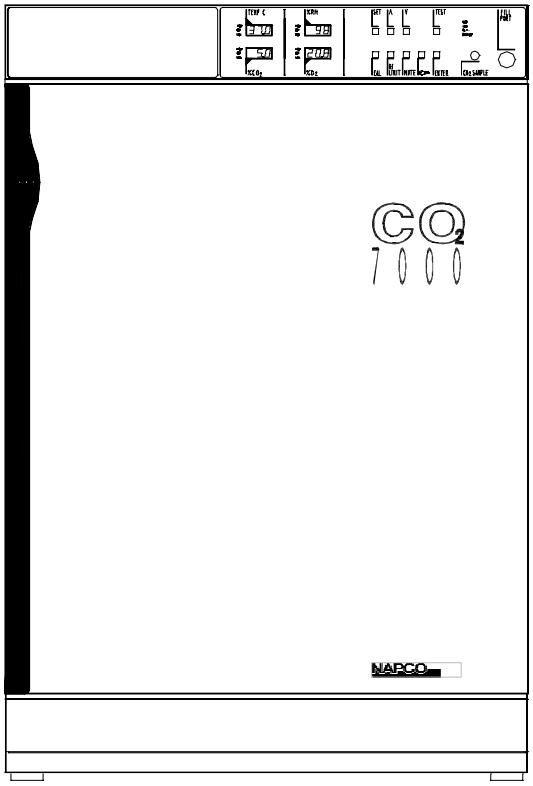
Thermo
ELECTRON CORPORATION

Instruction / Service Manual

NAPCO®

Microprocessor Controlled Automatic Water Jacketed CO_2 Incubators

Series 7101 (3566), 7101F (3568), 7101H (3570), 7101FH (3572), 7101C (3574), and 7101FC (3576)



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Manual P/N 3177868
Rev. E Dated 21SEP05

This symbol marks chapters and sections of this instruction manual which are particularly relevant to safety.

When attached to the unit, this symbol draws attention to the relevant section of the instruction manual.

This symbol indicates hazardous voltages may be present.

NOTICE

THE MATERIAL IN THIS MANUAL IS FOR INFORMATION PURPOSES ONLY. THE CONTENTS AND THE PRODUCT IT DESCRIBES ARE SUBJECT TO CHANGE WITHHOUT NOTICE. THERMO ELECTRON CORPORATION MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THIS MANUAL. IN NO EVENT SHALL THERMO BE LIABLE FOR ANY DAMAGES, DIRECT OR INCIDENTAL, ARISING OUT OF OR RELATED TO THE USE OF THIS MANUAL.

For repair information or replacement parts assistance from the manufacturer, call Technical Services using our toll free telephone number.

888-213-1790
740-373-4763
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REVISION STATUS

INDEX	DATE	AMENDED PAGES	NOTES
A	6/99		Initial release
B	12/99	41-43	Update parts list for new kit #'s
C	6/00	21	Correction to changing the value of "Uar" section
D	5/02	41-46	Update for coved corners
E	9/05	36100103	manual #, manufacture location

Contents

1. 0 Introduction

1.01 Your satisfaction and safety are important to Thermo and a complete understanding of this unit is necessary to attain these objectives.

1.02 As the ultimate user of this apparatus, you have the responsibility to understand its proper function and operational characteristics. This instruction manual should be thoroughly read and all operators given adequate training before attempting to place this unit in service. Awareness of the stated cautions and warnings, and compliance with recommended operating parameters — together with maintenance requirements — are important for safe and satisfactory operation. The unit should be used for its intended application; **alterations or modifications will void the warranty.**

⚠ WARNING

AS A ROUTINE LABORATORY PRECAUTION, ALWAYS WEAR SAFETY GLASSES WHEN WORKING WITH THIS APPARATUS.

1.03 This product is not intended, nor can it be used, as a sterile or patient connected device. In addition, this apparatus is not designed for use in Class I, II, or III locations as defined by the National Electrical Code.

2.0 Unpacking and Damage

2.01 This product was carefully packed and thoroughly inspected before leaving our factory. Save all packing material if apparatus is received damaged.

2.02 Responsibility for safe delivery was assumed by the carrier upon acceptance of the shipment; therefore, claims for loss or damage sustained in transit must be made upon the carrier by the recipient as follows:

Visible Loss or Damage: Note any external evidence of loss or damage on the freight bill or express receipt, and have it signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier's refusing to honor your claim. The form required to file such claim will be supplied by the carrier.

Concealed Loss or Damage: Concealed loss or damage is any loss or damage which does not become apparent until the merchandise has been unpacked and inspected. Should either occur, make a written request for inspection by carrier's agent within 15 days of the delivery date; then file a claim with the carrier.

2.03 If you follow the above instructions carefully, Thermo will guarantee our full support of your claim to be compensated for loss or damage in transit.

DO NOT — for any reason — return this unit to Thermo without first obtaining return authorization. In any correspondence with Thermo, please supply the nameplate data, including catalog number and serial number.

3.0 General Information

3.01 NAPCO® 7001 series water jacketed, microprocessor controlled CO_2 Incubators are ideal for applications requiring precise and uniform control of temperature, CO_2 , O_2 and R.H. Control. They provide a controlled environment for the growth of cultures common in virology, physiology and microbiology. These instructions are applicable to all models listed in Table 3.1.

3.06 Your incubator is equipped with an RS232 communications port which allows remote monitoring and control of the incubator.

3.07 Your incubator is supplied with five shelves per chamber and can hold a maximum of ten shelves per chamber. The entire stainless steel shelf system can be assembled and disassembled without the use of tools for ease of cleaning.

TABLE 3.1	Model 7001				Model 7001H				Model 7001C			
	Single Chamber		Dual Chamber		Single Chamber		Dual Chamber		Single Chamber		Dual Chamber	
Parameters Displayed:	Temperature CO2 Oxygen				Temperature CO2 Oxygen RH				Temperature CO2 Oxygen RH			
Parameters Controlled:	Temperature CO2 Oxygen				Temperature CO2 Oxygen				Temperature CO2 Oxygen RH			
Model Number 115VAC	TC Sensor 51200079	IR Sensor 51200080	TC Sensor 51200081	IR Sensor 51200082	TC Sensor 51200083	IR Sensor 51200084	TC Sensor 51200085	IR Sensor 51200086	TC Sensor 51200087	IR Sensor 51200088	TC Sensor 51200089	IR Sensor 51200090

"R" suffix added to Model Number denotes right-hinged door

3.02 The solid state digital control panel houses all functions necessary to operate the incubator. The push button switches and individual LED displays allow the operator to adjust temperature, CO_2, O_2, optional R.H. control and calibration via a single set of controls. No adjusting of trim pots is required for operation.

3.03 The proportional integral derivative (PID) temperature control allows precise temperature control from 5˚C above ambient to 50˚C. The patented NAPCO® internal air heater located within the chamber provides rapid temperature recovery unparalleled in the industry.

3.04 A digital hi-limit safety switch is provided which can be easily set through the control panel to prevent thermal runaway in the event of temperature control failure.

3.05 Visible and audible Hi and Lo alarms are provided for temperature and CO_2 , O_2, and optional R.H. control. Contacts are also provided on the rear of the unit for connection to a central monitoring system.

3.08 A stainless steel humidity pan is also supplied with the unit to promote high RH levels within the chamber. The humidity pan rests on the chamber floor to promote quick recovery of RH. For even quicker RH recovery levels, the bottom of the unit may be flooded with distilled water.

3.09 NAPCO® Incubators are available in both single chamber and double chamber configurations. The double units contain two independent sets of controls enabling operation of a single chamber even when the other is turned off.

3.10 Single chamber units are easily stackable with other NAPCO® incubators. See Section 5.05

3.11 Maintenance: Add water to water jacket when the red low water light is illuminated. Refer to section 8.06. For cleaning see section 13.0. No other maintenance is required.

3.12 Please call Techniocal Services at 1-888-213-1790 if you have any questions or require further assistance.

4.0 Specifications

"R" suffix added to catalog number denotes right-hinged door

TABLE 4.1	Model 7001		Model 7001H		Model 7001C	
	Single Chamber	**Dual Chamber**	**Single Chamber**	**Dual Chamber**	**Single Chamber**	**Dual Chamber**
Model Number 115VAC	TC Sensor 3166107 / IR Sensor 3166108	TC Sensor 3166109 / IR Sensor 3178612	TC Sensor 3166110 / IR Sensor 3178613	TC Sensor 3166111 / IR Sensor 3166112	TC Sensor 3166113 / IR Sensor 3166114	TC Sensor 3166115 / IR Sensor 3166116
Chamber Volume:	5.4 cu. ft. 153.5 liters	10.8 cu.ft. 307.0 liters	5.4 cu. ft. 153.5 liters	10.8 cu.ft. 307.0 liters	5.4 cu. ft. 153.5 liters	10.8 cu.ft. 307.0 liters
Chamber Dimensions: (usable)	(L x W x H) 17.3 x 17.5 x 25 in. 439 x 445 x 635 mm					
Exterior Dimensions:	(L x W x H) 29 x 24.5 x36 in. 737 x 623 x 914 mm	(L x W x H) 29 x 24.5 x 71.5 in. 737 x 623 x 1816 mm	(L x W x H) 29 x 24.5 x36 in. 737 x 623 x 914 mm	(L x W x H) 29 x 24.5 x 71.5 in. 737 x 623 x 1816 mm	(L x W x H) 29 x 24.5 x36 in. 737 x 623 x 914 mm	(L x W x H) 29 x 24.5 x 71.5 in. 737 x 623 x 1816 mm
Temperature Range: Control: Stability: Uniformity:	Ambient +5.0°C to 50.0°C * 0.1°C ±0.1°C ±0.25°C					
CO_2 Range: Control: Stability: Uniformity:	0 to 20% * 0.1% ±0.1% ±0.25%					
O_2 Range: Control: Stability: Uniformity:	1 to 30% 0.1% ±0.1% ±0.25%					
Humidity Range: Control: Source:	65% TO 98% n/a Pan (supplied)				65% TO 98% 1.0% Integral steam generator	
Shelves:	5 (supplied) 10 (maximum)	10 (supplied) 20 (maximum)	5 (supplied) 10 (maximum)	10 (supplied) 20 (maximum)	5 (supplied) 10 (maximum)	10 (supplied) 20 (maximum)
Shelf Capacity: (maximum)	20 sq. ft. 1.84 sq. meter	40 sq. ft. 3.66 sq. meter	20 sq. ft. 1.84 sq. meter	40 sq. ft. 3.66 sq. meter	20 sq. ft. 1.84 sq. meter	40 sq. ft. 3.66 sq. meter
Electrical Service 100V~ Overvoltage Category II +/-10% 50/60Hz	(all units 50/60 Hz) 550 watts, 4.7 amps	(all units 50/60 Hz) 1100 watts, 9.4 amps	(all units 50/60 Hz) 550 watts, 4.7 amps	(all units 50/60 Hz) 1100 watts, 9.4 amps	(all units 50/60 Hz) 650 watts, 5.5 amps	(all units 50/60 Hz) 1300 watts, 11.1 amps
Maximum BTU Output:	1,876	3,753	1,876	3,753	1,876	3,753
Net Weight:	188 lbs. (85 kg)	376 lbs. (171 kg)	188 lbs. (85 kg)	376 lbs. (171 kg)	188 lbs. (85 kg)	376 lbs. (171 kg)
Shipping Information Dimensions: L x W x H Weight: Volume:	36 x 33 x 43 in. (915 x 838 x 1092 mm) 265 lbs. (120 kg) 29.5 cu. ft. (0.83 cu. meter)	36 x 33 x 78 in. (915 x 838 x 1981 mm) 456 lbs. (207 kg) 53.76 cu. ft. (1.52 cu. meter)	36 x 33 x 43 in. (915 x 838 x 1092 mm) 265 lbs. (120 kg) 29.5 cu. ft. (0.83 cu. meter)	36 x 33 x 78 in. (915 x 838 x 1981 mm) 456 lbs. (207 kg) 53.76 cu. ft. (1.52 cu. meter)	36 x 33 x 43 in. (915 x 838 x 1092 mm) 265 lbs. (120 kg) 29.5 cu. ft. (0.83 cu. meter)	36 x 33 x 78 in. (915 x 838 x 1981 mm) 456 lbs. (207 kg) 53.76 cu. ft. (1.52 cu. meter)

Environmental Conditions

—Indoor Use Only

—Maximum Altitude 2000 meters

—Operating Ambient: 5° to 40°

—Relative Humidity: 80% for temperatures to 31°
50% for temperatures to 40°

—Pollution Degree: 2

5.0 Installation

NOTE

DO NOT SUPPLY POWER OR TURN ON INCUBATOR UNTIL AFTER READING EXPLANATION OF CONTROLS (SECTION 6.0) AND START UP (SECTION 8.0).

5.01 Materials Supplied - A packing list has been included with the incubator. Please check the list to verify that all materials listed have been supplied with the incubator. Should any of these items be missing, contact your dealer representative or NAPCO.

5.02 The most uniform operating conditions and results will be obtained by placing the incubator on a level surface in an area remote from drafts, ventilating outputs, radiators, and other areas where rapidly changing ambient conditions may be present. If at all possible, leave at least two (2) feet of space around the incubator to allow access to power, gas inlets, and remote alarms located on the back of the unit. Position the incubator in proper place prior to filling with water. *Once filled with water, the incubator is extremely heavy and* ***should not be moved****.* There are four (4) adjustable levelling legs on the bottom of the incubator to accommodate any unevenness of the floor or table top. The levelling feet should be adjustable by hand. If not use a 1-3/8" wrench.

5.03 Electrical Connections - Important, please read the following information carefully. Failure to follow instructions may result in personal injury.

⚠ WARNING

FOR PERSONAL SAFETY, AND FOR BEST PERFORMANCE, THIS APPARATUS MUST BE PROPERLY GROUNDED.

1. The power cord provided on this unit is equipped with a three connector (grounding) plug, which mates with a standard grounding wall receptacle to minimize the possibility of electric shock hazard from this apparatus. The user should have the wall receptacle and circuit checked by a qualified electrician to make sure the receptacle is properly grounded.

2. Where a non-grounding wall receptacle is encountered, it is the personal responsibility and obligation of the user to have it replaced with a properly grounded wall receptacle. ***Do not, under any circumstance, cut or remove the third (ground) prong from the power cord. Do not use a two-prong adapter plug.***

5.04 Determine the total amount of current being used by other apparatus connected to the circuit that will be used for this apparatus. It is critical that the added current demand (see nameplate) of this and other equipment used on the same circuit does not exceed the rating of the fuse or circuit breaker. See Table 4.1 for a list of utility requirements.

CAUTION

BE SURE THAT THE POWER SUPPLY IS OF THE SAME VOLTAGE AS SPECIFIED ON THE NAMEPLATE.

6.0 Explanation of Controls

6.01 Front Panel

Depending on options installed, your incubator will have one of the following control panels installed.

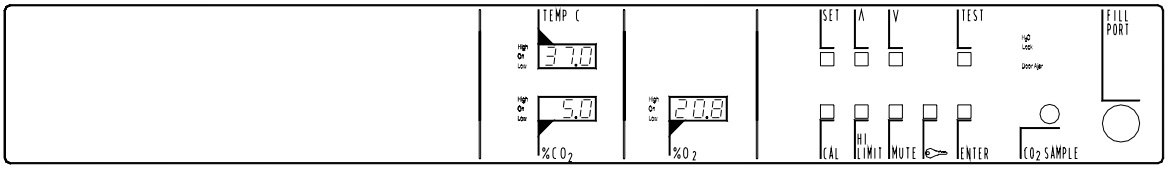


FIG. 6.1 - Basic unit with Temperature, CO_2, and O_2 Control

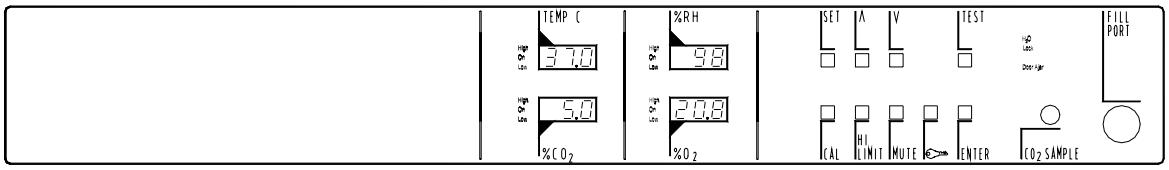
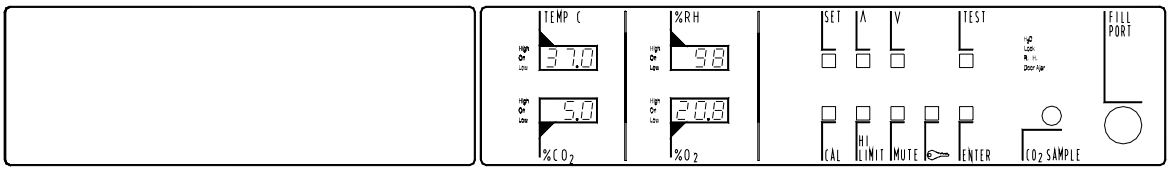


FIG. 6.2 - Same as FIG 6.1, but with optional R.H. Display installed



(R.H. Pump located behind left panel)

FIG. 6.3 - Same as FIG 6.1, but with optional R.H. Control installed

SET

Selects temperature, CO_2 , O_2 or R.H. control setpoint. Use to select R.H. display for "ON" or "OFF" entry.

CAL

Matches displayed value of temperature, CO_2, O_2 or R.H. display to actual measured chamber conditions.

HI LIMIT

Sets chamber high temperature limit.

MUTE

Temporarily silences audible alarm.

Locks SETPOINT and CALIBRATION values to protect against unauthorized or inadvertent changes, and to unlock controls once locked.

^

Increments displayed value. As button is pressed, displayed value scrolls up through values in the range. As button is held pressed, scroll rate accelerates.

V

Decrements displayed value. As button is pressed, displayed value scrolls down through values in the range. As button is held pressed, scroll rate accelerates.

TEST

Initiates a self-diagnostic check of the microprocessor controller. Pressing TEST from within another function will return unit to normal operating mode.

ENTER

Stores the newly entered values.

6.01.2 Front Panel Displays

"Temp. °C": Displays actual chamber temperature during operation. May be used for other display purposes during setup and calibration.

"% CO_2": Displays actual chamber CO_2 during operation. May be used for other display purposes during setup and calibration.

"%R.H.": Displays actual chamber relative humidity during operation.

"% O_2": Displays actual chamber O_2 during operation. May be used for other display purposes during setup and calibration.

6.01.3 Front Panel Fittings and Connectors:

"Fill Port:" Used to fill or to siphon drain the chamber water jacket.

"CO_2 Sample:" Provides a direct connection for sampling the chamber atmosphere for calibration of the CO_2 displayed value.

6.01.4 Front Panel Indicator Lamps

"H_2O" Indicates that water in the water jacket is below normal operating level.

"Lock" Illuminates when control panel settings have been locked.

"R.H." Illuminates when R.H. distilled water supply is empty.

"Door Ajar" Indicates that chamber door is open or has recently been opened. It will go out a short time after the door is closed.

