

2019
IKON
OPERATORS MANUAL
Edition 9:18

KEGEL LLC
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Lane Machine Manual

2019

IKON Specifications

17-5900 – 115v

17-5950 – 230v

(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: IKON - 331 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: 158-5919

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 IKON 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 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.



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.

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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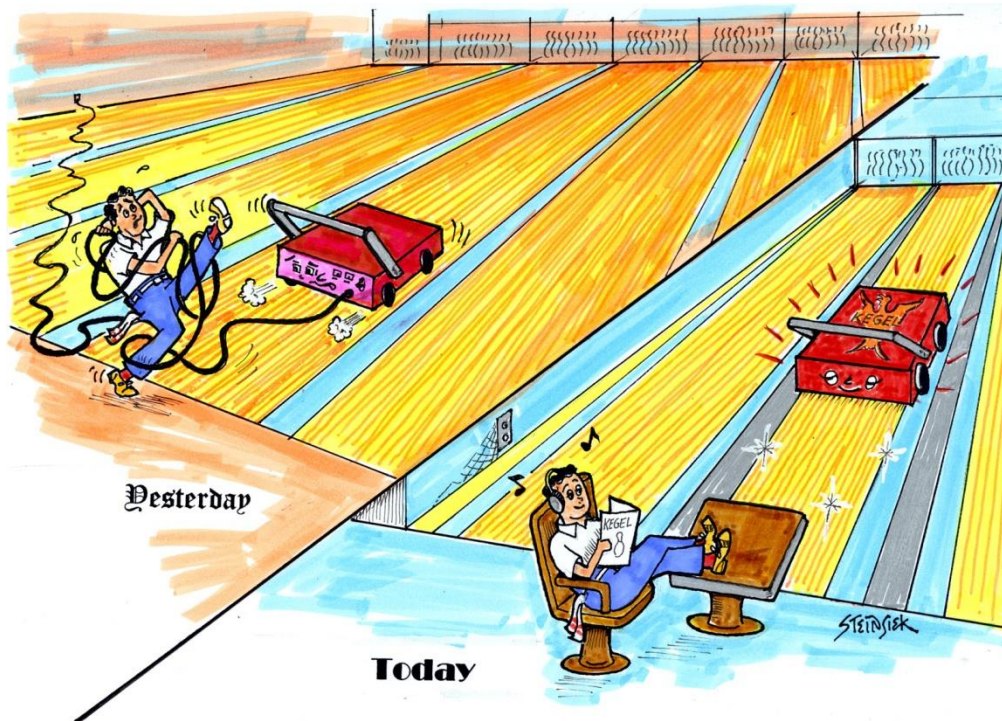
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PREFACE



The Kegel IKON 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 IKON machines operate like no other lane maintenance machines. Cordless operation of the IKON 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.

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 IKON. 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 for technical support.

Disclaimer

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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:

KEGEL www.kegel.net

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USA

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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 in the beginning was manufactured in David's garage.

In 1983, Kegel purchased Ridge Lanes in Sebring, Florida and the crew moved south to run the bowling center and start Research & Development of lane maintenance and machines. The Sanction Machine® 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 and the Flex Walker and the 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.

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:

- IKON Lane Machine**
- Cleaner Funnel – 158-8252
- Conditioner Funnel - 153-0052A
- Accessory Kit 264-5900AK
- KOSI PRO IKON 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 IKON with Kegel in order to receive valuable updates, service bulletins and your Limited Warranty. Fill out the card or go on-line.

IMPORTANT: Please take a minute and register at:

www.kegel.net

Machine Installation Procedures for the Distributor

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.

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 with a receptacle that has a power indicating light. 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 battery on charge as soon as possible after inspecting. See **Chapter 4** 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. Duster Up Switches
 - b. Cleaning Compartment Button - both functions should be explained
 - c. Lane Distance Sensor (LDS);
 - d. Tachometer Sensor (Tach);
 - h. Right & Left Board Edge Sensors;
 - i. Board Counting Sensor;
 - j. Brush and Squeegee Lift Switches;
 - k. Handle Button - explain the functions of this button;
 - l. Oil & Cleaner Floats Switches. Explain the purpose as outlined in the conditioning and cleaning troubleshooting in the respective chapter.
6. Discuss how important it is to have a good transition to the approach.
7. Show the Motor Controls for the Drive Motor and Cleaner Pump Motor.
8. Inspect all the relays and describe their function. Make sure all are seated properly in the socket bases.
9. 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 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).
10. 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.

11. Loosen the fasteners for the Main Control Plate to lift it out of the way and show the battery and the motor chain adjustments.
12. Open the Splash Guard and describe all of the components behind it.
13. Discuss how the cleaner tank can do up to 60 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).
14. Explain how the duster functions during the application.
15. 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.
16. 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.
17. 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!**

1. When the machine is powered ON the touchscreen will illuminate. Line the machine up with lane as if you are ready to operate.
2. Using the touchscreen, perform the starting sequence to run the machine.
3. Watch the machine operate on the lane and monitor the speeds. Make certain they are in the proper range for each speed.
4. When the machine enters the pin deck check to see if the squeegee completely clears the pin deck.
5. 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.
6. Monitor the machine back to the foul line.
7. 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

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.

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.

Filling the Conditioner Tank

1. To fill the conditioner tank assembly, lower the lane machine into the operating position and open the splash guard assembly.
2. Remove the cap for the oil supply tank, and with a towel wrapped around the base of the supplied white fill funnel.
3. Slowly pour the conditioner into the tank until you can see the conditioner around 1” from the top of the tank

Filling the Cleaner supply Tank

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 if on a wood approach. 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 NOTE

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

IKON Sequence of Events- “How it Works”

The following steps detail how the IKON operates. The IKON should be on the approach laying down in the operating position, and the HOME SCREEN displayed on the touchscreen. The IKON 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 IKON, how the errors work, and what happens as the IKON travels down your lanes.

1. Press the **START MACHINE** button to advance to the RUN screen. The display will change to the RUN screen and will be ready to operate.
2. Press the **START** button on the handle once and the machine will lower the duster cloth which is monitored by the duster switch. If the switch's 'normally open' contacts do not open, there will be a **DUSTER EMPTY** error displayed. The squeegee will move down and stop when the down switch's normally open contacts close. If the switch contacts do not close there will be a **SQUEEGEE DOWN** error displayed. The oil pump will turn on.
3. Push the machine onto the lane and make sure it is properly seated. If you want to add extra cleaner (pre-soak) to the front of the lane, press the **CLEANER PRESOAK** button on the bottom middle of the touchscreen. If more cleaner is needed, wait for the moving heads to stop and press the button again.
4. 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.
5. 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.
6. Additionally, the second press of the **start** button will start a clock to record the total amount of run time to be displayed on the screen, the total valve time will also be recorded and displayed.

7. 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.
8. 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.
9. 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.
10. When the oil distance is reached the buffer brush will stop and rise up, then the brush up switch's normally open contacts close. If the contacts do not close there will be a **BRUSH UP** error displayed. If the brush up switch sticks closed when it should be open it will give a **BRUSH DOWN** error.
11. When the oil distance has been reached the machine will shift into speed 6 (30ips) 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.
12. 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 and raise. 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.
13. When the machine reaches its travel distance and comes to a stop, the squeegee will proceed to lift up and stop when the squeegee up switch's normally open contacts close. If the contacts do not close, a **SQUEEGEE UP** error will be displayed.
14. 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.
15. 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.
16. 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.
17. The brush will begin buffing at the pre-determined distance as the IKON travels in reverse. The oil head will start back up again when it reaches the first reverse load distance.
18. As the machine continues to travel in reverse it will be down-shifting to lower speeds. After the machine applies the last reverse load the moving head will park. The machine will continue to the foul line then stop.
19. If the oil float contacts open, 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.

20. 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.
21. The machine cannot be resumed if the following errors occur: **OIL & CLEANER FLOAT; DUSTER UNWIND;** and **SQUEEGEE DOWN**. In the event one of these errors occurs, the machine will need to be re-started.

NOTE: If the machine stops and displays the message shown to the right it may 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**.



Basic Steps to Operate Your IKON

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 go directly to the Home Screen shown to the right.



Starting Your Machine

After you have positioned the machine in line with the lane, in the lower right corner of the screen press **START MACHINE**. The screen will change to the monitor screen as shown on the right. From this screen you can select to Clean Only, Clean and Oil or Oil Only. Whichever mode you select will be highlighted in green.



*In the event that the touchscreen should lose power, you can still operate the lane machine. Simply press and hold the start button until the squeegee and duster assemblies lower then push the machine onto the lane and run like normal. The handle button will now be enabled to condition the lanes with the program that is set in 7 day planner for that time period.

The screen will also display the pattern number that is currently set to run for that time period as well as the Oil Valve time, Run Time, Duster Count and Drive speed.

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.

Cleaner Presoak



CLEANER PRESOAK feature allows the operator to saturate the cushion roller assembly prior to running the lane machine. To use this function, press the START button and roll the machine onto the lane to where the two front 6" wheels just drop into the gutters. By pressing the CLEANER PRESOAK button, the cleaner head will move back and forth one time dispensing cleaner onto the lane. Now the machine is ready to be sent down the lane by pressing the START button a second time.

Keypad and Menus

The HOME Screen

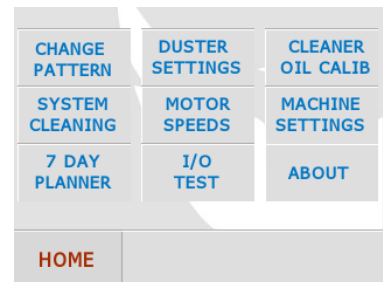
While the lane machine is in the HOME screen, there are three buttons that are active and can be pressed. By pressing MAIN MENU you will be taken to the below right screen to access various sub-menus for the machine.

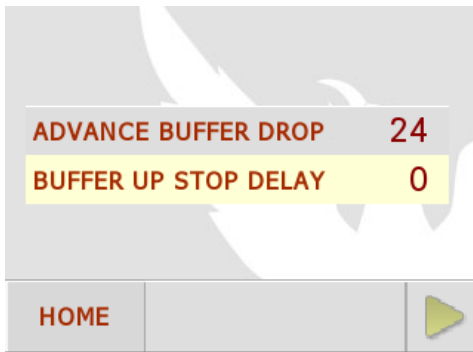
By pressing the RETURN TO FOUL LINE button, then pressing the handle button the machine will operate in reverse and stop at the foul line. Press the handle button a second time and the machine can be stopped where desired.



Machine Settings

From the Home Screen, press the MAIN MENU button as described above. A series of sub-menus appear on the screen.





By pressing MACHINE SETTINGS, you will arrive at the screen to adjust your buffer brush functions.

ADVANCE BUFFER DROP is used to fine tune where the buffer brush starts to lower in reverse on the way back to apply the reverse oil, 24 is the default setting, higher the value the sooner the brush will lower and start.

Buffer Up Stop Delay

The **BUFFER UP STOP DELAY** function is used to make a defined oil line at the end of the pattern. Value of Zero and the function is turned OFF, a value of 5 will give a ½ second pause while the brush lifts up.

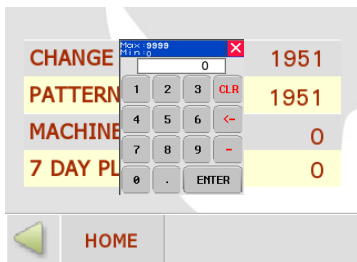
Press the Green arrow to advance to the next screen.

Language is where you change to different languages, 0 is English, 1 is Japanese, 2 is open and 3 is Korean.

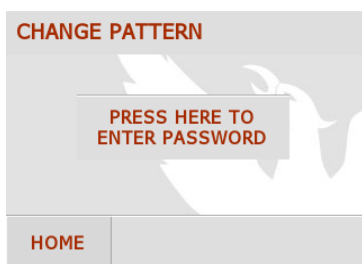
SET PASSWORDS is used to prevent unauthorized operation of the machine. The lane machine will come with the passwords all set to zero allowing you to customize a 4 digit passcode, such as the 1951 shown in the CHANGE PATTERN and PATTERN OVERRIDE lines.



Battery Meter Calibration is discussed in Chapter 4.



By pressing on the number to the right of CHANGE PATTERN a keypad will pop up allowing you to chose a 4 digit customized passcode.



In this example pressing CHANGE PATTERN in the main menu takes you to this password screen. By pressing on PRESS HERE TO ENTER PASSWORD a keypad will pop up that will allow you to enter the correct password to access the CHANGE PATTERN MENU.

7 Day Planner

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

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

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

To change the clock press SET CLOCK, then press on the number value you choose to change for a keypad to pop up, make your change then press ENTER. Entering in a value that is not correct will be rejected and the screen will display Data Input Failed.



Program Override

To override the preset pattern showing in the START screen, press the button that displays the pattern number and a keypad will pop up allowing you to change to any of the 15 preset programs. Once the current program is changed to a different one, it will remain there until the HOME key is pressed or there is a loss of power.



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. Errors are discussed in detail in the appropriate sections.

Whenever an error is present when machine is powered up, such as an Oil Float Error, the main screen will display ERROR DETECTED. Press on the message and it will take you to an error screen and the function which is in error will light up as shown below.



OIL FLOAT	DUST UNWIND
CLN FLOAT	DUST WINDUP
FWD DRIVE	OIL HEAD
REV DRIVE	SQU UP
BRUSH DOWN	SQU DOWN
BRUSH UP	
HOME	

LIST OF MACHINE ERRORS

FORWARD TRAVEL
 REVERSE TRAVEL
 DUSTER UNWIND
 DUSTER WINDUP
 BRUSH DOWN
 BRUSH UP

CLEANER EMPTY
 OIL EMPTY
 SQUEEGEE UP
 SQUEEGEE DOWN
 OIL HEAD TRAVEL ERROR

To the right is an 'example' of how an error messages will appear. Troubleshooting methods for this error along with all of the above errors, will be explained in the appropriate section of this manual.



Operator Menu Selections

CHANGE PATTERN	DUSTER SETTINGS	CLEANER OIL CALIB
SYSTEM CLEANING	MOTOR SPEEDS	MACHINE SETTINGS
7 DAY PLANNER	I/O TEST	ABOUT
HOME		

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 that displays the PLC PROGRAM VERSION, the machine SERIAL NUMBER, the INSTALL DATE, and the QC DATE.

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

PROGRAM VERSION	K3.2
SERIAL #	IK
INSTALL DATE	9 /15/18
QC DATE	8 /15/18
HOME	IKON 32

Maintenance, Recharging & Storage

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 battery. **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. In addition, loosen the duster cloth away from the cushion roller assembly.

Recharging

For proper charging: It is necessary to plug the charger into the machine first 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, fully charged the amp's 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 4 for more detailed information on charging.

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.

Daily, Monthly and Annual Cleaning

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.

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 build up is occurring on the ends of the buffer. Build up could be the result of dirty gutters.

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

Monthly Maintenance

1. Remove guards from both sides of machine to clean and inspect motor and sensor shaft.
2. Lightly oil sensor extension shaft and bushings in the cleaning compartment.
3. Inspect buffer belt and its tension.
4. Oil buffer belt idler.
5. Check and inspect sliding head belts.

6. Clean and inspect the compartment that contains the conditioner (oil) tank and pump.
7. Clean the transfer brush with buffer running, take an air compressor and blow out the transfer brush while brush runs, caution dirt will fly. This can be done weekly!

Annual 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.

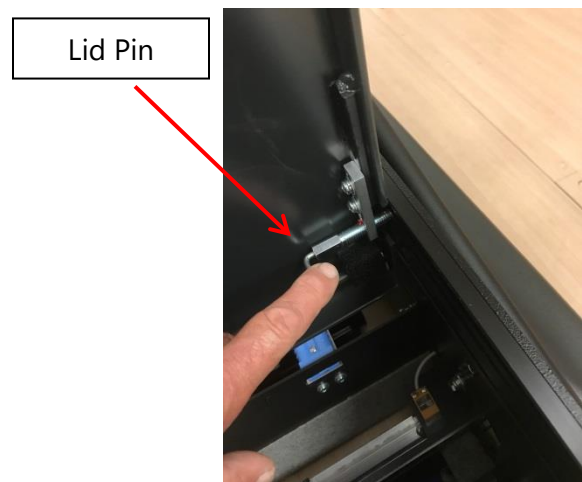
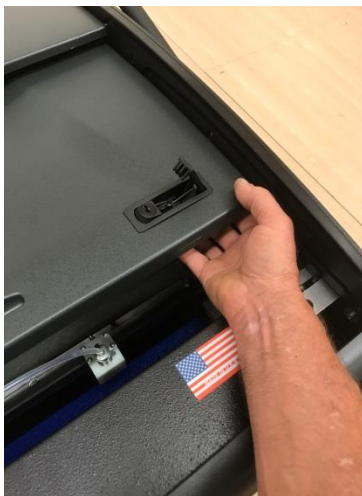
Lid and Guard Removal

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. 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.



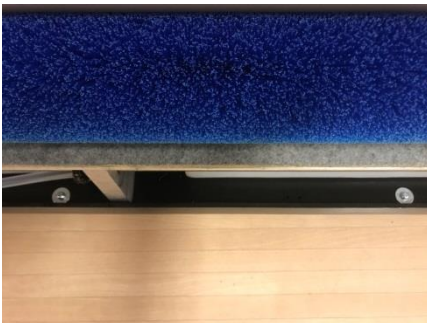
Front Cover removal

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 left. After removing these, set the machine down into the operating position.



Locate the single mounting screw that is under the cleaner splash guard and above the cleaner supply tank, as shown in the image to the right. Remove this screw along with the hardware and set aside.

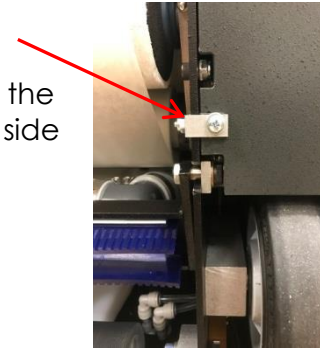


Next, remove all four of the transport casters including the attaching hardware and unplug the wiring for the tank lights then set aside for reassembly.

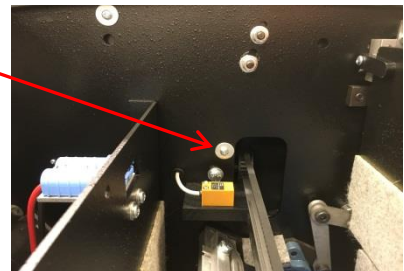


Side Cover Removal

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



Next, set the machine down in the operating position and slide back the cleaning compartment lid and remove the two (2) screws that fasten the side covers to the side plate of the machine, then do the same for the two in oil compartment.



Lane Maintenance 101

Overview

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

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



"The Oily Grail"

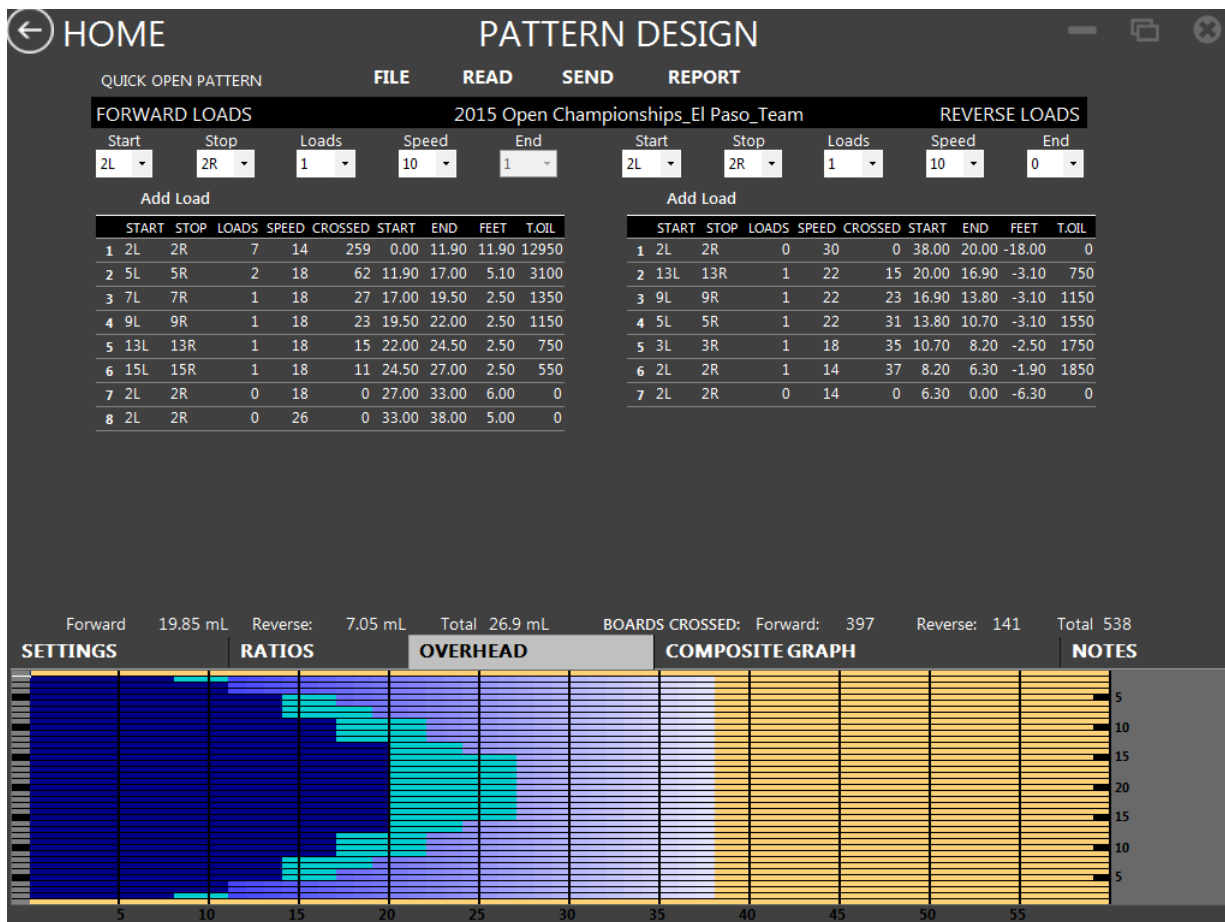
CHAPTER 2

Conditioning Overview

How Conditioner is Metered and Controlled

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

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



The size of the stream can be set to an exact amount, or volume. We achieve this exact stream and volume by using a 'highly' accurate fluid metering pump. This pump, running at a constant speed, gives absolute positive displacement of the conditioner. The accuracy of the pump is $\pm 1\%$ with a continued precision of $\pm 0.5\%$ after millions of cycles. To further express how accurate the pump is, these are the same pumps 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 and refer to it 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.

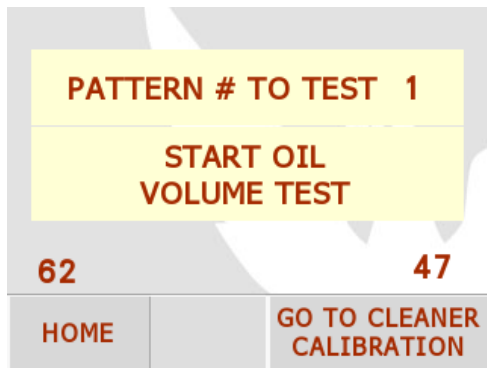
To give you a visual perspective of how much conditioner is being applied in 50 microliters, consider that about 20 microliters make up one drop of oil. So each time a stream of oil crosses one board it applies almost 2-1/2 drops of conditioner.

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 #16** 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.

Program Volume Test

Turn the machine ON and from the HOME screen press MAIN MENU and the screen will change to the one shown on the right allowing the operator to choose a function . By pressing the CLEANER OIL CALIB the screen will change to the screen on the following page.

CHANGE PATTERN	DUSTER SETTINGS	CLEANER OIL CALIB
SYSTEM CLEANING	MOTOR SPEEDS	MACHINE SETTINGS
7 DAY PLANNER	I/O TEST	ABOUT
HOME		



To change the program # to test, press the program # and a Keypad will pop up. Simply change the number in the keypad and press ENTER.

After the correct program has been selected, press on the line directly below that says 'Start Oil Volume Test'.

By pressing the START OIL VOLUME TEST button, the oil head will then begin to move back and forth, dispensing conditioner, until all of the boards for that particular program have been reached.

Once complete, remove the tip from the oil tank and place inside a clean graduated cylinder and perform the test a second time. The correct amount of conditioner in the cylinder should match what the program worksheet has for total volume. If an oil pump adjustment must be made, open the splash guard to access the oil pump assembly.

Conditioner pump adjustments are done by manually turning the Oil Pump assembly.

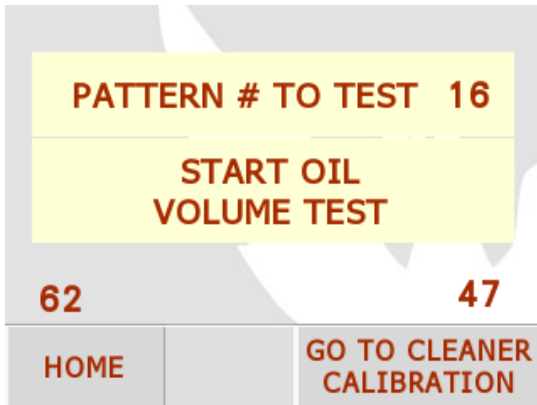
- If an **increase** to the amount of conditioner is needed, turn the oil pump **towards** you.
- If a **decrease** to the amount of conditioner is needed, turn the oil pump **away** from you.



TECHNICAL NOTE

To achieve full control of your lane maintenance program, as well as peace of mind, this process should be done daily! It's much easier to catch a mistake during this process than having a 100 angry bowlers yelling at the poor person working the front desk that night!

Oil Calibration Test

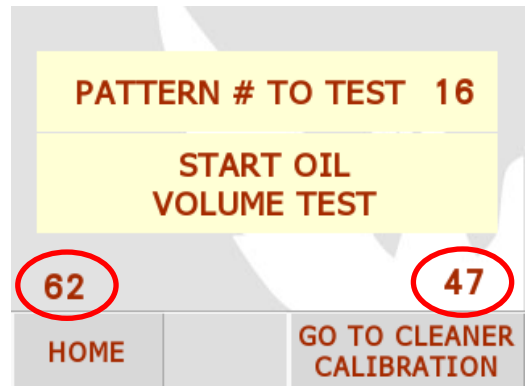


Program number 16 is a hidden program that is intentionally set for 400 boards, to be used to calibrate the oil pump.

To perform an Oil Calibration test, you must first 'Purge' the line by removing the oil tip assembly from the oil head and place inside a disposable cup, such a Styrofoam coffee cup. By pressing the START OIL VOLUME TEST button, the oil head will begin to move back and forth, dispensing conditioner, until the 400 boards have been reached.

Each time that an Oil Program test, or calibration have been performed, the numbers in the red circles (shown to the right) will increase.

The number in the lower left represents the calibration tests, while the number in the lower right shows the number of times the Oil Program has been performed.



Proving the Oil Pattern

We will use generic pattern settings as an example to explain how the math adds up. The numbers on the next page show the 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

$$37 \times 1 = 37$$

$$21 \times 3 = 63$$

$$15 \times 3 = 45$$

$$13 \times 2 = 26$$

$$15 \times 4 = 60$$

$$17 \times 4 = 68$$

$$19 \times 2 = 38$$

$$\underline{37 \times 1 = 37}$$

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 µl**) to determine the exact amount of oil used when conditioning with this pattern.

$$\begin{array}{r} 374 \text{ Boards} \\ \times \quad 50 \text{ microliters} \\ \hline \mathbf{18,700 \text{ microliters}} \end{array}$$

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

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

The special thing about Sanction Technology is that the patterns total volume 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 should be performed 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** volume tab in the Advanced Designer screen that allow you to see the forward, reverse, total oil volume and boards crossed, so you do not have to do the math.

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

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

Board Chart for Calibrating Oil Pattern (Program) Loads

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

		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® 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, a ceramic piston and cylinder are precisely milled to perfect clearances. This pump has no valves to impair its operation. The piston revolves and reciprocates during operation for flawless performance.

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

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

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

Change Pattern

CHANGE PATTERN	DUSTER SETTINGS	CLEANER OIL CALIB
SYSTEM CLEANING	MOTOR SPEEDS	MACHINE SETTINGS
7 DAY PLANNER	I/O TEST	ABOUT
HOME		

Press CHANGE PATTERN in the main menu screen to advance the CHANGE PATTERN menu.

VIEW PATTERNS IN STORAGE	1
HOUSE # 1	
START BRUSH	9
OIL DISTANCE	40
DROP BRUSH IN REV	40
HOME	▶

To the left is the main CHANGE PATTERN screen. From this screen you can choose the pattern to view and make edits.

By pressing on VIEW PATTERN IN STORAGE, you can view what patterns are stored in the machine. Press on pattern name for a keypad to pop up to change the pattern name.

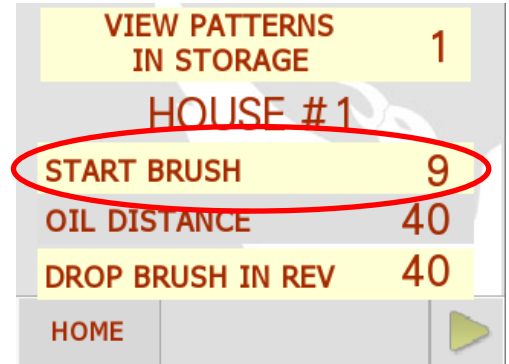
By pressing the right arrow located in the bottom right corner, you will be able to view all 15 stored programs.

1	WALL STREET
2	MAIN STREET
3	HIGH STREET
4	STONEHENGE
5	MIDDLE ROAD
HOME	CHANGE PATTERN ▶

Start Brush Distance

The default settings do not allow the machine to oil the first 24 inches of the lane. If the factory setting is increased, the area with no conditioner will need to be maintained by hand to keep 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.

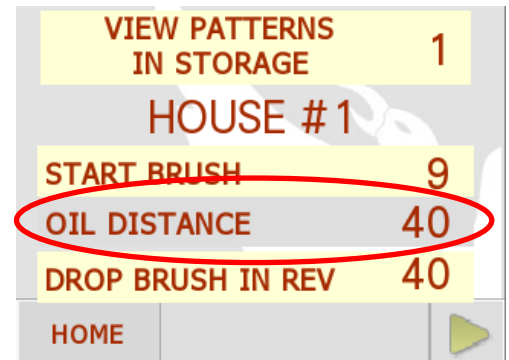


It is very important to not have the buffer brush and the vacuum motor to come on at the same time on the lane going forward. Monitor the on times, and adjust the Buffer Brush Start Distance to come on sooner or later to avoid potential lane machine shut down.

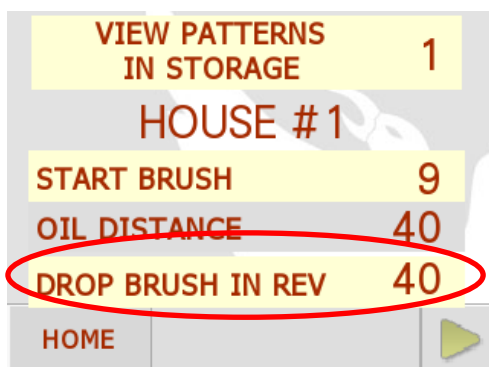
This feature is great for open play bowling when it is near impossible to keep customers behind the foul line. Another tip that does help is to never turn off foul lights during open play. This will make them think twice from going past the line and tripping the buzzer.

Oil Pattern Distance

To change the over all Oil Distance of the program, press on the value and a keypad will pop up allowing you to enter the desired distance.



Drop Brush in Reverse Location



To change the location in which the buffer lowers and turns on in reverse, press on the value and a keypad will pop up allowing you to enter the desired distance.

Designing the Oil Pattern

To Design an Oil Pattern, start with the first load screen, which is indicated by the number located in the upper left corner of the screen. 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).

1 FORWARD OIL			
LEFT BOARD	RIGHT BOARD	# OF LOADS	
2	2	×	5
START DIST	END DIST	SPEED IPS	
0 ->	10	14	
NEXT	-	+	ENTER

Press the ENTER button till the value you wish to change has the Green cursor borders around it, then press + or - buttons to adjust value. Upon making a change to LOADS or SPEED the NEXT button will disappear and you must press the ENTER button till the Green cursor has indexed to each variable once for it to reappear and it must be done on each screen forward or reverse depending on where change was made.

1 FORWARD OIL			
LEFT BOARD	RIGHT BOARD	# OF LOADS	
2	2	×	2
START DIST	END DIST	SPEED IPS	
0 ->	2	14	
NEXT	-	+	ENTER

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 when loads are present. These distances are automatically calculated based on # of loads and Speed.

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.

7 FORWARD OIL			
LEFT BOARD	RIGHT BOARD	# OF LOADS	
2	2	×	0
START DIST	END DIST	SPEED IPS	
35 ->	40	30	
NEXT	-	+	ENTER

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 allow you to skip between buff out and oil loads but it will not work!

1 REVERSE OIL			
LEFT BOARD	RIGHT BOARD	# OF LOADS	
2	2	×	0
START DIST	END DIST	SPEED IPS	
40	30	30	
NEXT	-	+	ENTER

After the forward screens are complete, the screen will advance to REVERSE OIL screen. 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 the beginning of where the Reverse oil will start to be applied.

The rest of the LINES work just like the Forward Screens. Row 2 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.

It's a good rule of thumb to have at least 7 feet of buff on the last reverse oil line.

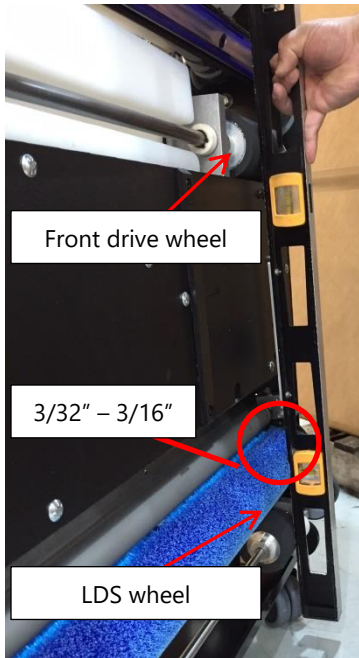


KEGEL's Original Mission
By: John Davis

Adjustments

Conditioning System

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. Press **I/O TEST** in main menu then press **OUTPUT TEST**. If the brush is not already down in the "zero" position, press **BRUSH LIFT**. This will lower the buffer brush into the operating position.

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).



Adjusting Bolts

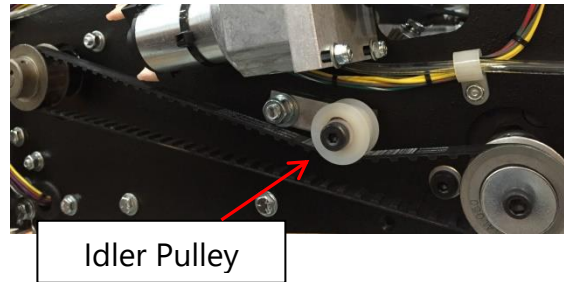
If an adjustment is needed, loosen the bolts located on the rear panel as shown in the pic. This will loosen the LDS shaft/wheels so that you can raise the shaft for **MORE** crush, or lower the LDS shaft for **LESS** crush. This is done easiest with the machine in the transport position.

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 down and fasten tight. **Do not over tighten belt!!**



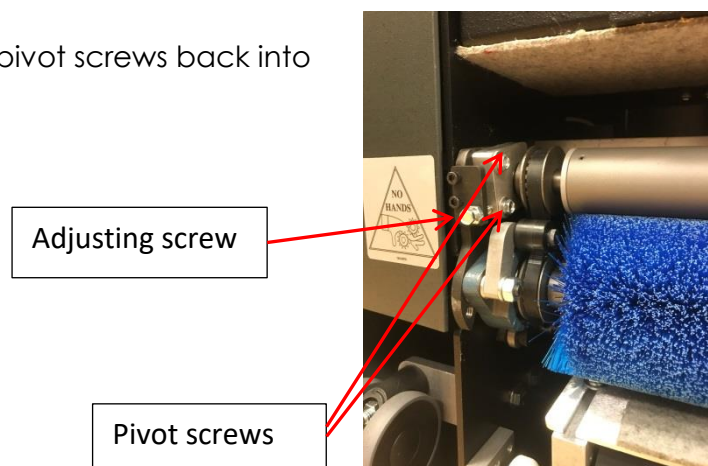
Transfer Brush

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

1. Loosen the four 1/4" 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 1/4-20 bolts on the front side that secure the adjustment bar, but keep them snug.
3. Using a 1/4" 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

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.



Oil Tip

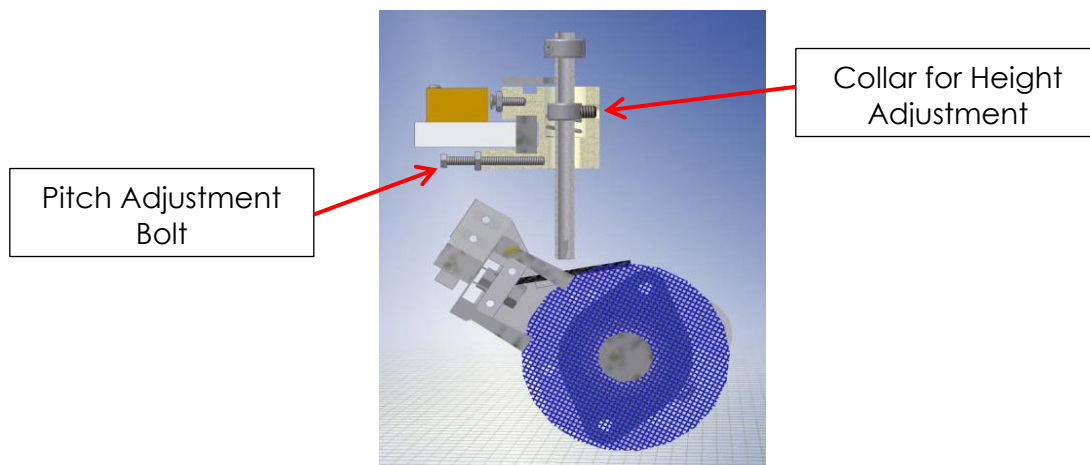
Correct adjustment of the Oil Tip is very important and is a determining factor in applying a consistent pattern.

