OPERATING & MAINTENANCE MANUAL

Versa-Clean
Flat Glass Washing
and
Drying Machine

Applicable to Models
VC20/VC24/VC30/VC36/VC40
Small Parts Washer - Single Lane

(PLC Controlled with Touchscreen)

Billco Manufacturing, Incorporated
100 Halstead Boulevard
Zelienople, PA 16063-9799
www.billco-mfg.com

A "Billco Manufacturing, Incorporated Manufactured Equipment Safety Manual" has been shipped with your machine or system. Please thoroughly read this safety manual as it provides important information on the safe use and maintenance of our equipment. Contact your Billco representative if you should need additional copies.

IMPORTANT INFORMATION

CAUTION

PRIOR TO INITIAL START UP OF YOUR MACHINE, YOU MUST THOROUGHLY:

- Check for looseness of assemblies, parts, and guards.
- Tighten as needed all fasteners, setscrews, and electrical terminals. This must include, but not limited to, bearing mounts, shaft setscrews, electrical connectors, plugs, terminal strips, and internal terminal box connections.
- Review the supplied Billco documentation package which includes the Operating and Maintenance Manual and equipment drawings. Especially pay attention to the periodic maintenance information in the maintenance Section of this manual.
- Read all supplied vendor's information and instructions.
- Make sure that the primary power source meets the specifications of supplied electrical drawings.

CAUTION: DO NOT MAKE PARAMETER CHANGES

Changes to parameters or folders/files will affect the operation of Billco's equipment/system or even cause it to become inoperative. Do not modify, move, or delete any parameters, programs, or folders/files unless there is a good reason to do so. **Call Billco first before making any changes.** Changes should only be made by a Billco trained qualified technician.

FAILURE TO ADHERE TO THESE REQUIREMENTS COULD VOID THE WARRANTY ON YOUR MACHINE.

TABLE OF CONTENTS

Note: Please read the important topics of pages i through xiii before operating or performing maintenance on this equipment.

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

EQUIPMENT WORK ORDER NUMBER

Please enter the work order number for your equipment in the space provided below. The work order number is located on a metal tag that is fastened to the equipment that make up this order.

The work order number for your Billco equipment is **W.O.** _____ .

It is very important to have this number on hand when ordering replacement parts. It should also be referenced in all correspondences concerning this equipment. The work order number reference will help Billco to provide you with prompt service and ensure that the ordered parts are correct for your equipment.

TECHNICAL ASSISTANCE

To Our Valued Customer:

Individuals involved in the installation, start up, operation and maintenance, or who in any way must come in contact with this machine, should be required to read and understand this manual to assure the safe operation of this equipment.

The operator should have access to this manual. If this manual is unavailable to the operator, another copy can be obtained from:

Billco Manufacturing, Inc.
100 Halstead Blvd.
Zelienople, PA 16063-9799

Phone: (724) 452-7390
Attention: Service Department

The equipment work order number and specifications listed in this manual should be checked against those of the purchased machine and its intended use in your plant. If any questions arise, the machine should not be operated until Billco Manufacturing has been contacted.

If you sell or scrap the machine, please advise us.

FOR REQUESTING SERVICE ASSISTANCE:

1. Obtain the work order number of the machine from a metal plate on the machine (number starts with **W.O.**).

   This number is also marked in this manual and on the lower right hand corner of associated engineering drawings.

2. Call 724-452-7390 and ask for the service department. With the above recorded work order number, our staff can have your machine file at their fingertips in seconds.

FOR ORDERING PARTS:

1. Obtain the work order number of the machine as described for Service Assistance above.

2. Identify the part number of the part you require. This number can normally be obtained from the engineering drawings that were provided with your equipment.

3. Call 724-452-7390 and ask for the parts department. With the recorded work order number and part number on hand, our staff is normally able to help you immediately.

Parts ordered from our parts department are warranted for six months. When you receive the parts, please open them immediately upon receipt. Billco will not be responsible for adjustments after 30 days. Special order items may require a higher restocking fee for returns. Billco accepts no returns on electrical components. When you return a part to Billco, you must call and request a Return Material Authorization Number (which must accompany your return or Billco may refuse the return). Defective parts are sent to our vendors for evaluation. If the vendor charges for this service, it will be the responsibility of the customer to pay this charge. All

returns must be returned to Billco prepaid unless otherwise authorized by Billco.

SPARE OR REPLACEMENT PARTS ORDER

What happens when you call our Parts Department:

Questions you may be asked (in this order).

- Work order number (W.O. #) of the machine for the parts you are ordering.
- Name and address —both your billing and "ship to" address.
- Part number(s) from your drawing(s).
- Type (e.g., washer, cutter) and/or Model (e.g., 1000, 2000 cutter) of your machine.
- Part description, including part number, of the part that you need.
- Any special instructions, such as shipping method.

Instructions on how to find the various information and numbers associated with identifying your machine and its parts are provided on the back of this bulletin.

Questions your Parts Specialist will answer.

- Parts availability.
- Parts cost.
- Shipping date.

The following is a quick checklist for your convenience. Fill in the blanks and check off each box so that your inquiry can be quickly processed. You might want to make several copies of this bulletin before marking it (so you can use it again for another inquiry).

Ready to place your order? Have you…

☐ Obtained the Work Order Number (W.O. Number) from your machine?
My machine W.O. Number is _____

☐ Prepared a list of products and part numbers you would like to order? See your prints provided with the machine.

☐ Identified your full shipping and/or billing address? If you need your order shipped and/or billed to separate addresses, just let us know.

BILL TO: **SHIP TO:**

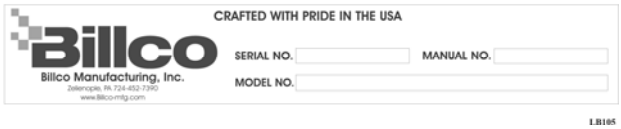
_____

_____

_____

Where to find the Work Order Number (W.O. Number) on your Billco machine: (The Work Order # is identified as the Serial # on machine labels.)

This label is generally located on the frame of small machines: machines:



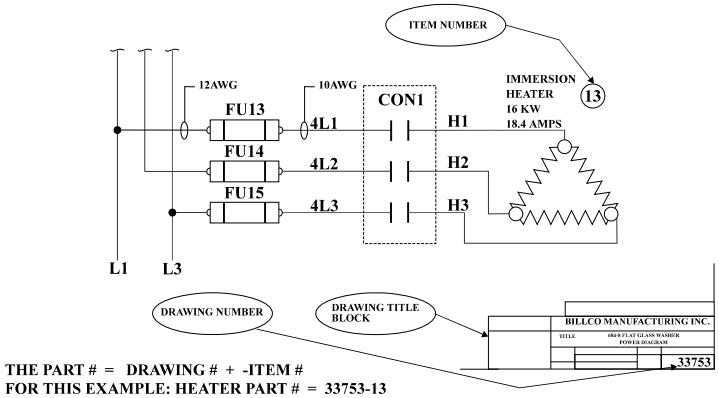
LB105

This label is located on the control panel for the machine, usually on the inside of door:

LB106

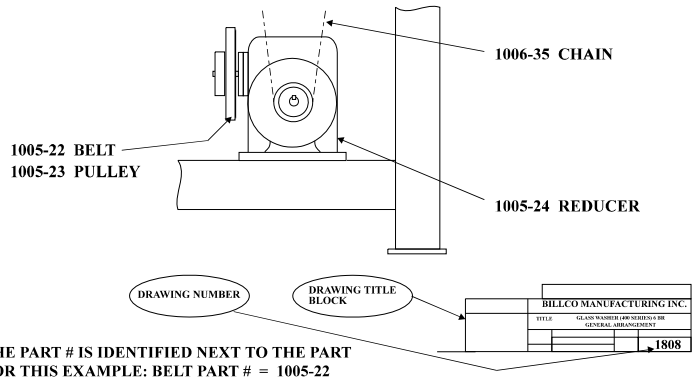
This label is located on the outside of the control panel for the machine and on an appropriate location of larger machines.

How to determine an electrical part # from your Billco machine electrical prints:



THE PART # = DRAWING # + -ITEM #
FOR THIS EXAMPLE: HEATER PART # = 33753-13

How to determine a mechanical part # from your Billco machine assembly prints:



THE PART # IS IDENTIFIED NEXT TO THE PART
FOR THIS EXAMPLE: BELT PART # = 1005-22

WARRANTY

All component parts of the equipment manufactured by Billco Manufacturing, Incorporated shall be guaranteed as to material and workmanship for a period of six (6) months from date of delivery when subjected to ordinary and normal use and service. Any such parts returned prepaid to our factory within 30 days of the date shown on our return material authorization, and determined upon our inspection to be defective will be repaired or replaced free of charge, F.O.B. our works, but the company will not assume the cost of installation nor shall it be liable for delays, loss or damage caused by such defective material. Parts returned without a return material authorization number will be returned to customer. Excluded from this guarantee are short lived items which due to severity of usage or environment are considered expendable.

Electrical equipment or other purchased equipment furnished with the company's equipment, or material purchased in accordance with customer's instructions, is guaranteed by the company only to the extent of the original manufacturer's guarantee. This warranty is in lieu of all other warranties, liabilities and obligations expressed or implied, unless stated otherwise by agreement of sales.

PUBLICATION USE STATEMENT

The product described in this document may employ hazardous voltages or might create other conditions that could, through misuse, inattention, or lack of understanding, result in personal injury, or damage to the product or to other equipment. It is imperative, therefore, that personnel involved in the installation, maintenance, or use of this product understand the operation of the product and the contents of this document.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations nor to provide for every possible contingency in connection with installation, operation, and maintenance. Features may be described herein which are not present in all systems. Billco Manufacturing, Incorporated assumes no obligation of notice to holders of this document with respect to changes subsequently made.

Billco Manufacturing, Incorporated makes no representation or warranty, expressed, implied, or statutory with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability of fitness for purpose shall apply.

1. SPECIFICATIONS

This manual was prepared to cover a standard machine which is available in a variety of sizes, configurations, and options to meet a wide range of production requirements. Therefore, descriptions and illustrations in the manual Sections that follow may not exactly represent your machine. Review the supplied drawings to determine the exact make up of your machine.

Fill out the SPECIFICATIONS column of TABLE 1.1 with the data specific to your machine for your reference. This information can be obtained from your contract, supplied drawings, and Billco representative. All inquiries require reference to the WO (Work Order) Number.

TABLE 1.1 Equipment Specifications

ITEM	SPECIFICATION
Work Order	W. O.
Model Designation/Control (Type)	
Required Hoist Capacity for Lifting Top (lb/kg)	
Maximum Glass Size (in./cm)	
Minimum Glass Size (in./cm)	
Maximum Glass Thickness (in./cm)	
Minimum Glass Thickness (in./cm)	
Water Supply Flow Rate (gpm/lpm)	
Wash Tank Capacity (gal/liters)	
Rinse Tank Capacity (gal/liters)	
Brush/Roll Diameters (in./cm)	
Air Knife Type (Standard or Wedge); Air Flow (cfm/cmm)	
Maximum Feed Rate (fpm/mpm)	
Voltage (VAC/Phase/Hz)	
Maximum Amperage (FLA)	

CAUTION: Do not weld on this or any connected equipment without totally disconnecting the PLC control and any other solid state equipment. This also includes all grounding interconnections. Otherwise, serious damage may occur to the equipment.

For any further information, please contact:

Billco Manufacturing, Inc.
100 Halstead Blvd.
Zelienople, PA 16063

Phone: (724) 452-7390
Service Department

IMPORTANT WARNINGS: NEVER CLIMB INTO AN OPENED WASHER. A LEAK IN THE MANUAL HYDRAULIC SYSTEM COULD CAUSE THE LIFT CYLINDERS TO RETRACT. WHEN USING EITHER THE MANUAL OR MOTOR-DRIVEN LIFT TO RAISE THE TOP SECTION, ALWAYS INSERT THE TWO SUPPLIED PROPS AT OPPOSITE CORNERS OF THE TOP SECTION AS A SAFETY MEASURE TO SECURE THE TOP SECTION OPEN.

IMPORTANT TOP LIFT SECTION WARNING:

THE TOP SECTION LIFT FOR THIS WASHER USES A "MOVOTEC LIFT SYSTEM". THERE ARE NUMEROUS SAFETY MECHANISMS ENGINEERED INTO THE "MOVOTEC LIFT SYSTEM", BUT TO ENSURE SAFE OPERATION OF THE SYSTEM, IT IS NECESSARY FOR USERS TO HEED THE INFORMATION ON THE WARNING LABEL AFFIXED TO EACH "MOVOTEC LIFT SYSTEM". THIS INFORMATION ADVISES USERS THAT THE TUBING IS UNDER PRESSURE AND TO AVOID CUTTING, PINCHING, OR DAMAGING THE TUBING IN ANY WAY. PARTIAL OR COMPLETE COLLAPSE OF THE UNIT MAY OCCUR, POSSIBLY CAUSING SERIOUS INJURY TO THE OPERATOR. TAMPERING WITH SYSTEM CONNECTIONS WILL ALSO VOID THE MANUFACTURER'S WARRANTY.

THIS FOREWARNING EXTENDS TO A BROKEN ROLL PIN IN THE PUMP CONNECTION TO THE CRANK WHICH IS A RESULT OF OVERDRIVING THE PUMP PORTION OF THE LIFT SYSTEM. THE PIN IS SIZED TO SHEAR DURING OVER TORQUING SITUATIONS TO RELIEVE THE PUSHER BLOCK FROM DAMAGE DUE TO EXCESSIVE FORCE. THE USER SHOULD NEVER REPLACE THE ROLL PIN WITH ANYTHING THAT DOES NOT MEET SUSPA INCORPORATED SPECIFICATIONS. THIS WILL ALSO VOID THE WARRANTY.

CONVEYOR SAFETY

CONVEYORS SHOULD NEVER BE MANUALLY LOADED OR UNLOADED WHILE RUNNING. SPECIFICALLY, A BILLCO CONVEYOR SHOULD NEVER BE LOADED OR UNLOADED FROM THE SIDE. HOWEVER, THERE IS AN EXCEPTION: A CONVEYOR THAT IS SPECIFICALLY DESIGNED TO BE MANUALLY LOADED OR UNLOADED FROM EITHER END WHILE RUNNING HAS AN UN-DRIVEN OUTSIDE END ROLL. NEVER REACH BEYOND THE UN-DRIVEN ROLL. IF THE FIRST OR LAST CONVEYOR ROLLS ARE DRIVEN, THE CONVEYOR WAS DESIGNED BY BILLCO FOR IN-LINE APPLICATION AND MUST NOT BE THE POINT OF MANUAL LOADING OR UNLOADING. TO PREVENT POSSIBLE PERSONNEL INJURY, IT IS THE CUSTOMER'S RESPONSIBILITY TO CONTROL OR RESTRICT ACCESS TO ALL CONVEYOR AREAS SO AS TO MEET THE REQUIREMENTS OF THIS SAFETY STATEMENT.

BE AWARE THAT ALL OTHER CONVEYOR ROLLS ARE DRIVEN AND CAN CAUSE SEVERE INJURY. ADDITIONALLY, PERSONNEL MUST NEVER LEAN AGAINST, REACH OVER, CRAWL UNDER OR HOLD ONTO CONVEYOR ROLLS, WHETHER THEY ARE RUNNING OR NOT RUNNING, AS SERIOUS INJURY CAN RESULT. A CONVEYOR CAN START UP UNEXPECTEDLY DURING A PRODUCTION LINE SEQUENCE.

MOVING DEVICES SAFETY

IN ADDITION TO THE CONVEYOR SAFETY CONSIDERATIONS ABOVE, NEVER REACH ACROSS ANY RUNNING OR MOVING DEVICES, ASSEMBLIES OR PARTS.

SAFETY LABELS ARE LOCATED IN AREAS WHERE SERVICING BY QUALIFIED PERSONNEL MAY BE REQUIRED. THE OPERATOR SHOULD NOT ENTER ANY SUCH DESIGNATED SERVICING AREAS AS HAZARDOUS CONDITIONS MAY BE PRESENT WITH ENERGIZED ELECTRICAL DEVICES, INCLUDING PNEUMATIC AND/OR HYDRAULIC DEVICES (ALTHOUGH ELECTRICAL POWER MAY BE LOCKED OUT). THUS, TO BE SURE OF SAFE CONDITIONS, DISCONNECT PLANT POWER, REMOVE PLANT AIR SUPPLY, AND SHUTDOWN HYDRAULICS. THEN PURGE ALL LINES AND DEVICES (PNEUMATIC AND HYDRAULIC).

2. EQUIPMENT DESCRIPTION

2.1 Model Identification

The Versa-Clean washer series is described by a model code such as **VC-36-6Z-30-2.5**. The code is defined (for this example) by:

VC = Versa-Clean series
36 = 36” capacity (91cm)
6Z = 6 zones (see zone description)
30 = 30 spaces of rolls
2.5 = 2.5” roll-to-roll centers (6.4cm)

2.2 Zone Description

Each zone in the washer is identified by the following functional designations:

- Entrance Deck
- Pre-Spray
- Wash (Brush)
- Rinse (Brush)
- Final Spray
- Drying
- Exit Deck

A Versa-Clean washer can include all or part of the above zone descriptions. Refer to the particular washer specifications of SECTION 1 and the supplied drawings to determine your washer makeup.

2.3 Washer Description

A typical washer layout is shown in FIGURE 2.1. A variety of different washer configurations and sizes are available along with optional material (stainless steel, PVC, etc.) makeup (structural and plumbing). The machine is available in widths of 20” (51cm) to 40” (102cm).

The washer is designed to wash and dry flat glass sheet in a production line operation. The glass is pinched between a conveying system which moves the glass through washing, rinsing, and drying zones. Upper rolls of pinch roll pairs may not be present in the drying zone, depending on the application requirements. The loading and unloading of the machine are provided with driven conveyor rolls. The first roll and last roll at the loading and unloading conveyors, respectively, are generally not driven as a safety precaution for personnel. All rolls and brushes are mounted in snap-out bearings to allow quick roll, brush and spray line changes. These bearings are grease-free, eliminating water contamination from this common source.

The machine consists of three major zones: Recirculating Washing Zone, Recirculating Rinsing Zone, and Drying Zone. These zones, and how they function together as a complete glass washing system, are described below.

NOTE: Supplied assembly drawings may provide a further breakdown of these zones (i.e., Zone 1, Zone 2, ...).

2.4 Touchscreen

All operator controls and indicator are implemented at a touchscreen panel with exception of the emergency ALL STOP pushbutton and POWER ON pushbutton. These are physical controls. The touchscreen panel is mounted on the operator's main control panel at the washer along with the physical controls. The touchscreen is of the pressure sensitive type, thus allowing

actuation of controls while wearing gloves. A general description of the touchscreen controls is covered in SECTION 6.

2.5 Conveyor

The glass is conveyed into, through, and out of the washer by the conveyor rolls and pinch rolls. The pinch rolls are inside the washer.

The bottom section conveyor is roller chain driven by a motor reducer. The top section rolls (of pinch roll sets) are individually driven by non-metallic end spur gears that engage with mating gears on their bottom rolls. The load and unload conveyors are driven by the same chain loop used for the bottom section pinch rolls.

The bottom and top section pinch rolls are designed to pinch the glass under a slight load (either spring or gravity loading from the top roll), depending on width (size) of washer. With no glass present, the top roll should just touch the corresponding bottom roll over its entire length. Adjustment is made with the top roll only; bottom roll is fixed in height.

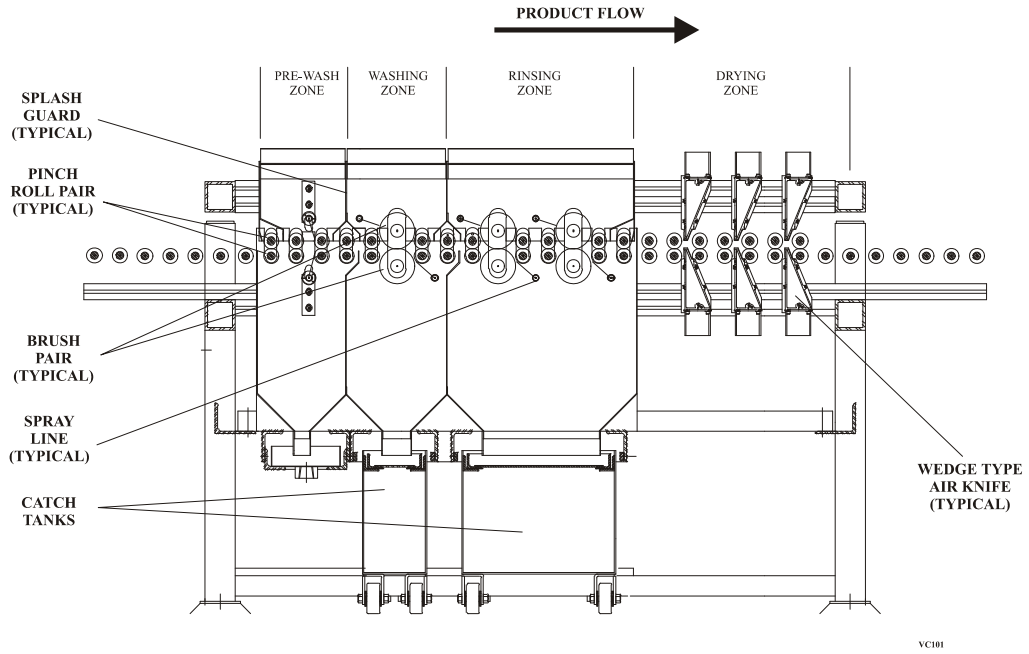


FIGURE 2.1 Typical 6-Brush Washer Layout
(Not to Scale)

Conveyor motor speed is set at the control panel by a variable control. The drive is available as a variable speed control. Refer to SECTION 1, SPECIFICATIONS for specific drive type provided on your machine.

2.6 Top Section Lift

The top section opens to allow maintenance of the washer. The lifting mechanism can consist of either hydraulic cylinders or screw jacks. These two methods of lifting the top section are described below.

2.6.1 Hydraulic Cylinders

The top section lift is operated by a crank handle that energizes four hydraulic cylinders at each corner of the machine. The top section can be opened to a separation of approximately 18”

(45.72cm). The washer does not require power to open the top section.

Optionally, a motorized hydraulic pump lift may be provided. A switch is provided on the washer frame to activate the lift. Sensors prevent the lift from over travel in either direction. Additional information is provided on the lift mechanisms in SECTION 7.

WARNING: When using either the manual or motorized hydraulic pump lift to raise the top section, always insert the two supplied props (see FIGURE 2.2) at opposite corners of the top section as a safety measure to secure the top section open.

CAUTION: Be sure to remove safety props before lowering the top section. Otherwise, the lifting mechanism (manual or motorized hydraulic pump) will be severely damaged, and it will not be possible to remove the props without an independent jacking device.

FIGURE 2.2 Typical Top Section Safety Prop

IMPORTANT TOP LIFT SECTION WARNING:

THE TOP SECTION LIFT FOR THIS WASHER USES A "MOVOTEC LIFT SYSTEM". THERE ARE NUMEROUS SAFETY MECHANISMS ENGINEERED INTO THE "MOVOTEC LIFT SYSTEM", BUT TO ENSURE SAFE OPERATION OF THE SYSTEM, IT IS NECESSARY FOR USERS TO HEED THE INFORMATION ON THE WARNING LABEL AFFIXED TO EACH "MOVOTEC LIFT SYSTEM". THIS INFORMATION ADVISES USERS THAT THE TUBING IS UNDER PRESSURE AND TO AVOID CUTTING, PINCHING, OR DAMAGING THE TUBING IN ANY WAY. PARTIAL OR COMPLETE COLLAPSE OF THE UNIT MAY OCCUR, POSSIBLY CAUSING SERIOUS INJURY TO THE OPERATOR. TAMPERING WITH SYSTEM CONNECTIONS WILL ALSO VOID THE MANUFACTURER'S WARRANTY.

THIS FOREWARNING EXTENDS TO A BROKEN ROLL PIN IN THE PUMP CONNECTION TO THE CRANK WHICH IS A RESULT OF OVERDRIVING THE PUMP PORTION OF THE LIFT SYSTEM. THE PIN IS SIZED TO SHEAR DURING OVER TORQUING SITUATIONS TO RELIEVE THE PUSHER BLOCK FROM DAMAGE DUE TO EXCESSIVE FORCE. THE USER SHOULD NEVER REPLACE THE ROLL PIN WITH ANYTHING THAT DOES NOT MEET SUSPA INCORPORATED SPECIFICATIONS. THIS WILL ALSO VOID THE WARRANTY.

2.6.2 Four-Corner Screw Jack

There is one powered screw jack lift on this washer. The top section of the washer rises evenly at all four corners by means of jack shafts to provide access to the inside of the washer unit for inspection and maintenance.

NOTE: If your washer uses any of the available options, additional supplemental information is included with the documentation package.

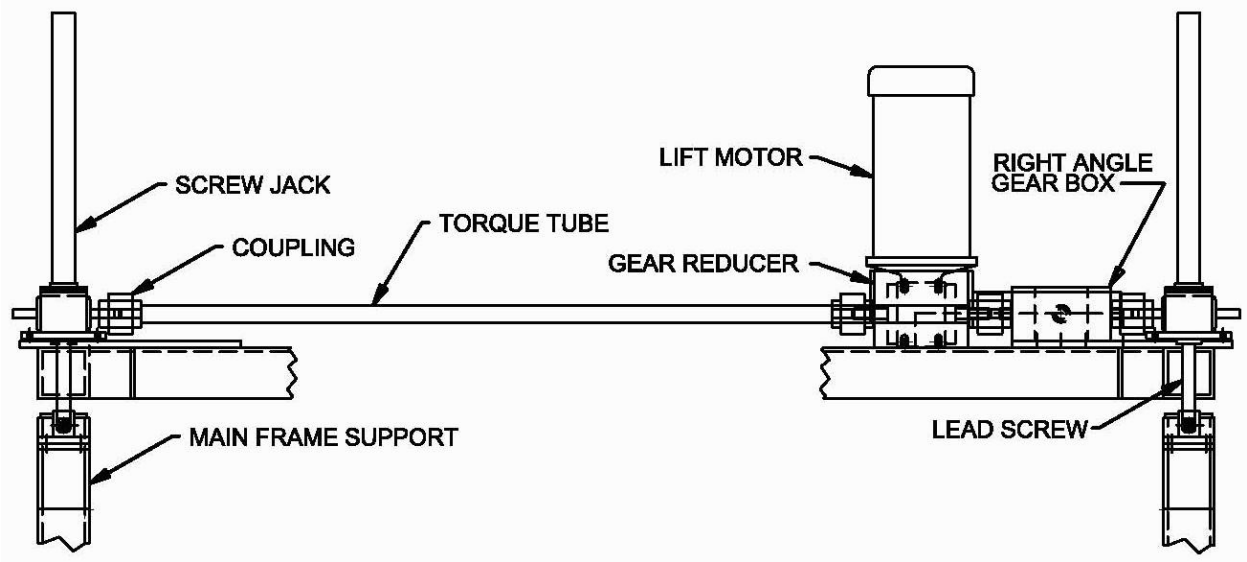


Figure 2.6 - Screw Jack Lift Details

2.7 Washing Zones

The washer can be configured to include all or multiples of the following zones plus integrated with a DI water rinsing system:

2.7.1 Pre-Wash Zone

The purpose of the pre-wash zone is to remove particle debris such as packing material, glass chips, etc. from the glass prior to the detergent wash zone. This zone consists of one pair of spray lines with spray nozzles and a catch pan. The pan has a drain fitting to remove the used water to a local floor drain or a dedicated recirculation tank. The water is recirculated from the tank back to the pre-spray lines. Furthermore, this recirculation system may be re-plumbed to accommodate a DI water system and/or a step-type recirculation from a downstream rinse tank.