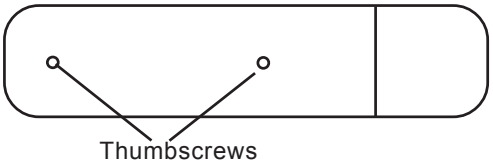
"High" Indicates that the current displayed value is above SETPOINT.

"Low" Indicates that the current displayed value is below SETPOINT.

"On" Indicates that controller is regulating this parameter.

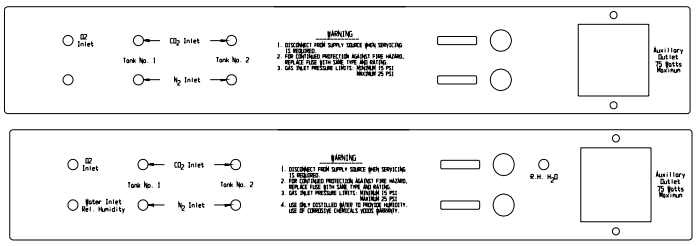
6.01.5 Front Panel: Access to Water Pump and Filter

(on models equipped with R.H. Controlled Unit)



6.02 Rear Panel

Depending on options installed, your incubator will have one of the following rear control panels installed:



"O_2 Inlet:" Provides 1/4" I.D. tubing connectors for connection to O_2 cylinder or supply.

"CO_2/N_2 Inlet" Provides 1/4" I.D. tubing connectors for connection to one or two CO_2/N_2 cylinders (tanks). There is one set of CO_2/N_2 input connectors per incubator.

"Tank No. 1:" The tubing connector for the CO_2/N_2 supply cylinder (or the primary cylinder if two are connected).

"Tank No. 2:" The tubing connector for the secondary CO_2/N_2 supply cylinder when two cylinders are connected.

"Water Inlet Relative Humidity" The tubing connector for supplying water to the steam generator. Used only in Relative Humidity Control models.

Fuses:

"Outlet" This fuse provides protection for the Auxiliary Power Outlet.

"Line:" This fuse provides protection for the primary incubator power line.

Auxiliary Outlet - 75 Watts Maximum: This convenience outlet provides electrical power for connection of low power electrical devices.

"R.H. H_20 Level Switch:" Optional with R.H. Control
This jack is a receptacle for an external level switch from the R.H. water supply optional).

6.03 Left Side Panel:

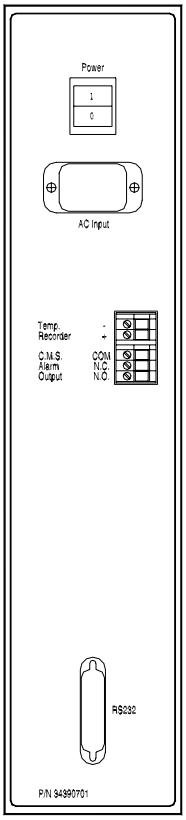
"Power:" Primary electrical power switch. There is one power switch for each chamber.

"AC Input:" IEC standard connector for connection to electrical service line. There is one "AC Input" per incubator.

"Temp Recorder:" Used to connect a recording device (10mv DC/°C) to monitor chamber temperature if desired. "+" and "-" connectors indicate signal polarity. There is one recorder output per chamber.

"CMS Alarm Output:" Used to connect to a central montioring system if desired. Connection is Form "C" contacts. May be wired NC (Normally Closed) or "NO" (Normally Open) with isolated ground ("COM" connection).

"RS232:" This accessory port provides two-way serial communications for printers or other computer devices.



7.0 Cleaning and Decontamination

NOTE

THIS INCUBATOR IS MANUFACTURED IN AN INDUSTRIAL ENVIRONMENT. WHILE EVERY EFFORT IS MADE TO KEEP THIS INCUBATOR AS CLEAN AS POSSIBLE DURING MANUFACTURE AND TRANSIT, IT IS NOT STERILE.

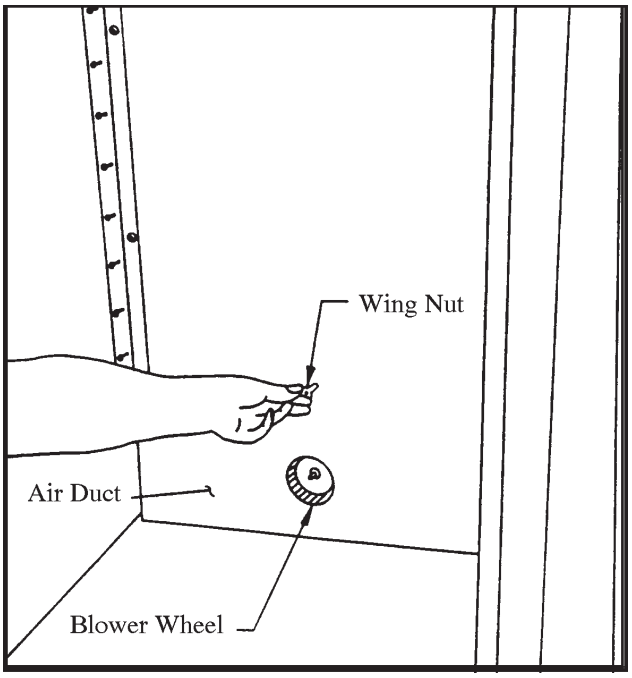
7.01 To ensure optimal growth conditions, we strongly recommend you thoroughly clean and disinfect the incubator prior to use.

7.02 Open the incubator doors and remove any packaging or accessory items.

7.03 Remove the air duct from each chamber

1. Loosen Wing Nut.
2. Carefully tilt top of air duct forward and toward either side.
3. Remove air duct from chamber.

.



7.04 Thoroughly clean and disinfect chamber(s), air duct(s), shelves, supports, shelf slide brackets, shelf slides, humidity pan(s), glass door, gasket, latch and any other objects which will be placed inside the chamber. All stainless steel parts may be autoclaved for thorough sterilization.

7.05 Blower wheel may be removed and cleaned. The blower wheel is fastened to the motor axle by a firm press fit. Some force may be required for removal.

NOTE

HANDLE ALL STERILIZED PARTS CAREFULLY TO REDUCE POSSIBILITY OF INTRODUCING CONTAMINANTS INTO THE INCUBATOR

7.06 Reinstall blower wheel and air duct.

Press the blower wheel firmly onto the axle until the blower wheel rests against the axle stop. Place the plastic spacer on the long stud located on the fan motor plate. Reinstall the air duct and fasten the plastic wing nut. Check for free rotation of the blower wheel by turning the wheel clockwise using a finger. If the blower wheel rubs against the air duct: a) verify that wheel is pushed back against the axle stop, and b) loosen the wing nut slightly.

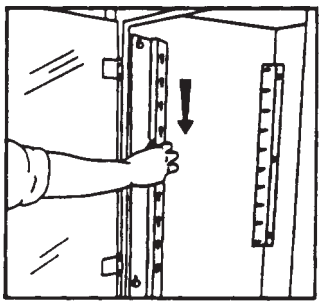
8.0 Setup

8.01 Ensure that the incubator is level. Adjust the 4 corner leveling feet as needed.

8.02 Ensure that the power switch is in the *off* position and that the incubator is plugged into a properly grounded outlet of the correct supply voltage.

8.03 Ensure that the blower wheel and air duct are properly installed (See Section 7.06).

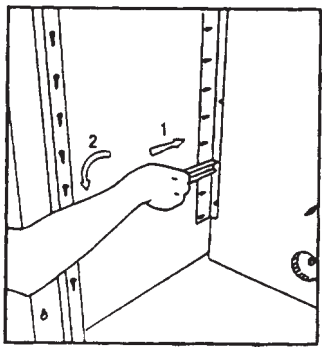
8.04 Install front shelf slide supports by sliding the keyed slots of each support into place over the buttons located near the top and bottom of each side wall of the chamber. Note that the keyed mounting slots should be at the edge of the shelf slide support which faces the front of the chamber.



8.05 Install shelves. The incubator is provided with five (5) shelves per chamber, and will accommodate up to ten (10) shelves per chamber. Each shelf rides on a pair of shelf slides for ease of access to samples. Shelf height may be adjusted by installing the slides into the proper keyways in the shelf slide supports. Additional shelf kits (which include one (1) shelf and one (1) pair of shelf slides) are available through your laboratory equipment dealer or from NAPCO.

Note that the shelf slides are keyed differently at each end — the end which installs into the rear slide support bracket has a key which is parallel to the length of the slide, while the end which installs into the front slide support bracket has a key which is perpendicular to the length of the slide.

1. Refer to the following illustration and insert the shelf slide into a rear keyway of your choice in the rear shelf slide bracket on either side of the chamber. Next insert the shelf slide into the matching front keyway. Attach another slide on the opposite side of the chamber at the same elevation. Repeat for the remaining shelf slides.



2. Slide a shelf into each pair of shelf slides. The shelves are designed so that they may be used with the lip facing either up or down.

8.06 Fill each chamber's water jacket with distilled water.

CAUTION

DO NOT LEAVE INCUBATOR UNATTENDED DURING FILLING. FAILURE TO TURN OFF WATER SUPPLY WHEN THE H_2O LAMP EXTINGUISHES WILL CAUSE EXCESS WATER TO FLOW FROM VENT PORT.

⚠ WARNING

WHEN SETTING UP VERTICALLY STACKED INCUBATORS, THE LOWER CHAMBER WATER JACKET MUST BE FILLED FIRST

CAUTION

TO AVOID BUILDUP OF MINERAL DEPOSITS AND TO PREVENT CORROSION, USE ONLY DISTILLED WATER (50-K OHMS TO 1-M OHMS) IN THE WATER JACKET.

DO NOT USE ULTRA-PURE OR DEIONIZED WATER

1. Turn the power switch on. The digital displays will light, and the "H_2O" low water jacket water level indicator will be illuminated. Verify that all set points are set to "0" or "OFF". See Section 10.03.

2. Unscrew the cap from the water jacket fill port and replace the cap with the threaded hose barb connector provided in the accessories kit.

3. Connect one end of the clear vinyl tubing provided in the accessory kit to the hose barb connector.

4. Add Quaternary Ammonium type germicide as recommended with the sanitizer provided in the accessory kit.

5. Connect the other end of the vinyl tubing to a source of distilled water. A faucet adapter is provided in the accessories kit for your convenience in connecting to an in-house central distilled water system.

CAUTION

WHEN FILLING WATER JACKET BE CAREFUL NOT TO OBSTRUCT THE WATER CHAMBER VENT PORT

6. Fill the water jacket until the "H_2O" indicator lamp on the display panel turns off (approximately 11 gallons (40 Liters)).

9.0 Connecting External Supplies

9.01 Type of gasses required

1. The incubator is equipped for connection to CO_2, N_2, and O_2. N_2 is required for oxygen-depleted atmospheres and O_2 is required for oxygen-enriched atmospheres. The incubator will never require the use of O_2 and N_2 simultaneously.

2. Only medical grade 100% CO_2 , O_2 , and N_2 should be used as gas supply for this incubator. The gas source may be either a cylinder or an in-house central gas supply equipped with shut-off valves and a pressure regulator.

⚠ WARNING

DO NOT USE CO_2 , N_2 , OR O_2 THAT HAS BEEN MIXED WITH OTHER GASSES OR AIR AS THIS WILL CAUSE POOR GAS CONTROL PERFORMANCE OR POSSIBLE HAZARDS.

9.02 Gas shuttle valves

1. This incubator is equipped with internal CO_2 and N_2 shuttle valves for connection of two CO_2 or N_2 cylinders. The shuttle valves will automatically switch from a primary gas cylinder to a secondary cylinder when the primary cylinder empties. The secondary cylinders are optional and do not have to be connected. If the secondary cylinders are not connected, the gas ports will not leak. The O_2 gas port does not have a shuttle valve.

9.03 Gas Pressure Regulation

9.03.1 When using cylinders as the gas supply, a 2-stage pressure regulator is required to reduce the tank pressure to the 15-25 PSI (1.0 - 1.7 BAR) recommended operating pressure. A 2-stage regulator must be used for each cylinder connected.

9.03.2 When using two cylinders for CO_2 or N_2, the primary (Tank 1) cylinder should be set 3-5 PSI (.2 - .4) BAR) higher than the secondary (Tank 2) cylinder. This will allow proper operation of the gas shuttle valve.

9.03.3 When using an in-house central gas supply, either a 1-stage or 2-stage pressure regulator will be required depending on the pressure level of the in-house source. Check with your facilities personnel and with your regulator vendor to ensure that the regulator will provide adequate pressure control at the 15 - 25 PSI (1.0 - 1.7 BAR) recommended operating pressure. The regulator should be installed near the incubator. When using an in-house supply, there is no benefit to connecting to both CO_2 and N_2 inlets. Use only the "Tank 1" connector.

9.04 Gas Connection

The accessory kit supplied with your incubator contains gas filters, hose clamps, and an ample length of tubing for connecting the incubator with gasses. Use the red tubing for CO_2 and N_2. Use the green tubing for O_2.

⚠ WARNING

USE UTMOST CARE WHEN HANDLING OXYGEN. BE SURE ALL FITTINGS ARE SECURE. KEEP AWAY FROM SPARKS OR OPEN FLAME.

A SET OF OXYGEN WARNING LABELS IS SUPPLIED WITH THIS INCUBATOR. IF YOU ARE USING OXYGEN, PLEASE PLACE THEM WHERE THEY ARE READILY VISIBLE.

Connect the gas supply to the incubator as follows:

1. Cut the supply hose to the length required.
2. Slide two hose clamps over the hose and connect one end of the hose to the pressure regulator and the other end to the incubator. Tighten the hose clamps at each connection.

CAUTION

DO NOT OVERTIGHTEN THE ADJUSTABLE HOSE CLAMPS. OVERTIGHTENING MAY DAMAGE THE HOSE.

3. Cut through the gas supply hose approximately 1-2 feet from the incubator gas inlet. Place one hose clamp over both open ends of the gas tubing.

NOTE

OBSERVE GAS FLOW DIRECTION ON THE CO_2 FILTER.

4. Connect a gas filter to the gas supply hose. Tighten the hose clamps to the gas filter.
5. Repeat the above for each gas supply used.

9.05 Relative Humidity Water Supply Connection

The following applies to units with Relative Humidity Control.

To use the relative humidity control features of this incubator, the operator must connect a supply of distilled water.

CAUTION

IT IS IMPERATIVE THAT DISTILLED WATER BE USED. OTHER TYPES OF WATER MAY RESULT IN CONTAMINATION, CORROSION, CLOGGED LINES AND FILTERS, AND EXCESSIVE WEAR AND TEAR ON THE STEAM GENERATOR.

1. Use the R.H. supply hose assembly which came with the incubator.
2. Drop the end with the sinker into a carboy or flask filled with distilled water. Keep the opening of your vessel shielded from debris but open to atmosphere. The level of the water supply must be at or below the level of the pump.

CAUTION

DO NOT USE A PRESSURIZED WATER SUPPLY

3. Attach the luer fitting to the connector on the rear panel.

9.06 R.H. H_2O Level Switch

A jack on the rear panel will accept input from a water level switch. The switch contacts will close when the water level drops low. This will turn on the "R.H." light on the control panel. On a double chamber unit only the upper "R.H." light will come on.

An optional water reservoir supply with level switch is available. See parts list.

10.0 Initial Operation & Calibration

Successful operation of the incubator requires careful attention to the calibration procedures listed in this section. Failure to follow the calibration procedures will result in poor operation of the incubator. This section should be repeated anytime the incubator has been out of service for more than 24 hours or when poor performance is suspected. The calibration procedure requires a minimum stabilization period of 24 hours.

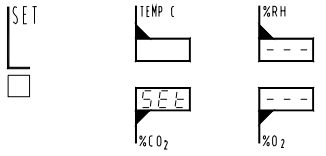
10.01 Fill the humidity pan (provided in the accessories kit) with distilled water one inch deep, and place pan on the floor of the chamber, at least two inches from the air duct.

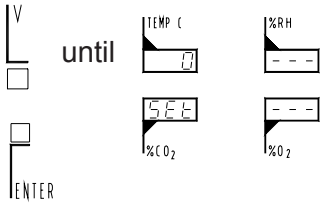
10.02 Place a reference thermometer on the center shelf of each chamber (Note: thermometers are not provided with the incubator). This thermometer will be used to verify temperature calibration. The thermometer should be positioned such that it can be easily read through the incubator's inner glass door.

⚠ WARNING

WHEN USING MERCURY THERMOMETERS, HANDLE WITH THE UTMOST CARE. VERY SMALL AMOUNTS OF MERCURY FROM A BROKEN THERMOMETER MAY CAUSE DAMAGE TO THE CHAMBER BY ELECTROLYSIS. MERCURY ALSO CREATES A TOXIC ENVIRONMENT IN THE CHAMBER, RENDERING THE INCUBATOR USELESS.

10.03 Verify that all setpoints are set to "0".

1. Press 

2. Press 

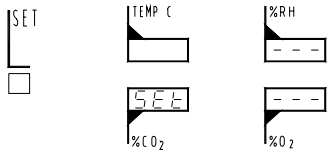
until

3. Press

4. Repeat for other parameters by pressing 

until the appropriate display is active.

10.04 Enter Temperature Setpoint.

1. Press 

2. Use 

until display shows desired setpoint.

3. Press 

4. The incubator will begin heating as indicated by the green "ON" LED indicator to the left of the temperature display.

CAUTION

NEVER OPERATE UNIT WITHOUT WATER IN THE WATER JACKET(S). OPERATION WITHOUT WATER IN THE WATER JACKET MAY RESULT IN POOR PERFORMANCE FROM THE INCUBATOR, OR MAY DAMAGE INCUBATOR COMPONENTS AND WILL VOID THE WARRANTY

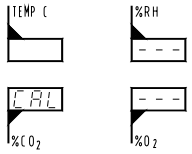
10.05 Calibrate Temperature. Allow the incubator to operate for a minimum of 24 hours before attempting to calibrate temperature. Do not open the glass door during this period.
After the incubator has stabilized at the desired operating temperature (at least 24 hours), open the **exterior door only. Do not open the glass door**. Compare the temperature of the digital display with the reference thermometer inside the chamber. If, these readings match, no temperature calibration is required. Skip to Section 10.06.

If these readings do not match, continue reading this section (10.05).

NOTE

DO NOT OPEN GLASS DOOR DURING THIS PROCEDURE

To calibrate temperature display:

1. Press CAL display will show 

2. Using ∧ ∨ keys, match displayed temperature with reference thermometer reading.

3. Press ENTER

Allow at least one hour for temperature to stabilize after calibration.

After allowing incubator temperature to stabilize, verify that displayed temperature matches the reference thermometer within the chamber. If not, repeat the above steps.

10.06 Calibrate Humidity.

The following applies to units equipped with either R.H. display or R.H. control.

Perform humidity calibration only after temperature calibration has been completed and a humidity pan with distilled water has been in the chamber with the glass door shut for at least 24 hours.

1. Press CAL three times
2. Use ∧ ∨ to set R.H. display to 98%.
3. Press ENTER

The humidity pan should now be removed from the chamber.

10.07 Set Relative Humidity.

The following applies to units equipped with R.H. control.

