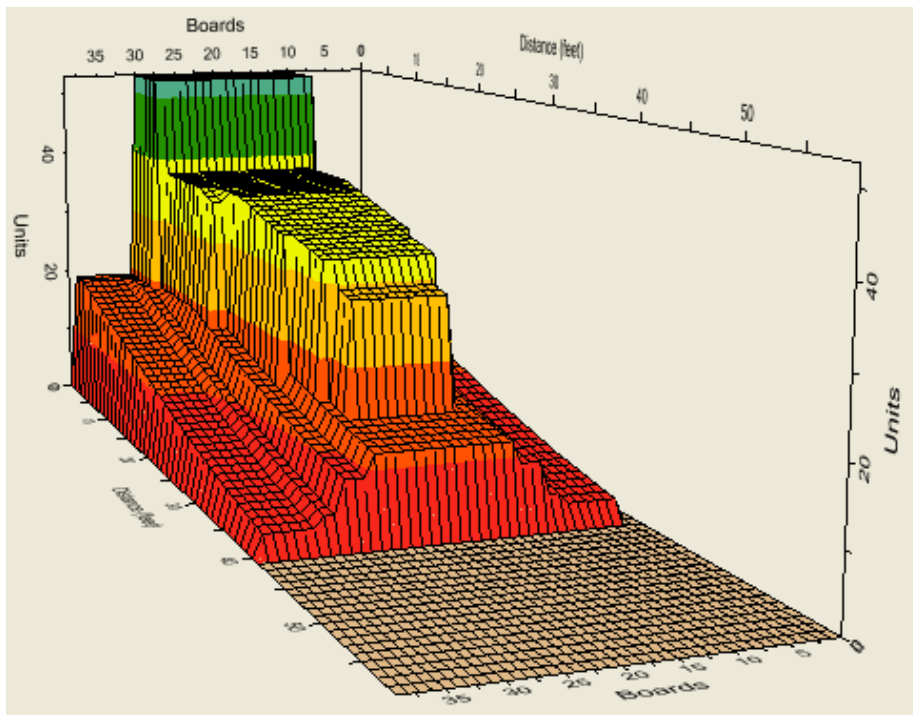
CHAPTER 2

Conditioning Overview

How the Conditioner (Oil) is Metered and Controlled

Sanction Technology™ is 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 about 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 **Program #04** 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



The following exercise teaches you to calibrate the machine which confirms the factory pump setting. The pump should be set at 50 microliters per board, unless otherwise specified by the oil pattern.

NOTE: This test will not work if the machine is set to CLEAN ONLY.

1. **TURN ON** the machine and go to the menu:

**OIL AND CLEANER
VOLUME TEST**

2. Press **NEXT** to access the:

*** OIL VOLUME
PRO#01 PRESS F6**

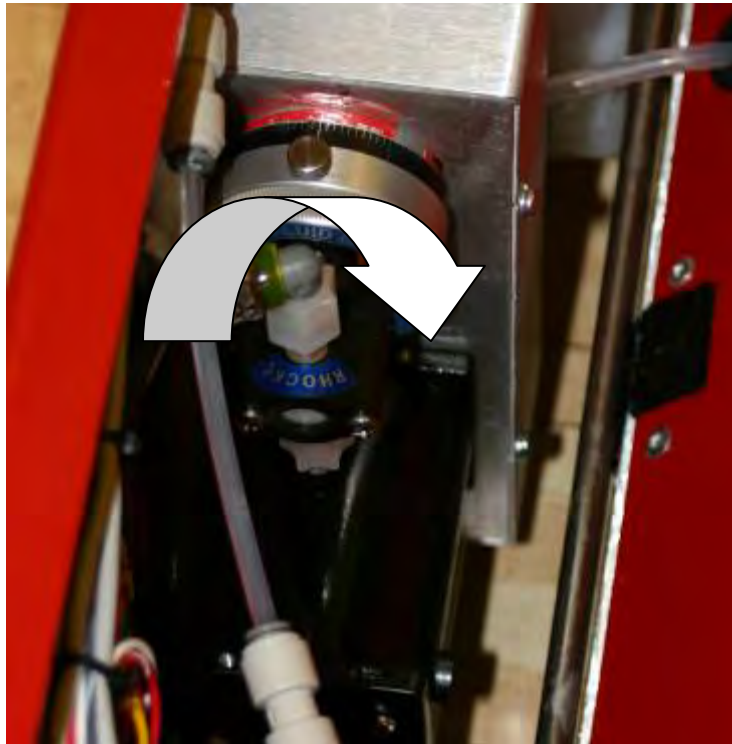
3. Use the **UP ARROW** and advance to **Program #04**.
4. Place the conditioner tip into a clean 25 or 50 milliliter graduated cylinder and press **F6**. Make sure the toggle switch is not set to **Clean Only**.

5. The head will travel back and forth 8 times to simulate forward loads and again 8 times for reverse loads. The loads of conditioner (oil) 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**.
6. 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 1,000 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.

7. After running the test, the amount in the cylinder should be **20 μ l**.
8. 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.*
9. Behind the splash guard on the rear wall of the machine is the conditioner pump assembly (shown below). If an adjustment is necessary, turn the dial approximately **5** small marks.

Each small mark on the dial is $1/10$ microliter; each large mark is a 1 microliter change in the output of the pump (per 1 revolution). The pump is revolving at approximately 3340 RPM. At the speed the oil head is traveling across the transfer brush, the pump actually revolves about 2-1/2 revolutions as it crosses one board.



NOTE: Direction of arrow in picture decreases the pump output.

10. 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.
11. Repeat steps 4 through 10 to check any adjustments that were made. (If a change makes the output too low, then unscrew the pump about 1/2 of the amount it was previously adjusted.)
12. 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.

Proving the Oil Pattern

We will use some pre-programmed sample settings from **Program #01** as an example. The chart below shows the position of the loads and how many times each different load is applied.

PROGRAM 01

2 - 2 x 2 (Forward Loads)

8 - 8 x 1

10 - 10 x 3

13 - 13 x 2

Zero Loads are ignored going forward and reverse.

15 - 15 x 1 (Reverse Loads)

14 - 14 x 2

13 - 13 x 4

11 - 11 x 4

10 - 10 x 2

Each load can quickly be condensed to a total number of boards by referring to the Board Chart 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 for Program 01, the numbers become very simple.

PROGRAM 01

37 x 2
25 x 1
21 x 3
15 x 2

11 x 1
13 x 2
15 x 4
19 x 4
21 x 2

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.

PROGRAM 01

37 x 2 = 74
25 x 1 = 25
21 x 3 = 63
15 x 2 = 30

11 x 1 = 11
13 x 2 = 26
15 x 4 = 60
19 x 4 = 76
21 x 2 = 42

407 Total Boards

In our example there are 192 boards covered during Forward travel and 215 boards covered during the Reverse travel. This total number (**407**) can be multiplied by the pump setting (**50** µl) to determine the exact amount of oil used when conditioning with this pattern.

407 Boards
x 50 microliters
20,350 microliters

The total amount is 20,350 microliters. To convert this to milliliters the number has to be divided by 1000.

$$20,350/1000 = \mathbf{20.35 \text{ milliliters}}$$

This total program amount can be confirmed by running an **OIL VOLUME TEST**. This step is the most important element in the Process Verification Procedure and you should perform it whenever conditioning lanes for competition.

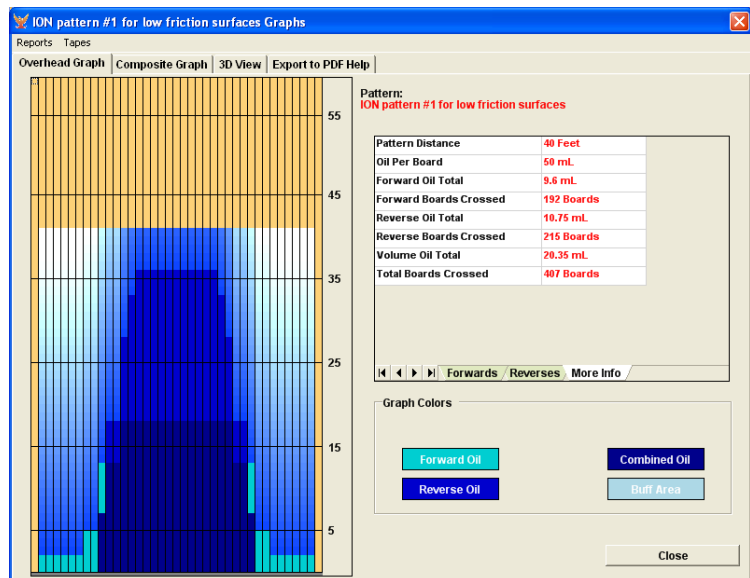
Running the test 3 or 4 times should be enough to convince anyone of the machine's accuracy and repeatability.

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.

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. To make it even easier, KOSI provides this information on **More Info** tab on the Overhead Graph and in the pattern summary reports.

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, this information 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.

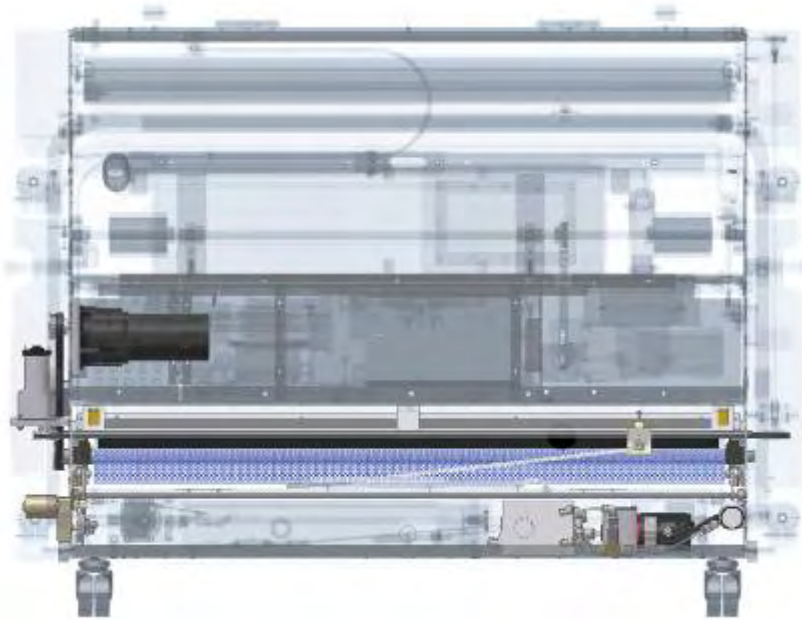
Board Chart for Calibrating Oil Pattern (Program) Loads

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 through the Program Calibration Test.

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

* Each load of oil must cross at least three boards, unless program is downloaded using KOSI.

Conditioning System



Highlighted view of the conditioning system

Theory of Operation

This machine uses proven "SANCTION TECHNOLOGY" patented by Kegel. This patented 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 on 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.**

Conditioning Menu Adjustments

Change Program

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 **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 "Oil Patterns" later in this Chapter.

To continue within the menu, enter the password using the appropriate sequence of keystrokes. A green light will indicate that the password has been entered. 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 -> 00

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. To change this distance, use the **UP** or **DOWN ARROW** to adjust.

NOTE: 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 smaller loads such as 19-19 in the first forward screen.

NOTE: There should be at least 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 ONLY DUST?

01=YES -> 01

This prompt will display the current setting of the duster. During OIL ONLY run, the operator has the opportunity to turn the duster off. This should only be used when conditioning on freshly cleaned lanes. The setting of this prompt will be ignored by the PLC if the program is set to clean the lane.

To change this setting, use the **UP** or **DOWN ARROW** to adjust, changing the value sets the data automatically. Setting the value to **01** will turn the duster ON for oil only operations.

These following screens will instruct the operator to change the load size, the number of loads and the speed in each menu of the selected conditioner program. These are sample settings and are used for illustration purposes only. They do NOT match the settings pre-loaded in the machine for any particular program.

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

OIL PATTERN DIST

IN FEET -> 40

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.

***NOTE:** 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 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 02
00->02 FT IPS=18

01F is the menu number for the first load screen for forward oil. There are 15 possible load screens for forward oil. If the oil pattern distance is reached in less than 15 screens, then the remaining screens will not be shown.

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 02** determines how many 2 to 2's will be applied; in this case it is 2.

On the bottom line the **00->02 FT IPS=18** says that the machine will travel from 0 feet (the foul line) to 2 feet at 18 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 (much 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 **02** 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 2 to 3 the 00->02 FT will change to 00->05 FT. Since the 18 in IPS=18 is now blinking you now may **UP** or **DOWN ARROW** the speed. You have six different speeds to choose from. 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->05 feet and you change the speed to 18 inches per second, the area for that load sequence will change to 00->07 feet.

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. 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 forward load screen.

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

02F 8L- 8R X 01
02->05 FT IPS=18

The **8L** will be blinking. In the previous screen we left with the load area at 00 to 02 feet, so the beginning screen for the second load 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.

The keypad display rounds the distance to the nearest foot, but the PLC accurately calculates the travel distance as the machine operates on the lane. The footage shown is only an estimate on the keypad. KOSI shows the actual travel distance in its reports.

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 03

05->12 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:

04F 13L-13R X 02

12->17 FT IPS=18

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 2L- 2R X 00

17->24 FT IPS=18

You may now change this screen to anything you want. Here we are using the last three screens for buffing. Sometimes it is necessary to utilize 3 buffing screens to achieve better front to back taper (notice the speed changes in the following screens). 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 2L- 2R X 00
24->33 FT IPS=22

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.

The **last load screen forward must have 00** for the number of loads. This screen is the buffer distance control. This gives time for the last load to get from the brush to the lane.

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.

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

07F 2L- 2R X 00
33->40 FT IPS=30

Since the ending distance for this load is the pattern distance (40 FT), this is the last forward load screen. If you enter around and decrease the ending distance for this screen, 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.

Always enter around the load screen and change the distance up or down to match the ending pattern distance that was set. 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. The last screen forward **must** be 0 loads.

***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.*

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 **ENTER** four times for each screen.

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

01R 2L- 2R X 00
40->35 FT IPS=30

Notice the screen number is now **01** again and the **F** has changed to an **R** (meaning reverse). The area for the load screens now starts with 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 screen press **ENTER** 4 times (if necessary) and press **NEXT** and the following menu will appear:

02R 15L-15R X 01

35->31 FT IPS=22

You may now change this screen to anything you want using the procedures described previously. Press **NEXT** after pressing **ENTER** four times (if changes were made) and the following screen will appear:

03R 14L-14R X 02

31->26 FT IPS=18

You may now change this screen to anything you want using the procedures described previously. Press **NEXT** after pressing **ENTER** four times and the following screen will appear:

04R 13L-13R X 04

26->16 FT IPS=18

You may now change this screen to anything you want using the same process. Press **NEXT** after pressing **ENTER** four times and the following screen will appear:

05R 11L-11R X 04

16->06 FT IPS=18

You may now change this screen to anything you want using the same process. Press **NEXT** after pressing **ENTER** four times and the following screen will appear:

06R 10L-10R X 02

06->03 FT IPS=10

You may now change this screen to anything you want using the same process.

Keep in mind that the last loads going in reverse should always end a minimum of **3 to 4 feet** before the foul line. If more than 2 or 3 loads are selected, 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 close attention to where the loads end, and how far the machine can travel as it buffs to the foul line.

Press **NEXT** after pressing **ENTER** four times and the following screen will appear:

07R 2L- 2R X 00
03->00 FT IPS=10

There are no loads in this screen which will allow the machine to properly buff out the conditioner. This is also the last screen in reverse that is available to the operator since the ending distance is zero.

There are a total of 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. You can 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 ***

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.

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 at (863) 734-0200 if this area needs to be accessed.

Auto Programming (7 Day Planner Program)

Press the **MENU** key until the following screen appears:

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 **NEXT** 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 **NEXT** 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 **NEXT** 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:

MONDAY AM

MONDAY PM

TUESDAY AM

TUESDAY PM

WEDNESDAY AM

WEDNESDAY PM

THURSDAY AM

THURSDAY PM

FRIDAY AM

FRIDAY PM

SATURDAY AM

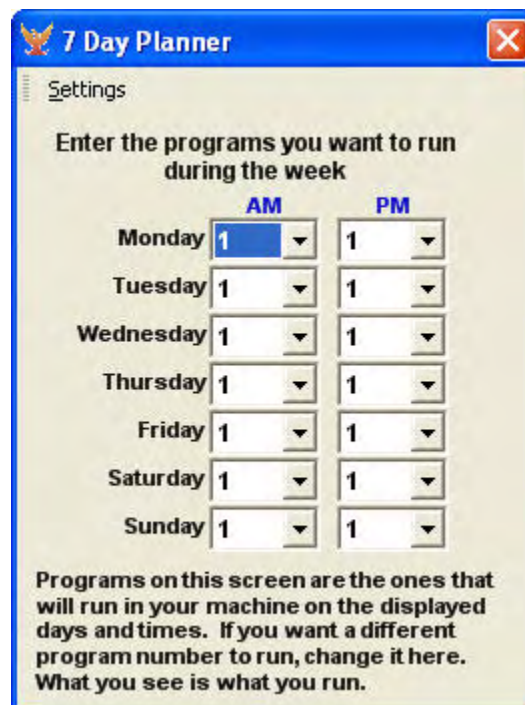
SATURDAY PM

SUNDAY AM

SUNDAY PM

***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 start 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.*

KOSI allows you to see all the programs you have set for each day and time period in one easy to use screen.



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. If the brush is not already down in the "zero" position, press **NEXT** until **OUTPUT #09** is displayed.

Press **ENTER** to activate this output. This will lower the buffer brush into the operating position. If the brush does not stop in the down position, check the condition of the Brush Down Switch.

With the brush down, stand the machine in an upright position and hold a level or straight edge across the drive wheels and rear lane distance wheels. 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"** (3.2 mm to 4.8 mm) of an inch 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 topside and make the adjustment the same way you adjusted the crush on the topside, 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.

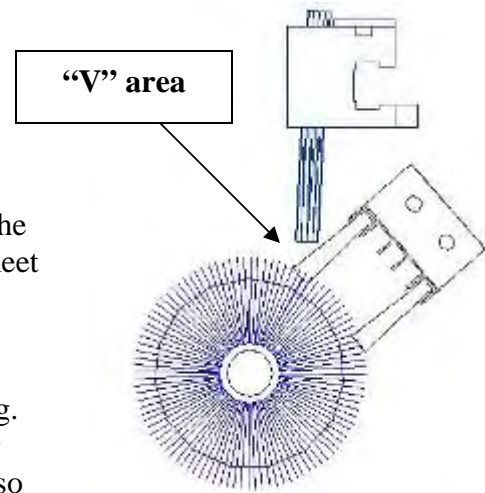
Oil Tip

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

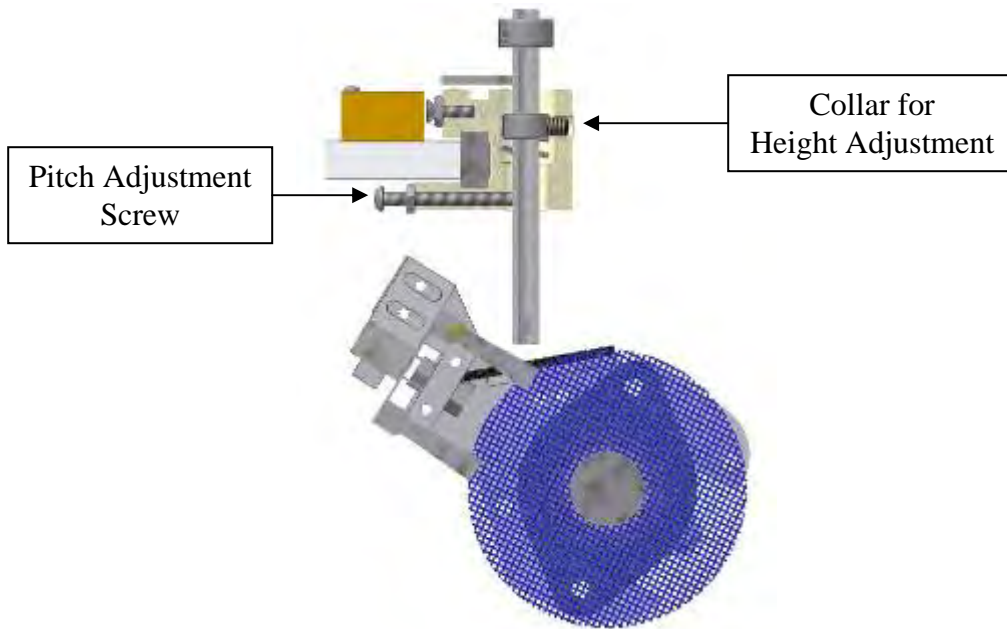
There are two adjustments that can be made to the oil tip. One adjustment is the **height** of the tip. The other is the position of the tip. The point where the Transfer Brush and the Buffer Brush meet will form a "V". The Oil Tip should be as close to this "V" as possible, without actually dispensing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

This adjustment should be checked with the buffer brush running. To operate the brush, press the button on top of the buffer motor relay (CR3). 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 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).*

Oil Pump

Beneath the splash guard on the rear wall of the machine is the fluid metering pump assembly (oil pump). The picture shows the calibration ring of the pump. If an adjustment is necessary you should turn the dial only 1/2 microliter.

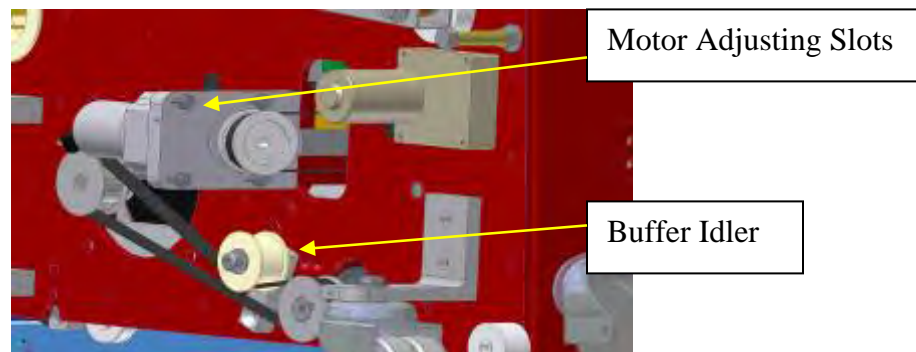


Each small mark on the dial is 1/10 microliter; each large mark is a one microliter change in the output of the pump (per 1 revolution). The pump is revolving at about 3340 RPM. At the speed the oil head is traveling across the transfer brush, the pump actually revolves 2-1/2 revolutions as it crosses one board.

***NOTE:** Direction of arrow in picture **increases** the pump output.*

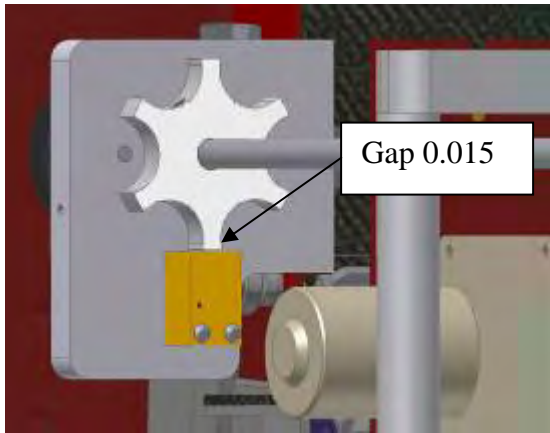
Timing Belts

There are 3 timing belts that operate in the conditioning system. Watch KOSI to see the proper amount of belt tension.



1. **Buffer Belt.** The machine has a belt tension idler roller that can be positioned to maintain the 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 very desirable.
2. **Oil Pump Belt.** It is important to run the oil pump belt on the loose side. Over-tightening of this belt will reduce bearing life in the pump. This may also cause oil volume fluctuations. Loosen up the oil pump fasteners to change belt tension.
3. **Oil Head Belt.** This belt should run on the tight side. **Unplug the motor before attempting to work on this belt to disable the braking circuit.** To adjust 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.

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



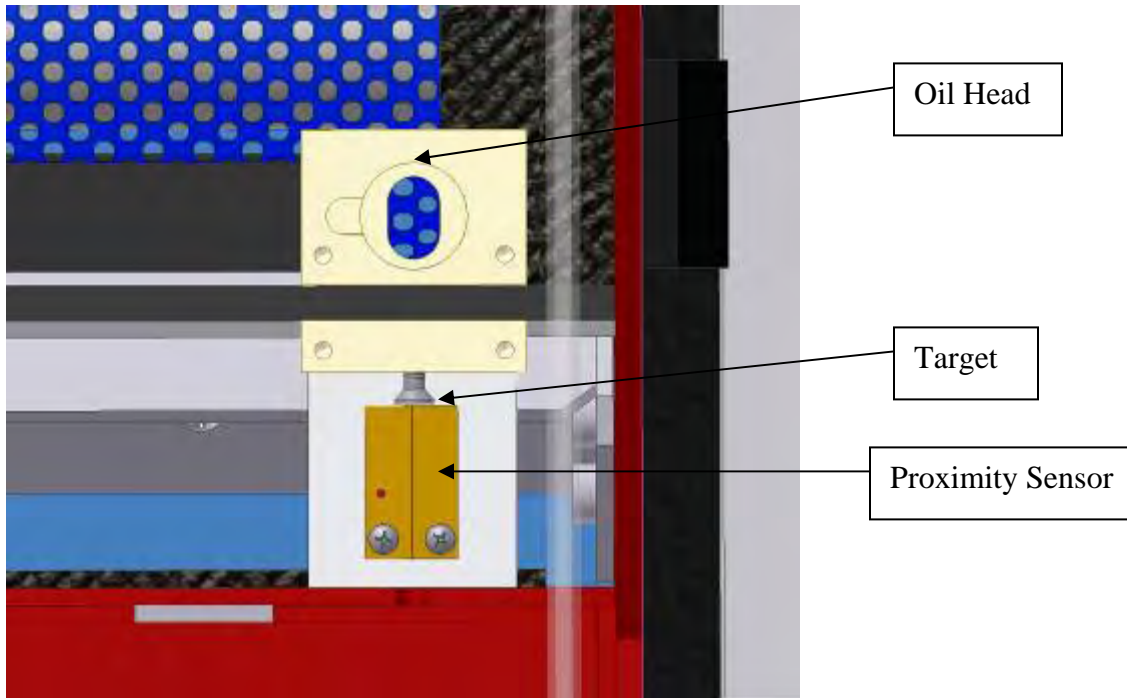
The timing for the oil head is a precise adjustment. Remove the plastic cover on the 10-pin side to access the sensor assembly. **Remove the plastic guard from the 7-pin side to access the Head Motor and unplug the motor to disable the braking circuit.**

Once the covers are off you will be able to see the belt tension and head timing assembly. Follow these steps closely to avoid confusion.

1. Move the oil head against the 10-pin side wall and check the belt tension.
2. When pushing down on the belt, half-way across the head track, you should feel the belt get tight just before it touches the track. Adjust tension if necessary.
3. The illustration 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" (± 0.005 "), which is about 0.38 mm. The proximity sensor should be mounted square to the plate.
4. 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 close to it).
5. 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.
6. 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.
7. 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 a clockwise rotation.
8. 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.

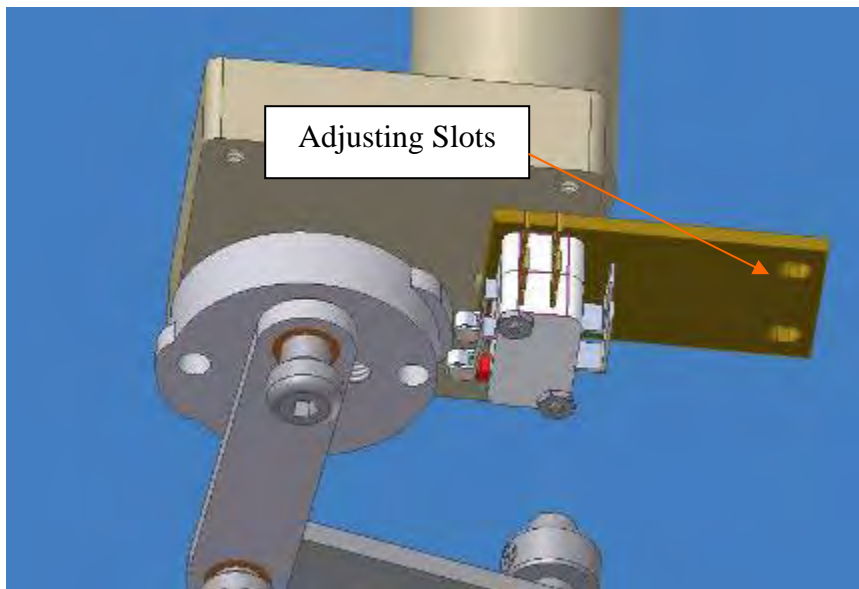
*NOTE: The machine's computer has to park the oil head on the right side to ensure the proper starting point for loads of conditioner. When the head goes to the home or zero position it will bump into the side wall and kick back. The clicking sound that is heard is **normal** and no damage is occurring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

Oil Head Target



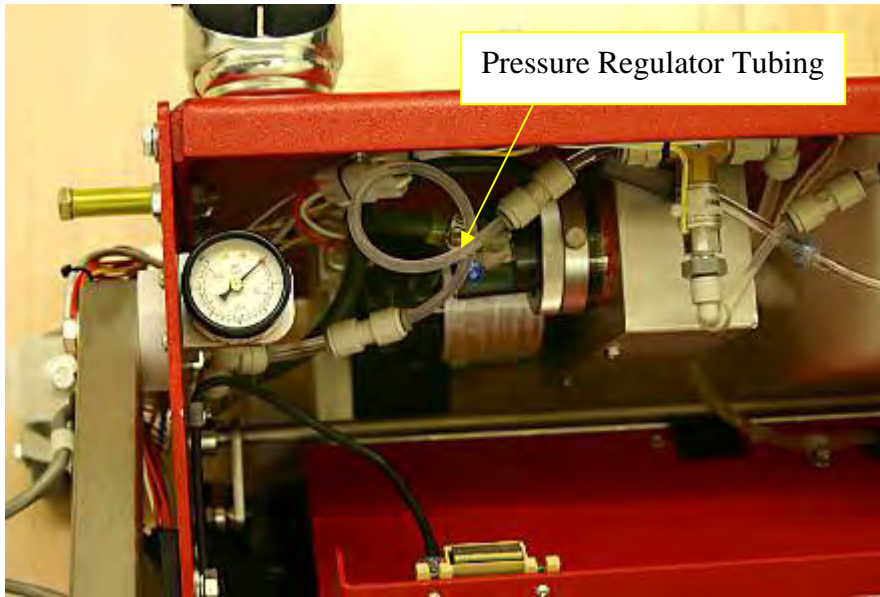
The moving Oil Head uses a flat head screw as a target for the Board Edge Sensors to “see”. The screw should be adjusted to 0.025” (0.635 mm) from the face of the proximity sensors. Check both sensors to be certain that the gap is the same. The proximity sensors have a small amount of adjustment so they 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 (0.13 mm ~ 0.254 mm).

Pressure Regulator Tubing Chart (for changing conditioner types)



The following ranges of conditioner viscosity have 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.

Testing was performed at 72° Fahrenheit with a variety of conditioners with the pump calibration set at 50µl. 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.

<i>Conditioner (Viscosity)</i>	<i>Size (OD)</i>	<i>Length</i>	<i>Pressure</i>
Offense HV (39.1 cps)	3/16"	5"	15psi
Offense HV	3/16"	8"	20psi
Prodigy (29.7 cps)	3/16"	10"	15psi
Prodigy	3/16"	15"	20psi
Defense-S (39.6 cps)	3/16"	5"	15psi
Defense-S	3/16"	8"	20psi
Infinity (35.4 cps)	3/16"	11"	15psi
Infinity	3/16"	15"	20psi

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 Kustodian ION ships from the factory with about a 7-1/2" piece (19 cm) of 3/16" pressure regulator tubing for Offense-HV.

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.

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. 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.

ERROR MESSAGE

**** CODE B3 ****

Buffer Brush did not lower error

Menu Out of the program and access the **MANUAL Reverse Menu** and depress the **Start Button** and return machine to the approach.

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 **B3 ERROR**.

1. The brush lift motor runs but the down switch failed to operate and send a signal to PLC **Input #5 0CH 05**.
 - a. Check and inspect 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 #09**. 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. CR7 Relay came loose in socket or has failed.
 - d. Motor failed.
 - e. Bad connection to motor, check all power wiring to motor.
 - f. PLC output 11CH 02 failed.

ERROR MESSAGE

**** CODE B4 ****

Buffer Brush did not raise error

Menu Out of the program and return machine to approach.

This error will occur at the end of the programmed oil distance.

Normally this error occurs when **Input 0CH 04** fails to receive a signal within 3.5 seconds of the motor starting. Here are the possible causes that can produce a **B4 ERROR**.

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 #09**. 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. CR7 Relay came loose in socket or has failed.
 - d. Motor 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.*

ERROR MESSAGE

**** CODE H7 ****

An **H7** error occurs 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.

Possible **H7** error causes include:

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 to cause this.
2. Oil Head Motor does not run in one or both directions.
 - a. Fuse is blown.
 - b. CR5 or CR6 relay is loose in socket base or has failed.
 - c. Motor has failed.
 - d. Motor unplugged or has a damaged wire between motor and control relays.
 - e. PLC output **11CH 00** or **11CH 01** has failed.

ERROR MESSAGE

**** CODE FO ****

Machine is low on conditioner (oil), fill and start machine to clear error from the screen. If this does not clear the error the float may have a problem. Unplug float and install jumper plug to bypass the float (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 everyday will eliminate many problems from turning into disasters.**

1. Oil Pump fails to run.
 - a. Blown fuse
 - b. Motor is unplugged or has a damaged or open connection.
 - c. CR4 relay is loose in socket base or has failed.
 - d. PLC output 10CH 07 failed.

2. Buffer fails to run.
 - a. Blown fuse.
 - b. Motor is unplugged or has a damaged or open connection.
 - c. The buffer motor relay CR3 operates when **Input 0CH 05** is on and the brush is down. Also when the pump relay is on and either forward or reverse relays are on. If any one of these areas fails, the buffer will not operate. Refer to wiring diagram for connections in Chapter 7.
 - 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 (also known as 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 (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 output 10CH 00 failed.
 - f. Filter is clogged.
 - g. No oil in tank, 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 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 everyday!!!

We suggest not using alcohol to clean the conditioner or cleaner 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 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 perfectly. 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.

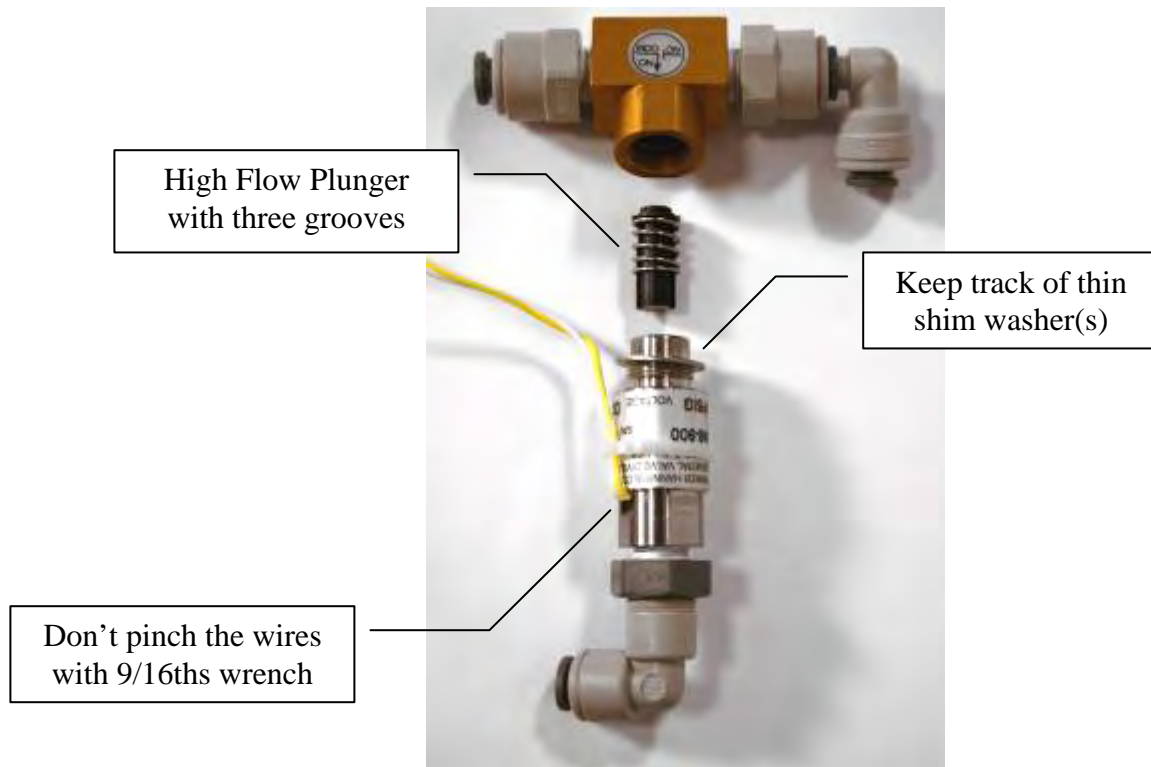
Procedure for Cleaning Oil Control Valve

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 stem elbows or the lines on the top of the valve. **PUSH IN** on the outer collet to release each elbow or oil line. Plug the open ends of the elbows to prevent dirt from entering the lines and to stop the oil from leaking (do 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 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 each elbow or line back into the proper fitting and clean around all the connections.
12. Return the oil assembly to the machine and plug in the connections.
13. Run the * **PUMP OUTPUT VOLUME TEST**. Run this 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.

League/House Sample Pattern Settings

*The programs in this section have been created using **KOSI**. Contact Lane Maintenance Central at (863) 734-0200 if you have questions about these patterns.*

Use KOSI to view and edit the following oil patterns. Keep in mind that the graphs on the following pages are only representations of the patterns that will be applied by the machine. Many variables can affect the graph, so it may not match your machine exactly.

These pages show the load structure along with an overhead graph and a composite graph for each of the pre-loaded patterns. Additional patterns are also provided for your convenience. A complete library of patterns is available for the Kustodian Ion and can be downloaded using KOSI.

Pattern #1: This is a starting point pattern for **low friction surfaces** like Brunswick Pro Anvilane™ and/or low lineage league play. This is located in slot #1 of the machine and is 40 feet. Modifications off of this pattern should allow for higher scores for most styles of player.

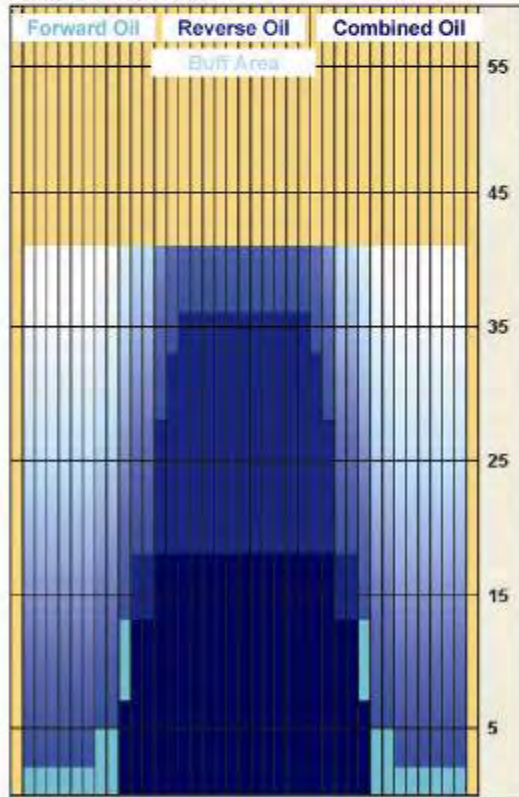
Oil Per Board: 50 mL Oil Pattern Distance: 40 Feet Volume Oil Total: 20.35 mL Total Boards Crossed: 407 Boards

#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	2	18	74	0.0	2.5	2.5	3700
2	8L	8R	1	18	25	2.5	5.0	2.5	1250
3	10L	10R	3	18	63	5.0	12.6	7.6	3150
4	13L	13R	2	18	30	12.6	17.7	5.1	1500
5	2L	2R	0	18	0	17.7	24.0	6.3	0
6	2L	2R	0	22	0	24.0	33.0	9.0	0
7	2L	2R	0	30	0	33.0	40.0	7.0	0
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

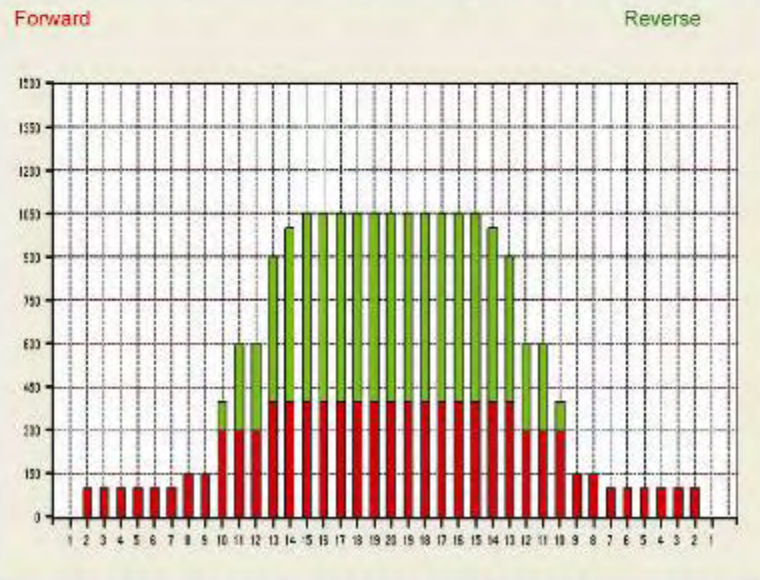
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	0	30	0	40.0	35.0	-5.0	0
2	15L	15R	1	22	11	35.0	31.9	-3.1	550
3	14L	14R	2	18	28	31.9	26.8	-5.1	1300
4	13L	13R	4	18	60	26.8	16.8	-10.2	3000
5	11L	11R	4	18	76	16.8	6.4	-10.2	3800
6	10L	10R	2	10	42	6.4	3.6	-2.8	2100
7	2L	2R	0	10	0	3.6	0.0	-3.6	0
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 9.6 mL
Forward Boards Crossed: 192 Boards

Reverse Oil Total: 10.75 mL
Reverse Boards Crossed: 215 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
10.50	10.50	2.63	1.00	1.00	2.63	10.50	10.50



Pattern #2: This is a starting point pattern for **medium friction surfaces** like Kegel Edge™ and AMF HPL™ 9000 and/or medium to higher lineage league play. This is located in slot #2 of the machine and is 42 feet. Modifications off of this pattern should allow for higher scores for most styles of player.

