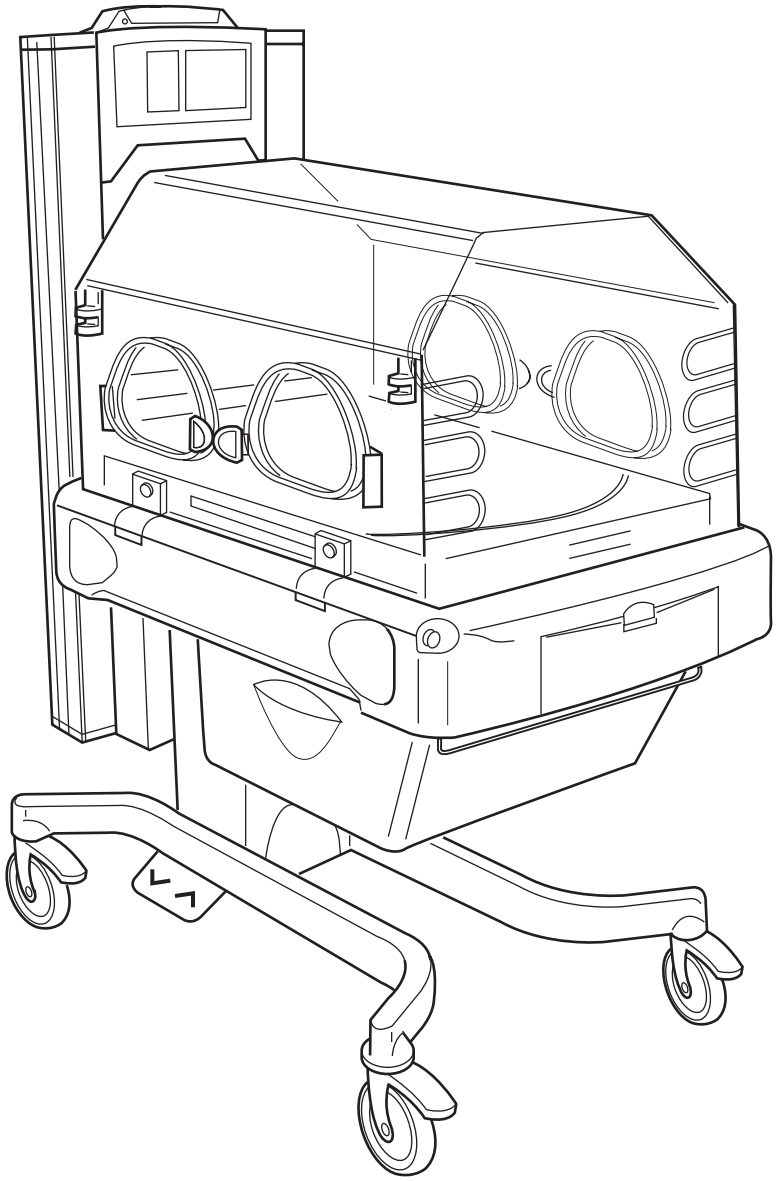
# Giraffe® Incubator
## Service Manual



## Important

The information contained in this service manual pertains only to those models of products which are marketed by Ohmeda Medical as of the effective date of this manual or the latest revision thereof. This service manual was prepared for exclusive use by Ohmeda Medical service personnel in light of their training and experience as well as the availability to them of parts, proper tools and test equipment. Consequently, Ohmeda Medical provides this service manual to its customers purely as a business convenience and for the customer's general information only without warranty of the results with respect to any application of such information. Furthermore, because of the wide variety of circumstances under which maintenance and repair activities may be performed and the unique nature of each individual's own experience, capacity, and qualifications, the fact that a customer has received such information from Ohmeda Medical does not imply in anyway that Ohmeda Medical deems said individual to be qualified to perform any such maintenance or repair service. Moreover, it should not be assumed that every acceptable test and safety procedure or method, precaution, tool, equipment or device is referred to within, or that abnormal or unusual circumstances, may not warrant or suggest different or additional procedures or requirements.

This manual is subject to periodic review, update and revision. Customers are cautioned to obtain and consult the latest revision before undertaking any service of the equipment.

**CAUTION** ⚠ Servicing of this product in accordance with this service manual should never be undertaken in the absence of proper tools, test equipment and the most recent revision to this service manual which is clearly and thoroughly understood.

This static control precaution symbol appears throughout this manual. When this symbol appears next to a procedure in this manual, static control precautions MUST be observed. Use the static control work station (Stock No. 0175-2311-000) to help ensure that static charges are safely conducted to ground and not through static sensitive devices.