NOTE

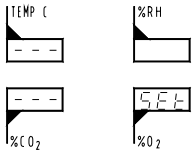
WHEN CONTROLLING OXYGEN PERCENTAGES BELOW AMBIENT CONDITIONS 20.9%, THE NATURAL DESICCATION EFFECT CAUSED BY THE PURGING OF NITROGEN EXTENDS THE LENGTH OF TIME FOR HUMIDITY TO RECOVER AFTER THE INCUBATOR CHAMBER HAS BEEN ACCESSED.

IT HAS BEEN DETERMINED THAT WHEN CONTROLLING OXYGEN PERCENTAGES BELOW AMBIENT THAT THE INSTALLATION OF A HUMIDITY PAN WITH DISTILLED WATER BE PLACED AT THE FLOOR OF THE INCUBATOR CHAMBER TO AID IN THE RECOVERY OF HUMIDITY.

THE HUMIDITY PAN WITH DISTILLED WATER AND IN COMBINATION WITH THE HUMIDITY CONTROL SYSTEM WILL PROVIDE OPTIMUM HUMIDITY RECOVERY AND MINIMIZE SAMPLE DESICCATION.

Set the R.H. control to the desired control setpoint. Allow at least one hour for the R.H. pump to pull the distilled water through the lines to the steam generator.

1. Press SET three times, display will show:



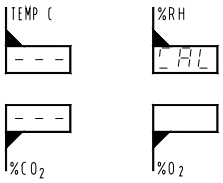
2. Set desired R.H. level.

3. Press ENTER

10.08 Calibrate Oxygen.

Perform oxygen calibration only after temperature and humidity calibration have been completed and both temperature and humidity are stable at the desired setpoints.

1. Press CAL 4* times



2. Using ∧ ∨ Cal O_2 display to 20.9%.

3. Press ENTER

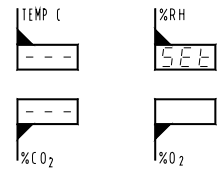
*3 times if unit is equipped with R.H. control or R.H. display.

After the incubator has stabilized at operating O_2 level for at least 30 minutes, measure actual chamber O_2 level using an O_2 gas sampling device such as a Fyrite® O_2 tester.

If display is flashing, the O_2 sensor is nearing the end of its life. The incubator will continue to operate. The flashing can be interrupted through the alarm delay command. Replace O_2 sensor at your earliest convenience.

10.09 Set Oxygen

1. Press SET 4* times



2. Use ∧ ∨ for desired O_2 setpoint. If O_2 control will not be used, press until O_2 display reads "OFF".

3. Press ENTER

*3 times if unit is equipped with R.H. control or R.H. display.

If the displayed O_2 level does not match the measured actual chamber O_2 level, repeat the O_2 calibration matching the display to the actual measured value.

NOTE

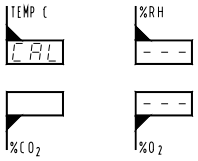
FOR ROUTING MAINTENANCE SEE CALIBRATION CHART AND INSTRUCTIONS ON PAGE 18.

10.10 Calibrate CO_2

Perform CO_2 calibration only after calibrating temperature, humidity, and oxygen. Failure to calibrate Temp., R.H., and O_2 prior to CO_2 will result in poor CO_2 performance.

The temperature, relative humidity, and oxygen must be stable at their desired setpoints prior to calibration of CO_2. Failure to do so will result in poor CO_2 performance.

1. Press CAL twice. Display will show



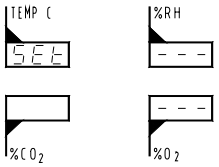
2. Using ∧ ∨ set CO_2 display to 0.0%..

3. Press ENTER

Do not be alarmed if the CO_2 display is negative or far from zero. This is normal upon initial calibration.

10.11 Set CO_2

1. Press SET



2. Use ∧ or ∨ to set desired CO_2 level.

3. Press ENTER

After the incubator has stabilized at operating CO_2 level for at least 30 minutes, measure actual chamber CO_2 using a CO_2 gas sampling device such as a FYRITE® tester.

If the displayed CO_2 level does not match the measured actual chamber CO_2 level, repeat the CO_2 calibration by matching the displayed value to the actual measured value.

10.12 Check each calibration in the following sequence and recalibrate as needed.

1. Temperature
2. Relative Humidity
3. Oxygen
4. CO_2

Calibration is now completed.

⚠ WARNING

USE UTMOST CARE WHEN HANDLING OXYGEN. BE SURE ALL FITTINGS ARE SECURE. KEEP AWAY FROM SPARKS OR OPEN FLAME. A SET OF OXYGEN WARNING LABELS IS SUPPLIED WITH THIS INCUBATOR. IF YOU ARE USING OXYGEN, PLEASE PLACE THEM WHERE THEY ARE READILY VISIBLE.

10.13 External Temperature Safety Backup Control.

The external temperature safety backup adjustment, located on rear panel, should be turned fully clockwise. After the incubator temperature has been stabilized, adjust as per Section 11.03.1, External Temperature Safety Backup Control.

NOTE

THE OXYGEN SENSOR IN THIS INCUBATOR OPERATES ON THE PRINCIPLE OF ELECTROLYTIC VOLTAGE GENERATION (A BATTERY) AND HAS A FINITE LIFE. END OF LIFE OF THE O_2 SENSOR IS THE POINT WHERE ITS OUTPUT VOLTAGE IS 70% OF INITIAL VALUE. AS THIS VALUE IS APPROACHED, THE OXYGEN DISPLAY WILL FLASH INDICATING THAT SENSOR SHOULD BE REPLACED. MONTHLY CALIBRATION AT AMBIENT O_2 (20.9%) IS NECESSARY TO ASSURE RELIABLE PERFORMANCE.

To Calibrate:

1. Turn CO_2 and O_2 setpoints to "off". Allow CO_2 displayed value to go to zero. Allow O_2 displayed value to go to 20.9. With the incubator glass door open this will take about 5 minutes.

2. Close door and allow temperature and R.H. to stabilize. Observe O_2 value.

3. Calibrate O_2 displayed value to read 20.9. See section 10.08.

4. If you are not able to calibrate to 20.9, replace the oxygen sensor.

CALIBRATION RECORD			
DATE	**OBSERVED VALUE FROM STEP 2**	**CALIBRATED VALUE FROM STEP 3**	**CALIBRATED BY**

11.0 Operation

Each controlled function has 3 modes of operation; "OFF", "0" and "Setpoint".

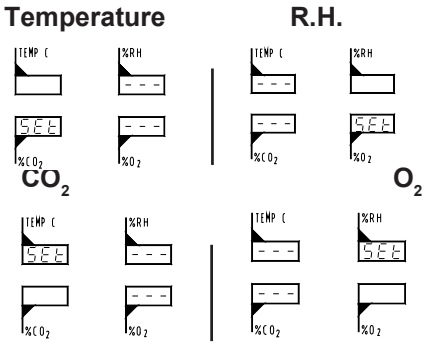
OFF When "OFF" is displayed in the window, the controlled function is inactive.

0 When "0" is displayed in the window, the controlled function only monitors and displays concentrations in the chamber.

Setpoint When a setpoint is entered, the unit will control to the entered value.

11.01 Changing Setpoints.

1. Press SET until the desired setpoint window is active. The word SET will appear above or below the active window.



2. Press ∧ ∨ to set desired setpoint.
3. Press ENTER
4. Press TEST at any time to return to normal operating mode.

11.02 Calibration

NOTE

TO ENSURE PROPER OPERATION OF THE INCUBATOR, CALIBRATION MUST BE COMPLETED PER SECTION 10 IN THE FOLLOWING SEQUENCE:

1. Temperature
2. Relative Humidity (if option is installed)
3. O_2
4. CO_2

FAILURE TO DO SO MAY RESULT IN POOR INCUBATOR CONTROL

11.03 Temperature Hi-Limit Safety

1. Press HI LIMIT
2. Use ∧ ∨ until desired Hi-Limit safety is displayed.
3. Press ENTER

The temperature Hi-Limit safety has a range from 26°C to 57°C. The temperature Hi-Limit safety can not be set nearer than 0.5°C above temperature setpoint.

When the temperature setpoint is changed upward or downward, the Hi-limit safety will automatically change a like amount to prevent the hi-limit safety from being set below the temperature setpoint.

11.04 Alarms

This incubator provides both visible and audible alarms to alert the operator to a variance in chamber conditions from SETPOINT operating conditions.

11.04.1 "High" and "Low" Alarms

Each controlled incubator function features "High" and "Low" alarms to indicate when the parameter's actual value rises above or falls below a fixed band around setpoint. See Table11.1 for a listing of the alarm bands for each parameter.

If an alarm condition exists, the appropriate red "High" or "Low" indicator lamp will light to the left of the display and an audible alarm will sound continuously. The alarms will remain active until the actual value returns to within the normal operating setpoint band.

See Table 11.1 for a listing of the factory default alarm delays and the maximum amount they can be adjusted. See section 11.04.3 on how to change alarm delays.

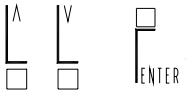
Table 11.1 Alarm Bands and Delay Times

Parameter	Alarm Band	Alarm Delay Default	Alarm Delay Limits
HIGH **TEMP**	+0.5°C	5m	0m-5m
LOW	-0.5°C	10m	0m-20mm
HIGH **CO_2**	+0.5%	5m	0m-5m
LOW	-0.5%	10m	0m-20m

11.04.2 Alarm Delays

Each alarm has an associated delay to prevent nuisance alarms. The alarm delays have been optimized and factory preset to prevent nuisance alarms under normal operating conditions. If these alarm delay settings are not appropriate for your application, they may be adjusted from the keyboard.

11.04.3 Changing Alarm Delays

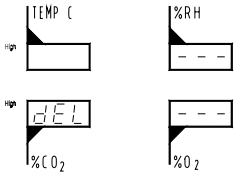
1. Press 

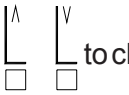
simultaneously.

   The incubator is now in communication parameter setup mode.

2. Press 

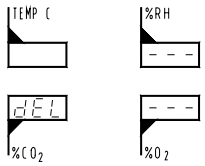
several times to cross through the communication parameter setup until the alarm delays are reached.

3. The display will show 

4. Press 
to change the temperature high alarm delay.

5. Press 

to store the new value and cross to the next parameter.

6. Repeat for temperature low alarm delay. The display will show 

7. Repeat for CO_2 and R.H. high and low alarm delays.

11.04.4 Muting audible alarm

To silence any audible alarm press 

.

Muting will silence the audible alarms for 15 minutes. The visual red "High" or "Low" indicator will continue to be displayed until the alarm condition is corrected. If the condition is not corrected within 15 minutes, the audible alarm will sound again.

If an alarm is currently muted, the presence of an additional alarm condition will override the MUTE and the audible alarm will sound.

If an alarm has been muted and the alarm condition is removed and returns the audible alarm will sound again regardless of when MUTE was pressed.

11.04.5 Door Heater Duty Cycle

The control circuitry has the capability of controlling the incubators door heater semi-separately for the purpose of eliminating any condensation build up along the outer perimeter of the inner glass door. There is a parameter "Uar" which is accessible through a configuration display where the user can change its value.

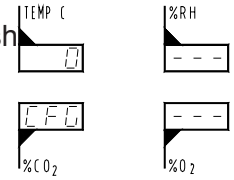
The value of "Uar" has a range of 1.0 to 3.0. When "Uar" is 1.0, the door heater is controlled in the same manner as the other heaters in the incubator. When "Uar" is increased above 1.0, the door heater remains on proportionally longer than the other heaters when the chambers temperature is within the proportioning band. For example, when "Uar" is set to 2.0, the door heater will be on twice as long as the other heaters.

The factory setting for "Uar" is 1.0. This value allows condensation to form on the glass door. Certain applications require that the glass door be free from condensation. Set "Uar" to an initial value of 1.8. Allow the incubator to stabilize for 24 hrs. Check the condition on the glass door. Increase the "Uar" value by 0.1 if the condensation is more than required. Decrease the "Uar" value by 0.1 if the condensation is less than required. The determination of the value for "Uar" is one of trial and error. Allow 24 hours for the incubator to stabilize before adjusting "Uar" to a new value.

To change the value of "Uar":

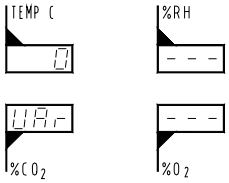
1. Press TEST once. Display will begin to flash. Press and hold ∧ and ∨ and then press ENTER.

2. . The displays will sh



3. Press ∧ until "7" is displayed in the temperature window and then press ENTER

The displays will show:



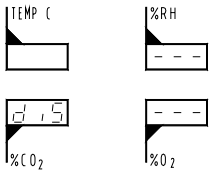
4. Use the ∧ and ∨ keys to select the desired value of "Uar" and then press ENTER.

The displays will flash and then return to their normal operating states.

11.04.6 Alarm Disable

All alarms may be disabled for a period of up to 99 hours.To disable or change the alarm disable time:

1. Press MUTE twice. Display shows



2. Using ∧ ∨ keys, enter the new alarm disable time in hours.

3. Press ENTER

The display will flash and a beep tone will confirm that the new value has been stored.

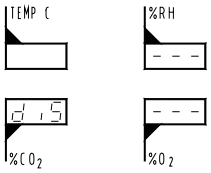
4. To check alarm disable time remaining, press MUTE twice at any time.

11.05 Using the Keyboard Lock

The keyboard may be locked to prevent inadvertent changes to previously stored values.

11.05.1 To lock the keyboard:

1. Press [□] display shows



2. Using [∧] [∨] keys, enter a numerical password of your choice.

3. Press [ENTER] .

The display will flash and a beep tone will confirm that the new value has been stored.

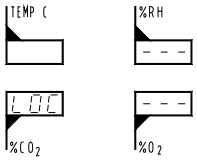
Your password is stored, the control panel is now locked, and the red "Lock" indicator illuminates to indicate the locked condition.

NOTE

RECORD YOUR PASSWORD IN A SAFE LOCATION

WHILE THE KEYBOARD IS LOCKED, SETPOINTS, CALIBRATION AND HI-LIMIT SAFETY VALUES MAY BE OBSERVED BUT NOT CHANGED.

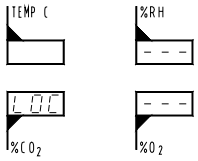
If an attempt is made to change a previously stored value while the keyboard is locked, the keyboard will beep and the display will show



11.05.2 Temporarily unlocking the keyboard

The control panel can be temporarily unlocked to change a setpoint, calibration, or Hi-Limit safety. The control panel will automatically re-lock after a new value has been entered. To temporarily unlock the keyboard:

1. Press [□] display will show



2. Using [∧] [∨] keys, enter your numerical password.

3. Press [ENTER] .

The red "LOCK" light will now blink on and off. Previously stored values may now be changed. The keyboard will re-lock after the new value is entered.

The keyboard will automatically re-lock after any of the following actions:

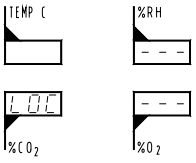
- Ten seconds elapse with no buttons pressed.
- After [ENTER] is pressed whether a value was changed or not.
- After [TEST] is pressed.

11.05.3 Permanently unlocking the keyboard.

The control panel can be permanently unlocked to allow operation without restricting keyboard entry.

When the control panel is unlocked, the incubator will accept changes to previously stored values. To permanently unlock the incubator:

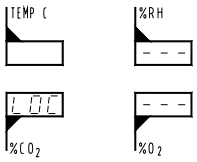
1. Press [□] display will show



2. Using ∧ ∨ keys, enter your numerical password.

3. Press ENTER to temporarily unlock the keyboard. The red “LOCK” light will now blink on and off.

4. Press ⚿ a second time, display will show



5. Using ∧ ∨ keys, re-enter your numerical password.

6. Press ENTER .

The red “LOCK” light will extinguish and the incubator will be permanently unlocked.

IF YOU HAVE FORGOTTEN OR LOST YOUR PASSWORD, ENTER 257

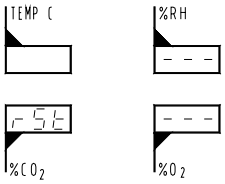
11.05.4 Factory Reset

NOTE

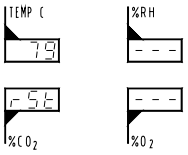
FOLLOWING A FACTORY RESET, THE INCUBATOR MUST BE RE-CALIBRATED PRIOR TO USE. FOLLOW THE INITIAL OPERATION & CALIBRATION PROCEDURE, SECTION 10.0.

The incubator can be reset to initial factory conditions at any time. To reset the incubator:

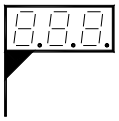
1. Press ∧ ∨ ⚿ simultaneously, display will show



2. Press ∧ until display reads



3. Press ENTER .

The incubator will beep, display  and return to initial factory settings.

The following table lists all parameters that are reset and their reset values.

Parameter	Reset Value
Temp. Setpoint	0
Temp. Calibration Offset	0°C
Temp. Hi-Limit Safety	50°C
CO2 Setpoint	0
CO2 Calibration Offset	0%
R.H. Setpoint	0
R.H. Calibration Offset	0%
O2 Setpoint	0%
O2 Calibration Offset	0%
Temp. Lo Alarm Delay	10 Minutes
Temp. Hi Alarm Delay	5 Minutes
CO2 Lo Alarm Delay	10 Minutes
CO2 Hi Alarm Delay	5 Minutes
R.H. Lo Alarm Delay	20 Minutes
R.H. Hi Alarm Delay	10 Minutes
O2 Lo Alarm Delay	10 Minutes
O2 Hi Alarm Delay	20 Minutes
Door Heater Pulse Rate	1.0

12.0 RS232 Communications

The RS232 PCB provides a bidirectional communication port that will allow the user to monitor the performance or the change the operating parameters of the Napco CO_2 Incubator from a remote computer. RS232 Communication will require a communication program such as a modem program installed in your computer which will allow the storage of data within your files.

The RS232 PCB utilizes one of the users computer serial ports, such as COM1 or COM2. The communication software must be configured to the selected port. The serial port is an IBM PC-ATstyle port. The cable that connects to it must end in a DB-25 (25-pin) male connector. The cable is a one-to-one wiring format. The pin assignments for the serial port are:

PIN	SIGNAL	DESCRIPTION
2	TXD	Serial Transmitted Data
3	RXD	Serial Received Data
7	GND	Signal Ground (O V)

SETTING UP THE INCUBATOR COMMUNICATION PARAMETERS

Your Napco CO_2 Incubator will require the selection of 6 parameters for communications. The first four are communication parameters. Your selections should be noted, so you will have them when setting up the communication you plan to use.

1) Baud Rate (bAU) - This is the speed of communication between the Napco CO_2 Incubator and computer. Whatever is selected for the incubator must also be selected in the communication software that is planned to be used.

2) Parity (PAr) - There are three choices for this parameter and are as follows:

No (No) - No Parity
Even (EVN) - Even Parity
ODD (Odd) - Odd Parity

No parity is the most commonly used.

3) Bits Per Character (bPC) - There are two choices for this parameter, 7 or 8. 8 is the more common of the two.

