# *7 Options*

## Purpose

This chapter contains information on any options you have that purchased from StingRay. The material in this chapter is meant to be used with material in other chapters -- for example, Chapter 2, *"Installation", Chapter 3, "Basic Operations",* and Chapter 5, *"Maintenance."*

## Prerequisites

Before you read this chapter, we recommend that you read the following thoroughly.

- *"Important Safety Instructions and Warnings"* (in the front material)
- Chapter 1, *"Overview"*

## Safety/Precautions

Before you install, operate, or maintain any option, read and follow these recommended safety/precaution instructions:

***WARNING! <u>NEVER</u> get inside the washer cabinet when the main power supply is ON. This could result in severe injury or death.***

***WARNING! Be sure that people who install and maintain the washer and options are qualified and trained for the task.***

## What You Will Learn In This Chapter

In this chapter you will learn the following about each option:

- Theory of Operation
- Installation
- Operations
- Maintenance
- Troubleshooting

# *1. Automatic Turntable/Swivel Bearings Lubrication*

The automatic turntable and swivel bearings lubrication system helps ensure that the critical bearings inside the wash chamber are lubricated as required.

## 1.1. Theory of Operation

The automatic lubrication system consists of the following:

- Grease reservoir.
- Electric Grease Piston Pump: 0.171 cubic inches/min, 5000 psi max, 4 or 8 liter capacity for 30-day capacity, NLGI #2 grease at ambient temperature with low-level sensor. Pump reservoir cover is transparent for visual confirmation of fill level. Standard grease fitting for filling. Pressure Relief valve on discharge port.
- Quick fill ALS manual filler pump available as an **option**. With the pump, a whole tube of grease is easy to put into reservoir in a few seconds. StingRay Parts # 85239
- Dividing valve meters grease to each bearing. An electronic sensor embedded in the dividing valve provides feedback to the controller to verify the system is distributing grease.
- Grease lines to bearings inside of the wash cabinet. Lines & fittings inside cabinet are Stainless Steel. External lines are flexible Nylon.
- System Controller.
- Yellow solid on Warning Light on main control panel indicates empty reservoir, power outage, failure to deliver grease.
- Green Lube Light indicator on main control panel turns on when grease pump runs.

***NOTE: Use Lubriplate 1444 grease ONLY.***

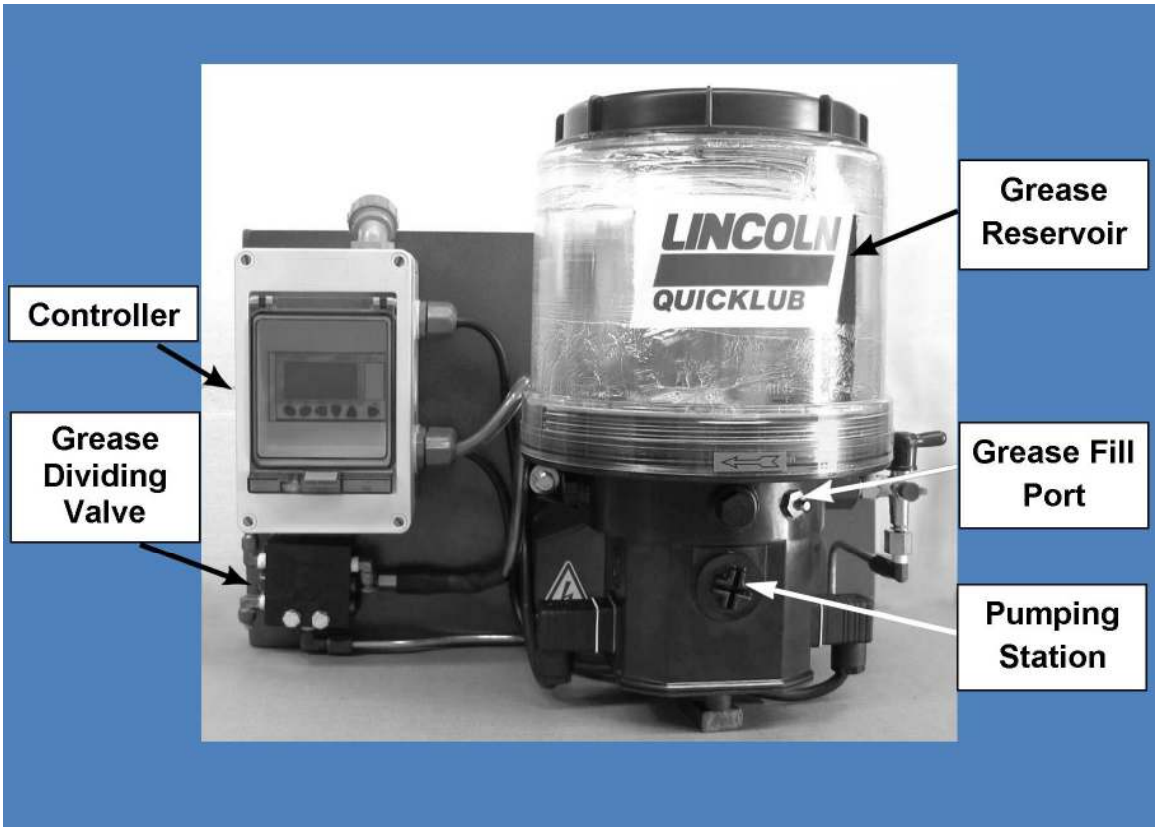
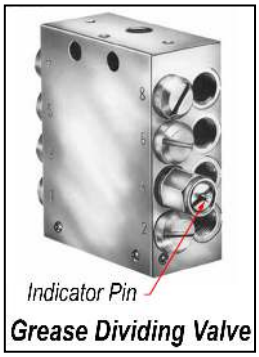



**Fig. 7 - 1: Automatic Lubrication System**

The fully automatic lubrication system is designed to provide a simple and inexpensive method of automating the lubrication of critical machine bearings inside of the wash cabinet. The Grease System Controller continuously monitors the total wash time of the machine. At the end of a wash cycle the controller operates the grease pump, delivering a specific amount of grease based on total wash time. The amount delivered is programmed by StingRay and may be adjusted by the user. The pumping station delivers grease to the dividing valve through a supply line.



*Grease Dividing Valve*

The dividing valve proportions the proper amount of grease to each bearing. The dividing valve is more than a drilled manifold block and incorporates a series of metering pistons that accurately dispense grease from each outlet. The grease-dividing valve is the heart of the lubrication system with a capability of overcoming 1000 psi of backpressure to assure that each bearing receives the proper amount of grease. An indicator pin confirms the valve has completed a full cycle. An electrical sensor connected to the controller verifies completion of grease piston strokes. Grease lines carry the grease from the dividing valve to each of the lubrication points.

The lubrication points on the standard power washer are:

- Upper Turntable Bearing
- Lower Turntable Bearing (except 30's and 40's)
- PBM Swivel Bearings

## 1.2. Installation

The automatic lubrication system arrives factory-installed.

## 1.3. Operations

The lubrication system is always operating in an automatic mode, monitoring the total wash time and automatically delievering grease to the bearings inside the wash chamber. There is no on/off switch. The only operator required function is to monitor the grease reservoir and maintain an adequate supply of grease.

The lubrication sequence is performed automatically or may be performed manually. The lubrication sequence consists of a factory programmed number of divider valve strokes to deliever a specific amount of grease. You may adjust the percentage of the programmed amount of grease.

A grease cycle is one divider valve stroke.

To run a manual cycle, press button "A" on the controller for 5 seconds.

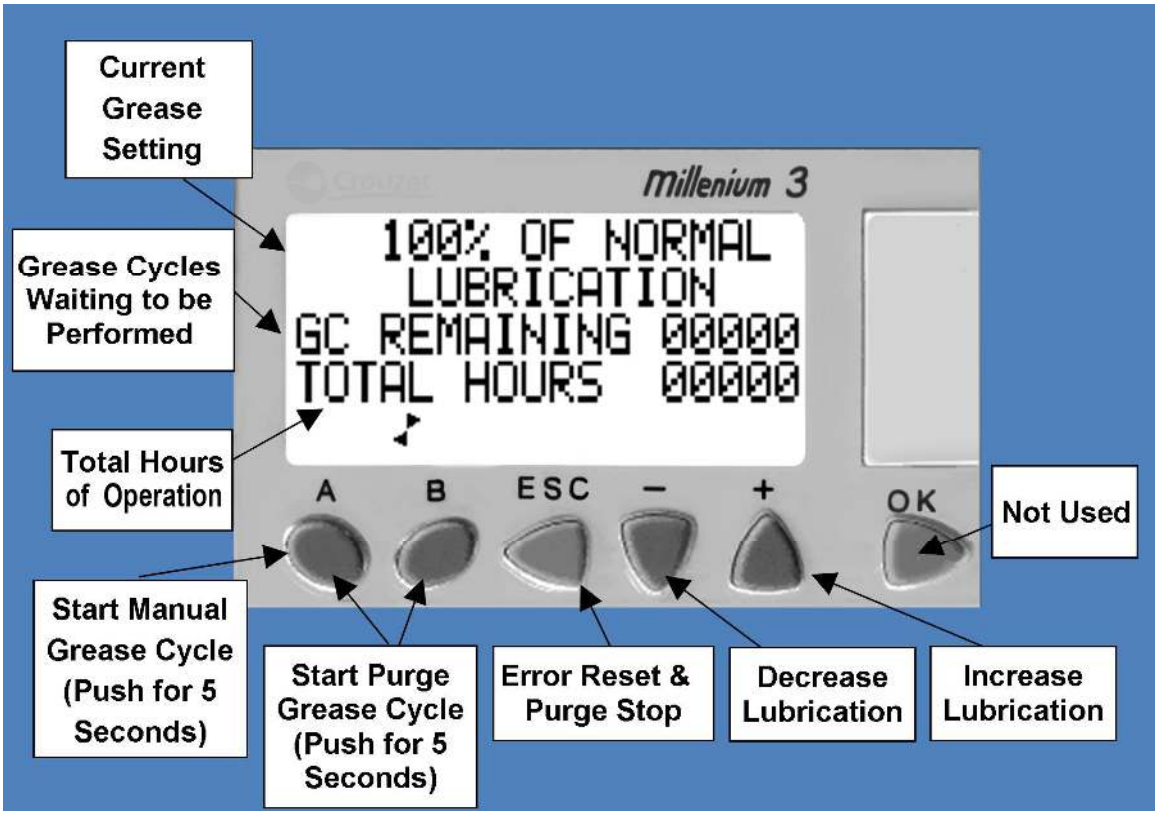



**Fig. 7 - 2: Automatic Lubrication System Controller Interface**

***SET-UP:***
***Verify Lubrication:***

Monitor the system carefully after initial installation. The proper amount of lubrication varies for different operating conditions. The Grease System requires adjustment to your particular operating conditions.

After start-up of your washer watch for the green indicator light on the main control panel at the end of wash cycles. For the first several days of washer operation check the amount of grease delivered to the turntable bearings and the PBM swivel each time you see the green pump light operate. The proper amount of lubrication purges all water from the bearings and pumps out a small bead of grease around the perimeter of the bearing seal and a small amount from the swivel overflow port.

Reduce the amount of lubrication if you see excess grease dripping at the swivel overflow port or a pile of grease on the internal reservoir cover below the turntable bearing. Increase the amount of grease if you see no grease around the perimeter of the lower turntable bearing seal or the swivel overflow port.

***How to change the amount of lubrication:***

Press the + and – keys to increase or decrease the percentage of factory programmed lubrication. The +/- keys change the programmed grease amount in 10% increments. The percentage may be adjusted between 30% to 300% of the factory program.

Total Hours of Operation: A maintenance reading indicating the total run time of the grease pump since installation

# 1.4. Maintenance

***Monitor the grease level in the reservoir on a weekly basis. Refill the reservoir when the level is ¼ full to maintain an adequate supply of grease.***

***Filling the Reservoir with Grease:***

> ***CAUTION:*** *Do not over-fill the grease reservoir. Grease will escape from the weep hole.*

> ***CAUTION:*** *Refill with* ***Lubriplate 1444*** *grease ONLY. Do not mix grease types as many are incompatible with each other.*

> ***WARNING:*** *Take great care to prevent dirt, metal chips or other debris from entering the lubrication system. Debris can jam the divider valve pistons and stall the pump.*

**Follow these steps to refill the grease reservoir:**

1. Wipe the reservoir grease **Fill Port** with a clean cloth. (see Figure 7-1)
2. Attach a grease gun or pump to the grease fitting.
3. Fill the reservoir until the follower plate assembly reaches the maximum level mark.
4. Push "ESC" on control panel if error light is on.

***Purge Mode for Maintenance:***

The system includes a special purge mode used to repair a broken line, test the system, empty the grease lines of one type of grease and replace it with another or for other maintenance operations.

To run the system in Purge Mode, press the “A” and “B” buttons simultaneously for 5 seconds. In purge mode the pump does not stop until you press “ESC”. Press “ESC” to STOP the pump.

If the purge is left ON, the system will shut-off when the low grease level switch is triggered.

***NOTE: Use Lubriplate 1444 grease ONLY.***

# 1.4. Troubleshooting

This section contains tables on the following problems:

- Automatic lubrication system pump does not run.
- Automatic lubrication system pump does not deliver the lubricant.

| ***Problem:*** | ***Automatic lubrication system pump does not run*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Power Supply interrupted** | Check the power supply and circuit breaker<br>Check the line leading from the fuses to the pump plug |
| **Electric Motor Defective** | Check the power supply to the motor. If necessary, replace the motor |

**Fig. 7 - 3: Troubleshooting: Automatic Lubrication System Pump Does Not Run**

***NOTE:*** If a lubriant low-level is available, the low level is indicated by the flashing light of the signal lamp in the case of pumps without printed circuit board. The flashing frequency depends on the speed of the motor.

***NOTE:*** Depending on the ambient temperature it may take 10 minutes of operation before the pump elements reach their full lubricant output.

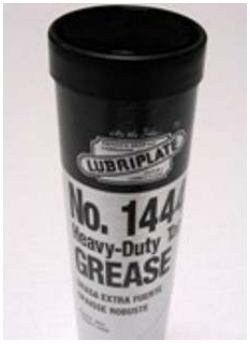
***NOTE:*** When push-in type fittings are used, the high-pressure plastic hose which is under pressure cannot be easily disconnected from the safety valve. For this purpose, loosen the pressure relief valve or filling nipple on the pressure relief valve in order to relieve the high-pressure hose.

***NOTE:*** **Use Lubriplate 1444 grease ONLY.**

| ***Problem:*** | ***Automatic lubrication system pump does not deliver the lubricant*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Reservoir Empty** | Fill up the reservoir with clean grease or oil. push "ESC" on controller. Allow pump to run until the lubricant issues from all the lubrication points. |
| **Air Bubbles in the Lubricant** | Trigger an additional lubrication cycle. Loosen outlet fitting or the main line at the pressure relief valve. The lubricant must issue without airl bubbles. |
| **Suction hole of the Pump element clogged** | Remove the pump element. Check the suction hole for foreign particles. If there are any, remove them. |
| **Pump piston worn** | Replace the pump element. |
| **Check valve in the Pump element defective or clogged** | Replace the pump element. |

**Fig. 7 - 4: Troubleshooting: Automatic Lubrication System Pump Does Not Deliver the Lubricant**

***NOTE:*** **Use Lubriplate 1444 grease ONLY.**





Long Term Answer to Lubricating

# 2. Center Manifold

The optional center manifold is used to clean very narrow-diameter, hollow, long parts whose interior is inaccessible to the washing solution. Examples of such parts include gun barrels, long pipes, and turbine pumps.

The center manifold oscillates vertically inside the part as the part rotates in the center of the turntable. The center manifold cleans the interior as the power blast manifold (PBM) cleans the exterior.

## 2.1. Theory of Operation

A *superstructure* on the reinforced roof of the washer cabinet houses the *center manifold*, as shown in the following figure. The center manifold consists of a vertical manifold tube the length of the work height of the washer with 2 wash nozzles located horizontally and connected to the lower end. The tube is guided through a pair of bushings in the cabinet roof. The tube is raised and lowered by a roller chain and carriage, which are driven by a gear motor.

Wash solution is piped to the vertical manifold tube through a hose attached to the back of the cabinet roof. Optionally, an extra tube may be attached to the vertical manifold tube for carrying rinse water to a pair of rinse nozzles on the lower end of the manifold. Flexible tubing is connected to the hose to carry rinse water. The fluid flow for the center manifold is provided from a tap off the flow to the power blast manifold (PBM).

***Door Lock.*** The center manifold system incorporates an additional feature on the standard washer to help prevent accidental damage to the vertical manifold tube or parts on the turntable. An electrically actuated solenoid locks the washer cabinet door closed during operating cycles to prevent accidental opening with the center manifold in the down position. The door remains locked until the manifold returns to the *home* position. The lock functions automatically whenever the center manifold system is used (in manual *and* automatic modes).

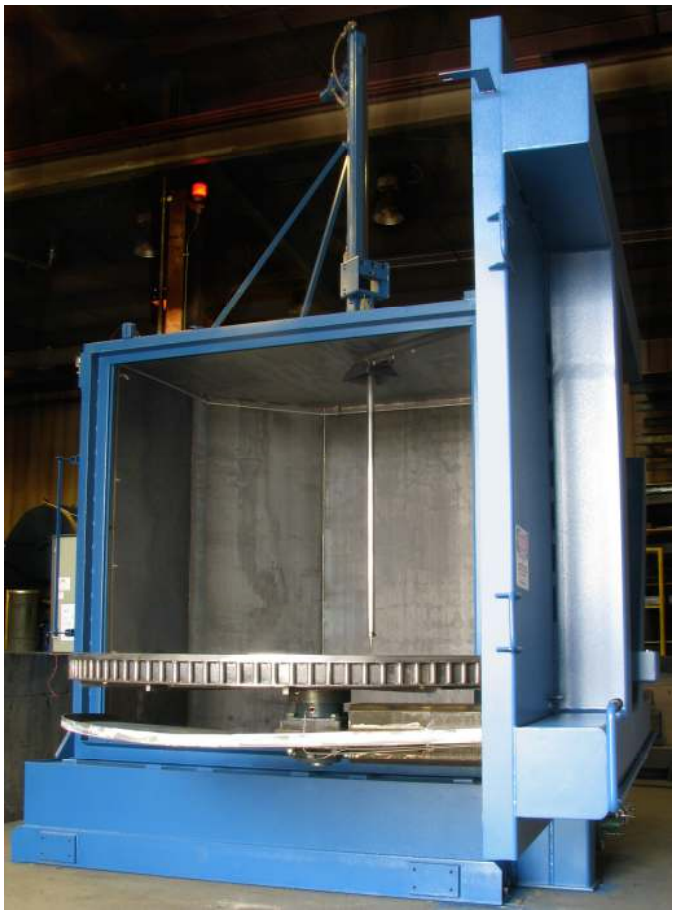
Power is required to unlock the door. In the event of a power failure or if power is turned off to the machine, the door-lock solenoid will de-energize and lock the door. The lock can be manually by-passed by pushing up the small pin that protrudes below the solenoid lock box and opening the door. This will probably require the assistance of another person. Be sure the manifold is in the *home* position before performing this procedure.

# 2.2. Installation

This option arrives with the vertical manifold and superstructure disconnected.

**To install the center manifold**, *follow this procedure*: (refer to the following figure)

1. Place beads of sealant around the roof opening.
2. Place the superstructure (frame and mechanism) on the pad support on the roof.
3. Connect the superstructure plate to the pad on the roof.
4. Connect the wash and rinse lines to the connections on the roof.
5. Connect bracing, if supplied.
6. Connect wires to the gear motor and to the brake assembly to the limit switch.