This adjustment should be checked with the buffer brush running. To operate the brush, go to your **I/O TEST** then press **OUTPUT TEST** then press **BUFFER** 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 is done with the buffer brush in the up position and against the 10 pin wall above the drip pad assembly. Adjust the tip by loosening the screw in the tip holder collar and sliding the tip holder up or down. Re-tighten the set screw when 1/8" height between the tip and the drip pad is achieved.

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



TECHNICAL NOTE

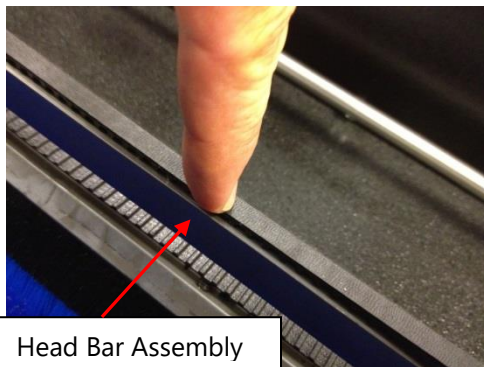
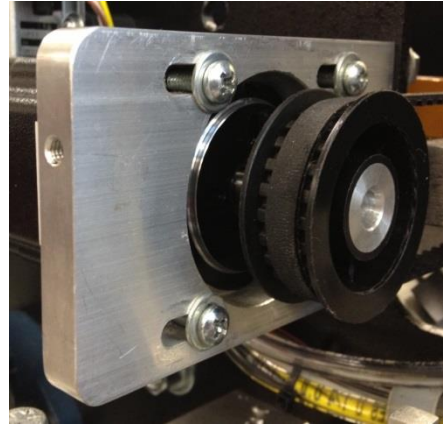
If you notice a zigzag pattern in the oil on the lane, you will need to adjust the Oil Tip position. Adjust the oil tip further up the transfer brush to eliminate this problem (make adjustments in small increments until zigzags disappear).

Timing Belt

There are various 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.

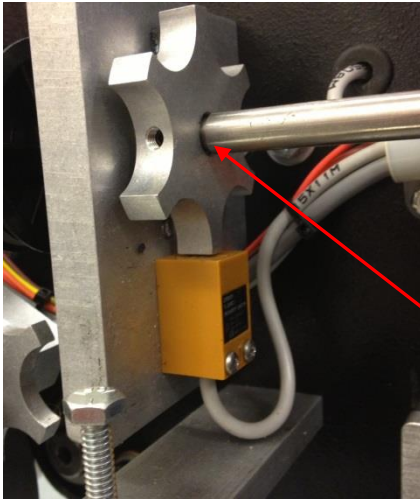
1. **Oil Head Timing Belt:** This belt should not run loose but do not over tighten.

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 there should be pressure as shown in the below figure.



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.

Board Counting Target and Proximity Switch



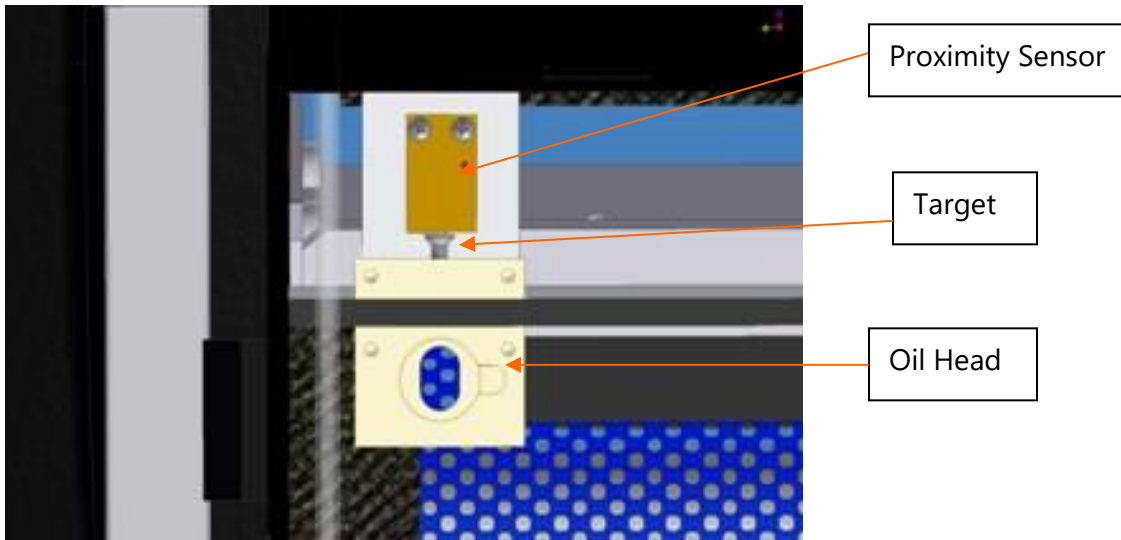
The timing for the oil head is a precise adjustment.

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 to the center of the Head Bar assembly.
2. The tooth of the board counting target should be straight in line with the proximity sensor as shown above. If not, loosen the set screw in the target and turn until its lined up and tighten.
3. Now it is time to make sure that the board counting target is secured and the head assembly is tight. Place the side cover back over the right side of the lane machine.

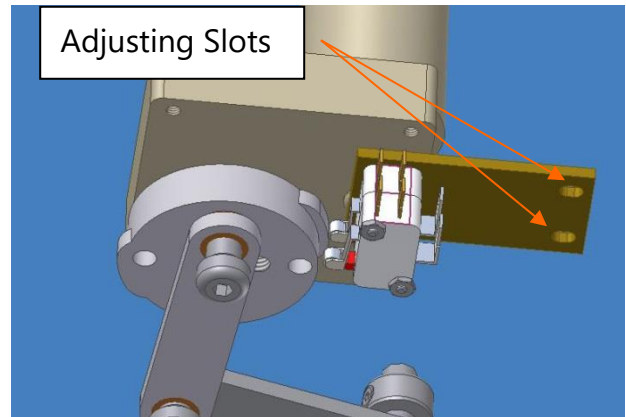
Oil Head Target



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).



Oil Pressure 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. An ideal oil pressure is between 15-20 PSI.



Pressure Regulator Tubing

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)

Increase the length to increase pressure. The return line back to the tank may also need adjusted to keep a balance of pressure for both flow directions.

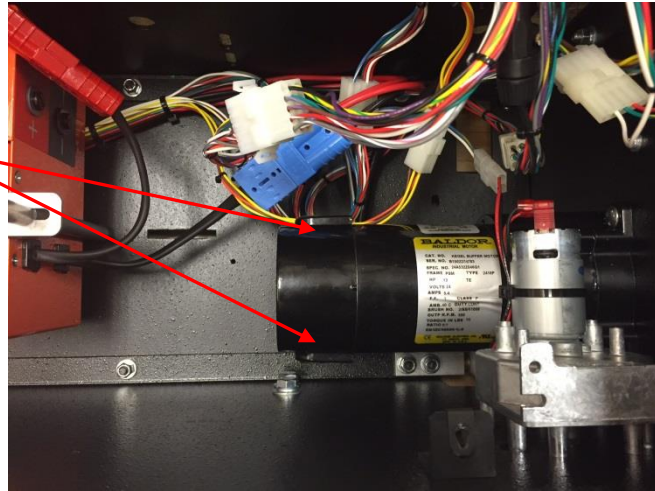
Buffer Motor Brush Removal

The Buffer brush motor is located in the center compartment under the electrical panel. To get to the buffer motor 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.

Take a right angle flathead screwdriver and remove the buffer motor brush caps. For some it maybe easier to remove motor for this maintenance.

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

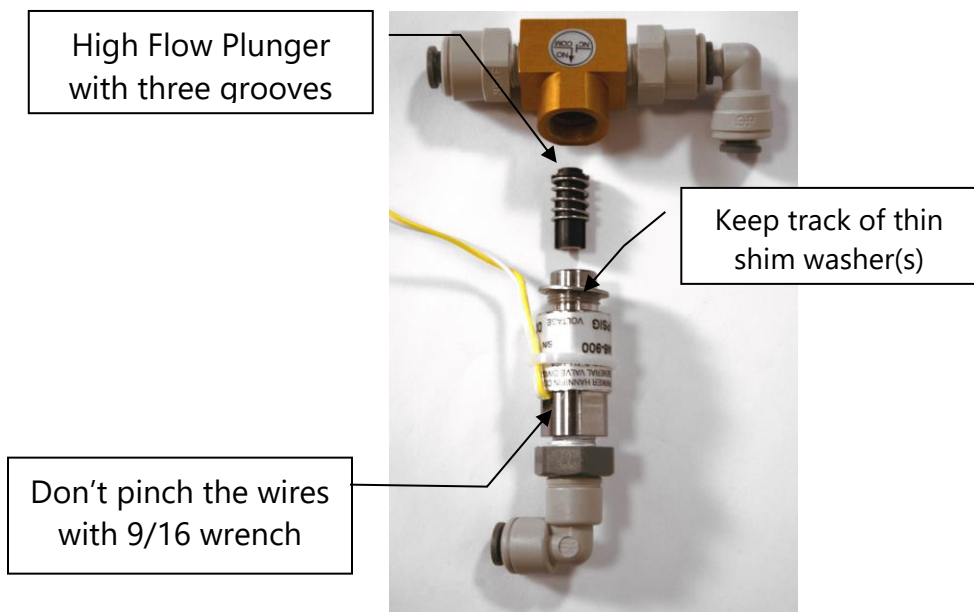
The following steps outline the procedure for disassembling the conditioner metering valve. Be careful when removing the oil lines from the fittings since they will leak.

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 valve 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 air lines 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 call KEGEL for an immediate replacement. All machines should have the "high flow" valves which are machined with three grooves. Please call **(863) 734-0200** if a replacement is needed.
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

Conditioning System

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

Conditioning Problems Indicated by Error Messages

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

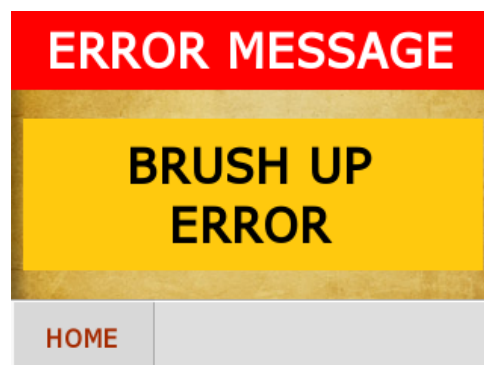
If an input fails to go off completely and still displays a dim light, the PLC will still consider that as a good input, so look very closely.

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 **I/O TEST** then **OUTPUT TEST** and press **BRUSH LIFT** to check the relay operation and voltages.



1. The brush lift motor runs but the down switch failed to operate and send a signal to PLC Input 005.
 - a. Check and inspect the microswitch, manually operate switch to see if Input 005 will illuminate.
 - b. Possible broken wire or loose connection in either the yellow 24 VDC wire or the Violet/Yellow Wire that connects to Input 005.
 - c. This error can also happen if the Brush Up Input 004 is stuck on.
2. Brush Lift motor does not run when tested in the Output Test. You will need to determine if power is getting to the motor.
 - a. Fuse is blown or fuse holder is bad.
 - b. Brush bearings are causing a bind not allowing free movement up and down.
 - c. Relay came loose in socket or has failed.
 - d. Motor has failed.
 - e. Bad connection to motor, check all power wiring to motor.
 - f. PLC output 101CH 02 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.

1. The Brush Lift motor runs but the up switch failed to operate and send the signal to PLC Input 004.
 - a. Check and inspect microswitch, manually operate switch to see if Input 004 will illuminate.
 - b. Possible broken wire or loose connection at either the yellow 24VDC, or the Green/White Wire that connects to Input 004.
 - c. This error can also happen if the brush down Input 005 is stuck on.

2. Brush Lift motor does not run when tested in the Output Test. You will need to determine if power is getting to the motor.
 - a. Fuse is blown or fuse holder is bad.
 - b. Brush bearings are causing a bind not allowing free movement up and down.
 - c. Relay came loose in socket or has failed.
 - d. Motor has failed.
 - e. Bad connection to motor, check all power wiring to motor.
 - f. PLC output 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. 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 **OIL HEAD ERROR**. If the Motor does not run, menu to the **I/O TEST** then **OUTPUT TEST** and press **OIL HEAD** to check for motor operation and voltages.



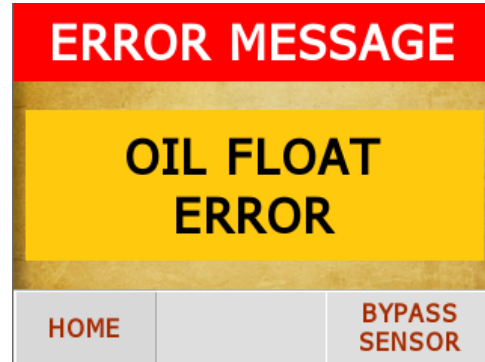
1. Oil Head Motor runs, but Input 001 does not operate when oil head is moving or it was interrupted.
 - a. Board counting sensor has failed.
 - b. Wire between sensor and PLC is damaged or loose causing an open connection.
 - c. Motor is starting too slow due to lack of lubrication on the oil and cleaner sliding head bars.
 - d. Cleaner belt jumped timing causing the cleaner head to jam against the wall of the machine. A set screw can come loose resulting in this problem.

2. Oil Head Motor does not run in one or both directions.
 - a. Motor has failed.
 - b. Motor brushes worn. Remove/inspect and blow out motor.
 - c. Motor unplugged or has a damaged wire.
 - d. PLC output 101CH 00 has failed causing no operation.
 - e. PLC output 101CH 01 has failed causing no operation right to left.

This error lets you know that the machine is low on conditioner (oil). Simply inspect the conditioner level in the tank and add if necessary.

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 **BYPASS SENSOR** button, it will override the **OIL FLOAT 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 06 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 00 failed.
 - f. Filter is clogged.
 - g. No oil in tank and the float failed to error machine.
5. Conditioner (oil) loads not ending at correct footage.
 - a. Oil Head not running at correct speed; Check Oil and Cleaner Heads for lubrication.
 - b. Machine speeds are not set correctly.
6. Oil Valve time has increased.
 - a. Oil Head is not running at correct speed, check oil and cleaner heads for lubrication.
 - b. Board counting target loose.
 - c. Wrong program was run or someone has changed the program (#1 culprit ☺).
 - d. Belts are too tight on one or both of the moving heads.
 - e. Shaft bushings need lubricated.

Oil Patterns

Why do we Apply Oil to Bowling Lanes?

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

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

The Landmark and Navigation Pattern series are available in Kegel's Pattern Library on 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 AND NAVIGATION PATTERN WORKSHEETS AND DESCRIPTIONS CAN BE FOUND IN THE APPENDIX OF THE MANUAL

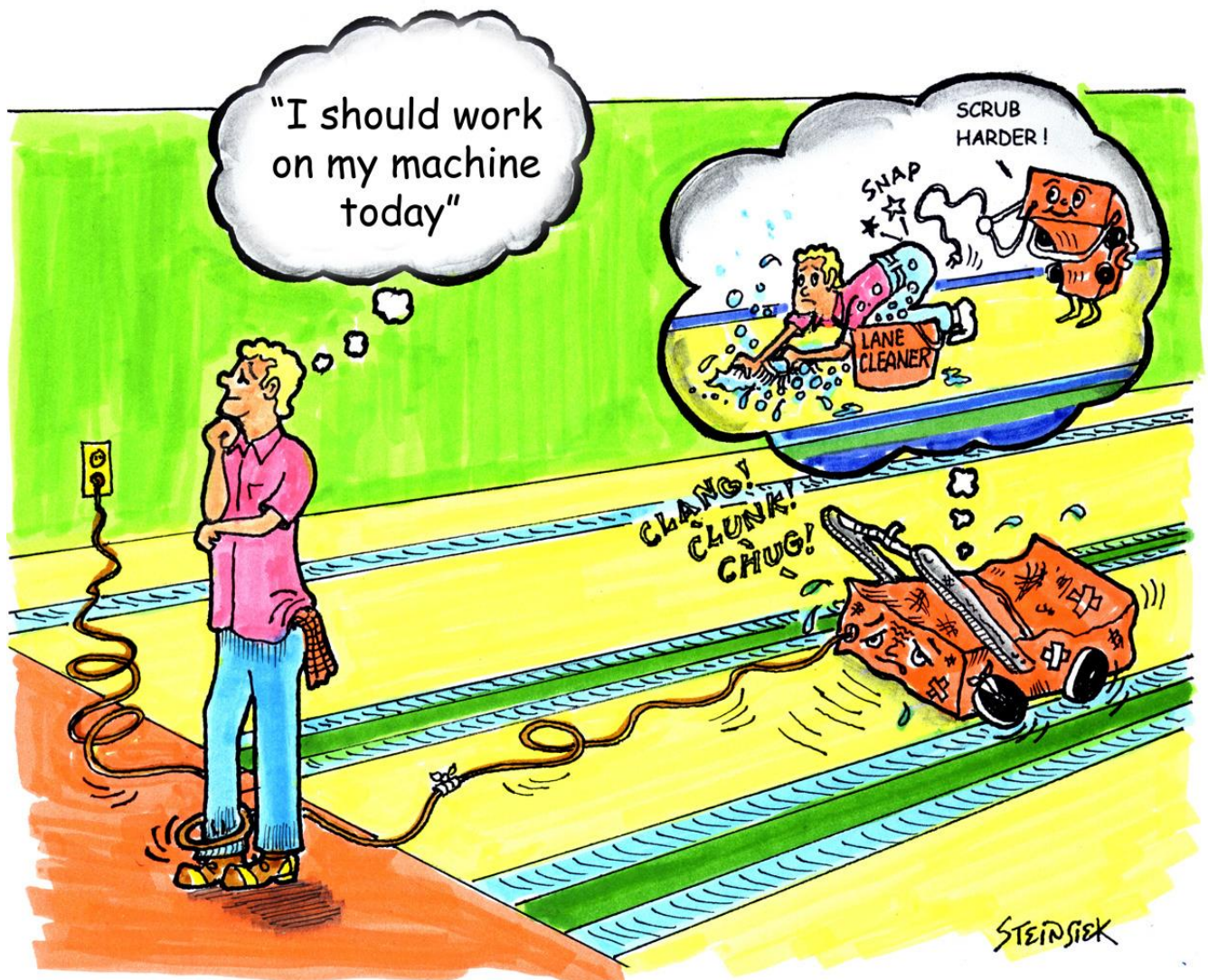
Go to <http://www.kegel.net/patternlibrary/default.asp> for additional patterns.

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 along side the machine while it runs, look at the display for speeds and on the way back check the back end for cleanliness. Check to see if the pattern looks uniform across the house. Do this each day and you may be able to stop and correct problems before they happen.
7. A general inspection of the machine should be done whenever there is a concern that something may be wrong. **Just because there were no 300's and 800's shot last night does not mean you should make a change. Bowlers don't always bowl great.**

8. There is always the chance for operator error when it comes to conditioning machines. Always do spot checks on employees that operate the machine to make sure they do the job properly.
9. We hope this does not happen to you...but make sure that 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 **carrydown**?

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAPTER 3

Cleaning System

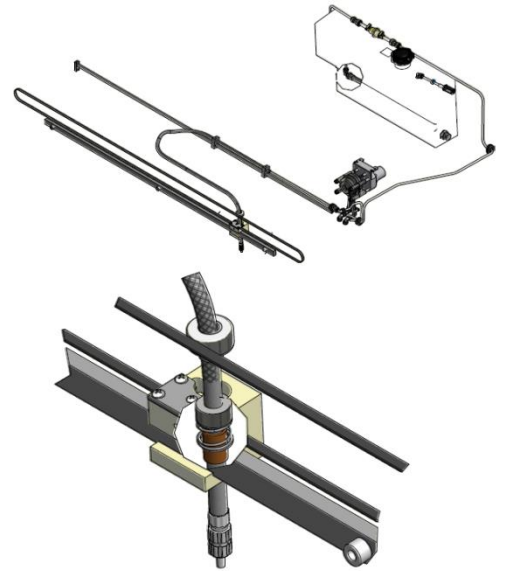
Theory of Operation

The cleaning system is the result of years of experience with automated lane care. The evolution 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 channeling the cleaner and the rear sharp blade cuts 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?



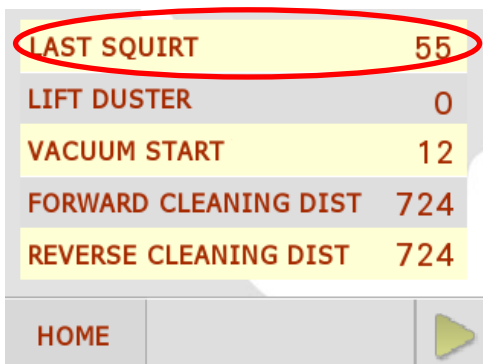
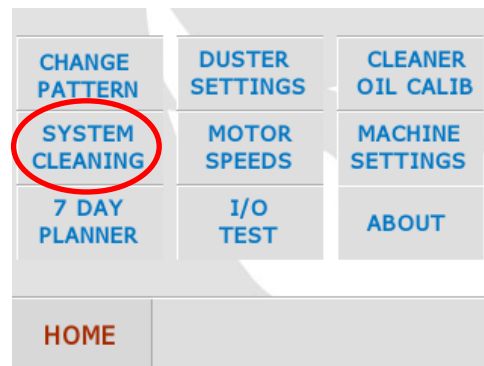
There are many reasons for cleaning lanes. One is to protect your investment. Not having a good lane maintenance program will not allow you to achieve the best results. It's also just good customer service. Another good reason would be to have your center create high scoring conditions (but that can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

From the Home screen, press Main Menu and you will be able to access the System Cleaning menu. Within this menu, you will be able to control various cleaning features that will help you in gaining optimum cleaning performance from your lane machine.





The Last Squirt distance setting is in feet from the foul line at which the cleaner pump will stop dispensing cleaner on the lane. The default number for this is 55 press on the value and a keypad will pop.

If you are getting a more than usual amount of Out of Range pins, then increasing this number may help in getting the pindecks a little more clean.

The Lift Duster feature is used to lift the duster off the lane prior to reaching the end of the lane, or what is called the tailplank. The default number is set to 20 and is in inches from the end of the lane.

If you are using a lot of cleaner, or your last squirt distance is set high, you may want to set this number to 20. This will allow the excess cleaner to be sucked up by the squeegee blades rather than be pushed off into the pit by the cushion roller.


LAST SQUIRT	55
LIFT DUSTER	0
VACUUM START	12
FORWARD CLEANING DIST	724
REVERSE CLEANING DIST	724
HOME	

LAST SQUIRT	55
LIFT DUSTER	0
VACUUM START	12
FORWARD CLEANING DIST	724
REVERSE CLEANING DIST	724
HOME	


The Vacuum Start is where the vacuum motor will turn on as the machine moves down the lane. The default number is 12 which represents the number of inches from the foul line when the vacuum turns on.

The Forward Cleaning Dist is where the lane machine will stop traveling forward. This is very important to dial in and can cause unnecessary problems when not adjusted properly. The default number is 716 and is in 'inches'.

If this number is set too low, the machine will stop short of the tailplank and will leave a line of cleaner mixed with the dirty conditioner. This will cause an increase in Out of Ranges as it will smear all over the pindeck.

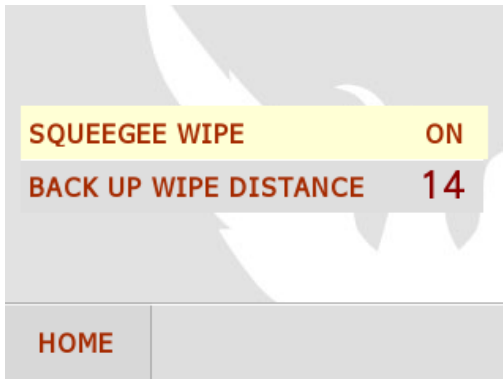
LAST SQUIRT	55
LIFT DUSTER	0
VACUUM START	12
FORWARD CLEANING DIST	724
REVERSE CLEANING DIST	724
HOME	

Another indication of the machine stopping short is that you will see drops of cleaner in the oil pattern that drip from the squeegee blades while in reverse.

LAST SQUIRT	55
LIFT DUSTER	0
VACUUM START	12
FORWARD CLEANING DIST	724
REVERSE CLEANING DIST	724
HOME	

After setting the Forward Cleaning Distance, you will need to adjust the Return travel distance. This number should be the same as the forward or maybe one or two counts less so that it does not ride up onto the approach.

By pressing the right arrow at the bottom of the screen, you will arrive at the last sub menu within the Cleaning System menus shown on the following page.



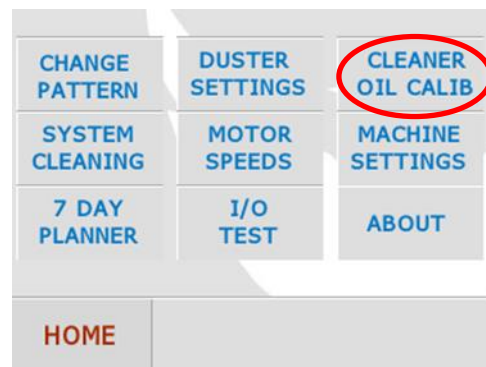
Squeegee Wipe, this function is used to prevent drips from falling off the squeegee. The machine stops in the pit area and then moves 14 inches in reverse and then stops again. It lowers the squeegee, travels forward 14 inches, and then raises the squeegee and returns to the foul line. It is very important that the rear squeegee blade clears the tail plank.

The Back up Wipe Distance is the number of inches that the machine will backup prior to lowering back down on the lane.

Turning the Squeegee Wipe to 'off' will disable this feature and will return to the foul line immediately after reaching the cleaning distance at the end of the lane.

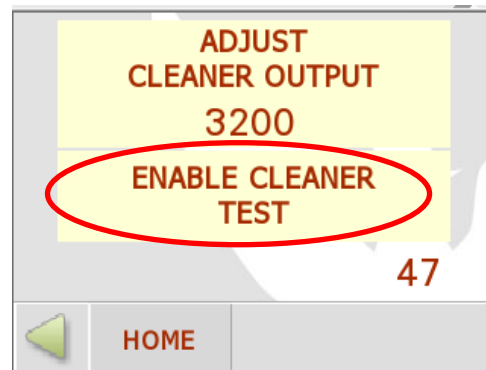
Cleaner Pump Volume Adjustment

The cleaner pump volume can also be checked in the same menu as the oil. Go to the main menu and press Cleaner oil calib, then press: go to cleaner calibration



In this screen follow these steps:

- 1) Press ENABLE CLEANER TEST.
- 2) Open up the cleaner compartment.
- 3) Remove the cleaner tip.
- 4) locate the button on the 10-pin side.
- 5) Hold cleaner tip over cloth then press button for one cycle to clear out air bubbles.
- 6) After clearing bubbles press button again and dispense cleaner into a graduated cylinder.



Factory setting is 30ml. Anywhere from 25 to 30ml, 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 speed press on ADJUST CLEANER OUTPUT and a keypad will pop up, enter in a new value then press ENTER, Min Max values are displayed on the keypad pop up.

The Max Speed trimpot is set at the factory and there should be no reason to adjust the control board to increase cleaner output. If your cleaner pump tubing is at least a year old, then the tubing should be replaced before making any adjustments. Typically, new tubing in the pump will fix a low output problem.



TECHNICAL NOTE

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

Duster Settings

CHANGE PATTERN	DUSTER SETTINGS	CLEANER OIL CALIB
SYSTEM CLEANING	MOTOR SPEEDS	MACHINE SETTINGS
7 DAY PLANNER	I/O TEST	ABOUT
HOME		

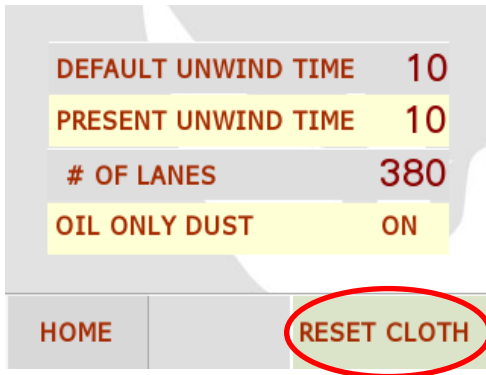
From the Home screen, press Main Menu and you will be able to access the Duster Settings menu. Within this menu, you will be able to reset the number of lanes left in a roll of cloth as well as fine tune the amount of cloth usage.

The DEFAULT 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. To change the number, tap on the number and a keypad will pop up allowing you to edit.

DEFAULT UNWIND TIME	10
PRESENT UNWIND TIME	10
# OF LANES	380
OIL ONLY DUST	ON
HOME	RESET CLOTH

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.



After the Duster Cloth is installed, press the RESET CLOTH button in the lower right corner and the '# OF LANES' left in the cloth will change back to the default number of 380.

When turning the OIL ONLY DUST OFF the machine will not utilize the duster during an OIL ONLY program.

'How to change the cloth' is explained later in this chapter.

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.

Cleaning System

Changing Duster Cloth

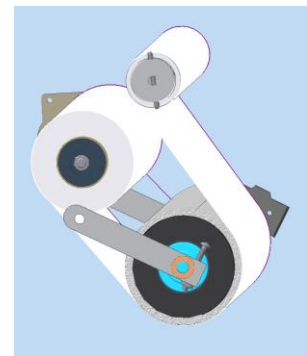
The machine uses a patented Dual Motor Ratcheting (DMR) Cloth system. The duster assembly operates by means of two brake motors. The first unwinds cloth and sets the cushion roller down on the lane surface. The second winds up used cloth onto the used core.

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.

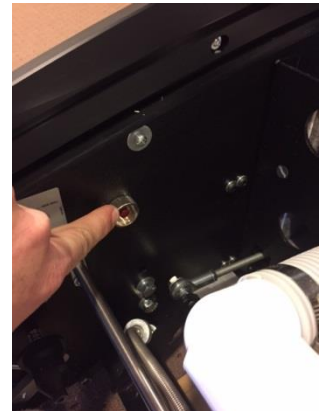
IMPORTANT! The machine can NOT be operated without Cleaning Cloth installed.

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

1. Remove the cleaner dispensing tip from the holder and then remove the old cloth (**make compartment**. The cleaner belt should be inspected and the sliding head bar lubricated **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** at this time.



3. Remove the pipe from the old duster core and insert into the new one. Unroll about 3 feet of cloth and then install the new roll into its location.
4. Route the cloth down between the squeegee and the cushion roller. Pull the cloth under the cushion roller and distribute it evenly.
5. Once the cloth is routed under the cushion, pull the excess cloth far enough through to get at least 3 or 4 wraps around the PVC take-up reel or EZ Core. Make sure the cloth is wrapped evenly from side to side around the pipe.
6. Insert the take-up reel into its location and **replace the cleaner dispensing tip.**
7. Locate the 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 it will wind-up cloth. The cloth should be rolled up tight and evenly across the assembly.
8. VERY IMPORTANT! After installing the new roll, you must reset the number of lanes in the cloth. Do this by going to your duster settings in the menus and press RESET CLOTH.



Filling the Cleaner supply Tank

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 if on a wood approach. 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. If the machine is to be transported without the tank in, use a towel to stuff into the inlet elbow to prevent any dripping that can potentially get into the electrical compartment.

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 though 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 NOTE

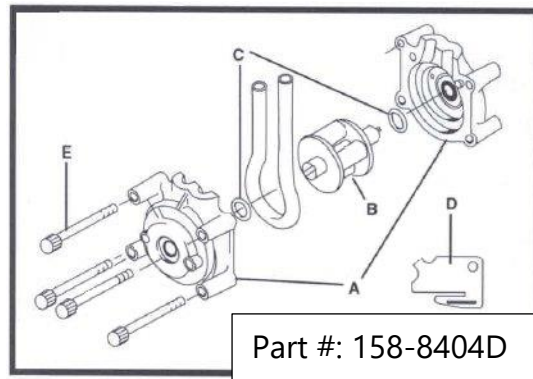
We suggest swapping recovery tank filters after each cleaning. Order a spare recovery tank filter.

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 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 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 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.



- 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.

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.

Adjustments

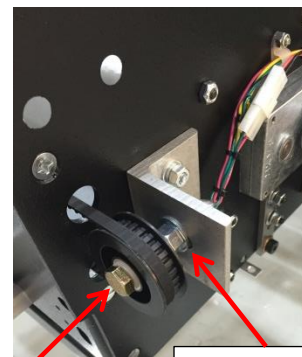
Cleaning System

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.)*



Loosen Bolt

Slotted

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

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.

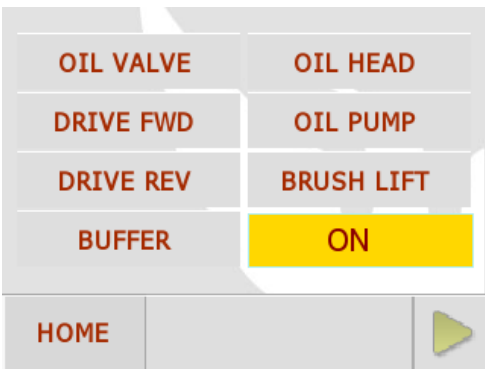
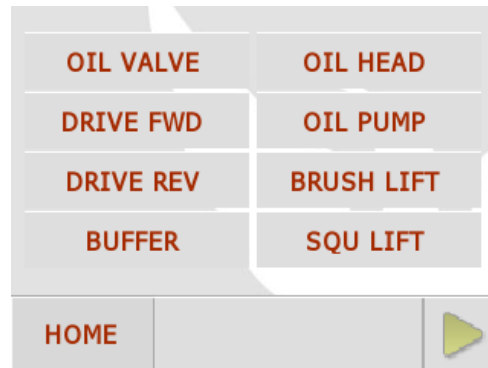
Squeegee Blades

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.*

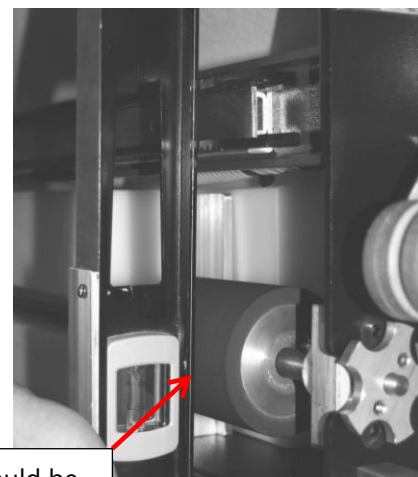
To check this **height adjustment** and make changes, the machine should be in the upright or transport position. The squeegee will need to be lowered to the down position.

To lower the squeegee, apply power to the machine and press MAIN MENU. Next, press the **I/O TEST** then **OUTPUT TEST**, and this screen will pop up.



Press the **SQU 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, either you held the button too long, or 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 **1/8" to 3/16"** (3.175 to 4.762)

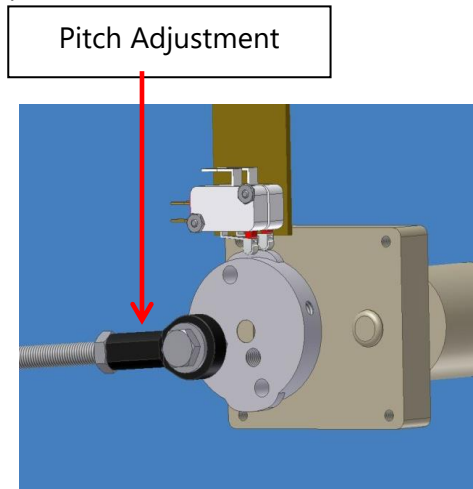


Gap should be 1/8" to 3/16"

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

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

1. Locate the squeegee motor on the right side plate of the machine. Mounted to the motor shaft (inside the machine) is a cam. Mounted to the cam is a rod end and rod. This rod lifts and lowers the squeegee (see diagram 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.



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*).

Troubleshooting

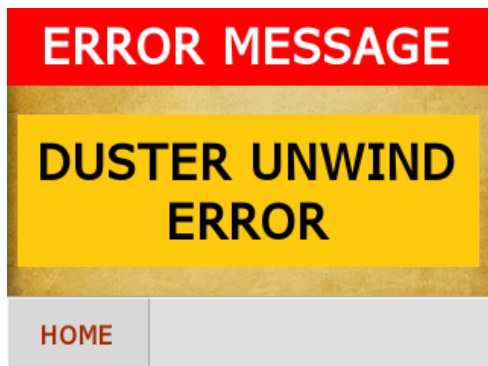
Cleaning System

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.



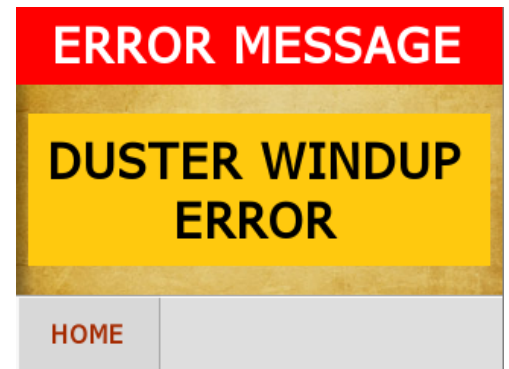
This error normally happens when Duster **Input 0CH 10** fails to open, meaning the input light does not turn off.

Below are a few things that can cause a **DUSTER UNWIND ERROR**. If the Motor does not run, menu to the **I/O TEST** then **OUTPUT TEST** and press **DUSTER DN** to check relay operation and voltages.