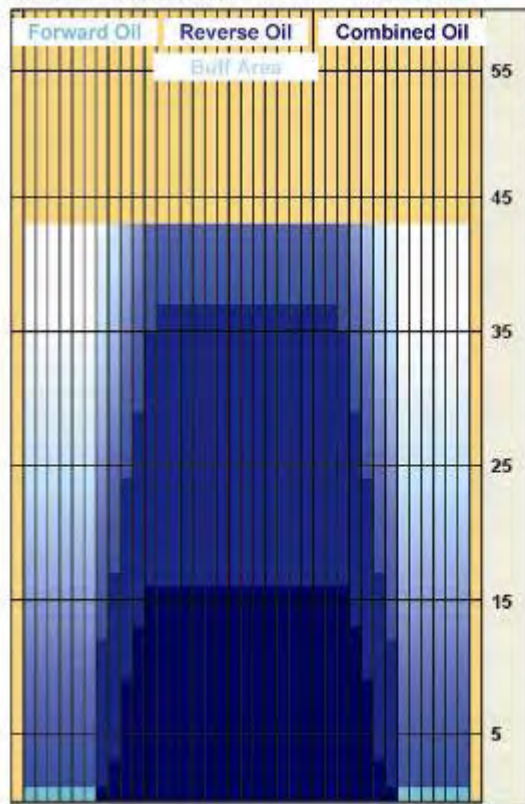
Oil Per Board: 50 mL Oil Pattern Distance: 42 Feet Volume Oil Total: 22.65 mL Total Boards Crossed: 453 Boards

#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	2	10	74	0.0	1.4	1.4	3700
2	9L	9R	1	10	23	1.4	2.8	1.4	1150
3	10L	10R	3	14	63	2.8	8.7	5.9	3150
4	11L	11R	2	14	38	8.7	12.6	3.9	1900
5	12L	12R	2	14	34	12.6	16.5	3.9	1700
6	2L	2R	0	18	0	16.5	34.0	17.5	0
7	2L	2R	0	26	0	34.0	38.0	4.0	0
8	2L	2R	0	30	0	38.0	42.0	4.0	0
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

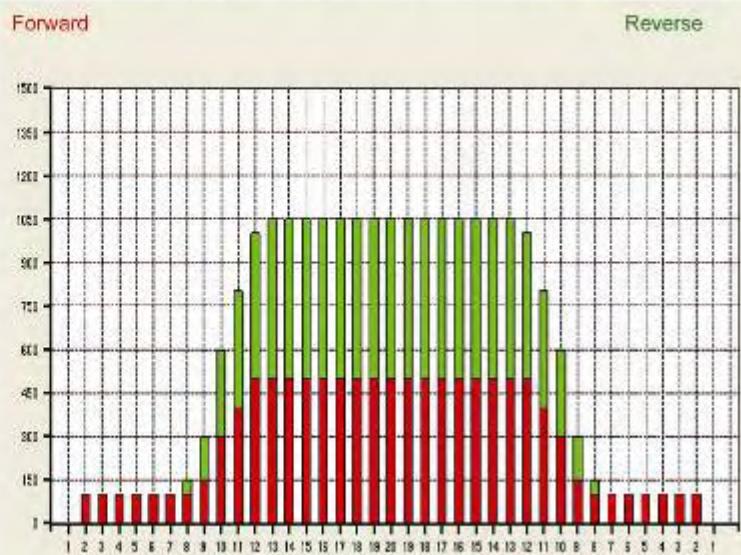
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	0	30	0	42.0	36.0	-6.0	0
2	13L	13R	1	18	15	38.0	33.5	-2.5	750
3	12L	12R	2	18	34	33.5	28.4	-5.1	1700
4	11L	11R	2	18	38	28.4	23.3	-5.1	1900
5	10L	10R	3	18	63	23.3	15.7	-7.6	3150
6	9L	9R	2	18	46	15.7	10.6	-5.1	2300
7	8L	8R	1	14	25	10.6	8.7	-1.9	1250
8	2L	2R	0	10	0	8.7	0.0	-8.7	0
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 11.6 mL
Forward Boards Crossed: 232 Boards

Reverse Oil Total: 11.05 mL
Reverse Boards Crossed: 221 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:9L	20:10L	20:15L	20:15R	20:10R	20:9R	20:2R
10.50	10.50	1.75	1.00	1.00	1.75	10.50	10.50



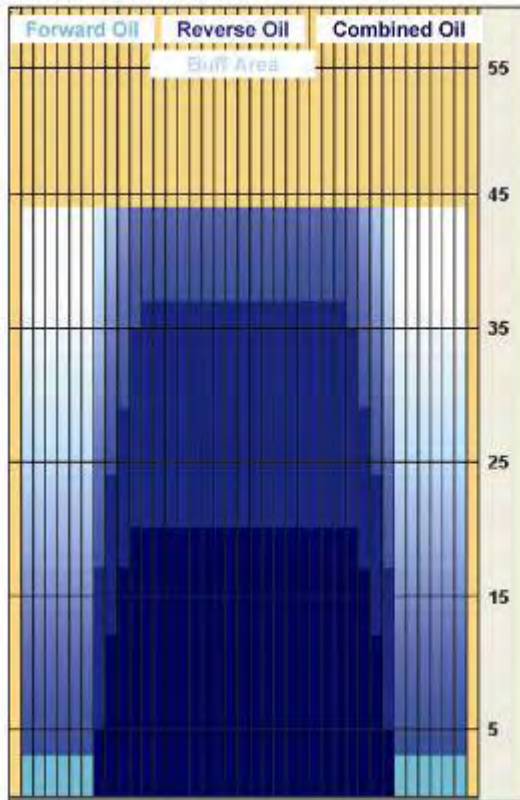
Pattern #3: This is a starting point pattern for **high friction surfaces** like synthetics older than 15 years, wood, and Guardian™ and/or centers with high lineage league play. This is located in slot #3 of the machine and is 43 feet. Modifications off of this pattern should allow for higher scores for most styles of player.

Oil Per Board: 50 mL Oil Pattern Distance: 43 Feet Volume Oil Total: 25.35 mL Total Boards Crossed: 507 Boards

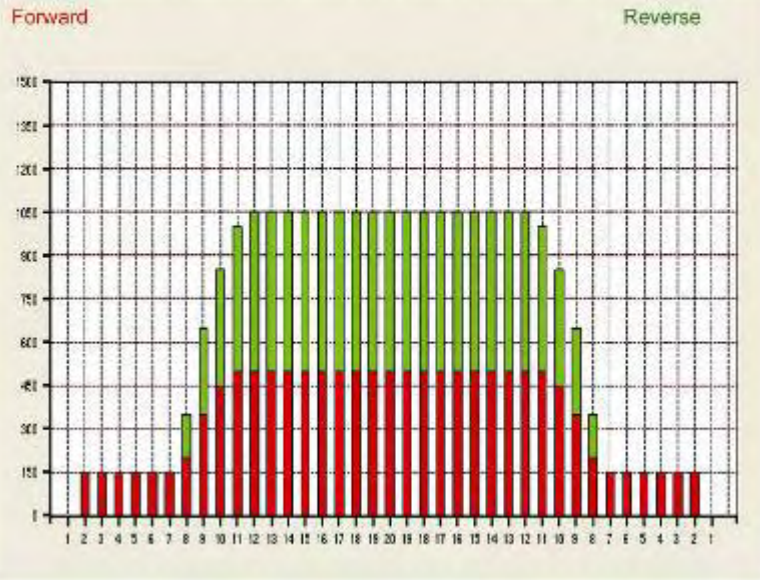
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil	#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	3	10	111	0.0	2.8	2.8	5550	1	2L	2R	0	30	0	43.0	36.0	-7.0	0
2	8L	8R	1	14	25	2.8	4.7	1.9	1250	2	12L	12R	1	18	17	36.0	33.5	-2.5	850
3	9L	9R	3	18	69	4.7	12.3	7.6	3450	3	11L	11R	2	18	38	33.5	28.4	-5.1	1900
4	10L	10R	2	18	42	12.3	17.4	5.1	2100	4	10L	10R	2	18	42	28.4	23.3	-5.1	2100
5	11L	11R	1	18	19	17.4	19.9	2.5	950	5	9L	9R	3	18	69	23.3	15.7	-7.6	3450
6	2L	2R	0	18	0	19.9	35.0	15.1	0	6	8L	8R	2	18	50	15.7	10.6	-5.1	2500
7	2L	2R	0	26	0	35.0	39.0	4.0	0	7	8L	8R	1	14	25	10.6	8.7	-1.9	1250
8	2L	2R	0	30	0	39.0	43.0	4.0	0	8	2L	2R	0	10	0	8.7	0.0	-8.7	0
9	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 13.3 mL
Forward Boards Crossed: 266 Boards

Reverse Oil Total: 12.05 mL
Reverse Boards Crossed: 241 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
7.00	7.00	1.24	1.00	1.00	1.24	7.00	7.00



Pattern #4: Calibration Program Only. This program is used to check the **calibration** of your oil pump. This program is loaded in slot #4 from the factory, but can be over-written for actual conditioning programs if necessary. Calibration can always be done using the pattern volume.

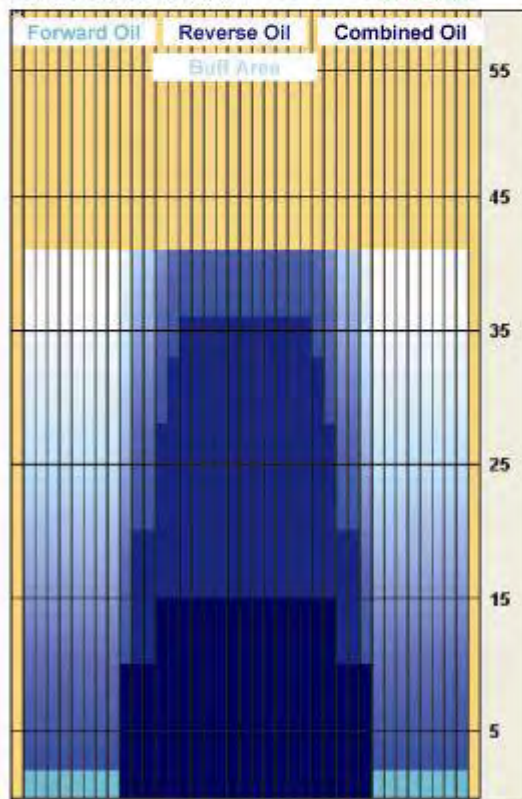
House Shot Pattern: This pattern is not pre-loaded in the machine and represents a modification to Pattern 1 (with a little less applied volume). It is a “quick start” pattern that provides a relatively easy starting point for a house shot. It is a medium volume pattern that can be used on most surfaces. Scoring pace can be controlled with subtle adjustments.

Oil Per Board: 50 mL Oil Pattern Distance: 40 Feet Volume Oil Total: 18.35 mL Total Boards Crossed: 367 Boards

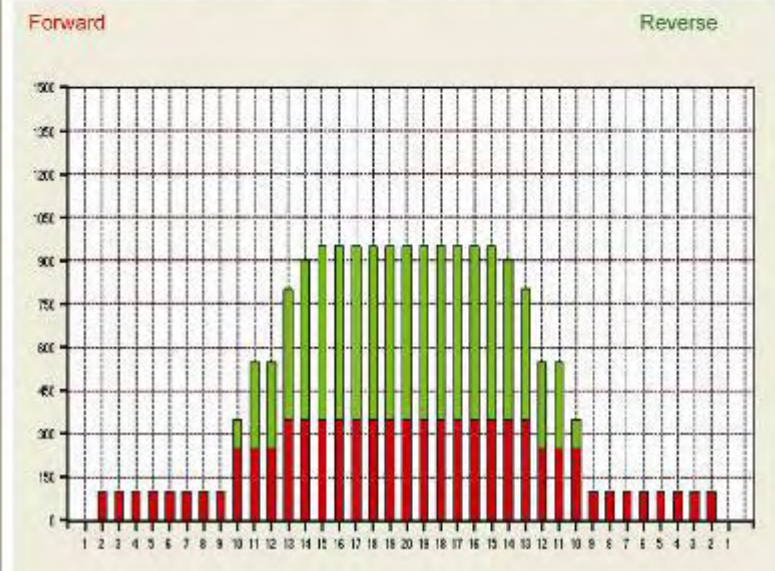
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil	#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	2	18	74	0.0	2.5	2.5	3700	1	2L	2R	0	30	0	40.0	35.0	-5.0	0
2	10L	10R	3	18	63	2.5	10.1	7.6	3150	2	15L	15R	1	22	11	35.0	31.9	-3.1	550
3	13L	13R	2	18	30	10.1	15.2	5.1	1500	3	14L	14R	2	18	26	31.9	26.8	-5.1	1300
4	2L	2R	0	18	0	15.2	24.0	8.8	0	4	13L	13R	3	18	45	26.8	19.2	-7.6	2250
5	2L	2R	0	22	0	24.0	33.0	9.0	0	5	11L	11R	4	18	76	19.2	9.0	-10.2	3800
6	2L	2R	0	30	0	33.0	40.0	7.0	0	6	10L	10R	2	10	42	9.0	6.2	-2.8	2100
7	-	-	-	-	-	-	-	-	-	7	2L	2R	0	10	0	6.2	0.0	-6.2	0
8	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 8.35 mL
Forward Boards Crossed: 167 Boards

Reverse Oil Total: 10 mL
Reverse Boards Crossed: 200 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
9.50	9.50	2.71	1.00	1.00	2.71	9.50	9.50



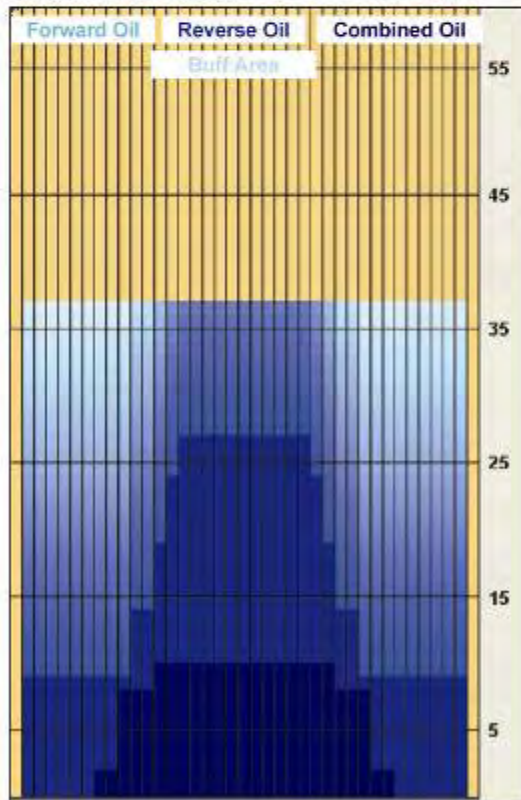
Open Play Pattern: This pattern is not pre-loaded in the machine and represents a relatively easy starting point for open play or glow bowling. It is a medium volume pattern that can be used on most surfaces. Scoring pace can be controlled with subtle adjustments.

Oil Per Board: 50 mL Oil Pattern Distance: 36 Feet Volume Oil Total: 13.05 mL Total Boards Crossed: 261 Boards

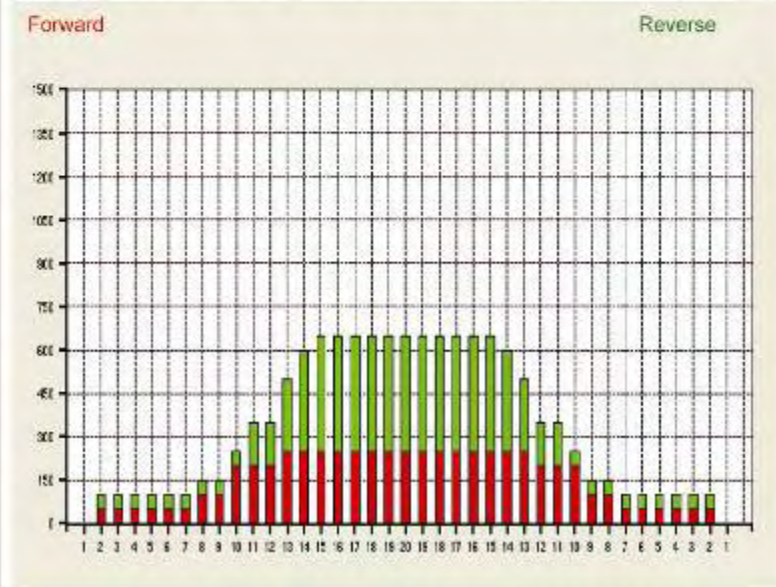
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil	#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	1	18	37	0.0	0.0	0.0	1850	1	2L	2R	0	30	0	36.0	26.0	-10.0	0
2	8L	8R	1	18	25	0.0	2.5	2.5	1250	2	15L	15R	1	22	11	26.0	22.9	-3.1	550
3	10L	10R	2	18	42	2.5	7.6	5.1	2100	3	14L	14R	2	18	26	22.9	17.8	-5.1	1300
4	13L	13R	1	18	15	7.6	10.1	2.5	750	4	13L	13R	2	18	30	17.8	12.7	-5.1	1500
5	2L	2R	0	18	0	10.1	24.0	13.9	0	5	11L	11R	2	18	38	12.7	7.6	-5.1	1900
6	2L	2R	0	30	0	24.0	36.0	12.0	0	6	2L	2R	1	18	37	7.6	5.1	-2.5	1850
7	-	-	-	-	-	-	-	-	-	7	2L	2R	0	18	0	5.1	0.0	-5.1	0
8	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 5.95 mL
Forward Boards Crossed: 119 Boards

Reverse Oil Total: 7.1 mL
Reverse Boards Crossed: 142 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
6.50	6.50	2.80	1.00	1.00	2.60	6.50	6.50



Tournament Sample Pattern Settings

The following patterns are provided for your reference but they are not loaded in the machine. Use KOSI to view, modify, and download them. Remember that the graphs on the following pages are only representations of the patterns so it may not match your machine exactly.

Tournament Pattern #1: This pattern is similar to the 2006 USBC Junior Gold-Short Pattern. This pattern was Sport Compliant on a 10-year old Brunswick Anvilane™ surface which was allowed a 2.5:1 guideline. This pattern is 36 feet and 22.3 milliliters and the scoring pace was medium to medium/low.

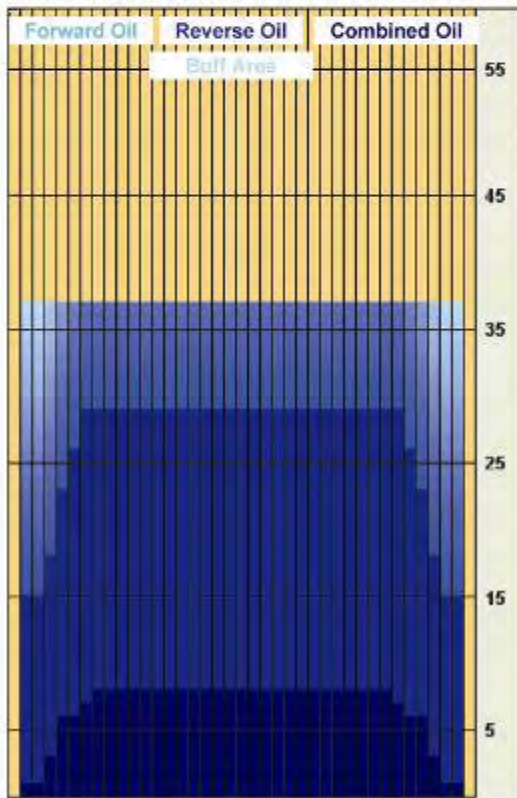
Oil Per Board: 50 mL Oil Pattern Distance: 36 Feet Volume Oil Total: 22.3 mL Total Boards Crossed: 446 Boards

#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOIL
1	2L	2R	2	10	74	0.0	1.4	1.4	3700
2	4L	4R	1	10	33	1.4	2.8	1.4	1650
3	5L	5R	2	10	62	2.8	5.6	2.8	3100
4	7L	7R	1	10	27	5.6	7.0	1.4	1350
5	8L	8R	1	10	25	7.0	8.4	1.4	1250
6	2L	2R	0	18	0	8.4	28.0	19.6	0
7	2L	2R	0	26	0	28.0	32.0	4.0	0
8	2L	2R	0	30	0	32.0	36.0	4.0	0
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

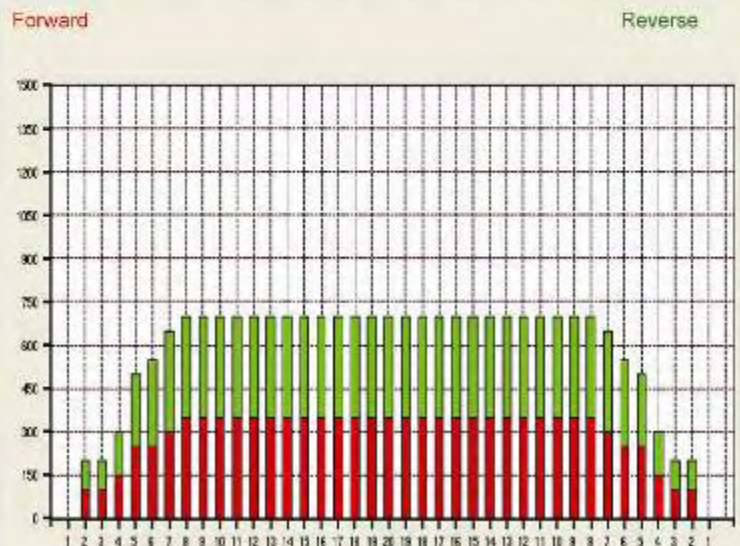
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOIL
1	2L	2R	0	30	0	36.0	28.0	-8.0	0
2	7L	7R	1	22	27	28.0	24.9	-3.1	1350
3	8L	8R	1	22	29	24.9	21.8	-3.1	1450
4	5L	5R	2	18	62	21.8	16.7	-5.1	3100
5	4L	4R	1	18	33	16.7	14.2	-2.5	1650
6	2L	2R	2	18	74	14.2	9.1	-5.1	3700
7	2L	2R	0	10	0	9.1	0.0	-9.1	0
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 11.05 mL
Forward Boards Crossed: 221 Boards

Reverse Oil Total: 11.25 mL
Reverse Boards Crossed: 225 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
3.50	1.40	1.00	1.00	1.00	1.00	1.40	3.50



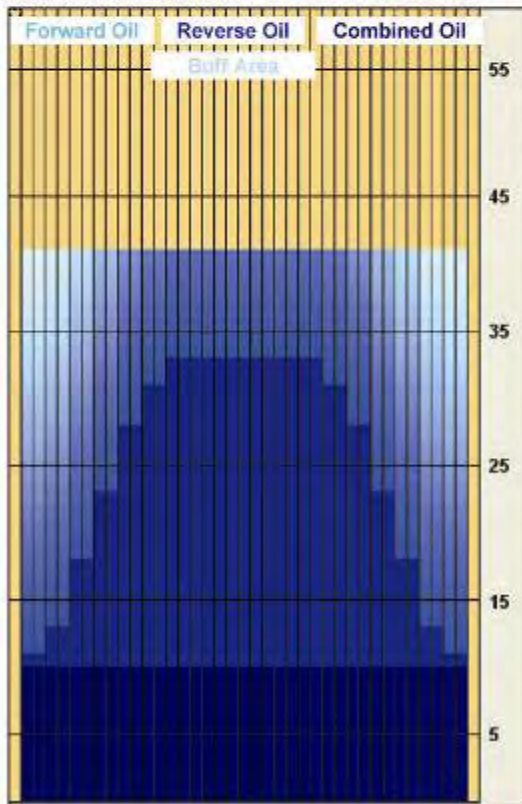
Tournament Pattern #2: This pattern is similar to the 2006 USBC Junior Gold-Medium Pattern. This pattern was Sport Compliant on a freshly resurfaced wood lane which was allowed a 2.0:1 guideline. This pattern is 40 feet and 25.45 milliliters and the scoring pace was medium to medium/low.

Oil Per Board: 50 mL Oil Pattern Distance: 40 Feet Volume Oil Total: 25.45 mL Total Boards Crossed: 509 Boards

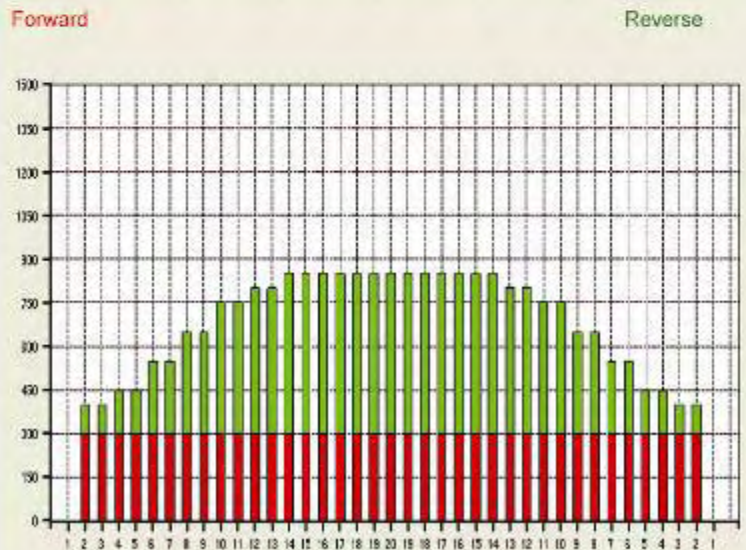
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil	#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	6	14	222	0.0	9.9	9.9	11100	1	2L	2R	0	30	0	40.0	32.0	-8.0	0
2	2L	2R	0	18	0	9.9	30.0	20.1	0	2	14L	14R	1	18	13	32.0	29.5	-2.5	650
3	2L	2R	0	26	0	30.0	35.0	5.0	0	3	12L	12R	1	18	17	29.5	27.0	-2.5	850
4	2L	2R	0	30	0	35.0	40.0	5.0	0	4	10L	10R	2	18	42	27.0	21.9	-5.1	2100
5	-	-	-	-	-	-	-	-	-	5	8L	8R	2	18	50	21.9	16.8	-5.1	2500
6	-	-	-	-	-	-	-	-	-	6	6L	6R	2	18	58	16.8	11.7	-5.1	2900
7	-	-	-	-	-	-	-	-	-	7	4L	4R	1	14	33	11.7	9.8	-1.9	1650
8	-	-	-	-	-	-	-	-	-	8	2L	2R	2	10	74	9.8	7.0	-2.8	3700
9	-	-	-	-	-	-	-	-	-	9	2L	2R	0	10	0	7.0	0.0	-7.0	0
10	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 11.1 mL
Forward Boards Crossed: 222 Boards

Reverse Oil Total: 14.35 mL
Reverse Boards Crossed: 287 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
2.13	1.89	1.13	1.00	1.00	1.13	1.89	2.13



Tournament Pattern #3: This pattern is similar to the 2006 USBC Junior Gold-Long Pattern. This pattern was Sport Compliant on 24' of Brunswick Anvilane™ and the remaining 36' was wood, which was allowed a 2.5:1 guideline. This pattern is 44 feet and 25.65 milliliters and the scoring pace was medium to medium/high.

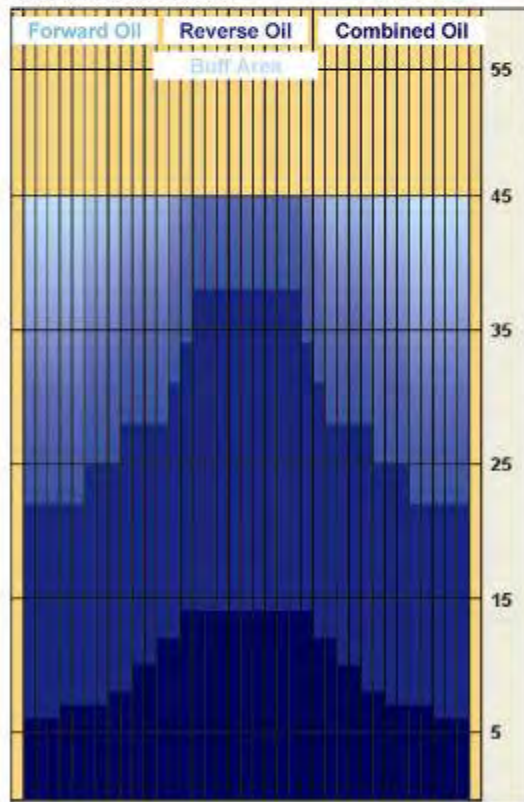
Oil Per Board: 50 mL Oil Pattern Distance: 44 Feet Volume Oil Total: 25.65 mL Total Boards Crossed: 513 Boards

#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	5	10	185	0.0	5.6	5.6	9250
2	5L	5R	1	10	31	5.6	7.0	1.4	1550
3	9L	9R	1	10	23	7.0	8.4	1.4	1150
4	11L	11R	1	14	19	8.4	10.3	1.9	950
5	13L	13R	1	14	15	10.3	12.2	1.9	750
6	15L	15R	1	14	11	12.2	14.1	1.9	550
7	2L	2R	0	18	0	14.1	34.0	19.9	0
8	2L	2R	0	26	0	34.0	39.0	5.0	0
9	2L	2R	0	30	0	39.0	44.0	5.0	0
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

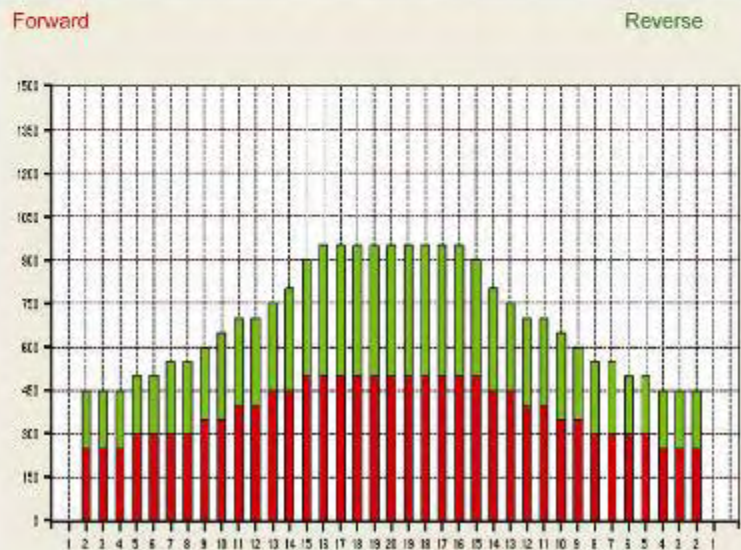
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	0	30	0	44.0	37.0	-7.0	0
2	16L	16R	1	26	9	37.0	33.4	-3.6	450
3	15L	15R	1	26	11	33.4	29.8	-3.6	550
4	14L	14R	1	22	13	29.8	26.7	-3.1	650
5	10L	10R	1	22	21	26.7	23.6	-3.1	1050
6	7L	7R	1	18	27	23.6	21.1	-2.5	1350
7	2L	2R	4	18	148	21.1	10.9	-10.2	7400
8	2L	2R	0	10	0	10.9	0.0	-10.9	0
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 14.2 mL
Forward Boards Crossed: 284 Boards

Reverse Oil Total: 11.45 mL
Reverse Boards Crossed: 229 Boards



Ratio of Oil from 20 Board to Displayed Board							
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
2.11	1.90	1.48	1.08	1.08	1.48	1.90	2.11



Tournament Pattern #4: This is the 2006 Aalborg (Denmark) International pattern. This is one of the tournament stops on the European Bowling Tour. This pattern is 38' and 22.9 milliliters. This pattern was not Sport Compliant but provided a medium scoring pace for some of Europe's better players.

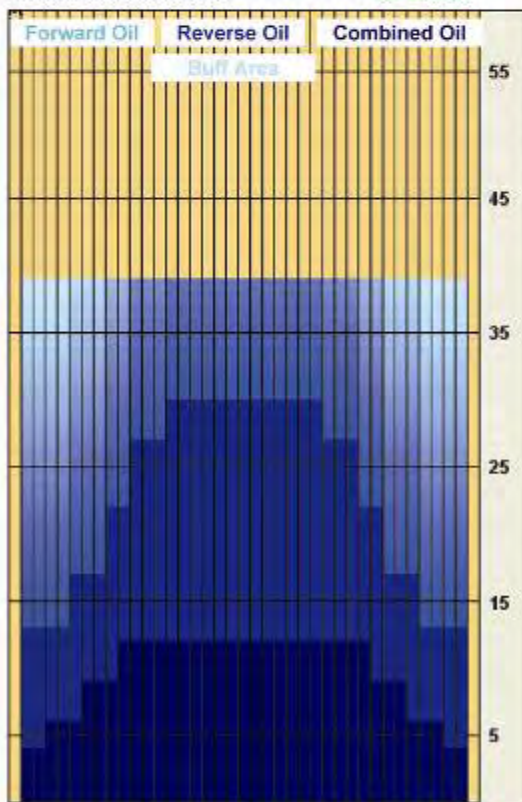
Oil Per Board: 50 mL Oil Pattern Distance: 38 Feet Volume Oil Total: 22.9 mL Total Boards Crossed: 458 Boards

#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	3	14	111	0.0	3.9	3.9	5550
2	4L	4R	1	18	33	3.9	6.4	2.5	1650
3	7L	7R	1	18	27	6.4	8.9	2.5	1350
4	10L	10R	1	22	21	8.9	12.0	3.1	1050
5	2L	2R	0	26	0	12.0	26.0	14.0	0
6	2L	2R	0	30	0	26.0	38.0	12.0	0
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

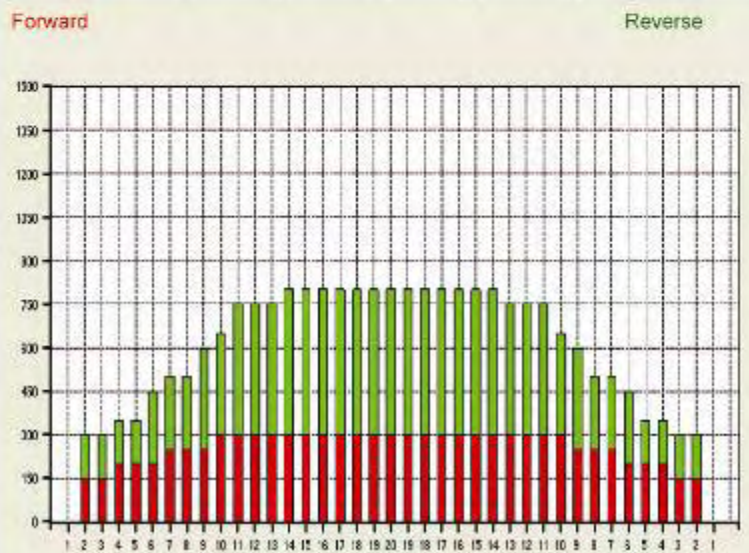
#	Start	Stop	Ld	Sp	Cr	Start F.	End F.	FT	TOil
1	2L	2R	0	30	0	38.0	29.0	-9.0	0
2	14L	14R	1	22	13	29.0	25.9	-3.1	650
3	11L	11R	2	18	38	25.9	20.8	-5.1	1900
4	9L	9R	2	18	46	20.8	15.7	-5.1	2300
5	6L	6R	2	14	58	15.7	11.8	-3.9	2900
6	2L	2R	3	10	111	11.8	7.6	-4.2	5550
7	2L	2R	0	10	0	7.6	0.0	-7.6	0
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-

Forward Oil Total: 9.6 mL
Forward Boards Crossed: 192 Boards

Reverse Oil Total: 13.3 mL
Reverse Boards Crossed: 266 Boards



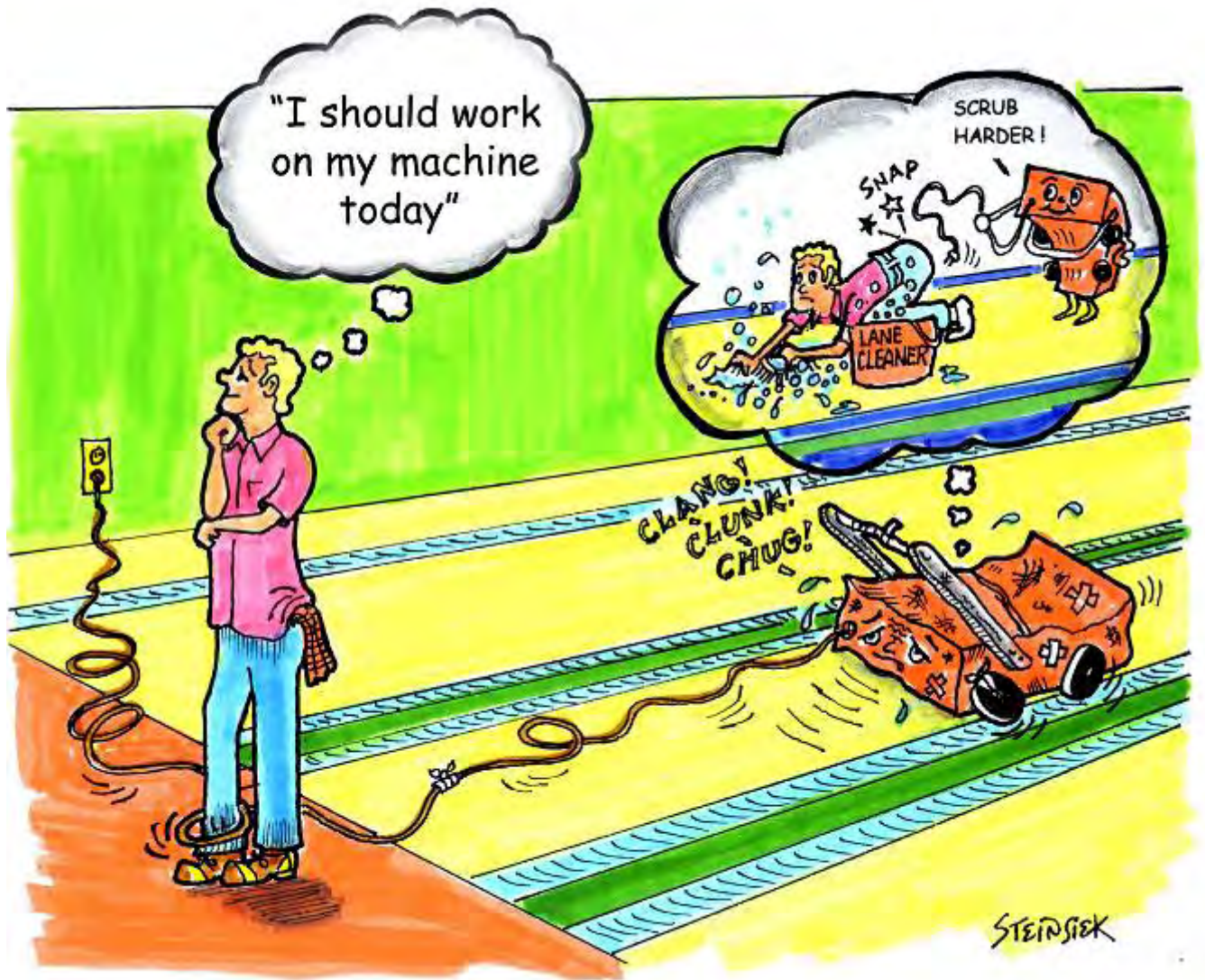
20:2L	20:5L	20:10L	20:15L	20:15R	20:10R	20:5R	20:2R
2.67	2.29	1.23	1.00	1.00	1.23	2.29	2.67



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. I suggest reading the following scenarios to see if it is similar to your problem (and to maintain your sanity).

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 had mixed cleaner mistaken for 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 have no cord to watch out for, walk along side 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 set recommendations about 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, the following page shows some suggestions to answer common questions about lane conditioning. These tips should help you make the proper adjustments to the patterns supplied in this manual.

Note: Failure to check machine operation before pattern adjustments can result in the loss of your sanity. If loss of sanity does occur, please call KEGEL at 863-734-0200 and we will be happy to 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?

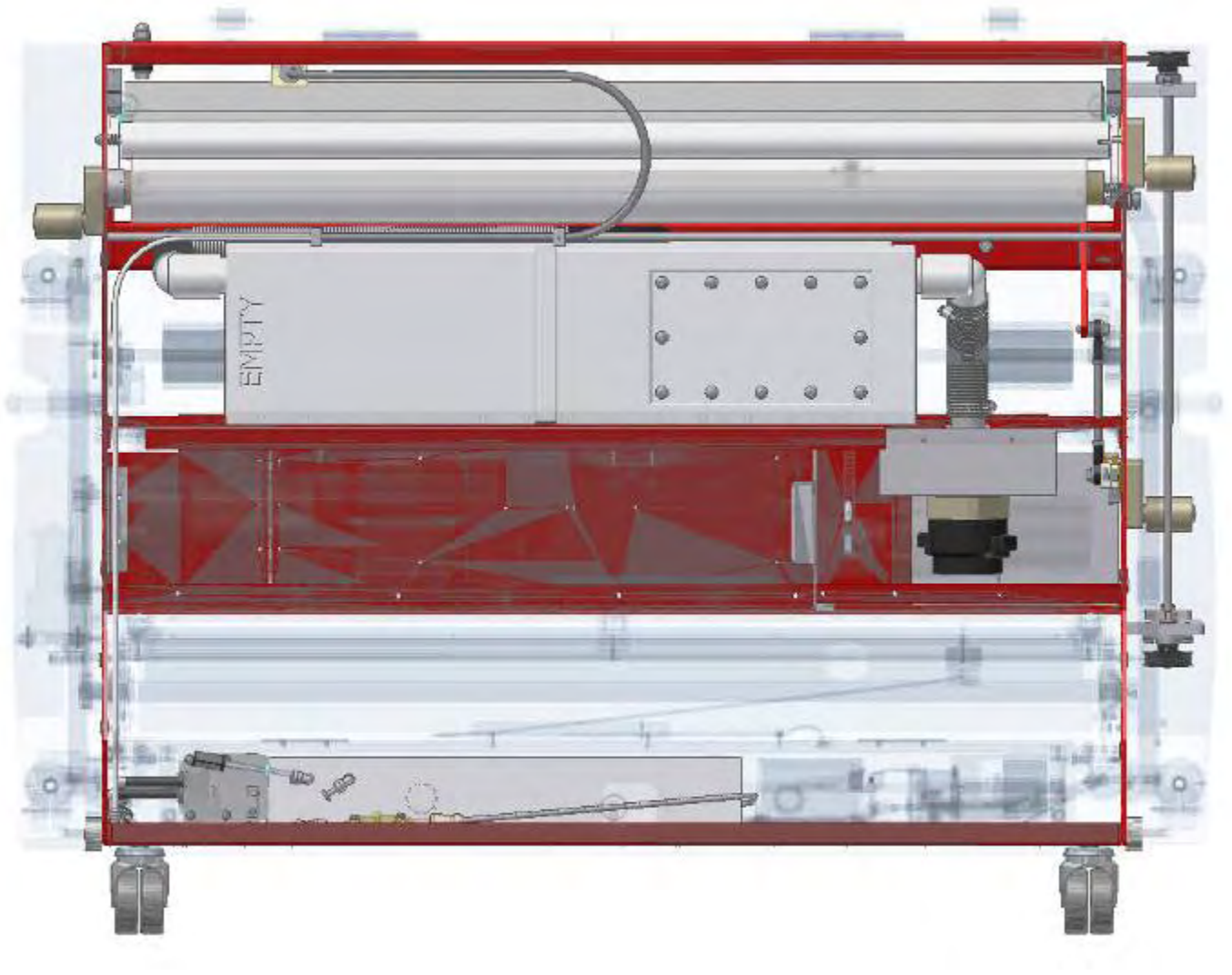
A: Many bowling centers do not apply enough oil to the track on both forward and return passes. The volume (in units) at the end of the pattern should be slightly more than the outside boards. Applying oil to the track on the return pass provides longevity and stability. This application of oil can be 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 in the Change Program menu in the forward screens only. Increasing the drive speed on your forward run will allow the lane condition to taper properly.

