Installation, Operation, Maintenance Manual

Trident High-Yield Series
(Duo - Trio- Quad)
Automatic Defluxing System

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Please read this manual thoroughly prior to installing and operating this unit. If you have any questions concerning the information contained in this manual, or if anything is unclear, please contact Aqueous Technologies for assistance.

The Trident Automatic Defluxing System is capable of operating with a variety of aqueous cleaning chemistries. Contact Aqueous Technologies to verify chemical compatibility before operating the machine!

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Supplemental Data

Trident Series Wash Solution Consumption Guide
Preface

Scope

This manual describes equipment manufactured by Aqueous Technologies Corporation. It may also contain information or documentation supplied by others, (i.e., component parts used in our equipment). All references to this externally supplied information are believed to be correct, however, we cannot guaranty its accuracy. All manufacturers claim the right to modify, change their products without notice to us.

Copyright Information

This manual is copyrighted by Aqueous Technologies. All rights are reserved. No part of this document, in whole or in part may be reproduced, stored, transmitted, or used for any purpose without the prior written permission of Aqueous Technologies.

Trademark Information

Aqueous Technologies®, Trident®, Focus Wash® and Vitrex® are registered trademarks of Aqueous Technologies, Corporation.

Other trademarks and service marks are the property of their respective owners.

Limitations

Under no circumstances, including negligence, will Aqueous Technologies, it directors, officers, employees, or agents be liable for any incidental, special, or consequential damages (including damages for the loss of business profits, business interruption and the like) arising out of the use or inability to use this equipment. This limitation applies even if Aqueous Technologies, or it directors, officers, employees, or agents have been advised of the possibility of such damages.

Origin

This equipment was designed and manufactured in the United States of America.
Symbols Used in this Document

Throughout this manual, the following types of symbols will be displayed:

![Symbol]

Caution, Risk of Danger

![Symbol]

Hot Surface

![Symbol]

Caution, Risk of Electrical Shock

![Symbol]

Important Documentation Note
Referenced Standards

The following standards are referred to, in whole or in part, in this manual. They are available from the indicated sources below.

National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, DC  20037

NEMA ICS 1.1-1984  Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
NEMA ICS 1.3  Preventive Maintenance of Industrial Control and Systems Equipment

American National Standards Institute
11 West 42nd Street
New York, NY  10036

ANSI/NFPA 70  National Electrical Code
ANSI/NFPA 70B  Electrical Equipment Maintenance

U.S. Department of Labor
Occupational Safety and Health Administration (OSHA)
200 Constitution Avenue, N.W.
Washington, D.C. 20210

29 CFR 1910  Electrical Subpart S, 1994 revision
29 CFR 1910.147  Control of Hazardous Energy (Lockout/Tagout)

IPC
2215 Sanders Road
Northbrook, IL  60062

IPC-CH-65A  Guidelines for Cleaning of Printed Boards and Assemblies
IPC-AC-62A  Aqueous Post Solder Cleaning Handbook
Overview

Intended Use

The Trident Automatic Defluxing System Series of machines are specifically designed to remove post-reflowed soldering fluxes from printed circuit boards. The features and characteristics of the unit are tailored specifically toward this application. Whereas other applications may be possible, they should NOT be assumed. Only written communication from the factory will be evidence of proper authorization for alternate applications.

Under no circumstances may a user modify the equipment in any manner without the express written consent of Aqueous Technologies. Any unauthorized modification of design or use will result in the immediate voiding of the equipment’s warranty and may result in equipment damage and / or user injury.

Under no circumstances shall the unit be used with any chemicals which are flammable in either its liquid or gaseous states.
Overview

While Trident High Yield Series (Duo, Trio, Quad) are considered as one machine, they are actually multiple independent defluxing systems that are mounted on one single frame. While they each share a common electrical service and water input, they function as independent machines. Because Trident High Yield Series equipment can be configured with differing chamber configurations, (Trident I, II, III), this manual is designed to describe the function of one single process chamber.

Each chamber within Trident High-Yield is available in three basic configuration technologies:

**Trident I:** The unit’s “fill and drain” process uses an automatic chemical management system to deliver a programmable concentration of defluxing solution directly into the unit’s sump tank. This solution is then heated automatically and sprayed onto the assemblies. At the end of the wash cycle, the solution is filtered and drained from the machine. Repeated rinses are performed until the desired cleanliness level is achieved, or the maximum number of rinses has been completed (which ever comes first). Each rinse is likewise filtered as it is sent to the drain. Assemblies are dried via a combination of radiant and forced hot air drying. This model has one available configuration options:

- ✓ Waste Evaporation System – for zero-discharge operation.

**Trident II:** The unit uses a closed-loop wash solution recycling system. Wash solution is transferred from a holding tank to the unit’s sump tank. It is automatically heated, then sprayed on the assemblies. At the end of the wash cycle, the solution is redirected back to the holding tank for subsequent reuse. Repeated rinses are performed until the desired cleanliness level is achieved, or the maximum number of rinses has been completed (which ever comes first). Each rinse is likewise filtered as it is sent to the drain. Assemblies are dried via a combination of radiant and forced hot air drying. This model has two available configuration options:

- ✓ Waste Evaporation System – for zero-discharge operation.
- ✓ Chemical Management System – automatically mixes the desired concentration of wash solution

**Trident III:** The Trident III has all the features of the Trident II (above), but adds to it a host of valuable features including:
• programmable maintenance reminders
• remote SPC viewing
• SPC data USB export
• Chemical management system – automatically mixes the desired concentration of wash solution

The Trident III has one available configuration option:

✓ Waste Evaporation System – for true zero-discharge operation.
## Specifications

The following matrix shows the various models of the Trident Automatic Defluxing System, and some salient specifications.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Wash Chambers</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Configurations Available</strong></td>
<td>Trident I</td>
<td>Trident II</td>
<td>Trident III</td>
<td></td>
<td>Trident III</td>
<td></td>
<td>Trident III</td>
<td></td>
<td>Trident III</td>
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</tr>
<tr>
<td><strong>Electrical Requirements</strong></td>
<td>208 VAC 40 Amps 60 Hz 3Ø/3wire</td>
<td>240 VAC 80 Amps 60 Hz 3Ø/3wire</td>
<td>208 VAC 62 Amps 50 Hz 3Ø/3wire</td>
<td>208 VAC 93 Amps 50 Hz 3Ø/3wire</td>
<td>208 VAC 120 Amps 60 Hz 3Ø/3wire</td>
<td>208 VAC 160 Amps 60 Hz 3Ø/3wire</td>
<td>208 VAC 150 Amps 60 Hz 3Ø/3wire</td>
<td>240 VAC 124 Amps 50 Hz 3Ø/3wire</td>
<td></td>
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</tr>
<tr>
<td><strong>Maximum branch circuit overcurrent rating</strong></td>
<td>50 Amps</td>
<td>40 Amps</td>
<td>90 Amps</td>
<td>80 Amps</td>
<td>150 Amps</td>
<td>125 Amps</td>
<td>200 Amps</td>
<td>150 Amps</td>
<td></td>
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</tr>
<tr>
<td><strong>Incoming Water Requirements</strong></td>
<td>Regulated and set at 40-80 PSI at approximately 10 GPM</td>
<td>Water quality should generally be de-ionized to &gt;2 MΩ</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Drain Requirements</strong></td>
<td>10 GPM maximum</td>
<td>20 GPM maximum</td>
<td>30 GPM maximum</td>
<td>40 GPM maximum</td>
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<tr>
<td><strong>Exhaust Requirements</strong></td>
<td>Approximately 400 CFM per wash chamber</td>
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<tr>
<td><strong>Overall Dimensions</strong></td>
<td>71 inches high 44 inches wide 34 inches deep</td>
<td>71 inches high 87 inches wide 34 inches deep</td>
<td>71 inches high 129 inches wide 34 inches deep</td>
<td>71 inches high 172 inches wide 34 inches deep</td>
<td></td>
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<tr>
<td><strong>Added depth with chamber door open</strong></td>
<td>Additional 26 inches from front</td>
<td></td>
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<tr>
<td><strong>Concentrated Chemical Tank Capacity</strong></td>
<td>Approximately 8 U.S. gallons per chamber</td>
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<tr>
<td><strong>Wash Tank Capacity</strong></td>
<td>Approximately 12 U.S. gallons per chamber</td>
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<tr>
<td><strong>Chamber Sump Tank Capacity</strong></td>
<td>Approximately 3 U.S. gallons (per chamber, per rinse event)</td>
<td></td>
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</table>
Safety

The equipment contains potentially lethal voltage levels. The primary purposes of the metal covers are for personnel safety. If the covers are removed for any reason, personnel could be exposed to these dangerous voltages.

