



Air-Jacketed Large Capacity Flo-Thru CO₂ Incubators

Model No.

399
399-1
399GWH

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Safety Information

Alert Signals



Warning

Warnings alert you to a possibility of personal injury.



Caution

Cautions alert you to a possibility of damage to the equipment.



Note

Notes alert you to pertinent facts and conditions.



Hot Surface

Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.

The Barnstead|Lab-Line Large-Capacity, 34 cu. ft. (963 liter), Flo-Thru CO₂ Incubator has been specially designed for laboratories that handle a high volume of work. The unit has been factory tested and needs only to be placed in a suitable location and connected to the required electrical supply and air and CO₂ (or nitrogen) sources at a pressure of 15 psi. A blower fan assists in maintaining uniformity of the CO₂ concentration in the chamber, as well as, minimizing any temperature gradients.

All controls are contained in the control panel. The micro-processor-based controller maintains temperature from slightly above ambient to 60°C. The hydraulic hi-limit thermostat controls temperature a few degrees above the user established set point in the event the main controller fails. This provides an added measure of protection to the chamber.

The KWIK-INJECT™ system provides quicker recovery and a more stable chamber environment. CO₂ is injected into the chamber to compensate for losses incurred during door openings. A timer on the control governs injection time from 3 to 60 seconds.

6 perforated stainless steel shelves provide a total area of 36 sq. ft. (3 sq. m) with a load capacity of 100 lbs. (45 kg) per shelf when the load is evenly distributed, 65 lbs. (29 kg) per shelf when the load is concentrated.

Humidification may be obtained simply by placing a pan of deionized or distilled water on one of the shelves. A humidifier and controller are available as factory-installed options and require a demineralized water source. The humidifier is controlled from the front panel and allows regulation of the relative humidity from approximately 20% above ambient to 98% RH. A panel meter gives a direct reading of relative humidity.

The exterior of the incubator is made from cold rolled steel with a durable powder coated finish. The interior and door are made of stainless steel. Inside the door and between the double walls is 3-inch thick glass wool insulation that helps hold heat loss to a minimum and promotes temperature uniformity in the chamber.

Model 399GWH has an optional humidifier with controller.

Specifications

Electrical Requirements

399, 399GWH: 120 Volts, 50/60 Hz, 1400 Watts, 11.7 Amps
399-1: 230/240 Volts, 50/60 Hz, 1400 Watts, 5.8 Amps

Temperature Range

Ambient +5°C to 60°C

Temperature Control

±0.5°C

Uniformity in Chamber

±0.5°C

Gas Flow Rates

Air: 1.0 to 14.0 liters/minute
CO2: 0.1 to 1.2 liters/minute

Volume

34 cu. ft. (963 liters)

Humidity

Range: ambient to 98% RH
Accuracy: ±3% RH

Dimensions

Exterior: 42"W x 35"D x 91"H (107cm x 89cm x 231cm)
Chamber: 36"W x 25"D x 65"H (91cm x 64cm x 165cm)

Shelves

6 perforated, stainless steel

Net Weight

980 lbs. (445 kg)

Options

H: Humidity Control
L: Left Hand Door
P: Built-in compressed air supply
GW: Glass Window 12" x 48" (30 x 122 cm)

Unit's Environmental Operating Conditions

Pollution Degree: 2
Installation Category: II
Altitude: 2000 meters MSL (Mean Sea Level)
Humidity: 80% maximum, non-condensing
Electrical Supply: 120VAC or 240VAC
Voltage Tolerance: $\pm 10\%$ of normal rated line
Temperature: 15°C to 40°C
Product Usage: This product is intended for use indoors **only**

Unpacking and Installation



Warning

Do not use in the presence of flammable or combustible materials or explosive gases. Do not use in the presence of pressurized or sealed containers. Fire or explosion may result, causing death or severe injury.



Warning

Do not heat any substance above a temperature that will cause it to emit toxic fumes. Death or severe injury may result.



Warning

Use only an inert gas such as carbon dioxide in the incubator. Do not under any circumstance inject oxygen or other explosive gas or mixture into unit. Failure to observe these precautions can result in explosion and/or fire and serious injury or death to personnel and property damage.

Shipping Carton

The shipping carton should be inspected upon delivery. When received, carefully examine for any shipping damage before unpacking. If damage is discovered, the delivering carrier should both specify and sign for the damage on your copy of the delivery receipt.

Open the carton carefully making certain that all parts are accounted for before packaging materials are discarded. After unpacking, if damage is found promptly report it to the carrier and request a damage inspection promptly.

IMPORTANT: Failure to request an inspection of damage within a few days after receipt of shipment absolves the carrier from any liability for damage. You must call for a damage inspection promptly.

Location

Select a location for the incubator that is free of drafts and extraneous vibrations. The unit should be level.

Electrical Power

Turn all controls to the off position. Connect the power cord of the incubator to an outlet providing the power characteristics specified on the unit's nameplate or in this manual.

Shelf Positioning

The 6 perforated stainless steel shelves are adjustable on 1/2" (12 mm) centers. Place the shelf support clips where desired and then set shelves in place. Shelves and support clips can be ordered to provide additional shelf space.

Adjustable Screw Guards for Protecting Back of Unit

Exercise care in placing the back of the unit against a wall to avoid damage to CO₂ tubing and related attachments. To protect against this, 2 adjustable screw guards on the back are used to establish a buffer zone for the CO₂ tubing. If unit is shipped upright, guards are in place; if shipped flat, guards are furnished loose and must be inserted.

Hooking Up Water

Connect supply water line to the 1/4" NPT fitting located on the inlet side of the D. I. cartridge. The recommended water pressure setting on the regulator gauge should be adjusted to read between 10 and 15 psi.

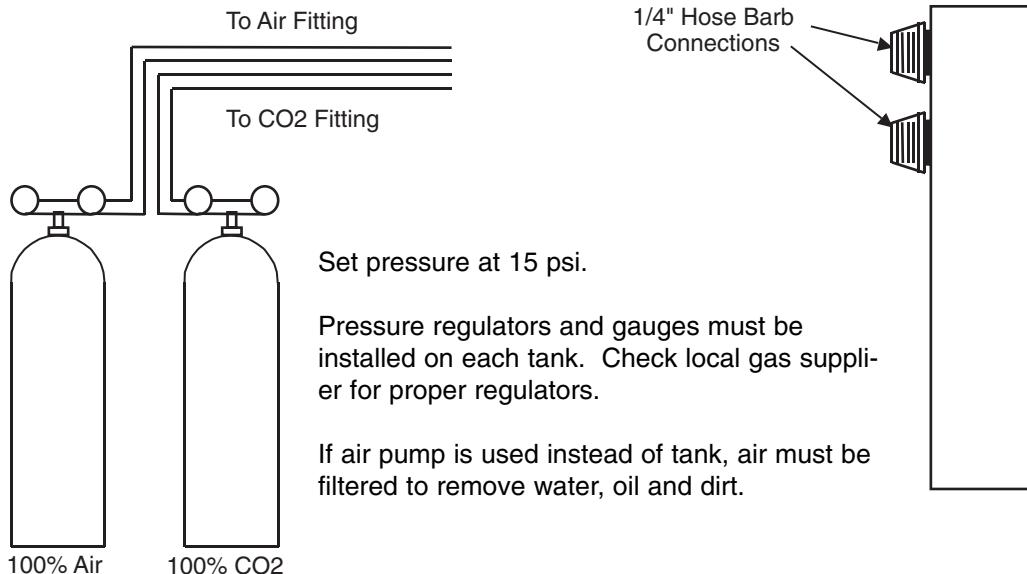
Connecting Condensate Drain to the Incubator

1/2" drain lines are located in back of the incubator.

