TABLE OF CONTENTS

SECTION I - Introduction

A. Overview

This lane cleaning and conditioning machine represents advanced technology in automated lane care. Clean and consistent bowling conditions are accomplished through the use of an on-board keypad linked to a programmable logic controller.

A patented conditioner metering transfer system, vacuum cleaning and squeegee 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 provides additional functions that are otherwise not available to the operator. KOSI should be used as a supplement to this manual.

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

Should you have any questions regarding any procedures pertaining to the proper operation of this machine, please contact Kegel at (863) 734-0200 also via LMC@kegel.net.

B. Machine Specifications

Models:
17-5100 Kustodian Plus (115V/60Hz)
17-5150 Kustodian Plus (230V/50Hz)

Power Supply:
Class I – Single Phase
110-120 Volts, 60 Cycle, 15 Amps
220-230 Volts, 50 Cycle, 12 Amps

Dimensions:
Width - 55-1/4" (140.34 cm)
Height – 14-1/2" (36.83 cm)
Length – 40-3/4" (103.51 cm)
Weight - 309 pounds (140.4 kg)

C. Care and Safety Procedures

This machine is manufactured of the highest quality materials, but keep in mind that it is a sensitive piece of equipment. Care should be taken to see that it is not dropped, knocked around, or handled roughly.

Doing so may damage the programmable logic controller, its components, the conditioner transfer system, the duster assembly, or the vacuum cleaning and squeegee system.

For care and safety reasons, follow these precautions:

- Avoid spilling any liquids or chemicals inside of the machine.
- Do not operate the machine with an extension cord or power cord other than the one provided.
- Make sure that the power outlet used provides the correct voltage and amps. It must be a clean circuit with no other loads on it.
- Do not attempt to make any wiring modifications.
- Do not attempt to re-program the system software.
- Do not operate the machine in an upright position.
- **ALWAYS** empty the recovery tank before standing the machine up and transporting it. Failure to empty the tank will cause the dirty cleaner to either spill out through the vacuum motor or out of the squeegee when going over ramps. Then the next time the machine is started, it will blow cleaner out of the vacuum exhaust.

Not following the above recommendations may cause damage to the machine, its computer, persons operating it, or void the warranty.

An authorized factory-trained Distributor should train persons assigned the responsibility of operating this equipment on its proper use.

D. Theory of Operation

This machine uses proven "SANCTION® TECHNOLOGY" patented by Kegel. This technology is the precise metering of oil to each board by volume. This model has the benefits of years of research and development, making SANCTION® TECHNOLOGY available for any bowling center trying to gain control over the oil pattern.

The machine uses one Fluid Metering Pump. The piston and cylinder are made of ceramic, milled to almost perfect clearances. The pump has no valves to impair its operation. The piston revolves as well as reciprocates during operation.

With the pump rotating at a constant RPM the oil 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 oil back to the oil tank. When turned ON the valve routes the oil 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 oil applied to the transfer system as the machine travels down the lane.

This stream of oil is a consistent, adjustable, and measurable amount per board. An example of a common league condition in the U.S. might be three 2 board to 2 board streams, followed by two 9 to 9’s, two 10 to 10’s, and four 11 to 11’s as the machine travels down the lane.

The total volume amount per board of the pattern can be represented by an exact amount.

This is done by simply multiplying:

1) the amount of oil per board value (determined during calibration)

by

2) the number of times the stream crossed each board.

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 the length and width.

Anyone who uses this machine and pays attention,

will begin to understand lane conditions like never before.

Because all adjustments to the oil pattern

are exact and repeatable,

Sanction® Technology is an instrument,

not just a lane machine.

SECTION II - Machine Description

A. Rear; Center; Front; Right; & Left Side

With the machine setting on the approach in a position ready to be operated on the first lane, the following descriptions will be used:

- **CONDITIONING (REAR) END:** The CONDITIONING or REAR END shall be the end of the machine closest to the operator and nearest the approach, where the buffing brush is located.

- **CENTER COMPARTMENT:** The COMPUTER or CENTER COMPARTMENT houses the electrical components and is located between the CONDITIONING END and the CLEANING END. Three partitions make up the compartment:
  - the vacuum and squeegee section (on the right);
  - the buffer motor section (on the left side) and;
  - the computer and drive motor section (in the center).

- **CLEANING (FRONT) END:** The CLEANING or FRONT END shall be the end nearest to the pins, where the recovery tank and the Duster Assembly are located.

- **RIGHT SIDE:** The RIGHT SIDE is the side to the right of the operator as he faces the pins. This is also the ten-pin side.

- **LEFT SIDE:** The LEFT SIDE is the side opposite the right, to the left of the operator as he faces the pins (seven-pin side).

B. Keypad

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

- **INDICATOR LIGHTS:** The red indicator light comes on any time you press any of the 6 keys and the handle button. The green indicates when the NEXT key is enabled in the Change Program area. The green light will also come on after the Managers Password has been entered correctly.
- **MENU/F1:** Pressing this key will display and advance the available main menus for the operator. It will also act as a zero button when the machine is in operation. When the key is pressed the machine will stop, the program will zero, and the menu will advance to MANUAL REVERSE.
- **NEXT/F2:** Use this key to advance within a main menu from one menu prompt to the next. It is also used to advance the output number in the Test Output menu.
- **DOWN ARROW/F3:** Use of this key will decrement or decrease numbers needed in certain menu prompts. Holding the key down will make the numbers decrease faster. This key is also used to change programs when the program override function is enabled.

  The Down Arrow will not work in screens that display a menu prompt requesting you to choose a program number.
- **UP ARROW/F4:** Use of this key will increment or increase numbers needed in certain menu prompts. Holding the key down will make the numbers increase faster. The Up Arrow will loop around to 01 when the upper limit is exceeded. The Up Arrow is also a backup start button.
- **ENTER/F5:** This key is used in the Change Program menu for entering data in the oil load screens. The key is also used to enable Program override and turn outputs ON and OFF in the Test Output menu.
- **RESET/F6:** This key has four functions.
  - It zeros the program like the Menu key, but it does not advance to the next menu,
  - it is used to start the oil Volume Test
  - it resets the Duster Cloth counters, and
  - it is used to return back to the Start Screen from any menu prompt (except for the two situations mentioned above).

NOTE: The Managers Password can be any combination of F3, F4, and F5. Contact Tech Support to change the password.

C. Conditioning (Rear) End Components

Located on the conditioning end of the machine are the following components:

- **DISTANCE WHEELS:** Located on the inside rear wall of the conditioning end are the lane distance wheels. These wheels measure the distance the machine travels down the lane in increments of one inch. This is done by counts stored in the PLC from the proximity sensor or Lane Distance Sensor (LDS) mounted on the center pillow block.

- **BUFFER BRUSH:** Located near the rear wall of the conditioning end is the buffer brush assembly. The belt-driven brush removes conditioner from the transfer brush and places it onto the lane surface.

- **BRUSH LIFT CAM:** Located to the left of the cleaner pump on the side plate is the brush lifting cam and switches.

- **CONDITIONER COMPONENTS**: Located under the splash guard on the rear wall are the following conditioning components:

  - the oil pump and motor;
  - the pulse dampener tubing (to smooth oil streams);
  - the valve assembly (24VDC) to control oil flow;
  - the pressure gauge (keep pressure at 10-15 PSI);
  - the pressure regulating capillary tube;
  - the oil tank with low-level float and filter (capacity is 0.63 gallons or 2400 milliliters);
  - a vent valve to prevent vacuum in oil tank;
  - a capacitor for the oil pump motor;
  - and a terminal block assembly.

- **SUPPLY TANK:** Mounted left of center on the rear wall is the cleaner supply tank. The capacity of this tank is approximately 1-7/8 gallons (7.1 liters); enough volume to completely clean in excess of 30 lanes. A vent valve prevents a vacuum inside the tank during operation. A float switch is located inside the supply tank to indicate when the cleaner level is getting low.
- **CLEANER PUMP:** Mounted to the left of the cleaner supply tank is the cleaner pump and cleaner volume adjusting valve.
- **OIL HEAD:** Located above the transfer brush is the Moving Head. This head rides along a guide bar and applies the conditioner to the transfer brush. The tip can be removed when performing a calibration check. A collar retains the tip height adjustment and locks the tip into the spring-loaded oil head.
- **TRANSFER BRUSH:** Mounted below the moving head is the conditioner transfer brush.
- **HEAD PROXIMITY SENSORS:** Located at each end of the head mounting bar is a proximity sensor. These sensors feed information to the PLC to reverse the cleaning/conditioning heads. These sensors are also used to "time" the oil position sensors.
- **START/INTERLOCK/RESUME BUTTON:** Located on the handle is the Start/Interlock/Resume button. This button is used to START the machine; STOP it any time during the conditioning run; or to RESUME operation after it has stopped for an error message or some other reason.
- **CLEANER PRESOAK BUTTON:** Located on the right side of the handle is the Cleaner Presoak Button. This button is used to add extra cleaner to the lane.

D. Center Compartment Components

The Center Compartment of the machine is divided into three sections. From left to right, they are the buffer motor section, the computer control and drive motor section, and the vacuum and squeegee cam section.

The following components are found in the LEFT section of the center compartment:

- **BUFFER MOTOR:** Mounted on the left side plate is the buffer brush motor. This AC single-speed motor rotates the buffer brush on the lane.

- **TERMINAL BLOCK:** Mounted on the left side plate above the buffer motor is a set of terminal blocks. These junction blocks are used for the left proximity switch and the tach sensor.

The following components are found in the MIDDLE section of the center compartment:

- **CONTROL PLATE ASSEMBLY:** The control plate assembly can be removed from the machine for maintenance by unplugging the wire connectors and removing four screws. Located on top of the control plate are the following components:
  - Buffer Motor Contactor (CR11);
  - Programmable Logic Controller;
  - CR1 Forward Relay (LY3);
  - CR2 Reverse Relay (LY3);
  - CR3 to CR6 PLC Secondary Relays;
  - CR7 Cleaner Pump Relay (24VDC LY2);
  - CR8 Vacuum Motor Relay (24VDC LY2);
  - CR9 Left to Right Head Motor Relay (24VDC LY2);
  - CR10 Right to Left Head Motor Relay (24VDC LY2);
  - Operation Toggle Switch;
  - Speed Adjustment Trimpots;
  - Circuit Breaker;
  - Fuses.

Located on the bottom of the control plate are the following components:

  - Printed Circuit Board;
  - Terminal Block Assembly.

- **BUFFER MOTOR CONTACTOR:** Mounted on the top left corner is the buffer motor contactor (designated as CR11). This component conducts AC power to the buffer motor when the PLC relay engages the coil. A din rail secures the contactor to the plate.

- **PROGRAMMABLE LOGIC CONTROLLER (PLC):** The PLC or PC is also mounted on the din rail. The terminal strips are removable if a replacement is necessary. Use care to prevent damage to the PLC, it controls all the functions of the lane machine.

WARNING: The PLC contains a Lithium battery. When it is replaced, the old battery should be discarded in accordance with local regulations.

- **CONTROL RELAY 1:** This relay controls the forward operation of the drive motor. It is an LY3 type relay.

- **CONTROL RELAY 2:** This relay controls the reverse operation of the drive motor. It is an LY3 type relay.

- **BRAKE RESISTOR:** Mounted to CR#1 and CR#2 is the Brake Resistor. This resistor stops the drive motor when the drive motor relays are turned off.

- **PLC RELAYS**: Four of the output relays of the PLC (located on OUTPUT CH11) are protected by a bank of small secondary relays. These 24VDC relays should prevent damage to the PLC if a short-circuit occurs. A light on top of the relay indicates when the coil is energized. These relays are easily replaceable, if necessary.

The following outputs are protected by a 24VDC secondary relay:

CR	OUTPUT	DESCRIPTION
3	11CH 02	BRUSH LIFTING MOTOR
4	11CH 03	SQUEEGEE MOTOR
5	11CH 04	DUSTER UNWIND MOTOR
6	11CH 05	DUSTER WINDUP MOTOR

- **CONTROL RELAY 7:** This relay controls the operation of the cleaner pump motor. It is an LY2 type relay with a 24VDC coil.
- **CONTROL RELAY 8:** This relay controls the operation of the vacuum motor. It is an LY2 type relay with a 24VDC coil.

- **CONTROL RELAY 9:** This relay controls the oil/cleaner head motor left to right. It is an LY2 type relay with a 24VDC coil.
- **CONTROL RELAY 10:** This relay controls the oil/cleaner head motor right to left. It is an LY2 type relay with a 24VDC coil.
- **OPERATION TOGGLE SWITCH:** This switch controls whether the program will CLEAN only, CONDITION only, or CLEAN and CONDITION at the same time. The machine will not calibrate the Pump Output if switch is set to CLEAN ONLY.

- **DRIVE MOTOR SPEED RELAYS AND ADJUSTING TRIMPOTS:** The speed adjusting trimpots are accessed through the top of the control plate. The relays and trimpots are mounted to the bottom side. Low speed comes on when either the forward or the reverse LY-type relay is on. The small speed relays are used for the other five speeds. The trimpots regulate each of the 6 speeds of the drive motor.

  Always adjust the speeds from low to high speed (left to right). Use the Range Pot only if necessary to give all trimpots some additional adjustment.

  The trimpots, and their inches per second speed ranges, go in order from left to right as follows:

  9-10 IPS (Affects speed for all other trimpots).
  13-14 IPS
  17-18 IPS
  21-22 IPS
  25-26 IPS
  29-30 IPS
  RANGE Pot (Adjusts speed for all trimpots).

NOTE: Speed trimpot 1 will also affect the other speeds. Always adjust Speed 1 first, and if a change is made to the Range Pot, begin adjusting again from Speed 1.

- **PROTECTIVE DEVICES:** Mounted on the PLC plate are several fuses and one or two circuit breakers. These components protect the operator and machine in the event of a current overload. The following is a list, from left to right, of the components:

- **Main Circuit Breaker:** The circuits for the entire machine are protected with a circuit breaker. It is rated at 15A on a 115V model, and at 10A on a 230V model.

- **PLC Power Fuse:** The PLC power supply is protected by a single slow blow fuse. It is rated at 0.5A on a 115V model, and 500mA on a 230V model.

- **PLC Common Fuse:** The PLC Outputs are protected by a single slow blow fuse. It is rated at 0.5A on a 115V model, and 500mA on a 230V model.

- **Drive Motor Fuse:** The drive motor control board is protected by 2 slow blow fuses, one for L1 and one for L2. These are ceramic-type fuses rated at 4A.
- **Conditioner Pump Motor Fuse:** The oil pump motor is protected with a slow blow fuse. It is rated at 0.75A on a 115V model, and at 315mA on a 230V model.
- **Cleaner Pump Fuse:** The cleaner pump is protected with a slow blow fuse. It is rated at 4A on a 115V model, and at 1.6A on a 230V model.
- **Secondary Relay Common:** The PLC secondary relays are protected by a 4A fuse on both 115V and 230V models.
- **Vacuum Fuse/Circuit Breaker:** The vacuum motor is protected with a slow blow fuse or a circuit breaker. The 115V model uses a ceramic-type fuse rated at 10A; or a circuit breaker rated at 8A is used on a 230V model.