It is mandatory that all personnel that require access to the inside of the unit, be properly trained for work around electrical and plumbing hazards.

Incorporated Safety Features

Emergency Switching Off

In the event of emergency, turn the unit off by rotating the red/yellow power switch (located on the main control panel) to the “OFF” position.

If the emergency involves water leaks, after turning off all electrical service to the machine, turn off all water service to the machine at its source.

Wash Chamber Door Switch

Opening the washer chamber’s door during a wet cycle (wash or rinse) will cause the spray pumps to turn off. When the door is closed, pumping will resume (after acknowledgment via the software).

Over-Temperature Switches

Both the sump solution heating system, as well as the heated air system incorporates over-temperature protection thermostats. These will limit the temperature to a safe level in event of a system malfunction.

Float Switches

Corrosion-resistant, stainless steel float switches are used inside the wash and rinse sump tanks. Certain switches will sense a “high” level, and will prevent liquid from overflowing out of the tanks. Other switches will detect a “low” level and will de-energize the pumps and heaters before they are in danger of dry operation.
Safety Do’s and Don’ts!

**NEVER**: Leave the machine’s power switch on when the building is unoccupied or no one is around to respond to the machine’s safety concerns.

**ALWAYS**: Shut down the machine and turn off the main power switch at the termination of a shift.

**NEVER**: Operate the machine with flammable chemicals or additives. Consult with Aqueous Technologies for specific chemical recommendations.

**NEVER**: Use this machine to clean stencils or misprint assemblies. Do not use this machine to clean non-reflowed solder paste.

**NEVER**: Operate the machine with its exterior panels removed.

**NEVER**: Operate the machine without the main water input connection turned ON.

**NEVER**: Attempt to modify the machine. Unauthorized equipment or software modification may result in the termination of the machine’s warranty.

**NEVER**: Operate the machine without a complete understanding of the machine, the process, or your chemical (if any).

**ALWAYS**: Report any unsafe condition or equipment concern to a supervisor and to Aqueous Technologies immediately.

**ALWAYS**: Contact Aqueous Technologies if there are any questions regarding the operation or maintenance of the machine.
Installation

Installation generally involves the following steps:

- Unpacking
- Checking for signs of damage
- Moving the unit into position
- Making the electrical, plumbing, and exhaust connections

Unpacking / Uncrating

The unit was packaged and braced suitably for shipping. If the equipment is received with obvious evidence of shipping damage, immediately notify the shipping company. All units include a "Tilt-Tell" device which indicates if the crate has been dropped or turned on its side during shipping (refer to the instructions on the "Tilt-Tell" found in the exterior packaging material). Retain all shipping material for inspection by the company representatives. In some cases, the factory may have to be contacted to obtain a repair or replacement quotation.

When unpacking the unit, be aware that the unit is designed to be lifted from the bottom only. To avoid damaging the leveling feet, the unit must not be dragged, pushed, or pulled off the shipping pallet.

After unpacking the unit and placing it on a level floor, inspect it for signs of concealed shipping damage.

Moving the Unit into Place

The unit should be moved into its desired location. Note - the Trident Automatic Defluxing System is designed for indoor installation only. Furthermore, the installation location must be deemed non-hazardous by both NFPA 70, Article 500 and IEC 600079. When choosing a location, forethought should be given to future access for maintenance, as well as the availability of the proper utility services. Always use a forklift or an adequately sized pallet-jack to move the machine. Sliding the machine on the floor may cause damage to the leveling feet or the floor surface. Adjust the four leveling feet, as needed, to level the unit and provide for a “wobble-free” installation.
In some localities, seismic regulations may require that the unit be secured to the floor. Hold-down clamps are available from Aqueous Technologies for this purpose.

Required Clearances

Both NEC and OSHA requirements dictate that 36 inches of working clearance must be maintained around of any equipment that may require examination, adjustment, servicing, or maintenance while energized. In order to avoid the disconnection and relocation of the unit should such service be required, we generally recommend conformance with these requirements. However because servicing to the rear of the unit is rare, reducing the clearance to approximately 24 inches is allowable. (The unit will have to be moved in case of major service)

Completion of placement

After the machine is placed:

1. Open all doors and remove any accessories that may be packaged within.
2. Cut-off and remove all packaging material from inside the cleaning chamber (if any).
3. Remove any and all tape from doors.

Electrical Connections

A qualified electrician, trained in the skill, shall make the electrical connections. The connections to the equipment shall comply with the applicable sections of the National Electrical Code (NFPA 70); of particular concern is the wiring ampacity and equipment grounding.

The unit is designed for 3-phase, 3 wire operation. The 3 phase conductors shall be connected to the terminals inside the electrical termination box.

The phase rotation is important. The unit is designed for A-B-C rotation being connected to L1-L2-L3 respectively.

The unit must be grounded. Connect a grounding wire to the Green/Yellow terminal block inside the electrical termination box. In most cases, this conductor can be smaller than the input phase conductors. See NEC Article 250 for sizing this conductor.
The Trident series of automatic defluxers shall be connected to a single, dedicated branch circuit. This branch circuit shall be protected by an overcurrent device no greater than the one listed in the specification section of this manual.

**Plumbing Connections**

The Trident I configurations have two plumbing connections, as follows:

- Water Inlet
- Primary Drain

The Trident II and Trident III configurations have three plumbing connections, as follows:

- Water Inlet
- Primary Drain
- Wash Solution Drain

These connections are located on the lower, rear of the machine. While the Trident High Yield machines use one common water inlet, they are equipped with separate drains (one primary drain and one wash solution drain). Aqueous Technologies provides an exterior common drain manifold for each of the drain types. A user may choose not to utilize the exterior common drain manifolds by removing them. In this case, the user must connect separate drain lines to each of the individual drain connections.

These connections require installation of ¾ inch NPT (male pipe thread) fitting suitable to connect into your intended plumbing system.

Hosing used to connect the machine shall be suitable for the duty involved. The minimum recommended hose will have a working pressure rating of 300 PSI and burst strength of 1200 PSI. The wash tank drain hose shall additionally be suitable for the hot water, and high pH chemistries typically used in the wash solution. The drain lines shall be minimum ¾ inch inside diameter (or equivalent).
In no case, shall a shutoff valve be used in either of the drain lines. The drain lines must be unobstructed to prevent backup of the system and possible pump damage.

To prevent siphoning of the tank contents in the event of a “leaky” drain pump, it is recommended that the drain be connected to a plumbing system that is properly vented to the atmosphere.

**Exhaust Connections**

The Trident Automatic Defluxing System uses forced, heated air to dry the boards. The unit is equipped with a 6” exhaust fitting located on the top of the machine.

In most cases, a fixed static ducting system will suffice. The exhaust system shall be capable of carrying 400 CFM (per wash chamber) with a maximum pressure drop of 0.5 inches of water. In the cases of multi-chambered units, the exhaust ducts can be connected together, if desired. If this pressure requirement cannot be met, an active ducting system can be used, (within limitations). Ideally, air would be exhausted only during a dry cycle, but because most active ducting systems are on continuously, it can pull air (and water mist) into the exhaust system during wash and rinse cycles. This is undesirable.

If an active ducting systems is desired. Consideration should be given to the use of an “air gap” between the machine’s output and the ducting’s input.