UNPACKING AND INSTALLATION

Air/CO₂ Hook-Ups

Turn the power switch to **OFF** and insert the plug into the outlet.



Warning

High concentrations of carbon dioxide produce metabolic abnormalities, disturbances of the central nervous system and cardiac instability. Unconsciousness may occur at concentrations above 10%.



Note

It is our recommendation that this unit run 24 hours empty before introducing media to be incubated. This will facilitate ease of servicing if required as well as nullify the need to decontaminate the chamber in the event a problem occurs.

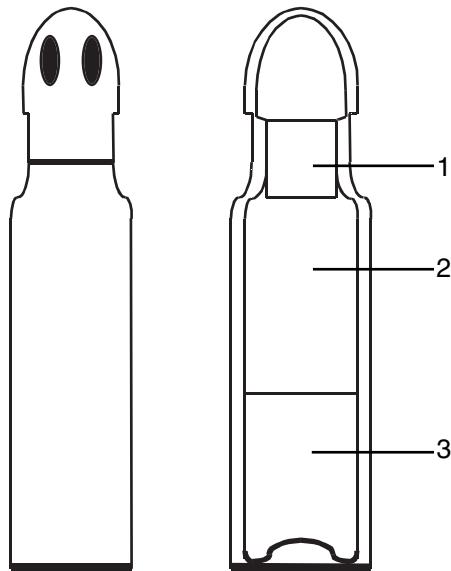
This unit cannot be accepted for servicing or credit by Barnstead International unless accompanied by a completed Certification of Decontamination form, included at the end of this manual.

Turn all flow meters on the incubator fully clockwise (closed). Connect air and CO₂ supply lines to their respective fittings on the back of the unit. Use 1/4" (6 mm) ID tubing, flexible metal hose, etc., (meeting local codes), with filters to ensure that the air and CO₂ are free of contaminants, for gas lines.

Set the supply regulators at 15 psi. Check all of the connections for leaks.

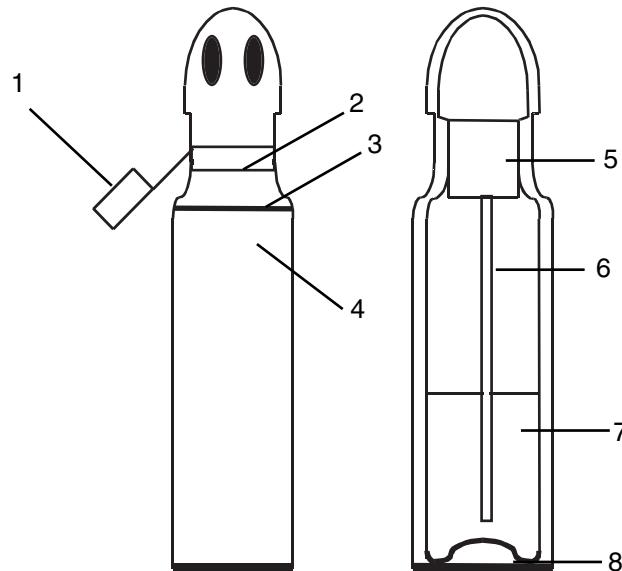
CO₂ Connection: Standard and Siphon Type CO₂ Gas Cylinders

Standard Type (Correct)



1. Compressed Gas Association #320 connector.
2. Gas head space.
3. Liquid CO₂ filled to 68% equal weight of water that cylinder would hold at 60°F.

Siphon Type (Incorrect)



1. Warning tag indicating that cylinder is siphoning type.
- 2*. Aluminum ring.
- 3*. Gold band.
- 4*. Stamp or marking on cylinder: "Siphon" or "Eductor Tube".
- 5*. Valve should be of special type for service.
- 6*. Withdrawal tube draws up the liquid CO₂.
- 7*. Gas head-space.
- 8*. Liquid CO₂ filled to 68% equal weight of water that cylinder will hold at 60°F.

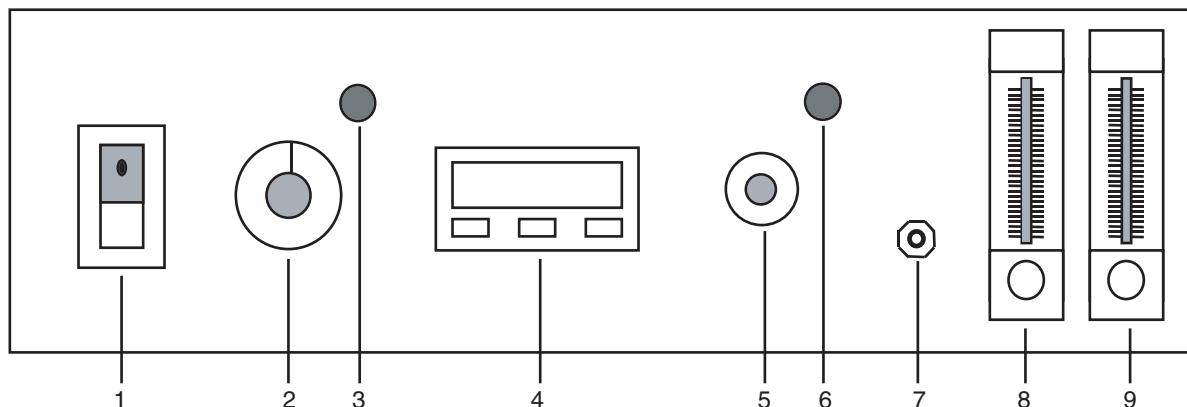
*Note: Some gas suppliers will have no markings to indicate an "Educator Tube" or "Siphon" type cylinder. Be sure to order DRY, LAB-GRADE CO₂.

Be sure to obtain a dual-stage regulator from the gas supplier for the CO₂ tank that is to be installed according to local codes. Connect 1/4" ID (6.35 mm) flexible tubing to the regulator. Connect the other end of the tubing to the unit's CO₂ inlet (located on the back top panel). Insert tubing over hose barb and fasten with an appropriate clamp to assure a proper connection. Adjust the regulator for the pressure recommended on the previous pages when CO₂ is to be injected into chamber. For optimum results, do not exceed or reduce this pressure.

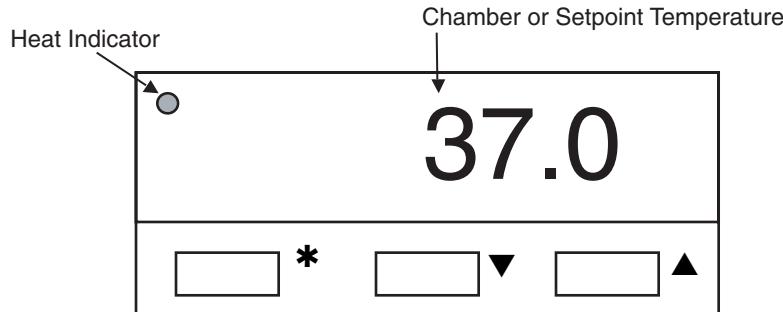
Operation

A microprocessor-based automatic tuning controller with a platinum RTD temperature sensor provides a display of either chamber or set point temperatures. The microprocessor used in the unit automatically tunes PID parameters to fit the characteristics of individual thermal systems.

