Shel Lab 5216

# Signature Series Air Jacketed CO2 Incubator



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# AIR JACKETED $CO_2$ INCUBATORS

MODEL: 5216

INSTALLATION AND OPERATION MANUAL

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**REV. 2/04**
**4861528**


These units are general purpose air jacketed $CO_2$ incubators for professional, industrial or educational use where the preparation or testing of materials is done at approximately atmospheric pressure and no flammable, volatile or combustible materials are being heated. These units are not intended for hazardous or household locations or use.




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# Section 1
# RECEIVING AND INSPECTION

***Your satisfaction and safety require a complete understanding of this unit. Read the instructions thoroughly and be sure all operators are given adequate training before attempting to put the unit in use. NOTE: This equipment must be used only for its intended application; any alterations or modifications will void your warranty.***

**1.1** **Inspection:** The carrier, when accepting shipment, also accepts responsibility for safe delivery and is liable for loss or damage. On delivery, inspect for visible exterior damage, note and describe on the freight bill any damage found, and enter your claim on the form supplied by the carrier.

**1.2** Inspect for concealed loss or damage on the unit itself, both interior and exterior. If any, the carrier will arrange for official inspection to substantiate your claim.

**1.3** **Return Shipment:** Save the shipping crate until you are sure all is well. Never ship anything back inside the chamber. If for any reason you must return the unit, contact your service representative for authorization and supply the data plate information. Please see the manual cover for information on where to contact Customer Service.

**1.4** **Accessories:** Verify that your accessory kit is complete. The 5216 is equipped with 3 shelves, supply hose kit and 4 leveling feet. Check all packaging materials before discarding.



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# Section 2
# INSTALLATION

Local city, county, or other ordinances may govern the use of this equipment. If you have any questions about local requirements, please contact the appropriate local agency. Installation may be performed by the end user.

Under normal circumstances this unit is intended for use indoors, at room temperatures between 18° and 27°C, at no greater than 80% Relative Humidity (at 25°C) and with a supply voltage that does not vary by more than 10%. Customer Service should be contacted for operating conditions outside of these limits.

**2.1** **Power Source:** Check the data plate for voltage, cycle, phase and ampere requirements. Plug the unit into a properly grounded and rated outlet of the correct style. VOLTAGE SHOULD NOT VARY MORE THAN 10% FROM THE DATA PLATE RATING. These units are intended for 50/60 Hz application. A separate circuit is recommended to preclude loss of product due to overloading or circuit failure. NOTE: Electrical supply to the unit must conform to all national and local electrical codes.

**2.2** **Location: In** selecting a location, consider all conditions, which might affect performance, such as heat from radiators, ovens, autoclaves, etc. Avoid direct sun, fast-moving air currents, heating/cooling ducts and high-traffic areas. To ensure air circulation around the unit, allow a minimum of 5cm (2") between the unit and walls or partitions which might obstruct free airflow.

**2.3** **Lifting / Handling:** These units are heavy and care should be taken to use appropriate lifting devices that are sufficiently rated for these loads. Units should only be lifted from their bottom surfaces. Doors, handles and knobs are not adequate for lifting or stabilization. The units should be completely restrained from tipping during lifting and transport. All moving parts, such as shelves and trays should be removed and doors need to be positively locked in the closed position during transfer to prevent shifting and damage.

**2.4** **Leveling:** The unit must sit level and solidly. Leveling feet are supplied and must be installed in the four holes in the bottom corners of the unit. With the feet installed and the unit standing upright, each foot can be raised by turning it in a counterclockwise direction. Adjust the foot at each corner until the unit stands level and solid without rocking. If the unit is to be moved, turn the leveling feet all the way clockwise to prevent damage while moving.



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**2.5 Cleaning:** The unit chamber was cleaned with a decontaminant at the factory, but it should be cleaned and disinfected prior to use. Your operating conditions and appropriate protocol will determine the correct procedure for decontamination. A typical decontamination procedure that is adequate for many situations is described below, as are certain steps that will help reduce the likelihood of contamination and the necessity of decontamination. Whatever process is appropriate, it needs to be done on a regularly scheduled basis. Depending on usage and protocol, this may be monthly, quarterly or otherwise. Regardless of the decontamination procedure used, certain precautions will need to be taken:

**A.** Always disconnect the unit from the electrical service when cleaning. Assure all volatile or flammable cleaners are evaporated and dry before reconnecting the unit to the power supply.

**B.** Special care should be taken when cleaning around sensing heads to Prevent damage.

(See figure 1)



Figure 1

**C. Do not use chlorine-based bleaches or abrasive cleaners. These will modify the stainless steel interior finish. DO NOT USE hard tools such as metal wire brushes or steel wool. Use non-abrasive cleaners and soft tools such as plastic brushes. (See 7.1 – A)**

**D.** Use only DISTILLED water in the humidity pan. DO NOT USE de-ionized water due to its reactivity with metal components.

## TYPICAL DECONTAMINATION PROCEDURE

**1.** Remove the humidity pan every week and autoclave, or wash with soap and water then disinfect with 70% alcohol solution diluted with distilled water. Replace in the incubator with fresh, DISTILLED water.



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2. Flush the sample port tubing with 70% alcohol solution. Replace any discolored lines.

3. Clean and disinfect the liner gaskets. Clean and disinfect all mounting grooves for the door gaskets.

4. Remove all shelves, shelf supports, shelf standards and slides. Autoclave, or wash and disinfect as described in item 1.

5. Wash and disinfect all interior surfaces.

6. Give special attention to cleaning and disinfecting all access ports, shaft holes, electrical pass-through, and any other passages into the chamber.

7. Replace all HEPA (Patent No. 6,333,004) and $CO_2$ filters every six months or when noticeably dirty on the upstream side. $CO_2$ filters are located in the shadow box just behind the GAS IN fitting and on $CO_2$ sample line. Hepa filter is located on the top air duct inside the chamber.

## A. OPERATION FOR MINIMIZING CONTAMINATION

1. Keep the outside of the incubator, including the air in the laboratory, as clean as possible. This is particularly important for units placed directly on the floor. Do not place incubators near doors, air vents or other areas of high air movement or traffic.

2. The floor around the unit needs to be clean. Units that are placed on the floor should be mounted higher – typically on a caster platform – for ease of moving the unit during cleaning and access to the back of the unit.

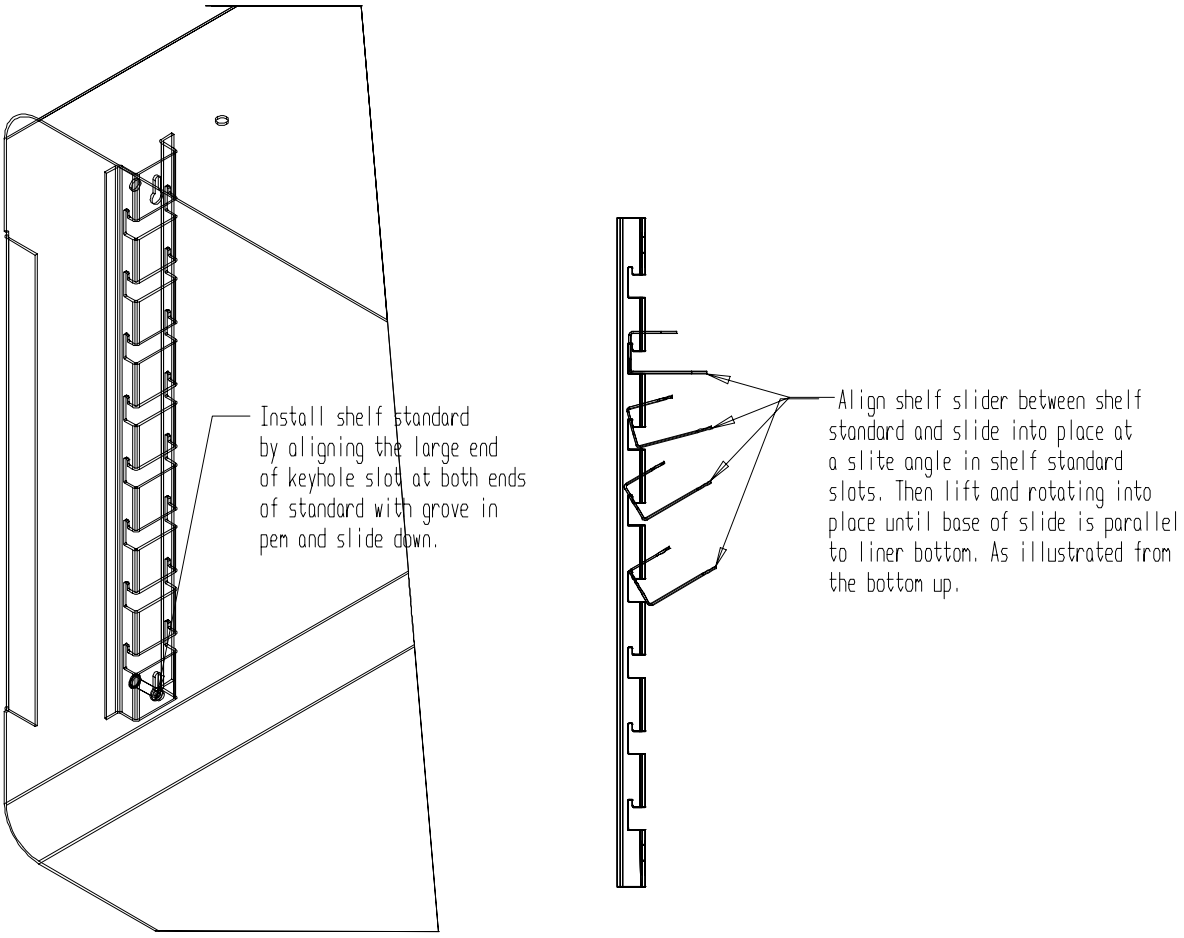
3. Minimize the number of times access is made to the chamber during normal operation.

4. Do not depend on the use of antibiotics to maintain uncontaminated conditions, as this is an inadequate technique for sterilization. Preferably use aseptic techniques as described above for maintaining sterile conditions in the incubator.



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**2.6** Place shelves in chamber as desired.





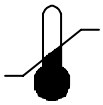

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# Section 3
# GRAPHIC SYMBOLS

Your CO2 incubator is provided with a display of graphic symbols on the control panel, which are designed to help identify the use and function of the adjustable components.

**1.**  Indicates that you should consult your manual for further description and discussion of a control or user item.

**2.**  Indicates **"Temperature"**

**3.**  Indicates **"Over Temperature"**

**4.** °C Indicates **"Degrees Centigrade"**

**5.**  Indicates **"AC Power**"

**6.**  Indicates **"Manual Adjustment"**

**7.**  Indicates **"Gas" ($CO_2$ pressurized gas for this unit)**

**8.**  Indicates **"Potential Shock Hazard"** behind partition

**9.**  Indicates **"Earth Ground"**

**10.** $CO_2$ Indicates **"Carbon Dioxide"**



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# Section 4
# CONTROL PANEL OVERVIEW (See Figure 2)

All controls are located on the front panel. Units with a detachable cord have a fused inlet located at the top rear of the incubator. This inlet has a recessed male plug, fuse and an EMI filtering system designed to filter out electrical interference. This inlet also prevents any internally generated interference from feeding out to the power grid.

**4.1** **Power Switch:** The I/O (ON/OFF) switch controls all of the power for the incubator and must be in the I/ON position before any systems are operational. Both temperature and $CO_2$ displays will illuminate when the power switch is in the ON position.

**4.2** **Safety Activated Light:** This pilot lamp is on whenever the Over Temperature Safety thermostat has been activated and taken control of the heating element. During normal operating conditions this indicator should never be on.

**4.3** **Temperature Control:** This controller is marked **C°** and indicates the actual temperature within the chamber to .1°C. The UP/DOWN buttons are used for imputing the set point, calibrating the display, and muting or unmuting the audible alarm. The HIGH and LOW alarm indicators will light whenever there is an alarm condition associated with the temperature within the chamber. The MUTE indicator will light whenever the audible alarm has been deactivated.

**4.4** **$CO_2$ Control:** This controller is marked **%$CO_2$** and indicates the %$CO_2$ content within the chamber to .1%. The UP/DOWN buttons are used for to input the set point, calibrating the display, and muting or unmuting the audible alarm. The HIGH and LOW alarm indicators will light whenever there is an alarm condition associated with the $CO_2$% within the chamber. The MUTE indicator will light whenever the audible alarm has been deactivated. The $CO_2$ injecting light will illuminate whenever the controller is injecting $CO_2$ into the chamber.

**4.5** **Over Temperature Safety Control (OTP):** This is a hydraulic thermostat that is wired between the Main Temperature Controller and the heating element and functions as an override control. If at any time the Temperature Control fails in the ON position, and the temperature in the incubator rises above its set point, the OTP is activated and maintains temperature at its own set point. Note that the HEATING indicator will continue to function under the control of the Over Temperature Safety.

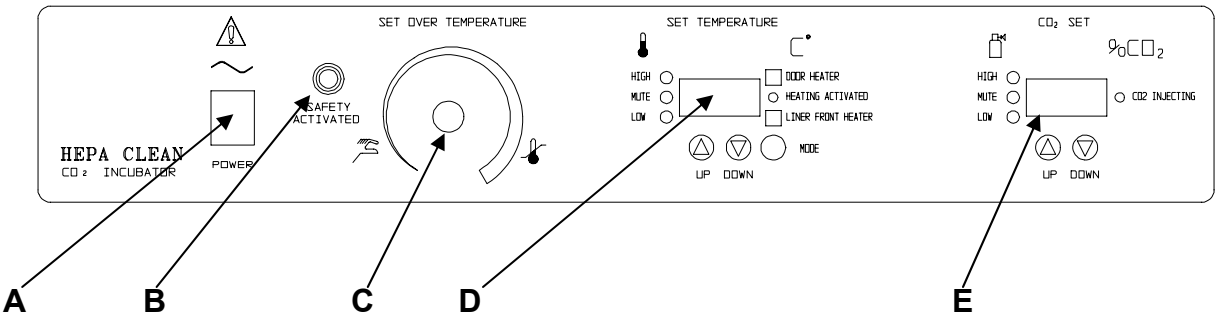
**4.6** **$CO_2$ Sample Chamber:** This is located in the upper front corner of the right side of the incubator. A sample can be drawn to measure the $CO_2$ content in the chamber at this port.



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## Figure 1

## Model 5216




**A. Power Switch**
**B. Safety Activated Light**
**C. Over temperature Safety Control**
**D. Temperature Control**
**E. $CO_2$ Control**

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# Section 5
# OPERATION

**5.1** Check power supply against unit serial plate; they must match. Be certain that the fuse is installed in the power inlet of the unit. Plug service cord into the electrical outlet.

**5.2** Push power switch to the ON position, and turn the High Limit Thermostat to its maximum position, clockwise. Temperatures must be set before CO2 connection and adjustments are made.

**5.3** **Set Main Temperature Control:** Inputting the set point on the controls is a very easy process.

A. Push and release either the UP or DOWN button and the digital display will start to blink from bright to dim.

B. While the display is blinking it will be showing the set point which can be changed using the UP or DOWN buttons.

C. If no buttons are pressed within five (5) seconds the blinking will stop and the display will revert to showing the process or actual parameter within the incubator chamber.

**5.4** **Calibration Procedure**: It is recommended that calibration is done once the unit is installed in its working environment and has been stable at set point for several hours. Place a certified reference thermometer in the center of the chamber. Be certain the thermometer is raised off the shelf and NOT touching any metal. Allow the temperature to stabilize again until the thermometer reads a constant value for one hour. Compare the digital display with the reference thermometer. If there is an unacceptable difference, more than two degrees) put the display into calibration mode by pressing **both** the Up and Down arrow pads **at the same time** for approximately five (5) seconds until the Display blinks on and off. While the decimal points are flashing the display can be calibrated to match the reference thermometer by pressing the Up and Down arrow pads until the display reads the correct value. Allow the incubator temperature to stabilize and repeat calibration if necessary.

**5.5** Set the CO2 Controls: Inputting the set point on any of the controls is a very easy operation.

A. Push and release either the UP or DOWN button and the digital display will start to blink from bright to dim.

B. While the display is blinking it will be showing the set point which can be changed using the UP or DOWN buttons.



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C. If no buttons are pressed within (5) seconds the blinking will stop and the display will revert to showing the process or actual parameter within the incubator chamber.

**5.6** **Set Over Temperature Thermostat:** As mentioned in step 5.2 the Over temperature Thermostat should be initially set to its maximum position (turn clockwise until it stops) to allow the unit to stabilize. Once the incubator is stable at the desired set point, turn the thermostat counterclockwise until the OVERTEMP ACTIVATED light turns on. Next, turn the Thermostat clockwise just until the light turns off. Then turn the Thermostat clockwise again, two minor increments on the dial past the point where the light went out. This will set the Over temperature Thermostat at approximately 1°C above Main Temperature set point.

**5.7** **Humidification:** Humidification of the unit is achieved by evaporation of water from the humidity pan placed in the bottom of the incubator. By filling this stainless steel reservoir pan with **DISTILLED WATER ONLY** and allowing this water supply to heat and evaporate, near saturation humidity is achieved. Do not use plastic, glass or other metals. Only 300 series stainless metals are acceptable for this reservoir pan. Do not use corrosive chemicals ***including copper sulfate or chlorine*** in the pan or chamber as damage may occur. **Use Distilled Water Only. DO NOT USE DEIONIZED WATER!**

Use of disinfecting chemicals in the chamber can change the surface tension of the reservoir water thus preventing evaporation and proper humidification of the chamber. Water in the pan should be changed and the pan cleaned at least once a week to help control contamination and to maintain proper surface tension.

**5.8** **$CO_2$ Supply System and Control System:** The $CO_2$ system is rated for input pressures between 5 to 40 PSI which should never be exceeded at any time



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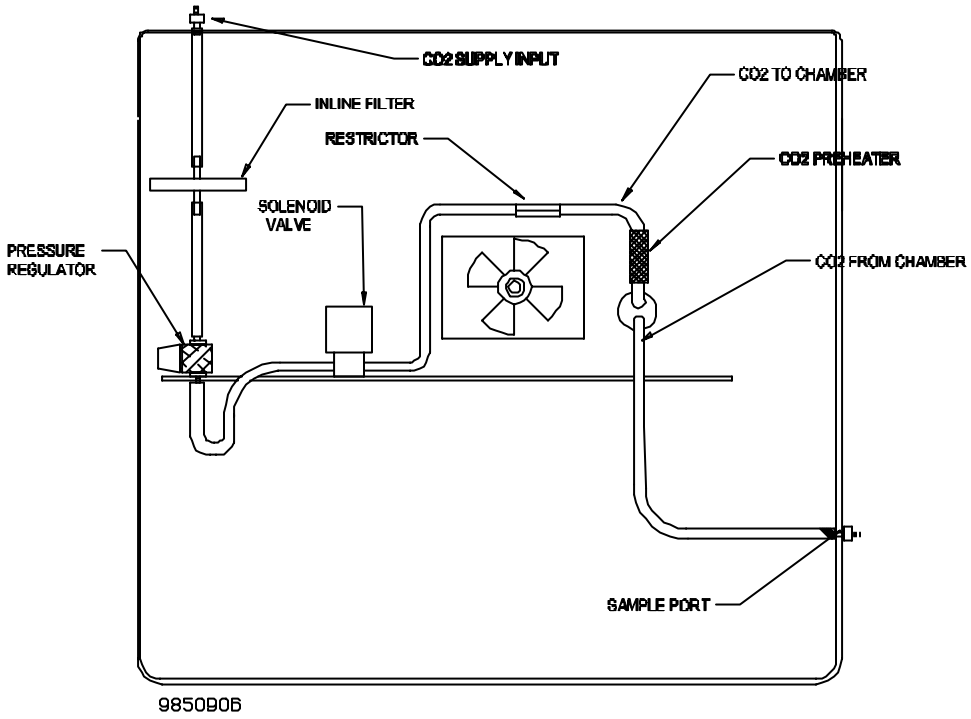


**Humidity Pan**



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## Figure 2
## PLUMBING DIAGRAM




**A.** The $CO_2$ inlet fitting is located at the back of the unit near the top (**see Figure 2**). It is marked $CO_2$ TO CHAMBER. A supply hose with in-line $CO_2$ filter (supplied with your accessories) connects from the fitting to a CO2 tank regulator.

**B.** It is highly recommended that a good quality 0-60 PSI output range **DUAL STAGE** pressure regulator be used on the $CO_2$ tank. The dual stage regulator will have two pressure gauges. The high pressure gauge (0-4000 PSI) will indicate the pressure within the tank. The low pressure gauge (0-60 PSI) will indicate the output pressure on the supply hose to the incubator. Do not use single stage regulators. They will not supply a stable pressure. Just because a regulator has two gauges does not mean that it is a dual stage regulator. **Insure that you are using a dual stage $CO_2$ regulator.**

**C**. It is normal for the high pressure gauge on your regulator to start out reading 800 to 1000 PSI with a full tank. The reading will drop to 500 to 800 PSI quickly and will stay there for most of the duration of the tank. At the end of use the pressure will drop quickly to zero to indicate that the tank is completely empty. Pure $CO_2$ is in a liquid state in the tank, and a constant vapor pressure is generated in the tank above the liquid level. The $CO_2$ is drawn off of the top as a gas. The same vapor pressure is maintained as long as any liquid is left in the tank. When the last of the liquid has



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evaporated into gas then the pressure will drop rapidly as the gas is drawn off. Pressure from the regulator to the incubator **should be set at 5 PSI**. Models with additional internal regulators have additional pressure reduction to 1 PSI to prevent overshoot.

**D.** **Only medical grade $CO_2$ should be used in your incubator. The use of any lesser grade may damage your incubator and void your warranty.**

**E.** The micro processor $CO_2$ control system interprets the information from the $CO_2$ sensor, displays the $CO_2$ concentration directly on the digital display, reads the $CO_2$ set point and controls the percentage of $CO_2$ in the incubator chamber.

**F.** The $CO_2$ sensors operate under the principal that a certain frequency of infrared light is absorbed by $CO_2$. The more $CO_2$ is present the more light is absorbed. Advantages to this system are that it is only sensitive to $CO_2$, so its accuracy is consistent no matter what the conditions, temperature and RH) are in the incubator.

**G.** $CO_2$ sensors are factory calibrated and under normal circumstances need no calibration in the field. It is recommended that the accuracy of the $CO_2$ control system be monitored. By measuring the actual $CO_2$ concentration on a weekly basis using a Fyrite or other measuring device. This should be done when the chamber has not been disturbed for an extended period of time i.e. after the weekend, or first thing on Monday morning.



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# Section 6
# FYRITE $CO_2$ CHECKING

A Bacharach FYRITE CO2 Gas Analyzer is recommended to measure CO2 concentrations in the incubator chamber. This test instrument is not supplied with the incubator but is readily available from your dealer. Follow the instructions provided with each Fyrite instrument carefully to insure correct and accurate readings. Your incubator has a chamber sampling port, marked as such, at the top right side of the body.

1. Press button on top of Fyrite canister to release $CO_2$ concentration. Tip canister to the side to ensure all fluid is released from top of canister.

2. Loosen screw on slide scale and align top of fluid with zero on the scale. Tighten screw.

3. Connect hose and aspirator bulb to unit being tested. The sample port for connection is located on the control panel.

4. Place the hose -sampling cap directly over the plunger valve on top of canister and depress firmly.

5. With button depressed, squeeze bulb 27 times. On the last squeeze and with bulb still deflated, release hose from button.

6. Turn Fyrite canister upside down 3 times, each time allowing all fluid to flow to the opposite end of the canister.

7. Tip canister to the 45-degree position to ensure all fluid has been released from top of canister.

8. Read $CO_2$ concentration in %.

***NOTE: Your Fyrite indicator will come with a complete set of detailed instructions, which should be followed carefully. The fluid used inside this Fyrite instrument is poisonous and corrosive and must not be taken internally. In the event of a spill or accidental body contact with the Fyrite fluid, follow the instructions on the refill bottle carefully.***



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# Section 7
# MAINTENANCE

***NOTE: Prior to any maintenance or service on the unit, disconnect service cord from the power supply.***

**7.1** **Cleaning:** Disinfect the incubator interior on a regular basis. To prepare the incubator for cleaning remove the shelves and shelf slides. These stainless steel parts are autoclavable.

**A.** First clean removed parts and interior with soap and water. To decontaminate use a disinfectant that is suitable for your application. DO NOT USE chlorine-based bleaches or abrasives, as this will damage the stainless steel interior. DO NOT USE spray cleaners that might leak through openings and cracks and get on electrical parts or that may contain solvents that will harm the coatings.

**WARNING:** Never clean the unit with alcohol or flammable cleaners with the unit connected to the electrical supply. Always disconnect the unit from the electrical service when cleaning and assure all volatile of flammable cleaners are evaporated and dry before reattaching the unit to the power supply.

**B.** When washing the interior, handle the gasket carefully so as not to impair the positive seal.

**7.2** Check the $CO_2$ supply periodically; do not let it run out. Automatic tank switches and "empty tank" alarms are available from your dealer.

**7.3** Periodically check $CO_2$ supply lines and connections for leaks. Use a liquid-soap solution to detect leaks and look for bubbles.

**7.4** Keep the $CO_2$ flow system free of impurities. Erratic $CO_2$ control is usually traceable to the $CO_2$ pressure regulator on the tank, impurities in the tank, or impurities trapped in the solenoid valve. Replace HEPA and $CO_2$ filters when noticeably dirty on the upstream side or every six (6) months. There is a $CO_2$ filter connected to the GAS-IN line inside the unit and accessible through the top and one attached to the supply hose kit.

**7.5** If the incubator is turned off for an extended period of time, clean and disinfect. The unit can be reactivated. Simply turn it on and allow 24 hours for recovery. NO adjustments are necessary. If the unit is shut down deliberately for storage disconnect the gas and power supply.

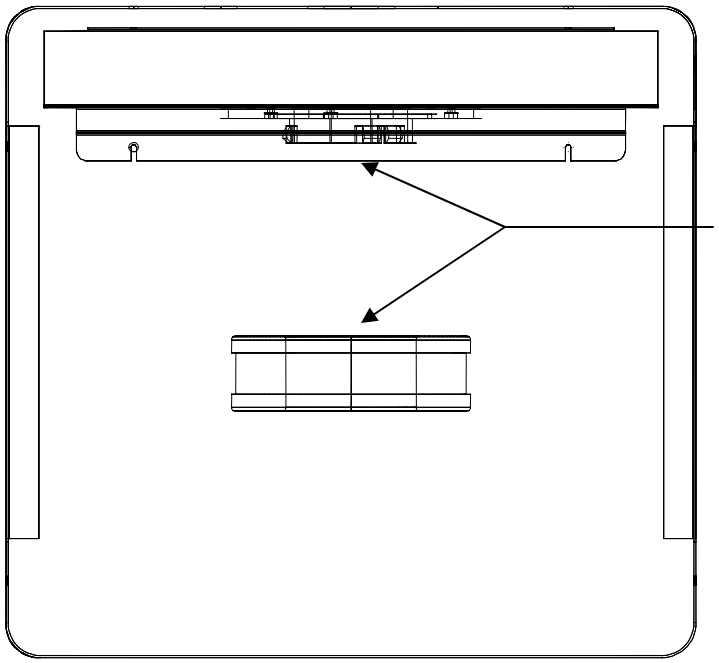
**7.6** There is no maintenance required on the electrical components. If the incubator fails to operate as specified, see Section 8.0, troubleshooting, before calling for service.



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# Section 8
# HEPA CO2 FILTER

The CO2 Incubator design features a HEPA filtration system with a patented copper housing. (Patent No. 6,333,004) As the chamber air is drawn through the filter system, airborne microbes and isolated particulates are not only removed from the air, but destroyed as well. It is through copper oxidation that the contaminants are actually killed. The HEPA filter is easily replaced without the need of any tools and has an efficiency rating of 99.97% at 0.3 microns.



The Hepa filter attaches to a fixed coupling ring with a direct “snap-in” action. Push straight up to the coupling ring to connect. Pull the filter straight down to disengage. Replacement Hepa filters are available from Sheldon Mfg., Inc. Part number 2800517.



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# Section 9
# TROUBLESHOOTING

Always make a visual inspection of the incubator and control console when troubleshooting. Look for loose or disconnected wires or tubing which may be the source of the problem.

The incubator is designed so that no internal electrical servicing should be required under normal conditions. If electrical servicing is necessary, qualified service personnel should perform it only. For information on where to reach technical service please see the manual cover. **FOR PERSONAL SAFETY, ALWAYS DISCONNECT THE POWER BEFORE SERVICING.**

| TEMPERATURE | |
|---|---|
| | Temperature too high |
| | 1/ controller set too high-see section 5.3.<br>2/ controller failed on – call Customer Service.<br>3/ wiring error – call Customer Service. |
| Display reads "HI" or "400"+ | |
| | Probe is unplugged, is broken or wires to sensor is broken – trace wire from display to probe; move wire and watch display to see intermittent problems. |
| Chamber temperature spikes over set point then settles to set point | |
| | Recalibrate – see section 5.4. |
| Temperature too low | |
| | 1/ Over temperature too low – see section 5.5.<br>2/ controller set too low – see section 6.3.<br>3/ unit not recovered from door opening – wait for display to stop changing.<br>4/ unit not recovered from power failure or being turned off – incubators will need 8 hours to warm up and stabilize.<br>5/ Element failure – see if HEATING light is on; compare current draw to data plate.<br>6/ controller failure – confirm with front panel lights that controller is calling for heat.<br>7/ Thermostat failure – confirm with front panel lights that Over temperature is operating correctly.<br>8/ wiring problem – check all functions and compare wiring to diagram in section 9.0, especially around any areas recently worked on.<br>9/ loose connection – check shadow box for loose connections. |



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| | |
|---|---|
| Display reads "LO" | |
| | 1/ Sensor is plugged in backwards – reverse sensor wires to controller.<br>2/ If ambient room temperature is lower than range of unit – compare set points and ambient temperature to rated specifications in section 9.0. |
| Unit will not heat over a temperature that is below set point | |
| | 1/ Confirm that fan is moving and that amperage and voltage match data plate – check fan motor motion in shadow box and feel for air movement in chamber.<br>2/ confirm that set point is set high enough, turn Over temperature counterclockwise and see if HEATING light or OVERTEMP light come on.<br>3/ check connections to sensor.<br>4/ Check calibration – using independent certified reference thermometer, follow instructions in sections 5.4. |
| Unit will not heat up at all | |
| | 1/ verify that controller is asking for heat by looking for HEATING light – if pilot light is not on continuously during initial start up there is a problem with the controller.<br>2/ check amperage – amperage should be virtually at maximum rated (data plate) amperage.<br>3/ Do all controller functions work?<br>4/ Is the Over temperature Thermostat set high enough? – For diagnostics, should be fully clockwise with the pilot light never on.<br>5/ Has the fuse/circuit breaker blown? |
| Chamber temperature unstable | |
| | 1/ ±0.1 may be normal.<br>2/ Is fan working? – Remove top panel and verify movement of cooling fan in center of shadow box.<br>3/ is ambient room temperature radically changing – either door opening or room airflow from heaters or air conditioning? – Stabilize ambient conditions.<br>4/ Sensor miss-located, damaged or wires may be damaged - check mounts for Main controller and Thermostat sensors then trace wires between sensors and controls.<br>5/ calibration sensitivity – call Customer Service.<br>6/ Over temperature set too low – be sure that set point is more than 5 degrees over desired Main set point; check if pilot light is on continuously; turn controller knob completely clockwise to see if problem solved then follow instructions in section 5.5 for correct setting.<br>7/ electrical noise – remove nearby sources of RFI including motors, arcing relays or radio transmitters. |



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| | |
|---|---|
| | 8/ bad connection on temperature sensor or faulty sensor – check connectors for continuity and mechanical soundness while watching display for erratic behavior; check sensor and wiring for mechanical damage.<br>9/ bad connections or faulty capacitor – check connectors for mechanical soundness and look for corrosion around terminals or signs of arcing or other visible deterioration. |
| Will not maintain set point | |
| | 1/ assure that set point is at least 5 degrees over Ambient room temperature.<br>2/ see if ambient temperature is fluctuating; if so, stabilize |
| Display and reference thermometer don't match | |
| | 1/ calibration error – see section 5.4.<br>2/ temperature sensor failure – evaluate if pilot light is operating correctly.<br>3/ controller failure – evaluate if pilot light is operating correctly<br>4/ allow at least 8 hours to stabilize.<br>5/ verify that reference thermometer is certified. |
| Can't adjust set points or calibration | |
| | 1/ turn entire unit off and on to reset.<br>2/ if repeatedly happens, call Customer Service. |
| Calibrated at one temperature, but not at another | |
| | This can be a normal condition. Could happen when operating temperatures varies with a wide range. For maximum accuracy, calibration should be done at or as close to the set point temperature. |

# CO2 LEVEL

| | |
|---|---|
| Overshoots set point but stabilizes - display and Fyrite match | |
| | 1/ turn set point up and down to see if solenoid valve works by feeling and listening to valve<br>2/ recalibrate with Fyrite, see section 5.4 and section 7.0<br>3/ fan not operating correctly<br>a- fan motor stopped<br>b- blower wheel blade fell off<br>c- wrong fan blade installed or mounted backwards<br>4/ wrong restrictor installed or missing altogether<br>5/ tank pressure too high, see section 5.9.A<br>7/ $CO_2$ sensor partially plugged with dirt or condensation<br>8/ regulator set wrong, see section 5.9 |



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| | |
|---|---|
| | 9/ incubator too heavily loaded<br>10/ incubator being operated without shelving<br>11/ CO2 attached to sample port instead of "CO2 IN" fitting<br>12/ internal regulator pressure too high (MODELS WITH INTERNAL REGULATOR)<br>13/ if display and Fyrite does not match, see below |
| Overshoots set point and continues to rise - display and Fyrite match | |
| | 1/ debris in solenoid causing it to leak continuously<br>2/ solenoid failed while open<br>3/ unit miss-wired<br>4/ controller output failed or shorted<br>5/ CO2 sensor or interface failure<br>6/ CO2 sensor plugged by debris or condensation |
| Rises very slowly | |
| | 1/ filter overly dirty or partially plugged<br>2/ hose kinked or leaking<br>3/ CO2 tank regulator set too low, see section 5.9<br>4/ poor door seal<br>5/ restrictor partially plugged<br>6/ CO2 tank near empty |
| Never rises | |
| | 1/ CO2 filter plugged<br>2/ CO2 hose blockage<br>3/ CO2 tank empty<br>4/ CO2 controller output failed while open<br>5/ solenoid failed while closed<br>6/ set point is at 0.0 and has not been reset, see section 5.3 and 5.4<br>7/ CO2 tank regulator not on |
| Display and Fyrite reading do not match | |
| | 1/ calibration error - clear chamber for 8 hrs and confirm at "0"<br>2/ turn set point up and down to see if solenoid valve works by feeling and listening to valve<br>3/ assure that IR tube block is completely tight<br>4/ if display is varying when doing Fyrite test, have a leak on IR base or mounting plate, or CO2 is injecting at time of test.<br>5/ take voltage reading across sensor leads 0=0V and 20=1V<br>6/ assure that sensor is properly mounted<br>7/ DISPLAY LOWER THAN FYRITE: air leak around the CO2 sensor or the fan motor shaft<br>8/ DISPLAY HIGHER THAN FYRITE: leak in tube from sample port to chamber, verify with liquid soap solution.<br>9/ DISPLAY HIGHER THAN FYRITE: Fyrite fluid |



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| | |
|---|---|
| | worn out, replace fluid with Fyrite refill.<br>10/ DISPLAY HIGHER THAN FYRITE: poor Fyrite sampling technique, see section 7.0<br>11/ DISPLAY HIGHER THAN FYRITE: defective Fyrite pump or tubing<br>12/ CO2 sensor, interface or controller failure<br>13/ Top air duct missing |
| If unstable – display or actual reading varies around set point | |
| | 1/ confirm that fan is working<br>2/ check for air leak around CO2 sensor or fan motor shaft<br>3/ magnetic field interference<br>4/ door not sealing properly<br>5/ atmospheric pressure fluctuations<br>6/ defective Fyrite pump or tubing<br>7/ CO2 entering chamber too quickly<br>a- tank pressure too high<br>b- regulator set wrong<br>c- restrictor incorrect or missing<br>8/ electronic problem with CO2 sensor, interface or controller<br>9/ top of unit exposed to cold air drafts<br>10/ unit being operated without shadow box cover<br>11/ electrical interference – atmospheric or conducted<br>12/ incubator too heavily loaded |
| Can't adjust set points or calibration - "locked up" | |
| | 1/ turn unit off and on to reset processor in controller<br>2/ if repeatedly happens, call Customer Service |
| Feeding continuously or abnormally high CO2 usage | |
| | 1/ do decay test: if more than 1% decay in an hour, check for leak: door gasket tightness, motor inlet to chamber, sensor and probe inlet to chamber<br>2/ check output signal from controller<br>3/ check solenoid valve for correct operation<br>4/ leak in plumbing including between regulator and CO2 tank<br>5/ door being opened too often |
| Won’t hold calibration – Fyrite reading varies but display stable | |
| | 1/ atmospheric pressure fluctuations<br>2/ top of unit exposed to cold air drafts<br>3/ unit being operated without shadow box cover in place<br>4/ condensation collecting on CO2 sensor<br>5/ CO2 sensor or interface failure<br>6/ unit incorrectly calibrated, see section 5.4<br>7/ taking Fyrite reading too soon after the door has been opened |



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| | |
|---|---|
| | 8/ air leak around CO2 sensor mounting plate |
| **MECHANICAL** | |
| Door not sealing | |
| | 1/ check physical condition of gasket.<br>2/ Confirm that door latch pulls door in tightly.<br>3/ Assure that gasket is in original location. |
| Motor doesn't move | |
| | 1/ if shaft spins freely: check connections to motor and check voltage to motor;<br>2/ if shaft rubs or is frozen, relieve binding and retest |
| Motor makes noise | |
| | 1/ If noise is from the motor, tap the top of motor shaft with ball peen hammer.<br>2/ If the sound gets worse, tap the other end of the shaft – avoiding touching the fan blade.<br>3/ If there is no change, call Customer Service.<br>4/ If noise is from shaft or fan blade, realign shaft. |
| Solenoid valve buzzing | |
| | After removing solenoid clean with alcohol for carbon build-up then blow out. Check valve seat or channels for contamination. Check CO2 filter and/or grade of CO2 used. If seat is worn, replace. |
| **OTHER** | |
| Controller on at all times - "locked-up" | |
| | 1/ turn unit off and on to reset.<br>2/ if cannot change any condition on the front panel, call Customer Service. |
| Front panel displays are all off | |
| | 1/ Check for wire damage.<br>2/ Make sure unit is plugged in. |
| Unit or wall fuse/circuit breaker is blown | |
| | 1/ Check wall power source.<br>2/ Compare current draw and compare to specs on data plate.<br>3/ See what other loads are on the wall circuit. |
| Unit will not turn on | |
| | 1/ Check wall power source.<br>2/ Check fuse/circuit breaker on unit or in wall.<br>3/ See if unit is on, e.g., fan or heater, and just controller is off.<br>4/ Check all wiring connections, esp. around the on/off switch. |
| Unit is smoking – Out of box | |
| | This can be a common experience as the elements burn off the protective coatings. Put unit under vent and run at full power for one hour until the smoke dissipates. |
| Contamination in chamber | |



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| | |
|---|---|
| | 1/ see cleaning procedure in Maintenance section 7.0<br>2/ develop and follow Standard operating procedure for specific application; include definition of cleaning technique and maintenance schedule. |



