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AUTOFLOW CONSTANT-FLOW CO_2 WATER-JACKETED INCUBATOR

MODELS NU-1500, 1600, 1700

OPERATION AND MAINTENANCE MANUAL

For Reference Only

REVISED
OCTOBER, 1989

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AUTOFLOW CONSTANT-FLOW CO_2 WATER-JACKETED INCUBATOR
OPERATION AND MAINTENANCE MANUAL

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OPERATION AND MAINTENANCE MANUAL
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NUAIRE, INC. - PLYMOUTH, MINNESOTA

1.0 INTRODUCTION

The NuAire Autoflow Constant Flow CO_2 water-jacketed incubator has been designed to provide a reliable controlled invitro environment for optimum tissue cell culture growth. Five parameters contribute to optimum growth conditions. These are:

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

Like all NuAire equipment, the Autoflow has been designed to provide the highest quality standards of performance with matching microprocessor technology, precise temperature control and dependable CO_2 controls combining state-of-the-art technology with years of design, quality and manufacturing experience.

In order to accomplish the foregoing objectives, the Autoflow features the following:

1.1 Extra large (16-gallon) Water Jacket - Each Chamber

The outer stainless steel wall is lined with a space-age insulation providing an R5.0 rating, minimizing heat loss. The large (16-gallon) water jacket utilizes water, one of nature's best "sinks" of heat. Its high capacity to hold heat makes it the ideal medium to surround a chamber in order to obtain temperature uniformity. In fact, the ability of materials to hold heat, called the specific heat, uses water as the comparative standard. The large water jacket surrounding the chamber permits the water to circulate within the jacket, producing a temperature uniformity of $\pm$ 0.2°C. The larger the mass, the less susceptible within the chamber to environmental fluctuations outside. It also adds cabinet stability for the growth of vibration sensitive cells.

1.2 Microprocessor Control Board

In conjunction with the large water jacket, NuAire provides an integrated Main Control Board which performs several control functions of the incubator. The functions include main temperature control, over-temperature setpoint, door temperature control, autopurge control, air supply monitor water jacket level monitor and options, tank switch and chart recorder. The main temperature control is proportional, which means that the energy supplied to the water is directly proportional to the difference between the water jacket temperature and the setpoint. This prevents/minimizes temperature overshoot within the chamber and provides transient-free temperature control.

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Over-temperature differential setpoint is preset at 1°C. over main temperature setpoint. The rest of the functions located on the board provide a small integrated package that is easily replaced for minimum down time in the field.

1.3 Precision High Accuracy Glass Tube Flowmeters

Precision high accuracy glass tube flowmeters are precise flow measuring instruments which provide a precise setting of CO_2 and/or air (or other gases). Once the flow rates are set to the desired concentration level, no further adjustments are necessary. Since NuAire constant flow incubators use such small quantities of CO_2, the difference in purchase price between an automatic and a constant flow incubator will purchase a lifetime of CO_2.

1.4 All Stainless Steel Construction

All NuAire incubators are constructed from stainless steel, which provides an easily cleanable (for decontamination) inert surface that does not in itself promote biological growth. In addition all shelves, shelf supports and guide rails are easily removable and can be autoclaved to remove contamination. All interior surfaces are smooth and free of burrs that may harbor contamination. Remember, the incubator is not selective; the growth environment is applied to all microorganisms within the interior equally.

1.5 Humidity

Humidification of the chamber is achieved through the process of water evaporation from a water reservoir placed within the incubator. In addition, water condensation (which actually lowers the relative humidity within the chamber) is prevented by having all interior surfaces exposed to the constant temperature water jacket, or heated separately via an integrated control that regulates door heat to maintain a condensation-free glass door. Without condensation and with an easily cleanable stainless steel interior, the probability of contamination is minimized.

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2.0 PERFORMANCE PARAMETERS

2.1 The incubator's exterior is constructed of 16-gauge, Type 304 stainless steel with the interior being 20-gauge, Type 304 stainless steel, with all seams fully welded, ground and polished. All exposed edges are deburred to insure that there are no sharp edges. The exterior is finished in a textured baked polyurethane finish, which is resistant to chemicals and easily cleaned, using a mild household detergent.

2.2 Each chamber's water jacket is one inch thick, the outer wall of which is insulated and holds 16 gallons of water. The large jacket promotes convection of water that is in conjunction with the time proportional control algorithm executed by the microprocessor, providing an interior chamber temperature uniformity of $\pm$ 0.2°C at 37.0°C.

2.3 Two temperature sensors are employed, one in the chamber and one in the water jacket. The microprocessor monitors both sensors and compares to the temperature setpoint to analyze execution of the time proportional control algorithm. The sensitivity of the analog to digital (A/D) converter permits temperature resolution to 0.0125°C. internally.

2.4 Display: The selected parameter is displayed on a bright red, 4-digit, light emitting diode (LED) display that is selected from the control panel. The resolution of the temperature is $\pm$ 0.1°C.

2.5 The concentrations of CO_2-air mixture are controlled by precision high accuracy glass tube flowmeters for the direct dial of the gases mixture. CO_2 flow ranges from 50 to 300 ccm (0 to 20%) per minute and air flow ranges from 0 to 3 liters per minute.

2.6 The CO_2 flow line into the chamber passes through a solenoid that interrupts the flow of CO_2 if (1) microprocessor fault conditions exist, (2) air supply is low or interrupted, or (3) a power fault occurs.

2.7 A high reliable internally mounted piston air pump.

2.8 An automatic CO_2 purge timer is provided to quickly recover the CO_2 concentration after an entry/exit from the chamber. The timer can be adjusted from 0 to 60 seconds, with an average time of 15 seconds required to bring the atmosphere back to a 5% CO_2/95% air mixture. An all solid-state magnetic switch monitors the motion of the inner glass door. The microprocessor executes a control algorithm proportional to the length of the time the door is opened.

2.9 The exterior door is heated with an integrated control that regulates the door heat to maintain a condensation-free inner glass door as well as to maintain the interior chamber temperature uniformity. A tempered glass door seals air-tight against a silicone rubber gasket to insure that no leakage occurs.

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2.10 All electronic controls are modular plug in/plug out, easily removed through the front Service Control Center.

2.11 All control electronics are protected with an 8 or 15-amp 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 (black pop-out button will appear), merely depress to reset.

2.12 A water fill access port is provided on the front of the incubator. A 1.4 inch NPT plated brass fill plug is removed and a 1/4-inch NPT to 3/8-inch hose adapter is provided.

2.13 The incubator has heavy-duty adjustable leveling legs to compensate for uneven laboratory surfaces.

2.14 The entire interior shelving assembly is easily removable for decontamination.

2.15 A full size water pan with brackets per chamber capable of being autoclaved or mechanically sterilized.

2.16 A through-wall access port is provided for operating electrical appliances such as roller apparatus, rockers, etc.

2.17 A CO_2 sample port is provided on the front panel to check the concentration of CO_2 in the chamber.

2.18 A water level float switch is provided to monitor the level of water within the jacket.

2.19 A water jacket drain is provided on the bottom of the unit for ease of maintenance.

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3.0 MODELS AND FEATURES

NuAire offers three configurations of the basic Model NU-1500 water-jacketed constant-flow CO_2 incubators. These are (1) Model NU-1500 the basic single chamber unit, (2) Model NU-1600, a side-by-side unit and (3) Model NU-1700, two single chamber units vertically stacked over/under.

3.1 Dimensions [See also specification Drawings BCD-02175, BCD-02174 and BCD-02176.]

Overall Dimensions	Model NU-1500 Single Unit	Model NU-1600 Side-by-Side Unit	Model NU-1700 Vertical Unit
Width	25"	51 1/2"	25"
Height	41 1.2"	41 1/2"	75"
Depth	27"	27"	27"

* The side-by-side incubator is two independent chambers with individual controls. doors open from the center.

3.2 Standard Features

* 100% Stainless Steel Construction
* Large Capacity Water-Jacketed (16-Gallon)
* Precision High Accuracy Glass Tube Flowmeters
* Chamber Temperature Uniformity: 0.2°C at 37°C
* Temperature Sensitivity: 0.1°C
* CO_2 Range: 0-20%
* CO_2 Accuracy: $\pm$ 0.2%
* CO_2 Autopurge System: 0-60 seconds
* Internal Air Supply

3.3 Standard Items Packed with Unit

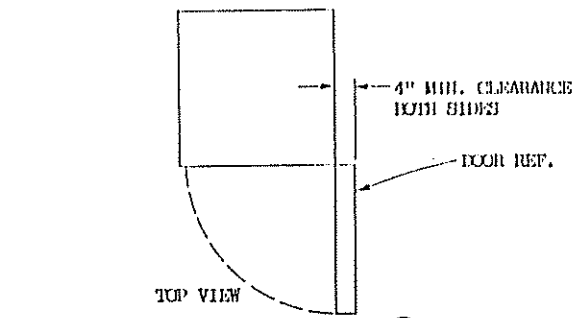
* (4) Stainless Steel Shelves
* (8) Stainless Steel Shelf Brackets
* (4) Stainless Steel Shelf Bracket Supports
* (1) Full Size Water Pan with Supports
* (1) Fill Port Fitting 3/8" Tube X 1/4" NPT
* (1) 6 ft. of 3/8" Tubing
* (4) Heavy Duty Leg Levelers

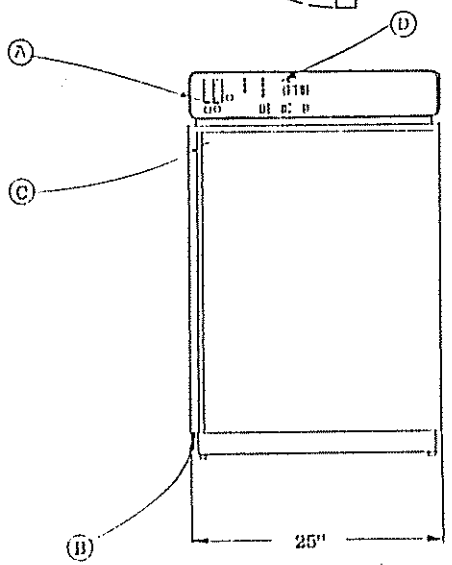
3.4 Accessories

* Model NU-1500 Automatic CO_2 Tank Switch
* Model NU-1552 CO_2 Alarm
* Model NU-1553 Stacker Tray (vertical stacking - single units)
* Model NU-1555 Additional Full-size Water Pan with Supports
* Model NU-1556 Additional Tubing Kit
* Model NU-1557 Additional Stainless Steel Shelf with Supports
* Model NU-1559 Fyrite Kit
* Model NU-1569 (Internal) Automatic CO_2 Tank Switch
* Model NU-1570 Chart Recorder Output (Single Unit)
* Model NU-1572 Chart Recorder Output (Dual Unit)

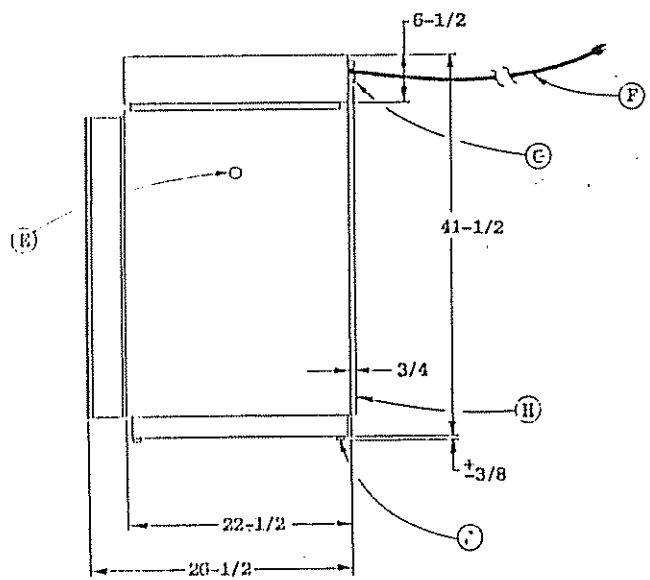
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REV	ECO	DESCRIPTION	DATE	INI.
A	——	REVISED CONTROL PANEL	1/87	TH
B	——	REMOVED LETTER K	9/87	TH





FRONT VIEW



RIGHT SIDE VIEW

TEMP RANGE: 5°C ABOVE AMBIENT TO 55 C°

TEMP. SENSITIVITY ± 0.1 C°

TEMP. UNIFORMITY ±0.2 AT 37 C°

CO_2 RANGE: 0 TO 20%

CO_2 ACCURACY ± 0.2%

CO_2 PURGE SYSTEM: 0 TO 60 SECONDS

ELECTRICAL : 115 VAC, 550 W, 60 HZ.

