CHAMBERS

OPERATION AND MAINTENANCE

At Conviron we develop and implement innovative and reliable controlled environment solutions.
PLEASE READ THESE INSTRUCTIONS CAREFULLY AND COMPLETELY BEFORE OPERATING AND/OR PERFORMING MAINTENANCE.
PREFACE

Welcome to the Operation and Maintenance manual for Conviron Chambers. This manual has been developed to assist with the basic operation and maintenance of Conviron’s extensive portfolio of reach-in and walk-in chambers. The Manual is provided to all clients who have purchased a chamber(s).

The Manual has been designed to provide sufficient detail for the majority of chamber configurations. The format is structured to provide step-by-step instruction. Clients will find sufficient detail for typical chamber installations including figures, diagrams, and graphics for ongoing operation and maintenance. However, given that installations are specific to each facility and that facilities may have unique circumstances, additional information or assistance from Conviron may be required. In such cases, contact information is provided.

This equipment is only to be used and maintained by authorized personnel – that is, personnel who have been trained on the proper operation and/or maintenance of the equipment and who have read this manual.

For troubleshooting and repair procedures refer to the Chambers - Troubleshooting Manual and/or contact Conviron.
SERVICE AND TECHNICAL SUPPORT

Conviron welcomes the opportunity to provide assistance and to answer any technical questions related to the start-up, use and general technical support and troubleshooting of its chamber(s). Before contacting Conviron, please check the following:

Read this Operation and Maintenance Manual in its entirety.

If you are having a problem using your chamber(s), pay particular attention to the relevant section and the pertinent information in this Manual, and use the information to diagnose and correct the problem. If the problem persists and/or you require additional assistance, please collect the following information prior to contacting Conviron:

- The serial number of the chamber which is located on the rating plate on the side of the chamber.
- The software version of the CMP6050 Controller. Instructions for obtaining the software version of your Controller are provided in the CMP6050 Operator’s Manual.
- A description of the problem.
- A description of what you were doing before the problem occurred.

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**Head office**  
Technical Services  
Conviron  
590 Berry St.  
Winnipeg, Manitoba  
Canada R3H 0R9

**Conviron Technical Services**

<table>
<thead>
<tr>
<th></th>
<th>North America</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toll free</td>
<td>+1.800.363.6451</td>
<td>+44.0.800.032.6422</td>
</tr>
<tr>
<td>Telephone</td>
<td>+1.204.786.6451</td>
<td>+44.0.1638.781.731</td>
</tr>
<tr>
<td>Fax</td>
<td>+1.204.786.7736</td>
<td>+44.1638.741.112</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:info@conviron.com">info@conviron.com</a></td>
<td><a href="mailto:service@conviron.eu">service@conviron.eu</a></td>
</tr>
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</table>
USER NOTICE

Following product installation and commissioning, the facility manager/user is to register the Conviron product that has been purchased on ConviroNet at www.conviron.com. Instructions for doing so are located on the peel-off decal located on your control panel and as pictured below:

CONVIRONET™ PORTAL

ConviroNet™ is a secure portal that offers value added services to our clients.
- Electronic manuals
- Data Sheets
- Warranty Registrations
- Tech Specs
- Brochures
- Hard copy manuals
- Bulletins

CONVIRONET™ REGISTRATION

To register for access to ConviroNet and to register your product warranty, please follow these steps:

Step 1: Remove this decal and take it to your workstation. If you have received multiple new chambers/rooms, please remove the decal from each chamber and take to your workstation.


Step 3: In the top right corner of the website Home page, click on the ConviroNet logo to launch the ConviroNet portal.

Step 4: If you are already registered with ConviroNet, login using your Username and Password. If you are not registered, please follow the online registration process. Registering for the site also includes registering your product warranty which requires inserting the product serial number for each new chamber.

The serial number for this chamber is ________________________.

Note: The registration process requires Conviron authorization. You will receive an authorization email typically within one working day.

Step 5: Login to ConviroNet regularly to access the available tools and to review recent news about Conviron.

For assistance please contact Kathy Burton at convironet@conviron.com.
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1.0 PRECAUTIONS

The following symbols are used throughout this manual and/or on your equipment to draw your attention to important warnings, guidelines and product information. Please take note of their respective meanings.

- **Hazard Warning**
- **Important Information**
- **Dangerous Electrical Current**
- **Please Note**
- **Hot Surface**
- **Grounding Mark**
- **Slippery Surface**
- **Caution, Moving Parts**

Please note the following Hazard warnings before operating or maintaining this equipment.

- This equipment is only to be operated and maintained by authorized personnel - that is, personnel who have been trained on the proper operation and/or maintenance of the equipment and who have read this manual.
- If in doubt about safe operation and/or maintenance of the equipment, contact the responsible party immediately.
- Prior to operating, users should conduct a visual inspection of the equipment and surrounding area by walking around the unit and checking both inside and outside to ensure no debris or obstacles are present that could pose a safety hazard. If operators see a potential hazard (e.g. water accumulating on the floor which could be slippery, an obstruction that would prevent the door from opening/closing properly) they should take appropriate steps such as alerting service personnel.
- Before powering up, the operator should ensure that all electrical boxes are in the closed position and that no one is present in the chamber – either servicing or working within/on the unit.
- Ensure that no one is using or could activate the room remotely during operation or maintenance activities.
• Avoid water coming in contact with the electrical components, as it presents a risk of water damage to both high and low voltage electrical components. If you have any doubt of safe watering practices, contact Conviron.