## Technical Competence

The procedures described in this service manual should be performed by trained and authorized personnel only. Maintenance should only be undertaken by competent individuals who have a general knowledge of and experience with devices of this nature. No repairs should ever be undertaken or attempted by anyone not having such qualifications. Genuine replacement parts manufactured or sold by Ohmeda must be used for all repairs. Read completely through each step in every procedure before starting the procedure; any exceptions may result in a failure to properly and safely complete the attempted procedure.

## Definitions

**Note:** A note provides additional information to clarify a point in the text.

**Important:** An Important statement is similar to a note, but is used for greater emphasis.

**CAUTION:** A CAUTION statement is used when the possibility of damage to the equipment exists.

**WARNING:** A WARNING statement is used when the possibility of injury to the patient or the operator exists.

 Type B Electrical equipment

 Protective ground

 Functional Ground

~ Alternating Current (AC)

 Static Control Precaution

 European Union Representative

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## List of Figures

# ⚠Warnings

Before using the Giraffe Incubator, read through the entire operator's manual. As with all medical equipment, attempting to use this device without a thorough understanding of its operation may result in patient or user injury. This device should only be operated by personnel trained in its operation under the direction of qualified medical personnel familiar with the risks and benefits of this type of device. Additional precautions specific to certain procedures are found in the text of this manual.

Complete the "Pre-operative Checkout Procedures" section of the Operator's manual before putting the unit into operation. If the incubator fails any portion of the checkout procedure it must be removed from use and repaired.

Do not use the incubator in the presence of flammable anesthetics; an explosion hazard exists under these conditions.

Always disconnect the power before performing service or maintenance procedures detailed in this manual. Apply power only if you are specifically instructed to do so as part of the procedure.

Thoroughly air dry the incubator after cleaning it with flammable agents. Small amounts of flammable agents, such as ether, alcohol or similar cleaning solvents left in the incubator can cause a fire.

# ⚠Cautions

Only competent individuals trained in the repair of this equipment should attempt to service it as detailed in this manual.

Detailed information for more extensive repairs is included in the service manual solely for the convenience of users having proper knowledge, tools and test equipment, and for service representatives trained by Ohmeda Medical.

This functional description is divided into four sections representing each of the four boards. The reader should also reference the block diagram and wiring diagram when studying this section.

## 1.1 Control Board

The Intel 80C188EC microcontroller is an enhanced X86 processor with many on-board peripheral features, such as a interrupt controller, DMA controller, peripheral chip select driver, programmable timers, etc. The two programmable timers are used to control the two heaters (bed and radiant). The input to these timers is line frequency. This allows the control signal to be synchronized with the line frequency to better control the zero-crossing solid state relays. The on-board interrupt controller has several interrupts: analog-to-digital converter (ADC) conversion ready signal, overtemperature comparator output, watchdog output, power fail signal, and module interrupt signal from the system data bus. The microcontroller external bus is a multiplexed address and data bus.

The system memory consists of a programmable read-only memory (PROM) and static random access memory (SRAM). The EEPROM is used for calibration values and infrequently changing variables. This memory holds the data even after power is turned off.

The RS-485 integrated circuit converts the RS-232 TTL signals from the microcontroller to RS-485 signals for the bus. This bus is the main communications bus from the control board to all other boards with processors.

There are two isolation transceivers used to isolate the circuits powered by +5V and the circuits powered by +5VSTBY (battery backup).

The board contains a 16 channel multiplexer. There are seven temperature measurement channels. These channels measure the two patient probes with two thermistors each, the two air temperature thermistors used for display and control, and an additional thermistor used to measure the heat sink temperature.
Additional channels include the humidity sensor (RHIN), LINE COMP & LINE COMP2, 5 Volts, Motor current, Vthref, VDAC, and 1.2Vind.

Attached to the environmental probe connection is the relative humidity signal conditioning circuitry. The 1V reference that is used for the analog circuitry is also the maximum input voltage and the offset voltage for the ADC. This yields a purely ratiometric system.

The overtemperature circuit compares the air temperature to a reference level, generates an interrupt, and turns off the heat if the air temperature is higher than the reference level. The overtemperature circuit requires varying its voltage levels to accommodate various thermistor measurements. This is because the calibration is digital (no potentiometer).

The watchdog circuitry monitors the 80C188 microprocessor, and monitors the +5V and +5VSTBY voltages. It generates the interrupt signal and power failure signal to the 80C188 microprocessors. The audio circuit includes a 8752 microcontroller that reads a wavetable located in a PROM and sends the table to a digital audio circuit and amplifier. The high priority (HP) and other alarm signal lines select an output at the correct frequencies.