NOTE: All spray lines (system wide) are equipped with quick disconnect nozzles and have "relocation spray collars" for positive realignment when replaced.

2.7.2 Detergent Wash Zone

In this zone, the product is further cleaned by the use of a heated (immersion heater) detergent solution supplied from the detergent tank. The detergent solution is pumped (by centrifugal pump) through one or two pairs of spray lines and directed towards the product at an angle so as to direct the wash spray towards the brushes. There can be either one or two sets of brushes in this zone. The brushes rotate at a higher angular velocity and in an opposite direction (i.e., top brush against direction and bottom brush with direction of glass movement) of the rolls. The pinch rolls and splash guards help to maintain the wash detergent from leaving the zone. The top and bottom brushes and top (only) pinch rolls are adjustable in distance from the glass.

The amount of brushes in a particular zone generally determines the operational speed capability of the machine. All brushes in this zone can be driven by a variable speed motor. The top and bottom brushes are driven by independent motors permitting separation of the top and bottom sections without the removal of any drive belts.

The detergent wash tank is located directly below to catch the returned wash water for recirculation. The wash water is directed to the tank by the bottom splash guard. The tank has a slide out screen on top to remove debris. All tanks have casters to allow for periodic cleaning by removing the tank from the machine structure. An overflow standpipe in the tank allows makeup of water without concern of overfill. Float level switches (as an option) are provided to monitor the water lever of the tank and activate a fill solenoid as needed. In-line strainers and tank screens are used in the recirculation system (at pump outlet) to catch any debris that may be present. Also, the spray lines have cleanout caps at one end for removing water deposits that may clog the spray ports. A wire brush can be used for this purpose.

As standard, the detergent wash tank is heated by a removable immersion heater. Temperature control is provided by a panel mounted electronic controller and thermocouple sensor. The rinse tank(s) may also optionally use immersion heaters.

2.8 Rinsing Zones

The rinsing zones consist of the rinse wash and final spray.

2.8.1 Rinse Wash

In this zone the product is rinse washed to remove the detergent wash residue. The rinse water is directed towards the product and brushes as described in the washing zone.

There are usually two set of brushes in the rinse water zone that can be plumbed in many combinations (see Machine Specifications or plumbing diagram for plumbing techniques). As in the wash zone, the top and bottom brushes are driven by independent motors permitting separation of the top and bottom sections. The rinse zone uses the same water containment and tank system as described in the wash zone.

NOTE: Small particle filters may be used in the rinse spray lines (one filter for each spray line). This filter type has an expendable cartridge that must be periodically replaced (not cleaned).

2.8.2 Final Spray

The purpose of the final spray zone is to completely rinse off the product. This zone consists of one pair of spray lines with spray nozzles and a catch tank to retrieve the water. The final spray is normally plumbed from a deionized water supply.

2.9 Drying Zone

In the drying zone, the product is wiped (sheeting action) dry of rinse water by multiple pairs of air knives (see Machine Specifications). The air knives receive air under high pressure from a blower. Pressure gauges and dampers can be supplied to set and redirect air flow through the individual air knives as desired.

A slit along the length of the air knife box (or wedge type) produces a high speed curtain of air that sheets the glass dry as the glass passes. Both sides of the glass are dried simultaneously by the pair of air knives. The air knives are factory set in distance from the glass and should not be disturbed.

The blower is a high horsepower unit which can be mounted on the top frame or floor. Air is ducted from the blower manifold to the air knife pair via flexible air ducts. Air filtering is provided by a filter box that contains the filter. The entire blower unit is enclosed in a sound-absorbing container.

An air knife pair that is designed to be mounted diagonally across the drying zone is also available. When installed, this configuration requires removal of several pinch rolls and existing air knives. The purpose of this slant configuration is to provide optimum air wiping of squared glass pieces that normally would require entry at an angle for the same drying quality. The slant air knife is available as a field installable kit from Billco.

2.10 Water Saver (Optional—See Machine Specifications)

This system allows the incoming (from plant) rinse water to run only when there is glass in the washer. Infrared sensors are located on the load conveyor to turn ON plant water. When glass enters the washer, the sensor at the load conveyor detects its presence and turns ON the plant water.

The water is permitted to flow into the final rinse spray lines for a preset period of time. The length of time the rinse water stays ON

is controlled by a timer in the program. In operation, this timer is set long enough to allow the glass to completely exit the rinsing zone of the washer.

3. INSTALLATION

Installation and start-up should be performed by qualified personnel who have a thorough understanding of this machine.

3.1 Required Special Tools

Standard hand tools can be used to install the equipment. It is recommended, however, that a transit be used to precisely position the equipment with relation to any other production line equipment.

3.2 Pre-Installation Preparation

1. Establish the location of the washer.

2. Establish the electric and water supply requirements—size of wire, voltage, full load amperes and diameter of water supply pipe.

3. Locate the approximate position on the equipment for the electric and water connections.

4. Determine the different kinds of wire and the amount of each needed for field wiring.

5. After washer is assembled, locate anchor bolts.

3.3 Lifting and Moving A Washer

It is not recommended to use a crane hoist to move the washer to the installation site. A preferable method is to leave the shipping skids, container, and all packing material intact. Then move the washer to the installation site with a forklift. Remove all shipping

material, but leave the skids intact. Then jog the washer shipping sections as close as possible to the floor anchor bolt location.

MOVEMENT CAUTION: The positioning of crane slings require detailed attention to prevent damage to equipment.

3.4 Equipment Installation

WARNING: Before performing any installation, be sure to read the **IMPORTANT TOP LIFT SECTION WARNING** of SECTION 1.

These instructions assume all site preparation such as power supply, water piping, etc. have been completed.

NOTE: Perform initial start-up of SECTION 5 after completing the installation.

1. Move machine (shipping section skids) to its permanent location (see **MOVEMENT CAUTION** above and **Lifting and Moving A Washer**).

2. Check inside the tanks for small parts that may have been stored for shipping purposes. One complete set of customer's engineering drawings is included with the machine.

3. If the conveyors were removed for shipment, bolt them to the machine now.

4. Level the entire machine using the roll surface for reference. Install the anchors and secure machine to the floor. Level the machine as necessary using the provided leveling feet.

Figure 3.4 Leveling feet

5. For remote mounting, locate blower in the area shown on the installation drawing. Install inlet air filters and vibration mounts. Install and connect the air duct tubing between the blower outlet manifold and the air knife inlets.

6. Set tanks and pumps in their proper positions under the pans and install the tank lids. Slide tanks as necessary to line up pan drains with tank lid openings. Make sure that the rubber flaps on the pans are positioned inside the tank walls.

7. Standpipes (round, plastic, open on one end, threaded on the other) must be reinstalled (turn clockwise) in the inside bottom of the tanks near the front (see FIGURE 3.1).

8. Connect tank drains to the plant drainage system as desired, being certain to adhere to all local sewage codes regarding proper disposal of solutions. A union should be used on drains to allow a tank to be pulled out for cleaning (see FIGURE 3.2).

9. Connect incoming plant water line to final rinse line filter unit. A 3/4” line is recommended.

   CAUTION: Before connecting plant water lines to the washer plumbing, flush out the plant lines of all soldering flux and debris.

10. Locate and anchor all safety guarding screens and sound baffling panels to the floor and/or machine framework.

11. Connect all wiring and conduit that may have been removed for shipping purposes.

12. Wire plant electrical service into the control panel, being certain to adhere to all pertinent codes for wiring and grounding.

    WARNING: Before electrical service is turned ON, make a final check to be sure the machine is free to operate and all personnel are clear of moving parts.

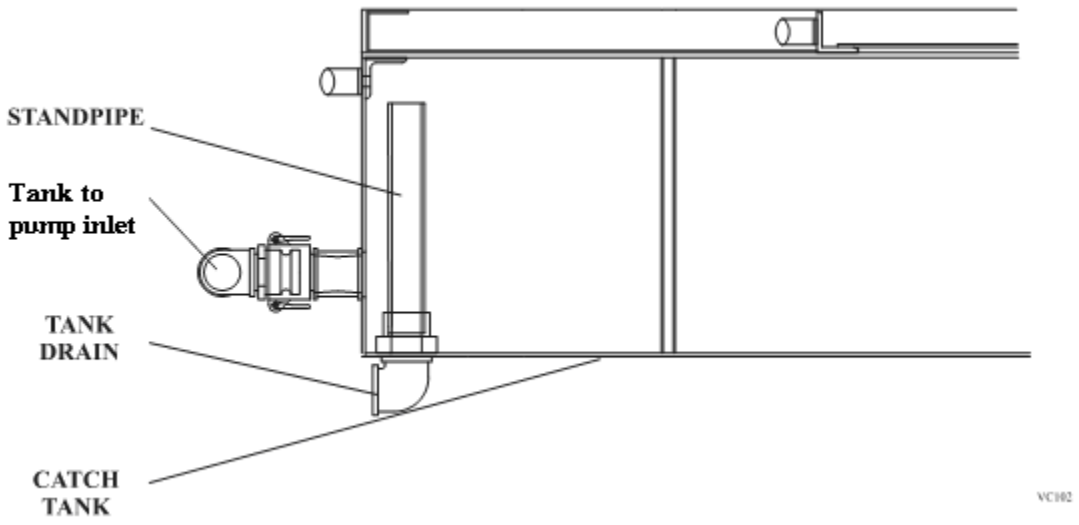


FIGURE 3.1 Tank Standpipe Installation

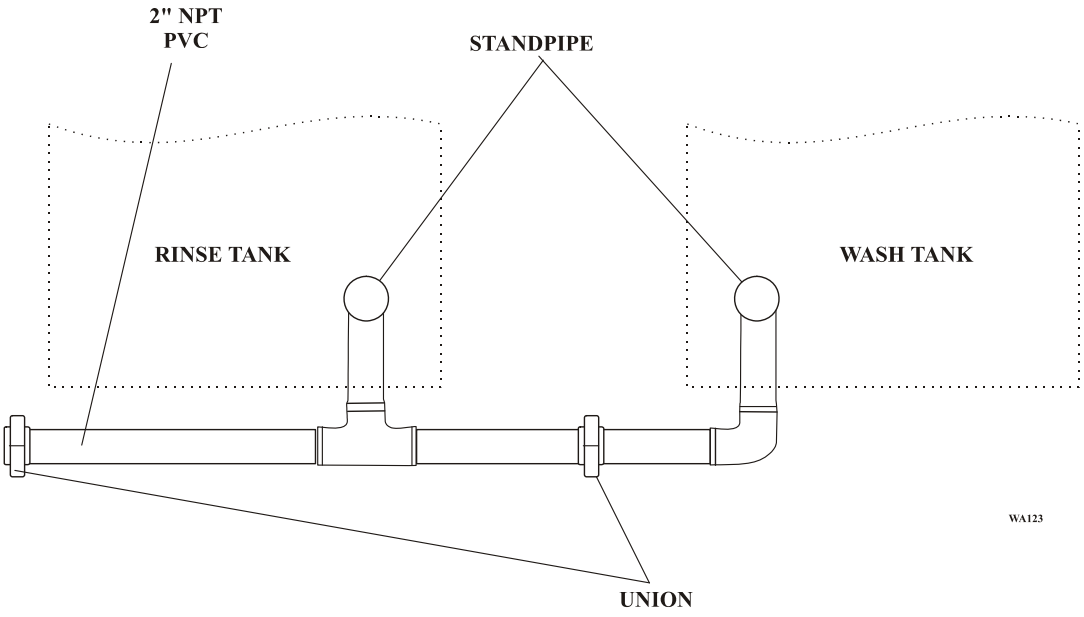


FIGURE 3.2 Tank Drain Installation

13. Install the E-Stop cable around the machine and adjust cable tension. **The operation of this emergency stop function must be tested before turning the machine over for production use (see SECTION 5).**

14. Check the position of the “top down” proximity switch interlock that is mounted on the loading end, plumbing side of the machine. When the top section is raised the blower, brushes, conveyor, and pumps must be disabled.

15. Raise the top section as described in SECTION 7, MAINTENANCE.

16. Install the drive chain according to the supplied drawings. Completely loosen the chain takeup, install the master link, and retighten the chain takeup as described in SECTION 4.

17. Reinstall and/or adjust all chain shoes (see SECTION 4).

18. Install the brush drive belts according to the supplied drawings.

19. Thoroughly clean all rolls (see SECTION 7).

20. Proceed to SECTION 5 for initial checkout and start up.

3.5 Static Bar with Air Assist

The static bar with air assist is factory assembled to the washer. Be sure that the assembly is supplied with conditioned air (i.e., non-lubricated, moisture removed, etc.) at 30 cfm (1cmm) and 20 psi (138kPa). The supply line must be 1/2" (1.27cm) plastic tubing.

Refer to SECTION 4, ADJUSTMENTS, for setup of this anti-static system. A diagram of the system is provided in FIGURE 4.10.

4. ADJUSTMENTS

WARNING: Before performing any adjustments, be sure to read the **IMPORTANT TOP LIFT SECTION WARNING** of SECTION 1.

Perform these adjustments as needed during initial start up and maintenance. See SECTION 6, OPERATION for control functions.

NOTE: The adjustments in this Section are not necessarily in the order that they may be performed.

WARNING: All adjustments, maintenance, and repairs should be performed only by qualified personnel who have a thorough understanding of this equipment. Guards, covers, and other safety devices should be securely installed before production is resumed.

WARNING: Observe **LOCKOUT** requirements before making any mechanical adjustments or performing any maintenance on this machine. Some adjustments require power to be applied to the machine. In these cases, be observant of moving parts.

All mechanical adjustments have been set during manufacturing tests to meet most applications. However, certain readjustments may be required to meet certain operating demands or to compensate for machine usage. Do not attempt to make any other adjustments then specified in this section. Call Billco if it is uncertain whether an out-of-adjustment condition exists and is affecting operation.

4.1 Pinch Roll Height Adjustment

The top rolls in the washer may be adjusted for material thickness changes or side-to-side levelness compensation. Normally, the

upper pinch rolls are adjusted so that they just touch the bottom pinch rolls along their entire length in the washing and rinsing zones. The upper pinch rolls are normally under a slight downward spring tension force.

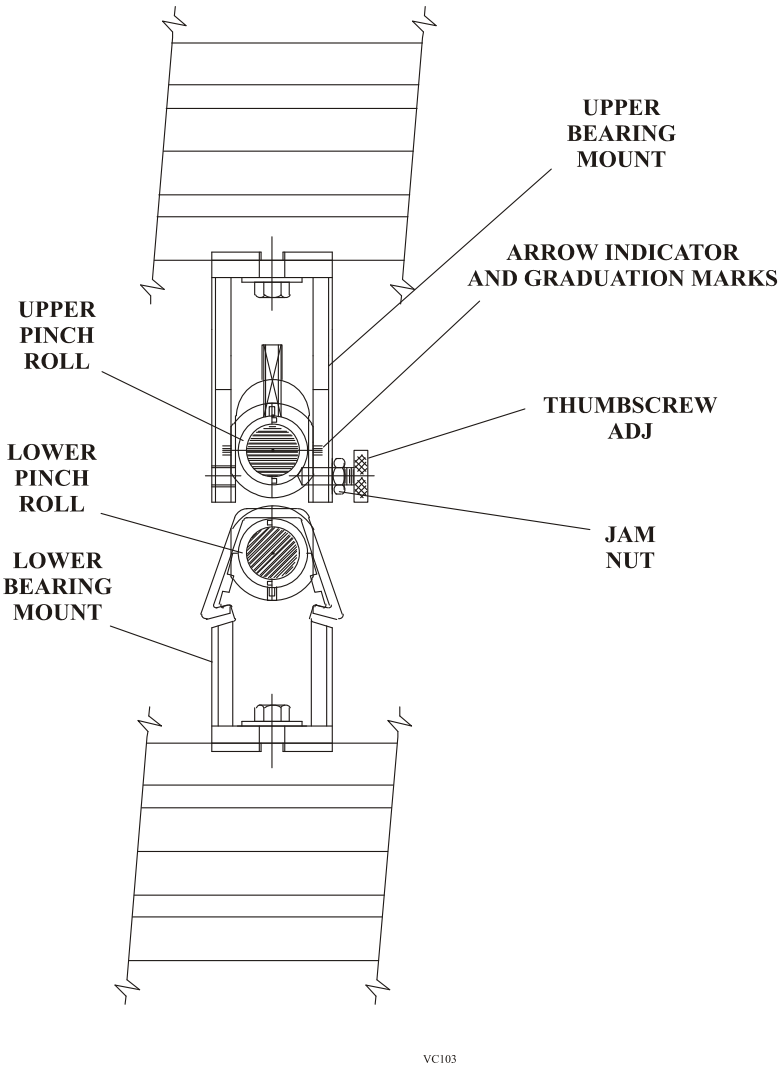


FIGURE 4.1 Pinch Roll Height Adjustment

1. Refer to FIGURE 4.1 and loosen the jam nut on the thumbscrew thread. Rotate the thumbscrew until the top roller just touches the bottom roll and appears to be level across the entire width of the

machine. It will be necessary to adjust both sides of the roll using the thumbscrews.

NOTE: The split roller bearing has an embossed arrowhead that can be used to align to the graduation marks provided on the upper bearing mount to register a desired location. Again, this must be equally adjusted on both sides of the machine to ensure roll height and levelness.

2. The jam nuts may now be re-tensioned against the side of the mount to hold roll position.

   CAUTION: Adjusting the roll as to cause too much weight or tension at the contact point between rolls could result in flat spots on the rolls.

4.2 Brush Height Adjustment

Each group of brushes, normally in pairs or one or two top or one or two bottoms, are defined by a zone cleaning description such as detergent, rinse, or special application. These brush groups are driven by a motor via belt sets and are independently top and bottom driven to allow for frame separation. Each brush has its own bearing holder, one each side, to allow for individual brush height adjustment.

The bottom brushes are adjusted first with the top section opened. A piece of glass is manually pushed over the brush. The brush is then rotated by hand and the take-up bearing block height is set for the proper scrub width of 1/2" (1.27cm) to 3/4" (1.91cm). The top brushes are adjusted next with the top section opened.

WARNING: With the top section open and power applied, a switch locks out operation of the washer. This switch is not a hard-wired interlock. It is an input to the PLC. Thus, to provide a completely safe environment, lock out the main power to the system when the top section is open and mechanically locked. NEVER BY PASS

THIS SWITCH. Although drive power is removed from the I/O with an ALL STOP, power is not removed from the PLC.

NOTE: If the brushes are worn unevenly, some additional satisfactory use may be obtained from them by setting the deepest spot on the brushes as above. If the variation in bristle height is 1/4” (0.635cm) or more, then the brushes must be trimmed or replaced.

The adjustment must be made with **power OFF**. The top section must be raised. It is assumed that guards and enclosures have been removed from both sides of the washer to allow access for adjustment. Please review **WARNING** above.

The adjustment that follows is applicable for a glass thickness range of 1/16” (0.159cm) to 1/4” (0.635cm) without readjustment.

4.2.1 Bottom Brush

1. Refer to FIGURE 4.2 and slide a piece of glass from the loading end until it covers the brush to be adjusted. The glass must be long enough to rest on the rolls on either side of the brush being adjusted.

2. Rotate the brush by hand to note the scrub width.

3. To adjust the slide plate, loosen the center lock bolt and rotate the knob. Alternately adjust the slide brush plate on the drive and non-drive sides of the washer until the brush marks out a 1/2” (1.27cm) to 3/4" (1.91cm) scrub width.

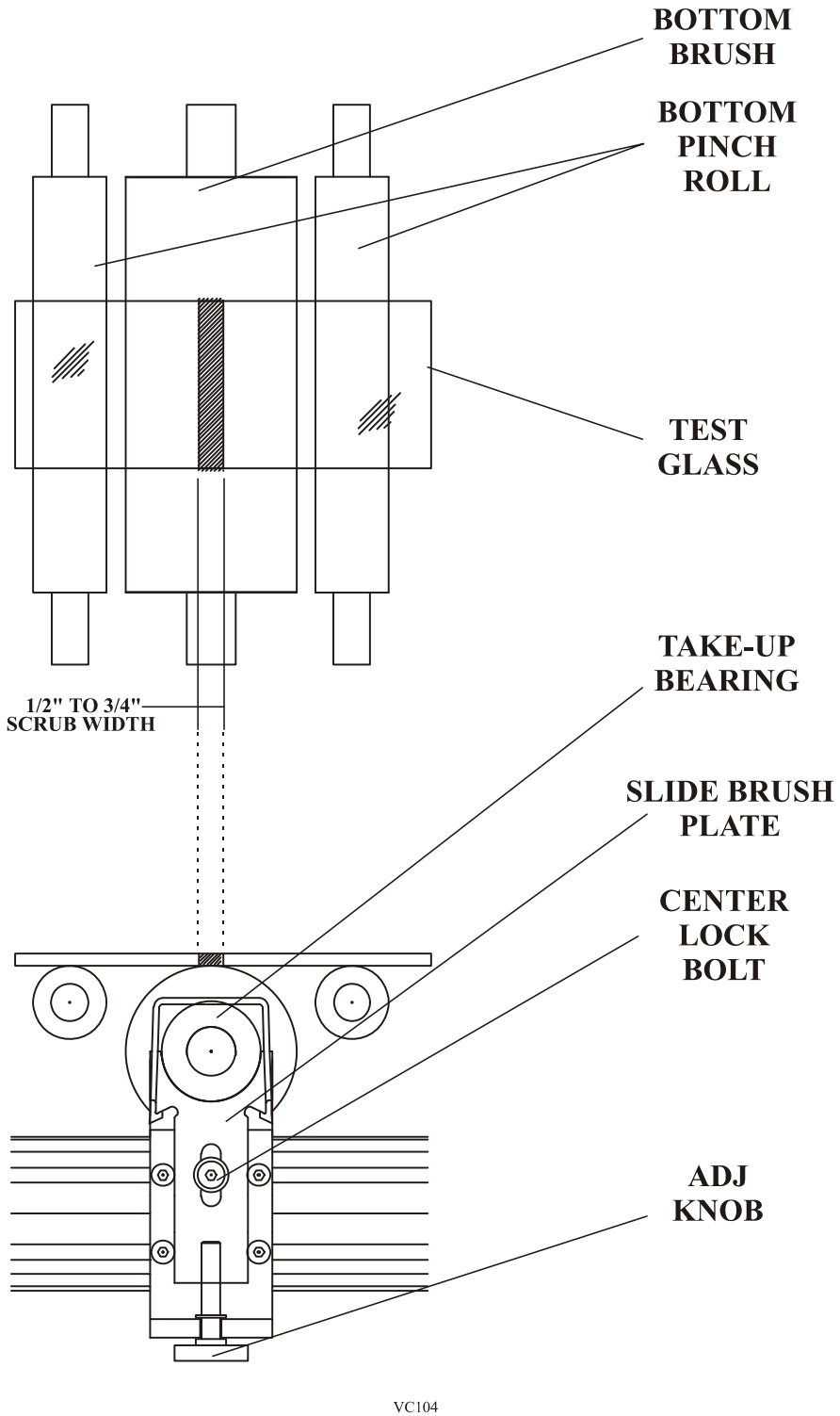


FIGURE 4.2 Bottom Brush Height Adjustment

4. Refine adjustment so that scrub width is the same over the entire length of the brush (i.e., parallel to glass surface). Make sure the center of the brush produces the 1/2” (1.27cm) to 3/4" (1.91cm) scrub width.

   If the brush is worn, it will usually be worn concaved (i.e., bristles more worn in the center than outer edges) as illustrated in FIGURE 4.4. The brush is still usable if the center bristles are worn no more than 1/4” (0.635cm) with respect to the bristles at the ends. The end 1/2” (1.27cm) of the bristles never wears.

5. Tighten locking bolt and remove the glass.

4.2.2 Top Brush

1. Check that there is no glass in the washer.

2. Refer to FIGURE 4.3 and raise the top section to its operating position.

   NOTE: Top roll height must have been previously checked and adjusted before proceeding with this procedure (see **Pinch Roll Height Adjustment**).

   NOTE: It may be necessary to have assistance when performing the remaining steps.

3. Place a straight edge across (right angle to brush) the lowest point of bristles for the brush to be adjusted. Make sure the ends of the straight edge rest on a full set of rolls on either side of the brush.

4. To adjust the slide plate, loosen the center lock bolt and rotate the knob. Alternately adjust the slide brush plate on the drive and non-drive sides of the washer until there is a 1/32” (0.08cm) to 1/16” (0.159cm) **gap** between the top of the straight edge and bottom of the brush. Do not readjust the bottom brush.

5. Refine adjustment so that scrub gap is the same over the entire length of the brush (i.e., parallel to glass surface). Make sure the center of the brush has a 1/32” (0.08cm) to 1/16" (0.159cm) **gap**.

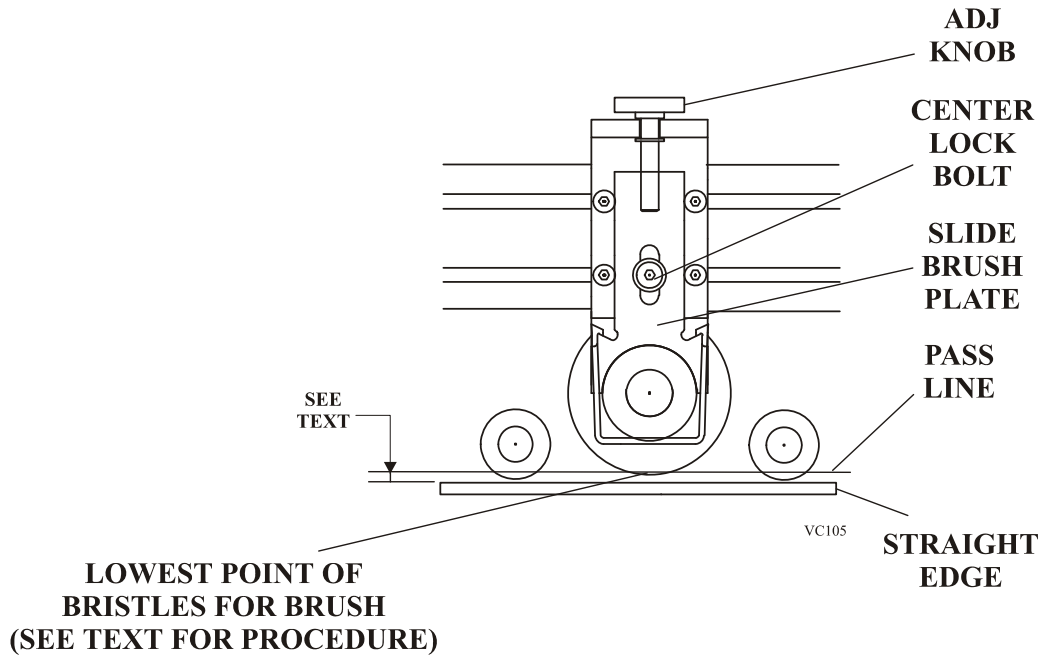


FIGURE 4.3 Top Brush Height Adjustment

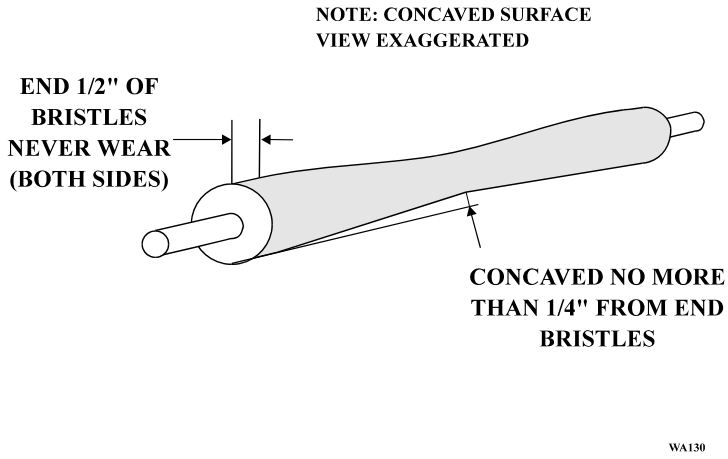


FIGURE 4.4 Worn Brush (Concaved) Limitation Check

6. If the brush is worn, it will usually be worn concaved (i.e., bristles more worn in the center than outer edges) as illustrated in FIGURE 4.4. The brush is still usable if the center bristles are worn no more than 1/4” (0.635cm) with respect to the bristles at the ends (i.e., gap). The end 1/2” (1.27cm) of bristles never wears.

