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Precision Scientific

Service Manual and Replacement Parts List

NAPCO®
Computer Controlled Incubators
Version 5

Models
7100 and 7300

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INTRODUCTION

This manual covers Models 7100/7300 manufactured after August 1988. Most information will be correct for Models manufactured previous to this date. If there is a difference, it will be so noted in the context of this manual.

This manual is divided into 3 basic parts. Part one (1) deals with the description of system operation, trouble-shooting the system, and test procedures.

Part two (2) deals with removal/replacement procedures, and replacement parts lists.

Part three (3) offers illustrations, figures, and schematics for trouble-shooting the incubator.

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PART 1.

DESCRIPTION OF SYSTEM OPERATION

TROUBLESHOOTING

TEST PROCEDURES

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1. DESCRIPTION OF SYSTEM OPERATION

The 7000 series incubators incorporate computer-compatible, microprocessor based control systems in a modular chassis design. All parameters for each chamber can be programmed independently through the touch-pad, membrane control panel. The incubator is completely automatic, easy to maintain and service in your laboratory. The following is a description of the system and how it operates.

The control systems are housed in a slide-in control panel for easy access. Most troubleshooting procedures of this system can be carried out with the control housing cover removed and the control panel pulled to the "Service Position." All electrical wires are identified and referenced to terminal connections in accordance with the schematic diagrams. All components and tubing connections (with the exception of those mounted on the motor plate for the 7300 lower chamber) can also be examined. The shelves, shelf support panels, and blower ducts are easy to remove from the chambers for cleaning. With these assemblies removed, the chamber walls can be cleaned without interference. There are no hard-to-clean areas.

Each water jacket chamber is manufactured individually and mounted into the incubator chassis, allowing easy removal and replacement of a damaged chamber. The chamber modules have been conveniently fitted with a combination fill/siphon port so the water jackets can be filled or emptied with the same hose connection. The water in the jacket maintains a constant temperature source surrounding the chamber, enhancing the incubator's ability to provide a uniform temperature throughout the chamber.

All environmental parameters in the incubator's chambers are monitored and regulated by microprocessor-based electronic controls. All sensors are located on the motor plate of each individual chamber, as are the gas injection ports, air heaters, and humidity generators. The close proximity of the sensors to the control devices permits the system to maintain precise control over the chamber environment and efficient recovery of the environment after the door is opened.

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Temperature control is achieved by means of a temperature sensor located on the motor plate, which monitors the chamber temperature. The control circuits provide proportional control to the heaters, thereby eliminating temperature overshoot. A second temperature sensor also monitors the chamber temperature, which is connected to a backup temperature control. In the unlikely event the main temperature control circuit fails, and tries to heat the chamber continuously, the backup temperature control will remove power from the chamber heaters, thus eliminating a run away temperature condition. When set properly, the backup temperature control can easily limit the maximum chamber temperature to within +0.5° C. of the setpoint entered in the main control.

The unit is equipped with heated exterior doors which remove the condensation from the inner glass doors. This feature enables laboratory personnel to make a visual check of the incubator's contents without disturbing the incubator atmosphere. The door heaters are controlled by the same circuitry that controls the chamber heaters.

There are three (3) heaters for each chamber, consisting of two (2) cartridge heaters located in the bottom of the water-jacket, directly heating the water, and one (1) air heater mounted to the fan motor plate. The air heater extends into the area enclosed by the fan blower duct at the top of each chamber, which heats the atmosphere within the chamber. The circulating fan moves the air across the air heater and behind the left shelf support, then enters the chamber at the bottom.

The CO_2 percentage in each chamber is maintained independently by the electronic controls and a thermo-conductivity type CO_2 sensor. The CO_2 sensor consists of a matched set of thermistor beads operating at an elevated temperature. One side of the sensor (reference section) is hermetically sealed, and senses only the chamber temperature. The other side is exposed to both chamber temperature and atmosphere.

When CO_2 is introduced into the chamber, the CO_2 has an insulating affect on the exposed section of the sensor. This causes the exposed thermistor temperature to increase, causing a voltage imbalance between the reference and sensing sections, which is compared by the analog circuitry.

If the CO_2 level sensed is below setpoint, the control circuit will proportionally control the CO_2 solenoid valve, and meter small amounts of CO_2 into the chamber, as required. Proportional control accounts for less deviation in the amount of CO_2 fluctuation within the chamber.

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Normally, CO_2 levels are affected by changes in relative humidity, when using a thermo conductivity type CO_2 sensor. The 7000 series incubators are able to compensate for changes in relative humidity (as well as changes in oxygen) by means of hardware and software. By monitoring the relative humidity and oxygen sensors, the software can compensate the CO_2 display to provide a correct reading, thus eliminating re-calibration normally necessary when changing to a different operating relative humidity level.

Oxygen (O_2) levels can also be controlled from ambient (20.8%) down to 3% when an O_2 sensor is installed. The O_2 sensor is a chemical-reaction type device, sensing the chamber atmosphere. When the O_2 level sensed is above the setpoint, nitrogen (N_2) is proportioned into the chamber, through the N_2 solenoid valve, until the correct O_2 level is achieved.

Relative humidity is controlled by using a solid state type relative humidity sensor mounted on the motor plate, the control circuit, and a steam generator. The sensor monitors the relative humidity level within the chamber. The steam generator is a small heated chamber. The steam generator has a small heater wrapped around the outside of the chamber, which when idle, receives a pulsed signal, supplying about 33% power.

When the relative humidity level drops below setpoint, the control circuit applies power proportionally to the relative humidity pump, as well as the steam generator, applying 100% power to the steam generator. When water from the pump enters the steam generator, it is immediately vaporized and injected into the chamber, thus raising the relative humidity level within the chamber.

Once the relative humidity setpoint is achieved, power is removed from the pump, and 33% power (duty cycle) is returned to the steam generator.

7000 series incubators are equipped with a serial (RS232) and parallel (CENTRONICS) type communication ports. This allows connection to a remote terminal, computer, or modem to the serial port, or a printer to the parallel port. This allows remote monitoring of the incubator, with hard copy capability.

The controls have a built-in diagnostics feature which, when used with a peripheral device such as a printer, checks the control circuits and hardware, and prints a list of items tested, and lists whether or not the item passes or fails the test(s).

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2. TROUBLE-SHOOTING THE INCUBATOR SYSTEM

SYMPTOM	CAUSE
1. Too much condensation on glass door	1. Door heater(s) faulty; see section 14. 2. Low or no voltage: check connections and wiring to solid state relay(s); see section 27. 3. Fuse blown; see section 5. 4. Solid state relay defective; see section 27.
2. CO_2 not regulating	1. Check if CO_2 supply tank is empty. 2. Check CO_2 tubing for leaks, kinks, bends, or bad connections. 3. Check CO_2 solenoid; see section 17. 4. Defective analog board; see section 8. 5. + and/or - 12 volt supply to analog board not adjusted properly; see section 21. 6. CO_2 sensor defective; see section 31.
3. Displays not lighted	1. Power supply not adjusted properly or defective power supply; see section 21.

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4. Displays show random data.	1. Run diagnostic and visually check displays during test. 2. Cable to display board not connected. 3. Address select jumper on display board incorrect. (J-1 or J-2); see section 9. 4. Power supply not adjusted properly or defective power supply; see section 21. 5. Defective display board; see section 9. 6. CPU board defective; see section 10.
5. Fan fault light on.	1. Fan motor; see section 15. 2. Fan fault sensor not aligned properly with motor shaft; reflective tubing not on motor shaft; see section 29. 3. Fan fault sensor defective; see section 29. 4. Analog board defective; see section 8.
6. Gas Press warning light on but N_2 and CO_2 supply pressures from tanks OK.	1. Check N_2 and CO_2 supply tubing for bends, kinks, or clogged filter. 2. Gas pressure sensors improperly set or defective; see section 23. 3. Gas selection switch in wrong position; see section 22. 4. Analog board defective; see section 8.
7. H_2O Pump not operating	1. Loose connections to pump motor; defective pump motor; see section 19. 2. Solid state relay defective; see section 29. 3. Analog board defective; see section 8.

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8.	No DC power.	1. Check fuse in center of power supply. 2. Check if there is AC power to the AC input terminals of the power supply. 3. Power supply defective; see section 21.
9.	DC voltages below normal.	1. Pull out all circuit boards from the mother board and check if any are loading down the power supply. 2. Check power supply calibration; see section 21.
10.	No AC power.	1. Defective AC power switch. 2. Defective power cord.
11.	Keypad not responding.	1. Cable from keypad disconnected from display board; see section 55, item 5. 2. Keypad defective; see section 4.
12.	O_2 level not regulating.	1. Check N_2 supply tank. 2. Check N_2 tubes for leaks, bends, kinks, or clogged filter. 3. + and/or - 12 volt supply to analog board not adjusted properly; see section 21. 4. O_2 sensor defective; see section 30.

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13.	Relative Humidity low even after calibration.	1. H_2O supply to RH pump depleted. 2. Tubing bent, filter clogged, or clamp on rear of RH pump too tight. 3. Steam generator clogged or defective; see section 20. 4. Analog board defective; see section 8. 5. RH sensor defective; see section 18. 6. Solid state relay defective; see section 27. 7. Limiting thermostat on steam generator is stuck open; see section 20.
14.	Relative Humidity high even after calibration.	1. Excess condensation in chamber causing humidity level to rise. 2. RH sensor defective; see section 18. 3. Analog board defective; see section 8.
15.	RS232 and printer port not functioning	1. Baud rate incorrectly set for RS232 (serial) peripheral device; see operator's manual. 2. Check Printer and RS232 cable connections to mother board. 3. CPU board defective; see section 10.
16.	Temperature above set-point and temperature safety indicator on.	1. Solid state relay defective; see section 27. 2. Defective temperature sensor; see section 28. 3. Defective analog board; see section 8. 4. Defective CPU board; see section 10.

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17.	Temperature in chamber not the same as that displayed.	1. Temperature calibration; see section 3. 2. Check temperature sensor connections. 3. Analog board defective; see section 8. 4. Temperature sensor defective; see section 28.
18.	Temperature too low.	1. Overtemperature control set below temperature setpoint; see operator's manual. 2. Heating element(s) defective; see section 13. 3. Solid state relay defective; see section 27.
19.	Low H_2O indicator LED on and chamber known to be full. Low H_2O LED off and chamber known to be low on water.	1. Float switch defective; see section 25.

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3. CALIBRATION

The calibration function is used to adjust the CO_2, O_2, temperature and relative humidity readings. Read this section carefully before attempting to calibrate the unit. Follow this procedure for the most accurate calibration. CO_2 must be calibrated last for the most accuracy. IT IS ASSUMED THAT THE FOLLOWING SETPOINTS WERE SET INITIALLY; CO_2 = 00.0%, O_2 = 00.0%, Temperature = 37.0° C., R.H. = 00.0%.

Prior to calibration, the CO_2 and N_2 supplies should be shut off and the chamber door opened for 2 minutes. Place an accurate thermometer in the center of the chamber so it can be read with the glass door closed. Now the door must be CLOSED for minimum of one (1) hour before performing the calibration procedure. NOTE: IF THE INCUBATOR IS BEING OPERATED FOR THE FIRST TIME OR HAS BEEN OUT OF SERVICE FOR SOMETIME, THEN THE INCUBATOR TEMPERATURE AND HUMIDITY MUST HAVE A CHANCE TO STABILIZE. IT IS RECOMMENDED THE UNIT BE IN OPERATION FOR ABOUT 24 HOURS BEFORE ATTEMPTING CALIBRATION.

TEMPERATURE CALIBRATION

1. An accurate thermometer should have been placed in the center of each incubator chamber previously. Read the thermometer and compare it with the temperature display. If the display and the thermometer readings disagree, press the <CALIB> button until the "° C." indicator blinks. Enter the thermometer reading into the keyboard. For example, if the thermometer reads 35.5° C., and the display read 37.0° C. (the reading before <CALIB> was pressed), enter 35.5 by pressing the <3>, <5>, and <5> buttons. Press the <ENTER> button to enter the new calibration value into memory. NOTE: AFTER PRESSING THE CALIBRATION BUTTON, YOU HAVE 15 SECONDS TO ENTER THE CALIBRATION VALUE. IF YOU WAIT LONGER THAN 15 SECONDS, YOU WILL NEED TO PRESS <CALIB> AGAIN.

2. Allow the incubator to stabilize for a minimum of one (1) hour and check the temperature readings. Re-calibrate if necessary.

WARNING

HANDLE MERCURY THERMOMETERS WITH THE UTMOST CARE. MINUTE AMOUNTS OF MERCURY IN THE INCUBATOR FROM A BROKEN THERMOMETER MAY CAUSE DAMAGE TO THE CHAMBER BY ELECTROLYSIS, AS WELL AS CREATING A TOXIC ENVIRONMENT WITHIN THE CHAMBER, RENDERING THE INCUBATOR USELESS.

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RELATIVE HUMIDITY CALIBRATION

A printer and/or terminal connected to the incubator is necessary for proper calibration of the relative humidity, unless you have an accurate way of measuring relative humidity. The relative humidity sensor is extremely accurate, once calibrated. Perform the following steps only after the temperature has been calibrated and stabilized.

1. Press <SETPOINT>, until the "% RH" indicator blinks. Enter the desired RH SETPOINT into the keypad and press <ENTER>. Allow the unit to stabilize for a minimum of one (1) hour. Repeat for the other chamber.

2. Press the <DIAG> button. The diagnostics parameters will be sent to the printer and/or terminal. The incubator will perform its diagnostics function as well, which takes about two (2) minutes.

3. Read the "OFFSET" value. This will be the FOURTH item on the terminal or printout and the SIXTH column. (Refer to page 13 for a sample printout.) Take note of this value.

4. When the diagnostics function is complete, two (2) dashes (--) will be displayed in the upper left display. Press the <+/-> button on the keypad. All displays will re-appear within about 10 seconds.

5. Now back to the offset value. The ideal offset value should be +002.0. If the offset value is correct, then Relative Humidity calibration is complete. If the value read from the terminal or Printer was different, then calibration is necessary.

6. We will give you an example. If the offset reading from the printer read -009.5, then a correction factor of +011.5 would be necessary. To enter this value, press <CALIB> until the "% RH" indicator blinks. Add +011.5 to the "% RH" reading ON THE DIGITAL DISPLAY FOR "% RH". In our example we will use 85.0%. (85.0 + 11.5 = 96.5.) Enter 96.5 by pressing the <9>,<6>, and <5> buttons. Press the <ENTER> button to enter the new calibration value into memory. Be sure to repeat for the other chamber.

NOTE: PRESS <DIAG>. CHECK THE RH OFFSET VALUES. THEY SHOULD NOW BE +002.0. IF NOT, RE-CALIBRATE AS NECESSARY. PRESS <+/-> TO EXIT THE DIAGNOSTICS. (OR WAIT 15 SECONDS, DIAGNOSTICS WILL EXIT ITSELF.)

This concludes relative humidity calibration procedure.

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TIME 12:00 DATE 01/01

LOWER CHAMBER DIAGNOSTICS

NO.	FUNC.	ANA. INPUT	LIMIT	P/F	OFFSET
1	$\%CO_2$	-03.8			008.8
2	dC	39.5			-002.5
3	$\%O_2$	24.9			0.800
4	%RH	88.0			002.0
5	REF	2.31	1.9 TO 2.7	P	
6	SEN	2.26	1.9 TO 2.7	P	
7	FAN	3.63	>3.0	P	
8	+5V DIG	5.04	4.8 TO 5.2	P	
9	+5V ANA	5.03	4.90 TO 5.10	P	
10	-5V ANA	- 5.00	-4.90 TO -5.10	P	
11	+12V	12.04	11.7 TO 12.3	P	
12	-12V	-12.04	-11.7 TO -12.30	P	
13	CO_2	0.80	0.5 TO 1.3	P	
		12.08	>10.5	P	
14	H REG	0.72	0.5 TO 1.3	P	
		11.07	>10.5	P	
15	DEHUMID	0.73	0.5 TO 1.3	P	
		11.04	>10.5	P	
16	N_2	0.81	0.5 TO 1.3	P	
		12.07	>10.5	P	
17	S GEN	0.73	0.5 TO 1.3	P	
		11.09	>10.5	P	
18	PUMP	0.72	0.5 TO 1.3	P	
		11.04	>10.5	P	
19	ALM REL	11.87	>10.5	P	
		0.78	0.5 TO 1.3	P	

DIAGNOSTICS PRINTOUT SAMPLE

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O_2 CALIBRATION

1. Once the temperature and relative humidity has been calibrated, the O_2 may be calibrated. This can be calibrated at ambient O_2 levels, which is known to be 20.8%.

2. If the displayed value is not 20.8%, press <CALIB>, until the "%O_2" indicator blinks. Enter 20.8% into the keypad and press <ENTER>.

3. The O_2 sensor has a limited operating life, and must be replaced periodically. It is recommended the O_2 calibration be checked often.

CO_2 CALIBRATION

1. Press <CALIB>, until the "% CO_2" indicator blinks. Enter 00.0 into the keypad and press <ENTER>. This will "ZERO" the display.

2. Turn the CO_2 supply ON. Press <SETPOINT>, until the "% CO_2" indicator blinks. Enter the desired CO_2 level into the keypad and press <ENTER>. Allow the unit to stabilize for a minimum of one (1) hour. Take a gas sample, from the "Gas Sample Port" with your CO_2 sampling instrument. The displayed reading and the actual reading from your CO_2 sampling instrument should agree. If not, press <CALIB>, until the "% CO_2" indicator blinks. Enter the reading obtained from your CO_2 measuring instrument into the keypad and press <ENTER>. This concludes the CO_2 calibration.

3. If the relative humidity or O_2 levels change for any reason, the control circuitry will compensate for this change and maintain a constant CO_2 level. This eliminates the need to re-calibrate the CO_2, when changing to other relative humidity or O_2 levels.

GAS SAMPLES

Gas samples are taken with a suitable sampling instrument ("Bacharach Fyrite" or Blood Gas Analyzer for example) through the gas sample ports, located on the control panel.

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4. DIAGNOSTICS

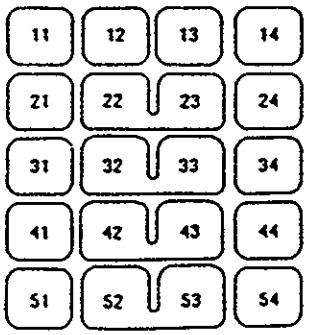
The diagnostics function is used to perform a series of on board tests to help troubleshoot problems associated with the incubator. If the incubator is connected to a modem, the diagnostics information can be sent to NAPCO Technicians which will allow them to study the problem and reply back to the customer with a remedy. The diagnostics information can also be sent to a printer for hard copy information.

1. Pressing <DIAG> starts the routine. All displays will go blank for about thirty seconds while the diagnostics checks the analog voltage levels and compares them to the voltage limits. A pass or fail condition will be indicated. Next the display board indicators will be tested one at a time. This will alert you of any LED'S that may have failed. This part of the test is relatively quick; observe the LED's closely.

2. Finally, when all the indicators have been tested, two (2) dashes (--) will be displayed in the upper left display. This alerts the operator to either test the key pad or bypass this operation. NOTE: AS SOON AS THE DASHES (--) APPEAR, YOU HAVE 15 SECONDS TO BEGIN THIS TEST. To test the keypad, press any button (except the <+/-> button) and observe the number on the display. It should correspond to the numbers shown below. However, if pressing the <ENTER> button (for example) does not display 51, then that button may be defective and servicing of the keypad may be necessary.

3. To exit the diagnostics or to bypass the keypad check, press the <+/-> button. All displays will return within ten (10) seconds. If you do not press the <+/-> button, DIAGNOSTICS will exit itself 15 seconds after the last button pressed.

4. It is important to exit the diagnostics testing quickly in order to maintain the previous SETPOINTS entered. This is extremely important if an experiment is being conducted in the chamber during diagnostics testing. NAPCO SCIENTIFIC CO. strongly recommends removing any experiment from the chamber when servicing is required.



KEYPAD NUMBER REFERENCE

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DIAGNOSTICS PRINTOUT

When a printer and/or terminal is connected to the incubator and Diagnostics is activated, a printout will be provided showing the present sensor readings, as well as various voltage levels.

Refer to the sample printout on page 13. The first row shows the time and date of diagnostics printout.

The second row shows which chamber the printout refers to. (Model 7300 only. Model 7100 does not print on this row.)

The third row shows column headings for ROW NUMBER, FUNCTION, ANALOG INPUT, LIMITS, PASS/FAIL, and OFFSET.

ROW NUMBER is used only as a reference point.

FUNCTION refers to the parameter being monitored.

ANALOG INPUT refers to analog voltages measured by the Diagnostics function.

LIMIT refers to the voltage limits allowed for that parameter. Limit does not function for item numbers one (1) through four (4).

P/F (PASS/FAIL) indicates whether or not a particular parameter is within the specified limits. P/F does not function for item numbers one (1) through four (4).

OFFSET refers to the amount of correction necessary to offset differences in measured values at a particular location or by a particular sensor, and the actual values measured within the incubator chamber.

Refer to the following items by ROW NUMBER.

Item No. one (1) refers to carbon dioxide (CO_2). The analog input is the measured value from the CO_2 sensor. The DISPLAYED value on the incubator control panel is the difference between ANALOG input value and the OFFSET value. The offset value for CO_2 is not critical, although a very high or very low reading (+ or - 070.0 or greater) may indicate a problem with either calibration or the CO_2 sensor.

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Item No. two (2) refers to temperature in Degrees C. The analog input is the measured value from the temperature sensor. The DISPLAYED value on the incubator control panel is the ANALOG input value, minus (-) the OFFSET value. Normally the offset value is about -002.5, but may vary due to the degree of accuracy during temperature calibration.

Item No. three (3) refers to Oxygen (O_2). The analog input is the measured value from the O_2 sensor. The DISPLAYED value on the incubator control panel is the ANALOG input value x the OFFSET value. For O_2, the offset value is actually a GAIN FACTOR. Normally the GAIN FACTOR is about 0.800 for a fresh O_2 sensor. As the useful life of the O_2 sensor is depleted, the GAIN FACTOR must be increased to compensate for the change. When the GAIN FACTOR $\geq$ 1.500, the O_2 sensor should be replaced. At this time, the O_2 sensor indicator on the control panel will illuminate.

Item No. four (4) refers to relative humidity (RH). The analog input is the measured value from the RH sensor. The DISPLAYED value on the incubator control panel is the ANALOG input value, plus (+) the OFFSET value. Normally the offset value is about 002.0, but may vary due to the degree of accuracy during relative humidity calibration.

Items No. five (5) and six (6) refer to the analog voltages measured at the CO_2 sensor, <u>at operating temperature</u>, with reference to analog ground. The values must fall within the limits of 1.9 to 2.7 volts. If the values are not met (indicated by a FAIL indication), then servicing is required.

Item No. seven (7) refers to the analog voltage measured at the fan motor sensor. If the fan motor does not turn fast enough, the sensor voltage will drop below 3.0 volts and activate the fan fault display and alarm. Again, if the proper values are not met, then servicing is required.

Items No. eight (8) through 12 refer to the various voltages necessary to operate the controls. Voltages are produced by a multiple output linear power supply. Items nine (9) and ten (10) (+ and -5 volts analog board supply) are actually derived from the + and -12 volt supply. The analog board has it's own voltage regulators adjusted at + and -5 volts.

Items No. 13 through 19 refer to various voltages necessary to either turn on (voltage goes high) or turn off (voltage goes low) various controls such as gas solenoid valves (items 13 and 16), solid state relays for heaters and pumps (items 14, 15, 17, 18), and alarm relays (item 19).

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NOTE

VOLTAGE AND RESISTANCE MEASUREMENTS ARE TAKEN ACROSS THE PART UNDER TEST. ALWAYS REMOVE POWER CORD FROM ELECTRICAL OUTLET WHEN REMOVING A WIRE FOR TESTS. NEVER MAKE A RESISTANCE/CONTINUITY MEASUREMENT WHILE UNIT IS PLUGGED INTO ELECTRICAL OUTLET. REFER TO ENCLOSED SCHEMATICS AND ILLUSTRATIONS TO AID IN TESTS.

5. FUSES

Fuses are located on the component platform inside the control housing. The position of each fuse is referenced from the back of the control housing. The table below shows the rating and purpose of each fuse.

MODEL 7100

FUSE POSITION	PURPOSE	RATING
1	NOT USED	-
2	R.H. PUMP	1A/250V
3	NOT USED	-
4	STEAM GENERATOR	2A/250V
5	NOT USED	-
6	HEATERS	5A/250V
7	NOT USED	-

MODEL 7300

FUSE POSITION	PURPOSE	RATING
1	NOT USED	-
2	R.H. PUMP (UPPER)	1A/250V
3	R.H. PUMP (LOWER)	1A/250V
4	STEAM GENERATOR (UPPER)	2A/250V
5	STEAM GENERATOR (LOWER)	2A/250V
6	HEATERS (UPPER)	5A/250V
7	HEATERS (LOWER)	5A/250V

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In addition, there is one fuse located near the back of the power supply. See Fig. 3. This fuse is rated at two (2) amps. All fuses should be rated MINIMUM 250 VOLT.

When encountering a condition where there is a lack of power, always check the fuses first for an open condition. The fuses may be checked visually. If in doubt, check with an ohm-meter.

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6. PRINTED CIRCUIT BOARDS

The printed circuit boards are located in the card cage on the control panel. The boards plug into a mother board. The positioning of each board is critical, that is you can not plug the boards into a slot at random. They must be plugged into particular slots. The position of each printed circuit board is referenced from the back of the control housing. Refer to Fig. 4 in the illustration section of this manual. The boards are arranged in the following manner:

MODEL 7100

BOARD POSITION	CIRCUIT BOARD DESCRIPTION
1	NOT USED
2	ANALOG CIRCUIT BOARD
3	I/O CIRCUIT BOARD
4	CPU CIRCUIT BOARD
5	NOT USED
6	NOT USED
7	NOT USED
8	DIGITAL DISPLAY CIRCUIT BOARD

MODEL 7300

BOARD POSITION	CIRCUIT BOARD DESCRIPTION
1	ANALOG CIRCUIT BOARD (UPPER CHAMBER)
2	ANALOG CIRCUIT BOARD (LOWER CHAMBER)
3	I/O CIRCUIT BOARD
4	CPU CIRCUIT BOARD
5	NOT USED
6	NOT USED
7	CONNECTION TO UPPER DISPLAY BOARD
8	LOWER DISPLAY CIRCUIT BOARD

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7. MOTHER BOARD

The mother board supplies power to the circuit boards, as well as providing the bus between circuit boards. Refer to Fig. 5 in the illustration section of this manual. The terminal block at the back of the board is the power input, as provided by the power supply. Terminals one (1) and three (3) are ground. Terminal two (2) is +5 volts. Terminal four (4) is -12 volts. Terminal five (5) is +12 volts.

The two (2) connectors located at the middle back of the mother board are for connection to peripheral devices. The Parallel (CENTRONICS) connector is located closest to the edge of the board. The Serial (RS232) connector is located next to the Parallel connector. The cables that connect here lead to the rear of the control housing, and terminate into two (2) DB-25 connectors.

Servicing of the mother board is not normal. In fact, if you suspect a defective mother board, contact the NAPCO Scientific Technical service department for specific instructions.

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8. ANALOG CIRCUIT BOARD

The analog circuit board receives input from various sensing devices, processes the appropriate signals into information the CPU can understand, which in turn sends information back to the analog board, and allows controlling of various devices, such as, but not limited to, heaters, solenoid valves, pumps, etc. (Processing between the analog and CPU board is achieved through the I/O board.) In addition the analog board samples the chamber operating conditions, which allows the monitoring of various parameters.

Refer to Figs. 6 and 7 in the illustration section of this manual. The connectors located across the top of the analog circuit board are for the analog input and output lines. Connector P-1 provides output for the Heater, Steam Generator, Relative Humidity Pump, CO_2, N_2, and optional De-humidifier functions. (De-humidifier no longer available.)

Connector P-2 interfaces with the Float Switch(es) for the water jacket level, Gas Pressure Switches to monitor the CO_2 and N_2 supplies, the alarm relay(s) to allow remote monitoring, and RH Float switch. The RH Float switch is provided with the optional Relative Humidity reservoir supplied by NAPCO, which monitors the RH water supply.

Connector P-3 interfaces with the sensor inputs from the Temperature, CO_2, O_2, RH, and Fan Fault sensors.

The analog circuit boards must be configured for operation with their respective Models and chamber designations, yielding a total of three (3) configurations. They are Model 7100, Model 7300 UPPER CHAMBER, and Model 7300 LOWER CHAMBER. The circuits boards are configured by selecting DIP switch and JUMPER BLOCK positions. See Fig. 7 for proper selection.

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ANALOG BOARD CALIBRATION

Normally, the analog circuit board will not require calibration, as it is calibrated at the factory. However, the following routine is provided as a reference. Refer to Figs. 6 and 7 in the illustration section of this manual. This routine must be followed exactly for optimum results. The power supply must be adjusted properly before adjusting the analog board(s). Refer to the power supply section for more details.

1. Disconnect the analog cables from P-1, P-2, and P-3. If the audible alarm sounds at this time, press the <1> and <2> buttons simultaneously to silence the alarm for up to one (1) hour.

2. Connect a voltmeter across TP-3 (analog ground) and TP-1.

3. Adjust R-57 for +5.0 Volts.

4. Connect voltmeter across TP-3 (analog ground) and TP-2.

5. Adjust R-56 for -5.0 Volts.

6. Connect voltmeter across TP-3 (analog ground) and IC-12 pin 36.

7. Adjust R-55 for 1.024 Volts. This is a reference voltage.

8. Short connector P-3 pins 25 to 26. Observe the O_2 digital display.

9. Adjust R-61 for "00.0" on the O_2 display.

10. Remove short from junction.

11. Short connector P-3 pins 12 to 13. Connect this junction to P-3 pin 11 with a 50 ohm resistor. Connect voltmeter across TP-3 and IC-17 pin 8.

12. Adjust R-60 for 00.0 Volts. This is for the CO_2 function.

13. Remove short and resistor from junction.

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14. Connect the analog sensor cable to P-3. A CO_2 sensor must be installed for this adjustment.

15. Connect voltmeter across P-3 pins 11 and 12.

16. Adjust R-58 for 2.1 Volts at 37.0 °C. chamber temperature. Voltage can alternately be set for 2.4 Volts at 25.0 °C. chamber temperature.

17. Re-connect analog cables to P-1 and P-2.

18. For model 7300, repeat above procedure for other analog board. The lower chamber analog board does not have a cable connected to P-2.

19. If the above conditions can not be met, replace analog board. Refer to section 52 for analog board replacement.

9. DIGITAL DISPLAY BOARD

The digital display board shows the operating conditions, as well as all other visual indications. The digital display board must be configured for operation with the chamber it is monitoring by means of jumpers located on the back of the board. Refer to Figs. 8 and 9 in the illustration section of this manual. There are no other adjustments to this board. The diagnostics function can be run to see if any LED's or segments might be defective. Refer to section 55 for digital board replacement.

10. CPU BOARD

The CPU (central processing unit) board contains an Intel 8088 microprocessor, as well as three (3) EPROM (erasable programmable read only memory) devices. This essentially is the brain of the system. The start-up routine is stored in the EPROM devices, as well as the default values. There are no adjustments that can be made to the CPU board, other than changing the EPROM devices for a software revision. Refer to section 53 for CPU board replacement.

11. I/O BOARD

The I/O (input/output) board basically communicates information between the CPU board and the analog board(s), as well as providing communications for the RS232 and Parallel ports. There are no adjustments that can be made to this board. Refer to section 54 for I/O board replacement.

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12. BACKUP TEMPERATURE CONTROL

The backup temperature control is wired in series with the primary temperature control. It's purpose is to prevent the incubator chamber temperature from exceeding a safe limit. When properly adjusted, the control can limit the maximum operating temperature well within +0.5° C. of the primary setpoint. It can not be over-stressed the importance of properly setting this control. This will help prevent the destruction of an experiment due to a failure with the primary temperature control circuit.

The backup temperature control has an independent sensor for monitoring the chamber temperature, which is located next to the primary temperature sensor. The relay on the control is configured to be energized in order for the incubator to heat. This configuration adds a margin of safety, in the unlikely event of a relay coil failure, transformer failure, or sensor failure. In either of the above mentioned failure modes, power will be removed from the heaters. When the backup control is over-riding the primary controls, a neon indicator will illuminate, directly above the temperature adjustment screw for the control.

Refer to Fig. 10 in the illustration section of this manual. Looking at the back of the control, the terminal block labeled P-1 is the power input/output. Terminal one (1) is ground, terminal two (2) is relay contact "COMMON". Terminal three (3) is relay contact "NO", terminal four (4) is relay contact terminal "NC". Terminal five (5) is the "HOT" power terminal, terminal six (6) is "neutral" (or common) power terminal. Connector P-2 is for the temperature sensor. Connectors P-3 and P-4 are not used.

To test the backup temperature control:

1. With power at P-1-2 and P-1-6, turn the adjustment screw on the front panel clockwise until the neon indicator is off. The relay coil should be energized, allowing power to flow to P-1-3, thus supplying power to the solid state relay for the heaters.

2. Turn the adjustment screw counter-clockwise until the neon indicator illuminates. At this time the relay coil should be de-energized, removing power from P-1-3.

3. If the above specifications are not met, replace the control. Refer to section 51 for backup temperature control replacement.

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13. CHAMBER HEATER

There are three (3)** heaters for each chamber, consisting of two (2) cartridge heaters located in the bottom of the water-jacket, directly heating the water, and one (1) air heater mounted to the fan motor plate, which heats the atmosphere within the chamber. All heaters are rated at 100 watts each, giving a total of 300 watts heat capacity. In addition, the door heaters provide approximately 56 watts (40 watts for 100 volt operation) of additional heat per chamber.

To test the cartridge heaters:

1. To provide access to cartridge heaters, first refer to section 32 for splash cover removal, and remove cover(s).

2. Disconnect the wires at cartridge heater terminals. Measure each heater individually, using an ohmmeter. The following resistance values should be met:

   100 volt heaters: 97 ohms ± 10% (cold resistance)
   120 volt heaters: 140 ohms ± 10% (cold resistance)
   220/240 volt heaters: 570 ohms ± 10% (cold resistance)

3. With cartridge heater wires disconnected, measure resistance from heating element case to one of its wires. Select highest range on ohmmeter . Do not touch test leads with hand. Meter should read infinity. Any reading less than infinity indicates cartridge heater is shorting to ground. Replace faulty cartridge heater. Refer to section 44 for cartridge heater replacement.

To test the air heater(s):

4. Disconnect the wires at heater terminals. For model 7300, fan/motor sensor plate must be dropped down in order to gain access to lower air heater terminals. Measure resistance across air heater terminals. Readings should be the same as for the cartridge heaters shown above.**

5. Next measure between heater sheath and heater terminals. Meter should read infinity.

6. If heater does not meet the above specifications, replace air heater. Refer to section 43 for air heater replacement.

** Units manufactured before September, 1988 did not use cartridge heaters. These units used one (1) air heater rated at 350 watts. The resistance values should be 26 Ohms (100 Volt), 40 Ohms (120 Volt), and 135 Ohms (220 Volt).

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14. DOOR HEATER

There are two (2) door heaters inside each door, attached to the door liner. Each heater has two sections. Each section is rated at approximately 14 watts. This yields approximately 56 watts per door. (40 watts for 100 volt operation). The door heater is controlled by the air heater circuit. When air heater is on, the door heater is on. The door heater eliminates a majority of the moisture on the glass door. The heaters are connected in a parallel connection for 100/120 volt operation, or series-parallel for 220/240 volt operation.

To test the door heater:

1. Disconnect the door heater wires at their wire-nut connection in the control housing. (For Model 7300 lower door, remove upper splash cover and disconnect wires for door heater.) Measure between the disconnected heater wires. The following resistance values should be met:

   100/120 volt operation (parallel): 266 ohms ±10%. Measure between the white (or blue) wire and the two (2) black (or brown) wires. Be sure the two (2) black (or brown) wires are twisted together during this test.

   220/240 volt operation (series-parallel): 1063 ohms ±10%. Measure between the two (2) black (or brown) wires. The white (or blue) wire is not connected.

2. If the above values are not met, replace the appropriate door heater. It is highly unlikely to find a defective door heater. Refer to section 45 for door heater replacement.

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15. FAN MOTOR

The fan motor provides circulation of the chamber atmosphere. Refer to Figs. 14, 15, 16 in the illustration section of this manual. The motor is an induction type AC motor, running at line voltage. The rotation of the motor is counter-clockwise as viewed from the top of the motor. The circulation of the atmosphere is vital for proper operation of the incubator. Without proper circulation, poor control of the environment may be experienced, relating to problems with temperature, humidity, and gas regulation.

The motor requires no servicing, as it uses permanently lubricated ball bearings.

If a fan motor fails to operate, try turning the motor shaft. If it is binding, check and make sure the impeller is not forced onto motor shaft too far, or that is binding against the blower duct. Also check for line voltage at the fan motor connector. If voltage is present, disconnect motor and check resistance of coil. If coil is open, replace motor. Refer to section 42 for fan motor replacement.

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16. NITROGEN SOLENOID VALVE

The nitrogen solenoid valves are of the normally closed configuration. Refer to Fig. 11 in the illustration section of this manual. Three (3) types of solenoid valves have been used. The first one is manufactured by CLIPPARD. It is important to maintain a minimum of 20 PSI (1.5 bar) pressure to properly seat this solenoid valve. The second valve is manufactured by Humphery. The third valve is manufactured by Precision Dynamics. The Humphery and Precision Dynamics valves are not susceptible to problems when operated at lower pressures as the CLIPPARD, but the same pressure should be maintained to provide the proper flow rate of N_2 to the chamber. 12 VDC applied to the coil activates (opens) the solenoid valve. The signal is supplied through the Analog printed circuit board.