When installing any ducting system, all vertical members shall be oriented so that water condensation forming in the inside the ducts will flow downward “inside” the ducting and not escape to the “outside”
Component Identification and Functions
Front Panel Controls

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
</table>
| Pressure Gauges  | Facility Water Pressure – Displays the pressure at the water inlet of the machine. Should typically be between 40 and 80 PSI. Low pressure is usually an indication of clogged filters or other restrictions in the facility’s water supply.  
Nozzle Pressure – Displays the pressure inside the pressure manifold during a spray cycle (wash or rinse). Typical readings are approximately 50-60 PSI, but can vary slightly depending on conditions.  
Drain Pressure – Displays the pressure while a drain cycle is in progress. In most cases, this pressure is rather low, due to the atmospheric venting of most drainage systems. Because this measures the pressure before the internal drain filter, a rise in pressure above its typical level is a good indication of a clogged filter. |
| Power Disconnect | This is the power disconnect for the unit. The switch must be on the OFF position in order to open the panel door. This switch may be locked in the open position, by using commonly available lockout devices.  
Note – on multiple-chambered units, the main power disconnect is on the rear of the unit. The front panel disconnect will only disconnect the power to the individual chambers. |

![Diagram of Front Panel Controls](image-url)
<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Screen</td>
<td>The combination display and touch screen controller is the primary user interface of the unit. It controls most of the functions of the unit. Mounted behind the display screen is the control computer.</td>
</tr>
<tr>
<td>Concentrated Chemical Level Gauge</td>
<td>This gauge shows the liquid level in the concentrate tank.</td>
</tr>
<tr>
<td>Wash Solution Level Gauge *</td>
<td>This gauge shows the liquid level in the solution tank.</td>
</tr>
</tbody>
</table>
| Add Wash Solution Switch *                     | This will add a mixture of chemical and water through the Chemical Management System into the wash solution tank. An upper level float in the tank will prevent an overflow.  
Note – Do not leave this switch energized depending upon the float to safely stop an overflow. During normal operation, as the tank’s solution is transferred within the unit, it would falsely appear as a condition to refill the tank. |
| Add Water Switch *                             | This will add water to the wash solution tank. An upper level float in the tank will prevent overflow.                                       |
| Wash Solution Drain Switch *                   | This will energize the internal diaphragm pump and send the contents of the wash solution tank to the drain. Although this pump is rated for dry operation, the tank level should be monitored and the switch turned off when the tank is empty. |
| Emergency Stop Switch                          | Depressing this switch will immediately disconnect the control power circuits, thereby, de-energizing the machine.                           |
| USB Port                                       | This is a standard USB “Type A” connector. It connects directly to the internal control computer. It can be used to connect an external mouse, keyboard, or storage device (thumb drive). |
| Grounding point                                | Available for connections to a ESD wrist strap for personal ESD protection while handling the PCB assemblies                                     |
| Panel Latch (2)                                | These quarter turn latches (together with the power disconnect switch) will prevent unauthorized access to the electrical parts behind this panel.  

*Components marked with an asterisk (*) are not installed, nor used, on a Trident I*
Theory of Operation

During the WASH, RINSE, and DRY cycles, the following events take place:

WASH:

If a wash cycle is programmed the following events will take place:
Reusable wash solution from the wash solution tank is pumped up into the sump tank using the fill pump. (The Trident I fills the sump with new solution at each cycle) It will continue filling until the sump’s float switch is activated. If the solution’s temperature is below the desired set point, the sump heaters will energize until the desired temperature is reached.

The spray pump will then energize and the wash cycle will begin. Both the sump heaters and the chamber heater will cycle to maintain the correct temperature.

When the wash cycle time has expired, the wash pump will turn off.

The machine will pause for a programmed “rest” time, allowing fluid on the chamber and board surfaces to drain back into the sump tank.

The wash solution is then drained back into the wash solution tank using the transfer pump. The flow is directed to the tank by way of a solenoid valve.

RINSE:

If a rinse cycle is programmed the following events will take place:

The inlet solenoid opens, allowing incoming water to fill the sump tank.

It will continue filling until the sump’s float switch is activated, then the solenoid will turn off.

The spray pump will then energize; the rinse cycle will begin.

Cleanliness Value Selected: When the rinse cycle has finished, the cleanliness (resistivity) of the rinse water is measured and compared to the programmed setpoint. This will determine if another rinse cycle is merited. If so, the rinse cycles will repeat until the desired cleanliness is achieved or the programmed value of rinse cycles is met.
Cleanliness Value Turned Off: All programmed rinse cycles will be preformed.

DRY:
If a dry cycle is programmed, the following events take place:
The blower turns on.
The airduct heaters and the chamber heater will energize, as necessary, to obtain and maintain the programmed drying temperature.
A cooldown period is provided at the end of the drying cycle. It is intended to dissipate some of the stored heating energy of the hot elements before the blower stops.

END OF CYCLE:
At the termination of a cleaning cycle, the display screen will indicate that the cycle is complete and will display a screen indicating the PASS or FAIL status of the rinse cycle.
Initial Startup

Power Up

Do not energize the power to the unit until a thorough inspection of the machine, electrical connections, and plumbing connections has been completed. If there are any signs of incorrect installation or equipment damage, do not proceed with power initialization or operation. Failure to properly install and inspect unit may result in damage to the equipment and potential injury.

Ensure power from the facility is turned ON.

To energize the unit, rotate the red/yellow power switch on the front panel. Upon energizing, the computer control systems will begin their boot sequence. During the boot process, do not attempt to press the screen until the main display screen (with Aqueous Technologies’ logo) is visible.

If the wash solution tank has not been filled, a warning will appear indicating that the tank is low and the machine cannot start.

Initially turn on the facility water supply. Check for signs of leakage.

Filling the Wash Chemical Concentrate Tank

The concentrate tank is designed to hold the concentrated chemical. It is located behind the right lower cabinet access door. For filling convenience, there is an angled filler spout on the front of the tank. This chemical will add to the solution tank (mixed with a programmed amount of water) when the ADD SOLUTION switch is activated on the front panel. An electrical float switch, located near the bottom of the tank, will sense a low chemical condition and inhibit the machine from starting.

Note – On Trident I models, the chemical is mixed with water and added directly into the wash chamber’s sump tank.

Contact Aqueous Technologies for a list of recommended chemicals. Adding chemicals not approved by Aqueous Technologies may result in damage to the equipment and potential injury.
in damage to equipment, undesirable cleaning results, and / or a voiding of the equipment’s warranty.

Never use flammable chemicals in the unit. The use of flammable chemicals will void the equipment’s warranty, damage the equipment, and may cause personal injury.

Follow all chemical manufacturers’ safety instructions concerning proper handling and operator protection.

Refer to chemical’s data sheet for concentration and temperature recommendations.

**Filling the Wash Solution Tank**  
* (Applies to Trident II and Trident III only)*

The unit’s wash solution tank is located behind the lower right cabinet access door. This tank supplies the unit’s wash solution. In almost all cases, a cleaning chemical will be used in the unit. Even in cases where water-soluble flux is being removed, the cleaning properties will be improved by addition of chemicals (lower surface tension, etc). Typically, chemicals will be added to the water in a percentage ratio with water. In some cases, chemicals are available as a ready-mix, with no dilution required.

During the initial fill always watch for foam. The mechanical agitation created by the initial fill may cause foam to form in the wash tank. If foam does occur, allow it to dissipate before adding more solution.

**Add water to tank:**

Activating the ADD WATER switch on the front panel will add water to the tank. Water may be necessary to account for evaporation losses, or when rinsing the tank (such as between chemical changes)

The tank is full when the solution level is approximately two inches (50mm) below the top of the tank. Overfilling is prevented due to an electrical float switch de-energizing the circuit.

**Add Mixed Chemical Solution:**

If your Trident Automatic Defluxing System is equipped with a Chemical Management System (standard on Trident III), be aware that, upon initial use, the Chemical Management System will need to be “primed” in order to expel the trapped air from the system. This
can usually be compensated for by slightly increasing the concentration during the initial fill.

If Trident is equipped with a Chemical Management System (CMS), the primary inlet’s incoming water temperature must not exceed 104°F.

### Draining the Wash Solution Tank

Turn on the drain pump by switching the WASH TANK DRAIN Switch located on the front panel to the unit. If desired, remove the lid of the wash tank to verify that tank is completely empty. Once draining is complete, turn the drain pump switch to the off position.

