Service and Maintenance Manual

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Creating Better Science Since 1886
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This service manual is intended as a guide to help thru the process of diagnosing and repairing Percival chambers. Only qualified service technicians should attempt to repair chambers and their components.

Since Percival chambers are hand made in the USA with over 50 options, this manual can not address every issue. Technical support is always available at no charge by calling:
1-800-695-2743 or email service@percival-scientific.com

When contacting Percival please provide the model and serial number of your unit to expedite diagnostic help.

Rev. 1.04.1

Written by Ralan Nelson

Table of Contents

Program Entry Table

Time	Temperature	%RH	Lights								CO_2/LS1/Aux

Refer to your Intellus Controller manual for detailed instructions for programming, security, communications (if applicable) and plant growth tables.

Intellus Controller

Please feel free to contact Percival Scientific with any questions you may have about this manual or using the IntellusUltra controller by calling 1-800-695-2743 or 515-465-9363 or by sending e-mail to:
service@percival-scientific.com

How to Use the Keys and Display

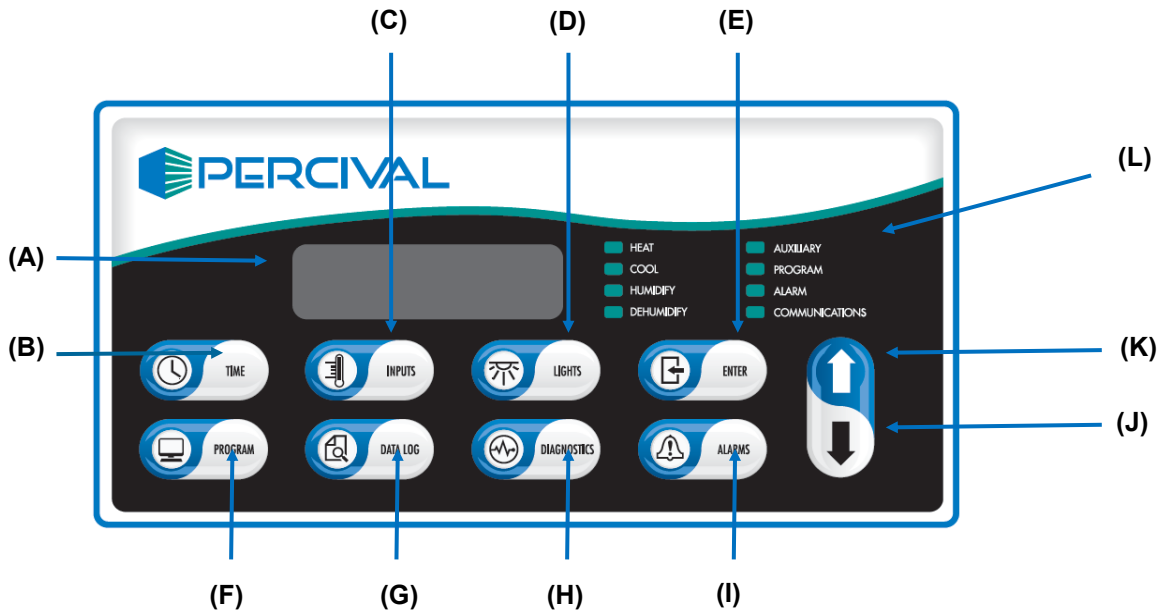


Figure 1 – IntellusUltra Display and Key Reference

(A) Main Display, (B) Time Key, (C) Inputs Key, (D) Lights Key, (E) Enter Key, (F) Program Key, (G) Data Log Key, (H) Diagnostics Key, (I) Alarms Key, (J) Decrement Key, (K) Increment Key, (L) LED Indicators

Intellus Controller cont.

Refer to Figure 1:

Main Display (A)

The main display shows all status and programming information.

Time Key (B)

The Time key is used to set the system time.

Inputs Key (C)

The Inputs key is used to enter the Inputs menu. The Inputs menu contains entries for the Manual settings for temperature, humidity (if applicable), and any auxiliary/expansion channels (if applicable). It is also used to enable or disable the outputs for the humidity input (e.g. humidify/dehumidify) and the outputs for any additional auxiliary/expansion channels.

Lights Key (D)

This key is only active when one or more of the following systems is provided on a chamber:

On/off lighting
On/off event output
Open-loop dimmable lighting
1 is for On and 0 is for Off

The Lights key is used to enter the Lights menu. The Lights menu contains entries for individual light and event settings, management of light lifetime information, and setting of the light lifetime alarm.

Enter Key (E)

This key is used to initiate the editing of values and to accept any changes made to them.

Program Key (F)

This key is used to enter the Program menu. The Program menu contains selections used to enter/edit programs, run programs or run manual settings. Please refer to the section titled "Programming" in IntellusUltra & IntellusUltra Connect Controller Manual for more information.

Note: Only the appropriate LEDs for the options ordered will function.

Intellus Controller cont.

Data Log Key (G)

This key is only active when an IntellusUltraConnect (C9) control system option is installed. The Data Log key is used to enter the Data Log menu. This menu is used to export data from the controller to a USB flash drive. Refer to the section titled "Data Log" in IntellusUltra & IntellusUltra Connect Controller Manual for more information.

Diagnostics Key (H)

This key is used to enter the Diagnostics menu which allows the user to view diagnostic information for the chamber. Refer to the section titled "Diagnostics" in IntellusUltra & IntellusUltra Connect Controller Manual for more information.

Alarms Key (I)

This key is used to enter the Alarms menu. The Alarms menu contains entries for setting high and low alarm settings for each of the process loops enabled on the IntellusUltra or IntellusUltraConnect control system. Refer to the section titled "Alarms Menu" in IntellusUltra & IntellusUltra Connect Controller Manual for more information.

Decrement (J) / Increment (K) Keys

These keys are used to scroll through available menu options and to decrease or increase values.

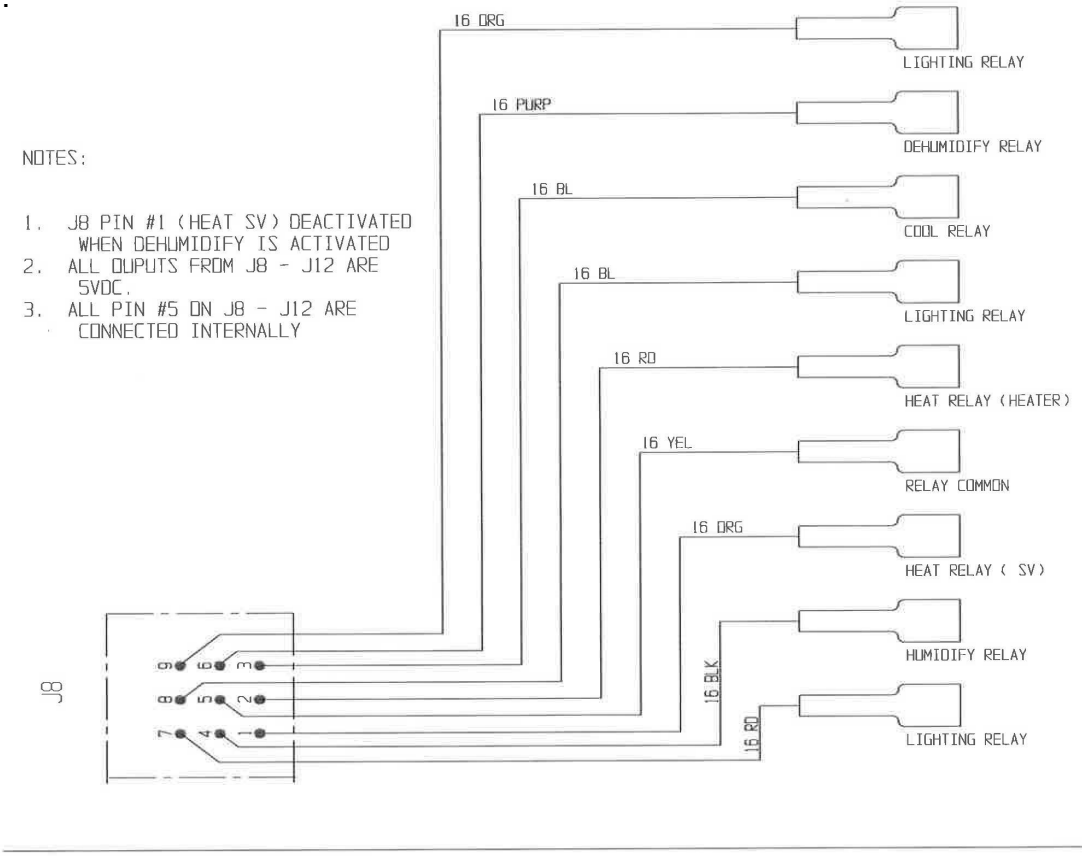
Status LEDs (L)

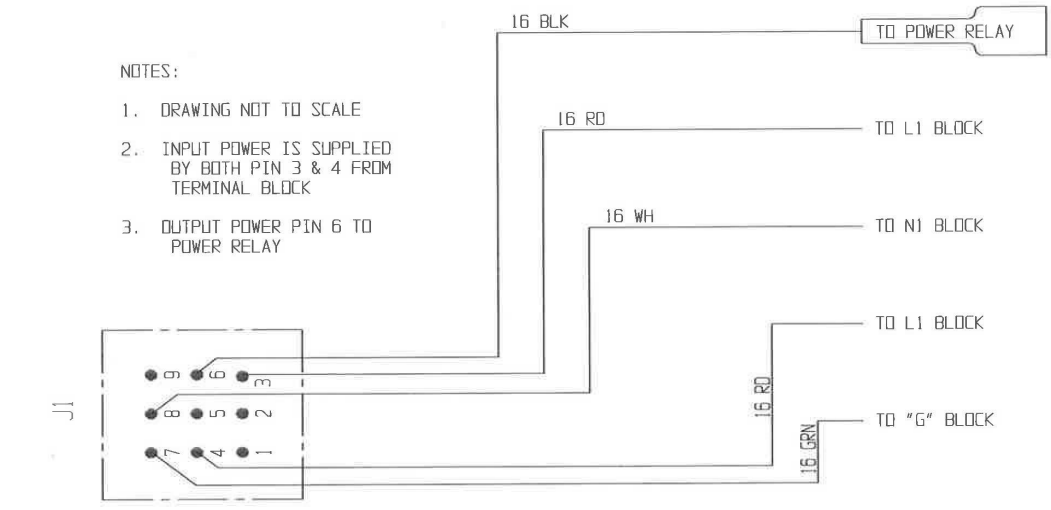
The Heat LED illuminates when the controller calls for chamber heating.
The Cool LED illuminates when the controller calls for chamber cooling.
The Humidify LED illuminates when the controller calls for the level of humidity to increase in the chamber.
The Dehumidify LED illuminates when the controller calls for the level of humidity to decrease in the chamber.
The Auxiliary LED illuminates when the controller calls for the level of the auxiliary channel to increase in the chamber.
The Program LED illuminates when the controller is running a program. The LED is off when the controller is running manual settings. The LED flashes when entering/editing a program. Refer to the sections titled "Running Manual Settings" and "Programming" in IntellusUltra & IntellusUltra Connect Controller Manual for more information.
The Alarms LED illuminates when there is an active alarm on the control system. Refer to the section titled "Alarms" in IntellusUltra & IntellusUltra Connect Controller Manual for more information.
The Communications LED illuminates when the controller is communicating over the Ethernet.