To test the nitrogen solenoid valve:

1. Disconnect the red wire at the solenoid coil. Connect a wire between the solenoid coil terminal and ground. The valve should be energized at this time. The valve makes an audible click (although not very loud), when energized. Monitor the voltage at the solenoid coil.

2. If the valve does not energize, disconnect both wires at the coil and measure the resistance. The resistance should be approximately 210 ohms (Clippard), 275 ohms (Humphery), or 220 ohms (Precision Dynamics) ±10%. If not, replace the solenoid valve. Refer to section 34 for solenoid valve replacement.

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17. CO_2 SOLENOID VALVE

The CO_2 solenoid valves are of the normally closed configuration. Refer to Fig. 11 in the illustration section of this manual. It is important to maintain a minimum of 20 PSI (1.5 bar) pressure to maintain the proper flow of CO_2 to the chamber. 12 VDC applied to the coil activates (opens) the solenoid valve. The signal is supplied through the analog printed circuit board.

To test the CO_2 valve:

1. Disconnect the black wire at the solenoid coil. Connect a wire between the solenoid coil terminal and ground. The valve should be energized at this time. The valve makes an audible click (although not very loud), when energized. Monitor the voltage at the solenoid coil.

2. If the valve does not energize; disconnect both wires at the coil and measure the resistance. The resistance should be approximately 210 ohms ±10%. If not, replace solenoid valve. Refer to section 34 for solenoid valve replacement.

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18. RELATIVE HUMIDITY SENSOR

The relative humidity sensor is a solid state device working on the principle of capacitance change for a change in relative humidity. The input voltage is +12.0 volts. The output voltage is 0-1.0 VDC, depending on the relative humidity being sensed. Refer to Figs. 12, 14, 15, 16 in the illustration section of this manual.

The input voltage can be measured between pins 21 and 19 on connector P-3 located on the analog circuit board. Refer to Figs. 6 and 7 in the illustration section of this manual. The output voltage can be measured between pins 21 and 23.

Pin 21 = ground. (White/brown wire.)
Pin 19 = +12.0 VDC. (White/red wire.)
Pin 23 = 0-1 VDC. (White/orange wire.)

If the incubator has been calibrated correctly, that is with a +2.00 offset for relative humidity, the reading at pins 21 and 23 should be 20 MV less than the displayed reading for relative humidity. (For example, if the display reads 85.0% relative humidity, this relates to 850 MV. The reading at pins 21 and 23 should be 830 Mv). If not, check the offset value for relative humidity using the diagnostics function. The reason for this offset is to compensate for the slightly higher temperature seen at the placement of the relative humidity sensor. This higher temperature tends to cause the average sensor reading to be 2% (or 20 Mv) lower than the average relative humidity as measured within the working area of the chamber.

The output is directly proportional to the relative humidity being sensed. Remember this value is the raw sensor output, not the offset compensated reading as displayed on the front panel.

If the above values are not met, then replace the relative humidity sensor. Refer to section 40 for relative humidity sensor replacement.

CAUTION

DO NOT ATTEMPT TO CALIBRATE THE POTENTIOMETERS ON THE RELATIVE HUMIDITY SENSOR. THEY ARE FACTORY CALIBRATED. TO DO SO WILL VOID THE WARRANTY.

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19. RELATIVE HUMIDITY PUMP

The relative humidity pump injects a metered quantity of H_2O into the steam generator. The pump receives AC voltage through solid state relay(s). Refer to Fig. 13 in the illustration section of this manual.

To test the pump:

1. Locate the violet wire leading from the relative humidity pump motor to the solid state relay. Disconnect at the solid state relay, and briefly touch disconnected wire to the input side of fuse block. The pump and motor should be turning. Monitor voltage across terminals. AC voltage should be present.

   If pump and motor are not running, (AC voltage present), replace relative humidity pump assembly. Refer to section 35 for relative humidity pump replacement.

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20. STEAM GENERATOR

The steam generator assembly consists of the generating tank, a H_2O inlet port, steam outlet port a 93 watt band heater, a limiting thermostat, and insulation. Refer to Figs. 14, 15, 16 in the illustration section of this manual.

During idle periods (no relative humidity setpoint or relative humidity level ≥ setpoint), the heater receives a pulsed AC signal from solid state relays. The pulse relates to a 33% duty cycle, yielding approximately 30 watts average. When the relative humidity pump is activated, the heater duty cycle is changed to 100%. This maintains a high enough temperature to allow complete vaporization of incoming H_2O, supplied by the pump.

If the temperature tries to increase beyond the limit of the limiting thermostat, the thermostat opens allowing the generator to cool to a safe level. This action maintains approximately 170°C.

To test the steam generator:

1. Disconnect the steam generator wires. Model 7300 fan motor/sensor plate must be dropped down in order to gain access to the lower steam generator. Measure resistance across connector terminals.

   100 volt: 105 ohms ±10%
   120 volt: 160 ohms ±10%
   220/240 volt: 525 ohms ±10%

2. If the reading is infinity, check across the limiting thermostat terminals. If the reading is still infinity, the limiting thermostat is faulty and should be replaced. Temporarily connect a jumper across the limiting thermostat terminals and repeat procedure one (1) to confirm the status of the heater. If specifications are not met, replace steam generator assembly. Refer to section 36 for Steam generator replacement.

3. Next measure between steam generator body and connector terminals. Meter should read infinity. If not, replace steam generator assembly. Refer to section 36 for Steam generator replacement.

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21. POWER SUPPLY

The power supply provides +12 VDC, -12 VDC, and +5 VDC for the printed circuit boards and controls. The input to the power supply may be wired for the operating voltage of the incubator, anywhere from 100 to 240 Volts, by means of a multi-tapped primary transformer, located on the power supply. Two (2) types of power supplies have been used with these units. They are manufactured by Standard, or Condor Inc. Refer to Fig. 17 in the illustration section of this manual.

STANDARD POWER SUPPLY

The Standard brand power supply is housed in a blue chassis. All voltages are referenced to ground. (Terminals CS C, -S, -V.)

The following voltages should be read at their respective terminals at the power supply:

WIRE COLOR	TERMINAL	VDC	LIMITS
BROWN	+V +5	+5.15	±0.15 VDC
ORANGE	+S +V	+12.00	±0.15 VDC
VIOLET	-V -S	-12.00	±0.15 VDC
GREEN	-S-V, CS C	GROUND	---------

Voltage adjustment for +5 volt supply is made with potentiometer R-13.

Voltage adjustment for +12 volt supply is made with potentiometer R-14.

Voltage adjustment for -12 volt supply is made with potentiometer R-29.

If the above conditions can not be met, replace power supply. Refer to section 57 for power supply replacement.

CAUTION

WHEN ADJUSTING THE VOLTAGES, DO NOT EXCEED ±0.15 VOLTS. FAILURE TO DO SO MAY CAUSE DAMAGE TO THE CONTROL SYSTEM. FOR EXAMPLE, SETTING THE +12 VOLT SUPPLY SHOULD NOT BE LESS THAN +11.85 OR GREATER THAN +12.15 VOLTS. DO NOT ATTEMPT TO ADJUST ANY OTHER POTENTIOMETERS ON THE POWER SUPPLY.

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CONDOR POWER SUPPLY

The Condor power supply is housed in a silver chassis. All voltages are referenced to ground. (Terminals -S -OUT, -S RETURN, COM, +S RETURN.)

The following voltages should be read at their respective terminals at the power supply:

WIRE COLOR	TERMINAL	VDC	LIMITS
BROWN	+S +OUT	+5.15	±0.15 VDC
ORANGE	+S +OUT	+12.00	±0.15 VDC
VIOLET	-S -OUT	-12.00	±0.15 VDC
GREEN	-S -OUT	GROUND	---------
" "	-S RTN, COM	GROUND	---------
" "	+S RTN	GROUND	---------

Voltage adjustment for +5 volt supply is made with potentiometer R-9.

Voltage adjustment for +12 volt supply is made with potentiometer R-82.

Voltage adjustment for -12 volt supply is made with potentiometer R-57.

If the above conditions can not be met, replace power supply. Refer to section 57 for power supply replacement.

CAUTION

WHEN ADJUSTING THE VOLTAGES, DO NOT EXCEED ±0.15 VOLTS. FAILURE TO DO SO MAY CAUSE DAMAGE TO THE CONTROL SYSTEM. FOR EXAMPLE, SETTING THE +12 VOLT SUPPLY SHOULD NOT BE LESS THAN +11.85 OR GREATER THAN +12.15 VOLTS. DO NOT ATTEMPT TO ADJUST ANY OTHER POTENTIOMETERS ON THE POWER SUPPLY.

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22. GAS SELECTION SWITCH

The gas selection switch allows the user to enable or disable gas pressure alarms. This allows proper operation when using CO_2 only, N_2 only, CO_2 and N_2, or no gas at all. When no gas is connected, the selection switch should be set to off, to avoid sounding the gas pressure alarm. Refer to Fig. 18 in the illustration section of this manual.

There are two test positions. These positions test the ground integrity of the selection switch, and wires leading back to the Analog circuitry. Switching to either test position should cause the gas press indicator(s) to illuminate, and audible alarm to sound. (Audible alarm will sound provided no audible alarm delay is programmed into controller.)

It is highly unlikely to find a defective gas selection switch. If replacement is necessary, refer to section 60.

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23. GAS PRESSURE SWITCHES

The gas pressure switches are set to activate the 'gas press' indicator(s) and audible alarm if the gas pressure drops below 18 PSI (1.3 bar). There are two switches; one for CO_2, one for nitrogen. The pressure setpoint is pre-set at the factory. Refer to Fig. 12 in the illustration section of this manual.

When the pressure drops below 18 PSI (1.3 bar), the normally closed contacts close and supply a ground path to activate the alarm.

1. Switch the gas selection switch to the pressure switch under test. For example, to test the CO_2 pressure switch move the rotary switch pointer to the CO_2 position). The pressure switch with the red wire is the nitrogen switch, the switch with the black wire is for CO_2.

2. Slowly lower the gas pressure to just below 18 PSI. The 'gas press' indicator and audible alarm should be activated.

3. Increase the gas pressure to just above 18 PSI. The alarm should de-activate.

   If the switch needs adjusting:

   a. Turn the pressure adjusting screw clockwise to decrease the activation point, counterclockwise to increase the activation point. Turn in 1/2 turn increments and repeat step three.

4. Repeat steps one through three for the other pressure switch.

5. Return the gas selection to its' operating position prior to this test.

6. If the above conditions cannot be met, replace the gas pressure switch(es). Refer to section 61 for gas pressure switch replacement.

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24. SHUTTLE SWITCH

The shuttle switch is designed to transfer gas tank supplies. When the primary tank supply is depleted, the backup tank is switched on line. This allows an uninterrupted supply of gas to the incubator. Refer to Fig. 18 in the illustration section of this manual.

The switch functions by means of pressure differential. When the primary tank pressure (which is normally set 3-5 PSI above the backup tank pressure) drops below the backup tank pressure, the shuttle switch valve opens the backup tank port to the incubator and at the same time closes the port to the primary tank, allowing the user to change tanks without leaks.

Normally, this switch requires no maintenance, unless dirt or oil has entered the inlet ports. If this is the case, the shuttle switch may either be dis-assembled for cleaning or replaced. Refer to section 62 for shuttle switch replacement.

25. FLOAT SWITCH

The float switch monitors the H_2O level of the water jacket. When the H_2O level drops a sufficient amount, the float switch contacts close, and allow the `low H_2O' indicator(s) to illuminate. Refer to Figs. 12 and 22.

To test the float switch for a low water condition:

1. Syphon a sufficient amount of H_2O through the H_2O syphon/fill port. (About three liters or less should be sufficient). The `low $H_2O$' indicator should illuminate. If not, syphon another four liters of $H_2O$. If the `low H_2O' indicator still does not illuminate, the float switch should be replaced.

To test the float switch for a high water condition:

2. Add three liters of H_2O to the syphon/fill port. The indicator should turn off, If not, add another four liters of H_2O.

Add this water slowly, for if the unit is overfilled, the excess water will run out the vent tube on the upper left face of the chamber.

If the `low H_2O' indicator does not turn off, the float switch should be replaced. Refer to section 46 for float switch replacement.

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26. COOLING FAN

The cooling fan located at rear of control housing should run continuously when incubator power switch is on. The cooling fan provides needed air flow to keep the electronic controls running at a safe operating temperature.

If cooling fan does not run:

1. Disconnect wires and measure resistance. Resistance should be 1000 ohms for 100/120 VAC, 2500 ohms for 220/240 VAC operation, ±10%. If not, replace cooling fan. Refer to section 58 for cooling fan replacement.

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27. SOLID STATE RELAYS

The solid state relays switch the AC line voltage on and off to various components. Refer to Fig. 11 in the illustration section of this manual.

The solid state relays are controlled by 12 VDC. When 12 VDC is present, the relay conducts AC power to the connected device. When 12 VDC is removed, the AC portion is switched off.

It is unlikely one of the solid state relays will be defective, unless it has been shorted.

An easy way to test the relays is to ground the terminal with the colored wire on the 12 VDC side of the relay under test. Do not ground the AC side. The 12 VDC side has the small gauge wires.

With the colored wire removed and the relay terminal grounded, measure the output side of the relay. Line voltage should be present.

When the terminal is ungrounded, the output should drop to zero. If not, the relay should be replaced. Refer to section 59 for solid state relay replacement.

Note: You must maintain a load on the output side of the relay to properly test the device. A seven watt lamp connected to the output would be sufficient.

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28. TEMPERATURE SENSOR

The temperature sensor is a solid-state device operating on +5.0 volts DC. The input to the sensor can be measured between pins eight (8) and nine (9) of P-3 on Analog Board. Refer to Figs. 14, 15, 16 in the illustration section of this manual.

The output of the sensor is measured between pins eight (8) and ten (10) of analog board connector P-3. The output should be about 25 MV above the true chamber temperature. In other words, if a thermometer reading in the center of the chamber reads 37.0 degrees, the voltage at pins eight and ten should be about 395 MV. The 25 MV is a default offset value stored in the software to compensate for the difference between the temperature the sensor sees, and the actual chamber operating temperature. The 25 MV is subtracted from the temperature reading, and displayed on the front panel. (Example: 395 MV sensor reading minus 25 MV=370 MV, or 37.0 degrees Celsius.)

If the above conditions are not met, check the temperature offset value by running the diagnostics function. The offset should be about -002.5. If the offset is correct, then replace the temperature sensor. Refer to section 39 for temperature sensor replacement.

29. FAN MOTOR FAULT DETECTOR

The fan motor fault detector is a solid state device which works on reflectivity. Refer to Fig. 14 in the illustration section of this manual.

The sensor is pointed toward the motor shaft. The shaft is covered with a dark material with the exception of one spot on the shaft which is a white material. As the shaft rotates, the emitter output is reflected from white spot, back to the detector, and sent to the Analog Board. when the fan motor is turning at full RPM, the sensor output should be above 3.00 volts DC. The output is measured at pin five (5) of P-7, and the center terminal of J-1, on the Analog Board. By slowing down the motor, the output voltage should drop with the motor speed, eventually reaching near zero volts when the shaft is not turning.

If the above conditions are not met, replace the sensor. Refer to section 41 for fan motor fault detector replacement.

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30. O_2 SENSOR

Refer to Figs. 14, 15, 16 in the illustration section of this manual. The O_2 sensor is a chemical reaction-type device. As the O_2 level decreases, voltage output decreases proportionally. At ambient O_2 levels (20.8%); the voltage measured at pin 25 and 26 of P-3 on the analog board should be between 20 to 30 MV. This value is for a fresh sensor. The output will gradually decrease as the useful life of the chemicals is depleted. If the output is less than 10 MV, replace the O_2 sensor. Refer to section 38 for O_2 sensor replacement.

31. CO_2 SENSOR

The CO_2 sensor is a matched set of thermistor beads operating at an elevated temperature. One side of the sensor (reference section) is hermetically sealed, and senses only the chamber temperature. The other side is exposed to both chamber temperature and atmosphere. Refer to Figs. 14, 15, 16 in the illustration section of this manual.

When CO_2 is introduced into the chamber, the CO_2 has an insulating affect on the exposed section of the sensor. This causes the exposed thermistor temperature to increase, causing a voltage imbalance between the reference and sensing sections, which is compared by the Analog Circuitry.

At 37.0° C., the sensor resistance should be approximately 1900 ohms. At 25.0° C., the resistance should be approximately 2800 ohms. This is for each section of the sensor and with sensor disconnected.

With the sensor connected, the voltage measured at analog board connector P-3, between pins 11 and 12, and 11 and 13 should be approximately 2.1 volts at 37.0°C. chamber temperature, or 2.4 volts at 25.0°C.

If the above resistance values are not met, replace the sensor. Refer to section 37 for CO_2 sensor replacement.

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PART 2.
REMOVAL/REPLACEMENT PROCEDURES
REPLACEMENT PARTS LIST

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CAUTION

BEFORE PERFORMING THE FOLLOWING REMOVAL/REPLACEMENT PROCEDURES, DISCONNECT THE ELECTRICAL SERVICE FROM THE UNIT. SHUT THE GAS SUPPLIES OFF BEFORE SERVICING SOLENOID VALVES AND RELATED FITTINGS.

32. SPLASH COVER

1. Remove two (2) retaining screws, located on each end of splash cover. Refer to Fig. 19.
2. The splash cover has a small flange on top of the cover which is positioned under a lip on the liner face.
3. To remove, push down on back of splash cover while pulling cover away from unit with a slight upward rotation. This rotation will help disengage splash cover from liner face.
4. Replace splash cover in the reverse of the above procedure.

33. SHELF SUPPORTS (AIR PLENUM)

1. Disconnect electrical service.
2. Remove contents from incubator shelves and remove shelves.
3. Grasp the bottom of the right shelf support panel with both hands. Refer to Fig. 23.
4. Pull the lower end away from the side of the chamber.
5. Support the fan blower duct with one hand while lifting the shelf support panel out of the chamber. Refer to Fig. 24.
6. Remove the fan blower duct from the chamber. Refer to Fig. 25.
7. Grasp the bottom of the left side shelf support panel with both hands and pull the lower end away from the side of the chamber. Refer to Fig. 26.
8. Remove the left shelf support panel from the chamber. The fan motor/sensor plate is now exposed.

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34. SOLENOID VALVES

1. Disconnect electrical service.
2. Remove the top cover.
3. Remove the wires from the solenoid valve. Remove screw(s) from the solenoid valve clamp/bracket. Refer to Fig. 11.
4. Remove the clamp from the solenoid valve. It will be used again.
5. Replace the solenoid valve in the reverse of the above procedure.

35. RELATIVE HUMIDITY PUMPS

1. Disconnect electrical service.
2. Remove the H_2O supply tubing from the pump. Refer to Figs. 2 and 13.
3. Remove four nuts around perimeter of pump. Pull the pump assembly out until the two wire connector is exposed.
4. Disconnect the wires at the connector.
5. Install pump assembly in reverse of the above procedure.

NOTE

When re-installing the PUMP, be sure the TUBING CLAMP ON THE PUMP BODY IS NOT COMPLETELY CLAMPED DOWN. IT SHOULD JUST HOLD THE PUMP TUBING IN PLACE FOR PROPER OPERATION.

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36. STEAM GENERATOR

1. Disconnect electrical service.
2. Refer to section 33 on shelf support (air plenum) removal.
3. Remove six screws from fan motor/sensor plate, and pull the plate down into chamber.
4. Disconnect H_2O supply tubing from steam generator. Refer to Figs. 14, 15, 16.
5. Disconnect steam generator heater wires at connector.
6. The insulator between the plate and steam generator is slit to allow removal. Remove the insulator, then with an appropriate wrench, loosen the compression fitting nut, and remove the steam generator.
7. Replace the steam generator in the reverse of the above procedure.

CAUTION

WHEN RE-INSTALLING THE MOTOR PLATE, BE SURE THE WIRING AND TUBING IS NOT KINKED, AND KEPT AWAY FROM THE MOTOR SHAFT, AS WELL AS THE STEAM GENERATOR BODY. THE STEAM GENERATOR OPERATES AT ELEVATED TEMPERATURES. LAYING THE TUBING NEAR THE STEAM GENERATOR MAY CAUSE THE TUBING TO MELT.

37. CO_2 SENSOR

1. Disconnect electrical service.
2. Refer to section 33 on shelf support (air plenum) removal.
3. Remove six screws from fan motor/sensor plate, and pull the plate down into chamber.
4. Remove 4 screws securing the CO_2 sensor assembly to fan motor/sensor plate. The CO2 sensor must be replaced exactly in the same orientation. Refer to Figs. 14, 15, 16.
5. Replace the CO_2 sensor in the reverse of the above procedure.

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38. O_2 SENSOR

1. Disconnect electrical service.
2. Refer to section 33 on shelf support (air plenum) removal.
3. With fan motor/sensor plate exposed, observe how far the O_2 sensor is installed into plate. Gently pull the O_2 sensor out of the plate, and disconnect the wires. Refer to Figs. 14, 15, 16.
4. Replace the O_2 sensor in the reverse of the above procedure.

> **NOTE**
>
> IT IS IMPORTANT TO MAINTAIN THE SAME AMOUNT OF EXPOSURE OF O_2 SENSOR INTO THE CHAMBER. (APPROXIMATELY 1.00 INCH.)

39. TEMPERATURE SENSOR

1. Disconnect electrical service.
2. Refer to section 33 on shelf support (air plenum) removal.
3. Remove six screws from the fan motor/sensor plate, and pull plate down into chamber.
4. Disconnect temperature sensor wires at connector and remove sensor. Refer to Figs. 14, 15, 16.
5. Replace temperature sensor in reverse of the above procedure.

> **CAUTION**
>
> WHEN RE-INSTALLING THE MOTOR PLATE, BE SURE THE WIRING AND TUBING IS NOT KINKED, AND KEPT AWAY FROM THE MOTOR SHAFT, AS WELL AS THE STEAM GENERATOR BODY. THE STEAM GENERATOR OPERATES AT ELEVATED TEMPERATURES. LAYING THE TUBING NEAR THE STEAM GENERATOR MAY CAUSE THE TUBING TO MELT.

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40. RELATIVE HUMIDITY SENSOR

1. Disconnect electrical service.
2. Refer to section 33 on shelf support (air plenum) removal.
3. Remove six screws from the fan motor/sensor plate, and pull plate into chamber.
4. Disconnect the relative humidity sensor wires at connector. Refer to Figs. 14, 15, 16.
5. Remove two screws from relative humidity sensor and remove sensor.
6. Replace relative humidity sensor in reverse of the above procedure.

CAUTION

WHEN RE-INSTALLING THE MOTOR PLATE, BE SURE THE WIRING AND TUBING IS NOT KINKED, AND KEPT AWAY FROM THE MOTOR SHAFT, AS WELL AS THE STEAM GENERATOR BODY. THE STEAM GENERATOR OPERATES AT ELEVATED TEMPERATURES. LAYING THE TUBING NEAR THE STEAM GENERATOR MAY CAUSE THE TUBING TO MELT.

41. FAN MOTOR FAULT DETECTOR

1. Disconnect electrical service.
2. Refer to section 33 on shelf support (air plenum) removal.
3. Remove six screws from the fan motor/sensor plate, and pull plate into chamber.
4. Disconnect fan motor fault detector wires at connector. Refer to Figs. 14, 15, 16.
5. Remove two screws from detector and remove, observing spacing between motor shaft and detector.
6. Replace detector in reverse of the above procedure.

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42. FAN MOTOR

1. Disconnect electrical service.
2. Refer to section 33 on shelf support (air plenum) removal.
3. Remove six (6) screws from the fan motor/sensor plate, and pull plate into chamber.
4. Disconnect fan motor and fan fault detector wires from connectors. Refer to Figs. 14, 15, 16.
5. Remove fan fault detector from motor.
6. Remove impeller from fan motor shaft.
7. Remove two (2) screws from fan motor and remove motor.
8. Replace fan motor in reverse of the above procedure.

NOTE

BE SURE MOTOR ROTATION IS CORRECT. ROTATION SHOULD BE COUNTER-CLOCKWISE WHEN VIEWED ABOVE INCUBATOR, LOOKING DOWN ONTO MOTOR.

CAUTION

WHEN RE-INSTALLING THE MOTOR PLATE, BE SURE THE WIRING AND TUBING IS NOT KINKED, AND KEPT AWAY FROM THE MOTOR SHAFT, AS WELL AS THE STEAM GENERATOR BODY. THE STEAM GENERATOR OPERATES AT ELEVATED TEMPERATURES. LAYING THE TUBING NEAR THE STEAM GENERATOR MAY CAUSE THE TUBING TO MELT.

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43. AIR HEATER

1. Disconnect electrical service.

2. Refer to section 33 on shelf support (air plenum) removal.

3. Remove six screws from the fan motor/sensor plate, and pull plate into chamber.

4. Disconnect heater wires at heater terminals. Refer to Figs. 14, 15, 16.

5. Remove two nuts and washers from heater posts, and remove heater.

6. Replace air heater in reverse of the above procedure. Be sure heater is installed straight and parallel with chamber walls to avoid hot spots.

CAUTION

WHEN RE-INSTALLING THE MOTOR PLATE, BE SURE THE WIRING AND TUBING IS NOT KINKED, AND KEPT AWAY FROM THE MOTOR SHAFT, AS WELL AS THE STEAM GENERATOR BODY. THE STEAM GENERATOR OPERATES AT ELEVATED TEMPERATURES. LAYING THE TUBING NEAR THE STEAM GENERATOR MAY CAUSE THE TUBING TO MELT.

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44. CARTRIDGE HEATERS**

1. Disconnect electrical service.

2. Refer to section 32 on splash cover removal.

3. Pull heater wires out from under chamber to gain access to wire nuts. Carefully remove wire nuts from heater wires, noting their position for replacement purposes. Refer to Figs. 19 and 20.

4. Remove the two (2) nuts holding the heater retaining strip to the chamber. See Fig. 20. Remove the retaining strip.

5. Slide heating element(s) out from chamber.

6. Replace cartridge heaters in reverse order of above procedure.

> **CAUTION**
>
> **RE-CONNECT HEATING ELEMENT WIRES EXACTLY AS REMOVED TO ASSURE PROPER OPERATION. IN CASE OF DIFFICULTY REFER TO THE ELECTRICAL WIRING DIAGRAM FOR THE PROPER HEATER WIRING ARRANGEMENT FOR YOUR ELECTRICAL SERVICE.**

** Units manufactured before September, 1988 did not use cartridge heaters. These units used one (1) air heater rated at 350 watts.

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45. DOOR HEATERS

1. Disconnect electrical service.

2. When servicing lower door, refer to section 32 for splash cover removal, and remove upper splash cover.

3. When servicing upper door, remove cover from upper door support. Refer to Figs. 20 and 21.

4. Remove cover from upper door support bracket.

5. Remove door heater wires from wire nuts. Note wiring arrangement.

6. Remove 26 screws which fasten door liner to door. Raise inner edge of gasket to gain access to screws. Do not remove screws completely from gasket; this will aid in re-assembly because screw tips will hold location of holes in gasket.

7. Remove door liner and at same time pull door heater wires out through door hinge access tube.

8. Carefully peel door heater from door liner to avoid wrinkling door liner.

9. Remove paper backing from new door heater and apply adhesive side to liner in same position; with wires extending in same direction as faulty heater. Be sure all air pockets are removed when applying new heater to door liner. This will prevent hot spots.

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10. Route heater wires through door wiring access tube and re-fasten door liner to door.

    a. Dual element (3 wires) 100/120V operation: Connect the two black (or brown) heater wires together to the black (or brown) power wire. Connect the white (or blue) heater wire to the white power wire. This wires the two elements in parallel.

    b. Dual element (3 wires) 240V operation: Connect one black (or brown) heater wire to the black (or brown) power wire. Connect the second black (or brown) heater wire to the white (or blue) power wire. This wires the two elements in series. The white (or blue) heater wire is not used on 240V operation. The end of the white (or blue) wire must be insulated with a plastic wire nut.

11. Re-position wires and connectors and then replace all covers.

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46. FLOAT SWITCHES

1. Disconnect electrical service.

2. For the upper chamber, remove associated float switch wires from terminal block. Refer to Fig. 11.

3. For the lower chamber, remove upper splash cover; see section 32. Also remove port bracket. Refer to Figs. 19 and 20. Remove wire-nuts from the float switch wires.

4. With a thin flat blade screw driver or knife, carefully pry the nylon float switch mounting bushing from the top of the chamber. This bushing has been hand pressed into place. Once the bushing has come loose, lift the float switch out from the top of the chamber.

5. Replace the float level switch in the reverse of the above procedure. Refer to Fig. 22.

47. INNER GLASS DOOR

1. Remove the four acorn nuts securing the two glass door hinges to chamber face. Refer to Fig. 20.

2. Remove the glass door.

3. Replace glass door in the reverse of the above procedure.

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48. OUTER DOOR

1. Disconnect electrical service.

2. Refer to section 32 for splash cover removal.

3. Refer to section 45 for door heater wire disconnections. Also disconnect door ground wire (green wire) at its connectors.

4. Remove two (2) screws from lower door mounting bracket and loosen third screw. Refer to Fig. 20.

5. While holding door up against its upper mounting bracket, remove remaining screw.

6. Tip bottom of door slightly to the side with lower mounting bracket still attached to door.

7. Lower door enough to disengage door from upper mounting bracket.

8. Remove outer door with lower mounting bracket attached.

9. Replace door in reverse of the above procedure. when re-tightening the doors lower support bracket, position bracket squarely with the unit and raise bracket to hold the door lightly against its upper mounting point.

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OUTER DOOR ADJUSTMENT

1. There are adjustment points at the upper and lower door mounting brackets so that the outer door may be adjusted to close properly. The outer door gasket should contact the incubator body evenly on all four sides. If the door needs adjustments proceed as follows:

2. Refer to section 32 for splash cover removal.

3. Remove the cover from the upper support bracket for the door being adjusted. Refer to Fig. 21.

4. With a wrench, loosen the two nuts directly beneath the lower door support bracket. Do not remove. This will allow adjustment of the lower section of the door. Adjust and tighten as necessary. Do not use excessive torque on these nuts.

5. With an appropriate hex-head wrench, loosen the two nuts directly on top of the upper door support bracket. This will allow adjustment of the upper section of the door. Adjust and tighten as necessary. Again, do not use excessive torque on these screws.

6. Install all cover(s).

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49. WATER JACKET CHAMBER MODULE

1. Disconnect electrical service.

2. Syphon or pump water from chamber at fill port.

3. Remove glass door. Refer to section 47.

4. Refer to section 33 for shelf assembly removal.

5. Refer to section 32 for splash cover removal. Remove both for lower chamber removal.

6. Disconnect CO_2 sensor, float level switch,temperature sensor, O_2 sensor, relative humidity sensor, fan fault detector, steam generator, air heater connections, fan motor connector, CO_2, N_2 injection and sample tubes. Also, remove relative humidity H_2O supply tube. For lower chamber it will be necessary to remove with nut behind center of port bracket and then remove port bracket to gain access to connectors.

7. Remove the insulation from the top of the chamber.

8. Remove the two (2) screws (one left and one right) which secure the chamber bottom to the unit's exterior body. See Fig. 20.

9. Remove the two (2) 1/4-20 bolts from the chamber's upper mounting brackets (one on each side). Refer to Fig. 3.

10. Remove the water jacket chamber module by sliding chamber out of the front of the exterior body. These chambers are awkward to handle and heavy. Another person to aid in removal is advised. If returning chamber to factory for repairs or replacement, remove the fan motor mounting bracket and float switch. Refer to sections 42 and 46.

11. Replace water jacket chamber module in reverse of the above procedure.

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50. FUSES

1. Disconnect electrical service.
2. Remove cover from top of incubator.
3. Remove fuse(s) in question from fuse block on component mounting platform. (There is one additional fuse located near the inside edge of the power supply.)
4. Locate source of fuse failure before replacing fuse(s).
5. Replace with new fuse(s) as required.
6. Replace cover on top of unit.

51. BACKUP TEMPERATURE CONTROL

1. Disconnect electrical service.
2. Remove cover from top of incubator.
3. Loosen flexible shaft coupling from backup temperature control. Refer to Fig. 10.
4. Remove wires and connectors from control, noting their positions.
5. Remove screws securing temperature control and bracket between the power supply and the card cage.
6. Remove screws securing the mounting bracket to the temperature control.
7. Replace backup temperature control in reverse order of above procedure.
8. Refer to the operator's manual under FIRST TIME OPERATION for proper setup and calibration of the backup temperature control. The section deals with TEMPERATURE SETPOINT, and TEMPERATURE LIMIT.

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52. ANALOG CIRCUIT BOARD

WARNING

THE ANALOG CIRCUIT BOARD CAN BE EASILY DAMAGED BY STATIC ELECTRICITY. OBSERVE ALL RULES CONCERNING THE PROPER HANDLING OF STATIC SENSITIVE DEVICES. GROUND YOURSELF TO A KNOWN EARTH GROUNDED METAL OBJECT IMMEDIATELY BEFORE HANDLING STATIC SENSITIVE EQUIPMENT.

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Loosen panel screw. In order to remove the Analog board at position No. 1 (see Fig. 4), you will need to release the control panel from the control housing. This is accomplished by grasping both control panel handles and forcing the back of the control panel upward. Now, at the same time, slide panel out approximately 1 inch. At this point, the panel should suddenly become released. Pull the panel out enough to allow access to the board. Be sure to support the panel as it is no longer held captive by the control panel housing.

4. Remove any connectors from the top of the circuit board, noting the position of each connector. Firmly pull the circuit board(s) up and out of the card cage. It is best to wrap or lay the board(s) in Anti-static bags when handling them out of the card cage. Many components used are static sensitive, and can be easily damaged.

5. Before replacing the analog board, be sure the board is configured for operation as either for Model 7100, or 7300 lower chamber, or 7300 upper chamber. The incubator will not function properly if the board is mis-configured. Refer to Fig. 7 for proper configuration of the DIP switches and jumpers. If in doubt, refer to section 8 of this manual regarding the ANALOG CIRCUIT BOARD.

6. Replace Analog circuit board in reverse order of above procedure.

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7. The Analog circuit board is pre-calibrated at the factory. DO NOT ADJUST THE POTENTIOMETERS ON THE BOARD. If the board has been tampered with, refer to section 8 of this manual regarding ANALOG BOARD CALIBRATION.

8. Refer to the calibration section of this manual and perform a complete re-calibration of the incubator.

53. CPU CIRCUIT BOARD

WARNING

THE CPU CIRCUIT BOARD CAN BE EASILY DAMAGED BY STATIC ELECTRICITY. OBSERVE ALL RULES CONCERNING THE PROPER HANDLING OF STATIC SENSITIVE DEVICES. GROUND YOURSELF TO A KNOWN EARTH GROUNDED METAL OBJECT IMMEDIATELY BEFORE HANDLING STATIC SENSITIVE EQUIPMENT.

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Loosen panel screw and pull panel out to "Service" position. Refer to Fig. 4.

4. Firmly pull the circuit board up and out of the card cage. It is best to wrap or lay the board(s) in Anti-static bags when handling them out of the card cage. Many components used are static sensitive, and can be easily damaged.

5. Replace CPU circuit board in reverse order of above procedure.

NOTICE

WHEN REPLACING THE CPU CIRCUIT BOARD, PERFORM A COMPLETE RE-CALIBRATION OF THE UNIT. THE FOLLOWING PROCEDURE RESETS THE HARDWARE AND SOFTWARE TO THE DEFAULT CONDITIONS. THIS MEANS ALL SETPOINTS AND CALIBRATION PREVIOUSLY SET WILL BE ERASED. THIS PROCEDURE IS ABSOLUTELY NECESSARY WHEN REPLACING A CPU CIRCUIT BOARD. FOLLOW THIS PROCEDURE CAREFULLY.

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6. While pressing the <7> and <9> buttons on the keypad simultaneously (for model 7300, use the lower keypad, which is the left keypad on control panel), turn the power switch on. Release the <7> and <9> buttons after about two (2) seconds. This initiates the hardware/software reset.

7. Refer to the calibration section of this manual and perform a complete re-calibration of the incubator. Also refer to the operator's manual section regarding ACCESS CODE.

54. I/O CIRCUIT BOARD

WARNING

THE I/O CIRCUIT BOARD CAN BE EASILY DAMAGED BY STATIC ELECTRICITY. OBSERVE ALL RULES CONCERNING THE PROPER HANDLING OF STATIC SENSITIVE DEVICES. GROUND YOURSELF TO A KNOWN EARTH GROUNDED METAL OBJECT IMMEDIATELY BEFORE HANDLING STATIC SENSITIVE EQUIPMENT.

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Loosen panel screw and pull panel out to "Service" position. Refer to Fig. 4.

4. Firmly pull the circuit board(s) up and out of the card cage. It is best to wrap or lay the board(s) in Anti-static bags when handling them out of the card cage. Many components used are static sensitive, and can be easily damaged.

5. Replace I/O circuit board in reverse order of above procedure.

6. Allow the unit to stabilize and check the setpoints and calibration of the unit and re-calibrate as necessary.

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55. DIGITAL DISPLAY CIRCUIT BOARD

WARNING

THE DIGITAL DISPLAY CIRCUIT BOARD CAN BE EASILY DAMAGED BY STATIC ELECTRICITY. OBSERVE ALL RULES CONCERNING THE PROPER HANDLING OF STATIC SENSITIVE DEVICES. GROUND YOURSELF TO A KNOWN EARTH GROUNDED METAL OBJECT IMMEDIATELY BEFORE HANDLING STATIC SENSITIVE EQUIPMENT.

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Loosen panel screw and pull panel out to "Service" position.