CHAPTER 3

Cleaning Systems



Highlighted view of the cleaning system

Theory of Operation

The Kustodian ION 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 ION 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 is its 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.

Special Cleaning Functions

Squeegee Wipe

This function is used to prevent drips from falling off the squeegee. The machine stops in the pit area and then moves 4 inches in reverse and then stops again. It lowers the squeegee, travels forward 4 inches, and then raises the squeegee and returns to the foul line.

It is very important that the rear squeegee blade clears the tail plank.

This function can be turned off if desired, call Lane Maintenance Central for help.

Cleaner Pump Reversing

The cleaner pump has no valve that turns off the flow of cleaner, nor does it re-route cleaner back to the supply tank. The cleaner is held back by the pinch of the rollers inside the pump. For this reason the cleaner pump reverses for a second at the pin deck to suck back the cleaner in the line to prevent it from dripping.

System Control Duster Menus

Unwind Time

These screens will be used to operate and reset the duster functions.

Press the **MENU** key until the following screen appears:

SYSTEM CONTROL DUSTER

From this menu prompt the operator may run the duster motors to help when installing a new roll of duster cloth. Pressing the **handle button** will operate the unwind motor. Pressing the **cleaner presoak** button will operate the windup motor. This motor will run until contact is made with the duster up switch then it automatically stops.

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

*** UNWIND TIME**
F6 TO RESET 06

This screen will display the current unwind time setting for each "ratchet" of cloth. This number will automatically increase as the size of the cloth roll decreases. This value will return to the default setting of **06** when **F6** is pressed.

This prompt is referring to the amount of time in tenths of seconds. The "**06**" is actually 0.6 seconds. To change the amount of unwind time, use the **UP** or **DOWN ARROWS**. Changing the value sets the data automatically.

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 pin chasers has presented you with this problem.

The unwind time varies from **06** for a fresh roll to **20** 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, set the time to **13**.

The machine will default back to a setting of **06** when a new roll of cloth is installed and the unwind time is reset using the **F6** or **RESET** key.

System Control Cleaning Menus

This series of screens will be used to adjust various cleaning features in the machine's program.

Press the **MENU** key until the following screen appears:

SYSTEM CONTROL CLEANING

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

LAST SQUIRT DIST IN FEET -> 57

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.

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

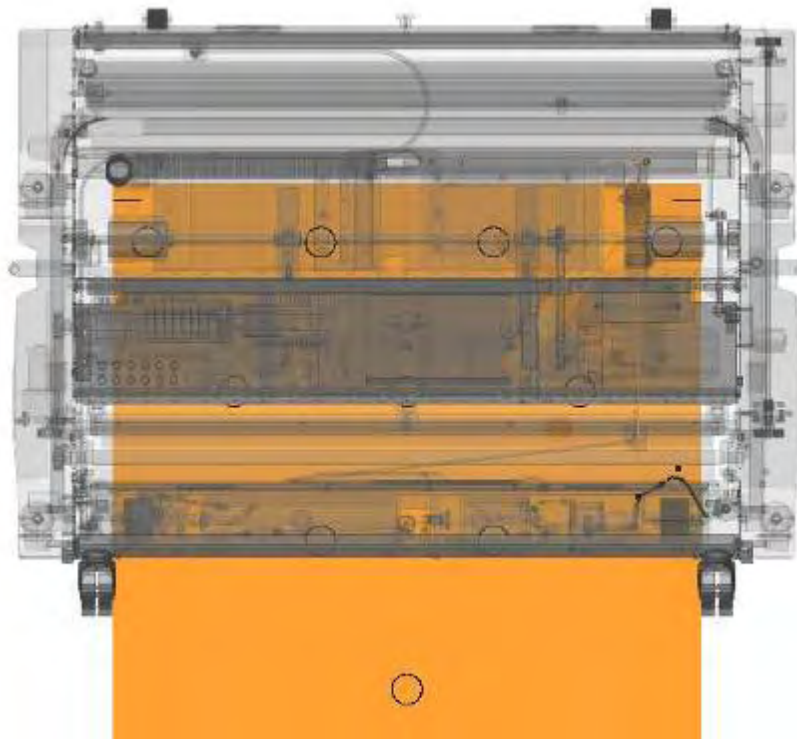
LIFT DUSTER IN INCHES -> 20

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.

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

FORWARD DISTANCE SUBTRACT -> 32

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.



*Machine overview showing maximum distance for Forward Travel.
Drive wheels cover 7-pin & 10-pin spots when squeegee is off the pin deck.*

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

**REVERSE DISTANCE
SUBTRACT -> 32**

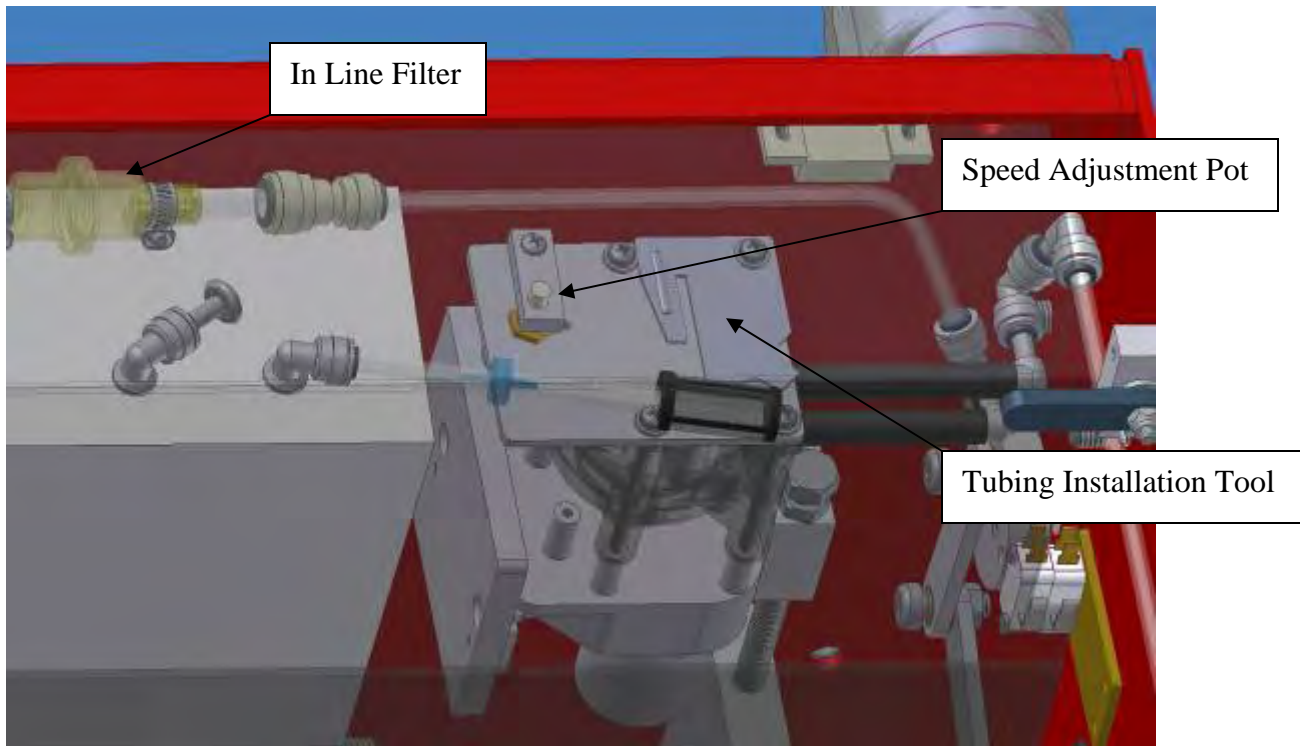
This prompt allows the operator to adjust the travel back to the foul line. Increasing the number subtracts more from the distance, so the machine will stop further away from the foul line. Use the **UP** or **DOWN ARROW** to adjust. The PLC accepts any changes to the data automatically.

This concludes the selections in the
SYSTEM CONTROL CLEANING MENU.

Press **NEXT** to loop around to the start of the menu again.

Mechanical Adjustments

Cleaner Pump Volume Adjustment (Cleaner Calibration)



The cleaner pump volume can also be checked in the same menu prompt as the oil. Press **MENU** to access the correct screen which displays:

OIL AND CLEANER VOLUME TEST

Press the **NEXT** key and remove cleaner tip from the holder (*make sure the spring in the tip holder block doesn't fall out*). Place the tip in a 50ml graduated cylinder and press the **PRESOAK** button on the handle; this will make the oil and cleaner heads start operating.

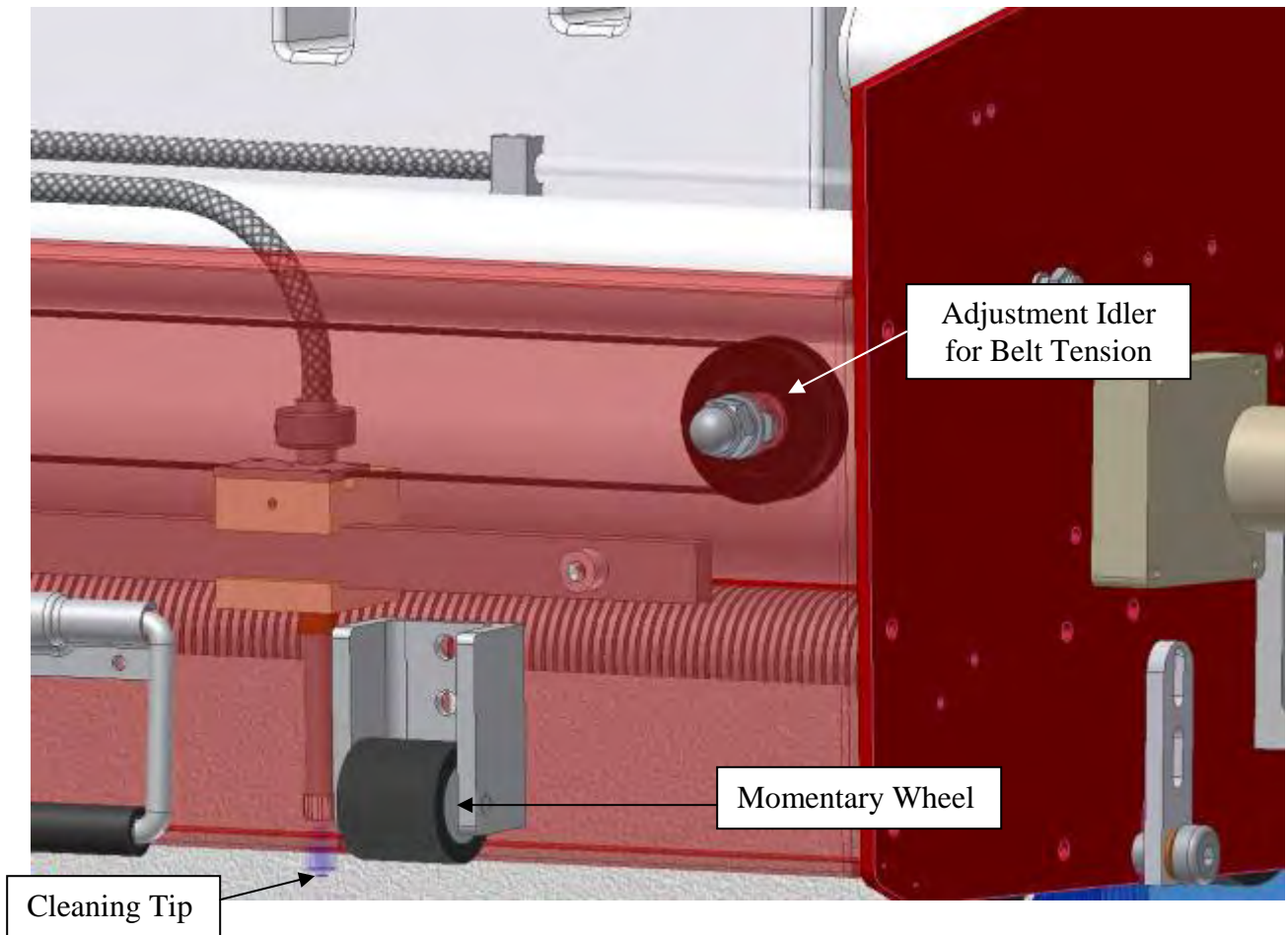
The cleaner head will apply one stream of cleaner then stop. **Repeat this test three more times and write down the volume dispensed. The factory setting for 4 streams of cleaner is 30 μ l.**

To adjust the cleaner volume, simply loosen the 8-32 set screw on the locking bar. Turn the adjusting pot on the cleaner pump **clockwise to increase volume** and counter-clockwise to decrease the volume. The factory setting will clean between 50 and 55 lanes.

As the cleaner pump tubing ages the volume will tend to decrease. The motor will need to increase in speed to dispense the same volume. When the adjusting pot has been turned to the maximum setting, the tubing should be replaced.

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

Adjustment of Cleaner Dispensing Tip (An adjustment video can be viewed in KOSI.)



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 the 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, but who knows?*)

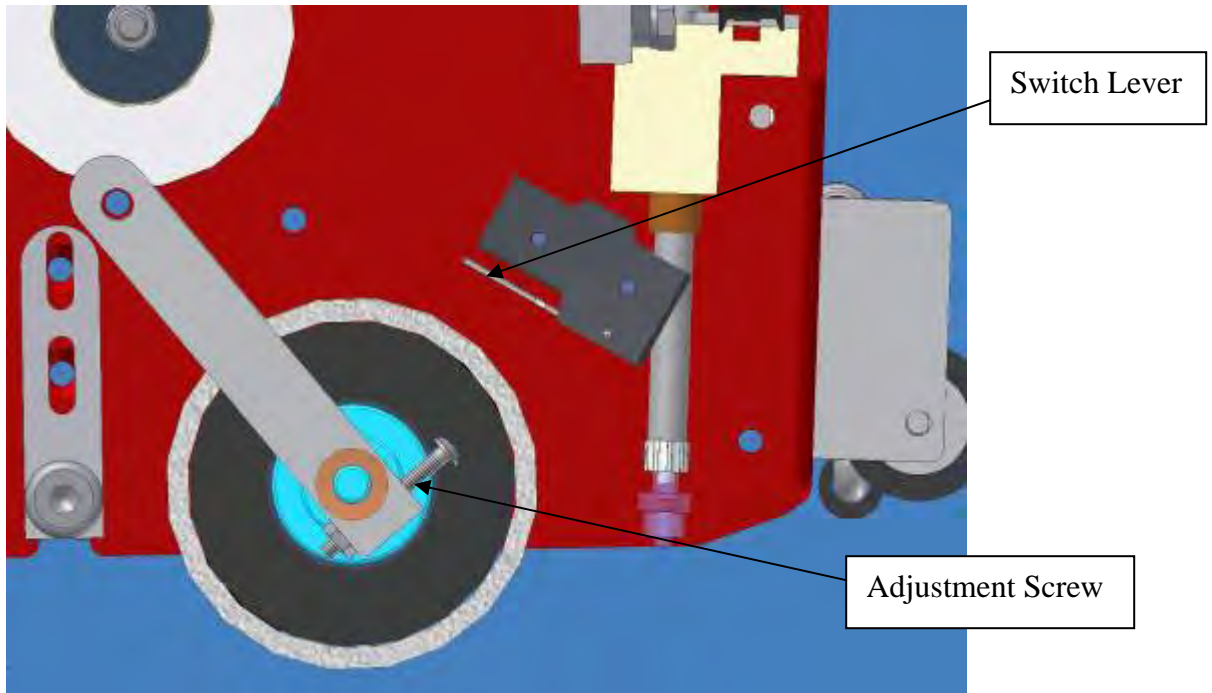
Momentary Wheel Adjustment

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 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 ~ 3.2 mm).

The wheels need to be as close to the lane as possible without touching, provided the lanes are 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.*

Duster Switches (An adjustment video can be viewed in KOSI.)



Adjust the duster switches only when the machine is standing up in the transport position.

1. Unwind some cloth so there is free movement of the cushion roller.
2. Lift the cushion roller up to actuate the switch and hold it against the stop. The switch should clearly actuate before the cushion lever hits the stop and there should be a small amount of over-travel of the switch lever.
3. Check the other side and be certain that both switches are adjusted with the same amount of over-travel.
4. If there is no over-travel, loosen adjusting screw with an 11/32 nut driver and back the screw out until there is some over-travel of the switch lever.
5. Tighten nut and check adjustment.

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. To lower the squeegee, apply power to the machine and menu to the **TEST OUTPUT** screen.

When you reach the **TEST OUTPUT** section, press the **NEXT** key and advance to **OUTPUT #11**.

Press the **ENTER** key once. The squeegee motor will activate and rotate 180°, this will lower the squeegee. If the squeegee does not stop in the down position, check the condition of the Squeegee Down Switch.

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.

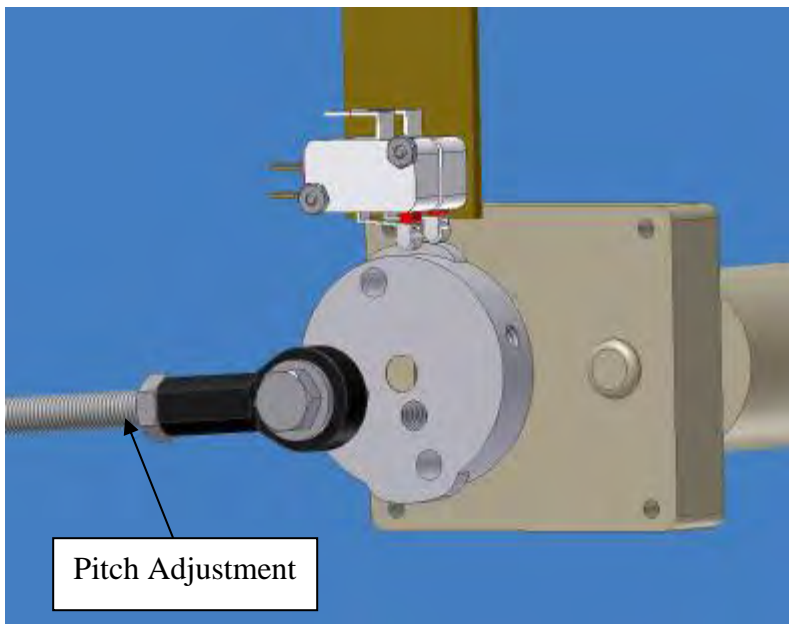
If the distance is more or less, loosen the bolts (two on each side) that hold the squeegee pivot in place. Move the pivot mount until the squeegee height is correct. This should be done for both the left and the right side. Tighten the bolts after the adjustment is acceptable.

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 strip properly and will cause stress on the assembly.*

Squeegee Switches



The squeegee switches should have a little over-travel in the lever of about 0.015. 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.)

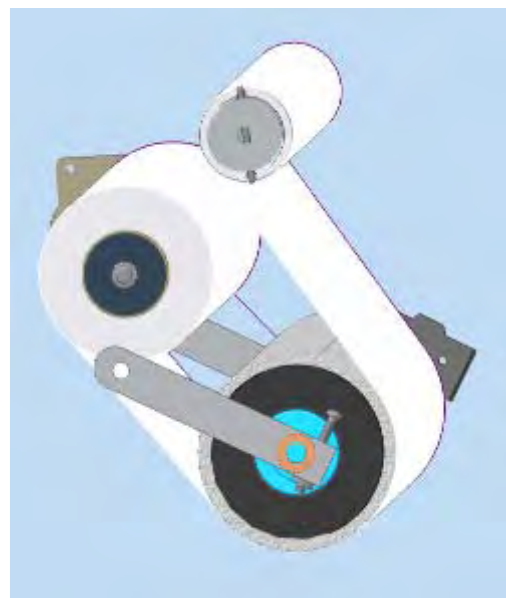
The Kustodian ION uses a patented Dual Motor Ratcheting (DMR) Cloth system. The duster assembly operates by means of two brake motors. The first unwinds cloth and sets the cushion roller down on the lane surface. The second winds up used cloth onto the used core.

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 Lane 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.
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 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. Apply power to the machine and bring up the **SYSTEM CONTROL DUSTER** menu.
8. When the keypad shows the **SYSTEM CONTROL DUSTER** on the display the handle buttons become active. Press the **start button** to unwind and press the cleaner **presoak button** to wind up cloth. The cloth should be rolled up tight and evenly across the assembly.



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.

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 foam build up in the tank due to soft water conditions at your facility it will be necessary to purchase a de-foaming agent.

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.

5. It is recommended that the inside of the tank be cleaned and the filter material in the tank be replaced periodically. **A good rule of thumb would be: If you have a 40 lane house and clean twice a day we would recommend changing the filter every 30 days.** Maintenance will vary depending on center size so it is best to inspect the tank filter by looking through the end that connects to the vacuum 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 Filter:

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

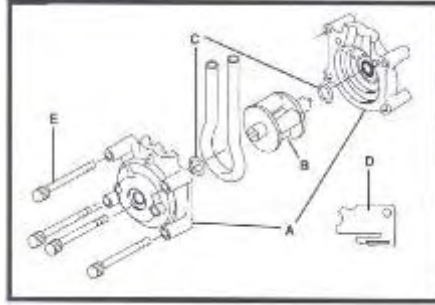
Pump Tubing Replacement

If the cleaner pump maximum volume output is a problem, follow these instructions to disassemble the pump and replace the tubing. This probably needs to be done once a year. 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 mount plate.
3. Remove both stem elbows from tubing (note the direction of elbows). Save for re-installation on new tubing if a complete assembly is not being installed.
4. 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.
5. 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.

6. 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)

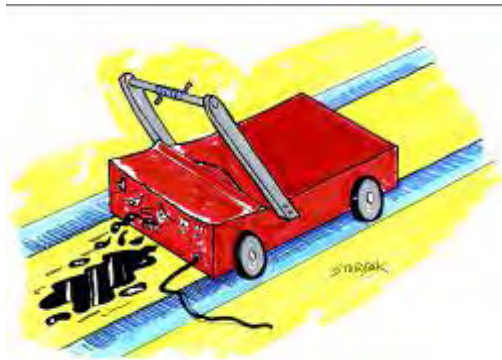
7. Position the other end bell on top and press the end bells together. Be careful not to pinch the tubing. If end bells do not snap tightly together you need to reload the tubing. If necessary, turn the key in the slot on rotor shaft to adjust tubing.
8. With key in slot on rotor shaft, turn the key 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).
9. Replace stem elbows in new tubing if necessary. Make sure elbows are facing correct direction.
10. Re-attach the cleaner pump to mount plate.
11. 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 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

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

ERROR MESSAGE

** CODE D5 **

Menu Out of the Program and Return machine to approach.

This error normally happens when Duster **Input 0CH 10** fails to open, meaning the input light does not turn off. Here are a few things that can cause a **D5** error. If the Duster Motor does not run, menu to the **Test Output** and check **Output #12** to check relay operation and voltages.

1. Duster cloth is empty. Replace cloth.
2. One or both of the Duster Up Switches are stuck. Check if **Input 0CH 10** has an LED light showing on the PLC with the cushion roller adjusting screws off the switches.
3. Motor failed.
4. Blown fuse.
5. Duster CR9 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 was dumped onto switch causing it to short, but only a dim light is on **Input 0CH 10**.

ERROR MESSAGE

** CODE D6 **

Menu Out of the Program and Return machine to approach.

This error normally happens when the duster fails to windup the cloth and actuate the duster up switch, failing to turn on **Input 0CH 10**. Here are a few things that can cause a **D6** error. If the Duster Motor does not run, access the **Test Output** menu and check **Output #13** to check relay operation and voltages.

1. Blown fuse.
2. Motor has failed.
3. Duster Up Switches are both broken or out of adjustment.
4. Duster CR10 relay has 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 motor Green / Red wire is damaged or there is a loose wire between the motor and CR10 relay.

ERROR MESSAGE

** CODE SA **

Squeegee did not lower error

Menu Out of the Program and Return machine to approach.

Normally this error occurs when **Input 1CH 00** fails to receive a signal within 3.5 seconds of the motor starting. Here are the possible causes that can produce an **SA ERROR**.

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. 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 #11**. You will need to determine if power is getting to the motor.

- a. Fuse is blown.
- b. Squeegee linkage is in a bind.
- c. CR8 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 03** failed.

ERROR MESSAGE

**** CODE S9 ****

Squeegee did not raise error

Menu Out of the Program and Return machine to approach.

Normally this error occurs when **Input 1CH 01** fails to receive a signal within 3.5 seconds of motor starting. Here are the possible causes that can produce an **S9 ERROR**.

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 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 #11**. You will need to determine if power is getting to the motor.

- a. Fuse is blown.
- b. Squeegee linkage is in a bind.
- c. CR8 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 start 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.

Hint: In a bind you can use a paper clip as a jumper, but please make proper repairs to maintain your machine in proper working order.

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. CR2 relay failed or is loose in socket base.
 - c. Bad connection between motor and relay.
 - d. Loose connection at speed control.
 - e. Speed control has failed.
2. Cleaner pump volume low.
 - a. Tubing is starting to wear. (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 1/100th 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 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 bad connection.
 - c. Machine is not running 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 overfilled machine and made a mess.
11. Duster cloth hangs down on one side and sometimes touches the lane when pulling the machine out 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 Tech Support at 863-734-0200.

CHAPTER 4

Drive Systems

Manual Reverse

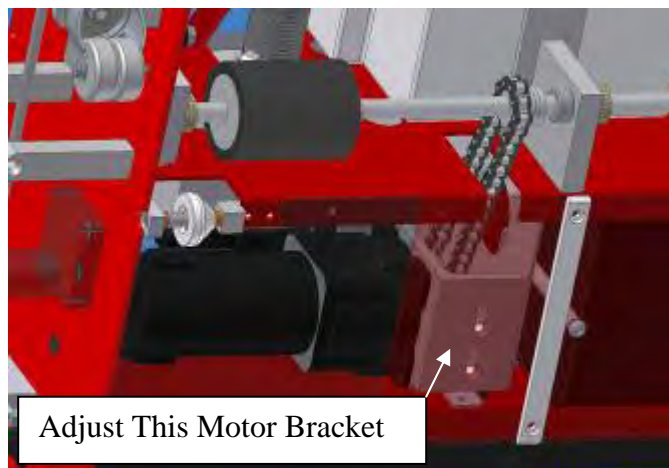
From this menu prompt the machine can be operated in reverse after clearing an error. The menu will be displayed as seen below.

*** MANUAL REVERSE
PRESS BUTTON**

To return the machine to the foul line, press the **START BUTTON** on the handle and hold it. The machine will return to the foul line at about 22 inches per second as long as the button is held down. Use caution when operating the machine in manual mode.

Adjustments

Drive Chain (An adjustment video can be viewed in KOSI.)



It is important for the drive chain to stay tight. To adjust the chain, loosen the drive motor mounting bolts. Slide the motor by hand until it will move no more and tighten motor bolts. A loose chain can cause damage to the motor, but too much tension will have the same effect.

Guide Roller



Front Guide Wheel Assembly



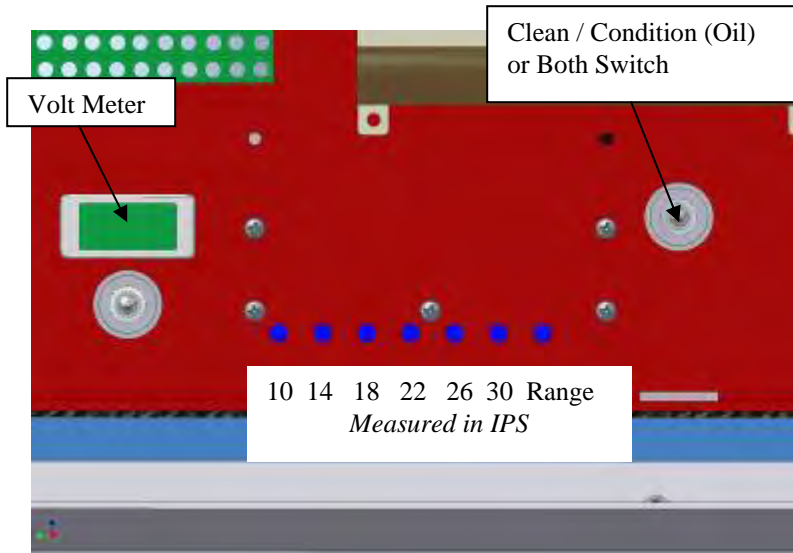
Rear Guide Wheel Assembly

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 guide roller 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 Speeds (A video is available in KOSI.)



To set the drive speeds you will need to Menu to the **Test Output** area. **Outputs #02** through **#07** will run the drive motor in a forward and reverse direction and the speed will be displayed on the screen in place of the **OFF** text.

The machine can be put onto the lane to check the **load speeds** and it will travel 30 feet stop and return to the foul line for each speed.

NOTE: While the machine is operating, it is possible to advance to each speed because it may not be necessary to monitor each speed for the entire forward and reverse cycle.

TEST OUTPUT #02
PRESS F2-F5 000

The adjusting trimpots are located on the control plate in front of the PLC Relays. The trimpots and their speed ranges go in order from left to right as follows:

- 9-10 IPS**
- 13-14 IPS**
- 17-18 IPS**
- 21-22 IPS**
- 25-26 IPS**
- 29-30 IPS**

RANGE Pot (Adjusts speed for all trimpots).

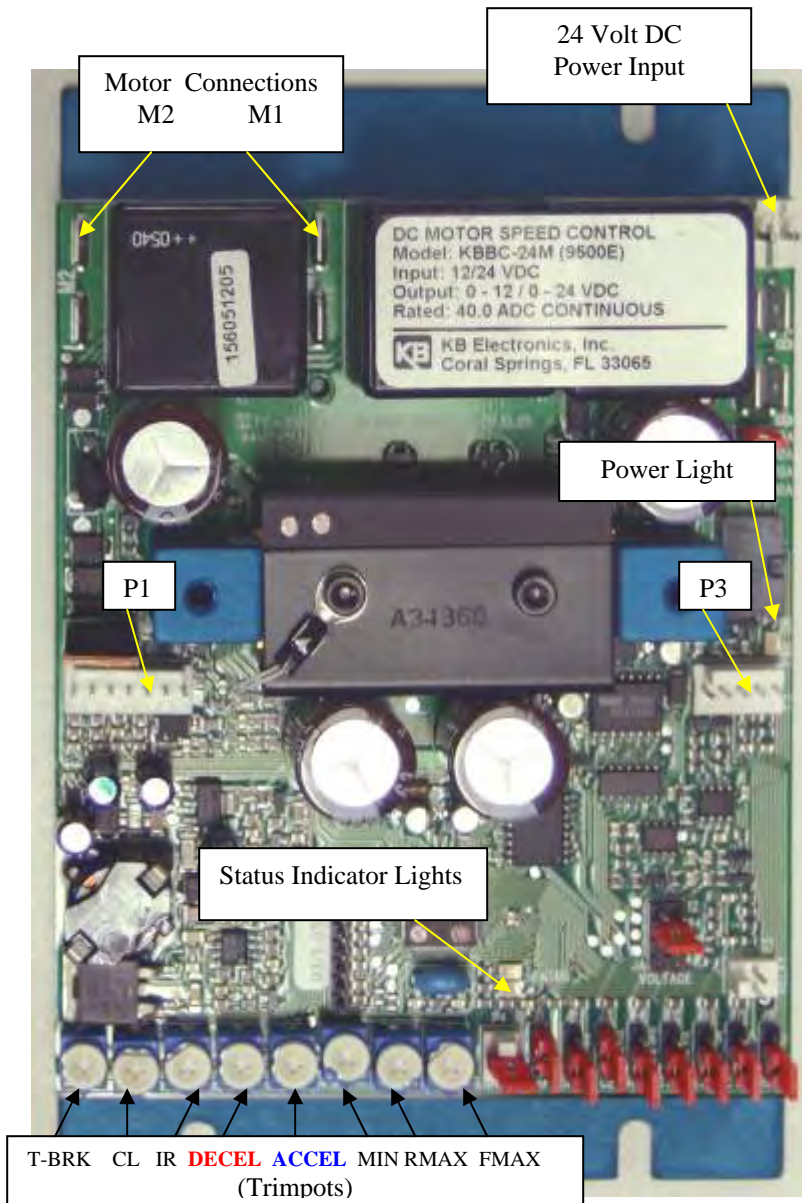
When adjusting the speeds always start with the 10 inches per second speed. It affects **ALL** of the other speeds.

1. After you have reached the **Test Output** screen press **NEXT (F2)** to advance to **Output #02**, then press **ENTER (F5)**. The speed will be displayed on the lower right side of the keypad. Using a small screwdriver, turn the trimpot clockwise to increase the speed if needed. The screen should flash between 9-10 for the low speed.
2. Press **NEXT** to advance to the next speed. Adjust your second speed to 13-14 then advance to the other speeds by pressing **NEXT** and adjust accordingly if needed.

3. 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 after adjusting the RANGE trimpot.**
4. 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.
5. It is possible that the load and no load speeds will never match 100% on each speed. This is due to the fact that the machine is only operating off 24 VDC. If the speeds don't match take note of the difference for each speed.
6. For example, if the 2nd speed shows a load speed range of 12-13 and the no load speed shows the correct setting of 13-14, increase the no load speed to 14-15.
7. Run machine on the lane and check all 6 drive speeds. Repeat the step above if needed for each speed.

NOTE: *The most important thing is that the load speeds are correct it is **not** necessary to have the load and no load speeds match. See the video in KOSI or call Kegel Tech Support anytime at 863-734-0200.*

Drive Motor Controller



*The drive control board has all kinds of adjustments. **Please don't touch anything unless you know what you are doing.***

There are only two adjustments that may need to be fine-tuned and they are the Deceleration (**DECEL**) and Acceleration (**ACCEL**) trim pots.

The **Acceleration** trimpot needs to be adjusted for a smooth transition from one speed to the next without sudden jerks of the machine. Turning the trimpot clockwise will increase the ACCEL time.

Increasing the ACCEL trimpot too quickly could result in the drive board shutting down and displaying an error light on the board itself.

The **Deceleration** trimpot is adjusted for smooth decelerations from one speed to the next. Decelerating too quickly will result in the drive board shutting down from an over-voltage fault.

*If you adjust the DECEL too much in the clockwise direction the machine may not slow down properly when entering the pin deck. **Be certain that the machine is absolutely slowing down before coming to a stop.***

The Drive Motor Controller also has indicator lights used to display error codes. The codes can help in troubleshooting a problem with the drive that may be nothing more than a trimpot adjustment.

Function	Flash Code	LED Color
Normal Operation Mode	Slow	Green
Stop Mode	Quick	Green
Speed Pot Fault	Quick	Red/Green (Alternate)
Temperature Fault	Slow	Red/Green (Alternate)
Over/Under Voltage	Quick	Red+Green
Under Voltage Warning	Slow	Red+Green
Motor/Brake Fault	Quick	Red,Red / Green,Green
Internal Fault	Slow	Red,Red / Green,Green
Current Fault	Steady	Red
TCL (Current limit time out)	Quick	Red
Normal Control Operation	Steady	Green
Bus & Power Supply Fault	Off	

Maintenance

There are only a few things that the operator should do to maintain the Drive System. Here are a few suggestions that should be done to maintain a perfect machine.

1. Keep all of the bushings oiled on the drive shaft (one or two drops is plenty). There are felt washers to help hold the oil longer next to the bushings. **DO NOT OVER-OIL!**
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).

Drive System Problems Indicated by Error Messages

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

Errors **T1** and **T2** normally happen when 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. Here are a few things that can cause a **T1** or **T2** error.

If the Drive Motor does not run, menu to the **Test Output** and check **Output #02** to check relay operation and voltages. **T1** is for forward errors and **T2** is for reverse.

ERROR MESSAGE

**** CODE T1 ****

ERROR MESSAGE

**** CODE T2 ****

1. The drive motor runs but gives **T1** or **T2** errors.
 - 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 in the pit when the machine does the squeegee wipe. 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.

2. Drive Motor does not run.
 - a. CR11 Forward Relay is loose in socket or failed.
 - b. CR12 Reverse Relay is loose in socket or failed.
 - c. One of the motor control plugs are loose or unplugged. Check speed control, relay board and drive motor plugs.
 - d. Blown fuse.
 - e. Drive Motor or Speed Control failure.
 - f. Go to the Test Output Menu and Check **Output #01** Forward Drive Relay and **#03** Reverse Drive Relay.

3. Machine drives off into pit giving a **T1** 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 not turning freely.
 - d. Lane Distance target loose.
 - e. Lane Distance Proximity Sensor too far from target.
 - f. Lane Distance Proximity Sensor damaged.
 - g. Operator needs more training and is starting the machine too far past the foul line.
 - h. Tail plank missing from pin deck. (Look for missing tail planks.)

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. The return distance will have to be adjusted while the machine is configured to operate this way. Go to the SYSTEM CONTROL CLEANING menu to adjust the return distance.*

Drive System Problems that Do Not Display Errors

There are a number of things that can go wrong with the Drive System and the machine will appear to operate poorly. Most of these problems can be corrected before the machine fails, but only if the operator is paying attention. **Checking the drive speeds as the machine runs is a good thing! It is kind of fun to have a machine with no cord to watch!**

1. Machine has a jerky motion to it.
 - a. Drive chain is loose.
 - b. Sprocket is loose and is destroying the motor shaft and keyway.
2. Machine jerks when shifting to next speed.
 - a. Acceleration trimpot needs adjusted clockwise on speed control.
3. Machine takes too long to ramp up to next speed.
 - a. Acceleration trimpot needs to be adjusted counter-clockwise on speed control.
4. Machine comes to sudden stop, not smooth controlled stops.
 - a. Deceleration trimpot needs to be adjusted clockwise on speed control.
5. Machine takes too long to ramp down to next speed.
 - a. Deceleration trimpot needs to be adjusted counter-clockwise on speed control.

CHAPTER 5

Battery Power and Charging Systems

Batteries



The Kustodian ION Model B uses two types of batteries: Absorbed Glass Mat (AGM) or Regular batteries and Extended Life (XL) lithium-ion batteries.

Regular Battery: Two Odyssey™ AGM dry cell batteries are connected in series to produce 25.6 Volts fully charged. These are nonspillable batteries and can be mounted on their side. The batteries should be recharging any time the machine is not in use, but make sure the charger has adequate ventilation.

In large centers, opportunity charging may need to be done to the AGM batteries. Any time you stop to fill the supply tank or dump the recovery tank is time that can be used to charge the batteries. If storing the batteries for an extended period of time, make sure they are fully charged and disconnect the negative battery cable to eliminate discharge during storage.

It is not a bad idea to get a set of spare batteries just to keep on hand.

WARNING! *Do not use a battery that is not authorized by Kegel in this machine.*
DO NOT USE FLOODED ACID BATTERIES *in this machine.*

Battery Disposal: Always properly recycle your lead acid battery by returning it to an authorized recycling center or automotive dealer.



Pb



Pb

NEVER PLACE USED BATTERIES IN YOUR REGULAR TRASH!

Extended Life Battery: On the XL model, two lithium-ion batteries are connected in series to produce 27.6 Volts fully charged. These are sealed batteries and the environmentally friendly design eliminates the need for recycling, but you still need to follow local laws/regulations when disposing of these batteries.

Additional equipment is connected to these batteries to indicate the state of charge and to prevent damage to the batteries (from over-charging or over-discharging). The patented technology makes these lithium-ion batteries inherently safe and does not allow thermal runaway. Another advantage is there is no “memory” effect that reduces capacity when partially discharged and the batteries can be fully discharged without damage.

Batteries have a short circuit protection and built-in electronic monitoring with internal cell balancing. The batteries should be recharging any time the machine is not in use, but make sure the charger has adequate ventilation.

Fuse Link



The regular capacity batteries (Odyssey) are fused with a 40 Amp fuse between the two batteries. Model A machines used a GLASS AGU fuse, which has been discontinued from production. Picture shows a machine without the battery door.



The Model B machine was originally equipped with a mini ANL type fuse, which was replaced with a MAXI fuse (automotive-style Blade Fuse). This fuse link provides an additional safeguard that will prevent serious injury to the operator and protect the machine’s vital electrical components in the event that there is a short between the batteries. Picture to the left shows the Model B machine with the battery door.



The automotive-style fuse replaces the other two types. It is located in the in-line fuse link housing that is attached to the inside terminals of both batteries. If necessary, replacement fuses and fuse links are available from your Distributor. Always check for the correct type before ordering. Kegel recommends upgrading to the newer automotive-style link (Part Number 154-8421) if a replacement is necessary.



NOTE: Disconnect the battery charger from the batteries before replacing the fuse.

The lithium-ion XL (Extended Life) Batteries do not have this fuse link. Additional hardware, such as the U-BDI, is connected to the batteries as a protective device.

Battery Cycle Life

The Odyssey Batteries (AGM) are capable of 400 charge/discharge cycles to 80% depth of discharge (DOD). That is equal to doing 32 lanes once-a-day or 16 lanes twice-a-day for about a year (365 days). When the batteries are brand new they can complete a maximum of about 50 lanes on a full charge, depending on machine pattern settings. As the batteries age the maximum number of lanes per charge will tend to decrease.

The XL lithium-ion batteries are capable of 2000 charge/discharge cycles to 80% depth of discharge (DOD). That is equal to doing 32 lanes once-a-day or 16 lanes twice-a-day for about 5 years. Plus these batteries can run up to 80 lanes on a full charge when they are first put in service.

Battery life depends tremendously on the correct charging voltage so we can't say enough about monitoring your charging voltage.

