

# **FLEX**

# 2018

OPERATORS MANUAL  
Edition 03:18





### **FLEX Walker Specifications**

17-5801 FLEX Walker - Red  
17-5803 FLEX Walker - Black  
17-5805 FLEX Walker - White  
17-5807 FLEX Walker - Blue

(24VDC) Class I - Single Phase  
115 Volts, 50/60 Hz, 7 Amps  
230 Volts, 50/60 Hz, 3.5 Amps

### **FLEX Specifications**

17-5701 FLEX - Red  
17-5703 FLEX - Black  
17-5705 FLEX - White  
17-5707 FLEX - Blue

(24VDC) Class I - Single Phase  
115 Volts, 50/60 Hz, 7 Amps  
230 Volts, 50/60 Hz, 3.5 Amps

### **Machine Dimensions**

Width - 59.5" (151.13 cm)  
Height - 16.5" (41.91 cm)  
Length - 44" (111.76 cm)

Weight: FLEX Walker - 370 pounds (167.8 kg)

Weight: FLEX - 350 pounds (150.1 kg)  
(Without Batteries)

158-1634	Red Battery - 24 pounds (10.8 kg)
158-1634B	Orange Battery - 29 pounds (13.1 kg)
158-1634C	Yellow Battery - 39 pounds (17.6 kg)

Manual Part Number: 164-5718

# WARRANTY

KEGEL warrants that lane machines and replacement parts will be manufactured free from defects in material and workmanship under normal use and service. Except as stated below, KEGEL shall repair or replace, at its factory or authorized service station, any lane machine or replacement part ("Warranty Item") which, within ONE YEAR after the date of installation by an authorized KEGEL Distributor, has been determined to be defective upon examination by KEGEL. For FLEX Lane Machines, KEGEL shall repair or replace, at its factory or authorized service station, any lane machine or replacement part ("Warranty Item") which, within eighteen (18) MONTHS after the date of installation by an authorized KEGEL Distributor, has been determined to be defective upon examination by KEGEL. In no event shall the Warranty coverage be more than twenty-four (24) months from the date of shipment from KEGEL's factory.

In the contiguous United States, the bowling center or end-user will be responsible for requesting Warranty Items from KEGEL and must return Warranty Items directly to KEGEL, following the required procedures. KEGEL will pay reasonable freight charges to deliver and receive Warranty Items from the bowling center. KEGEL will not be responsible for any "expedited" shipping charges. Customer will be invoiced for Warranty Items that are not promptly returned per the required procedures.

Outside the contiguous United States, the bowling center or end-user will be responsible for requesting Warranty Items from the DISTRIBUTOR and must return Warranty Items directly to the DISTRIBUTOR, following the required procedures. KEGEL will compensate the DISTRIBUTOR for reasonable freight charges to deliver and receive the Warranty Items from bowling center and to return them to KEGEL. Under no circumstances will KEGEL be responsible for any "expedited" shipping charges or taxes and duties.

This Warranty shall not apply to any lane machine repaired or altered outside of KEGEL's factory, or authorized service station, in any way, or where replacement parts have been installed in the lane machine other than KEGEL approved replacement parts, or where the lane machine has been subjected to misuse, negligence, accident or abuse.

KEGEL reserves the right to inspect and make the final decision on any claim under Warranty which it deems questionable. KEGEL's liability under the Warranty expressed above is limited to repair or replacement; KEGEL shall have no liability for any and all incidental or consequential damages or costs.

KEGEL DISCLAIMS ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

## KEGEL KOMFORT BONUS WARRANTY PROGRAM

The KEGEL Komfort Bonus Warranty program provides Sanction Technology™ customers, additional protection on costly components after the initial standard Warranty expires. By accepting the KEGEL Komfort Program, the owner will receive an additional eighteen (18) month Warranty by committing to use KEGEL Chemical Products exclusively in their lane machine. This includes Conditioner, Cleaner and Cloth for the first three (3) years of operating the machine. To accept the program, simply check the box on the front of the Warranty card.



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

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

# Safety First

This Class I Single Phase lane cleaning/conditioning machine shall be grounded while charging to protect the operator from electric shock. The machine is provided with a three-conductor charger cord for use in a properly grounded receptacle. Machines rated at 115 Volts A.C. are for use on a nominal 120-volt circuit and machines rated at 230 Volts A.C. are for use on a nominal 240-volt circuit.

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

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

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

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

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

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

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. Register your machine on line at [www.kegel.net](http://www.kegel.net).

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

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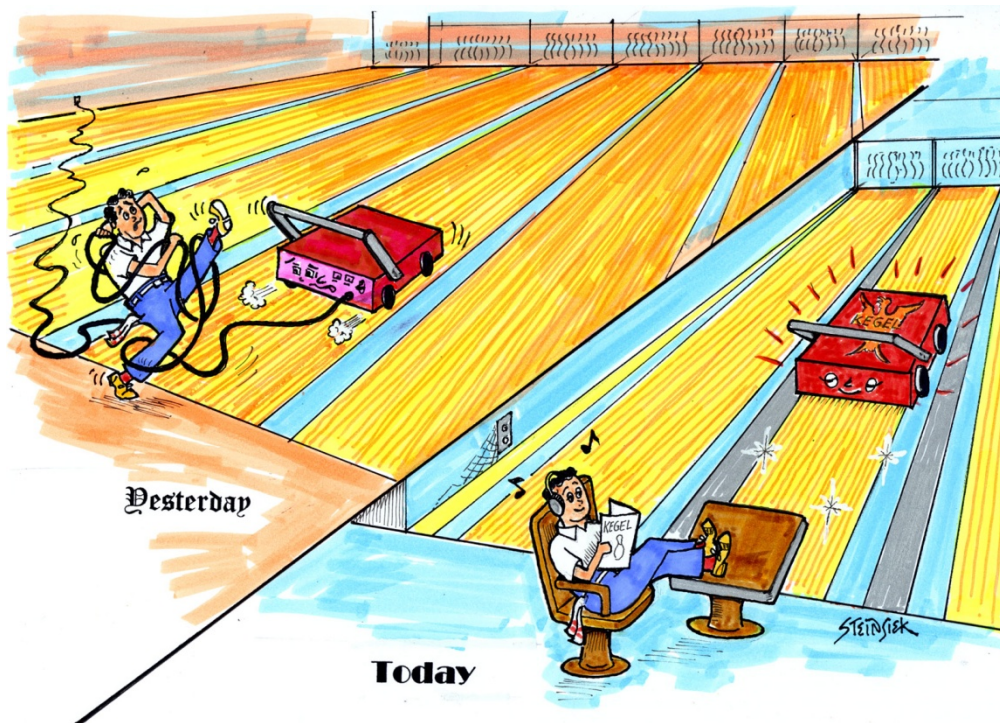
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# PREFACE



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

Battery-operated FLEX machines operate like no other lane maintenance machines. Cordless operation of the FLEX and automatic lane to lane advancement of the Walker allows for fewer operating problems and increased customer satisfaction.

A patented fluid metering transfer system, along with the vacuum/squeegee cleaning system and duster system, allow the machine to maintain clean and consistent bowling conditions.

In addition to this manual, Kegel has developed an On-line Support Interface called KOSI. This software is provided free with the machine. KOSI allows the operator to access additional functions that are otherwise not available to the operator through the keypad. KOSI includes programs and instructional videos which should be used as a supplement to this manual.

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

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## About This Manual

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

## The Intended User / Operator

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

## Disclaimer

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

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## Conformity

This lane machine has been independently tested to comply with applicable standards for the equipment.

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

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(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 at a time in David’s garage.

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

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

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

Kegel Bowling Technologies – This division develops and blends conditioners and cleaners that are used in our lane conditioning machines, as well as other areas in bowling and beyond. Lane Maintenance Central (LMC) – Regarded by many as the best in the industry, LMC provides 24 hour telephone support, educational seminars, workshops, and on-site support to bowling centers and distributors throughout the world.

Kegel Training Center – Located on-site, we custom built this 12-lane bowling center for serious bowlers to train to be the best. Kegel is proud to host educational clinics in various forms for bowlers, coaches and pro shop operators. The first of its kind, the Kegel Training Center boasts original concepts including, 12 adjustable topography lanes, and advanced coaching tools like Specto, and the Torch.

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 and a 33,000 sq. ft. facility located in Lake Wales, Florida. Kegel has done this with a simple philosophy of researching the problems that exist in the bowling industry, developing a product or service to solve that problem, and making sure to support the customer with the highest of standards.



"Wah-lah...I did them the same!"



# CHAPTER 1

## Installation & Setup

### Machine Inspection

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

Fill in the following Check Boxes and Information:

- FLEX Walker Lane Machine
- FLEX Lane Machine
- Cleaner Funnel – 158-8252
- Accessory Kit
- Operators Manual – 164-5718
- KOSI PRO FLEX Software on USB drive & PLC Cable – 154-8781
- Extra Roll of EZ Core Cloth - 153-0047EZ
- Maintenance Supplies Starter Kit - 154-8866
- External Charging Assembly
- K2 Battery Assembly

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

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

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

Battery Serial Number: \_\_\_\_\_

### Register your Lane Machine

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

[www.kegel.net/kegel-lane-machine-warranty-registration-form](http://www.kegel.net/kegel-lane-machine-warranty-registration-form)

## Machine Installation Procedures for the Distributor

When using this manual make note that ALL fonts that are in **BLUE** contain information that pertain to the FLEX Walker ONLY. All other documentation will be used for both FLEX model lane machines.

Also, please be aware that the screen shots are for illustration purpose only and the settings within may or may not be the exact factory setting. Please read the description to fully understand what the setting should be for your particular lane machine.

1. Decide on the storage area for machine, which is where the charger will be mounted. It is strongly suggested to use only a dedicated circuit. The light may prevent the machine from not being charged due to a tripped breaker (a simple night light works fine).
2. Unpack and inspect machine for shipping damage; make sure all the extra items are included in the shipping crate. Put batteries on charge as soon as possible after inspecting. See *Chapter 5* for instructions.
3. Menu to the 'ABOUT' screen and enter the install date.
4. Remove the lid and the side guards to reveal all of the components.
5. Inspect all of the switches and sensors and describe the function of each one:
  - a. 7-pin & 10-pin Whiskers Switches - adjusting screw is hard to see (FW only);
  - b. Bumper Switches (FW only);
  - c. On Lane sensor (OLS) – it is very important to show this sensor since it is hard to see.
  - d. Duster up Switches (FLEX & FW);
  - e. Cleaning Compartment Button - both functions should be explained;
  - f. 7-pin & 10-pin Approach Sensors (FW only);
  - g. Lane Distance Sensor (LDS);
  - h. Tachometer Sensor (Tach);
  - i. Right & Left Board Edge Sensors;
  - j. Board Counting Sensor;
  - k. Brush and Squeegee Lift Switches;
  - l. Handle Button (FLEX) - explain the functions of this button;
  - m. Recovery Tank Switch – explain that this switch will produce an error message when the recovery tank is not present;
  - n. Oil & Cleaner Floats Switches. Explain the purpose as outlined in the conditioning and cleaning troubleshooting in the respective chapter.
  - o. Stop by Sensor mounted on Squeegee channel (FLEX & FW);
6. On the Walker, examine the Zero Turn Radius (ZTR) Wheels and explain how these wheels, plus the approach casters, are the only wheels on the approach when the machine is turning and moving to next lane. The rear black wheels help the machine out of the lane and also help steer the machine just before they leave the approach as the

machine is going into lane. Also mention that the 7-pin drive wheels turn off after the machine enters the lane.

Discuss how important it is to have a good transition to the approach. The adapters from gutter to approach must be the same for the machine to come out as straight as possible, it is up to the center to make this happen. Extra dusty approaches are not good. [This is very important for the Walker lane machine.](#)

7. On the Walker, describe how the black Bumper Wheels function and make certain that adjustment is not too wide for center (always run the machine first before making any adjustments). The factory adjustment will typically work just fine.
8. On the Walker, show the Whisker adjustment and make sure they are not adjusted too wide for center (run the machine before adjusting). Factory adjustment usually works well. Describe how the Whiskers self-adjust when machine is moving onto the lane.
9. Show the Motor Controls for the Drive Motor, Cleaner Pump Motor and the two Stepper Motor controls. On the Walker, also show the resistance wire box and explain how to balance the motors. Make sure they call Kegel for advice on balancing the motors.
10. Inspect all the relays and describe their function. Make sure all are seated properly in the socket bases.
11. On the Walker, show the two steering relays (CR15 & CR16) and notice that both input lights come on when just one whisker switch is operated (when machine is not in motion). When both drive motors are on while traveling forward, the Whiskers will only turn on their input. When both input lights come on it is due to the Negative DC power feeding back through the coil of the relays. Positive DC power for the coils of CR15 & CR16 is routed through the Whisker Control Relay (CR14).
12. Show the PLC and how the Inputs light up when a sensor or switch is actuated. Explain the channel designations and which Inputs are 0CH and which are 1CH; Outputs are 100CH and 101CH. This can be confusing for both the Inputs and Outputs since it is not clearly printed this way on the PLC (i.e. 2 connections are labeled 00, but one is 0CH 00 and the other is 1CH 00).
13. Describe the CVR and what components have controlled voltage: Oil Pump; Drive Motors; Buffer Motor; Moving Head Motor; Oil Valve; and all of the Relays.
14. Loosen the fasteners for the Main Control Plate to lift it out of the way and show the batteries and the motor chain adjustments.
15. Open the Splash Guard and describe all of the components behind it.

16. Discuss how the cleaner tank can do up to 50 lanes depending on cleaner volume settings and show how this adjustment is made (Chapter 3). The recovery tank holds what the cleaner supply tank dispenses (and it is heavy when full).
17. Explain the Conditioner cartridges and how they work (Chapter 2).
18. Discuss the operation of the Pindeck treatment function. Explain how the duster functions during the application, and how important the tip cover is to be in place when not in use! Please read more on this in Chapter 3.
19. Stop and take a break...let some of the information sink in and consider getting something to drink. Reassure them that Kegel provides many resources with this information.
20. Point out the KOSI software located on the USB storage key that was provided for their PC. Some may want to install it right away. (The CP1H PLC requires a different cable than the other Omron PLCs.)
21. View all of the menus on the touchscreen.

## *Gentlemen,* **start your ENGINES ...**

Now that a thorough overview of the machine has been completed, we are ready to crank it up. Keep in mind that some steps only apply to the [Walker](#).

1. When the machine is powered ON the touchscreen will illuminate. With power applied, press the **MOVE MACHINE** icon on the touchscreen and demonstrate how easy it is to position the machine. Line the machine up with lane as if you are ready to operate.

When starting the machine on the first lane it is important to position it the correct distance from the foul line. The front bumper should be about 20" to 22" (51 to 56 cm) away from the foul line. This is required so the machine functions will happen at the proper location relative to the foul line of the first lane.

2. Have the operator(s) practice moving the machine and provide tips on what to look for.
3. Using the touchscreen, perform the starting sequence to run the machine. On the Walker, if you are just checking lane to lane settings choose program 30, it is set to run for 10 feet at oil only.

4. Watch the machine as it enters the lane. Describe the function of the Whiskers as they operate to steer the machine. Watch how the machine will continue to move on one side and slow down on the other to steer if one of the Whiskers hits the foul light cover.
5. As the machine enters and sets itself onto the lane describe how the On Lane Switch changes the machine from approach functions to on-lane functions. For example, on the Walker, the 7-pin drive motor turns off as a result of this action.
6. Watch the machine operate on the lane and monitor the speeds. Make certain they are in the proper range for each speed.
7. When the machine enters the pin deck check to see if the squeegee completely clears the pin deck. [Listen for the Buzzer to make certain that the Lane Distance Sensor stops the machine.](#)
8. Explain the squeegee wipe function when the machine enters the pin deck and how this is meant to remove any excess drips of cleaner that could fall off on the lane or approach.
9. Monitor the machine back to the foul line. On the Walker, watch for the 7-pin drive motor to turn on and make sure that it does so well before the machine reaches the foul line.  
**Note:** The touchscreen buzzer will indicate the machine is going into approach drive functions and will sound the entire time while on the approach.
10. Watch closely as the machine exits the lane. This is where you can see if the adapters from gutter to approach will cause any problems with the operation of the machine.
11. Watch the machine travel from lane to lane. It is possible to customize the travel to each lane and all settings in your center.
12. Be very alert when machine exits the lane, turns 90 degrees, moves to the next lane, turns back 90 degrees and goes forward toward lane. This is where you watch to see how closely the two drive motors are balanced.
13. Observe the machine as it enters the second lane and note how far off it is from center. Estimate how many counts you think it will take to achieve perfection and make a mental note. As the machine enters the third lane, note how far off-center it is as it enters and estimate how many counts it will take to be correct. Stop the machine before it goes into the third lane and change the lane to lane settings for the entire center set-up using these revised values, if necessary.
14. Check the lane to lane distances the same way for the opposite direction of travel (if the machine is going to be run from both directions).
15. After adjusting these settings, re-start the machine on Lane #1 (or the high end) and operate it across the center. Point out things the operator can do while the machine is running to impress their boss by multi-tasking.

16. After operation, review proper steps to transport, clean, and charge the machine for its next use. Tell them to read this Operators Manual and show them how the manual is organized to help them find what they are looking for.

## Daily Setup and Operation

### Moving & Transporting your Lane Machine

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

Ramps that are used for moving the machine to and from the approach should also be “machine friendly”. These ramps should be no less than 12 feet long with no bump on either end of the transition. Improving these transitions will not only extend the life of your machine, but can make it easier to transport the machine to and from the approach. The transition from the gutter to the approach should be as smooth as possible for an easy entrance and exit for the lane machine. This will prolong the life of the casters as well as other parts. Better transitions also help in preventing drips of cleaner from falling off the squeegee.

When setting the machine down into the operating position, roll the machine away from you a foot or two. This will allow the casters to face the best direction for ease of lowering. If using the lift, do the same thing, only pushing it away from the wall prior to hooking the machine up.

### Replacing the Conditioner Cartridge

It is best to change Conditioner Cartridges only when empty! Drips may occur while changing a cartridge that has conditioner left in it.....

1. To replace the conditioner cartridge, the machine should be in the operating position with the lid slid back just far enough to expose the conditioning compartment.
2. Next, simply reach into the conditioning compartment and pull cartridge retainer back and pull cartridge out of the machine. Use a towel to clean up any drips in oil compartment.
3. Remove the metal valve cap assembly from the old cartridge and place it on the new conditioning cartridge and tighten. Make certain to not cross thread the cap to the tank.
4. Before inserting the cartridge into the machine, it's a good idea to ensure the cap has a good seal. Position the cartridge to look for drips forming around the cap and squeeze lightly to force a bad seal to leak. Always clean around cap before inserting.
5. Insert the new conditioning cartridge into the lane machine matching it with the corresponding letter.

When finished, be sure to refill your conditioning cartridges if necessary.

**DO NOT OVERTIGHTEN THE CAP FOR THE CARTRIDGE!!**



### **Filling the Cleaner supply Tank**

With separate water and cleaner tanks

1. To fill the Cleaner Supply Tank, the machine should be in the down or operating position on the lane.
2. Add water to the supply tank located on the left or the 7 pin side. Add water until you reach ½" (1.3cm) below the top of the tank.
3. Add straight cleaner to the right tank assembly or the 10 pin side tank.
4. Clean up any spills that may have occurred during the filling.

With single cleaner supply tank assembly

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 towel beneath the tank. Open the tank cap and place a towel 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.



#### TECHNICAL

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.



## FLEX Walker Sequence of Events - “How it Works”

The following steps detail how the Walker operates. Skip to Page 15 for the FLEX. The Walker should be on the approach in the down or operating position behind the first lane with the HOME SCREEN showing. The machine needs to be in CLEAN & 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. If errors are present, the recovery tank is missing, or the duster cloth low there will be a message indicating this on the Home Screen.

1. Press the **GO TO STARTING LANE** button to advance to the starting lane screen. Choose the starting lane then press **GO TO ENDING LANE** and choose the ending lane. After choosing the ending lane, press **START MACHINE** the machine will change to a screen that will ask you to double check your info. If it's correct press **YES** and the machine will be ready to operate.
2. The Walker starts moving toward the lane using two drive motors, each monitored by a proximity sensor. If the 7-pin motor sensor fails to receive a signal while on the approach, there will be an **APPROACH 7 PIN** error. If the 10-pin sensor fails, there will be an **APPROACH 10 PIN** error.
3. The **OLS** error is also active when the Walker is moving toward the lane. If the On Lane Sensor (OLS) does not close the contacts in 8 seconds, then the PLC assumes that the machine has failed to seat on the lane or it is going too slowly and displays an **OLS LATE** error. If the OLS sensor is actuated before the machine goes into the lane an **OLS STUCK ON** error will be displayed. *All error messages are explained on the touchscreen and in their appropriate section.*
4. As the Walker moves toward the lane, the squeegee, duster, cleaner pump, and oil head will start up at their individual preset distance. The duster cloth 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 displayed. The squeegee will move down and stop when the down switch normally open contacts close. If the switch contacts do not close there will be a **SQUEEGEE DOWN** error displayed. Finally, the oil pump will turn on.
5. As the Walker enters the lane the 10-pin whisker sensor will just brush the foul light which will turn on the steering relay. This will cause the machine to go into its steering function. The 7-pin motor will slow down due to the steering relay opening up the power to the motor. At the same time, the 10-pin motor will continue to run to turn left. When the 10-pin whisker sensor comes off the foul light the machine will either be lined up with the lane or the 7-pin whisker sensor will come in contact with the left division rail. If the 7-pin whisker touches, the machine will turn back to the right and will most likely be lined-up with the lane.

6. The moving heads will start and move in opposite directions. The cleaner head will start to apply cleaner when signaled 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.
7. When the oil head reaches the left board edge proximity sensor, the head motor will reverse. At the very moment the moving oil head reaches the 7-pin side, the machine should be entirely on the lane.
8. When the On Lane Sensor receives a signal from the arm, the 7-pin drive will turn off, the whisker sensors will be disabled, the buffer will turn on at the programmed distance and the main drive will remain on to continue moving the Walker forward. After the Walker has traveled about 2 feet, the vacuum will turn on.
9. Additionally, the OLS sensor will start a clock to record the total amount of run time and display it on the screen.
10. As the Walker 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, a **MOVING HEAD TRAVEL** error will be displayed.
11. As the Walker 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 **FORWARD TRAVEL** error will be displayed. The speed of the machine is also being displayed on the screen.
12. As the Walker continues to move forward, speeds will change and oil and cleaner will continue to be dispensed to the lane as programmed. As the Walker approaches the applied oil distance, the oil will turn off and the buffer will continue to buff oil onto the lane.
13. When the end oil distance is reached the buffer brush will stop and rise up, then the brush up switch normally open contacts close. If the contacts do not close there will be a **BRUSH UP** error displayed. If the brush up switch sticks closed when it should be open it will give a **BRUSH DOWN** error.
14. When the end oil distance has been reached, the machine will shift into high speed and continue to travel toward the pin deck. As the Walker approaches the pin deck, the last squirt distance will turn off the cleaner pump and the moving heads will park. At the same time, the Walker will down shift to low speed to reduce its momentum into the pin deck.
15. When the machine enters the pin deck, the duster wind-up motor will turn on at its pre-determined distance and start to wind up the cloth (to raise the duster). The

duster up switch's normally open contacts will close to turn off the duster wind-up motor. If the contacts do not close there will be a **DUSTER WINDUP** error displayed.

16. There are two ways to reverse the Walker or Flex. In this scenario, the LDS sensor stops the machine and the alarm buzzer will sound to alert the operator.
17. The other option is the Stop by Sensor. The machine will be signaled to stop when the Sensor goes passed the tail plank and trips before the LDS. Using both functions to stop forward travel creates a back-up method for the stopping the machine.
18. When the Walker reaches its travel distance and comes to a stop, the squeegee will proceed to lift up and stop when the squeegee up switch normally open contacts close. If the contacts do not close, a **SQUEEGEE UP** error will be displayed.
19. If the Pindeck Treatment function is disabled, the Walker will then start traveling in reverse and stop after moving 14 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. If the Pindeck Treatment function is enabled the machine will start moving in reverse until the cleaner head assembly is line with the 2-3 pin deck spots then drop the duster. ([refer to Chapter 3 for more information](#))
20. The machine will then start up the moving head to apply the Pin Deck Treatment. After application of Pindeck Treatment the machine will wipe it onto the Pindeck and stop with duster on back row of spots then duster will lift.
21. The Walker 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.
22. As the Walker travels in reverse at high speed the lane distance sensor is counting inches traveled and is also monitoring the movement of the machine. If travel is interrupted, a **REVERSE TRAVEL** error will be displayed.
23. As the Walker reaches the Lower Buffer Brush and Turn on in Reverse location, it will begin to lower and stop in its down position when the brush down switch normally open contacts close. If the contacts do NOT close a **BRUSH DOWN** error will be displayed. If the brush down switch sticks closed when it should be open, it will give a **BRUSH UP** error.
24. The brush will begin buffing at the pre-determined distance as the Walker travels in reverse. The oil head will start back up again when it reaches the first reverse load distance.
25. As the Walker continues to travel in reverse it will be down-shifting to lower speeds. After the Walker applies the last reverse load the moving heads will park.

26. As the Walker approaches the foul line the 7-pin side motor will turn on and the buzzer will begin to sound. When both motors turn on they are once again monitored by their respective sensors to confirm they are in motion. The Walker will drive up on the approach and stop at the preset distance past the foul line.
27. After a short delay the Walker will turn 90 degrees; the direction of turn will be determined from the starting lane and ending lane. The machine will stop, have a short delay, move to the next lane, stop, have a short delay, turn 90 degrees, and face the next lane.
28. When the Walker stops after the second 90 degree turn all functions will reset and the machine will begin to operate on the next lane. When the Walker is done it will back out of the lane and stop.
29. If the oil float contacts open, an **OIL EMPTY** error will be displayed after the Walker has completed its second 90 degree turn. The oil will then need to be filled and the Walker will have to be re-started.
30. If the cleaner float contacts open, a **CLEANER EMPTY** error will be displayed after the Walker has completed its second 90 degree turn. The cleaner will then need to be filled and then re-started. Always empty the recovery tank when filling the cleaner tank.
31. The Walker cannot be resumed if the following errors occur: **APPROACH 7 & 10; OLS LATE OR STUCK; OIL & CLEANER FLOAT; DUSTER UNWIND; and SQUEEGEE DOWN**. In the event one of these errors occurs, the machine will need to be re-started.



#### TECHNICAL

If the Walker 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), if the E-Stop is pressed, or if there is a loose power connection.

### FLEX Sequence of Events - "How it Works"

The following steps detail how the FLEX operates, which is much like the Walker. The FLEX should be on the approach in down or operating position with the HOME SCREEN displayed on the touchscreen. The FLEX 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 FLEX, how the errors work, and what happens as the FLEX travels down your lanes.

1. Press the **GO TO STARTING LANE** button to advance to the starting lane screen. Choose the starting lane then press **GO TO ENDING LANE** and choose the ending lane. After choosing the ending lane, press **START MACHINE** the machine will change

to a screen that will ask you to double check your info. If it's correct press **YES** and the screen will change to the run screen and it will be ready to run.

2. 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 displayed. The squeegee will move down and stop when the down switch normally open contacts close. If the switch contacts do not close there will be a **SQUEEGEE DOWN** error displayed. The oil pump will turn on.
3. Push the machine onto the lane and make sure it is properly seated. Press the **start** button a second time and the moving heads will start and move from left to right or from right to left (the heads move in opposite directions). The cleaner head will start to apply cleaner instantly to the lane and not stop until the last squirt distance has been reached. When the oil head reaches the right board edge proximity sensor, the moving heads will reverse and begin to apply the first stream of oil.
4. The moving heads are now moving in opposite directions, so when the oil head reaches the left board edge proximity sensor, the head motor will reverse and the drive motor will start up. The buffer will then turn on and the machine will begin its forward travel down the lane. When using the factory settings, the buffer motor does not turn on until the rear of the machine is about 3 feet (0.914 meters) past the foul line. Also, the vacuum motor does not turn on until the rear of the machine is about 3 to 4 feet (0.914 to 1.2 meters) past the foul line.
5. Additionally, the second press of the **start** button will start a clock to record the total amount of run time to be displayed; the total valve time will also be recorded and displayed.
6. As the machine travels forward down the lane the moving heads will continue to operate applying oil and cleaner. The board counting proximity sensor monitors the motion of the moving heads. If the motion is interrupted, a **MOVING HEAD TRAVEL** 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 **FORWARD TRAVEL** error will be displayed. The speed of the machine is also being displayed on the screen.
8. As the machine continues to move forward, speeds will change and oil and cleaner will continue to be dispensed to the lane as programmed. As the machine approaches the applied oil distance, the oil will turn off and the buffer will continue to buff oil onto the lane.
9. When the oil distance is reached the buffer brush will stop and rise up, then the brush up switch normally open contacts close. If the contacts do not close there will

be a **BRUSH UP** error displayed. If the brush up switch sticks closed when it should be open it will give a **BRUSH DOWN** error.

10. When the oil distance has been reached the machine will shift into high speed and continue to travel toward the pin deck. As the machine approaches the pin deck the last squirt distance will turn off the cleaner pump and the moving heads will park. At the same time the machine will down shift to low speed to reduce its momentum into the pin deck.
11. When the machine enters the pin deck, the duster wind-up motor will turn on at its pre-determined distance and start to wind up the cloth (to raise the duster). The duster up switch's normally open contacts will close to turn off the duster wind-up motor. If the contacts do not close there will be a **DUSTER WINDUP** error displayed.
12. There are two ways to reverse the Walker or Flex. In this scenario, the LDS sensor stops the machine and the alarm buzzer will sound to alert the operator.
13. The other option is the Stop by Sensor. The machine will be signaled to stop when the Sensor goes passed the tail plank and trips before the LDS. Using both functions to stop forward travel creates a back-up method for the stopping the machine.
14. When the machine reaches its travel distance and comes to a stop, the squeegee will proceed to lift up and stop when the squeegee up switch normally open contacts close. If the contacts do not close, a **SQUEEGEE UP** error will be displayed.
15. If the Pindeck Treatment function is disabled, the machine will then start traveling in reverse and stop after moving 14 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. If the Pindeck Treatment function is enabled the machine will start moving in reverse until the cleaner head assembly is line with the 2-3 pin deck spots then drop the duster. [This reverse distance can be adjusted for fine-tuning. \(refer to Chapter 3 for more information\)](#)
16. The machine will then start up the moving head to apply the Pin Deck Treatment. After application of Pindeck Treatment the machine will wipe it onto the Pindeck and stop with duster on back row of spots then duster will lift.
17. 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.
18. As the machine travels in reverse at high speed the lane distance sensor is counting inches traveled and is also monitoring the movement of the machine. If travel is interrupted, a **REVERSE TRAVEL** error will be displayed.
19. The brush will begin buffing at the pre-determined distance as the Walker travels in reverse. The oil head will start back up again when it reaches the first reverse load distance.

20. 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.
21. If the oil float contacts open, an **OIL EMPTY** error will be displayed after the machine has completed its run. The oil will then need to be filled and the machine re-started.
22. If the cleaner float contacts open, a **CLEANER EMPTY** error will be displayed after the machine has completed its run. The cleaner will then need to be filled and the machine re-started. Always empty the recovery tank when filling the cleaner tank.
23. The machine cannot be resumed if the following errors occur: **OIL & CLEANER FLOAT; DUSTER UNWIND;** and **SQUEEGEE DOWN**. In the event one of these errors occurs, the machine will need to be re-started.

### Basic Steps to Operate Your FLEX or FLEX Walker

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. Locate the **E-Stop** and rotate the red button to reset and turn the machine on. Next, press the Machine Power button for the machine to boot up. When the machine is powered ON, the touchscreen will change to the Password Screen shown below on the left (or if this has been disabled it will go directly to one of the two Home Screens on the right, depending on your model).



Since the machine allows for different users to have different permissions, select the correct user or master icon assigned to you to access the above Home Screen.

By pressing on the screen just below the 2018 (shown in the upper middle screen) and holding for 20 seconds, you will be able to either to turn 'ON' or turn 'OFF' the number of lanes left in the conditioner tanks, both A and B.

The Question Mark on the bottom right of the screen provides access to HELP.



After selecting the User Type, enter your assigned password to gain access to machine menus.

The Green arrow pointing to the left at the bottom of the screen is the "back" button to take you to the previous screen. In some menus you'll see a "forward" button pointing to the right that will advance you to the next screen.

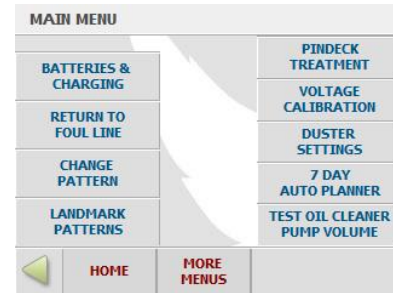


If you enter the wrong password, the touchscreen will display a notification. Press CONTINUE and try again.

## Machine Setup I

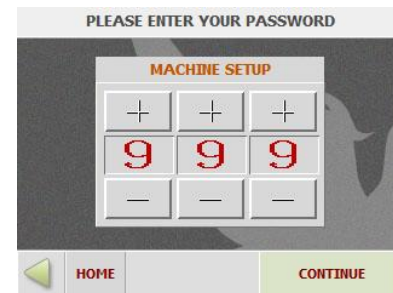
From the Home Screen, press the icon for the MAIN MENU. A series of sub-menus appear on the screen.

To access the MACHINE SETUP menus, press MORE MENUS and then select the MACHINE SETUP icon.



If the Password feature is enabled, then the screen to the right will appear. If disabled, continue to the MACHINE SETUP I screen.

The screen will change to the password screen where you will need to enter the correct password to access these settings.



Once the correct password is entered press CONTINUE.



To access the MACHINE *SETUP*I screen, from the Main Menu screen, press MORE MENUS then the MACHINE SETUP button.

The ENABLE BUTTON at the bottom will need to be pressed *AT THE SAME TIME* as one of the listed functions to enable or disable the selected function.

The PLC Operating System is able to operate either a FLEX WALKER or FLEX. When the machine type icon is pressed, along with the ENABLE button, the name will change (along with the available functions for that model).

The FLEX quick start in the lower left corner will only be visible to those operating FLEX model machine. This feature is not available for the FLEX Walker.

When selecting FLEX QUICK START function, the STARTING LANE button will change to START MACHINE. This bypasses the STARTING LANE and ENDING LANE setup and allows the machine to run an unlimited number of lanes.



The NUMBER OF LANES button allows you to set the size of the center. Press on the number and a keypad will appear to update the program with the correct number of lanes. To lock in the setting press ENTER. To exit the keypad press CANCEL.

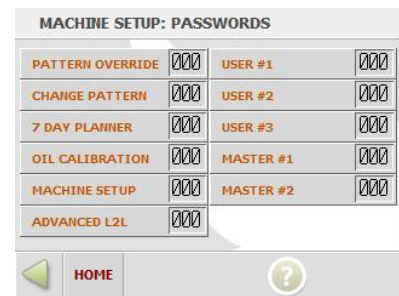
The NUMBER OF READ ONLY PATTERNS will allow the user to set which patterns are able to be edited. If the number of Read Only patterns is changed to 9 for example, then the first 9 programs will be Read Only mode.

PASSWORD START is used to prevent unauthorized operation of the machine. For convenience, you can disable the password and the machine start functions will be unlocked and the operator will not need a password just to run the machine.

The SQUEEGEE WIPE is a function to help remove excess cleaner off the blades. With this function set to ON, the lane machine will reach the forward overall travel distance and stop, the squeegee will then raise to the up position. The lane machine will start in reverse and stop at the programmed distance and lower the squeegee back down onto the lane. The squeegee will then rise back up and the lane machine will return towards the foul line. Disabling this function will stop the machine from doing the reverse/forward/reverse jog in the pit.

When the default setting has been changed in a menu screen, the background color of the button will change to yellow.

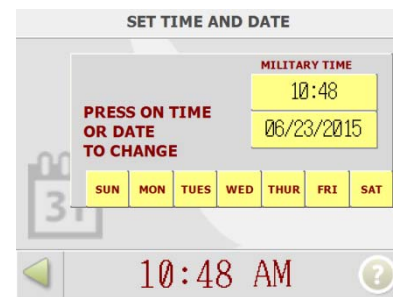
Press CHANGE PASSWORDS to advance to the password control screen (shown at right, in the FLEX Walker mode). To change passwords, press on the value and a keypad will pop up, type in the new password and press ENTER.



Up to three unique USERS can be setup in this screen. Additionally, MASTER 1 & MASTER 2 can be set with the ability to gain access in all areas. If zeros are left in for the master passwords then ALL users will still have access.

SYSTEM MENU should never be enabled unless you need access to the SPECIAL FUNCTIONS of the touchscreen.

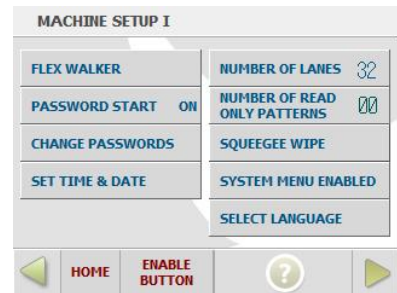
SET TIME & DATE is used to set the correct time and date. To update this data, press SET TIME & DATE and the screen to the right will appear. Adjustments can be made by pressing the appropriate button under Military Time. When setting time and date, be certain to put the period in its proper place, there is an example at the top of the keypad to follow as a guide. Please note that the time at the bottom of the screen will show 00 for the hour when it is 12 am or 12 pm, so it looks like it is only displaying the minutes.



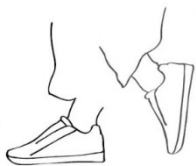
Press on the day of the week to choose the proper DAY and the button will change color to show the selected day.

SELECT LANGUAGE is used to choose which language is displayed on the touchscreen. English, Chinese and Japanese are available.

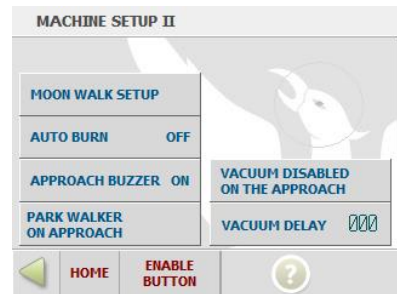
Pressing the yellow Forward Arrow (in the lower right corner of the screen) will advance the menu to the MACHINE SETUP II options for the Walker.



The MACHINE SETUP II provides additional Walker options as described below.



MOON WALK SETUP will advance to the next screen when pressed. This is where the data can be customized for your center.



Press on MOON WALK TO LAST LANE to enable or disable this function. This feature allows the machine to back-up to the end pairs that are built next to a wall or other obstacles.



The MOON WALK TO POLES OR WALLS is useful when there is a pole or wall to walk around. The flexibility of the machine allows it to back-up to obstacles before it walks around it.

For example, if the machine needs to back-up going to Lane 8, then 7 will be the Lane Value for going Left to Right. If the machine is going Right to Left and needs to back up to Lane 9, then 10 will be the Lane Value.

**AUTO BURN** is for when the 7 DAY PLANNER is set to use ZONES, when the pattern changes to the next ZONE, the machine will run the first two lanes twice before continuing on with the rest of the lanes. Press on the AUTO BURN button and the ENABLE BUTTON at the same time to enable or disable this function.

**VACUUM DISABLED ON THE APPROACH** can be activated by pressing that button and the **ENABLE BUTTON** at the same time. These two buttons pressed at the same time will toggle the function ON and OFF. Setting this ON will cause the vacuum to turn on as it exits the lane.

The **APPROACH BUZZER** can be disabled if the noise is just too much. Press **ENABLE BUTTON** and **APPROACH BUZZER** buttons at the same time to toggle the alarm between ON and OFF.

The **PARK WALKER ON APPROACH** button is used to either have the machine park on the approach or on the lane upon the completion of a program run. The default setting for this is on the approach; however, if you want the machine to stop on the lane, simply press the button.

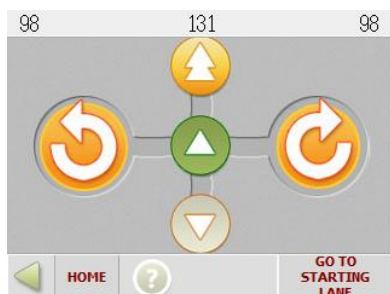
To operate this machine you need to understand the Machine Sequence of Events as described on Page 12. Read pages 12 - 17 again if you do not fully understand “How it Works”!

### Positioning Your FLEX Walker

When starting the FLEX Walker it is best to line it up with the lane as accurately as possible. From the home screen, simply press the **MOVE MACHINE** button.

In **Move Machine** you can adjust the turning and how far it goes forward or backward. The left number is the Forward value, while the middle number is the Turning value and the right is the Reverse value. Press on the number and a keypad pops up to adjust the value. To move your Walker like a pro you should practice and pay close attention to where your main approach drive wheels are. These wheels represent the center of the turning radius.

Use the **Down Arrow** to move the machine 5 feet in reverse and the **Green Up Arrow** for forward 5 feet. Press either button one time and the machine will move 5 feet in that direction and then stop. By pressing the **Double Up Arrow** the machine will travel until you press STOP.



To turn the machine, use the two turning buttons. The one on the left is the **Counter Clockwise** direction and the button to the right is **Clockwise**. Like the other buttons, they will disappear while the machine is moving. If the side of the machine is parallel to the foul line and the main drive wheels are on the center board, the machine will be lined up with the lane when turned 90 degrees.

The buttons will disappear after they are pressed and a STOP MACHINE screen will take their place. The buttons will re-appear when the machine stops or after the stop button is pressed.

It is not unusual to start then stop the machine quickly to obtain the exact position desired.



#### TECHNICAL

Caution should be used when positioning your machine!  
Turning the machine too close to the foul lights will result in the machine crashing into them and causing possible damage to the lane sensing whiskers.

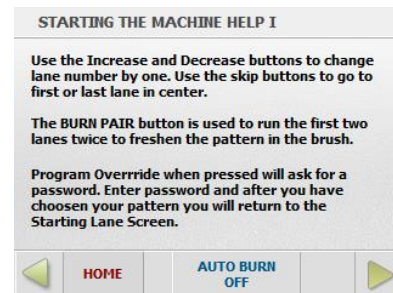
### Starting Your Machine

After you have positioned the machine, press GO TO STARTING LANE. From this screen you can select the PROGRAM OVERRIDE function to choose a different pattern, condition the first two lanes twice by pressing BURN PAIR, and choose the STARTING LANE.



The screen will also display the name of the pattern that is currently set to run for that time period. To choose the starting lane you can use the SKIP buttons to go to the FIRST LANE or the LAST LANE in your center. Or you can simply change the value in one (1) or ten (10) lane increments by using the buttons on either side of the Lane Number to DECREASE or INCREASE the value.

To set the machine to **run the first two lanes twice**, press the **BURN PAIR OFF** button. When used on a Walker, the machine will turn and come back to the starting lane when activated. When used on a FLEX it will automatically calculate this into the number of lanes to be conditioned. When it is pressed, the button will change to **ON** and the function will be enabled. Pressing it again will turn it back off. The function can also be set to happen if the machine changes patterns (ZONES) from the settings in the **7 DAY PLANNER**. This setting can be done in the **MACHINE SETUP II** screen. You can also choose to have this feature automatically turn on by going into the Help screen by pressing on the question mark at the bottom of the screen.

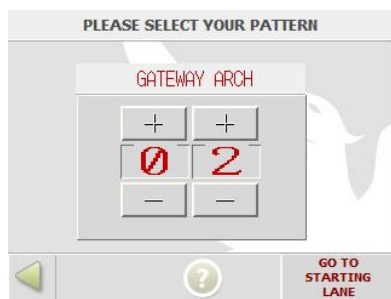


#### TECHNICAL

When starting the walker, for each time you stop the machine while moving to next lane the approach speed will increase and this could cause the machine to miscount when running normal.

**NOTE:** Running two warm-up lanes will allow the Transfer Brush and Buffing Brush to be replenished with conditioner and return to a constant refreshed state. This will help prevent the first lane and 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.

To override the preset pattern showing in the STARTING LANE screen, press the **PROGRAM OVERRIDE** button (in the bottom center of the screen) and the display will change. A password will need to be entered into the screen to continue.



After you enter a valid password, the screen will allow you to choose your desired pattern number. The name of the pattern will also appear above the pattern number. After choosing the desired pattern press **GO TO STARTING LANE**.

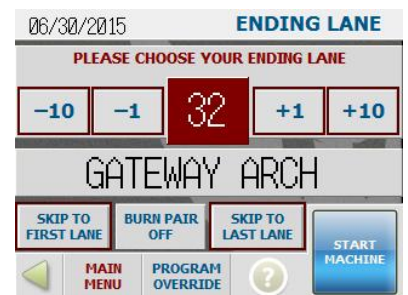
not a 3 for the left digit).

When entering the pattern number each digit must be adjusted. The left digit will go no lower than 0 and no higher than 3, the right digit will go from 0 to 9 (as long as there is

The upper limit is **30**, which is the number of total patterns stored in the program. To advance from pattern 29 to 30 you will need to change the right digit to 0 before you can change the left digit to 3. Program 31 is a READ ONLY calibration program that cannot be accessed from the Program Override menu.

After you have chosen the starting lane, press **GO TO ENDING LANE** to advance to the screen on the left. Choose the ending lane the same way as the starting lane.

You can still choose to do a Pattern Override and set the **Burn Pair function** from the ending lane screen.



After you have chosen the last lane for this operation, press **START MACHINE** in the lower right corner of the display.

The screen will change to a confirmation screen for your review to ensure all information has been entered correctly.



The screen is very informative! It will show the pattern name and number, what lanes the machine is going to run, the number of lanes that are left in the conditioner cartridges, both A and B, the number of lanes left in the Pindeck Treatment can, and the mode of operation.

It is also the screen where the operator can turn on the Pindeck treatment option by simply pressing the PINDECK TREATMENT text.

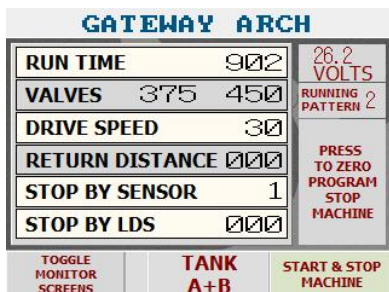
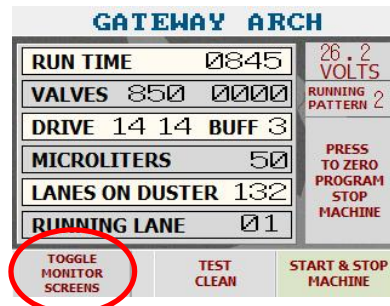
If all the data entries are correct then press **START MACHINE** or use the Back Arrow to return to the previous Starting Lane screen. Once you press START MACHINE the FLEX will be ready to operate and the Walker will begin to operate.

The **Main Monitor Screen** will display the pattern NAME, RUN TIME for one lane, OIL VALVE TIMES, DRIVE IPS, BUFFER SPEED, current MICROLITERS per board, and the estimated amount of LANES LEFT ON DUSTER CLOTH. The display also shows the current VOLTAGE the machine is operating at. If the Burn Pair function has been enabled, this will be displayed in place of the RUNNING LANE and ENDING LANE. When the TEST CLEAN button is pressed, the machine will change to CLEAN ONLY mode for one lane only.

The 'monitoring area' itself is a big pause and resume button when needed. Just press on the START & STOP MACHINE button to STOP the machine, press it again to RESUME operation. Additionally, the program can be reset if necessary by pressing in the ZERO PROGRAM area.

### Toggle Monitor Screens

The machine has 3 monitor screens that can be viewed by pressing the TOGGLE MONITOR SCREENS while the machine is operating on the lane. These screens are used for trouble shooting or just general information and are explained below.



This Monitor screens main function is to show which function stops the machine at the end of the lane, and if an adjustment is needed to either of the stopping functions, or both. This screen automatically pops up when both motors are turned on for walkers so it is displayed for each lane to view. In the Flex, you must press the monitor button to view.

The last two monitor screens allow the user to see exactly what inputs are turning 'off' and 'on' as the machine is in operation.

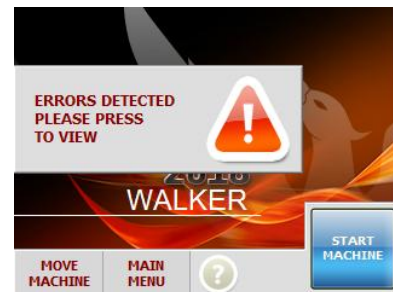
These screens are very helpful in troubleshooting of the lane machine.

GATEWAY ARCH		
INPUT 000 ON LANE PROX	INPUT 006 TACH PROX	28.2 VOLTS
INPUT 001 BOARD CNT PROX	INPUT 007 LANE DIST PROX	RUNNING PATTERN 2
INPUT 002 LT BOARD EDGE	INPUT 008 START/RESUME	PRESS TO ZERO PROGRAM STOP MACHINE
INPUT 003 RT BOARD EDGE	INPUT 009 STEPPER DRIVE SW	
INPUT 004 BRUSH UP SW	INPUT 010 DUSTER UP SW	
INPUT 005 BRUSH DOWN SW	INPUT 011 BUFFER TACH	
TOGGLE MONITOR SCREENS	TANK A	START & STOP MACHINE

## Keypad and Menus

### Machine Error Messages

The machine is equipped with Error Messages that are displayed on the touchscreen in case the machine malfunctions. These messages will indicate the type of operational error that has occurred. A description of some common causes of how the errors might occur can be viewed from the error message screen.



This manual may hold more detailed information on some errors that require more explanation.

If errors are present when the machine is turned on, the screen will display the ERRORS DETECTED message as shown above. Pressing on the message will take you to the Error List (there are two screens). The error that was detected will have the border of the button flashing.



Press on the flashing error to view possible causes. If no errors are detected, you can still press in the area where the message appears even when it is not present to view the error list. Additionally, you can even select HISTORY MONITOR to view errors.

### LIST OF MACHINE ERRORS

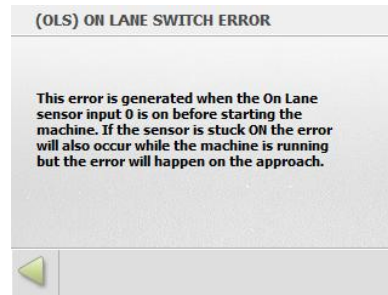
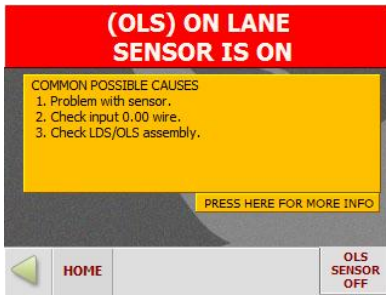
- |                       |                          |
|-----------------------|--------------------------|
| FORWARD TRAVEL        | CLEANER EMPTY            |
| REVERSE TRAVEL        | OIL EMPTY                |
| OIL HEAD TRAVEL ERROR | DUSTER NOT RESET         |
| DUSTER WIND-UP        | DUSTER UNWIND            |
| BRUSH UP              | SQUEEGEE UP              |
| BRUSH DOWN            | SQUEEGEE DOWN            |
| STEPPER DRIVE         | RECOVERY TANK IS MISSING |
| BUFFER MOTOR          |                          |

## ADDITIONAL ERROR LIST FOR FLEX WALKER

OLS SENSOR TOO LATE  
APPROACH 7-PIN SIDE  
7/10 PIN WHISKER

OLS SENSOR STUCK ON  
APPROACH 10-PIN SIDE  
BUMPER SWITCH

Below is an 'example' of how an error messages will appear along with its help screen. Refer to Chapter

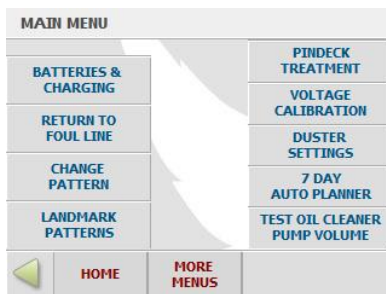


When the machine loses battery power, or if the **E-STOP** is pressed while operating on the lane, the machine will display this error message when the power resumes.



Press anywhere on the screen to return to the Home Screen.

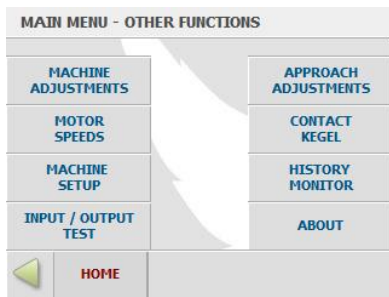
## Operator Menu Selections



The machine has a series of menus that are accessed from the Main Menu screen.

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





The ABOUT menu is where the program version and other pertinent machine information is located. This data will be required for technical support on the machine.



Pressing the ABOUT button brings up a screen telling you the PLC PROGRAM VERSION, the machine SERIAL NUMBER, the INSTALL DATE, and the QC DATE.

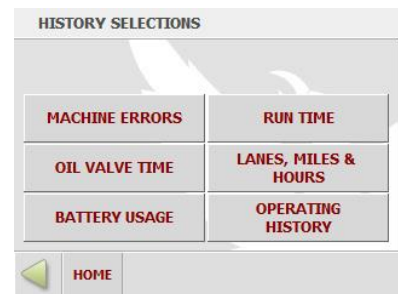
The dates are used to determine if the machine is still under warranty and should not be adjusted to prevent voiding your warranty.

Technical support on the machine is available at any time, day or night. To reach a technician, press the CONTACT KEGEL button and several ways to access Kegel is displayed.



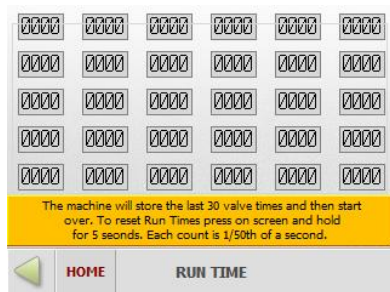
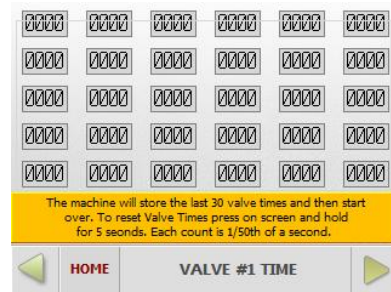
### History Selections

From the MAIN MENU screen, press the MORE MENUS button, then HISTORY MONITOR, and you will be able to view the OPERATING HISTORY of the Lane Machine.



By pressing the MACHINE ERRORS key you will be able to view how many times that a specific error has popped up during operation.

The OIL VALVE TIME screen (shown to the right) will display 30 consecutive valve times to the screen, each count is 1/50<sup>th</sup> of a second. To ensure consistency in conditioner application, frequently check the valve times. A button on the menu screen allows the times to be reset, when desired.



The RUN TIME screen (to the right) will display 30 consecutive run times to the screen, each count is 1/10<sup>th</sup> of a second and these should be checked periodically to ensure the travel speed of the machine is consistent.

The BATTERY USAGE screen is used to enter the serial number of your battery and the date of installation. It's a good idea to monitor usage so that you can prepare for future battery replacement.



By pressing the bottom BATTERY LOW text box you can toggle between AGM or Lithium ION batteries.

By pressing the LANES, MILES & HOURS you will be able to view the usage within each of the components. This will be very useful in changing out parts and the wear and tear items to keep your machine in top shape.

To reset the Hours or Miles, press on the function and hold until reset. The functions that can be reset are:

LANE, MILES & HOURS	
MILES TRAVELED	0000
CLEANER PUMP HOURS	0000
BUFFER BRUSH HOURS	0000
WATER PUMP HOURS	0000
MAIN DRIVE MOTOR HOURS	0000
CLEAN & OIL	0000000
7 PIN DRIVE MOTOR HOURS	0000
OIL ONLY	0000
MILES ON CUSHION ROLLER	0000
CLEAN ONLY	0000
MILES ON SQUEEGEE	0000
DUST ONLY	0000

- MILES ON SQUEEGEE
- 7 PIN DRIVE MOTOR HOURS
- BUFFER BRUSH HOURS
- MAIN DRIVE MOTOR HOURS
- CLEANER PUMP HOURS
- WATER PUMP HOURS
- CUSHION ROLLER

The machine will record the Day, Month, Hour, User #, Pattern #, Start Lane, End Lane and Number of Lanes Run each time the machine completes one lane or more.

The main function of this feature is to keep track of the centers conditioning program. It will also monitor any operational error codes as well as restarts. If many restarts are recorded, this may indicate a potential operating problem. It will hold and display the last 55 operations

DAY	MONTH	TIME	USER #	PTRN. #	START LANE	END LANE	# OF LANES
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00

By pressing the Blue question mark, you will be able access the HELP screens that will assist you in understanding the OPERATING HISTORY screens.

### Maintenance Reminder Pop Ups

There are 7 Maintenance Reminders that will appear on start up when maintenance or inspection is needed to be done. These are for the Drive Motors, Cushion Roller, Squeegee, Buffer Brush and Cleaner & Water Pump operating hours. After performing the necessary maintenance the reminders can be reset by entering into the HISTORY MONITOR screen under LANE, MILES & HOURS.



### 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

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

## Weekly or Monthly Cleaning

- Use compressed air to remove dust from those hard to reach areas.
- Inspect recovery tank filter.
- Clean lint from Transfer Brush and wipe between the brush assembly.
- Whenever the duster cloth is changed, clean entire cleaning compartment and lube the cleaner head bar.
- Wipe off casters; they should not grow hair.
- Inspect the motor end of the vacuum and make sure dust does not build up on the cover for the vacuum motor. Not keeping this clean will shorten the life of the motor.
- Inspect the vacuum housing and investigate if wet.

## 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.

## **Charger Location & Storing of the Machine**

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).

The storage location is where you will have the charger mounted for charging the batteries. There should be a reliable dedicated receptacle for the charger, along with a power indicating light to show there is power to the charger.

If storing the lane machine for a lengthy period of time, such as for the summer, be sure to drain the cleaner tank and rinse with water to remove Defense-C from the lines. For Cleaner Upgrade, relieve the pressure from the pump tubing and remove from the system.

## Recharging

For proper charging, it is necessary to plug the charger into the machine first, and then power the charger. When the charger is being unplugged, it is necessary to remove power

from the charger, allow the charger to shut down then unplug the charger from the machine. When charging, the volts will be below 29.2 volts and the amps will be high teens to 20.8 amps, when fully charged the amps will go to 0.02 or 0.00 and the voltage will go up to 29.2 volts.

**DO NOT;** leave the charger plugged into power when the charger is not in use. The charger will have the appearance of working properly when actually it could shut down the DC output voltage.

If the ProNautic Charger does not recognize a connection to batteries or the lane machine, or if it detects a bad ground or connection on the AC power side the charger will NOT charge properly.

Refer to Chapter 5 for more detailed information on charging.

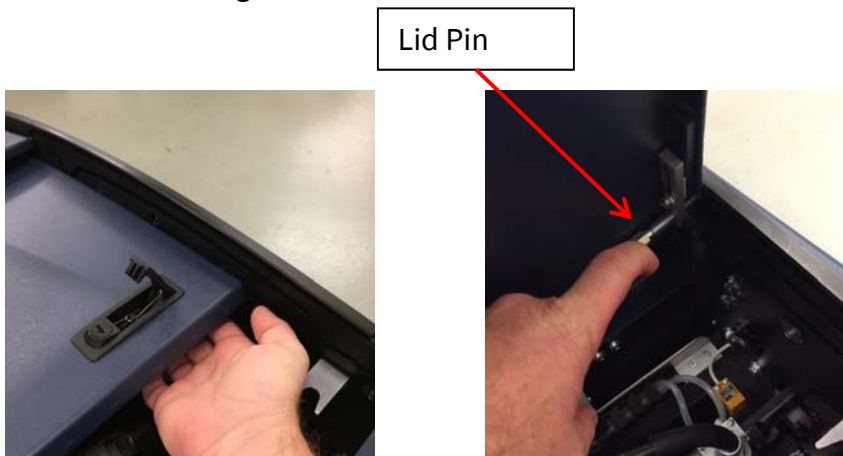
### **Lid and Side Cover Removal**

In some cases it may be necessary to remove the Lid and/or side covers to access certain areas of the lane machine.

#### Conditioner Compartment Lid Removal

To remove the lid, set the machine down in the operating position.

1. Slide the conditioning compartment lid back as shown in the pic below left.
2. Reach your hand under the lid and locate the Lid Pin Ring and pull the spring loaded pin from the pin guide, do the same for both the 7 side.
3. Tilt the lid assembly up as shown on the right and pull the spring loaded pin back and lift lid out of the guides.



#### Cleaning Compartment Lid Removal

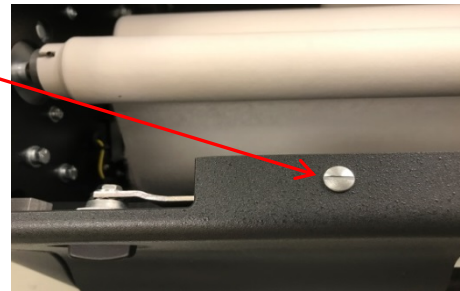
To remove the lid set the machine down in the operating position.

1. While in the operating position, stand facing the lane machine from the cleaner compartment side and push the lid all the way away from you.
2. Standing in rear of the machine, lift the cleaner lid assembly up and out of the rear guide opening. Pull the back of the lid towards you and lift the rear portion up and out of the guide openings as well.



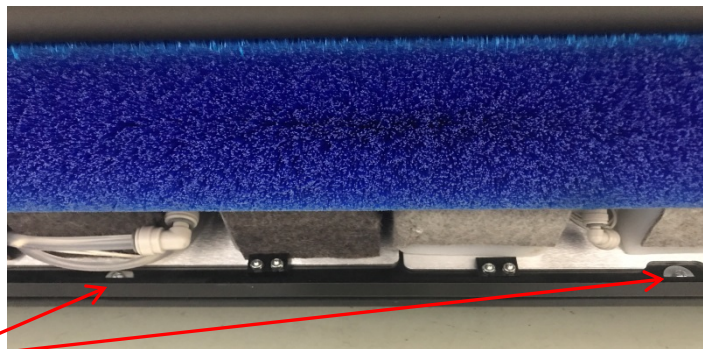
### Front Cover Removal

To remove the front cover, simply unfasten the 4 screws that secure the top of the cover, and remove from the attaching pins located on the bottom.



### Rear Cover Removal

With the machine in the up-right transport position, locate the two screws that are on the inside front panel and below the buffer brush assembly as shown to the right. After removing these, set the machine down into the operating position.



Locate the single mounting screw under the cleaner splash guard and above the cleaner supply tank, as shown in the image to the left.

Next, remove all four of the transport casters including the attaching hardware and unplug the wiring for the tank lights then set aside for reassembly.

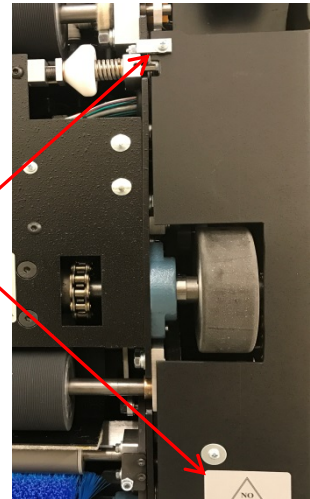
Warning: When removing the rear cover, be extra careful to unplug the LED light located on the inside of the cover!

### Side Cover Removal

With the machine in the up-right transport position, locate the two (2) screws that mount the bottom of the side cover as shown, on a Flex Walker.

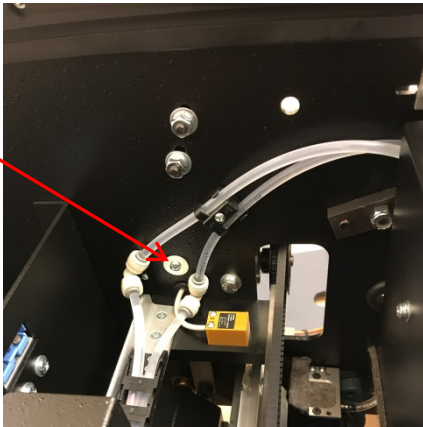
The Flex machine will have three (3) mounting screws like the one shown at the top of picture.

NOTE: On the Flex Walker it will be necessary to remove the bumper wheels on both sides of the lane machine, note the adjustment.

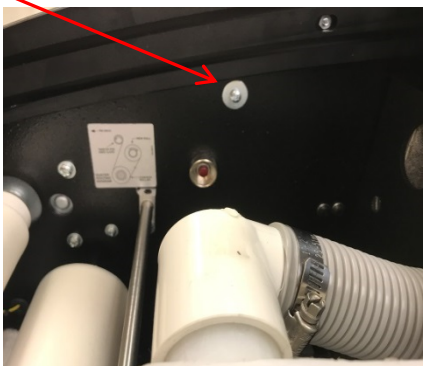
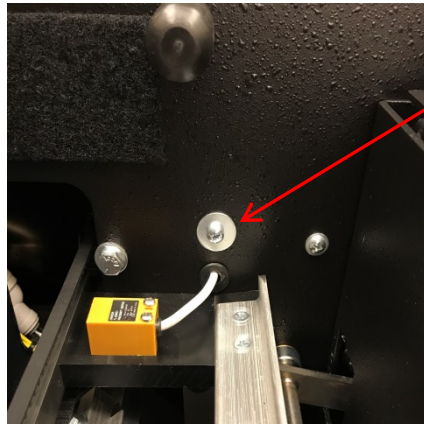


Next, set the machine down in the operating position and remove both lids. Remove the two (2) screws in each guard that fasten the side covers to frame.

10 pin side

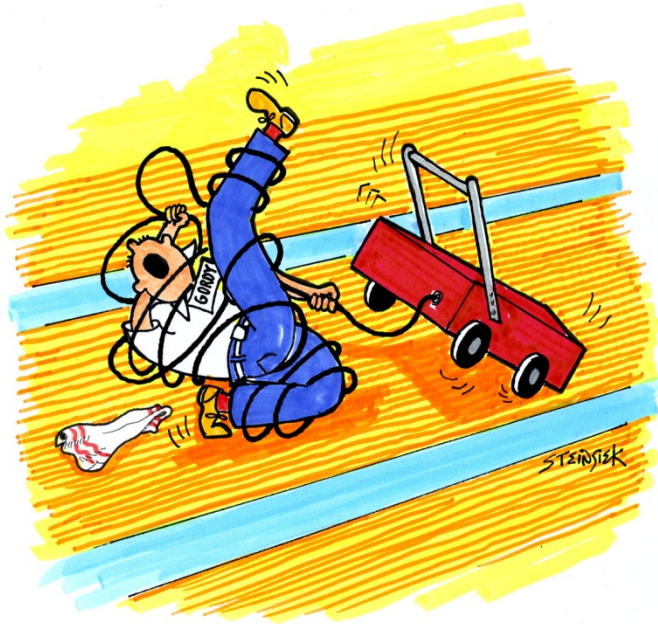


7 pin side





## 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.

Here are a few time-saving 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 dependable battery-operated lane machine.

# 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.
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.
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 Conditioner is Metered and Controlled

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

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

**OIL PATTERNS**      **PATTERN DESIGN**

QUICK OPEN PATTERN      **FILE**   **READ**   **SEND**   **REPORTS**   **HELP**

**FORWARD LOADS**      2008 USBC OIL ONLY      **REVERSE LOADS**

Start Stop Loads Mics/Load Speed Buf Speed End      Start Stop Loads Mics/Load Speed Buf Speed End

2L 2R 1 50 10 4 1      2L 2R 1 50 10 4 0

+ ADD      X CANCEL      + ADD      X CANCEL

	START	STOP	LOADS	SPEED	BUFFER	CROSSED	START	END	FEET	T.OIL
1	2L	2R	4	10	2	148	0.0	4.2	4.2	7400
2	6L	6R	1	10	2	29	4.2	5.6	1.4	1450
3	8L	8R	1	14	2	25	5.6	7.5	1.9	1250
4	11L	11R	1	14	2	19	7.5	9.4	1.9	950
5	13L	13R	1	18	2	15	9.4	11.9	2.5	750
6	2L	2R	0	18	2	0	11.9	34.0	22.1	0
7	2L	2R	0	22	2	0	34.0	38.0	4.0	0
8	2L	2R	0	30	2	0	38.0	39.0	1.0	0

	START	STOP	LOADS	SPEED	BUFFER	CROSSED	START	END	FEET	T.OIL
1	2L	2R	0	30	2	0	39.0	32.0	-7.0	0
2	14L	14R	1	22	2	13	32.0	28.9	-3.1	650
3	12L	12R	2	18	2	34	28.9	23.8	-5.1	1700
4	10L	10R	2	18	2	42	23.8	18.7	-5.1	2100
5	9L	9R	1	18	2	23	18.7	16.2	-2.5	1150
6	7L	7R	1	14	2	27	16.2	14.3	-1.9	1350
7	5L	5R	1	14	2	31	14.3	12.4	-1.9	1550
8	2L	2R	2	10	2	74	12.4	9.6	-2.8	3700
9	2L	2R	0	10	2	0	9.6	0.0	-9.6	0

OIL VOLUME: Forward 11.8 mL Reverse: 12.2 mL Total 24 mL      BOARDS CROSSED: Forward: 236 Reverse: 244 Total 480

**SETTINGS**      **RATIOS**      **OVERHEAD**      **COMPOSITE GRAPH**      **NOTES**

5      10      15      20      25      30      35      40      45      50      55

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

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

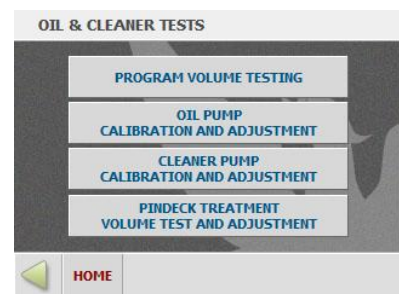
The pump output is measured in *microliters*. This is a metric measurement for fluid volume. The factory setting for the pump is 50 microliters per board.

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

Since this amount of conditioner is too small to measure with the naked eye, we must use a larger number of boards to get an amount we can visibly measure. Factory-set **PATTERN #31** 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

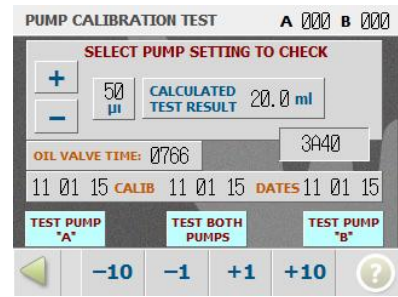
Turn the machine on and go to the main menu and press **TEST OIL CLEANER PUMP VOLUME** and the screen will change to the display on the right.



Press OIL PUMP CALIBRATION AND ADJUSTMENT and the screen will change to the password screen if enabled, enter password and press CONTINUE.

Conditioner pump adjustments are done through the touchscreen. Press on the + or – symbols to select the MIC per microliter (µl) selection to highlight the button and check the pump volume for that setting. In this example, we will use the 50 µl PUMP SETTING.

The OIL VALVE TIME will be displayed on the screen.

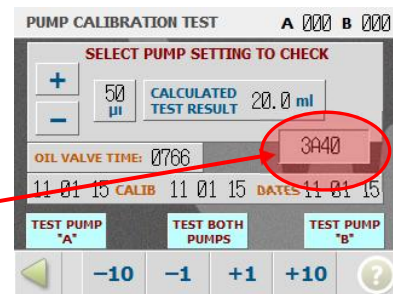


### Matching the Oil Pumps

The volume test for each tank should dispense the same amount of conditioner in the cylinder.

1. Place the conditioner tip into a perfectly clean 25ml graduated cylinder and press **TEST PUMP A**.
2. The head will travel back and forth eight times to simulate forward loads. It will pause and then run again for eight loads in reverse. The loads of conditioner are deposited from **2-to-2** four times and **14-to-14** four times for each direction in the graduated cylinder. This is equivalent to a total oil stream of **400 boards**.
3. Remove the tip from the graduated cylinder and read the amount. If the pump is set at 50 microliters, then the output in the cylinder should be 20,000 microliters or **20 milliliters**.
4. Next, clean the graduated cylinder and place the conditioner tip back in and **TEST PUMP B**.
  - If the volumes come out to be the same, then no adjustment is needed.
  - If the volumes come out to be the same, but they are equally too high or too low, adjust the speed of the motor on the keypad assembly as shown in Step 5.
  - If the volume is too high or low in either tank, then a manual adjustment will need to be made. This is explained on the following page.

3. The Oil Pumps are adjusted by changing the speed of the motor. Use the buttons on the bottom of the screen to add or subtract from the motor speed value located to the right under the microliter selection. The adjustment will only affect the setting that is highlighted.



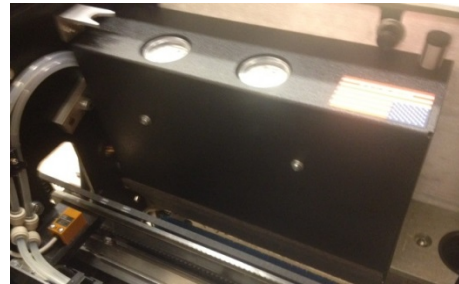
4. Clean out the graduated cylinder using the long felt wick that is provided with the machine. A thorough cleaning is important because any oil left clinging to the sides of the cylinder will give inaccurate readings.

*NOTE: When felt gets soaked with oil it can be cleaned by squeezing it in a towel g or just use strips of towels. Keep repeating the test until the amount in the graduated cylinder reads **EXACTLY 20 milliliters**.*

### **Manual Adjustment of the Oil Pumps**

One motor operates both oil pump assemblies. The manual adjustment is used when both oil pumps are putting out different amounts of conditioner. To manually adjust the Oil pump assemblies, one of the pumps must first be dialed in to 50ul as explained in step 5.

1. Slide the oil head to the center of the head bar assembly.
2. Remove the two screws on the oil pump cover and tilt the cover back as far as you can.
3. Reach under the assembly and rotate the Oil pump in whichever direction it needs to be adjusted. By rotating the pump clockwise, it will decrease the amount of conditioner. By turning it counter-clockwise it will increase the amount. (Oil pump A is on the left and Oil pump B is on the right side).
4. Perform the calibration test until the amount in the graduated cylinder reads **EXACTLY 20 milliliters** and reinstall the cover assembly.



### **Proving the Oil Pattern**

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

## PATTERN STRUCTURE

2 - 2 x 1 (Forward Loads)

10 - 10 x 3

13 - 13 x 3

Zero Loads are ignored going forward and reverse.

14 - 14 x 2 (Reverse Loads)

13 - 13 x 4

12 - 12 x 4

11 - 11 x 2

2 - 2 x 1

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

After converting all the loads the numbers become very simple.

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

## TOTAL PATTERN BOARDS

$$37 \times 1 = 37$$

$$21 \times 3 = 63$$

$$15 \times 3 = 45$$

$$13 \times 2 = 26$$

$$15 \times 4 = 60$$

$$17 \times 4 = 68$$

$$19 \times 2 = 38$$

$$37 \times 1 = 37$$

374 Total Boards

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

374 Boards

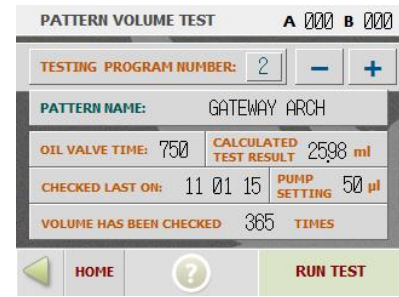
$$\begin{array}{r} \times \quad 50 \text{ microliters} \\ \hline 18,700 \text{ microliters} \end{array}$$

The total amount is 18,700 microliters. To convert this to milliliters the number has to be divided by 1,000.

$$18,700/1,000 = 18.7 \text{ milliliters}$$



The special thing about Sanction Technology is that this total pattern amount can be confirmed by running the pattern and performing a **PATTERN VOLUME TEST**. This step is the most important element in the PVP (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 anybody of the machine's accuracy and repeatability.



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

By calculating your program's total oil volume and double-checking the math, you can use the reading you get to check your volume per board adjustment. When the math is correct, it will tell you if the pump needs adjusting. The KOSI software provides a **Total** tab in the Advanced Designer screen that allow you to see the forward, reverse, and total oil volumes and boards crossed so you do not have to do the math. PLEASE SEE CHAPTER 7 FOR KOSI FLEX.

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

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

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

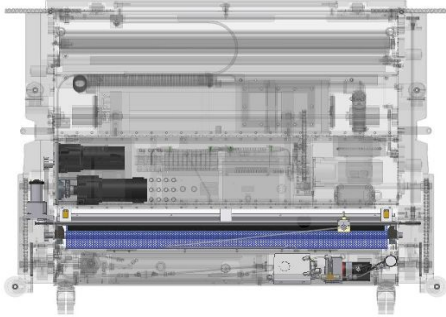
This chart shows the total number of boards the head travels across when distributing conditioner. This will make it much easier to determine the amount of oil that is used for your pattern, on paper, before it is measured by the machine during a Calibration Test.

		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 should cross at least three boards.

# Conditioning System

## Theory of Operation



This machine uses proven SANCTION TECHNOLOGY<sup>®</sup> patented by Kegel. This exclusive technology, perfected over the past 3 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 the pump is a ceramic piston and cylinder that are precisely milled to perfect clearances. This pump has no valves to impair its operation. The piston revolves and reciprocates during operation for flawless performance.

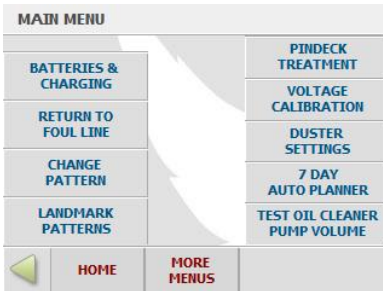
With the pump rotating at a constant RPM, the conditioner is pumped at an exact flow rate to a three-way valve known as the Oil Pattern Control Valve. The valve in its OFF state routes the conditioner back to the conditioner tank. When turned ON, the valve routes the conditioner to a line connected to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

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

Anyone who pays attention to the machine's operation will really be able to understand lane conditions.

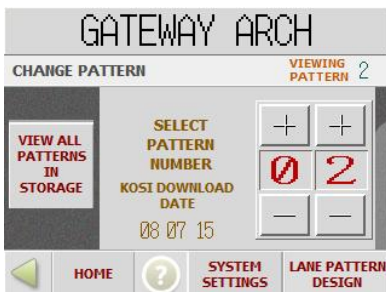
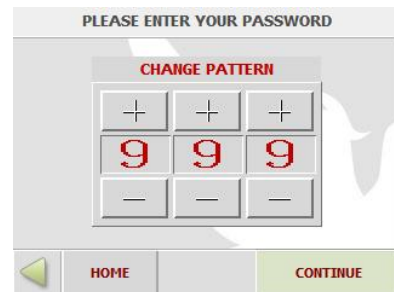
We use Sanction Technology because all adjustments to the oil pattern are exact and repeatable.

## Change Pattern



Press CHANGE PATTERN in the main menu screen and the screen will change to the password screen.

Enter the password, and press “CONTINUE”. The factory default is 000.



To the left is the main CHANGE PATTERN screen. From this screen you will choose the pattern to view and then you can check the settings in SYSTEM SETTINGS or LANE PATTERN DESIGN.

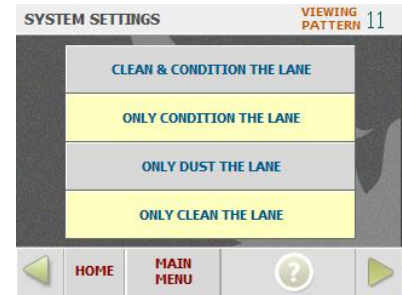
System Settings is the area where all of the special adjustments that can be made for each pattern can be selected. Lane Pattern Design is where the pattern is created.

To the left of the screen you can press the VIEW ALL feature to see a list of the patterns that are loaded into your lane machine. This will let the operator know where a specific pattern is stored rather than toggling through all of the patterns.

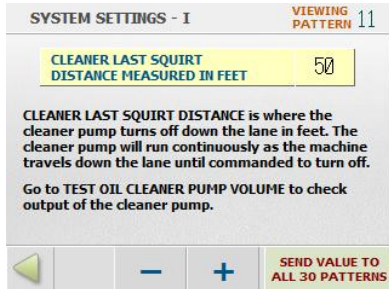
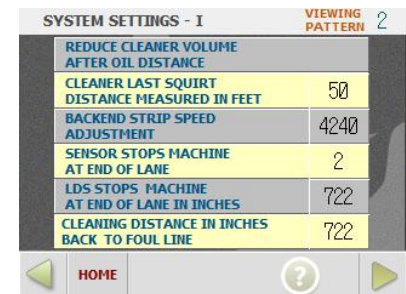
You can change the name of each individual pattern by pressing the Name Button. A keyboard will appear to type in a new name, press CLR then type a new name, and press ENTER to lock in the changes.

## System Settings Menus

Located at the bottom of the Change Program home screen is the System Settings button. Press on the mode to set the machine to perform the desired operation. When pressed, the button will turn yellow and the text will change indicating what mode the pattern is set to perform.



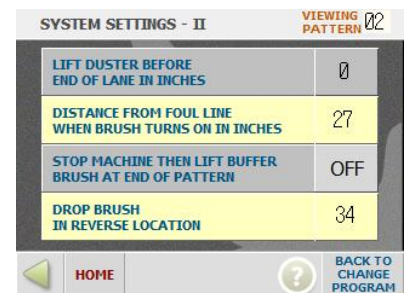
SYSTEM SETTINGS I are all cleaning related adjustments that can be set different in each pattern. Press on the numerical value located to the right of the function you want to adjust. The screen will then change to the adjustment screen as shown below. All cleaning related adjustments will be discussed in detail in Cleaning System Chapter 3.



This is an example of the adjustment screen for the System Settings. Once in this screen simply increase or decrease the value by using the + or - buttons at the bottom. Simply press the back arrow to exit, or send to the value to all 30 patterns.

### SYSTEM SETTINGS II

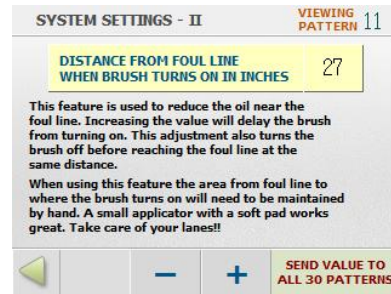
SYSTEM SETTINGS II has one duster related adjustment and that is explained in the CLEANING section of the operator's manual.



## Distance from Foul Line When Brush Turns on

The default settings do not allow the machine to oil the first 27 inches of the lane. This area will need to be maintained by hand to keep the oil in the area to a smudge and the area looking good.

This feature is used to reduce the oil near the foul line. Increasing the value will delay the brush from turning on. This adjustment also turns the brush off before reaching the foul line at the same distance.



The default setting is 27 inches from the foul line. Changes made for the Walker will also require changes to be made in System Settings III to time the start of duster, cleaner and squeegee. The lower limit to this adjustment is 15 inches from the foul line and is explained in detail later in this chapter.

It is very important to not have the buffer brush and the vacuum motor to come on at the same time on the lane going forward. Monitor the on times, and adjust the Buffer Brush Start Distance to come on sooner or later to avoid potential lane machine shut down.

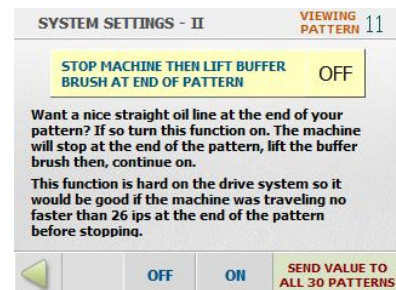
This feature is great for open play bowling when it is near impossible to keep customers behind the foul line. Another tip that does help is to never turn off foul lights during open play. This will detour some from going past the line and tripping the buzzer.

When using this delayed oil application feature the area from foul line to where the brush turns on will need to be maintained by hand. A small applicator with a soft pad works great. Take care of your lanes!!

## Stop Machine and Lift Buffer Brush

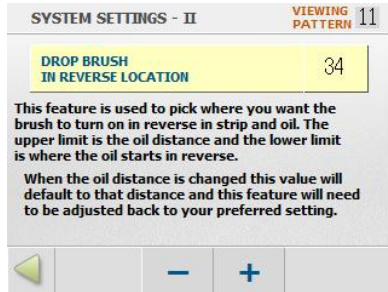
Want a nice straight oil line at the end of your pattern? If so, turn this function ON. The machine will stop at the end of the pattern, lift the buffer brush and then continue on.

The function has a preset delay so all that is needed is to turn it off or on.



**PLEASE BE AWARE!** This function can cause more wear on the drive system so it is best to use this when the machine is traveling less than 26 IPS at the end of the pattern before abruptly stopping.

## Drop Brush in Reverse Location

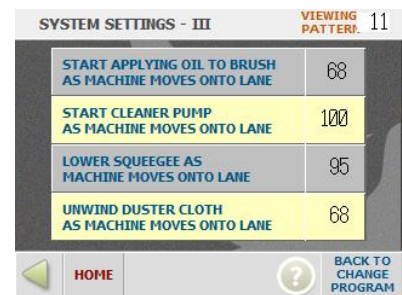


This feature is used to choose where you want the brush to turn on in reverse. The upper limit is the oil distance and the lower limit is where the oil starts in reverse.

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

## SYSTEM SETTINGS III

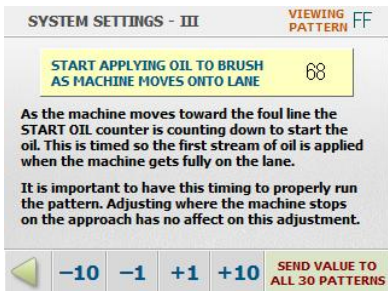
In SYSTEM SETTINGS III there are Walker functions that are timed to happen as the machine moves onto the lane. It is very important to understand what affect the numbers will have in this screen before changing them. Be careful when changing the values; and for each change you need to make sure you test your machine for the desired results.



## Start Applying Oil to the Brush as Machine Moves onto Lane

As the Walker moves toward the foul line the START OIL counter is monitoring travel and counting down to start the oil. This feature is timed so the first stream of oil is applied when the machine gets fully seated on the lane.

7



Adjustment to this value should not be needed, but is available if necessary. Any change here will affect the distance where the oil loads begin.

It is important to have this timing set properly when running a pattern. Adjusting where the machine stops on the approach has no effect on this adjustment.

## Fine Tuning Buffer Brush Settings

Hidden within the SYSTEM SETTINGS menu, there are special adjusting features to help in fine tuning the Buffer Brush to the lane. Please contact Kegel to learn how to access these menus as well as fully understanding the benefit of each feature.

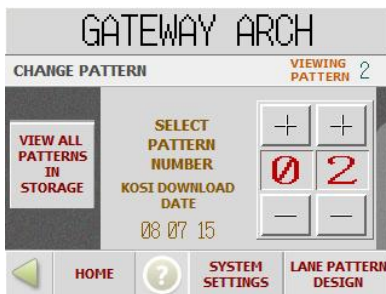
SYSTEM SETTINGS - IV		VIEWING PATTERN 11
DROP BRUSH IN REVERSE FINE TUNING	36	
TURN BRUSH OFF IN REVERSE STRIP AND OIL FINE TUNING	62	
TURN BRUSH OFF IN REVERSE OIL ONLY FINE TUNING	52	
START BRUSH MOVING FORWARD FINE TUNING	7	
OIL ONLY RETURN TO FOUL LINE FINE TUNING	60	
OIL TRAVEL DISTANCE FINE TUNING	6	
HOME		BACK TO CHANGE PROGRAM

## LANE PATTERN DESIGN

A new feature that was added to the FLEX AND FLEX WALKER in 2016 is the ability to blend to conditioners as the machine travels on the lane. But before you go designing the Mona Lisa of oil patterns, and mixing your two favorite conditioners, you must understand that:

**NOT ALL LANE CONDITIONERS ARE COMPATIBLE!**

\*Please contact KEGEL's Lane Maintenance experts for compatibility of lane conditioners.



By pressing the LANE PATTERN DESIGN button in the bottom right corner, you will access the settings to control the base of your oil program.

In this screen you will adjust the Forward Oil Distance, Drop Brush in Reverse Distance, and the Volume per Board setting of the oil pump. Press on the function to enable the adjustment, the function will turn yellow to indicate it is active. The pump setting can be changed in increments of 1 from a minimum of 20 to a maximum of 60.