4. Remove three (3) screws from the top edge of the display board.

5. When you are ready to pull the board out, be careful not to damage the connector attaching the membrane (push-button) panel to the display board. This connector is attached to a short cable leading from the membrane panel, which you will see as soon as you remove the digital display board. Firmly pull the circuit board(s) up and out of the card cage. Disconnect the membrane panel connector from the display board (see Fig. 8), noting how the cable was folded, to avoid damage. It is best to wrap or lay the board(s) in Anti-static bags when handling them out of the card cage. Many components used are static sensitive, and can be easily damaged.

6. Before replacing the digital display board, be sure the board is configured for operation as either for Model 7100, 7300 lower chamber, or 7300 upper chamber. The incubator will not function properly if the board is mis-configured. Refer to Fig. 9 for proper configuration of the jumpers. If in doubt, refer to section 9 of this manual regarding the DIGITAL DISPLAY BOARD.

7. Replace digital display circuit board in reverse order of above procedure, making sure the membrane panel connector is folded properly to avoid damage. If the mounting screws are misplaced, do not replace mounting screws with a longer type. Longer screws will damage the membrane panel.

8. Allow the unit to stabilize and run DIAGNOSTICS to check that all LED's are functioning. Check the setpoints and calibration of the unit and re-calibrate as necessary.

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56. MOTHER BOARD

WARNING

CIRCUIT BOARDS ARE EASILY DAMAGED BY STATIC ELECTRICITY. OBSERVE ALL RULES CONCERNING THE PROPER HANDLING OF STATIC SENSITIVE DEVICES. GROUND YOURSELF TO A KNOWN EARTH GROUNDED METAL OBJECT IMMEDIATELY BEFORE HANDLING STATIC SENSITIVE EQUIPMENT.

1. Disconnect electrical service.
2. Remove cover from top of incubator.
3. Loosen panel screw and pull panel out to "Service" position. Refer to Figs. 4 and 5.
4. Refer to sections 52, 53, 54, 55 regarding removal of Analog, CPU, I/O, and Digital display boards. Remove these boards.
5. For Model 7300, remove the digital display connector from the mother board, located between the digital display and CPU boards.
6. Remove the power supply wires from the connector at the rear edge of the motherboard, noting their position.
7. Remove the Serial and Parallel port connectors at the rear edge of the mother board.
8. Remove 15 nuts from the top of the mother board. The mother board can now be removed from studs.
9. Replace in reverse order of above procedure.

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57. POWER SUPPLY

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Loosen panel screw and pull panel out to "Service" position. Refer to Figs. 3 and 17.

4. Disconnect the power input wires from the power switch wires.

5. Remove the power supply wires from the connector located near the rear edge of the mother board.

6. Remove four (4) mounting nuts from the power supply. Remove the Backup temperature control mounting screw(s) from the side of the power supply housing. The power supply may now be removed from the control panel.

7. Replace power supply in reverse order of above procedure.

> **NOTE**
>
> EVEN THOUGH REPLACEMENT POWER SUPPLIES ARE PRE-CALIBRATED AT THE FACTORY, IT IS RECOMMENDED THE POWER SUPPLY VOLTAGES BE CHECKED AND ADJUSTED AS REQUIRED. REFER TO SECTION 21 REGARDING POWER SUPPLY CALIBRATION.

58. COOLING FAN

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Disconnect the fan motor wires from fuse block.

4. Remove mounting screws and nuts from cooling fan. Fan and guard can now be removed.

5. Replace cooling fan in reverse order of above procedure.

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59. SOLID STATE RELAYS

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Remove wires from solid state relay, noting their position for replacement purposes. Refer to Fig. 11.

4. Remove mounting screws from base of solid state relay. Relay can now be removed.

5. Replace solid state relay in reverse order of above procedure.

60. GAS SELECTION SWITCH

1. Disconnect electrical service.

2. Remove cover from top of incubator.

3. Remove wires leading from gas selection switch, at the gas pressure switches and terminal block, noting their position for replacement purposes. Refer to Fig. 18.

4. Remove knob and mounting nut from switch. Switch may now be removed.

5. Replace gas selection switch in reverse order of above procedure.

61. GAS PRESSURE SWITCH

1. Disconnect electrical service. Turn off gas supplies.

2. Remove cover from top of incubator.

3. Remove wires at the gas pressure switch, noting their position for replacement purposes. Refer to Fig. 12.

4. Remove gas tubing from switch. Switch may now be removed.

5. Replace gas pressure switch in reverse order of above procedure. Refer to section 23 regarding recalibration.

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62. SHUTTLE SWITCH

1. Disconnect electrical service. Turn off gas supplies.

2. Remove cover from top of incubator.

3. Remove tubing clamps and tubing at the shuttle switch, noting their position for replacement purposes.

4. Remove screws securing shuttle switch bracket. Shuttle switch may now be removed. Refer to Fig. 18.

5. Replace shuttle switch in reverse order of above procedure.

> **NOTE**
>
> WHEN SERVICING SHUTTLE SWITCHES, IT IS IMPORTANT NOT TO LET PIPE THREAD SEALANT ENTER THE SHUTTLE SWITCH, AS THIS WILL CAUSE RAPID FAILURE, RESULTING IN LEAKS.

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63. REPLACEMENT PARTS LIST MODELS 7100/7300 VERSION 5

Germicide	65043	
R.H. Reservoir Assy	101301008	{Optional}
Blower Wheel	101402003	
O2 Sensor Assy	105028012	
Temp Sensor Assy	105028013	
CO_2 Sensor Assy	105028026	
R.H. Sensor Modified Assy	102961032	
2-Way Solenoid Assy	105007005	{CO_2}
3-Way Solenoid Assy	105007020	{N2}
Filter 5 Micron Modified	102921006	{H_2O}
Filter .3 Micron Modified	102921005	{Gas}
Fuse 5 amp	289068	{Air Heater}
Fuse 2 amp, 250V fast blo	289001	{R.H. Heater}
Fuse 2 amp, 250V slow blo	289081	{Power Supply}
Fuse 1 amp	1408-026	{R.H. Pump}
Solid State Relay	101416010	
Pump Assy Modified (120V)	102961029	
Pump Assy Modified (220V)	102961050	
Pump Assy Modified (100V)	102961051	
Cord Set 100/120V	101422002	
Cooling Fan 100/120V, 50/60Hz	101550007	{For ventilation}
Cooling Fan 220/240V, 50/60Hz	101550008	{For ventilation}
Gas Pressure Switch Assy	102204029	
Power Switch	101420041	
Air Plenum Assy	106027007	
Blower Duct Assy	106046002	
Gasket, Blower Duct, 36" Req.	72004	
Gasket, CO_2 Sensor	296102801	
Gasket, Fan Motor Plate	102921003	
Glass Door	330260	
W/J Cartridge Heater	143304100	{120/220V}
W/J Cartridge Heater	143304102	{100V}
Door Heater	1433-077	{All Voltages}
Limit Control, 120V	503005400	
Limit Control, 220/240V	503005401	
Limit Control, 100V	503005402	
I/O PC Board Assy	105030058	
Display PC Board Assy	105030027	
CPU PC Board Assy	503006500	

{Above CPU board for Model 7100 Software version 5.xx only}

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CPU PC Board Assy	503006501	
{Above CPU board for Model 7300 Software version 5.xx only}		
Analog PC Board Assy	503004200	
{Above Analog board for Model 7100 only}		
Analog PC Board Assy	503004202	
{Above Analog board for Model 7300 lower chamber only}		
Analog PC Board Assy	503004201	
{Above Analog board for Model 7300 upper chamber only}		
Fan Motor Assy	500401100	{120V}
	500401101	{220V}
	500401102	{100V}
Air Heater {100 Watts}	247431	{120V}
	247432	{220V}
	247430	{100V}
Steam Generator Repl. Kit	220409100	{120V}
	220409101	{220V}
	220409102	{100V}
Power Supply Assy	500200200	{120V}
	500200201	{220V}
	500200202	{100V}

When ordering parts, give the unit model and serial number, as well as the software version number. The software version number can be found by pressing the 1 and 3 buttons simultaneously. (Keypad must be accessed first.) The software version number will be displayed in the temperature display window.

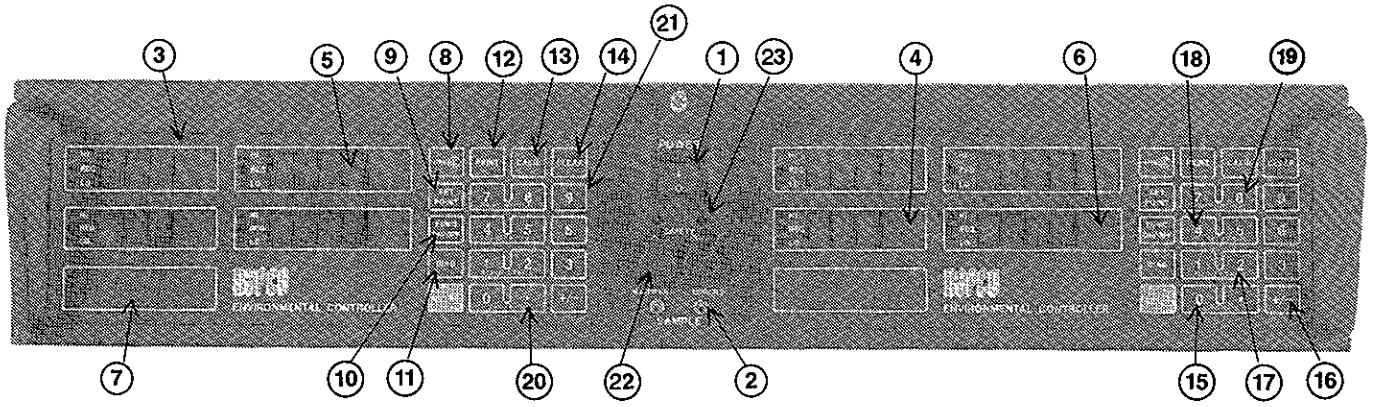
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PART 3.

ILLUSTRATIONS, FIGURES, AND SCHEMATICS

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Fig. 1 CONTROL PANEL



1. POWER SWITCH: Applies power to the entire unit. (Including fan motors)

2. GAS SAMPLE PORTS: Used for sampling the chamber atmosphere.

3. UPPER LEFT DISPLAY: Displays CO2 parameters. Also displays keypad data when used in the Diagnostics mode.

4. LOWER LEFT DISPLAY: Displays 02 parameters.

5. UPPER RIGHT DISPLAY: Displays temperature and Month/Day parameters, Software version, Access code, and Baud rate.

6. LOWER RIGHT DISPLAY: Displays Relative Humidity and Hour/Minute parameters, Audible Alarm Disable time, and Print Interval log rate.

7. LOWER LEFT DISPLAY BLOCK: Displays alarm conditions for gas pressure, fan fault, RH H20, Low H2O, 02 sensor, and alarm. "ACCESS" and "PASSED" indicators also are displayed here.

8. <ACCESS> BUTTON (Picture of a key): Used to allow keyboard access to change your Personal Access Code.

9. <SETPOINT> BUTTON: Used to enter the desired CO2, O2, Temperature, Date, Time and Relative Humidity levels.

10. <FUNC ON/OFF> BUTTON: Used in conjunction with the <SETPOINT> button to turn CO2, O2, Temperature, and Relative Humidity controls ON or OFF. Allows user not to have to enter setpoints each time.

11. <DIAG> BUTTON: Used to perform on board system checks.

12. <PRINT> BUTTON: Used to send data to the printer or RS232 ports.

13. <CALIB> BUTTON: Used to calibrate CO2, O2, Temperature and Relative Humidity functions.

14. <CLEAR> BUTTON: Used to clear an erroneous entry from the keypad.

15. <BAUD RATE> BUTTONS: Used to display and enter the communication speed for the serial communications to the RS232 port.

16. <+/-> BUTTON: Used to exit the Diagnostics function. When used in conjunction with the <ALARM DISABLE> buttons, <+/-> selects the programmable HIGH and LOW alarm delay function.

17. <ALARM DISABLE> BUTTONS: Used to disable the audible alarm for a pre-selected period of time. Also used to select a different high and/or low alarm delay time. (Other than the default values.)

18. <CO2 SETPOINT TWO> BUTTONS: Reserved function for future enhancements. Not used at this time.

19. <PRINT INTERVAL> BUTTONS: Used to change the log rate sent to printer and RS232 ports.

20. <.> BUTTON: The Decimal button by itself is not used, as the Decimal is entered automatically when entering the necessary parameters.

21. <0> THROUGH <9> BUTTONS: Used to enter the various input conditions for operating the incubator.

22. SAFETY CONTROL: Used to establish a limiting temperature for each chamber in case of failure of the primary control.

23. SAFETY INDICATOR: Indicates when the safety limiting temperature has been reached, indicating removal of power from heater.

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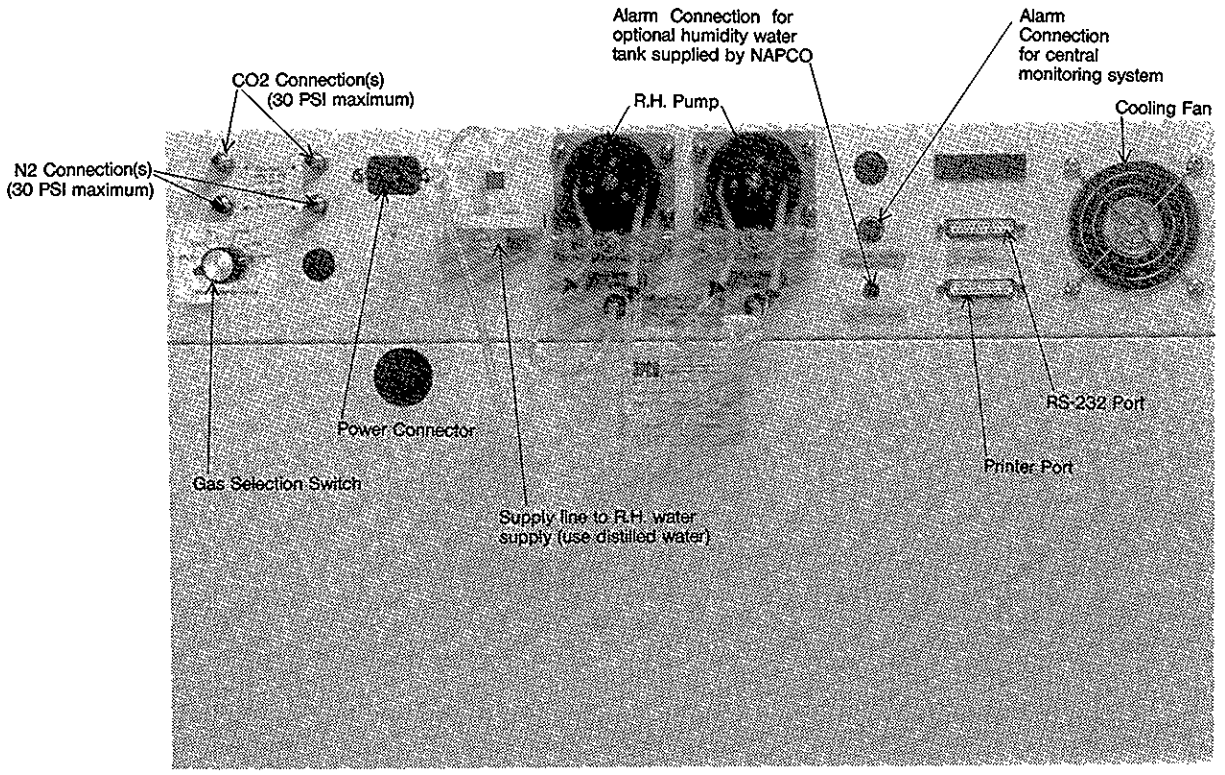


Fig. 2 CONTROL HOUSING REAR VIEW

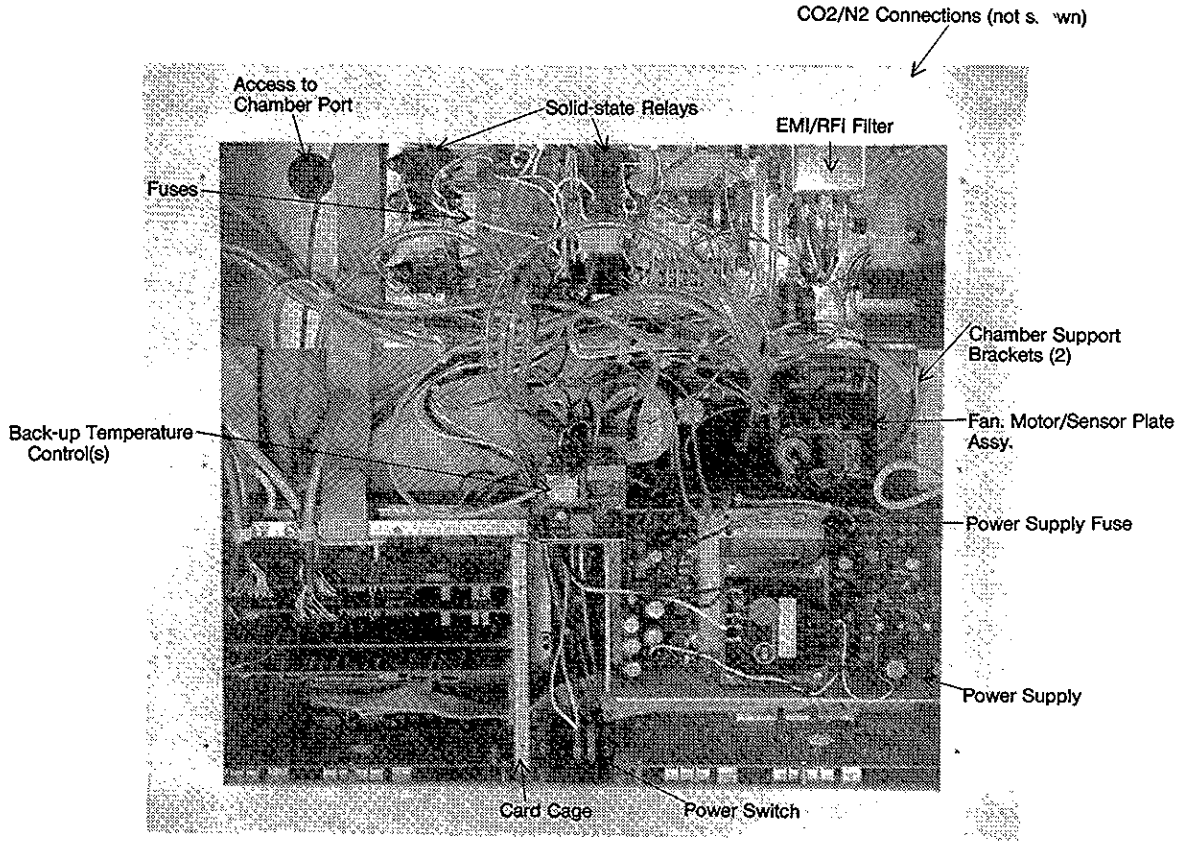


Fig. 3 CONTROL HOUSING

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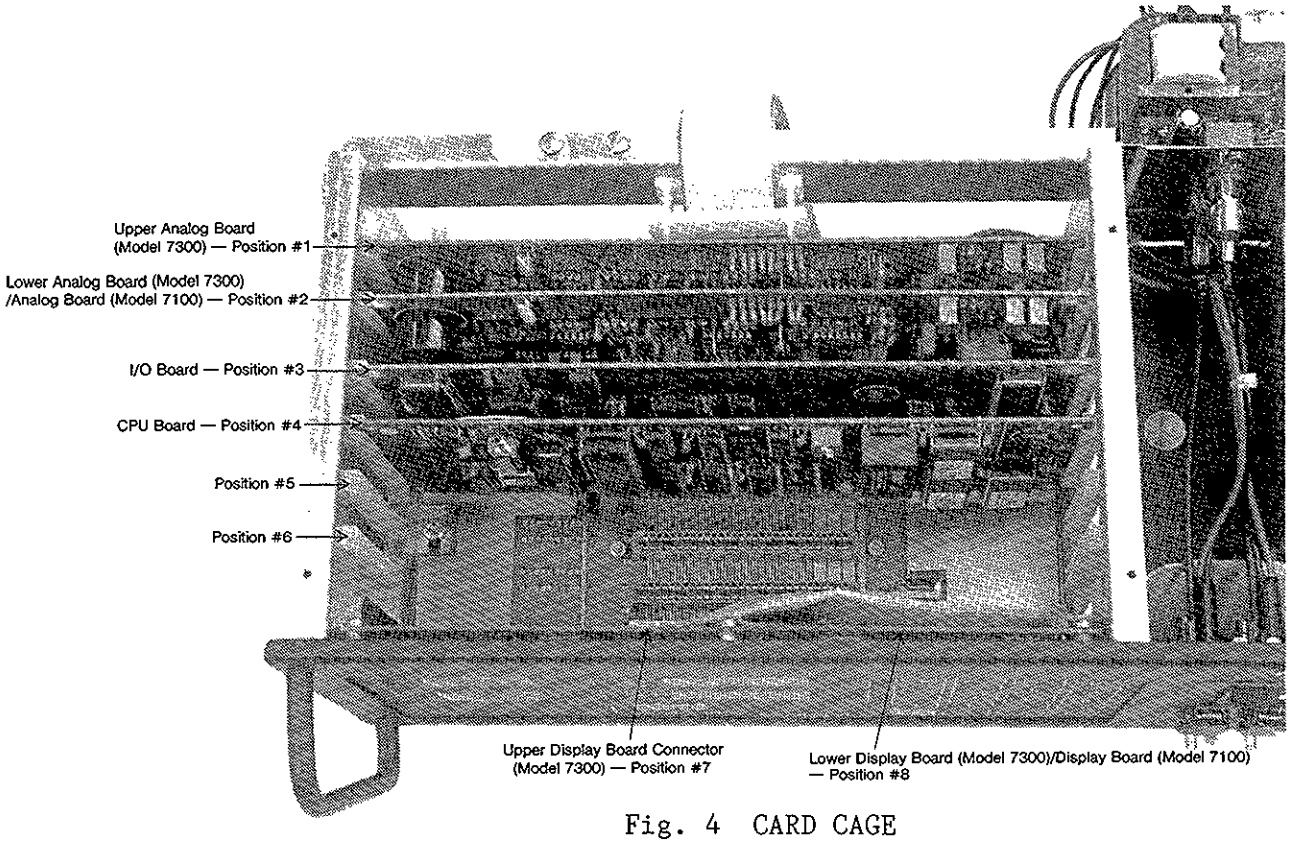


Fig. 4 CARD CAGE

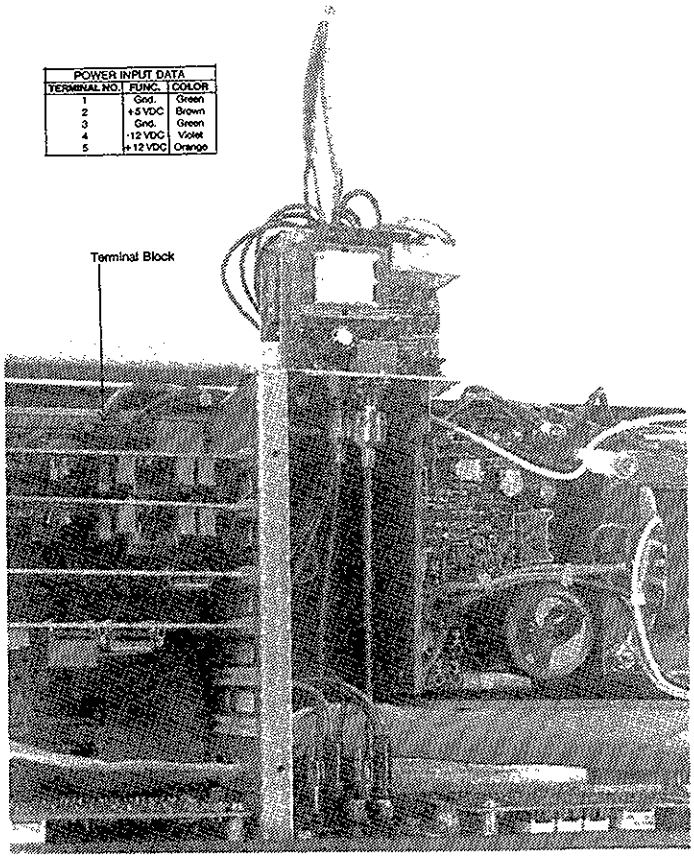
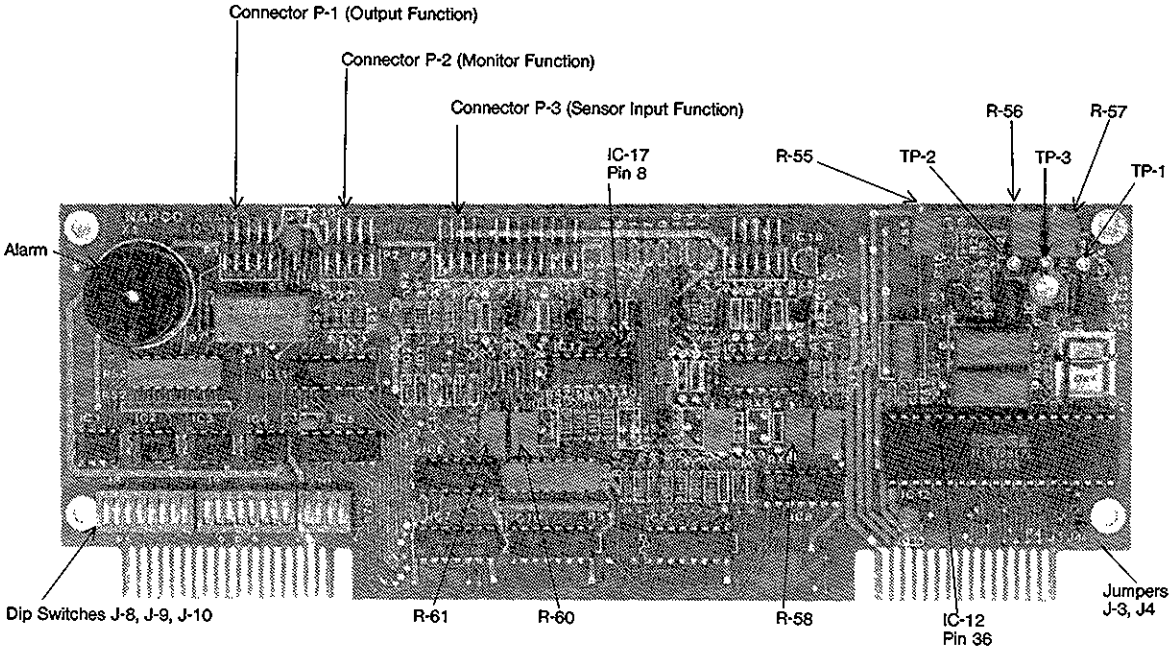


Fig. 5 MOTHER BOARD CONNECTOR

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NOTE: ANALOG BOARD *MUST* BE CONFIGURED FOR PROPER OPERATION BY MEANS OF DIP SWITCHES J-8, J-9, J-10, AND JUMPERS J-3, J-4

Fig. 6 ANALOG CIRCUIT BOARD

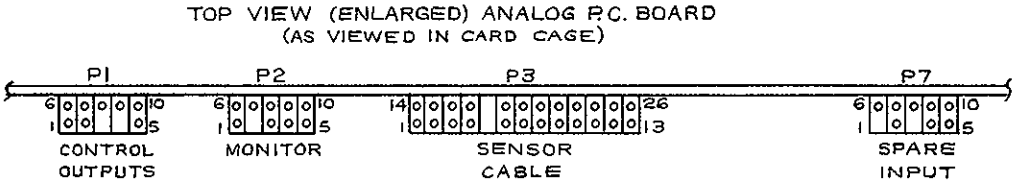


FIG. 7 ANALOG BOARD CONFIGURATION DETAIL

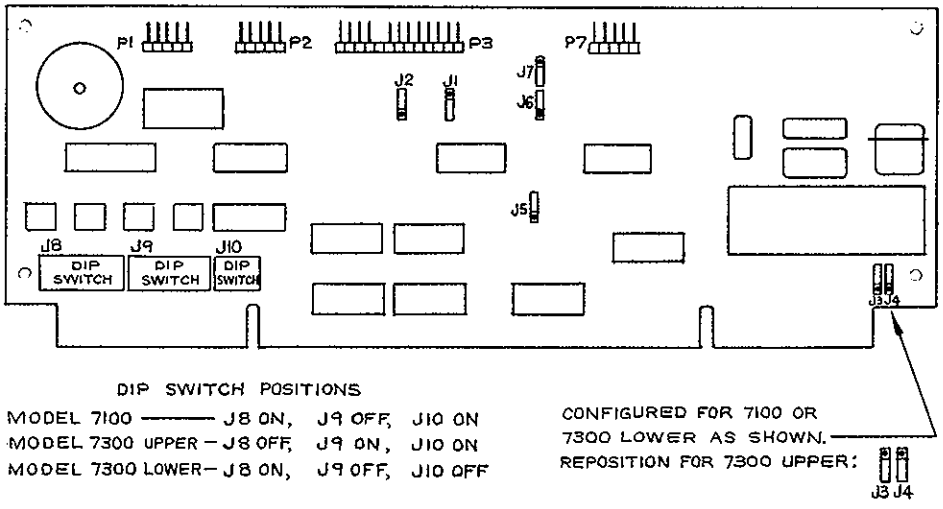


Fig. 7 ANALOG BOARD CONFIGURATION DETAIL

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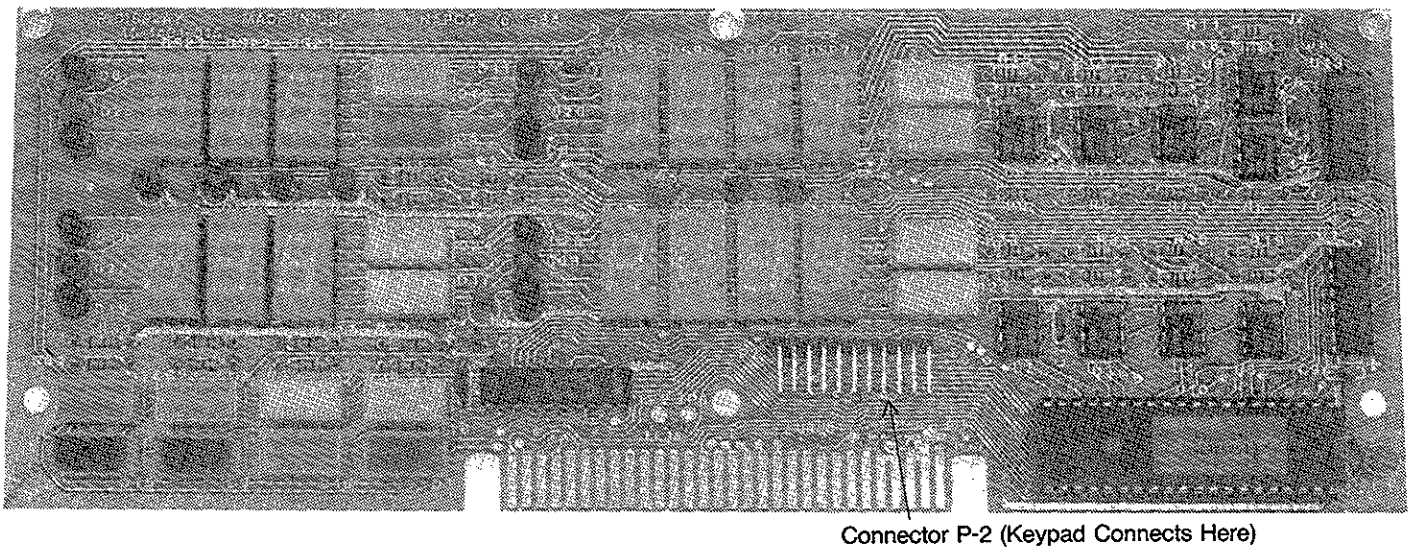


Fig. 8 DIGITAL DISPLAY BOARD

MODEL	CHAMBER	JUMPER J-1, J-2	JUMPER J-3, J-4	JUMPER J-5, J-6
7100	—	J-2	J-4	J-6
7300	Upper	J-1	J-3	J-5
7300	Lower	J-2	J-4	J-6

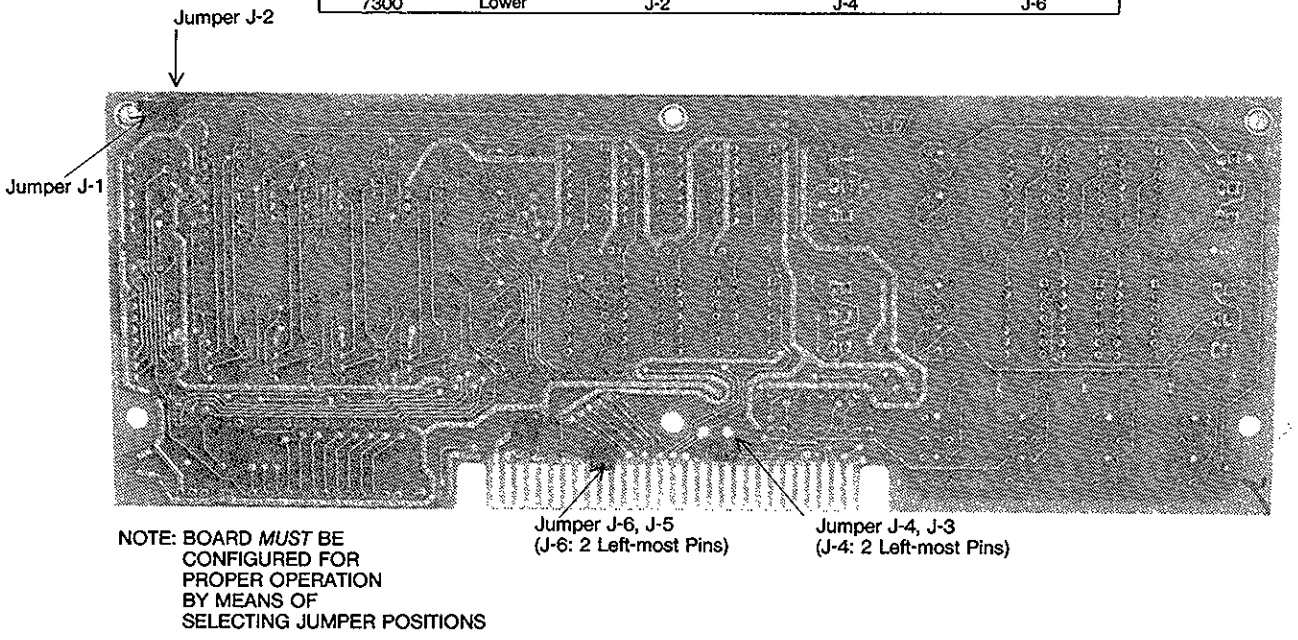


Fig. 9 DIGITAL DISPLAY BOARD (BACK VIEW)

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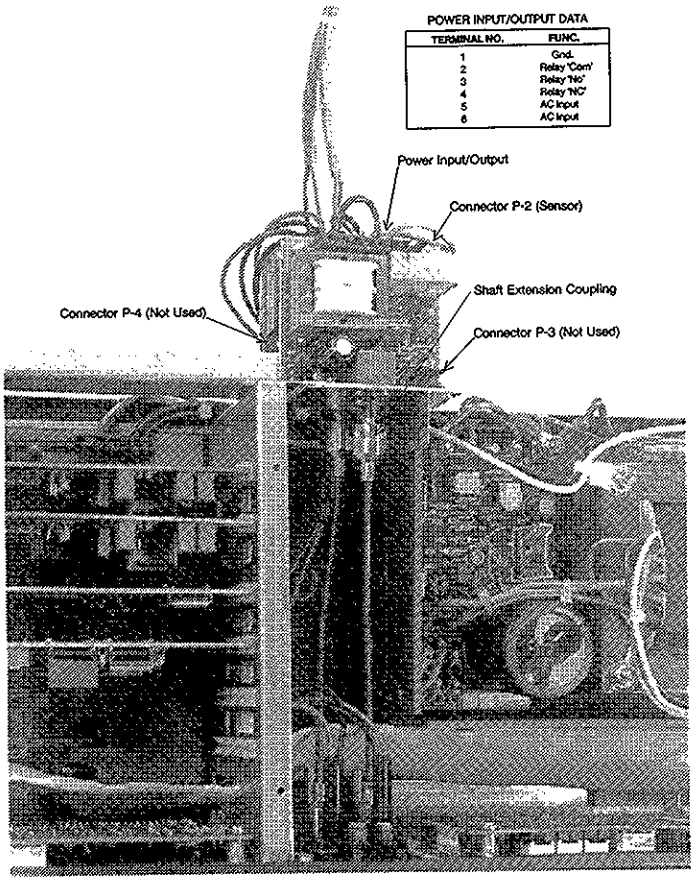


