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## 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 computer.

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

**IT IS EXTREMELY IMPORTANT THAT THE OPERATOR THOROUGHLY READ AND UNDERSTAND THIS OPERATING MANUAL BEFORE USING THE MACHINE. WHEN ALL ELSE FAILS...READ THE MANUAL**

Should you have any questions regarding any procedures pertaining to the proper operation of this machine, please contact The Kegel Company, Inc. at: Toll Free (800) 280-2695 or +1 (63) 734-0200. The technicians at Lane Maintenance Central have dedicated their careers to supporting the bowling industry. They can help you with any problems or questions you may have.

### B. Machine Specifications

**Models:**

17-4700 Kustodian (115V/60Hz)

17-4750 Kustodian (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"

Height - 14-1/2"

Length - 40-3/4"

Weight - 350 pounds

### **C. Care and Safety Procedures**

This machine is manufactured of the highest quality materials, but keep in mind that this 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 computer, 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.

Persons assigned the responsibility of operating this equipment should be trained in its use by an authorized factory-trained Distributor.

## **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. would 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.

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

To do this simply multiply:

- 1) the value of the amount of oil per board of the oil stream (done 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.**

**Simply 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 transfer motor 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. The green indicates when the NEXT key is enabled in the Change Program area.
- **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.  
  
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 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 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).

### 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 an infrared LDS (Lane Distance Sensor) 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 roller 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 and filter (capacity is 0.53 gallons or 2000 milliliters);
  - a vent valve (115V/230V) 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; enough volume to completely clean in excess of 20 lanes. An in-line filter is located between the pump and tank. A vent valve prevents a vacuum inside the tank during operation.

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- **PUMP MOTOR:** Mounted on the rear wall to the left of the cleaner tank is the cleaner pump motor. This motor pumps the cleaning liquid from the supply tank through the spray jets and onto the lane surface. Check fittings periodically for leaks to prevent potential moisture damage.
- **OIL HEAD:** Located above the transfer roller is the Moving Head. This head rides along a guide bar and applies the conditioner to the transfer roller. 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 ROLLER:** Mounted below the moving head is the conditioner transfer roller. This stainless steel roller is chain driven and transfers conditioner onto the buffing brush.
- **PATTERN SMOOTHING ASSEMBLY:** Mounted in front of the transfer roller are 10 spring-loaded pads that touch the transfer roller. These pads help distribute the conditioner around the roller as it rotates.
- **PROXIMITY SENSORS:** Located at each end of the head mounting bar is a proximity sensor. These sensors feed information to the PC to reverse the conditioning head. 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.

#### 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 transfer motor 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;
  - Programmable Computer;
  - CR1 Forward Relay (LY4);
  - CR2 Reverse Relay (LY3);
  - CR3 Vacuum Motor Relay (LY2);
  - Operation Toggle Switch;
  - Speed Adjustment Trimpots;
  - Circuit Breaker;
  - Fuses.

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

- Printed Circuit Board;
- Terminal Block Assembly.

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- **BUFFER MOTOR CONTACTOR:** Mounted on the top left corner is the buffer motor contactor. This conducts AC power to the buffer motor when the PC relay engages the coil. A din rail secures the contactor to the plate.
- **PROGRAMMABLE COMPUTER:** The 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 PC.

**WARNING:** The PC 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 LY4 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.
- **CONTROL RELAY 3:** This relay controls the operation of the vacuum motor. It is an LY2 type relay.
- **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 POTS:** The speed adjusting pots 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.

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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 PC plate are several fuses and one circuit breaker. 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.
  - **PC Power Fuse:** The PC 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.
  - **PC Common Fuse:** The PC Outputs are protected by a single slow blow fuse. It is rated at 7.5A on a 115V model, and at 6.3A 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.
  - **Transfer Roller Motor Fuse:** The transfer roller motor is protected with a slow blow fuse. It is rated at 2.25A on a 115V model, and at 1A on a 230V model.
  - **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.

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- **Cleaner Pump Fuse:** The cleaner pump is protected with a slow blow fuse. It is rated at 0.75A on a 115V model, and at 315mA on a 230V model.
- **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:

- **PC 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 PC Program: DC Drive Motor; Brush Lifting Motor; Squeegee Motor; Oil Head 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.

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- **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 PC 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.

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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.

- **TRANSFER ROLLER DRIVE MOTOR:** Mounted under the vacuum motor, on the right side plate, is the transfer roller drive motor. This motor drives the transfer roller during conditioning runs.
- **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 kill 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 PC that the cushion roller is in the UP position. Avoid getting liquid near these switches (and all 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 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 Kloth* in the Kustodian (Part Number 153-0047K). DBA #8460 or Lane DynamX #9460 products will also work in the machine. Approximately 1-1/2" of cloth will be used per lane.

- **RECOVERY TANK:** The large plastic tank in the center of the compartment is the recovery tank. This tank will hold over 20 lanes of used liquid without needing to be emptied. Empty the tank from the inlet side (connected to squeegee).  
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.
- **SPRAY JET ASSEMBLIES:** Mounted to the front wall are four spray jet assemblies. These assemblies can be angled up or down, and left or right, to adjust spray coverage to the entire lane. Mounted with the spray tip is a combination check valve/filter. The tips in the center are #8003 and the tips on the outside are #1501. These provide cleaner coverage across the entire lane.
- **VACUUM EXHAUST PLATE:** The area where the vacuum exhaust is located is covered with felt in case any moisture blows through the motor. Use a soft rag to absorb any moisture that may collect in this area.
- **SQUEEGEE CAM & 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 toward the top of the machine is the Squeegee Down Switch and the switch located toward the bottom of the machine is the Squeegee Up Switch. These switches are protected behind a guard. Prevent moisture from contaminating this area.
- **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.  
NOTE: Do not make the pitch linkage too short as this may cause the motor to bind during travel.
- **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. The target is connected to an idler pulley that controls the belt tension for the head drive system.
- **TRANSFER CHAIN:** Mounted beneath a cover is the transfer roller drive chain and sprocket.
- **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 timing disk with ten targets is rotated as the drive shaft turns. As the disk passes through this sensor, pulses are sent to the PC. The PC counts these pulses and calculates the IPS (INCHES PER SECOND) travel speed of the machine. This is used to set 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 Head. This motor, along with a cogged drive belt, moves the head back and forth along a rectangular track above the transfer roller.
- **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.

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- **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 parks in the down position. The machine should be stored with the brush down to prevent the transfer roller from spreading the fibers too much.

**NOTE:** The output that operates the brush lift motor is also used to vent the oil tank beginning with program version 7G. During an Oil Only run, the brush will rotate 360° when the machine returns to the foul line.

- **PRIME PUMP BUTTON:** Located next to the handle pivot mount is the cleaner prime pump button. This button will activate the cleaner pump in any mode of operation. Make sure the machine is positioned properly before applying cleaner.
- **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 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.



## **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 down position on a level surface. Open the splash guard and pull out both gray tank plugs located on the top of the tank. (Push down on the collet before pulling on the plug.)

Insert the funnel assembly provided with the machine. A clear sight tube is located on the tank to help determine when the tank is getting full.