1. Duster cloth is empty. Replace cloth.
2. One or both of the Duster Up Switches are stuck. Check if **Input 0CH 10** has an LED light showing on the PLC with the cushion roller adjusting screws off the switches.
3. Duster Unwind Motor has failed.
4. Blown fuse.
5. Duster Unwind relay failed or is loose in socket base.
6. Duster motor wire is damaged or there is a loose wire between the motor and CR4 relay.
7. Cleaner dumped onto switch causing it to short, but only a dim light is showing on **Input 0CH 10**.

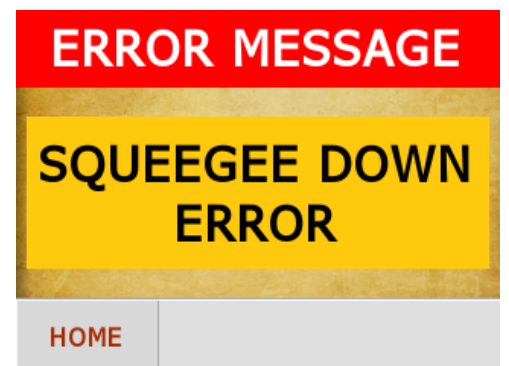
This error screen normally happens when the duster fails to wind-up the cloth and actuate the duster up switch, failing to turn on **Input 0CH 10** on the PLC.

Below are a few things that can cause a **DUSTER WINDUP ERROR**. If the Motor does not run, menu to the **I/O TEST** then **OUTPUT TEST** and press **DUSTER UP** to check relay operation and voltages.



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

Normally, this error screen occurs when **Input 1CH 00** fails to receive a signal within 3.5 seconds of the motor starting. A few things that can cause this **SQUEEGEE DOWN ERROR** are shown on the next page. If the Motor does not run, menu to the **I/O TEST** and press **SQU LIFT** to check relay operation and voltages.



1. The Squeegee **motor runs** but the down switch failed to operate and a send signal to PLC **Input 1CH 00**.
 - a. Check and inspect the microswitch. Manually operate the switch to see if **Input 1CH 00** will illuminate.
 - b. Possible broken wire or loose connection. It will be either the **Yellow** (24 VDC) or the **Black Wire** that connects to **Input 1CH 00**.
 - c. This error can also happen if the squeegee up **Input 1CH 01** is stuck on.
2. Squeegee motor does not run when tested in the **Output Test**. You will need to determine if power is getting to the motor.
 - a. Fuse is blown.
 - b. Squeegee linkage is in a bind.
 - c. Relay came loose in socket base or has failed.
 - d. Motor has failed.
 - e. Bad connection to the motor. Check all power and wiring to motor.
 - f. PLC **Output 101CH 03** failed.

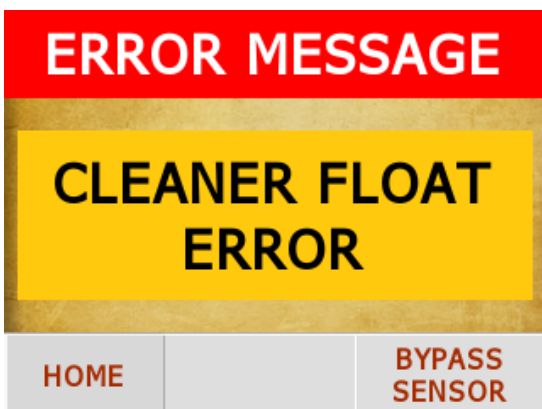
Normally this error occurs when **Input 1CH 01** fails to receive a signal within 3.5 seconds of the motor starting. The following list will cover a few things that can cause a **SQUEEGEE UP ERROR**.

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



1. The Squeegee motor runs but the up switch failed to operate and send signal a to PLC **Input 1CH 01**.
 - a. Check and inspect the microswitch, manually operate the switch to see if **Input 1CH 01** will illuminate.
 - b. Possible broken wire or loose connection with either the **Yellow** (24 VDC) or the **Yellow / Green Wire** that connects to **Input 1CH 01**.
 - c. This error can also happen if the squeegee down **Input 1CH 00** is stuck on.

2. Squeegee motor does not run when tested in the **Output Test**. You will need to determine if power is getting to the motor.
 - a. Fuse is blown.
 - b. Squeegee linkage is in a bind.
 - c. Relay came loose in socket base or has failed.
 - d. Motor has failed.
 - e. Bad connection to the motor. Check all power and wiring to the motor.
 - f. PLC Output 101CH 03 failed.



Machine is low on cleaner. 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 **BYPASS SENSOR** button, it will override the **CLEANER FLOAT ERROR** message. When the machine powers down, it will reset back to normal operation. Use the temporary bypass to operate the machine in pinch.

Cleaning System Problems that Do Not Display Errors

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

1. Cleaner pump fails to run.
 - a. Blown fuse.
 - b. Bad connection at the PLC analog 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.

3. Machine leaves water on the lane after a test clean in various spots but cleans everywhere else.
 - a. Squeegee not low enough to the lane (#1 cause).
 - b. The lane has bad depressions, possibly more than 1/100th of an inch (mostly around screw holes).
 - c. Squeegee has a damaged area.
 - d. Squeegee is worn out and should have been replaced a long time ago.
 - e. Recovery tank is not in machine.

4. Machine leaves oil streaks in various spots, but cleans everywhere else.
 - a. Duster 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 are ready to operate.

If the ProNautic Charger does not recognize a connection to battery 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.



- ⚠ **WARNING:** This product contains DEHP and other chemicals known to the State of California to cause cancer and birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov

ProNautic® Charger (set for Lithium batteries)

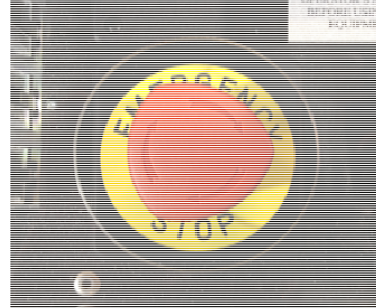
When the ProNautic charger is used to charge Lithium Battery, it will charge at 29.2 volts the entire length of the charging process. The only thing that will drop is the charging AMP's along with the charging percentage.

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.



Troubleshooting Battery & Charging Problems

SERIAL # H14K05-001	
BATTERY VOLTAGE	25.8
CVR VOLTAGE	27.2
CVR	BATTERY
640	500
HOME	

The screen to the left is used to calibrate the internal battery meter, to be used as a reference voltage only. As the machine operates Battery voltage is displayed on the main running screen.

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



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 battery 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 battery.
3. Screw terminals in back of charger, positive and negative.
4. Red plug between battery 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 has been reduced or is 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 battery.
6. Possible battery problem.

Battery 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 battery.
4. Blue Plastic Battery plug broken causing bad connection.

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.

Batteries

Battery Cycle Life

When running the lane machine only once per day, the maximum amount of lanes that can be done 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 machine only once per day, the maximum amount of lanes that can be done 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 machine only once per day, the maximum amount of lanes that can be done 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**

Battery Replacement

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.



CHAPTER 5

Drive System

Drive Menu

CHANGE PATTERN	DUSTER SETTINGS	CLEANER OIL CALIB
SYSTEM CLEANING	MOTOR SPEEDS	MACHINE SETTINGS
7 DAY PLANNER	I/O TEST	ABOUT
HOME		

Press on MAIN MENU then press on MOTOR SPEEDS to advance to the speed setting screen.

F 10 IPS 2100	R 10 IPS 2100	
F 14 IPS 2700	R 14 IPS 2700	
F 18 IPS 3300	R 18 IPS 3300	
F 22 IPS 3900	R 22 IPS 3900	
F 26 IPS 4500	R 26 IPS 4500	
F 30 IPS 5100	R 30 IPS 5100	
HOME	14	SET SPEED

In this screen you can run the drive motor to set the speeds. Press on 10 ips of either speed direction to turn motor on. Monitor speed then press on the value and a keypad will pop up to adjust speed. Press and hold handle button for a moment to index to each speed. After setting either of the 30 ips speeds press handle button once more to turn motor off.

CLEAN ONLY OFF	CLEAN AND OIL ON	OIL ONLY OFF
VALVE TIME 455	RUNNING PATTERN	
RUN TIME 890		
DUSTER COUNT 380	16	
DRIVE SPD 14 14		
HOME	26.2	START

To fine tune the speed settings press SET SPEED and the screen will advance to the RUN screen. Pattern 16 is set special to run 10 ips forward and reverse. Run machine like normal and the speeds should settle into their correct setting for all 6 adjustable speeds.

Note: when ever a value shows up in Blue it will mean that the value is out of the limits for that setting and should be changed back within its

adjustable limits. In this case its part of the programming and can't be changed.

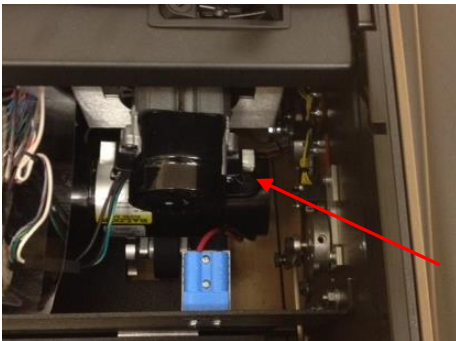
Drive System

Drive 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).

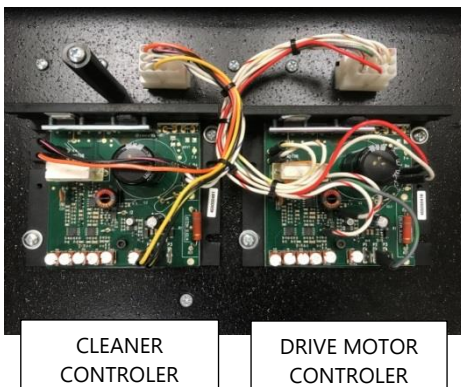
Drive Motor Brushes



Remove the oil compartment lid to gain access to the drive motor located under the Vacuum motor assembly. Stand machine back up so as to access both brush caps.

With a flathead screwdriver remove the drive motor brush caps and remove both the brushes. With compressed air blow into one side to blow the carbon dust out. Once the motor is blown out replace the brushes. Its best to replace brushes in the same hole and position.

Drive Control Board



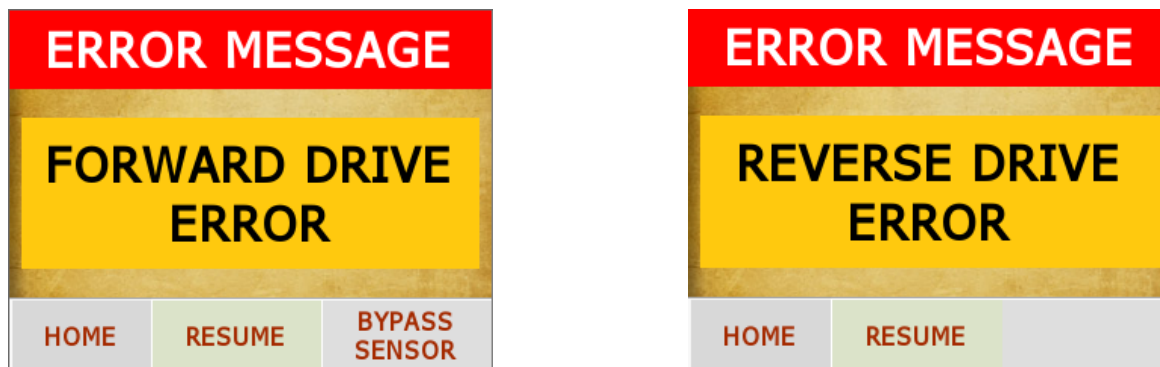
Shown the left are the control boards for the Cleaner Pump and the Drive Motor, the boards are the same but adjusted differently and are located on the top side of control plate.

Drive System

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 OCH 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 DRIVE ERROR**.



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

Menu to **I/O TEST** then **OUTPUT TEST** to run the motor.

1. The drive motor runs but gives a **Forward or Reverse Drive Error**.
 - a. Machine is not seated on the lane, there are high gutters, or the drive wheels are slipping.
 - b. LDS signal has failed or the LDS shaft is binding.
 - c. Wire is loose or broken for the **OCH 07** Input circuit.
 - d. Turn the LDS shaft and see if **Input OCH 07** is flashing on the PLC as the wheels rotate.

2. Drive Motor does not run.
 - a. Forward Relay is loose in socket or failed.
 - b. Reverse Relay is loose in socket or failed.
 - c. One of the motor control plugs is loose or unplugged. Check the speed control and drive motor plugs.

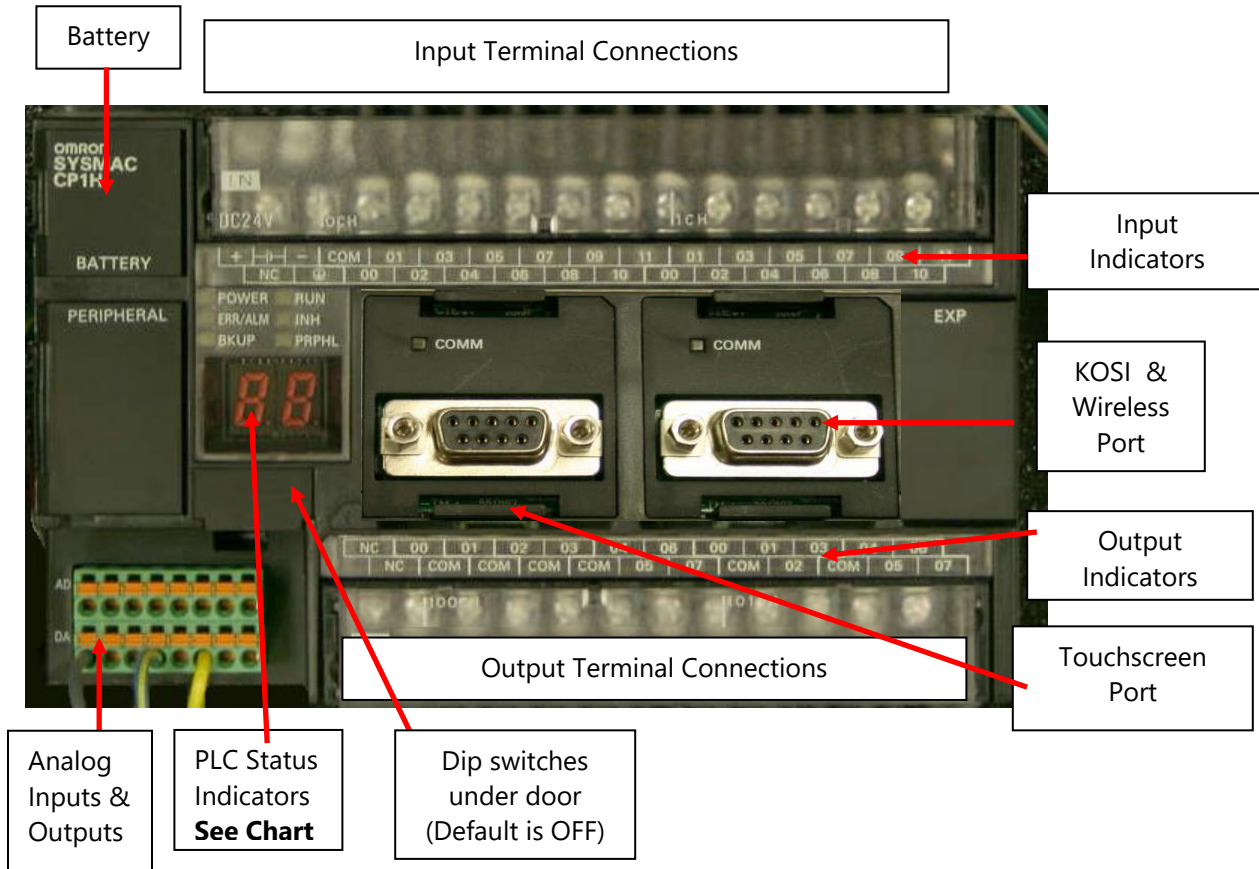
- d. Blown fuse.
 - e. Drive Motor or Speed Control has failed.
 - f. Go to the proper menu and check the operation of the relays.
3. Machine drives off into pit giving a **Forward Drive Error**.
- a. Forward Cleaning Distance needs to be Decreased by the correct number of counts.
 - b. Lane Distance shaft is not turning freely.
 - c. Lane Distance target is loose.
 - d. Lane Distance Proximity Sensor is too far from target.
 - e. Lane Distance Proximity Sensor is damaged.
 - f. Operator needs more training and is starting the machine too far past the foul line.
 - g. 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: when the lane machine stops and displays the error message, you will have the option to **BYPASS SENSOR**. This will allow you to get through conditioning your lanes until you can address the problem. Once power has been removed, you will need to press on the **BYPASS SENSOR** again if problem has not been corrected.

CHAPTER 6

Computer and Control Relays



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

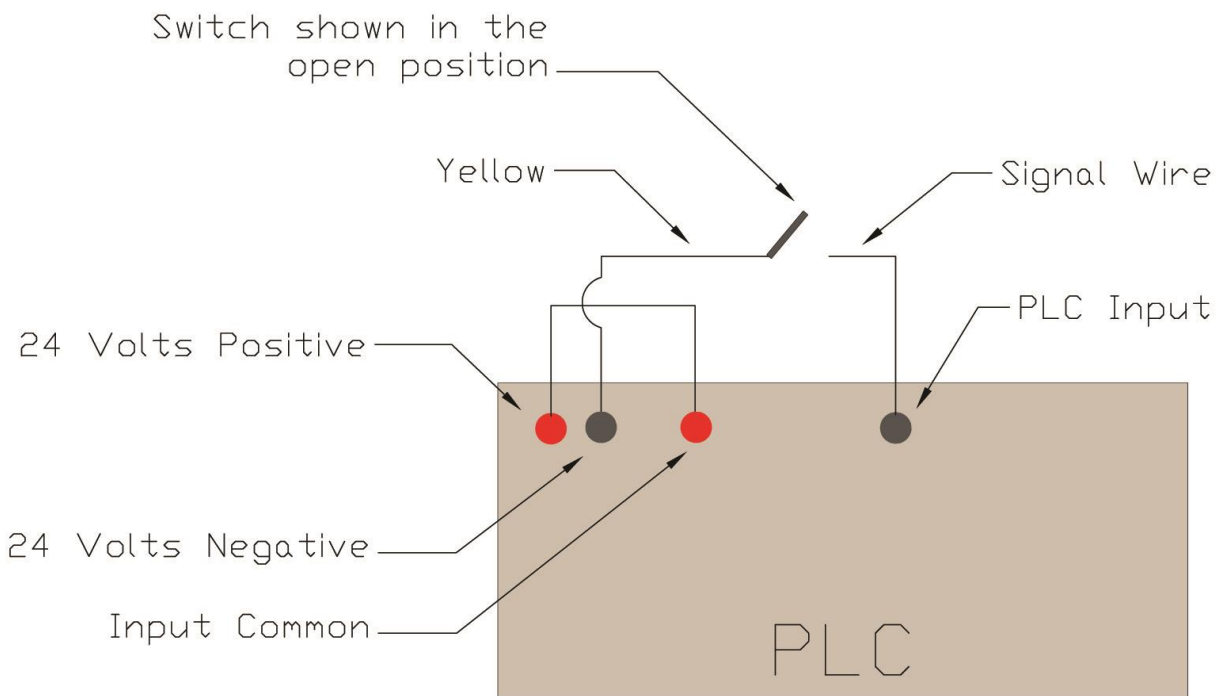
The PLC assembly of the machine has 24 inputs, 16 SSR outputs, and two analog outputs. Inputs accept data from various sensors or switches in the machine and then use that information to control functions of the machine through its outputs. Here is a list of the **INPUT** numbers for the PLC along with their wire color and designations:

<u>INPUT</u>	<u>DESCRIPTION</u>	<u>WIRE COLOR</u>
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 (IKON ONLY)	VIOLET
010	DUSTER UP SWITCHES (2)	GREEN / BLACK
100	SQUEEGEE DOWN SWITCH	BLACK
101	SQUEEGEE UP SWITCH	YELLOW / GREEN
102	OIL FLOAT SWITCH	GRAY / WHITE
103	CLEANER FLOAT SWITCH	GRAY / BLACK
104	DUSTER/CLEANER TEST BUTTON	BROWN/VIOLET

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.

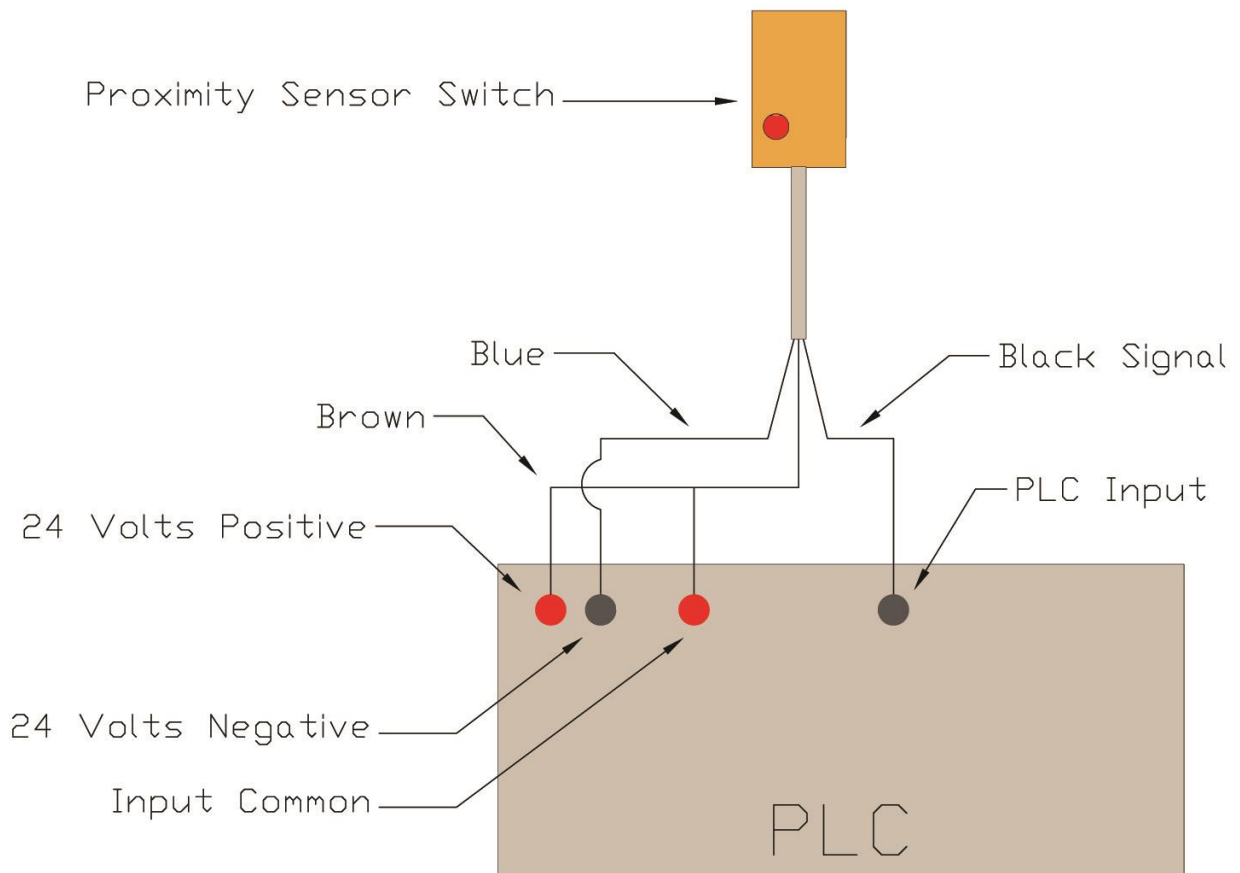
The following wiring drawings will show the simplest way a switch and proximity sensor connect to the PLC.

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 battery 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 battery 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.



Inputs and Outputs

PLC Outputs

Go to the main menu and select I/O Test then press OUTPUT TEST and the screen will change to show the first 8 OUTPUTS. Press on an output selection to test, below is an example of the OUTPUT test screen. Outputs OIL VALVE, BUFFER and CLEANER PUMP will toggle ON and OFF when pressed but the rest of the outputs are only momentary buttons and are on only as long as you press on the button.



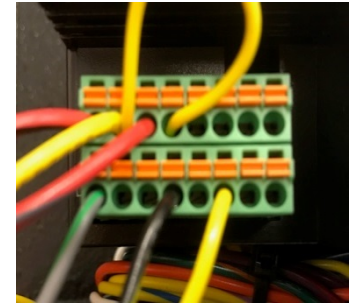
To check inputs, press on one of the two input screens to view. The inputs that are ON will change color to yellow. To test an input you will need to physically operate the switch by pressing on it or pass metal by a proximity sensor.

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 CONTROL VALVE	ORANGE
100.01	POWER OFF RELAY (NOT A TEST)	GRAY/YELLOW
100.02	FORWARD DRIVE	GREEN / ORANGE
100.03	REVERSE DRIVE	YELLOW / VIOLET
100.04	CLEANER PUMP REVERSE	
100.06	OIL PUMP MOTOR	GRAY/VIOLET
100.07	BUFFER MOTOR	YELLOW / BLUE
101.00	MOVING HEAD MOTOR DIRECTION (NOT A TEST)	VIOLET/RED
101.01	MOVING HEAD MOTOR RUN	VIOLET/ORANGE
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
101.07	VACUUM MOTOR	BLUE / BLACK

Analog Variable Speed Control

The variable speed for the Drive Motor and Cleaner Pump in the machine are controlled by an analog output. The signal comes from the green junction on the PLC then goes to the Motor Speed Control Boards located on the left side of the electrical compartment.



The analog module works by taking values from the PLC and converting them to voltage. The higher the 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 and the Black / Yellow wire (fourth from the left) is the cleaner pump motor. As with all DC circuits, the Yellow is common. The top terminal row is used for the Analog Inputs, the internal reference voltage meter.

Electrical Panel

Fuses

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

IMPORTANT: 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.

DRIVE MOTOR	7.5A
BUFFER MOTOR	10A
DUSTER UNWIND	3.2A
DUSTER WINDUP	3.2A
SQUEEGEE MOTOR	3.2A
BRUSH LIFT MOTOR	3.2A
HEAD DRIVE MOTOR	1A (ceramic)
OIL PUMP MOTOR	4A
PLC INPUT POWER	.5A
PLC COMMON	.5A
TOUCH SCREEN	.5A
CLEANER PUMP	3.2A
VACUUM MOTOR	20A

FUSE PART NUMBERS	
.5A	154-1261
1A (ceramic)	154-1229C
3.2A	154-1267
4A	154-1268
7.5A	154-1270
10A	154-1273
20A	154-1274

**ALL FUSES ARE SLOW BLOW STYLE FUSE*

Control Relays

All of the components on the IKON 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 SSR relays.

The IKON machine is equipped with 10 replaceable control relays that operate ALL the motors of the machine.

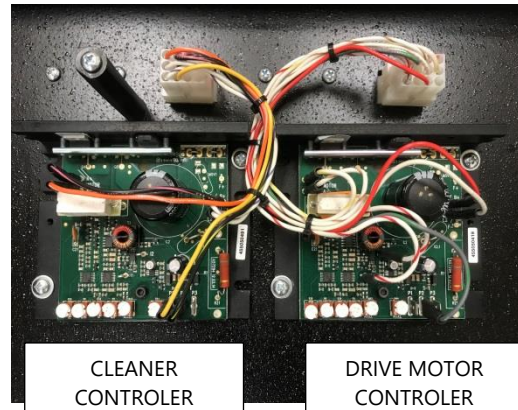
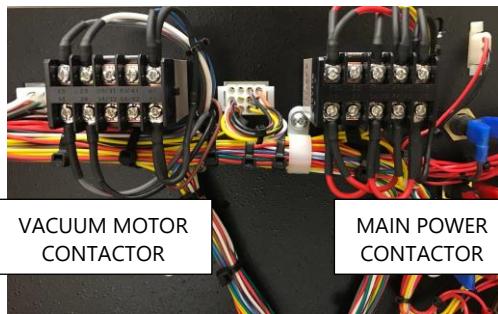


CR13

CR1

- **CONTROL RELAY 1:** Oil Control Valve SSR Relay
 - **CONTROL RELAY 2:** Power Off Relay
 - **CONTROL RELAY 3:** Dust Windup Motor Relay
 - **CONTROL RELAY 4:** Dust Unwind Motor Relay
 - **CONTROL RELAY 5:** Squeegee Motor Relay
 - **CONTROL RELAY 6:** Brush Lift Motor Relay
 - **CONTROL RELAY 7:** Oil Pump Motor Relay
 - **CONTROL RELAY 8:** Cleaner reversing Relay
 - **CONTROL RELAY 9:** Buffer Motor Relay
 - **CONTROL RELAY 10:** Oil Head Motor Relay
 - **CONTROL RELAY 11:** Oil Head Reversing Relay
 - **CONTROL RELAY 12:** Reverse Drive Motor Relay
 - **CONTROL RELAY 13:** Forward Drive Motor Relay
- 158-1460
- 158-1458
- 158-1462
- 164-1231

Below to the left are the Vacuum relay and the Main Power relay located under the control plate. To the right are the control boards for the Cleaner Pump and the Drive Motor, the boards are the same but adjusted differently and are located on the top side of control plate.



CHAPTER 7

Miscellaneous Parts

Stickers and Decals



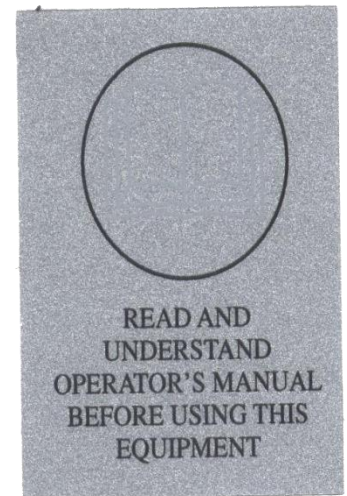
153-0037



154-0272



154-0274



158-0207



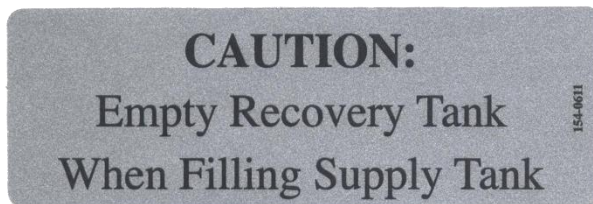
154-0297



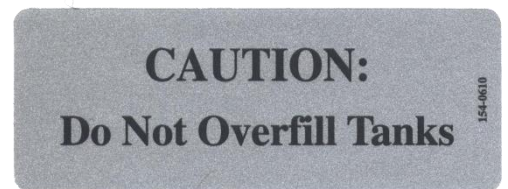
154-0266



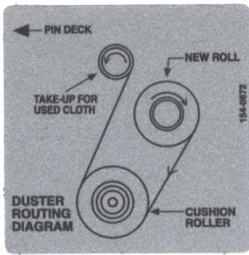
154-0269



154-0611



154-0610



154-0872



154-0270

WARNING: To reduce the risk of fire, use only commercially available bowling lane cleaners and conditioners intended for machine application.

154-0262

CAUTION: Moving Parts - To Reduce The Risk Of Injury, Unplug Before Servicing.

154-0265



164-00140-714C

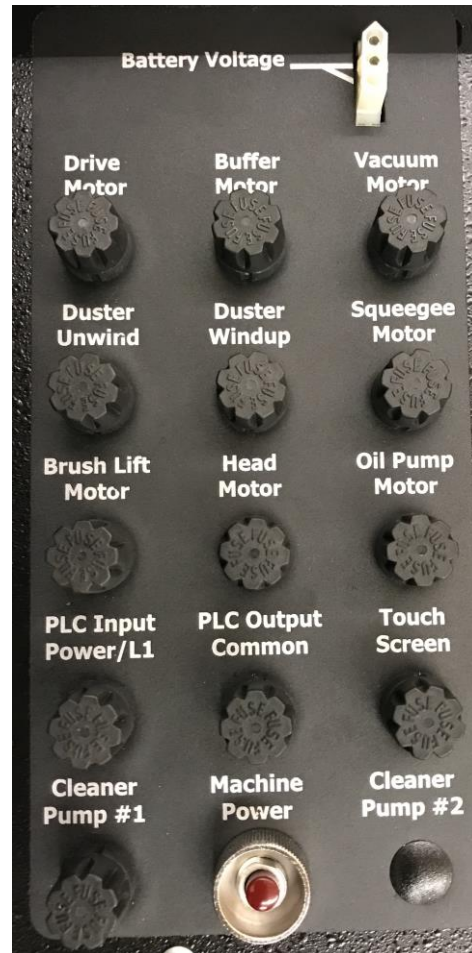


164-00150-714C



164-0024 - Part Number for the "K" only

164-00230-714C - Part Number for the "ION" only



164-0025

Fittings



Elbow-
1/4" Tube x 1/4" Tube
154-0243



Elbow-
3/8" Tube x 3/8" Tube
154-0256



Elbow-
3/8" NPT x 1/4" Tube - 154-0225
1/4" NPT x 1/4" Tube - 154-0223



Elbow-
1/4" Stem x 1/4" Tube
154-0222



Elbow-
3/8" Stem x 3/8" Tube
154-0258



Elbow-
1/4" Stem x 1/4" Hose Barb
154-0226



Elbow-
1/4" Stem x 5/16" Hose Barb
154-0227



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

CHAPTER 8

Mechanical Drawings

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Oil Head Assembly.....	109
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Duster Assembly.....	117
Squeegee Assembly.....	119
Recovery Tank and Vacuum Motor Assembly.....	121