The drain pump is rated to operate “dry”, but users should not routinely operate the drain pump for longer than necessary. For estimation of required drain times, it is helpful to know that the drain pump is rated for a flow rate of approximately 3 GPM (11.4 liters per minute).

### Draining the Concentrated Wash Chemical Tank

Most users will rarely need to drain this tank. If needed, a hose is provided, to facilitate drainage into a short container.

### Phase Rotation Check

The pumps and blower of the unit are phase rotation sensitive. Improper phase rotation will cause these devices to rotate in the opposite direction and will lead to device damage.

It is imperative that the first powerup include a visual verification of proper phase rotation, as follows:

Only personnel trained in the skill should perform this test.

1) Remove the upper rear cover of the unit

2) Locate the air blower; notice that the rotating impeller is clearly visible.

3) Using the touch screen controller, go to the manual device control screen (this will require familiarity with the software section of this manual)
4) Tap the blower button once to energize the blower, then immediately tap the button again to de-energize it.

5) Visually observe the blower’s spinning impeller. It should be rotating in a counter-clockwise direction (blowing air “up” into the ductwork)

6) If the impeller is rotating in the wrong direction, the incoming phase rotation must be reversed. This is easily accomplished by transposing any two wires of the incoming power.

NOTE – This change involves the facility-supplied wiring only. Do not change any wires that are part of the original factory wiring of the unit.

Stand clear of the blower when in operation. Do not allow loose clothing or other items near the blower. Do not place hands near the blower. Once the phase rotation check is completed, immediately re-install the rear upper panel.
Operation

Loading the Board Rack

The board is designed to hold a wide variety of board shapes and sizes. The tine bars can be adjusted, as needed.

Some tips for loading boards include:

- Some components can “cup” water (e.g., certain connectors). These should be positioned downward, to facilitate drainage.

- Because the boards will “lean” against the support tines, it is sometimes advantageous to lean the boards in one direction, or the other, to enhance drainage.

- Be aware of “shadowing” issues. If possible, arrange boards so that larger parts do not block the spray pattern, (from either the top or the bottom).

- If doing a small quantity of boards, distribute the boards across the entire rack area.

- If washing very small or lightweight boards, be aware of the possibility for the boards to move within the rack. Contact Aqueous Technologies for special techniques, in these cases.

Note the board rack has a small metal plate at its center, rear. It is important that the rack be loaded with this plate towards the rear of the unit.
Software Operation

If the unit is ready to start, without any internal faults, press the Green colored start button to begin the programmed cycle.

The unit can be paused or stopped by pressing the appropriate button during operation.

Unloading the Board Rack

Upon the successful completion of the cycle, the entire rack and its boards will be HOT. Care should be exercised during handling.

Some customers, in high volume production, find it advantageous to purchase an additional board rack. This one rack may be unloaded and reloaded while the other rack is in process.

Recommended Process Variables

The following program recipe guide is a general guideline. Specific program parameters will be determined by the type and quantity of boards to be cleaned, the flux application method, the specific type and brand of flux and other relevant factors. Consult with Aqueous Technologies for more specific instructions +1.909.944.7771.

<table>
<thead>
<tr>
<th></th>
<th>Wash Time</th>
<th>Wash Temp</th>
<th># Rinses</th>
<th>Cleanliness</th>
<th>Dry Time</th>
<th>Dry Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosin / No-Clean Flux / Paste</td>
<td>6 - 10 min</td>
<td>150°F</td>
<td>6 - 8</td>
<td>750 - 1000 KΩ</td>
<td>12 - 15 min</td>
<td>160 - 170°F</td>
</tr>
<tr>
<td>Water Soluble Flux / Paste</td>
<td>6 - 10 min</td>
<td>150°F</td>
<td>5 - 6</td>
<td>750 - 1000 KΩ</td>
<td>12 - 15 min</td>
<td>160 - 170°F</td>
</tr>
</tbody>
</table>
Recommended Chemicals

In-house brands
Aqueous Technologies produces a cost-effective, high performance selection of de-fluxing chemicals. These chemicals are provided by, and supported by Aqueous Technologies.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Chemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqueous Technologies</td>
<td>PCB-Wash</td>
</tr>
<tr>
<td>Aqueous Technologies</td>
<td>Vitrex AT200</td>
</tr>
<tr>
<td>Aqueous Technologies</td>
<td>Vitrex CA</td>
</tr>
<tr>
<td>Aqueous Technologies</td>
<td>Vitrex Ultra</td>
</tr>
</tbody>
</table>

Other brands
In addition to Aqueous Technologies’ chemicals, we are pleased to recommend other brands.

Chemicals and chemical manufacturers change their selection and formulations frequently. Therefore, we recommend that you contact Aqueous Technologies for an updated list of recommended chemicals.
Software

The Trident series of machines uses Microsoft Windows CE based operating system. This proven platform is ideal for systems such as this. Among its many virtues is the common Windows “look and feel”. The Trident application software is written using Microsoft development tools. It is intended to be intuitive in its operation, with distinct screens to perform various functions, numerous dialog boxes, and ample use of status indicators to provide operator feedback of the machine’s status.

The built-in touch screen makes operation easy, without the use of a mouse or keyboard.

There are two factory default passwords needed to operate the unit. It is highly recommended that the user changes these passwords to prevent unauthorized editing of important cycle parameters.

The default supervisor password is SUPER

The default administrator password is ADMIN

The default maintenance password is MAINT

For password purposes, a “supervisor” is a person authorized to create, edit and delete the process recipes. An “administrator” is a person authorized to edit the configuration variables such as drain times. Only an administrator can change passwords. The maintenance password resets the maintenance reminders (if equipped).

The following page is an elementary diagram of how some of the display screens interact.
Screen Shot Overview (actual screen views may differ)
Software Functions, by Task

Programming Recipes

A supervisor password is required to access the Recipe Editor. To access the Recipe Editor, press the Program Setup button located on the lower left side of the main display screen. Enter the supervisor password and press Enter.

Create a New Program

To create a new recipe, press the down arrow at the right end of the current Recipe box. At the end of the recipe list is New Recipe. Select New Recipe. The Recipe box will initially be blank, using the alphanumeric keypad, type in a recipe name.

Next, using the parameter up / down arrows, move the desired parameter value either up or down, until the desired value is displayed. When all six parameter values are correctly displayed, press the green Done button. This will return you to the main screen with the newly programmed recipe in the recipe box.

Modify an Existing Program

To modify an existing recipe, enter the Recipe Editor screen. To access the Recipe Editor, press the Program Setup button located on the lower left side of the main display screen. Enter the supervisor password and press Enter.

Select the desired recipe to modify by selecting it from the recipe dropdown box. Using the parameter up / down arrows, move the desired parameter value either up or down, until the desired value is displayed. When all six parameter values are correctly displayed, press the green Done button. This will return you to the main screen with the newly modified recipe in the recipe box.

Deleting a Recipe

To delete an existing recipe, enter the Recipe Editor screen. To access the Recipe Editor, press the Program Setup button located on the lower left side of the main display screen. Enter the supervisor password and press Enter.

Select the desired recipe to edit by selecting it from the recipe dropdown box. Press the Delete Recipe box to the right of the Recipe name box. Confirm your desire to delete the recipe by pressing YES when prompted. When completed, press the green Done button.
This will return you to the main screen with the newly modified recipe in the recipe box.

Starting a Cycle

To start a cleaning cycle, place loaded board rack into the unit’s chamber and close the door. Ensure that your water and drain lines are open and that there is sufficient was solution in the wash tank.

Choose the desired recipe from the recipe dropdown box. When the desired recipe is displayed in the recipe dropdown box, press the START button. Once the wash solution temperature reaches the programmed temperature, the programmed cycle will begin.

The status of the cycle will be displayed on the main screen. In addition, the following information will be displayed:

- Recipe Name
- Recipe Contents
- Current Time
- Estimated Time of Completion
- Wash Temperature
- Device Status (door, valves, sump level)
- Device Annunciation (condition on / off)
- Current Resistivity (during rinse cycle)

Upon the completion of a programmed cycle, a “Cycle Complete” dialog box will appear confirming the Cycle Complete status and the Cleanliness Value.

