



Fisher Scientific

Isotemp

Laboratory CO₂ Incubators

Installation and Operation Manual

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Appendices: Gas connections for stacked units and for tank switcher with single gas supply

Installation of passive humidity in "R" models

1 Introduction

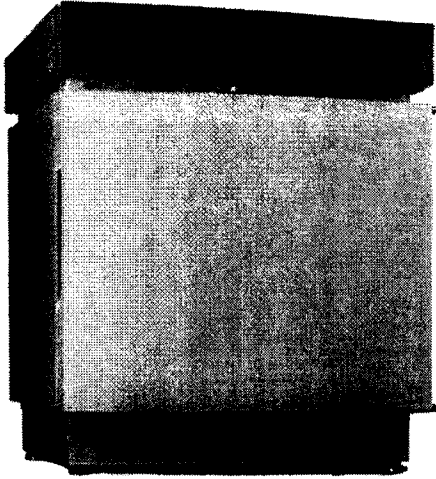


Figure 1. Isotemp Incubator

1.1 Features and Benefits

Isotemp incubators are designed to create a stable, reliable environment for cell culture applications. They operate at temperatures ranging from 5°C above ambient temperature to +60°C, accurate to $\pm 0.2^\circ\text{C}$. The gas system controls within $\pm 0.1\%$ of measurable setpoint.

- Convenience Outlet. A receptacle rated at 115 VAC, 75 watts maximum, is located at the rear of the incubator. The outlet is ideal for electronic recorders or other small loads. Do not exceed the electrical capacity of this outlet.
- Alarms:
 - High and low level CO₂ setpoint alarms, adjustable to within $\pm 1\%$ of setpoint.
 - High and low temperature alarms settable by the user.
 - On tri-gas models, O₂ setpoint alarms.
- Chamber Drain. All models are provided with a chamber drain valve at the bottom left of the cabinet.
- CO₂ tank switchover and Alarm.
- CO₂ sample port located in the center of the inner glass door.
- 1 1/4" access port with a soft plug, located at the rear wall of the chamber.
- Advanced microprocessor controls with large, easy-to-read display. On program request, software steps the user through initial installation and startup procedures.
- Automatic environment recovery to setpoints after door openings.
- Keyed power/alarm switch provides setpoint security.
- Units are stackable.
- HEPA filter is standard.

1.2 Requirements






- High quality two-stage, low pressure 30 psig pressure regulators are required for proper operation of the CO₂ and (if applicable) O₂ gas supplies, 15 psig at the incubator.
- CO₂ used in the incubator must be at least 99.9% pure.
- In-line gas supply filters must be used on the CO₂ supply and (on tri-gas units) the O₂ supply to prevent damage to the solenoid valve(s). One filter for each gas is supplied with the startup kit:
 - Type: Microbiological
 - Specification: 0.3 micron
 - Location: rear of unit
- Each 5.8 cu. ft. chamber contains approximately 11 gallons of jacket water when filled. The water takes six to eight hours to heat from 20° to 37°C. This time must be allowed for the interior temperature to stabilize before any adjustments or permanent calibrations are made.
- "R" models with controlled humidity require 20 to 30 psi distilled water connected at the rear of the unit.

2 Safety Precautions

In this manual and on labels attached to this product, the words WARNING and CAUTION mean the following:

- WARNING: a potentially hazardous situation which, if not avoided, could result in serious injury or death.
- CAUTION: a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damage to the equipment.

The following symbols are used in caution, warning and informational labels attached to the incubator:

	caution, info		on
	electrical hazard	○	off
	hot surface	~	alternating current
	earth ground		
	protective conductor terminal		

Before installing, using or maintaining this product, please be sure to read this manual and product warning labels carefully. Failure to follow these instructions may cause this product to malfunction, which could result in injury or damage.

Below are important safety precautions that apply to this product:

- Use this product only in the way described in the product literature and in this manual. Before using it, verify that this product is suitable for its intended use.
- Do not modify system components, especially the controller. Use OEM exact replacement equipment or parts. Before use, confirm that the product has not been altered in any way.
- Disconnect the unit from all power sources before cleaning, troubleshooting, or performing other maintenance on the product or its controls. To disconnect power supply to the incubator, unplug the supply cord at the back of the incubator. Note that turning the key switch on the front control panel to the Off position is not sufficient to disconnect power.



WARNING! The user is responsible for carrying out appropriate decontamination procedures when hazardous materials are spilled on or inside the incubator.

3 Operating Standards

The incubators described in this manual are classified for use as stationary equipment in a Pollution Degree 2 and Overvoltage Category II environment, according to the UL3101-1 and IEC 664 standards.

These units are designed to operate under the following environmental conditions:

- Indoor use
- Altitude up to 2000m
- Maximum relative humidity 80% for temperatures up to 31°C
- Main supply voltage fluctuations not to exceed 10% of the nominal voltage.

4 Pre-Installation

4.1 Included Parts

The following items are packaged and shipped inside the incubator cabinet:

- This manual
- Shelves and shelf brackets
- 3/16 in. (476 mm) ID clear tubing for the gas connection
- A T fitting is supplied with dual-chamber units
- Decontamination kit: 0.3 micron gas filter, replacement Blower Wheel, CO₂ Sensor gasket, and Injection Port Assembly gasket
- Tubing, funnel, and bottle of water conditioning crystals for filling the water jacket
- Humidity pan with cover
- HEPA filter
- A thin, 1/2" open-end wrench to adjust leveling legs and relocate the outer door hinge

4.2 Unpacking

At delivery, examine the exterior for physical damage while the carrier's representative is present. If exterior damage is present,

carefully unpack and inspect the unit and all accessories for damage. If there is no exterior damage, unpack and inspect the equipment within five days of delivery. If you find any damage, keep the packing materials and immediately report the damage to the carrier. **Do not return goods to the manufacturer without written authorization.** When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment.

4.3 Set-up

Remove shelves from the inside of the incubator and clean the incubator (refer to Section 8.1 on page 14). The shelves and brackets can be autoclaved at this time.

4.4 Location

Install the unit in a level area free from vibration with a minimum of three inches (7.6 cm) of space on the sides and rear and 12 inches (30.5 cm) at the top. The floor must be able to support 40 PSI (single chamber incubator) or 75 PSI (double chamber incubator).

Be sure to position the incubator so that the power cord can easily be reached to disconnect power.

Do not position the equipment in direct sunlight or near any HVAC duct/diffusers. The ambient temperature range at the location must be 59 to 90°F (15 to 32°C).

4.5 Gas Supplies

Verify that the incubator gas supplies are available near the installation area: CO₂ for all incubators, also O₂ and N₂ as required for tri-gas models. The required gas supply pressure is 15 PSI, controlled by a high-quality, two-stage regulator suitable for each connected input gas.

Do not connect the gas at this time.

4.6 Wiring



CAUTION! Connect the equipment to the correct power source. Be sure to operate the incubator at the voltage specified on the dataplate. Incorrect voltage can result in severe damage to the equipment.



WARNING! For personal safety and trouble-free operation, this unit must be properly grounded before it is used. Failure to ground the equipment may cause personal injury or damage to the equipment. Always conform to the National Electrical Code and local codes. Do not connect the unit to overloaded power lines.

The incubators described in this manual are rated for supply voltage 115/120 VAC, single-phase, 60Hz, 6 amps.

Always connect the unit to a dedicated (separate) circuit. Do not exceed the electrical and temperature ratings printed on the dataplate located near the upper hinge of the unit. Electrical codes require fuse or circuit breaker protection for branch circuit conductors. Use time delay fuses for #12 AWG circuits.

5 Initial Start-Up Procedures

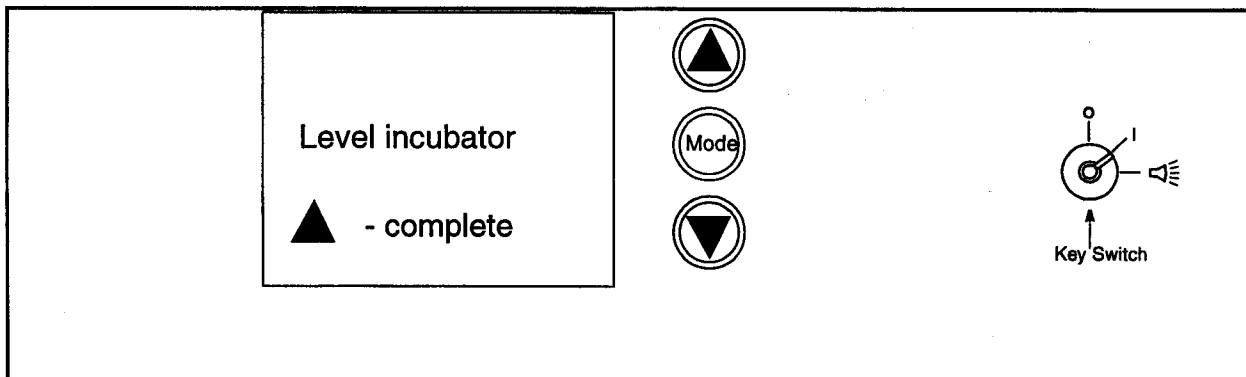


Figure 2. Control Panel: First Start-Up Prompt

IMPORTANT NOTE: When setting up your incubator for the first time, be sure to follow the control instructions on the sticker provided on the control panel, and in Section 5.3 below.