Other protective measures include the following:

- **PLC Program:** The program also acts as a protective device on certain motors. These motors "time out" or have built in monitoring that trips an error message and stops operation. This will prevent the motors from overheating in the event of a locked rotor condition. The following motors are protected with the PLC Program: DC Drive Motor; Brush Lifting Motor; Squeegee Motor; Oil Head Motor; Cleaner Pump Motor; and the Duster Unwind and Wind-Up Motors.

- **Buffer Motor:** A fuse is not required for the AC motor, it has an automatic thermal overload breaker. A button must be pressed on the back of the AC motor to reset the overload trip circuit.

WARNING: Make sure no power is applied to the machine when re-setting the overload breaker (so the motor won't start unexpectedly).

The following components are found underneath the control plate in the center compartment:

- **DRIVE MOTOR PRINTED CIRCUIT BOARD:** Mounted on the bottom side of the control plate is a printed circuit board with relays and trimpots. This board controls the DC voltage to regulate the drive motor speeds.

- **TERMINAL BLOCK ASSEMBLY:** Mounted on the bottom of the control plate are the main terminal blocks for the machine. The plate lifts out of the machine by removing the four mounting screws to allow access to this wiring when trouble-shooting a problem.

- **DRIVE MOTOR:** Mounted under the control plate is the DC drive motor. It turns the drive shaft, and the tachometer actuating disk. This motor is mounted on slots to allow the chain tension to be adjusted.

- **DRIVE MOTOR SPEED CONTROL BOARD:** Mounted to back wall of the middle compartment, under the control plate, is the drive motor speed control board. The board converts AC voltage into DC voltage for the drive motor. Do not adjust the trimpots on the board unless instructed to do so by the Kegel Technical Support staff.

- **EMI FILTER:** (On 230 Volt Machines Only) Mounted directly below the drive motor speed control board is an EMI filter. The speed control board must be filtered to reduce line conducted and radiated emissions. This filter must be connected properly to ensure compliance with Electromagnetic Compatibility Directives (CE Mark).

- **EMI FILTER:** (On 230 Volt Machines Only) Mounted below the relay plate is a large EMI filter. The electrical circuits of the entire machine are filtered to reduce line conducted and radiated emissions. This filter must be connected properly to ensure compliance with Electromagnetic Compatibility Directives (CE Mark).

- **EMI FERRITE:** (On 230 Volt Machines Only) The 24V DC circuit is filtered at the output of the PLC Power Supply. A ferrite is clamped to the Brown and Yellow wires to reduce line conducted emissions. This component is required to comply with CE Directives.

The following components are found in the RIGHT section of the center compartment:

- **VACUUM MOTOR:** Located on the right side is the vacuum motor. This motor is used with the squeegee assembly and recovery tank to vacuum the cleaner off the lane. A specially designed chamber reduces the noise created by the vacuum. **This motor needs regular maintenance**, and is mounted by two 1/4-20 bolts for easy access.

  NOTE: The lid can be taken off the machine to make it easier to remove the vacuum motor and perform necessary maintenance.

- **SQUEEGEE CAM AND SWITCHES:** The position of the squeegee is controlled by two switches mounted on the right side plate. A cam connected to the squeegee motor has an offset lobe that actuates the switches. The switch mounted next to the plate is the squeegee up switch and the switch to the outside is the squeegee down switch.

- **EMERGENCY STOP BUTTON:** (On 230 Volt Machines Only) Located in the right compartment is an emergency stop switch. This safety button will disconnect power to the drive components of the machine if there is an emergency.

  This button will have to be rotated to be reset and the start button will need to be pushed to resume operation.

  If power is applied to the machine, but the circuits are dead, check the position of this emergency stop switch.

E. Cleaning (Front) End Components

The following components are located under the lid on the cleaning end of the machine:

- **POWER CORD INLET:** Mounted on the left side wall is the power cord inlet. This inlet is grounded to the machine frame. Make sure to use the correct voltage and amperage when connecting the cord to the inlet.

HIGH VOLTAGE WARNING: Use caution with electrical components. Refer servicing to qualified personnel. Observe and follow all Warning and Safety Labels.

- **DUSTER UP SWITCH:** Located on each side wall is a microswitch. These switches, when actuated, tell the PLC that the cushion roller is in the UP position. Avoid getting liquid near these switches (and all other electrical components).
- **DUSTER/CLEANING CLOTH ASSEMBLY:** Mounted inside and across the entire front end is the Duster Cleaning Cloth Assembly. Two motors, one located on each side, move the cloth from one core to the next. The gear motor on the left side is called the **UNWIND MOTOR**. When operated, it will let out new cloth from the supply roll. The gear motor on the right side is the **WIND-UP MOTOR**. When operated, it will wind up the used, dirty cloth on the white PVC take-up roller.

  The duster uses gravity to clean the lane. The cloth-covered cushion roller pivots and contacts the lane surface when cloth is unwound. This makes the cloth contour to the lane surface for optimum cleaning. At the end of the lane, just before the end of travel, the duster winds up dirty cloth and lifts the cushion roller off the lane. The cloth remains wound up during the return travel to the foul line.

  For best results, use **Kegel K2** (153-0047P) lane cleaning cloth. The machine will use approximately 1-1/2" (3.81 cm) of cloth per lane.

- **RECOVERY TANK:** The large plastic tank in the center of the compartment is the recovery tank. This tank will hold in excess of 30 lanes of used liquid without needing to be emptied. Empty the tank from the inlet side (connected to squeegee). Empty this tank EVERY time the cleaner tank is filled.

  Use care when removing tank to prevent spilling liquid in the machine. Do not drop the tank or handle it roughly. This may cause it to leak.

- **CLEANER DISPENSING HEAD:** Mounted to the front panel is the cleaner dispensing head assembly. The dispensing head moves along the guide bar applying cleaner to the lane surface in front of the cushion roller. The dispensing tip is equipped with a 1-5 psi check valve to prevent drips. The tip can be removed to check the volume output.

- **LIFTING HANDLE**: There are two lifting handles mounted on the front panel for lifting and placing the machine on the approach. When possible, have two people set the machine down and lift it into the transport position.

- **MOMENTARY WHEELS**: Mounted on the front outside wall are two small wheels. These wheels come in contact with the lane momentarily as the machine enters and exits at the foul line.

F. Bottom Side Components

Located on the bottom or underneath the machine are the following components:

- **DRIVE SHAFT:** Located toward the center of the bottom is the lane drive shaft. This shaft is driven by the drive motor.

- **DRIVE WHEELS:** Mounted on the lane drive shaft are the two drive wheels. These wheels rotate under power from the drive motor to move the machine on the lane.

- **SQUEEGEE ASSEMBLY:** Mounted near the front of the machine is the squeegee assembly. This assembly vacuums the cleaner and oil off of the lane during lane cleaning. The unique mount for the squeegee allows the tilt or pitch to be adjusted. There are also independent height adjustments for the left and right side.

- **GUIDE ROLLERS:** Mounted on the outside walls are four spring-loaded guide rollers. These tapered rollers ride along the edge of the lane to keep the machine straight and square as it travels on the lane surface.

- **SKID PLATES:** Two small UHMW pieces are mounted to the floor of the machine. These will help prevent damage if the machine travels too far forward and ends up in the pit.

G. Right Side Components

The following components are located on the right outside wall of the machine:

- **DUSTER WIND-UP MOTOR**: Mounted toward the front of the machine is the duster wind-up motor. When this brake motor operates, it winds-up used cloth and lifts the cushion roller from the lane surface.

- **TRANSPORT HANDLE**: A handle is provided to make the machine easier to move while in the transport position.

- **LANE-TO-LANE CASTERS:** Located on the outside of the frame are two lane to lane casters that support machine as it is moved on the approach from one lane to the next.

- **SQUEEGEE MOTOR:** Mounted to the right side plate is the mechanical-brake motor which controls the up and down movement of the squeegee. A cam is mounted on the shaft to hold the adjusting linkage for the squeegee pitch.

- **SQUEEGEE ADJUSTMENT:** The squeegee height can be adjusted by loosening the pivot mounts located on the side plates and setting them to the desired height. There is a separate adjustment for the left and right sides. Make sure the squeegee stays relatively level in the machine.

- **OIL HEAD TIMING PROXIMITY SENSOR**: Mounted toward the rear of the machine is a proximity switch that controls the oiling head. Protected beneath a cover, this proximity switch keeps track of the position of the oiling head by sensing an aluminum target.

- **OIL/CLEANER HEAD SHAFT**: This shaft is used to mount the board counting target and also extends to the front of the machine to drive the cleaner head assembly.

- **HANDLE CATCH**: A small piece of UHMW is mounted to the top of the side wall to hold the handle in place during transport.

H. Left Side Components

The following components are located on the left outside wall of the machine:

- **DUSTER UNWIND MOTOR**: Mounted toward the front of the machine is the duster unwind motor. This brake motor operates to unwind new cloth and lower the cushion roller onto the lane surface.

- **DRIVE TACHOMETER SENSOR:** Mounted near the bottom of the left side plate is the DRIVE TACH sensor. A metal target is rotated as the drive shaft turns. As the target passes in front of the proximity sensor, pulses are sent to the PLC. The PLC counts these pulses and calculates the IPS (INCHES PER SECOND) travel speed of the machine. This is used to set and monitor the 6 different drive speeds of the machine.

- **SQUEEGEE ADJUSTMENT:** The squeegee height can be adjusted by loosening the pivot mount and relocating it to the desired height. There is a separate adjustment for the left and right sides.

- **OIL HEAD DRIVE MOTOR:** Located on the outside of the left side panel is the Drive Motor for the Oil/Cleaner Heads. This motor, along with a cogged drive belt, moves the heads back and forth along rectangular tracks. The motor is also used to adjust the belt tension.

- **HEAD MOTOR CAPACITOR:** Mounted beneath a cover is the capacitor for the oil head motor.

- **BUFFER BELT**: The buffer belt is located beneath a cover on the left side. It is routed around an idler pulley. Check the tension of the belt periodically to ensure proper operation.

- **TRANSPORT HANDLE**: A handle is provided to make the machine easier to move while in the transport position.

- **HANDLE CATCH**: A small piece of UHMW is mounted to the top of the side wall to hold the handle in place during transport.

- **BUFFER BRUSH LIFT MOTOR:** Mounted on the left side of the machine under the handle is the buffer brush lift motor. This motor lifts the buffer brush off the lane. The brush needs to be lifted at times where conditioner is not being applied (i.e. from the end of oil through pindeck during all cleaning cycles). The brush always parks in the down position, even after a clean only function.

- **LANE-TO-LANE CASTERS:** Located on the outside of the frame are the lane to lane casters. These casters support the machine as it is moved on the approach from one lane to the next.

SECTION III - Pre-Installation

Preparation of the Bowling Lanes

Prior to operating this equipment for the first time, it is highly recommended that a thorough inspection of the bowling lane and approach area take place.

All loose foul lights, divisions, cappings and adapter blocks and channels should be tightened, repaired or replaced.

High channels or bumper gutters will lift one side of the machine and cause errors. Loose capping screws, loose gutters, and missing capping sections will cause damage to the power cord.

Note: The transition from the gutter to the approach should be as smooth as possible for easy insertion and removal of the lane machine. This will prolong the life of the casters as well as other parts.

Ramps that are used for moving the machine from and to 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 not only will extend the life of the machine but will make it easier to operate.

SECTION IV - Operating Instructions

A. Filling the Conditioner Tank

Completely fill the conditioner tank prior to operating on the first lane. To fill the conditioner tank, the machine should be in the operating position on a level surface. Open the splash guard and remove the cap located on the top of the tank.

Insert the funnel assembly provided with the machine. Wrap a rag around the bottom of the funnel to prevent spills from getting in the machine.

Fill the tank until the conditioner level in the tank is about 1-1/2" (3.8 cm) from the top edge. Failure to watch the tank level could cause the tank to overflow.

This overflow can drain down onto the lane distance sensor or the buffer brush, which will cause an excess amount of conditioner to be applied to the lane in that area for several lanes. You should place rags beneath the tank to prevent this from happening.

When finished, be sure to remember to replace the cap. Failure to do so could cause a major mess when the machine is lifted to the transport position.

B. Filling of Cleaner Supply Tank

To fill the Cleaner Supply Tank, the machine should be in the down or operating position. Prepare an appropriate mixture of cleaner and water. Open the splash guard and place a rag beneath the tank. Open the tank cap and place a rag around the base of the funnel to prevent foam from over-flowing into the machine.

Slowly pour the mixture into the 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 all 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. At the very least, this will reduce the cleaner output and result in inadequate stripping. This may lead to customer complaints, ball calls, and an excess of out-of-range pins. When necessary, the supply tank can be removed for cleaning.

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

Any spills or drops of cleaner onto the approach should be wiped up immediately! Any spills on the machine can stain the paint and make the machine ugly. Ugly machines do not run as well as clean, sharp, and highly maintained machines.

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

C. Turning the Unit On

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

Connect the power cord into a suitable outlet. MAKE SURE THAT THE OUTLET IS SUPPLYING THE CORRECT VOLTAGE AND AMP RATING (see Section 1-1). Connecting the power cord into an outlet located toward the center lanes of the establishment will allow more lanes to be cleaned and/or conditioned without changing outlets. Then plug the twistlock connector plug into the machine.

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

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

If the machine does not appear to have any power after it has been plugged in, check the E-STOP switch to make sure it hasn't been accidentally pressed. Rotate the red button to reset this switch. Power will resume immediately. **E-STOP switches are on 230 volt machines only.**

NOTE: It is necessary to run 2 complete lanes with the machine each time you put out a pattern. After running the two lanes you then can condition your lanes. These 2 warm-up lanes will allow the Transfer Brush to become saturated and will prevent the first pair from being drier.

D. Keypad Display

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

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

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

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

E. Operators Menu Selections

Operation of the machine is controlled by a series of programs located within the memory of the programmable logic controller (PLC). These programs and settings may be changed or modified by following a simple sequence of prompts within the available menus displayed on the keypad. This section will lead the operator step-by-step through the menus and prompts.

To make this section easily understandable, the operator should be familiar with the keypad as detailed in Section II of this manual.

1. Run Mode

When the machine is powered up the RUN SCREEN will appear first:

*** 0000 K+ 0000**
SPEED 00 PRO# 01

The Kustodian Plus is always ready to run when this prompt is displayed. The display shows four pieces of information that can be useful in monitoring machine operation. The top left will show the oil valve time, if the time shows a steady increase this may indicate lack of lubrication on the oil and cleaner rails. The top right will be the total time it takes to run one lane, steadily decreasing or increasing values may indicate the need to check machine speed settings. The lower left is the speed in inches per second and the lower right is the program number the machine is running.

Note: The oil valve time and machine run time are in tenths of seconds and they will vary, so it will be important to know what the average is to be able to recognize a potential problem.

A. Program Override

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

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

B. Normal Run Mode Clean and Oil

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

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

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

Note: If the machine is not seated on the lane properly there is the possibility of a travel error.

2. Return to Foul Line Menu

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

*** MANUAL REVERSE**
PRESS BUTTON

To return the machine to the foul line, press the START BUTTON on the handle and hold it. The machine will return to the foul line at about 22 inches per second as long as the button is held down.