The display screen will indicate that the cycle is complete. Opening the chamber door will reset the display screen to “Ready for New Load”.

Pausing a Cycle

When the START button is pressed, a PAUSE button will appear. If you need to pause the program, press PAUSE (when the PAUSE button is pressed, a RESUME button will take its place. To continue the program, press RESUME.

Stopping a Cycle

To stop (abort) a cycle, press STOP. All machine functions will stop. Confirm that you want to terminate the cycle by confirming your choice in the dialog box. Once the cycle has terminated, press CONTINUE to clear the screen.
Opening the Chamber Door During a Cycle

**Do not open the chamber door during a cycle.** If the chamber door must be opened, press the PAUSE button, wait for at least twenty seconds to allow the rotating spray bars to stop. Open the door cautiously to ensure the spray bars are not still spinning. To resume the cycle, close the door and press RESUME.

**NOTE:**

If the door is opened prior to pressing the PAUSE button, the machine will initiate an automatic PAUSE function. Press RESUME to continue operation.

Understanding Resistivity

The Trident Automatic Defluxing System resistivity controller is a highly sensitive measuring device designed to detect minute quantities of contaminants in the rinse water.

The resistivity meter is only capable of measuring ionic contamination in the water. During a wash cycle, flux and other contaminants are solubilized. The rinse cycles rinse off the wash solution and newly solubilized flux from the boards. The solubilized flux is ionic (it affects the water's electrical resistance). As long as flux or wash chemicals are detected in the rinse water, the boards are assumed to be dirty. During each rinse cycle, the resistivity meter measures the electrical resistance of the rinse water. When the resistance is above a programmable setpoint, board cleanliness is assumed.

**NOTE**

Non-solubilized flux cannot be measured by the resistivity meter.

**NOTE**

The higher resistivity value, the cleaner the water.

It is important to consider the following facts:

The unit cannot clean boards to levels exceeding the incoming water's cleanliness.

The resistivity control system may not be able to measure normal 'tap' water. De-Ionized water is normally required for automatic rinsing operations.

SPC Data

**NOTE**
SPC = Statistical Process Control

The Trident Automatic Defluxing System is equipped with a data-capture utility.

All program data is automatically recorded and captured. Access to this data is available from the Administrator Setup screen.

SPC Data may be either exported or viewed.

Viewing SPC Data:

SPC data is automatically captured and may be viewed in an HTML format on the machine’s built-in web server. To access the web server, press the Web Admin Page button. This will call up Internet Explorer and will load the internal web page.

To view the SPC data, press the SPC Data link. An HTML table-based SPC data chart will appear. The length of the SPC data file will increase as more cycles are performed. To return to the previous page, press the X button in the upper right portion of the SPC data page. To return to the Administrator Setup screen, press the X button in the upper right portion of the Web Server page.

SPC data may be exported as an Excel-based (.xls) file. To export the data, insert an approved USB memory stick into the USB port under the display screen on the front of the chamber door. When the approved USB Memory stick is inserted, press the Export SPC button. A dialog box will confirm that the SPC data has been transferred.

NOTE:

Factory settings control the maximum size of the SPC data file. If the file grows too large, a prompt at the end of a cycle will encourage you to export the SPC data (as an Excel file) to the approved USB memory stick. Once the data has been exported, the internal data will be erased and the SPC Data log will start over.

Software Updates

From time to time, Aqueous Technologies may produce a software update. They may include patches, bug fixes, performance upgrades, feature upgrades, etc. With the consent of Aqueous service personnel, software updates can be downloaded from the company web site using a desktop computer then transferred to a standard USB “thumb drive”. This drive’s contents are then transferred to the Trident Automatic Defluxing System. Detailed instructions are provided with the updates.
Software Functions, by Screen

The following pages show the major display screens, and describe their controls.
The main screen is where the program will spend the most time. It is the “gateway” to all other screens and it is the screen where normal starting of cycles is performed.

**Recipe DropDown Box**

Tapping on the dropdown arrow will display a list of current programmed recipes. Tap the desired recipe name to make it become the active recipe.

**Recipe Parameter Displays**

These show the parameters of the current active recipe.

**Sensor Displays**

The sump temperature, chamber temperature and cleanliness readings are the actual, real-time readings of these sensors. 

*Note that the cleanliness reading will normally vary greatly during the cycle. This is because the probe sees a wide gamut of environments, from dry air to wash solutions. The only meaningful measurement is at the end of a rinse cycle, when it properly indicates the rinse solution’s resistance level.*
### Main Status Display

The center of the screen shows the current status of the unit. The text displays the major events. The upper progress bar will graphically show the cycle’s progress from beginning to end. The lower progress bar will graphically show the progress on the current event.

### Cleaner Control Panel

These are the three buttons used to perform the primary operation of the unit. The button’s descriptions are as follows:

<table>
<thead>
<tr>
<th>Position</th>
<th>Legend</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Button (Green)</td>
<td>- - - - -</td>
<td>The unit is inhibited from starting</td>
</tr>
<tr>
<td>Center Button (Red)</td>
<td>STOP</td>
<td>Tapping this button will stop the current cycle.</td>
</tr>
<tr>
<td>Lower Button</td>
<td>Program Setup</td>
<td>Tapping this button will bring up the login screen</td>
</tr>
</tbody>
</table>

### Device Annunciation Panel

These individual indicators will show the status of various output devices.
<table>
<thead>
<tr>
<th>Status Panel</th>
<th>These indicators show the status of several different input devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Reminders (if included with software license)</td>
<td>These show the cycle count for several sections of the machine. It could be useful for determining maintenance intervals. The normally green colored indicator will change to yellow when the actual cycle count reaches 90% of the programmed threshold, then red when the number of cycles exceeds the programmed threshold. This threshold is programmable via the Administrator setup screen. After the appropriate maintenance has been performed, the counter can be reset to zero and returned to green by tapping the indicator and entering the maintenance password.</td>
</tr>
</tbody>
</table>
The login screen is used to enter passwords. Passwords are required to access the setup and configuration screens of the unit.

**Keyboard**

The keyboard is used to enter passwords.

*Note, as the keys are tapped, they will highlight, indicating their input. If the key taps are routinely indicating that a neighboring key has been tapped, this is an indication of a miscalibrated touchscreen. The Windows “Stylus” control panel (described later in this section) can be used to recalibrate the touchscreen.*

**Login Button**

This will check the validity of the password and display the appropriate next screen, depending upon the password entered.

**Cancel Button**

Tapping this will exit this screen and return to the main screen.
Recipe Editor Screen

Recipe DropDown Box | Tapping the dropdown box’s arrow will present a list of the currently available programs. In addition, a special line is named <<Add New Recipe>>. Selecting this will display a blank box, ready to accept a new recipe name.

Delete Recipe Button | This will delete the currently selected recipe

Recipe Parameter Displays | Displays the parameters of the currently selected recipe

Up/Down Setpoint Arrows | Tapping these arrows will increment (or decrement) the parameter. Note that the values are limited to a range appropriate to that parameter.
### Cleanliness Button

By default, a supervisor may select the desired cleanliness value by pressing the up or down arrow until the desired value is displayed. If the supervisor chooses to operate the machine based solely on the quantity of rinse cycles, simply tap the Cleanliness button above the value. This will cause the Cleanliness button to turn grey, indicating that the machine will run the quantity of rinse cycles programmed without regard for actual cleanliness.

### Keyboard

Used to enter/edit a recipe name.

### Done Button

The DONE button will save this screen’s settings and return the user to the main screen. The recipe chosen in the screen will become the current selected recipe, and will appear on the main screen, ready to run.
The administrator setup screen is accessed via the administrator password. It contains many of the configuration parameters of the unit.

**Note:** *It is not necessary to change the factory defaults in most cases. If in doubt, contact Aqueous Technologies service department at +1.909.944.7771.*

When the cursor enters an alphanumeric field, a keyboard will appear near the bottom of the screen for entry of these fields.