Fig. 10 BACKUP TEMPERATURE CONTROL

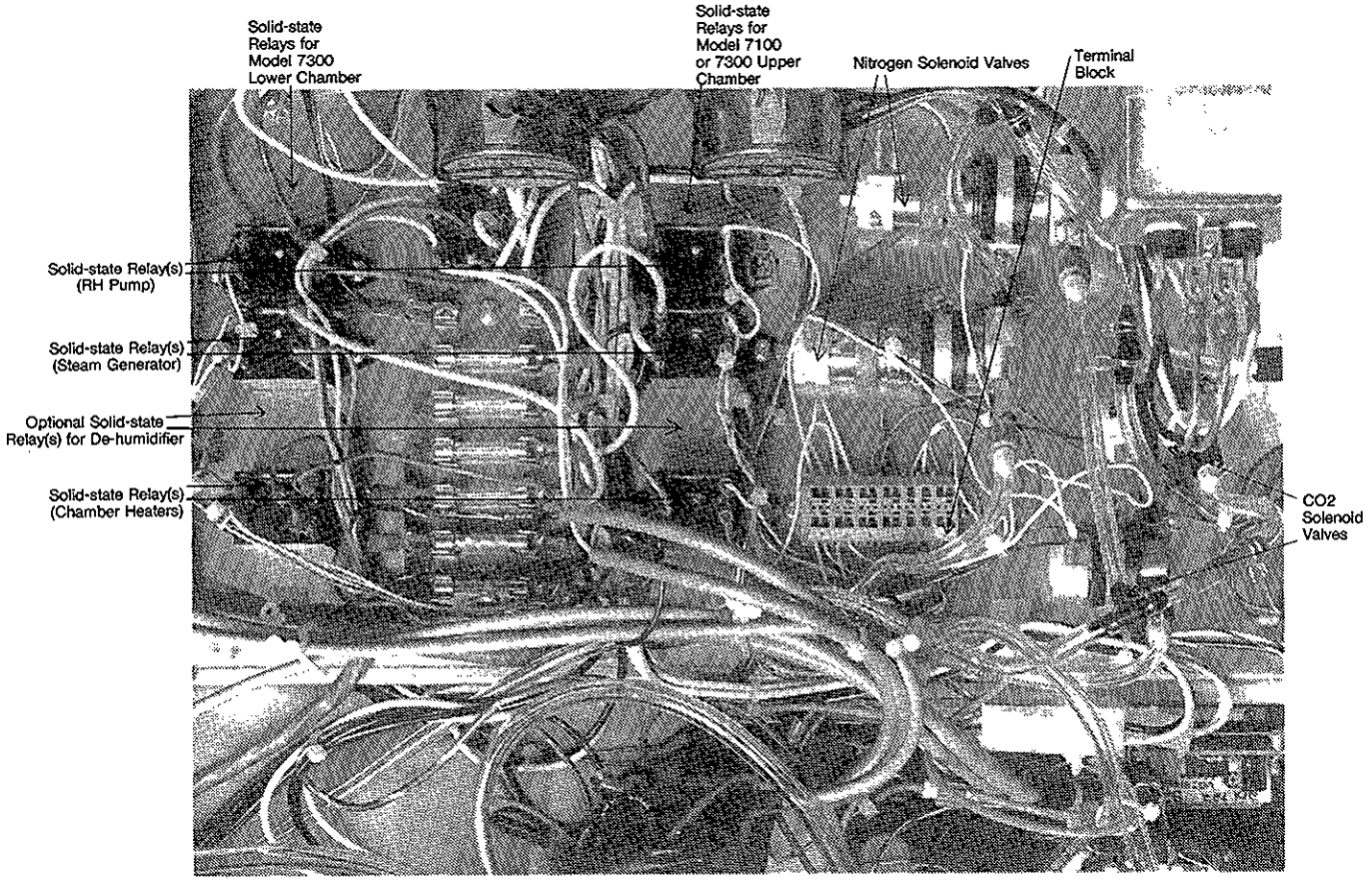


Fig. 11 RELAYS/SOLENOID VALVES TERMINAL BLOCK

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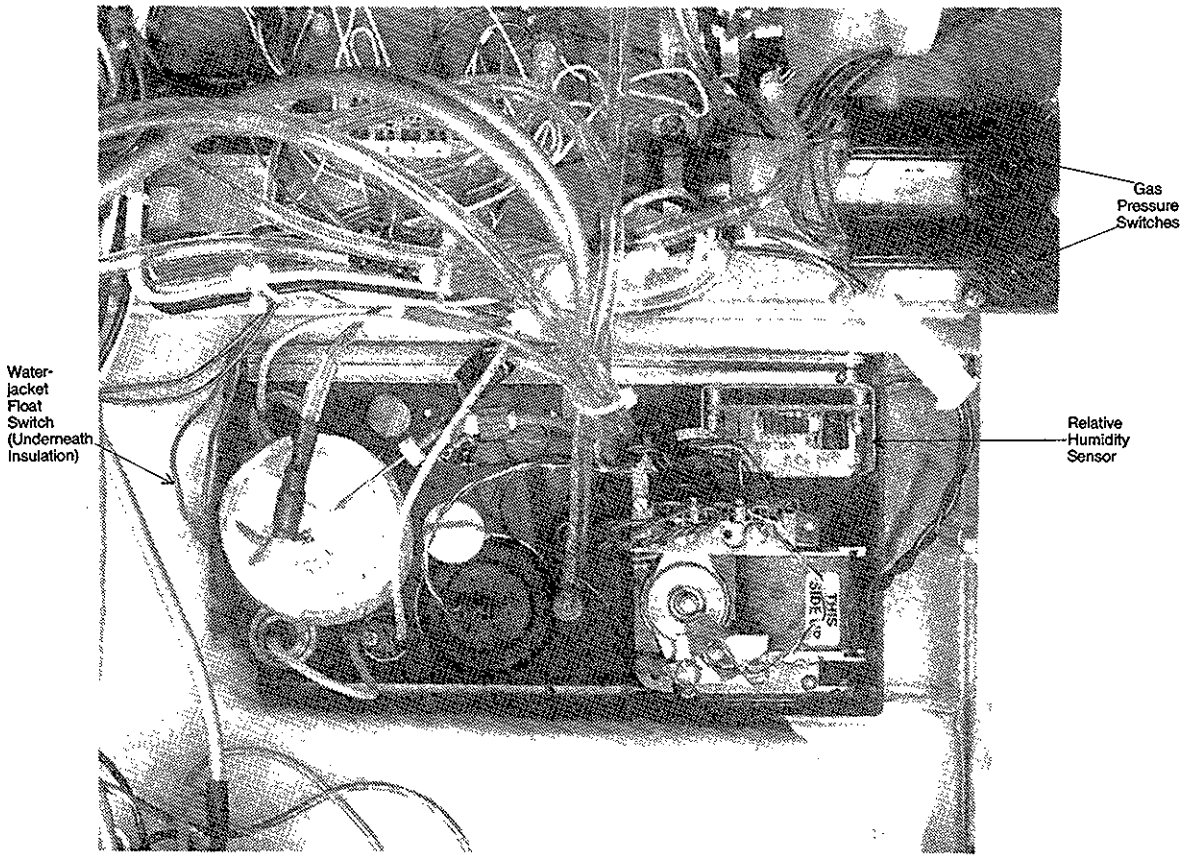


Fig. 12 PRESSURE SWITCHES/RH SENSOR/FLOAT SWITCH

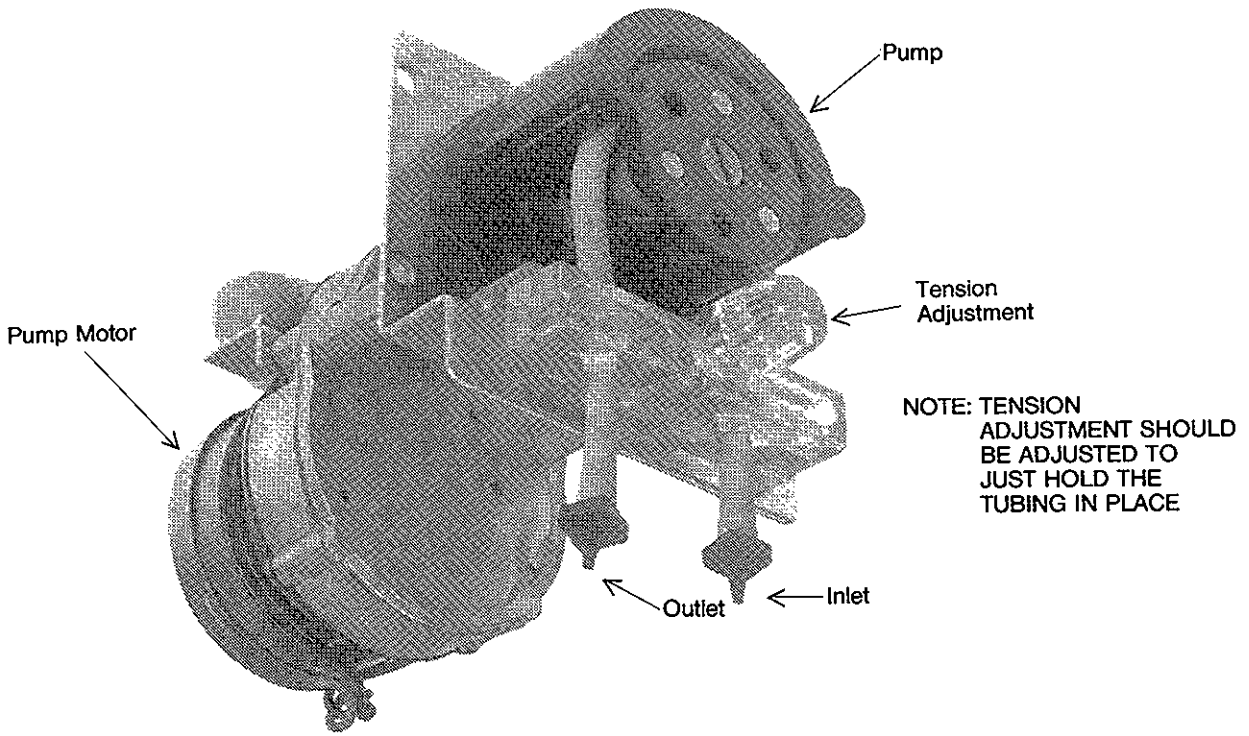


Fig. 13 RELATIVE HUMIDITY PUMP

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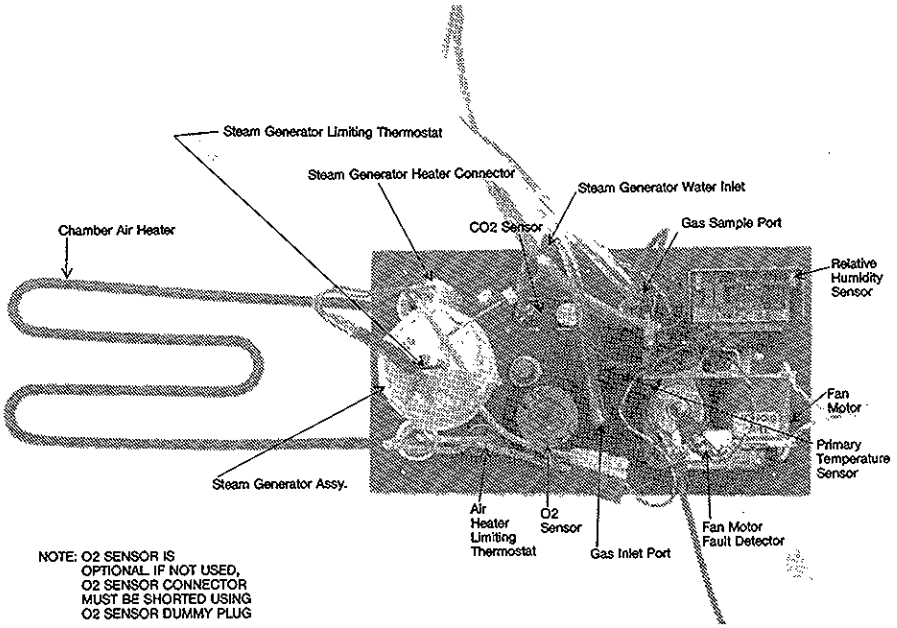


Fig. 14 FAN MOTOR/SENSOR PLATE (TOP VIEW)

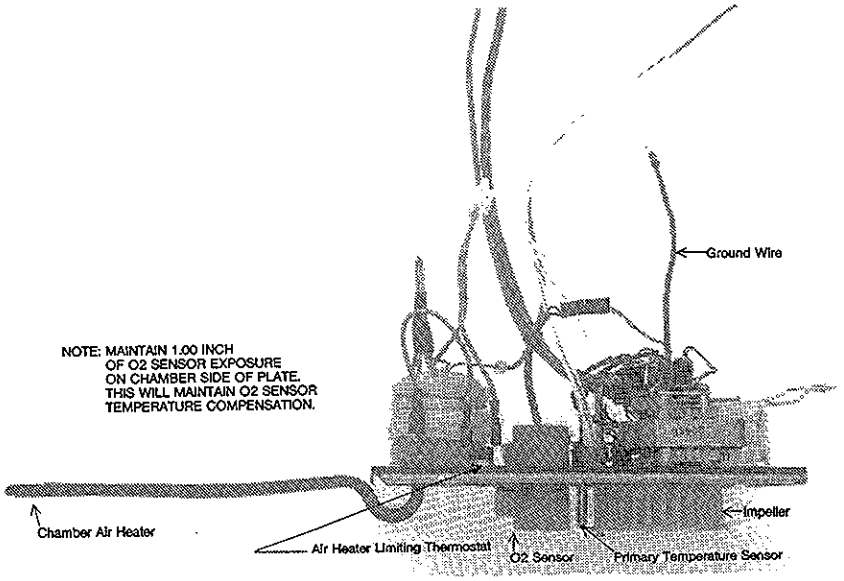


Fig. 15 FAN MOTOR/SENSOR PLATE (SIDE VIEW)

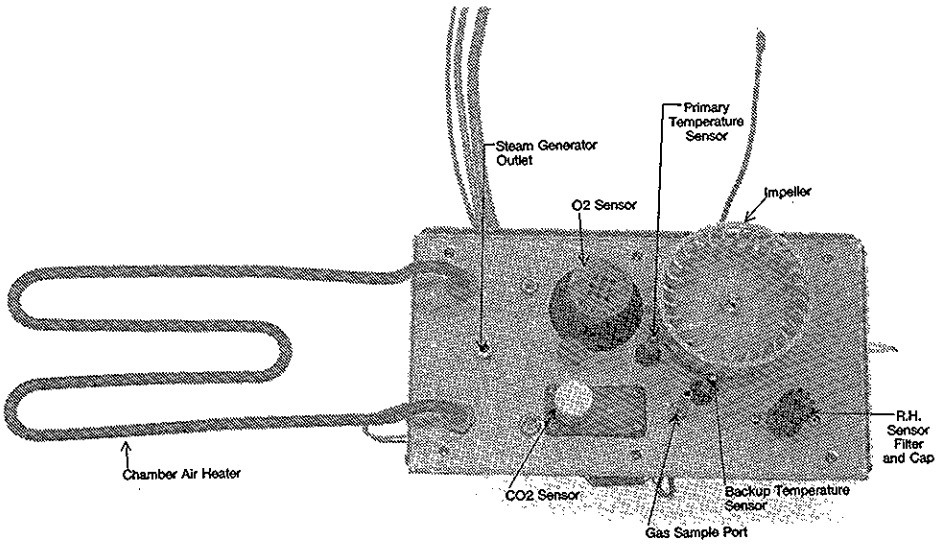
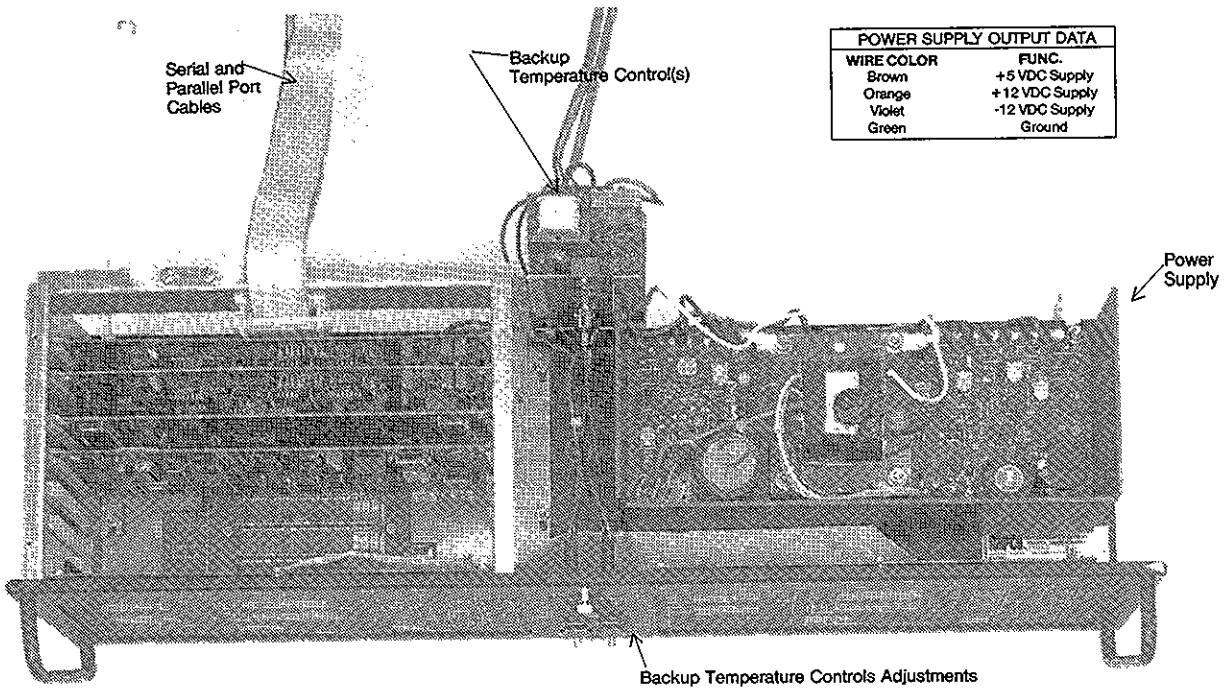


Fig. 16 FAN MOTOR/SENSOR PLATE (BOTTOM VIEW)

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NOTE: DO *NOT* ATTEMPT TO ADJUST THE POWER SUPPLY WITHOUT FIRST REFERRING TO THE "POWER SUPPLY" SECTION OF SERVICE MANUAL.

Fig. 17 CONTROLS (TOP VIEW)

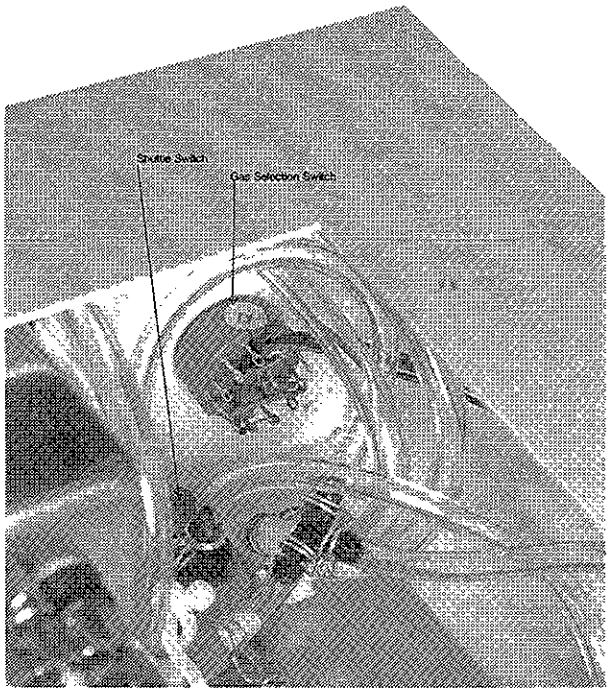


Fig. 18 GAS SELECTION SWITCH/SHUTTLE SWITCH

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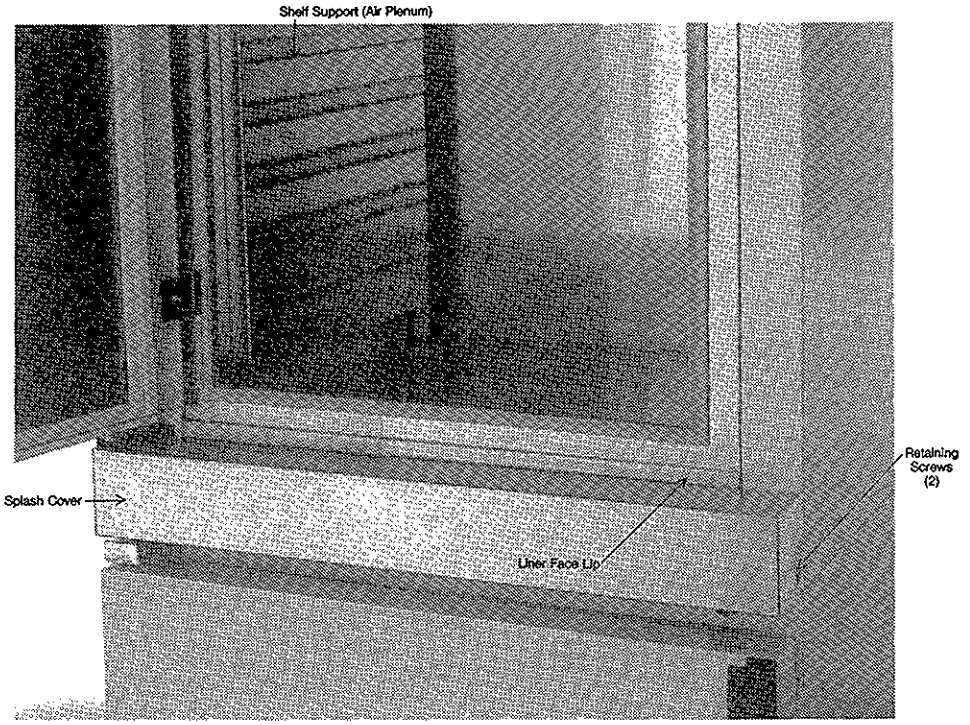


Fig. 19 SPLASH COVER

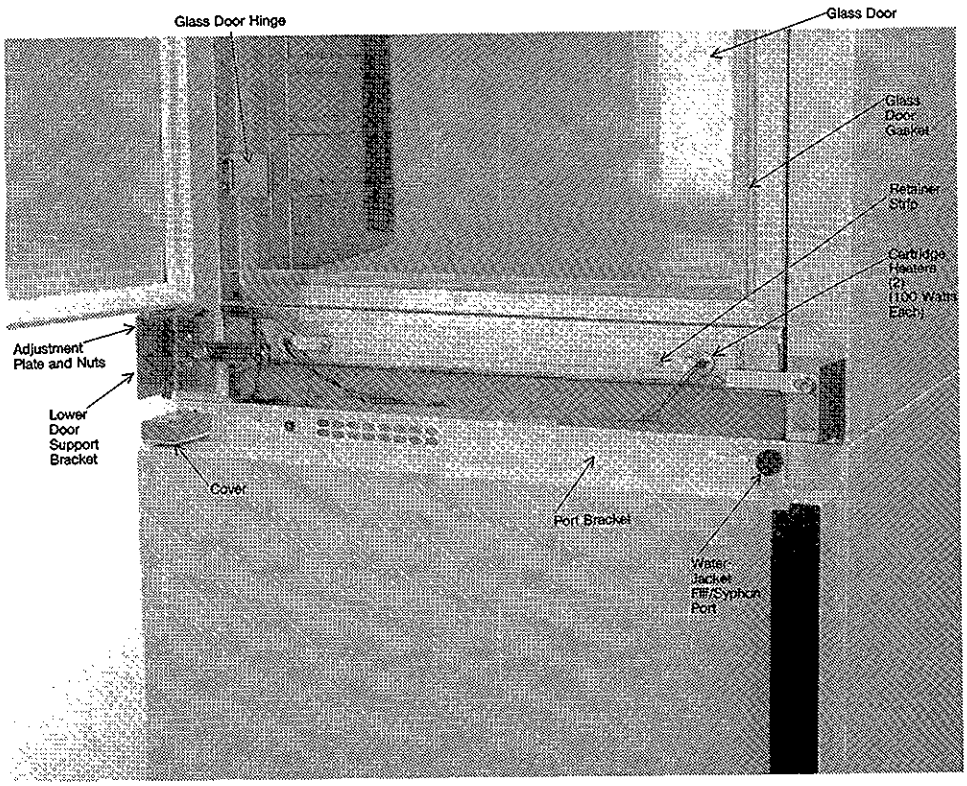


Fig. 20 SPLASH COVER REMOVED

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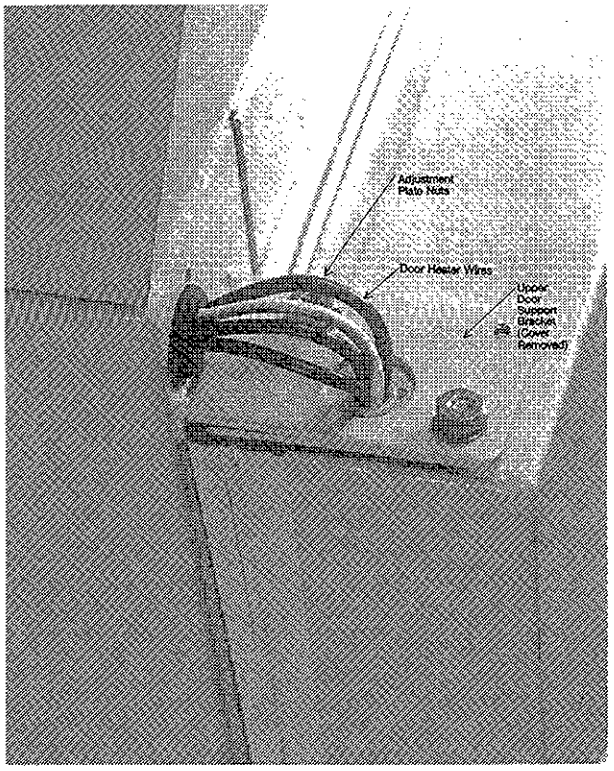
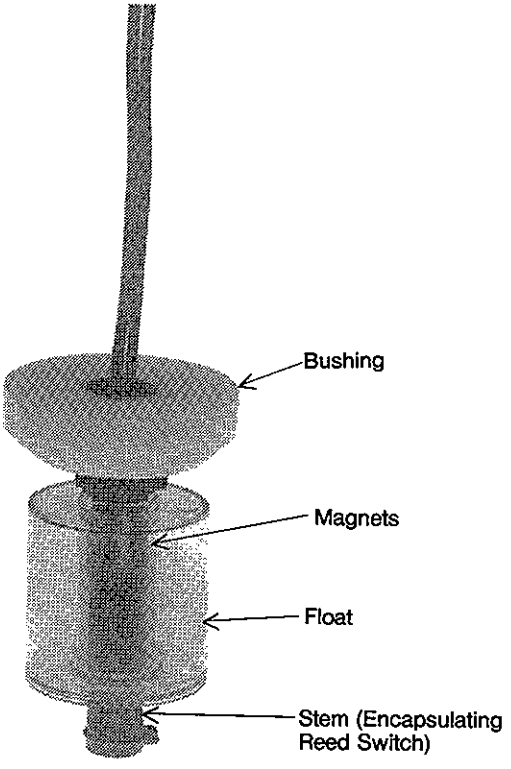


Fig. 21 UPPER DOOR SUPPORT



NOTE: MAGNETS MUST BE AT TOP OF FLOAT AS SHOWN. IF NOT, REMOVE RETAINER AND FLIP FLOAT OVER.

Fig. 22 FLOAT SWITCH

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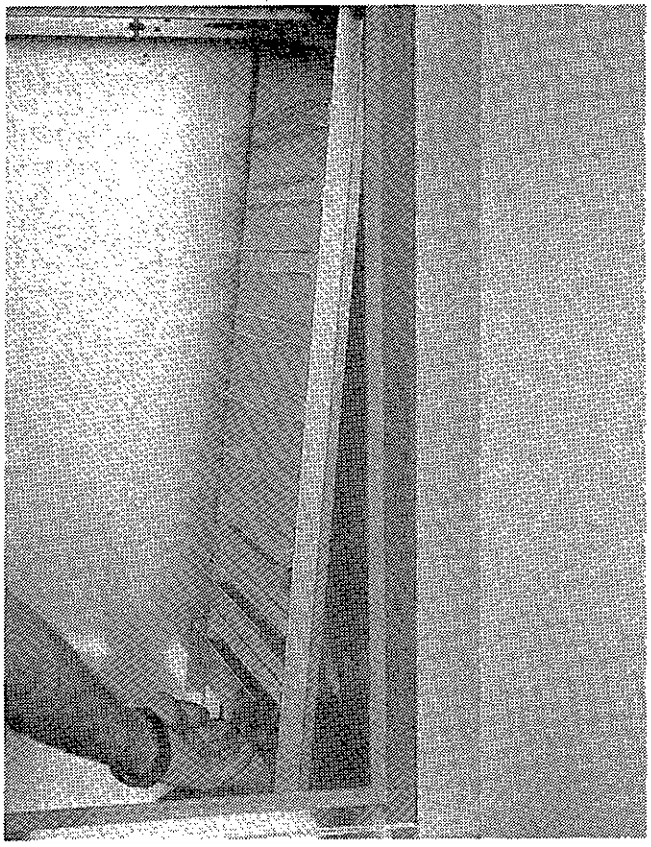


Fig. 23 SHELF SUPPORT REMOVAL (STEP NO.1)



Fig. 24 SHELF SUPPORT REMOVAL (STEP NO.2)

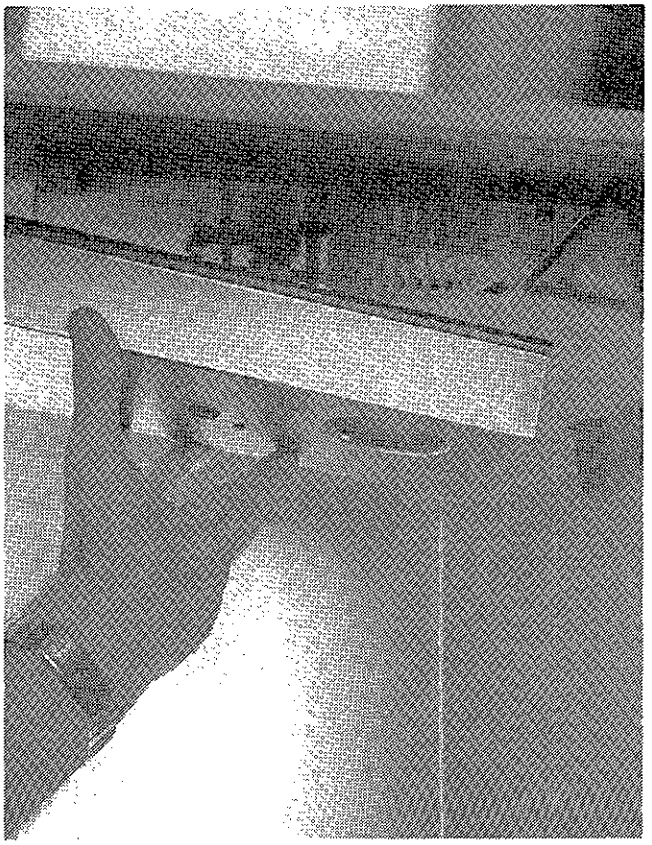


Fig. 25 SHELF SUPPORT REMOVAL (STEP NO.3)

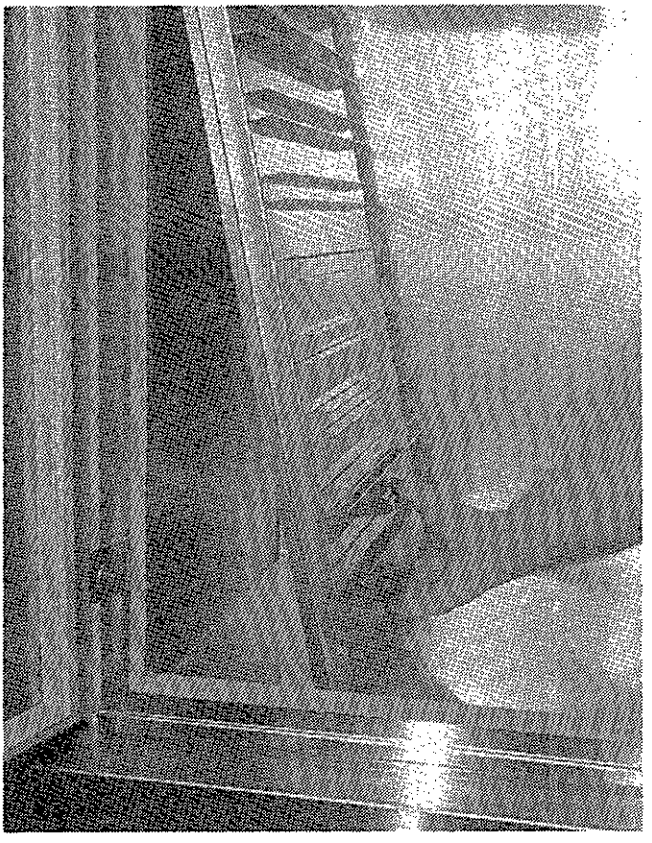
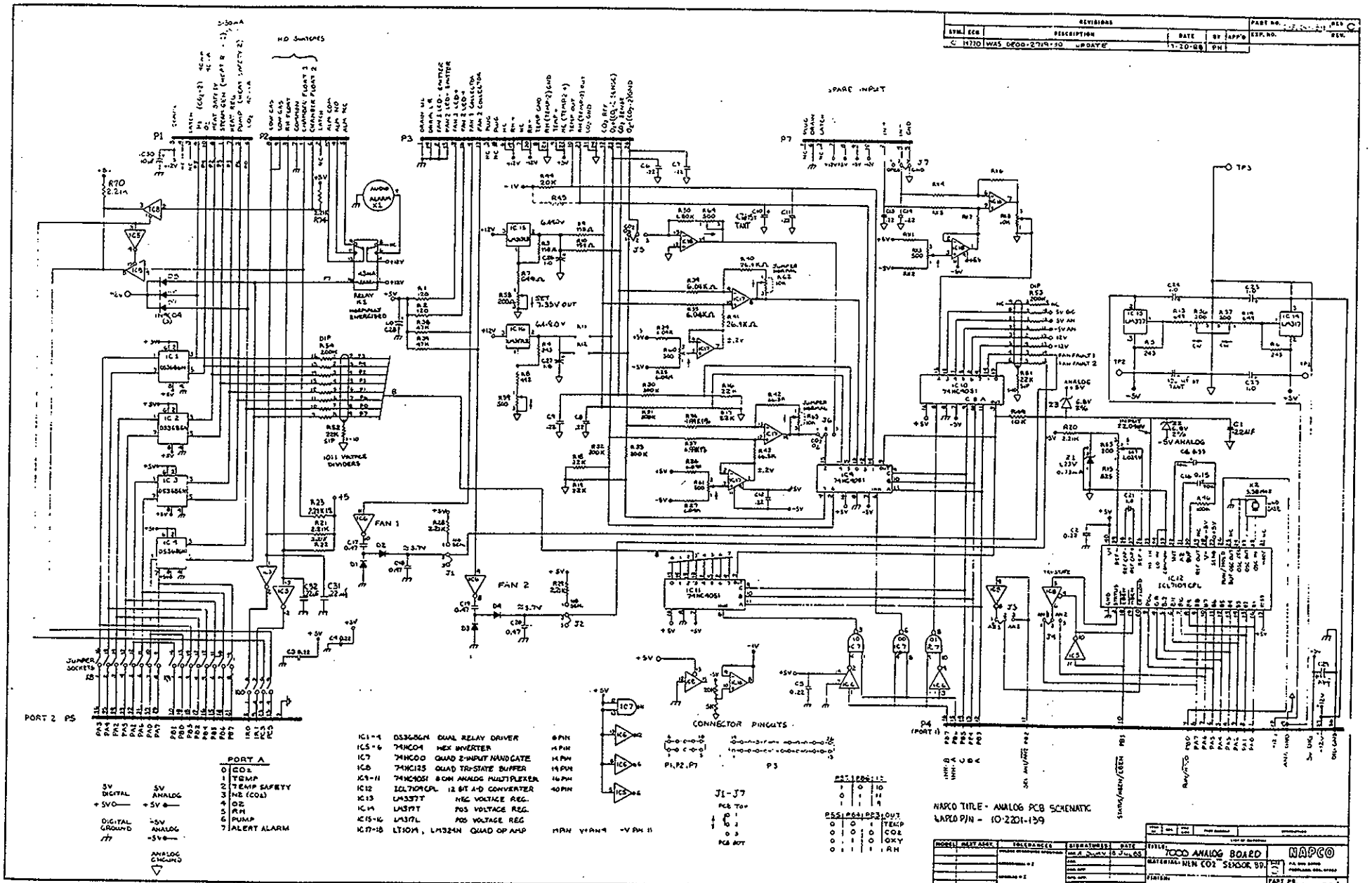
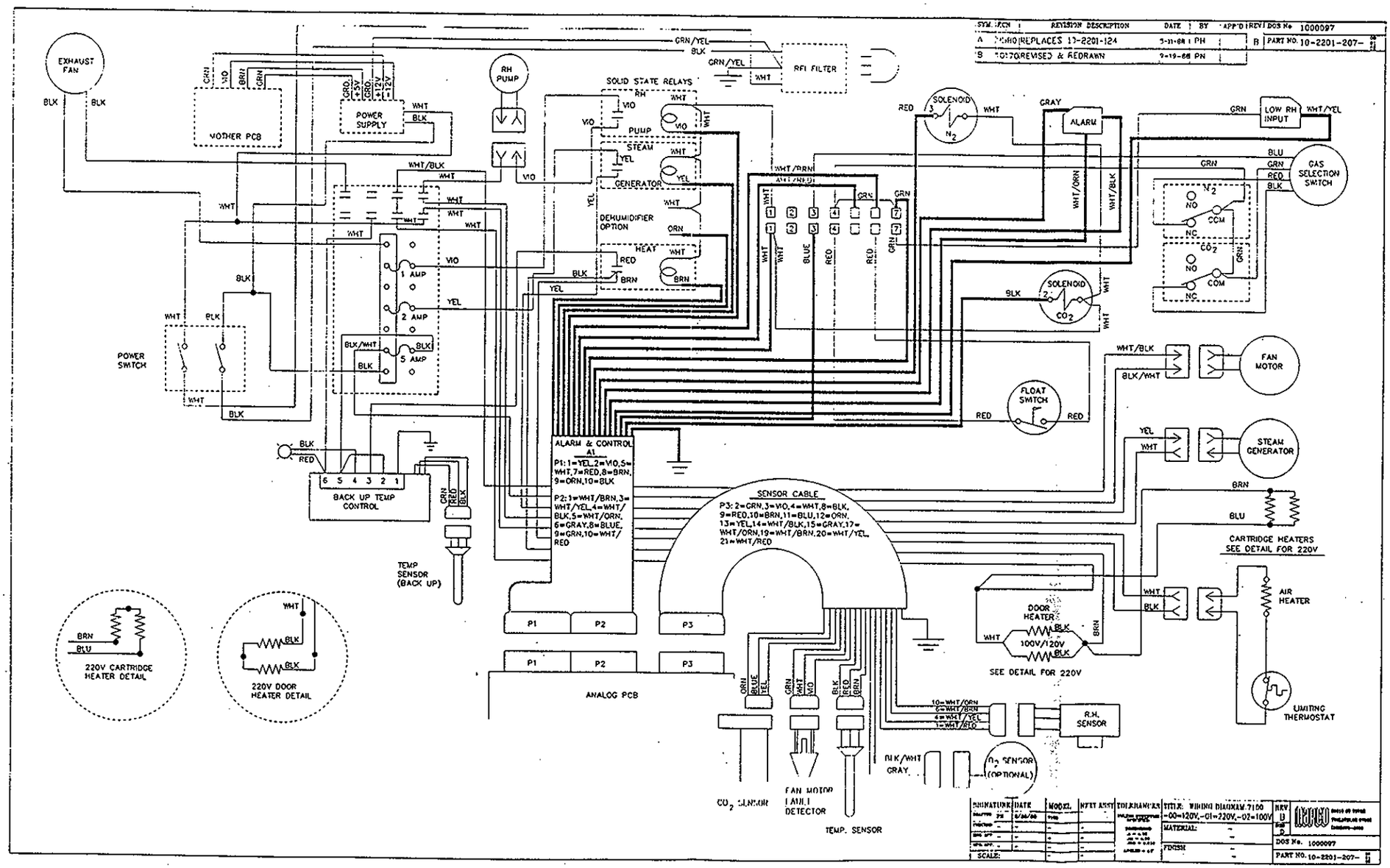