Battery Charger

Charging with the IQ4 smart module

Located on the side of the charger is the IQ4 module which turns the charger into a three stage "smart" charger. The three stages and their voltages are:



Charging Stage	Min Voltage	Max	Light Activity
Bulk Charge	29.0	29.4	Rapid Flash
Absorption Charge	28.0	28.4	Slow Flash
Float Charge	27.0	27.4	Solid

The green light on the smart module will indicate the stage of the charger. For example, if you check the charging voltage with the green light is solid you should read 27.2 volts. The float voltage can vary from 27.0 to 27.4 and be normal.

There is a voltage check point in the back of the charger in case the voltmeter fails. Here is where you can plug your meter in to check voltage.

Green LED Indicator

The LED Indicator on the IQ4 informs the user as to the status of the battery and the charging stage. When first activated, the IQ4 will read the number of cells in the battery and indicate the voltage of the battery through a number of flashes.

- 6 flashes = 12 volt battery
- 12 flashes = 24 volt battery
- 18 flashes = 36 volt battery
- 24 flashes = 48 volt battery

After reading the battery, the IQ4 will initiate either a Bulk Charge or Float Charge depending on the battery's charge status. When the IQ4 is in the Bulk Charge mode, the green LED indicator will flash rapidly.

When the Bulk Charge is complete, the IQ4 begins the Absorption Charge. The LED Indicator will flash at a slower rate. When the battery charging is complete and the IQ4 begins the Float Charge, the LED will remain lit or solid green.

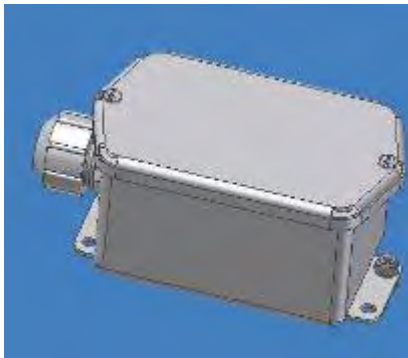
If, when first activated, the battery is not in need of charging, the IQ4 will immediately begin the Float charge and the LED will remain lit after it has counted the battery cells.

To improve battery life, always leave the machine plugged in and charging in a safe place when not in use.

Charging without the IQ4 smart module

Machines that do not have the IQ4 smart module plugged into the RJ-11 jack charge at one voltage only. The machines will have a jumper plugged into the jack and the charging voltage will be set at 28.2 volts. Without the jumper, the charger output defaults to 27.0 volts.

Constant Voltage Regulator (CVR)



The CVR is located under the PLC and relay plate. It maintains a constant 26.2 - 26.6 volts to the key components of the machine. It controls the drive motor, oil pump, sliding head motor, and buffer motor.

There is a voltage check point attached to the CR3 relay in case the voltmeter was to fail. Here is where you can plug your meter in to check the CVR voltage. The CVR is protected by an internal user replaceable fuse.

DO NOT attempt to adjust the CVR voltage unless authorized to do so by KEGEL!

Voltmeter

This machine is equipped with an LCD Volt screen and toggle switch. The toggle is a momentary on / momentary off spring-loaded switch. This means you have to hold the switch to the left to check the voltage from the CVR (constant voltage regulator) and hold it to the right to check the voltage from the batteries (or charger).



CAUTION: DO NOT check voltage when machine is operating on the lane, this could cause damage to the meter. It is best to do this test with a hand held volt meter at the available voltage check points.

It is recommended that you only use this screen as a troubleshooting tool. The far right digit will only read in even numbers.

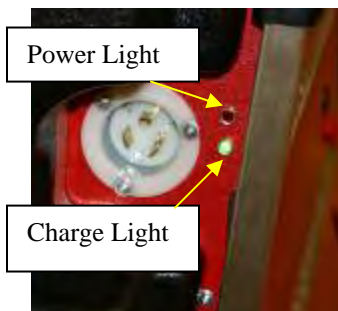
To use the voltmeter, press the toggle switch to the **right** and you will read the charger voltage when charging, unplug the charger and you can read the battery voltage.

Press the toggle switch to the **left** and you will read the CVR output voltage. The CVR voltage will always be at 26.2 - 26.6 volts unless the charger is plugged in.

If the charger is charging at a bulk voltage of 29.2 volts, the CVR voltage will read 28.8 volts (0.4 volts less than the supplied voltage).

It is recommended that you check the charging voltage daily. **The E-Stop will need to be turned on to check voltages. This is the only way to know if there is a possible charging problem before you get to the lanes. Do NOT check the voltage while the machine is running on the lane, damage will occur to the LCD Volt Screen.**

Indicating Lights



There are two indicating lights on the side of the machine next to the power cord inlet. The RED one will indicate the machine has AC power applied and the charger should be working.

The GREEN light will indicate the E-Stop is turned on and the machine is ready to run.

E-Stop



The E-Stop is located to the right of the charger and is used to remove battery power from the machine. The machine should always be turned off by the E-Stop during charging or maintenance.

When the E-Stop is pressed while operating on the lane the machine program will be zeroed and the machine will need to be returned to the foul line and restarted.

Running with the Power Cord

The machine can be run off the cord when there is a battery or charging problem, provided it is not the charger at fault. Before the machine is plugged in you will need to **unplug the jumper** for the IQ4 from the RJ-11 jack in the top of the charger. This will ensure that the machine will only get the 27 volt float charge and not the 29 volt bulk charge as a power source. The machine is ready to run and should perform like normal. ***Remember to plug the jumper or IQ4 back into the RJ-11 jack in the top of the charger before charging.***

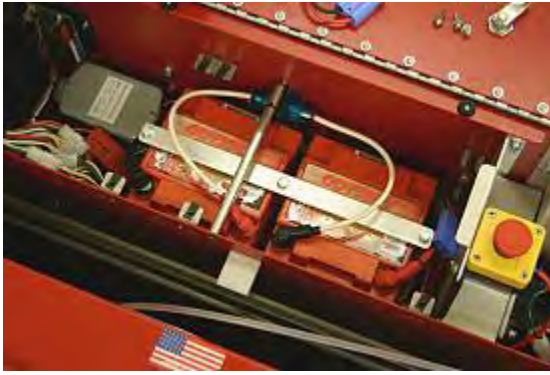
Replacing Batteries

Replacing the batteries is simple on models that have the rear compartment door. However, you should use great care whenever this job is being done.

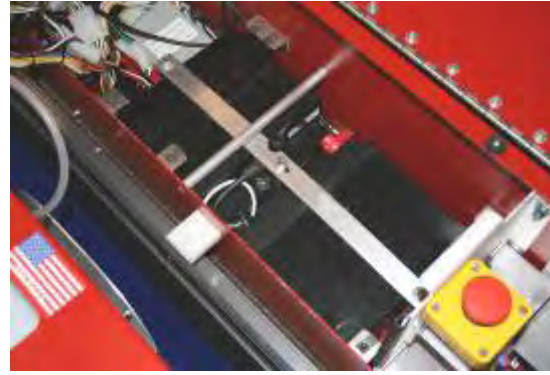
1. First, turn the E-Stop OFF. **Power to the machine must be turned OFF.**
2. Remove the fasteners on bottom of the machine and open the battery compartment.
3. Because the batteries are heavy, use caution when sliding them out of the machine. Do not apply downward pressure! Secure the machine so it can't fall over from improper weight balance.
4. Remove the fuse link first using a 10 mm socket. The fuse link is used as protection on the Odyssey batteries only. Once removed, this will disable both batteries.
5. Remove the negative wire on the left battery and then remove the positive wire on the right battery.
6. Remove the mounting hardware.
7. Remove batteries. **BE CAREFUL!** Each regular battery weighs about 26 lbs.



8. After replacing batteries and mounting hardware, hook batteries up in the reverse order; putting the fuse link in last. Be certain not to over-tighten battery terminals but make sure they are tight. Bad connections at the batteries will cause operating problems and may simulate dead batteries.
9. Close compartment door and replace the fasteners, making sure all bolts are tight.
10. Set the machine down and turn power on to check the charger and battery voltage.



Odyssey Batteries with original Fuse Link



Extended Life Batteries without Fuse Link

Replacing both types of batteries in machines without the Battery Door

1. First turn the E-Stop OFF. **Power to the machine must be turned OFF.**
2. Remove the charger plate and unplug the charger from the machine.
3. Remove the PLC plate and set it in the brush compartment.
- 4a. To disable the batteries, remove the fuse link between the Odyssey (AGM) batteries using a 10 mm socket. Go to step 4b if your machine has XL batteries.
- 4b. The XL batteries have two cables instead of the fuse link; one runs to the Battery Discharge Indicator (BDI) and one is connected between the two batteries. Both of these cables need to be disconnected from the batteries.
5. Remove the negative wire on the left battery and then remove the positive wire on the right battery.
6. Remove the mounting hardware and then remove both batteries. **BE CAREFUL!** The AGM battery weighs up to 26 lbs.
7. After replacing batteries and mounting hardware, hook batteries up in the reverse order putting the Fuse Link (regular batteries) or BDI & Communication cables (XL batteries) in last. Do not over-tighten battery terminals but make sure they are tight. Bad connections at the batteries will cause operating problem and may simulate dead batteries.
8. Replace the PLC plate taking care to not pinch any wires under the mounts.
9. Replace battery charger and also make sure all plugs are secure and the wires do not get pinched. Turn the machine on to check charger and battery voltage.

NOTE: *It is always a good idea to inspect all battery connections any time you are in this compartment. Refer to troubleshooting for a list of check points.*

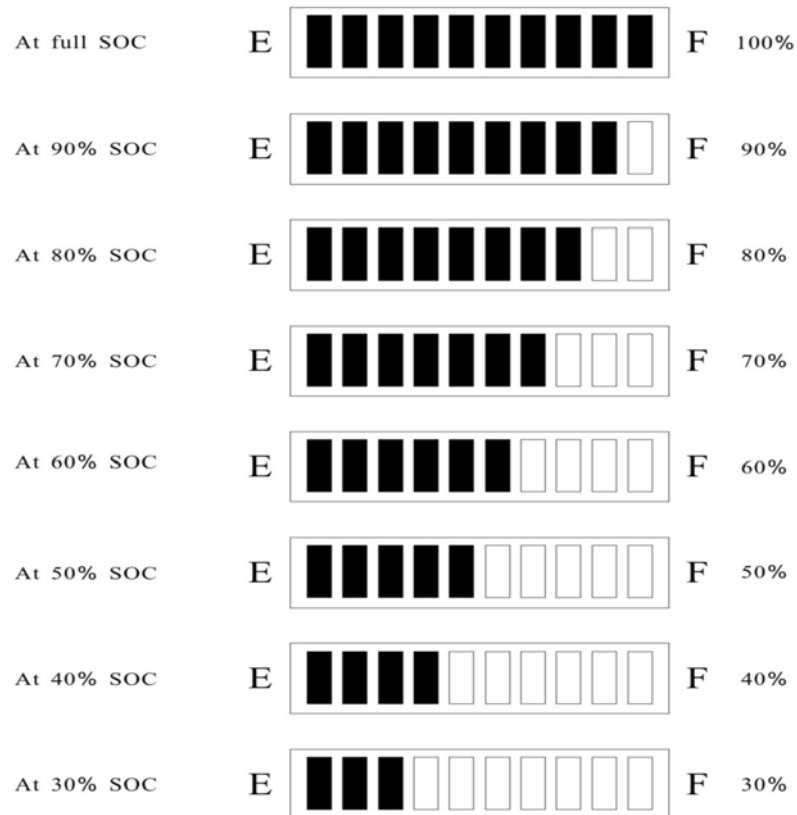
XL Battery Discharge Indicator (BDI)

The BDI performs the following functions on the **Extended Life Batteries** (not used on regular AGM type batteries):

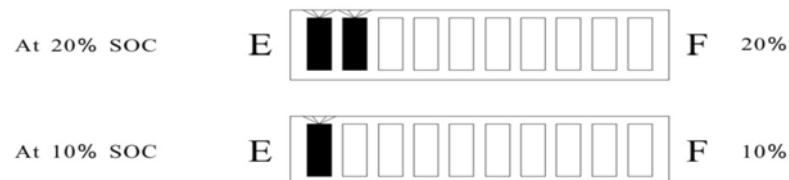
1. State-of-Charge (SOC) Indication
2. Charging Indication
3. Error Indication
4. Engages Pack to Pack State-of-Charge Equalization

The BDI functions in the following modes:

1. **Normal Use Mode:** When the XL battery packs are being discharged, the LEDs will show the state of charge of the battery packs.



NOTE: AT 20% SOC AND LESS, WHICHEVER DISPLAY LIGHTS ARE ON WILL ALSO FLASH.



2. **Charging Mode:** When the XL battery pack is being charged, the BDI LEDs will indicate charging by sequentially flashing from the lowest LED to the present state of charge. When the battery packs are fully charged, the BDI will indicate 100% State-of-Charge by illuminating the furthest right LED.

Troubleshooting Battery & Charging Problems

Battery problems are not fun, no matter what piece of equipment you are using. It is a fact of life you will experience battery problems, but to have a lane machine that has no cord..... it may be something we can live with.

Battery connections can be very deceiving. You can read voltage on a fully charged battery, but just as soon as a load is introduced, it's gone. So when it comes to 24 Volt battery connections you must have nothing less than perfect connections! Here are a few things that can cause battery or charging problems.

The last thing you want your machine to have is.... loose connections...

Loose connections are the number one cause of charging and operating problems. Here is a list of all of the locations between the batteries and the machine control plate.

Always turn OFF E-Stop when inspecting connections.

1. Battery terminals (4 locations).
2. Fuse link between AGM batteries.
3. Colored connector between charger and batteries.
4. Screw terminals in back of charger (positive and negative).
5. Fuse mounts in back of charger.
6. Red plug between batteries and PLC plate.
7. Terminal junction block on back of PLC plate.
8. Terminal junction block jumpers.
9. E-Stop.

Machine will not run on batteries or cord.

Voltmeter shows charger is output is 27.2 volts but batteries are dead. It is possible for the voltmeter to show proper charging float voltage but the connection is not good enough to operate machine or charge batteries.

1. Loose connection between the two batteries or fuse link is the most common cause.
2. Bad Fuse.
3. Loose connection between charger and batteries.
4. Loose battery terminal. Check ALL connections.
5. Faulty charger and/or dead batteries.

Machine runs but the number of lanes have been reduced or are reducing.

Any time this occurs the charging voltage should be monitored daily to determine if the charger is working 100% of the time.

1. The charger voltage is incorrect or is set too low. Check voltage and refer back to adjustments in this section.
2. Charger operates intermittently. Battery charger has internal bad connection.
3. Vacuum is drawing more amps.
4. Machine run time is longer.
5. Possible bad connection between charger and batteries.
6. Possible battery problem.

Batteries are not charging.

Charger shows no output voltage.

1. Charger has failed.
2. Blown fuse in back of charger.
3. Open or very bad connection between charger and batteries.

CVR is not working.

1. Fuse blown inside CVR.
2. CVR is unplugged.
3. Bad connection to CVR
4. CVR has failed.

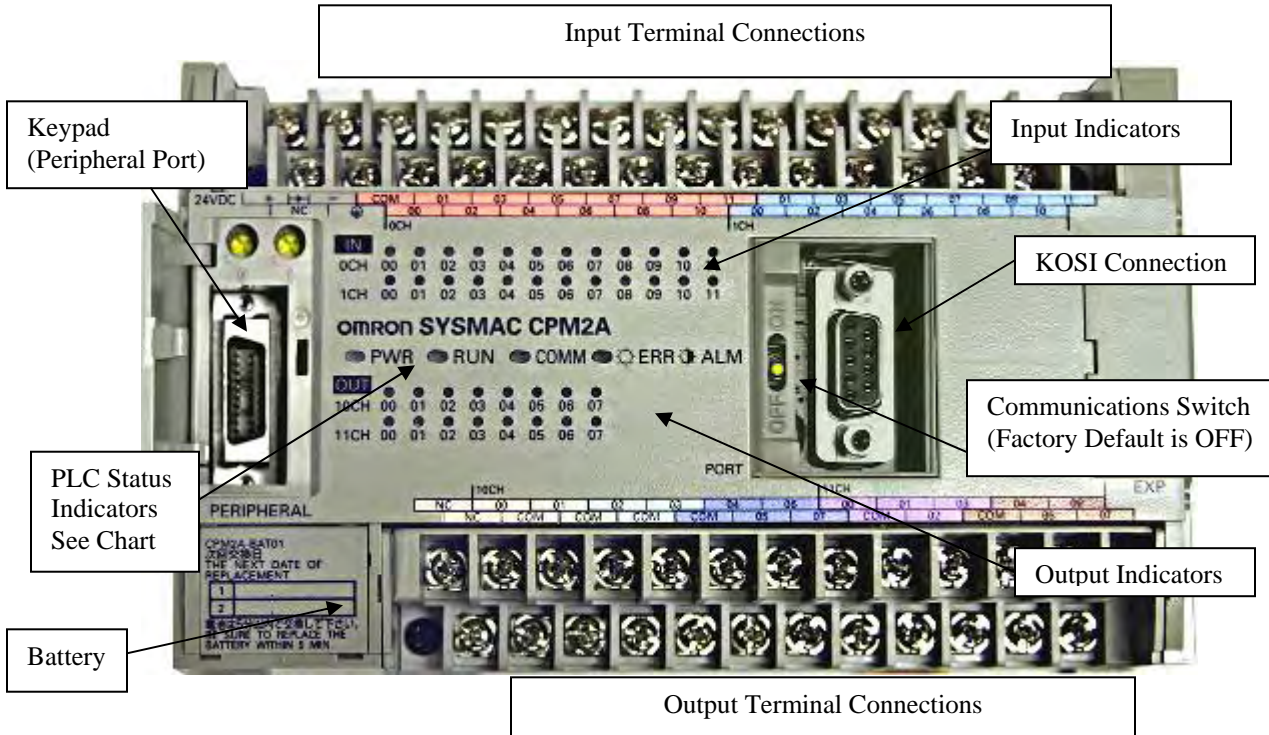
CVR not maintaining set voltage.

1. CVR has failed. It may operate the machine, but not as designed.

CHAPTER 6

Computer and Control Relays

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.

Inputs and Testing

The PLC assembly of the machine has 24 inputs and 16 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	VIOLT / YELLOW
0CH 06	DRIVE SHAFT TACHOMETER PROX SENSOR	BLACK / BLUE
0CH 07	LANE DISTANCE PROXIMITY SENSOR (LDS)	WHITE / PINK
0CH 08	START BUTTON (HANDLE)	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

The following three Inputs are programmed to be a redundant back-up to the Input shown above. In an emergency, these Inputs can be used by activating them with a jumper wire. Call Tech Support at 863-734-0200 for assistance.

These Inputs are designated on the PLC as:

<u>INPUT</u>	<u>DESCRIPTION:</u>
1CH 06	BACK-UP PROGRAM RESET
1CH 10	BACK-UP RESET FOR DUSTER
1CH 11	BACK-UP DUSTER INCREMENT FUNCTION

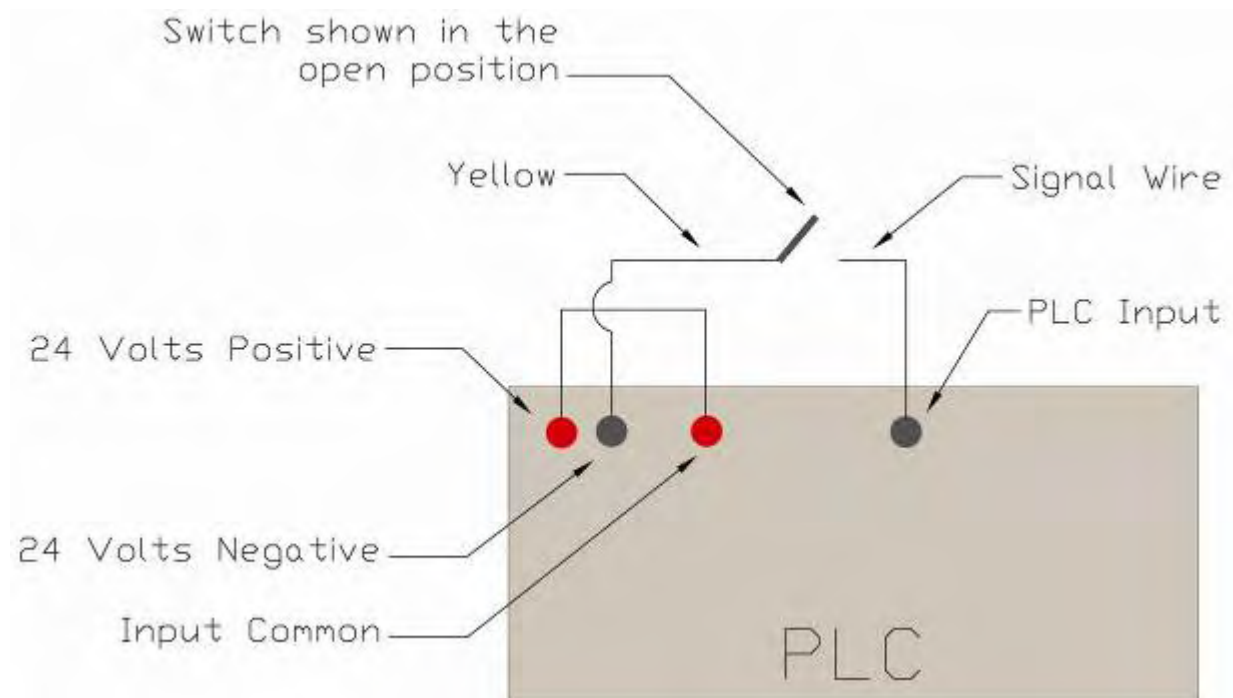
Inputs and Testing Continued...

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

The first one shown below is an example of a typical input circuit using a microswitch. One side of the microswitch goes to the PLC Input and the other side of the microswitch 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.

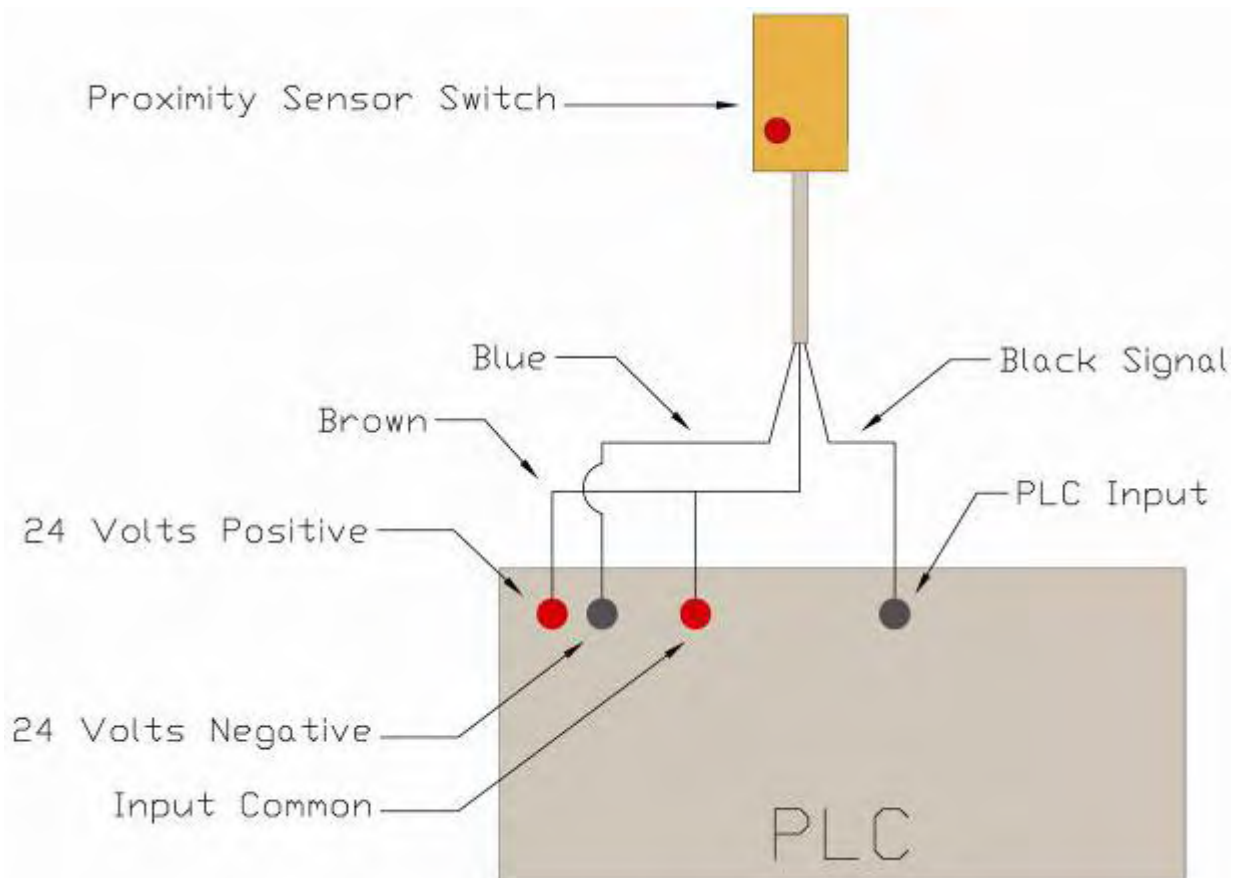
All of the machine switches are wired like this. The only difference is that the wires will pass through plugs and junction blocks.



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 machines' Proximity Sensor Switches are wired like this; the only difference is that the wires will pass through plugs and junction blocks.



Outputs and Testing

Here is a list of the **OUTPUT** numbers for the PLC along with their Test Output number, wire color and designations:

<u>OUTPUT</u>	<u>TEST #</u>	<u>DESCRIPTION</u>	<u>WIRE COLOR</u>
10CH 00	#08	OIL PROGRAM CONTROL VALVE	ORANGE
10CH 01	#02	SR1 SPEED RELAY	WHITE / RED
10CH 02	#01	FORWARD DRIVE	GREEN / ORANGE
10CH 03	#03	REVERSE DRIVE	YELLOW / VIOLET
10CH 04	#04	SR2 SPE ED RELAY	WHITE / GREEN
10CH 05	#05	SR3 SPEED RELAY	BLACK / PINK
10CH 06	#06	SR4 SPEED RELAY	YELLOW / ORANGE
10CH 07	#10	OIL PUMP	RED / BROWN
11CH 00	#17	LEFT TO RIGHT OIL HEAD DRIVE	GRAY
11CH 01	#16	RIGHT TO LEFT OIL HEAD DRIVE	YELLOW / RED
11CH 02	#09	BRUSH LIFT MOTOR	WHITE / BLACK
11CH 03	#11	SQUEEGEE MOTOR	BLUE / WHITE
11CH 04	#12	DUSTER UNWIND	GREEN / BLUE
11CH 05	#13	DUSTER WINDUP	GREEN / RED
11CH 06	#15	CLEANER PUMP MOTOR	BLUE / YELLOW
11CH 07	#14	VACUUM MOTOR	BLUE / BLACK

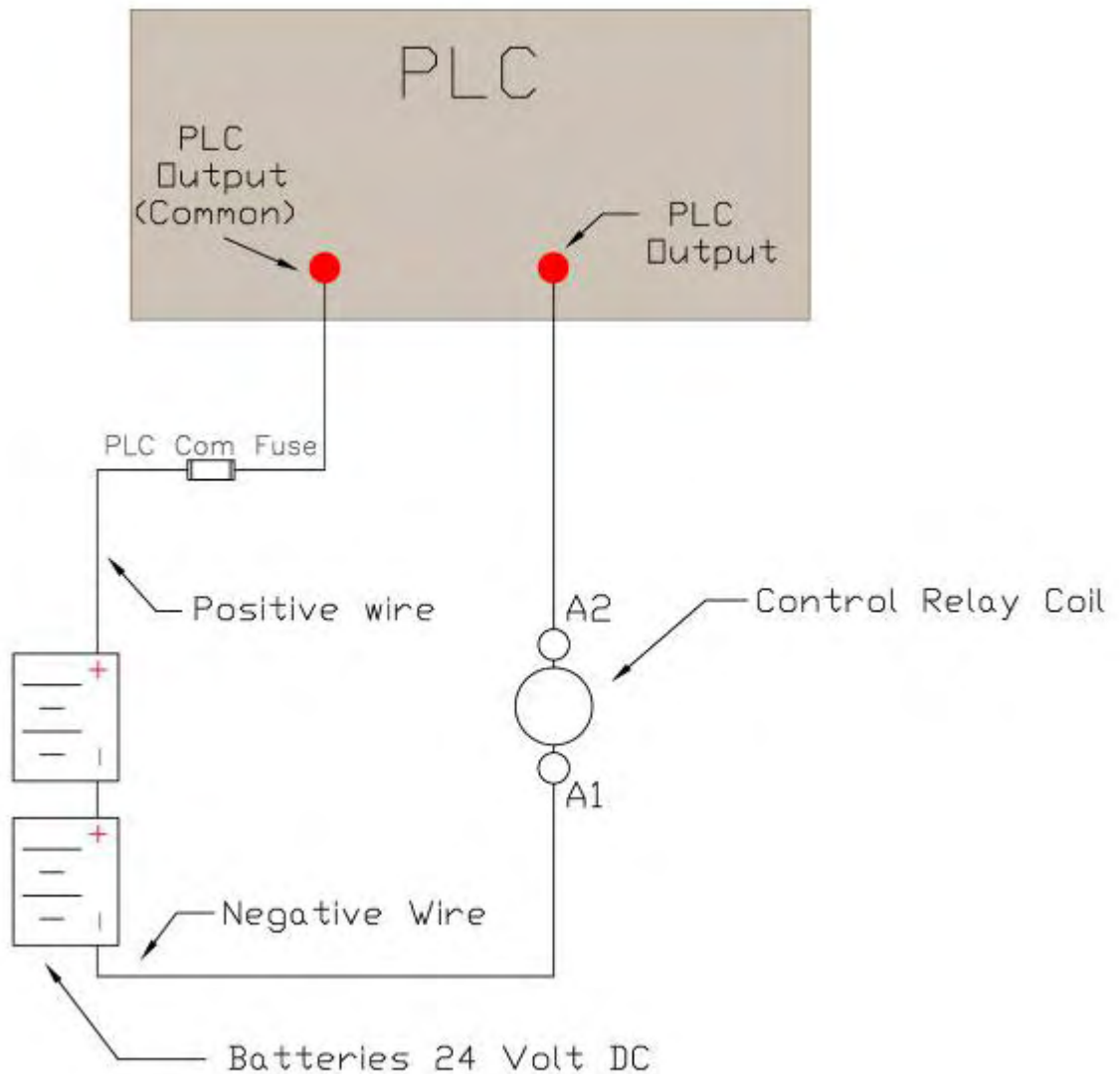
NOTE: The **Buffer Motor** does not have a direct output that operates its relay. The buffer motor relay operates when the brush down switch (Normally Open) contacts close, when the Oil Pump Relay turns on, and when either of the Forward or Reverse Relays turn on.

NOTE: Test Output #07 not listed above is a combination of output 10CH 05 and 10CH 06 turning on to operate the drive motor in high speed.

Testing

Here is an example how the PLC output is wired to the isolation Control Relay. When the PLC output turns on the control relay coil 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



Mounted on the control plate are several slow-blow fuses and a circuit breaker to protect your ION.

- PLC Power Fuse - 0.5A (PLC Input Power / L1)
- PLC Common Fuse - 0.5A (PLC Output Common)
- Vacuum Motor Circuit Breaker - 20A (*Some models used a Fuse*)
- Conditioner Pump Fuse - 4A (Oil Pump Motor)
- Squeegee Lift Fuse - 3.2A
- Duster Windup Fuse - 3.2A

- Drive Motor Fuse - 7.5A
- Buffer Fuse - 10A
- Oil and Cleaner Head Fuse - 0.75A (Head Motor)
- Cleaner Pump Fuse - 3.2A
- Brush Lift Fuse - 3.2A
- Duster Unwind Fuse - 3.2A

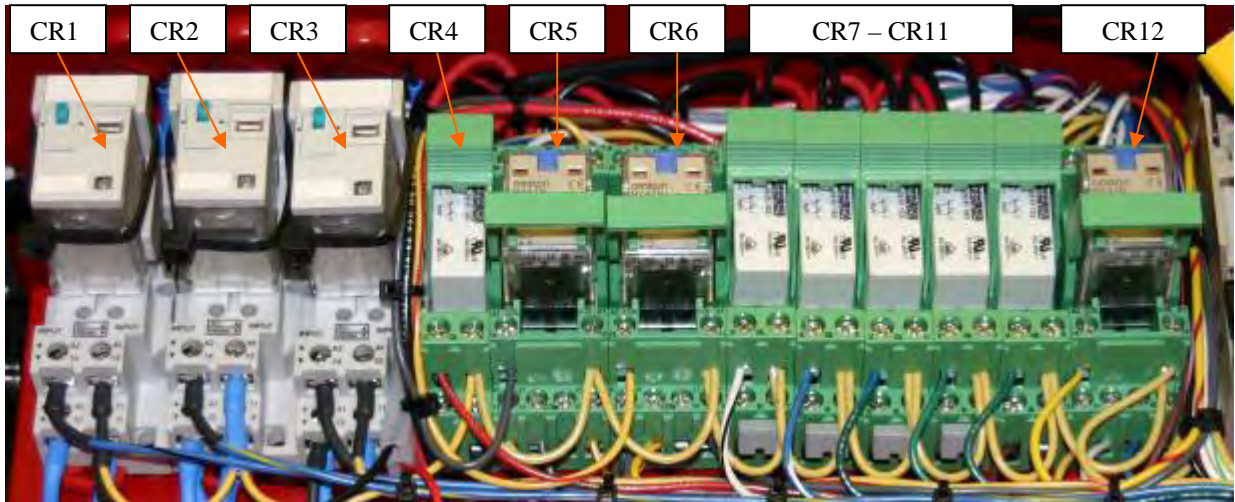
Mounted on the Odyssey batteries is another fuse to protect your ION.

- In-line Fuse between AGM Batteries - 40A (Not used on XL Batteries)



Do not over-amp fuses. If you can't find the direct replacement you will cause damage to the smaller motors.

Control Relays



All of the components on the Kustodian ION are isolated from the PLC (except for the Oil Control Valve since the PLC operates it directly). When we say isolated, we mean 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 internal PLC relays.

The machine has 12 replaceable control relays that operate ALL the motors of the machine and 4 speed control relays that are not replaceable. (Speed relays can be replaced, but not easily.)

Control Relays 1 - 4 & 7 - 11 are two-pole | **Control Relays 5, 6, & 12** are four-pole relays.

- **CONTROL RELAY 1:** Vacuum Motor
- **CONTROL RELAY 2:** Cleaner Pump Motor
- **CONTROL RELAY 3:** Buffer Motor
- **CONTROL RELAY 4:** Oil Pump Motor and Buffer Motor
- **CONTROL RELAY 5:** Oil/Cleaner Head Motor (Left to Right Direction)
- **CONTROL RELAY 6:** Oil/Cleaner Head Motor (Right to Left Direction)
- **CONTROL RELAY 7:** Brush Lift Motor
- **CONTROL RELAY 8:** Squeegee Lift Motor
- **CONTROL RELAY 9:** Duster Unwind Motor.
- **CONTROL RELAY 10:** Duster Windup Motor.
- **CONTROL RELAY 11:** Forward Operation of the Drive Motor & Buffer Motor.
- **CONTROL RELAY 12:** Reverse Operation of the Drive Motor, Buffer Motor, and reverses the voltage to the Cleaner Pump (to prevent drips).
- **OPERATION TOGGLE SWITCH:** This switch controls whether the program will CLEAN only, CONDITION only, or CLEAN and CONDITION at the same time. The machine will NOT calibrate the Pump Output if switch is set to CLEAN ONLY.



Troubleshooting

Visit www.kegel.net or call KEGEL Tech Support at 863-734-0200.



CHAPTER 7

Kegel On-line Support Interface

Using KOSI on your Computer

Specially developed software called KOSI (Kegel On-line Support Interface) is provided with the Kustodian Ion. A complete set of instructions is included in the software. This Chapter outlines the desktop version of KOSI for the machine.

You can also purchase Pocket KOSI to have the power and convenience of this software in the palm of your hand. A Dell™ Axim™ X51 PDA is available for an additional charge (Part Number 154-8721).

And to “cut the cord” entirely, you can also purchase an optional Bluetooth® wireless adapter (Part Number 154-8751) for your KOSI. This specially-designed component connects to the PLC to provide wireless communications to your Bluetooth® enabled device.

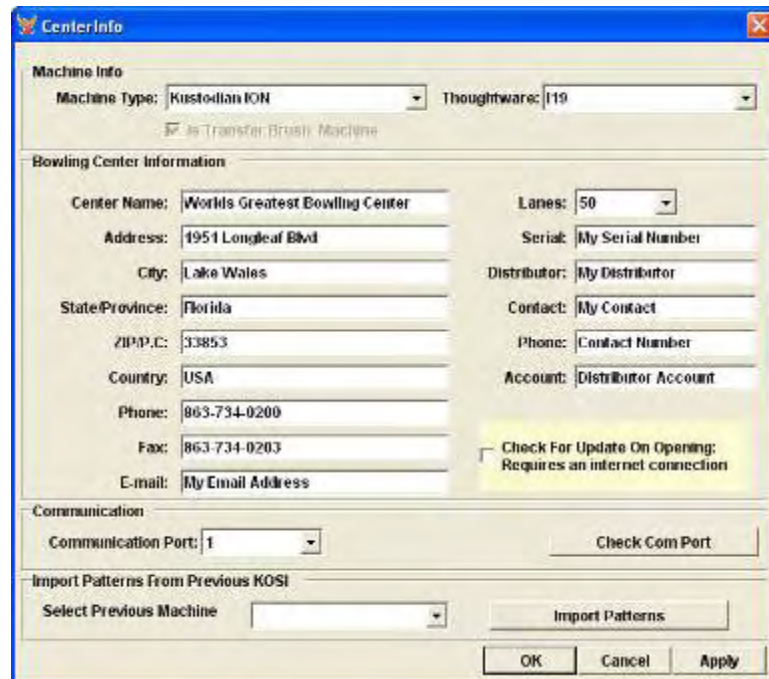
Refer to the instructions to load KOSI software on your PC or laptop. When the software is loaded you will need to select **Center Information** from the Main Screen when you open the software. Select the **Machine Type** and **Thoughtware** from the pull-down boxes and fill in the rest of the information. After selecting the Machine Type, the Main Screen will display Kustodian Ion.



Center Information Menu

The **Center Information** screen is used to:

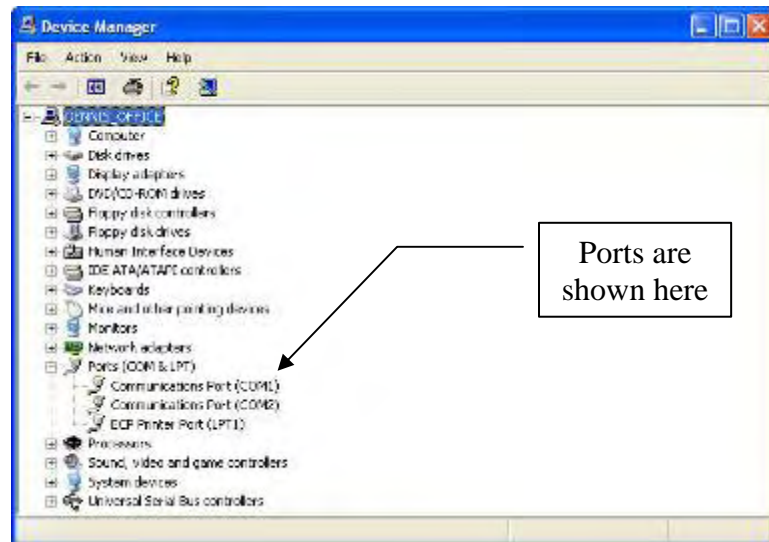
1. Select your lane **Machine Type** from the drop-down box.
2. Select the **Thoughtware** in your lane machine from the drop-down box.
3. Enter your **Center Name, Address, etc.**
4. Always enter the correct number of **Lanes** in your center. This number must match the number of lanes you set in your machine's PLC.



5. Set KOSI to check the internet for Application Updates. Leave this checked **ONLY** if you are always on the internet. Leave unchecked to make your application open faster without checking for updates.

6. Set your Serial **Communication Port** number. If you are not sure what the number is, click on **Check Com Port** to find your Com Port number

7. The Com Port number will be listed under the **Ports** list. If you are using a USB to Serial adapter, the USB to Serial adapter will be listed under Ports, along with the number it is using. **IMPORTANT:** The Port number used by the USB to Serial adapter could change if you plug the adapter into a different USB port.



8. **Import Patterns** from 5.x version of KOSI after you **Select Previous Machine** from the drop-down list.

Pattern Designers Menu

The **Pattern Designers** menu has four options.

1. **Novice Designer** screen is used to:

1. Select a pre-defined pattern to send to your lane machine based on the following criteria.

a. Type of Pattern (choose one)

i. **House Pattern**

ii. **Tournament Pattern**

iii. **Sport Pattern**

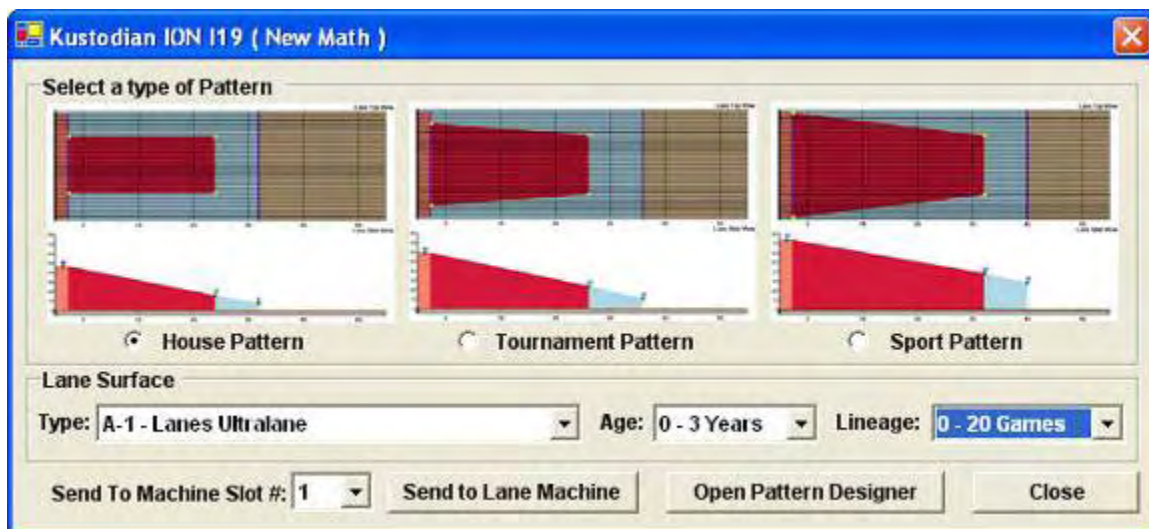
b. **Lane Surface Type** (select from drop-down box).

c. **Age of Surface** (select from drop-down box).

d. Amount of **Lineage** expected to be bowled on the pattern.