7. Tighten locking bolt and remove the glass.

4.3 Brush Drive Belt Tension Adjustment

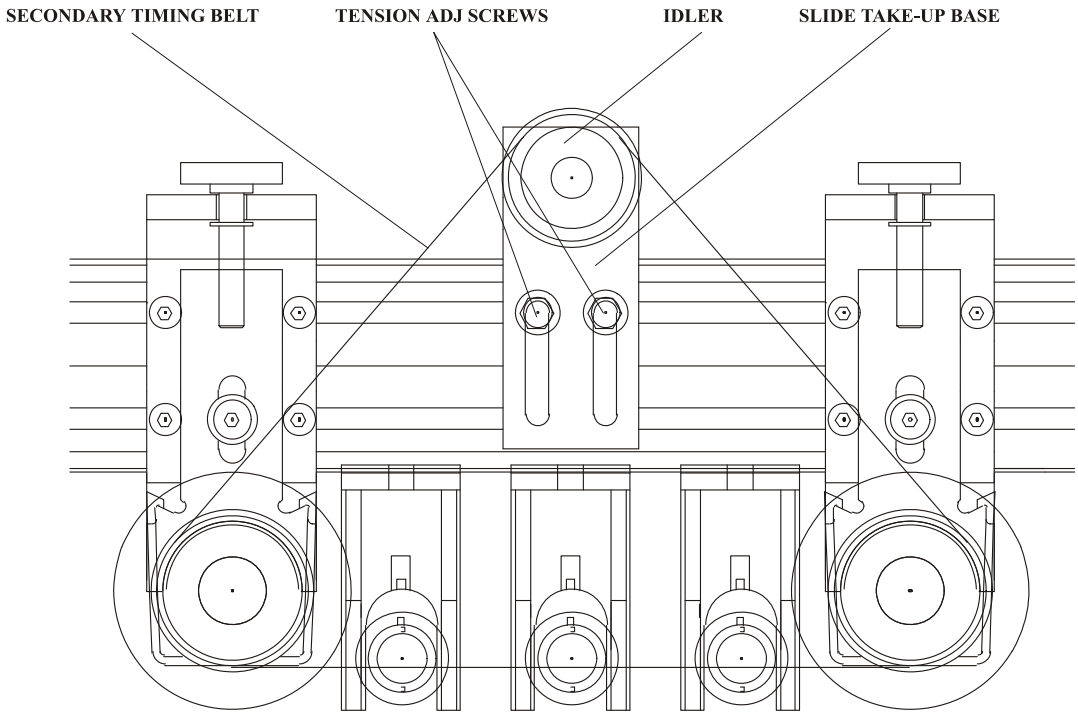
The adjustment is made with **power locked OFF** and the top section closed to operating position. It is assumed that guards and enclosures have been removed from the drive side of the washer to allow access for adjustment.

1. Referring to FIGURE 4.5, the tension for the primary brush drive timing belts is set by the position height of the motor base. The motor bases (top and bottom) can be adjusted by turning the threaded screws located on the base plates.

2. To remove the primary brush drive belt or to install a belt, turn the base adjusting screws until the center distance between pulleys is reduced enough to allow the proper belt length to be mounted or removed as needed.

3. The tension for the secondary brush drive belts is set by the slide take-up base. By loosening the two screws on the base, the idler is then positioned to set the proper tension on the belts.

4. To remove the secondary belts, position the slide take-up base to allow enough slack in the belts for mounting or removal.



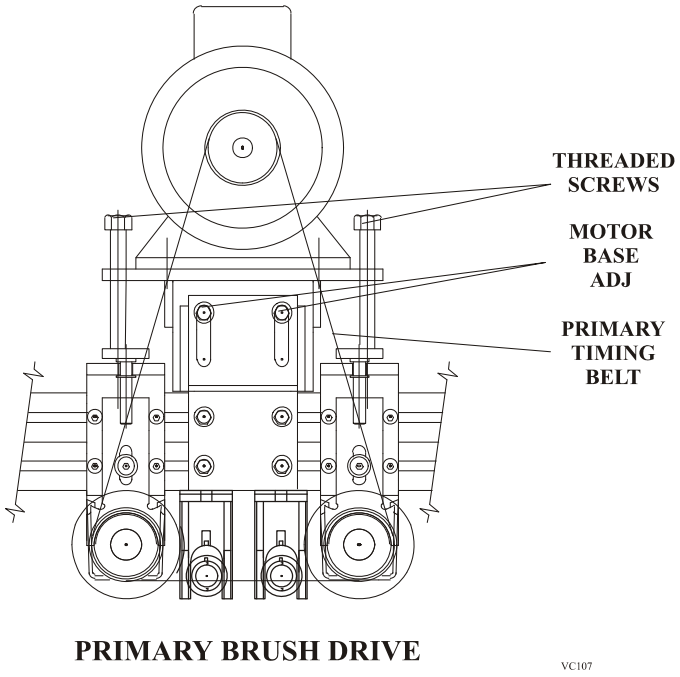


FIGURE 4.5 Brush Drive Belt Tension Adjustment

4.4 Air Knife Height Adjustment

Multiple pairs of air knives are used in the drying zone. Each pair consists of a top and bottom air knife that sandwiches the pass line of the glass as it passes through from the rinsing zone. The bottom air knife is set 1/8" (0.32cm) from the bottom surface of the glass and the top air knife is set 1/2" (1.27cm) above the top of the bottom air knife. Height adjustment is made with the all-thread rods and nuts at the ends of the air knives.

WARNING: With the sections open and power applied, a proximity switch locks out operation of the washer. This proximity switch is not a hard-wired interlock. It is an input to the PLC. Thus, to provide a completely safe environment, lock out the main power to the system when the sections are open and mechanically locked. NEVER BY PASS THIS PROXIMITY SWITCH. Although drive power is removed from the I/O with an ALL STOP, power is not removed from the PLC.

NOTE: During manufacturing of the washer, the normal angle of the air knives may be adjusted to minimize the air rush noise level. When replacing an air knife, try to duplicate their original angular orientation by counting and recording the thread position of the mounting nuts on the threaded rods.

The adjustment may be made with **power OFF**. The top section must be raised. It is assumed that guards and enclosures have been removed from both sides of the washer to allow access for adjustment. Please review **WARNING** above if power is applied.

4.4.1 Bottom Air Knife

1. Refer to FIGURE 4.6 and raise the top section (see SECTION 7).

2. Slide two pieces of glass (1 foot (30.48cm) wide and 2 feet (60.96cm) long) from the loading end and over each end of the lower air knife to be adjusted. Position each glass piece so that it is resting on a roll on each side of the air knife.

3. Check each end of the air knife. Each end must be parallel and 1/8” (0.32cm) below the glass bottom surface. Alternately adjust the positioning nuts on the drive and non-drive sides of the washer (both ends of air knife), as necessary, to meet the requirements of this step.

4. Tighten the locking nuts and remove the glass.

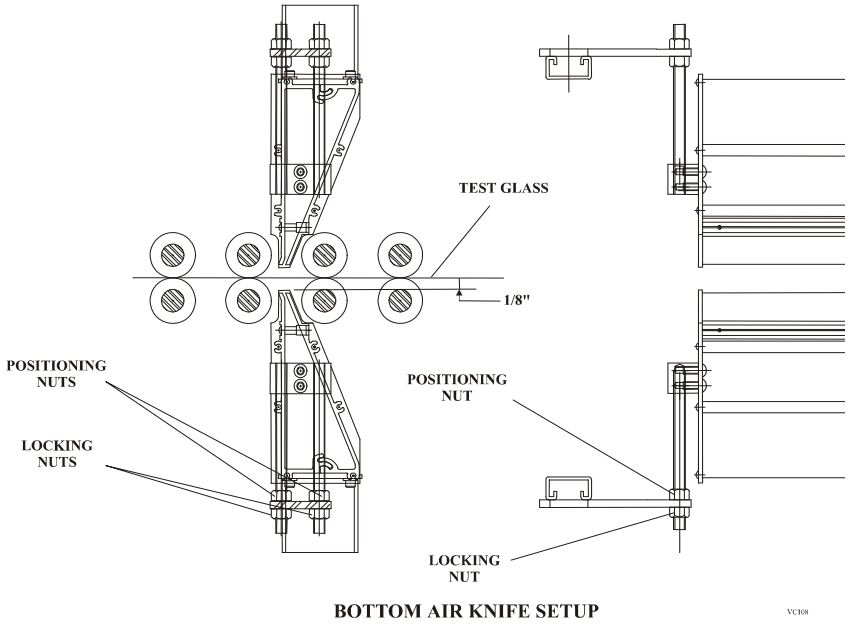


FIGURE 4.6 Bottom Air Knife Adjustment

4.4.2 Top Air Knife

1. Check to see that there is no glass in the washer.

2. Refer to FIGURE 4.7 and lower the top section to its operating position.

3. Check each end of the air knife. Each end must be parallel and 1/2” (1.27cm) above the top of the bottom air knife. Alternately adjust the positioning nuts on the drive and non-drive sides of the

washer (both ends of air knife), as necessary, to meet the requirements of this step. Do not readjust the bottom air knife.

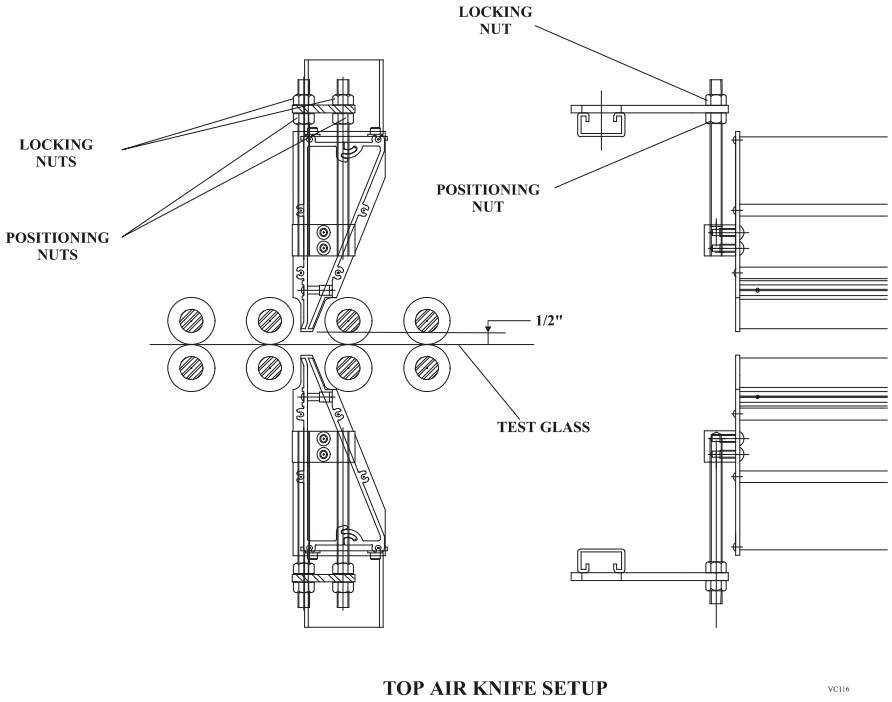


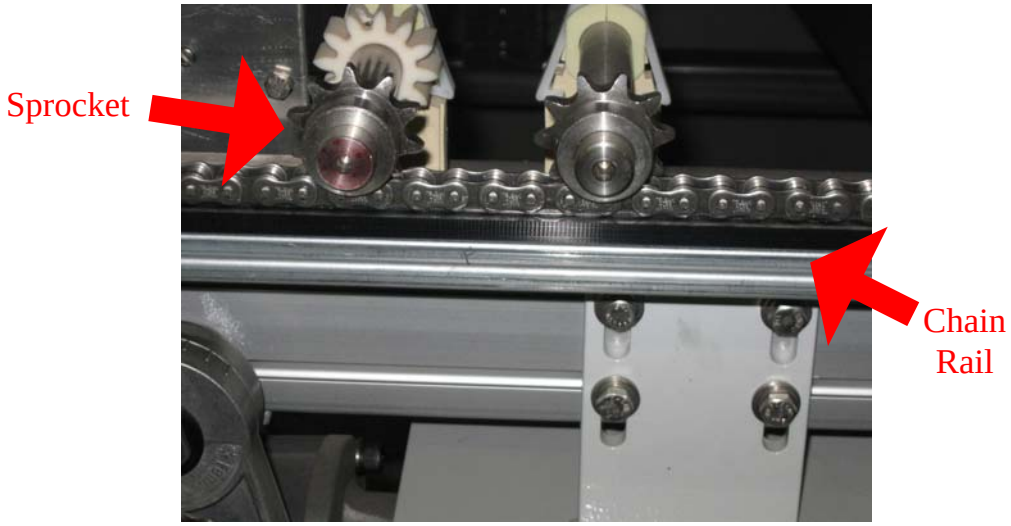
FIGURE 4.7 Top Air Knife Adjustment

4.5 Conveyor Drive Chain Adjustment

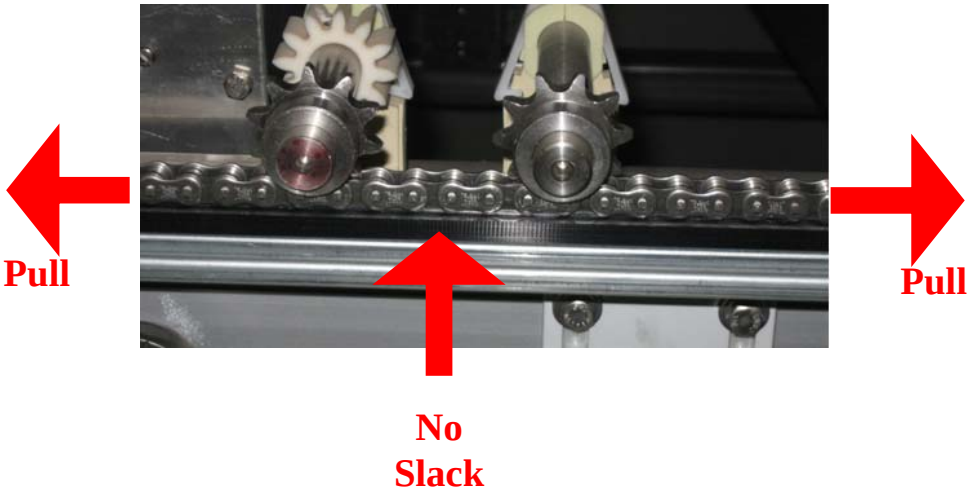
Before you begin…

⚠ Make certain that the machine has been properly locked-out.

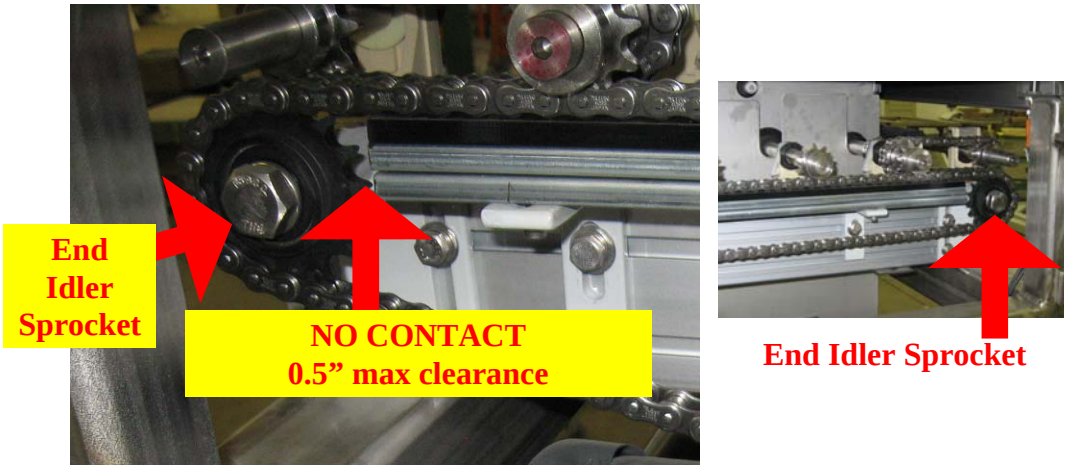
1. Fit chain onto the chain rail. Place all drive sprockets into proper locations on chain.



2. Pull chain in both directions to eliminate slack between sprockets.

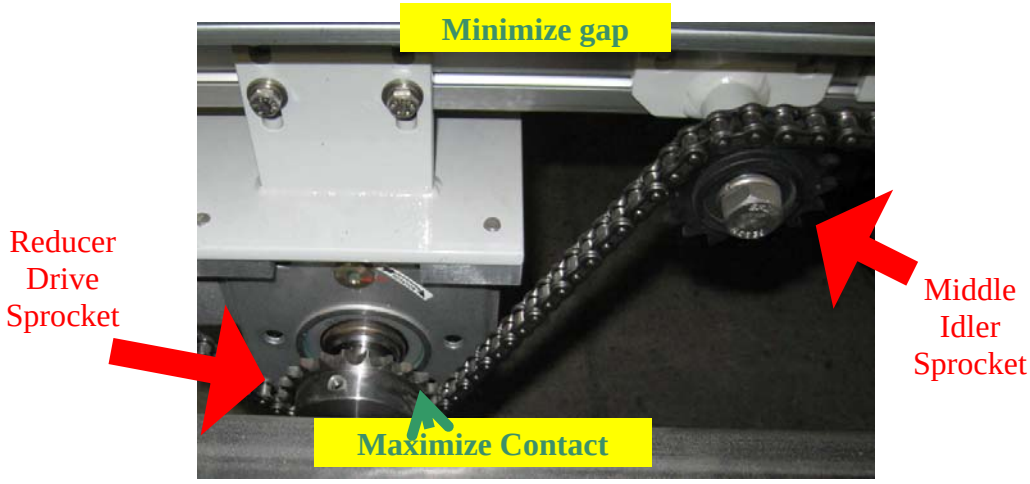


3. Adjust end idler sprockets to create a smooth transition from the chain rail to idler sprocket. Idler sprocket should be clear of chain rail, but no more than 0.5” away.

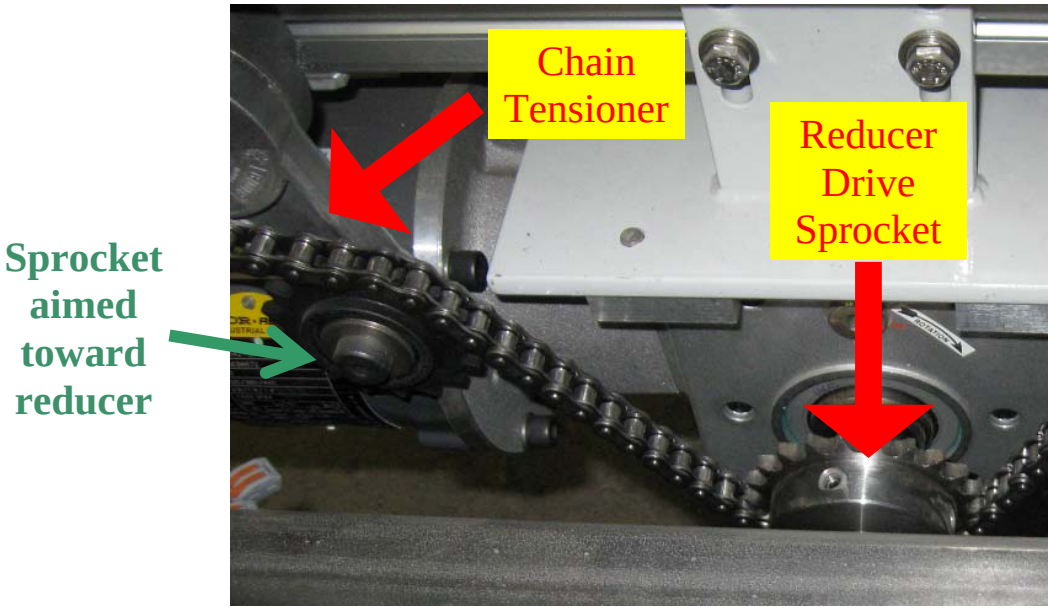


4. Install chain on middle idler sprockets as shown in pictures.

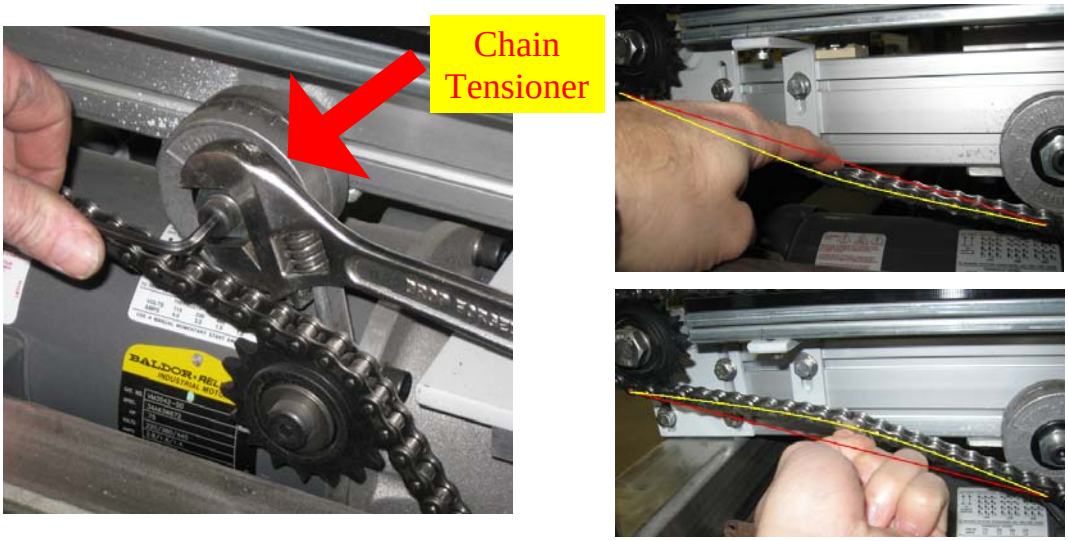
5. The middle idler sprocket nearest to the drive reducer should be kept as close as possible to maximize contact (wrap-around) with the reducer drive sprocket.



6. The chain tensioner should be installed so that its sprocket is aiming towards the reducer drive and the tension is forcing the chain upwards in a counter-clockwise direction relative to its mount.



7. Adjust the tensioner until the chain is reasonably taut.



RULE OF THUMB: Under moderate finger pressure, chain should deflect no more than 0.5” in either direction.

4.6 Chain Shoe Adjustment

The chain guide adjustment is set by raising the guide high enough to the bottom of the sprockets to engage the chain and teeth without causing any drag (see FIGURE 4.9).

The adjustment is made with **power locked OFF** and the top section closed to operating position. It is assumed that guards and enclosures have been removed from the drive side of the washer to allow access for adjustment.

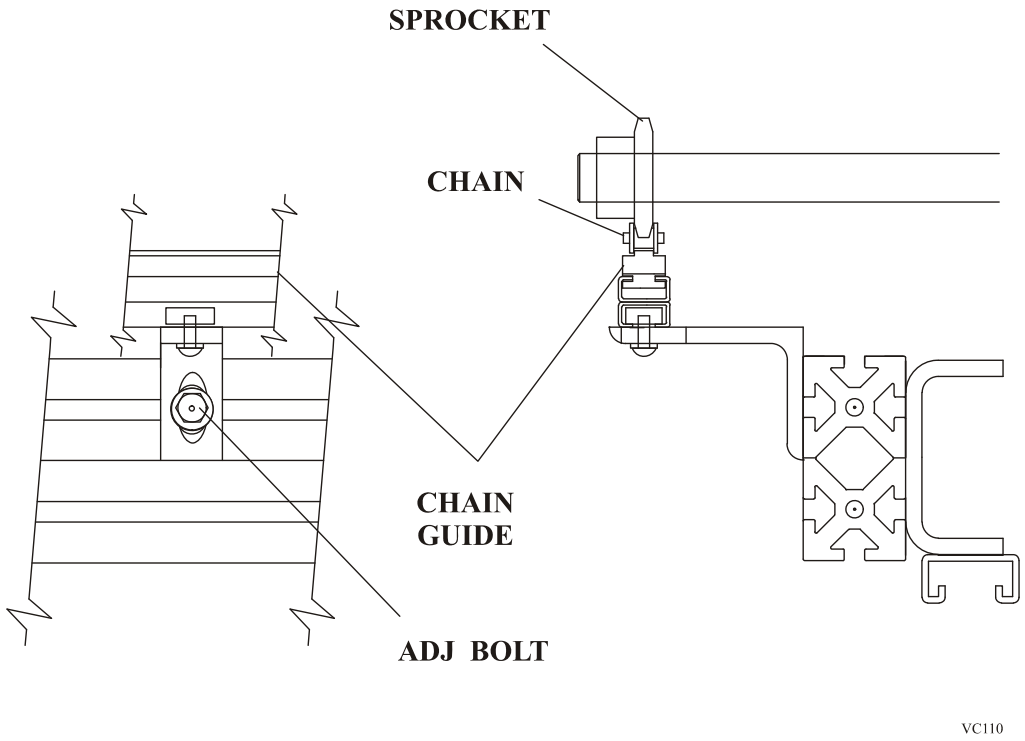


FIGURE 4.9 Chain Shoe Adjustment

4.7 Immersion Heater Set Temperature Adjustment

The temperature of the immersion heater is controlled from a dedicated controller on the main control panel. The controller allows the set temperature to be entered via key pad. The actual temperature is sensed by a thermocouple in the tank.

4.8 Auto-Water Shut-Off System Sensor Adjustment

An infrared sensor set is located at the load conveyor. The beam for the sensor is directed across the path of the glass. The glass is detected when the beam is broken by the glass as it moves along the conveyor. The infrared sensor beam must be aligned and adjusted in height to detect the glass.

NOTE: Beam alignment has been performed during manufacturing of the washer and should not require further adjustment unless it was disturbed during shipment.

The adjustment is made with **power ON** and the top section closed to operating position. The procedure assumes that the sensor is completely out of alignment.

1. Apply power to the washer (turn ON disconnect handle and press the POWER ON/OFF pushbutton). **Do not** turn ON any motors.

2. Visually line up and snug the infrared sensor in their brackets. A piece of string can be stretched between the infrared sensor lens to ensure that the beam will be broken by the presence of glass on the conveyor; readjust the height of the sensors as necessary.

3. Set the receiver light-operate mode switch (switch provided on rear of unit) to LO (light).

4. Turn the receiver GAIN control (15-turn pot) to its maximum clockwise position. If the receiver is “seeing” the emitter’s infrared beam, the receiver LED indicator (rear of unit) will be ON. Readjust the receiver unit in its bracket as necessary to “see” the beam.