Fig. 26 SHELF SUPPORT REMOVAL (STEP NO.4)

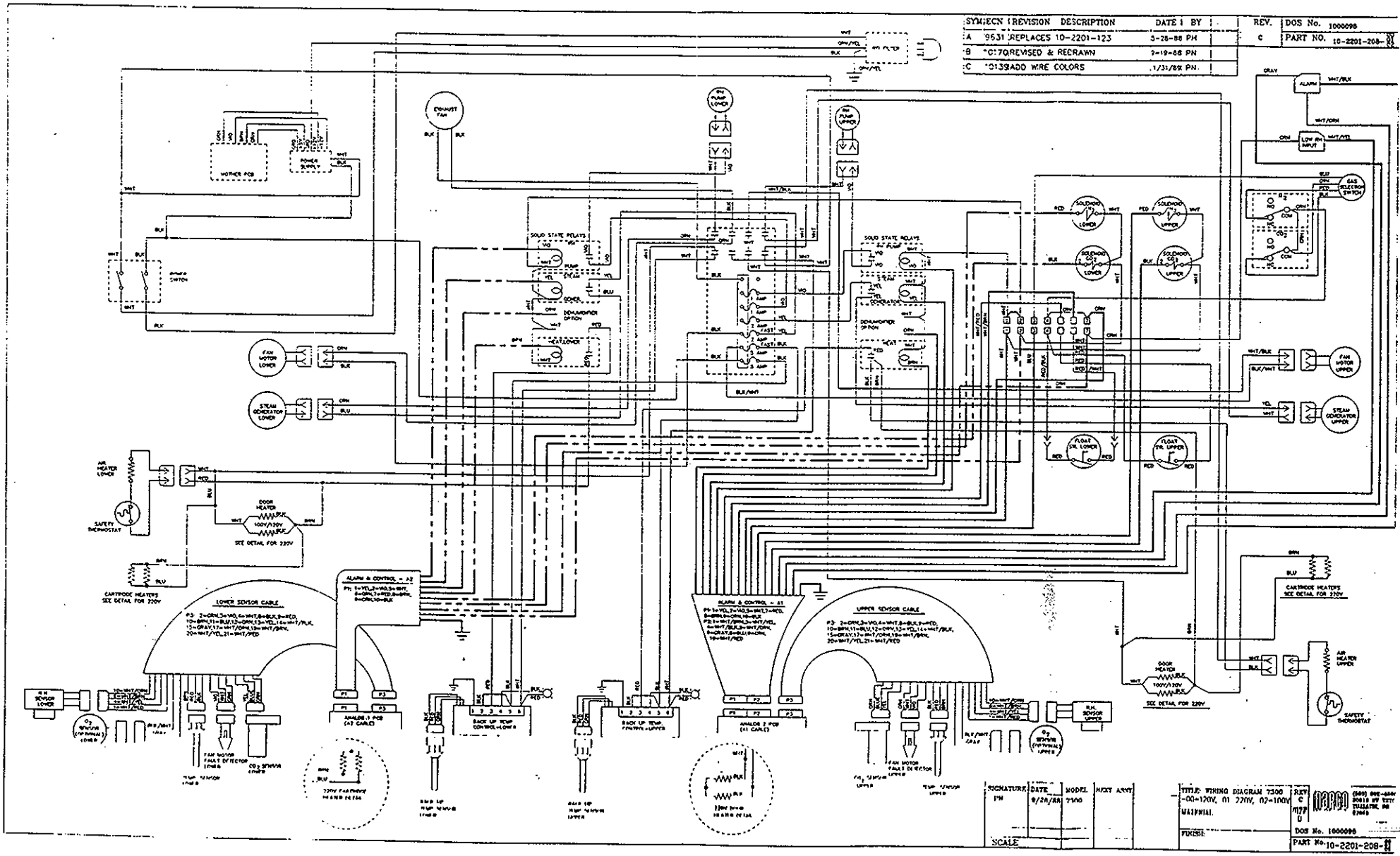
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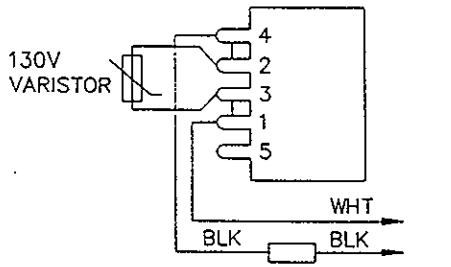
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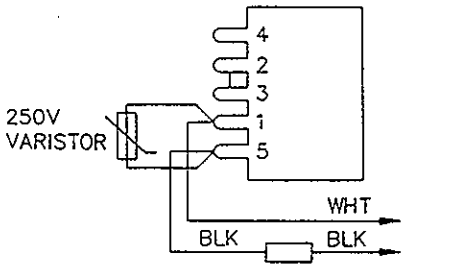


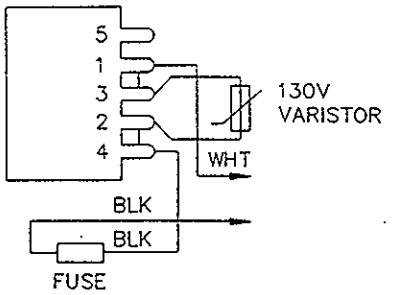
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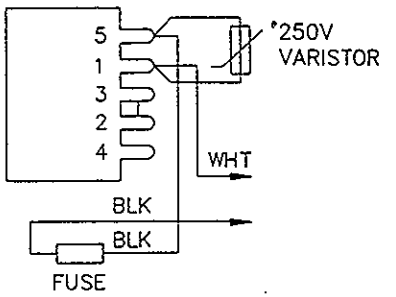


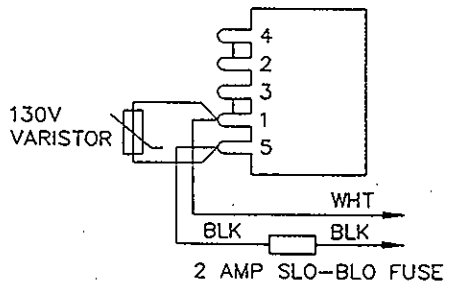
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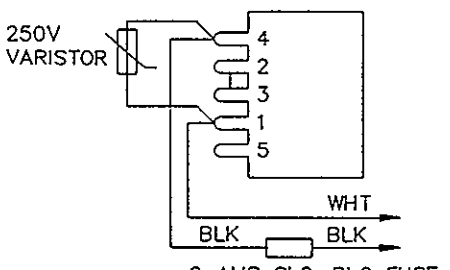


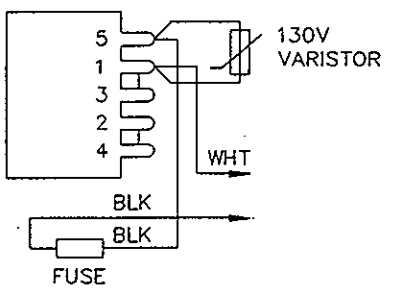


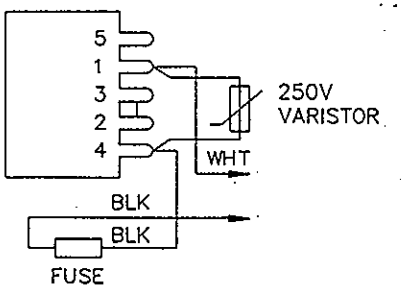








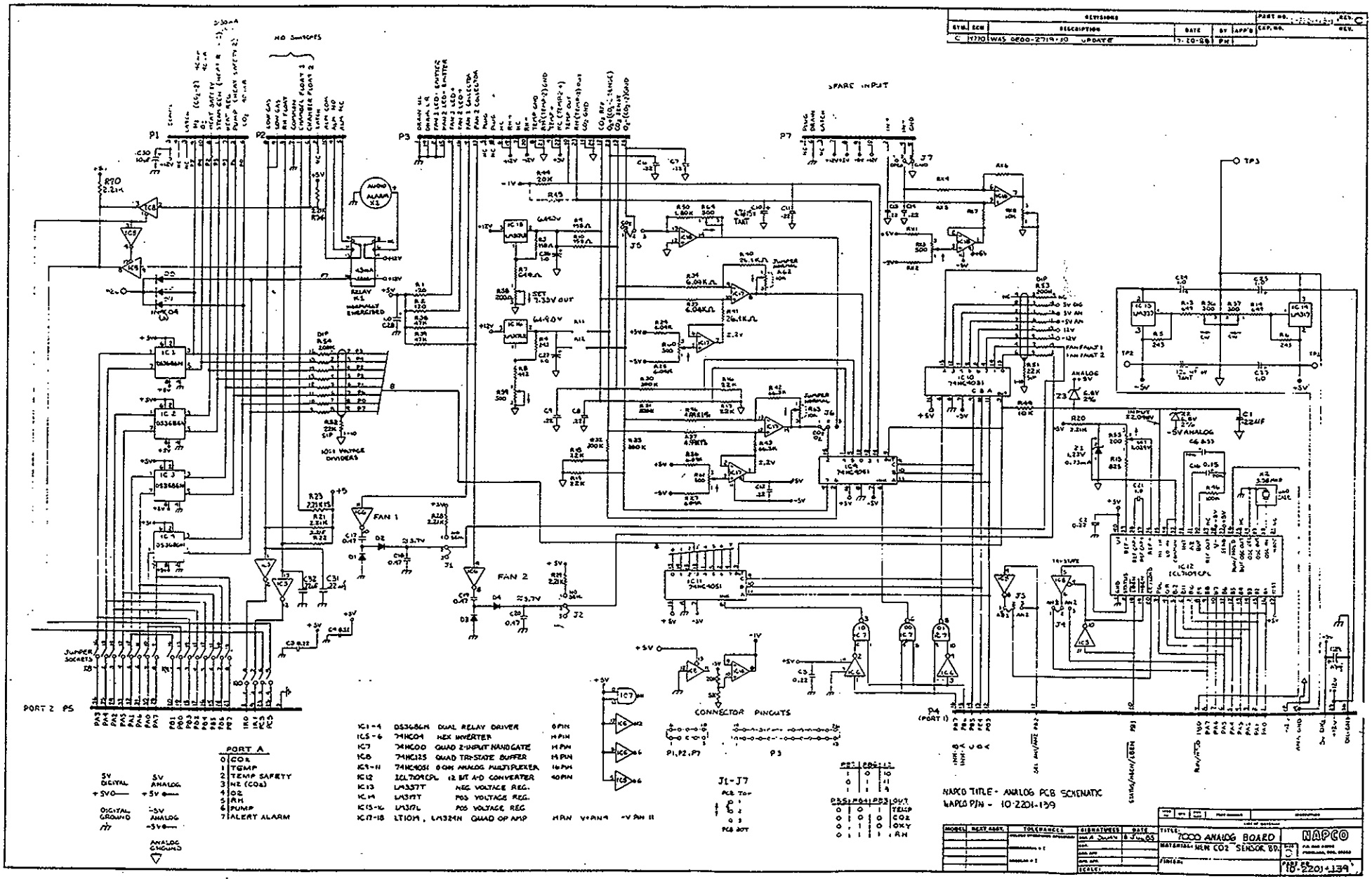




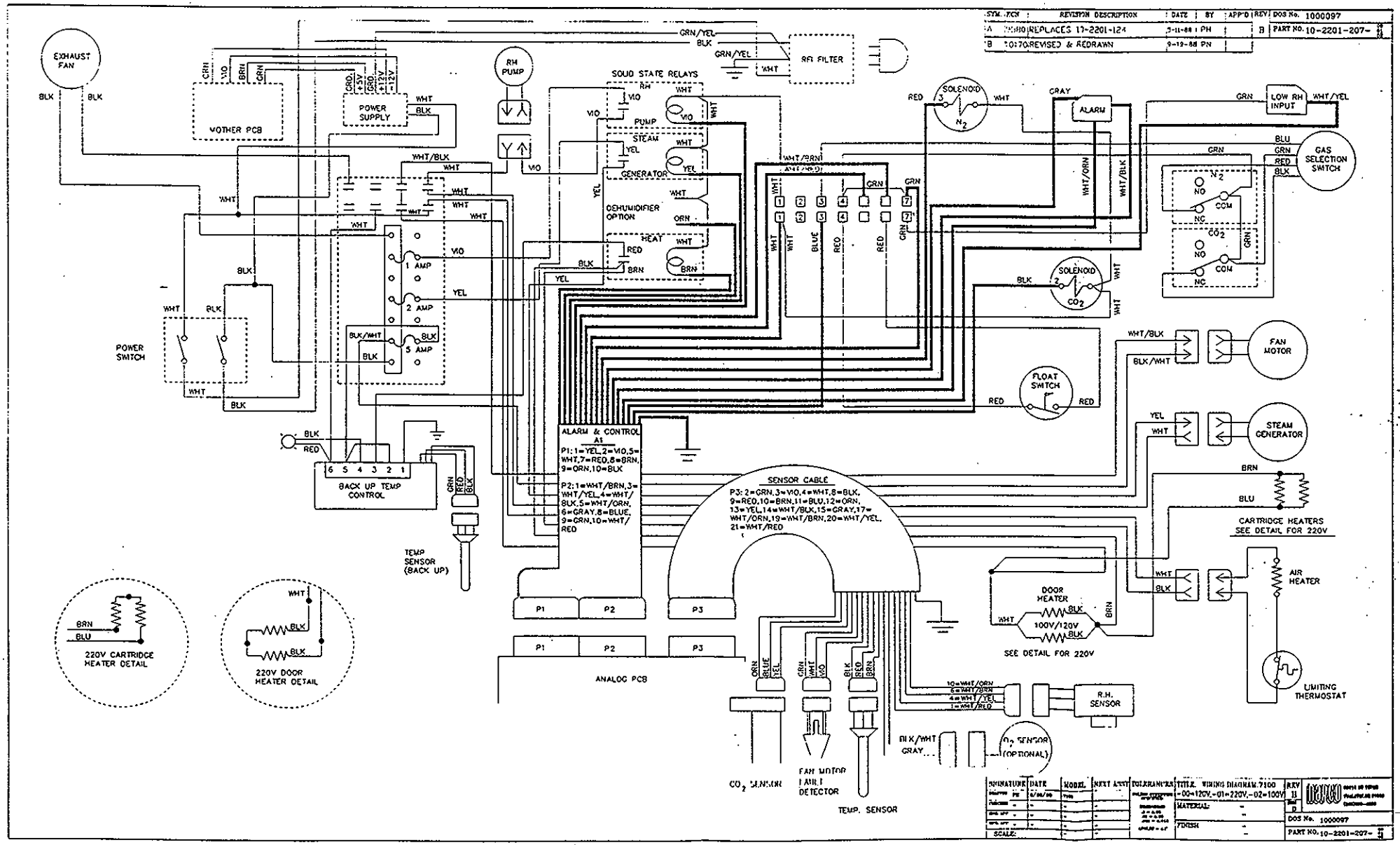
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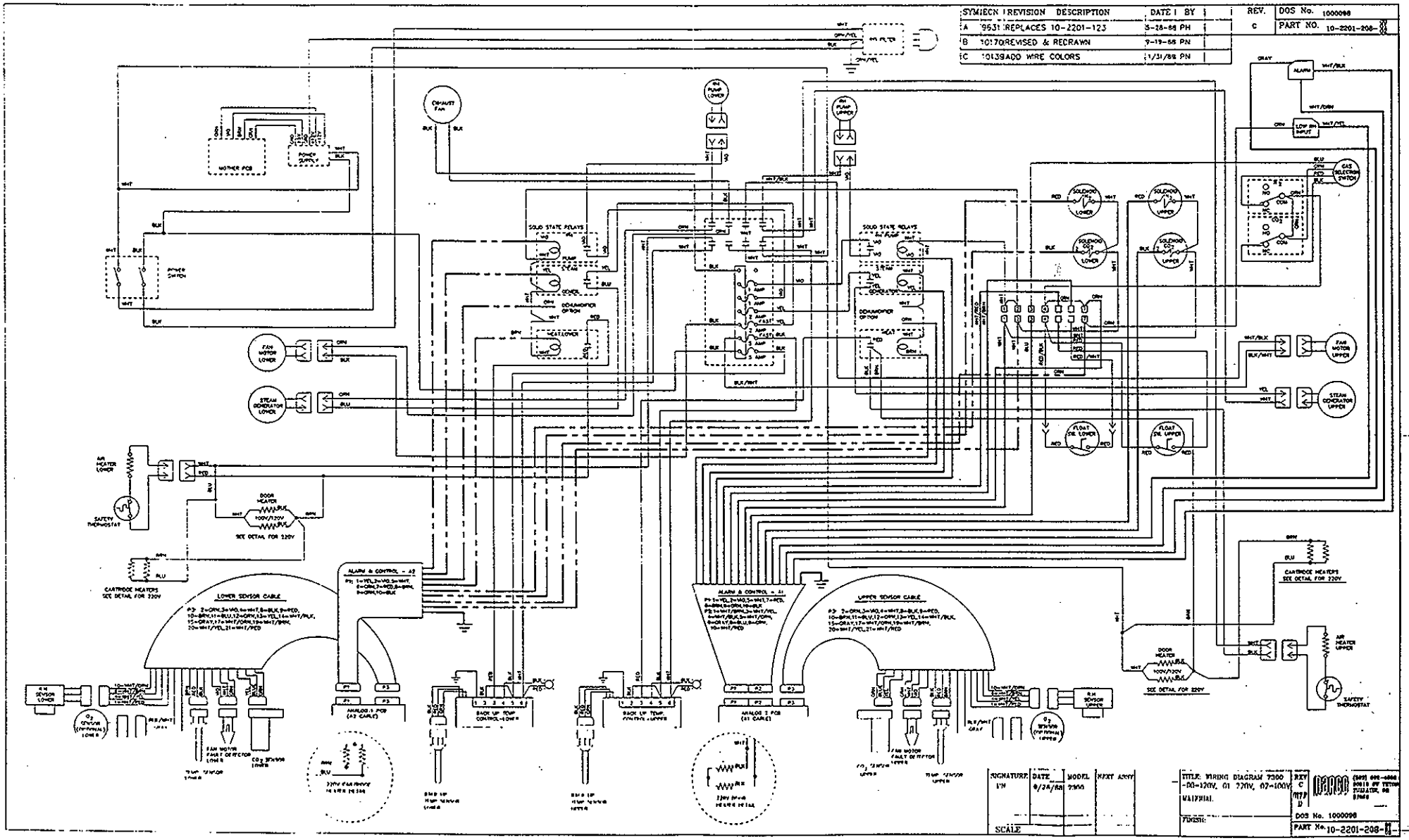
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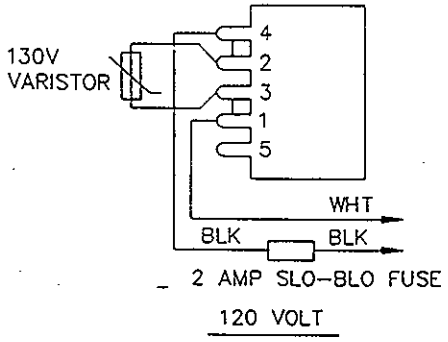
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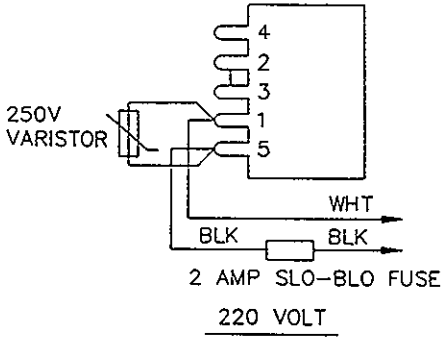


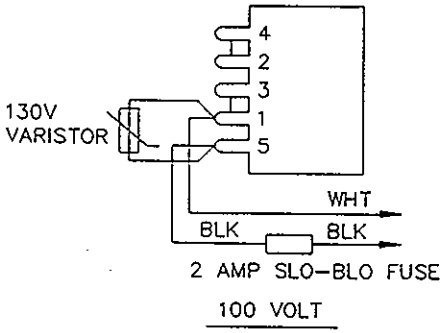
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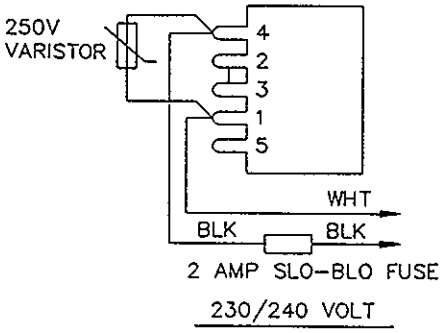


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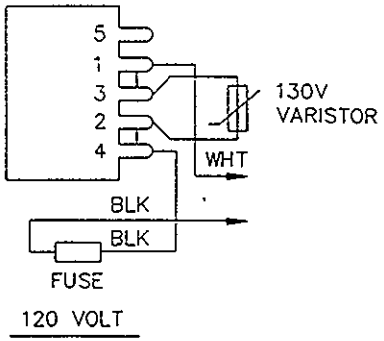


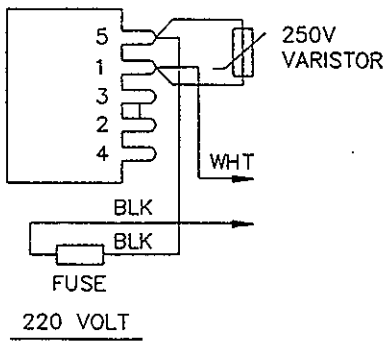


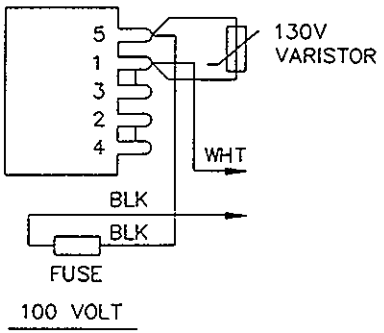


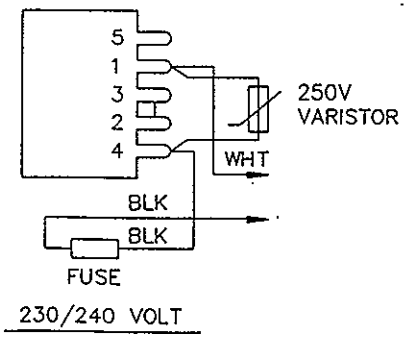


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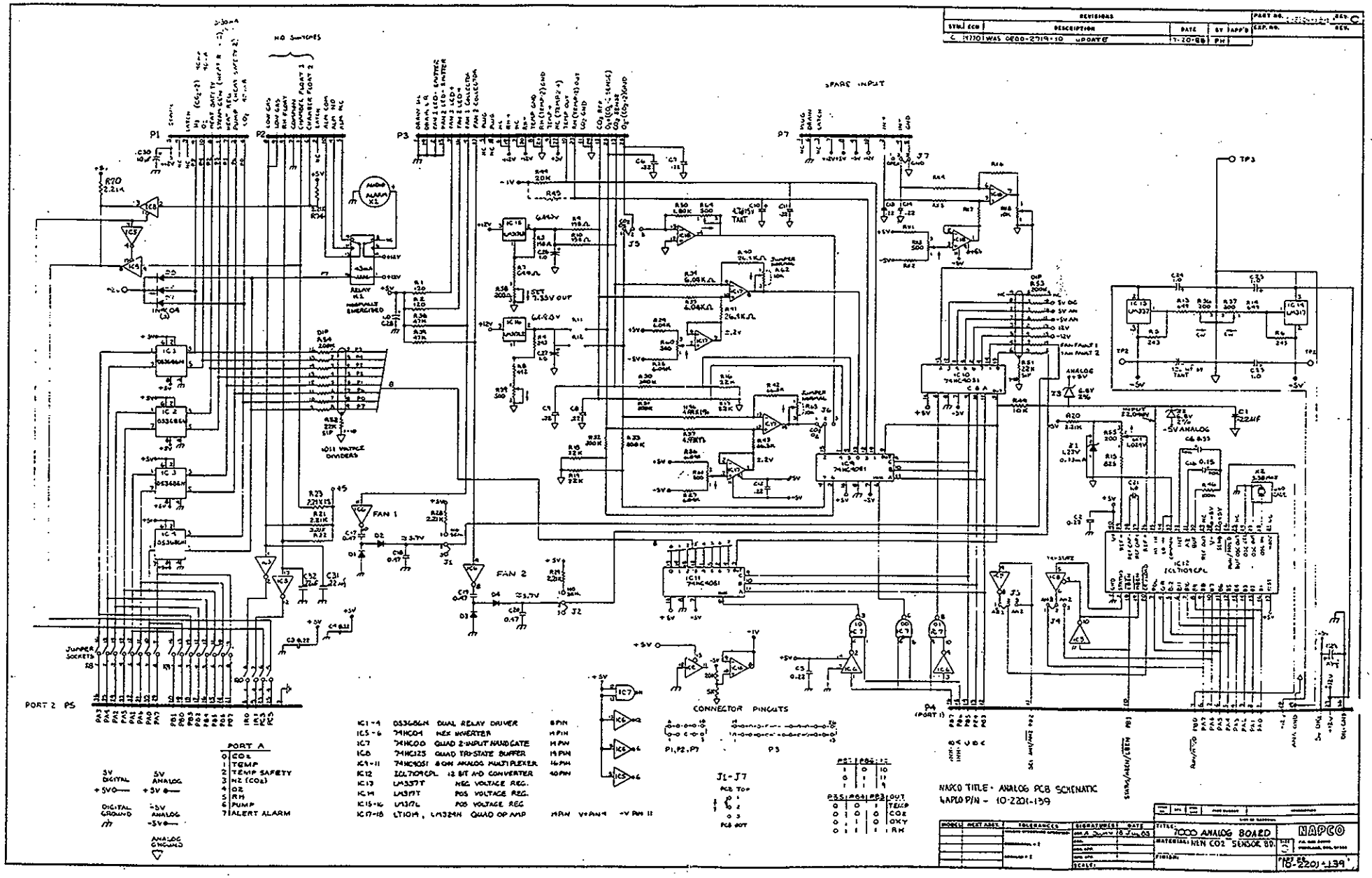




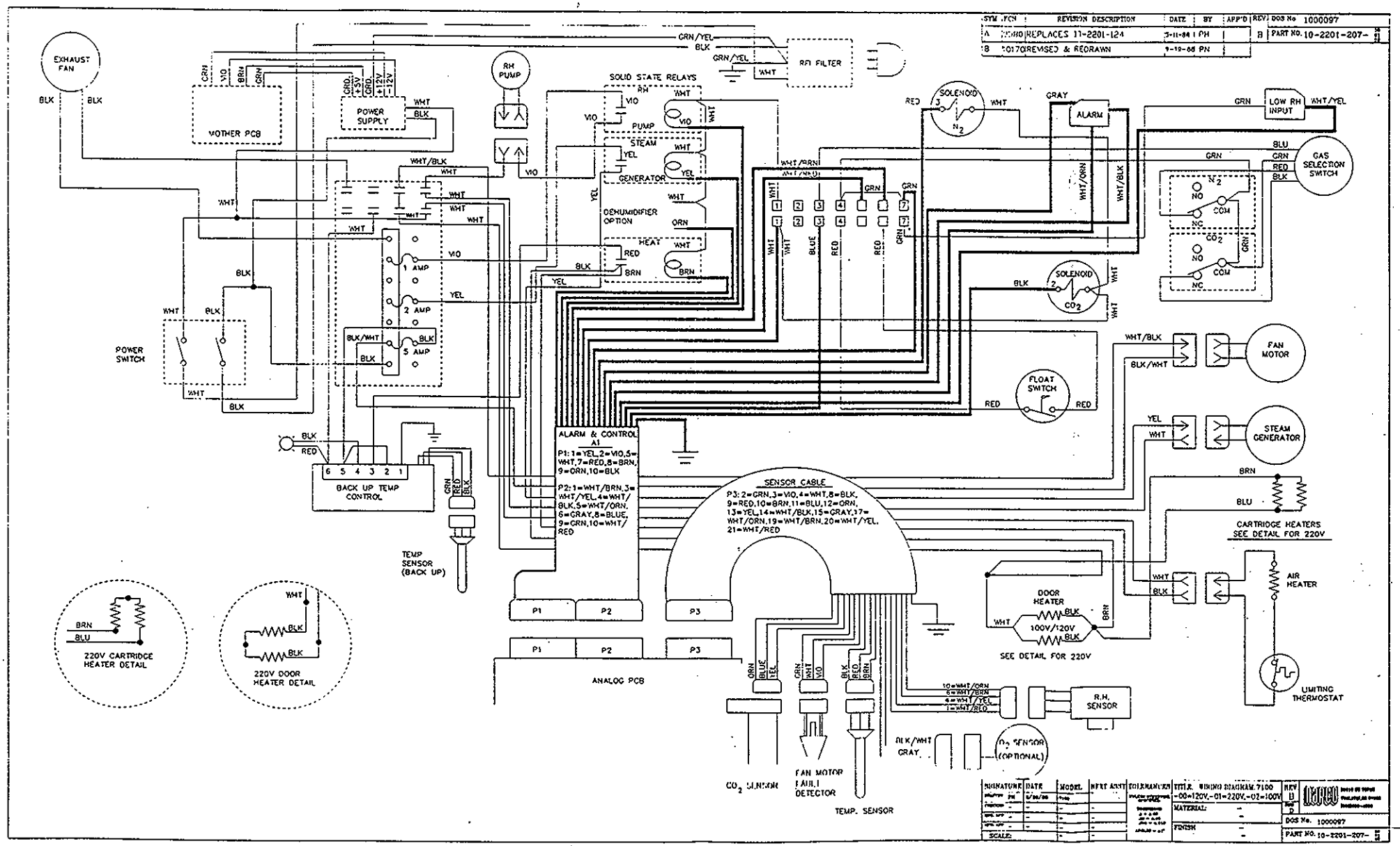


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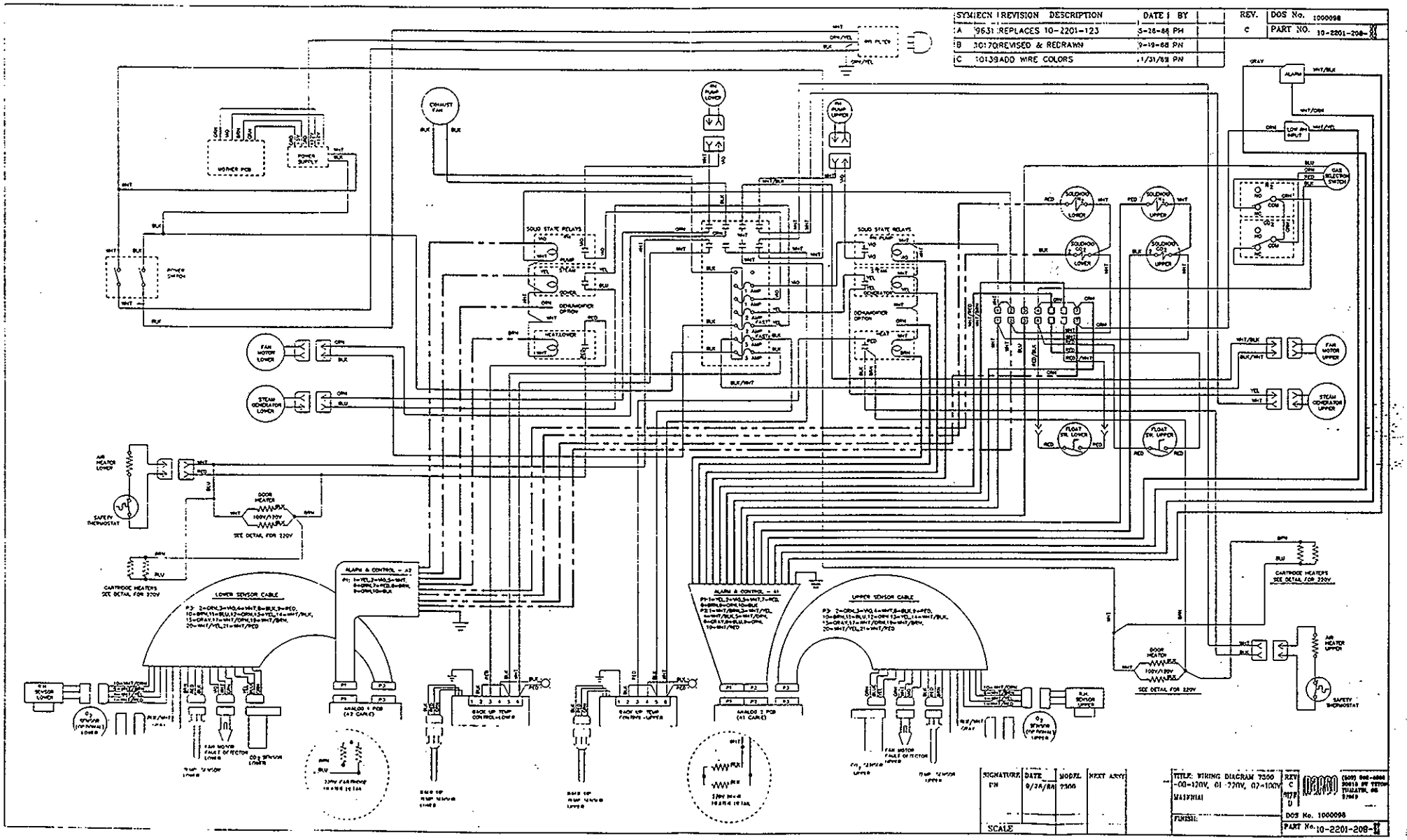
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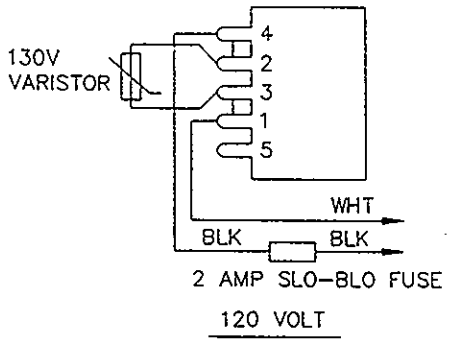
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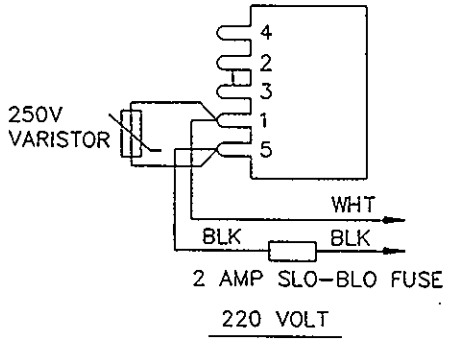


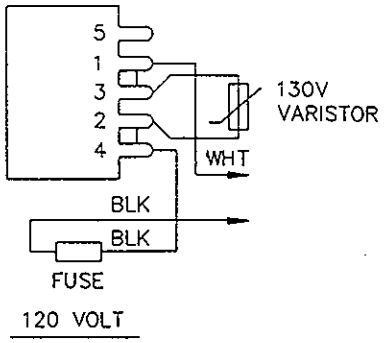
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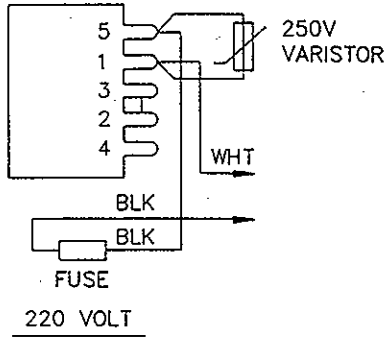