Fill the tank until the oil level in the tank reaches the bottom edge of the right angle gray fitting on the top side of the tank. Failure to watch the sight glass 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 an oil rag beneath the tank, under the oil fill vent hole, to prevent this from happening. When finished be sure to remember to replace both gray tank plugs. 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 both the vent and fill fittings. Pour the mixture into the Supply Tank using the supplied funnel until the level in the sight glass is about 1/2" below the top of the tank. This will prevent an air pocket from forming and blocking the fluid flowing from the funnel.

**NOTE:** Always use the black funnel supplied with the machine. The black 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 in-line filter to become clogged frequently. It can also cause premature failure of the cleaner pump. At the very least, this will reduce the cleaner output of the spraying system 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 PC causing improper operation. A wet switch may also produce a dim LED light on the PC.

**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.

Note: E-STOP switches are on 230 volt machines only.

#### 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 computer. 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 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:

**\* THE KUSTODIAN  
SPEED 00 PRO# 01**

The Kustodian is always ready to run when this prompt is displayed. By pressing the handle button or the UP ARROW the machine sequence will start.

Pressing the button the first time 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 into the lane. At this time you may prime the cleaner pump by pressing the button located next to the left-side handle pivot mount. This button works any time you push it when power is applied to the machine.

Now press the button a second time and the machine will begin operating. The speed of the machine will be displayed on the screen, as well as the program number, during operation.

## 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**. The Down Arrow and Up Arrow are 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 Down Arrows, followed by the appropriate number of Up Arrows. 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.

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

### **START CLEANING**

**DISTANCE -> 00**

This prompt will display the current distance where the machine should begin cleaning. To change this distance, use the UP or DOWN ARROW to adjust, changing the value sets the data automatically.

**NOTE:** For full lane cleaning, the Start Cleaning Distance should be set at "00". For back-end cleaning, enter the distance where cleaning should begin.

The duster cloth will not drop until the Start Cleaning Distance is reached. The first spray of cleaner will also be delayed on a back-end cleaning run to allow the squeegee time to lower into position.

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 PC 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.

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**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 -> 37**

This prompt will display the current travel distance (buff out) for the conditioning portion of the program selected. To change this distance, use the UP or DOWN ARROW and the value will be set.

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

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

**01F 2L- 2R X 03  
00->05 FT IPS=14**

**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 03** determines how many 2 to 2's will be applied, in this case it is 3.

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On the bottom line the **00->05 FT IPS=14** says that the machine will travel from 0 ft (the foul line) to 5 ft at 14 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 must begin on the left side and end on the right side, so the smallest load would cover 3 boards (19L to 19R).

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 **03** 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 3 to 4 the 00->05 FT will change to 00->07 FT. Since the 14 in IPS=14 is now blinking you now may Up Arrow or Down Arrow the speed.

The speed choices you have are 10, 14, 18, 22, 26, and High Speed (about 30). 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.