DIMENSIONS: INTERIOR
25-1/2"H, x 21-1/2"W x 21" D,

DIMENSIONS EXTERIOR:
41-1/2"H, 25" W, x 27" D,

SHELF: 19-1/4"x 19-1/4"

A – FRONT PANEL CONTROLS & INDICATORS
B – WATER SIPHON PORT
C – WATER FILL ACCESS PORT (BEHIND DOOR)
D – FRONT REMOVABLE PLATE FOR CONTROL PANEL
E – ELECTRICAL ACCESS PORT
F – POWER CORD 8'
G – ACCESSORY OUTLET 1 EACH UNIT (FOR AIR PUMP)
H – WIRE COVER
J – LEG LEVELER ±3/8 ADJUSTMENT

DFTM	P S	9/5/86
CHKD		
APPR		
MATERIAL		
APPLICABLE SERIES		

nuAire, Inc.
MINNEAPOLIS, MINNESOTA

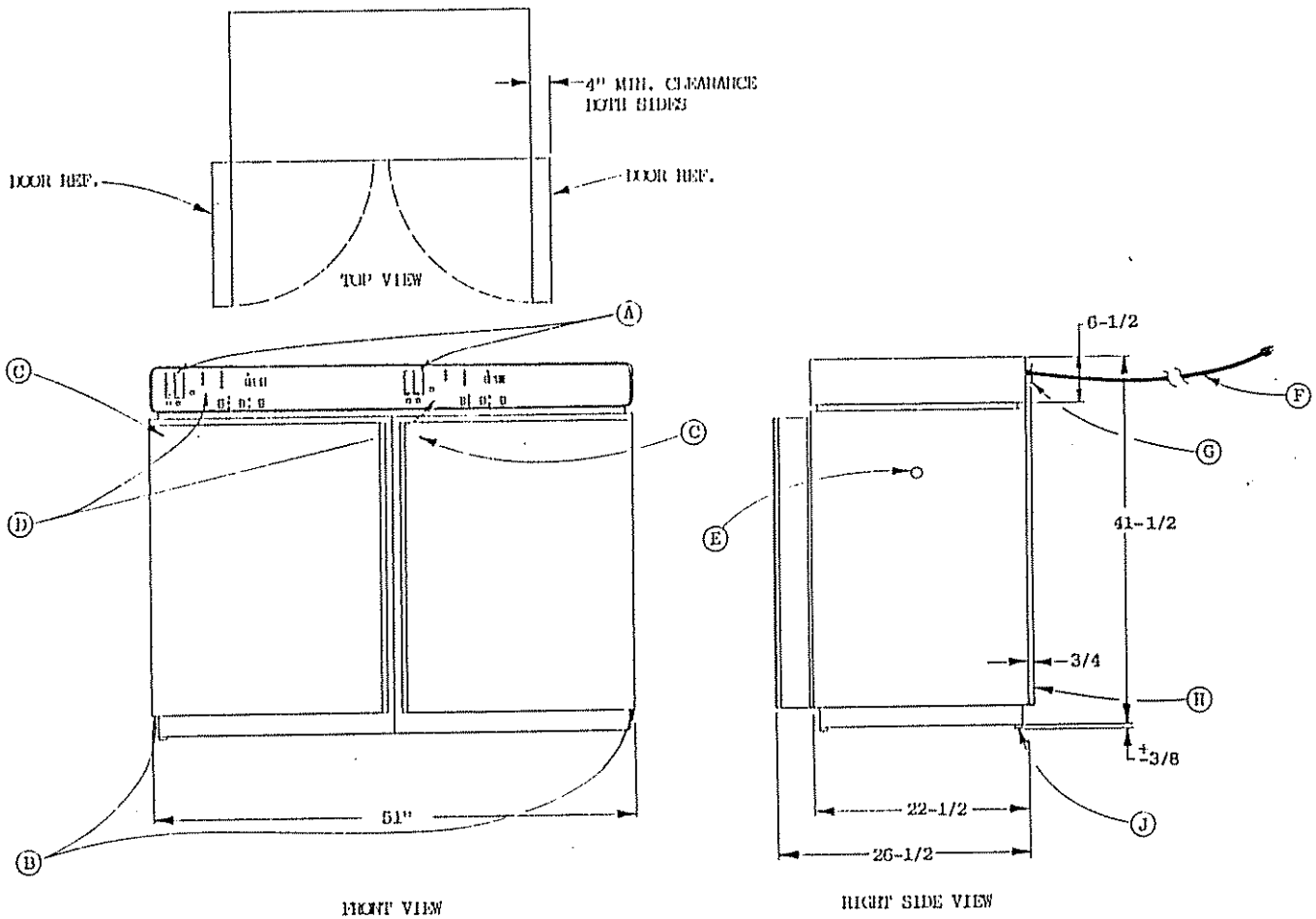
SPECIFICATION DRAWING MODEL NU-1500
CONSTANT FLOW CO_2 INCUBATOR

DRAWING NUMBER BCD-02175

SCALE ~ SHEET 1 OF 1

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REV	ECO	DESCRIPTION	DATE	INL
A	———	REVISED CONTROL PANEL	1/87	TH
B	———	REMOVED LETTER K	9/87	TH



TEMP RANGE: 5°C ABOVE AMBIENT TO 55 C°

TEMP SENSITIVITY ± 0.1 C°

TEMP UNIFORMITY ±0.2 AT 37 C°

CO_2 RANGE: 0 TO 20%

CO_2 ACCURACY ± 0.2%

CO_2 PURGE SYSTEM: 0 TO 60 SECONDS

ELECTRICAL : 115 VAC, 1100 W, 60 HZ,

DIMENSIONS: INTERIOR (EACH CHAMBER) 25-1/2"H, x 21-1/2"W, x 21" D,

DIMENSIONS EXTERIOR: 41-1/2"H, 51" W, x 27" D,

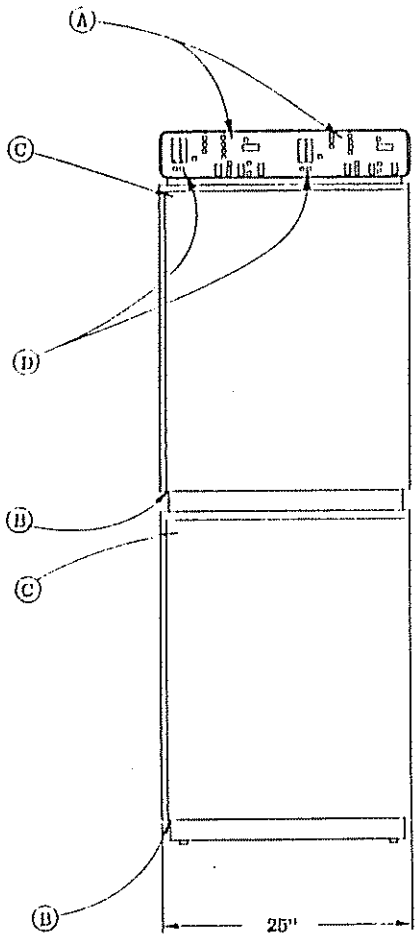
SHELF: 19-1/4"x 19-1/4"

A – FRONT PANEL CONTROLS & INDICATORS
B – WATER SIPHON PORT
C – WATER FILL ACCESS PORT (BEHIND DOOR)
D – FRONT REMOVABLE PLUG IN/OUT CONTROL PANEL
E – ELECTRICAL ACCESS PORT (BOTH ENDS)
F – POWER CORD 8'
G – ACCESSORY OUTLET 1 EACH UNIT (FOR AIR PUMP)
H – WIRE COVER
J – LEG LEVELER ±3/8 ADJUSTMENT

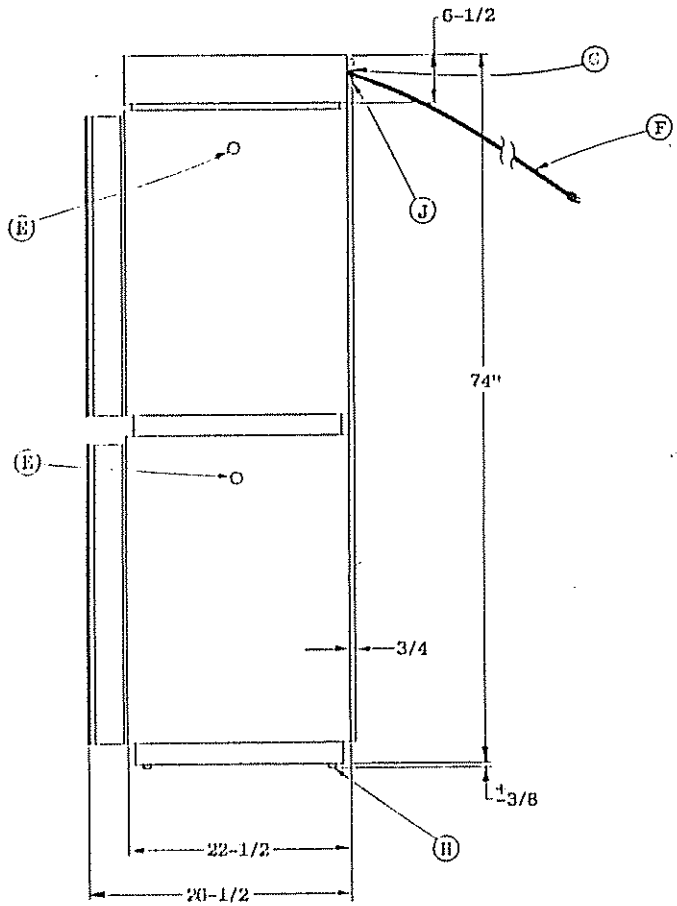
DFTM P S	9/5/86	nuAire, Inc. MINNEAPOLIS, MINNESOTA
CHKD		SPEC. DRAWING MODEL NU-1600 SIDE BY SIDE CONSTANT FLOW CO_2 INCUBATOR
APPR		DRAWING NUMBER BCD-02174
MATERIAL		SCALE ~ SHEET 1 OF 1
APPLICABLE SERIES		

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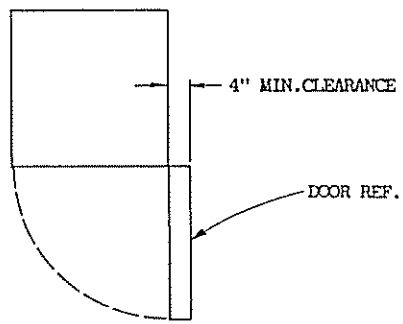
REV	ECO	DESCRIPTION	DATE	INL
A	——	REDRAW CONTROL PANEL	1/87	TH
B	——	REMOVED LETTER K	9/87	TH



FRONT VIEW



RIGHT SIDE VIEW



TOP VIEW

A – FRONT PANEL CONTROL & INDICATORS
B – WATER SIPHON PORT
C – WATER FILL ACCESS PORT (BEHIND DOOR)
D – FRONT REMOVABLE PLUG IN/OUT CONTROL PANEL
E – ELECTRICAL ACCESS PORT
F – 8' POWER CORD
G – ACCESORY OUTLET 1 EACH UNIT (FOR AIR PUMP)
H – WIRE COVER
J – LEG LEVELER ±3/8 ADJUSTMENT

TEMP. RANGE:5°C ABOVE AMBIENT TO 55 C°

TEMP. UNIFORMITY: ±0.2 AT 37 C°

TEMP. SENSITIVITY: ±0.1 C°

CO_2 PURGE: 0 TO 20 PERCENT

CO_2 ACCURACY ±0.2%

CO_2 PURGE: 0 TO 60 SECONDS

ELECTRICAL 115 VAC, 1100 W, 60 HZ

DIMENSIONS INTERIOR (EACH CHAMBER)
25-1/2"H x 21-1/2"W x 21" D

DIMENSIONS EXTERIOR:
74" H x 25" W x 27" D

SHELF: 19-1/4"x 19-1/4"

DFTM P S	9/5/86	nuAire, inc. MINNEAPOLIS, MINNESOTA
CHKD		
APPR		SPEC. DRAWING NU-1700 OVER/UNDER CONSTANT FLOW CO_2 INCUBATOR
MATERIAL		DRAWING NUMBER BCD-02176
APPLICABLE SERIES		SCALE ~ SHEET 1 OF 1

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4.0 TEST PERFORMANCE AND 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's performance to the specifications. In all instances where product quality cannot be easily assessed on the end item, (i.e. water jacket leak tightness), 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 door opens/closes freely without binding of the hinges. The vinyl gasket seals the inner glass door tightly. The glass door is free of scratches.