Auto-tune is a user-initiated function. It provides a tune-at-temperature function that means the controller runs the auto-tune program when the incubator is at set point. Program parameters are retained in the nonvolatile memory in the event that there is power failure or interruption.



1. Power Switch
2. Hi-Limit Thermostat
3. Hi-Limit Thermostat Status Lamp
4. Temperature Controller
5. Kwik-Inject Control Dial
6. Kwik-Inject Status Lamp
7. Sample Access Port
8. Air Flow Meter
9. CO₂ Flow Meter



1. CONTROLLER SELF-TEST: When the incubator is powered up, the controller will display 8888 along with three decimal points and the heat ON indicator lamp will light. The display will then blank out for 2 seconds before showing the chamber temperature.
2. HEAT ON INDICATOR: The heat ON indicator lamp is lit when the chamber heater is receiving power. The lamp will normally flash when the chamber temperature is at set point.
3. SET POINT ADJUSTMENTS: The temperature controller normally displays the chamber temperature. To view or change the temperature set point proceed as follows:

Press	Controller
*	View setpoint
*▼	Decrease setpoint
*▲	Increase setpoint

- A. Press and hold the star key and use either the up or down arrow key to adjust the set point to the desired temperature. Release the star key.
- B. Allow at least 1 hour for the chamber temperature to stabilize.

Auto Tune

The auto-tune program automatically adjusts the controller parameters to achieve optimal temperature control.

It is not necessary to run the auto-tune program when setting up the incubator. However, if the temperature appears to be unstable, the auto-tune program can be run using the procedure shown below:

For Best Results

- Set the usual set point temperature and use normal load conditions.
- Allow the incubator to stabilize at set point for at least 1 hour.

Auto-Tuning Procedure

1. Enter the program mode by pressing and holding BOTH the up and down arrow keys for 3 seconds.
2. Release BOTH arrow keys when **tunE** is displayed.
3. The controller display should now be alternating between **tunE** and **oFF**.
4. Press and hold the “STAR” (*) key. Press and release the up arrow key until **At.SP** is displayed. Release the “STAR” (*) key.
5. After one minute has elapsed, the controller display will begin to alternate between showing the chamber temperature, **tunE** and **At.SP**.
6. Allow the program to run until the display again shows only the chamber temperature.

Temperature Calibration

1. Place a calibrated thermometer inside the chamber on the corner shelf. Close both doors.
2. Press and hold the “STAR” (*) key and using the up or down arrow key, adjust the set point to the desired temperature.
3. Allow the unit to run for at least 1 hour.
4. The controller display should now be indicating the set point temperature. Make note of the thermometer reading.
5. Press and hold both arrow keys until the controller display indicates **tunE**. Release the arrow keys. Press and release the down arrow key, the display should now indicate **LEUL**. Press and hold the “STAR” (*) key and using the up arrow key adjust the display to read **3**. Release the “STAR” (*) key. Press and release the up arrow key until the display indicates **Zero**. The display should now alternate between **Zero** and a numerical value.
6. Using the examples shown below and the thermocouple value obtained in step above, enter the correct **Zero** value into the controller using the up or down arrow keys. If there is already a **Zero** value present then add the new value to the one already present.

Thermometer	=	60°C	Thermometer	=	70°C
Controller Reading	=	65°C	Controller Reading	=	65°C
Subtract	=	-5°C	Subtract	=	+5°C

Enter **Zero** value of -5°C

Enter **Zero** value of +5°C

7. When the correct **Zero** value has been entered, press and hold the two arrow keys together until the display again indicates the chamber temperature. If the procedure was done correctly, the controller display should now agree with the thermometer reading to within ±0.5°C.

8. Allow the unit to run for at least 1 hour.
9. Re-check the thermometer reading, the controller display and the thermometer should agree to within $\pm 0.5^{\circ}\text{C}$. If not, repeat steps 4 and 5 above.

Setting the Hi-Limit Thermostat

- Rotate the Hi-Limit thermostat (2) fully clockwise.
- Allow sufficient time for the unit to reach and stabilize at the set point temperature plus an additional hour or two for unit to cycle at the temperature—4 hours for 37°C is typical.
- After this time has elapsed, rotate the Hi-Limit thermostat counterclockwise while watching the red lamp (3). When the lamp is lit, you have adjusted the Hi-Limit set point to be equal to the operating set point. *NOTE: Do not leave Hi-Limit at this setting.*
- Now rotate the Hi-Limit thermostat clockwise 30 degrees of rotation past the point where the lamp goes out. *This distance should be similar to the distance from the twelve o'clock to the one o'clock positions.* This establishes a buffer of a few degrees between the operating set point and the HI-LIMIT temperature set point and allows PID control to function normally.
NOTE: Under normal operating conditions, the Hi-Limit LED should never come on. If it does, readjust slightly clockwise.

**Warning**

Do not operate the unit, if any of the temperature controls become inoperative. A hazardous condition will develop which can result in injury or death and property damage.

Loading the Incubator

Load the chamber, spacing the items as far apart as possible (for maximum air circulation).

Air/Gas Ratio

Set the flow meters to obtain the required air and CO₂ flow—using the lowest possible CO₂ flow rate will help to conserve gas.

Use one of the following formulas to find the desired air-to-gas ratio:

R = % CO₂ in the chamber atmosphere

A = Air flow in liters/minute

C = CO₂ flow in liters/minute

Equation 1 (to be used if air and CO₂ flow rates are known):

$$R = \frac{C}{A + C} \times 100$$

Equation 2 (to be used if air flow rate and % CO₂ are known):

$$C = \frac{RA}{100-R} \text{ liters/min.}$$

Equation 3 (to be used if CO₂ flow rate and % CO₂ are known):

$$A = \frac{100C - RC}{R} \text{ liters/min.}$$

Example 1: If a CO₂ percentage of 15% is desired at a flow rate of 0.4 liters/min. of CO₂, use Equation 3.

$$A = \frac{100(0.4) - 15(0.4)}{15} = \frac{40-6}{15}$$

$$= 2.26 \text{ liters/min. of air}$$

Example 2: If flow rates are set 0.1 liters/min. of CO₂ and 3 liters/min. of air, use Equation 1 to find percentage of CO₂.

$$B = \frac{0.1}{3.0 + 0.1} \times 100 = 3.2\% \text{ CO}_2 \text{ in chamber atmosphere}$$

Humidity Adjustment

Placing a pan with water on the chamber floor can raise chamber humidity. For minimum humidity, chamber should be dry.

CO₂ Sampling/Measurement

Insert sample probe into the sample access port making sure that a tight seal is attained. Obtain a sample of CO₂ sufficiently large to meet the requirements of the analytical apparatus or procedure being used. Perform CO₂ analysis.

Air and CO₂ (or Nitrogen)

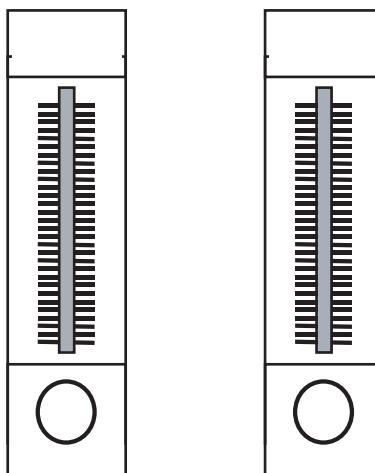
The incubator is designed to be used with air and CO₂ or nitrogen only. Do not use any other gases. Each of the two gas circuits has its own flow control. Air and CO₂ flow meters should be turned fully clockwise (shown below). Make connections at the top of the unit at the air and CO₂ inlets.