5.1 Start-Up Prompts

When you first turn the incubator key switch to the on position (see Section 5.3 below), the control display will go through several prompts that will guide you through the entire set-up process, from leveling the incubator to adjusting the operating parameters.

During normal operation, the control panel display looks like Figure 8 on page 8. The next chapter explains all the control functions available during normal operation. On initial start-up, however, you will see a series of prompts similar to the one shown above. This chapter explains the start-up prompts and the procedures they ask you to follow.

5.2 Installation Tools

Tools you will need to complete installation are:

- A sharp knife or scissors suitable for cutting plastic tubing
- A bubble level, at least 9 in. (23 cm) long, for leveling the incubator
- A thin, 1/2 in. (1.25 cm) open-end wrench (provided with your incubator) to adjust the leveling feet

5.3 Power and Key Switch

Turn the key switch (shown in the figure above) to the “1” position.

The Fisher logo will then roll across the display.

While the logo is displayed, press and hold the Increase button (▲) until the logo disappears to initiate the special start-up prompts. The first prompt is the one shown above: if you see a temperature display instead, you haven’t pressed the Increase button long enough — turn the key switch back to “0” and try again.

5.4 Level and Position

The first prompt asks you to level the incubator. **It is very important to level the unit both left to right and front to back.**

1. Place a bubble level across the top of the incubator (side to side).
2. Use the thin, 1/2 in. (1.25 cm) open-end wrench to adjust the leveling feet located at the base of the incubator.
3. Repeat steps 1 and 2, this time placing the bubble level on top of the incubator front to back.

Remember that after the water jacket is filled (Section 5.6) the incubator must be leveled again left to right and front to back.

When the incubator is level, press ▲ to advance to the next prompt.

5.5 Shelving, HEPA Filter

The next prompt asks you to install the shelves and the HEPA filter.

5.5.1 Shelves

The incubator shelves are fully adjustable. First install the side support walls and top duct. Then determine the location you want for each shelf and install the shelf brackets (refer to Figure 3).

1. Place the base pan with the hole for the humidity pan facing the front of the cabinet.
2. Place a shelf support wall on top of the base on the left side, with the indicator hole toward the front bottom of the unit. The curve of the support wall aligns with the curve of the chamber.
3. Install the top air duct, making sure that the circular hole is to the right directly under the HEPA filter fan.
4. Lean the right support wall against the right side of the chamber and slide it up carefully into vertical position under the top duct. The three parts should lock firmly into place. Do not install the HEPA filter (Section 5.5.2) until the shelf assembly is complete.
5. Position a shelf bracket in the slots on the wall, with the bottom pointing up and the side flange facing down. Then pop the shelf bracket up into the slots.
6. Install another shelf bracket in the same location on the opposite wall of the incubator.
7. Slide a shelf into the clips.

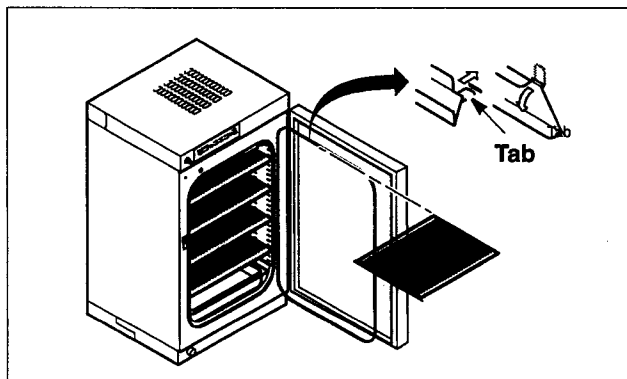


Figure 3. Shelving Detail

5.5.2 HEPA Filter

You can use a HEPA filter to remove airborne particulates from the chamber environment. The filter provided is 99.97% efficient with a 0.3 micron rating. It should normally be replaced every three months, more often if the chamber environment has a relatively high concentration of particulates.

To install the filter, place it in the hole in the top duct and twist, as shown in Figure 4.

When the shelves and filter are in place, press **▲** to advance to the next prompt

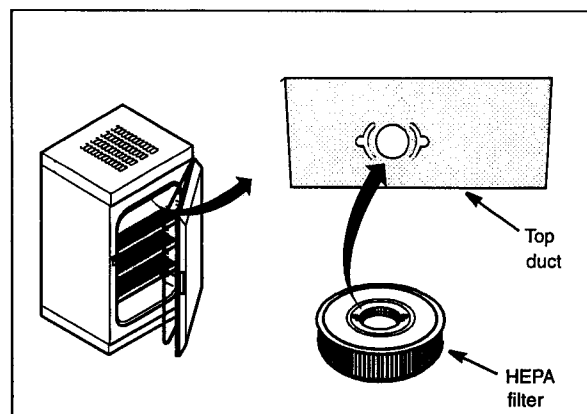


Figure 4. HEPA Filter

5.6 Water Jacket Fill

The next prompt asks you to fill the water jacket. Since water level is monitored automatically by the incubator control program, you will not see this prompt if the water level sensor detects that the jacket is already full.

Before starting to fill the water jacket, have a water source or 11 gallons of water available near the incubator. Also, make sure that the drain valve (located on the lower left side of the unit) is closed.

IMPORTANT NOTE: For double (stacked) units, always fill the bottom unit first.



WARNING! Over-filling the water jacket may result in damage to electronic components and can become hazardous. Avoid filling beyond the weep hole located near the upper left corner of the glass door.

The fill port is located on the front of the unit behind the upper left corner of the inner glass door. It is labeled **FILL**. To fill the water jacket, complete the following steps:

1. Locate the plastic bottle of water conditioning crystals, funnel, and length of 3/8 inch tubing supplied with the incubator.
2. Connect one end of the 3/8 inch tubing to the funnel.
3. Fill the plastic bottle of water conditioning crystals with warm water, replace the cap, and shake the bottle to dissolve some of the crystals.

Note: It is important that you use the entire bottle of crystals to treat the water in the water jacket. Not all of the crystals will be dissolved on the first try. Pour off the solution, add more warm water, cap the bottle and keep shaking the bottle until all the crystals are dissolved.

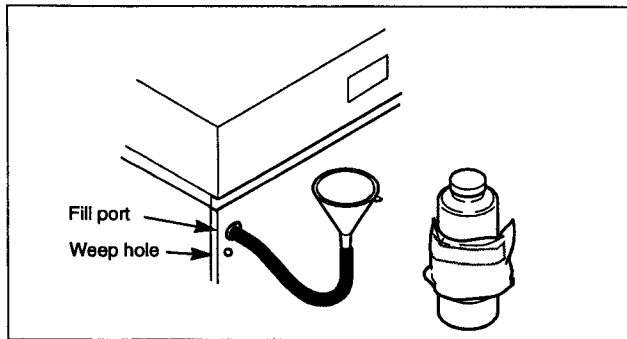


Figure 5. Water Jacket Fill

4. Open the outer door of the incubator and remove the fill port stopper located in the upper left corner (labeled FILL).
5. Slide the tubing to the fill fitting as shown in Figure 5.
6. Add approximately two gallons of *cool* tap water to the water jacket through the funnel provided.
 - *Always use cool tap water to fill the water jacket.* If you use hot water to fill the water jacket, temperature correlation will be impossible for days.
 - *Do not use deionized water to fill the water jacket.*
 - If the water jacket is too full, water will come out of the weep hole. If that happens, remove any excess water from the water jacket, using the drain valve at the bottom of the incubator (refer to Section 8.3 on page 14.)
7. Carefully pour about half the conditioning crystal solution into the funnel.
8. Add approximately two more gallons of water to the water jacket.
9. Carefully add the remainder of the conditioning crystal solution.
10. Continue to fill the jacket with cool tap water (approximately six gallons).
 - If the water jacket is too full, water will come out of the weep hole. If that happens, remove any excess water from the water jacket, using the drain valve at the bottom of the incubator (refer to Section 8.3 on page 14.)
11. Replace the fill port cap.
12. Close both incubator doors; when the water jacket is full, the program automatically advances to the next prompt and beeps.

5.7 Re-level Incubator

Level the incubator left to right and front to back (refer to Section 5.4 on page 3). press **▲** to advance to the next prompt.

5.8 Set Up CO₂ Supply

This step will be skipped if internal devices already detect adequate input pressure.

Two CO₂ gas connections, located at the rear of the unit, allow the incubator to be connected to two separate gas supplies. The incubator will automatically switch from an empty supply tank to a full one. If you intend to run the incubator using only one CO₂ gas supply, refer to the appendix "Tank Switcher Connections, Operations and Alternate Connections" at the end of this manual.