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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 02
05->11 FT IPS=14
```

The 9L will be blinking. In the previous screen we left with the load area at 00 to 05 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.

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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**  
**11->17 FT IPS=22**

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

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

**04F 11L-11R X 04**  
**17->29 FT IPS=22**

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

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Remember to hit **ENTER** 4 times. Press **NEXT** and the following menu will appear:

**05F 13L-13R X 00**  
**29->37 FT IPS=22**

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 roller 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.

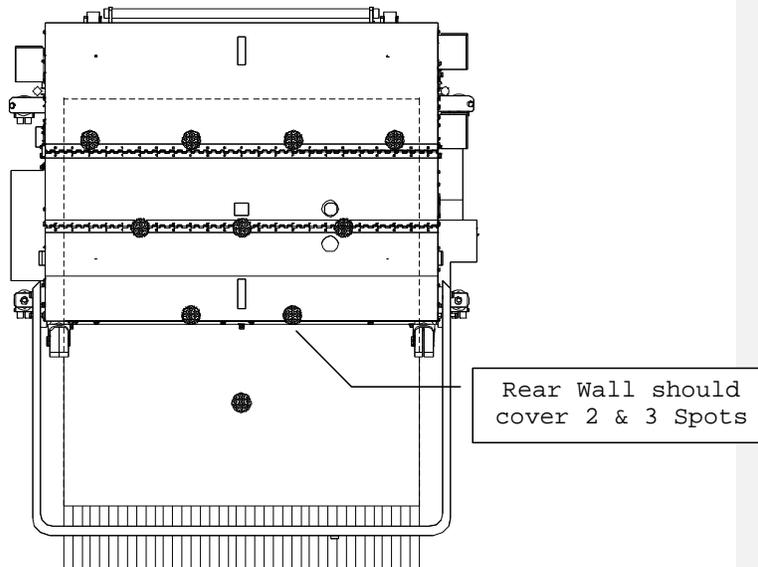
Don't forget you must hit ENTER 4 times after changing any speed or number of loads. If you do this, it will open up another forward screen when you press the NEXT key. The number of loads will be 00 automatically and the ending distance could be anything above the oil travel distance (or even below 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.

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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**  
**37->10 FT IPS=30**

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 (0 loads) for at least the first 1 foot of return travel. The last screen in reverse should be 0 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.

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

**02R 8L- 8R X 03**  
**10->05 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:

**03R 2L- 2R X 00**  
**05->00 FT IPS=14**

Remember the last screen in reverse should always end a minimum of **4 feet** before the foul line (or 0 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.

There are also 15 screens possible in reverse. Normally you will only use the reverse oil to beef up the lay down and or skid area in the first 10 to 20 feet of the lane. Do this with 3 or 4 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.

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

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

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

This concludes the **CHANGE PROGRAM SETTINGS** 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:

**SPRAY ON TIME**  
**IN TENTHS --> 04**

This prompt is referring to the amount of time for the spray to be "ON" each time cleaning solution is sprayed. (NOTE: The number shown refers to "tenths" of seconds. For example, "04" is actually 0.4 seconds.)

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To adjust the time, use the UP or DOWN ARROW to change the setting (changing the value locks in the data automatically when the screen is exited).

If this number is correct, press **NEXT** and the following will appear:

**SPRAY OFF DIST  
IN INCHES -> 30**

The number displayed on this screen refers to the amount of DISTANCE between sprays. The number shown refers to INCHES. For example, "30" is actually 30 INCHES between spray pulses.

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

### ***IMPORTANT!***

*Correct adjustment of the "Spray On" times and "Spray Off" distances is critical to proper cleaning. For example, if a film remains on the outer boards of the lane, a decrease of the "off" distance and an increase of the "on" time, or both, may be needed. The center jets may also be adjusted if a film remains in the center of the lane.*

If this number is correct, press **NEXT** and the following will appear:

**LAST SPRAY DIST  
IN FEET -> 45**

The number displayed will refer to the distance in feet down the lane at which no more sprays of cleaner will be made (until the pin deck spray). To change this distance, use the UP or DOWN ARROW to adjust. Once the value has been changed, the program accepts the data automatically.

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

**DECK SPRAY??**

**01=YES -> 01**

This prompt allows the operator to add an extra spray of cleaner as the machine enters the pindeck. This will help ensure the proper amount of solution is available to clean the pindeck. It also allows the last spray distance to be reduced (as short as the oil pattern distance) if desired.

Use the UP or DOWN ARROW to adjust. Changing the value sets the data automatically. The value of 01 means that you will spray the pin deck. Where the spray happens, and how long, are pre-set values in the program.

**NOTE:** Failure to remove the pins from the deck prior to spraying cleaner reduces the cleaning efficiency in the pindeck area and may contribute to Out-of-Range calls.

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.

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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 PC 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

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 automatically stop.

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

### UNWIND TIME F6 TO RESET 10

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 10 when F6 is pressed.

This prompt is referring to the amount of time in tenths of seconds. The "10" is actually 1.0 second. 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 pinchers has presented you with this problem.*

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The unwind time varies from 10 for a fresh roll to 21 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 10 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 PC 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. Advance to the rest of the days of the week and enter the program numbers that you wish to run.

NOTE: The machine will only run the program set for that day and time. If you wish to override a program, it will have to be changed in the appropriate day and time period.

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

Press NEXT to loop around to the start 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

The Kustodian with Sanction® Technology allows the oil pump to be precisely calibrated before, during, and after use. Press the **MENU** key until the following screen appears:

**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 PC.

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.

**NOTE:** Before running the calibration test, remove one plug in the conditioner tank to prevent any chance of creating a vacuum while the pump is running.

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.

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3. Then press the **F6** key. The Brush Lift Motor and Oil Vent Valve will operate momentarily. The Oil Head will start running back and forth across the roller 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 as it travels across the width of the machine. During calibration, the oil is dispensed while the head travels from one side to the other. If the head binds up and travels too slowly, more oil will be dispensed and the readings will be higher (since pump runs at constant speed).