Three OR gates are combined to generate the error signal. The inputs to the circuit are overtemperature, power failure, and system failure. This circuit generates an error signal that turns off the heater and sounds the HP alarm. This circuit is independent of the microcontroller.

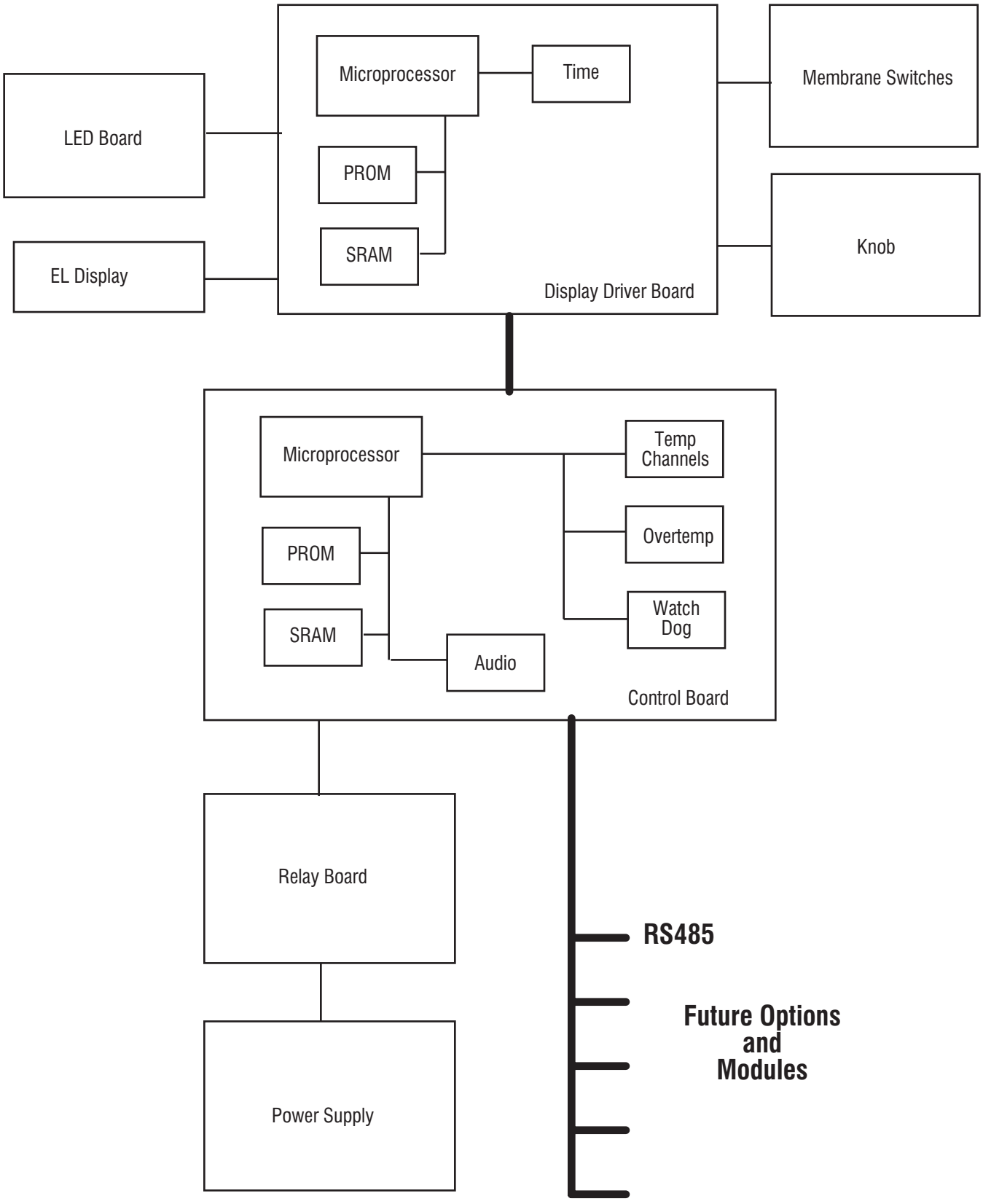



**Figure 1-1**
Block Diagram

## 1.2 Relay Board

The Relay Board includes 2 safety relays, which close to supply mains power to the heater and motor circuits. Safety relay 1 is wired in series with the primary coil of the isolation transformer for the incubator heater. Safety relay 2 closes the mains supply to the humidifier isolation transformer and the transformer for the e-base motor. Control signals for the two relays originate on the Control Board.