Note: *The required gas supply pressure is 15 PSI. Make sure the supply is available in the installation area.*

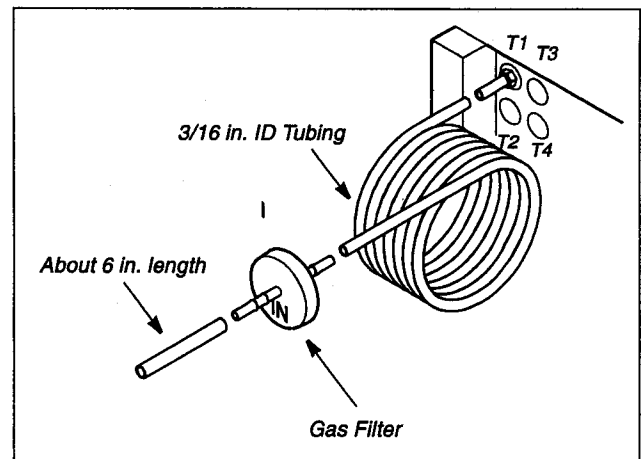


Figure 6. Gas Connections

To install the CO₂ connections, complete the following steps:

1. Be sure that you have the right size tubing (3/16 in. interior diameter).
2. Cut a small length (approximately 6 in.) from the supplied roll of 3/16 in. ID tubing and attach to the side marked "IN" on a high-quality input gas filter (refer to Figure 6). A 0.3 micron filter is supplied with the incubator.
3. Attach the opposite end of the short piece of tubing to the regulator on the gas supply.
4. Attach one end of the roll of tubing to the gas filter opposite the "IN" fitting, as shown in Figure 6.
5. Pull the cap off the gas connection port T1 at the rear of the incubator and attach one end of the tubing to the gas connection port T1. Keep the tubing length as short as possible to minimize pressure drop.
6. Repeat Steps 1-5 for the gas connection to port T2.
- 7.

Note: *Stacked units require separate gas connections. The proper gas connections for stacked units are shown in an appendix at the end of this manual.*

5.9 Set Up O₂ or N₂ Supply (Tri-Gas Units Only)

For tri-gas units, the gas you hook up at T3 and T4 depends on whether the ambient oxygen level is above or below the desired O₂ setpoint. It is very important to select the right gas depending on whether you are aiming for O₂ enhancement or depletion.

If the O₂ (oxygen) setpoint is *greater than* ambient, hook up O₂ supplies (enhancement mode).

If the O₂ setpoint is *less than* ambient, hook up N₂ (nitrogen) supplies (depletion mode).

In both case, hook up the gas connections in a similar way to the CO₂ connections described in Section 5.8. Use connections T3 and T4 as shown in Figure 6. The right connections to use will be shown in the display prompts.



WARNING! Never use oil to lubricate fittings used for O₂ connections. Oil easily combusts in the presence of high concentrations of oxygen.

5.10 Tank Switcher

All incubators have a tank switcher system built into each control compartment. This system is designed to monitor the pressure of the gas supply lines, switch to a full tank, and indicate on the display when a supply tank is empty. For this system to operate as intended, there need to be two separate gas supply lines for the gas inlet connections.

If only one gas supply line is available, follow the instructions in the Tank Switcher Connections appendix at the end of this manual.

When the gas supplies are properly connected and the supply is turned on, the display will indicate T1=F, T2=F, T3=F, and T4=F, and automatically advance to the next prompt. (T3 and T4 are displayed only for tri-gas units.)

5.11 RH Option: Water Connection

If you have Relative Humidity control (an RH model) the next prompt asks you to set up the water supply.

A copper tubing fitting is installed on the back of the incubator, on the upper right side.

1. Connect the end of your plastic tubing to the water supply.
2. Check all connections and make sure they are secure.

Use *distilled water* only, with a maximum input pressure of 30psi.

Press **▲** when the water supplies are properly connected and the supply is turned on and proceed to Section 5.12.

If you are using a humidity pan instead of the RH option, refer to Section 5.13 on page 7.

5.12 Setpoint Parameters

Once you have completed the previous installation steps, you will then be prompted to accept or adjust the values of several operating parameters. In each case, press the Increase or Decrease buttons to change a displayed value, press Mode when the displayed value is the one you want. The modifiable value is always the one that is flashing.

If you do not adjust a displayed parameter and 60 seconds elapse, the software will register the existing default value and move to the next parameter.

If you want to operate with all the factory-set defaults, press Mode repeatedly until you come to the end of the prompts.

The adjustable parameters are:

- Temperature (default 37°C)
- Warm alarm (default 40°C; cannot deviate from the temperature setpoint by less than 0.3°C)
- Cold alarm (default 34°C; cannot deviate from the temperature setpoint by less than 0.3°C)
- CO₂ setpoint (default 5%)
- High CO₂ alarm (default 6%; cannot deviate from the CO₂ setpoint by less than 1%)
- Low CO₂ alarm (default 4%; cannot deviate from the CO₂ setpoint by less than 1%)
- Humidity (RH control models only; default 0%)
- High humidity alarm (RH control models only; default 98%, cannot deviate from the humidity setpoint by less than 1%)
- Low humidity alarm (RH control models only; default 2%)
- O₂ setpoint (tri-gas models only; default is typical atmospheric, 20.9%)
- High O₂ alarm (tri-gas models only; default 23.9%; cannot deviate from the O₂ setpoint by less than 1%)
- Low O₂ alarm (tri-gas models only; default 17.9%; cannot deviate from the O₂ setpoint by less than 1%)

When you have finished adjusting the parameters, the screen will return the normal display (shown on the next page). An additional message will indicate that the stabilization period has begun (normally 11 to 12 hours).

During this initial stabilization period, no gas or water will be injected and you must leave the door closed.

5.13 Humidity Pan (non-controlled-RH Only)

If you are *not* using the R option (see Section 5.11 on page 6) you will use a humidity pan instead.

1. After you have entered the appropriate operating parameters (described in Section 5.12 on page 6) and completed the initial start-up procedure, *wait approximately eight hours* for the cabinet temperature to stabilize.
2. Fill the humidity pan with cold water and place it in the bottom of the chamber (refer to Figure 7 on page 7); then press **▲** to continue.

Note: *To retard microorganism growth, you can use 0.25 ml of Lysol Sanitizer or the equivalent (1:15,000 ratio) in the humidity pan. Do not use the water conditioning crystals. Test the Lysol Sanitizer for effects on cell growth prior to applying to the humidity pan.*

3. After installing the humidity pan, wait another four hours for stabilization. Your incubator will then be ready to operate.

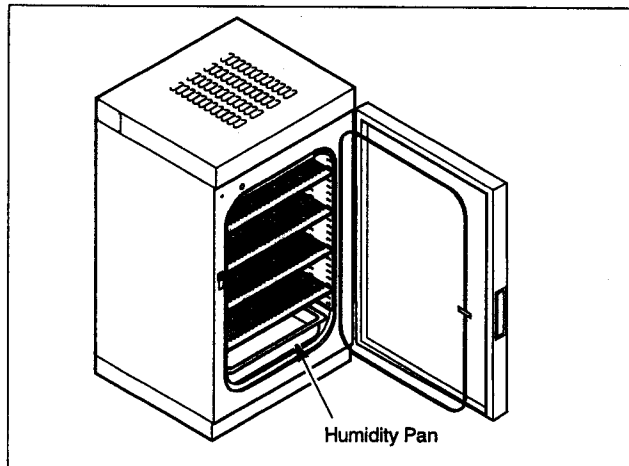


Figure 7. Humidity Pan

Note: *If you wish to use a passive humidity pan with an "R" model equipped for humidity control, refer to the appendix "Installation of Passive Humidity" at the end of this manual.*

6 Key Switch and Control Operation

6.1 Key Switch

To operate the incubator with alarms activated, be sure to turn the key switch all the way to the rightmost position (as shown in the figure below). To avoid nuisance alarms, work with the key switch in the "1" position during the set-up procedures described in Section 5.

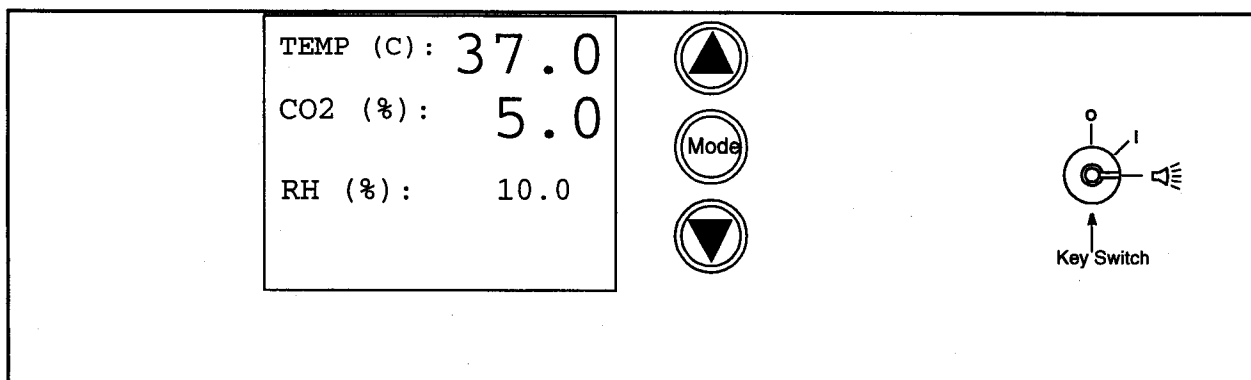


Figure 8. Control Panel, with optional RH display

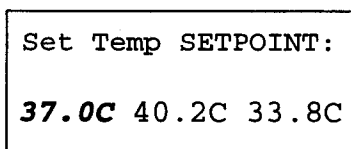
6.2 Control Panel Features

The control panel is located on the front top of your incubator.

Before loading and using your incubator, be sure to take some time to review the control panel functions.

The main display, during normal operation, shows: chamber temperature in degrees Celsius, as measured by the sensor inside the chamber; and percentage levels of carbon dioxide (CO₂), relative humidity (RH models only) and O₂ (tri-gas models only). When the word "alarm" is displayed instead of a normal value, an alarm or error condition is indicated. Note that alarm conditions are displayed only when the key switch is turned to the alarm position.

To change values, you enter programming mode by turning the key to the "1" position, pressing Mode, and holding until the display changes. When you are in programming mode (described in detail in Table 2) the main display changes to show the setpoint you are viewing and related alarm setpoints. For example:



Here the first value displayed is temperature setpoint; the next two values are the warm alarm and cold alarm setpoints. The flashing value is the one you can change using the increase and decrease buttons.

The Increase (▲) and Decrease (▼) pushbuttons are used to change setpoint values in programming mode and for various display functions.

The Mode pushbutton is used: to silence an audible alarm; to enter programming and service modes; and in combination with the other buttons for various display functions.

For full descriptions of display, programming, and service functions, refer to Tables 1, 2, and 3.

6.3 Display Functions

Table 1. Control Panel Display Functions

Function	Meaning	Sequence	Display
Normal operation	Default display while incubator is running	—	Display shows cabinet temperature, CO ₂ , Relative Humidity, O ₂ .
Cold excursion	Show coldest chamber temperature since last startup or reset	Press ▼	Display shows cold excursion while button is pressed.
Warm excursion	Show warmest chamber temperature since last startup or reset	Press ▲	Display shows warm excursion while button is pressed.
Mode	Silence audible alarm	Press Mode	Display shows current values, alarm or error field continues to flash.
Reset	Return to default display after excursion or alarm condition	Press ▲ and ▼ simultaneously	Excursion values are reset; display shows current values. Display flashes twice
Water temperature	Show water temperature as measured by sensor in water jacket	Press ▼ and Mode simultaneously	Display shows water temperature.

6.4 Setpoint and Alarm Programming Functions

To enter programming mode, turn the key to the “1” position, press Mode, and hold until the display indicates that you are changing to program mode. Pressing Mode repeatedly scrolls through the available functions. Whichever parameter you are currently changing, the display will automatically return to normal operating mode 30 seconds after the last entry. You can also exit programming mode by scrolling through all available functions and parameters using the Mode button. For a summary of alarm operation, refer to

Table 2. Setpoint and Alarm Programming Functions

Function	Programming Sequence
Adjust temperature setpoint	Enter programming mode by pressing Mode and holding for 5 seconds. On release, the current temperature setpoint value flashes in the display; use ▼ and ▲ to adjust it.
Adjust warm alarm setpoint	Press Mode again. The current warm alarm setpoint value then flashes in the display; use ▼ and ▲ to adjust it. There is a minimum deviation of 0.3° C between each alarm setpoint and the temperature setpoint.
Adjust cold alarm setpoint	Press Mode again. The current cold alarm setpoint value then flashes in the display; use ▼ and ▲ to adjust it. There is a minimum deviation of 0.3° C between each alarm setpoint and the temperature setpoint.
Adjust CO ₂ setpoint	Press Mode again. The display changes to display CO ₂ setpoint and high and low CO ₂ alarm setpoints, with the operating CO ₂ setpoint flashing. Use ▼ and ▲ to adjust it.
Adjust CO ₂ high alarm setpoint	Press Mode again. The current high CO ₂ alarm setpoint then flashes; Use ▼ and ▲ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating CO ₂ setpoint.
Adjust CO ₂ low alarm setpoint	Press Mode again. The current low CO ₂ alarm setpoint then flashes; Use ▼ and ▲ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating CO ₂ setpoint.
Adjust relative humidity setpoint (RH option only)	Press Mode again. The display changes to display relative humidity setpoint and high and low RH alarm setpoints, with the operating RH setpoint flashing. Use ▼ and ▲ to adjust it.
Adjust RH high alarm setpoint (RH option only)	Press Mode again. The current high RH alarm setpoint then flashes; Use ▼ and ▲ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating RH setpoint.
Adjust RH low alarm setpoint (RH option only)	Press Mode again. The current low RH alarm setpoint then flashes; Use ▼ and ▲ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating RH setpoint.
Adjust O ₂ setpoint (tri-gas only)	Press Mode again. The display changes to display O ₂ setpoint and high and low O ₂ alarm setpoints, with the operating O ₂ setpoint flashing. Use ▼ and ▲ to adjust it.
Adjust O ₂ high alarm setpoint (tri-gas only)	Press Mode again. The current high O ₂ alarm setpoint then flashes; Use ▼ and ▲ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating O ₂ setpoint.
Adjust O ₂ low alarm setpoint (tri-gas only)	Press Mode again. The current low O ₂ alarm setpoint then flashes; Use ▼ and ▲ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating O ₂ setpoint.
Set Temp offset	Press Mode again. The display changes to display temperature offset (for calibration purposes). Use ▼ and ▲ to adjust it. Do not adjust unless you have followed the calibration procedures described in Section 6.8.
Set CO ₂ offset	Press Mode again. The display changes to display CO ₂ offset (for calibration purposes). Use ▼ and ▲ to adjust it. Do not adjust unless you have followed the calibration procedures described in Section 6.8.

6.5 Service Mode Parameters

From any display in programming mode, you can enter service mode by pressing Mode and holding for 5 seconds. Pressing Mode repeatedly scrolls through the available functions. For any modifiable parameter you can use ▼ and ▲ to adjust the value. The display automatically returns to normal operating mode 30 seconds after the last entry or after scrolling through all available functions and parameters.

Table 3. Service Parameters

Parameter	Notes
Network Adr	Network address (for RS485 applications). Default 238.
SN	Serial number (full number needed for RS485 applications).
Check Sum	Checksum to identify firmware version
Ambient Temp	Ambient temperature in °C, as measured by a sensor in back of the cabinet.
Water Temp	Water jacket temperature in °C.
Temp Offset	For temperature setpoint calibration; default 0°C.
RH Offset (RH option only)	For relative humidity setpoint calibration; default 0%.
CO ₂ Offset	For CO ₂ setpoint calibration; default 0%.
O ₂ Calibration (tri-gas only)	For O ₂ setpoint calibration; default 0.

In service mode, data and bar graphs are also displayed showing power usage, for diagnostic purposes.

6.6 Restore Function

When the incubator is first powered up, you can restore all factory-set program parameter defaults as follows:

Function	Sequence	Notes
Restore program defaults	Press ▲ and ▼ simultaneously, hold for five seconds	Restores original (factory-set) values of all program parameters; clears excursion values. This is useful for tracking recent excursions (for example, minimum and maximum operating temperatures within a one-day period).

6.7 Alarm Summary

This section describes the alarm functions in detail.

Some important general notes:

- Alarms are activated only when the key switch is turned to the alarm position.
- Audible alarms may be silenced at any time by pressing MODE; in that case a full ringback (not a chirp) will occur in 15 minutes. When audible alarms are no active, the ringback condition will clear automatically. Note, however, that has-been alarms can still be active.
- 'Has-been' alarms (indicating past alarm conditions) may be cleared by pressing ▲ and ▼ simultaneously. Be careful, however, because this action also clears temperature excursions: you may want to view excursions before clearing has-been displays.

The following table describes all alarm functions. Not all alarms are available on all units: for example, O₂ alarms are only relevant to tri-gas units.

Table 4. Incubator Alarm Functions

Alarm	Visual	Audible	Remote	Has-been	Hysteresis	Notes
Temperature Warm	x	x	x	x	0.2° C	
Temperature Cold	x	x	x	x	0.2° C	
CO ₂ High	x	x	x	x	0.0%	
CO ₂ Low	x	x	x	x	0.0%	Visual alarm is immediate but audible, remote, and has-been are delayed 15 minutes
O ₂ High	x	x	x	x	0.0%	
O ₂ Low	x	x	x	x	0.0%	Visual alarm is immediate but audible, remote, and has-been are delayed 15 minutes
RH High	x	x	x	x	0.0%	
RH Low	x	x	x	x	0.0%	Visual alarm is immediate but audible, remote, and has-been are delayed 30 minutes
Ambient Warm	x					
Ambient Cold	x					
Power Fail	x	x	x	x		If the key switch is not in the alarm position, the display will still be dimmed for backup battery conservation.
Add Water	x	x	x			Checked every 2 seconds and displayed every 4 seconds
HEPA Reminder	x					Will display for 18 hours, then clear automatically
Battery Low	x					Checked every 4th, 12th and 20th hour
Door Open	x	x	x			If the door is open for 3 minutes, mute will be interrupted
Tank 1 CO ₂ Main	x	x	x			Audible and remote alarms active only when both tanks are empty, else visual only
Tank 2 CO ₂ Backup	x	x	x			
Tank 3 O ₂ /N ₂ Main	x	x	x			
Tank 4 O ₂ /N ₂ Backup	x	x	x			

6.8 Calibration (Optional)

6.8.1 CO₂ Measurement and Calibration

This method uses an instrument, such as the Fyrite, to read the actual CO₂% in the chamber.

Samples of the chamber CO₂ concentration can be taken through the sample port in the center of the inner glass door. The display can be changed to agree with the measured reading. The factory standard method, using traceable gas standards, assures an accuracy of $\pm 0.2\%$. The Fyrite instrument obtains $\pm 0.5\%$ accuracy.

Note that if you are using a Fyrite, you will need to order this part separately.

To use the Fyrite for CO₂ concentration measurement, complete the following steps:

1. Wait at least 15 minutes after the CO₂ level arrives at setpoint before attempting any concentration measurement.
2. Make sure that the wick in the Fyrite sample tube is moist and make sure that the tubing is in good condition (no cracks or cuts).
3. Hold the Fyrite upright and away from your face. Depress the plunger valve briefly to vent the Fyrite and release the valve.



WARNING! Never depress the plunger valve when the Fyrite is in the inverted position. Doing so causes fluid, which is corrosive and contains poisonous elements, to spill. Refer to the MSDS sheet contained in the Fyrite instruction packet for additional information.

4. Invert the Fyrite, holding it at a slight angle to drain the fluid into the top reservoir.
5. Turn the Fyrite up to a 45 degree angle momentarily to allow flow into the bottom reservoir.
6. Hold the Fyrite completely upright and away from your face. Depress the plunger valve briefly and release the valve.
7. Loosen the locknut at the rear of the scale. Slide the scale until the top of the fluid column lines up with zero on the scale. Tighten the locknut.

Note: *When setting zero, hold the Fyrite vertically and level with your eyes while sighting across the scale to the top of the fluid column. Use this same procedure for adjusting zero and reading percent CO₂.*

Note: *The sample port stopper must be closed in place in order to close the outer door.*

8. Remove the plug from the grommet in the glass door, and insert the open end of the tube through the opening in the grommet. In some instances it may be easier to use a metal tube at the end of the Fyrite.
9. Holding the Fyrite in the upright position, place the sampling rubber connector tip over the plunger valve on the Fyrite. Purge the sample line by squeezing the aspirator bulb twice, then depress the plunger valve firmly with the connector tip. Squeeze and release the aspirator bulb 18 times. During the 18th squeeze and with bulb held deflated, release the connector tip and the plunger valve.

Note: *Always hold the Fyrite by the fins only to prevent warming of the Fyrite fluid during analysis.*

10. Invert the Fyrite *slowly* until the fluid drains into the top reservoir, then turn the Fyrite upright to drain the fluid into the bottom reservoir. Avoid creating foam in the fluid. Repeat this step once.
11. Briefly hold the Fyrite at a 45 degree angle to allow the fluid to drain into the bottom reservoir.
12. Hold the Fyrite completely upright and immediately read the CO₂ percent on the scale at the point corresponding to the top of the fluid column.
13. Wait a few minutes, then repeat the entire procedure (steps 3 through 12) once to confirm the reading.

To offset the CO₂% level, refer to Section 6.4 on page 9.

6.8.2 Temperature Correlation

The factory standard method of temperature calibration uses instruments with an accuracy of $\pm 0.1^\circ\text{C}$ or better. Take the temperature measurement in the center of the chamber. To offset the temperature, refer to Section 6.4 on page 9.

6.9 Remote Alarm Connection

Terminal strips for remote alarms are located on the back of the control housing. The contacts are not powered from internal circuits. These terminals provide normally open or normally closed contacts for switching remotely powered alarms.

7 Control Systems Theory

7.1 Temperature Control System

Laboratory CO₂ Incubators have a "jacket" between the incubator chamber and the exterior wall of the unit. In water-jacketed incubators, the jacket is filled with water.

Interior chamber temperature control is maintained by two sensors. One sensor is located in the jacket and the other sensor is located in the chamber air. Both sensors constantly signal the electronic circuitry. The chamber air provides a reference point while the jacket is being controlled. This circuitry recognizes that jacket temperature is very slow to react to any change in either ambient or chamber temperature but the chamber temperature can change very rapidly due to door opening.

For example:

The chamber inner door is opened. The chamber air sensor immediately signals a large drop in temperature but the control recognizes that, unless there is a corresponding (smaller) drop in jacket temperature, there is no need to increase the heat. The system does nothing until sufficient time passes to measure how fast the chamber air temperature is rising to meet the jacket temperature after the door is closed. Heat is applied to the jacket in short bursts. The rate of heat application changes as the circuit monitors the two sensors. This control scheme is extremely accurate and stable, with the ability to control within $\pm 0.2^{\circ}\text{C}$ of the setpoint.

7.2 Overtemperature Monitoring System

This system is activated whenever the key is in the alarm position and the chamber air sensor detects a temperature above the overtemperature setpoint, which should be set no closer than 0.3°C above the chamber temperature. When the system is activated, the jacket heater is turned off and both audio and visual alarms are activated. Control is now effectively switched to the overtemperature monitoring system. The overtemperature sensor is the chamber air sensor which also provides the signal for the digital display on the control panel.

7.3 Door Heat System

Heating the inner surface of the outer door with a low wattage, large area heater provides enough radiant heat to the glass door to control condensation. The micro-processor control operates the door heater.

8 Maintenance

8.1 Cleaning

The incubator can be easily cleaned and disinfected in about 30 minutes.

Be sure to use an appropriate disinfectant solution: Roccal II; its Lysol equivalent, 5 milliliters per liter; or O-Syl in a one percent solution. *You should always dilute disinfectants with sterile, distilled water.*



CAUTION! Before using any cleaning or decontamination method except for those recommended in this manual, contact Technical Service to verify that you will not damage the equipment.



CAUTION! Do not use strong alkaline or caustic agents, which can cause corrosion, rust and pitting of stainless steel surfaces. Stainless steel is corrosion-resistant but not corrosion-proof.



CAUTION! Do not use sodium hypochlorite solutions such as Purex and Clorox. These can also cause corrosion and pitting of stainless steel.



CAUTION! Do not use steel wool pads such as Brillo; they deposit carbon particles in the chamber.

When cleaning stainless steel, use the mildest cleaning procedure that will do the job effectively. To avoid marring the surface, always rub in the direction of the finish polish lines.

Do not use aromatic solvents to clean the cabinet interior: residues could cause contamination of the cabinet environment.



CAUTION! When cleaning the incubator, be sure to avoid getting the sensors wet.

To clean and disinfect your incubator:

1. Remove the shelves, support walls and pans.
2. Clean all interior surfaces with the disinfectant solution using a clean sponge.
3. Rinse the interior surfaces at least twice with sterile distilled water.
4. Clean the inner door gasket thoroughly.
5. Clean the inside of the glass door with the disinfectant solution, then rinse twice with sterile distilled water or an autoclave.
6. Clean the shelves, support walls and pans with disinfectant and rinse thoroughly with sterile distilled water.
7. Wipe down all disinfected surfaces with an alcohol solution.



CAUTION! Alcohol is volatile and flammable. Use only in a well-ventilated area removed from open flames and other heat sources. Allow sufficient time for fumes to dissipate before using cleaned components.

8.2 CO₂ Filter Replacement

You should replace the CO₂ filter at least once every three months. To replace the CO₂ filter:

1. Turn the main power switch to OFF.
2. Turn the gas supply (or supplies) to OFF.
3. Remove the tubing from both ends of the gas filter.
4. Note the flow direction on the filter. The side marked IN points to the gas supply. Install the new filter onto the tubing connected to the incubator and the tubing connected to the gas supply (refer to Section 4.5 on page 2 and Figure 6 on page 5).
5. Turn the gas supply (or supplies) to ON.
6. Turn the main power switch to ON.

8.3 Draining the Water Jacket

A drain valve is located on the bottom left side of the unit. To drain the water jacket:

1. Turn the main power switch to OFF.
2. Run a flexible plastic drain line to the nearest floor drain or a large container.

Note: *The jacket holds approximately 11 gallons of water. Make sure that the floor drain or container can accommodate that amount of water.*



CAUTION! Water will rush out of the incubator rapidly. Make sure that one end of the drain line is located in a floor drain or large container before connecting the other end of the drain line to the drain fitting.

3. Attach the drain line to the water drain fitting on the lower left side of the incubator; this allows the jacket to drain.
4. Open the valve. Removing the fill port stopper will make the water jacket drain more quickly.

8.4 Changing the HEPA filter

If you are using a HEPA filter, you should change it every three months, or more frequently if you have a high concentration of particulates in your environment.

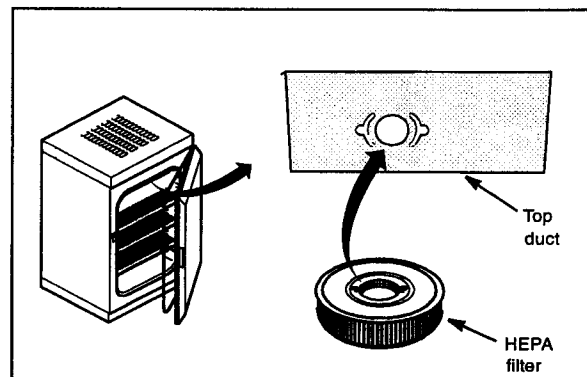


Figure 9. HEPA Filter

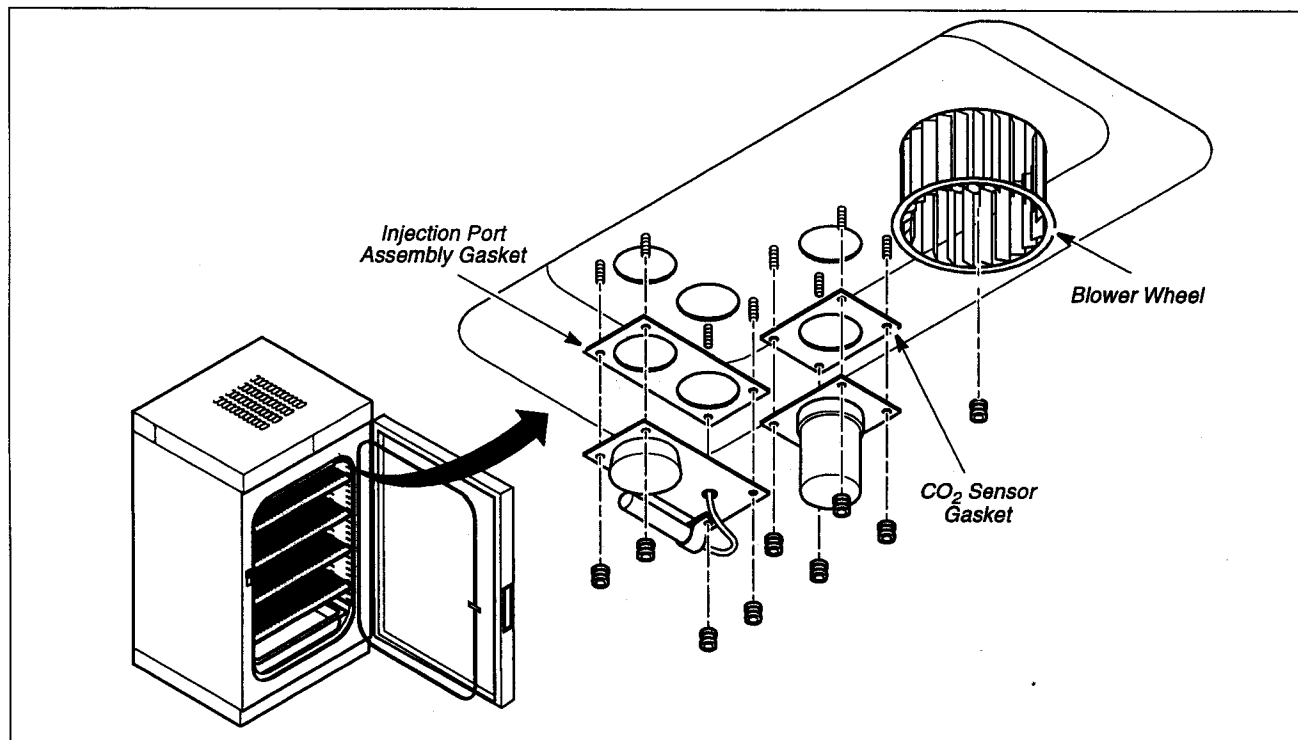


Figure 10. Top Duct Components

8.5 Decontamination Kit

The decontamination kit provided with your incubator includes:

- a replacement blower wheel
- a CO₂ Sensor gasket
- and Injection Port Assembly gaskets.

To install replacement components (shown in Figure 9):

1. Turn off the main power supply by unplugging the service cord.
2. Turn the gas supply (or supplies) to OFF.
3. Remove the shelves and shelf brackets.
4. Slide one duct wall bottom toward the center of the incubator until it disengages from the top duct.



CAUTION! The top duct will drop down when the side wall is disengaged.

5. Remove the duct wall, the top duct, and the other duct wall.
6. Remove the blower wheel by carefully pulling firmly in a downward direction until the wheel slides off the motor shaft.
7. Replace the blower wheel with the one provided in the decontamination kit. Make sure that the blower wheel spins freely and does not come into contact with the motor mounting screws.
8. Carefully remove the thumbnuts from the sensor and injection plates, allowing to hang freely from the ceiling of the incubator. Remove one plate at a time.
9. Carefully disconnect the wiring connectors or tubing from the plates.

10. Remove and discard the gaskets and replace them with the ones provided in the decontamination kit.
11. Replace the plates.
12. Reinstall the shelves and shelf supports.
13. Turn the main power switch to ON.

8.6 Fuses

The fuses used in this incubator are located on the power supply board and should only be replaced by a qualified technician.

The F1 and F2 fuses are Type "T", rated at 120V/6A or 230VAC/3A.

The F3 and F4 fuses are Type "T", rated at 120V/500mA or 230VAC/300mA.

Refer to the Replacement Parts List on page 19 for service part numbers.

8.7 Door Seal Check

To check the door seal, complete the following steps:

1. Open the inner glass door.
2. Insert a strip of paper (a couple of inches wide) between the door gasket and the cabinet flange and close the door.
3. Slowly pull the paper strip from the outside. You should feel some resistance.
4. Repeat this test at 4 inch (10 cm) intervals around the door. If the door does not seal properly, call your Technical Service representative: the gasket needs to be adjusted or replaced.

8.8 Moving the Incubator

If you need to move the incubator, it is recommended that you drain the water jacket first. This will eliminate excess weight and reduce the risk of damage to the unit and/or personal injury.

8.9 Replacing the Alarm Battery

The tools needed to replace the alarm battery are a Phillips head screwdriver, a flat screwdriver, and a 1/4" wrench.

To replace the battery:

1. Turn the key switch to the OFF position.
2. Disconnect electrical power to the incubator.
3. Access the inside of the control compartment by removing two screws at the bottom of the control panel, located about four inches from each corner.
4. Pull on the control panel to slide the control compartment away from the cabinet.
5. The alarm battery is located at the front of the control compartment.
6. Carefully disconnect each of the two wires from the battery terminals, noting the wire color and terminal markings. Red goes to + and black to -.
7. Remove the old alarm battery and bracket from the control compartment.
8. Install the new battery and bracket.
9. Fasten the bracket to the control compartment using the four original mounting screws.
10. Connect the two wires to the appropriate terminals.
11. When you slide the control compartment back into the cabinet, carefully observe the wiring harnesses in the center and push them aside.
12. Fasten the control compartment using the two screws near the bottom corners.
13. Carefully reconnect electrical power to the incubator.
14. Turn the key switch to the ON position and check display and fan motor operation.

Note: *The display may take up to eight hours to clear the "Battery Low" message.*

8.10 Preventive Maintenance Schedules

Table 5. Suggested Preventive Maintenance Schedule

Suggested Interval	Maintenance Task
Daily	<p>Visually inspect the temperature and gas displays to make sure they match setpoints.</p> <p>Visually inspect the humidity display (if applicable) to make sure it is reading correct chamber humidity levels.</p> <p>Visually inspect chart recorder readings (if applicable) to make sure that the recorder is rotating at the correct speed and that the readings match the displays.</p>
Weekly	<p>Correlate the CO₂ display with an independent analyzer.</p> <p>Check the humidity pan level (if used) and top off if necessary.</p> <p>Check the high pressure gauges on CO₂ tanks to ensure adequate supplies.</p>
Monthly	<p>Correlate the temperature display with a calibrated thermometer in the geometric center of the air chamber.</p> <p>Inspect the power cord and the internal power outlet for signs of excessive wear (cracks, exposed wires, burn marks on the plug, etc.).</p> <p>Check the chart recorder wiring for excessive wear (if applicable).</p> <p>Check all gas lines and connections for signs of excessive wear (cracks, discoloration, kinks, etc.)</p>
Every 6 months	<p>Remove the interior shelving system and check each component for signs of wear, corrosion, and/or contamination.</p> <p>Check the sensors located at the top of inner chamber for signs of wear, corrosion and/or contamination.</p> <p>Check air filters for discoloration and replace if necessary.</p>
Yearly	<p>Thoroughly disinfect the interior and autoclave all removable parts.</p> <p>Thoroughly clean all exterior surfaces.</p> <p>Install a new decontamination kit (part 6990).</p> <p>Drain the water jacket and refill with clean tap water; repeat until the water looks clean coming out. Then refill the jacket with cool tap water, using the water conditioning crystals (part 6326).</p> <p>Have a certified service technician check the electrical system and perform a board level recalibration of the gas and temperature systems.</p>

9 Troubleshooting



WARNING! Troubleshooting procedures involve working with high voltages which can cause injury or death. Troubleshooting should only be performed by trained personnel.

Table 6. Troubleshooting Procedures

Symptom	Solution
General	
No display on control panel.	<p>No power:</p> <ul style="list-style-type: none"> The service cord is loose in the outlet. Check the outlet for power. Check the circuit breaker in the power panel. Make sure the circuit serving the incubator is a dedicated circuit. Reset the circuit breaker. Check that the main power switch on the incubator is turned on.
Water leaking from the cabinet.	<p>Water jacket is overfilled:</p> <ul style="list-style-type: none"> Visually check the water level. Drain some water from the water jacket.
Temperature display disagrees with setpoint.	<ul style="list-style-type: none"> Check the jacket water level. The water must be up to the weep hole. Allow sufficient time for stabilization. Make sure door was not recently opened. If door was opened, allow stabilization time. Make sure power did not fail recently. If power failed, allow stabilization time after power is restored.
High temperature alarm flashes.	<ul style="list-style-type: none"> Check the incubator location. Do not open the door more frequently than at five minute intervals. Set the operating temperature setpoint at least 5°C above the maximum ambient temperature.
Oxidation forming on interior surfaces.	<ul style="list-style-type: none"> Do not wipe surfaces with a Clorox solution greater than 10%. Always wipe surfaces with a mild detergent and water to remove Clorox residue. Never use a Brillo pad on interior surfaces. Use a non-metallic pad (e.g., Scotch-brite). Corrosive culture medias can cause oxidation.
Add-Water indicator is illuminated and alarm is sounding.	<ul style="list-style-type: none"> Do not fill the incubator with de-ionized water. Use tap or distilled water. Check the floor for evidence of a leak. Make sure the incubator is level. Make sure that the valve is closed. Check that water is visible at the weep hole. If not, add water.
Condensation	
Humidity is too low.	<ul style="list-style-type: none"> Close the glass door for at least 30 minutes. Make sure that the humidity pan is stainless steel, has at least 150 square inches of water surface area, and more than one inch of water depth. Check the water level in the humidity pan. Check the jacket water level. Make sure the glass door seals properly. Use the door seal procedure to check the inner door seal.
Too much condensation on glass door.	<ul style="list-style-type: none"> Outer door gasket is not sealing properly or is damaged. Make sure that the humidity pan cover is in place.
Condensation on inside of outer door.	<ul style="list-style-type: none"> Door seal is not tight.
Condensation on interior walls/ceiling.	<ul style="list-style-type: none"> Check the water level. Make sure the incubator is level. Check the incubator location. Make sure the glass door seals properly. Use the door seal procedure to check the inner door seal. Make sure that the humidity pan cover is in place.
Temperature Control	
Temperature display is drifting.	<ul style="list-style-type: none"> Check the incubator location.
Inside temperature is not equal to the display temperature.	<ul style="list-style-type: none"> Verify the calibration procedure. Check the incubator location.
Temperature not controlling at setpoint.	<ul style="list-style-type: none"> Close the doors for a minimum of 30 to 40 minutes. Check the setpoint.
Temperature is over-shooting during the day.	<ul style="list-style-type: none"> Do not open the door more frequently than at five minute intervals. Check the incubator location.

Symptom	Solution
CO₂ Gas Control	
CO ₂ display indicates more than 0.2 above setpoint.	<ul style="list-style-type: none"> • Check the setpoint. • Check the incubator location.
CO ₂ display indicates more than 0.2 below setpoint.	<ul style="list-style-type: none"> • Check the setpoint. • Check the CO₂ gas supply. • Replace the gas input filter. • Check the gas tubing for dirt and replace if necessary.
CO ₂ recovery takes too long.	<ul style="list-style-type: none"> • Make sure a gas supply filter is installed. • Replace the gas input filter. • Check the gas tubing for dirt and replace if necessary.
CO ₂ display is drifting.	<ul style="list-style-type: none"> • Close the glass door for at least ten minutes. • Check the CO₂ gas supply.
CO ₂ concentration measurement does not equal the display.	<ul style="list-style-type: none"> • Check the setpoint. • Verify Fyrite analyzer operation.
CO ₂ concentration (as measured by a gas analyzer) is less than the setpoint.	<ul style="list-style-type: none"> • The gas pressure regulator is set too low (should be 15 psi). • The door seal is not tight. • The gas setpoint is incorrect. • CO₂ concentration measured too soon after door closing. • Make sure power did not fail recently. If power failed, allow stabilization time after power is restored.
CO ₂ concentration (as measured by a gas analyzer) is greater than the setpoint.	<ul style="list-style-type: none"> • The gas percentage is incorrectly set. • The CO₂ injection solenoid is stuck open.
CO ₂ setpoint and display agree. Fyrite analyzer reads lower.	<ul style="list-style-type: none"> • Fyrite not zeroed. Check the Fyrite Operation manual • Wool filter in Fyrite is dry. • Fluid in Fyrite needs to be changed. • Chamber absolute humidity has decreased.
CO ₂ setpoint and display agree. Fyrite analyzer reads higher.	<ul style="list-style-type: none"> • Fyrite not zeroed. • Chamber absolute humidity has increased. • CO₂ control is incorrectly zeroed.
CO ₂ alarm and light are activated. Can be silenced.	<ul style="list-style-type: none"> • CO₂ level has deviated beyond alarm setpoints. • CO₂ supply has been interrupted.
Digital CO ₂ display and Fyrite read more than one percent different from setpoint. CO ₂ alarm is not activated.	<ul style="list-style-type: none"> • Defective alarm. • Alarm circuit is not active (check key position). • Defective CO₂ sensor or control.
Digital CO ₂ display and Fyrite read 0% CO ₂ . Setpoint is okay. CO ₂ alarm and light are activated. CO ₂ inject light is on.	<ul style="list-style-type: none"> • Loss of CO₂ supply. • Defective CO₂ solenoid. • Blocked CO₂ inline filter.
Digital CO ₂ display locks up. Shows some random number or a decimal point.	<ul style="list-style-type: none"> • Defective display board. • Defective output to display board. • Faulty interconnect wiring.
Digital CO ₂ display will not go to zero no matter how long the inner door is left open.	<ul style="list-style-type: none"> • Defective CO₂ sensor. • Defective CO₂ control.
Display flickers badly or counts up or down three or four tenths of a percent.	<ul style="list-style-type: none"> • Defective display board. • Excessive RFI or EMI near cabinet.
CO ₂ setpoint cannot be changed.	<ul style="list-style-type: none"> • Check key position (should be "1"). • Defective CO₂ control. • Defective CO₂ sensor.
CO ₂ overshoots badly.	<ul style="list-style-type: none"> • Defective air circulator. • CO₂ control defective. • CO₂ inlet pressure is too high. • CO₂ solenoid valve is stuck.
CO ₂ recovers extremely slowly.	<ul style="list-style-type: none"> • Plugged orifice in CO₂ solenoid valve. • Inline CO₂ filter is partially blocked. • Leak around the sensor gasket. • Leak around the port cover gasket. • CO₂ inlet pressure is too low. • Blockage in the CO₂ injection line.
Actual CO ₂ is higher than the setpoint and display. Re-zeroing helps, but the symptom returns.	<ul style="list-style-type: none"> • Defective CO₂ sensor. • Incorrect calibration of CO₂ control. • Defective solenoid valve.

Symptom	Solution
CO ₂ alarm sounds while CO ₂ level is controlling at setpoint.	<ul style="list-style-type: none"> Excessive EFI or EMI near cabinet. Faulty grounding circuit. Defective CO₂ control.
CO ₂ setpoint changes by itself.	<ul style="list-style-type: none"> Defective main control board. Defective CO₂ control. EMI or RFI.

10 Replacement Parts

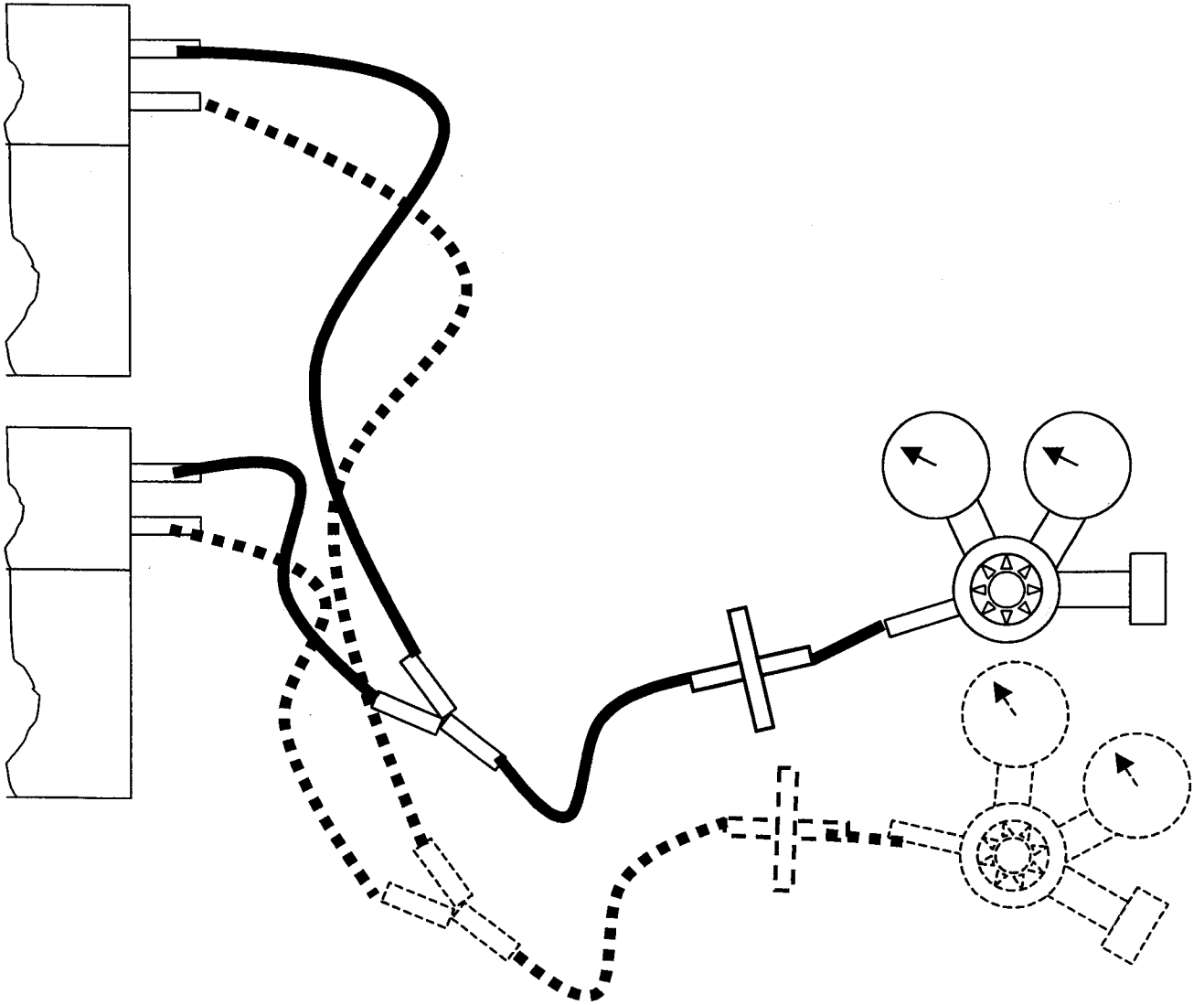
Part Number	Description	UM	Quantity
21487H01	Motor, Fan 110/120V 50/60Hz	ea	1
33862G05	Valve, Inject Assembly	ea	1
305819H01	Gasket, Outer Door, 3 cu.ft. models	ea	1
305597H01	Gasket, Outer Door, 5.8 cu.ft. models	ea	1
309115G02	Glass, Inner Door, 3 cu.ft. models	ea	1
309115G01	Glass, Inner Door, 5.8 cu.ft. models	ea	1
29323H01	Gasket, Inject/Sensor Plate	ea	1
305673H01	Hinge, Glass Door, Top	ea	1
305673H02	Hinge, Glass Door, Bottom	ea	1
309109G01	Outer Door Assembly, DOM	ea	1
305172H01	Board, Display	ea	1
302268H02	Board, Power	ea	1
31727G01	Rust Inhibitor Water Conditioner	ea	1
31853G01	Gas Sensor Assembly (T/C)	ea	1
301935G01	Gas Sensor Assembly (I/R)	ea	1
309159H01	Thermistor Sensor with Cable - Water jacket	ea	1
309159H02	Thermistor Sensor with Cable - Display	ea	1
38747H01	Foot, Leveling	ea	4
86764G02	Latch Assembly, Glass Door	ea	1
305859H01	Heater, Door 120V, 3 cu.ft. models	ea	1
305860H02	Heater, Door 120V, 5.8 cu.ft. models	ea	1
86832H01	Wheel, Blower #250X125C181C1	ea	1
86836H01	Gasket, Sensor CO ₂ Inc	ea	1
86961H01	Receptacle, Snap-in 125V Eagle #49BK	ea	1
87333H01	3/16 in. ID and 5/16 in. OD Clear Tubing	ft	as req'd
88673H03	Gasket, Continuous Inner Door	ft	8
39297H02	Fuse, Type T, 120V @6A, power board F2	ea	2
309327H02	Fuse, Type T, 120V @500mA, power board F4	ea	2
60678H02	Battery, 12V sealed lead acid	ea	1

11 Accessories

Description	Part No.
Cleaning, Sanitizing Agents	
Lysol Sanitizer, 3.5 liter bottle	6314
Amphyl Spray, disinfecting agent, 12 cans/case	6315
Amphyl, 3.5 liter bottle	6316
General	
Maintenance/Decontamination Kit	6990
Gas Filter, in-line, disposable bacteriological filter.	6320
Humidity Pan	6322
REplacement HEPA Filter Kit (4 filters)	6951
Water Conditioning Crystals, for one water-jacketed chamber	6326
Gas Analyzers, including aspirator and case	
Fyrite CO ₂ /O ₂	6309
Fyrite CO ₂	6310
Replacement Fluid, CO ₂ , one bottle	6312
Gas Regulators	
CO ₂ Gas Regulator, two-stage, CGA fitting 320	6317
Shelves, stainless steel with channel brackets	6305

Gas Connections to Stacked Incubators

Use 'Y' or 'T' Connectors to split a gas supply line that is needed at top and bottom stacked incubator chambers. Second gas supply for second tank connections with tank-switcher system. See the illustrations.



Tank Switcher Connections, Operations and Alternate Connections

CO2 and Tri-Gas Incubators have a Tank Switcher System built into each control compartment. This system is designed to monitor the pressure of the gas supply lines, switch to a full tank and indicate on the display when a supply tank is empty. For this system to operate as intended, the gas inlet connections should have two separate gas supply lines.

In some instances a single supply line of a gas is available. In this case it is recommended to make the following connections WITH the attached WARNINGS.

Connections to Tank Switcher with Single Gas Supply Line

WARNINGS:

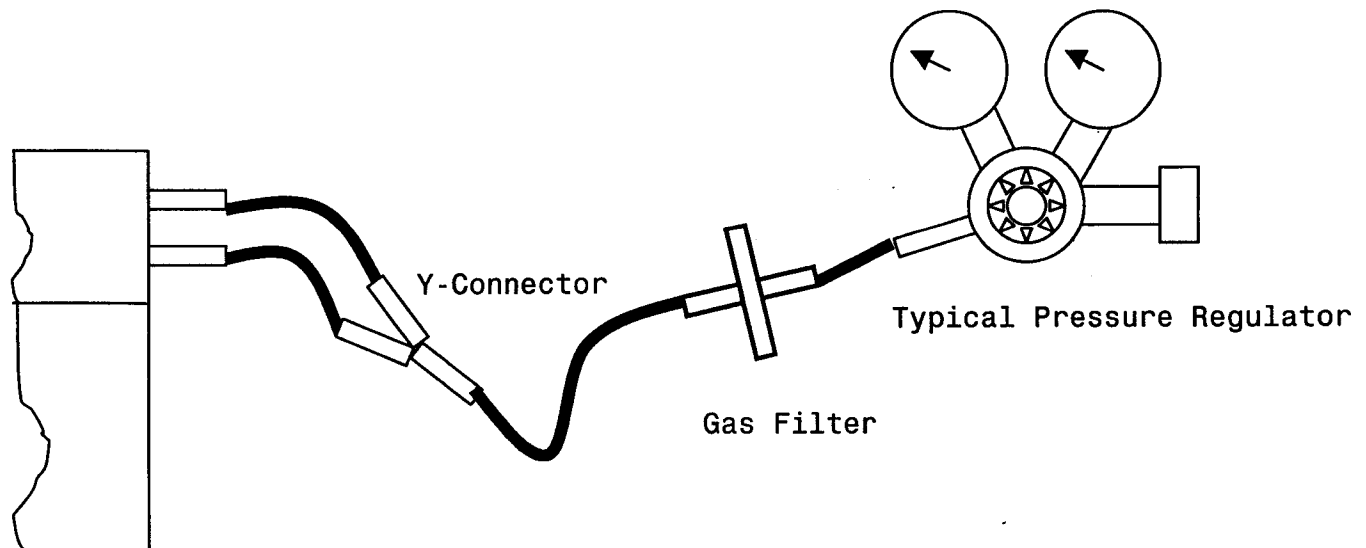
- When this only supply tank empties, the chamber will retain close to the gas setpoint for about 1 hour. After the first hour the chamber environment will continue degrade to ambient levels, eventually endangering the product.

RECOMMENDATIONS:

- Monitor the high pressure gage if less than 50 psi and expect to change to a full tank before leaving for a weekend or extended periods.
- Have a full supply tank available for quick replacement.

Connect as shown below, using a Y-Connector designed for the 3/16" ID tubing supplied with the Incubator.

Up to four Incubator chambers can be connected from the same regulator, using Y-Connectors to split the supply gas lines as needed, with the rule that a maximum of ten feet of 3/16" ID tubing from the regulator to the Incubator.



Side View of Cabinet Rear
Showing Gas Inlets

Installation of Passive Humidity in Humidity Controlled "R" Incubator

The installation and use of the stainless steel passive humidity pan (16" x 10" x 2-1/2") on controlled humidity units requires several measurements and adjustments of the temperature and RH control system to accommodate this alternative humidity source.

This passive alternative is used in cases where the distilled water supply of between 10 and 30 psi is not available or has been interrupted. The passive humidity operation is initiated with the following steps.

1. Select the RH Setpoint to "0" (zero) %. On units manufactured after March 1, 2003, (serial number ending "PN" or later), and some older units that may have newer firmware, the zero RH setpoint will disable the heater for the humidifier (steam generator). On units manufactured before March 1, 2003, the heater harness for the humidifier must be manually disconnected. The harness connector is located just behind the fan motor.
2. Position an independent temperature measuring device having at least 0.1°C increments in the geometric center of the working chamber and not touching a shelf. Allow 24 hours to stabilize the temperature.
3. Lift the perforated cover of the passive humidity pan and add one gallon of distilled only water to within 1/2" of the pan top. Reinstall perforated cover. Allow 4 hours to stabilize humidity.
4. Compare the independent temperature measurement (without opening the glass door) to the temperature display. If a difference greater than 0.2°C is found, make adjustments in the "Set Temp OFFSET" display to match the measured temperature value. Allow 24 hours to stabilize the temperature. Repeat this step as needed to match these temperatures within 0.2°C.
5. Measure the chamber RH with independent humidity device having at least 1% RH increments. Allow one hour for the humidity to stabilize after the glass door is closed.
6. Compare the independent measurement to the RH display. If a difference greater than 2% RH is found, make adjustments in the "Set RH OFFSET" display to match the RH measured value. Repeat this step as needed to match these humidity measurements within 2% RH.
7. Observe the RH% display to confirm a normal display measurement at least 90% after glass door has been closed for 24 hours. See 'Low Humidity Diagnostics' if less than 90% RH observed.

NOTES: If the humidity heater had NOT been disabled and the unit is operated with water in the humidity pan, then these conditions may exist.

A- Condensation may be found on the glass door,

B- Lower than expected temperature and/or humidity display values.

To correct these conditions, remove the water from the humidity pan and complete Steps 1 through 7 above.

Passive Humidity in Humidity Controlled unit