Make sure the head moves freely on the rectangular bar. Only a slight resistance of the motor gearbox should be felt when the head is moved by hand. However, there should not be excessive play or wobble in the oiling head.

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

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 2000 7K**

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

On the second line of the display, on the far right, is the program version in the PC. 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 **7K**.

**NOTICE:** The PC 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 \* **THE KUSTODIAN** screen.

## SECTION V - Adjustments

### A. Cleaning Cloth Replacement & Adjustment

The Kustodian 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.

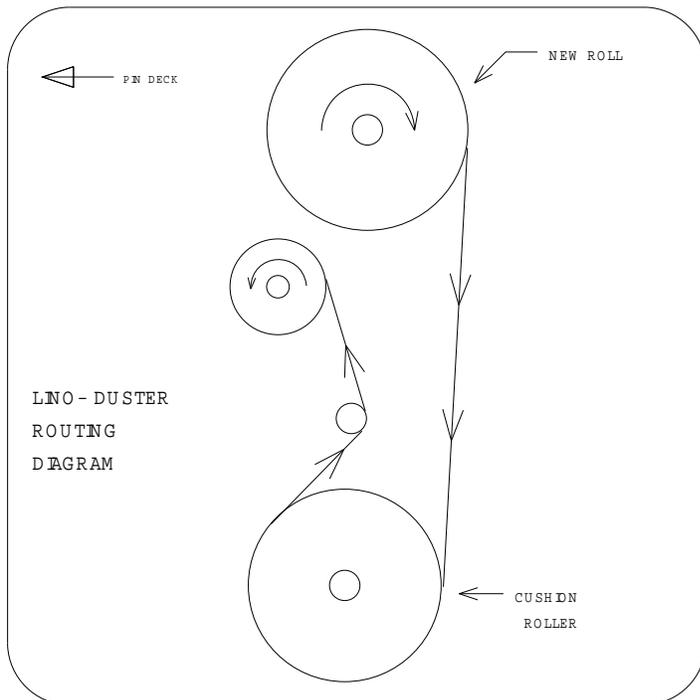
**IMPORTANT! The machine can NOT be operated without Lane Cleaning Cloth installed.**

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

1. Unroll about 3 feet of cloth and lay it on the lid. Insert the metal duster support pipe into the new roll.
2. Route the cloth down between the squeegee and the cushion roller. Wrap the cloth around the cushion roller and pull it up above the front wall.
3. Distribute the cloth evenly around the cushion roller (removing all folds) before routing it around the stainless steel bar. Don't forget to route around the stainless steel bar. Failure to do this will drastically reduce the cleaning efficiency.
4. Once the cloth is square in the machine, push it between the cushion roller and the stainless steel routing bar.

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5. Pull the cloth far enough through the Routing assembly 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.
6. Place the take-up reel in the machine first and then the fresh roll of cloth.
7. Apply power to the machine and bring up the **SYSTEM CONTROL DUSTER** menu.
8. 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 made. The cloth should be rolled up taut and evenly across the assembly.



## **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.

Disconnect power, open the splash guard, and place a rag under the tank.

Open the fill and vent fittings, and pour the mixture into the Supply Tank using the supplied funnel.

Fill the tank until the fluid is about 1/2" from the top of the tank. Do NOT overfill this tank.

**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 light on the PC.

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

## **C. Emptying of Recovery Tank**

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 plate 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 best to let liquid flow out the inlet end, or the end which 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.

To reconnect the tank, reverse the disconnect procedure.

#### D. Adjustment of Spray Jets

The machine uses a four spray jet system to spray cleaner onto the lane surface. These specially designed stainless steel jets spray in a "V" pattern and when properly adjusted spray cleaner across the entire width of the lane.

The spray jets are factory-set, but may need to be adjusted so all boards across the lane are covered, and so that overspray into the channels does not occur.

If coverage is too narrow and edge boards are not being sprayed, adjust by raising the spray tips slightly, or rotating the jet mounting angle.

If coverage is too wide and overspray occurs, adjust spray tip down or toward the center.

To adjust, simply loosen the hex bolt on the aluminum body of the spray assembly. Rotate the spray jet up or down as needed. The middle tips are at an angle, positioned at about a 45-degree or a 135-degree angle as shown below. Adjust these until you get the best spray pattern, then tighten hex bolt.

The outside jets can be angled toward the center to eliminate any overspray into the channels. The outside jets should be positioned vertically.



*Typical Factory Settings for Spray Tips*

## **E. 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.

## **F. 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" 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.

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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 1/8" to 3/16" 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 adjusted 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. Remove the three screws holding the switch cover. Mounted to the cam is a rod end and rod. This rod lifts and lowers the squeegee.
2. Remove the bolt that connects the rod end to the cam.
3. Loosen the jam nut between the rod end and the rod.
4. Rotate the rod end as needed to increase or decrease the pitch. Do NOT make the linkage too short.
5. Tighten the rod end to the rod with the jam nut.
6. Re-install and tighten the bolt to connect the rod end to the cam.

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7. Re-check the gap between the straight edge and the drive wheels.
8. Check cleaning to ensure adjustment is adequate.
9. Replace the switch cover.

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

### **G. 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. 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  $3/16$ " beyond the level for proper adjustment. This crush is 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  $1/8$ ".

**NOTE:** Amp draw is also affected by the amount of crush the transfer roller has into the brush.

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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. 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 1/16" adjustment.) 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 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.

### **H. Transfer Roller Adjustment**

The amount of crush the transfer roller has into the brush can be easily adjusted by raising and lowering the transfer assembly. The factory setting is about  $5/32$ ".

To adjust, remove the buffer belt and head timing guards. Six bolts hold the transfer assembly in place. Two are for the head motor mount, two are for the idler mount, and the other two are located across the top of the transfer wall. When these bolts are loose, and the transfer motor chain has slack in it, the assembly (motor and all) can be raised and lowered with the two vertical bolts in the conditioning compartment.

The factory setting for this adjustment is two full turns (of each bolt) after the transfer roller first contacts the brush.

## I. 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 at in the pindeck area.

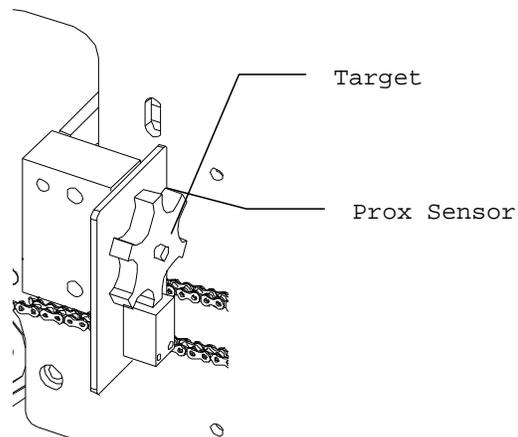