3. Change Program Settings

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

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

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

CHANGE PROGRAM

CHOOSE -> 01

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

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

START BRUSH

IN INCHES -> 00

This prompt will display the current distance where the machine should start and stop the buffer motor from the foul line. This delay in starting the buffer will apply less oil near the foul line.

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

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

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

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

OIL ONLY DUST?

01=YES -> 01

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

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

THIS CONCLUDES THE CLEANING PORTION OF THE PROGRAM

THE FOLLOWING PROMPTS MAKE CHANGES TO THE

CONDITIONING PORTION OF THE PROGRAM.

NOTE: These selections will allow the operator to change the load size, the number of loads, the speed, and each menu of the selected conditioner program.

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

OIL PATTERN DIST

IN FEET -> 39

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

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

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

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

01F 2L- 2R X 04

00->04 FT IPS=10

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

02F 9L- 9R X 01

04->06 FT IPS=14

The 9L will be blinking. In the previous screen we left with the load area at 00 to 04 feet, the beginning screen in the second screen forward begins with the ending

distance of the previous screen. The area for this screen is calculated from the number of loads and the speed.

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

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

03F 10L-10R X 02

06->10 FT IPS=14

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

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

04F 11L-11R X 02

10->13 FT IPS=14

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

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

05F 12L-12R X 02

13->19 FT IPS=18

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

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

06F 13L-13R X 01

19->21 FT IPS=18

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

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

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

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

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

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

07F 2L-2R X 00

21->39 FT IPS=26

The **last load screen forward must have 00** for the number of loads. This screen is the buffer distance control. It is a real good idea to always **end all loads at least 4 feet** before the end of travel. This gives time for the last load to get from the brush to the lane.

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

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

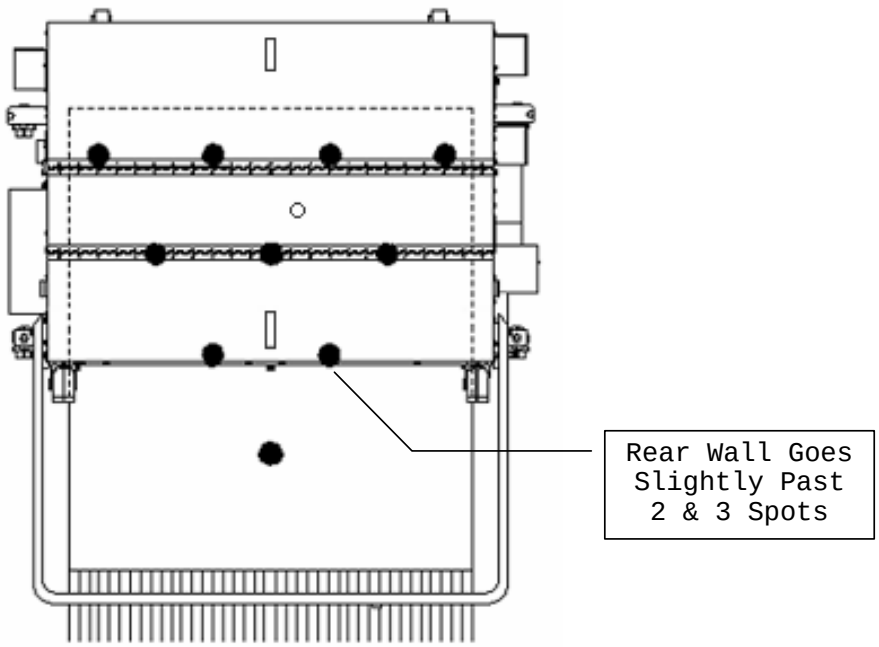
NOTE: If you were to go into the screen with the last oil distance to increment the number of loads from 0 to 1, the program will not allow you to increase the number of loads until you "enter around" to the travel distance and decrement it. Use the Down Arrow to change it to something less than the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

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

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

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

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



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

RETURN OIL SCREENS

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

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

01R 2L- 2R X 00

39->33 FT IPS=26

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

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

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

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

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

02R 13L-13R X 03

33->25 FT IPS=18

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

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

03R 12L-12R X 02

25->20 FT IPS=18

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

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

04R 11L-11R X 04

20->12 FT IPS=14

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

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

05R 10L- 10R X 03

12->06 FT IPS=14

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

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

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

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

06R 2L- 2R X 00

06->00 FT IPS=14

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

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

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

NEXT TO REVIEW

*** MENU TO EXIT ***

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

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

4. System Control Cleaning

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

Press the MENU key until the following screen appears:

SYSTEM CONTROL

CLEANING

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

LAST SQUIRT DIST

IN FEET -> 50

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

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

LIFT DUSTER

IN INCHES -> 20

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

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

FORWARD DISTANCE

SUBTRACT -> 31

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

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

REVERSE DISTANCE

SUBTRACT -> 31

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

This concludes the selections in the
SYSTEM CONTROL CLEANING menu.
Press NEXT to loop around to the start of the menu again.

5. System Control Duster Menus

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

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

SYSTEM CONTROL

DUSTER 0000

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

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

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

UNWIND TIME

F6 TO RESET 08

This screen will display the current unwind time setting for each "ratchet" of cloth. This number will automatically increase as the size of the supply cloth roll decreases. This value will return to the default setting of 08 when F6 is pressed.

This prompt is referring to the amount of time in tenths of seconds. The "08" is actually 0.8 seconds. To change the amount of unwind time, use the UP or DOWN ARROWS. Changing the value sets the data automatically.

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

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

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

This concludes the selections in the
SYSTEM CONTROL DUSTER menu.

6. Auto Program

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

7 DAY PROGRAM

PLANNER

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

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

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

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

*** MONDAY**
****** AM --> 01**

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

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

*** MONDAY**
****** PM --> 01**

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

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

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

MONDAY AM	**MONDAY PM**
TUESDAY AM	**TUESDAY PM**
WEDNESDAY AM	**WEDNESDAY PM**
THURSDAY AM	**THURSDAY PM**
FRIDAY AM	**FRIDAY PM**
SATURDAY AM	**SATURDAY PM**
SUNDAY AM	**SUNDAY PM**

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

This concludes the selections in the
7 DAY PROGRAM PLANNER menu.

Press NEXT to loop around to the
beginning of the menu again.

7. Test Output

Press the MENU key until the following screen appears:

TEST OUTPUT #01
PRESS F2-F5 OFF

The prompt above shows that output #01 is to be tested, by pressing the F5 key and holding it down, the output will come on and stay on. When the key is released the output will go off.

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

Refer to Section VII for a list of the outputs. A list of outputs is also provided next to the keypad for easy reference.

NOTE: The outputs that operate the drive motor (except reverse) will go on and stay on until the F5 key is pressed again. These outputs are programmed to stay on so the motor can run while you are adjusting the different speeds. The speeds will be displayed in place of the OFF text. Refer to Section V for drive speed adjustments.

This concludes the selections in TEST OUTPUT menu.

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

8. Pump Output Volume Test/Cleaner Output Test

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

PUMP OUTPUT

VOLUME TEST

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

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

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

*** OIL VOLUME**

PRO#01 PRESS F6

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

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

To Calibrate:

1. Remove the oil tip from the moving head by pushing down and turning counter-clockwise.

2. Place the tip into a clean 25 or 50 ml graduated cylinder.

3. Then press the **F6** key. The Brush Lift Motor will operate momentarily. The Cleaner Head and Oil Head will start running. The Oil Head moves back and forth across the transfer brush as if the machine were operating on the lane. The Oil Program Valve will be turning on and off. When it finishes the forward loads, it will pause for a second and do the reverse loads.

4. Check the volume of conditioner in the graduated cylinder. It should match the amount shown on your program worksheet.

   NOTE: How to calculate the actual amount of conditioner that each program should dispense is explained in the beginning of **Section VIII - Oil Patterns**.

IMPORTANT! If different readings occur during calibration there may be a problem with the oiling head or cleaner head as they travel across the width of the machine. During calibration, the oil is dispensed while the heads travel from one side to the other. If one of the heads bind up and travel too slowly, more oil will be dispensed and the readings will be higher (since pump runs at constant speed).

Make sure the heads move freely on the rectangular bars. Only a slight resistance of the motor gearbox should be felt when the heads are moved by hand. However, there should not be excessive play or wobble in either head.

After cleaning and lubricating the bars, adjust the belt tension if needed. Make a habit of cleaning the lint and hair from the heads after running the machine to avoid this problem.

Cleaner Pump Test:

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

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

This concludes the selections in PUMP OUTPUT menu.

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

9. Copyright

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

*** (C) COPYRIGHT**

KEGEL CO 2004 9M

On the second line of the display, on the far right, is the program version in the PLC. You may be asked for this information during a technical support phone call. The operating program downloaded into this machine when it was produced is identified as **9M**.

NOTICE: The PLC program is © Copyright protected. Do not attempt to make unauthorized copies of the program or download it into a machine without obtaining permission from Kegel.

This is the last menu available. Press MENU to return to operating screen.

SECTION V - Adjustments

A. Cleaning Cloth Replacement & Adjustment

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

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

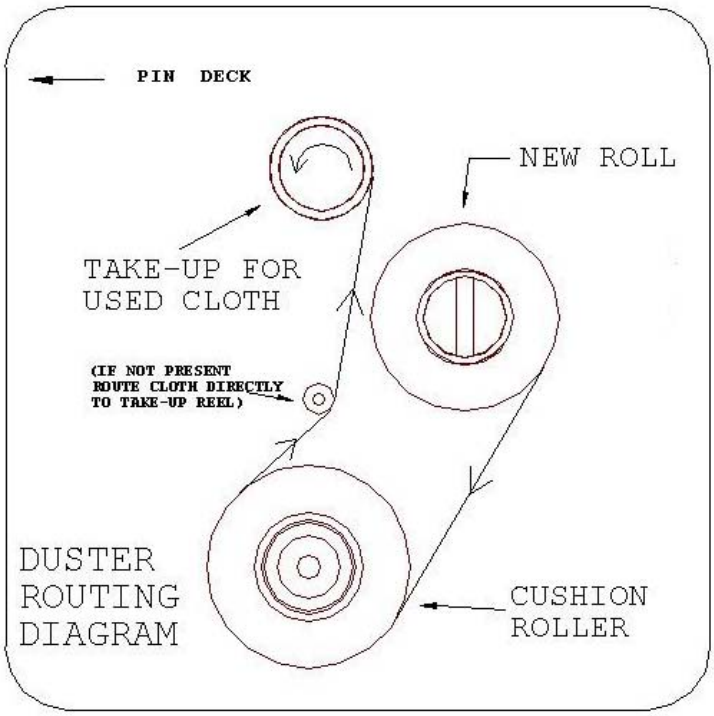
IMPORTANT! The machine can NOT be operated without Lane Cleaning Cloth installed.

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

1. Remove the cleaner dispensing tip from the holder and then remove the old cloth.
2. 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.
3. Route the cloth down between the squeegee and the cushion roller. Pull the cloth under the cushion roller and distribute evenly.
4. 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. Make sure the cloth is wrapped evenly from side to side around the pipe. Use the PVC clamps to hold the cloth.
5. Insert the PVC roll into its location and replace the cleaner dispensing tip.
6. Apply power to the machine and bring up the **SYSTEM CONTROL DUSTER** menu.
7. The start button on the handle can be used to take-up the slack from the fresh roll of cloth. Push and hold the button in, the unwind motor will operate until the button is released. The next time the button is pressed and

held in, the wind-up motor will run until the duster up switch is actuated. The cloth should be rolled up taut and evenly across the assembly.

A sticker similar to the diagram below is affixed to the machine as a reference for proper cloth routing.



B. Filling of Cleaner Supply Tank

To fill the Cleaner Supply Tank, the machine should be in the down or operating position. Prepare an appropriate mixture of concentrated cleaner and water.

Disconnect power, open the splash guard, and place a rag under the tank. Open the tank cap, insert the funnel with a rag around the base, and pour the mixture into the Supply Tank using the supplied funnel (with screen filter).

Fill the tank until the fluid is about 1/2" (1.3 cm) from the top of the tank. Do NOT overfill this tank. Replace the cap.

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

CAUTION: Do not spill cleaner inside the machine. Spills may "short" the electronic components and cause the machine to malfunction. A wet switch may also produce a dim INPUT LED on the PLC.

Any spills or drops of cleaner should be wiped up immediately!

C. Emptying & Cleaning of Recovery Tank

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

To empty the Recovery Tank, the machine must be in the down or operating position. Disconnect the inlet from the side of the recovery tank and the outlet hose from vacuum motor by removing the PVC elbows.

Remove tank from machine and dispose of 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.

NOTE: When dumping liquid from Recovery Tank, it is important to dump from the end marked EMPTY, or the end that was connected to the squeegee assembly. If liquid accumulates between baffles on the opposite side of tank, dirty cleaner may be discharged from the vacuum exhaust and onto the lane until the line is cleared.

It is recommended that the inside of the tank be cleaned and the filter material in the tank be replaced periodically. A good rule of thumb would be: if you have a 40 lane house and strip twice a day, we recommend changing the filter every 30 days. Maintenance will vary depending on center size, so it is best to inspect the tank filter by looking though the inlet end where the tank is emptied from to determine how often it needs to be maintained.

To replace filter, set the tank on a flat surface. Remove the phillips screws from both covers, use a flat-head screwdriver to gently pry covers off. Clean silicone residue from both covers and the tank. Remove filter material from the tank and rinse thoroughly with clean water. Use a clean rag to wipe any dirt or residue from the inside of the tank. Replace filter material in the correct position in tank (filter material is not square, it will fit only one way). Place a bead of silicone on the area where both covers will seat. Replace fasteners in both covers and tighten down. DO NOT over-tighten. Allow silicone to cure before operating machine.

To reconnect the tank, reverse the disconnect procedure.

D. Adjustment of Cleaner Dispensing Tip

The machine uses a single cleaner dispensing tip that moves back and forth to apply cleaner to the lane surface in front of the duster cloth. Factory adjustment of the tip is 3/8″ above the lane surface. If tip is adjusted closer to lane, make sure tip does not come in contact with the lane surface when machine enters or exits the lane.

The machine also uses a cog belt to drive the cleaner head back and fourth. This belt can be adjusted to shift the cleaner dispensing head to the left or right if the machine tends to favor one side of the lane. 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 end in the proper direction, **not the idler end.** Once the belt is moved adjust the belt tension and tighten the idler.

E. Cleaner Pump Adjustment

There are two ways to adjust cleaner output with the Kustodian Plus. One is to simply adjust the distance the machine applies cleaner in the Systems Control Cleaning menu. The second is to vary the output of the pump with the needle valve mounted with the pump assembly. Maximum output will clean approximately 24-26 lanes with Last Squirt set at 50 ft. This is done with the valve turned off allowing zero flow back to the tank. Minimum output will do approximately 30 lanes or more with Last Squirt set at 50 ft. The valve is opened one quarter turn or more. The minimum output is set by the length of tubing that returns back to the tank. Decreasing the length of this tubing will decrease the volume and increasing the length will increase the volume output.

NOTE: If the cleaner tip is dripping it may be due to a weak check valve. Turning the adjusting valve to the "Closed" position may help reduce this until you can replace the check valve.