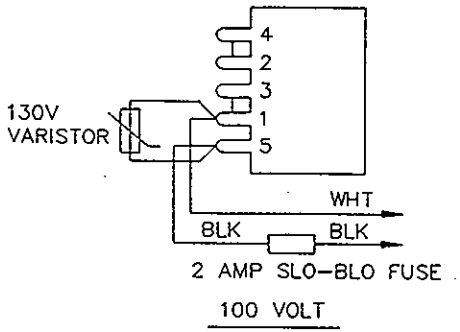
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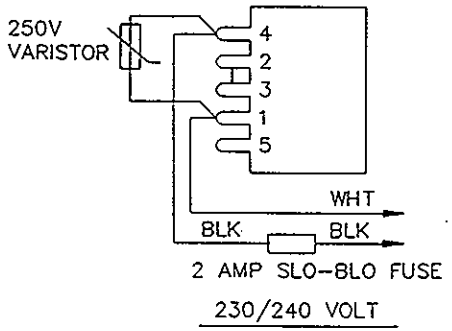


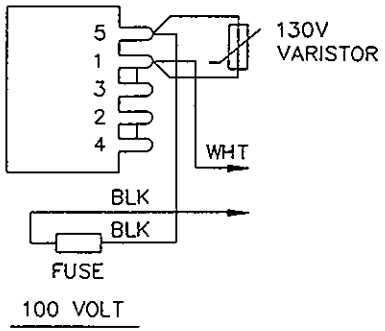


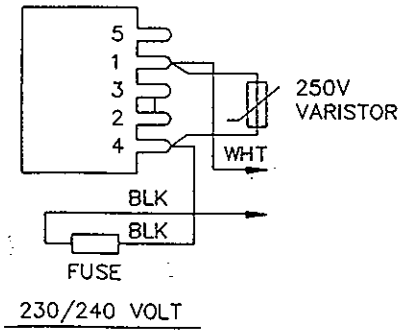








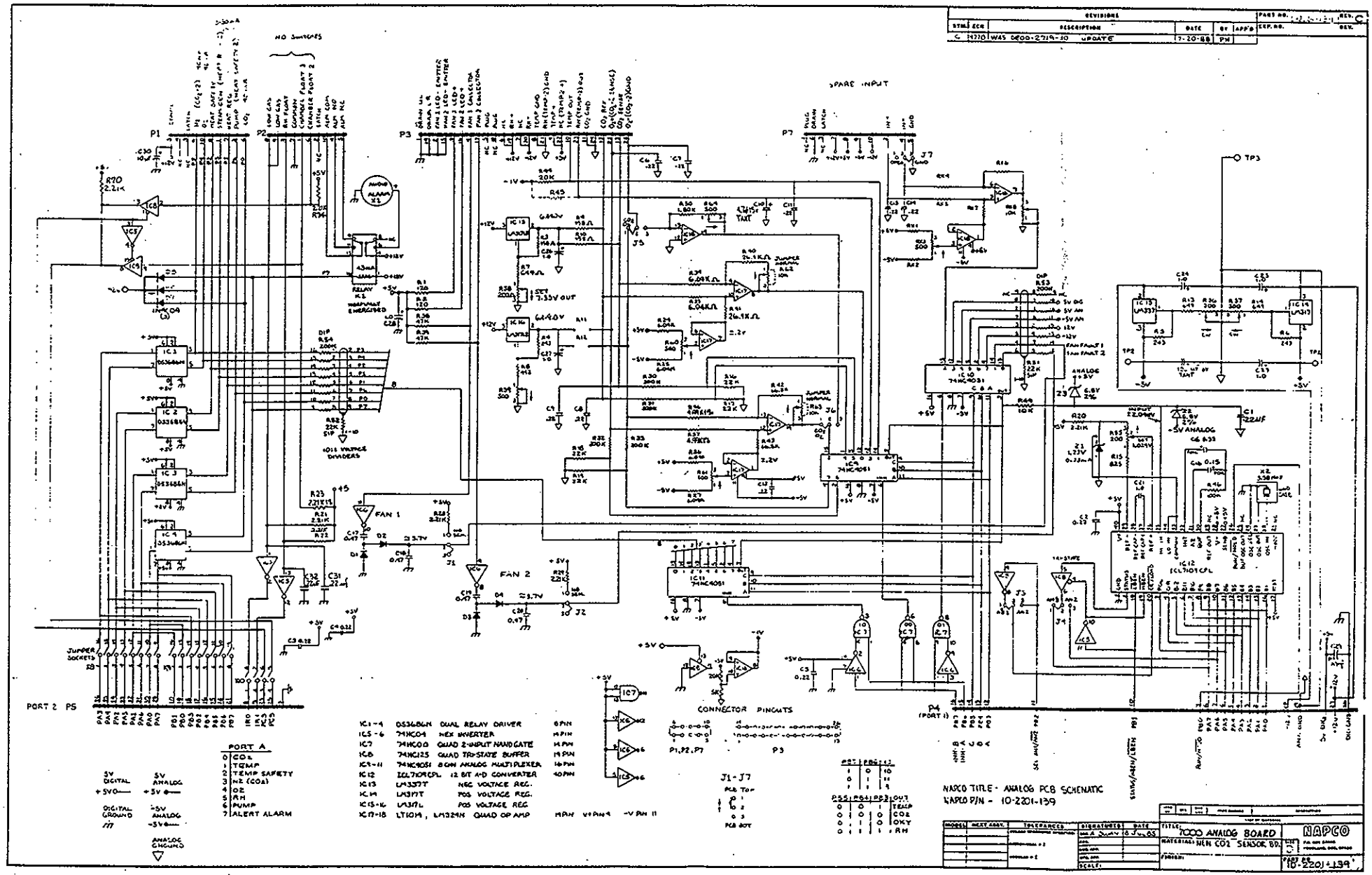




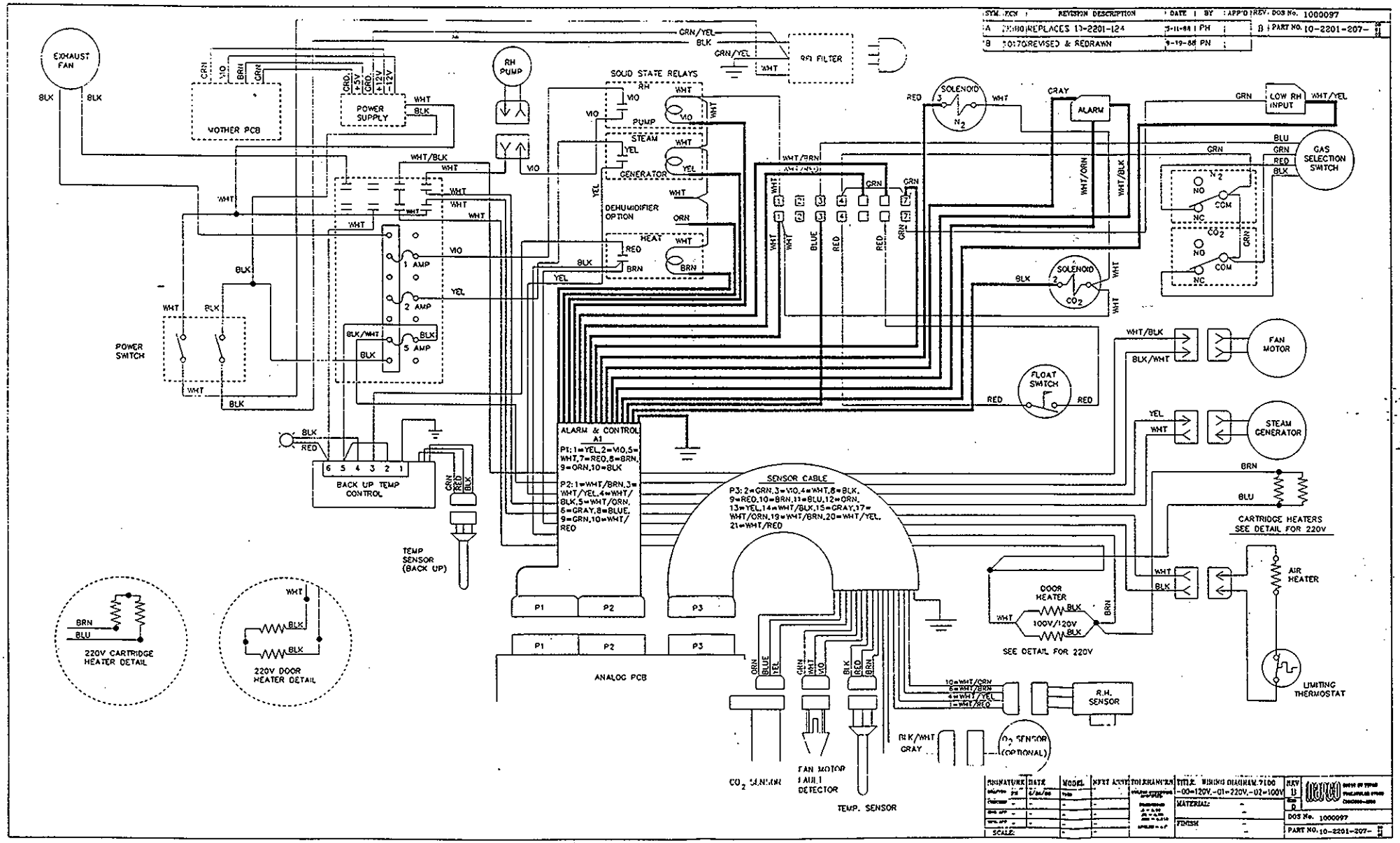
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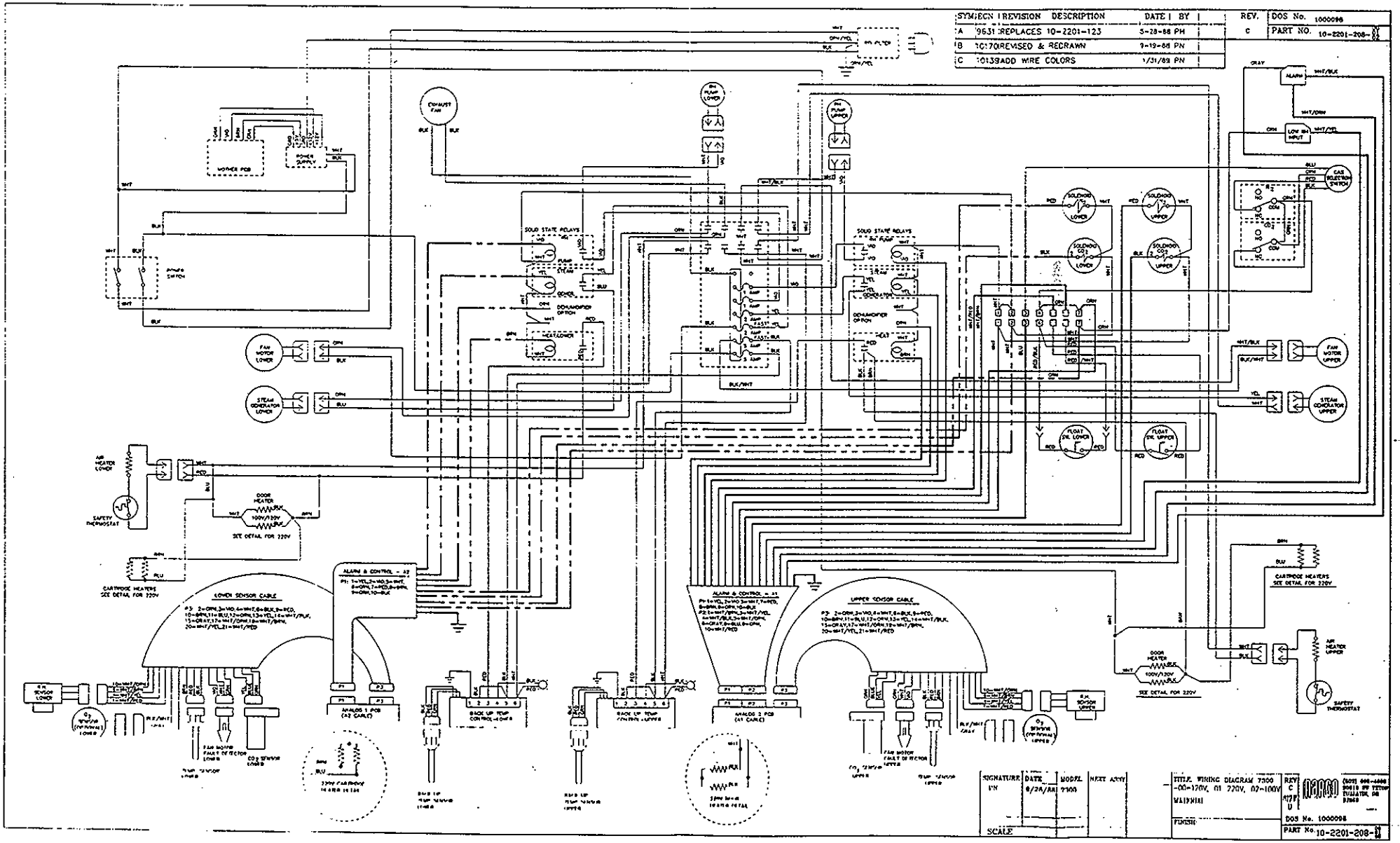
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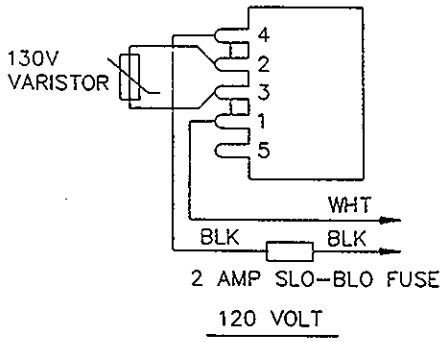
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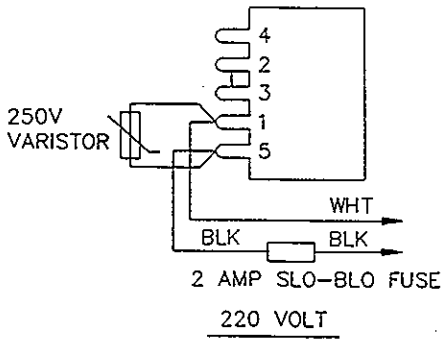


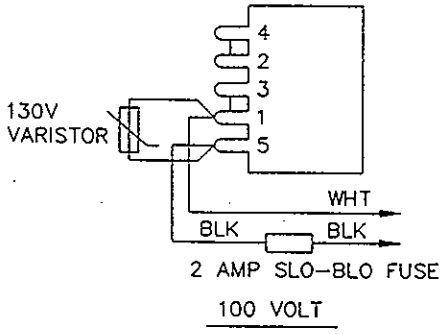
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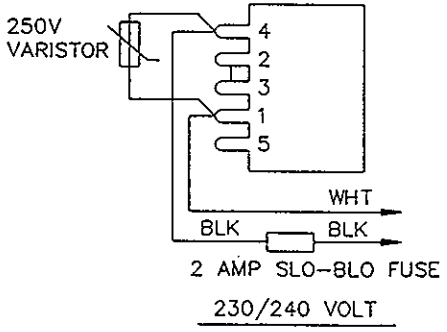


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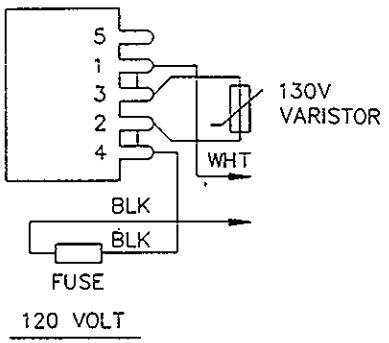


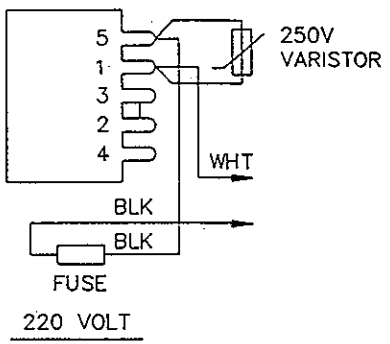


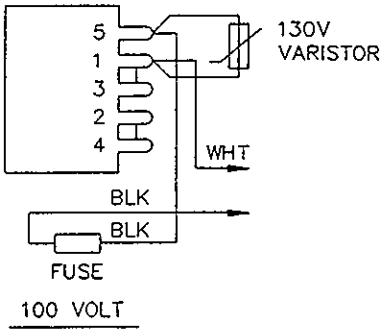


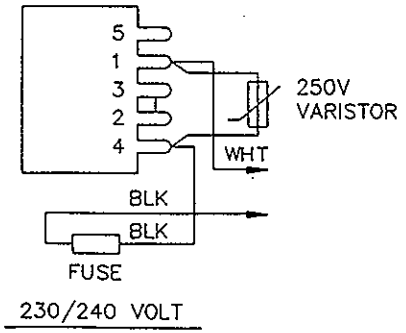


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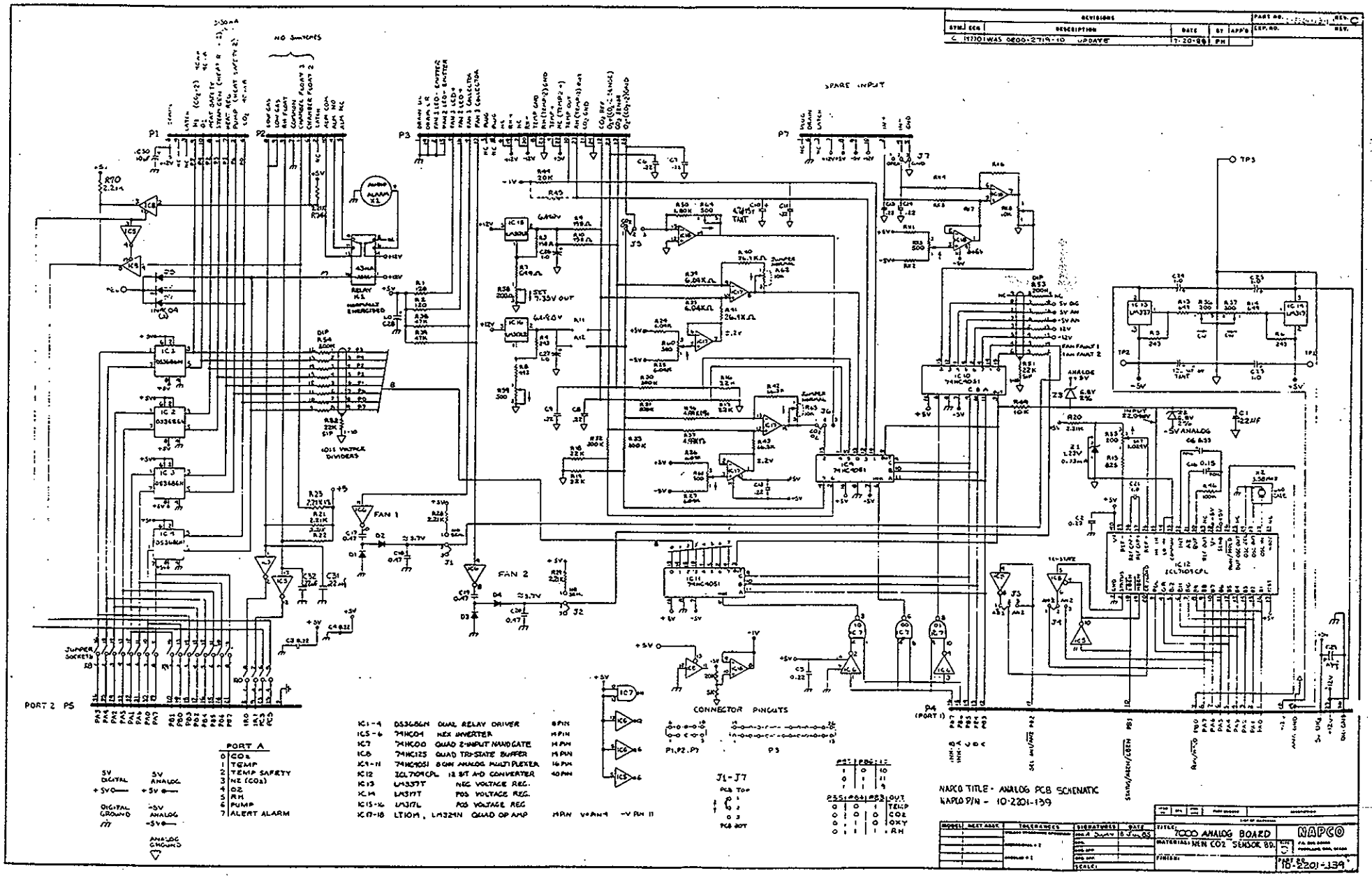




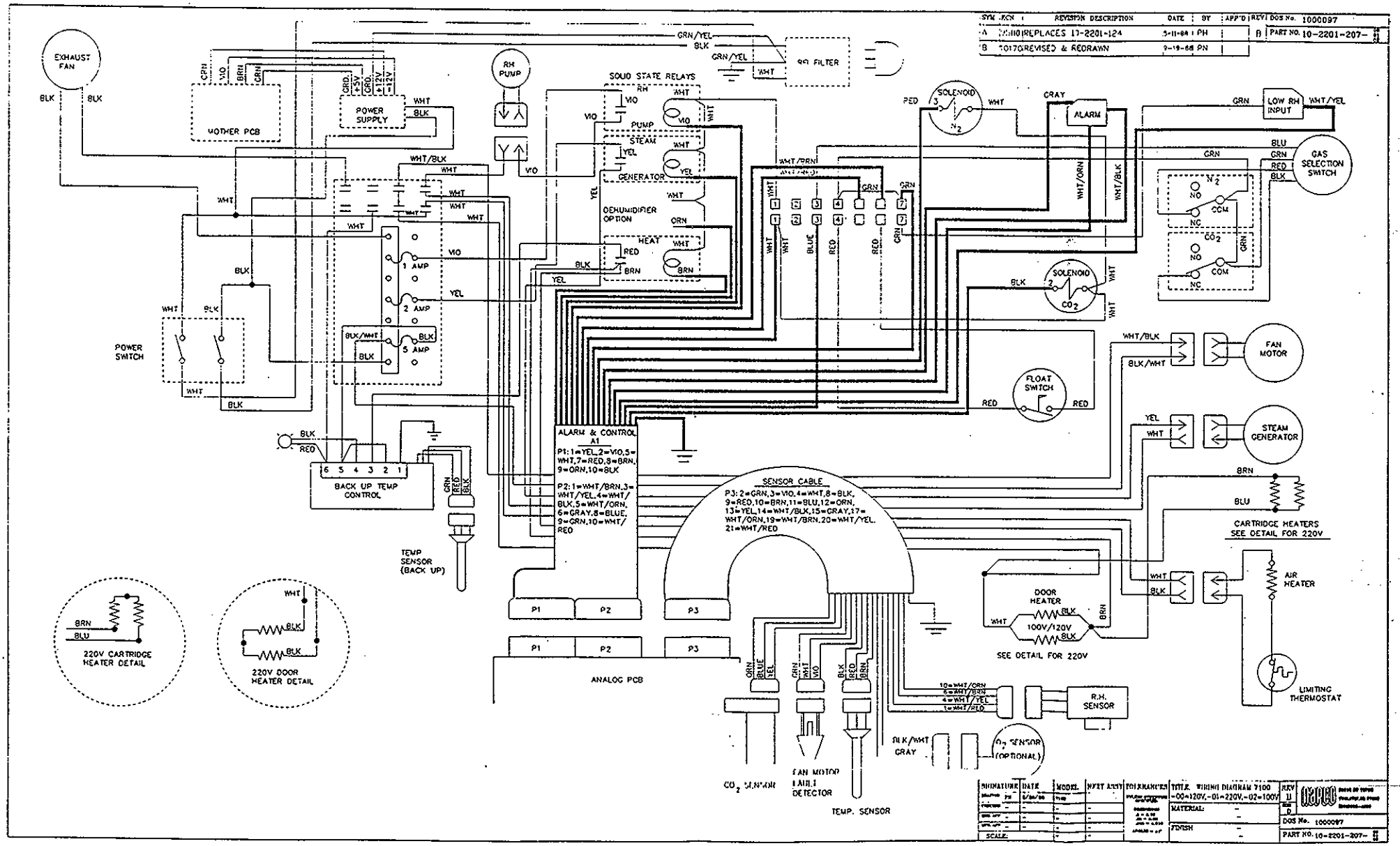


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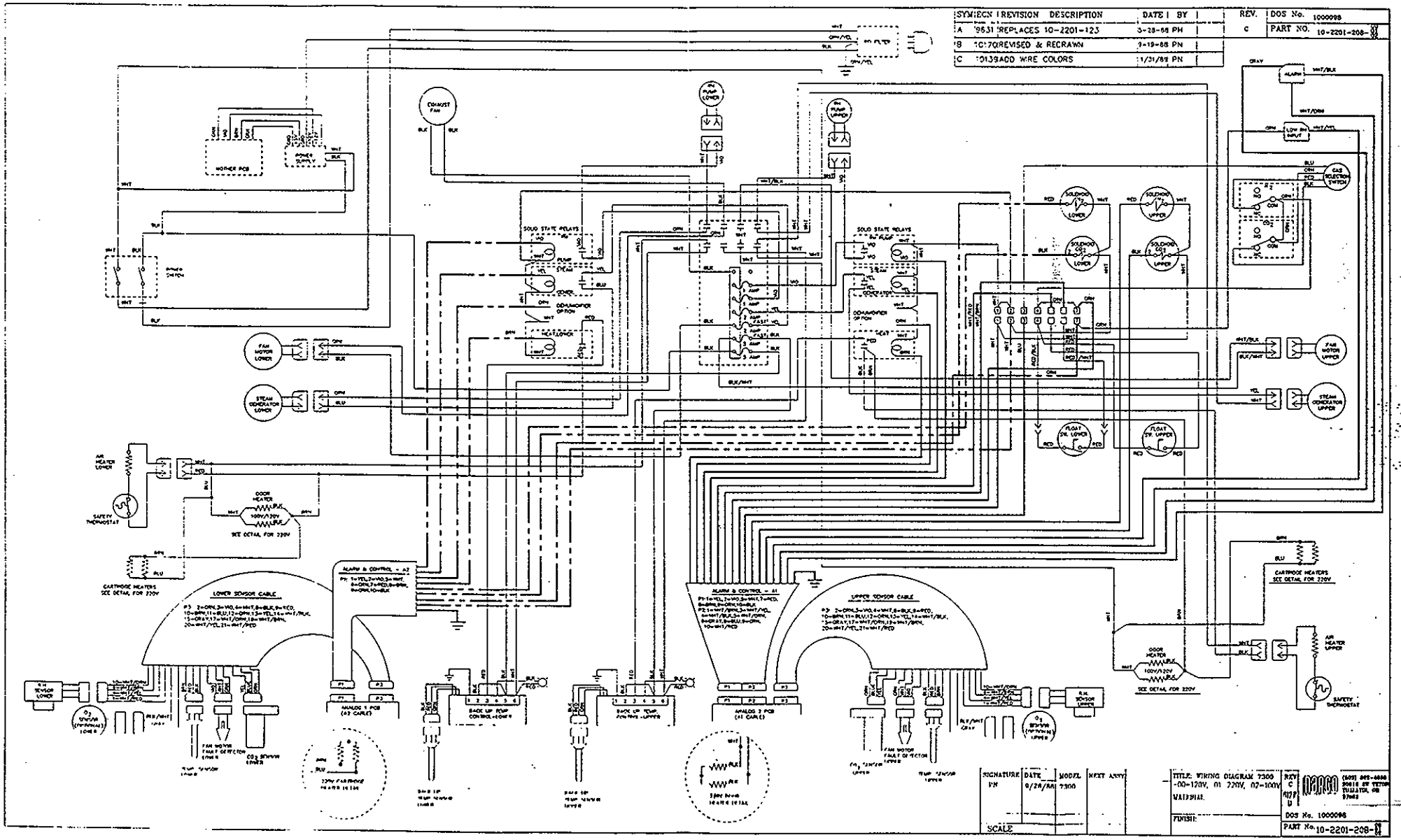
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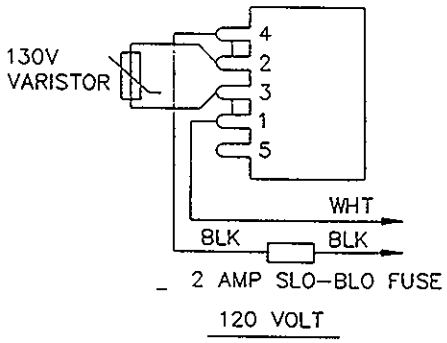
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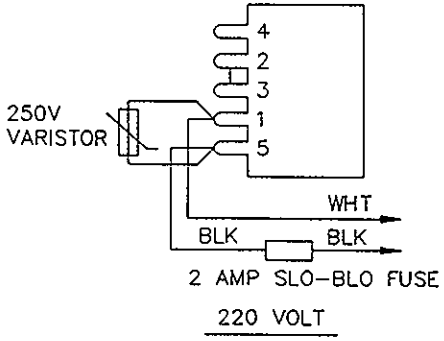


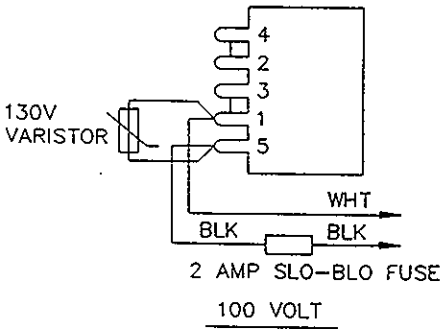
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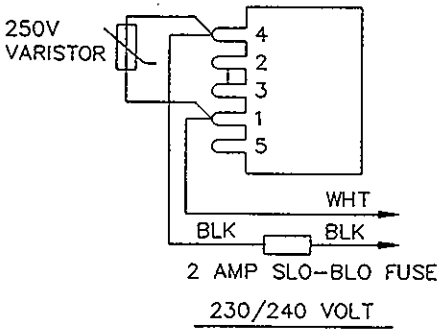


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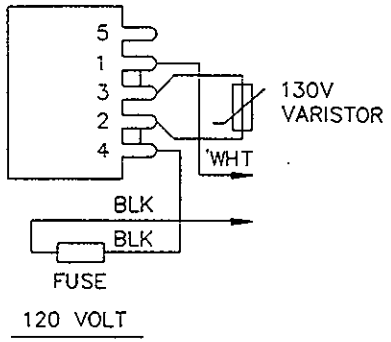


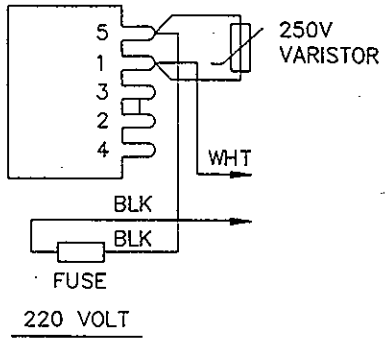


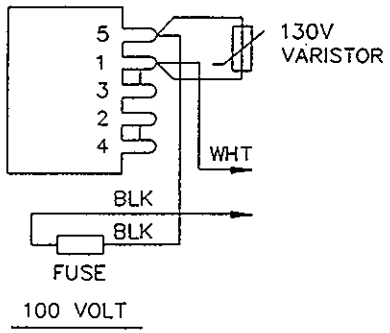


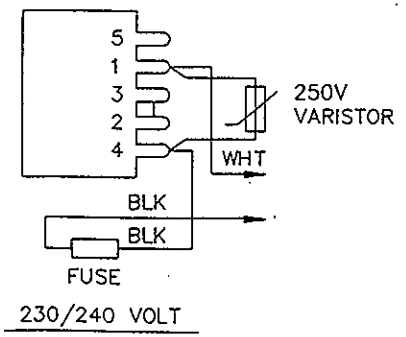


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USING "STANDARD" POWER SUPPLY