4) Stop Bits (StP) - There are two choices for this parameter, 1 or 2. 1 is the most commonly used.

5) Print Time (Prt) - This is the time between communication transmissions and it is in seconds. The range is from 0 to 999 seconds.

6) Print Format (PFt) - There are three choices for this parameter, 1, 2, or 3. They are as follows:

SELECTION	DESCRIPTION
1	Used for a multi-line format with English headings with continuous screen DATE: 18:47 24/June/1993 TEMP: 37.00°C 37.0 CO2: 5.0% 5.0% R.H.: 97% 97% O2: 10% 10% Actual Setpoint
2	Used for a raw, one-line status output suitable for importing into a spreadsheet 20:36 22.0 37.0 5.6 10.0 43.0 50.0 21.5 25.0 ALARM TIME ACTUAL TEMP SET TEMP ACTUAL CO2 SET CO2 ACTUAL RH SET RH ACTUAL O2 SET O2 ALARM STATUS
3	Is an extension of 2 and is not recommended for customer use

Please read the following steps before performing any of them. It will allow you to familiarize yourself with the procedure and to determine the values you want beforehand.

Please note: *In the following setup mode there is a thirty (30) second time out feature that is active following each entry. If the thirty (30) seconds has been exceeded, the unit will return to the normal operation mode. If the time out occurs before the value was entered, start over.*

1. With the incubator on, simultaneously press ∧ ∨ and ENTER. The display will show: 96 / bAU

   Note: 96 might not be the number that is displayed.

   Choose the number appropriate for the Baud Rate desired.

   OFF = OFF
   3 = 300
   12 = 1200
   24 = 2400
   48 = 4800
   96 = 9600
   192 = 19200

   Press the ∧ or ∨ until the display reads your selection. Press ENTER. The baud rate has been entered.

2. The display should change to the following: no / PAr

   Note: "No" might not be the selection displayed.

   Using ∧ and ∨, make your selection of No, Even, or Odd. Keep in mind that "No" is used the most. Press ENTER.

3. The display should change to the following: 8 / bPC

   Note: 8 might not be the number that is displayed.

   Using ∧ or ∨ make your selection of 7 or 8.

   Keep in mind 8 is used most. Press ENTER.

4. The display should change to the following: 1 / StP

   Note: 1 might not be the number that is displayed.

   Using ∧ or ∨ make your selection of 1 or 2.

   Keep in mind 1 is used the most. Press ENTER.

5. The display should change to the following: 15 / Prt

   Note: 15 might not be the number that is displayed.

   Using ∧ or ∨, make your selection. Keep in mind the units for this are in seconds. Press ENTER.

6. The display should change to the following: 1 / PFt

   Note: 1 might not be the number that is displayed.

   Using ∧ or ∨, make your selection of 1, 2, or 3.

   Press ENTER. The unit will return to normal operation.

7. The display should change to the following: 20 / thh

Note: 20 might not be the number displayed.

This parameter is not for communications and should not be changed. All the communication parameters have been set. At this point, either let the unit time-out for 30 seconds or press the "TEST" button to get back to the normal operating mode.

SETTING UP THE COMPUTER:

Your communications software will most likely have a setup routine to set the parameters listed below. These are the values the incubator is using, so you must match your computers software parameters accordingly. Also, you will probably have to select the "COM" serial port you chose when you connected the cable from your computer to the incubator. The software may ask what format the data is in. You should choose "ASCII".

Parameter	Settings
Baud Rate:	Baud Rate value selected earlier in Step 1.
Parity:	None (0)
Data Bits:	Eight (8)
Stop Bits:	One (1)
COM Port:	Selected by user
Format:	ASCII

USING THE COMMUNICATIONS:

The incubator transmits information on its RS232 Port as long as your selection for "Prt" is not "0." If you start your communication software with the incubator on, most likely you will see the error messages as follows:

? NO SUCH TASK

Wait for the "Prt" duration you selected to complete, and the communications will correct itself.

Besides having the incubator transmit information in one of the two formats, the user can monitor other values or even change some of these from their computer.

The incubator can be queried or controlled via the RS232. To query the incubator, type the appropriate command, a question mark, and press Enter. To control the incubator, type the appropriate command, the new value, and press Enter. For a listing of available commands, see table 12.3 .

Example: Change CO2 setpoint to 10%. **CS10 (Enter)** CO2 setpoint will change to 10%.

Example: Query actual temperature. **TA? (Enter)** The actual temperature of the incubator will be displayed on the computer monitor.

The incubator will accept both uppercase and lower case commands.

Typing **?** (Enter) will display a help screen on the monitor showing all available commands. The help screen is reproduced below.

Task (Task Code):	Actual	Setpoint	Offset	H Delay	L Delay		Safety
Temperature (T):	A	S	O	W	L		F
CO2 (C):	A	S	O	W	L		N/A
R.H. (R):	A	S	O	W	L		N/A
O2 (O):	A	S	O	W	L		N/A
System (S):	Hours	Minutes	Day	Month	Year	Rate	Format
	H	M	D	T	Y	R	F

The following table lists the the available commands for monitoring or controlling your incubator

Table 12.3 Communication Commands			
Temperature	Actual	TA	Query Only
	Setpoint	TS	Query and Control
	Offset	TO	Query and Control
	Safety	TF	Query and Control
	High Alarm Delay	TW	Query and Control
	Low Alarm Delay	TL	Query and Control
CO2	Actual	CA	Query only
	Setpoint	CS	Query and Control
	Offset	CO	Query and Control
	High Alarm Delay	CW	Query and Control
	Low Alarm Delay	CL	Query and Control
R.H.	Actual	RA	Query only
	Setpoint	RS	Query and Control
	Offset	RO	Query and Control
	High Alarm Delay	RW	Query and Control
	Low Alarm Delay	RL	Query and Control
O2	Actual	OA	Query Only
	Setpoint	OS	Query and Control
	Offset	OO	Query and Control
	High Alarm Delay	OW	Query and Control
	Low Alarm Delay	OL	Query and Control
System	Hours	SH	Query and Control
	Minutes	SM	Query and Control
	Day	SD	Query and Control
	Month	ST	Query and Control
	Year	SY	Query and Control
	Print Rate	SR	Query and Control
	Print Format	SF	Query and Control

The following diagnostic format is output every time

Model Version Date Time							
Function	Current Display	Current Setpoint	Sensor Reading	Offset	Alarm Delay		Alarm Status
					High	Low	
Temp	37.0°C	37.0°C	5247	0.0°C	0M	10-M	None
CO2	5.0%	5.0%	16730	0.0%	0M	10-M	None

13.0 Care and Cleaning of Stainless Steel

Please note: The following is a general write up intended as information. It can be used on incubators or water baths.

Stainless steel is an alloy of steel with chromium and nickel which increase the metal's resistance to rust and corrosion. However, if not properly cared for it can rust and corrode. Exposure to air provides the passivations for clean stainless steel. This exposure produces a thin, durable chromium-oxide film that forms rapidly on the alloy surface and gives stainless steel its characteristic "stainless" quality. Exposure of the surface to water and other oxidizing environments also produces this passivating film. However, if free oxygen is not available due to scale or contamination buildup the metal surface may become vulnerable to attack.

Maintaining a neutral pH and frequent cleaning with detergent and water will give you years of trouble free service for your incubator or water bath. The following are some guidelines to consider.

Water

Distilled water is recommended. Maintain pH between 7 and 9 to minimize corrosion of the stainless steel.

Deionized or reverse-osmosis water may be used. However, if this water is very pure it may be corrosive to stainless steel; **and in such cases always add 20-40 ppm (20 to 40 mg/liter) disodium phosphate or sodium bicarbonate. Adjust dosage to give a pH of 7 to 9. See "pH Control" below.**

If the above water is not available you may use clean, aerated soft tap water provided the total solids concentration is <500 ppm.

pH Control

Be sure to check pH regularly. If pH is <6.0, add disodium phosphate to increase pH to a 7 to 9 value. Sodium carbonate or sodium bicarbonate may be used but tend to form scale which must be rinsed out regularly. If pH is >10.0 add sodium bisulfate to decrease pH to a 7 to 9 value. Avoid adding harsh alkalines or acids since they may cause localized corrosion and result in unstable pH.

Anti-Fungal/Anti-Bacterial Additives

These additives are permissible to use as long as the pH of the aqueous solution is kept within the range of 7 to 9. Some of these are available through your supply dealer. Be sure they are not harmful to stainless steel.

Prevention of Scale Buildup

Additives commonly available for use in swimming pools and spas may be acceptable in circulating baths only. In static baths these are generally not effective. This is why it is best to clean the bath(especially around immersion heaters) and replace water as soon as practical.

Other Water Additives

Proper maintenance of the stainless steel bath chamber will help assure many years of service.

It should be cleaned regularly with mild soapy water and rinsed with distilled water. Always thoroughly dry the chamber after cleaning.

IMPORTANT: *If it is necessary to use the following chemicals, limit the exposure time to a maximum of four hours. Clean surfaces immediately after use.*

Aluminum Chloride
Chlorinated Lime
Dakin's Solution
Citric Acid (Boiling)
Phenol
Potassium Permanganate
Carbonic Acid
Stannous Chloride
Mercuric Chloride
Barium Chloride
Calcium Chloride
Ferrous Chloride
Mercury Salts
Dichloride of Mercury
Potassium Thiocyanate
Sodium Hypochlorite
Tartaric Acid

NEVER USE THE FOLLOWING:

Aqua Regia
Sodium Azide
Iodine
Ferric Chloride
Bromine
Fluorine
Sulfuric Acid

Cleaning

Spills of any chemical, especially those listed above should be removed as soon as possible and the stainless steel surface cleaned with mild soapy water followed by copious rinse with clean water. Do not use soap filled or any metallic pads. Even stainless steel pads are to be avoided as they may destroy the passive film on the surface of the metal and create crevices that may harbor contamination. If stubborn stains persist use a plastic light duty cleansing pad and rub gently in the direction of the metal grain. If stains continue to persist use one of the following methods.

⚠ WARNING

THE FOLLOWING CHEMICAL METHODS HAVE PROVEN SUCCESSFUL BUT EXTREME CARE MUST BE TAKEN WHEN HANDLING THESE MATERIALS. ALWAYS WORK IN AN AREA WITH ADEQUATE VENTILATION. USE THE PRECAUTIONS OUTLINED IN THE MATERIAL SAFETY DATA SHEET (MSDS) AND MANUFACTURER'S INSTRUCTIONS FOR THE PRODUCT YOU ARE WORKING WITH. FOLLOW THE PERSONAL PROTECTION INDEX FOUND IN THE HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS) SECTION OF THE MSDS.

The use and disposal of these chemicals may be regulated by your local municipality. Consult the regulations before disposing of these materials.

1. Bathroom tub and tile cleaners. Available at supermarkets.

2. Any of a variety of "scale removers" available at your local supermarket or hardware store. Generally sold for cleaning coffee makers, humidifiers and vaporizers.

3. Citric acid based cleaners. Contact your lab supply dealer.

4. A 15 to 35% phosphoric acid solution. Available form chemical supply dealers for scale and rust removal. Allow solution to soak the surface affected until rust and scale is loosened. Immediately rinse with copious amounts of clean water.

5. Oxalic Acid 2% to 5% in warm water. Swab solution on surface allowing it to remain until rust is loosened. Immediately flush with copious amounts of clean water.

6. A mixture of 20% nitric acid and 1.5% hydrofluoric acid (or hydrochloric acid). Swab solution on surface allowing it to remain until rust is loosened. Immediately flush with copious amounts of clean water.

The above are ranked in order of mild to strong cleaning agents. Items 5 and 6 should only be used if severe rust and scale stains have developed and cannot be removed by any other method. In any case the chemical should be allowed to do the cleaning with minimal scrubbing. **Always follow the manufacturer's instructions.**

Chamber Disinfecting

Materials known to be effective in disinfecting are:

*Household Bleach
*Glutaraldehyde
*Alcohol

Consult with your staff chemist for advice on using these chemicals.

CAUTION

Always rinse with copious amounts of clean water. Air dry and/or fill with fresh water and follow the guidelines in "WATER" above.

DISCLAIMER

The above information is the result of limited investigation and Precision Scientific makes no claims as to the suitability to your particular application. These are intended to be guidelines only. Consult your staff chemist to determine what works best in your lab.

14.0 Troubleshooting Procedures

⚠ WARNING

REFER SERVICING TO QUALIFIED SERVICE PERSONNEL. WHEN POWER IS APPLIED DANGEROUS VOLTAGES EXIST WITHIN THE CHASSIS COMPONENTS. USE EXTREME CARE WHEN MEASURING VOLTAGES ON A LIVE CIRCUIT.

Problem

14.01 No Heat

Poor Temperature Control

Non-Uniform Temperature

Slow Temperature Recovery

Procedure

1. Verify that setpoint temperature is greater than actual temperature.

2. Check heaters.
   - A. Disconnect power cord. Remove rear cover.
   - B. Disconnect connectors J16 (bottom left) and J17 (bottom) from power supply board.
   - C. Check heater resistances with an ohmmeter. Approximate heater resistances (at ambient temperature) are shown below:

Heater	Connections	Resistance (in ohms) 115V
Air	J16 Pins 6 & 7	129-151
Water #1	J17 Pins 6 & 7	129-152
Water #2	J17 Pins 7 & 8	129-152
Aux.	J17 Pins 9 & 10	502-583
	J17 Pins 10&11	502-583
Door	J17 Pins 1 & 2	114-132

   - D. Replace any heater that does not match the approximate resistances above.

3. Check TRIAC
   - A. Turn power on.
   - B. Place an AC voltmeter between pins 6 & 7(115V-units) on wire side of connector J16 on power supply board.
   - C. Set temperature setpoint below actual chamber temperature. Voltmeter should read 0 VAC.
   - D. Set temperature setpoint to at least 5°C above actual chamber temperature. Voltmeter should read line voltage.
   - E. If voltmeter does not show correct values in either C or D, replace power supply board.

4. Check Safety Relay
   - A. Turn power on.
   - B. Place an AC voltmeter between chassis ground and right hand side of R53 on power supply board.
   - C. Set temperature setpoint to at least 5°C above actual chamber temperature.
   - D. Voltmeter should read line voltage. If voltmeter does not read line voltage, replace power supply board.

Problem	Procedure
14.01 No Heat *continued*	5. Check temperature sensor. The temperature sensor used in this unit is a solid state style which does not lend itself to simple ohmic testing. Problems with the temperature sensor are identified by characteristic codes on the temperature display. An open sensor creates "n n n" on the display and short circuit conditions create "U U U" on the display. The audible alarm for Hi temperature and Lo temperature visible alarm prompt or the Lo temperature visible alarm prompt in the absence of these actual conditions in the chamber may also indicate the need for temperature sensor replacement. A. Turn power on. B. Place a DC voltmeter between pins 1 and 3 on temperature sensor connector (J7) on power supply board. C. Voltage should read 5 VDC. If not, replace power supply board. D. Place a DC voltmeter between pins 2 and 3 on temperature probe connector. Verify that the output of the temperature probe is 10 MV/°C.
14.02 Poor CO_2 Control (TC - CO_2 Sensor)	1. Verify that incubator is stable at setpoint temperature and R.H. levels. Calibrate the TC - CO_2 Sensor when the incubator is stable at setpoint temperature and R.H. levels. See Section 10.
	2. Check power supply board. A. Turn power on. B. Check voltage between TP1 and TP2 on power supply board using a DC voltmeter. Voltage should read 7.00±.05V. C. Adjust R5 (pot at upper-right corner) until potential between TP1 and TP2 reads 7.00 ± 0.05V.
	3. Check power supply board A. Check resistance between TC - CO_2 connector (J5) Pin #1 and TP1 with TC - CO_2 sensor removed. B. Check resistance between TC - CO_2 connector (J5) Pin #2and TP1 with TC - CO_2 sensor removed. C. Both resistances should be 150 ohms. If not, replace power supply board.
	4. Check gas flow lines. Assure that gas is getting to solenoid valve inlet.
	5. Check Solenoid A. Turn CO_2 setpoint up until CO_2 setpoint is 3 to 5% above the displayed actual CO_2 value. The green "on" light should be on. B. Place a DC voltmeter between Pin 2 on the solenoid connector J12 and TP2 on power supply board. Voltmeter should read 5 VDC. If not, replace power supply board.

Problem	Procedure
14.02 Poor CO_2 Control (TC - CO_2 Sensor) *continued*	C. Place a DC voltmeter between Pins 1 & 2 on the solenoid connector J12 on power supply board. The voltmeter display should be cycling between 0 V and less than one volt. If not, replace the power supply board. D. There should be an audible "click" from the solenoid each time the valve is activated. If not ,replace the solenoid.
	6. Check CO_2 Sensor The CO_2 sensor used in this unit is a thermal conductivity thermistor type. Two thermistors are connected in series and have a common connection The approximate in-circuit voltage across each junction at 37°C is 2.1 VDC and at 25°C is about 2.5 VDC. The resistance of the sensor thermistors will vary with temperature but a general range of resistance, as measured between Pins 1 & 2 or between Pins 2 & 3 should between 2K ohms to 4K ohms. Each junction will have about 1.5K ohms of resistance at 37°C.
14.03 Poor CO_2 Control (IR - CO_2 Sensor)	1. Actual CO_2 percent does not agree with displayed CO_2 percent, displayed CO_2 percent drifts or will not inject CO_2, unit will not hold calibration. May signal possible problems with the IRCO_2 sensor.
	2. After following the CO_2 calibration procedure as outlined in Section 10.08, if a problem continues the sensor or Power PCB may be defective. After eliminating the power supply as a potential problem check the signal output at the IRCO_2 sensor. Connect a digital voltmeter "NEG" lead to jack J1 labeled lead "COM" (ground). There are 2 "COM" leads, either lead can be used. Connect the digital voltmeter "POS" lead to jack J1 lead labeled "LINEAR" (signal output). This linear function gives 0.0 VDC to 1.0 VDC output which equates to 0.0% CO_2 to 20.0 CO_2.
	3. With the temperature and humidity stable for at least two (2) hours and with a CO_2 setpoint of 0.0% CO_2 and no CO_2 in the chamber, adjust the "FINE ZERO" potentiometer until the digital voltmeter reads 0.0 VDC+ 0.01 VDC. Enter a CO_2 setpoint between 5.0% CO_2 to 10.0% CO_2 and allow it to stabilize for about ten (10) minutes. Measure the CO_2 with a Fyrite. Multiply the measured CO_2 percentage by a factor of 0.05 and the value obtained will be the IRPCB output voltage, e.g. 5.5% - CO_2 measured X 0.05 0.275 VDC IRPCB volts out

Problem	Procedure
14.03 Poor CO_2 Control (IR - CO_2 Sensor) *continued*	Slowly adjust the "SPAN" potentiometer until the proper output voltage is obtained. After completing the above procedure, follow the CO_2 calibration procedure Section 10.10
14.04 Excessive Condensation	1. Check magnetic door gasket. A. Does the gasket fit evenly along the incubator body? There should be no distortions in the gasket that could cause air to flow between the gasket and the incubator. B. If distortions exist, remove door liner and reposition or replace gasket.
	2. Check glass door gasket. A. Check for gasket tears or imperfections. Replace gasket, if imperfections found. B. Verify that the gasket is completely adhered to the incubator chamber. If not, apply RTV Silicone sealant (Dow Corning #732) to gasket and chamber. Allow to cure for 24 hours. C. Shut and latch the glass door firmly in place. The gasket/ glass door interface should be completely sealed around the entire perimeter of the glass door. Try to place a business card between the glass door and gasket in any suspect areas. If a business card can be placed between the gasket and glass door, replace the gasket or check glass door alignment.
	3. Check glass door alignment. A. Check that the two plastic nuts are secured tightly to the two stainless steel hinges. B. If the door does not appear to be properly aligned, loosen the four capnuts holding the hinges onto the incubator and realign the glass door. C. Repeat step 2C to verify the glass door alignment. Humidity within the chamber can vary with changing temperature, ambient conditions, and the nature of the sample. The condensation, or lack thereof, on the glass door is by no means a proper way to measure the relative humidity within the chamber, but as a general rule there will be a very slight amount of condensation near the edges of the glass door during normal operation or sometimes no condensation whatsoever. If all of the glass or greater than half the surface area of the glass is covered with moisture, this may indicate that the door heater may require an adjustment of the pulse rate to the heater.