F. Guide Roller Adjustments

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

To adjust the guide rollers, remove the bottom bolt that holds the mounting block to the frame. This provides clearance to remove the guide roller, spring, bronze bushings, and the shoulder bolt from the mounting block.

One bronze bushing is normally between the roller and the side plate of the machine and one is between the head of the shoulder bolt and the wheel (in the front section of the machine only).

Place the bronze bushing located toward the side plate between the head of the mounting bolt and the guide roller on one side of the machine (both front and rear rollers). This will give approximately 1/4" additional clearance between the guide rollers as the machine travels on the lane surface.

Operate the machine after changing one side. If needed, change the other side of the machine.

G. Squeegee Assembly 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. 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.

To check this adjustment and make changes, the machine should be in the upright or transport position. The squeegee will need to be lowered to the down position. To lower the squeegee, apply power to the machine and menu to the **TEST OUTPUT** screen.

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

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

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

If the distance is more or less, loosen the bolts (two on each side) that hold the squeegee pivot in place. Move the pivot mount until the squeegee height is correct. This

should be done for both the left and the right side. Tighten the bolts after the adjustment is acceptable.

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

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

2. Loosen the jam nut between the rod end and the rod.

3. Remove the bolt that connects the rod end to the cam.

4. Rotate the rod end as needed to increase or decrease the pitch. Do NOT make the linkage too short.

5. Re-install and tighten the bolt to connect the rod end to the cam.

6. Re-check the gap between the straight edge and the drive wheels.

7. Tighten the rod end to the rod with the jam nut.

8. Check cleaning to ensure adjustment is adequate.

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

H. Buffer Brush Adjustment

The buffer brush is manufactured 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.

An Amp Draw should be taken on the buffer motor when adjusting the brush. Too much "crush" can cause excessive load on the motor and wear on the brush.

To check the buffer brush adjustment the brush must first be lowered onto the lane. This is done at the **TEST OUTPUT** menu. If the brush is not already down in the "zero" position, press the NEXT key until OUTPUT #09 is displayed.

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

With the brush down, stand the machine in an upright position and hold a level or straight edge across the drive wheels and rear lane distance wheels. The buffer brush material should extend approximately **3/32"** to **3/16"** (2.38 mm to 4.76 mm) beyond the level for proper adjustment. This crush should be determined by the amp draw of the buffer motor and smoothness of the conditioning pattern. The buffer brush is factory adjusted prior to being shipped at approximately 1/8".

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

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

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

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

NOTE: When cleaning the Buffing Brush, NEVER use any type of cleaner on the brush. Use of cleaners will decrease the brush's ability to hold conditioner, and greatly affect the lengthwise taper of the conditioner pattern.
All that is needed to clean the Buffer Brush is a clean, soft, dry rag. Wipe the brush clean daily.

I. Transfer Brush Adjustment

Before making any adjustment to the Transfer Brush you should make these observations.

Apply power to the machine, open the lid to expose the electrical compartment and press the buffer contactor actuator button down to run the motor. Observe the interaction of the two brushes; the buffer brush should look like it is contacting the entire Transfer Brush without bending the bristles back excessively or at all. All of the bristles should be in line with no stray bristles sticking up from the group.

To check the actual penetration into the buffer brush, remove power from the machine and rotate the buffer brush opposite its normal running direction. Observe the gap that is created; the measurement should not exceed ½" and should not be less than ¼".

Next, stand the machine up onto its transport casters to observe the bottom transfer brush. With power removed rotate the buffer brush in its normal running direction. The gap that is created should be relatively the same as the upper transfer brush. The adjusting bolt that is in the center of the transfer brush assembly is used to prevent the assembly from being forced back by the buffer brush.

If an adjustment needs to be made be certain that close attention is paid to the reference marks that are around the mounting plates. The reference marks indicate the factory adjustment and should be used as a beginning point for any future adjustments.

J. End Cleaning Distance Travel Adjustment

When the machine is installed the End Cleaning Travel Distance must be checked and adjusted.

This distance is different in each bowling center around the world. These vary because of specification tolerances that are allowed during the construction of the lanes. Always leave a margin of error when setting the end cleaning distance. This can be accomplished by starting the machine a couple of inches past the foul line when making this adjustment.

Making sure that the machine is traveling the correct distance is important to how well the pindecks are cleaned. If the pindecks are not getting cleaned well enough, the pins slide more, creating Out-of-Ranges. This is an unnecessary call for any bowling center.

To adjust the pindeck travel, go to the **SYSTEM CONTROL CLEANING** menu and press the **NEXT** key until the screen reads:

FORWARD DISTANCE

SUBTRACT -> 31

Increase the number with the Up Arrow to go shorter, decrease with the Down Arrow to go longer. After the change is made, run the machine and observe where the machine stops in the pindeck area.

NOTE: An adjustment may be necessary in the **REVERSE DISTANCE SUBTRACT** menu when travel settings are changed. It should be adjusted so the machine travels the correct distance back to the foul line. The return distance should be a little less than the End Cleaning Distance. Adjust the setting to control the reverse travel distance.

K. Oil Head Timing Adjustment

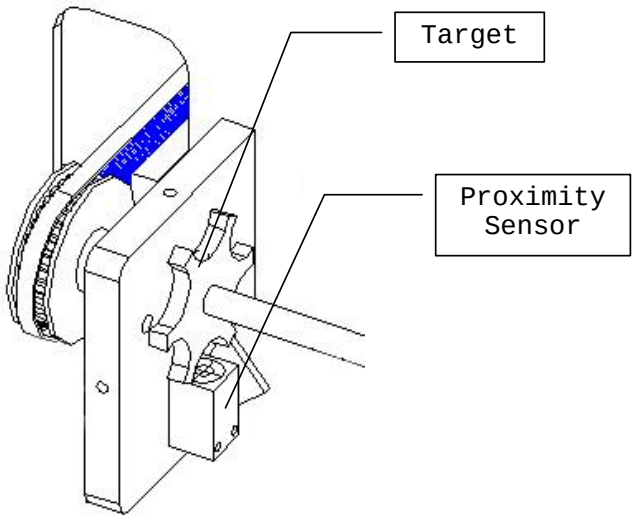
The timing for the oil head is a precise adjustment. This should not be touched unless the head drive belt needs replacing or the machine is displaying ERROR CODE L8.

On the 10-pin side of the machine is a cover for the head timing sensors. Remove the two screws that hold the cover in place. Slide cover off. Once the cover is off you will be able to see the belt tension and head timing assembly. Follow these steps closely to avoid confusion.

1. Move the oil head against the 10-pin side wall.

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

3. The diagram below shows the board counting target and the board counting proximity sensor. The gap between the target and the proximity sensor should be 0.015 (±0.005). The proximity sensor should be mounted square to the plate.



View of Head Timing Assembly

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

   NOTE: The distance between the metal target on the oil head and the proximity sensor should be a gap of **0.025**".

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

6. After doing step #5 if you have the board counting sensor indicator light coming on in the same position for both lane edge sensors then the adjustment is good. If not, go to the next step.

7. If on the 10-pin side the board counting sensor comes on too soon and the 7-pin side comes on late, the board counting target will need to be turned in a counter-clockwise direction and vice-versa if they are off in the other direction.

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

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

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

L. Drive Motor Speed Adjustments:

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

TEST OUTPUT #02
PRESS F2-F5 OFF

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

9-10 IPS
13-14 IPS
17-18 IPS
21-22 IPS
25-26 IPS
29-30 IPS
RANGE Pot (Adjusts speed for all pots).

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

1. After you have reached the Test Output screen press NEXT (F2) to advance to output #02, then press ENTER (F5). The speed will be displayed on the lower right side of the keypad. Using a small screwdriver, turn the pot clockwise to increase the speed if needed. The screen should flash evenly between 9-10 for the low speed.

2. Press NEXT to advance to the next speed. The motor will stay on as long as you don’t press the ENTER key. If you do press it, simply press ENTER again and it will come back on. Adjust your second speed to 13-14, then advance to the other speeds by pressing NEXT and adjust accordingly if needed.

3. If one of the speeds can't be reached, adjust the RANGE trimpot. Turn it clockwise to slow down and counter clockwise to speed up the drive motor. Always go back to Speed 1 and check all the speeds again.

4. Once the 6 speeds are set, run the machine on the lane and check each speed to see if it matches the no load adjustments that were just made.

5. If the speeds don't match, it will be necessary to make an adjustment to the Speed Control board. The following steps outline this procedure.

6. Remove power to the machine and remove the four screws that hold the control plate inside the machine.

7. Lift the control plate up and locate the DC Speed Control Board. There will be a trimpot on the board labeled **IR**, this is a compensation adjustment. This adjustment is used to equal the load and no load speeds.

8. If the machine is traveling faster on the lane, then you will need to turn the trimpot counter-clockwise. If the full-load speeds are slower, turn it clockwise. If the speed difference is not much it will be a very small adjustment.

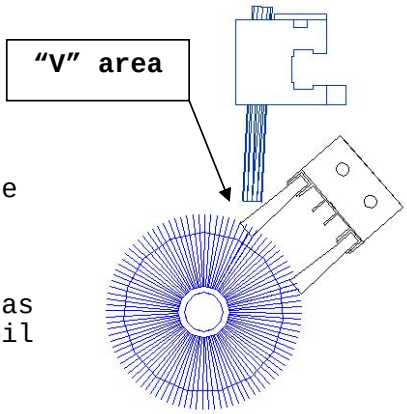
9. Run machine on the lane and check all 6 drive speeds, repeat the step above if needed.

10. If speeds are set properly, replace screws in control plate and make sure that all plugs are securely fastened.

M. Momentary Wheel Adjustment:

To adjust the momentary wheels the machine will have to be on the lane. Once the machine is on the lane, loosen (do not remove) the bolts that hold the momentary wheels to the machine. Slide the momentary wheel housing up or down until the gap between the wheel and the lane is approximately 1/16”. The wheel needs to be as close to the lane as possible without touching. Tighten the bolts in the housing once the desired gap is achieved. Repeat steps for each momentary wheel housing. If you notice that sections of the lane are being missed by the squeegee (mainly on wood lanes), you will have to adjust the momentary wheels further up.

N. Oil Tip Adjustment:



Correct adjustment of the Oil Tip is very crucial and is a determining factor in putting out a consistent pattern. There are two adjustments that can be made to the oil tip. One adjustment is the height of the tip, the other is the position of the tip. The point where the Transfer Brush and the Buffer Brush meet will form a “V”. The Oil Tip should be as close to this “V” as possible, without actually dispensing oil into the “V” area. Check this with the buffer brush running. To operate the brush, press the button on top of the buffer motor contactor. After making each position adjustment you will also need to make sure the tip is as close to the black brush as possible without touching. The height can be adjusted by loosening the set screw in the tip holder collar and sliding the tip holder up or down. Re-tighten set screw when desired height is achieved.

NOTE: If you notice a zig-zag 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 zig-zags disappear). Also, make sure the Oil Tip does not drag through the Transfer Brush during a “Clean Only” cycle (this is due to the fact that the buffer brush is in the “UP” position during a “Clean Only” cycle)

Section VI - Maintenance

Maintenance: The following items should be done to the machine on a regular basis:

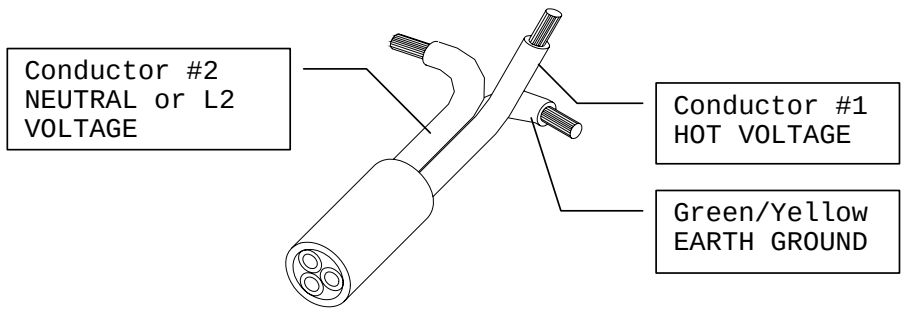
A. Power Cord

Care should be taken to see that the power cord is handled properly and stored correctly. Do **NOT** wrap the cord around the machine for storage. Some type of cord wrap or cord spool for storage will add life to the cord. Make large loops when wrapping the cord.

Should the power cord become damaged or frayed, it should be repaired or replaced **IMMEDIATELY**! To keep the power cord clean, pull it through a rag as the machine is being operated on every lane.

Important Note About The Power Cord

The machine power cord is certified to comply with UL, CSA, and CE Safety Directives. To achieve all these certifications, two of the wire conductors in the cord are colored **BLACK**. Each conductor has a number printed on it: 1 or 2. The #**1** conductor should be connected to the **HOT** leg (L1) of the voltage source. The #**2** conductor should be connected to L2 or the **NEUTRAL** leg of the voltage source (if applicable on 230V). Make sure to follow the proper cord wiring instructions when replacing the cord ends. Use only cord stock equivalent to the factory specifications.



B. Squeegee

Wipe the blades and housing with a clean cloth after each operation. Check the blades for wear and tear. The edges of the blades should be sharp and square. Rounded edges mean it's time to replace the blades.

C. Lane-to-Lane Casters

Clean after each operation. If casters are showing excessive wear inspect gutter adapter blocks for sharp edges.

D. Drive Wheels

Clean daily after each operation.

E. Vacuum Motor

Important! This motor should be wiped off daily and blown out weekly. This is especially important in high dust areas, or bowling centers that do not dust gutters and caps daily.

Dirt can build up on the electrical end of the motor, which will obstruct the air flow. This will result in increased heat and wear of the brushes and commutator. This will drastically decrease the life of the vacuum motor. **You have been warned!**

The vacuum motor is mounted by two bolts on the cleaner wall, removing the lid will make it easier to remove.

F. Inside Machine

Wipe up excess dust and dirt daily. Pay close attention to the computer compartment to keep dirt from damaging the PLC and components. Avoid spilling liquids inside the machine.

G. Recovery Tank Removal

Remove and drain (from inlet end) after each operation. Always drain the recovery tank when filling the supply tank. Flush tank with warm, soapy water periodically to eliminate build-up.

H. Filters

The cleaner and oil tanks both have a filter inside the tank. Periodically inspect and clean the internal tank filters to keep the machine operating at peak performance.

The recovery tank also has a filter inside that periodically needs inspected and replaced.

I. Changing of Conditioner

1) DRAINING THE TANK:

Unplug all hoses running to the tank. Use rags to prevent spilling oil inside the machine. Wipe up all spills immediately!

Remove the two bolts securing the tank to the rear wall and lift it out of the machine. Prepare an area on a bench where the tank can be drained into a container.

Open the cap and drain all the oil from the tank. After draining, flush the tank and re-install it back into the machine. Connect everything except the oil return line from the oil control valve.

2) FLUSHING THE LINES:

The oil lines should be flushed to remove all the old conditioner. Place the oil return line into a clean cup.

With the return line in the cup, turn the machine on. This will pump the majority of the remaining oil out of the lines.

When a large amount of air starts to spit out of the return line, turn OFF the machine. Do NOT run the pump dry for an extended period of time...damage may occur.

Important Note: When changing to a conditioner with a higher viscosity, be prepared to change the pressure regulator tubing. Failure to monitor the pressure may result in damage to the pulse dampener tube.