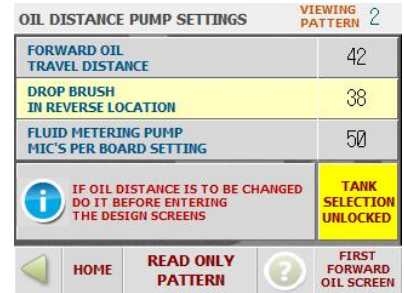
OIL DISTANCE PUMP SETTINGS		VIEWING PATTERN 2
FORWARD OIL TRAVEL DISTANCE	42	
DROP BRUSH IN REVERSE LOCATION	38	
FLUID METERING PUMP MIC'S PER BOARD SETTING	50	
<p><b>IF OIL DISTANCE IS TO BE CHANGED DO IT BEFORE ENTERING THE DESIGN SCREENS</b></p>		TANK SELECTION LOCKED
HOME		FIRST FORWARD OIL SCREEN



## Tank Selection

This new feature will allow the pattern designer to blend two compatible lane conditioners on each of the program lines in the forward or reverse screens.

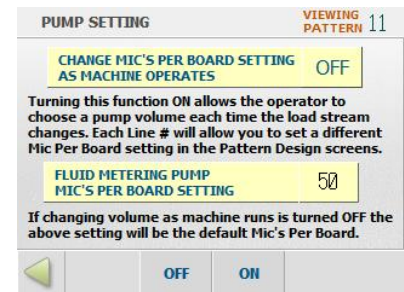
By pressing the TANK SELECTION LOCKED button, the screen will be highlighted in yellow and changed to UNLOCKED. You will now be able to choose either Tank A, Tank B or both within each program line. This will be explained later in this chapter.



## Adjustable Pump Volume

The purpose of this feature is to give the programmer the added FLEX ability when fine tuning your oil pattern. You can run one volume setting on your first load line to control the amount of oil distributed on the outside, while giving you the ability to increase the volume in the center of the pattern for increased hold area. It can also be useful when more or less volume is needed in a given part of the line without compromising another part of the oil pattern.

From the OIL DISTANCE PUMP settings screen, press on the FLUID METERING PUMP MIC'S PER BOARD and the screen to the right will appear. By pressing the OFF button, the screen will change to ON allowing the operator to adjust the volume output on each of the oil lines within the programming screen. If no adjustment is made, the default value will be 50 $\mu$ l.



FORWARD SCREEN - I					BUFFER SPEEDS	$\mu$ l	TANK SELECT
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	SPEED IPS	START DIST	END DIST	
F1	2	2	4	18	45	7	
F2	10	10	5	18	45	20	
F3	11	11	1	18	50	22	
F4	13	13	1	18	50	25	
F5	14	14	1	18	50	27	

Navigation buttons: Home, ?, -, +, VIEWING PATTERN 2, Right Arrow

Press the button labeled  $\mu$ l located above the START DIST button and the values for the  $\mu$ l for each of the program lines appear in place of the START DISTANCE values.

After doing this, you will have enabled the Mics per board setting and will be able to change the Volume Output on each of the LOAD LINES within each of the screens.

With the ability to change the oil pump volume output on each load screen, also comes some mechanical limitations. While the lane machine is in motion, and going from one pump setting ( $\mu\text{L}$  per board volume output) to a different pump setting, it will require the oil pump motor to change speeds.

The limits of the pump motor are  $2.5\mu\text{L}$  (+/-) per board starting from board 5 on left the left and board 5 on the right. We say the 5 board, because the oil program will recognize the change in the volume per board, but will take a moment to adjust to the change of speed in the oil pump. The change of speed occurs when the target screw on the oil head passes in front of the proximity sensor either going left to right or right to left, pending on the oil pattern requirements.

Therefore we have set some guidelines in the chart on right to show how many boards it will require for the oil pump to change speeds and settle in to dispense the correct amount of conditioner.

For instance; if your 2-2 load screen is set at a  $50\mu\text{L}$  pump setting, your upper limit would be  $52\mu\text{L}$  or lower limit would be  $48\mu\text{L}$  if the next screen is a 5-5 load. If your next load after your 2-2 load is an 8-8 load, you can adjust the pump setting up to  $60\mu\text{L}$  or down to  $40\mu\text{L}$  and still be confident your volume output is correct.

STARTING BOARD	UL MAX DIFFERENCE +/-
2	X
3	X
4	X
5	2
6	5
7	7
8	10
9	12
10	15
11	17
12	20
13	22
14	25
15	27
16	30
17	30
18	30
19	30

The X's in the chart are because the oil pump motor will not be settled in time to dispense a correct amount of conditioner when going from a 2-2 to a 3-3 or a 4-4.

## Variable Speed Buffer (Upgraded Machines only)

One of the available factory upgrades is the Variable Speed Buffer feature. This allows the programmer to change the RPM of the buffer brush allowing for more FLEX ability with the taper within an oil pattern.

To change the buffer brush's RPM within the pattern, press on the BUFFER SPEEDS button located above the speed IPS. Once this is done, you will be able edit the buffer speeds by tapping on the speed value for that particular line. Use the chart below to determine which speed you wish to use.

FORWARD SCREEN - I				BUFFER SPEEDS	μl	TANK SELECT
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	SPEED IPS	START DIST	END DIST
F1	2	2	4	4	0	7
F2	10	10	5	3	7	20
F3	11	11	1	3	20	22
F4	13	13	1	3	22	25
F5	14	14	1	3	25	27

VIEWING PATTERN 2

FACTORY DEFAULT BUFFER RPM IS 'SPEED 3' OR 500 RPM'S

SPEED 1 – 060

SPEED 2 – 200

SPEED 3 – 500 (default speed without the Variable buffer upgrade)

SPEED 4 – 700

## Tank Selection (continued)

To choose which tank is to be used, press on the TANK SELECT button located above the END DIST button. By pressing this button the last two columns of the Forward screen will be able to be changed to whichever tank you wish to use.

The last column, TANK A or B, will be used to either select tank A or tank B. The BOTH TANKS column, when turned on, will use both tanks and distribute two times the amount of conditioner on that selected line only.

In order to prevent the oil pump to dump an excessive amount of conditioner for that line, you must change the mic stream column for that line to dispense half of what the total amount you are requesting. For example: If you want a 50mic stream, set the adjustable mic setting to 25μl.

FORWARD SCREEN - I				BUFFER SPEEDS	μl	TANK SELECT
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	SPEED IPS	BOTH TANKS	TANKS A or B
F1	2	2	4	18	A+B	A
F2	10	10	5	18	OFF	B
F3	11	11	1	18	OFF	B
F4	13	13	1	18	OFF	B
F5	14	14	1	18	OFF	B

VIEWING PATTERN 2

## Designing the Oil Pattern

To Design a Pattern, start with the first LINE, F1, and choose the Board Numbers that you want the oil stream to go from and to. For example, most patterns start with 2 to 2 (which is from the 2-board on the left to the 2-board on the right).

Press on the desired value to activate, then press the + or - until you arrive at the new value that you wish to use.

FORWARD SCREEN - I						VIEWING PATTERN 11	
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	BUFFER SPEEDS	μ	END DIST	
F1	2	2	4	4	40	5	
F2	7	7	1	4	40	7	
F3	9	9	1	4	45	9	
F4	12	12	1	4	50	12	
F5	2	2	0	4	50	26	

FORWARD SCREEN - I						VIEWING PATTERN 11	
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	SPEED IPS	START DIST	END DIST	
F1	2	2	4	14	0	0	
F2	7	7	1	14	5	7	
F3	9	9	1	14	7	9	
F4	12	12	1	18	9	12	
F5	2	2	0	18	12	26	

Next, choose how many times you want to repeat the oil stream. We refer to an oil stream as a “load”, so enter the number of LOADS F1 will have.

Once the LOADS are set, choose how fast the machine will travel while applying the loads. Have the machine start out USING slower speeds and gradually increase through the 6 available conditioning speeds. The ability to change speeds while applying these loads is a patented feature of Kegel lane machines.

Start Distances and End Distances are not adjustable. These distances are automatically calculated based on # of loads and Speed IPS.

The first LINE that does not have any LOADS will be the first BUFF LINE. This is also the first LINE that will allow you to change the END DISTANCE.

You can have more than one BUFF LINE in the pattern, which normally will be at different speeds. Just choose the distance & speed for each BUFF LINE, with the OIL DISTANCE being your upper limit.

FORWARD SCREEN - I						VIEWING PATTERN 11	
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	BUFFER SPEEDS	START DIST	END DIST	
F1	2	2	4	4	0	0	
F2	7	7	1	4	5	7	
F3	9	9	1	4	7	9	
F4	12	12	1	4	9	12	
F5	2	2	0	4	12	26	

Once you have created a LINE with ‘0’ zero LOADS and started your BUFF LINES you cannot create the next LINE with LOADS. The present program will not allow you to skip between buff out and oil loads.

Whenever the OIL DISTANCE is increased the last BUFF LINE will need to be adjusted to the OIL DISTANCE. When this change is made, the program will automatically change the OIL DISTANCE to the 15th Forward BUFF LINE (F15). You will need to fix this.

REVERSE SCREEN - I						VIEWING PATTERN 11	
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	SPEED IPS	START DIST	END DIST	
R1	2	2	0	30	39	30	
R2	14	14	1	18	30	27	
R3	12	12	2	18	27	22	
R4	10	10	2	14	22	18	
R5	8	8	1	14	18	16	

After the forward screens are complete, through F15, the screen will advance to REVERSE SCREEN I. "R1", the first reverse line, will be used for buffing only. With the machine traveling in reverse, the buffer brush will drop wherever the REVERSE DROP BRUSH is set to and buff the lane until the END DIST is reached. The END DIST is also where the beginning of where the Reverse oil will start to be applied.

The rest of the LINES, work just like the Forward screens. Row R2 will be the first LINE to have LOADS.

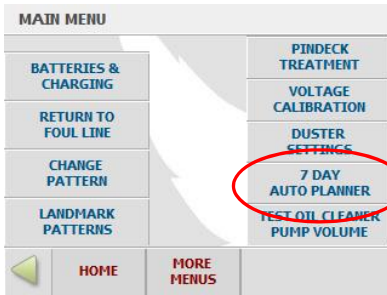
The DISTANCE will automatically be calculated when the LOADS & SPEEDS are entered. It is possible to have more than one BUFF LINE during the return trip to the foul line, by entering lines until you hit zero footage as the lower limit.

REVERSE SCREEN - II						VIEWING PATTERN 11	
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	SPEED IPS	START DIST	END DIST	
R6	6	6	1	14	16	14	
R7	2	2	2	14	14	10	
R8	2	2	2	10	10	8	
R9	2	2	0	10	8	0	
R10	2	2	0	10	0	0	

REVERSE SCREEN - III						VIEWING PATTERN 11	
LINE #	LEFT BOARD	RIGHT BOARD	# OF LOADS	SPEED IPS	START DIST	END DIST	
R11	2	2	0	10	0	0	
R12	2	2	0	10	0	0	
R13	2	2	0	10	0	0	
R14	2	2	0	10	0	0	
R15	2	2	0	10	0	0	

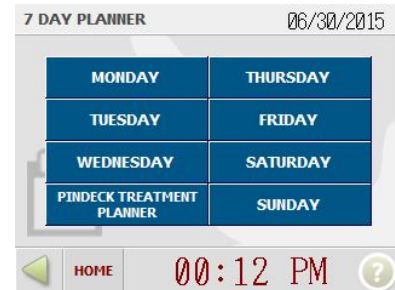
Like the Forward screens, once you have created BUFF LINES you cannot create the next LINE with LOADS; the present program does not allow skipping.

## Auto Programming (7 Day Planner Program)

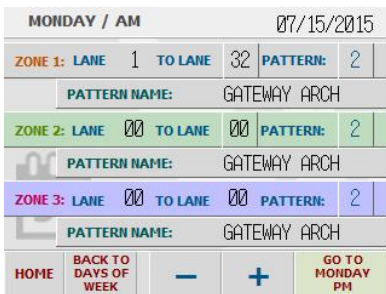


Go to the main menu and press 7 DAY AUTO PLANNER and the password screen will appear, enter password and press CONTINUE.

You will be given the option to choose one of the days to edit, or select PINDECK TREATMENT PLANNER to set up your Pindeck treatment program



The day selection will appear press MONDAY and the screen will change to MONDAY AM. The button in the lower right will change you to PM settings for Monday (screens shown at bottom of page).



Press on the Pattern number to enable it and then use the Decrease and Increase buttons to make the change.

It is possible to have 3 Conditioning Zones across the center. When there are no Lane Numbers in Zones 2 & 3 the Zones are disabled.

To create a second Zone, press on the Ending Lane number in Zone #1 and decrease the TO LANE Number that is highlighted. By doing this, you will see that the line below,

Zone #2, will auto fill Starting Lane.

To create a third Zone, press on the Ending Lane number in Zone #2 and decrease the TO LANE Number that is highlighted. By doing this, you will see that the line below, Zone #3, will auto fill Starting Lane and the ending land will automatically be the last lane.

To disable the Zones just Increase the Ending Lane in Zone #1 or #2 to the last lane.

To setup the Pindeck Treatment Planner, simply press the button and then press on which day you wish to condition the pindecks. The Flex and Walker can be set to automatically do a Burn Pair function in MACHINE SETUP when using Zones.

## Adjustments

### Buffer Brush

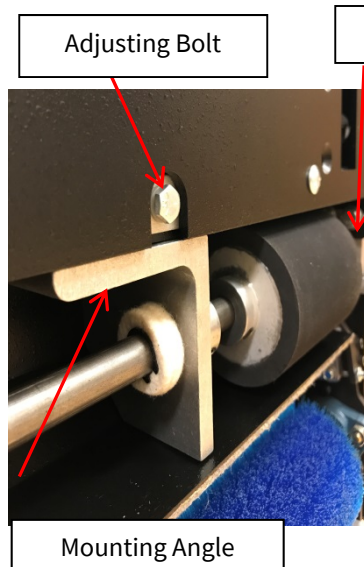


The buffer brush is made of a long-lasting synthetic bristle, which under normal circumstances, can be expected to last approximately 18 months. However, changing this annually before each league season is recommended to ensure consistency throughout the year.

To check the buffer brush adjustment, the brush must first be in the down position. This is done at the **INPUT/OUTPUT TEST** menu. If the brush is not already down in the "zero" position, press **BRUSH LIFT**.



Press **TEST BUTTON** 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 and the machine standing in the transport position hold a level or straight edge across the front drive wheels and rear drive wheels (shown above). The buffer brush material should extend approximately **3/32"** to **3/16"** (2.38 mm to 4.76 mm) beyond the straight edge for proper adjustment. The buffer brush is factory adjusted prior to being shipped at approximately **1/8"** (3.2 mm).

If an adjustment is needed, loosen the four (two on each side) mounting angle bolts as shown in the picture to the left and the two mounting plates on the shaft ends.

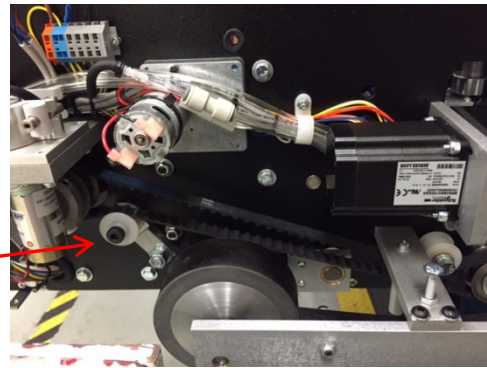
Then turn the adjusting bolt to set the buffer brush crush by turning clockwise for less or counter clockwise for more.

Once the buffer brush adjustment has been made, fasten the four mounting angle bolts tightly and end mounts.

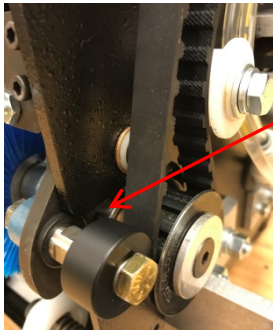
**NOTE:** When cleaning the buffing brush, **NEVER** use any type of cleaner on the brush. Use of cleaners will decrease the brush's ability to hold conditioner and greatly affect the lengthwise taper of the conditioner pattern. All that you need to clean the buffer brush is a clean, soft, dry towel.

## Buffer Belt

Adjustment of the Buffer Belt is done with the buffer brush in the down position.  
Loosen up the idler pulley and push it all the way up and fasten tight, do not over tighten belt.



Idler Pulley



This idler roller is used to keep belt from jumping cogs. It uses an eccentric adjusting sleeve to adjust it closer or farther from the belt. Loosen bolt and turn sleeve to adjust, rotate brush to make sure roller is not pinching belt too tight to pulley before tightening bolt. Always inspect for good belt alignment from motor to brush pulley.

## Transfer Brush

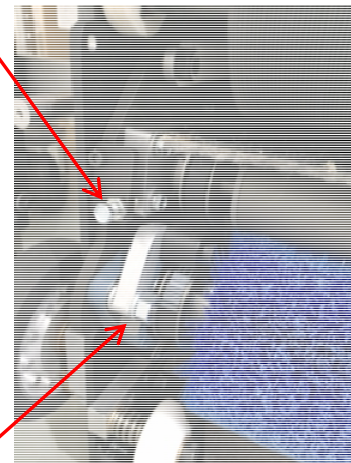
The following steps adjust the transfer brush to the buffer brush.

1. Loosen the four ¼” jam nuts on each square head bolts and back them away so that the transfer brush can move all the way in and out of the buffer brush assembly.
2. Loosen the five ¼-20 bolts on the front side that secure the adjustment bar, but keep them snug.
3. Using a ¼” wrench, screw the square headed bolts into the Transfer Brush to lower. Do this until the Transfer Brush just contacts the buffer brush assembly. Once this happens, turn the screws two full turns and tighten them all the way.

## Transfer Roller

Adjusting screw

1. With the machine in the operating position, loosen the roller pivot screws.
2. Then loosen the jam nut on the Roller adjusting screw and turn the screw in or out until the 1/8” – 3/16” crush is obtained by turning the adjustment screws OUT, INCREASES THE CRUSH, by turning the screws IN, DECREASES THE CRUSH.
3. Tighten the jam nut and the pivot screws back into place.



Pivot



## Oil Tip

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

This adjustment should be checked with the buffer brush running. To operate the brush, go to your test INPUT/OUTPUT screen and press the BUFFER MOTOR then press the button in the center that says BUFFER TEST to turn on the motor. After making each position adjustment you will also need to make sure the tip is as close to the drip pads as possible, without touching them.

There are two adjustments that can be made to the oil tip.

One adjustment is the height of the tip in relation to the Transfer Brush. The other is the position of the tip front to back. Adjust the Oil Tip as close to the “V” as possible without actually dispensing oil into the “V” area.

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

The oil tip pitch can be adjusted by using the set screws located in the front and back of the Oil Head block assembly. The pitch should be set to dispense conditioner on the black transfer brush (very close to the V) but not directly onto the blue buffer brush.



### TECHNICAL NOTE

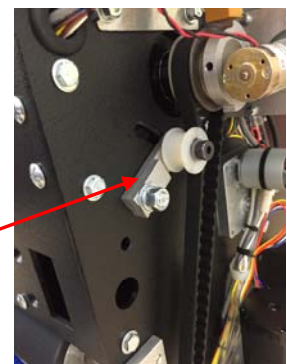
If you notice a zigzag pattern in the oil on the lane, you will need to adjust the Oil Tip position. Adjust the oil tip further up the transfer brush to eliminate this problem (make adjustments in small increments until zigzags disappear).

## Timing Belts

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

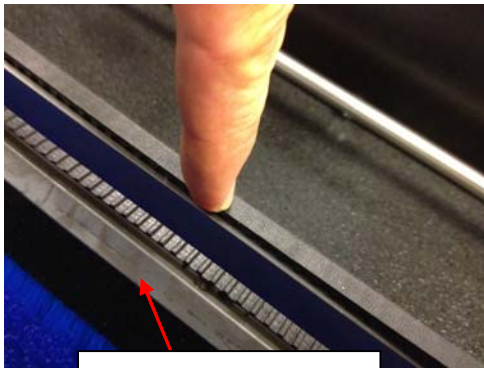
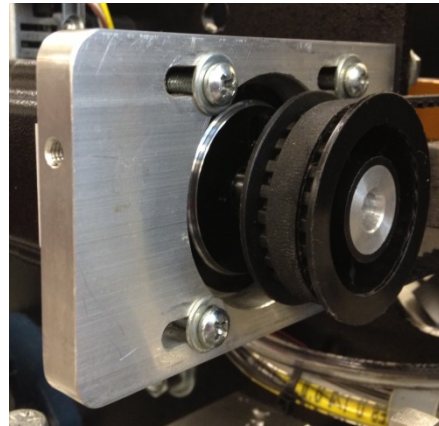
1. **Buffer Belt:** The machine has a belt idler roller that can be positioned to maintain the proper tension. The belt should have a fair amount of tension, but do not over tighten. It also has an idler next to the buffer pulley to keep the belt in the pulley cogs.

Mounting block fastener



2. Oil Head Timing Belt: This belt should be adjusted a little on the tight side. Unplug the head motor fuse before attempting to work on this belt to disable the braking circuit.

To adjust head belt tension, loosen the 4 screws in the slotted bracket, adjust the belt so that when you push the belt down from the top it just touches the head bar assembly as shown in the below figure.



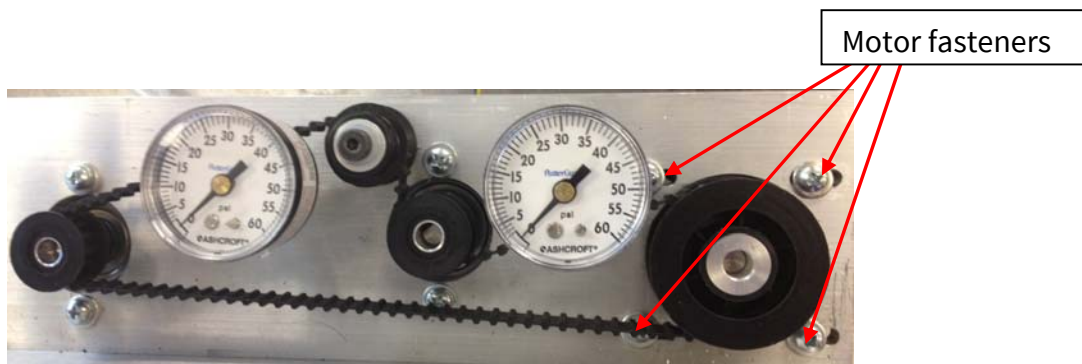
Head Bar Assembly

Fasten all screws when done. This belt drives the board counting disk and the cleaner assembly making it important that the belt not run loose. A loose belt can cause the machine to lose its oil head timing and the timing that controls the movement of the cleaner head.

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

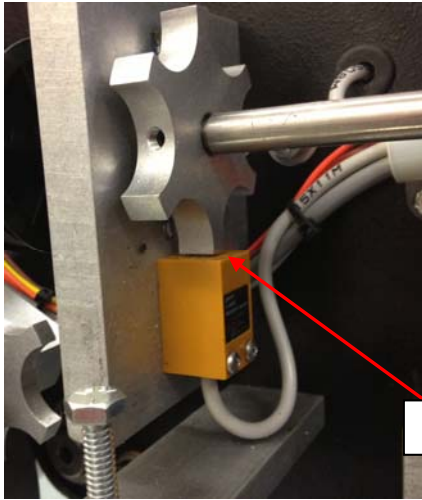
### Oil Pump Belt

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 and cause premature failure of the oil pump motor. This may also cause oil volume fluctuations. Loosen up the oil pump motor fasteners to change belt tension.



Motor fasteners

## Board Counting Target and Proximity Switch (look for tutorial video on KOSI)



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

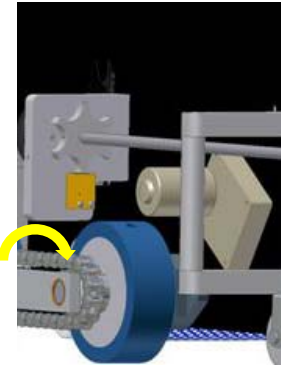
Remove the plastic cover on the 10-pin side to access the sensor assembly. Once the cover is off, you will be able to see the belt tension and head timing assembly. If a timing adjustment is necessary, follow these steps closely to avoid confusion.

Gap is 0.010"

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 bar, 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 proximity sensor. The gap between the target and the proximity sensor should be **0.010"** ( $\pm 0.005$ ) or about 0.254 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 the clockwise rotation. The illustration shows a clockwise adjustment (when the 7-pin sensor light is coming on too soon).



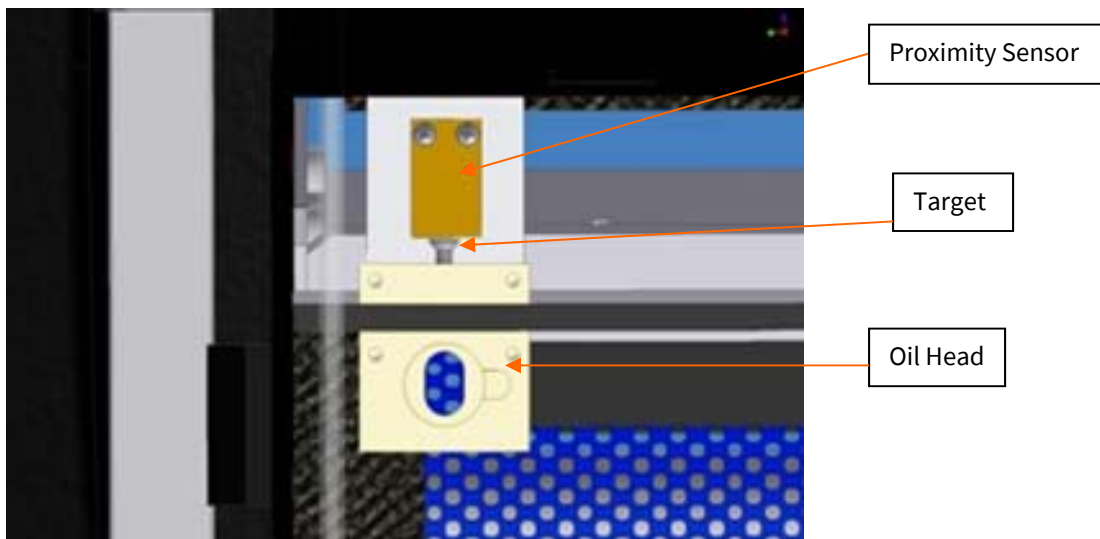
8. Now it is time to make sure that the board counting target is secured and the head assembly is tight. Place the cover back on the head assembly and re-insert the two mounting screws. Replace the fuse for the motor.



#### TECHNICAL NOTE

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

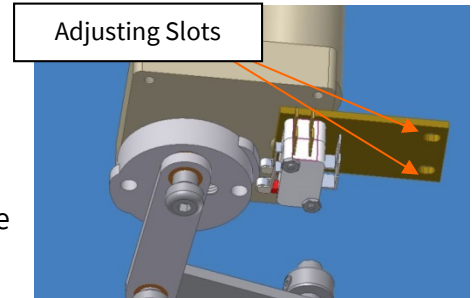
### Oil Head Target



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

## Brush Lift Switches

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



## Stepper Motor Controls

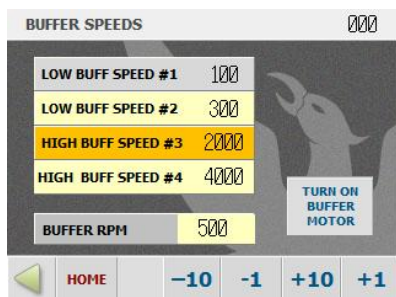
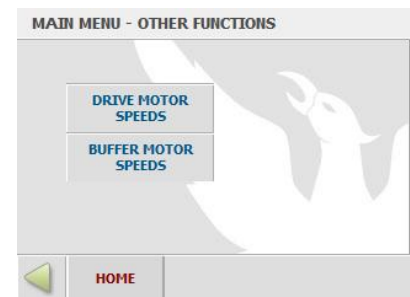
The two stepper controls do not have any user adjustments, all adjustments are done through the touchscreen. Changing any dip switch settings will only cause operational errors; each of the controls uses the same dip switch settings.

The **Moving Head Control** uses two PLC outputs; one for movement and the other for direction. When output **100.04 is on** and output **100.05 is off** the motor will run the oil head left to right, when both outputs are on the oil head runs right to left.

The **Oil Pump Motor Control** is set to run the pump motor in a counter-clockwise rotation and is controlled by **output 100.00**. The controller is wired to run the motor in this direction and uses only one PLC output to operate the motor.

## Variable Speed Buffer

To set the buffer speeds (rpm), the machine must be on the lane so that a load is placed on the buffer brush to simulate operation. Once on the lane, go to the MENUS screen and then MORE MENUS and press the MOTOR SPEEDS selection.



By pressing BUFFER MOTOR SPEEDS the screen to the left will appear that will allow you to adjust each of the four buff speeds.

Press the buffer speed you wish to change followed by the TURN ON BUFFER MOTOR button. This will activate the motor allowing you to use the + or - buttons at the bottom of the screen to dial in the buffer speeds. Please note that it will take 6 seconds for the motor to settle and give the exact reading.

Use the chart below as reference:

SPEED 1	60 RPM
SPEED 2	200 RPM
SPEED 3	500 RPM
SPEED 4	700 RPM

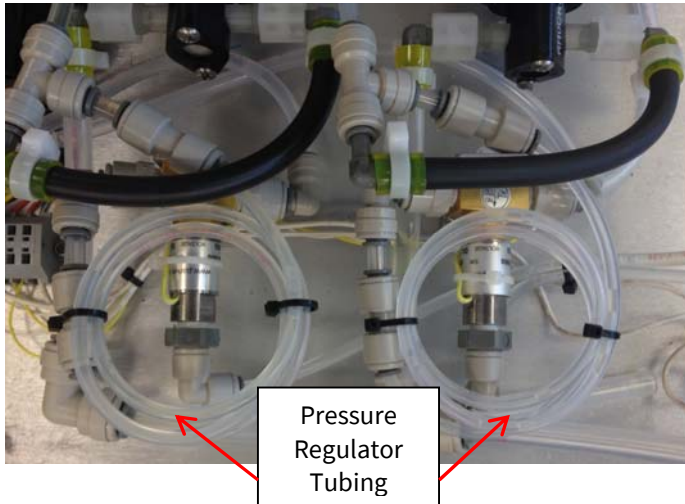
Speed Control board settings:



The above speed pots are held in place by electric tape after being adjusted in factory.

## Pressure Regulator Tubing

A wide range of conditioner viscosity has been tested in the machine to determine the size and length of the pressure regulator tubing that is needed. Keep in mind that these are only **guidelines**; temperature greatly affects viscosity and may change these results.



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

The oil pressure for this model machine is a little higher than previous designs due to the variable pump speeds available in the machine. The mechanical adjustment of the pump is done at the 50 $\mu$ l setting at the maximum speed value of 45B0 (this is a hexadecimal value).

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)

## 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 head bar.
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 buildup is occurring on the ends of the buffer. Buildup could be the result of dirty gutters.

Clean the conditioning compartment every day!!!

We do not recommend using alcohol to clean the plastic tanks.

### Monthly Maintenance

1. Remove guards from both sides of machine to clean and inspect motor and sensor shaft.
2. Lightly oil sensor extension shaft and bushings in the cleaning compartment.
3. Inspect buffer belt and its tension.
4. Oil buffer belt idler.
5. Check and inspect sliding head belts.
6. Clean and inspect the compartment that contains the conditioner (oil) tank and pump.
7. Clean the transfer brush. Take an air compressor and blow out the transfer brush while loosening up the dirt with your hand.

### Yearly Maintenance

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

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



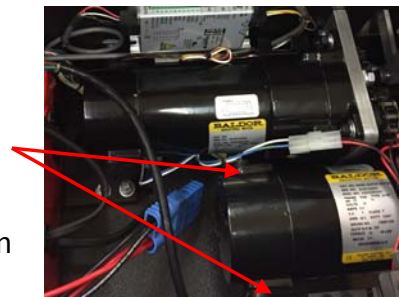
## Buffer Motor Brushes

When the lane machine has been in operation for 300 hours, this screen will pop up indicating that the Buffer Motor is in need of service. This is an indication that the Buffer Motor brushes should be inspected and/or replaced.



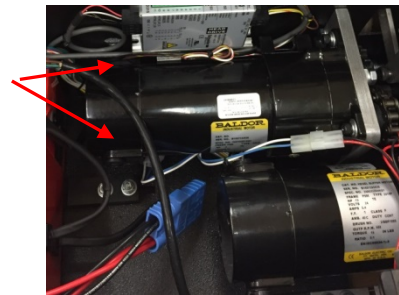
The Buffer brush motor is located in the center compartment under the electrical panel. To get to the top buffer motor brush, it will be necessary to remove the conditioner compartment lid assembly as well as the cleaner compartment lid. Refer to Chapter 1 for removal of lids.

Once the lids have been removed, remove the three screws on the back side of the hinged electrical panel. Tilt the electrical panel up towards you to view the top of the drive motor brush cap. Remove the drive motor brush cap followed by the drive motor brush.



Take a good flathead right angle screwdriver and remove the drive motor brush cap.

Once both caps have been removed, take the air compressor and blow the motor out freeing it from any potential carbon build up.



## Procedure for Cleaning Oil Control Valve

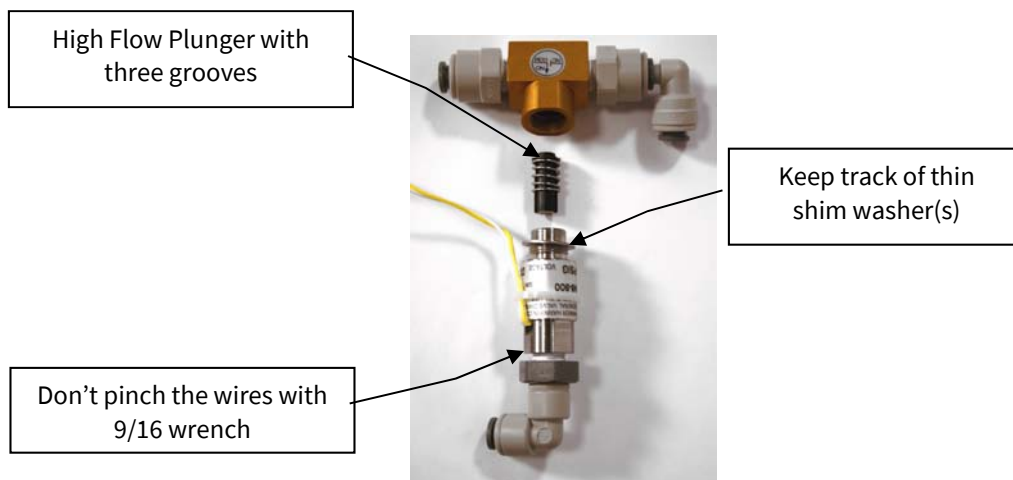
The following steps outline the procedure for disassembling the conditioner metering valve. Be careful when removing the oil lines from the fittings since they will leak.

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.

Disconnect power and place the machine in the operating or down position.

1. Remove the oil assembly from the rear wall.
2. Clean the area around the oil assembly.
3. Use a Phillips screwdriver to remove the two screws holding the valve to the back plate.
4. Remove the two pieces of tubing from the top of the valve. **PUSH IN** on the outer collet to release the tubing or the elbow. Plug the open ends to prevent dirt from entering the lines and to stop the oil from leaking (be careful to not split the elbow).
5. 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.



6. 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 airlines may be forced into the manifold.)
7. 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 contact 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.

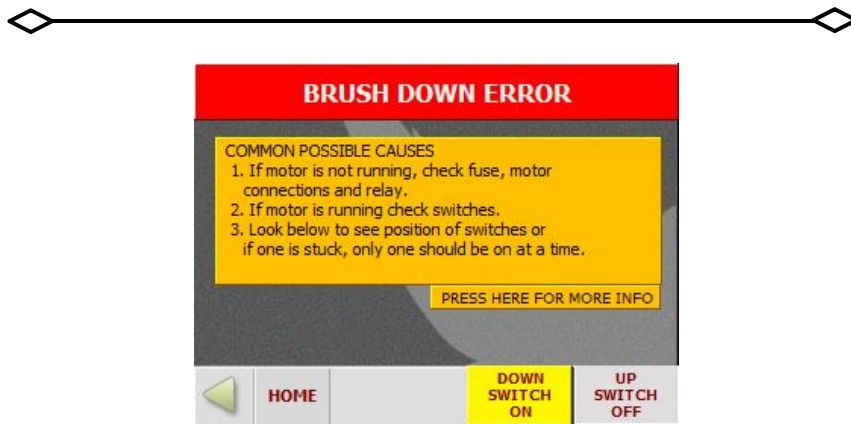
8. Replace the valve body on the head of the valve using the same shim washer(s). Do not over tighten!
9. Replace the valve on the back plate.
10. Plug the line or elbow back into its proper fitting and clean around all the connections.
11. Return the oil assembly to the machine and plug in the connections.
12. Run the **OIL VOLUME** test once to clear the lines out. Then check the volume of conditioner output for a typical program and adjust the pump if necessary.

## Troubleshooting the Conditioning System

### Conditioning Problems Indicated by Error Messages

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

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



Normally, this error occurs when Input 005 fails to receive a signal within 3.5 seconds of the motor starting.

Here are the possible causes that can produce a BRUSH DOWN ERROR. If the Brush Lift Motor does not run, menu to the **INPUT/OUTPUT TEST** and press **BRUSH LIFT** to check the relay operation and voltages.

#### Problem:

The brush lift motor runs but the down switch failed to operate and send a signal to PLC Input 0CH 05.

#### Possible Cause:

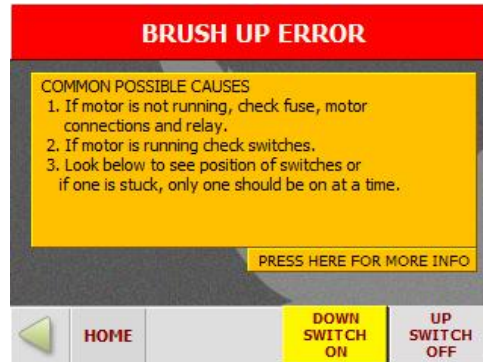
- Check and inspect the micro-switch. Manually operate switch to see if Input 0CH 05 will illuminate.
- Broken wire or loose connection in either the yellow 24 VDC wire or the Violet/Yellow Wire that connects to Input 0CH 05.
- This error can also happen if the Brush Up Input 0CH 04 is stuck on.

### Problem:

Brush Lift motor does not run when tested in the Output Test. You will need to determine if power is getting to the motor.

### Possible Cause:

- Fuse is blown or fuse holder is bad.
- Brush bearings are causing a bind not allowing free movement up and down.
- Relay came loose in socket or has failed.
- Faulty motor.
- Bad connection to motor, check all power wiring to motor.
- PLC output 10CH 05 failed.



Normally, the Brush Up Error occurs when Input 004 fails to receive a signal within 3.5 seconds of the motor starting. Below is a list of the possible causes that can produce a BRUSH UP ERROR.

If the Brush Lift Motor does not run, menu to the **I/O TEST** then **OUTPUT TEST** and press **BRUSH LIFT** to check relay operation and voltages.

### Problem:

The Brush Lift motor runs but the up switch failed to operate and send the signal to PLC Input 004.

### Possible Cause:

- Check and inspect microswitch, manually operate switch to see if Input 004 will illuminate.
- Possible broken wire or loose connection at either the yellow 24VDC, or the Green/White Wire that connects to Input 004.
- This error can also happen if the brush down Input 005 is stuck on.

### Problem:

Brush Lift motor does not run when tested in the Output Test. You will need to determine if power is getting to the motor.

### Possible Cause:

- Fuse is blown or fuse holder is bad.
- Brush bearings are causing a bind not allowing free movement up and down.
- Relay came loose in socket or has failed.
- Motor has failed.
- Bad connection to motor, check all power wiring to motor.
- PLC output 101CH 02 failed.



### TECHNICAL NOTE

Both the Brush lift motor and the Squeegee motor, will time-out in 9 seconds if the position switch, that the PLC is looking for, is not actuated. Before the motor "times-out", the machine will stop and display an error message.



Normally, this error screen appears when Input 001 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.

Here are the possible causes that can produce a MOVING HEAD TRAVEL ERROR. If the Motor does not run, menu to the **INPUT/OUTPUT TEST** and press **HEAD MOTOR** to check for motor operation and voltages.

**Problem:**

Oil Head Motor runs, but Input 001 does not operate when oil head is moving or it was interrupted.

**Possible Cause:**

- Board counting sensor has failed.
- Wire between sensor and PLC is damaged or loose causing an open connection.
- Motor is starting too slow due to lack of lubrication on the oil and cleaner sliding head bars.
- Cleaner belt jumped timing causing the cleaner head to jam against the wall of the machine. A set screw can come loose resulting in this problem.

**Problem:**

Oil Head Motor does not run in one or both directions.

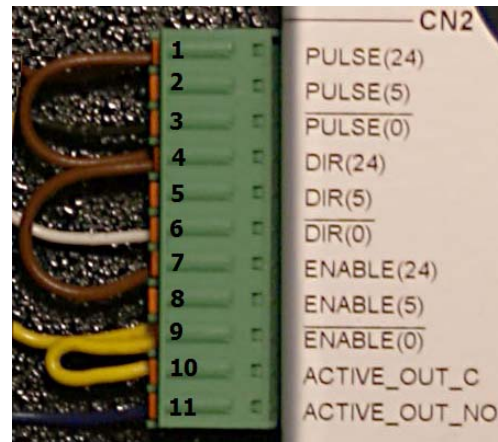
**Possible Cause:**

- Motor has failed.
- Motor brushes worn. Remove/inspect and blow out motor.
- Motor unplugged or has a damaged wire.
- PLC output 101CH 00 has failed causing no operation.
- PLC output 101CH 01 has failed causing no operation right to left.



Normally, this error screen occurs when Input 009 is not turned on. Either Drive Board can cause this error.

Each Driver Board has a switch at terminals 10 and 11. Terminal 10 is the Common and terminal 11 is Normally Open. The switches are wired in series back to Input 009.



- Possible Cause:**
- Turning power off, then back on quickly, will send the driver into fault.
  - Bad power connections at the CN1 plug.
  - Bad E-Stop Button
  - Loose or open connection at the CN2 plug (shown above).
  - Removing the fuse and re-installing it while power is on.
  - Blown fuse.

A Flashing Red Light will indicate there is a FAULT with the Drive. To clear it, turn the power off then wait a few seconds before turning the power back on. This will usually reset the error.

A flashing green light will indicate the drive has been de-activated, which is a wiring problem at the CN2 plug. Check terminals 7 & 9 on that plug.

The following chart helps determine what type of fault is present.

STEPPER ERROR CODE		
FUNCTION	FLASH CODE	LED COLOR
Amplifier Activated	STEADY	Green
Amplifier Deactivated	EVEN	___ GREEN ___
Temperature Fault	EVEN	___ RED ___
Overvoltage	QUICK	Red _____
Under Voltage Warning	QUICK	Red Red _____
Signal Frequency High	QUICK	Red Red Red _____
Short Circuit	QUICK	Red Red Red Red _____

If the Temperature fault was flashing you would see an even on off flash of the red light.  
 If the Overvoltage fault was flashing you would see a quick flash with a pause before the next flash.

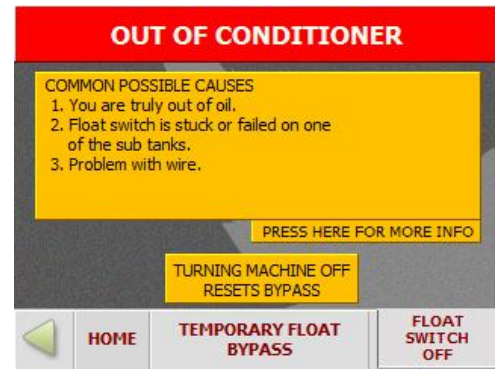
Press anywhere on screen to return.



This error lets you know that the machine is low on conditioner (oil). Simply inspect each of the conditioning cartridges and replace the one or both of the empty cartridges.

If this does not clear the error the float may have a problem. In a pinch you may temporarily bypass the float allowing you to finish conditioning.

By simply pressing the **TEMPORARY FLOAT BYPASS** button, it will override the **OUT OF CONDITIONER** error message. When the machine powers down, it will reset back to normal operation.



### Conditioning System Problems that DO NOT Display Errors

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

1. Oil Pump fails to run.
  - a. Motor is unplugged or has a damaged or open connection.
  - b. Motor has failed.
  - c. PLC output 100CH 00 failed.
  
2. Buffer fails to run, which will cause serious conditioning problems if the motor works on some of the lanes and fails on others.
  - a. Blown fuse.
  - b. Motor is unplugged or has a damaged or open connection.
  - c. The buffer motor relay failed or is loose in the base.
  - d. Motor has failed.
  - e. Belt is broken.
  
3. Machine oils 2-2 more than programmed or looks as if it is just oiling 2-2 badly (a.k.a. Sport Shot Error).
  - a. Board counting target is loose but not giving errors.
  - b. Gap is too large between the board counting sensor and the target.
  - c. Oil tip insert has come out of the line (Replace with part # 154-6832).

4. Machine fails to dispense oil from tip.
  - a. Oil pump motor has failed.
  - b. Pump has failed.
  - c. Pump belt is broken.
  - d. Oil control valve has failed.
  - e. PLC oil control valve output 100CH 07 failed.
  - f. Filter is clogged.
  - g. No oil in tank and the float failed to error machine.
  
5. Conditioner (oil) loads not ending at correct footage.
  - a. Oil Head not running at correct speed; Check Oil and Cleaner Heads for lubrication.
  - b. Machine speeds are not set correctly.
  
6. Oil Valve time has increased.
  - a. Oil Head is not running at correct speed, check oil and cleaner heads for lubrication.
  - b. Board counting target loose.
  - c. Wrong program was run or someone has changed the program (#1 culprit©).
  - d. Belts are too tight on one or both of the moving heads.
  - e. Shaft bushings need lubricated.



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 you're playing conditions to keep them consistent and provide the best customer service.

## Landmark Pattern Settings



As modern bowling trends change, it is important for our environment to evolve with them. To accomplish this, we have created the Landmark Pattern Series, the next generation of custom oil patterns from Kegel, which utilizes the groundbreaking technology of the FLEX lane machine.

With the innovative features in the Kegel FLEX lane machine, three of the patterns in each series will use a combination of the variable buffer speed, multi-mic stream, and dual lane conditioner features. FLEX lane machine owners with all upgrades will be able to provide their customers oil patterns that are on the cutting edge of pattern development.

Like the Navigation Patterns, the Landmark Patterns are divided up into three levels of difficulty; Recreation, Challenge, and Sport. The colors and the number of pillars represent the level of difficulty for the series.

All of the Landmark Patterns are grouped and separated by three levels of difficulty: **Recreation**; **Challenge**; and **Sport**. The Recreation Series of patterns will be at a ratio of 5.0:1 or greater; the Challenge Series patterns will be between 3.1:1 to 4.9:1; and all Sport Series patterns will be USBC Sport Bowling compliant, which adhere to a ratio of 3.0:1 or less.



**RECREATION**  
5.0:1 and Greater



This oil pattern is a long standing stone wall that has evolved over many years in the game of bowling. From simple grooves in the lane in the 30's, to the short oil walls of the 80's, and now the typical long oil house shot, this recreation oil pattern has stood the test of time.



John Davis, the Founder of Kegel, was from Missouri and used to have a saying; "they always like 'em easy in St. Louis." The Gateway Arch pattern is a tribute to that saying and yes, the composite shape is one large arch...from 9R-9L!



One of the most popular landmarks in the UK is the Elizabeth Tower, which houses Big Ben, the largest bell of the clock in the tower. At 44' in length, this Recreation pattern will also be very popular as it will provide a lane condition conducive to many styles of play. So when bowling on this oil pattern, get your own Big Ben and ring the bell with every high score!



Long associated with a blocked lane condition, the Great Wall of China pattern is the wall of all walls. At 48' in length, the best way to attack this pattern is up against the wall of oil instead of jumping to the drier part of the lane. Once lined up properly on the Great Wall of China, it will be almost impossible to cross



CHALLENGE  
3.1:1 to 4.9:1

**CHALLENGE**



Known as the Crown of Palaces, this Challenge Series pattern is also a wide crown-shaped pattern at 38' in length. Because of the “not too long and not too short” length of this oil pattern, along with being dome like in shape, this jewel can wash away all past sins if you decide to visit it.



Meaning “at the mouth of the well of the Itza”, the composite graph of this oil pattern resembles the shape of this ancient Mayan ruin. But beware, even though the pattern ratios fit into the Challenge Series, the continuous slope from the least amount of conditioner to the peak can often make climbing to the top of this oil pattern more difficult than it appears.



Also known as the Leaning Tower of Pisa, this pattern is asymmetric in design with a shift to the inside on the left, or if looking at it from another perspective, a shift to the outside on the right. At 41' in length, this oil pattern retains much of its shape throughout the entire length of the pattern, just like the Tower of Pisa does



The Statue of Liberty was a gift of friendship from the people of France to the United States. So to compliment the Eiffel Tower Sport pattern, the Statue of Liberty is the longest pattern in the Landmark Challenge Series. As with most long patterns there isn't a lot to figure out, but to gain the freedom of high scores on this Sport oil pattern, you should keep it on the straight and narrow side of freedom!



SPORT

3.0:1 or Less



38' patterns can often handcuff players because they are too short to play inside, but too long to play outside. However, within the Alcatraz oil pattern there looks to be an escape route, and many have tried to use it, but very few have succeeded



The Sphinx pattern can take on many forms and requires numerous personalities to conquer it successfully. With the supreme difficulty level of this pattern, you'll have to think like a human and attack it like a lion to gain access to the temple-like feeling that the Sphinx is the guardian of.



This oil pattern is flat side-to-side with the oil-only part separated from the buff-only parts in two square-like distances. In bowling "red numbers" means under 200 average; so will you be stuck "in the red" or can you make it "in the black" on the Red Square?



This pattern is the longest pattern in the Sport Series and is built in steps from the widest point until it narrows towards the end. Ironically, there are 300 steps in the climb from ground level to the first level of the Eiffel Tower and to the roof is just over 300 meters – the question is, can you navigate the steps in this Sport pattern and reach the pinnacle 300 meters?

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

LANDMARK PATTERN WORKSHEETS, AND DESCRIPTIONS CAN BE FOUND IN THE APPENDIX OF THE MANUAL

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

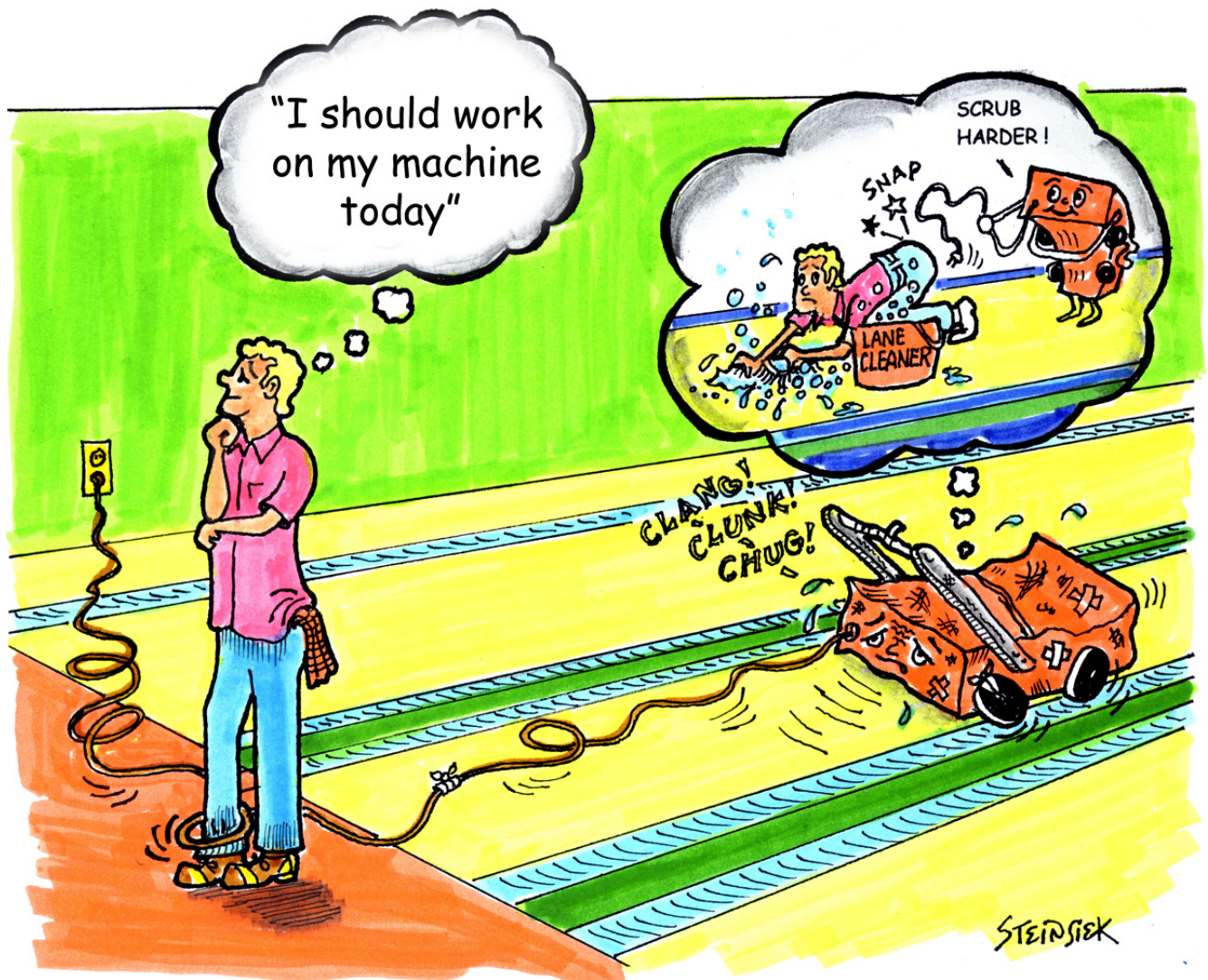
## Troubleshooting Lane Conditions

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

1. First, why do you think there is something wrong with your conditions? Are all of your bowlers complaining, or is it just a few? Are the bowlers right to complain? Don't let bowlers manage your lane maintenance program, you can please some of your bowlers all of the time but you can't please all of them all of the time. Sometimes good personal relations make your customers just as happy as good conditions.
2. Looking for the Holy Grail of lane conditions is something you can't get caught up in either. Bowlers can and will adjust to all kinds of conditions but only if they can bowl on the same thing more than once. Don't make a change for the sake of change. Think before changing the pattern. It is best to prove a change before unleashing it on your bowlers.
3. Never make pattern adjustments before checking the stripping; run your machine in clean only. If your lanes are not coming clean like they should, this could be your only problem. Check your squeegee, cleaner volume, and duster adjustments. Refer to Chapter 3 for the cleaning troubleshooting for solutions to possible problems.
4. Who mixed the cleaner last? Concentration of the cleaner is very important and must stay consistent. At Kegel, we have seen mixed diluted cleaner mistaken as the concentrate. Then it was diluted again making a very, very weak solution. However, mixing cleaner stronger than a 4 to 1 ratio is not good either.
5. When was the last time you checked your oil calibration? Maybe someone adjusted the pump and didn't tell anyone. This should be one of the first things checked along with cleaning. Calibration should be checked regularly and if there is an oil output problem check the troubleshooting section for the conditioning system.
6. Now that you have no cord to watch out for, walk alongside the machine while it runs; look at the display for speeds and on the way back check the back end for cleanliness. Check to see if the pattern looks uniform across the house. Do this each day and you may be able to stop and correct problems before they happen.
7. A general inspection of the machine should be done whenever there is a concern that something may be wrong. Just because there were no 300's and 800's shot last night does not mean you should make a change. Bowlers don't always bowl great.



8. There is always the chance for operator error when it comes to conditioning machines. Always do spot checks on employees that operate the machine to make sure they do the job properly.
9. We hope this does not happen to you...but make sure that conditioner was not put in the cleaner tank. Sounds funny, but this happens more than you think and it is no fun to fix.
10. Did someone put the wrong conditioner in the oil tank or use the wrong cleaner? Always make sure that your KEGEL lane machine uses KEGEL products. We have thoroughly tested and established recommendations for all of our lane maintenance chemicals and supplies. It just makes sense to use KEGEL Genuine products.



## Pattern Troubleshooting

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

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

**A:** Shorten the applied oil distance. Too much oil in the middle and at the end of the pattern can cause excessive carry down. 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 carry down problems when the pattern length is increased.

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

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

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

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

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

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

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

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

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

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

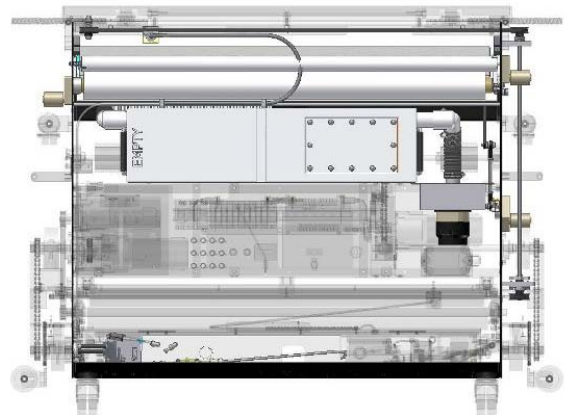
# CHAPTER 3

## Cleaning System

### Theory of Operation

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

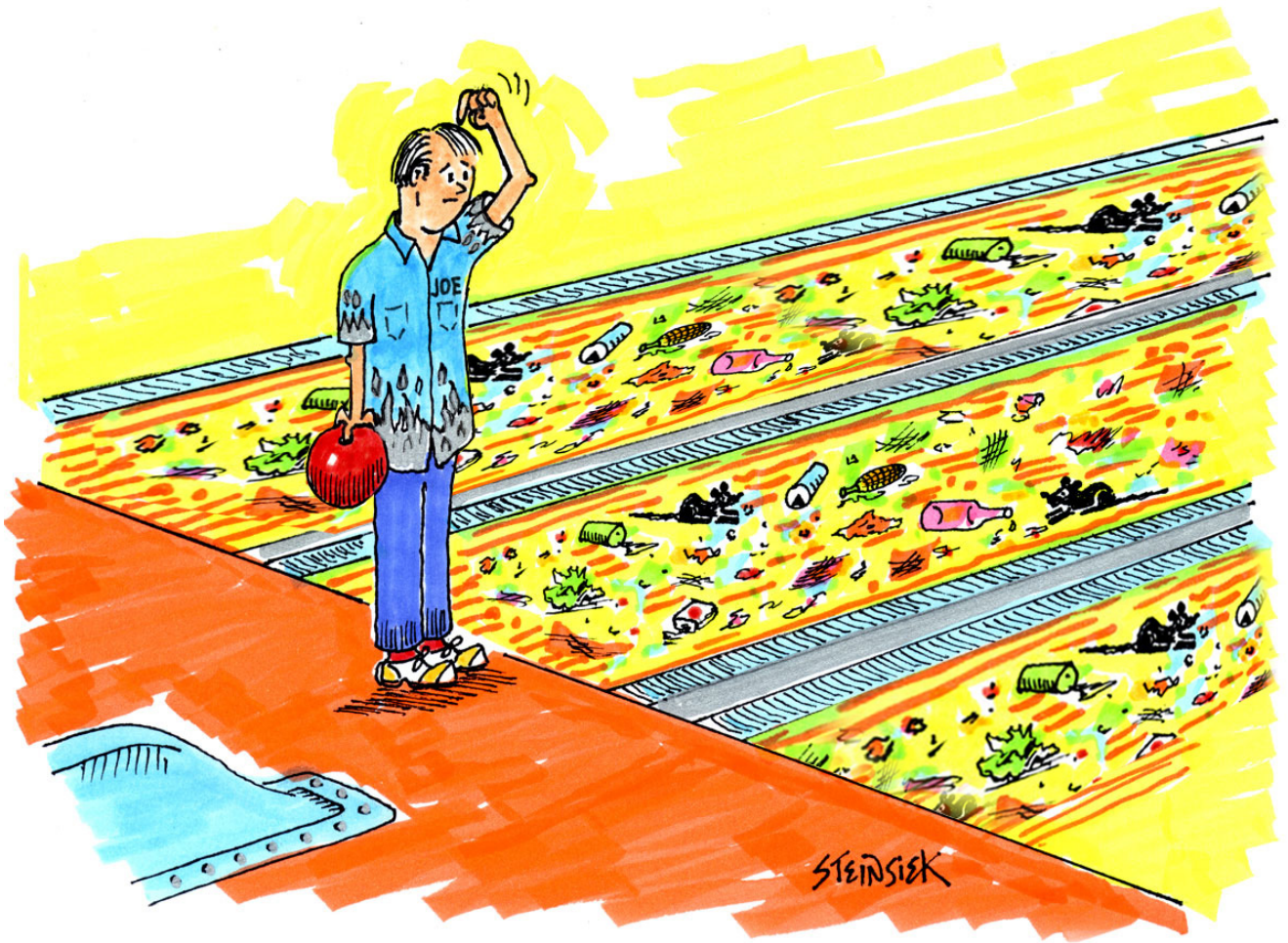
The proper cleaning of your lanes is very important to the consistency of your playing conditions. Various things can cause the machine to not adequately remove the dirt and conditioner from your lanes. In this section we will describe how the machine cleans your lanes and reasons why it may not.



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

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

## Why do we Clean Lanes?



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

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

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

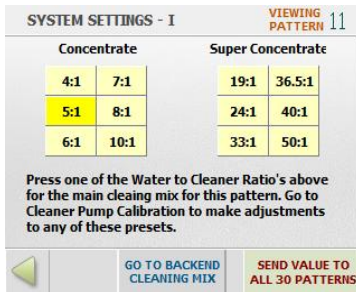
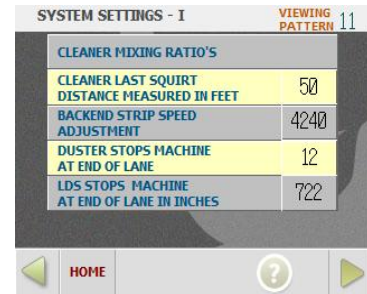
## System Settings Cleaning Menus

The following are the Change Pattern/System Settings that relate to the cleaning of the lane. All System Settings adjustments are individual to the pattern selected and the below information will vary based on whether the lane machine has the Cleaner Tank upgrade or not.

### With Cleaner Mixing System upgrade (dual tank)

The Flex with the Cleaner Mixing System upgrade allows the operator to mix the cleaner at the desired ratio as the machine operates. Press on the menu for Mixing Ratio's to advance to the screen to choose a preset.

**NOTE: IF YOU ARE USING A SUPER CONCENTRATE CLEANER, AND THE MACHINE HAS SAT IDLE FOR MORE THAN A WEEKS TIME, IT IS A MUST TO INSPECT THE TUBING LOCATED IN THE CLEANER PUMP. THERE IS A CHANCE THAT CLEANER HAS TURNED TO A GEL AND CAN CAUSE POTENTIAL BLOCKING. REFER TO CHAPTER 1 FOR LONG TERM STORAGE**



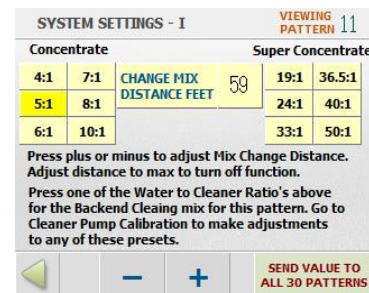
the

From this screen you will be able to set your ratio for cleaning. You can choose between normal concentrate cleaners such as Defense C, or a super concentrate cleaner such as Defense CX4 and Defense CX4-S.

Simply press the ratio on the screen shown the left and lane machine will mix for you. Once the correct ratio has been chosen, you can press Send to ALL 30 Patterns.

**NOTE:** Once the ratio has been set, you must go to the TEST OIL CLEANER PUMP VOLUME screen and perform a test!

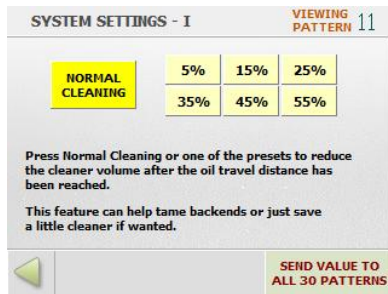
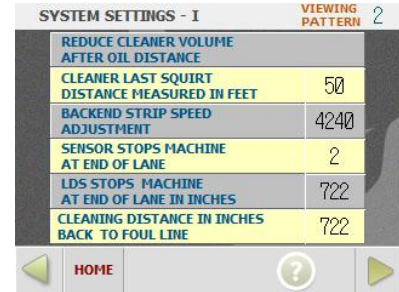
Press on GO TO BACKEND CLEANING MIX to change cleaning ratio on the backend of the lane. In this screen you can choose where and at what ratio you want to change to. When the machine has almost reached its last Squirt Distance the cleaning Ratio will return to the normal ratio and dispense the last of the mix change and be set up for the next lane to dispense the proper mix for the front end of the lane.



To turn the backend Cleaning ratio off, simply increase the Change Mix Distance to the max value of 59 feet and this function will be turned off. Choosing the same ratio for backend cleaning as front end cleaning will also act as if this feature is turned off.

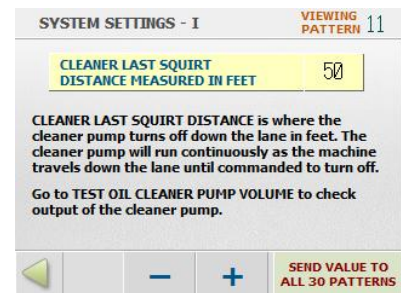
**With Standard Cleaner Tank system (single tank)**

Within the Flex System Settings screens the operator has the ability to reduce the cleaner volume output on the backend of the lane. Press, “REDUCE CLEANER VOLUME AFTER OIL”.

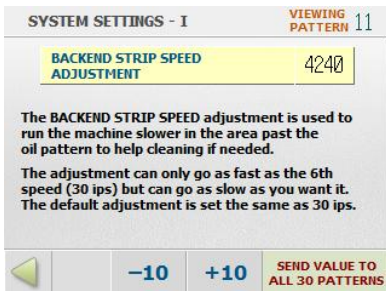


When Normal cleaning is selected the machine will dispense the same volume of cleaner throughout the run. Select one of the reduced percentages to change the backend cleaning volume and the machine will change the speed of the pump motor just before the forward oil distance has been reached. The machine will reduce the volume output for the rest of the cleaner travel distance.

The CLEANER LAST SQUIRT refers to the distance in feet down the lane at which no more streams of cleaner will be applied. It is possible for the machine to look like it is applying cleaner farther down the lane, but this may be the moving head continuing to travel in order to park in the proper position.



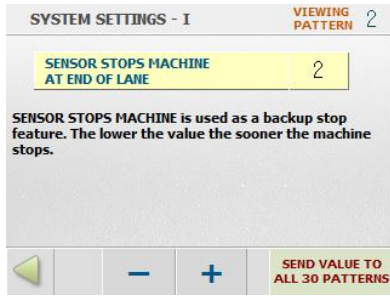
To change the values, use the increase and decrease to adjust. Once the value has been changed, the program accepts the data automatically.



The BACKEND STRIP SPEED adjustment is used to run the machine slower in the area past the oil pattern to help cleaning, if needed.

The adjustment can only go as fast as the 6<sup>th</sup> speed (30 IPS) but can go as slow as you want it. The default adjustment is set the same as the 30 IPS speed setting.

This adjustment should be monitored and checked.

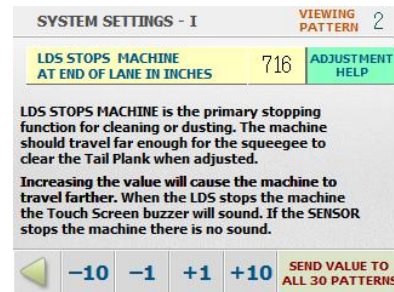


The Sensor on the WALKER or FLEX located on the Squeegee assembly is used to stop the machine any time needed. It works when the Sensor goes passed end of the Pindeck.

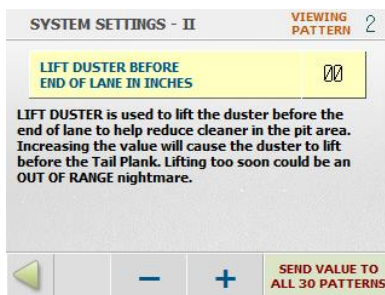
When the machine is stopped by the Sensor there is no buzzer sound from the touchscreen. The adjustment is in increments of 0.30 of an inch (7.62 mm) for fine adjustments (available on the Walker only).

LDS STOPS MACHINE is the primary stopping function for cleaning or dusting. The machine should travel far enough for the squeegee to clear the tail plank when adjusted. Increasing the value will cause the machine to travel farther.

When the LDS stops the machine the touchscreen buzzer will sound. If the Sensor stops the machine there is no sound. Use the increase and decrease value buttons to make adjustments. Any change to the value sets the data automatically.



If this value is set too high it will show up in the Monitor Screen, the value left over in LDS Stops Machine would be a good amount to adjust this function by.

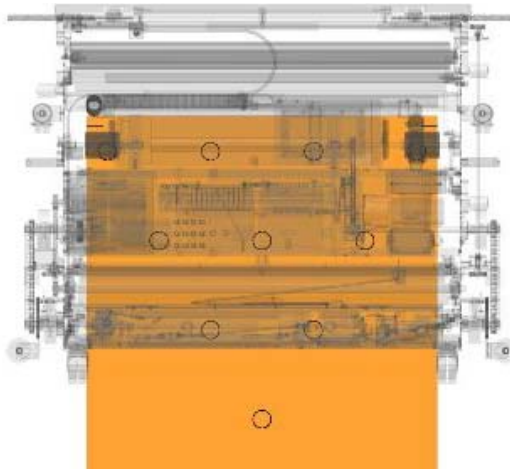


The number displayed in the screen to the left will refer to the distance from the tail plank the duster will begin to lift off of the lane. This feature prevents the cushion roller from dropping off the tail plank when reaching the end of the lane.

To change this distance, use the + or - buttons to adjust. Once the value has been changed, the program accepts the

data automatically.





Machine overview showing maximum distance for Forward Travel.

The drive wheels cover 7-pin & 10-pin spots when squeegee is off the pin deck

### Fine-Tuning for Stopping the Machine at the End of Lane

It really does not matter which function stops the lane machine, just as long as it stops and the squeegee completely clears the tail plank. Run machine, if a Flex, press on the TOGGLE MONITOR SCREEN to see what function stops the machine and the left over values. This screen comes up automatically at foul line on Walkers.

If the Stop by LDS has zero in the counter, Stop by Sensor will be 1 or 2 depending on the set value. If a line of cleaner remains on the tailplank, then the machine is not traveling far enough, and adjustment will need to be made. Check where the cleaner is left and increase STOP by Sensor by 1 count only. A value of more than 3 maybe two much depending on machine speed when entering the Pindeck.

If Stop by LDS has several counts left, then it is set too high and an adjustment is needed. A good starting point for this adjustment would be to reduce the number by how much was left over in STOP by LDS counter.

Run the machine and watch the average of the two Stop features. It will be common to have either function stop the machine. Check the Pindeck to make sure the squeegee completely cleared it.

Using the two functions together will ensure that the lane machine has a back-up system for stopping in the pit.

On the Walker or Flex, if the LDS wheels start counting late, then the Stop by Sensor will stop and reverse the Walker before it travels too far forward.



#### TECHNICAL NOTE

When the Lift Duster is used to raise the cushion roller before reaching the end of the lane, the Stop By LDS is the only function that will stop the machine.

## Pindeck Treatment Settings

THE OPERATOR MUST FULLY UNDERSTAND THE CARE NEEDED TO USE THIS FUNCTION!!  
THE MAINTENANCE AND UPKEEP OF THIS PART OF THE MACHINE SHOULD ONLY BE  
PERFORMED BY THE MOST TRUSTED PLAYER ON THE TEAM!!!

The Pindeck Treatment feature is a new item as of the 2016 FLEX and FLEX Walker model lane machines and is used to help eliminate sliding pins causing out-of-ranges and other issues. The application of Pindeck Treatment should be done twice a week and can be automatically set to come on within the 7 day program planner.

HOW IT WORKS.....

When the treatment has been enabled, and after the machine has started, the moving head will move to the far right and park which will position the treatment tip over the drip tray. The machine will enter the Pindeck and travel to the end of the lane as it normally does, then back up to the set distance for coverage, the duster cloth will unwind and then the moving head will start to move and apply the treatment. The machine will then move forward far enough so that the cushion roller does not drop off of the Pindeck, but rather stopping on the tail plank. The cloth will wind up and the machine will resume reverse operation. After the machine has delivered its last load of oil the moving head will park so the treatment tip is over the drip tray and it will continue to operate that way until the machine has done its last lane.

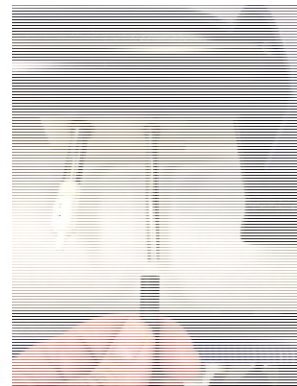
### Application Tip Cover

We cannot stress the importance of paying very close attention to having the tip cover in place when not in use

The Spot On Pindeck treatment will start its curing process when contact with air is made. That being said, if the tip cover is left off then the Spot On will start to dry inside the lines and will clog them. Thus, you will be spending a minute of your time cleaning the tip. If this should happen, try using a 1/16 size drill bit to loosen any dried treatment from the lines.

After clearing the line, do a test to ensure the line is free of obstruction and no air bubbles are present.

IF BUBBLES ARE PRESENT TOWARDS THE FITTING ON THE 'SPOT ON CAN', THIS IS AN INDICATION OF A PROBLEM THAT NEEDS CORRECTING PRIOR TO OPERATION. It's possible that the problem is in a defective can of Spot On, or the actuator itself needs to be removed and cleaned, or replaced. Do NOT operate the lane machine, or turn off this feature, prior to operation.



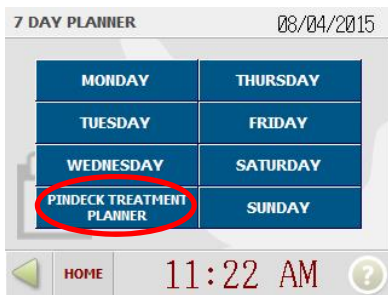


When the Pindeck Treatment mode is 'on', you will have screens pop up that will remind you to be certain that you are ready to go. This would include removal of the Tip Cover and the tip assembly firmly in place in the head block.

**DO NOT LOSE THE TIP COVER ASSEMBLY!!!**

## Programming the Pindeck Feature

The Pindeck Treatment has two ways it can be used, one is to choose when you want to apply it when starting the machine the other is to have it enabled by the 7 Day Planner. If using this feature on start, you can turn this 'on' or 'off' from the confirmation start screen, shown to the right, by simply pressing the top bar.



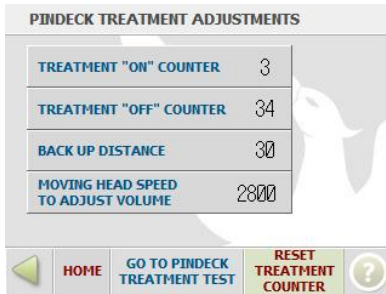
To have the Pindeck Treatment automatically come on when conditioning, press the 7 Day Auto Planner from the Main Menu, then press the Pindeck Treatment Planner in the lower left corner.

Next, select the day of the week and the time that you would like for the treatment to be applied. Remember, twice a week should do a sufficient job. (This can still be turned off at the time of conditioning).



## Adjustments

The tip height to the bowling lane should be equal to the tip height of the cleaner tip assembly, which is flush with the frame. Adjusting the tip up or down from the default height (flush with the frame) will change the start and stop points of the treatment stream. Turning the tip a little to the left, or right, will adjust the stream location.



The Treatment 'ON' Counter and the Treatment 'OFF' Counter help align the application of treatment on the lane.

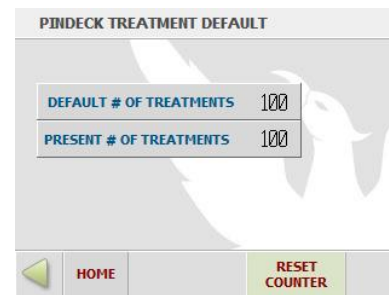
The Backup Distance is used to control the lengthwise distance.

The Moving Head Speed is used to adjust the volume of treatment dispensed onto the lane. The slower the head travels, the more treatment will be allowed to be applied while the faster the head travels will result in less treatment.

## Pindeck Treatment Can Replacement

When it comes time to replace the Pindeck Treatment can, spillage can occur causing a sticky, nasty mess to clean up.

**With this in mind, do NOT do this on the approach!** Do this with the machine laying down on the shop floor.



1. With the hose assembly still attached to the nozzle, pull holding lever back and lift the bottle up and out of the compartment.
2. Before removing cap and hose assembly, help free up the cap from the bottle by twisting the cap back and forth on the bottle as shown. (shown without hose attached)
3. Remove the cap and hose, as one by pushing up on the assembly as shown to the right. Even though you have a new actuator cap with the new bottle, your old cap should work just fine.



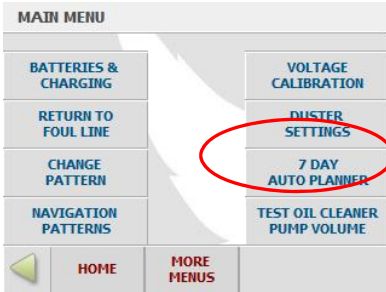
4. Place the cap and hose assembly on top of the new bottle and push firmly on the outside portion of the cap to attach it to the stem. Even though the protective cap is in place, be careful to not press the center button during this process, you will have a sticky mess to clean up! If replacing the entire cap, remove the protective cap after installing the actuator cap and press down to break the plastic on the actuator button.



5. After installing, too ensure proper flow, go to the output menus and with the tip assembly in disposable cup, continuously press the Pindeck treatment output key until the air is out of the lines and a steady flow is present.

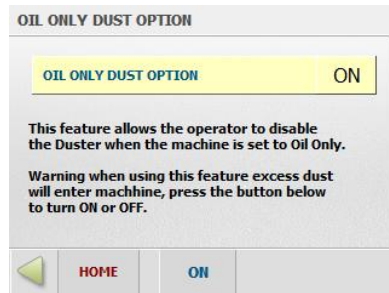
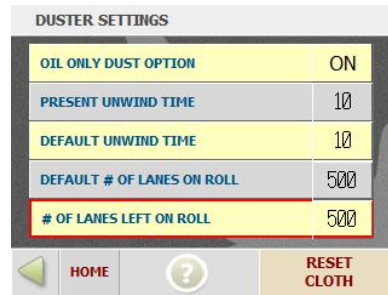
After replacing the can, be sure to reset the number of lanes left in the can by pressing COUNTER RESET from the Pindeck Treatment screen in Main Menus.

# Duster Settings



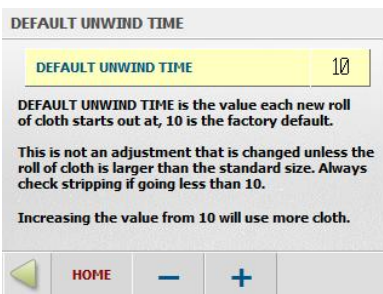
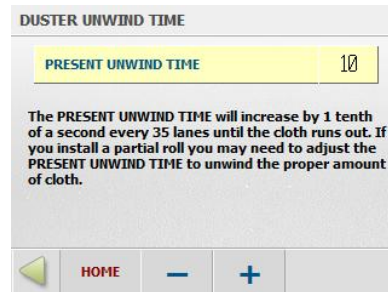
Go to the Main Menu and press on DUSTER SETTINGS and the screen will change.

Press on a function and the screen will go to an adjustment screen. If resetting the duster cloth counter, press RESET CLOTH.



The lane machine will always be set to have the duster operate during all conditioning modes. However, you may disable the duster operation during the oil only process by simply turning this function to OFF.

The PRESENT UNWIND TIME will increase by 1/10 (one-tenth) of a second every 35 lanes until the cloth runs out. If you install a partial roll you may need to adjust the PRESENT UNWIND TIME to unwind the proper amount of cloth. Use the buttons at the bottom to change the unwind time value.



DEFAULT UNWIND TIME is the value each new roll of cloth starts out at; 10 is the factory default. This is not an adjustment that is changed unless the roll of cloth is larger than the standard size. Always check your cleaning when changing this to less than 10. Increasing the value from 10 will use more cloth.

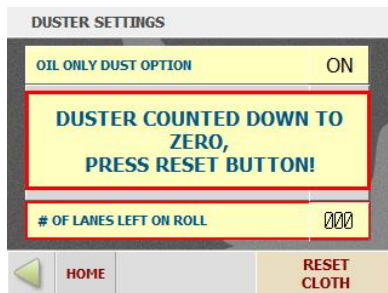
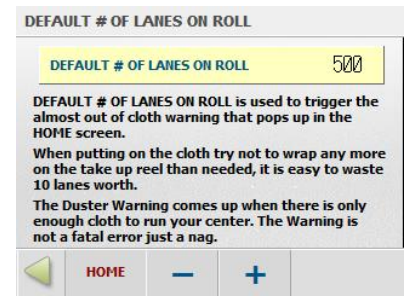
DEFAULT # OF LANES ON ROLL is used to trigger the “Almost Out of Cloth Warning” that pops up in the HOME screen.

When replacing a roll of cloth try not to wrap any more on the take-up reel than needed, it is easy to waste 10 lanes worth of cloth by making extra wraps.

The Duster Warning (to the right) comes up when there is only enough cloth left to run your center. The Warning is not a fatal error just a reminder to check the roll.

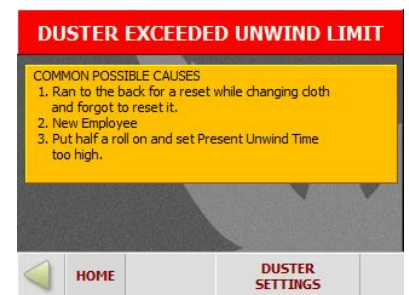
While in the duster screen press CHANGING CLOTH? PRESS HERE and the button will change and the cloth counter will be reset.

If you press this button and reset the counter when it is not time yet, simply adjust the Present Unwind Time to unwind the proper amount of cloth.



When the duster cloth is allowed to count down to ‘zero’ and is not reset, the GO TO STARTING LANE button will change to DUSTER NEEDS RESET (screen on left) the next time that the machine is turned on to be started. This will force the operator to the DUSTER SETTING menu where the cloth can be reset so that none is wasted.

The duster error is generated when the present unwind time reaches 25, which it should never reach. The only way to see this error is to forget to reset the cloth after changing out the roll or if you put half a roll of cloth back in the machine and guess too high for the present unwind time.



If the DUSTER UNWIND LIMIT screen is ignored, and the unwind time has reached 0 (zero), the home screen will change to DUSTER NEEDS RESET in place of START MACHINE. When this happens, you will need to press this button and will be directed DUSTER SETTINGS screen and reset the number of lanes in the cloth.

The unwind time varies from **10** for a fresh roll to **22** for an almost empty roll. If accidentally reset, use an educated guess on how much of the roll is already used and set your time accordingly. **EXAMPLE:** If the roll is about half used, set the time to **16**.



#### TECHNICAL NOTE

Resetting the DUSTER counter prior to the roll of cloth being empty could reduce the cleaning efficiency of the machine.

## Special 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 14 inches in reverse and then stops again. It lowers the squeegee, travels forward 14 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.



The values for the wipe distances can be changed to fine tune where the squeegee contacts the lane.

This function can be turned off if necessary in MACHINE SETUP.

### 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 peristaltic 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.

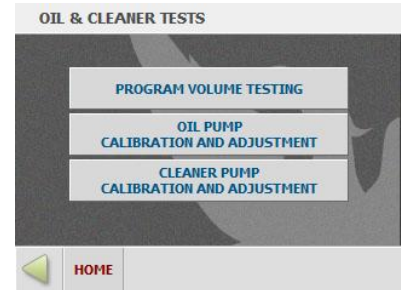


## Mechanical Adjustments

### Cleaner Pump Volume Adjustment with standard Cleaning System

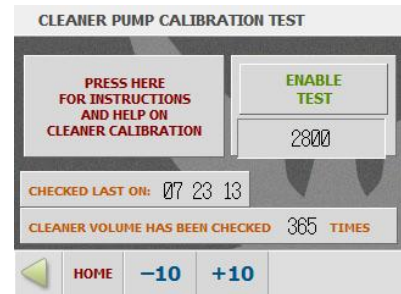
The cleaner pump volume will be checked in the same menu as the oil volume. Go to the Main Menu and press TEST OIL CLEANER PUMP VOLUME, then press:

#### CLEANER PUMP CALIBRATION AND ADJUSTMENT



In this screen follow these steps:

1. Press, "ENABLE TEST".
2. Open up the cleaner compartment.
3. Remove the cleaner tip and place inside calibration tube.
4. Hold cleaner tip over cloth then press button for one cycle to clear out air bubbles.
5. Press the button on the inside of the 10-pin side plate.
6. The machine will now dispense 4 passes of the head into a graduated cylinder.



The factory setting is 30  $\mu\text{l}$ . Anywhere from 25 to 30  $\mu\text{l}$  should adequately clean the lane. 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. To increase the speed, use the **-10** and **+10** buttons. The value shown under Enable Test button is the present value set in the machine.

Cleaner Speed control board settings:

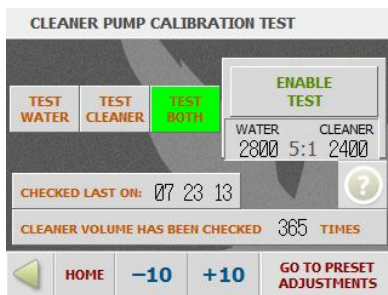
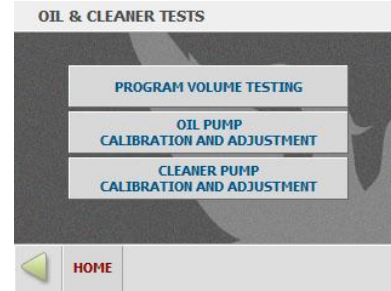


#### TECHNICAL NOTE

When making changes to the cleaner volume output, always perform this test more than once and note the volume with each adjustment.

## Cleaner Pump Volume Adjustment with Cleaner Mixing System Upgrade

The cleaner pump volume can also be checked in the same menu as the oil. Go to the Main Menu and press TEST OIL CLEANER PUMP VOLUME, then press CLEANER PUMP CALIBRATION AND ADJUSTMENT



In the Cleaner Pump Calibration screen, you can test the water volume output, the concentrate volume output or both outputs simultaneously. The Ratio that is set to run the machine will be the ratio used to test and is displayed between the cleaner and concentrate adjustment values. When making changes to either pump from this screen, it will affect ALL preset pump ratios equally.

By pressing TEST WATER, followed by the ENABLE TEST button, you will be able to check the volume of water that is being dispensed. After pressing the ENABLE TEST button, the screen will change to TEST ENABLED and the button located in the cleaning compartment will become activated.

Take the large 50ml calibrating tube and insert the cleaner tip assembly into it and press the red button inside on the 10 pin wall. This will make the cleaner head travel back and forth four times dispensing a set amount of water into the cylinder.

By pressing TEST CLEANER, followed by the ENABLE TEST button, you will be able to check the volume of cleaner that is being dispensed. After pressing the ENABLE TEST button, the screen will change to TEST ENABLED and the button located in the cleaning compartment will become activated.

Below is a chart to determine the amount of Water and the amount of Cleaner that should be dispensed during testing.

RATIO CHART		
RATIO	CONCENTRATE	
	WATER (mL)	CLEANER (mL)
4:1	24	12
5:1	25	10
6:1	25.71	8.56
7:1	26.25	7.5
8:1	26.67	6.66
10:1	27.27	5.46
SUPER CONCENTRATE		
19:1	28.6	11.28
24:1	28.88	9.04
33:1	29.16	6.72
36:1	29.25	6
40:1	29.3	5.6
50:1	29.44	4.48
HOME		MORE RATIO INFO

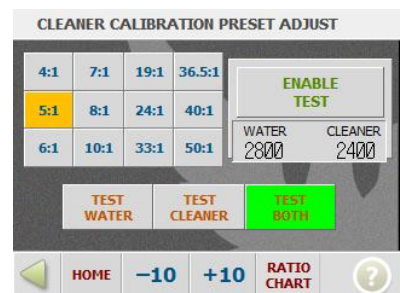
#### REGULAR CONCENTRATE: (example Defense C)

If you were to test the water output at 5:1, you would see by the chart that a total volume of 25.00mL would be dispensed. The cleaner, which puts out 2 times the amount during the test, would be at 10mL or 5.00 x 2.