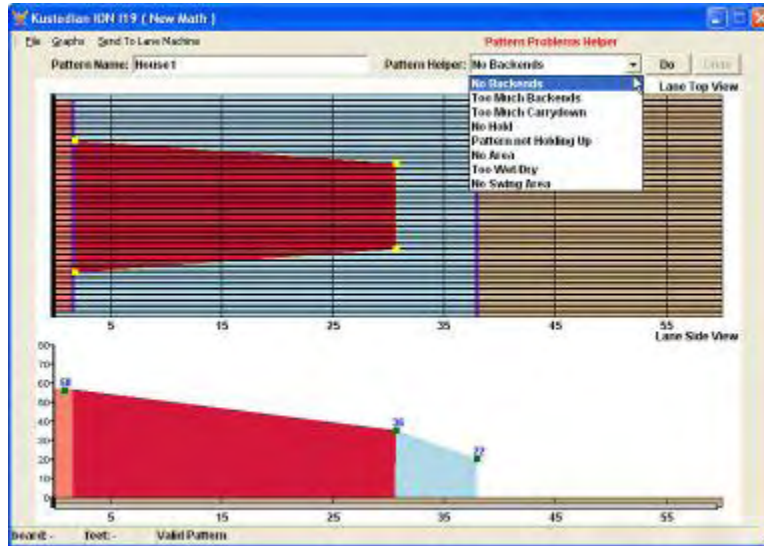
2. **Send** the pattern to your lane machine for the selected PLC Program **Slot**.

3. **Open** the selected pattern in the Graphical Designer or you can select **Close** to exit the screen.



2. The **Graphical Designer** has three pull-down menus. This screen is used to:

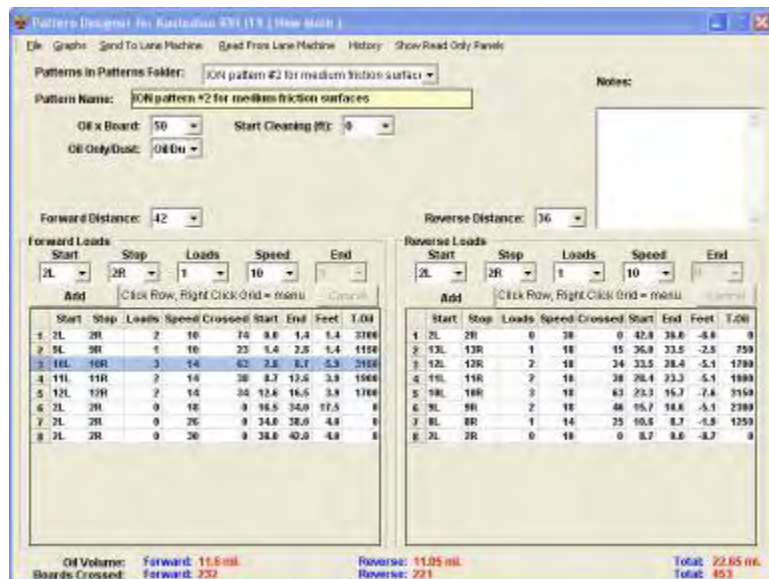
1. Create a **New** graphically-designed pattern.
2. **Open** pre-defined patterns designed in the Graphical Designer.
3. Adjust patterns opened from the Novice Designer.
4. Make adjustments to any graphically-designed pattern by selecting and dragging the yellow or green handle points on the graph with your mouse pointer. You can also select and drag the purple vertical bar to change overall pattern length.
5. View and/or Print 3 types of **Graphs**.
6. **Send** the pattern to the desired program **Slot #** in your lane machine.



The **Pattern Problems Helper** provides a “wizard” to suggest possible adjustments that should help improve your condition. Select a description of the problem from the pull-down menu and then select the **Do** button to apply the change. Select **Undo** to reverse the previous Pattern Problem Helper modification.

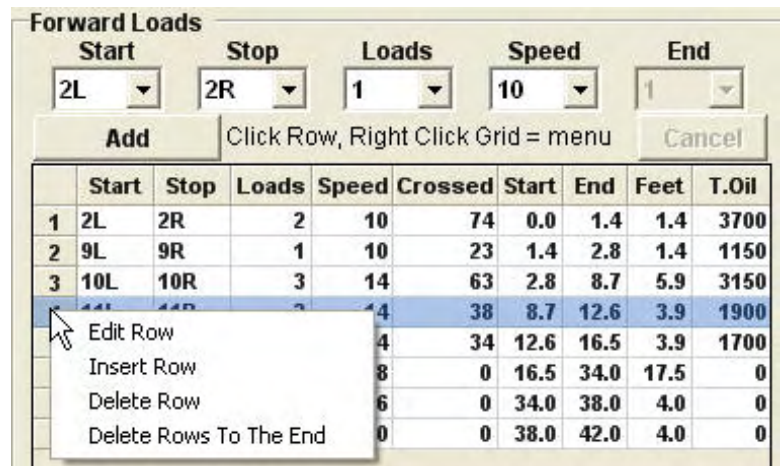
3. The **Advanced Designer** screen is used to create a **New** pattern with exact settings, **Open** an existing pattern to make an adjustment, and **Save** the pattern.

To make an adjustment, select a row to modify and then “Right Click” on the row (using the right button on the mouse) to display the Action Menu.



From the Action Menu you can **Edit, Insert, and Delete Rows**. The label on the button below **Start** will change based on the selected action from the pop-up menu box.

To **Edit** the row, choose the desired row then select **Edit Row**. This will move the data for that row into the pull-down boxes at the top of the screen.



Modifications can be made to the **Start** board, **Stop** board, number of **Loads**, travel **Speed** (in IPS) and the **End** distance from the pull-down boxes on top of the screen.

Once the changes are made select the **Edit** button (below the **Start** board) to apply the change.

A row can be inserted into the pattern by selecting **Insert Row** from the Action Menu. The settings chosen in the drop-down boxes will create a new load in the pattern. Check all load screens when you insert a load to make sure speeds flow evenly and that the pattern settings update properly.

When the screen first appears the **Add** button is present. This adds rows to the end of the pattern, but this is only allowed if the travel distance has not been reached by existing load screens and if there are no Zero Load screens present in the pattern. To add a row, choose the data for each pull-down and select the **Add** button. The **Add** button will appear when the **Cancel** button is selected.

When the Action Menu is selected on a row, the **Delete Row** and **Delete Rows To The End** are active and will complete the command when chosen.

The **Advanced Designer** screen is also used to:

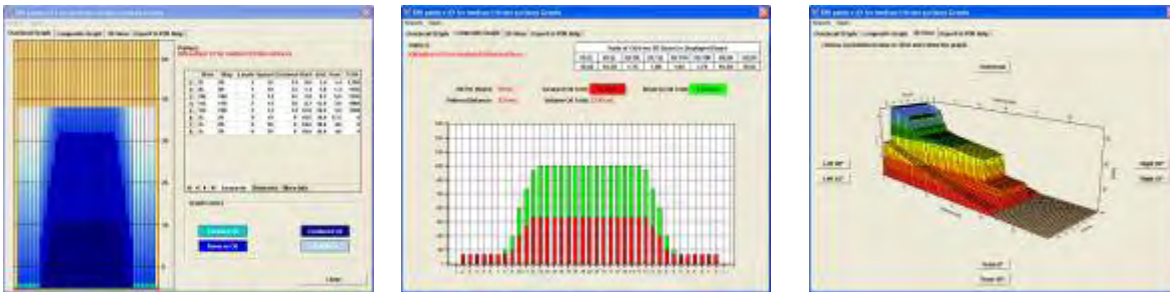
- **View** and/or **Print Graphs**.
- **Send** patterns to a specific **Slot #** in your lane machine's PLC.
- **Read** patterns from your lane machine.
- View **History** of downloaded patterns.
- **Show Read Only Panels**.

The **Show Read Only Panels** are used as a reference point to see existing settings when editing the **Forward** and **Reverse Grids**. You can also view inside to outside **Ratios** of applied conditioner and see the **Composite Graph** for the pattern. To exit one of these panels simply click in the Title Bar and it will disappear.

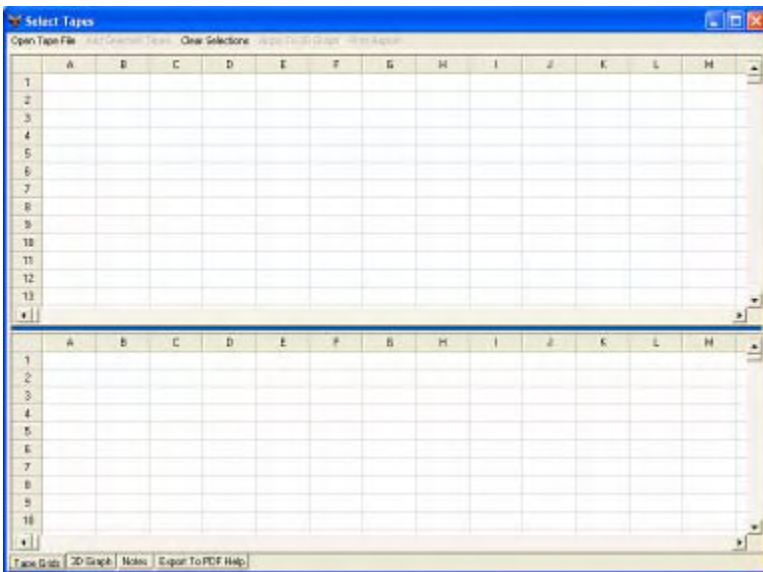
Three types of **Graphs** can be viewed and printed from the Advanced Designer menu. The **Overhead**, the **Composite**, and the **3D** views are included. Select one view from the pull-down menu and the software will generate a screen with tabs across the top for each graph type (and a **Help** screen for exporting a report).

The type of graph you selected will appear in a new window. To print a report showing the Overhead and Composite graph, along with the pattern settings, select **Report** and choose **Standard Report**. A new window will open with the Report for that pattern.

The **3D Graph** does not print, but you can change the orientation of the view with the buttons on that screen. There is also a template for making reports in the **Report** menu. These can be used to provide league reports or prepare media kits.



To exit the **Graphs** window, select the **Close** button on the **Overhead Graph** tab.



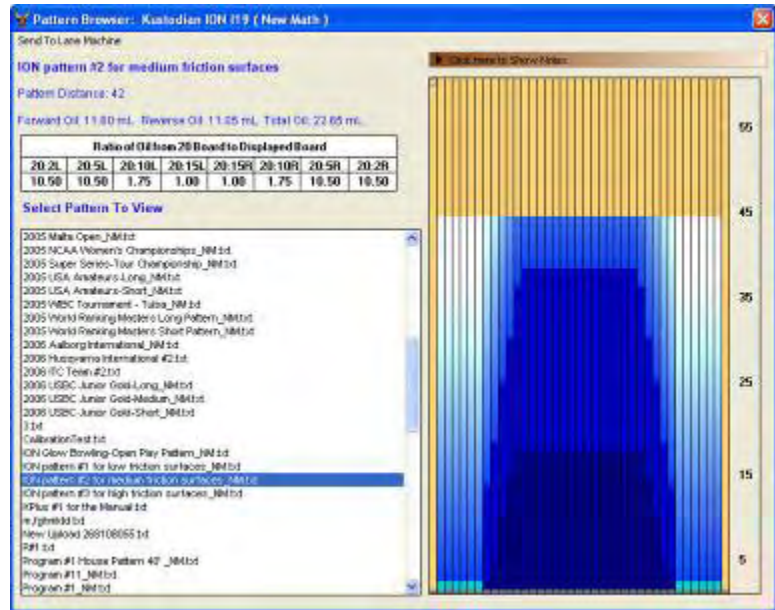
The **Tapes** menu allows you to import tape data from your Lane Monitor™ files and create graphs in KOSI. Once you select **Tapes**, a new window opens and you can **Open Tape Files** from here. Tabs along the bottom of the screen allow you to see it in a **3D Graph** and make **Notes**. Once a tape is loaded, you can **Add Selected Tapes**, **Clear Selections**, Apply the tape data to a **3D Graph**, and **Print Reports** from the pull-down menus.

4. The **Pattern Designers** menu also includes a **History** menu to provide a record of patterns that have been downloaded to the lane machine's PLC.



Pattern Browser Menu

The **Pattern Browser** screen is used to quickly select and **View** the overhead graph of your pattern and **Send** the displayed pattern to one of your lane machine's PLC slots.



System Menu

The **7 Day Planner** is used to set specific programs to run during two different time periods on each day of the week. This menu is accessed from the pull-down **System** menu.

The current programs in the machine can be uploaded from the PLC by selecting the menu **Settings** and then **Read Settings**. The screen will display the current programs in the machine when KOSI is connected to the PLC.

To change a program, select the appropriate number to run on the days and times shown from the drop-down boxes. The machine will accept different programs for AM and PM for each day of the week.

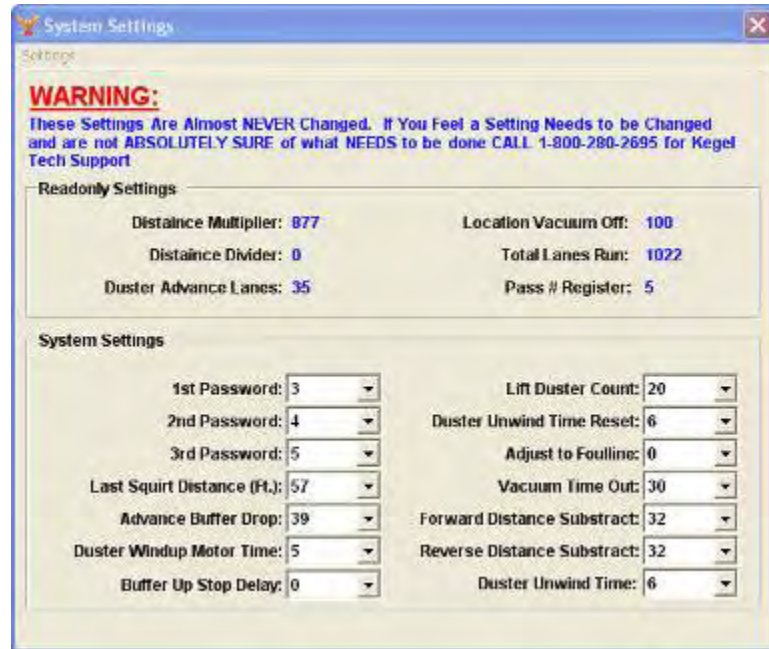
When the programs are correct, select the menu **Settings** and then **Send Settings** to download the new programs to your Ion (when KOSI is connected to the machine's PLC).

The **System Settings** screen, located under the **System** menu, is used to quickly modify some settings that are hardly ever changed. This screen is typically used only when the PLC Thoughtware is refreshed or upgraded.

CONTACT KEGEL if you are not absolutely sure about what effect a change to these settings will cause.

When connected to the machine, the operator can **Read/Save Settings** to a file for future use.

After the PLC is updated, the **Load Settings** will open the saved file. Then the **Send Settings** can be used to download the original settings back into the machine's PLC.



The **Kegel Utilities >** screen is used to **Clear** the PLC of all Thoughtware and program data and install a new operating program (i.e. Thoughtware version I19). *This must be done with the help of a KEGEL technical support representative.*

Before a PLC upgrade or refresh is performed the PLC must be cleared. A **Response Code** (available only from KEGEL) is required to clear and download new Thoughtware into the Ion.

When the machine is connected, the operator should select **System** and then **Kegel Utilities >**. The pull-down menu expands to a pop-up showing the available operating programs for the lane machine and an option to **Clear** the PLC.

After the PLC is cleared, select the Thoughtware version to download.

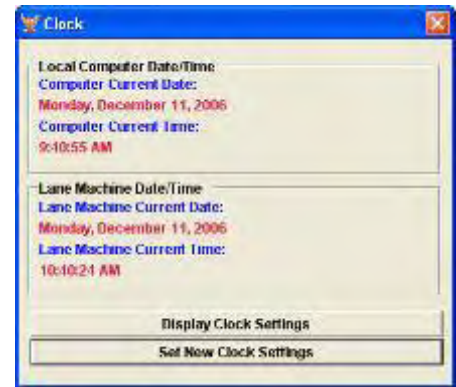
The screen will appear with a **Challenge Code** and a space for the **Response Code**, just like it did to clear the PLC. Enter the **Response Code** provided by the KEGEL technician and select **Start Download** to begin writing data to the PLC.



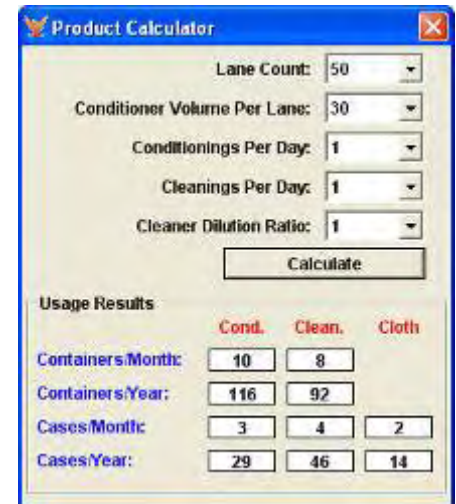
The **Clock** screen is used to quickly read and set the clock in the lane machine's PLC. The date and time of your computer is used to set the clock in the PLC.

Select **Display Clock Settings** to read the data from the PLC.

Select **Set New Clock Settings** to write the time and date information back to the PLC.



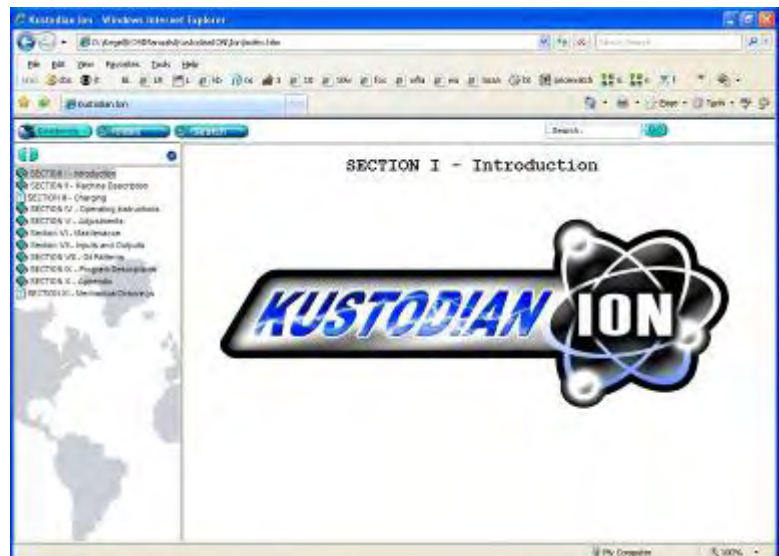
The **Product Calculator** is used to estimate the amount of **Conditioner**, **Cleaner**, and lane cleaning **Cloth** required for your center. Simply enter the values from the drop-down boxes to determine how much product you will need for the month and the year.



Manuals Menu

KOSI includes an electronic version of the Operators Manual and maintenance videos for the machine. These can be accessed from the **Manuals** menu by selecting **Electronic Manual** or **Maintenance Videos**.

When KOSI is first loaded on your computer the Operators Manual is included, but the option to load the Videos must be selected. These are not loaded as the default due to the space requirements for them. If they are not installed, the KOSI CD must be inserted into the CD drive on your computer to access the videos.



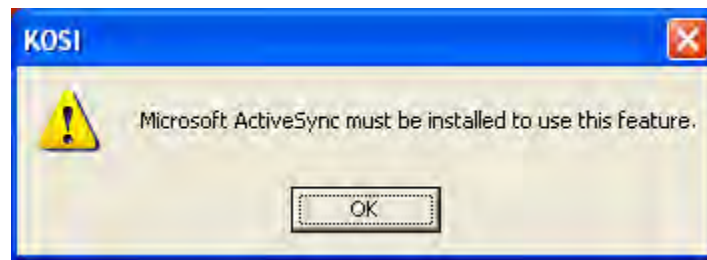
NOTE: You must use *Microsoft Internet Explorer* to view the videos.

An index of the videos will appear in a new window titled **Video Training**. Select the video you want to watch and it will begin playing with the default program on your computer.

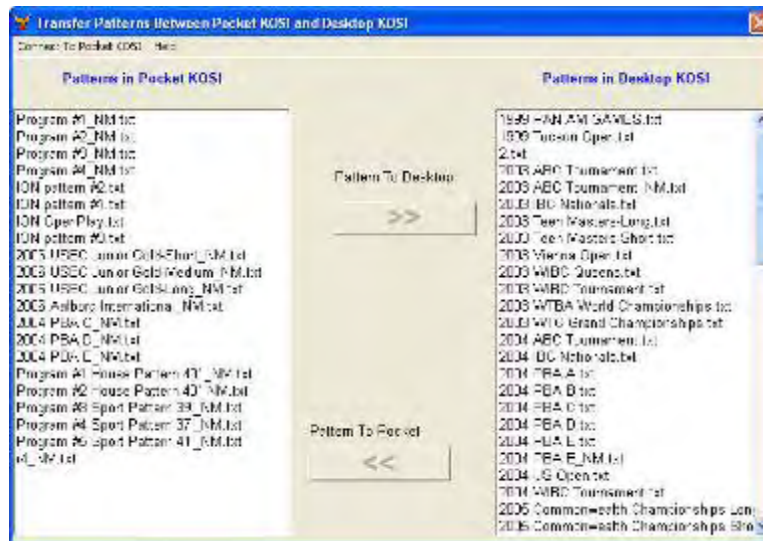
Pocket KOSI Menu

The **Pocket KOSI** menu is used to transfer patterns between your Pocket KOSI (Dell™ PDA) and your personal desktop computer or laptop.

In order to use this feature, your personal computer will need to have a program called “ActiveSync” loaded. If KOSI does not find this program you will be prompted to load it.



When the **Pocket KOSI** menu is selected, a window will open and show patterns that are loaded in each application. If you select a pattern from the list on the left and then select **Pattern To Desktop**, the application will transfer that pattern from your Pocket KOSI to your desktop computer (or laptop). If you select a pattern on the right and select **Pattern To Pocket**, you will transfer the pattern from the personal computer or laptop to the PDA.



Lane Tapes Menu

The **Lane Tapes** menu allows you to import tape data from your Lane Monitor™ files and create graphs in KOSI. This menu was described earlier in the **Advanced Designer** menu.

Help Menu

The **Help** menu provides several tutorial videos and general information about KOSI. Detailed instructions for using the **Pattern Designers** are included as videos in this menu. Make your selection from the pull-down menu to open it up a new window.

About Menu

The **About** menu provides the **Version Info** for KOSI and **System Info** about your computer. This may be needed to trouble-shoot your application. Check the KOSI version periodically to make sure you are working with the latest updated version (if you are not automatically checking for updates).

Contact Kegel for more information about purchasing Pocket KOSI and the Bluetooth® wireless adapter that is now available for your Kustodian Ion.

CHAPTER 8

Mechanical Drawings

Machine Descriptions and Part Numbers

The following figures show major systems and their associated parts:

Figure 1 – Kustodian ION B (Top View)

Figure 2 – Kustodian ION B (Bottom View)

Figure 3 – Kustodian ION B (Left View)

Figure 4 – Kustodian ION B (Right View)

Figure 5 – PLC Plate Assembly

Figure 6A– Voltage Regulator and Regular Battery Assembly

Figure 6B – Voltage Regulator and Extended Life Battery Assembly

Figure 7 – Transfer Assembly One-Piece

Figure 8 – Conditioning Assembly

Figure 9 – Brush Lift Assembly

Figure 10 – Lane Distance Sensor Assembly

Figure 11 – Cleaner Assembly

Figure 12 – Squeegee Assembly

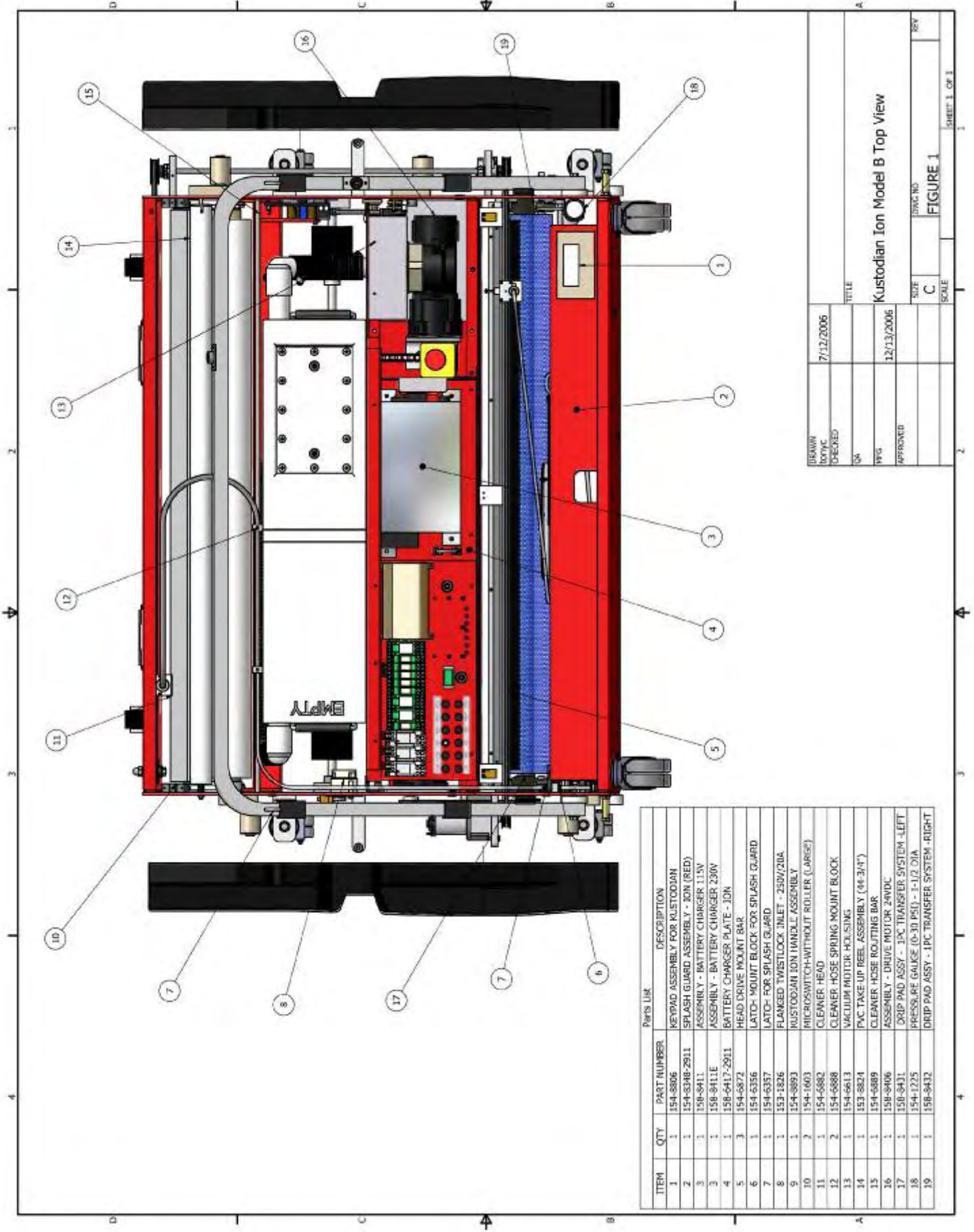
Figure 13 – Vacuum Assembly

Figure 14 – Duster Assembly

Figure 15 – Oil Transfer Assembly

Figure 16 – Drive Shaft Assembly

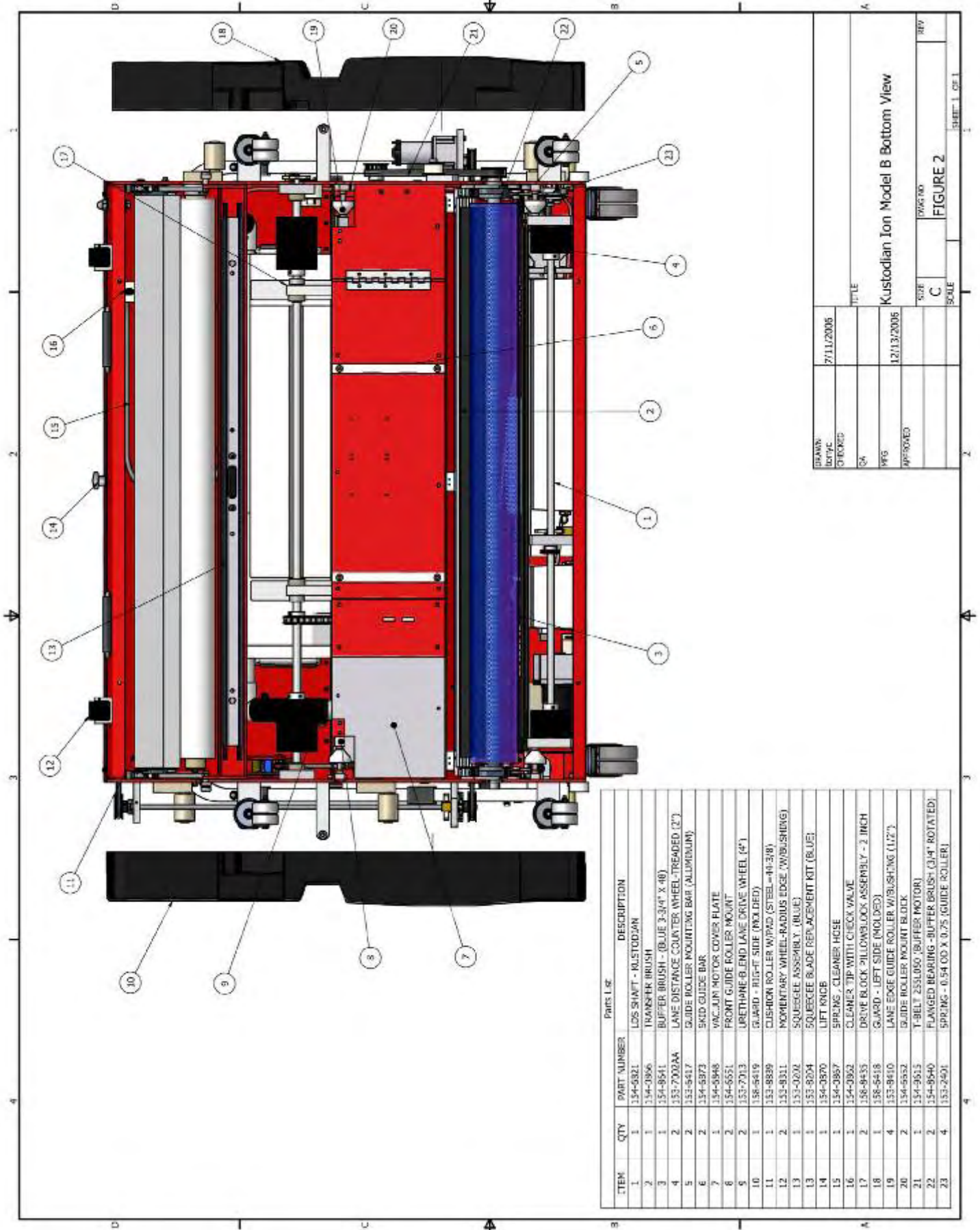
Figure 1 – Kustodian ION B (Top View)



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-8806	KEYPAD ASSEMBLY FOR KUSTODIAN
2	1	154-8348-2911	SPLASH GUARD ASSEMBLY - ION (RED)
3	1	158-8411	ASSEMBLY - BATTERY CHARGER 115V
3	1	158-8411E	ASSEMBLY - BATTERY CHARGER 230V
4	1	158-6417-2911	BATTERY CHARGER PLATE - ION
5	3	154-8872	HEAD DRIVE MOUNT BAR
6	1	154-6356	LATCH MOUNT BLOCK FOR SPLASH GUARD
7	1	154-6357	LATCH FOR SPLASH GUARD
8	1	153-1826	FLANGED TWISTLOCK INLET - 250V/20A
9	1	154-8893	KUSTODIAN ION HANDLE ASSEMBLY
10	2	154-1603	MICROSWITCH-WITHOUT ROLLER (LARGE)
11	1	154-6882	CLEWER HEAD
12	2	154-6888	CLEANER HOSE SPRING MOUNT BLOCK
13	1	154-6613	VACUUM MOTOR HOUSINGS
14	1	153-8824	PVC TAKE UP REEL ASSEMBLY (48-3/4")
15	1	154-6889	CLEANER HOSE ROUTING BAR
16	1	158-8406	ASSEMBLY - DRIVE MOTOR 24VDC
17	1	158-8431	DRIP PAD ASSY - 1PC TRANSFER SYSTEM -LEFT
18	1	154-1225	PRESSURE GAUGE (0-30 PSI) - 1-1/2 DIA
19	1	158-8432	DRIP PAD ASSY - 1PC TRANSFER SYSTEM -RIGHT

DESIGN	7/12/2006	TITLE	Kustodian Ion Model B Top View
TOP/PC		DATE	12/13/2006
CHECKED		SCALE	C
QA		TRAC NO	FIGURE 1
WFG		REV	
APPROVED			

Figure 2 – Kustodian ION B (Bottom View)



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-9321	LOS SHAFT - KUSTODIAN
2	1	154-9366	HANDSHK BRUSH
3	1	154-9541	BUFFER BRUSH - (BLUE 3-3/4" X .48)
4	2	153-2002AA	LANE DISTANCE COUNTER WHEEL-TREADED (2")
5	2	153-9417	GUIDE ROLLER MOUNTING BAR (ALUMINUM)
6	2	154-9373	SKID GUIDE BAR
7	1	154-9348	VACUUM MOTOR COVER PLATE
8	2	154-9551	FRONT GUIDE ROLLER MOUNT
9	2	153-2013	URETHANE-BLEND LANE DRIVE WHEEL (4")
10	1	158-8419	GUARD - 81/2" SIDE (MOLDED)
11	1	153-8839	CUSHION ROLLER WIPER (STEEL-41-3/8)
12	2	153-8311	MOMENTARY WHEEL-RADIUS EDGE (W/BRUSHING)
13	1	153-9202	SQUEEGEE ASSEMBLY - (BLUE)
13	1	153-9204	SQUEEGEE BLADE REPLACEMENT KIT (BLUE)
14	1	154-9370	LIFT KNIFE
15	1	154-9357	SPRINGS - CLEANER HOSE
16	1	154-9362	CLEANER TIP WITH CHECK VALVE
17	2	158-9435	DRIVE BLOCK W/ILLOBLOCK ASSEMBLY - 2 INCH
18	1	158-8418	GUARD - LEFT SIDE (MOLDED)
19	4	153-9410	LANE EDGE GUIDE ROLLER W/BRUSHING (1.7")
20	2	154-9552	GUIDE ROLLER MOUNT BLOCK
21	1	154-9515	T-BELT 253L050 (BUFFER MOTOR)
22	2	154-9540	FLANGED BEARING - BUFFER BRUSH (3/4" ROTATED)
23	4	153-2401	SPRINGS - 0.54 OD X 0.75 (GUIDE ROLLER)

DRAWN DTPVC	7/11/2005	TITLE	Kustodian Ion Model B Bottom View
CHECKED		DATE	12/13/2005
SCALE		SCALE	
		DWG NO	FIGURE 2
		REV	001

Figure 3 – Kustodian ION B (Left Side)

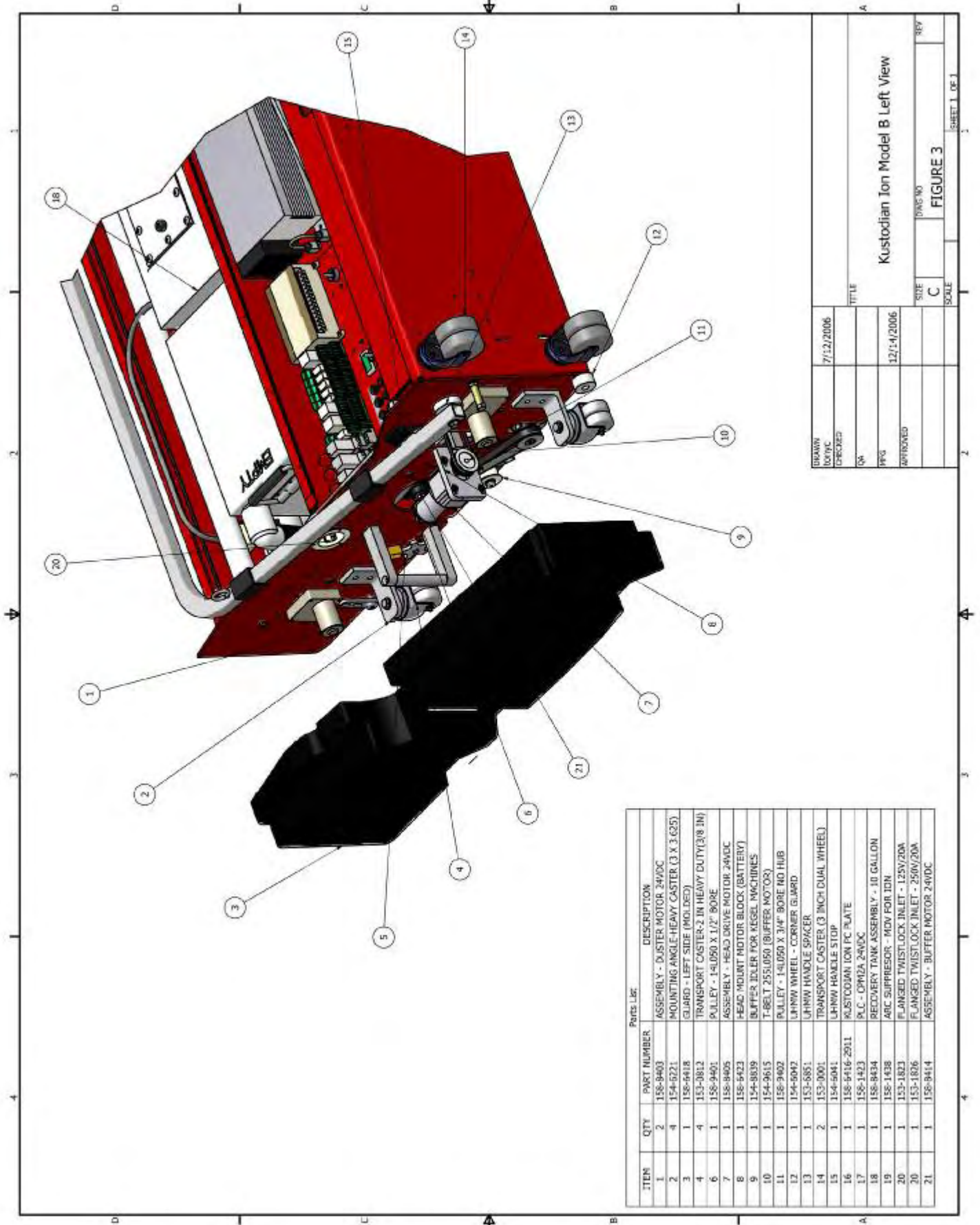
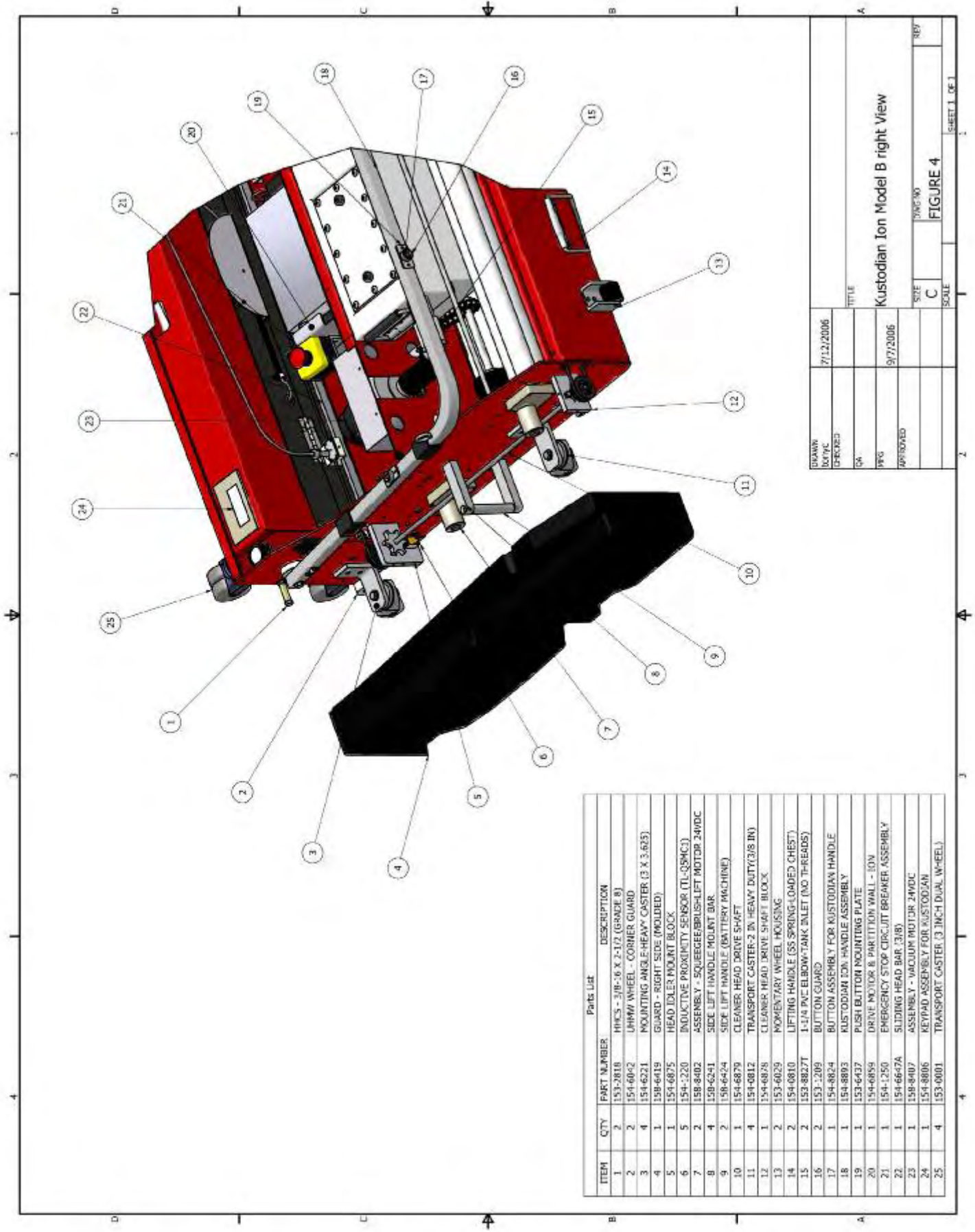


