SPRAYLEAN
A PRODUCT OF PEM CORPORATION

OWNER'S MANUAL

SPRAYLEAN

INLINE WASHER & PRETREATMENT SYSTEM

PEM

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Introduction

The PEM SprayLean® Inline Washer and Pretreatment System (Figure 1) is a multi-stage inline washer for industrial cleaning of parts prior to their painting or powder coating. It has a modular, interchangeable pod design system for use with an overhead conveyor.

The system has a small footprint and is easily expandable for any additional process. It is designed for quick setup, low and easy maintenance and efficient energy consumption.

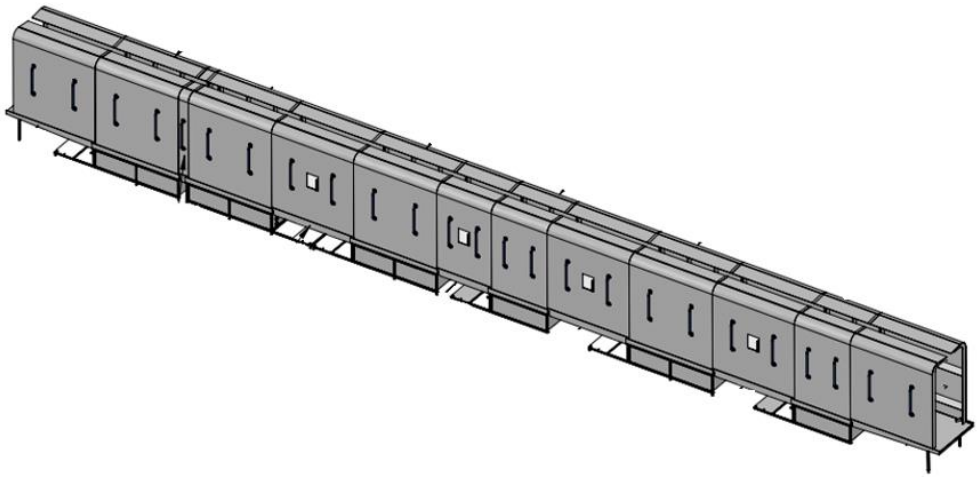


Figure 1: SprayLean® Inline Washer and Pretreatment System overview drawing

Warning: To prevent injury and equipment damage, thoroughly read and understand the contents of this manual before installing, operating or maintaining the SprayLean® system.

Limited warranty

PEM Corporation warrants the SprayLean® Inline Washer to be free from material and workmanship defects for 1 year commencing with installation of the machine by the original owner. The control panel, junction boxes, metal frames and poly materials are included in this warranty.

PEM will honor the manufacturer's limited warranty for pumps, heaters, and controls.

Safety

Safety alert symbol

This safety alert symbol (Figure 2) indicts important messages in this manual. When you see this symbol, carefully read the message that follows, and be alert to the possibility of injury or death if you do not adhere to the requirements of the safety message. Also review and follow the safety decals on the machine.

Figure 2: Safety alert symbol

Signal words

Danger indicates a hazardous situation that, if not avoided, will likely result in death or serious injury.

Warning indicates a hazardous situation that, if not avoided, could result in death or serious injury.

Caution indicates a hazardous situation that, if not followed, could result in minor or moderate injury.

Note indicates practices not related to physical injury. Some notes indicate situations that could cause equipment damage.

General safety practices

 **Warning:** PEM Corporation cannot anticipate every possible circumstance that might involve a potential hazard. The safety messages in this manual are therefore not all inclusive. If you use an operating procedure, installation or work method not specifically recommended, you must satisfy yourself that it is safe for you and for other persons. You must also ensure that the product will not be damaged or made unsafe by the procedure that you use.

Note: PEM Corporation encourages the use of environmentally friendly chemicals and waste storage and disposal practices. Always store and/or dispose of chemicals in a manner that complies with local, state and federal regulations. Furthermore, always read and follow the directions printed on product labels when using chemicals**.**

 **Warning:** Fluids under pressure spray can be nearly invisible and can penetrate the skin and cause extremely serious injury. Avoid contact with high pressure spray. Specifically:

- Never put your hands or fingers over the spray nozzle while the machine is in operation.
- Never use your hands to stop or detect leaks.
- If any fluid appears to have penetrated the skin, get emergency medical care at once. Do not treat as a simple cut. Tell the doctor exactly what was injected. For treatment instructions, have your doctor call the **National Poison Control Network at 412-681-6669**.