#### SUPER CONCENTRATE: (example CX4 or CX4S)

If you were to test the water output at 40:1, you would see by the chart that a total volume of 29.3mL would be dispensed. The cleaner, which puts out 8 times the amount during the test, would be at 5.60 or .70 x 8.

To set a different ratio other than what is being used in your daily use, go to the PRESET ADJUSTMENT screen explained on the following pages in this manual. By pressing GO TO PRESET ADJUSTMENTS you will advance to the screen that is used to set all the presets at the factory. It is best to test the presets that are normally used for proper ratio.



By pressing on Ratio Chart you will go to a screen that list the presets and the result you should see in a test.

**IMPORTANT:** When making changes to the volume from this screen it will change ALL preset ratios equally.

When testing Regular Concentrate, the pump will run a set number of board counts from the board counting sensor **2 times the normal run compared to the water test because of the low volume used.**

When testing Super Concentrate it will be **8 times the normal run compared to the water test** because of the low volume used. Press More Ratio Info to see comparisons with normal concentrate and super concentrate when it comes to how many caps of super concentrate to 2.5 gallons of water.

**IMPORTANT:** If your lane machine is equipped with separate water and cleaner supply tanks and are storing the lane machine for a lengthy period time, you must drain the cleaner supply tank and run water through the system. This is done to prevent any cleaner that is left in the lines to leave residue.

Speed control Board settings for upgraded system:

Cleaner:

Water:



### Cleaner Head Timing Belt

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

Before loosening the idler, place a reference mark on the belt and drive pulley. Loosen the idler and shift the belt one cog on the drive pulley in the proper direction. **Do not adjust from the idler end.** Once the belt is moved adjust the belt tension and tighten the idler.

Verify that both heads are in the center of the machine after an adjustment is made.

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

### Momentary Wheel Adjustment

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

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

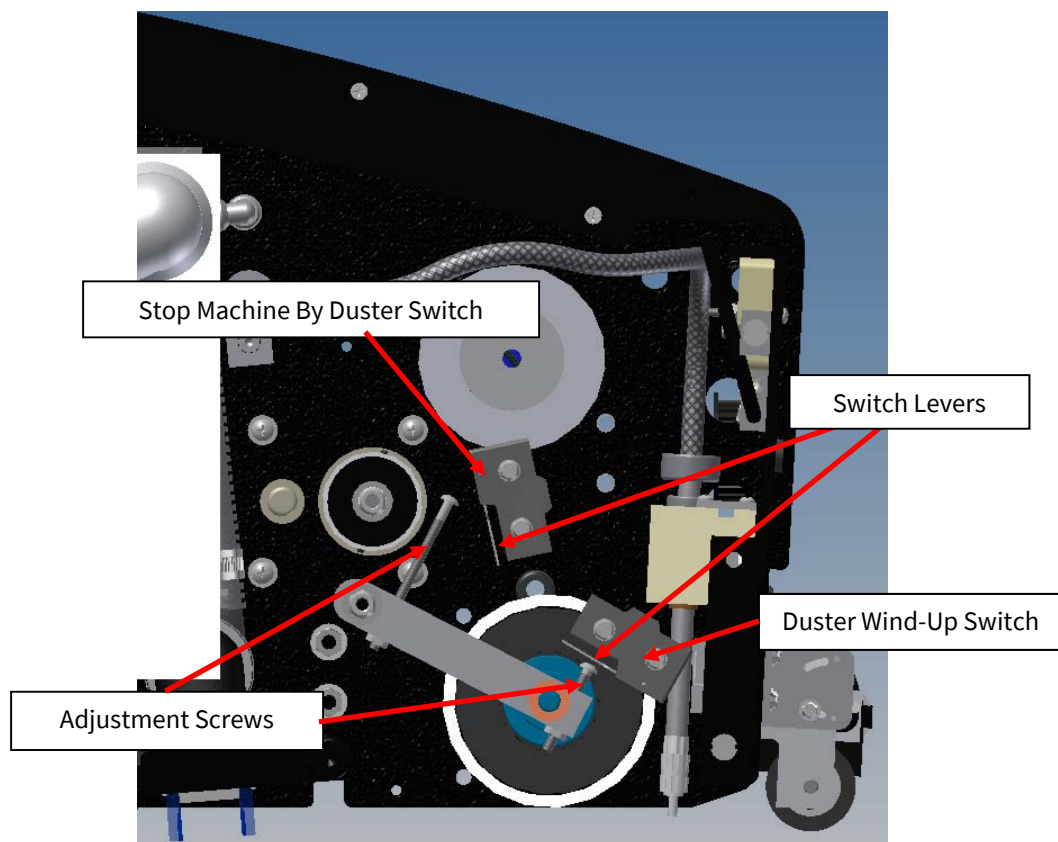


#### TECHNICAL NOTE

After the machine has been pushed onto the lane and an area close to the foul line has been 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

This illustration points out the adjustments for the duster switches.



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. Check the **Wind-Up Switches** first by lifting the cushion roller up and holding it against the stop bolts. The switches on both sides should clearly actuate before the cushion lever screws hit the stops and there should be a small amount of over-travel of the switch levers.
3. Be certain that the switches on both sides are adjusted with the same amount of over-travel. If there is no over-travel, loosen adjusting screw with an 11/32" wrench and back the screw out until there is some over-travel of the switch lever. Tighten the nut(s) and make sure the cushion roller moves up and down freely.
4. Check the **Stop Machine By Duster Switches**. The switches above the duster arm pivots will stop the machine when the cushion roller falls off the tail plank.

## Squeegee Blades

When the lane machine has been operated in any combination that requires cleaning, this maintenance pop up will appear after 100 miles have been reached.

Replace the squeegee blades and follow the below information for the proper adjustment.



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 **INPUT/OUTPUT TEST**.

When you reach the **INPUT/OUTPUT TEST** section, press SQUEEGEE LIFT to access the screen shown to the left.

Press the **SQUEEGEE LIFT TEST BUTTON** 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 rest it on the squeegee blade across the main drive wheels to the rear drive wheels. The gap between the straight edge and the drive wheels should be about **3/16"** to **1/4"** (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.

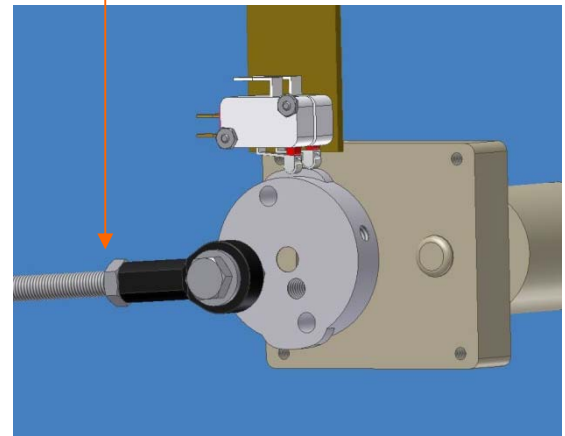
Gap should be  
3/16" to 1/4"



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 on the following page).
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.

Pitch Adjustment



#### TECHNICAL NOTE

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

## Maintenance

### Cushion Roller Assembly

When the lane machine has been operated in any combination that requires dusting of the lane, this maintenance pop up will appear after 200 miles have been reached.



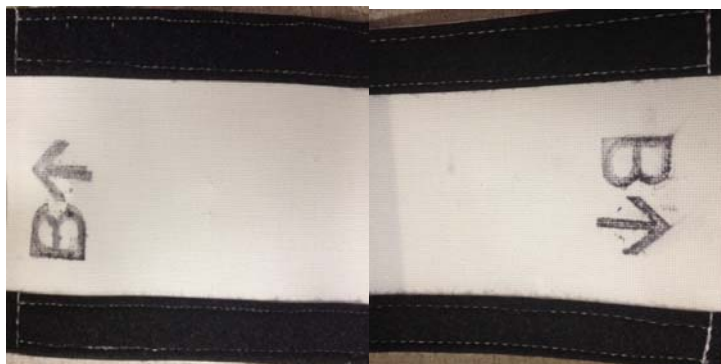
It may be possible to replace the cushion roller wrap only. The cushion roller wrap comes stamped with a letter on the underside to determine the size of the wrap. Over a period of time, the diameter of the cushion roller assembly will be reduced because of the winding up of the cloth.

When ordering the cushion roller wrap, measure the diameter of the cushion roller assembly. Follow the measurement guide below.

Size A - 11 ½”	154-8889A
Size B - 11”	154-8889B
Size C - 10 ½”	154-8889C
Size D - 10”	154-8889D
Size E - 9 ½”	154-8889E

When installing the cushion roller wrap into the machine, make certain that the arrows on the underside of the wrap are both facing outward towards the side panels.

Ten pin side



Seven pin side



If the Cushion Roller shows excessive wear, it will be necessary to replace the entire assembly.

## Changing Duster Cloth

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

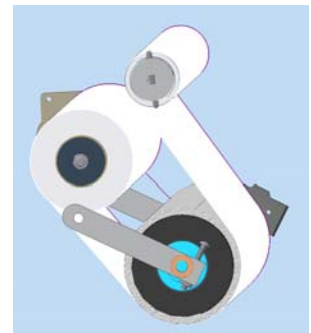
The wind-up motor also lifts the cushion roller off the lane at the end of the run. This dual action simulates that of a ratcheting duster, helping to eliminate dirt lines during a conditioning run. This system also controls cloth usage better and has no clutch mechanism to adjust.

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

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

1. Remove the cleaner & Pindeck treatment 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 that the cloth is out of the way, take this opportunity to clean and maintain this compartment. The cleaner belt should be inspected and the sliding head bar lubricated at this time.
3. Remove the pipe from the old duster core and insert into the new one. Unroll about 3 feet of cloth and then install the new roll into its location.
4. Route the cloth down between the squeegee and the cushion roller. Pull the cloth under the cushion roller and distribute it evenly.
5. Once the cloth is routed under the cushion, pull the excess cloth far enough through to get at least 3 or 4 wraps around the PVC take-up reel or EZ Core. Make sure the cloth is wrapped evenly from side to side around the pipe.
6. Insert the take-up reel into its location and **replace BOTH dispensing tips**.
7. Locate the motor button in the cleaner compartment; this button is always enabled to operate the duster (unless the cleaner volume is being checked). Press the button once and the duster will unwind, press again and the duster will wind-up the cloth. The cloth should be rolled up tight and evenly across the assembly.

**VERY IMPORTANT!** After installing the new roll, you must reset the number of lanes on the cloth. You can do this by pressing and holding the function button until you hear 3 beeps followed by a steady beep, then release. Or, going to your duster settings in the menus and press RESET CLOTH.



## Filling the Cleaner Supply Tank

With separate water and cleaner tanks:

1. To fill the Cleaner Supply Tank, the machine should be in the down or operating position on the lane.
2. Add water to the supply tank located on the left or the 7 pin side. Add water until you reach ½" (1.3cm) below the top of the tank.
3. Add straight cleaner to the right tank assembly or the 10 pin side tank.
4. Clean up any spills that may have occurred during the filling.

**IMPORTANT:** If your lane machine is equipped with separate water and cleaner supply tanks and are storing the lane machine for a lengthy period time, you must drain the cleaner supply tank and run water through the system. This is done to prevent any cleaner that is left in the lines to leave residue.

With single cleaner supply tank assembly:

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 towel beneath the tank. Open the tank cap and place a towel 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.

## 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 the vacuum motor by removing the PVC elbows. It is best to have a towel in each hand to hold over the fittings to help prevent drips.
2. Remove the tank from the 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 the tank dirty cleaner may be discharged from the vacuum exhaust and onto the lane until the line is cleared.

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

#### To Replace the Filter:

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



#### TECHNICAL

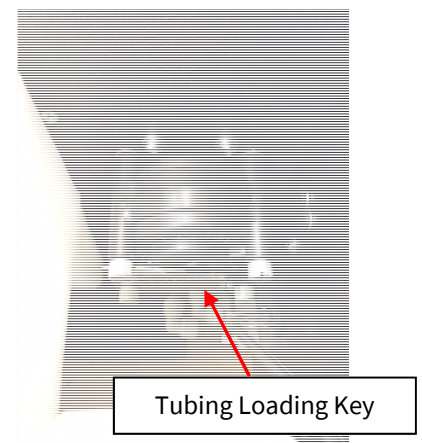
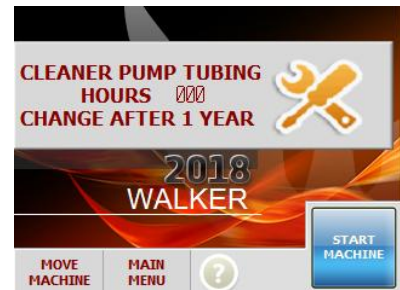
We suggest swapping recovery tank filters after each cleaning. Order a spare recovery tank filter.

#### Pump Tubing Replacement

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

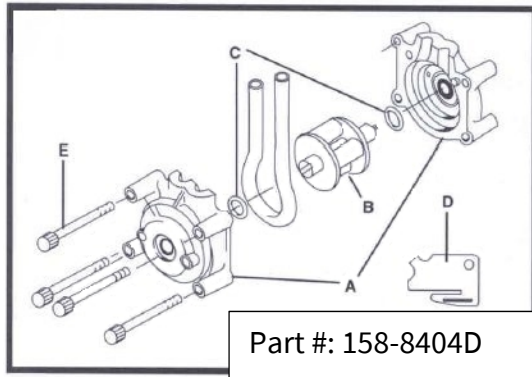
##### STEPS:

1. Release both tube fittings from the quick disconnects (depress collet and pull tube from quick disconnect fitting).
2. Remove the four screws that attach the pump to the mounting 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 the diagram). Hold the end bell containing the rotor (as shown on opposite page) 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 the smaller prong of the 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.



Part #: 158-8404D

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

For parts identification only!  
Parts not sold individually

7. Position the other end bell on top and press the end bells together. Be careful not to pinch the tubing. If the 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 the stem elbows in the new tubing if necessary. Make sure the elbows are facing the correct direction.
10. Re-attach the cleaner pump to the mount plate.  
**DO NOT OVER TIGHTEN THE MOUNTING SCREWS. DAMAGE TO THE PUMP MAY OCCUR.**
11. Press the stems back into the quick disconnect fittings.

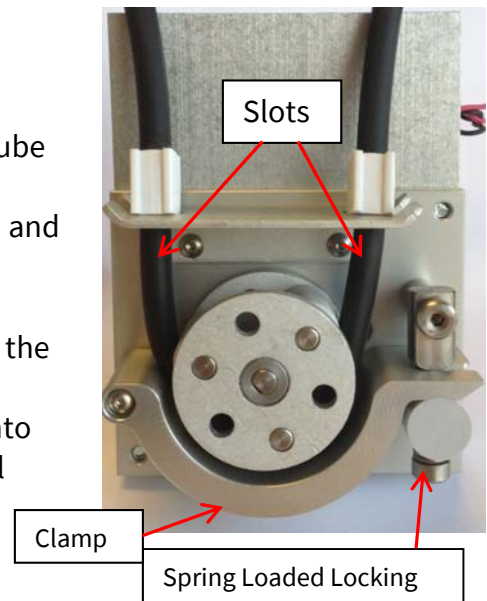
## Secondary Pump Tubing Replacement (Upgraded machine only)

For the FLEX machines that are equipped with the Cleaner Mixing System upgrade, it will be necessary to replace the tubing inside the cleaner pump motor periodically.

Because of the availability of two types of cleaner, standard concentrated cleaner and super concentrated, different tubing will be used for each. If standard concentrated cleaner is used, such as Defense C, the 16 gauge tube will be needed. If a Super Concentrate cleaner is used, such as CX4 or CX4S then the 14 gauge tubing will be used.

### STEPS:

1. With the machine in the operating position, remove the 7 pin side cover.
2. Release both tube fittings from the quick disconnects (depress the collet and pull the tube from the quick disconnect fitting).
3. Next, push the spring loaded Locking Lever in and away from the Clamp.
4. Pull the Clamp away from the tubing.
5. Pull the tubing out of the slots and dispose of the old pump tubing.
6. Take the new pump tube and slide one end into the slot and stretch around the bearing wheel assembly and insert the other end into the opposite slot.
7. Close the Clamp back into place and secure with the spring loaded Locking Lever.
8. Insert the ends, back into the quick disconnects that were removed in step 2.
9. Recalibrate the secondary cleaner pump.



### TECHNICAL NOTE

If there is little or no cleaner coming out of the concentrate pump, it may be possible that the tubing is being restricted by the indentations that the roller in the pump leaves in the tubing. This typically happens if the machine has been sitting for a lengthy period of time. Simply remove the tube from the pump and pinch the tubing in those indentations to free up.

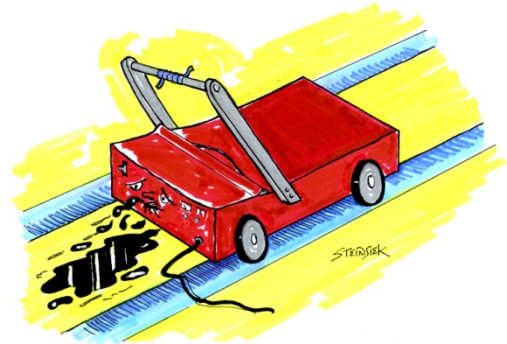
## General Maintenance

1. The Squeegee should be wiped down after each use.
2. Place a drop of oil on the adjusting link end fittings and the squeegee pivots once every 6 months.
3. Flip squeegee blades every 6 months and replace blades once a year.
4. Change filter in recovery tank once a month or when needed.

5. Check vacuum housing once a week and clean if any debris is present.
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 are usually easily corrected and happen for a definite reason. Usually a stuck or out-of-adjustment switch or possible loose or damaged wires will cause most problems.

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



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

### Problem:

Duster Motor UNWIND motor does not run.

### Possible Cause:

- Duster cloth is empty. Replace cloth.
- 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.
- Duster Unwind Motor has failed.
- Blown fuse.
- Duster Unwind relay failed or is loose in socket base.
- Duster motor wire is damaged or there is a loose wire between the motor and CR4 relay.
- Cleaner dumped onto switch causing it to short, but only a dim light is showing on **Input 0CH 10**.



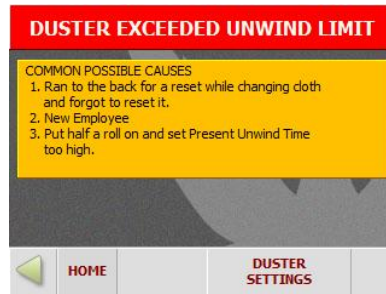
This error screen normally happens when the duster fails to wind-up the cloth and actuate the duster up switch, failing to turn on **Input 0CH 10** on the PLC.

### Problem:

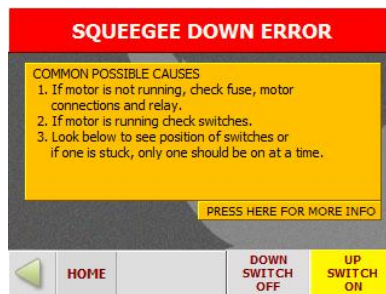
Duster Motor WIND UP motor does not run.

### Possible Cause:

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



This error is generated when the present unwind time reaches 25, which it should never reach. The only way to see this error is to forget to reset the cloth after changing it or putting half a roll in the machine and guessing too high for the present unwind time.



Normally, this error screen occurs when **Input 1CH 00** fails to receive a signal within 3.5 seconds of the motor starting. If the Motor does not run, menu to the **INPUT/OUTPUT TEST** and press **SQUEEGEE LIFT** to check relay operation and voltages.

**Problem:**

The Squeegee **motor runs** but the down switch failed to operate and a send signal to PLC **Input 1CH 00**.

**Possible Cause:**

- Check and inspect microswitch. Manually operate switch to see if **Input 1CH 00** will illuminate.
- Possible broken wire or loose connection. It will be either the **Yellow** (24 VDC) or the **Black Wire** that connects to **Input 1CH 00**.
- This error can also happen if the squeegee up **Input 1CH 01** is stuck on.

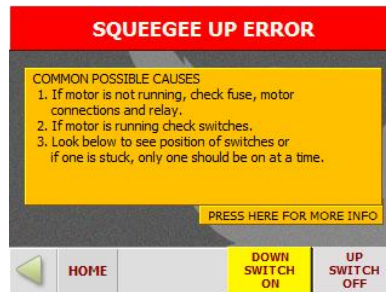


**Problem:**

Squeegee motor does not run when tested in the **Output Test**. You will need to determine if power is getting to the motor.

**Possible Cause:**

- Fuse is blown.
- Squeegee linkage is in a bind.
- Relay came loose in socket base or has failed.
- Motor has failed.
- Bad connection to the motor. Check all power wiring to motor.
- PLC Output 10CH 07 failed.



Normally this error occurs when **Input 1CH 01** fails to receive a signal within 3.5 seconds of the motor starting. The following list will cover a few things that can cause a **SQUEEGEE UP ERROR**.

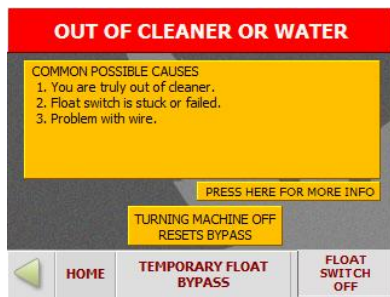
If the Motor does not run, menu to the **INPUT/OUTPUT TEST** and press **SQUEEGEE LIFT** to check for relay operation and voltages.

**Problem:**

The Squeegee motor runs but the up switch failed to operate and send signal to PLC **Input 1CH 01**.

**Possible Cause:**

- Check and inspect microswitch, manually operate switch to see if **Input 1CH 01** will illuminate.
- Possible broken wire or loose connection with either the **Yellow** (24 VDC) or the **Yellow / Green Wire** that connects to **Input 1CH 01**.
- This error can also happen if the squeegee down **Input 1CH 00** is stuck on.



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

If this does not clear the error the float may have a problem. In a pinch you may temporarily bypass the float allowing you to finish cleaning.

By simply pressing the **TEMPORARY FLOAT BYPASS** button, it will override the **OUT OF CLEANER** error message. When the machine powers down, it will reset back to normal operation.

With the Recovery Tank empty, install the tank into the Lane Machine and restart. If this does not clear the error the switch may be defective. Use the temporary bypass to operate the machine in pinch.



By simply pressing the **TEMPORARY TANK BYPASS** button, it will override the switch allowing the operator to condition the lanes. When the machine loses power, these features will have to be reset.

### 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. Either of the Cleaner pumps fails to run.
  - a. Blown fuse.
  - b. Bad connection at the PLC analog card/board connection.
  - c. Loose connection at speed control.
  - d. Speed control has failed.
2. Cleaner pump volume is low or no output.
  - a. Tubing is starting to wear – probably more than a year old. (See Cleaner Pump Adjustment in this section.)
  - b. Filter is clogged.
  - c. Someone has tampered with the adjustment.
  - d. The Concentrate cleaner pump tubing has closed up internally (upgraded machines only). Remove the tubing and roll in your hand to loosen any potential blockage.

3. Machine leaves water on the lane after a test clean in various spots but cleans everywhere else.
  - a. Squeegee not low enough to the lane (#1 cause).
  - b. The lane has bad depressions, possibly more than 1/100<sup>th</sup> of an inch (mostly around screw holes).
  - c. Squeegee has a damaged area.
  - d. Squeegee is worn out and should have been replaced a long time ago.
  - e. Recovery tank is not in machine.
4. Machine leaves oil streaks in various spots, but cleans everywhere else.
  - a. Duster is not touching the lane and may not be unwinding enough cloth.
  - b. Lane has bad depressions.
5. Machine leaves streaks that look like squeegee marks.
  - a. Cleaner dilution is weak.
  - b. Someone made a mistake and diluted the diluted cleaner instead of the concentrate, making one very weak solution.
  - c. Duster is not touching the lane and may not be unwinding enough cloth.
  - d. You must not be using Defense-C!
  - e. Lane has not been cleaned in months, just oiled.
6. Machine strips only 'where' cleaner is applied on the lane.
  - a. The duster is definitely not touching the lane.
7. Machine drips dirty cleaner and oil off of 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 the gutters and excessive amounts into the pinsetter.
  - a. The 'Not Me' employee forgot to put the 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 is leaking cleaner.
  - a. Tubing in pump failed or has come loose and needs to be replaced.
  - b. Tubing connector failed or came loose.
  - c. Tank is leaking around fittings.
  - d. Operator over-filled machine and made a mess.

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

# CHAPTER 4

## Battery Power and Charging Systems

### Chargers

#### Proper Location and Mounting of Charger

It is recommended that the Charger be mounted in a secure, cool dry place and plugged into a dedicated circuit. Before using any outlet, be sure to double-check the connections inside the outlet.

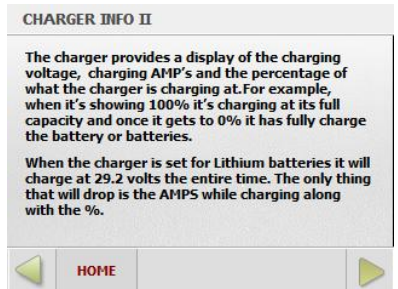
The charger provides a display of the charging voltage, charging AMP's and the percentage of what the charger is charging at. For example, when the charger is showing 100%, the charger is working at its full capacity. When the charger shows 0%, it has fully charged the battery or batteries and is ready to operate.



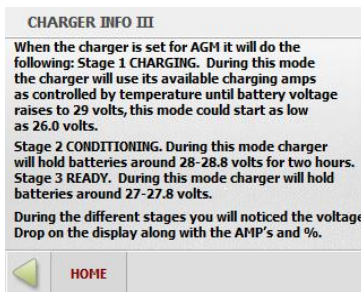
If the ProNautic Charger does not recognize a connection to batteries or the lane machine, the display on the charger will read BC. Once the charger is plugged into the lane machine and a connection is made, it will operate as normal.

#### ProNautic® Charger (set for Lithium batteries)

When the ProNautic charger is used to charge Lithium Batteries, it will charge at 29.2 volts the entire length of the charging process. The only thing that will drop is the charging AMP's along with the charging percentage.



#### ProNautic® Charger (set for AGM batteries)



Located on the ProNautic Charger, you will find 3 LED lights that indicate where the batteries are in the charging process.

After operating the machine and the machine is plugged in for charging, the ProNautic charger will go through its 3 stages of charging.

The first stage is the **Charging** stage producing an output voltage of around 29.0 volts. This process will take

approximately 1-2 hours depending on the beginning voltage.

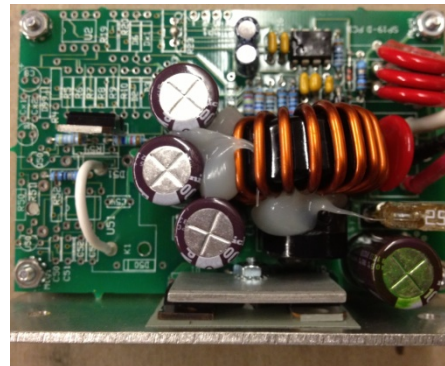
After the Charging stage is complete, the charger will then go into the **Conditioning** stage. During this stage the output voltage will drop to around 28 to 28.8 volts during this time. This process will take approximately 2 hours.

The last stage of the charging cycle is the **READY** stage. Once the charger has gone through the first two stages it will enter the Ready stage where the output voltage stays at a consistent 27 to 27.8 volts. At this point, the battery charging process is complete.

### Constant Voltage Regulator – CVR

The CVR is mounted under the hinged control panel.

The function of the CVR is to maintain a constant 26.2 - 26.6 volts to the key components of the machine. The CVR regulates the voltage output to the drive motor, oil pump, sliding head motor and the buffer motor.



Located on the CVR is a 25A internal fuse\* (Part Number 158-1439) which can be replaced by the operator.



\*If the lane machine is equipped with the variable speed Buffer Motor option, the buffer motor assembly will have an in-line fuse soldered to the board. This CVR utilizes a 30A in line fuse assembly (Part Number 164-1214).

## E-Stop

By pressing the red E-Stop breaker, power will be removed from the lane machine. To resume power, simply turn the breaker clockwise.

The machine should always be turned off by the E-Stop during charging or maintenance.

When the E-Stop is pressed during operation, the machine program will be zeroed and the machine will need to be returned to the foul line and re-started.



## Batteries

### Battery Cycle Life

When running the lane machine only once per day, the maximum amount of lanes that can be done with this battery is 40 lanes. When running the machine twice per day, the maximum amount of lanes that can be done is 24 lanes per cycle, or a total of 48 lanes per day. This means that you can run 24 lanes (or less), recharge the battery at least 4 hours, and then run another 24 lanes (or less) for a total maximum of 48 lanes per day.



158-1634  
RED K2 BATTERY



158-1634B  
ORANGE K2 BATTERY

When running the lane machine only once per day, the maximum amount of lanes that can be done with this battery is 62 lanes. When running the machine twice per day, the maximum amount of lanes that can be done is 46 lanes per cycle, or a total of 92 lanes per day. This means that you can run 46 lanes (or less), recharge the battery at least 4 hours, and then run another 46 lanes (or less) for a total maximum of 92 lanes per day.

When running the lane machine only once per day, the maximum amount of lanes that can be done with this battery is 90 lanes. When running the machine twice per day, the maximum amount of lanes that can be done is 72 lanes per cycle, or a total of 144 lanes per day. This means that you can run 72 lanes (or less), recharge the battery at least 4 hours, and then run another 72 lanes (or less) for a total maximum of 144 lanes per day.



158-1634C  
YELLOW K2 BATTERY

**BATTERIES / CHARGER INFO I**

**KEGEL uses one KEGEL K2 Lithium battery that produces 25.6 Volts fully charged or two Odyssey Dry Cell batteries connected in series to produce 25.6 Volts fully charged.**

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

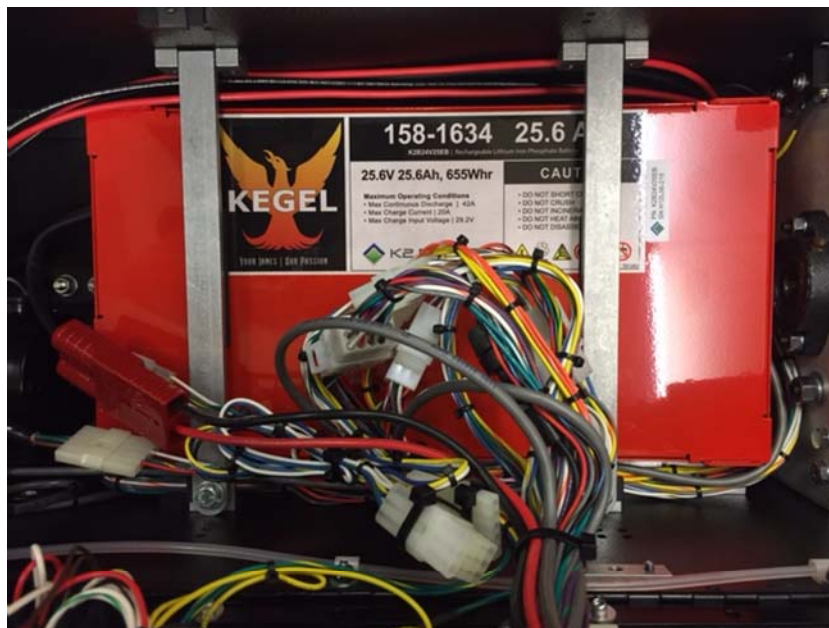
**NOTE: Do not use any battery not authorized by Kegel in this machine. DO NOT USE FLOODED ACID BATTERIES in this machine.**

◀ HOME ▶

## Replacing Batteries

Replacing the battery is simple, but with the center compartment hinged open, great care should be used whenever this job is done.

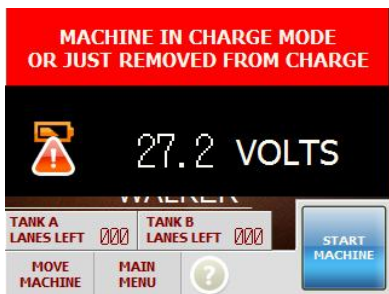
1. First turn the E-Stop OFF. Power to the machine must be turned off
2. Refer to Chapter 1 and remove the Lids and side covers.
3. Loosen the three fasteners across the top of the center compartment plate and tilt the plate up toward you.
4. Remove the mounting strap across the top of the battery.
5. Unplug the battery and carefully remove the battery. Given the weight of the battery, care should be taken when removing.
6. After carefully replacing the battery and mounting hardware, plug the battery back into the connector.
7. Close the center compartment and tighten fasteners.
8. Turn machine ON to check charger and battery voltage.
9. After replacing the battery, reset the BATTERY REPLACEMENT DATE within the HISTORY MONITOR screen.





## Troubleshooting Battery & Charging Problems

Battery problems are no 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 ... well it may just be something you are willing to deal with.



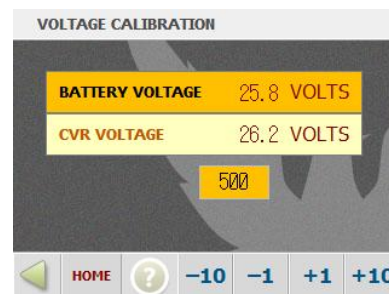
This screen is displayed when the charger is plugged into the machine. It will show the charge voltage and highlight the present charging stage of the machine. If this screen does not appear when charging it can indicate the charger is not functioning or the signal voltage has been lost.

This advisory screen will pop up when the battery voltage is equal to or lower than 24 Volts. This may indicate the machine was not charged or the machine meter is not calibrated, check voltage with a reliable meter.



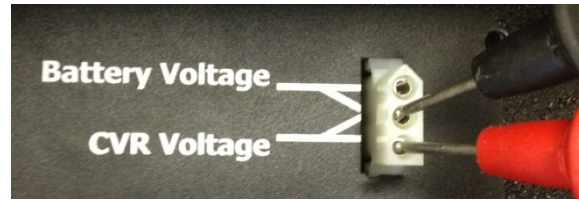
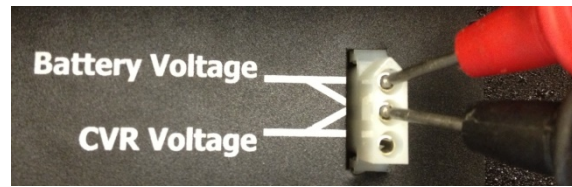
This advisory screen will pop up when the CVR voltage is not detected or is equal to or lower than 25 Volts. This may indicate the CVR has failed or the meter is not calibrated. If the CVR has failed, check the fuse inside and if it is good, then check the calibration of the machine meter with an external meter that is reliable.

Using the screen to the right, press on the Voltage you want to adjust; the buttons will become enabled and an adjustment reference number will appear.



To adjust the voltage meters accurately you must have a dependable voltmeter. Locate the three-pin plug above the fuse bank.

Put the voltmeter probes in the appropriate pins then add or subtract using the buttons at the bottom of the screen until the Voltage on the screen matches the correct Voltage from the external voltmeter.



**VOLTAGE CALIBRATION HELP**

Calibration of the voltage displays are done at the factory but should be checked with a dependable meter if they are in error.

Lead acid batteries should show a full charge of 25.6 volts shortly after being removed from a charge. Lithium batteries will show a charge of 26.6 volts shortly after being removed from a charge.

The CVR voltage should display a voltage between 26.2 and 26.4 volts.

Call Kegel for assistance when calibrating.

HOME

The screen to the left provides information about calibrating the Voltage display.

Each time the machine is powered-up after charging, the machine will detect the full charge and count it. If the machine has not gone below 25 Volts when put on charge the charge will not be counted. **Always change date when replacing batteries.**

**BATTERY USAGE**

SERIAL NUMBER H12L06-160

BATTERIES LAST CHANGED ON THIS DATE 02 19 2016

BATTERY LOW WARNING FOR LITHIUM ION

HOME ? 04/19/16

**BATTERY USAGE HELP**

Each time the machine is powered up after charging, the machine will detect the full charge and count it. If the machine has not gone below 25 volts when put on charge the charge will not be counted.

Always change date when replacing batteries.

Press on the Battery Low Warning button to switch between AGM and Lithium Ion battery warning settings.

HOME

The screen to the left provides instructions to reset the battery cycle counter when a new battery, or a set of batteries are installed in the machine.

Battery connections can be very deceiving when there is a bad connection. You can read fully charged battery voltage but just as soon as a load is introduced it is gone. When it comes to 24-Volt battery connections, you must have nothing less than perfect connections or you may be dead in the water. Here are a few things that can cause battery or charging problems.

The two screens below will show up when the battery voltages have dropped below their preset warning voltages set in the PLC. If these show up, contact your Distributor immediately so that you will have enough time to order new ones and make the change.



If the lane machine experiences a loss of power, it is possible that one of the components has a short somewhere in the wiring or in the component itself. In the event that this happens, go to the test output feature to troubleshoot each of the components for proper function.

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 are all of the locations between the batteries and the machine control plate.

Always turn off E-Stop when inspecting connections.

1. Battery terminals have 2 locations.
2. Blue connector between charger and batteries.
3. Screw terminals in back of charger, positive and negative.
4. Red plug between batteries and PLC plate.
5. Terminal junction block on back of PLC plate.
6. Terminal junction block, jumpers.
7. E-Stop.

Machine will not run. Check for the following:

1. Bad fuse.
2. Loose battery connection. Check all connections.
3. Dead battery.

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.
2. Charger operates intermittently. Battery charger has internal bad connection.
3. Vacuum is drawing more amps.
4. Machine run times are longer.
5. Possible bad connection between charger and batteries.
6. Possible battery problem.

Batteries are not charging. Check for the following when the charger shows no output voltage.

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

CVR not working, Check for the following:

1. Fuse blown on the CVR.
2. CVR has come unplugged.
3. Bad connection to CVR
4. CVR has failed.

CVR not maintaining set voltage.

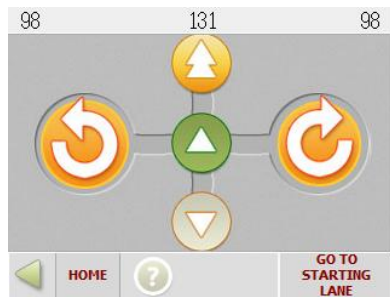
1. CVR has failed. It may operate the machine but not as designed.

# CHAPTER 5

## Drive Systems

### Manual Walker Operation

From this screen on the Walker you can position your machine, test the motors, and return the machine back to the foul line in the event of an error. While in the Home Screen press MOVE MACHINE and the following screen appears:



To move your FLEX Walker like a pro you should practice and pay close attention to your main approach drive wheels. These wheels represent the center of the turning radius. Using the **STOP** button to stop the machine and the **Arrow** buttons to position the machine, you will be smoothly operating your machine in no time.

In Move Machine you can adjust the turning and how far it goes forward or backward. In the screen shot shown above, the left number is the Forward value, the middle number is the turning value and the right is the Reverse value. Press on the number and a keypad pops up to adjust the value.

Use the **Down Arrow** to move the machine in reverse 5 feet and the **Green Up Arrow** for forward 5 feet. Press the **Double Up Arrow** and the machine will move continuously forward. Once in motion, the arrow buttons will disappear and the screen to the right will pop up when a button is pressed. This is a STOP button that will take their place. The buttons come back when the machine stops or after the stop button is pressed. The Down Arrow is also used for return to foul line, when pressed on the lane the machine will travel back to the approach and park.

To turn the machine use the two turning buttons, the one on the left is **Counter-Clockwise** direction the button to the right is **Clockwise**. Like the other buttons, they will disappear while the machine is moving. If the machine is parallel to the foul line and the main drive wheels are on the center board, the machine will be lined up with the lane when turned 90 degrees.

It is not unusual to start then stop the machine quickly to obtain the exact position desired.

## Approach Adjustments



Go to the Main Menu on the Walker and select APPROACH ADJUSTMENTS and the screen will change to LANE TO LANE ADJUSTMENTS. From this screen you choose Standard or Super Advance.

Press STANDARD LANE TO LANE and the screen will change to the adjustment screen.

First choose a direction and press one of the buttons to the right of the STEPS. The NEXT and LAST buttons will appear and the STEPS can be enabled.



Press on a STEP and it will change color to show it is enabled to be adjusted.

Use the buttons at the bottom to increase or decrease the value. In most cases, the STOP ON APPROACH value will never need to be changed but the others will. Use your NEXT and LAST buttons to advance lanes or back up lanes.

There are 4 steps used for each lane to guide the machine across the center: 1, 2, 7, and 8. Steps 3 through 6 are used for SUPER ADVANCE programming.

STEP #1 is used to stop the machine on the approach after it has exited the lane.

STEP #2 is used to turn 90 degrees away from the lane.

STEP #7 is used to travel to the next lane. STEP #7 is also the STEP that is adjusted by the Whiskers.

STEP #8 is used to turn 90 degrees to face the lane.

Steps 2, 7 and 8 will be the ones that need the most attention. As the machine gets older its turning adjustments may need to be modified to make up for mechanical wear.

STEP #2 should always be adjusted so the machine does not drift closer to the foul line.

STEP #7 and #8 should be adjusted to enter the lane as perfectly as possible.

Having all 4 steps adjustable for every lane that the machine travels to will make the Walker easier to fine-tune and you can customize the adjustments for all of the lanes, if needed.

One example might be if the machine has a drive motor that runs a little slow each day until it warms up. If the motor gets faster as the Walker moves across the center, then steps 2 and 8, above, can be adjusted at certain lane intervals to compensate for the change in the motor's speed.

### Programming Around Large Divisions Between Pairs

It is very easy to adjust the Walker to move around walkways or larger divisions (i.e. columns). First, measure to find out what the distance is from center dot to center dot on the lanes that have the large division. If you find out that the measurement is 93 inches then divide **0.62** into 93 to get 300. Enter this value into the proper lane to lane location and run the machine to see how close the setting comes to lining up with the lane.

### Programming Around Poles or Walls



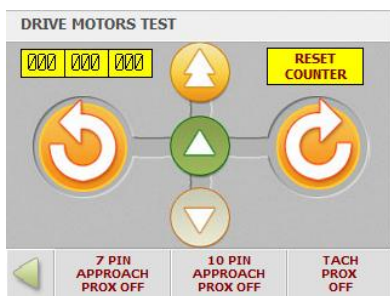
To view Super Advance settings, menu back to the LANE TO LANE ADJUSTMENT screen and press on SUPER ADVANCE. A password screen will appear, enter your password and press CONTINUE.

In SUPER ADVANCE LANE TO LANE there are four more adjustments, two turning and two straight, that can be used to maneuver around objects. There is a 6 STEP version and

an 8 STEP version.

The “6 STEP” version uses steps 1, 2, 3, 4, 7, and 8. To enable the “6 STEP” version, increase the values of STEPS 3 and 4 to a number greater than 40. If a value greater than 40 is put in steps 5 and 6, then all 8 STEPS will be used. Put 40 back in steps 3 through 6 and the function turns off. The machine will not enable Super Advance function if steps 1, 2, 5, 6, 7, and 8 are used, only the above 6 Step method will work. Call Kegel for help when using the Super Advance function.

LANE:	1	TO LANE:	2	NEXT LANE		LAST LANE	
STEP #1 STOP ON APPROACH	100						
STEP #2 TURN AWAY FROM LANE	131						VIEWING LEFT TO RIGHT
STEP #3 STRAIGHT FORWARD	40						
STEP #4 SECOND TURN	40						
STEP #5 STRAIGHT FORWARD	40						
STEP #6 THIRD TURN	40						
STEP #7 STRAIGHT FORWARD	113						
STEP #8 TURN TO FACE LANE	131						
	HOME	?	-10	-1	+1	+10	



To assist you in determining what the starting values should be menu to the INPUT/OUTPUT TEST and then press DRIVE MOTORS. The yellow counter above the STOP button will be your guide. The counter will make it very easy to see what each turn, and the straight value should be, or at least a starting point.

You must first have an idea what path the machine is going to take. First, make sure the machine is parked on the lane behind the foul line where it will normally stop after running a lane and reset the counter. If the machine needs to back-up farther than where it normally stops, then press the reverse button and stop the machine at the new location and write down the number in the counter.

This will be added to STEP #1. Reset the counter and press the turning button and stop the machine at the proper angle, record the counter value for STEP #2. Do the same procedure for the rest of the steps and then enter that data in its proper places.

It is very important that when the machine TURNS TO FACE THE LANE that the machine is the same spot as it came out of the lane for STEP #1. This ensures that the Cleaner, Duster, Oil and Squeegee all happen in their proper places on the lane.

It may be necessary for the machine to back up to the lane that is next to an obstacle that the machine needs to maneuver around. If the machine has to back up to a lane, other than the end lanes, you will need to menu to MACHINE SETUP and press the Forward Green Arrow and advance to MACHINE SETUP II.



From here you press MOON WALK SETUP.

The MOON WALK TO POLES OR WALLS is available for situations where there is a pole or wall to walk around that requires the machine to first back up to it before it can walk around it.

If the machine needs to back up going to lane 8, then 7 will be the lane value for going left to right. If the machine is going right to left and needs to back up to lane 10, then 9 will be the lane value to enter in this menu.

### Steering Whiskers

The FLEX Walker uses “whiskers” to sense when it is too far to the right or left when entering the lane. When the machine enters the lane and the 7-pin whisker contacts the foul light, the 7-pin drive motor will continue to run and the 10-pin drive will slow down.

When the machine over-steers it will contact the opposite whisker to straighten the machine onto the lane. A light brush of the whisker will result in a small steering movement and the other whisker should not hit.

If the Walker makes more than three whisker strikes the machine may be way out of alignment with the lane or is slow entering the lane.





## Automatic Lane to Lane Adjustments

The FLEX Walker is equipped with automatic lane to lane adjusting. The two whiskers mounted in the front of the machine not only steer the machine into the lane but they also detect if the machine is traveling too far or too short.

When the machine is programmed to travel left to right if the 7-pin whisker hits first, it will indicate the machine has traveled short and will add one count to the value for that lane. After the first whisker contact, the feature is disabled. As the PLC “learns” the center, the lane to lane distances will become very accurate.



### TECHNICAL

Keeping the machine traveling straight in and out of the lane will result in a machine that makes small adjustments when steering into the lane. It should be common to watch the machine miss both foul lights and only make light brushes of the whiskers when they do hit.

## Motor Speeds

Go to the Main Menu and select MOTOR SPEEDS and the screen will advance to the Motor Speeds.

SPEEDS	
FORWARD 10 IPS 2022	REVERSE 10 IPS 2157
FORWARD 14 IPS 2521	REVERSE 14 IPS 2661
FORWARD 18 IPS 3117	REVERSE 18 IPS 3146
FORWARD 22 IPS 3526	REVERSE 22 IPS 3656
FORWARD 26 IPS 4240	REVERSE 26 IPS 4136
FORWARD 30 IPS 4542	REVERSE 30 IPS 4646
OPERATE MOTOR 14	REV HI SPEED 4747

Navigation buttons: HOME, -10, +10, AUTO SPEED ADJUST, ?

In this screen you can now run the drive motor. Press on one of the speeds, followed by pressing and hold the Operate Motor button until the motor starts. You can now check and change the no load speed settings; generally the motor will run 3 to 4 IPS faster under no load. If a Flex Walker make sure wheels are not touching approach before starting motor!

Press AUTO SPEED ADJUST to advance to the next screen. From this screen you can have the machine adjust the speeds by running up and down a single lane. As the machine travels it is monitoring the speed and making adjustments when it goes above or below the limits.

The Walker will come out of the lane, stop, and go back into the lane for the next speed so you can do other things while it sets the speeds. The FLEX will need to be operated as if you were running 6 lanes; you must pull it in and out of the lane to complete the settings. This process will take about 20 minutes.

**AUTO SPEED ADJUST**

IF MACHINE IS LINED UP WITH THE LANE THEN PLEASE PRESS "START SPEED ADJUST" BUTTON

LAST DONE ON: 08 05 15 # OF TIMES DONE: 011

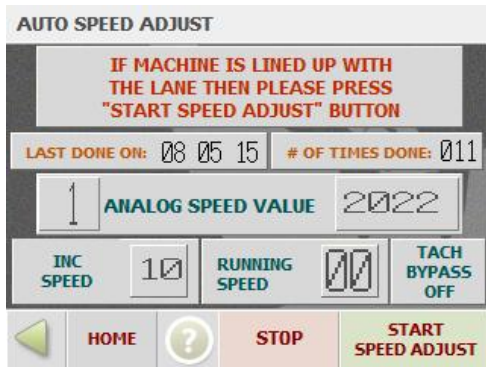
1 ANALOG SPEED VALUE 2022

INC SPEED 10 RUNNING SPEED 00 TACH BYPASS OFF

Navigation buttons: HOME, ?, STOP, START SPEED ADJUST

The machine will clean and condition 6 lanes while adjusting its speeds using pattern 31 (calibration pattern). Press **Start Speed Adjust** and the machine will start operating. The machine sets 10 IPS first for the Forward and Reverse settings.

The number to the left of Analog Speed Value is the Step Number; 1 is 10 IPS Forward and 2 is 10 IPS Reverse, 3 is 14 IPS Forward and 4 is 14 IPS Reverse. This number sequence continues through all the speeds.



The number to the right of Analog Speed Value is the adjustment value. Below these numbers we show the TARGET SPEED and the RUNNING SPEED. The higher speeds may need to be run a couple of times to properly set the adjustment.

To skip to the higher speeds, press where it says Analog Speed Value. The TARGET SPEED button will change to INC SPEED, then press where it says INC SPEED to change the step number.

**Warning:** ODD numbers are for FORWARD travel and EVEN numbers are REVERSE travel. Do not run the wrong step number in forward or reverse travel.

The following list shows the Inches per Second settings and DC voltages for the machine speeds:

1.	9-10 IPS	9.24VDC
2.	13-14 IPS	11.54VDC
3.	17-18 IPS	14.21VDC
4.	21-22 IPS	16.82VDC
5.	25-26 IPS	18.91VDC
6.	29-30 IPS	21.70VDC

#### TECHNICAL

These six speeds will need to be adjusted through the touchscreen. High speed and speeds for approach travel are all self-adjusting and do not need any adjustment.

#### Bumper Wheels

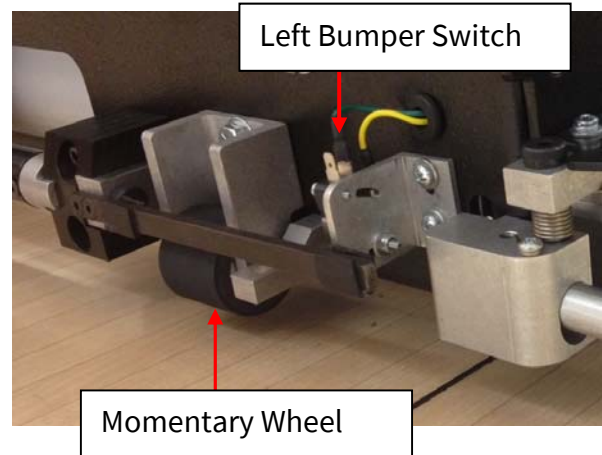
Located in the rear of the Walker are two Bumper Wheels. These wheels will help seat the machine on the lane by kicking the rear end around if the machine does not enter the lane squarely. The overall width of the machine from outside of bumper wheel to bumper wheel should be between 59-½ to 60 inches (152.4 cm), depending on foul lights and lane installation. Adjust the height between the bottom of the wheel and the surface of the approach to about 1-½” (3.81 cm).

Basically, the bumper wheels need to be set to prevent the guide roller on the opposite side from sitting on top of the lane. If the adjustment is too wide the machine may get wedged between the foul lights.

#### Safety Stop Bumper

The machine is equipped with a front bumper in case the machine comes in contact with something, most likely a foul light cover.

On the Walker, this typically occurs if the machine is started on the wrong lane. If this happens, the Walker will stop and give the **BS** error.



To move the Walker away from the foul light or other obstacle, menu to **MOVE MACHINE** on the touchscreen then press and hold the **DOWN ARROW**. This will drive the machine backwards and away from the foul light or whatever it ran into.

**NOTE:** The button must be held down or the Walker will not move in reverse.

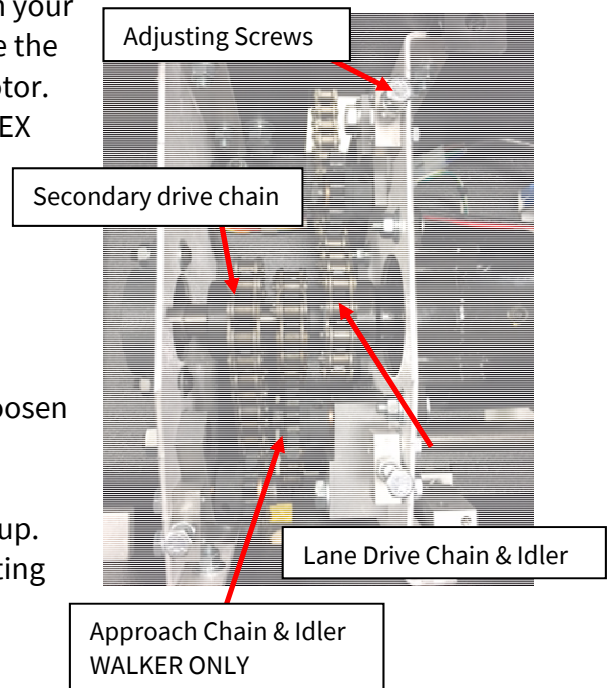
## Adjustments

### Main Drive Motor Chains

It is important for the drive chains to stay tight but not too tight. First, determine what adjustment needs to be made. A chain that is too tight means that there is no movement of the chain when you press between the sprockets with your finger. A chain that is too loose is when you can move the drive wheels back and forth without engaging the motor. The lane drive chain adjustment is the same in the FLEX and FLEX Walker.

To adjust Lane Drive Chain:

1. Loosen the three screws that secure the center compartment and hinge it back.
2. Locate the lane drive chain idler adjustment and loosen main pivot and adjusting jam nut.
3. Turn adjusting screw until the drive chain tightens up. Do not overtighten. Proceed to tighten and inspecting until proper tension is achieved.



To adjust 10-pin Approach Drive Chain:

1. Loosen the three screws that secure the center compartment and hinge it back.
2. Locate the chain idler adjustment and loosen the main pivot and adjusting jam nut.
3. Adjust the idler until there is no play in the approach wheel. Make sure the sprockets not come in contact with each other after the adjustment is made.
4. Tighten the jam nut and pivot and check for play in the wheel.

To adjust 7-pin Approach Drive Chain:

1. Loosen the three screws that secure the center compartment and hinge it back.
2. Loosen the motor mount from the outside of the panel.
3. Loosen the adjusting screw jam nut if one is used on the machine.
4. Turn the adjusting screw in or out so the chain has between 1/4 inch and 3/8 inch (6.35mm to 9.53 mm) of movement, but no play in the approach wheel.
5. Re-tighten the motor mount and adjusting screw jam nut then check the buffer belt tension and re-adjust if needed.
6. Hinge the PLC control plate into place and tighten the three screws.

**Note:** It is a good idea to inspect and clean everything in the center compartment when it is open.

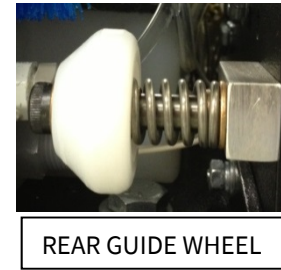
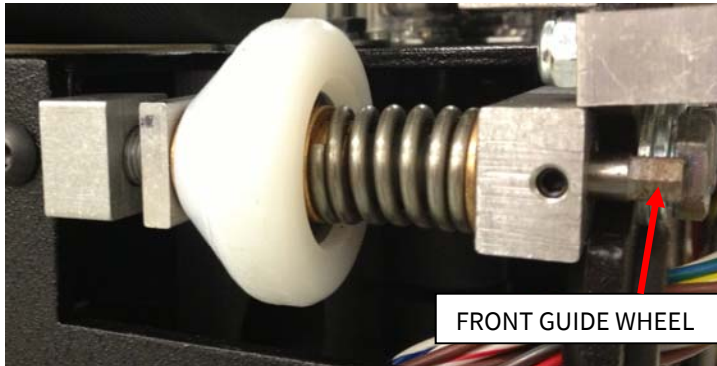
### Rear Approach Wheel Chains

These chains should never be tight and the adjustment should last a long time due to the light duty of these wheels. The plastic idler used to give chain tension is only removing the excess slack in the chain. A little movement in the rear approach wheels is fine.

### Approach Sensor Chains

The Approach Sensors located on each side of the machine use a #25 chain to drive the target. This chain is small and should never be tight; it should always run a little loose. A good adjustment would be to have 1/2 inch (1.27 cm) of total play in the chain. To make an adjustment, loosen the two bolts on the bracket and move the assembly to achieve the proper amount of play.

## Guide Rollers



Adjustment of the front 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 causing the machine to not track properly. In most cases, adjustment to the guide rollers on one side will be all that is required.

To adjust the front guide rollers:

1. Remove the side cover on either side of the machine.
2. Loosen the set screw that locks the adjusting shaft of the guide wheel assembly.
3. With a 7/32 socket, turn the adjusting shaft clockwise for the wheel to move 'away' from the lane, and counter-clockwise to tighten to the lane.
4. Tighten the set screw once the adjustment has been made.
5. Operate the machine after the adjustment has been made. Repeat adjustment procedure if necessary until the machine is tracking straight.

## Adjusting the Lanes Sensing Whiskers

Adjusting a whisker is done by simply loosening the two set screws that hold it to its pivot mount and sliding the shaft in or out. The whiskers will be around 6 inches (15.24 cm) from the side plate of the Walker, depending on foul light castings and the lane installation. To determine if the whisker adjustment is correct, line the Walker up to just miss the 10-pin whisker when it enters the lane. The machine should go straight into the lane without either of the front guide rollers sitting on top of the lane.

If the 7-pin side front guide roller were to hang up on top of the lane this would mean the 10-pin whisker needs to be extended out from the machine at least half an inch. If you hear the guide roller snap off the lane when the machine enters the lane, the adjustment may only be a 1/4-inch (6.35 mm). The 7-pin whisker can be checked the same way.

The gap between each whisker and the foul light cover should be between 1/2-inch and 3/4-inch (1.27 cm to 1.91 cm).



The goal is when the machine enters the lane and the whiskers just miss the guide rollers never have a chance to high-center the machine and cause a travel error. The whisker should just miss the foul lights and seat the machine on the lane correctly without hearing a guide roller snap over the edge of the lane.

The whiskers also detect when the machine has traveled too far or too short so they are always adjusting the Lane to Lane settings to keep your Walker entering the lane as close to perfectly as possible.

### **Adjusting the On Lane Sensor (OLS)**

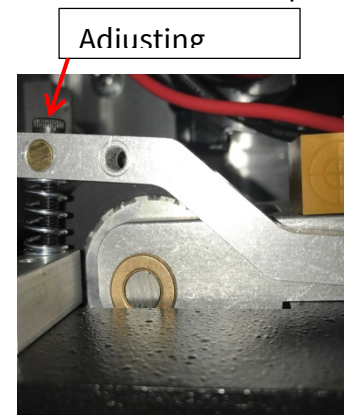
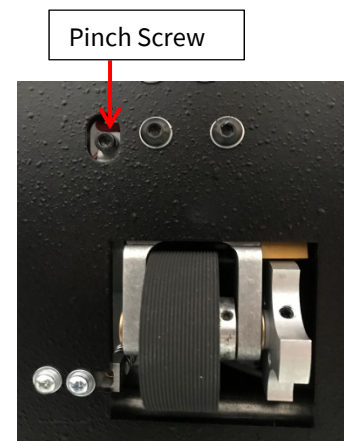
Adjusting the OLS sensor is done with the machine in the upright transport position, with lids removed.

Locate the allen head screw through hole located just above and to the left of the OLS wheel as shown to the right. This screw is used to pinch the shaft tight, loosen but do not remove screw.

Now, from the top side of the machine, locate the adjusting screw that is threaded through the arm and the spring assembly on the floor plate. The correct adjustment should be when the rear of the machine drops onto the lane, and is fully setting on the lane; the input light (0CH00) should come on simultaneously.

To make the adjustment, you will need to access the adjusting screw through the top of the machine. If the OLS sensor needs to activate sooner, turn the screw **CLOCKWISE** and if the OLS sensor needs to read later, then turn the screw **COUNTER-CLOCKWISE**.

Once the adjustment is made, verify with the input light again. When the sensor is adjusted properly, tighten the OLS arm screw from the bottom of the machine and reinstall the lid assembly.



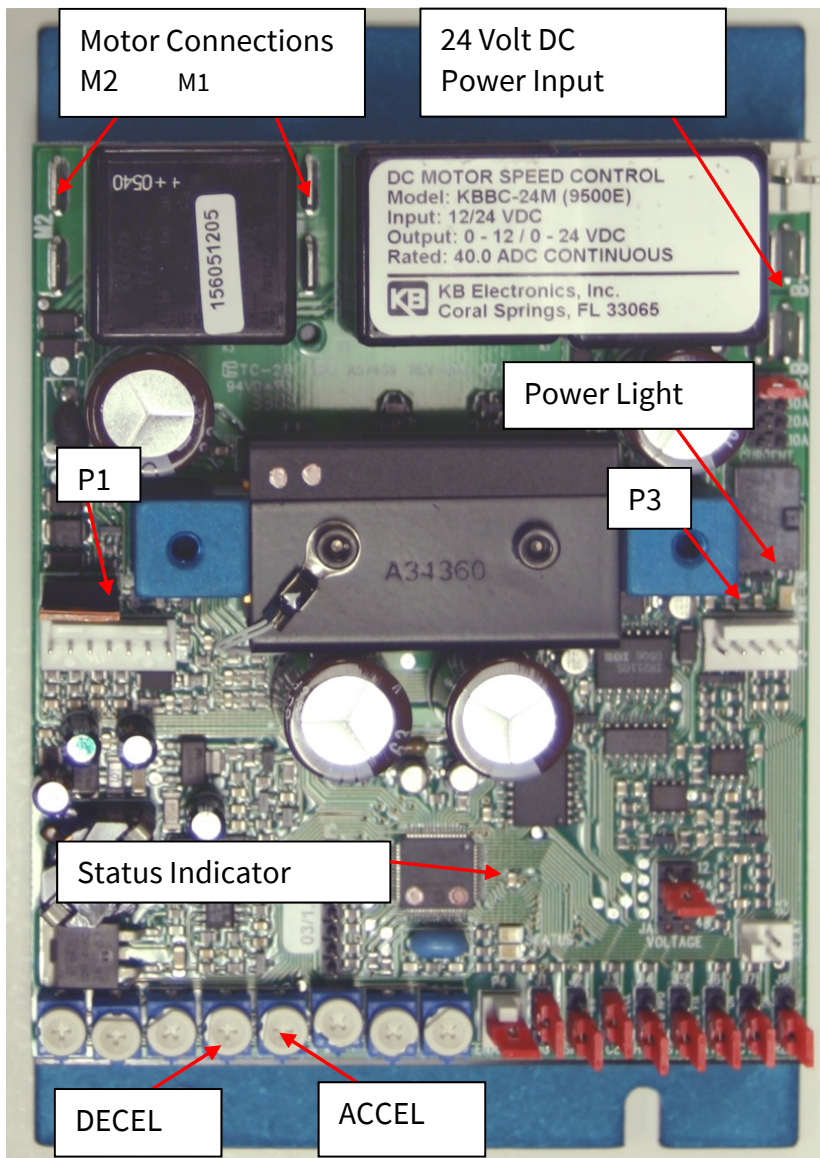
### **Drive Board Adjustments**

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

The **Acceleration** trim pot needs to be adjusted for a smooth acceleration from one speed to the next without sudden jerks of the machine when shifting speeds. Turning the trim pot clockwise will increase the ACCEL time and turning the trim pot counter-clockwise will

decrease the ACCEL time (which could cause the machine to make sudden speed changes). This function can cause travel errors in the pit if the acceleration time is too slow.

The **Deceleration** trim pot is adjusted for smooth decelerations from one speed to the next. Decelerating too quickly will possibly cause the drive board to shut down from an over-voltage fault when going from a higher speed to a lower speed. Turning the trim pot clockwise will increase the Decel time and turning the trim pot counter-clockwise will decrease the Decel time (which could cause the machine to make sudden speed changes). If you adjust the DECEL too much in the clockwise direction the machine may not properly slow down entering the pin deck. **Be certain that the machine is definitely slowing down before coming to a stop.**



The Drive Motor Controller, shown above, 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 trim pot adjustment. These codes are located with the Forward and Reverse travel errors in the touchscreen.

BOARD ERROR CODE CHART		
FUNCTION	FLASH CODE	LED COLOR
Motor Running	SLOW	Green
Motor Stopped	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
Current Limit Time Out	QUICK	RED
Power On	STEADY	GREEN
Power Off	OFF	OFF

Press anywhere on screen to return.

#### DRIVE BOARD DEFAULT SETTINGS



The above speed pots are sealed in place after being adjusted in factory using liquid tape.  
Balancing the Two Walker Drive Motors

The two drive motors are “balanced” with a long 22 AWG yellow wire. This wire is used on either the 7-pin or the 10-pin drive motor, depending on which motor needs more resistance.

The wire only receives current while the machine is traveling on the approach and it is only creating a small amount of resistance in the circuit to balance the two motors so they will run at the same speed. A longer length of wire will make the motor run slower.

To balance the motors on the Walker, first determine which motor is using or needs the resistance wire. The instructions below are written as if there is no resistance wire.

1. Go to the **MOVE MACHINE** screen and position the machine as if it were going to the next lane.
2. Line the rear panel up with the approach boards so they are parallel with each other.
3. Press the **DOUBLE UP ARROW** and stop the machine where desired.
4. Check to see if the rear panel is still parallel with the approach boards. If one side only advances  $\frac{1}{2}$  an inch this may not be a concern (unless you want it absolutely perfect).
5. Press the **DOWN ARROW** and observe if the machine advances back to where it started.
6. Do this exercise, several times, to see if the machine repeats its movements forward and back.
7. If the machine repeats its error and is off by as much two boards, then replace the proper jumper with a wire between 6 and 8 feet (1.8 to 2.4 m) to start with. If the machine does not travel the same in both directions then you will need to split the difference when adjusting the resistance wire.
8. If the yellow resistance wire is used to control the **7-pin motor** it will be connected to the two terminals on the left hand side of the black box (red wires).
9. If the yellow resistance wire is used to control the **10-pin motor** it will be connected to the two terminals on the right hand side of the black box (white wires).
10. When stripping the wire, remove  $\frac{1}{2}$  inch of the insulation so you can fold the wire in half when inserting into the terminal block.
11. Be certain to turn the power off when adjusting the wire length.
12. After you have installed the length of wire (which we hope is a little long to start), repeat steps 1 through 5 and observe the movement of the Walker.
13. Shorten the yellow wire if needed in 6 to 12 inch increments (~15 to 30 cm) and then test the results. Continue until the motors are balanced and the machine travels straight. Put the excess wire inside the black box along with the jumper when finished.



#### TECHNICAL

The length of wire used will vary from machine to machine and it may be necessary to move the resistance wire to the other motor after both motors break in.



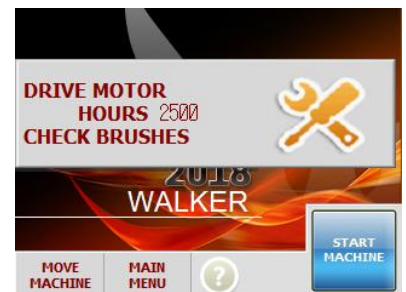
## Maintenance

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

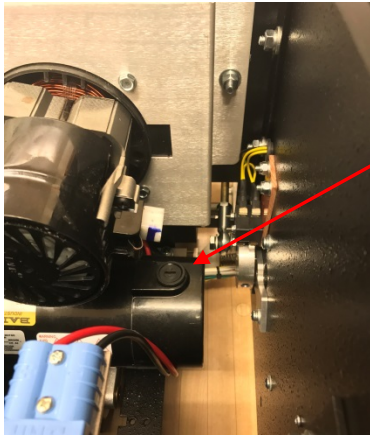
1. Keep all of the bushings oiled on the drive shaft (one or two drops is plenty). Do not allow chains to get dry but do not over-oil. There are felt washers to help hold the oil longer next to the bushings. **DO NOT OVER-OIL, THEY WILL DRIP FOREVER!**
2. Keep the LDS shaft bushings oiled, one drop of oil every 4 to 6 months is sufficient.
3. Inspect the drive wheels for tightness and free rotation each time you clean the machine.
4. Inspect the drive chain adjustment whenever the wheels are checked or cleaned.
5. Inspect the LDS when cleaning the machine to make sure all parts are tight (it takes just a second).
6. Inspect the main ZTR wheels for loose chains or set screws on the Walker.
7. Inspect the rear ZTR wheels on the Walker for loose set screws or excessively loose chains (but keep in mind that these chains can run loose with no problem).
8. Inspect the two approach sensor chains on the Walker. They should run loose, but not too loose.

### Drive Motor Brushes

When the lane machine has been in operation for 2500 hours, this screen will pop up indicating that the Drive Motor is in need of service.



Slide back the oil compartment lid to gain access to the drive motor located under the Vacuum motor assembly.

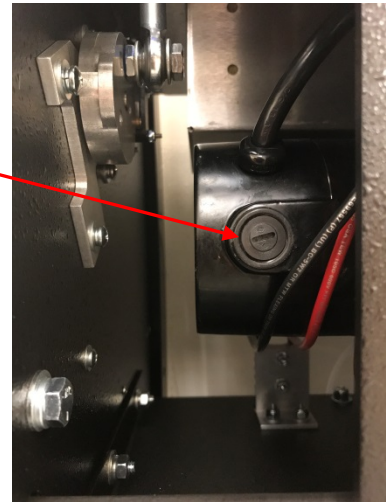


With a flathead screwdriver remove the drive motor brush cap and remove the brush. It may be necessary to pry this out with small screwdriver.

Next, with the machine standing up, remove the opposite side drive motor brush.

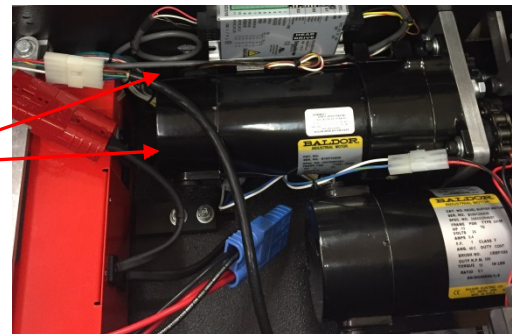
With the machine in the upright, transport position, you will have access through the bottom plate of the lane machine.

Once both motor brushes have been removed, take an air compressor and blow out the carbon residue that may have built up over time.



The FLEX Walker will have an additional drive motor to blow out. This motor is located in the center compartment under the electrical panel. To do this, it will be necessary to remove the conditioner compartment lid assembly as well as the cleaner compartment lid. Refer to Chapter 1 for removal of lids.

Once the lids have been removed, remove the three screws on the back side of the hinged electrical panel. Tilt the electrical panel up towards you to view the top of the drive motor brush cap. Remove the drive motor cap followed by the drive motor brush.

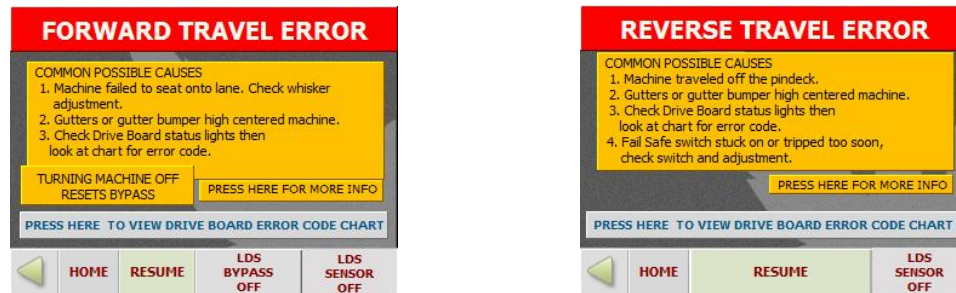


Note: The 7 pin drive motor does not operate as often as the 10 pin motor, so the need to do this often is not needed unless trouble shooting a drive problem.

## Troubleshooting

### Drive System Problems Indicated by Error Messages

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



Forward and Reverse Travel Errors 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. We've made a list of a few things that can cause a **Forward or Reverse Travel Error**.

In a pinch, it is possible to bypass the LDS sensor so that the operator may finish conditioning the lanes. Simply press the "LDS BYPASS" button. If the machine powers down, the machine will automatically reset to the normal operating setting.

If the Drive Motor does not run, menu to the **MOVE MACHINE** screen for the Walker and check the operation of the relays and voltages. For the FLEX, menu to the **INPUT/OUTPUT TEST** screen to run the motor.

#### Problem:

The drive motor runs but gives a **Forward or Reverse Travel Error**.

#### Possible Cause:

- Machine is not seated on the lane, there are high gutters, or the drive wheels are slipping.
- LDS signal has failed or the LDS shaft is binding.
- Wire is loose or broken for the **0CH 07** Input circuit.
- Turn the LDS shaft and see if **Input 0CH 07** is flashing on the PLC as the wheels rotate.
- Machine Deceleration trim pot 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 trim pot will be needed.
- Machine Acceleration trim pot needs to be adjusted. This problem will show up the most often in the pit when the machine does the squeegee wipe function. There will also be an error code flashing on the speed control board when the ACCEL needs to be adjusted. A clockwise turn of the trim pot will be needed.

**Problem:**

The drive motor does not run

**Possible Cause:**

- Forward Relay is loose in socket or failed.
- Reverse Relay is loose in socket or failed.
- Motor control plugs is loose or unplugged. Check speed control and drive motor plugs.
- Blown fuse.
- Drive Motor or Speed Control has failed.
- Go to the proper menu and check the operation of the relays.

**Problem:**

Machine drives off into pit giving a **Forward Travel Error**.

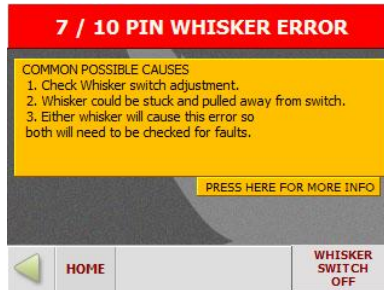
**Possible Cause:**

- Forward Subtract needs to be increased by one or two counts.
- Lane Distance shaft is not turning freely.
- Lane Distance target is loose.
- Lane Distance Proximity Sensor is too far from target.
- Lane Distance Proximity Sensor is damaged.
- Operator needs more training and is starting the machine too far past the foul line.
- Tail plank is missing from pin deck. Check for missing tail planks.

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

**A:** 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.

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



Whisker errors are generated when the whisker is already pulled away from the switch when the machine is started.

A whisker or switch that is damaged or just out of adjustment can cause this error. Input 109 is for the 7 pin and input 110 is for the 10 pin.



Normally this Walker error screen appears when **Input 1CH 06** fails to receive a signal within 1.5 seconds of the 7-pin Approach Motor starting. On the following page are the possible causes that can produce an **APPROACH 7 PIN** error.

In a pinch you may bypass the sensor temporarily in order finish conditioning the lanes. If the machine is powered down, it will reset back to normal operating mode.

### Problem:

7-pin Approach Motor runs but gives an error.

### Possible Cause:

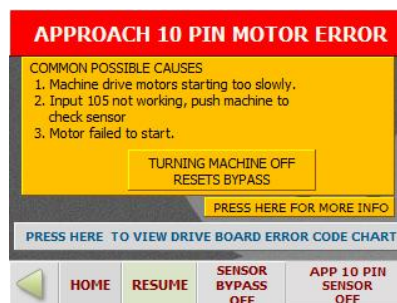
- Sensor has failed.
- Bad connection between sensor and PLC.
- Chain is broken that drives sensor target.
- Main drive chain to rear wheel is off.
- Sensing target is loose or has fallen off.

### Problem:

7-pin Approach Motor does not run, menu to **MOVE MACHINE** screen to test motors.

### Possible Cause:

- Drive motor has failed.
- CR2 (ZTR Enabling Relay) is loose in socket base or failed.
- CR1 (Directional Relay) is loose in the socket base.
- Fuse is blown.
- The Motor Drive Board has a fault; check error code for drive board. Turn the machine off for a few seconds and then back on to see if the fault resets.
- The motor is unplugged.
- Make sure CR3 is seated properly in its socket base.
- Check 10-pin Whisker Switch.



Normally this approach error occurs when **Input 1CH 05** fails to receive a signal within 1.5 seconds of the motor starting.

**Problem:**

10-pin Main Drive Motor runs but gives an error.

**Possible Cause:**

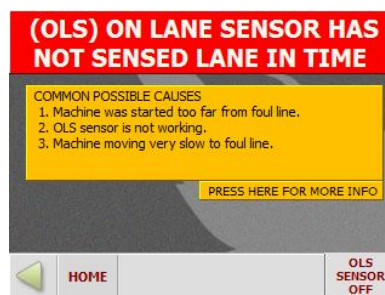
- Sensing target is loose or has fallen off.
- Sensor has failed.
- Bad connection between sensor and PLC.
- Chain has broken that drives sensor target.
- Main drive chain to rear wheel is off.

**Problem:**

10-pin Main Drive Motor does not run, menu to **MOVE MACHINE** screen to test motors.

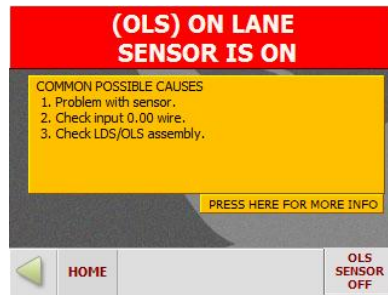
**Possible Cause:**

- CR12 (Forward Relay) is loose in socket base or failed.
- CR13 (Reverse Relay) is loose in socket base or failed.
- Fuse is blown.
- 10-pin Motor Drive Board has a fault; check error code for the drive board. Turn machine off for a few seconds and then back on to see if the fault resets.
- Motor is unplugged.
- 7-pin Whisker Switch is stuck.
- Make sure CR4 is seated in socket base.
- Drive motor has failed.

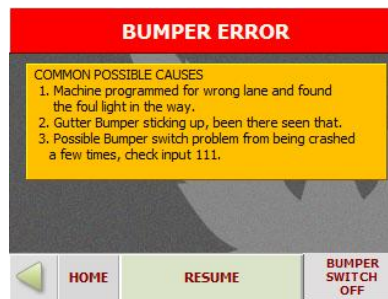


There are two On Lane Switch (OLS) errors for the Walker. The OLS is used to detect when the Walker is on the lane or if it is taking too long to get there. In order for the OLS switch to work, the Walker must be fully seated and start rolling the LDS shaft.

The OLS LANE error is enabled when the machine begins its movement toward the lane. If the machine takes more than 8 seconds to close the normally open contacts, it will display the error. The machine could either be high-centered on the lane by a guide roller or the speed is set too slow.



The OLS STUCK error is displayed when the OLS contacts are already closed due to a bad switch or the wheel was rotated, causing it to close the switch. Someone could wire the switch wrong as well.



The BUMPER error is displayed on the Walker when the bumper switch contacts close due to a bad switch or running into something while the machine is moving.

This error will show when either bumper switch is receiving a signal. Make sure the machine is not up against a foul cover creating a signal. If so, clear the machine and start over. If all is clear, there is possibly a faulty switch causing the error message to appear.



## Drive System Problems that Do Not Display Errors on Lane or Approach

There are a number of things that can go wrong with the Drive System and the Walker will appear to operate poorly. Most of these problems can be corrected before the machine fails, but only if the operator is paying close attention.

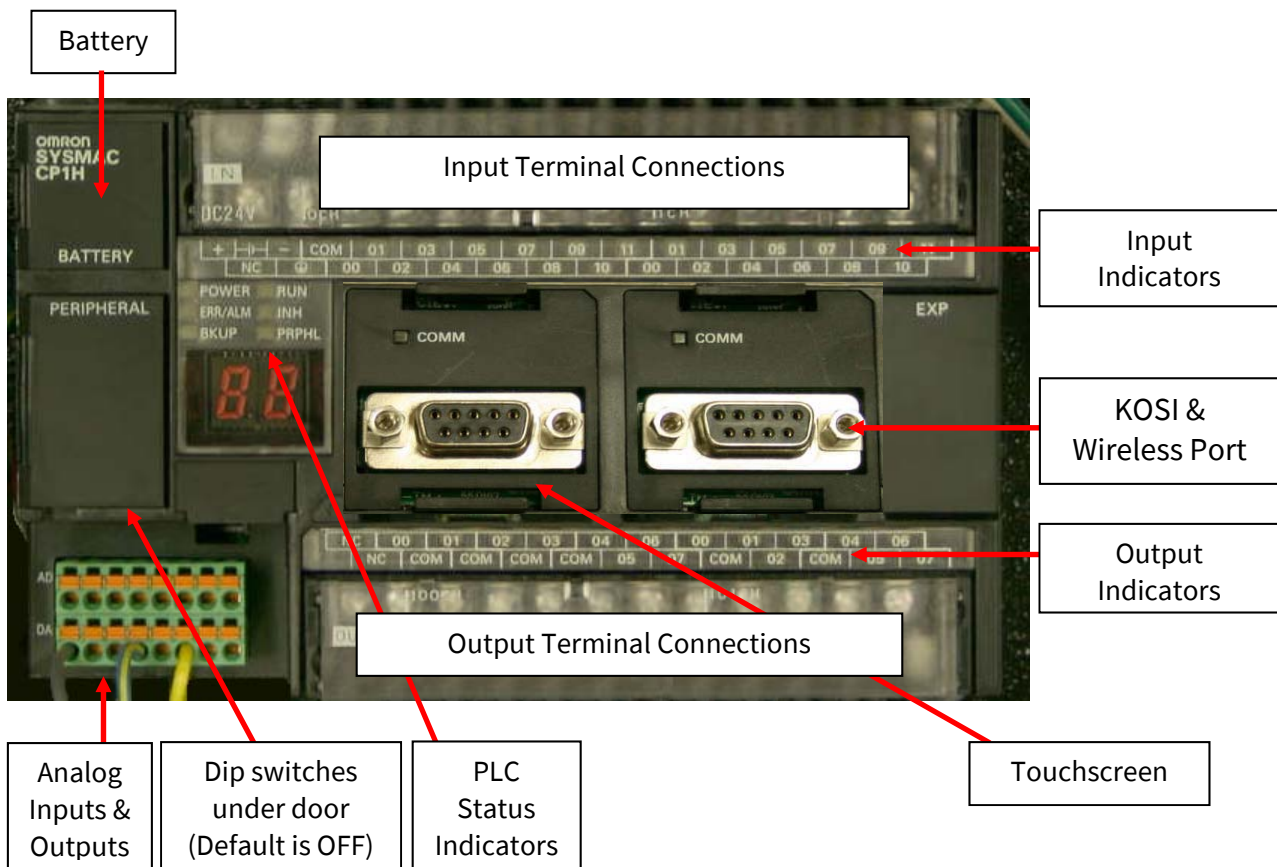
NOTE: When making changes to how the machine moves and turns, the Lane to Lane adjustments will also change.

1. When the machine comes out of the lane and onto the approach it drifts to the left or right.
  - a. Check gutter adapter blocks to see if they are causing the machine to come out crooked.
  - b. The machine could be favoring the left or right side and coming out a little crooked.
  - c. The 10-pin motor could be running too fast. Adjust the length of the yellow resistance wire.
2. The machine turns more than (or less than) 90 degrees when turning clockwise or counter- clockwise.
  - a. Check the STEP #2 TURN AWAY FROM LANE and STEP #8 TURN TO FACE LANE adjustment to see if they are set properly for each lane.
  - b. The 10-pin Approach Sensor is miss-counting allowing it to go beyond 90 degrees.
3. The machine drifts to right or left when traveling to the next lane.
  - a. The yellow resistance wire needs to be adjusted to balance the motors.
4. The machine will not make a 90 degree turn.
  - a. The CR1 Directional Relay is not operating.
5. The machine makes more than three whisker strikes when entering the lane.
  - a. The whiskers are set too wide and are not giving the machine enough room to maneuver.
  - b. Lane to Lane adjustments have not been fine-tuned.
6. The machine slows down suddenly when down-shifting or stopping
  - a. The Decel Potentiometer on the drive board needs to be adjusted clockwise.
7. The machine appears not to ramp down to a slower speed just before stopping when operating on the approach.
  - a. The Decel Potentiometer on the drive board needs adjusted counter-clockwise.
8. The machine starts very quickly and makes sudden speed changes.
  - a. The Accel Potentiometer needs adjusted clockwise.
9. The machine starts slowly and may display travel errors.
  - a. The Accel Potentiometer needs adjusted counter-clockwise.

# 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.

## PLC Inputs and Testing

The PLC assembly of the machine has 24 inputs, 16 relay outputs, and two analog 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>
000 *	ON LANE SENSOR (OLS)	YELLOW / ORANGE
001	BOARD COUNTING PROX SENSOR	RED / WHITE
002	LEFT OIL HEAD REVERSING PROX SENSOR	RED / ORANGE
003	RIGHT OIL HEAD REVERSING PROX SENSOR	ORANGE / BLACK
004	BUFFER BRUSH UP SWITCH	GREEN / WHITE
005	BUFFER BRUSH DOWN SWITCH	VIOLET / YELLOW
006	DRIVE SHAFT TACHOMETER PROX SENSOR	BLACK / BLUE
007	LANE DISTANCE PROXIMITY SENSOR (LDS)	WHITE / PINK
008	RESUME BUTTON / HANDLE BUTTON (FLEX ONLY)	VIOLET
009	STEPPER DRIVE SWITCH	BROWN / YELLOW
010	DUSTER UP SWITCHES (2)	GREEN / BLACK
011	BUFFER TACH	BROWN/BLUE
100	SQUEEGEE DOWN SWITCH	BLACK
101	SQUEEGEE UP SWITCH	YELLOW / GREEN
102	OIL FLOAT SWITCH	GRAY / WHITE
103	CLEANER FLOAT SWITCH	GRAY / BLACK
104	RECOVERY TANK SWITCH	VIOLET / GREEN
105 *	10-PIN APPROACH SENSOR	GRAY / ORANGE
106 *	7-PIN APPROACH SENSOR	GRAY / BROWN
107 *	STOP BY SENSOR	WHITE / ORANGE
108	MANUAL DUSTER / CLEANER CALIBRATION	BROWN / VIOLET
109 *	7-PIN WHISKER	VIOLET / ORANGE
110 *	10-PIN WHISKER	RED / VIOLET
111 *	BUMPER SWITCHES (2)	GREEN

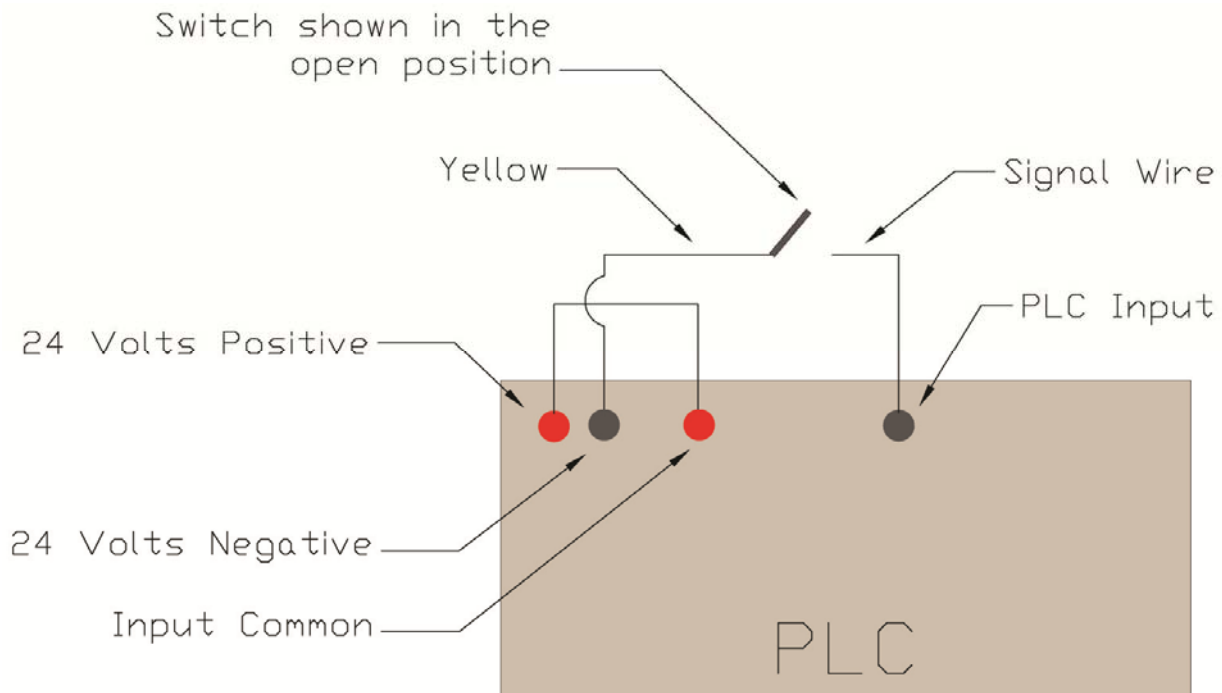
**Note:** Inputs with an \* next to them are only used in the Walker.