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

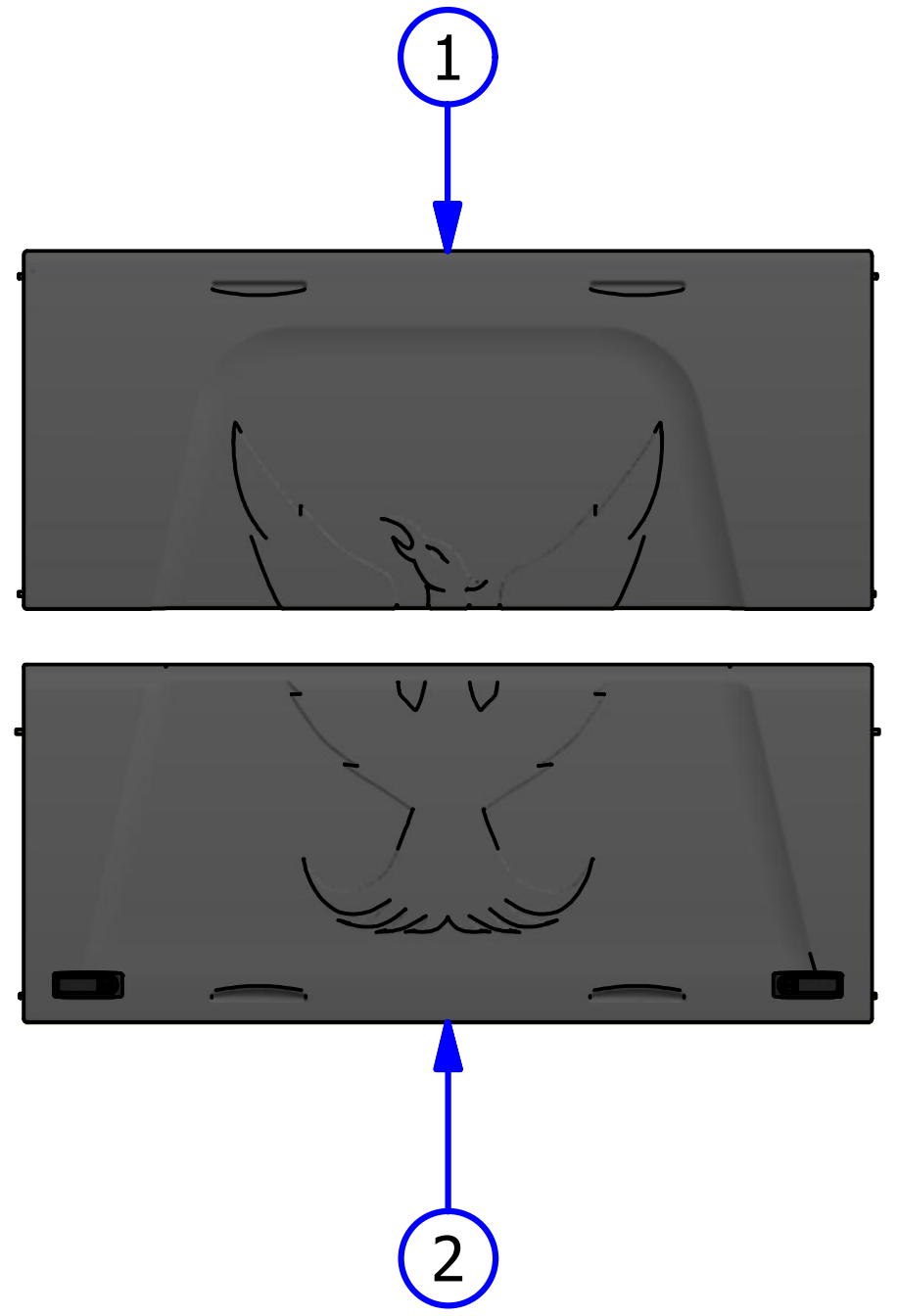
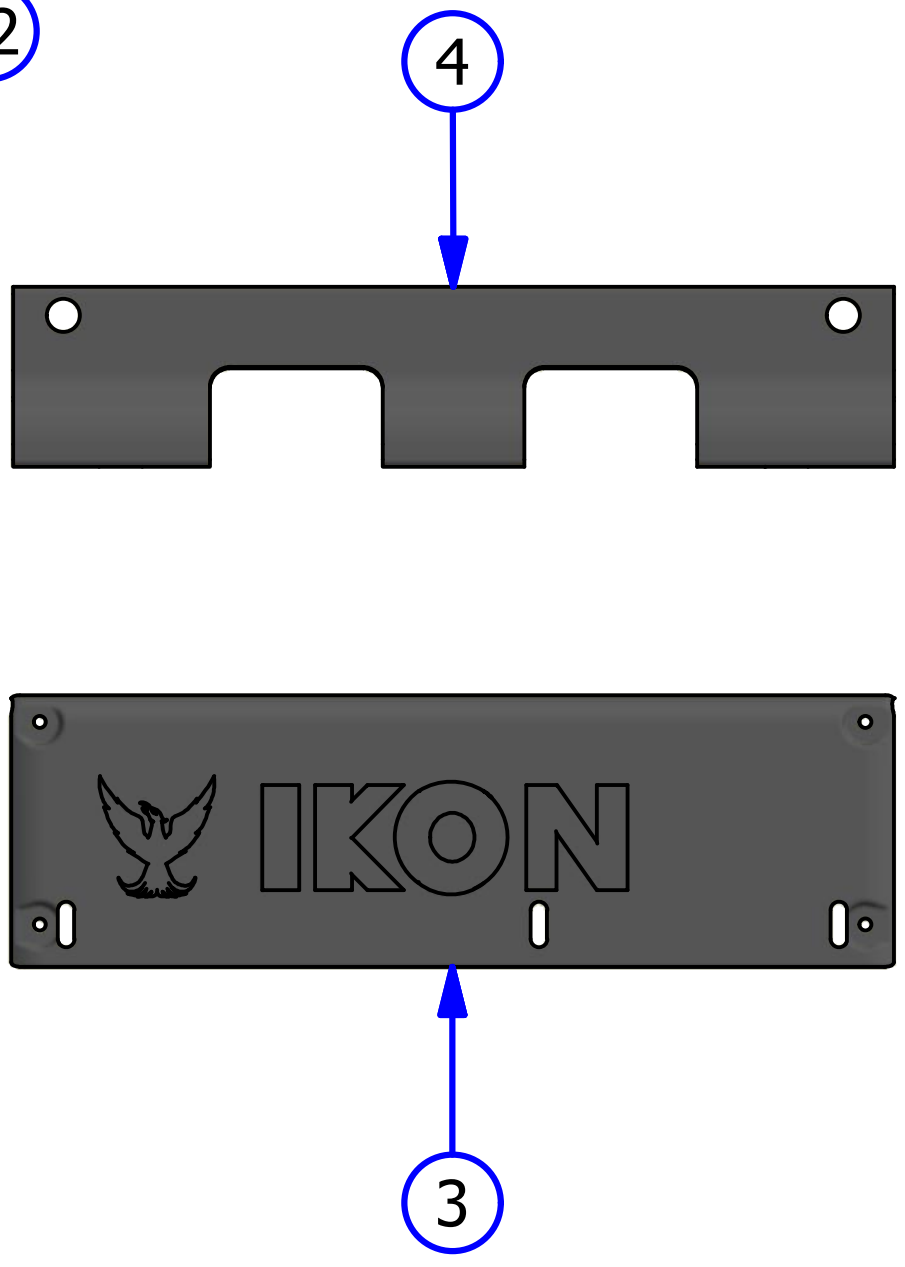
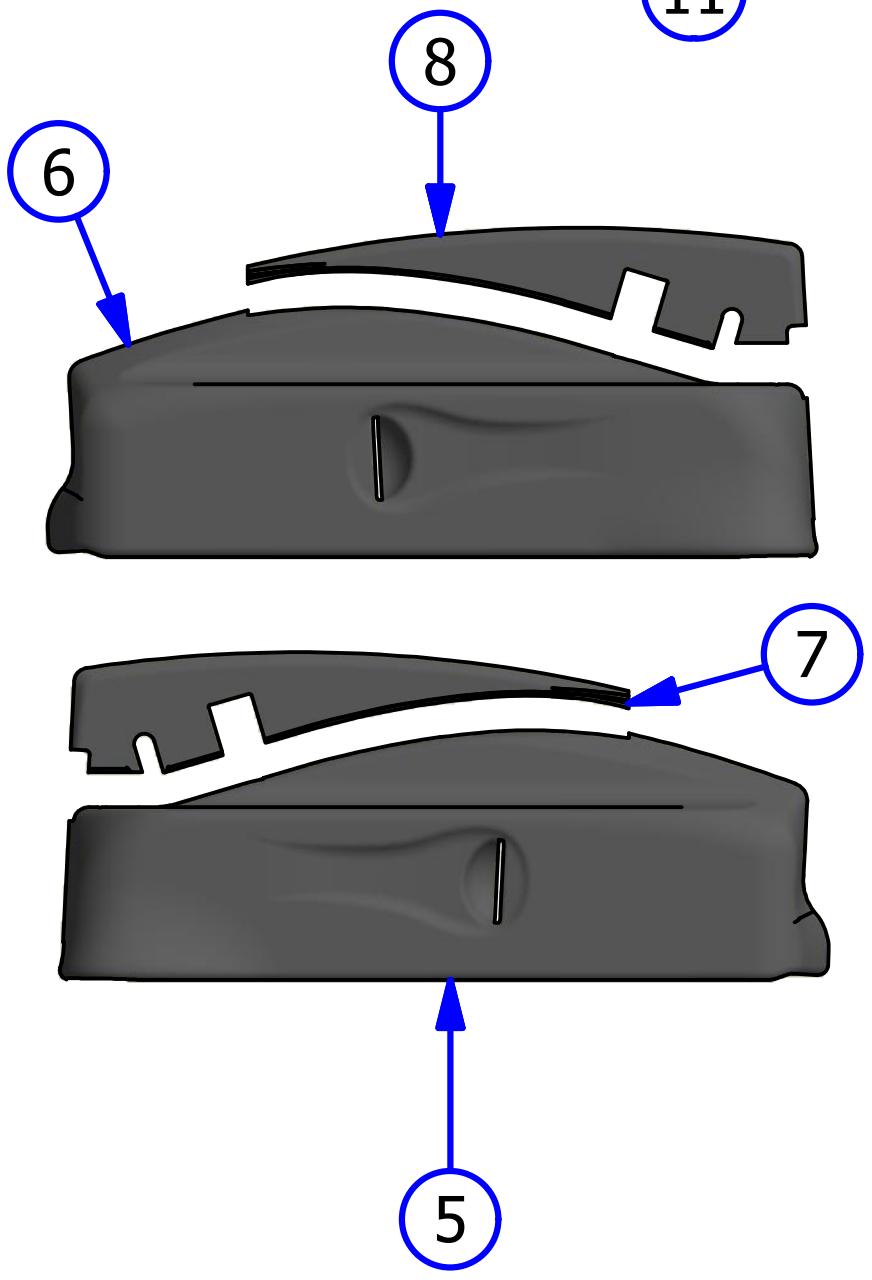
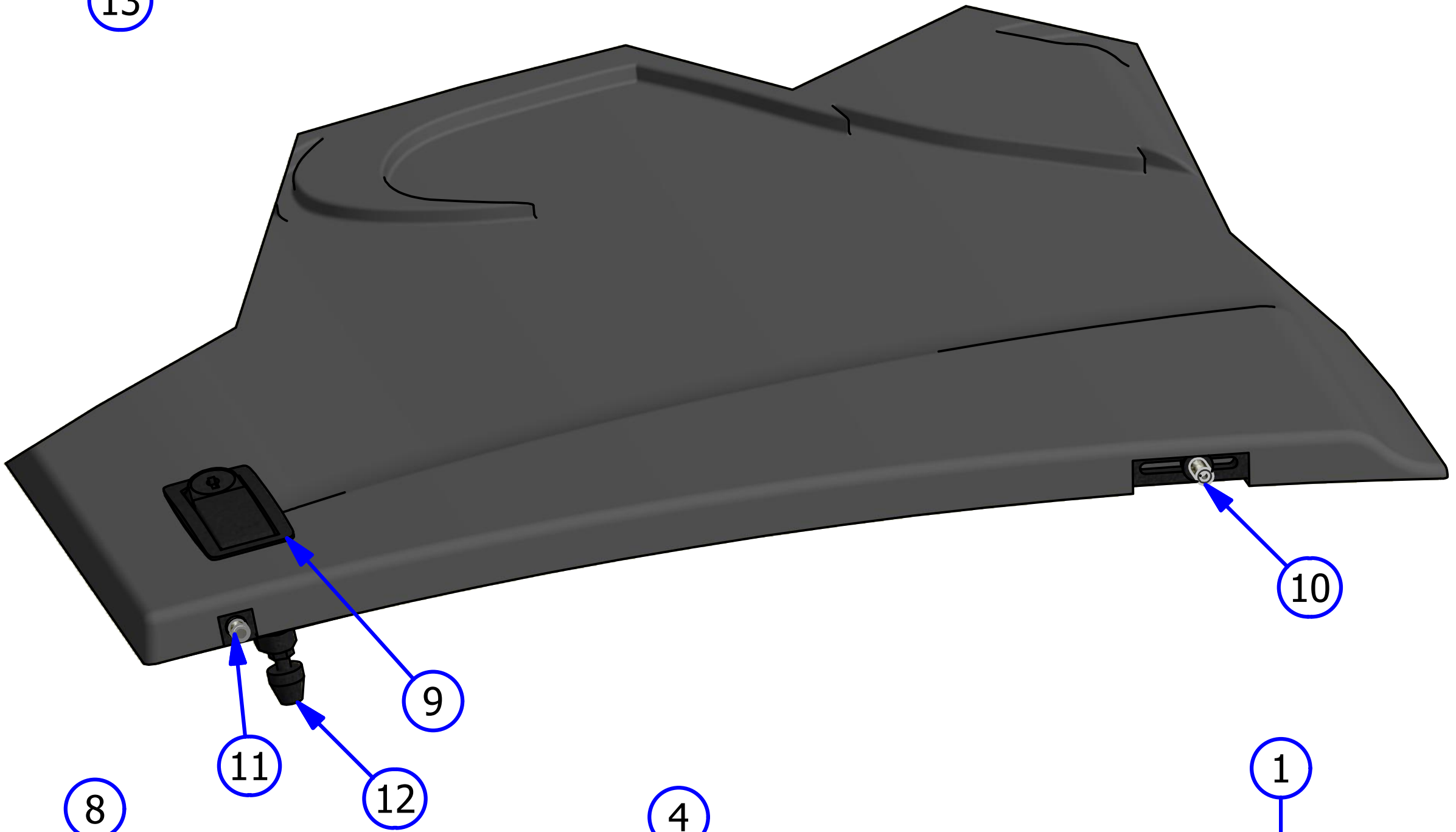
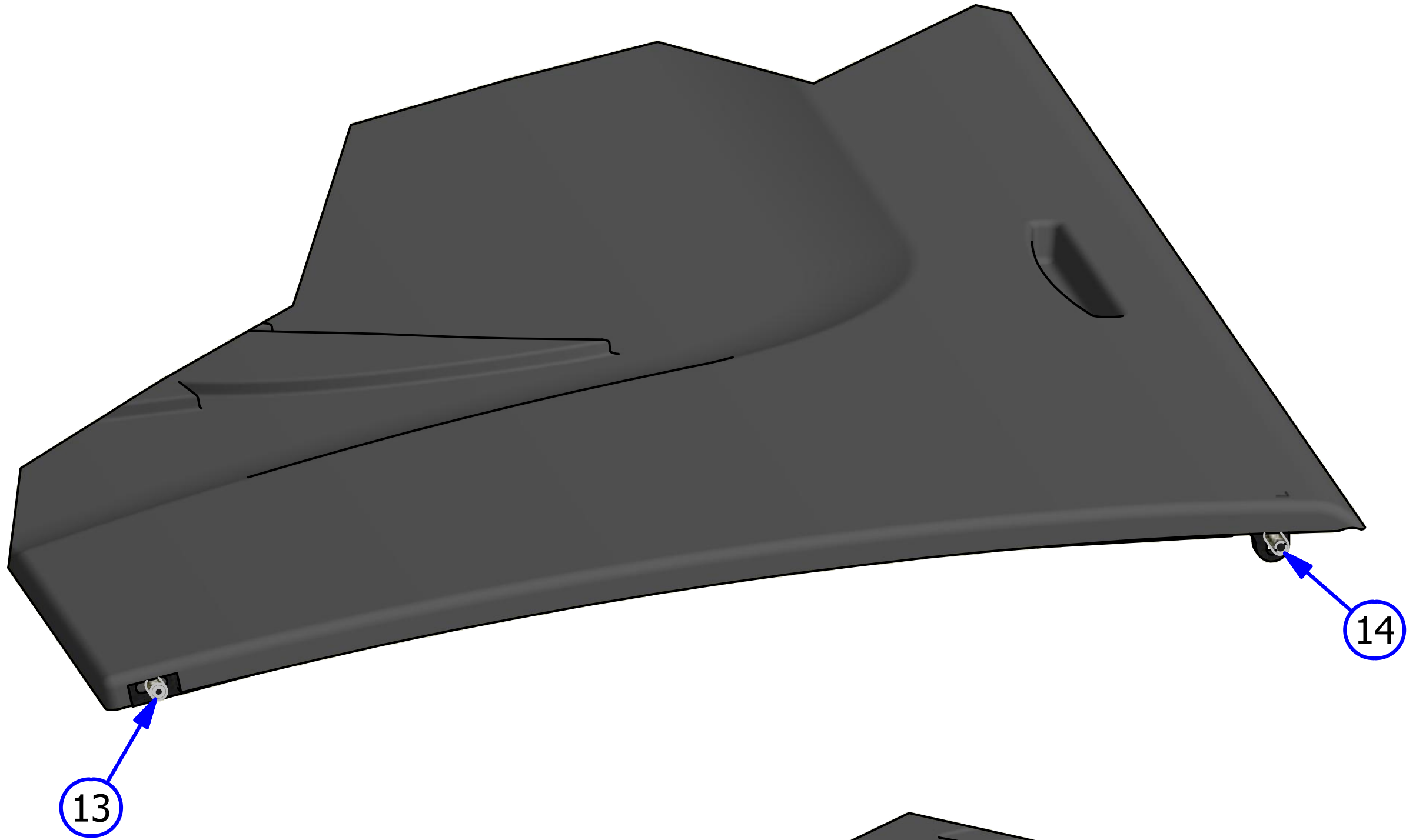
EXTERNAL BATTERY CHARGER ASSEMBLY – 230v

DC Power Cord Assembly – 6FT External – 164-8475

LID AND GUARDS

REV. 9/18

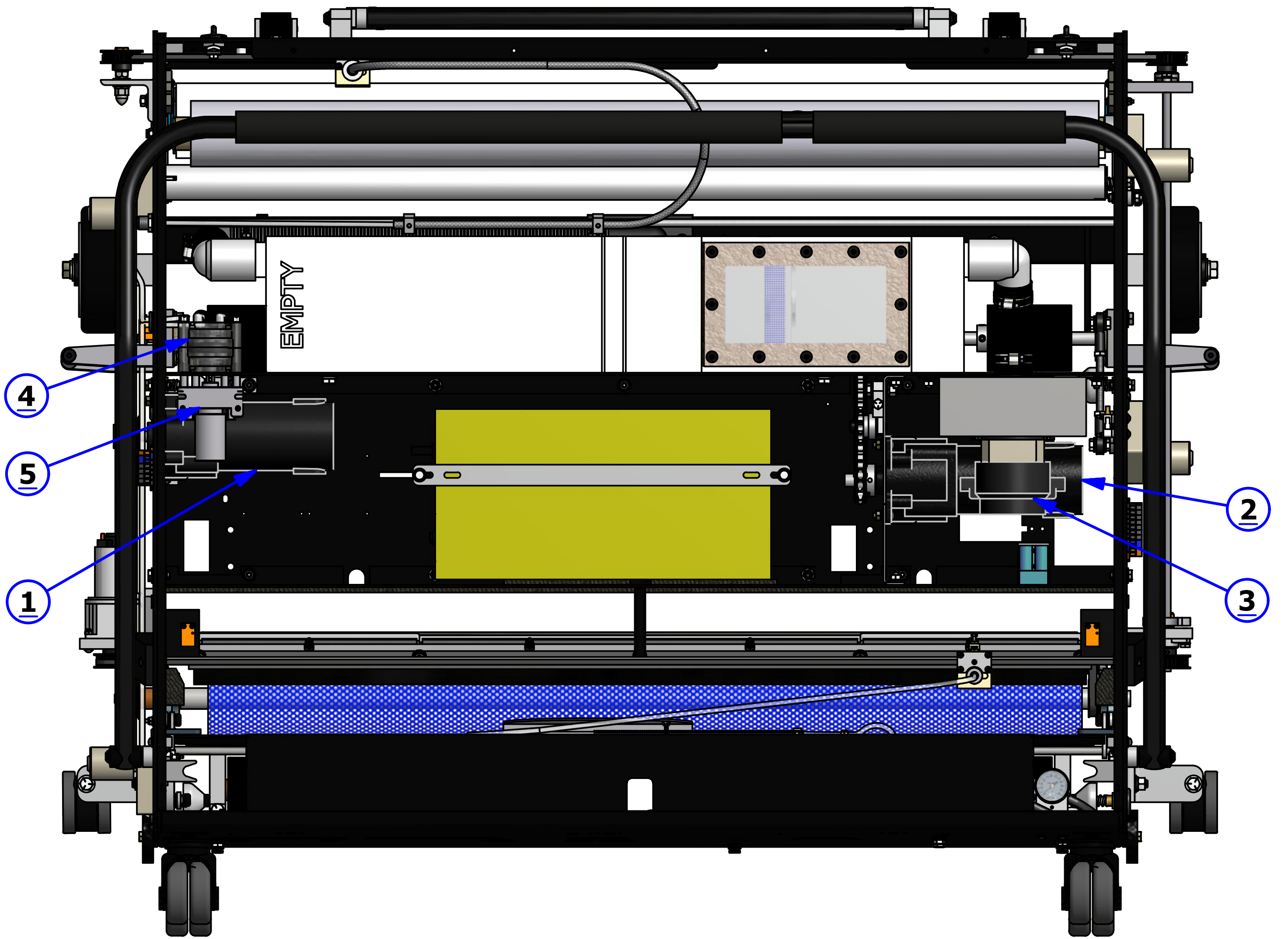
<u>INDEX</u>				
<u>NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8801	SLIDING LID ASSEMBLY - HEAD	EA
2	1	164-8802	SLIDING LID ASSEMBLY - TAIL	EA
3	1	164-8808	REAR PANEL	EA
4	1	164-8804	FRONT BUMPER	EA
5	1	164-8809	IKON RT SIDE GUARD - LOWER	EA
6	1	164-8810	IKON LT SIDE GUARD - LOWER	EA
7	1	164-8811	IKON RT SIDE GUARD - UPPER	EA
8	1	164-8812	IKON LT SIDE GUARD - UPPER	EA
9	2	153-2232L	FLUSH MOUNT LID LATCH (WITH LOCK)	EA
10	2	164-2069	SPRING PLUNGER THREADED	EA
11	2	164-2002	DETENT - SPRING PLUNGER	EA
12	2	164-6164	LID LATCH BUMPER	EA
13	2	164-2044	STANDOFF FEMALE THREADED 8-32 X 3/8	EA
14	2	164-2069M	STANDOFF FEMALE THREADED 8-32 X 5/8	EA



TOP VIEW

REV. 5/16

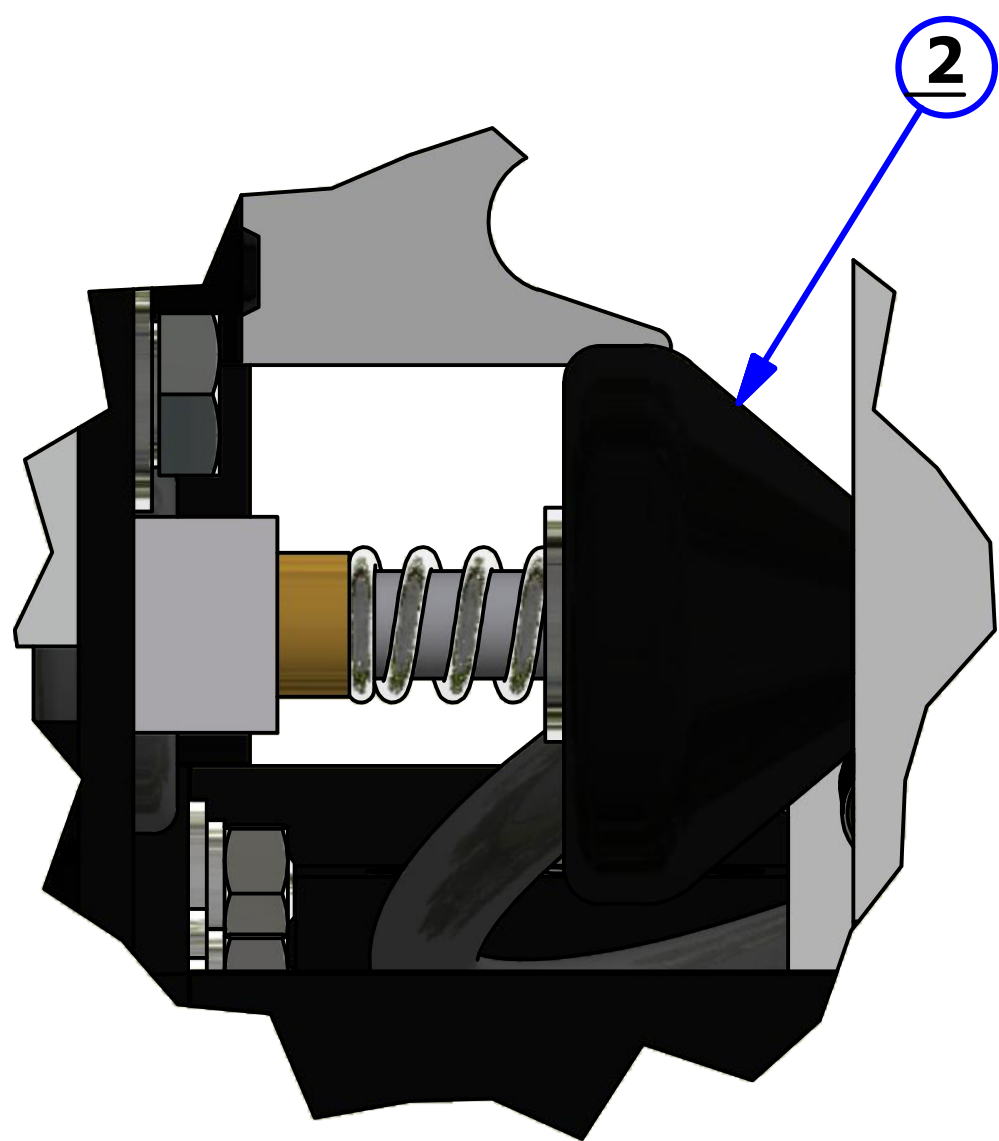
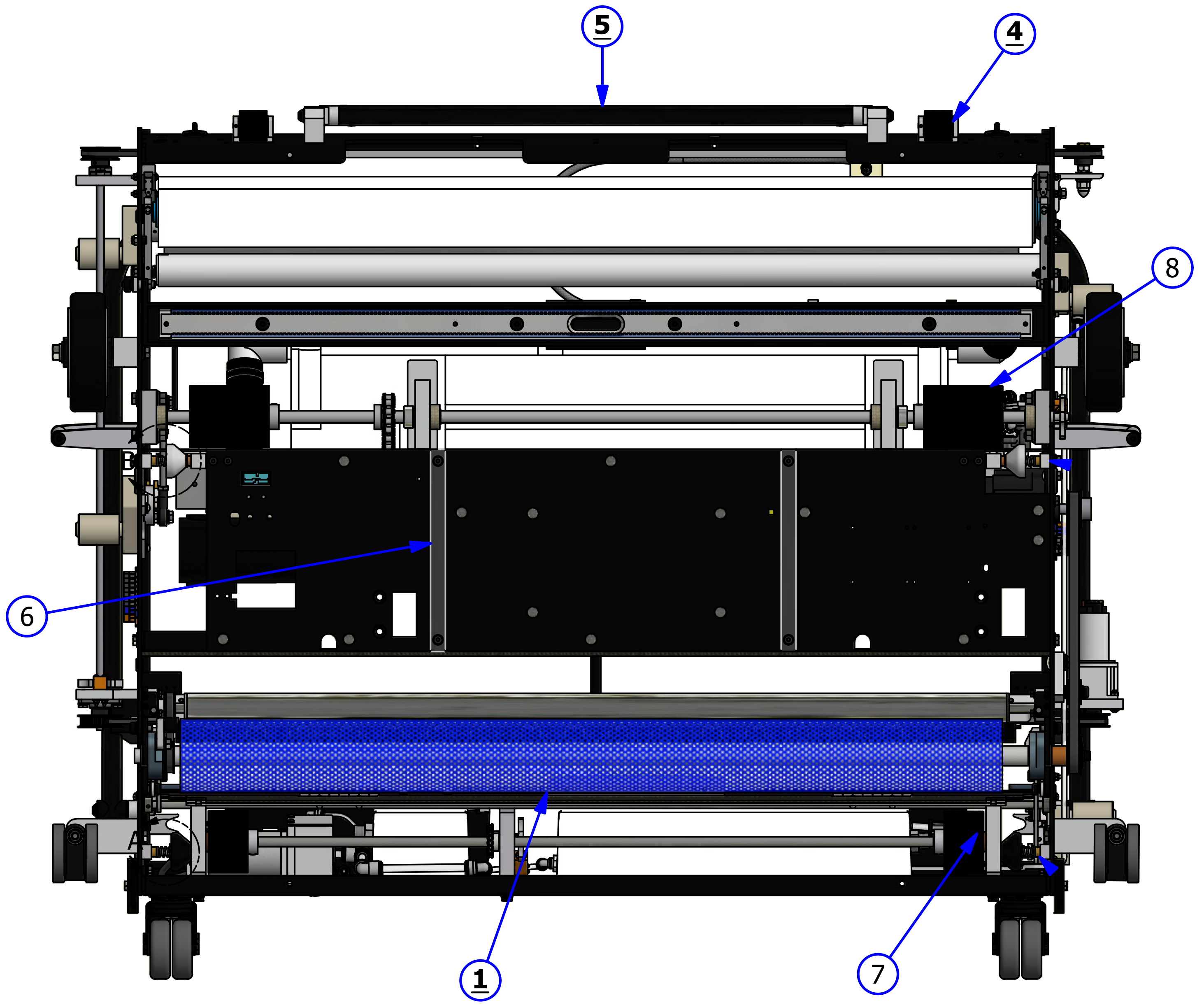
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	158-8414	BUFFER MOTOR	EA
	1	158-1406B	BUFFER MOTOR BRUSHES (PAIR)	PR
	1	164-9019	BUFFER BELT	EA
	1	158-9401	PULLEY (14 TOOTH 1/2" BORE)	EA
2	1	158-8406	DRIVE MOTOR	EA
	1	158-1405B	DRIVE MOTOR BRUSHES (PAIR)	PR
	1	154-9601	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
3	1	158-8407	VACUUM MOTOR - 24VDC	EA
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



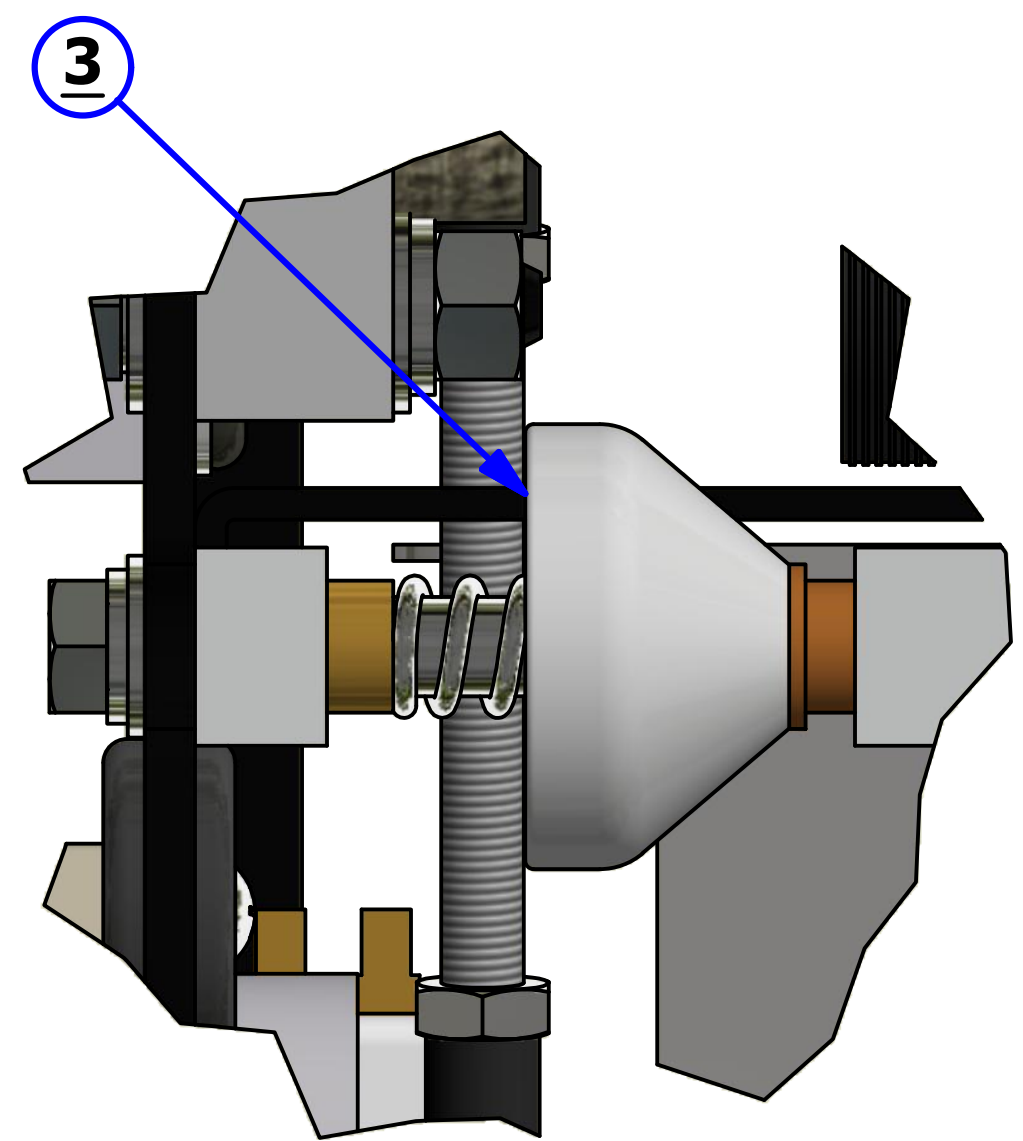
BOTTOM VIEW

REV. 5/18

<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	164-9019	BUFFER BELT ASSEMBLY	EA
2	2	164-8815	REAR EDGE GUIDE WHEEL ASSEMBLY - BLACK	EA
	2	153-2401	SPRING - COMPRESSION FOR GUIDE WHEEL (NOT SHOWN)	EA
	2	153-2407	BOLT FOR GUIDE ROLLER - FRONT (NOT SHOWN)	EA
	2	153-6417	REAR LANE EDGE GUIDE ROLLER MOUNT	EA
3	2	158-8637	FRONT LANE EDGE GUIDE ROLLER ASSEMBLY - WHITE	EA
	2	153-2401	SPRING - COMPRESSION FOR GUIDE WHEEL (NOT SHOWN)	EA
	2	153-2527	BOLT FOR GUIDE ROLLER - REAR (NOT SHOWN)	EA
	2	153-6417	FRONT LANE EDGE GUIDE ROLLER MOUNT	EA
4	2	153-7005R	MOMENTARY WHEEL ASSEMBLY (WHEEL ONLY) <i>THE BELOW ATTACHED PARTS ARE NOT SHOWN</i>	EA
	2	153-6006	MOMENTARY WHEEL SHAFT	EA
	2	153-6029	MOMENTARY WHEEL HOUSING ASSEMBLY	EA
	2	153-2049	SET SCREW (NOT SHOWN)	EA
5	1	164-8012	HANDLE ASSEMBLY (COMPLETE)	EA
6	2	158-6645	SKID GUIDE	EA
7	2	153-7002AA	LDS/DRIVE WHEEL (NO SET SCREW)	EA
	2	153-2819	SET SCREW (NOT SHOWN)	EA
8	2	153-7013	DRIVE WHEEL (NO SET SCREW)	EA
	2	153-2819	SET SCREW (NOT SHOWN)	EA



DETAIL A

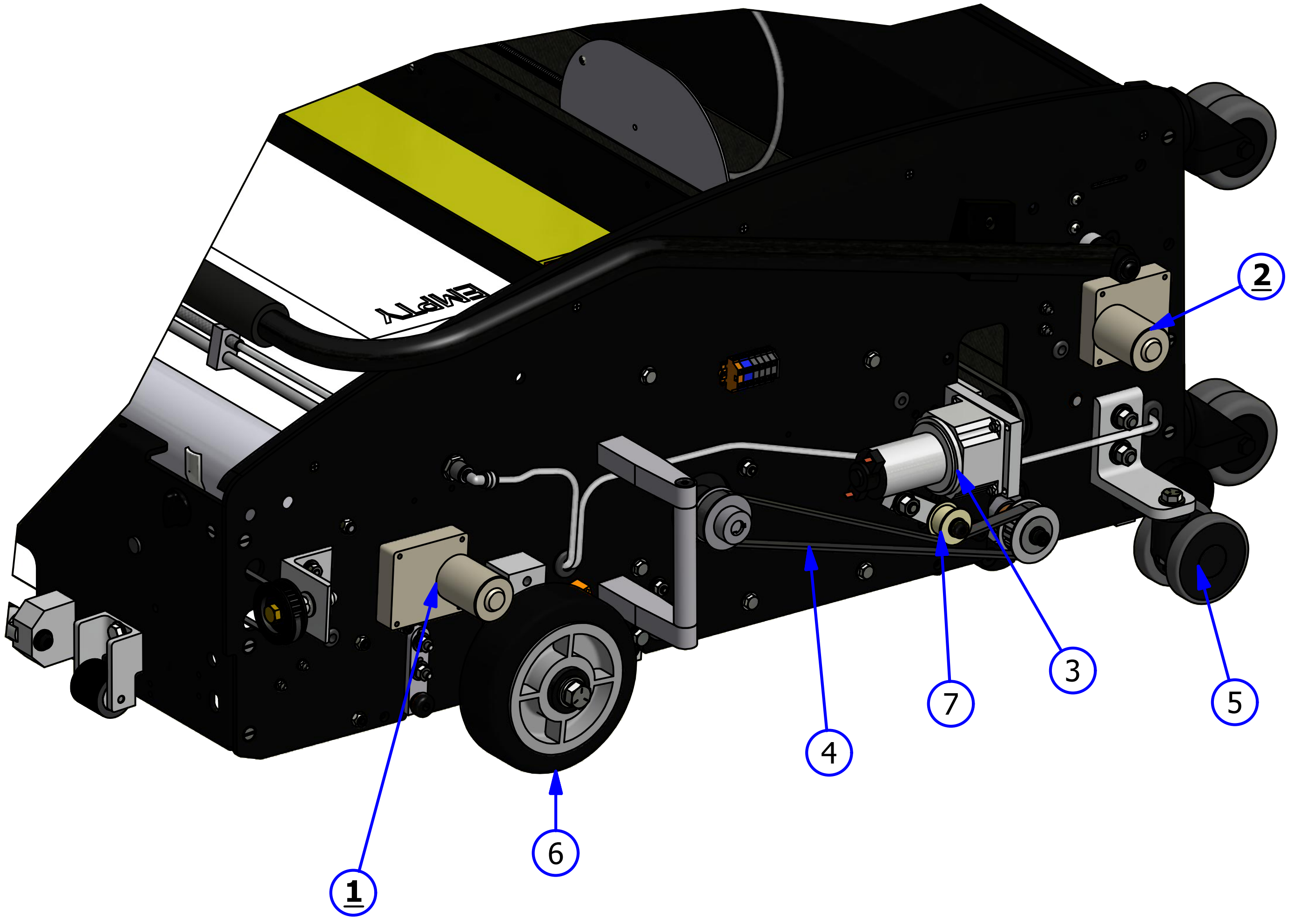


DETAIL B

LEFT SIDE VIEW

REV. 5/16

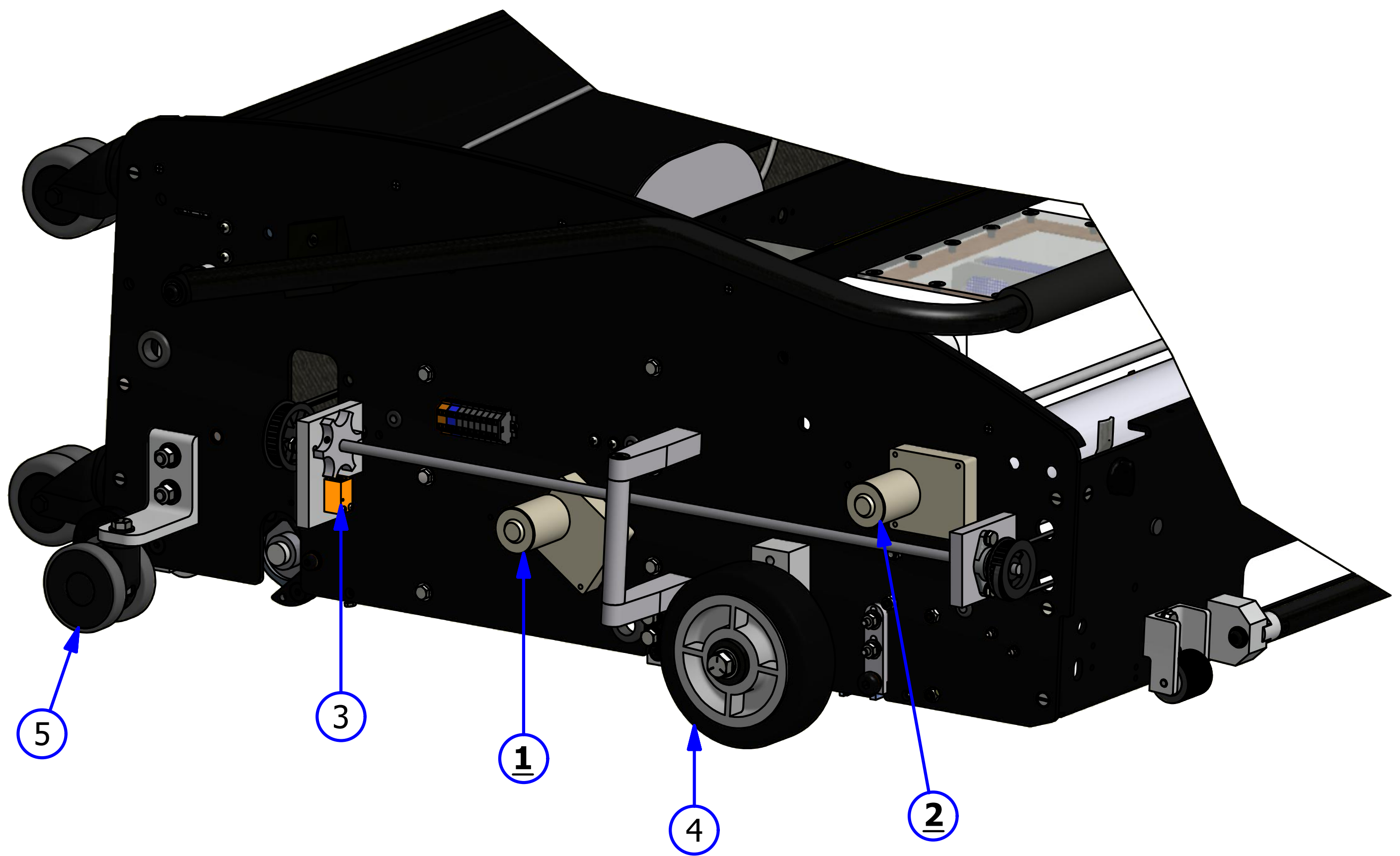
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	158-8403	ASSEMBLY - DUSTER MOTOR 24VDC	EA
2	1	158-8402	BUFFER LOWERING MOTOR	EA
3	1	158-8405	HEAD DRIVE MOTOR ASSEMBLY	EA
		154-9607	PULLEY FOR HEAD DRIVE (NOT SHOWN)	EA
4	1	164-9019	BUFFER BELT ASSEMBLY	EA
5	2	164-0022	L TO L CASTER ASSEMBLY	EA
6	2	158-7002	6" WHEEL ASSEMBLY	EA
7	1	153-8039	BUFFER IDLER PULLEY	EA