Intellus Controller Operation

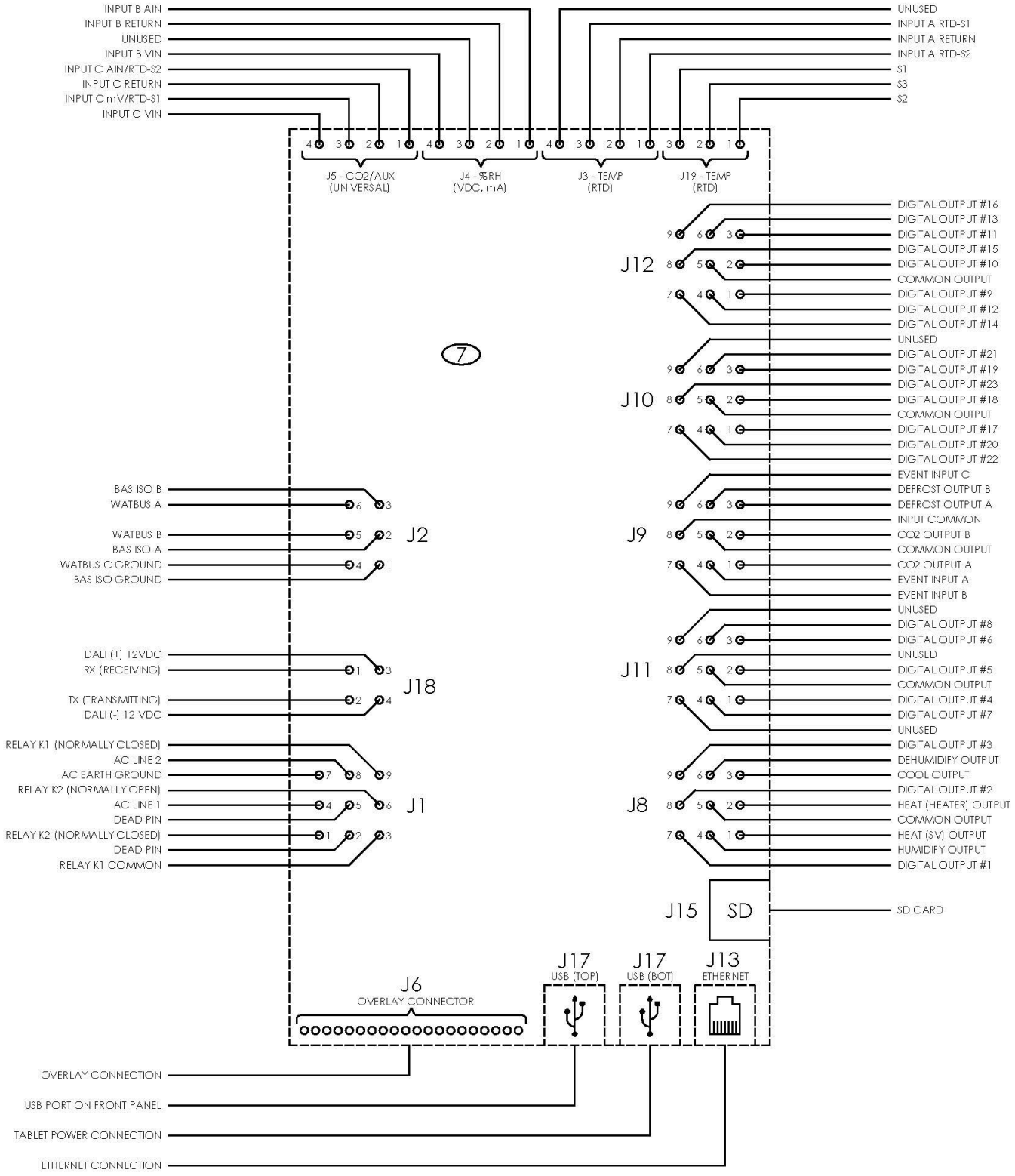
Order of operation

Controller requires A/C input voltage at J1 pins #3 & #4. If internal conditions are met i.e. sensors connected, safeties within specs, the controller then sends A/C output voltage thru J1 pin #6 which normally activates the power relay or contactor. The relay or contactor then distributes power to the rest of the system i.e. compressor, fans, relays etc. Most components like the lights, heaters, humidity etc. are controlled by the Intellus controller sending D/C voltage (5VDC) to a solid state relay. Connectors J8—J12 are all D/C output volts. Pins #5 are all common.





IntellusUltra & IntellusUltraConnect Pinouts



Service Information - General

⚠ WARNING

Disconnect all unnecessary electrical power when servicing equipment.
Majority of circuits are high voltage.

Chamber does not power up:
1. Check source (facility) electrical power, circuit breakers, fuses, etc.
2. Check chamber power cords, circuit breakers, power switches, etc.

Convenience receptacles do not work:
1. Check wiring, connections, and physical condition of receptacles.
2. Check circuit breaker.

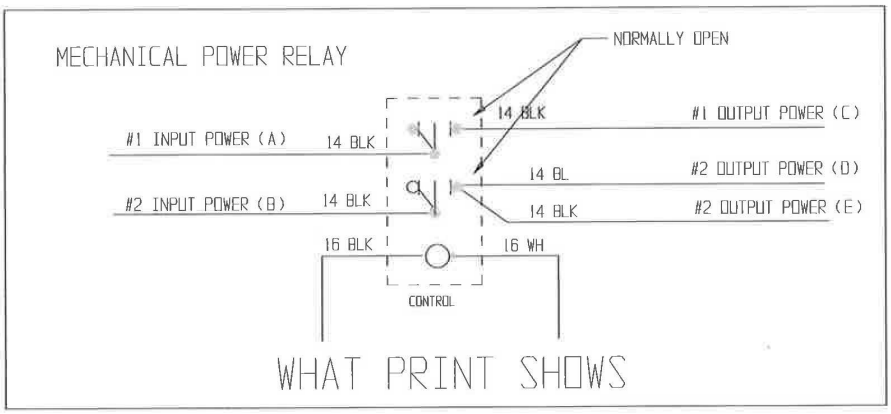
Circuit breaker trips:
1. Check electrical system for shorts and convenience receptacles for overloading.
2. Check voltage to chamber.
3. Check electrical connections (must be tight) at circuit breaker.

Chamber powers up but compressor does not:
1. Most units have 2 power cords. Make sure both are plugged into a power source.
2. Check for error codes on Intellus controller.
3. Test electrical components for fault.

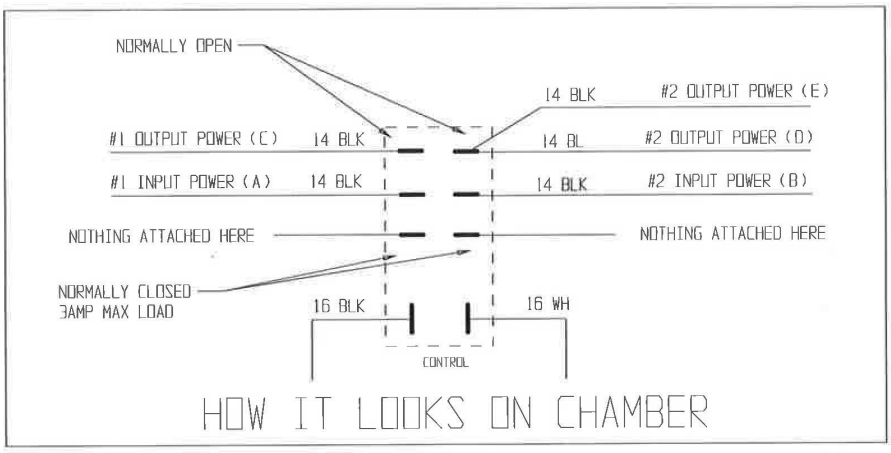
Display Loop Error Codes

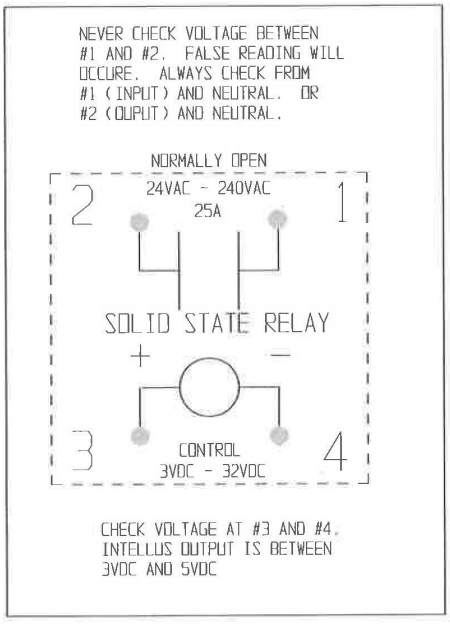
Display	Selections Text	Help Text
E 0 1 Temp Input Error on Temp Input	Calibration, A/D Under Range, A/D Over Range, Sensor Under Range, Sensor Over Range	Status Menu - Temp Input Error. Check the Temperature sensor for proper connections, replace if necessary. If replacement does not fix the error contact Percival Scientific
E 0 2 RH Input Error on RH Input	Calibration, A/D Under Range, A/D Over Range, Sensor Under Range, Sensor Over Range	Status Menu - RH Input Error. Check the RH sensor for proper connections, replace if necessary. If replacement does not fix the error contact Percival Scientific
E 0 3 Aux Input Error on Aux Input	Calibration, A/D Under Range, A/D Over Range, Sensor Under Range, Sensor Over Range	Status Menu - Aux Input Error. Check the Aux sensor/input signal for proper connections, replace if necessary. If replacement does not fix the error contact Percival Scientific
XOXOX	Internal error	Indicates internal error. Replace controller

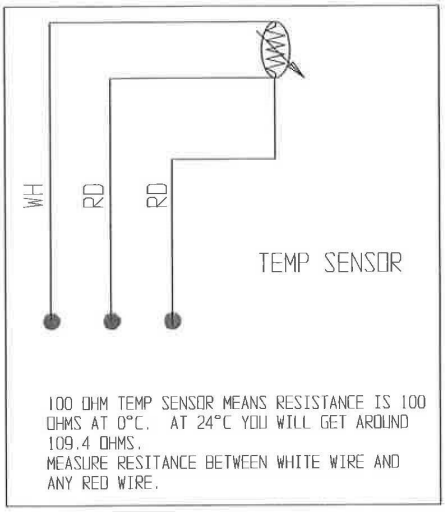
ELECTRICAL COMPONENT TESTING



MEASURE CONTROL VOLTAGE. SHOULD BE 120VAC OR 230VAC
VERIFY INPUT VOLTAGE BETWEEN 'A' AND NEUTRAL AND 'B'
AND NEUTRAL. (120VAC OR 230VAC). CHECK OUTPUT VOLTAGE
BETWEEN 'C' AND NEUTRAL AND 'D' AND NEUTRAL. (120VAC OR 230VAC)







NOTE: Solid state relay output #2 needs a load in order for the contacts to open. Best to check voltage with wire/connector attached to relay.

Service Information - Lighting System (if applicable)

⚠ WARNING

Disconnect all unnecessary electrical power when servicing equipment.
Majority of circuits are high voltage.

Lighting malfunctions - group of lamps not on (refer to lamp flowchart)

Intellus controller: Check the controller for correct voltage output to the lighting relays. The voltage should be approximately 5VDC. If the controller fails to output the correct voltage, the controller will need to be repaired or replaced.

Lighting relay: Check existing lighting relays for proper function and replace if necessary.

Light fixture plug: Check to insure that light fixture plug is secured in its receptacle.

Ballast failure: Locate the defective ballast in the mechanical compartment by energizing all ballasts and measuring amperage of each ballast individually. The ballast that has failed will yield much lower amps then others. Refer to ballast for amperage rating. Also a failed ballast produces little to no heat.

Lighting malfunctions - fluorescent not on

Installation: Check for proper installation of lamp in lamp holder. Check wiring and connections.

Lamp failure: Replace the defective lamp with a known good lamp.

"LIGHT LIFETIME ALARM". How do I reset it?

A. Light Lifetime Alarm

The light lifetime alarm can be set to inform you when your lamps have been on beyond their recommended lifetime. Each light output configured in the controller will accumulate the number of hours it has been programmed on. When any of the configured light outputs has been on for longer than the light lifetime alarm setting then a light lifetime alarm will occur. When a light lifetime alarm occurs, the alarm buzzer will activate and a message indicating the alarm will be displayed. To silence the alarm, press any key. The lights controlled by the light output which caused the light lifetime alarm should be changed and the light lifetime reset. The alarm message will only clear by resetting the light lifetime for the light output that triggered the alarm.

To adjust the light lifetime alarm setting use the following steps:

1. Press the **LIGHTS** key.
2. Use the ▲ and ▼ keys as necessary to select 'Light Life Alarm' and then press **ENTER**.
3. Use the ▲ and ▼ keys as necessary to change the light lifetime alarm setting and then press **ENTER**.
4. Press the **LIGHTS** key to return to the main display.

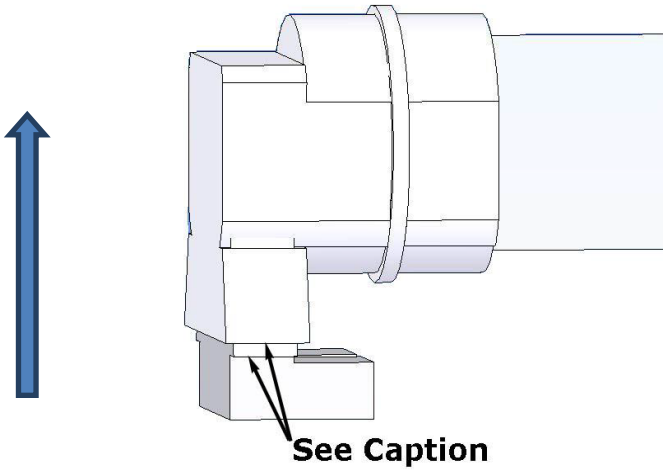
In the event of an alarm, to investigate which light output(s) caused the alarm use the following steps:

1. Press the **LIGHTS** key.
2. Use the ▲ and ▼ keys as necessary to select 'Light 1 Life'. Review this value. If it's greater than the light lifetime alarm setting then the accumulated lifetime for this light output should be reset.
3. Press the ▼ key repeatedly to review each additional light output configured on the chamber. If the light lifetime for any additional light output exceeds the light lifetime alarm setting then reset the accumulated lifetime for that output.
4. Press the **LIGHTS** key to return to the main display.

