



CADENCE STEAM AGING SYSTEM™

USER GUIDE **VERSION 2.02**



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RPS PRODUCTS COVERED

This User Guide is relevant to the following RPS products:

RPS Cadence Steam Aging System:	2010, 2011 model years
RPS Cadence DX Steam Aging System:	2010, 2011 model years

TRADEMARK ACKNOWLEDGEMENTS

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1 INTRODUCTION

Welcome to the Cadence Steam Aging System™

The Cadence is powerful system for artificial steam aging. Steam aging is used to accelerate the aging process of electronic component leads by subjecting the components to a heated, moisture-rich environment.

The Cadence meets the component-aging requirement of the Mil-STD-202 and the ANSI-J standards. Used in conjunction with a solderability test (provided by systems such as the **RPS Prelude “Dip and Look” Solderability Test System**), the artificial aging step will qualify components for storage beyond 12 months.

Included with each purchase, the Cadence will be configured to accept a stand-alone Carboy water source or an in-house plumbed de-ionized water supply. Select the desired plumbing as a configuration option at the time of order.

This User Guide provides instruction in the mechanical operation of the system, including maintenance and troubleshooting.



2 STEAM AGING HISTORY

Electronic component steam aging got its start in the 1980's at IBM. They were searching for a better method of predicting component solderability over time.

THE IBM TESTS

The first thing that had to be determined was how much aging needed to be done to simulate one year on the shelf. Test components were sent to all parts of the country. The components were left in storage lockers, stockrooms, on shelves; just about anywhere parts might be stored. After one year had elapsed, the components were collected and the weight gain of Oxygen (Copper Oxide) was determined. The results were averaged and a baseline average was determined for acceptable limits of weight gain.

The next step was to develop a test that could accelerate and largely mimic the impact of one-year of storage.

After substantial trial and error, it determined that eight hours in a steam environment produced similar aging characteristics as the one-year storage baseline.

THE TEXAS INSTRUMENTS TESTS

However, it was also determined that steam aging process produced wide variances in component impact. Subsequent tests by Texas Instruments were performed to determine the cause of variability.

Texas Instruments used steam agers that controlled the temperature of the steam very closely and setup a test to determine the parameters that affected the growth of Oxygen (Copper Oxide). The temperature and oxygen content were closely monitored. Texas Instruments found that the maximum weight gain was most prevalent at 95° C. Temperature higher than that showed a great fall off in growth, to the point where above 100°C showed no growth at all.

It is thought that this is caused by a depletion of Oxygen as the temperature nears or exceeds 100°C. Prior to this study, available steam aging systems did little except boil water, and little or nothing to control the environmental temperature within the steam vessel itself.

TODAY

Today, as a result of these ground breaking studies by IBM and Texas Instruments, , the IPC and EIA have agreed on a steam monitored test specification: in a nutshell, component steam aging must maintain the steam temperature at $93^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for at least 8 hours. This test most closely mimics the real-world impact of storing components for one year.

3 CADENCE OVERVIEW

The Cadence Steam Aging Systems are designed to meet military and commercial Hi-Rel specifications (MIL-STD 202, Method 208 and others) for artificial aging of all electronic components and circuit boards, including high density, discrete components, relays, transistors, capacitors, including SMT and axial components.

APPLICATIONS

Artificial steam aging of components must occur over a very narrow temperature range, typically at 93 C +/- 3 degrees. The Cadence Steam Aging Systems are the only systems currently on the market that meet this precise control requirement. This thermal accuracy makes the Cadence Systems ideal for component manufacturers and military, commercial, and industrial end users.

CONFIGURATIONS

The Cadence Systems come in 2 configurations, the standard configuration offers a single steam chamber for large components. The DX features 3 individually timed, ESD protected drawers with a unique closure mechanism that reduces steam escapement during drawer removal. All systems provide complete monitoring and control of steam or water temperature and feature automatic timing of the test duration.

BASIC OPERATION

Dozens of different product types and tests can be run at the same time. The user simply sets the timer to specify the duration of the test, loads the product and the process will automatically take place and alert the operator when complete.

Constructed of treated stainless steel, the Cadence is virtually unaffected by de-ionized or distilled water. Elapsed time and cycle time are indicated digitally. The cycle timer will not time the cycle unless temperature is within process parameters. Boiler temperature control is accurate to $\pm 2^{\circ}\text{C}$ from pre-set, with a readout provided. Condensation is always kept away from components. Extensive indicators display operating condition. Select the water source for each system configuration: either carboy stand-alone or inline pressurized water.

SAFETY | EASE OF MAINTENANCE

Steam is always safely vented and safety features prevent leakage, over temp and insufficient steam.

The unit automatically shuts down at the end of the pre-programmed cycle. The cover is designed so that steam is condensed and channeled to the side. Temperature controllers monitor for over-temp and insufficient water and will automatically shut the system down when triggered.

The stainless steel steam vessel is un-impacted by de-ionized, distilled or de-mineralized water. The external coating is high durability to handle the occasional water exposure. The Cadence System is virtually maintenance free.

3.1 HOW TO USE THIS GUIDE



READ THIS MANUAL. MANUAL AND PROPER OPERATION MUST BE UNDERSTOOD BEFORE YOU OPERATE, SERVICE, OR REPAIR THIS SYSTEM. THIS SYSTEM MAY ONLY BE OPERATED BY QUALIFIED PERSONS WHO HAVE READ THIS ENTIRE USER GUIDE. USE ONLY THOSE TOOLS AND CLEANING METHODS RECOMMENDED BY RPS.

This manual is designed to provide the operator with a thorough guide to the installation, operation, and maintenance of the Rhythm SPX. To that extent, **it is vital that the operator read this manual in its entirety** before attempting to operate this machine.

THIS GUIDE IS USEFUL FOR THE FOLLOWING:

- Set-up
- Calibration
- Safety
- Parts List
- Maintenance
- Electrical Schematic
- Assembly Schematic

3.2 RPS WARRANTY PROTECTION

All RPS equipment is covered by a 12 month system parts and labor warranty. RPS solder pots are covered by a lifetime warranty. Failure to follow proper operation of the system, including maintenance will void the RPS warranty. Failure to use this system for its intended purpose and unauthorized modification of the system will void the RPS warranty.

3.3 RPS SUPPORT SERVICES

You are a valued RPS customer— if you have any needs at any time, please do not hesitate to contact us. We have many resources dedicated to help you resolve process, system, system, maintenance or programming needs that may arise. Please use these resources as and when needed.

- **Online** www.rpsautomation.com
- **E-Mail** support@rpsautomation.com
- **Phone** [509.891.1680](tel:509.891.1680)

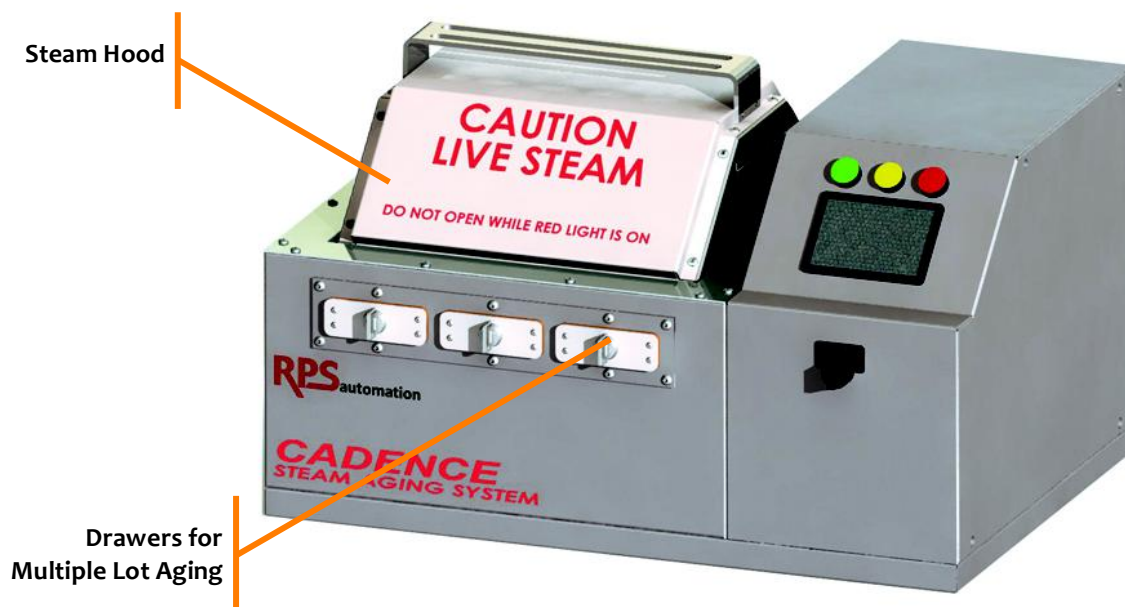
Phone support is free for normal support services. Normal support hours are 6:30 AM to 5:30 PM, Pacific Standard Time, Monday through Friday. Extraordinary service support may be subject to an hourly fee. 24/7 support plans are available, see RPS for further information.