• When a Schedule is not running, Alarms are disabled! No one other than a single, designated on-site service technician should be operating the chamber while servicing or diagnosing. Altering output parameters to troubleshoot a chamber, while others are handling mechanical or electrical systems within the chamber, COULD BE HAZARDOUS AND MAY RESULT IN PERSONAL INJURY. As such, manipulation of output parameters must be performed with either a qualified service technician present or via phone support with Conviron’s Technical Services group.

• Qualified trades-people such as electricians, plumbers, refrigeration mechanics, etc. should perform all work as required by local codes and regulations.

• Refrigeration lines can be very hot when the chamber is operating. For safe operation, insulate remote hot gas lines on site to prevent inadvertent contact. (i.e. exposed refrigeration lines)

• Shipping vibration can cause electrical and plumbing connections to loosen. Inspect all connections BEFORE connecting to main building services.

• Take all appropriate safety precautions when using and maintaining this equipment – including wearing appropriate safety apparel, using appropriate tools and utilizing fall protection equipment if working on elevated areas.

• Use only original replacement parts when maintaining the equipment.

• If in doubt about safe operation and/or maintenance of the equipment, contact the responsible party immediately.

• Procedures in this manual involve working on or near high voltage equipment. DO NOT attempt them unless you have appropriate knowledge and experience. Take appropriate safety precautions.

• To avoid personal injury, never check evaporator fan for free movement while power remains on.

• Decibel readings of up to a maximum of 82 dBA can be expected inside your chamber. Actual decibel level will be dependent on your model configuration and system operation. Your chamber may come equipped with a decibel reduction feature which should be used at all times while inside the chamber. If the decibel reduction feature is not provided or is not utilized, appropriate hearing protection must be used at all times.
• Working with high voltage will be required when installing this equipment. Do NOT attempt this work unless you have the appropriate knowledge and experience. Take appropriate safety precautions and ensure that the building power supply to the chamber is off prior to installation.

• The main terminal in the control panel has live voltage unless the external breaker is OFF. Use extreme caution when working in the control panel to prevent injury.

• Water that could come in contact with the electrical components presents a high voltage hazard. Avoid these conditions. If you have any doubt of safe watering practices, contact Conviron.

• Controller may come equipped with an optional Uninterrupted Power Supply (UPS) such that power will remain live for a period of time even if the power supply is turned OFF. Use extreme caution when working on the control panel to prevent injury. If you have any doubts as to whether your unit comes equipped with a UPS, contact Conviron.

• Inside the control panel is an independent temperature shut-off device called the ir33. This ir33 acts as a secondary fail-safe protector that shuts off the chamber if its temperature limits are exceeded. The ir33 is set by Conviron and is factory protected (requires Access Level 3). The factory default setting for the ir33 temperature limit is ten degrees beyond the chamber operating range. The standard operating range of a chamber is +4°C to +45°C while the standard ir33 shut down settings are -6°C to +55°C depending on the size of the chamber, size of the compressor and other factors. Always verify, when changing the (Alarm) Temperature limits, that the limits are still within the minimum and maximum operating limits for the Chamber. This will ensure that the ir33 only triggers in the event that the actual temperature exceeds the Chamber’s minimum or maximum temperature limit by 10 degrees. It will also ensure that the ir33 does not trigger ‘before’ a high or low temperature tracking alarm. The ir33 is located inside the control panel where there is live high voltage. Contact Conviron Client Services for more information or help if necessary.
HID lamps can cause serious skin burn and eye inflammation from short-wave ultraviolet radiation if the lamp envelope is punctured or broken. Do not use if individuals will remain inside the chamber for more than a few minutes unless adequate shielding or other safety precautions are used. The arc tube of Metal Halide lamps is designed to operate under high pressure at temperatures up to 900°C. If ruptured, the outer bulb may break causing very hot glass to be discharged into the surrounding area with a risk of property damage or personal injury. To reduce the possibility of arc tube rupture:

- Turn lamps off at least once per week for 15 minutes in systems that operate on a continuous basis (24 hours/7 days/week). Relamp fixtures before the end of rated life. Do not burn lamps until they fail as it may increase the possibility of inner arc tube rupture.
- Operate lamps only at its recommended operating position.
- Operate lamps with proper circuits and auxiliary equipment.
- Use only in enclosed fixtures capable of withstanding particles of glass having temperatures up to 1000°C.

Do not scratch or subject the outer bulb to pressure. This causes it to crack or shatter. If the outer bulb is broken or shattered, turn off and replace the lamp to avoid possible injury. Protect lamp base, socket and wiring from moisture, corrosive atmospheres, and extreme heat. Be careful handling or disposing of these lamps. A partial vacuum in the outer bulb may cause glass to fly if struck. Avoid skin contact with any of the contents if the arc tube is broken. Lamps require 10 to 20 minutes to relight when power is interrupted. Let the lamps stabilize in color when turned on for the first time. This may require several hours and more than one start. Lamp color is also subject to excess vibration or shock. Color appearance may vary between individual lamps.

Operators should note that water may accumulate on the floor which could be slippery and pose a safety hazard. Always ensure floors remain dry and wear non-slip footwear.

To avoid injury, never check evaporator fans for free movement while power remains ON.
- To avoid injury, only perform visual and auditory checks to ensure circulating fans are operating.
2.0 INTRODUCTION AND DESCRIPTION

Thank-you for choosing Conviron products. Building quality products and serving our customers well has earned our reputation as the world leader in controlled environment technology.

Conviron manufactures a diverse lineup of reach-in chambers, walk-in rooms and custom engineered solutions for a variety of applications where strict control of temperature, humidity, lighting and other parameters is required. This is a general Operations and Maintenance manual based on the commonalities of products within Conviron's diverse product line. For specific questions on product features not covered within the scope of this manual, please contact Conviron’s Technical Services group.