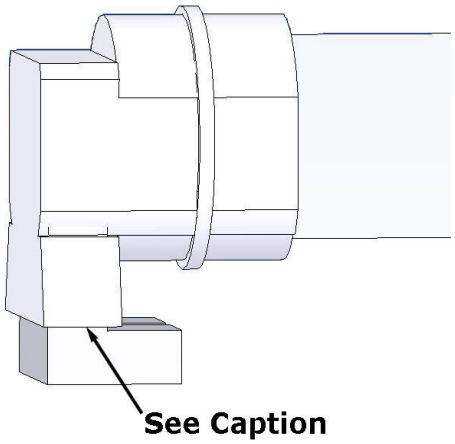
To reset the accumulated light lifetime of a light output use the following steps:

1. Press the **LIGHTS** key.
2. Use the ▲ and ▼ keys as necessary to select 'Light x Reset Time' where x is the number of the light output you want to reset and then press **ENTER**.
3. Use the ▲ and ▼ keys as necessary to select 'Yes' and then press **ENTER.**

*** - NOTE: The lamp holder caps must be securely installed against the lamp holders! Please reference the drawings below:**



Incorrect installation – gap exists between lamp holder cap and lamp holder

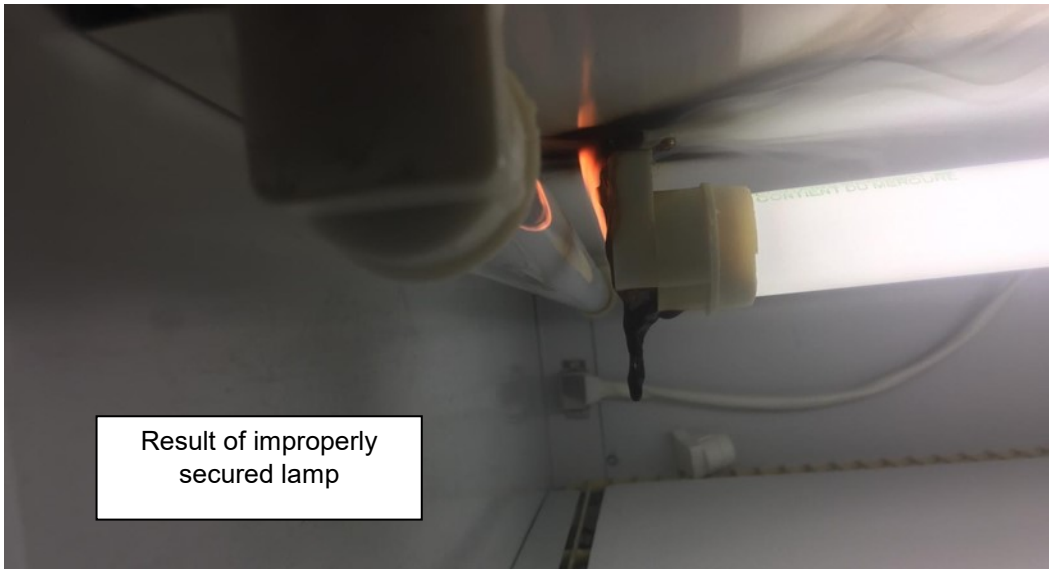


Correct installation – no gap exists

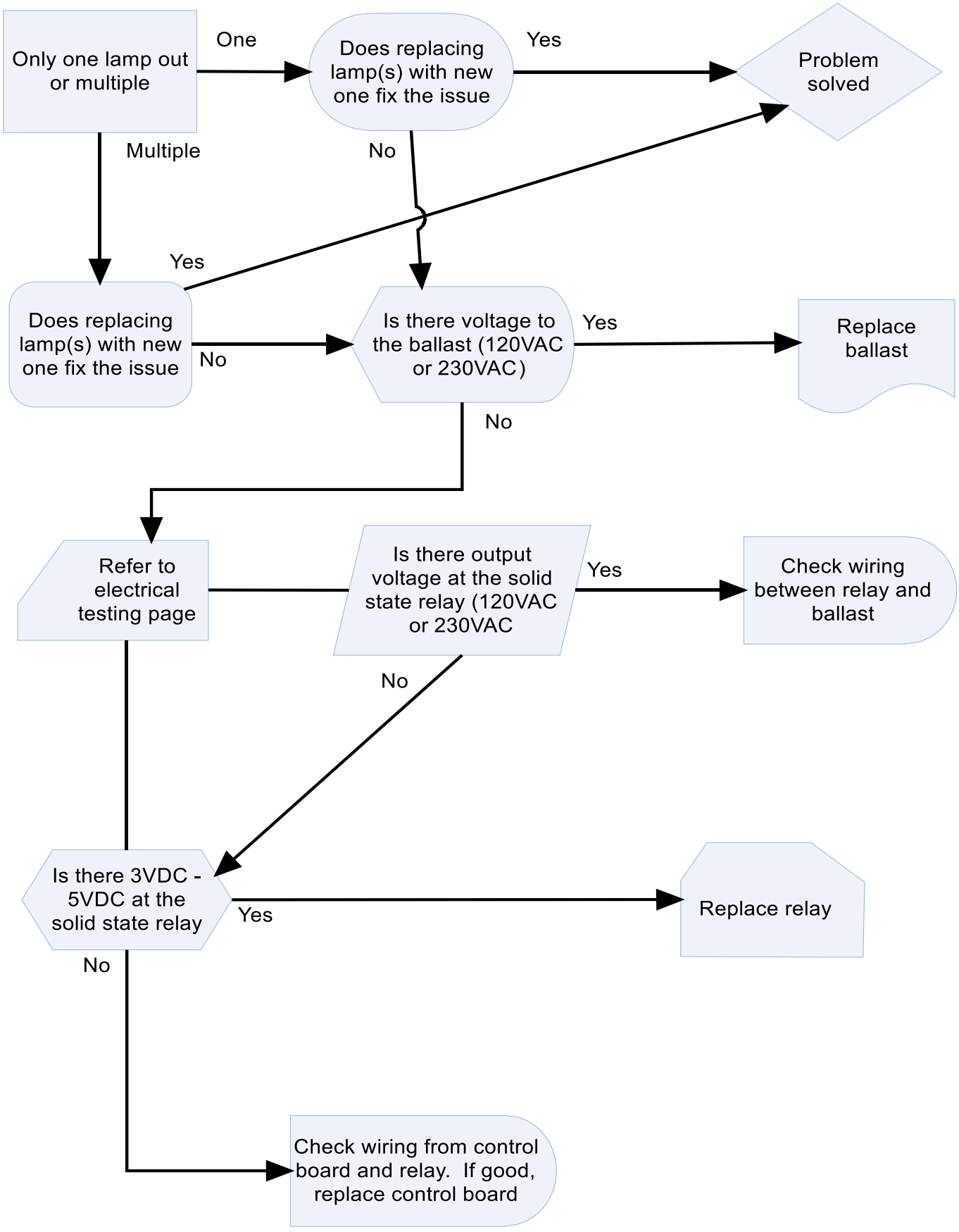
TO REMOVE LAMP PULL STRAIGHT OUT OF SOCKET (LAMP HOLDER). SOME RE-SISTANCE WILL OCCUR. ON OLD LAMPS, THE PLASTIC CAP MAY FUSE TO THE LAMP HOLDER.
TO INSTALL, PUSH STRAIGHT DOWN. YOU MAY HEAR AND FEEL IT ENGAGE.

⚠ WARNING

Failure to secure lamps will result in part failure and even fire.

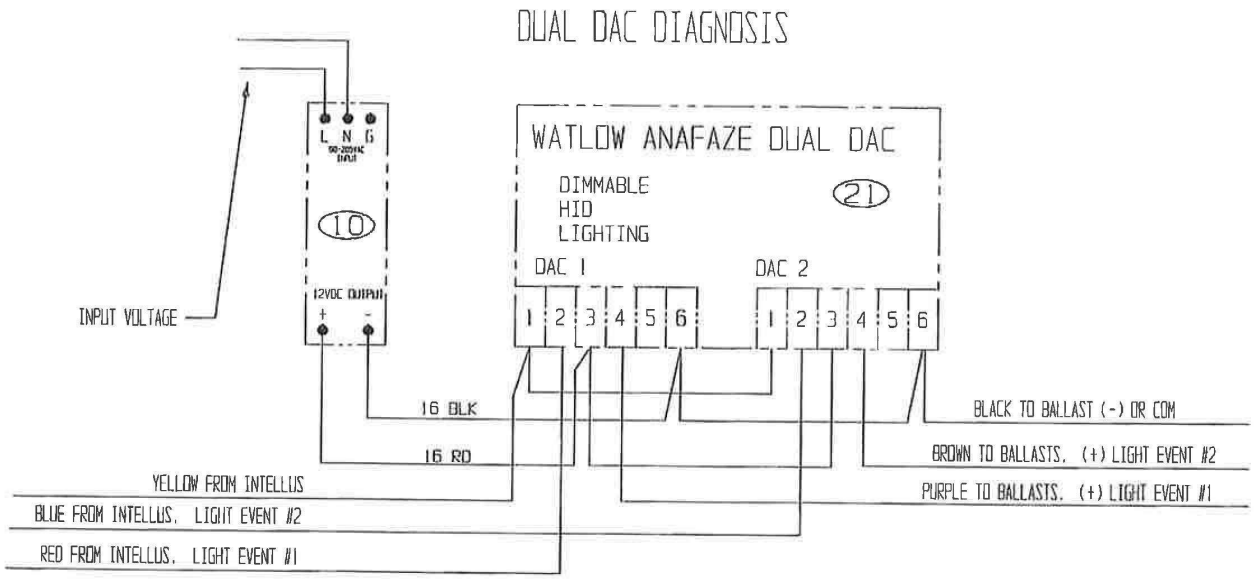


LAMP DIAGNOSIS



Dimming Control

One way for dimming control is via Dual DAC Anafaze. This converts a digital signal to analog signal to the ballasts. Below is one way to test this Anafaze.



DAC 1 VOLTAGES. LIGHT #1 AT 100%
TERMINALS 1 & 2 = 5VDC
TERMINALS 4 & 6 = 10VDC

DAC 1 VOLTAGES. LIGHT #1 AT 51%
TERMINALS 1 & 2 = 2.5VDC
TERMINALS 4 & 6 = 5VDC

DAC 2 = SAME AS DAC 1

NOTE:
2. DEPENDING ON HOW MANY LIGHT EVENTS, USE OF DAC 1, DAC 2 OR BOTH MAY BE USED.
2. IF YOU REMOVE THE CONNECTOR ALTOGETHER THE LIGHTS SHOULD GO TO FULL BRIGHT.

DAC 1 VOLTAGES. LIGHT #2 AT MAX OUTPUT
TERMINALS 1 & 2 = 5VDC
TERMINALS 4 & 6 = 10VDC

DAC VOLTAGES. LIGHT #2 AT 50% OF OUTPUT
TERMINALS 1 & 2 = 2.5VDC
TERMINALS 4 & 6 = 5VDC

DAC 2 = SAME AS DAC 1

Another way for dimming control is with an RM module. This does the same function as the Dual DAC but has more flexibility to control other components. Special programming is required for this system and is chamber specific. Contact Percival Scientific for detailed troubleshooting instructions.

Service Information - Humidity System (if applicable)

⚠ WARNING

Disconnect all unnecessary electrical power when servicing equipment.
Majority of circuits are high voltage.

Loss of humidity control (refer to humidity flowchart)

Intellus controller: Check the controller for correct voltage output to the humidification and/or dehumidification relay. If the controller fails to output the correct voltage (approximately 5VDC), repair or replace the controller.

Signal conditioner and/or sensor failure: If provided, check the voltage signal from the signal conditioner to the controller. For the humichip sensor, the voltage should be more than 0VDC but less than 1VDC. For the microprocessor RH controller, the voltage should be more than 0VDC but less than 5VDC. If it is not, the controller and/or sensor may need to be replaced.

Humidification and/or dehumidification relays: Check humidification and/or dehumidification relays for the correct output voltage.

Loss of humidity control - over dehumidifies

Dehumidification solenoid valve (if applicable): If the valve will not close, replace the solenoid or entire valve, evacuate, and recharge the refrigeration system - see refrigeration diagram and/or serial plate for type and amount of charge.

Loss of humidity control - no humidification

Insufficient water level in humidifier: Check the water in the humidifier and, if low, check for proper operation of the mechanism that fills the humidifier (float valve, solenoid valve, etc.).

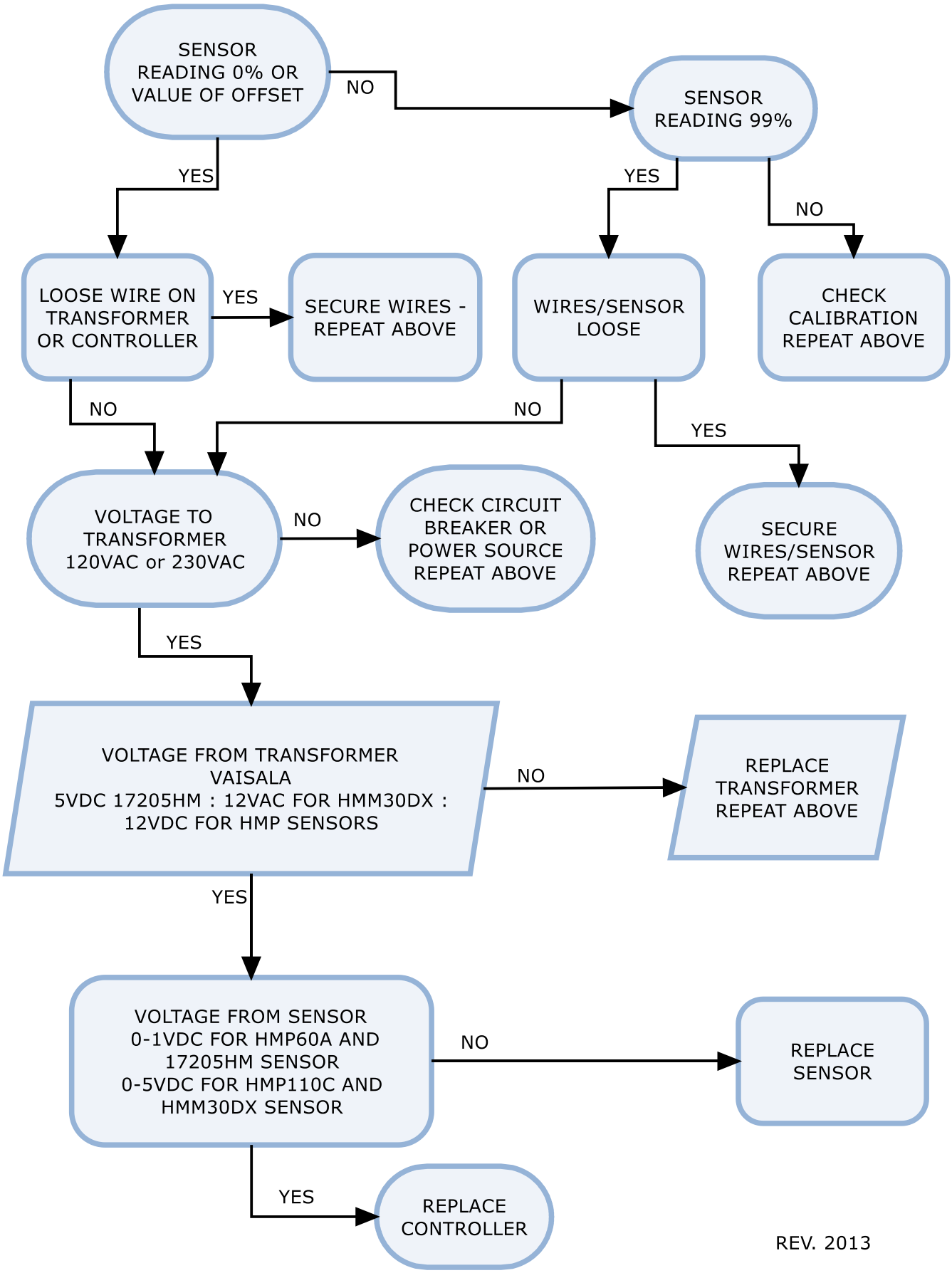
Humidification heater(s) failure: Check humidification heater(s) for proper operation.

Loss of humidity control - no dehumidification

Dehumidification solenoid valve (if applicable): If valve will not open, replace solenoid or entire valve, evacuate, and recharge the refrigeration system - see refrigeration diagram and/or serial plate for type and amount of charge.

Refrigeration system failure: Check other components of refrigeration system for proper operation.

HUMIDITY SENSOR TROUBLESHOOTING



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NOTES

Refrigeration Diagnostics:

The refrigeration system is the heart of the chamber. If it is not working properly then it can affect your studies along with increased energy cost. Along with measuring Superheat and Subcool, a lot of issues can be diagnosed by the system pressures.

The pressures listed on the next page are to be used as a guide. Many variables will affect the pressures. Keep in mind that Percival chambers maintain the temperature of the chamber by heating and cooling. Heating is done by electric heat as well as hot gas. The pressure of the hot gas has a wide range depending on several conditions. It may only indicate an issue if it goes outside of the listed range.

The number one cause of refrigeration issues is evaporator motors. That is what should be checked first. The second most common issue is the hot gas solenoid valve sticking open or closed. Just because there is no power doesn't mean the valve is closed or completely closed. A temperature difference should be taken before and after the valve. Minimum temp difference is a good indicator that the valve may be stuck open.

PRESSURE - TEMPERATURE GUIDELINES R-134a

CHAMBER TEMP (°C)	SUCTION PRESSURE - COOL (PSI)	SUCTION PRESSURE - HEAT (PSI)	DISCHARGE PRESSURE - COOL (PSI)	DISCHARGE PRESSURE - HEAT (PSI)
0	18	90*	125 - 175**	90***
5	20	90*	125 - 175**	90***
10	22	90*	125 - 175**	90***
15	24	90*	125 - 175**	90***
20	26	90*	125 - 175**	90***
25	28	90*	125 - 175**	90***
30	30	90*	125 - 175**	90***
35	32	90*	125 - 175**	90***
40	34	90*	125 - 175**	90***
PRESSURES INDICATING A POSSIBLE ISSUE	↓ 10 AND ↑ 45	↓ 25 AND ↑ 125	↓ 100 AND ↑ 200	= TO SUCTION PRESSURE

* If unit is fitted with a CPR valve, this value will not be greater than the CPR setting. Normally 35psi or 25psi

** For air cooled units. This value will depend on ambient temperatures. Higher ambient = higher pressure.

*** Discharge pressure should be greater then suction pressure during heating.

NOTE: ALL VALUES ARE APPROXIMATE. SHOULD ONLY BE AS A GUIDE.

Refrigeration

Basic Refrigeration System Troubleshooting Table

System → Problem ↓	Discharge Pressure	Suction Pressure	Superheat	Sub-cooling	Amps
Overcharge	▲	▲	▼	▲	▲
Undercharge	▼	▼	▲	▼	▼
Liquid Restriction (Drier)	▼	▼	▲	▲	▼
Insufficient Evaporator Airflow	▼	▼	▼	▲	▼
Dirty Condenser	▲	▲	▼	▼	▲
Low Outside Ambient Temperature	▼	▼	▲	▲	▼
Inefficient Compressor	▼	▲	▲	▲	▼
TXV Sensing Bulb Charge Lost	▼	▼	▲	▲	▼
TXV Sensing Bulb Loose	▲	▲	▼	▼	▲
TXV Sensing Bulb Poorly Insulated	▲	▲	▼	▼	▲

(Table, courtesy Carrier Corporation)

▲ = System pressure is high

▼ = System pressure is low

Symptom vs. Cause Troubleshooting Table

Symptom → Prob. Cause ↓	Low side (Suction) Pressure	DX Coil Superheat	High Side (Hotgas) Pressure	Condenser Liquid Sub-cooling	Cond. Unit Amperage Draw
Insufficient, or unbalanced load	▼	▼	▼	★	▼
Excessive load	▲	▲	▲	★	▲
Low ambient (cond. entering air temp)	▼	▲	▼	★	▼
High ambient (cond. entering air temp)	▲	▲	▲	★	▲
Refrigerant Undercharge	▼	▲	▼	▼	▼
Refrigerant Overcharge	▲	▼	▲	▲	▲
Liquid line restriction	▼	▲	▼	▲	▼
Plugged capillary tube	▼	▲	▲	▲	▼
Suction line restriction	▼	▲	▼	★	▼
Hot gas line restriction	▲	▲	▲	★	▲
Inefficient compressor	▲	▲	▼	▼	▼

(Table from ARI)

▲ = System pressure is high

▼ = System pressure is low

★ = System pressure is normal

Troubleshooting Chart for Evaporators

Problem Category	Symptoms	Possible Causes
Insufficient Airflow	• Low saturated suction temperature • Low suction-gas superheat • Low saturated condensing temperature • Low compressor power draw • Low supply-air temperature • Low system capacity • High chamber environment temperature • Iced over or frosted evaporator coils/fins • Compressor liquid floodback • Compressor slugging	• Dirty evaporator coil • Badly bent/damaged evaporator fins • Dirty filters • Debris or chamber components blocking evaporator intake fans • Low supply voltage to evaporator fans • Damaged or broken evaporator fans • Evaporator fans installed backwards (reversed air flow) • Air bypassing around evaporator coil(s)
Excessive Airflow	• High supply air temperature • High saturated suction temperature • High compressor power draw • System excessively noisy	• Fan motor speed control set too high • Undersized coil
Uneven Airflow Over Coil	• Low system capacity • Low saturated suction temperature • Uneven condensate coverage over coil surface • Uneven coil surface temperature • Refrigerant flood back to compressor • Compressor slugging	• Lack of necessary baffling near and around coil • Obstruction near or within air handler • Air circulation fans improperly spaced • Air circulation fans mounted too close to evaporator coils/fins
Low Refrigerant Supply	• Low system capacity • Low saturated suction temperature • High suction-gas superheat • Low compressor power draw • Low saturated condensing temperature • Measurable temperature drop in liquid line • Visible bubbles in liquid line sight glass • High supply air temperature • Frosted or iced evaporator coils/fins • High discharge-gas superheat	• System undercharged • Liquid line kinked or crushed • Evaporator tube crushed (check return bends) • System refrigerant leak • Blocked or malfunctioning metering device (TXV) • Undersized metering device • Undersized distributor nozzle • Head pressure control faulty at low outdoor ambient temperatures • Filter-drier plugged
Uneven Refrigerant Distribution to Coil Circuits	• Low system capacity • Low saturated suction temperature • Little or no suction-gas superheat • TXV hunting • Compressor floodback • Compressor slugging • Uneven coil surface temperature • Uneven condensate and/or frost formation on evaporator	• Plugged evaporator feeder tube(s) • Kinked or crushed feeder tube(s) • Partially blocked distributor • Oversized distributor and/or nozzle • Improperly installed distributor • Crushed evaporator tubing (return bends) • Plugged evaporator circuit

Troubleshooting Chart for Metering Devices

Problem Category	Symptoms	Possible Causes
Evaporator Overfeed (Flooding)	• High saturated suction temperature • Low suction-gas superheat • Liquid floodback • Compressor slugging • Compressor overheats • High compressor power draw • Compressor failure • Compressor pumps incorrectly • TXV hunts	• System overcharge (fixed metering device – cap tube) • Oversized metering device • TXV stuck open • TXV superheat setting too low • TXV type wrong for refrigerant in system • Uninsulated TXV sensing bulb in warm area • Loose TXV sensing bulb • Incorrectly located TXV sensing bulb • Partial load too low for metering device • Excess oil circulating in system • High head pressure (fixed metering device – cap tube)
Evaporator Underfeed (Starvation)	• Low system capacity • Low saturated suction temperature • High suction-gas superheat • Low compressor power draw • Low saturated condensing temperature • High discharge-gas superheat • High supply-air temperature • Iced or Frosted evaporator	• System undercharged • Undersized metering device • Plugged metering device • Plugged distributor or nozzle • Undersized distributor or nozzle • Kinked or crushed capillary tube • TXV stuck in open position • Wrong TXV for refrigerant in system • Plugged or crushed TXV external equalizing line • TXV superheat setting too high • Incorrect TXV sensing bulb location • Low head pressure (fixed metering device – cap tube) • Faulty head pressure control device
TXV Hunting	• Saturated suction temperature oscillates high then low in a cyclical fashion • Suction gas superheat oscillates high and low in a cyclical fashion • Compressor power draw oscillates high and low in a cyclical fashion • Intermittent floodback and compressor slugging • Unstable supply air temperature • Unstable evaporator surface temperature	• Oversized TXV • Improper part-load control operation loads TXV too lightly • Very light cooling load • Rapid cooling load changes • Rapidly changing high-side pressure • Intermittent flashing in liquid line
Distributor Nozzle(s)	• Evaporator underfeed (see symptoms above)	• Undersized distributor nozzle
	• Evaporator unevenly fed by refrigerant (see symptoms on evaporator sheet)	• Oversized nozzle • Nozzle not sized for low load stability

Troubleshooting Chart for Condensers

Problem Category	Symptoms	Possible Causes
High Head Pressure (Saturated condensing or discharge temperature)	• Compressor cycles off intermittently on high-pressure switch while system calls for cooling • Compressor cycles off intermittently on compressor motor protection switch • High saturated condensing temperature • High discharge-gas superheat • Compressor overheats • Compressor seizure • Compressor motor burnout • High compressor power draw • Low system capacity • Saturated suction temperature normal to high • Excessive condenser water flow rate	• Faulty head pressure control device • Dirty condenser coil • Faulty condenser fan motor • Extensive fin damage • Condenser air recirculation • Dirty condenser fan • Condenser air flow blocked • Prevailing winds prohibit proper air flow across coil • Backward condenser fan rotation • Bent or broken condenser fan blades • Scaled water-cooled condenser tubes • Faulty condenser water pump • Plugged condenser water lines or filters/screens • Condenser water value stuck closed • Condenser water supply problems creating insufficient or no water flow • Condenser water supply temperature is too high • Condenser cooling water supply lines undersized • System overcharged with refrigerant • Non-condensable gasses present
Refrigerant Charge Incorrect	• High head pressure • High liquid sub-cooling • Low system capacity • High saturated suction temperature	• System overcharged
	• Low head pressure • Low saturated suction temperature • Low system capacity • Low or non-existent liquid sub-cooling • Flash gas at metering device	• System undercharged
Low Head Pressure	• Low saturated condensing temperature • Low system capacity • Low saturated suction temperature • Low compressor power draw	• Faulty head-pressure control device • Refrigerant system leak • Undercharged system • Condenser water valve stuck open

Troubleshooting Chart for Refrigeration System Accessories

Problem Category	Symptoms	Possible Causes
Plugged Liquid Line Filter-Drier	• Starved evaporator symptoms (see evaporator chart) • Compressor cycles on low pressure switch	• Dirty refrigeration system • Improper evacuation/dehydration • Debris in system from installation
Wet Filter-Drier	• Moisture indicator inside sight glass shows moisture in system • Valves stick intermittently and system cycles off from internal ice blockage • Sealed-tube test of refrigerant shows moisture	• System refrigerant leak • Improper evacuation/dehydration • Leaking water-cooled condenser tubes • Filter-drier exposed to air before installation
Undersized Filter-Drier	• Low system capacity • Low compressor power draw • Low saturated suction temperature • Low saturated condensing temperature • High discharge-gas superheat • Flash gas in liquid line sight glass • High liquid refrigerant sub-cooling	• Improperly sized filter-drier during design • Improperly sized filter-drier installed after service work
Crankcase Heater Inoperative	• Flooded start • High compressor power draw • Noisy compressor operation • Excessive compressor vibration • Overheating of compressor • Violent oil foaming (visible in compressor sight glass)	• Not turned on • Heater element broken • Control circuit problem • Electrical connections loose or damaged • Circuit breaker in safe state (tripped)
Oil Separator Trapping Oil	• Oil level low on compressor sight glass • High compressor power draw • Compressor very noisy • Compressor overheating • Compressor failure	• Sludge blocking oil separator float valve orifice • Oil separator float assembly faulty
Oil Separator Float Valve Stuck Open	• High saturated suction temperature • High saturated condensing temperature • High compressor amperage draw • Flooded start	• Debris at oil separator orifice keeps float valve from seating properly • Faulty float assembly • Liquid refrigerant migrates through separator at compressor oil sump at shutdown

Service Record

A permanent data sheet should be prepared on each refrigeration system at an installation, with a copy for the owner and the original for the installing contractor's files. If another firm is to handle service and maintenance, additional copies should be prepared as necessary.

System Reference Data

The following information should be filled out and signed by Refrigeration Installation Contractor at time of start-up.

Date System Installed: _____

Installer and Address: _____

_____

_____

Condensing Unit Unit Model#: _____

Unit Serial #: _____

Compressor Model #: _____ Compressor Model #: _____

Compressor Serial #: _____ Compressor Serial #: _____

Electrical _____ Volts _____ Phase _____

Voltage at Compressor L1_____ L2 _____ L3 _____

Amperage at Compressor L1_____ L2 _____ L3 _____

Evaporator(s) Quantity _____

Evaporator Model #: _____ Evaporator Model #: _____

Evaporator Serial #: _____ Evaporator Serial #: _____

Electrical _____ Volts _____ Phase _____

Expansion Valve Manufacturer/Model _____ _____

Ambient at Start-Up _____°F

Design Box Temperature _____°F _____°F

Operating Box Temperature _____°F _____°F

Thermostat Setting _____°F _____°F

Defrost Setting _____ / day _____ minutes fail-safe _____/day _____minutes fail-safe

Compressor Discharge Pressure _____PSIG _____PSIG

Compressor Suction Pressure _____PSIG _____PSIG

Suction Line Temperature @ Comp. _____°F _____°F

Discharge Line Temperature @ Comp. _____°F _____°F

Superheat at Compressor _____°F _____°F

Suction Line Temperature @ Evaporator _____°F _____°F

Superheat at Evaporator _____°F _____°F

Evacuation: # times _____ Final Micron_____ # Times _____ Final Micron_____

Evaporator Drain Line Trapped Outside of Box: yes ☐ no ☐

Calibration Offsets

⚠ CAUTION

Calibration offsets are <u>not</u> normally altered. Calibration offsets should only be changed when the temperature, humidity or auxiliary values displayed on the controller do not agree with your measurement device.

The chamber is calibrated at our factory at a temperature of 25°C with all lights on and all lights off. If the current temperature, humidity level or auxiliary level displayed disagrees with your measurement device(s) adjust the calibration offsets. Multiple day and night offsets are available for temperature. Single day and night offsets are available for temperature, temperature limit 2, humidity (if ordered) and auxiliary (if ordered). The Day Offset will be used when any light output is on. The Night Offset will be used when all light outputs are off. The value entered for each offset is added to the input value as required and the new value is displayed and used for control. For example, if you have placed a thermometer in the chamber at the location of your experiment and it reads 26.3°C and the IntellusUltra controller reads 26.0°C then you'd enter a calibration offset of 0.3°C. Calibration offsets cannot be set while programming.

<u>It may be necessary to recalibrate the Day offset if only using some of the light events or light values other than 100%. I suggest keeping a log of Day offsets at different light events or levels as there is only one Day offset.</u>

If the chamber needs to be calibrated to a different standard measurement device use the following steps as a guide:

1. Turn all lights off in the chamber
2. Position the new standard measurement device in the area of the chamber of most interest/importance to the experiment
3. Set the chamber to 'Manual' mode, and set the manual set points to the desired calibration value(s).
4. Let the chamber run for approximately 20-30 minutes to allow the system to stabilize
5. Compare the IntellusUltra process value to the value output from the standard, and enter the **difference** between the two into the night calibration offset menu. For example: If the IntellusUltra controller is reading 30°C and the standard thermometer reads 28°C, then enter -2.0°C into the night temperature offset menu. This will offset the IntellusUltra temperature readout so that it agrees with the standard. Entering -2.0°C will change the readout from the IntellusUltra display to 28°C from the previous 30°C. Refer to the information below for information on setting the temperature offsets.

6. At this point the IntellusUltra controller is re-calibrated to the new standard for night mode (all lights off). Repeat steps 1 through 5, running the chamber in day mode (all lights on), and enter the calibration offset into the day calibration offset.

To adjust the temperature offsets using a single day/night offset use the following steps:

1. Press and hold both the **ENTER** and **INPUTS** keys for approximately 3 seconds until the display changes to read 'Select Offset'. **Note:** Always press and hold the **ENTER** key before pressing and holding the **INPUTS** key.
2. Press the **ENTER** key to enter the 'TEMP' offset menu.
3. If the Multiple Offsets value is set to 'No', press the ▼ key. If the Multiple Offsets value is set to 'Yes', press the **ENTER** key and use the ▼ and ▲ keys as necessary to select 'No' and then press **ENTER**. Next, press the ▼ key.
4. Press the **ENTER** key and use the ▼ and ▲ keys as necessary to change the 'Day Temp Offset' and then press **ENTER**.
5. Press the ▼ key to select 'Night Temp Offset' and then press **ENTER**.
6. Use the ▼ and ▲ keys as necessary to change the night offset and then press **ENTER**.
7. Press the **INPUTS** key to return to the main display.

The limit 2 sensor is typically configured as an independent sensor which is used as a backup to the limit 1 sensor. This sensor measures the temperature in the chamber and the user can set alarm limits which will trigger a limit alarm (see Alarms section) if the temperature exceeds the bounds set. The limit 2 sensor should be calibrated to match the main temperature reading. An exception to this is when a dew chamber has been ordered. The dew chamber uses the limit 2 sensor to measure the chamber air temperature and the main temperature sensor measures the wall temperature. **Do not use the following procedure to calibrate limit 2 on a dew chamber.**

The limit 2 sensor should be calibrated to match the main temperature reading when lights are both on (day mode) and off (night mode). All of the lights should be turned on in order to determine the day offset that should be applied. The main temperature reading is displayed in tenths. The limit 2 reading is displayed in whole numbers. To compare the main temperature reading to the limit 2 reading first note the temperature displayed on the main display. For example, the main temperature is 24.3C in the sample display below.

3:30PM	24.3C	75%RH
LT:110		800PPM

To view the current limit 2 reading, press the ▲ key once from the main display.

Limit 2	26C	

Limit 2 Reading

In the example above the limit 2 reading is 1.7C higher than the main temperature reading. To adjust the limit 2 reading always round up the main reading to the nearest whole number and subtract that number from the limit 2 reading. In the example, you'd round 24.3C to 25C and then subtract that from 26C. Hence, you'd use an offset of -1C for limit 2.

If the main temperature reading is a negative number, round up to the next negative whole number. For example, if the main reading was -2.1C round that number to -3C and use this value as reference for determining the limit 2 offset.

To adjust the limit 2 offsets use the following steps:

1. Press and hold both the **ENTER** and **INPUTS** keys for approximately 3 seconds until the display changes to read 'Select Offset'. **Note:** Always press and hold the **ENTER** key before pressing and holding the **INPUTS** key.
2. Press the **ENTER** key to enter the 'TEMP' offset menu.
3. Repeatedly press and release the ▼ key until 'Limit 2 Day Offset' is displayed.
4. Press the **ENTER** key and use the ▼ and ▲ keys as necessary to change the 'Limit 2 Day Offset' value and then press **ENTER**.
5. Press the ▼ key to select 'Limit 2 Night Offset' and then press **ENTER**.
6. Use the ▼ and ▲ keys as necessary to change the night offset and then press **ENTER**.
7. Press the **INPUTS** key to return to the main display.

To adjust the humidity offsets use the following steps:

1. Press and hold both the **ENTER** and **INPUTS** keys for approximately 3 seconds until the display changes to read 'Select Offset'. **Note:** Always press and hold the **ENTER** key before pressing and holding the **INPUTS** key.
2. Use the ▼ and ▲ keys as necessary to select 'RH' and then press **ENTER** to enter the humidity offset menu.
3. Press the **ENTER** key and use the ▼ and ▲ keys as necessary to change the 'RH Offset Day' value and then press **ENTER**.

4. Press the ▼ key to select ‘RH Offset Night’ and then press **ENTER**.
5. Use the ▼ and ▲ keys as necessary to change the offset and then press **ENTER**.
6. Press the **INPUTS** key to return to the main display.

To adjust the auxiliary offsets (CO_2 or closed loop dimmable lighting – LS1) use the following steps:

1. Press and hold both the **ENTER** and **INPUTS** keys for approximately 3 seconds until the display changes to read ‘Select Offset’. **Note:** Always press and hold the **ENTER** key before pressing and holding the **INPUTS** key.
2. Use the ▼ and ▲ keys as necessary to select ‘CO2’ or ‘LS1’ and then press **ENTER** to enter the auxiliary offset menu.
3. Press the **ENTER** key and use the ▼ and ▲ keys as necessary to change the ‘CO2 Offset Day’ or ‘LS1 Offset Day’ value and then press **ENTER**.
4. Press the ▼ key to select ‘CO2 Offset Night’ or ‘LS1 Offset Night’ and then press **ENTER**.
5. Use the ▼ and ▲ keys as necessary to change the offset and then press **ENTER**.
6. Press the **INPUTS** key to return to the main display.

Service Information - Temperature System

⚠ WARNING

Disconnect all unnecessary electrical power when servicing equipment.
Majority of circuits are high voltage.

Loss of temperature control - overheating or overcooling

Intellus controller: Check the controller for the correct voltage output to the heating and/or cooling relay. The voltage should be approximately 5VDC. If the controller fails to output the correct voltage, repair or replace the controller.

Temperature sensor: Check the sensor for the correct resistance and replace if necessary. The correct resistance is 100 ohms at 0°C.

Heating and/or cooling relays (as applicable): Check existing heating and/or cooling relays for correct output voltage.

Hot gas solenoid valve (if applicable): When in the heating mode, the hot gas solenoid valve should be open and in the cooling mode the valve should be closed. If the valve is not functioning, replace solenoid or entire valve, evacuate, and recharge the refrigeration system - see Refrigeration Diagram and/or serial plate for type and amount of charge.

Liquid line solenoid valve (if applicable): When in the heating mode, the liquid line solenoid valve should be closed and in the cooling mode the valve should be open. If the valve is not functioning, replace solenoid or entire valve, evacuate, and recharge refrigeration system - see Refrigeration Diagram and/or serial plate for type and amount of charge.

Loss of temperature control - overheating (refer to flowchart #1)

Loss of refrigerant: Check for loss of refrigerant. If leaks are found, correct, evacuate and recharge the refrigeration system - see Refrigeration Diagram and/or serial plate for refrigerant type and amount.

Restricted expansion device or restricted drier: If adequate refrigerant exists in the system and if suction pressures are acceptable, the expansion device (capillary tube or expansion valve) inlet and/or the drier could possibly be restricted. To check the drier, gauge the outlet temperature with the inlet temperature. If the outlet is as warm as the inlet temperature, the drier is operating properly - if colder than the inlet, the drier is restricted.

Condenser & condenser fan: Check the condenser and fan. If dirty, clean condenser and fan. Replace motor and fan if necessary. Check condenser air inlet temperature near center from approximately one inch away. If above 90°F, provide cooler air (by means of a circulation fan, air conditioner, etc.). If water-cooled, check the head pressure and rate of flow. If necessary, adjust the rate of flow, clean condenser, or replace condenser.

Compressor: If the compressor fails to operate, check the power source, overload protector, start relay (if provided), and windings. Replace as required.

Air circulating fans: If the chamber is overheating, check the air circulating fans. Clean as necessary. If the fans are not operating properly, replace either the motor or the entire assembly (fan, motor, and blade).

Evaporator: Check evaporator airflow openings by observing the amount of light passing through the fin spaces. Clean as required.

Loss of temperature control - overcooling (refer to flowchart #2)

Heating heater: Check the heating heater located inside the chamber for proper function.

Reheat heater (if applicable): If the chamber overcools when in the dehumidification mode, check the reheat heater for proper function.

General temperature system problems

Temperature indicator reads incorrect temperature: If the temperature inside the chamber disagrees with the indicator, adjust the calibration offset.

CHAMBER OVERHEATING

If the chamber has 2 power cords, check if both are plugged in and power is provided to both cords. Each cord should have its own dedicated receptacle (one cord per duplex outlet). The cooling unit has a dedicated power cord and all other functions are provided by the other one (lights, fans, controller). A building breaker may have been tripped for the compressor receptacle. Have facility maintenance reset breaker and test function of chamber. If building breaker trips again, have maintenance person check amperage draw of compressor. There may be an issue with the building electrical or with the chamber cooling unit.

Chamber circuit breakers: Newer models are built with circuit breakers inside the control box. There is one GFCI circuit breaker and a number of individual breakers for components (lights, heaters, condensing unit etc.). They are normally mounted inside the control box behind the main controller. All circuit breakers should be facing the same way. Reset if necessary and check for proper operation.

Intellus controller: Check the temperature set point. While the controller display reads "Temp Safety Alarm"; press up arrow until it reads "STPTS". This tells you the temp set point. Press up arrow again and it will give you the actual temp inside the chamber. If the actual temp reads very high from the set point, there may be an issue with the temperature sensor or extremely large temp offset (normally no more than +/- 3°C). See manual to access temp offset menu. If equipped with Watlow Aux Temp Safety controller, make sure the safeties are set as the Intellus controller. Adjust if necessary. Note: This will display an alarm message but not an audible one.

Check the safety high alarm setting: Press the "Temp Alarm" key. The display will read "Manual Temp Set Pt". Press the down arrow and it will display the High safety alarm set point. If this is close to the set point, it may need to be adjusted. We recommend at least 3° above/ below set point. Some chambers tend to overshoot when heating so this set point may need to be adjusted higher. Also, someone may have inadvertently changed this setting. If other than the Intellus controller, consult owner's manual for temp alarm settings.

If the above checks out, here are some other items to check. During a temperature alarm, everything inside the chamber (lights, fans, and compressor) will turn off except the controller to prevent further overheating. In order to check some of the following, the chamber needs to be running. Open the door to allow the inside of the chamber to cool down. Your chamber will turn on automatically once the temperature gets below the safety set point. Another way would be to adjust the high safety set point higher than actual temp. Again, the chamber will turn on automatically.

1. Evaporator fans: These are the circulating fans inside the chamber. Are they all working? Is there something obstructing the air flow (dust, debris)? Clean if dirty.
2. A minimum of 6" is allowed for the right hand side of the chamber to allow air flow through the top mechanical compartment (condenser). Also, make sure there is nothing on top of the chamber preventing proper air flow (top panel of chamber). This panel is perforated to allow air flow out of the mechanical compartment.

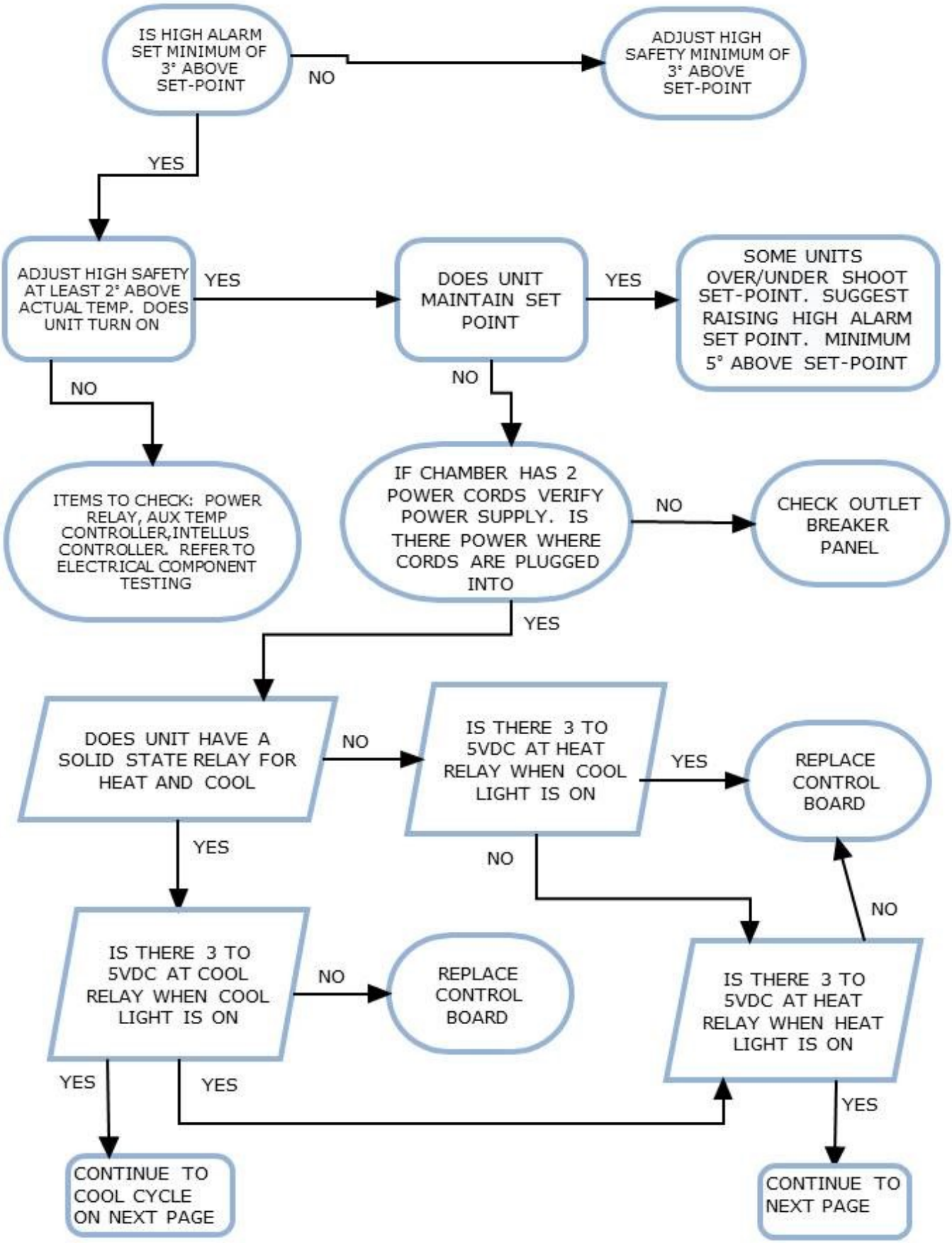
3. Condenser dirty? This is usually located in the top mechanical compartment on the right hand side. There is a perforated screen on top right hand side; look inside and you will see a black finned coil. Is it dirty? This needs to be clean to allow air flow through the condenser. Clean if necessary.

4. Condenser fan motor working or dirty? This is located just behind the condenser coil to draw air through it. Clean if necessary or if it is not working, it needs to be replaced.

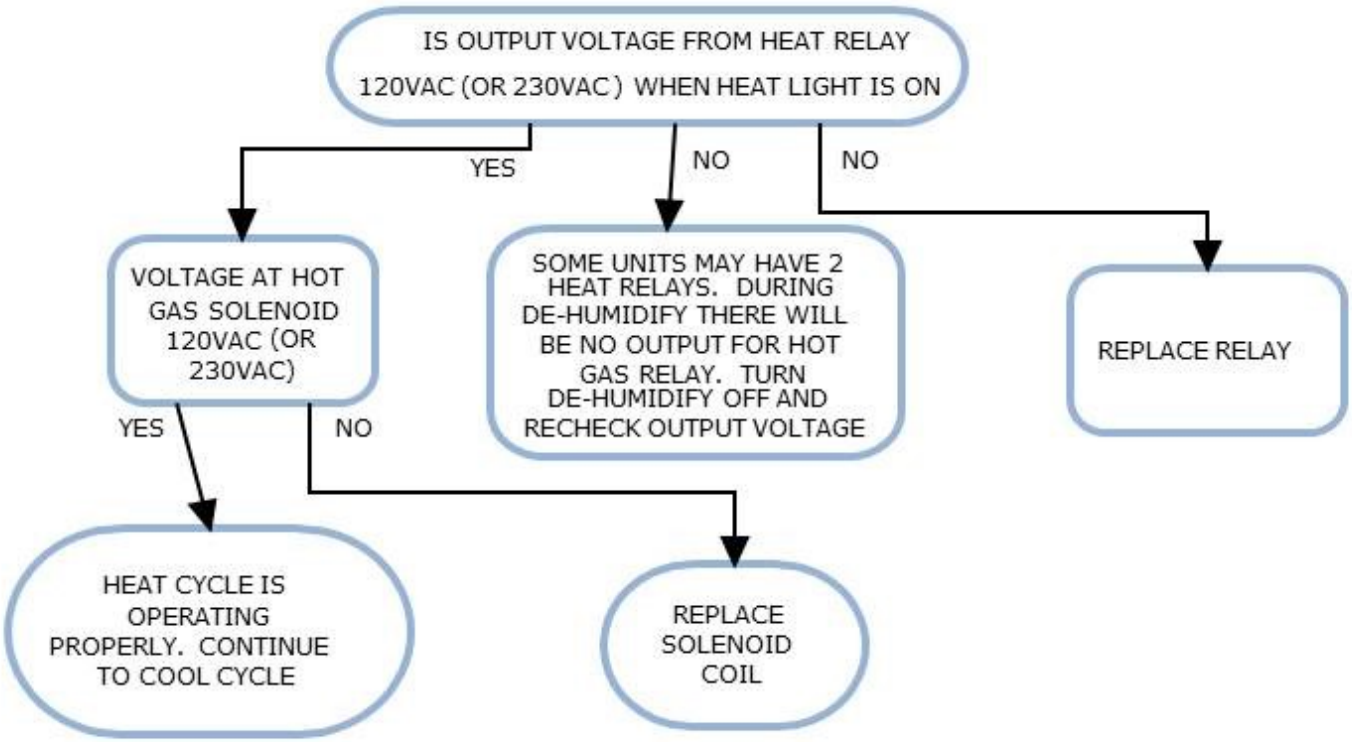
5. Is the compressor running? Even though the condenser fan is working, this does not mean the compressor is. Carefully touch the top of the compressor (large black cylinder). CAUTION: Compressor may be very hot. If it is working, you will feel it vibrating and also hear it a bit (humming noise).

If the above items check out ok, then a qualified service company needs to take a look. There are some items they can check but require specialized knowledge and tools.

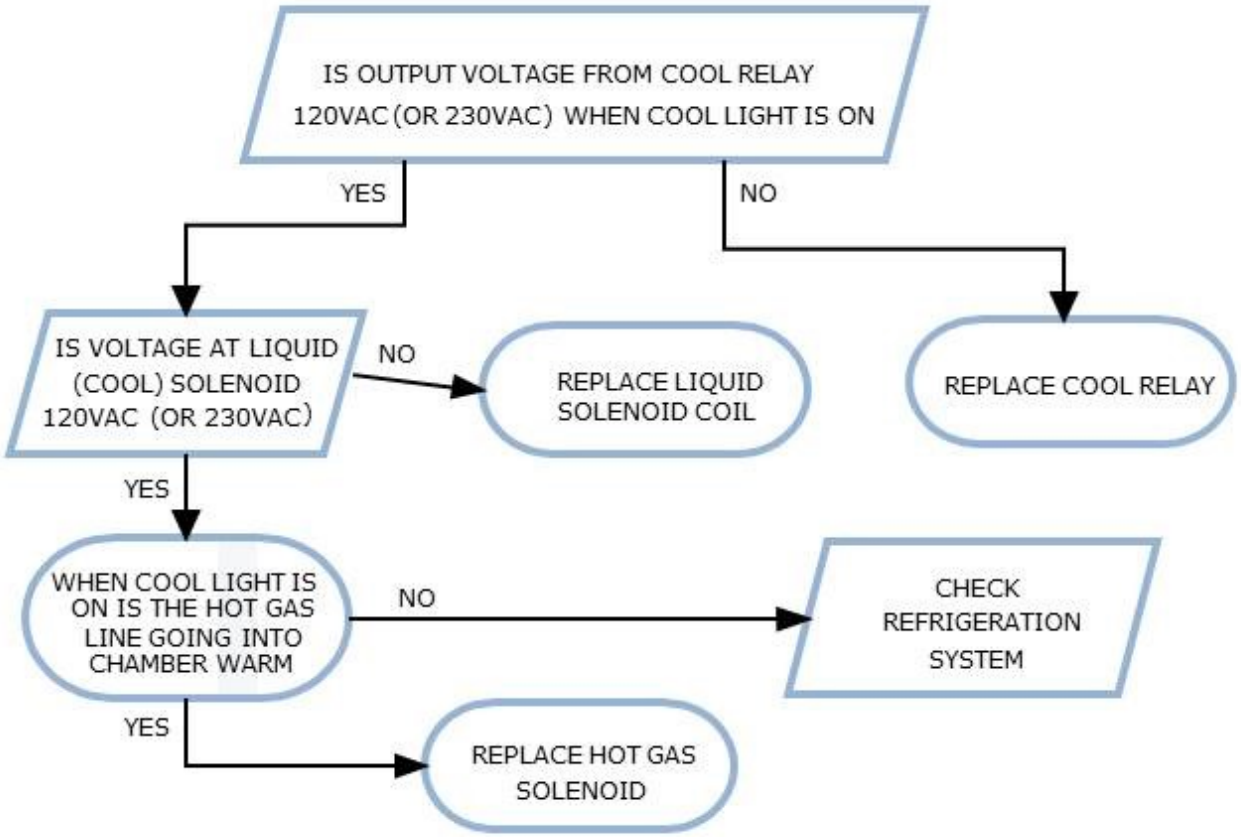
CHAMBER OVERHEATING #1



CHAMBER OVERHEATING #2
HEAT CYCLE



COOL CYCLE



Preventive Maintenance

Unit Coolers

At every six month interval, or sooner if local conditions cause clogging or fouling of air passages through the finned surface, the following items should be checked.

1) Visually inspect unit
   Look for signs of corrosion on fins, cabinet, copper tubing and solder joints.

   Look for excessive or unusual vibration for fan blades or sheet metal panels when in operation. Identify fan causing vibration and check motor and blade carefully.

   Look for oil stains on headers, return bends, and coil fins. Check any suspect areas with an electronic leak detector.

   Check drain pan to insure that drain is clear of debris, obstructions or ice buildup and is free draining.

2) Clean Evaporator coil and blades
   Periodic cleaning can be accomplished by using a brush, pressurized water or a commercially available Evaporator Coil Cleaner or mild detergent. Never use an acid based cleaner.
   Follow label directions for appropriate use. Be sure the product you use is approved for use in your particular application.

   Flush and rinse coil until no residue remains.

   Pay close attention to drain pan, drain line and trap.

3) Check the operation of all fans and ensure airflow is unobstructed

   Check that each fan rotates freely and quietly. Replace any fan motor that does not rotate smoothly or makes an unusual noise.

   Check all fan set screws and tighten if needed.

   Check all fan blades for signs of stress or wear. Replace any blades that are worn, cracked or bent.

   Verify that all fan motors are securely fastened to the motor rail.

   Lubricate motors if applicable.

4) Inspect electrical wiring and components
   Visually inspect all wiring for wear, kinks, bear areas and discoloration. Replace any wiring found to be damaged.

   Verify that all electrical and ground connections are secure, tighten if necessary.

   Check operation/calibration of all fan cycle and defrost controls when used.

   Look for abnormal accumulation of ice patterns and adjust defrost cycles accordingly

   Visually inspect heaters to ensure even surface contact with the coil. If heaters have creeped decrease defrost termination temperature and be sure you have even coil frost patterns.

5) Refrigeration Cycle

   Visually inspect coil for even distribution

   Check condition of compressor and heater contactors. Look for discoloration and pitting. Replace as required

   Clean electrical cabinet. Look for signs of moisture, dirt, debris, insects and wildlife. Take corrective action as required.

Air Cooled Condensing Units

Quarterly

1) Visually inspect unit
   - Look for signs of oil stains on interconnection piping and condenser coil. Pay close attention to areas around solder joints, building penetrations and pipe clamps.

     Check any suspect areas with an electronic leak detector.

     Repair any leaks found and add refrigerant as needed.

   - Check condition of moisture indicator/sightglass in the sight glass if so equipped. Replace liquid line drier if there is indication of slight presence of moisture. Replace refrigerant, oil and drier if moisture concentration is indicated to be high.

   - Check moisture indicator/sightglass for flash gas. If found check entire system for refrigerant leaks and add refrigerant as needed after repairing any leaks.

   - Check compressor sightglass (if equipped) for proper oil level.

   Check condition of condenser. Look for accumulation of dirt and debris (clean as required).

   Check for unusual noise or vibration. Take corrective action as required.

   Inspect wiring for signs of wear or discoloration and repair if needed.

   Check and tighten all flare connections.

Semi-Annually

Repeat all quarterly inspection items.

Clean condenser coil and blades

   Periodic cleaning can be accomplished by using a brush, vacuum, pressurized air or a commercially available foam coil cleaner. If foam cleaner is used, it should not be an acid based cleaner. Follow label directions for appropriate use.

   Rinse until no residue remains.

4) Check operation of condenser fans
   Check that each fan rotates freely and quietly. Replace any fan motor that does not rotate smoothly or makes excessive noise.

   Check all fan blade set screws and tighten- as required.

   Check all fan blades for signs of cracks, wear or stress. Verify that all motors are mounted securely.

   Lubricate motors if applicable. Do not lubricate permanently sealed, ball bearing motors.

5) Inspect electrical wiring and components
   - Verify that all electrical and ground connections are secure, tighten as required.

Air Cooled Condensing Units - continued

6) Check refrigeration cycle
   • Check suction, discharge and net oil pressure readings. If abnormal take appropriate action.

Check pressure drop across all filters and driers. Replace as required.

Verify that superheat at the compressor conforms to specification. (target of 20°F)

Check pressure and safety control settings and verify proper operation.

Air Cooled Condensers and Fluid Coolers

At every six month interval, or sooner if local conditions cause clogging or fouling of air passages through the finned surface, the following items should be checked.

1) Visually inspect unit
   • Look for signs of corrosion on fins, cabinet, copper tubing and solder joints.

Look for excessive or unusual vibration for fan blades or sheet metal panels when in operation. Identify fan cell(s) causing vibration and check motor and blade carefully.
Look for oil stains on headers, return bends, and coil fins. Check any suspect areas with an electronic leak detector.

2) Clear unnecessary trash and debris away from condenser.

3) Check the operation of all fans
Check that each fan rotates freely and quietly. Replace any fan motor that does not rotate smoothly or makes an unusual noise.

Check all fan set screws and tighten if needed.

Check all fan blades for signs of stress or wear. Replace any blades that are worn, cracked or bent. -

Verify that all fan motors are securely fastened to the motor rail.

Lubricate motors if applicable (most Heatcraft condenser motors are permanently sealed ball bearing type and do not require lubrication)

4) Inspect electrical wiring and components
Visually inspect all wiring for wear, kinks, bare areas and discoloration. Replace any wiring found to be damaged.

Verify that all electrical and ground connections are secure, tighten if necessary.

Check operation/calibration of all fan cycle controls when used.

Replacement Parts

Whenever possible, replacement parts are to be obtained from a local wholesaler authorized to sell one of Heatcraft Refrigeration Products' brands.

CLEANING YOUR PERCIVAL CHAMBER

There are a few key items on your chamber that should be cleaned on a regular basis to ensure proper operation and reduce failures. Recommended maintenance schedule: Every 6 months.

These items are:

1. Chamber interior
2. Evaporator
3. Humidifier (if applicable)
4. Condensate drain line
5. Air cooled condenser
6. Sterilization

Approved cleaners are:

a. Liquid soap detergent and warm water
b. Lysol
c. Pine sol
d. Pine oil or other terpene based cleaners
e. Bleach/water solution 10% bleach
f. Isopropyl alcohol

⚠ WARNING

Never use pressurized water to clean unit. Injury or electrical damage may occur.

CHAMBER INTERIOR

To clean the chamber's interior and exterior, use soap (or mild liquid detergent) and water. Do not use abrasive type cleaners because these will scratch the surface or harsh chemicals or acid based cleaners. Care must be taken because some parts may be sharp.

EVAPORATOR (UNIT COOLER)

It is recommended that the evaporator and fan blades be inspected for the accumulation of dirt. To access the evaporator and blades, carefully remove the unit cooler cover by the mounting screws (normally 2 on each side). Accumulation of dirt around the evaporator fin openings will indicate the need for cleaning the blades and evaporator. Clean the evaporator by brushing, vacuuming and/or by using compressed air. The unit cooler drain line and existing humidifier reservoirs should be checked and cleaned, if necessary, at this time with a solution of vinegar and water. Refer to figures 1 and 2 for removal and cleaning.
Remove the (4) mounting screws on the unit cooler fan cover. Depending on the model it can be removed and taken out for cleaning. Some units it is recommended that the cover just be lowered to inspect evaporator and remove any dirt/debris. Remember metal edges may be sharp.

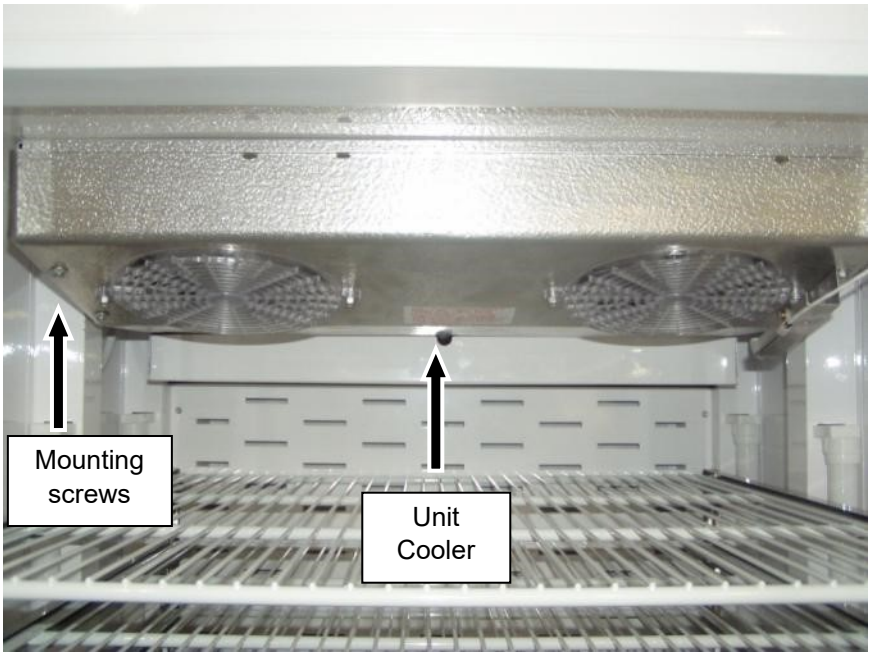


Figure 1

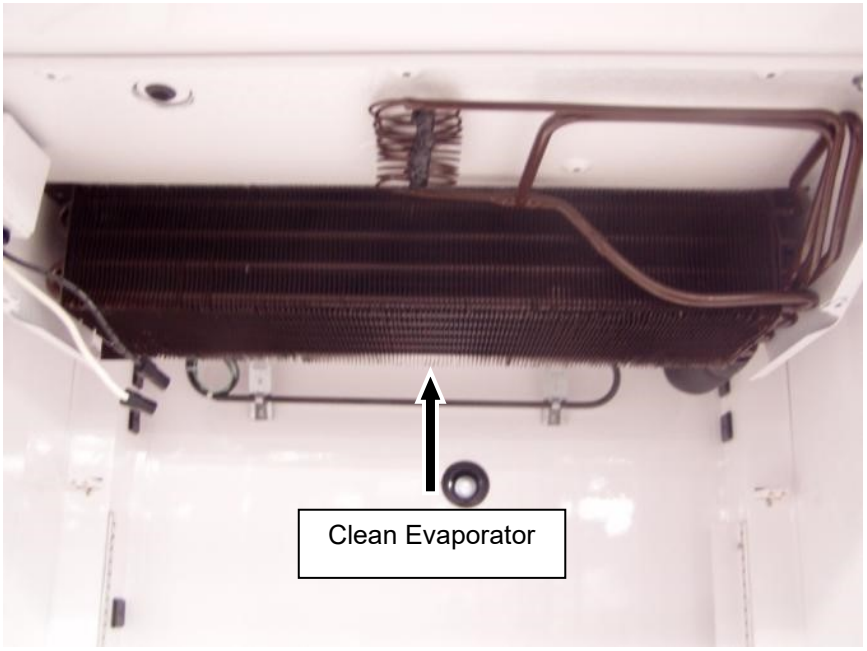


Figure 2

HUMIDIFIER

If provided with a humidifier pan that is located inside the chamber it is recommended that the pan be removed and cleaned. Refer to figure 3. Prior to cleaning the pan, shut off the water supply to the humidifier by closing the water supply hand valve. Remove the power plug for the humidifier from its receptacle. Next, disconnect the humidifier from the water supply line**.** Remove and clean the pan with a mixture of vinegar and water. Baking soda may also be added to the mixture if necessary. When finished, reinstall the components in the reverse order.

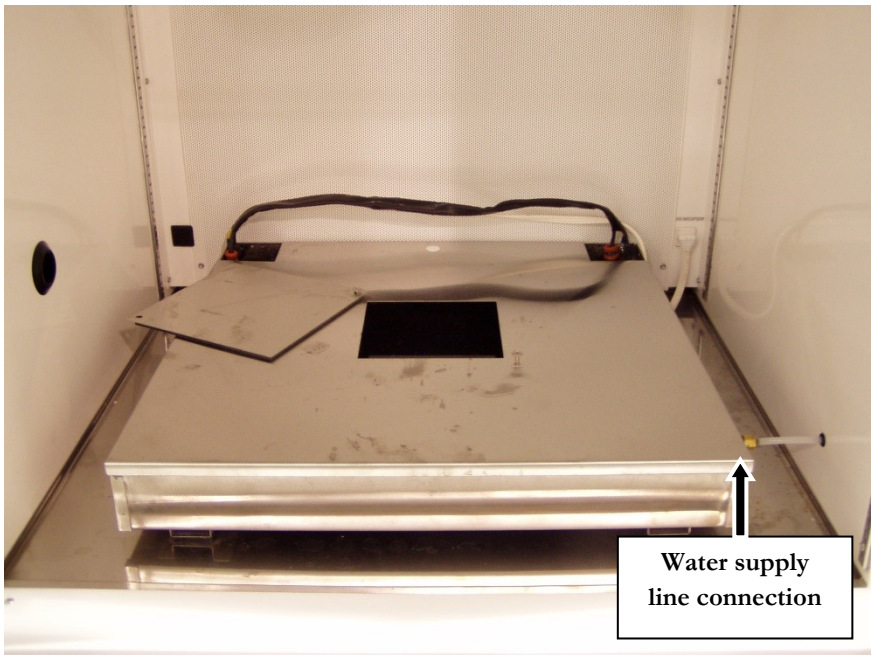


Figure 3

If provided with a humidifier pan that is mounted behind the unit cooler as seen in figure 4 it is recommended that the pan be removed and cleaned. Prior to cleaning the pan, shut off the water supply to the humidifier by closing the water supply hand valve located on the outside right-hand or rear wall of the chamber. Remove the upper light fixture and shelf. Place a bucket under the drain tubing located in the pan front. Open the drain and allow all water to drain from the pan. On CU-36 models it may be necessary to remove more than one fixture and shelf in order to fit a bucket under the drain tube. Remove the top rear false wall cover by removing the screws that secure the cover to the receptacle panels. Next, unplug the humidifier heater and float switch power cords from their receptacles. Remove the humidifier pan by unscrewing the pan from the rear receptacle panels and ceiling. Remove the humidifier heater and float switch from the pan. Clean the pan with a mixture of vinegar and water. Baking soda may also be added to the mixture if necessary. When finished, reinstall the components in the reverse order.

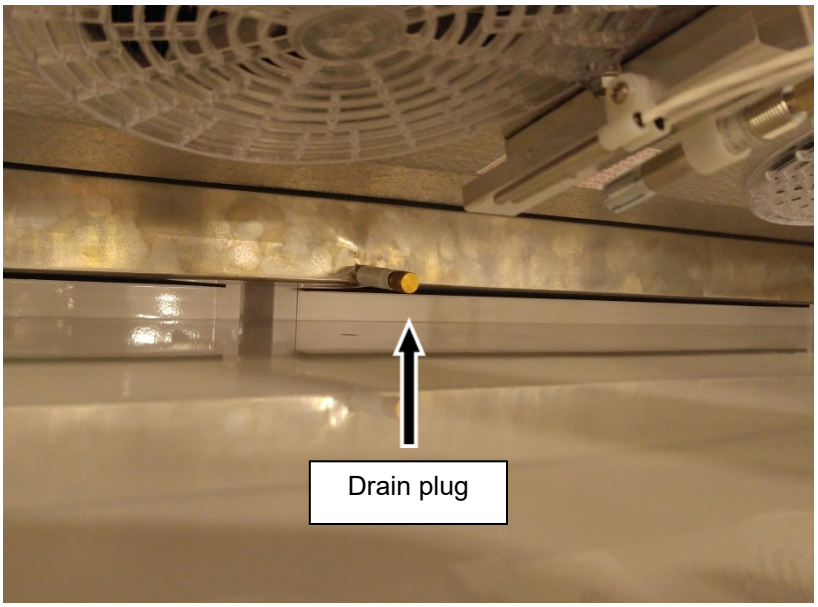


Figure 4

CONDENSATE DRAIN LINE

The condensate drain line can be removed and flushed with water or a solution of the above cleaners. Verify the water is free flowing out of the bottom of the chamber's drain line. The drain line should not be kinked or coiled up that would produce a trap.
Some units are more difficult to remove the drain line because there may be an air diverter in front of it. Contact Percival Scientific for detailed instructions for cleaning the drain line.

AIR COOLED CONDENSER

A dirty condenser is the main culprit for chamber damage. The condenser is designed to sub-cool the refrigerant and needs proper airflow. Refer to figure 5. Remove any dust or debris by using a vacuum or simply wiping it off with a damp rag. Never use compressed air to blow the dust further into the finned coil.

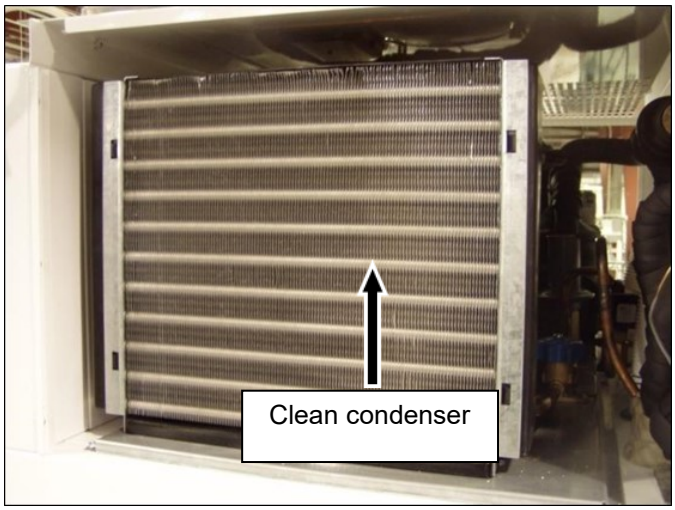
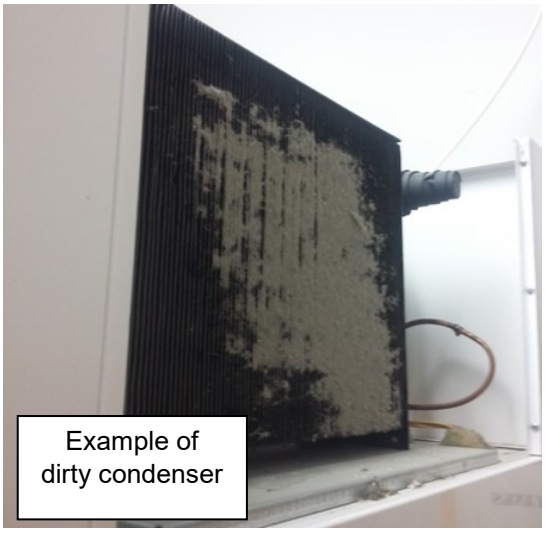


Figure 5



STERILIZATION

If it becomes necessary to sterilize your chamber because of reoccurring mold growth you may, after first cleaning the interior, add some bleach water into the humidifier pan, set RH to 85% and temperature up to 39°C for 6 to 8 hours. Note: The controller will deactivate RH at 40°C. If your unit has a top mounted water pan or Ultrasonic humidifier you may place a shallow pan with bleach water on a shelf and set temperature up to 40°C for 6 to 8 hours. Repeat if necessary.
Please contact Percival Scientific if you require assistance or have questions about your chamber.

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PERCIVAL MODEL AND SERIAL NUMBER LOOKUP

AR 41 L2

APPLICATION

AL	ALGAE
AR	ARABIDOPSIS
BF	BUTTERFLY EMERGENCE
CT	COLD ROOM-TEMPERATURE
CTH	COLD ROOM-TEMP & RH
CU	TISSUE CULTURE
DR	DROSOPHILA
D	DEW FORMATION
DL	DEW FORMATION WITH LIGHTS
E	ENVIRONMENTAL
GR	GERMINATION
I	INCUBATION
IR	INCUBATION ROOM
LED	LED LIGHTING
LT	LOW TEMPERATURE
M	MICROBIOLOGICAL
PGC	PLANT GROWTH CHAMBER
PGV	PLANT GROWTH W/VESTIBULE
PR	PLANT GROWTH WALK-IN
RX	PHARMACEUTICAL
SS	SEED STORAGE
TE	THERMOELECTRIC
VT	VERNALIZATION
WE	PLANT GROWTH WALK-IN

LIGHT CONFIGURATION

HID	HIGH INTENSITY DISCHARG
L	HORIZONTAL LIGHTING
L#	NUMBER OF LIGHTED SHELVES
LED	LED LIGHTING
LL	HORIZONTAL LIGHT IN INCUBATORS
LLVL	HORIZONTAL & VERTICAL LIGHT
NL	NON-LIGHTED
VL	VERTICAL LIGHTING

CHAMBER SERIES / INTERIOR SPACE FT³

6	PLANT GROWTH REACH-IN	36
9/2	DUAL CHAMBER REACH-IN (STACKED)	33.8 EACH
10	PLANT GROWTH REACH-IN	64
15	PLANT GROWTH REACH-IN	94.8
20	PLANT GROWTH REACH-IN	147.9
22	DUAL CHAMBER REACH-IN (STACKED)	7.3 EACH
30	SMALL BENCH TOP REACH-IN	9.7
36	SINGLE DOOR STAND UP REACH-IN	29.7
40	PLANT GROWTH REACH-IN OR WALK-IN	147.9
41	SINGLE DOOR REACH	37.2
66	DOUBLE DOOR STAND UP REACH IN	62.4
75	PLANT GROWTH REACH-IN	71.6
95	PLANT GROWTH REACH-IN	95.9
100	PLANT GROWTH REACH-IN	147.9
105	PLANT GROWTH REACH-IN	108.3
	WALK-IN BUILT TO SUIT	

SERIAL NUMBER

28315 .01 .20 B

- **28315** — INTERNAL SALES ORDER NUMBER
- **.01** — NUMBER OF CHAMBER IF MULTIPLE ORDERED AT A TIME
- **.20** — YEAR MANUFACTURED
- **B** — MONTH SHIPPED: A = JANUARY B = FEBRUARY C = MARCH D = APRIL ETC.

NOTE: CHAMBERS MANUFACTURED AROUND 1988 AND PRIOR HAVE A DIFFERENT FORMAT WITH THE YEAR AND MONTH LISTED FIRST

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