   NOTE: Infrared beam is not visible to user.

5. Move the receiver unit in its bracket slightly to locate the center of movement range within which the LED stays ON. Reduce the gain (GAIN control counterclockwise rotation) to restrict the range of motion or area of detection and allow precise positioning of unit.

6. Tighten the receiver unit in its bracket. Check that the emitter unit is tight in its bracket. The LED of the receiver should remain ON. If not, repeat Step 5.

7. Set the receiver light-operate mode switch to DO (dark). The receiver LED will go out (no glass present).

8. Slide a piece of glass over the conveyor to break the beam. The receiver LED should be lit. If the LED remains OFF or flickers, slightly **reduce** the receiver gain until the LED goes ON.

9. Repeat Step 8 until reliable glass detection is obtained.

4.9 Screw Jack Lift Adjustment

The screw jacks have been carefully aligned during manufacturing to raise all four corners evenly. If it is suspected that there is binding during a lift, contact Billco. The only other items that may require adjustment is the overtravel limit switches and "top down" proximity switch.

4.9.1 Overtravel Limit Switches

The overtravel limit switches are mounted on one of the screw jack posts.

Refer to separate supplemental information supplied with your equipment for adjustment procedures.

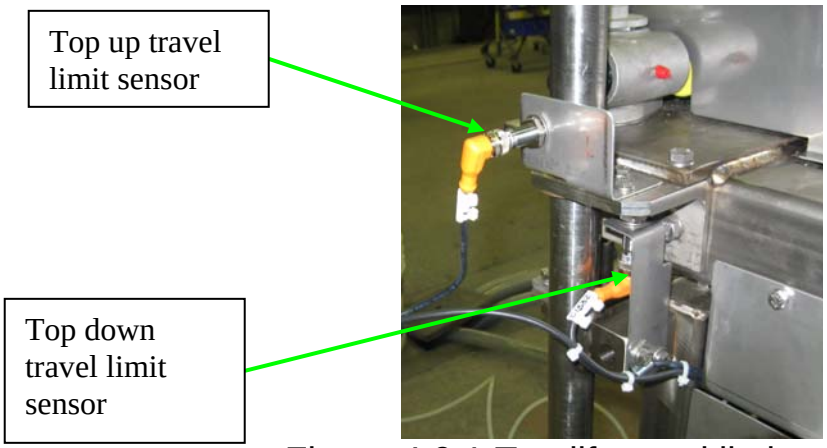


Figure 4.9.1 Top lift travel limit switches

4.9.2 Top Down Proximity Switch

The "top down" proximity switch is mounted on one of the screw jack posts. Generally, it is mounted on the same post as the assembly for the overtravel limit switches. The proximity switch is the inductive type where the proximity barrel is mounted on the post (i.e., fixed) and the target is mounted on the top section frame.

When the top section is down to its operating position, the proximity switch makes contact (i.e., target sensed). In the operating (closed) position, the sensing end of the proximity switch must not make physical contact with the target plate. The target distance must be maintained. A built in LED lights when the target is sensed.

The adjustment is made with **power ON** and the top section is lowered to the operating position. It is assumed that guards and enclosures have been removed from the washer to allow access for adjustment.

WARNING: When power is applied and adjustments are being made, the washer can operate in an unexpected manner. Be aware of all potentially moving assemblies (rolls, top section lift, chain drives, etc.). Never position yourself so as to cause a possible hazardous condition with these assemblies. Always have an assistant located at an E-Stop in the event that a hazardous condition should occur.

1. Check the adjustment for the overtravel switches (see **Overtravel Limit Switches Adjustment**).

2. Before lowering the top section, check that the "top down" proximity switch cannot bottom-out on the target plate. It may be necessary to remove the target plate to prevent this from happening.

3. Lower the top section to the required operating position (per glass thickness).

4. Set the proximity switch target distance to 0.20 inch (0.508cm) by adjusting the barrel of the proximity switch in its mount. The built in LED will light when the target is sensed.

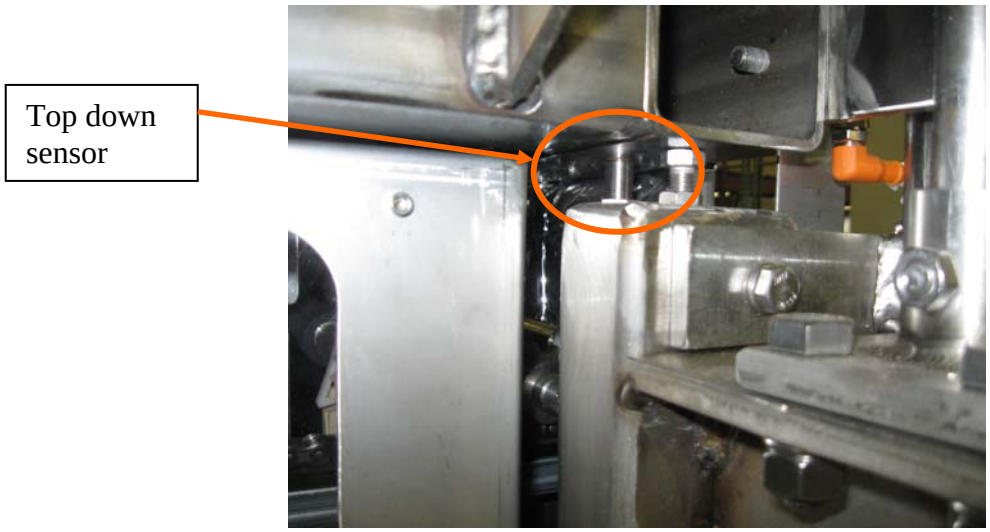


Figure 4.9.2 Top down sensor

4.10 Static Bar with Air Assist Adjustment

This system uses an air spray along with a standard static bar assembly to remove clinging particles as a result of a built up static charge on the glass after air drying.

4.10.1 Static Bar Height Adjustment

Refer to FIGURE 4.10 and adjust the height of the top and bottom static bars to the specified dimensions. The metal casing of the static bar should not be less than 1/8" (0.32cm) nor more than 1-1/4" (3.175cm) from the glass surface. Best results are obtained when the distance is between 1/2" (1.27cm) and 1" (2.54cm). The glass must never touch a bar. This height specification is for a 1" (2.54cm) diameter bar.

4.10.2 Air Assist Adjustment

The air assist spray tubes are fixed in height. However, they can be turned slightly to redirect the air spray. It is not recommended to attempt to readjust the orientation of these tubes.

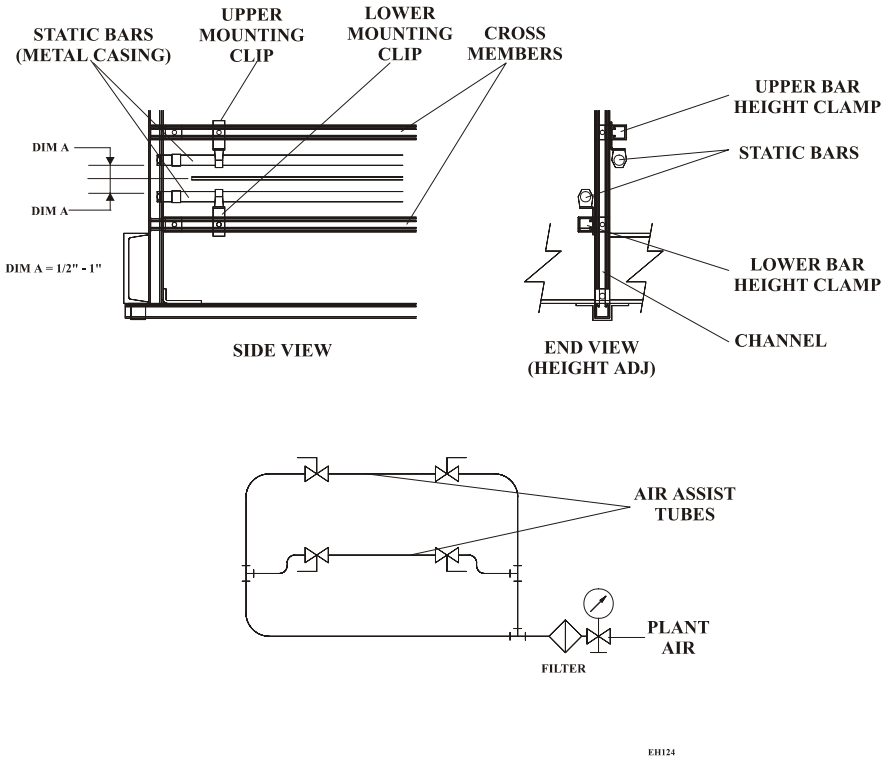


FIGURE 4.10 Static Bar Height Adjustment

5. INITIAL STARTUP

5.1 Pre-Checks

WARNING: Before performing any operations, be sure to read the **IMPORTANT TOP LIFT SECTION WARNING** of SECTION 1.

Initial startup is used after installation or after a long shutdown. These procedures should not be used as a daily startup routine. (The operating sequence is provided in SECTION 6).

WARNING: Lockout system electrical power at plant power distribution box.

CAUTION: Make sure that the primary power source meets the specifications of SECTION 1.

1. Check that all bolts, setscrews, etc. are tightened.
2. Check that all guard covers are installed and secured properly.

   NOTE: Due to vibration when shipping, it is essential that steps 1 and 2 be checked.

3. Set the control panel disconnect handle to OFF.
4. Press the ALL STOP and CONVEYOR STOP pushbuttons on the main control panel.
5. Check that conveyor is clear of tools, etc.
6. Proceed to **Installation Checkout** below.

NOTE: Refer to SECTION 6 for information on controls and indicators and details on the machine operating sequence. Adjustment information is provided in SECTION 4.

5.2 Installation Checkout

WARNING: Make sure the door disconnect switch handle is in its OFF position and panel ALL STOP pushbutton has been pressed before continuing with this checkout. When pressed, the machine I/O is disconnected from its operating power source.

NOTE: Refer to SECTION 6, OPERATION for descriptions of all controls and indicators.

1. Before applying primary power to the machine (by removing the primary power lockout and turning ON the control panel disconnect handle), make a "short test" from main control fuse to ground—never tolerate a direct short. Be aware that resistance measurements may be through coils, solenoids, relays, etc.

   Remove all fuses and unlock the primary power source. Do not turn ON the control panel disconnect handle yet. Check for proper 3-phase line voltage and then **lock OFF** primary power source.

   CAUTION: If line voltage phasing is incorrectly connected to the washer, motor drives may be reversed.

   Reinstall fuses (being sure to **lock OFF** main control panel primary power source first). Turn ON control panel disconnect handle and check for proper voltages at all fuses and terminals.

2. With system power OFF (ALL STOP pushbutton pressed on the main control panel), visually check around the machine to be sure all clamps, tools, etc., have been removed from the area and all fasteners have been tightened.

3. Check that top section is completely down to its operating position, belts installed, and guards in place. **The machine power is disabled by a proximity switch when the top section is not in its down operating position.**

4. Check that standpipes are installed and hand-tightened, only (never use a wrench).

5. Check that cleanout caps are tight on spray lines.

6. Check that the filter plug is tight on all in-line filters.

7. Check that cable switch is reset (i.e., set to center position).

8. Fill the detergent tank halfway with water. Manually turn ON the pumps (see SECTION 6) and load the detergent. Then continue to fill the tank to its overflow standpipe. To fill the tank, open the makeup water line valve. Alternately, the tank can be filled with a hose being supplied from plant water.

   NOTE: If powdered detergent is used, first dissolve the detergent in a container of warm water. Then add the detergent to the tank (with pumps running). When adding the detergent solution to the tank, do not pour the solution directly onto the heaters; rather, add the solution to the tank at its intake corner. This will assure that the detergent does not lump in the tank or on a heater element. See SECTION 7 for information on washer detergent.

   NOTE: The machine power is disabled by a proximity switch when the top section is not in its down operating position.

9. Open all necessary water supply valves and check plumbing for leaks.

   NOTE: If the system uses the DI option, refer to the manufacturer's instructions for operation of their DI system.

10. Proceed to SECTION 6 to operate the washer.

11. Perform final adjustments to fine tune the operation (see SECTION 4). Check the operation by actually running several pieces of glass through the machine. Readjust as necessary.

    NOTE: Rolls may become dirty in shipment and storage. Run a piece of glass through the washer many times to thoroughly clean the rolls.

    NOTE: When loading glass, feed the left edge first (see SECTION 6, FIGURE 6.1). Usually, this orientation will allow wiping of rinse water off along the entire trailing edge, rather than from just a corner.

12. Proceed to SECTION 6 to operate the washer on a daily basis.

6. OPERATION

This washer has been designed to be controlled by a touchscreen interface.

WARNING: Before lowering the top section, be sure that all personnel, tools, etc. are clear of the washer. The top section is heavy and can cause serious or fatal injuries while lowering into its operating position. Items left between the top and bottom sections may also cause equipment damage. Should a mechanical, electrical, or hydraulic malfunction occur (or any other fault) that causes the top section to "hang up" while lowering, **do not** attempt to enter the washer for corrective action - call Billco.

Before performing any operations, be sure to read the **IMPORTANT WARNINGS** of SECTION 1.

WARNING: The ALL STOP, E-STOP cable, and local disconnects do not necessarily remove power from the system (such as contactors and electrical terminals). To be sure that all power is removed, lock out the main power to the washer. Use a consistent lockout procedure of the following:

- Lock out local disconnects as needed.
- Press ALL STOP pushbutton.
- Lock out main power to washer.

When the control panel door is opened, main power is disconnected from the main three-phase fuse block.

> **WARNING:** To prevent injuries from unexpected machine movements, at the main control panel set the disconnect handle to

OFF before leaving the machine unattended. If the machine is not to be used for an extended period of time, lockout the primary power and empty the tanks. Also, all items of equipment should be thoroughly cleaned, including draining of pumps (drain plug provided) and filters.

CAUTION: Should a glass sheet hang up or break within the machine, shut down the system motors immediately with the ALL STOP pushbutton. If possible, manually remove all pieces. It may be necessary to run the conveyor to completely remove all glass. Set the conveyor speed to a low value. Inspect all rolls, brushes, and assemblies for damage. Determine the cause of the hang up and/or glass breakage and correct before returning to production.

WARNING: Always wear protective clothing, gloves, and safety glasses (with side shields) that are approved for handling glass when running or maintaining the washer.

6.1 Washer Start-Up Sequence

WARNING: To prevent injuries from unexpected machine movements, press the ALL STOP pushbutton and lock out primary power to washer before leaving the machine unattended. If the machine is not to be used for an extended period of time, press the ALL STOP pushbutton, lock out all local disconnects, lock out primary power to washer, and empty tanks. Also, all items of equipment should be thoroughly cleaned, including draining of pumps (drain plug provided).

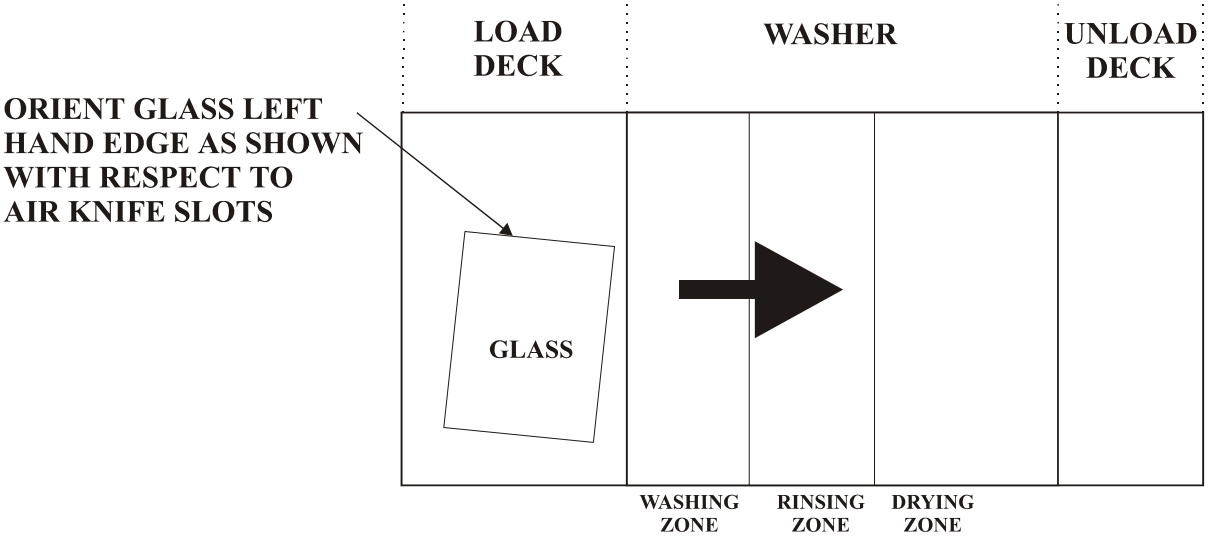
CAUTION: Should a piece of glass break within the machine, shut down the system immediately with the ALL STOP pushbutton and lock out all motor local disconnects, except the local screw jack motors. (It may be necessary to reset the ALL STOP pushbutton to activate the top section lift, depending on the control program.) Raise the top section and remove all pieces of glass. Inspect all rolls and brushes for damage. Check the catch pans and tanks for glass. Clean particle filters (see SECTION 7). Be aware that the

tank heaters may be ON, unless intentionally locked out at their individual local disconnects.

Observe the safety precautions covered in the preface of this manual when handling glass during the performance of this maintenance. There must not be any glass residue within the system. Clean all parts of the system as necessary to meet this requirement. Otherwise serious damage to rolls and brushes may occur.

NOTE: When loading glass, feed the left edge first (see FIGURE 6.1). This orientation will allow wiping of rinse water off along the entire trailing edge.

As glass is loaded into the washer, attempt to alternately place the glass so as to eventually use the entire width of the conveyor during a daily run. This method of running the glass through the washer will allow the brushes to wear evenly across their entire length, resulting in a longer brush life. An unevenly worn brush can only be adjusted in height within very small limits and may still provide unsatisfactory cleaning action.



WA415

FIGURE 6.1 Glass Feed Orientation

6.1.1 Start-Up Preparations

1. Check that manual water valves are turned ON and those optional systems; such as, an installed DI system, is ready to operate (see manufacturer's instructions).

2. Check that detergent tank is filled with detergent water and rinse tanks are filled with water.

3. Ensure that the washer is ready for operation and clear of glass and other materials.

4. Make certain that the top section has been completely lowered.

5. Readjust top section for glass thickness, if necessary.

6. Make sure that the cable emergency pull-switch cable is connected and free to move, and that the cable pull-switch is in the center position.

7. Ensure that all persons in the area of the washer are aware that the machine is to be activated.

8. Proceed to **Washer Activation**.

6.1.2 Washer Activation

1. Turn the disconnect handle on the control panel to the ON position.

2. Press the POWER ON pushbutton. This button will light when pressed. The temperature controllers will also become enabled and power will be applied to I/O. Power, however, will not be applied to the heaters unless water is above the float level and until the applicable heater pushbutton is pressed.

6.2 Operator's Touchscreen Operation

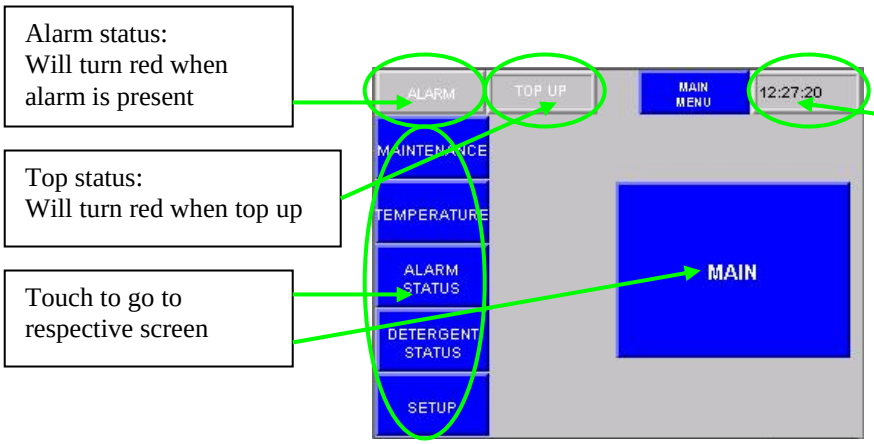
The operator's control pushbuttons are touchscreen implemented and are activated by a finger touch. The touch activation is pressure sensitive.

Activation of touchscreen buttons can either cause an action (such as a motor turn ON) or entry into a second level menu. The button nomenclature is worded to make its intended operation obvious to the user. Generally, button images intended for actions are red when OFF and green when ON. Washer operation is not effected during navigation to the various screens.

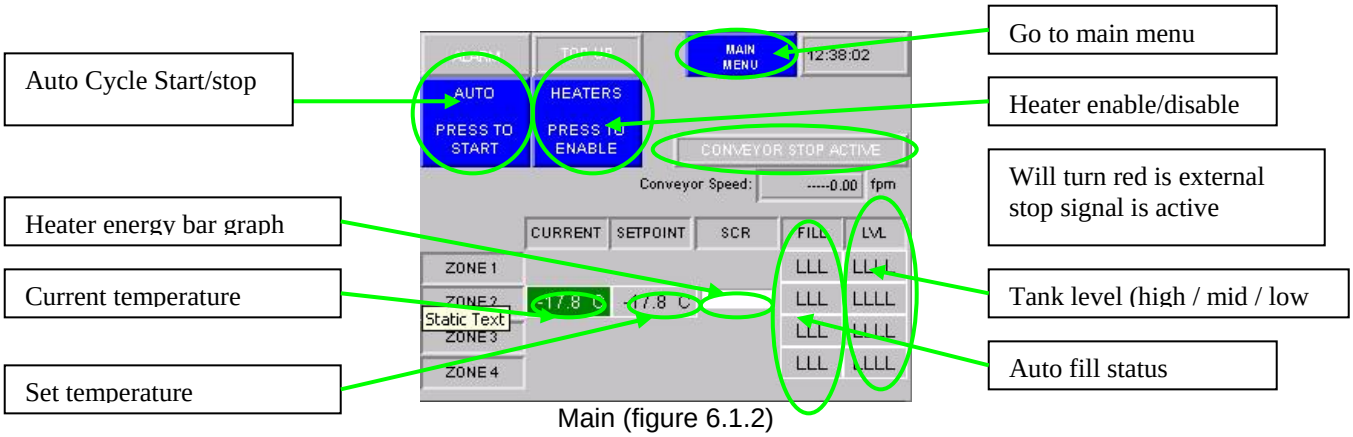
NOTE: Error codes may appear at boot up. Press "acknowledge all" and "clear all" at the screen panel to remove these codes.

The screens are setup as follows:

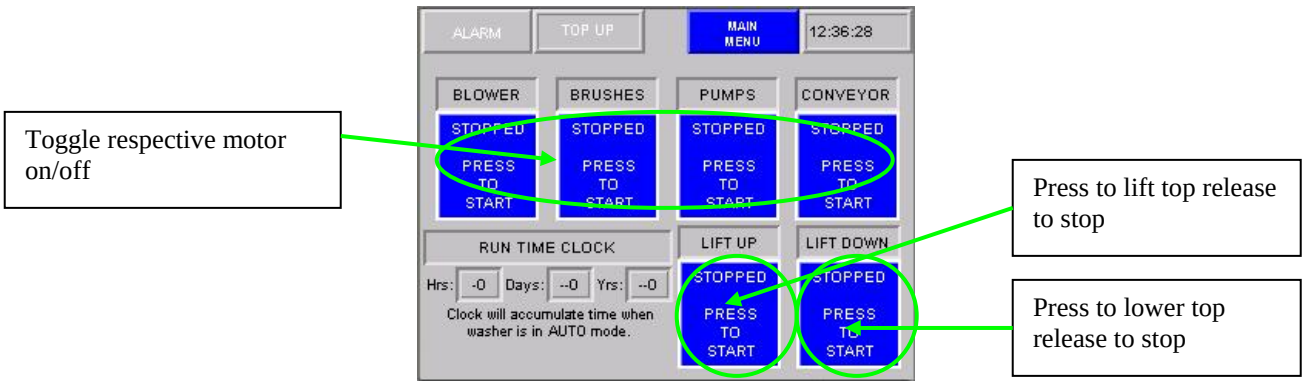
- Main Menu (figure 6.2.1)
  - Main Screen (figure 6.2.2)
  - Maintenance (figure 6.2.3)
  - Temperature (figure 6.2.4)
  - Alarm Status (figure 6.2.5)
  - Setup (figure 6.2.6)
    - Conveyer Setup (figure 6.2.7)



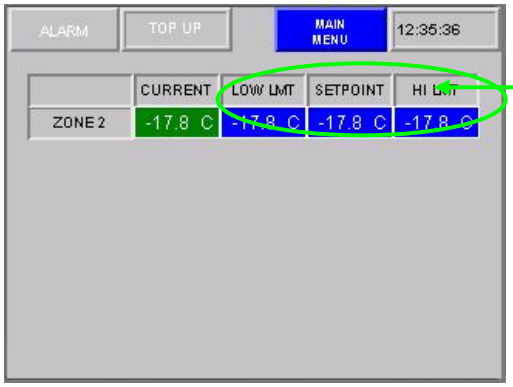
Main menu (figure 6.1.1)



Main (figure 6.1.2)



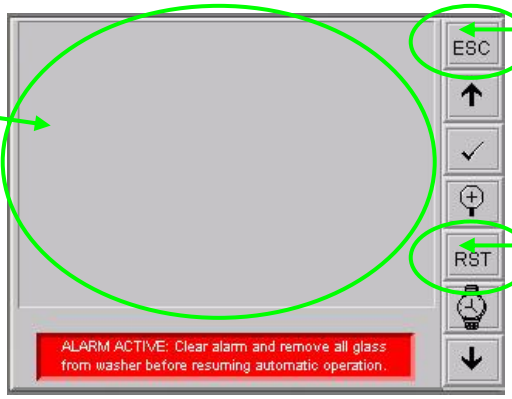
Maintenance (figure 6.1.3)



User changeable set points for heater control
Click in field and a keypad will pop up to enter value.

Temperature (figure 6.1.4)

Active alarms will show in this area highlighted red.



Return to main menu

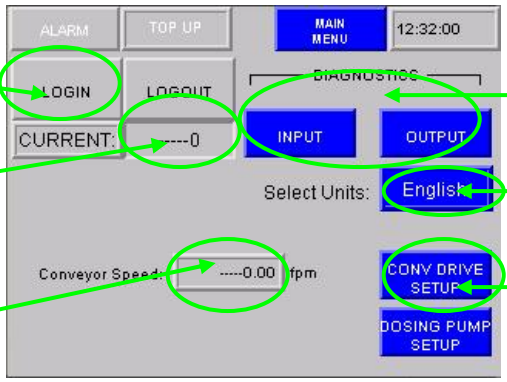
Reset alarms

Alarms (figure 6.1.5)

Touch to bring up keypad for user login

Current user login

Current conveyer speed setting



Touch to bring up window with PLC input/output indicators

Touch to select display units

Touch to enter conveyer drive speed setup

Setup (figure 6.1.6)

Conveyer Setup (figure 6.1.7)

6.3 Water Temperature and Immersion Heater Control

The heater does **not** turn ON automatically when initiating operation in the AUTO START mode. Turn ON the heater at the AUTO START SCREEN before initiating the automatic start up sequence. Allow the heated water to reach temperature before initiating the sequence. The temperature set-points and status are on the temperature screen. Also, the temperature status is provided on the main screen.

There is a HEATER SCR indicator on the MAIN SCREEN will show how much energy (%) is being applied to the heating element.

- If the water level in a heated tank drops to an unsafe level, the heater will be disabled automatically. It is impossible to enable the heater, when the water-level is too low.
- The heater will operate regardless of the position of the top section.
- Pressing the ALL STOP pushbutton or pulling the cable pull-switch will shut OFF the immersion heater.

6.4 Automatic Sequential Motor Start-Up

WARNING: Make certain that all persons in the washer system area are aware that the motors are to be started.

NOTE: It is advantageous to preheat the detergent tank water prior to running in the AUTO mode. To do this, press the touchscreen HEATERS PRESS TO ENABLE button about 10 minutes before starting up in the AUTO mode. This button is located on the AUTO START SCREEN.

1. At the MOTOR RUNNING SCREEN, make sure that all motors are turned OFF (i.e., red), including the conveyor.

2. Ensure that the top section has been lowered completely. (On washers with motorized lifts, motors will not run if the top is up, or if the top lift motor is active.)

3. Make certain that all personnel in the washer area are aware that the motors are to be started.

4. At the touchscreen, press the AUTO START pushbutton to initiate the automatic start-up sequence. The blower will start first, and the brushes and pumps will start seconds later (allowing the blower to reach speed). The MOTOR RUNNING SCREEN will show the status of each motor and heater.

   NOTE: Do not press the BLOWER, BRUSHES, PUMP or CONVEYOR button in the MANUAL START SCREEN during the automatic sequence. This action will shut down all motors and terminate the sequence. The automatic sequence will then need to be reinitiated.

6.5 Conveyor Operation

The conveyors must be running first before the brushes are started. If the conveyors are turned OFF (i.e., CONVEYOR STOP pushbutton pressed), then the brushes will also turn OFF.

6.6 Manual Motor Start-Up

1. Ensure that the top section has been lowered completely. The motors will not run if the top is up or lift is in operation.

2. Make certain that all persons in the washer area are aware that motors are to be started.

3. The motors may be started **manually**, by pressing the BLOWER, BRUSHES, PUMP, or CONVEYOR touchscreen button. When any of these buttons are pressed to start a motor (or motors), its touchscreen button will light green.

   NOTE: Pressing any of these buttons, when the corresponding motor is running, will stop the motor.

6.7 Shutdown

Shut down the washer if it will be left unattended for extended periods such as over night. Use the ALL STOP pushbutton to shut down the washer. If maintenance is to be performed on the washer, be sure to lock out the main power to the washer (see **WARNING** at beginning of this SECTION).

1. Ensure that all glass has exited the washer.

2. Press the ALL STOP pushbutton. All motors, immersion heater, and temperature controller will shut off.

3. Make sure that the POWER ON/RESET pushbutton indicator light on the control panel is OFF.

4. Turn the disconnect handle on the control panel to OFF.

6.8 External Signals

When in automatic startup, external commands HALT and RESUME cause the following to occur:

HALT	Blower gate valve reverts to vent.
	Brushes stop.

	Conveyor stops.
RESUME	Brushes start up.
	Blower gate valve reverts to air knives.
	Conveyor starts up.

6.9 Controls and Indicators

The controls and indicators described below are typical of the type provided with a standard machine. However they are implemented via touchscreen, with exception of POWER ON/RESET pushbutton and ALL STOP pushbutton. These controls are physical units mounted on the control panel along with the touchscreen. Slight variations of nomenclature, from that represented below, may be present on your machine.

WARNING: Regardless of machine control status, use care when operating machine.

All controls are located on the main control panel and are described in TABLE 6.1. There is one exception to this statement; a set of CONVEYOR START/STOP pushbuttons are provided at the washer conveyor unload deck. Local ALL STOP pushbuttons, in addition to a safety E-Stop cable, may also be present on the machine.

Figure 6.9 Conveyer control buttons

NOTE: When the ALL STOP pushbutton is pressed, all system motion is inhibited. Power remains on the PLC, but controller output voltage is disabled.

NOTE: An emergency ALL STOP cable is provided around the perimeter of the machine. When the cable is pulled, an emergency E-Stop is initiated and system power for the temperature controller and output devices are removed (PLC power remains ON). The system power ON pushbutton is inhibited until the ALL STOP cable switch is reset by centering its actuator. The disconnect handle shuts OFF all power from the primary source to the control panel. **However, primary power is still present at the main input terminal block of the disconnect switch.**

LEGEND:

ID	Touchscreen Soft Indicator
PB	Hard or Touchscreen Soft Pushbutton Switch
PBL	Hard Pushbutton Switch With Indicator Light

TABLE 6.1 Controls and Indicators

CONTROL	TYPE/ ACTION	FUNCTION
NOTE: If the top section is not completely down in its operating position, all motors will be inhibited from operating.		
PHYSICAL CONTROLS		

TABLE 6.1 Controls and Indicators

CONTROL	TYPE/ ACTION	FUNCTION
Disconnect Handle	Disconnect Door Switch	Disconnects plant primary power from control panel.
POWER ON/RESET	PBL	Applies power to temperature controller and I/O. Lights when activated.
ALL STOP	PB (Pull out to reset.)	Removes primary power from output devices, except PLC. Power is available to motors, but contactors (output devices) are not operational. The static eliminator will not be affected.
E-STOP (Emergency Cable)	Cable Switch (Cable switch with center ON.)	Pulling perimeter cable will activate an E-stop as described for the ALL STOP pushbutton. The switch must be centered to its ON position to reset. Cable is tensioned to maintain switch in its center position.
TEMPERATURE CONTROLLER	Readout Display (Available at touchscreen.)	Provides temperature set point for minimum water temperature and immersion heaters control. Monitors temperature of detergent tank. Set points can be changed (see **Water Temperature and Immersion Heaters Control**). This device is a card located in the PLC rack inside the main control panel.
CONVEYOR SPEED	Readout Display (Available at touchscreen.)	Controls speed of conveyor. The actual setting depends on the judgment of the operator. Speed is set on the touchscreen.
CONVEYOR START/STOP	PB	Controls conveyor motion from the unload deck.
GLASS THICKNESS (Optional)	PB	Pushbutton selection of 1/4" (0.635cm), 1/2" (1.27cm), and 3/4" (1.91cm) glass thickness. Conveyor can be running but no glass present in washer.
TOUCHSCREEN CONTROLS AND INDICATORS		
NOTE: When a touchscreen button or indicator function is ON (i.e., motor running) the button or indicator is green. When its function is OFF, the button or indicator is red or blue.		
AUTO START SCREEN		
AUTO PRESS TO START	Touchscreen PB	Toggles between ON and OFF. Initiates the automatic start up sequence of all motors. Heater operation is independent of sequence.
AUTO ON	Touchscreen ID	Indicates status of auto mode.
HEATERS	Touchscreen PB	Toggles between ON and OFF. Enables

TABLE 6.1 Controls and Indicators

CONTROL	TYPE/ ACTION	FUNCTION
PRESS TO ENABLE		automatic control of immersion heaters. The heaters should be enabled about **10 minutes** before starting in the AUTO mode.
HEATERS ENABLED	Touchscreen ID	Indicates status of immersion heaters.
HEATERS ON	Touchscreen ID	Indicates the temperature cycling of immersion heaters.
TEMPERATURE CURRENT	Touchscreen ID	Indicates temperature value in F or C degrees. The desired unit of measurement must be programmed into the system.
TEMPERATURE SET POINT	Touchscreen ID	Indicates temperature set point value in F or C degrees.
TOP DOWN	Touchscreen ID	Indicates status of top section position. Motors will not run when the top section is up.
WATER TEMP LOW	Touchscreen ID	Indicates status of detergent tank temperature status.
RUN SCREEN	Touchscreen PB	Navigation button.
MAINTENANCE SCREEN **NOTE:** Activation of any manual motor touchscreen button will terminate the automatic mode. The automatic mode will then require re-initiation at the AUTO START SCREEN.		
BLOWER PRESS TO START	Touchscreen PB	Toggles motor between ON and OFF.
BLOWER RUNNING	Touchscreen ID	Indicates status of blower motor.
BRUSHES PRESS TO START	Touchscreen PB	Toggles motor between ON and OFF.
BRUSHES RUNNING	Touchscreen ID	Indicates status of brush motor.
PUMPS PRESS TO START	Touchscreen PB	Toggles motor between ON and OFF.
PUMPS RUNNING	Touchscreen ID	Indicates status of pump motors. The pump motors cannot be independently operated.
CONVEYOR PRESS TO START	Touchscreen PB	Toggles motor between ON and OFF.
CONVEYOR RUNNING	Touchscreen ID	Indicates status of conveyor motor.
TOP DOWN	Touchscreen ID	Indicates status of top section position. Motors will not run when the top section is up.
WATER TEMP LOW	Touchscreen ID	Indicates status of detergent tank temperature status.
AUTO START	Touchscreen PBs	Navigation buttons.

TABLE 6.1 Controls and Indicators

CONTROL	TYPE/ ACTION	FUNCTION
RUN SCREEN TEMP SETTING GOTO CONFIG		
RUN SCREEN		
BLOWER RUNNING	Touchscreen ID	Indicates status of blower motor.
BRUSHES RUNNING	Touchscreen ID	Indicates status of brush motors.
PUMPS RUNNING	Touchscreen ID	Indicates status of pump motors.
CONVEYOR RUNNING	Touchscreen ID	Indicates status of conveyor motors.
HEATERS ON	Touchscreen ID	Indicates status of immersion heaters.
TOP DOWN	Touchscreen ID	Indicates status of top section position. Motors will not run when the top section is up.
WATER TEMP LOW	Touchscreen ID	Indicates status of detergent tank temperature status.
AUTO START MAINTENANCE TEMP SETTING	Touchscreen PBs	Navigation buttons.
ALARM SCREEN		
CLEAR	Clears selected alarm message after ACK.	
ACK ALL	Acknowledges all alarm messages. Must acknowledge before clearing.	
ACK	Acknowledges selected alarm message. Must acknowledge before clearing.	
CLEAR LIST	Clears entire list of alarm messages after ACK ALL.	
CONFIGURATION MODE SCREEN		
This screen is specific to the A-B PanelView display. It is not a part of the Billco screens for the washer operation. These parameters do affect the operation of the washer. To leave the screen, press EXIT. Changed parameters will be saved. The configuration parameter entries for the display have been preset and should not be disturbed. For information concerning this screen, consult the A-B PanelView instruction manual. This manual is available at the A-B web site. For reference purposes only, the following parameters apply.		
COMMUNICATION SETUP	COMMUNICATION PARAMETERS: no parity, 8 data bits, 1 stop bit BAUD RATE: 9600 ERROR DETECTION: crc NODE: 2 HANDSHAKING: off	
PRESET OPERATIONS	KEY REPEAT RATE: 0ms KEY REPEAT DELAY: 400ms	

TABLE 6.1 Controls and Indicators

CONTROL	TYPE/ ACTION	FUNCTION
SCREEN SETUP	SCREEN SAVER: off TIMEOUT: 10min INTENSITY: 10 CONTRAST: 15	
PRINTER SETUP	HANDSHAKING: none COMMUNICATION PARAMETERS: no parity, 8 data bits, 1 stop bit BAUD RATE: 9600	

7. MAINTENANCE

NOTICE: If the inside of a glass washer is dirty, including the tanks and plumbing, the washer cannot produce clean glass.

CAUTION: When a vinegar solution is used to clean a washer, be sure to isolate all water filtering and DI systems from the washer. This can be accomplished by either removing interconnecting hoses or by using by pass valves for this purpose. Check your system plumbing for details. Vinegar contamination of filtering and DI system will be detrimental to their operation.

CAUTION: When preparing a vinegar solution, only use household white distilled vinegar which has an acidity level between 4 and 7%, as mandated by the U.S. Food and Drug Administration (FDA). A higher acidity level can cause degradation of donut rolls and roll coverings.

In addition to dirt and grease that can collect on rollers and brushes, there is a coating (slime) that can build up on the inner surfaces of the sheet metal that surrounds the brushes, tanks and plumbing. This coating can be a combination of minerals in the water, powder packing from the glass, and algae growth.

If this coating is not eliminated from the inside of the washer, it will be recirculated through all the internal components of the washer. The result will be dirty glass coming out of the washer.

The recommended solution to controlling this coating is as follows:

- Use a heated detergent solution that is acceptable by the glass supplier (especially by your supplier of vacuum or soft coated glass) and for use in a Billco washer.

- Other than a mild detergent or cleanser, do not use any other chemicals for cleaning the internal components of the washer. Denatured alcohol is also acceptable for use. Some chemicals can damage the washer components and/or the coating on the glass that is being processed.

- Periodically check inside washer by carefully running your hand along the inside of the sheet metal, including lips, edges, and corners of the sheet metal and tanks. If these items have a slimy coating, follow the instructions in this manual for cleaning the inside of the washer.

- If deionized water is being used in the washer, make certain that the system has an ultraviolet light in the recirculating system to control algae build-up. A word of caution: an ultraviolet light is only effective when water passes through it. Algae can still form inside the washer, especially when the washer is not in use. Algae will also form when using non-deionized city water.

There is no substitute for periodic and thorough maintenance of the entire washer. For users of Billco washers, a complete and extensive maintenance program is provided in this manual.

WARNING: Before performing any maintenance, be sure to read the **IMPORTANT TOP LIFT SECTION WARNING** of SECTION 1.

7.1 Visual Checks

These checks should be performed daily or at each shift change.

TABLE 7.1 Daily Visual Checks

ITEM	ACTION
Worn, Loose, torn, and Broken Parts	Inspect the following items: • Water Lines (Hoses and Copper Tubing) • Hydraulic Lines (top section lift) • Blower Tubing • Chains • Belts • Electrical Cables • Fasteners • Tie Straps • Control Panel Indicator Bulbs
Guards	Guards must be all securely attached.
Infrared Sensor	Wipe optics with a dry-clean cloth.
Wash and Rinse Tanks	Inspect for presence of glass. If present, check rolls and brushes for damage (e.g., imbedded glass, broken bristles, etc.). Clean tanks and in-line filters (and replace small particle filters, if present). If rolls or brushes are damaged, they may need replaced.
Rolls and Brushes	Check rolls and brushes for imbedded glass, broken or worn bristles, etc. They may need to be replaced if damaged. Check for presence of grease on rolls. If present, clean brush bristles and roll covering with a mild detergent then follow up with a water rinse. Afterwards, use a cloth dampened lightly with denatured alcohol. Never soak a roll in a solvent. It will be necessary to refill tanks with clean water.
Water Hoses	Check that connections are tight.
Water Lines	Check solder joints for leaks.
Sidestream and Pre-spray	Drain, clean, and refill final rinse tank every 8 hours. Refer to separate supplemental instructions provided for these items.

7.2 Weekly (40 Hours) Maintenance

TABLE 7.2 Weekly (40 Hours) Maintenance

ITEM	ACTION
Air Filters	Clean or replace air filter(s). Be sure to use exact

TABLE 7.2 Weekly (40 Hours) Maintenance

ITEM	ACTION
	replacements. An incorrect filter could affect washer performance (contact Billco). A filter that is too small in thickness could be sucked into blower compartment.
Wash and Rinse Tanks	Remove the standpipe and screen for each tank and drain. Thoroughly clean the tanks and removable screens. Check the immersion heater (below). Read the CAUTION notice concerning the use and method of cleaning Billco washers at the beginning of this Section.
Immersion Heaters	Check the immersion heaters for scale build up. Even a thin build up will cause the elements to split. Use any commercially available detergent for removing mineral deposits to clean the heater.
Fasteners, Setscrews, and Attached Items	Check all around machine for looseness of parts. Tighten, as needed, all fasteners and setscrews. These checks should be performed at least every 40 hours or as frequently as equipment use and experience dictates.

7.3 Six-Week (250 Hours) Maintenance

TABLE 7.3 Six-Week (250 Hours) Maintenance

ITEM	ACTION
Chain and Belts	Check condition and tension of chain and belts. Refer to SECTION 4.
Brush Bristles	Check condition of bristles. Clumped bristles are an indication of a need for brush height adjustment. Refer to SECTION 4 **Bottom Brush** and **Top Brush** adjustments.
Blower Inlets	With the filter(s) removed, clean blower inlet and silencer with a vacuum cleaner.
Roll Sprockets	Check sprockets for looseness and wear. Tighten setscrews.
Optional Deionization System	Refer to manufacturer's Instructions for maintenance.

7.4 Three-Month (500 Hours) Maintenance

Perform the following periodic maintenance on a 3-month basis.

TABLE 7.4 Three-Month (500 Hours) Maintenance

ITEM	ACTION
In-Line Filters	Remove the stainless steel filters from the in-line filters and clean.
Small Particle Filter	Clean the inner housing and replace small particle filter element.
Pinch rolls and Brushes	Clean brush bristles and roll covering with a mild detergent then follow up with a water rinse. Afterwards, use a cloth dampened lightly with denatured alcohol. Never soak a roll in a solvent. Check height adjustment (see SECTION 4). Drain tanks and refill.
Conveyor Rolls	Clean rolls with denatured alcohol. Drain tanks and refill.
Chain Shoe	Clean off any lubricant that was picked up from the chain. Check height adjustment (see SECTION 4).
Chain	Lightly (with a clean cloth dampened with 30 wt petroleum oil without additives) lubricate the chain.
Spray Nozzles	Clean spray nozzles. A small diameter steel wire can be used.
Air Knife	**WARNING:** Use of high pressure air can cause debris to be blown free at dangerously high velocities. Clean slots with a piece of thin sheet steel. Be careful to not damage the slots. Remove end plate and blow out air knife with blower running. Do not allow blower to run more than 30 seconds with end plate removed. Check height adjustment (see SECTION 4).
Brush Bearing Guides and All-Thread Adjustment Rods	Lightly (with a clean cloth dampened with 30 wt petroleum oil without additives) lubricate the guides and adjustment rods.
Belt Idler Pulley	Lightly (with a clean cloth dampened with 30 wt petroleum oil without additives) lubricate the sliding surfaces of the slotted guide.
Conveyor Drive Gear Reducer	Check that oil is at **level plug hole**. Top off, as necessary, with Pennzoil Cylinder Oil #8 or equivalent to level plug hole.

TABLE 7.4 Three-Month (500 Hours) Maintenance

ITEM	ACTION
Spray Lines	Remove caps from end of spray lines and clean lines with a circular wire brush of sufficient diameter.
Lift Hydraulic Pump	Check hydraulic fluid level and top off as needed. Refer to manufacturer's manual.

7.5 Yearly (2000 Hours) Maintenance

TABLE 7.5 Yearly (2000 Hours) Maintenance

ITEM	ACTION
Conveyor Drive Gear Reducer	Drain out gearbox and refill with #8 Pennzoil or equivalent to level plug hole. When changing to an alternate oil type, completely flush with light oil before refilling. Check the oil level after a few hours of operation. Top off after the first 500 hours of operation.
Blower	Disassemble blower and clean the fan blades and housing.
Drive Motors (rolls, brushes, and blower)	Check motor name plate for lubrication type and schedule. Small washers may use permanently lubricated motors.
Tanks, Splash Guards, and Catch Pan	Completely remove these items and clean (see **Washer Teardown for Yearly Cleaning**). Check splash guard rubber for damage and replace as necessary. Read the CAUTION notice concerning the use and method of cleaning Billco washers at the beginning of this Section.
Air Knives, Blower, and Blower Tubing	Blow out the air knives. Clean inside of blower tubing with a 6-inch bottle brush dampened with soapy water. Always clean inside of the blower housing as a part of this cleaning procedure. If necessary, use a scraper attached to a pole to clean the inside of the air knives. **Do not remove air knives from the washer.**

7.6 In-System Tank Cleaning

The tanks may be kept clean of algae and residue by periodically performing the following procedure. It is recommended to perform this procedure during an off-shift for four hours. It is also suggested to never use a water softener as it may be contributing to the deposits of salt residue in the system.

1. Drain tanks and thoroughly rinse them to remove existing algae and residue.

2. Wipe the tanks clean to remove any residue from the rinse procedure.

3. Fill tanks with clean water and add household white distilled vinegar which has an acidity level between 4 and 7% to each tank. Add at a rate of one gallon of vinegar to 80 gallons (303 liters) of water. (Standard liquid laundry bleach could be substituted for vinegar.)

   CAUTION: When a vinegar solution is used to clean a washer, be sure to isolate all water filtering and DI systems from the washer. This can be accomplished by either removing interconnecting hoses or by using by pass valves for this purpose. Check your system plumbing for details. Vinegar contamination of filtering and DI system will be detrimental to their operation.

4. Operate the washer to circulate the vinegar-water solution through the entire system to treat the rolls, brushes, and spray lines for at least two hours.

5. Drain the entire system including, tanks, and lines. Rinse tanks to remove any debris that may have resulted from the circulation of the vinegar-water solution. Wipe tanks clean.

6. Fill tanks with clean water and add detergent to begin operation again.

7.7 Washer Teardown for Yearly Maintenance

The following provides disassembly procedures for accessing items that require a yearly cleaning and inspection. Refer to FIGURE 7.1 for details. The sequence of disassembly and maintenance is as follows:

- Remove/clean top splash guard.
- Remove/clean tanks.
- Remove/clean catch pans and drip trays.
- Remove/clean bottom splash guard.
- Reassemble in reverse order and then clean air knives.

NOTE: Generally, the removal procedures for catch pans, trays, and tanks are applicable to all washers. Refer to the assembly drawings supplied with the machine for details.

7.7.1 Top Splash Guard Removal and Maintenance

The top splash guard is secured in place by support angles that attach to the top section structural frame. Rubber splash flaps are glued to the sides of the splash guards to prevent wash and rinse water from splashing out at the journal ends. The feathering of the rubber where journals protrude are particular susceptible to damage. A rubber flap is also attached to the front of the top splash guard. Internally, metal baffles are used to prevent splashing between brushes. Some models have rubber flaps extending down into the splash pans from the bottom splash guard.

CAUTION: Assistance is needed to perform this procedure.

1. With the top section down, remove the covers from the top splash guard.

2. Unfasten the top splash guard support angles by removing the row of bolts from the top section frame member (both sides). **Do not remove the bolts that attach the support angles to the side of the splash guard.**

3. With assistance, carefully lift the top splash guard up and out from the top section. Be careful not to buckle the sheet metal or damage the baffles and rubber flaps. The support angles remain attached to the splash guard (see Step 2).

4. Note the orientation of the splash guard with respect to the washer. Place the guard on a large, clean, and solid work surface so that there is no overhang.

5. Thoroughly clean the splash guard with a high quality commercial decalcifier to remove all deposits. The use of a high pressure spray is recommended to remove soap scum, etc. If necessary, lightly scrape the metal surface (stainless steel) to loosen hard deposits. Pay particular attention to removing debris that is lodged in corners of the sheet metal. Clean up surfaces with denatured alcohol. Let air dry.

   CAUTION: Be careful not to damage any rubber flaps or bend any baffles when cleaning the splash guard. Do not direct a high pressure spray at the edges of the rubber as it may tear the rubber and/or loosen the adhesive coating. See Step 6 for additional details.

6. Inspect all rubber flaps, including feathering for the brush and roll journal shafts for damage or deterioration. If any defects are found, replace the entire rubber strip. Use AD•E•BOND No. 228 (manufactured by Har Adhesive, Cleveland, Ohio) or its equivalent as the adhesive.

   If the rubber is in good condition but just lifting in places from poor adhesion, it may be glued back in place. Both surfaces must be cleaned of glue residue before reapplication. It is not recommended to remove and reglue large sections of the rubber strip—it must be replaced in its entirety.

7.7.2 Tank Removal

The plumbing and drain must be removed from a tank before it can be pulled from it position. The use of unions in plumbing, as described in SECTION 3, will greatly ease removal and replacement.

1. Disconnect plumbing to tanks by removing hoses (secured by clamps, quick disconnects, etc.).

2. Disconnect electrical lines to the tanks.

3. Remove floor drain plumbing from tanks.

4. Remove tanks by pulling them out from the plumbing side of the washer.

7.7.3 Tank Maintenance

After removing the tanks, place them on a large clean, solid work surface so that there is no overhang.

Thoroughly clean the tanks and drip pans with a high quality commercial decalcifier to remove all deposits. The use of a high pressure spray is recommended to remove soap scum, etc. If necessary, lightly scrape the metal surface (stainless steel) to loosen hard deposits. Pay particular attention to removing debris that is lodged in corners of the sheet metal. Clean up surfaces with denatured alcohol. Let air dry.

7.7.4 Bottom Splash Guard Maintenance

The bottom splash guard is removed last and is secured in place by support angles that attach to the bottom section structural frame.

1. Unfasten the bottom splash guard from its support angles by removing the row of bolts along the side of the guard (both sides).

Do not remove the bolts that attach the support angles to the bottom support member.

2. With assistance, carefully lower the bottom splash guard down to where the tanks were located and out from under the washer. Be careful not to buckle the sheet metal or damage the baffles and rubber flaps. The support angles remain attached to the frame member.

3. Note the orientation of the splash guard with respect to the washer. Place the guard on a large clean, solid work surface so that there is no overhang.

4. Thoroughly clean the splash guard with a high quality commercial decalcifier to remove all deposits. The use of a high pressure spray is recommended to remove soap scum, etc. If necessary, lightly scrape the metal surface (stainless steel) to loosen hard deposits. Pay particular attention to removing debris that is lodged in corners of the sheet metal. Clean up surfaces with denatured alcohol. Let air dry.

   CAUTION: Be careful not to damage the rubber side flaps or bend any baffles when cleaning the splash guard. Do not direct a high pressure spray at the edges of the rubber as it may tear the rubber and/or loosen the adhesive coating. See Step 7 for additional details.

5. Inspect the rubber flaps, including feathering for the brush and roll journal shafts for damage or deterioration. If any defects are found, replace the entire rubber strip. Use AD•E•BOND No. 228 (manufactured by Har Adhesive, Cleveland, Ohio) or its equivalent as the adhesive.

   If the rubber is in good condition but just lifting in places from poor adhesion, it may be glued back in place. Both surfaces must be cleaned of glue residue before reapplication. It is not recommended to remove and reglue large sections of the rubber strip—it must be replaced in its entirety.

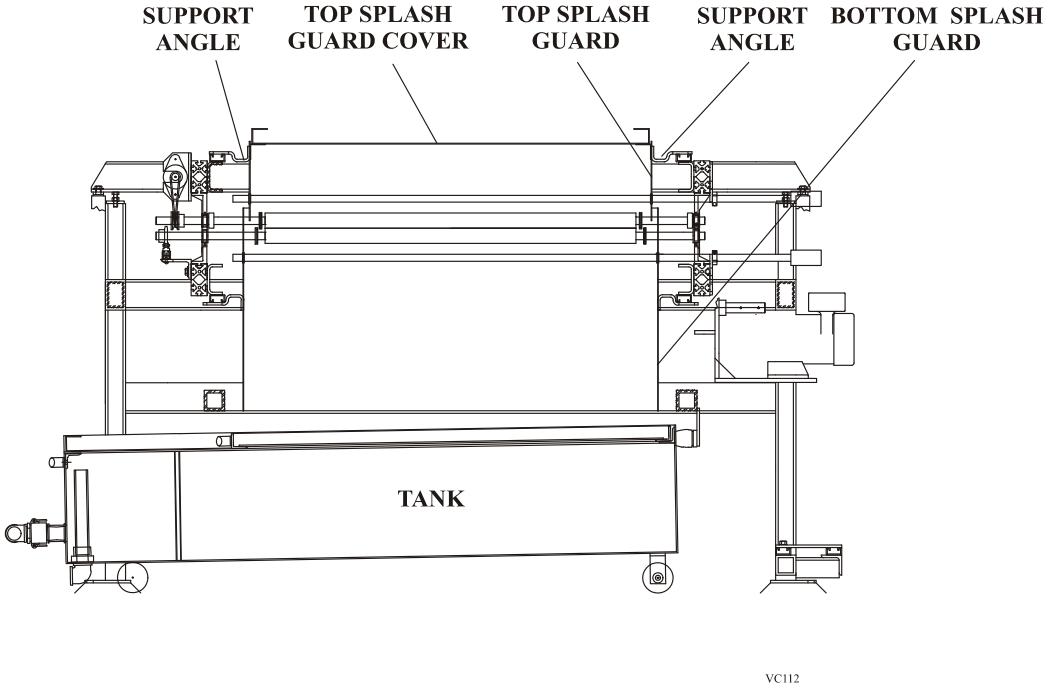


FIGURE 7.1 Washer Teardown for Yearly Maintenance

7.7.5 Reinstallation of Catch Pans, Drip Trays, Tanks, and Splash Guards

Generally, the assemblies removed for yearly maintenance are reinstalled in the reverse manner of removal with the following considerations.

NOTE: The top and bottom splash guards contain baffles to prevent cross contamination between brushes. Splash guards are not needed or supplied in the drying zone. The internal top baffles are set higher than the outside end baffles of the top splash guard. All baffles of the bottom splash guard are the same height. Thus, when adjusting the top splash guard height over the glass pass line, be sure to make measurements at the outside end baffles only. If the internal baffles are used for reference, the splash guard will be too low.

- When installing the bottom splash guard, the top edge of the baffles must be 1/8” (0.32cm) below the glass pass line. The measurement is made at the outside baffle at each end of the washer (see FIGURE 7.2). A check of the internal baffle height should also be performed to determine whether the splash guard is bent.

- When installing the top splash guard, the bottom edge of the outside baffles must be 1/2” (1.27cm) above the pass glass line as measured from the bottom pinch rolls. This distance can be set by using a 1/2” (1.27cm) thick piece of wood as a gauge (no glass present). Be sure the wood is resting on a set of pinch rolls (i.e., two rolls at both ends of the washer (all four corners).

  Allow the guard to drop down and rest on the wood before installing the angle bolts (see FIGURE 7.3). After installing the splash guard, be sure to raise the top section and remove the wood.

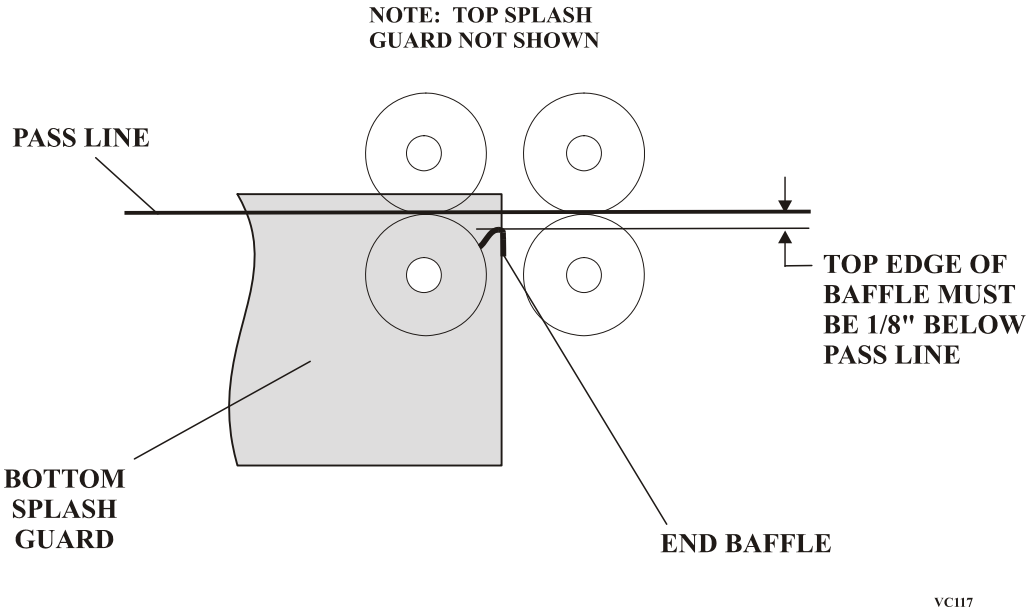


FIGURE 7.2 Installing Bottom Splash Guard

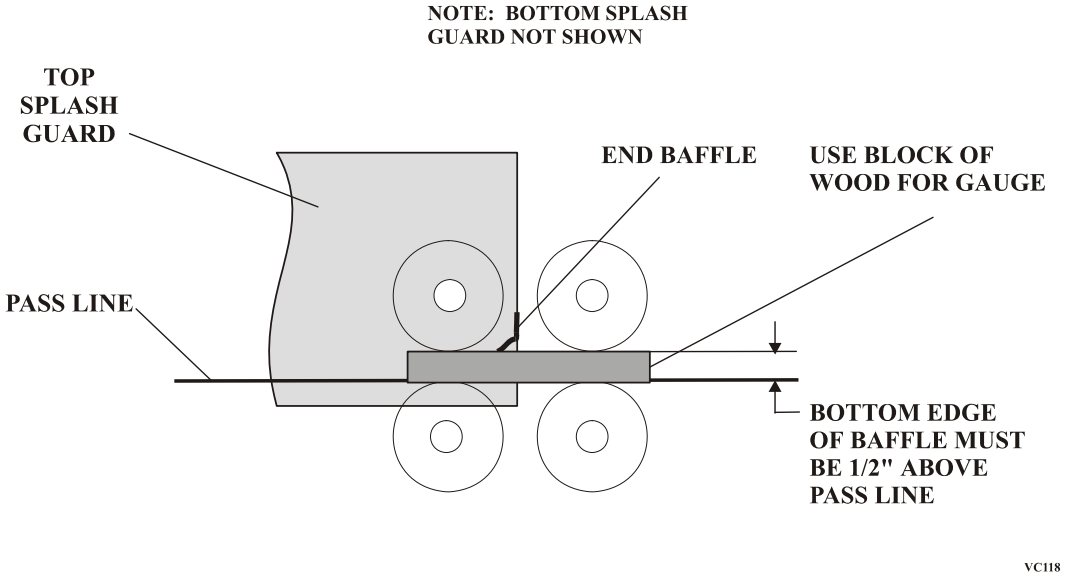


FIGURE 7.3 Installing Top Splash Guard

7.7.6 Re-Rubbering Splash Guards

Rubber is supplied solid and over sized from Billco. When applying to splash guards, use care in determining the location, size, etc. Pay particular attention to feathering cuts for the journal cutouts. Examine the old rubber for cutting details. Refer to FIGURE 7.4 for cutting details.

1. Thoroughly remove rubber from the surface to be re-rubbered.

2. Be sure to remove all adhesive residues from the metal surface. Clean both the metal and rubber surfaces with denatured alcohol, only.

3. Apply glue to both surfaces and carefully mate together.

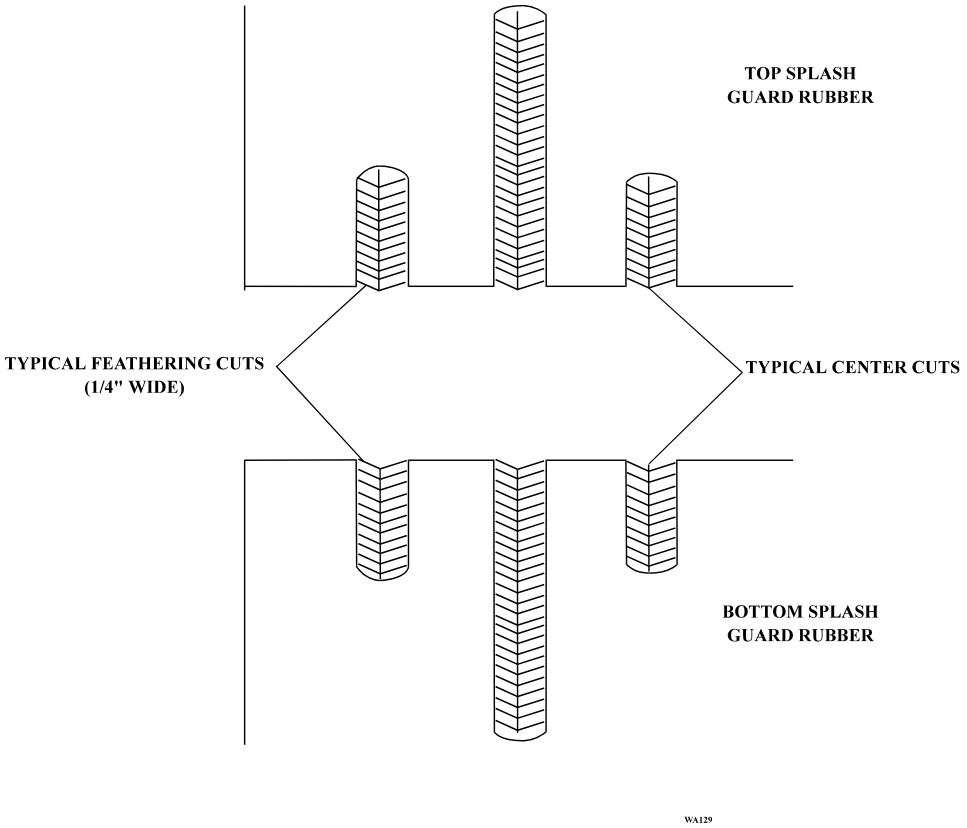


FIGURE 7.4 Splash Guard Re-Rubber Cutting Details

4. Use a small roller to make positive contact of adhesive surfaces and smooth out. Trim rubber overhang from edges of metal surface.

5. Cut each slot by making a center cut with a razor blade or sharp utility knife.

   Make feathering cuts with the orientations shown in FIGURE 7.4.

7.7.7 Air Knives Yearly Cleaning

Perform the **Air Knife Maintenance** of this Section. Use care so as not to disturb air knife adjustment (see SECTION 4).

7.8 Gear Reducer Lubrication Guide

Equivalent lubricants that may be used in the gear reducer for the conveyor drive are provided in TABLE 7.6.

TABLE 7.6 Gear Reducer Lubrication Guide

AMBIENT TEMP	**15 to 50°F**	**50 to 125°F**
VISCOSITY RANGE MM/S @ 40°C ISO GRADE	414-506 460	612-748 680
AGMA LUB NO.	#7 Comp	#8 Comp
Amoco	Worm Gear	Cylinder Oil 680
Atlantic Richfield (ARCO)		Modoc 175
Chevron	Cylinder Oil 460X	Cylinder Oil 680X
Conoco	Inca Oil	
Exxon	Cylesstic TK460	Cylesstic TK680
Fiske	SPO 277	SPO 288
Gulf Oil	Senate 460	Senate 680
Gulf-Canada	Senate 460	Senate 680
Keystone-Penwalt	K-600	
Mobil	600W Cylinder Oil	600W Super Cylinder Oil
Pennzoil	Cylinder Oil #8	Cylinder Oil #6
Phillips Petroleum	Hector 460S	Hector 630S
Shell	Valvata Oil J460	Valvata Oil J680
Sohio	Enegol DC-600C	Energol DC-600C
Texaco	Vanguard 460	Honor 680
Union	Steaval B110	Steaval B165

7.9 Brush Maintenance

CAUTION: Do not use a high pressure spray on the bristles. Never use a solvent on a brush. Brushes can be cleaned with a mild detergent then follow up with a water rinse.

Check the **Brush Height Adjustment** in SECTION 4. A brush will wear prematurely if more than 1/16" (0.159cm) of bristle is touching the glass. Brushes can be trimmed to extend their useful life. Information concerning the trimming of brushes follows.

For 3-1/2" (8.89cm) diameter brushes:

- New bristle length is 2-3/8" (5.16cm).
- Usable bristle length is 1-1/4" (3.175cm).

7.10 Air Knife Maintenance

An air knife can be cleaned by running a thin piece of sheet metal along its slot. The slot is a precision cut of 0.05" (0.127cm). Use care not to create burrs when cleaning the slot.

NOTE: If necessary, a mild commercial detergent may be used to clean air knife surfaces. Rinse clean any detergent residue with clean water or (preferably) high pressure hot water. Let air dry.

For yearly maintenance, the end plate of the air knife can be removed and the inside can be blown clean with compressed air or the washer blower can be used (do not run blower over 30 seconds). If necessary, use a scraper attached to a pole to clean the inside of the air knives.

WARNING: Use of high pressure air can cause debris to be blown free at dangerously high velocities. Always use safety glasses when blowing out an air knife.

Remove the blower air duct from the end of the air knife to allow escape of trapped dirt. Inspect the blower and clean the inside

housing and fan blade if necessary. Inspect the flexible duct for trapped dirt and tears. Always replace the blower air filter before use for this maintenance.

NOTE: Clean inside blower duct with a 4-inch (10.16cm) bottle brush (with an attached extension pole). Do not remove air knives from washer. Always clean inside the blower housing as a part of the cleaning procedure.

7.11 Spray Line Maintenance and Replacement

Remove caps from end of spray lines and clean lines with a circular wire brush of sufficient diameter. Clean nozzle orifice or hole with a small diameter steel wire (e.g., paper clip). If a nozzle is used, replace for a completely plugged orifice condition.

When replacing a spray line, try to duplicate its original angular orientation. It is suggested to mark angular-position reference lines on a spray line before its removal.

Also check the mineral content of the plant water. If a DI system is in use, refer to the manufacturer's manual and/or contact Billco.

To remove a spray line, proceed as follows (applies to both top and bottom spray lines):

NOTE: It is not necessary or recommended to remove the nozzles.

1. Remove the end cap.
2. Remove the supply hose via its quick disconnect.
3. Remove the knurled knob that supports the clamp for the line.
4. Twist the line so that the nozzles slip through the provided clearance cutouts on the splash guard.

5. With assistance, carefully and slowly pull the spray line out from the plumbing side of the washer.

7.12 Pinch and Conveyor Rolls Maintenance

Check the **Pinch Roll Height Adjustment** in SECTION 4. Clean pinch rolls and conveyor rolls are essential to producing clean glass. The glass is clean when it leaves the last rinse brush. If there is any dirt on the pinch or conveyor rolls after this zone, it will be deposited on the clean glass. Cuts and gouges in the covering of the pinch rolls can also cause water streaks and stains in the drying zone.

The rubber coverings (non-marking Buna) on pinch rolls and donuts on the conveyor rolls can be replaced. The roll must be removed from the washer and returned to Billco. Billco can also provide new rolls.

Clean roll covering with a mild detergent then follow up with a water rinse. Afterwards, use a cloth dampened lightly with denatured alcohol. Never soak a roll in a solvent.

7.13 Belt Removal

Refer to FIGURE 7.5 for belt removal.

For primary brush motor drive belts:

To remove the primary brush drive belt, unlock the two bolts on the drive motor base plate. Slide the motor base plate towards the brush pulleys to free the belt for removal.

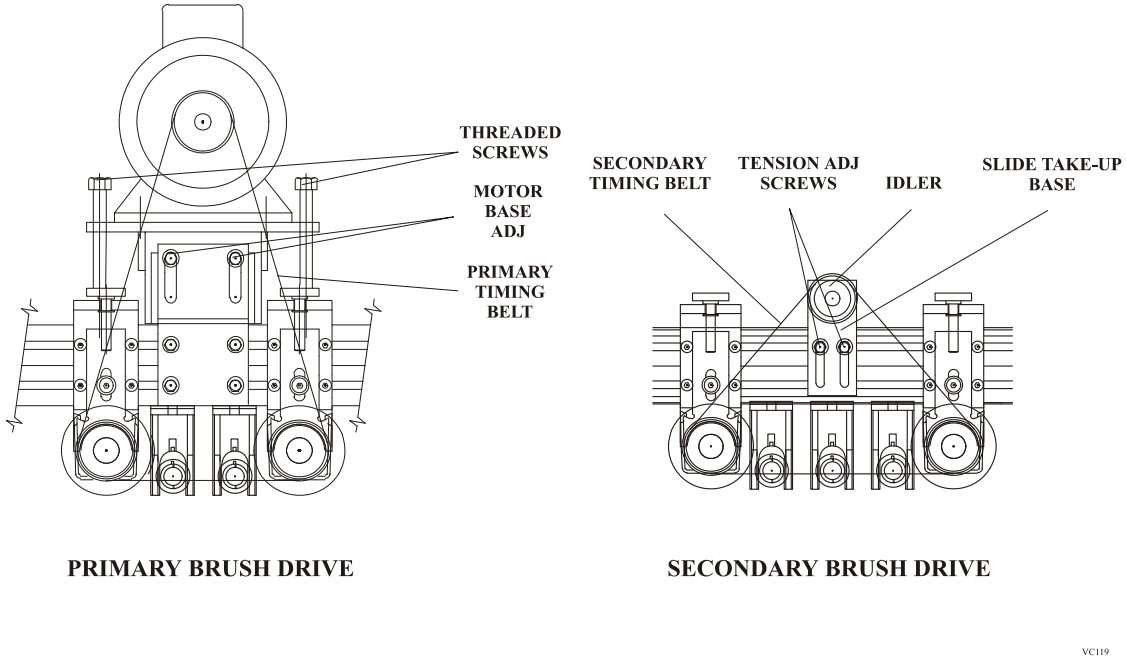


FIGURE 7.5 Belt Removal
(Standard Single Drive Arrangement Shown)

For secondary brush drive belts:

To remove the secondary brush drive belt, unlock the two bolts on the slide take up base. Slide the take-up towards the brush pulleys to free the belt for removal.

7.14 Chain Removal

Adjust the idler sprocket tensioner to release the tension on the chain. Remove all the bottom conveying rolls from the machine. Lift the chain out of the chain guide and off the drive and idler sprockets.

NOTE: It is recommended to raise the top section so that the top rolls do not need to be moved.

7.15 Drive Motors (Rolls, Brushes, and Blower)

Check motor name plate for lubrication type and schedule. If none is listed, use Chevron SR1 #2 or Shell DOLIUM R or equivalent on a yearly basis. Small motors may be permanently lubricated.

Motors should be lubricated while warm. Stop the motor and grease with several pumps from a standard grease gun.

7.16 Washer Detergent

The recommended detergent is Billco Glass Washer Detergent which is available as a powder or liquid type cleaner that is added to the water in the wash tank.

NOTE: Billco liquid detergent contains no phosphates or nitrates which can harm the environment. The surfactants (cleaning agents) are biodegradable and break down naturally into simpler compounds, helping to eliminate suds or foaming problems in lakes and streams.

CAUTION: When adding the detergent solution to a tank, do not pour the solution directly onto the heaters; rather, add the solution to the tank at its intake corner. This will assure that the detergent does not lump in the tank or on a heater element.

CAUTION: Consult Billco for use of any other detergent brand in the washer. General detergent requirements are:

- It must be non-foaming.
- It must be effective in removing cutting oil and packaging materials.
- It must not attack or deteriorate the glass, or the metal, rubber, and nylon components of the washer.

Liquid concentrate organic detergent solution preparation:

Mix 1 ounce (30ml) to 25 gallons (95 liters) of water. For soft water, use slightly less concentrate. For hard water, use more concentrate. Do not exceed 1 ounce (30ml) of concentrate to 20 gallons (76 liters) of water.

Additional mixing concentrates are:

- 1.6 ounces (47ml) to 40 gallons (151 liters) of water
- 2.4 ounces (71ml) to 60 gallons (227 liters) of water
- 3.2 ounces (95ml) to 80 gallons (303 liters) of water

Powdered detergent solution preparation:

For ease of use, first dissolve the detergent in warm water, then pour into the wash tank with pump running. Add 1 quart (1 liter) of solid detergent to 80 gallons (303 liters) of heated water in the tank with the recirculating pump running.

The maximum recommended period of use for one tank-full of detergent is 40 operating hours or one week. Shorter periods may be necessary if glass is exceptionally dirty of detergent has been diluted with make-up water. The tank(s) should be cleaned out between each change.

7.17 "Side Stream" DI System for a Closed Loop Rinse Recirculation System

CAUTION: When a vinegar solution is used to clean a washer, be sure to isolate all water filtering and DI systems from the washer. This can be accomplished by either removing interconnecting hoses or by using by pass valves for this purpose. Check your system plumbing for details. Vinegar contamination of filtering and DI system will be detrimental to their operation.

NOTE: If your Billco washer is equipped with a DI System, refer to the supplement manual included for the DI System.

Billco does offer DI Systems, recommendations for DI Sytems, and DI tank exchange. Washers that have been manufactured beginning on April 2000, and plumbed for use with a rinse DI system, will be compatible with the new "side stream" DI installation to meet U.S. Food and Drug Administration requirements (see paragraphs below for additional information concerning DI use and "side stream" feature).

7.17.1 Water Streaks and Spots Problem

Water may contain a large variety of minerals such as calcium or limestone. These minerals may leave a white, chalky residue on the glass in the form of streaks when the water is evaporated during the washing-drying process. Chemically treated soft water is not recommended to alleviate this streaking because the soft water will replace the minerals with salt which could also result in white spotting of the glass. Additionally, the brine backwash used in a soft water system is generally timer-set to come ON when the washer is not in use. If the backwash should occur when the washer is in use (e.g., timer comes ON during production), the brine solution will enter the washer rinse water plumbing and severely contaminate the rolls, brushes, etc. The use of DI water will eliminate these problems that can occur with a soft water system.

7.17.2 Deionization Process

Ion exchange can be defined as a reversible exchange of ions between a solid (resin) and a liquid (containing dissolved ionized solids or salts) in which there is no apparent change in the structure of the solids. Deionization is the process of removing the dissolved ionized solids from water by ion exchange. The major portion of total dissolved solids is mineral salts, such as calcium bicarbonate, magnesium sulfate, and sodium chloride. Mineral salts have a commonality of being comprised of cations and anions. Since deionization requires the removal of all ions (both the negatively charged anions and the positively charged cations),

materials capable of attracting both are required. These materials are known as anion exchange resins and cation exchange resins. Deionizers are fixed bed systems in which the ion exchange resins are contained in pressure tanks, and the water to be deionized is forced through these resins. The anion and cation exchange resins have a specific capacity to remove a known amount of ionizable solids. After a service run, the resins become exhausted and are unable to remove additional ions. When the resins are exhausted, they must be regenerated with a strong acid and a strong base to restore their ion exchange capacity. Cation resin is typically regenerated with hydrochloric or sulfuric acid. Anion resin is normally regenerated with sodium hydroxide, although potassium hydroxide can be used under certain circumstances.

Two-bed model deionizers have two separate resin containing vessels, one following the other. The first vessel is a cation deionizer unit which is followed by an anion deionizer vessel. Cation resin in the hydrogen form (as it will be after regeneration with a strong acid) collects all of the positively charged cations such as calcium, magnesium, sodium, and potassium, and exchanges them for hydrogen. The discharge from the cation tank has a very low pH because the hydrogen combines with the negatively charged anions in the water to form acids such as hydrochloric, sulfuric, and nitric. There will be a small amount of sodium which will not be exchanged, and the sodium “leakage” will determine the final water quality.

Mixed bed units contain mixed cation and anion resin in a predetermined ratio that produces extremely high quality water. Silica removal and carbon dioxide removal are usually accomplished by the use of a strong base resin. Mixed bed unit pH is typically 7.0 before the water is exposed to the atmosphere because of the almost complete deionization that occurs.

The quality or degree of deionization is generally expressed in terms of specific impedance (ohms or specific conductance - mhos). Ionized material in water will conduct electricity. The more ions, the more conductivity and the less resistance. When ions are

removed, resistance goes up, and therefore the water quality has been improved. A combination of the two-bed and mixed-bed units will produce an impedance of 10 to 18 megohms.

7.17.3 DI Rinse Water Systems

DI water is essentially pure water (H_2O). It has a complete absence of minerals, salts, or other contaminants. When DI water is used for rinsing and is then allowed to evaporate, there are no minerals present to leave a residue on the glass. Thus, the glass is free of streaks or spots (i.e., perfectly clean glass) when it comes out of the washer. Even if the regular plant water provides sufficiently clean glass, it still may be desirable to use DI rinse water. Use of DI water will provide an extra measure of assurance that the glass will always be clean without any concern of the plant water mineral content "fogging" the glass later. DI water is recommended for use in washers that are cleaning glass prior to coating, silk screening, or laminating. Producers of "soft coat" low-e glass are also strongly recommending the use of DI rinse water.

DI water is normally produced by one of the following two systems:

- **Portable DI Tanks:** Two DI tanks are used, and these tanks are exchanged periodically when they become contaminated. This exchange service is provided by water conditioning companies. This system is commonly called a duo-bed system. A third charcoal filter tank is used in front of the two DI tanks. The charcoal filter is basically used for removing chlorine and small amounts of detergent carryover.

  NOTE: Water conditioning dealers do not always have a DI exchange service. Only dealers that have DI recharging facilities can provide this service (tank exchange).

  The portable exchange tank system is used by a majority of companies requiring DI water. It is inexpensive, and the water-conditioning maintenance is performed by the supplier.

- **Self-sufficient Deionizing System:** This system is a complete, unit which recirculates the water and automatically recharges itself. The initial cost of this type of system is quite high, and the user must periodically recharge the system with acid and caustic chemicals. Since these chemicals must be neutralized prior to discharging, a waste treatment system is also required.

7.17.4 Affects of Industry Changes and FDA

There have been changes in the deionized-water industry that affects the glass industry. First, the largest supplier of DI water has been purchased by U.S. Filter. US Filter maintains the same dealer locations throughout North America, but under the name of U.S. Filter. The second change, and more important one, concerns the way in which DI tanks can be used. Recently, the U.S. Food and Drug Administration (FDA) has made a declaration: *Since DI tanks are used in hospitals, they can no longer be used in a closed-loop process system such as the final rinse of a glass washing machine.* The concern is that the tanks may pick-up a harmful residue of chemicals from the glass washing process which could remain in the tanks after recharging. The next recipient of those contaminated tanks could possibly be a hospital where the water will be used for such medical procedures as dialysis.

On a typical glass washer with no DI rinse and with three or four pair of brushes, the first pair or the first two pair of brushes operate in recirculated, heated detergent water (i.e., wash section). The last two pair of brushes use regular plant rinse water (i.e., rinse section) which may or may not be recirculated.

In the past on a typical washer with DI rinse, Billco has recommended that exchange DI tanks be plumbed so that the first pair of rinse brushes normally use plant water. The DI water is then recirculated through a closed loop system on the last pair of brushes. This closed loop system consists of a holding tank, recirculating pump, exchange DI tanks or DI unit, and necessary plumbing to connect the system to the washer. However, this configuration is no longer acceptable according to the FDA.

7.17.5 "Side Stream" Plumbing Solution

To circumvent the problem of tank-exchange contamination in hospitals, the tanks must be plumbed in a “side-stream” configuration, rather than in closed-loop. However, a closed-loop recirculating system is still used. This system continuously recirculates approximately 40 gallons (151 liters) of DI water through an in-line DI cartridge and a carbon filter. These are cartridge-type throwaway filters that continually “polish” the already deionized water in the closed-loop system. The exchange DI tanks are located off-line. When a DI quality indicator in the closed loop system senses that the DI water quality in the closed-loop system is low, it is time to change the cartridges, change the water in open rinse tanks, and also exchange the DI tanks. New DI water flows from the DI exchange tanks into the closed-loop system at a rate of one-half to one gallon per minute. This flow rate continuously refreshes the DI recirculating in the rinse tank of the washer. The “side stream” system maintains a constant quality level of deionized water for the final rinse in the washer, yet it does not permit the process water to enter the DI exchange tanks.