RIGHT SIDE VIEW

REV. 5/16

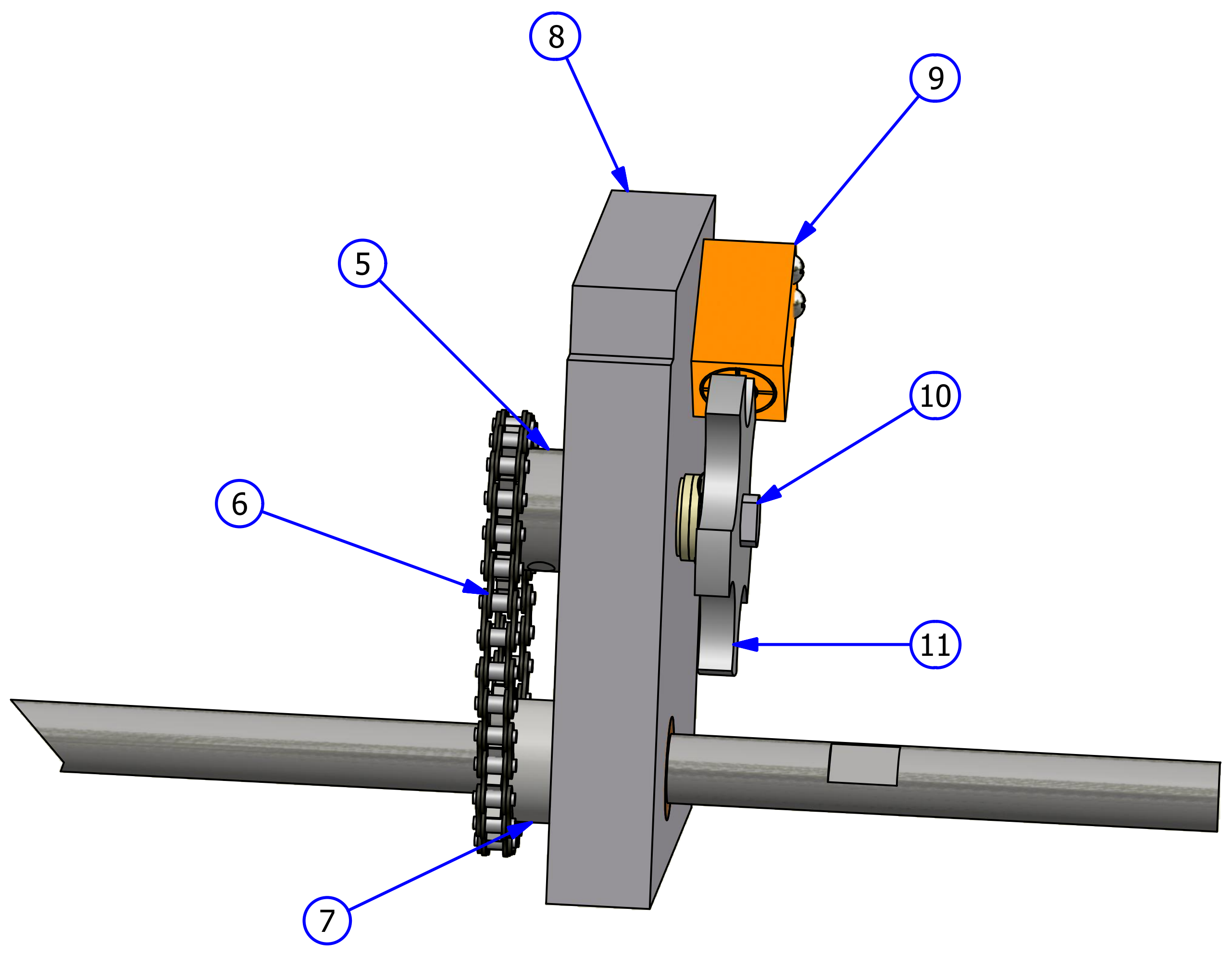
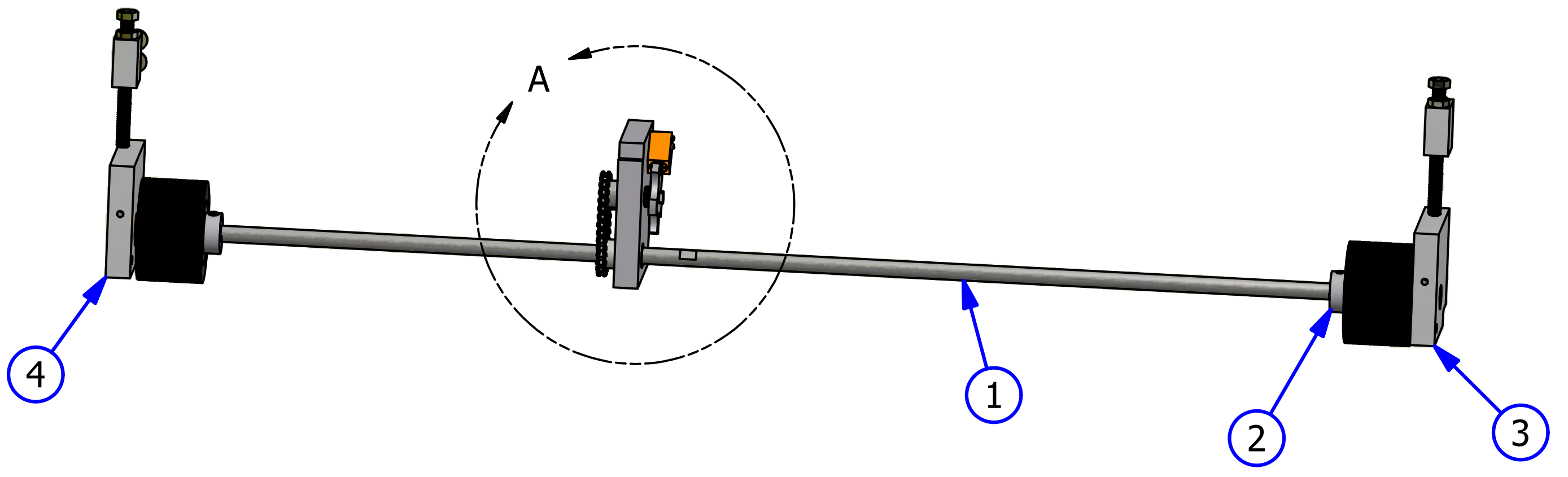
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	158-8402	SQUEEGEE / BRUSH LIFT MOTOR - 24VDC	EA
2	2	158-8403	DUSTER MOTOR ASSEMBLY - 24VDC	EA
3	1	154-1220	PROXIMITY SENSOR	EA
4	2	153-7002	6" WHEEL ASSEMBLY	EA
5	2	164-0022	L TO L CASTER ASSEMBLY	EA



LDS ASSEMBLY

REV. 5/16

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	154-6821	LDS SHAFT ASSEMBLY	
2	1	153-7002AA	LDS WHEEL ASSEMBLY	EA
	2	153-2819	SET SCREW - 10-32 X 3/8	EA
3	1	154-8619	LDS MOUNTING BLOCK ASSEMBLY - LEFT	EA
4	1	154-8621	LDS MOUNTING BLOCK ASSEMBLY - RIGHT	EA
5	1	154-9213	SPROCKET 25B15 (1/2")	EA
6	1	154-9211	LDS AND TACH SENSOR DRIVE CHAIN #25	EA
	1	153-9045	MASTER LINK #25 (NOT SHOWN)	EA
7	1	153-9010	SPROCKET - 25B15 (3/8")	EA
8	1	154-8320	LDS MOUNTING BLOCK ASSEMBLY - CENTER	EA
9	1	154-1220	PROXIMITY SENSOR	EA
10	1	154-6264	SHAFT FOR TIMING DISK ASSEMBLY	EA
11	1	154-6717	5 TOOTH SENSOR DISK	EA

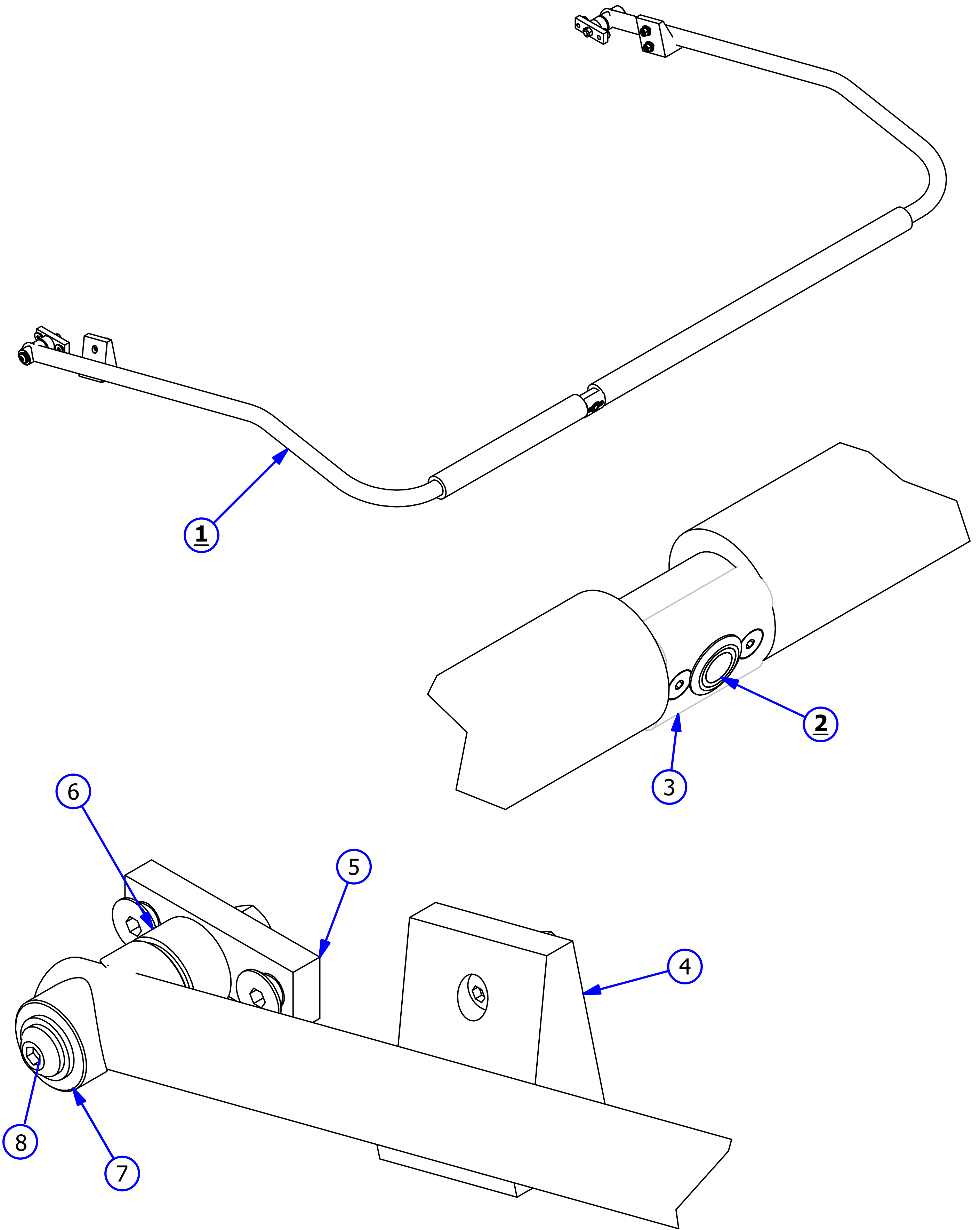


DETAIL A

HANDLE ASSEMBLY

REV. 12/18

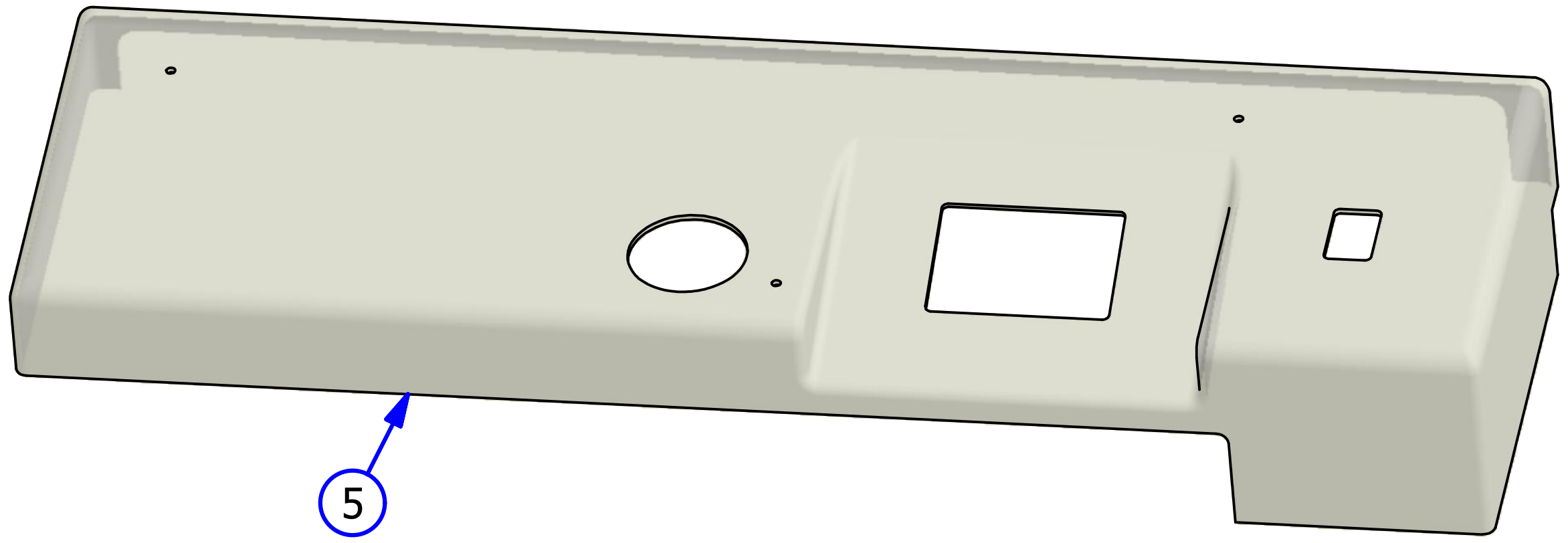
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8012	HANDLE ASSEMBLY (COMPLETE)	EA
2	1	164-8013	HANDLE BUTTON REPLACEMENT ASSEMBLY (W/WIRES)	EA
3	1	164-6083	BUTTON COLLAR	EA
	2	158-2003	SCREW 8-32 X 1/2 FHCS BLK OXIDE	EA
4	2	164-6057	HANDLE CATCH	EA
5	2	164-6084	HANDLE MOUNT ASSEMBLY	EA
6	2	164-6058	HANDLE SPACER	EA
7	4	164-2001	UNTHREADED CURVED SPACER BLACK	EA
8	2	164-2028	HHCS FLANGED 5/16-18 X 3 PARTIAL THREAD	EA



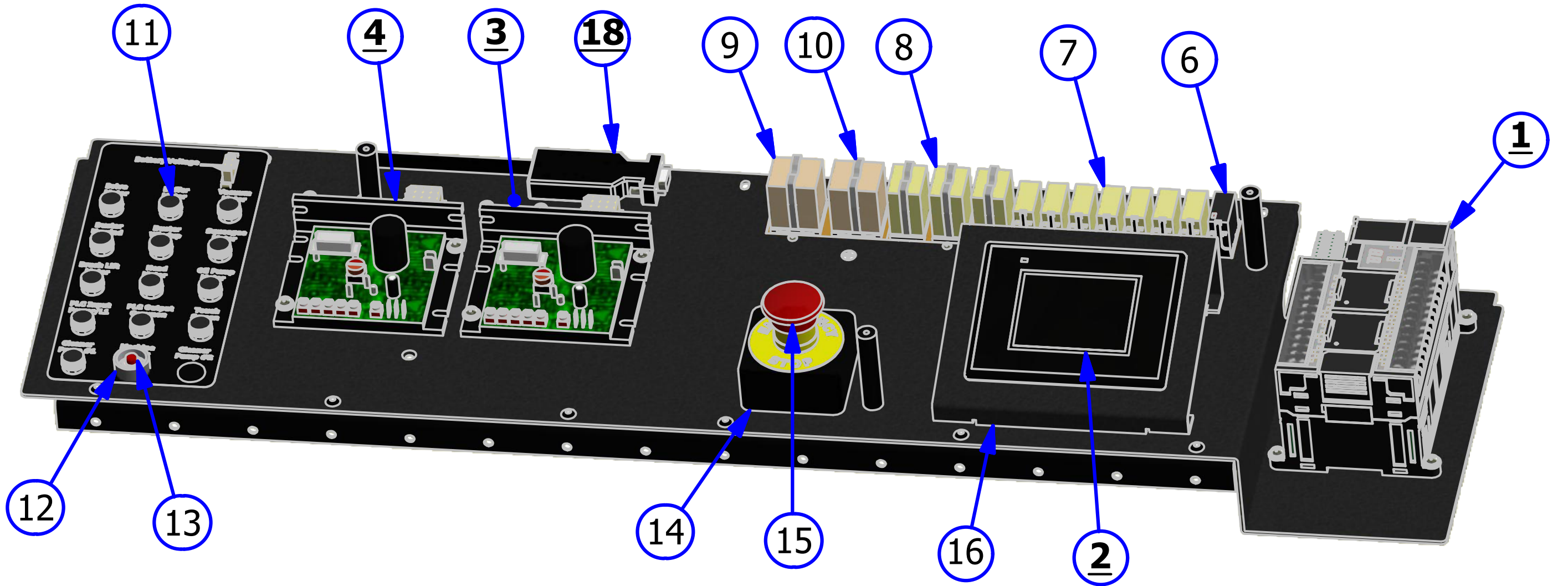
PLC PLATE ASSEMBLY

REV. 1/18

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	158-1610P	PLC FOR IKON - SPECIFY SOFTWARE VERSION	EA
	1	158-1610S	SERIAL CONVERTER FOR FLEX	EA
	1	164-1235	CABLE TO TOUCHSCREEN - 24IN (NOT SHOWN)	EA
2	1	164-8803	TOUCH SCREEN ASSEMBLY	EA
	1	164-1234	SCREEN PROTECTOR (NOT SHOWN)	EA
3	1	164-8807	SPEED CONTROL ASSEMBLY - DRIVE	EA
4	1	164-8806	SPEED CONTROL ASSEMBLY - CLEANER PUMP	EA
5	1	164-6815	CLEAR PC PLATE COVER	EA
6	2	158-1460	RELAY SOLID STATE	EA
7	6	158-1458	RELAY - OMRON 24DC DPDT GENERAL PURPOSE	EA
8	6	158-1462	24 V RELAY DPDT 10A W/DIODE	EA
9	2	164-1231	LY3 RELAY	EA
10	2	164-1207	LY3 RELAY CLIP	EA
11	13	153-1028	PANEL-MOUNT FUSE HOLDER - UL (COMPLETE)	EA
12	1	153-1209	BUTTON GUARD	EA
13	1	158-8439	PUSH BUTTON (RED = NORMALLY OPEN)	EA
14	1	164-6161	E-STOP BOX	EA
15	1	164-8223	E-STOP SWITCH ASSEMBLY	EA
	1	164-1223B	BREAKER FOR ESTOP	EA
16	1	164-6805-2850	TOUCH SCREEN MOUNT	EA
17	2	158-1465	CONTACTOR 24VDC	EA
18	1	164-8820	WI-FI ADAPTER REPLACEMENT ASSEMBLY	EA



5



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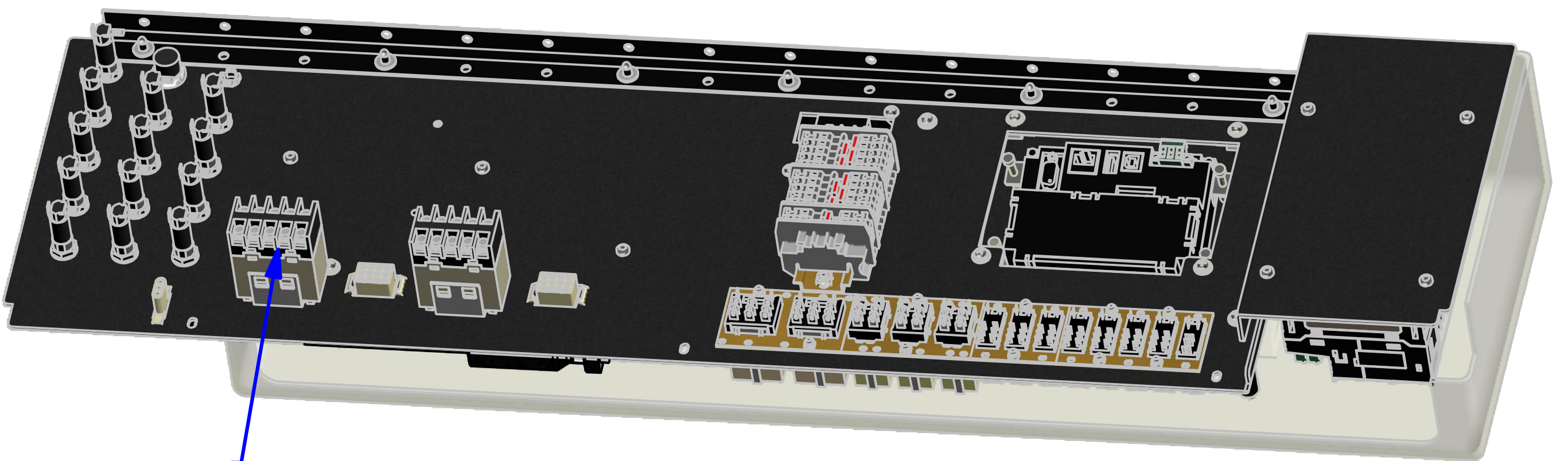
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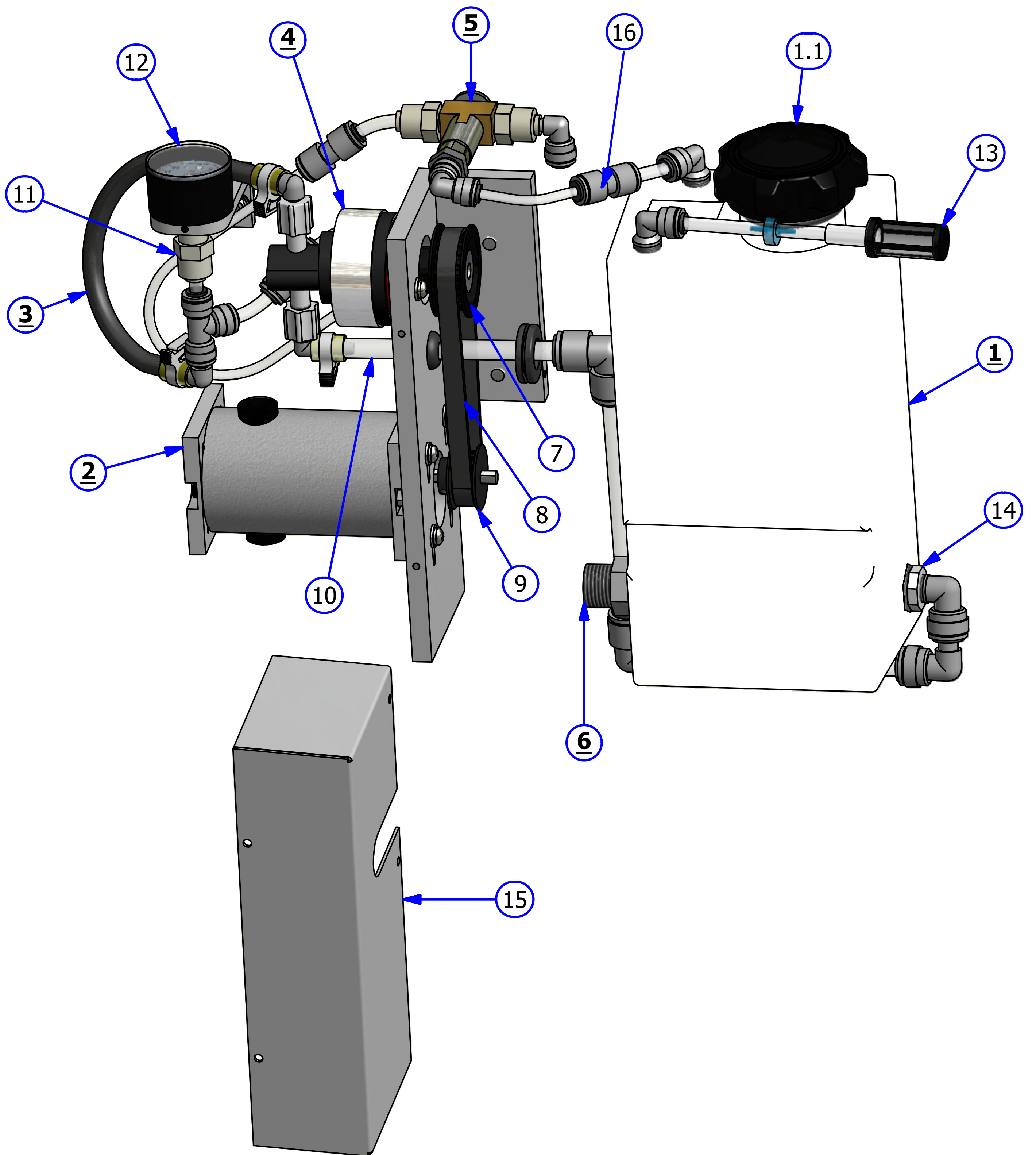


17

OIL VALVE ASSEMBLY

REV. 10/18

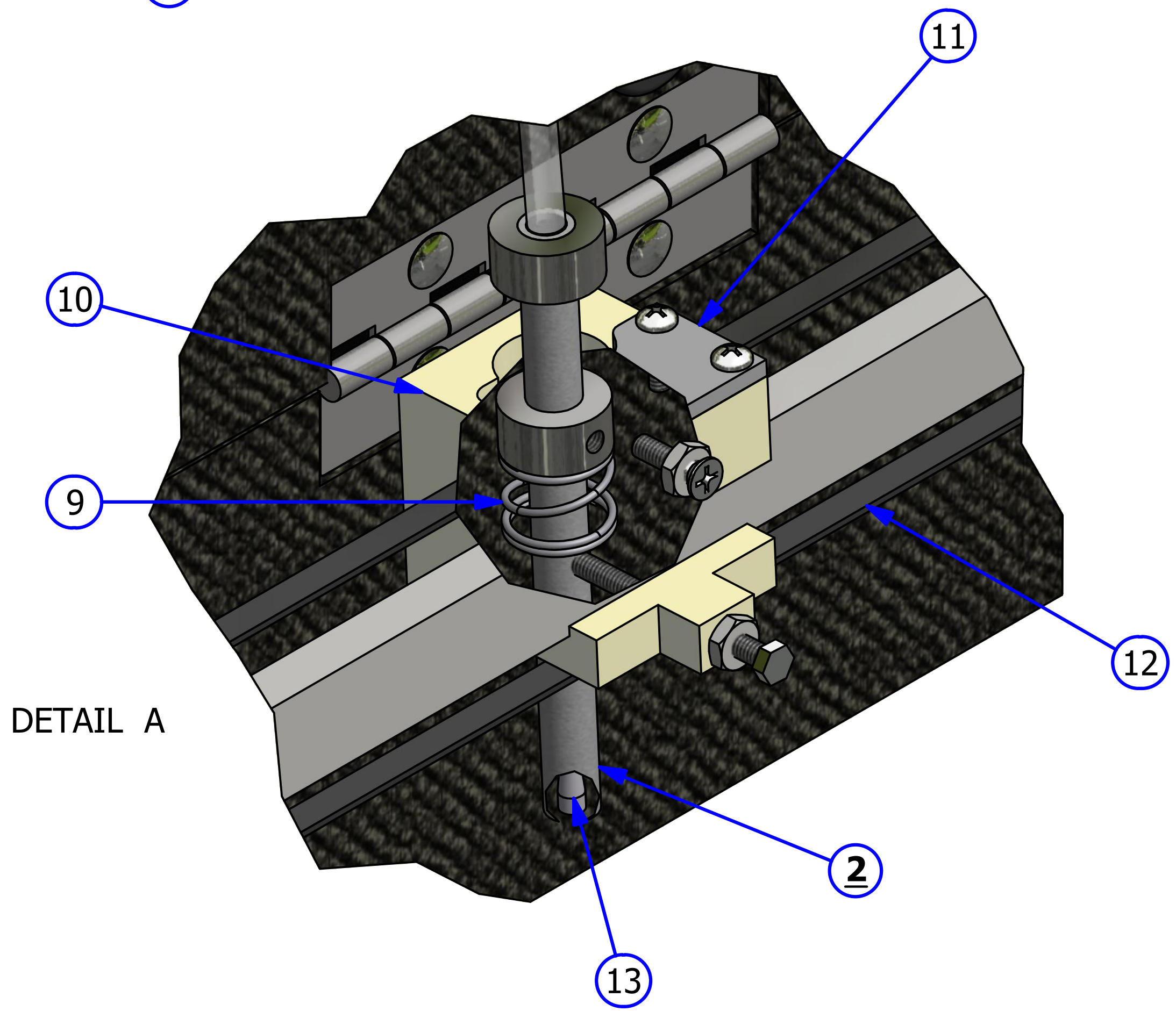
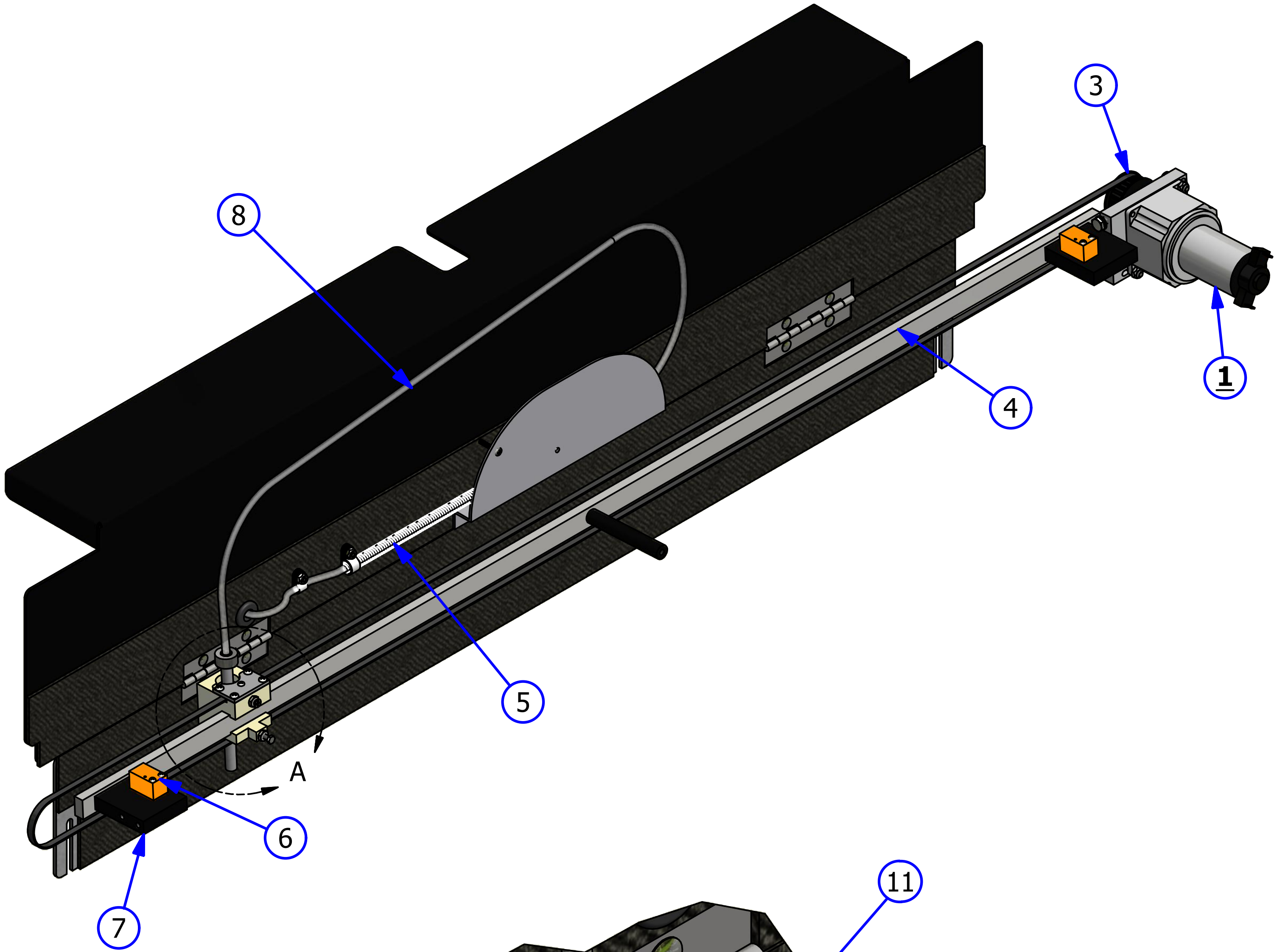
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
<u>1</u>	1	154-8682	CONDITIONER TANK ASSEMBLY	EA
	1	164-8081	SUPPLY TANK CAP (NOT SHOWN)	EA
	1	164-0021	GASKET FOR SUPPLY TANK CAP (NOT SHOWN)	EA
<u>2</u>	1	158-8401A	OIL PUMP MOTOR ASSEMBLY	EA
<u>3</u>	1	154-8816	PULSE SUPPRESSION TUBE	EA
<u>4</u>	1	154-1214	FLUID METERING PUMP-0.05 ML/STROKE	EA
<u>5</u>	1	154-8298	OIL CONTROL VALVE (24VDC) WITH EXTENDED WIRES	EA
6	1	154-8693	FLOAT SWITCH ASSEMBLY	EA
7	1	154-9607	PULLEY - (24XL 5/16" BORE)	EA
8	1	154-9202A	CONDITIONER PUMP BELT	EA
9	1	154-9404	PULLEY 16XL037 X 1/4" BORE	EA
10	16.5	154-0202	PUMP TUBING STOCK (3/8" OD X 1/4"ID)	IN
11	1	154-0257	FEMALE CONNECTOR - 1/4" TUBE X 1/8" FPT	EA
12	1	158-1613	PRESSURE GAUGE - 60PSI	EA
13	1	154-8817	MANUAL VENT VALVE ASSEMBLY	EA
14	1	154-0212	OIL TANK FILTER ASSEMBLY	EA
15	1	154-6287	GUARD FOR PUMP	EA
16	1	154-0248	REDUCING UNION CONNECTOR-1/4" X 3/16"	EA