Remove the cap on top of the oil tank and fill it with the new conditioner. Turn the machine ON and allow it to run until the new conditioner flows into the cup. Re-connect the return line into the tank fitting. Check for leaks.

Go to the "Pump Output Volume Test" menu.

Press NEXT to access the following screen.

*** OIL VOLUME**

PRO#01 PRESS F6

The machine will dispense oil as soon as F6 is pushed. Remove the oil tip from the moving head by pushing down, and then turning counter-clockwise. Place it in a cup and press F6. The machine will do a Volume Test which should flush any old oil or air out of the lines. Replace the tip into the moving head. **NOTE: This test can not be performed if the machine is in CLEAN ONLY.**

NOTE: The machine will need to be operated on the lanes to remove any build-up of conditioner in the brush.

3) CHECKING THE PRESSURE:

After filling the machine with new conditioner, place it in the operating position. Check the pressure gauge on the transfer compartment wall. The normal operating pressure is approximately **10-15 PSI**.

The pressure will affect the amount of pulse dampening for the streams of oil. It primarily determines the appearance of the oil stream, giving it a consistent flow on the transfer brush. Having too little pressure (5 PSI) is not a fatal error, but excessive pressure (more than 20 pounds) may blow the pulse dampening tube.

NOTE: ALWAYS run a Volume Check when adjusting the pressure. This is the best way to ensure the machine is operating properly.

The conditioner pressure is primarily dependent on *viscosity*. The type of conditioner and the temperature are what will affect pressure the most. If an adjustment is needed, adjust the length of tubing used to regulate the pressure.

The factory supplied tubing is 3/16" OD (4.762 mm) at a length of 7-1/2" (19.05 cm). This typically provides 12-15 pounds of pressure using Offense-HV at a temperature of 72° Fahrenheit.

Various lengths and sizes of tubing are available depending on the type of conditioner being used. Sizes range from 3/16" OD (light oil) to 1/4" OD (6.35 mm). The length of tubing may vary from a few inches to several feet. A chart in the Appendix recommends the proper pressure regulator tubing for each viscosity range, however adjustments may be needed depending on the operating climate.

J. Buffing Brush

If build-up of dirt occurs, the brush should be wiped with a clean cloth. Do not use any cleaner. Cleaning agents can affect the brush's ability to hold oil.

K. Transfer Brush

The Transfer Brush should be cleaned periodically to prevent excessive build up of lint. Use an air compressor or a comb like tool to remove lint from the brush. The mounting angle and surrounding area should be wiped clean of oil after each use.

L. Oil and Cleaner Head Rails

For smooth operation of the oil and cleaner assemblies it is important to keep rails lubricated. Lack of lubrication will result in possible errors and conditioning problems.

Section VII - Inputs and Outputs

A. Inputs

The PLC assembly of the machine has 24 inputs and 16 outputs. Inputs accept data from various components in the machine, and then use that information to control functions of the machine through its outputs. As an example, distances are input to the PLC from the lane distance sensor, at which point data in ROM or RAM chips activate certain outputs as programmed. An output example would be one of the brake motors.

Here is a list of the **INPUT** numbers for the PLC along with their designations:

INPUT	DESCRIPTION:
0CH 01	BOARD COUNTING PROXIMITY SENSOR
0CH 02	LEFT OIL HEAD REVERSING PROXIMITY SENSOR
0CH 03	RIGHT OIL HEAD REVERSING PROXIMITY SENSOR
0CH 04	BUFFER BRUSH UP SWITCH
0CH 05	BUFFER BRUSH DOWN SWITCH
0CH 06	DRIVE SHAFT TACHOMETER PROXIMITY SENSOR
0CH 07	LANE DISTANCE PROXIMITY SENSOR (LDS)
0CH 08	START BUTTON (HANDLE)
0CH 09	OIL ONLY SWITCH
0CH 10	DUSTER UP SWITCHES (2)
0CH 11	CLEAN ONLY SWITCH
1CH 00	SQUEEGEE DOWN SWITCH
1CH 01	SQUEEGEE UP SWITCH
1CH 02	OIL FLOAT SWITCH
1CH 03	CLEANER FLOAT SWITCH
1CH 04	CLEANER PRESOAK BUTTON

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

These Inputs are designated on the PLC as:

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

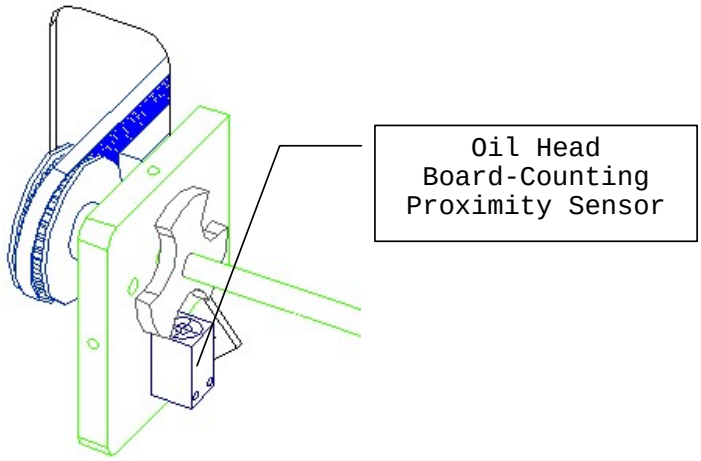
B. Outputs

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

OUTPUT	TEST #	DESCRIPTION:
10CH 00	#**08**	OIL PROGRAM CONTROL VALVE (24V DC)
10CH 01	#**02**	FORWARD DRIVE (CR1 RELAY)
10CH 02	#**01**	REVERSE DRIVE (CR2 RELAY) AND
10CH 03	#**03**	SR1 SPEED RELAY
10CH 04	#**04**	SR2 SPEED RELAY
10CH 05	#**05**	SR3 SPEED RELAY
10CH 06	#**06**	SR4 SPEED RELAY
10CH 07	#**10**	BUFFER CONTACTOR
11CH 00	#**17**	LEFT TO RIGHT OIL HEAD DRIVE
11CH 01	#**16**	RIGHT TO LEFT OIL HEAD DRIVE
11CH 02	#**09**	BRUSH LIFT MOTOR
11CH 03	#**11**	SQUEEGEE MOTOR
11CH 04	#**12**	DUSTER UNWIND
11CH 05	#**13**	DUSTER WINDUP
11CH 06	#**15**	CLEANER PUMP MOTOR
11CH 07	#**14**	VACUUM MOTOR

C. Description of Inputs

0CH 01 Board Counting Proximity Sensor: This sensor is located underneath the target when looking at the Head Timing Assembly. This sensor counts the number of boards that the head crosses in both directions. This works along with the proximity sensors that will show the lane edge when moving left to right or from right to left. (Input 0CH, LED #01)



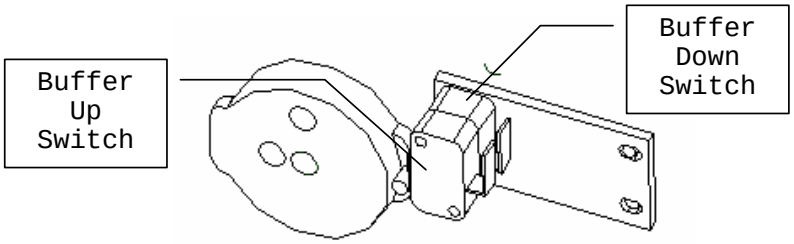
Oil Head Position Sensor Assembly

0CH 02 Left Proximity Sensor: This sensor is found on the left side of the Conditioning Compartment (1-1/8" or 2.86 cm from the left side wall). The proximity sensor senses metal, which is in the form of a flat head screw located on the backside of the oil head block. This sensor, along with the right sensor, has multiple purposes. The main purpose is to reverse the head drive motor. The proximity sensor also acts as a guide for the position sensor by indicating the lane edge when the oil head is traveling from left to right. (Input 0CH, LED #02)

0CH 03 Right Proximity Sensor: This sensor is found on the right side of the electrical wall in the Conditioning Compartment (1-1/8" or 2.86 cm from the right side wall). The proximity sensor senses metal, which is in the form of a flat head screw located on the backside of the oil head block. This sensor, along with the left sensor, has multiple

purposes. The main purpose is to reverse the head drive motor. The proximity sensor also acts as a guide for the position sensor by indicating the lane edge when the oil head is traveling from right to left. (Input 0CH, LED #03)

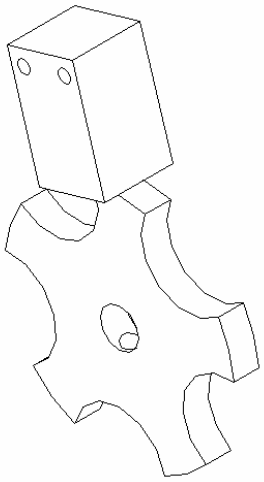
0CH 04 Buffer Up Switch: This switch is located on an adjusting plate, mounted on top of the Down Position Switch (it's the outside switch). When the lobe of the cam on the motor shaft actuates this switch, the PLC receives a signal that the brush is in the UP position. This switch is wired Normally Open. (Input 0CH, LED #04)



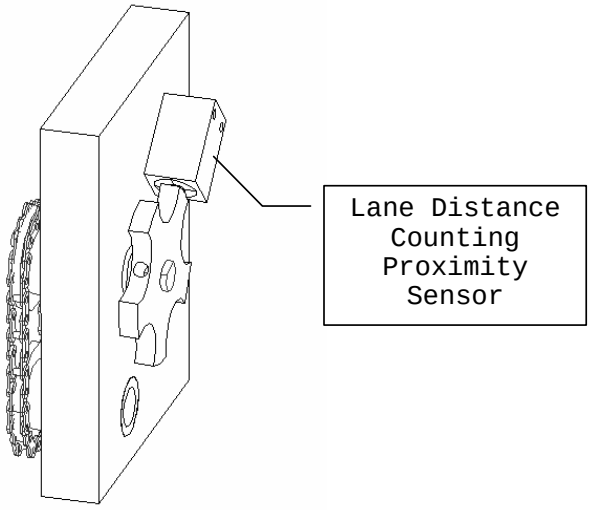
0CH 05 Buffer Down Switch: This switch is located on the mounting plate between the plate and the Up Switch. When the lobe of the cam actuates this switch, the PLC receives a signal that the brush is in the DOWN position. The down switch must be actuated for the buffer drive motor to function during any conditioning operation. This switch is wired Normally Open. The brush parks in the Down Position and this switch indicates the brush is in the zero position. (Input 0CH, LED #05)

Note: All microswitches on the machine are wired Normally Open. When replacing switches, make sure the wiring is connected to the **COM** and **NO** contacts.

0CH 06 Drive Shaft Tachometer Sensor: Mounted to the left side of the machine is the TACH sensor. A metal target passes in front of the sensor as the drive shaft rotates. As the proximity sensor turns on and off, pulses are sent to the PLC. The PLC counts these pulses and calculates the **IPS** (INCHES PER SECOND) travel speed of the machine. This is used to set the 6 different speeds of the machine. (Input 0CH, LED #06)



0CH 07 Lane Distance Sensor (LDS): This proximity sensor is mounted on a block on the rear wall of the machine. A metal target passes in front of this sensor as the shaft turns. It counts in one-inch increments as the machine travels down the lane. If this sensor does not send pulses to the PLC, the machine will display a T1 or T2 Error Code. (Input 0CH, LED #07)



0CH 08 Start Button: Located on the handle, this normally open push button has a couple of different functions during operation. (Input 0CH, LED #08)

- With the machine in the RUN mode, when the button pressed for the **FIRST** time, it will send a signal to the PLC. This signal will tell the PLC to run specific outputs as needed in the program (i.e. lower the squeegee and duster cloth).

  The **SECOND** time the button is pressed, the PLC will begin running the program on the lane.

  NOTE: The **UP ARROW** is also a backup switch that can perform all the functions of the Start Button.

- During operation, the button acts as a **Pause and Resume** Button for the machine.

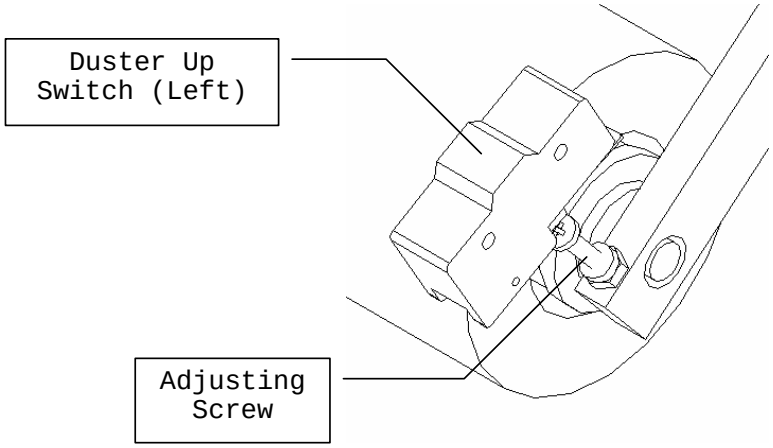
- In the **Manual Reverse Menu**, when the start button is pressed and held, the machine will travel in reverse at 22 IPS.

- In the **System Control Duster** screen, the FIRST time the button is pressed, the brake motor will unwind cloth while the button is held.

  The SECOND time it is pressed, the motor will wind-up cloth. The wind-up motor will stop running when the Duster Up Switch makes contact.

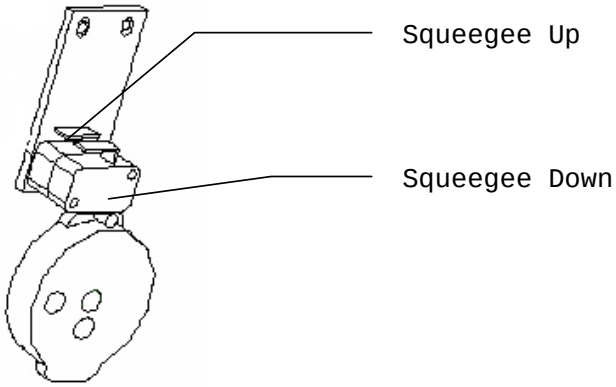
0CH 09 Condition Only: This input tells the PLC to oil without cleaning. Flipping the toggle switch on the control panel to Oil Only will turn this operation ON. In this mode the duster can be turned off if needed. (Input 0CH, LED #09)

0CH 10 Duster Up Switches: These two microswitches are located on the top side of the Cushion Roller Pivot Arms, on each side of the machine. When the cloth is wound up, a screw in the pivot arm activates the switch and one or both of these switches send a signal to the PLC. These switches are wired Normally Open. (Input 0CH, LED #10)



0CH 11 Clean Only: This input tells the PLC to clean without oiling. The cleaning speeds are the same as the oiling speeds in each of the programs. Flipping the toggle switch on the control panel to Clean Only will turn this operation ON.