<table>
<thead>
<tr>
<th>Machine ID (nickname)</th>
<th>This is a text field for entering a name recognizable by the users. It could be the name of the production line, or the location in the building, or any other name. This name will appear on the SPC data reports and is especially useful for customers with multiple units.</th>
</tr>
</thead>
</table>

**Password Setup**

<table>
<thead>
<tr>
<th>Supervisor #1</th>
<th>SUPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor #2</td>
<td>S</td>
</tr>
<tr>
<td>Supervisor #3</td>
<td>S</td>
</tr>
<tr>
<td>Administrator</td>
<td>A</td>
</tr>
<tr>
<td>Maintenance</td>
<td>M</td>
</tr>
</tbody>
</table>

**Maintenance Reminders (Cycles)**

<table>
<thead>
<tr>
<th>Wash Chain</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter</td>
<td>100</td>
</tr>
</tbody>
</table>

**Temperatures shown as**

- °F
- °C

**Process Parameters**

<table>
<thead>
<tr>
<th>Mix Time</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Time</td>
<td>45</td>
</tr>
<tr>
<td>Exchange Time</td>
<td>9</td>
</tr>
<tr>
<td>Exchange Temperature (over spoto)</td>
<td>9</td>
</tr>
<tr>
<td>Rest Time</td>
<td>45</td>
</tr>
<tr>
<td>Rinse Time</td>
<td>20</td>
</tr>
<tr>
<td>Cool Down Time</td>
<td>60</td>
</tr>
</tbody>
</table>
### Process Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mix Time</strong>:</td>
<td>This is the amount of time the wash solution tank mixer will operate before transferring wash solution to the sump tank.</td>
</tr>
<tr>
<td><strong>Drain Time</strong>:</td>
<td>This is the amount of time the drain pump will operate at the end of a rinse cycle. The default is set between 10 and 15 seconds.</td>
</tr>
<tr>
<td><strong>Exchange Time</strong>:</td>
<td>This is the amount of time the transfer pump will operate (removing wash solution from the sump tank and replacing it with colder solution) if the sump solution’s temperature exceeds the set temperature by more then the “Exchange Temperature” setpoint.</td>
</tr>
<tr>
<td><strong>Exchange Temperature</strong>:</td>
<td>This is the degrees (temperature) over the sump’s set temperature when the machine will attempt to cool down the wash solution. This is only necessary when operating excessively long wash cycles (greater than 15 minutes). Excessive heat is caused by friction in the pump.</td>
</tr>
<tr>
<td><strong>Rest Time</strong>:</td>
<td>Upon the completion of a wash cycle, the machine will ‘rest’ for a period of time (rest time) in order to allow residual wash solution to drain from the wash chamber into the sump tank. The default rest time is 10 seconds. A rest time too short may result in the consumption of excess wash solution. A rest time too long only lengthens the total cycle time.</td>
</tr>
<tr>
<td><strong>Rinse Time</strong>:</td>
<td>Each rinse cycle is performed for a pre-set time. The rinse time is determined by the value in the ‘rinse’ timer. The default rinse time is 20 seconds. A user may choose to alter the rinse time. Rinse times under 20 seconds are not recommended.</td>
</tr>
<tr>
<td><strong>Cooldown Time</strong>:</td>
<td>The Cooldown time is the amount of time at the end of the drying cycle the blower will operate without the air heaters. For example, if a dry time of 12 minutes is programmed and the Cooldown time is 60 seconds, the drying cycle will operate with heat for the first 11 minutes and without heat the last 60 seconds.</td>
</tr>
</tbody>
</table>

### Password Setup

Here, the passwords are entered. Note that they are displayed in clear text.
### Maintenance Reminders

These are the thresholds used to determine if the indicator on the main screen should be green (under 90% of maximum value), yellow (over 90% of maximum value), or red (100% or more of maximum value).

**Inhibit Cycle When Exceeded:** Each of the two maintenance reminders may be programmed to inhibit the machine’s operation if the actual cycle count exceeds the maximum programmed value. By clicking the box, a check mark will appear indicating that the machine will not run additional cycles when the respective indicator is in a red condition. By leaving the boxes unchecked, the maintenance reminders will indicate the condition but will not inhibit machine operation. Maintenance reminders may be reset to zero by taping the desired reminder and entering the maintenance password.

<table>
<thead>
<tr>
<th><strong>Temperature shown as:</strong></th>
<th>Choose temperatures to be displayed in Fahrenheit or Celsius, as desired</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Windows Control Panels Button</strong></td>
<td>This will launch the Windows Control Panel Screen (described later in this section).</td>
</tr>
<tr>
<td><strong>Import … Button</strong></td>
<td>This will begin a routine to import a selection of data points (Recipe Files, Administrator Settings, Machine Settings) as desired by the operator. Follow the prompts to insert a USB drive and transfer the data.</td>
</tr>
<tr>
<td><strong>Export … Button</strong></td>
<td>This will begin a routine to export a selection of data points (Recipe Files, Administrator Settings, Machine Settings). Follow the prompts to insert a USB drive and transfer the data.</td>
</tr>
<tr>
<td><strong>Web Admin Page Button</strong></td>
<td>This will launch Internet Explorer and will display a web page showing the SPC data.</td>
</tr>
<tr>
<td><strong>Clear SPC Data Button</strong></td>
<td>This will clear the SPC data from the computer’s internal flash drive.</td>
</tr>
<tr>
<td><strong>Manual Device Control Button</strong></td>
<td>This will launch the Manual Device Control Screen (described later in this section).</td>
</tr>
<tr>
<td><strong>Manage Licenses Button</strong></td>
<td>This will launch the License Key Screen (described later in this section).</td>
</tr>
<tr>
<td><strong>Done Button</strong></td>
<td>The DONE button will save this screen’s settings and return the user to the previous screen.</td>
</tr>
</tbody>
</table>
Control Panel Screen

The control panel screen is an easy way to access the various Windows control panels. Access to these is seldom required.

Control Panel Icon Buttons | These will launch the standard Windows control panels used to enter various system configuration settings. Details are not provided here, but should be familiar to most users of Windows desktop machines.
---|---
Save and reboot now Button | This will save the settings to the Windows registry and reboot the system.
This screen is provided for testing and diagnosis only. Regular use of this screen is not anticipated. Care should be used, together with an understanding of the device functions when using this screen.

For safety reasons, some functions are disabled during unsafe conditions, such as energizing the spray pump when the chamber door is open.

<table>
<thead>
<tr>
<th>Power Devices</th>
<th>Tapping these buttons will energize the devices.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Functions</td>
<td>Tapping these buttons will energize the devices.</td>
</tr>
<tr>
<td>Switch Status</td>
<td>These will indicate the status of these devices.</td>
</tr>
</tbody>
</table>
| Calibration Controls | **Under most conditions, for most users, routine or periodic calibration is not required.**  

The up/down arrows, when tapped, will increment/decrement the scaled readings. To properly calibrate the unit, an external sensor (either temperature or resistivity) will need to be placed in the same environment as the unit’s internal probe, and given time to reach equilibrium.  

Proper calibration of the resistivity probe is especially difficult due to the turbulent nature of the flowing water. Trapped air bubbles, and the changing amount of dissolved gasses make a steady reading almost impossible.  

*Note - it is Aqueous’ position that rather than depending upon the resistivity reading to be accurate, in an absolute sense, that the reading be understood in a relative sense. Once a certain setting is determined to be sufficient (perhaps by secondary random analytical testing). This setting will be repeatable into the future and can be used to “predict” the final board’s cleanliness.* |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Done Button</td>
<td>The DONE button will save this screen’s settings and return the user to the previous screen.</td>
</tr>
</tbody>
</table>
The license keys screen will rarely need to be accessed by the user. This screen is used to enter the license keys of the various purchased software features.

**Entry Fields Boxes**

These boxes contain the license keys. Each key is a 16-digit number. For entry into a box, tap the box’s interior to place an insertion point, then begin typing on the keypad.

**Activate/Delete Buttons**

The legend on the button will change from activate to delete after entering a valid key.