4 SYSTEM COMPONENTS

4.1 CADENCE FUNCTIONAL COMPONENTS



4.2 CADENCE DX FUNCTIONAL COMPONENTS



4.3 SERVICE ACCESS POINTS

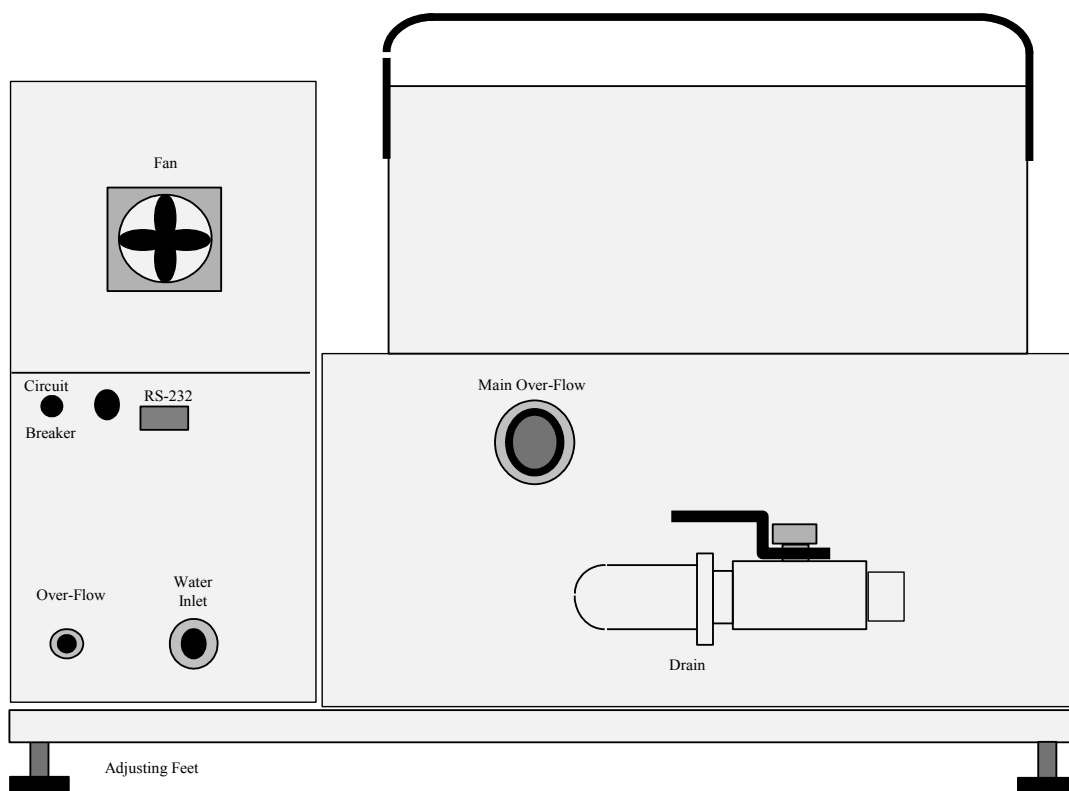


Figure 1 (Steam Ager Installation Points)

5 HEALTH & SAFETY

5.1 SAFETY WARNING SYMBOLS

This manual contains safety instructions wherever required. These instructions are divided into two categories as follows:



WARNING combined with the yellow symbol: Warning is used to indicate the following: FAILURE TO FOLLOW THIS PROCEDURE OR TAKE REQUIRED PRECAUTIONS CAN RESULT IN PERSONAL INJURY AND / OR SUBSTANTIAL EQUIPMENT DAMAGE.



RECOMMENDATION NOTE combined with the blue symbol: A note is used to indicate the following: SPECIAL ACTIONS, PROCEDURES, INSTRUCTIONS, AND INFORMATION IS BEING PROVIDED WHICH IS RELEVANT TO SUCCESSFUL OPERATION OF THE EQUIPMENT. INOBSERVANCE OF THE INFORMATION CAN RESULT IN DAMAGE TO THE MACHINE AND/OR TO THE PROCESS MATERIAL.

5.2 SAFETY FEATURES

Several hazards exist in the system and particular care should be taken in familiarizing operators with these hazards.



SAFETY GUARDING. THE MACHINERY EMPLOYS HOT WATER AND STEAM THAT PRESENT A HAZARD WHEN PROPER SAFEGUARDS ARE IGNORED OR IF SYSTEM IS IMPROPERLY OPERATED. MAKE SURE ALL POWER SOURCES ARE DISCONNECTED AND LOCKED OUT BEFORE SERVICING. DO NOT CIRCUMVENT ANY SAFETY FEATURES OF THIS MACHINE, AS THE HAZARDS ABOVE ARE POTENTIALLY VERY SERIOUS. ALL SAFETY GUARDING MUST REMAIN IN PLACE AND NOT BE BY-PASSED OR DISABLED. REMOVAL OF ANY SAFETY FEATURE ORIGINALLY INSTALLED ON THE SYSTEM, OR SYSTEM OPERATION OR MAINTENANCE, WHICH DOES NOT CONFORM TO THE GUIDELINES OF THIS MANUAL, RELIEVES RPS AUTOMATION LLC OF WARRANTY OBLIGATIONS AND/OR LIABILITY ASSOCIATED WITH PERSONAL INJURY OR EQUIPMENT DAMAGE.

5.3 SAFE OPERATING GUIDELINES

Care must be exercised to prevent possible injury to the operator. All general rules regarding proper training and supervision apply to the operation of this system. The following guidelines, though important, are no substitute for thorough training and understanding of safety procedures.

- Always switch off main power when performing maintenance on the equipment.
- Always wear safety goggles or face shield.
- Beware of hot surfaces.
- Wear heat tolerant protective gloves when handling hot pieces of equipment.

6 INSTALLATION

These procedures are intended for the use of those staff members adequately trained in the installation of capital equipment. No procedure should be executed which appears to the installers to be hazardous or present a significant risk to the equipment or personnel.

6.1 FUNCTIONAL SPECIFICATIONS

STEAM MANAGEMENT & CONTROL

Operation	Automatic
Test Duration	8 Hours Standard Emulates 1 Year Aging Duration Timer (1 – 99+ hours)
Thermocouple	Selectable Thermocouple (<i>Water or Steam</i>)
Accuracy	± 2°C Steam
Steam Chamber Insulation	High-Density Ceramic Wool
Standard Process Area (<i>W x L x H</i>)	12 x 12 x 2+” 305 x 305 x 50+ mm
DX Process Area Drawers (<i>W x L x H</i>)	3 Drawers Each with 3 Configurable Sections 3 x 9.5 x 0.86 ” 76 x 305 x 51 mm <i>per Drawer</i>

OPERATION

Temperature Control	100°C Max PID Proportional
Programming	Touch Screen
Water Capacity	1.25 gal 0.56 kgs
Max Water Use (8 hour cycle)	2.50 gal 1.13 kgs
Pressure Regulator	5 PSI Max Regulator Pressurized Configuration
Data Recording & Export	Option Export Download
Safety	Automatic Low Water Shutdown High Water Overflow to Drain Over Temperature Shut Off Caution Light Illuminates Above 40°C

PHYSICAL

Electrical	110 VAC 1 Ø 60Hz 15 Amps
Construction	Stainless Steel Wet Surfaces Epoxy Coated External
Water Type	Demineralized / Deionized Water ONLY
Plumbing Connection	Specify Carboy ¼” poly quick connect Specify Pressurized ¼” NPT pipe (female) Drain ¼” pipe (female)
Compliance	Meets CE, UL, NRTL Standards
Dimensions Footprint (<i>W x D x H</i>)	24 x 16 x 18” 615 x 410 x 460 mm
System Weight Ship Weight	40 lbs 18 kgs 50 lbs 22kgs

6.2 UNPACK & PLACE

1. Remove the top and sides of the main crate and inspect for damage.
2. The system may be lifted by hand **2 PERSONS should perform this task.**



LIFT WITH CARE. TWO PEOPLE SHOULD REMOVE THE SYTEM FROM PACKAGING AND PLACE ON LEVEL SERVICE FOR OPERATION.

3. Before setting the unit down, insure that the provided swivel pad feet are screwed into the frame legs at each outer bottom corner of the frame.
4. Place on at least 36" w X 24" d X 30" h table or contact RPS for a matching support stand.
5. Adjust each swivel pad to a preliminary setting of 1" from the bottom of the pad to the bottom of the square steel tube frame leg, and tighten the jam nut.

6.3 ELECTRICAL

Electrical connections shall be made to the disconnect box in accordance with the codes and regulations in place in your location. The system is wired for **110 VAC, 3-prong (NEMA 5-15P), 50/60 cycle, 15 amps**. The ground is critical for safety reasons and for machine operation so be sure to use a grounded receptacle (NEMA 5-15R).

A disconnect should be installed in accordance with local electrical codes at the source power feed point. This should allow an operator to shut down power to the unit in case of an emergency.

The system is wired in compliance with the National Electric Code and an electrician should make your connections familiar with these standards.

6.4 WATER SUPPLY CONNECTION

Located on the back bottom of the machine is the facilities panel. The system requires water in the form of **deionized (distilled) water**.

Pressurized Water Supply: Pressurized water (5 PSI) can be plumbed to the water inlet. The unit will accept ¼" stainless steel tubing for the water supply line. An ON/OFF valve should be installed in the supply line so that water may be shut-off in case of an emergency. The pressurized source is to be regulated to 5 PSI. The Cadence will be configured for this type of supply.

Stand Alone Carboy Supply: water container operation is facilitated with a ¼" poly quick connect. The Cadence will be configured for this type of supply and will use an internal peristaltic pump to provide pump and flow control.