**Caution**

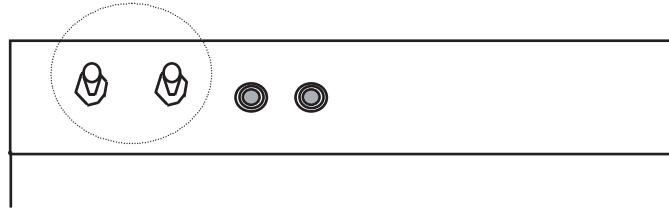
Gas and air supplies must be equipped with pressure-reducing valves that are set at 15 psi. The incubator is designed for a continuous flow of gas, not for chamber pressure.

**Warning**

High concentrations of carbon dioxide produce metabolic abnormalities, disturbances of the central nervous system and cardiac instability. Unconsciousness may occur at concentrations above 10%.



Control Panel Flow Meters



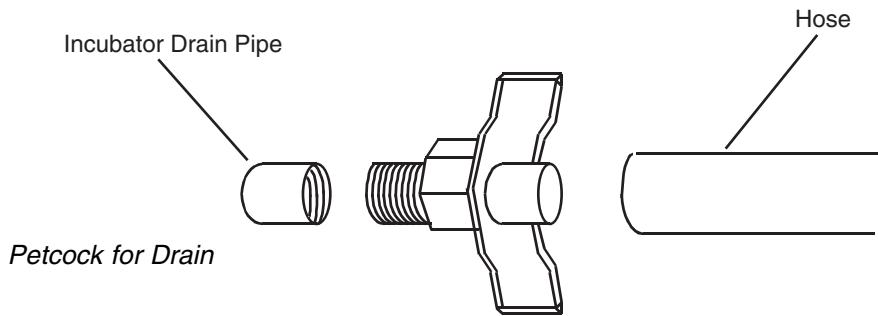
Rear/Top of Unit, Air and CO₂ Inlets

Humidification

If the incubator is not to be humidified, keep the drain valve (located on the bottom/rear outer panel) closed.

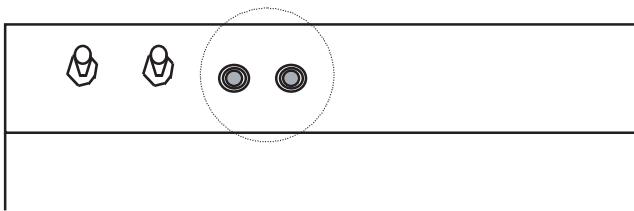
Humidifying without the Optional Humidifier

Place a pan of distilled or deionized water on one of the shelves to provide humidification. Run a hose from the drainpipe at the bottom/center rear of the unit to a floor drain or a pan. The drain petcock should be open. Alternatively, moisture can be sponged up from the bottom of the unit.



Humidifying with the Optional Humidifier

1. Humidity is produced by a humidifier located on the roof of the unit.
2. The water inlet and outlet are on the rear panel of the incubator (see figure at left).
3. Only demineralized or deionized water should be used.
4. On the left side of the incubator is a rack for a deionizer cartridge that can be connected as shown in the deionizer diagram. Be sure to connect a drain hose to the unit's drain pipe and open the drain petcock.



Rear/Top of Unit, Water Inlet/Outlet

**Caution**

Distilled water shall be provided by others at a minimum rate of 18 gallons per day and a minimum pressure of 20 psig with an electrical resistivity between 500 K ohms and 1 meg ohms.

**Note**

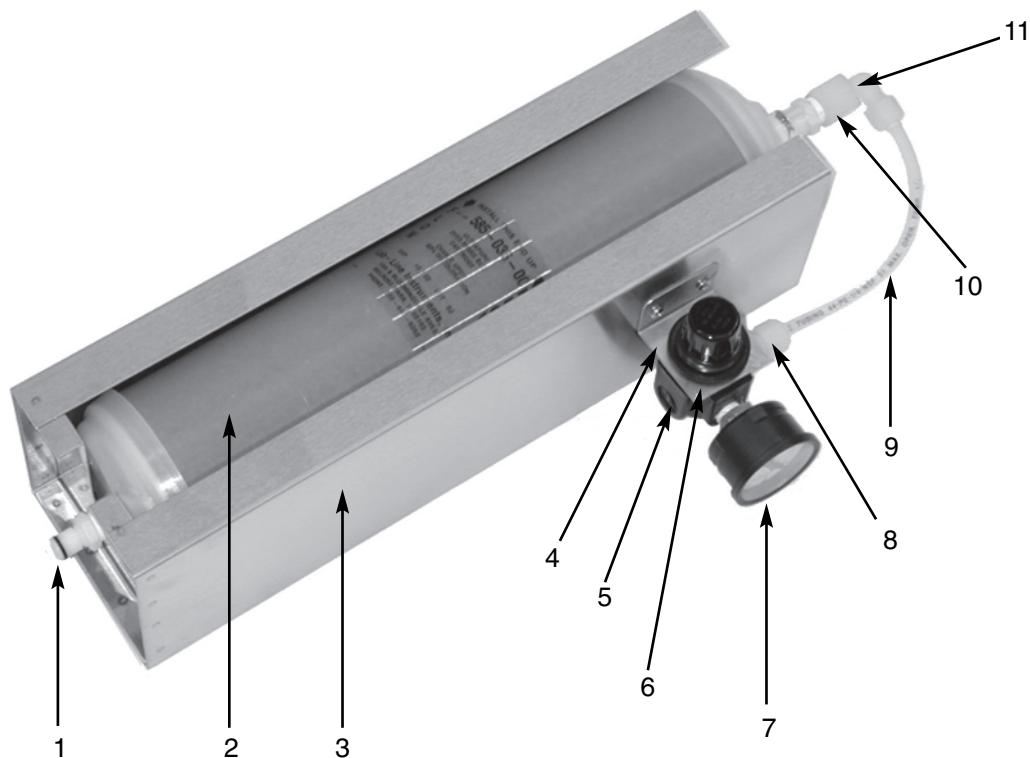
Barnstead International expressly disclaims liability for damage to humidifier(s) and for loss sustained by the user as a result of humidifier failure, if such damage is the result of improper treatment of water used for humidification.

About the Kind of Water to Use

Distilled or deionized water MUST BE USED for humidifier(s). ELECTRICAL RESISTIVITY OF THE DISTILLED OR DEIONIZED WATER MUST BE BETWEEN 500 K OHMS AND 1 MEG OHMS as measured between opposite faces of a centimeter cube of an aqueous solution as per ASTMD 1125-82. Distilled water, if available, will give the best results and the longest life expectancy for the equipment. All DI and/or city water final connects shall be by others. Due to the great variations in water hardness and chemical makeup from one geographical area to another, demineralizer cartridges may not, in all cases, be adequate to prevent damage to the internal wetted parts of the humidifier(s).

Purchasers are responsible for determining, through water analysis and recommendations by a qualified water treatment company, if further treatment is required, either before, after, or in place of using a demineralizer cartridge. If further water treatment is necessary or advisable, the user is obligated to supply and install all equipment that might be required for this purpose.