1CH 00 Squeegee Up Switch: This switch is located on the right inside wall of the cleaning compartment, just above the cam. The switch works the same way as the Buffer Up Switch. When the cam lobe actuates the switch the PLC receives the signal telling the machine the squeegee is UP. This switch is wired Normally Open. The squeegee parks in the Up Position and this switch indicates the squeegee is in the zero position. (Input 1CH, LED #00)



1CH 01 Squeegee Down Switch: This switch is located outside of the Up switch (on the right inside wall of the cleaning compartment) just above the cam. The microswitch tells the PLC when the squeegee is in the DOWN position. A signal is sent to the PLC when the cam lobe actuates the switch. While operating, the squeegee must be in the down position. If the PLC does not get the signal from this switch, an error message will appear on the screen. This switch is wired Normally Open. (Input 1CH, LED #01)

1CH 02 Oil Float switch: This switch is located inside the oil tank and indicates when the oil needs to be refilled. Refilling the tank and starting the machine will clear the error from the screen. (Input 1CH, LED #02)

1CH 03 Cleaner Float Switch: This switch is located inside the cleaner supply tank and indicates when the cleaner needs to be refilled. Refilling the tank and starting the machine will clear the error from the screen. (Input 1CH, LED #03)

1CH 04 Cleaner Presoak Button: This button is located on the right hand side of the handle. Pressing this button prior to the first push of the start button will enable the presoak feature of the machine. After the first presoak cycle has been done pressing the button again will allow another cycle. (Input 1CH, LED #04)

DO NOT PRESS THR PRESOAK BUTTON WHILE THE MACHINE IS ON THE APPROACH

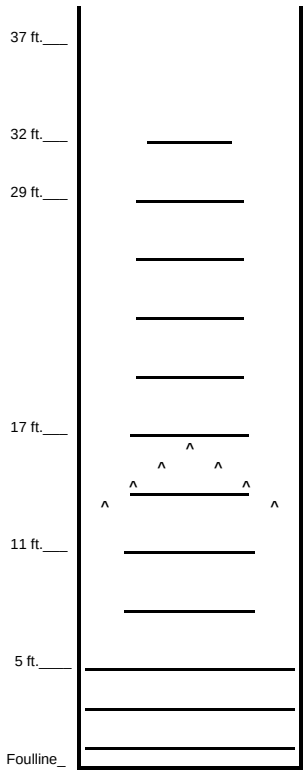
SECTION VIII - Oil Patterns

A. Understanding the Machine

How the machine controls the amount of oil.

The machine is capable of applying precise amounts of lane conditioner. An explanation of how this is accomplished will help you understand the operation of the machine.

When conditioning a lane the head travels back and forth across the transfer brush, applying streams of oil as it goes. The streams (or loads) are illustrated in this figure.



The size of the stream can be set to an exact amount or volume. We achieve this exact stream volume by using a highly accurate fluid metering pump. This pump, running at a constant speed, gives absolute positive displacement of the oil. The accuracy of the pump is ± **1%.**

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 oil that goes on each and every board within the stream. We measure this amount as the **Volume Per Board**.

The pump output is measured in *microliters*, a very small quantity. This is a metric measurement for fluid volume. The factory setting for the pump is 40 microliters per board.

To give you a visual perspective of how much conditioner is being applied in 40 microliters, we'll measure only one drop. About 16 microliters make up one drop of oil. So each time a stream of oil crosses one board, it applies about 2-1/2 drops of oil.

Actual Size of 16μL Drop of Conditioner

Since this amount of oil is too small to measure with the naked eye, we must use a larger number of boards to get an amount we can visibly measure. Factory-set Program #04 is designed to condition 400 boards. This will give us enough oil to determine how much oil is being applied per board. Using a large round number makes the math a little easier to figure.

NOTE: The following procedure uses Program #04 to perform the Volume Per Board test. Once you have set and proved your calibration, you may use Program #04 for one of your preset programs if needed. You can always determine your Volume Per Board by adding up the number of boards in any program.

The following exercise teaches you to calibrate the machine to confirm the factory pump setting. The pump should be set at 40 microliters per board. **NOTE: This test will not work if the machine is set to CLEAN ONLY.**

1. Apply power to the machine and menu to the:

PUMP OUTPUT

VOLUME TEST

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

*** OIL VOLUME**

PRO#01 PRESS F6

3. Use the UP ARROW and advance to Program #04.

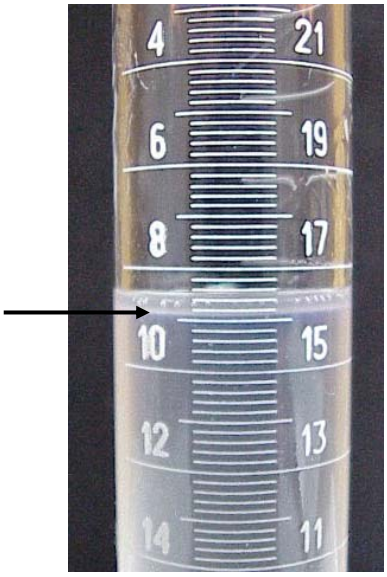
4. Place the tip into a **CLEAN** 25 or 50 milliliter graduated cylinder. Make sure the Toggle Switch is not set to Clean Only.

5. The head will travel back and forth 8 times for Forward and 8 times for Reverse. The loads of oils are deposited from **2-to-2** four times and **14-to-14** four times for each direction in the graduated cylinder. This is equivalent to a total oil stream of **400 boards**.

6. Remove the tip from the graduated cylinder and read the amount. If the pump is set at 40 microliters, then the output in the cylinder should be 16000 microliters or **16 milliliters**.

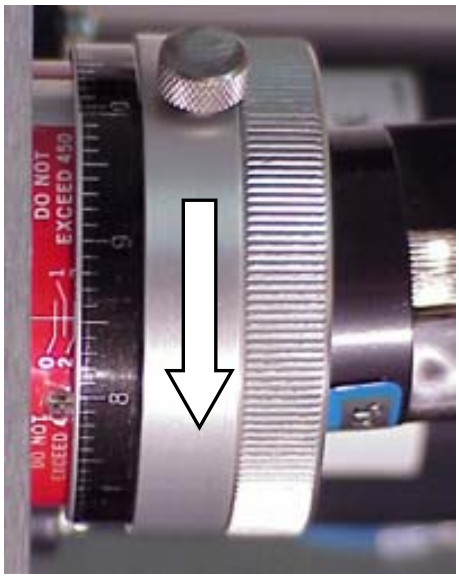
NOTE: There are 1000 *microliters* (unit of measurement for pump) in one *milliliter* (unit of measurement for graduated cylinder), we divided 16000 by 1000 to get 16.

7. After running the test the amount in the cylinder should be **16 mL** (read bottom of bubble as shown in diagram).



8. If the amount of oil is higher or lower than 16, a pump adjustment is necessary. (Note: Check to make sure the head is moving freely. If it binds up during travel the oil output may be affected.)

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



Each small mark on the dial is 1/10 microliter, each large mark is a one microliter change in the output of the pump (per 1 revolution). The pump is revolving at 3400 RPM. At the speed the oil head is traveling across the transfer brush, the pump actually revolves about 2-1/2 revolutions as it crosses one board.

NOTE: Direction of arrow in picture <u>increases</u> the pump output.

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

NOTE: When felt gets soaked with oil it can be cleaned by squeezing it in a rag.

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

12. Keep repeating the test until the amount in the graduated cylinder reads **EXACTLY 16 mL**.

This calibration sets the machine to a standard stream size of 40 microliters per board. This allows us to "prove" the oil pattern that is programmed into the machine.

B. Proving the Oil Pattern

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

PROGRAM 01

```
 2 -  2 x 4  (Forward Loads)
 9 -  9 x 1
10 - 10 x 2
11 - 11 x 2
12 – 12 x 2
13 - 13 x 1

13 – 13 x 3
12 – 12 x 2
11 – 11 x 4
10 - 10 x 3  (Reverse Loads)
```

Each load can quickly be condensed to a total number of boards by referring to the Board Chart at the end of Section 8. Using the Board Chart we can determine that a load or stream of oil from **2 - 2 covers 37 boards.**

This information is also provided for the factory programs on the Program Record Worksheets located in Section IX.

After converting all the loads for Program 01, the numbers become very simple.

PROGRAM 01

37 x 4
23 x 1
21 x 2
19 x 2
17 x 2
15 x 1

15 x 3
17 x 2
19 x 4
21 x 3

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

PROGRAM 01

37 x 4 = 148
23 x 1 = 23
21 x 2 = 42
19 x 2 = 38
17 x 2 = 34
15 x 1 = 15

15 x 3 = 45
17 x 2 = 34
19 x 4 = 76
21 x 3 = 63

518 Total Boards

In our example there are 300 boards covered during Forward travel and 218 boards covered during the Reverse travel. This total number (**518**) can be multiplied by the pump setting (**40** µL) to determine the exact amount of oil used when conditioning with this pattern.

466 Boards
x 40 microliters
20,720 microliters

The total amount is 20,720 microliters. To convert this to milliliters the number has to be divided by 1000.

20720/1000 = **20.72 milliliters**

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

The following exercise will make you familiar with this procedure.

1. Apply power to the machine and press MENU until the display reads:

PUMP OUTPUT
VOLUME TEST

2. Press **NEXT** to access this screen:

OIL VOLUME
PRO#01 PRESS F6

In this screen the PLC will operate only the conditioning part of the program.

The program number is displayed on the second line of the display. If the number is different than the program you want to check, use the **UP ARROW** to change to the correct program number. The DOWN ARROW does not function in this menu. The program

number will loop back around to 01 if the UP ARROW is pressed with PRO#04 showing.

3. Place the tip in a CLEAN graduated cylinder.

4. Then press the F6 key. The Oil Head will start running back and forth across the transfer brush as if the machine were operating on the lane. The **Oil Program Control Valve** will be turning on and off.

5. When it finishes the Forward loads it will pause for a second and then begin the Reverse loads.

6. When the head stops moving, remove the tip from the graduated cylinder and read the amount of oil.

7. The bottom of the oil line should be between **21.5** and **22** milliliters.

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

Blank worksheets are provided at the back of the lane graph section to assist with this task. Having the total output for the program will insure that the program values are entered correctly. It will also help you to better understand each change you make.

C. Board Chart for Calculating Program Loads

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

		RIGHT																	
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	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
LEFT	8	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
	9	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12
	10	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11
	11	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10
	12	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9
	13	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8
	14	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7
	15	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6
	16	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5
	17	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4
	18	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3
	19	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	*
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	*	*

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

SECTION IX - Program Descriptions

The following pages contain sample program settings for League and Tournament patterns. The machine's PLC is capable of holding ONLY FOUR programs at a time; the first three are lane conditioning programs and the fourth is a factory installed calibration program that covers 400 boards. Programs can be easily changed in the machine with **K**egel **O**n-line **S**upport **I**nterface (KOSI). This software allows you to store an unlimited number of programs for future download. KOSI also contains video tips, an electronic manual, and tutorials on machine maintenance.

A. League/House Sample Pattern Settings

The programs in this section have been created using **KOSI**. Contact Lane Maintenance Central at (863) 734-0200 or (800) 280-2695 if you have questions about these patterns.

B. Tournament Sample Pattern Settings

The programs in this section have been created using **KOSI**. Contact lane Maintenance Central at (863) 734-0200 or (800) 280-2695 if you have questions about these patterns.

Pattern Trouble-shooting Tips

Here are some suggestions to common questions about lane conditioning. These tips should help you make the proper adjustments to the patterns supplied in this manual.

Q: What should I do if I have too much **carry down**?
A: Shorten the applied oil distance. Too much oil in the middle, at the end of the pattern, causes carry down. Change only the buff-out distance, do not shorten the pattern, as this only creates more transition and possibly more moves. Make sure the machine is cleaning properly before making any pattern adjustments.

Q: What should I do if the **backends** are too strong?
A: Lengthen the pattern to tone down the reaction. Tamer backends provide predictable ball reaction and makes spare shooting easier. Be aware of potential carry down problems when the pattern length is increased.

Q: What should I do if I do not have enough **hold**?
A: The distance of the applied oil on the return pass creates hold. This area is known as the mid-lane (from about 18-32 feet). The mid-lane provides direction to the breakpoint and dictates the score-ability of a pattern. Starting the reverse oil loads farther down the lane will help increase hold.

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

Q: What should I do if I have no **swing**?
A: The amount of oil on the outside boards, or adverse lane topography, can affect swing. Reducing the length (or volume) of the applied oil will increase the amount of swing. If this is a topography issue, the pattern should be adjusted by reducing the amount of oil on the outside boards to allow bowlers to play a more direct line to the pocket. This should create more area in play at the breakpoint.

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 will allow the lane condition to taper properly.

B. Tournament Sample Pattern Settings

These programs have been created using **KOSI** These graphs are only a representation of the patterns that will be applied by the machine. Many variables can affect the graph, so it may not match your machine exactly.

Pattern 1 2004 Intercollegiate Bowling Championships—Nationals. This pattern was used for the 2004 IBC Nationals at Riverlanes in Tulsa, Oklahoma. This pattern met all ABC/WIBC specifications and passed all Sport Bowling compliances.

Pattern 2 2004 American Bowling Congress Championship Tournament. This pattern was used for the 2004 ABC Championship Tournament at the National Bowling Stadium in Reno, Nevada. It met all ABC/WIBC specifications.

Pattern 3 2004 Women's International Bowling Congress Championship Tournament. This pattern was used for the 2004 WIBC Tournament at Northrock Lanes in Wichita, Kansas. This pattern met all ABC/WIBC Specifications.

Pattern 4 2003 Intercollegiate Bowling Championships—Nationals. This pattern was used for the 2003 IBC Nationals at River Lanes in Tulsa, Oklahoma. This pattern met all ABC/WIBC specifications and passed all Sport Bowling compliances.

Pattern 5 2003 American Bowling Congress Tournament. This pattern was used for the 2003 ABC Tournament in Knoxville, Tennessee. It met all ABC/WIBC specifications.

Pattern 6 2003 Women's International Bowling Congress Championship Tournament. This pattern was used for the 2003 WIBC Tournament at AMF Bowlero in Milwaukee, Wisconsin. It met all ABC/WIBC specifications.

A. League/House Sample Pattern Settings

These programs have been created using **KOSI** These graphs are only a representation of the patterns that will be applied by the machine. Many variables can affect the graph, so it may not match your machine exactly.

Pattern 1 League/House Pattern for Low Friction Surfaces. This is a starting point pattern for lower friction synthetic surfaces and for wood surfaces with lower friction coatings. This is a **39 ft.** pattern. This pattern is saved as Program **#1** in the machine.

Pattern 2 League/House Pattern for High Friction Lane Surfaces. This is the starting point pattern for non-synthetic lane surfaces with a significant amount of wear or synthetic lane surfaces that are more than 15 years old in age. This is a **41 ft.** pattern. This pattern is saved as Program **#2** in the machine.

Pattern 3 League/House Pattern for Guardian Lane Surfaces. This is the starting point pattern for lanes with Guardian™ lane surfaces or Brunswick Barricade™ lane surfaces. This is a **41 ft.** pattern. This pattern is saved as Program **#3** in the machine.

Pattern 4 League/House Pattern for Wood and Higher Friction Lane Surfaces. This is the starting point pattern for wood in good condition and synthetics that are less than 5 years old. This is a **40 ft.** pattern.