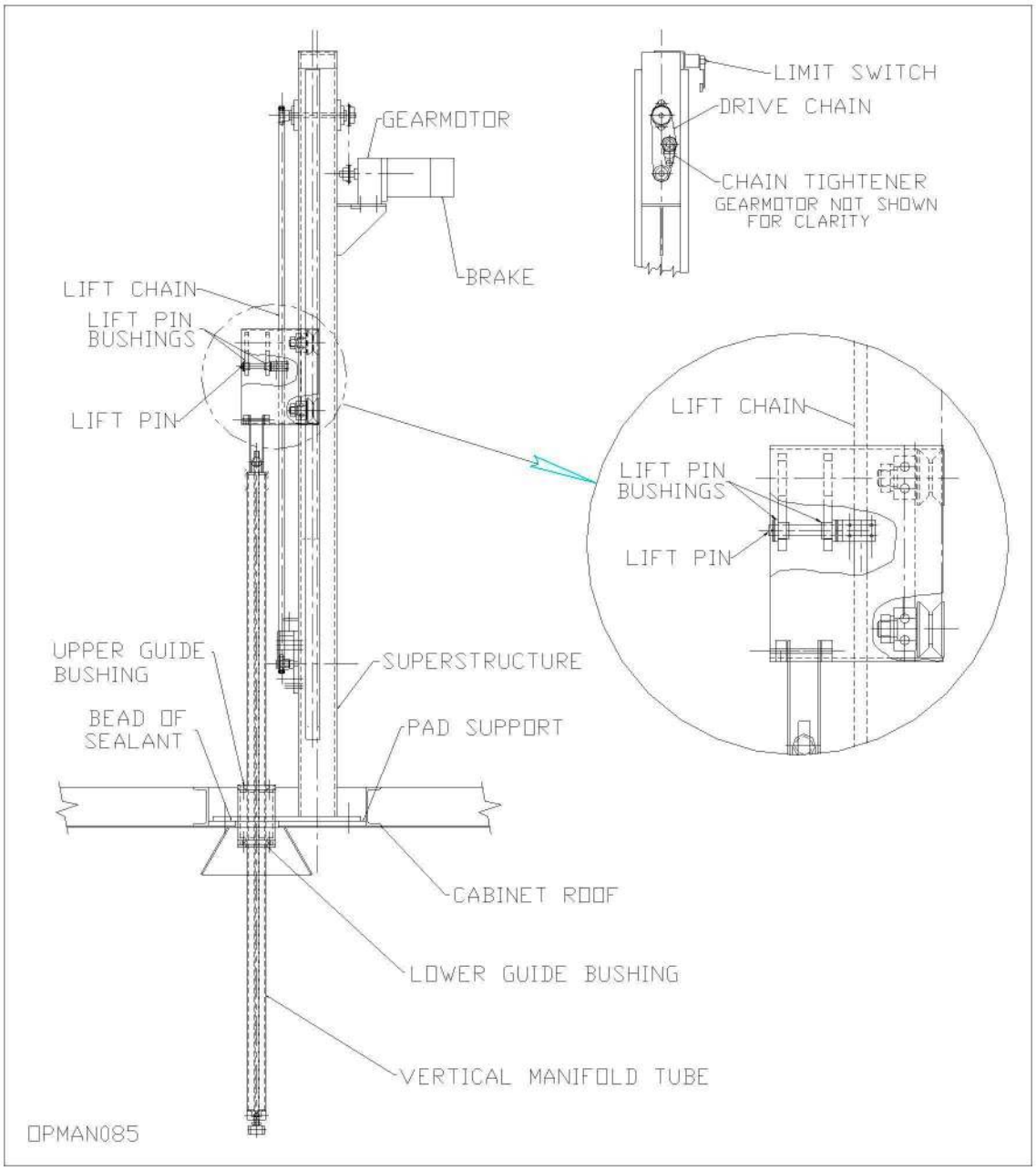



**Fig. 7 - 5: Center Manifold Mechanism and Superstructure**

# 2.3. Operations

> ***WARNING! The minimum inside diameter of a part that can be cleaned by the center manifold is 5 inches.***

**To operate the center manifold,** *follow this procedure*:

1. Verify that the manifold is *up* near the roof of the cabinet.

> ***NOTE:*** The center manifold has an automatic *Home* (or *up*) position controlled by a limit switch at the top of the superstructure.

2. Place the part to be washed in the center of the turntable. (A special fixture may be needed to keep the part centered on the turntable and properly aligned with the center manifold.)

> ***WARNING! Be sure the part is centered properly, so that the center manifold does not hit the part!***

3. Set the ***center manifold mode*** *selector switch*, located on the washer's control panel, to one of the following:

    - *Man:* Turns *auto* mode *OFF*. Activates the ***manifold jog*** *push button,* which lets you manually control the down/up position of the center manifold.

    - *Auto:* Returns the manifold to the *home* position and sets *automatic cycle* as part of the wash/rinse cycle. A light on the control panel illuminates each time the center manifold strokes during operation. The center manifold works with the power blast manifold (PBM).

    - *OFF:* Returns the manifold to the *home* position and disables *auto* cycle.

Refer to chapter *"Basic Operations"* for more information on loading and unloading parts.

# 2.4. Maintenance

Refer to the previous figure to help locate parts during maintenance procedures.

***Every 40 Hours of Operation***

Oil the chains and lift-pin bushings in the carriage.

*Follow this procedure*:

1. Turn the *main power supply OFF*.
2. Verify that the manifold is up near the top of the cabinet roof, in the *Home* position.
3. Inspect the lift chain; lift pin, and bushings for wear and looseness.
4. *If loose,* tighten the lift chain by using the adjuster located near the bottom of the superstructure.
5. Check the adjustment of the drive chain at the gear motor. Remove any excess play with the chain tightener.

***Every 250 Hours of Operation***

***Teflon Bearing Plates***

Inspect the Teflon bearing plates in the double-bearing housing. Look for excessive sideways movement of the center manifold or for bearing wear (hole is oblong): Replace the plates.

# 2.5. Troubleshooting

This section contains tables on the following problems:

- Water leaks onto cabinet roof
- Center manifold assembly does not work
- Center manifold light does not illuminate

| ***Problem:*** | ***Water leaks onto cabinet roof*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| M**anifold hose** | Cracked (replace)<br>Loose (tighten) |
| **Rinse pipefittings** | Broken tubing (replace)<br>Loose fittings (tighten) |

**Fig. 7 - 6: Troubleshooting: Water Leaks Onto Cabinet Roof**

| ***Problem:*** | ***Center manifold assembly does not work*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Superstructure** | Damaged (replace) |
| **Limit switch** | Damaged (replace) |
| **Electric solenoid** | Burned out (replace) |
| **Fuses** | Blown (turn power *OFF* and pull <u>out</u> of electrical panel to check) |
| **Relay(s)** | Need to be tightened or replaced |
| **Overload** | Tripped (reset)<br>Chain jammed<br>Brake not releasing |

**Fig. 7 - 7: Troubleshooting: Center Manifold Assembly Does Not Work**

| ***Problem:*** | ***Center manifold light does not illuminate*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Selector switch** | Not set to *auto* or *manual* (manifold at *home* position) |
| **Switch light bulb** | Burned out (replace) |

**Fig. 7 - 8: Troubleshooting: Center Manifold Light Does Not Illuminate**

# 3. Chemical Conductivity Controller

After you have determined an effective chemical concentration, as described in chapters *"Overview"* and *"Advanced Operations: Process-Control,"* you must monitor and maintain that concentration to provide consistent cleaning performance.

The optional Chemical Conductivity Controller automatically monitors and maintains chemical concentration by electronically measuring the (electrolytic) conductivity of the cleaning solution. This is a useful technique for figuring out when to add more detergent to a high-ionic strength cleaning solution such as those based on salts. (Potassium hydroxide, sodium hydroxide, or sodium metasilicate) This is **not** a useful technique for monitoring high emulsifying cleaners that rely on surfactants for a significant part of the cleaning mechanism.

*Electrolytes* are ionic compounds such as salts, acids, or bases. Added to water, or a water-based (aqueous) solution, they increase its conductivity.

*Conductivity* is defined as the ability of a substance to conduct electric current. All aqueous solutions conduct electricity to some degree. The addition of electrolytes increases conductivity. Since conductive liquids consist of ionic compounds (electrolytes) dissolved in water, more ions in the solution indicate higher conductivity. In applications using very pure to very concentrated chemical solutions, a rising conductivity reading indicates a generally increasing chemical concentration.

Thus, a simple electronic conductivity test can measure the makeup of a ionic solution and indicate its approximate chemical concentration. Unfortunately, compounds other than cleaning chemicals affect the conductivity of the solution. (These compounds include iron oxide (rust) and carbon, both commonly found in most washing applications.) And some cleaning compounds are not conductive. Conductivity measuring systems provide an *estimate* of the strength of the chemical in the solution by measuring the *relative* conductivity of the solution.

Conductivity is expressed in millionths of a Siemen:
microSiemens/cm, or μS/cm. One mS/cm equals 1000 μS/cm.

Contact your chemical supplier for a chart of conductivity vs. concentration for your chemical and to determine if conductivity measurement is an appropriate technique for controlling the concentration of your solution.

# 3.1. Theory of Operation

The Chemical Conductivity Controller system consists of the following:

- Conductivity controller
- Electrode-probe
- Peristaltic pump
- Tubing

For the system to function properly, the concentration of your chemical must be proportional to its conductivity.

The system measures conductivity with electronics connected to a *probe* immersed in the washer's cleaning solution. A concentrated chemical is added by a pump to maintain the conductivity of the solution at the selected set point.

The *conductivity controller* uses a set point for the minimum allowable conductivity. When the *electrode probe* senses that **conductivity has fallen below the set point** you have selected, it closes a relay. If the relay closes while the wash pump is operating, the *peristaltic pump* activates and pumps concentrated chemical solution into the washer's reservoir. Concentrate is only added during the wash cycle, so that mixing occurs. When the probe senses that **conductivity has risen above the set point**, the controller relay opens. This prevents the peristaltic pump from adding concentrate.

The *peristaltic pump* turns rollers, which squeeze concentrate through the precision-bore, *high-tolerance tubing* in a wave-like motion, acting like a positive-displacement pump. The concentrate comes in contact *only* with the tubing, *not* the pump. The pump is self-priming and non-siphoning.

The probe is mounted to the end of a tube. This tube is used to insert the probe into the pump suction tube. The probe can be removed without draining the washer.

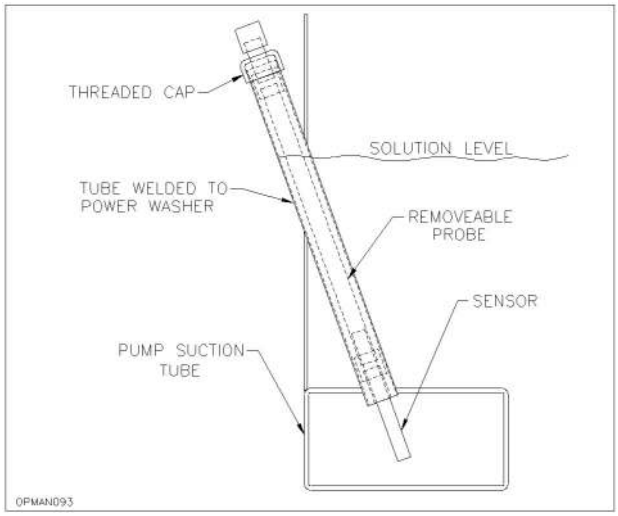



**Fig. 7 - 9: Chemical Conductivity Probe**

## *Chemical Management*

When a washer is first put into service, it is easy to compute the concentration of the cleaning compound because you started with a fixed volume of water and added a known quantity of chemical. After you begin using the washer, however, you can only *estimate* the chemical concentration -- until you drain the washer, clean it out, and recharge it with fresh water and chemical.

There are two commonly used estimating tools:

- Conductivity measuring systems
- Titration kits

### Conductivity Measurement

A conductivity measuring system measures the strength of a fixed electrical current flowing between two or more electrodes that are held at a fixed distance. Since the addition of cleaning compounds (chemical) to water changes the capacity of water to conduct electricity, conductivity measuring systems can provide an *estimate* of the strength of the chemical in the solution by measuring the *relative* conductivity of the solution.

Unfortunately, compounds other than cleaning chemicals also affect the conductivity of the solution in the washer. These compounds include iron oxide (rust) and carbon, both commonly found in most washing applications.

This means that while conductivity measuring systems can be used as a control point, this is done with the understanding that the oils, greases, metal particles, and other contaminants that are byproducts of the cleaning process affect conductivity.

Thus, the only true measure of chemical concentration is to use titration tests in conjunction with conductivity measurements to determine a correlation. Once you know the correlation, you can get a fairly accurate estimate of chemical concentration in the solution by using a conductivity measuring system.

### Titration

Titration is the estimation of the strength of a compound by measuring the amount of another compound of known strength that is required to produce an observable reaction.

Almost all titration kits supplied with cleaning compounds use phenolphthalein (indicator P) as a reactant, and an acid (hydrochloric or phosphoric) as a neutralizer. The indicator P turns red or pink or blue when added to a sample of the solution. By counting the drops of acid it takes to turn the solution back to its original color, you can arrive at a good *estimate* of the chemical concentration.

**Correlating Titration Results and Conductivity Measurements**

To measure the chemical concentration in your washer's cleaning solution, titrate the solution once a week and perform a conductivity test at the same time. Your objective is to learn how chemical concentration and conductivity vary from wash to wash. Set up a graph that shows the correct concentration and then graph the actual variance in concentration and conductivity.

After several weeks of testing and graphing, you should see a pattern -- this is the correlation between chemical concentration and conductivity. Given any conductivity reading on your graph, you will most likely see a difference between the ideal and the actual chemical concentration of the solution. Use this "compensation factor" to know how to adjust chemical concentration based on conductivity readings.

**Conclusion**

After you have developed a correlation between chemical concentration (the results of titration) and conductivity measurement testing, you can use a conductivity measuring system to provide a *close estimate* of the strength of the chemical in the solution.

At this point, conductivity measurement can be used for one of two purposes:

- As an indicator of the need to titrate.
- As an indicator of the need to add chemicals.

If the correlation between conductivity and titrated concentration is close enough for the purposes of the operator, then titration should only be used as a periodic check on the conductivity measuring system.

# 3.2. Installation

The Chemical Conductivity Controller system is factory-installed and shipped ready for use.

The electrode-probe arrives installed in the washer, based on your specifications.

# 3.3. Operations

*Follow this procedure*:

1. Check the *conductivity reading* on the *controller panel* at the chemical concentration recommended by your chemical supplier or developed through process-control testing (refer to chapter *"Advanced Operations: Process-Control."*)

2. Adjust the *LO set point* to this reading.

> ***NOTE**:* Refer to the controller-vendor-supplied manual for instructions on changing ranges and setting set points.

3. Insert the *peristaltic pump suction tube* into a *barrel* of 50%-diluted chemical concentrate.

> ***NOTE:*** The peristaltic pump only pumps during wash cycles when chemical is needed.

# 3.4. Maintenance

Every 160 hours of operation:

- *Monitor* chemical usage by the peristaltic pump. Replace the empty barrel after the concentrate has been completely used.

- *Test* peristaltic pump operation:
    1. Set the controller *LO set point* 10% below the actual solution conductivity.
    2. Run a wash cycle.
    3. Verify that the pump is pumping chemical into the reservoir.
    4. Re-set the LO set point to your *control set point*.

***Peristaltic Pump and Tubing***

The pump has few moving parts and no seals or valves to clog, clean, or replace. As tubing fatigues (and eventually cracks), move it to a section that has not been under the pump rollers. Then, continue pumping.

When you run low on tubing, order a new spool.

***Sludge Clean-Out***

During sludge clean out, clean the probe thoroughly. Follow the vendor-supplied instructions.

# 3.5. Troubleshooting

This section contains tables on the following problems:

- Peristaltic pump does not pump
- Concentration cannot be maintained

| ***Problem:*** | ***Peristaltic pump does not pump*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Pump tubing** | Cracked (move or replace) |
| **Barrel** | Empty of concentrate (replace) |
| **Power** | Not *ON* |
| **Fuses** | Not intact (remove and measure continuity) |
| **Overloads** | Not all of them are re-set |
| **Probe** | Dirty (clean) |
| **Set point** | Too high (set below readout level) |
| **Pump motor** | Defective (replace) |

**Fig. 7 - 10: Troubleshooting: Peristaltic Pump Does Not Pump**

| ***Problem:*** | ***Conductivity cannot be maintained*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Peristaltic pump tubing** | Cracked (move or replace) |
| **Barrel** | Empty of concentrate (replace) |
| **Conductivity controller** | Set point incorrectly set<br>Defective (replace) |
| **Chemical** | Concentration:<br>Wrong type of chemical<br>Wrong concentration recommended or developed<br>Concentration not proportional to conductivity |

**Fig. 7 - 11: Troubleshooting: Conductivity Cannot Be Maintained**

# *4. Internal Reservoir Cover*

The internal reservoir cover provides the following benefits:

- Safety: Provides a barrier covering the wash solution reservoir. This isolates the operator from accidental contact with the hot wash solution as might occur if someone was to slip and fall.

- Catch: Catches small parts that may loosen during the cleaning cycle and fall from the turntable. The floor prevents the parts from falling into the solution and being lost in the reservoir.

- Insulation: Provides a thermal insulation cover over the reservoir tank. This slows down the heat loss from the reservoir (saves energy) especially when the cabinet door is open.

## 4.1. Theory of Operation

The internal reservoir cover is steel-sheet-supported by angles welded to the cabinet walls above the wash solution reservoir and below the turntable. It funnels all liquid back through an expanded-metal screen area to the reservoir.

The internal reservoir cover is removable for sludge clean out and other maintenance procedures. It is held in place by thumbscrews, which are easily removed and replaced.

## 4.2. Installation

If you purchase the optional internal reservoir cover, your power washer is delivered with the internal reservoir cover factory-installed and ready to use.

## 4.3. Operations

There are no operational procedures for the internal reservoir cover.

***WARNING! Do NOT OVERLOAD the internal reservoir cover or other horizontal surfaces. The internal reservoir cover is intended as a chemical-solution cover ONLY! Horizontal surfaces are NOT designed for walking or standing! Walking on the internal reservoir cover, tank cover, or other horizontal surfaces could result in serious injury or death.***

# 4.4. Maintenance

Clean the internal reservoir cover as required. Pay particular attention to the expanded-metal screen area: be sure that no bolts or other parts, gasket material, or debris clog the screen. **NOTE: If your internal reservoir cover has the optional chip baskets, do not stand on or in the baskets**.

If the expanded-metal screen or the optional chip baskets becomes clogged, the pump(s) may flood the IRC, resulting in cleaning solution or rinse water pouring over the doorframe into the front reservoir. Refer to section *"Troubleshooting."*

# 4.5. Troubleshooting

This section contains tables on the following problems:

- Water leaks over doorframe

| ***Problem:*** | ***Water leaks over doorframe*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Internal Reservoir Cover** | Expanded-metal screen area clogged with bolts or other parts, gasket material, debris (clean screen) |

**Fig. 7 - 12: Troubleshooting: Internal Reservoir Cover: Water Leaks Over Door Frame**

# *5. 50 Hertz Electrical Power*

This option is intended for installation sites that use 50 Hz electrical power instead of 60 Hz. The pump system has been reconfigured using V-belts to drive the pump, enabling a washer powered by 50 Hz to deliver the same performance as one powered by 60 Hz. This results in the same efficiency, pressures, and flows.

All other systems and components are the same. For 50 Hertz with the Variable Frequency Drive (VFD), please see Section 8, Variable Frequency Drive.

## 5.1. Theory of Operation

The pump motor is no longer directly coupled to the pump. This option uses a V-belt drive to recover the loss in rpm and turn the pump at the same rpm it would turn at 60 Hz. The bigger sheave (pulley) is on the pump motor; the smaller, on the pump.

The pump motor is mounted on an adjustable base at the side of the reservoir. This allows for aligning the belt drive as well as tensioning the belt(s). Depending on the horsepower of the pump, the V-belt drive uses 1 to 3 belts.

## 5.2. Installation

This option arrives factory-installed.

## 5.3. Operations

Operations are the same as those for a standard washer.

## 5.4. Maintenance

*After the first 8 hours of operation*, check belt tension and sheave alignment.

**To adjust belt tension,** *follow this procedure:*

1. Remove the *belt guard*.

2. Turn the upper and lower adjusting bolts on the motor's adjustable base to tighten or loosen belts. Turn each of the bolts *exactly* the same number of turns to maintain belt alignment.

3. Use a *belt tension checker* to verify proper tension. **NOTE:** Follow belt-tensioner directions for proper tension adjustment.

> ***NOTE:*** When a properly tensioned belt is running, the tight side of the belt forms a straight line from sheave to sheave. The slack side slightly bows.

**To verify sheave alignment*, follow this procedure***:

1. Remove the *belt guard*.

2. Adjust belt tension.

3. Use a *level* to verify that the motor shaft and the pump shaft are parallel. (This prevents excessive wear of the sheaves and belts.)

4. Be sure that the sheaves are at the same height in the same plane, so that the belts run true.

Every 250 hours of operation:

- Visually inspect belt(s) for wear, and adjust tension as needed.

***General Maintenance***

- Keep belts clean. *Never* use belt dressing! This will damage belts and cause early failure. See www.marttechservices.com for more information

- Be sure that air can circulate freely around the V-belt drive, and that temperatures are moderate. This will extend belt life.

- *Never* cover the expanded metal guards (vents) that protect the V-belt drive.

- Replace belts with original manufacturer's equipment or equivalent.

- Keep extra belts stored in a cool, dark, dry place.

# 5.5. Troubleshooting

This section contains tables on the following problems:

- Squealing sounds from pump area
- No wash cycle (no water pumped): simplex pump system
- Poor cleaning results *or* abnormal pump noise: duplex pump system

| ***Problem:*** | ***50 Hz electrical power -- Squealing sounds from pump area*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Belt(s)** | Slippage (tighten)<br>Worn and frayed (replace) |
| **Sheaves** | Walls worn, with resulting belt slippage (replace) |

**Fig. 7 - 13: Troubleshooting: 50 Hz Electrical Power -- Squealing Sounds from Pump Area**

| ***Problem:*** | ***50 Hz electrical power -- No wash cycle (no water pumped): simplex pump system*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Belt(s)** | Broken (replace) |

**Fig. 7 - 14: Troubleshooting: 50 Hz Electrical Power -- No Wash Cycle (No Water Pumped): Simplex Pump System**

| ***Problem:*** | ***50 Hz electrical power -- Poor cleaning results or abnormal pump noise: duplex pump system*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Main pump belt(s)** | Broken (replace) |
| **Booster pump belt(s)** | Broken (replace)<br>If squeaks,<br>align<br>adjust with belt tensioner to proper setting<br>See www.marttechservices.com for belt adjustment |

**Fig. 7 - 15: Troubleshooting: 50 Hz Electrical Power -- Poor Cleaning Results *or* Abnormal Pump Noise: Duplex Pump System**

# *6. Filters*

The optional *Filters* remove particles as small as 1 micron from the wash solution. If you have purchased this option, your StingRay representative will have worked with you to select a micron rating that best suits your washer's configuration and your applications.

When you purchase replacement filters, be sure the micron-rating is appropriate for your washer's configuration: A filter with extremely fine pores could significantly increase the pressure-differential and overload the capacity of the filter housing, affecting pump pressure and flow rate.

## 6.1. Theory of Operation

The two filter types are:

- Bag
- Cartridge

### ***Filter Types***

**Bag filters** are generally recommended for 50-100 microns, although they can filter down to 1 micron at lower flow rates. Bag filters are less expensive than cartridge filters, easier to change, and re-usable. One filter at a time is inserted into the housing. Bags are constructed of polypropylene, especially selected for reliable performance in a hot, caustic environment.