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

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

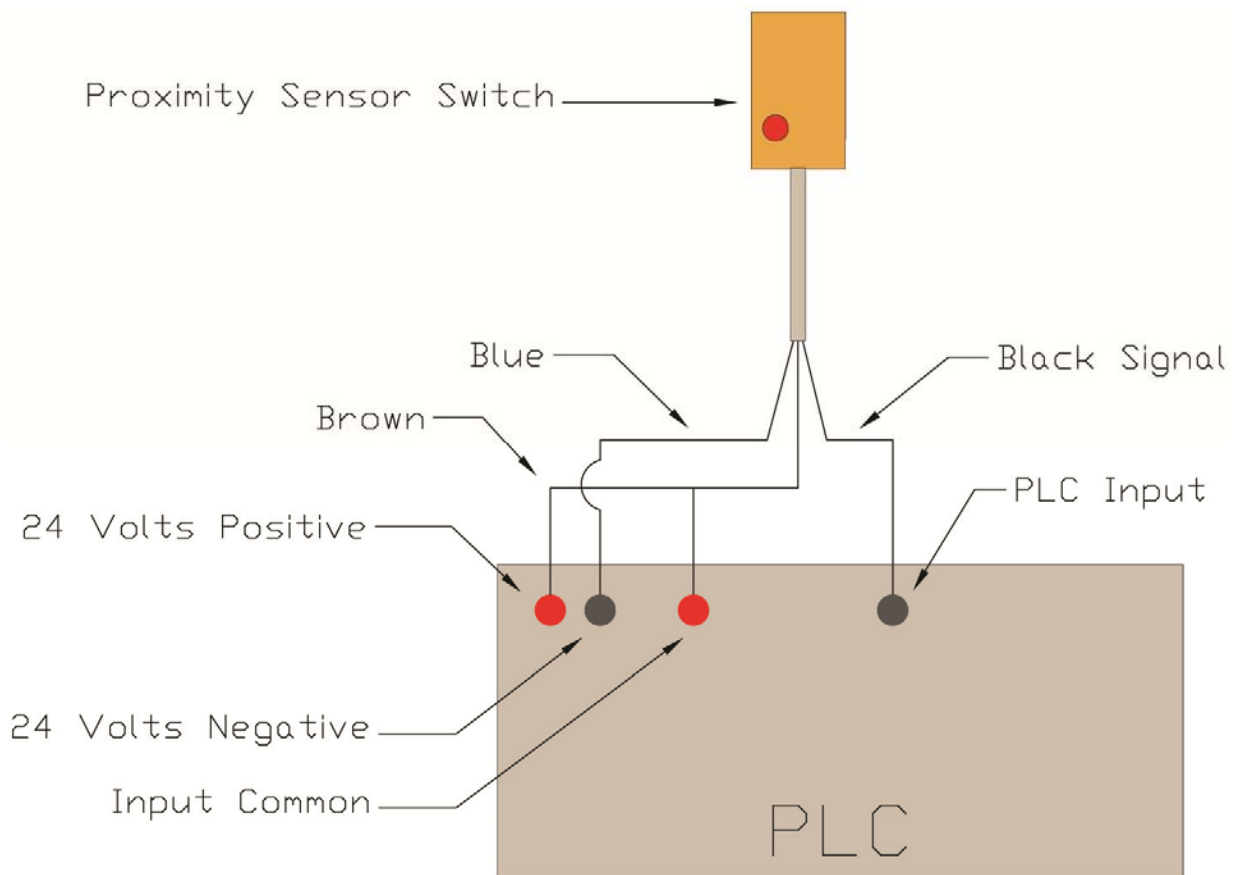
The following wiring drawings will show the simplest way a switch and proximity sensor connect to the PLC.

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



### Inputs and Testing Continued...

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



## PLC Outputs

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

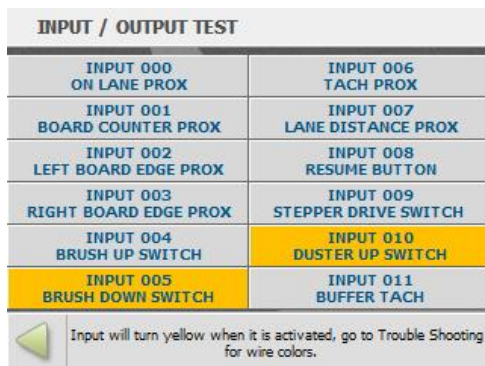
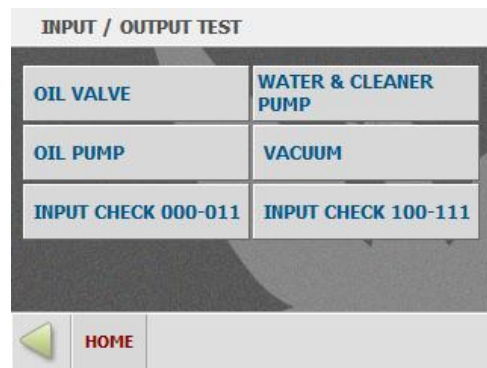
<u>OUTPUT</u>	<u>DESCRIPTION</u>	<u>WIRE COLOR</u>
100.00	OIL PUMP MOTOR	RED
100.01	POWER OFF RELAY	GRAY / YELLOW
100.02	FORWARD MAIN DRIVE	GREEN / ORANGE
100.03	REVERSE MAIN DRIVE	YELLOW / VIOLET
100.04	MOVING HEAD MOTOR RUN	BLACK
100.05	MOVING HEAD MOTOR DIRECTION	WHITE
100.06	BUFFER MOTOR/PINDECK TREATMENT	YELLOW / BLUE
100.07	OIL CONTROL VALVE	ORANGE
101.00 *	ZTR ENABLE RELAY	WHITE / GREEN
101.01 *	ZTR DIRECTIONAL RELAY	BLACK / PINK
101.02	BRUSH LIFT MOTOR	WHITE / BLACK
101.03	SQUEEGEE MOTOR	BLUE / WHITE
101.04	DUSTER UNWIND	GREEN / BLUE
101.05	DUSTER WIND-UP	GREEN / RED
101.06	OIL VALVE TEST	ORANGE / WHITE
101.07	VACUUM MOTOR	BLUE / BLACK

**Note:** Outputs with an \* next to them are only used in the Flex Walker.

## INPUT / OUTPUT TEST


Go to the main menu and select INPUT/OUTPUT TEST and the screen will change to the first test screen. Press on an output selection to test, below is an example of the BRUSH LIFT test. The Brush Lift test also shows the inputs that control the motor to stop in the proper position. When testing the motor you are also testing and watching for correct switch operation at the same time.

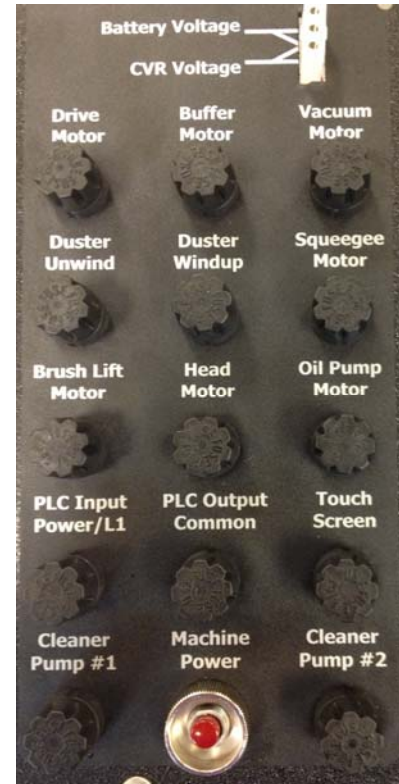
To check inputs, press on one of the two input screens to view. The inputs that are on will change color to yellow. To test an input you will need to physically operate the switch by pressing on it or pass metal by a proximity sensor.



## Fuses

Mounted on the control plate are several protective devices for your FLEX. From the Input/ Output Test Menu press the Machine Fuse List and the below screen will appear.

MACHINE FUSES			
		PINDECK SOLENOID	3.2 AMP
PLC POWER	0.5 AMP	OIL PUMP MTR	2.25 AMP
PLC COMMON	0.5 AMP	DRIVE MTR	7.5 AMP
VACUUM MTR	20 AMP	BUFFER MTR	10 AMP
SQUEEGEE MTR	3.2 AMP	HEAD MTR	2.25 AMP
BRUSH LIFT MTR	3.2 AMP	CVR	25 AMP
DUSTER UNWIND	3.2 AMP	TOUCH SCREEN	0.5 AMP
DUSTER WINDUP	3.2 AMP	CHARGER	30 AMP
CLEANER PUMP #2	3.2 AMP	CLEANER PUMP #1	3.2 AMP
 HOME			



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

If the machine is equipped with the Variable speed buffer upgrade, the Buffer CVR will utilize a 30 amp inline type fuse.



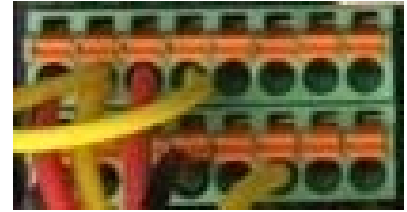
### TECHNICAL NOTE

The Cleaner Pump #2 fuse will only be present on models that have the Cleaner Pump Upgrade System.



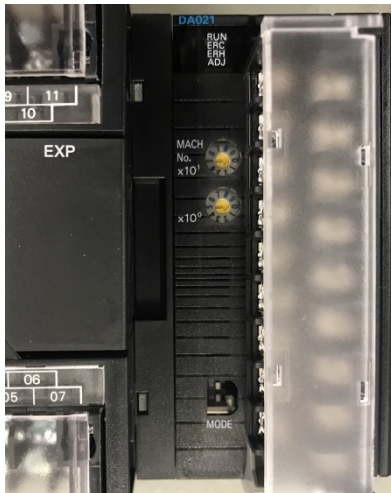
## Analog Controls

The variable speeds for the Cleaner pump and Drive Motor(s) in the machine are controlled by a built in analog output. The signal comes from the green junction on the PLC first, then onto the Motor Speed Control Boards located on the left side of the electrical compartment.



The analog output works by taking values from the PLC and converting them to voltage, the higher the analog voltage, the higher the speed. The analog outputs generate voltage from 0 to a maximum of 5 VDC.

The Gray / Green wire on the bottom left is the drive motor output, the Blue / Yellow wire (fourth from the left) is the cleaner pump motor and as with all DC circuits, the Yellow is common.



The plc also has built in Analog Inputs used for the reference voltage meters.

The module to the left is an Analog add-on module used for the Cleaner and the Buffer upgrades. The two yellow dials shown should always have the arrow pointing towards zero.

## Control Relays on the FLEX / FLEX Walker

All of the components on the FLEX and FLEX Walker are isolated from the PLC. When we say isolated, it means there is a control relay between the PLC and the motor or device. This is to protect the PLC against power spikes from motor amp loads that can cause damage to the smaller internal PLC relays.

The FLEX machine is equipped with 10 replaceable control relays and the **FLEX Walker has 15 replaceable relays** that operate ALL the motors of the machine. The Vacuum Relay (CR19) and Power Relay (CR20) are located on the bottom side of the electrical panel.



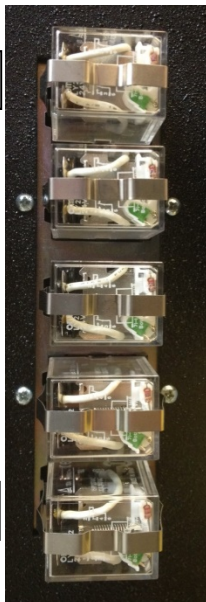
CR13

CR1

**FLEX WALKER ONLY**

- CONTROL RELAY 1: Oil Valve Relay Tank 'A'
- CONTROL RELAY 2: Oil Valve Relay Tank 'B'
- RELAY CR1-CR2: 158-1460
- RELAY BASE FOR CR1-CR2: 164-1206
- CONTROL RELAY 3: Control Relay
- CONTROL RELAY 4: Duster Polarity Switch
- CONTROL RELAY 5: Pindeck Treatment Relay
- CONTROL RELAY 6: Power Off Relay
- CONTROL RELAY 7: Duster Windup Motor
- CONTROL RELAY 8: Duster Unwind Motor
- CONTROL RELAY 9: Squeegee Motor
- CONTROL RELAY 10: Brush Lift Motor
- CONTROL RELAY 11: Forward Drive Motor
- RELAY CR3-CR11: 158-1458
- RELAY BASE FOR CR3-CR11: 164-1204
- CONTROL RELAY 12: Reverse Drive Motor
- RELAY CR12: 158-1463
- RELAY BASE FOR CR9: 164-1205
- CONTROL RELAY 13: Buffer Motor Relay
- RELAY CR13: 158-1462
- RELAY BASE FOR CR-13: 164-1203
- CONTROL RELAY 14: Whisker Enable Relay
- CONTROL RELAY 15: Whisker 10-Pin Side Relay
- CONTROL RELAY 16: Whisker 7-Pin Side Relay
- CONTROL RELAY 17: ZTR Enabling Relay
- CONTROL RELAY 18: ZTR Reverse Relay
- RELAY CR11-CR15: 158-1462
- RELAY BASE FOR CR11-CR15: 164-1203
- CONTROL RELAY 19: Vacuum Motor Relay (Not Shown)
- CONTROL RELAY 20: Power Relay (Not Shown)

CR14



CR18



# CHAPTER 7

## Miscellaneous Parts

### Stickers and Decals



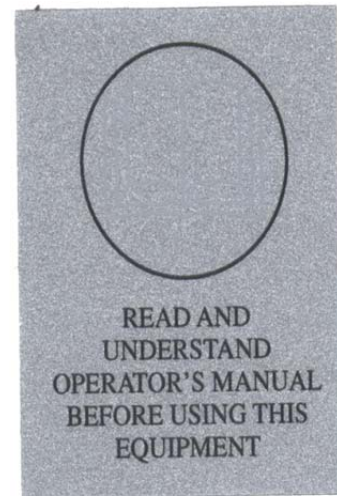
153-0037



154-0272



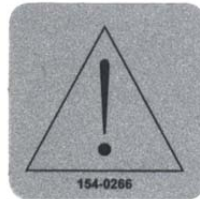
154-0274



158-0207



154-0297



154-0266



154-0269



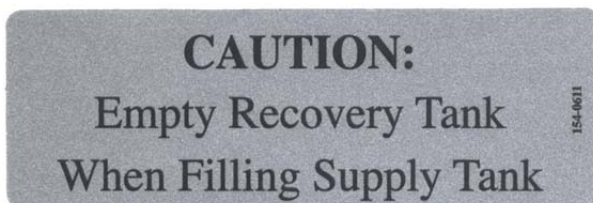
154-0647



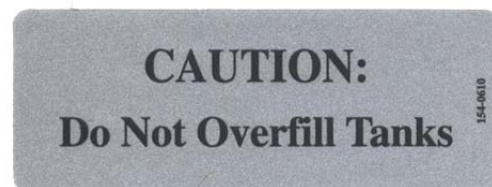
154-0648



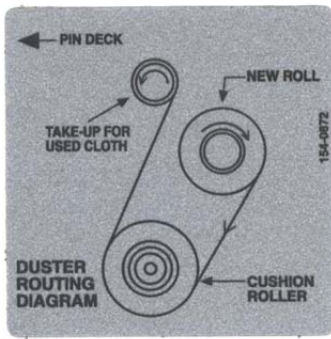
164-0013



154-0611



154-0610



154-0872



154-0270

**HEAD  
DRIVE**

153-0850

**OIL  
PUMP**

153-0849

**Main Drive Speed Control**

158-0606

**WARNING:** To reduce the risk of fire, use only commercially available bowling lane cleaners and conditioners intended for machine application.

154-0262

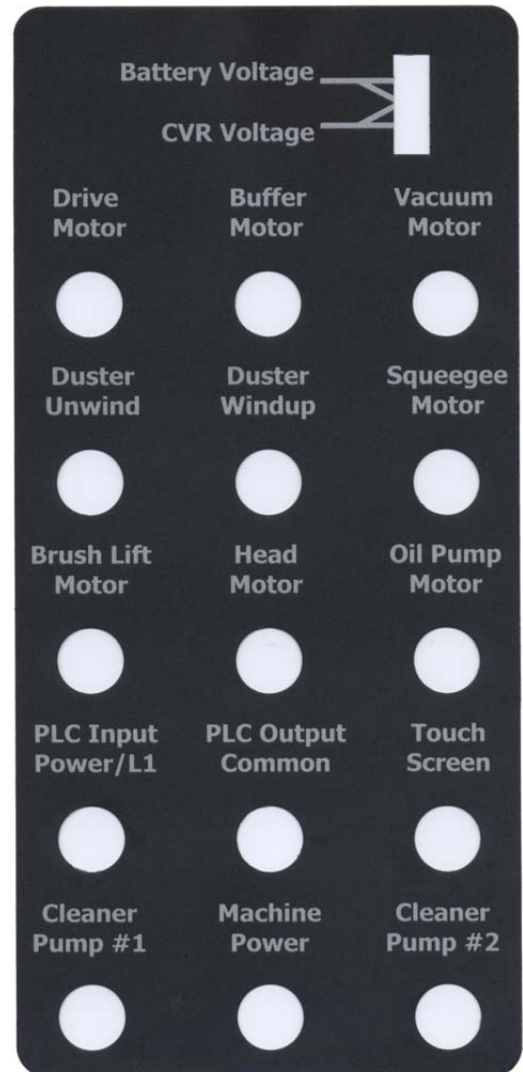
154-0262



**CAUTION:** Moving Parts -  
To Reduce The Risk Of Injury,  
Unplug Before Servicing.

154-0265

154-0265



164-0005

**FLE**

164-0007

**FLE**

164-0008



164-0009



164-0014



164-0016



164-0015



164-0017

## Fittings



Elbow-  
1/4" Tube x 1/4"  
Tube



Elbow-  
3/8" Tube x 3/8"  
Tube



Elbow-  
3/8" NPT x 1/4" Tube -  
154-0225



Elbow-  
1/4" Stem x 1/4"  
Tube



Elbow-  
3/8" Stem x 3/8"  
Tube



Elbow-  
1/4" Stem x 1/4" Hose  
Barb



Elbow-  
3/8" Stem x 5/16"  
Hose Barb



Reducing Union-  
1/4" x 3/16" - 154-  
0248



Union-  
1/4" x 1/4" - 154-  
0241



Male Lure-  
1/8" Hose Barb - 154-  
0863



Female Connector-  
1/4" Tube x 1/8" FPT - 154-  
0257



Male Swivel  
Elbow-  
1/4 Tube x 1/4





# CHAPTER 8

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## Mechanical Drawings

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Recovery Tank Assembly .....	217
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# BATTERIES AND CHARGERS

Rev. 12/13



158-1634 – K2 LITHIUM – 25.6 Ah



158-1634B – K2 LITHIUM – 38.4 Ah



158-1634C – K2 LITHIUM – 51.2 Ah

Battery Quick Disconnects

Red - 158-1407

Blue - 158-1408

## ProNautic® Charger and Accessories



164-8471 -

EXTERNAL BATTERY CHARGER ASSEMBLY – 115V

164-8471 E

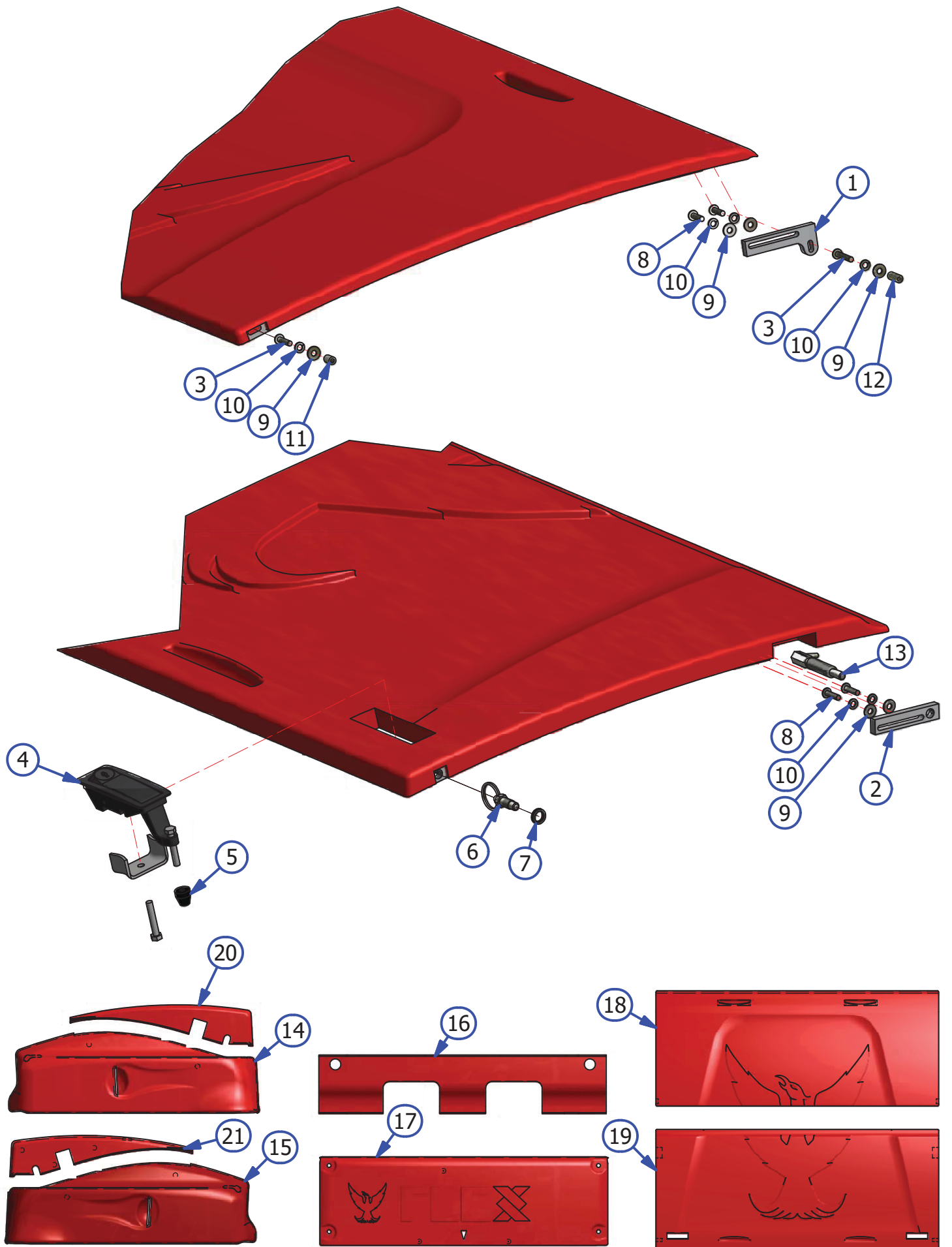
EXTERNAL BATTERY CHARGER ASSEMBLY – 230v

DC Power Cord Assembly – 6FT External – 164-8475

# LID AND COVER ASSEMBLY - FLEX

REV. 8/18

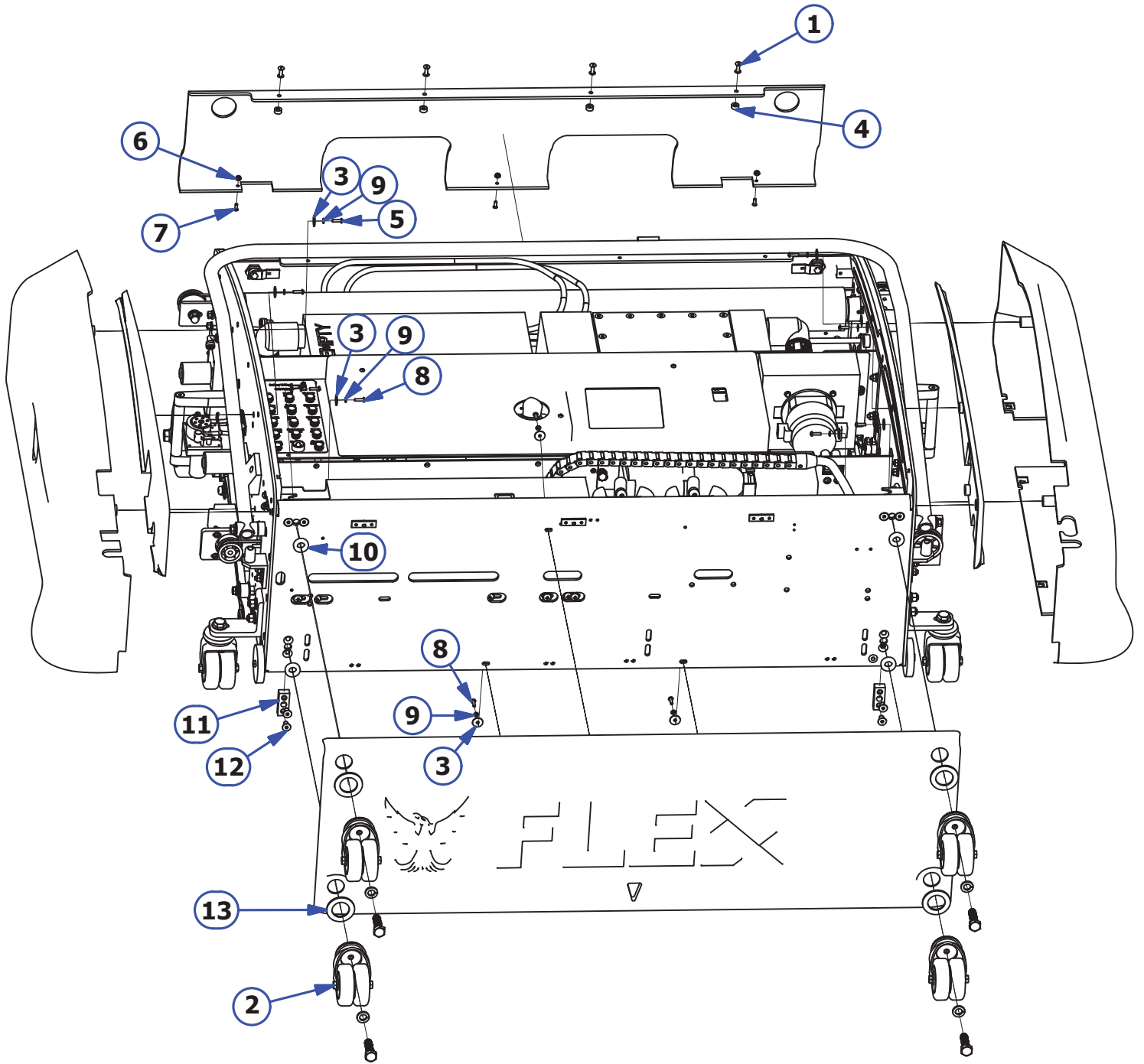
<u>INDEX</u>				
<u>NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	164-6234	SLIDING LID MOUNT (CLEANING LID)	EA
2	2	164-6233	SLIDING LID MOUNT (CONDITIONING LID)	EA
3	4	164-2072	SHCS 8-32 X 3/4 THREAD LOCKING PATCH	EA
4	2	153-2232L	FLUSH MOUNT LID LATCH (WITH LOCK)	EA
5	2	164-6164	LID LATCH BUMPER	EA
6	2	164-2002	DETENT - SPRING PLUNGER	EA
7	2	164-2041	SHIM FOR SCREW SHOULDER	EA
8	8	153-2086	MS PHILLIPS 8-32 X 5/8	EA
9	12	153-2002	FLAT WASHER #8	EA
10	12	153-2013	LOCK WASHER #10	EA
11	2	164-2044	STANDOFF FEMALE THREADED 8-32 X 3/8	EA
12	2	164-2071	STANDOFF FEMALE THREADED	EA
13	2	164-2069	SPRING PLUNGER THREADED	EA
14	1	164-8234	FLEX LT SIDE GUARD - WHITE	EA
	1	164-8234-1525	FLEX LT SIDE GUARD - BLUE	EA
	1	164-8234-2850	FLEX LT SIDE GUARD - BLACK	EA
	1	164-8234-2911	FLEX LT SIDE GUARD - RED	EA
15	1	164-8235	FLEX RT SIDE GUARD - WHITE	EA
	1	164-8235-1525	FLEX RT SIDE GUARD - BLUE	EA
	1	164-8235-2850	FLEX RT SIDE GUARD - BLACK	EA
	1	164-8235-2911	FLEX RT SIDE GUARD - RED	EA
16	1	164-8236	FRONT BUMPER - WHITE	EA
	1	164-8236-1525A	FRONT BUMPER - BLUE	EA
	1	164-8236-2850A	FRONT BUMPER - BLACK	EA
	1	164-8236-2911A	FRONT BUMPER - RED	EA
17	1	164-8049	FLEX BACK PANEL - WHITE	EA
	1	164-8049-1525	FLEX BACK PANEL - BLUE	EA
	1	164-8049-2850	FLEX BACK PANEL - BLACK	EA
	1	164-8049-2911	FLEX BACK PANEL - RED	EA
18	1	164-8230	SLIDING CLEANER COMPARTMENT LID - WHITE	EA
	1	164-8231-2850	SLIDING CLEANER COMPARTMENT LID - BLACK	EA
	1	164-8230-2911	SLIDING CLEANER COMPARTMENT LID - RED	EA
	1	164-8230-1525	SLIDING CLEANER COMPARTMENT LID - BLUE	EA
19	1	164-8231	SLIDING LID ASSEMBLY - WHITE	EA
	1	164-8231-2850	SLIDING LID ASSEMBLY - BLACK	EA
	1	164-8231-2911	SLIDING LID ASSEMBLY - RED	EA
	1	164-8231-1525	SLIDING LID ASSEMBLY - BLUE	EA
21	1	164-6733	LEFT SIDE GUARD FLEX UPPER - WHITE	EA
	1	164-6733-2850	LEFT SIDE GUARD FLEX UPPER - BLACK	EA
	1	164-6733-2911	LEFT SIDE GUARD FLEX UPPER - RED	EA
	1	164-6733-1525	LEFT SIDE GUARD FLEX UPPER - BLUE	EA
22	1	164-6732	RIGHT SIDE GUARD FLEX UPPER - WHITE	EA
	1	164-6732-2850	RIGHT SIDE GUARD FLEX UPPER - BLACK	EA
	1	164-6732-2911	RIGHT SIDE GUARD FLEX UPPER - RED	EA
	1	164-6732-1525	RIGHT SIDE GUARD FLEX UPPER - BLUE	EA



# PANEL EXPLOSION - FLEX

REV. 9/17

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	4	164-2066	BINDING POST	EA
2	4	164-8814	TRANSPORT CASTER ASSEMBLY - COMPLETE	EA
	4	153-0001BK	TRANSPORT CASTER - CASTER ONLY	EA
	4	153-2017	1/2 LOCKWASHER	EA
	4	164-2039	HHCS 1/2-13 X 1 3/4 GRADE 5	EA
3	11	153-2953	FENDER WASHER - #8	EA
4	4	164-2038	RUBBER BUMPER SBR	EA
5	4	153-2087	MS PHILLIPS - 8-32 X 3/4	EA
6	3	164-2051	THIN HEX LOCKNUT - 8-32	EA
7	3	153-2817	FHMS-8-32 X 1/2	EA
8	7	153-2086	MS PHILLIPS - 8-32 X 5/8	EA
9	11	153-2013	#10 LOCKWASHER	EA
10	4	164-2084	WASHER - OVERSIZED 1/2"	EA
11	4	164-6252	TRANSPORT CASTER MOUNT	EA
12	8	153-2802	FHSS - 5/16-18 X 5/8"	EA
13	4	164-2080	FELT WASHER (BLACK)	EA

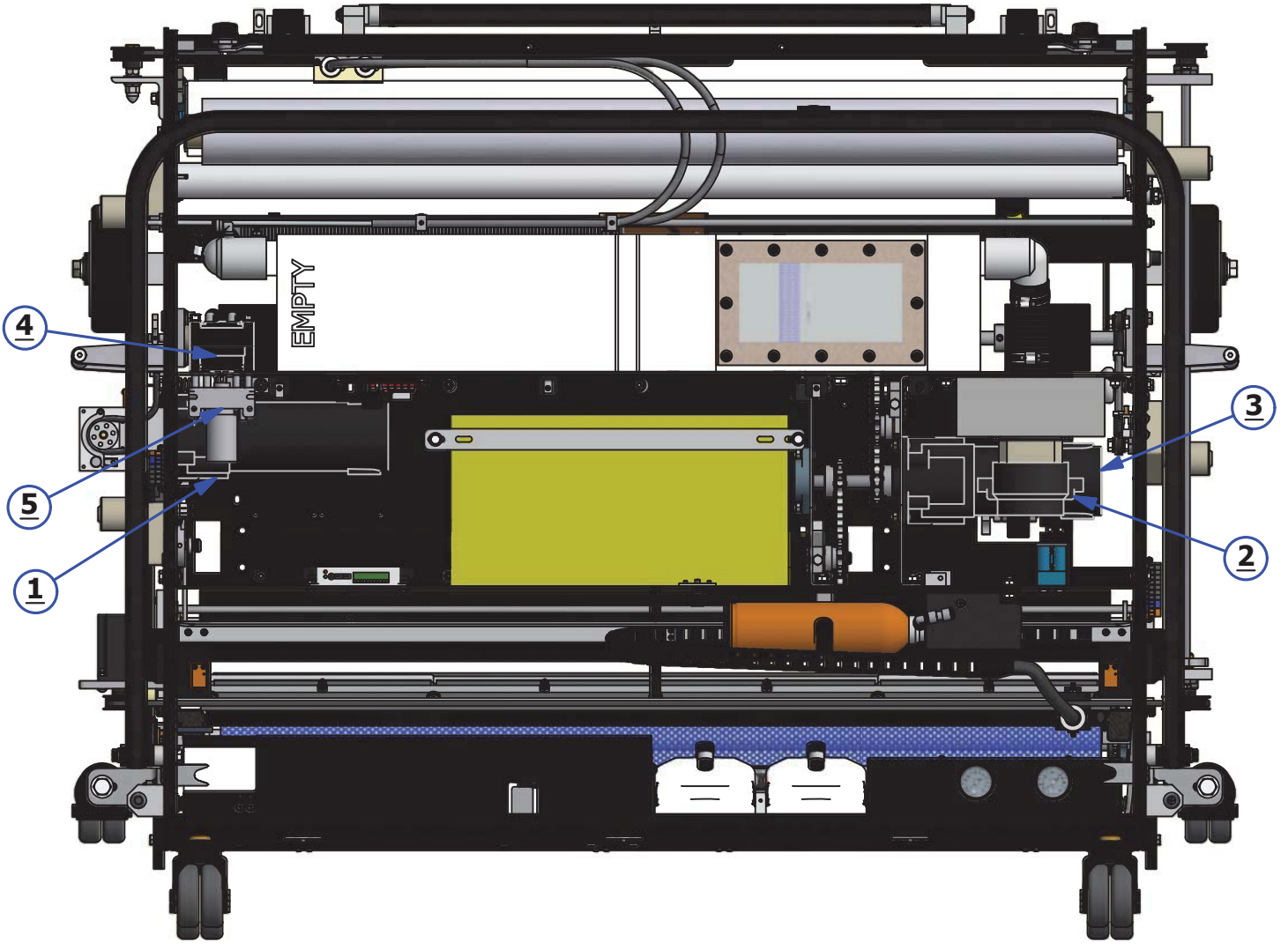


# TOP VIEW - FLEX

REV. 1/17

<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
<b>1</b>	1	158-8414	BUFFER MOTOR - 24VDC - 500RPM - STANDARD	EA
	1	158-1406B	BUFFER MOTOR BRUSHES (PAIR)	PR
	1	164-9016	BUFFER BELT STANDARD	EA
	1	158-9401	PULLEY (14 TOOTH 1/2" BORE)	EA
<b>1</b>	1	164-8014	BUFFER MOTOR - 24VDC - 700RPM - VARIABLE BUFFER	EA
	1	158-1405B	BUFFER MOTOR BRUSHES (PAIR)	PR
	1	164-9017	BUFFER MOTOR BELT VARIABLE	EA
	1	164-9014A	BUFFER MOTOR PULLEY ASSEMBLY	EA
<b>2</b>	1	164-8217	MAIN DRIVE MOTOR 24V	EA
	1	158-1405B	DRIVE MOTOR BRUSHES (PAIR)	PR
	1	154-9601	CHAIN (FOR 153-9002 SPROCKET)	EA
	1	153-9047	MASTER LINK #40	EA
	1	153-9048	OFFSET LINK #40	EA
	1	153-9002	SPROCKET - 40B13 (5/8 IN)	EA
<b>3</b>	1	158-8407	VACUUM MOTOR - 24VDC	EA
<b>4</b>	1	158-8404D	CLEANER PUMP ASSEMBLY	EA
	1	154-0861B	NORPRENE TUBING FOR CLEANER PUMP ASSEMBLY	EA
<b>5</b>	1	158-8404	CLEANER PUMP MOTOR - 24VDC	EA





4

3

5

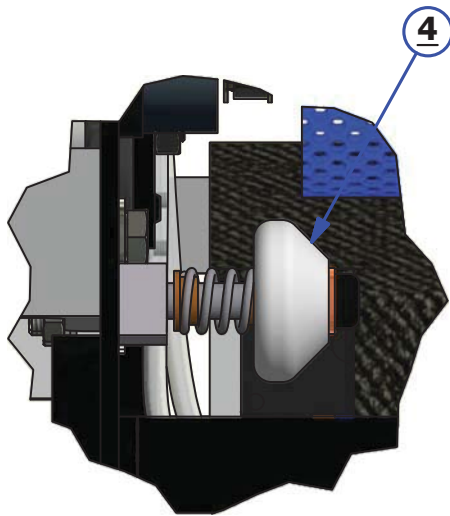
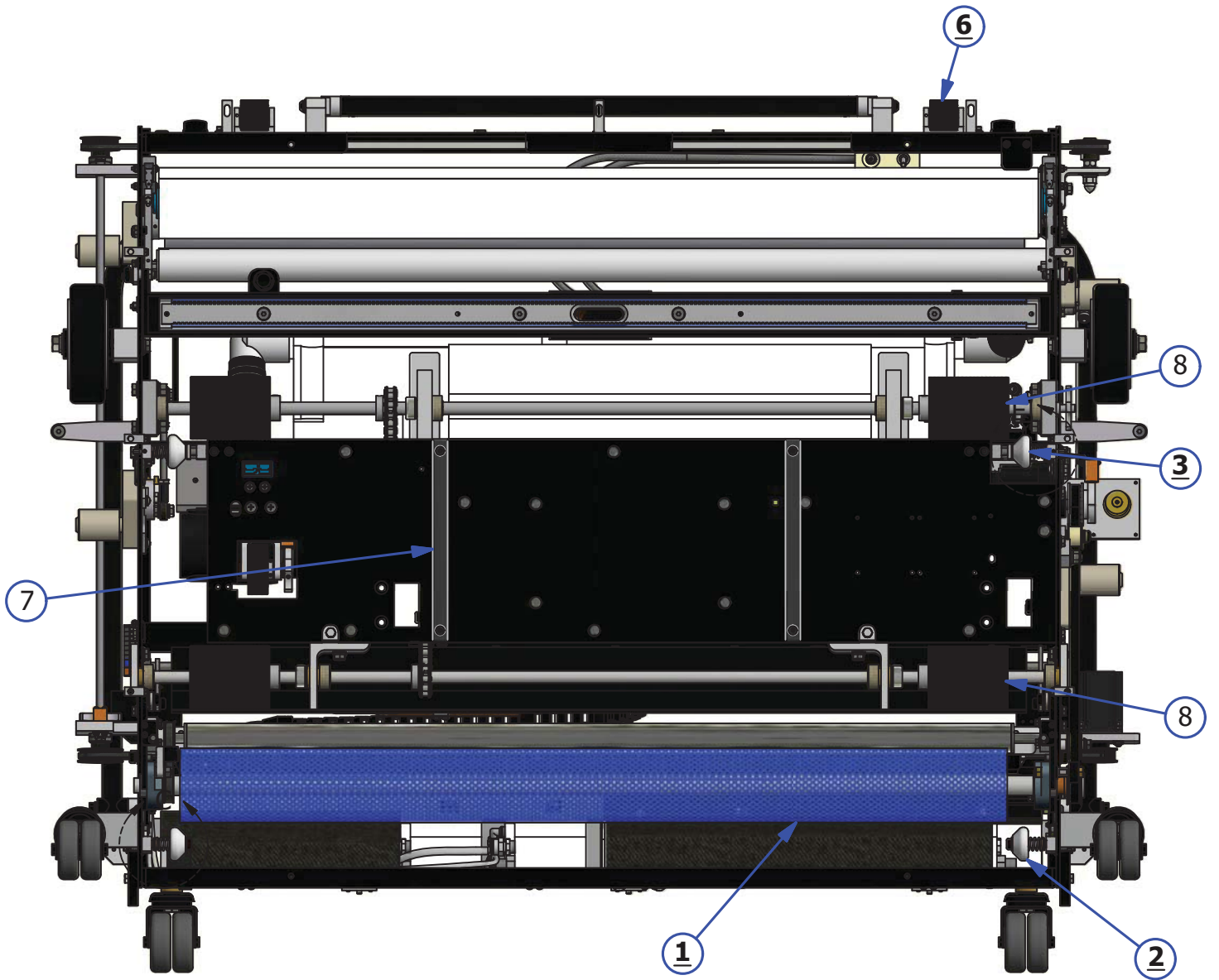
2

1

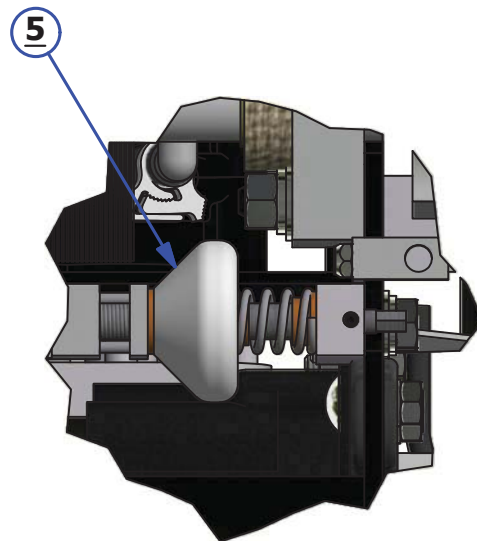
# BOTTOM - FLEX

REV. 9/17

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8001A	BUFFER BRUSH ASSEMBLY	EA
	1	164-9016	BUFFER BELT ASSEMBLY - NON-VARIABLE	EA
	1	164-9017	BUFFER BELT ASSEMBLY - VARIABLE BUFF	EA
2	2	164-8815	REAR GUIDE WHEEL ASSEMBLY - COMPLETE <i>THE BELOW ATTACHED PARTS ARE NOT SHOWN</i>	EA
	2	153-2407	SHOULDER BOLT 3/8 X 1 3/4	EA
	2	153-2978	SPRING - COMPRESSION FOR GUIDE WHEEL	EA
	2	164-8816	GUIDE WHEEL ASSEMBLY - REAR	EA
3	2	158-8643	FRONT GUIDE WHEEL ASSEMBLY - COMPLETE <i>THE BELOW ATTACHED PARTS ARE NOT SHOWN</i>	EA
	2	153-9803	FLANGED BUSHING - 3/8 X 1/2 X 3/4	EA
	2	153-2978	SPRING - COMPRESSION FOR GUIDE WHEEL	EA
	2	158-8637	GUIDE WHEEL ASSEMBLY - FRONT	EA
4	2	158-8636	GUIDE WHEEL ASSEMBLY - REAR (WHEEL ONLY)	EA
5	2	158-8637	GUIDE WHEEL ASSEMBLY - FRONT (WHEEL ONLY)	EA
6	2	153-7005R	MOMENTARY WHEEL ASSEMBLY (WHEEL ONLY)	EA
	2	153-6006	MOMENTARY WHEEL SHAFT	EA
	2	153-6029	MOMENTARY WHEEL HOUSING ASSEMBLY	EA
7		153-9803	SKID GUIDE	EA
8	4	153-7013	DRIVE WHEEL ASSEMBLY	EA



DETAIL A

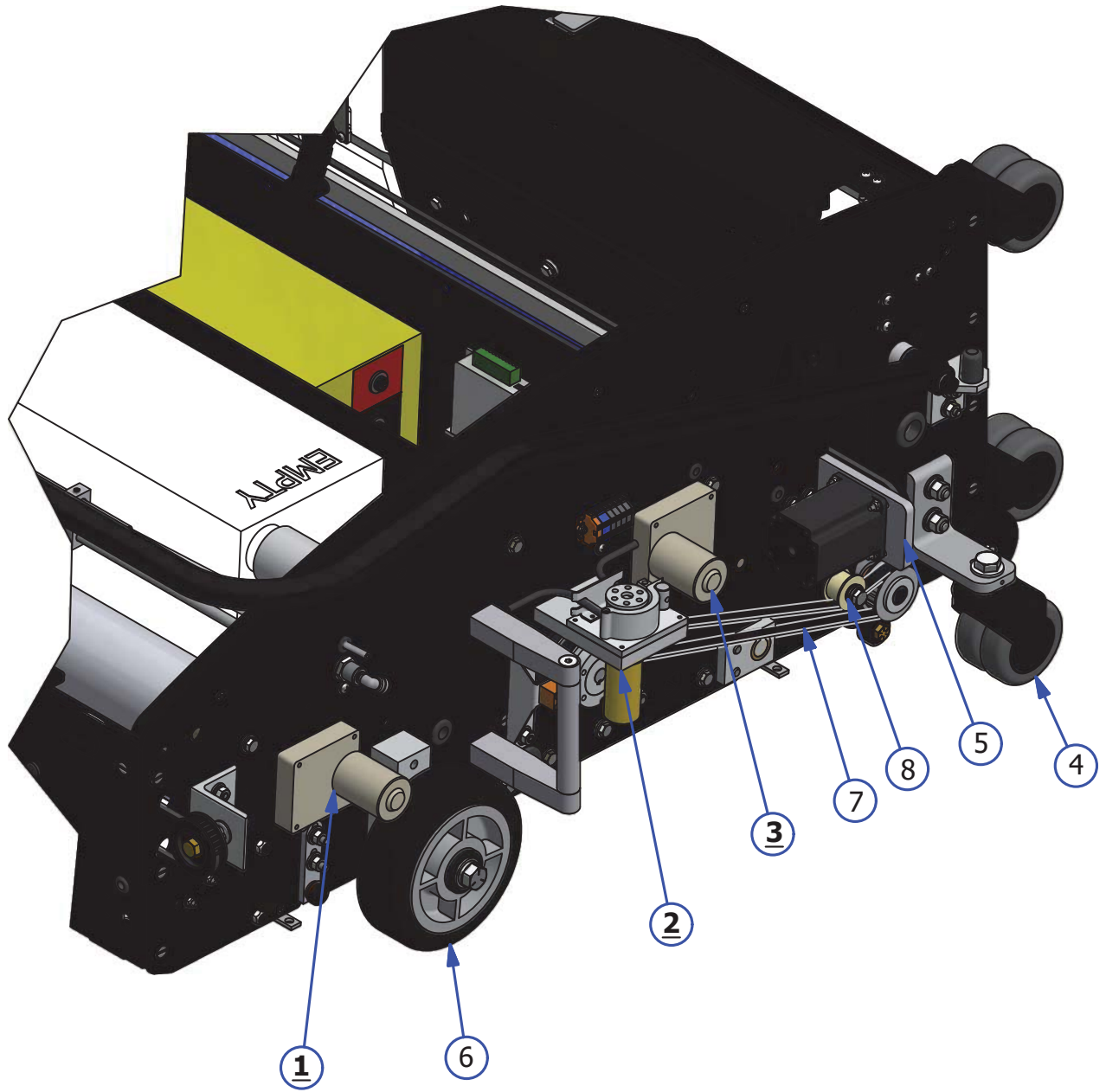


DETAIL B

# LEFT SIDE - FLEX

9/17

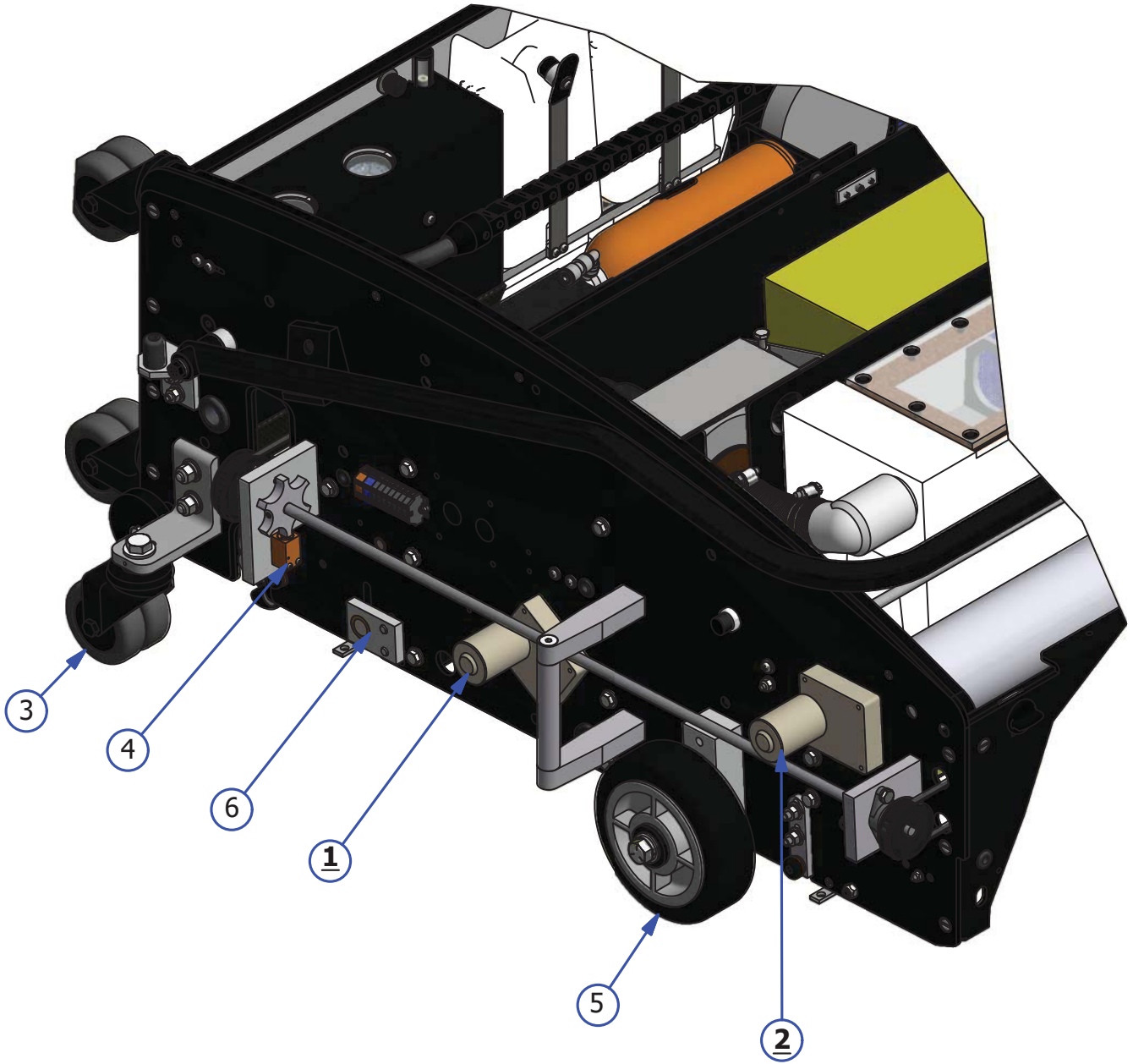
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	158-8403	ASSEMBLY - DUSTER MOTOR 24VDC	EA
2	1	164-8027	CLEANER PUMP ASSEMBLY - CONCENTRATE (UPGRADE ONLY)	EA
		164-8025	CLEANER TUBING #14 FOR SUPER CONCENTRATE	EA
		164-8026	CLEANER TUBING #16 FOR REG CONCENTRATE	EA
3	1	158-8402	BUFFER LOWERING MOTOR	EA
4	2	164-0022	CASTER ASSEMBLY (3 INCH DUAL WHEEL)- BLACK	EA
5	1	164-8032	HEAD DRIVE MOTOR ASSEMBLY	EA
6	2	158-7002	6" WHEEL ASSEMBLY	EA
7	1	164-9016	BUFFER BELT ASSEMBLY - STANDARD	EA
	1	164-9017	BUFFER BELT ASSEMBLY - VARIABLE BUFF UPGRADE	EA
8	1	153-8039	BUFFER IDLER PULLEY	EA



# RIGHT SIDE - FLEX

REV. 9/17

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	158-8402	SQUEEGEE / BRUSH LIFT MOTOR - 24VDC	EA
2	2	158-8403	DUSTER MOTOR ASSEMBLY - 24VDC	EA
3	2	164-0022	CASTER ASSEMBLY (3 INCH DUAL WHEEL)- BLACK	EA
4	1	154-1220	PROXIMITY SENSOR	EA
5	2	153-7002	6" WHEEL ASSEMBLY	EA
6	2	164-8216	REAR DRIVE SHAFT BLOCK	EA

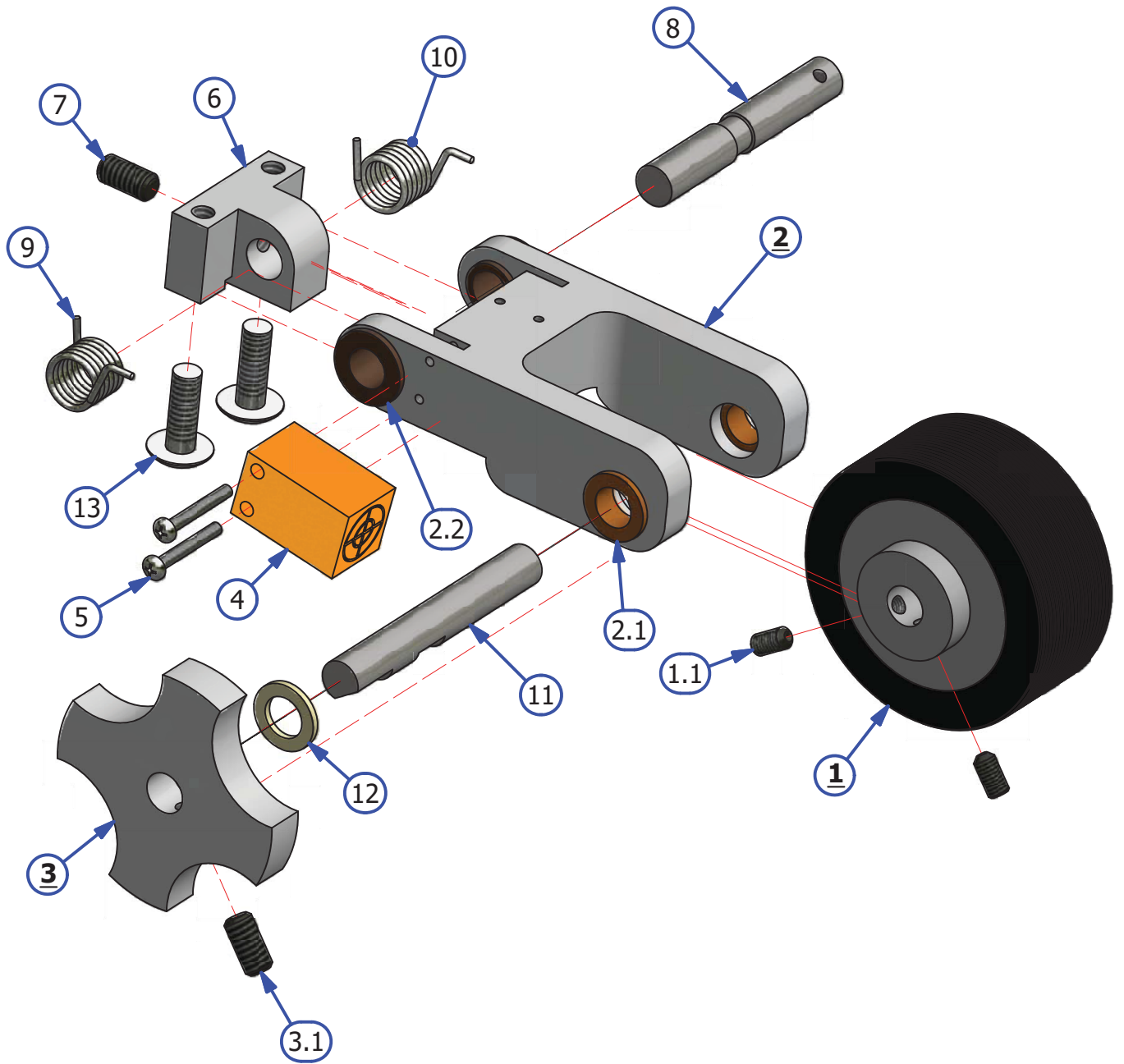


# LDS ASSEMBLY - FLEX

REV. 9/17

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-7001A	LDS WHEEL ASSEMBLY	
1.1	2	153-2201	SET SCREW - 10-32 X 3/8	EA
2	1	164-8052	LDS ARM ASSEMBLY	EA
2.1	2	153-9803	FLANGED BUSHING (3/8 X 1/2 X 1/4)	EA
2.2	2	153-9402	FLANGED BUSHING (3/8 x 1/2 x 1/2)	EA
3	1	164-6131A	FLEX LDS DISK	EA
3.1	1	153-2051	SET SCREW - 1/4-20 X 1/2	EA
4	1	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MC1)	EA
5	2	153-2216A	MS PHILLIPS - 4-40 X 7/8	EA
6	1	164-6128	LDS ARM MOUNT	EA
7	1	153-2051	SET SCREW - 1/4-20 X 1/2	EA
8	1	164-6129	LDS ARM SHAFT	EA
9	1	153-2944	TORSION SPRING - RH	EA
10	1	153-2945	TORSION SPRING - LH	EA
11	1	164-6130	LDS WHEEL SHAFT	EA
12	1	153-2009	NYLON FLAT WASHER (3/8 - 0.060)	EA
13	2	153-2052A	MS PHILLIPS - 1/4-20 X 3/4 TRUSS HEAD	EA

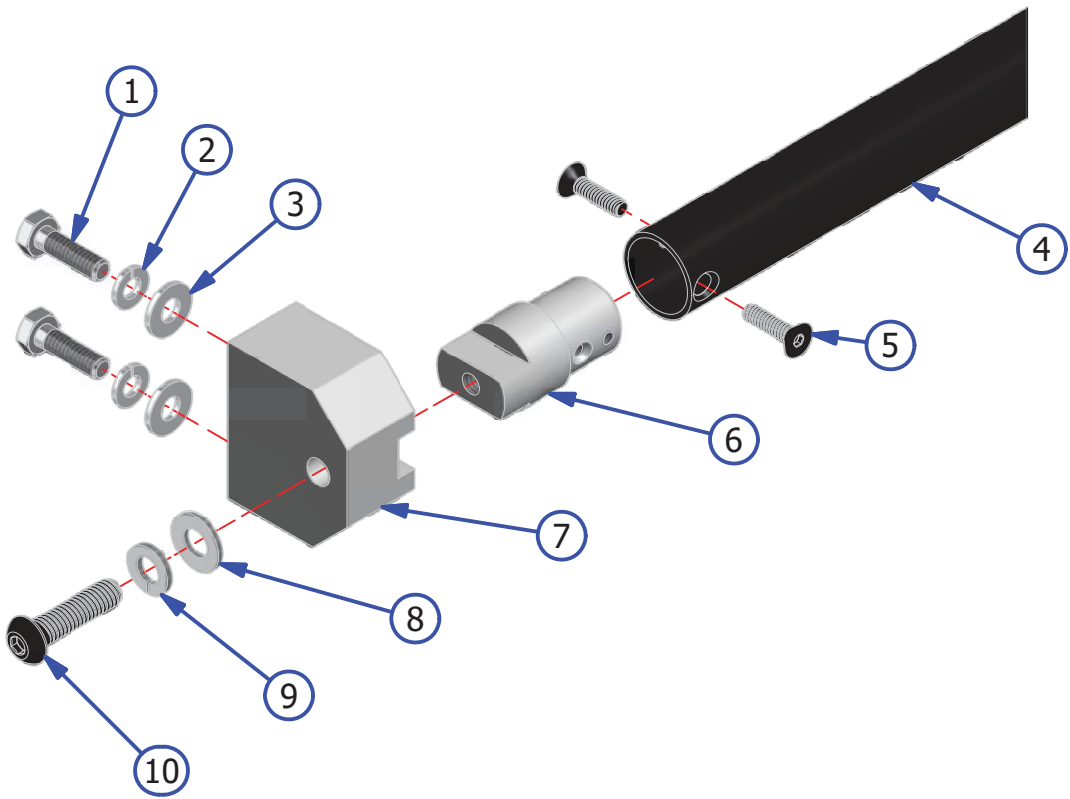




# FRONT HANDLE ASSEMBLY - FLEX

REV. 3/16

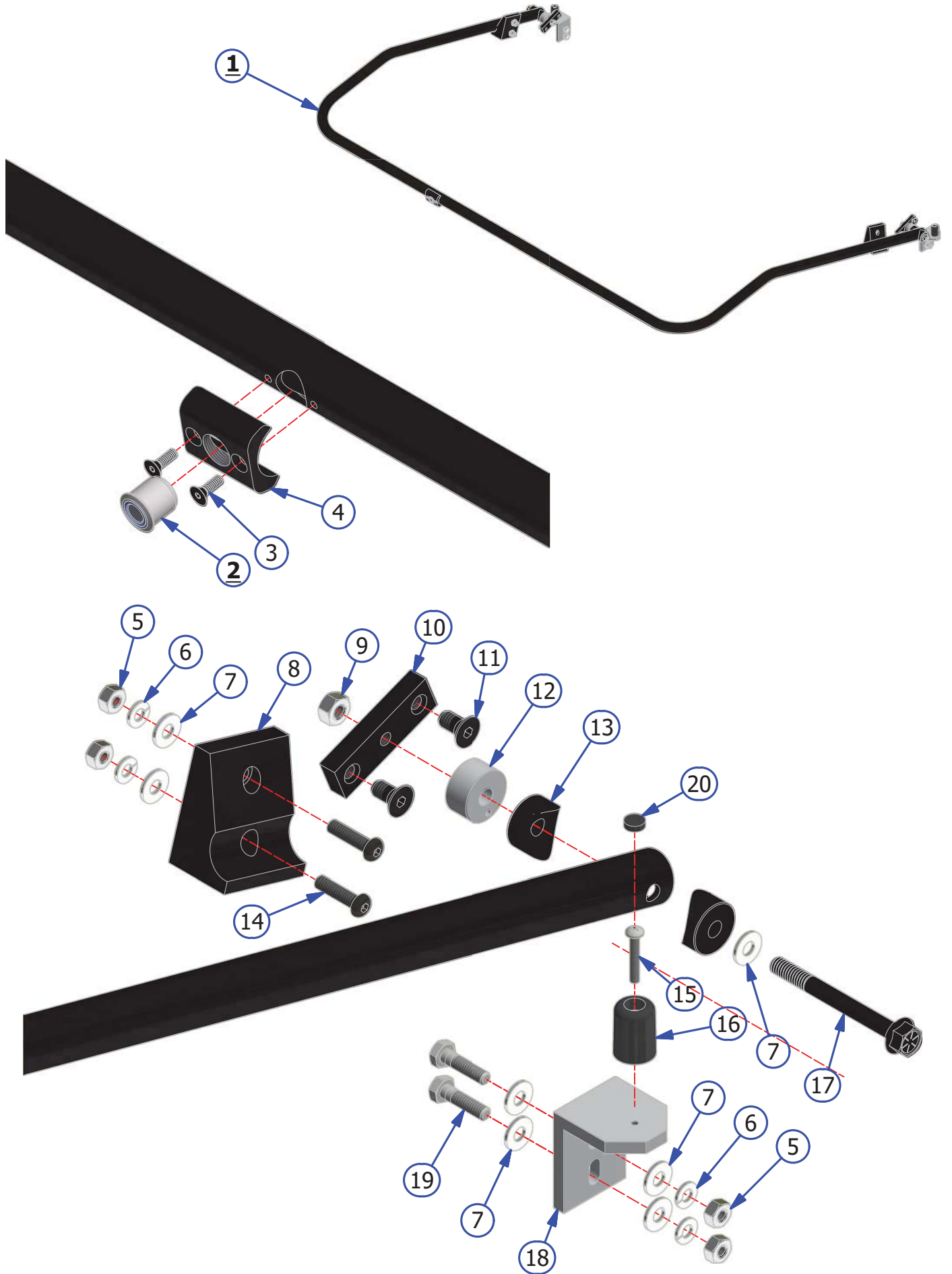
<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	4	153-2052	HHCS - 1/4-20 X 7/8	EA
2	4	153-2014	1/4 LOCKWASHER	EA
3	4	153-2004	1/4 FLATWASHER	EA
4	1	164-8073F	FRONT HANDLE - COMPLETE ASSY	EA
5	4	153-2996	SCREW - FHCS 10-24 X 3/4 BLACK OXIDE	EA
6	2	164-6072	FRONT HANDLE PLUG	EA
7	2	164-6087	FRONT HANDLE BRACKET	EA
8	2	153-2005	5/16 FLATWASHER	EA
9	2	153-2015	5/16 LOCKWASHER	EA
10	2	164-2045	BHSCS 5/16-18 X 1-1/4	EA



# HANDLE ASSEMBLY - FLEX

REV. 9/17

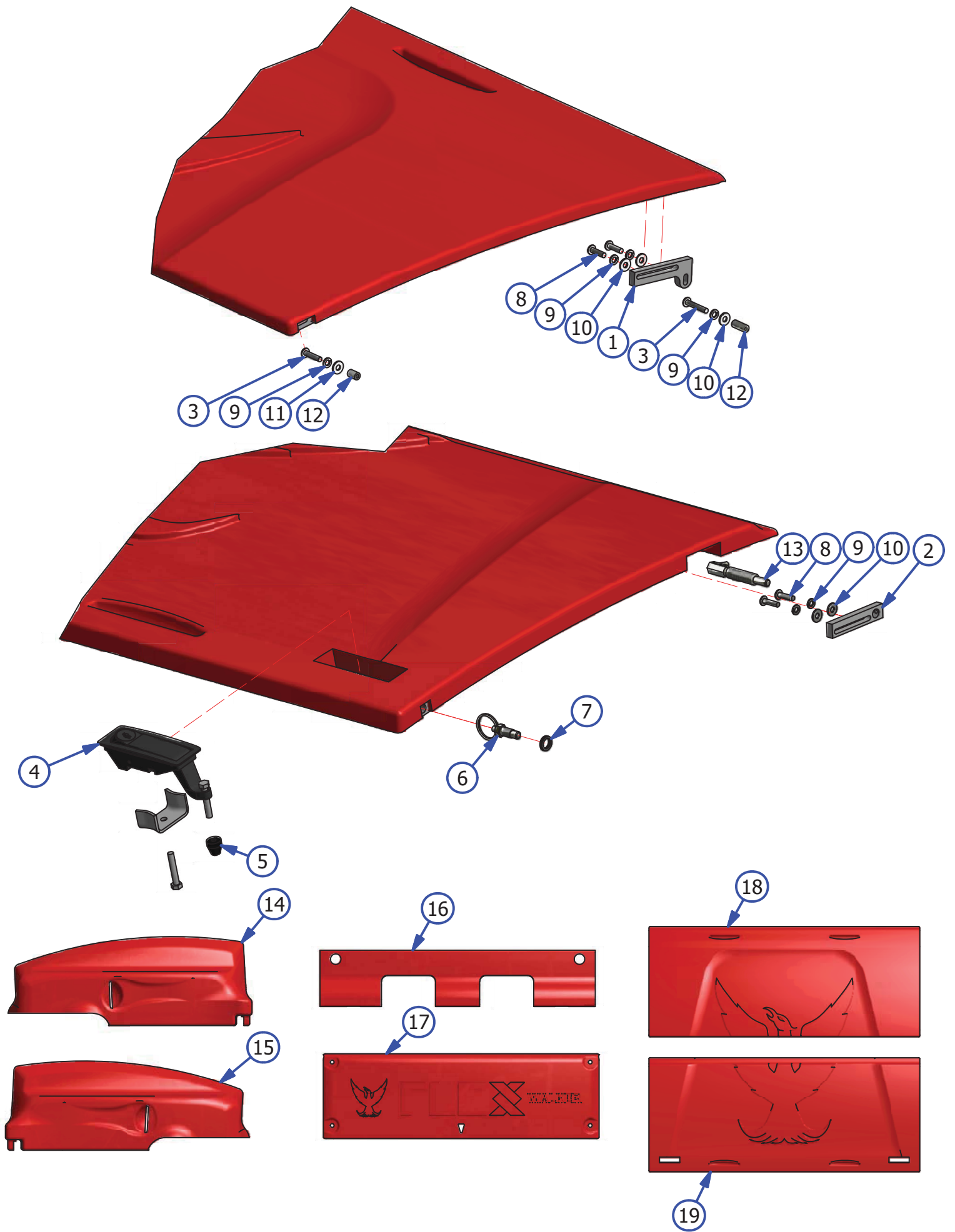
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8012	HANDLE ASSEMBLY (COMPLETE)	EA
2	1	164-8013	HANDLE BUTTON REPLACEMENT ASSEMBLY (W/WIRES)	EA
3	2	158-2003	SCREW 8-32 X 1/2 FHCS BLK OXIDE	EA
4	1	164-6083	BUTTON COLLAR	EA
5	8	153-2023	1/4-20 HEX NUT	EA
6	8	153-2014	1/4 LOCKWASHER	EA
7	14	153-2004	1/4 FLATWASHER	EA
8	2	164-6057	HANDLE CATCH	EA
9	2	153-2116	NYLOCK - 5/16-18	EA
10	2	164-6084	FLEX HANDLE MOUNT	EA
11	4	153-2802	FHSS - 5/16-18 X 5/8	EA
12	2	164-6058	FLEX HANDLE SPACER	EA
13	4	164-2001	UNTHREADED CURVED SPACER BLACK	EA
14	4	153-2053A	BHSS - 1/4-20 X 1	EA
15	2	153-2089	MS PHILLIPS - 8-32 X 1	EA
16	2	164-8213	RUBBER BUMPER-3/4 DIA X 1 HIGH	EA
17	2	164-2028	HHSCS 5/16-18 X 3 PARTIAL THREAD	EA
18	2	164-6081	FLEX HANDLE BUMPER MT	EA
19	4	153-2053	HHCS - 1/4-20 X 1	EA
20	2	164-6946	POLYURETHANE BUMPER PLUG	EA
21	1	164-8006	HANDLE GRIP - 12 INCH	EA



# LID AND COVER ASSEMBLY - FLEX WALKER

REV. 3/16

<u>INDEX</u>				
<u>NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	164-6234	SLIDING LID MOUNT (CLEANING LID)	EA
2	2	164-6233	SLIDING LID MOUNT (CONDITIONING LID)	EA
3	4	164-2072	SHCS 8-32 X 3/4 THREAD LOCKING PATCH	EA
4	2	153-2232L	FLUSH MOUNT LID LATCH (WITH LOCK)	EA
5	2	164-6164	LID LATCH BUMPER	EA
6	2	164-2002	DETENT - SPRING PLUNGER	EA
7	2	164-2041	SHIM FOR SCREW SHOULDER	EA
8	8	153-2086	MS PHILLIPS 8-32 X 5/8	EA
9	12	153-2002	FLAT WASHER #8	EA
10	12	153-2013	LOCK WASHER #10	EA
11	2	164-2044	STANDOFF FEMALE THREADED 8-32 X 3/8	EA
12	2	164-2071	STANDOFF FEMALE THREADED	EA
13	2	164-2069	SPRING PLUNGER THREADED	EA
14	1	164-8232	FLEX WALKER LT SIDE GUARD - WHITE	EA
	1	164-8232-1525	FLEX WALKER LT SIDE GUARD - BLUE	EA
	1	164-8232-2850	FLEX WALKER LT SIDE GUARD - BLACK	EA
	1	164-8232-2911	FLEX WALKER LT SIDE GUARD - RED	EA
15	1	164-8233	FLEX WALKER RT SIDE GUARD - WHITE	EA
	1	164-8233-1525	FLEX WALKER RT SIDE GUARD - BLUE	EA
	1	164-8233-2850	FLEX WALKER RT SIDE GUARD - BLACK	EA
	1	164-8233-2911	FLEX WALKER RT SIDE GUARD - RED	EA
16	1	164-8236	FRONT BUMPER - WHITE	EA
	1	164-8236-1525A	FRONT BUMPER - BLUE	EA
	1	164-8236-2850A	FRONT BUMPER - BLACK	EA
	1	164-8236-2911A	FRONT BUMPER - RED	EA
17	1	164-8049	FLEX BACK PANEL - WHITE	EA
	1	164-8049-1525	FLEX BACK PANEL - BLUE	EA
	1	164-8049-2850	FLEX BACK PANEL - BLACK	EA
	1	164-8049-2911	FLEX BACK PANEL - RED	EA
18	1	164-8230	SLIDING CLEANER COMPARTMENT LID - WHITE	EA
	1	164-8231-2850	SLIDING CLEANER COMPARTMENT LID - BLACK	EA
	1	164-8230-2911	SLIDING CLEANER COMPARTMENT LID - RED	EA
	1	164-8230-1525	SLIDING CLEANER COMPARTMENT LID - BLUE	EA
19	1	164-8231	SLIDING LID ASSEMBLY - WHITE	EA
	1	164-8231-2850	SLIDING LID ASSEMBLY - BLACK	EA
	1	164-8231-2911	SLIDING LID ASSEMBLY - RED	EA

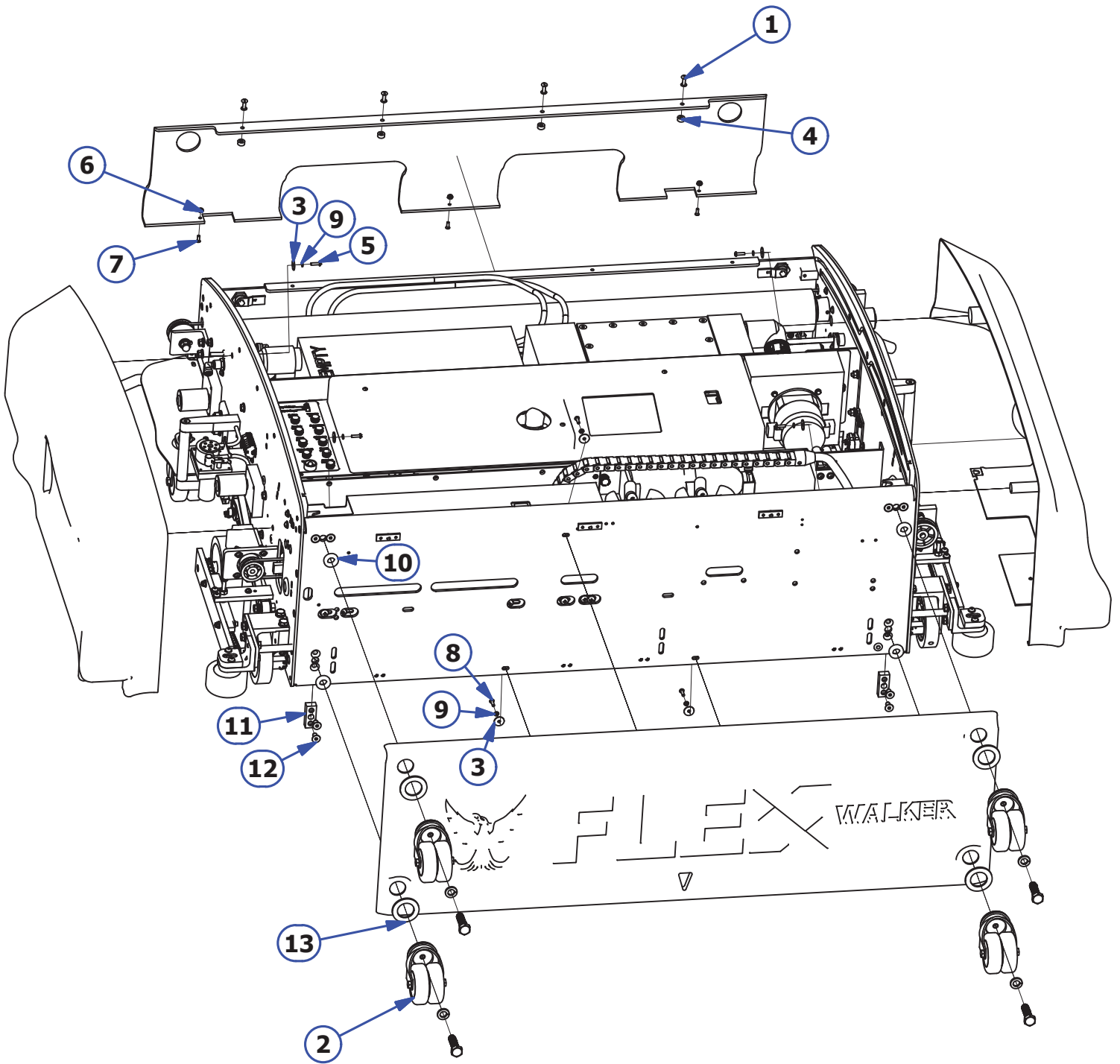


# PANEL EXPLOSION - FLEX WALKER

REV. 9/17

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	4	164-2066	BINDING POST	EA
2	4	164-8814	TRANSPORT CASTER ASSEMBLY - COMPLETE	EA
	4	153-0001BK	TRANSPORT CASTER - CASTER ONLY	EA
	4	153-2017	1/2 LOCKWASHER	EA
	4	164-2039	HHCS 1/2-13 X 1 3/4 GRADE 5	EA
3	9	153-2953	FENDER WASHER - #8	EA
4	4	164-2038	RUBBER BUMPER SBR	EA
5	4	153-2087	MS PHILLIPS - 8-32 X 3/4	EA
6	3	164-2051	THIN HEX LOCKNUT - 8-32	EA
7	3	153-2817	FHMS-8-32 X 1/2	EA
8	7	153-2086	MS PHILLIPS - 8-32 X 5/8	EA
9	11	153-2013	#10 LOCKWASHER	EA
10	4	164-2084	WASHER - OVERSIZED 1/2"	EA
11	4	164-6252	TRANSPORT CASTER MOUNT	EA
12	8	153-2802	FHSS - 5/16-18 X 5/8"	EA
13	4	164-2080	FELT WASHER (BLACK)	EA

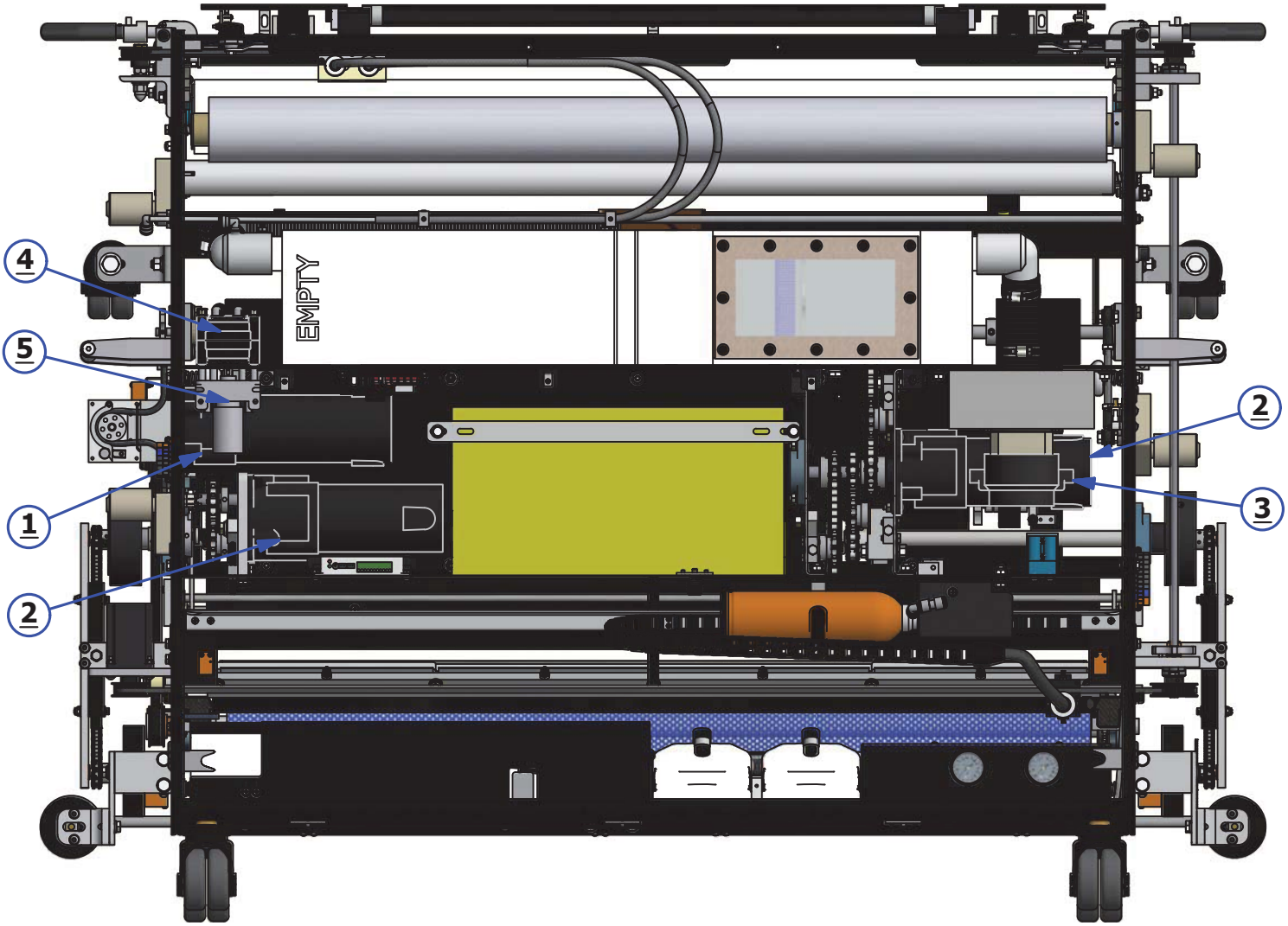




# TOP VIEW - FLEX WALKER

REV. 1/18

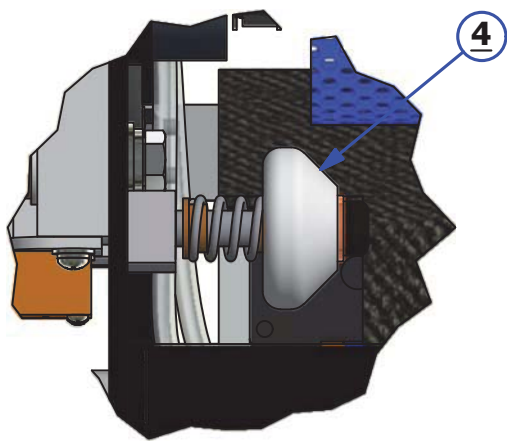
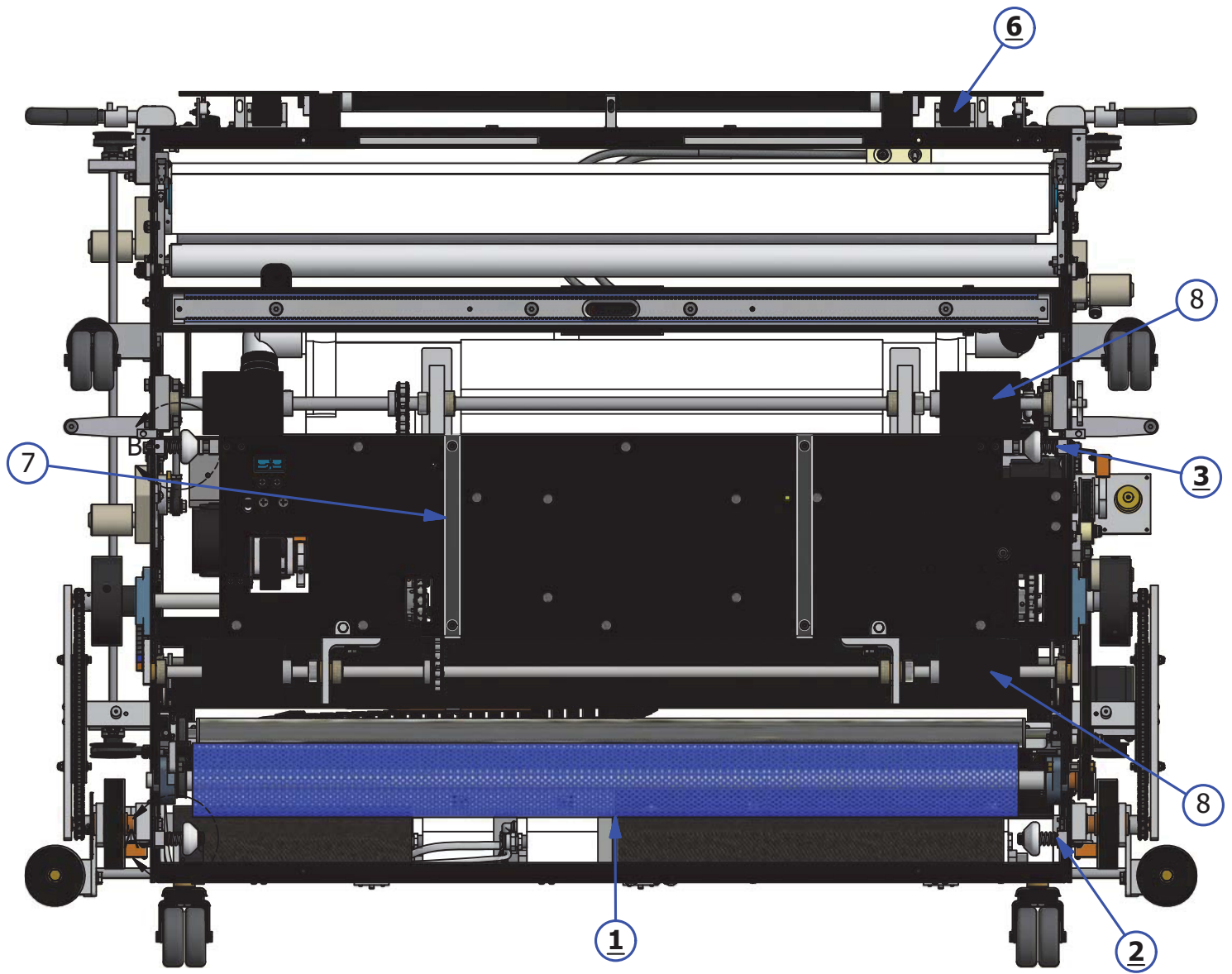
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	158-8414	BUFFER MOTOR - 24VDC - 500RPM - STANDARD	EA
	1	158-1406B	BUFFER MOTOR BRUSHES (PAIR)	PR
	1	164-9016	BUFFER BELT	EA
	1	158-9401	PULLEY (14 TOOTH 1/2" BORE)	EA
1	1	164-8014	BUFFER MOTOR - 24VDC - 700RPM - VARIABLE BUFFER	EA
	1	158-1405B	BUFFER MOTOR BRUSHES (PAIR)	PR
	1	164-9017	BUFFER MOTOR BELT	EA
	1	164-9014A	BUFFER MOTOR PULLEY ASSEMBLY	EA
2	1	164-8217M	RIGHT MAIN DRIVE MOTOR 24V	EA
2	1	158-8602	LEFT DRIVE MOTOR 24V	EA
	1	158-1405B	DRIVE MOTOR BRUSHES (PAIR)	PR
	1	154-9601	CHAIN (FOR 153-9002, INSIDE AND OUTSIDE SPROCKET)	EA
	1	153-9444	CHAIN (FOR 153-9003, MIDDLE SPROCKET)	EA
	1	153-9047	MASTER LINK #40	EA
	1	153-9048	OFFSET LINK #40	EA
	1	153-9002	SPROCKET - 40B13 (5/8 IN) INSIDE AND OUTSIDE SPROCKET	EA
	1	153-9003	SPROCKET - 40B10 (5/8 IN) INSIDE AND OUTSIDE SPROCKET	EA
	3	1	158-8407	VACUUM MOTOR - 24VDC
4	1	158-8404D	CLEANER PUMP ASSEMBLY	EA
	1	154-0861B	NORPRENE TUBING FOR CLEANER PUMP ASSEMBLY	EA
5	1	158-8404	CLEANER PUMP MOTOR - 24VDC	EA