2.1 Warranty Service

Please refer to the warranty document included with your chamber. In the event warranty work is required, contact the distributor in your area or Conviron’s Customer Service Department at the locations below:

North America: (800) 363-6451
International: (204) 786-6451
Fax: (204) 786-7736
Email: info@conviron.com
World wide web: www.conviron.com

Conviron also offers extended warranties.

2.2 After Warranty Service

Conviron maintains a network of authorized service centers and can assist you in finding other reputable service providers in your area.

Alternatively, you may wish to use your own maintenance staff. Conviron provides technical support and runs regular service schools to provide additional training. For further details, contact the Customer Service Department.

When contacting Conviron, please be prepared with the model and serial number of the equipment. It is also helpful to have specific information as to program settings and ambient conditions.

2.3 Equipment Safety

Avoid water coming in contact with the electrical components, as it presents the risk of water damage to both high and low voltage electrical components. If you have any doubt of safe watering practices, contact Conviron.
2.4 Static Sensitive Items

Your equipment may come equipped with a CO₂ monitor. CO₂ monitors are static sensitive and require following proper Electrostatic Discharge (ESD) precautions. If you are unsure, please contact CONVIRON.

2.5 Work Station

Operators workstation will either be at the control panel, in the chamber/room itself or remotely managing equipment operations if a Central Management™ (CM) system is being used.

2.6 Technical Support

Contact Conviron if you need technical support during the installation of your chamber:

North America: (800) 363-6451
International: (204) 786-6451
Fax: (204) 786-7736
Email: info@conviron.com
World wide web: www.conviron.com

2.7 Conviron Testing Methods

After power is connected to the unit, the software is installed in the Controller. The circuits are checked at this point to ensure they are functioning correctly. Initial check-off sheets are completed as the circuits are checked for correct operation.

The unit is charged with refrigerant, the operating pressures are set, and the pressure controls are set for safe operation of the chamber. Pull down temperature tests are conducted with a full lighting load to determine if the chamber performs correctly. Humidity tests are performed with both lights on and off. These tests are recorded along with temperature charts, and placed in the chamber’s service file. These records are the actual recording instrument sheets used to verify equipment control and performance.

Conviron tests all fully assembled reach-in units or walk-in units with separated machine compartments before they are delivered to the customer. All units are set up for tests and are run for a minimum of 24 hours. During this time the circuits are tested for control of temperature, humidity, and lighting. Each circuit is carefully checked first visually, then electrically before startup. Each chamber comes with a setup sheet containing operating parameters for temperature, humidity, and lighting.

Before shutdown of the chamber, final checks are done on the circuits as well as visual inspection for refrigeration leaks, as per final test inspection. Each chamber has amperage draws recorded and the unit is signed off before being shipped.
Changes from standard ambient conditions (i.e. 21°C and 50% RH) have a direct effect on the performance of each chamber. During periods of high ambient temperatures, the air-cooled units may experience high head pressures. High or low humidity in the building may result in problems if the chambers have fresh air intakes.

An ambient controlled enclosure in Conviron’s test area is used to simulate desired ambient conditions of the area the unit will be in at the client’s facility. Tests are done and modifications implemented to improve the control of the chamber in this ambient environment or if the design or the client requires it.

2.8 Quality Standards

Conviron is registered to ISO 9001:2008. This internationally recognized quality standard was selected to guide us in providing world class service and products and to embrace continuous improvement.

Conviron products are designed using North American and European safety standards as minimum requirements. For North America Conviron products are CSA US certified. For Europe Conviron applies the CE mark to show acceptance in the market place.
3.0 START-UP AND OPERATION

3.1 Factory Settings

Conviron reach-in equipment is fully tested as a unit at the factory while control panels and lamp canopies for walk-in units are factory tested. A setup sheet providing chamber test specification results is included with the unit prior to installation or for the customer to fill out if self installed. Before shipping, all switches and breakers are turned to OFF.

3.2 Summary Of Procedures For Operating And Maintaining The Chamber

Following these procedures helps ensure your chamber responds properly to commands from the Controller. This is not a complete maintenance schedule. Please refer to the Maintenance chapter for further details.

3.2.1 Follow Start-Up Procedures

If the chamber has been down for one hour or more, follow the chamber start-up procedure.

3.2.2 Use Proper Settings

Protect your experiments from accidental over or under heating by adjusting the high and low temperature tracking limit settings or the maximum/minimum temperature for your program. See CMP6050 Operator’s Manual.

3.2.3 Keep Equipment Clean

- Clean the chamber drain pan and drain line regularly. Water backing up in the pan will damage chamber components. If your chamber is equipped with a machine compartment, clean the compartment drain pan and drain line regularly. Stop the unit prior to cleaning.
- Keep the condenser cooling fins clean for efficient operation on chambers equipped with air-cooled refrigeration systems. Be careful not to fold fins over if using a high pressure washer or high pressure air.
- Clean chamber lamps regularly for maximum lighting efficiency. Users can set a warning message to pop up at the Controller as a reminder.
- Clean chamber internal walls regularly for maximum reflectance. Use a mild, non-abrasive, soap solution.
3.3 Safety

3.3.1 Controller Disconnect Switch

The main disconnect switch for walk-in chambers are located on the outside of the control panel. It turns off the electrical supply to all components within the unit and is used when performing maintenance.

Electrical power remains at the main terminals. Use extreme caution during maintenance procedures to prevent injury.

Controller may come equipped with an optional Uninterrupted Power Supply (UPS) such that power will remain live for a period of time even if the main power supply is disrupted or turned OFF. Use extreme caution to prevent injury. If you have any doubts as to whether your unit comes equipped with a UPS, contact Conviron.

3.4 Starting Your Chamber - DX Systems

3.4.1 Before Starting The Unit

- Check that the proper electrical power is connected to the main terminal beside the ‘MAIN SERVICE CONNECTION’ label.
- Ensure all breakers are on.

3.4.2 Visual Checks

1. Check the evaporator fan for free movement. Some chambers have a separate breaker for fans.

   To avoid injury, never check evaporator fans for free movement while power remains ON.

2. Check that all lights function when turned ON.

3. Check that the doors are light tight. Inspect the doors with interior lights ON, in a darkened room.

4. If your chamber has centrifugal atomizing humidifiers program %RH to maximum. Check that mist being generated.
3.4.3 Start-Up Procedures

1. Ensure that all drain lines, water lines, or refrigerant lines on units with a remote or air-cooled condenser are connected. Turn main switch to ON.

2. Do not turn the Controller off during boot up.

3. Chamber is shipped with refrigerant valves closed. Remove cap and open valves.

4. With the Controller powered up, set and run a program in the Controller. Refer to the CMP6050 Operator’s Manual for further details.

Operate your Conviron equipment for a few days before introducing any plant material. This acquaints you with the equipment’s operation and ensures the equipment meets the requirements for your experiments.

3.5 Starting Your Chamber - Glycol Or Chilled Water Systems

3.5.1 Before Starting The Unit

• Check that the proper electrical power is connected to the main terminal beside the ‘MAIN SERVICE CONNECTION’ label.

• Ensure all breakers are on.

• Open all hand valves on pump stand.

• Open all manual air vents. Ensure automatic air vents are open.

• Fill System with glycol and glycol main lines.

• Shut off valve or circuit setters in discharge line from pump to coil(s).

3.5.2 Visual Checks

1. Check the evaporator fan for free movement. Some chambers have a separate breaker for fans.

To avoid injury, never check evaporator fans for free movement while power remains ON.

2. Check that all lights function when turned on.

3. Check that the doors are light tight. Inspect the doors with interior lights on, in a darkened room.
4. If your chamber has centrifugal atomizing humidifiers program %RH to maximum. Check that mist being generated.

3.5.3 Start-Up Procedures

1. Ensure that all drain lines, water lines, or refrigerant lines on units with a remote air cooled condenser are connected.

2. Turn main switch to ON.

3. With the Controller powered up, set and run a program in the Controller. Refer to CMP6050 Operator’s Manual for further details.

4. Turn the START/STOP selector switch to ON (where preset).

5. Purge air from the pump to avoid air locks in the line. Gradually open the valve to the coil (or circuit setter to first coil on multi-coil rooms). Purge air from coil using the air vent located on the back of each coil housing.

6. For multi-coil rooms, after air is purged from first coil, slowly open circuit setter to subsequent coils in turn to purge air from them.

Operate your Conviron equipment for a few days before introducing any plant material. This acquaints you with the equipment’s operation and ensures the equipment meets the requirements for your experiments.

3.6 Lighting - Fluorescent And Incandescent

3.6.1 Fluorescent And Incandescent Combination

A typical lamp canopy includes fluorescent and incandescent lamps. However, other types of lamps and configurations are common. Lamps should be changed regularly, as intensity diminishes with use. Refer to the lamp manufacturer’s specifications.

All control outputs including lighting are logged and it is possible to determine how long lights have been on. Users can set a “warning” message to pop up at the Controller as a reminder.

3.6.2 “LIGHTRIGHT®”

Some Conviron units feature a LightRight® canopy which is counter balanced to provide easy height adjustment to compensate for aging lamps and growing plants. The LightRight® canopy lets you maintain consistent lighting levels. Movable parts on these canopies are maintenance free.
Fluorescent lamps lose intensity over time although newer generation lamps are much better in this regard. The chart below shows the reduction in output over time.

![Figure 3-1: Fluorescent lamp life comparison](chart)

Fluorescent lamp intensity is affected by temperature. Chambers equipped with barriered lighting systems keep lamp temperature more constant regardless of setpoint and therefore are not significantly affected by chamber temperature.

3.6.3 Dimmable Lighting

With improvements in fluorescent lighting technology a demand for dimmable lighting has emerged. Conviron has met the demand by providing closed loop dimmable lighting on select chambers.

Prior to operating dimmable fluorescent lamps you are required to run the lamps at full intensity for a period of 100 hours. This is because there are impurities on the filaments (ends) of the lamps. The burn time burns off these impurities. If a lamp is not burned in, it will reduce the life of the lamp. If lamps are run at 90% intensity then the impact on lamp life is not significant. Running the lamps at 90% will burn the impurities off; however, it will take
slightly longer than running at full intensity. If run at 10% intensity, then the impurities will have a greater effect on the lamp such as blackened ends, reduced life and flickering. These effects vary between lamp manufacturers. For the reduction in lamp life, when the lamp is run at the lowest setting, the lamp life is reduced by half, which is 10,000 hours for a lamp that has a life of 20,000 hours.

Programmable settings are in micromoles and the maximum set point values will depend on the chamber.

3.7 Lighting - High Intensity Discharge

3.7.1 High Intensity Discharge Lighting (HID Option)

The two types of HID lamps commonly used are high-pressure sodium (HPS) and metal halide (MH). They are often used together to provide optimum spectral blend.

HID light can be harmful to your eyes. Use caution when working with HID equipped chambers.

The HID Design

- Features lamps that last longer and have an output that declines slower over time than standard incandescent lamps.
- Lamp canopy includes a light barrier which is made of material that transmits only about 90% as much light as glass.

The light barrier has several protective functions. This includes:
- Screening out excessive levels of ultraviolet (UV) radiation that could occur if the protective glass envelope of the HID lamp was broken.
- Protecting the user and the plant material from injury if a lamp shatters.
- Accommodating easy removal for cleaning, which should be done at regular intervals to maximize light levels.
3.8 General Design

3.8.1 “UNIFLOOR®”

The Unifloor® is a unique floor design that ensures uniform conditions throughout the entire growth area. Plant material is placed directly on the floor and does not need to be moved. This allows for drainage of excess irrigation water, and ensures the drainage area is clear of debris and drain lines flow freely for accurate humidity control.

3.8.2 Aspirator

The aspirator is a plastic container containing control sensors for all reach-in models. The aspirator receives a sample of air from the Telensair® for measurement and control. It is located outside the growth area to prevent false readings caused by radiant energy from the chamber lighting.

3.8.3 Aspirator With Dry Humidity Sensor

If the chamber has an additive humidification option, a dry humidity sensor reads the humidity level. See Figure 3-2 for details.

Figure 3-2: Aspirator with dry humidity sensor

![Aspirator diagram](image-url)
3.8.4 Wet Aspirator

The wet aspirator is used only for the G30 and dew room (DR) models. It uses the temperature and wet bulb temperature to determine %RH. The wet aspirator has a float valve to regulate a water reservoir to maintain a wet bulb temperature.

3.8.5 Portable Aspirator

A portable aspirator is a metal container used in walk-in rooms and some reach-ins (instead of the fixed aspirator shown above) for all controlling and recording sensors. The aspirator receives an air sample from the room to measure and control conditions. Place the aspirator in the growth area with the sensors (bottom) located at the same height of the plant leaves or by hanging it as centrally as possible relative to the lighting configuration. For improved chamber uniformity (for 6050 controlled environments only) a second aspirator is possible.
3.8.6 New Generation Portable Aspirator

Some chambers are equipped with a new generation portable aspirator. This is a new, compact aspirator, designed to hang from the light canopy. A chain is provided. All controlling and alarm sensors are contained within.

![Figure 3-4: New generation portable aspirator](image)

3.9 Refrigeration

3.9.1 Single Evaporator Defrost System (DFT Option)

When a chamber operates near or below the freezing point of water there is the danger of ice forming on the evaporator. To prevent this, Conviron uses an automatic defrost option as part of the Controller software. This option is activated whenever the chamber temperature set point is set below a pre-programmed threshold and functions without the need for any further operator intervention.

The Controller begins a defrost cycle when the actual temperature and set point is below the **threshold temperature set point value** (typically factory set at 4°C). The cycle consists of three phases:

1. Control Interval - The interval the unit cycles through to defrost. Every 180 minutes the unit defrosts.
2. **Defrost Interval** - During defrost, the time hot gas is circulated through chamber evaporator coil to defrost the coil. Until the coil temperature exceeds 4°C or a maximum of 20 minutes.

3. **Fan Delay Interval** - The amount of time the fan is shut off during the defrost interval to provide a cool down period after defrosting. Normally this interval is 2 minutes.

These three periods add up to the defrost cycle period. Refer to Figure 3-5.

After the Control Interval has expired, the Controller begins the defrost interval. It switches off the circulating fans, chamber lights (if programmed on) and control heaters, and switches to full heating (diverting hot gas through the evaporator and energizing electric defrost heaters if so equipped).

After the Defrost Interval the Controller begins the Fan Delay Interval, switching from full heating to cooling (diverts liquid refrigerant to the evaporator and de-energizes any defrost heaters that may be on). The fans and chamber lights remain off, giving the evaporator time to reach its programmed temperature. The fans and chamber lights come on once the Controller enters the next control period.

The chamber temperature may rise above the temperature set point and/or the threshold temperate set point during a defrost cycle. The Controller will terminate the defrost cycle immediately if this occurs during the control portion of the cycle. The Controller will complete the cycle up to the end of the fan delay and then terminate the defrost cycle if it occurs during the actual defrost or fan delay segments.

**Figure 3-5: Defrost cycle single evaporator defrost system**

![Diagram of Defrost Cycle Single Evaporator Defrost System]

**NOTES:**

1. CONTROL PERIOD TIME = DEFROST CYCLE TIME (DEFROST TIME + FAN DELAY)
2. CONTROLLED INDICATES NORMAL THERMOSTATIC OR TIME LINE CONTROL.
3.9.2 Optional Additive Humidity Control (With DFT Option)

Units provided with optional humidity control must have water drained from within the chamber when operating the unit below freezing temperatures. This is done automatically by a drain down system activated by the control system and purged by compressed air. (Compressed air must be supplied by the client.)

3.10 Shutdown

Should the chamber not be used for a period of approximately 2 weeks (or less) it is best to keep it running (temperature at/near ambient and fans running only). If experiments will not be run for a period of two weeks or longer to minimize unnecessary electricity consumption ensure all plants and soil are removed from growth area, clean the unit as per the Maintenance and Cleaning Section 4.0 and leave chamber doors open slightly to reduce moisture buildup. Contact Conviron if you are unsure.
4.0 MAINTENANCE AND CLEANING

This equipment is only to be used and maintained by authorized personnel - that is, personnel who have been trained on the proper operation and/or maintenance of the equipment and who have read this manual.

To ensure that you have reliable performance from your Conviron equipment, the following checks will minimize the need for service.

4.1 Each Day

Users and Administrators:
• Humidity, temperature, light, CO₂ as programmed. (Optional)

Maintenance personnel:
• Lamps - visual inspection and replace where necessary.
• Temperature as programmed.

4.2 Each Month

Maintenance personnel should check all items shown under “each day” plus:
• Check operation of centrifugal atomizing humidifiers. With the unit stopped, ensure pump and impellers are clean. (If so equipped)
• Check circulating fans are operating. Since the unit should be ON for this check, listen and/or perform a visual check ONLY so as to prevent injury.

To avoid injury, only perform visual and auditory checks to ensure circulating fans are operating.

• Clean air intake filter.
• Clean air-cooled condensers with whisk brush and vacuum cleaner or compressed air.

4.3 Each New Experiment

Maintenance personnel should check all items mentioned in monthly, plus:
• Calibrate by comparing a handheld temperature/humidity meter placed in or next to aspirator to be sure sensors are within spec. It is recommended that the independent sensor be shielded from radiant energy of lamps.
• Monitor nozzles to ensure they are performing at 100%. If there is an oil filter hooked up to the air line into the humidity system, regular filter maintenance should be performed at the end of each experiment.

4.4 Every Six Months

Maintenance personnel should check all items mentioned above, plus:

• Contact Conviron or have a refrigeration service technician check the unit to prevent any small fault developing into a major breakdown. Ask the technician to report operating pressures, which the factory will review if necessary. See Preventative Maintenance Checklist, Section 5.0.

• Check door hinges and latches. Adjust if necessary.

• Clean all drain traps.

• Clean water strainer. (If so equipped)

• Clean the water-cooled condenser if head pressures are higher than normal. Contact Conviron or a refrigeration service technician.

• Check the chamber Vaisala™ CO₂ sensor against independent CO₂ sensor. Calibration recommended every 2 years. See CO₂ Calibration section 4.10.6.

4.5 Cleaning

4.5.1 Plastic Light Barrier And Plexiglas Doors

Light barriers, where applicable, must be cleaned often to allow maximum intensity. Clean the barrier after each experiment.

To clean plastic and Plexiglas, use a mixture of 2 teaspoons (10 milliliters) of liquid detergent in 2 quarts (2 liters) of warm water. Wipe the surface with a soft cloth saturated in the solution. Do not rub vigorously. This solution will remove average dust and fingerprint smudges (if the plastic has paint on it, use Naphtha Gas, Solvesso 100 or equivalent to remove it, then use the detergent solution).

Never rub the plastic with a dry cloth, paper or your hand to remove dust particles. Severe marking will result if the plastic is rubbed while dry. In addition, it sets up a static charge in the plastic, which attracts dust. Always use the detergent solution.

Under extreme dust conditions, a light film of liquid wax will help protect the plastic from dust abrasion.
4.5.2 Tempered Glass Barriers

Use mixture of 1 part vinegar to 20 parts water to clean glass barriers. Spray both sides of glass and wipe dry with a soft cloth or mild glass cleaner.

4.5.3 Baked Enamel

The “easy-to-clean” baked enamel exterior surfaces should be wiped regularly with a damp cloth. Occasionally use a polish to restore the original luster. NEVER use an abrasive or alkaline solution.

4.5.4 Stainless Steel

Clean frequently with a damp cloth. Rub dry with a soft cloth. Commercial glass cleaner will remove fingerprint smudges and supplement with multipurpose stainless steel cleaner.

4.5.5 Interior Surfaces

It is important that the interior of your cabinet be cleaned periodically beginning with the initial installation. Spillage causes objectionable odors. When this occurs, clean the entire interior with a solution of mild detergent and warm water, and wipe dry.

4.6 Doors

4.6.1 Ensure Proper Gasket Seal

Test the door gasket seal by closing the door(s) on a piece of light paper at the intervals of approximately six inches around the perimeter of each door. When the seal is proper, a substantial drag should be felt when attempting to remove the paper with the door completely closed. Each hinge is provided with slotted mounting holes on the hinge side of the door. Adjustment of gasket on the lock side of the door is accomplished by adjusting the strike assembly. Either tightening or loosening the screws can adjust the strike assembly.

If it becomes necessary to remove the complete door assembly, remove the screws that secure the hinge to the cabinet exterior. In doing so, the gasket pressure originally applied will not be disturbed. To remove doors equipped with cam-lift hinges, simply open doors and lift off. Reach in doors are fastened with screws and would require unscrewing.

4.7 Lighting

We recommend the use of fluorescent lamps and long life tungsten incandescent lights. The frequency of lamp changes will be determined by application. The height adjustable lamp fixture (not available on all models) lets you maintain consistent lighting levels.
4.8 Refrigeration

4.8.1 Air-Cooled Condensers

Regularly remove accumulating dirt on the condenser. Obstruction lowers the efficiency of the system. A brush with stiff bristles will loosen the particles and enable removal with a vacuum cleaner.

4.8.2 Cooling Tower (CTO Option) - Bypass

All Conviron water cooled units are equipped with control valve and bypass line. Both the control valve and by-pass line are required to permit continuous operation of the cooling tower system supplying condenser water.

When only one condenser is connected to the system, the by-pass line hand valve must be adjusted for a water flow sufficient to provide the minimum recommended flow in the cooling tower.

The adjustment is made with the compressor shut down and the cooling tower pump operating. When several condensers are connected to the cooling tower system all the by-pass hand valves must be adjusted for equal flow and for a total flow from all bypasses sufficient to provide the minimum recommended nozzle pressure.

Improperly adjusted by-pass hand valves in a multiple condenser system can cause cooling water starvation to some condensers with resulting compressor shut down on high head pressure. The bypass valve is used to regulate the flow of water in the bypass line of a three-way water valve used in a cooling tower condenser water supply system.

The bypass valve is factory set and does not normally require further adjustment. In the event that service becomes necessary, contact Conviron.

4.8.3 Mechanically Cleanable Condenser (MCC Option)

Mineral scale and sludge deposits seriously reduce heat transfer in any condenser and affect system performance unless removed. However, deposits can be safely cleaned mechanically for water-cooled condensers to restore ‘new unit efficiency’ quickly. No need to risk acid damage to condensers, cooling towers and pumps (if so equipped).

The end plates can be moved quickly and easily to provide complete access to the water tubes. A simple, spiral wire-cleaning tool is inserted and powered by an ordinary electric drill to remove the corrosive material.
4.9 Humidification Systems

If your chamber is equipped with optional additive humidification, please follow instructions to ensure proper control.

4.9.1 Humidity Sensing

Remove the humidity-sensing unit by unplugging it from the multi-pin cord connector. Remove the protective cover to expose the sensing element. Blow off loose dust and dirt with a gentle clean (oil free) air blast. If dirt remains, brush lightly with a clean camelhair brush.

The sensing element may be held by its edges but **DO NOT** touch the face with your fingers. Do not expose the sensing element to organic solvents, water, or ionic-laden liquids. Check to ensure the numbered pins are inserted into the connector holes of the same number when reinstalling the sensing unit.

4.9.2 Dry Humidity Sensor (DHS)

The dry humidity sensor is included in all humidity systems (except systems for DR rooms and the I24L) but can be ordered separately if only monitoring is required.
4.9.3 Maintenance

Do not use compressed air or solvents. Do not touch the humidity sensor or sensor surface.

The humidity sensor is protected against mechanical damage by a plastic guard and a membrane filter. Gently blow off any soot, dust or other particles deposited on the sensor surface. Do not wash the sensor. If the sensor is very dirty, immerse the sensor in distilled water for one to two minutes. Dry by blowing gently. (Do not use compressed air)

Regular calibration checks are very important. Check calibration twice a year. Intervals can be altered later to suit operating conditions.

To replace a humidity sensor:
1. Remove the sensor guard.
2. Pull out the defective sensor from the socket.
3. Insert new sensor into the socket holding it by the connector.
4. Replace sensor guard and membrane filter.
5. Recheck sensor calibration.

4.9.3.1 Calibration Checks
Check the calibration of the humidity transmitter regularly. An annual check is adequate.

There are two methods of checking calibration:
- Use a humidity sensor certified as calibrated to a nationally recognized standard.
- To use the salt method, place a calibration cell (saturated salt solution) over the DHS probe.

4.9.3.2 Spray Nozzle Humidification (SNH Option)

The frequency of cleaning depends on local water conditions. (Use humidity water that meets Conviron published service bulletin SBRH001B specifications)

1. Turn off water supply.
2. Remove stainless steel spray nozzle head from adapter.
3. Disassemble the nozzle head and remove the slotted core.
4. Clean the orifice in the head by soaking in citric acid solution or ultrasonic cleaner for eight hours. Sight through the orifice to see if it is clean.
5. Re-assemble the nozzle head; ensure that the core is securely fastened.
6. Replace the nozzle head in the adapter, turn on the water supply and check operation.

A minimum of 60 psi is required to operate spray nozzles.

**Figure 4-2: Spray nozzles humidifier(s)**

**4.9.3.3 Ultrasonic Humidification (USH)**

USH uses the principle of high frequency vibration to atomize water to develop humidity. Please contact factory for maintenance practices.

**4.9.3.4 Centrifugal Atomizer Humidification (CAH Option)**

1. Turn off the water supply at the inlet valve.
2. Disconnect the power supply to the humidifier.
3. Lift out the discharge dome “A” and the atomizing section “B”. Check to see if the water level is at least 1 ½ “ (35mm) deep in base pan. If not, adjust float “C”. Bend float arm down if water is too high and bend up if water level is too low.
4. Look through the impeller pump “D” slot. Ensure that the six holes at the top of the impeller tube are open. Use pipe cleaners for cleaning out the holes. Twist and pull out the pump “D” to remove the impeller pump. The pump is a press fit. If pump is difficult to remove, place the assembly under hot water for two to three seconds. The plug will then twist out easily. Flush water through the impeller after cleaning.
5. If necessary, disconnect the water line and remove the bottom pan ‘E’ for cleaning.

6. Reassemble the unit according to the diagram.

Carefully rotate the impeller, making sure it turns freely before starting up humidifier. The hole in the side of the bottom pan next to the water connection is for water overflow. Keep hole open.

7. Reconnect the water and power supply.

Figure 4-3: Centrifugal atomizing humidifier maintenance (Service bulletin SBRH002). Available in 120V only. For the 240V application use part #232288 hydro fogger.

4.9.3.5 Air Assisted Spray Nozzle Humidification (ASNH Option)

The frequency of cleaning depends on local water conditions (Use humidity water that meets Conviron published specifications).

1. Turn off water and air supply at the inlet valve. It is advisable also to turn off the power to the chamber.
2. Disassemble the nozzle by twisting the fluid/air cap ¼ turn to the left.
3. Look in the air/fluid cap and body. If there is a build up of oil in any of those parts then wipe them out with a degreaser. It is not necessary to disconnect the nozzles for this procedure. If the nozzle parts are worn in any way, replace nozzle assembly.

It is a good practice to monitor the nozzles to ensure they are performing at 100%. If there is an oil filter hooked up to the air line into the humidity system, regular filter maintenance should be performed at the end of each experiment.

4.10 Additive Carbon Dioxide Control (CO₂ Option)

4.10.1 Description
The Carbon Dioxide control option provides additive control of CO₂. The option is available for most models. It includes a sensor and monitor that connects to the Controller and includes a solenoid controlled injection system to elevate CO₂ in the chamber.

4.10.2 Major Components
Major components of the CO₂ option include the following:
- Component board
- Sensor cable and sensor
- Injection system
  - Pressure regulator
  - Solenoid valve
  - Tubing for CO₂ injection

The CO₂ Vaisala™ transmitter module supplies a 4-20 mA signal to the Controller for CO₂ control. The placement of the module and probe varies according to the machine and options. The start/stop switch controls power to the CO₂ solenoid and the rest of the chamber. Power and signal output wiring are shown on the schematics provided with each chamber.

The level of CO₂ in the chamber is displayed in parts per million (PPM) on the Controller and is programmed the same way as temperature and humidity. CO₂ is monitored continuously as long as the Controller is active. Close the main valve on the CO₂ tank when it’s not in use. Do not adjust the regulator on the CO₂ tank once it’s been set up.

4.10.3 Set Up
CO₂ control requires a high pressure and a low-pressure regulator. In most chambers the low-pressure regulator and the solenoid assembly are located in the machine compartment and are factory set at 2 pounds per square inch (psi). Do not adjust this setting unless there is difficulty reaching higher concentrations of CO₂ in larger chambers.
The high-pressure regulator is located on the customer supplied CO₂ tank. This regulator comes in two styles of flow meters, a dial gauge or a glass tube and ball style. In North America, Conviron provides the high-pressure regulator. Outside North America, the customer supplies the high-pressure regulator due to different thread size on the CO₂ tanks.

Apply Teflon® tape to the threads on the CO₂ tank outlet to ensure leak free connections. Thread the high-pressure regulator onto the CO₂ tank. Connect the outlet of the high-pressure regulator on the CO₂ tank(s) to the low-pressure regulator using ¼” polyethylene tubing. Hard copper may be used as an alternative. Ensure all connections are tight.

Open the main valve on the CO₂ tank approximately 3/4 of a turn. Program and run a CO₂ set point in the chamber that is above actual conditions in order to open the CO₂ solenoid. You should hear a click when the solenoid opens.

Set the flow meter. With one tank only, set the high-pressure regulator for 15 cubic feet per hour (CFH). If two or more tanks are used, set the first for 15 CFH and the rest for 10 CFH. The tube and ball style should be set to just lift the ball off its seat for one or multiple tanks.

4.10.4 Programming And Control
There are two variables to consider: programming desired CO₂ concentration and control of air flow through the chamber.

Programming the CO₂ set point is as easy as programming temperature or relative humidity. Values are entered in parts per million (PPM) in the CO₂ zone on the Main Status Program Screen of the Controller. The Vaisala™ CO₂ monitor operates to 2000 ppm.

Ambient CO₂ levels are usually at least 350 ppm and can be higher depending on proximity to other CO₂ sources such as human beings or automobiles. The CO₂ concentration in the chamber can never be less than the ambient concentration because CO₂ control is additive only.

Controlling fresh air into and exhausting air out of the chamber is important to achieving desired CO₂ concentrations. Failure to consider this will lead to undesired results. Most chambers with CO₂ control are equipped with an automated damper to control airflow. These units will also typically have a manual fresh air inlet and exhaust outlet for running programs without CO₂ control. Some chambers are only equipped with the manual inlet and outlet.

For 6050 Controllers, the CO₂ Exhaust Damper option allows the automatic or manual control of an exhaust damper.

The exhaust damper option comes pre-configured from the factory. Once enabled, the damper will require a digital output for control.

The exhaust damper setting can be changed in the Schedule - Preferences Menu. In automatic mode, the position of the exhaust damper is based on the CO₂ set-point. If the CO₂ set-point ≥ 800ppm, the normally open contact on the Controller is de-energized and
the exhaust damper is closed. If the CO₂ set-point < 800ppm, the normally open contact on the Controller is energized and the exhaust damper is open. In manual mode the user can select whether the damper is open, Open (Override) in the Schedule - Preferences Menu, or closed, Closed (Override) in the Schedule - Preferences Menu.

The status of the exhaust damper can be seen in the I/O Status screen under Digital Outputs. The status of the damper is displayed as either an open or closed switch.

The I/O and Log File Labels for the CO₂ exhaust damper is CO2_DAMPER.

The exhaust damper also serves to purge CO₂ in the event of a high level CO₂ alarm. If the high CO₂ limit is set below the CO₂ set point, the exhaust damper will open to purge CO₂ to the surrounding space.

4.10.5 Maintenance

Check the chamber Vaisala™ CO₂ sensor against an accurate, independent, preferably NIST traceable, CO₂ sensor. Checking the Vaisala™ CO₂ sensor is recommended twice a year. Simply place the independent CO₂ sensor in the same location of the Chamber CO₂ sensor and compare readings.

4.10.6 Calibration

Calibration is recommended every two years.

Remove the CO₂ sensor probe from the cable and return it to Vaisala™ for calibration.

Conviron recommends that a spare, new or recently calibrated sensor probe be purchased in order to keep the CO₂ function operational while the first probe is away being calibrated. Vaisala™ can provide NIST traceable calibration certificates.

Refer to www.vaisala.com for calibration information and a calibration kit for further information.