Problem	Procedure
14.04 Excessive Condensation *continued*	Refer to Section 11.06 to adjust the heater.
	4. Check door heater and auxiliary heater. A. Turn power off. B. Disconnect connector J17 from the power supply board. C. See section 14.01 for pin numbers and resistance values.
14.05 Poor R.H. Control (with optional R.H. Control)	1. Excessive condensation inside the incubator will cause an overshoot in the R.H. If condensation exists, remove condensation with a sponge.
	2. See troubleshooting Section 14.04 (Excessive Condensation). Verify that no problems exist.
	3. Check R.H. distilled water supply. If supply is empty, a setpoint can not be reached; therefore, add more distilled water.
	4. Check power supply board. A. Turn power on. B. Set R.H. setpoint to 97%. Note: setpoint must be higher than actual humidity being displayed. C. With a DC voltmeter check the following voltages on the power supply board. TP2 & TP4 13.5V - 15.5V TP2 & TP3 5V If any of the voltages are incorrect replace the power supply board.
	5. Check R.H. pump. A. Turn power on. B. Set R.H. setpoint to 97%. Setpoint must be higher than actual humidity being displayed. C. Open front cover of control panel by loosening the two thumb screws. D. Place an AC voltmeter between Pins 1 & 3 on the wire side of the white connector on the R.H. pump mounting bracket. The pump does not run continuously but should run when the "on" light next to the R.H. display is illuminated. Voltmeter should read line voltage. If not, check wiring. (Refer to wiring diagram at end of manual.) E. If part D checks okay and pump is not turning, replace pump.

Problem	Procedure
14.05 Poor R.H. Control *continued*	6. Check neoprene tubing A. Turn power off. B. Remove front cover from control panel by loosening the two thumb screws. C. Inspect the cream-colored tubing which fits inside the peristaltic pump. D. The tubing should lie evenly around the pump. If not, loosen the clear plastic thumbscrew and place the norprene tubing in the correct position. Re-tighten the plastic thumbscrew. E. Inspect the neoprene tubing for wear. If the tubing shows any type of wear, replace the tubing.
	7. Check tubing system for leaks. A. Disconnect the tubing from the steam generator. B. Turn power on. C. Set R.H. setpoint to 97%. Setpoint must be higher than actual humidity being displayed. D. Verify that the pump is turning and that there is an ample distilled water supply. E. Look for small droplets of water exiting the tubing where it has been disconnected from the steam generator. This could take up to 30 minutes if the distilled water supply is fresh. If water is not flowing, first replace the distilled water filter adjacent to the pump. Be careful to install the new filter in the correct orientation. F. Repeat the above test. If water still does not flow, check for kinks or breaks in the tubing system.
	8. Check steam generator. A. If water is being injected into the incubator rather than steam, the steam generator should be suspected. B. Turn power off. C. Disconnect connector J16 from the power supply board. D. Check the resistance between connector Pins 4 and 5 with an ohmmeter. At ambient temperature, ohmmeter should read as follows: 115V 129-152 ohms If not, replace the steam generator.

Problem	Procedure
14.06 Poor O_2 Control	1. Verify that setpoint is not "Off".
	2. Check glass door gasket. Replace gasket, if necessary.
	3. Verify that the incubator is stable at setpoint temperature and R.H.. Calibrate the O_2 sensor when the incubator is stable at setpoint temperature and R.H. See Section 11.02 (calibrate O_2)
	4. Check O_2 sensor. Place a DC voltmeter on the back of pins 1 & 2 of J4 on the power supply board. Voltmeter should read approximately 10 mv / %O_2 . If sensor does not read at least 111 mv, replace sensor.
	5. Sensor life. The O_2 sensor has a limited life of 3 - 5 years. If the sensor is 3 years old and poor O_2 control is a problem, replace the sensor. See calibration record in section 10.
	6. Check for gas flow line problems. **Note: This section is applicable to both O_2 and N_2 .** A. Verify that the gas supply is present and the pressure is regulated between 15 and 25 psi. B. Check for gas line leaks by using a soapy water solution. C. Check for a clogged filter. Remove downstream tube from filter. If the gas flow through the filter is not robust, replace the filter. Observe the gas flow direction mark on the filter and verify that the filter has been installed properly. D. Remove back cover from the incubator and check the internal gas lines. Check for a clogged filter by repeating (C) above. E. Check solenoid. Turn O_2 setpoint to "Off". Remove clear plastic tubing from downstream (bottom) side of solenoid. There should be no gas flow through the solenoid. If gas flow is detected, replace solenoid. Verify that the solenoid is oriented properly by observing the gas flow arrow on the solenoid. F. If the gas control setpoint is "Off" and the solenoid is actuating (you will hear "clicking"), replace the power supply board.

Problem	Procedure
14.06 Poor O_2 Control *continued*	7. Check solenoid. **Note: The instructions for N_2 are written here. When instructions for O_2 differ from N_2, they will be shown in parenthesis.** A. Turn O_2 control down (up) until O_2 setpoint is below (above) the displayed actual O_2 value. The green "On" light should be flashing. B. Place a DC voltmeter between pin 4 and pin 3 (1) on the solenoid connector J13 on power supply board. Volt meter should read 4.5 to 5V DC. If not, replace power supply board. C. There should be an audible "click" from the solenoid each time the valve is actuated. If not, replace the solenoid.
14.07 Noisy Fan	Noise inside the incubator chamber, above what would normally be expected, is usually an indication of fan blade or fan motor trouble. Problems with excessive humidity and poor temperature uniformity can also signal fan motor or fan blade trouble. The fan blade mounts to the fan motor shaft by friction. The proper rotation of the fan blade, observing the blade from within the chamber, is clockwise. Air is drawn into the fan and is blown out tangent to the fan blade. Buzzing noises can be isolated by checking the fanblade position on the shaft; it may be too close to the plenum, or pushed too far back against the fan motor plate.

15.0 Part Replacement Procedures

⚠ WARNING

DISCONNECT POWER CORD BEFORE PERFORMING ANY OF THE FOLLOWING PROCEDURES.

15.01 Temperature Sensor

1. Disconnect incubator from power source.
2. Remove the six (6) screws which secure rear cover plate.
3. Locate jack J7 on the main PCB and disconnect.
4. Pull out sensor from fan motor plate.
5. Reinstall new sensor, reversing above procedure.

NOTE:

WHEN INSTALLING NEW PROBE MAKE CERTAIN THE FLARE AT THE CABLE END OF THE PROBE STOPS AT THE BLACK GROMMET ON THE FAN MOTOR PLATE.

6. Recalibrate temperature control, if necessary. Follow procedure in Section 10.05.

15.02 CO_2 Sensor

1. Disconnect incubator from power source.
2. Remove the six (6) screws which secure rear cover plate.
3. Locate jack J5 on the main PCB and disconnect.
4. Remove the four (4) screws which fasten the CO_2 sensor to the fan motor plate.
5. Reinstall new sensor by reversing above procedure.
6. Allow the temperature and humidity to stabilize for at least two (2) hours. Recalibrate the CO_2 control following the procedure in Section 10.08.

15.03 IRCO_2 Sensor

1. Disconnect power from incubator.
2. Remove the screws which secure the rear cover plate.
3. Locate jack J1 on Power PCB and disconnect.
4. Remove shelves, supports and inner rear wall from chamber exposing the sensor and remove the four (4) screws which secure the sensor and shield.
5. Install new sensor, carefully replace the metal shield near the sensor, reversing the above procedure.
6. Allow temperature and humidity to recover for at least four (4) hours and follow the CO_2 Calibration Procedure in Section 9.02.2.

15.04 Fan Motor

1. Disconnect incubator from power source.
2. Remove the six (6) screws which secure rear cover plate.
3. Locate jack J16 on the main PCB and remove the leads, remove the ground lead from the motor as well.
4. Remove the shelves and plenum from the chamber. Pull fan blade off shaft, remove retaining ring and two (2) screws which secure motor to fan motor plate.
5. Reinstall the new motor, carefully noting the rotation of the shaft. Reverse the above procedure.

NOTE:

THE MOTOR IS MULTIPLE VOLTAGE. THERE ARE FOUR (4) LEADS FROM THE FIELD WINDINGS. ATTACH LEADS AS FOLLOWS:

100 VAC and 115 VAC - White and red together to neutral. Brown and black together to hot.

220 VAC and 240 VAC - White to neutral. Red and brown together with wire nut. Black to hot.

15.05 Air Heater

1. Disconnect incubator from power source.
2. Remove the shelves, supports, and plenum from within the incubator chamber.
3. Remove the six (6) screws which secure rear cover plate. Note: It is not necessary to remove the fan motor plate to change the air heater.
4. Disconnect the spade terminals leading from the main PCB at heaters ends.
5. Remove the two (2) nuts which secure the heater to the fan motor plate and pull heater out through the front of the fan motor plate.
6. Reinstall new heater, reversing the above procedure.

15.06 Water Jacket Heaters

1. Disconnect incubator from power source.
2. Remove the six (6) screws which secure rear cover plate.
3. Locate the water jacket heaters, one left, one right, at rear near the bottom of the jacket. Remove the nut and retaining washer which secure the heater in the thermowell.
4. Locate jack J17 on the main PCB and disconnect the heater leads.
5. Remove the heaters from the thermowells. Note: Grasp the heater sheath with pliers if heater will not easily slide out. Do not pull them out by the leads, as they may rip out and leave the heater sheath stuck on the thermowell tube.
6. Reinstall new heaters, reversing the above procedure.

15.07 Door Heaters

1. Disconnect incubator from power source.
2. Remove the screws which secure control panel.
3. Disconnect leads connected with wire nuts which pass through door hinge.
4. Remove screws which secure inner liner of outer door. These screws are under the outer door gasket.
5. Peel off defective heater from door liner.
6. Install a new door heater, reversing the above procedure.

15.08 Auxiliary Heater

1. Disconnect incubator from power source.
2. Remove the screws which secure control panel.
3. Remove insulation.
4. Disconnect leads connected with wire nuts.
5. Peel off defective heater from top of chamber.
6. Install a new door heater, reversing the above procedure.

15.09 Power Supply/CPU PCB

The power supply and CPU circuit board must be replaced together as a matched set.

WARNING:

DISCONNECT POWER CORD BEFORE PERFORMING THIS SERVICE PROCEDURE.

1. Disconnect incubator from power source.
2. Remove the screws which secure the rear cover plate.
3. There are two jumpers on the power supply--JP2 and JP3. These jumpers configure the power supply to match the A/C line input voltage. Remove the replacement board from its pouch and configure the jumpers to match the board in the unit. Note the location of each connector going to the power supply board. Carefully remove each connector from the board.
4. Remove the screws which secure the Power Supply PCB.
5. Install new Power Supply PCB reversing steps 3, 4.
6. Remove the ribbon cables connected to J1 and J2 on the CPU PCB.
7. Remove the screws which secure the CPU PCB to the chassis.
8. Install new CPU PCB reversing steps 6, 7. Replace rear cover plate.

The unit now needs to have the new CPU PCB configured for the model in which its placed. Find the model number of the incubator on the id tag on the outer door liner, then match it to the model in the table. Note the unit id code for your model.

1. Reapply power to the incubator.
2. Press 

.
3. Press 

and 

simultaneously.
4. Display will show: 

5. Enter configuration password 37 (use 

).

6. Press ENTER.

   If the value is not entered within 1 (one) minute, the unit automatically times out. If this occurs, repeat the setup starting at item 2.

7. Using ∧ ∨, enter the I.D. number for your model. (See table 15.1)

8. Press ENTER.

9. Press TEST to return to normal display.

To check unit, press TEST again and unit will scroll through a series of verifications:

- Software revision level.
- Unit id - this should match value you selected from table.
- CO_2 sensor type (T/C or IR)
- LED segment check

Table 15.1

Models	Unit ID
7101-0 7301-0	7t
7101F-0 7301F-1	7f
7101H-0 7301H-1	7th
7101FH-0	7fh
7101C-0 7301C-0	7tc
7101FC-0 7301FC-0	7fc

Press TEST again to exit.

Calibration of the unit must be performed. See Section 10.0.

15.10 CO_2 Solenoid Valve

1. Disconnect incubator from power source.
2. Remove the six (6) screws which secure the rear cover plate.
3. Locate jack J12 and unplug connector.
4. Disconnect hoses from defective valve assembly.
5. Remove valve assembly.
6. Install new valve assembly, reversing the above procedure.

15.11 Display/Keyboard PCB - 3176756

1. Disconnect incubator from power source.
2. Remove the screws which secure the control panel to the body of the incubator. These four (4) screws are located on the underside of the control housing and can be seen when you open the door.
3. Disconnect the CO_2 gas sample hose and water fill hose.
4. Disconnect the ribbon cables from the circuit board.
5. Remove 11/32" nylon nuts which fasten the circuit board to the panel. Do no use metal nuts or metal washers in place of these nylon nuts as they may short the solder traces on the board or crack the board.
6. Install new Display/Keyboard PCB reversing above procedure.

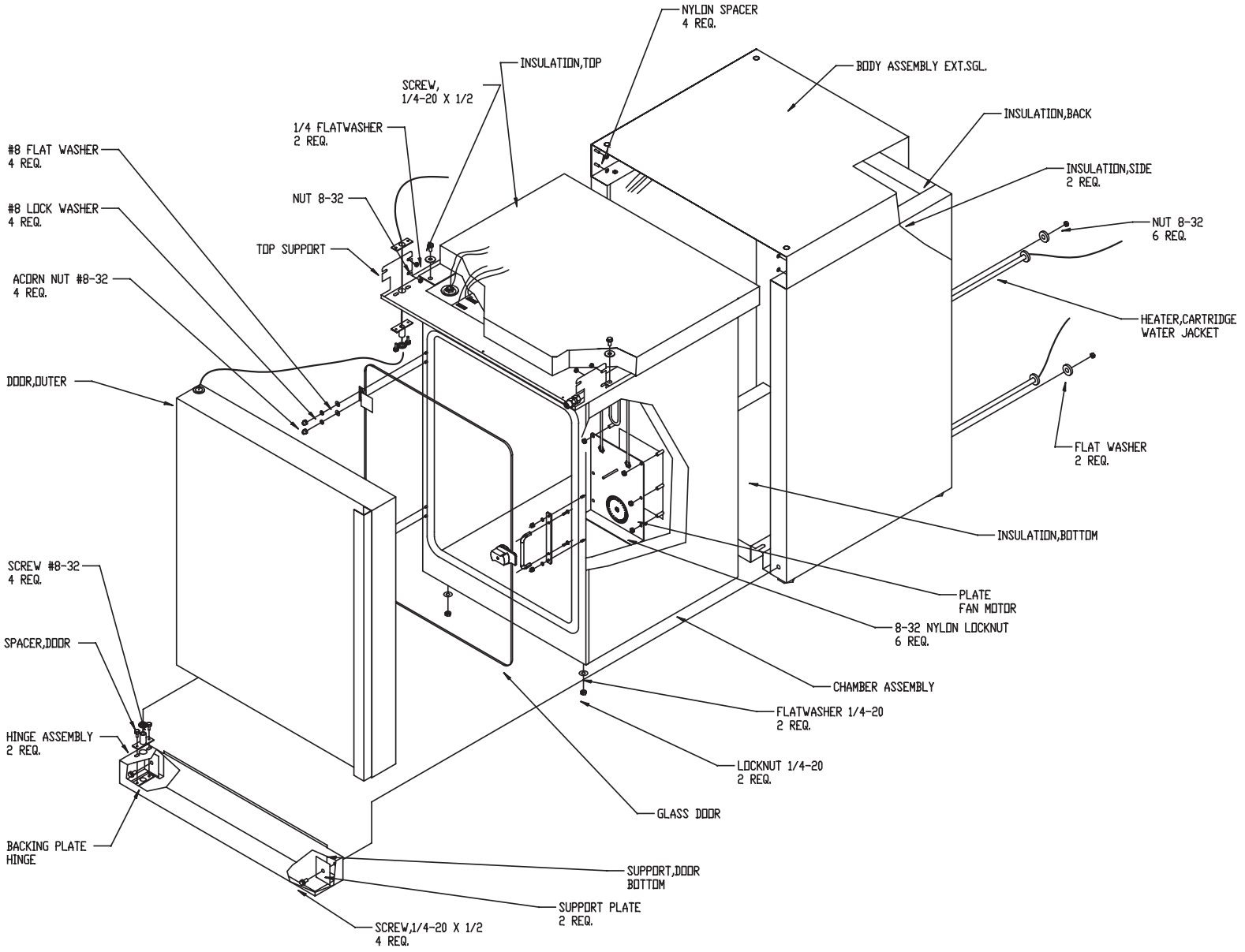
15.12 Steam Generator

1. Disconnect incubator from power source.
2. Remove the screws which secure the rear cover plate.
3. Allow steam generator to cool.
4. Disconnect heater wires from J-16 terminals 4 and 5. Disconnect ground wire.
5. Disconnect steam generator from retaining bracket.
6. Loosen bulkhead fitting and pull steam generator out of fan motor plate.
7. Install new steam generator reversing above procedure.