 **Warning:** Operate and maintain the machine in a manner that prevents injury to you and others and damage to equipment. Specifically:

- Never alter or modify the equipment.
- Never allow children or any unauthorized or untrained persons to operate, adjust or repair this machine.
- Never spray inflammable or toxic liquids or chemicals such as insecticides or weed killer.
- Never operate the machine when combustible fumes or dust may be present.
- Never use detergents that are not compatible with the discharge hose. Read and follow instructions provided by the detergent manufacturer. Also follow directions on the container regarding contact with the eyes, nose or skin.
- Always connect the machine to the correct electrical supply outlet. Comply with all federal, state and local codes and ordinances regarding electrical requirements.
- Always respect and be alert for the potential hazards of electrical equipment, hot burners, moving parts, high-pressure spray and steam.
- Always be certain that the machine safety decals are kept clean and legible. Replace any decals that become damaged, lost or painted over.
- Never attempt repairs or modifications that you do not understand. Contact your service dealer or contractor.
- Always keep protective guards covers and shields in place. Replace any that were removed for service or that were damaged before operating the machine.

 **Danger:** Chemicals used for cleaning are dangerous. Keep all chemicals out of reach of children and untrained adults. Take proper safety precautions before handing any chemicals. Read and follow all directions and instructions on the product label as well as the safety data sheets before using the chemical. Wear eye protection and rubber gloves when handling or using chemicals. Always have a clean supply of water available to wash off any contact with the skin or eyes. Should any chemical contact the eyes, immediately flood the eyes with clean water and seek medical attention at once. If skin contact occurs, flood the affected area with plenty of water for 15 minutes. If irritation persists, seek medical attention. If chemicals are swallowed, follow the product label directions and get immediate medical attention.

 **Danger:** To prevent unexpected energizing, startup or release of energy that could cause injury to people working on the machine follow the steps of the OSHA Lockout/Tagout Rule below to ensure that power to the machine will be under control:

1. Turn off the equipment.
2. Dissipate or release all residual energy in the machine.
3. Shut off the main power, and lock out/tag out the machine.
4. Check all previous steps, and then try to operate the machine to ensure that it won't work.

General description

The SprayLean® system is made up of several modules that can be connected together in various sequences depending upon the pretreatment requirements. The system also includes a control panel for turning on and off the spray pumps and setting the wash or pretreatment fluid temperature.

Note: The manufacturer reserves the right to make improvements in design and/or changes in specifications at any time without incurring any obligation to install them on units previously sold. Some photos and/or illustrations may not be exact representations of your particular machine; however, the technical information will apply.

Spray module

The spray module (Figure 3) is used for chemical application (wash or pretreatment) or for rinsing.

The module is either 4-feet (PEM 400) or 6-feet long (PEM 600) and includes a stainless-steel frame assembly (1), a 120-gallon (PEM 400) or 180-gallon (PEM 600) tank (2), vertical ribs (3), a removable shroud on each side (4), a drip edge (5), a filter support tray (6), and a filter tray (7). Installed in the spray module are risers (pipes with quick-change nozzles).

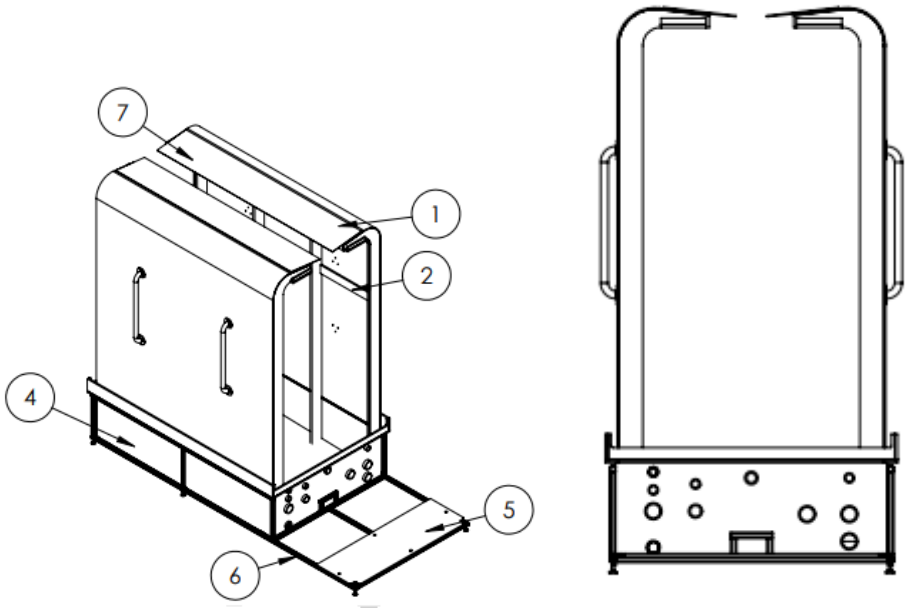


Figure 3: Spray module

Nozzles - The quick-change nozzles (Figure 4) are preplaced on the risers according to design requirements. The nozzles are easily cleaned and can be angled or replaced with optional nozzles of different spray patterns or with a plug for different spray requirements and volumes.