4.2 Electrical Tests

4.2.1 Electrical Leakage Test AC electrical leakage shall not exceed 500 microamperes using a Simpson Model 229 or equivalent testor.

4.2.2 Dielectric Voltage - Withstand 1250 volts is applied between dead metal parts and the hot/neutral power source lead with no electrical breakdown using a Slaughter Model 101-2.5.

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 0.15 ohms.

4.3 Functional Tests

The following tests are performed on every unit:

4.3.1 Temperature Controller Both the main temperature controller and the over-temperature are cycled to insure proper operation of control circuitry and alarms.

4.3.2 Flowmeters Flowmeters are checked to insure that the internal regulator functions properly, no foreign matter is lodged in the orifice and the meter movement provides a stable reading.

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4.3.3 Purge Timer The purge timer is checked to insure that it provides a minimum of 159 cm/sec of CO_2 flow which corresponds to a 15-second interval of a 5 percent CO_2/air mixture.

4.3.4 Temperature Stabilization/Variation All units of every production lot are subject to a 24-hour temperature stabilization/variation test to insure that no production/manufacturing processes have been introduced into the product to cause a loss of performace. This test requires that the incubator be checked under actual operating conditions. The following are checked:

(1) Temperature overshoot shall not exceed $0.05^{\circ}C$

(2) Internal temperature variance shall not exceed at $37^{\circ}C$, $\pm$ $0.2^{\circ}C$

(3) The over-temperature control properly activates.

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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 12 months after the date of sale if proved 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.

NuAire, Inc. warrants the water jacket and will repair or replace FOB its factory or furnish without charge FOB its factory the water jacket within five years after the date of sale, if proved to the satisfaction of the company to have been defective at the time it was sold.

This warranty shall not apply to any NuAire product or part thereof which has been subject to misuse, abuse, filling the water jacket improperly, using additives in water jacket, 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.

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6.0 SHIPMENTS

NuAire takes every reasonable precaution to assure that your Incubator arrives without damage. Motor carriers are carefully selected and shipping cartons have been specially designed to insure your purchase. However, damage can occur in any shipment and the following outlines the 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 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.

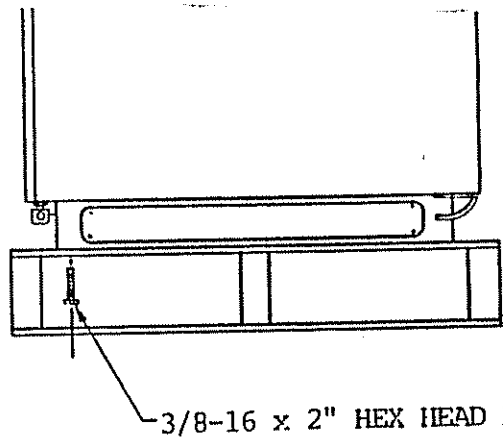
6.1.3 If concealed damage is found, it is absolutely necessary to NOTIFY THE FREIGHT AGENT AT ONCE, and request an inspection. Without this inspection, the transportation company may not accept a claim for loss or damage.

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.

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7.0 INSTALLATION

The autoflow is fastened to a base skid and it is usually the best procedure to leave the skid attached until the autoflow 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 autoflow carefully. Inspect both the exterior and the interior of the autoflow for any transit damage before discarding the shipping crate, [see Section 6.1.3].

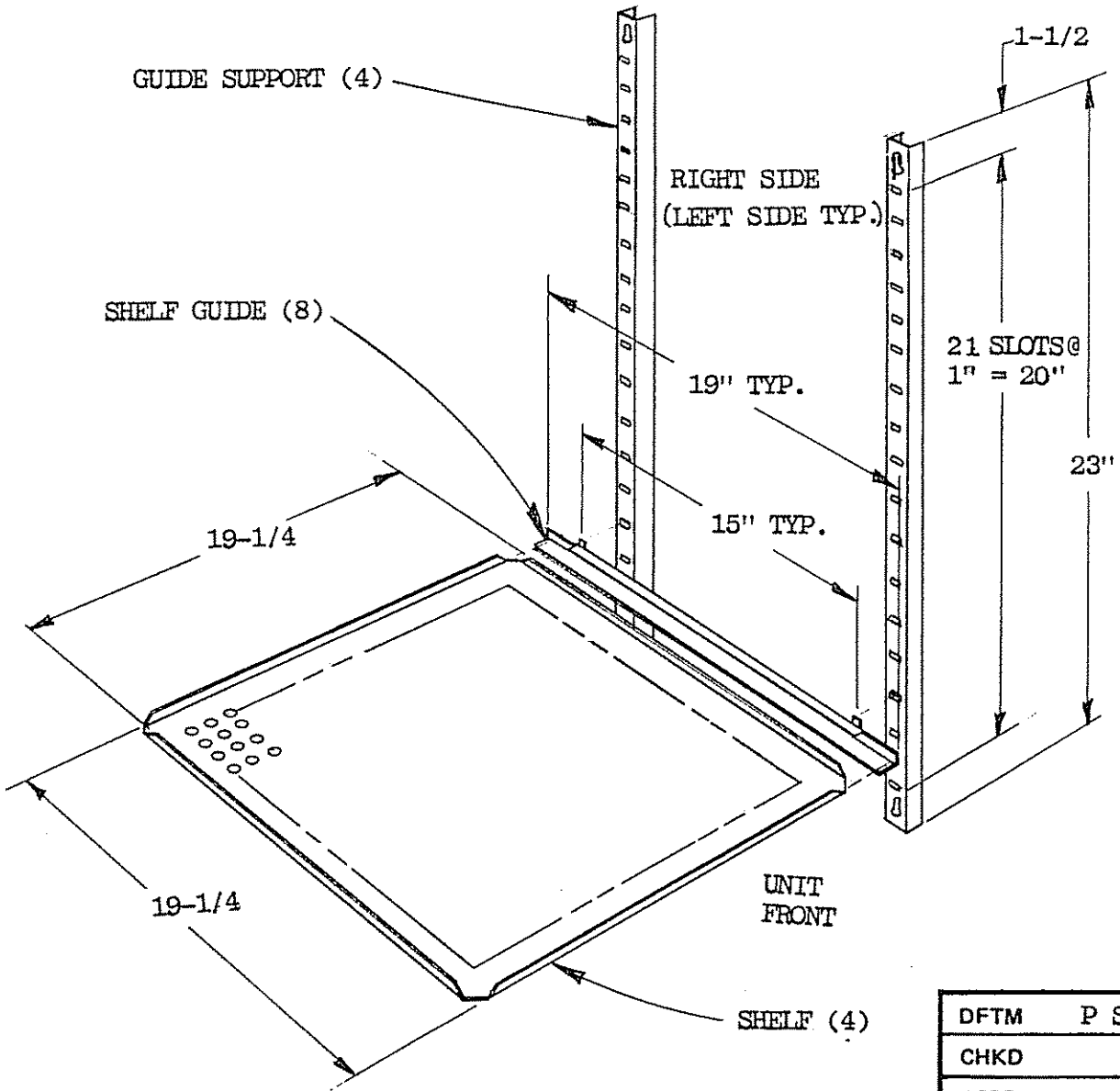


7.1 Location In locating the autoflow, consider all possible conditions that might affect its performance as well as laboratory procedures for its intended purpose. Do not locate near heating or cooling ducts, or next to equipment that generates heat (steam radiators, stoves, ovens, autoclaves, etc.). Avoid direct sun rays and rapidly moving air currents. The autoflow needs even heat loss on all surfaces in order to maintain an internal temperature variation of less than 0.2 degrees C. As a result, a minimum of 2 inches must be allowed between the rear and sides of the autoflow and any walls, partitions or obstructions to facilitate adequate convection of air around the autoflow's water jacket. For maintenance/service purposes the top cover containing the electronics should remain accessible. Four (4) screws (two on each side) hold the cover to the incubator. The cover must be lifted straight up for removal, [see Drawing BCD-02316].

7.2 Leveling The autoflow should be leveled prior to filling with water, and should rest firmly on the bench or floor. Uneven water levels may cause false ADD WATER indications on the front panel as well as to affect the water circulation paths within the water jacket, which could cause condensation on the walls of the chamber. Leveling feet are provided for this purpose and installed into the base of the incubator, using the same holes the base skid was fastened to. Turning the adjustable leveling feet counterclockwise raises the autoflow. The leveling feet height should be approximately 1/4 inch below the autoflow base.

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REV	ECO	DESCRIPTION	DATE	INL



FOUR SQUARE STAINLESS STEEL SHELVES WITH REMOVABLE INTERIOR SHELF ASSEMBLY GREATLY SIMPLIFIES DECONTAMINATION PROCEDURES.

DFTM	P S	9/8/86
CHKD		
APPR		
MATERIAL		
APPLICABLE SERIES		

nuAire, inc.
MINNEAPOLIS, MINNESOTA

SHELF INSTALLATION

DRAWING NUMBER ACD -02177

SCALE ~ | SHEET 1 OF 1

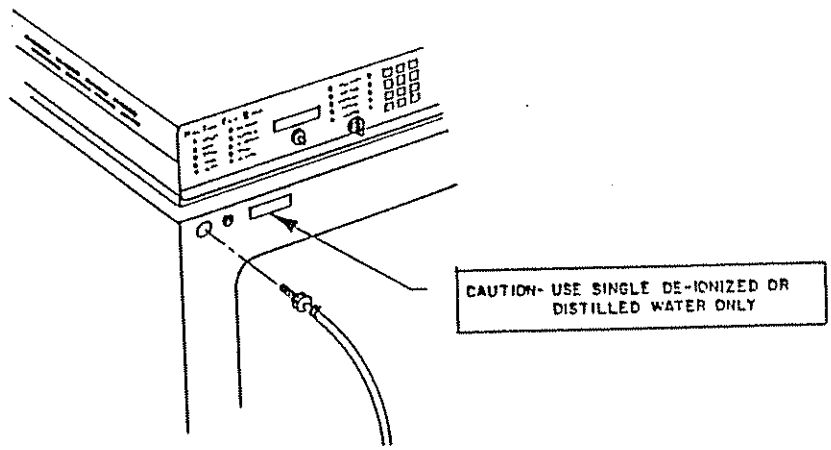
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7.3 Decontamination and Shelf Installation Before installation of the shelves, NuAire recommends to decontaminate all surfaces within the interior chamber, glass door and outer door with gasket. They can be wiped down with a disinfectant of 70 percent alcohol, 2 percent alkaline gluaraldehyde or similar noncorrosive antimicrobial agent. Provided with each autoflow are four shelves. The shelves are easily installed per Drawing ACD-02177 by attaching the guide supports to the stainless steel pins in the interior of the chamber. Additional shelves and shelf guides are available.

7.4 Electrical The electrical supply circuit to the incubator must conform to all national and local electrical codes. Consult the incubator's serial-data plate for voltage, cycle, phase and ampere requirements before making connection. Plug the eight-foot service cord securely into grounded outlet. VOLTAGE SHOULD NOT VARY MORE THAN 5% FROM SERIAL PLATE RATINGS. A separate branch circuit is recommended to prevent possible loss of product due to overloading or failure of other equipment on the same circuit.

7.5 Precaution for Incubator Filling To prepare the incubator for filling, turn on main power switch located on backpanel and set mode switch to PROGRAM. The digital indicator should light up as well as the ADD WATER light.