OIL HEAD ASSEMBLY

REV. 5/16

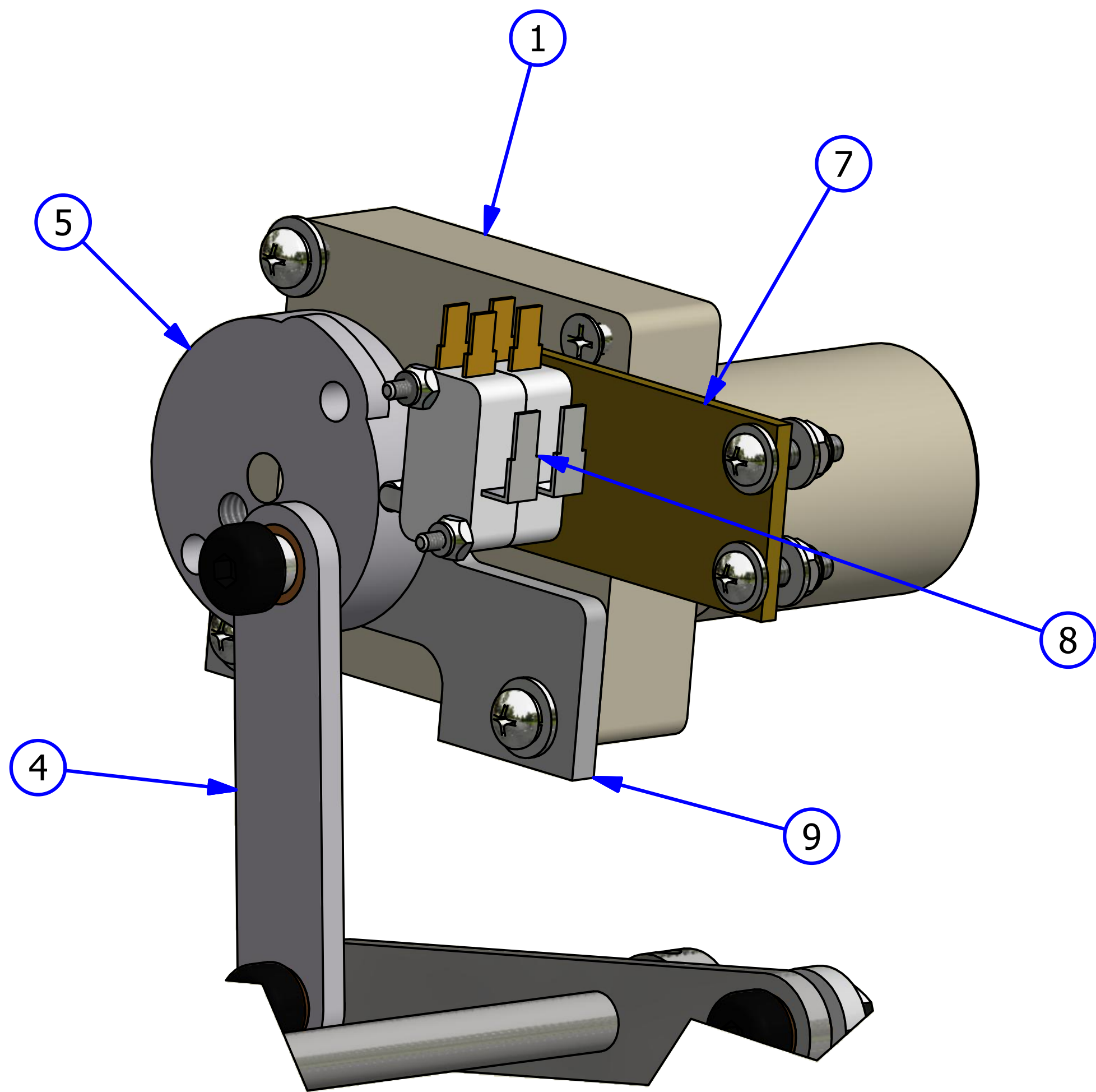
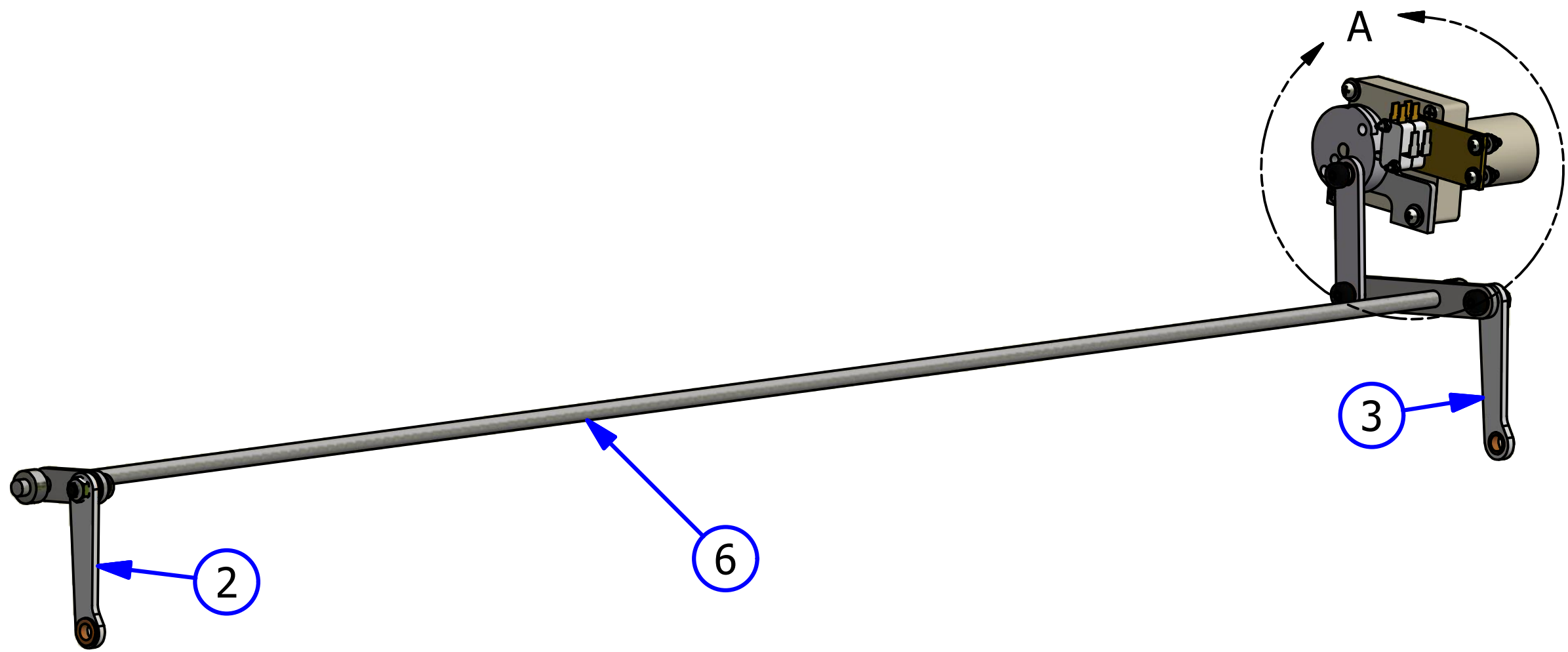
<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
<u>1</u>	1	158-8405	OIL HEAD DRIVE MOTOR ASSEMBLY	EA
<u>2</u>	1	154-8851	OIL HEAD HOSE AND TIP ASSEMBLY	EA
3	1	154-9607	PULLEY	EA
4	1	154-6647A	SLIDING HEAD BAR ASSEMBLY	EA
5	1	154-0206	SPRING FOR OIL HOSE TIP ASSEMBLY	EA
6	2	154-0220	PROXIMITY SENSOR	EA
7	2	164-6280	HEAD BAR MOUNTING BLOCK	EA
8	1	154-0202A	PENCIL TUBING STOCK	IN
9	1	153-2713	OIL HEAD SPRING	EA
10	1	154-6893	OIL HEAD ASSEMBLY	EA
11	1	154-6646	HEAD MOUNT PLATE ASSEMBLY	EA
12	1	154-9201	OIL HEAD DRIVE BELT ASSEMBLY	EA
13	1	154-6832	OIL PENCIL TIP ASSEMBLY	EA



BRUSH LIFT ROD ASSEMBLY

REV. 5/16

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	158-8402	MOTOR ASSEMBLY - 24VDC	EA
2	1	154-8639	BUFFER BRUSH LOWER LINK - RIGHT	EA
3	1	154-8638	BUFFER BRUSH LOWER LINK - LEFT	EA
4	1	154-8837	BRUSH LIFT ROD TO CAM LINK	EA
5	1	154-6243	MOTOR CAM-DUAL LOBES (STACKED SWITCHES)	EA
6	1	154-8637	BRUSH LIFT ROD ASSEMBLY	EA
7	1	154-6824	CAM SWITCH PLATE	EA
8	2	153-1203	MICROSWITCH W/ROLLER	EA
9	1	158-8634	SQUEEGEE/BRUSH MOUNT PLATE ASSEMBLY	EA
	1	158-9614	BALL BEARING MINITURE (NOT SHOWN)	EA

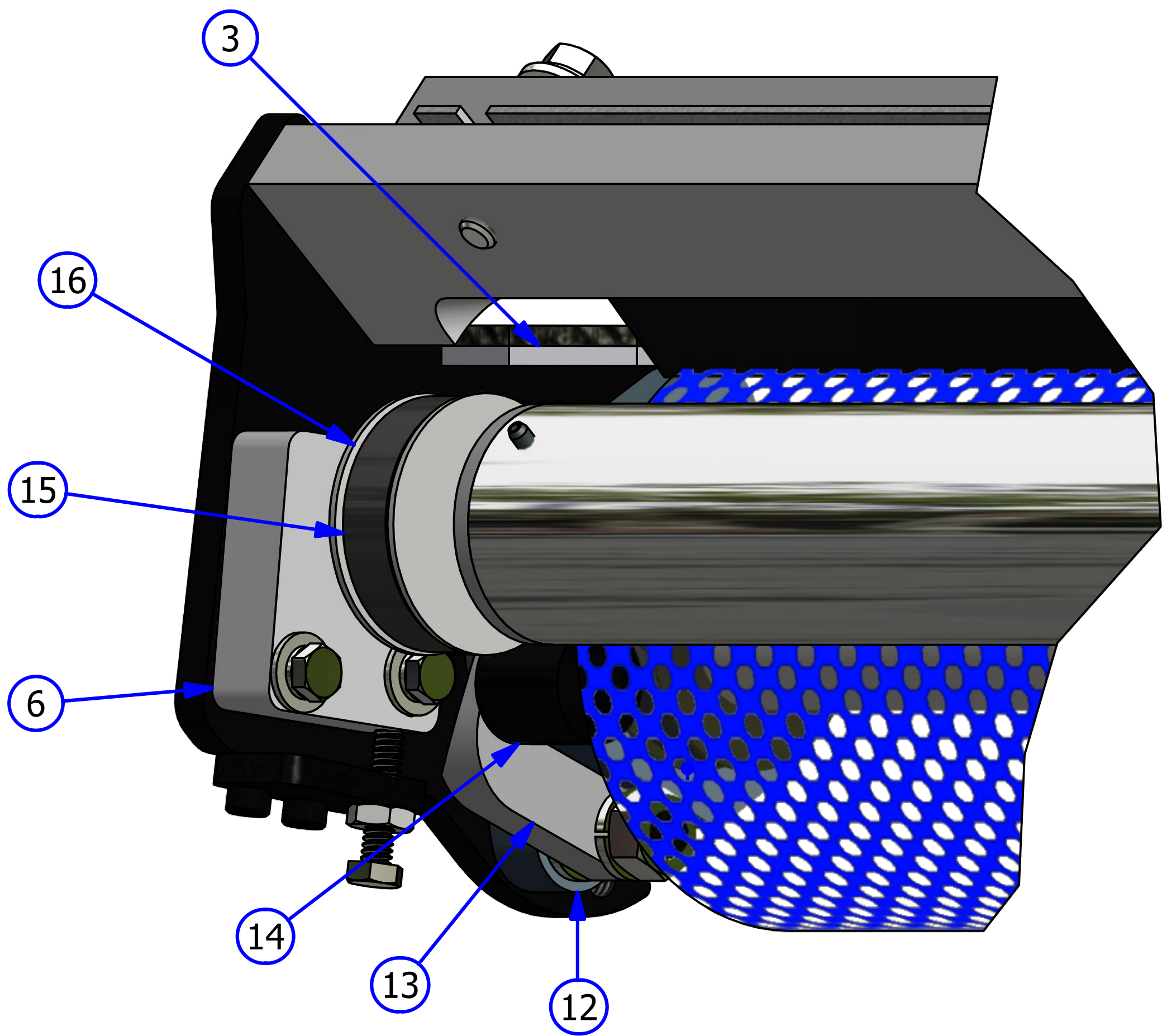
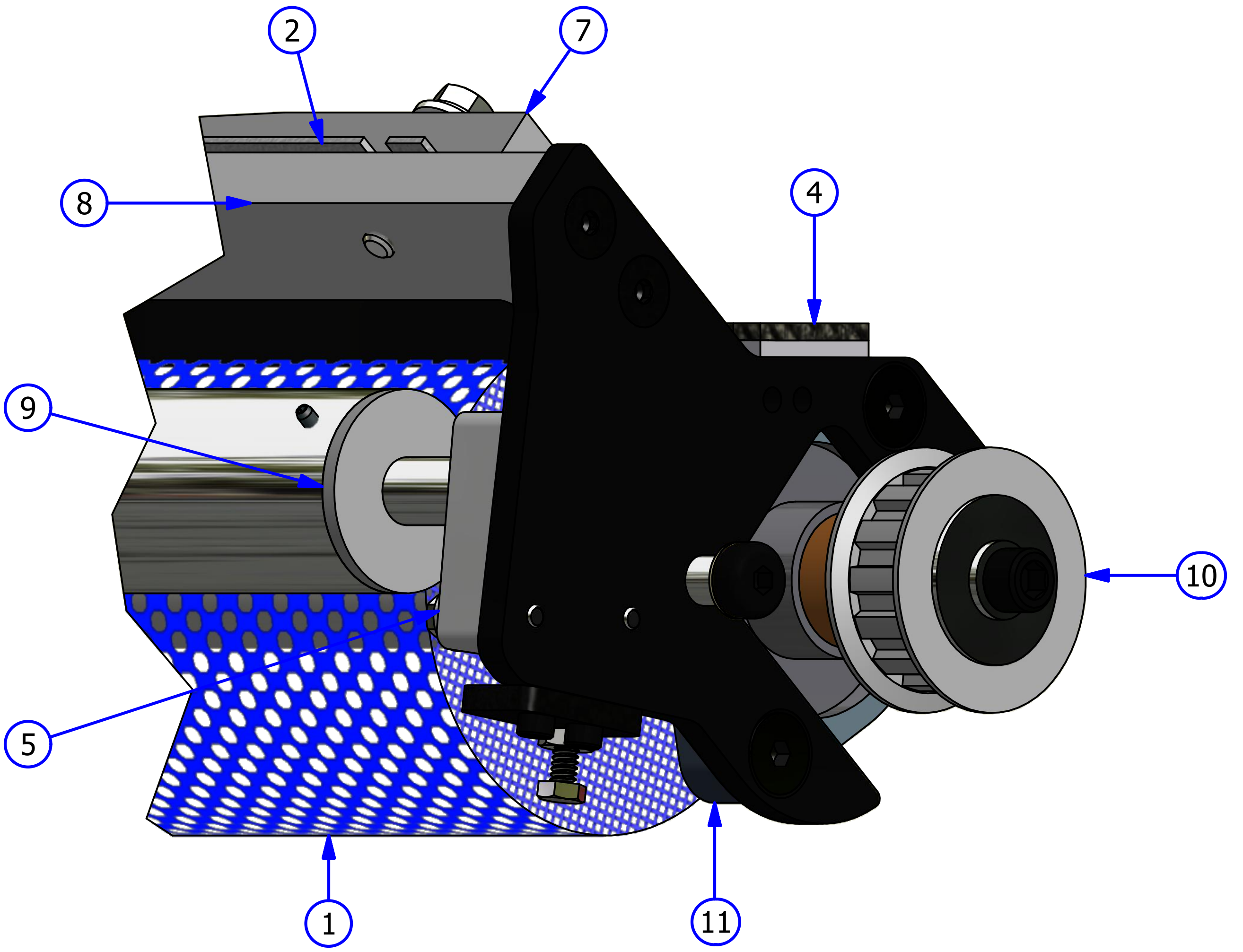


DETAIL A

OIL TRANSFER ASSEMBLY

REV. 9/17

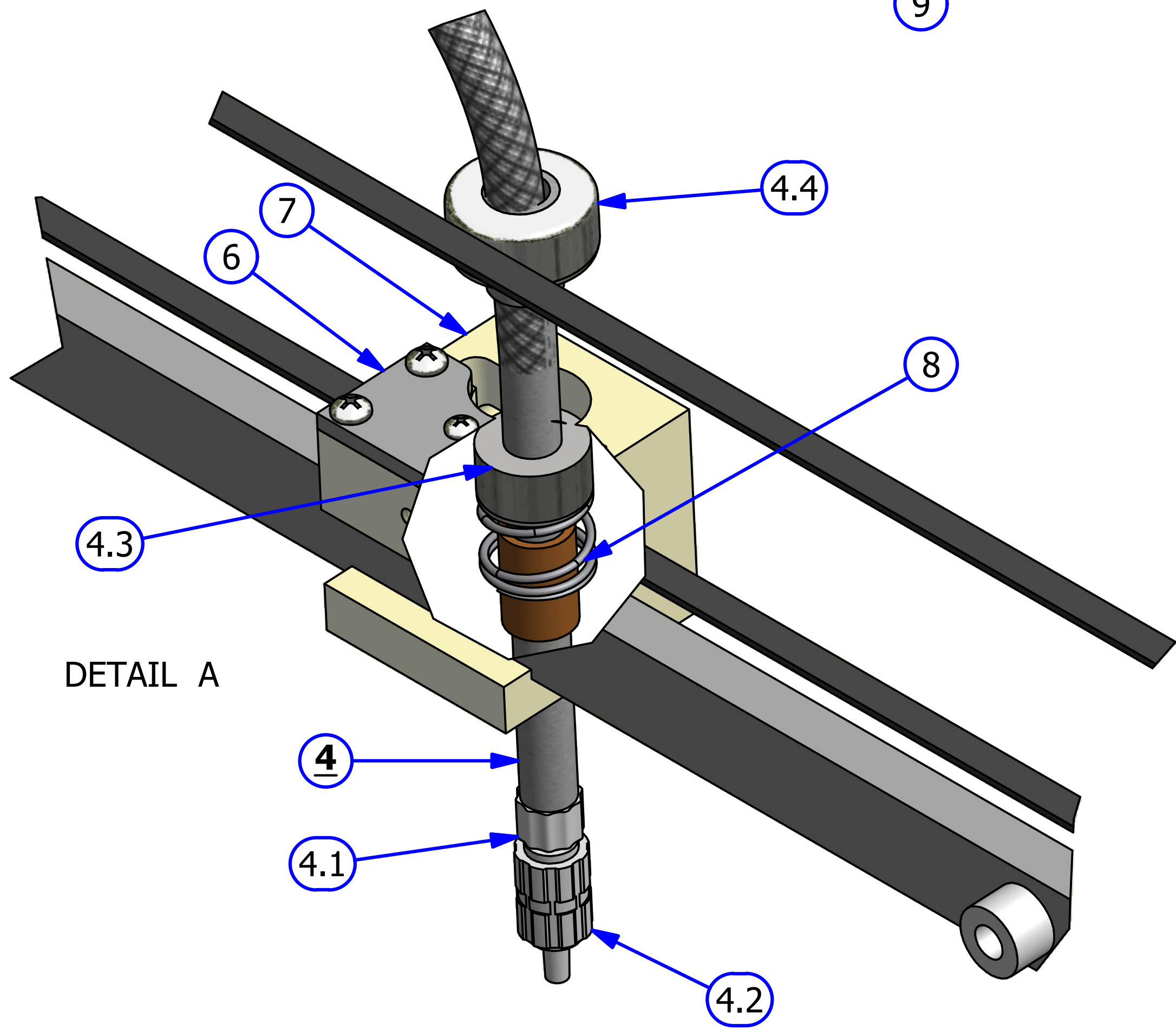
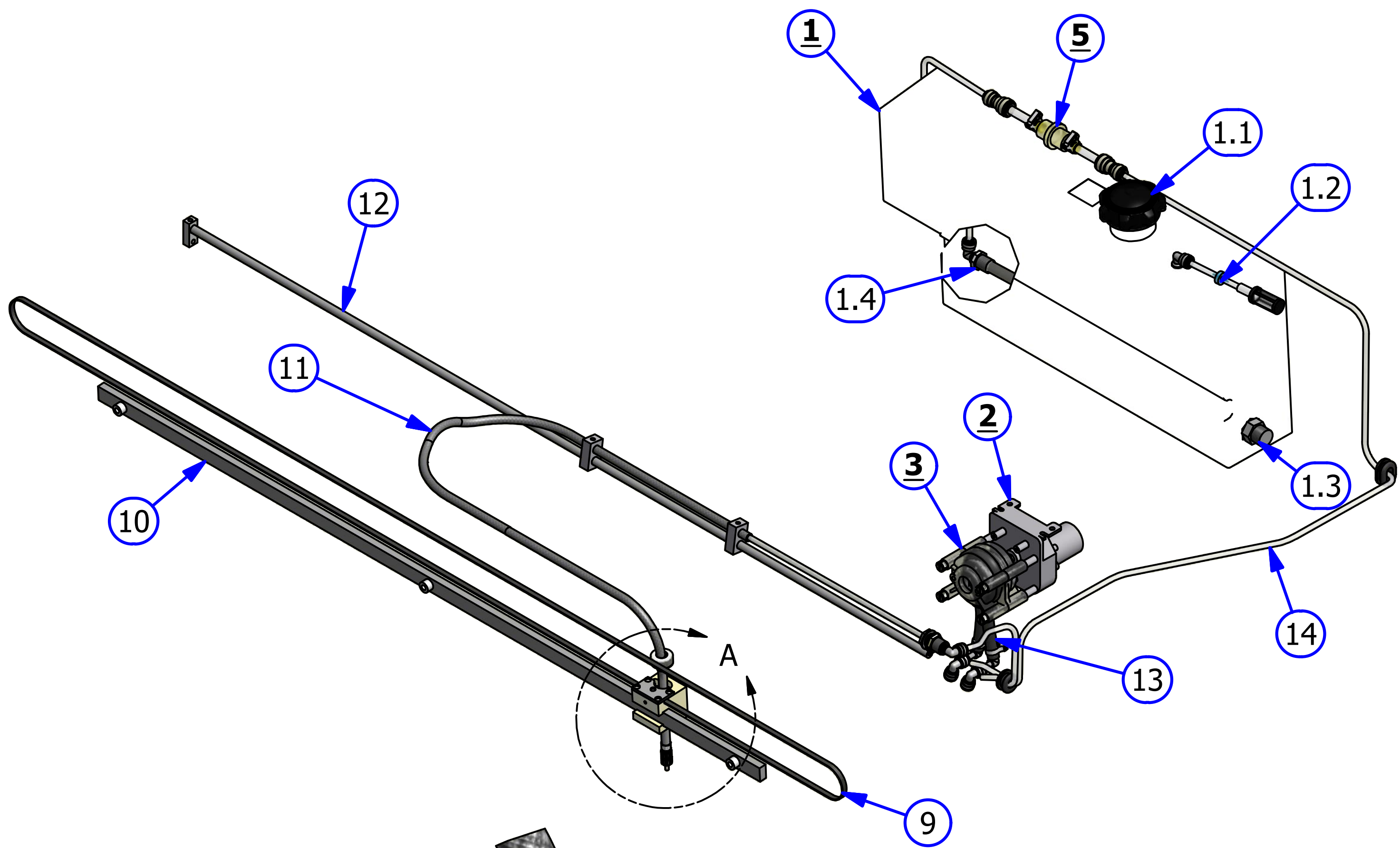
<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	164-8001A	BUFFER BRUSH ASSEMBLY	EA
2	1	164-0866	SINGLE TRANSFER BRUSH ASSEMBLY	EA
3	1	164-8805	DRIP PAD ASSEMBLY (SOLD IN PAIRS)	PR
4	1	164-8805	DRIP PAD ASSEMBLY (SOLD IN PAIRS)	PR
5	1	164-8046	BEARING MOUNT ASSEMBLY - LEFT	EA
6	1	164-8045	BEARING MOUNT ASSEMBLY - RIGHT	EA
7	1	158-6735	BRUSH TRACK MOUNT SUPPORT	EA
8	1	158-6732	SINGLE BRUSH TRACK MOUNT ASSEMBLY	EA
9	1	164-8008	TRANSFER ROLLER ASSEMBLY	EA
10	1	158-9402	BUFFER BRUSH PULLEY ASSEMBLY	EA
11	1	153-9816	FLANGED BUFFER BRUSH BEARING	EA
12	1	154-8640	FLANGED BUFFER BRUSH BEARING - ROTATED	EA
13	2	164-6051	TRANSFER ROLLER IDLER BELT BLOCK	EA
14	1	158-6742	TRANSFER ROLLER BELT IDLER ROLLER ASSEMBLY	EA
15	1	154-9203	TRANSFER TOLLER BELT ASSEMBLY	EA
16	1	164-9015	PULLEY ASSEMBLY	EA



CLEANER TANK AND HEAD ASSEMBLY

REV. 5/15

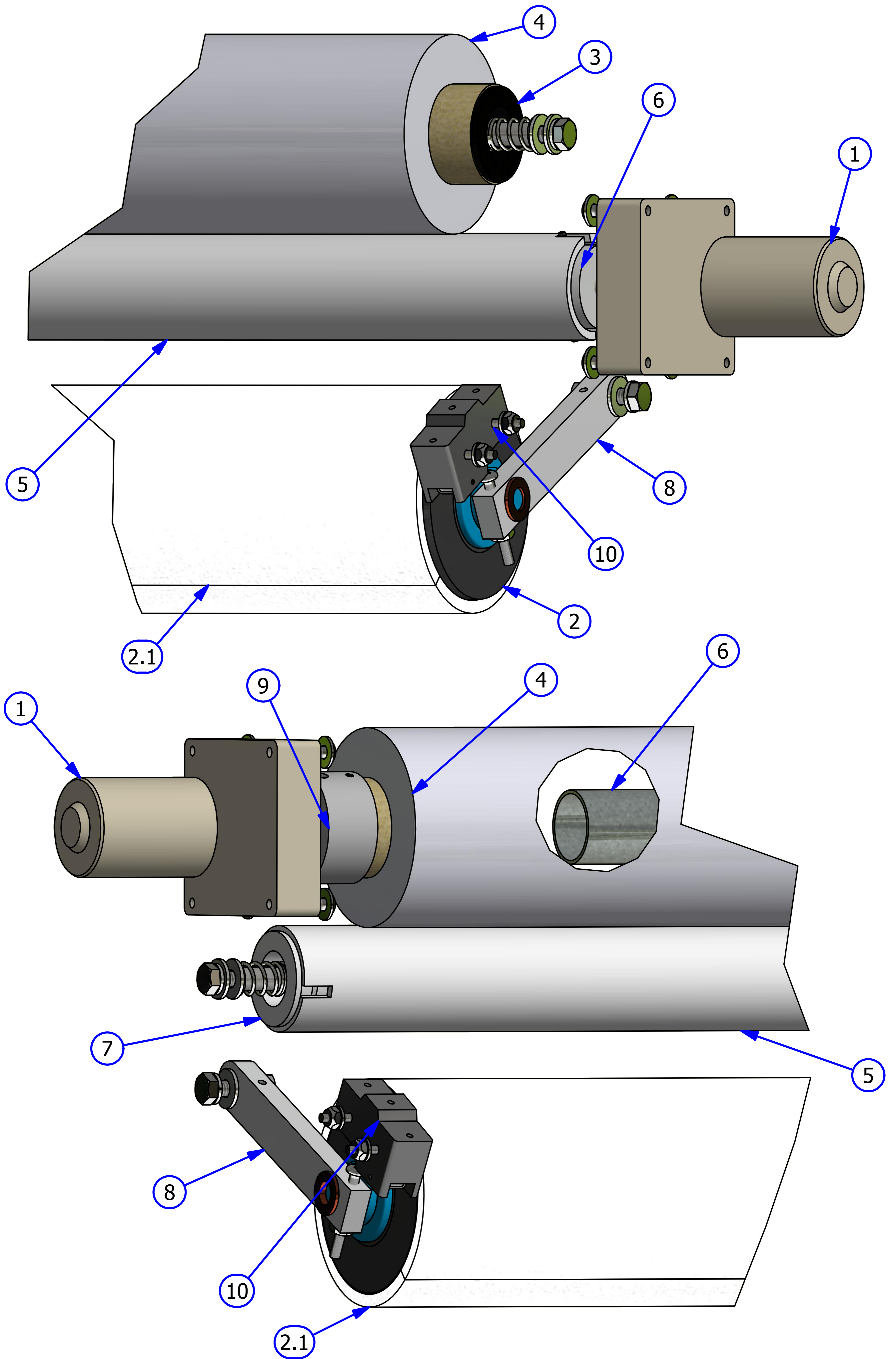
<u>INDEX</u> <u>NUMBER</u>	<u>QTY.</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	158-8433C	CLEANER SUPPLY TANK ASSEMBLY (COMPLETE)	EA
1.1	1	164-8081	CLEANER SUPPLY TANK CAP	EA
1.2	1	154-8817	MANUAL VENT VALVE ASSEMBLY	EA
1.3	1	154-8693	CLEANER FLOAT SWITCH ASSEMBLY	EA
1.4	1	154-0212B	FILTER ASSEMBLY	EA
1.5	1	164-0021	CLEANER SUPPLY CAP GASKET (NOT SHOWN)	EA
2	1	158-8404	CLEANER PUMP MOTOR ASSEMBLY	EA
3	1	158-8404D	CLEANER PUMP ASSEMBLY	EA
4	1	154-8852	CLEANER HOSE AND TIP ASSEMBLY	EA
4.1	1	154-0863	LURE HOSE BARB	EA
4.2	1	164-0012M	CLEANER TIP WITH CHECK VALVE	EA
4.3	1	153-2804	COLLAR - 3/8 X 3/4 X 3/8	EA
4.4	1	153-2902	COLLAR - 1/2 X 1 1/8 X 1/2	EA
5	1	154-8867A	IN LINE FILTER ASSEMBLY	EA
6	1	154-6646	CLEANER HEAD BELT MOUNT PLATE	EA
7	1	154-6882	CLEANER HEAD ASSEMBLY	EA
8	1	153-2713	SPRING FOR CLEANER HEAD ASSEMBLY	EA
9	1	154-9201	CLEANER HEAD BELT ASSEMBLY	EA
10	1	154-6877	CLEANER HEAD BAR ASSEMBLY	EA
11	1	154-0867	SPRING, CLEANER HOSE	EA
12	1	154-6889	CLEANER HOSE ROUTING BAR	EA
13	1	154-0861B	NORPRENE TUBING	EA
14	16	154-0202A	PENCIL TUBING STOCK - 1/4" OD X 1/8" ID	IN



DUSTER ASSEMBLY

REV. 8/18

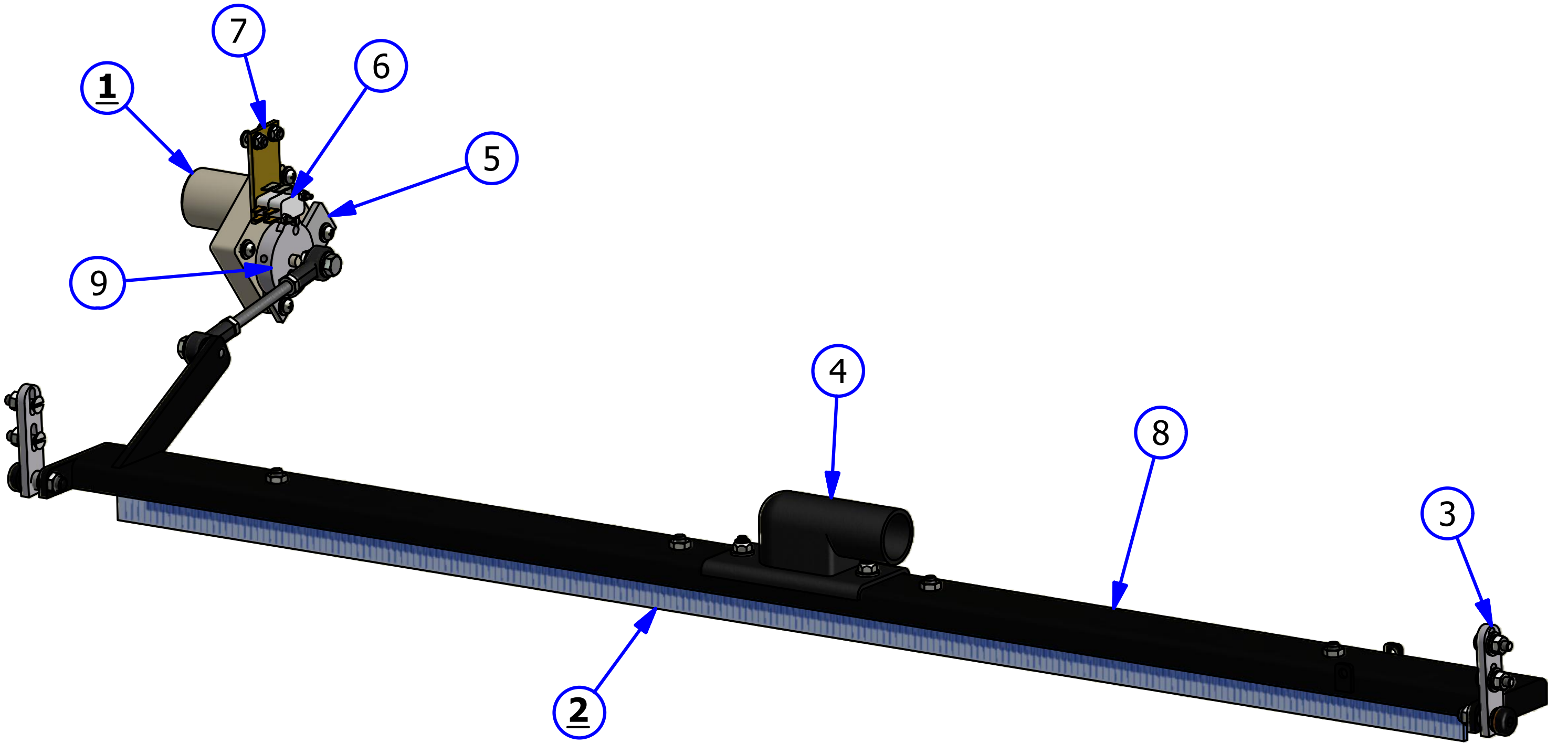
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	2	158-8403	DUSTER MOTOR ASSEMBLY	EA
2	1	164-8839	CUSHION ROLLER WITH WRAP ASSEMBLY	EA
3	1	164-6108A	DUSTER PLUG CARDBOARD CORE	EA
4	1	153-0047EZ	K2 SELECT DUSTER CLOTH (BOX OF 4)	CASE
5	1	154-0052	PVC TAKE UP REEL ASSEMBLY	EA
6	1	153-0429	DUSTER ROLL SUPPORT PIPE (40 INCH)	EA
7	1	164-6109A	UHMW DUSTER PLUG FOR PVC TAKE UP REEL	EA
8	2	164-8823	CUSHION ROLLER PIVOT ARM	EA
9	1	153-8202B	DUSTER SOLID DRIVE HUB (PVC)	EA
10	2	154-1603	MICROSWITCH WITHOUT ROLLER (LARGE)	EA



SQUEEGEE ASSEMBLY

REV. 5/16

<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
1	1	158-8402	MOTOR ASSEMBLY -24VDC	EA
2	1	164-8038K	SQUEEGEE BLADE AND GASKET REPLACEMENT (1 SET)	EA
	1	164-0003	GASKET (NOT SHOWN)	EA
3	2	154-8802	SQUEEGEE ADJUSTMENT ARM	EA
4	1	154-6677A	SQUEEGEE HOSE ADAPTER NYLON	EA
5	1	158-8634	SQUEEGEE/BRUSH MOUNT PLATE ASSEMBLY	EA
	1	158-9614	BALL BEARING MINITURE (NOT SHOWN)	EA
6	2	153-1203	MICROSWITCH W/ROLLER	EA
7	1	154-6824	SQUEEGEE CAM SWITCH PLATE	EA
8	1	154-6339-2850	SQUEEGEE MOUNT ANGLE	EA
9	1	154-6243	MOTOR CAM-DUAL LOBES (STACKED SWITCHES)	EA



RECOVERY TANK AND VACUUM MOTOR

REV. 5/16

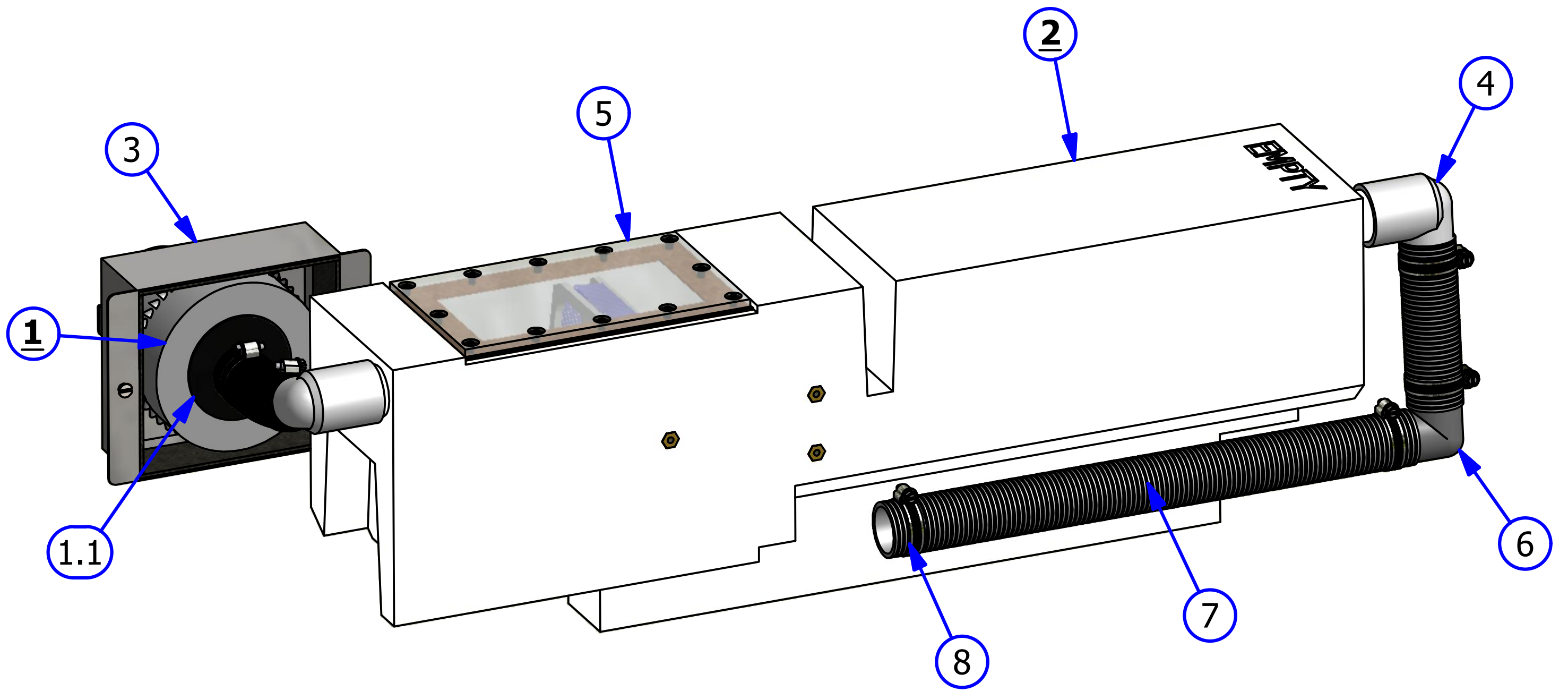
<u>INDEX NUMBER</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>UOM</u>
<u>1</u>	1	158-8407	VACUUM MOTOR ASSEMBLY	EA
1.1	1	153-6221M	VACUUM HOSE ADAPTER	EA
	1	158-1421B	VACUUM MOTOR BRUSHES (NOT SHOWN)	EA
<u>2</u>	1	164-8017	RECOVERY TANK	EA
	1	164-8017F	RECOVERY TANK FILTER (NOT SHOWN)	EA
	1	158-0405	RECOVERY TANK GASKET (NOT SHOWN)	EA
	12	153-2968	SCREW - 1/4" X 3/4" FSHCS (NOT SHOWN)	EA
4	2	153-8827T	1-1/4 PVC ELBOW-TANK INLET (NO THREADS)	EA
5	1	164-6120	FLEX RECOVERY TANK COVER PLATE	EA
6	1	154-0607	PVC ELBOW - 1-1/2 BARB X 1-1/2 BARB	EA
7	40	154-0260	FLEXIBLE HOSE - SOLD BY THE INCH	IN
8	6	153-2406	HOSE CLAMP (2 INCH)	EA



TECHNICAL NOTE

WHEN ATTACHING PART NUMBER 153-6221M, USE A TWO (2) PART EPOXY AND ALLOW TO DRY ACCORDING TO DIRECTIONS.