Demineralizer Cartridge



1. Water Outlet – To Chamber
2. D. I. Cartridge, #585-036-00
3. D. I. Cartridge Housing, #019-153-01
4. Regulator Bracket, #593-798-00
5. 1/4" NPT water inlet fitting, supplied by user
6. Plastic Regulator, #950-147-01
7. PSI Gauge, #950-147-02, Set for 10 to 15 psi
8. Connector, #730-414-01, Regulator Outlet
9. Tubing, #720-113-00
10. Quick Disconnect, #731-093-00
11. 90° Fitting, #730-501-01

**Caution**

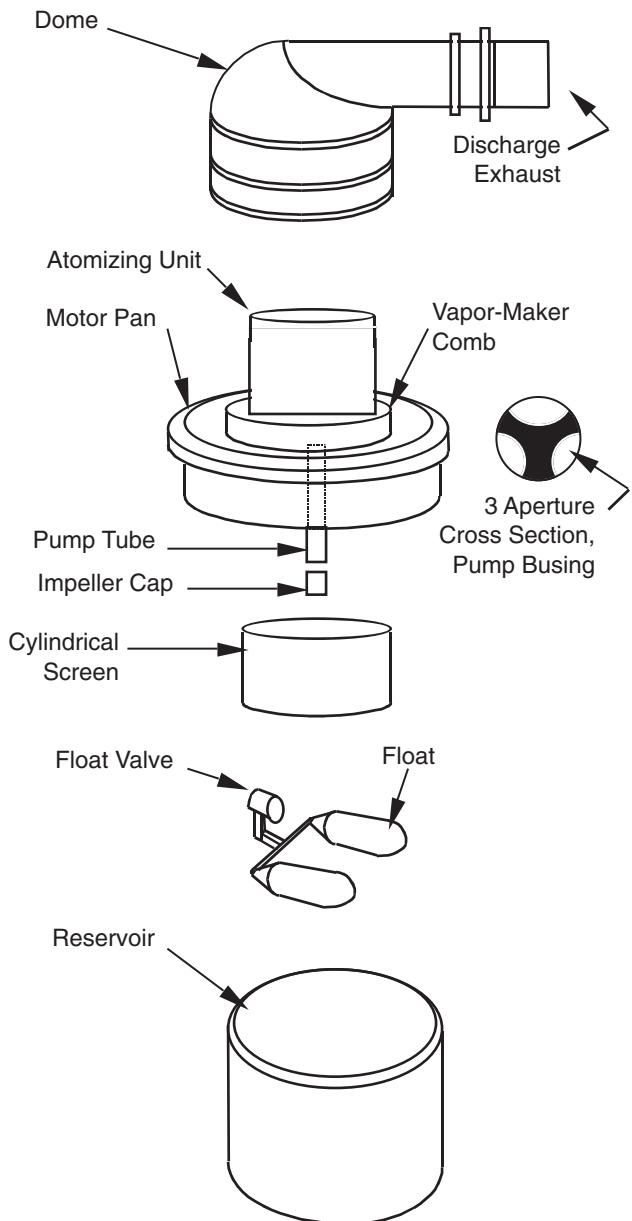
FAILURE TO CHANGE THE DEMINERALIZER CARTRIDGE AS REQUIRED CAN RESULT IN DAMAGE TO THE HUMIDIFIER AND AFFECT IT'S PERFORMANCE, EFFICIENCY AND VOID THE MANUFACTURER'S WARRANTY.

Operation of Humidification System

1. Water pressure is not to exceed 20 pounds per square inch. The recommended water pressure setting is 10 to 15 psi.
2. Water temperature should be regulated to 77°F (25°C) for optimal cartridge usage.
3. Do not store in an area where temperature will be below 33°F or above 100°F.
4. When mounting cartridge in bracket, tighten nut moderately tight and turn on water. If leak occurs, tighten nut until leak is stopped.
5. To obtain optimum performance from the demineralizer cartridge, it is important to check the color change that the resin undergoes. When the color of the resin in the cartridge has changed from brown to tan, the cartridge should be replaced. Preferably, cartridge replacement should be done before the entire cylinder has changed color.

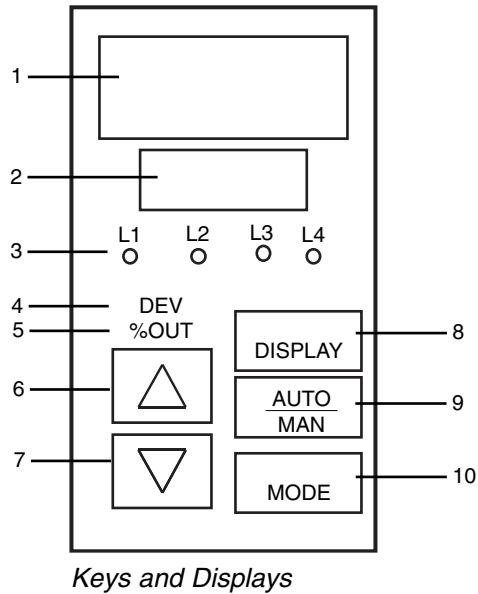
Periodic Cleaning and Inspecting of Humidifier

1. Disconnect power source from unit. Turn off water supply.
2. Remove dome from unit after first removing the dome strap. The dome rests on the chromed motor pan. It lifts out and away from the duct and the unit. Tube seal is on the dome discharge exhaust and will be carried with the dome.
3. Lift out the atomizing unit—this rests freely on the reservoir and lifts out easily.
4. Clean the atomizing unit. DO NOT SUBMERSE IN WATER. First, remove the cylindrical screen—twist slightly out of the LOCK position and remove. Next, remove the impeller cap from the pump tube by tapping lightly against



the bottom edge of the cap. DO NOT TAP FACE OF CAP. Gently free the 3 apertures inside the pump tube of any solids that may have accumulated. Replace impeller cap on the pump tube. Tap lightly into place around edge. DO NOT TAP FACE OF IMPELLER CAP. Spin the pump tube by hand to ensure that it rotates freely. Replace screen by twisting into LOCK position. Brush-clean vapor maker comb. Clean out motor pan. Discard waste.

5. Empty and clean reservoir of all liquids and waste—care should be taken so as not to disturb floats or float valves. Check float valve operation before reassembly.
6. Reassemble unit. Replace the atomizing unit on the reservoir. Place the dome on the chromed motor pan with the discharge exhaust and tube seal inserted in place.
7. Reconnect power source to unit. Turn on water supply valve.



Keys and Displays

Humidity Controller

1. UPPER DIGITAL DISPLAY: Displays actual incubator humidity, operating prompt values or error codes. When powering up, the display will be blank for 3 seconds.
2. LOWER DISPLAY: Indicates the set point, deviation, percent power humidity unit or menu prompts
3. L1 LED: This LED will light when the unit is powered up. The remaining LED's are not enabled in this configuration.
4. DEV LED: When lit, the deviation from the current set point is shown in the lower display.
5. %OUT LED: When lit, the current percent output is shown in the lower display.
6. UP KEY: Increases the value of the displayed prompt. New data are self-entering in 5 seconds or once the MODE key or display key is pressed.
7. DOWN KEY: Decreases the value of the displayed prompt. New data are self-entering in 5 seconds or once the MODE key or display key is pressed.
8. DISPLAY KEY. Pressing this key enters the display loop.
9. AUTO/MAN LED: Lit when control is in manual operation. Press the AUTO/MAN key twice to enter automatic operation. When blinking, press the AUTO/MAN key to between auto and manual. After 5 seconds, without pressing the AUTO/MAN key, the LED stops blinking and returns to its previous state.