**Cartridge filters** are rated for 1-50 microns. Multiple filters may be inserted into the housing.

**Filter housings** have a swing-away lid. Filter elements are inserted into the housing from the top. The housing lid is tightened with swing-bolts.

The following table shows micron comparisons to guide you in selecting filters.

**Micron Comparisons**

| ***Substance*** | ***Microns*** |
|---|---|
| Table salt | 100 |
| Human hair (avg. dia.) | 50-70 |
| White blood cell | 25 |
| Talcum powder | 10 |
| Cocoa ... | 8-10 |
| Red blood cell | 8 |
| Bacteria (cocci) | 2 |

**Fig. 7 - 16: Micron Comparisons**

***NOTE**:* The lower limit of visibility to the naked human eye is 40 microns.

### ***Filtering System Configurations***

There are two filtering system configurations. The following diagram shows solution flow:

| | | | | |
|---|---|---|---|---|
| **Wash pump** | ➔ | Filter | ➔ | Manifold (PBM) |
| ***Or*** | | | | |
| **Filter pump** | ➔ | Filter | ➔ | Eductor nozzles (in reservoir) |

The filter-pump-driven system allows for continuous filtering operation.

## 6.2. Installation

The filters are delivered installed, according to the configuration you specified.

## 6.3. Operations

The *wash-pump-driven configuration* is fully automatic and runs during the wash cycle.

**To operate the filter-pump-driven configuration**, *follow this procedure*:

1. Set the *filter-pump timer*, located in the washer's electrical control panel. The standard 5-hour timer is numbered 1-10 (each number represents a 1/2-hour increment). The timer controls the length of time the filter pump operates in *auto* mode, *if* you set the selector switch to *auto* (in the following step).

2. Set the filter pump's *selector switch*, located on the washer's control panel, to one of the following:

    - *Manual:* Activates the filter pump. It will run continuously.

    - *Off:* Turns the filter pump off.

    - *Auto:* Automatically activates the filter pump at the beginning of a wash cycle and runs the filter pump for the time indicated on the *filter-pump timer.*

# 6.4. Maintenance

Every 40 hours of operation:

- Check the filter elements. Replace dirty elements.

If you notice that cleaning results are not as good as usual or that more time is necessary, check the filter elements. If they are dirty, replace them.

If your washer is equipped with the optional pressure-differential gauge, replace the filter when the pressure-differential has increased by 10 PSI (142 kg/cm$^2$) or more.

# 6.5. Troubleshooting

This section contains tables on the following problems:

- Wash load not clean
- Solution leaks from filter cover

| ***Problem:*** | ***Wash load not clean*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Filter** | Dirty (change filter) |

**Fig. 7 - 17: Troubleshooting: Wash Load Not Clean**

| ***Problem:*** | ***Solution leaks from filter cover*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Cover gasket** | Dirty (clean) |
| **Cover clamps** | Loose (tighten) |

**Fig. 7 - 18: Troubleshooting: Solution Leaks from Filter Cover**

# *7. Variable Frequency Drive (VFD)*

The optional *Variable Frequency Drive* is an electronic device that controls pump motor speed. The result is control of pressure and flow output.

## 7.1. Theory of Operation

The StingRay AC variable speed drive provides control of motor speed and torque for energy efficient wash pressure and flow control. The Variable Frequency Drive (VFD) controls the speed of the pump motor thereby adjusting the pressure and flow discharge.

## 7.2. Installation

If you specify that your *Variable Frequency Drive* be mounted on the washer cabinet, no further installation is required.

## 7.3. Operations

The VFD is mounted externally of the main control panel. To make pressure adjustments change the pump motor speed using the digital control panel on the VFD. The VFD allows for fully variable pump pressures using a simple set-point adjustment on the digital readout. Safe guards pre-programmed at the factory limit the adjustments within the normal operating range of the pump.

In addition to providing the pressure adjustment the VFD functions as the pump motor starter with overload protection, provides a soft-start function for reduced amp draw on start-up and provides the automatic pressure equalization on simplex pumps systems to prevent water hammer. The VFD is factory pre-set to 10 seconds to ramp the pump motor from zero to full speed. The overload set-point, APE setting and maximum amp draw are factory preset and not user adjustable.

**To change the Pressure output of the Pump:**

1. Reference the Pressure/Speed graph provided with the documents in your washer to determine the motor speed required for the desired pressure. A sample is shown above.
2. Using the digital control panel on the VFD press the SCREEN TOGGLE BUTTON until Motor Speed (rpm) is shown in the center of the screen (see Fig 7-20)
3. The pump speed may be adjusted at any time whether the pump is operating or not. When the pump is operating, the speed is adjusted with the UP & DOWN BUTTONS. When the pump is “off”; Press the STOP BUTTON and then use the UP & DOWN BUTTONS to adjust the pump to the desired speed.
4. The pump speed is adjustable from 1000 rpm to 3600 rpm
5. The pump operates at the new speed setting until manually changed.

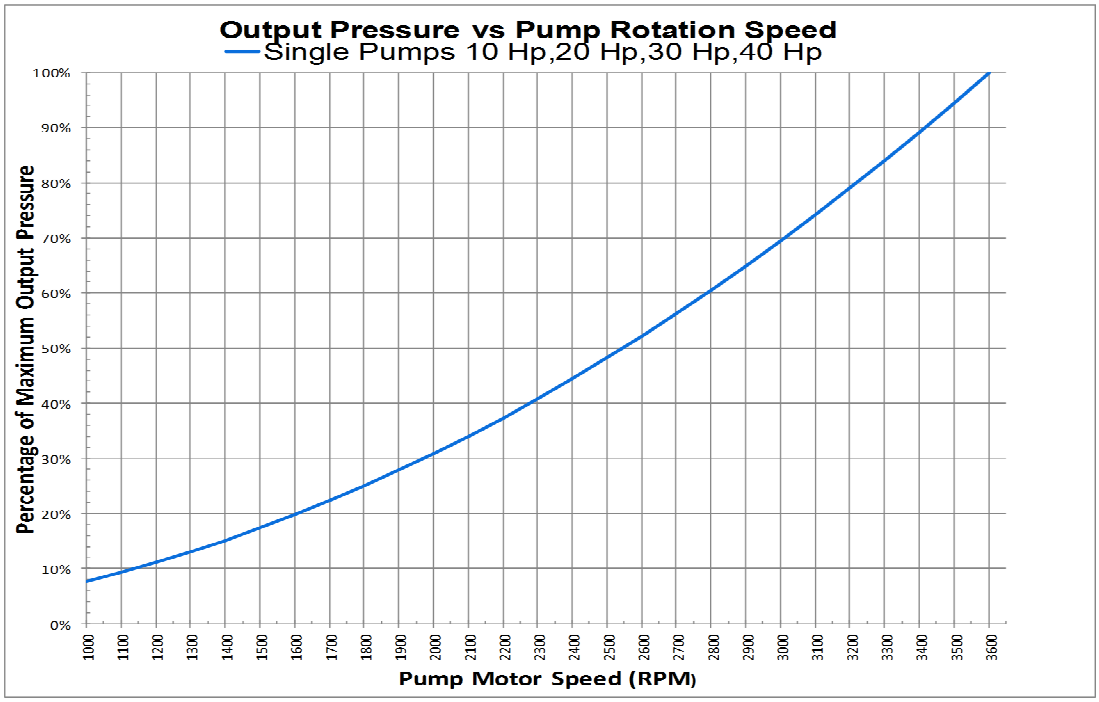



**Fig. 7 - 19: Setting Pump Pressure – Simplex Pump**

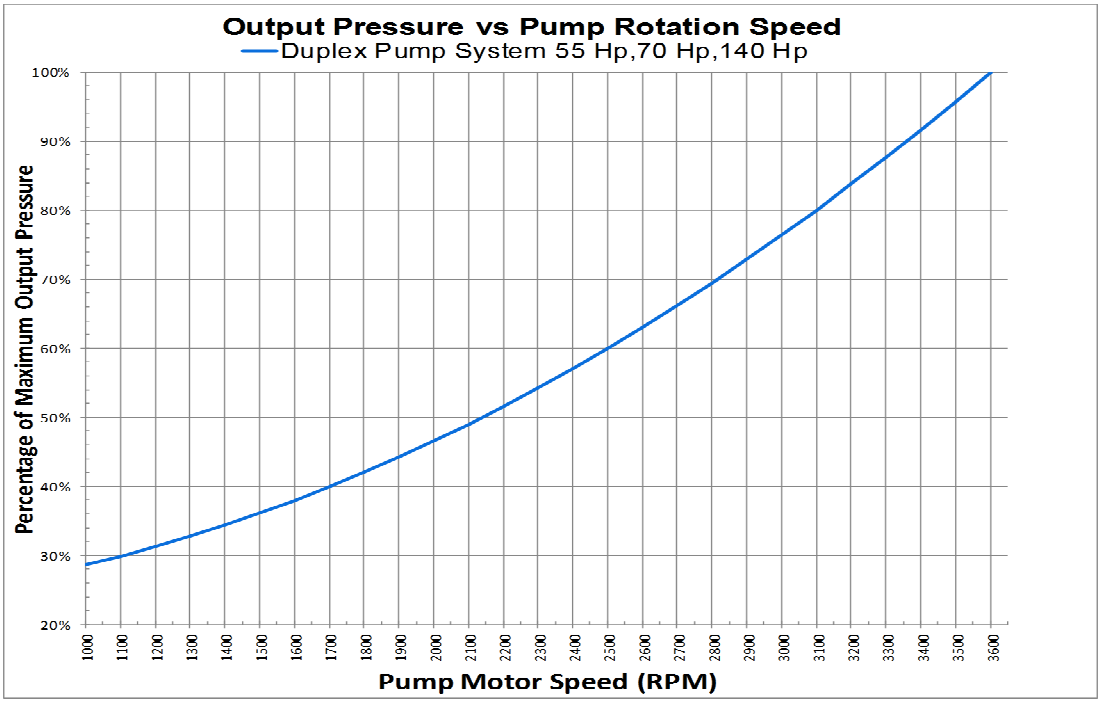



**Fig. 7 - 20: Setting Pump Pressure – Duplex Pump**

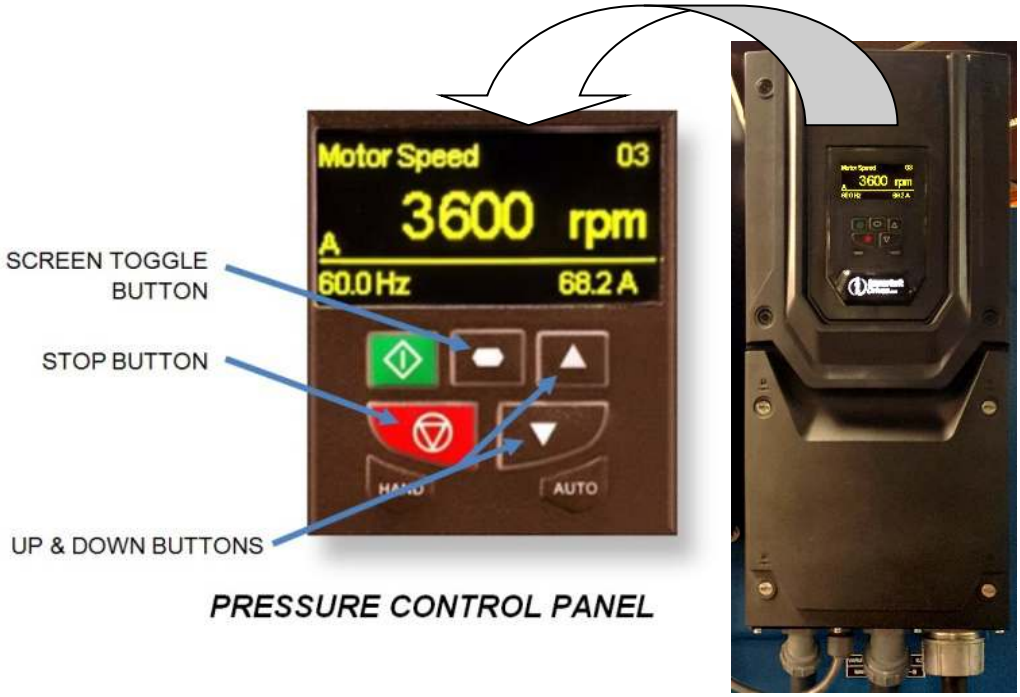



**Fig. 7 - 21: Pressure Control Panel**

# 7.4. Maintenance

Every 6 months:

Clean Heat Sink.

# 7.5. Troubleshooting

This section contains tables on the following problems:

- Pressure Control Panel displays errors.

| ***Problem:*** | ***Pressure Control Panel dispays errors*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Fault Displays:** | |
| **O-I (Over Current)** | Check the motor and motor connection cable for phase-phase and phase-earth short circuits.<br>Check the pump mechanically for a jam, blockage or stalled condition. |
| **It.trp (Overload Trip)** | See *Chapter 6, Fig 6-6.* |
| **O-t (Over Temperature Trip)** | Ensure the drive internal cooling fan is operating.<br>Ensure the cooling airflow path to-and-from the drive is not restricted. |
| **P-loss (Input phase loss)** | Drive requires a 3-phase supply; one input phase has been disconnected or fuse blown. |
| **Fan-F (Cooling fan fault)** | Ensure the drive internal cooling fan is operating. |
| **O-Torq (Exceed max torque)** | Ensure pump is rotating freely. |
| **Out-F (Output phase loss)** | One of the motor output phases is not connectd to the drive. |

**Fig. 7 - 22: Troubleshooting: Pump Motor Does Not Run**

# *8. Hot-Air Blow-Off (HABO)*

The optional Hot-Air Blow-Off (HABO) system "flash"-dries parts by high-velocity, direct blasts of air that blow most of the water off parts. Heat evaporates any remaining water.

All HABO systems are delivered with the following features:

- Heater contactor wired in-line with blower
- Over-temperature protection
- Duct-heater
- TEFC fan motor
- Direct-coupled aluminum, balanced fan blade
- High-velocity conversion nozzles 3 inches (7.6 cm) from the edge of the turntable

## 8.1. Theory of Operation

The HABO system activates after wash and rinse cycles have completed: The fan turns on while the turntable continues to rotate. Air is inducted from outside the washer cabinet by the fan and blown through the electric heating coils. The air picks up heat as it passes around the heating coils. Finally, the heated air is accelerated to high velocity as it travels through the plenum and out the nozzles to blow water off parts on the turntable.

The heating units are sized to provide a minimum of 110° F (43° C) rise above ambient to operating air temperature.

***Steam-Exhaust Fan***

***NOTE****:* The HABO system removes steam using a variable-speed AC-drive centrifugal steam-exhaust fan, which replaces the standard ASE unit. The centrifugal fan differs from the standard unit in two keyways:

- The inlet is at a 90° angle from the outlet.
- The outlet ducting is *square* and connects to a *round* pipe.

Therefore, you must modify the standard installation procedures given in chapter *"Installation"* in this manual to account for these two differences. Refer to the following section, *Installation,* for more information.

The centrifugal fan runs at two speeds:

- *Low speed* provides normal steam exhaust. (It works similar to the auto steam exhaust [ASE] feature).
- *High speed* minimizes steam leakage from the cabinet during HABO.

Refer to the vendor-supplied cutsheet for instructions on setting fan speed.

***Controlling HABO Heat***

Thermocouples in the outside plenum on top of the washer cabinet and a temperature controller inside the electrical control panel control HABO heat.

**NOTE**: The *outside plenum* contains the blower unit, the thermocouples, and the heating element.

A redundant (back-up) heat-source measuring system works in conjunction with a high-level shutdown system to de-activate the HABO system if the heating element should overheat. Refer to section *"Troubleshooting."*

# 8.2. Installation

If you have a HABO system, you must modify standard ASE installation procedures. Refer to the following figures.

StingRay has available as an option flanged transition pieces to adapt the ASE fan to round ducting.

**To install the HABO**, *follow these guidelines*:

1. There are two couplings welded into the ASE fan blade housing. Use one of these couplings to connect a drain. This will allow condensed water vapor to drain back to the washer's drain coupling in the machine pump frame.
2. The output of the ASE fan can be rotated to any direction. Select a direction for the output that puts one of the two drain couplings on the fan in the DOWN position.

3. Remove the fan housing and rotate it to the selected direction.

4. During reassembly, thoroughly caulk all joints of the fan with a good-quality silicone caulk.

   *Tip:* Seal all joints with a 100% pure silicone caulking compound to prevent dripping and leaking from the steam in the exhaust.

   *Tip:* If at all possible, install the ASE fan **outside** to eliminate many of the nuisance dripping problems associated with steam condensing in the fan.

*Tip:* If your planned piping route contains any 90° elbows, install the fan at the elbow.

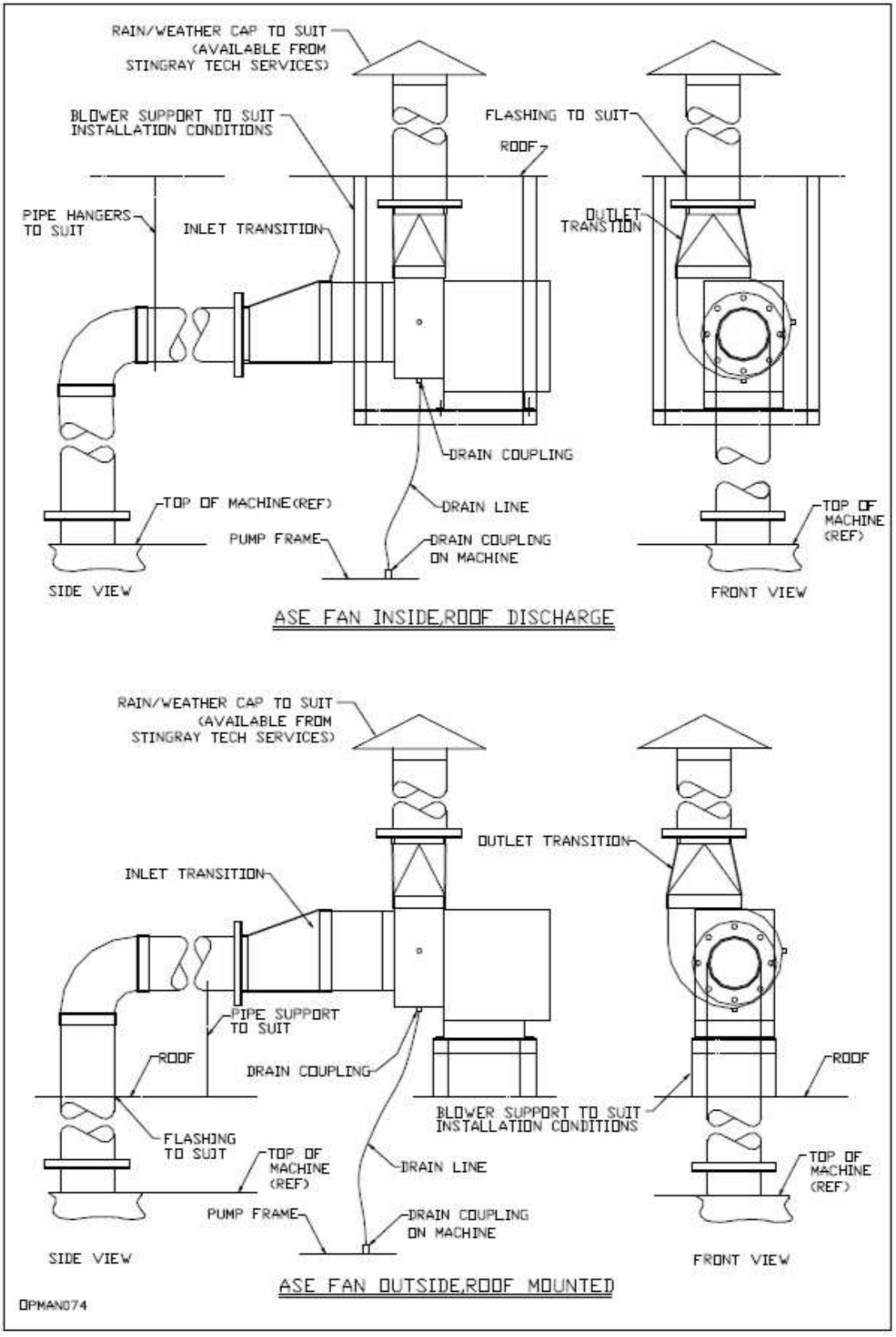



**Fig. 7 - 23: HABO -- ASE Fan Installation**

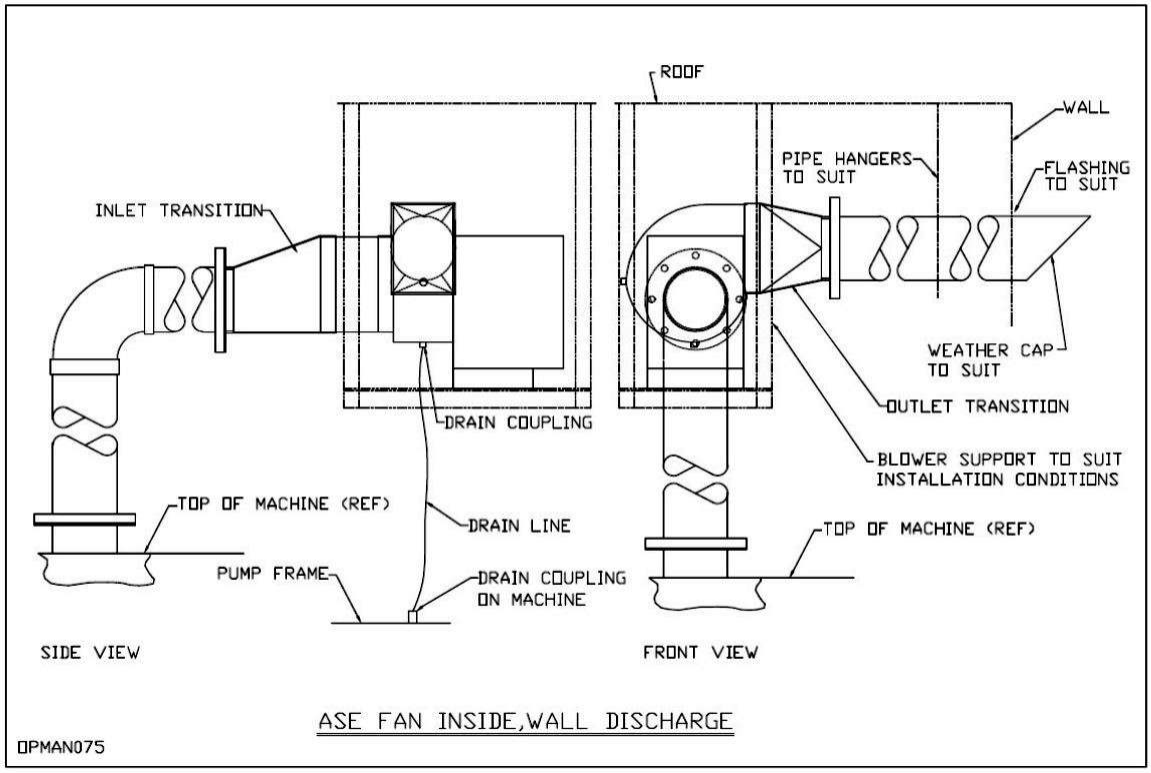



**Fig. 7 - 24: HABO -- ASE Fan Installation**

The HABO *inside plenum*, located in the washer cabinet and shown in the following figure, is always shipped installed.