Replacement and Accessory Parts	
Catalog Number - for all t ypes unless noted	
Voltage	115 Volt
	Part Number
Battery, Lithium CR2330 (For CPU PCB)	Available Locally
Blower Wheel	100032
Cable ASM , CPU/Display	3177614
Cable ASM CPU / Powerboard	3177616
Caplug (For Door Liner)	3174909
Caster Kit	3166241
Clamp, 3/8" Self Tightening	3177107
Clamp, (External Supply) Hose	3175645
Clamp, Steam Generator	3175649
Clamp, Tygon Tubing	3175650
Clean Start Kit	3166243
Connector, Power	3177885
CO2 Tank Regulator	3166240
Door Assembly, Glass	3176329
Duct, Blower	3160495
Filter, EMI/RFI	3172886
Filter Kit, HEPA Gas	3164603
Filter, Water	3160512
Fuse Kit, 5x20mm, 0.8A SLOBLO	3167282
Fuse Kit, 5x20mm, 6.3A SLOBLO	3167272
Fuseholder Kit, 15A	3167280
Gasket, Glass Door	3175095
Gasket, Magnetic Outer Door	3174682
Germicide, Bottled Ammonium	3174324
Heater, Air	3175509
Heater, 50W Auxillary (Above Chamber)	3175520
Heater, 100W Cartridge (Water Jacket)	3172873
Heater, Door	3175518

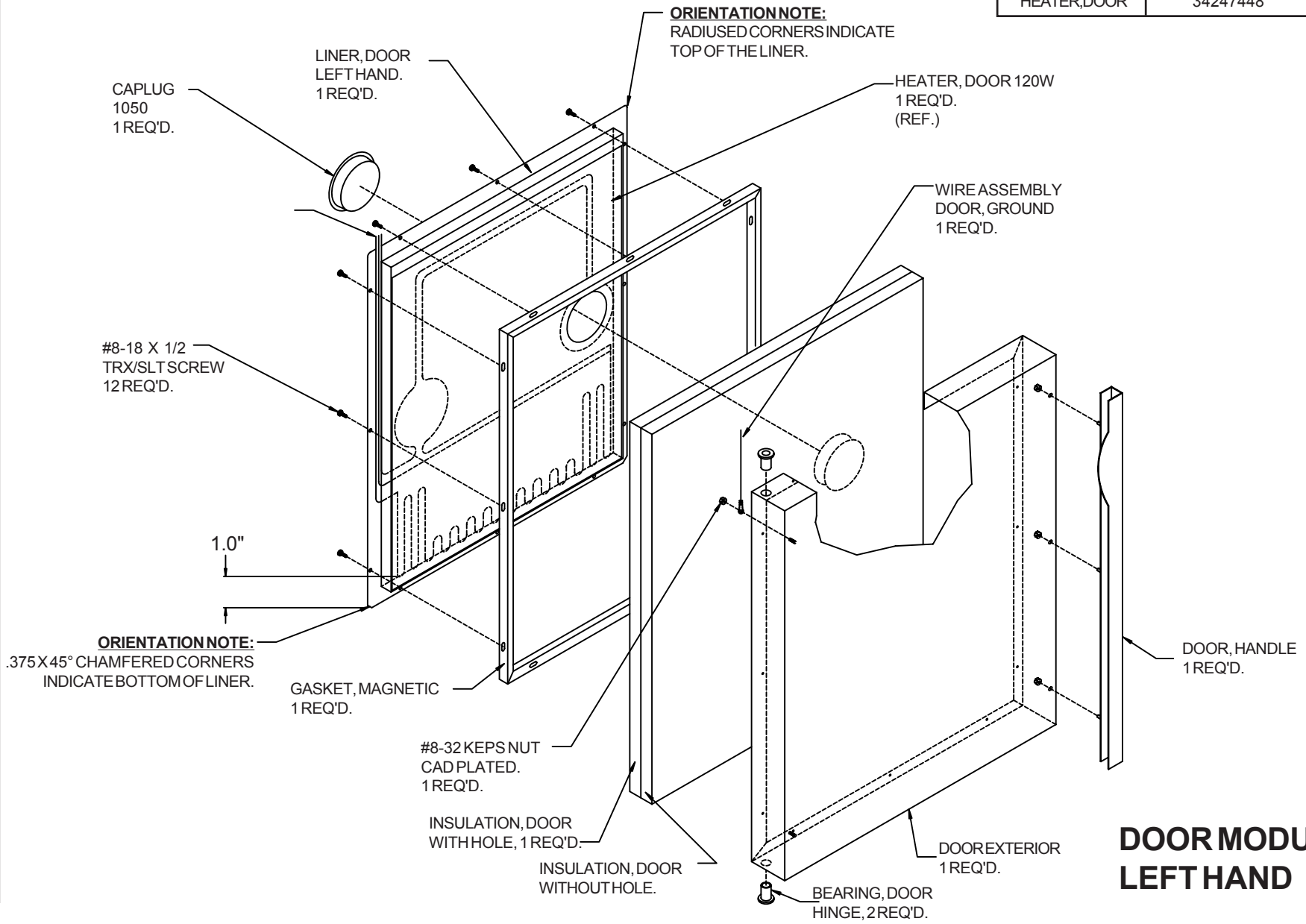
Replacement and Accessory Parts	
Catalog Number - for all unit types, unless noted	
Voltage	115 Volt
	Part Number
Hose Assembly, Supply (R.H.)	3161117
Hose Assembly, Water Fill (8 ft w/Fitting)	3166244
Hose, CO2 Supply (8 ft)	3161877
Hose, Oxygen Supply (8 ft.)	3161878
Jack, R.H. Level	3172909
Leveler Kit, 5/16-18 Foot	3167255
Liner, Left Hand Door (Hinge Left)	3160519
Liner, Right Hand Door (Hinge Right)	3164496
Motor Replacement Kit, Fan	3161198
Outlet, Auxillary 100/115Volt	3175175
Outlet,Auxillary 230 Volt	3174213
Pan Kit, Humidity	3166239
PCB, Power Supply	3160589
PCB, CPU	
PCB, Keypad/Display	3176756
PCB, RS232	3166245
PCB, Slave Display	3176757
Power Cord, 100/120Volt	3176550
R.H. Supply Assembly (Pump), for units with "C" in part number	3162842
Reservoir, R.H. H_2O Supply, for units with "C" in part number	3160722
Sensor, Asm Oxygen, for units with "H" or "C" in part number	3167051
Sensor, Relative Humidity	3162696
Sensor Assembly, Temperature	3164527
Sensor Assembly, TC CO2	3164510
Sensor Kit, Infrared CO2 (Sensor & PCB)	3160750
Sensor, Oxygen	3162697
Shelf	3178682
Shelf Kit (One Shelf & Two Slides)	3162000

Replacement and Accessory Parts	
Catalog Number Catalog # for all unit types, unless noted	
Voltage	115 Volt
	Part Number
Shelf Slide	3173262
Shelf Standard ,Left Front	3160509
Shelf Standard, Rear	316325
Shelf Standard, Right Front	3160510
Steam Generator Kit	3167012
Stopper, #6 Solid Green (For Rear Port)	3174915
Switch Assembly, Float	3164526
Switch, Power	3175318
Thumbscrew, Front Panel	3172924
Transformer Assembly, Power	3161986
Tubing, Clear Gas	3174646
Tubing Replacement Kit, Water Pump, includes tubing, fittings, & filter for units with "C" in part number	3164605
Valve Asm, Shuttle	3166192
Valve Assembly, Solenoid (CO_2& O_2)	3162119
Valve Assembly, Solenoid (N_2)	3162793

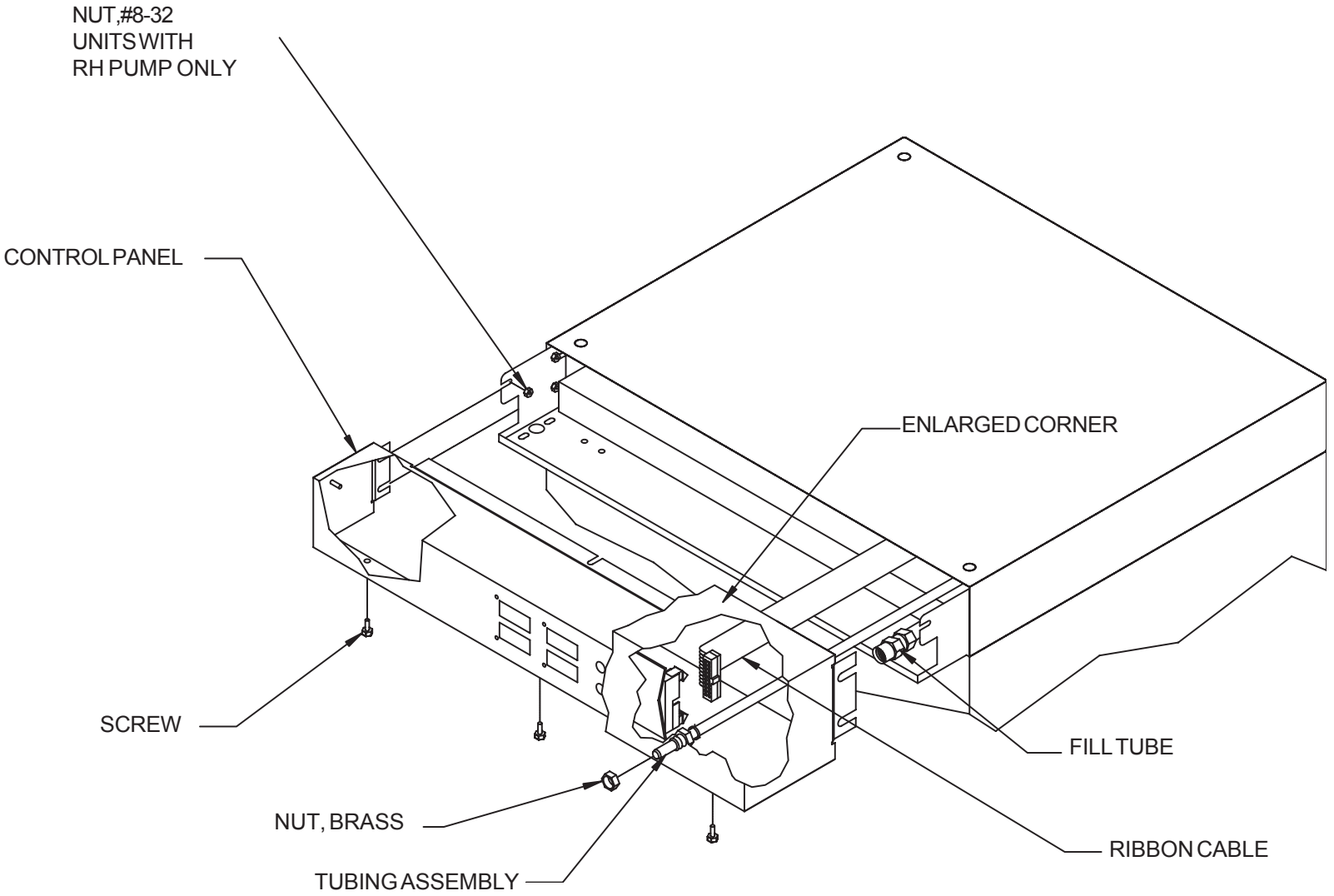


UNIT ASSEMBLY,SINGLE

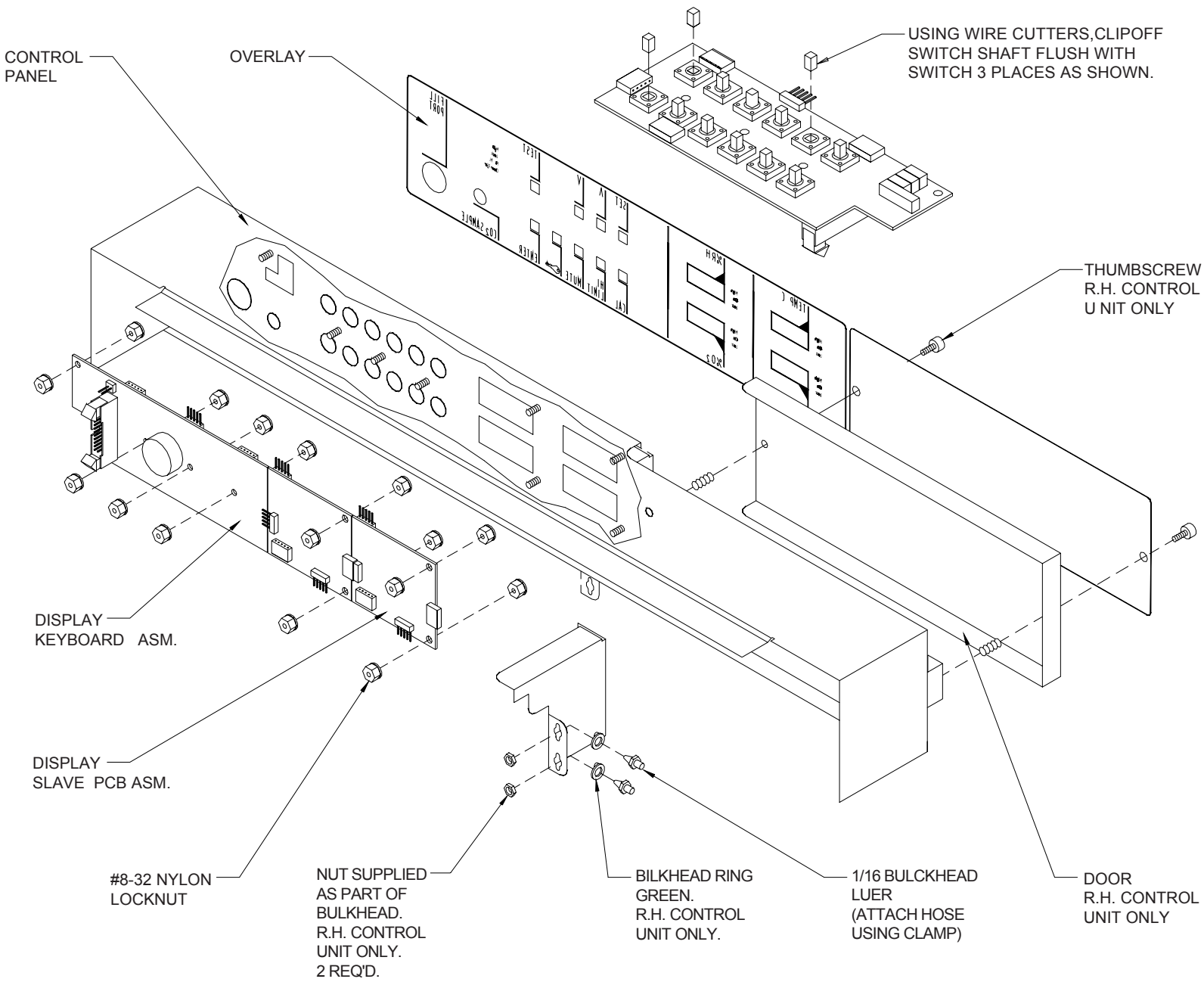
HEATER TYPE	VOLTAGE/PART NO.
	120V
HEATER,DOOR	34247448