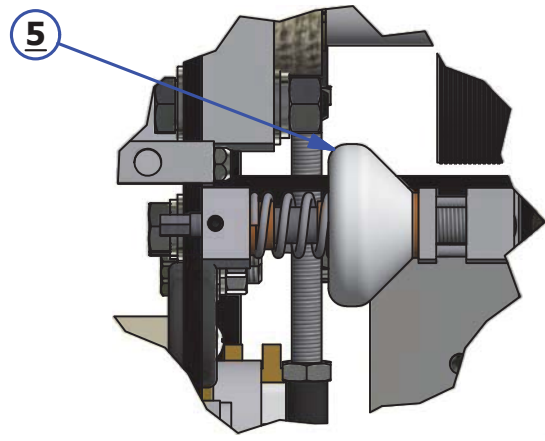
# BOTTOM - FLEX WALKER

REV. 9/17

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8001A	BUFFER BRUSH ASSEMBLY	EA
	1	164-9016	BUFFER BELT ASSEMBLY NON-VARIABLE	EA
	1	154-9617	BUFFER BELT ASSEMBLY - VARIABLE BUFF	EA
2	2	164-8815	bottom	EA
	2	153-2407	SHOULDER BOLT 3/8 X 1 3/4	EA
	2	153-2978	SPRING - COMPRESSION FOR GUIDE WHEEL	EA
	2	164-8816	GUIDE WHEEL ASSEMBLY - REAR	EA
3	2	158-8643	FRONT GUIDE WHEEL ASSEMBLY - COMPLETE	EA
3.1	2	153-9803	FLANGED BUSHING - 3/8 X 1/2 X 3/4	EA
3.2	2	153-2978	SPRING - COMPRESSION FOR GUIDE WHEEL	EA
3.3	2	158-8637	GUIDE WHEEL ASSEMBLY - REAR	EA
4	2	158-8636	GUIDE WHEEL ASSEMBLY - REAR (WHEEL ONLY)	EA
5	2	158-8637	GUIDE WHEEL ASSEMBLY - FRONT (WHEEL ONLY)	EA
6	2	153-7005R	MOMENTARY WHEEL ASSEMBLY (WHEEL ONLY)	EA
	2	153-6006	MOMENTARY WHEEL SHAFT	EA
	2	164-6053	MOMENTARY WHEEL HOUSING ASSEMBLY	EA
7	2	153-9803	SKID GUIDE	EA
8	4	153-7013	DRIVE WHEEL ASSEMBLY	EA



DETAIL A

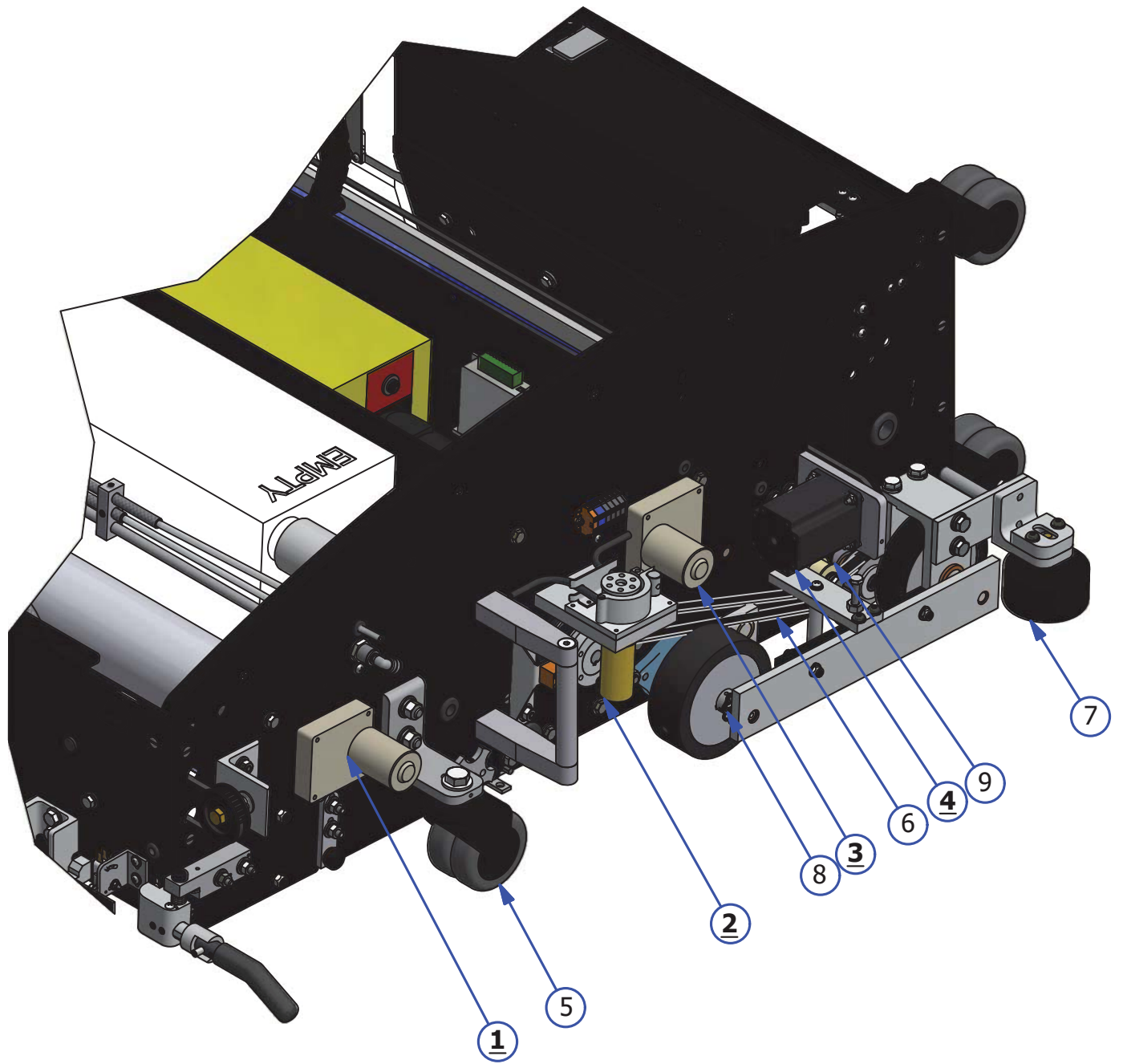


DETAIL B

# LEFT SIDE - FLEX WALKER

REV. 1/16

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	158-8403	ASSEMBLY - DUSTER MOTOR 24VDC	EA
2	1	164-8027	CLEANER PUMP ASSEMBLY - CONCENTRATE (UPGRADE ONLY)	EA
		164-8025	CLEANER TUBING #14 FOR SUPER CONCENTRATE	EA
		164-8026	CLEANER TUBING #16 FOR REG CONCENTRATE	EA
3	1	158-8402	BUFFER LOWERING MOTOR	EA
4	1	164-8032	HEAD DRIVE MOTOR ASSEMBLY	EA
5	6	153-0001BK	CASTER ASSEMBLY (3 INCH DUAL WHEEL)- BLACK	EA
6	1	164-9016	BUFFER BELT ASSEMBLY - STANDARD	EA
	1	164-9017	BUFFER BELT ASSEMBLY - VARIABLE BUFF UPGRADE	EA
7	2	153-7203	BUMPER WHEEL ASSEMBLY	EA
8	1	164-9005	#35 CHAIN ZTR KICKUP	EA
	1	153-9046	MASTER LINK #35 (NOT SHOWN)	EA
9	1	153-8039	BUFFER IDLER PULLEY	EA

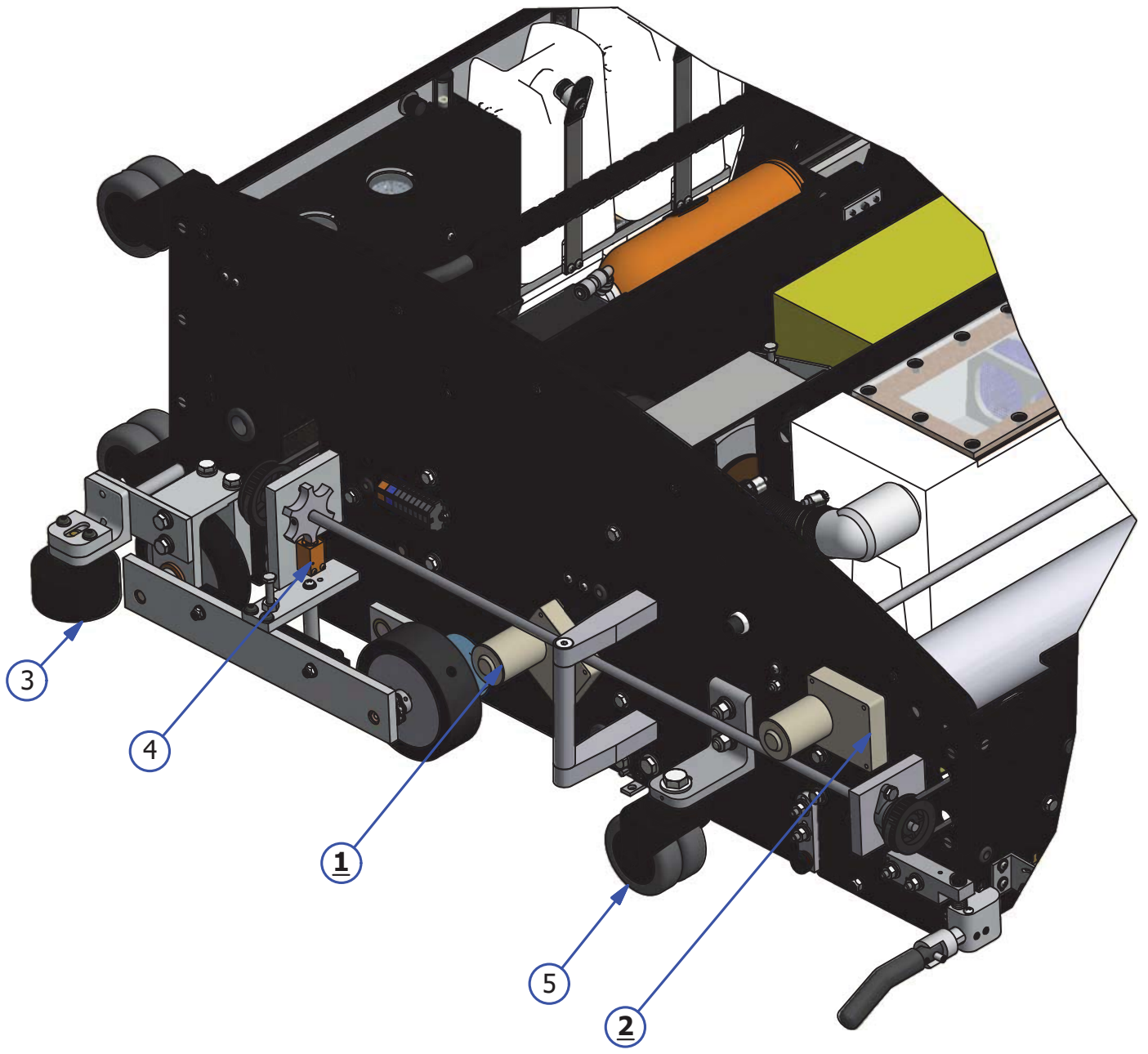


# RIGHT SIDE - FLEX WALKER

REV. 1/16

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	158-8402	SQUEEGEE/BRUSH LIFT MOTOR - 24VDC	EA
2	1	158-8403	DUSTER MOTOR ASSEMBLY - 24VDC	EA
3	1	153-7203	BUMPER WHEEL	EA
4	2	154-1220	PROXIMITY SENSOR	EA
5	6	153-0001BK	CASTER ASSEMBLY (3 INCH DUAL WHEEL)- BLACK	EA

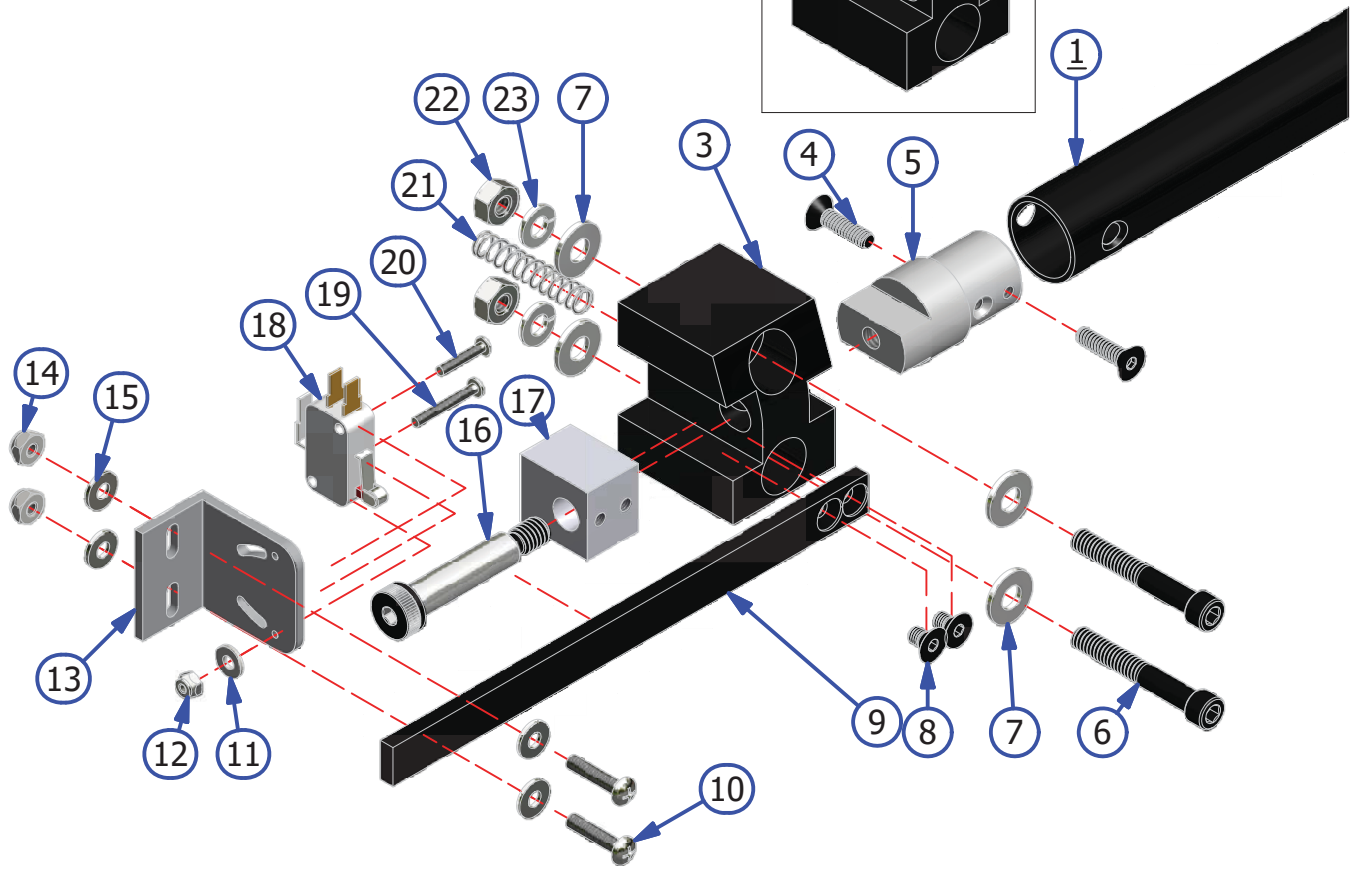
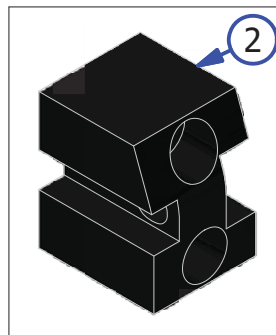




# FRONT HANDLE ASSEMBLY - FLEX WALKER

REV. 1/16

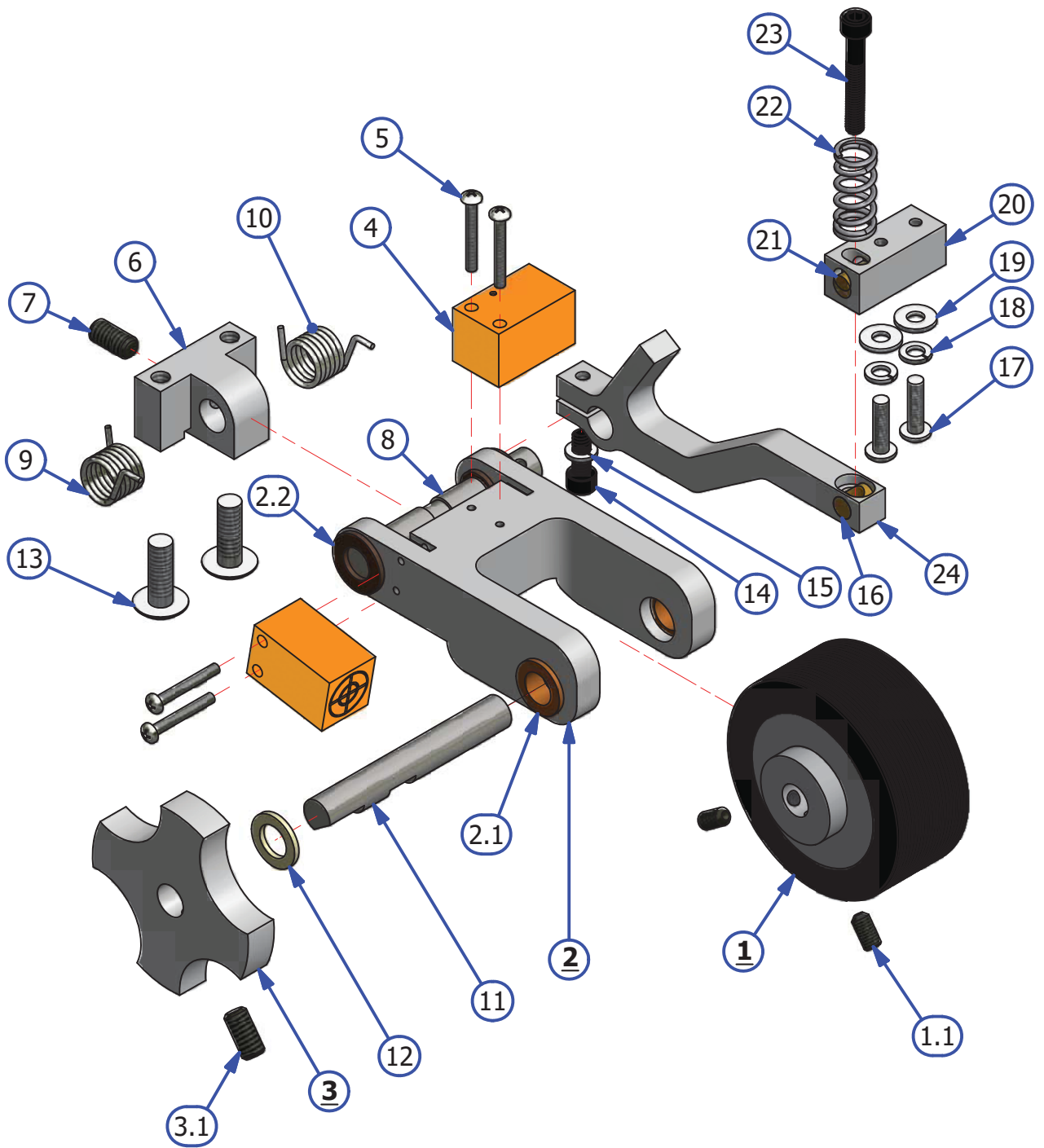
<u>INDEX</u>				
<u>NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8073	FRONT HANDLE ASSEMBLY	EA
2	1	164-6069	FLEX FRONT HANDLE BLOCK (LT)	EA
3	1	164-6068	FLEX FRONT HANDLE BLOCK (RT)	EA
4	4	153-2996	SCREW - FHCS 10-24 X 3/4 BLACK OXIDE	EA
5	2	164-6072	FRONT HANDLE PLUG	EA
6	4	164-2009	SHCS-1/4-20	EA
7	8	153-2004	1/4 FLATWASHER	EA
8	4	164-2017	FHSCS-10-32 X 5/16	EA
9	2	164-6071	BUMPER ARM	EA
10	4	153-2087	MS PHILLIPS - 8-32 X 3/4	EA
11	2	153-2001	#6 FLATWASHER	EA
12	2	153-2231	LOCKNUT - 4-40	EA
13	2	164-6032	FLEX BUMPER SWITCH BRACKET	EA
14	4	153-2019	LOCKNUT - 8-32 (NYLOK)	EA
15	8	153-2002	#8 FLATWASHER	EA
16	2	164-2008	SHOULDER BOLT 3/8 X 1-1/2 5/16-18	EA
17	2	164-6070	BUMPER BAR BLOCK	EA
18	2	153-1203	MICROSWITCH W/ROLLER	EA
19	2	153-2216A	MS PHILLIPS - 4-40 X 7/8	EA
20	2	153-2216	MS PHILLIPS - 4-40 X 5/8	EA
21	2	164-2010	SPRING-0.300 OD X 1.50	EA
22	4	153-2023	1/4-20 HEX NUT	EA
23	4	153-2014	1/4 LOCKWASHER	EA



# LDS ASSEMBLY - FLEX WALKER

REV. 9/17

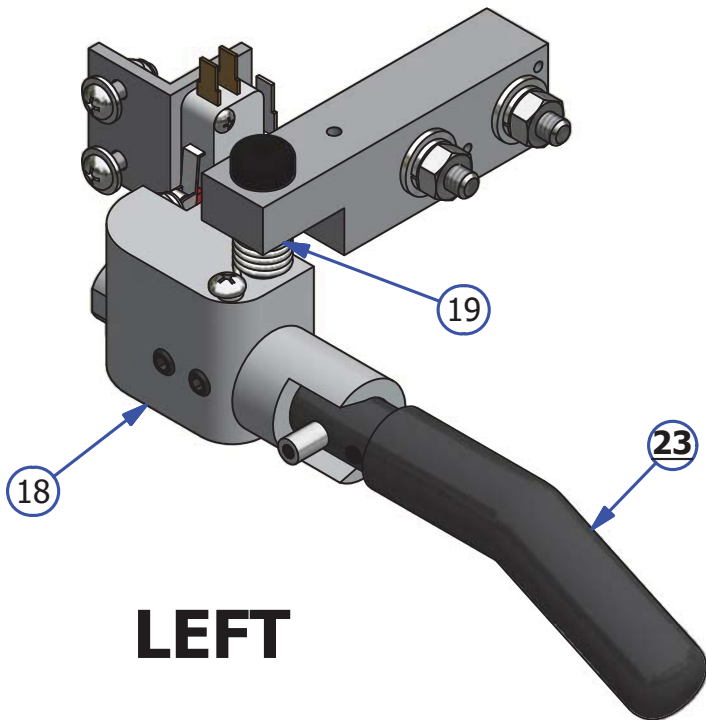
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-7001	LDS WHEEL ASSEMBLY	
1.1	2	153-2201	SET SCREW - 10-32 X 3/8	EA
2	1		LDS ARM ASSEMBLY	EA
2.1	2	153-9803	FLANGED BUSHING (3/8 X 1/2 X 1/4)	EA
2.2	2	154-9617	FLANGED BUSHING (3/8 x 1/2 x 3/8)	EA
3	1		FLEX LDS DISK	EA
3.1	1	153-2051	SET SCREW - 1/4-20 X 1/2	EA
4	2	154-1220	INDUCTIVE PROXIMITY SENSOR (TL-Q5MC1)	EA
5	2	153-2216A	MS PHILLIPS - 4-40 X 7/8	EA
6	1	164-6128	LDS ARM MOUNT	EA
7	1	153-2051	SET SCREW - 1/4-20 X 1/2	EA
8	1	164-6129	LDS ARM SHAFT	EA
9	1	153-2944	TORSION SPRING - RH	EA
10	1	153-2945	TORSION SPRING - LH	EA
11	1	164-6130	LDS WHEEL SHAFT	EA
12	1	153-2009	NYLON FLAT WASHER (3/8 - 0.060)	EA
13	2	153-2052A	MS PHILLIPS - 1/4-20 X 3/4 TRUSS HEAD	EA
14	1	153-2121	OXIDE ALLOY STL SHCS 10-24 X 1/2	EA
15	2	153-2013	LOCK WASHER #10	EA
16	1	164-6207	BRASS THREAD ROD	EA
17	2	153-2086	MS PHILLIPS 8-32 X 5/8	EA
18		153-2013	LOCK WASHER #10	EA
19	2	153-2002	FLAT WASHER #8	EA
20	1	164-6205	OLS ACTUATOR MOUNT	EA
21	1	164-6206	BRASS THRU ROD	EA
22	1	153-2093	SPRING - .42 OD X .75	EA
23	1	164-2059	SHCS 10-32 X 1 1/4	EA
24	1	164-6204	OLS ACTUATOR	EA



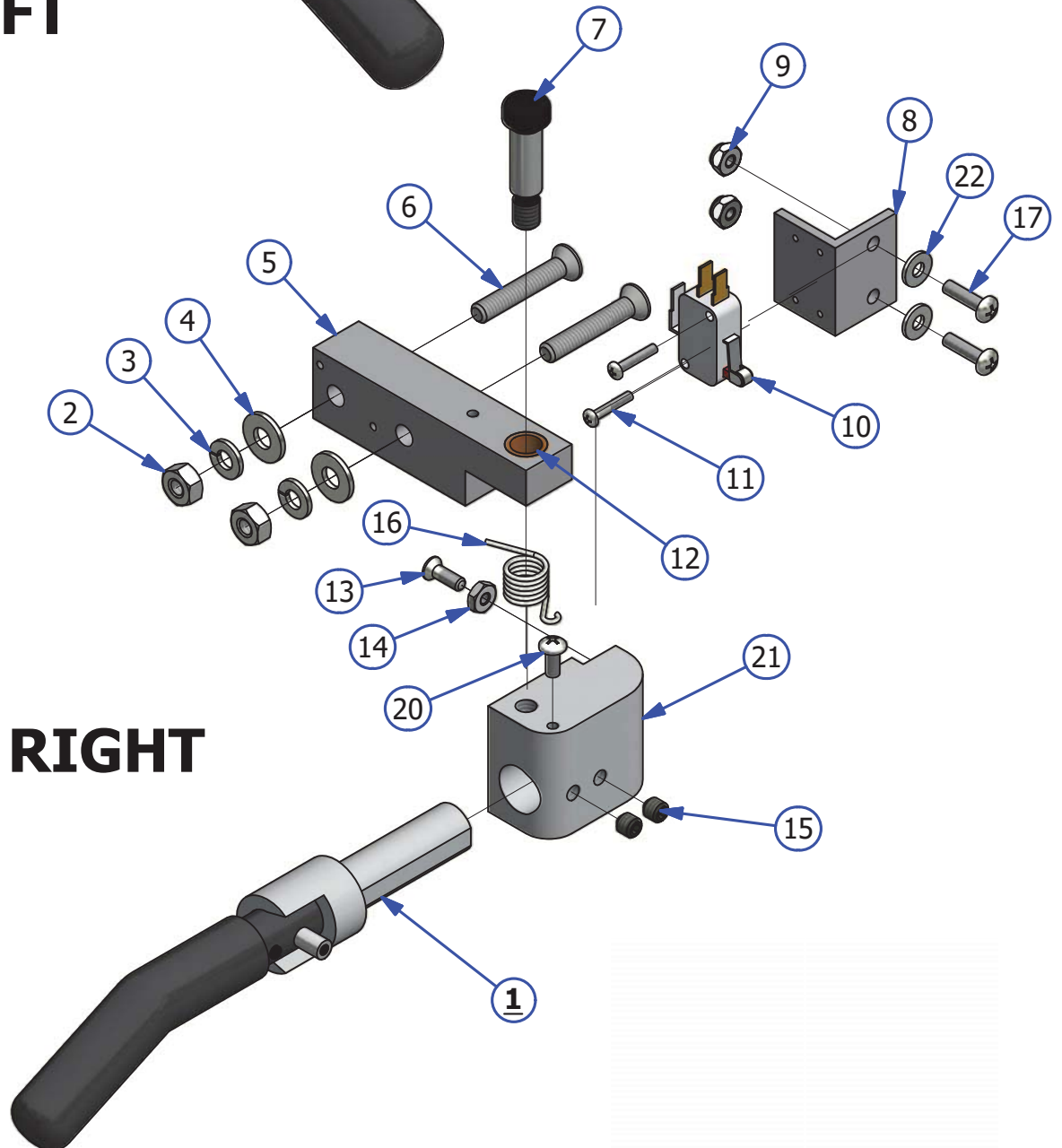
# WHISKER ASSEMBLY

REV. 9/17

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8825	RIGHT WHISHER ASSEMBLY	EA
2	4	153-2023	1/4-20 HEX NUT	EA
3	4	153-2014	1/4 LOCKWASHER	EA
4	4	153-2004	1/4 FLATWASHER	EA
5	2	158-8611	WHISKER BEARING BLOCK ASSEMBLY WITH BUSHING	EA
6	4	153-2227A	FHMS - 1/4-20 X 1-1/2	EA
7	2	153-2739	SHOULDER BOLT 3/8 IN DIA 1" LONG	EA
8	2	158-6641	WHISKER SWITCH MOUNT PLATE	EA
9	4	153-2231	LOCKNUT - 4-40	EA
10	2	153-1203	MICROSWITCH W/ROLLER	EA
11	4	153-2216A	MS PHILLIPS - 4-40 X 7/8	EA
12	2	154-9212	BUSHING ONLY	EA
13	2	153-2817	FLAT HEAD PHILLIPS - 8-32 X 1/2	EA
14	2	153-2414	HEX NUT - 8-32	EA
15	4	153-2051A	SET SCREW - 1/4-20 X 1/4	EA
16	1	153-2944	TORSION SPRING - RIGHT	EA
17	4	153-2086	MS PHILLIPS - 8-32 X 5/8	EA
18	1	164-6181	WHISKER SPRING MOUNT BLOCK - LEFT	EA
19	1	153-2945	TORSION SPRING - LEFT	EA
20	2	153-2086A	MS PHILLIPS - 8-32 X 3/8	EA
21	1	164-6182	WHISKER SPRING MOUNT BLOCK - RIGHT	EA
22	4	153-2002	FLAT WASHER #8	EA
23	1	164-8824	LEFT WHISKER ASSEMBLY	EA



**LEFT**

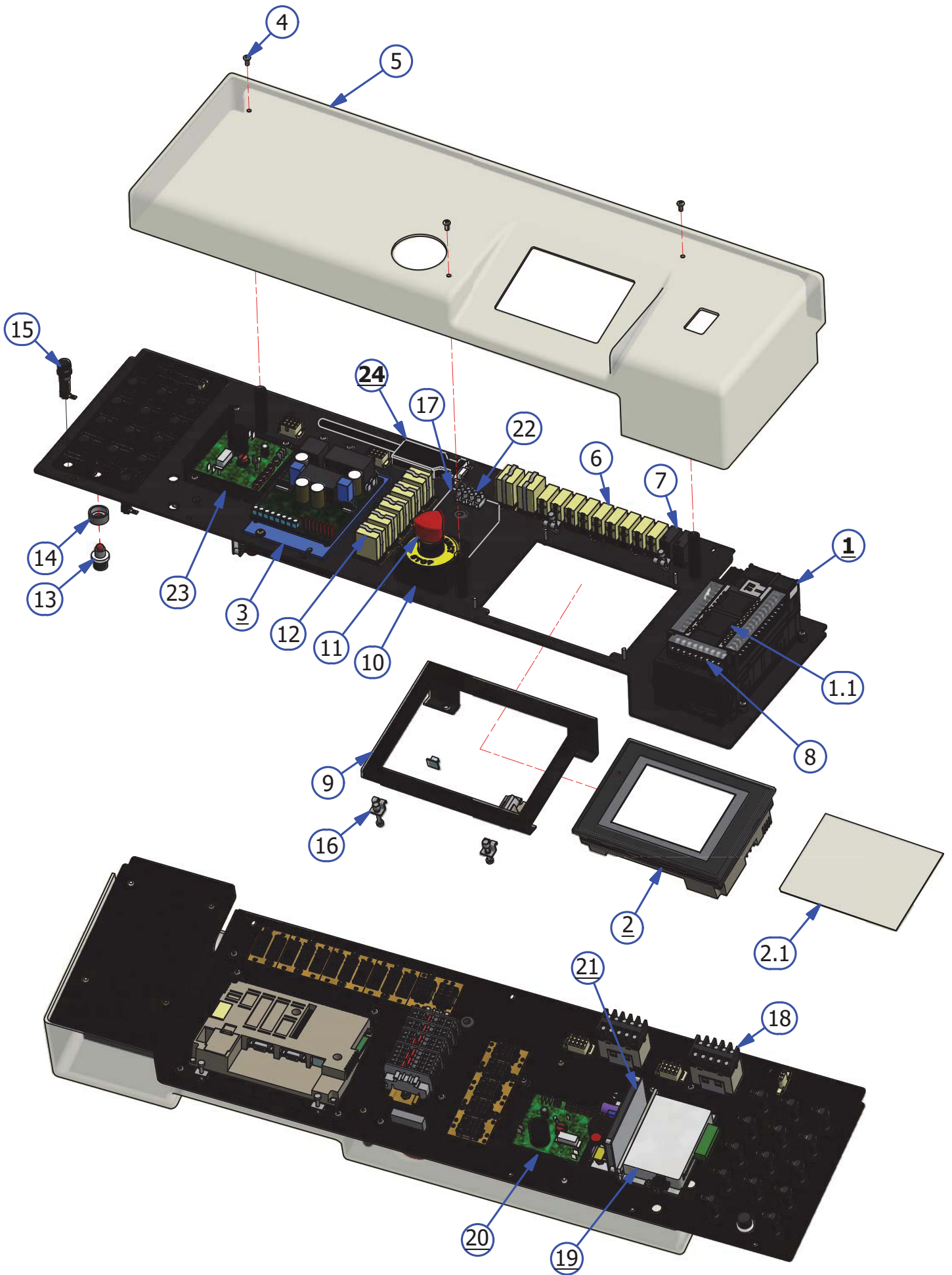


**RIGHT**

# PLC PLATE ASSEMBLY

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
<b>1</b>	1	158-1610P	PLC FOR FLEX - SPECIFY SOFTWARE VERSION	EA
1.1	1	158-1610S	SERIAL CONVERTER FOR FLEX	EA
	1	158-1610D	CABLE TO TOUCHSCREEN - 24IN (NOT SHOWN)	EA
<b>2</b>	1	164-8011	TOUCH SCREEN ASSEMBLY	EA
2.1	1	158-1612	SCREEN PROTECTOR	EA
<b>3</b>	1	164-8010	SPEED CONTROL ASSEMBLY - DRIVE	EA
4	7	153-2086A	MS PHILLIPS - 8-32 X 3/8	EA
5	1	164-6062	CLEAR PC PLATE COVER	EA
<b>6</b>	6	158-1458	RELAY - OMRON 24DC DPDT GENERAL PURPOSE	EA
6.1	6	164-1204	RELAY BASE FOR RELAY 158-1458	EA
<b>7</b>	2	158-1460	RELAY SOLID STATE	EA
7.1	2	164-1206	RELAY BASE FOR RELAY 154-1460	EA
8	1	164-1217	ANALOG OUTPUT (Buffer and/or Cleaner Upgrade only)	EA
9	1	164-6730	TOUCH SCREEN MOUNT	EA
10	1	164-6161	E-STOP BOX	EA
<b>11</b>	1	164-8223	E-STOP SWITCH ASSEMBLY	EA
11.1	1	164-1223B	BREAKER FOR ESTOP	EA
<b>12</b>	6	158-1462	24 V RELAY DPDT 10A W/DIODE	EA
12.1	6	164-1203	RELAY BASE FOR RELAY 158-1462	EA
13	1	153-1408	PUSH BUTTON (RED = NORMALLY OPEN)	EA
14		153-1209	BUTTON GUARD	EA
15	14	153-1028	PANEL-MOUNT FUSE HOLDER - UL (COMPLETE)	EA
16	4	158-1610TC	TOUCH SCREEN MOUNT CLIP	EA
17	1	158-6666	RESISTANCE ADJUSTMENT BOX - MODIFIED	EA
18	2	158-1465	CONTACTOR 24VDC	EA
19	1	158-1605	STEPPER SPEED CONTROL BOARD	EA
20	1	158-8415	SPEED CONTROL BOARD - CLEANER	EA
21	1	164-8028	CVR ASSEMBLY - VARIABLE BUFF ONLY	EA
21.1	1	158-1433A	CVR ASSEMBLY ALL	EA
22	1	158-1611	MOLEX TERMINAL BLOCK	EA
22.1	1	158-8619W	RESISTANCE WIRE ASSY - 22AWG	EA
23	1	164-8225	SPEED CONTROL ASSEMBLY - BUFFER DRIVE	EA
24	1	164-8220	WIFI ADAPTER	EA
	1	164-1239	COMMUNICATION CABLE	EA

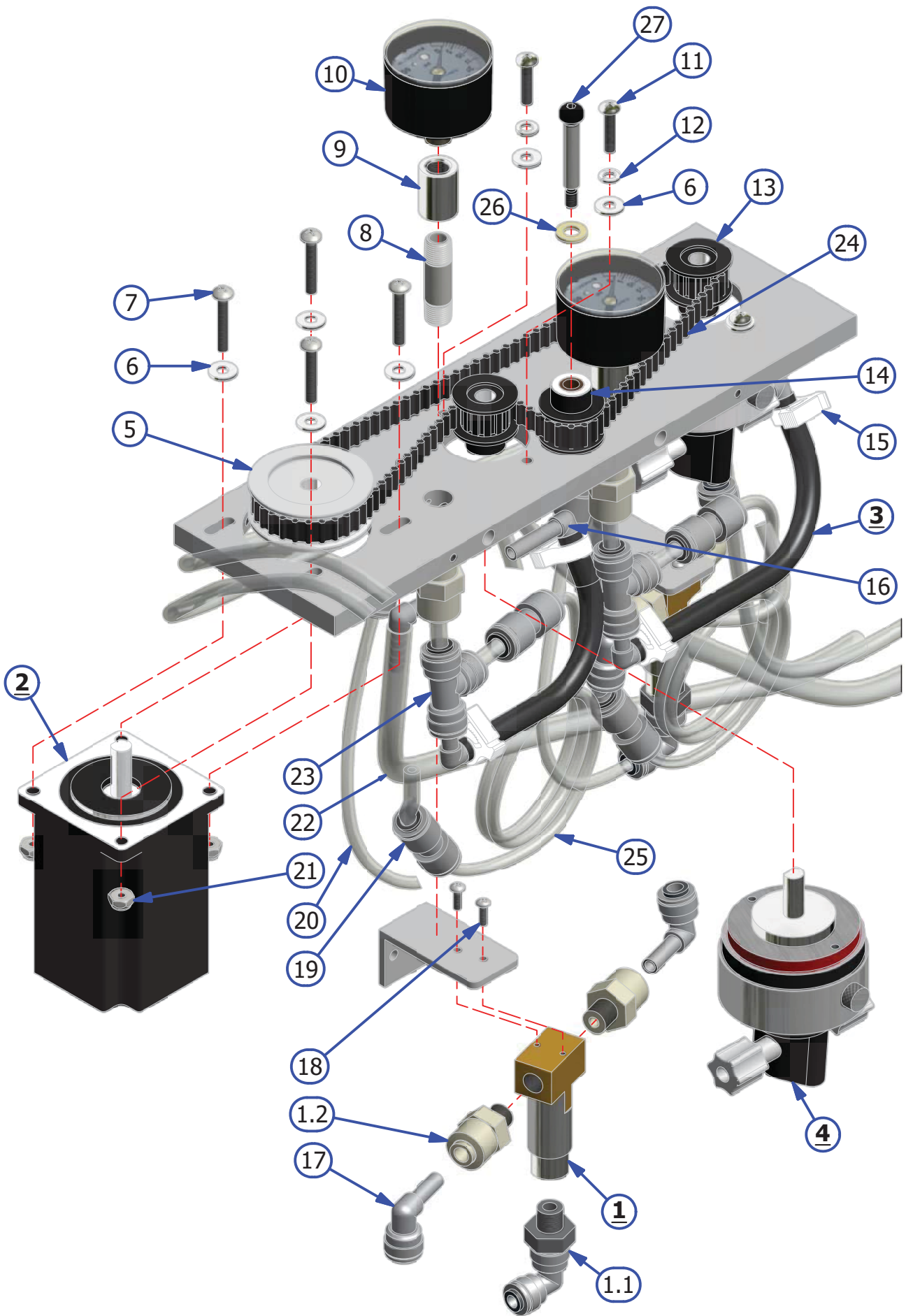




# OIL VALVE ASSEMBLY

REV. 2/16

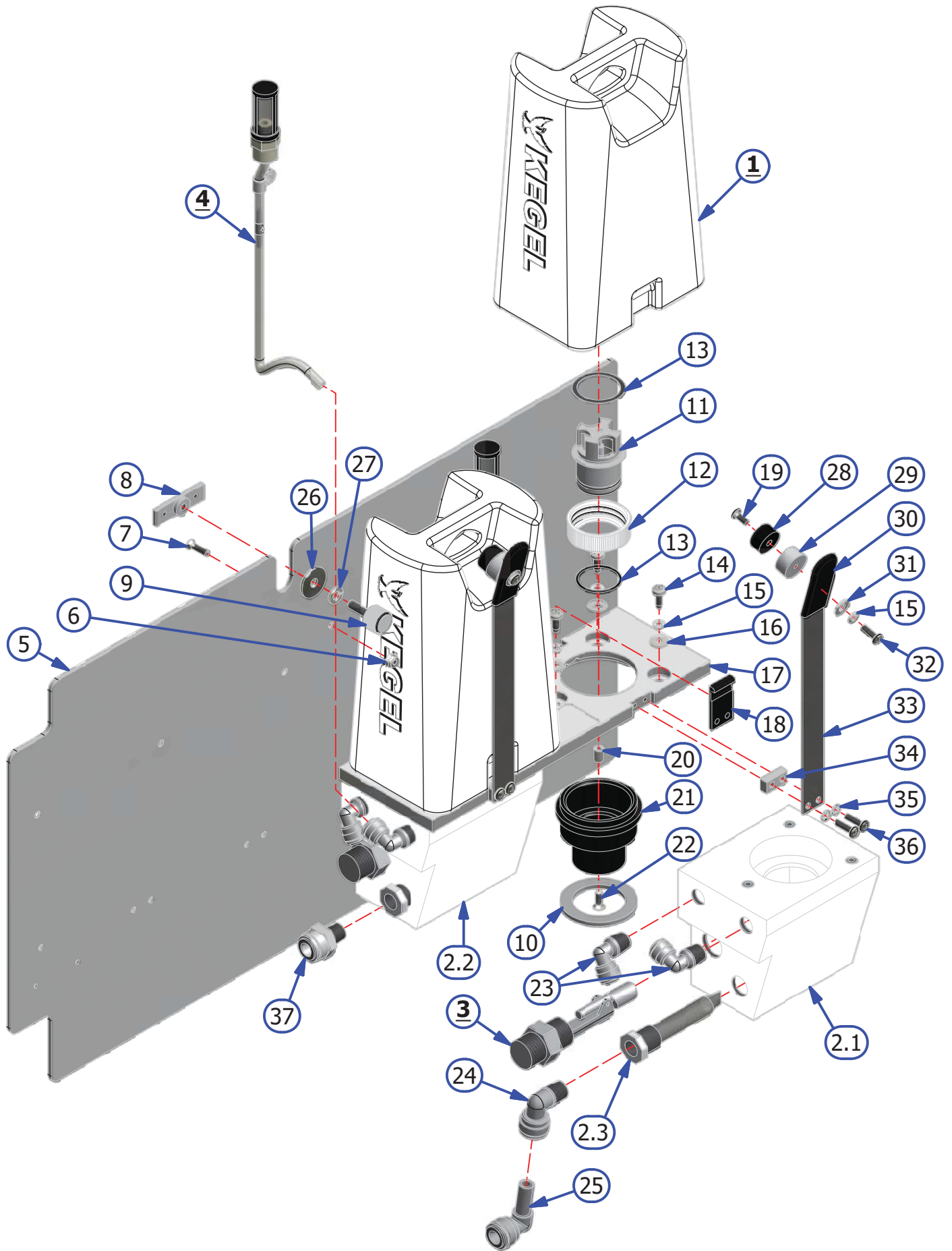
<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	154-8298	OIL CONTROL VALVE (24VDC) WITH EXTENEDED WIRES	EA
1.1	2	154-0613	ELBOW - 1/8 NPT X 3/16 TUBE	EA
1.2	4	154-0224	MALE CONNECTOR - 1/4" TUBE X 1/8 NPT	EA
2	1	158-8632	OIL STEPPER MOTOR ASSEMBLY	EA
3	2	164-8021	FLEX PULSE SUPRESSION TUBE	EA
4	2	154-1214	FLUID METERING PUMP-0.05 ML/STROKE	EA
5	1	158-9403	PULLEY - 26XL037 X 5/16" BORE	EA
6	8	153-2002	#8 FLATWASHER	EA
7	4	153-2089	MS PHILLIPS - 8-32 X 1	EA
8	2	164-0207	PIPE NIPPLE - THREADED BLK - 1/8 X 1 1/2	EA
9	2	154-0230	IN-LINE COUPLER (1/8 NPT) FLOAT	EA
10	2	158-1613	PRESSURE GAUGE - 60PSI	EA
11	4	153-2087	MS PHILLIPS - 8-32 X 3/4	EA
12	4	153-2013	#10 LOCKWASHER	EA
13	2	154-9208	PULLEY - 12XL - 5/16" BORE W/SET SCREW	EA
14	1	164-8029	OIL PUMP IDLER ASSEMBLY	EA
15	4	164-2046	HOSE CLAMP	EA
16	6	154-0226	ELBOW - TUBE TO HOSE BARB (1/4 X 1/4 ID)	EA
17	4	154-0222	ELBOW - 1/4" STEM X 1/4" TUBING OD	EA
18	4	153-2504	MS PHILLIPS - 4-40 X 3/8	EA
19		154-0248	REDUCING UNION CONNECTOR-1/4" X 3/16"	EA
20	1	154-0202A	PENCIL TUBING STOCK 1/4OD X 1/8ID	IN
21	4	153-2019	LOCKNUT - 8-32 (NYLOK)	EA
22	1	154-0202	PENCIL TUBING STOCK 3/8OD X 1/4ID	IN
23	2	153-0815	UNION TEE (1/4 X 1/4 X 1/4 - QUICK DISC)	EA
24	1	164-9008	TIMING BELT DOUBLE SIDED (220XL038	EA
25	1	154-0202B	PENCIL TUBING STOCK - 3/16 OD X 1/16 ID	IN
26	1	153-2510	NYLON WASHER - 1/4	EA
27	1	153-2803	SHOULDER BOLT - 1/4 X 1-1/4 (10-24)	EA



# SUB TANK CARTRIDGE ASSEMBLY

REV. 3/16

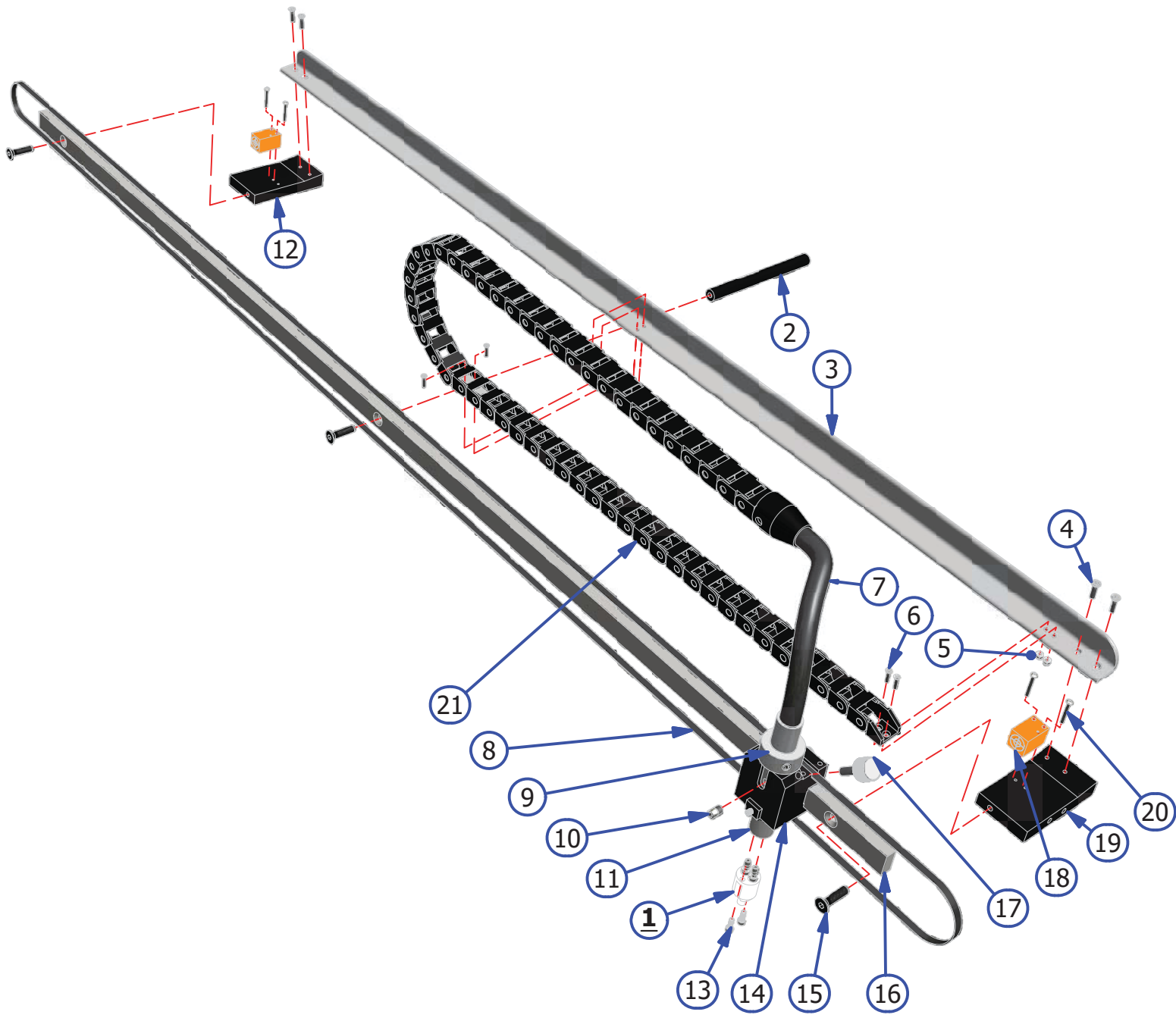
<u>INDEX</u>		<u>PART</u>			
<u>NUMBER</u>	<u>QTY.</u>	<u>NUMBER</u>	<u>DESCRIPTION</u>		<u>UOM</u>
1	2	164-8015	FLEX 1.5L CARTRIDGE		EA
	1	164-8015A	CARTRIDGE ONLY (NO PLUNGER ASSEMBLY)		EA
2.1	1	164-6015A	FLEX CONDITIONER SUB TANK A		EA
2.2	1	164-6015B	FLEX CONDITIONER SUB TANK B		EA
2.3	2	154-0212	CONDITIONER TANK FILTER ASSEMBLY		EA
3	2	154-8693	FLOAT SWITCH ASSEMBLY		EA
4	2	164-8007	OIL VENT VALVE ASSEMBLY		EA
5	1	164-6124	OIL PLATE ASSEMBLY		EA
6	2	153-2019	LOCKNUT - 8-32 (NYLOK)		EA
7	2	153-2806	FLAT HEAD PHILLIPS - 8-32 X 5/8		EA
8	1	164-6122	OIL PLATE MOUNT		EA
9	1	164-2016	THUMB SCREW - KNURLED HEAD		EA
10	2	164-0002	VALVE GASKET		EA
11	2	164-8015P	CARTRIDGE VALVE ASSY		EA
12	2	164-0004	FLEX CARTRIDGE CAP 38MM W/ HOLE		EA
13	2	164-6079	1.125 O-RING		EA
14	6	153-2605	MS PHILLIPS - 10-32 X 1/2 (SELF-TAP)		EA
15	6	153-2013	#10 LOCKWASHER		EA
16	6	153-2003	#10 FLATWASHER		EA
17	1	164-6113	CONDITIONER TANK MOUNT		EA
18	4	164-6153	CARTRIDGE RETAINER		EA
19		153-2086A	MS PHILLIPS - 8-32 X 3/8		EA
20	2	164-2044	STANDOFF FEMALE THREADED 8-32 X 3/8		EA
21	2	164-8086	SUB TANK PLUG		EA
22	2	153-2817	FLAT HEAD PHILLIPS - 8-32 X 1/2		EA
23	4	154-0223	ELBOW (90 DEGREE) - 1/4 NPT X 1/4" TUBE		EA
24	1	154-0225	ELBOW - 3/8 TUBE OD X 1/4 NPT		EA
25	1	154-0258	ELBOW - 3/8 STEM X 3/8 TUBE		EA
26	1	162-2013	FENDER WASHER 1/4 X 7/8		EA
27	1	153-2014	LOCK WASHER 1/4		EA
28	2	164-2052	RUBBER BUMPER		EA
29	2	164-6167	RUBBER BUMPER STANDOFF		EA
30	2	164-2053	RECTANGLE CAP		EA
31	2	153-2035	BLIND RIVET WASHER - 3/16		EA
32	2	153-2541	MS PHILLIPS - 8-32 X 1/2		EA
33	2	164-8020	CARTRIDGE CLAMP ASSEMBLY		EA
34	2	164-6168	SPRING STEEL SPACER		EA
35	4	153-2533	INTERNAL TOOTH LOCK WASHER - #8		EA
36	6	153-2086	MS PHILLIPS - 8-32 X 5/8		EA
37	1	154-0814	FITTING - 1/4 NPT X 3/8 TUBE		EA



# OIL HEAD ASSEMBLY

REV. 2/16

<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8051	DUAL OIL TIP WITH FITTINGS	EA
2	1	164-6046	FLEX HEAD BAR SUPPORT	EA
3	1	164-6104	OIL TIP HOSE ANGLE	EA
4	5	153-2806	FLAT HEAD PHILLIPS - 8-32 X 5/8	EA
5	4	153-2231	LOCKNUT - 4-40	EA
6	4	153-2724	FHMS PHILLIPS - 4-40 X 1/2	EA
7	1	164-8023	OIL TUBE SLEEVE	EA
8	1	154-9201	BELT FOR HEAD DRIVE	EA
9	1	153-2937	SHAFT COLLAR 3/4" ID	EA
10	1	153-2972	THREADED PIN 1/4-20 FOR TIP AND HOSE ASSY	EA
11	1	164-6156	OIL TIP TUBE	EA
12	1	164-6102	LEFT HEAD BAR MOUNT	EA
13	2	153-2987	SCREW 6-32 X 3/8 SHCS	EA
14	1	164-6111	FLEX OIL HEAD ASSY	EA
15	3	153-2702	FHMS - 1/4-20 X 1 SELF-LOCKING	EA
16	1	154-6647A	SLIDING HEAD BAR (3/8) - STANDARD	EA
17	1	164-2016	THUMB SCREW - KNURLED HEAD	EA
18	2	154-1220	PROXIMITY SENSOR	EA
19	1	164-6103	RIGHT HEAD BAR MOUNT	EA
20	4	153-2216A	MS PHILLIPS - 4-40 X 7/8	EA
21	1	165-9009	FLEX-CABLE CARRIER	EA

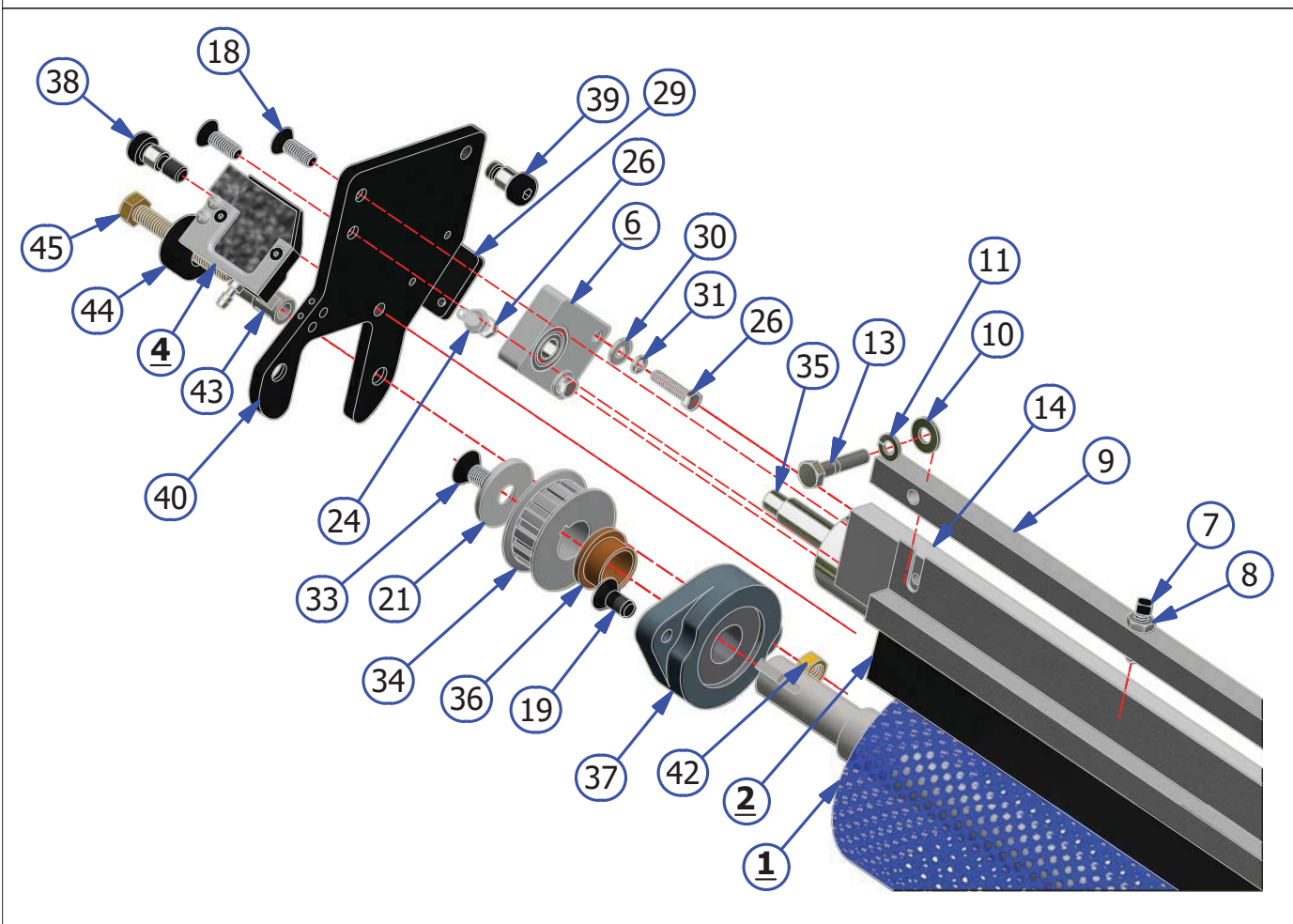
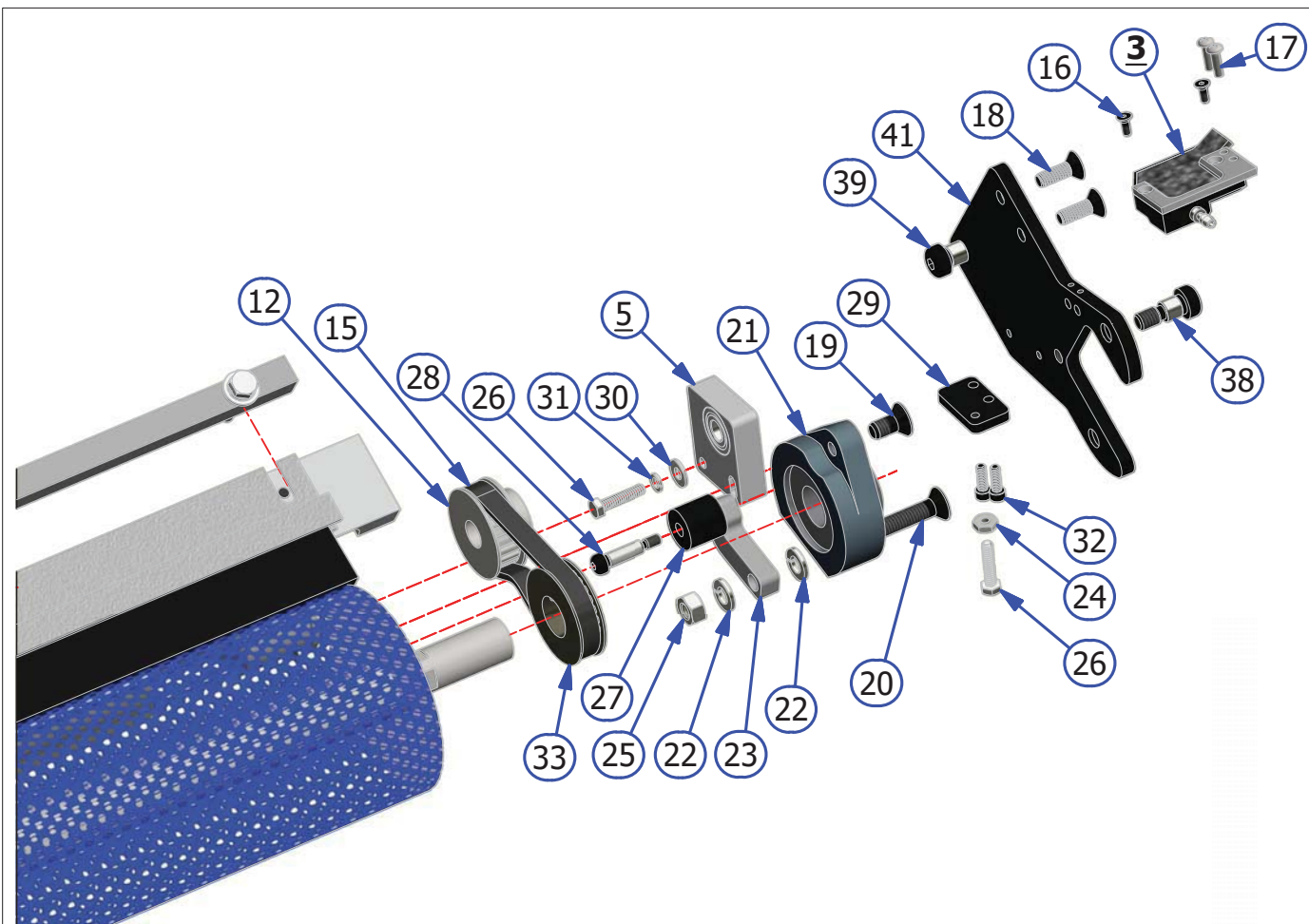


# OIL TRANSFER ASSEMBLY

REV. 9/17

<u>INDEX</u>		<u>PART</u>		<u>DESCRIPTION</u>	<u>UOM</u>
<u>NUMBER</u>	<u>QTY.</u>	<u>NUMBER</u>			
1	1	164-8001A		BUFFER BRUSH ASSEMBLY	EA
2	1	164-0866		SINGLE LONG BRUSH ASSEMBLY (TRANSFER BRUSH)	EA
3	1	164-8019		FLEX RIGHT DRIP PAD ASSEMBLY	EA
	1	154-0228S		FELT MATERIAL	EA
4	1	164-8018		FLEX LEFT DRIP PAD ASSEMBLY	EA
	1	154-0228S		FELT MATERIAL	EA
5	1	164-8045		BEARING MOUNT ASSEMBLY - RIGHT	EA
5.1	1	153-2309		BEARING ASSEMBLY 3/8 SHAFT	EA
6	1	164-8046		BEARING MOUNT ASSEMBLY - LEFT	EA
6.1	1	153-2309		BEARING ASSEMBLY 3/8 SHAFT	EA
7	4	153-2306		CUP POINT SQ HEAD SET SCREW 1/4-20 X 1	EA
8	4	153-2304		JAM NUT - 1/4-20	EA
9	1	158-6735		BRUSH TRACK MOUNT SUPPORT	EA
10	5	153-2004		1/4 FLATWASHER	EA
11	5	153-2014		1/4 LOCKWASHER	EA
12	1	154-9205D		PULLEY 24XL037 3/8 BORE	EA
13	5	153-2054		HHCS - 1/4-20 X 1-1/4	EA
14	1	158-6732		SINGLE BRUSH TRACK MOUNT	EA
15		154-9203		BELT FOR TRANSFER ROLLER	EA
16	4	153-2831		SCREW - 6/32 X 3/8 FHCS	EA
17	4	153-2081		MS PHILLIPS - 6-32X 1/2"	EA
18	4	153-2968		SCREW - 1/4-20 X 3/4 FHSHCS	EA
19	2	153-2802		FHSS - 5/16-18 X 5/8	EA
20	1	153-2513		FHSS - 5/16-18 X 1-1/2	EA
21	1	154-8640		FLANGED BEARING-STD BRUSH (3/4" ROTATED)	EA
22	2	153-2015		5/16 LOCKWASHER	EA
23	1	164-6051		TRANSFER ROLLER IDLER BELT BLOCK	EA
24	2	153-2022		HEX NUT - 10-24	EA
25	1	153-2024		HEX NUT - 5/16-18	EA
26	6	153-2955		10-24 x 7/8 HEX HEAD MACHINE SCREW	EA
27	1	158-6742		TRANSFER ROLLER BELT IDLER ROLLER	EA
28	1	153-2308		HEXAGON SOCKET HEAD SHOULDER SCREW	EA
29	2	164-6052		TRANSFER ROLLER ADJUSTMENT PLATE	EA
30	2	153-2035		BLIND RIVET WASHER - 3/16	EA
31	4	153-2013		#10 LOCKWASHER	EA
32	4	153-2999		SCREW - SHCS 8-32 X 1/2 BLACK OXIDE	EA
33	1	164-9007		PULLEY 24XLO37 3/4 BORE NO HUB NO KWY	EA
34	1	158-9402		PULLEY FOR BUFFER BRUSH ASSEMBLY	EA
35	1	164-8008		TRANSFER ROLLER ASSEMBLY	EA
36	1	158-9601		FLANGED BUSHING	EA
37	1	153-9816		FLANGED BUFFER BRUSH BEARING ASSEMBLY	EA
38	2	153-2801		SHOULDER BOLT - 3/8 X 3/8 (5/16-18)	EA
39	2	153-2801A		SHOULDER BOLT CUT - 3/8 X 3/8 (5/16-18)	EA
40	1	164-6013		LEFT BEARING MOUNT	EA
41	1	164-6014		RIGHT BEARING MOUNT	EA
42	1	162-2032		LOCKNUT CENTERLOCK 5/16-18	EA
43	1	164-6166		CONCENTRIC IDLER SLEEVE	EA
44	1	164-6165		BELT SLACK CONTROL IDLER	EA
45	1	164-2079		HHCS 5/16 X 2 1/4	EA

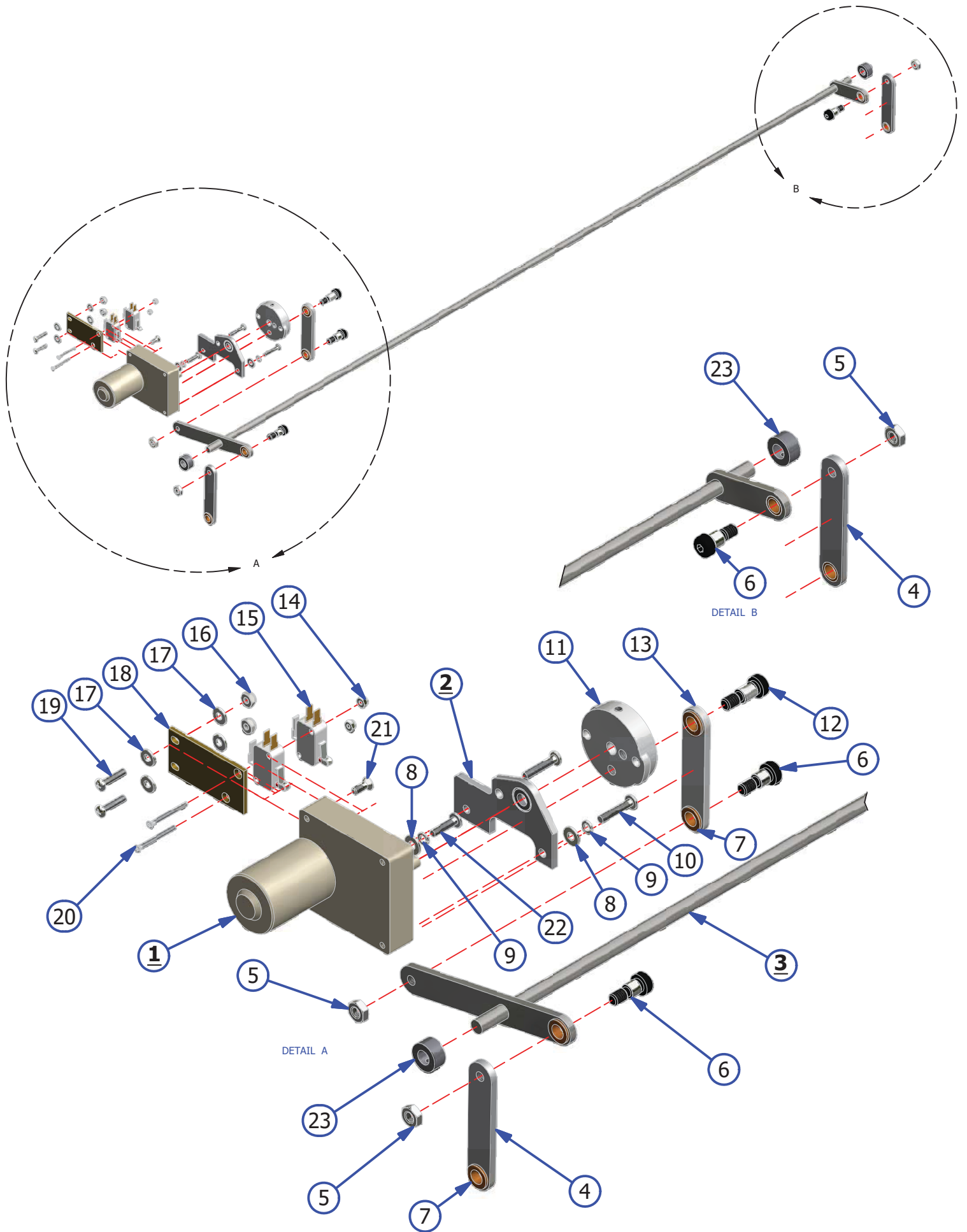




# BRUSH LIFT ROD ASSEMBLY

REV. 2/16

<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	158-8402	MOTOR ASSEMBLY - 24VDC	EA
2	1	158-8634	SQUEEGEE/BRUSH MOUNT PLATE ASSEMBLY	EA
	1	158-9614	BALL BEARING MINITURE	EA
3	1	164-8218	FLEX BRUSH LIFT ROD - 2016	EA
4	2	164-6011	FLEX BRUSH LIFT ROD TO BEARING LINK	EA
5	3	153-2027A	JAM NUT - 5/16-18	EA
6	5	153-2801	SHOULDER BOLT-3/8 X 3/8 (5/16-18)	EA
7	6	153-9803	FLANGED BUSHING (3/8 X 1/2 X 1/4)	EA
8	3	153-2003	#10 FLATWASHER	EA
9	3	153-2013	#10 LOCKWASHER	EA
10	2	153-2092	MS PHILLIPS - 10-32 X 1	EA
11	1	154-6243	MOTOR CAM-DUAL LOBES (STACKED SWITCHES)	EA
12	1	153-2515	SHOULDER BOLT - 3/8 X 1/2 (5/16-18)	EA
13	1	164-6012	FLEX BRUSH LIFT ROD TO CAM LINK	EA
14	2	153-2231	LOCKNUT - 4-40	EA
15	2	153-1203	MICROSWITCH W/ROLLER	EA
16	2	153-2019	LOCKNUT - 8-32 (NYLOK)	EA
17	4	153-2002	#8 FLATWASHER	EA
18	1	154-6824	CAM SWITCH PLATE	EA
19	2	153-2086	MS PHILLIPS - 8-32 X 5/8	EA
20	2	153-2727	4-40 X 1-1/4 FHMS	EA
21		153-2817	FLAT HEAD PHILLIPS - 8-32 X 1/2	EA
22	1	153-2091	MS PHILLIPS - 10-32 X 3/4	EA
23	2	153-2804	COLLAR - 3/8 X 3/4 X 3/8	EA



# VACUUM MOTOR ASSEMBLY

REV. 1/16

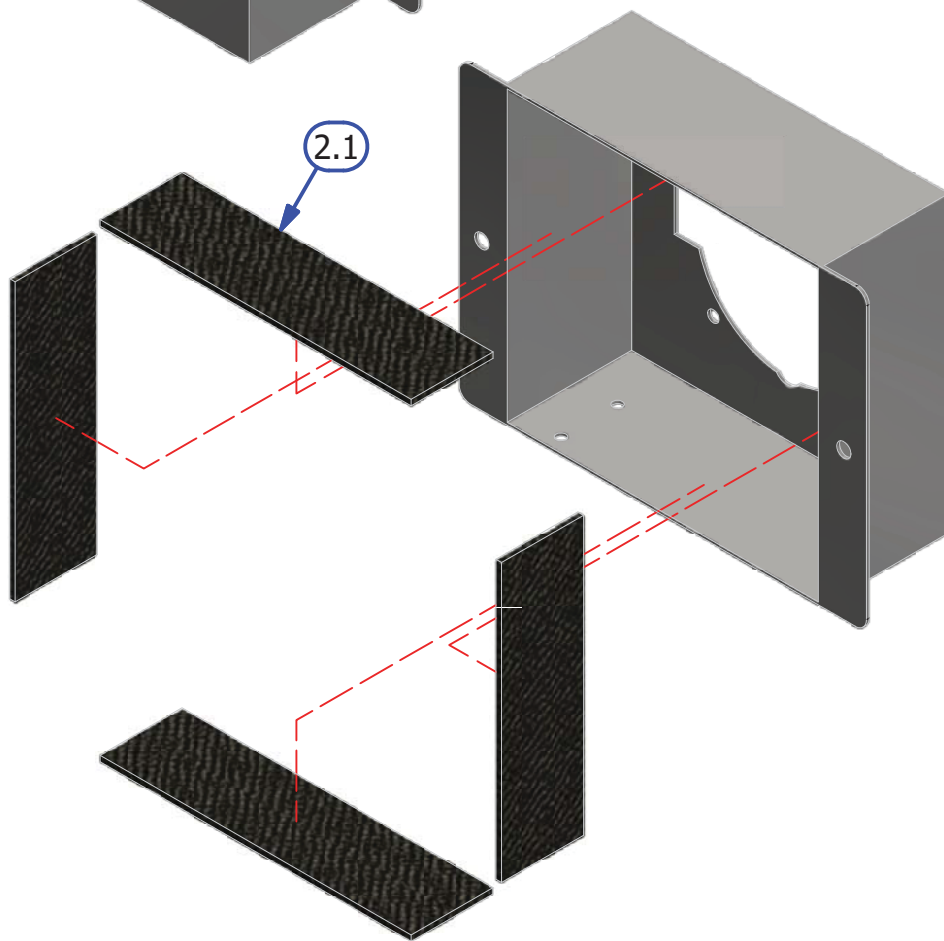
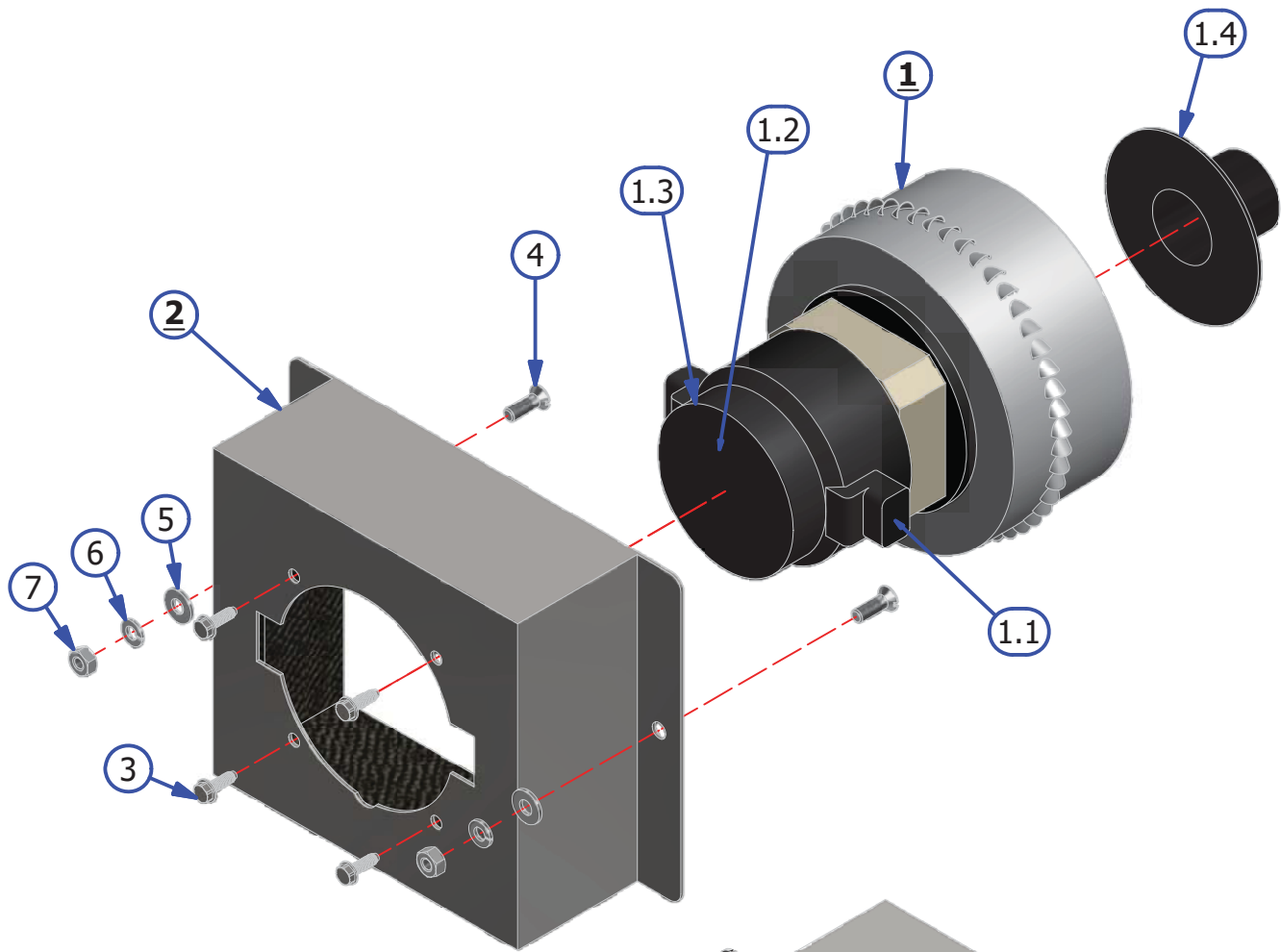
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
<b>1</b>	<b>1</b>	<b>158-8407</b>	<b>VACUUM MOTOR ASSEMBLY (COMPLETE)</b>	
1.1	1	158-1421B	VACUUM MOTOR BRUSHES	PR
1.2	1	153-0204F	FAN BLADE	EA
1.3	1	153-0204H	FAN BLADE COVER	EA
1.4*	1	153-6221M	VACUUM WALL PLASTIC ADAPTER (See Below)	EA
<b>2</b>	<b>1</b>	<b>158-8618</b>	<b>VACUUM MOTOR HOUSING</b>	
2.1		154-0228S	STOCK - 1/8 IN GRAY FELT	IN
3	4	153-2830	HEX HEAD SELF TAP #10 X 5/8 SCREW	EA
4	2	153-2078	FHMS - 1/4 - 20 X 3/4	EA
5	2	153-2004	1/4 FLAT WASHER	EA
6	2	153-2014	1/4 LOCK WASHER	EA
7	2	153-2023	1/4/-20 HEX NUT	EA



## **TECHNICAL NOTE**

WHEN ATTACHING PART NUMBER 153-6221M, USE A TWO (2) PART EPOXY AND ALLOW TO DRY ACCORDING TO DIRECTIONS.

BE CAREFUL NOT TO CRUSH THE VACUUM MOTOR HOUSING INTO INTERNAL BLADES.



# CLEANER TANK ASSEMBLY

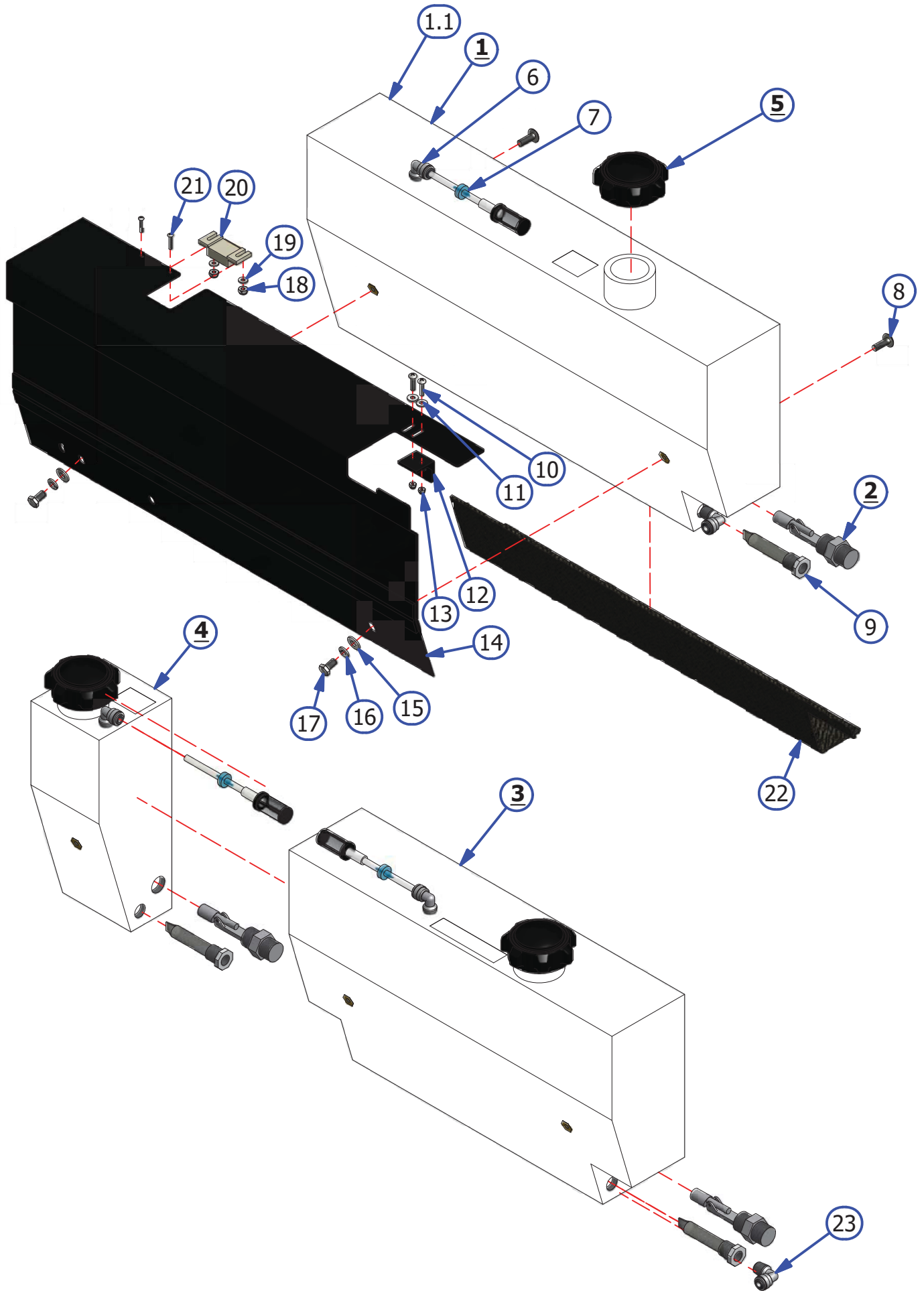
REV. 9/14

<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8042	CLEANER SUPPLY TANK (COMPLETE)	EA
1.1	1	164-6016	CLEANER SUPPLY TANK ONLY	EA
2	1*	154-8693	CLEANER SUPPLY TANK FLOAT ASSEMBLY	EA
3	1	164-8041	FLEX UPGRADED WATER TANK ASSEMBLY (COMPLETE)	EA
3.1	1	164-6740	UPGRADED WATER TANK (TANK ONLY)	EA
4	1	164-8043	FLEX UPGRADED CLEANER TANK ASSEMBLY (COMPLETE)	EA
4.1	1	164-6741	UPGRADED CLEANER TANK (TANK ONLY)	EA
5	1*	164-8081	SUPPLY TANK CAP WITH GASKET	EA
5.1	1*	164-0021	GASKET FOR SUPPLY TANK CAP	EA
6	1	154-0223	ELBOW (90 DEGREE) 1/4NPT X 1/4IN TUBING	EA
7	1	154-8817	VENT VALVE ASSEMBLY	EA
8	2	153-2924	MS PHILLIPS - 1/4-20 X 3/4	EA
9	1*	154-0212B	FILTER ASSEMBLY FOR SUPPLY TANK	EA
10	2	153-2086	MS PHILLIPS - 8/32 X 5/8	EA
11	2	153-2002	FLAT WASHER #8	EA
12	1	154-6827M	MOUNTING ANGLE - MOLDED PLASTIC	EA
13	2	153-2231	LOCKNUT - 4-40	EA
14	1	164-8078	SPLASH GUARD (SPECIFY COLOR)	EA
15	2	153-2004	FLAT WASHER 1/4	EA
16		153-2014	LOCK WASHER 1/4	EA
17	2	153-2726	1/4-20 X 1/2 HHCS	EA
18	2	153-2019	LOCKNUT - 8-32 (NYLOK)	EA
19	2	153-2001	FLAT WASHER #6	EA
20	1	154-0609	MAGNETIC CATCH / PLATE ASSEMBLY	EA
21	2	153-2216	MS PHILLIPS 4-40 X 5/8	EA
22	1	164-8212	FELT KIT - 24" X 1/8 48" X 9" X 1/8"	IN



## **TECHNICAL NOTE**

\*FOR MACHINES WITH THE UPGRADED CLEANING SYSTEM, THESE PARTS ARE QUANTITY OF TWO.

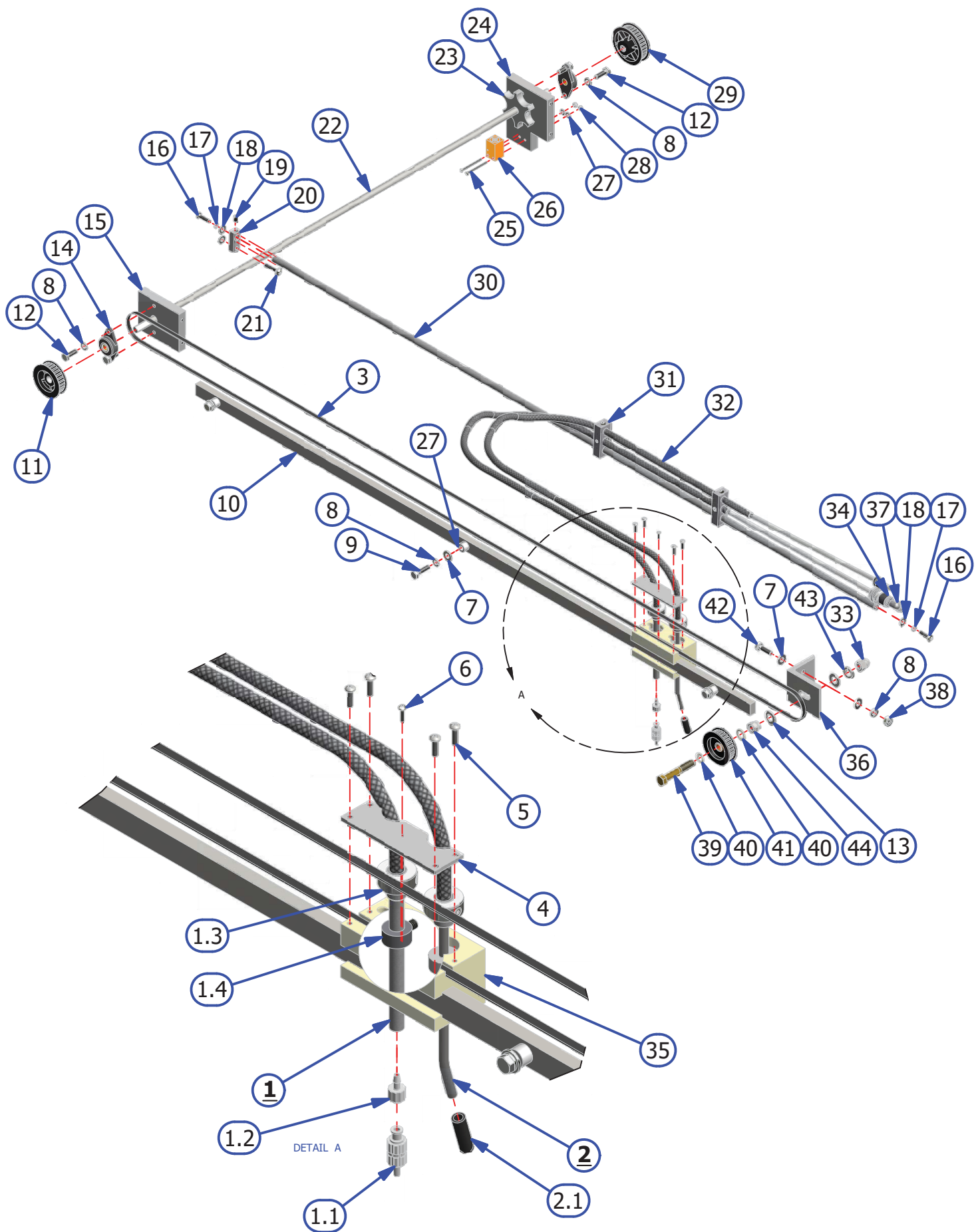


# CLEANER HEAD ASSEMBLY

REV. 3/16

<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	154-8852	CLEANER HOSE AND TIP ASSEMBLY (COMPLETE)	EA
1.1	1	164-0012M	CLEANER TIP WITH CHECK VALVE	EA
1.2	1	154-0863	FITTING - MALE LUER TO 1/8 IN HOSE BARB	EA
1.3	1	153-2713	SPRING - TIP RETAINER	EA
1.4	1	153-2804	COLLAR - 3/8 X 3/4 X 3/8	EA
1.5	1	153-2902	COLLAR - 1/2 X 1 1/8 X 1/2	EA
2	1	164-8228	PINDECK TREATMENT TIP ASSEMBLY	EA
2.1	1	164-2067	PINDECK TREATMENT TIP COVER	EA
3	1	154-9201	HEAD DRIVE BELT ASSEMBLY	EA
4	1	164-6230	CLEANER HEAD BELT MOUNT	EA
5	4	153-2081	MS PHILLIPS - 6-32 X 1/2	EA
6	1	153-2504	MS PHILLIPS - 4-40 X 3/8	EA
7	1	153-2004	FLAT WASHER	EA
8	1	153-2014	LOCKWASHER - 1/4	EA
9	1	153-2053	HHCS - 1/4 X 1"	EA
10	1	154-6877	CLEANER HEAD GUIDE BAR	EA
11	1	154-9205B	PULLEY (28XL 3/8 BORE)	EA
12	1	153-2603	HHCS 1/4-20 X 3/4	EA
13	1	153-2006	FLAT WASHER 3/8	EA
14	2	154-9804	FLANGED BEARING FOR CLEANER DRIVE SHAFT	EA
15	1	154-6878	CLEANER HEAD DRIVE SHAFT BLOCK	EA
16	4	153-2091	MS PHILLIPS - 10-32 X 3/4	EA
17	4	153-2013	LOCK WASHER #10	EA
18		153-2003	FLAT WASHER #10	EA
19	2	153-2051A	SET SCREW - 1/4-20 X 1/4	IN
20	1	164-6090	CLEANER HOSE SHAFT MOUNT	EA
21	2	153-2092	MS PHILLIPS - 10-32 X 1	EA
22	1	164-6047	FLEX CLEANER HEAD DRIVE SHAFT	EA
23	1	154-6884	6 TOOTH SENSOR DISK	EA
24	2	164-6064	CLEANER HEAD IDLER MOUNT BLOCK	EA
25	2	153-2516	MS PHILLIPS - 4-40 X 1-1/2	EA
26	1	154-1220	PROXIMITY SENSOR	EA
27	2	153-2001	FLAT WASHER #6	EA
28	2	153-2231	LOCKNUT - 4-40	EA
29	1	154-9805	PULLEY - 32XL037 - 3/8 BORE DF DBL SET	EA
30	1	154-6889	CLEANER HOSE ROUTING BAR	EA
31	2	164-6231	HOSE SPRING MOUNT BLOCK	EA
32	2	154-0867	CLEANER HOSE SPRING	EA
33	1	153-2030	ACORN NUT 3/8 - 16	EA
34	1	154-0222	BULK HEAD UNION	EA
35	1	164-6224	CLEANER HEAD ASSEMBLY	EA
36	1	164-6048	CLEANER HEAD IDLER MOUNT	EA
37	1	154-0222	ELBOW - 1/4 IN STEM X 1/4 IN TUBING OD	EA
38	1	153-2023	HEX NUT - 1/4-20	EA
39	1	153-2815	HHCS - 3/8-16 X 2-1/4 (GRADE 8)	EA
40	1	153-2009	NYLON FLAT WASHER	EA
41	1	154-9806	PULLEY - (28XL037 - 1/2 BORE NO SET	EA
42	1	153-2052	HHCS - 1/4-20 X 7/8"	EA
43	1	153-2016	LOCK WASHER 3/8"	EA
44	1	153-2025	HEX NUT - 3/8-16	EA

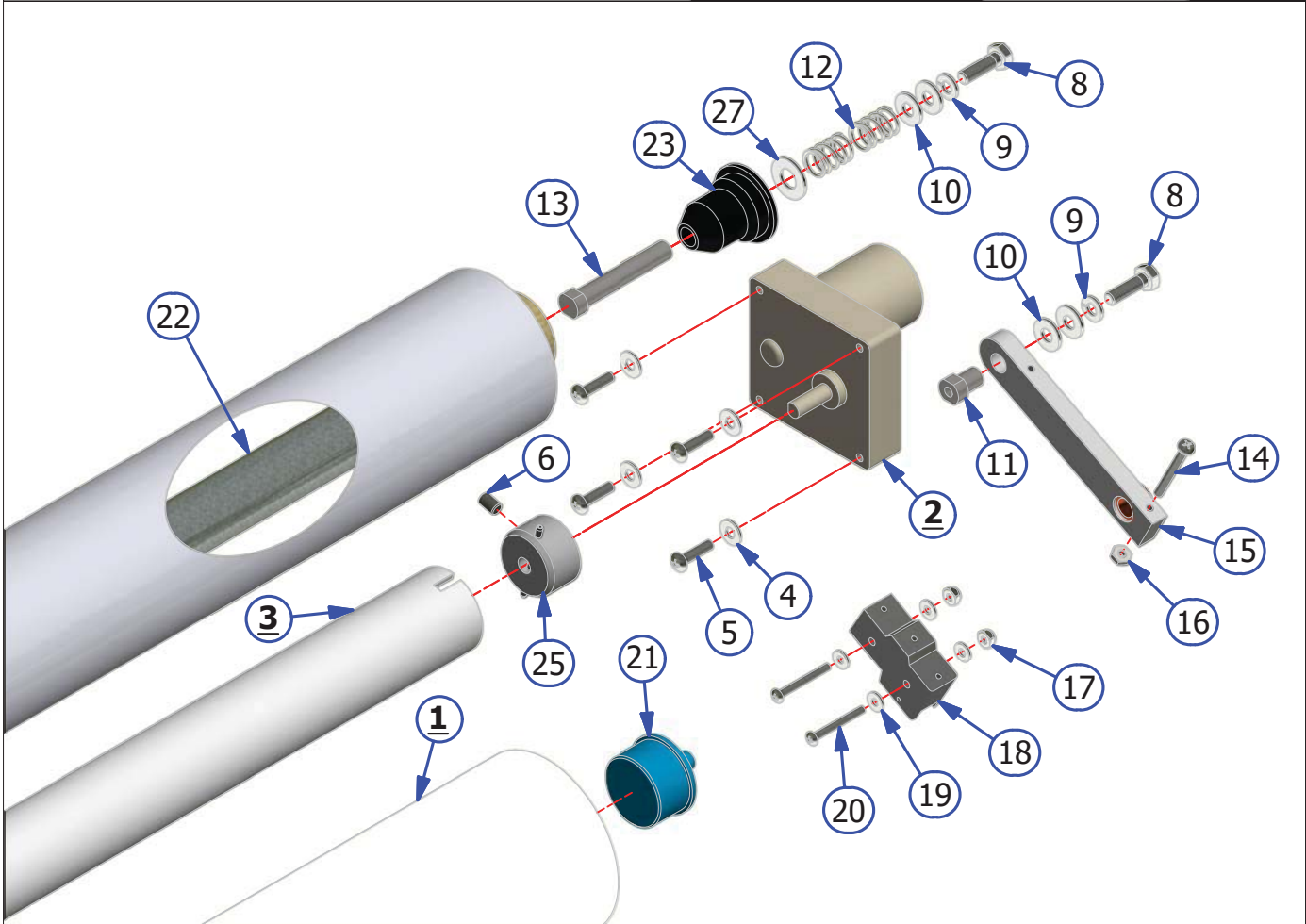
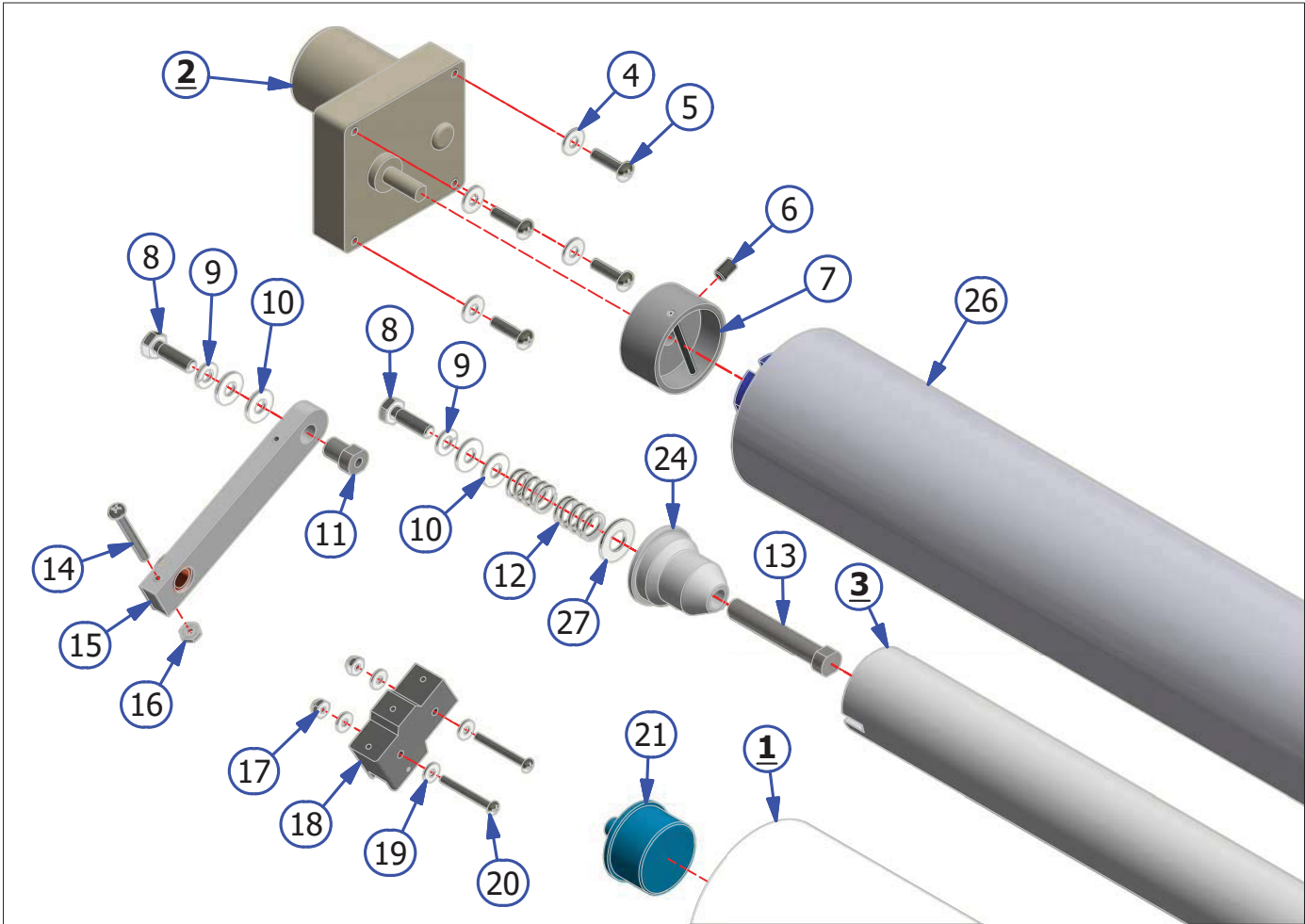




# DUSTER ASSEMBLY

REV. 9/17

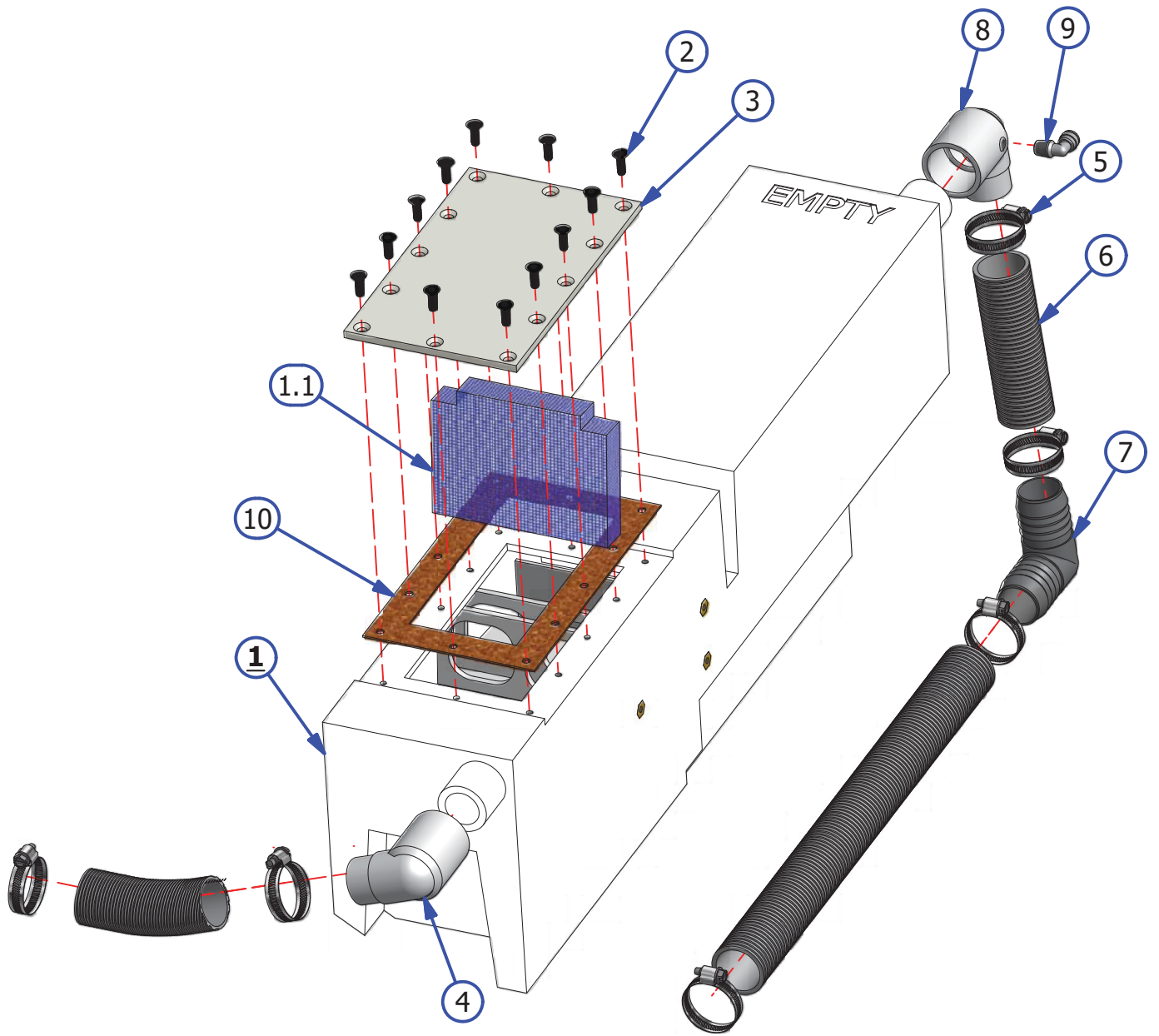
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<b>1</b>	<b>1</b>	<b>153-8839</b>	<b>CUSHION ROLLER WITH WRAP ASSEMBLY</b>	EA
1.1		154-8839A	CUSHION ROLLER COVER - SIZE A	EA
1.2		154-8839B	CUSHION ROLLER COVER - SIZE B	EA
1.3		154-8839C	CUSHION ROLLER COVER - SIZE C	EA
1.4		154-8839D	CUSHION ROLLER COVER - SIZE D	EA
1.5		154-8839E	CUSHION ROLLER COVER - SIZE E	EA
<b>2</b>	<b>2</b>	<b>158-8403</b>	<b>DUSTER MOTOR ASSEMBLY</b>	EA
<b>3</b>	<b>1</b>	<b>153-8824</b>	<b>PVC TAKE UP REEL</b>	EA
4	8	153-2003	#10 - FLATWASHER	EA
5	8	153-2091	MS PHILLIPS - 10-32 X 3/4	EA
6	2	153-2050	SET SCREW 1/4-28 X 3/8	EA
7	1	153-8201B	DUSTER DRIVE HUB ASSEMBLY (1/4-28)	EA
8	4	153-2603	HHCS - 1/4-20 X 3/4	EA
9	2	153-2014	LOCK WASHER 1/4"	EA
10	8	153-2004	FLAT WASHER 1/4-20	EA
11	2	164-6175	CUSHION ROLLER STUD	EA
12	4	164-2081	DUSTER SPRING FOR STUD MOUNT	EA
13	2	164-6174	DUSTER PLUG STUD	EA
14	2	153-2090	MS - PHILLIPS - -32 X 1-1/2	EA
15	2	164-8826	CUSHION ROLLER ARM ASSY FOR STUD MOUNT	EA
16	2	153-2414	HEX NUT 8-32	EA
17	8	153-2018	LOCKNUT 6-32	EA
18	2	154-1603	MICROSWITCH WITHOUT ROLLER (LARGE)	EA
19	8	153-2001	FLAT WASHER #6	EA
20	4	153-2085	MS PHILLIPS - 6-32 X 1 1/4	EA
21	2	153-9051	CUSHION ROLLER PLUG WITH STUD	EA
22	1	153-0429	DUSTER ROLL SUPPORT PIPE (40 INCH)	EA
23	1	164-6108A	DUSTER PLUG CARDBOARD CORE (STUD MOUNT)	EA
24	1	164-6109A	DUSTER PLUG FOR PVC CORE (STUD MOUNT)	EA
25	1	153-8202B	DUSTER SOLID DRIVE HUB (PVC)	EA
26	1	153-0047EZ	K2 SELECT DUSTER CLOTH (BOX OF 4)	CASE
27	2	153-2006	FLATWASHER - 3/8"	EA



# RECOVERY TANK

REV. 2/16

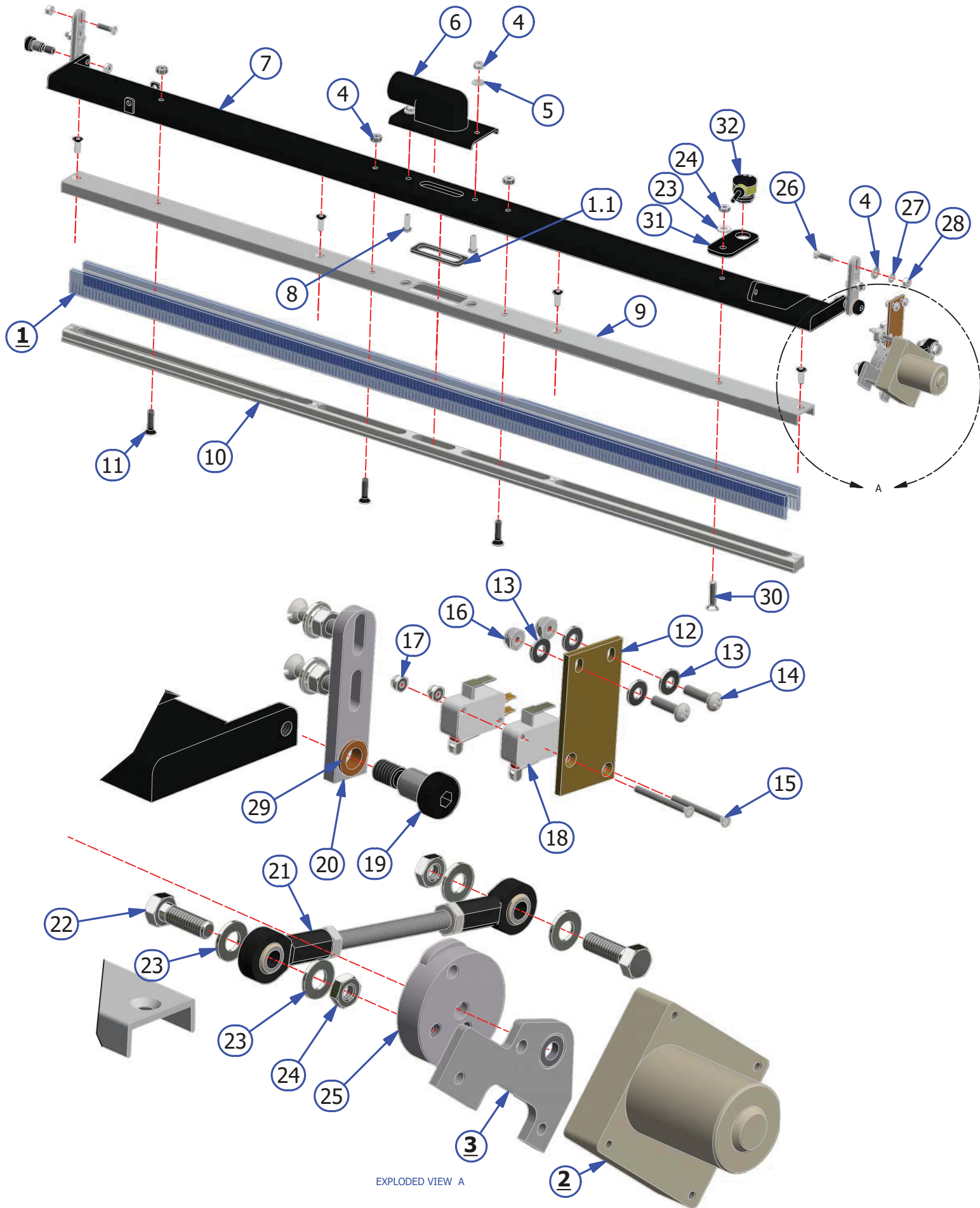
<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8017	FLEX RECOVERY TANK	EA
1.1	1	164-8017F	RECOVERY TANK FILTER	EA
2	12	153-2968	SCREW - 1/4-20 X 3/4 FSHCS	EA
3	1	164-6120	FLEX RECOVERY TANK COVER PLATE	EA
4	1	153-8827T	1-1/4 PVC ELBOW-TANK INLET (NO THREADS)	EA
5	6	153-2406	HOSE CLAMP (2 INCH)	EA
6	1	154-0260	FLEXIBLE HOSE - SOLD BY THE INCH	IN
7	1	154-0607	PVC ELBOW - 1-1/2 BARB X 1-1/2 BARB	EA
8	1	158-6244	ELBOW -RECOVERY TANK WITH TAPPED HOLE	EA
9	1	154-0223	ELBOW - 1/4" TUBE X 1/4" NPT	EA
10	1	158-0405	FLEX RECOVERY TANK GASKET	EA



# SQUEEGEE ASSEMBLY

REV. 9/17

<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8038K	SQUEEGEE BLADE AND GASKET REPLACEMENT (1 SET)	EA
1.1	1	164-0003	GASKET	EA
2	1	158-8402	MOTOR ASSEMBLY -24VDC	EA
3	1	158-8634	SQUEEGEE/BRUSH MOUNT PLATE ASSEMBLY	EA
	1	158-9614	BALL BEARING MINITURE	EA
4	2	153-2020	LOCKNUT - 1/4-20 (NYLOK)	EA
5	6	153-2004	1/4 FLATWASHER	EA
6	1	154-6677A	SQUEEGEE HOSE ADAPTER NYLON	EA
7	1	154-6339	SQUEEGEE MOUNT ANGLE - BLACK (USE 154-6339-2850)	EA
8	2	164-2023	BHSCS 1/4-20 X 3/4	EA
9	1	164-6074	EXTRUDED SQUEEGEE CHANNEL	EA
10	1	164-6075	MACHINED SQUEEGEE CHANNEL INSERT	EA
11	3	153-2503	FHSS - 5/16-18 X 1-1/4	EA
12	1	154-6824	SQUEEGEE CAM SWITCH PLATE	EA
13	4	153-2002	#8 FLATWASHER	EA
14	2	153-2086	MS PHILLIPS - 8-32 X 5/8	EA
15	2	153-2727	4-40 X 1-1/4 FHMS	EA
16	2	153-2019	LOCKNUT - 8-32 (NYLOK)	EA
17	2	153-2231	LOCKNUT - 4-40	EA
18	2	153-1203	MICROSWITCH W/ROLLER	EA
19	2	153-2303	SHOULDER BOLT-3/8 X 5/8 (5/16-18)	EA
20		154-6822	SQUEEGEE ADJUSTMENT ARM	EA
21	2	153-0211	ROD END	EA
22	2	153-2061	HHCS - 5/16-18 X 1	EA
23	5	153-2005	5/16 FLATWASHER	EA
24	3	153-2027A	JAM NUT - 5/16-18	EA
25	1	154-6243	MOTOR CAM-DUAL LOBES (STACKED SWITCHES)	EA
26	4	153-2079	FHCS - 1/4 X 20 1 BLACK ALLOY	EA
27	4	153-2014	LOCK WASHER 1/4"	EA
28	4	153-2023	1/4-20 HEX NUT	EA
29	2	153-9803	BUSHING	EA
30	1	153-2513	FHSS - 5/16-18 X 1-1/2	EA
31	1	164-6176	FAILSAFE SENSOR MOUNT PLATE	EA
32	1	164-1241	FAILSAFE BEAM SENSOR	EA

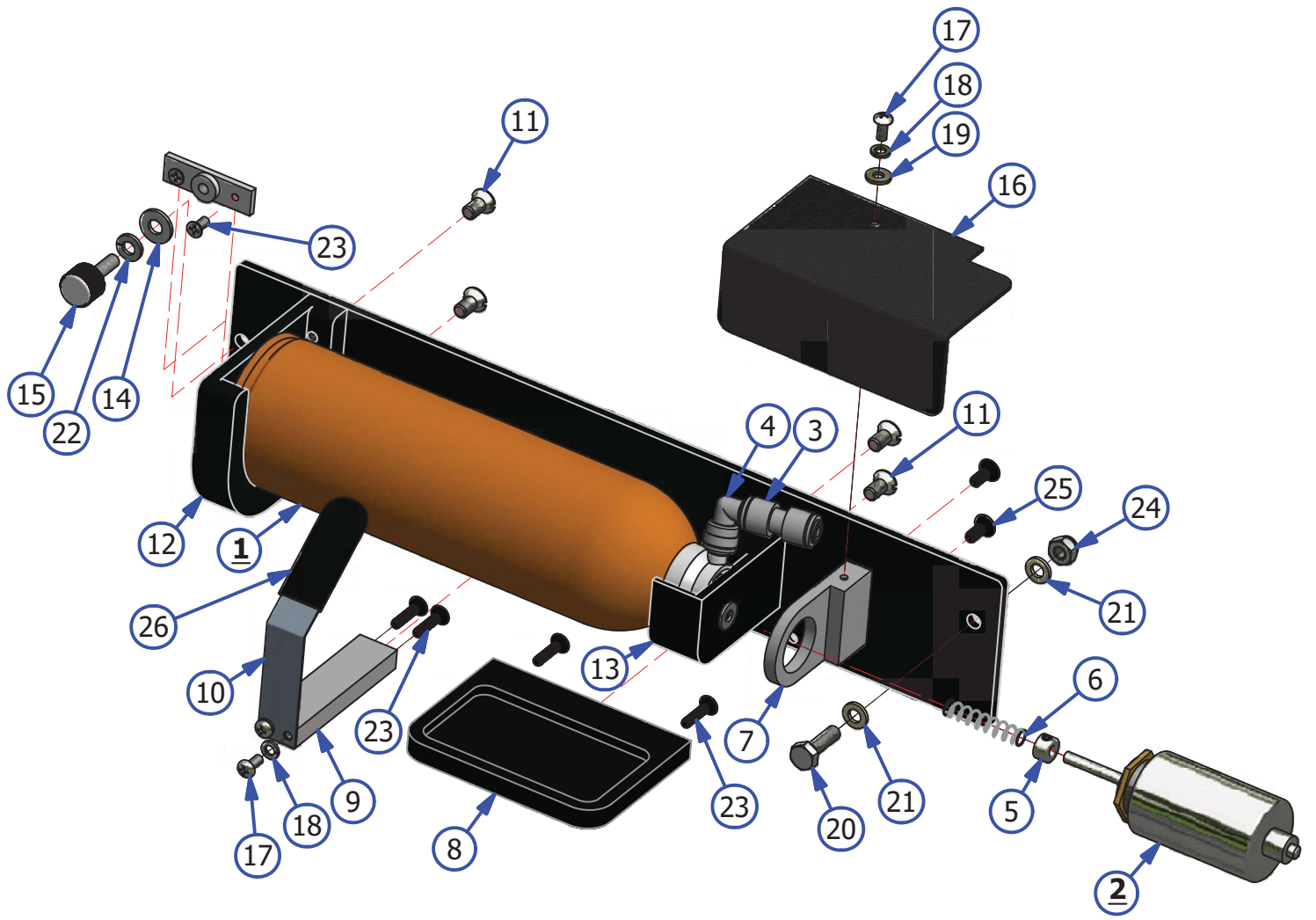


# PINDECK TREATMENT ASSEMBLY

REV. 3/16

<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
<u>1</u>	1	156-8310	SPOT ON PINDECK TREATMENT (CASE OF 4)	EA
<u>2</u>	1	164-8226	PINDECK SPRAY SOLENOID	EA
3	1	154-0248	REDUCING UNION	EA
4	1	154-0222	ELBOW 1/4" STEM X 1/4" TUBING OD	EA
5	1	164-2065	SHAFT COLLAR 3/16"	EA
6	1	164-1227	SOLENOID SPRING ASSEMBLY	EA
7	1	164-6242	SOLENOID BRACKET ASSEMBLY	EA
8	1	164-6245	DRIP TRAY ASSEMBLY	EA
9	1	164-6241	CAN CLIP BRACKET	EA
10	1	164-6240	CAN CLIP	EA
11	4	153-2742	FHMS 1/4-20 X 1/2	EA
12	1	164-6238	CAN CRADLE BOTTOM	EA
13	1	164-6237	CAN CRADLE TOP	EA
14	1	153-2004	FLAT WASHER 1/4"	EA
15	1	164-2016	THUMB SCREW - KNURLED HEAD	EA
16	1	164-6246	SOLENOID COVER	EA
17	3	153-2086A	MS PHILLIPS 8-32 X 3/8	EA
18	3	153-2013	LOCK WASHER #10	EA
19	1	153-2002	FLAT WASHER #10	EA
20	1	153-2052	HHCS 1/4-20 X 1"	EA
21	1	153-2510	NYLON WASHER 1/4"	EA
22	1	153-2014	LOCK WASHER 1/4"	EA
23		153-2542	FHSS ALLEN 8-32 X 3/4	EA
24	1	153-2020	LOCKNUT (NYLOCK 1/4")	EA
25	1	153-2998	FHCS SCREW 10-24 X 1/2" BLACK OXID	EA
26	1	164-2053	RECTANGLE CAP	EA

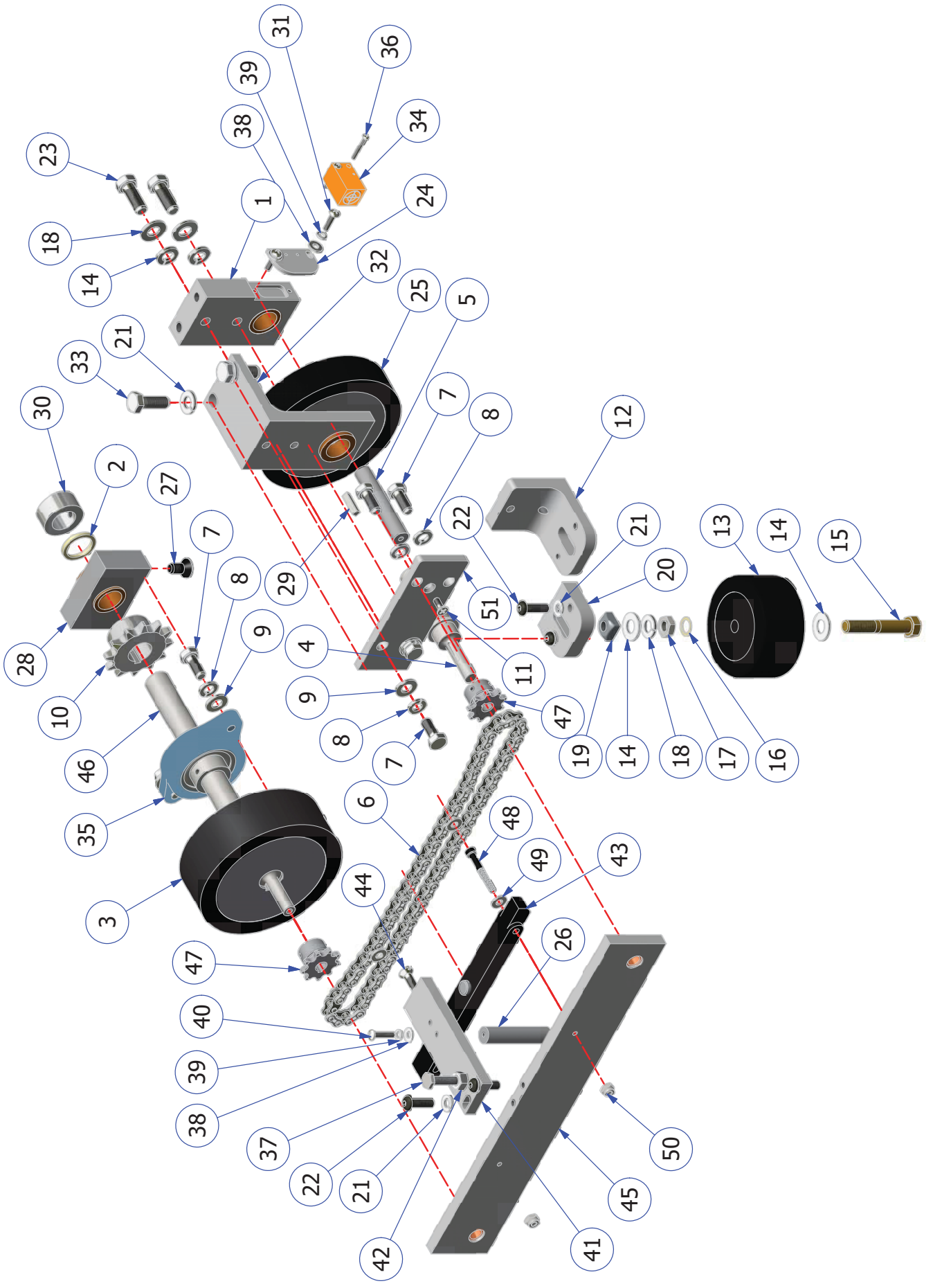




# ZTR ASSEMBLY - LEFT

REV. 3/16

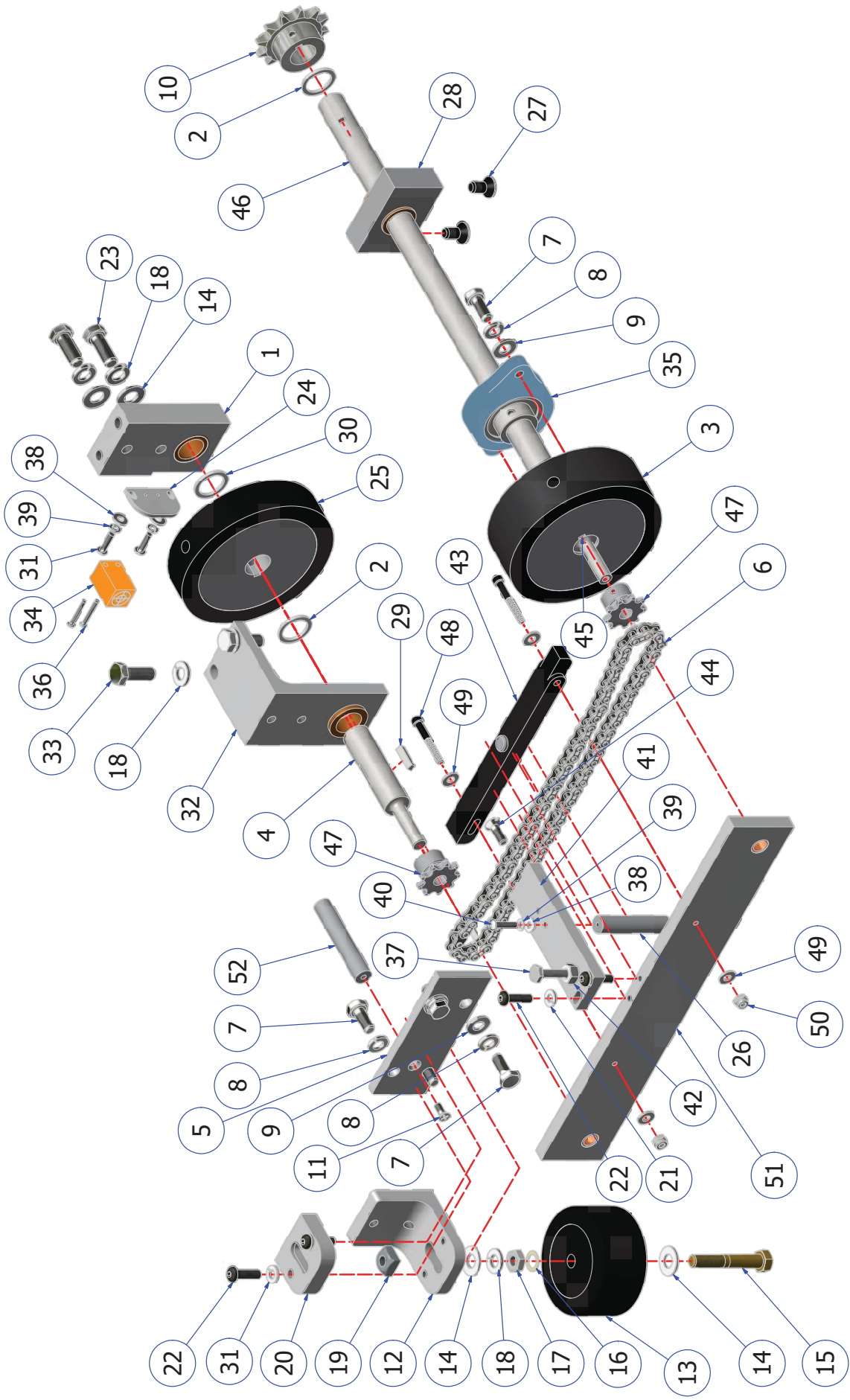
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-6034	KICK UP WHEEL MOUNTING BLOCK	EA
2	3	153-2939	NYLON WASHER 3/4" X 1/16"	EA
3	2	158-7001	DRIVE WHEEL 4.5 IN	EA
4	1	164-6030	FLEX KICK-UP WHEEL SHAFT	EA
5	1	158-6705	BUMPER WHEEL SIDE POST	EA
6	1	164-9005	CHAIN (35P67) ZTR KICKUP	EA
7	6	153-2602	HHCS - 5/16-18 X 3/4	EA
8	6	153-2015	5/16 LOCKWASHER	EA
9	4	153-2005	5/16 FLATWASHER	EA
10	1	158-9602	SPROCKET 40BAH 3/4 BORE WITH KEYWAY AND SET	EA
11	1	153-2604	MS FLAT PHILLIPS - 10-32 X 1/2	EA
12	1	164-6038	BUMPER WHEEL MOUNT ANGLE	EA
13	1	153-7203	BUMPER WHEEL	EA
14	2	153-2006	3/8 FLATWASHER	EA
15	1	153-2815	HHCS - 3/8-16 X 2-1/4 (GRADE 8)	EA
16	1	153-2531	NYLON FLAT WASHER - 3/8 (0.030)	EA
17	1	153-2027	JAM NUT - 3/8-16	EA
18	1	153-2016	3/8 LOCKWASHER	EA
19	1	164-2005	SQUARE NUT - 3/8-16	EA
20	1	164-6039	BUMPER WHEEL NUT RETAINER	EA
21	4	153-2014	1/4 LOCKWASHER	EA
22	4	153-2052A	BHSS - 1/4-20 X 7/8	EA
23	2	153-2066	HHCS - 3/8-16 X 1	EA
24	1	164-6222	ZTR PROXIMITY SENSOR MOUNT	EA
25		164-7002A	1" WIDE KICK UP WHEEL ASSEMBLY	EA
26	1	164-6162	GUARD STAND OFF	EA
27	2	153-2802A	FHSS - 5/16 X 5/8	EA
28	1	158-8601	ZTR SHAFT BUSHING BLOCK ASSEMBLY	EA
29	1	153-2100	KEYSTOCK - 3/16 X 3/4	EA
30	1	153-2937	SHAFT COLLAR 3/4" ID	EA
31	2	153-2086	MS PHILLIPS - 8-32 X 5/8	EA
32	1	164-8220	KICK UP WHEEL ANGLE ASSEMBLY	EA
33	2	153-2055	HHCS - 1/4-20 X 1-1/2	EA
34	1	154-1220	INDUCTIVE PROXIMITY SENSOR	EA
35	1	153-9816	3/4 IN FLANGED BEARING - 5/16-18 TAPPED	EA
36	2	153-2216A	MS PHILLIPS - 4-40 X 7/8	EA
37	1	153-2528	HHCS - 1/4"-20 X 1-3/4"	EA
38	1	153-2002	#8 FLATWASHER	EA
39	1	153-2013	#10 LOCKWASHER	EA
40	1	153-2087	MS PHILLIPS - 8-32 X 3/4	EA
41	1	164-6033	FLEX ZTR SUPPORT MOUNT	EA
42	1	153-2304	JAM NUT	EA
43	1	164-6031	ZTR CHAIN TENSIONER	EA
44	1	153-2078	FHMS - 1/4-20 X 3/4"	EA
45	1	164-6040	FLEX ZTR SHAFT SUPPORT	EA
46	1	164-6028	FLEX ZTR DRIVE SHAFT - LEFT	EA
47	2	164-9003	SPROCKET - 40B10 (5/8")	EA
48	2	164-2004	SHCS - 10-24 X 1-1/2	EA
49	2	153-2035	BLIND RIVET WASHER - 3/16	EA
50	2	153-2208	LOCKNUT - 10-24 (NYLOK)	EA
51	1	164-6221	BUMPER WHEEL PLATE	EA



# ZTR ASSEMBLY - RIGHT

REV. 3/16

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8219	KICK UP WHEEL MOUNTING BLOCK	EA
2	2	153-2939	NYLON WASHER 3/4" X 1/16"	EA
3	1	158-7001	DRIVE WHEEL 4.5 IN	EA
4	1	164-6030	FLEX KICK-UP WHEEL SHAFT	EA
5	1	164-6221	BUMPER WHEEL PLATE	EA
6	1	164-9005	CHAIN (35P67) ZTR KICKUP	EA
7	6	153-2602	HHCS - 5/16-18 X 3/4	EA
8	6	153-2015	5/16 LOCKWASHER	EA
9	4	153-2005	5/16 FLATWASHER	EA
10	1	158-9602	SPROCKET 40BAH 3/4 BORE WITH KEYWAY AND SET	EA
11	1	153-2604	MS FLAT PHILLIPS - 10-32 X 1/2	EA
12	1	164-6038	BUMPER WHEEL MOUNT ANGLE	EA
13	1	153-7203	BUMPER WHEEL	EA
14	2	153-2006	3/8 FLATWASHER	EA
15	1	153-2815	HHCS - 3/8-16 X 2-1/4 (GRADE 8)	EA
16	1	153-2531	NYLON FLAT WASHER - 3/8 (0.030)	EA
17	1	153-2027	JAM NUT - 3/8-16	EA
18	1	153-2016	3/8 LOCKWASHER	EA
19	1	164-2005	SQUARE NUT - 3/8-16	EA
20	1	164-6039	BUMPER WHEEL NUT RETAINER	EA
21	4	153-2014	1/4 LOCKWASHER	EA
22	4	153-2052A	BHSS - 1/4-20 X 7/8	EA
23	2	153-2066	HHCS - 3/8-16 X 1	EA
24	1	164-6222	ZTR PROXIMITY SENSOR MOUNT	EA
25		164-7002A	1" WIDE KICK UP WHEEL ASSEMBLY	EA
26	1	164-6162	GUARD STAND OFF	EA
27	2	153-2802	FHSS - 5/16 X 5/8	EA
28	1	158-8601	ZTR SHAFT BUSHING BLOCK ASSEMBLY	EA
29	1	153-2100	KEYSTOCK - 3/16 X 3/4	EA
30	1	158-9601	BUSHING FLANGED - 3/4 ID X 7/8 OD	EA
31	2	153-2086	MS PHILLIPS - 8-32 X 5/8	EA
32	1	164-8220	KICK UP WHEEL ANGLE ASSEMBLY	EA
33	4	153-2066	HHCS - 3/8-16 x 1	EA
34	1	154-1220	INDUCTIVE PROXIMITY SENSOR	EA
35	1	153-9816	3/4 IN FLANGED BEARING - 5/16-18 TAPPED	EA
36	2	153-2216A	MS PHILLIPS - 4-40 X 7/8	EA
37	1	153-2528	HHCS - 1/4"-20 X 1-3/4"	EA
38	1	153-2002	#8 FLATWASHER	EA
39	1	153-2013	#10 LOCKWASHER	EA
40	1	153-2087	MS PHILLIPS - 8-32 X 3/4	EA
41	1	164-6033	FLEX ZTR SUPPORT MOUNT	EA
42	1	153-2304	JAM NUT	EA
43	1	164-6031	ZTR CHAIN TENSIONER	EA
44	1	153-2078	FHMS - 1/4-20 X 1" SELF LOCKING	EA
45	1	153-2102	KEYSTOCK - 3/16 X 1-1/4"	EA
46	1	164-6029	FLEX ZTR DRIVE SHAFT - RIGHT	EA
47	2	164-9003	SPROCKET - 40B10 (5/8")	EA
48	2	164-2004	SHCS - 10-24 X 1-1/2	EA
49	4	153-2035	BLIND RIVET WASHER - 3/16	EA
50	2	153-2208	LOCKNUT - 10-24 (NYLON)	EA
51	1	164-6040	FLEX ZTR SHAFT SUPPORT	EA
52	1	158-6705	BUMPER WHEEL SIDE POST	EA





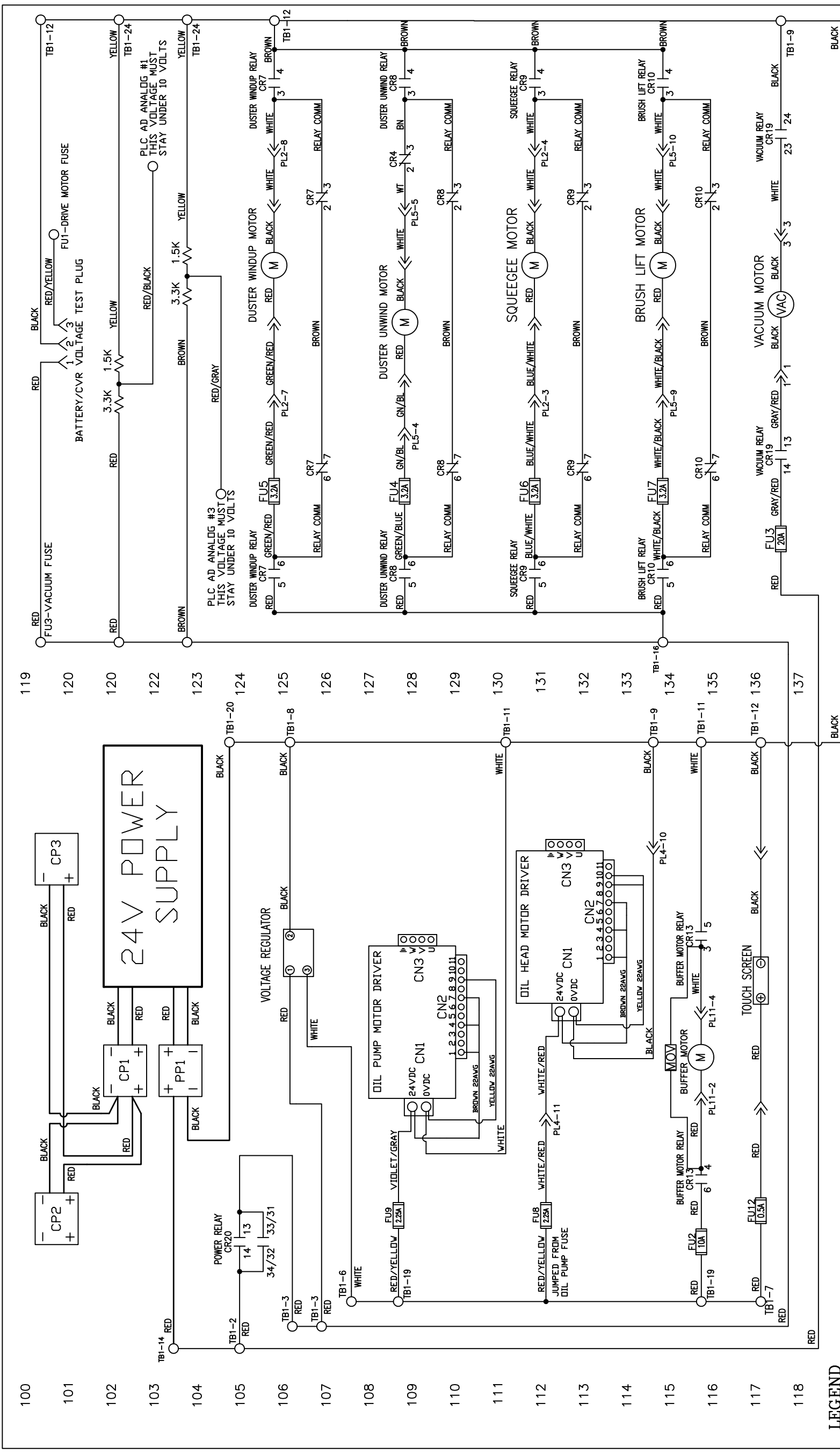
# CHAPTER 9

## FLEX ELECTRICAL DRAWINGS

The following diagrams show wiring schematics for the Kustodian Walker. Detailed diagrams for the Ion follow this section. If you have any questions please call 863-734-0200 or email [tech@kegel.net](mailto:tech@kegel.net).

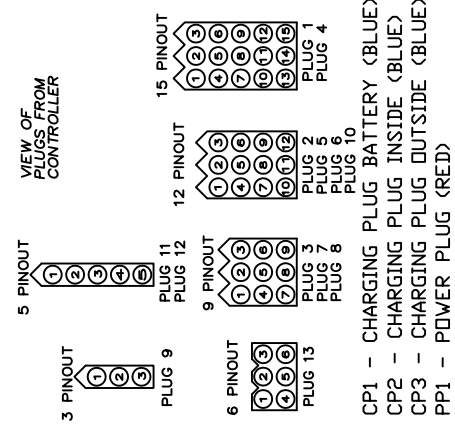
Flex Motor Wiring Layout	230
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Flex Analog Wiring Layout	234
Flex Terminal Block Wiring Layout	235
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### Flex Motor Wiring Layout



**LEGEND**

- CR1 - OIL VALVE RELAY TANK A
  - CR2 - OIL VALVE RELAY TANK B
  - CR3 - CONTROL RELAY
  - CR4 - DUSTER POLARITY SWITCH RELAY
  - CR5 - PIN DECK TREATMENT RELAY
  - CR6 - POWER OFF RELAY
  - CR7 - DUSTER WINDUP MOTOR RELAY
  - CR8 - DUSTER UNWIND MOTOR RELAY
  - CR9 - SQUEEGEE LIFT MOTOR RELAY
  - CR10 - BRUSH LIFT MOTOR RELAY
  - CR11 - FORWARD DRIVE MOTOR RELAY
  - CR12 - REVERSE DRIVE MOTOR RELAY
  - CR13 - BUFFER MOTOR RELAY
  - CR14 -
  - CR15 -
  - CR16 -
  - CR17 -
  - CR18 -
  - CR19 - VACUUM MOTOR RELAY
  - CR20 - POWER RELAY
- FU1 - DRIVE MOTOR 7.5A
  - FU2 - BUFFER MOTOR 10A/20A
  - FU3 - VACUUM MOTOR 20A
  - FU4 - DUSTER UNWIND 3.2A
  - FU5 - DUSTER WINDUP 3.2A
  - FU6 - SQUEEGEE MOTOR 3.2A
  - FU7 - BRUSH LIFT MOTOR 3.2A
  - FU8 - HEAD DRIVE MOTOR 2.25A
  - FU9 - OIL PUMP MOTOR 2.25A
  - FU10 - PLC INPUT POWER/L1 0.5A
  - FU11 - PLC OUTPUT COMMON 0.5A
  - FU12 - TOUCH SCREEN 0.5A
  - FU13 - CLEANER PUMP #1 3.2A
  - FU14 - CLEANER PUMP #2 3.2A
  - FU15 - CVR POWER 25A/30A
  - FU16 - LED LIGHTS 1A
  - FU17 - TRIGGER SOLENOID 3.2A
- PL1 - 10-PIN SIDE PLUG (15)
  - PL2 - 10-PIN SIDE PLUG (12)
  - PL3 - 10-PIN SIDE PLUG (9)
  - PL4 - 7-PIN SIDE PLUG (15)
  - PL5 - 7-PIN SIDE PLUG (12)
  - PL6 - DRIVE SPEED BOARD PLUG (12)
  - PL7 - CLEANER PUMP #1 SPEED BOARD PLUG (9)
  - PL8 - CLEANER PUMP #2 SPEED BOARD PLUG (9)
  - PL9 -
  - PL10 - BUFFER SPEED BOARD PLUG (12)
  - PL11 - BUFFER MOTOR PLUG (5)
  - PL12 - BUFFER MOTOR VARIABLE SPEED PLUG (5)
  - PL13 - OIL PLATE ASSEMBLY PLUG (6)
- TB1 - TERMINAL BLOCK 1 (MAIN)
  - TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
  - TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
  - TB4 - TERMINAL BLOCK 4 (OIL PLATE)
  - TB5 - TERMINAL BLOCK 5 (TOP PLC PLATE)

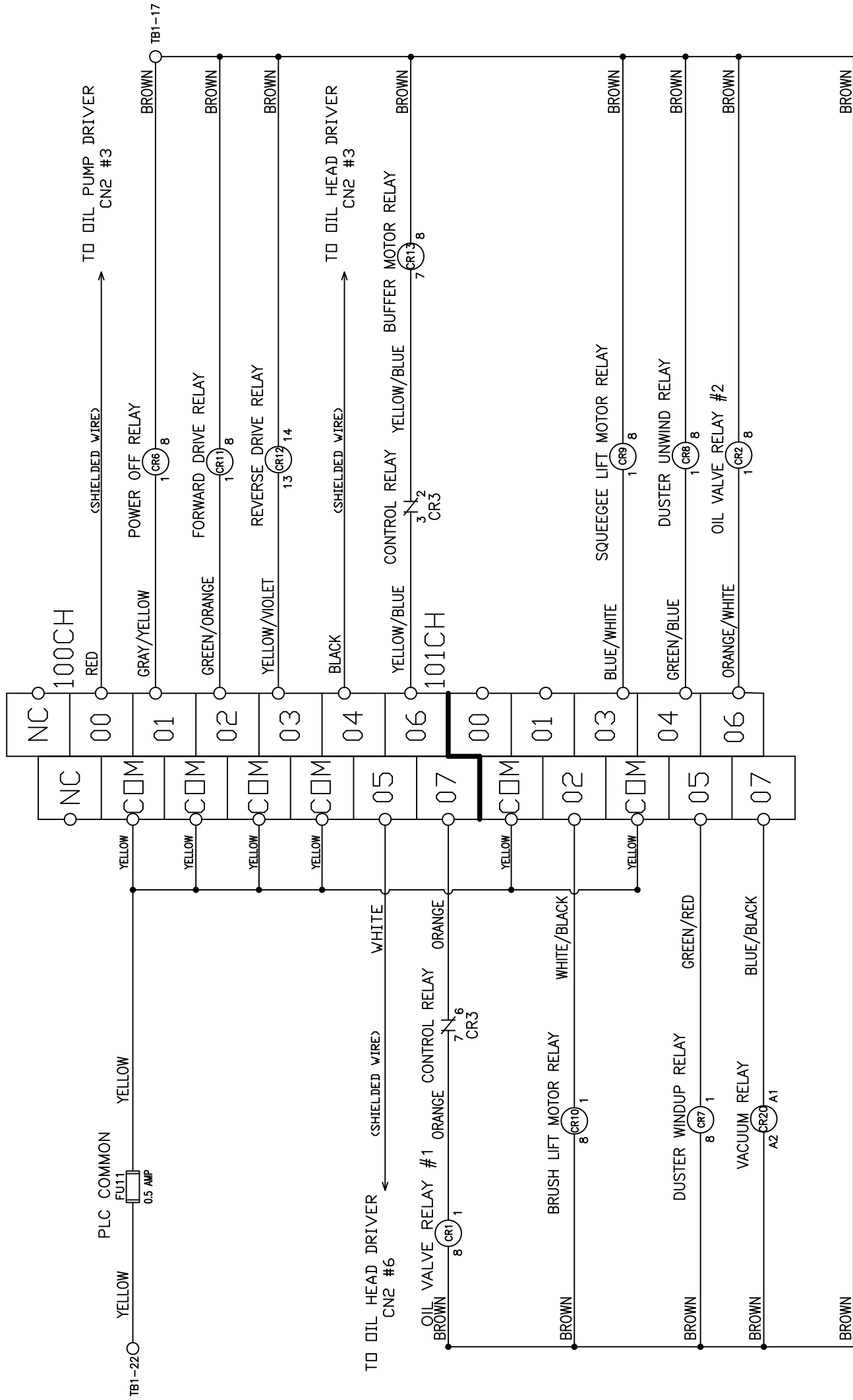


<b>MATERIAL</b>		N/A	
<b>DESCRIPTION</b>		MOTOR WIRING SCHEMATIC	
<b>DRAWN BY</b>	SLS	<b>DATE</b>	07/21/15
<b>APPROVED:</b>	MP	<b>REV DATE</b>	
<b>DOC REV</b>		<b>SIZE</b>	QTY/MACHINE PART NUMBER
		<b>SCALE</b>	C N/A
		<b>SHEET</b>	1 OF 26

1961 LONGLEAF BLVD.  
LAKE WALES, FL 33859  
(866) 784-0200



DMRON  
SYSMAC  
CPIH  
OUTPUTS



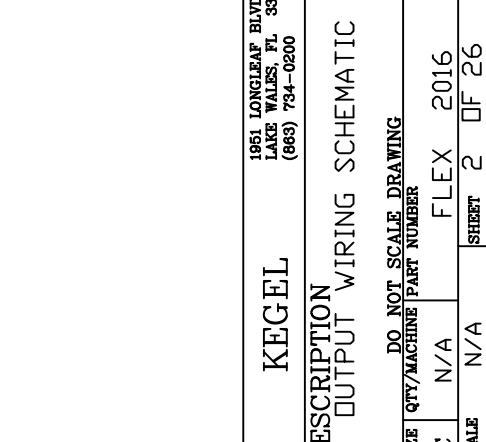
LEGEND

- CR1 - OIL VALVE RELAY TANK A
- CR2 - OIL VALVE RELAY TANK B
- CR3 - CONTROL RELAY
- CR4 - DUSTER POLARITY SWITCH RELAY
- CR5 - PIN DECK TREATMENT RELAY
- CR6 - POWER OFF RELAY
- CR7 - DUSTER WINDUP MOTOR RELAY
- CR8 - DUSTER UNWIND MOTOR RELAY
- CR9 - SQUEEGEE LIFT MOTOR RELAY
- CR10 - BRUSH LIFT MOTOR RELAY
- CR11 - FORWARD DRIVE MOTOR RELAY
- CR12 - REVERSE DRIVE MOTOR RELAY
- CR13 - BUFFER MOTOR RELAY
- CR14 -
- CR15 -
- CR16 -
- CR17 -
- CR18 - VACUUM MOTOR RELAY
- CR20 - POWER RELAY

- FU1 - DRIVE MOTOR 7.5A
- FU2 - BUFFER MOTOR 10A/20A
- FU3 - VACUUM MOTOR 20A
- FU4 - DUSTER UNWIND 3.2A
- FU5 - DUSTER WINDUP 3.2A
- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 2.25A
- FU9 - OIL PUMP MOTOR 2.25A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - PLC OUTPUT COMMON 0.5A
- FU12 - TOUCH SCREEN 0.5A
- FU13 - CLEANER PUMP #1 3.2A
- FU14 - CLEANER PUMP #2 3.2A
- FU15 - CVR POWER 25A/30A
- FU16 - LED LIGHTS 1A
- FU17 - TRIGGER SOLENOID 3.2A

- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (9)
- PL4 - 7-PIN SIDE PLUG (15)
- PL5 - 7-PIN SIDE PLUG (12)
- PL6 - DRIVE SPEED BOARD PLUG (12)
- PL7 - CLEANER PUMP #1 SPEED BOARD PLUG (9)
- PL8 - CLEANER PUMP #2 SPEED BOARD PLUG (9)
- PL9 -
- PL10 - BUFFER SPEED BOARD PLUG (12)
- PL11 - BUFFER MOTOR PLUG (5)
- PL12 - BUFFER MOTOR VARIABLE SPEED PLUG (5)
- PL13 - OIL PLATE ASSEMBLY PLUG (6)

- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
- TB4 - TERMINAL BLOCK 4 (OIL PLATE)

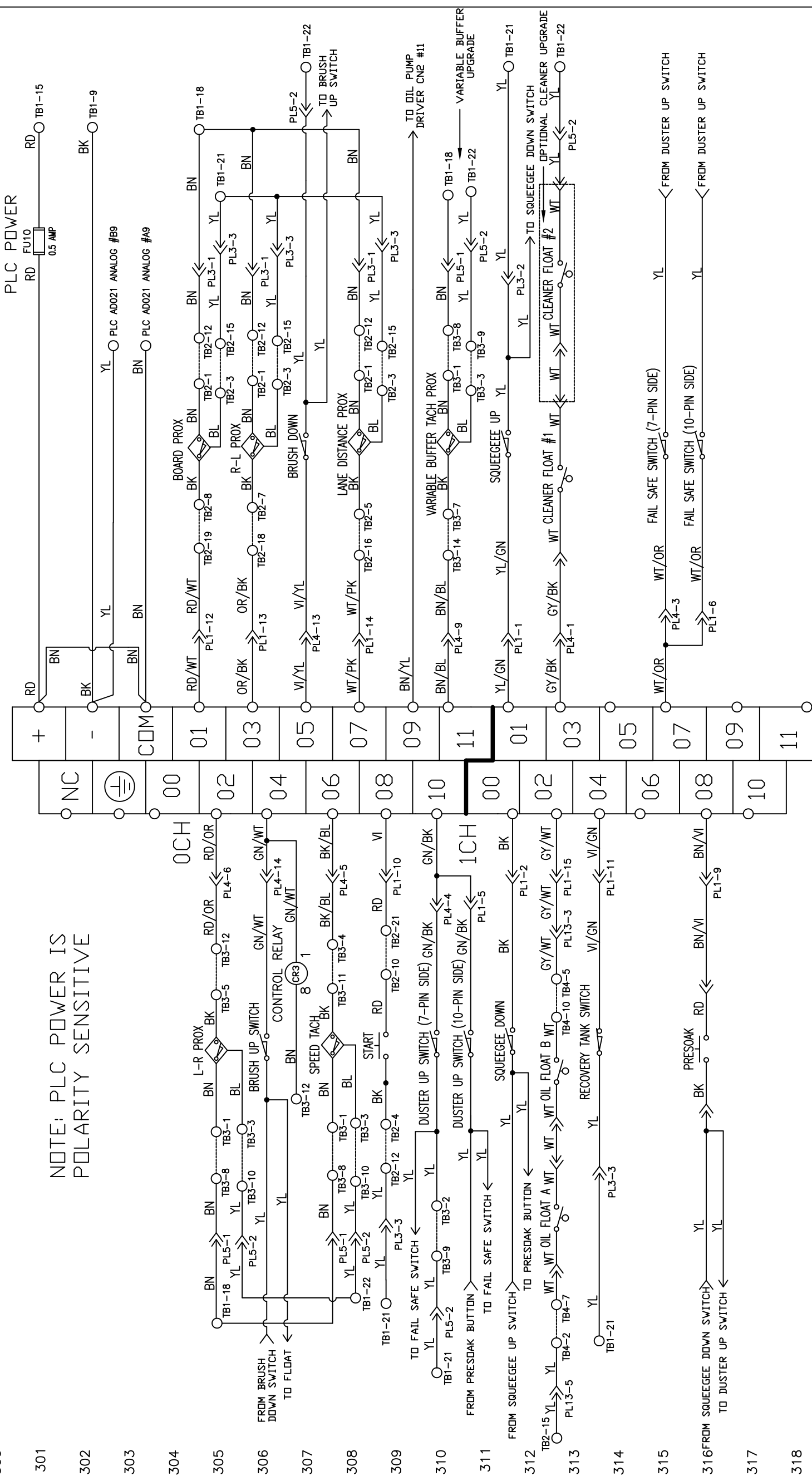


MATERIAL		N/A	
DESCRIPTION		OUTPUT WIRING SCHEMATIC	
DRAWN BY	DATE	DO NOT SCALE DRAWING	
SLS	07/20/15	SIZE	QTY/MACHINE PART NUMBER
APPROVED:	MP	C	N/A
DOC REV	SCALE	N/A	SHEET 2 OF 26

1951 LONGLEAF BLVD.  
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(888) 794-0200

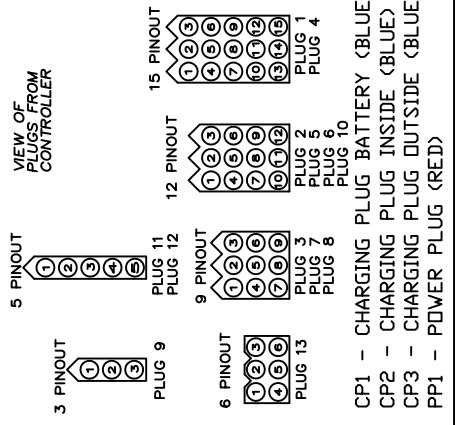
OMRON SYSMAC CP1H INPUTS

NOTE: PLC POWER IS  
POLARITY SENSITIVE



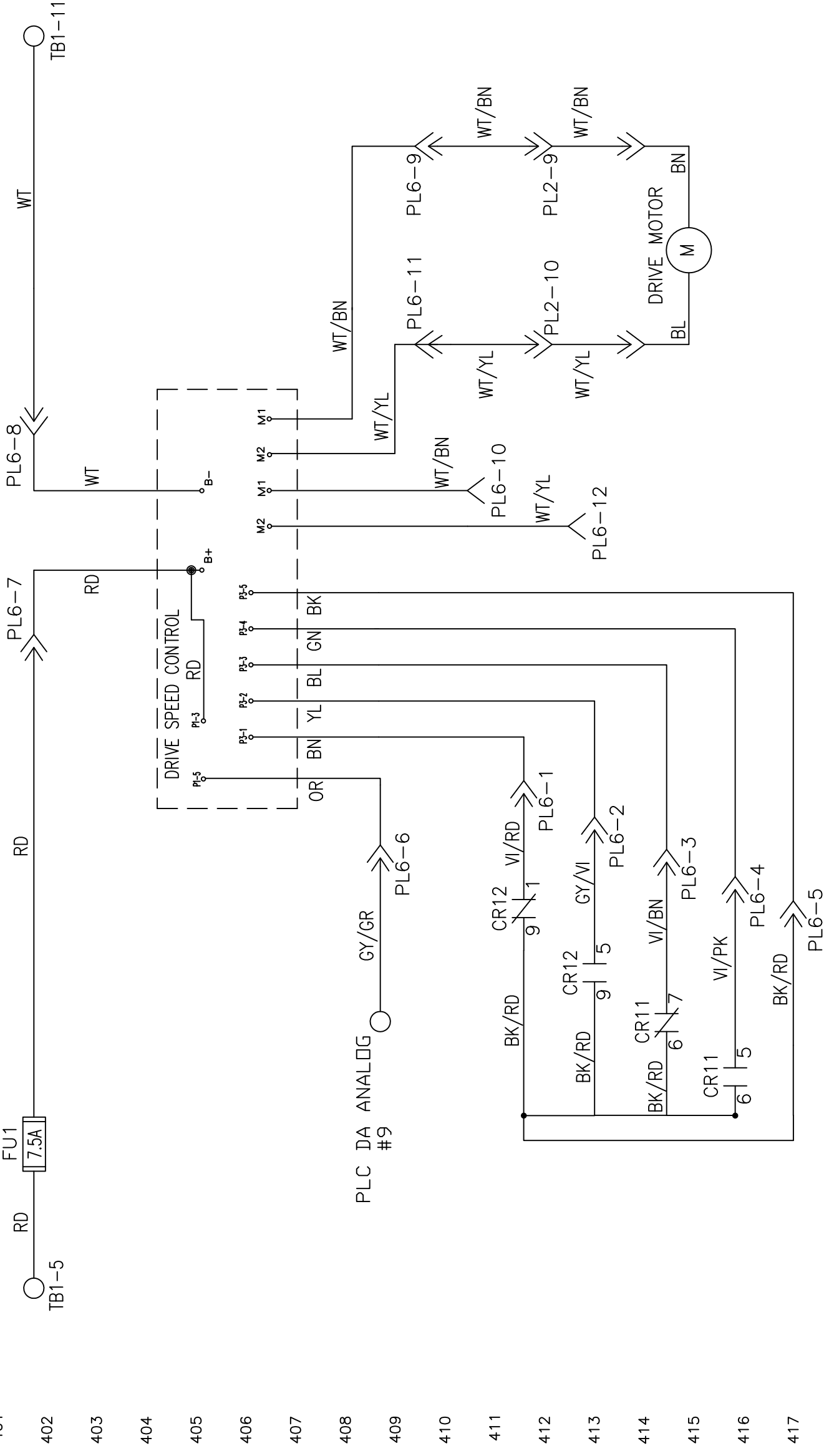
LEGEND

- CR1 - OIL VALVE RELAY TANK A
- CR2 - OIL VALVE RELAY TANK B
- CR3 - CONTROL RELAY
- CR4 - DUSTER POLARITY SWITCH RELAY
- CR5 - PIN DECK TREATMENT RELAY
- CR6 - POWER OFF RELAY
- CR7 - DUSTER WINDUP MOTOR RELAY
- CR8 - DUSTER UNWIND MOTOR RELAY
- CR9 - SQUEEGEE LIFT MOTOR RELAY
- CR10 - BRUSH LIFT MOTOR RELAY
- CR11 - FORWARD DRIVE MOTOR RELAY
- CR12 - REVERSE DRIVE MOTOR RELAY
- CR13 - BUFFER MOTOR RELAY
- CR14 -
- CR15 -
- CR16 -
- CR17 -
- CR18 - VACUUM MOTOR RELAY
- CR20 - POWER RELAY
- FU1 - DRIVE MOTOR 7.5A
- FU2 - BUFFER MOTOR 10A/20A
- FU3 - VACUUM MOTOR 20A
- FU4 - DUSTER UNWIND 3.2A
- FU5 - DUSTER WINDUP 3.2A
- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 2.25A
- FU9 - OIL PUMP MOTOR 2.25A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - PLC OUTPUT COMMON 0.5A
- FU12 - TOUCH SCREEN 0.5A
- FU13 - CLEANER PUMP #1 3.2A
- FU14 - CLEANER PUMP #2 3.2A
- FU15 - CVR POWER 25A/30A
- FU16 - LED LIGHTS 1A
- FU17 - TRIGGER SOLENOID 3.2A
- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (9)
- PL4 - 7-PIN SIDE PLUG (15)
- PL5 - 7-PIN SIDE PLUG (12)
- PL6 - DRIVE SPEED BOARD PLUG (12)
- PL7 - CLEANER PUMP #1 SPEED BOARD PLUG (9)
- PL8 - CLEANER PUMP #2 SPEED BOARD PLUG (9)
- PL9 -
- PL10 - BUFFER SPEED BOARD PLUG (12)
- PL11 - BUFFER MOTOR PLUG (5)
- PL12 - BUFFER MOTOR VARIABLE SPEED PLUG (5)
- PL13 - OIL PLATE ASSEMBLY PLUG (6)
- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
- TB4 - TERMINAL BLOCK 4 (OIL PLATE)



MATERIAL		N/A	
DESCRIPTION		INPUT WIRING SCHEMATIC	
DRAWN BY	DATE	SIZE	SCALE
SLS	07/20/15	C	N/A
APPROVED:	REV DATE	QTY/MACHINE PART NUMBER	SHEET
MP		FLEX	26
DOC REV			3 OF 26

KEGEL P/N  
154-1270

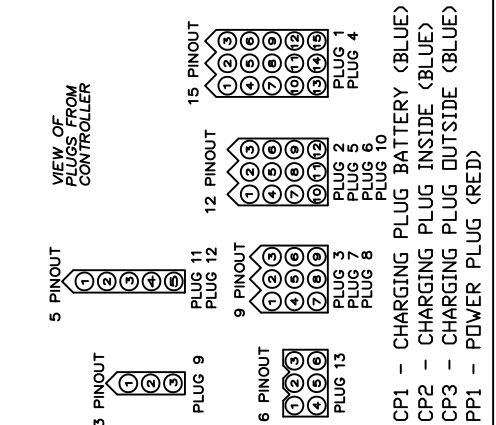


**LEGEND**

- CR1 - OIL VALVE RELAY TANK A
- CR2 - OIL VALVE RELAY TANK B
- CR3 - CONTROL RELAY
- CR4 - DUSTER POLARITY SWITCH RELAY
- CR5 - PIN DECK TREATMENT RELAY
- CR6 - POWER OFF RELAY
- CR7 - DUSTER WINDUP MOTOR RELAY
- CR8 - DUSTER UNWIND MOTOR RELAY
- CR9 - SQUEEGEE LIFT MOTOR RELAY
- CR10 - BRUSH LIFT MOTOR RELAY
- CR11 - FORWARD DRIVE MOTOR RELAY
- CR12 - REVERSE DRIVE MOTOR RELAY
- CR13 - BUFFER MOTOR RELAY
- CR14 -
- CR15 -
- CR16 -
- CR17 -
- CR18 - VACUUM MOTOR RELAY
- CR20 - POWER RELAY

- FU1 - DRIVE MOTOR 7.5A
- FU2 - BUFFER MOTOR 10A/20A
- FU3 - VACUUM MOTOR 20A
- FU4 - DUSTER UNWIND 3.2A
- FU5 - DUSTER WINDUP 3.2A
- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 2.25A
- FU9 - OIL PUMP MOTOR 2.25A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - PLC OUTPUT COMMON 0.5A
- FU12 - TOUCH SCREEN 0.5A
- FU13 - CLEANER PUMP #1 3.2A
- FU14 - CLEANER PUMP #2 3.2A
- FU15 - CVR POWER 25A/30A
- FU16 - LED LIGHTS 1A
- FU17 - TRIGGER SOLENOID 3.2A

- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (9)
- PL4 - 7-PIN SIDE PLUG (15)
- PL5 - 7-PIN SIDE PLUG (12)
- PL6 - DRIVE SPEED BOARD PLUG (12)
- PL7 - CLEANER PUMP #1 SPEED BOARD PLUG (9)
- PL8 - CLEANER PUMP #2 SPEED BOARD PLUG (9)
- PL9 -
- PL10 - BUFFER SPEED BOARD PLUG (12)
- PL11 - BUFFER MOTOR PLUG (5)
- PL12 - BUFFER MOTOR VARIABLE SPEED PLUG (5)
- PL13 - OIL PLATE ASSEMBLY PLUG (6)
- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
- TB4 - TERMINAL BLOCK 4 (OIL PLATE)

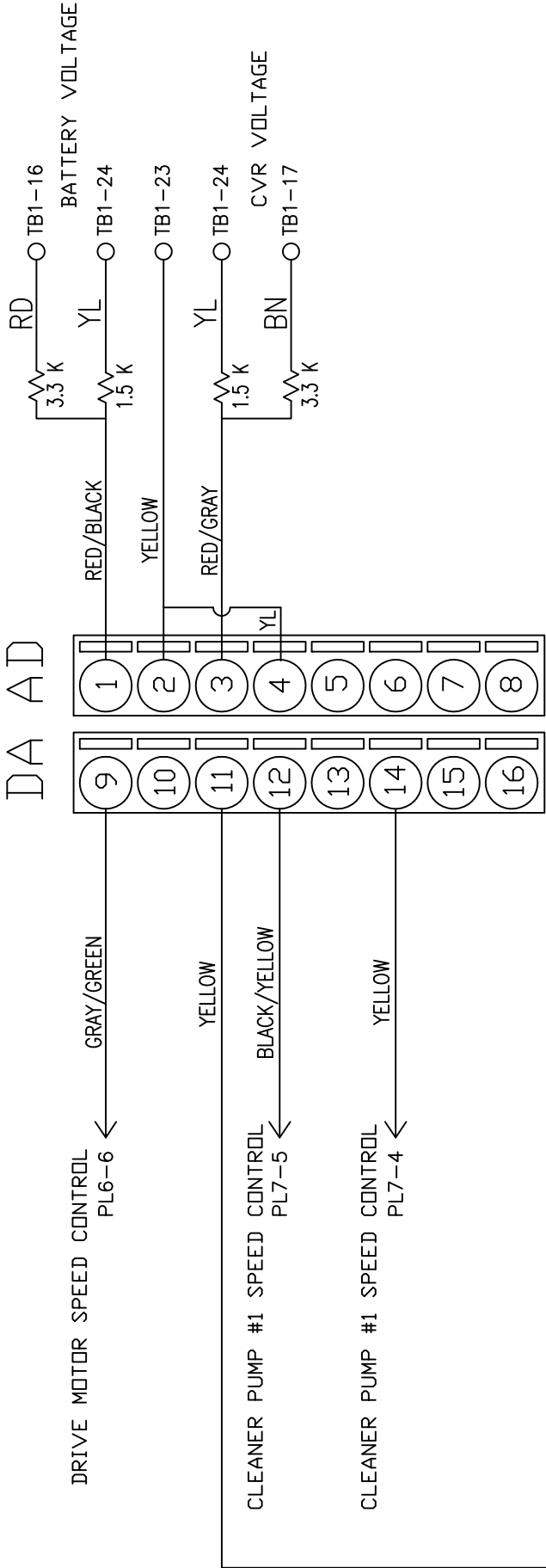


<b>MATERIAL</b>		N/A	
<b>DESCRIPTION</b>	SPEED CONTROL SCHEMATIC		
<b>DATE</b>	07/21/15	<b>DO NOT SCALE DRAWING</b>	
<b>DRAWN BY</b>	SLS	<b>APPROVED:</b>	MP
<b>SIZE</b>	C	<b>QTY/MACHINE PART NUMBER</b>	N/A
<b>SCALE</b>	N/A	<b>REV</b>	4
<b>REV</b>		<b>SHEET</b>	4 OF 26

1961 LONGLEAF BLVD.  
LAKE WALES, FL 33869  
(863) 734-0200

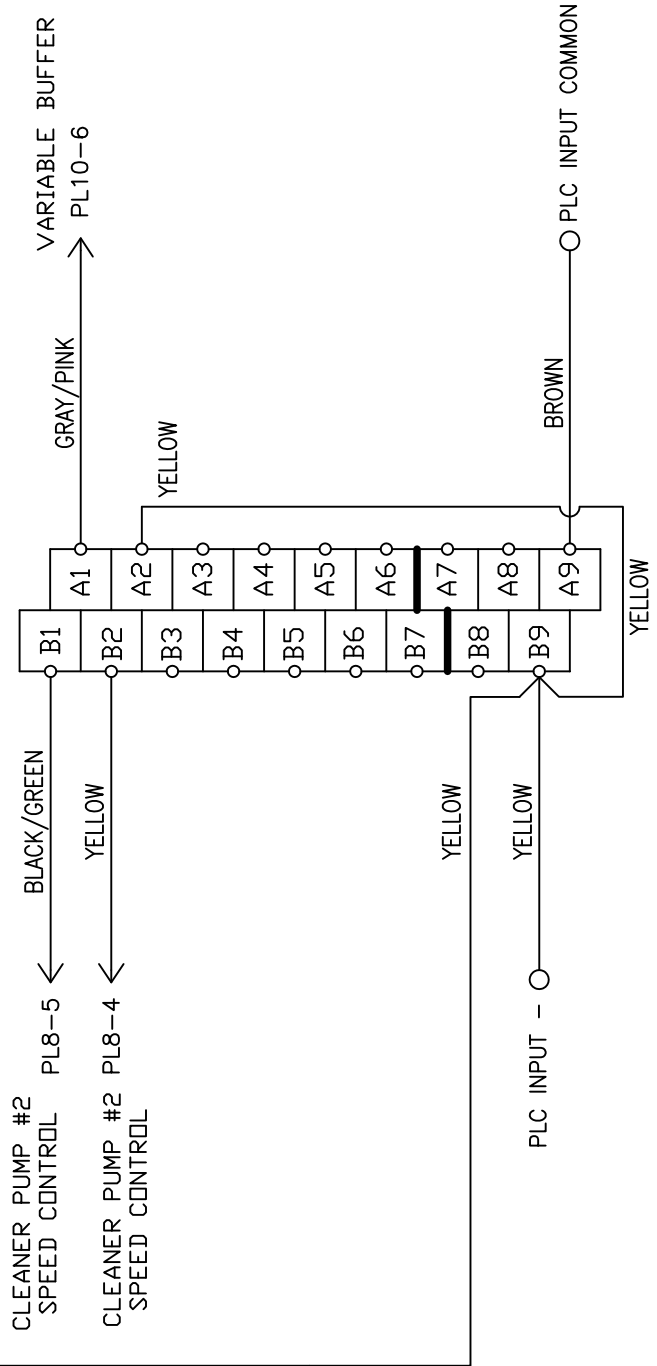
- CP1 - CHARGING PLUG BATTERY (BLUE)
- CP2 - CHARGING PLUG INSIDE (BLUE)
- CP3 - CHARGING PLUG OUTSIDE (BLUE)
- PP1 - POWER PLUG (RED)

# BUILT IN PLC ANALOG



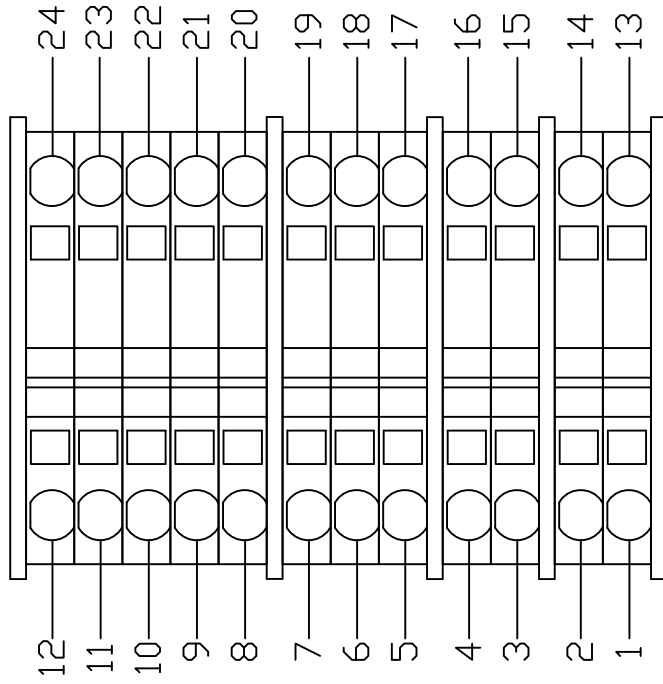
YELLOW

# AD021 ANALOG ADD ON UNIT



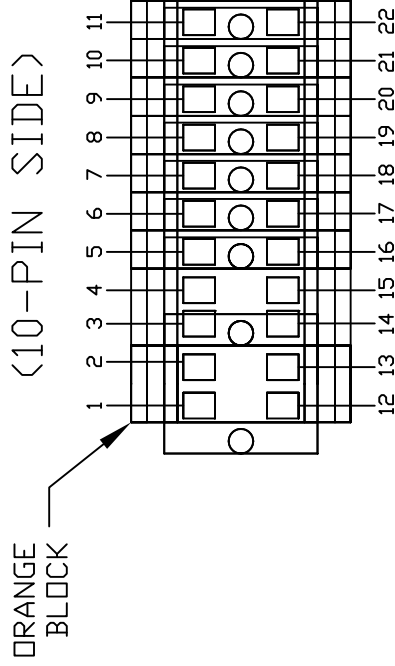
MATERIAL NA		KEGEL	
DRAWN BY SLS		DESCRIPTION ANALOG WIRING SCHEMATIC	
DATE 07/21/15	DO NOT SCALE DRAWING	1061 LONGLEAF BLVD.	
APPROVED: MP	SIZE: C	LAKE WALKER, FL 33669	
REV: 5	SCALE: N/A	(866) 734-0200	
FLEX 2016		CVR VOLTAGE	
SECRET		BATTERY VOLTAGE	
5		CVR VOLTAGE	
DF		CVR VOLTAGE	
26		CVR VOLTAGE	

# TB1 <MAIN>



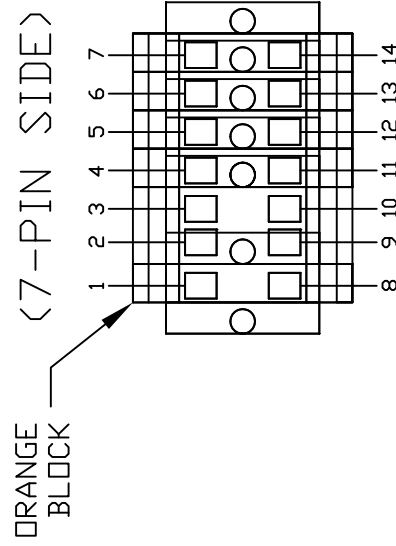
# TB2

<10-PIN SIDE>



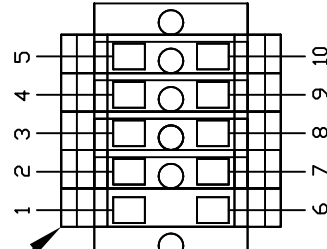
# TB3

<7-PIN SIDE>



# TB4

<OIL PLATE>



## LEGEND

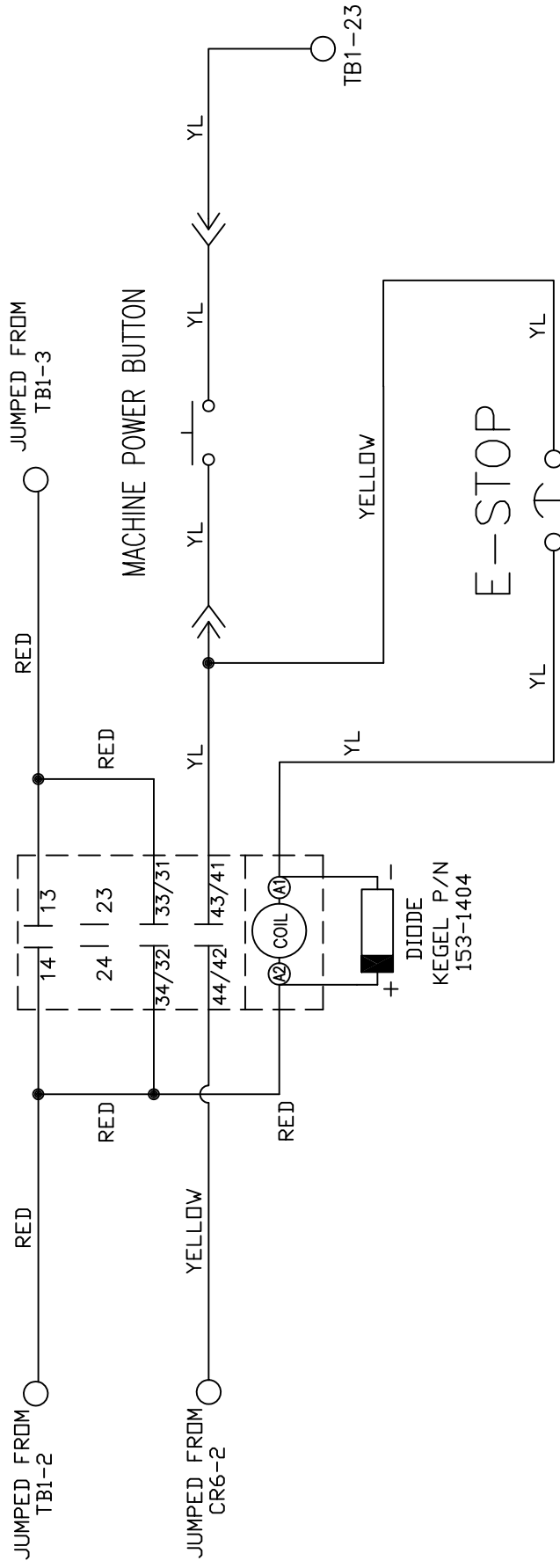
- TB1 - TERMINAL BLOCK 1 <MAIN>
- TB2 - TERMINAL BLOCK 2 <10-PIN SIDE>
- TB3 - TERMINAL BLOCK 3 <7-PIN SIDE>
- TB4 - TERMINAL BLOCK 4 <OIL PLATE>

MATERIAL NA		KEGEL 1961 LONGLEAF BLVD. LAKE WALKER, FL 33669 (863) 734-0200	
DRAWN BY SLS		DESCRIPTION TERMINAL BLOCK LAYOUT	
DATE 07/21/15	DO NOT SCALE DRAWING	SIZE C	REV DATE
APPROVED: MP	DO NOT SCALE DRAWING	SCALE N/A	REV 6
ISSUE REV	QTY/MACHINE PART NUMBER	FLEX 2016	OF 26

4 3 2 1

D C B A

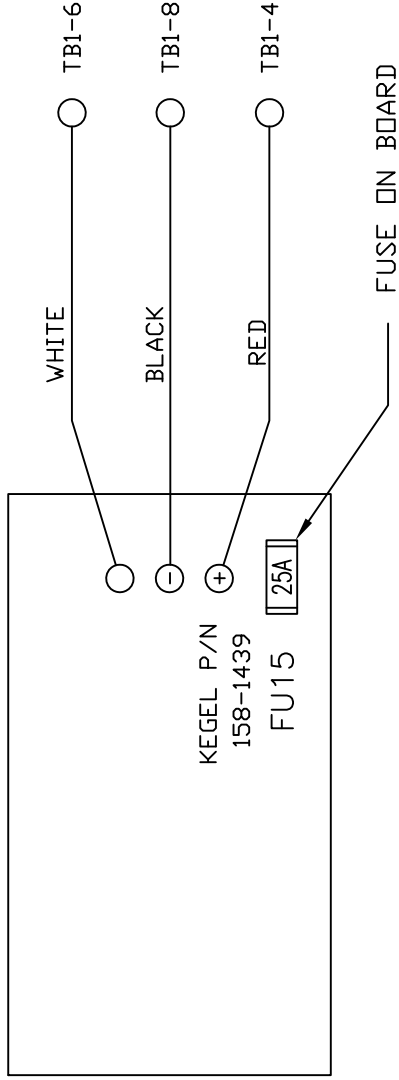
POWER RELAY  
CR20



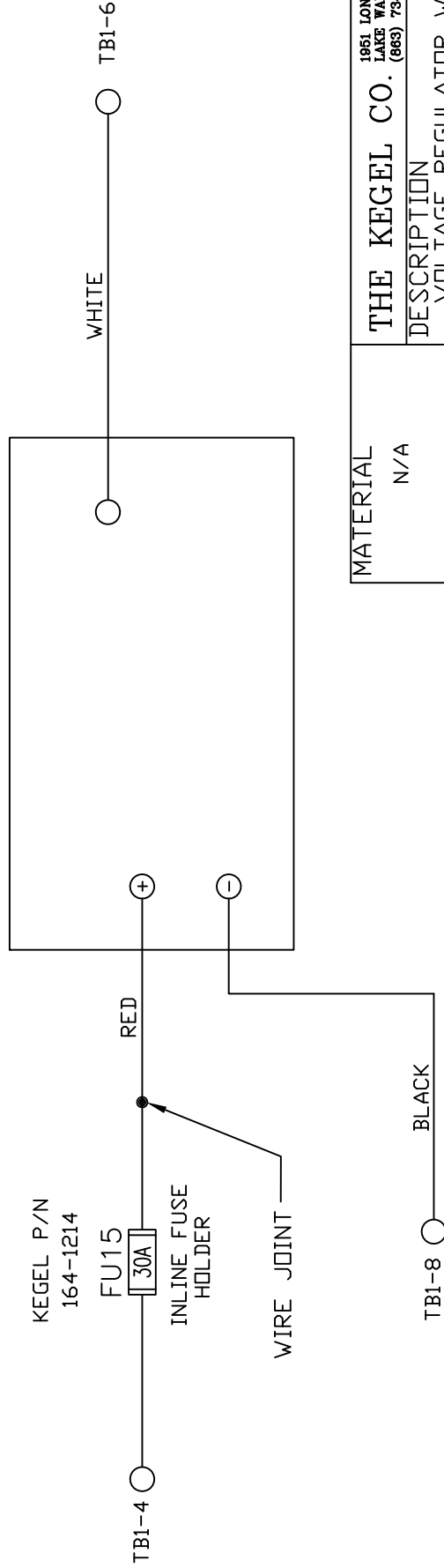
4 3 2 1

D C B A

# VOLTAGE REGULATOR



# UPGRADED VOLTAGE REGULATOR

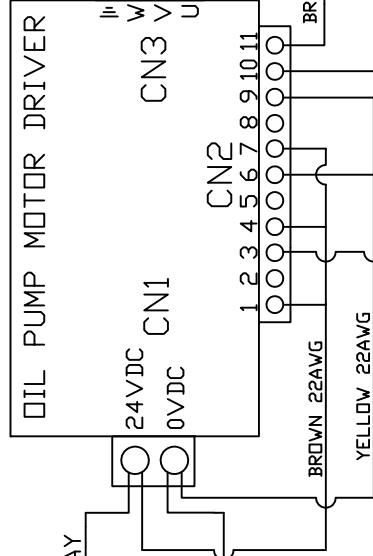


MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33859	
N/A		THE KEGEL CO. (888) 734-0200	
DESCRIPTION			
VOLTAGE REGULATOR WIRING			
DRAWN BY	DATE	DO NOT SCALE DRAWING	
SLS	07/21/15	SIZE	QTY/MACHINE PART NUMBER
APPROVED:	REV DATE	A	N/A
MP		SCALE	N/A
DWG		SHEET	8 OF 26
REV			

# OIL PUMP MOTOR



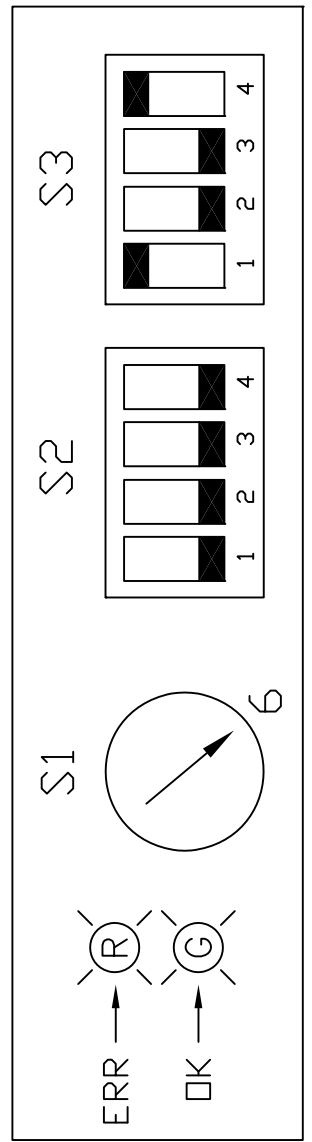
KEGEL P/N  
154-1266



SHIELDED WIRE

SHIELDED WIRE

SHIELDED WIRE



MATERIAL		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		DESCRIPTION	
OIL PUMP DRIVER & MOTOR WIRING		DO NOT SCALE DRAWING	
DATE	07/21/15	SIZE	A
REV DATE		QTY/MACHINE	N/A
MP		SCALE	N/A
DOC		SHEET	9 OF 26
REV			



# OIL HEAD MOTOR

M

YELLOW/BLACK  
WHITE/BLUE  
RED/DRANGE

KEGEL P/N  
154-1266  
FU9

JUMPED FROM  
OIL PUMP  
FUSE

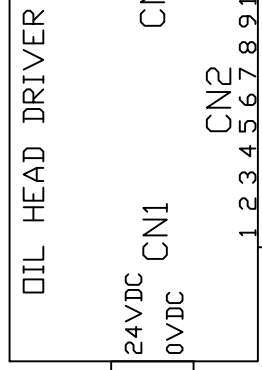
2.25A

WT/RD

WHITE/RED

24VDC

0VDC



OIL HEAD DRIVER

RED/DRANGE

WHITE/BLUE

YELLOW/BLACK

BROWN/YELLOW

PL5-8

OIL PUMP MOTOR  
DRIVER CN2 #10

BLACK

BLACK

BLACK

WHITE/RED

PL4-10

PL4-11

BLACK

WHITE

BLACK

SHIELDED WIRE

WHITE

BLACK

PLC OUTPUTS  
CH100 #05  
PLC OUTPUTS  
CH100 #04

TB1-9

BLACK

BLACK

WHITE/RED

PL4-10

PL4-11

BLACK

WHITE

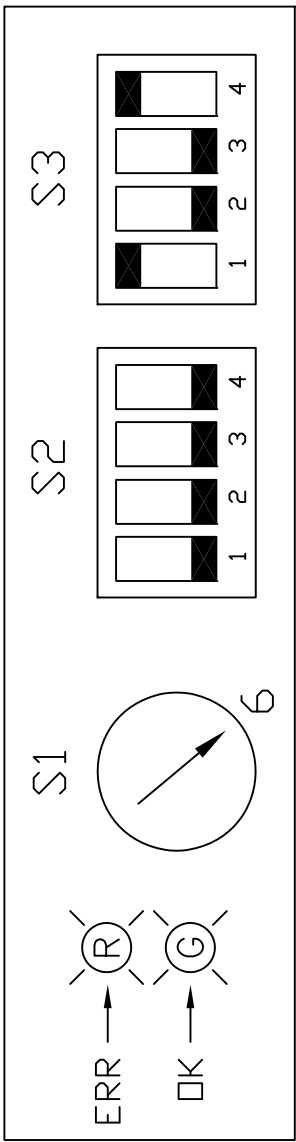
BLACK

SHIELDED WIRE

WHITE

BLACK

PLC OUTPUTS  
CH100 #05  
PLC OUTPUTS  
CH100 #04



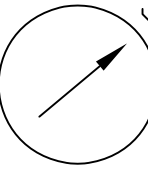
S1

S2

S3

ERR

OK



1 2 3 4

1 2 3 4

1 2 3 4

MATERIAL  
N/A

DRAWN BY  
SLS

DATE  
07/21/15

APPROVED:  
MP

DO NOT SCALE DRAWING  
SIZE QTY/MACHINE PART NUMBER

DESCRIPTION  
OIL HEAD DRIVER & MOTOR WIRING

THE KEGEL CO. (689) 734-0200  
1951 LONGLEAF BLVD.  
LAKE WALES, FL 33869

SCALE N/A

SHEET 10 OF 26

FLEX 2016

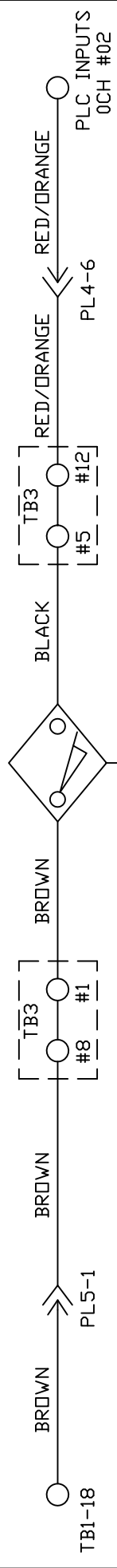
REV

4 3 2 1

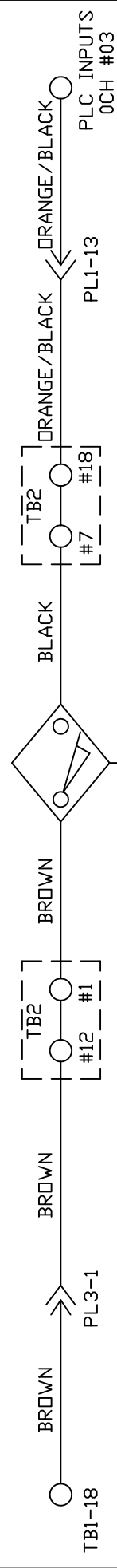
1 2 3 4

4 3 2 1

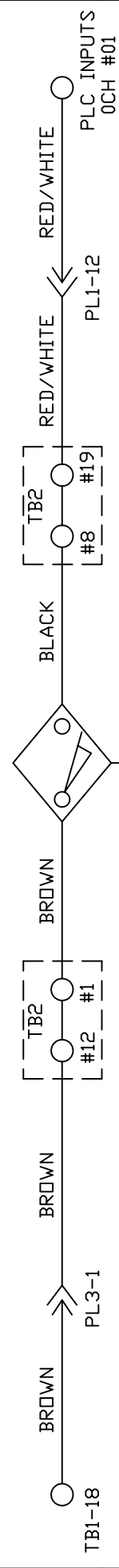
### L-R HEAD PROX



### R-L HEAD PROX



### BOARD PROX



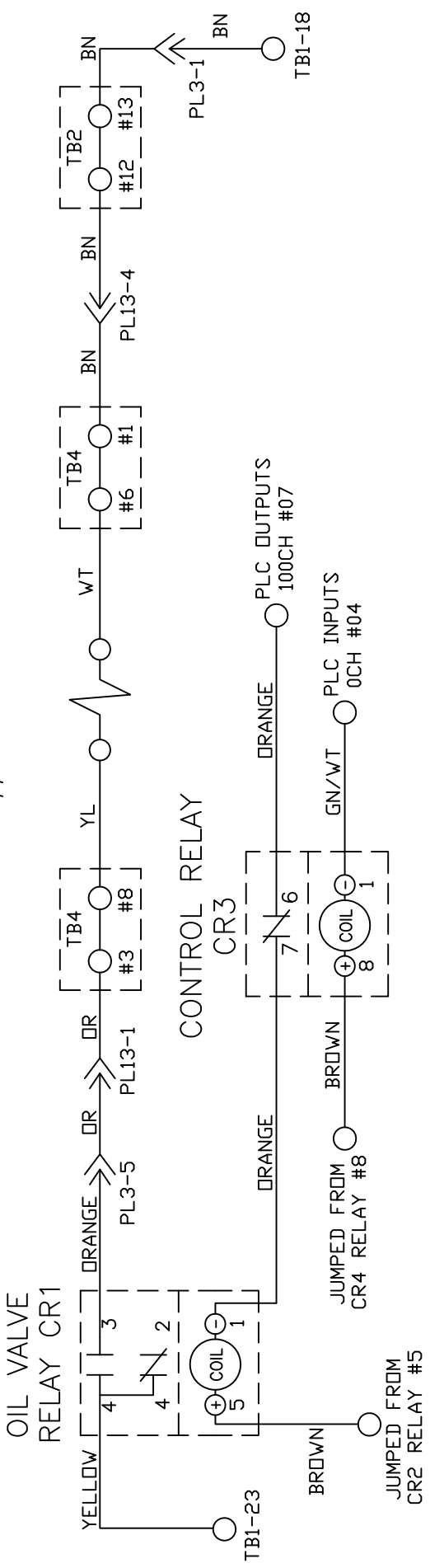
MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33669	
N/A		THE KEGEL CO. (888) 734-0200	
DESCRIPTION			
L-R, R-L & BOARD PROX WIRING			
DRAWN BY	DATE	DO NOT SCALE DRAWING	
SLS	07/21/15	SIZE	QTY/MACHINE PART NUMBER
APPROVED:	REV DATE	A	N/A
MP		SCALE	FLEX 2016
DWG REV		SCALE	N/A
		SHEET	11 OF 26

D C B A

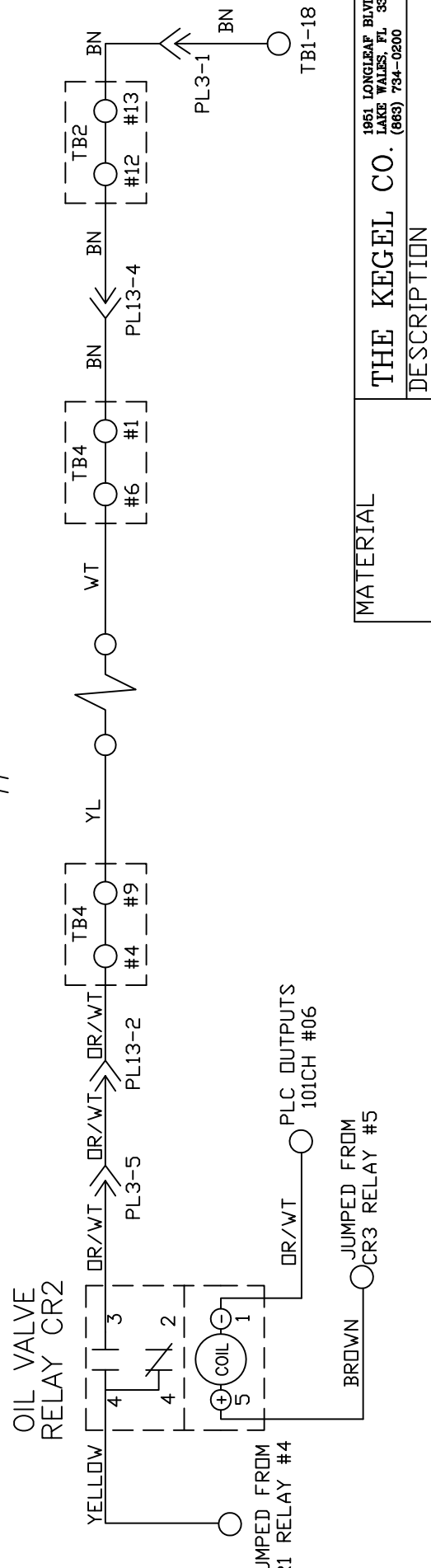
4 3 2 1

4 3 2 1

# OIL VALVE #1 - TANK A



# OIL VALVE #2 - TANK B



MATERIAL		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
DESCRIPTION		OIL VALVES RELAY WIRING	
DRAWN BY	DATE	DO NOT SCALE DRAWING	
SLS	07/21/15	SIZE	QTY/MACHINE PART NUMBER
APPROVED:	REV DATE	A	N/A
MP		SCALE	N/A
DWG REV		SHEET	12 OF 26

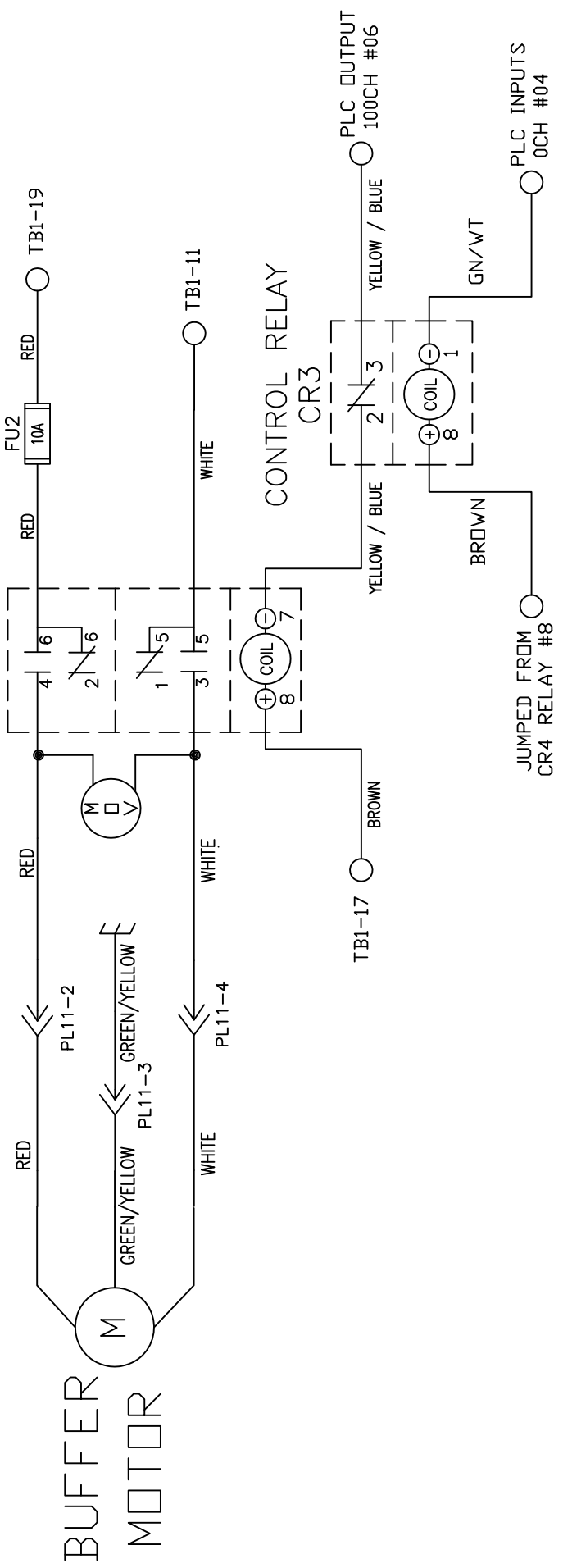
4 3 2 1

1 2 3 4

D C B A

### BUFFER MOTOR RELAY CR13

KEGEL P/N  
154-1273  
FU2  
10A

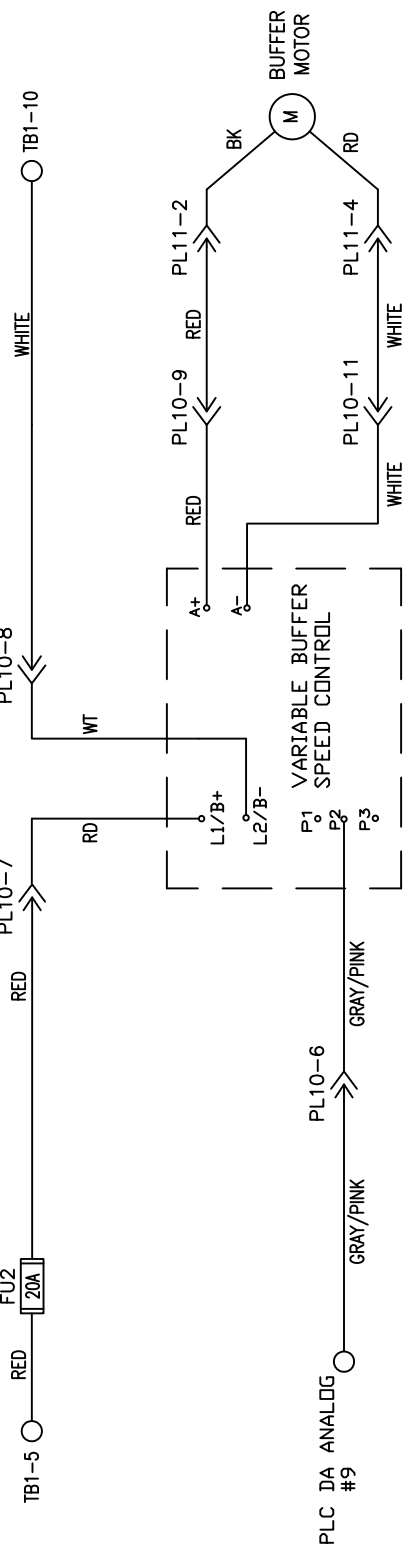


MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33859 (889) 734-0200	
DESCRIPTION BUFFER MOTOR WIRING		DO NOT SCALE DRAWING	
DRAWN BY SLS	DATE 07/21/15	SIZE A	QTY/MACHINE PART NUMBER N/A
APPROVED: MP	REV DATE	SCALE N/A	FLEX 2016
DWG REV		SHEET 13	OF 26

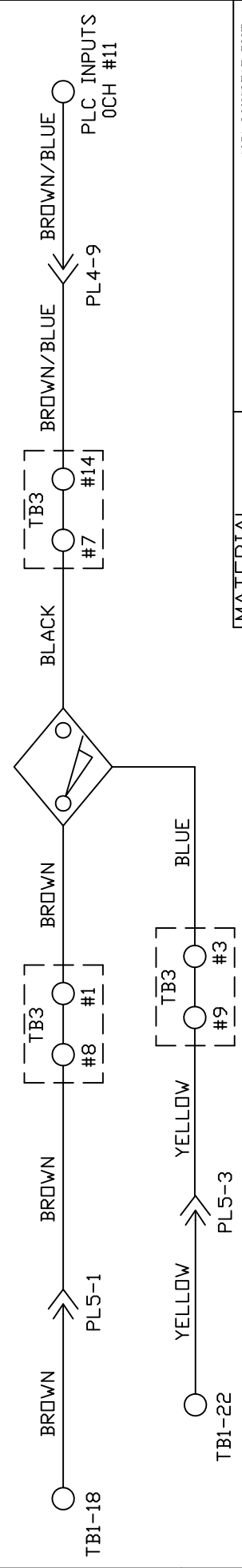
2 3 4 1

4 3 2 1

KEGEL P/N  
154-1270



### VARIABLE BUFFER PROX



MATERIAL		THE KEGEL CO. (668) 734-0200	
N/A		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	VARIABLE BUFFER MOTOR	
APPROVED:	REV DATE	& TACH WIRING	
MP		DO NOT SCALE DRAWING	
DOC	REV	SIZE	QTY/MACHINE PART NUMBER
		A	N/A
		SCALE	N/A
			FLEX 2016
			SHEET 14 OF 26

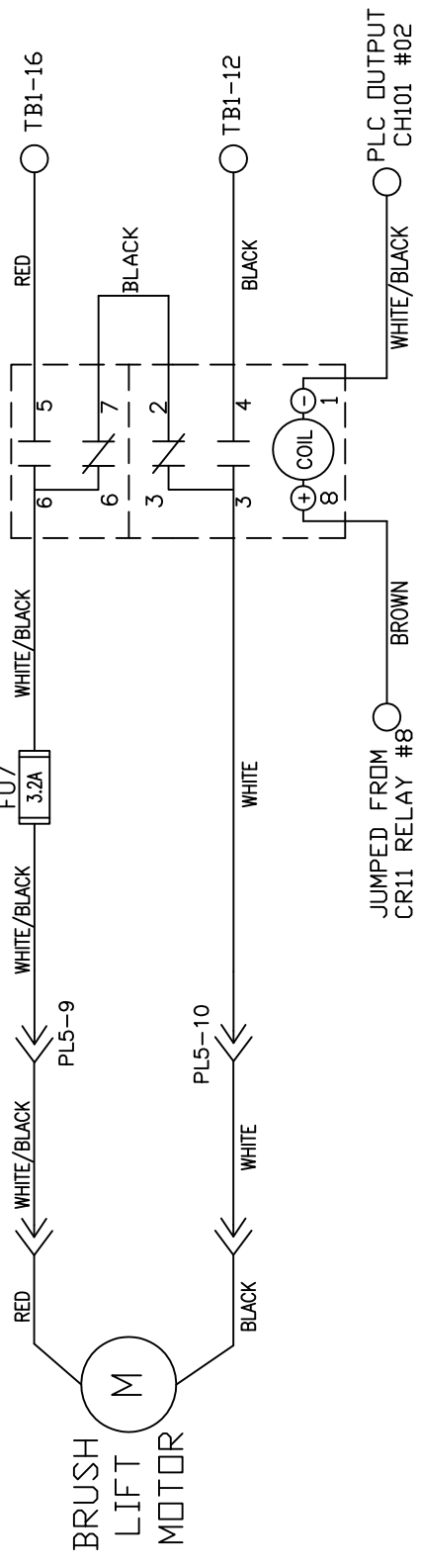
4 3 2 1

4 3 2 1

D C B A

### BRUSH LIFT MOTOR RELAY CR10

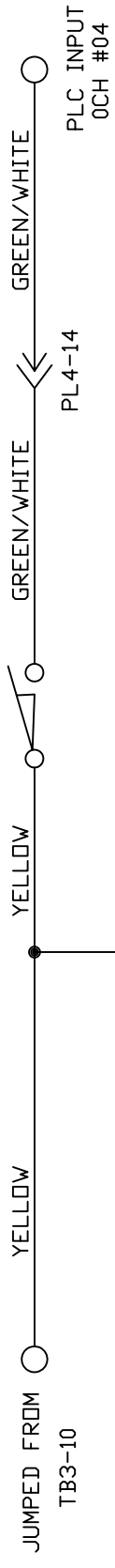
KEGEL P/N  
154-1267  
FU7  
3.2A



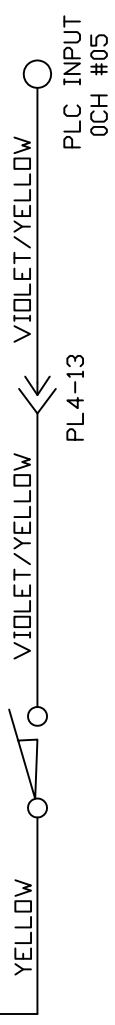
JUMPED FROM  
CR11 RELAY #8

PLC OUTPUT  
CH101 #02

### BRUSH UP SWITCH



### BRUSH DOWN SWITCH



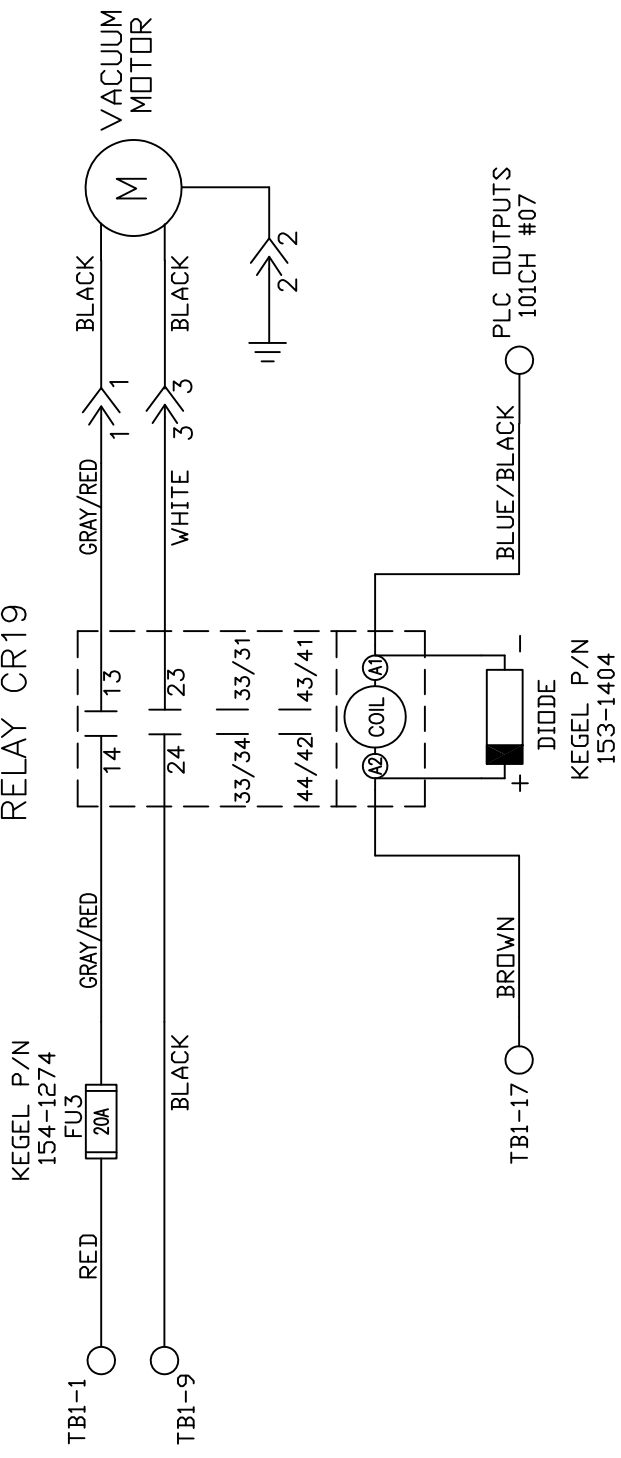
MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
N/A		DESCRIPTION		BRUSH LIFT MOTOR & SWITCH WIRING DO NOT SCALE DRAWING	
DRAWN BY	DATE	SIZE	QTY/MACHINE	PART NUMBER	
SLS	07/21/15	A	N/A	FLEX	2016
APPROVED:	REV DATE	SCALE	N/A	SHEET	15 OF 26
MP					
DWG	REV				

4 3 2 1

4 3 2 1

D C B A

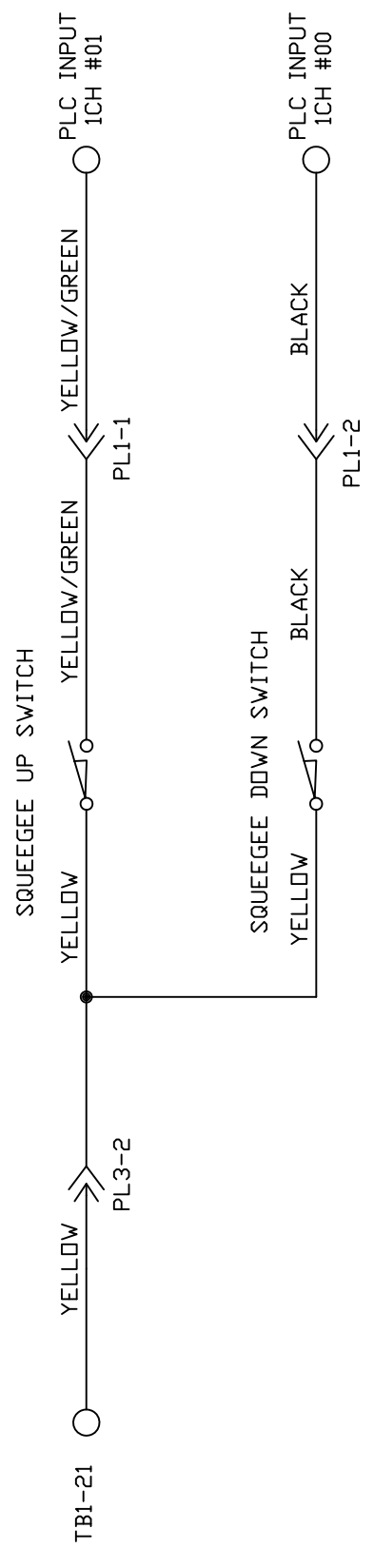
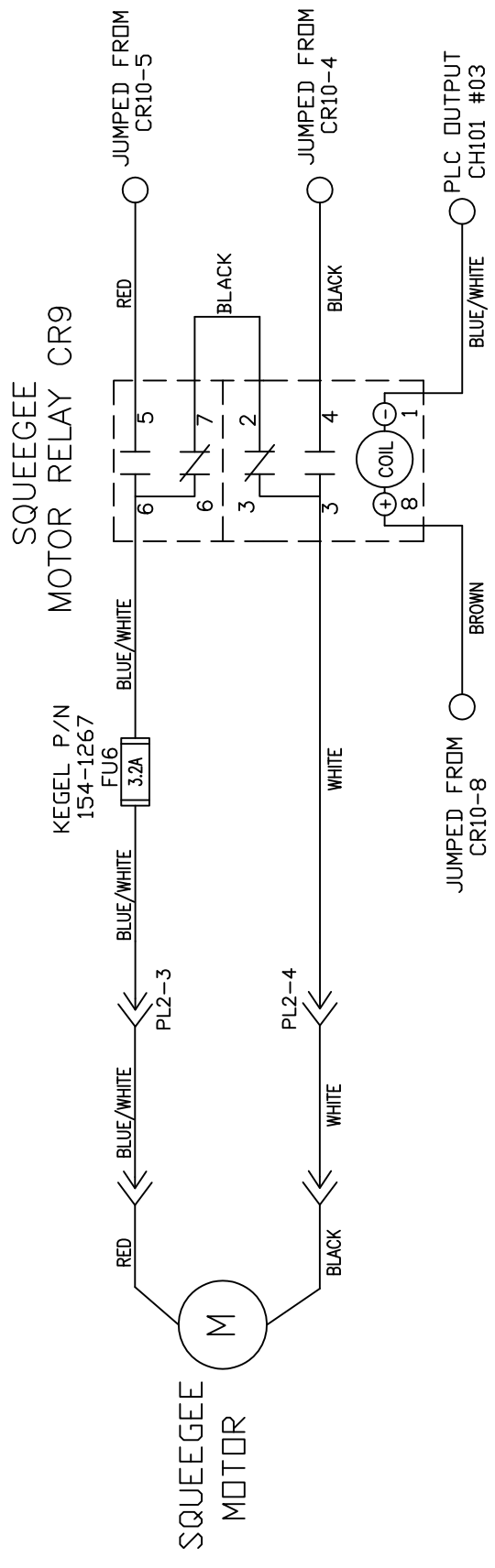
VACUUM MOTOR  
RELAY CR19



MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
N/A		DESCRIPTION		VACUUM MOTOR WIRING	
DRAWN BY	DATE	DO NOT SCALE DRAWING		SIZE	QTY/MACHINE PART NUMBER
SLS	07/21/15			A	N/A
APPROVED:	REV DATE			SCALE	N/A
MP					FLEX 2016
DWG				SHEET	16 OF 26
REV					

4 3 2 1

4 3 2 1



MATERIAL		THE KEGEL CO. (689) 734-0200	
N/A		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
DESCRIPTION	SQUEEGEE MOTOR & SWITCH WIRING		
DO NOT SCALE DRAWING	DO NOT SCALE DRAWING		
DATE	07/21/15	SIZE	A
REV DATE		QTY/MACHINE PART NUMBER	N/A
MP		SCALE	N/A
DOC REV		SHEET	17 OF 26

4 3 2 1

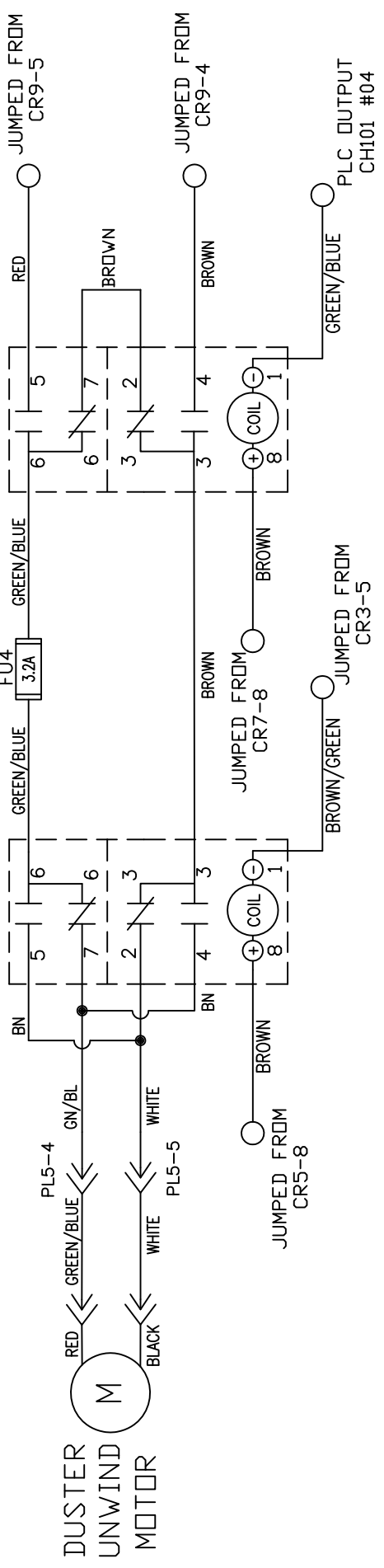


4 3 2 1

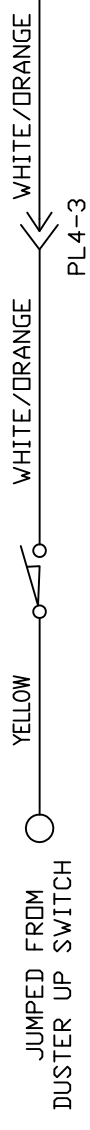
DUSTER POLARITY RELAY CR4

DUSTER UNWIND MOTOR RELAY CR8

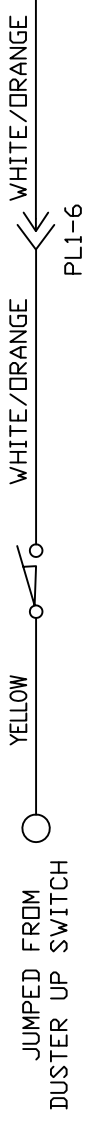
KEGEL P/N 154-1267  
FU4 3.2A



7-PIN SIDE FAIL SAFE SWITCH



10-PIN SIDE FAIL SAFE SWITCH



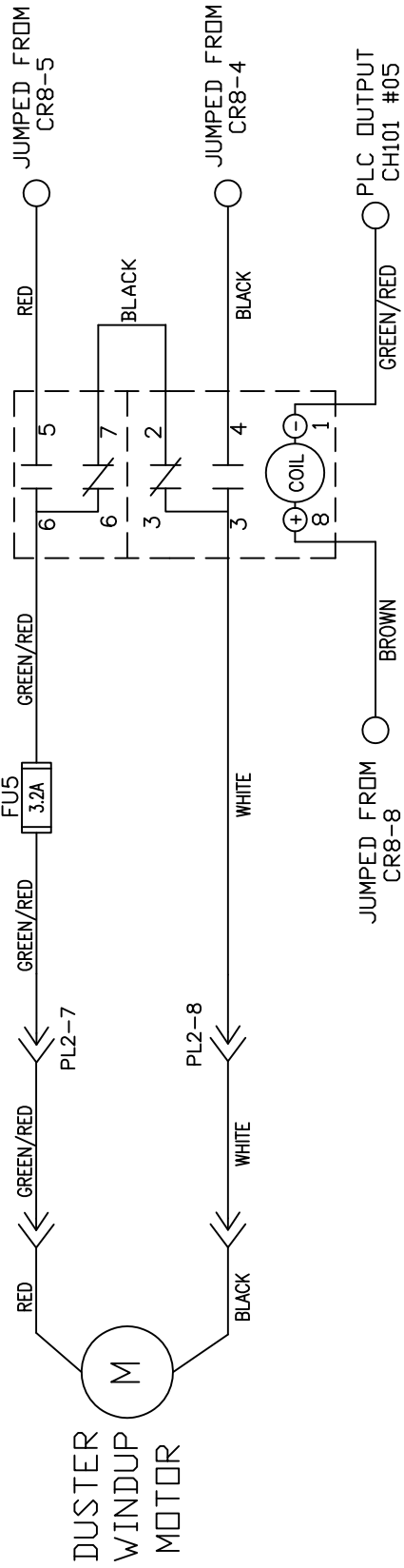
MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		DESCRIPTION		DUSTER UNWIND & SWITCH WIRING	
DRAWN BY	DATE	SIZE	QTY/MACHINE	SCALE	SHEET
SLS	07/21/15	A	N/A	N/A	18
APPROVED:	REV DATE	MP	FLEX	2016	26
DWG REV					

4 3 2 1

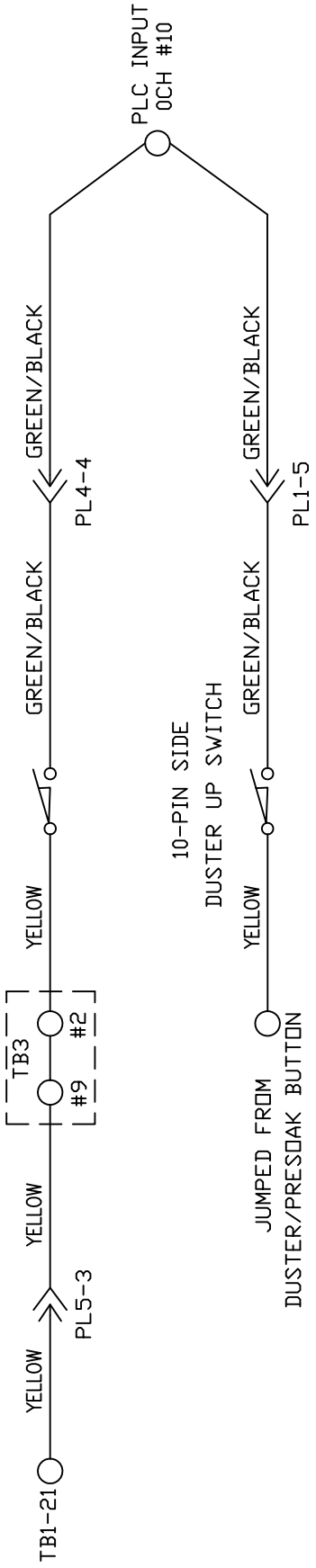
4 3 2 1

DUSTER WINDUP  
MOTOR RELAY CR7

KEGEL P/N  
154-1267  
FU5  
3.2A

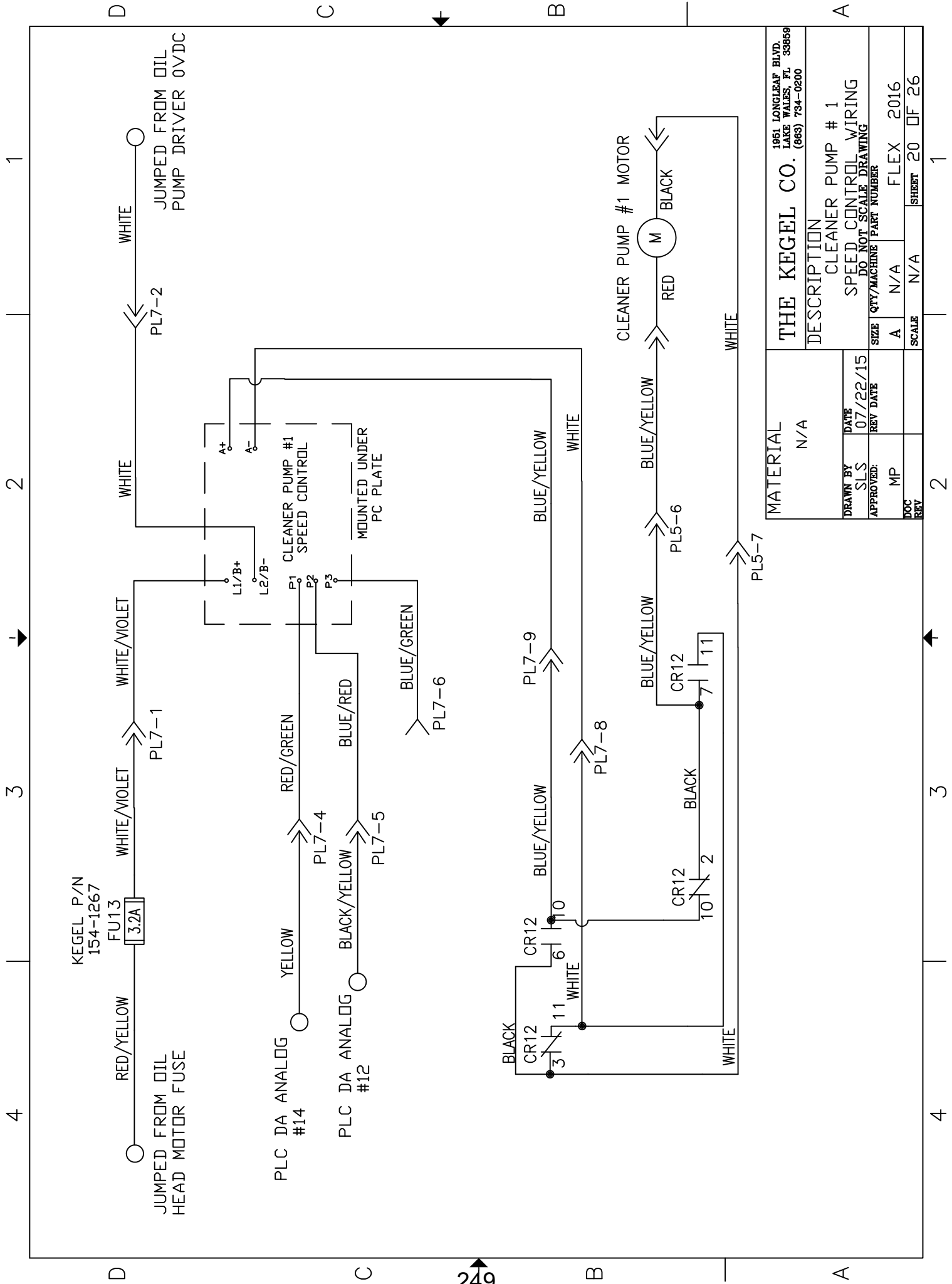


7-PIN SIDE  
DUSTER UP SWITCH

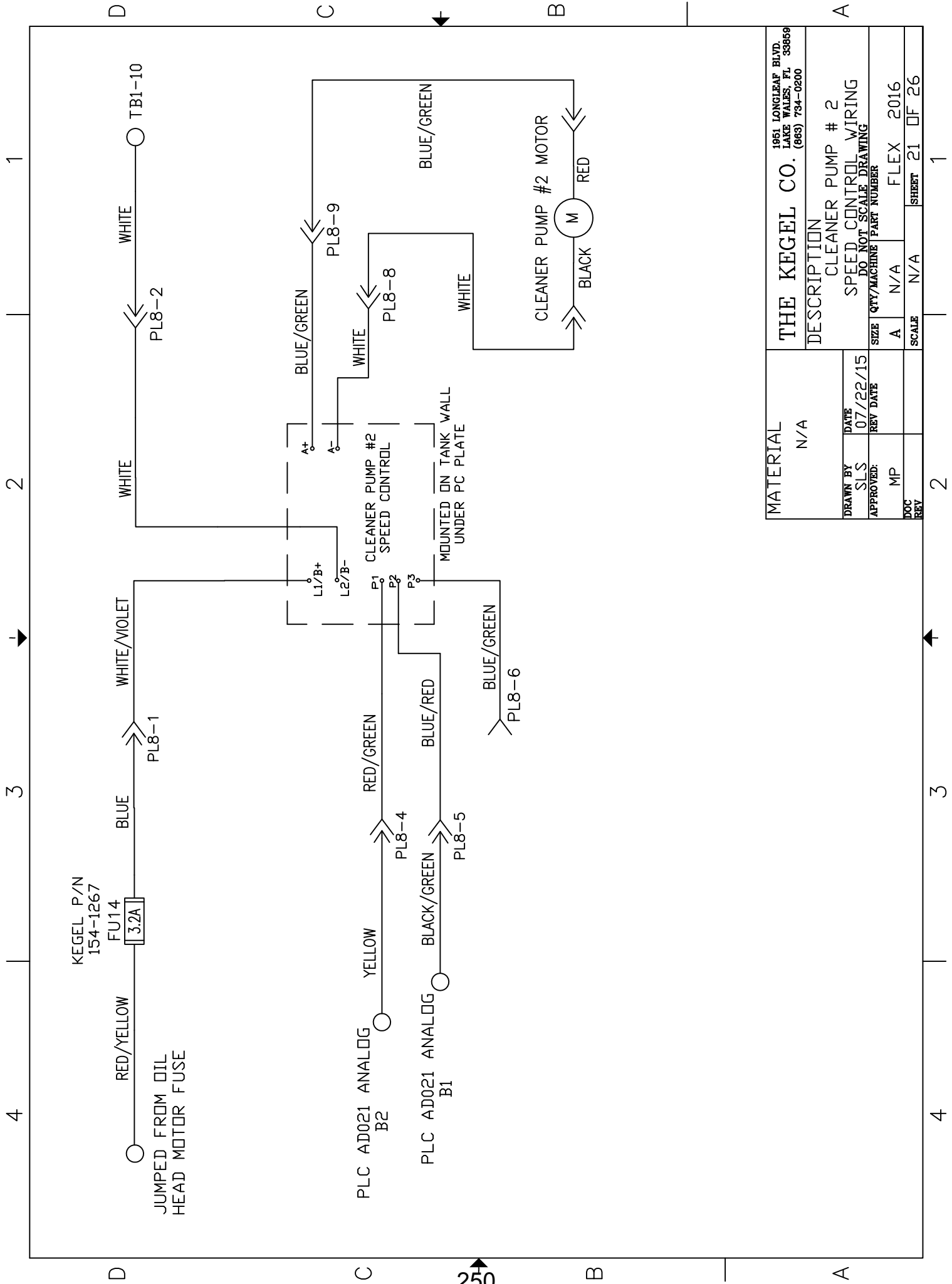


MATERIAL		THE KEGEL CO. (689) 734-0200	
N/A		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
DESCRIPTION	DUSTER WINDUP & SWITCH WIRING		
DO NOT SCALE DRAWING	DO NOT SCALE DRAWING		
DATE	07/21/15	SIZE	A
REV DATE		QTY/MACHINE PART NUMBER	N/A
MP		SCALE	N/A
DOC REV		SHEET	19 OF 26

4 3 2 1



MATERIAL		N/A	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/22/15	CLEANER PUMP # 1	
APPROVED:	REV DATE	SPEED CONTROL WIRING	
MP		DO NOT SCALE DRAWING	
DOC	SIZE	QTY/MACHINE	PART NUMBER
REV	A	N/A	FLEX 2016
	SCALE	N/A	SHEET 20 OF 26



KEGEL P/N  
154-1267

FU14  
3.2A

JUMPED FROM OIL  
HEAD MOTOR FUSE

PLC AD021 ANALOG  
B2

PLC AD021 ANALOG  
B1

RED/GREEN  
PL8-4

BLACK/GREEN  
PL8-5

BLUE/RED  
PL8-6

CLEANER PUMP #2  
SPEED CONTROL

MOUNTED ON TANK WALL  
UNDER PC PLATE

CLEANER PUMP #2 MOTOR  
M

MATERIAL	N/A		
DESCRIPTION	CLEANER PUMP # 2 SPEED CONTROL WIRING DO NOT SCALE DRAWING		
DRAWN BY	DATE	SIZE	QTY/MACHINE PART NUMBER
SLS	07/22/15	A	N/A
APPROVED:	REV DATE	SCALE	N/A
MP			FLEX 2016
DOC REV			SHEET 21 OF 26

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

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

CLEANER PUMP # 2  
SPEED CONTROL WIRING  
DO NOT SCALE DRAWING

SIZE QTY/MACHINE PART NUMBER  
A N/A FLEX 2016  
SCALE N/A SHEET 21 OF 26

D C B A

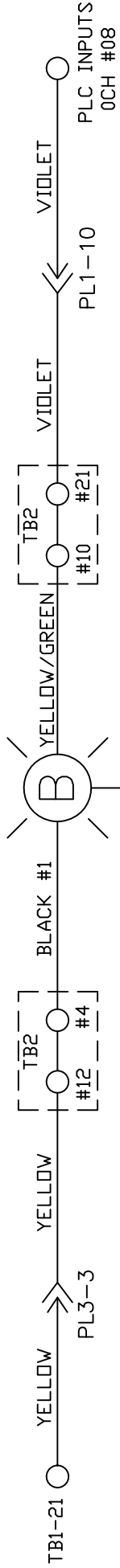
4 3 2 1

4 3 2 1

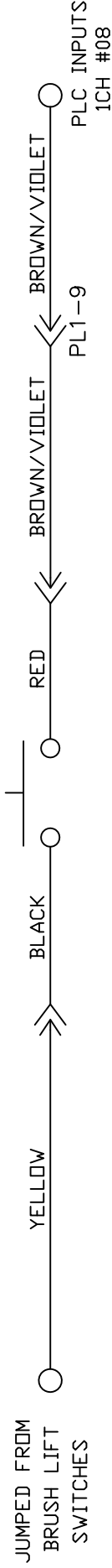
4 3 2 1

4 3 2 1

# START BUTTON



# DUSTER/PRESOAK BUTTON

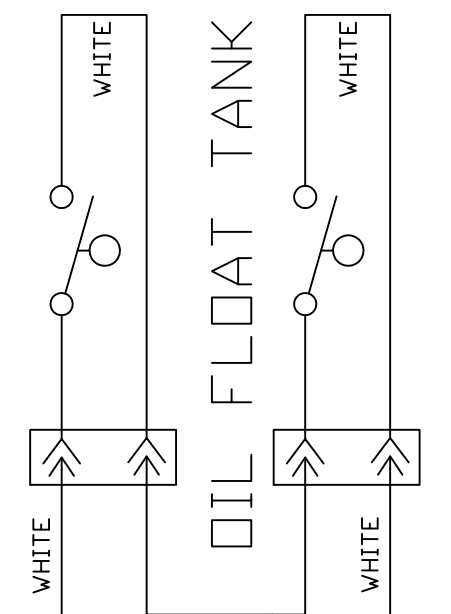


MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
DESCRIPTION START BUTTON & DUSTER/PRESOAK BUTTON DO NOT SCALE DRAWING		SIZE A N/A FLEX 2016	
DRAWN BY SLS	DATE 07/22/15	SCALE N/A	SHEET 22 OF 26
APPROVED: MP	REV DATE		
DOC REV			

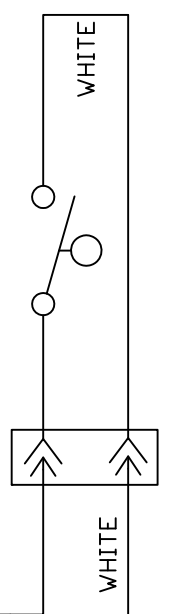
4 3 2 1

4 3 2 1

# OIL FLOAT TANK A



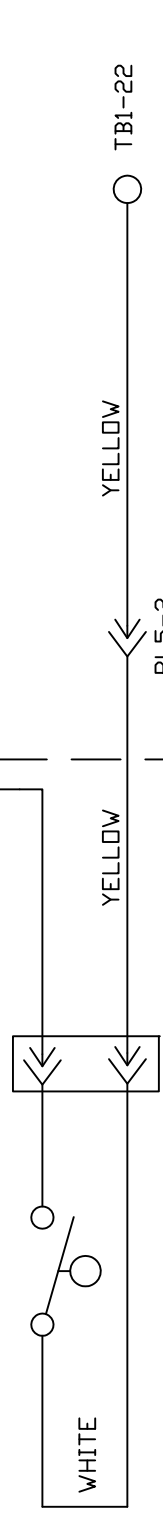
# OIL FLOAT TANK B



# CLEANER FLOAT PUMP #1



# CLEANER FLOAT PUMP #2



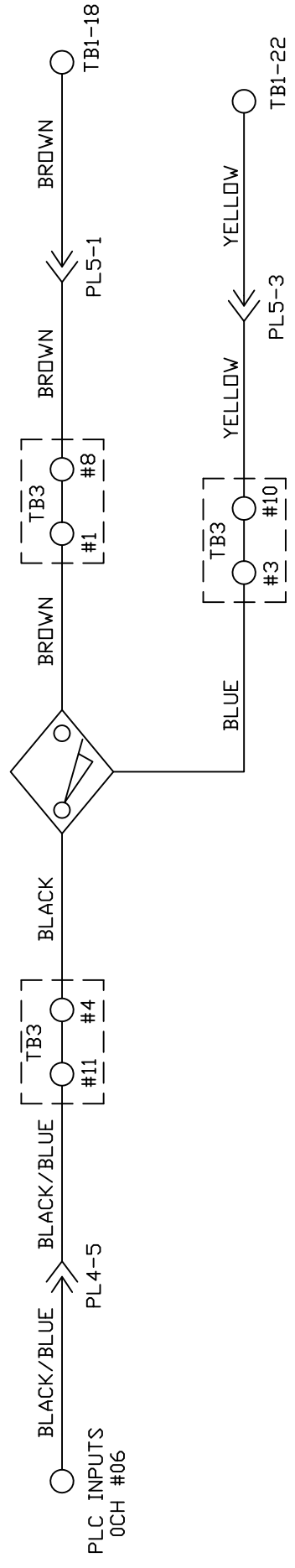
# OPTIONAL CLEANER UPGRADE

MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (889) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/22/15	OIL FLOATS & CLEANER FLOATS WIRING	
APPROVED:	REV DATE	DO NOT SCALE DRAWING	
MP		SIZE	QTY/MACHINE PART NUMBER
		A	N/A
DOC		SCALE	N/A
REV			FLEX 2016
			SHEET 23 OF 26

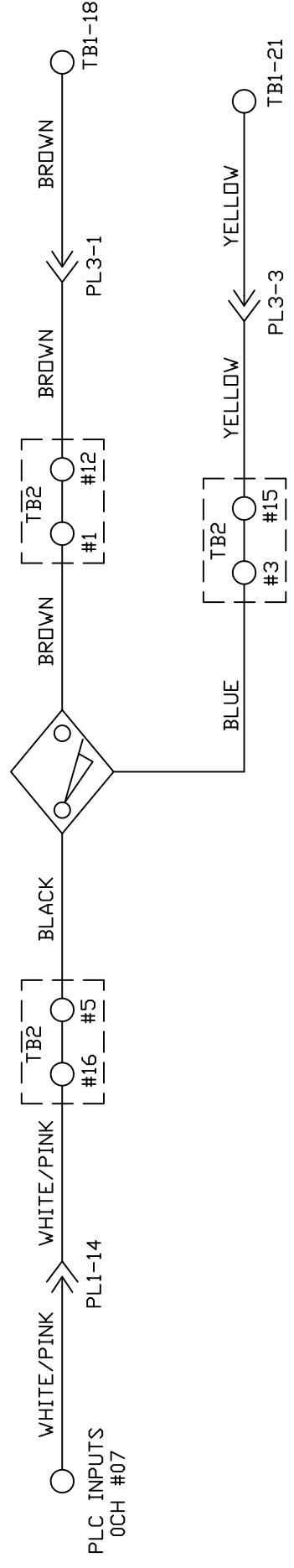
1 2 3 4

4 3 2 1

# SPEED TACH PROX



# LANE DISTANCE PROX



MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DESCRIPTION			
SPEED TACH & LANE DISTANCE WIRING			
DO NOT SCALE DRAWING			
DRAWN BY	DATE	SIZE	QTY/MACHINE PART NUMBER
SLS	07/22/15	A	N/A
APPROVED:	REV DATE	SCALE	N/A
MP			FLEX 2016
DWG REV			SHEET 24 OF 26

4 3 2 1

4 3 2 1

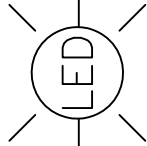
TB1-15

KEGEL P/N  
155-1229  
FUJ16  
1A

PL4-12

RED/GREEN

RED/GREEN

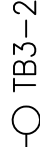


YELLOW/WHITE

YELLOW

YELLOW

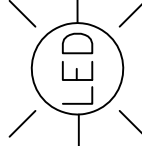
YELLOW



LED TANK  
LIGHT SWITCH

YELLOW

LED ARROW  
LIGHT



RED/GREEN

D

C

B

A

D

C

B

A

254

MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33859	
N/A		DESCRIPTION		LED TANK LIGHT WIRING	
DRAWN BY	DATE	DO NOT SCALE DRAWING	SIZE	QTY/MACHINE	PART NUMBER
SLS	07/22/15		A	N/A	FLEX 2016
APPROVED:	REV DATE		SCALE	N/A	SHEET 25 OF 26
MP					
DOC					
REV					

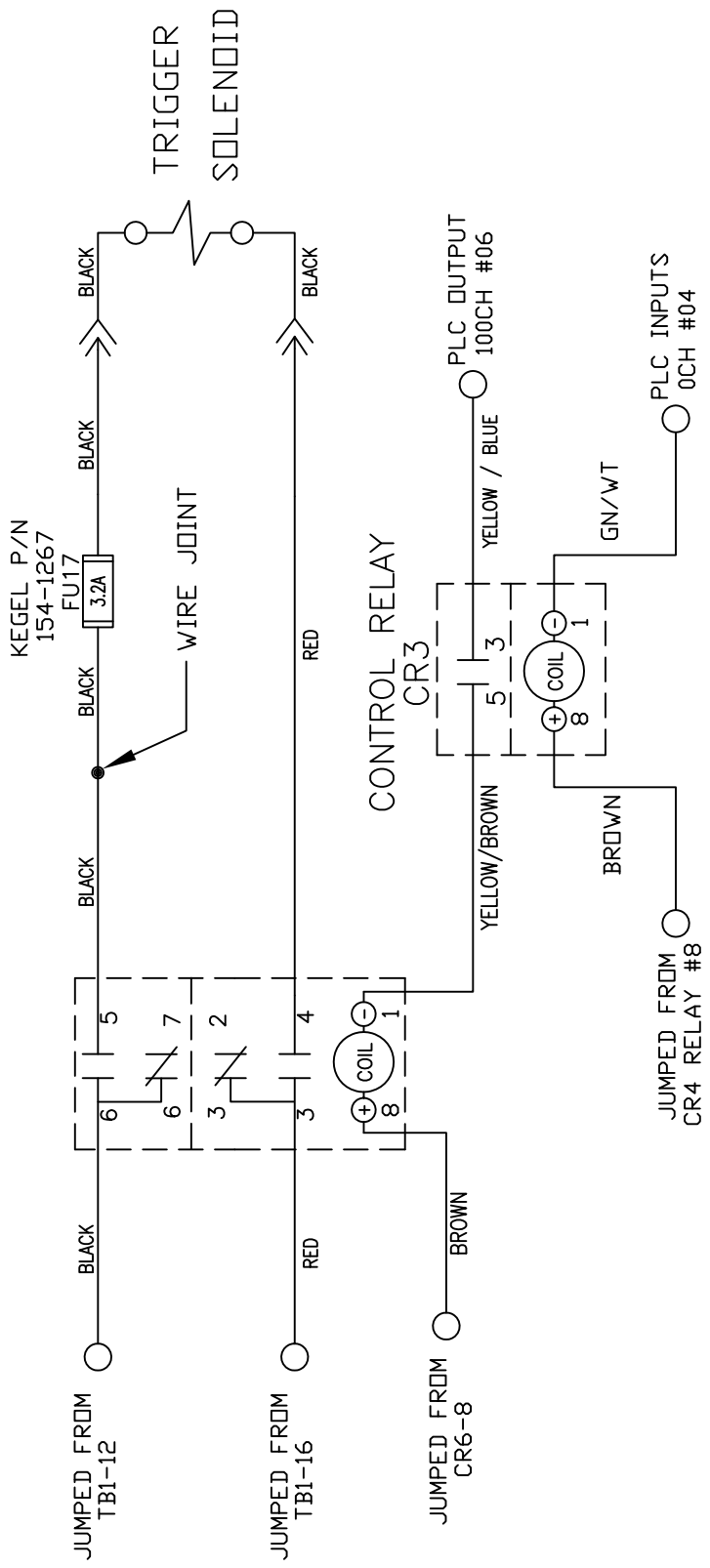
4 3 2 1



4 3 2 1

D C B A

PIN DECK TREATMENT  
RELAY CR5



MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DESCRIPTION	TRIGGER SOLENOID WIRING		
DO NOT SCALE DRAWING	DO NOT SCALE DRAWING		
DATE	07/22/15	SIZE	A
REV DATE		QTY/MACHINE	N/A
MP		SCALE	N/A
DOC REV		SHEET	26 OF 26

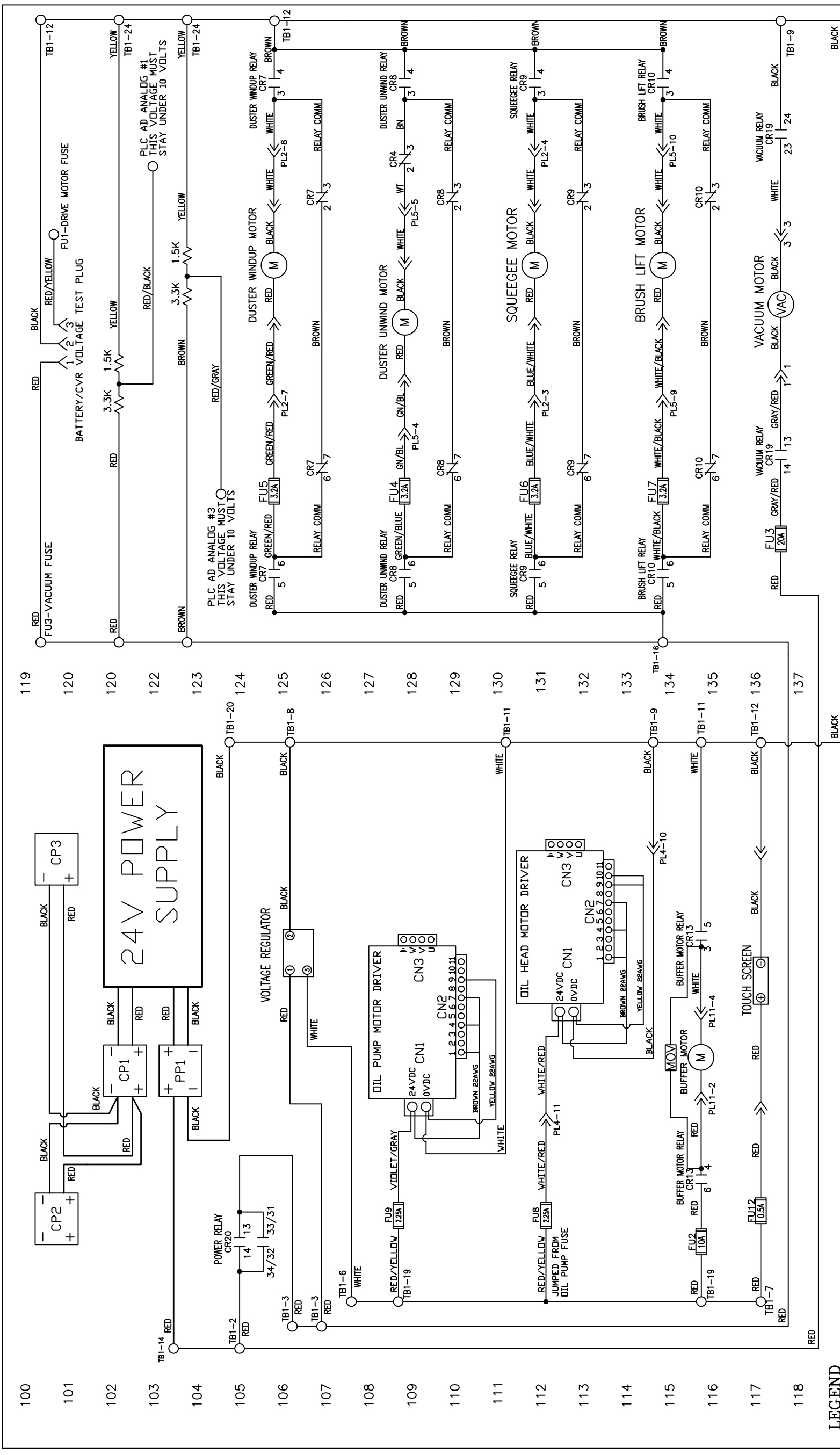
4 3 2 1



# FLEX WALKER ELECTRICAL DRAWING

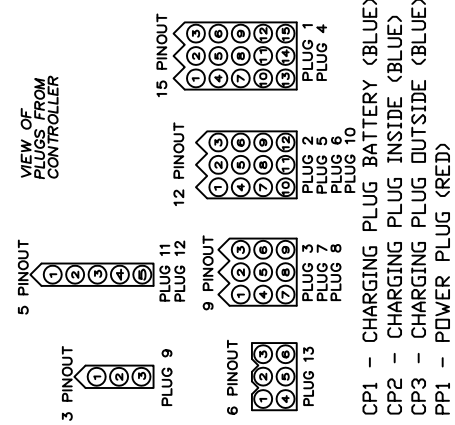
The following diagrams show wiring schematics for the Kustodian Walker. Detailed diagrams for the Ion follow this section. If you have any questions please call 863-734-0200 or email [tech@kegel.net](mailto:tech@kegel.net).

Flex Walker Motor Wiring Layout	257
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Flex Walker 7-Pin & 10-Pin Side Approach Distance Sensor Wiring Layout	282
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**LEGEND**

- CR1 - OIL VALVE RELAY TANK A
- CR2 - OIL VALVE RELAY TANK B
- CR3 - CONTROL RELAY
- CR4 - DUSTER POLARITY SWITCH RELAY
- CR5 - PIN DECK TREATMENT RELAY
- CR6 - POWER OFF RELAY
- CR7 - DUSTER WINDUP MOTOR RELAY
- CR8 - DUSTER UNWIND MOTOR RELAY
- CR9 - SQUEEGEE LIFT MOTOR RELAY
- CR10 - BRUSH LIFT MOTOR RELAY
- CR11 - FORWARD DRIVE MOTOR RELAY
- CR12 - REVERSE DRIVE MOTOR RELAY
- CR13 - BUFFER MOTOR RELAY
- CR14 - WHISKER ENABLE RELAY
- CR15 - WHISKER 7 PIN SIDE RELAY
- CR16 - WHISKER 10 PIN SIDE RELAY
- CR17 - ZTR ENABLE RELAY
- CR18 - ZTR REVERSE RELAY
- CR19 - VACUUM MOTOR RELAY
- CR20 - POWER RELAY
- FU1 - DRIVE MOTOR 7.5A
- FU2 - BUFFER MOTOR 10A/20A
- FU3 - VACUUM MOTOR 20A
- FU4 - DUSTER UNWIND 3.2A
- FU5 - DUSTER WINDUP 3.2A
- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 2.25A
- FU9 - OIL PUMP MOTOR 2.25A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - PLC OUTPUT COMMON 0.5A
- FU12 - TOUCH SCREEN 0.5A
- FU13 - CLEANER PUMP #1 3.2A
- FU14 - CLEANER PUMP #2 3.2A
- FU15 - CVR POWER 25A/30A
- FU16 - LED LIGHTS 1A
- FU17 - TRIGGER SOLENOID 3.2A
- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (9)
- PL4 - 7-PIN SIDE PLUG (15)
- PL5 - 7-PIN SIDE PLUG (12)
- PL6 - DRIVE SPEED BOARD PLUG (12)
- PL7 - CLEANER PUMP #1 SPEED BOARD PLUG (9)
- PL8 - CLEANER PUMP #2 SPEED BOARD PLUG (9)
- PL9 - ZTR DRIVE MOTOR PLUG (3)
- PL10 - BUFFER SPEED BOARD PLUG (12)
- PL11 - BUFFER MOTOR PLUG (5)
- PL12 - BUFFER MOTOR VARIABLE SPEED PLUG (5)
- PL13 - OIL PLATE ASSEMBLY PLUG (6)
- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
- TB4 - TERMINAL BLOCK 4 (OIL PLATE)
- TB5 - TERMINAL BLOCK 5 (TOP PLC PLATE)

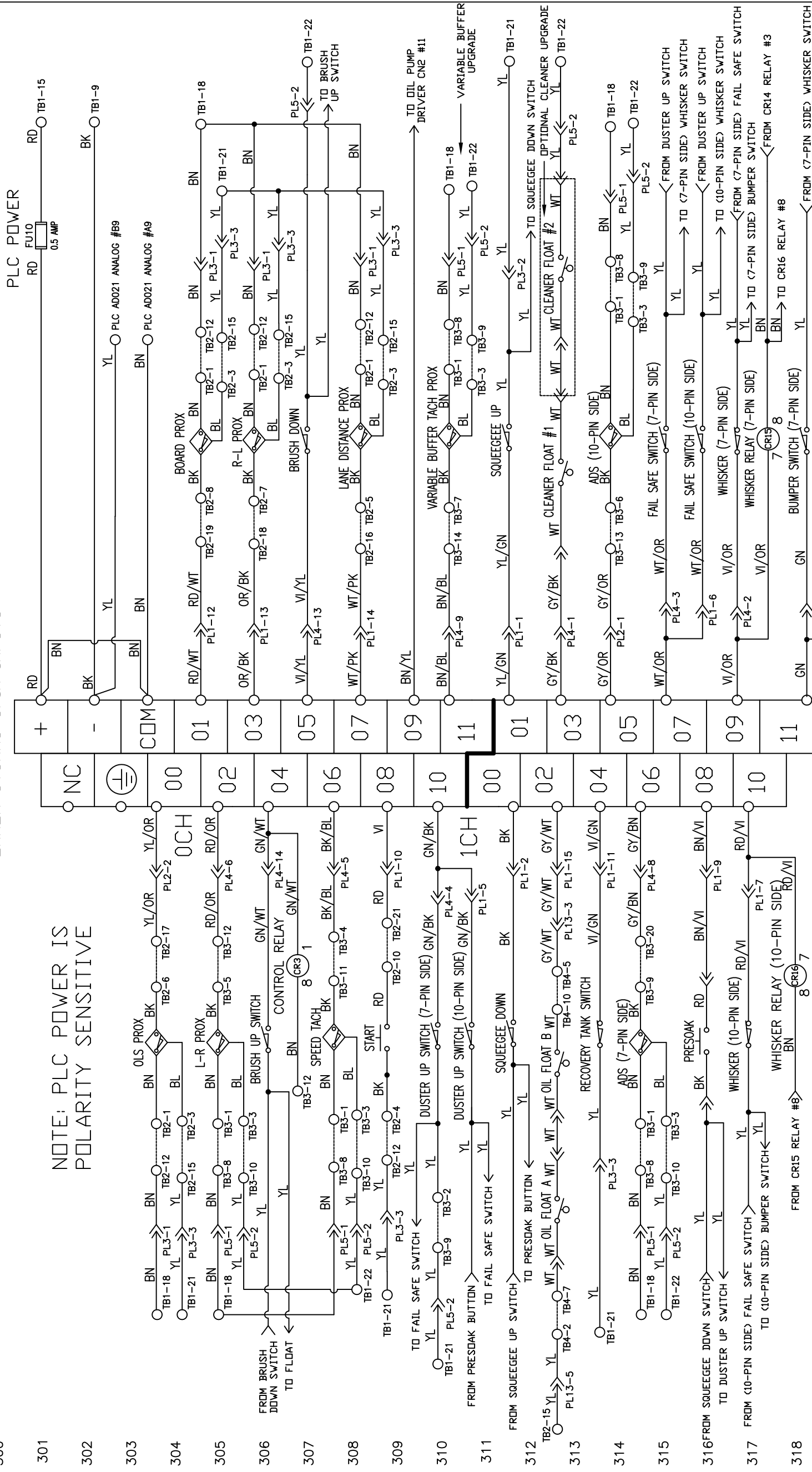


MATERIAL		N/A	
DESCRIPTION		MOTOR WIRING SCHEMATIC	
DRAWN BY	DATE	SIZE	QTY/MACHINE PART NUMBER
SLS	07/17/15	C	N/A
APPROVED:	REV DATE	SCALE	N/A
MP			
DOC REV		SHEET	1 OF 27

1961 LONGLEAF BLVD.  
LAKE WALES, FL 33859  
(866) 784-0200

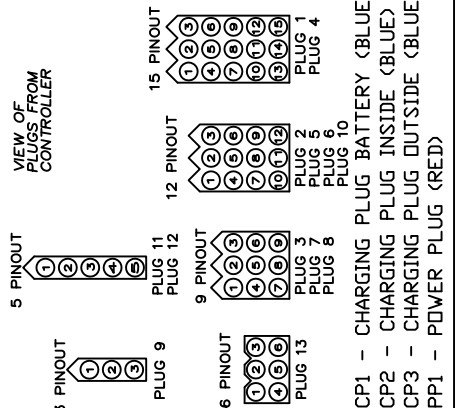


NOTE: PLC POWER IS POLARITY SENSITIVE



LEGEND

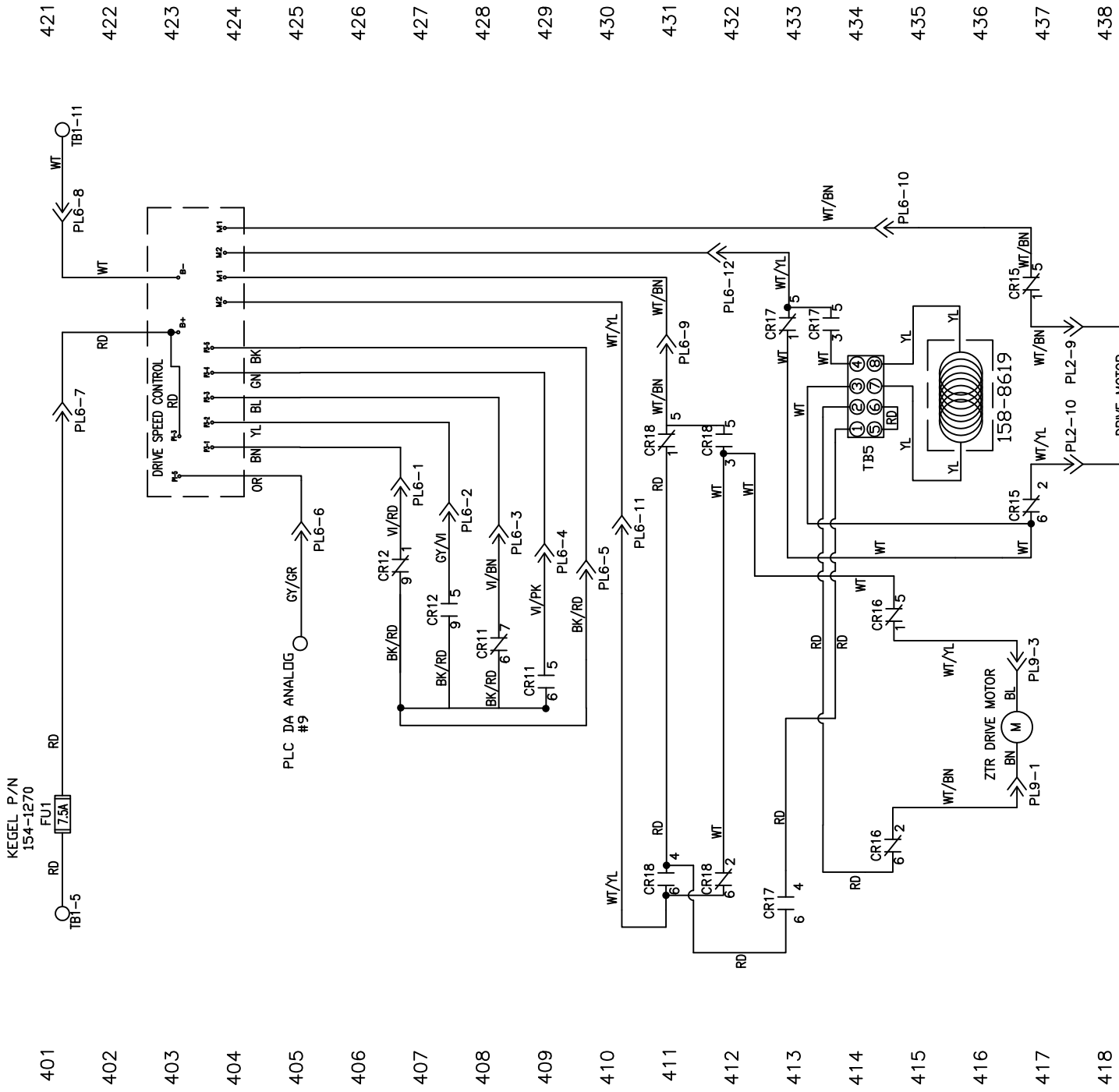
- CR1 - OIL VALVE RELAY TANK A
- CR2 - OIL VALVE RELAY TANK B
- CR3 - CONTROL RELAY
- CR4 - DUSTER POLARITY SWITCH RELAY
- CR5 - PIN DECK TREATMENT RELAY
- CR6 - POWER OFF RELAY
- CR7 - DUSTER WINDUP MOTOR RELAY
- CR8 - DUSTER UNWIND MOTOR RELAY
- CR9 - SQUEEGEE LIFT MOTOR RELAY
- CR10 - BRUSH LIFT MOTOR RELAY
- CR11 - FORWARD DRIVE MOTOR RELAY
- CR12 - REVERSE DRIVE MOTOR RELAY
- CR13 - BUFFER MOTOR RELAY
- CR14 - WHISKER ENABLE RELAY
- CR15 - WHISKER 7 PIN SIDE RELAY
- CR16 - WHISKER 10 PIN SIDE RELAY
- CR17 - ZTR ENABLE RELAY
- CR18 - ZTR REVERSE RELAY
- CR19 - VACUUM MOTOR RELAY
- CR20 - POWER RELAY
- FU1 - DRIVE MOTOR 7.5A
- FU2 - BUFFER MOTOR 10A/20A
- FU3 - VACUUM MOTOR 20A
- FU4 - DUSTER UNWIND 3.2A
- FU5 - DUSTER WINDUP 3.2A
- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 2.25A
- FU9 - OIL PUMP MOTOR 2.25A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - PLC OUTPUT COMMON 0.5A
- FU12 - TOUCH SCREEN 0.5A
- FU13 - CLEANER PUMP #1 3.2A
- FU14 - CLEANER PUMP #2 3.2A
- FU15 - CVR POWER 25A/30A
- FU16 - LED LIGHTS 1A
- FU17 - TRIGGER SOLENOID 3.2A
- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (9)
- PL4 - 7-PIN SIDE PLUG (15)
- PL5 - 7-PIN SIDE PLUG (12)
- PL6 - DRIVE SPEED BOARD PLUG (12)
- PL7 - CLEANER PUMP #1 SPEED BOARD PLUG (9)
- PL8 - CLEANER PUMP #2 SPEED BOARD PLUG (9)
- PL9 - ZTR DRIVE MOTOR PLUG (3)
- PL10 - BUFFER SPEED BOARD PLUG (12)
- PL11 - BUFFER MOTOR PLUG (5)
- PL12 - BUFFER MOTOR VARIABLE SPEED PLUG (5)
- PL13 - OIL PLATE ASSEMBLY PLUG (6)
- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
- TB4 - TERMINAL BLOCK 4 (OIL PLATE)
- TB5 - TERMINAL BLOCK 5 (TOP PLC PLATE)



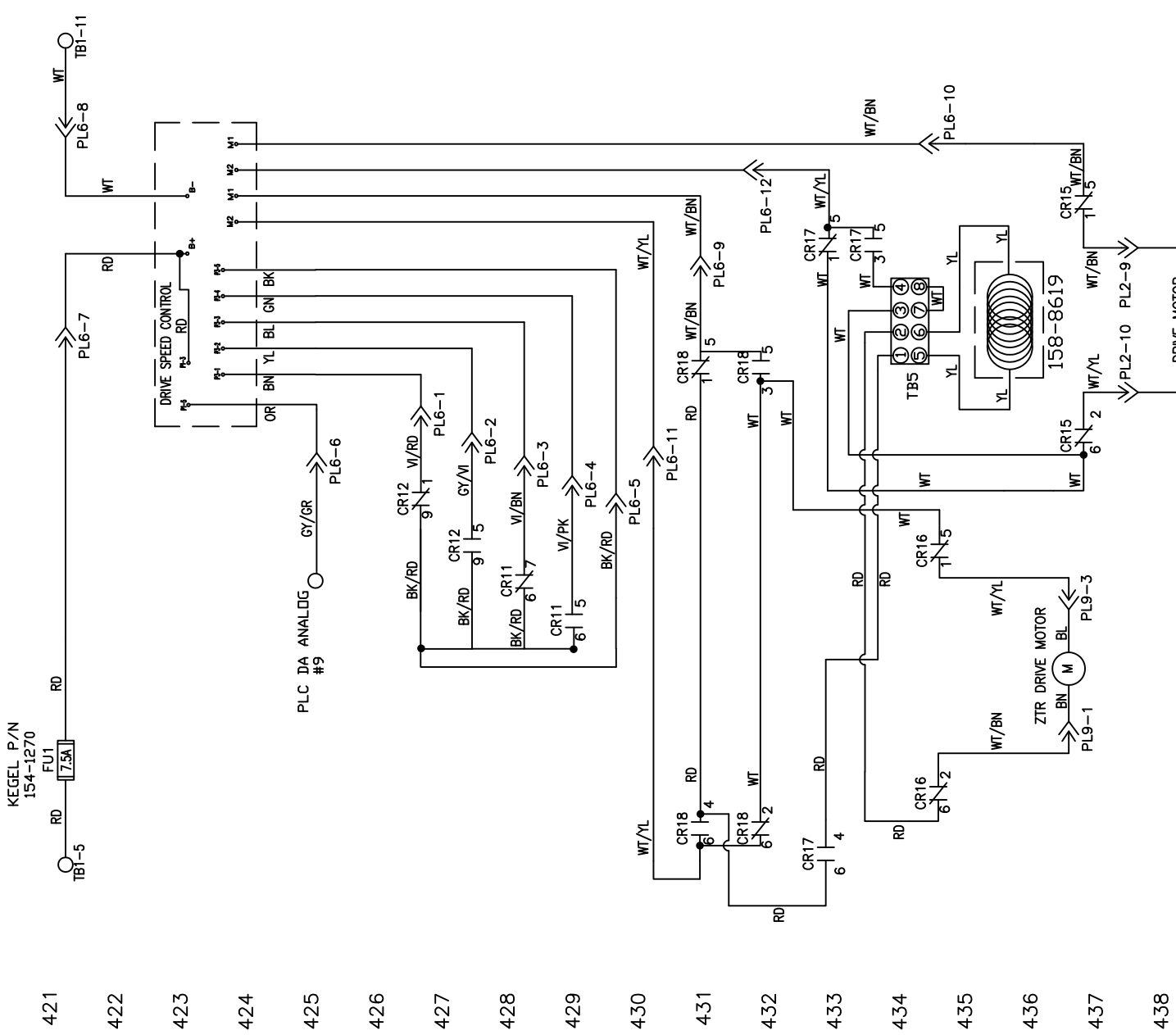
MATERIAL		N/A	
DESCRIPTION		INPUT WIRING SCHEMATIC	
DRAWN BY	DATE	SIZE	QTY/MACHINE PART NUMBER
SLS	07/20/15	C	FLEX WALKER 2016
APPROVED:	REV DATE	SCALE	N/A
MP			
DOC REV		SHEET	3 OF 27

1651 LONGLEAF BLVD.  
 LAKE WALKER, FL 33869  
 (866) 784-0200

SCHEMATIC FOR RESISTOR WIRE ON MAIN DRIVE MOTOR

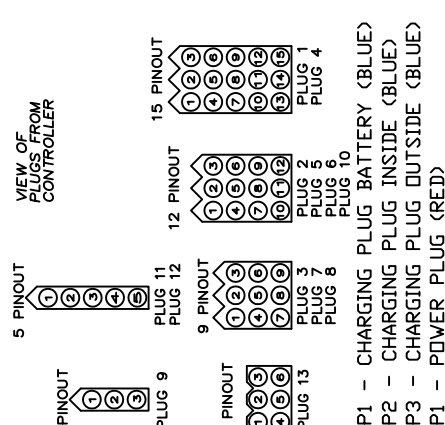


SCHEMATIC FOR RESISTOR WIRE ON ZTR DRIVE MOTOR



LEGEND

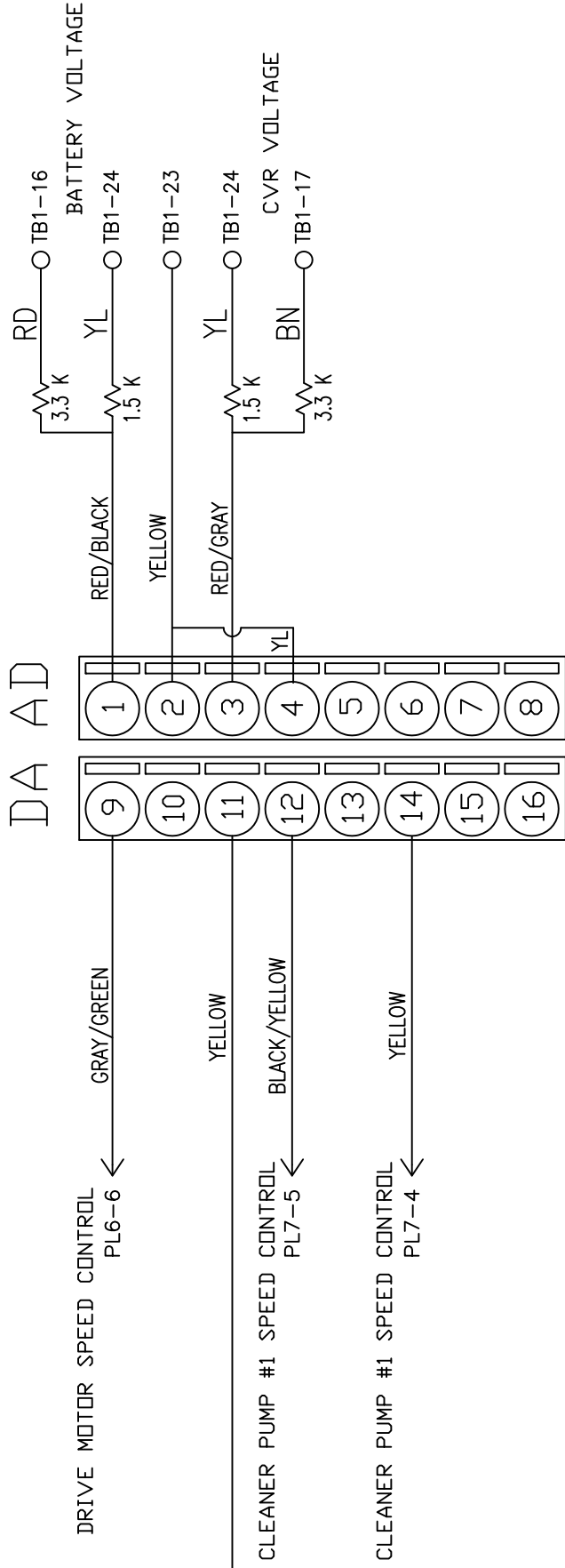
- CR1 - OIL VALVE RELAY TANK A
- CR2 - OIL VALVE RELAY TANK B
- CR3 - CONTROL RELAY
- CR4 - DUSTER POLARITY SWITCH RELAY
- CR5 - PIN DECK TREATMENT RELAY
- CR6 - POWER OFF RELAY
- CR7 - DUSTER WINDUP MOTOR RELAY
- CR8 - DUSTER UNWIND MOTOR RELAY
- CR9 - SQUEEGEE LIFT MOTOR RELAY
- CR10 - FORWARD DRIVE MOTOR RELAY
- CR11 - REVERSE DRIVE MOTOR RELAY
- CR12 - BUFFER MOTOR RELAY
- CR13 - WHISKER ENABLE RELAY
- CR14 - WHISKER 7 PIN SIDE RELAY
- CR15 - WHISKER 10 PIN SIDE RELAY
- CR16 - ZTR ENABLE RELAY
- CR17 - ZTR REVERSE RELAY
- CR18 - VACUUM MOTOR RELAY
- CR20 - POWER RELAY
- FU1 - DRIVE MOTOR 7.5A
- FU2 - BUFFER MOTOR 10A/20A
- FU3 - VACUUM MOTOR 20A
- FU4 - DUSTER UNWIND 3.2A
- FU5 - DUSTER WINDUP 3.2A
- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 2.25A
- FU9 - OIL PUMP MOTOR 2.25A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - TOUCH SCREEN 0.5A
- FU12 - CLEANER PUMP #1 3.2A
- FU13 - CLEANER PUMP #2 3.2A
- FU14 - CVR POWER 25A/30A
- FU15 - LED LIGHTS 1A
- FU16 - TRIGGER SOLENOID 3.2A
- FU17 - TRIGGER SOLENOID 3.2A
- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (9)
- PL4 - 7-PIN SIDE PLUG (15)
- PL5 - 7-PIN SIDE PLUG (12)
- PL6 - DRIVE SPEED BOARD PLUG (12)
- PL7 - CLEANER PUMP #1 SPEED BOARD PLUG (9)
- PL8 - CLEANER PUMP #2 SPEED BOARD PLUG (9)
- PL9 - ZTR DRIVE MOTOR PLUG (3)
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- PL12 - BUFFER MOTOR VARIABLE SPEED PLUG (5)
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- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)
- TB4 - TERMINAL BLOCK 4 (OIL PLATE)
- TB5 - TERMINAL BLOCK 5 (TOP PLC PLATE)



MATERIAL		N/A	
DESCRIPTION		SPEED CONTROL SCHEMATIC	
DATE	07/20/15	DO NOT SCALE DRAWING	
DRAWN BY	SLS	SIZE	C
APPROVED:	MP	QTY/MACHINE PART NUMBER	N/A
DOC REV		SCALE	N/A
		SHEET	4 OF 27

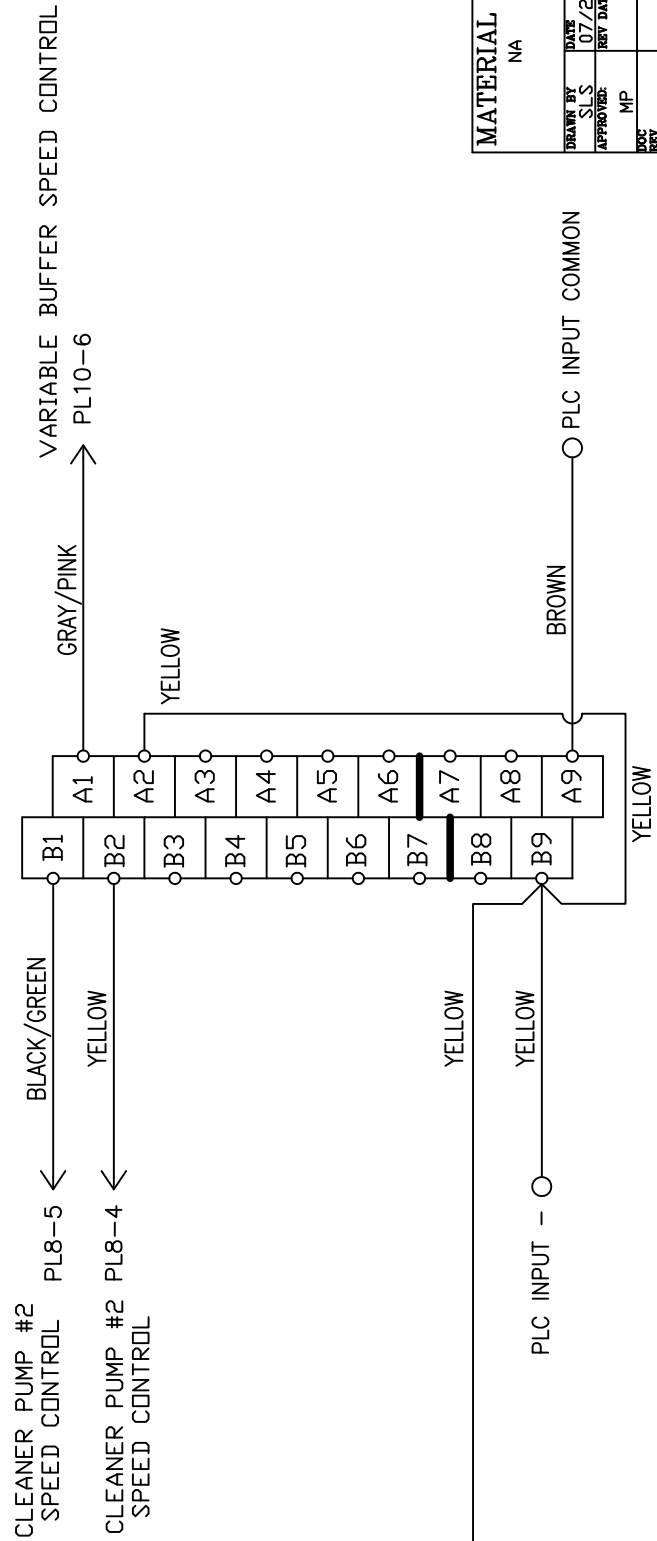
1961 LONGLEAF BLVD.  
LAKE WALES, FL 33869  
(866) 734-0200

# BUILT IN PLC ANALOG



YELLOW

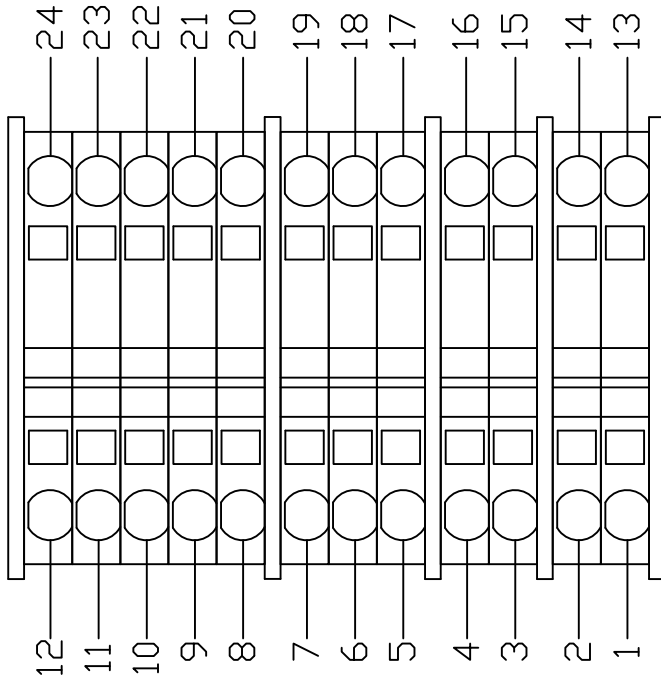
# AD021 ANALOG ADD ON UNIT



MATERIAL	KEGEL	1961 LONGLEAF BLVD. LAKE WALKER, FL 33669 (813) 734-0200
DESCRIPTION	ANALOG WIRING SCHEMATIC	
DO NOT SCALE DRAWING		
SIZE	QTY/MACHINE PART NUMBER	
C		
SCALE	N/A	
REV	5	DF 27
APP'D	MP	FLEX WALKER 2016
DATE	07/20/15	
DRAWN BY	SLS	
APPROVED:		
REV DATE		



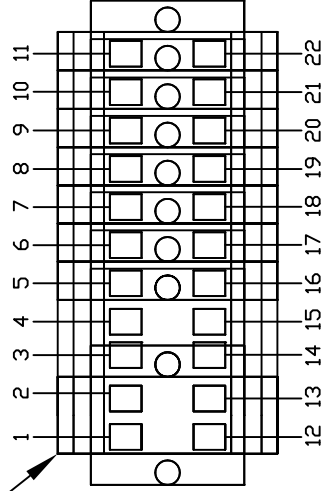
# TB1 <MAIN>



# TB2

<10-PIN SIDE>

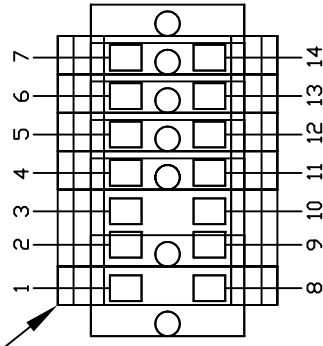
ORANGE  
BLOCK



# TB3

<7-PIN SIDE>

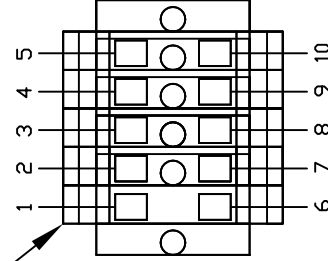
ORANGE  
BLOCK



# TB4

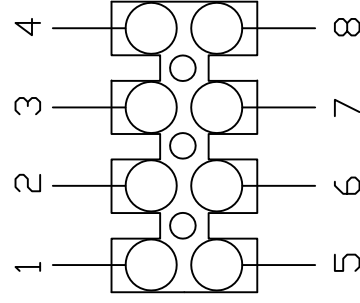
<OIL PLATE>

ORANGE  
BLOCK



# TB5

<TOP PLC PLATE>



## LEGEND

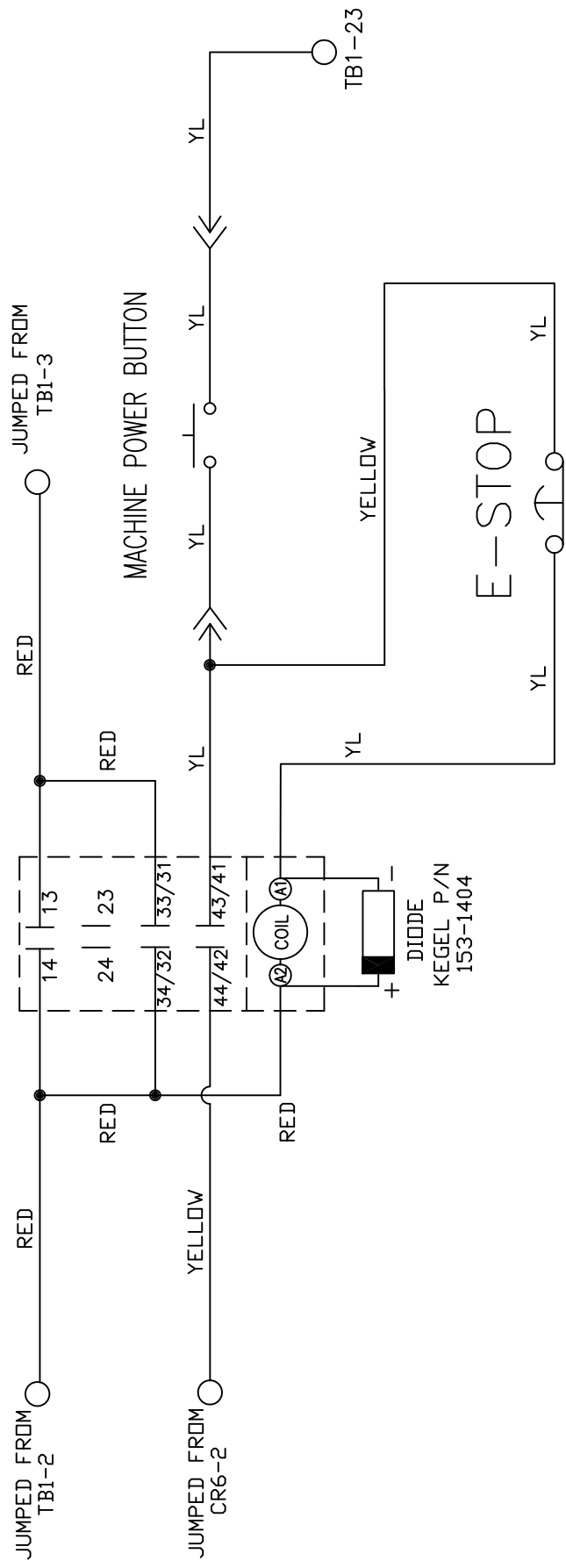
- TB1 - TERMINAL BLOCK 1 <MAIN>
- TB2 - TERMINAL BLOCK 2 <10-PIN SIDE>
- TB3 - TERMINAL BLOCK 3 <7-PIN SIDE>
- TB4 - TERMINAL BLOCK 4 <OIL PLATE>
- TB5 - TERMINAL BLOCK 5 <TOP PLC PLATE>

MATERIAL NA		KEGEL		1961 LONGLEAF BLVD. LAKE WALKER, FL 33669 (863) 734-0200	
DRAWN BY SLS		DATE 07/20/15		DESCRIPTION TERMINAL BLOCK LAYOUT	
APPROVED: MP		REV DATE		DO NOT SCALE DRAWING SIZE QTY/MACHINE PART NUMBER	
ISSUE REV		SCALE N/A		FLEX WALKER 2016	
				SECRET 6 OF 27	

4 3 2 1

D C B A

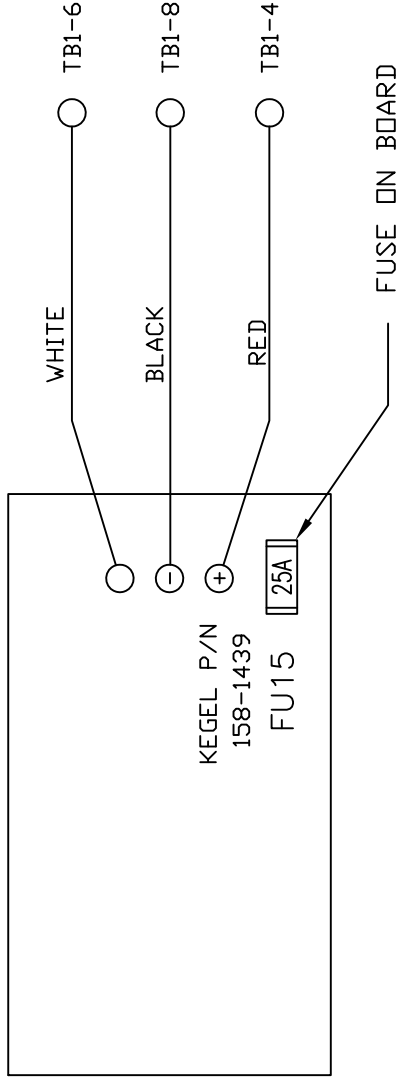
POWER RELAY  
CR20



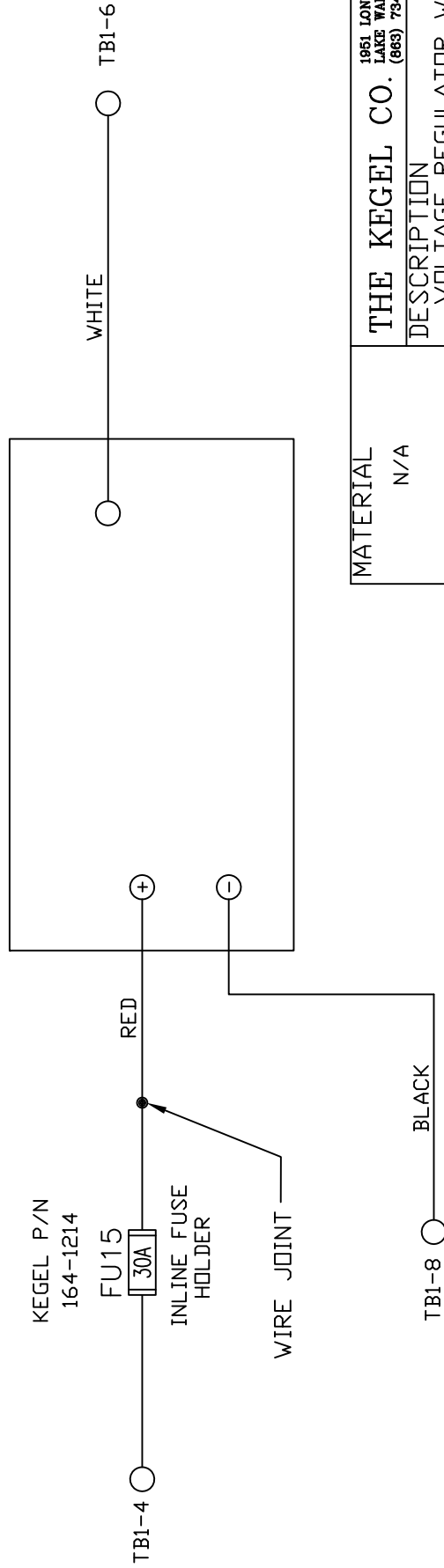
MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO.	
DESCRIPTION		POWER RELAY WIRING	
DO NOT SCALE DRAWING	DATE	SIZE	QTY/MACHINE PART NUMBER
MP	07/20/15	A	N/A
DOC	REV	SCALE	N/A
			SHEET 7 OF 27

4 3 2 1

# VOLTAGE REGULATOR

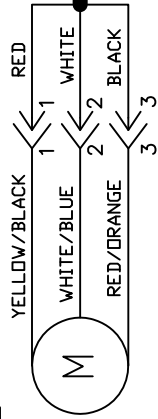


# UPGRADED VOLTAGE REGULATOR

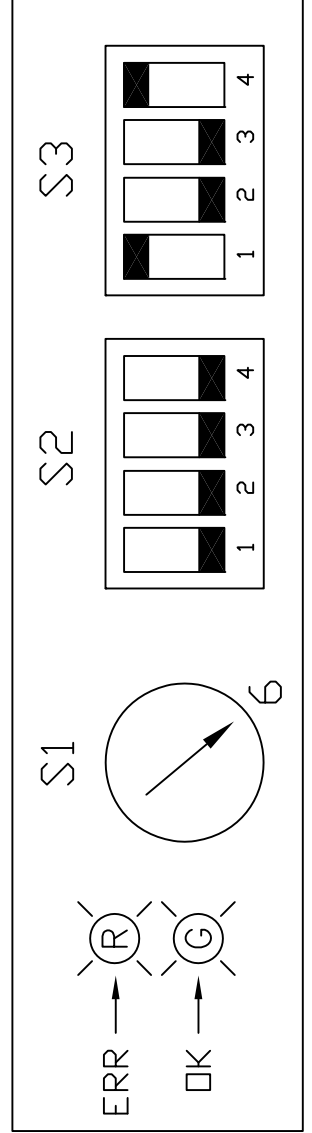
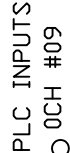
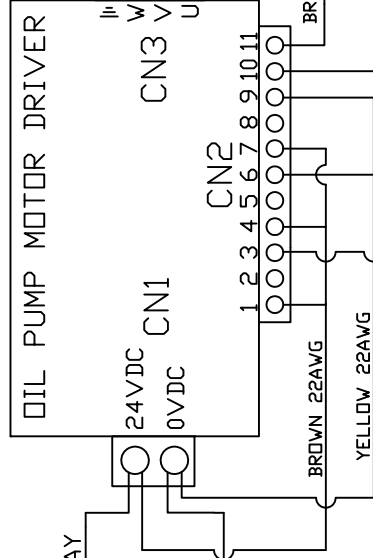


MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33859	
N/A		THE KEGEL CO. (888) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	VOLTAGE REGULATOR WIRING	
APPROVED:	REV DATE	DO NOT SCALE DRAWING	
MP		SIZE	QTY/MACHINE PART NUMBER
		A	N/A FLEX WALKER 2016
DWG		SCALE	N/A
REV		SHEET	8 OF 27

# OIL PUMP MOTOR



KEGEL P/N  
154-1266



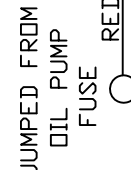
MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		DESCRIPTION		OIL PUMP DRIVER & MOTOR WIRING	
DRAWN BY	DATE	DO NOT SCALE DRAWING		SIZE	
SLS	07/21/15	QTY/MACHINE PART NUMBER		A N/A	
APPROVED:	REV DATE	SCALE		SHEET 9 OF 27	
MP		N/A		FLEX WALKER 2016	
DOC		N/A		SHEET 9 OF 27	
REV		N/A		SHEET 9 OF 27	

4 3 2 1

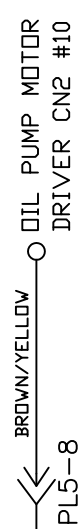
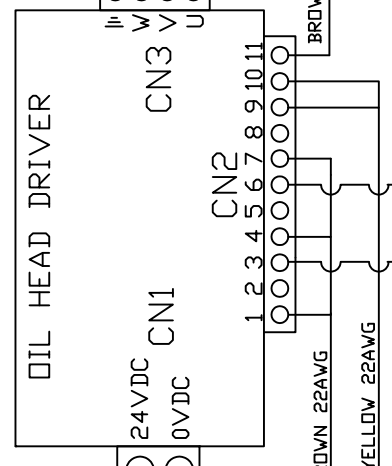
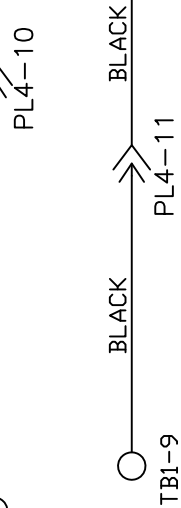
# OIL HEAD MOTOR



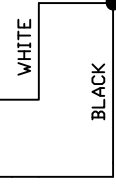
KEGEL P/N  
154-1266  
FU9



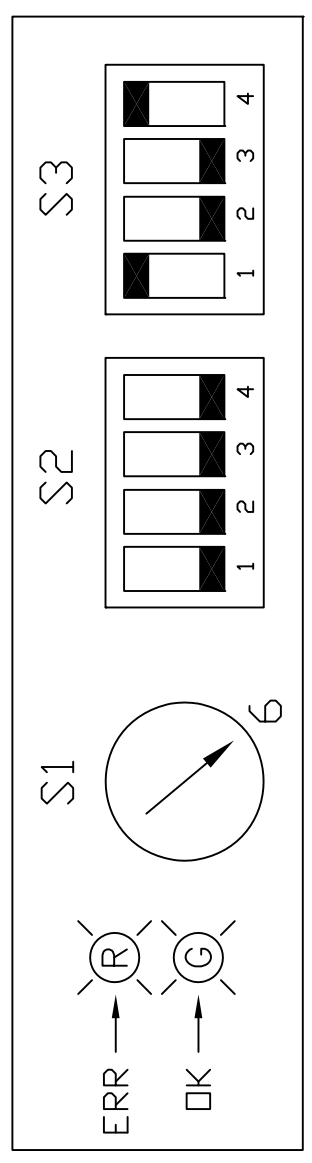
WHITE/RED  
PL4-10



OIL PUMP MOTOR  
DRIVER CN2 #10



PLC OUTPUTS  
CH100 #05  
PLC OUTPUTS  
CH100 #04

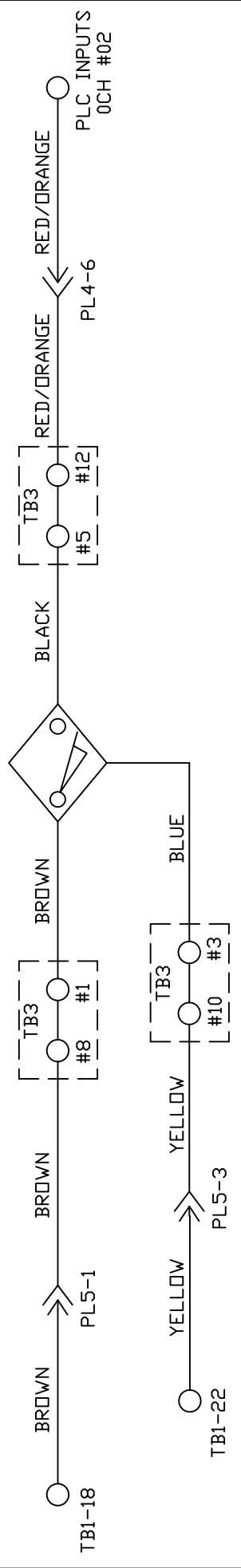


MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (889) 734-0200	
DRAWN BY SLS	DATE 07/21/15	DESCRIPTION OIL HEAD DRIVER & MOTOR WIRING	
APPROVED: MP	REV DATE	DO NOT SCALE DRAWING SIZE QTY/MACHINE PART NUMBER	
DOC REV	MP	A N/A	FLEX WALKER 2016
		SCALE N/A	SHEET 10 OF 27

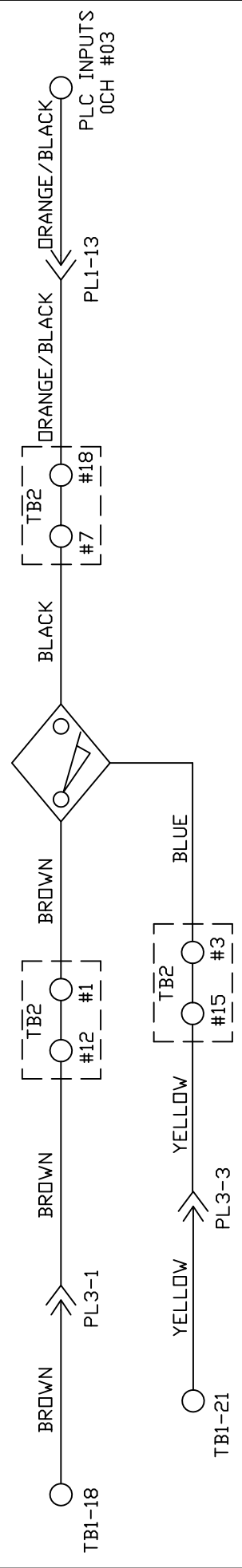
4 3 2 1

4 3 2 1

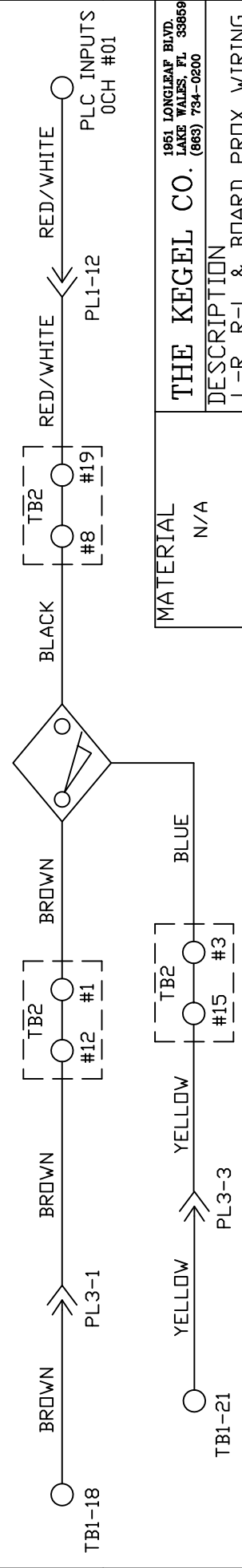
### L-R HEAD PROX



### R-L HEAD PROX



### BOARD PROX



MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33609	
N/A		THE KEGEL CO. (888) 734-0200	
DESCRIPTION			
L-R, R-L & BOARD PROX WIRING			
DO NOT SCALE DRAWING		DO NOT SCALE DRAWING	
DATE	07/21/15	SIZE	A
REV DATE		QTY/MACHINE	N/A
MP		SCALE	N/A
DWG REV		SHEET	11 OF 27

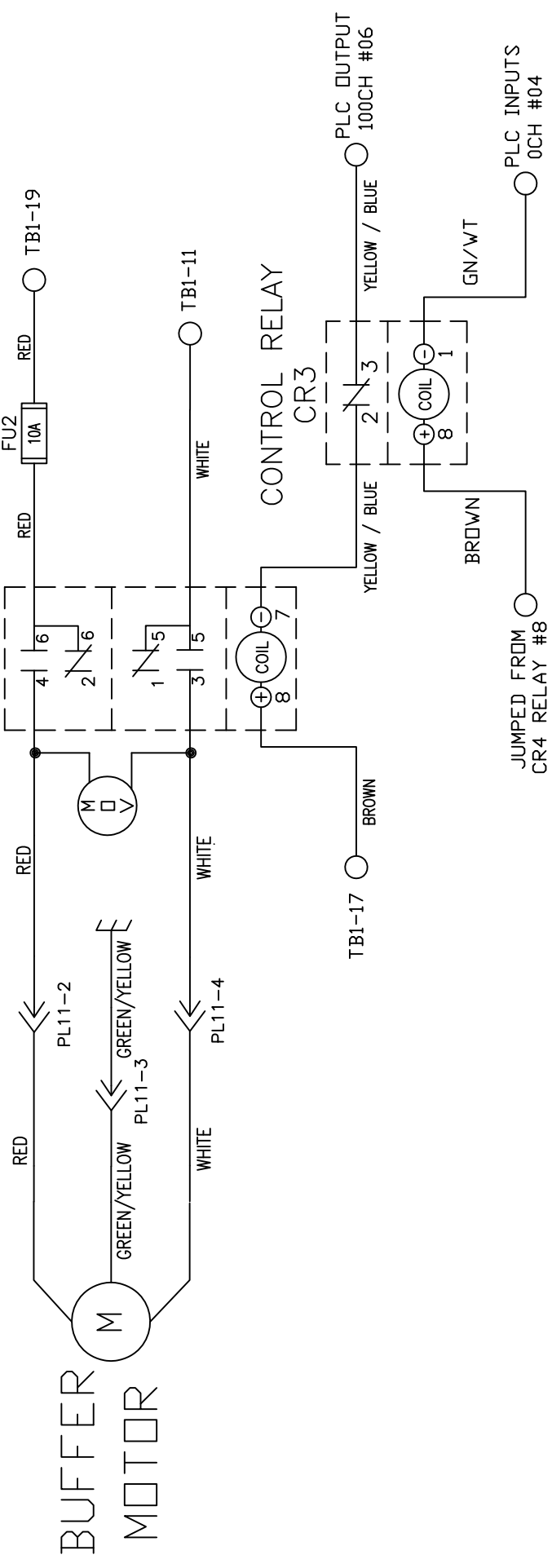


4 3 2 1

D C B A

BUFFER MOTOR RELAY CR13

KEGEL P/N  
154-1273



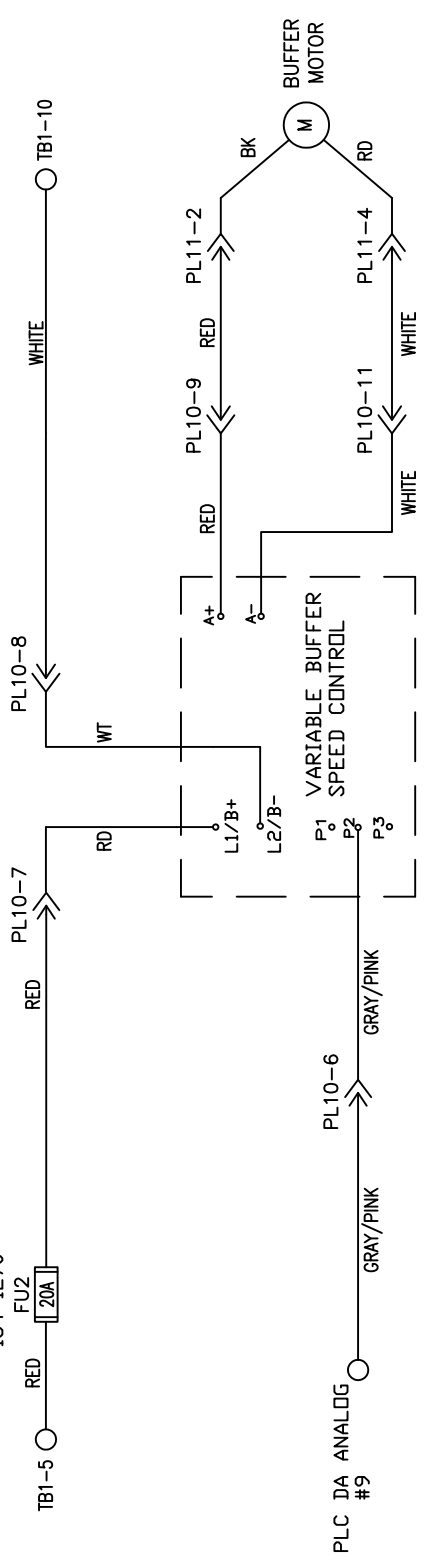
MATERIAL	THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33859		
N/A	DESCRIPTION BUFFER MOTOR WIRING		
DRAWN BY	DATE	DO NOT SCALE DRAWING	SIZE
SLS	07/21/15		A
APPROVED:	REV DATE	QTY/MACHINE PART NUMBER	N/A
MP			N/A
DOC REV		SCALE	SHEET
		N/A	13 OF 27

4 3 2 1

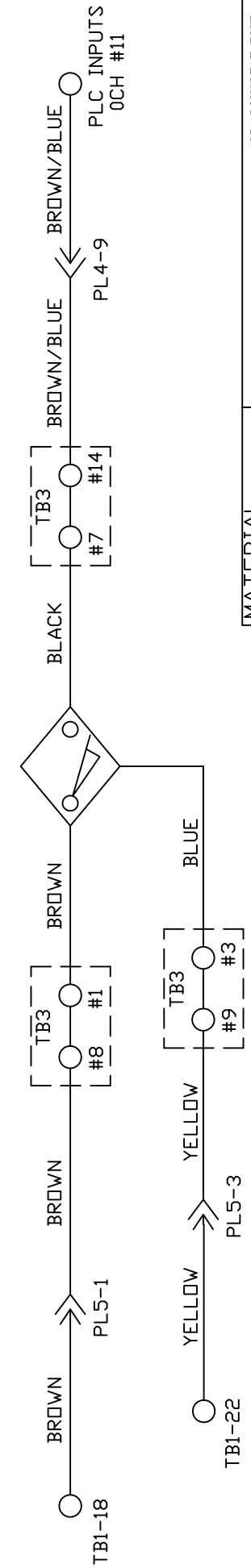


1 2 3 4

KEGEL P/N  
154-1270  
FU2  
20A



### VARIABLE BUFFER PROX



MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
DRAWN BY SLS		DATE 07/21/15	
APPROVED: MP		REV DATE	
DESCRIPTION VARIABLE BUFFER MOTOR & TACH WIRING DO NOT SCALE DRAWING		SIZE A	QTY/MACHINE N/A
PART NUMBER		SCALE N/A	REV 14
FLEX WALKER 2016		SHEET 14 OF 27	

2 3 4

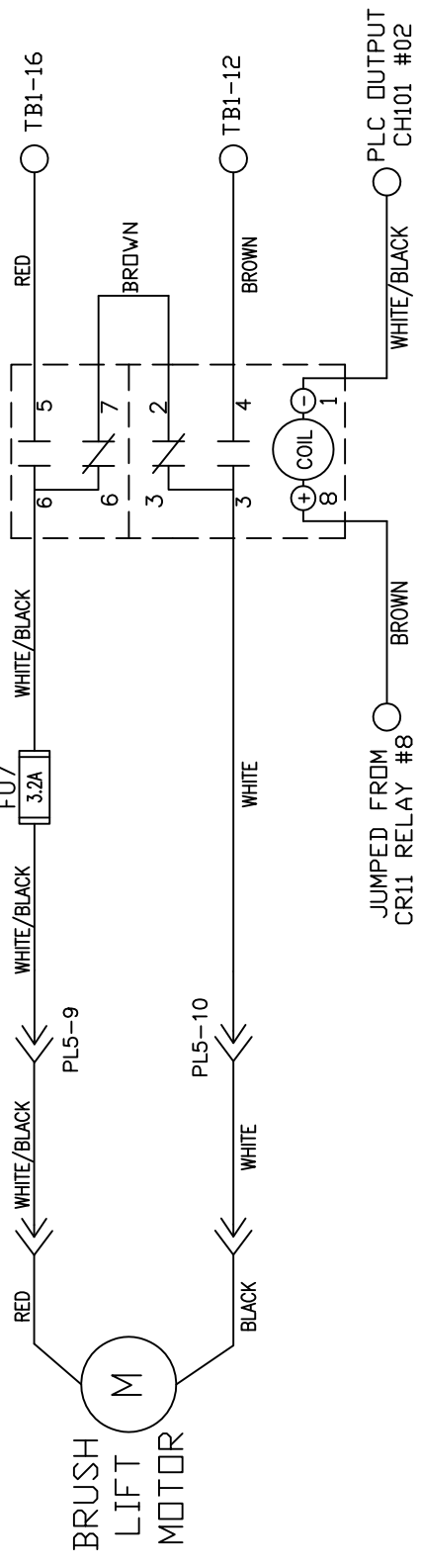
1 2 3 4

4 3 2 1

D C B A

### BRUSH LIFT MOTOR RELAY CR10

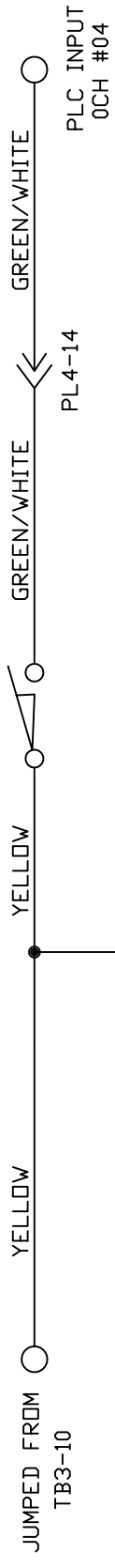
KEGEL P/N  
154-1267  
FU7  
3.2A



JUMPED FROM  
CR11 RELAY #8

PLC OUTPUT  
CH101 #02

### BRUSH UP SWITCH



PLC INPUT  
0CH #04

### BRUSH DOWN SWITCH



PLC INPUT  
0CH #05

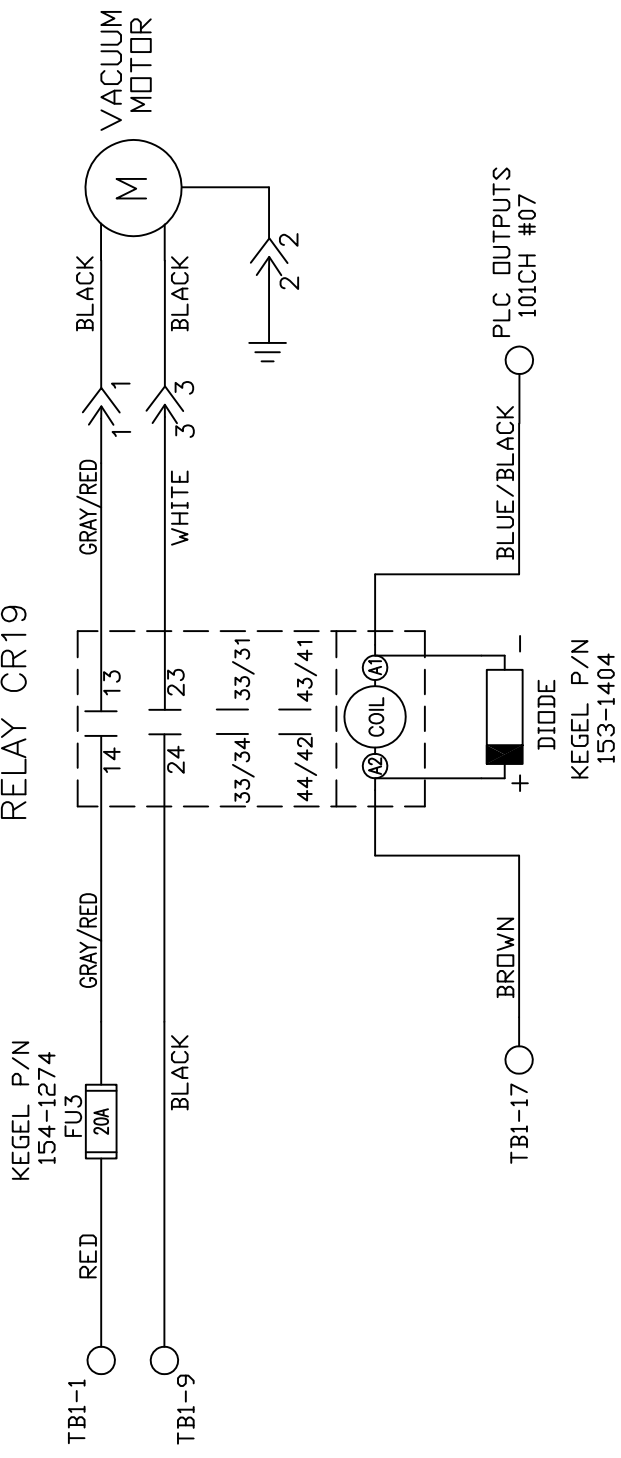
MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
DESCRIPTION BRUSH LIFT MOTOR & SWITCH WIRING DO NOT SCALE DRAWING		DRAWN BY SLS	
DATE 07/21/15		REV DATE	
APPROVED: MP		SIZE A	
QTY/MACHINE PART NUMBER		N/A	
SCALE N/A		SHEET 15 OF 27	
DOC REV		FLEX WALKER 2016	

4 3 2 1

4 3 2 1

D C B A

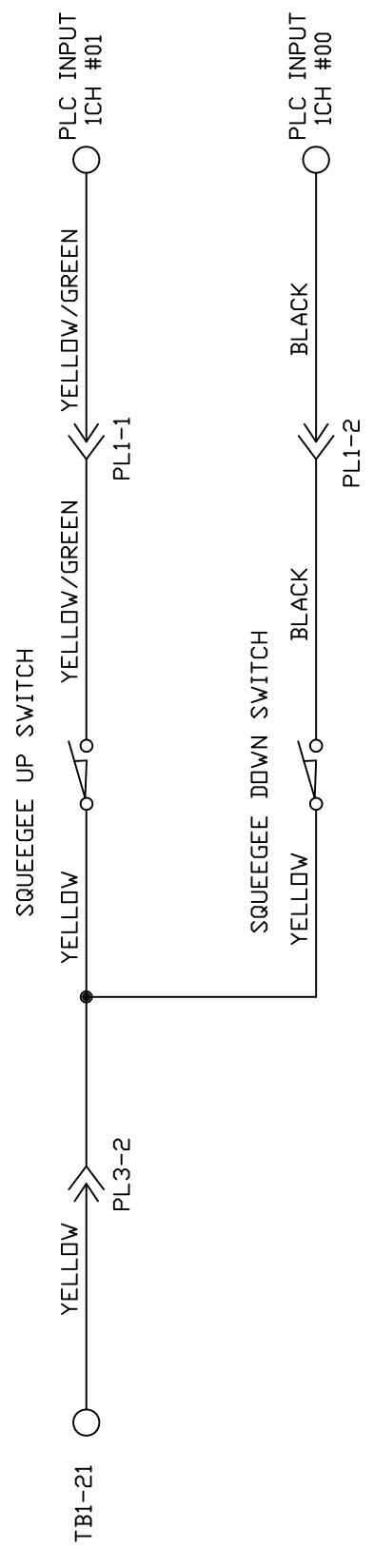
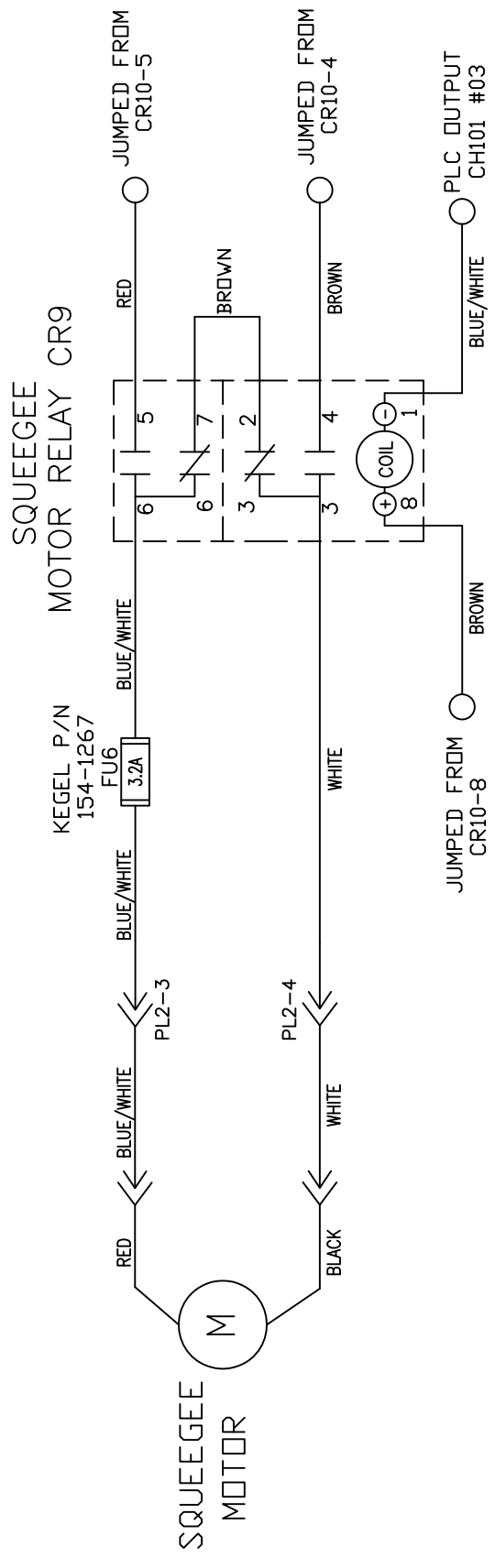
VACUUM MOTOR  
RELAY CR19



MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33859 (888) 734-0200	
N/A		DESCRIPTION		VACUUM MOTOR WIRING	
DRAWN BY	DATE	DO NOT SCALE DRAWING		SIZE	QTY/MACHINE PART NUMBER
SLS	07/21/15			A	N/A
APPROVED:	REV DATE			SCALE	N/A
MP				SHEET	16 OF 27
DWG REV					

4 3 2 1

4 3 2 1



MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33859	
N/A		DESCRIPTION		SQUEEGEE MOTOR & SWITCH WIRING DO NOT SCALE DRAWING	
DRAWN BY	DATE	SIZE	QTY/MACHINE	PART NUMBER	
SLS	07/21/15	A	N/A	FLEX WALKER	2016
APPROVED:	REV DATE	SCALE	N/A	SHEET	17 OF 27
MP					
DOC					
REV					

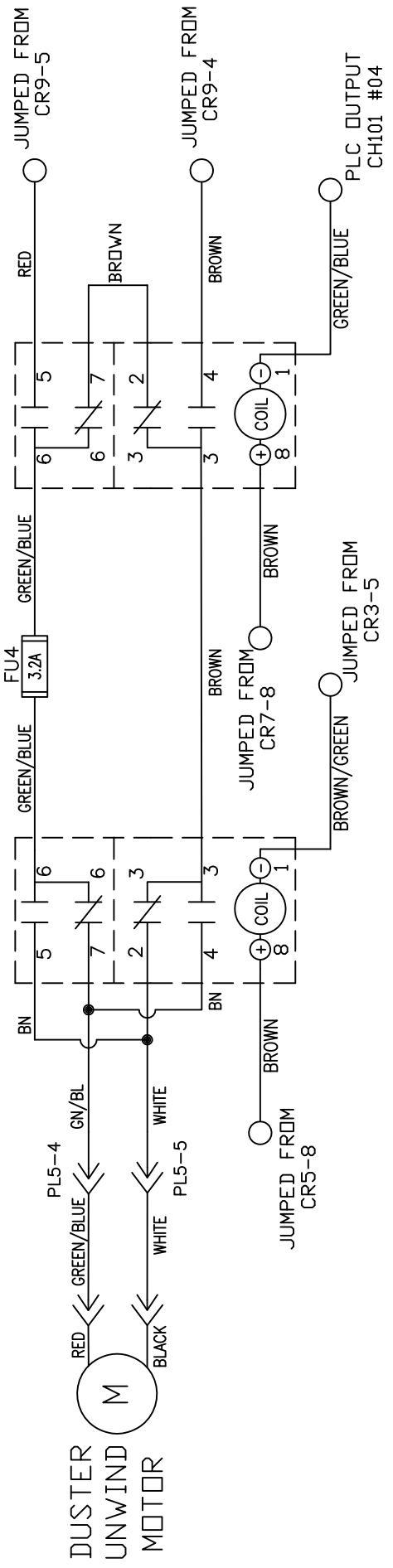
4 3 2 1

4 3 2 1

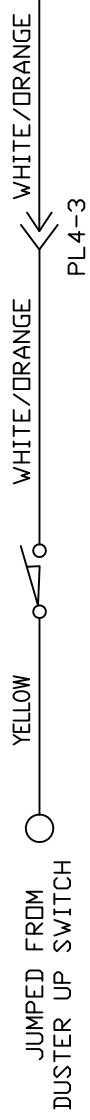
DUSTER POLARITY  
RELAY CR4

DUSTER UNWIND  
MOTOR RELAY CR8

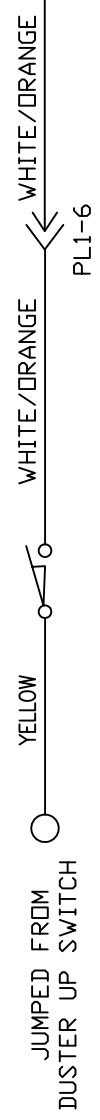
KEGEL P/N  
154-1267  
FU4  
3.2A



7-PIN SIDE  
FAIL SAFE SWITCH



10-PIN SIDE  
FAIL SAFE SWITCH



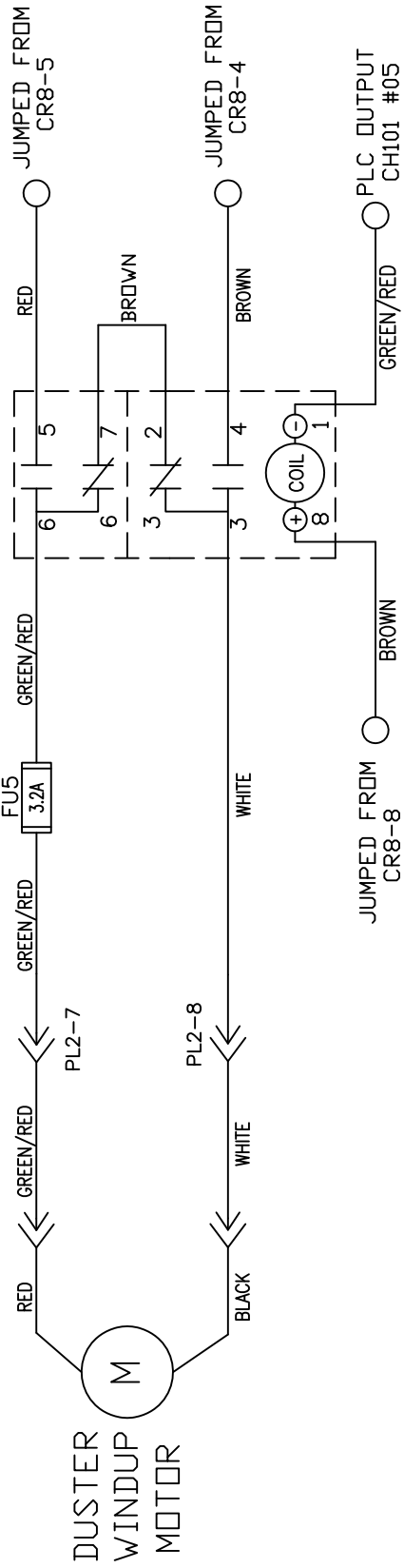
MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		DESCRIPTION		DUSTER UNWIND & SWITCH WIRING DO NOT SCALE DRAWING	
DRAWN BY	DATE	SIZE	QTY/MACHINE	PART NUMBER	
SLS	07/21/15	A	N/A	FLEX WALKER	2016
APPROVED:	REV DATE	SCALE	N/A	SHEET	18 OF 27
MP					
DOC REV					

4 3 2 1

4 3 2 1

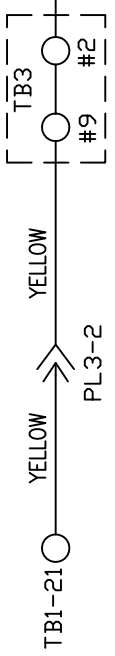
DUSTER WINDUP  
MOTOR RELAY CR7

KEGEL P/N  
154-1267  
FU5  
3.2A



275

7-PIN SIDE  
DUSTER UP SWITCH

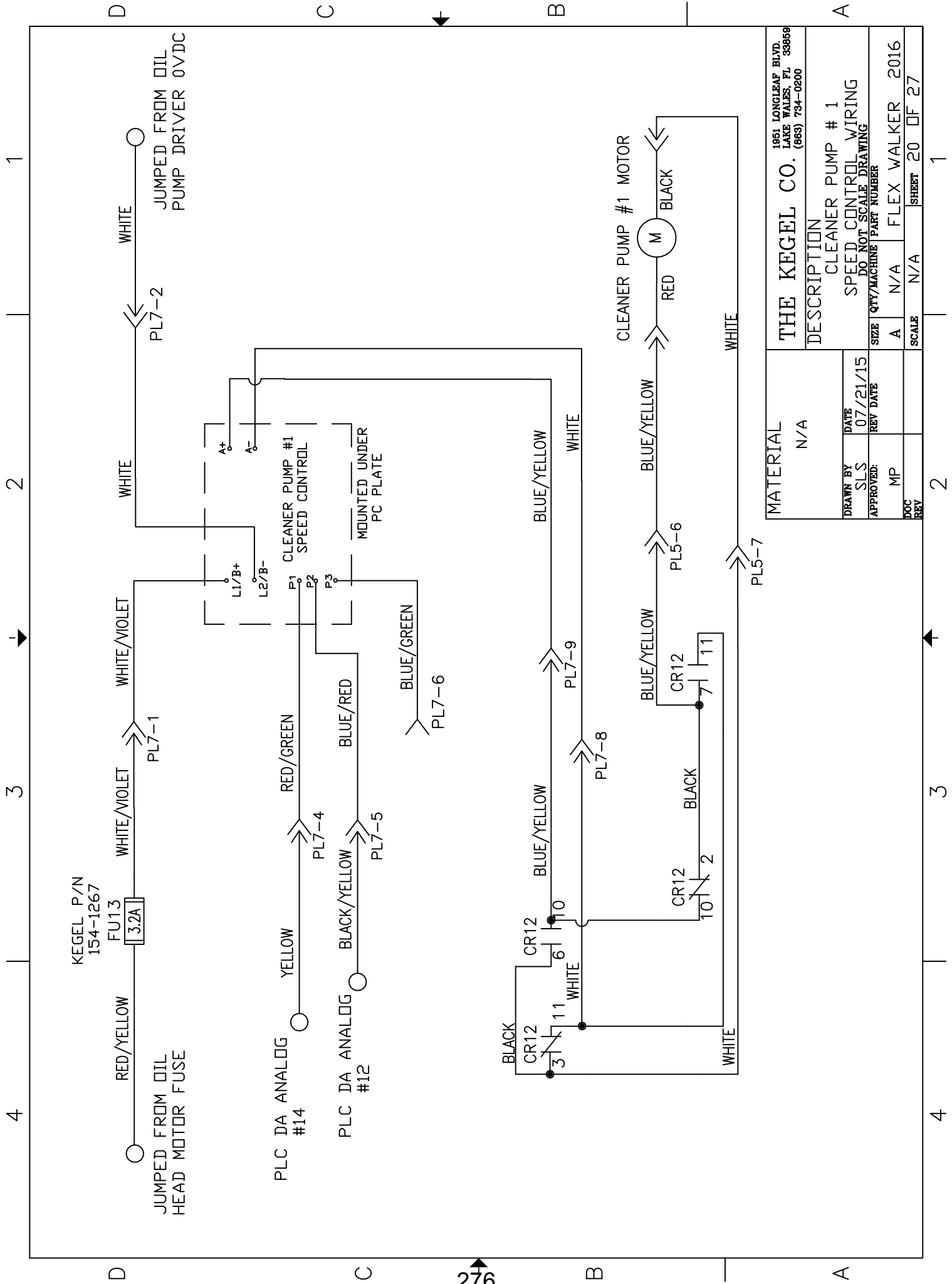


10-PIN SIDE  
DUSTER UP SWITCH



MATERIAL		THE KEGEL CO. (689) 734-0200	
N/A		1951 LONGLEAF BLVD. LAKE WALES, FL 33859	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	DUSTER WINDUP	
APPROVED:	REV DATE	& SWITCH WIRING	
MP		DO NOT SCALE DRAWING	
DOC	MP	SIZE	QTY/MACHINE PART NUMBER
REV		A	N/A
		SCALE	N/A
		SHEET	19 OF 27

4 3 2 1



KEGEL P/N  
154-1267

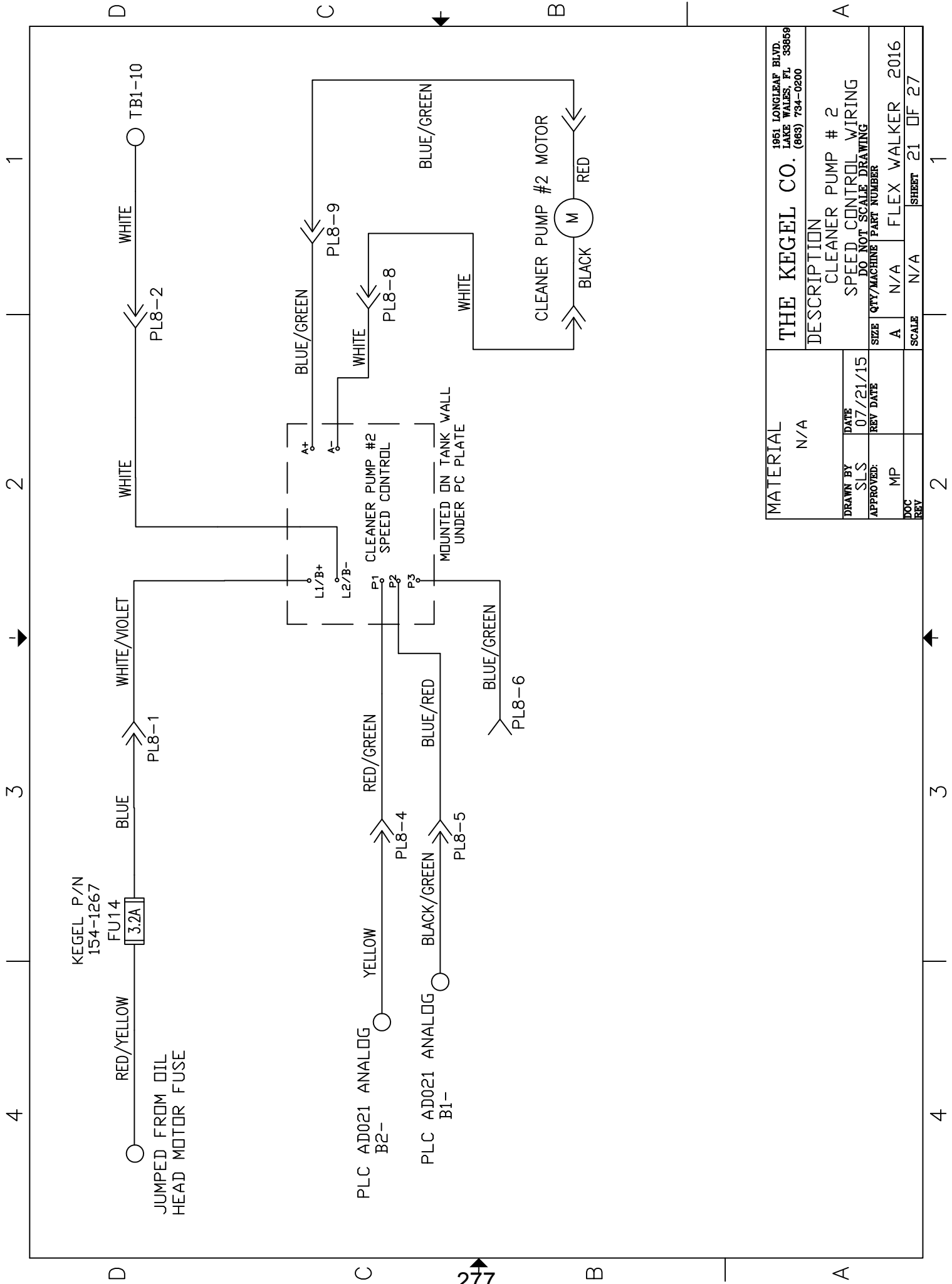
FU13  
3.2A

WHITE  
PL7-2  
JUMPED FROM OIL  
PUMP DRIVER 0VDC

CLEANER PUMP #1  
SPEED CONTROL  
MOUNTED UNDER  
PC PLATE

CLEANER PUMP #1 MOTOR

MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	CLEANER PUMP # 1	
APPROVED:	REV DATE	SPEED CONTROL WIRING	
MP		DO NOT SCALE DRAWING	
DOC	SIZE	QTY/MACHINE	PART NUMBER
REV	A	N/A	
	SCALE	N/A	
		SHEET	20 OF 27



KEGEL P/N  
154-1267

FU14  
3.2A

JUMPED FROM OIL  
HEAD MOTOR FUSE

PLC AD021 ANALOG  
B2-

PLC AD021 ANALOG  
B1-

RED/GREEN  
PL8-4

BLACK/GREEN  
PL8-5

BLUE/GREEN  
PL8-6

CLEANER PUMP #2  
SPEED CONTROL

MOUNTED ON TANK WALL  
UNDER PC PLATE

CLEANER PUMP #2 MOTOR  
M

MATERIAL	N/A	
DESCRIPTION	CLEANER PUMP # 2 SPEED CONTROL WIRING DO NOT SCALE DRAWING	
DRAWN BY	DATE	07/21/15
SLS	REV DATE	
APPROVED:	MP	
SIZE	QTY/MACHINE	PART NUMBER
A	N/A	FLEX WALKER 2016
SCALE	N/A	SHEET 21 OF 27

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

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

CLEANER PUMP # 2  
SPEED CONTROL WIRING  
DO NOT SCALE DRAWING

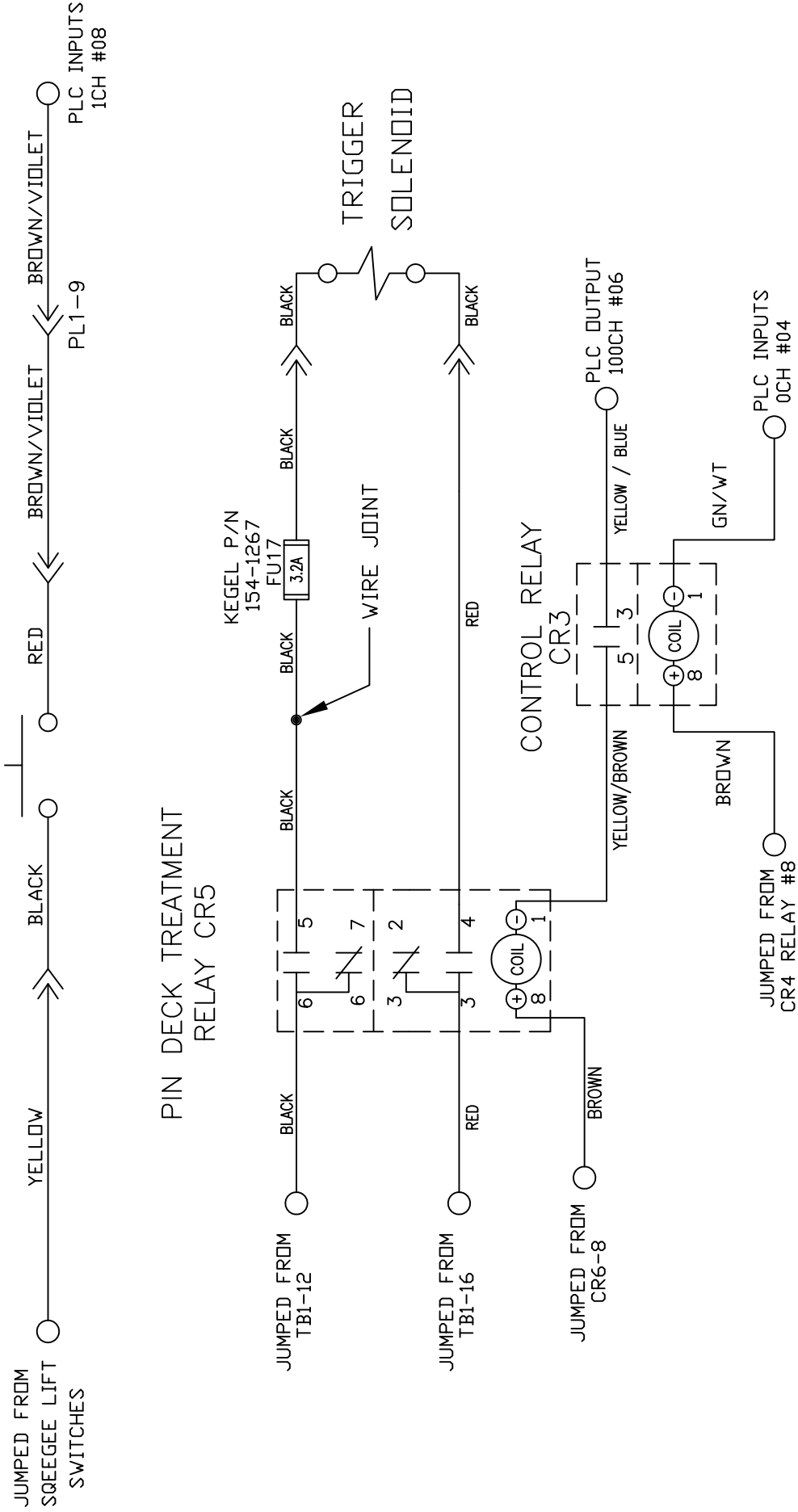
MP

FLEX WALKER 2016

SHEET 21 OF 27



# DUSTER/PRESOAK BUTTON



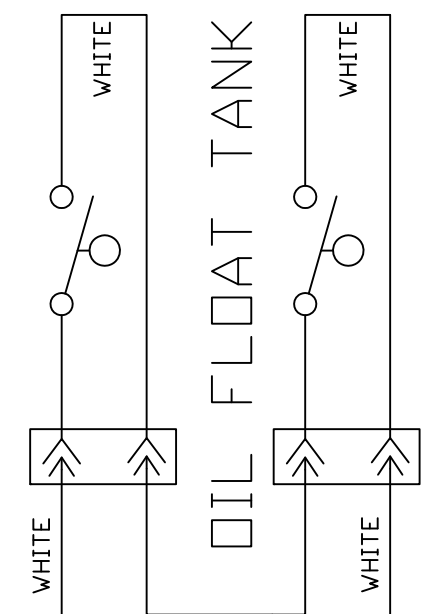
MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	DUSTER/PRESOAK BUTTON	
APPROVED:	REV DATE	& TRIGGER SOLENOID	
MP		SIZE	DO NOT SCALE DRAWING
		QTY/MACHINE	PART NUMBER
		A	N/A
DOC	SCALE	N/A	N/A
REV			

4 | 3 | 2 | 1

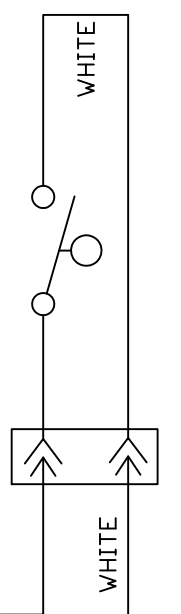
4 | 3 | 2 | 1

4 3 2 1

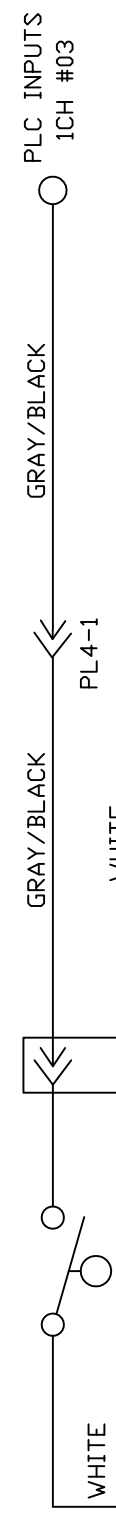
# OIL FLOAT TANK A



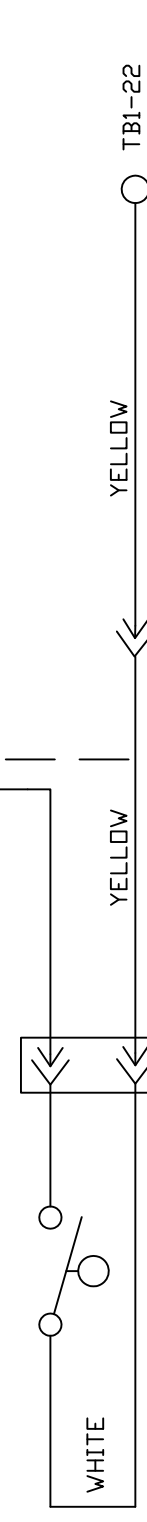
# OIL FLOAT TANK B



# CLEANER FLOAT PUMP #1



# CLEANER FLOAT PUMP #2



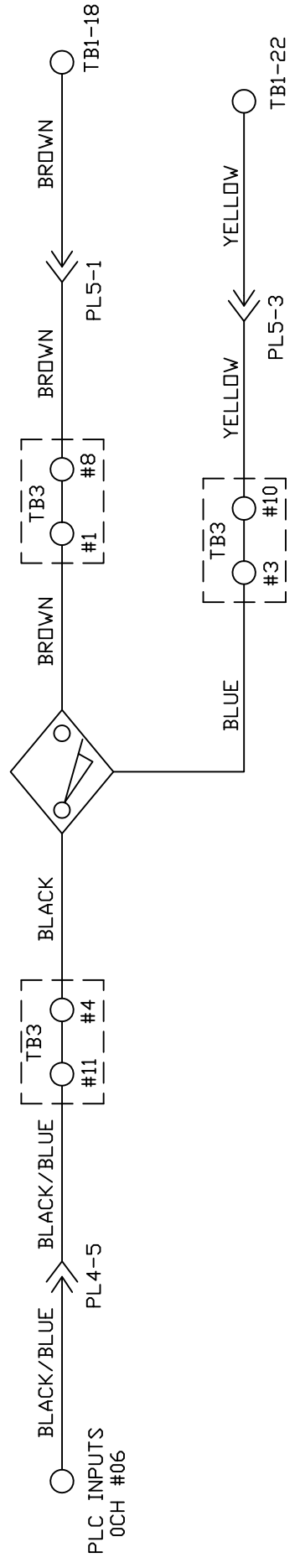
# OPTIONAL CLEANER UPGRADE

MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KECEL CO. (889) 734-0200	
DESCRIPTION	OIL FLOATS & CLEANER FLOATS WIRING DO NOT SCALE DRAWING		
DRAWN BY	DATE	SIZE	QTY/MACHINE PART NUMBER
SLS	07/21/15	A	N/A
APPROVED:	REV DATE	SCALE	N/A
MP			FLEX WALKER 2016
DWG REV		SHEET	23 OF 27

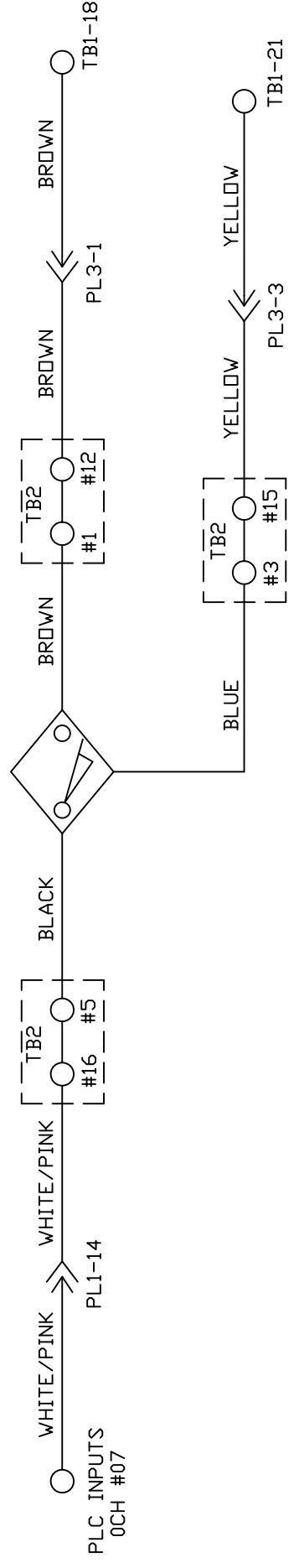
4 3 2 1

4 3 2 1

# SPEED TACH PROX



# LANE DISTANCE PROX



280

MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (888) 734-0200	
DESCRIPTION SPEED TACH & LANE DISTANCE WIRING DO NOT SCALE DRAWING			
DRAWN BY SLS	DATE 07/21/15	SIZE A	QTY/MACHINE N/A
APPROVED: MP	REV DATE	SCALE N/A	REV N/A
DOC REV		SHEET 24 OF 27	

4 3 2 1

4 3 2 1

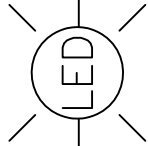
TB1-15

KEGEL P/N  
155-1229  
FUJ16  
1A

PL4-12

RED/GREEN

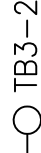
RED/GREEN



YELLOW/WHITE

YELLOW

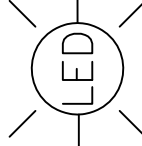
YELLOW



LED TANK  
LIGHT SWITCH

YELLOW

LED ARROW  
LIGHT



RED/GREEN

D

C

B

A

D

C

B

A

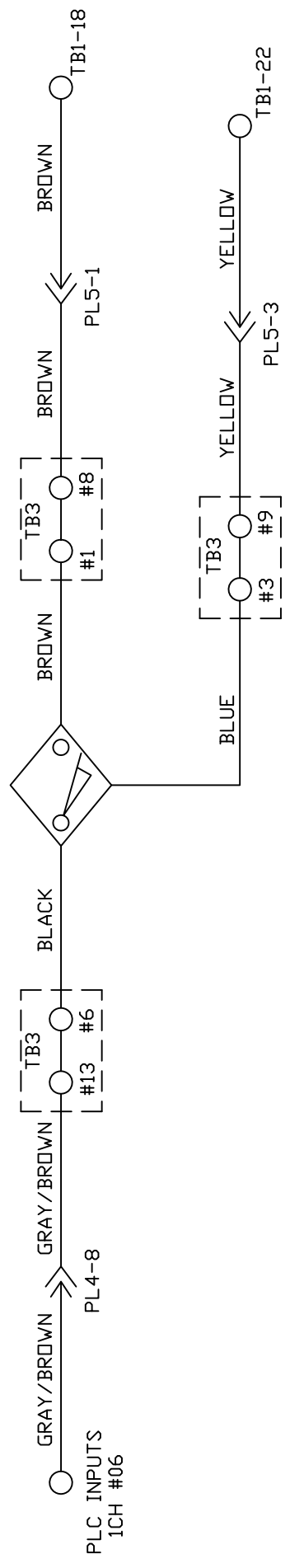
281

MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33859	
N/A		DESCRIPTION		LED TANK LIGHT WIRING	
DRAWN BY	DATE	DO NOT SCALE DRAWING		SIZE	QTY/MACHINE PART NUMBER
SLS	07/21/15			A	N/A
APPROVED:	REV DATE			SCALE	N/A
MP				SHEET	25 OF 27
DOC					
REV					

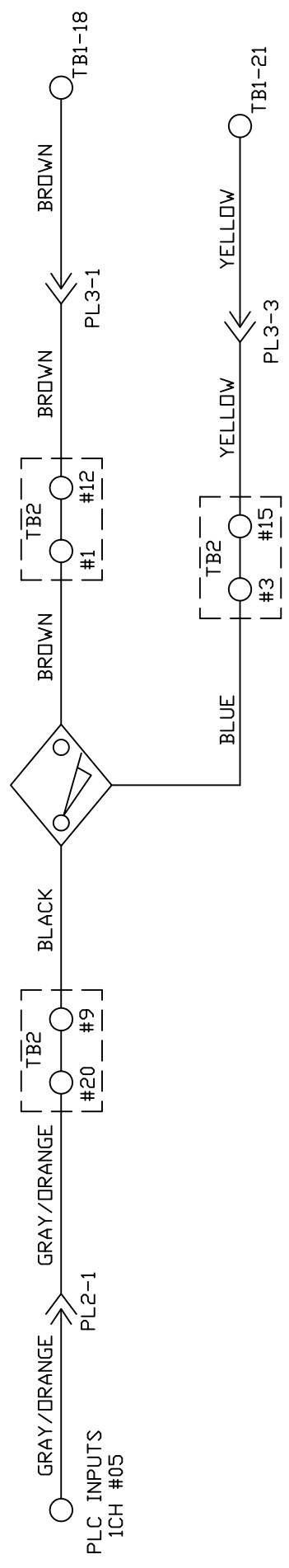
4 3 2 1

4 3 2 1

### ADS PROX 7-PIN SIDE



### ADS PROX 10-PIN SIDE

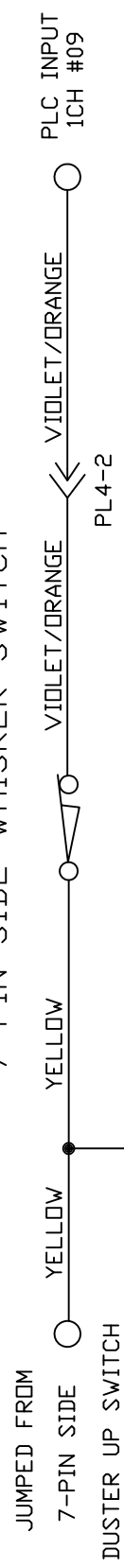


MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DESCRIPTION			
ADS WIRING			
7-PIN & 10-PIN SIDE			
DO NOT SCALE DRAWING			
DRAWN BY	DATE	SIZE	QTY/MACHINE PART NUMBER
SLS	07/21/15	A	N/A
APPROVED:	REV DATE	SCALE	N/A
MP			
DOC REV			

4 3 2 1

4 3 2 1

7-PIN SIDE WHISKER SWITCH



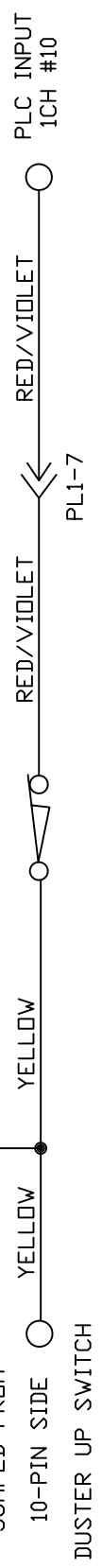
7-PIN SIDE BUMPER SWITCH



10-PIN SIDE BUMPER SWITCH



10-PIN SIDE WHISKER SWITCH



MATERIAL		THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		DESCRIPTION		BUMPER & WHISKER	
DRAWN BY	DATE	DO NOT SCALE DRAWING		SIZE	
SLS	07/21/15	DO NOT SCALE DRAWING		QTY/MACHINE PART NUMBER	
APPROVED:	REV DATE	A	N/A	FLEX WALKER	2016
MP		SCALE	N/A	SHEET 27 OF 27	
DWG REV				1	

4 3 2 1