7.6 Filling and Draining the Incubator The fill port plug is located on the front top left side behind the exterior door. Remove the plug and install the 1/4" NPT X 3.8" tube adaptor. Place the 3/8" tubing over the adaptor and connect the other end to either a funnel or serrated tap. USE SINGLE DISTILLED OR DEMINERALIZED WATER to fill the water jacket. No purer than 10 megohm water should be used. While the unit is on, fill the water jacket until the ADD WATER light turns off. Add an additional quart of water, remove the tube adaptor and replace the fill port plug.



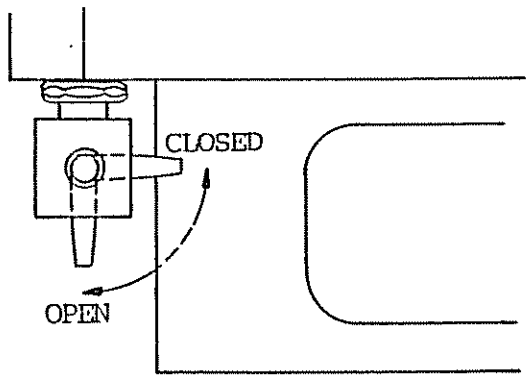
CAUTION
BE SURE TO POSITION AND LEVEL THE INCUBATOR
DO NOT OVERFILL

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The water jacket requires no anti-bacterial agents. The autoflow already incorporates a copper tube producing copper sulfate which eliminates bacterial growth within the water jacket. Absolutely NO chlorinated or halogen materials are to be used in the water jacket.

A safety over-fill port is located next to the fill port plug so if overfill does occur, the water will be relieved through the port.

The water jacket can be drained from the drain plug located on the bottom left side. The drain uses a ball valve to control the drain water. If the valve stem is horizontal the drain is closed, and if it is vertical the drain is open. A safety plug must be removed prior to draining, located on the bottom of the ball valve. It also insures no leakage will occur.



7.7 CO_2 and Air Supply Included with every autoflow are two tubing kits consisting of two six-foot vinyl tubes and two 50 mm polypropylene hydrophobic filters. The filters should be used on both air and CO_2 supply lines. If house air supply is used, it is recommended that an air filter be used to remove contamination from the line to protect the flowmeters.

7.7.1 CO_2 Supply

1. Before the CO_2 supply to the autoflow is turned on, fill the water jacket and set the temperature, [see Section 8].

CAUTION
CO_2 PRESSURE TO THE AUTOFLOW INLET IS RATED FROM 10 TO 20 P.S.I.G.
DO NOT EXCEED 25 P.S.I.G.

2. CO_2 of medical grade is recommended.

3. A two-stage pressure regulator, Linde Part #998343, or equal, is recommended.

4. DO NOT USE a single-stage regulator.

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7.7.2 CO_2 Regulators The regulator's high pressure stage direct from supply cylinder must have a range from zero to 2,000 PSI. This gauge indicates actual tank pressure. The low pressure stage should have a range from 0 to 30 PSI (50 PSI maximum). This gauge will indicate the actual CO_2 pressure into the incubator system. Some single-stage CO_2 pressure regulators have two gauges. USE A TWO-STAGE REGULATOR. All NuAire autoflows use CO_2 in such small quantities that precise metering of CO_2 input pressure is important for maximum performance of the incubator.

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 gasket is in place before making connection.

7.7.3 CO_2 Connection Connect the CO_2 supply from the low-stage of the two-stage regulator, to the 1/8" inlet fitting located at the top rear of the control panel. The filter should be inserted downstream of the low-stage regulator before the 1/8" inlet nozzle to the incubator. Observe proper flow orientation of the filter. The tubing is easily cut with a sharp knife.

7.7.4 CO_2 Adjustment With the regulator OFF (i.e., fully counter-clockwise), open the cylinder valve SLOWLY; usually 1 two (2) turns is sufficient.

NEVER STAND IN FRONT OF OR BEHIND THE REGULATOR WHEN OPENING THE VALVE. ALWAYS STAND TO ONE SIDE.

The cylinder tank pressure should read 700 to 800 PSI, 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 approximately 20 PSIG. 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 Model NU-1555, an Automatic Tank Switch, is purchased, separate installation instructions are provided.

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8.0 AUTOFLOW OPERATION

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

8.1 Sterility The environment provided by the autoflow 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 autoflow, the shelves and shelf brackets should be sterilized. The interior side walls, (top, bottom, door, as well as the gasket) should be wiped clean with a 70% solution of isopropyl alcohol or other disinfectant to remove any contamination. Use mild detergent to clean exterior of autoflow.

8.2 Humidity Humidification of the autoflow is achieved through the process of water evaporation (vapor water pressure) from the stainless steel water pan included with your incubator, placed on the bottom of the autoflow shelf rack. 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 autoflow's chamber.

Use only distilled or mineral-free water in the stainless steel pan. The water should be changed at least once a week, preferably more often. Flooding the bottom of the autoflow IS NOT RECOMMENDED, since it is difficult to change the water weekly and almost necessitates the use of chemicals which are not recommended and may damage the stainless steel. Also it promotes condensation on the autoflow's inner walls because it steals the natural convection heat flow through the inner chamber and condensation points occur.

Humidity recovery will be back to 95% within 15-20 minutes after a 30-second door opening, with a water reservoir area of 361 square inches, (i.e., a NU-1555 full-sized pan).

Active chemicals, such as copper sulfate or other bacteria growth inhibitors should not be used and never placed on the bottom of the chamber. These chemicals change the vapor pressure of water and lower the recovery rate of humidity.

Condensation on the walls, top or bottom of the chamber, indicates an incorrect balance of door heat which should be calibrated to allow the N.I.C.E. main temperature control to heat the chamber, not the door heater.

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8.3 System Introduction The autoflow utilizes a state-of-the-art microprocessor that samples input sensors, analyses the input data, sets control outputs accordingly and displays incubator status on a control panel. Both the microprocessor with its attendant support integrated circuits and the control panel have been integrated into a single easily replaceable printed wiring board (PWB) that provides:

8.3.1 Single chamber control in a single package
8.3.2 Optional automatic CO_2 tank switch
8.3.3 Optional chart recorder output of temperature voltage values
8.3.4 Preset over-temperature control $1^{o}C$ over setpoint
8.3.5 Enhanced information presentation of the following:

* Chamber Temperature (setpoint and actual)
* Door Heater (percentage time on)
* Recovery (purge) Time
* Output and Alarm Status of the following:

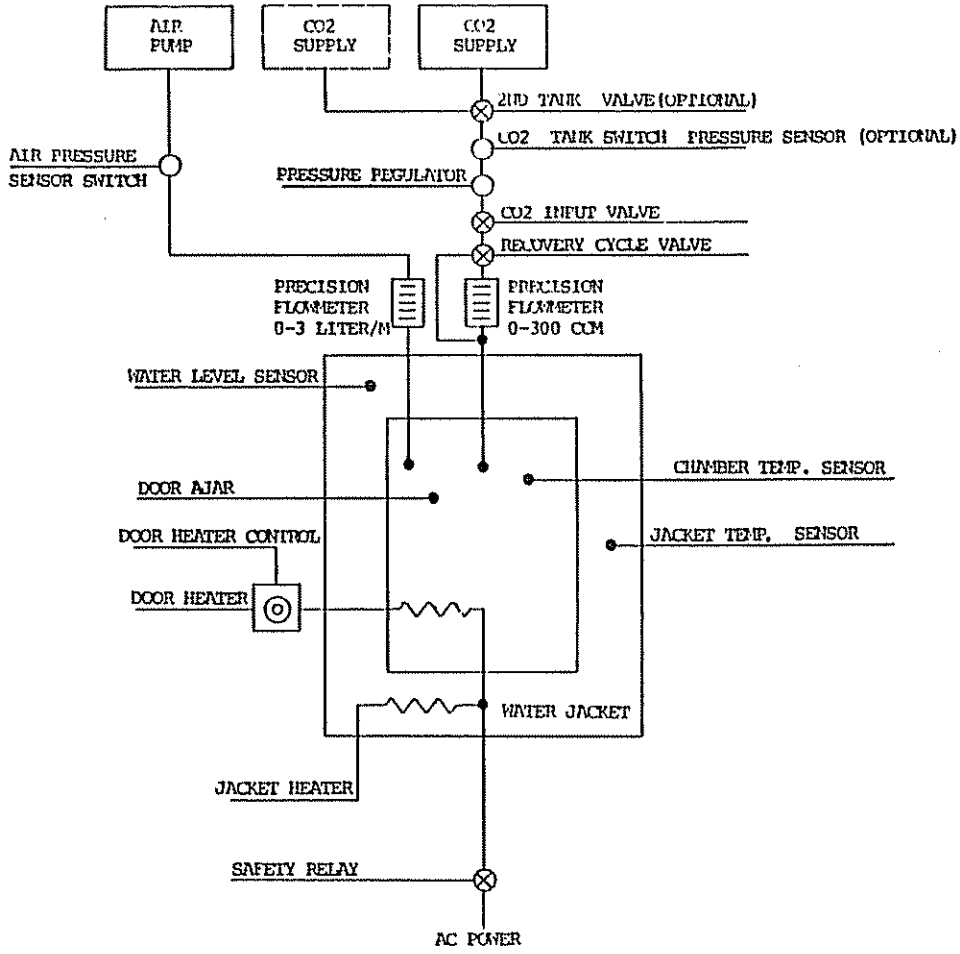
    * Water-Jacket Heater Status
    * Recovery (purge) Cycle
    * CO_2 Control Status
    * Water Jacket Low Water Status
    * Chamber Door Ajar
    * CO_2 Tank Selection
    * Air Supply Status

8.3.6 Simplified operator controls. The control panel is operated using three rocker switches as follows:

* Mode Switch - Run with alarm
  Program- Standby
  Silence - Run without alarm

* Chamber Environment Display - Temperature Display
  Recovery (Purge) Time Display
* Chamber Environment Control - Up
  Down

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AUTOFLOW CONTROL INPUT AND OUTPUTS

8.3.6 Automatic modification of abnormal situations. The red LEDs on the control panel will light to indicate a fault within the system. Such faults include:

* Power failure
* Control Failure (i.e., temperature exceeds setpoint tolerance)
* Air Failure (shuts off CO_2 flow to incubator).

8.3.7 Diagnostic and calibration assists. By adding an electrical jumper wire (supplied) on the PWB, the diagnostic mode is entered, which permits (should only be performed by a qualified technician):

* 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.

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8.4 Front Panel Controls and Indicators

The Digital Control Panel The following describes each function in detail, [see Drawing BCD-02285].

8.4.1 Heat Jacket Indicating Light The heat jacket light indicates when the chamber heater is turned on.

8.4.2 Water Fill Indicating Light The LOW WATER indicator will turn off when the water jacket is full. Always add an additional quart of water to the water jacket to act as a buffer. If the LOW WATER indicator goes on, the water jacket should be filled as soon as possible to avoid uneven heating.

8.4.3 Sample Port The sample port is provided in order to manually measure the percentage of CO_2 with a Fyrite CO_2 indicator, or other suitable instrument.

8.4.4 CO^2 and Air Flow Incubators have Matheson Instrument high accuracy flowmeters with direct dial adjustment of air and CO_2. The CO_2 flowmeter is calibrated for 50 to 300 cubic centimeters per minute and the air flowmeter is calibrated for zero to 3 liters per minute. These are precision metering instruments and should NOT be used as a shut-off valve. Damage to the valve and seat may occur if the adjustment is tightly closed (full clockwise).

8.4.5 Door Ajar Indicating Light The door ajar light indicates when the inner glass door is not closed. The light acts upon a magnetic switch located along the lower right corner of the glass.

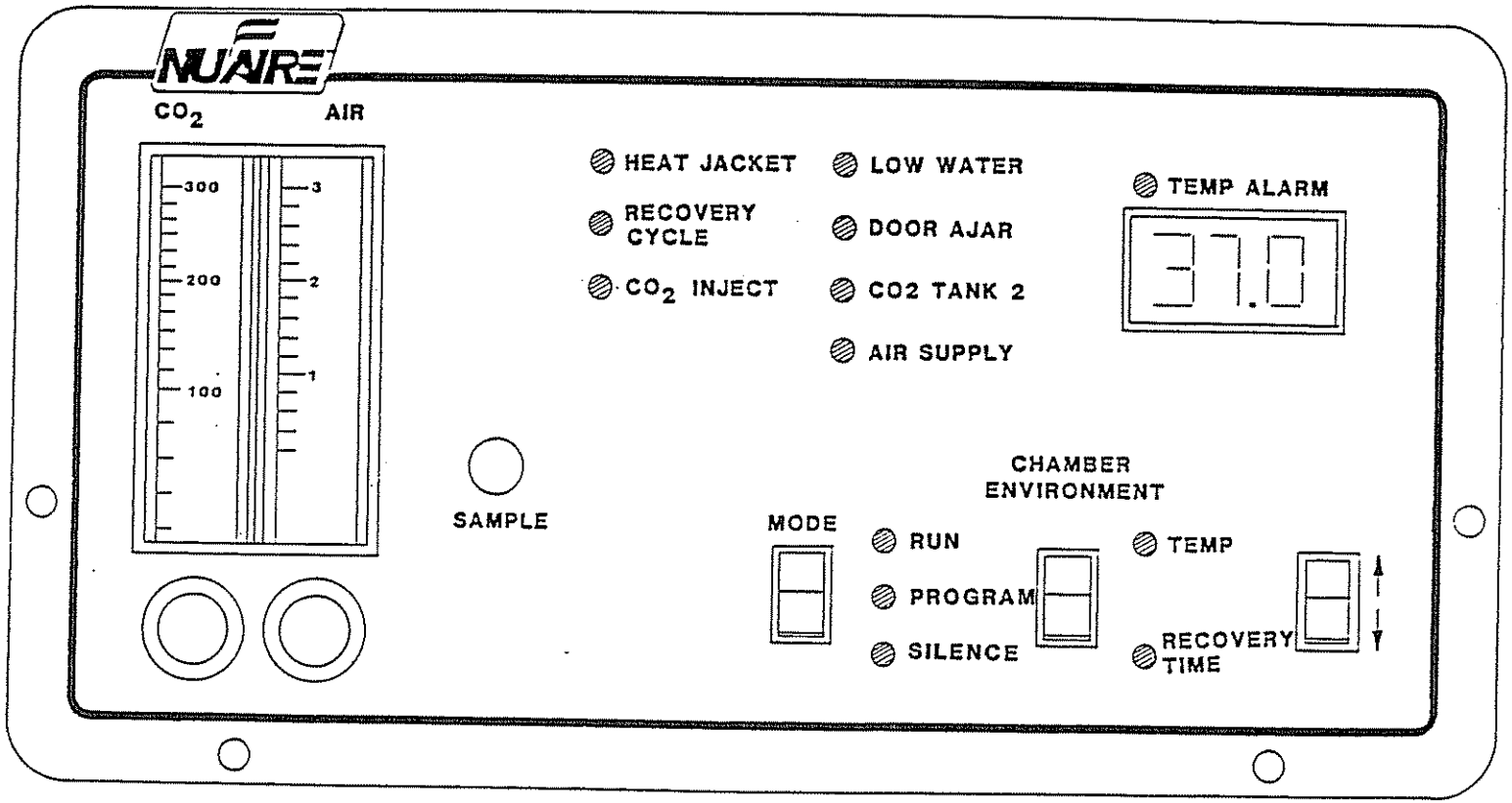
8.4.6 Air Supply Indicating Light The air supply light indicates when there is insufficient air pressure to the incubator. If this occurs, the CO_2 flow will be interrupted to leave the chamber in a dormant stage until sufficient air pressure can be restored. Interrupting the CO_2 flow insures against tissue cell culture degradation.

8.4.7 Mode Switch The mode switch indicates the running mode of the incubator. RUN condition indicates a running mode which sounds an alarm when the temperature exceeds its set point by greater than $1^{\circ}C$. PROGRAM condition indicates that the incubator heater is off and setpoints can be entered into the controller. SILENT condition indicates a running mode which controls the incubator. Visual alarms are still present, but audio alarms for temperature alarm remain silent.

8.4.8 Chamber Environment Switch The chamber environment switch indicates what the digital display is showing. Temperature or recovery time (seconds of purge cycle) are the two setable features.

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REVI	ECO	DESCRIPTION	DATE	INL
A	2457	Revised to Rotameter	4/27/87	RC



DFTM	TH	1/23/87
CHKD		
APPR		
MATERIAL		
APPLICABLE SERIES		

nuAire, inc.
MINNEAPOLIS, MINNESOTA

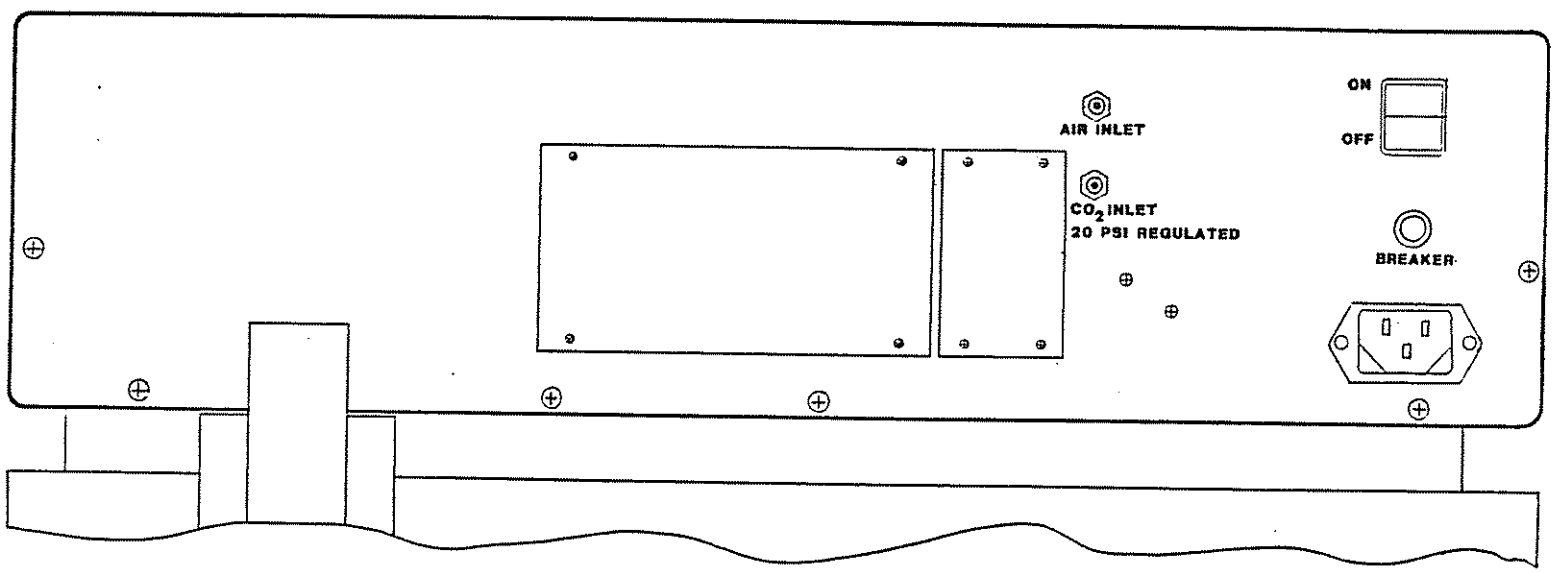
LABEL, NU-1500 INCUBATOR CONSTANT FLOW

DRAWING NUMBER BCD-02295 A

SCALE | SHEET 1OF 1

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REV	ECO	DESCRIPTION	DATE	INL
A	—	REVISED PANEL	1/87	TH
B	—	ELIMINATED DOOR HEATER CONTROL	9/87	TH
C	2611	REVISED PANEL	9/88	RC



DFTM	9-12-86	nuAire, inc. MINNEAPOLIS, MINNESOTA
CHKD		
APPR		REAR PANEL ARRANGEMENT — INCUBATOR
MATERIAL		DRAWING NUMBER BCD-02180 C
APPLICABLE SERIES		SCALE ~ SHEET / OF /

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8.4.9 Adjustment Switch The adjustment switch changes the set-points of both temperature and recovery time in standby mode.

8.4.10 Temp Alarm Indicating Light The temp alarm light indicates when the temperature exceeds 1°C above setpoint and the safety relay interrupts power to the chamber heater.

8.4.11 CO_2 Tank 2 Indicating Light (Option) When purchased as an option, the CO_2 Tank 2 light is part of a built in automatic tank switch. When the CO_2 Tank 2 is lit, a tank switch has occurred and Tank 1 needs to be replaced.

8.5 Rear Panel Arrangement

The rear control panel contains the following functions described in detail, [see Drawing BCD-02180].

8.5.1 Power Cord The power cord is 8 ft. in length, Type "SVT" molded plug, allowing for long life and easy cleanability.

8.5.2 Circuit Breaker All control electronics are protected with an 8 or 15 Amp 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 (black pop-out button will appear), merely depress to reset.

8.5.3 Convenience Outlet The convenience outlet is provided for the optional tank switch or tank alarm if purchased. Any of these accessories can be conveniently plugged in, ready to use at any time.

8.5.4 CO_2 and Air Inlets The CO_2 and air inlets provide a fitting for standard 1/4 inch O.D. Clear Vinyl Tubing. Be sure to use the recommended inlet pressure to insure proper flow rates and consistant CO_2 percentage readings.

8.5.5 Power Switch The main power ON/OFF switch controls all power to the incubator and must be ON before any systems are operational. When the main power switch is on, the control circuitry is energized. The mode switch on the front panel should have an indicating light ON in one of the operational modes. The run or alarm mode permits flow of CO_2, the standby mode does not permit flow of CO_2. In the event of a power failure, this safety feature prevents an excessive CO_2 concentration in the incubator.

8.5.6 Internal Tank Switch (Option) The internal tank switch is an option which is customer installed in the field. The tank switch performs the critical backup function of switching from Tank 1 to Tank 2 and back again when each depleted tank is replaced. The installation is illustrated in Drawing BCD-02313.

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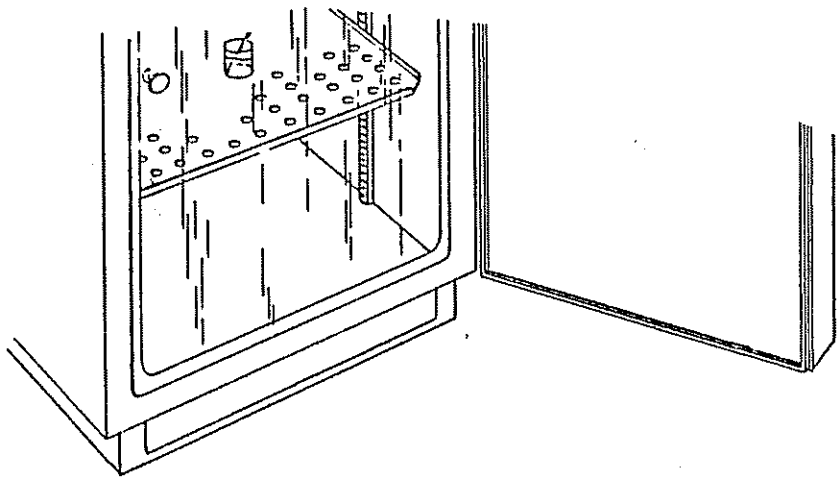
8.5.7 Chart Recorder Terminals The chart recorder terminals allow a recording of an arbitrary voltage which corresponds to temperature. Once initial setpoint has been estabilised, a 10-millivolt change will represent 1^{o} Celsius in change, either positive or negative.

8.6 Temperature Adjustment

8.6.1 Chamber Temperature Calibration

The Autoflow's TEMPERATURE CALIBRATION MUST BE PERFORMED WITHIN $1^{o}C$ OF THE PLANNED OPERATING TEMPERATURE. Normally, $37.0^{o}C$ is the most common setpoint. To initiate the procedure, turn on the autoflow via the power switch on the backpanel. Set mode switch to PROGRAM to check the temperature value parameter for your planned operating temperature and change if necessary. Set mode switch back to RUN and let stabilize for 8 to 12 hours.

In the beginning of this procedure, set a mercury glass thermometer in a glass beaker filled with water resting on a shelf in the middle of the incubator chamber. Do not place the glass beaker on the bottom of the chamber because it will result in a slightly higher temperture due to the heater pan being located just below the chamber bottom.



STEP 1: Set mode switch to SILENCE position.
STEP 2: Set chamber environment switch to TEMP position.
STEP 3: Press adjustment switch either up or down for a minimum of 10 seconds until the display starts to move.
STEP 4: The display will go up or down. Adjust temperature to agree with mercury thermometer in chamber as per above description.
STEP 5: Set mode switch to PROGRAM and back to RUN position to enter the calibrated temperature.

The over-temperature setpoint is preset at $1^{o}C$. above main temperature setpoint. If the main temperature rises to the over-temperature setpoint, a safety relay will interrupt power to

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the chamber heater and remain interrupted until the temperature falls below over-temperature setpoint. At this point, the TEMP ALARM indicating light will be lit and the incubator will control to $1^{o}C$. above main temperature setpoint until service can be performed.

8.6.2 Door Heater Adjustment The door heater is controlled by the main control board on a percentage time basis. The door heater adjustment sets the time the heater is on or off. for example, if the heater is set at 50, the heater will be on 30 seconds in one minute.

STEP 1: Set mode switch to run position.

STEP 2: Set chamber environment switch to temp position.

STEP 3: Press adjustment switch either up or down for a minimum of 10 seconds until the display starts to move.

STEP 4: The display will move up or down. Adjust door heater percentage up for more heat, or down for less. Typically, 50-60 percent is normal.

STEP 5: Set mode switch to PROGRAM and back to RUN position to enter the door heater percentage.

8.7 Autopurge Recovery Time Adjustment The autopurge system is provided to recover the percentage of CO_2 quickly, following a glass door opening. The autopurge recovery time has a range of 0 to 60 seconds and an indicator light to show when the system is energized. Due to the variations in pressure, reducing valves and tube lengths, a precision setting of the autopurge recovery time cannot be predicted assuming all of the CO_2 has escaped the chamber. As a general rule, the autopurge recovery time should be initially set at 15 seconds, which correlates to approximately 5% CO_2.

The autopurge system acts upon the magnetic DOOR AJAR switch located along the lower right corner of the glass door. When the switch is opened (glass door opened and closed), the recovery time cycle will "time out". If the door is opened during a time cycle, the autopurge system will reset for a full cycle. If the glass door opening is less than 10 seconds, the autopurge system will time 1/12 of the set recovery period for every 1 second the door is open or until the full time cycle is met. The autopurge recovery time adjustment is performed identically to the temperature adjustment.

STEP 1: Set mode switch in PROGRAM, set chamber environment switch in RECOVERY TIME.
STEP 2: Then, adjust either up or down, the digital display until the desired recovery time is shown on the display.
STEP 3: To lock the recovery time in, move either the mode or chamber environment switch to another position.

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When initially determining the proper percentage with a Fyrite, allow approximately one minute after the autopurge system has expired to measure the percentage of CO_2 in the chamber. This will permit the CO_2 to diffuse evenly throughout the interior.

8.8 CO_2 Adjustment

The autoflow uses Matheson Instruments flowmeters. The flowmeters combine construction and performance features essential to accurate low flow measurement. Information herein is intended as a guide to efficient use and care; careful compliance should result in long and useful service. Never use the flowmeter as a shut-off valve.

Inspect flowmeters for any damage which may have been incurred during shipment. When air and CO_2 have been hooked up, [see Section 7.6], open valve counterclockwise and check that the float in the flow tube moves freely. OCCASIONALLY, in very low flow rate tubes, foreign particles prevent continuous motion of float, [see Section on meter service].

It is recommended that a maximum of 25 micron (0.3 micron are supplied with incubator) filter be installed at autoflow inlet, [see Section 7.6.3] where dirt from the CO_2 tank or supply can interfere with the operation of the flowmeters.

CAUTION

Avoid sudden pressure surges. The impact of the flow at the top of the flow tube can damage the meter if exposed directly to full line pressure. Shock can be avoided by closing (not tightly) the meter valve befroe startup. The pressure can then be introduced into the meter by slowly opening the valve. Flow readings are read at the center of ball floats. Units of flow (50 to 300 cc on CO_2 meter and 1 liter to 3 liters on air meter) are noted on the side of the tube.

After the chamber temperature has stabilized, turn on the air and CO_2 supply to autoflow. Slowly open the air and CO_2 valves on the flowmeters and set using the table below.

DESIRED CO_2 PERCENTAGE	CO_2 (CCM) SETTING	AIR (LFM) SETTING
5	80	1.6
10	80	.8
20	150	.6

The values given above are approximate, and change for every incubator. These figures represent starting points, but should be verified with a Fyrite CO_2 analyzer.

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Adjustments should be made using the CO_2 flowmeter only, thus reducing one variable of adjustment. The flowmeter ball may drift up and down, which should not affect the CO_2 percentage. This is considered normal operation, but again the Fyrite is the best check for CO_2 percentage.

The Fyrite CO_2 analyzer is the best known tool to measure CO_2 gas concentrations, if used properly. Please take time to read the instruction book supplied with the Fyrite to perform this check properly. Remember, always allow the chamber to stabilize, initially two hours before taking Fyrite readings.

8.9 Air Supply Switch Adjustment

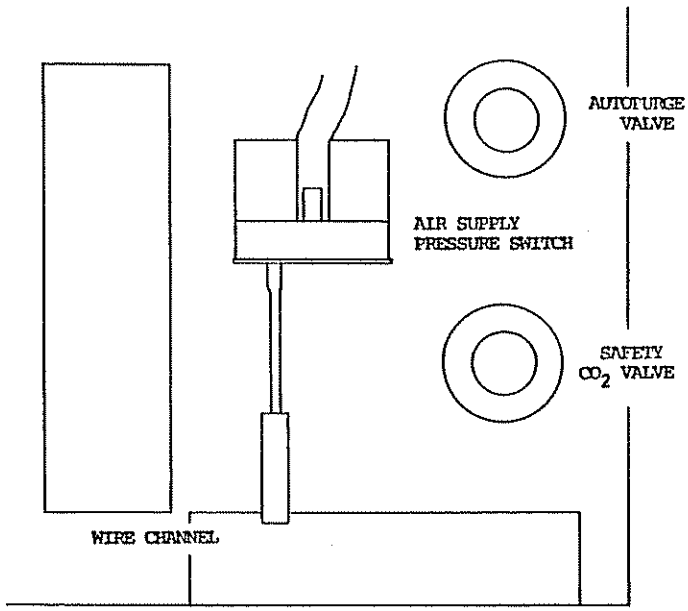
The autoflow monitors the internal air supply with a pressure switch which only allows CO_2 flow when the air supply pressure is above the minimum setpoint on the pressure switch. To access the pressure switch, remove the front control panel, [see BCD-02136].

STEP 1: Turn on air pump and open air flow meter (full open).

STEP 2: Using small blade screwdriver, turn pressure switch screw until air supply red LED turns ON/OFF, with a small adjustment of the screw.

STEP 3: Back off pressure switch screw counterclockwise 1/2 to 3/4 turn, until the air supply red LED is continuously on.

STEP 4: Set air flowmeter to 1.6 lpm, which should turn off air supply red LED. If it doesn't, turn pressure switch clockwise until it does.



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9.0 PREVENTATIVE MAINTENANCE

The Autoflow CO_2 Incubator requires periodic preventative maintenance to insure a reliable controlled atmosphere. Filter change, tubing check and flowmeter cleaning is required periodically just as your car requires a tune-up to maintain peak performance and to avoid breakdowns.

9.1 CO_2 Supply Filter
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.

9.2 Air Inlet Filter
The Air Inlet Filter is located on the backpanel. The purpose of the filter is to cleanse the room air which is drawn into the chamber. The air inlet filter should be replaced every three months or when the filter is visibly discolored (yellow-brown). Note direction of flow (IN is labeled) when replacing filter.

9.3 Tubing Check all tubing connections for tight fit and brittleness. Replace is necessary.

9.4 Autoflow Chamber
The chamber maintenance is only required as to the extent of cleanliness and sterility. The shelves and bracket supports are all removable and autoclavable. The interior should be wiped down with an appropriate disinfectant such as AMPHYL, ROCCAL II, ISOPROPYL or equivalent. DO NOT USE ANY CHLORINATED OR HALOGEN MATERIALS IN THE CHAMBER.

9.5 Autoflow Water-Jacket
The water-jacket requires no anti-bacterial agenets. The Autoflow already incorporates a copper tube producing copper sulfate which eliminates bacterial growth within the water-jacket. DO NOT USE ANY CHLORINATED OR HALOGEN MATERIALS IN THE WATER-JACKET.

9.6 Flowmeter
Preventative maintenance is essential for the proper operation of flowmeteres. It is recommended that this maintenance be performed at least once per year to insure proper operation of flowmeters and ultimately incubator CO_2 percentage.

Disassembly

A. A 5/32" hex wrench fits the recess in seal screw located at one end of the meter. Turn the hex wrench conterclockwise until the compression plug is flush with the inside surface of the end fitting.

B. Remove tube cube from frame by sliding it forward.

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C. Remove tube from cube.

1) Remove center seals from tube cube and inspect for damage. Flowmeter tube can be easily removed from tube cube.

NOTE

Under normal conditions, no further disassembly should be necessary for maintenance.

2) Clean tube assembly (see Cleaning of Parts) and reassemble in tube cube as above, in reverse.

D. If complete disassembly is necessary, continue as follows:

1) Remove the retaining ring from the compression plug jack screw. (Do not overstretch the ring).
2) Push jack screw and compression plug through the end fitting.
3) Complete disassembly of 'O' rings and parts.
4) Remove piping connectors (adaptors).
5) Clean all parts thoroughly.
6) Lubricate left hand thread on jack screw and reassemble.
7) Examine 'O' rings for damage, lubricate and reassemble.
8) Replace connector into seal fitting.
9) Replace compression plug assembly so that the milled flat is toward the piping connector.
10) Replace retaining ring.

NOTE

Occasionally it is necessary to turn jack screw clockwise to lift retaining ring groove sufficiently to insert retaining ring. Spread retaining ring only enough to fit over the jack screw.

11) Replace the tube cube into frame until the rear of the tube cube is flush with the rear surface of end fittings and tab stops.
12) Tighten compression plug.

CAUTION
DO NOT OVER-TIGHTEN

13) Check meter for leaks.

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Cleaning Procedure

General cleanliness conditions are noted here. If oxygen cleaning procedure is required, contact the factory.

A. Tube and Float Cleaning

1) Remove float stops; take care to avoid chipping inside edges of tube.
2) Flush inside of tube with solvent (without wax or inhibitors, i.e. Glycols). Isopropyl alcohol 90% is recommended. All parts should be ultrasonically cleaned if possible.
3) Blow dry and with a lint-free tissue, clean the inside of tube.
4) Clean float in the same manner. Floats should always be handled using tweezers with soft holding surfaces.
5) Clean and replace inlet float stop. Be sure it is firmly in tube. Crimp fins of "Y" section if necessary.

B. Metal Parts Cleaning

Ultrasonic immersion cleaning in trichloroethane 1,1,1 is preferred; however, any industrial solvent which does not attack the metal or influence the process performance is acceptable.

C. 'O' Rings and Seals

1) Wash thoroughly with detergent.
2) Rinse and sponge with Trichlorethane 1,1,1.
3) Lubricate and reapply to metal parts. Halocarbon grease is recommended.

For further assistance, call NuAire Service, 1-800-328-3352 or (612) 553-1270.

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10.0 TROUBLE SHOOTING

In the event the incubator does not operate properly, check the following before calling sales representative or NuAire service.

Is electrical power reaching the incubator?

1. Check for blown or tripped circuit breaker.
2. Is service cord connected to outlet?
3. Always turn autoflow on/off on rear control panel to clear controls.

Always make a visual inspection of incubator and control console when trouble shooting to find loose or disconnected wires or tubing which may be the source of trouble.

Below are some major failure conditions to help isolate the source of the problems and check/corrections which should be performed during the troubleshooting procedure.

10.1 CO_2 Percent/Flowmeter

Fault	Check/Correction
CO_2 percent high	Close CO_2 flowmeter
CO_2 percent low	Open CO_2 flowmeter
Flowmeter ball erratic	Incoming CO_2 cylinder pressure too low/ raise pressure/ flowrate set too low/ raise flowrate for CO_2 & air equally/ dirty flowmeter/ clean.

10.2 Temperature

Fault	Check/Correction
Over-temperature	Location, air vents, direct sunlight/ move chamber/ low water/ heater pan operation/ faulty main control board/ door heater set too high.
Under-temperature	Location, air vents/ main control board/ heater pan operation/ incoming voltage.
Chamber temperature Fluctuation	Door heater set too high/ location/ low water in water jacket/ incoming voltage.

10.3 RH Percent

Fault	Check/Correction
Chamber Wall Condensation	Door heater too high/ adjust/ low water in water jacket.
Inner Glass Door Condensation	Door heater too low/ adjust/ location, door near cool air vent/ large space in outer door gasket/ adjust door.
Low RH Percent	Insufficient water in pan.

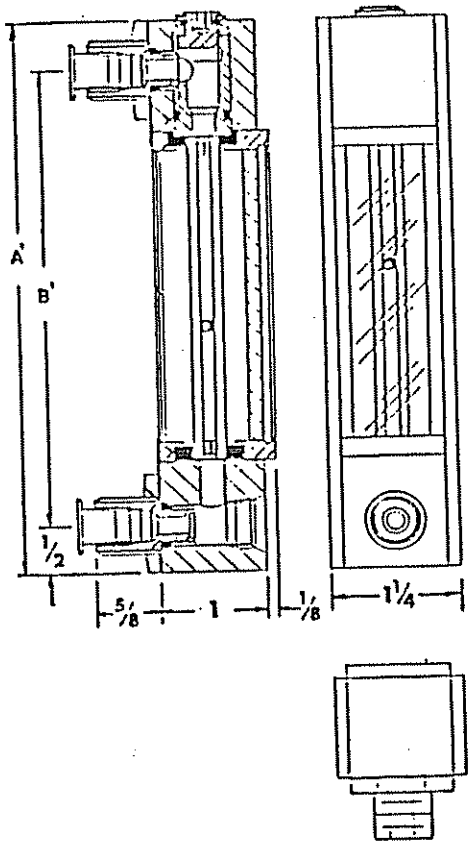
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11.0 REPLACEMENT PARTS LIST

The following is a list of replacement parts. For replacement of electrical parts, refer to the electrical schematic. Please consult NuAire for parts not listed. To order, specify model number, serial number and part number.

PART NUMBER	DESCRIPTION	QUANTITY NU-1500	QUANTITY NU-1600,1700
F-1500-109	CONTROL PANEL MODULE	1	2
A-1500-164	MAIN CONTROL CIRCUIT BOARD	1	2
A-9980463	FLOWMETER	1	2
A-999287-02	CONTROL PANEL CONNECTOR - MALE	1	2
A-999287-01	CONTROL PANEL CONNECTOR - FEMALE	1	2
A-999624	SOLENOID VALVE (2-WAY)	1	2
A-999625	SOLENOID VALVE (3-WAY)	1	2
A-980554	REGULATOR (PRESET @ 5 PSI)	1	2
A-999309	EMI FILTER	1	1
A-999168	CIRCUIT BREAKER (5 AMP)	1	-
A-999224	CIRCUIT BREAKER (10 AMP)	-	1
A-999676	MAIN POWER SWITCH STDP	1	1
A-1500-010	MAGNETIC DOOR GASKET	1	2
A-999338	DOOR PANEL HEATER	1	2
A-1500-051	GLASS DOOR	1	2
F-1500-124	HEATER PAN ASSEMBLY	1	2
A-1500-071	INCUBATOR SHELF	AR	AR
A-1500-065	SHELF BRACKETS	AR	AR
A-980446	LEG LEVELERS	AR	AR
A-999550	ELECTRICAL CORD 3 COND. 8 FT.	1	1
A-980324	1/4" NPT X 3/8 TUBE FITTING (NYLON)	1	2
A-980308	HOSE BARB (1/8 NPT X 3/16 TUBE)	6	6
F-1500-309	MAGNETIC SWITCH ASSY	1	2
A-980464	MAGNET	1	2
A-999599	PRESSURE SWITCH (AIR) 138-INCH	1	2
A-999314-02	FUSE (MAIN CTRL BD, 5 AMP 250 VOLT)	1	2
A-999615	POWER SUPPLY	1	2
A-980385	IN-LINE GAS FILTER, DRY	2	2
A-980758	DRAIN VALVE	1	2
F-1500-112	FLOAT SWITCH ASSEMBLY	1	2
A-999605-03	SENSOR, CHAMBER	1	2
A-999605-03	SENSOR, WATER JACKET	2	2
A-999008	AIR PUMP	1	1

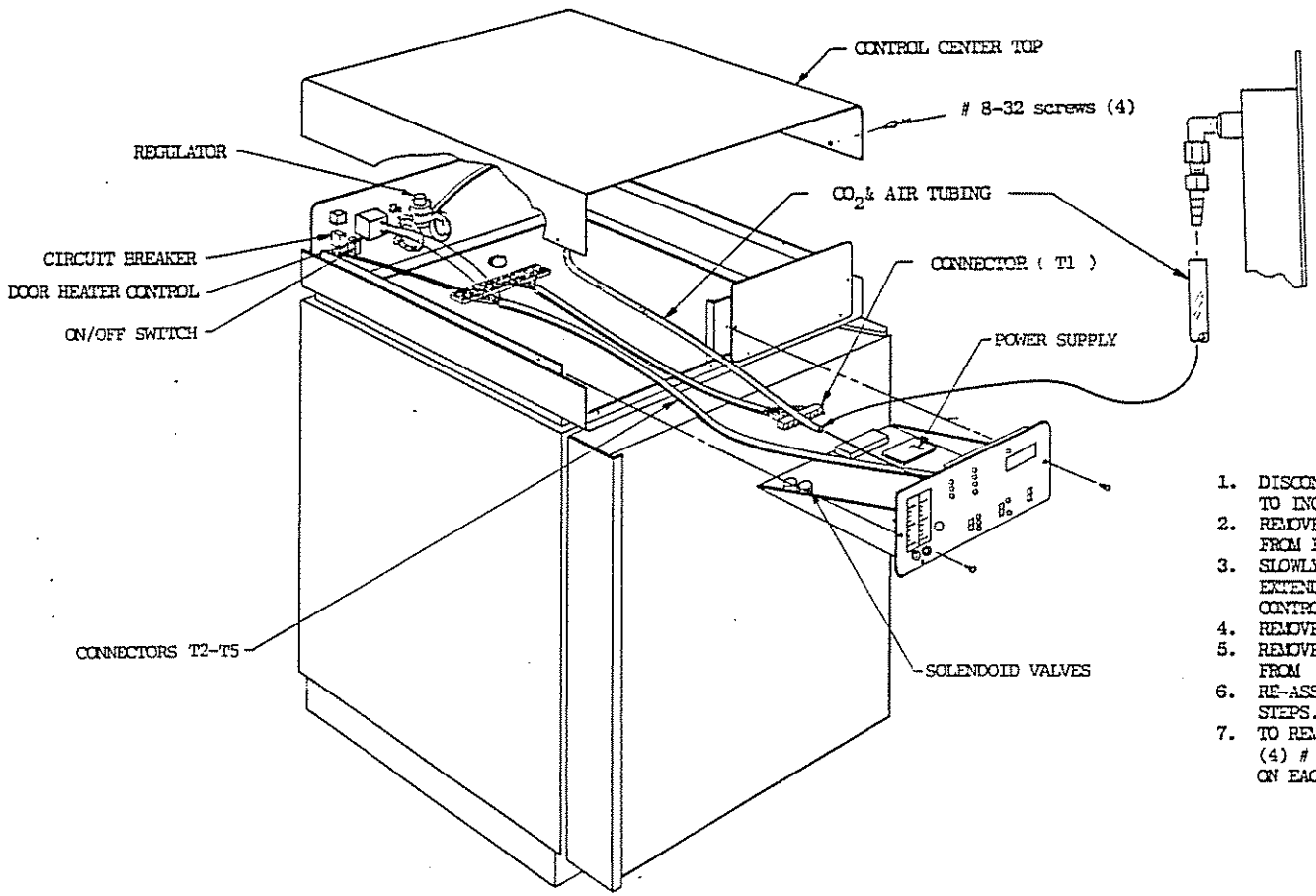
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REV	ECO	DESCRIPTION	DATE / INL
A	2023	REVISED	9/10/84
B		REVISED FACE PLATE	1-29-87 TH



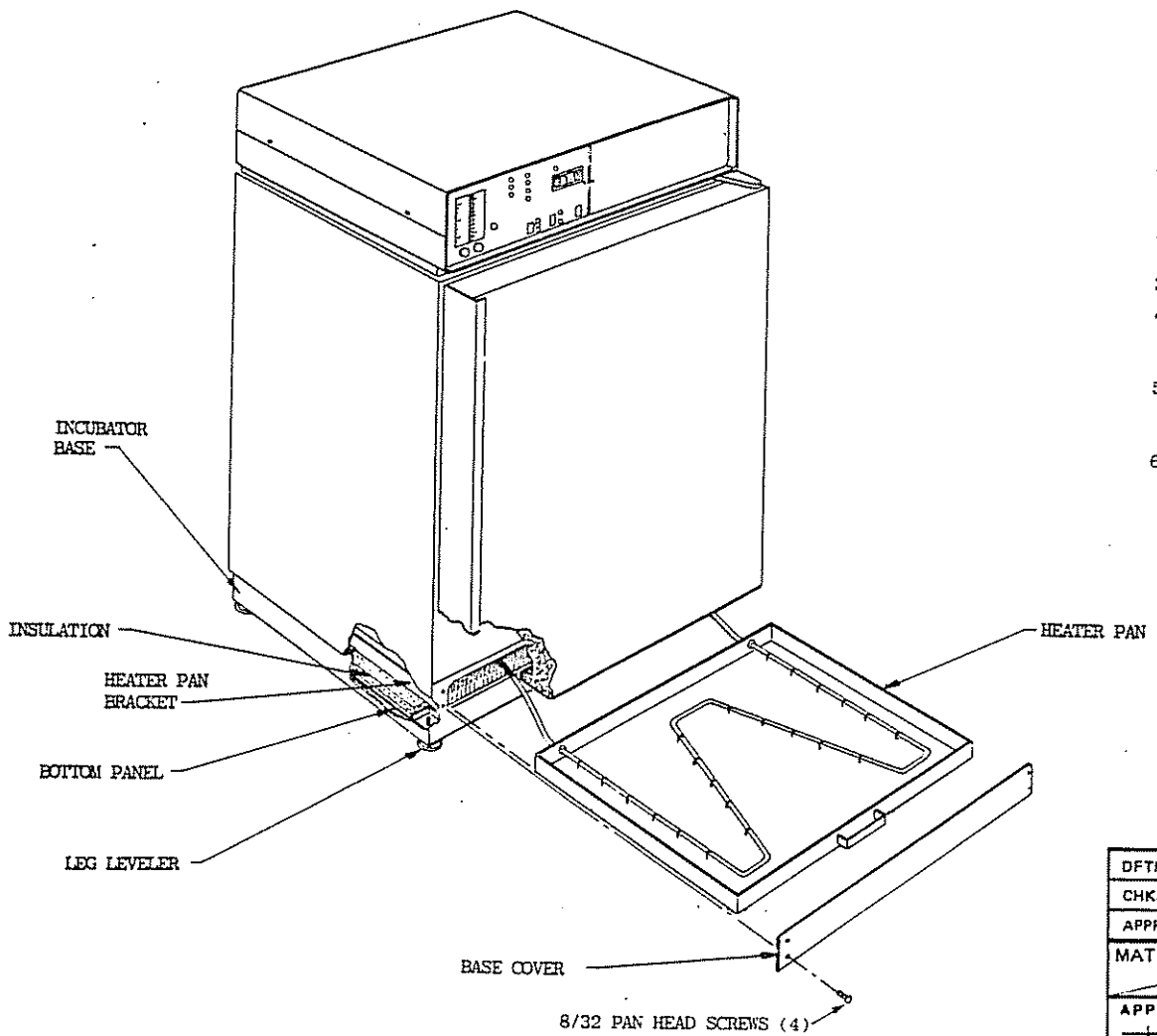
PROCEDURE

1. DISCONNECT ALL ELECTRICAL POWER TO INCUBATOR.
2. REMOVE (4) #8-32 PAN HEAD SCREWS FROM FACE OF CONTROL PANEL.
3. SLOWLY PULL OUT CONTROL PANEL TO EXTEND JUST PAST THE END OF THE CONTROL CENTER.
4. REMOVE CONNECTORS T1 THROUGH T5
5. REMOVE CO_2, AIR AND SAMPLE TUBING FROM FITTINGS AS SHOWN.
6. RE-ASSEMBLE BY REVERSING THE ABOVE STEPS.
7. TO REMOVE CONTROL CENTER TOP, REMOVE (4) # 8-32 PAN HEAD SCREWS , TWO ON EACH SIDE

DFTM P S	7/1/86	nuAire, inc. MINNEAPOLIS, MINNESOTA
CHKD		
APPR		
MATERIAL		INCUBATOR CONTROL PANEL REMOVAL PROCEDURE
APPLICABLE SERIES		DRAWING NUMBER BCD-02136 B
		SCALE ~ SHEET 1 OF 1

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REV	ECO	DESCRIPTION	DATE	INL
A		REVISED CONTROL PANEL	1/87	TH



PROCEDURE

1. DISCONNECT ALL ELECTRICAL POWER.
2. REMOVE (4) 8/32 PAN HEAD SCREWS HOLDING ON BASE COVER.
3. REMOVE BASE COVER.
4. PULL OUT HEATER PAN SLOWLY TO FULL EXTENSION TO ACCESS REAR WIRE TERMINATIONS.
5. REMOVE REAR WIRE TERMINATIONS USING 3/8" END WRENCH TO REMOVE RING CONNECTORS.
6. TO INSTALL NEW HEATER PAN, REVERSE THE ABOVE STEPS.

DFTM	P S	6/30/86
CHKD		
APPR		
MATERIAL		
APPLICABLE SERIES		

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MINNEAPOLIS, MINNESOTA

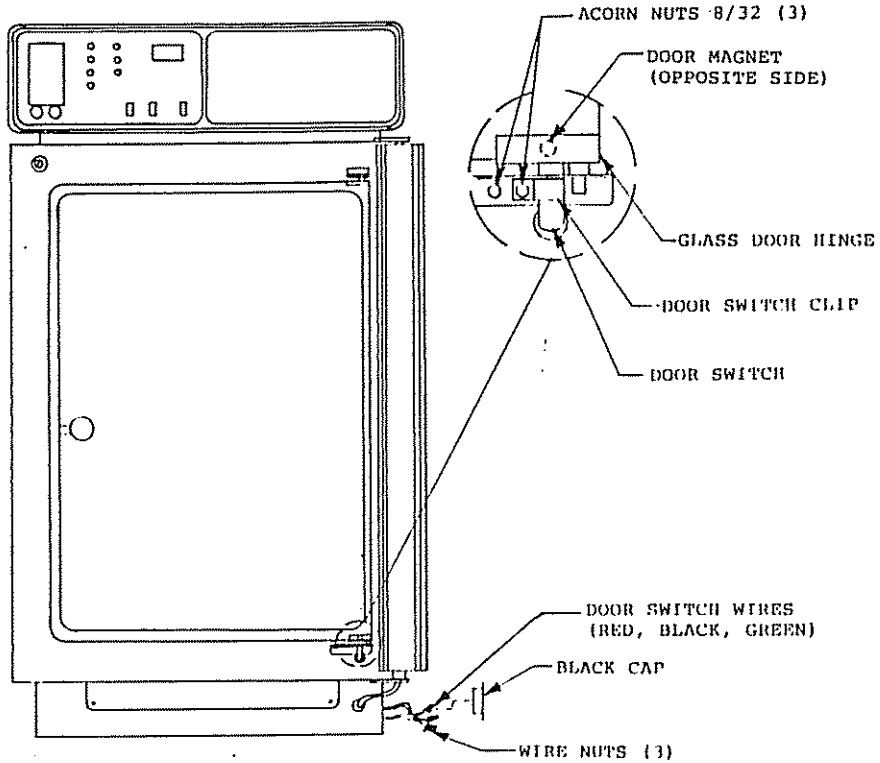
HEATER PAN REMOVAL PROCEDURE

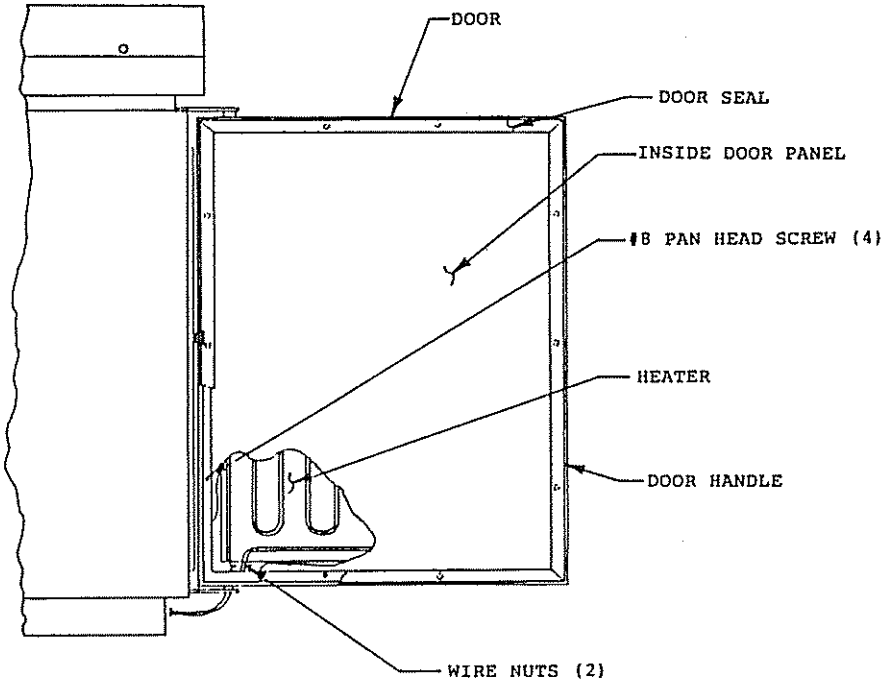
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BCD-02134

SCALE ~ | SHEET 1 OF 1

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REV	ECO	DESCRIPTION	DATE	INL
C	2611	REVISED & REDRAWN	9/88	EC





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. REMOVE BLACK CAP ON SIDE OF BASE COLLAR.
5. PULL OUT DOOR SWITCH WIRES.
6. REMOVE WIRE NUTS (3) AND PULL OUT DOOR SWITCH FROM FRONT OF UNIT.
7. INSTALL NEW DOOR SWITCH FROM FRONT OF UNIT REVERSING THE ABOVE STEPS. (NOTE,CHECK DOOR SWITCH OPERATION SO, THE DOOR SWITCH IS ACTIVATED BY THE MAGNET.)

DOOR HEATER
REPLACEMENT PROCEDURE

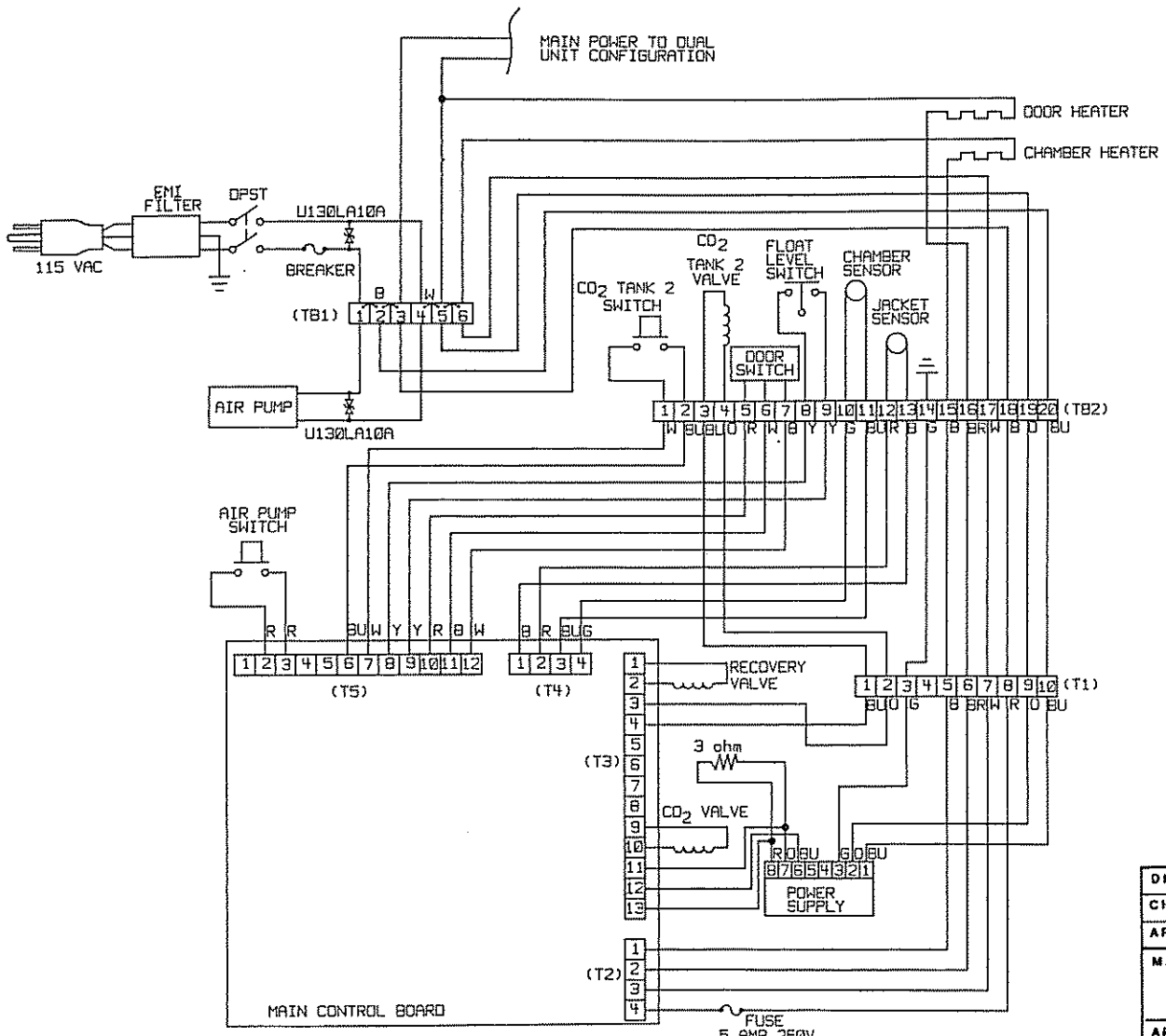
1. DISCONNECT ALL ELECTRICAL POWER.
2. REMOVE (10) #8 PAN HEAD SCREWS LOCATED UNDER THE DOOR SEAL.
3. REMOVE DOOR PANEL W/SEAL MOVING SLOWLY AWAY FROM DOOR EXPOSING WIRES.
4. DISCONNECT DOOR HEATER (WIRE NUTS). NOTE COLOR CODE.
5. REMOVE DOOR HEATER.
   -PULL OFF DOOR HEATER AND REPLACE.
   -NOTE,SILICON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

DFTM R. Cole	9/2/88	nuAire, inc. MINNEAPOLIS, MINNESOTA
CHKD		DOOR HEATER AND SWITCH REPLACEMENT
APPR		DRAWING NUMBER BCD-01545
MATERIAL		SCALE ~ SHEET 1 OF 1
APPLICABLE SERIES		

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REV	ECO	DESCRIPTION	DATE	INL



NOTE: FOR DUAL UNIT CONFIGURATION, THE SCHEMATIC IS DUPLICATED.

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CHKD		
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APPLICABLE SERIES		

NUAIRE
PLYMOUTH, MINNESOTA

TITLE
NU-1000 SERIES ELECTRICAL SCHEMATIC

DRAWING NUMBER 8CD-02299 B

SCALE | SHEET 1 OF 1

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