**Note:** An adjustment may be necessary in the **REVERSE DISTANCE SUBTRACT** menu when travel settings are changed. It should be adjusted so the machine travels the correct distance back to the foul line. The return distance should be a little less than the End Cleaning Distance. Adjust the setting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

## J. 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 5/16-18 cap nuts that hold the cover. Slide cover off of the mounting bolts. 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 ( $\pm 0.005$ ). The proximity sensor should be mounted square to the plate.



*View of Head Timing Assembly*

**Section 5-10**

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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 is passed 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 tighten the acorn nuts.

**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.

## **K. Drive Motor Speed Adjustments:**

To set the drive speeds you will need to Menu to the **Test Output** area. Outputs #02 to #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 PC. 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 screw driver, 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.

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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 to the machine.
7. Lift the control plate up and locate the Speed Control. 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.



## 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. Only replace the cord with one that is identical 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. Sensors

All sensors can be cleaned by blowing out with an air compressor. This will remove any dust build-up which could cause false sensing. Sensors may need to be sprayed lightly with electrical contact cleaner (the type for PC boards) if there is oil contamination. Do NOT clean the sensors if they do not appear to have oil and dirt build-up around them. The old saying is true, "If it isn't broken, don't fix it".

### D. Lane-to-Lane Casters

Clean after each operation.

### E. Drive Wheels

Clean daily after each operation.

#### **F. 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 who 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.

#### **G. Inside Machine**

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

#### **H. Recovery Tank Removal**

Remove and drain (from inlet end) after each operation. Always drain the recovery tank when filling the supply tank.

#### **I. Filters**

The cleaner and oil tanks both have an in-line filter outside the tank. There are also four check-valve filters, one on each spray jet that should be cleaned.

Periodically clean the check-valve filters and replace the in-line filters to keep the machine operating at peak performance.

## J. Changing of Conditioner

### 1) DRAINING THE TANK:

Remove the Oil Tank from the machine, and the oil fittings. 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.

Remove the elbow fittings connecting the clear sight glass tubing to the tank elbows. Pressing in on the gray collet will release the fittings.

Open the top side first, then remove the bottom elbow. Be prepared to capture the oil. Drain all the oil from each of the oil lines on the assembly. After draining, replace the sight glass and install the assembly 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, go to Test Output #15 and press F5 to turn the pump 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 output. 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 two gray fill plugs on top of the oil tank and fill it with the new conditioner. Turn the output ON for the Pump Motor and allow it to run until the new conditioner flows into the cup. Re-connect the return line into the fitting. Check for leaks.

Exit the "Test Output" and menu to the "Pump Output Volume Test" menu.

Press NEXT to access the following screen.

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

The pump will begin running when this menu is accessed. 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: 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 and turn ON the Oil Pump. 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 roller. 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 the 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 at a length of 12". This typically provides 12-15 pounds of pressure using Offense-HV at a temperature of 72° Fahrenheit.

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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. 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.

**NOTE:** When using conditioners with a viscosity less than 18 centipoise, use the special reducer attachment found in the accessory kit. Attach to the oil return line and adjust the pressure as stated above. This attachment will increase the back pressure of the return line at the oil control valve.

#### **4) CHECKING THE LOAD STREAM:**

Once the previous procedures have been completed, the oil load stream must be checked. This is done by running a couple of lanes to prime the oil head line.

Select any program and change screen **01F** to 2L- 2R x 06 and **02F** to ##L-##R x 00. (The other values are not important.) Run the machine down the lane to the end of the pattern. As the machine does the 2-2 loads, watch closely where the oil streams begin and end. On the top transfer roller there are etched marks at the outside edge of each 2-board. The oil stream should begin about on or about 1/8" inside the mark when the load begins and 1/8" outside of it when it ends.

Adjust the height of the tip UP if the stream is starting early, or DOWN if it starts too late. A collar on the tip holds the position of the tip and locks it into the head. (The collar may need to be rotated on the tip to allow the head tubing to move properly within the compartment.)

After the tip height is set properly and the head tubing moves freely, tighten the set screw that secures and locks the tip into the head.

Return the program values to their original settings.

**NOTE:** In order to make the loads stop and start consistently the distance between the transfer roller and the tip must be the same on both ends of the roller. The transfer assembly can be raised or lowered at each end. If the tip is too close it will pull oil from the tip or drag on the roller.

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The hose must be routed properly to prevent the head from hitting the tubing as it travels to the left. The head tubing must be secured to the tip holder so when it travels to the left the hose falls toward the rear of the machine and allows the head to travel all the way to the side wall.

**K. 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.

## Section VII - Inputs and Outputs

### A. Inputs

The PC 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 PC 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 PC along with their designations:

<u>INPUT</u>	<u>DESCRIPTION:</u>
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 UP SWITCH