The *outside plenum*, which contains the blower unit, the thermocouples, and the heating element, is shipped installed on smaller washers. You must install the outside plenum on larger washers.

To install the outside plenum on larger washers, *follow this procedure*:

1. Turn the *main power supply OFF*.
2. Place a bead of sealant on the flange on the machine.
3. Mount the *outside plenum* on the washer *cabinet*.
4. Bolt the *plenum* to *connection points* on the *cabinet*.
5. Connect *heating-element wires* and *blower-motor wires* to the *conduit* on the washer match corresponding wire *labels*.
6. Turn the *main power supply ON*.

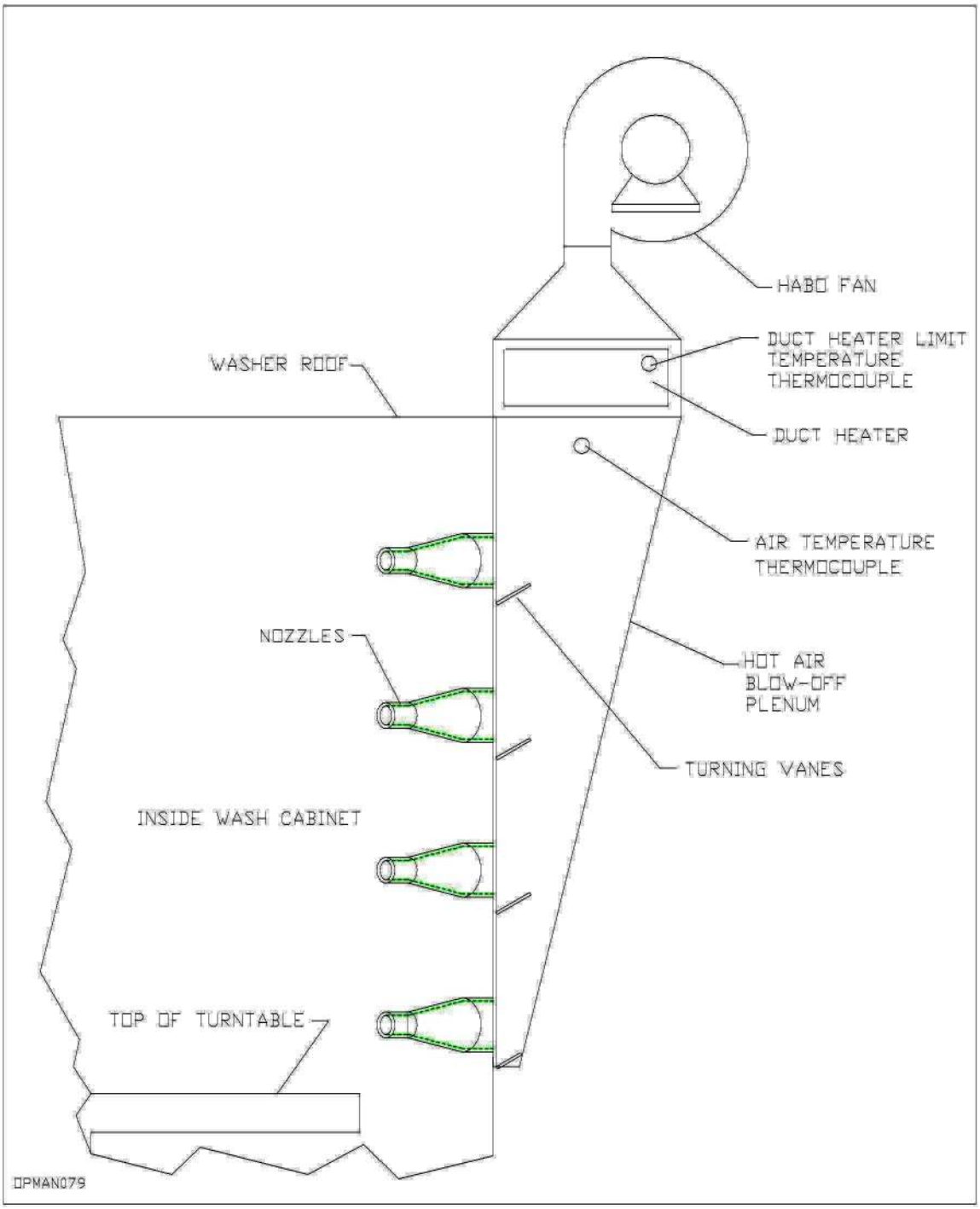



**Fig. 7 - 25: Hot-Air Blow-Off (HABO) Inside Plenum**

# 8.3. Operations

Refer to chapter *"Basic Operations"* for general washer operating procedures.

> ***WARNING! Turn the washer's main power supply OFF before opening the electrical control panel.***

*Follow this procedure:*

1. Position *parts on the turntable* so they will drain as best as possible. (Deep pockets or hidden areas will retain water.)

2. Place *parts as close to the nozzles as possible*. (Air velocity is highest near the outer edge of the turntable.)

3. Set the *HABO temperature controller* to the desired temperature. (The controller is located inside the electrical control panel.)

> ***WARNING! Do NOT set the HABO temperature controller above a maximum set point of 250°F (121°C)! Exceeding 250°F (121°C) may burn out the electric element or trip the over-temp sensor system.***

4. Set the *HABO timer*, located inside the electrical control panel. Each numbered increment on the timer increases HABO duration by 1 minute. The maximum run-time is 10 minutes

5. Set the *HABO auto/off switch*, located on the control panel, to *auto*. This will activate the HABO system after the wash cycle, unless your washer is equipped with the optional auto rinse cycle (ARC). If your washer is so equipped, then the HABO system activates *after* the *rinse cycle*.

6. Refer to the vendor-supplied cutsheet for instructions on setting fan speed.

   If your washer is equipped with HABO, it is also equipped with auto steam exhaust (ASE). An added benefit of HABO is that you can also use the HABO steam-exhaust fan-speed control to adjust the amount of steam exhaust during ASE cycles.

***NOTE:*** If you set the ASE higher than the absolute minimum required for the desired rinse cycle, the steam exhaust wastes energy and raises operating costs. Initially, set the ASE speed control to the lowest setting that will satisfactorily keep steam in the washer during operation. If this setting does not provide an adequate rinse, adjust it higher for longer rinse cycles.

# 8.4. Maintenance

Every 1100 hours of operation:

- **Oil** the HABO blower motor with a standard electric-motor oil, suitable for small electric motors. For example, 10W-50 SAE oil.

  Refer to the vendor-supplied cutsheet for grease/oil points.

- **Inspect and clean** the electric heating coils:
  - Turn the *main power supply OFF*.
  - Remove the *coils* from the *upper plenum*.
  - Carefully clean any debris from the coils.
  - Insert the coils back in the upper plenum.
  - Turn the *main power supply ON*.

\

# 8.5. Troubleshooting

This section contains tables on the following problems:

- HABO heating element begins to overheat

| ***Problem:*** | ***HABO heating element begins to overheat*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Fan** | Not activating (check HABO selector switch, fuses) |
| **Fan motor** | Burned out<br>Blown fuse |
| **Fuses** | Blown (pull out of electrical control panel to check)<br>*Be sure to shut off power **before** checking!* |
| **Temperature controller** | Heat set-point set too high (do not exceed 250°F/ 121° C) |
| **Over-temp** | Tripped (reset the over-temp device) |

**Fig. 7 - 26: Troubleshooting: HABO Heating Element Begins to Overheat**

# 9. Jib Crane – Rear Mount

The optional Rear Mounted Jib Crane is designed to pick up parts in front of the reservoir and place them on the turntable. The crane is rear washer-mounted, with a hoist. The crane is sized by washer, with a load capacity compatible with that of the washer turntable. The maximum load capacity is stenciled on the crane.

**NOTE**: The jib-crane kit with trolley is supplied by StingRay. The hoist is provided by others, not by StingRay.

## 9.1. Theory of Operation

The operator pivots the horizontal lifting jib crane about a column located in the rear-center of the washer. A roller on the jib crane rides on a support over the top of the doorframe. Stops at each end of the support limit the arc-travel of the crane.

## 9.2. Installation

***WARNING! Never cut or weld or add anything to the column or jib-crane structure!***

***WARNING! Use only the bolts provided.***

*Follow this procedure*: (refer to the following two figures)

1. Mount the *column* on the studs welded to the machine cabinet. The studs are located at the rear-center of the washer. There are 2 studs at the top of the washer cabinet and 2 studs at the bottom.

2. Using the hardware provided, install a flat washer, then a lock washer, then a nut on each stud.

3. Tighten the nuts to 200 ft-lbs.

4. Install the boom track on the mounting pads located on top of the door frame.

5. Using the hardware provided, install 8 bolts and lock washers.

6. Make sure the *wheel stops* are located toward the *back of the washer* (not the front).

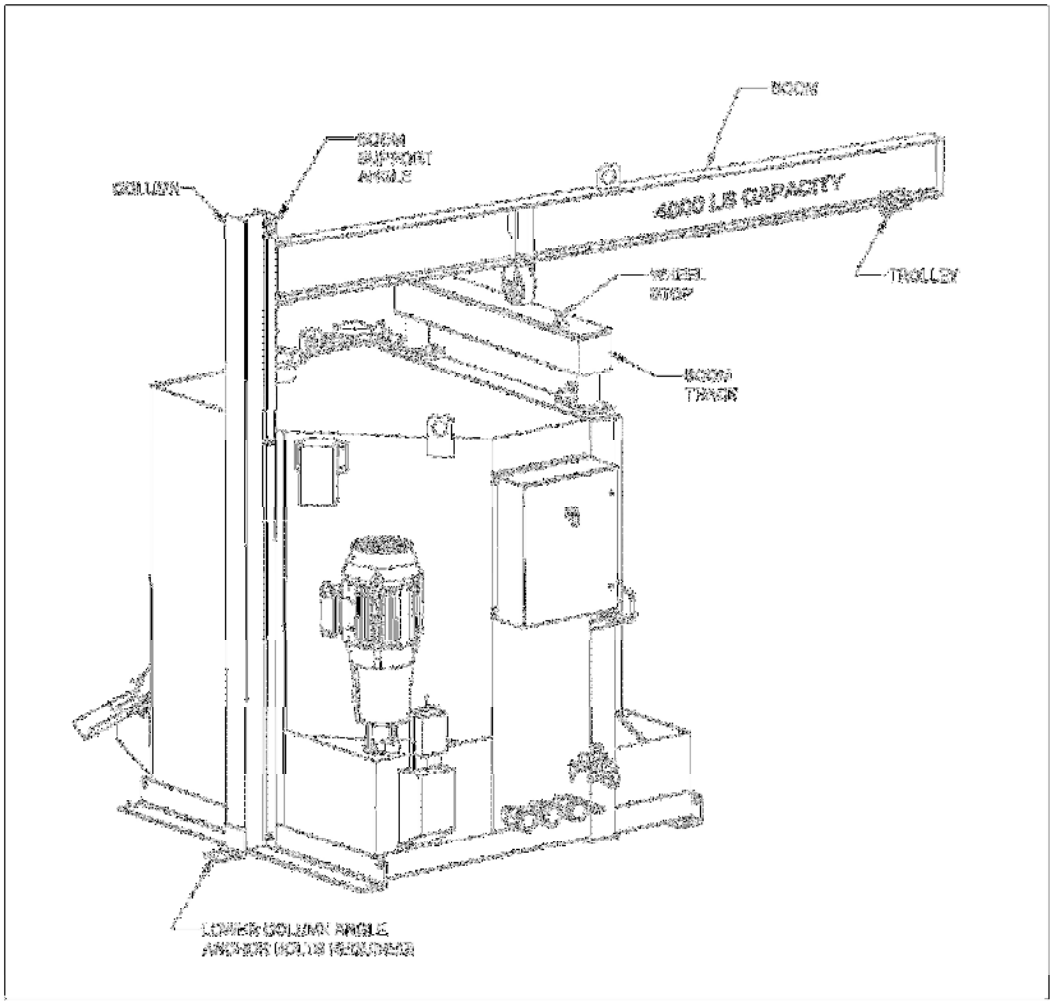



**Fig. 7 - 27: Jib Crane, Rear-Mounted**

7. Follow these instructions to install the boom:

   - Use a lifting method that maintains a level condition for the boom at all times.
   - Lift the boom in the orientation it is used with the wheel on the lower flange, using the lifting lug or a forklift.
   - Raise the boom until the lower boom sharft is slightly above the column divot point.
   - Position the boom shaft over the hole in the bronze bushing.
   - Lower the boom shaft into the bronze bushing on the column while at all times keeping the boom level.

8. Fit **BOTH** *bronze washers* onto the ***TOP*** portion of the boom shaft. It is important that NO washers go on the bottom shaft. (See Fig 7-29)

9. Fit the *Boom Support Angle* onto the *shaft over the TWO washers*. (Verify that there is a bronze bushing in the angle.)

10. Bolt the *Angle* to the *Column* with the hardware provided. Use a flat washer, then lock washer, then a nut on each connection. Tighten to 200 ft-lbs.

11. Follow the trolley installation instructions to install the trolley on the lower flange of the beam.

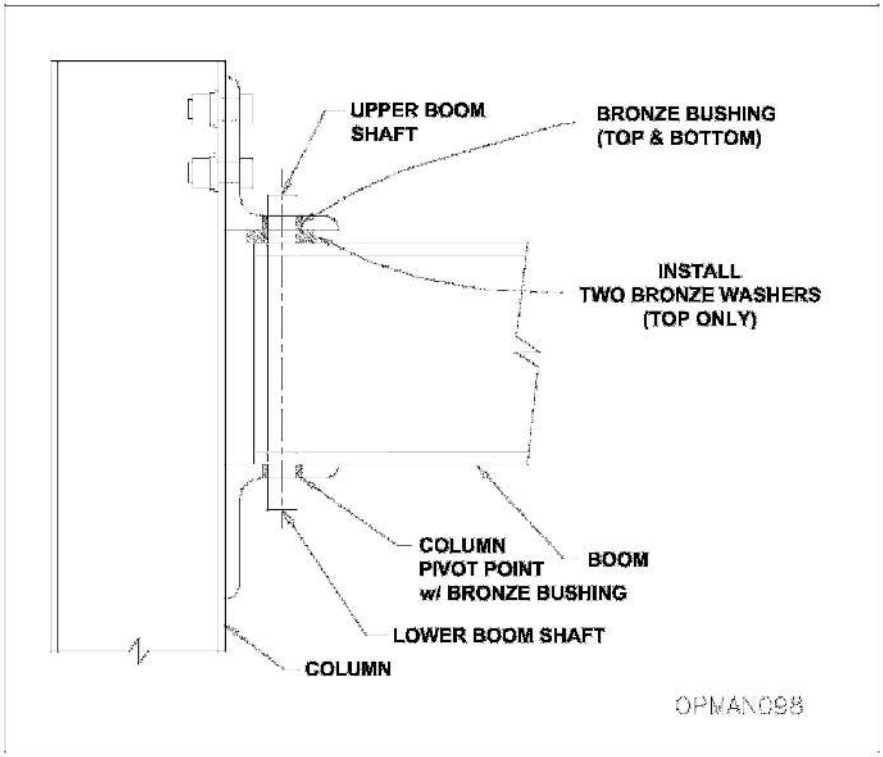



**Fig. 7 - 28: Rear Mounted Jib Crane: Bronze Bushing and Washer Locations**

***Since the crane is a lifting device, be sure to check the installation work:***

1. Swing the *crane* manually -- and *carefully* -- to be sure it moves freely.

2. Check all *bolts* for tightness.

3. Check the *jib-crane wheel* located at the top-front of the cabinet above the door to be sure that the *shaft pin* is actually all the way through the wheel and held in place by the cotter pin.

# 9.3. Operations

***WARNING! Be sure you have anchored the washer to the floor BEFORE using the Jib Crane! DO NOT OPERATE the Jib Crane if you have not anchored the washer to the floor -- the washer could tip over and severely injure or kill the operator!***

***WARNING! Be sure the washer reservoir is filled to capacity with solution BEFORE using the Jib Crane! DO NOT OPERATE the Jib Crane if you have not filled the reservoir to capacity with solution -- the washer could tip over and severely injure or kill the operator!***

To **load a part using the Rear Mounted Jib Crane**, *follow this procedure*:

1. Hold the *door position-lock handle up* and push the door *slowly* away from the cabinet *past the first position lock* (wider than a 90° angle from the washer frame).

2. Move *parts* up to the front reservoir.

3. Attach the *hoist* to a part.

4. Lift the part.

5. Rotate and hold the *door position-lock handle up* and push the door *slowly* toward the cabinet, until it locks in the first (90° angle) position.

6. Move the part over the *center* of the *turntable*.

7. Lower the part to the turntable.

8. Remove the hoist from the part.

To **unload a part from the washer using the Rear Mounted Jib Crane**, *follow this procedure*:

1. Pull the door open *slowly*, until it locks in the *first* position (90° angle from cabinet frame).

2. Use the *"jog" button*, located on the control panel, to *rotate the turntable* for easy access to the *part* you wish to unload.

3. Attach the *hoist* to a *part*.

4. Lift the part.

5. Rotate and hold the *door position-lock handle up* and push the door *slowly* away from the cabinet *past the first position lock* (wider than a 90° angle from the washer frame).

6. Lower the part to the *transporter*.

7. Remove the hoist from the part.

# 9.4. Maintenance

Inspect the jib crane according to OSHA 29CFR Section 1910.179.

Every 160 hours of operation:

- Inspect the bronze washer on the crane shaft to be sure it is in good condition. Replace the washer if it is worn.

**Every year** inspect the jib crane for the following:

- Swing the crane manually -- and carefully -- to be sure it moves freely.
- Check all bolts and parts for tightness.
- Check the jib-crane wheel located at the top-front of the cabinet above the door to be sure that the shaft pin is actually all the way through the wheel and held in place by the cotter pin.
- Verify that there are no permanent distortions; or cracked or corroded members.

Repair or replace parts as needed.

## 9.5. Troubleshooting

This section contains tables on the following problems:

- Crane does not swing freely

| ***Problem:*** | ***Crane does not swing freely*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Bronze washer** | Bronze washer on crane shaft has worn (replace) |
| **Jib-crane wheel track** | Dirty (clean) |

**Fig. 7 - 29: Troubleshooting: Crane Does Not Swing Freely**

# *10. Jib Crane – Door Frame Mount*

The StingRay Door Frame Mounted Jib Crane provides a convenient loading means anchored to the parts washer. The load capacity of this style crane is generally lower than the turntable capacity. The maximum load capacity is indicated on the crane.

The engineered crane, with supplied trolley, provides simple installation of overhead lifting equipment. No foundation or other structural enhancements are needed to the building. Simple bolt-on installation to the parts washer. Small, nimble cranes are faster than motorized bridge cranes.

For lighter loads the highly maneuverable door frame jib crane provides a wide range of picking locations. The lower mass crane and optimum door jamb location reduces operator fatigue and yet still reaches the full turntable as well as the side of the washer. The 180 degree swing range allows storing the jib crane out of the shop isle way and clear of the loading area in front of the washer. This clears the loading area and allows use of a forklift or overhead crane in tandem with the StingRay Jib Crane.

**NOTE**: The jib crane kit with trolley is supplied by StingRay. The hoist is provided by others.

## 10.1. Theory of Operation

The operator pivots the horizontal lifting jib crane about a column located on top of the door frame structure. Stops at each end of the column limit the arc-travel of the crane. Using the jib crane, the operator loads and unloads parts from anywhere on the washer turntable to areas in front of the washer and to the parts washer side.

## 10.2. Installation

***WARNING! Never cut or weld or add anything to the column or jib crane structure!***

***WARNING! Use only the bolts provided.***

***WARNING! Be sure you have anchored the washer to the floor BEFORE using the Jib Crane! DO NOT OPERATE the Jib Crane if you have not anchored the washer to the floor -- the washer could tip over and severely injure or kill the operator!***

*Follow this procedure*: (refer to the following two figures)


**Fig. 7 - 30: Jib Crane Component Parts**

1. Mount the *column* on the anchoring pad located over the pillar on the top of the door frame header using the *bolts* provided. There are 4 bolts going through the column flange into the pad on the top of the washer cabinet. Locate the post such that the lower pivot faces forward.

2. Place *lock washers* on the bolts, insert then tighten the *bolts.*

3. Mount the *right hand brace on the pad located on the door frame header and to the vertical column using lock washers and bolts provided.*

4. Mount the rear turnbuckle from the back of the washer cabinet to the vertical column using lock washers and bolts provided.

5. Verify the column is plumb with a bubble level. Adjust turnbuckle as required.

6. Lift the horizontal crane using an overhead crane or a forklift such that crane is lifted horizontally.

7. Install the two bronze thrust washers on the LOWER crane shaft and lower the crane so the shaft enters into the lower pivot point on the column. Make sure the crane remains level at all times and does not torque the lower pivot bushing.

8. Position the upper pivot plate on top of the column and over the upper crane shaft. NOTE: There are no bronze washers on the upper shaft.

9. Install the 2 anchoring bolts to hold the pivot plate in place. Torque all bolts to specified torque (See Fig. 7-32).

10. Release crane lifting equipment and test crane swing.

11. Install Trolley per instructions included from the manufacturer.

12. Attach your hoist to the trolley. Follow the hoist and trolley manufacturer's instructions.

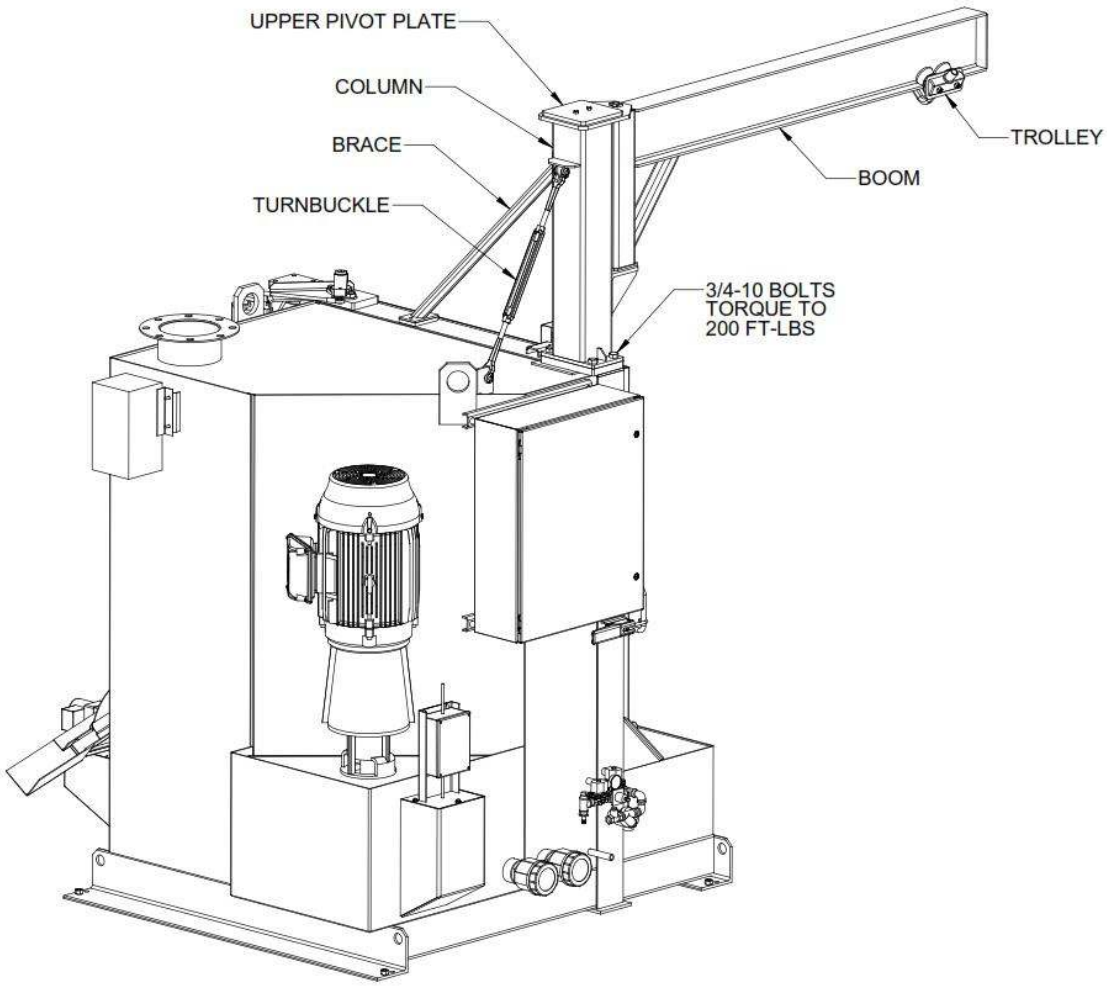



**Fig. 7 - 31: Washer Jib Crane, Door Frame Mount**

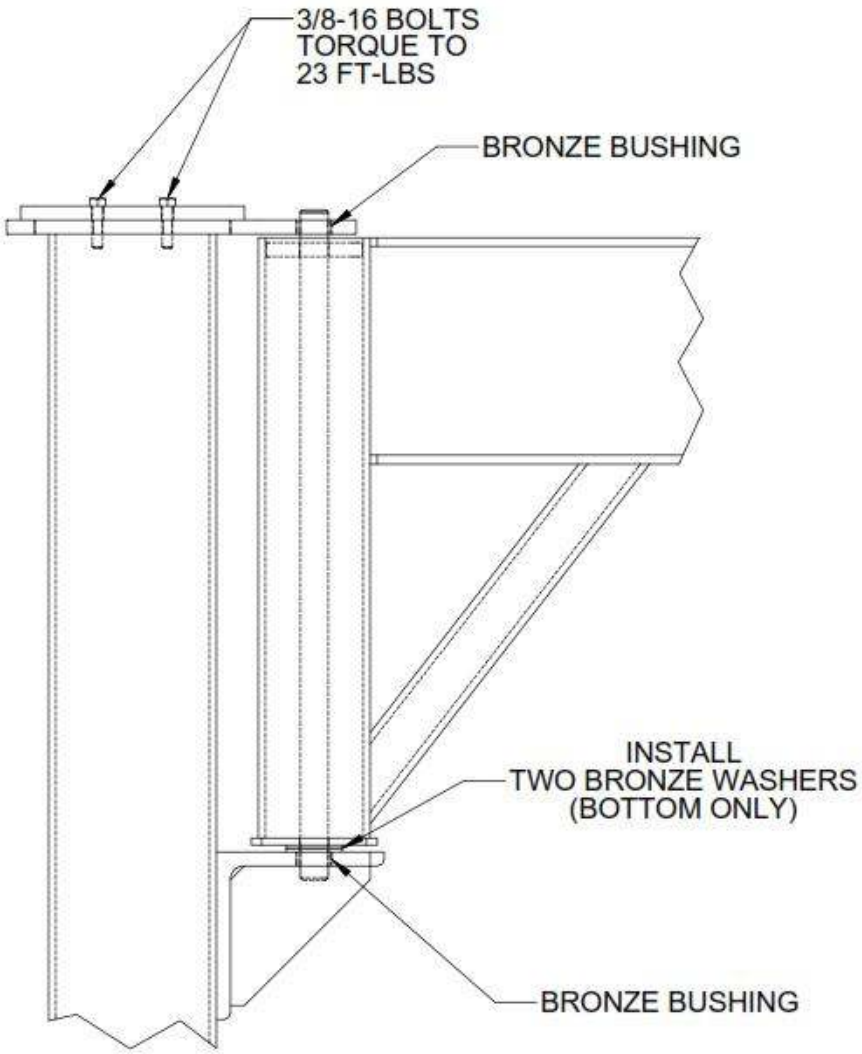



**Fig. 7 - 32: Jib Crane: Thrust Washers Location**

***The Jib Crane is a lifting device, be sure to check the installation work:***

1. Swing the *crane* manually -- and *carefully* --verifing it moves freely. It should stay in the position when released.
2. Check all *bolts* for tightness with torque wrench.
3. Check the *jib crane pivot points for proper installation of thrust washers* located at the top-front of the cabinet above the door. Verify that the bushing is in place on both pivot points.

# 10.3. Operations

***WARNING! Be sure the washer reservoir is filled to the solution set point BEFORE using the Jib Crane! DO NOT OPERATE the Jib Crane if you have not filled the reservoir to capacity with solution -- the washer could tip over and severely injure or kill the operator!***

To **load a part using the Jib Crane**, *follow this procedure*:

1. Hold the *door position-lock handle up* and push the door *slowly* away from the cabinet *to the first position lock*.
2. Move *parts* up to the front reservoir.
3. Attach the *hoist* to a part.
4. Lift the part.
5. Move the part over the *center* of the *turntable*.
6. Lower the part to the turntable.
7. Remove the hoist from the part.

To **unload a part from the washer using the Jib Crane, Follow instructions in reverse for loading.**

# 10.4. Maintenance

Inspect the jib crane according to OSHA 29CFR Section 1910.179.
Every 160 hours of operation:

- Inspect the bronze washers on the lower crane shaft to be sure they are in good condition. Replace washers if worn.
- Lubricate the bronze washers on the crane shaft and the shaft bushings with a good quality lubricating oil.

Every year inspect the jib crane for the following:

- Swing the crane manually -- and carefully -- to be sure it moves freely.
- Check all bolts and parts for tightness.
- Verify that there are no permanent distortions; or cracked or corroded members.

Repair or replace parts as needed.

# 10.5. Troubleshooting

This section contains tables on the following problems:

- Crane does not swing freely

| ***Problem:*** | ***Crane does not swing freely*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Bronze washers**<br>**Levelness** | Bronze washers on crane shaft are worn (replace)<br>Verify and adjust by shimming or turnbuckle adjustment that the unloaded crane is completely horizontal in a position facing forward and with the crane positioned at 90 degrees to the washer cabinet. |

**Fig. 7 - 33: Troubleshooting: Crane Does Not Swing Freely**

# 11. Oil Skimmer

The optional Oil Skimmer removes from the surface of the power washer's sump floating oils, greases, sludge, fatty acids, and other contaminants that cling to the wheel. These contaminants cling to the rotating skimmer wheel and are then scraped off into a container by spring-loaded wiper blades. Water is not removed.

The skimmer provides these benefits:

- Extension of cleaning-solution life
- Better cleaning results
- Reclamation of oil in many cases

## 11.1. Theory of Operation

The Oil Skimmer is mounted in a small box on the side of the power washer cabinet. Refer to the following figure.

**Skimmer Assembly**: The skimmer is electrically connected to the washer by a standard 120V 3-prong grounded plug. It is operated by a single-phase, 60-cycle gear motor. The skimmer is lightweight and has only one moving part.

The skimmer's *manual/off/auto* switch is located on the washer's control panel.

**Skimmer Function**: The lower part of the skimmer wheel is submerged in the solution. As the wheel rotates, it picks up oil and other clinging contaminants from the surface of the solution. The contaminants are collected in the run-off trough and directed to a suitable disposal container. The skimmer will remove up to 30 gallons (114 liters) of contaminants each hour.

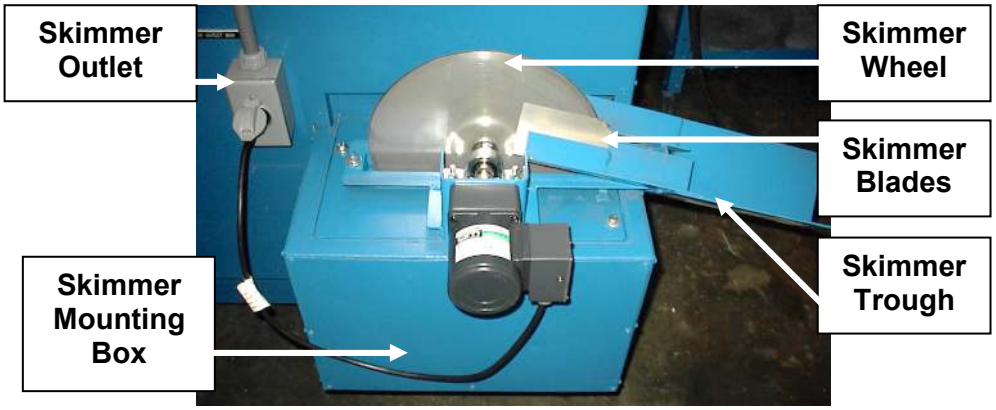



**Fig. 7 - 34: Oil Skimmer Assembly**

## 11.2. Installation

*Follow this procedure*:

1. Unpack the *skimmer assembly* from the turntable inside the washer cabinet.

2. Set the *assembly* into the *skimmer box*.

3. Tighten the *wing nut*.

4. Attach the *grounded plug to the outlet* on the *washer*.

## 11.3. Operations

The Oil Skimmer is designed to operate when the washer is in use, *or* after hours, when the washer is in "shut-down" (*off*) mode.

**To operate the Oil Skimmer,** *follow this procedure*:

1. Set the skimmer's *selector switch*, located on the washer's control panel, to one of the following:

    - *Manual:* Activates the skimmer. It will run continuously.

    - *Off:* Turns the skimmer off.

- *Auto:* Automatically activates and runs the skimmer according to the program set for circuit #2 of the 7-day clock.

> ***NOTE**:* You *must* program the 7-day clock's circuit #2 for *ON/OFF* times and set the skimmer's selector switch to *auto.*

***NOTE:*** Oil skimming works best when the emulsified oils are allowed time to float and collect on the surface of the solution. Program your 7-day clock circuit #2 to run the Oil Skimmer several hours after washer shutdown in order to achieve the best oil-skimming results. Also, some defoamers float on the surface at higher temperatures. By skimming when the solution is cooler, less defoamer will be skimmed off with the oils.

# 11.4. Maintenance

**Every 40 hours of operation:**

- **Clean** the wheel and frame. If necessary, remove the skimmer assembly and box cover to clean out any sludge in the box.

**During sludge clean out:**

- **Clean** the wheel and frame. If necessary, remove the skimmer assembly and box cover to clean sludge out of the box.

Refer to chapter *"Maintenance"* for more information on sludge clean out.

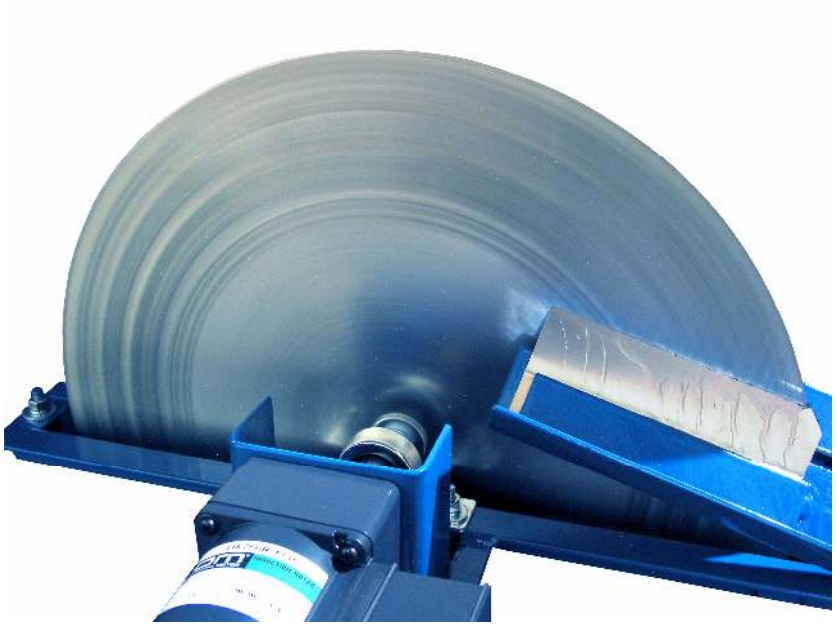
# 11.5. Troubleshooting

This section contains tables on the following problems:

- Skimmer-wheel does not skim

| ***Problem:*** | ***Skimmer-wheel does not skim*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Drain trough** | Clogged |
| **Blades** | Not contacting wheel:<br>Bend to adjust<br>Replace if worn |
| **Wheel** | Not turning (check/tighten shaft nuts) |
| **Motor** | Motor not turning (115 V):<br>Fuse needs to be replaced<br>Overload tripped<br>Wires need to be tightened<br>Motor needs to be replaced |

**Fig. 7 - 35: Troubleshooting: Skimmer-Wheel Does Not Skim**



# 12. Oil Coalescer

The *Oil Coalescer* is an oil/water separator that uses gravity separation techniques to separate waste oil from aqueous parts washer cleaning solution. The system removes oil to a lower concentration than a disc oil skimmer.

## 12.1. Theory of Operation

The *Oil Coalescer* is a continuous process device. It can run during washing as well as during idle periods. The system has a floating suction head located in the washer reservoir and a processing chamber mounted to the outside of the washer. Inside the processing chamber is a separation reservoir, an overflow reservoir, and a coalescer media pack.

The floating suction head removes free-floating oils from the parts washer surface with a diaphragm pump. The pump discharges the oil concentrated solution into the coalescing chamber top. The solution travels down the chamber through the coalescer media to the overflow chamber.

In the chamber, the coalescing media attracts and agglomerates small oil droplets until they are large globules and buoyant enough to float to the surface. The adjustable weir removes accumulated oil from the surface that drains to a container next to the washer for disposal.

Cleaned solution is returned to the aqueous parts washer reservoir. Bottom drain allows removal of any accumulated solids that sink. Coalescing efficiency is improved during periods when washer solutions are cooler such as non-production hours. Non-emulsifying parts washing cleaners take maximum advantage of coalescer technology.

## 12.2. Installation

The Oil Coalescer is factory-installed. A compressed air supply is required for operation.

1. Provide and install a 1/2-inch-diameter (13 mm) compressed-air line to the washer air –inlet. **Note:** If your washer uses compressed air for other functions there is one common connection and you may have already installed the required compressed air-line. An additional air-line is NOT required. (The incoming pressure range should be between 60-125 PSIG 414-860 kilopascals).

2. Connect an air filter in-line with the washer's compressed air inlet. **Note:** The compressed air inlet is a 1/2 inch NPT fitting. The in-line filter is suppled by others.

# 12.3. Operations

***Follow this procedure*:**

1. Close the pump speed control valve attached to the pump.
2. Set the coalescer regulator pressure to 60 psi.
3. Open the pump speed control valve two full turns, stopping at 0.
4. Place the oil discharge hose into a 5 gallon collection bucket or other suitable container (customer supplied).
5. Ensure the top of the floating suction head pipe is approximately 1/8" below the surface of the reservoir water. (Adjustments should be made when reservoir water is calm at the surface).
    a. Adjusting heights are accomplished by raising the suction head float balls to lower the suction head or by lowering the suction head float balls to raise the suction head.
    b. Loosen the nuts of the suction head float balls, adjust both float balls to be of equal height, retighten the nuts, re-install the float ball assembly, and check for proper height (approximately 1/8" below reservoir water surface).
6. Set Coalescer panel switch to "Manual" to start diaphragm pump. Allow pump to fill the oil coalescer collection chamber. (Pump is self-priming.)
7. Adjust the water level to the top of the water level plate by screwing the water weir up or down (see Fig. 7-36). (**Note:** It is important to not allow the water to flow across the top of the water level plate).
8. Adjust the oil weir to a height of 1/8" to 1/4" above the water level. (This will allow the oil to collect on top of the water and flow to the collection bucket.)

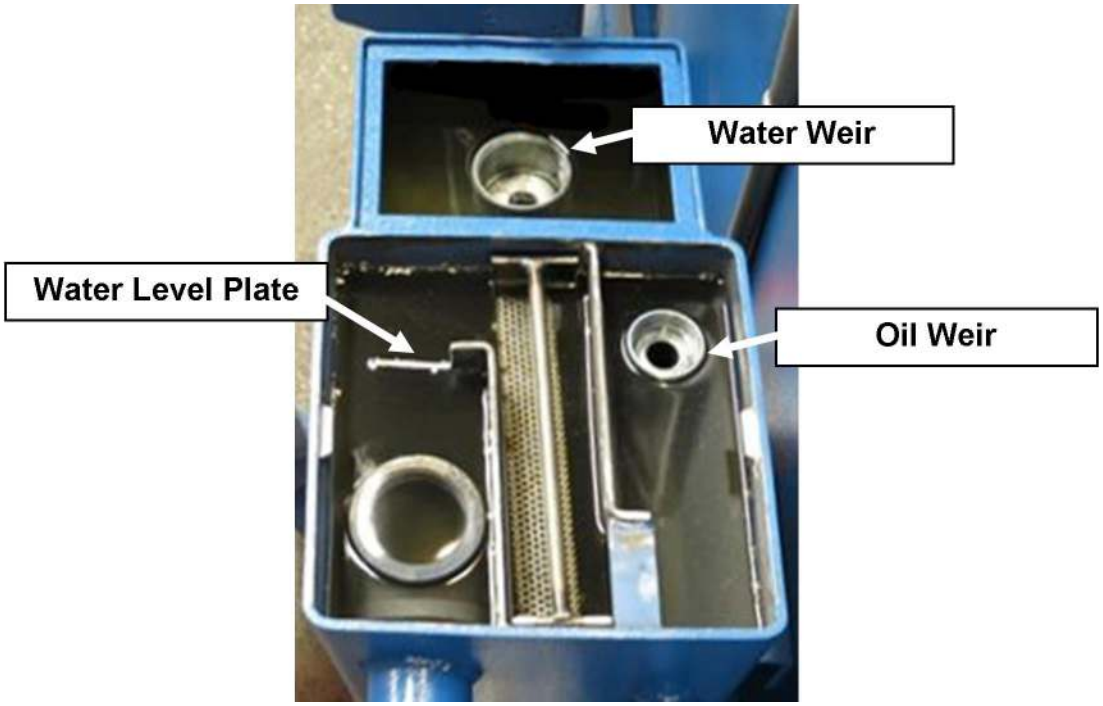



**Fig. 7 - 36: Oil Coalescer Collection Chamber**

## 12.4. Maintenance

**Oil Coalescer Pack:** Clean the oil coalescer pack weekly to remove sludge, sediment, and debris. Depending on the type of cleaning and the number of cleaning cycles, the coalescer pack may require more frequent inspection and cleaning.

1. Weekly (minimum) the coalescer pack should be visually inspected for sludge, sediment, and debris.
2. Clean visible sludge, sediment, and debris that cover more than 50% of the coalescer pack. Follow these steps:
    a. Turn off the oil coalescer.
    b. Remove the coalescer pack by sliding up and out.
    c. Place coalescer pack in the parts washer for one wash cycle.
    d. Re-install the coalescer pack.
    e. Turn on the oil coalescer.
    f. Adjust water and oil flow in accordance with the operating instructions.

**Oil Coalescer Collection Chamber:** Clean the coalescer collection chamber during the same intervals as the machine wash reservoir. Follow these steps:

1. Remove the oil coalescer pack.
    a. Deactivate the oil coalescer.
    b. Remove the coalescer pack by sliding up and out.
    c. Place in the parts washer for one wash cycle.
2. Follow customer washer lockout tag-out procedures.
3. Remove the drain plug.
4. Drain oil coalescer. (Approximately 15 gallons).
5. Rinse/clean the interior of the coalescer collection chamber. Ensure that all sludge, sediment, and debris are removed.
6. Install the drain plug.
7. Install the oil coalescer pack.
8. Fill chamber and adjust water and oil weirs in accordance with the operating instructions.

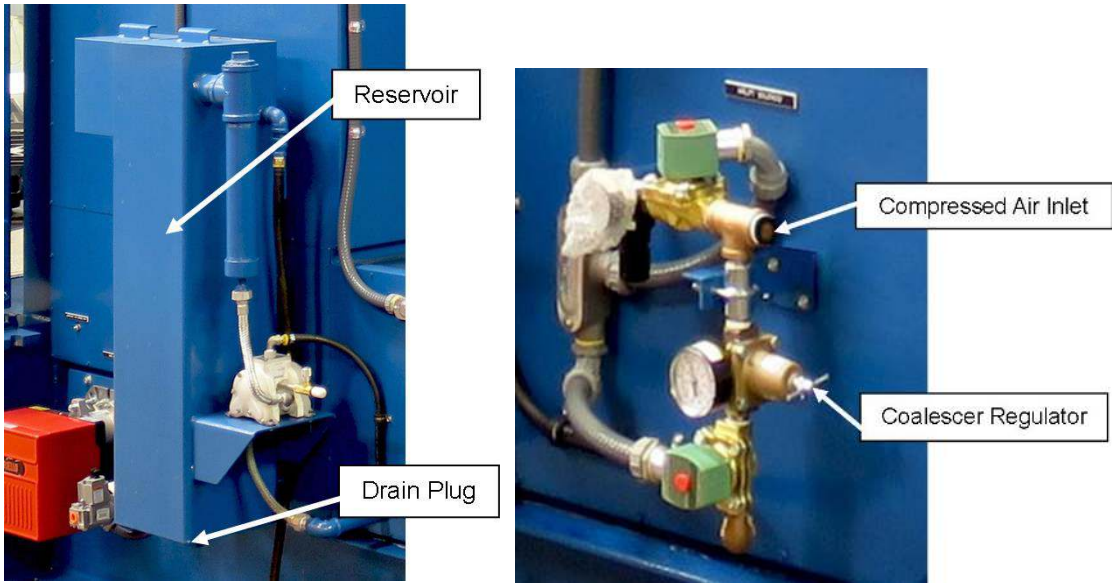



**Fig. 7 - 37: Oil Coalescer Reservoir and Regulator**

**Pump Suction Filter and Y-strainer:** Clean the pump suction filter during the same intervals as the machine wash reservoir. Follow these steps:

1. Remove screen from Y-strainer by unscrewing the outer screen plug.
2. Clean screen and inside of Y-strainer.
3. Apply new PTFE tape to plug.
4. Install screen and tighten plug.

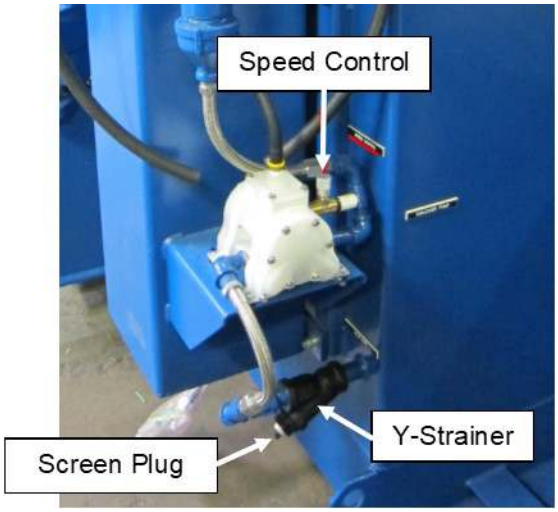



**Fig. 7 - 38: Oil Coalescer Pump Suction Filter**

**Floating Suction Head (Float Balls):** Inspect and clean the suction head float balls weekly (minimum).

1. Visually inspect the float balls for sludge and debris accumulation.
2. Slide suction head float assembly up and off the suction tube.
3. Secure the suction head float assembly in the parts washer and wash for one cycle.
4. Re-install suction head float assembly and ensure the suction head slides freely along the suction tube.

.

# 12.5. Troubleshooting

Your Oil Coalescer is designed and tested to provide many years of trouble free performance. Should you encounter operational trouble, the following provides technical reference for troubleshooting.

| ***Problem:*** | ***Pump not pumping*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Air Supply** | Check air supply |
| **Floating Suction Head** | Adjusted too high (readjust) |
| **Air Discharge Muffler** | Plugged (clear) |
| **Air-pressure** | Too Low (check air-supply system) |
| **Pump Speed Control** | Not opened properly (open) |
| **Diaphragm Pump** | Plugged with debris (clear) |
| **Floating Suction Head** | Clogged with debris or sludge (clear) |

**Fig. 7 - 39: Troubleshooting: Oil Coalescer Pump Not Pumping**

| ***Problem:*** | ***Excessive water removed with oil*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Oil Weir** | Too close to or below water level (readjust) |
| **Pump Speed Control** | Adjusted too high (readjust) |

**Fig. 7 - 40: Troubleshooting: Excessive Water Removed with Oil**

| ***Problem:*** | ***Excessive air being pumped into oil*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Pump Speed Control** | Adjusted too high (readjust) |
| **Floating Suction Head** | Adjusted too high (readjust) |

**Fig. 7 - 41: Troubleshooting: Excessive Air Pumped into Oil Coalescer Chamber**

| ***Problem:*** | ***Cleaned Solution not draining back into washer reservoir*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Water Weir** | Adjusted too high (readjust) |
| **Drain Tube to Washer Reservoir** | Clogged (unclog) |

**Fig. 7 - 42: Troubleshooting: Cleaned Solution Not Draining Back into Washer Reservoir**

# *13. Power-Assisted Door*

The optional *Power-Assisted Door* supplies power to the door of the washer cabinet, which makes heavier-weight loads easier to handle: the operator can easily open and close the door weighted with up to 20,000 pounds (9070 kg) of load.

> ***NOTE:*** **The door can be operated manually, without power-assist.**

## 13.1. Theory of Operation

The *Power-Assisted Door* is pneumatically powered. A tandem air/hydraulic cylinder dampens and smoothes door operation. Speed-control valves on top of the cabinet can be adjusted to regulate the general range of opening and closing speed.

You can fine-tune your control of the speed at which the door opens and closes by raising and lowering the position-lock handle, which is located at the bottom of the door. The handle works like a throttle to increase and decrease speed.

## 13.2. Installation

The *Power-Assisted Door* is shipped installed on the cabinet. The speed-control valves are factory pre-set for a moderate opening and closing speed range.

## 13.3. Operations

> ***WARNING! NEVER put hands, legs, or head inside the door! This could result in severe injury or death!***

> ***WARNING! Before you attempt to open or close the power-assisted door, be sure you have enough clearance for the full arc-travel of the door as it swings!***

***WARNING! NEVER swing the power-assisted door open to a position lock at an accelerated speed! Control the speed of the door by the position-lock handle, located at the bottom of the door. Use the handle like a throttle to adjust speed.***

**To operate the door,** *follow this procedure*:

1. Select *open* or *close* on the *power-assist selector switch*, located on the front of the door.

2. Unlatch the door, if it is latched.

3. Lift and hold the *position-lock handle up* to keep the power-assist activated.

4. Release the handle to stop the power-assist.

The position-lock handle is located at the bottom of the door. The two position lock slots hold the door open at approximately a 60° angle and a 90° angle, respectively, from the front of the cabinet.

***Securing the Door***

Always be sure that the open door is locked in position:

- Visually check the position lock slot, *or*
- Try to pull or push the door

Refer to chapter *"Basic Operations"* for more general information on opening and closing the door.

# 13.4. Maintenance

**Every 160 hours of operation**:

- Check the filter/regulator/lubricator unit. The lubricator has an oil reservoir, and is located on the right side of the washer. Add oil, if required, to the fill-level.

Refer to your vendor-supplied cutsheet for instructions.

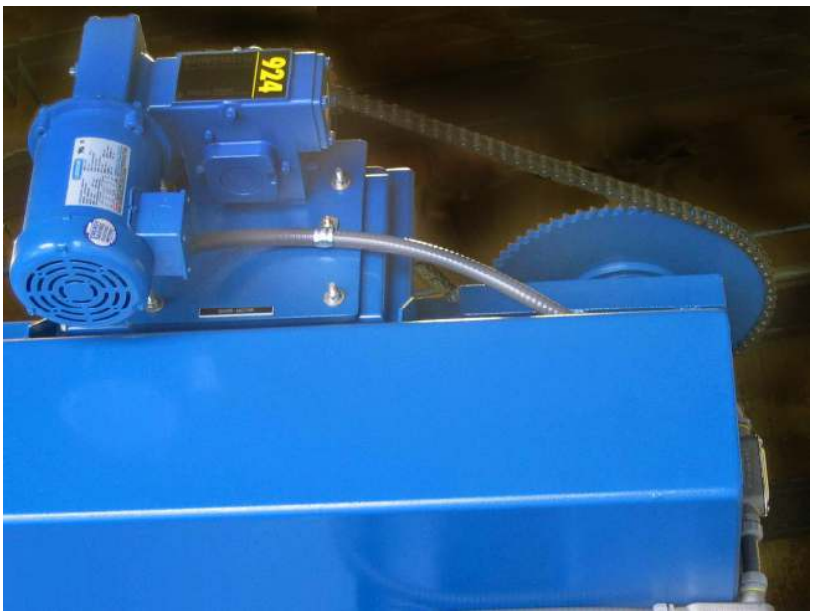
# 13.5. Troubleshooting

This section contains tables on the following problems:

- Power-assist does not activate

| ***Problem:*** | ***Power assist does not activate*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Control valve** | Stuck (replace) |
| **Position-lock handle** | Defective limit switch (replace) |
| **Selector switch** | Defective (replace) |
| **Air-pressure** | Not in the 75-100 PSI [1000-1400 kg/sq cm] range (check air-supply system) |
| **Electric solenoid** | Burned out (replace) |

**Fig. 7 - 43: Troubleshooting: Power-Assist Does Not Activate**



# *14. Pump Pressure Gauge*

The optional pressure gauge indicates the amount of pressure in the piping from the wash pump to the power blast manifold (PBM).

## 14.1. Theory of Operation

A coupling welded into piping between the pump and the PBM is used as a pressure tap point for a glycerin-filled pressure gauge. The pressure tap piping is a large diameter for easy clean out.

The pressure gauge assembly includes a diaphragm seal that prevents solution from entering the gauge. Pressure on the diaphragm is transmitted through the glycerin inside the gauge to the reading dial.

## 14.2. Installation

This option arrives factory-installed.

## 14.3. Operations

There are no operator instructions. The pump pressure gauge will indicate the pressure in the piping from the wash pump to the power blast manifold (PBM).

## 14.4. Maintenance

***WARNING! NEVER disconnect the pressure gauge from the diaphragm seal! Glycerin will leak out and damage the gauge assembly!***

**If the gauge does not read pressure**, *follow this procedure*:

1. Unscrew the diaphragm seal and gauge *together*.

2. Clean the gauge pipe out.

3. If the problem persists, replace the gauge and diaphragm-seal assembly.

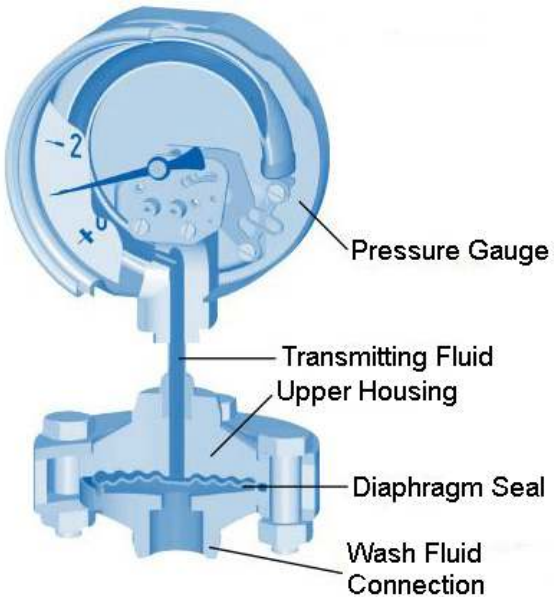
# 14.5. Troubleshooting

This section contains tables on the following problems:

- Pump pressure gauge does not work

| ***Problem:*** | ***Pump pressure gauge does not work*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Gauge pipe** | Clogged (clean out) |
| **Gauge** | Damaged (replace)<br>Glycerin leakage (replace) |
| **Diaphragm seal** | Damaged (replace) |

**Fig. 7 - 44: Troubleshooting: Pump Pressure Gauge Does Not Work**



# 15. Rack and Fixture Set, or Small-Parts Basket

All parts must be secured to the turntable during the cleaning cycle. To do this, use the following:

- Rack and fixture set
- Small-parts basket

Refer to chapter *"Basic Operations - Loading and Securing Parts"* for information on using securing devices.

## 15.1. Theory of Operation

The rack and fixture set and small-parts basket are optionally available from StingRay. Refer to the following two figures.

You may want to discuss your requirements with your StingRay representative, especially before you alter or add to the basic configuration to customize it for an application.

## 15.2. Installation

There is no installation required. The rack and fixture set and small-parts basket arrive ready to use.

**NOTE**: Large racks or fixtures may need to be assembled.

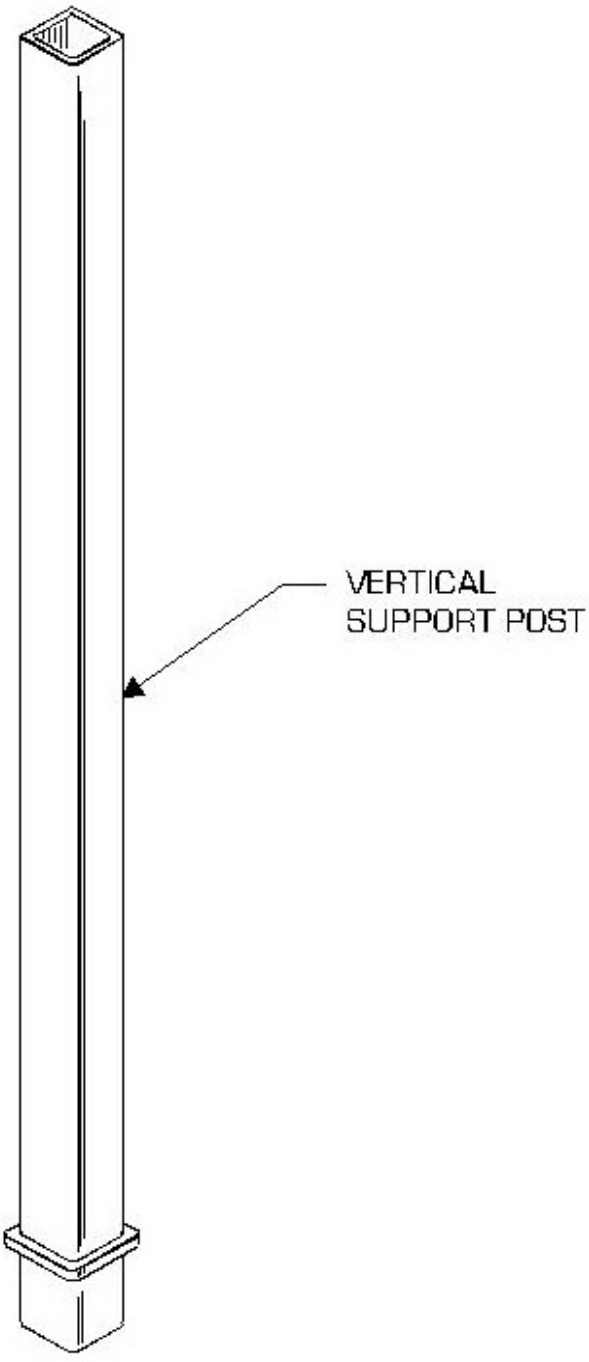



**Fig. 7 - 45: Rack and Fixture Set**

# 15.3. Operations

Refer to chapter *"Basic Operations - Loading and Securing Parts"* for information on using securing devices with the rack and fixture set.

**To use the rack and fixture set**, *follow this procedure*:

1. Select the appropriate 16-inch (40.6 cm) or 32-inch (81.3 cm) vertical post.

2. Insert it into a *turntable socket* that will position the *load nearest the center* of the turntable and ensure that no part of the load will hang outside the turntable.

3. Attach a *head rack* or other *fixture* to the *top* of the *centering vertical post,* facing the center of the turntable.

4. Load the *part* vertically inside the head rack or fixture.

5. Attach *securing devices*, as described in chapter *"Basic Operations - Loading and Securing Parts."*

**To use the small-parts basket**, *follow this procedure*: (refer to the following figure)

1. Load *small parts* into the *basket*.

2. Secure the *lid*.

3. Place the basket on the *center* of the *turntable*.

4. Attach *one end of the chain* to a *hook* located on the inner surface of the *turntable*'s outer rim.

5. Run the chain through both *basket handles*.

6. Attach the *end of the chain* or a *link* to a *hook,* located on one end of the load binder.

7. Attach the *hook* on the *other end* of the load binder to a *chain eyelet* directly across (180° angle) from the first hook.

8. Tighten the chain with the provided *load binder*.

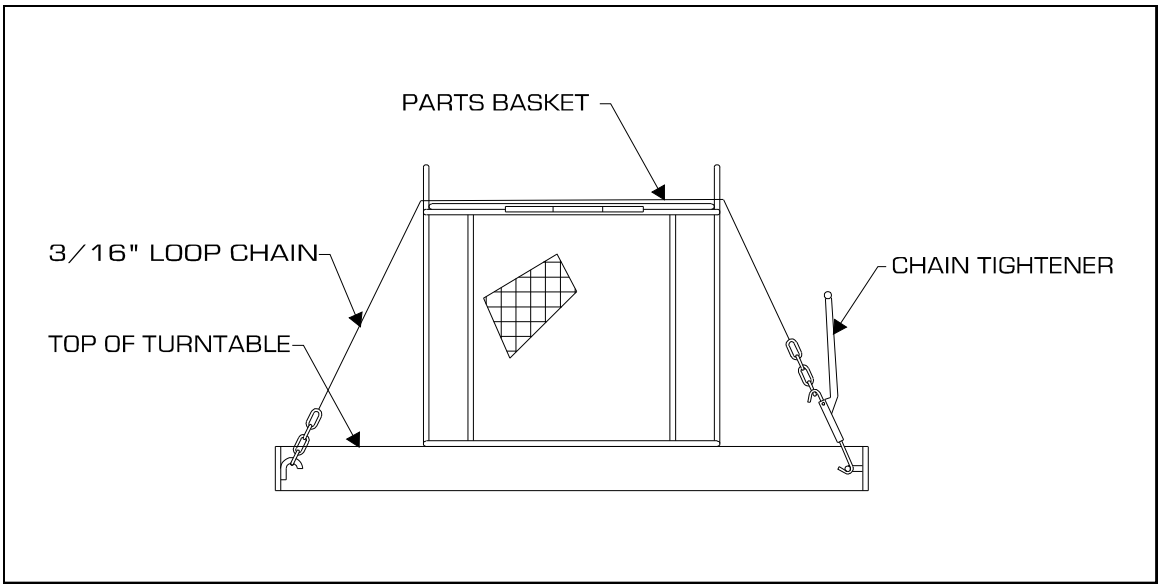



**Fig. 7 - 46: Small-Parts Basket**

## 15.4. Maintenance

Clean racks, fixtures, and baskets as required.

## 15.5. Troubleshooting

If you properly secure all parts, using racks, fixtures, small-parts baskets, and appropriate securing devices, no problems should arise from these options.

# 16. Remote Grease Fittings

The optional *Remote Grease Fittings* allow you to grease the turntable or the Power Blast Manifold (PBM) swivel bearings from the outside of the washer cabinet.

## 16.1. Theory of Operation

This option eliminates the need to disassemble any part of the washer or to get inside the cabinet in order to grease the turntable or the Power Blast Manifold (PBM) swivel bearings. It improves accessibility, reducing maintenance time.

This option is available for any bearing in the washer.

## 16.2. Installation

The optional *Remote Grease Fittings* are delivered installed, according to your specifications.

## 16.3. Operations

The *Remote Grease Fittings* are located on the nearest outside surface of the washer to the bearing. They are placed at a convenient height for the operator.

The remote turntable grease point is on the cabinet door. The remote swivel grease point is on the wash manifold side of the washer near the door.

## 16.4. Maintenance

None.

## 16.5. Troubleshooting

None.

# *17. Rinse Wand*

The Rinse Wand is an optional addition to the standard rinse system. Its purpose is to manually rinse spot areas after a wash cycle.

The Rinse Wand consists of a gun-shaped handle with an extended tube that has a spray nozzle at its apex. The spray wand is hand-operated. Whenever the operator depresses the trigger, water from the supply line is released through the nozzle at line pressure.

**NOTE:** The water from the wand is not heated and contains no chemicals.

## 17.1. Theory of Operation

Supply-line water pressure powers the spray. The wand uses a two-gallon-a-minute fan-shaped nozzle. Since water from spray is normally returned to the water reservoir, a solenoid valve connected to the solution-level control system disallows spray-wand use whenever the solution level is at the HIGH-HIGH (maximum) mark. A light on the control panel indicates this condition.

## 17.2. Installation

This option is factory-installed.

## 17.3. Operations

After a cleaning cycle has completed, open the washer door to the first door-position lock stop. Use the *jog button* to rotate the turntable as you inspect the wash load for any area that may need additional rinsing. If you find such an area, release the *jog button* to stop the turntable.

> ***WARNING! Be sure to wear protective gear (face shield, gauntlet gloves, rubber apron)! Spray could be deflected back at you and could contain chemical residue that could cause serious chemical and scald-type burns to eyes and skin!***

*Follow these operating guidelines:*

1. Stand back several feet from the washer.
2. Aim the wand at the part.
3. Pull the trigger and direct the spray to the area that needs to be rinsed.

*Remember the following:*

- Wand water is not heated. It will not flash-dry as quickly as rinse water in the washer.
- Wand water returns to the reservoir and uses part of the rinse-bank (*rinse-bank* is the available volume for rinse water). Therefore, use of the wand could result in shortened rinses or no rinse at all. Keep rinse-wand use to a minimum to avoid this problem.
- Rinse-wand water contains no chemical additives such as rust inhibitor. Therefore, excessive use of the wand could cause rusting of parts.

## 17.4. Maintenance

Lubricate the gun trigger periodically.

## 17.5. Troubleshooting

This section contains tables on the following problems:

- No hand rinse

| ***Problem:*** | ***No hand rinse*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Light on control panel** | Solution level at HIGH-HIGH (maximum) mark<br>Solenoid failed (replace) |
| **Nozzle** | Clogged (remove and clean) |

**Fig. 7 - 47: Troubleshooting: Rinse Wand: No Hand Rinse**

# 18. Sludge Scraper

The Sludge Scraper removes sludge from the power washer's reservoir to a bin or barrel. The materials to be removed by the sludge scraper can be any solid material or any material that is of a consistency that will not run off of the scraper bars.

The sludge scraper provides these benefits.

- Extension of cleaning-solution life
- Better cleaning results

## 18.1. Theory of Operation

The washer is mounted on the sludge-scraper assembly, which replaces the original floor of the washer's reservoir. Part of the assembly extends as a chute behind the washer at a 45-degree angle.

When the Sludge Scraper is operating, scraper bars move across the bottom of the reservoir, collecting sludge and carrying it up the chute. At the end of the chute, the sludge drops into a bin or barrel. The scrapers then move back down the chute into the washer reservoir and begin to scrape the bottom of the reservoir.

The scrapers are attached to a sprocket-mounted drag chain that continuously rotates. The drag chain is direct drive with a head shaft-mounted gear motor and internal torque-limiter factory set at 33 ft-lbs.

The gear motor is a reversable AC-drive motor.

The Scraper is operated with a Mode Selector Swich on the main control panel with three selections: Auto, Manual and Off. In Manual Mode, there is a remote forward/reverse jog switch on the scraper chute.

An external view of the sludge scraper is shown in the following figure.

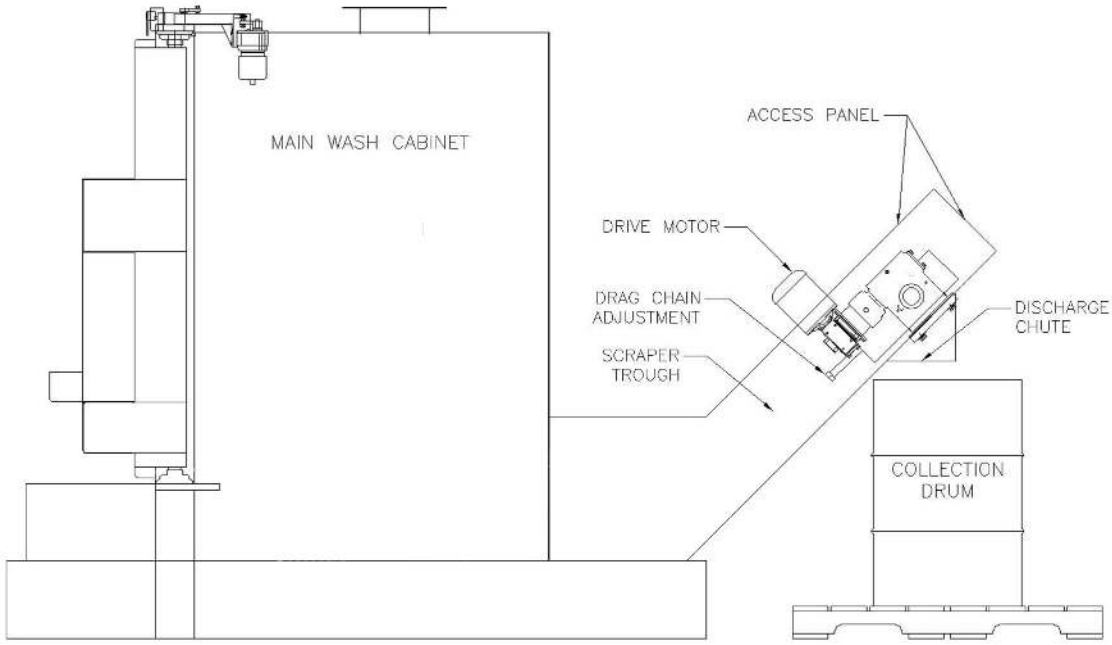



**Fig. 7 - 48: Sludge Scraper -- External View**

# 18.2. Installation

The Sludge Scraper is factory-installed.

# 18.3. Operations

The Sludge Scraper is designed to operate when the washer is in use, or after hours, when the washer is in "shut-down" (off) mode. A forward and reverse jog feature is provided to help free any scraper jams.

> ***WARNING! NEVER put your hands into the scraper chute! This could result in severe injury.***

To operate the Sludge Scraper, follow this procedure:

***WARNING! Disconnect power before opening the control panel.***

1. Set the Sludge Scraper timer, located in the washer's electrical control panel. The 1-hour timer is numbered 1-10 (each number represents a 6-minute increment). The timer controls the length of time the scraper operates in AUTO mode.

2. Set the scraper's mode selector switch, located on the washer's control panel, to one of the following:

    - MAN (MANUAL): Allows manual operation of the sludge scraper using the chute mounted FWD/REV switch.

    - OFF: Turns the scraper off.

    - AUTO: Automatically activates and runs the scraper at the end of a wash cycle for the time indicated on the scraper timer, 0 to 1 hour. The scraper will not operate during a wash cycle.

To operate the jog function, follow this procedure:

1. Set the selector switch on the control panel to MAN.

2. Go to the sludge scraper's discharge area and rotate the forward or reverse lever switch located in the small sludge scraper control panel.

## 18.4. Maintenance

Every 40 hours of operation:

Check chain tension.

If you need to adjust the tension of the drag chain, adjust the large bolts on the take-up frames. Adjust both sides equally.

The slip clutch is factory pre-set to 33 ft-lbs (4.5 kg-m), which is 5 ft-lbs. (.7 kg-m) below the allowable motor torque. Slight slippage during washing is common and normal.

Lubricate the take-up bearings with Lubriplate 1444 grease. The grease fittings are located at the chute end of the sludge scraper.

Check the blade wiper's initial contact when the wiper blade is at the top of the scraper bar.. To adjust the location of the initial contact, use the wiper adjustment bolts (See Fig. 7-48).

A diagram of the scraper is shown in the following figure.

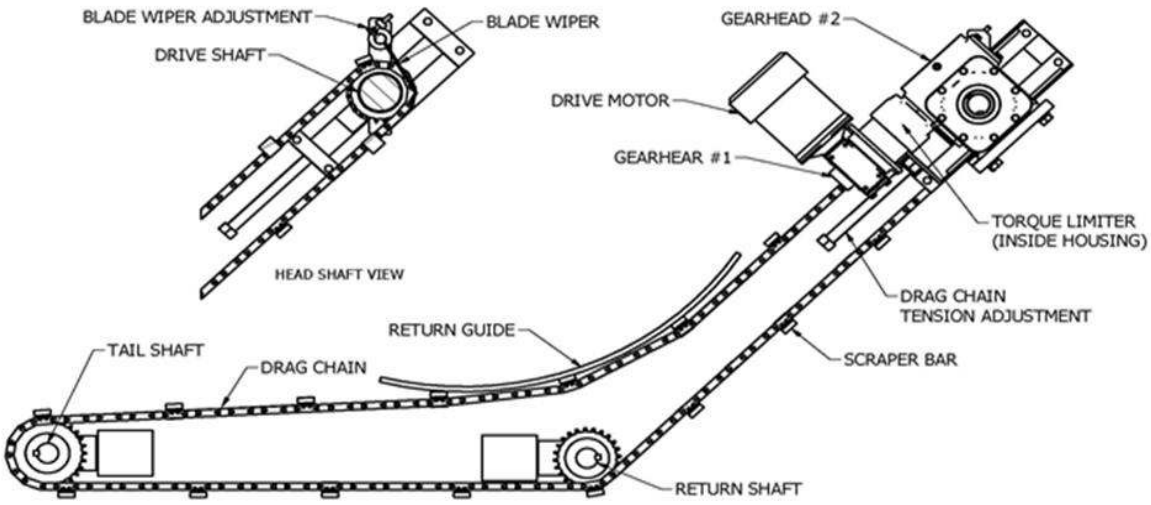



**Fig. 7 - 49: Sludge Scraper -- Diagram of Parts**

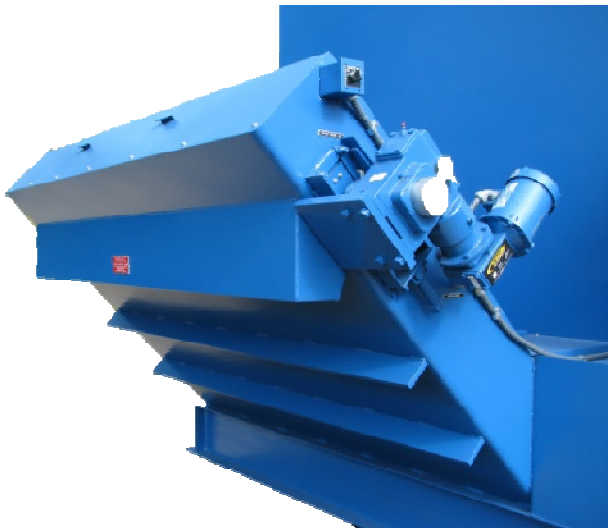
# 18.5. Troubleshooting

This section contains tables on the following problems:

- Sludge scraper drag chain does not move

| ***Problem:*** | ***Sludge scraper drag chain does not move*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Chain** | Caught on something (Use reverse jog) |
| | Broken |
| | Drive sprocket too loose (adjust tension -- tighten) |
| **Sprockets** | Chain is not on sprockets |
| **Torque-limiter** | Not adjusted correctly |
| **Motor** | Motor not turning: |
| | Selector switch OFF |
| | 7-day clock not set properly |
| | Fuse needs to be replaced |
| | Wires need to be tightened |
| | Motor needs to be replaced |

**Fig. 7 - 50: Troubleshooting: Sludge Scraper Drag Chain Does Not Move**



# *19. Airlift System*

The optional Airlift System adds the additional function of grease and floating contaminant removal to the parts washer sludge scraper. The Airlift System is the least expensive way of automatically removing floating grease. If your unit is equipped with the Mini Surface Drag-off Conveyor, the Airlift System is included.

The Airlift System provides these benefits:

- Removal of grease and other contaminants that float
- Increases the length of the cleaning solution life
- Reduces clean out costs
- Improves quality of cleaning

## 19.1. Theory of Operation

Grease and other floating contaminants are removed by compressed air-powered circulation system in conjunction with the sludge scraper. The airlift forces floating waste in front of the scraper bars for removal. Circulation of wash solution improves washer heat-up and recovery times by reducing thermal stratification.

Compressed air released through eductors creates fluid circulation in the reservoir. Solution is “lifted” from the bottom and moved across the solution surface toward the sludge scraper blades. Floating waste is forced in front of the blades, lifted out of the solution, dragged up the scraper chute and deposited in drums along with the waste hauled off the bottom of the reservoir.

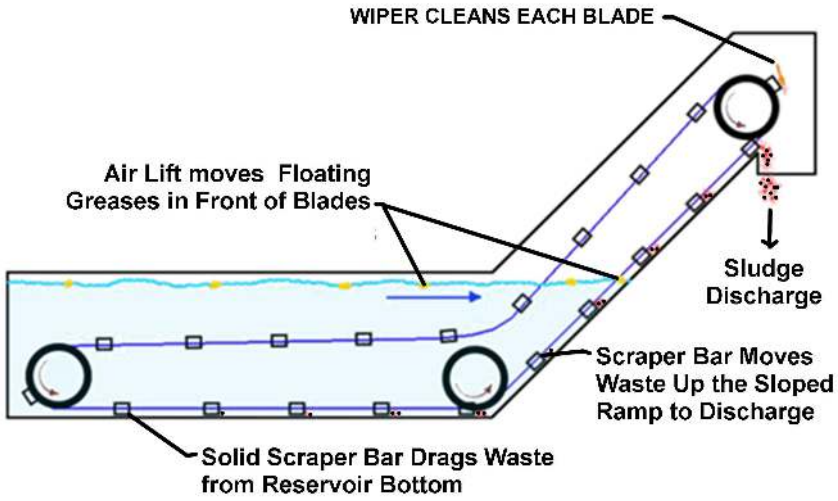



**Fig. 7 - 51: Airlift System in Sludge Scraper**

# 19.2. Installation

If you purchase the optional airlift system, your power washer is delivered with the airlift system factory-installed and ready to use. If your unit is equipped with the Mini Surface Drag-off Conveyor, the Airlift System is included.

1 Provide and install a 1/2-inch-diameter (13 mm) compressed-air line to the washer air –inlet. **Note:** If your washer uses compressed air for other functions there is one common connection and you may have already installed the required compressed air-line. An additional air-line is NOT required. (The incoming pressure range should be between 20-125 PSIG 138-860 kilopascals).

2 Connect an air filter in-line with the washer's compressed-air inlet. **Note:** The compressed air inlet is a 1/2 inch NPT fitting.

3. Airlift Regulator: Set the pressure regulator to the lowest setting that moves the solution at a steady rate. This pressure is generally within the 5 to 10 psi range, but can be more or less depending on your particular machine configuration and incoming compressed air configuration. Excessive air pressure will not yield more flow and tends to cool the wash solution instead of circulating it.

# 9.3. Operations

The airlift system is automatically controlled during scraper operating times and during washer heat-up periods. This system connects to factory compressed air.

# 19.4. Maintenance

During clean-out, inspect system and clean out any debris or soil build-up.

# 19.5. Troubleshooting

| ***Problem:*** | ***Airlift System is not functioning*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Eductors** | Clogged (Clean out) |
| **Air Valve** | Clogged (Clean out) |
| | Not opening (Replace) |
| **Regulator** | Clogged (Clean out) |
| | Set too low (Set to proper pressure) |
| **Compressed Air** | Blocked (Clean out) |

**Fig. 7 - 52: Troubleshooting: Airlift System is Not Functioning**

# 20. Short High Impact Manifold (SHIM) System

The Short High Impact Manifold (SHIM) is designed to give you the advantage of two machines in one. A standard work height machine and a shorter work height, ultra high impact machine. When retracted you have the benefit of the entire cabinet height to wash tall parts and, when deployed, all the blasting energy is concentrated into a smaller work area for shorter loads and baskets of parts.

## 20.1. Theory of Operation

Two Power Blast Manifolds are coupled together and a set of valves directs the flow to one of the Manifolds. The Standard PBM is full height and SHIM, when deployed, reduces the work height by approximately one-half. The SHIM Manifold has a fold down horizontal upper arm. The vertical sections of the standard and SHIM manifold have the same number of nozzles so that the nozzles in the SHIM are packed more tightly together. The nozzles in the standard Manifold have a 25 degree blast pattern while the SHIM has narrower 15 degree pattern nozzles, thus more than doubling the impact pressure for shorter wash loads. A SHIM manifold is shown in the following figure.

## 20.2. Operations

Choose the proper manifold with the selector valve. Refer to the selector valve schematic diagram below and on the front of the Power Washer door for manifold selection.

To deploy the SHIM, reposition the PBM selector valve handle, remove the locking pin in the fold down arm section, pivot the arm to its horizontal position, and replace the locking pin to hold the horizontal SHIM arm in place.

> Be sure the fold down arm is locked in the proper position for the height of the wash load. A tall wash load may hit the fold down arm and damage the PBM drive

Do not walk on the internal reservoir cover to raise or lower the fold down arm or to switch the selector valve. Stand on the outside reservoir lid and reach into cabinet to make adjustments.

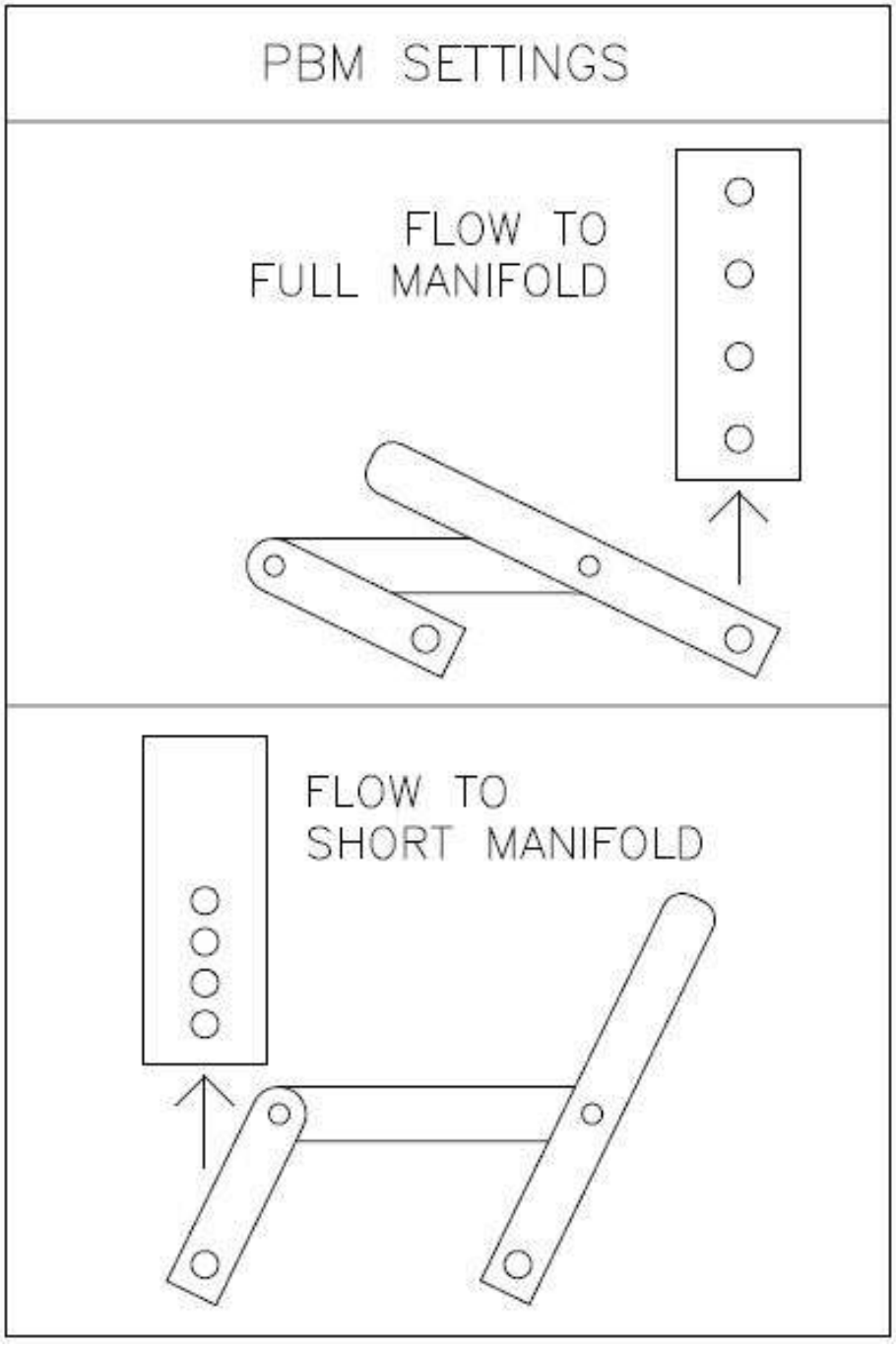



**Fig. 7 - 53: SHIM Manifold Selector Valve Schematic (See Door of Washer)**

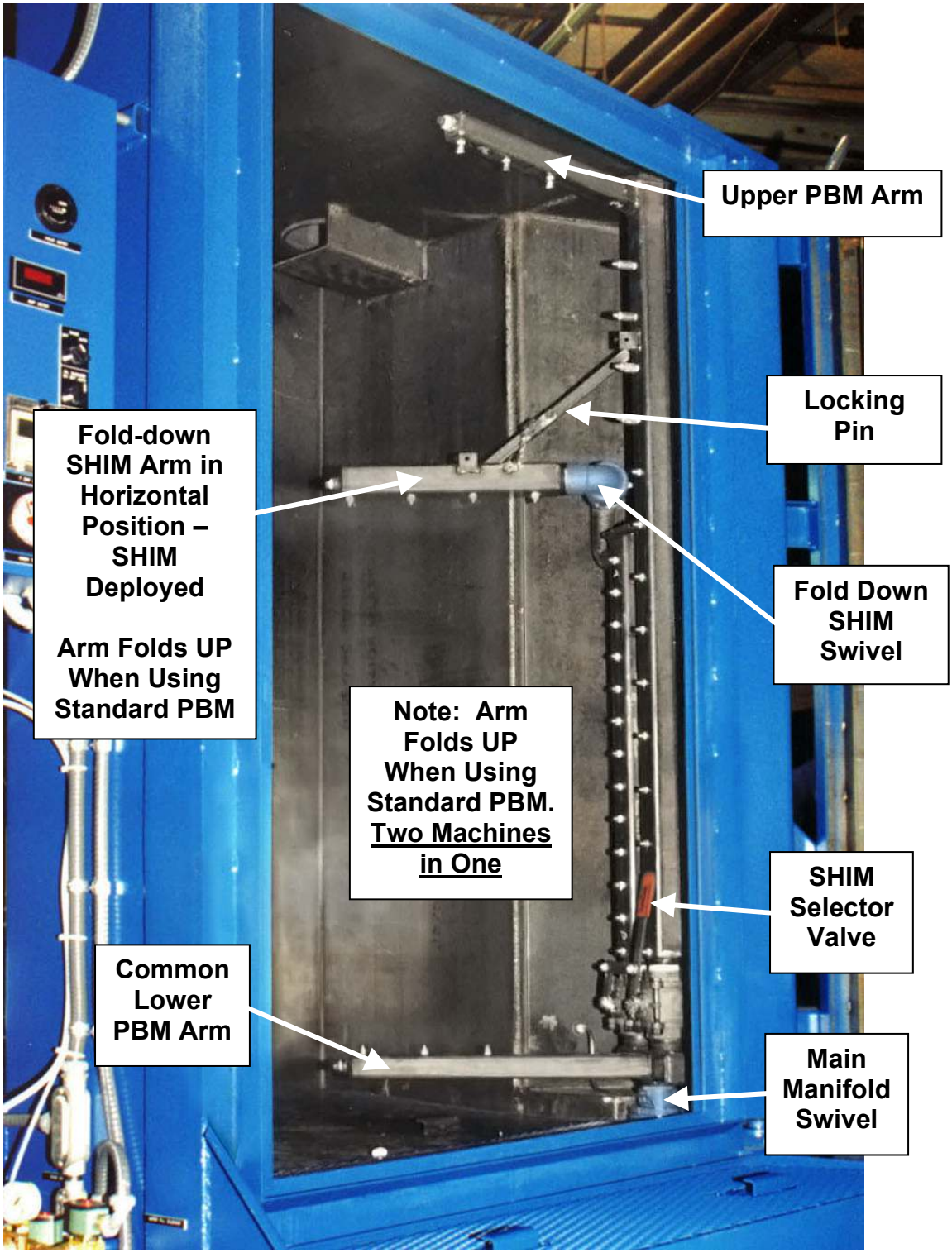



**Fig. 7 - 54: SHIM Manifold System SR4063**

# 20.3. Maintenance

Lubricate Fold down Arm Swivel every 8 hours of operation or as required with Lubriplate 144 grease.

Replace worn nozzles in both manifolds as required to prevent overloading of pumping system

# 20.4. Troubleshooting

Use procedures in chapters *"Installation", "Advanced Operations: Process-Control",* or *"Maintenance"* to correct a problem after you have diagnosed it.

Or, refer to your vendor-supplied manuals or cut sheets for instructions on correcting problems.

This section contains tables on the following problems:

- PBM not oscillating

| ***Problem:*** | ***PBM not oscillating*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Linkage** | Not connected |
| | Out of adjustment |
| | Loose |
| | Not connected to shaft |
| **Bearings** | Failed |
| **Swivel** | Not properly adjusted |
| | Not lubricated |
| | Not moving freely |
| **PBM gear motor** | Not rotating (check wires/fuses/overload tripped) |
| **PBM mounting plate** | Motor not securely attached to it |

**Fig. 7 - 55: Troubleshooting: PBM Not Oscillating**

# 21. Pure Water/Pure Rinse: Integrated RO Water Fill & Rinse System

The StingRay Pure Water option is an integrated Reverse Osmosis filtration system that removes hard water minerals and other contaminates from the incoming water supply and stores the purified water in a machine mounted tank. The transfer pump runs on-demand when the solution level control system calls for make-up water or to provide water for the optional Auto Heated Rinse Cycle.

## 21.1. Theory of Operation

The Pure Water system is a machine specific engineered option that is sized and configured to produce and store purified water based on the consumption demand of the Parts Washer. The incoming water supplied to the system first travels through a 5 micron sediment filter to remove any solids and protect the pump. Additionally, the sediment filter is an activated charcoal block that removes chlorine to prevent damage to the membranes. The membranes provide the means of filtration for the system. Reverse Osmosis is a filtration method that uses a pump to force the incoming water through a thin film membrane. The pure water flow, exiting through the membrane, is called Permeate. This water is stored in the holding tank mounted on the machine. Water that does not pass through the membrane contains a higher concentration of deposits and undesirable hard water minerals, is called Concentrate. The Concentrate water is sent to the drain. To reduce overall water consumption, some of the Concentrate is sent through the recycle valve back to the inlet of the pump so it takes another trip through the system and turns more of the Concentrate into Permeate. The hydraulic flow schematic shown in Fig. 7-55 illustrates this functionality.

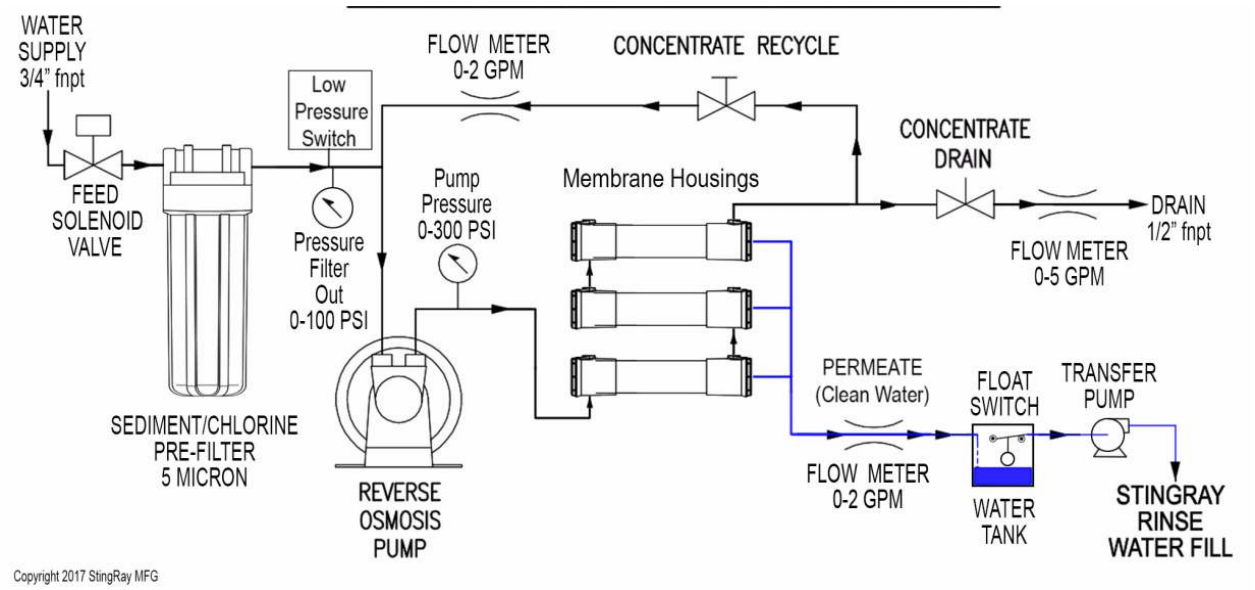



**Fig. 7-56: General Schematic StingRay Pure Water Option**

The incoming water conditions limit how much Concentrate can be recycled. To properly configure the Pure Water system, a detailed analysis of the incoming water supply is required. An incoming water analysis is available from your munincipal water supplier. In general, the Pure Water system operates effectively with a Total Dissolved Solids (TDS) value less than 2000 ppm and a preferred Total Hardness value of 0 ppm to 250 ppm. Values of hardness above zero shorten the life of the membranes. When the quality of the incoming water has values exceeding the Preferred Range, additional conditioning equipment such as an antiscalant injector or a water softener system can be utilized to prolong the life of the membranes.

The individual components of the Pure Water system are identified in Fig. 7-56:

1. Solenoid Valve – Turns On/Off Feed Water
2. Activated Carbon Block Pre-filter - removes chlorine and sediment to 5 micron
3. Pressure Switch – Low pressure shut down
4. RO Pump – Pressurizes RO System
5. Concentrate Valve – Controls flow of waste (concentrated) water to the drain
6. Recycle Valve – Controls flow of Concentrate Water back to the feed.
7. Recycle Flow Meter
8. Concentrate Flow Meter
9. Permeate Flow Water
10. Filter Out Pressure Gauge
11. Pump Pressure Gauge
12. Membrane Housings
13. Control Switch, Turns System On/Off

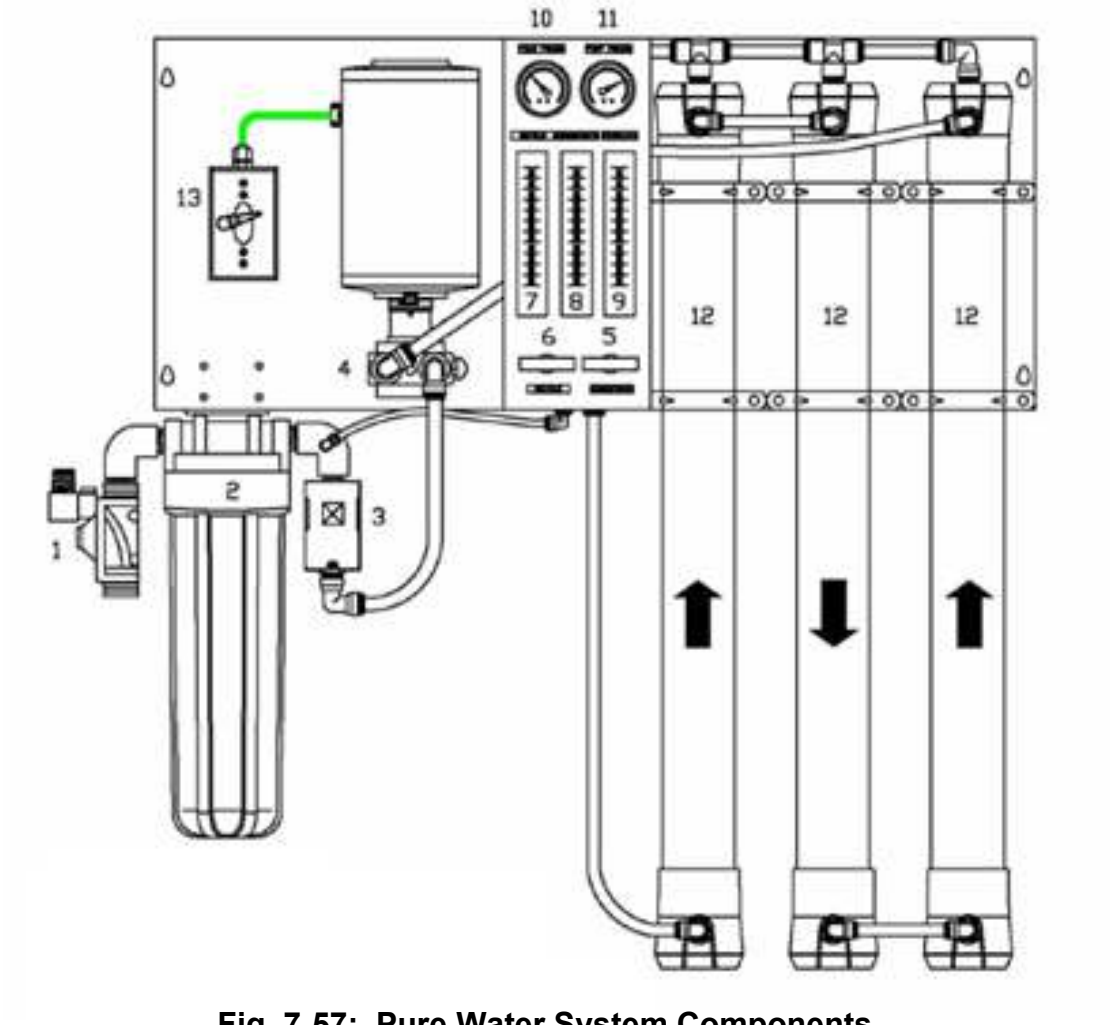



**Fig. 7-57: Pure Water System Components**

# 21.2. Installation

The Pure Water System is fully installed, wired, plumbed, and tested at the factory. Only the inlet water supply and concentrate (waste) discharge need connection.The incoming water supply requires connection to the ¾" NPT bulkhead fitting on top of the Pure Water System enclosure. Incoming water pressure must be regulated to between 45 – 85 psi (310-590 kPa) and at a temperature between 40 – 85 °F (5 - 30°C). Then, the waste line is connected to the ½" NPT drain connection located under the Pure Water tank frame. Once these connections are made, the system is ready for purging and the start-up procedure. Please refer to the spec sheet attached to the Pure Water system enclosure for your machine specific spec sheet. You will use these settings in the Start-Up Procedure.

**INSTALLATION**

1. Check all plumbing and electrical connections for tightness and verfity they did not loosen during shipment.
2. Connect water supply to ¾" NPT fitting located on top of system housing.
3. Connect drain line to ½" NPT fitting located under the water tank mounting frame.

**PURGING & START-UP PROCEDURE**

1. System Purge.
    a. Fully open concentrate valve.
    b. Fully close recycle valve.
    c. Engage bypass lever (red) on the feed solenoid (Fig. 7-57).
    d. Turn on the water supply and let the system purge until no visible bubbles appear in the concentrate flow meter.
    e. Disengage the bypass lever.
2. Apply electrical power to the machine, which provides power for the Pure Water system.
3. Regulate incoming water supply between 45 – 85 psi (310-590 kPa) then read Filter Out pressure gauge and record in Table 1 on the system spec sheet.
4. Adjust pump bypass screw (Fig. 7-58), concentrate valve, and recycle valve to the system settings indicated on the machine specific spec sheet.
5. Subtract 10 psi (70 kPa) from the initial Filter Out reading and record on the spec sheet. This value indicates when it is time to change the filter cartridge..
6. Allow system to fill the machine reservoir and actuate float level switch, ensure system shuts off when machine reservoir and holding tank is full.


**Fig. 7 – 58: Feed Solenoid Bypass Lever**


**Fig. 7 – 59: Pump Bypass Screw**

# 21.3. Operations

The functions of the Pure Water system are integrated with the standard automatic features of the Parts Washer. When the machine is empty such as when it is first installed or after draining and cleaning, the Pure Water system fills the entire reservoir to set point automatically, however this process takes several hours so it is suggested to allow the machine to fresh fill overnight. Keep in mind that pure water is an aggressive form of water and can cause corrosion quickly on bare steel surfaces. Means to protect the cabinet with rust preventative is important.

During normal cleaning operation, the Pure Water system runs and produces permeate automatically when the Water Tank is below the fill point. During a Rinse Cycle, the transfer pump runs automatically to provide the rinse system with water. When the machine is not running a wash cycle and the water level is below set point, the transfer pump runs automatically to fill the machine with make-up water as described in Chapter 3.2.8.

# 21.4. Maintenance

Refer to Fig. 7-52 to help locate the individual components described in the maintenance procedures.

***Every 40 Hours of Operation***

System Flushing removes hard water particles and other solids from the surface of the membranes increasing efficiency and prolonging membrane life.

*Follow this procedure:*

1. Perform flushing procedure with RO system running while tank is filling.
2. Fully open the Concentrate (waste) Valve and fully close the Recycle Valve.
3. Allow the system to run for 10 to 20 minutes. If necessary, the system can be “forced” on by pressing the float rod on the machine down for about 30 sec which causes the pump to fill the machine with water from the tank.
4. After 10 to 20 minutes, adjust the Concentrate Valve and Recycle Valve to the previous settings.

***Every 200 Hours of Operation***

Replace the pre-filter cartridge (p/n 54502) to prevent the membranes from fouling by chlorine and to prevent damage to the pump from sediment. The pre-filter cartridge may need replacement more often depending on operating conditions, if the pressure on the Filter Out gauge drops by 10 psi (70kPa) from when it was first installed, it is time to change the cartridge.
Replacement filter cartridges (p/n 54502) are available from StingRay Tech Services.

*Follow this procedure:*

1. Have the new cartridge ready along with a 5 gallon bucket.
2. Turn off the Control Switch on the RO System Panel. This closes (deenergizes) the Solenoid Valve.
3. Using the black filter housing wrench, loosen the filter housing. When looking down at the wrench, turn handle clockwise.
4. Remove wrench from housing and continue turning until the housing can be pulled down off the mount.
5. Dump the old cartridge and water into the bucket.
6. Place the new, unwrapped cartridge centered into the housing and install onto the base. Snug by hand, then tighten with wrench ¼ turn.
7. Perform the System Purge procedure as described in Section 20.2.
8. Check for leaks and tighten the housing if necessary.

***Every 1000 Hours of Operation***

Replace the membranes. Observe the Permeate flow meter and compare to the Permeate Flow value found on the system performance specifications table located on the RO enclosure door. The membranes may need to be replaced sooner if Permeate water production drops by 20% or if the system is operating at a higher pressure. Do not operate above 150 psi (1034kPa). If the system is supplied with hard water containing calcium and magnesium particles, the membranes can foul with scale at a faster rate and will require replacement more often to maintain the desired level of Permeate water production.

Replacement Membranes (p/n 54500) are available from StingRay Tech Services. Detailed membrane installation instructions are included.

# 21.5. Troubleshooting

| *Problem:* | *Low Filter Pressure* |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Low Supply Pressure** | Increase inlet pressure |
| **Cartridge Filter Plugged** | Change Filter |
| **Solenoid Valve Malfunction** | Replace coil and/or solenoid valve |
| **Pump Motor Failure** | Check motor amp draw and winding continuity |
| **Pump Damage** | Install pump repair kit |
| **Damaged Concentrate Valve** | Check/Clean/Replace needle valve |
| **Leaks** | Ensure proper hose insertion/replace fitting |

**Fig. 7 - 60: Troubleshooting: Low Filter Pressure**

| *Problem:* | *Low Permeate Flow* |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Low Inlet Flow** | Adjust concentrate valve |
| **Cold Feed Water** | Permeate production decreases proportionately with temperature |
| **Low Operating Pressure** | See Low Filter Pressure |
| **Defective Membrane** | |
| **Brine Seal** | Inspect and/or replace o-rings |
| **Fouled or Scaled Membrane** | Clean membranes and/or replace |

**Fig. 7 - 61: Troubleshooting: Low Permeate Flow**

| *Problem:* | *High Permeate Flow* |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Damaged Product Tube** | |
| **O-Rings** | Inspect and/or replace o-rings |
| **Damaged or Oxidized** | |
| **Membrane** | Replace membrane |
| **High Feed Water Temperature** | Do not exceed 85°F (29°C) feed water temperature |

**Fig. 7 - 62: Troubleshooting: High Permeate Flow**

| ***Problem:*** | ***Poor Permeate Quality*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Low Operating Pressure** | See 'Low Filter Pressure' |
| **Damaged Product Tube O-Rings** | Inspect and/or replace o-rings |
| **Damaged or Oxidized Membrane** | Replace membrane |

**Fig. 7 - 63: Troubleshooting: Poor Permeate Quality**

| ***Problem:*** | ***No Water Fill in Washer*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Float switch failed or stuck** | Replace switch |
| **Transfer Pump Not Running** | Check pump overload/Service pump |
| **No Permeate in Water Tank** | Check RO System overload/Check Settings |
| **Water Supply Shut Off** | Open water supply |
| **Pre-filter Clogged** | Replace filter |
| **Membranes Clogged/Fouled** | Service/replace membranes |

**Fig. 7 - 64: Troubleshooting: No Water Fill in Washer**

| ***Problem:*** | ***Transfer Pump Runs Constantly*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **Delay Timers Set Incorrectly** | Set timers as shown on electrical schematic |

**Fig. 7 – 65: Troubleshooting: Transfer Pump Runs Constantly**

| ***Problem:*** | ***Washer Fills Slowly*** |
|---|---|
| **Check This:** | **Probable Cause(s)** |
| **RO System Operating Below Spec** | Service RO System |
| **Reduced RO System output** | Incoming water quality limits permeate flow |
| **Limited RO System Capacity** | By design, machine takes several hours to fill |

**Fig. 7 – 66: Troubleshooting: Washer Fills Slowly**