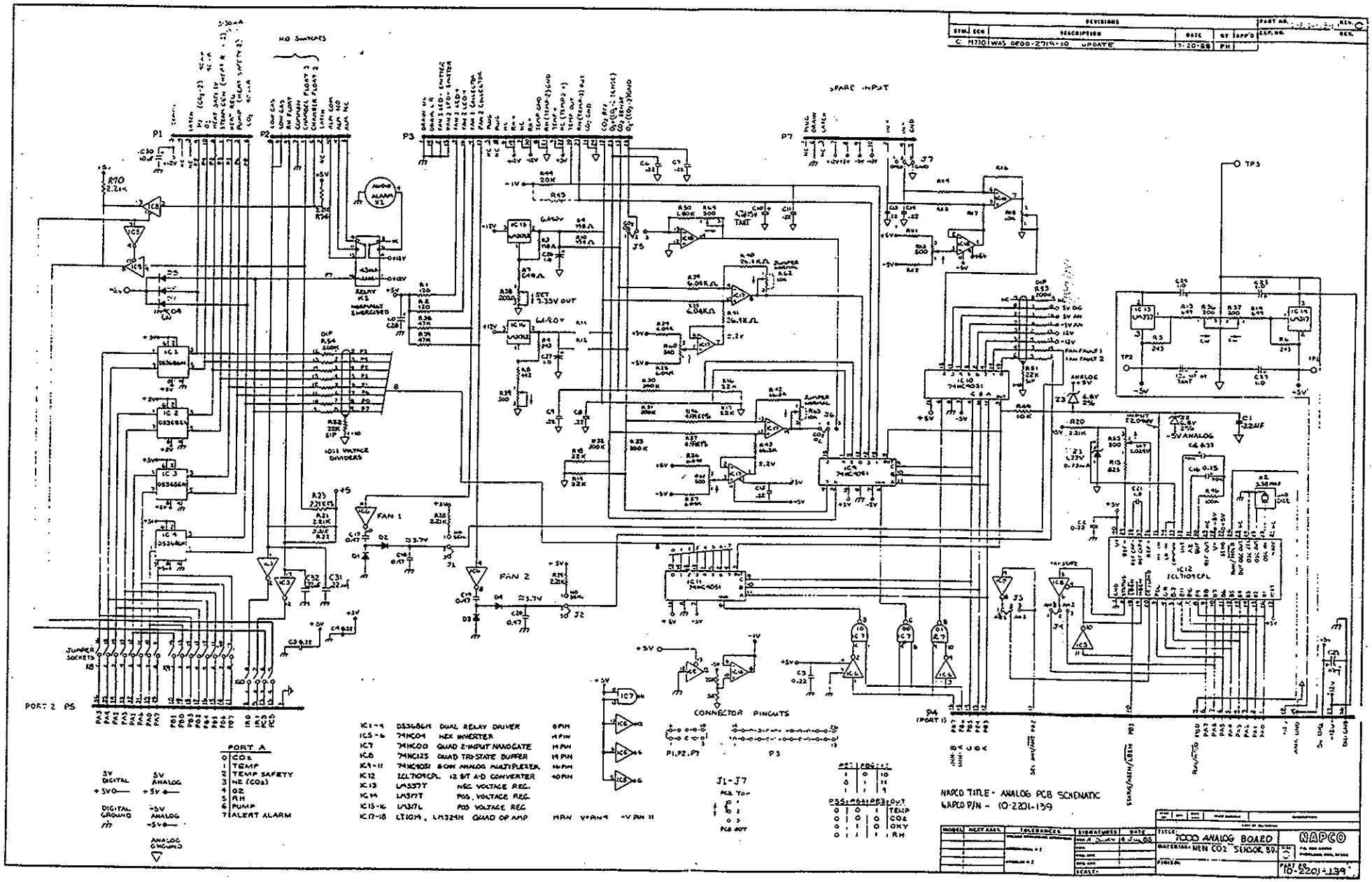




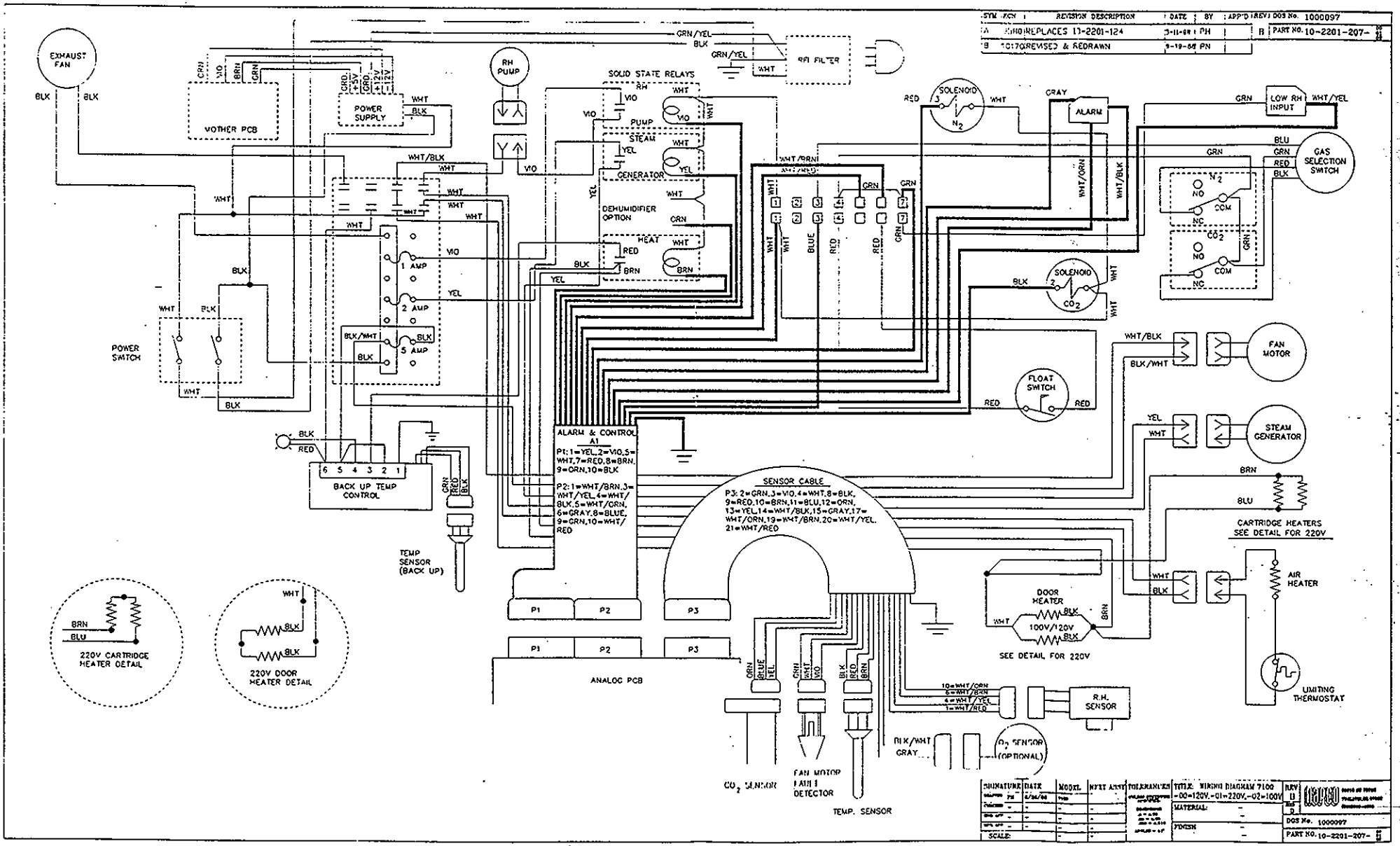


POWER SUPPLY WIRING FOR TRANSFORMER
USING "CONDOR" POWER SUPPLY

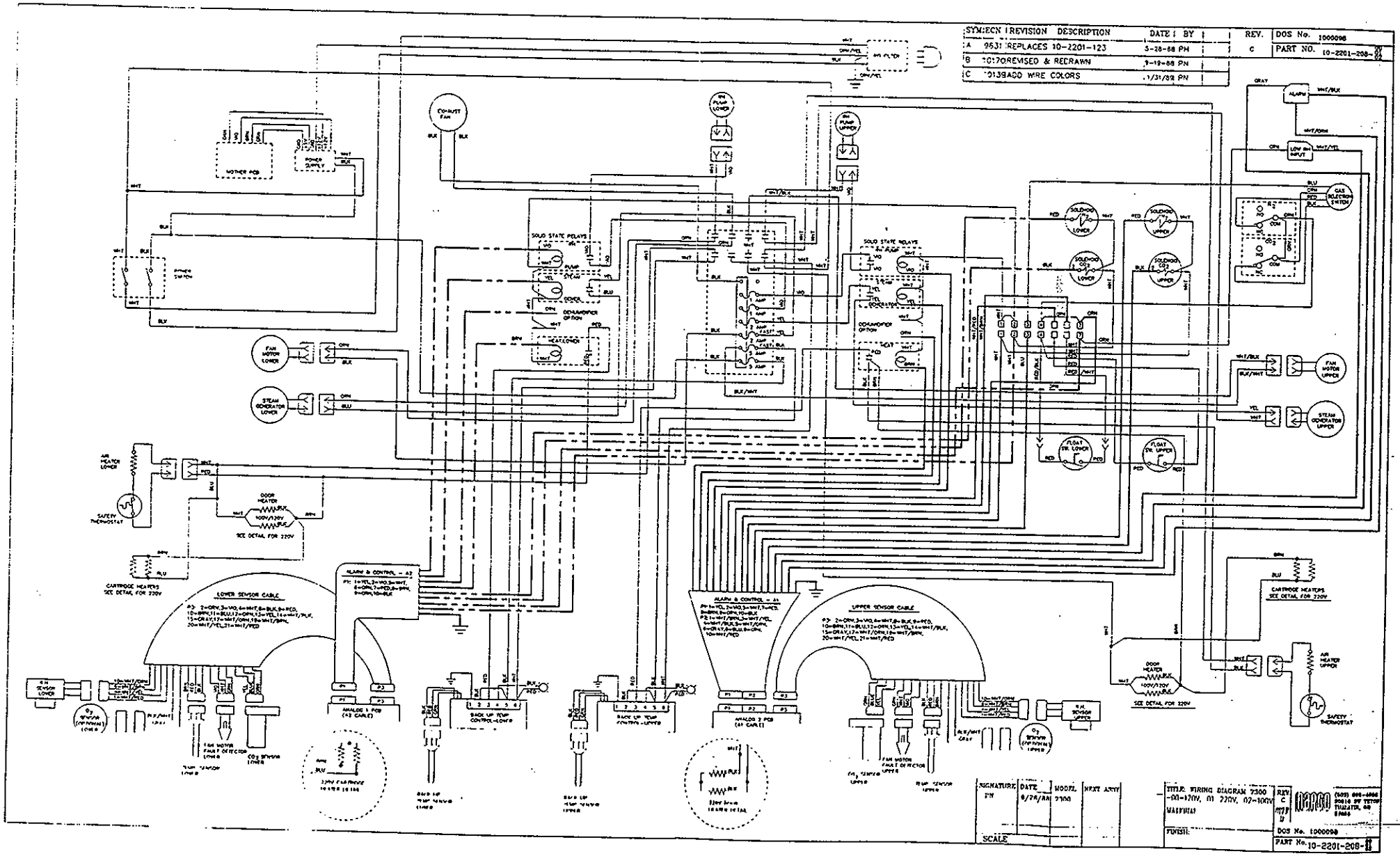
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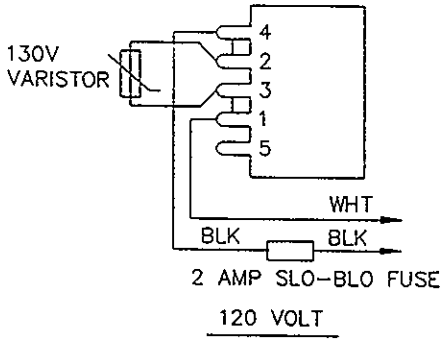
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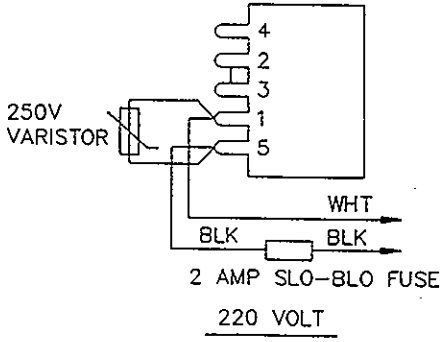


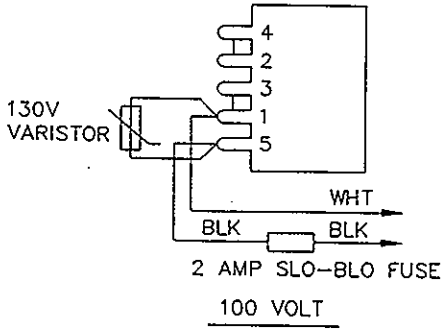
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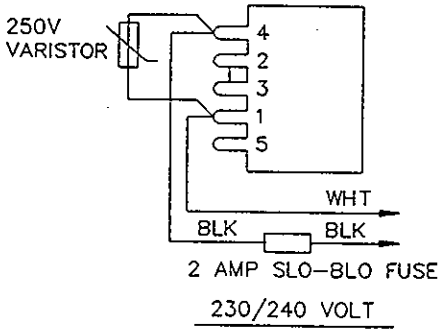


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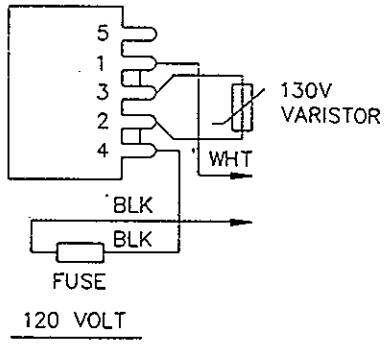


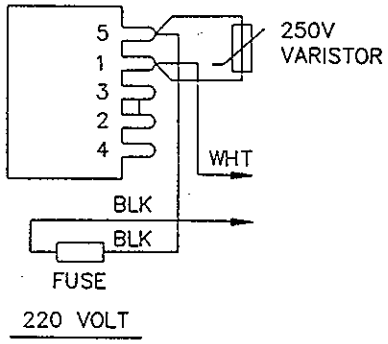


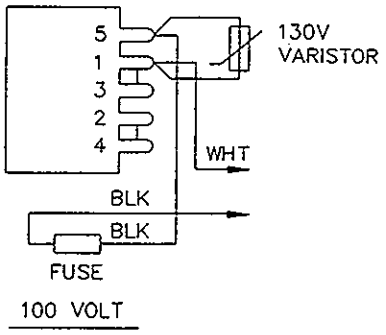


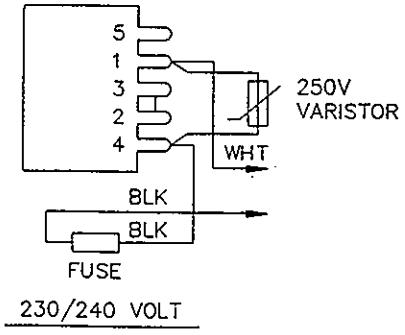


POWER SUPPLY WIRING FOR TRANSFORMER
USING "STANDARD" POWER SUPPLY









POWER SUPPLY WIRING FOR TRANSFORMER
USING "CONDOR" POWER SUPPLY

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63. REPLACEMENT PARTS LIST MODELS 7100/7300 VERSION 5

R.H. Reservoir Assy	101301008	(Optional)
Blower Wheel	101402003	
O2 Sensor Assy	105028012	
Temp Sensor Assy	105028013	
CO2 Sensor Assy	105028026	
R.H. Sensor Modified Assy	102961032	
2 Way Solenoid Assy	105007005	(CO2)
3 Way Solenoid Assy	105007020	(N2)
Filter 5 Micron Modified	102921006	(H2O)
Filter .3 Micron Modified	102921005	(Gas)
Fuse 5 amp	289068	(Air Heater)
Fuse 2 amp 250v fast blo	289001	(R.H. Heater)
Fuse 2 amp 250v slow blo	289081	(Power Supply)
Fuse 1 amp	1408-026	(R.H. Pump)
Solid State Relay	101416010	
Pump Assy Modified (120v)	102961029	
Pump Assy Modified (220v)	102961050	
Pump Assy Modified (100v)	102961051	
Cord Set 100/120v	101422002	
Cooling Fan 100/120v 50/60Hz	101550007	(For ventilation)
Cooling Fan 220/240v 50/60Hz	101550008	(For ventilation)
Gas Pressure Switch Assy	102204029	
Power Switch	101420041	
Air Plenum Assy	106027007	
Blower Duct Assy	106046002	
Gasket, Blower Duct 36" Req.	72004	
Gasket, CO2 Sensor	296102801	
Gasket, Fan Motor Plate	102921003	
Glass Door	330260	
W/J Cartridge Heater	143304100	(120/220v)
W/J Cartridge Heater	143304102	(100v)
Door Heater	1433-077	(All Voltages)
Limit Control 120 V	503005400	
Limit Control 220/240 V	503005401	
Limit Control 100 V	503005402	

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62. SHUTTLE SWITCH

1. Disconnect electrical service. Turn off gas supplies.

2. Remove cover from top of incubator.

3. Remove tubing clamps and tubing at the shuttle switch, noting their position for replacement purposes.

4. Remove screws securing shuttle switch bracket. Shuttle switch may now be removed. Refer to Fig. 18.

5. Replace shuttle switch in reverse order of above procedure.

NOTE

WHEN SERVICING SHUTTLE SWITCHES, IT IS IMPORTANT NOT TO LET PIPE THREAD SEALANT ENTER THE SHUTTLE SWITCH, AS THIS WILL CAUSE RAPID FAILURE, RESULTING IN LEAKS.

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I/O PC Board Assy	105030058
Display PC Board Assy	105030027
CPU PC Board Assy (Above CPU board for Model 7100 Software version 5.xx only)	503006500
CPU PC Board Assy (Above CPU board for Model 7300 Software version 5.xx only)	503006501
Analog PC Board Assy (Above Analog board for Model 7100 only)	503004200
Analog PC Board Assy (Above Analog board for Model 7300 lower chamber only)	503004202
Analog PC Board Assy (Above Analog board for Model 7300 upper chamber only)	503004201
Fan Motor Assy	500401100 = 120v 500401101 = 220v 500401102 = 100v
Air Heater (100 Watts)	247431 = 120v 247432 = 220v 247430 = 100v
Steam Generator Repl. Kit	220409100 = 120v 220409101 = 220v 220409102 = 100v
Power Supply Assy	500200200 = 120v 500200201 = 220v 500200202 = 100v 500200203 = 240v

**For units without cartridge heaters. (Previous to September, 1988 manufacturing date.)

When ordering parts, give the unit model and serial number, as well as the software version number. The software version number can be found by pressing the 1 and 3 buttons simultaneously. (Keypad must be accessed first.) The software version number will be displayed in the temperature display window.

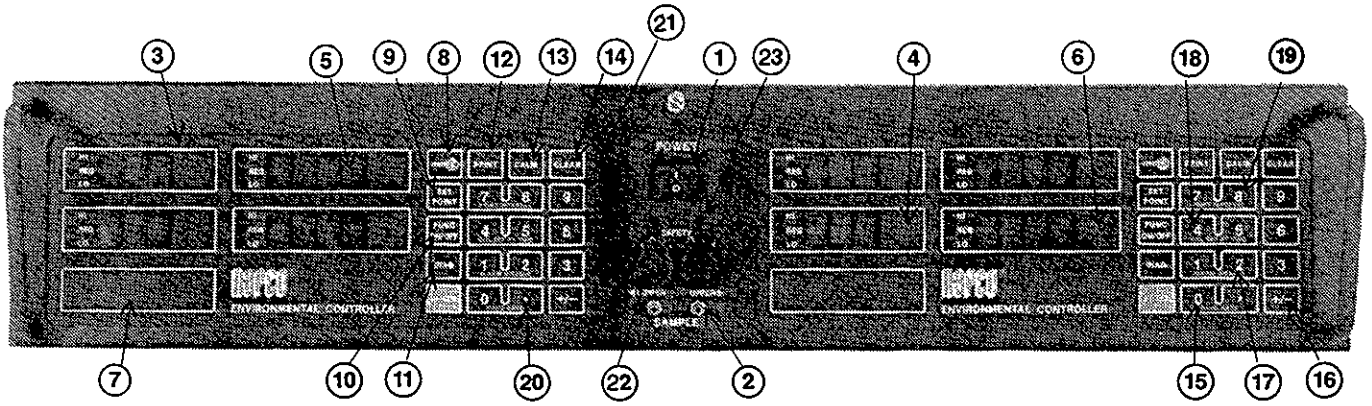
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PART 3.

ILLUSTRATIONS, FIGURES, AND SCHEMATICS

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Fig. 1 CONTROL PANEL



1. POWER SWITCH: Applies power to the entire unit. (Including fan motors)

2. GAS SAMPLE PORTS: Used for sampling the chamber atmosphere.

3. UPPER LEFT DISPLAY: Displays CO2 parameters. Also displays keypad data when used in the Diagnostics mode.

4. LOWER LEFT DISPLAY: Displays 02 parameters.

5. UPPER RIGHT DISPLAY: Displays temperature and Month/Day parameters, Software version, Access code, and Baud rate.

6. LOWER RIGHT DISPLAY: Displays Relative Humidity and Hour/Minute parameters, Audible Alarm Disable time, and Print Interval log rate.

7. LOWER LEFT DISPLAY BLOCK: Displays alarm conditions for gas pressure, fan fault, RH H20, Low H2O, 02 sensor, and alarm. "ACCESS" and "PASSED" indicators also are displayed here.

8. <ACCESS> BUTTON (Picture of a key): Used to allow keyboard access to change your Personal Access Code.

9. <SETPOINT> BUTTON: Used to enter the desired CO2, O2, Temperature, Date, Time and Relative Humidity levels.

10. <FUNC ON/OFF> BUTTON: Used in conjunction with the <SETPOINT> button to turn CO2, O2, Temperature, and Relative Humidity controls ON or OFF. Allows user not to have to enter setpoints each time.

11. <DIAG> BUTTON: Used to perform on board system checks.

12. <PRINT> BUTTON: Used to send data to the printer or RS232 ports.

13. <CALIB> BUTTON: Used to calibrate CO2, O2, Temperature and Relative Humidity functions.

14. <CLEAR> BUTTON: Used to clear an erroneous entry from the keypad.

15. <BAUD RATE> BUTTONS: Used to display and enter the communication speed for the serial communications to the RS232 port.

16. <+/-> BUTTON: Used to exit the Diagnostics function. When used in conjunction with the <ALARM DISABLE> buttons, <+/-> selects the programmable HIGH and LOW alarm delay function.

17. <ALARM DISABLE> BUTTONS: Used to disable the audible alarm for a pre-selected period of time. Also used to select a different high and/or low alarm delay time. (Other than the default values.)

18. <CO2 SETPOINT TWO> BUTTONS: Reserved function for future enhancements. Not used at this time.

19. <PRINT INTERVAL> BUTTONS: Used to change the log rate sent to printer and RS232 ports.

20. <.> BUTTON: The Decimal button by itself is not used, as the Decimal is entered automatically when entering the necessary parameters.

21. <0> THROUGH <9> BUTTONS: Used to enter the various input conditions for operating the incubator.

22. SAFETY CONTROL: Used to establish a limiting temperature for each chamber in case of failure of the primary control.

23. SAFETY INDICATOR: Indicates when the safety limiting temperature has been reached, indicating removal of power from heater.

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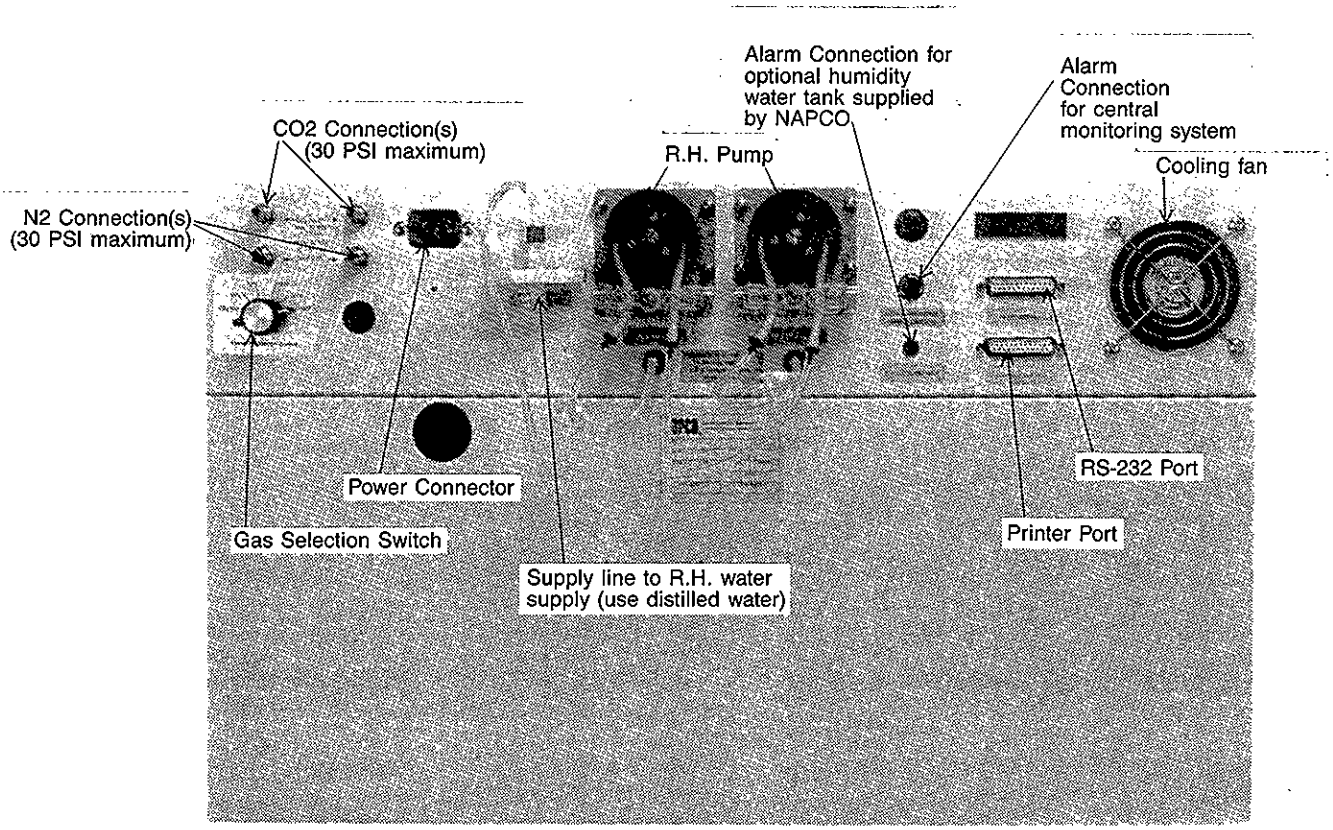


Fig. 2 CONTROL HOUSING REAR VIEW

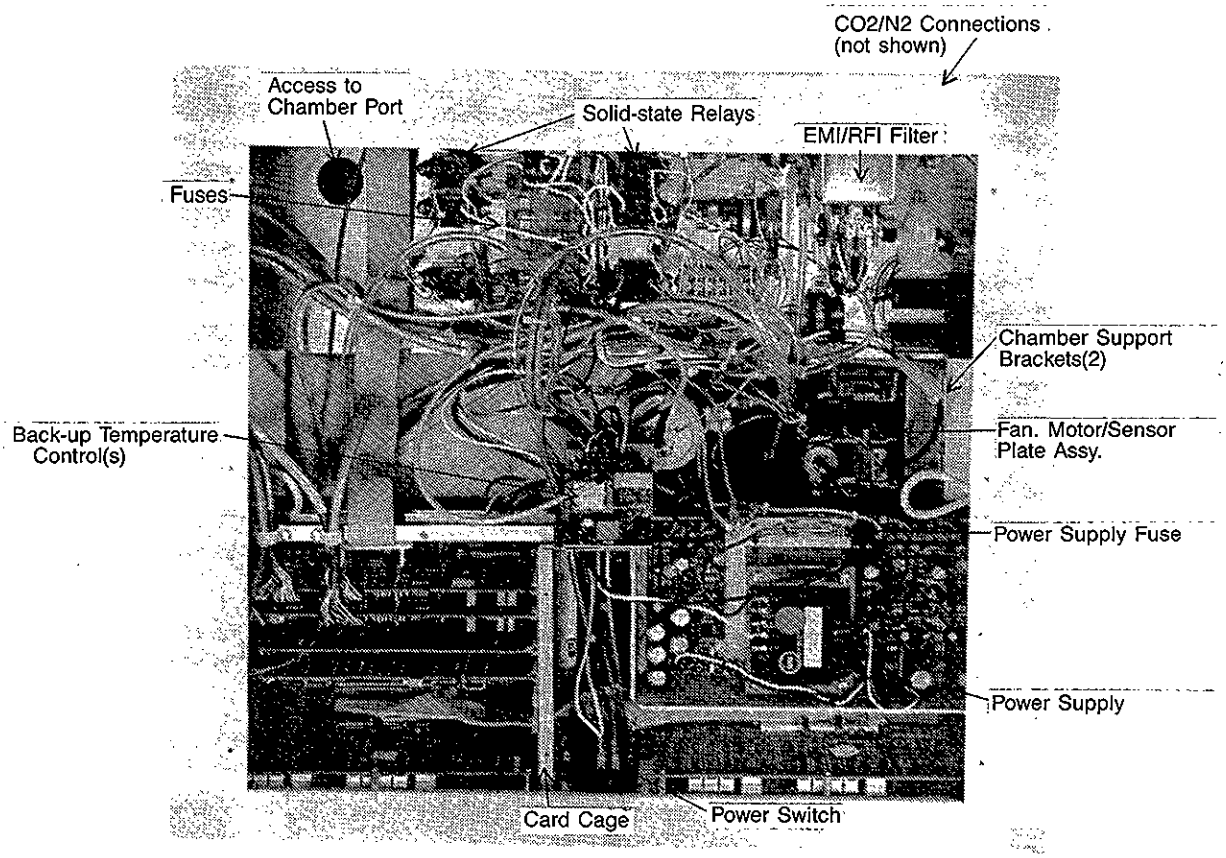


Fig. 3 CONTROL HOUSING

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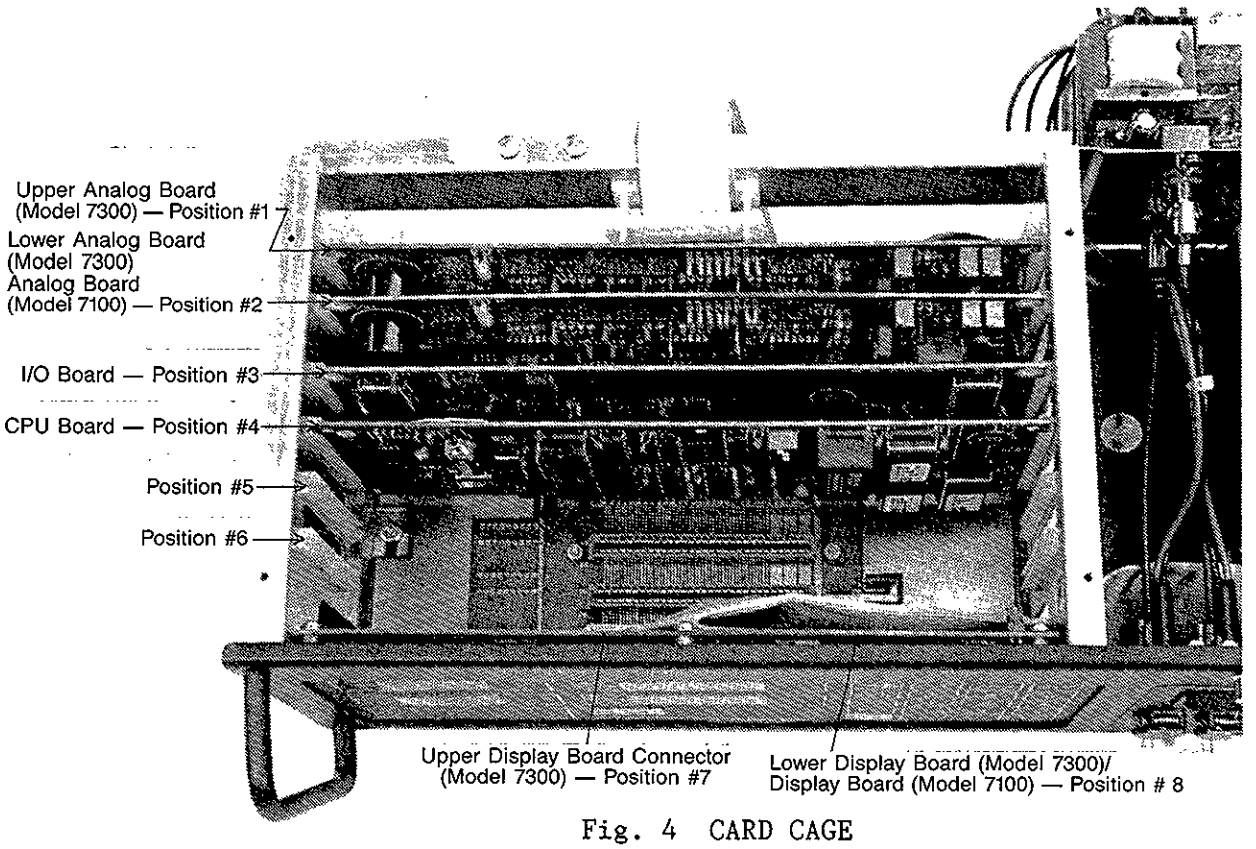


Fig. 4 CARD CAGE

POWER INPUT DATA		
TERMINAL NO.	FUNC.	COLOR
1	Gnd.	Green
2	+5 VDC	Brown
3	Gnd.	Green
4	−12 VDC	Violet
5	+12 VDC	Orange

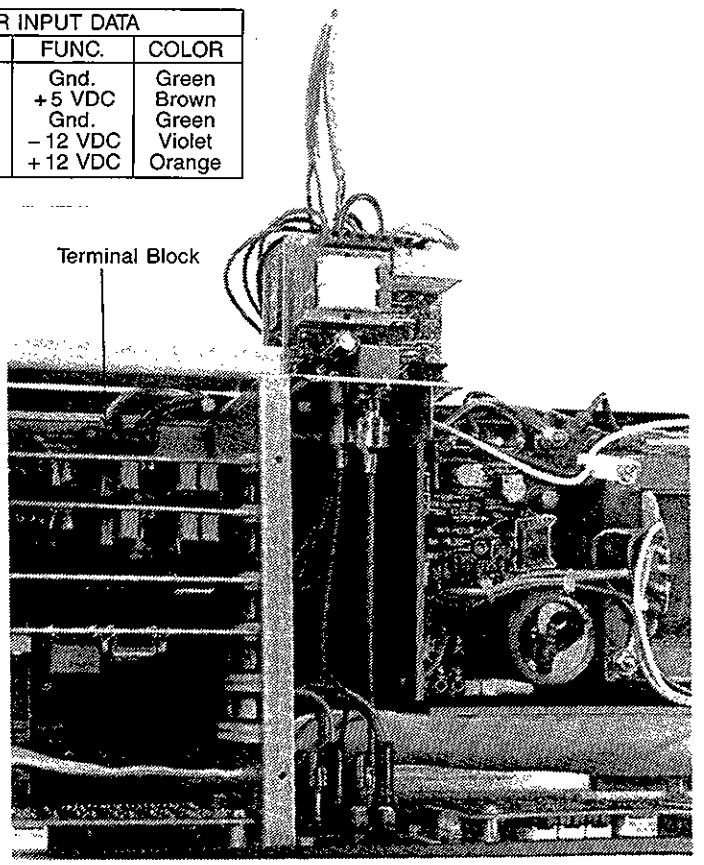
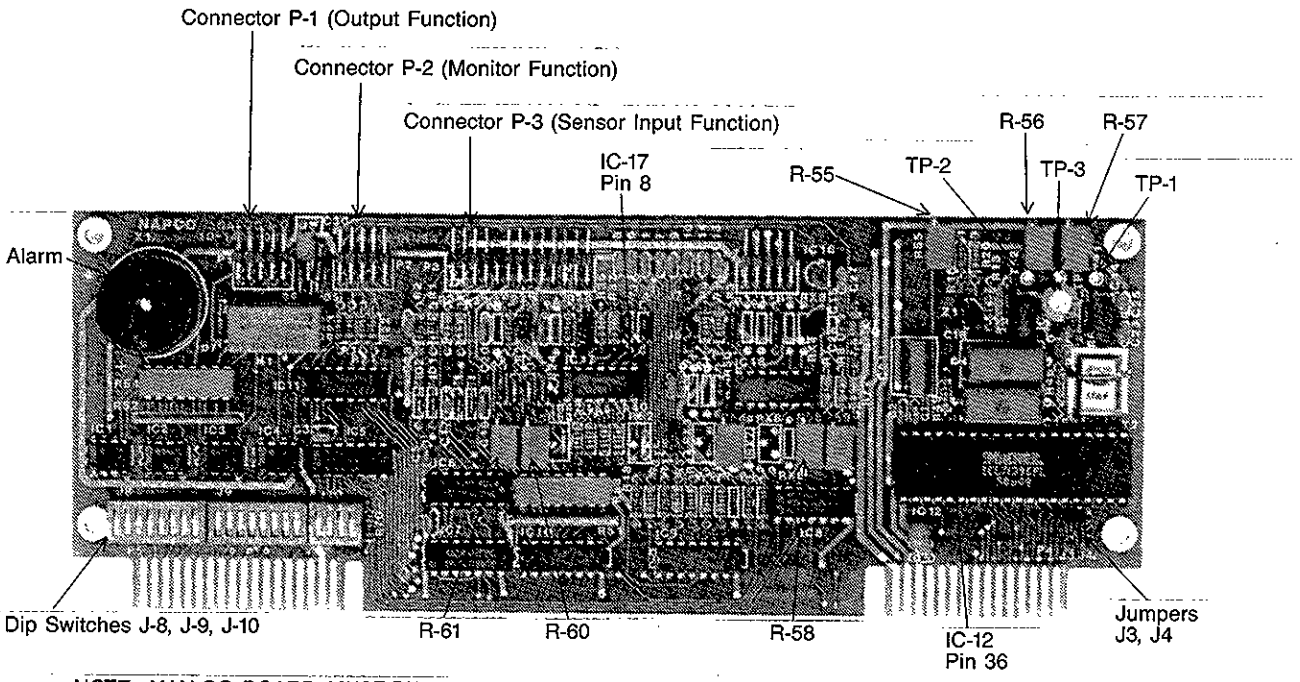


Fig. 5 MOTHER BOARD CONNECTOR

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NOTE: ANALOG BOARD *MUST* BE CONFIGURED FOR PROPER OPERATION BY MEANS OF DIP SWITCHES J-8, J-9, J-10, AND JUMPERS J-3, J-4

Fig. 6 ANALOG CIRCUIT BOARD

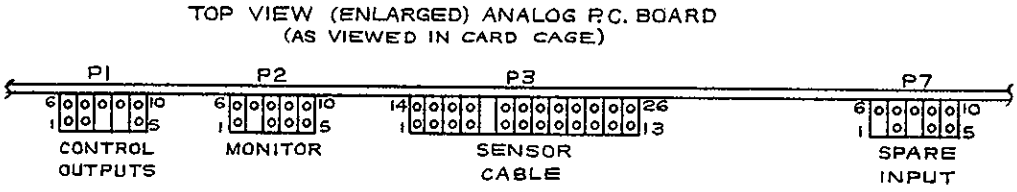


FIG. 7 ANALOG BOARD CONFIGURATION DETAIL

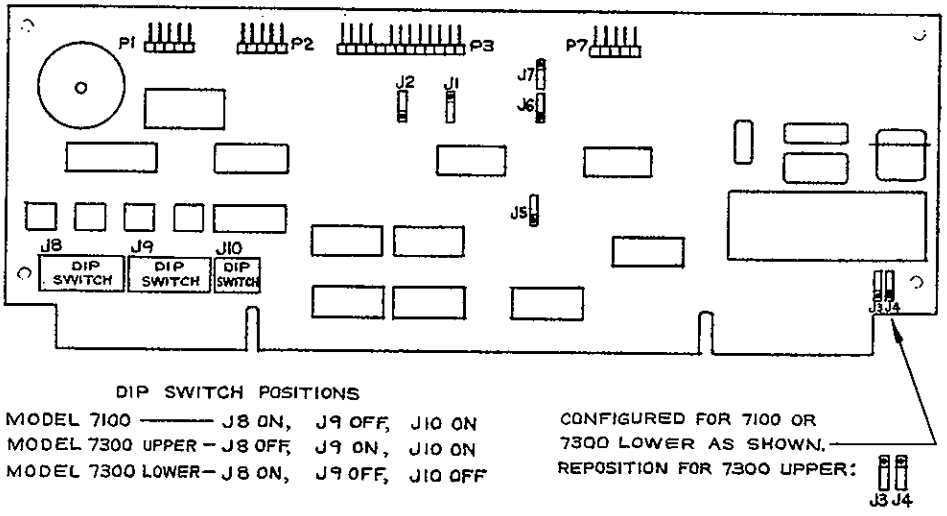


Fig. 7 ANALOG BOARD CONFIGURATION DETAIL

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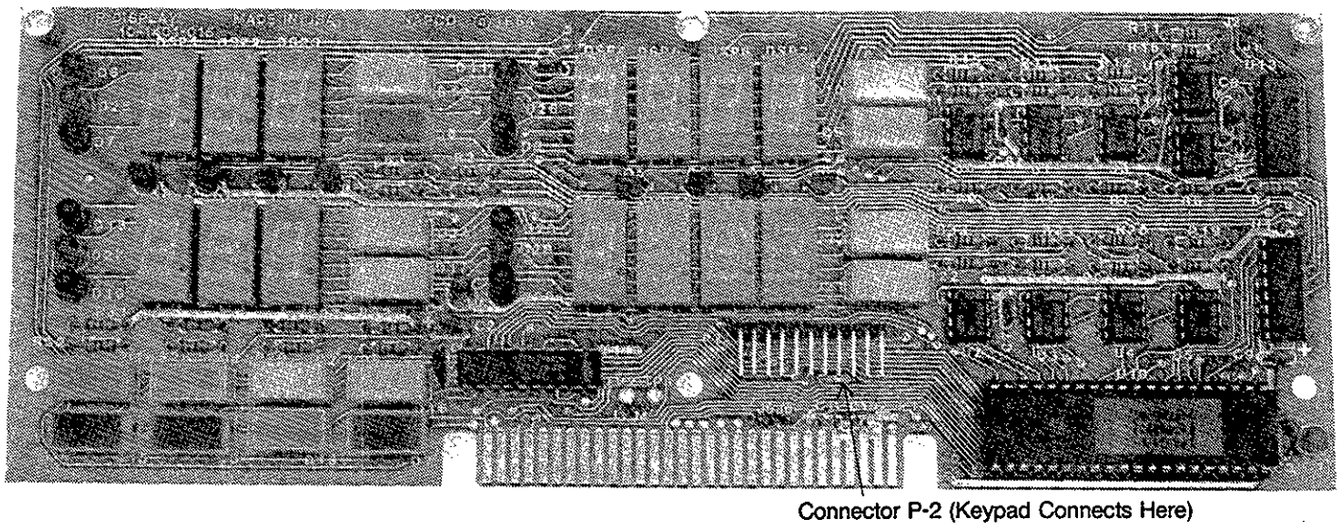


Fig. 8 DIGITAL DISPLAY BOARD

MODEL	CHAMBER	JUMPER J-1, J-2	JUMPER J-3, J-4	JUMPER J-5, J-6
7100	—	J-2	J-4	J-6
7300	Upper	J-1	J-3	J-5
7300	Lower	J-2	J-4	J-6