0CH 05	BUFFER DOWN SWITCH
0CH 06	DRIVE SHAFT TACHOMETER SENSOR
0CH 07	LANE DISTANCE SENSOR (LDS)
0CH 08	START BUTTON (HANDLE)
0CH 09	OIL ONLY SWITCH
0CH 10	DUSTER UP SWITCH
0CH 11	CLEAN ONLY SWITCH
1CH 00	SQUEEGEE DOWN SWITCH
1CH 01	SQUEEGEE UP SWITCH

The following two 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 Kegel Technical Support for assistance. These Inputs are designated on the PC as:

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

## B. Outputs

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

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

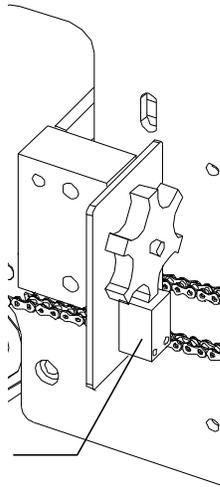
**Note:** The output that controls the Reverse Relay and the Cleaner Pump is wired through the Forward Relay (LY4). This allows one output to do two jobs.

When the machine is traveling forward, the output **10CH 02** is used to operate the cleaner pump (through the normally open contacts of the relay).

When the machine stops at the end of travel, the forward relay turns off and the normally closed contacts return to the closed circuit condition. In this state, the reverse relay can now be activated by the output.

### 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)



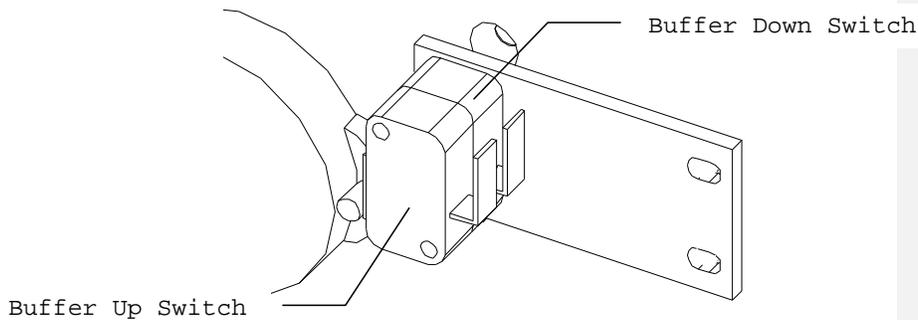
Board Counting Sensor

*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" 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)

**OCH 03 Right Proximity Sensor:** This sensor is found on the right side of the electrical wall in the Conditioning Compartment (1-1/8" 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 OCH, LED #03)

**OCH 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 PC receives a signal that the brush is in the UP position. This switch is wired Normally Open. (Input OCH, LED #04)



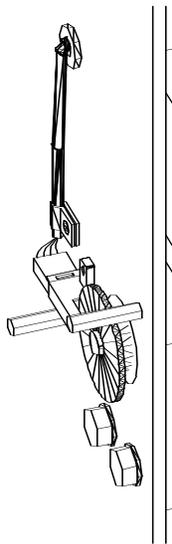
*Buffer Brush Switches*

**OCH 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 PC 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 oiling 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 OCH, LED #05)

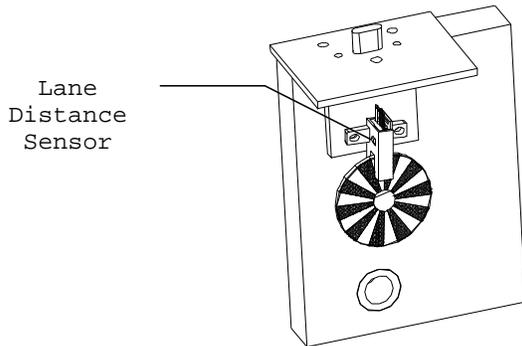
**Note:** All microswitches on the machine are wired Normally Open. When replacing switches, make sure the wiring is connected to the **COM** and **NO** contacts.

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**0CH 06 Drive Shaft Tachometer Sensor:** Mounted to the left side of the machine is the TACH sensor. A ten-target timing disk is rotated by the drive shaft. As the targets of the disk pass through this sensor, pulses are sent to the PC. The PC 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 infrared pass-through sensor is mounted on a block on the rear wall of the machine. A ten-target disk passes through this sensor as the shaft turns. It counts in approximately one inch increments as the machine travels down the lane. If this sensor does not send pulses to the PC, 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 PC. This signal will tell the PC 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 PC 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.

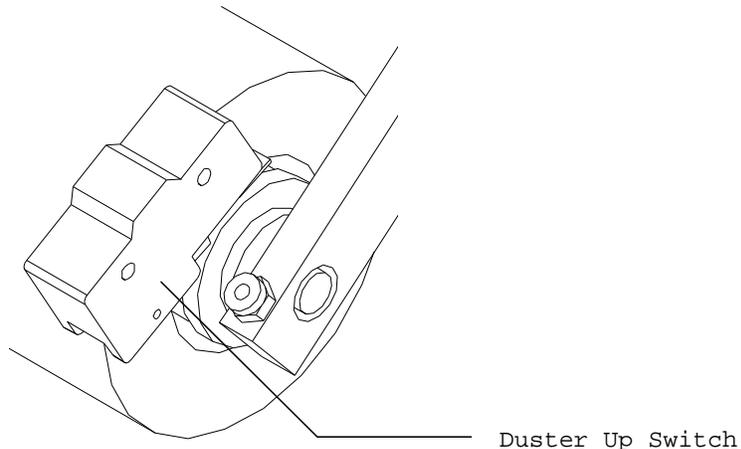
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- In the **System Control Duster** screen, the **FIRST** time the button is pressed, the brake motor will unwind cloth while the button is held.

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.

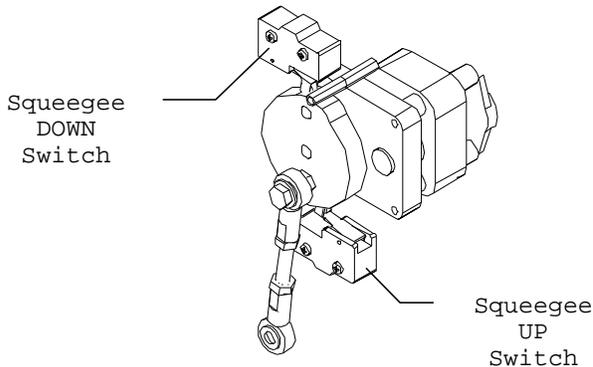
**0CH 09 Oil Only:** This input tells the PC to oil without cleaning. Flipping the toggle switch on the control panel to Oil Only will turn this operation ON. In this mode the duster can be turned off if needed. (Input 0CH, LED #09)

**0CH 10 Duster Up Switch:** 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 a signal is sent to the PC by one or both of these switches. These switches are wired Normally Open. (Input 0CH, LED #10)



**0CH 11 Clean Only:** This input tells the PC 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. The PUMP OUTPUT will not operate if switch is set to CLEAN ONLY. (Input 0CH, Led #11)

**1CH 00 Squeegee Up Switch:** This switch is located on the right inside wall of the cleaning compartment, just below the cam. The switch works the same way as the Buffer Up Switch. When the cam lobe actuates the switch the PC 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 on the right inside wall of the cleaning compartment, just above the cam. The microswitch tells the PC when the squeegee is in the DOWN position. A signal is sent to the PC when the switch is actuated by the cam lobe. While operating the squeegee must be in the down position. If the PC 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)

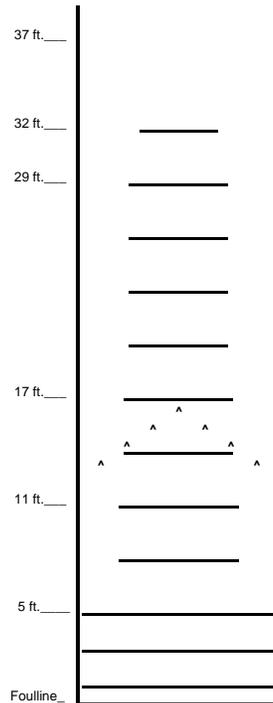
## SECTION VIII - Oil Patterns

### 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 roller, applying streams of oil as it goes. The streams (or loads) are shown 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  $\pm 1\%$ .

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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.

 = 16 microliters

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.

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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.

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

**PUMP OUTPUT**

**VOLUME TEST**

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

**\* OIL VOLUME**

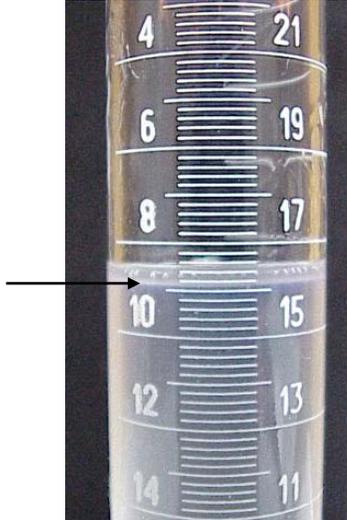
**PRO#01 PRESS F6**

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.

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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 roller, the pump actually revolves about 2-1/2 revolutions as it crosses one board.

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

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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 3  
12 - 12 x 1  
13 - 13 x 1  
  
12 - 12 x 2  
11 - 11 x 2  
10 - 10 x 2  
8 - 8 x 1  
8 - 8 x 1 (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.

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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 3  
17 x 1  
15 x 1

17 x 2  
19 x 2  
21 x 2  
25 x 1  
25 x 1

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

PROGRAM 01

37 x 4 = 148  
23 x 1 = 23  
21 x 2 = 42  
19 x 3 = 57  
17 x 1 = 17  
15 x 1 = 15

17 x 2 = 34  
19 x 2 = 38  
21 x 2 = 42  
25 x 1 = 25  
25 x 1 = 25

**466 Total Boards**

In our example there are 302 boards covered during Forward travel and 164 boards covered during the Reverse travel. This total number (**466**) can be multiplied by the pump setting (**40 µL**) to determine the exact amount of oil used when conditioning with this pattern.

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466 Boards  
x 40 microliters  
**18,640 microliters**

The total amount is 18,640 microliters. To convert this to milliliters the number has to be divided by 1000.

$18640/1000 = 18.64$  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 PC 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.

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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 roller as if the machine were operating on the lane. The **Oil Program 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 **18.5** and **19** 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.

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

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

## SECTION IX - Program Descriptions

These programs have been created using **Offense™-HV** Lane Conditioner. Contact Kegel Bowling Technologies at (863) 382-6588 for information about this product.

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.

**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.

**Program 2** is similar to Program 1, **HEAVIER** in track area for excessively "hooking" surface.

**Program 3** is a **WIDER** variation of Program 1, it allows the bowlers to play further outside.

**Program 4** is the **Volume Per Board** test pattern. It is set to condition 400 boards. This program can be changed if it is needed.

If the program is changed for another use, then it will be very important that the operator understand and know how to calibrate the pump.

The Total Volume of Oil for each program will indicate if the pump needs adjusting, but always double check the math before adjusting the pump.



## 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 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 the 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.

#### PATTERN SMOOTHING PADS:

The pattern smoothing pads should be cleaned on a regular basis. Compressed air can be used to remove debris that collects between the pads and the roller. If the pads become very dirty, it will be necessary to remove them from the machine and clean them with a dry towel. Do not use an abrasive material or chemicals to clean the pads, as damage may occur.

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**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								
Remove pattern smoothing pads & clean thoroughly with dry towel								
Clean buffer brush with air and check adjustment								
Flush recovery tank (use hot water)								
Clean filters and spray tips								
Check squeegee for wear and adjustment								
Check all chain tensions								
Check all belt tensions (buffer, head, and oil pump)								
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 timing pulley shaft bushings (See Fig. 14)
		Lubricate pivot arm bushings on the duster assembly with 2 drops of 10W oil
		<b>TIGHTEN ALL SET SCREWS</b> (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 PC and PC Mounting plate
		Tighten all terminal strips and wire blocks

**CONDITIONER AREA:**

		Check transfer roller mounting arms for tightness
		Move oil head by hand, checking for free travel along the bar
		Check oil head for excessive play or wobble, adjust if needed
		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" 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

## **B. Instructions To Clean Water Spray Pump**

If water pump output is low, the valves inside the pump may be clogged. First clean or replace the Supply Tank In-line Filter and Spray Jet Check Filters. Also check the length of the pressure regulator tubing (length is 6" of 3/16" tubing).

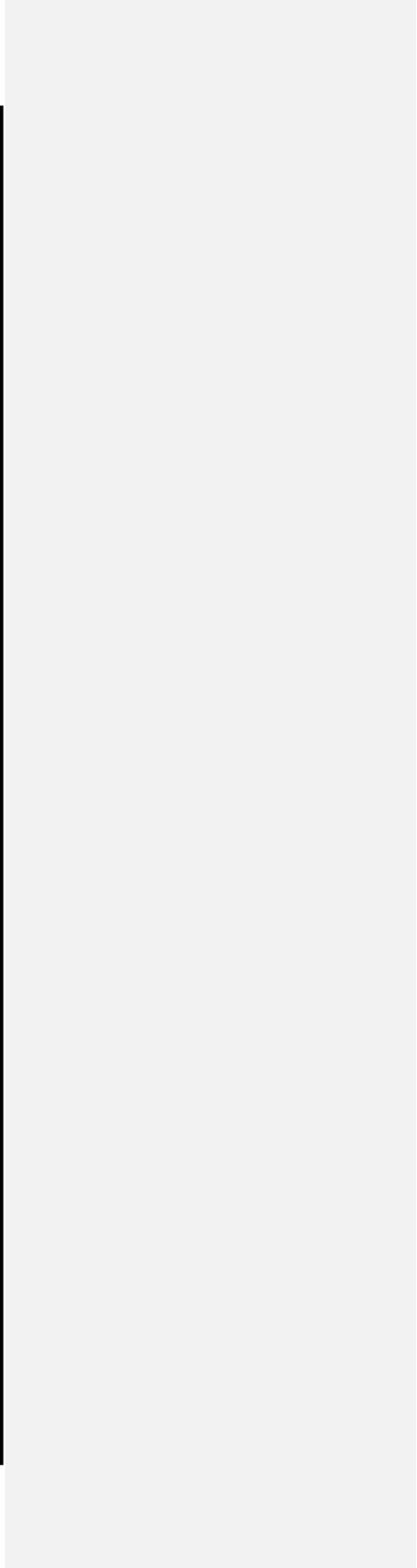
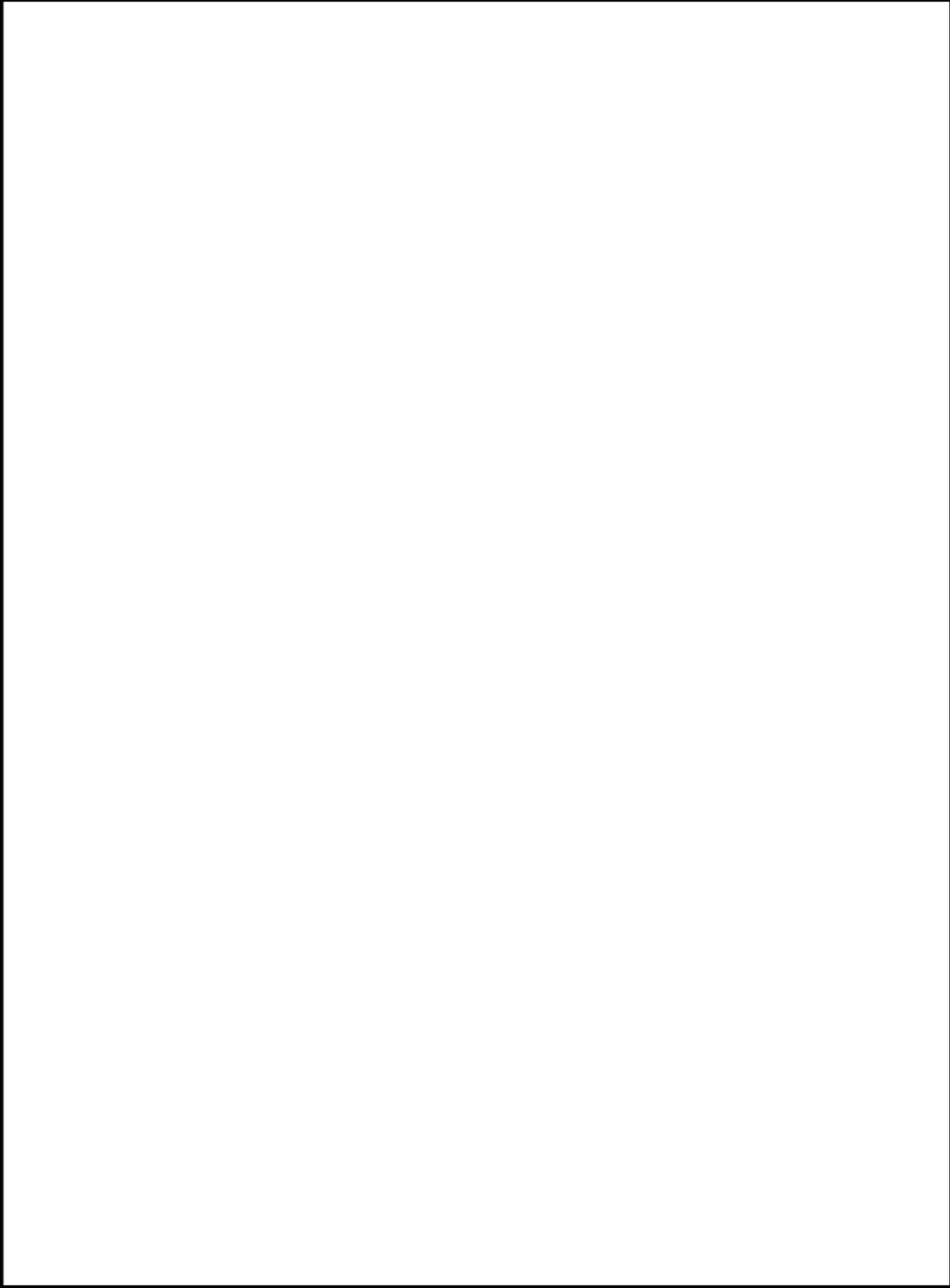
If pressure continues to be a problem, follow these instructions to disassemble the FloJet™ pump and clean the valves. To prevent cleaner from leaking inside the motor, do not remove the Diaphragm Assembly. (See the exploded view of the pump on Page 8.)

### **DISASSEMBLY:**

1. Disconnect power and remove hoses from the pump. Use a rag to catch any cleaner before it spills on the machine.
2. Get the pump out of machine by removing the 4 fasteners holding the pump to the rear wall.
3. With the pump on a workbench remove the Pump Head assembly. The Pump Head is attached by (4) long phillips-head fasteners. (Note: There is no need to remove the (2) recessed screws.)
4. Remove the Pump Valve Assembly. This is the black piece with grills that sits inside the pump head. Make sure the O-ring is in the assembly.
5. Rinse the Pump Valve Assembly with warm soapy water, concentrating on the areas where the cleaner passes through the grills. Do not pry on the black rubber pieces, as damage to these will ruin the valves.

### **ASSEMBLY:**

1. Place the Valve Assembly (with the O-ring) on the Diaphragm.
2. Place the Pump Head over the Valve & Diaphragm Assembly. Make sure the "direction of flow" arrow points from left to right as the pump sits flat on the base.
3. Insert (4) long #10-32 screws until each threads into the Pump Motor, then tighten each screw securely.
4. Replace pump in machine. Replace hoses and test for leaks.



### C. Procedure For Cleaning Oil Control Valves

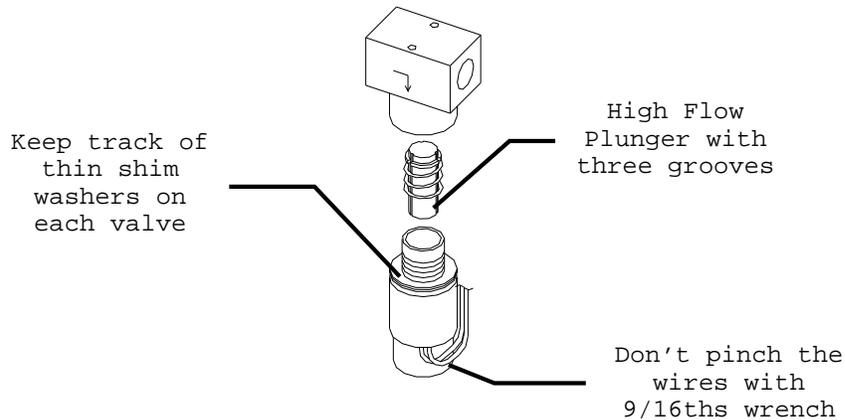
The following steps outline the procedure for disassembling the conditioner metering valve. Be careful when removing the oil lines from the fittings since they will leak.

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.
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 one 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.

Comment [PC1]:



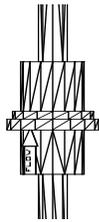
7. The top section of the valve should be blown out with a canister of compressed air. Air should flow freely from the bottom through both sides at the top. A few short bursts of canned air in both holes should displace any debris. Alcohol can also be used to remove any build-up of sediment. (Do not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

**IMPORTANT:** If a valve is found to have only one groove please contact *The Kegel Company, Inc.* for an immediate replacement. All machines should have the "high flow" valves which are machined with three grooves. Please call (863) 382-6588 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.

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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.
14. Check the in-line filter located on the oil supply line. Replace this filter if it is filled with debris. If this filter clogs frequently check the inside of the oil tank.



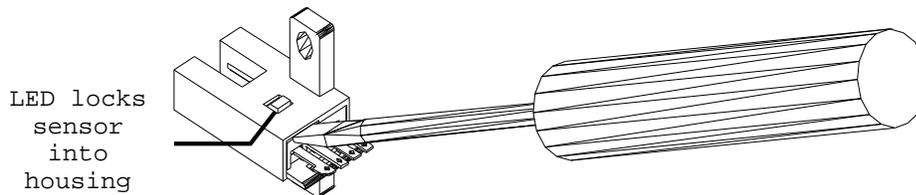
*View of In-Line Filter*

#### D. Procedure For Cleaning Infrared Sensors

The following steps outline the procedure for cleaning the photoelectric sensors used for the drive speed tachometer, the lane distance counter, and pump tachometer.

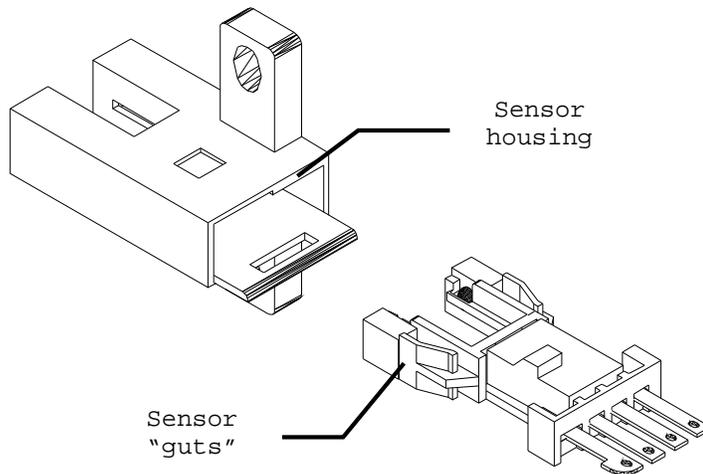
If these sensors become contaminated with dirt and oil they will not function properly. With a little care they can be taken apart and cleaned.

1. Remove the protective cover for the sensor and check for proper disk alignment. Make sure the disk does not touch either side of the sensor.