Pattern 5 League/House Pattern for High Friction Lane Surfaces. This is the starting point pattern for non-synthetic lane surfaces with a significant amount of wear or synthetic lane surfaces that are more than 15 years old in age. This is a **40 ft.** pattern.

Pattern 6 This pattern was designed for Sport Bowling competition. All forward loads, it meets both the ABC/WIBC specifications and Sport Bowling compliances. This is a **35 ft.** pattern.

C. LaneTech Sample Pattern Settings

These programs have been created using **LaneTech**™ Lane Conditioner. These graphs are only a representation of the patterns that will be applied by the machine.

Program 1 is designed for use on good lane surfaces, both synthetics and freshly resurfaced lanes. The pattern is good for all types of players and styles.

Program 2 is designed to reduce carry-down by shortening the applied oil distance. Too much oil in the middles, at the end of the pattern, causes carry down. Shortening the pattern can create more transition and more moves.

Program 3 is a longer pattern to tone down the back end reaction. Tamer backe ction and makes spare

Program 4 is modified ance of the applied oil, d. This area is known as vides direction t e score-ability of a

DO NOT USE THIS PAGE… SPACER ONLY

Program 5 is a patter wo things can cause the heads to hook, the amount of oil in the lay down area, or the lane surface. 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 rotation of the buffer brush).

Program 6 is designed to provide more swing. Swing is controlled by the amount of oil on the outside boards, or by lane topography. This pattern reduces the length (and volume) of the applied oil. If this is a topography issue, the pattern should be adjusted to allow bowlers to play a more direct line to the pocket. This allows more room for error at the breakpoint.

Program 7 is a pattern to prevent the track from drying up too quickly. 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 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 increased to longer distances

on the return without drastically affecting the forward oil readings and ball reaction.

SECTION X - Appendix

A. Recommended Maintenance Inspections

DAILY:

1. Clean entire oil compartment with a dry towel. This will help keep the pattern consistent from day to day.

2. Wipe squeegee blades after each use with a damp cloth. When the squeegee dries it becomes tackier, making it harder to clean. FAILURE TO CLEAN SQUEEGEE BLADES CAN AFFECT THE CLEANING QUALITY AND EFFICIENCY!!

3. Wipe cord down during use and when wrapping after use. Make large loops.

4. Clean the Lane to Lane Casters, Transport Casters, and the Drive Wheels.

5. Wipe off Vacuum Motor. Lint can clog the air intake.

6. Drain Recovery Tank and WIPE UP ALL SPILLS IMMEDIATELY!! Most cleaners can corrode aluminum.

WEEKLY:

1. Clean entire machine with dry towel.

2. Blow out the vacuum motor with air. This is especially critical in high dust areas. Dirt will restrict air flow and cause premature wear of the motor.

3. Keep duster and squeegee position switches clean. Avoid spilling fluids on these, or any switches. This may cause the machine to malfunction.

4. Wipe the LDS wheels, drive wheels, and all casters.

CLEANING COMPARTMENT:

When changing the duster cloth, always use this opportunity to clean the front area of the machine.

KEEP YOUR PRECISION INSTRUMENT LOOKING NEW:

Buffing the machine with a light coat of wax will seal the paint and protect the finish of the machine. This will also help remove deep down dirt and mild stains.

If you really care about your valuable investment, and about the consistency of your lanes, you will never regret keeping the machine clean.

MAINTENANCE INSPECTIONS:

Periodic maintenance will keep the machine operating at peak performance. The following 4 pages are checklists that should be used at the appropriate mileage intervals. A formula you can use to calculate the mileage the machine has traveled is shown below.

Measurements: ~1460 Inches of Travel per Lane
12 Inches = 1 Foot
5280 Feet = 1 Mile

Math: 1460/12 = 121.67 Feet of Travel per Lane
5280/121.67 = **43.4 Lanes per Mile**

Calculate the number of times the machine runs each week and mark this on a calendar. Use this to schedule your maintenance intervals.

For example, a 32-lane center that runs the machine twice a day Monday through Friday and once on Saturday and Sunday operates the machine 384 lanes/week (or 8.85 miles).

The math is: (32 x 2) x 5 = 320 (Monday thru Friday)
+ (32 x 1) x 2 = 64 (Saturday & Sunday)
384 Lanes per Week

In this example, about every 16 days the 20-mile maintenance should be performed.

The math is: 20 x 43.4 = 868 Lanes between Inspections
868/384 (# per week) = 2.26 Weeks
2.26 x 7 = 15.82 Days between Inspections

20 MILE MAINTENANCE INSPECTION

Complete every 20 miles (~868 lanes) of operation

(Use special 100 and 200 mile checklist at appropriate times.)

NOTICE TO OPERATORS: When the 20 mile maintenance is due, please examine the entire machine thoroughly, paying close attention to items listed below on the 20 mile checklist. When your inspection and repairs are complete, review what you have done with your Supervisor.

	20 mile	40 mile	60 mile	80 mile	100 mile	120 mile	140 mile	160 mile
Clean entire machine thoroughly								
Inspect lane-to-lane casters								
Inspect LDS and Drive wheels								
Inspect sensors and switches Clean if needed								
Inspect drive motor brushes & clean cap with compressed air								
Clean lint from transfer brush								
Clean buffer brush with air and check adjustment								
Flush recovery tank (use hot water)								
Clean filters								
Check squeegee for wear and adjustment								
Check all chain tensions								
Check all belt tensions (buffer, head, and oil pump)								
Check Cleaner Volume Output								
Operator's Initials								
Date								
Actual Mileage								
Supervisor's Initials								

100 MILE MAINTENANCE

Complete every 100 miles (~4,340 lanes) of operation

NOTICE TO OPERATORS: When the 100 mile maintenance inspection is due, please examine the entire machine thoroughly, paying close attention to the items listed below. When your inspection and repairs are complete, review what has been done with your Supervisor.

100 mile	200 mile	COMPLETE THE FOLLOWING INSPECTIONS:
		Complete all 20 mile maintenance inspections
		Inspect all motor pulleys and remove dirt build-up
		Inspect all cleaner supply lines and tee fittings
		Inspect vacuum hoses for breaks
		Inspect all oil lines and fittings. Check line pressure (10-15 PSI)

PERFORM THE FOLLOWING MAINTENANCE:

		Lubricate all drive chains with 2-3 drops of 50W oil
		Lubricate the felt washers with 10W oil until saturated
		Lubricate LDS shaft bushings with 2 drops of 10W oil
		Lubricate buffer belt idler bushing with 3 drops of 10W oil
		Lubricate Oil & Cleaner Head rails
		Lubricate timing pulley shaft bushings (See Fig. 14)
		Lubricate pivot arm bushings on the duster assembly with 2 drops of 10W oil
		TIGHTEN ALL SET SCREWS (brush, cams, pulleys, sprockets, hubs, and wheels)
		Operator's Initials
		Date
		Supervisor's Initials
		Actual mileage

200 MILE MAINTENANCE INSPECTION

Complete every 200 miles (~8,680 lanes) of operation

NOTICE TO OPERATORS: When the 200 mile maintenance inspection is due, please examine the entire machine thoroughly, paying close attention to the items listed below. When your inspection and repairs are complete, review what has been done with your Supervisor.

200 mile	400 mile	COMPLETE THE FOLLOWING INSPECTIONS:
		Complete all 20 and 100 mile maintenance inspections

COMPUTER AREA:

		Tighten PLC and PLC Mounting plate
		Tighten all terminal strips and wire blocks

CONDITIONER AREA:

		Check set screws in Cleaner/Conditioner cog pulleys
		Move oil head by hand, checking for free travel along the bar
		Check head drive rails for lubrication
		Inspect all wires for tightness and breaks

MISCELLANEOUS:

		Inspect all wires in cleaning end for tightness and breaks
		Test all inputs and outputs through I/O Test on keypad
		Check LDS for excessive play (1/16” or 1.587 mm maximum)
		Check for excessive play in squeegee assembly

200 MILE MAINTENANCE INSPECTION (CONTINUED)

200 mile	400 mile	INSPECT THE FOLLOWING ASSEMBLIES FOR TIGHTNESS:
		Lane guide rollers (4)
		Lane-to-lane casters (4)
		Main drive (5) and LDS (3) shaft pillow block
		All frame assembly bolts
		Operator's Initials
		Date
		Supervisor's Initials
		Actual mileage

We recommend replacing the following parts at:

# of Lanes		Part Description		Part #
35,000		Buffer Brush		154-8641
35,000		Cushion Roller		153-8839
24,000	Flip at 12,000	Squeegee Blades		153-8204
35,000		Buffer Belt		154-9615
60,000		Vacuum Motor Brushes		154-0204B (115V) 154-0204C (230V)
120,000		Drive Motor Brushes		154-1809B

We also recommend having the following parts on hand after 1760 miles (71,000 lanes):

1760 Miles	Part Description		Part #
	Speed Control Board		153-1012 (115V) 153-1812 (230V)
	Circuit Board Assembly		154-8810 (115V) 154-8811 (230V)

Recommendations are based on a 32 lane house conditioning twice a day (annually)

B. Instructions To Change Cleaner Pump Tubing

If the pump max volume output is a problem, follow these instructions to disassemble the pump and replace the tubing (See the exploded view of the pump on the following page.) 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 quick disconnects (Depress collet and pull tube from quick disconnect fitting).

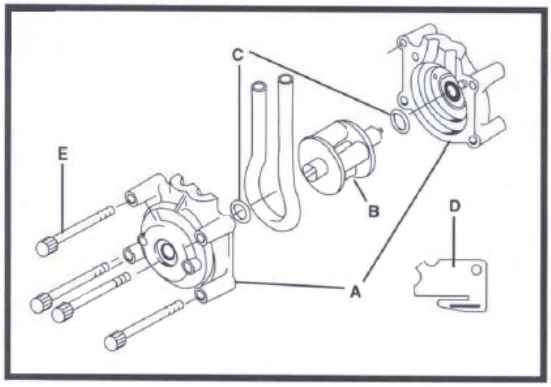
2. Remove the (4) screws that attach pump to mount plate.

3. Remove both stem elbows from tubing (note direction of elbows). Save for re-installment on new tubing.

4. Separate the end bells (the pump head valves). Hold the end bell containing the rotor as shown with tubing retainer grooves pointing down. Remove old tubing.

5. Place new tubing (which is broken in at the factory before shipping)in the right groove and against the first two rollers. Hold tubing with your thumb. Near the groove, insert smaller prong of loading key between the top of the rotor and tubing. Push key in as far a possible.

6. Push down and turn key counterclockwise (ccw) completely around the rotor. The key will push the tubing uniformly into the end bell assembly. Hold the second end of tubing. Remove the key.



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

7. Position the other end bell on top and press the end bells together. Be careful not to pinch the tubing. If end bells do not snap tightly together, reload tubing. If necessary, turn key in slot on rotor shaft to adjust tubing.

8. With key in slot on rotor shaft, turn key to align tang on rotor shaft with slot in motor drive shaft. Point tubing retainer grooves up. Shift the pump head slightly until it snaps on the alignment pins (if present).

9. Replace stem elbows in new tubing. Make sure elbows are facing correct direction.

10. Re-attach pump to mount plate.

11. Press stems back into quick disconnects.

C. Procedure For Cleaning Oil Control Valve

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

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

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

1. Disconnect power and place the machine in the operating position.

2. Remove the oil tank from the rear wall.

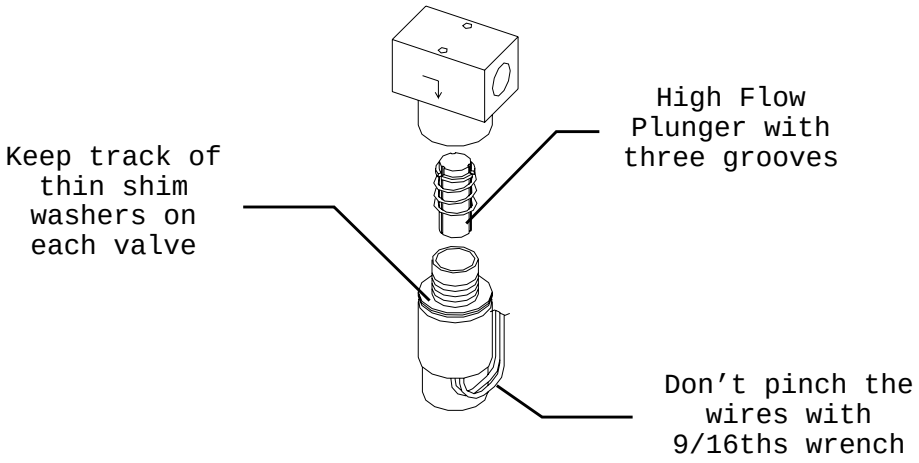
3. Clean the area around the tank.

4. Use a Phillips screwdriver to remove the two screws holding the valve to the rear wall.

Comment [PC1]:

5. Remove the stem elbow connected the oil tip line on the valve. PUSH IN on the outer collet to release the elbow. Also release the other oil line. Plug the open end of the elbow and the line to prevent dirt from entering and to stop the oil from leaking (do not split the elbow).

6. Use a 9/16" open-end wrench to remove the bottom half of the valve. Do not pinch the small wires on the base of the valve. Keep track of the thin shim washers on the valve. Make sure to use the same washers during re-assembly.



7. The top section of the valve should be blown out with a canister of compressed air. Air should flow freely from the bottom through both sides at the top. A few short bursts of canned air in both holes should displace any debris. Alcohol can also be used to remove any build-up of sediment.

   NOTE: Do not use an air compressor to blow out the valve, water in the lines may be forced into the manifold.

8. The bottom section contains a plunger and spring. Make sure the three grooves on the sides of the plunger are clean. This part should be cleaned with a cotton swab and alcohol to remove the debris.

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

9. Replace the valve body on the head of the valve using the same shim washers.

10. Replace the valve on the rear wall.

11. Plug the elbow and line back into the proper fitting and clean around all the connections.

12. Return the oil tank to the machine and plug in the connections.

13. Run the **PUMP OUTPUT VOLUME TEST**. Run this test once to clear the lines out; then check the volume of conditioner output for a typical program and adjust the pump if necessary.