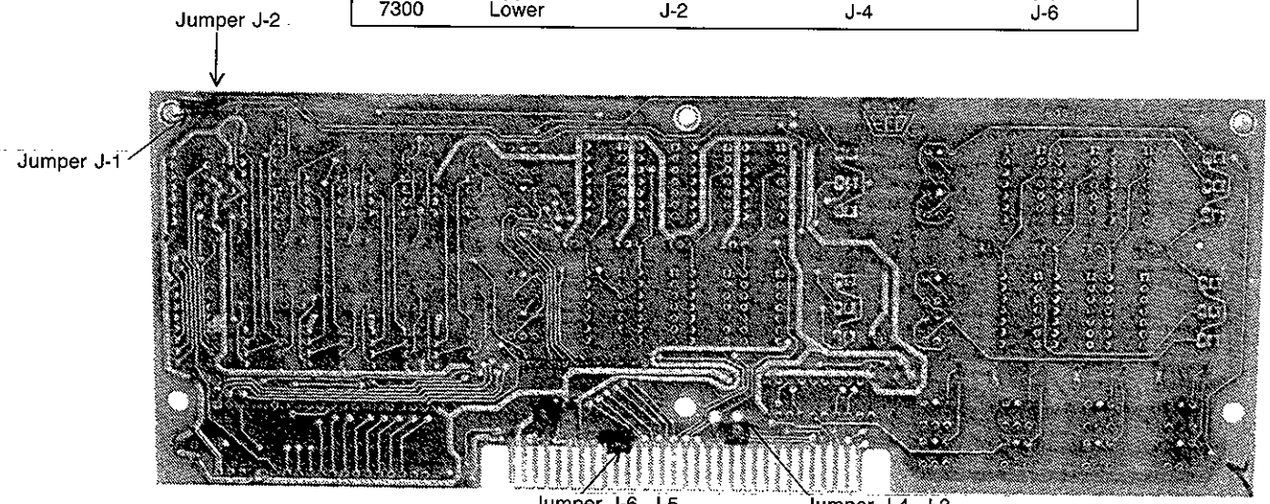


Fig. 9 DIGITAL DISPLAY BOARD (BACK VIEW)

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POWER INPUT/OUTPUT DATA

TERMINAL NO.	FUNC
1	Gnd.
2	Relay 'Com'
3	Relay 'No'
4	Relay 'NC'
5	AC Input
6	AC Input

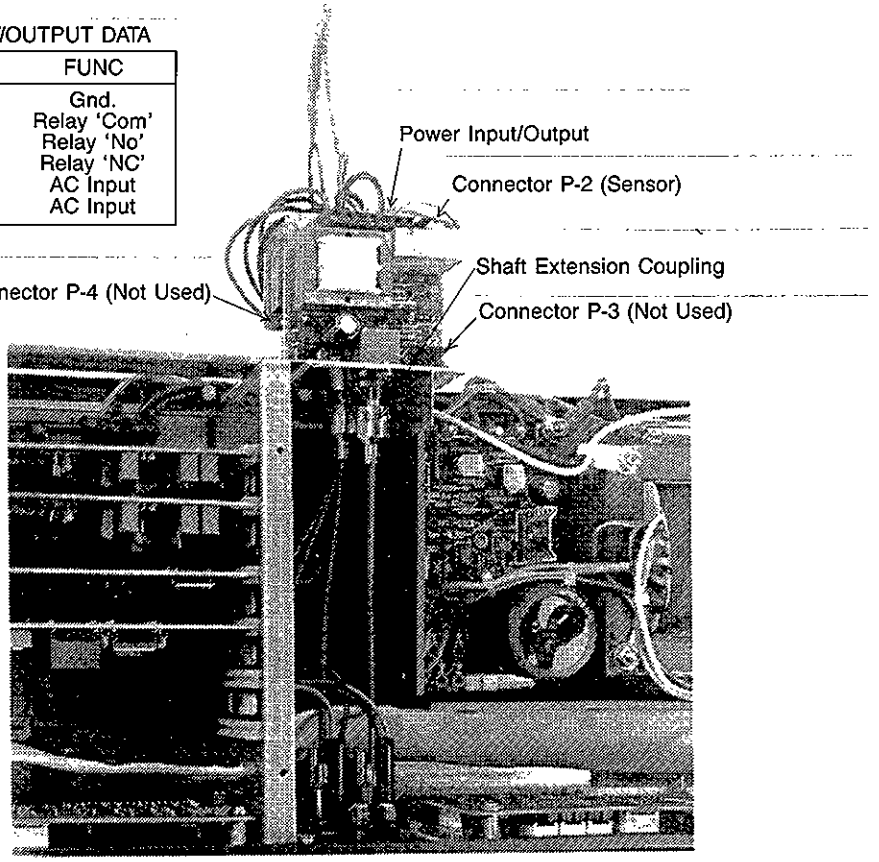


Fig. 10 BACKUP TEMPERATURE CONTROL

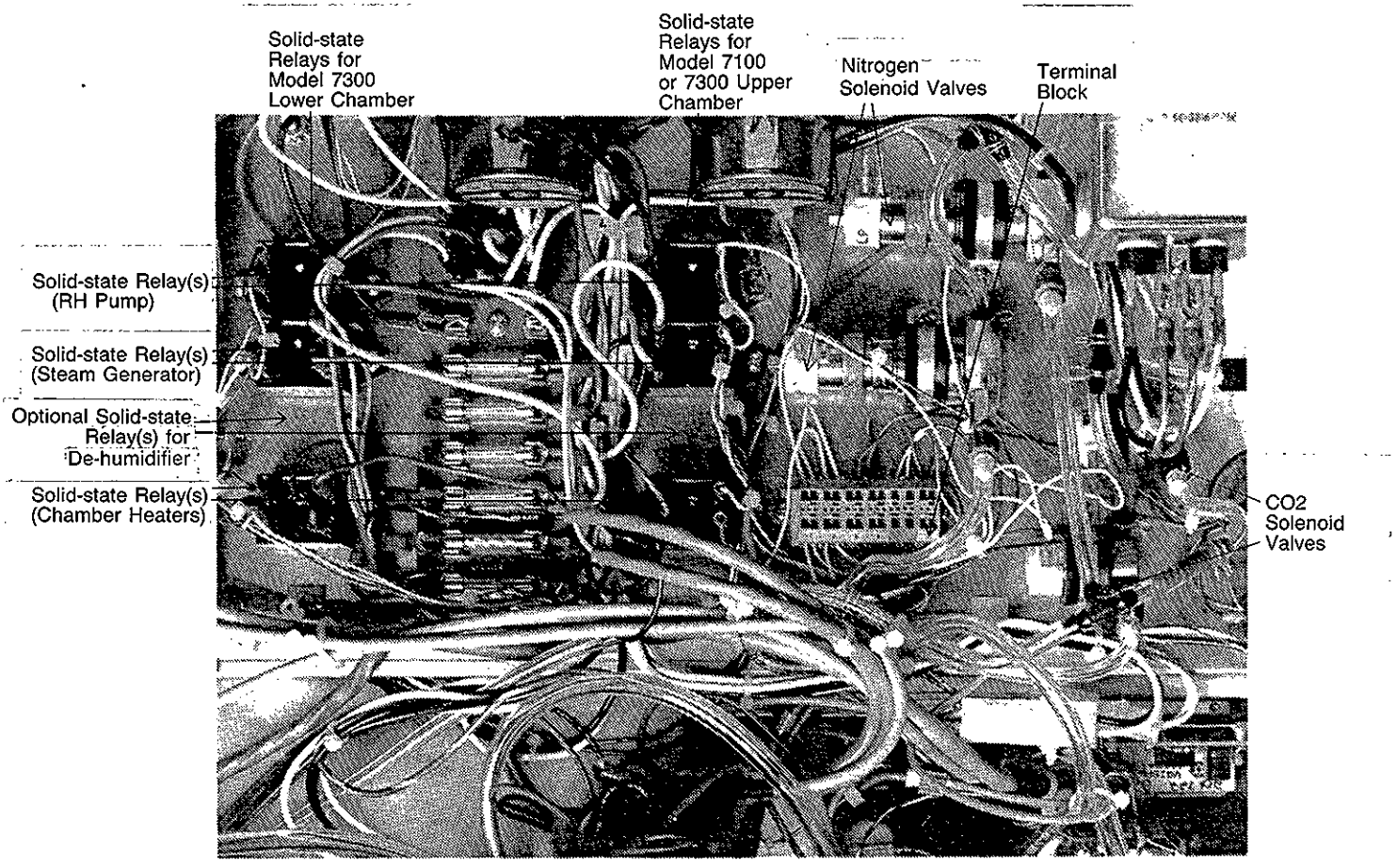


Fig. 11 RELAYS/SOLENOID VALVES TERMINAL BLOCK

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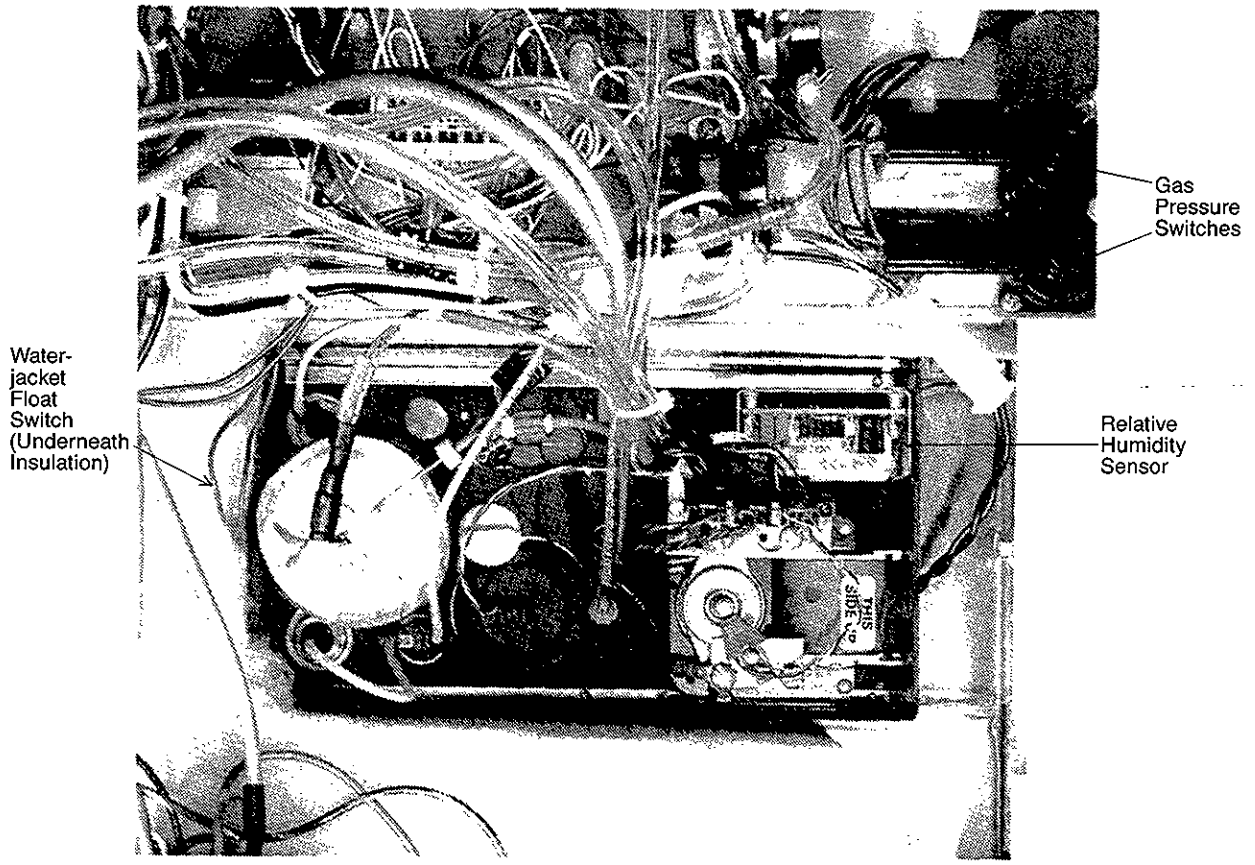


Fig. 12 PRESSURE SWITCHES/RH SENSOR/FLOAT SWITCH

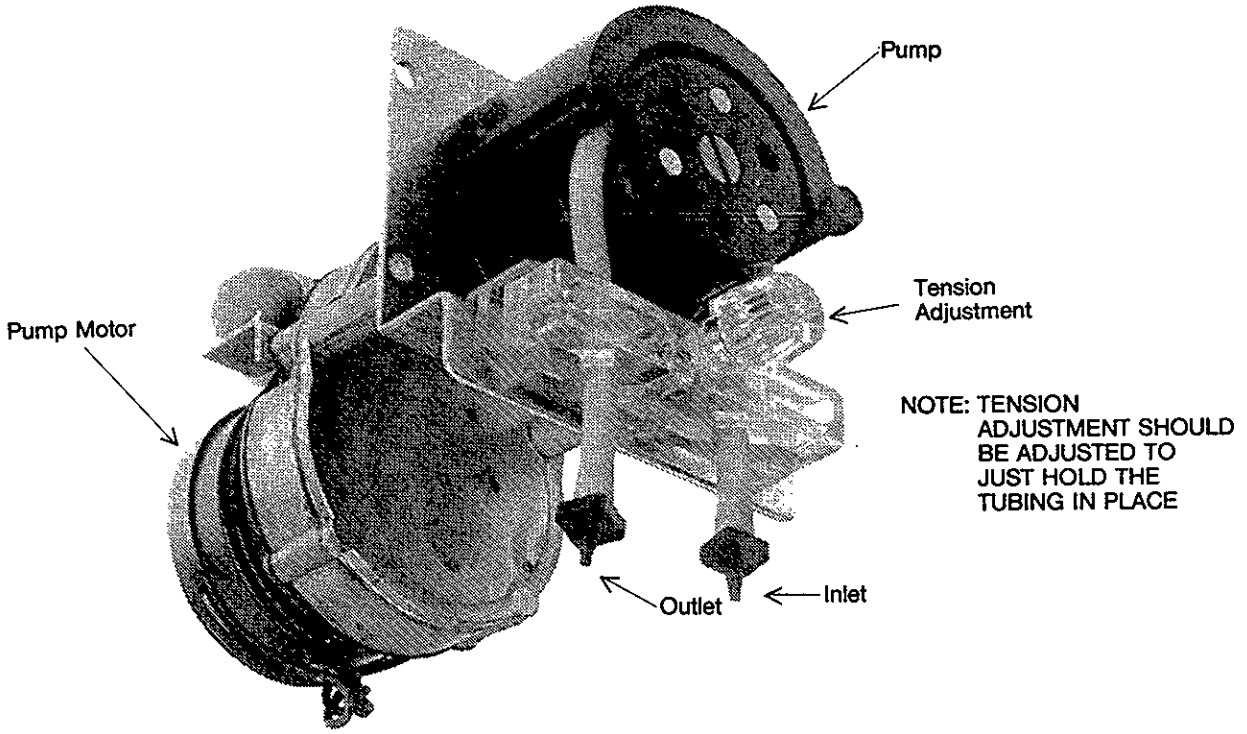


Fig. 13 RELATIVE HUMIDITY PUMP

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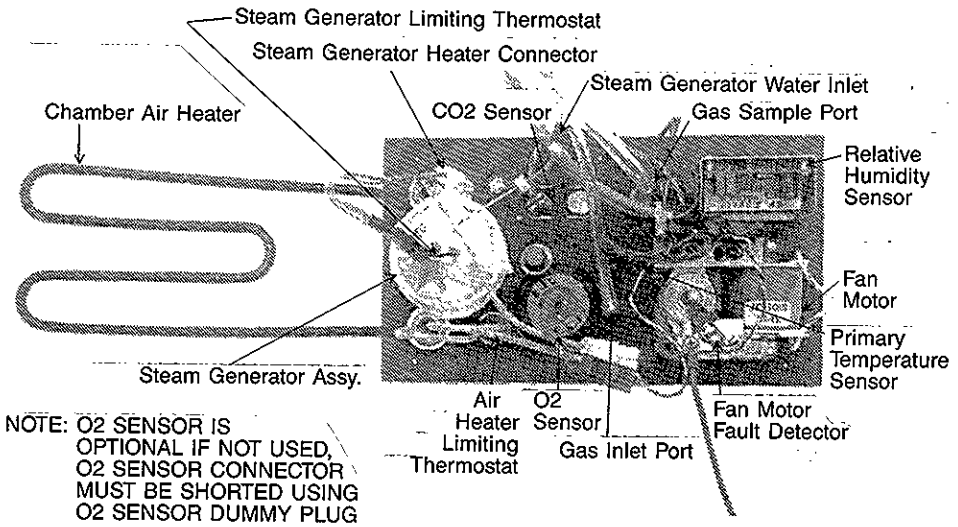


Fig. 14 FAN MOTOR/SENSOR PLATE (TOP VIEW)

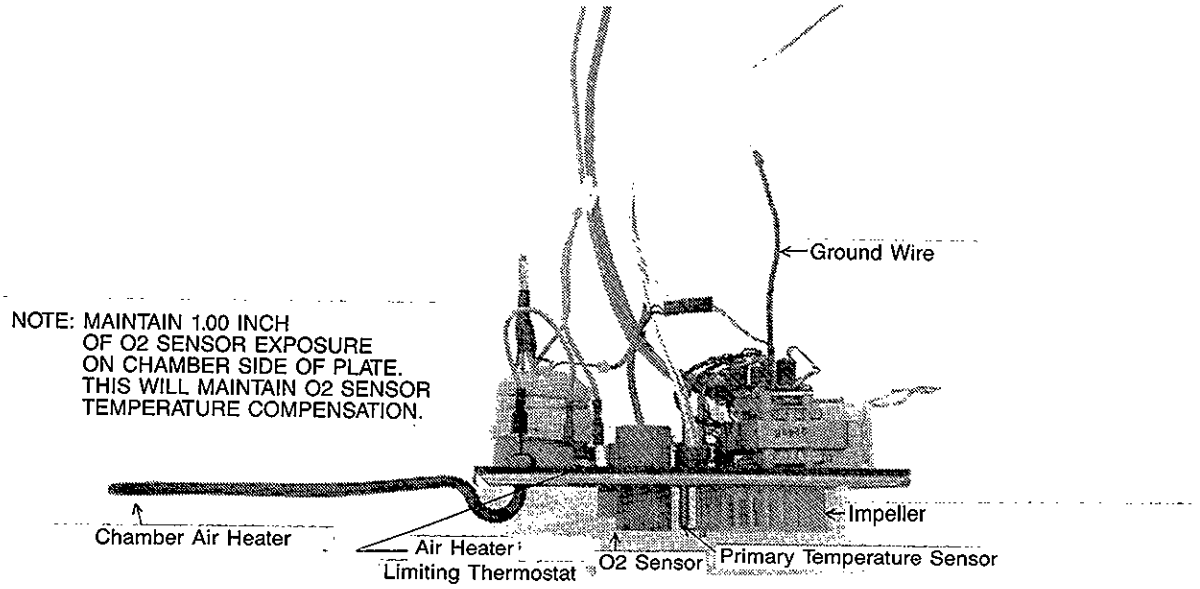


Fig. 15 FAN MOTOR/SENSOR PLATE (SIDE VIEW)

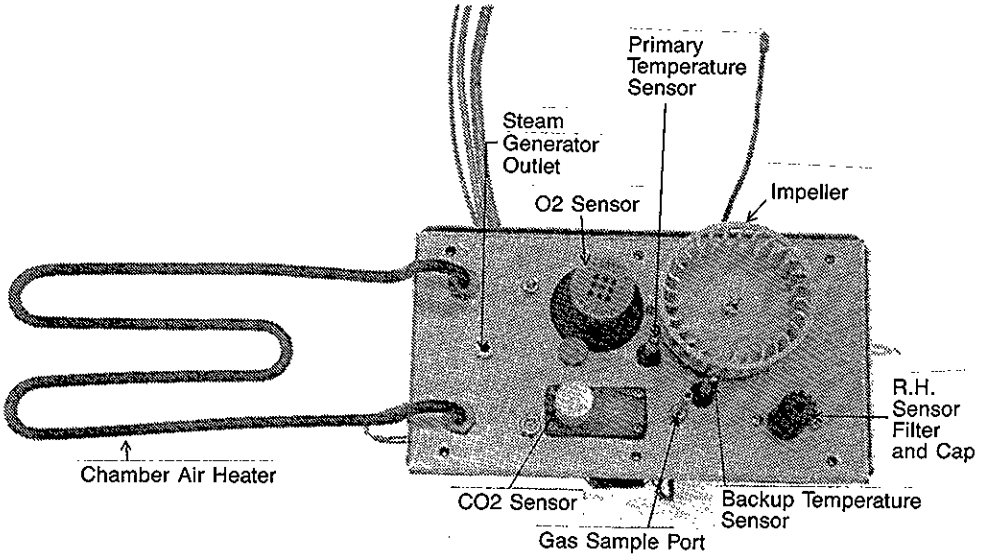


Fig. 16 FAN MOTOR/SENSOR PLATE (BOTTOM VIEW)

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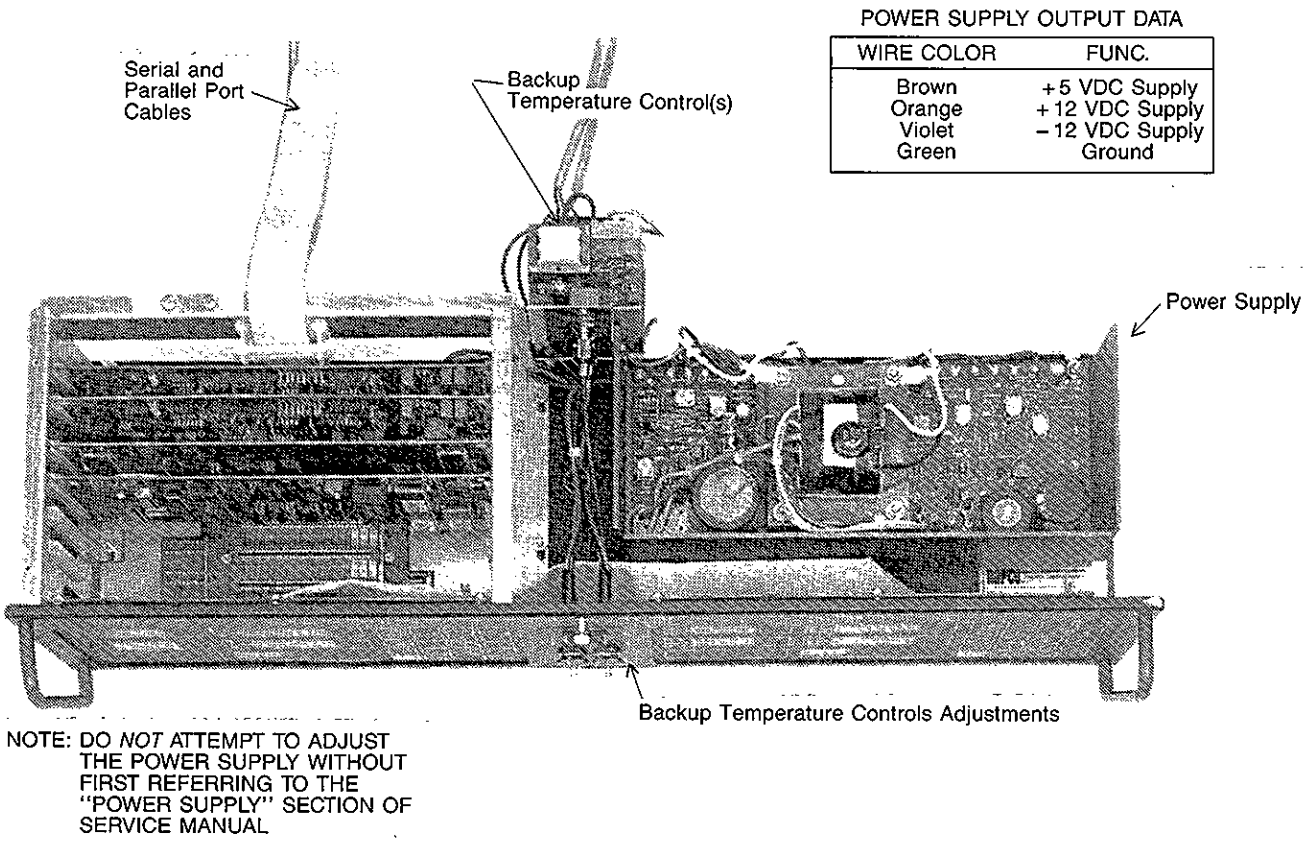


Fig. 17 CONTROLS (TOP VIEW)

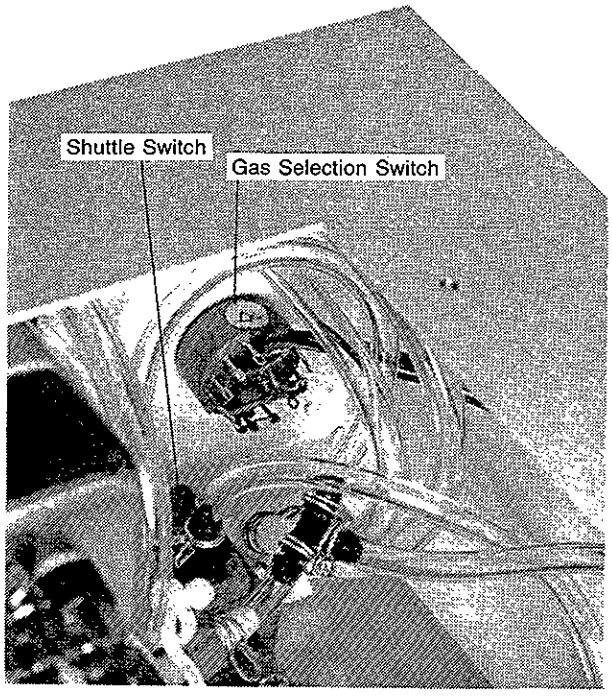


Fig. 18 GAS SELECTION SWITCH/SHUTTLE SWITCH

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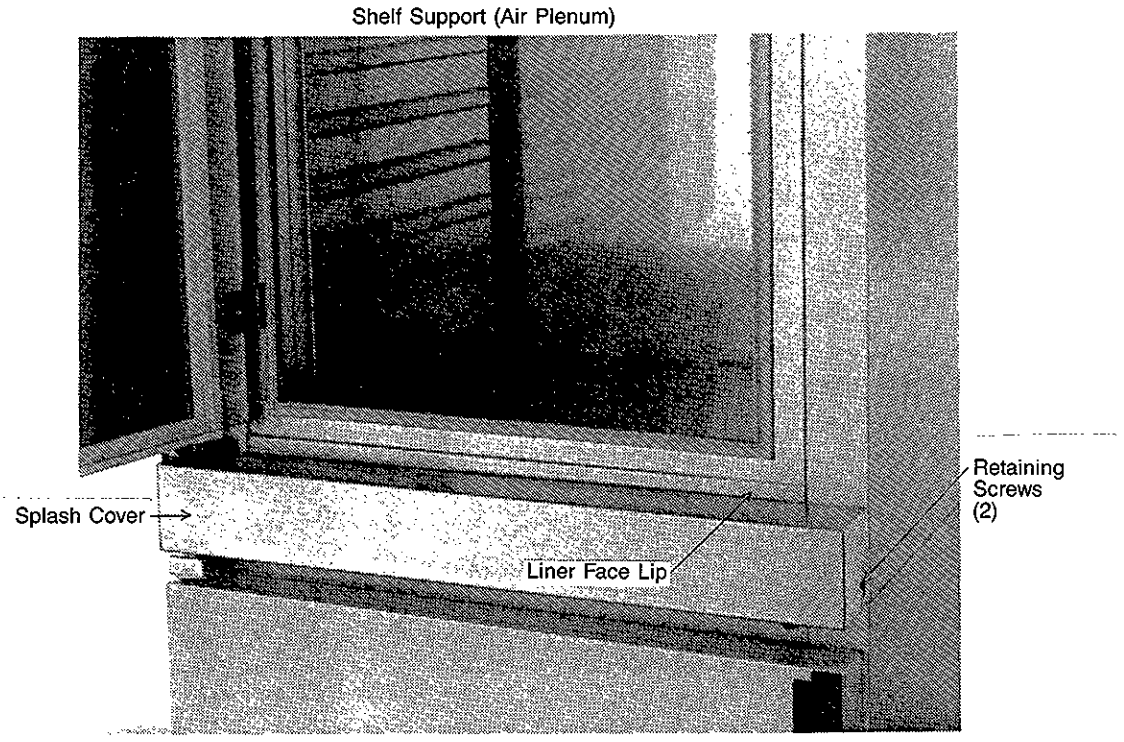


Fig. 19 SPLASH COVER

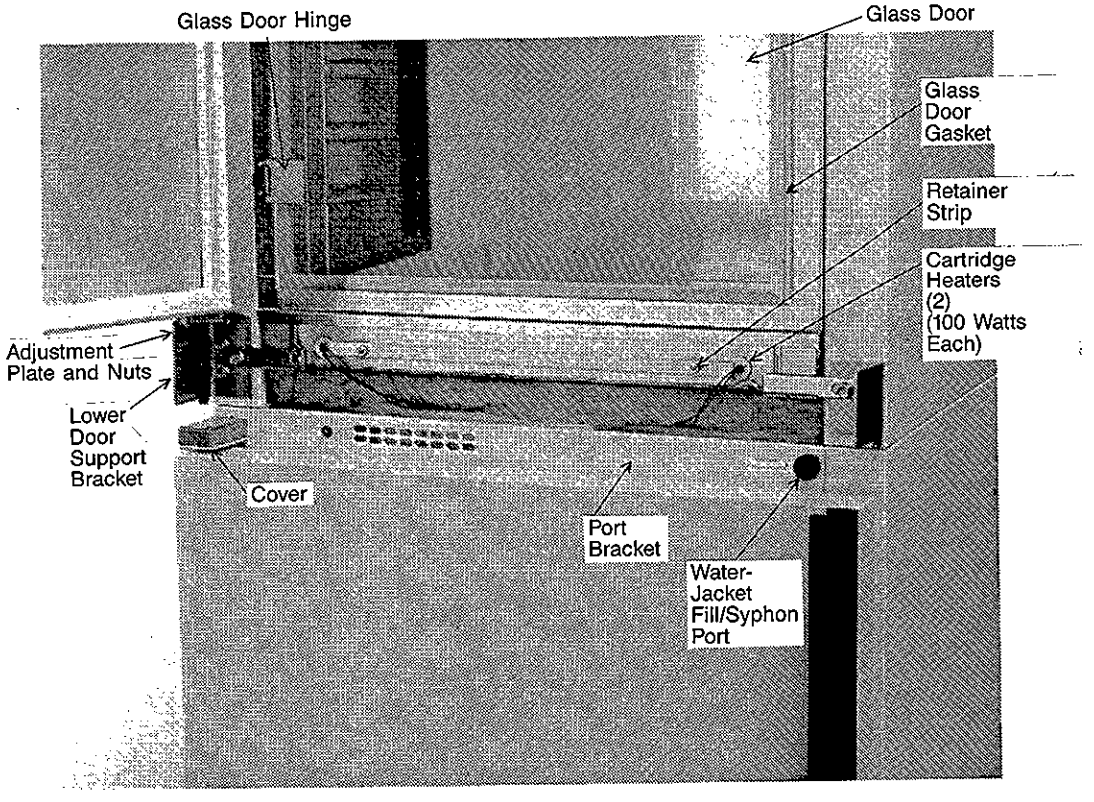


Fig. 20 SPLASH COVER REMOVED

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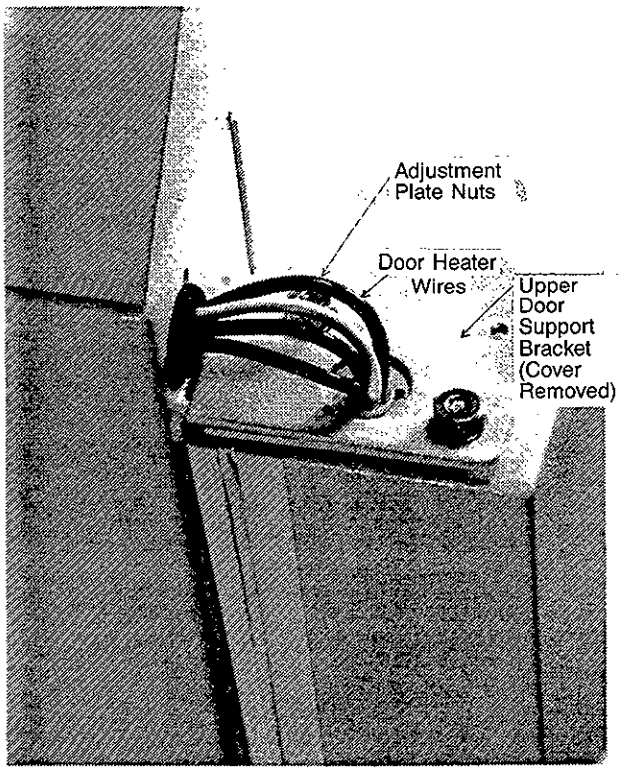
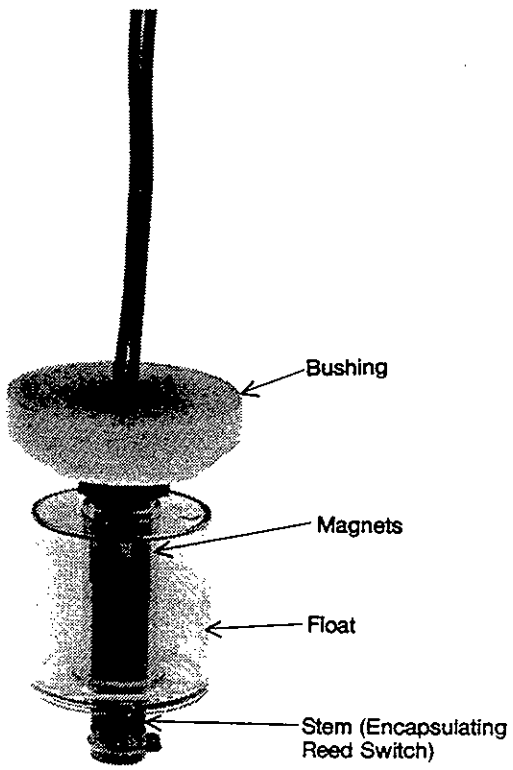


Fig. 21 UPPER DOOR SUPPORT



NOTE: MAGNETS MUST BE AT TOP OF FLOAT AS SHOWN. IF NOT, REMOVE RETAINER AND FLIP FLOAT OVER.

Fig. 22 FLOAT SWITCH

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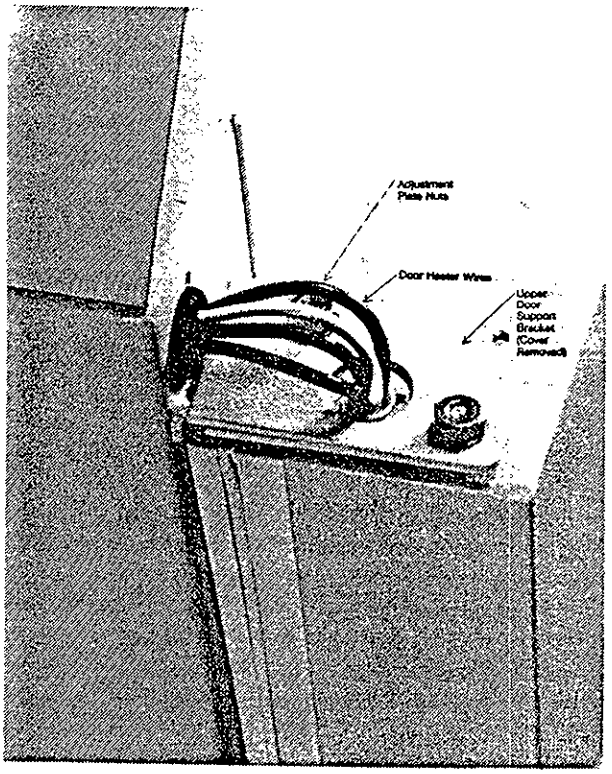
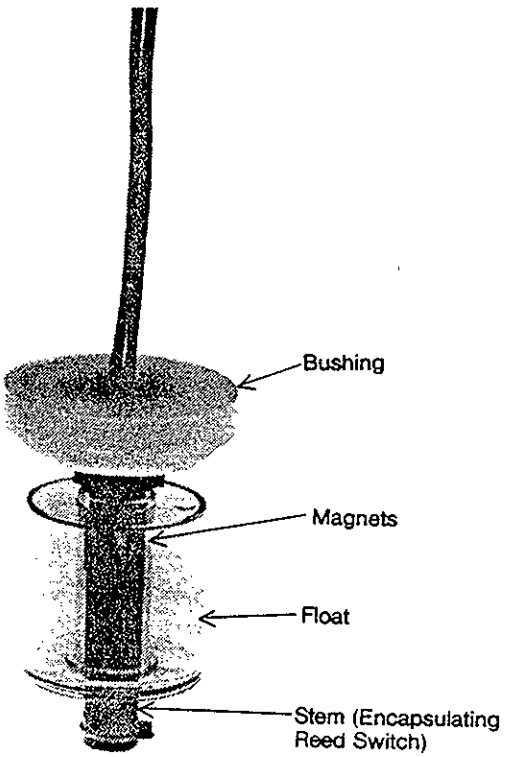


Fig. 21 UPPER DOOR SUPPORT



NOTE: MAGNETS MUST BE AT TOP OF FLOAT AS SHOWN. IF NOT, REMOVE RETAINER AND FLIP FLOAT OVER.

Fig. 22 FLOAT SWITCH

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