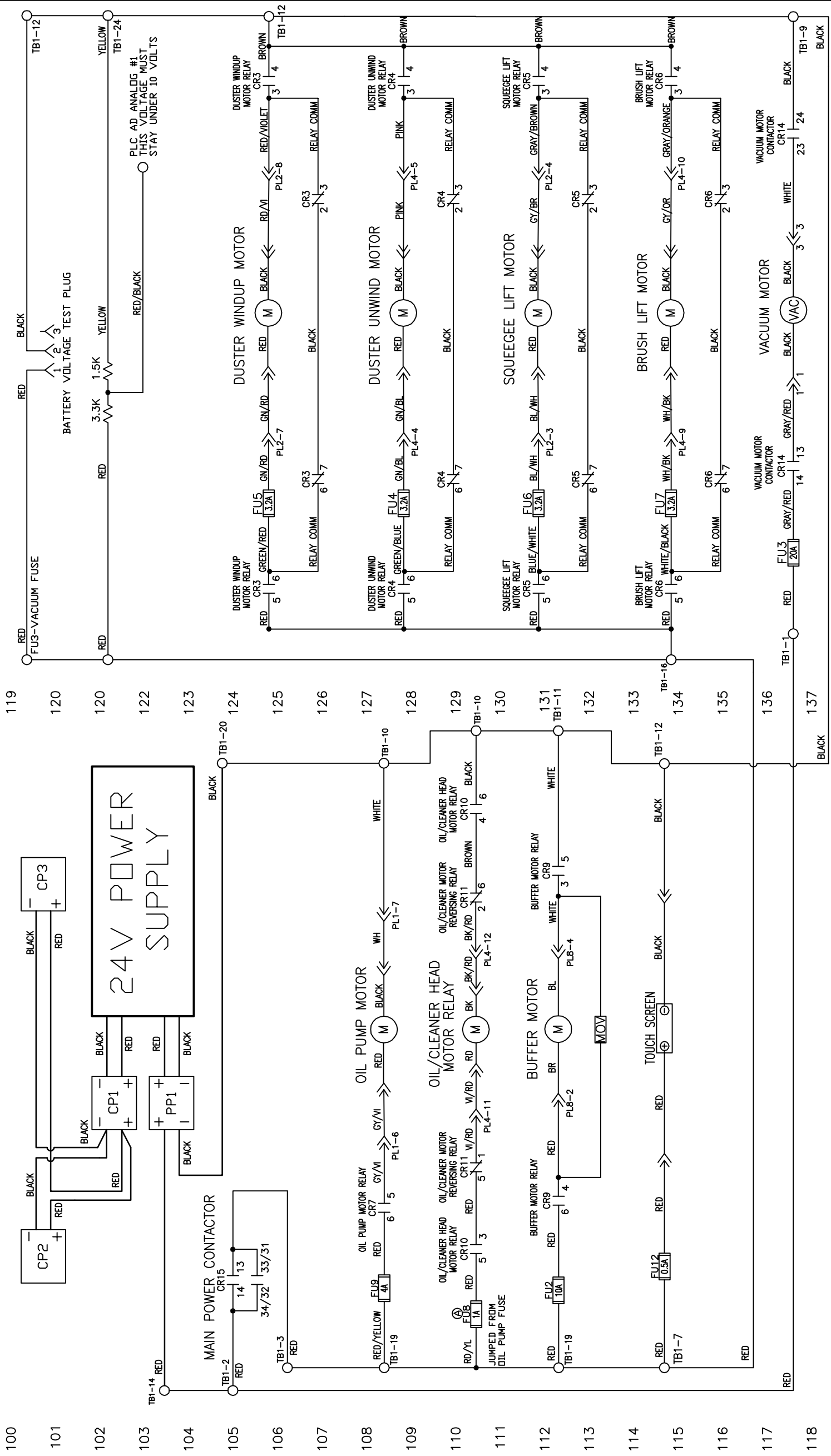
BE CAREFUL NOT TO CRUSH THE VACUUM MOTOR HOUSING INTO INTERNAL BLADES.



CHAPTER 9

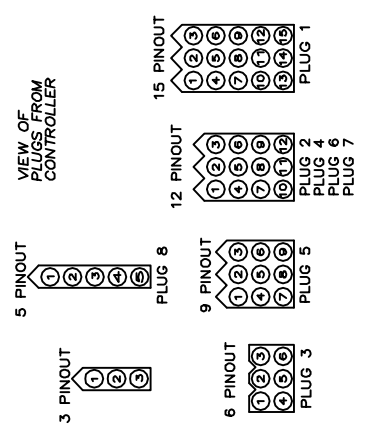
IKON ELECTRICAL DRAWINGS

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LEGEND

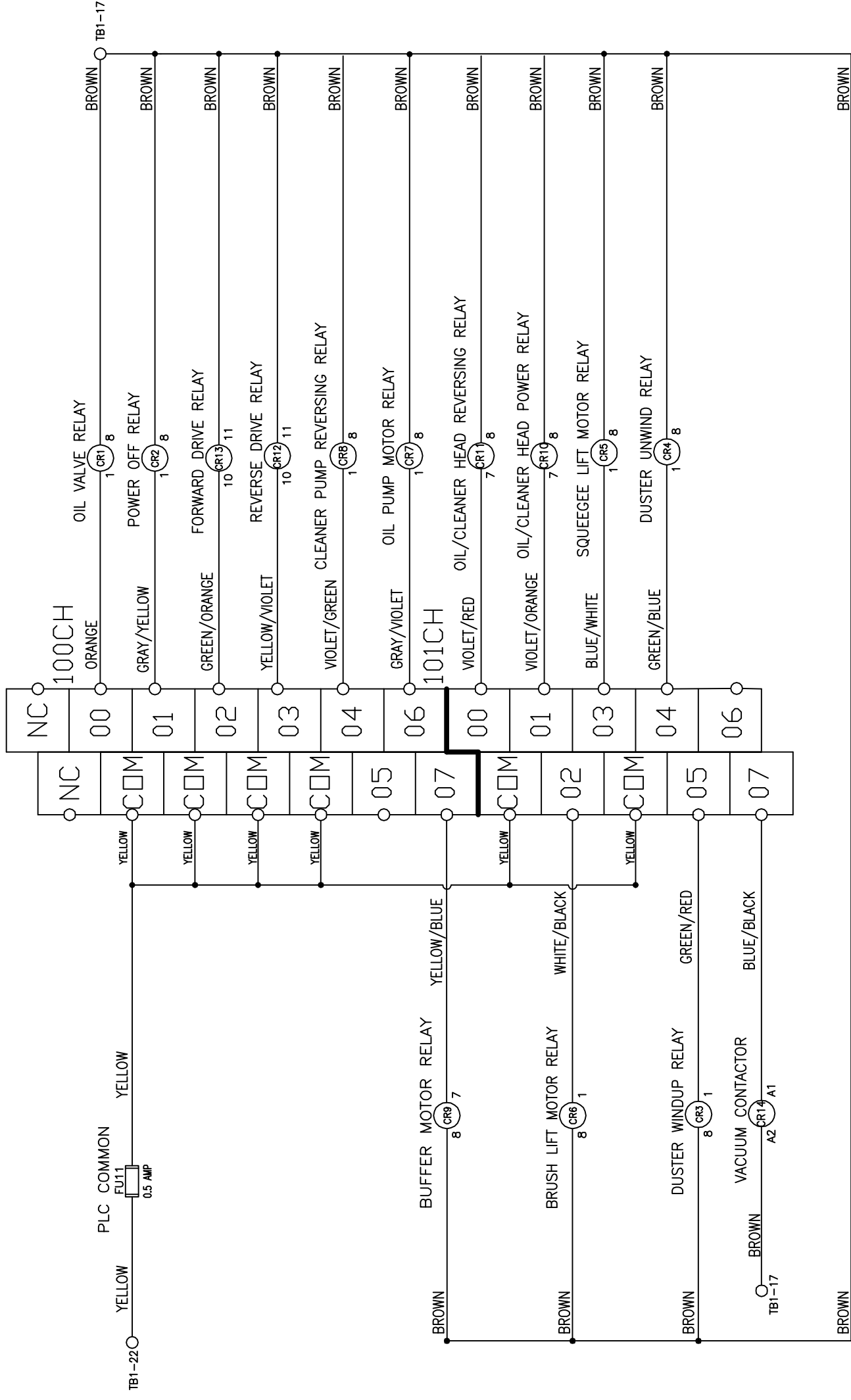
- CR1 - OIL VALVE RELAY
 - CR2 - POWER OFF RELAY
 - CR3 - DUSTER WINDUP MOTOR RELAY
 - CR4 - DUSTER UNWIND MOTOR RELAY
 - CR5 - SQUEEGEE LIFT MOTOR RELAY
 - CR6 - BRUSH LIFT MOTOR RELAY
 - CR7 - OIL PUMP MOTOR RELAY
 - CR8 - CLEANER PUMP REVERSING RELAY
 - CR9 - BUFFER MOTOR RELAY
 - CR10 - OIL/CLEANER HEAD POWER RELAY
 - CR11 - OIL/CLEANER HEAD REVERSING RELAY
 - CR12 - REVERSE DRIVE MOTOR RELAY
 - CR13 - FORWARD DRIVE MOTOR RELAY
 - CR14 - VACUUM MOTOR CONTACTOR
 - CR15 - MAIN POWER CONTACTOR
- FU1 - DRIVE MOTOR 7.5A
 - FU2 - BUFFER MOTOR 10A
 - 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 1A
 - FU9 - OIL PUMP MOTOR 4A
 - FU10 - PLC INPUT POWER/L1 0.5A
 - FU11 - PLC OUTPUT COMMON 0.5A
 - FU12 - TOUCH SCREEN 0.5A
 - FU13 - CLEANER PUMP 3.2A
 - FU14 -
 - FU15 -
 - FU16 - LED LIGHT 1A
- PL1 - 10-PIN SIDE PLUG (15)
 - PL2 - 10-PIN SIDE PLUG (12)
 - PL3 - 10-PIN SIDE PLUG (6)
 - PL4 - 7-PIN SIDE PLUG (12)
 - PL5 - 7-PIN SIDE PLUG (9)
 - PL6 - DRIVE SPEED BOARD PLUG (12)
 - PL7 - CLEANER PUMP SPEED BOARD PLUG (12)
 - PL8 - BUFFER MOTOR PLUG (5)
- CP1 - CHARGING PLUG BATTERY (BLUE)
 - CP2 - CHARGING PLUG INSIDE (BLUE)
 - CP3 - CHARGING PLUG OUTSIDE (BLUE)
 - PP1 - POWER PLUG (RED)
- TB1 - TERMINAL BLOCK 1 (MAIN)
 - TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
 - TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)



REV	LTR	DATE	DESCRIPTION
A		12/15/17	Changed Head Drive Fuse From 0.75A to 1A Car# 17117
B		01/05/18	REMOVED CVR CAR# 17118

MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 38859 (866) 784-0200	
N/A		KEGEL	
DESCRIPTION			
MOTOR WIRING SCHEMATIC			
DRAWN BY	SLS	DATE	07/21/15
APPROVED:	MP	REV DATE	
DOC REV		SIZE	QTY/MACHINE PART NUMBER
		C	N/A
		SCALE	N/A
		SHEET	1 OF 22

OMRON
SYSMAC
CPIH
OUTPUTS

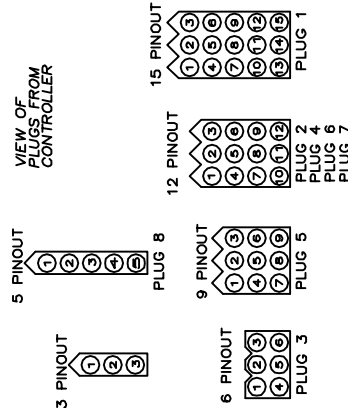


LEGEND

- CR1 - OIL VALVE RELAY
- CR2 - POWER OFF RELAY
- CR3 - DUSTER WINDUP MOTOR RELAY
- CR4 - DUSTER UNWIND MOTOR RELAY
- CR5 - SQUEEGEE LIFT MOTOR RELAY
- CR6 - BRUSH LIFT MOTOR RELAY
- CR7 - OIL PUMP MOTOR RELAY
- CR8 - CLEANER PUMP REVERSING RELAY
- CR9 - BUFFER MOTOR RELAY
- CR10 - OIL/CLEANER HEAD POWER RELAY
- CR11 - OIL/CLEANER HEAD REVERSING RELAY
- CR12 - REVERSE DRIVE MOTOR RELAY
- CR13 - FORWARD DRIVE MOTOR RELAY
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- CR15 - MAIN POWER CONTACTOR

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- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 1A
- FU9 - OIL PUMP MOTOR 4A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - PLC OUTPUT COMMON 0.5A
- FU12 - TOUCH SCREEN 0.5A
- FU13 - CLEANER PUMP 3.2A
- FU14 -
- FU15 -
- FU16 - LED LIGHT 1A

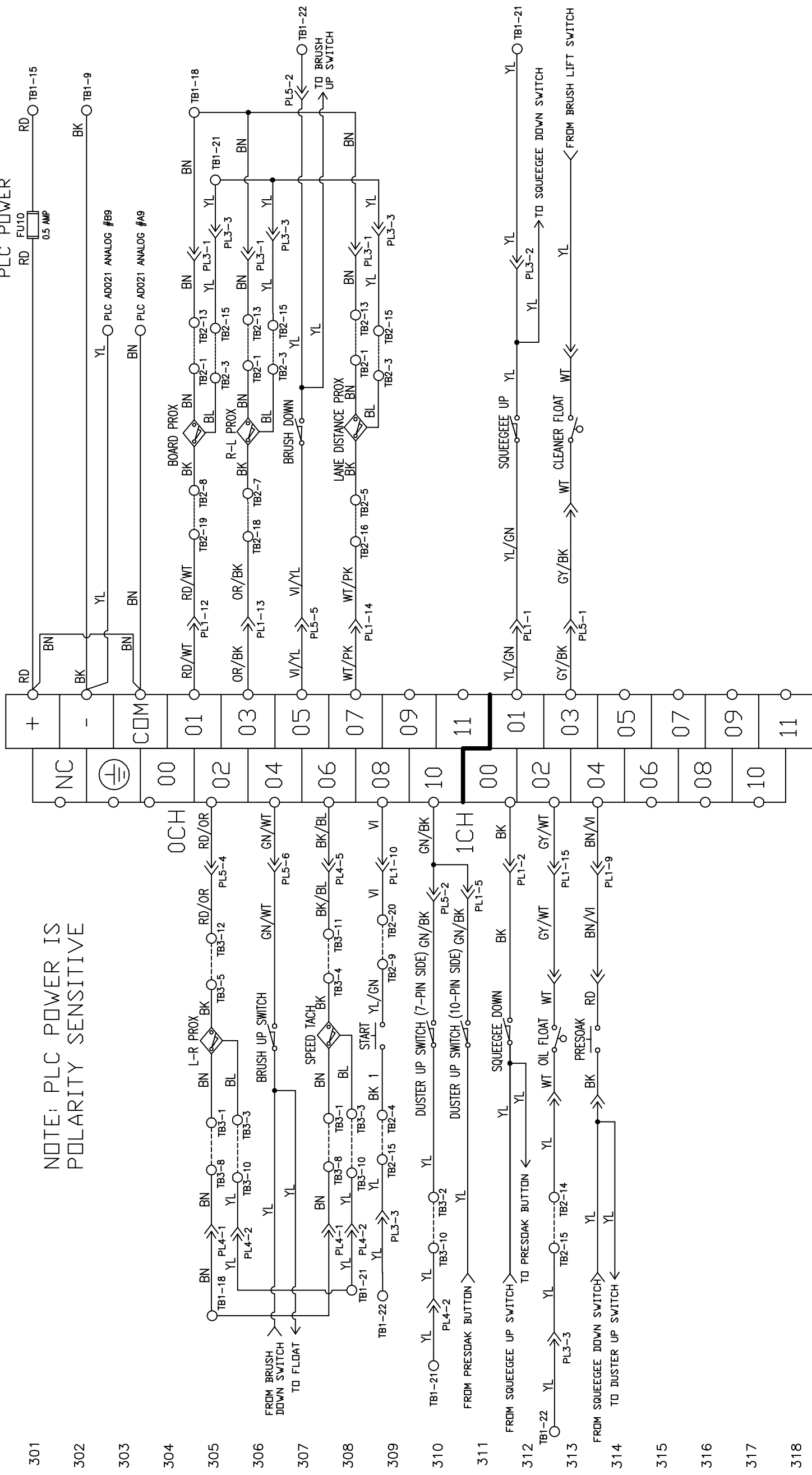
- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (6)
- PL4 - 7-PIN SIDE PLUG (12)
- PL5 - 7-PIN SIDE PLUG (9)
- PL6 - DRIVE SPEED BOARD PLUG (12)
- PL7 - CLEANER PUMP SPEED BOARD PLUG (12)
- PL8 - BUFFER MOTOR PLUG (5)
- CP1 - CHARGING PLUG BATTERY (BLUE)
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- CP3 - CHARGING PLUG OUTSIDE (BLUE)
- PP1 - POWER PLUG (RED)
- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)



MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33859 (863) 734-0200	
N/A		KEGEL	
DESCRIPTION		DO NOT SCALE DRAWING	
OUTPUT WIRING SCHEMATIC		SIZE	QTY/MACHINE PART NUMBER
C	N/A	C	N/A
SCALE	N/A	17-5900	SHEET 2 OF 22
DATE	07/20/15	REV	
DRAWN BY	SLS	MP	
APPROVED:			

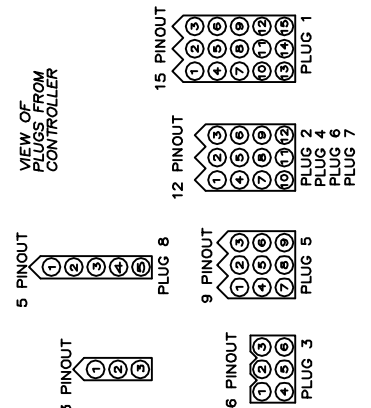
OMRON SYSMAC CP1H INPUTS

NOTE: PLC POWER IS
POLARITY SENSITIVE



LEGEND

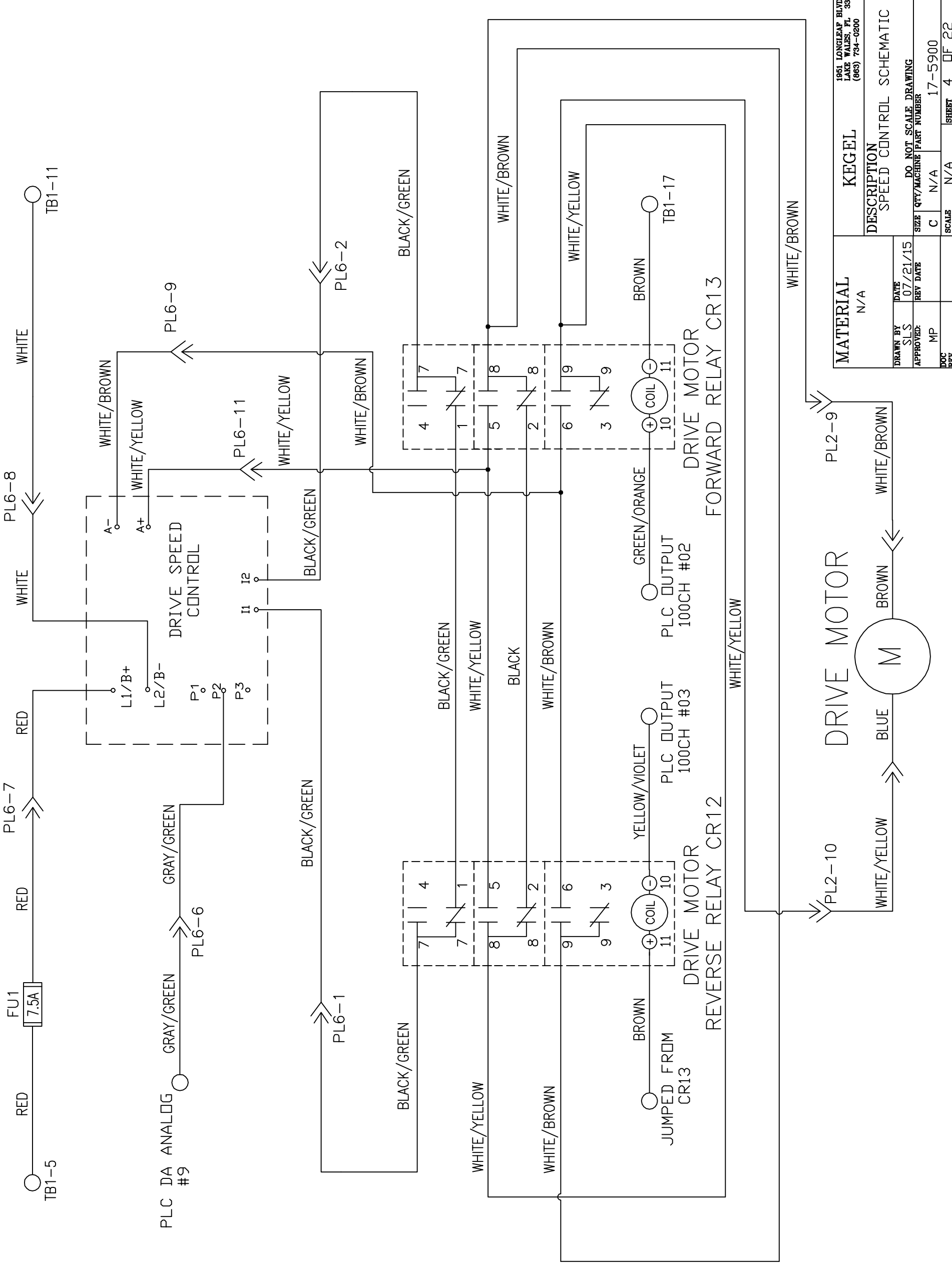
- CR1 - OIL VALVE RELAY
- CR2 - POWER OFF RELAY
- CR3 - DUSTER WINDUP MOTOR RELAY
- CR4 - DUSTER UNWIND MOTOR RELAY
- CR5 - SQUEEGEE LIFT MOTOR RELAY
- CR6 - BRUSH LIFT MOTOR RELAY
- CR7 - OIL PUMP MOTOR RELAY
- CR8 - CLEANER PUMP REVERSING RELAY
- CR9 - BUFFER MOTOR RELAY
- CR10 - OIL/CLEANER HEAD POWER RELAY
- CR11 - OIL/CLEANER HEAD REVERSING RELAY
- CR12 - REVERSE DRIVE MOTOR RELAY
- CR13 - FORWARD DRIVE MOTOR RELAY
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- FU5 - DUSTER WINDUP 3.2A
- FU6 - SQUEEGEE MOTOR 3.2A
- FU7 - BRUSH LIFT MOTOR 3.2A
- FU8 - HEAD DRIVE MOTOR 1A
- FU9 - OIL PUMP MOTOR 4A
- FU10 - PLC INPUT POWER/L1 0.5A
- FU11 - PLC OUTPUT COMMON 0.5A
- FU12 - TOUCH SCREEN 0.5A
- FU13 - CLEANER PUMP 3.2A
- FU14 -
- FU15 -
- FU16 - LED LIGHT 1A
- PL1 - 10-PIN SIDE PLUG (15)
- PL2 - 10-PIN SIDE PLUG (12)
- PL3 - 10-PIN SIDE PLUG (6)
- PL4 - 7-PIN SIDE PLUG (12)
- PL5 - 7-PIN SIDE PLUG (9)
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- PL8 - BUFFER MOTOR PLUG (5)
- CP1 - CHARGING PLUG BATTERY (BLUE)
- CP2 - CHARGING PLUG INSIDE (BLUE)
- CP3 - CHARGING PLUG OUTSIDE (BLUE)
- PP1 - POWER PLUG (RED)
- TB1 - TERMINAL BLOCK 1 (MAIN)
- TB2 - TERMINAL BLOCK 2 (10-PIN SIDE)
- TB3 - TERMINAL BLOCK 3 (7-PIN SIDE)



MATERIAL		N/A	
DESCRIPTION		INPUT WIRING SCHEMATIC	
DRAWN BY	DATE	DO NOT SCALE DRAWING	SCALE
SLS	07/20/15		N/A
APPROVED:	REV DATE	SIZE	SHEET
MP		C	3
DOC		QTY/MACHINE PART NUMBER	OF
REV		17-5900	22

1951 LONGLEAF BLVD.
LAKE WALES, FL 33859
(866) 734-0200

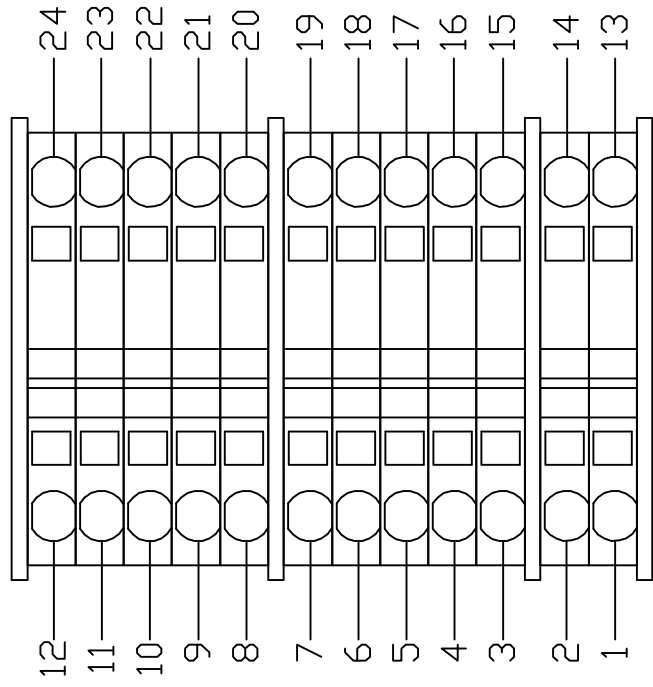
KEGEL P/N
154-1270



MATERIAL N/A		1951 LONGLEAF BLVD. LAKE WALES, FL 33869 (863) 734-0200	
DESCRIPTION SPEED CONTROL SCHEMATIC	DO NOT SCALE DRAWING	SIZE C	QTY/MACHINE PART NUMBER N/A
DRAWN BY SLS	DATE 07/21/15	SCALE N/A	SHEET 4
APPROVED: MP	REV DATE	SCALE	OF 22
DOC REV			17-5900

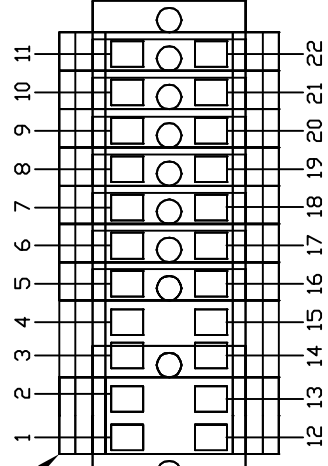
4 3 2 1

TB1
<MAIN>



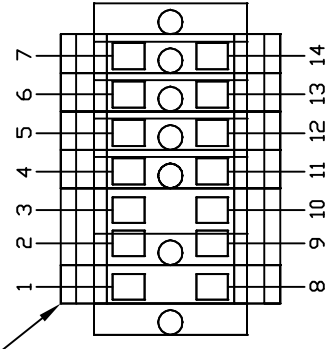
TB2

DRANGE BLOCK
<10-PIN SIDE>



TB3

DRANGE BLOCK
<7-PIN SIDE>



LEGEND

- TB1 - TERMINAL BLOCK 1 <MAIN>
- TB2 - TERMINAL BLOCK 2 <10-PIN SIDE>
- TB3 - TERMINAL BLOCK 3 <7-PIN SIDE>

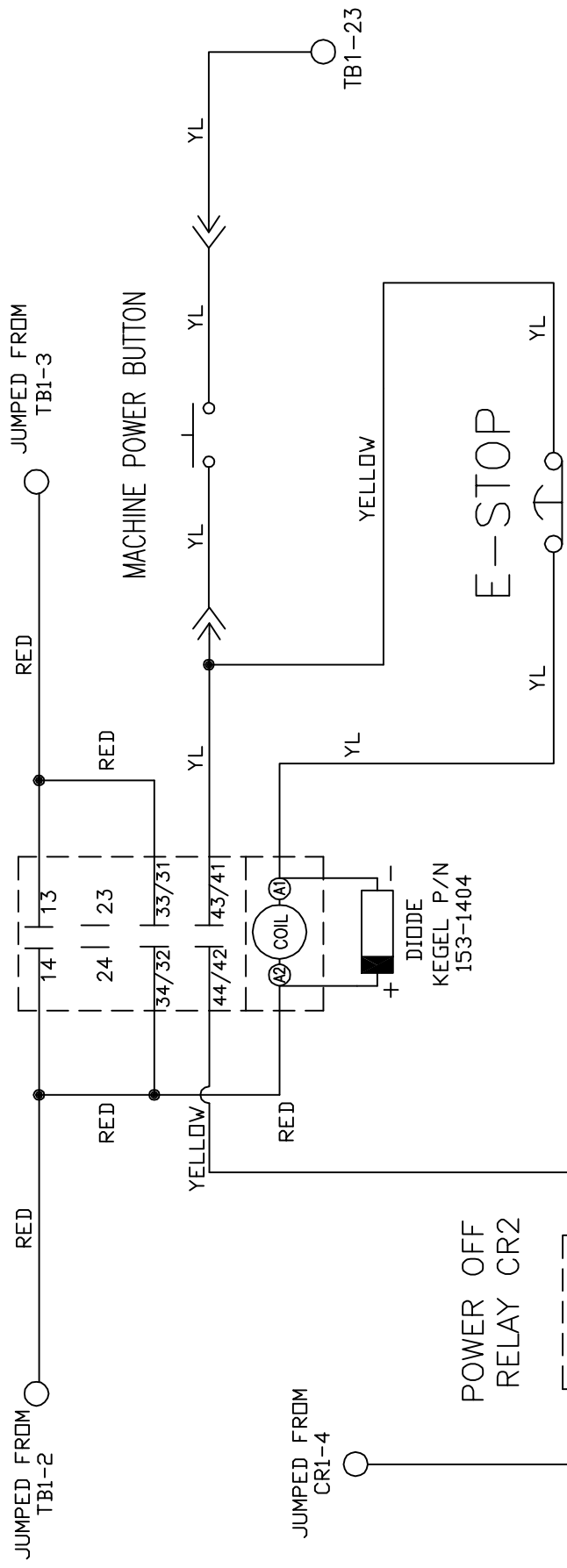
REV LTR	DATE	DESCRIPTION
A	1/5/18	REMOVED CVR SPACER CAR# 17118

MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
DRAWN BY SLS	DATE 07/21/15	DESCRIPTION TERMINAL BLOCK LAYOUT	
APPROVED: MP	REV DATE	DO NOT SCALE DRAWING	DO NOT SCALE DRAWING
DOC REV A	SIZE A	QTY/MACHINE N/A	PART NUMBER 17-5900
	SCALE N/A	SHEET 6	OF 22

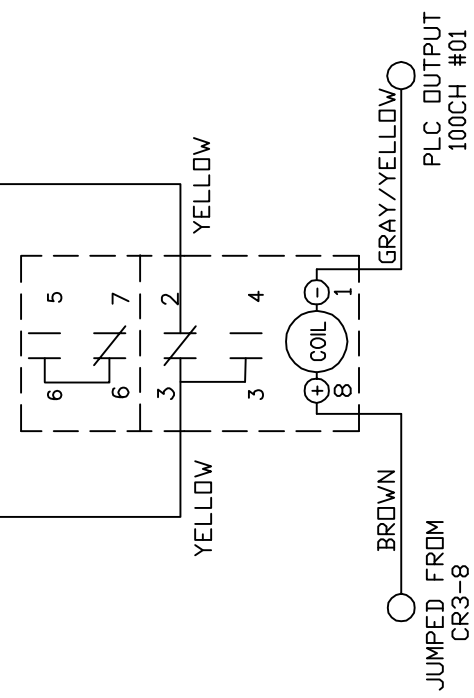
4 3 2 1

4 3 2 1

POWER CONTACTOR
CR15



POWER OFF
RELAY CR2

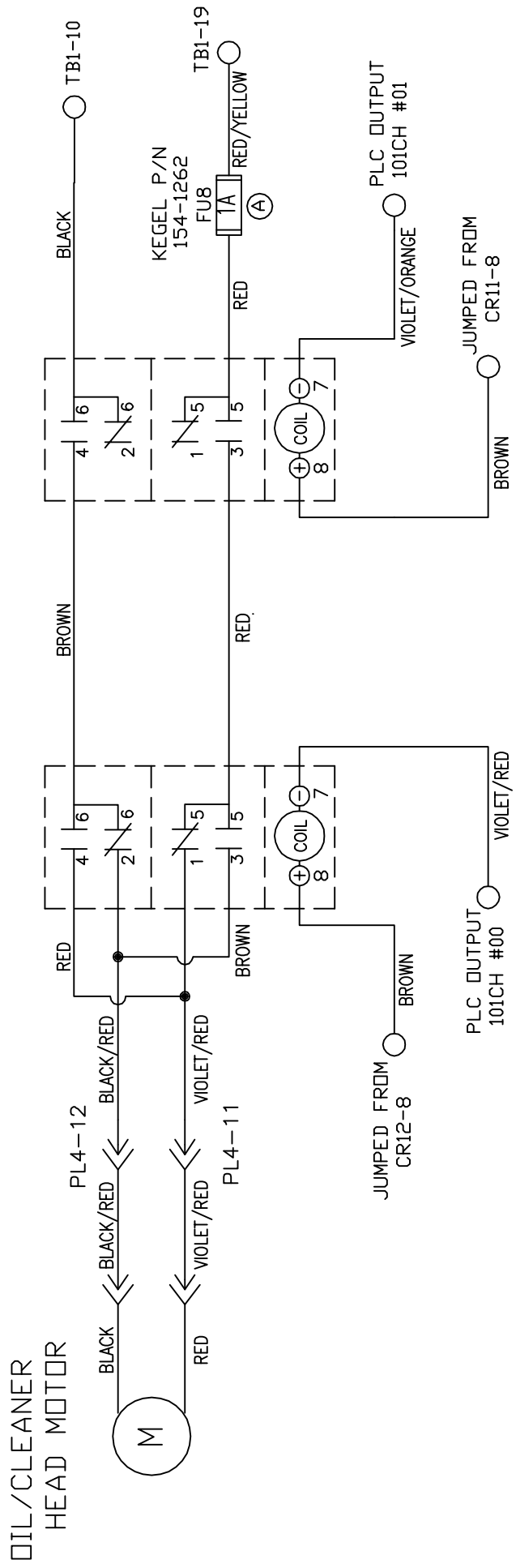


MATERIAL		1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	POWER CONTACTOR	
APPROVED:	REV DATE	& RELAY WIRING	
MP		DO NOT SCALE DRAWING	
DOC	SIZE	QTY/MACHINE	PART NUMBER
REV	A	N/A	17-5900
	SCALE	N/A	SHEET 7 OF 22

2 3 4 1

REV LTR	DATE	DESCRIPTION
A	12/15/17	Changed Head Fuse from 0.75A to 1A CAR# 17117

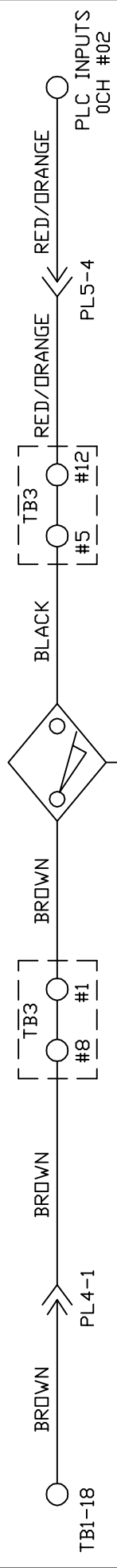
OIL/CLEANER MOTOR OIL/CLEANER HEAD
 REVERSING RELAY CR11 MOTOR RELAY CR10



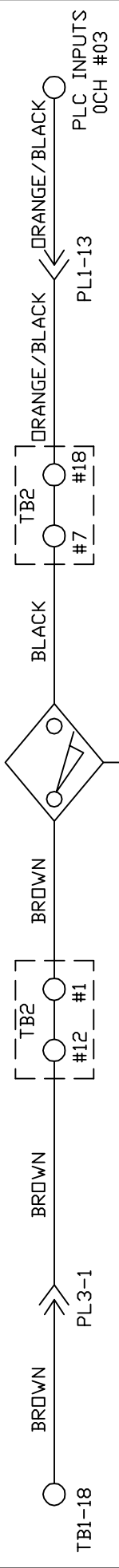
MATERIAL	1951 LONGLEAP BLVD. LAKE WALES, FL 33869		
	THE KEGEL CO. (888) 734-0200		
	DESCRIPTION		
	OIL-CLEANER HEAD MOTOR WIRING		
DRAWN BY	DATE	DO NOT SCALE DRAWING	
SLS	07/21/15	SIZE	QTY/MACHINE PART NUMBER
APPROVED:	REV DATE	A	N/A
MP		SCALE	N/A
DOC			17-5900
REV			SHEET 9 OF 22

4 | 3 | 2 | 1

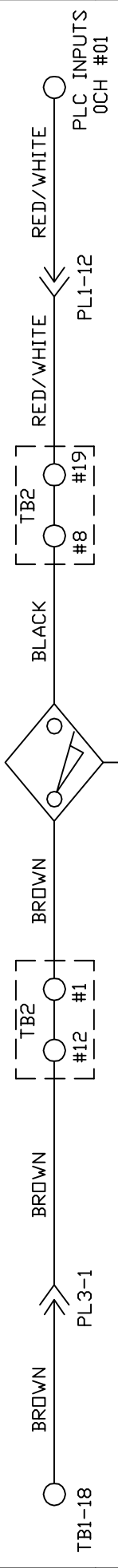
L-R HEAD PROX



R-L HEAD PROX



BOARD PROX



MATERIAL		1951 LONGLEAF BLVD. LAKE WALES, FL 33669	
N/A		THE KEGEL CO.	
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	17-5900
DOC		SHEET	10 OF 22
REV			

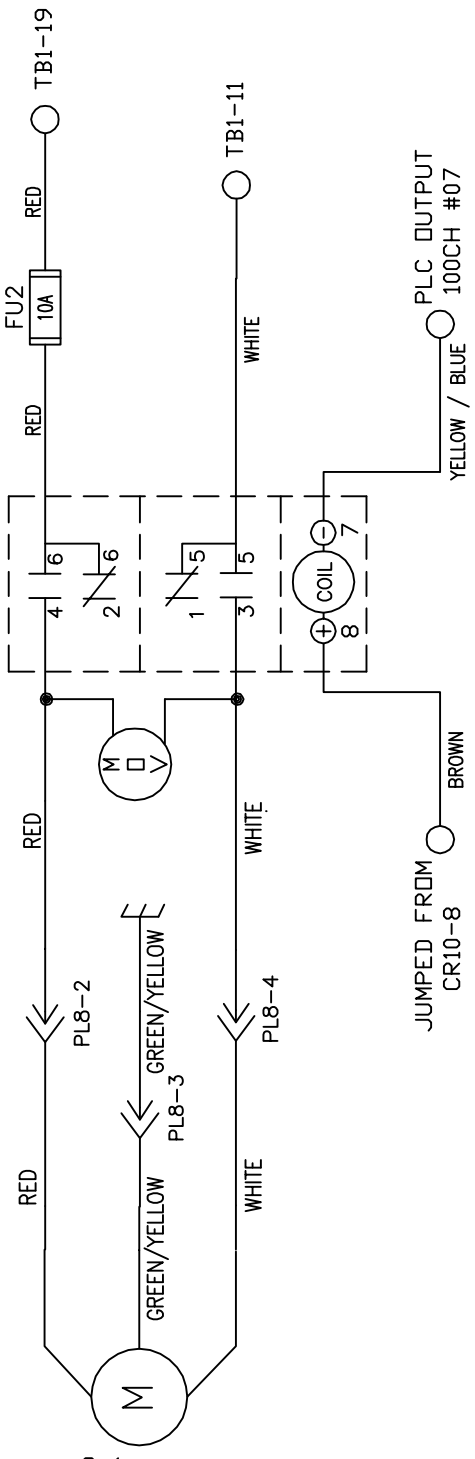
4 | 3 | 2 | 1

4 3 2 1

D C B A

BUFFER MOTOR RELAY CR9

KEGEL P/N
154-1273



BUFFER MOTOR

MATERIAL		THE KEGEL CO. (666) 734-0200	
N/A		1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	BUFFER MOTOR WIRING	
APPROVED:	REV DATE	DO NOT SCALE DRAWING	
MP		SIZE	QTY/MACHINE PART NUMBER
		A	N/A
DOC		SCALE	N/A
REV		SHEET	12 OF 22

4 3 2 1

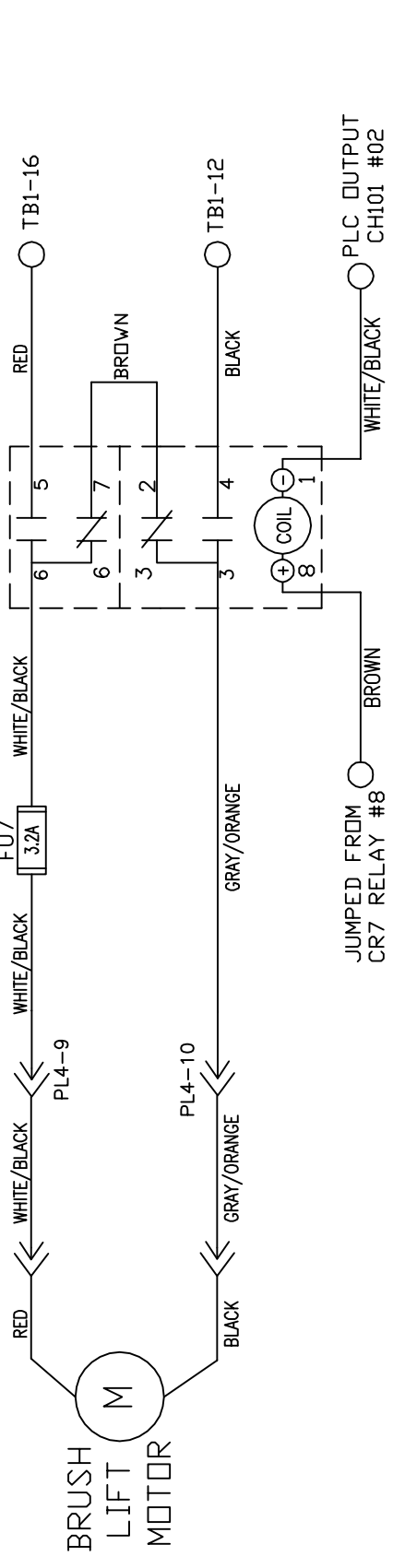
D C B A

4 3 2 1

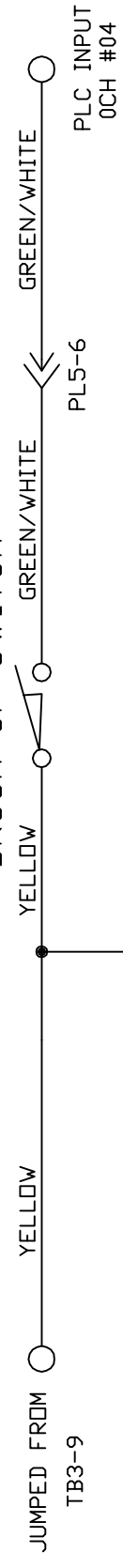
D C B A

BRUSH LIFT MOTOR RELAY CR6

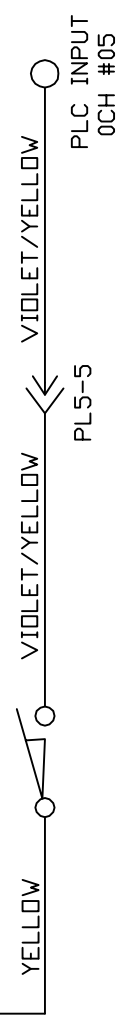
KEGEL P/N
154-1267
FU7
3.2A



BRUSH UP SWITCH



BRUSH DOWN SWITCH



MATERIAL		THE KEGEL CO.		1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
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	17-5900	
APPROVED:	REV DATE	SCALE	N/A	SHEET	13 OF 22
MP					
DOC	REV				

4 3 2 1

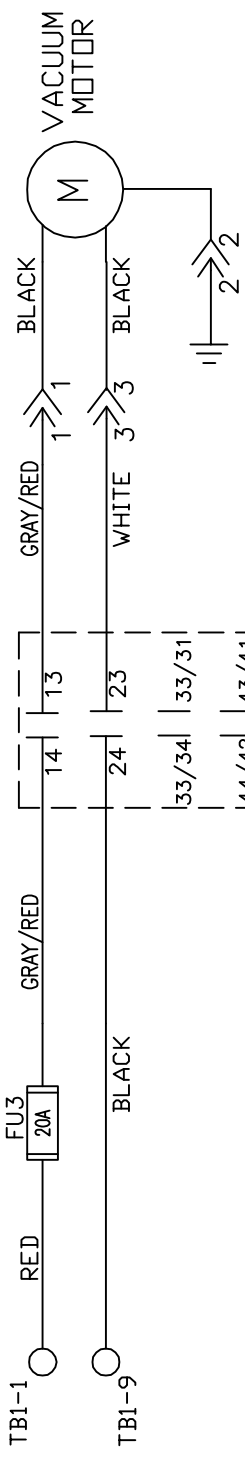
D C B A

4 3 2 1

D C B A

VACUUM MOTOR CONTACTOR CR14

KEGEL P/N
154-1274



PLC OUTPUTS
101CH #07

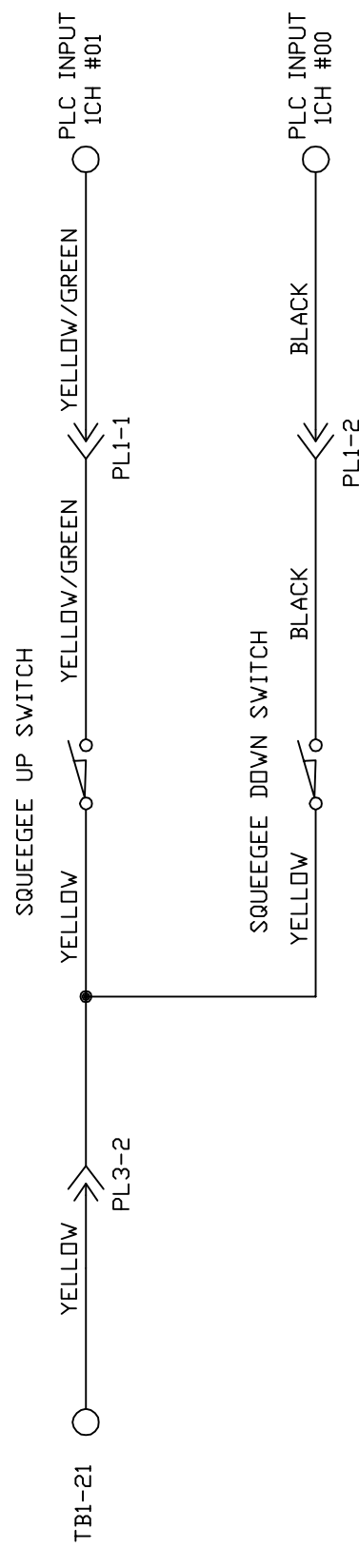
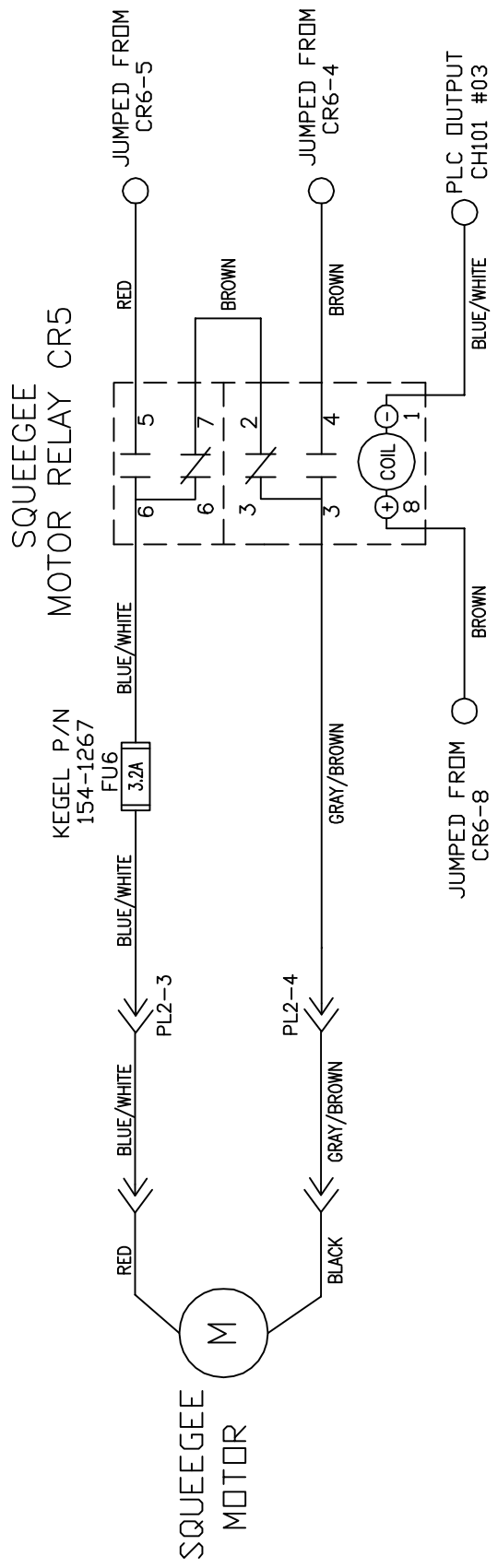
KEGEL P/N
153-1404

MATERIAL N/A		THE KEGEL CO. 1951 LONGLEAP BLVD. LAKE WALES, FL 33869 (888) 734-0200	
DRAWN BY SLS	DATE 07/21/15	DESCRIPTION VACUUM MOTOR WIRING	
APPROVED: MP	REV DATE	DO NOT SCALE DRAWING	SIZE QTY/MACHINE PART NUMBER
DOC REV	MP	A N/A	17-5900
		SCALE N/A	SHEET 14 OF 22

4 3 2 1

D C B A

4 3 2 1



MATERIAL		THE KEGEL CO. (669) 734-0200	
N/A		1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/21/15	SQUEEGEE MOTOR	
APPROVED:	REV DATE	& SWITCH WIRING	
MP		DO NOT SCALE DRAWING	
DOC	REV	SIZE	QTY/MACHINE PART NUMBER
		A	N/A
		SCALE	N/A
			17-5900
		SHEET	15 OF 22

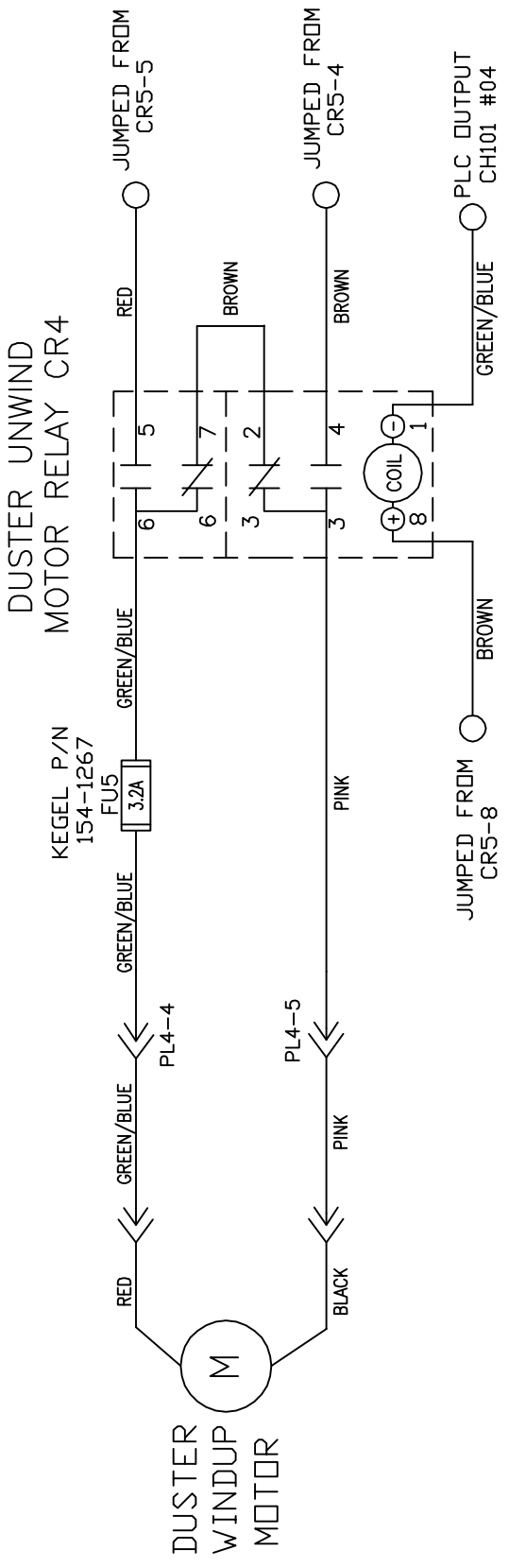
2 3 4

D C B A

D C B A

4 3 2 1

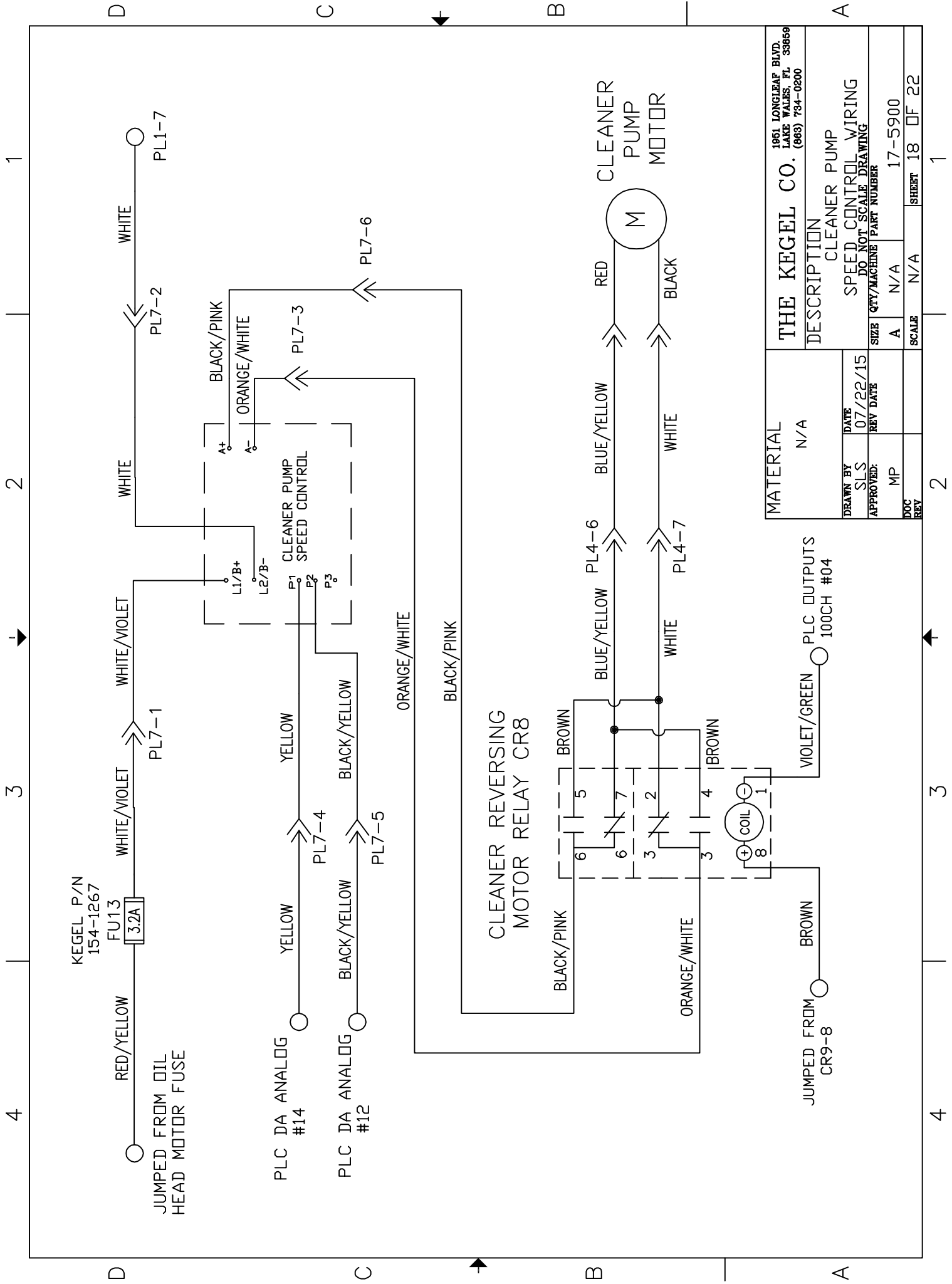
D C B A



MATERIAL		THE KEGEL CO. 1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
N/A		DESCRIPTION	
DRAWN BY	DATE	DUSTER UNWIND	
SLS	07/21/15	MOTOR WIRING	
APPROVED:	REV DATE	DO NOT SCALE DRAWING	
MP		SIZE	QTY/MACHINE PART NUMBER
		A	N/A
DOC REV		SCALE	N/A
			17-5900
		SHEET	16 OF 22

4 3 2 1

D C B A

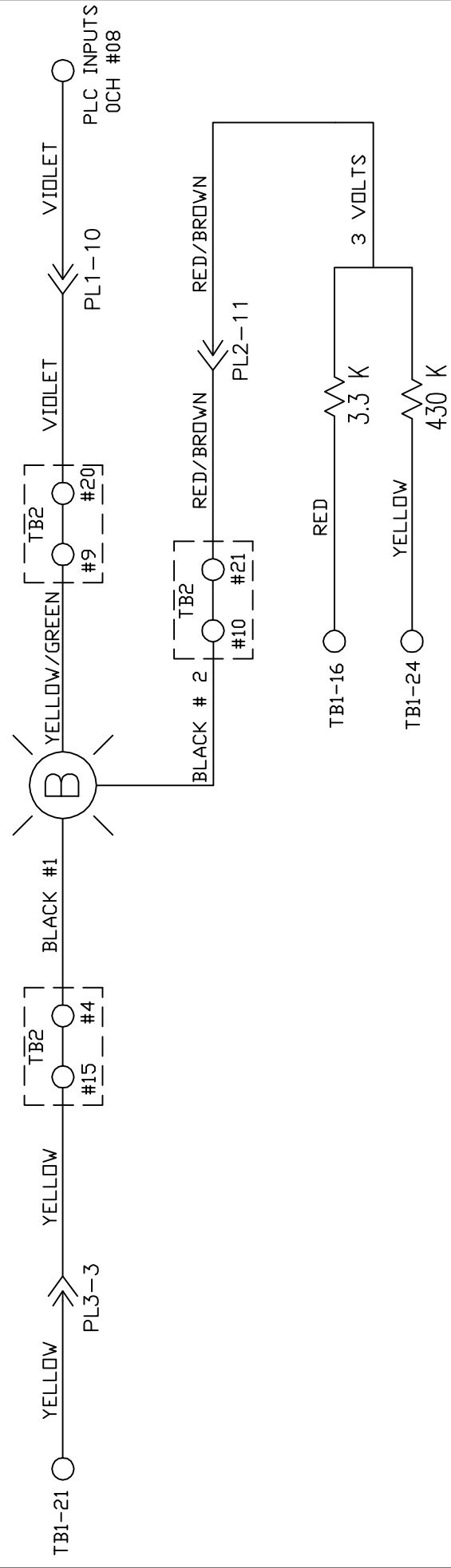


MATERIAL		N/A	
DESCRIPTION		CLEANER PUMP	
DRAWN BY	DATE	SPEED CONTROL WIRING	
SLS	07/22/15	DO NOT SCALE DRAWING	
APPROVED:	REV DATE	SIZE	QTY/MACHINE PART NUMBER
MP		A	N/A
DOC	REV	SCALE	N/A
			17-5900
		SHEET	18 OF 22

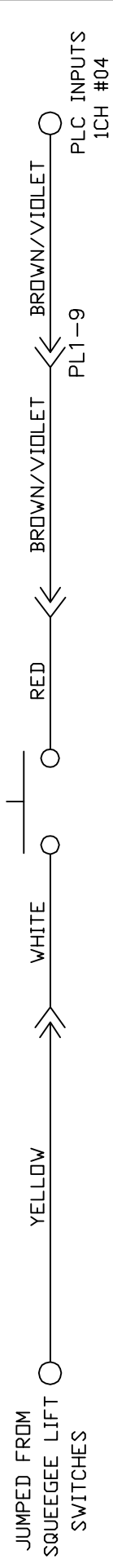
THE KEGEL CO.		1951 LONGLEAF BLVD. LAKE WALES, FL 33669	
CLEANER PUMP		SPEED CONTROL WIRING	
DO NOT SCALE DRAWING		DO NOT SCALE DRAWING	
SIZE	QTY/MACHINE PART NUMBER	SCALE	N/A
A	N/A		17-5900
DOC	REV	SHEET	18 OF 22

4 3 2 1

START BUTTON



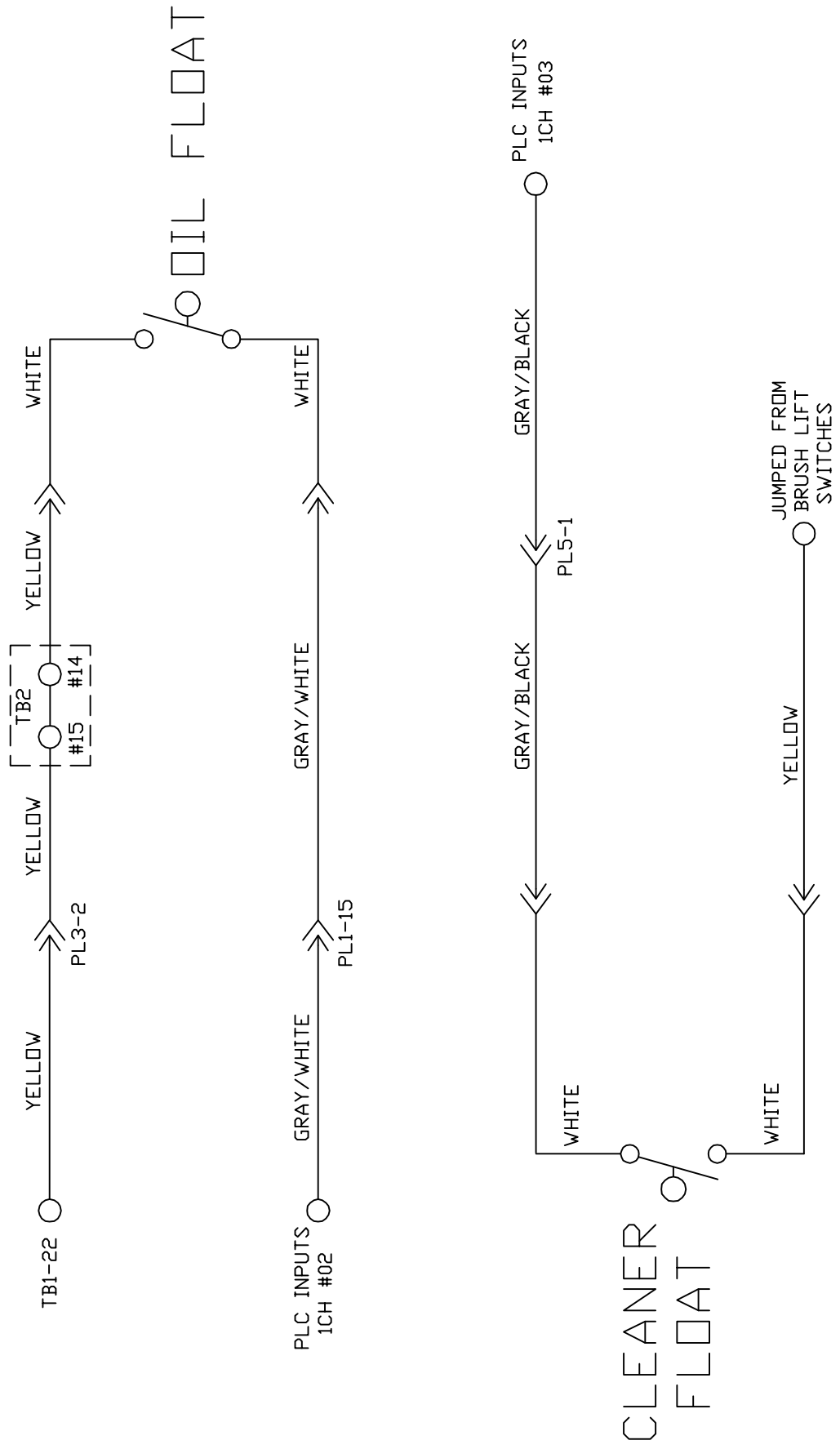
DUSTER/PRESOAK BUTTON



MATERIAL		1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DESCRIPTION			
START BUTTON & DUSTER/PRESOAK BUTTON 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			17-5900
DOC			SHEET 19 OF 22
REV			

4 3 2 1

4 3 2 1

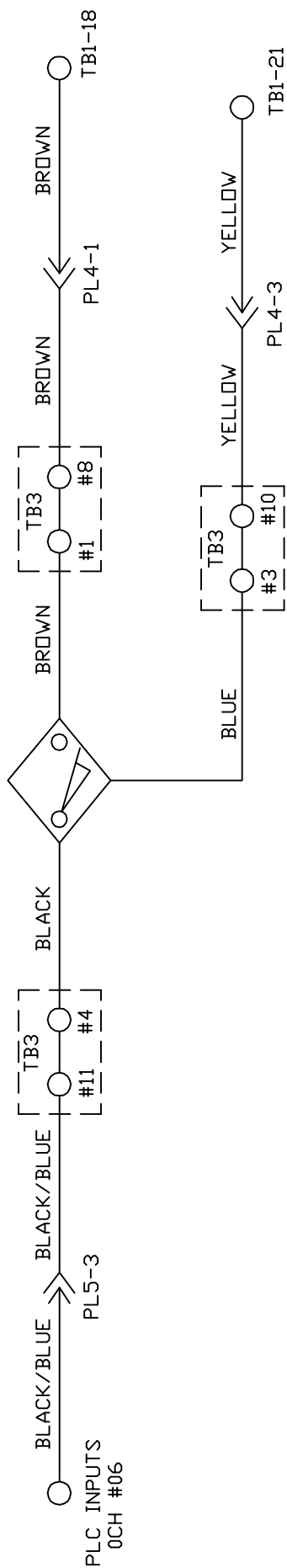


MATERIAL		1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
N/A		THE KEGEL CO. (888) 734-0200	
DRAWN BY	DATE	DESCRIPTION	
SLS	07/22/15	OIL & CLEANER	
APPROVED:	REV DATE	FLOAT WIRING	
MP		SIZE	DO NOT SCALE DRAWING
		QTY/MACHINE	PART NUMBER
		A	N/A
DOC		SCALE	N/A
REV			17-5900
		SHEET	20 OF 22

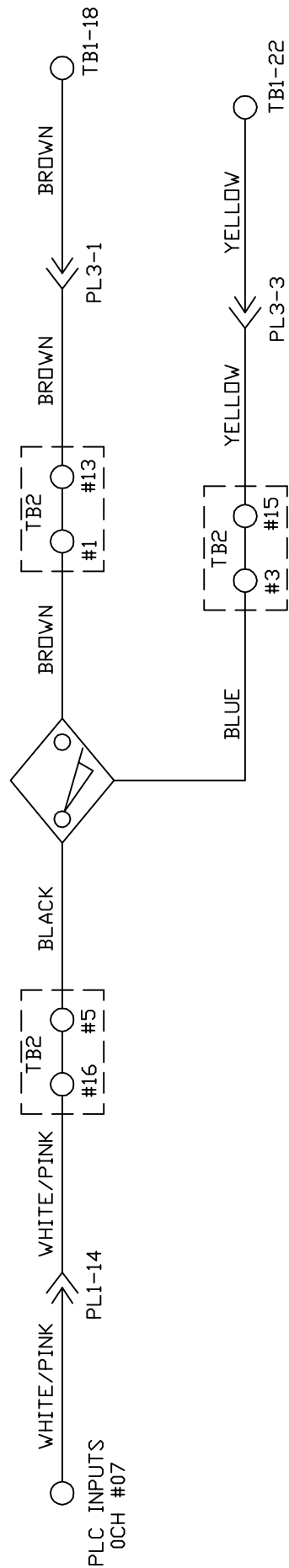
4 3 2 1

4 3 2 1

SPEED TACH PROX



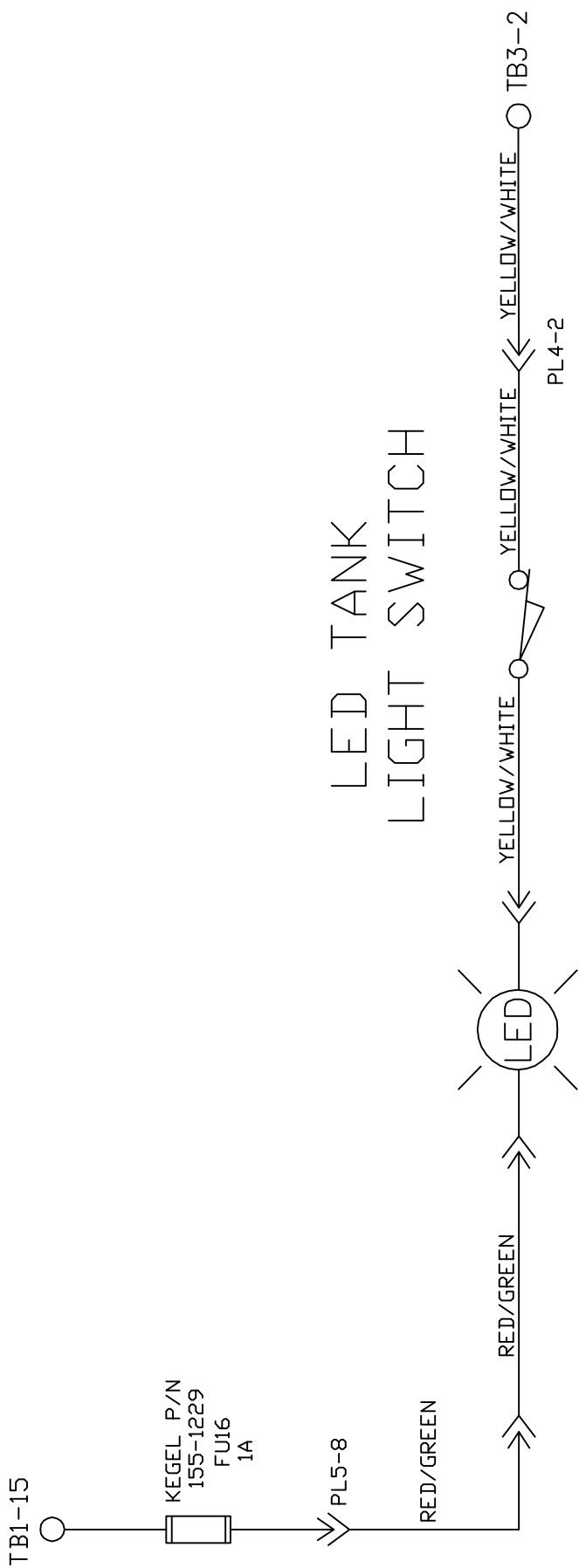
LANE DISTANCE PROX



MATERIAL N/A		THE KEGEL CO. (669) 734-0200 1951 LONGLEAP BLVD. LAKE WALES, FL 33869	
DRAWN BY SLS	DATE 07/22/15	DESCRIPTION SPEED TACH & LANE DISTANCE WIRING	
APPROVED: MP	REV DATE	DO NOT SCALE DRAWING	
DOC REV	MP	SIZE A	QTY/MACHINE PART NUMBER N/A
		SCALE N/A	17-5900
		SHEET 21	OF 22

4 3 2 1

LED TANK LIGHT SWITCH



MATERIAL		THE KEGEL CO. 1951 LONGLEAF BLVD. LAKE WALES, FL 33869	
N/A		DESCRIPTION	
		LED TANK LIGHT WIRING	
DRAWN BY	DATE	DO NOT SCALE DRAWING	
SLS	07/22/15	SIZE	QTY/MACHINE PART NUMBER
APPROVED:		A	N/A
MP		SCALE	N/A
DOC		SHEET	22 OF 22
REV			

4 3 2 1

D C B A

4 3 2 1

D C B A