6.5 DRAIN CONNECTION

As can be seen in the back panel image, two outlets go to the drain. Both use ½" pipe (MNPT) and can be plumbed to a common drain. The upper pipe is for overflow, while the lower pipe is for quick dump of the tank chamber via the stainless steel valve. For proper operation a drain must be attached. If the drain is left open to the air, drafts may occur and reduce steam ager effectiveness.

7 SYSTEM FUNCTIONS

7.1 GENERAL

The Cadence is a bench top unit weighing approximately 50 lbs. The unit is easily incorporated into most laboratory settings. The system is designed to expose electronic components to steam for a set period of time in order to replicate the aging characteristics of a component left in storage for 1 year.

7.2 ENVIRONMENTAL CHAMBER

All other wetted parts are made of electro-polished stainless steel, Kynar, Polyethylene or Polypropylene.

The water level is automatically maintained to within 1/8" of the set point level, which exceeds the requirements of the applicable Military Specifications.

There are two thermocouples located within the test chamber. One is located in the steam environment, positioned within the chamber at the same elevation as the components under test, while the other is submerged in the water. These are used to provide feedback to the controller and provide a temperature sensor for recording purposes. The thermocouples are stainless steel sheathed, non-grounded type J.

7.3 LID AND VENTS

The steam hood/lid is fitted with an adjusting slide to control the amount of steam that is allowed to escape. This side adjusts the venting and may be fully closed to wide open. Running with **the vent completely sealed is not recommended** as pressure inside the vessel will cause the top to spit hot water in random fashion. **Always run tests so that a vent is at least 1/8" open to allow pressure to stay within safe range.**



FULL OPEN VENTS: IF THE SLIDES ARE REMOVED THE UNIT WILL APPROXIMATE THE OLD SPECIFICATION MIL 202F, METHOD 208F OF HAVING AN OPEN VENT TO AMBIENT AIR. IF YOU CHOOSE TO WORK TO THE OBSOLETE SPECIFICATIONS, SET FOR WATER TEMPERATURE MONITORING.



PLEASE NOTE: RUNNING THE UNIT WITH A FULL OPEN VENT CAN CAUSE ACCELERATED WEAR AND TEAR DUE TO EXCESSIVE CYCLING OF THE PUMP AND THE HEATER. THESE ARE NON-WARRANTY ITEMS SHOULD THEY REQUIRE REPLACEMENT.

7.4 HEATERS

Chamber heaters are heavy-duty industrial-grade immersion heaters.

7.5 WATER LEVEL CONTROL

Water level sensors measure high and low water level. The water level sensor is housed in a cold water reservoir and far from the hot water boiling in the vessel. This provides a more precise control of the water level. The water level sensors are constructed of PVC and Kynar. The sensors, one high-level, one low-level, use internal reed float valves.

Water is added to the system until the high level sensor is triggered. If the low level sensor is triggered, the system will stop and a message “LOW WATER” will be displayed.

At system start-up, remove the lid and, if a DX, the drawers. Fill the water vessel with water to the bottom of overflow outlet (just touching the top horizontal portion of the heating element as it enters the water vessel). Once the system is turned on, the water level will be automatically maintained.

7.6 PROCESS CONTROL

The system is controlled by a Programmed Logic Controller (PLC). The touch screen interfaces with the PLC and is used to program and control the system. Temperature is controlled by a PLC temperature module and PID loop.

7.7 POWER

The “Power On/Off” switch energizes and de-energizes the system and can be used as an Emergency Stop switch.

7.8 CARBOY WATER SOURCE

A minimum capacity of 2.5 gallons is recommended for a stand alone (i.e., Carboy) water supply. Stand alone water supplies are available through RPS Automation or through alternative suppliers.

The Cadence with the Carboy-source plumbing uses a peristaltic pump that is self priming and self sealing.

7.9 DIRECT PRESSURIZED WATER SOURCE

A maximum of 5 PSI is recommended for a pressurized water supply.

The Cadence in direct plumb mode does not require a pump. A solenoid is used to electronically control the water level.

7.10 PUMP AND FLOAT RESERVOIR

The float reservoir has two floats; a Low Level and Normal Level. The Low Level prevents the steam ager from operating with a low water level condition and the other reads the Normal Level, turning the pump / solenoid on and off in order to maintain the appropriate water level.

Upon filling, it will take some time for the level of reservoir to equalize to main vessel. Until the lower level switch signals that the water level is within safe parameters, a program will not run or reset.

7.11 RS232 PORT | REPORTING & REMOTE OPERATION

The optional reporting feature enables tracking of process data including time, temp and duration. Also enabled with the reporting option is remote system control from a PC, laptop or netbook.

8 OPERATION

8.1 STEAM AGING AT A GLANCE

1. **FILL WITH H₂O:** Remove lid (or drawers) and fill vessel with water to bottom of overflow outlet (just touching the top horizontal portion of the heating element as it enters the water vessel).
2. **PLACE SAMPLES:** Place samples in trays and/or drawers. Make sure metallic surfaces are not in contact with another (either parts, sides or basket).
3. **TURN ON:** Turn main power on.



CAUTION: Temperature set point must be set slightly below the boiling point of water at the test site altitude. See Appendix for altitude/boiling correlations.

4. **VERIFY WATER SOURCE & PRESSURE:** Verify DI water source and pressure (if direct plumb).
5. **PROGRAM:** Program a cycle. Make sure Test Duration setting is 8:00 (eight hours).
6. **SELECT STEAM IF NECESSARY:** If the test is to be controlled by the steam temperature, ensure that the STEAM/H₂O switch is set on STEAM.
7. **CHECK VENT:** Make sure the vent is open at least 1/8 inch.
8. **SET POINT:** Set the Setpoint to 93°C.



WARNING. If STEAM is selected but the TEMPERATURE CONTROLLER is set for water, the heaters will be continually ON. This can damage the chamber.



PROCESS INSIGHT: Maximum aging occurs at 93° C ± 2° as measured at the component under test. Higher steam temperature tends to lower the oxygen ratio and reduce the aging effect.

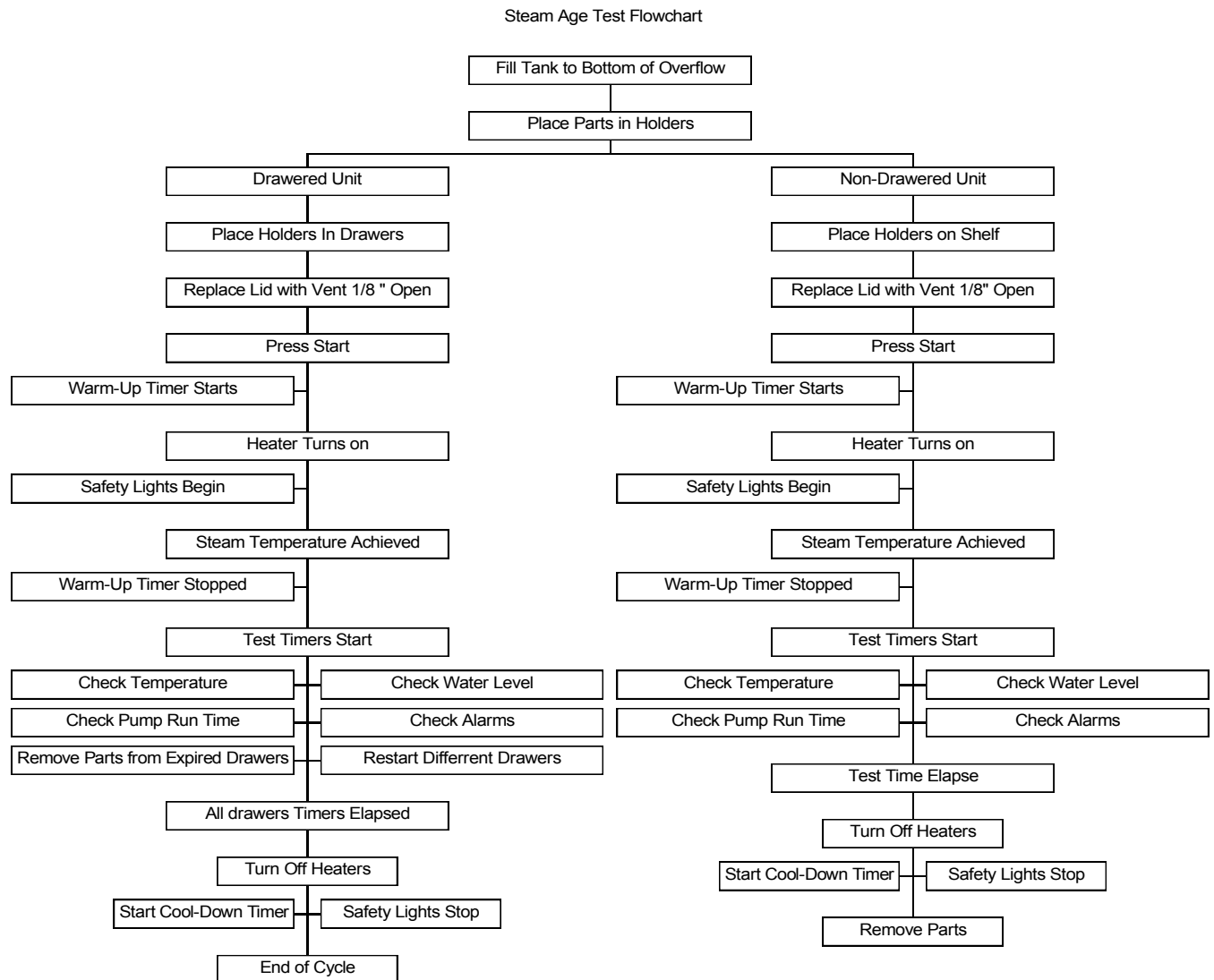
9. **REPLACE HOOD:** Place hood lid over vessel. If running steam, open the left vent.
10. **START:** Press the TEST CYCLE On button.