2. Apply power to the machine and check for proper operation before removing the sensor. When actuated, a light will appear on the Input module at the designated number. There is also a light on the sensor that will appear if there is no obstruction blocking the pass-through area.
3. If a problem is evident, remove power and unplug the sensor cable.
4. Carefully remove the sensor from the mounting surface. (Note: Do not lose any shim washers used to space the sensor from the mounting surface.)
5. Locate the LED indicator on the sensor. It is the white section on top of the sensor. It acts as a key that locks the photoelectric section into the black plastic housing
6. Use a small standard screwdriver to carefully pry up on the black housing behind the LED.



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7. With the housing raised off of the LED, pull back on the screwdriver using the tip to drag the guts out of the housing. Do not break the sensor housing; only pry on it far enough to get the leading edge of the LED underneath it.



8. Use an electrical contact cleaner to remove any oil and dirt build-up on the sensor and inside the housing. Use a contact cleaner that is safe for PC boards.
9. Slide the guts of the sensor back into the housing and plug it into the cable.
10. Apply power and check the light on the sensor. It should illuminate if the sensor is functioning properly.
11. Block the sensor off to make the LED go dark, then check the PC Input module. An LED should be lit at the designated Input number.
12. If the sensor passes this test, disconnect power and re-install it on the machine.
13. Check for proper sprocket alignment and replace the protective cover.

**E. Operators Menu Selections**

* THE KUSTODIAN SPEED 00 PRO#01	* MANUAL REVERSE PRESS BUTTON	CHANGE PROGRAM CHOOSE -> 01	SYSTEM CONTROL CLEANING	SYSTEM CONTROL DUSTER
		START CLEANING 00 DISTANCE 00	SPRAY ON TIME IN TENTHS -> 04	UNWIND TIME F6 TO RESET 10
		OIL ONLY DUST? 01 1-YES,0-NO 01	SPRAY OFF DIST IN INCHES -> 30	
		OIL PATTERN DIST 37 IN FEET 37	LAST SPRAY DIST IN FEET -> 45	
		01F 2L- 2R X 04 00->10 FT IPS=18	DECK SPRAY?? 01=YES -> 01	
		02F 9L- 9R X 01 10->12 FT IPS=18	FORWARD DISTANCE SUBTRACT -> 30	
		03F 10L-10R X 02 12->17 FT IPS=18	REVERSE DISTANCE SUBTRACT -> 31	
		04F 11L-10R X 03 17->26 FT IPS=22		
		05F 12L-12R X 01 26->29 FT IPS=22		
		06F 13L-13R X 01 29->32 FT IPS=22		
		07F 13L-13R X 00 32->40 FT IPS=22		
		01R 2L- 2R X 00 40->28 FT IPS=26		
		02R 12L-12R X 02 28->23 FT IPS=18		
		03R 11L-11R X 02 23->18 FT IPS=18		
		04R 10L-10R X 02 18->13 FT IPS=18		
		05R 8L- 8R X 1 13->11 FT IPS=18		
		06R 8L- 8R X 1 11->10 FT IPS=14		
		07R 2L- 2R X 00 10->00 FT IPS=14		
		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 2000 7K
* 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.

## **F. 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.

### **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 PC 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 7** 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 PC.

## 2. Inputs

To test the Inputs the operator will have to manually activate the device that sends the signal to the PC. 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 infrared sensors are all wired Normally Open. Passing an object between the forks of the sensor will activate the Input; the LED on the sensor and the PC will go on and off (at opposite times) as the object passes through the sensor.

**Note:** Mechanical switches and infrared 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.

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 PC will go on and off (at the same time) as the object passes by the sensor.

**Note:** The target passing in front of the board counting proximity switch must be a gap between 0.015" and 0.020". Gaps greater than 0.035" 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" on each side. If the target is too far away from the sensor, an L8 Error might occur.

## G. 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.

<u>ERROR CODE</u>	<u>DESCRIPTION</u>
T1	FORWARD TRAVEL ERROR
T2	REVERSE TRAVEL ERROR
B3	BRUSH DOWN ERROR
B4	BRUSH UP ERROR
D5	DUSTER UNWIND ERROR
D6	DUSTER WIND-UP ERROR
H7	OIL HEAD TRAVEL ERROR
L8	OIL HEAD TIMING ERROR
S9	SQUEEGEE UP ERROR
SA	SQUEEGEE DOWN 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.

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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 OCH #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 OCH #07 is flashing on the PC 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 OCH #06 and put it in place of the wire that is on Input OCH #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 OCH #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 OCH #07 is flashing on the PC 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 OCH #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 OCH #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 OCH #10 has an LED light showing on the PC 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 PC 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 PC 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" 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 (0.015" - 0.020").
3. Use the Blacklight to monitor the loads as the machine travels on the lane. This will help you determine the severity of the problem. Do not allow Head Timing problems to undermine the consistency of the machine.
4. 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.
5. 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.

This concludes the ERROR MESSAGES that are available.

## H. 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 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)

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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's Lane Maintenance Central at (800) 280-2695.**  
The factory is located in Lake Wales, Florida USA. Office hours are typically from 8:00 a.m. to 5:00 p.m. EST Monday through Friday. Calls outside these hours will be handled by an automated message system. 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.

**Important Note About The Power Cord**

The machine power cord is certified to comply with UL, CSA, 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 wiring instructions when replacing the cord ends. Use only cord stock equivalent to the factory specifications.

## I. 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.

<u>Viscosity Range</u>	<u>Length</u>	<u>Size (OD)</u>	<u>Conditioner</u>
<10	6~7 Ft.	3/16"	LV2 or U-300
~10	30 In.	3/16"	DBA #501
~20	15 In.	3/16"	Clear #801
~30	6 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 piece of tubing that is approximately 3" long 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 ships from the factory with a 12" piece of 3/16" pressure regulator tubing for Offense-HV.

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

- 154-0202A** - 1/4" OD Tubing Stock (Inch)
- 154-0202B** - 3/16" OD Tubing Stock (Inch)

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