7.17.6 System Maintenance

Since DI water removes chlorine from water, it is a good idea to run a commercially available chlorine solution through the plumbing at least every two weeks. This will kill any build-up of bacteria slime in the washer. **It is important to bypass the DI tanks when the system is flushed with chlorine.** An in-line ultraviolet light is also recommended in a DI system for bacteria removal.

7.18 Zero Water Consumption

There is a continual overflow of plant rinse water from the first pair of rinse brushes. This water usage can only be limited when glass is being processed through the washer by using an automatic water off/on device.

It is possible to almost completely eliminate water usage in a glass washer (except for make up, periodic tank draining, and back flushing). This is accomplished by installing a Billco Closed Loop Recirculating System on the first pair of rinse brushes. The water in this system is pumped through a high capacity charcoal filter system.

7.19 In-Line and Small Particle Filters (If Equipped)

Turn off water supply before performing filter maintenance. Drain lines.

Removing and cleaning in-line filters:

The in-line filters have a removable stainless steel screen filter. The filter can be removed from the fitting with a 2" (50mm) open end wrench. Clean the filter by heating it with a propane torch and then lightly tapping the screen or flushing clean with a stream of water.

Replacing and cleaning small particle filters:

The filter element **cannot** be cleaned; it must be replaced. Whenever a filter is replaced, be sure to clean the bottom of the filter housing before installing filter cartridge.

1. For valve in-head units, rotate handle to OFF position.
2. Unscrew bottom of housing.
3. Locate and remove large o-ring or gasket and wipe clean.
4. Discard used cartridge.
5. Rinse out bottom of housing and fill about 1/4 full with water. Add about 2 tablespoons (30ml) of bleach and scrub cap and bottom of housing with non-abrasive sponge or cloth—rinse thoroughly.
6. Lubricate o-ring or gasket with clean water.

7. Place o-ring back into groove and smooth into place with a finger (or place gasket on rim of bottom of housing).

8. Insert new cartridge over standpipe in bottom of housing. Cartridges with tapered ends need to be specifically installed with the tapered end toward the threads of the housing.

9. Screw bottom of housing onto the cap and hand tighten. Do not over-tighten. Make sure cap standpipe slips into cartridge.

10. Slowly turn on water to allow system to fill with water. For valve in-head units, slowly rotate handle to ON position.

11. Some units have a relief valve. Depress the relief button to release trapped air.

12. Check for leaks.

7.20 Water Pumps

There is no maintenance required for the water pumps. The pumps used on this system have permanently lubricated bearings. Drain the pumps if the washer will be shut down for an extended period of time (i.e. several days).

7.21 Top Section Raising and Lowering Procedure

The washer may be provided with a manual hydraulic lift, motorized hydraulic lift, or a four-corner, motorized screw jack lift. All three lift types are described below.

WARNING: Before lowering the top section, be sure that all personnel, tools, etc. are clear of the washer. The top section is heavy and can cause serious or fatal injuries while lowering into its operating position. Items left between the top and bottom sections may also cause equipment damage. Should a mechanical, electrical, or hydraulic malfunction occur (or any other fault) that

causes the top section to "hang up" while lowering, **do not** attempt to enter the washer for corrective action - call Billco.

7.21.1 Manual Hydraulic Lift

The washer does not require electrical power to raise the top section for maintenance when using the manual hydraulic lift. However, if power is left ON, a proximity switch locks out drive power. Please read **WARNING** below.

WARNING: With the sections open and power applied, a proximity switch locks out operation of the washer. This proximity switch is not a hard-wired interlock. It is an input to the PLC. Thus, to provide a completely safe environment, lock out the main power to the system when the sections are open and mechanically locked. NEVER BY PASS THIS PROXIMITY SWITCH. Although drive power is removed from the I/O with an ALL STOP, power is not removed from the PLC.

WARNING: Before performing any operations, be sure to read the **IMPORTANT TOP LIFT SECTION WARNING** of SECTION 1.

Refer to the manufacturer's literature for maintenance on this unit.

CAUTION: A crank handle is used to actuate the four corner lift. Never use an extension on the crank handle, exceed the stroke limit of pump and its cylinders, or use any motorized crank assist as this will damage the unit and void the warranty.

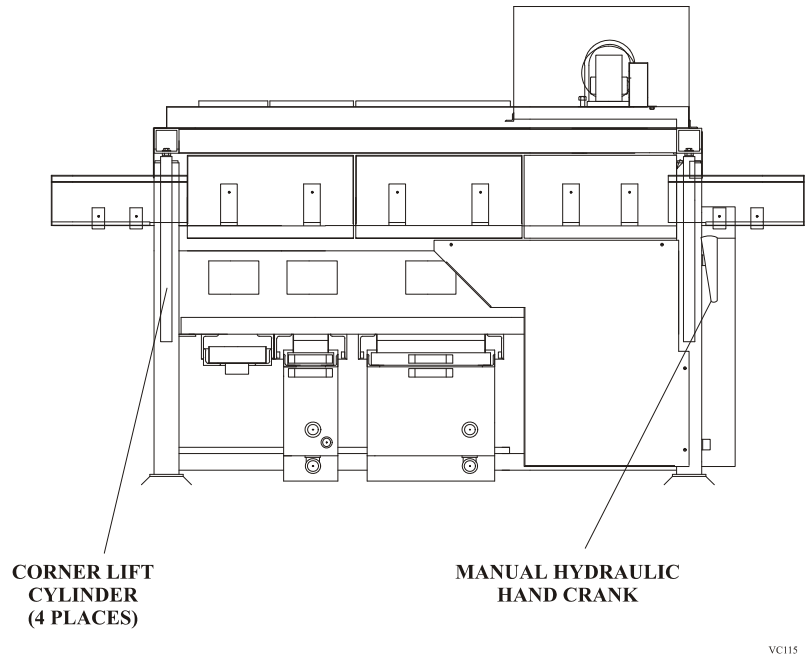


FIGURE 7.6 Top Section Hydraulic Lifting Details

There is no maintenance associated with the pump except for the periodic checking of fluid level (see manufacturer's refill instructions). If the pump becomes defective, it must be replaced as a unit. However, should a hydraulic line require replacement, a refill procedure must be performed after its replacement as described by the manufacturer of the pump.

Air accumulation in a hydraulic system will cause erratic action. This may appear as pump failure. If this is suspected, perform the manufacturer's refill procedure previously mentioned.

1. Press the ALL STOP pushbutton to shut down the washer.

2. Rotate the crank handle on the cylinder lift assembly to raise or lower the top section. The top section can open to a maximum of 16” (0.16cm) of clearance.

7.21.2 Top Section Safety Props

Two safety props are provided for propping open the top section during maintenance. These props are intended to be installed at two opposite corners of the top section. The corners to be selected are not of importance; however, ALWAYS USE THE PROPS.

It is necessary to raise the top section slightly above and then lower to engage the props. Use care in installing the props so that they are securely engaged. **If using a manual crank, only crank the top open just enough to provide clearance for inserting the props. Never force the crank to raise the top section beyond its design limit in either direction. Otherwise, the lifting mechanism will be damaged and the top section will be unsecured by the mechanism.**

WARNING: When using either the manual or motorized hydraulic pump lift to raise the top section, always insert the two supplied props at opposite corners of the top section as a safety measure to secure the top section open.

CAUTION: Be sure to remove safety props before lowering the top section. Otherwise, the lifting mechanism (manual or motorized hydraulic pump) will be severely damaged, and it will not be possible to remove the props without an independent jacking device.

7.21.3 Motorized Hydraulic Pump Lift

WARNING: Before performing any operations, be sure to read the **IMPORTANT TOP LIFT SECTION WARNING** of SECTION 1.

The hydraulic pump used by this system is identical to the one used for the manual hydraulic pump lift, except for the addition of stroke limit sensors and attachment of a motor drive assembly in place of the hand crank.

The maintenance of the hydraulic pump unit is the same as that described for the manual pump unit, above. There is no maintenance required for the drive motor assembly.

CAUTION: Do not change the sensor locations on the hydraulic pump unit. These sensors are used to turn OFF the drive motor before the stroke limit of the pump is reached at either end.

IMPORTANT NOTICE: Should it be necessary to replace the hydraulic pump unit or motor drive, review the following procedure. These procedures are only intended to be a general guide or reference for maintenance personnel. **Contact Billco before attempting the actual replacement.**

CAUTION: The motor will overheat after about 2 minutes of run time. This is about the time for one cycle of raise and lower of the top section. Leave the motor cool down for at least 15 minutes before reuse. The motor has current and thermal cutouts which will automatically reset after cool down.

CAUTION: The motorized hydraulic lift is capable of lifting the weight of the top section, only. Do not leave anything resting (i.e., extra weight) on the top section during a lift. This action will void the equipment warranty.

NOTE: It is suggested to leave all hydraulic lines attached and work on the hydraulic pump unit on the floor as close as possible to its mounting location. This assumption is made in the procedure below.

Refer to FIGURES 7.7a through 7.7j.

1. Unattach and lower linear hydraulic pump from machine and let it lay on the floor. If possible, do not disconnect hydraulic lines. If the lines are removed, a hydraulic refill procedure must be performed as described by the manufacturer of the pump after reconnection.

2. Turn pump lead screw shaft clockwise to hand tight. This is the far end stop for the pusher block position. Then remove the lead screw handle.

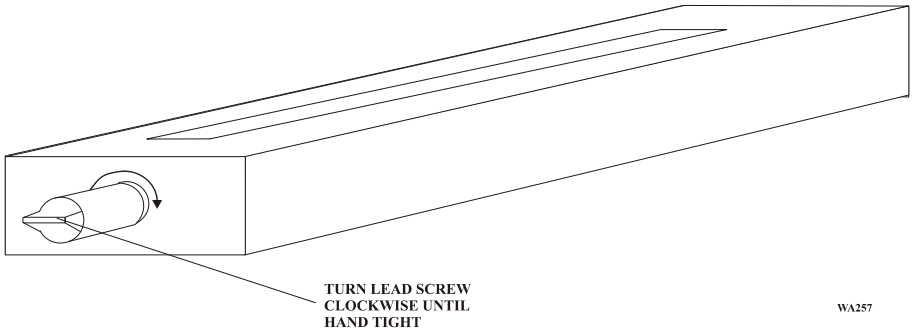


FIGURE 7.7a Motorized Hydraulic Pump Replacement, Lead Screw Positioning and Handle Removal

3. Install coupler onto pump lead screw shaft end in place of the handle. Align split pin hole in coupler with existing hole (used for handle) in motor shaft. If it is not possible to align holes, then drill through a 1/8" (0.32cm) hole into the shaft.

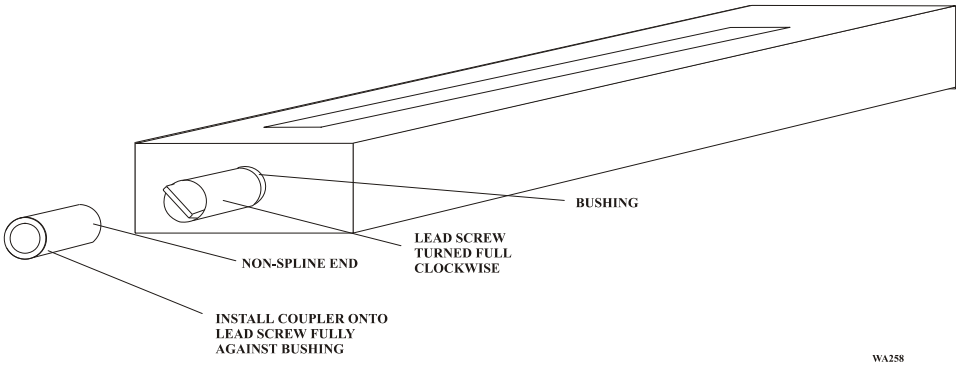


FIGURE 7.7b Motorized Hydraulic Pump Replacement, Coupler Attachment

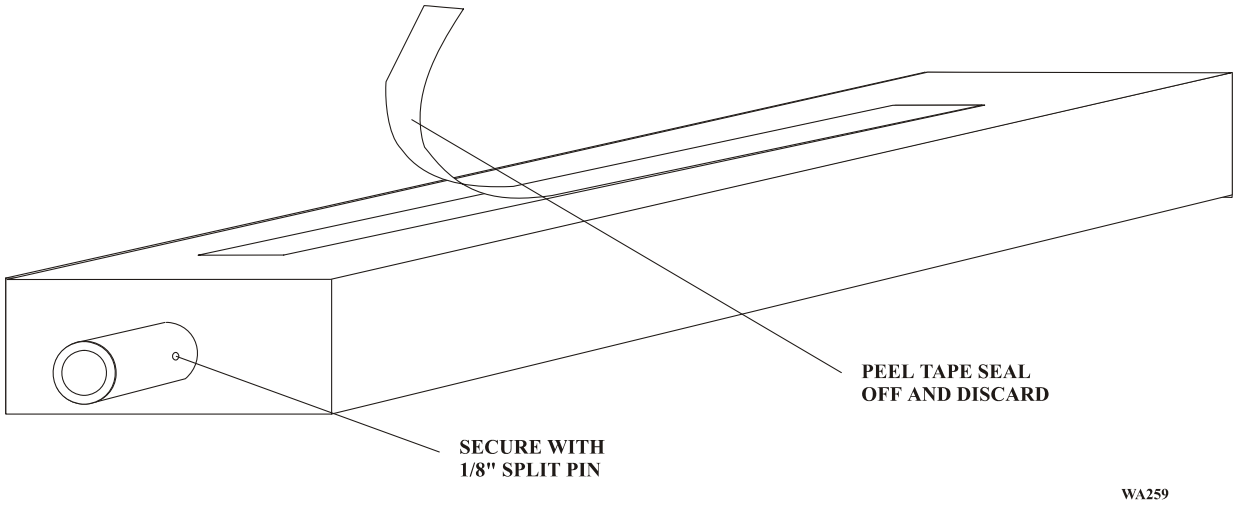


FIGURE 7.7c Motorized Hydraulic Pump Replacement, Coupler Pump Attachment and Tape Seal Removal

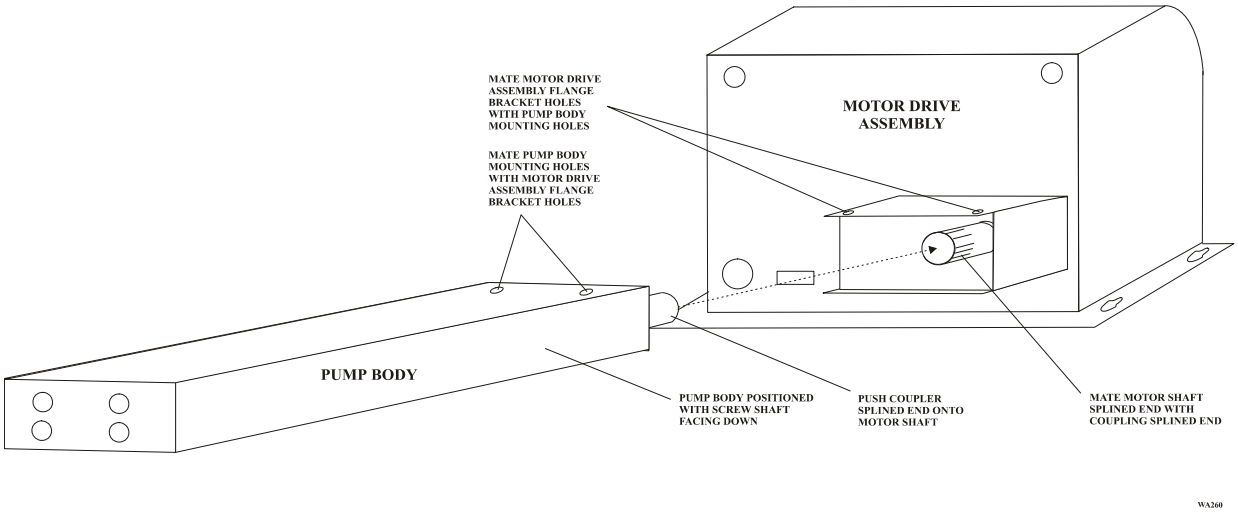


FIGURE 7.7d Motorized Hydraulic Pump Replacement, Coupler Drive Motor Attachment

4. Secure coupling non-splined end to shaft with a 1/8" (0.32cm) split pin into existing hole. This hole was previously used for securing the handle. Remove tape seal from cutout along pump.

5. Align other end of coupler (splined end) with motor shaft protruding from rear of drive assembly. Firmly press shaft into coupling to completely engage splines while paying attention to aligning mounting holes of drive assembly flange bracket with mating holes on pump body.

6. Secure motor drive assembly to body of pump with two long screws through aligned holes. Leveling bracket may or may not be used. This bracket may be the one supplied by the manufacturer of the pump or especially fabricated by Billco.

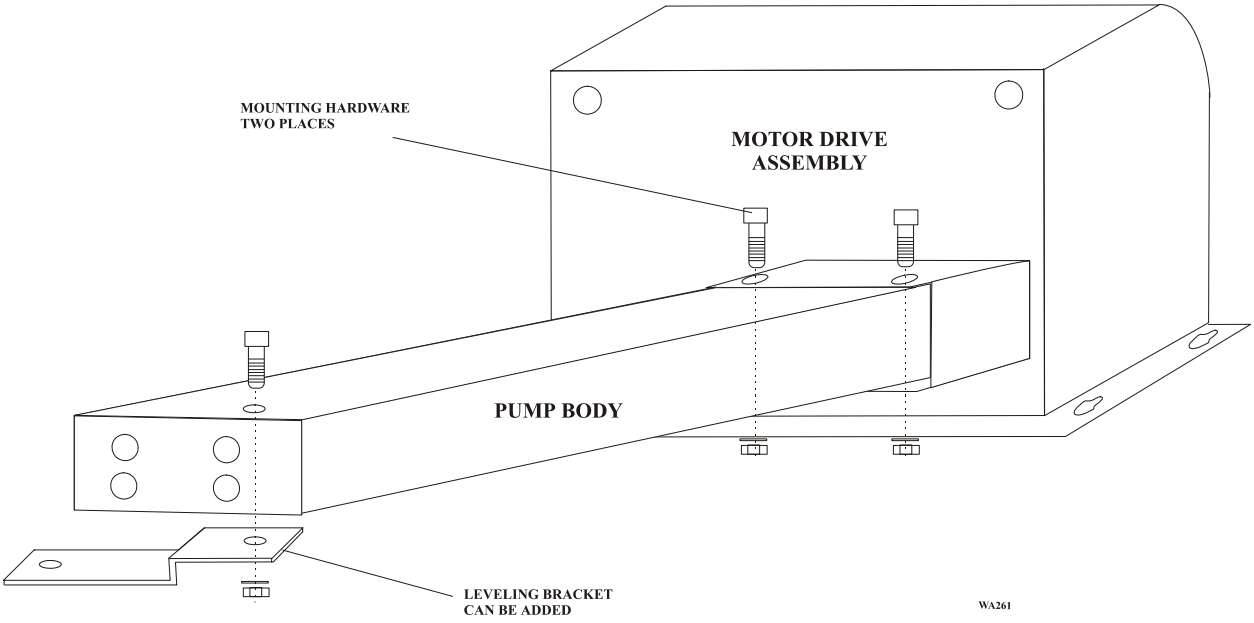


FIGURE 7.7e Motorized Hydraulic Pump Replacement, Drive Assembly to Pump Attachment

7. Open drive assembly box and drill two mounting holes on the bottom of the box for the rocker switch box. Be careful not to damage internal components of drive assembly.

8. Mount rocker switch box and close drive assembly box.

9. On the pusher block, drill out the round hole furthermost from the coupling end with a 1/4" (64mm) drill bit to 1/8" (3mm) deep.

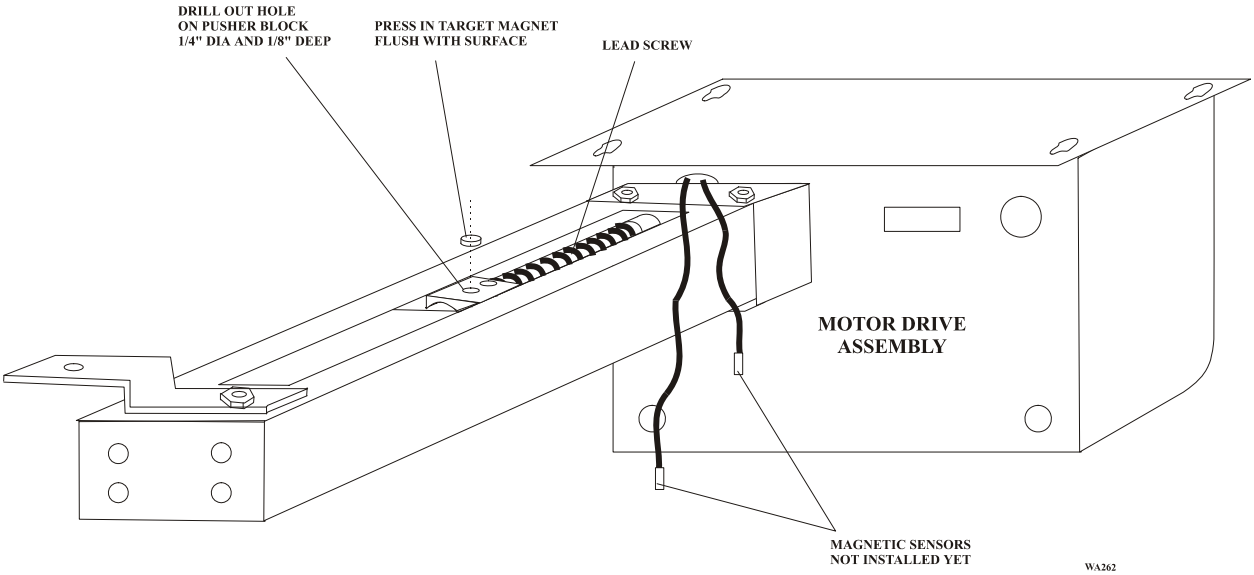


FIGURE 7.7f Motorized Hydraulic Pump Replacement, Pusher Block Target Magnetic Insertion

10. Lightly lubricate the lead screw.

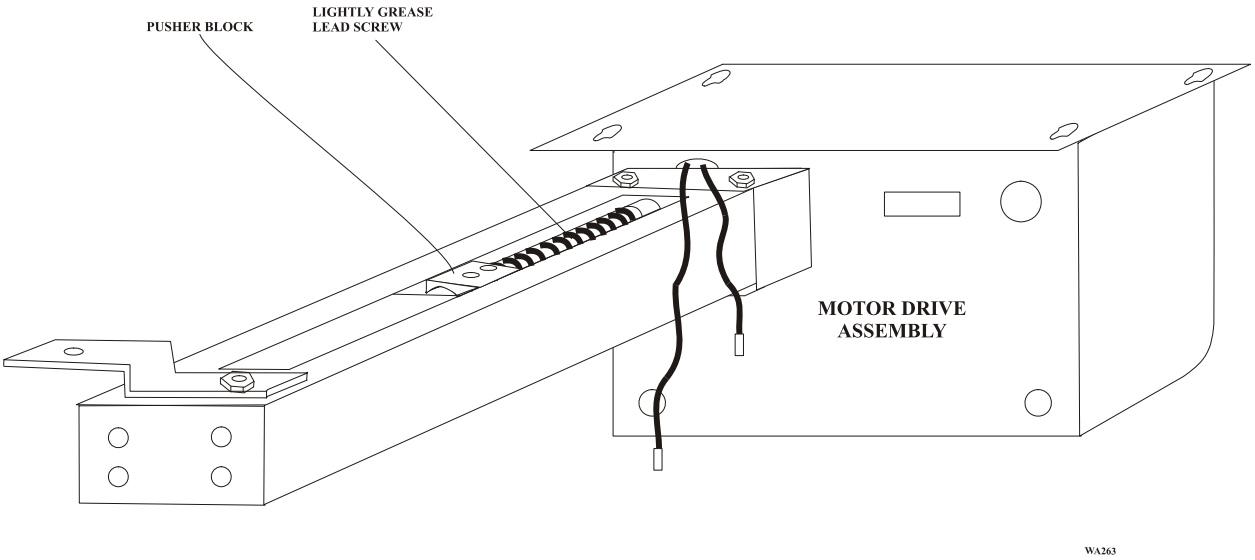


FIGURE 7.7g Motorized Hydraulic Pump Replacement, Lead Screw Lubrication

11. Press the target magnet into the pusher block prepared hole. Press in magnet flush with surface of pusher block.

12. Snap in the sensor holder into the cutout over the lead screw. Be sure the end of the holder is butt against the cutout edge at the coupling end. ONCE THE HOLDER IS SNAPPED IN PLACE, IT CANNOT BE EASILY REMOVED WITHOUT DAMAGING IT.

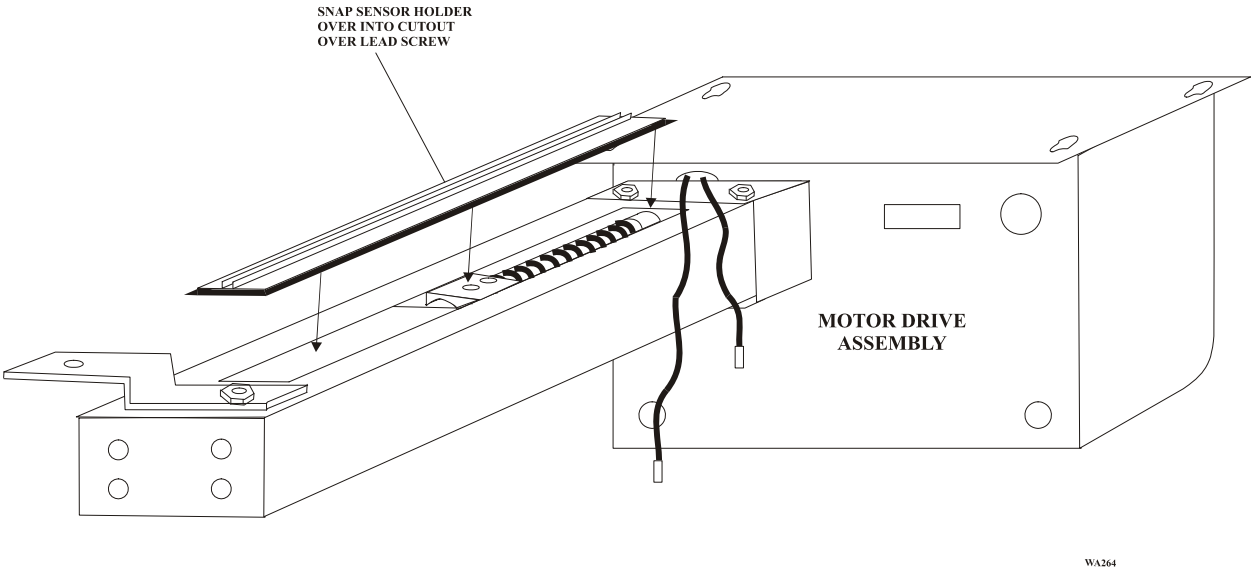


FIGURE 7.7h Motorized Hydraulic Pump Replacement, Sensor Holder Attachment

13. Snap the sensor with the longest leads into the sensor holder so its end is 13 inches (33cm) from the edge of the cutout at the coupling end.