PROCESS INSIGHT: If low level alarm is activated make sure water is full to overflow and blow some air into vent of float reservoir to clear it. Check temperature. Make sure heaters are functioning.

8.2 STEAM AGE PROCESS FLOW CHART

This chart is a useful reference for the process flow in setting up a steam aging test (i.e., program).



8.3 TEMPERATURE ACTIVATION

TEMPERATURE CONTROLLER will activate the bath heater and bring the water or steam temperature to the set point. The Red Light (SAFETY LIGHT) illuminates at 68°C and above.



WARNING: DO NOT OPEN LID WHEN **RED** SAFETY LIGHT IS ON. HOT STEAM CAN ESCAPE AND BURN THE OPERATOR. USE EXTREME CAUTION.

8.4 TEST DURATION

Once the set point temperature is reached, the TEST DURATION will start its countdown and the Message Board will display which drawers are in progress. The bath heater will be activated periodically to hold the steam temperature. When activated, the SSR indicator will illuminate. As steam is vented during the test, the peristaltic pump will periodically pump water into the vessel to replace the quantity released as steam.

8.5 TEST COMPLETION

When the Test Duration has counted down to 00:00, the alarm will sound along with the illumination of the amber light. The Test is now complete; reset the alarm.

If multiple drawers (timers) are selected the drawers (timers) will decrement until all of the drawers have counted down to 00:00. When all of the active drawers have completed their test cycles the unit will go into the "cool-down" mode. The Green Light illuminates when temperature is below 68°C.

In the "cool-down" mode, power to the heaters is stopped and the cool down timer begins counting down. As the temperature of the steam goes below the Safety Limit the green light will illuminate. Now the steam is cool enough to open the lid safely and remove the parts.



OPERATOR SAFETY | BURN PREVENTION: **Open the chamber lid pivoting the open end away from the operator**, thereby directing steam to the rear of the machine. Use thermal gloves when removing drawers. The drawers are below temperature that can burn, but they will be warm enough to be uncomfortable to hold.

8.6 POWER OUTAGE | LOW WATER SHUT DOWN

During the course of a test, a power outage or a "low water-level" condition could occur. If either of these situations occurs, the unit will shut down automatically. Once back in temperature or water range, the timer will continue counting.

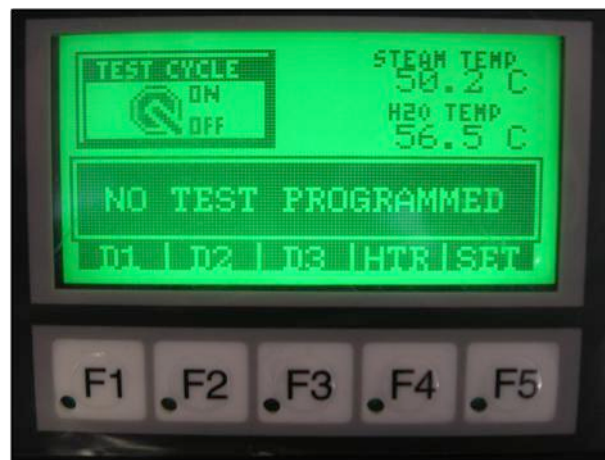
The **optional reporting feature** will verify the time and temperature over the length of the test and should be used to check if a test was satisfactorily completed prior to a shut down.

9 PROGRAMMING

9.1 BASIC CONTROLS

The Touch Screen controls all aspects of programming and operation of the system.

HOME SCREEN	On the home screen you will see TEST CYCLE, STEAM TEMP, H2O TEMP, a message box (ex: NO TEST PROGRAMMED), D1, D2, D3, HTR, and SET.
TEST CYCLE	To start and stop test cycle. If there is no test entered in D1, D2, or D3, it will not turn on.
STEAM and H2o	Displays the current temperature in the chamber.
MESSAGE BOX	Displays the current operations.
D1, D2, D3	To display the set up window for corresponding drawer in a DX system.
HTR	To display set up window for H2O and Steam Set points, thermocouple Process Select, and view Actual H2O and Steam temperatures.
CAL	To display set up window for H2O and Steam thermocouple bias setting (see Calibration procedure).
SET	To display set up window for:
<u>START TIMER</u>	enter hours and minutes to countdown time to start D1-D3.
<u>DAY</u>	set up window for date.
<u>TOD</u>	set up window for time (military)
<u>MAN</u>	window for manually testing function of the alarm and peristaltic pump.



Cadence System

Touch Screen Control Panel

9.2 CADENCE DX DRAWER PROGRAMMING

All drawer programming is done the same way. Touch the D1 button and it will open the set up for Drawer 1 (“D1”).

In this window, the following can be set:

LOAD TEST TIME	load the time for a test after it is entered in the HR: MIN window.
HR	Enter the hour duration of a test
MIN	Enter the minute duration of a test
TIME TO GO	Displays the time left in the test cycle
ALARM RESET	Press to reset alarm. The alarm indicates a drawer’s test cycle is complete. To silence the alarm press the D1, D2, or D3 button and open that window and push ALARM RESET.
BAK	Returns to the previous window.
SSR	This shows the Pulse Width Modulation or the on/off cycle of the heater SSR while in operation. This is used as a diagnostic tool to determine if the SSR is being commanded to fire.

9.3 TIME AND TEMPERATURE SETTINGS

Time and temperature readings are set by using the same touch pad method.

Touch the appropriate button to open the window of the numerical key pad.

ESC	Escape will leave the number entered and close the window.
BS	Back Space will delete the flashing number in the top window of the numbered display.
CL	Clear will delete the number entered in the window.
ENT	Enter will save the number entered and exit the window.

9.4 TEST PROGRAM EXAMPLE

The following is a sample test program. All drawers will program in the same manner.

1. Press **SET** and then **TOD** to set the current Time Of Day.
2. Set **START TIMER** if test is to start at a specific time.
3. Press **BAK** to return to main window.
4. Press **D1** to enter test set up of drawer 1.
5. Press **HR/MIN** to enter test duration.
6. Press **ENT** to enter the test time in the **DRAWER 1 TEST DURATION** hour/min window.

7. Press **LOAD TEST TIME** to enter process time. The time that was entered should be displayed in the **TIME TO GO** window.
8. Press **BAK** to leave this window and return to main.
9. Press **HTR** to open test temperature of **H2O/STEAM**. Set steam to 93 C the same way that time is set. This may be different if the altitude is different and the test is done with a **H2O** test. *Reference the Altitude Offset Chart for H2O altitude offsets.*
10. Press **PROCESS SELECT** for H2O/STEAM and select STEAM.
11. Press **BAK** to return to main menu.
12. Press **TEST CYCLE on/off** to begin test.
13. The test should start and messages should be displayed as follows (see image below):
WARMING UP... D1 IN PROCESS... STEAM MODE
14. After the test is done an alarm will sound, press **D1** to open the drawer #1 set up window and press **ALARM RESET** to silence alarm.
15. To repeat test go to **D1** window and press **LOAD TEST TIME** to enter time if it is the same. Press **BAK** to return to main window.
16. If a new test is to be run while other tests are in process, simply go to the drawer window and enter **LOAD TEST TIME**. Press **BAK** to return to main window and the cycle for that drawer will begin.



10 REPORTING | REMOTE OPERATION

Reporting is an **option** on all Cadence systems. With the reporting capability comes the ability to control the Cadence from a remote PC or netbook. That remote PC system must be attached to the Cadence via the RS232 port in the back of the system.

10.1 REPORTING

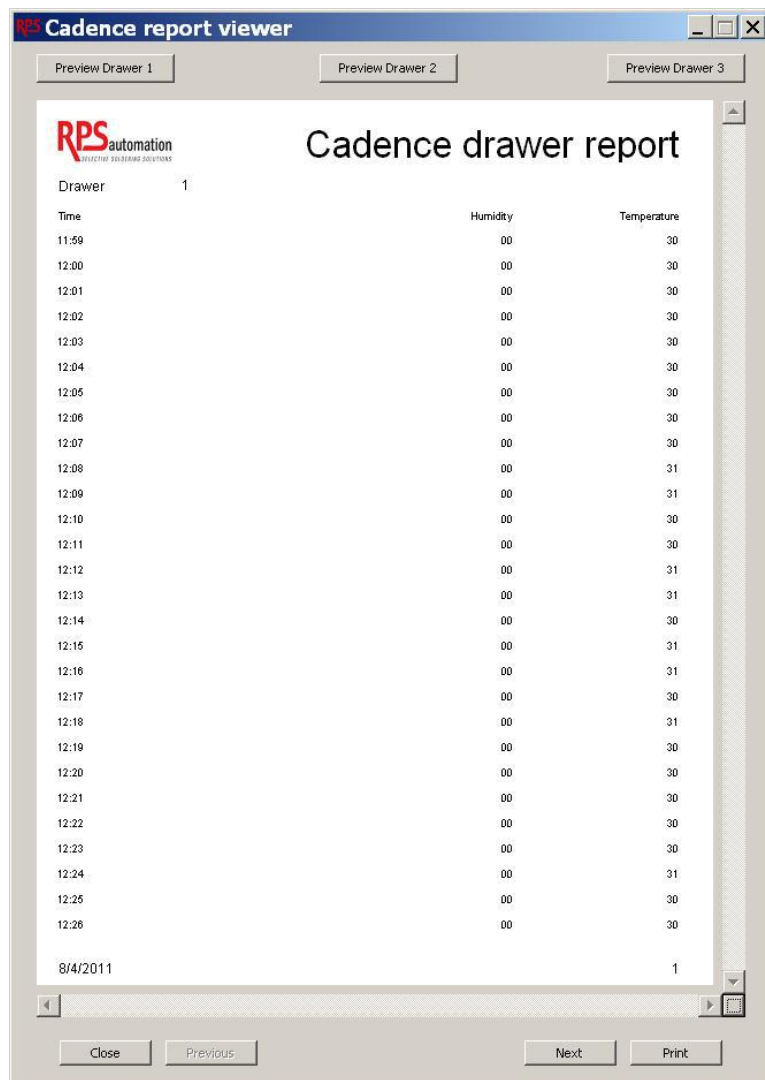
To enable reporting, simply connect to the RS232 port in the back of the system.

CONNECTION: We recommend using a RS232 to USB cable, enabling the use of common USB ports on most PCs, laptops and netbooks.

SYSTEM REQUIREMENTS: Reporting is available for Windows 7. See RPS for alternate platforms such as Mac OS, Linux, and Windows 2000, Vista and XP.

The reporting feature enables the following:

- Program Report / 8 Hour Cycle
- Save Report
- Report per Drawer
- Print Report
- Export Data to a CSV File

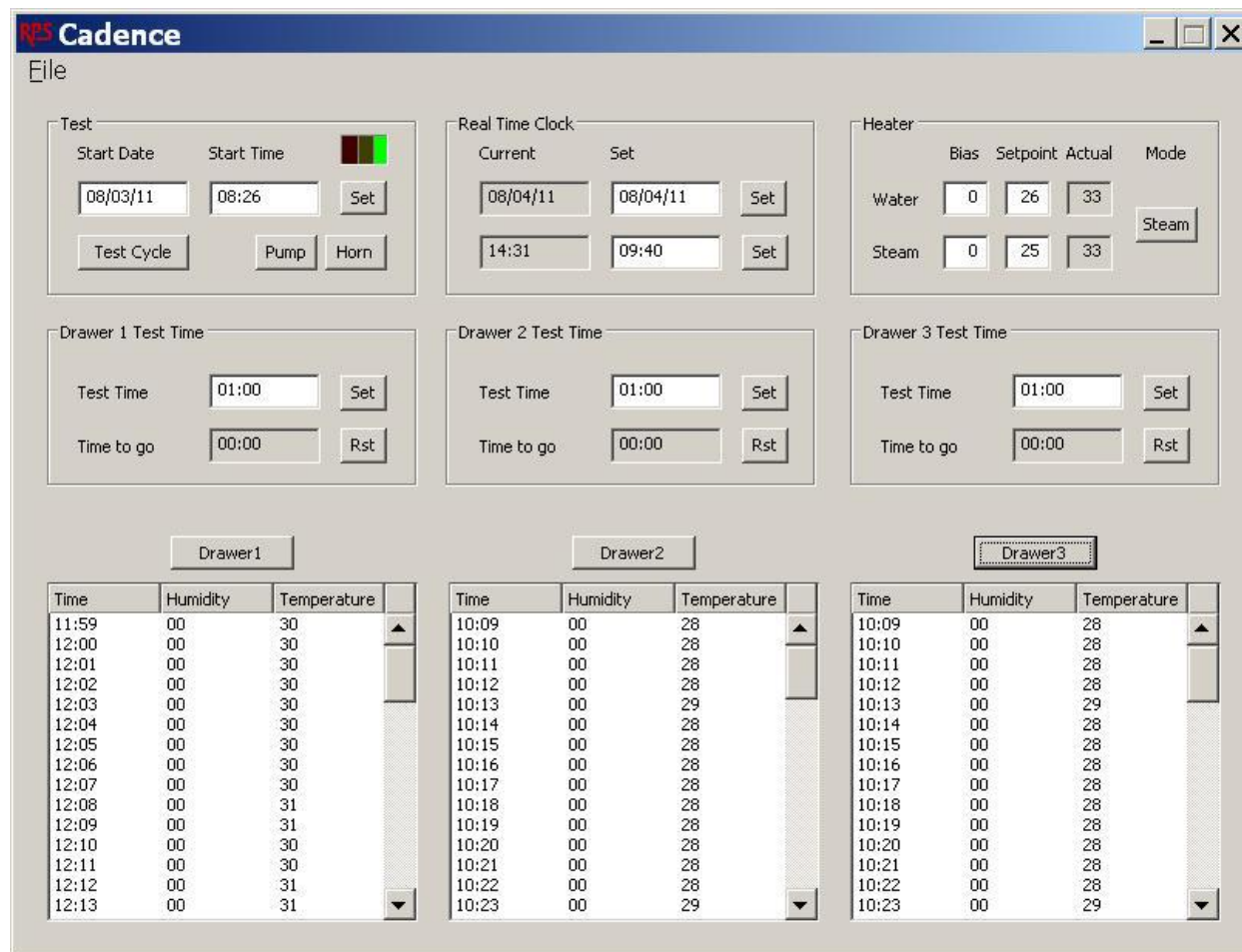


10.2 SYSTEM CONTROL FROM PC

The Cadence can be operated from a PC, Netbook or laptop if the optional reporting feature is purchased. This is a simple application that enables full control of the Cadence from one screen.

All buttons act as they do under normal program and operation using the HMI touch Screen. The Touch Screen will be standard and will still operate the machine. Either control package can be used and both will utilize the last used default settings.

Below is the Remote Operating Panel for a Cadence equipped with optional Reporting.



Time	Humidity	Temperature
11:59	00	30
12:00	00	30
12:01	00	30
12:02	00	30
12:03	00	30
12:04	00	30
12:05	00	30
12:06	00	30
12:07	00	30
12:08	00	31
12:09	00	31
12:10	00	30
12:11	00	30
12:12	00	31
12:13	00	31

Time	Humidity	Temperature
10:09	00	28
10:10	00	28
10:11	00	28
10:12	00	28
10:13	00	29
10:14	00	28
10:15	00	28
10:16	00	28
10:17	00	28
10:18	00	28
10:19	00	28
10:20	00	28
10:21	00	28
10:22	00	28
10:23	00	29

Time	Humidity	Temperature
10:09	00	28
10:10	00	28
10:11	00	28
10:12	00	28
10:13	00	29
10:14	00	28
10:15	00	28
10:16	00	28
10:17	00	28
10:18	00	28
10:19	00	28
10:20	00	28
10:21	00	28
10:22	00	28
10:23	00	29

CONNECTION: We recommend using a RS232 to USB cable, enabling the use of common USB ports on most PCs, laptops and netbooks.

SYSTEM REQUIREMENTS: Reporting is available for Windows 7. See RPS for alternate platforms such as Mac OS, Linux, and Windows 2000, Vista and XP.

11 SYSTEM MAINTENANCE

Service	Daily	Weekly	Monthly	6 Months
Check Water Supply and Feed Hoses	***			
Clean Tooling		***		
Drain and Clean Tank and Drawers/Shelf		***		
Check Electrical Box for Leaks			***	
Check for Seams of Metal			***	
Check Pump Tubing			***	
Temperature Calibration				***
Timing Calibration				***

11.1 CLEANING

System maintenance involves periodic cleaning of the environmental chamber and it's components with a commercial hard water cleaner such as Limeaway™ or CLR™. Remove the stage from the chamber and clean separately.

11.2 USE PROPER CLEANING METHODS TO PREVENT DAMAGE

Do not use a cleaning instrument such as a metal scouring pad to remove film or deposits on chamber components. Such abrasive cleaning could remove or damage the surface within the chamber. **Non recommended cleaning will void the System Warranty.**

11.3 CALIBRATE TEMPERATURE | 6 MONTHS

The purpose of this procedure is to verify that the temperature of the steam ager is correct.

EQUIPMENT REQUIRED:

- a) Digital thermometer traceable to NIST
- b) Stop watch traceable to NIST
- c) Nylon Zip tie

TEMPERATURE VERIFICATION:

- Using the thermocouple of the digital thermometer, Zip-tie the digital thermometer's thermocouple to the system's thermocouple above the parts tray (Steam). Start a test with the Set Point Temperature at 93 ° C.
- When the Steam ager is at a stable temperature proceed to the next step.
- Observe and verify the steam thermocouple's reading on Touch Screen's **HTR** page and compare with the digital thermometer's reading. The factory specification is ± 1 degree C.
- If the reading is off, average the difference over a 1 minute time period.
- Stop the test.
- Press and enter the **[CAL]**ibration page. Press icon/button for thermocouple bias, H₂O or Steam. Enter the bias (offset) calculated in step **d** above.
- Retest until reading is within ± 1 degree C.

NOTE ABOUT TEMPERATURE CYCLE OPERATION

Thermocouple Calibration only calibrates the actual temperature reading. Once the temperature controller reaches the Setpoint Temperature, the heater element is disengaged and the temperature will fall faster than the time required to recover and heat back up to Setpoint. This is the normal recurring cycle and is within specs. To set the Setpoint one degree higher (still within specs), the average temperature range may fluctuate closer to the target testing temperature.

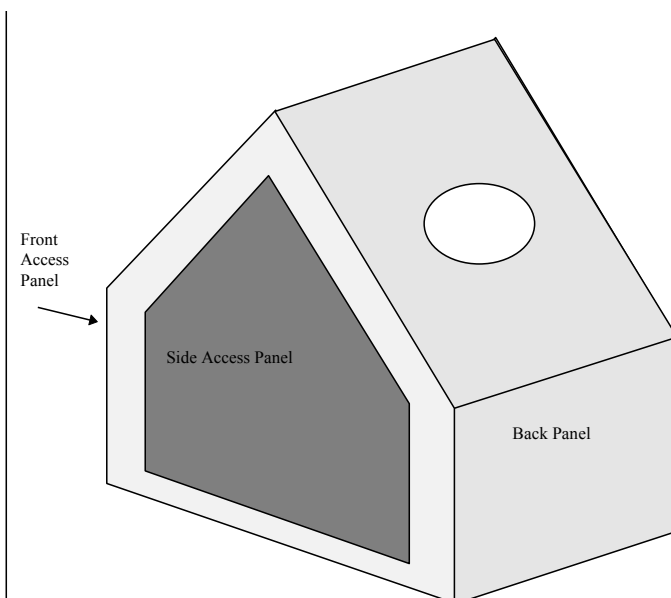
11.4 TIME CALIBRATION & VERIFICATION | 6 MONTHS

- The steam ager must be in valid test mode, temperature stabilized.
- Using the stop watch, verify the timing of the system. The timing standard is five (5) minutes.
- If the system is off more than 20 seconds over a 5 minutes test, please contact RPS for service.

11.5 ELECTRICAL

In addition to system cleaning, electrical troubleshooting may, at some point, be required within the unit control console. Refer to the figure below for access panel locations.

Access Panel Location



12 SAFETY

General safety practices and common sense must be the rules for operation. The test chamber and exhaust duct reach temperatures of near 100° C. **DO NOT TOUCH** until test is completed and unit has cooled and a green process light is present.



RED LIGHT WARNING: DO NOT OPEN THE TEST CHAMBER LID WHILE THE RED SAFETY LIGHT IS ILLUMINATED.



SAFE COVER REMOVAL: ALWAYS OPEN THE CHAMBER LID COVER PIVOTING AWAY FROM THE OPERATOR, RELEASING STEAM TO THE REAR OF THE UNIT.

12.1 KEY SAFETY FEATURES

- A safety light (red light) illuminates when tank environment is $\geq 68^{\circ}\text{C}$.
- A circuit breaker and 2 fuses are located in the rear of the unit.
- A water overflow port to drain is provided in the event of float sensor failure.
- A low water float sensor will shut down the system in the event of low or lack of water.

13 BOILING POINT

13.1 ALTITUDE/BOILING POINT CORRELATIONS

These correlations are to be used for tests utilizing water temperature monitoring. The Steam monitoring methods do not use these values.

ALTITUDE		BOILING POINT		CONTROLLER	
		OF WATER		SETPOINT	
METERS	FEET	F°	C°	F°	C°
0	0	212	100	208	98
500	1640	207.9	97.7	204	96
1000	3281	205.9	96.6	202	94
1500	4921	203.1	95.1	200	93
2000	6562	199.9	93.3	196	91

14 MIL STANDARDS

14.1 MIL-STD 202 | METHOD 208F (EXCERPTS)

SECTION 2.4 | “A non-corrosive or nonmetallic container shall be used of sufficient size to allow the suspension of the specimens inside the container 1 ½ inches above the boiling distilled water. (A 2000 ml beaker is one size that has been used satisfactorily for small components.) The cover shall be one or more stainless steel plates and shall be capable of covering approximately 7/8 of the open area of the container so that a constant temperature may be obtained. Perforations or slots in the plates are permitted. A suitable method of suspending the specimens shall be improvised using a non-contaminating material.”

SECTION 4.2 "AGING" | “Prior to the application of the flux and subsequent solder dips, all specimens assigned to this test shall be subjected to aging by exposure of the surfaces to be tested to steam in the container specified in 2.4. The specimens shall be suspended so that no portion of the specimen or termination is more than 2 ½ nor less than 1 ½ inches above the boiling distilled water with the cover in place for 60 + 5, -0 minutes. (Beginning 1, April 1987, steam aging time shall be 4 to 8 hours.) If necessary, additional hot distilled water may be gradually added so that the water will continue to boil and the temperature will remain essentially constant. A heat baffle may be used to insulate the body of the component from the boiling water.”

14.2 MIL-STD 883C: NOTICE 5, METHOD 2003.5 (EXCERPTS)

SECTION 2.4 | “A non-corrodible container of sufficient size to allow the suspension of the specimens 1½ inches above the boiling distilled water shall be used. (A 2,000 ml beaker is one size that has been used satisfactorily for smaller components.) The cover shall be of one or more non-corrodible plates and shall be capable of covering proximately 7/8 of the open area of the container so that a more constant temperature may be obtained. A suitable non-corrodible method of suspending the specimens shall be improvised. Perforations or slots in the plates are permitted for this purpose.”

SECTION 3.2 | AGING | “Prior to the application of the flux and subsequent solder dips, all specimens assigned to this test shall be subjected to aging by exposure to the surfaces to be tested to steam in the container specified in 2.4. The specimens shall be suspended so that no portion of the specimen is less than 1 ½ inches above the boiling distilled or de-ionized water with the cover specified in 2.4 in place for 4-8 hours. In effect, while the manufacturer may accept on the basis of 4 hours aging, the customer/user shall be able to reject on the basis of results after 8 hour aging. Means of suspension shall be a non-corrodible holder. If necessary, additional hot distilled or de-ionized water many be gradually added in small quantities so that the water will continue to boil and the temperature will remain essentially constant.”

15 CONTROL SPECIFICATIONS

15.1 PLC CONTROLLER

The DLo6 PLC controls the Cadence Steam Ager. The function is to control all of the various timing, temperature, alarm, display and liquid control necessary in the system:

- Controls the Aging Chamber temperature by one of two thermocouple inputs.
- Times the complete cycle and alerts the operator at the completion of the test.
- All necessary outputs to operate and monitor the various control functions.
- Displays to indicate the Temperature, Set Point, Test Time and Test Duration.
- Status and alarm functions, providing alpha numeric information about the parameter setups and alarm conditions.
- Time of Day Clock: The clock has two specific functions. First, it captures the data of any communications output. Second, an automatic STARTUP function (Alarm Clock) is implemented. This allows the machine to start a test cycle without an operator being present.

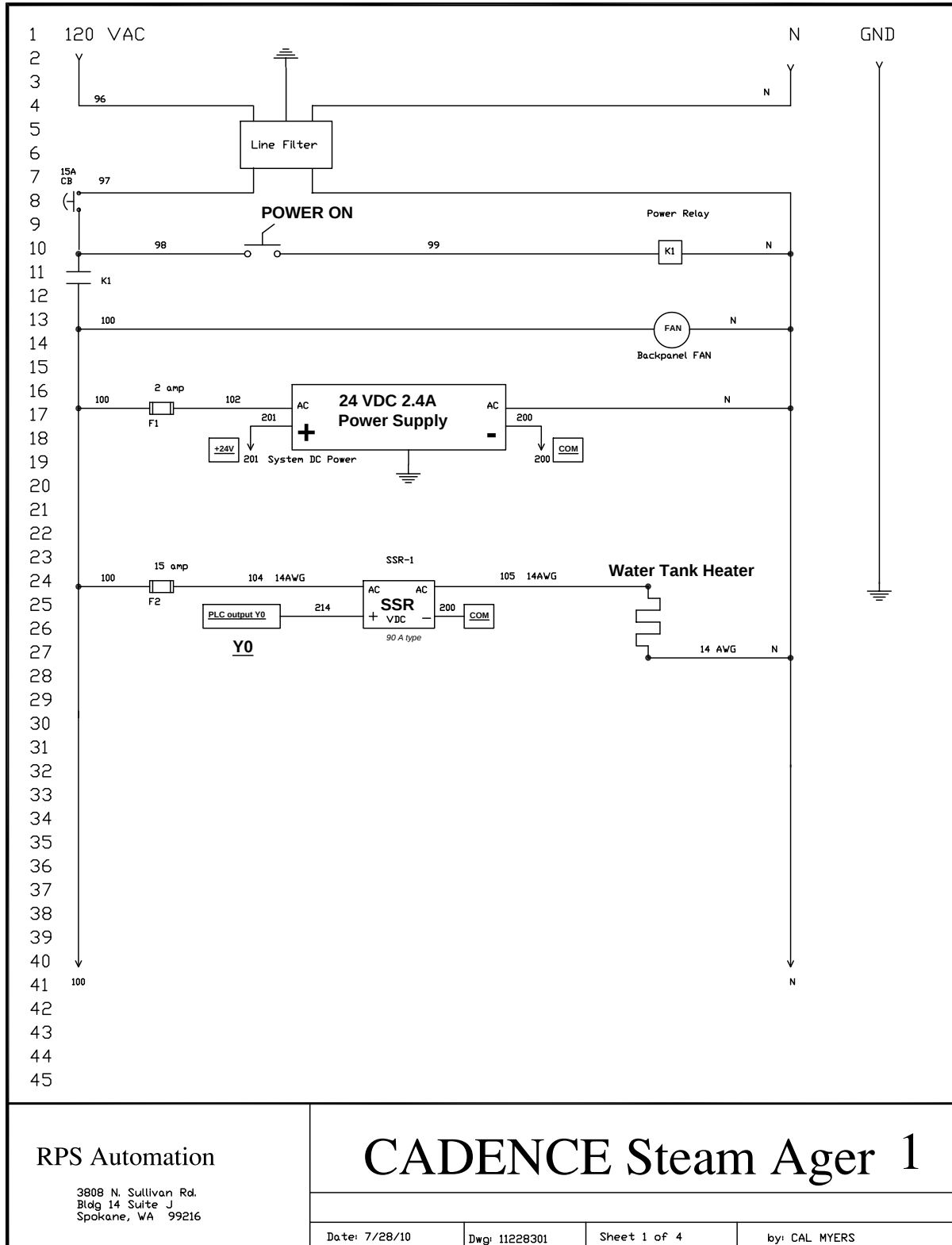
PLC	DLo6 CPU, 20 DC in / 16 DC out, 110/220 VAC power supply, with 0.3A 24 VDC auxiliary device power supply. 14.8K words total (7679 words ladder - flash, 7488 words V-memory), RLL/RLLPLUS programming (DirectSOFT32 Version 4.0 or higher), two built-in RS232C communication ports. Secondary communications port supports RS232C/RS422/RS485, DirectNET Master/Slave, MODBUS RTU, Master/Slave, and ASCII In/Out. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). First 4 inputs are configurable in one of several high-speed I/O features such as 7KHz counter input, pulse catch input, or interrupt input (not available when using pulse output). Outputs: 16 DC outputs, 12-24 VDC current sourcing 1.0A/pt. max., 4 commons non-isolated (4 points per common). 2 outputs are configurable for independent CW/CCW pulse train output or step and direction pulse output up to 10KHz (0.5A/pt.). Four option slots available for I/O or communication modules.
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15.2 COMPONENT TECHNICAL DETAIL

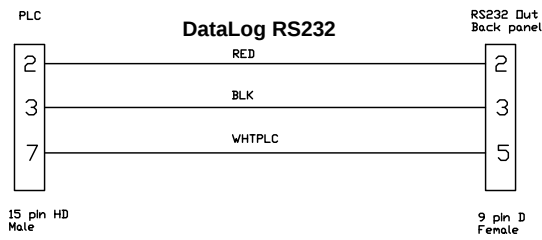
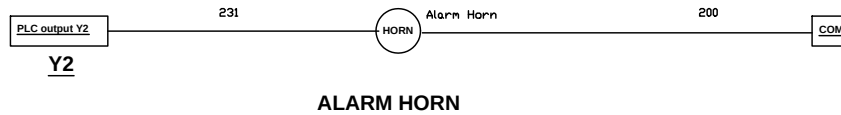
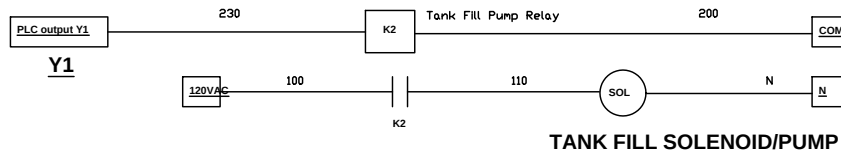
DISPLAY	<u>EA1-S3ML</u>: 3 IN, MICRO-GRAPHIC, STN TOUCH PANEL, LCD, MONOCHROME: 3.1-inch C-more Micro-Graphic Touch Panel with STN LCD monochrome, 128 x 64 dot display. LED backlights (5 selectable backlight colors), 5 user-defined function keys with LED indicators. Power supplied through serial communication port connection when used with DirectLOGIC PLCs having an RJ12 communication port. EA-MG-SP1 (power supply with serial port option module) required when connecting to third party PLCs. NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only).
SENSOR	Standard - Type J Thermocouple, Cold Junction Compensation, Up Scale Break Protection
CONTROL	Fo-04THM: 4-channel Thermocouple Input Module: 0.1 degrees Celsius or Fahrenheit resolution, supports: J, E, K, R, S, T, B, N, C type thermocouples; 0-39.0625mV, +/-39.0625mV, +/-78.125mV, 0-156mV, +/-156mV, and 0-1.25V at 16-bit resolution.
TEMP RESOLUTION	0.1 Degrees C. (Control) 1 Degrees C. (Display)
TIME RANGE (hrs : min)	0:0 to 99:59 1 minute resolution
OPERATING RANGE	0 to 50 Degrees C
STORAGE RANGE	-40 to 60 Degrees C
OUTPUT	Heater: OCT, 50 max. Relay: 1 HP, 10 amp, 120 VAC
POWER	120 VAC +10%, 50/60 HZ

16 SCHEMATICS

Attached are sub-system schematics for standard operations and maintenance.



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RPS Automation

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Bldg 14 Suite J
Spokane, WA 99216

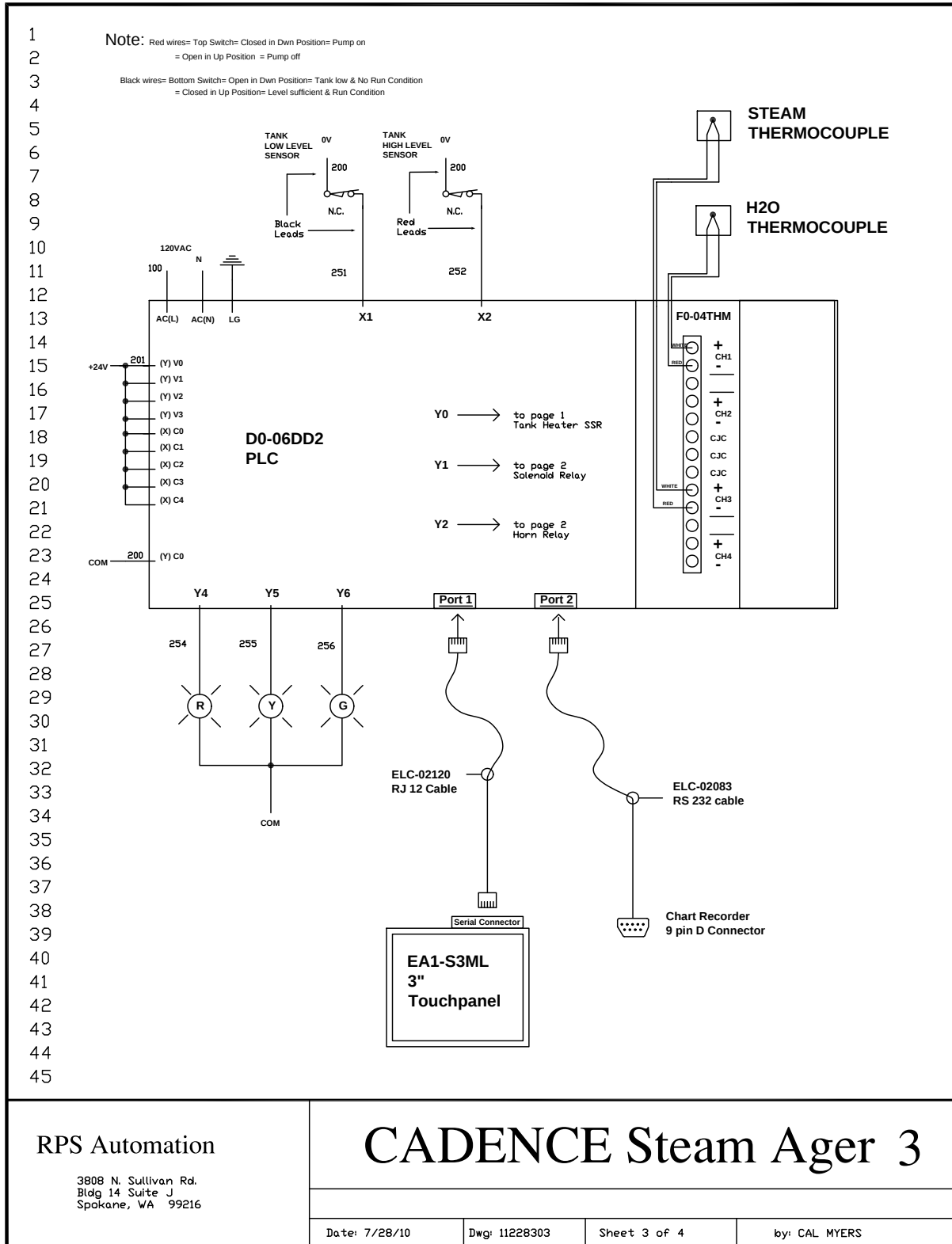
CADENCE Steam Ager 2

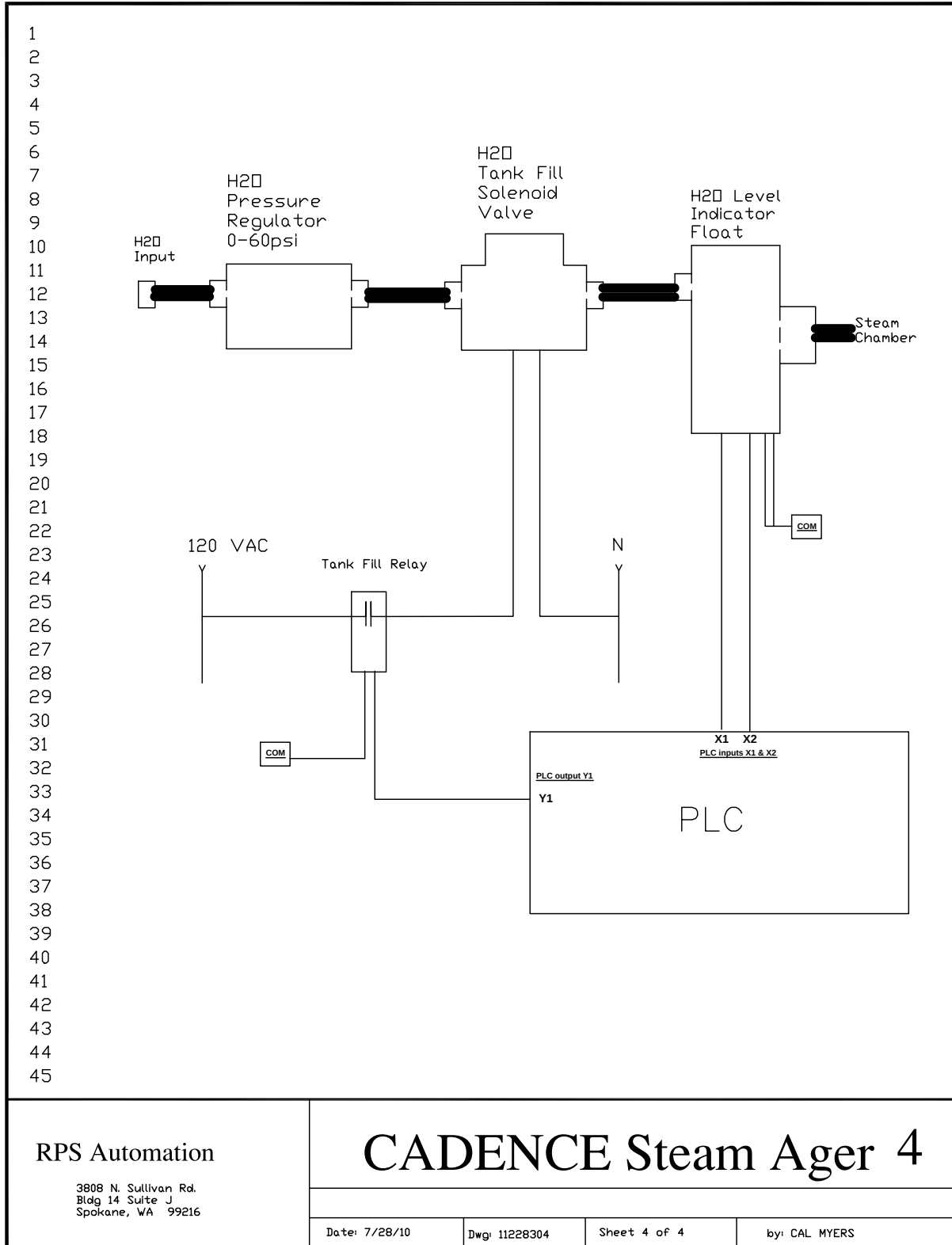
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Sheet 2 of 4

by: CAL MYERS





17 TOOLS & SPARE PARTS

An “*” indicates a part included in the Annual Spare Parts Kit “SPK”, these parts should be inspected/replaced or held in stock after approximately 2,000 to 3,000 hours of operation or as needed for 24x7 operations. Include system serial number with orders. Spare Parts Kit PN#: 720070

PART NUMBER	DESCRIPTION
ELC-00015	FLOAT SWITCH Cadence *
ELC-00076	SM. CONTACTORS *
ELC-00105	SSR DC IRE 90 AMP *
ELC-00325	CIRCUIT BREAKER 15 AMPS *
ELC-00358	IMMERSION HEATER *
ELC-00363	THERMOCOUPLE *
FPLM-00165	Cadence PUMP HOSE *
ELC-00401	3.25" FAN
ELC-00403	FINGER GUARD 3.25 FAN
ELC-00404	PUMP (Carboy ONLY)
ELC-00753	9-PIN MALE CONNECTOR KIT
ELC-02070	4 CHANNEL THERMO INPUT CARD
ELC-02120	3" MICRO SCREEN TOUCH PANEL
ELC-02122	FLOAT SWITCH TUBE
MEC-00975	MOUNTS, SWIVEL LEVELING
Floor Stock	¼" AIR LINE
PEC-00044	AIR FITTING 10-32X5/32 TB
PLM-00026	WATTS VALVE ½ NPT
PLM-00030	1/2" NPT X 4" SS NIPPLE
PLM-00032	½ CLOSE NIPPLE SS
PLM-00042	½ NPT 90 ELBOW SS
PLM-00050	3/8T X ¼ STR SS
PLM-00098	3/8T X ¼ STR POLY
PLM-00100	NYLON FITTING 1/4NPTX1/4T
PLM-00128	3/8 POLYETHEL. TUBING
PLM-00134	1/4T NYLON BULKHEAD UNION
PLM-00164	½ NPT PVC CAP
ELC-02069	PLC, DLo6 CPU, 20 DC in /16 DC out
ELC-02037	Power Supply 24v , 60w
ELC-00304	CHEATER CORD FOR 115VAC
207000001	Cadence BASE
207000003	Cadence TANK
207000118 REV A	Cadence DX TANK
207000002	Cadence WRAP AROUND
207000101	Cadence DX WRAP AROUND
207000012	Cadence ELECTRONICS PLATE
207000009	Cadence BACK COVER (TANK)
207000004 REV A	Cadence R.H. SIDE PANEL (S)
207000005	Cadence L.H. SIDE PANEL (CO)
207000006	Cadence COVER PLATE
207000008 REV A	Cadence CONTROL BOX RR CVR
207000007 REV A	Cadence CONTROL BOX FRT CVR
207000011 REV A	Cadence LID ASSEMBLY (SS)
100129	Cadence GATE (STEAM VENT)
20700010 REV A	Cadence LID COVER (PAINT)
207000123	Cadence DX DRAWER FLANGE B.H.
100120	Cadence DX DRAWER DIVIDER
207000116	Cadence DX DRAWER BOX
207000014	Cadence HANDLE
207000121	Cadence DX DRAWER FLANGE T.H.
740600	Cadence Drawer assembly
1001243	Cadence PARTS SCREEN

18 TROUBLESHOOTING

18.1 BASIC OPERATION

#	PROBLEM	POSSIBLE CAUSE & SOLUTION
1	No Main Power	• Check system plugged in • Check main breaker tripped, blown • Check system fuse tripped, blown
3	Sudden Changes in Controller Values	<u>Causation</u> The unit is being subjected to electrical noise which needs to be isolated and eliminated immediately as it is damaging the controller <u>Solution</u> Replace Quencharc and snubbers.
4	Control Panel Turns Off During Test	This indicates MAJOR problems with the power. • The power must be isolated and verified to be within specifications. • The voltage must not exceed 10% of rated voltage. • In the event this can be isolated to a specific event in the test cycle, isolate that event and call factory for assistance. • In the event this involves the pump, check the pump action for correct duty cycle. • If the pump is constantly turning off and on, clear the tube in between the float switch and the main tank. If the pump cycle is correct, the pump's RC noise suppresser may have failed.

18.2 TEST PROCESSING

#	PROBLEM	POSSIBLE CAUSE & SOLUTION
1	System will not run test cycle.	System temperature varies widely so that the test timers stop and start. • Verify that lid vent position is partially open • Check if DI water source pressure is 05 PSIG • Verify the overflow to drain is not open to air • Verify thermocouple bias
2	Unit shuts down prematurely or will not start test cycle.	<u>Possible Cause:</u> Lack of water Blocked water feed line <u>Possible Solutions:</u> • Verify the unit is filled with water to begin test. • Clear any air bubbles in the feed line by tilting the unit toward the float switch (1" high maximum). • In extreme conditions blow air into the breather tube to clear any obstructions.
3	Contamination of Test Parts	<u>Possible Causation</u> • The test chamber needs to be cleaned weekly. If this is not done the chance of the parts being contaminated by items growing in the water is great. • When the steam ager is new some spots in the tank may develop surface rust spots. These spots are caused by spots of welding slag that contacted the tank and have caused the surface of the stainless steel to heat up. <u>Possible Solutions</u> • Drain and fill with fresh water • Scrub the spots where the slag attached. This may require some time to work the ferrites out completely. The leaching process is accelerated by the weekly cleaning using the "Lime Away". It has never been an issue as to contamination of parts.

19 EXTRAS

RPS customers and technicians are always finding new and creative ways to process their application. Provided below are a few outlets for these creative and talented energies

19.1 ADVANCED TECHNIQUES

If you are interested in learning more about using advanced techniques— perhaps for a difficult or unusual application— please contact your RPS Technician or RPS at support@rpsautomation.com. RPS is always happy to provide additional documentation and training to support your efforts.

19.2 TIPS & TRICKS

Don't hesitate to call RPS or your field technician with questions regarding your process and programming needs. We are always happy to share our strategies and approaches to make the most of your RPS System.



NOTES

RPS Cadence and Cadence DX Steam Aging Systems™ v2.02 User Guide

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