D. Operators Menu Selections

* 0000 K + 0000 SPEED 00 PRO#03	* MANUAL REVERSE PRESS BUTTON	CHANGE PROGRAM CHOOSE -> 03	SYSTEM CONTROL CLEANING	SYSTEM CONTROL DUSTER 0000
		START BRUSH IN INCHES -> 00	LAST SQUIRT DIST IN FEET 00	UNWIND TIME F6 TO RESET 10
		OIL ONLY DUST? 1-YES,0-NO 01	LIFT DUSTER IN INCHES -> 50	
		OIL PATTERN DIST IN FEET 41	FORWARD DISTANCE SUBTRACT -> 30	
		01F 2L- 2R X 04 00->04 FT IPS=10	REVERSE DISTANCE SUBTRACT -> 31	
		02F 8L- 8R X 01 04->06 FT IPS=14		
		03F 09L-09R X 01 06->08 FT IPS=14		
		04F 10L-10R X 02 08->11 FT IPS=14		
		05F 11L-11R X 02 11->17 FT IPS=18		
		06F 12L-12R X 01 17->19 FT IPS=18		
		07F 13L-13R X 02 19->24 FT IPS=18		
		08F 02L-02R X 00 24->41 FT IPS=30		
		01R 2L- 2R X 00 41->35 FT IPS=30		
		02R 13L-13R X 02 35->29 FT IPS=18		
		03R 12L-12R X 03 29->24 FT IPS=14		
		04R 11L-11R X 03 24->18 FT IPS=14		
		05R 10L-10R X 3 18->12 FT IPS=14		
		06R 9L- 9R X 2 12->09 FT IPS=10		
		07R 8L- 8R X 1 09->08 FT IPS=10		
		08R 2L- 2R X 00 08->00 FT IPS=10		
		NEXT TO REVIEW * MENU TO EXIT *		

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

Operators Menu Selections (Continued)

7 DAY PROGRAM PLANNER	TEST OUTPUT #01 PRESS F2-F5 OFF	PUMP OUTPUT VOLUME TEST	(C) COPYRIGHT KEGEL CO 2004 9M
* MONDAY **** AM--> 01	TEST OUTPUT #02 PRESS F2-F5 OFF	* OIL VOLUME PRO#01 PRESS F6	
* MONDAY **** PM--> 01	TEST OUTPUT #03 PRESS F2-F5 OFF		
* TUESDAY **** AM--> 01	TEST OUTPUT #04 PRESS F2-F5 OFF		
* TUESDAY **** PM--> 01	TEST OUTPUT #05 PRESS F2-F5 OFF		
* WEDNESDAY **** AM--> 01	TEST OUTPUT #06 PRESS F2-F5 OFF		
* WEDNESDAY **** PM--> 01	TEST OUTPUT #07 PRESS F2-F5 OFF		
* THURSDAY **** AM--> 01	TEST OUTPUT #08 PRESS F2-F5 OFF		
* THURSDAY **** PM--> 01	TEST OUTPUT #09 PRESS F2-F5 OFF		
* FRIDAY **** AM--> 01	TEST OUTPUT #10 PRESS F2-F5 OFF		
* FRIDAY **** PM--> 01	TEST OUTPUT #11 PRESS F2-F5 OFF		
* SATURDAY **** AM--> 01	TEST OUTPUT #12 PRESS F2-F5 OFF		
* SATURDAY **** PM--> 01	TEST OUTPUT #13 PRESS F2-F5 OFF		
* SUNDAY **** AM--> 01	TEST OUTPUT #14 PRESS F2-F5 OFF		
* SUNDAY **** PM--> 01	TEST OUTPUT #15 PRESS F2-F5 OFF		
	TEST OUTPUT #16 PRESS F2-F5 OFF		
	TEST OUTPUT #17 PRESS F2-F5 OFF		

For an explanation of each menu read Section IV.

E. Troubleshooting Outputs and Inputs

Troubleshooting of the machine is simplified by the **Test Output** menu and the LED lights. This allows the operator to activate an Output and check that it is functioning properly. Refer to **Section VII** to see a list of the Inputs and Outputs for the machine.

NOTE: When testing the output for the oil control valve, the pump motor is running. Machine WILL dispense conditioner. When testing the output for the cleaner pump, the machine WILL dispense cleaner.

1. Outputs

Apply power to the machine and menu to **TEST OUTPUT**. The screen will display:

TEST OUTPUT #01

PRESS F2-F5 OFF

To test Output #01, press the **F5** key. Output #01 in this case is the Reverse relay. The display will change to "ON" and the relay coil will engage. As soon as the key is released the output will go off.

Press the **F2** key and the display will change to:

TEST OUTPUT #02

PRESS F2-F5 OFF

To test Output #02 press and release the **F5** key. Output #02 is the Forward drive relay. The display does not change to "ON", it will start displaying the speed of the drive motor. To turn the motor off, press **F5** again and the display will change back to "OFF".

The TEST OUTPUT menu is where the drive speeds are adjusted. The Forward Drive Output and all of the Speed Relay Outputs will run the motor and display the respective speeds for viewing. Refer to **Section V** for drive speed adjustments.

Review the rest of the Outputs and watch their function. LED lights on the PLC will come on as each output is activated, this can aid in troubleshooting. It is important that the operator understand how to use this menu. It can increase the speed of diagnosing repairs and minimize "down" time.

NOTE: Refer to **Section VII** of the manual for a list of the Outputs and their number. The Outputs do not come on in the order they are shown on the PLC.

2. Inputs

To test the Inputs the operator will have to manually activate the device that sends the signal to the PLC. When the Input is activated, the LED light for that Input will light up indicating a good circuit. Refer to **Section VII** for a list of all Inputs.

The mechanical switches are all wired to the Normally Open side of the switch, so the switch in its normal position is OFF. Simply depressing the lever of the switch will activate the Input and the LED will light.

The proximity sensors are also wired Normally Open. Passing a metal object in front of the face of the sensor will activate the Input; the LED on the sensor and the PLC will go on and off (at the same time) as the metal object passes by the sensor.

NOTE: Mechanical switches and sensors can be damaged by dirty, oily conditions. Getting cleaner in a mechanical switch can "short" the switch and give a false input. The Input's LED may be very dim, but it will still be received as a good signal.

IMPORTANT: The target passing in front of the board counting proximity switch must be a gap between 0.015" and 0.020" (0.38 mm to 0.51 mm). Gaps greater than 0.035" (0.89 mm) may cause errors in operation of this sensor.

The target for the 2 head position sensors should be a gap of no more than 0.025" (0.63 mm) on each side. If the target is too far away from the sensor, an L8 Error might occur.

F. Machine Error Messages

The machine is equipped with Error Message Codes that are displayed in the event the machine malfunctions. These message codes indicate the type of operational error that has occurred with the machine.

ERROR CODE	DESCRIPTION
T1	FORWARD TRAVEL ERROR
T2	REVERSE TRAVEL ERROR
B3	BRUSH DOWN ERROR
B4	BRUSH UP ERROR
D5	DUSTER UNWIND ERROR
D6	DUSTER WIND-UP ERROR
H7	OIL HEAD TRAVEL ERROR
L8	OIL HEAD TIMING ERROR
S9	SQUEEGEE UP ERROR
SA	SQUEEGEE DOWN ERROR
FO	OIL EMPTY ERROR
FC	CLEANER EMPTY ERROR

In most cases, correcting the problem and resuming the machine after an Error Message is possible. In some instances, the machine will need to be returned to the foul line and then re-started.

Follow the Error Message information shown here to get several suggestions as to the reason the error occurred. Along with these suggestions there are troubleshooting suggestions.

The following is a list of the errors that may occur.

ERROR MESSAGE

**** CODE T1 ****

1. Machine is not seated on the lane, there are high gutters, or the drive wheels are slipping.

2. LDS signal failure or the LDS Shaft is binding.

3. Drive Motor or Speed Control failure.

4. Wire is loose or broken for the 0CH #07 Input circuit.

5. Go to the Test Output Menu and Check Output #02 Forward Drive Relay.

6. Turn the LDS shaft and see if Input 0CH #07 is flashing on the PLC as the wheel rotates.

If there is a definite Lane Distance Sensor failure, it is possible to use the TACH sensor for the LDS functions. The operator will have to remove the wire off of Input 0CH #06 and put it in place of the wire that is on Input 0CH #07.

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

NOTE: If the TACH sensor is used as a distance counting sensor the machine will run short (as much as a foot of travel). The return distance will have to be adjusted while the machine is configured to operate this way. Go to the **SYSTEM CONTROL CLEANING** to adjust the return distance.

ERROR MESSAGE

**** CODE T2 ****

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

2. Drive Motor or Speed Control failure.

3. Wire is loose or broken for the 0CH #07 Input circuit.

4. Go to the Test Output Menu and Check Output #01 Reverse Drive Relay.

5. Turn the LDS shaft and see if Input 0CH #07 is flashing on the PLC as the wheel rotates.

ERROR MESSAGE

**** CODE B3 ****

Menu Out of the Program and Return machine to approach.

1. If Brush Lift Motor runs continuously, Input 0CH #05 is not getting the signal from the Brush Motor Down Switch.

2. If the Brush Lift Motor does not run, menu to the Test Output screen and check Output #09.

ERROR MESSAGE

**** CODE B4 ****

Menu Out of the Program and Return machine to approach.

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

1. If Brush Lift Motor runs continuously, Input 0CH #04 is not getting the signal from the Brush Motor Up Switch.

2. If the Program is RESET, the brush should park in the DOWN position. If it does, this indicates the DOWN Switch is good.

3. If the Brush Lift Motor does not run, menu to the Test Output screen and check Output #09.

NOTE: The Brush Lift Motor and the Squeegee Motor will both time-out in 9 seconds if the position switch it is looking for is not actuated. Before the motor "times-out", the machine should have stopped and displayed an error.

ERROR MESSAGE

**** CODE D5 ****

Menu Out of the Program and Return machine to approach.

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 cloth unwound.

3. Duster did not unwind.

4. If the Duster Motor does not run, menu to the Test Output and check Output #12.

ERROR MESSAGE

**** CODE D6 ****

Menu Out of the Program and Return machine to approach.

1. Duster motor did not operate, or the set screw is loose and the hub is slipping on the motor shaft.

2. Make sure the duster rolls are seated in the drive hubs and routed properly.

3. Check adjustment of Wind-Up Switches and see if Input 0CH #10 has an LED light showing on the PLC when each of the switches is actuated.

4. If the Duster Motor does not run, menu to the Test Output menu and check Output #13.

ERROR MESSAGE

**** CODE H7 ****

1. Oil Head Motor stopped or did not start moving.

2. Board Counting proximity sensor is not working.

3. If the Oil Head Motor does not run, menu to the Test Output screen and check Outputs #16 and #17.

4. Check the adjustment of the Board Counting sensor and look for an LED on Input 0CH #01 to light up when the target passes in front of the sensor.

ERROR MESSAGE

** CODE L8 **

1. This Error will appear if the PLC program doesn't turn the oil control valve on as the head travels between the two proximity sensors. The machine is programmed to oil when the head moves and it should never travel without oiling. This error does not prevent the machine from running, but the Start Button on the handle must be pressed to resume operation.

2. Check for a proper gap of 0.025" (0.64 mm) between the target on the head and the proximity sensors on both sides of the machine. Also check the gap between the head timing target and the timing sensor, which should be between 0.015" and 0.020" (0.38 mm to 0.51 mm).

3. Using the machine with the head out of adjustment will result in missed or improperly placed loads. Adjust the sensor gaps or head timing as soon as possible if this error occurs. Refer to **Section V** for instructions on adjusting the head timing.

4. If the travel speeds of the machine are improperly set the program may try to load oil up until the end of the pattern. This will not cause the Head Timing Error, however this problem should be fixed to eliminate improperly placed loads.

ERROR MESSAGE

** CODE S9 **

Menu Out of the Program and Return machine to approach.

1. If Squeegee Motor runs continuously, Input 1CH #01 is not getting the signal from the Squeegee Up Switch.

2. If Squeegee Motor does not run, menu to the Test Output screen and check Output #11.

ERROR MESSAGE

**** CODE SA ****

Menu Out of the Program and Return machine to approach.

1. Machine was put on the lane before the Squeegee was lowered.
2. If Squeegee Motor runs continuously, Input 1CH #00 is not getting the signal from the Squeegee Down Switch.
3. If Squeegee Motor does not run, menu to the Test Output screen and check Output #11.

ERROR MESSAGE

**** CODE FO ****

1. Machine is low on oil, fill and start machine to clear error from the screen. If this does not clear the error the float may have a problem. Unplug float and install jumper plug to bypass the float. Call technical support before installing jumper plug.

ERROR MESSAGE

**** CODE FC ****

1. Machine is low on cleaner, fill and start machine to clear error from the screen. If this does not clear the error the float may have a problem. Unplug float and install jumper plug to bypass the float. Call technical support before installing jumper plug.

This concludes the ERROR MESSAGES that are available.

G. Technical Support Instructions

Please follow these steps if there is a problem with the machine.

1. Obtain as much information about the problem as possible. Can you duplicate the problem? If so, **write down** the steps that cause it to occur. Keep in mind that the technical support person will have to fix your problem with the information you provide. The more details you can provide the quicker they can find a solution.

2. Check for error messages while operating the machine. Investigate the suggestions shown in the Manual.

3. Go to the **TEST OUTPUT** menu and check all the Outputs. Test all the Inputs manually. If any of these do not work, inspect the wiring to the component. Each Input and Output also has an LED on the Control Module. These lights can also be used to monitor the machine's functions during operation.

4. Check the Operators Manual or KOSI to see if it addresses your problem. This may give you enough information to solve the problem yourself, or at least it gives you the background to communicate the problem more readily to a technical support person. **If all else fails...read the manual**!

5. If you still need to call for help, get the following information ready:

_____ **Machine Serial Number** (on bottom of machine)

_____ **Machine Production Date** (on bottom of machine)

_____ **Installation Date**

_____ **Program Number** Where Problem Occurs (if not all)

_____ **Line Voltage** Coming Into The Machine (AC)

6. Get the machine powered-up near a phone **before** you call for help. You should also have a meter handy to check AC and DC voltages and continuity. (This is an especially helpful tool during trouble-shooting.)

7. **Call Kegel at (863) 734-0200 or 800-280-2695.** The Kegel factory is located in Lake Wales, Florida USA. Office hours are typically from 7:00 a.m. to 5:00 p.m. EST Monday through Friday. Calls outside these hours will be handled by an automated message system or answering service. Once a message is taken, a tech will be notified and you will be called back as soon as possible.

Following these steps before you call will allow a technical support person to isolate and solve the problem much faster. Each time you call take notes on how the problem was solved to refer back to if the problem occurs again.

H. Pressure Regulator Tubing Chart

The following ranges of conditioner viscosity have been tested in the machine to determine the size and length of the pressure regulator tubing that is needed. Keep in mind that these are only **guidelines**, temperature greatly affects viscosity and may change these results.

Testing was performed at 72-degrees Fahrenheit with a variety of conditioners. Equipment is available to measure the viscosity of any conditioner. A Viscosity Cup, Thermometer, and a Stopwatch are valuable tools if you are mixing your own blend of conditioner. Call Kegel for more information on how to obtain this equipment.

Viscosity Range	*Length*	*Size (OD)*	*Conditioner*
<10	6~7 Ft.	3/16"	LV2 or U-300
~10	30 In.	3/16"	DBA #501
~20	15 In.	3/16"	Clear #801
~29.7	15 In.	3/16”	Prodigy
~39.1	7.5 In.	3/16"	Defense-S/Offense-HV
~40	36 In.	1/4"	Special Blend
~50	12 In.	1/4"	Clear Super 50
>60	*See Note	1/4"	Special Blend

*Note: When using a conditioner with a higher viscosity than 60, use a 1/4" OD (6.35 mm) piece of tubing that is approximately 3" long (7.62 cm) and connect it between the Tee Fitting and the Oil Control Valve Input Fitting. Store all the elbows, fittings, and lines in a safe place in case you want to switch back to a lighter conditioner. The machine has been tested up to 100 centistokes. The Kustodian Plus ships from the factory with about a 7-1/2" piece of 3/16" pressure regulator tubing for Offense-HV (30.48 cm piece at 4.762 mm OD).

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)

SECTION XI - Mechanical Drawings

Table of Contents

Edition 06:04


KUSTODIAN
PLUS