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# Section 10
# PARTS LIST

| Description | 5216 | |
|---|---|---|
| | 115 | 220 |
| 4 to 20mA Board | 1750667 | 1750667 |
| Blower Wheel | 2600519 | 2600519 |
| Chamber Gasket, 8 feet | 3450546 | 3450546 |
| Circulating Fan | 210002 | 210001 |
| CO2 Display Board | 1750660 | 1750550 |
| CO2 Fan Motor | 4880508 | 4880507 |
| CO2 Filter | 100199 | 100199 |
| Door Heater | 103068 | 103068 |
| Door Switch | X1000022 | X1000022 |
| Element | 9570787 | 9570752 |
| Fuse, 6.3 amp 250v | 3300516 | 3300515 |
| Glass Door Assembly | 9520831 | 9520831 |
| HEPA Filter | 2800517 | 2800517 |
| IR Transmitter | 8320501 | 8320501 |
| Multi-Channel Main Board | 1750658 | 1750657 |
| On/Off Switch | 103351 | 103351 |
| Over temperature Thermostat | 10000J | 10000J |
| Pilot Light, Red | 200020 | 200020 |
| Power Cord | 104189 | 104192 |
| Power Supply | 6750507 | 6750507 |
| Recorder Jack | 100163 | 100163 |
| Shelf | 5121018 | 5121018 |
| Solenoid Valve | 8600528 | 8600529 |
| Temperature Display Board | 1750714 | 1750714 |



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# UNIT SPECIFICATIONS

| Weight | Shipping | Net |
|---|---|---|
| 5216 | 195 | 134 |

| Dimensions | Exterior WxDxH (in.) | Interior WxDxH (in.) |
|---|---|---|
| 5216 | 26.25X19.75X37.75 | 18.25X19.75X21.75 |

| Capacity | Cubic Feet |
|---|---|
| 5216 | 5 |

| Temperature | Range | Control | Uniformity | CO2 Range |
|---|---|---|---|---|
| 5216 | 5° above amb. to 60°C | ±0.1°C | ±0.25° @ 37°C | 0-20% |

| TO 20mA Board Conversions | |
|---|---|
| CO2 @ 4mA=0% CO2 | CO2 @ 20mA=20% CO2 |
| Temperature @ 4mA=0° Celsius | Temperature @ 20mA=70° Celsius |

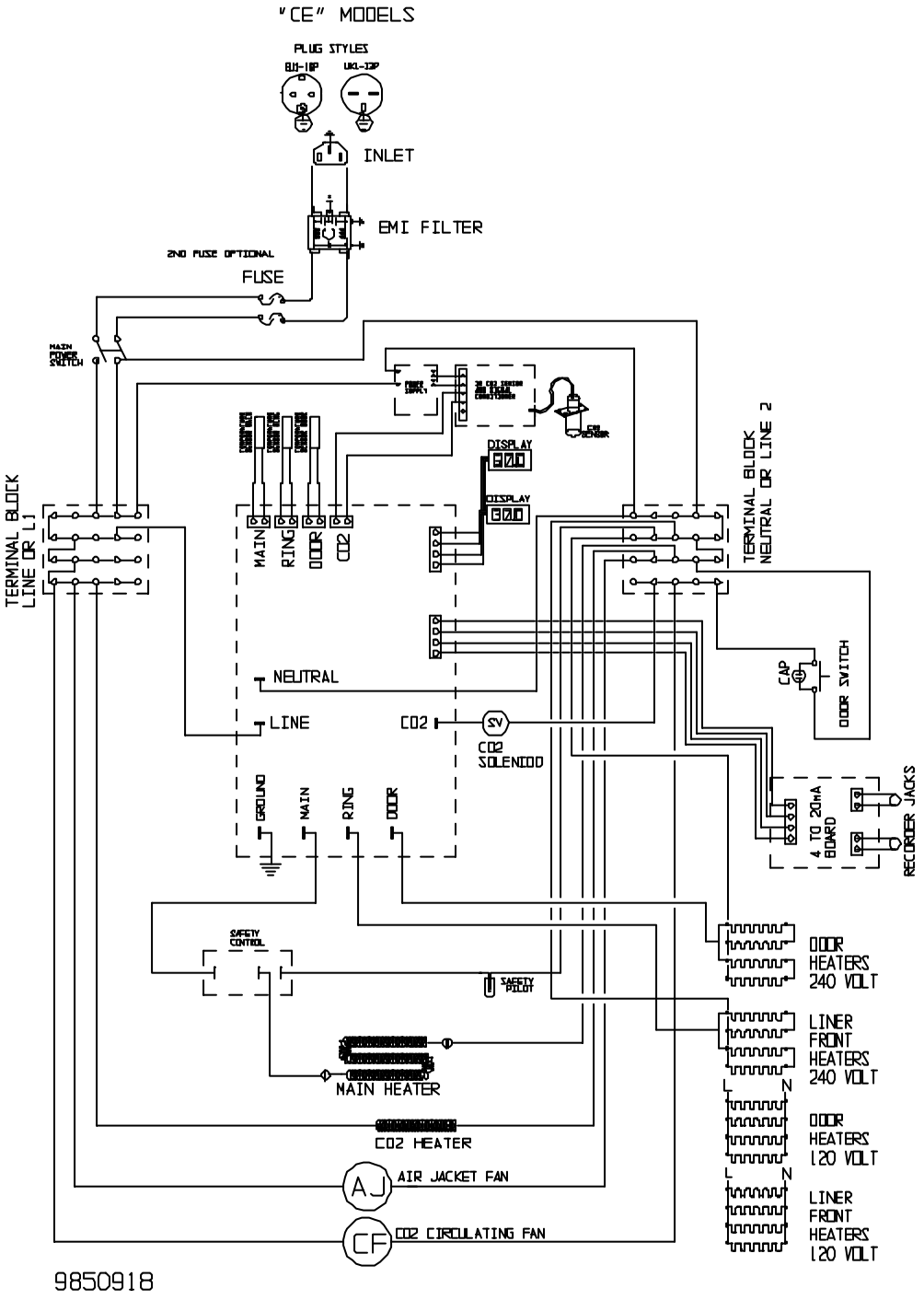
## INCUBATOR ACCESSORIES

1. **$CO_2$ Tank Switch**
2. **Fyrite $CO_2$ Gas Analyzer**
3. **In-Line Filter**
4. **HEPA Filter**
5. **Caster Platform**



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# WIRE DIAGRAM






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