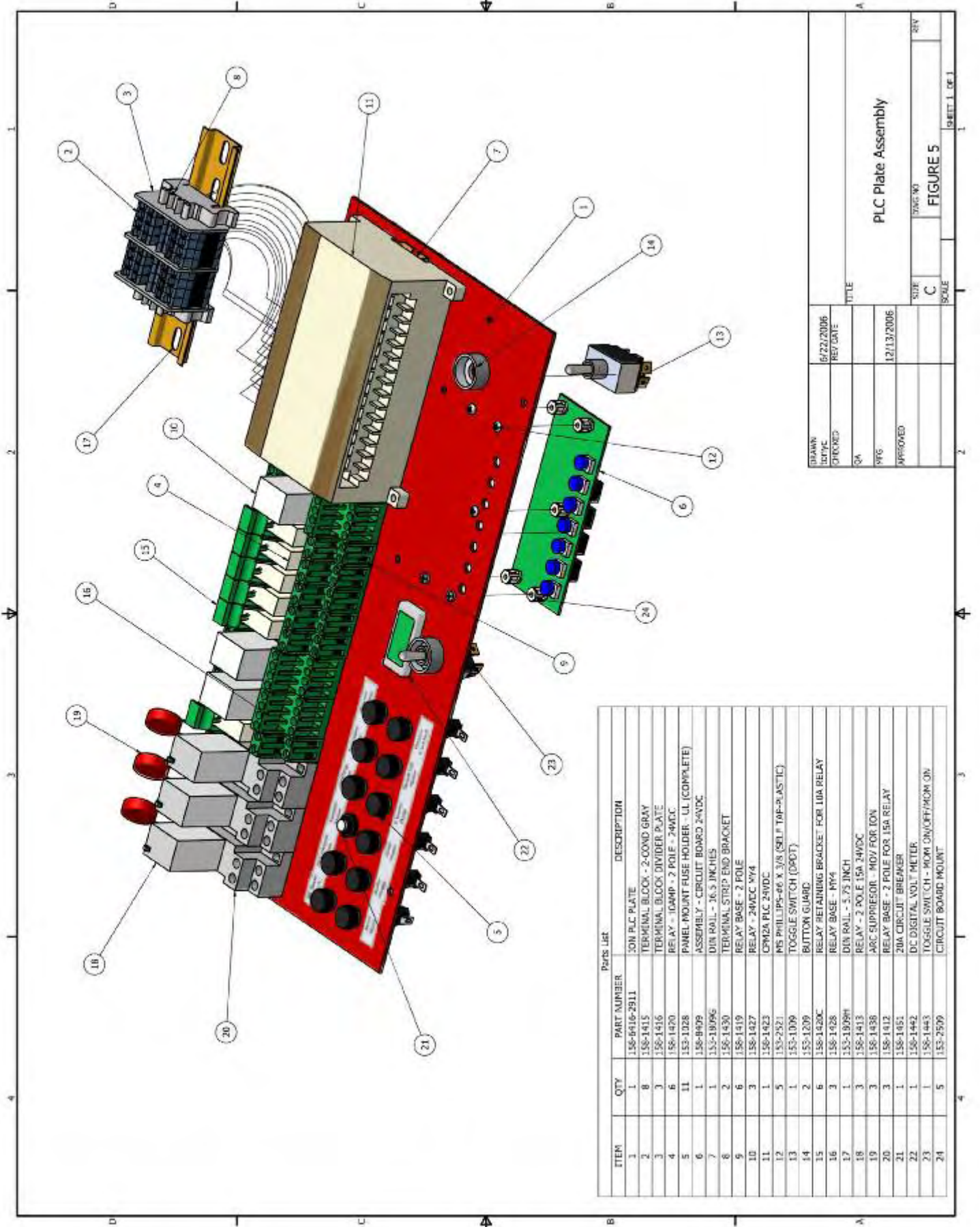
Figure 4 – Kustodian ION B (Right Side)



Parts List		
ITEM	QTY	PART NUMBER DESCRIPTION
1	2	153-2010 MHCS - 3/8" X 7-1/2" (HANDLE B)
2	2	154-6062 UHMW WHEEL - CORNER GUARD
3	4	154-6221 MOUNTING ANGLE-HEAVY CASTER (3 X 3.625)
4	1	158-6419 GUARD - RIGHT SIDE (MOLDED)
5	1	154-6875 HEAD IDLER MOUNT BLOCK
6	5	154-2220 INDUCTIVE PROXIMITY SENSOR (I-05MCI)
7	2	158-8402 ASSEMBLY - SQUEEGEE/BRUSH-LEFT MOTOR 24VDC
8	4	158-6241 SIDE LIFT HANDLE MOUNT BAR
9	2	158-6424 SIDE LIFT HANDLE (BATTERY MACHINE)
10	1	154-6879 CLEANER HEAD DRIVE SHAFT
11	4	154-0812 TRANSPORT CASTER-2 IN HEAVY DUTY(3/8 IN)
12	1	154-6878 CLEANER HEAD DRIVE SHAFT BLOCK
13	2	153-6029 MOMENTARY WHEEL HOUSING
14	2	154-0810 LIFTING HANDLE (SS SPRING-LOADED CHEST)
15	2	153-8827T 1-1/4 PVC ELBOW-TANK INLET (NO TH-READS)
16	2	153-2209 BUTTON GUARD
17	1	154-8824 BUTTON ASSEMBLY FOR KUSTODIAN HANDLE
18	1	154-8893 KUSTODIAN ION HANDLE ASSEMBLY
19	1	153-6437 PUSH BUTTON MOUNTING PLATE
20	1	154-6854 DRIVE MOTOR B PARTITION WALL - ION
21	1	154-1250 EMERGENCY STOP CIRCUIT BREAKER ASSEMBLY
22	1	154-6647A SLIDING HEAD BAR (3/8)
23	1	158-8407 ASSEMBLY - VACUUM MOTOR 24VDC
24	1	154-8806 KEYPAD ASSEMBLY FOR KUSTODIAN
25	4	153-0001 TRANSPORT CASTER (3 INCH DUAL WHEEL)

DATE	7/12/2006
DESIGNED BY	
CHECKED BY	
SCALE	
TITLE	Kustodian Ion Model B right view
DATE	9/7/2006
DESIGNED BY	
CHECKED BY	
SCALE	
TITLE	FIGURE 4
SHEET NO	
REV	

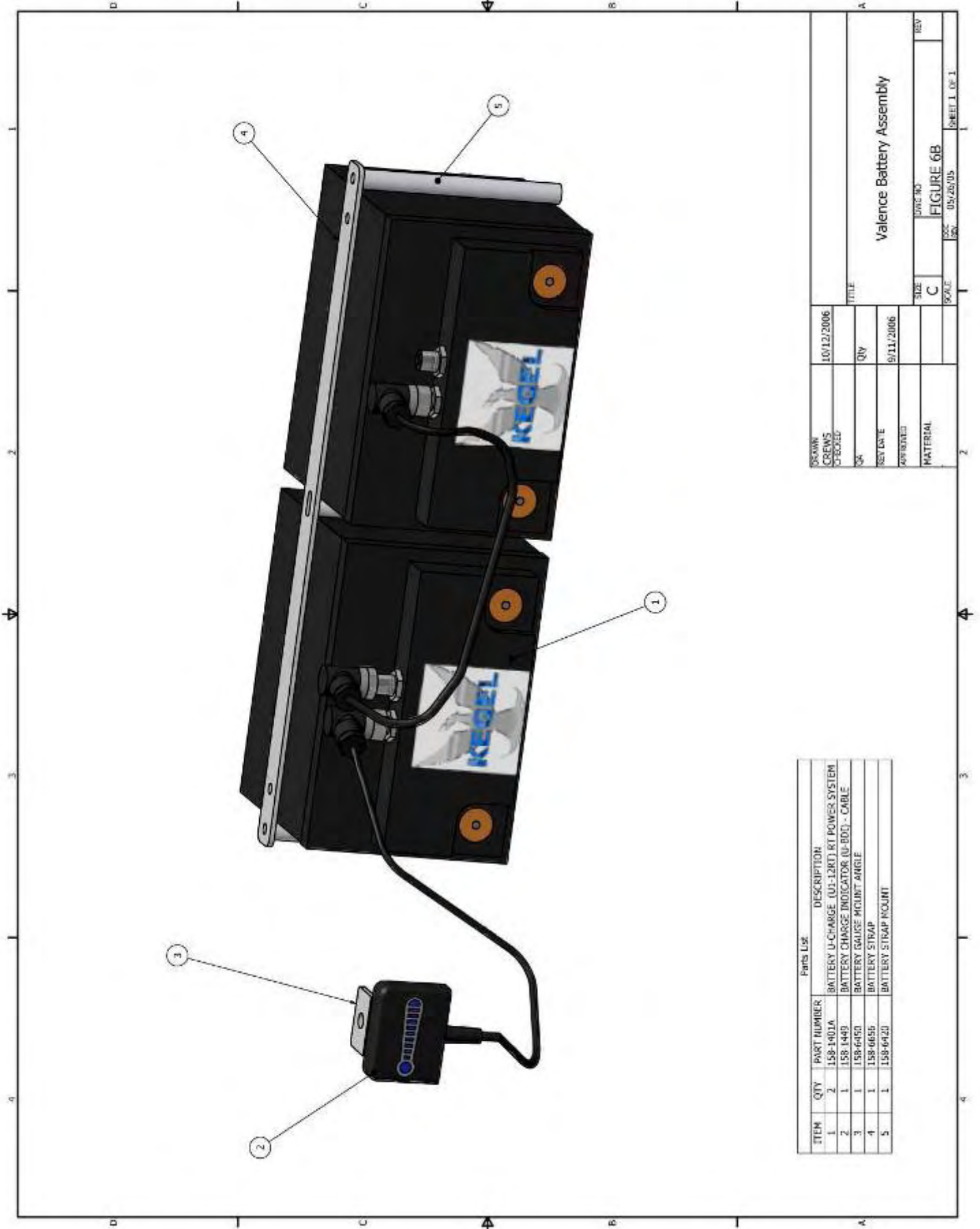
Figure 5 – PLC Plate Assembly



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	158-8416-2911	50N PLC PLATE
2	8	158-1415	TERMINAL BLOCK - 2-COND GRAY
3	3	158-1416	TERMINAL BLOCK DIVIDER PLATE
4	6	158-1420	RELAY - 10AMP - 2 POLE - 24VDC
5	11	153-1028	PANEL MOUNT FUSE HOLDER - UL (COMPLETE)
6	1	158-8409	ASSEMBLY - CIRCUIT BOARD 24VDC
7	1	153-19096	DIN RAIL - 3/8 INCHES
8	2	158-1430	TERMINAL STRIP END BRACKET
9	6	158-1419	RELAY BASE - 2 POLE
10	3	158-1427	RELAY - 24VDC W/4
11	1	158-1423	CPM2A PLC 24VDC
12	5	153-2521	MS PHILIPS-66 X 3/8 (SELF-TAP-PLASTIC)
13	1	153-1009	TOGGLE SWITCH (DROT)
14	2	153-1209	BUTTON GUARD
15	6	158-1426C	RELAY RETAINING BRACKET FOR 10A RELAY
16	3	158-1428	RELAY BASE - 1P/4
17	1	153-1909H	DIN RAIL - 5.75 INCH
18	3	158-1413	RELAY - 2 POLE 15A 24VDC
19	3	158-1438	ARC SUPPRESSOR - MOV FOR ION
20	3	158-1412	RELAY BASE - 2 POLE FOR 15A RELAY
21	1	158-1461	20A CIRCUIT BREAKER
22	1	158-1462	DC DIGITAL VOLT METER
23	1	158-1463	TOGGLE SWITCH - MOM ON/OFF/MOM ON
24	5	153-2509	CIRCUIT BOARD MOUNT

DRAWN	6/22/2006	REV DATE	6/22/2006
CHECKED	QA	DATE	12/13/2006
APPROVED	VP6	DATE	12/13/2006
SCALE	C	SCALE	SCALE
TITLE			
PLC Plate Assembly			
FIGURE 5			
SHEET 1 OF 1			

Figure 6B – Voltage Regulator and Extended Life Battery Assembly

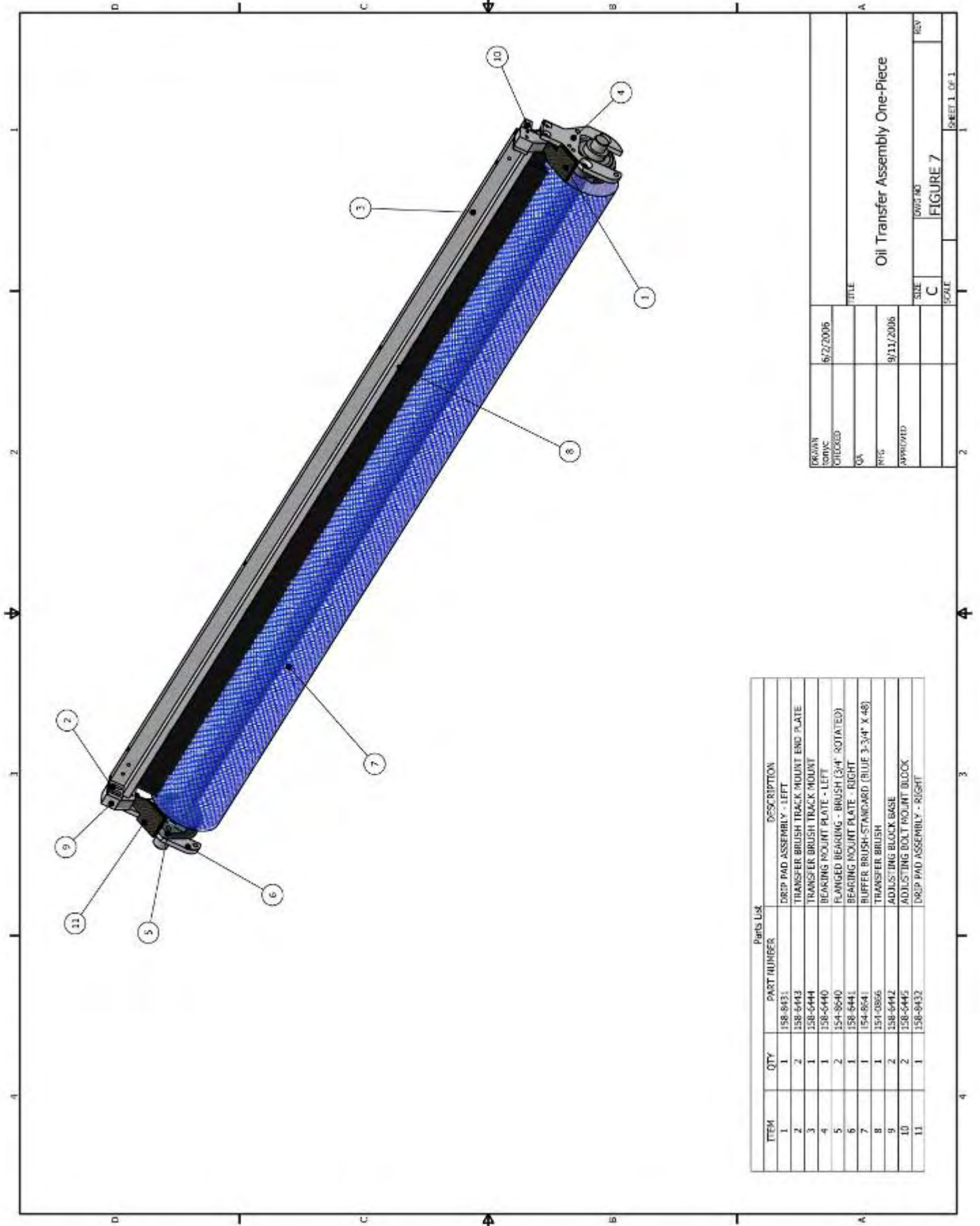


Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	158-1401A	BATTERY U-CHARGE (U-12RT) RT POWER SYSTEM
2	1	158-1449	BATTERY CHARGE INDICATOR (U-BDC) - CABLE
3	1	158-6450	BATTERY GAUGE MOUNT ANGLE
4	1	158-6655	BATTERY STRAP
5	1	158-6420	BATTERY STRAP MOUNT

DATE	10/12/2006	TITLE	Voltage Battery Assembly	
CREW'S CHECKED		QTY		
APP'D		REV DATE	9/11/2006	
MATERIAL		SIZE	C	REV
		SCALE	05/25/05	FIGURE 6B
				SHEET 1 OF 1

Figure 7 – Transfer Assembly One-Piece



Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	158-8432	DROP 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	PLANGED BEARING - 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
9	2	158-6442	ADJUSTING BLOCK BASE
10	2	158-6445	ADJUSTING DOLT MOUNT BLOCK
11	1	158-8432	DROP PAD ASSEMBLY - RIGHT

DATE	6/2/2006	TITLE	Oil Transfer Assembly One-Piece
DRAWN	RMVC	DATE	9/11/2006
CHECKED	QA	APPROVED	
SCALE	C	SIZE	DWG NO
SHEET	7	FIGURE	FIGURE 7
			REV
			SCALE
			SHEET 1 OF 1

Figure 8 – Conditioning Assembly

The Kustodian ION Conditioner Distribution System known, as Sanction Technology™, is the heart of the conditioner transfer system. The descriptions below are by item number.

#1 - Conditioner Tank: Works best when using KEGEL Genuine Conditioners. Capacity of the tank is 0.63 gallons and it is equipped with a fluid level switch (#28) and a stainless steel mesh filter (#31).

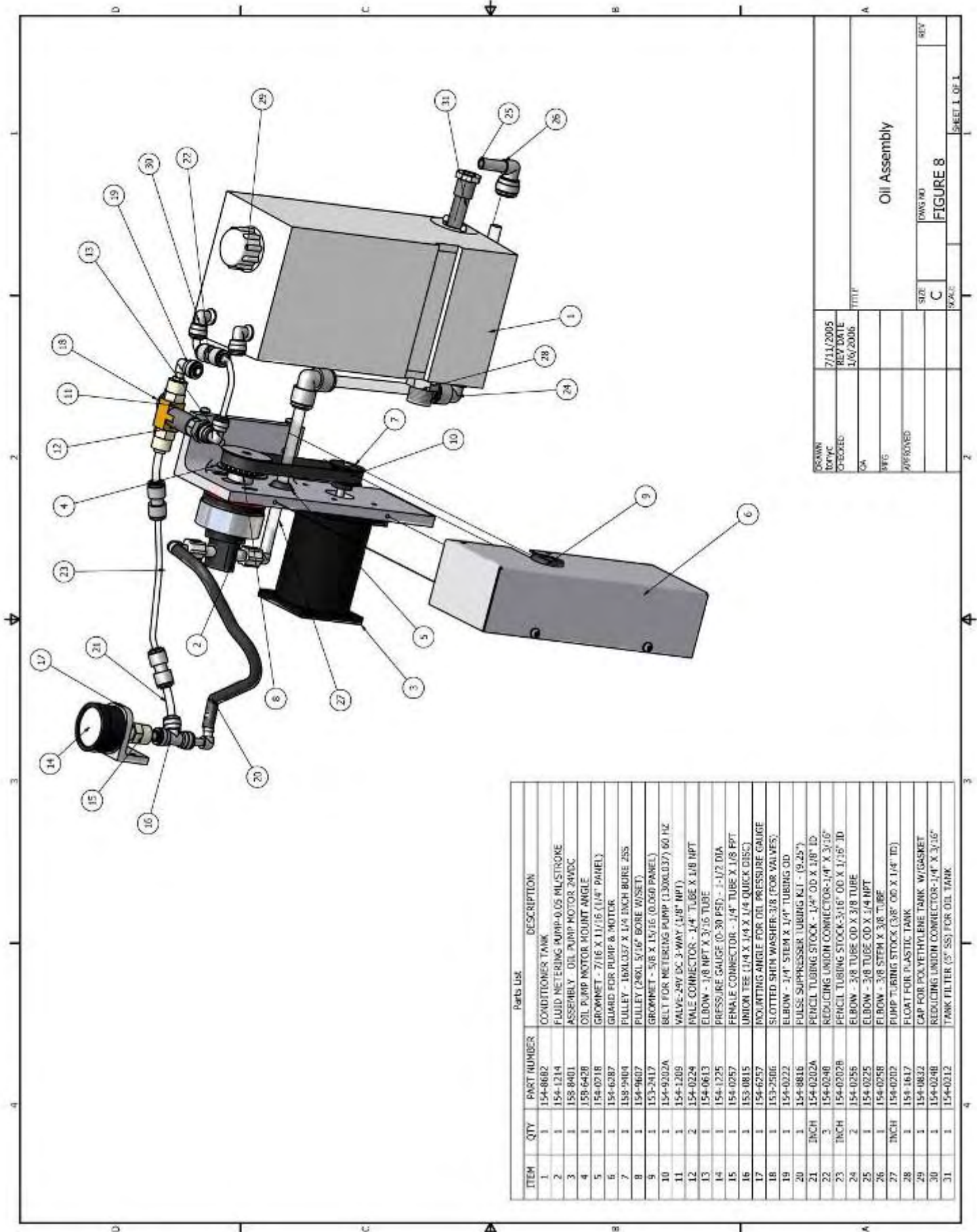
#2 – Fluid Metering Pump: This adjustable pump delivers exact amounts of conditioner to the transfer system. The pump has no valves to clog, runs at a constant speed, and can pump from 0-50 microliters per revolution. The pump does about 2.5 revolutions per board.

#3 - 24 Volt DC Motor: Geared to run the oil pump at close to 3340 RPM. This motor runs at a constant speed controlled by the Constant Voltage Regulator.

#11 - 24 Volt DC 3-Way Solenoid Valve: This valve controls the flow of the oil. When the valve is on the conditioner goes to the lane, when off it is routed back to the supply tank.

#14 - Oil Pressure Gauge: This gauge is used to monitor the system's pressure. A normal pressure range is around 15 lbs.

#20 - Pulse Suppressor Tubing: This soft tubing is used to smooth out the strokes of the pump so the conditioner comes out in a continuous, smooth stream.



Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-8682	CONDITIONER TANK
2	1	154-1214	FLUID METERING PUMP-0.05 MIL/STROKE
3	1	158-8401	ASSEMBLY OIL PUMP MOTOR 24VDC
4	1	153-6428	OIL PUMP MOTOR MOUNT ANGLE
5	1	154-0718	GROMMET - 7/16 X 1 1/16 (1/4" PANEL)
6	1	154-6287	GUARD FOR PUMP & MOTOR
7	1	158-9404	PULLEY - 1.8X1.037 X 1/4" INCH BORE Z55
8	1	154-9607	PULLEY (28X1.5716" BORE W/SET)
9	1	153-2417	GROMMET - 5/8 X 1 1/16 (0.060 PANEL)
10	1	154-9202A	BELT FOR METERING PUMP (1300X0.37) 60 HZ
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 - 3/8 NPT X 3/16 TUBE
14	1	154-1225	PRESSURE GAUGE (0-30 PSD) - 1-1/2 DIA.
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	ROUTING ANGLE FOR OIL PRESSURE GAUGE
18	1	153-2586	SLOTTED SHIM WASHER-3/8 (FOR VALVES)
19	1	154-0222	ELBOW - 1/4" STEM X 1/4" TUBING OD
20	1	154-8816	FUSS SUPPRESSOR TUBING KIT - (9.25")
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	154-0255	ELBOW - 3/8 TUBE OD X 3/8 TUBE
25	1	154-0225	ELBOW - 3/8 TUBE OD X 3/4 NPT
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	154-1617	FLAT FOR PLASTIC TANK
29	1	154-0832	CAP FOR POLYETHYLENE TANK W/GASKET
30	1	154-0248	REDUCING UNION CONNECTOR-1/4" X 3/16"
31	1	154-0212	TANK FILTER (5" SS) FOR OIL TANK

DRAWN	7/11/2005	TITTY
BY/CHK	REV DATE	
CHECKED	1/6/2006	
QA		
ENG		
APPROVED		
Oil Assembly		
SIZE	DWG NO	REV
C	FIGURE 8	
SCALE		

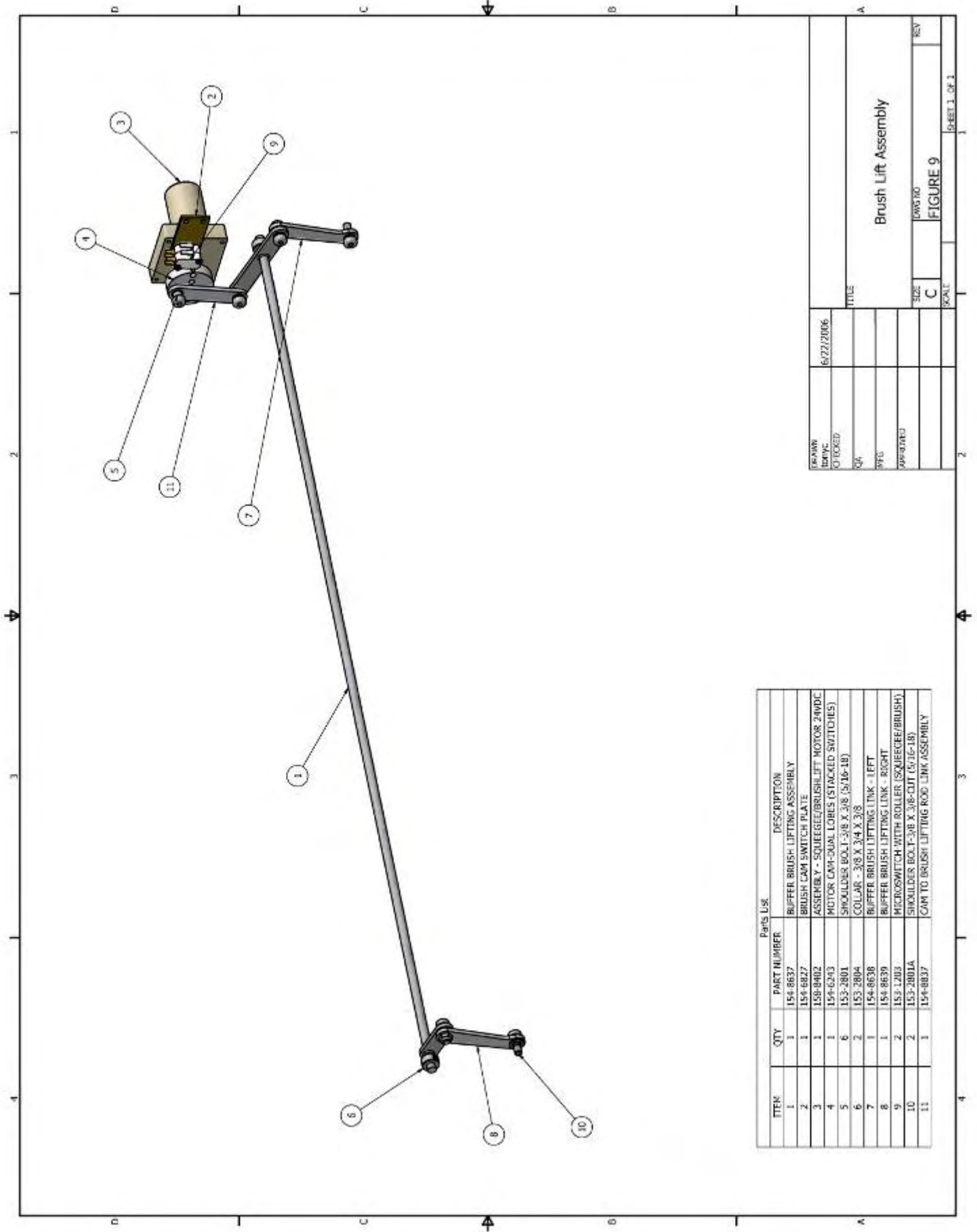
Figure 9 – Brush Lift Assembly

The descriptions below are by item number.

#1 - Buffer Brush Lifting Assembly: This is a stainless steel assembly designed to lift the brush off the lane so it does not transfer conditioner to the backend of the lane.

#2 - Brush Cam Switch Plate: This plate is adjustable and has two roller switches (#9) mounted on it to control the position of the buffer brush.

#3 - 24 Volt DC Brush Lift Motor: This motor runs at 30 RPM to quickly lift and lower the brush.

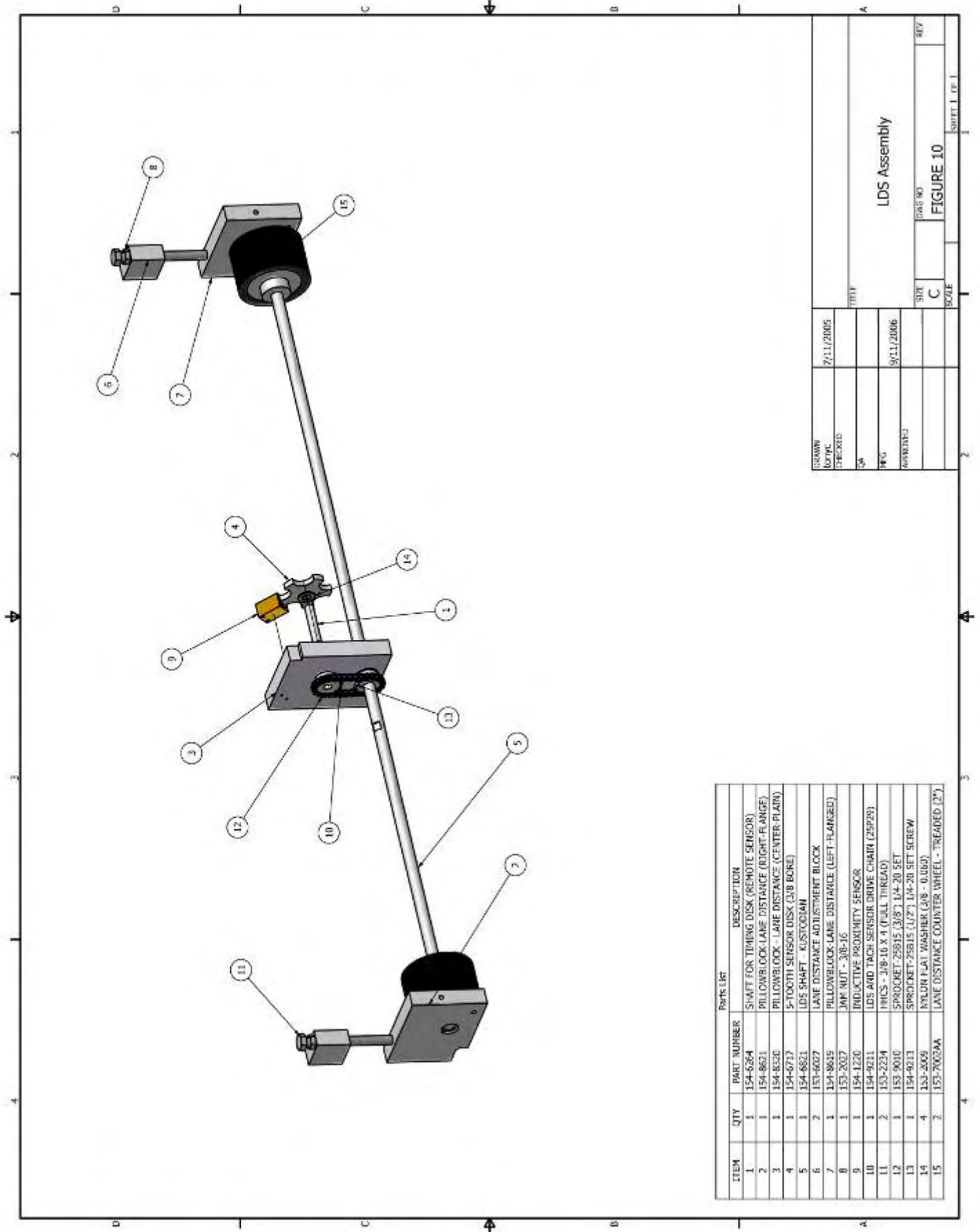


Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-8637	BUFFER BRUSH LIFTING ASSEMBLY
2	1	154-8627	BRUSH CAM SWITCH PLATE
3	1	158-8402	ASSEMBLY - SQUEEGE/BRUSHLIFT MOTOR 24VDC
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 (SQUEEGE/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

DATE	6/22/2006		
DRAWN			
CHECKED			
QA			
RFG			
APPROVED			
TITLE		Brush Lift Assembly	
SIZE	C	UNSW TO	FIGURE 9
SCALE			
		SHEET 1 OF 1	

Figure 10 – Lane Distance Sensor Assembly



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	154-8330	PILLOWBLOCK -LANE DISTANCE (CENTER-FLANG)
4	1	154-6717	5-TOOTH SENSOR DISK (3/8 BORE)
5	1	154-8621	LDS SHAFT - KUSTODIAN
6	2	153-6027	LANE DISTANCE ADJUSTMENT BLOCK
7	1	154-8619	PILLOWBLOCK-LANE DISTANCE (LEFT-FLANGED)
8	1	153-2027	SHIM NUT - 3/8-16
9	1	154-1220	INDUCTIVE PROXIMITY SENSOR
10	1	154-9211	LDS AND TACH SENSOR DRIVE CHAIN (25P25)
11	2	153-2234	PHCS - 3/8-16 X 4 (FULL THREAD)
12	1	153-9010	SPROCKET-25B15 (3/8") 1/4-20 5FT
13	1	154-6011	SPROCKET-25B15 (1/2") 1/4-20 SET SCREW
14	4	153-2065	NYLON FLAT WASHER (3/8 - 0.005)
15	2	153-7002AA	LANE DISTANCE COUNTER WHEEL - TREADED (2")

DRAWN	7/11/2005	DATE	7/11/2006
CHECKED		DATE	
QA		DATE	
REC		DATE	
APPROVED		DATE	
LDS Assembly			
SCALE		C	
SHEET 1 OF 1		FIGURE 10	

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the layout of adjacent pages.**

Figure 11 – Cleaner Assembly

This system uses a peristaltic pump to transfer cleaner to the lane. The descriptions below are by item number.

#1 - Pump Motor: This is a 24 VDC motor that is powered from the battery source. This motor runs in reverse for a second when it backs out of the pin deck.

#4 - Cleaner Pump: Mounted to the left of the cleaner supply tank is the cleaner pump and cleaner volume adjusting potentiometer. The pump operates by three rollers rotating in a plastic housing. The tubing fits in the housing in such a way that the rollers pinch the tubing off completely to create suction.

#5 – Potentiometer: The volume adjusting potentiometer is used to control the speed of the pump motor, which will change the volume output. Clockwise will increase the volume output.

#10 - Cleaner Head: The cleaner head slides back and forth across the **Head Bar (#9)** to apply cleaner to the lane surface. The Cleaner Tip can be removed when changing the duster cloth or when checking the volume output.

#14 - Cleaner Tip: The cleaner tip is also a check valve to hold back the cleaner. *Caution should be used when changing tip. Do not over tighten.*

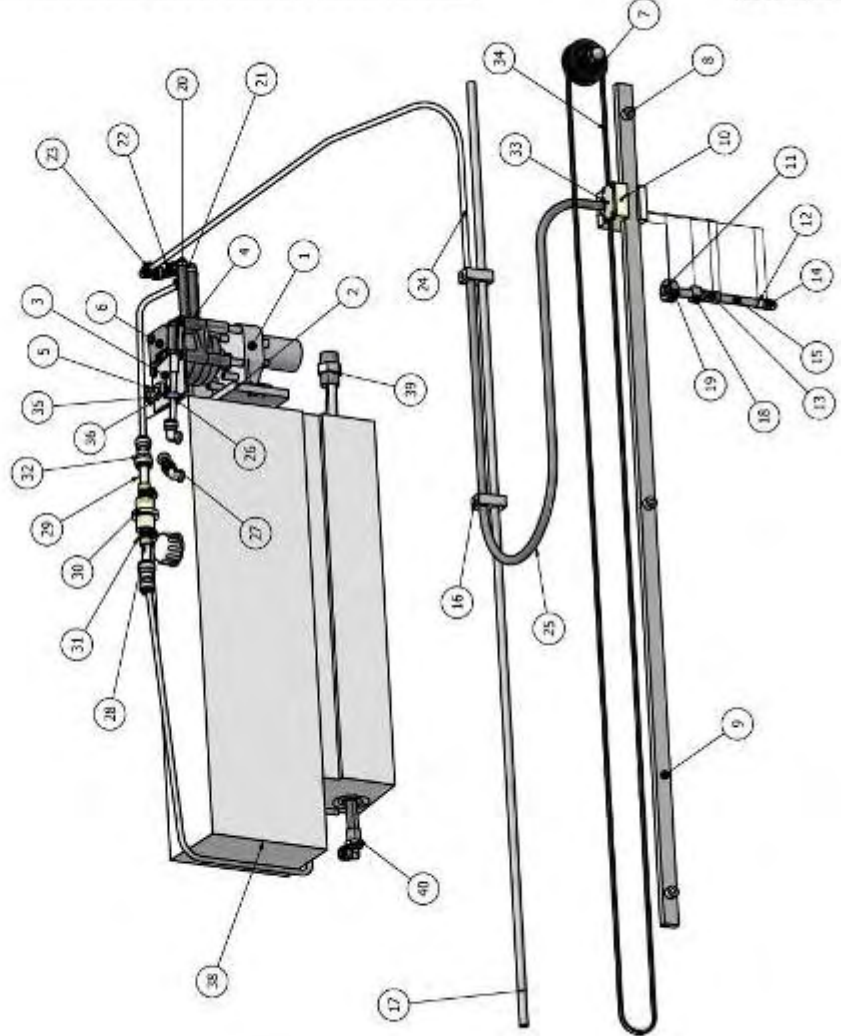
#30 – In-Line Filter: The in-line filter is another filter used to prevent debris from collecting at the tip and causing drips. Keep an eye on this. Cleaning and changing it regularly prevents clogs.

#38 - Supply Tank: Mounted left of center (on the rear wall) is the cleaner supply tank. The capacity of this tank is approximately 3 gallons (7.1 liters); enough volume to completely clean in excess of 50 lanes. A vent valve prevents a vacuum inside the tank during operation. A float switch is located inside the supply tank to indicate when the cleaner level is getting low.

#39 - Float Switch: This switch will prevent the machine from operating when running low on fluid. It can be bypassed if it fails to operate correctly.