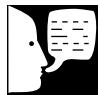
AUTO/MAN KEY: Pressed once, it toggles between the auto and manual modes. If pressed again within 5 seconds, it will change from auto to manual or vice versa.

**Note**

Unit is designed to operate in AUTO/MAN mode only.

10. **MODE KEY:** Steps the control through the menus. New data is entered once the MODE key is pressed.

MODE/UP KEY: To move backward through the menus, hold down the MODE key, then press the Up key to scroll. The MODE key must be pressed first and held before the Up key will begin scrolling. Scrolling is disabled once the keys are released or you reach the top of the menu.

**Note**

ONLY USE AUTO TUNE IF CONTROL IS UNSTABLE.

Auto Tune (only if necessary)

1. When Menu set-up is complete, set controller to desired RH set point and wait until chamber humidity reaches set point.
2. Press the **MODE** key twice until **AUt** appears in the lower display.
3. Press the **UP/DOWN** key to select **PibA**.
4. Press the **MODE** key. While the controller is in tuning mode, the lower display alternately displays the normal information and the **tunE** prompt at 1-second intervals.
5. When tuning is complete, the displays return to their previous state and **AUt** reverts to off.

**Offset Humidity Calibration
(only if necessary)**

Humidity calibration can be accomplished using the controller and a known and accurate humidity measuring device.

Set controller to desired RH set point and let chamber atmosphere stabilize 15 to 20 hours.

Place humidity measuring device in the approximate geometric center of the chamber.

- Press the UP and DOWN keys simultaneously and hold for 3 seconds.

**Note**

DO NOT access or change parameters other than **CAL1**. To do so will adversely affect the performance of the unit and nullify the warranty herein provided.

- The lower display will show **SEt** and the upper display will show **InPt**. By using the **Up** and **Down** arrow keys, you can select **InPt**, **OtPt**, **qLbL** or **COM**.
- Press the **UP** and **DOWN** keys at the same time and hold for three (3) seconds to access **InPt**.
- Press the **MODE** key to advance through this menu until you reach **CAL1**; then use the **UP** and **DOWN** arrow keys to enter the difference between controller reading and the humidity sensor reading. For example:

Humidity Measurement =	65% RH	Humidity Measurement =	60% RH
<u>Upper Display</u>	=	<u>Upper Display</u>	=
Add OFFSET value	=	+5% RH	Add OFFSET value = -5% RH

- Allow the humidity in the chamber to stabilize a minimum of 4-hours. Press **DISPLAY** key at the new value before attempting any further adjustment, if required.

Operating Suggestions

- In order to obtain and maintain the desired CO₂ gas concentration, periodically check the tightness and integrity of the gasket that secures the glass door to the incubator.
- To be sure of maintaining desired gas pressure, periodically check outflow pressure from gas supply source.
- If maintaining humidity conditions within the incubator, check the level of water in pan and replenish as necessary.
- After power is disconnected to the unit, do not permit humidity water to remain in the unit. Remove any pans and/or dry the interior thoroughly.

- Insofar as possible, keep the incubator door closed in order to reduce the possibility of fungus growth starting from airborne organisms entering the chamber.

Hints on Using the Fyrite

The following information is intended to supplement that found in the Fyrite manual and is based on experience working with users of our incubators.

One of the most important aspects of using the Fyrite procedure and one that is frequently overlooked is the condition of the fluid. The Fyrite accepts a sample of the Incubator's environment into its own chamber where it is absorbed by the Fyrite fluid to determine the CO₂ percentage or tension. Keeping outside air from the sample drawn from the Incubator is of special importance. Any outside air contaminating the sample is detrimental to an accurate reading, and more importantly, to the growth of your cells. Inspection of the fluid should be performed only with the user wearing protective gloves, as the Fyrite fluid is slightly corrosive. The inspection should review the following:

- **THE DATE OF THE LAST FLUID CHANGE:**
Old fluid will not absorb as much CO₂ and will produce a false reading. This may lead the user to recalibrate the Incubator to higher CO₂ tensions that can prove lethal to cell cultures.
Fyrite fluid should be changed after approximately 350 uses. This approximates a change of fluid once a year if the Fyrite procedure is carried out on a daily basis. Keep track of the number of uses and if the Fyrite is used with more than one Incubator. Experience shows that the color of the fluid is not as important as the age of fluid.
- **CHECK THE CONTAINMENT VESSEL AND HOSES AT LEAST ONCE A MONTH:** Make sure that there are no cracks in the vessel or leakage of fluid to the outside of the container. This can indicate a leaky seal or internal crack. Hoses should be stretched slightly and inspected for cracks or holes. This is critical as cracks

OPERATION



Note

A little water goes a long way. Use only a couple drops of distilled water at once.



Caution

Do not use Fyrite fluid to adjust the level of fluid use distilled water only. The only time to use fresh Fyrite fluid is when you change it due to the age of the fluid.

and/or holes in the hoses can draw in outside ambient air and produce a false reading.

- **CHECK THE FLUID DAILY AND ADJUST THE SLIDE GAUGE TO READ ZERO:** If you have adjusted the slide gauge all the way down and the fluid level is still too low, place a couple of drops of distilled water into the plunger on the top of the Fyrite. Depress the plunger and the water will transfer into the Fyrite causing the fluid level to rise. Repeat this procedure until the fluid level reads correctly.
- Inspect the Fyrite filter in the clear plastic casing between the hoses for any contamination or growth. Change it if necessary. CAUTION: MAKE SURE THE FILTER IS MOIST BEFORE YOU TAKE YOUR READING. A MOIST FILTER IS A MUST FOR AN ACCURATE READING.

To moisten the filter:

- 1) Remove the end of the short hose without the squeeze bulb that connects to the incubator.
- 2) Add several drops of distilled water to the filter, replace the hose and squeeze the bulb.
- 3) Release the bulb and the water will be drawn into the filter.
- 4) Squeeze the bulb and quickly release it to remove any excess water. You will see this water (if any) come out of the end of hose that is closest to the squeeze bulb. This is the cupped end that is depressed onto the Fyrite.



Caution

The incubator must be stable.

Taking a Fyrite Reading

It is recommended that Fyrite CO₂ and independent temperature tests be performed at intervals to be determined individually or as dictated by established protocol. Some laboratories conducting critical work may want to record CO₂ and temperature readings on a daily basis.

1. Clear the Fyrite of any residue CO₂. Simply depress the plunger on the head or the top of the Fyrite taking care not to cover the hole. This introduces fresh ambient air into the Fyrite chamber.
2. Release the plunger and turn the Fyrite upside down, holding it at a 45-degree angle until most of the bubbles surface and the fluid has filled the head. Even the smallest bubbles may contain CO₂, so that it is important to let most of the smaller bubbles surface.
3. Turn it right side up and hold it at 45 degrees. Allow the fluid to fill the Fyrite and depress the plunger again. This clears the Fyrite of any CO₂ that might cause a false reading.
4. Attach the filter side of the hose to the incubator's CO₂ sample port. Remove the brass tube, if present, from the Fyrite hose, as it is not needed and attach the hose to the CO₂ sample port. (The brass tube was once used with older incubators that utilized a hole in the Incubator wall or door to measure CO₂ but this method proved to cause contamination problems.)
5. **LOOK AT YOUR FYRITE GAUGE AND ADJUST THE ZERO IF NECESSARY.** Take the squeeze bulb end of the hose and with the hole of the cupped end facing down, place it onto the plunger of the Fyrite and hold it firmly in position. **IMPORTANT: ONCE YOU HAVE DEPRESSED THE PLUNGER OF THE FYRITE, IT IS CRITICAL THAT IT NOT BE RELEASED DURING THE FOLLOWING PROCEDURE.**
6. Depress the plunger and hold it down. It is very important not to allow the plunger to spring up—if this occurs, you will be repeating an already existing reading. It will not matter how many times you pump the squeeze bulb, as long as you hold the plunger down you will introduce only one sample to the Fyrite. But, by releasing the plunger and immediately pushing it back down, you will then be adding an additional

OPERATION

sample to the Fyrite chamber causing the reading to double or triple. In the event that it is difficult to hold the plunger down while pumping the squeeze bulb, find a more suitable or comfortable position.