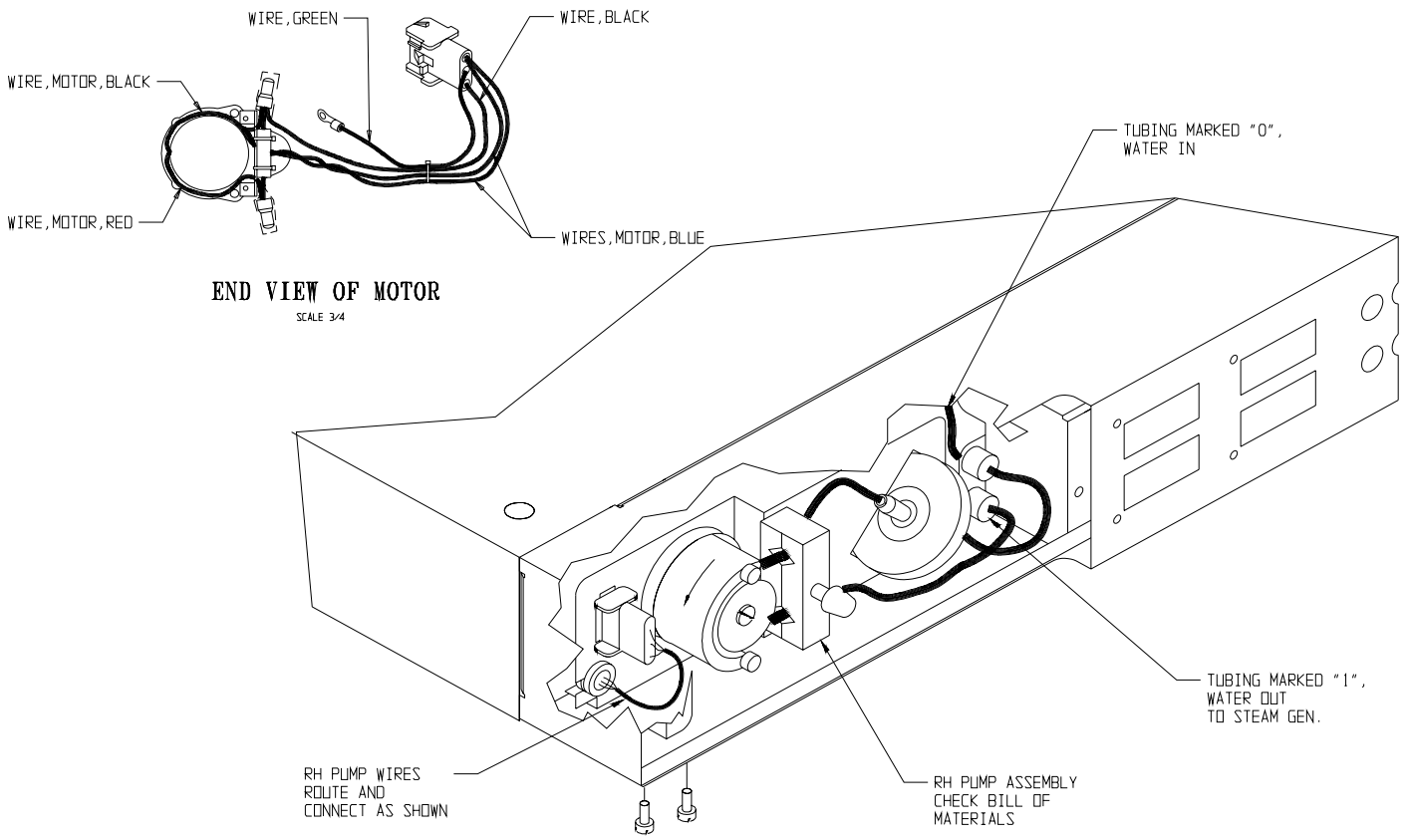
DOOR MODULE LEFT HAND



CONTROL PANEL CONNECTIONS

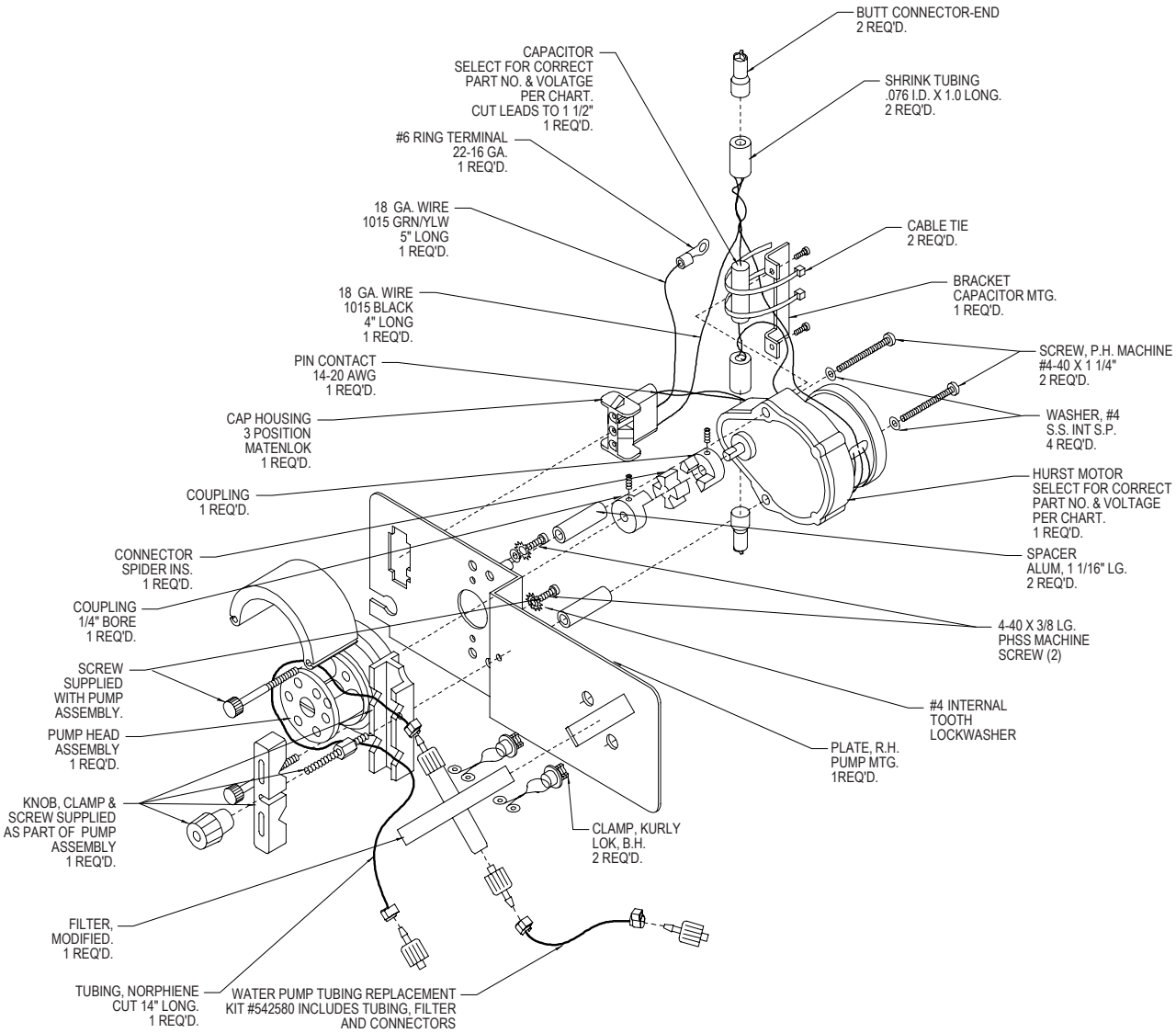


CONTROL PANEL

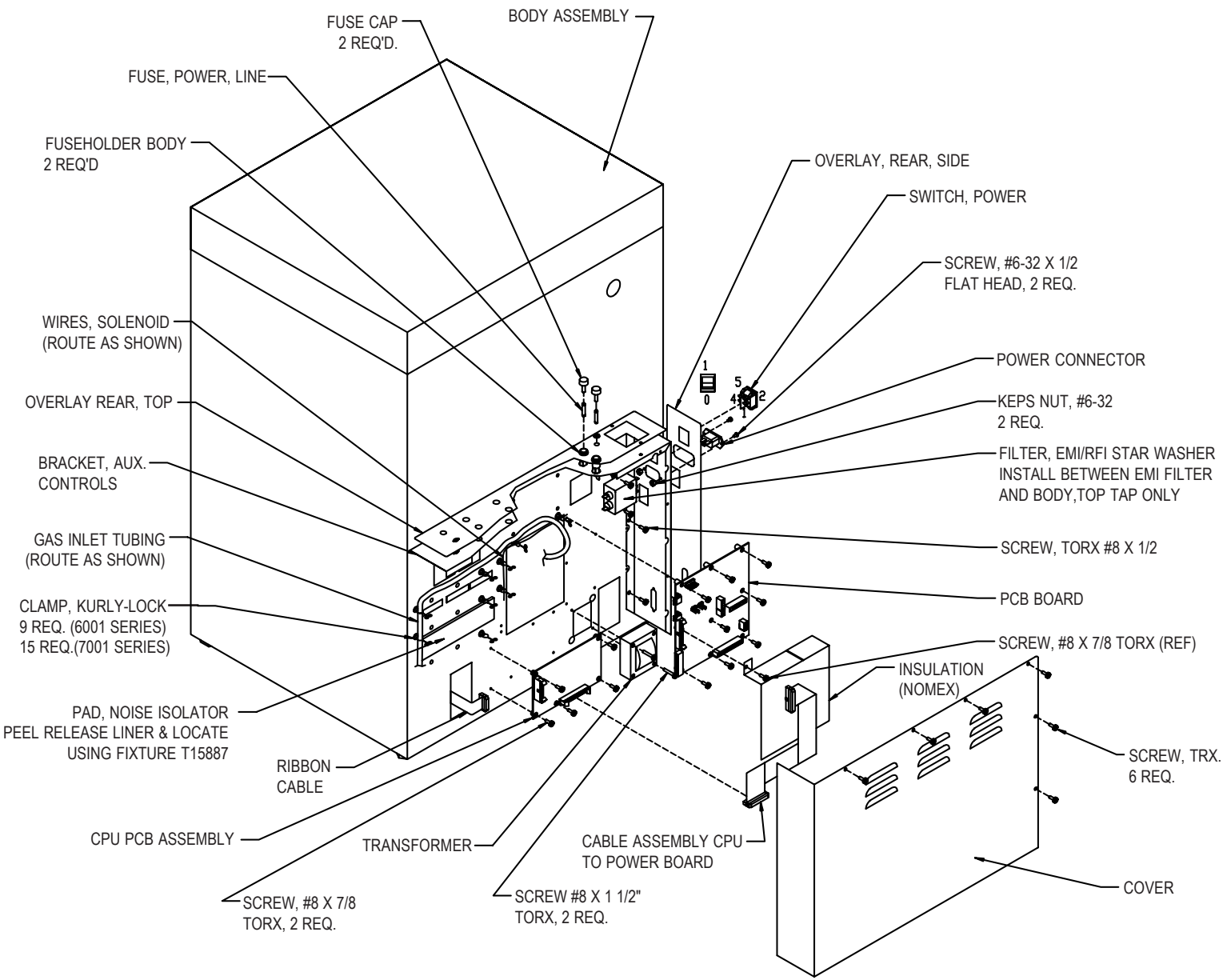


R.H. PUMP SUPPLY

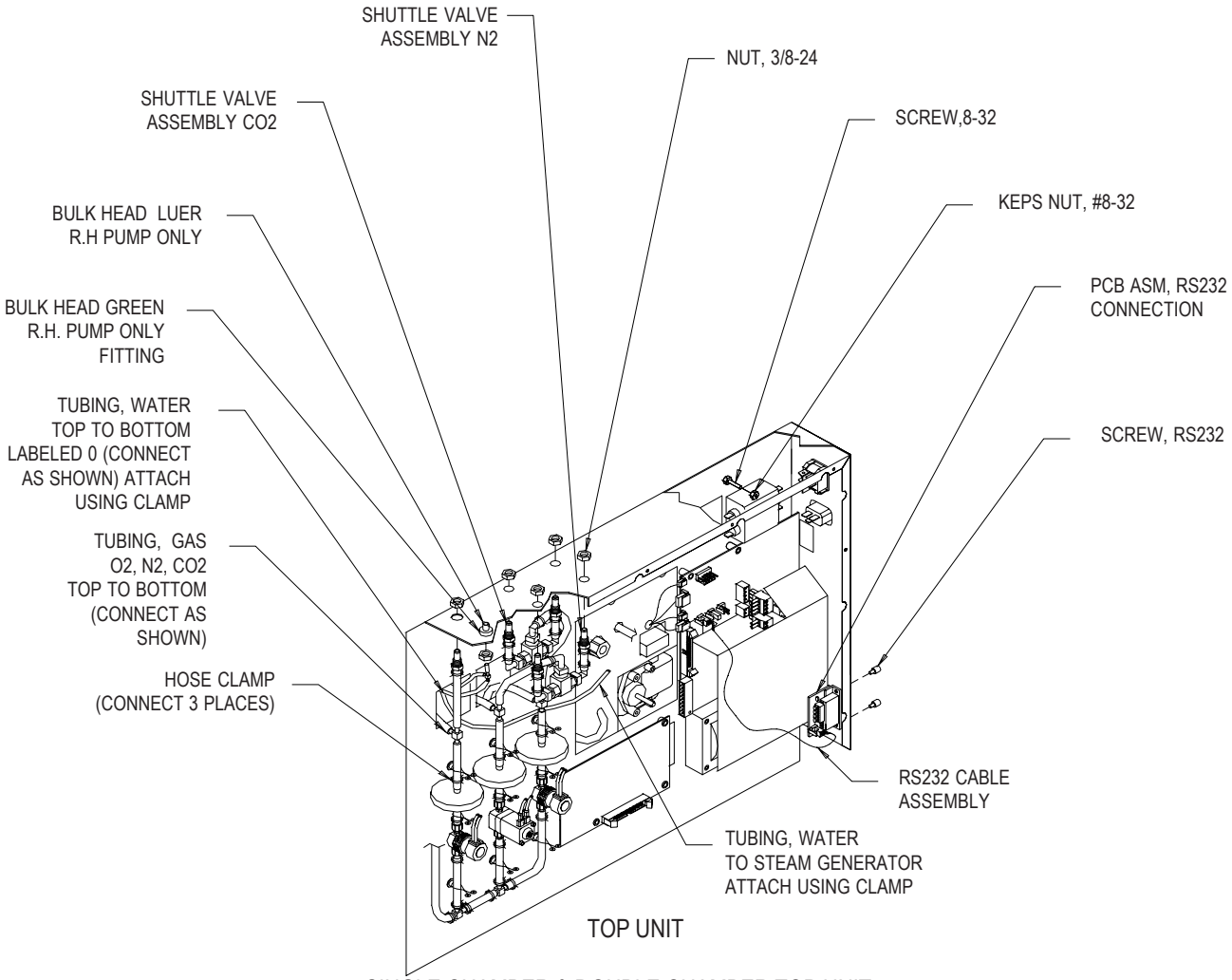
MOTOR, CAPACITOR & VOLTAGE SELECTION CHART			
ASSEMBLY PART NO.	**DESCRIPTION**	**VOLTAGE**	**PART NO.**
3162842	MOTOR 115V / 60 Hz.	100/115V	3172931
	CAPACITOR 0.50mFD		(SUPPLIED WITH MOTOR)
3162843	MOTOR 220V / 60 Hz.	23OV	3172917
	CAPACITOR 0.15mFD		3172951



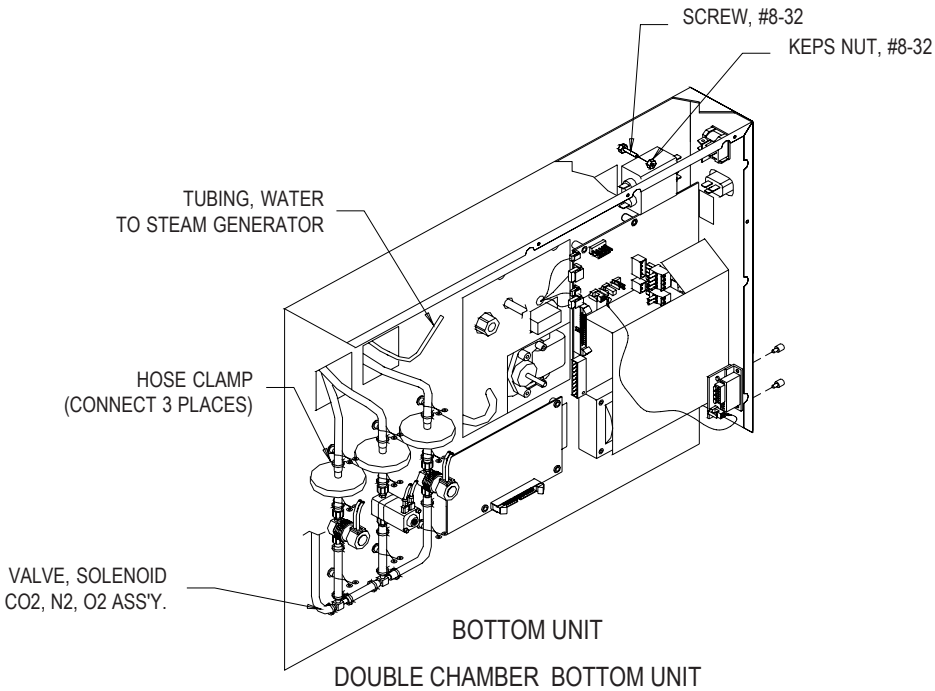
R.H. SUPPLY, PUMP & MOTOR ASSEMBLY



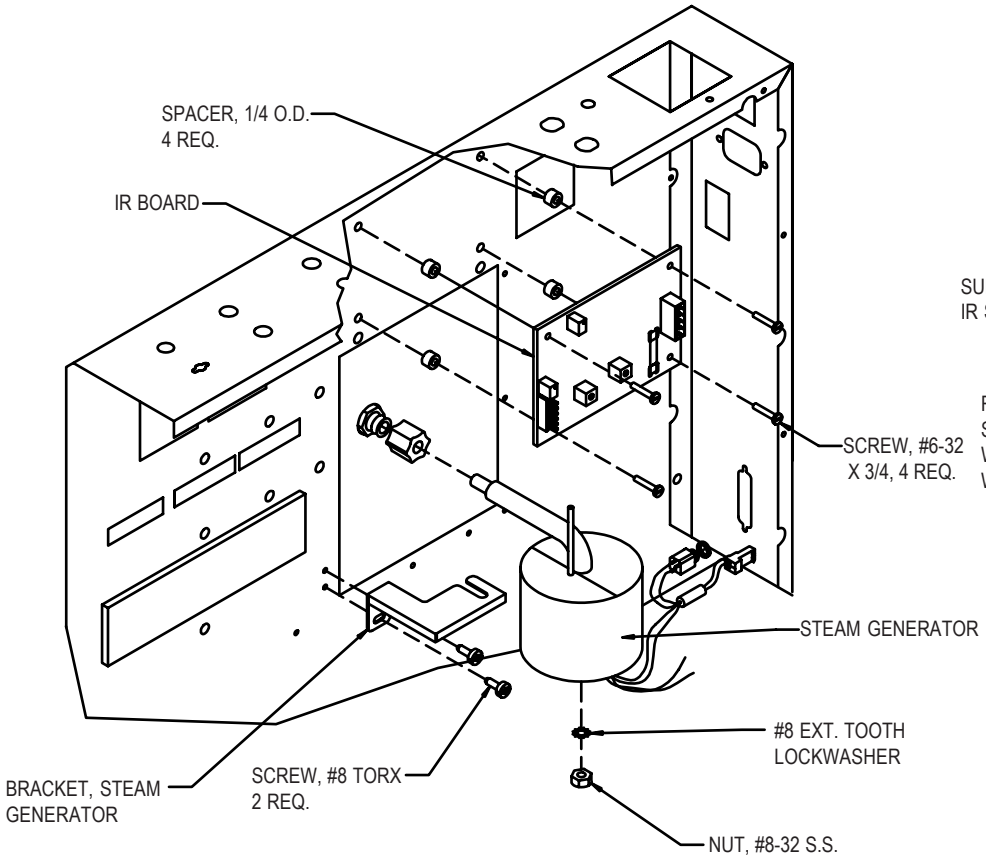
UNIT ASSEMBLY, SINGLE, REAR, 230V



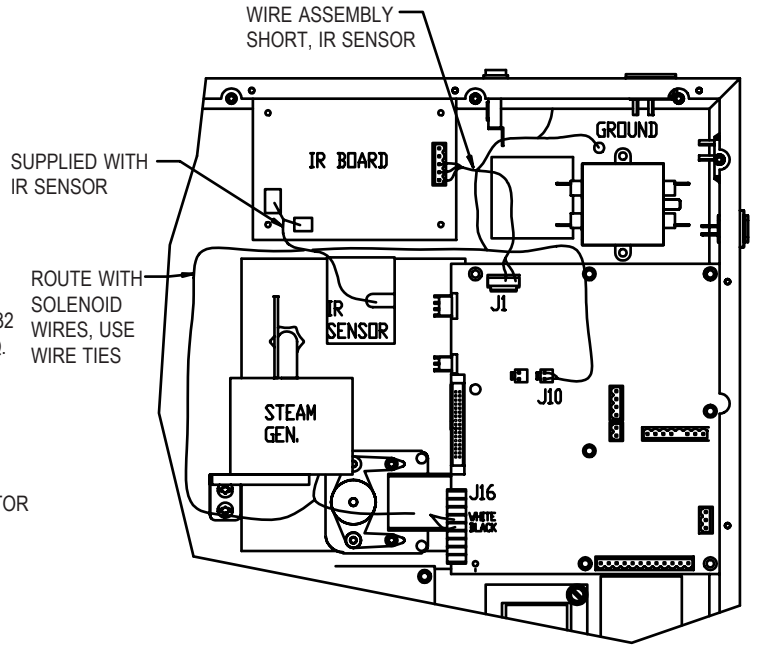
SINGLE CHAMBER & DOUBLE CHAMBER TOP UNIT
CO2 GAS & R.H. WATER TUBING CONNECTIONS