**Numeric Keypad**

Used to enter the keys, the typed digits will appear at the insertion point.

**Done Button**

The DONE button will save this screen’s settings and return the user to the previous screen.
About this Machine Screen

This screen is accessed via tapping the Aqueous Logo on the main screen. It will display some of the factory settings as well as a log of the runtime hours on several of the major power components.

Done Button

The DONE button will save this screen’s settings and return the user to the previous screen.
Maintenance and Service

The unit is designed for a long and useful life. However, because of the moving parts and the chemicals involved, the unit will require routine and periodic maintenance beyond that of strictly electronic equipment.

Only those persons, qualified, trained and knowledgeable in the skill, shall perform maintenance and service. Proper maintenance and service should follow established practices. The guidelines of NEMA ICS 1.3 shall be followed in addition to any safety and quality standards in place at the user’s facility.

Periodic Maintenance

The following is a list and recommended frequency of required maintenance to be performed:

<table>
<thead>
<tr>
<th>Period</th>
<th>Component</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>Chamber Screen</td>
<td>Wipe clean, or in some cases, a shop vacuum may be useful</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>It may be useful to identify the cause and source of anything trapped by this screen.</em></td>
</tr>
<tr>
<td>Weekly</td>
<td>Concentrated Chemical</td>
<td>Check the level of the concentrated chemical and add more, if necessary.</td>
</tr>
<tr>
<td></td>
<td>Mixed Cleaning Solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Trident II and Trident III only)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>See the paragraphs below for details regarding chemical maintenance.</td>
</tr>
<tr>
<td>Monthly</td>
<td>Inlet air filter</td>
<td>Replace with a new filter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>The replacement period for this filter is greatly dependant upon the local air quality. Obviously, if the unit is in an environment supplied with clean, filtered air, this filter will have a longer useable life.</em></td>
</tr>
</tbody>
</table>
### Drain Filter
- **Replace with a new filter.**
  
  *The replacement period for this filter is greatly dependent upon the actual usage conditions. The monthly recommended interval may be adjusted based upon actual experience.*

- **Inspect for leakage, corrosion**
  - Visually inspect hoses and pipe fittings for evidence of leakage. Clean and repair, as needed.

- **Check for clogged spray nozzles**
  - Using a small diameter wire, probe each nozzle orifice for signs of blockage.

### Annually

<table>
<thead>
<tr>
<th>Maintenance Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pump Seals</strong></td>
<td>Inspect and replace as needed</td>
</tr>
<tr>
<td><strong>Plastic Hoses</strong></td>
<td>Check condition of all plastic hoses</td>
</tr>
</tbody>
</table>

No periodic lubrication is required of any components.

### Wash Solution Maintenance

#### Maintaining a full level

Because of normal evaporation and dragout, it is required to maintain the level and concentration of the wash solution. In the event of a low solution level, a float switch cause the unit into an inhibit condition. This will prevent a new cycle from commencing (if the unit was previously idle), or will interrupt and stop a currently operating cycle.

Proper maintenance of the sump level will eliminate the possibility of unwanted downtime due to low sump conditions. Fortunately, the Chemical Management System makes it easy to add the proper ratio of chemical/water. Activating the ADD SOLUTION Switch on the front panel, automatically “tops-off” the sump tank with the preset ratio. The tank’s upper float switch prevents overfilling.
Proper detection of a low tank condition is a safety issue. In the event of a low tank, the unit must turn off its pumps and heaters to prevent possible damage. From the machine’s point of view, that is the proper course of action. However, should this condition occur during a wash cycle, it could leave wash solution on the user’s board surfaces. This is usually undesirable, especially for long periods. Aqueous Technologies highly recommends that the wash tank level be monitored and adjusted to eliminate any concerns regarding unwanted low tank conditions.

**Changing the wash solution**

Periodically, the wash solution will need to be disposed of, and replaced with a new chemical solution. The exact timeline of the chemical replenishment is highly dependant upon the flux type, board quantity and sizes, and chemical concentration. As such, it is beyond the scope of this manual to recommend a specific period of time.

The procedure is rather straightforward. Drain the old solution (use proper disposal methods), and refill with new solution.

**Major Service**

Major service may include anything from replacing a pump, to finding and stopping a stubborn leak. Persons properly trained and knowledgeable in the field of electro-mechanical equipment should have no problem performing even major service on the unit.

Keep in mind that Aqueous Technologies has full-time service personnel, trained and familiar with this equipment. They are available for both in-warranty and out of warranty service.

The following components will require settings or adjustments during replacement.
### Component

<table>
<thead>
<tr>
<th>Component</th>
<th>Location</th>
<th>Setting, Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sump Overtemperature Switch</td>
<td>Mounted into a pipe fitting of sump tank</td>
<td>Temporarily set a recipe for 170°F wash temperature. Begin the cycle, wait for the sump to heat, the sprays to commence, and the temperature to stabilize at 170°F. Because this switch will cause the heater’s contactor to drop out, listening for the dropout and re-energization is the easiest way to perform the adjustment. However, the contactor will also dropout due to the regulating nature of the circuit, so adjustment is only possible when the contactor is closed and is presently heating. Note that the screw is adjusted down (CCW) to INCREASE the set point, and up (CW) to DECREASE the set point. After finding the 170°F tripping point, increase the screw ¼ turn (CCW). This will provide a suitable margin for safety.</td>
</tr>
<tr>
<td>Overload Protection Circuit Breakers</td>
<td>Electrical Bay</td>
<td>Adjust the trip points on the circuit breakers as indicated below.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CB</th>
<th>Function</th>
<th>400VAC 50Hz</th>
<th>208 or 240VAC 60Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>Spray Pump</td>
<td>6.3A</td>
<td>9A</td>
</tr>
<tr>
<td>K2</td>
<td>Chamber Heater</td>
<td>20A</td>
<td>20A</td>
</tr>
<tr>
<td>K3</td>
<td>Transfer Pump</td>
<td>4A</td>
<td>6.3A</td>
</tr>
<tr>
<td>K4</td>
<td>Blower</td>
<td>2.5A</td>
<td>4A</td>
</tr>
<tr>
<td>K5</td>
<td>Tank Heaters</td>
<td>9A</td>
<td>16A</td>
</tr>
<tr>
<td>K6</td>
<td>Sump Heaters</td>
<td>9A</td>
<td>16A</td>
</tr>
<tr>
<td>Air overtemperature switch</td>
<td>Air duct (access from rear)</td>
<td>Set at 180°F</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------</td>
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</tr>
</tbody>
</table>
| Chamber Heater Control Module | Electrical Bay | This module uses phase –control techniques to reduce the incoming mains voltage to a lower level suitable for the chamber heater. Typically, we set this for 14 amps (±1A) at the factory.

Note – The chamber heater current can be adjusted to a lower value should the factory default setting create a “hot spot” concern during the drying cycle.

*The heater's power reduction is dependent upon the mathematical square of the current. Therefore, a small reduction of current results in a larger reduction of power.*
Optional Accessories

Dosatron Chemical Management System

(Some of the content below is sourced from DOSATRON INTERNATIONAL)

The DOSATRON operates by using the incoming facility water pressure as the power source. The water activates the DOSATRON, which takes up the required percentage of concentrated chemical. Inside the DOSATRON, the chemical is mixed with the water. The water pressure delivers the solution into the wash solution tank. The dose of chemical will be directly proportional to the volume of water entering the DOSATRON, regardless of variations in flow or pressure that may occur in the main line.

The maximum temperature rating of the Dosatron is 40°C (104°F). The incoming facility water temperature must be below this value.
### Priming the Dosatron

1) Energize the ADD WASH SOLUTION switch.
2) Press the bleed button on the top of the DOSATRON (as shown).
3) When a constant flow of water is seen coming from around the bleed button (no more "spitting" of air), release the button.
4) Continue to operate the DOSATRON until the chemical is drawn up into the doser body (the product is visible through the plastic tube).
5) The DOSATRON makes a characteristic “click clack” noise when working.

**NOTE:** The time required to prime the suction tube depends on the water flow-rate, the ratio setting and the length of the suction tube. To bleed the air from the suction tube and accelerate the priming, set the injection rate at maximum. Once the DOSATRON is primed, adjust to the required injection rate.

### Maintenance

When using soluble products to be made up into solutions, we recommend the periodic dismantling of the entire dosing part. Thoroughly rinsing all the elements of the dosing part with water and re-assembling them after having previously lubricated the seal with a silicone lubricant, in the case of difficulty in re-fitting.

Before putting the DOSATRON into operation after a non-use period, remove the motor piston and soak it into lukewarm water < 40° C [104° F] overnight. This helps to dissolve any deposits which may have dried onto the piston motor.
### CLEANING THE WATER FILTER 350 microns - 50 mesh

Frequency: once per month depending on use.

To remove the filter

1) Close the valve upstream of the DOSATRON and allow the pressure to drop to zero.
2) Remove the injection assembly.
3) Unscrew the bell housing by hand and remove it
4) Remove the motor piston
5) Remove the filter.
6) Remove the seal.
7) Clean the filter and the seal with clean water.

To refit the filter

1) Before re-assembly, make sure that the seating area of the filter and seal in the lower pump body and the bell housing are clean. If necessary, the seal has to be replaced.
2) Then proceed in reverse order to the above. Important: in all cases, tightening must be done by hand.
### Adjusting the injection rate

**IMPORTANT!** Use no tools.

Adjustment must be made when there is no pressure in the Dosatron.

Holding by hand the sleeve (as shown), screw or unscrew the adjusting nut so as to bring the top of the nut into line with the desired injection rate.
Setting the chemical concentration in the Aqueous equipment

The Dosatron adjustment is marked as a percentage (5%-20%). However, the marking should actually be better understood as a ratio.

For example, the marking of 20% is a ratio of 1:5. Therefore, in this example, the resulting solution will be one part of chemical, and five parts of water, for a total of six parts. This is a 16.7% solution.

<table>
<thead>
<tr>
<th>Chemical concentration using a single Dosatron system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examples</strong></td>
</tr>
</tbody>
</table>
| Marking (ratio) | Concentration (percentage) | If the Dosatron setting is named variable \( a \), then: \[
Concentration = \frac{a}{a+1}
\] |
| 20%         | 16.7%          | Using 20% as an example: \[
Concentration = \frac{0.2}{1.2} = 0.16667 = 16.7\%
\] |
| 19%         | 16.0%          |
| 18%         | 15.3%          |
| 17%         | 14.5%          |
| 16%         | 13.8%          |
| 15%         | 13.0%          |
| 14%         | 12.3%          |
| 13%         | 11.5%          |
| 12%         | 10.7%          |
| 11%         | 9.9%           |
| 10%         | 9.1%           |
| 9%          | 8.3%           |
| 8%          | 7.4%           |
| 7%          | 6.5%           |
| 6%          | 5.7%           |
| 5%          | 4.8%           |
Dual Dosatron Units

Dual Dosatron systems are used where the desired chemical concentration exceeds the rating of a single unit. By cascading the units, concentrations of almost double can be achieved.

Note – although not readily apparent, the total output concentration is NOT the sum of the two units. The first unit sees only water at its input, while the second unit sees a chemical/water solution at the same input, making the calculation more complex.

<table>
<thead>
<tr>
<th>Examples</th>
<th>Formula</th>
</tr>
</thead>
</table>
| Unit #1 (ratio) | Unit #2 (ratio) | Overall Concentration (percentage) | If $a$ is the marking on unit #1 and $b$ is the marking on unit #2, then: 

\[
\text{Concentration} = \frac{a}{a+1} + \left(\frac{b}{b+1}\right)
\]

| 20% | 20% | 30.5% |
| 20% | 15% | 27.6% |
| 20% | 10% | 24.2% |
| 20% | 5% | 20.6% |
| 5% | 5% | 9.3% (minimum setting) | Simplifying the terms, results in:

\[
\text{Concentration} = \frac{ab + a + b}{ab + a + b + 1}
\]
Documentation

Fluid Diagram

Electrical Diagram
Supplemental Data

Feature: **Wash Solution Recirculation Option**

**Location:** Admin Screen

**Description:** Trident’s wash solution holding tank contains 30 gallons (11.4 liters) of wash solution. Once the sump tank has been filled with wash solution, the sump tank’s heaters will initialize and heat the solution to the temperature programmed in the current recipe setting. When the set temperature has been acquired, the spray pump turns on and the wash cycle begins. During the first several minutes of the wash cycle, the wash solution’s temperature will decrease as the hot solution contacts the cold boards and chamber walls. During the wash cycle time, the sump heaters will reheat the solution and restore its temperature to the original setpoint. When the setpoint has been achieved, the sump heaters will turn off.

During exceptionally long wash cycle times, friction created in the pump and within the plumbing may cause the wash solution’s temperature to rise beyond the current recipe’s setpoint. Normally, this is not a concern as the cleaning performance of wash solution only improves with elevated temperatures. If, however, it is the desire of the operator to prevent the wash solution’s temperature from exceeding the setpoint, one may program the “Wash Solution Recirculation Option”.

The Wash Solution Recirculation Option works by redirecting a small portion of the wash solution from the sump tank into the wash solution holding tank during the wash cycle. Cooler solution in the wash solution holding tank will then be directed into the sump tank. This exchange of solution provides a cooling effect.

In the ADMIN screen, enter the amount of seconds for “Exchange Time” (5 seconds is best). This will be for how long the exchange will take place each time. Next, enter the “Exchange Temperature (over setpoint)” value. This will be the number of degrees the wash solution must be over the recipe setpoint for the exchange to take place.
Supplemental Data

Trident Series
Wash Solution Consumption Guide

Trident Automatic Defluxing and Cleanliness Testing System is available in two basic configurations:

Trident I: Trident I utilizes a 3 gallon (11.4 liter) sump tank used on the wash and rinse cycles. During the wash cycle, water is automatically mixed with defluxing chemical, heated, and sprayed onto the target boards for a programmable period of time. At the end of the wash cycle, the wash solution (water and chemical) are discharged from the Trident. Because Trident I does not reuse the wash solution, its operational costs are higher then other models that utilize wash solution re-use technology.

**Trident I Cost Example:**
- Cost of defluxing chemical: USD $ 65.00 / gallon
- Cost of a 15% chemical mixture: USD $ 28.80 (57.6 ounces)
- Cost of chemical per load of boards USD $ 28.80

Trident III: Trident III utilizes a 3 gallon (11.4 liter) sump tank used on the wash and rinse cycles. Unlike Trident I, Trident III is equipped with a wash solution holding tank. During a wash cycle, wash solution (defluxing chemical and water) is transferred from the wash solution holding tank and directed into the sump tank. The wash solution is heated, and sprayed onto the target boards for a programmable period of time. At the end of the wash cycle, the wash solution (water and chemical) are transferred back into the wash solution holding tank for use on subsequent wash cycles. Because Trident III reuses most of the wash solution, its operational costs are substantially lower than Trident I.

It is important to note that while Trident III is equipped with wash solution re-use technology, 100% of the wash solution is not reused. 100% of the wash solution will not be transferred back into the wash solution holding tank due to the surface area of the wetted surfaces within the Trident III. Wetted surfaces include the wash chamber interior walls, the inside surfaces of the plumbing and, most importantly, the surface area of the boards being cleaned. As wash solution clings to these surfaces, it will not be transferred back into the wash solution holding tank. As a user places more boards into the chamber, this will increase the loss of wash solution. This is normal. Another cause for wash solution loss is evaporation during the wash cycle. Heated wash solution is finely diffused...
within the wash chamber. Normal evaporative losses can be expected. Finally, Trident’s transfer pump will also retain a small volume of wash solution.

**Trident III Cost Example (empty chamber):**

- Cost of defluxing chemical: USD $ 65.00 / gallon
- Average chemical loss: 12 ounces of wash solution / 1.8 ounces of defluxing chemical
- Cost of chemical per load of boards USD $ 0.90

**NOTE:**

Trident III’s chemical loss is based on an empty chamber. The actual chemical loss will be based on the quantity and size of boards being cleaned within one load and will therefore be greater.