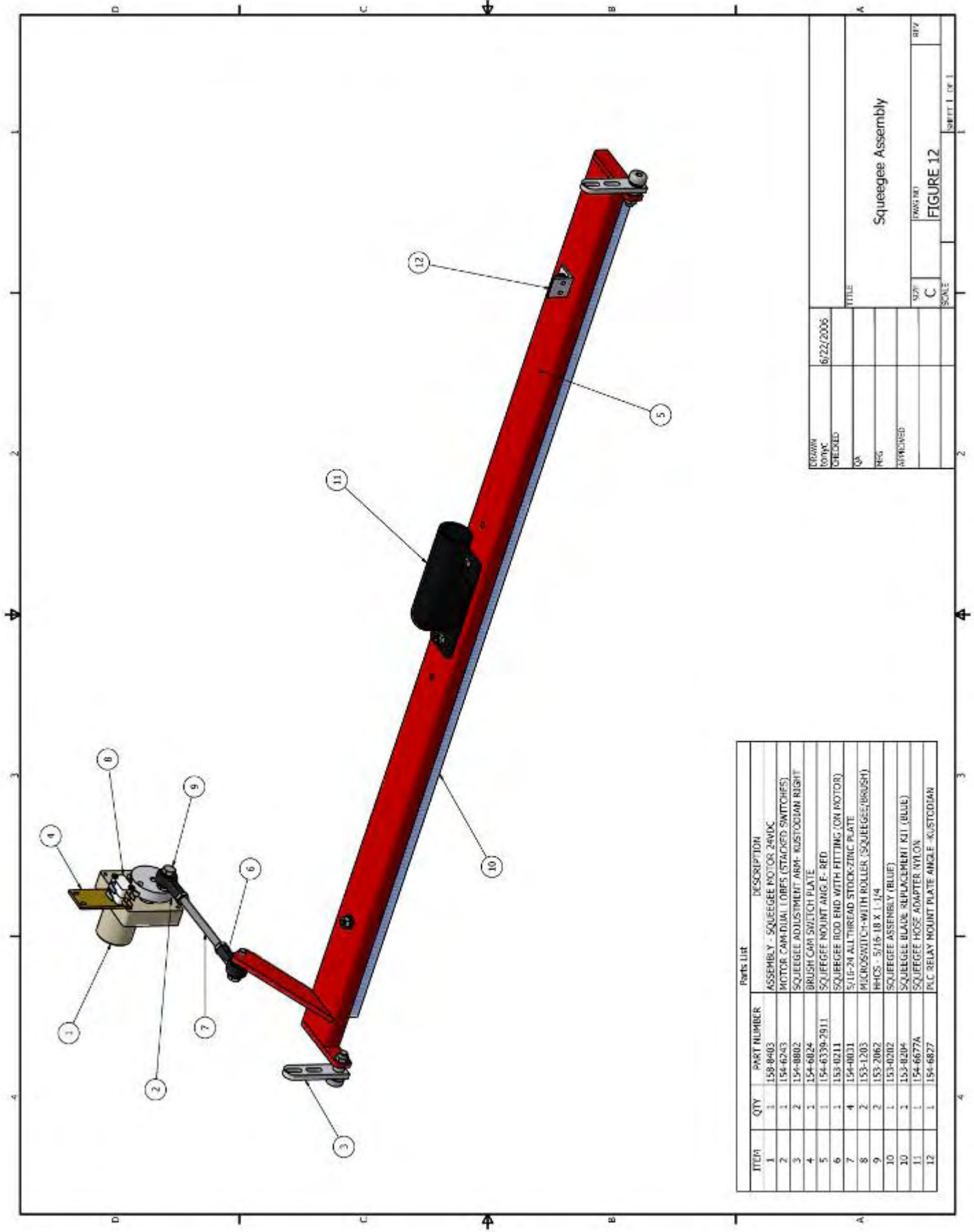
#40 - Tank Filter: This is the first line of defense against debris. **Keep a close eye on this filter.**

Parts List		
ITEM	QTY	PART NUMBER DESCRIPTION
1	1	158-6404 ASSEMBLY - CLEANER PUMP MOTOR 24VDC
1	1	158-6404C ASSEMBLY - CLEANER PUMP COMPLETE - 24VDC
2	1	154-6865 CLEANER PUMP MOUNT ANGLE
3	1	154-6866A CLEANER PUMP POTENTIOMETER PLATE
4	1	154-6860A PUMP, MASTER FLEX
5	1	154-6846 POTENTIOMETER ASSEMBLY - SPEED CONTROL (2.5K OHM)
6	1	N/A CLEANER PUMP TUBE LOADING TOOL
7	1	154-6806 PULLEY - 28X1037 - 1/2 BORE NO SET SCREW
8	3	154-6874 CLEANING HEAD BAR SPACER
9	1	154-6877 CLEANER HEAD GUIDE BAR
10	1	154-6882 CLEANER HEAD
11	1	154-6885 CLEANER HOSE AND SPRING CONNECTOR
12	1	154-6887 OIL HOSE AND TIP HOLDER
13	1	153-6035 PLAIN BUSHING (3/8 X 1/2 X 3/4)
14	1	154-6862 CLEANER TIP WITH CHECK VALVE
15	1	154-6863 FITTING - MALE UICR TO 3/8" HOSE BARB
16	2	154-6888 CLEANER HOSE SPRING MOUNT BLOCK
17	1	154-6889 CLEANER HOSE ROUTING BAR
18	1	153-2804 COLLAR - 3/8 X 3/4 X 3/8
19	1	153-2902 STEEL COLLAR - 1/2 X 1-1/8 X 1/2
20	INCH	154-6851B NONPNEURE TUBING FOR PUMP
21	2	154-0227 ELBOW (90 DEGREE) 1/4 X 1/4 (GUEST)
22	2	154-0243 ELBOW - 1/4" STEM X 1/4" TUBING OD
23	1	154-0222 FLOW - 1/4" STEM X 1/4" OD X 1/8" ID
24	INCH	154-0202A PENCIL TUBING STOCK - 1/4" OD X 1/8" ID
25	1	154-0867 SPRING, CLEANER HOSE
26	1	154-8817 MANUAL VENT VALVE ASSEMBLY FOR TANK VENT
27	1	154-0245 PLUG - 1/4" TUBE OD
28	INCH	154-0245STK YES LOW TYPON TUBING - 1/2 OD X 3/8 ID
29	INCH	154-0202 PUMP TUBING STOCK (3/8" OD X 1/4" ID)
30	1	154-0255 IN-LINE FILTER (1/4" BARB X 1/4" BARB)
31	2	154-8867A IN-LINE FILTER ASSEMBLY - KOLUS AND 3CM
32	2	153-2517 HOSE CLAMP (5/16 IN) RANGE - 7/32 - 5/8
33	1	154-0244 REDUCER - 3/8" TUBE TO 1/4" TUBE
34	1	154-0246 HEAD BELT MOUNT PLATE
35	1	154-5201C CLEANER HEAD DRIVE BELT
36	1	158-6432 POTENTIOMETER LOCKING BAR
37	1	153-2719 SPACER TO ACTIVATE DUSTEN SWITCH
38	1	153-2087 MS PHILLIPS - 8-32 X 3/4
39	1	158-6433 ASSEMBLY - POLY CLEANER SUPPLY TANK (SPIN WELD ONLY)
40	1	158-6430C ASSEMBLY - POLY CLEANER SUPPLY TANK (COMPLETE)
40	1	154-0212B FLOAT FOR PLASTIC TANK
40	1	154-0212B FILTER FOR SUPPLY TANK (5" SS) PVC



DESIGN	6/5/2006	TITLE	Cleaner Assembly
REVISED		DATE	
QA		SIZE	C
FIG	10/12/2006	ISSUE NO	FIGURE 11
APPROVED		SCALE	
			SHEET 1 OF 1

Figure 12 – Squeegee Assembly

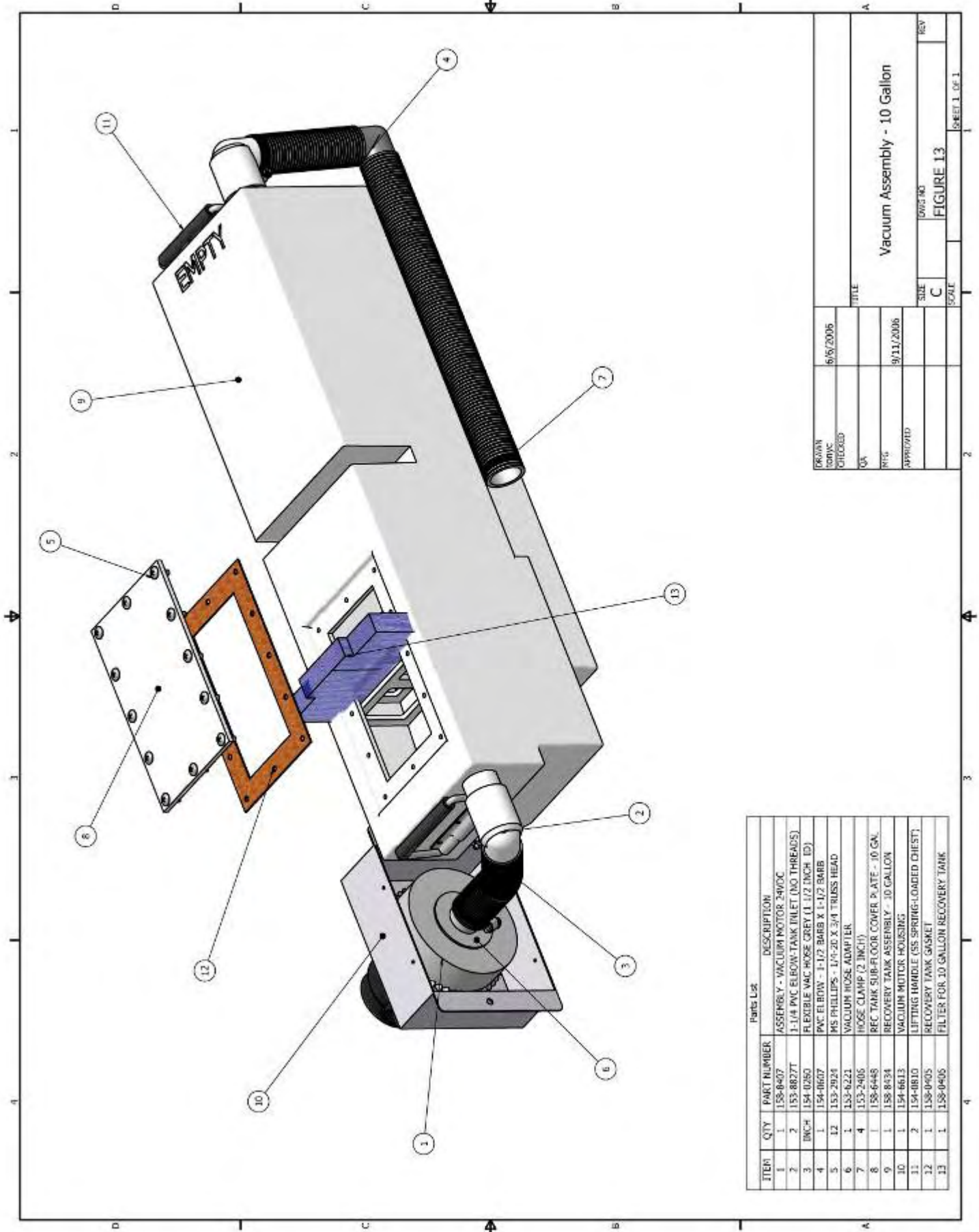


Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	158-8403	ASSEMBLY - SQUEEGEE MOTOR 24VDC
2	1	154-6243	MOTOR CAM/DUAL LOBES (STACKED SWITCHES)
3	2	154-8802	SQUEEGEE ADJUSTMENT ARM- KUSTODIAN RIGHT
4	1	154-6824	BRUSH CAR SWITCH PLATE
5	1	154-6339-2911	SQUEEGEE MOUNT ANG. E. RED
6	1	153-0211	SQUEEGEE ROD END WITH FITTING (ON MOTOR)
7	4	154-0031	5/16-24 ALL THREAD STOCKING PLATE
8	2	153-1203	MICROSWITCH-WITH ROLLER (SQUEEGEE, BRUSH)
9	2	153-2062	PHCS - 5/16-18 X 1-1/4
10	1	153-0202	SQUEEGEE ASSEMBLY (BLUE)
11	1	153-8294	SQUEEGEE BLADE REPLACEMENT KIT (BLUE)
12	1	154-6677A	SQUEEGEE HOSE ADAPTER NYLON
12	1	154-6827	P/LC RELAY MOUNT PLATE ANGLE - KUSTODIAN

DRAWN	6/22/2006	TITLE	SQUEEGEE ASSEMBLY
CHECKED		DATE	
QA		SCALE	C
REV		FIGURE NO	FIGURE 12
APPROVED		SHEET NO	1 OF 1

Figure 13 – Vacuum Assembly



Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	158-8407	ASSEMBLY - VACUUM MOTOR 24VDC
2	2	153-8827T	1-1/4 PVC ELBOW-TANK INLET (NO THREADS)
3	1	154-0367	FLEXIBLE VAC HOSE GREY (1 1/2 INCH 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	153-6221	VACUUM HOSE ADAPTER
7	4	153-2406	HOSE CLAMP (2 INCH)
8	1	158-6448	REC TANK SUB-FLOOR COVER PLATE - 10 GN.
9	1	158-8434	RECOVERY TANK ASSEMBLY - 10 GALLON
10	1	154-6613	VACUUM MOTOR HOUSING
11	2	154-0810	LIFTING HANDLE (SS SPRING-LOADED CHEST)
12	1	158-0905	RECOVERY TANK GASKET
13	1	158-0405	FILTER FOR 10 GALLON RECOVERY TANK

DESIGNED	6/5/2006	TITLE	Vacuum Assembly - 10 Gallon
CHECKED		DATE	
QA		SCALE	C
APPROVED	9/11/2006	FIGURE NO	FIGURE 13
		REV	
		SHEET	1 OF 1

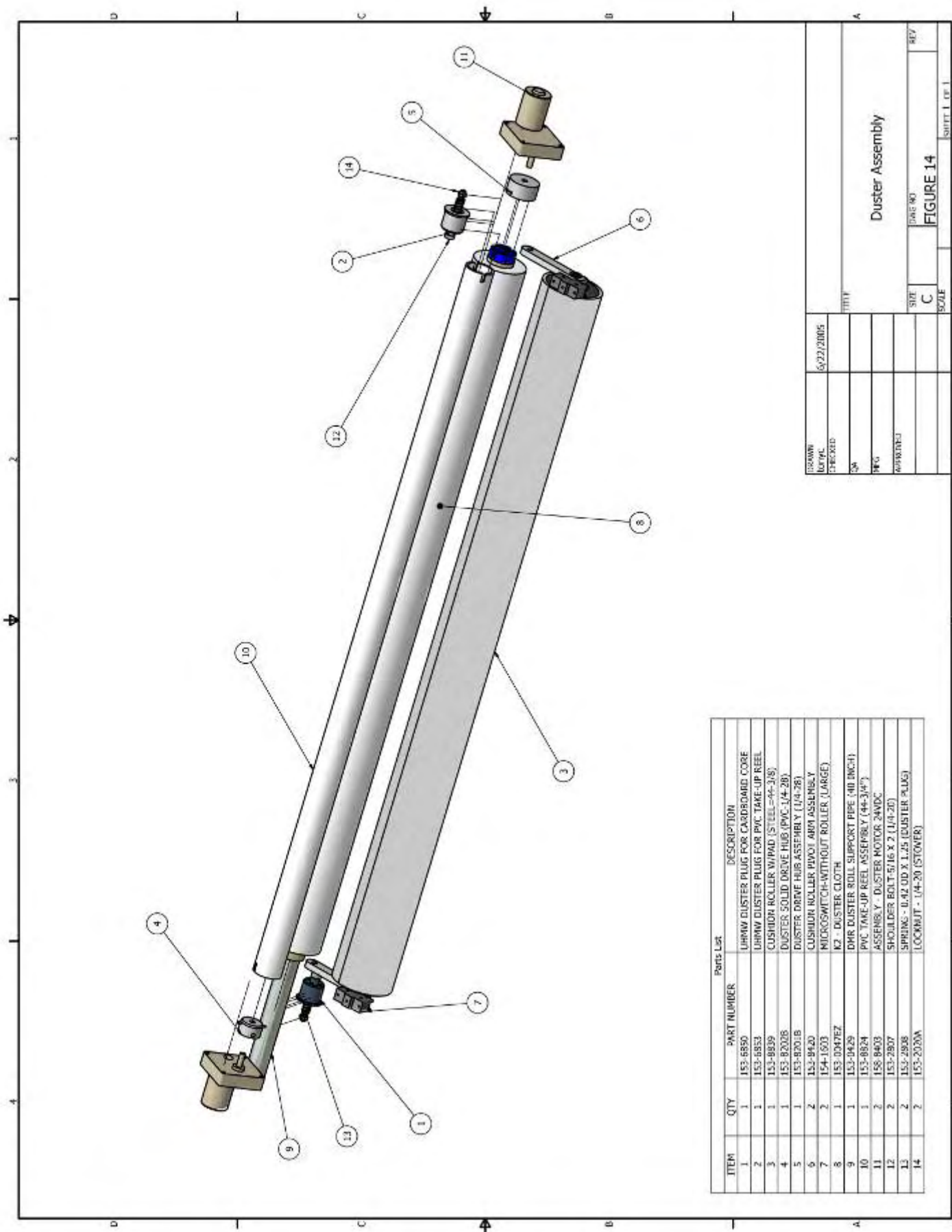
Figure 14 – Duster Assembly

This system wipes the cleaner on the lane, picks up the dust, and traps it in the cloth. The descriptions below are by item number.

#3 - Cushion Roller: The cushion roller with the external pad helps press the cleaning cloth on the lane surface; following the crowns and depressions. The cushion roller rotates as it unwinds and winds up the cloth, making one revolution every 5 or 6 lanes.

#7 - Duster Switch: There are two switches mounted on each side of the machine. These two switches monitor the duster operation. Two possible errors are generated from these switches **D5** or **D6**.

#11 - Duster Motor: There are two 9 RPM DC Motors that operate the duster. The 7-pin side unwinds the cloth and the 10-pin side winds it up. The motors do not have mechanical brakes, but use what is called dynamic braking. With this method of braking, the motor uses the magnetic force in the motor to lock the armature.

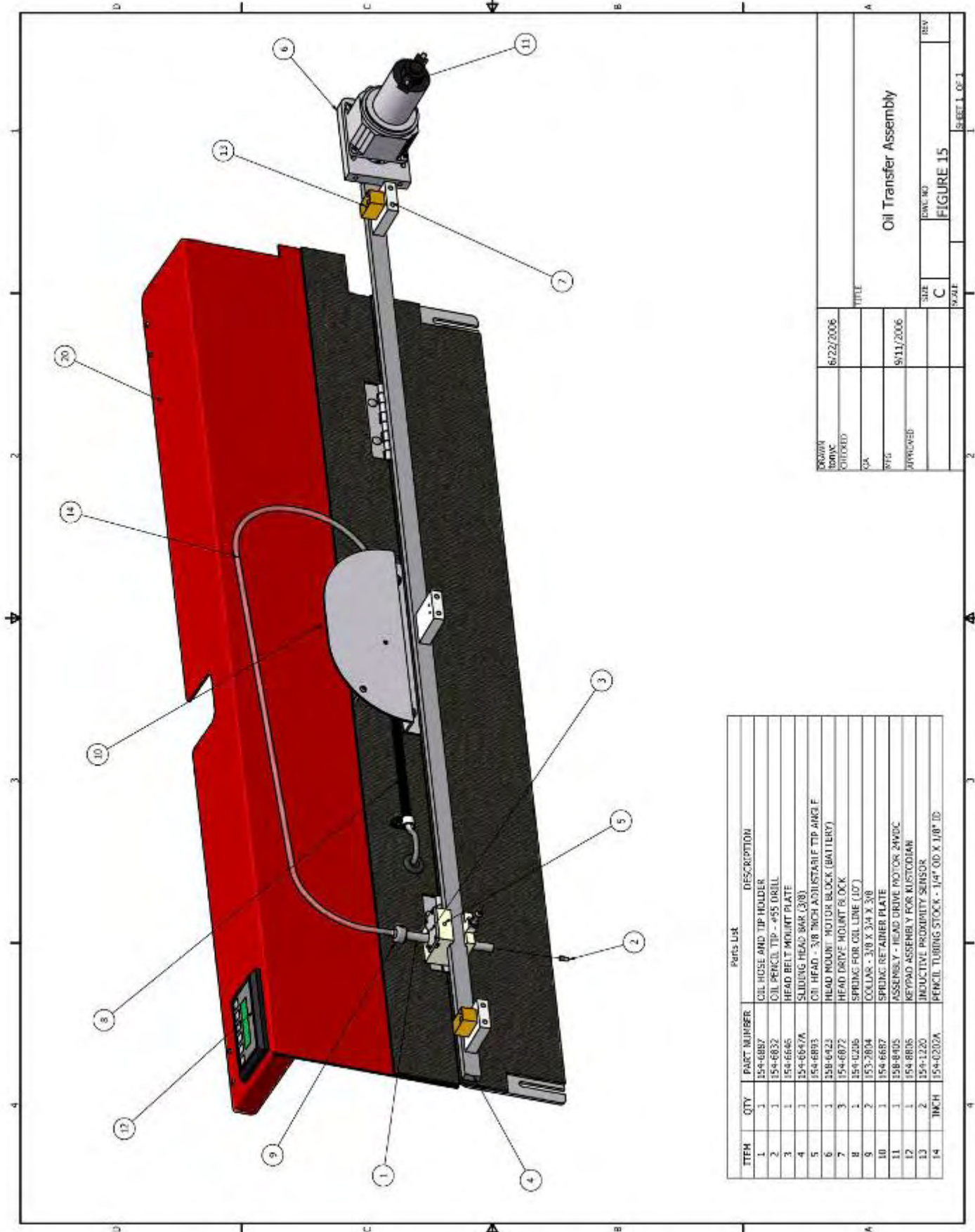


Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	153-6850	UHMW DUSTER PLUG FOR CARDBOARD CORE
2	1	153-6853	UHMW DUSTER PLUG FOR PVC TAKE-UP REEL
3	1	153-8839	CUSHION ROLLER W/PAD (STEEL-44-3/8")
4	1	153-8208	DUSTER SOLID DRIVE HUB (PVC-1/4-28)
5	1	153-8201B	DUSTER DRIVE HUB ASSEMBLY (1/4-28)
6	2	153-8420	CUSHION ROLLER PIVOT ARM ASSEMBLY
7	2	154-1503	MICROSWITCH-WITHOUT ROLLER (LARGE)
8	1	153-0047E2	K2 - DUSTER CLOTH
9	1	153-0429	DMR DUSTER ROLL SUPPORT PIPE (40 INCH)
10	1	153-8824	PVC TAKE-UP REEL ASSEMBLY (44-3/4")
11	2	158-8403	ASSEMBLY - DUSTER MOTOR 24VDC
12	2	153-2807	SHOULDER BOLT-5/16 X 2 (1/4-20)
13	2	153-2808	SPRINGS - 0.42 OD X 1.25 (DUSTER PLUG)
14	2	153-2000A	LOCKWASHER - 1/4-20 (STOWER)

DATE	6/22/2005
BY	
CHKD	
APP'D	
REV	
SIZE	C
SCALE	
Duster Assembly	
FIGURE 14	
SHEET 1 OF 1	

Figure 15 – Oil Transfer Assembly

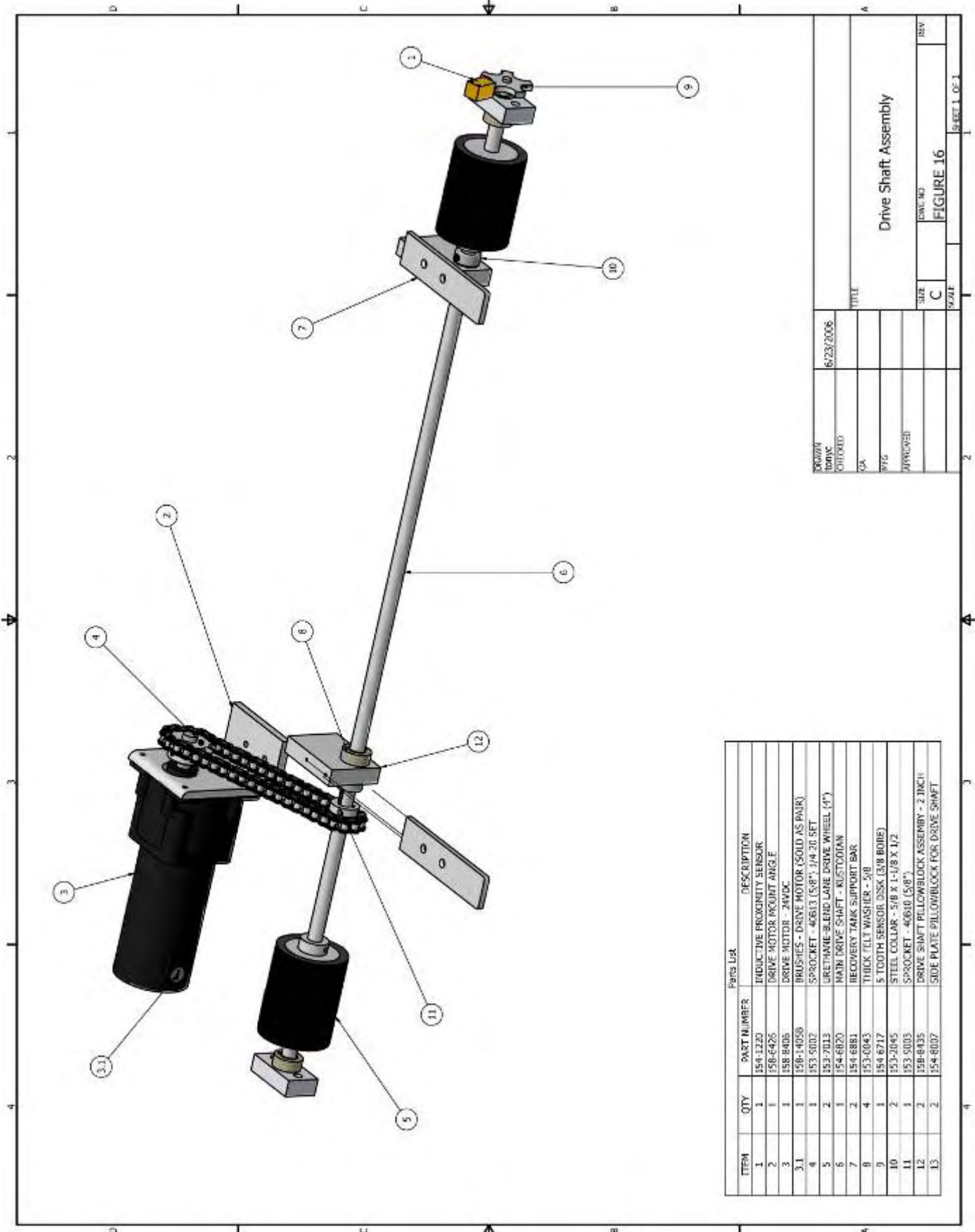


Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-6887	COIL HOSE AND TIP HOLDER
2	1	154-6832	COIL 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	COIL HEAD - 3/8" INCH ADJUSTABLE TIP ANGLE
6	1	158-6423	HEAD MOUNT MOTOR BLOCK (BATTERY)
7	3	154-6872	HEAD DRIVE MOUNT BLOCK
8	1	154-0206	SPRING FOR COIL LINE (107)
9	2	153-2804	COLLAR - 3/8" X 3/4" X 3/8"
10	1	154-6887	SPRING RETAINER PLATE
11	1	158-8405	ASSEMBLY - HEAD DRIVE MOTOR 24VDC
12	1	154-8816	KEYPAD ASSEMBLY FOR KUSTODIAN
13	2	154-1220	INDUCTIVE PROXIMITY SENSOR
14	1	154-0202A	PENCIL TUBING STOCK - 1/4" OD X 1/8" ID

DRAWN	6/22/2006	TITLE	Oil Transfer Assembly
CHKD		DATE	
APP'D	9/11/2006	SIZE	C
		SCALE	FIGURE 15
		REV	

Figure 16 – Drive Shaft Assembly



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	154-1120	INDUCTIVE PROXIMITY SENSOR
2	1	158-6426	DRIVE MOTOR MOUNT ANGLE
3	1	158-8406	DRIVE MOTOR - 24VDC
3.1	1	158-14058	BRUSHES - DRIVE MOTOR (SOLD AS PAIR)
4	1	153-5002	SPROCKET - 40613 (5/8"), 1/4" ZD SET
5	2	153-7013	URETHANE-BLENDED LARL DRIVE WHEEL (4")
6	1	154-6820	MAIN DRIVE SHAFT - KUSTODIAN
7	2	154-6881	RECOVERY TANK SUPPORT BAR
8	4	153-0043	THICK FELT WASHER - 5/8
9	1	154-6717	5 TOOTH SENSOR DISK (3/8 BORE)
10	2	153-2045	STEEL COLLAR - 5/8 X 1-1/8 X 1/2
11	1	153-5003	SPROCKET - 40610 (5/8")
12	2	158-8435	DRIVE SHAFT PILLOWBLOCK ASSEMBLY - 2 INCH
13	2	154-8007	SIDE PLATE PILLOWBLOCK FOR DRIVE SHAFT

DATE	6/23/2006	TITLE	Drive Shaft Assembly
DESIGNED	ITMVC	SIZE	C
CHECKED		SCALE	
QA		DWG. NO.	FIGURE 16
RTG		REV	
APPROVED		SHEET	1 OF 1

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 .

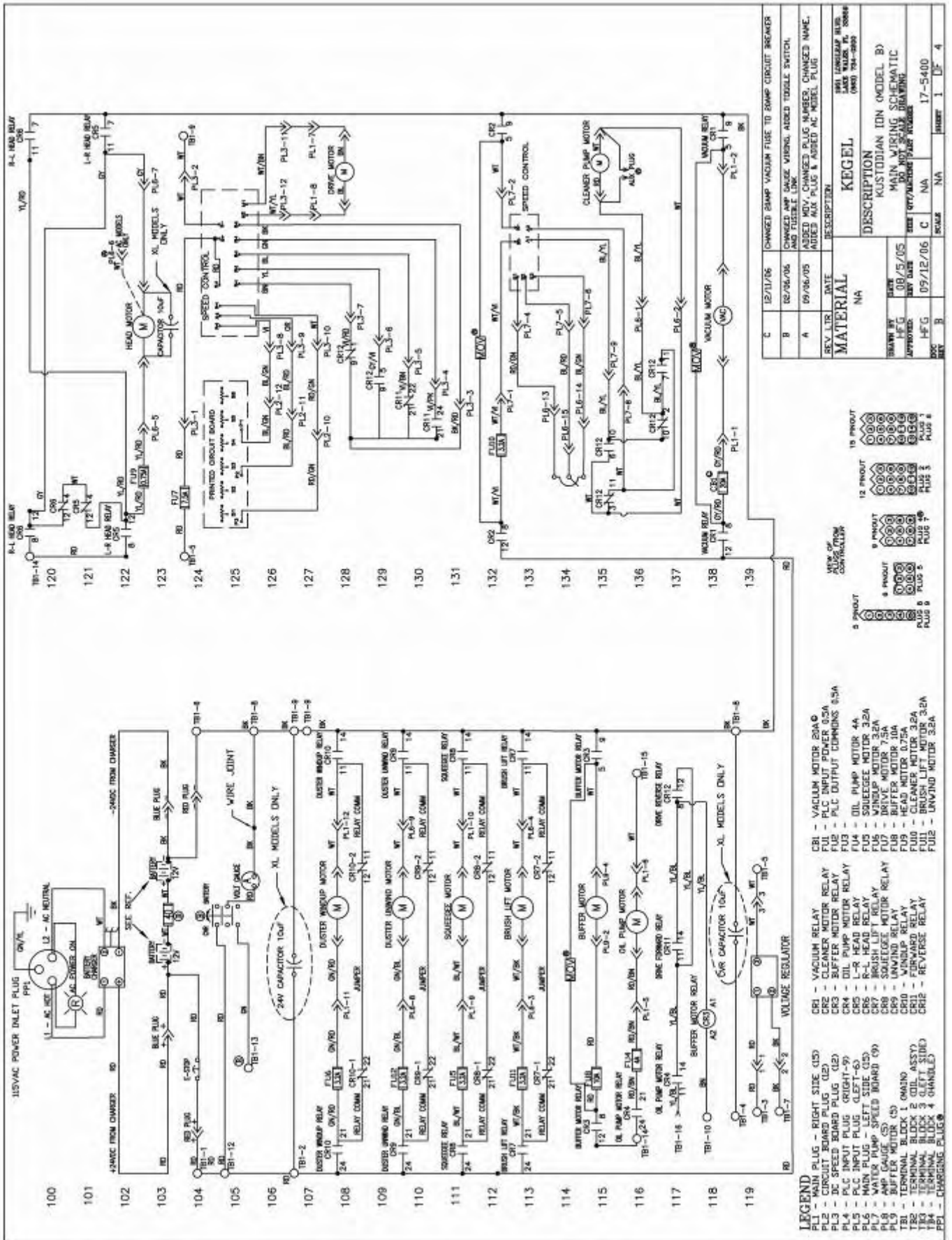
General Diagrams:

- Main Wiring Diagram
- Output Wiring
- Input Wiring
- Terminal Block Layout

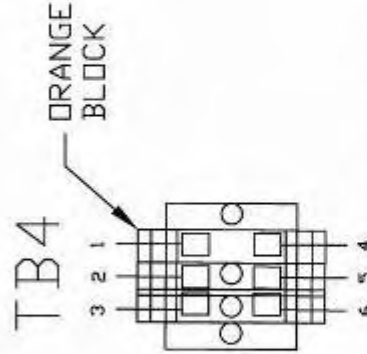
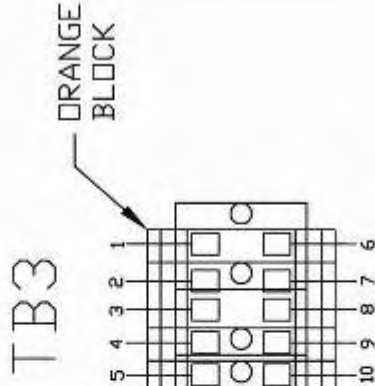
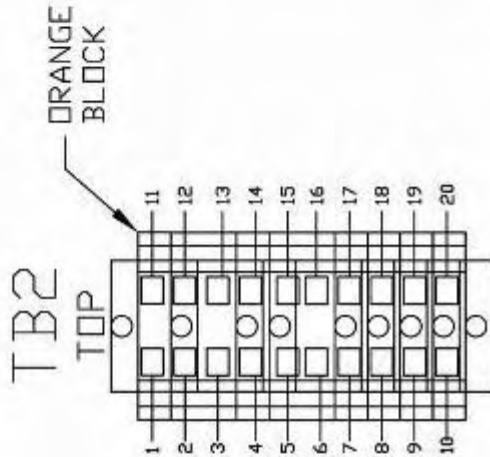
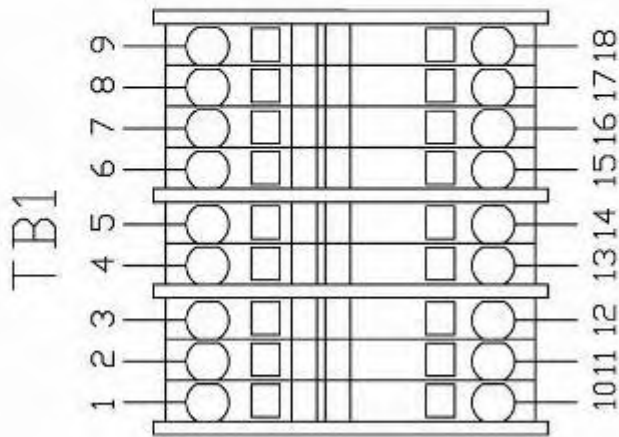
Detailed Diagrams:

- Battery Charger & E-Stop Wiring (Odyssey)
- Battery Charger & E-Stop Wiring (Valence)
- Voltage Regulator Wiring
- Vacuum Motor Wiring
- Squeegee Motor and Switch Wiring
- Speed Tachometer and Lane Distance Sensor Wiring
- Presoak and Cleaner Float Wiring
- Brush Lift Motor and Switch Wiring
- Buffer Motor Wiring
- Conditioner Pump and Float Wiring
- Duster Unwind Motor Wiring
- Duster Wind-Up and Switch Wiring
- Conditioning/Cleaning Head Directional Proximity Switch Wiring
- Conditioning/Cleaning Head Motor Wiring
- Conditioner Control Valve and Board Counting Proximity Switch Wiring
- LCD Voltmeter Switch Wiring

Main Wiring Diagram



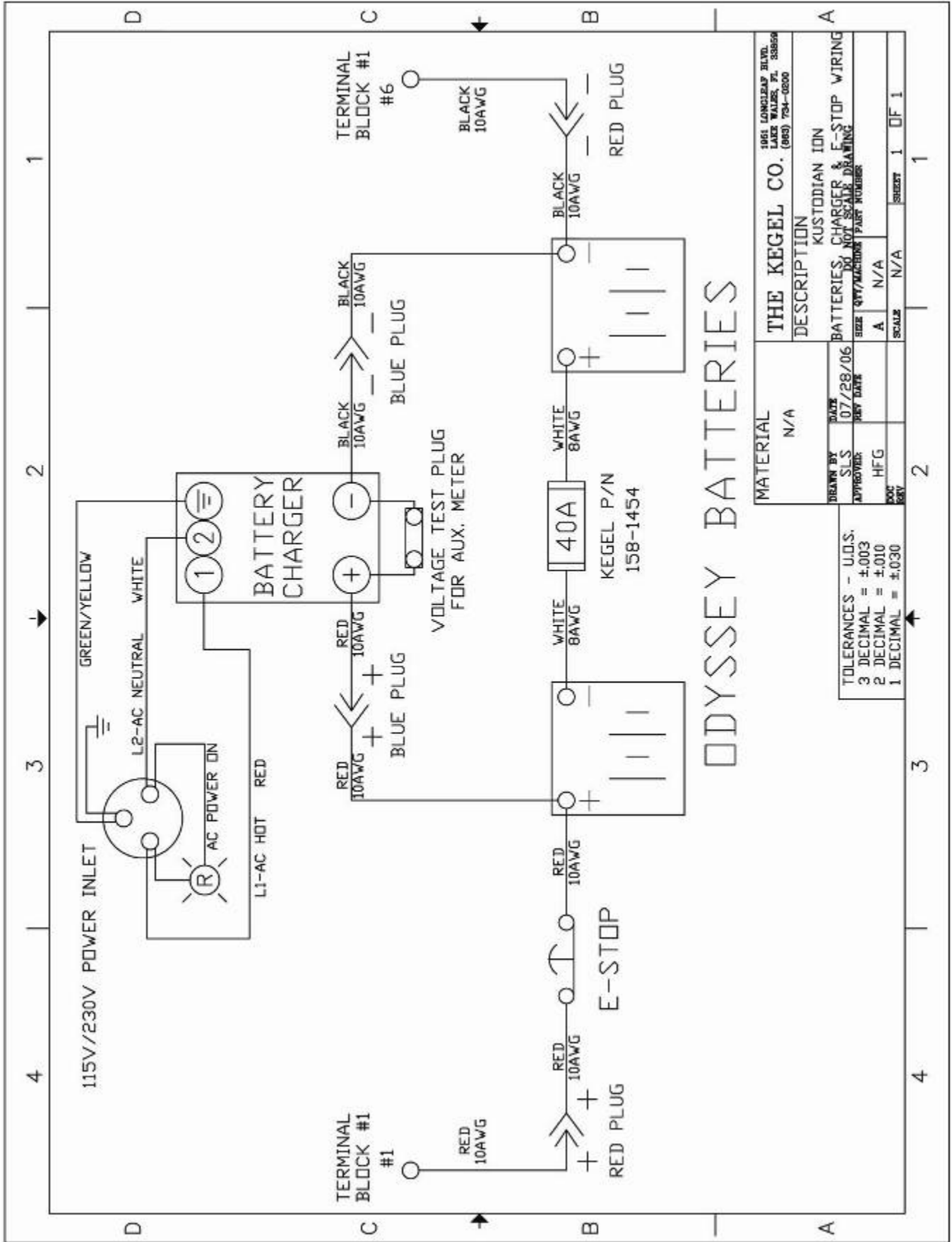
Terminal Block Layout



- LEGEND**
- PL1 - MARK PLUG - RIGHT SIDE (S)
 - PL2 - CIRCUIT BOARD PLUG (S)
 - PL3 - 3C SPEED BOARD PLUG (S)
 - PL4 - PLC INPUT PLUG (RIGHT-9)
 - PL5 - PLC INPUT PLUG (LEFT-6)
 - PL6 - MAIN PLUG - LEFT SIDE (S)
 - PL7 - MAIN PLUG - RIGHT SIDE (S)
 - PL8 - AND GALEY (S)
 - PL9 - BUFFER MOTOR (S)
 - TB1 - TERMINAL BLOCK 1 (WIND)
 - TB2 - TERMINAL BLOCK 2 (OIL ASSY)
 - TB3 - TERMINAL BLOCK 3 (LEFT SIDE)
 - TB4 - TERMINAL BLOCK 4 (CHINDLE)
 - PP1 - CHINDLE PLUG (S)
 - CR1 - VACUUM RELAY
 - CR2 - CLEANER MOTOR RELAY
 - CR3 - BUFFER MOTOR RELAY
 - CR4 - OIL PUMP MOTOR RELAY
 - CR5 - L-R HEAD RELAY
 - CR6 - R-L HEAD RELAY
 - CR7 - SQUEEZE MOTOR RELAY
 - CR8 - SQUEEZE MOTOR RELAY
 - CR9 - UNWIND RELAY
 - CR10 - WINDUP RELAY
 - CR11 - FORWARD RELAY
 - CR12 - REVERSE RELAY
 - FU1 - VACUUM MOTOR 20A0
 - FU2 - PLC INPUT POWER 0.5A
 - FU3 - PLC OUTPUT COMMONS 0.5A
 - FU4 - FUI
 - FU5 - FUI
 - FU6 - FUI
 - FU7 - FUI
 - FU8 - FUI
 - FU9 - FUI
 - FU10 - FUI
 - FU11 - FUI
 - FU12 - FUI
 - MO1 - OIL PUMP MOTOR 4A
 - MO2 - SQUEEZE MOTOR 3.2A
 - MO3 - SQUEEZE MOTOR 3.2A
 - MO4 - DRUM MOTOR 3.2A
 - MO5 - DRUM MOTOR 3.2A
 - MO6 - DRUM MOTOR 3.2A
 - MO7 - BUFFER MOTOR 10A
 - MO8 - HEAD MOTOR 0.75A
 - MO9 - CLEANER MOTOR 3.2A
 - MO10 - BRUSH LIFT MOTOR 3.2A
 - MO11 - UNWIND MOTOR 3.2A

REV	DATE	DESCRIPTION		
C	12/11/06	CHANGED 20AMP VACUUM FUSE TO 20AMP CIRCUIT BREAKER		
B	02/06/06	CHANGED AMP GAUGE WIRING, ADDED TERGELE SWITCH, AND FUSE/BLK LINK		
A	09/06/03	CHANGED PLUS NUMBER, CHANGED NAME, CHANGED TERM LOCATIONS, PLUGS AND WIRE COLOR		
REV LTR	DATE	DESCRIPTION		
MATERIAL				
ITEM NO	QTY	DESCRIPTION		
NA		KEGEL		
DESCRIPTION				
TERMINAL BLOCK LAYOUT				
TERMINAL BLOCK LAYOUT				
TERMINAL BLOCK LAYOUT				
TERMINAL BLOCK LAYOUT				
REV	DATE	BY	CHKD	ISSUE
C	12/11/06			4 OF 4

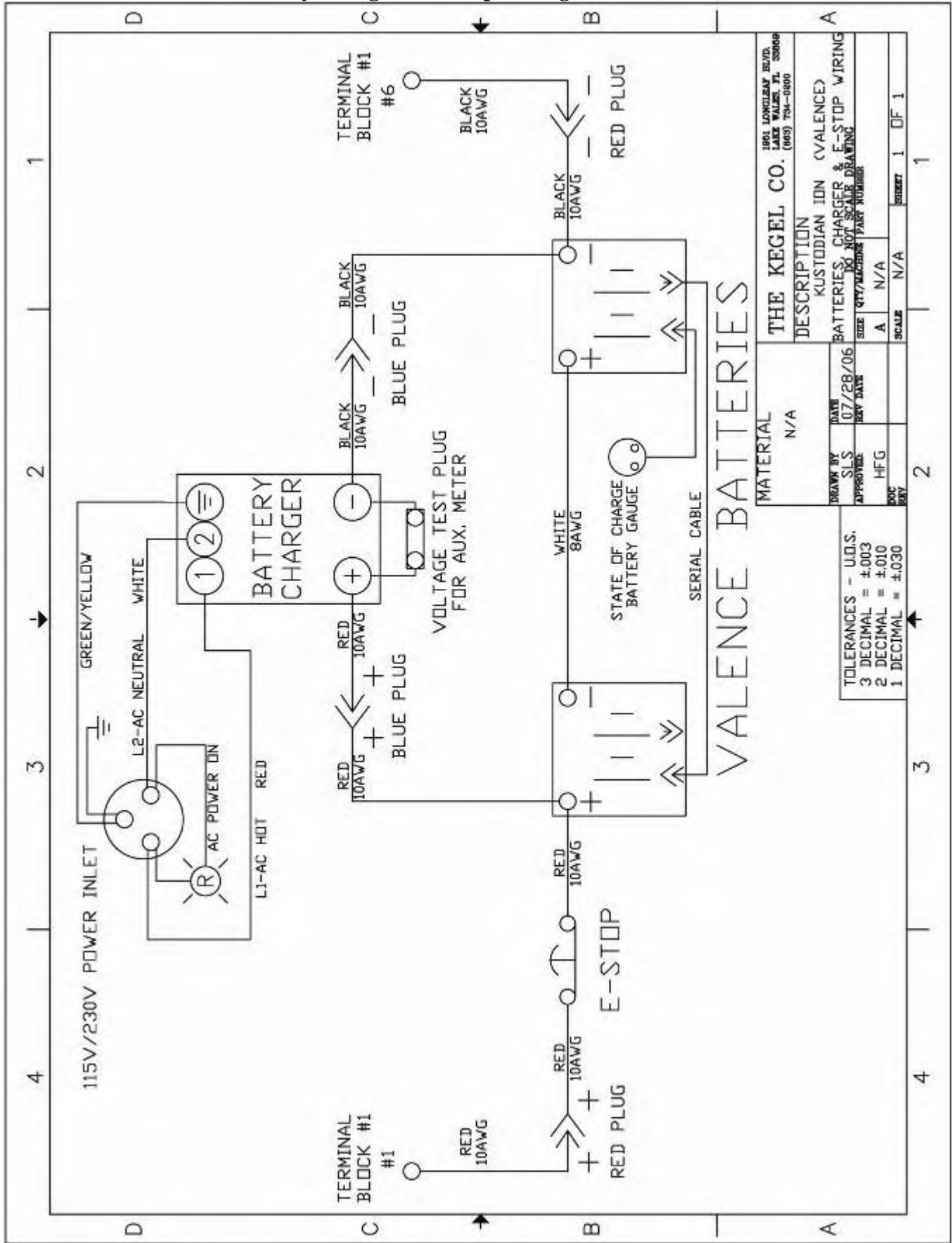
Battery Charger & E-Stop Wiring (Odyssey)



MATERIAL		N/A	
DESCRIPTION		THE KEGEL CO. 1061 LONGLEAF BLVD. LAKE WALES, FL 33856 (863) 794-0200	
DRAWN BY		SLS	
DATE		07/28/06	
APPROVED BY		HFG	
SIZE		N/A	
SCALE		N/A	
SHEET		1 OF 1	

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

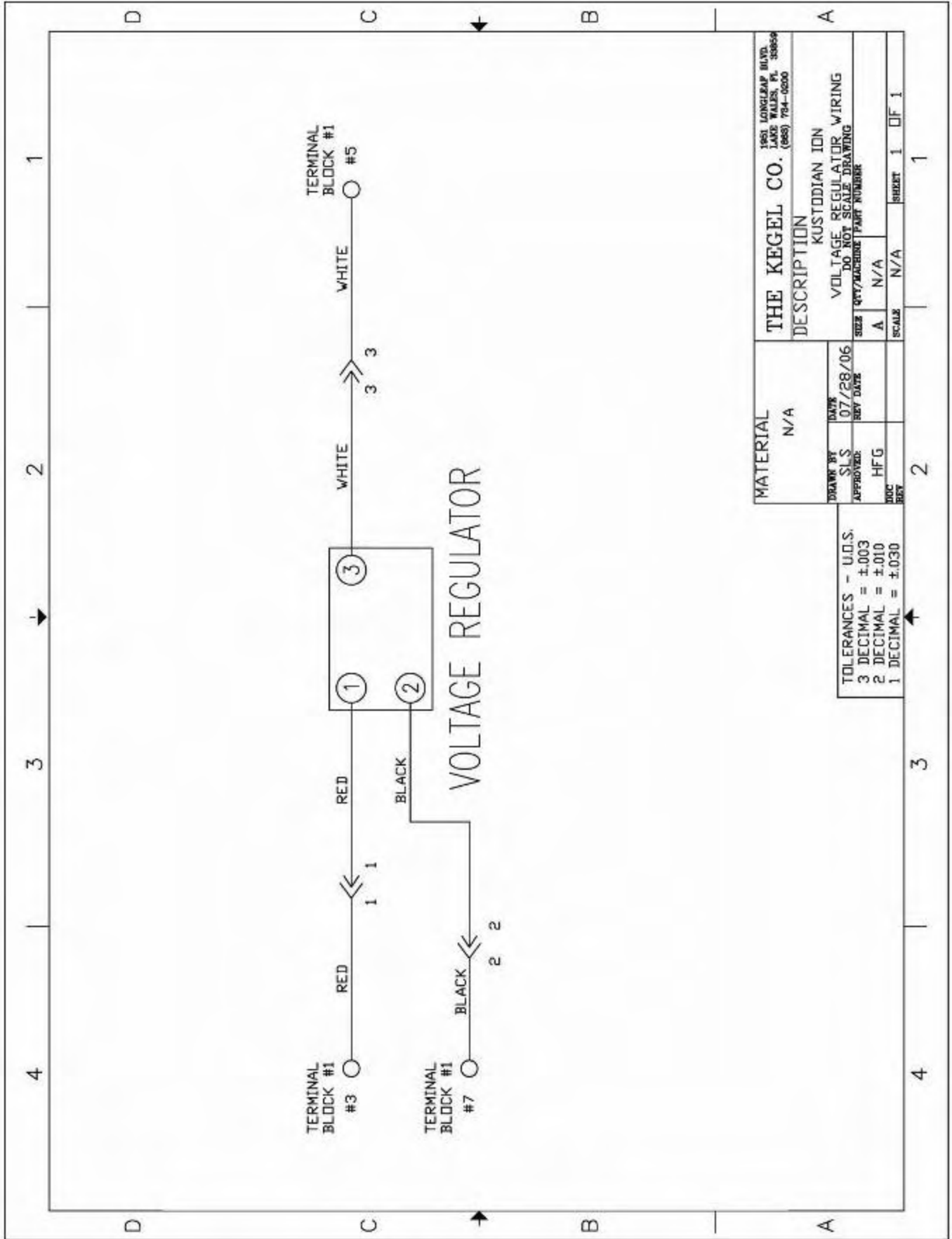
Battery Charger & E-Stop Wiring (Valence)



MATERIAL		N/A	
DATE	07/28/06	DATE	07/28/06
DESIGNED BY	SLS	DESIGNED BY	SLS
APPROVED BY	HFG	APPROVED BY	HFG
DOC NO.		DOC NO.	
REV		REV	
DESCRIPTION		KUSTODIAN ION (VALENCE)	
BATTERIES, CHARGER & E-STOP WIRING		DO NOT SCALE DRAWING	
SIZE	A	SIZE	A
QTY/MACHINE	N/A	QTY/MACHINE	N/A
SCALE	N/A	SCALE	N/A
SHEET	1	SHEET	1
OF	1	OF	1

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

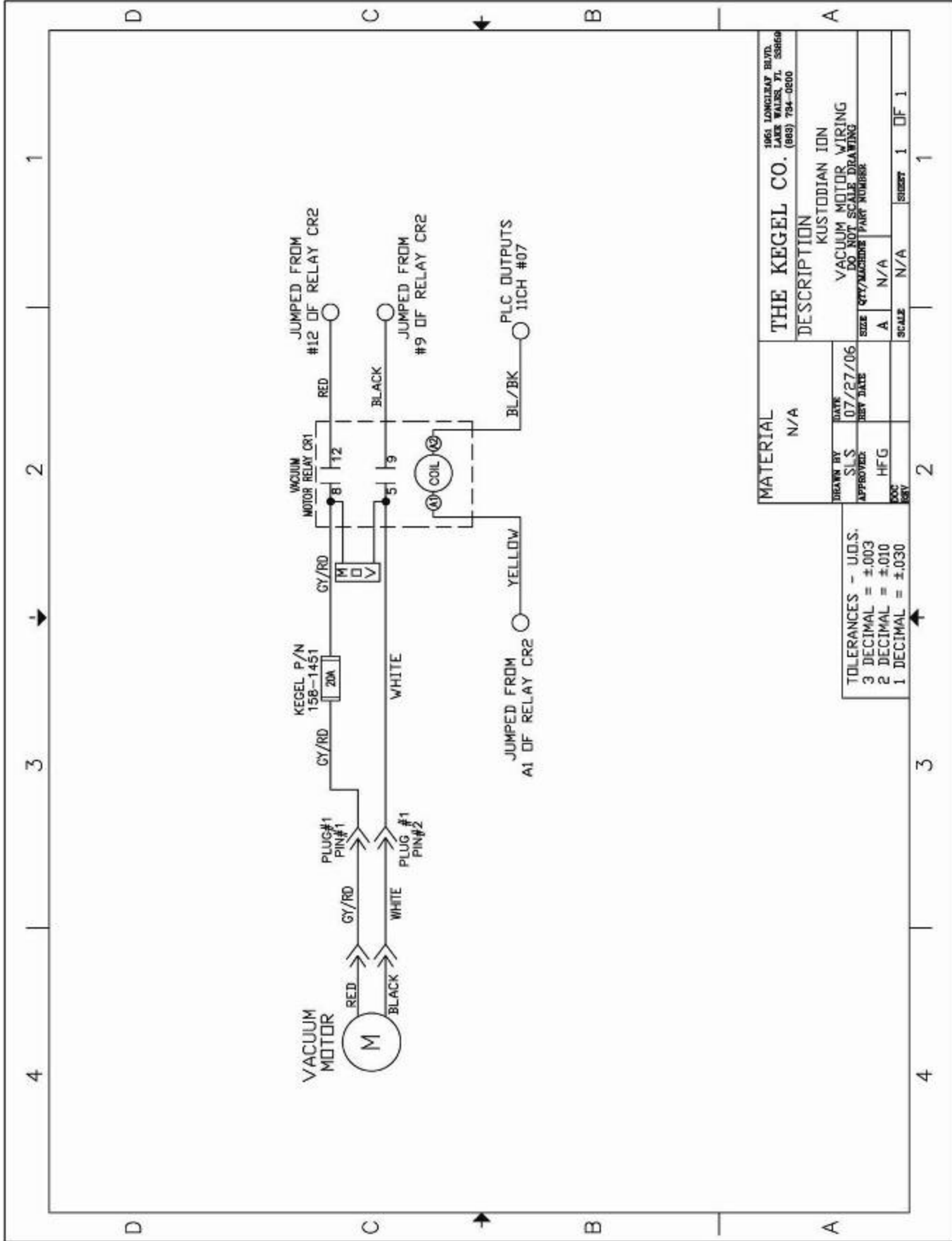
Voltage Regulator Wiring



MATERIAL		N/A	
DATE	07/28/06	DATE	07/28/06
DESIGNED BY	SLS	DESIGNED BY	HFG
APPROVED BY	HFG	APPROVED BY	HFG
DOC NO.		DOC NO.	
REV		REV	
DESCRIPTION		KUSTODIAN IDN	
VOLTAGE REGULATOR WIRING		DO NOT SCALE DRAWING	
SIZE	A	SCALE	N/A
QUANTITY	N/A	REV	1
THE KEGEL CO. (888) 794-0200		1 OF 1	

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

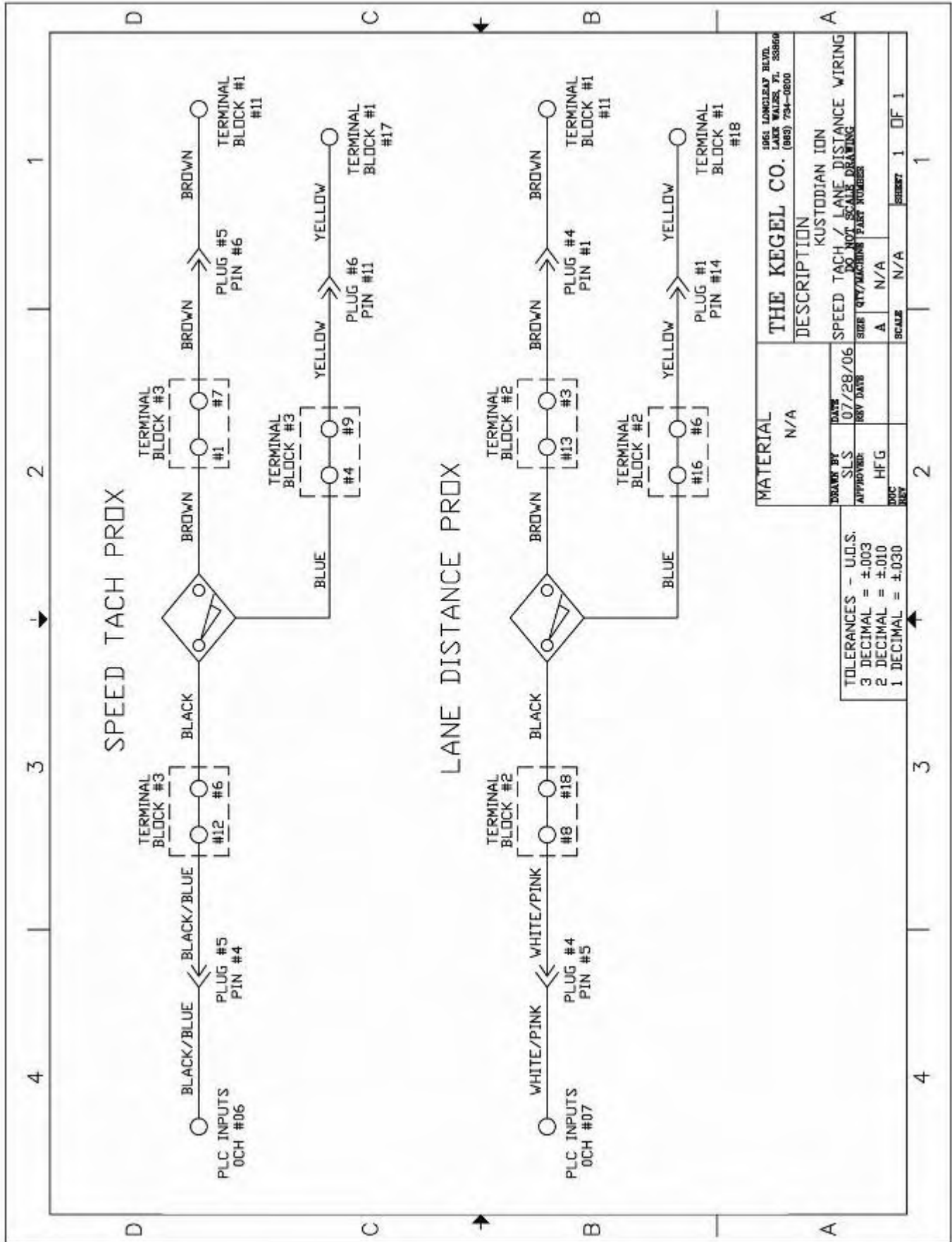
Vacuum Motor Wiring



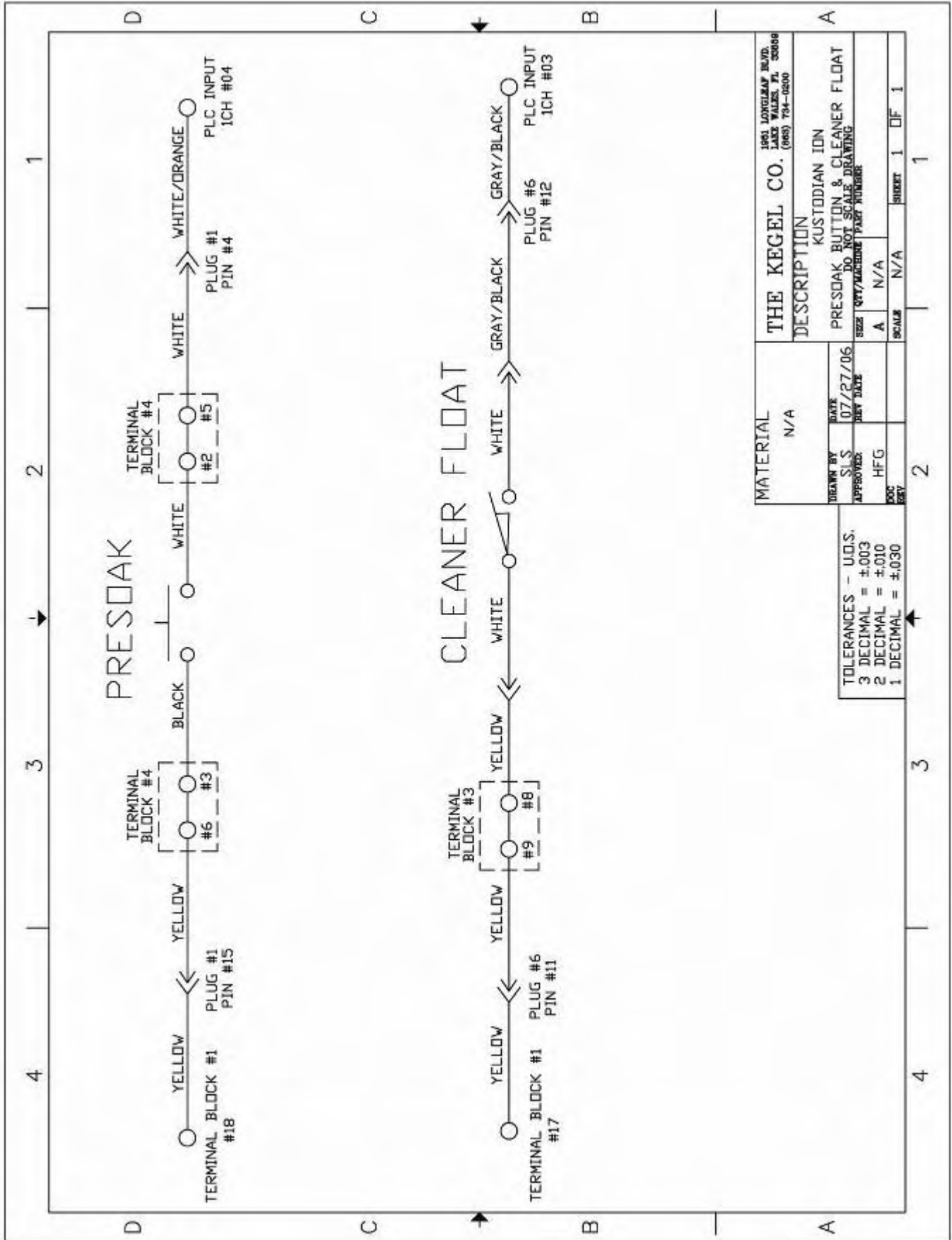
MATERIAL		N/A	
DESIGNED BY	DATE	1065 LONGLEAF BLVD. LAKE WALES, FL 33866 (888) 794-0800	
APPROVED	ISSUE DATE	KUSTODIAN IDN	
DOC NO	REV	VACUUM MOTOR WIRING DO NOT SCALE DRAWING	
		SIZE	QTY/MACHINE PART NUMBER
		A	N/A
		SCALE	N/A
		SHEET	1 OF 1

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

Speed Tachometer and Lane Distance Sensor Wiring



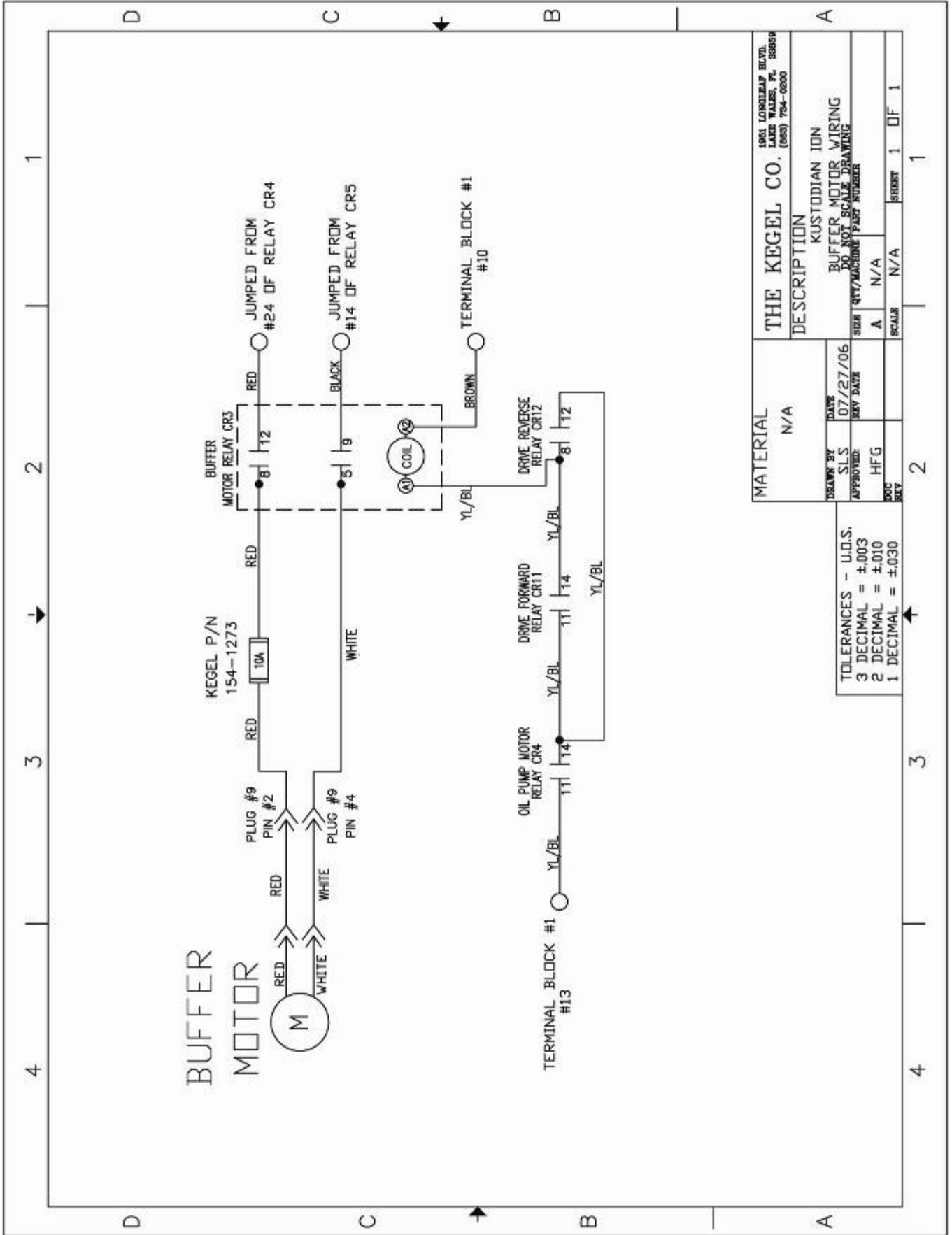
Presoak and Cleaner Float Wiring



THE KEGEL CO. 1991 LONGLEAF BLVD. LACE WALKER, FL 33006 (888) 794-0800	
DESCRIPTION KUSTODIAN IDN PRESOAK BUTTON & CLEANER FLOAT DO NOT SCALE DRAWING SIZE 100/MACHINE PART NUMBER	
MATERIAL N/A	SCALE N/A
DRAWN BY SLS	DATE 07/27/06
APPROVED HFG	REV DATE
DOC REV	SHEET 1 OF 1

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

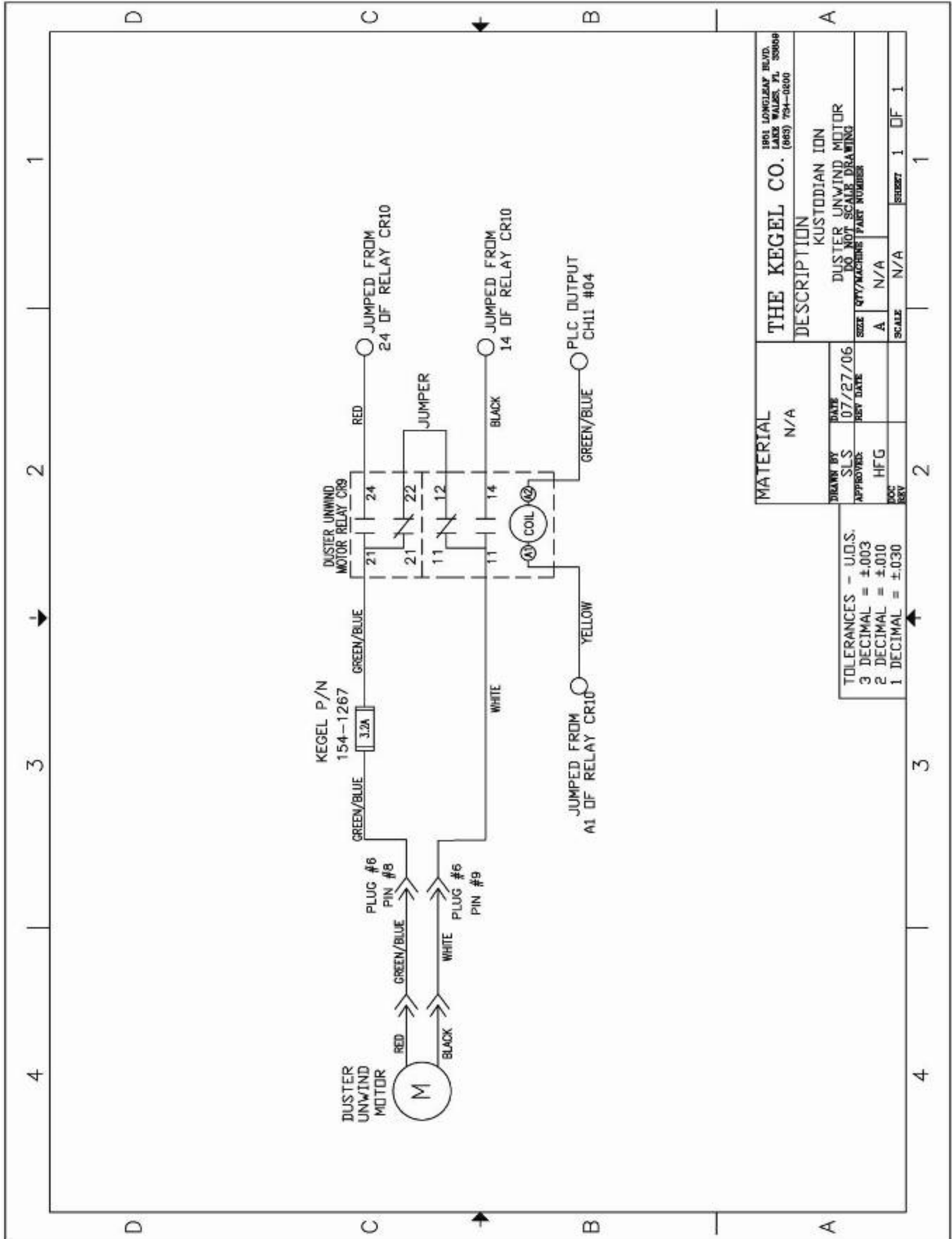
Buffer Motor Wiring



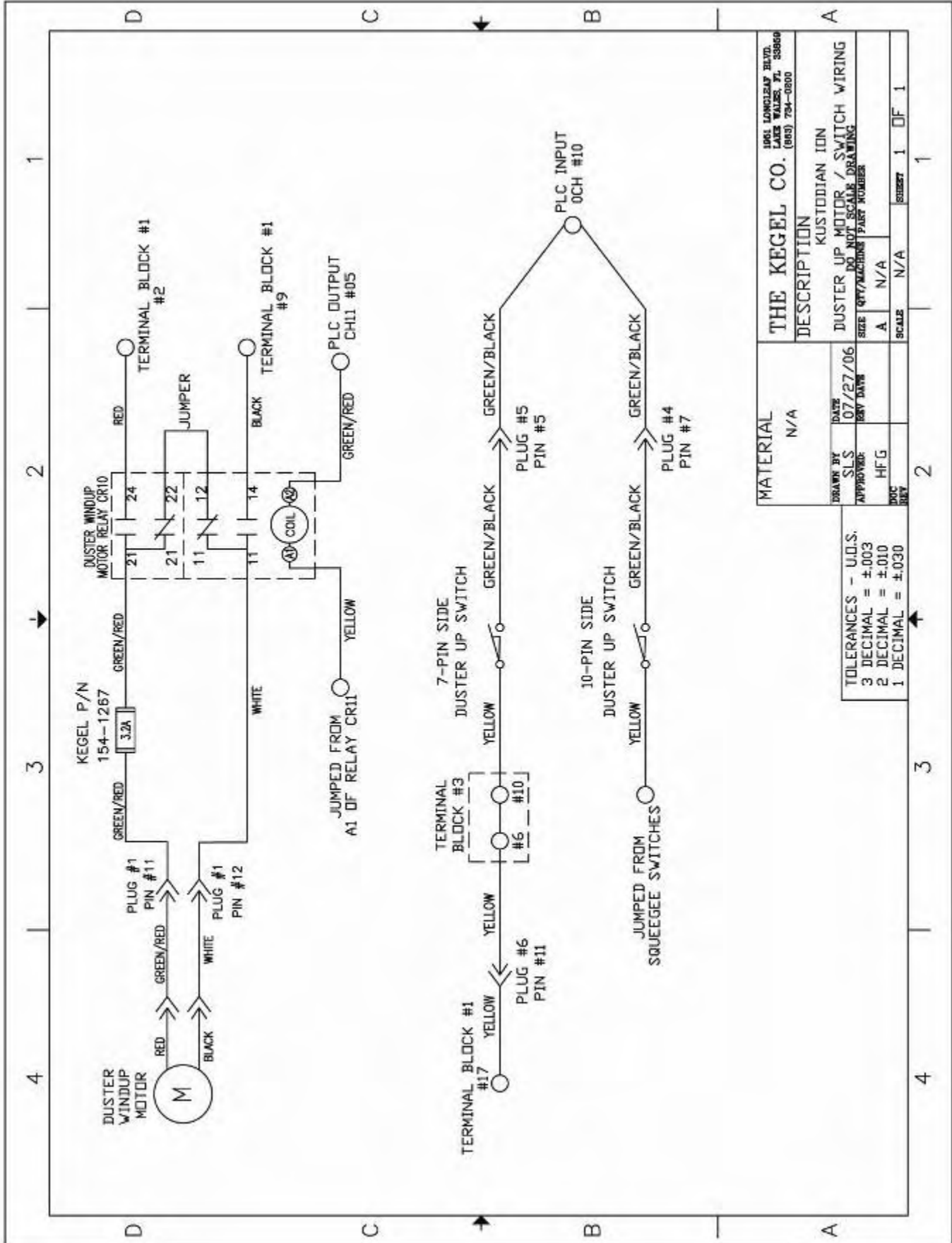
MATERIAL		N/A	
DESIGNED BY	DATE	1961 LONGLEAF BLVD. LAKE WALES, FL 33856	
SLS	07/27/06	THE KEGEL CO.	
APPROVED:	REV DATE	DESCRIPTION	
HFG		KUSTODIAN IDN	
DOC		BUFFER MOTOR WIRING	
REV		DO NOT SCALE DRAWING	
		SIZE: QTY/MACHINE PART NUMBER	
		A	N/A
		SCALE	N/A
		SHEET	1 OF 1

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

Duster Unwind Motor Wiring



Duster Wind-Up and Switch Wiring

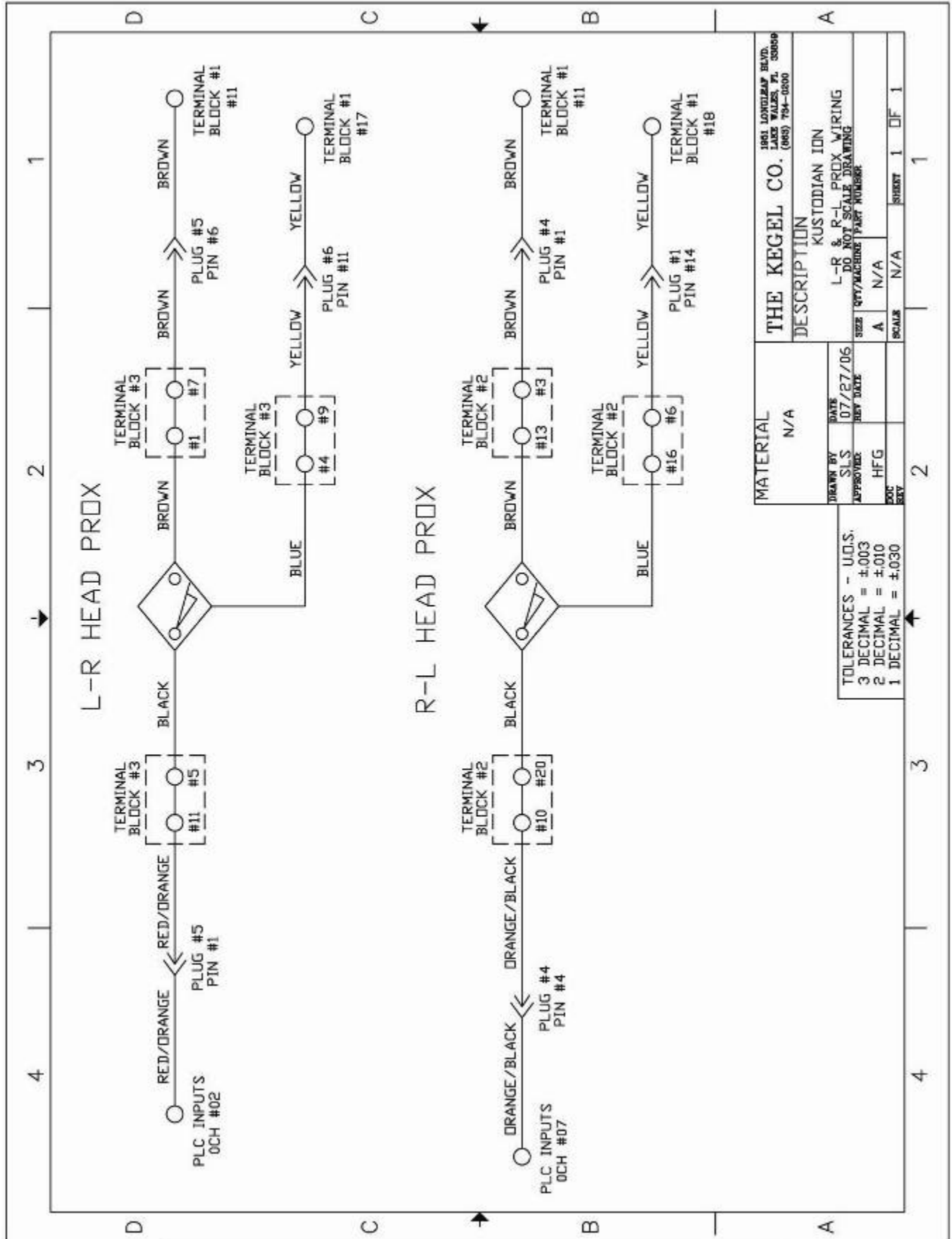


THE KECEL CO. 1061 LONCLEYAUF BLVD. LAKE WALES, FL 33866 (888) 794-0800	
DESCRIPTION	
DUSTER UP MOTOR / SWITCH WIRING	
SIZE	QTY/MACHINE PART NUMBER
A	N/A
SCALE	N/A
SHEET	1 OF 1

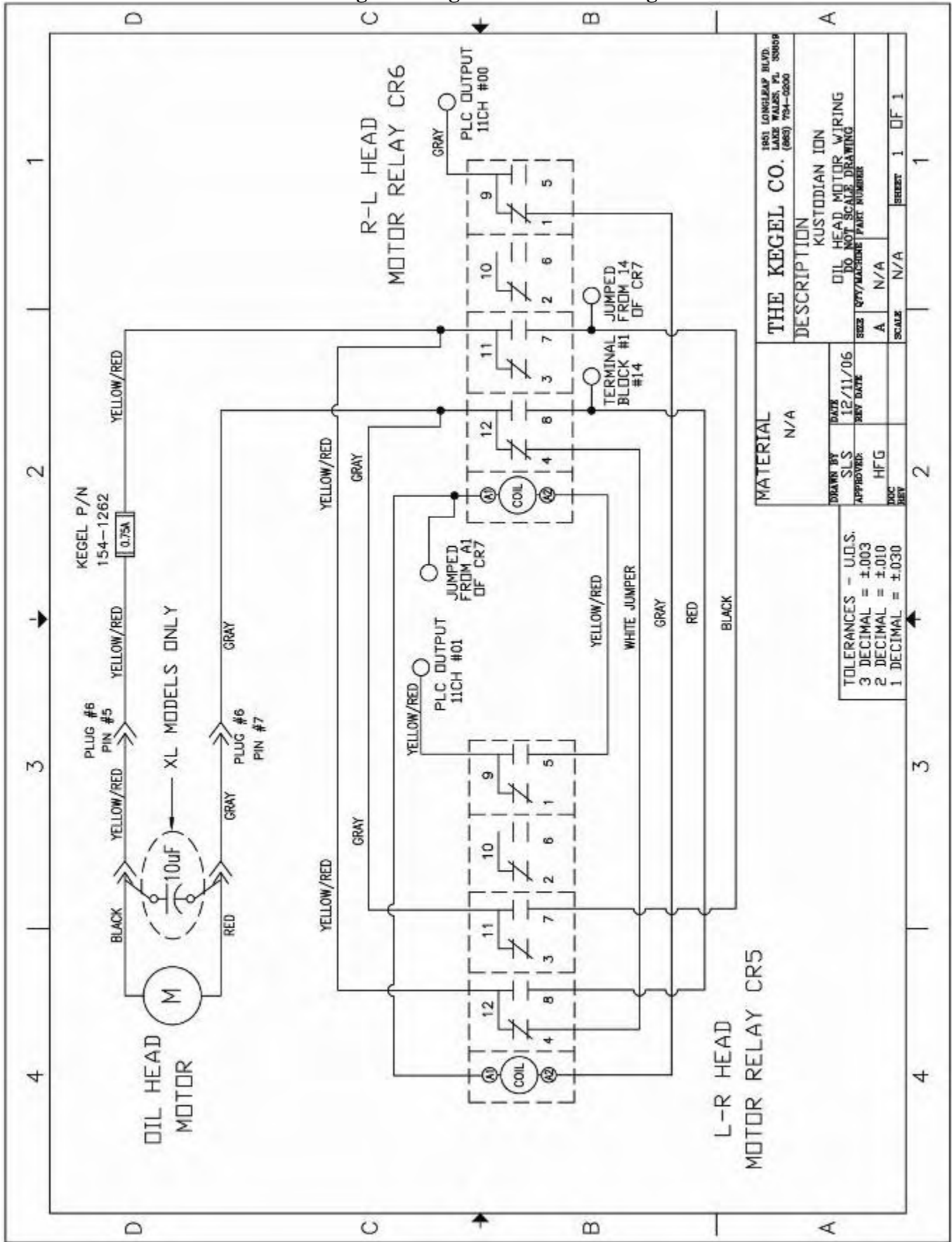
MATERIAL	
N/A	
DATE	07/27/06
DESIGNED BY	SLS
APPROVED BY	HFG
DWG NO.	
REV	

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

Conditioning/Cleaning Head Directional Proximity Switch Wiring



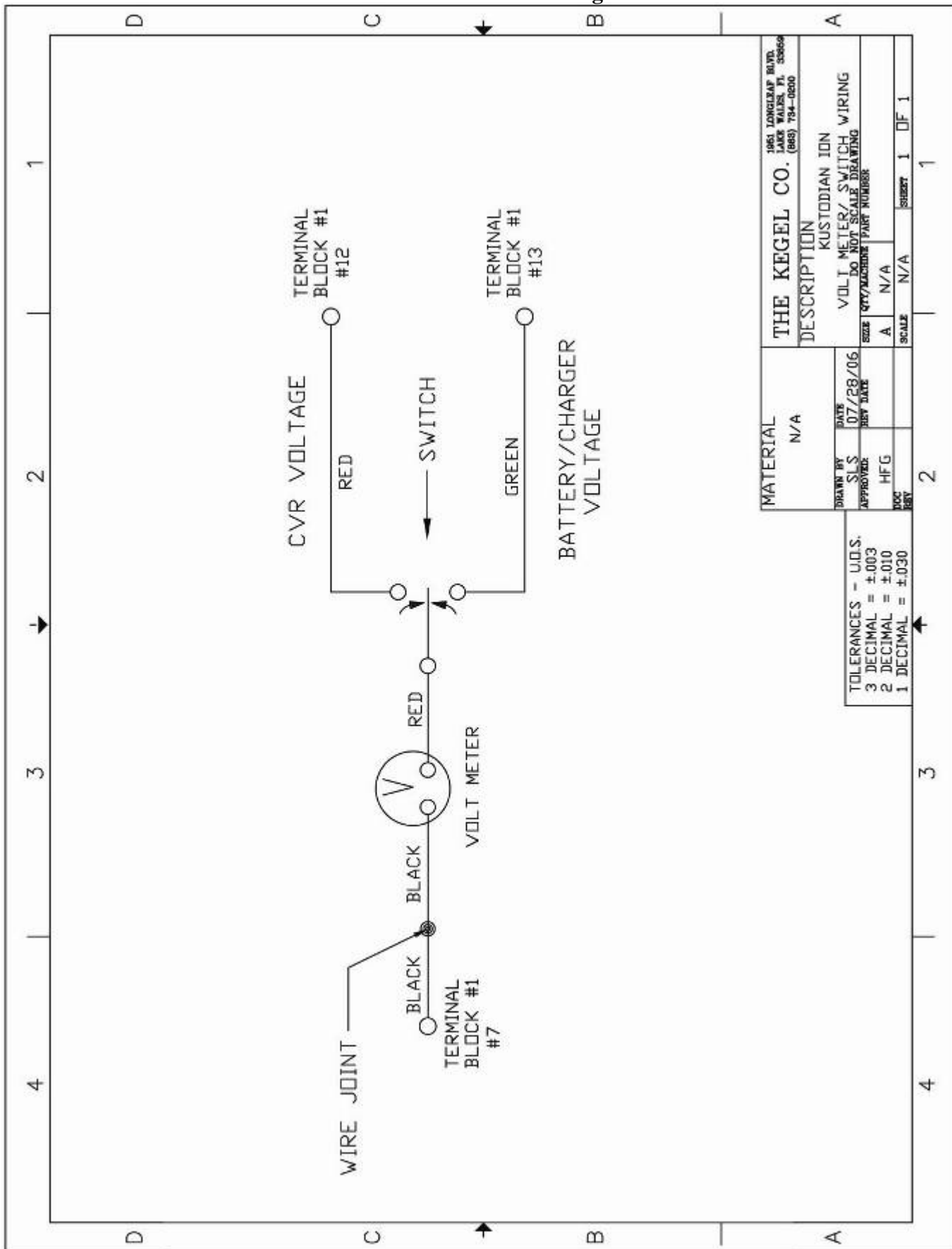
Conditioning/Cleaning Head Motor Wiring



MATERIAL		N/A	
DRAWN BY	DATE	DESCRIPTION	
SLS	12/11/06	THE KEGEL CO. KUSTODIAN ION	
APPROVER	REV DATE	DIL HEAD MOTOR WIRING	
HFG		DO NOT SCALE DRAWING	
DOC		SIZE	QTY/MACHINE PART NUMBER
REV		A	N/A
		SCALE	N/A
		SHEET	1 OF 1

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

LCD Voltmeter Switch Wiring



MATERIAL N/A		THE KEGEL CO. 1961 LONGLEAF BLVD. LAKE WALKER, FL 33669 (888) 794-0800	
DRAWN BY SLS		DATE 07/28/06	
APPROVED HFG		REV DATE	
DOC REV		SCALE N/A	
TOLERANCES - U.D.S.		DESCRIPTION KUSTODIAN ION VOLT METER/ SWITCH WIRING DO NOT SCALE DRAWING	
3 DECIMAL = ±.003		SIZE N/A	
2 DECIMAL = ±.010		SCALE N/A	
1 DECIMAL = ±.030		SUBSET 1 OF 1	

Attaching Parts & Complete 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 for the latest upgrades, parts lists, and more. Parts are subject to change.



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