7. Without releasing the plunger, pump the squeeze bulb at least 20 times— this assures complete and thorough transfer of the sample to the Fyrite chamber.
8. Once the bulb has been pumped the required number of times, HOLD THE SQUEEZE BULB IN THE "SQUEEZED" POSITION and release the pressure on the cup that will also release the plunger. This traps the sample from the Incubator in the Fyrite chamber and allows the fluid to absorb the CO₂.
9. With the plunger now released, turn the Fyrite upside down again and hold at a 45-degree angle to allow the smaller bubbles to surface while the fluid fills the chamber head.
10. Reverse and turn Fyrite right side up and hold at a 45-degree angle to allow the same thing to happen. Repeat this procedure.
11. Hold upside down at 45-degree angle and right-side up at 45-degree angle. Finish by shaking the Fyrite slightly while holding at 45-degree angle to allow residue droplets of fluid to drain into the measuring tube.
12. Read the gauge: It should match or be close to your CO₂ set point. It is possible that you may be off as much as $\pm 3\%$. If you read more than 8%, it is possible that you may have introduced two samples or the Incubator is way out of calibration. If a wide variation between the reading and CO₂ set point exists, it is recommended that the sampling and measurement procedure be repeated.
13. Once the possibility of any error in Fyrite reading has been eliminated, calibrate your incubator to conform to the reading obtained.

Kwik Inject Automatic CO₂ Recovery System

When the chamber door is opened and then closed during an operation, this triggers the Kwik Inject system which acts to replenish CO₂ lost during open door period. In the event that the CO₂ is not replenished to the level required, this can be solved by adjusting the Kwik Inject control KNOBI (5) on the control panel. The setting of this control fixes the amount of time—from 3 to 60 seconds—that CO₂ is injected into the chamber to increase the CO₂ level.

Built-In Compressed Air Supply

1. Turn main power switch on.
2. The unit can be operated with the power switch on and the air compressor switch off. No air should be delivered to the unit.
3. With both power and compressor switches on, adjust the air flow meter. When operating properly, sufficient air will be supplied to set the air flow meter at a maximum flow rate of 5.0 liters per minute.
4. For optimum operation, the filter should be replaced at least once a year—more often if the air conditions are subject to severe dust or dirt contamination.
 - a. Disconnect power to the unit.
 - b. Remove top cover of incubator.
 - c. Remove filter capsule from filter holders.
 - d. Install new filter capsule in holders.
 - e. Check for a tight fit of tubing to filter.
 - f. Replace top cover.

Maintenance

**Warning**

Disconnect from the power supply prior to maintenance and servicing.

**Warning**

Refer servicing to qualified personnel.

**Note**

PCB contacts at rear of controller fit into contacts at rear of controller housing.

Replacing Temperature and/or Humidity Controller

1. Place ON/OFF switch in OFF position.
2. Unplug incubator from outlet power supply.
3. To remove controller from control housing:
 - a. Use both hands to firmly grip each side of the controller bezel
 - b. press on the bezel side grips until the bezel tabs release
 - c. slowly pull controller from housing
4. To install new, factory configured controller:
 - a. Carefully slide new controller into controller housing.
 - b. Press controller bezel into controller housing until bezel tabs securely lock controller into place.
5. Plug incubator into outlet power supply.
6. Place ON/OFF switch in ON position.

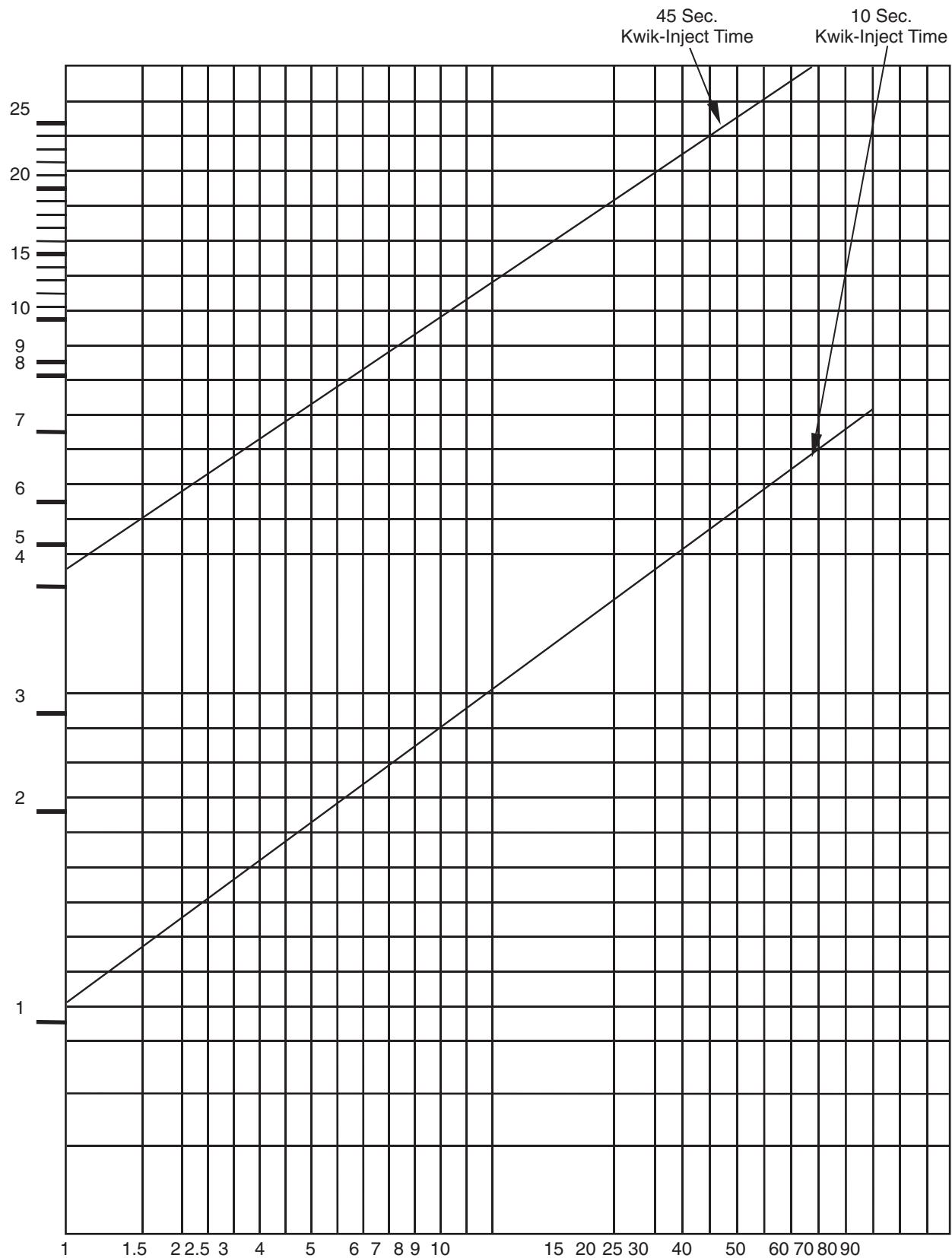
CO₂ and Air Bubbler

CO₂ and air supply pass through a porous bubbler in the bottom of the incubator. The bubbler, being submerged in water, may clog up with particles. It will be necessary to remove the bubbler and clean it by back flushing and scrubbing. The frequency of cleaning depends on the type of water used. Distilled water is preferable.