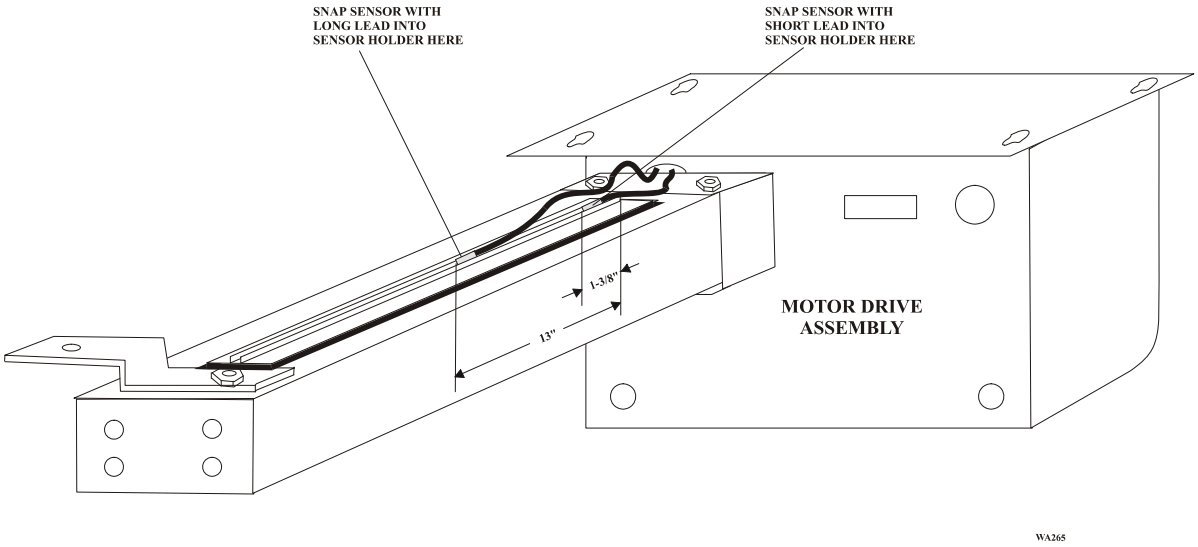


FIGURE 7.7i Motorized Hydraulic Pump Replacement, Position Sensors Attachment

14. Snap the sensor with the shortest leads so its end is 1-3/8" (2.6cm) from the edge of the cutout at the coupling end.

15. Snap sensor holder cover in place over the sensor holder.

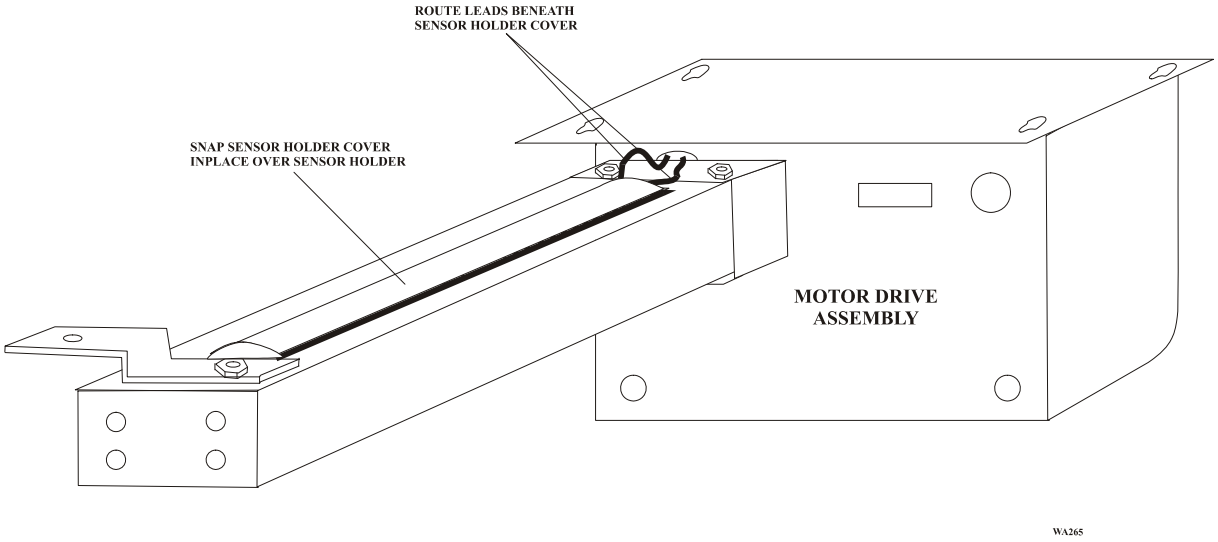


FIGURE 7.7j Motorized Hydraulic Pump Replacement, Sensor Holder Cover Attachment

16. Check location of sensors so that a safe limit stop position exists at each end of the hydraulic stroke for the pusher block.

17. Reinstall linear hydraulic pump.

18. Mount transformer within low-voltage cable reach of drive assembly and high-voltage cable reach (within 3 meters) of 120vac standard grounded outlet.

7.21.4 Motorized Four-Corner Screw Jack

The washer requires electrical power to raise the top section for maintenance. Limit switches, mounted on the frame post at the dryer end and on the drive side, are used to prevent over travel in either direction. A manual hand wheel is provided on the plumbing side of the washer for minor height adjustment after the top section is completely lowered. The screw jack lift components are shown in FIGURE 7.8.

WARNING: Before entering the interior of the washer, lock out plant main electrical power to washer.

1. Press the POWER ON/RESET pushbutton to apply power to the washer.

2. Activate the lift pushbutton switch for the desired raise or lower function located on the MAINTENANCE screen.

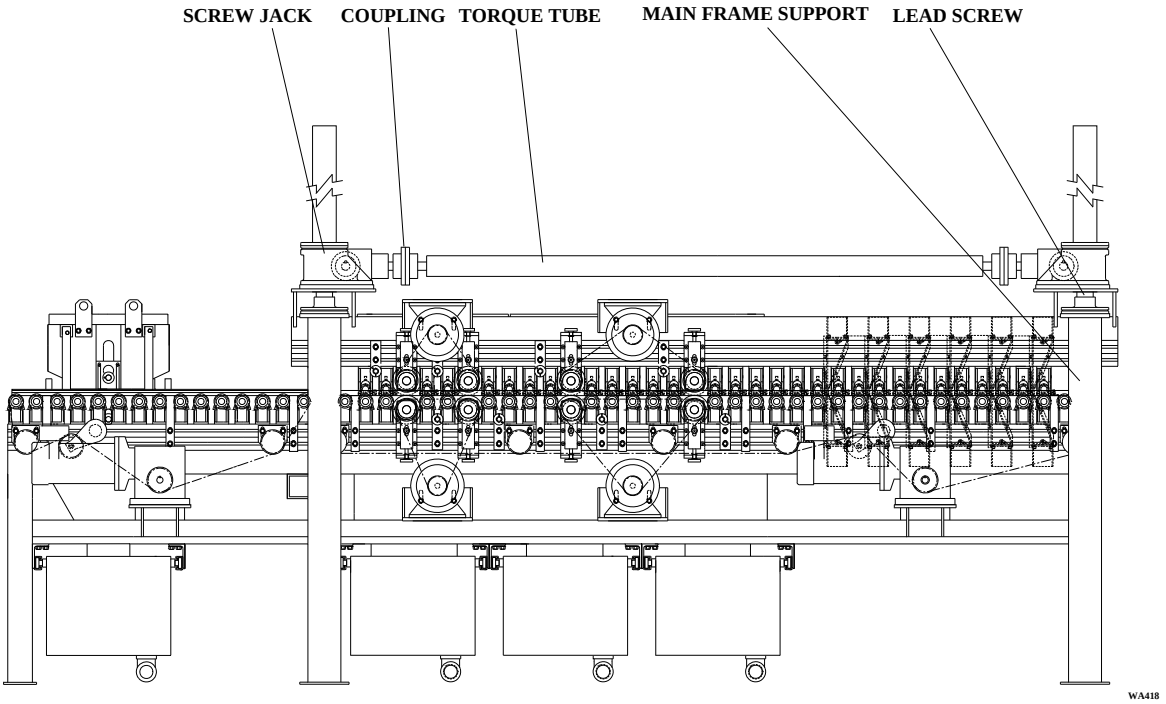


FIGURE 7.8 Screw Jack Lift Details

7.22 Static Elimination

Refer to the manufacturer's literature for maintenance of this system.

WARNING: Make sure primary power is **locked OFF** before performing maintenance on this device.

General maintenance:

Generally, the static bar can be cleaned of particles with compressed air. Isopropyl alcohol can be used to clean high voltage points.

Static elimination:

Build-up of static electricity on the glass as it passes through the washer can cause a discharge (i.e., shock) to the operator when unloading the glass. This charge is produced by the rubber covered rollers, nylon brush bristles, and high velocity air (from air knives). A charge build-up generally occurs during low humidity (under 50%) as a result of hot dry air or winter heating. Generally, this charge can be quickly dissipated by a grounded machine frame. If frame grounding does not correct the static build-up problem, a static eliminator kit should be installed. This kit consists of a pair of specially designed high voltage bars and power supply.

The bars are mounted above and below the glass pass line and immediately after the drying zone. The bars are connected to a power supply which provides a high voltage from the service power line. As the glass passes between the bars, the static electrical charge in the glass passes to the bars and is neutralized.

NOTE: The bars are not mounted directly in line with each other, but are offset by 1/2” (1.27cm) or more.

7.23 Air Assisted Static Bar Maintenance

The static bar should be cleaned daily to assure proper operation. The static bar can be removed for cleaning but it is not necessary under general use. After cleaning, refer to SECTION 4 and check its height adjustment. Two static bars are used; one for the top surface and one for the bottom surface. Each static bar has an air assist tube to remove neutralized particles on the glass surface with a light air spray (adjustable, see SECTION 6, **Start-Up Preparations**).

Refer to the supplemental manual included for the static elimination system.

7.23.1 Spark Check

1. Turn on the static bar high voltage supply with the control panel STATIC BAR selector switch.

2. Use the end of a screwdriver to check the spark at a high voltage point. Ground the screwdriver against the edge of the point hole.

3. Draw a spark at the end of the screwdriver with the tip of the point. To indicate a properly operating static bar, a very faint and thin spark should occur at about 1/8" (0.32cm) from the point. If this specification (for 1" diameter bar) (2.54cm) is not met, refer to SECTION 8 for troubleshooting the static bar.

7.23.2 Static Bar Cleaning

1. Turn off high voltage supply with the STATIC BAR selector switch and inspect points for collected dust and foreign particles.

2. Use a soft brush to wipe each high voltage point, and then use compressed air to blow clean. Built up deposits on the points can be removed with the soft eraser end of a pencil. Press the eraser down on the end of a point and twist the pencil. Use isopropyl alcohol to remove resistant coatings. Do not use any other cleaner as it may damage plastic parts of the bar assembly.

7.23.3 Air Assist Maintenance

The air assist tube normally will not require any maintenance. The air supplied to this system must be clean and non-lubricated.

If a port becomes clogged, use a small diameter wire (0.04") (0.10cm) to remove the obstruction. An air filter is included on the supply line, but contains a non-replaceable filter element. The entire filter assembly must be replaced should it become contaminated to a point where it no longer functional.

7.24 Washing Coated and Low-E Glass

For pyrolytic and vacuum coated glass, observe the following rules to assure good results:

- Keep the washer clean.
- Keep the washer adjusted with a minimum of roll and brush pressure (see SECTION 4).
- Use a detergent that has been tested with samples of coated glass being washed. It is recommended to consult the glass supplier for any information concerning cleaning of their glass.
- Never stop the glass part way through the washer.
- Use DI rinse water if possible.

For processing vacuum coated low-E glass there are low-E brushes with special bristles. However, most low-E glass can be washed with standard bristled brushes.

7.25 Tank Level Switch

There is no maintenance required on the level switch. However, if moisture enters the switch contact seal, the contacts may appear closed. Replace the level switch if this occurs.

Billco offers a package to totally automate tank level monitoring. If so equipped, radar level sensors are used in place of the normal low level sensors. Set at pre-determined levels the sensor monitors tank levels. This information is used to turn solenoid valves on or off, and as low level shut-down protection. Refer to supplemental information on these style sensors.

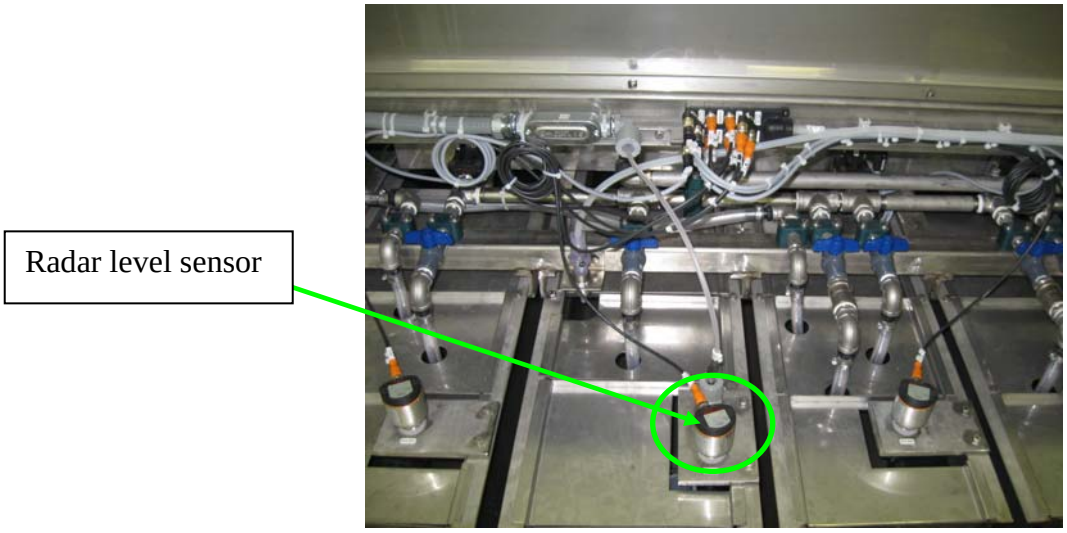


Figure 7.25 Radar level sensor

7.26 Temperature Controller and Immersion Heater

The temperature controller has been factory set to provide the correct wash water temperature for the installed immersion heater element. Do not change the temperature without consulting with Billco. A higher set temperature will shorten the life of the element. Billco's detergent is also formulated to operate within the temperature range of 110°F (43°C) to 150°F (66°C).

Immersion heater maintenance:

- Check line connections to make sure they are tight, free of oxide build-up, and that no dust or dirt build-up is present. Retighten to 20in-lb (2.26N-M).
- Check end enclosure for rust, dirt or dust. Remove rust with steel wool and thoroughly blow clean with dry, oil-free air.
- Check condition of cover gasket. It must seal the enclosure against moisture.
- Check condition of heater element sheath. It must be free of mineral deposits. Clean with solvent for removing water deposits such as calcium. A recommended method of cleaning the elements is to add 1 cup (237ml) of household white distilled vinegar which has an acidity level between 4 and 7% to the

wash tank on a monthly basis. Run the washer during an off-shift for about four hours to circulate the water.

CAUTION: When a vinegar solution is used to clean a washer, be sure to isolate all water filtering and DI systems from the washer. This can be accomplished by either removing interconnecting hoses or by using by pass valves for this purpose. Check your system plumbing for details. Vinegar contamination of filtering and DI system will be detrimental to their operation.

8. TROUBLESHOOTING

The PLC has I/O indicators that can be used to determine if I/O devices are active. Refer to I/O drawing for wire numbers and locations.

NOTE: Marks remaining on the glass after cleaning that are stains, scratches (from broken glass embedded in rolls), fired on dirt (by tempering), etc. that cannot not be removed with light pressure from a damp cloth are not a problem caused by the washer. The glass itself is defective.

8.1 Spots on Glass

TABLE 8.1 Spots on Glass

POSSIBLE CAUSE	ACTION
Dirty rolls.	Clean all pinch and conveyor rolls (see SECTION 7, **Pinch and Conveyor Roll Maintenance**).
Glass Runs too close together.	Feed the glass no closer to each other than the circumference of a roll, unless using DI water. When using DI water, glass feed can be 2" (5cm apart.
Spray line(s) clogged.	Clean clogged line tubing and nozzles (see SECTION 7, **Spray Line Maintenance and Repair**).
Static Bar not defective.	Check spark specification (see SECTIONS 4 and 7).
Air assist pressure incorrect.	Adjust the air supply psi (see SECTION 6).
Water softener treated water.	Re-plumb system around water softener. The salt content in the water is leaving mineral deposits.

8.2 Streaks in Direction of Glass Flow

TABLE 8.2 Streaks in Direction of Glass Flow

POSSIBLE CAUSE	ACTION
Air knife slots dirty	Clean the slots with a thin piece of sheet metal (see SECTION 7, **Air Knife Maintenance**).
Final rinse water not turned on.	Check manual valves. Check operation of solenoid valve.
Water saver solenoid not turned on.	Check I/O.
Wash or rinse tank screen plugged.	Remove standpipe and drain tank. Thoroughly clean the tank screen, and in-line filter strainers.
Uneven brush wear.	The glass is not being run over entire area of the conveyor (see SECTION 6). Readjust brush height (see SECTION 4). It may be necessary to replace worn brushes.
Flat spot on roll.	Replace roll and/or gears.
Dirty rolls.	Clean rolls in drying zone.

8.3 Streaks Across Glass Width

TABLE 8.3 Streaks Across Glass Width

POSSIBLE CAUSE	ACTION
Flat spot on roll.	Replace roll and/or gears.
Dirty rolls.	Clean rolls in drying zone.
Glass stopped in drying zone.	Generally an operator's error. Rerun glass through washer.
Glass feed spaced too close.	Feed glass no closer to each other than one circumference apart.
Low rinse water flow.	Set higher rinse water flow rate.

8.4 Water Droplets on Glass

TABLE 8.4 Water Droplets on Glass

POSSIBLE CAUSE	ACTION
Air knife slots dirty.	Clean the slots with a thin piece of sheet metal (see SECTION 7, **Air Knife Maintenance**).
Glass stopped in drying zone.	Generally an operator's error. Rerun glass through washer.
Glass not fed into washer correctly.	When loading glass, feed the left edge first (for standard air knife) so that the glass orientation of the left edge is leading (see FIGURE 6.1).
Glass Runs too close together.	Feed the glass further apart.
Too much water in final rinse.	Water pressure may be too high. Contact Billco.
Air knives require adjustment.	Top and bottom air knife slots are not aligned with each other (see SECTION 4, **Air Knife Height Adjustment**).
Blower running in reverse.	Check motor direction. Reconnect motor 3-phase wiring as necessary to obtain correct direction (see wiring diagrams supplied with equipment).

8.5 Lines Across Width of Glass

TABLE 8.5 Lines Across Width of Glass

POSSIBLE CAUSE	ACTION
Dirty or cut rolls.	Clean all pinch and conveyor rolls (see SECTION 7, **Pinch and Conveyor Roll Maintenance**).
Air knife slots dirty.	Clean the slots with a thin piece of sheet metal (see SECTION 7, **Air Knife Maintenance**).
In-line filters or small particle filters plugged.	Refer to SECTION 7, **In-Line and Small Particle Filters**.
Uneven brush wear.	The glass is not being run over entire area of the conveyor (see SECTION 6). As glass is loaded into the washer, attempt to alternately place the glass so as to eventually use the entire width of the conveyor during a daily run. Readjust brush height (see SECTION 4). It may be necessary to replace worn brushes.

8.6 Lines in Direction of Glass Flow

TABLE 8.6 Lines in Direction of Glass Flow

POSSIBLE CAUSE	ACTION
Dirty rolls.	Clean all pinch and conveyor rolls (see SECTION 7, **Pinch and Conveyor Roll Maintenance**).
Glass stopped in drying zone.	Generally an operator's error. Rerun glass through washer.
Glass not fed into washer correctly	When loading glass, feed the left edge first (for standard air knife) so that the glass orientation of the left edge is leading (see FIGURE 6.1).
Glass Runs too close together.	Feed the glass further apart.

8.7 Glass Not Clean

TABLE 8.7 Glass Not Clean

POSSIBLE CAUSE	ACTION
Final rinse water not turned on.	Check manual valves.
Water saver solenoid not turned on.	Check operation of solenoid valve at I/O.
Pumps not turned on.	Start pumps at control panel. Check operation of switch at I/O.
In-line filters or small particle filters plugged.	Refer to SECTION 7, **In-Line and Small Particle Filters**.
Wash or rinse tank screen plugged.	Remove standpipe and drain tank. Thoroughly clean the tank and screen.
Slipping brush belt.	Correct belt tension (see SECTION 4, **Brush Drive Belt Tension Adjustment**).
Brush height needs adjusted.	Refer to SECTION 4, **Brush Height Adjustment**.
Top section not completely seated in saddles.	Check that top section is lowered to its operating position by observing that all rolls are parallel. The "top down safety interlock" proximity switch should be closed when the top section is down.
Uneven brush wear.	The glass is not being run over entire area of the conveyor (see SECTION 6). As glass is loaded into the washer, attempt to alternately place the glass so as to eventually use the entire width of the conveyor during a daily run. Readjust brush height (see SECTION 4). It may be necessary to replace worn brushes.

TABLE 8.7 Glass Not Clean

POSSIBLE CAUSE	ACTION
Dirty rolls.	Clean all pinch and conveyor rolls (see SECTION 7, **Pinch and Conveyor Roll Maintenance**).

8.8 Film on Glass

TABLE 8.8 Film on Glass

POSSIBLE CAUSE	ACTION
Dirty rolls.	Clean all pinch and conveyor rolls (see SECTION 7, **Pinch and Conveyor Roll Maintenance**).
Final rinse water not turned on.	Check manual valves.
Mineral content in water too high.	Mineral content needs to be removed from plant water. If DI system is in use, refer to manufacturer's manual and/or contact Billco.
No water or low water in final rinse.	Inspect tank for water level.
Oil in air assist lines.	Clean out air assist tubes and air lines. Replace air filter. Refer to SECTION 7, **Air Assist Maintenance**.

8.9 Rough or Uneven Conveyor Drive

TABLE 8.9 Rough or Uneven Conveyor Drive

POSSIBLE CAUSE	ACTION
Conveyor drive chain loose.	Adjust chain tension (see SECTION 4, **Conveyor Drive Chain Adjustment**).
Chain shoe needs adjusted.	Adjust chain shoe (see SECTION 4, **Chain Shoe Adjustment**).
Pinch roll height needs adjusted.	Refer to SECTION 4, **Pinch Roll Height Adjustment**.
Worn finger gears.	Check finger gears at end of pinch rolls for worn teeth or cracks (finger gears are generally non-metallic).
Conveyor gear reducer running hot.	Check lubricant level of gear reducer. Top off with correct lubricant (see SECTION 7, TABLE 7.6 and **Gear Reducer Lubrication Guide**.
Defective bearing	Replace bearing.

8.10 Pump Troubleshooting Guide

The following information provides some general symptom-cause relationships associated with water pumps. If the problem is found to be with the pump itself, replace the pump.

Problem: No Discharge

- Pump not primed.
- Speed too slow.
- Discharge head too high.
- Suction lift too high for pump.
- Impeller completely plugged.
- Rotation direction wrong.
- Intake clogged.

Problem: Insufficient Discharge

- Air leak in suction or stuffing boxes.
- Speed too slow.
- Discharge head higher than anticipated.
- Suction lift too high or insufficient.
- Clogged suction line or screen.
- Impeller partially plugged.
- Suction head too low for hot or volatile liquids.
- Wearing rings worn.
- Impeller damaged.
- Foot valve too small.
- Foot valve or suction opening not submerged enough.
- Impeller installed backwards.
- Rotation direction wrong.

Problem: Insufficient Pressure

- Speed too low.
- Wear rings worn.
- Impeller damaged.

- Impeller diameter too small.
- Impeller running backwards.
- Rotation direction wrong.

Problem: Loss of Suction Following Period of Satisfactory Operation

- Leaky suction line.
- Water seal plugged.
- Suction lift too high or insufficient.
- Air or gases in liquid.
- Casting gasket defective.

Problem: Excessive Power Consumption

- Speed too high.
- Head lower than rating (pumps too much liquid).
- Specific gravity or viscosity of liquid too high.
- Shaft bent.
- Rotating element binding.
- Stuffing boxes too tight.
- Wear rings worn.

8.11 Air Assisted Static Bar Troubleshooting

Perform a spark check at each point as described in SECTION 7.

When the spark check produces a spark at only some points, check the area of these points for accumulated particles.

When the spark check produces a very heavy and long spark at a point, the bar is defective and must be replaced.

When the spark check produces no spark at any points, either the attaching high voltage cable or high voltage power supply is defective. Isolate the defective part and order a replacement.

9. OPTIONS

Various optional equipment and systems are available for glass washing machines. These options are briefly covered below. Your machine may or may not have these options. Contact Billco for additional details. Refer to SECTION 1, SPECIFICATIONS for the specific option(s) provided on your machine.

- Deionized Rinse Water System: This system produces essentially pure rinse water with complete absence of minerals, salts, and other contaminates from the plant water. The process used is called water deionization (DI water). Thus, the dried glass is spot free of these residues.

  The DI rinse water is normally used to supply the last pair of rinse spray lines in a "side stream" connection (see SECTION 7). Usually, the first pair of rinse sprays use the plant water system as its source.

  DI water is normally produced from either of two DI systems. One system uses a pair of portable DI tanks (called a Duo-Bed System) which is periodically changed by the water conditioning company with recharged (chemically) tanks. The flow to the tanks generally includes a charcoal tank that removes impurities. The other system is a complete, self-sufficient deionizing unit which recirculates the water and automatically recharges itself. However, the unit does need periodic recharging with chemicals (via reverse osmosis procedure).

- Zero Consumption (Rinse Water): This system is used to almost completely eliminate rinse water consumption (except for make-up, periodic tank draining, and back flushing). This is accomplished by installing a Billco Closed Loop Recirculating System on the first pair of rinse spray lines. The water in this system is pumped through a high capacity charcoal filter to remove organic solids (does not purify water).

- Separate Rinse System: This system consists of two tanks and two pumps. During the first rinse, the water is pumped by the first rinse pump from the first tank and through the first pair of rinse sprays and onto the first pair of rinse brushes. The rinse water then drains back to the first tank. The rinse water for the second rinse is circulated in the same manner, except it is associated with the second pump, tank and brushes. The incoming plant water is only used to replenish the tanks.

- Pre-Spray: The pre-spray system unit is mounted on the load conveyor and takes away about 20" (51cm) of space from the conveyor section. Two different types of pre-spray systems are available:

  One system consists of a pair of spray lines enclosed in a sheet metal housing. The spray lines are arranged in the same manner as those in the main washer; that is, located above and below the pass line of the glass to effectively remove any packing powder or glass grindings from the glass. A splash guard and catch pan assembly is included with the unit.

  The water supply system arrangement is available in several configurations:

- Supplied by incoming plant water and then sent directly to a drain.

- Supplied plant water pressure can be boosted by a high pressure pump.

- Pumped water from first rinse section and then to drain.

- Recirculated in a closed system consisting of a tank and pump. Pump can be rated at 30psi (207kPa) to 300psi (2068kPa).

  The other system consists of a pair of brushes in addition to the pair of spray lines. The water supply configurations are the same.

- Tank Float Level Switch: High and mid level water switches are available for mounting within the tanks. The mid level switch turns on the make-up water if the water level goes below a certain point, and the high level switch shuts off the water when the tank is at its full level. A

solenoid valve is provided in the make-up line for this purpose. A third "lowest" level switch is used to disable the tank heater(s) when make-up water is provided. If no make-up water capability is provided, then only the "lowest" level switch is present.

- Variable Speed Conveyor Drive: A variable speed conveyor drive is offered. Each speed of the drive is adjustable.

INDEX

H

L

M

O

P

R

S

T

Billco Manufacturing, Incorporated
100 Halstead Boulevard
Zelienople, PA 16063-9799

Web: www.billco-mfg.com
Sales: sales@ billco-mfg.com

Phone: 724-452-7390
Fax: 724-452-0217