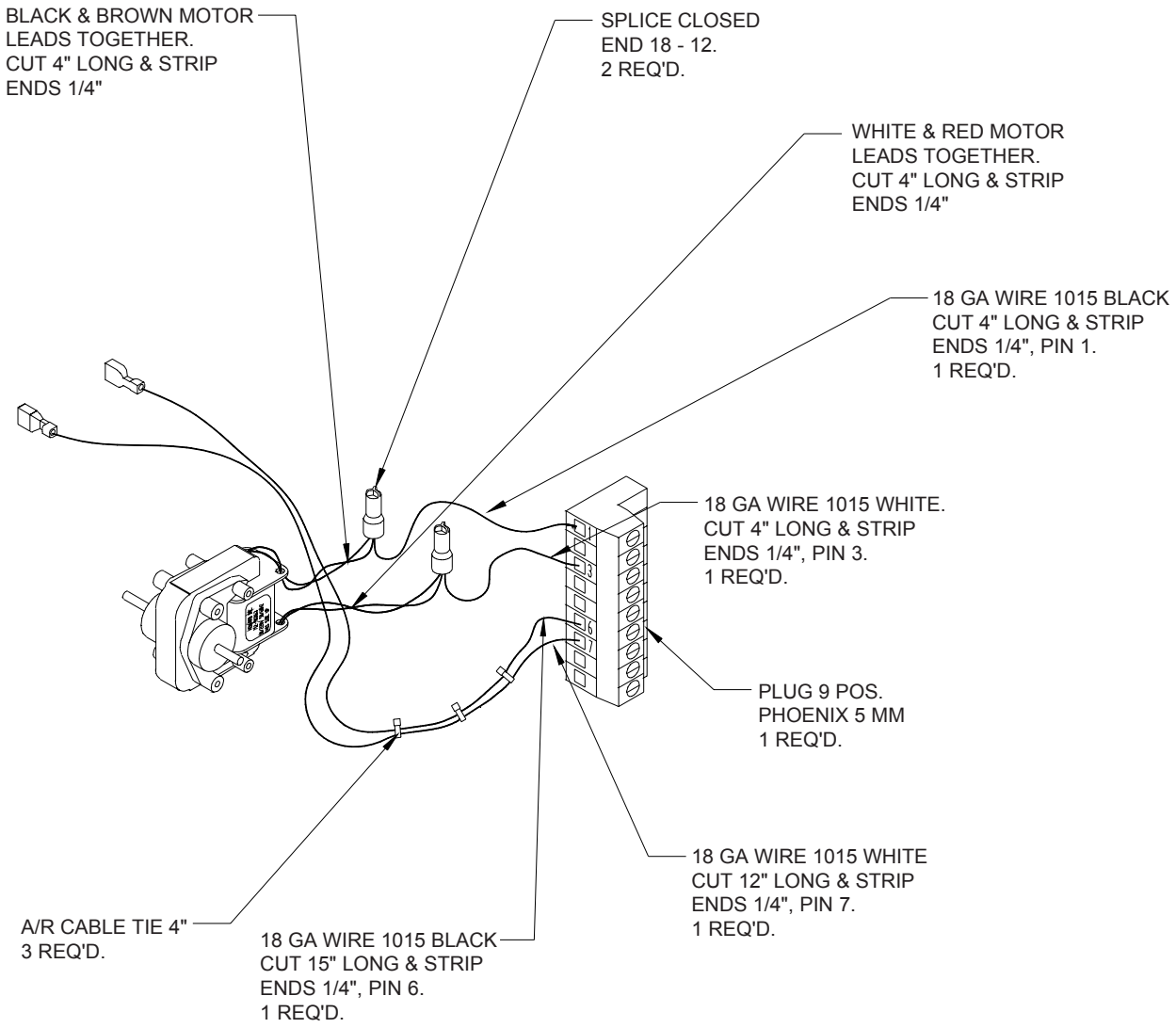
DOUBLE CHAMBER BOTTOM UNIT
CO2 GAS & R.H. WATER TUBING CONNECTIONS



STEAM GENERATOR AND IR CO2 SENSOR ASSEMBLY

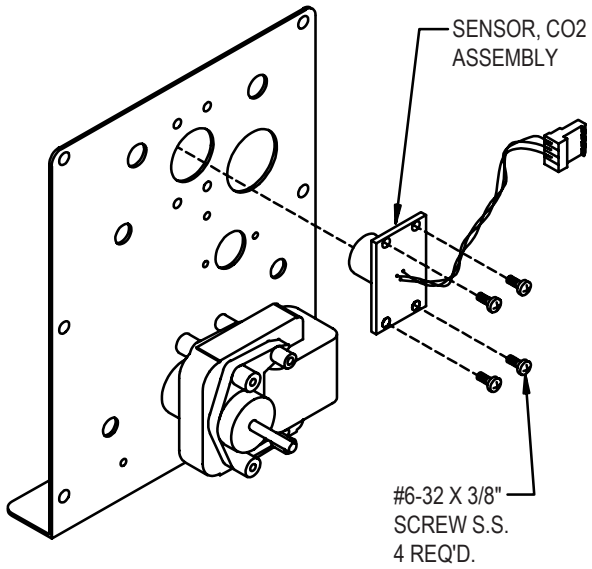


STEAM GENERATOR AND IR CO2 SENSOR CONNECTIONS

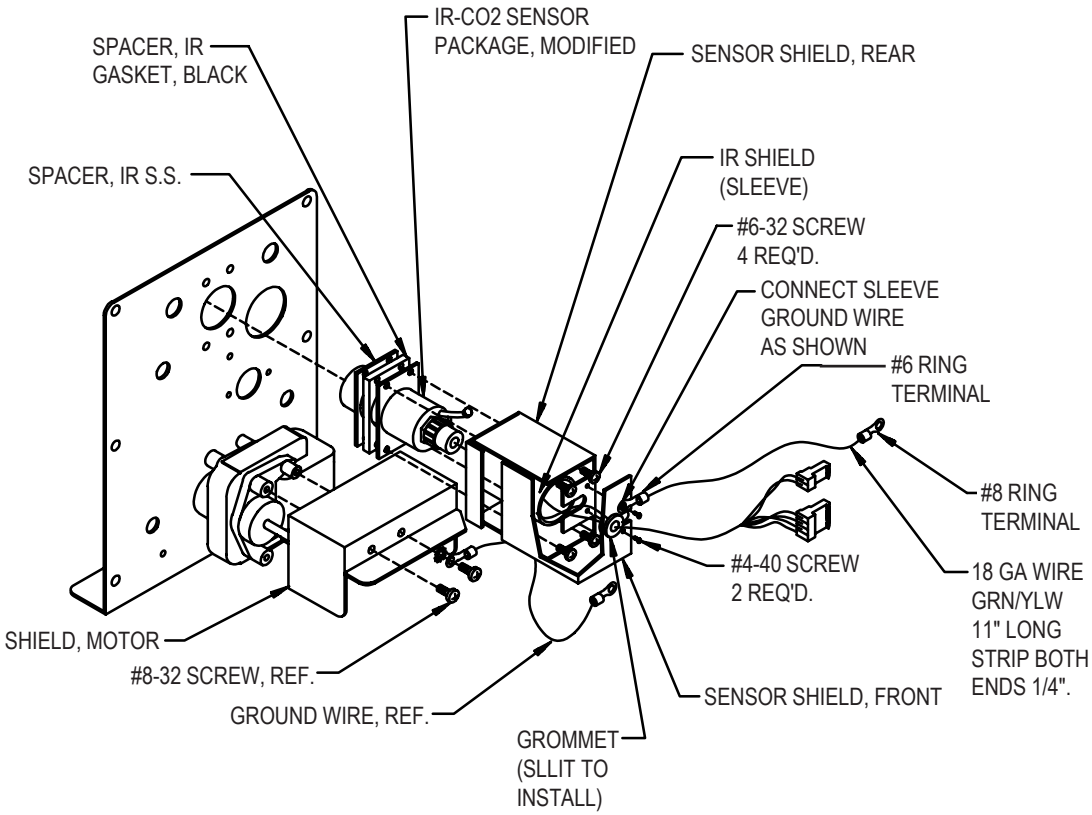


WIRING DIAGRAMS 100 & 115 VAC
(-0 -2)

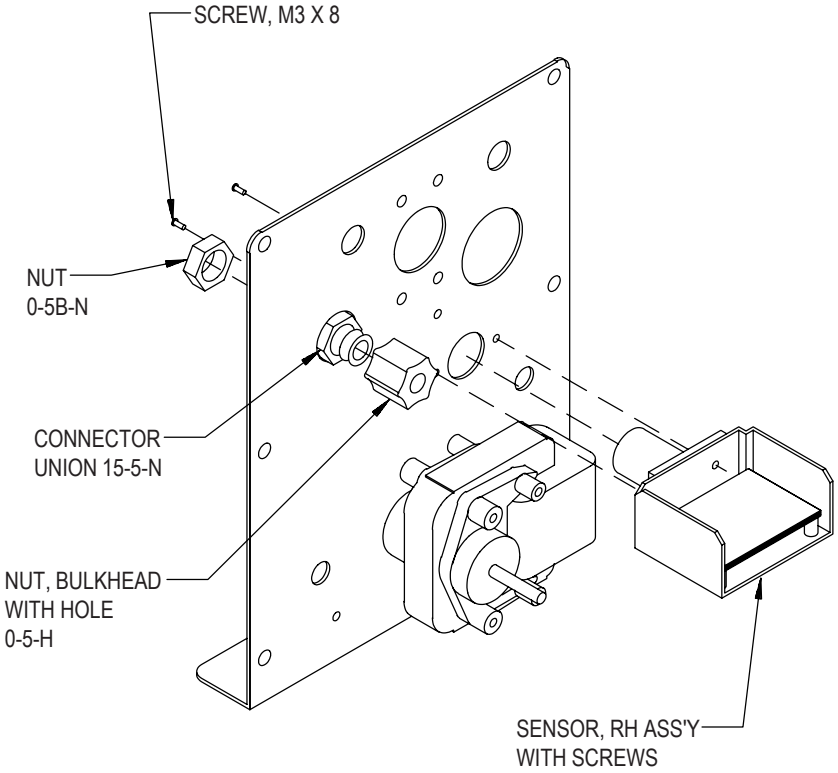
G:\NAPCO\CO2\00391618.PRT



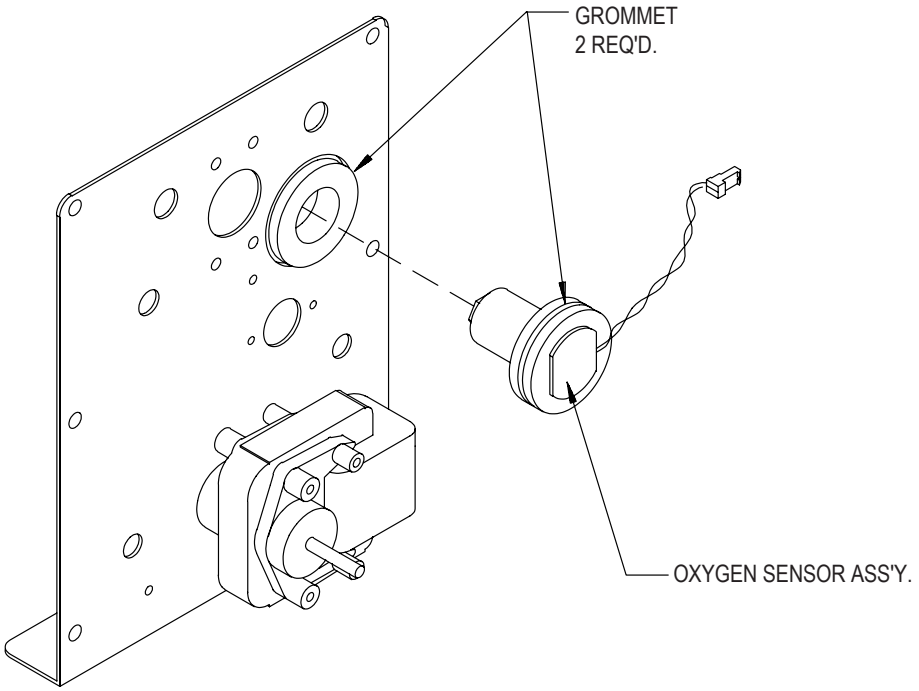
TC CO2 SENSOR ASSEMBLY



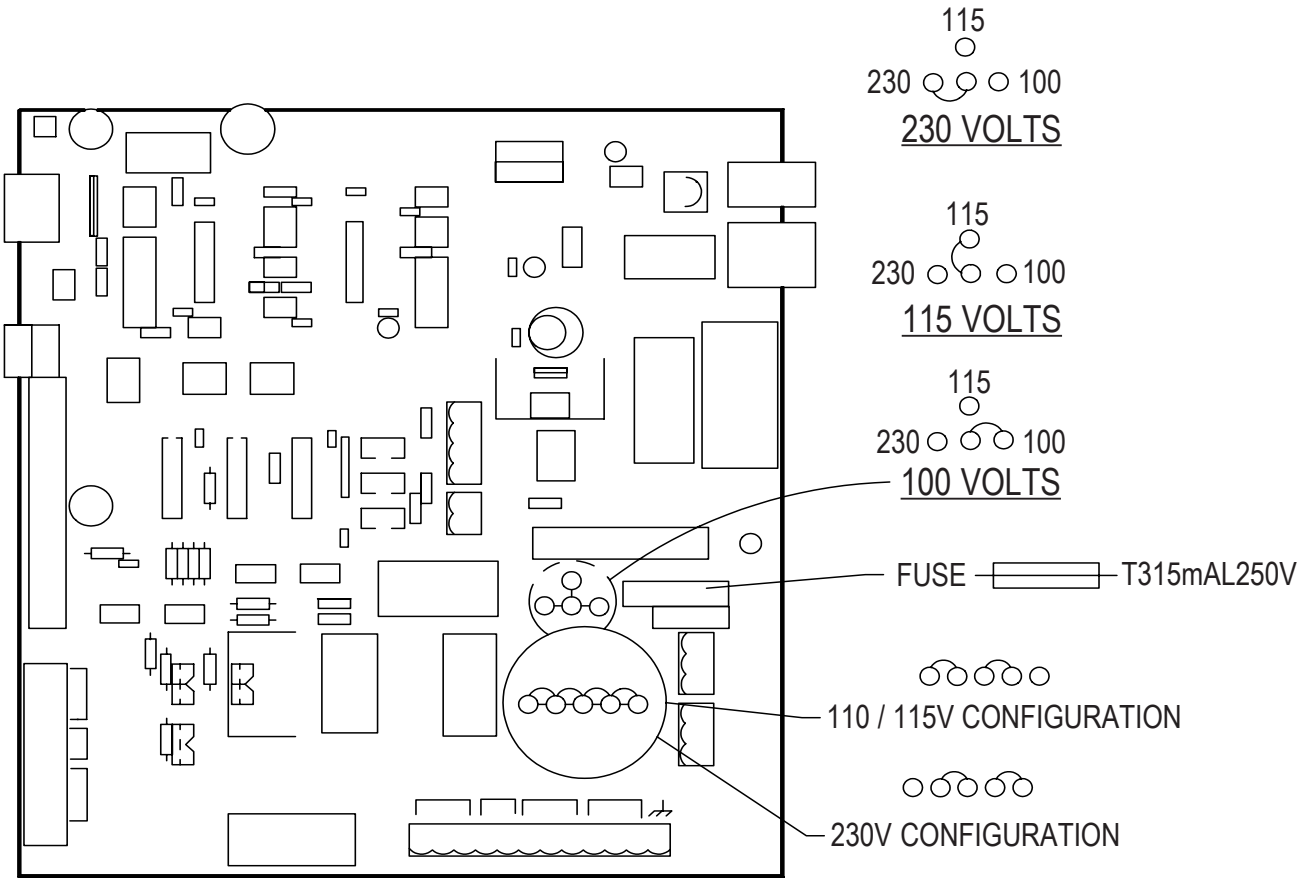
IR CO2 SENSOR ASSEMBLY OPTIONAL



RH SENSOR ASSEMBLY
OPTIONAL



OXYGEN SENSOR ASSEMBLY
7000 SERIES ONLY

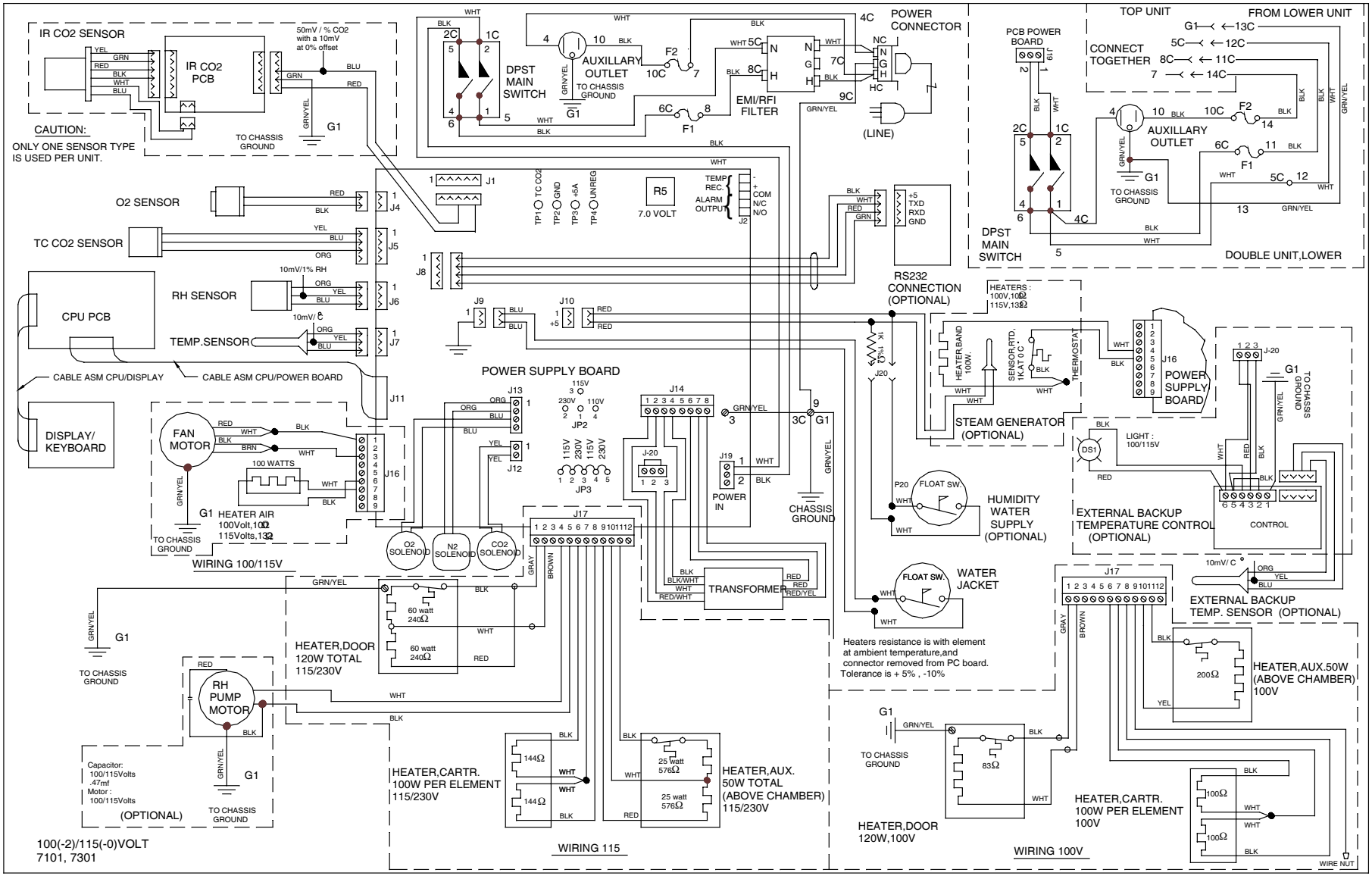


PCB POWER BOARD JUMPERS

CAUTION:

JUMPERS JP1 AND JP2 ON POWER BOARD MUST BE SET FOR CORRECT LINE VOLTAGE OR DAMAGE TO THE ELECTRICAL CIRCUIT COULD RESULT.

POWER SUPPLY PCB
LINE VOLTAGE JUMPERS



100(-2) / 115(-0) VOLT
7101,7301

THERMO ELECTRON CORPORATION STANDARD PRODUCT WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period.

During the first year, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. Installation and calibration are not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment. At Thermo's option, all non-conforming parts must be returned to Thermo Electron Corporation postage paid and replacement parts are shipped FOB destination.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

If equipment service is required, please call your Technical Services Office at 1-888-213-1790 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special application. Outside the USA, contact your local distributor for warranty information.

ISO 9001 REGISTERED

Rev. 2 1/03