Adjusting Automatic CO2 Recovery System

If the automatic CO2 recovery system does not replenish CO2 content properly when the door is opened and then closed, the time delay relay must be adjusted to increase or decrease the "on time." This relay has a 3- to 60-second range and is located on the right-hand side of the control panel. The time delay can be changed by rotating the relay knob to the desired time marked on the panel.

Maintenance



CO₂ Tank Regulator Pressure, PSI 3/8" Line)

Replacement Parts

<u>DESCRIPTION</u>	<u>PART NUMBER</u>	
Aerator Stone:	750-005-00	DEMINERALIZER CARTRIDGE ASSEMBLY:
Alarm, Temperature:	145-010-00	DI Cartridge Assy: 019-168-00
Blower Wheel:	160-055-00	WITH OPTIONAL RECORDER:
Blower Wheel:	160-055-01	Chart Paper: 920-339-01
Circuit Breaker, 10 Amp:	330-119-00	Recorder, Single Pen: 920-389-00
Clip, Support:	170-029-00	Wiring Schematic: 228-153-00
CO2 Recovery Timer Module:	485-180-00	
Cordset:	470-105-00	WITH OPTIONAL HUMIDITY:
Feet, Adjustable:	790-341-00	Heater: 340-031-00
Flow meter, Air:	660-098-00	Humidity Controller: 485-291-00
Flow meter, CO2:	660-100-00	Humidity Sensor: 924-037-00
Gasket, Door:	530-069-00	Linecord: 470-105-00
Heater (120 V, 800 W):	340-291-00	Humidifier: 585-001-00
Knob:	560-225-00	Demineralizer Cartridge: 585-036-00
Latch:	600-041-00	Pressure Regulator: 950-147-01
Motor:	370-235-00	Regulator Pressure Gauge: 950-147-02
Potentiometer (CO2 Recovery Timer):	412-105-00	
Shelf:	582-982-01	
Skid Pad, Vinyl:	790-342-00	
Status Lamp Lens, Red:	360-234-00	
Status Lamp Base, Red:	360-233-01	
15-Amp Circuit Breaker:	330-124-00	
1-Amp Circuit Breaker:	330-158-00	
Switch, Door:	440-080-00	
Thermostat, Hi-Limit:	920-126-00	
Power Supply:	460-305-00	
Piping Diagram:	730-983-00	
Wiring Diagram:	228-999-00	
Wiring Diagram 399P:	228-996-00	
Wiring Diagram 399GWH:	229-364-00	
Configured Temperature Controller:	485-360-02	
RTD Temperature Sensor:	410-632-00	
Power Switch:	440-359-00	
Kwik-Inject Lens:	360-238-00	
Kwik-Inject Lamp Base:	360-249-01	

Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

All parts listed herein may be ordered from the **Barnstead International** dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed we ask that you check first with your dealer. If the dealer cannot handle your request, then contact our Customer Service Department at 563-556-2241 or 800-553-0039.

Prior to returning any materials to **Barnstead International**, please contact our Customer Service Department for a "Return Goods Authorization" number (RGA). Material Returned without an RGA number will be returned.

Decontamination Statement

We cannot accept any product or component sent to Barnstead International for repair or credit that is contaminated with or has been exposed to potentially infectious agents or radioactive materials.

No product or component will be accepted without a "Return Goods Authorization" (RGA) number.

Certification of Decontamination

We cannot accept for service or credit a product that has been exposed to or contaminated with chemically or biologically toxic or infectious substances or subjected to radioactivity without first being certified as free from said contamination.

Please have your Medical and/or Safety Officer sign this form certifying that proper decontamination procedures have been followed to render the product safe and free from hazards.

Any product forwarded to us that is not accompanied by this form and a proper Return Goods Authorization Number will be returned to the sender. To obtain Return Goods Authorization Number, contact: Customer Service Department at 1-800-553-0039.

We hereby certify that the Barnstead|Lab-Line. product:

Model No. _____ Serial No. _____

that is being forwarded has been properly decontaminated and is free from all toxic hazards, infectious agents, radioactivity and/or other hazards.

Company/Institution Name: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Name (please print): _____ Title: _____

Signature: _____

Phone: _____

DECONTAMINATION PROCEDURE (Be Specific):

Nature of Hazard That Required Decontamination:

Two Year Limited Warranty

BARNSTEAD INTERNATIONAL ("BARNSTEAD") warrants that a product manufactured by Barnstead shall be free of defects in materials and workmanship for two (2) years from the first to occur of (i) the date the product is sold by BARNSTEAD or (ii) the date the product is purchased by the original retail customer (the "Commencement Date"). Except as expressly stated above, BARNSTEAD MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO THE PRODUCTS AND EXPRESSLY DISCLAIMS ANY AND ALL WARRANTIES, INCLUDING BUT NOT LIMITED TO, WARRANTIES OF DESIGN, MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

An authorized representative of BARNSTEAD must perform all warranty inspections. In the event of a defect covered by BARNSTEAD's warranty, BARNSTEAD shall, as its sole obligation and exclusive remedy, provide free replacement parts to remedy the defective product. In addition, for products sold by BARNSTEAD within the continental United States or Canada, BARNSTEAD shall provide free labor to repair the products with the replacement parts, but only for a period of ninety (90) days from the Commencement Date.

BARNSTEAD's warranty provided hereunder shall be null and void and without further force or effect if there is any (i) repair made to the product by a party other than BARNSTEAD or its duly authorized service representative, (ii) misuse (including use inconsistent with written operating instructions for the product), mishandling, contamination, overheating, modification or alteration of the product by any customer or third party or (iii) use of replacement parts that are obtained from a party who is not an authorized dealer of BARNSTEAD.

Heating elements, because of their susceptibility to overheating and contamination, must be returned to the BARNSTEAD factory and if, upon inspection, it is concluded that failure is due to factors other than excessive high temperature or contamination, BARNSTEAD will provide warranty replacement. As a condition to the return of any product, or any constituent part thereof, to BARNSTEAD's factory, it shall be sent prepaid and a prior written authorization from BARNSTEAD assigning a Return Materials Number to the product or part shall be obtained.

IN NO EVENT SHALL BARNSTEAD BE LIABLE TO ANY PARTY FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, OR FOR ANY DAMAGES RESULTING FROM LOSS OF USE OR PROFITS, ANTICIPATED OR OTHERWISE, ARISING OUT OF OR IN CONNECTION WITH THE SALE, USE OR PERFORMANCE OF ANY PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE), ANY THEORY OF STRICT LIABILITY OR REGULATORY ACTION.

The name of the authorized Barnstead International dealer nearest you may be obtained by calling 1-800-446-6060 (563-556-2241) or writing to:

