Air-Jacketed Automatic CO_2 Incubator

Models
NU-5510
NU-5510E

Operation and Maintenance Manual

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Revision 12
(Series 6 & Higher)

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Air-Jacketed DHD Autoflow Automatic CO_2 Incubator

Operation & Maintenance Manual

NU-5510/E

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1.0 General Description

The NuAire DHD Autoflow Automatic CO_2 Air-Jacketed Incubator has been designed to provide a reliable controlled in-vitro environment for optimum tissue cell culture growth. The chamber also provides an environment for the storage and preservation of embryos, gametes and animal tissue cell cultures at on near body temperature. There are five parameters that contribute to optimum growth conditions. These are:

1. Humidity
2. Precise temperature control
3. Precise CO_2 control
4. Sterility
5. Reliability

Like all NuAire equipment, this Incubator has been designed to provide the highest quality standards of performance with matching computer technology, precise temperature control, and CO_2 gas control system combining state-of-the-art technology with years of design, quality, and manufacturing experience.

In order to accomplish the foregoing objectives, this Incubator features the following:

1.1 Incubator Chamber

The design and size of the DHD Autoflow inner chamber provides a large capacity, and ease of use. The chamber walls are directly heated by physically attached foil heating elements on the sides, bottom, top, and back of the chamber, providing a temperature uniformity of $\pm$0.3°C. A space-age high-density insulation that has a high "R" rating covers the complete outer surfaces of the Incubator inner chamber.

1.2 Incubator Blower Fan & HEPA Filter

A continuous operating fan motor drives a blower wheel within the upper air plenum and sidewall duct system. Air is constantly re-circulating within the chamber keeping every cubic inch of volume at a uniform temperature. This airflow is distributed uniformly and at very low velocity, so as not to influence culture growth. A large replaceable HEPA filter cartridge continually filters the air that circulates in the chamber.

1.3 Incubator Control Electronics

The NuAire Incubator Control Electronics is a state-of-the-art microcomputer based control system specifically designed to service the precise control requirements of the chambers environment, providing optimum programmable conditions for culture growth. The microcomputer is “user-friendly” with status indicators, LED display of control parameters and five touch control keypads to permit efficient operator entry of data.

The microcomputer is supported with Read Only Memory (ROM) containing executable software, Random Access Memory (RAM) for temporary storage, and Electronically Erasable Programmable Read Only Memory (EEPROM) for control set points and parameters. The EEPROM provides for indefinite storage of these values during periods of power off or power interruption (power fault tolerant). The microcomputer includes a complete internal diagnostic software package that permits fault isolation detection down to the failed component.

1.4 Incubator CO_2 Control

The NuAire direct heat Incubator incorporates a microprocessor-based, non-dispersive infrared CO_2 induction sensor. The amount of energy received at the detector is an approximate logarithmic function of the CO_2 concentration in the gas between source and detector. The wavelengths used are absorbed only by CO_2 making the measurement insensitive to other components, such as water vapor. Detector linearization is performed with 32 bit digital accuracy. Advanced design provides a very stable output minimizing drift and requiring less frequent calibration. The output is digital, alleviating tolerances brought about by analog signals. The sensor is within the chamber air plenum so very accurate CO_2 control is achieved. The CO_2 sensor consists of a control board and a detector assembly connected by a cable. Calibration of this control is accomplished through the front of the unit where there is a CO_2 test port.

1.5 Incubator Construction

The outer shell of the air-jacketed Incubator is cold-rolled steel with a powder coat paint finish. The front frame surface of the outer shell is heated with a foil type heater directly attached behind the front perimeter opening.

The front frame perimeter heater, as well as the outer front door heater is duty cycle controlled (manually adjusted for specific ambient conditions) to balance the heat that reaches the chamber and thus reduces the possibility of condensation forming on the inner glass door and the inner chamber walls.

The inner chamber is 16 gauge, type 304, polished stainless steel using crevice-free construction, which provides an easily cleanable inert surface that does not in itself promote biological growth. In addition, all shelves, shelf supports, guide rails and the air plenum are easily removable and can be autoclaved to remove contamination.

Remember: The chamber is not selective. The growth environment is applied equally to all microorganisms within the chamber.

1.6 Incubator Humidity

A relative humidity level of up to 95% is achieved in the Incubator by the use of a stainless steel pan filled with distilled water no purer than 1 mega ohm, and placed on the bottom of the chamber. It is necessary to set the duty cycle (0-100%) of the door and front perimeter heater in proper proportions to reduce the possibility of condensation forming on the glass inner door and the chamber walls. It is also important to thoroughly wipe the walls and the glass door clean before adding the humidity water pan. Condensation will occur more readily at contamination points. There is no electronic sensing and thus no automatic control of the humidity level in the air jacketed Incubator. An air pump injects fresh air into the chamber at a preset duty cycle to reduce condensation forming on the chamber walls and front glass door. The air injections are settable by the user to help control condensation. (See section 8.8 for this option.)

1.7 Cabinet Ventilator Fan

An axial fan is mounted to the bottom cover panel of the Incubator and runs continuously when the unit is switched on. This fan pulls air into the cabinet shell thru the top panel louver openings and discharges it out of the bottom of the unit. The operation of this fan is necessary to assure accurate chamber temperature control over the 60°F to 85°F ambient temperature range that the equipment may see.

2.0 Performance Parameters and Features

- Both the interior and exterior of the DHD Autoflow are constructed of 16-gauge material. The interior is highly polished type 304 stainless steel, using crevice-free construction. All exposed edges are deburred to insure no sharp edges. The exterior is cold rolled steel finished in a powder coated polyurethane finish, which is resistant to chemicals and easily cleaned using mild household detergents.
- The DHD Autoflow's microcomputer temperature control system has two temperature sensors located in the chamber. The temperature sensors compare the values to a set point and execute a differential control algorithm that energizes a solid-state switch, supplying power to the heaters.
- Up to 17 shelves can be placed inside the chamber (4 supplied).
- Space-age high temperature material is used to insulate the inner chamber walls.
- Foil heaters are directly attached to the chamber walls and the top and bottom surfaces of the inner chamber.
- Incubators can be stacked for space saving, and can still be serviced from the front.
- Easily removable inner chamber plenum shelves and rails for sterilization.
- Most electronics, motors, pumps, and valves are fully accessible from the front of the unit.
- A CO_2 sample port is provided on the front panel to check the concentration of CO_2 in the chamber.
- The CO_2 percentage is controlled by a solid-state gas infrared sensor, which provides accurate monitoring of CO_2 affected minimally by changes in temperature or humidity levels in the chamber.
- Automatic recovery of the CO_2 level after a 1minute door opening to 5.0 $\pm$ 0.2% is within a 4-1/2 minute period.
- The outer door includes an internal radiant heater in order to minimize condensation on the inner glass door. A magnetic outer door gasket helps to insure a tight seal against the cabinet.
- The inner glass door is 3/16” tempered with smooth-ground edges and seals are tight against a U-grooved silicone rubber gasket. The door latch is cam action. An all solid-state magnetic switch monitors door motion.
- All control electronics are protected with a circuit breaker that may trip at 110% of loading rating but will trip at 145% of load rating in less than 2 seconds. Should the circuit breaker open (pop-out button will appear), merely depress to reset.
- The Incubator has factory-installed adjustable leveling legs to compensate for uneven laboratory surfaces.

3.0 Models & Features

NuAire offers a basic Model NU-5510/E Air-Jacketed DHD Autoflow CO_2 Incubator.

3.1 Dimensions (see also Specification Drawing BCD-09807)

Overall Dimensions - inches (mm):		**Model NU-5510/E**
Height:	Exterior:	39.5 Inches (1003.3mm)
Width:		25.5 Inches (647.7mm)
Depth:		26.5 Inches (673.1mm)
Height:	Interior:	25.5 Inches (647.7mm)
Width:		21.5 Inches (546.1mm)
Depth:		21.0 Inches (533.4mm)

Shelf Capacity:

Size:	19.25 Inches (489mm) x 19.25 Inches (489mm)
Supplied:	4 Shelves
Max. Capacity:	17 Shelves
Max. Weight Capacity:	30 lbs (Do not try to remove shelf with more than 20 lbs on it.)

Water Pan:

Dimensions:	Mean Length	16.25” (413mm)
	Mean Width	11.04” (280mm)
	Depth	2.375” (60mm)
Capacity:	Maximum	6.75 Liters
	Recommended Fill	5.5 Liters

3.2 Performance Parameters

- Temperature Range: 18°C to 55°C (5°C above ambient to 30°C ambient max.)
- Temperature Uniformity: $\pm$0.3°C @ 37°C.
- Temperature Accuracy: $\pm$0.1°C.
- Minimum Temperature for Decontamination: 145 DEG Cycle 135°C; 95 DEG Cycle 87°C
- CO_2 Range: 0.1 to 20%.
- CO_2 Accuracy: $\pm$0.1%
- CO_2 Recovery: Up to 5% $\pm$0.2% in 4 minutes.
- Temperature Recovery: 0.3°C/min. (Average)
- Temperature Display Resolution: 0.1°C
- CO_2 Display Resolution: 0.1%
- Door and Perimeter Heater Control Logic: Proportional 0-100% (adjustable)
- Door & Perimeter Heater Duty cycles are processor controlled.
- Temperature Sensor Type: Precision Integrated Circuit
- CO_2 Control Logic: Fixed Algorithm/Manual Environmental Adaptable.
- CO_2 Sensor Type: Infrared
- Connectors on rear panel are provided for chart recorder, remote alarm, and printer connection.

NOTE: RATINGS APPLY ONLY AT DEFAULT CONTROL AND OPTION SETTINGS

3.3 Standard Items Packed With Unit

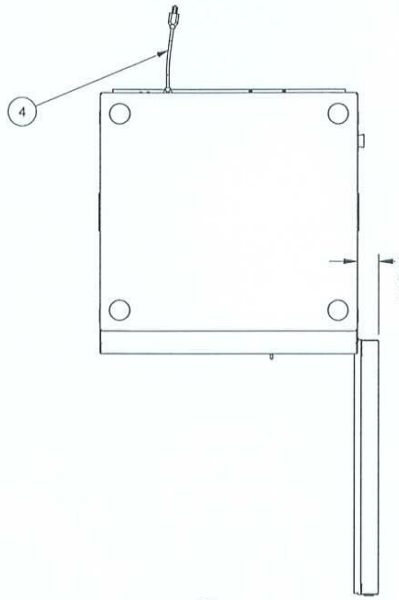
- Four (4) stainless steel shelves
- Eight (8) stainless steel shelf brackets
- Two (2) sidewall plenums (installed)
- One (1) blower plenum (installed)
- One (1) water pan
- Gas tube and filter
- Air intake tube and filter
- Access port plug with breather holes (installed)
- Outer shell plastic hole ring (installed)
- 2 meters long electrical cord
- Operation and Maintenance Manual
- Operating Instructions

3.4 Accessories (Ordered Separately)

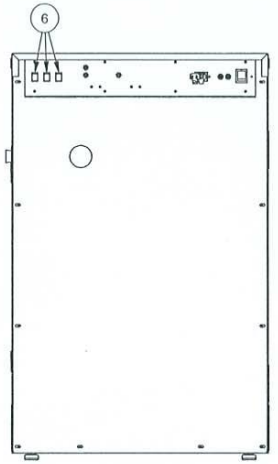
- Model NU-1550 Automatic Tank Switch (External) (115 VAC)
- Model NU-1550E Automatic Tank Switch (External) (230 VAC)
- Model NU-1552 CO_2 Tank Alarm (115 VAC)
- Model NU-1551E CO_2 Tank Alarm (230 VAC)
- Model NU-1557 Additional Shelves
- Model NU-1559 CO_2 Analyzer Fyrite Kit (Dry) 0-20% (replacement fluid required)
- Model NU-1561 Replacement Fluid for CO_2 Analyzer (two bottles/carton)**
- Model NU-2568 Surge Protector (115 VAC)
- Model NU-1564 CO_2 Regulator (2 Stage)

**Fyrite Replacement Fluid may only be ordered when shipment is possible by UPS Ground Service.

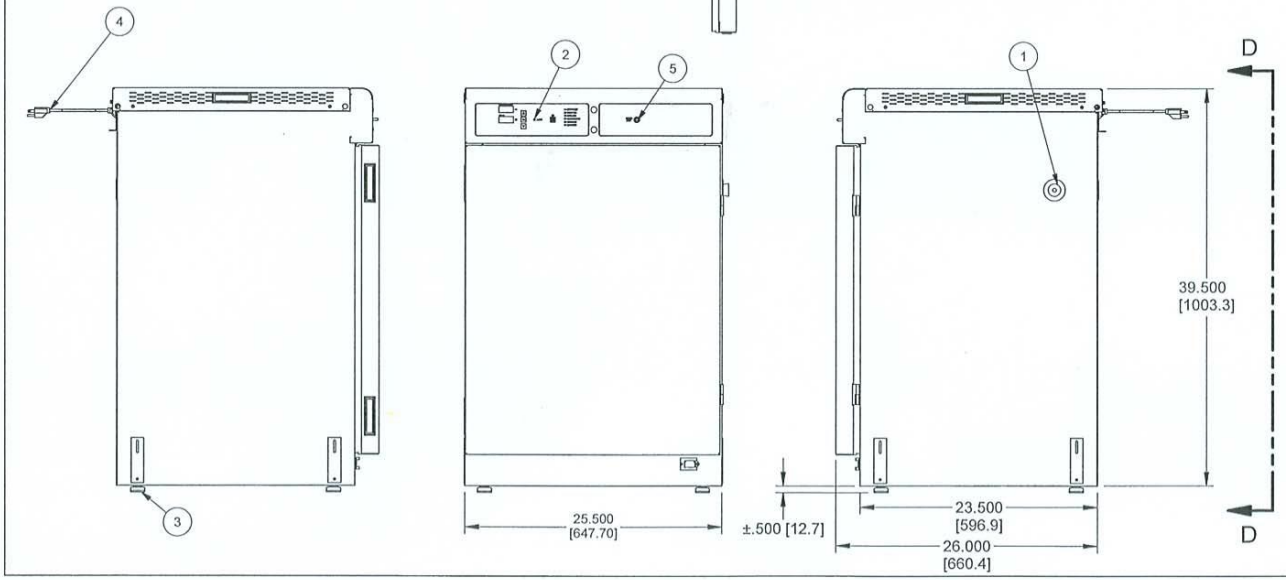
REV	ECO	DESCRIPTION	DATE	DFTR	CHKD
C	11019	UPDATED TO CAD	10/19/2010	DHH	KCK



1. - ACCESS PORT (Ø1.125 [28.5 mm])
2. - FRONT PANEL CONTROLS & INDICATORS
3. - LEG LEVELER (±.500" ADJUSTMENT)
4. - POWER CORD 8" [2.5M]
5. - CO2 SAMPLE PORT
6. - COMMUNICATION AND REMOTE ALARM
FACTORY WIRED CONNECTORS ON BACK PANEL



VIEW D-D
CABINET REAR



INTERIOR DIMENSIONS:

25-1/2"[647.7] H X 21-1/2"[245.1] W X 21" [533.4] D

EXTERIOR DIMENSIONS:

39-1/2"[1003.3] H X 25-1/2"[647.7] W X 26"[660.4] D

SHELF DIMENSIONS:

19-1/4"[488.9] X 19-1/4"[488.9]

ORIGINAL

INCHES [mm]

DATE	9/5/2003
DFTM	AY
CHKD	KCK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
-TOLERANCES-
DECIMALS ± .032
ANGLES ± 2'

TITLE: NU-5510/5510E
DIRECT HEAT CO2 INCUBATOR

MATERIAL: AS NOTED

PART NUMBER: BCD-09807 C

PROJECT NUMBER:

SHEET 1 OF 1

4.0 Test Performance & Procedures

All equipment is thoroughly inspected at the NuAire Factory at the time of shipment. Quality control is maintained by constant surveillance over the product, beginning at the receipt of purchased material and concluding with a final inspection, which certifies the Incubator performance to the specifications. In all instances where product quality cannot be easily assessed on the end item, the product is inspected during sub-assembly fabrication. The following test procedures are conducted on each cabinet and a copy of the test report is included with each unit.

4.1 Visual Inspection

4.1.1 Each Incubator is visually inspected to insure that the interior is clean and free from scratches, nicks, and burrs and that all welds, both interior and exterior are ground and polished smooth.

4.1.2 Painted surfaces are inspected to be free of scratches, nicks, insufficient covering, and runs.

4.1.3 The doors open and close freely without binding of the hinges. The gasket seals the inner glass door tightly. The glass door is free of scratches.

4.2 Electrical Tests

4.2.1 Electrical Leakage Test

All Incubators are required to have primary-circuit filtering to meet EMC (electromagnetic compatibility) regulations. Electrical leakage may exceed 0.5 milliampere provided the leakage current does not exceed 1.0 milliamperes.

4.2.2 Dielectric Voltage - Withstand

1770 volts (VDC ONLY) is applied between dead metal parts and the hot/neutral power source lead with no electrical breakdown using an Associated Research Model 4045AI or 3560D for 115 VAC units. 2100 volts (VDC ONLY) is applied for 230 VAC units.

4.2.3 Grounding Continuity

The resistance between the green bonding conductor of the supply cord and any dead metal part of the cabinet shall not exceed 0.10 ohms.

4.3 Functional Tests

These functional tests are performed on every unit after a 48-hour burn-in period.

4.3.1 Control Systems

All diagnostic functions are exercised to insure proper operation of control systems, components and alarms.

4.3.2 CO_2 Control

Each unit is calibrated to function at a 5% CO_2 level. The concentration is checked with an independent instrument. Each unit is monitored during the 48-hour burn-in period and only accepted with zero failures.

4.3.3 CO_2 Recovery

Each unit is exercised for CO_2 recovery time at the end of the 48-hour burn in period. The door is opened for 1 minute to deplete the CO_2. After the door is closed, the unit shall recover to 5% $\pm$0.2% within a 4-minute period.

4.3.4 Temperature

Each unit is monitored for stable temperature control over the 48-hour burn-in period (37°C).

4.3.5 Humidity

Each unit is subjected to the highest achievable RH during the 48-hour burn-in period and any condensation problems corrected. Door and perimeter duty cycles are set at 18% and 32% respectively for this test. These are the default settings from the factory.

5.0 Warranty

NuAire, Inc. warrants that it will repair F.O.B. its factory or furnish without charge F.O.B. its factory a similar part to replace any material in its equipment within 24 months after the date of sale if proven to the satisfaction of the company to have been defective at the time it was sold provided that all parts claimed defective shall be returned, properly identified to the company at its factory, charges prepaid. Factory installed equipment or accessories are warranted only to the extent guaranteed by the original manufacturer and this warranty shall not apply to any portion of the equipment modified by the user. Claims under this warranty should be directed to NuAire, Inc. setting forth in detail the nature of the defect, the date of the initial installation and the serial and model number of the equipment.

This warranty shall not apply to any NuAire product or part thereof which has been subject to misuse, abuse, accident, shipping damage, improper installation or service, or damage by fire, flood or acts of God. If the serial number of this product is altered, removed, or defaced as to be illegible, the Warranty shall be null and void in its entirety.

The warranty is for the sole benefit of the original purchaser and is not assignable or transferable. Prior to returning any item, for any reason, contact NuAire for a Return Authorization Number. This number must accompany all returns. Any product shipped to NuAire without this number will be returned, refused shipment or collect freight.

6.0 Shipments

NuAire, Inc. takes every reasonable precaution to assure that your Incubator arrives without damage. Motor carriers are carefully selected and shipping cartons have been specifically designed to insure your purchase. However, damage can occur in any shipment and the following outlines are steps you should take on receipt of a NuAire Incubator to be sure that if damage has occurred, the proper claims and actions are taken immediately.

6.1 Damaged Shipments

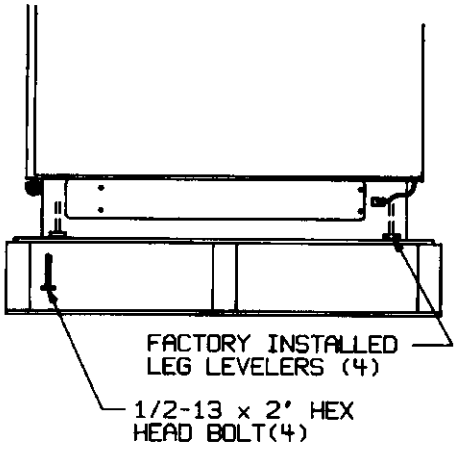
6.1.1 Terms are F.O.B. factory, unless stated otherwise. Therefore, it is important to check each shipment before acceptance.

6.1.2 If there is visible damage, the material can be accepted after the driver makes a notation on the consignee's copy of the freight bill. Then an inspection must be made to verify the claim against the carrier. This inspection is the basis of your filing the claim against the carrier.

6.1.3 If concealed damage is found, it is absolutely necessary to NOTIFY THE FREIGHT AGENT AT ONCE, and request an inspection. Without this inspection, the transportation company may not accept a claim for loss or damage. If the carrier will not perform the inspection, an affidavit must be prepared stating that he was contacted on a certain date and that he failed to comply with the request. This, along with other papers in the customer's possession will support the claim.

7.0 Installation

The Incubator is fastened to the base skid and it is usually the best procedure to leave the skid attached until the Incubator is located in its approximate position to facilitate ease in handling. The base skid can then be removed by removing the four bolts holding the cabinet to the skid. Examine the Incubator carefully. INSPECT both the exterior and the interior for any transit damage before discarding the shipping crate.



7.1 Location

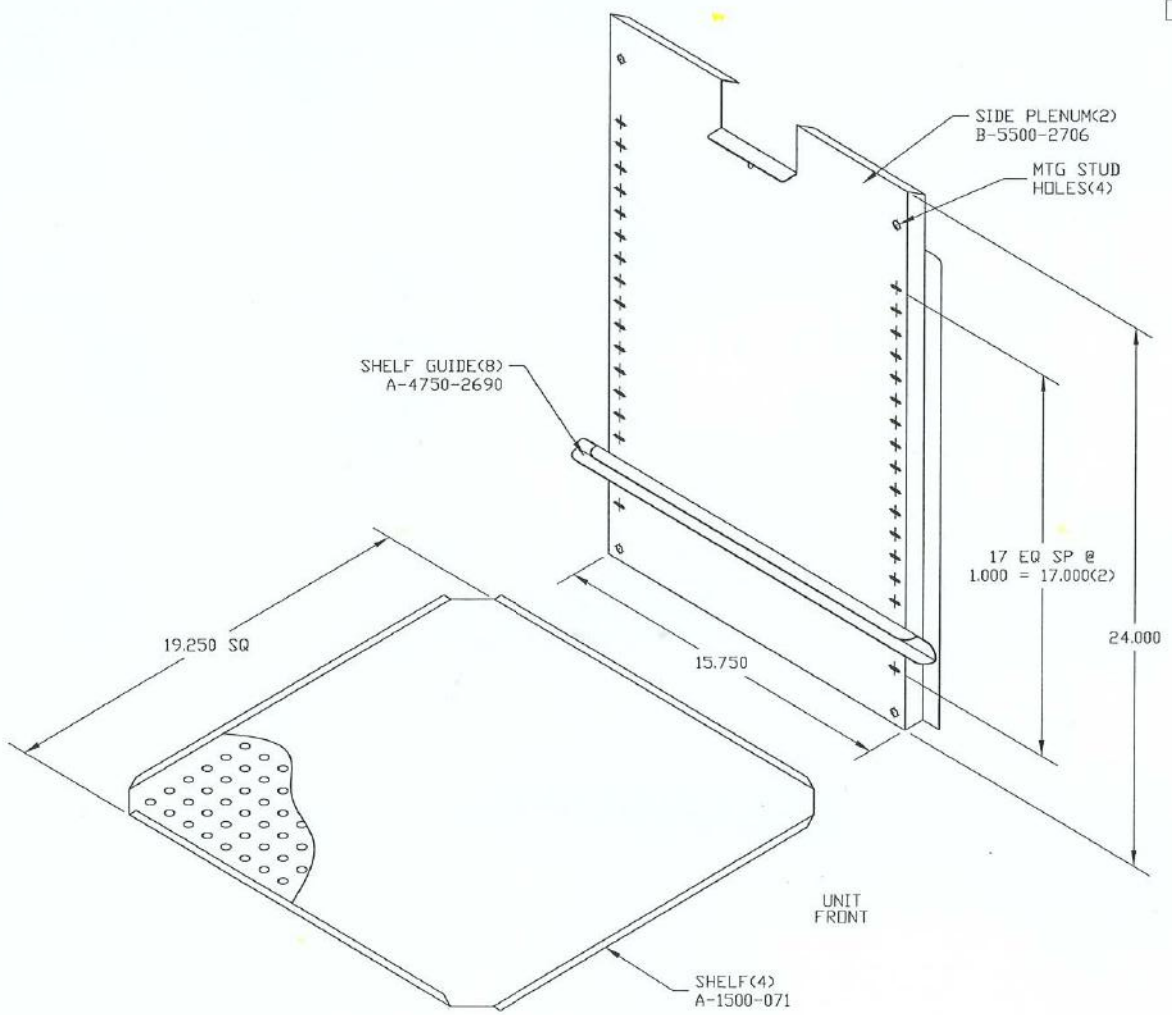
In locating the Incubator, consider all possible conditions that might affect its performance as well as laboratory procedures for its intended purpose. **Do not locate near heating or cooling ducts, or next to equipment that generates heat (steam radiators, stoves, ovens, autoclaves, etc). Avoid direct sunrays and rapidly moving air currents**. These conditions adversely affect the even heat dissipation required from the exterior surfaces of the Incubator and will cause the temperature variation in the chamber to exceed specifications as stated in section 3.2. Since the Incubator needs even heat dissipation on all surfaces in order to maintain an internal temperature variation of less than 0.2 degrees C, a minimum of 2 inches (50mm) must be allowed between the rear and sides of the Incubator and any walls, partitions or obstructions to facilitate adequate convection of air around the unit. Confirm clearance with a tape measure if needed. Adjust the Incubator location accordingly. **In addition, since the Incubator is cord connected, the cord must be readily accessible for disconnection if necessary.** For maintenance/service purposes, the control center electronics should remain accessible.

Place Incubators 10” apart when placed side-by-side to enable running the heated Decon Cycle while surrounding Incubators are in normal mode.

7.2 Leveling

Prior to use the incubator should be leveled using a bubble level on a middle shelf in the chamber. The Incubator should have all 4 feet firmly on the bench or floor. Level from side to side and front to back. Leveling feet are provided for this purpose, factory installed into the base of the Incubator. By turning the adjustable leveling feet counter-clockwise, raises the Incubator. The leveling feet height should be a minimum of 1/4 inch (6mm) below the base. **IT IS IMPORTANT THAT THE OUTER CABINET BE OFF THE FLOOR BY AT LEAST 1/4-INCH (6MM) TO ASSURE CABINET AIR FLOW RELIEF.** Confirm with a tape measure if needed.

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
B	9730	UPDATE SHELF PART #	4/23/07	CV	KCK



ORIGINAL

PLENUM SHELF
INSTALLATION

DFTM	JR	12/17/02	CHKD	KCK	SHEET 1 OF 1

DRAWING NUMBER BCD-09409 B

7.3 Shelf Plenums & Water Pan Installation

Before installation of the shelves, and water pan, NuAire recommends to decontaminate all surfaces within the interior chamber, glass door, and outer door with gasket. They can be wiped down with a disinfectant of 70 percent alcohol or similar non-corrosive antimicrobial agent. Use only disinfectants that are compatible with the vinyl gasket and the powder coat paint on the outer door. If the user desires, the top and side plenums can be removed to disinfect the chamber surfaces that they cover. **Absolutely no chlorinated or halogen materials are to be used in the chamber.**

Provided with each Incubator, are four shelves. The shelves are easily installed by attaching the shelf guide supports to the sidewall plenums. If the shelf does not bind or disengage from the horizontal bracket it is installed correctly. Additional shelves and shelf guides are available. The water pan shall be placed directly on the bottom of the chamber.

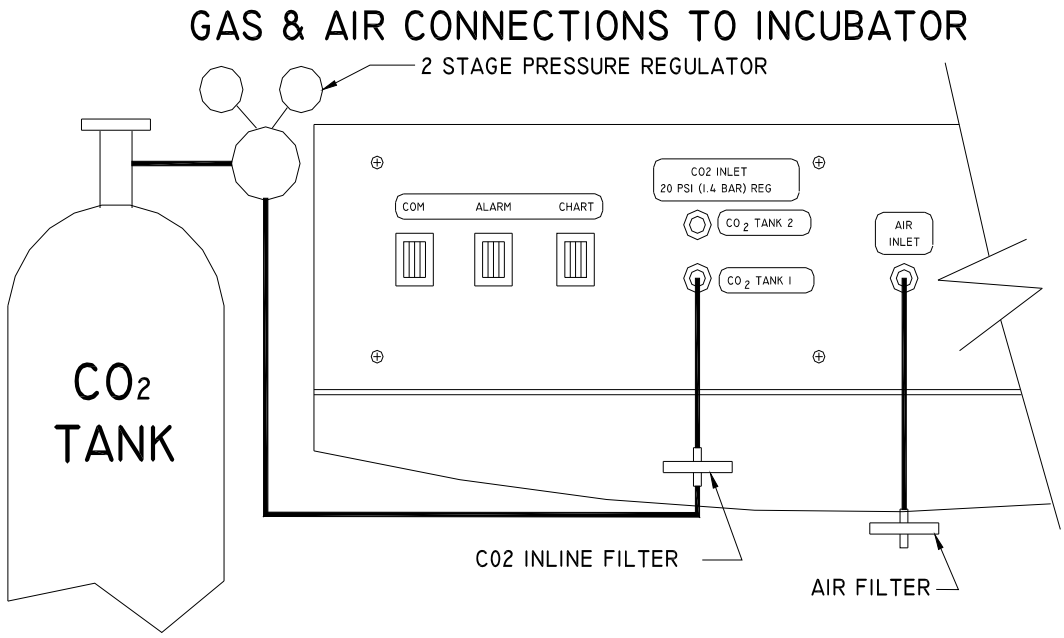
7.4 Electrical

The electrical supply circuit to the Incubator must conform to all national and local electrical codes. Consult the serial-data plate, located at the front of the right side of the Incubator, for voltage, cycle, phase, and ampere requirements before making connection. Plug the power cord securely into a grounded power source. VOLTAGE SHOULD NOT VARY MORE THAN 5% FROM SERIAL PLATE RATINGS. Have a qualified technician check with the power source with a properly rated volt meter if needed. A separate branch circuit is recommended to prevent possible loss of product due to overloading or failure of other equipment on the same circuit. A SURGE PROTECTOR IS STRONGLY RECOMMENDED to avoid power-related faults.

7.5 Air Inlet Connection

An air inlet tubing kit consists of one-foot clear vinyl tube and (1) 50mm polypropylene .3-micron HEPA filter. Locate the air inlet port on the back panel of the unit. Remove the cover cap; connect one end of tubing to the air inlet port, and the other end of tubing to the air filter.

CAUTION: This is a free air supply. DO NOT connect to pressurized source.



7.6 CO_2 Connection

High concentrations of CO_2 gas can cause asphyxiation! Install Incubator in well ventilated area.

This Incubator is designed to be operated with CO_2 gas only. Connecting a flammable or toxic gas can result in a hazardous condition. Gases other than CO_2 should not be connected to this equipment. CO_2 gas cylinders have a UN1013 label on the cylinder and are equipped with a CGA 320 outlet valve. Check the gas cylinder for the proper identification labels.

Do not use CO_2 gas cylinders equipped with siphon tubes. A siphon tube is used to extract liquid CO_2 from the cylinder which can damage the pressure regulator. Consult with your gas supplier to ensure that the CO_2 cylinder does no contain a siphon tube.

7.6.1 CO_2 Tube Connection

Included with the Incubator are a tubing kit consisting of (1) six foot (2m) vinyl tube and (1) 50mm polypropylene 0.3 micron HEPA filter.

7.6.2 CO_2 Supply

1. CO_2 of medical grade is recommended.
2. A two-stage pressure regulator, Linde# 19590, or equal, is recommended.
3. DO NOT USE a single stage regulator. It will not give a stable output at 20 psi and exposes the Incubator to the gas cylinder pressure.

7.6.3 CO_2 Regulators

The regulator's high-pressure stage direct from the supply cylinder must have a range of from 0 to 2000 PSI or 0 to 140 BAR. This gauge indicates actual tank pressure. The low-pressure stage should have a range of 0 to 30 PSI or 0 to 2 BAR (100 PSI or 6 BARS maximum). This gauge will indicate the actual CO_2 pressure to the Incubator. Some single stage CO_2 pressure regulators have two gauges. USE A TWO-STAGE REGULATOR. All NuAire Incubators use CO_2 in such small quantities that precise metering of CO_2 input pressure is important for maximum performance.

To connect the regulator: First open the CO_2 cylinder slightly, for an instant (this is termed "cracking the valve.") This will blow out dust or dirt that may have collected in the valve outlet. BE SURE to keep your face away from the valve outlet to protect your eyes from dust or dirt. Second, MAKE SURE the regulator pressure-adjusting screw is released by turning it counterclockwise until it turns freely. Third, attach the regulator to the cylinder valve and tighten the connection nut with a wrench. BE SURE DISC SEAL IS IN PLACE BEFORE MAKING CONNECTION.

7.6.4 CO_2 Connection

Connect the CO_2 supply from the low-stage of the two-stage regulator, to the inlet fitting located on the Incubator back panel labeled "CO2 tank 1". The filter should be inserted downstream of the low-stage regulator before the inlet fitting on the Incubator as shown in the figure. Secure each connection with the clamps supplied. Observe proper flow orientation of the filter (look for "in" or a green dot on the filter). The tubing is easily cut with a sharp knife.

7.6.5 CO_2 Supply Adjustment

With the regulator OFF (i.e. fully counterclockwise), open the cylinder valve slowly usually 1 to 2 turns is sufficient.
NEVER STAND IN FRONT OR BEHIND THE REGULATOR WHEN OPENING THE VALVE. ALWAYS STAND TO ONE SIDE.

The cylinder tank pressure should read 700 to 800 PSI or 48 to 55 BAR, more or less, depending on the temperature of the cylinder. Next, turn the regulator's pressure adjusting screw clockwise, until the low-pressure gauge reads 20 PSI or 1.4 BAR. The CO_2 connection is now complete.

NOTE: **OSHA requires the CO_2 tanks to be physically restrained (i.e. via chained to wall) to prevent accidental damage to cylinder.**

If optional feature Model Number I01, CO_2 Automatic Tank Switch (Internal) is purchased, separate installation instructions are provided.

7.6.6 Checking the Connections

The connections can be checked for leakage by brushing a small amount of soapy water on each one. Observe to see if any bubbles are blown. If not the connection is secured properly. If it is, the cause of the leaking needs to be determined, (i.e. loose clamp or damaged hose) and corrected.

7.7 Air Pump Assembly Shipping Foam: One or more blocks of foam is used to secure the air pump during shipping.

IMPORTANT: FOAM BLOCK MUST BE REMOVED BEFORE OPERATION

To remove foam block:

1. Remove control center cover by unscrewing the (4) screws holding it to the top of the Incubator. Lift the cover straight up and set it aside.

2. Remove the foam block from under the air pump allowing the pump to hang freely in the mounting bracket. It is located to the right of the sensor shroud on the right side of the Incubator.

3. Reinstall the control center cover on top of the Incubator and secure it with the screws removed in Step 1.

NOTE: Foam block can be removed through the front control panel. Remove the 2 locking screws (one each) either side of the control center lid. Open the outer door and the control panel will swing down and open.

7.8 Water Pan

Place water pan in the center on the bottom of the chamber and fill with Single distilled water no purer than 1 Mega Ohm. It is recommended to fill the pan to about 1/2 inch below the top rim. See Sections 3.1 and 8.2 for more specifications and operational details.

7.9 Stacking Units: Refer to BCD-09812 in the ASSEMBLY Section

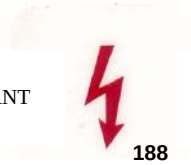
Align the feet of the top Incubator with the indentations in the lid of the bottom Incubator. Ensure that there is a minimum of 1/4 inch air gap between the Incubators as explained in section 7.2 to avoid obstructing the cabinet air flow. Secure the stacking straps that are attached to the bottom of the top Incubator to the lid of the bottom Incubator using the 4 screws that secure the lid. Only stack units 2 high.

7.10 Correct Installation

When the Incubator is installed correctly connected to the power source it is rated for gas connections made properly, the water pan filled, the shelves in place, and the unit is leveled. Read section 8 and follow all instructions for setting set points at the desired value. Then calibrate the Incubator control systems as explained in section 9. If the Incubator is installed and calibrated correctly it will meet the performance specs listed in section 3.2.

8.0 DHD Autoflow Operation

ATTENTION ACCOMPANY'S INFORMATION OR IMPORTANT SYMBOL



POTENTIAL ELECTRICAL HAZARD ONLY QUALIFIED PERSON TO ACCESS

HOT SURFACE BURN POTENTIAL

CAUTION: A qualified technician who is familiar with the proper maintenance procedures required for this equipment, as well as repair must perform all maintenance actions on this equipment.

The Incubator is designed to provide a sterile, constant temperature, constant CO_2 level and naturally humidified atmosphere for optimum growth of tissue cell cultures and other organisms requiring this precise environment. To operate the Incubator properly, the following parameters must be reviewed, carefully set, and/or prepared.

8.1 Sterility

The environment provided by this Incubator is not selective. As a result, any contamination within the chamber is subjected to the same environment as the specimens. Therefore, before placing any cultures in the Incubator, the shelves and sidewall top plenums should be sterilized. The interior sidewalls, top, bottom, door, as well as the gasket should be wiped clean with a 70% solution of isopropyl alcohol or other disinfectant compatible with the chamber construction, to remove any contamination. Use mild detergent to clean the exterior of the Incubator. This Incubator gives the lab professional a choice of 2 heated decontamination cycles. (See section 10.1 for further information.)

8.2 Humidity

Humidification of the Incubator chamber is achieved through the process of water evaporation (vapor water pressure) from a stainless steel water pan placed on the bottom of the chamber. Materials of different thermal resistance (i.e. glass, plastic) do not offer sufficient thermal recovery and are not recommended for use. Although some metals offer better thermal coefficients than stainless steel, dissimilar metals cause electrolysis in the acid atmosphere (carbonic acid) and should never be used, or placed within the chamber.

Use only distilled or mineral-free water, no purer than 1 mega ohm, in the stainless steel pan. The water should be changed at least once a week, preferably more often. FLOODING THE BOTTOM OF THE INCUBATOR IS NOT RECOMMENDED since it is difficult to change the water weekly and almost always necessitates the use of chemicals, which are not recommended and may damage the stainless steel. Also, it promotes condensation on the inner walls because it steals the natural convection, heat flow through the inner chamber and condensation points occur. **ABSOLUTELY NO CHLORINATED OR HALOGEN MATERIALS ARE TO BE USED IN THE CHAMBER**.

Humidity recovery to 90% of original level within 20-40 minutes after a 15-second door opening with a water reservoir area of 210 square inches. Contamination in the water pan may be avoided by adding a small amount of copper sulfate to the water pan after each decontamination of the chamber.

Condensation on the glass door, walls, top, or bottom of the chamber indicates an incorrect balance of door and front perimeter heat. Both the door and front perimeter heaters operate on a duty cycle. A good starting point for these duty cycles is the default setting for the door & perimeter heaters in a room ambient temp of 22ºC (72ºF) at a temperature set point of 37.0ºC. The fresh airflow that the air pump delivers to the chamber has been preset at the factory. If condensation starts forming on the sides or backwall in the chamber, the number and length of air injections into the chamber can be increased. (See section 8.8.1.2 for instructions.) To alleviate the condensation, increase the airflow. To increase RH in the chamber reduce the airflow. If airflow is decreased, some condensation may be unavoidable. The port plug with breather hole must be used on the back port. **DO NOT SEAL THE OPENING IN THE PORT PLUG EXCEPT WHERE INSTRUCTED TO DO SO. THIS IS A PRESSURE RELIEF FOR THE DECON CYCLES.**

8.3 Control System

The NuAire Incubator Control Electronics system is designed to serve the control requirements of the Incubator chamber. Temperature and CO_2 levels are controlled by preset values to provide the optimum conditions for culture growth within a chamber. Operator input is coordinated through the control panel keypad and status displays. Figure 1 shows the various inputs and outputs of the system.

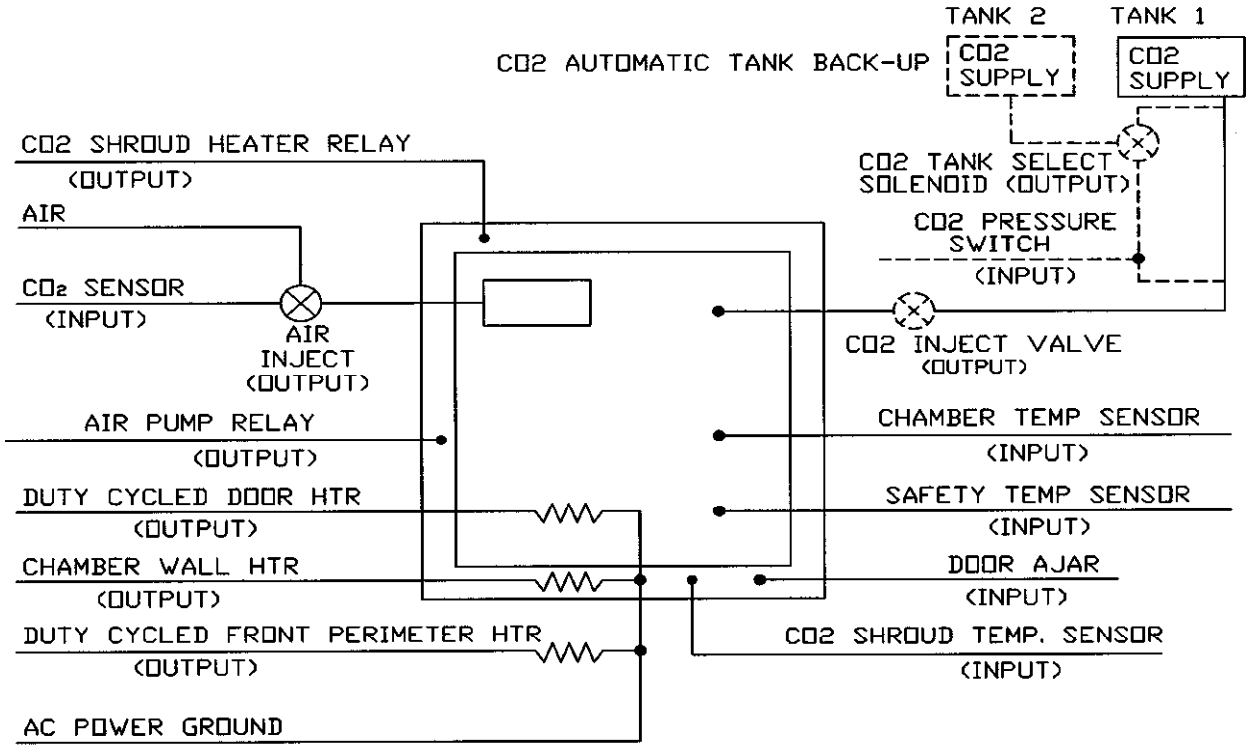


Figure 1: Direct Heat Control Inputs & Outputs

The NuAire Incubator Control Electronics is a state-of-the-art microcomputer based system that provides:

8.3.1 Chamber control in a single electronic package.

8.3.2 Enhanced information presentation

- A chamber temperature (set point and actual)
- A CO_2 level (set point and actual)
- An alarm LED
- A mode switch status LED
- A temperature status digital LED
- A CO_2 status digital LED
- A heat, CO_2 inject, door ajar, air class, and two CO_2 tank status LEDs.
- A heated decon. Cycle LED

8.3.3 Simplified operator controls

The control panel is operated using 6 keys. The keypad switches and their functions:

Run/Setup: Switches between "Run" mode and the "Setup" mode when pressed for 3 seconds.

Run mode: The green LED above the switch pad is lit continuously and Incubator is fully functional. System calibrations are performed in this mode.

Setup mode: The green LED is blinking with the Temperature & CO2 displays flashing alternating between the set point values and "SEt" "UP". Changes in the set point values are performed in this mode by pressing the "SEL" key to choose the system indicated by lighting the green LED next to the display and using the up/down arrows to change the value in the display. The Incubator is in a "standby" condition and heat or gas functions are not active.

NUAIRE Logo: When pressed for 3 seconds it gives access to the "tSt", "Opt" & master reset menus.

Up and Down Arrows: Increase or decrease the value in the display during a calibration in run mode changing the system set points in setup mode.
They are also used for advancing to the "tSt", "Opt" and master reset menus after the logo key is pressed. These keys are also used to change state of systems in the "tSt" menus and adjust values of the systems in the "Opt" menu.

SELect key: Advances between and selects the active system displays for calibration functions in run mode and changing set points in setup mode. The lit green LED indicates selection. This key also advances between systems in the "tSt" & "Opt" menus.

95/145 cycle: Starts the heated Decon Cycle when pressed for 3 seconds and it also advances through the phases of the Decon Cycle.

8.3.4 Automatic notification of abnormal situations

The red alarm LED on the control panel indicators will light to indicate a fault within the system. An audible alarm is also heard.

- System intermittent
- Temperature Control Fault
  - Temperature is over set point by more than 1.0°C.
  - Temperature does not reach set point within 4 hours within 0.2º.
  - Sensors disagree by 4º
- CO_2 Control Fault
  - CO_2 percent is over set point by more than 1%.
  - CO_2 percent does not reach set point within 30 minutes within 0.2%.
  - Tank Switch

NOTE: See Section 11 for all alarm conditions.

8.3.5 Password Protection

If desired, the NuAire Incubator Control Electronics may be configured to prevent users who are unauthorized to change the set points (CO_2%, Temp), running conditions of the Incubator or initiate a Decon Cycle. The password protection may be initiated by accessing the option configuration parameters in diagnostic mode (see Section 8.8). Once the password protection is initiated, the user must use the correct sequence of the UP, DOWN, and SELECT keys to access the setup mode. To operate, first press the SETUP key. The displays will then indicate "Pas rEq", or “password required”, then enter the correct sequence of the UP, DOWN, and SELECT keys followed by pressing and holding the SETUP key for three seconds to access the setup mode.

8.3.6 Provision for add-on expansion capability

- Chart recorder output (option)
- Automatic tank switch (option)
- RS-232 output

8.3.7 Diagnostic and calibration assists.

- Individual analog inputs may be displayed to assist calibration.
- Individual outputs may be forced to an on or off condition.
- Individual digital inputs may be displayed.
- Front panel lamps may be tested.
- Memory and internal processor diagnostics may be selected.
- All options may be individually tested.
- Packaging is designed such that all accessories are easily removed and replaced

8.4 Front Control Panel Descriptions

The system front control panel contains the following functions (BCD-09709).

8.4.1 Heat Jacket Status LED

The green LED indicates when the chamber heater is turned on. A blinking LED indicates the chamber heater is being cycled to maintain chamber set point temperature.

8.4.2 Inject CO_2 Status LED

The green LED indicates when the CO_2 control valve is open and CO_2 is flowing into the chamber. When it blinks on/off briefly, the system is injecting CO_2 to maintain set point.

8.4.3 Door Ajar Status LED

The door ajar yellow LED indicates when the inner glass door is not closed and latched. The LED acts upon a magnetic switch located along the lower right corner of the inner glass door. The LED blinks after door is closed, indicating door delay time (40 second default)

8.4.4 Air Class ISO 5 LED

Green LED lights and stays on when the chamber air has run through the HEPA filtration system long enough to clean it to ISO Class 5 (Equivalent to US Federal Standard 209E Class 100) air quality.

CL 5 Will also show in the temperature display (with CL flashing) for 10 seconds. These events will happen when power is cut and then re-stored and after door openings.

8.4.5 CO_2 Tank 1 Status LED

The green LED indicates when the Incubator is consuming CO_2 from tank 1.

8.4.6 CO_2 Tank 2 Status LED (Option)

The yellow LED indicates when the Incubator is consuming CO_2 from tank 2.

8.4.7 Alarm Status LED

The red LED indicates an abnormal status condition. The alarm LED and audible alarm indicates the abnormality. If the Alarm Status LED is on continuously, a catastrophic condition exists. A catastrophic temperature control condition will de-energize the safety relay and cause the chamber to cool below the set point. Then again the temperature control will try to control.

8.4.8 Chamber Sample

The chamber sample port is provided to allow measurement of CO_2 percentage manually with a fyrite CO_2 indicator, or other suitable instrument.

8.4.9 Parameter Indicators (LED)

The parameter indicators, located next to the TEMPERATURE & CO_2 WINDOWS indicate the activated parameter being shown in the three-digit display. If the parameter indicator is activated, the parameter (i.e. CO_2) may be altered via the arrow keypad.

8.4.10 Mode Switch (RUN/SETUP Pad)

The mode switch keypad is used to select the operating mode of the Incubator chamber, SETUP or RUN.

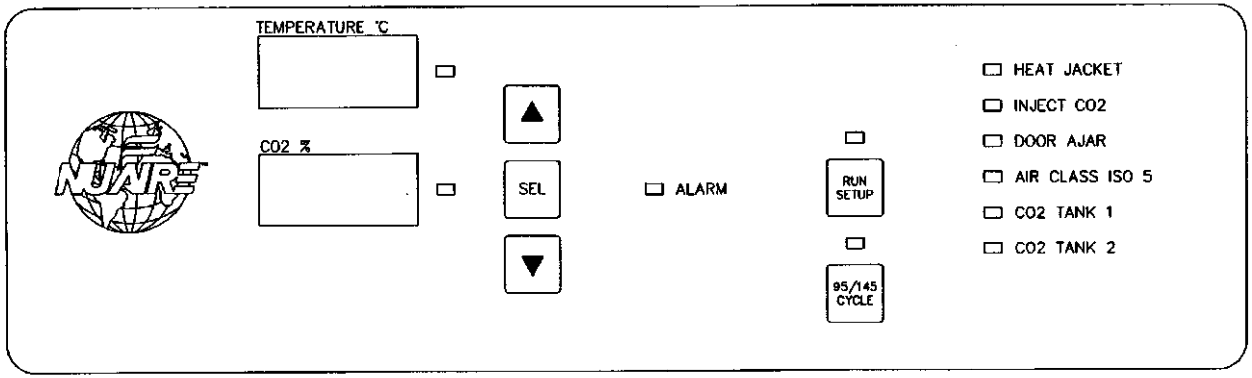
8.4.11 Selection & Arrow Keypad

The selection and arrow keypad (KEYPAD INPUT SHOULD BE DONE WITH FINGER ONLY, DO NOT USE PENCIL OR SHARP INSTRUMENTS) is used for operator interaction with the system. The “SEL” key is always active. Repeated depression of this key causes display of the next value in sequence as listed for the parameter indicators. The arrow keypads are used to input set points and access the calibration functions.

8.4.12 Decon Cycle Indicator LED

The yellow LED indicates that the Decon Cycle is in operation. When flashing it indicates a warming up to or cool down from the cycle. When lit continuously it indicates that the decon temperature has been achieved. The LED will be lit in conjunction with messages in the Temperature and CO_2 displays.

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	8643	RELEASED TO PRODUCTION REF: SK-09601-02	06/06/03	LS	KCK



NU-5510
FRONT PANEL LABEL

DFTM	LS	06/06/03	CHKD	KCK	SHEET 1 OF 1

DRAWING NUMBER BCD-09709 A

8.5 Rear Panel Detail

The rear control panel contains the following functions (BCD-09809).

8.5.1 Power Cord

The power cord is 8-foot (2m) in length, type "SVT" molded plug, allowing for long life and easy cleanability.

8.5.2 Circuit Breaker

All control electronics are protected with a circuit breaker that may trip at 110% of load rating, but will trip at 145% of load rating in less than 2 seconds. Should the circuit breaker open (pop-out button will appear), merely depress to reset.

8.5.3 CO_2 Inlet

The CO_2 inlet provides a fitting for vinyl tubing. Be sure to follow the recommended inlet pressure to insure proper flow rates and consistent CO_2 percentage readings.

8.5.4 Air Inlet

The Incubator is provided with clear vinyl tubing and a 0.3-micron HEPA filter. This is a free air supply. **DO NOT CONNECT TO A PRESSURIZED SOURCE.**

8.5.5 Power Switch

The power switch, located at the top of the rear panel, controls all power to the Incubator.

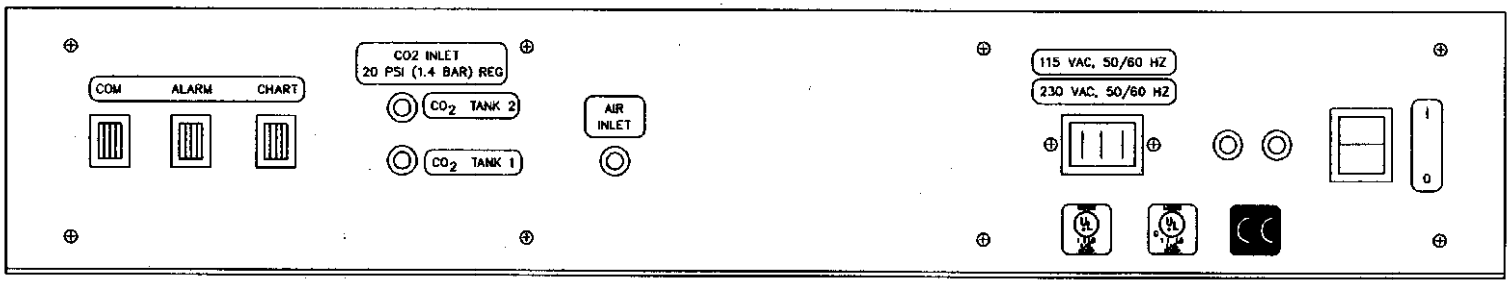
8.5.6 Internal Tank Switch (Option)

The internal tank switch is an option, which is customer installed in the field, or at the time of manufacture. The tank switch performs the critical back-up function of switching tank 1 and tank 2 and back again when each depleted tank is replaced.

8.5.7 Communication Interface/Alarm

Three receptacle connectors are provided for direct field connection of a computer/printer, remote alarm indicator and chart recorder.

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	8687	RELEASED TO PRODUCTION	09/05/03	AY	KCK



REAR
PANEL

DFTM	AY	09/05/03	CHKD	KCK	SHEET 1 OF 1

DRAWING NUMBER BCD-09809 A

8.6 Run Mode Operator Interactions

The mode switch is used to select the mode of chamber operation: setup or run.

Pressing the run/setup key for three seconds changes the chamber operation mode. The mode switch LED will display a green light when in run mode.

In general, there is no need for operator interaction in "run" mode. However, operator interaction is required to perform calibration functions and abnormal condition status. If an abnormal condition has, or does, exist for a particular parameter, a blinking green LED next to the parameter will be lit. This could be a catastrophic alarm condition, which could harm the tissue culture cells. It does indicate an operational abnormality and should be checked. To acknowledge the abnormality, simply press the mode switch to setup and back to run to clear the system. The blinking green LED will then extinguish. If the abnormality still exists, the blinking green LED will again be lit.

Let run normally, if the blinking green LED doesn't come back on, everything is normal. If the blinking green LED does come back on, use the troubleshooting guide to correct the abnormality (see Section 11.0).

8.7 Setup Mode Operator Interactions

Pressing the RUN/SETUP key for three seconds changes the chamber operation mode. The mode switch LED will display a green and blinking light when in setup.

8.7.1. Chamber Temperature Set point, CO_2 Percent Set point

Pressing the “SEL” key until the LED is lit next to the desired parameter indicator enters Set point values. The value of the selected parameter will be shown in the display in the form "XX.X". To enter a set point, perform the following:

Chamber Temperature

- Press mode switch to setup.
- Press [SEL] to indicate green LED next to chamber temperature display.
- Press ▲ or ▼ to indicate desired temperature.
- Press mode switch back to run.

CO_2 Percent

- Press mode switch to setup.
- Press [SEL] to indicate green LED next to CO_2 percent display.
- Press ▲ or ▼ to indicate desired CO_2 percent.
- Press mode switch back to run.

8.8 Diagnostic and Checkout Procedures

The Incubator controller provides general diagnostic facilities:

- Diagnostic mode is intended for factory and field technicians. It allows them to turn the controller's output signals (heaters, valves, etc.) on and off.

8.8.1 Diagnostic Mode

The diagnostic mode allows the operator to configure and/or check the Incubator for input/output signals manually and individually. The diagnostic mode has three menus to select from that are the following:

1) tst-test output parameters
2) opt-option configuration parameters
3) rst-reset, master

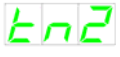
To initiate the diagnostic mode, perform the following:

- In either run or setup mode, press and hold the hidden key (flag on NuAire logo) for four seconds. Temperature display will indicate the first menu "test".
- To advance to the second menu, press ▲ key, temp. Display will indicate, "opt".
- To advance to the third menu, press ▲ key, temp. Display will indicate "rst".
- To repeat the menus, continue to press the ▲ key, which will advance the menus in a round robin fashion.

The "tst" and "opt" menus each have several function parameters as described below. The "rst" menu performs a master reset function, which clears the microprocessor's memory and resets all parameters to their default condition.

To enter the function parameters, press the "SEL" key while the temp. display indicates the desired menu. Then, while in the menu, press "SEL" key to advance through the function parameters, again, in a round robin fashion. Once in the desired function parameter, press the ▲or ▼ key to alter or toggle on/off.

8.8.1.1 Test Output Parameters (Evaluation Unit 6-03)

1) ALL LIGHTS - Display/LED Test
2)  - Safety Relay (**yes**/no)
3)  - Chamber Temp. Sensor (**0**, 25, 50, 75, 100)
4)  - Safety Temp. Sensor (**0**, 25, 50, 75, 100)
5)  - CO2 Inject Valve (on/**off**)
6)  - Chamber Fan (on/**off**)
7)  - CO2 Tank 2 Valve (on/**off**)
8)  - Door Heater (**0**, 25, 50, 75, 100)
9)  - Perimeter Heater (**0**, 25, 50, 75, 100)
10)  - Air Inject Solenoid (on/**off**)
11)  - Air Pump Relay (Turns air pump relay on & off)
12)  - Alarm Relay (on/**off**)
13)  - Sensor shroud temp. (Shows sensor shroud temp.) Relay (on/**off**)

(**Note**: Default values are in bold)

Once you have made your menu selection, you will remain within that menu selection until you exit the diagnostic mode. If another menu selection is desired, you must re-enter the diagnostic mode via the hidden key.

To exit the function parameters, press the hidden key (flag on NuAire logo).

1 - Display/LED Test **ALL LIGHTS**

This function will turn all individual LED's and value segments on, sequentially turn them all off, and repeat the sequence until another function is selected.

2 - Safety Relay

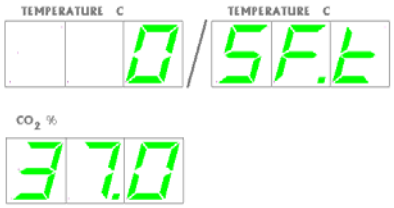
This function shows the current state of the safety relay. The CO_2 percent display will show "yes" or "no" corresponding to the relay condition. The state can be changed by pressing ▲▼.

3 - Chamber Temperature Sensor

This function shows the current value of the chamber control temperature sensor, on the CO_2 display. This function also allows the chamber heater to be turned on at different percentages (0, 25, 50, 75, 100) flashing the temperature display. Use the ▲ ▼ to change the percentage of power to the heaters.

4 - Safety Temperature Sensor

This function shows the current value of the safety temperature sensor, on the CO_2 display. This function also allows the chamber heater to be turned on at different percentages (0, 25, 50, 75, 100) flashing the temperature display. Use the ▲ ▼ to change the percentage of power to the heaters.



5 - CO_2 Inject Valve

This function shows the current state of the CO_2 inject valve. The temperature percent display will show "on" or "off" corresponding to the valve condition. The CO_2 display shows the percent of CO_2 that the sensor detects.

6 - Chamber Fan

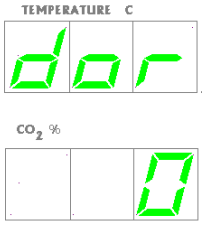
This function shows the current state of the chamber fan. The CO_2 percent display will show "on" or "off" corresponding to the fan condition.

7 - CO_2 Tank 2 Valve

This function shows the current state of the CO_2 tank 2 valve. The CO_2 percent display will show "on" or "off" corresponding to the valve condition.

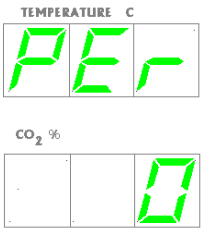
8 - Door Heater

This function shows the current state of the door heater. This function also allows the door heater to be turned on at different percentages (0, 25, 50, 75, 100) alternating with the "dor" indicator.



9 - Perimeter Heater

This function shows the current state of the perimeter heater. This function also allows the perimeter heater to be turned on at different percentages (0, 25, 50, 75, 100) alternating with "the PEr" indicator.



10 - Air Inject Valve

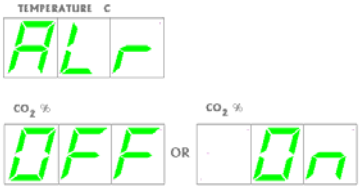
This function shows the current state of the air inject valve. The CO_2 percent display will show “on” or “off” corresponding to the relay condition.

11- Air Pump Relay

This function shows the current state of the relay that turns the air pump on and off.

12 - Alarm Relay

This function shows the current state of the alarm relay. The CO_2 percent display will show "on" or "off" corresponding to the relay condition.



13 - Sensor Shroud Temperature

This function shows the temperature of CO_2 sensor shroud in the temperature display. The CO_2 display shows the state of the heater relay as being on or off. The temp displayed should be at least chamber temperature + 1 deg. on an Incubator in stable condition. It can display as high as 57 deg. C.

8.8.1.2 Option Configuration Parameters (Evaluation Unit 6-03)

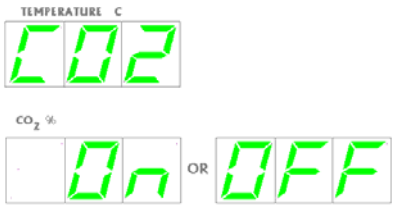
1)  - CO_2 System Enable (**on**/off)
2)  - CO_2 Tank 2 Enable (on/**off**)
3)  - CO_2 Auto Switch Back (on/**off**)
4)  - Closed Door CO_2 Zero/Span Calibration (on/**off**)
5)  -Alarm Audible Enable (**on**/off)
6)  - Decon. Cycle (95/**145**) (Selects Decon Cycle)
7)  - Password Protection (on/**off**)
8)  - Auto Zero (**on**/off)
9)  - CO_2 Inject Delay Time (seconds/**60**)
10)  - Door Delay Time (seconds/**40**)
11)  - Air Inject Time (seconds/**35**)
12)  - Air Inject Cycle (minutes/**10**)
13)  - Print Frequency Time (minutes/**0**)
14)  - Temperature Time Out (minutes/**240**)
15)  - CO_2 Time Out (minutes/**30**)
16)  - Temperature Recovery Delay Time (seconds/**30**)
17)  - Temp. Sensor Differential (°C/**4.0**)
18)  - Temp. Max. Above Set point (°C/**1.0**)
19)  - CO_2 Max. Above Set point (%/**1.0**)

(**Note**: Default values are in bold)

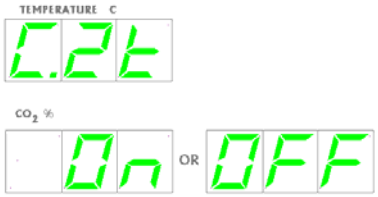
Once you have made your menu selection, you will remain within that menu selection until you exit the diagnostic mode. If another menu selection is desired, you must re-enter the diagnostic mode via the hidden key.

To exit the function parameters, press the hidden key (flag on NuAire logo).

1 - CO_2 System Enable
This function will enable or disable the CO_2 system. The value display will show "on" or "off" corresponding to the current condition. In run mode, the CO_2 percent display will indicate either the CO_2 percent when the system is on, or nothing when the system is off.



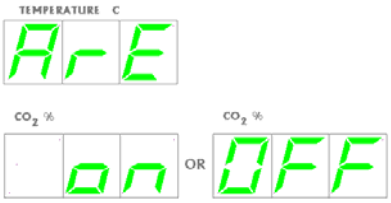
2 - CO_2 Tank 2 Enable (Optional)
This function will enable or disable the optional CO_2 tank 2 system. The value display will show "on" or "off" corresponding to the current condition.



3 - CO_2 Tank Switch Back (option)
Note: function can only be enabled with the CO_2 tank 2 option in use. Unit will automatically check tank 1 for gas pressure every 12 hours, and stay on tank 1 if pressure is detected

4 - Closed Door CO_2 Zero/Span Calibration
This option enables user to run zero & span calibration on the CO_2 sensor with out opening the Incubator door. (See section 9.4.2).

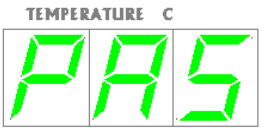
5 - Alarm Audible Enable
This function will enable or disable the audible alarm ring back function. The value display will show "ON" or "OFF" corresponding to the current condition. If the function is "ON"; the audible alarm will provide a ring back of the alarm condition. If the user pushes any key to silence the audible alarm, after 15 minutes of silence the audible alarm will return. If the function is "OFF", the ring back of the alarm condition will never come back after the user pushes a key to silence the audible alarm.



6 - Decon Cycle selection
This function allows the user to select either the 145 dry or 95 moist Decon Cycle by pushing the ▲▼ arrows. Follow all instructions in section 10.1 of the manual for either of the cycles chosen.

7 - Password Protection

This function allows users to disable/enable password to prevent unauthorized change of set point, using the UP, DOWN and SELECT keys combination. Password requires three digits. If password option is enable, whenever 'SET UP' key is pressed, password will be required. Every time password option is disabled and re-enable, old password is cleared and new password will be required. The heated Decon Cycles are also protected by the password. When activated the password will be requested when the decon key is pressed.

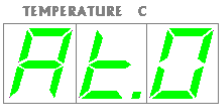


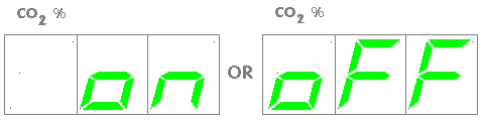
To set password:

- Press hidden key to enter option menu.
- Press ▲ to advance to "opt".
- Press [SEL] to advance to "Pass".
- Press ▲ to enable option, "ON".
- Press hidden key twice to exit option menu.
- Enter your password.
  When front panel message displays "Ent-Pas".
- Re-enter your password, when front panel message displays 'Pas-rEq'.
- Press mode key to SETUP, then back to run.

8. Auto Zero Enable

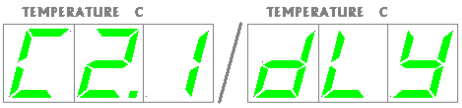
This function turns the CO_2 automatic zeroing routine on and off. Default on.





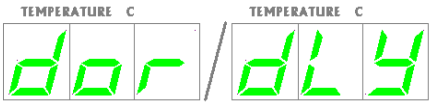
9 - CO_2 Inject Delay Time

This value specifies the time, in seconds, for an injection of CO_2 to be measurable at the sensor. When CO_2 is injected into the chamber, the system delays until this period has elapsed before making a new control decision. In this manner, diffusion induced delays do not cause the CO_2 system to overshoot the control set point.



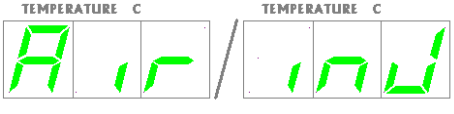
10 - Door Delay Time

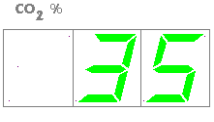
This value determines the time, in seconds, to turn on the door heater to a 100 percent duty cycle after an inner glass door opening. Also inhibits CO_2 control for the same period.



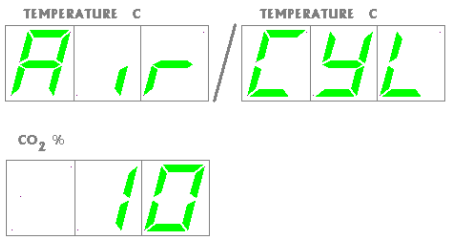
11 - Air Inject Time

This value specifies the time, in seconds, for an injection of air into the chamber.

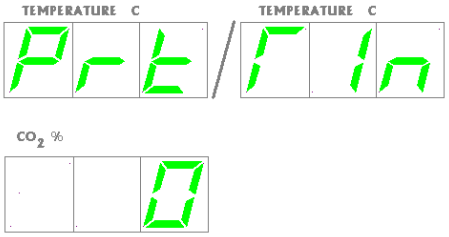




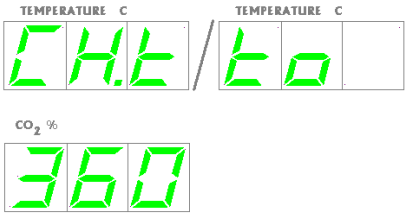
12 - Air Inject Cycle Time
This value specifies the amount of time in minutes between each injection of air into the chamber



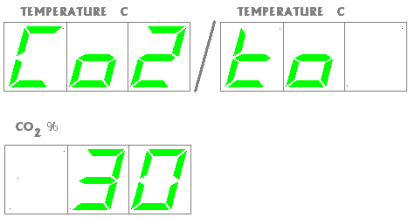
13 - Print Frequency Time
This parameter specifies the frequency, in minutes that lines are to be printed on a status report. If the frequency is specified as zero, no report will be printed.



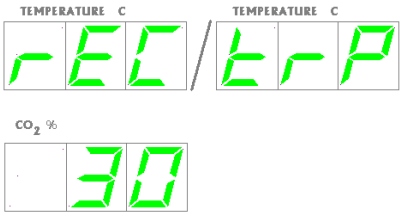
14 - Temperature Time Out
This value determines the time, in minutes, for the temperature to achieve set point. If the temperature doesn't get to within 0.2º of set point within this time period, an alarm condition is declared.



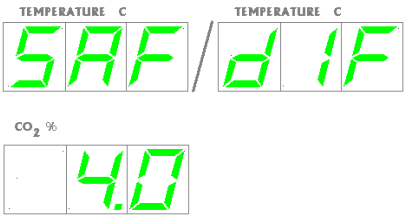
15 - CO_2 Time Out
This value determines the time, in minutes, for the CO_2 percentage to achieve set point. If the CO_2 percentage doesn't get to within 0.2% of set point within this time period, an alarm condition is declared.



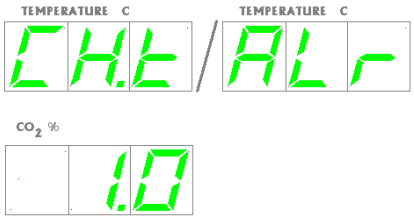
16 - Temperature Recovery Delay Time
This value determines the time, in seconds, to turn off the main heater in half-degree increments during a temperature recovery cycle. The delay time is required to prevent temperature overshoot of the control set point.



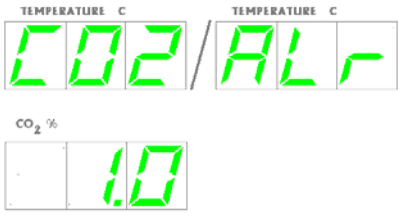
17 - Temperature Sensor Differential
This value specifies a maximum differential, measured in temperature (°C) that the two temperature sensors may deviate from one another, or from the last read value. If this differential is exceeded, a warning LED is shown on the running chamber. If multiple sensors fail to read within the specified limits, an alarm condition is declared. An alarm condition will cause the chamber to enter a safe condition where no power is enabled to any of the system output controls until the situation is rectified.



18 - Temperature Maximum Above Set point
This value determines the maximum deviation, measured in (°C) that the chamber is permitted to rise above set point, once it is researched before an alarm condition is declared. An alarm condition will cause the chamber to enter a safe condition where no power is enabled to any of the system output controls until the situation is rectified.



19 - CO_2 Maximum Above Set point
This value determines the maximum deviation, measured in CO_2 percent (%) that the chamber is permitted above or below, once the Incubator reaches the specified set point before an alarm condition is declared.



8.8.1.3 Reset, Master

The master reset diagnostic function is the last effort to correct operational faults which otherwise cannot be solved.

By reloading the default configuration, the entire memory will be reset and **ALL CALIBRATION OFFSETS AND CONFIGURATION OPTIONS WILL BE LOST.** All calibrations will need to be performed following a master reset.

To reset: At master reset menu, hit [SEL] key twice, turn off Incubator for about 10 seconds, and then turn it back on to complete master reset.

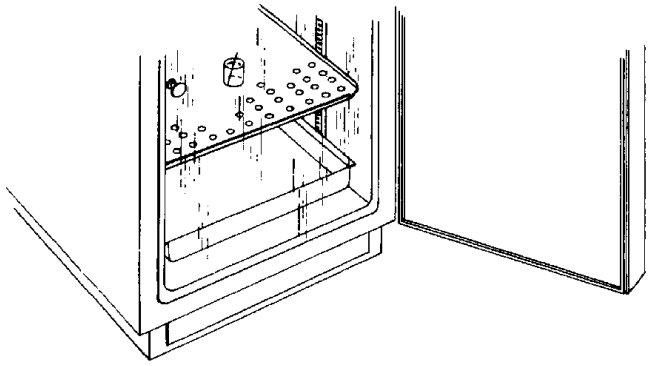
9.0 Calibration

Proper calibration of the DHD Autoflow involves four parameters: chamber temperature, door temperature, perimeter temperature, and CO_2 sensor. The first three, chamber, door, and perimeter temperature should be completed and stabilized before any CO_2 sensor calibration is performed. Below, each calibration procedure is described in detail. For the best results, follow the procedure carefully, and if the desired result is not achieved, try procedure again from the start.

9.1 Chamber Temperature Calibration

The DH Autoflow's TEMPERATURE CALIBRATION MUST BE PERFORMED WITHIN 1°C OF THE PLANNED OPERATING TEMPERATURE. Normally, 37.0°C is the most common set point. To initiate the procedure, turn on the DHD Autoflow via the power switch on the back panel. Press mode switch to setup. The default set point is 37.0°C; use the ▲▼arrows to change if desired. Press mode switch back to run and let stabilize for 8 to 12 hours. Use an independent instrument to check and calibrate the temperature.

Below is a description of calibration with a glass thermometer as one example for temperature calibration. At the beginning of this procedure, set a calibrated glass thermometer in a glass beaker filled with water resting on a shelf in the middle of the DHD Autoflow chamber. Do not place the glass beaker on the bottom of the chamber because it will result in a slightly higher temperature reading due to the heater located on the chamber bottom. Placing the thermometer in glass beaker on the middle shelf will give the most accurate results for calibration. The chamber should be humidified to avoid false low readings due to evaporation of water from the flask. An accurate digital thermometer with a type K thermal couple could also be used.



When the unit has stabilized at the operating temperature, perform the following calibration procedure.

- Allow Incubator to stabilize at its given temperature set point in run mode.
- Press "SEL" to indicate LED next to temperature display.
- Press and hold ▲ key for three seconds.
- Determine actual temperature within chamber by reading temperature measurement instrument.
- Press ▲ or ▼ key to indicate same temperature as the actual temperature being measured in the chamber.
- Press "SEL" to set current value and exit calibration.

The chamber temperature calibration is complete. Let unit stabilize for 8 to 12 hours. If the chamber temperature (actual thermometer) still does not match the display, perform the above procedure again. In some cases it might be necessary to calibrate several times to achieve a stable condition due to ambient conditions of temperature and humidity within the laboratory.

9.2 Door and Perimeter Temperature Calibration

The DHD Autoflow's inner glass door and outer shell perimeter temperature calibration is best accomplished by running the Incubator 24 hours with the water pan in place and perform the following calibration sequence, if required. Open the Incubator door and look for general condensation. Some condensation on the glass door can be desirable as an indication of adequate humidity in the chamber. Typically, one to two inches of condensation in the corners of the glass door indicates a properly calibrated door heater. The perimeter heater is the heater located on the outer shell next to the glass door. Typically, no condensation should form on the inner chamber next to the glass door. However, if calibration is required, simply perform the procedure as stated below. The door and perimeter heater operates as a duty cycle percentage ON/OFF (0 is off, 100 is Full ON). Typically, 14 to 22 percent is the most effective duty cycle for the door heater and 30% to 40 % for the perimeter heaters in 22ºC ambient with a 37.0ºC set point. Default settings are 18% for the door and 32% for the perimeter.

The following steps should be taken for setting these duty cycle percentages:

- Allow Incubator to stabilize at its given temperature and humidity level in run mode.
- Press "SEL" to indicate LED next to temperature display.
- Press and hold ▲ and ▼ keys simultaneously for three seconds. Temperature display alternates between either "dor" or "PEr" and the duty cycle percentage.
- Press ▲ or ▼ key to desired "dor" or "PEr" duty cycle percentage (press RUN/SETUP key to change from "dor" to "PEr" and back again). A maximum adjustment of 2% for the door and 4% for the perimeter heaters should be made at a time.
- Press "SEL" to set current value and exit calibration.

9.2.1 Door and Perimeter heater duty cycle automatic control

The door and perimeter duty cycles are automatically reduced when the room temperature in the lab increases enough to allow the contribution from these heaters to overheat the chamber. For example if the door and perimeter duty cycles are set up when the room temperature is 22ºC and the room temperature is allowed to increase to 27ºC. Less heat is required to keep the chamber at set point. If the chamber starts to overheat, the duty cycles will be reduced at a rate of 1% per minute starting when the chamber temperature is 0.2ºC above set point. The duty cycles will continue to be reduced until the chamber temperature returns to set point. These duty cycles are continuously monitored and will be increased slowly again, as long as the chamber temperature does not go over the set point. If the room ambient reduces back to 22ºC the door and perimeter duty cycles will actually be returned to their original settings.

Note: If it is known that the lab room temperature where the Incubator is installed will vary significantly. (For example, the heater or air conditioning is shut off after work hours or there is no air conditioning and the room temperature has large temperature swings.) The door and perimeter duty cycles should be set in the lower temperature expected in the lab. Then the door and perimeter heaters will automatically be adjusted to avoid over temperature conditions in the chamber when the room temperature rises. In this case the chamber should be monitored for condensation regularly. If the chamber walls and ceiling start to get excessive condensation the door and perimeter heater duty cycle settings will need to be reduced. Do not adjust the duty cycle settings by more than 2% on the door heater or 4% on the perimeter heater at a time.

9.3 Setting Air Injections

If there is still some undesired condensation in the chamber when the door and perimeter heaters are set for the desired result, the air injections can be adjusted. There is a control for length of the air injection labeled, Air Inject Time, and the frequency that air is injected called, Air Inject Cycle. These controls are described in more detail in the "Opt" menu. The default is 35-second injections every 10 minutes. Start by increasing the length of the injection by a few seconds at a time then increase the frequency if needed.

9.4 CO_2 Calibration

The DHD Autoflow infrared CO_2 sensor may be calibrated using one of three techniques: CO_2 control, CO_2 sensor and CO_2 injection calibration. The CO_2 control and CO_2 injection calibration procedure are easily performed on the front panel similar to the temperature offset requiring no tools. The CO_2 sensor internal procedure is more in depth requiring approximately 15 minutes to perform.

9.4.1 CO_2 Control Calibration

CO_2 Control Calibration can be performed anytime an independent measurement doesn't correlate to the front panel display. However, this calibration SHOULD NOT BE PERFORMED MORE THAN ONCE PER WEEK. Sensor calibration should be performed if an independent measurement doesn't match the display within $\pm$0.3 percent within one week after a sensor calibration. Before doing the following calibration, check and change, if necessary, the Incubator in-line filter found within the control center.

When unit has stabilized at the operational temperature and CO_2 percentage, take an independent measurement and, if necessary, perform the following:

- In run mode press "SEL" to indicate LED next to CO_2 percent display.
- Press and hold ▲ key, CO_2 display alternates between “ADJ” and the CO_2 percentage.
- Press both ▲ and ▼ keys simultaneously, (clears all previous offsets).
- Use an independent instrument to determine actual CO_2 percentage (compare the display CO_2 to the independent measurement). If these two readings have a difference of less than 1.0 percent, proceed to enter the CO_2 Fyrite value. (See * **Note** below) If the difference is greater than 1.0 percent, proceed to CO_2 sensor zero/span calibration.
- Press ▲ or ▼ key to indicate same CO_2 percentage as the independent measurement.
- Press "SEL" to set current value and exit calibration.

*__Note__: When the display value is more that 0.3% different from the measured value, offset display 1/2 the difference measured. Allow the Incubator to stabilize back to set point, then measure the CO_2 in the chamber again. Offset the display again if necessary.

9.4.2 CO_2 Sensor Calibration (Zero/Span/CAL. INJ.)

There are 2 sensor (zero/span) calibration routines available to the lab professional. The first option is the "open door" routine involving opening the outer and inner door to zero the sensor. This routine also automatically calibrates to the CO_2 injection rate during the injection for the span portion of the sensor calibration. It is recommended that this routine be used during the initial setup of the Incubator, if the set point of the system is changed or if other changes are made on the Incubator affecting the CO_2 system. The second option is a "closed door" routine. This routine allows calibration of the sensor with out opening the door avoiding undue exposure to the cultures that may be in process. This routine injects "fresh air" into the detector head of the sensor to calibrate zero. The chamber air is then allowed back into the detector head to calibrate the gas span that is detected. The closed-door routine option is activated through the Options menu and must be turned off to use the open door routine.

<u>OPEN DOOR CO_2 SENSOR CALIBRATION ROUTINE</u>

(Default CO_2 calibration routine):

Zero calibration

- Make sure unit is in Run mode, the green LED above the mode key should be on and not blinking.
- Press the "SEL" key to indicate the LED next to the CO_2 display.
- Open the inner and outer doors then push the ▼ until "dor" appears in the temperature display: When "dor" starts flashing after 90 seconds close the doors.
- Display shows old value if other than zero then zeros out.

Note: If the value in the display is greater than 0.2 prior to the display zeroing, the zero portion of the routine should be confirmed. Complete the current calibration by running the remaining steps listed below. Then run the zero span routine again checking to make sure that the display reaches zero.

The CO_2 display will show the following in order:

Span Calibration

"INJ" alternating w/value: Shows right after the door is closed from the zero calibration. The unit injects CO_2 targeting the selected set point.

"DLY" alternating w/value: Shows for 90 seconds to indicate the delay to give CO_2 time to mix in chamber.

"SPn" alternating w/value: Indicates the span value shown in the display is ready for verification. Measure chamber CO_2 at sample port on the front panel with an independent instrument. Change display value to match this measurement using "▲▼".

Press Run/Setup key to switch to Setup then back to Run to lock in value and go back to normal running mode.

Note: The CaL inject rate is automatically calculated from the CO_2 injection made during the span calibration making it unnecessary to run the separate "CAL InJection" calibration. The injection is dependent on the proper gas pressure and factory set flow rate. Any changes in either will result in a change to the value reached during this injection.

CLOSED DOOR SENSOR CALIBRATION ROUTINE

(Default “OFF” see section 8.8.1.2 item 4):
Activating the routine

- Press logo key until tSt flashes in display then press ▲ to select the OPt menu.
- Press "SEL" until C.SC appears in the display.
- Press the ▲to turn this option on and shut off the open door routine.
- Press the logo key to return to run.

Note: Turning off this routine will reactivate the “open door” calibration routine.

Zero Calibration

- Make sure unit is in Run mode, the green LED above the mode key should be on and not blinking.
- Press the "SEL" key to indicate the LED next to the CO_2 display.
- Press the ▼ until “ZEr/value” alternate in the display: Air is being pumped through the sensor to confirm the sensor zero value. After 60 seconds the display is automatically zeroed and the span portion of the routine is started.

Note: If the value in the display is greater than 0.2 prior to the display zeroing, the zero portion of the routine should be confirmed. Complete the current calibration by running the remaining steps listed below. Then run the zero span routine again checking to make sure that the display reaches zero.

The CO_2 display will show the following in order:

Span Calibration

"DLY" alternating w/value: Shows for 90 seconds to indicate the delay to give CO_2 from the chamber time to reenter the detector head and get an accurate reading.

"SPn" alternating w/value: Indicates the span value shown in the display is ready for verification. Measure chamber CO_2 at sample port on the front panel with an independent instrument. Change display value to match this measurement using either "▲▼”.

Press mode key to switch to Set up then back to Run to lock in value and go back to normal running mode.

Note: When the span measurement is greater than the setpoint, open the door briefly to remove the excess CO_2 .

Allow unit to run and stabilize for a minimum of 2 hours then, check calibration with an independent instrument. Compare the display CO_2 percent to your independent measurement. If these two readings have a difference greater than 0.3%, repeat above procedure. If these two readings have a difference of less than 0.3%, perform the CO_2 control calibration procedure in Section 9.4.1.

9.4.3 CO_2 Injection Calibration

The CO_2 injection calibration can be performed separately from zero/span calibration to optimize the gas injection time required to recover the CO_2 level to set point after a door opening. The recovery time should be as minimal as possible with virtually no overshoot. Verify the CO_2 sensor calibration prior to performing an injection calibration. The injection calibration is not required after an "Open Door" sensor calibration since it is performed automatically during this routine. The injection calibration should be performed after a "Closed Door" sensor calibration when possible, if CO_2 supply pressure of the Incubator is changed, or is the CO_2 flow control valve is disturbed.

The following steps should be taken for the CO_2 injection calibration:

- Press "SEL" to indicate LED next to CO_2 percent display.
- Press and hold ▲and ▼ keys simultaneously for three seconds. "CAL" and current indicated CO_2% will blink.
- Open door for at least 1 minute to evacuate the CO_2 from the chamber. The value on the display should be below 1% before closing the door to continue the routine
- Press and hold ▲ and ▼ keys simultaneously again to start auto calibration procedure.
- Observe display, which will indicate the following sequence:
    a) dLY - Wait for door delay, prior inject delay, temp. in range.
    b) INJ - Inject CO_2 for fixed time period according to the set point
    c) dLY - Wait for post inject diffusion.
    d) End - Done with Calibration
- Press "SEL" to set current value and exit calibration.
- If necessary, open glass door to vent excess gas.

9.4.4 CO_2 System Auto Zero Calibration Function

This Incubator is programmed to automatically check and adjust the zero calibration of the CO_2 sensor. HEPA filtered room air is pumped through the sensor detector cell for 2 minutes. The CO_2 reading is checked at this time. If it 0.5% or less different than the current zero the sensor will use the new value as zero. When the value is greater than $\pm$ 0.5%, the auto zero routine is aborted and an ACF alarm is sounded. See Section 11.0 on Trouble Shooting for responses to this alarm.

The auto zero routine is scheduled to be initiated 12 hours after the Incubator is turned on and then every 24 hours thereafter. This timing is structured to run the auto zero routine daily at a time that would be considered "off hours". The timer for this routine can be reset at any time by simply turning the Incubator off then back on. Power failures will reset the timer.

This routine is essentially transparent to the operation of the Incubator and the factory supplied options like the chart recorder or the printer outputs while it is running. After the routine is done the CO_2 level will be reduced by about 0.2% to 1.0% depending on the amount of air that has be injected to perform the routine. The routine can run as long as 7 minutes because it will try to perform the zero function up to 5 times before declaring an "ACF" alarm. If any calibrations are attempted during this routine "SLF" shows in the display and the calibration is inhibited until the routine is complete. An independent monitoring system will record a minor shift in CO_2 and temperature during the routine. This happens because the air injected into the sensor, during the purge and while the sensor is performing the zero function, is passed into the chamber.
This routine compensates for minor shifts in zero due to electronic drift. Regularly scheduled checks of the calibration by an independent instrument must still be performed.

9.5 To abort the Auto Zero routine open the inner glass door and close it again.

10.0 Maintaining Your DHD Autoflow

DHD Autoflow Chamber
The chamber maintenance is up to the discretion of the owner and the extent of cleanliness and sterility desired. The shelves and bracket supports are all removable and autoclavable. The interior should be wiped down with an appropriate disinfectant such as 70% ISOPROPYL ALCOHOL or equivalent.

DO NOT USE ANY CHLORINATED OR HALOGEN MATERIALS IN THE CHAMBER. SUCH MATERIAL IS HARMFUL TO THE POLISHED STAINLESS STEEL.

The humidity pan should also be sterilized and the water changed regularly to assure sterility.
A small amount of copper sulfate may be added to the humidity pan to inhibit bacterial growth.

CO_2 Supply Filter P/N X-980385 (50 mm Disk, Uni-directional In-Line, Dry)*
The CO_2 Supply Filter should be replaced every fifth empty CO_2 tank or when the filter is visibly discolored (yellow-brown). **Note** direction of flow (IN is labeled on one side of filter) when replacing filter.

Chamber HEPA Filter P/N A-980899-02 (Radial HEPA Filter for Heated Decon Cycles)
The chamber HEPA filter should be replaced approximately every two years to assure optimum performance. A visual check should be performed periodically and during CO_2 sensor calibration to assure filter integrity. A visual check would include, removing the plenum top and observing the HEPA filter interior and exterior for heavy discoloration (yellow-brown) or filter change. To replace, remove the knurled nuts holding it to the top of the chamber.

Air Supply Filter P/N X-980385 (50 mm Disk, Uni-directional In-Line, Dry)*
The Air Supply Filter should be replaced every fifth empty CO_2 tank or when the filter is visibly discolored (yellow-brown). **Note** direction of flow (IN is labeled on one side of filter) when replacing filter.

Air Pump Filters P/N X-980366 (50mm Disk, Uni-Directional In-Line, Wet)*
The Air Pump Filters should be replaced EVERY TWO YEARS to assure optimum performance. A visual check should be performed during CO_2 sensor calibration to assure filter integrity. Remove the sensor housing cover to perform visual check.

CO_2 Chamber Sample Port P/N X-980366 (50mm Disk, Uni-Directional In-Line, Wet)*
Should be changed when discolored (yellow brown). Filter is plumbed in the chamber sample hose and can be inspected when the cover is removed to check the air pump filter. This filter has a green dot to distinguish it from the "dry" filter.

*** The word "In" on the outer rink of the body indicates the inlet side of the filter and should be installed toward the gas supply.**

10.1 Heated Decon Cycles

NU-5510 Heated Decontamination Cycle Preparation and use Procedures

IMPORTANT
READ AND UNDERSTAND ALL OF THE ATTACHED INSTRUCTIONS BEFORE USING THE HEATED DECONTAMINATION CYCLES

Nuaire gives the lab professional the choice of the 2 most commonly accepted, heated decontamination cycles available. They are a 95° C humidified cycle and a 145° C dry cycle. To choose the user goes to options menu and pushes "SEL" to the 6th option [option title: dEc (95/**145**)] The 145 cycle is the default cycle. Press the down arrow to select the 95 cycle if that cycle is desired. You can return to the 145 cycle by pressing the up arrow while in the 95.

USING THE 145° DECON CYCLE
The 145º C decontamination cycle is high temperature dry cycle to ensure that the contaminating agents are eradicated. The complete cycle takes about 10 hours to run.
(See graph for cycle phases). There is no need to recalibrate or remove the CO2 IR sensor since it is remote from the chamber. See the instructions above for choosing this cycle in the options menu.

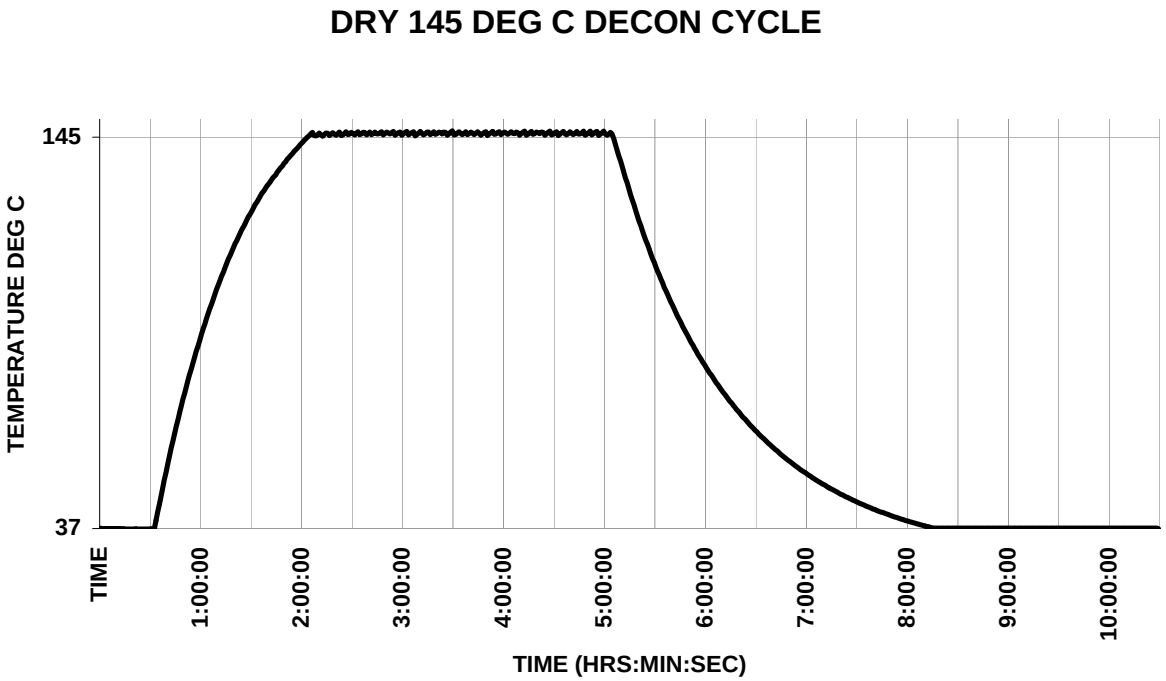
OUTER DOOR MUST REMAIN CLOSED DURING THE DOCONTAMINATION CYCLE OR IF CHAMBER TEMPERATURE IS OVER 55°.

THE DECONTAMINATION CYCLE WILL HEAT THE INCUBATOR INTERIOR SURFACES TO 145° C +. CONTACT WITH ANY SURFACE INSIDE OF THE OUTER DOOR DURING THIS CYCLE CAN RESULT IN BURNS.

PREPARATION
- ⇒ Remove culture cells, samples, dishes, instruments, or other user-introduced equipment from the chamber.
- ⇒ Wiping out all spills and materials from chamber walls, shelves, plenums, & inner door may be required to avoid stains, odor and material baked on these surfaces during the cycle.
- ⇒ IF a cleaner is used make sure it is compatible with the construction of the chamber.
- ⇒ Ensure the hole in the access port plug at the back of the Incubator is open. This is a relief for the chamber during the Decon Cycle.

FOLLOW ALL FEDERAL, STATE AND LOCAL REGULATIONS THAT APPLY WHEN USING CLEANER. ANY RESIDUE LEFT OF THE CLEANER WILL BE EXPOSED TO THE DECON. TEMPERATURES CHECK WITH MANUFACTURER ABOUT EXPOSURE OF THE CLEANER TO THESE TEMPERATURES.

STARTING THE CYCLE



- Press the 95/145 button (for 3 seconds) until the Incubator displays show the following:
    - TEMP. display temperature continuous
    - CO2 display H2O/out flashing
    - The LED over the 95/145 button will flash on /off.

Indicates that user should:

- Open the inner and outer doors
- Empty water pan and put it back into the chamber.
- Close the inner and the outer doors

Note: CO_2 system will be idle during the cycle. Protection of the sensor during the heated cycle is automatic. The Decon Cycle will not advance to the heat up phase unless the door is opened to empty the water pan and clean the chamber. When trying to advance the Incubator will beep rapidly and "dor" will show in the Temperature display.

HEAT UP 3 hours

- Press the 95/145 button again to start the heat up portion of the cycle.
    - Temperature display shows chamber temperature.
    - CO_2 display flashes dCn
    - The LED over the 95/145 button will flash on /off.

DECONTAMINATION 3 hours

- The unit automatically starts a timer for the correct length of cycle when the decontamination temperature is reached.
    - Temperature display shows chamber temperature.
    - CO_2 display shows the time remaining for decontamination.
    - The LED over the 95/145 button is lit continuously.

COOL DOWN & STABILIZING 4 hours

- When the decontamination period is complete the heaters are shut off and the air pump is turned on blowing HEPA filtered air to cool the chamber to the user chosen temperature set point.
    - Temperature display shows chamber temperature during cycle.
    - CO_2 display shows CoL/dCn
    - The LED over the 95/145 button is flashing on/off.

CYCLE COMPLETE

Temperature display	temperature	continuous
CO_2 display	H2O/In	flashing

Indicates the user should:

- Refill the water pan with single distilled water no purer than 1 Mega OHM in preparation to return to normal running.

Note: Chamber fan HEPA filter remains installed during the Decon Cycle. If Decon Cycle is run as routine maintenance it is ok to reuse the HEPA filters the service life indicated in Section 10. If contamination is an issue due to the room environment HEPA filters can be replaced as necessary.

RESUME NORMAL OPERATION

- Press the 95/145 button to resume normal operation.
    - This puts the Incubator into normal run mode
    - CO_2 control resumes
    - Checking the calibration of the temperature sensor is recommended. Follow the instructions in section 9.1 of the manual

DECON CYCLE NOTES:

- Aborting the cycle:
  To abort any phase of either the 95 or 145 decontamination cycles press the 95/145 button to step through the different phases of the cycle that are described above. The cool down phase cannot be bypassed until temperature reduces to the temperature set point. See cautions below.
- In case of a power interruption, the heat up, drying & cool down phases will resume when power is restored. The decon phase will reset to the beginning of the cycle or if the temperature drops more than 1 degree it will go back to the heat up phase then resume the cycle when decon temperature is reached.
- It is considered normal for some odor to occur during the Decon Cycles. This odor reduces with use of the Decon Cycle.
- Some discoloration due to heat of the chamber and its components can be expected.
- If decon temperature is not reached with in the time allotted (set by the temp. Time Out option). The Incubator will alarm and indicate a “tO.E” condition in the Temperature display.
- If the inner glass door is opened during the Decon Cycle an alarm sounds and "dor" flashes in the temperature display telling the user to close the door.
- Place Incubators 10" apart when placed side-by-side to enable running the heated Decon Cycle while surrounding Incubators are in normal run mode.
- When Incubators are stacked, the heated Decon Cycle can be run on either Incubator with out affecting the normal operation of the other unit in the stack.

USING THE 95° DECON CYCLE

The 95º C decontamination cycle is humidified to ensure that the contaminating agents are eradicated. The complete cycle takes about 14 hours to run. (See graph for cycle phases). There is no need to recalibrate or remove the CO_2 IR sensor since it is remote from the chamber.

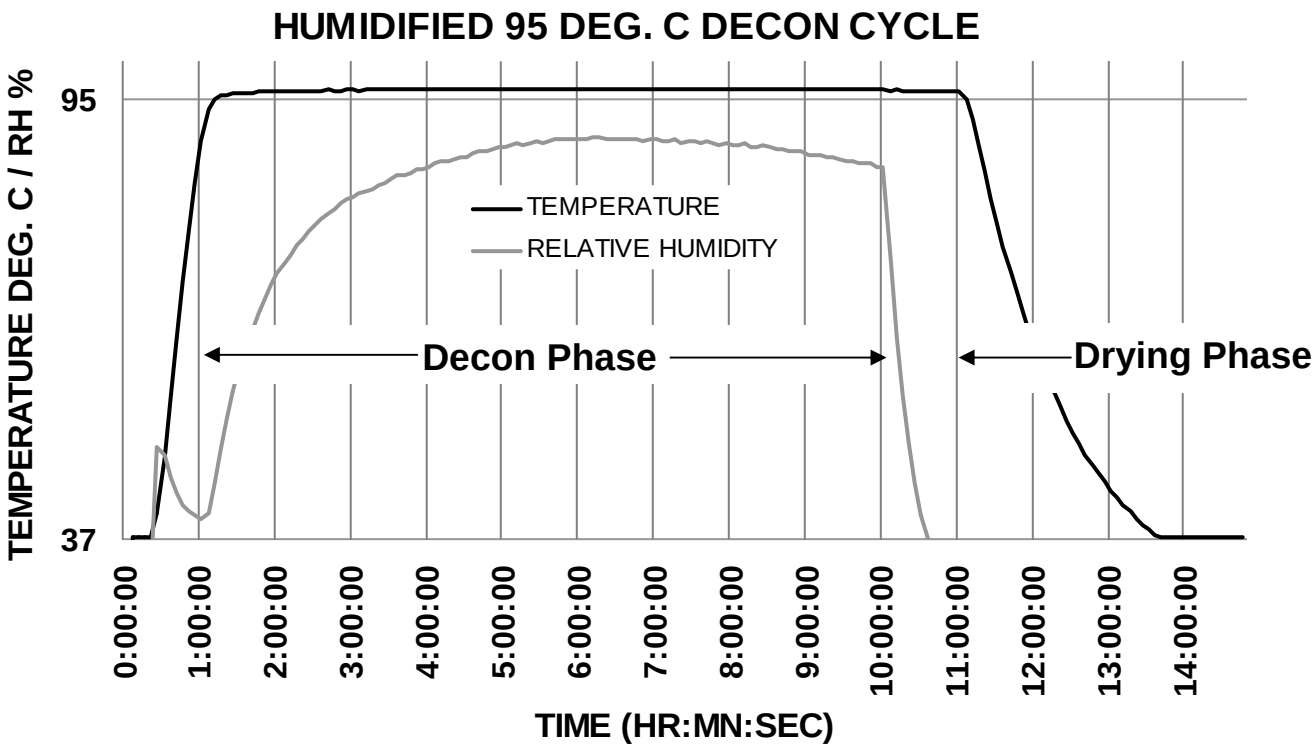
OUTER DOOR MUST REMAIN CLOSED DURING THE DOCONTAMINATION CYCLE OR IF TEMPERATURE IS OVER 55°.

THE DECONTAMINATION CYCLE WILL HEAT THE INCUBATOR INTERIOR SURFACES TO 95° C +. CONTACT WITH ANY SURFACE INSIDE OF THE OUTER DOOR DURING THIS CYCLE CAN RESULT IN BURNS.

PREPERATION

- ⇒ Remove culture cells, samples, dishes, instruments, or other user-introduced equipment from the chamber.
- ⇒ Wipe out all spills and materials from chamber walls, shelves, and plenums using a disinfectant of choice that is compatible with construction of the Incubator chamber and instrumentation.
- ⇒ Ensure the hole in the access port plug at the back of the Incubator is open. This is a relief for the chamber during the Decon Cycle.
- ⇒ Ensure that the sample port in the front panel of the Incubator is capped. Condensation can form in tubing if it is left open.

FOLLOW ALL FEDERAL, STATE AND LOCAL REGULATIONS THAT APPLY TO THE DISINFECTANT USED TO CLEAN THE CHAMBER.



STARTING THE CYCLE

- Press the 95/145 button (for 3 seconds) until the Incubator displays show the following:
  - TEMP. display H2O flashing
  - CO_2 display out flashing
  - The LED over the 95/145 button will flash on /off.

Indicates that user should:

- Open the inner and outer doors
- Empty water pan disinfect it and refill with 300 ml of distilled water. Place it back in the chamber on the highest shelf.
- Close the inner and the outer doors

Note: CO_2 system will be idle during the cycle. Protection of the sensor during the heated cycle is automatic. The Decon Cycle will not advance to the heat up phase unless the door is opened to empty the water pan and clean the chamber. When trying to advance the Incubator will beep rapidly and "dor" will show in the Temperature display.

HEAT UP .75 hours

- Press the 95/145 button again to start the heat up portion of the cycle.
    - Temperature display shows chamber temperature.
    - CO_2 display flashes dCn
    - The LED over the 95/145 button will flash on /off.

DECONTAMINATION 9 hours

- The unit automatically starts a timer for the correct length of cycle when the decontamination temperature is reached.
    - Temperature display shows chamber temperature.
    - CO_2 display shows the time remaining for this phase flashing with "dCn".
    - The LED over the 95/145 button is lit continuously.

HUMIDITY REDUCTION 1hour

- The unit remains at the decontamination temperature and the air pump is turned on to reduce the humidity left from the decontamination phase.
    - Temperature display shows chamber temperature during cycle.
    - CO_2 display shows the time remaining for this phase flashing with "drY".
    - The LED over the 95/145 button is lit continuously.

COOL DOWN 3 hours

- When the humidity reduction period is complete the heaters are shut off to cool the chamber to the user chosen temperature set point.
    - Temperature display shows chamber temperature during cycle.
    - CO_2 display shows CoL/dCn
    - The LED over the 95/145 button is flashing on/off.

CYCLE COMPLETE

Temperature display	H2O	flashing
CO_2 display	In	flashing

Indicates the user should:

- Refill the water pan with single distilled water no purer than 1 Mega OHM in preparation to return to normal running.

Note: If Decon Cycle is run as routine maintenance it is ok to reuse the HEPA filters for the service life indicated in Section 10. If contamination is an issue due to the room environment HEPA filters can be replaced as necessary.

RESUME NORMAL OPERATION

- Press the 95/145 button to resume normal operation.

This puts the Incubator into normal run mode
CO_2 control resumes
Checking the calibration of the temperature sensor is recommended.
Follow the instructions in section 9.1 of the manual

10.2 Chemical Decontamination of the Incubator Chamber

To chemically decontaminate NuAire Incubators, users may use the traditional formaldehyde, Vapor Phased Hydrogen Peroxide, or Chlorine Dioxide. All three of the chemicals are compatible to all parts within NuAire Incubators.

NOTE: As stated previously, the chamber and components can also be wiped down with a 70% solution of Isopropyl Alcohol for cleaning and decontamination.

11.0 Error Indicators & Troubleshooting

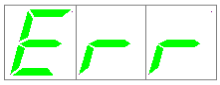
Step 1 NOTE ALL ERROR INDICATORS. When the Incubator is running, any and all red or yellow LEDs indicate an error. Pressing any key will silence the audible alarm for 15 minutes.

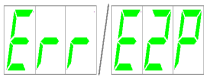
Step 2 CLEAR ERROR INDICATORS. Error indicators can be cleared by pressing the mode key to Setup and back to Run.

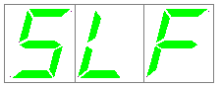
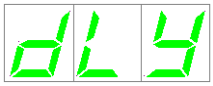
Step 3 MONITOR REOCCURRENCE OF ERROR INDICATORS. If reoccurrence of the error indicator is immediate or daily, use guide below to correct the situation.

Error Indicator Troubleshooting Guide

DISPLAYED ERROR CODE	CODE DESCRIPTION	CHECKS & CORRECTIONS
Temperature System		
	-Temperature over setpoint Normal mode and Decon Cycle	1. Check temperature sensor calibration. 2. Faulty TRIAC, replace control board.
 	-Temperature time out error during normal running and in Decon Cycle - Decon Time Out	1. Check temperature sensor calibration 2. Replace fuse. 3. Faulty TRIAC, replace control board 4. Faulty chamber heater contact NuAire Technical Service. 5. Door/Perimeter heater needs to be increased with a high temperature set-point in a low ambient temperature
	-Sensor temperature (differential) error normal running. Occurs when difference between sensors exceeds 4°C.	1. Check temperature sensor calibration 2. Check connection on control board 3. One or both temp sensors faulty, replace
	-Sensor temperature (differential) error Decon Cycle. Occurs when difference between sensors exceeds 10° C.	1. Check temperature sensor calibration 2. Check connection on control board 3. One or both temp sensors faulty, replace
CO2 Sensor Shroud Heater		
	-Defective shroud temperature sensor	1. Confirm it is plugged in at board connector P6. 2. Replace CO_2 shroud temperature sensor
	-Low shroud temperature	1. Check control board output to relay, replace board if faulty. 2. Check heater relay for function, replace if faulty 3. Check both shroud heaters for function, replace if faulty.

CO_2 System		
	- CO_2 over setpoint	1. Perform CO_2 sensor calibration 2. Check injection solenoid for leaking valve 3. Check sensor and disk filter for condensation
	- CO_2 time out error	1. Check CO_2 gas supply - inline gas filters, CO_2 gas tank pressure, CO_2 sensor function 2. Run Cal Inj. Calibration (see Section 9.3.3) 3. Check/replace CO_2 gas supply tanks 4. Check for leaks in chamber - inner door gasket, chamber blower fan shaft seal 5. Check for leaks in air pump and hosing
	- CO_2 tank switch occurrence	1. Press mode key to “SETUP” and back to RUN to reset alarm
	- Cal inject calibration failed. Not enough increase in the CO_2 reading after gas was injected.	1. Check gas supply then run calibration again 2. Call NuAire Technical Services if error persists.
	- Auto zero failure. The value for zero generated by the routine is greater than 0.5%. This is an alert only and does not affect the operation of the CO_2 system	1. Zero span calibrate the CO_2 sensor 2. Check ambient CO_2 level. Ventilate area if level exceeds normal limits 3. Check air inject system function 4. Check for plugged filter 5. Contact NuAire Tech. Service if problem persists

Memory Chip Fault		
	- Corrupted memory data read at start-up	1. Turn Incubator off and back on. 2. If CrC message persists, push “NUAIRE” button to reset. All systems will require recalibration 3. Continuation of 2, refer to Section 9. If CrC still persists, call NuAire Technical Service.
	- Set up information read failure	1. Turn Incubator off then on again. If error indicator continues, replace main control board. If error indicator is cleared, recalibrate Incubator temperature and CO_2 control.
	- Data write to EEProm chip failure	1. Occurs when the checksum read of manually or automatically input data fails at the time of the input. Input data will be active in volatile memory but will be lost if power to the Incubator is interrupted. Contact NuAire Technical Service to replace control board.

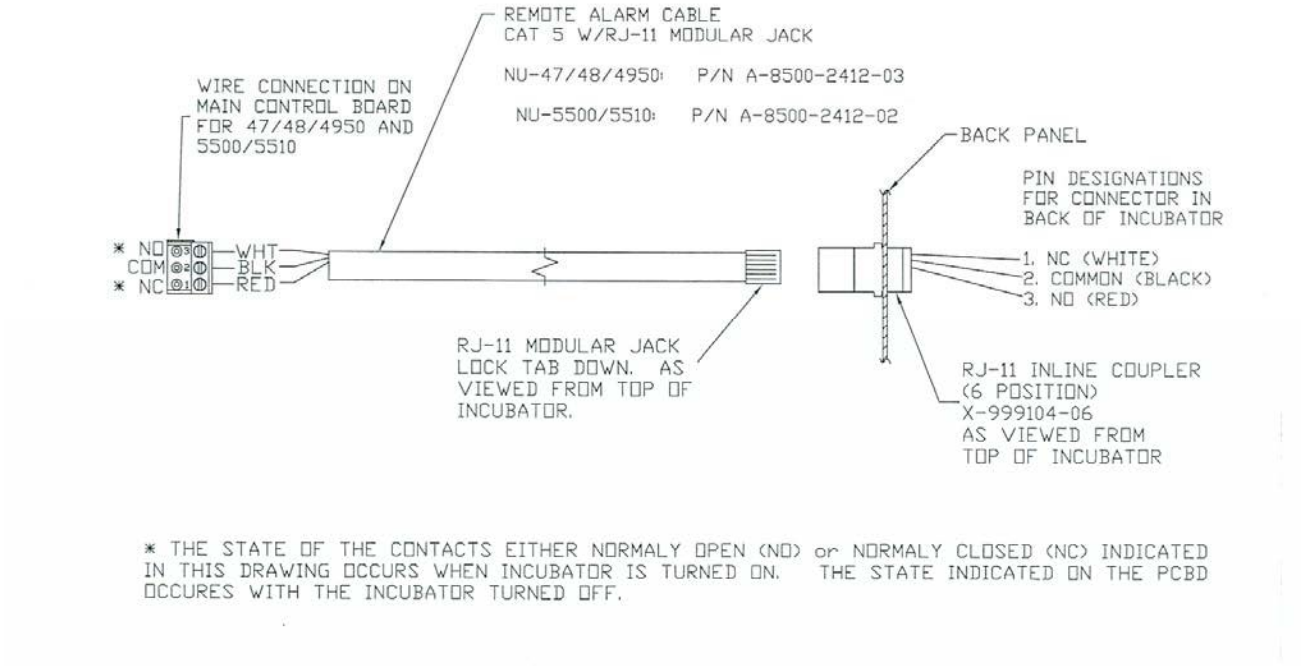
General Indicators		
DOOR AJAR LED	- Inner glass door is not closed or magnetic switch needs a position adjustment	1. Close and latch inner glass door. 2. Adjust switch position to align it with the disk magnet on the glass door hinge by loosening acorn nut on the cable clip. 3. Check door switch, if faulty, replace.
	- Self diagnostic move	1. Indicates Incubator is performing self diagnostic task - Calibration can be performed when task is completed.
	- When performing on off set calibration DLY shows in display and the value will not change	1. Indicates the Incubator is busy with an automatic function like an air injection. Then display can be changed when the function is complete. This usually takes a few seconds CO_2 control is in delay for one of the following reasons: A. Power interruption just occurred. Will resume CO_2 within 1-minute. B. Chamber temperature is not within 2.0°C of Setpoint. Cannot bypass. 2. Shows for 1 minute in CO_2 display after a menu exit.

BLINKING DISPLAY	- Interruption of power	1. Press any key to stop blinking displays.
CONDENSATION EXCESSIVE (Humidity pan in place)	- Glass door, gasket or front wall of chamber wet.	1. Increase door and front perimeter heater duty cycles. See section 9 for detailed instructions.
	- Back wall bottom and top walls	1. Decrease door and front perimeter heater duty cycle. See section 9 for detailed instructions.
Note: Depending on the room ambient that the Incubator is operating, the operator may have to readjust the door and perimeter heater duty cycle are too high and likewise if the door and perimeter heater duty cycles are too low the glass door and front wall of the chamber will show excessive condensation.		
CONDENSATION PERSISTS AFTER DOOR & PERIMETER DUTY CYCLES ARE ADJUSTED		1. Increase air injections, increasing duration first, recommended initial change to 45 sec (Air Inj) & 10 min (Air Cyc)
EXCESS VIBRATION		1. Check for and remove the block of shipping foam from under the air pump. 2. Remove top plenum and ensure that blower wheel is not rubbing on anything. 3. Check jacket fan mounted in bottom on Incubator

For further assistance, call NuAire Customer Service at 1-800-328-3352 or (763) 553-1270 USA.

12.0 Remote Alarm Contacts

The NuAire DHD Autoflow contains a set of contact points to connect to a remote alarm system. The contacts are located on the rear panel. The contacts are housed in a modular (RJ-11) telephone jack and rated for (30V at 1 Amp). The contacts provided are normally open (NO), normally closed (NC) and common (COM) as shown below. The alarm contacts do not distinguish between a CO_2 temperature or any other alarm. Each will open or close the contacts upon an alarm condition. Power interruption will also change the state of the contacts. To reset the alarm contents press the Run/Setup key to setup, then back to Run.



13.0 Electrical/Environmental Requirements

13.1 Electrical

NU-5510	115V,	50/60Hz,	1 Phase,	12.5 Amps
NU-5510E	230V,	50/60Hz,	1 Phase,	5 Amps

Start Up Power	345 WATTS
Running Power	175 WATTS
Decon Cycle	1190 WATTS

13.2 Operational Performance (for indoor use only)

Environment Temperature Range:	60°F-85°F (15°C - 30°C)
Environment Humidity:	20% - 60% Relative Humidity
Environment Altitude:	6562 ft (2000 m) over sea level maximum

13.3 Light Exposure

Standard Fluorescent Lighting @ 150 ft. candles (1614 LUX) maximum intensity.

13.4 Installation Category: 2.0

Installation category (overvoltage category) defines the level of transient overvoltage, which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II, which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

13.5 Pollution Degree: 2.0

Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.

13.6 Chemical Exposure

Chemical exposure should be limited to antibacterial materials used for cleaning and disinfecting. Chlorinated and Halogen materials are not recommended for use on stainless steel surfaces. Chamber decontamination can be accomplished by paraformaldehyde, vapor phased Hydrogen Peroxide or Ethylene Oxide without degradation of cabinet materials.

13.7 EMC Performance (classified for light industrial)

European Standard EN 61000-3-2 (1995) (+A14: 2000) Electromagnetic Compatibility Limits for Harmonic Current Emissions (equipment input current $\leq$ 16 Amps per phase).

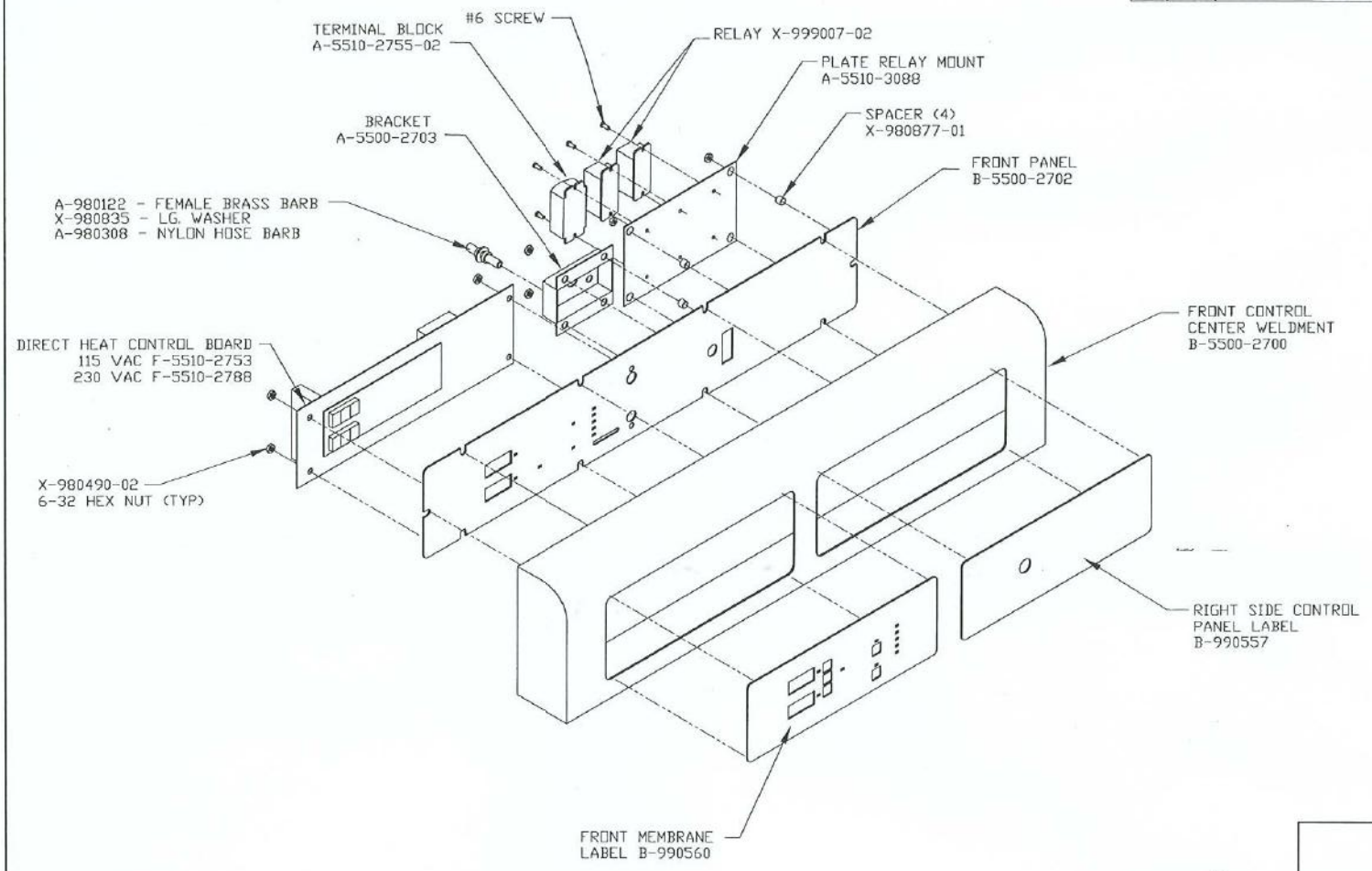
European Standard EN 61000-3-3 (1995) Electromagnetic Compatibility - limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current $\leq$ 16 Amps.

European Standard EN 61326-1 (1997) (+Amendment A1, 1998) Electrical Equipment for Measurement, Control, and Laboratory Use - EMC Requirements.

(**Note**: The EMC performance requirements are generated within the product enclosure. The enclosure will be all metal grounded to earth. In addition, the membrane front panel will also include a ground plane for maximum protection and an electrostatic shield.

13.8 Heat Rejection: 10 BTU/Min.

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
B	9651	UPDATE PER SERIES CHANGE	01/25/07	CV	KCK



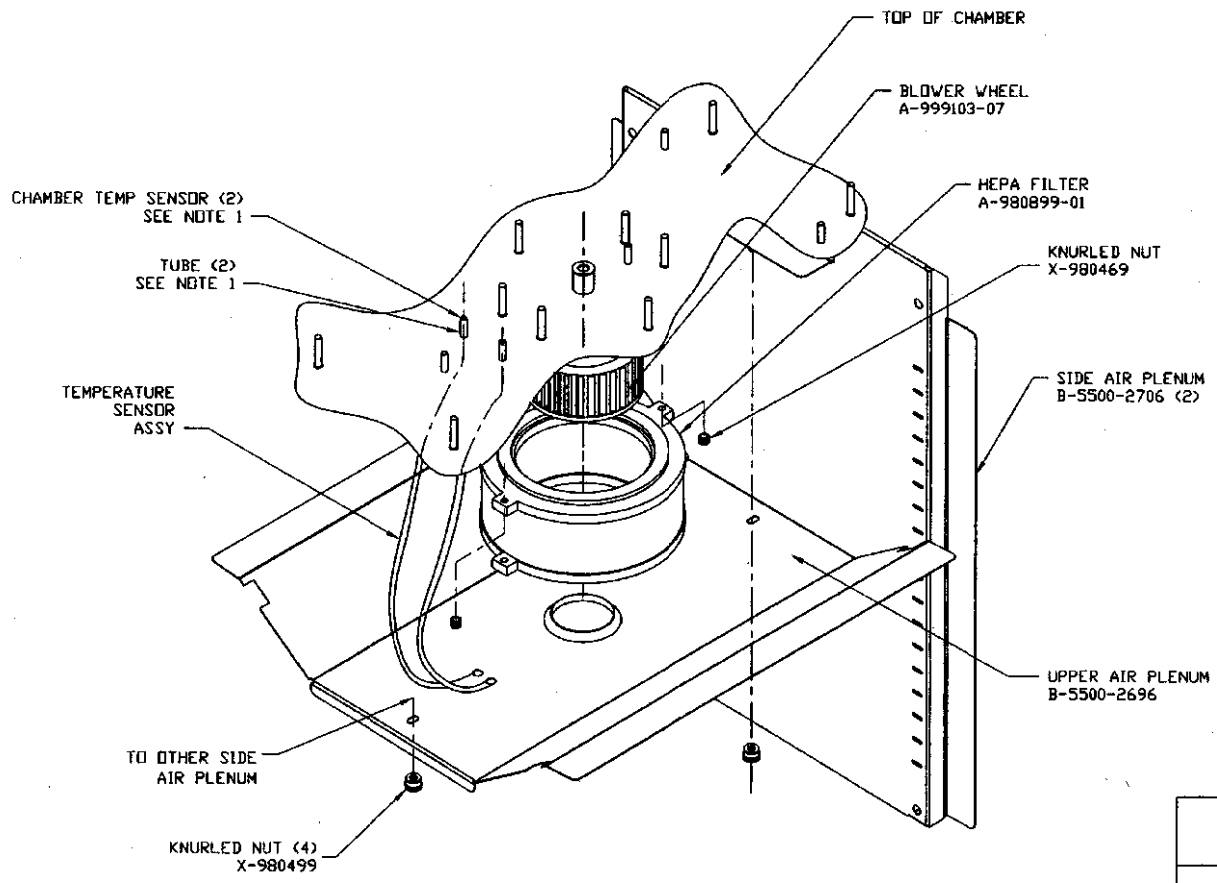
ORIGINAL

NU-5510
FRONT PANEL
ASSY

DFTM	AY	09/05/03	CHKD	KCK	SHEET 1 OF 1

DRAWING NUMBER BCD-09810 B

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	8687	RELEASED TO PRODUCTION	09/18/03	LS	KCK

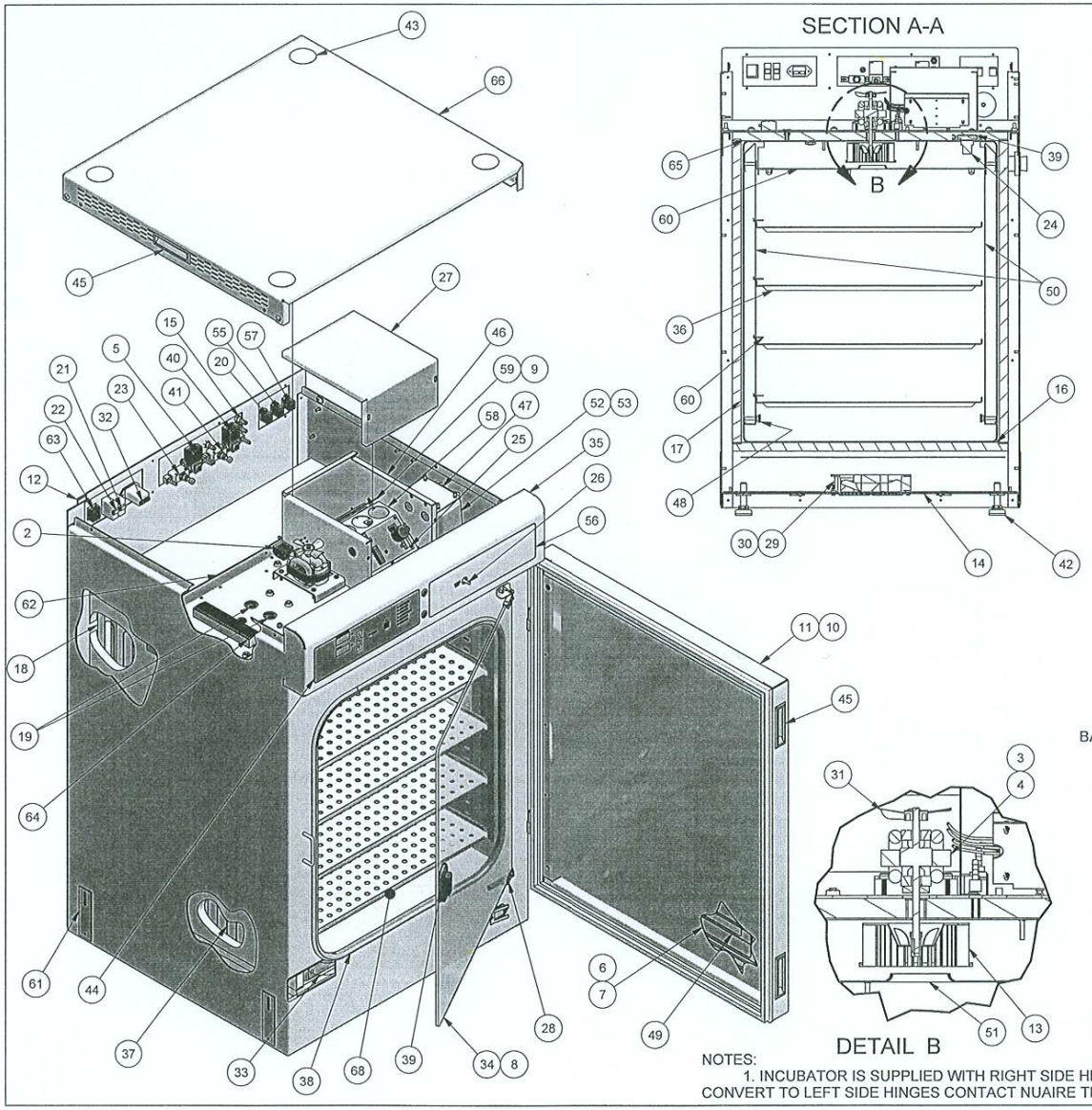


NOTE: 1. REPLACEMENT ASSY PART NUMBER F-5510-2754

NU-5510
CHAMBER
ASSEMBLY

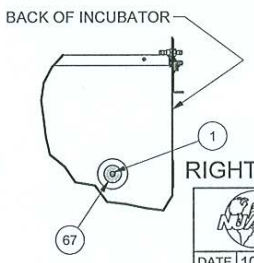
DFTM	LS	09/16/03	CHKD	KCK	SHEET 1 OF 1

DRAWING NUMBER BCD-09811 A



SECTION A-A

DETAIL B



RIGHT SIDE VIEW

REV	ECO	DESCRIPTION	DATE	DFTR	CHKD
D	11019	UPDATED TO CAD	10/19/2010	DHH	KCK

Parts List		Parts List	
ITEM	DESCRIPTION	ITEM	DESCRIPTION
41	INTERNAL TANK SWITCH (OPTIONAL)	1	ACCESS PORT
42	LEG LEVELERS (4)	2	AIR SOLENOID
43	LOCATORS FOR STACKING UNITS (4)	3	ASSY CHMBR FAN MOTOR 115V (S-1)
44	MAIN CONTROL KEYPAD AND DISPLAY	4	ASSY CHMBR FAN MOTOR 230V (S-1)
45	MOLDED DOOR HANDLE	5	ASSY CO2 INJECT VALVE
46	NU-5510 SENSOR SHROUD	6	ASSY DOOR PANL HEATR 115V
		7	ASSY DOOR PANL HEATR 230V
47	NU-5510 PUMP BRACKET	8	ASSY GLASS DOOR (S-1)
48	NUT KNURLED 1/4-20 NKL BRS	9	ASSY SENSOR HEATER MOUNTING 115V
49	OUTER DOOR FOIL HEATER (INSIDE DOOR) INCLUDED WITH ITEMS 6 & 7	10	ASSY, OUTER DOOR 115V
		11	ASSY, OUTER DOOR 230V
50	PLENUM SIDE	12	BACK PANEL COMPONENT MOUNT
51	PLENUM TOP MODIFIED	13	BLOWER WHEEL Ø4.000 X 1.625
52	PUMP AIR HIBLOW 115V	14	BOTTOM COVER PANEL 5500
53	PUMP AIR HIBLOW 230V	15	BULKHD UNION NIC PL .25 ID 3/8 OD
54	RECEPTACLE PWR CORD IEC FEMALE	16	C INSULATION RS 5510
55	REMOTE ALARM CONNECTION	17	C INSULATION SIDE
56	RIGHT SIDE CONTROL PANEL LABEL	18	CHAMBER INSULATION NU-5510 BACK
57	RS232 PORT	19	CHAMBER TEMP SENSOR
58	SENSOR MOUNTING BRIDGE	20	CHART RECORDER CONNECTOR
59	SENSOR SHROUD HEATER ASSY 230V	21	CIRCUIT BRKR 3 A
60	SHELF BRACKET	22	CIRCUIT BRKR 5 A
61	STACKING HOLD DOWN STRAPS (2 PER SIDE)	23	CO2 CONTROL VALVE (FACTORY SET)
		24	CO2 SENSOR
62	SUPPORT, CHAMBER (S-6)	25	CO2 SENSOR BOARD
63	SWITCH DPST ROCKER	26	CO2 TEST SAMPLE PORT
64	TERMINAL BLOCK 28 POSITION	27	COVER SENSOR SHROUD
65	TOP INSULATION 5510	28	DOOR SWITCH
66	TOP PANEL	29	FAN AXIAL 115V 123CFM
67	VENTED PLUG	30	FAN AXIAL 230V 123CFM
68	WATER PAN (INCLUDED) (NOT SHOWN)	31	FAN BLADE 2.625 DIA
		32	FILTER EMI, 15 A
		33	FRONT PERIMETER HEATER (BEHIND)
		34	GLASS DOOR INCUBATOR
		35	HINGED CONTROL BOX
		36	INCUBATOR SHELF
		37	INNER CHAMBER FOIL HEATER (SIDES, BACK, BOTTOM AND TOP)
		38	INNER DOOR SEAL
		39	INNER GLASS DOOR LATCH
		40	INTERNAL TANK SOLENOID (OPTIONAL)

NOTES:
1. INCUBATOR IS SUPPLIED WITH RIGHT SIDE HINGED DOORS TO CONVERT TO LEFT SIDE HINGES CONTACT NUAIRE TECHNICAL SERVICE

ORIGINAL

DATE	10/14/2010
DFTM	DHH
CHKD	KCK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
-TOLERANCES-
DECIMALS ± .032
ANGLES ± 2°

TITLE: NU-5510 COMPONENT LAYOUT

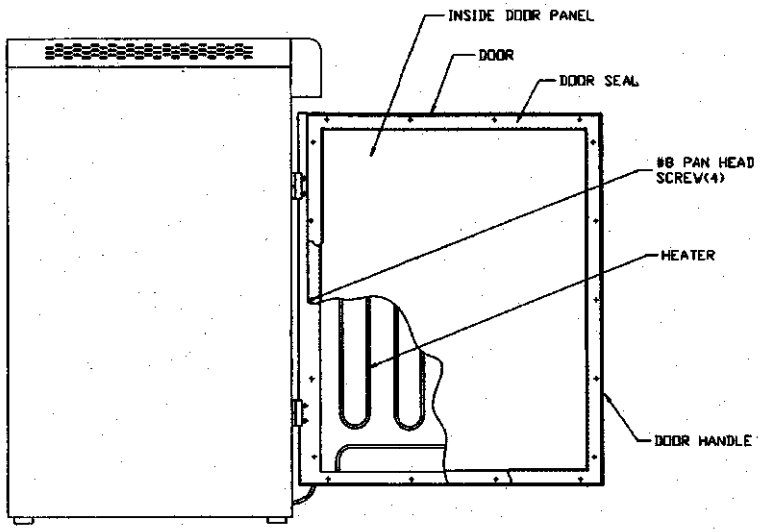
MATERIAL: AS NOTED

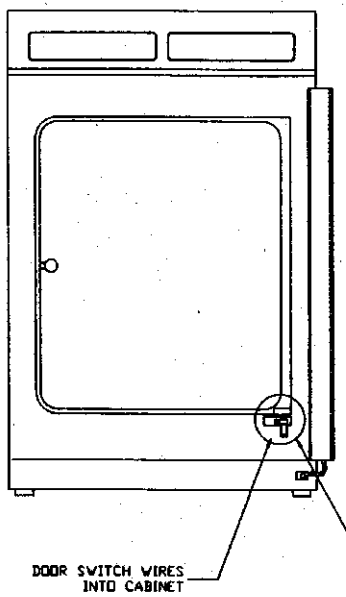
PART NUMBER: BCD-09812 D

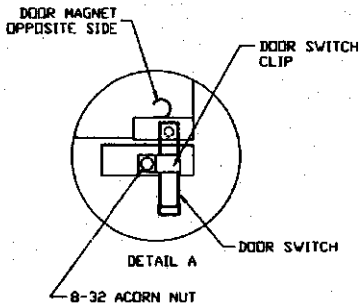
PROJECT NUMBER:

SHEET 1 OF 1

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
B	7180	CHANGED AND ADDED NOTES	6/24/98	AS	DB







DOOR SWITCH
REPLACEMENT PROCEDURE

1. DISCONNECT ALL ELECTRICAL POWER.
2. REMOVE DOOR SWITCH CLIP(1) 8/32 ACORN NUT.
3. PULL SWITCH AWAY FROM DOOR HINGE AREA.
4. LAY DOWN THE UNIT ON THE BACK.
5. REMOVE BOTTOM PANEL BY UNSCREWING(12) SCREWS.
6. LOCATE DOOR SWITCH WIRES, PULL OUT AND CUT OFF ABOUT 8" FROM THE TIP OF SENSOR.
7. CONNECT NEW DOOR SWITCH, USING PROVIDED BUTT SPLICES.
8. INSTALL NEW DOOR SWITCH FROM FRONT OF UNIT REVERSING THE ABOVE STEPS. NOTE COLOR CODE. (NOTE, CHECK DOOR SWITCH OPERATION SO, THE DOOR SWITCH IS ACTIVATED BY THE MAGNET.)

DOOR HEATER
REPLACEMENT PROCEDURE

1. DISCONNECT ALL ELECTRICAL POWER.
2. REMOVE(10) #8 PAN HEAD SCREWS. LOCATED UNDER THE DOOR SEAL.
3. REMOVE DOOR PANEL W/SEAL. MOVING SLOWLY AWAY FROM DOOR EXPOSING WIRES.
4. CUT BUTT SPLINE CONNECTORS FROM DOOR HEATER, NOTE COLOR CODE.
5. REMOVE DOOR HEATER.
   -PULL OFF DOOR HEATER AND REPLACED.
   -NOTE, SILICON RTV MUST BE APPLIED. TO CORNERS OF HEATERS.
6. REPLACE DOOR HEATER REVERSING THE ABOVE STEPS.

DATE	4/17/98
DFTM	TC
CHKD	AS

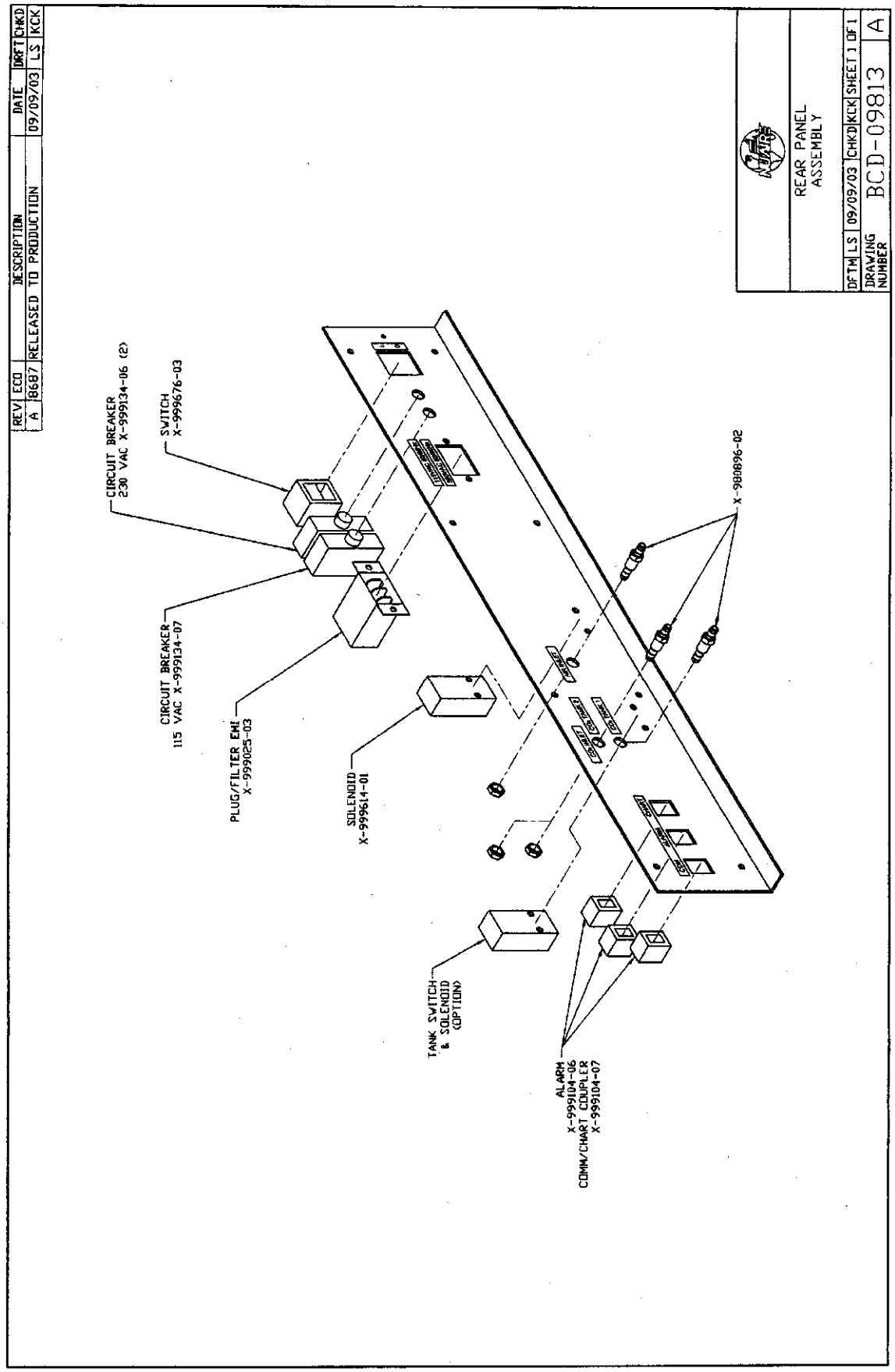
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES- DECIMALS ±.032 ANGLES ±2°

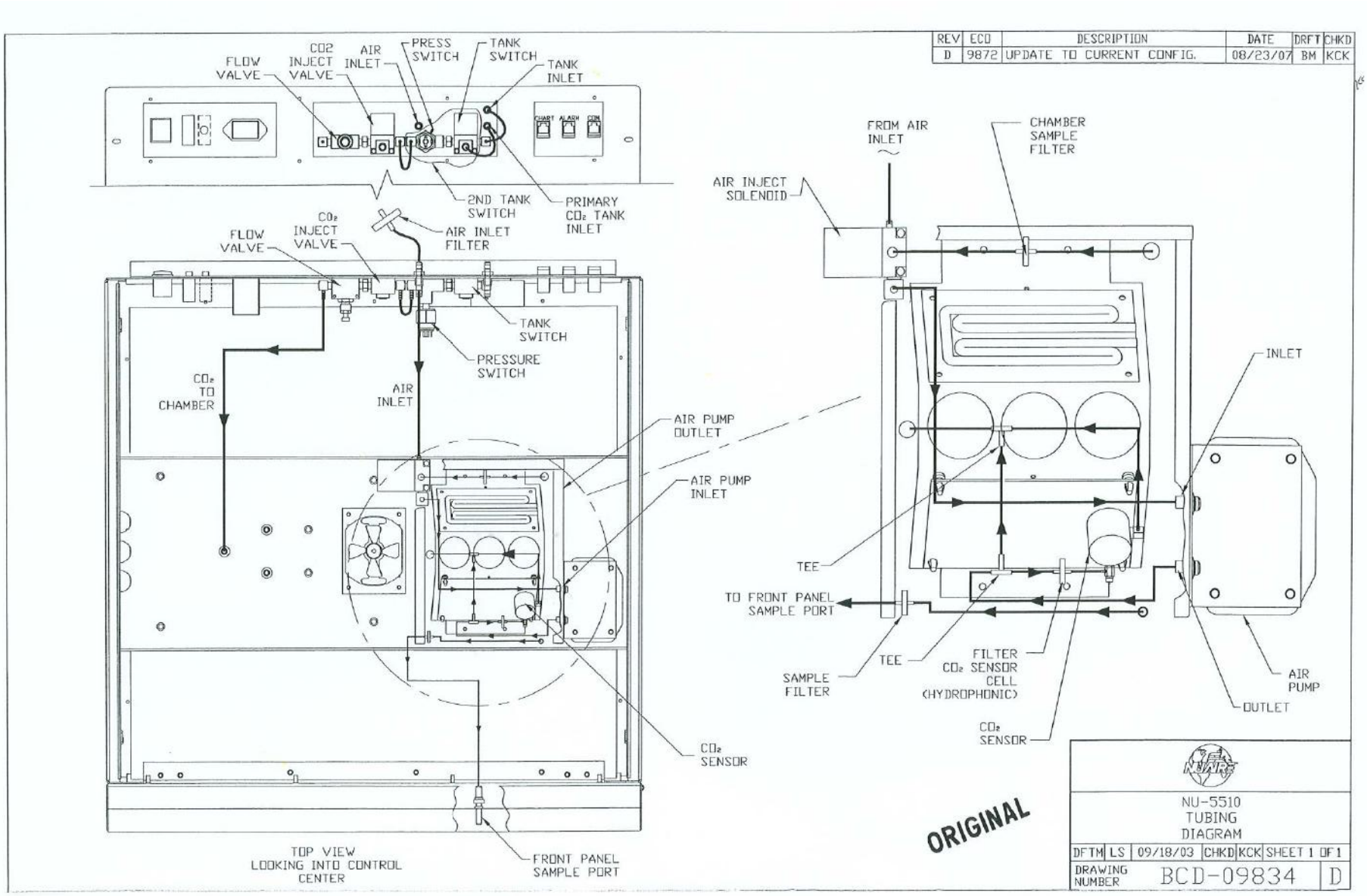
TITLE: DOOR HEATER AND SWITCH ASSEMBLY

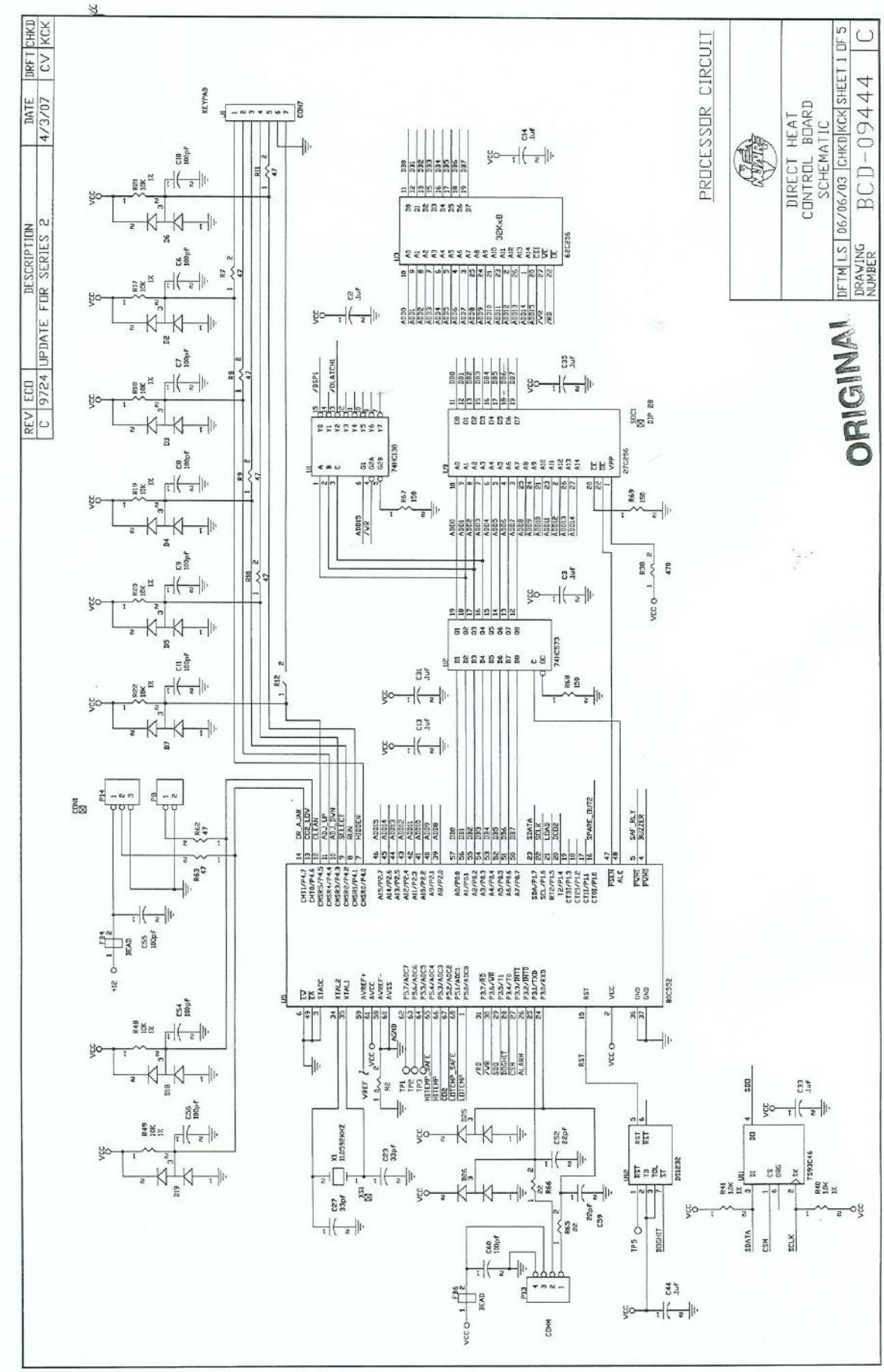
MATERIAL: AS NOTED

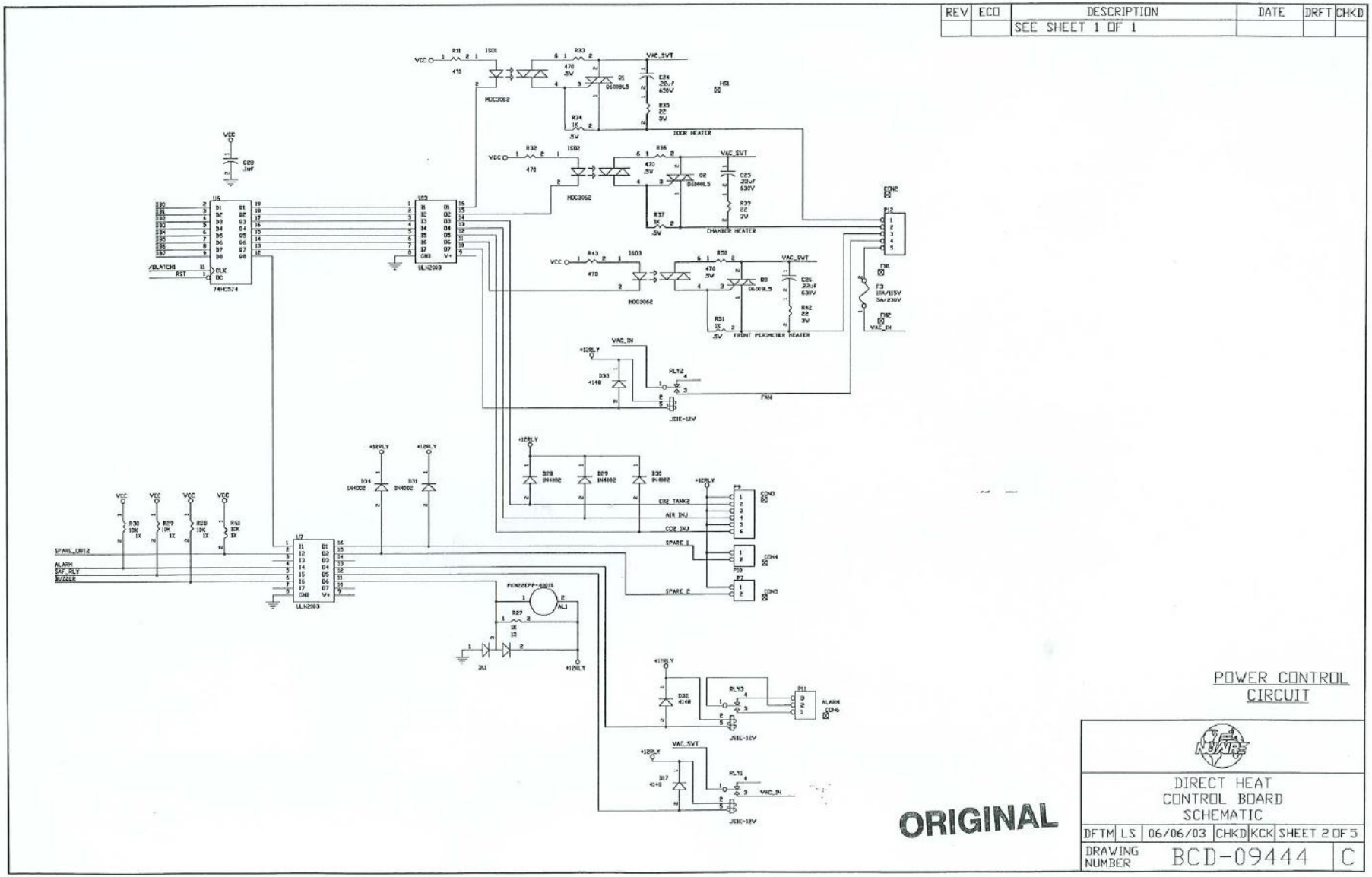
NUMBER: BCD-06782 | B

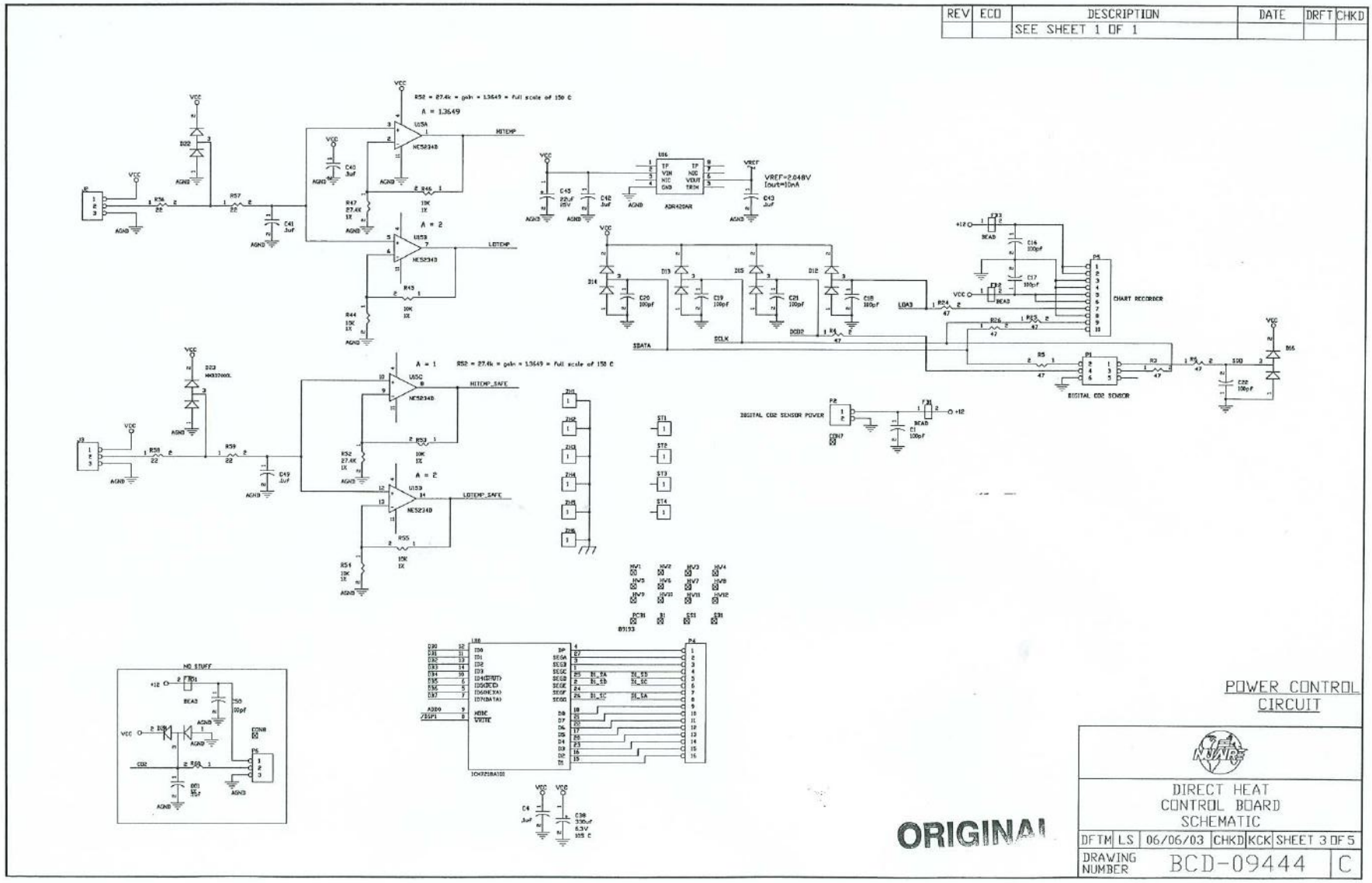
DO NOT SCALE DRAWING | SHEET 1 OF 1

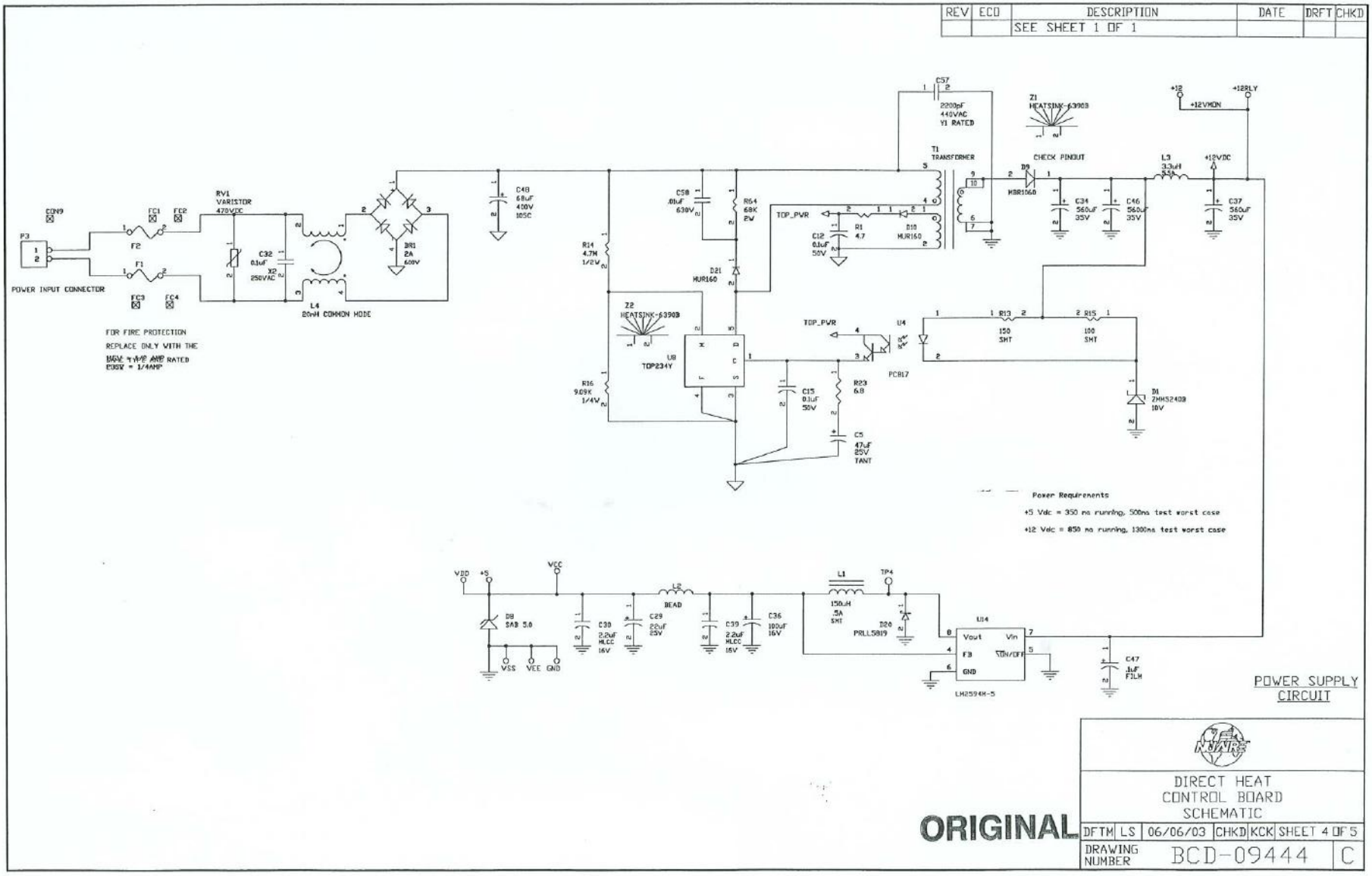

REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
A | 8687 | RELEASED TO PRODUCTION | 09/09/03 | LS | KCK
CIRCUIT BREAKER
230 VAC X-999134-06 (2)
SWITCH
X-999676-03
CIRCUIT BREAKER
115 VAC X-999134-07
PLUG/FILTER EMI
X-999025-03
SOLENOID
X-999614-01
X-980896-02
TANK SWITCH
& SOLENOID
(OPTION)
ALARM
X-999104-06
COMM/CHART COUPLER
X-999104-07
REAR PANEL
ASSEMBLY
DFTM | LS | 09/09/03 | CHKD | KCK | SHEET 1 OF 1
DRAWING NUMBER
BCD-09813
A


REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
D | 9872 | UPDATE TO CURRENT CONFIG. | 08/23/07 | BM | KCK
FLOW VALVE
CO2 INJECT VALVE
AIR INLET
PRESS SWITCH
TANK SWITCH
TANK INLET
2ND TANK SWITCH
PRIMARY CO2 TANK INLET
AIR INLET FILTER
TANK SWITCH
PRESSURE SWITCH
CO2 TO CHAMBER
AIR PUMP OUTLET
AIR PUMP INLET
CO2 SENSOR
TOP VIEW LOOKING INTO CONTROL CENTER
FRONT PANEL SAMPLE PORT
FROM AIR INLET
CHAMBER SAMPLE FILTER
AIR INJECT SOLENOID
INLET
TEE
TO FRONT PANEL SAMPLE PORT
SAMPLE FILTER
FILTER
CO2 SENSOR CELL (HYDROPHONIC)
AIR PUMP OUTLET
ORIGINAL
NU-5510
TUBING
DIAGRAM
DFTM | LS | 09/18/03 | CHKD | KCK | SHEET 1 OF 1
DRAWING NUMBER BCD-09834 D

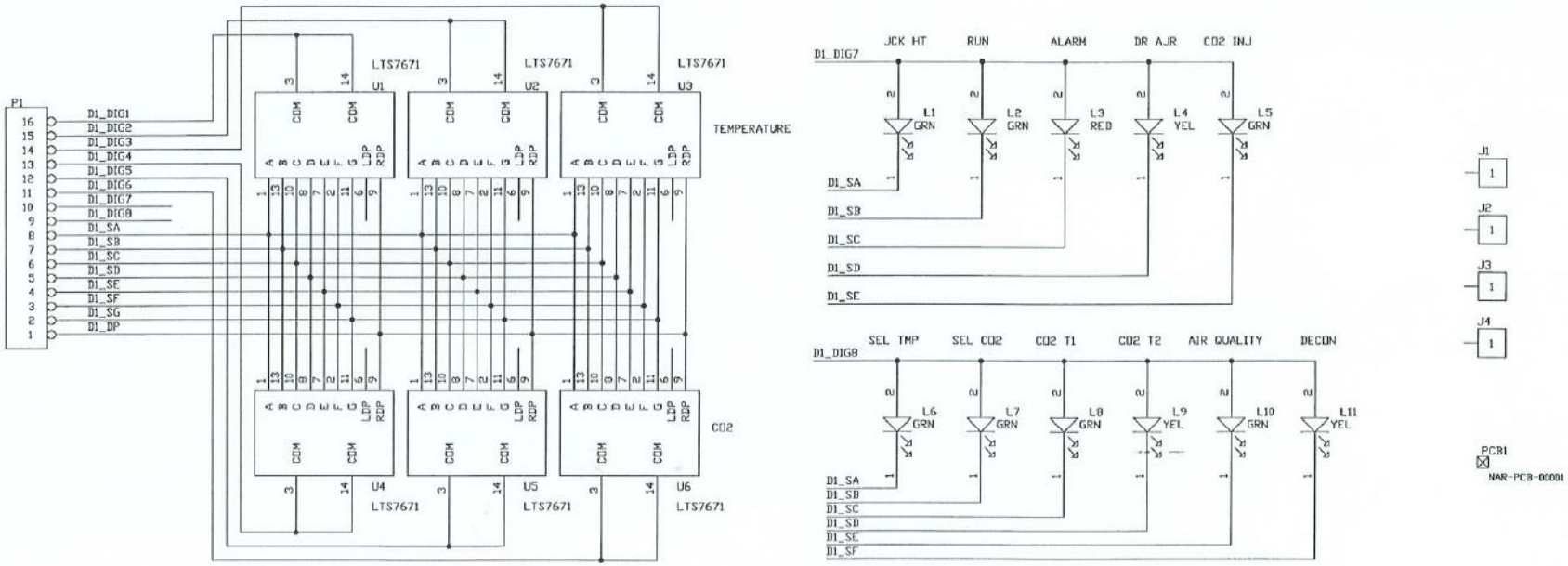

REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
C | 9724 | UPDATE FOR SERIES 2 | 4/3/07 | CV | KCK
PROCESSOR CIRCUIT
DIRECT HEAT
CONTROL BOARD
SCHEMATIC
DFTM | L.S. | 06/06/03 | CHKD | KCK | SHEET 1 OF 5
DRAWING NUMBER | BCD-09444 | C
ORIGINAL


REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
SEE SHEET 1 OF 1
DOOR HEATER
CHAMBER HEATER
FRONT PERIMETER HEATER
FAN
ALARM
POWER CONTROL
CIRCUIT
ORIGINAL
DIRECT HEAT
CONTROL BOARD
SCHEMATIC
DFTM | LS | 06/06/03 | CHKD | KCK | SHEET 2 OF 5
DRAWING NUMBER BCD-09444 | C


REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
SEE SHEET 1 OF 1
POWER CONTROL CIRCUIT
ORIGINAL
DIRECT HEAT CONTROL BOARD SCHEMATIC
DFTM | LS | 06/06/03 | CHKD | KCK | SHEET 3 OF 5
DRAWING NUMBER BCD-09444 | C


REV
ECO
DESCRIPTION
SEE SHEET 1 OF 1
DATE
DRFT
CHKD
POWER INPUT CONNECTOR
FOR FIRE PROTECTION
REPLACE ONLY WITH THE
SAME TYPE AND RATED
250V - 1/4AMP
VARISTOR
TRANSFORMER
HEATSINK-63903
CHECK PINOUT
TOP234Y
PC817
LM2594M-5
Power Requirements
+5 Vdc = 350 ma running, 500ma test worst case
+12 Vdc = 850 ma running, 1300ma test worst case
POWER SUPPLY
CIRCUIT
ORIGINAL
DIRECT HEAT
CONTROL BOARD
SCHEMATIC
DFTM LS 06/06/03 CHKD KCK SHEET 4 OF 5
DRAWING NUMBER BCD-09444 C

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
		SEE SHEET 1 OF 1			



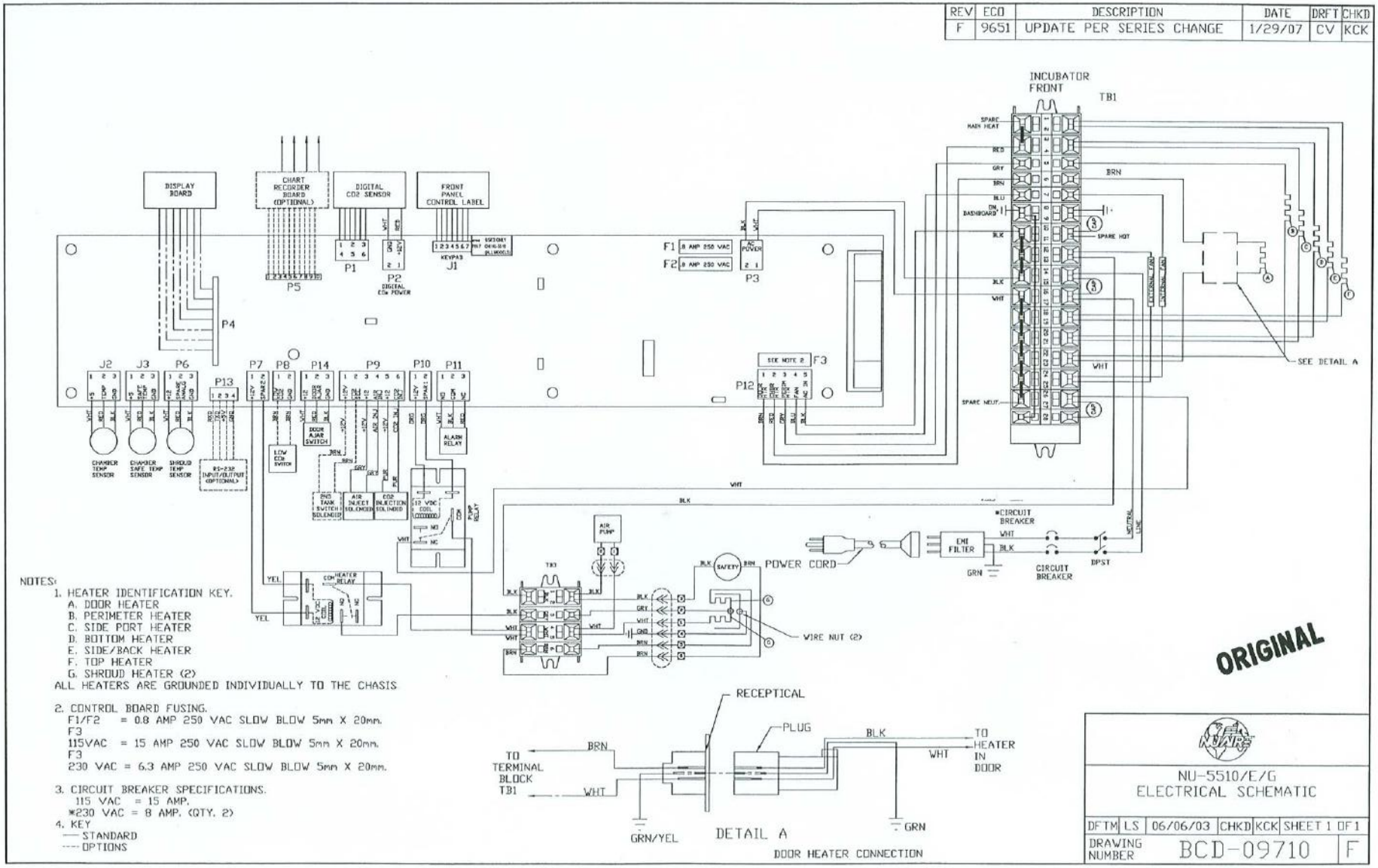
DISPLAY CIRCUIT

ORIGINAL

DIRECT HEAT
CONTROL BOARD
SCHEMATIC

DFTM	LS	06/06/03	CHKD	KCK	SHEET 5 OF 5

DRAWING NUMBER BCD-09444 C


REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
F | 9651 | UPDATE PER SERIES CHANGE | 1/29/07 | CV | KCK
INCUBATOR FRONT
TB1
DISPLAY BOARD
CHART RECORDER BOARD (OPTIONAL)
DIGITAL CO2 SENSOR
FRONT PANEL CONTROL LABEL
P1
P2
P3
P4
P5
J1
F1 8 AMP 250 VAC
F2 8 AMP 250 VAC
F3
SEE NOTE 2
P12
SEE DETAIL A
J2
J3
P6
P7
P8
P14
P9
P10
P11
P13
CHAMBER TEMP SENSOR
CHAMBER SAFE TEMP SENSOR
SHROUD TEMP SENSOR
RS-232 INPUT/OUTPUT (OPTIONAL)
DOOR AJAR SWITCH
LOW CO2 SWITCH
IN/O TANK SWITCH SOLENOID
AIR INJECT SOLENOID
CO2 INJECTION SOLENOID
12 VDC COIL (OPTIONAL)
ALARM RELAY
PUMP RELAY
HEATER RELAY
AIR PUMP
SAFETY
WIRE NUT (2)
*CIRCUIT BREAKER
EMI FILTER
POWER CORD
CIRCUIT BREAKER
DPST
SPARE HOT
SPARE NEUT.
SPARE MAIN HEAT
NOTES:
1. HEATER IDENTIFICATION KEY.
A. DOOR HEATER
B. PERIMETER HEATER
C. SIDE PORT HEATER
D. BOTTOM HEATER
E. SIDE/BACK HEATER
F. TOP HEATER
G. SHROUD HEATER (2)
ALL HEATERS ARE GROUNDED INDIVIDUALLY TO THE CHASIS
2. CONTROL BOARD FUSING.
F1/F2 = 0.8 AMP 250 VAC SLOW BLOW 5mm X 20mm.
F3
115VAC = 15 AMP 250 VAC SLOW BLOW 5mm X 20mm.
F3
230 VAC = 6.3 AMP 250 VAC SLOW BLOW 5mm X 20mm.
3. CIRCUIT BREAKER SPECIFICATIONS.
115 VAC = 15 AMP.
*230 VAC = 8 AMP. (QTY. 2)
4. KEY
—— STANDARD
---- OPTIONS
RECEPTICAL
PLUG
TO TERMINAL BLOCK TB1
TO HEATER IN DOOR
BRN
WHT
BLK
GRN/YEL
GRN
DETAIL A
DOOR HEATER CONNECTION
ORIGINAL
NU-5510/E/G
ELECTRICAL SCHEMATIC
DFTM | LS | 06/06/03 | CHKD | KCK | SHEET 1 OF 1
DRAWING NUMBER BCD-09710 | F