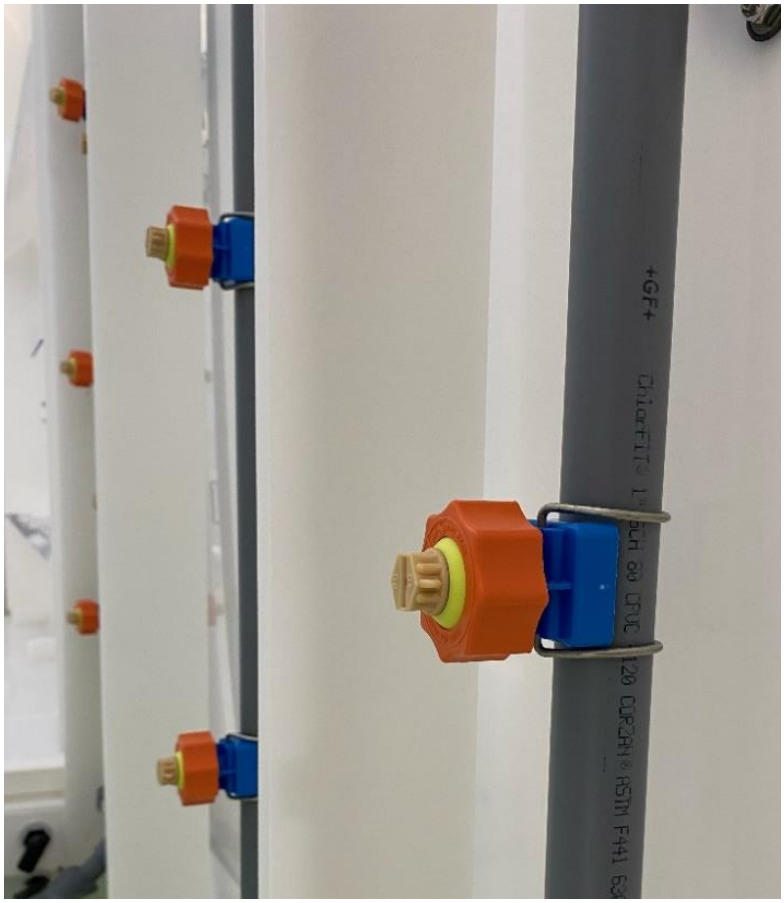


Figure 4: Quick-change nozzle

Pumps - One or two pumps (Figure 5) are located on the stainless-steel frame.

All spray modules will have a spray pump to move liquid from the tank assembly up to the risers and nozzles.

Modules for LP or natural-gas heated wash or pretreatment will also have a heater (re-circulating) pump that continuously circulates liquid from the tank assembly through a water heater.

Each pump includes a pressure gauge mounted on side of the steel frame to monitor pump pressure.

To stop large particles from entering the pumps, suction screens, are located inside the tank at the pump inlet piping.

Figure 5: Spray pump (left) and heater (re-circulating) pump (right); note the pressure gauges mounted on the steel frame

Heated modules - Heated modules may be heated by an LP gas / natural gas heater for a fluid temperature up to 130° F. See below for a more detailed description of the heaters.

Filter tray - Wash stages include a removable sliding filter tray that serves as a base for replaceable filter media.

Auto-fill transfer pump - Rinse stages following chemical stages have an auto-fill transfer pump (Figure 6) to carry fluid back to the chemical module to compensate for drag out and evaporation.

A float in the chemical stage starts the auto-fill transfer pump, which pumps liquid from the rinse stage back to the chemical stage. The pump runs until the float proves and the timer times out. The timer is set in the control panel to maintain a determined level above the float.

Figure 6: Auto-fill transfer pump

Overflow system - A series of overflow piping can be connected between various stages to carry overflow from tank to tank in order to maintain bath levels. The overflow system is used to flow fresh water into the final rinse stage and back through the system.

Some systems are designed to only overflow the rinse stages, and therefore the auto-fill transfer pumps are used to maintain the bath level in the chemical stages. Some systems are designed to overflow all of the stages, in which case the transfer pumps are used if the overflow system does not flow fast enough.

A flow meter is recommended to control fresh water input for the overflow system.

Tank ports - Figure 7, Figure 8 and

Table **1** illustrate the input and output layout in the front of the tank assembly. In Figure 7, the (optional) gas heater will be on the right side. In Figure 8, the heater is on the left side.

Table **1** defines a typical layout, although the ports used may vary somewhat depending upon configuration.

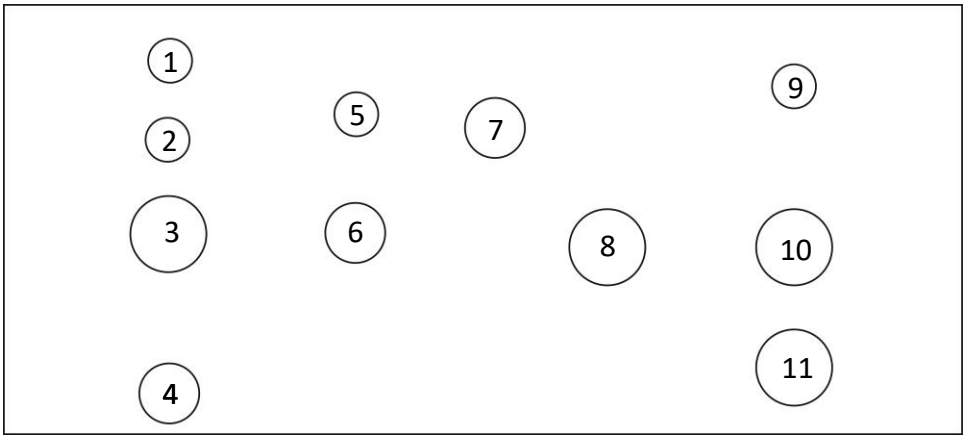


Figure 7: Tank assembly layout, left-side spray pump (facing entrance)

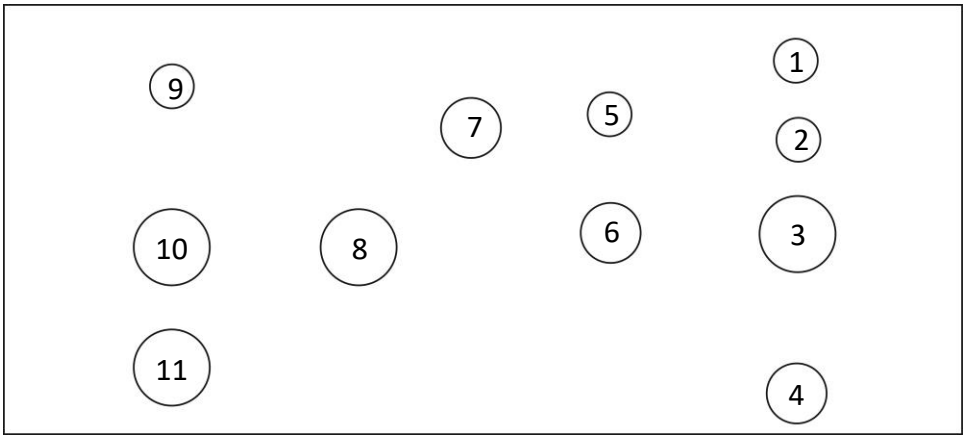


Figure 8: Tank assembly layout, right-side spray pump (facing entrance)

LP / NG Heated Module			
Port	**Size -FNPT**	**Function**	**Connected to**
1	1”	Water supply valve	Customer-supplied water line
2	1”	Spray pump bypass valve	Nozzle pump discharge bypass valve 1”
3	2”	Spray pump suction	Nozzle pump suction line 1.5”
4	1.5”	Tank drain valve	Customer supplied drain line
5	1”	Optional auto-fill inlet / plugged	Auto-fill transfer pump inlet 0.5” / plugged
6	1.5”	Nozzle pump discharge, riser supply line	Nozzle pump discharge line 1.5”
7	1.75”	Optional level control float /plugged	Level control float or plugged
8	2”	Heater pump suction	Heater supply pump suction 1.5”
9	1” (or 1.5”)	Heater pump bypass valve	Heater pump bypass line 1.0”
10	2”	Discharge line from heater	Heater discharge line 1.5”
11	2”	Optional equalizer line when two modules are connected / plugged	Equalizer line on connected tank 2” w/ valve
Ambient Module			
Port	**Size -FNPT**	**Function**	**Connected to**
1	1”	Water supply valve	Customer-supplied water line
2	1”	Spray pump bypass valve	Nozzle pump discharge bypass valve 1”
3	2”	Spray pump suction	Nozzle pump suction line 1.5”
4	1.5”	Tank drain valve	Customer-supplied drain line
5	1”	Optional auto-fill outlet or inlet / plugged	Auto-fill transfer pump 0.5” / plugged
6	1.5”	Nozzle pump discharge, riser supply line	Nozzle pump discharge line 1.5”
7	1.75”	Plugged	Plugged
8	2”	Plugged	Plugged
9	1” (or 1.5”)	Overflow line	1.5” Overflow hose
10	2”	Overflow Inlet line	1.5” Overflow hose
11	2”	Optional equalizer line when two modules are connected / plugged	Equalizer Line 2” hose / plugged

Table 1: Key to Figure 7 and Figure 8 (Typical layout; configurations may vary)

Drip module

Drip modules (**Figure 9**) are located between spray modules and catch the overspray and fluid draining off the parts. Both sides anchor into the spray modules. Drip modules are available 4 or 6-foot increments.

The drip trays are sloped to drain the overspray back into the spray modules. The 6-foot lengths slope 4 feet backward and 2 feet forward. The 4-foot modules slope 2.5 feet backward and 1.5 feet forward.

Drips modules have a removable shroud on each side

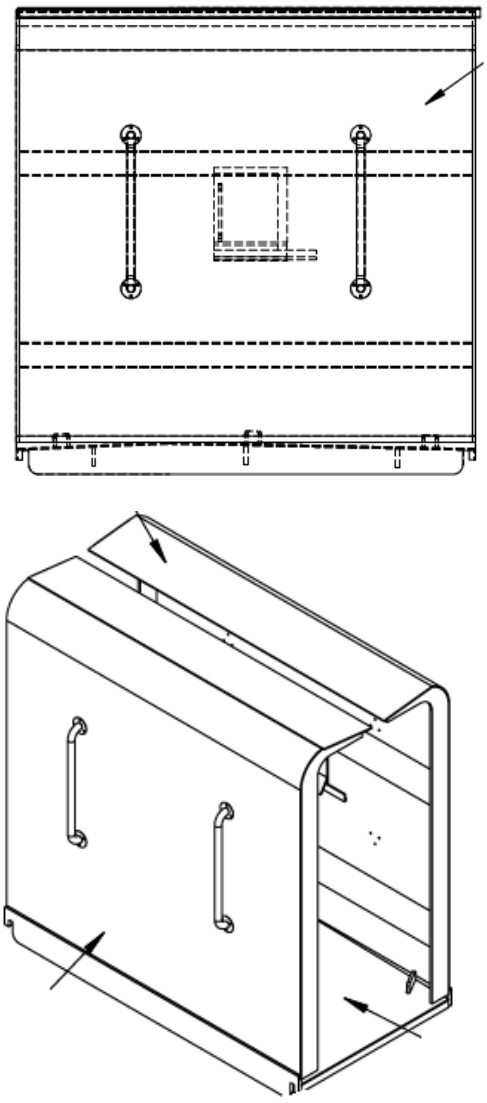


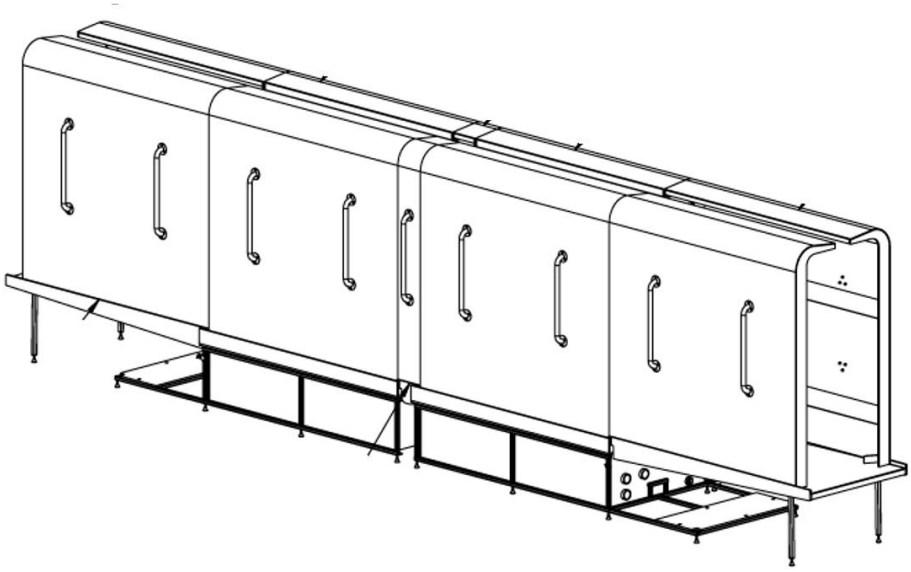
Figure 9: Drip module

Mini-drip module

A mini-drip module is a 9-inch drip zone that is used to connect two spray modules back to back and maintain consistent spacing of the risers when a longer spray zone is needed. The drip tray drains to the spray zones in both directions.

When two spray modules are connected like this, there is a gravity-based equalizer system, a hose connected to hole 11 in Figure 7 and Figure 8 that maintains an equal fluid level in the tank assemblies of the two spray modules.

Mini-drips modules have a removable shroud on each side.



Entrance and exit vestibules

Entrance and exit vestibules (Figure 10) are 4 or 6-foot modules are located on the ends of the spray line and contain spray from the spray modules that they are attached to. One side anchors into the spray module while the other side has metal legs for support.

The drip tray is sloped to run the spray back into the spray module tank assembly. The entrance and exit vestibules also have removable shrouds.

Figure 10: Entrance/exit vestibule

Heaters

Heaters are used for heated zones and are either LP gas / natural gas heaters (Figure 11). When gas heaters are used, the system is typically configured so the heaters are all on one side of the line with the fill and drain valves on the opposite side.

The LP or natural-gas water heater will turn on when it meets a point set on the control panel. Valves on the heater discharge and heat pump bypass can be adjusted to control discharge temperature and volume.

Figure 11: LP / natural gas heaters

Heated modules have a thermocouple mounted in the face of the tank that senses the liquid temperature in the tank and runs through the control box mounted on the frame and goes directly to the temperature controller on the main control panel, which is used to control the heaters.

Control panel

The control panel (Figure 12) is used for turning on and off the spray pumps, heater pumps, auto-fill transfer pumps and setting the wash or pretreatment fluid temperature. Indicator lights on the control panel turn on when the temperature controller signals heat is required. The timer for the auto-fill transfer pumps is inside the control panel.

Switches

Each pump in the system has an on-off switch. Each heater also has an on-off switch.

Indicator lights

Each pump in the system has an indicator light that turns on when the pump is operating.

Temperature controller

Each heater has a temperature controller for setting temperature.

Run time

The control panel has a run-time hour meter for the heated stage pump.

Control panel disconnect

A panel disconnect switch is located in the top right side of the control panel. Turn it to shut off electricity to the entire washer.

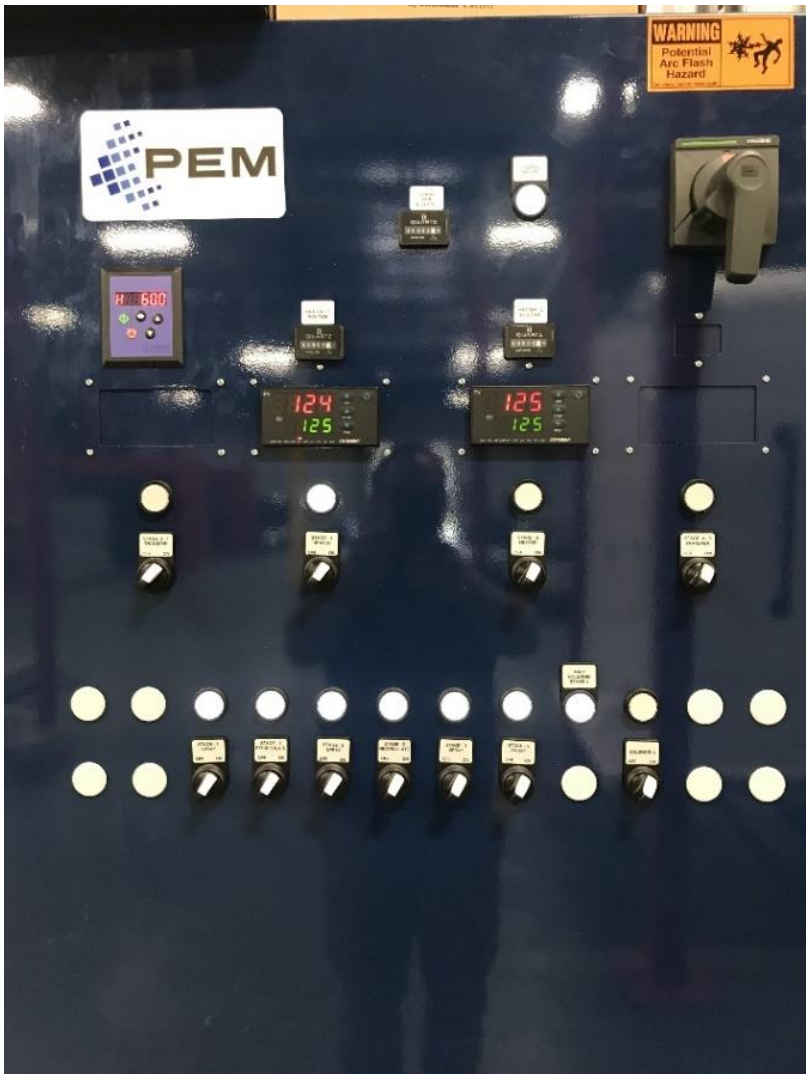


Figure 12: Control panel (layout may vary depending upon system configuration)

Installation

System delivery and inspection

The system is shipped to minimize on-site setup. Each modular section for the system is delivered on a pallet.

Before unpacking, check the equipment for any damage that may have occurred during shipment. Note any damage and immediately contact the carrier to make a damage or shortage claim. Also contact PEM.

Machine setup

Since exact machine setup may vary somewhat between machine models, refer to the diagrams that came with the machine. The following information will be a general guideline. Contact your dealer or authorized service representative for special installation or setup requirements.

Note: In order to avoid unnecessary expense of complying with or correcting the violation of a regulation, investigate all applicable state and local codes before attempting to install the machine.

Installing the modules

1. Un-package the modules, shrouds, and trays.

2. Slide each module onto a pallet jack or forklift, lift it, and re-tap the threaded holes for 3/8-16 levelers in order to remove debris from the threads.

   Note: If debris is left in the threaded holes the levelers will bind up and will need to be cut off.

   Note: 6-foot stages have eight levelers, and 4-foot stages have six levelers.

3. Install 3/8-16 SS levelers, leaving 3 inches from frame to the bottom of the leveler.

   Note: To avoid bending the levers, do not slide modules across the floor. Lift the modules to move them.

4. Using a vertical laser level or plumb bob, spot a line on the floor directly below the center of the overhead conveyor.

5. Mark the centerline on the floor with a chalk line. This will be the center of each module frame.

6. Start from the beginning (or end) of the line. Mark the floor where the entrance (or exit) will be.

7. Measure the length of the entrance (or exit) vestibule tray from the end to the frame attachment notch, and mark the distance from the mark made in the previous step to this length.

8. Install the required spray module tank frame to line up at that point on the floor.

   Note: Verify that spray pumps water inlet / drain valves are on correct side of washer (L/R).

9. Center the module frame on the conveyor centerline marked on the floor.

10. Measure the distance on the next drip zone tray from notch to notch. Mark on floor that distance from tank frame to tank frame.

11. Install the next spray module at the required distance, and center the frame on the conveyor centerline.

12. Install the drip module (tray) between the spray modules to verify they are placed the correct distance apart.

13. Continue this process down the line until all spray modules and drip trays are in place.

14. Install levelers on each leg support on the entrance and exit vestibule trays.

15. Install vestibule trays on the ends of the wash line.

16. Install the filter frame and tray in the cleaning modules.

17. Measure from the bottom of the track to the top of the filter tray, and determine required bottom of part opening elevation. Raise or lower the frame levelers as required.

    Note: Optimal distance from the bottom of the frame to the floor for running plumbing under the modules is 2.5 inches.

18. Level stage 1 module lengthwise and side to side based on the required elevation.

19. Raise or lower the leg support levelers on the entrance vestibule tray to keep the end of the tray approximately the same elevation as the top of the filter tray or slightly higher.

20. With the laser level placed horizontally, pick a point on the stage 1 module, and use that to level the rest of the modules down the line.

    Note: The critical elevation is the distance from the bottom of conveyor to the high point in the drip zones. After the washer is level, measure this distance at each drip zone and adjust accordingly. Note that the conveyor may not be installed level to the floor.

21. Install all of the drip module and vestibule shrouds to make sure they fit correctly.

22. Ensure the spray modules are level and straight for the shrouds to fit correctly.

23. Once the spray modules are in place and all of the shrouds fit correctly, remove the shrouds and drip modules to begin plumbing and wiring of the SprayLean® system.

    Note: After plumbing and wiring, ensure the drip modules are orientated correctly during reinstallation as their backward and forward slopes are not equal. The longer slope is toward the entrance of the washer (see the General Description section).

Water supply, drain and internal connections

Install the water supply. It will connect to a 1-inch CPVC valve.

Install the drain and connect the drain lines with a 1.5-inch CPVC valve.

If the system includes two spray zones connected by a mini drip zone, connect the fittings from hole 11 (see Figure 7 and Figure 8), using the 2-inch equalizer hose provided.

Connect the auto-fill transfer pumps to the auto fill inlet using 0.5-inch braided nylon hose.

Electrical service

Warning: Ensure a qualified, licensed electrician installs the electrical service. Be sure to follow all federal, state and local codes.

Mechanical (gas) service

 **Warning:** If gas heaters are used, ensure a qualified, licensed mechanical technician installs and connects the gas service. Be sure to follow all federal, state and local codes regarding burner ventilation.

Operation

Control panel

 **Warning:** To ensure safe operation, familiarize yourself with the machine controls and indicator lights before starting or operating the machine. See the General Description section of this manual.

Tank filling

To manually fill the tanks, open and then close the 1-inch CPVC water-fill valves on each module.

Starting the machine

1. Turn on the pump switches (spray, re-circulating, auto-transfer) on the control panel to start the pumps.

2. Turn on the heater switches on the control panel to start the heaters (if applicable).

   Note: The heater (re-circulating) pumps must be on before the heaters will fire.

Shutting down the machine

1. Turn off the heater switches on the control panel to turn off the heaters if applicable.

2. Turn off the spray and auto-transfer pump switches.

3. Wait several minutes and then turn off the re-circulating (heater) pump switches (if applicable).

Adjusting fluid temperature

Adjust the main control panel thermostat to raise and lower the heated stage temperature.

Predictive maintenance

Warning: To prevent damage to the machine and injury of personnel, make daily inspections of the machine for anything that could cause damage, fire or any other safety problem.

Warning: To prevent injury from electric shock or accidental machine startups, disconnect the electrical power supply before servicing any part of the machine. Follow lock-out, tag-out procedures to prevent accidental startup.

Spray modules

Filters

In wash stages, periodically replace the filter media by sliding out the filter tray to the drip zone or vestibule tray, replacing the fabric filter and sliding the filter tray back in place.

Quick-change nozzles

To prevent clogging of the quick-change nozzles (Figure 4), inspect them daily (or as experience dictates), and clean them as necessary as follows:

1. Remove the nozzle tip by turning it 90 degrees counterclockwise and then pulling it out.
2. Inspect the tip for debris, and remove the obstruction.
3. Replace the tip, and turn it 90 degrees clockwise.
4. Ensure the nozzle tip is angled the same as before removal.

Suction screens

To prevent clogging of the suction screens (Figure 13) inspect them weekly (or as experience dictates), and clean them as necessary as follows:

1. Pull the suction screen to remove it from the CPVC slip fitting.
2. Clean out the wire mesh by mechanical methods.
3. Replace the suction screen.

Figure 13: Suction screen

Note: It is critical that the suction screens remain clean and completely below water level. If the pumps are not completely flooded, they will suck air and not operate properly. If the pump inlets are restricted at all, the pumps will lose pressure and not operate properly.

Troubleshooting

 **Warning:** To prevent serious or fatal injury, ensure the machine is shutoff and disconnected from the electrical supply before attempting any repairs or maintenance. Use lockout-tagout procedures.

Troubleshooting is an organized study of the problem and a planted method of investigation and correction. The following troubleshooting guide includes some of the problems that you may encounter during service of the machine. It does not give all the possible methods to correct the problems listed, but is meant to stimulate a train of thought and indicate a work procedure directed toward finding the source of the problem.

Most problems are simple and easily corrected. To save time and trouble, always check the easiest and obvious thing first.

Study the problem thoroughly, and ask yourself these questions:

- What were the warning signs preceding the trouble?
- What previous repair and maintenance work has been done?
- Has a similar problem occurred before?
- If the machine still runs, is it safe to continue operation to make further checks?

SprayLean Start-Up Process:

Verifications:

- Gas supply w/ regulator is connected to water heater gas valve with proper pressure (7”-9” wc)
- 12” Type B Vent – Heater Exhaust
- Power ran to main control panel
- Power ran from control panel to each junction box on the washer modules as well as power from main panel to water heater(s).
- Thermocouple wire ran from temperature controller(s) in main panel to thermocouple probe connection on heated stages.
- Compressed air line ran to solenoid on air diaphragm transfer pumps
- Water lines ran to 1” inlet valve on each stage as well as ½” lines to each water solenoid valve
- Drain is available to dump and re-charge tanks when checking for leaks

SprayLean process verification:

- Verify all spray nozzles are properly adjusted and unions on risers are all tight.
- Verify the union on the CPVC header inside the tank is tight
- Verify all unions are tight on the pumps, water fill, bypass and drain, equalizer valves.
- Verify all ¼” tubing fittings are tight on pumps as well as on pressure gauges
- Check proper motor rotation on spray and recirc pumps (clockwise when looking at rear of motor)
- Fill SprayLean tank with water – do not add chemical. Fill to 45 degree elbow on risers.
    - Watch for leaks during water fill
    - Tighten fittings, hose clamps as necessary
    - Repeat for each spray module
- Turn on main control panel power
    - Turn on transfer pump switches
    - Push down on low level floats and make sure the proper solenoid opens to auto fill or transfer water to spray module.
    - Release float to full position and verify the timer in the control panel closes the solenoid after the proper time and fill / transfer stops
- If the proper auto fill / transfer operation does not take place troubleshoot the electrical wiring for the float and/or solenoid to allow for proper operation

- When an autofill process is tied to the Spray pump, turn on spray pump and verify the solenoid opens and closes with the pump on / off properly
    - Set auto fill / halo flowmeter gauge to 1.5gpm (adjust as necessary during production)
- Turn on each spray pump independently and verify proper spray pattern, check for plugged nozzles
    - Adjust nozzles as necessary to contain spray in each module

SprayLean Heater / Recirc Process:

- Turn on heater recirc pump
    - Verify proper flow and pressure (approx. 25psi. at pump) through bag filter / heater
    - Check for leaks in the filter / heater loop
- Turn on heater temperature controller and follow temperature controller parameter entries as shown on parameter document

- Turn on burner switch on heater
    - Set high limit parameter on heater controller to 190F. (Follow parameter process)
- Turn on temperature controller switch
    - Verify pilot lights on burner (purge air in gas piping if necessary)
    - Verify flow switch allows main burner to light
    - Turn off recirc pump switch
    - Verify flow switch shuts off main burner (adjust setting on flow switch if necessary)
- Turn off temp controller – verify water heater turns off

- Turn on temp controller – verify temp controller temperature temperature is similar to actual bath temperature (use temp gun /probe to verify)

    - Adjust temp offset in temperature controller parameters (Scb parameter) if necessary
- Set temp controller setpoint to 120F
- Document the time it takes from ambient temperature to reach 120F in the bath temperature.
    - Temp in bath should rise approx.. 3 degrees per minute to reach setpoint time.
    - Monitor water heater high temp output, high temperature should reach approx.. 170F when bath is 120F.

- Turn on spray pump, bath will drop in temperature, document time to get bath back up to 120F.
- Turn on all spray pumps, monitor spray and verify heated stage(s) maintains temp setpoint

Service record

Type	Date

Service record

Type	Date

Service record

Type	Date

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