The Relay Board interfaces the DC Control signal to the chassis mounted solid-state relay (SSR), which controls the incubator heater. The Control signals for the heater SSR originates on the Control Board.

The Relay Board includes a SSR for the humidifier. The SSR output is wired in series with the humidifier heater. The humidifier SSR control signal originates on the Control Board.

There is one current sense circuit for the incubator and an additional one for the humidifier heater. These circuits consist of a small signal transformer that produces a current proportional to the current through the heater circuits. The current is rectified and measured. The subsequent comparator then generates a digital level based on a specified current level. This results in a signal to the Control Board representing the state of the heater (on or off).

The line compensation circuit consists of a signal transformer connected to the mains voltage. The secondary of this transformer feeds a full wave rectifier and capacitor. The resulting DC voltage is proportional to mains voltage, and it is measured on the Control Board.

The line frequency circuit consists of a full wave rectifier and a comparator. This circuit generates a digital pulse with frequency twice that of the line frequency (50 or 60 Hz). The output signal is provide to the Control Board.

The Relay Board provides the +5v standby power supply to the entire Giraffe system. A +5V regulator generates the +5V standby from the diode OR combination of the system +12V power supply or the backup battery. If there is no mains power, then +12v is not present, and the battery will generate the +5V standby. When +12V is present, the battery is biased out of the circuit with the diode and is merely being trickle charged though a resistor.

The motor driver circuit turns the DC motor coils in the incubator airflow fan motor on and off based on feedback from the hall effect position sensors. This integrated circuit can also vary the speed and brake the motor based on input signals from the Control Board.

The airflow sensor consists of an opto-coupler that outputs a clocking pulse proportional to the fan movement. The signal is AC coupled to eliminate offset voltages and drifts. The resulting pulse is half wave rectified and stored in a capacitor to yield a DC voltage proportional to the fan speed. If the fan stops or there is no fan, this DC voltage becomes zero. The output signal is provide to the Control Board to indicate proper airflow motor operation.

The elevating base circuit consists of a series of relays that apply voltage to the elevating base motor. The ebase motor is always driven at 30 volts. The motor current sense circuit consists of a small signal transformer that produces a current proportional to the motor current. The transformer output current is converted to a voltage and filtered. An output voltage indicative of the motor current amplitude is provided to the Control Board. A subsequent comparator then generates a digital level based on a specified current level. This results in a signal to the Control Board indicating whether or not the e-base motor is stalled.

The Relay Board interfaces the user and system status input switch signals to the Control Board. Switch signals include, e-base activation, humidifier reservoir, and water level status.

## 1.3 Display Driver Board / EL Display

The Display Driver board contains the same Intel microcontroller as the Control board. The processor on the display board is used to control the EL display contents and monitor user inputs received from the membrane switch panel and rotary encoder knob.

There are two groups of digital inputs: membrane switch panel and rotary encoder knob. The membrane switches are pulled high; pressing the switch grounds the input. The encoder also has a switch, and two optically isolated lines that pulse out of phase with each other. The number of pulses represents the number of steps the knob rotates. The phase of the pulses represents the direction of the knob rotation.

The display board system memory consists of a programmable read-only memory (PROM) and static random access memory (SRAM).

The RS-485 integrated circuit converts the RS-232 TTL signals from the microcontroller to RS-485 signals for the bus.

The timekeeping RAM has a battery integrated into the chip so that the time and date run are kept current even with the power off. The battery has a minimum life of 10 years.

The graphics controller is an S-MOS VGA controller. The graphics controller interfaces the data from the video RAM to the EL display. The controller also synchronizes the display using a horizontal pulse (LP) and a vertical pulse for the whole display frame (YD). The controller handshakes with the 80C188 using the READY line to eliminate any lost data during display refreshes.

## 1.4 LED Board

The LED Board contains five display banks and two display drivers. One of the display drivers controls the patient temperature and air temperature display banks. The other driver controls the patient set temperature, air set temperature, warmer bar graph, and the mode and override indicators.

This allows the two large displays (patient and air temperature) to be multiplexed at a slower rate than the other LEDs. This results in brighter large displays. Each driver has a brightness potentiometer that is preset at the factory and should not be adjusted in the field.

## 1.5 Power Supply

The universal input switching power supply converts the line voltage to +5V DC and +12V DC. This supply can source up to 75 watts.  The 5 volts powers the electronics and the 12 volts is used by the EL display and for future boards.

## 1.6 Peripheral Components

There are several peripheral components. The isolation transformer isolates the overhead heater from the line voltage.

The toroidal transformer bucks the line voltage to the range of the elevating base and the canopy lift drive system.

The humidifier isolation transformer isolates the humidifier heater from the line voltage.

The solid state relays mounted to the chassis are used to control the bed heater.

## 1.7 DataLink Option

The DataLink option allows direct output of serial data to various remote monitoring systems, such as a computer or commercial RS-232 monitor. The DataLink option board contains the electronic circuitry necessary to provide a 2500 VRMS isolated serial interface to meet the logic levels specified by EIA RS-232D and CCITTV.28.

The MAX250 and MAX251 (U1 and U2), together with two 6N136 optocouplers and transformer TR1, form an isolated RS-232 transmitter and receiver. The MAX250 connects to the non-isolated or “logic” side of the interface, translating logic signals to and from the optocouplers, while the MAX251 resides on the isolated or “cable” side, translating data between the optocouplers and RS-232 line drivers and receivers. In addition to the optocoupler drivers and receivers, the MAX250 also contains isolation transformer drive circuitry which supplies power to the isolated side of the interface, and the MAX251.

The transmit signal is input to the MAX250 driver (U1 pin 4) whose output (U1 pin 3) drives optocoupler U4. The optocoupler output (U4 pin 6) is then fed into the MAX251 driver (U2 pin 3). The output of the MAX251 driver (U2 pin 12) is at the logic levels conforming to EIA RS-232D and CCITTV.28. Conversely, the receive signal enters the MAX251 driver (U2 pin 10) and is stepped down to CMOS/TTL levels at U2 pin 5. This logic level drives optoisolator input (U3 pin 3) whose output is fed into U1 pin 10. The output (U1 pin 9) signal is then available to the control printed circuit board.

A slide switch SW1 is used as a “self test” for the RS-232 interface. In the closed position, the J30-1 transmit signal is sent through the MAX250/MAX251 transmitter and back into the receiver portions. The signal can be read at J30-2 and verified to be correct. Any external cable connection must be removed for this self test to function. CR1 and CR2 provide transient protection for MAX251. In normal operation SW1 should be in the open (OFF) position.

The nurse call signal is input at J30-5 as a TTL logic level. In the “no alarm” state, this signal is a logic high, which turns on Darlington Q1, energizing relay K1. This results in contact closure between J31-1 and J31-2. In the “alarm” state, J30-5 is a logic low, which turns off Q1, de-energizes K1 and results in contact closure between J31-2 and J31-3. K1 provides 2500 VRMS isolation between the relay coil inputs and contact outputs.

## 1.8 Servo Controlled Oxygen Option

The Giraffe Servo Control Oxygen System consists of an oxygen sensing circuit, Servo Oxygen circuit board, and an oxygen delivery system.

The sensing circuit is located beneath the bed and consists of a pair of fuel cell oxygen sensors, a three-way solenoid calibration valve, and a calibration fan. In normal operation the calibration valve is closed and allows the Giraffe fan to circulate gas from the infant compartment across the sensors.

The unit must be calibrated at least every 24 hours when servo oxygen is in use. After 24 hours have elapsed the system prompts the user to perform calibration. Once the operator initiates calibration, the calibration valve opens and the calibration fan is turned on. This draws ambient air across the sensors until a stable reading is obtained. This 21% oxygen reference value is then used to calibrate the measuring algorithm. After calibration 100% oxygen is briefly delivered to the system to ensure there are no occlusions. When calibration is complete the unit will resume controlling oxygen based on the last set point.

The system must have two sensors present to operate. One sensor is always used for control and the other is used for a redundant check and display. The sensors generate a voltage of about 40 millivolts at 21% oxygen concentration and about 200 millivolts at 100% oxygen concentration. The voltage is directly proportional to the concentration of oxygen. Humidity and temperature sensors located in the sensor plug are used for voltage compensation. A fan mounted to the sensor-housing door is activated when the temperature reaches 50 degrees C. This fan circulates air to keep the sensors below the maximum allowable operating temperature, about 55 degrees C.

The Servo O2 board is located in the Giraffe controller. The microcontroller and integrated EPROM on the board perform the following:

Convert sensor output from analog to digital
Activates oxygen alarm conditions.
Two-way communications via 485 bus with the Giraffe control board.
Controls the calibration valve to select calibration mode.
Controls the two supply valves to maintain the desired oxygen set point.
Opens the safety relay, which removes power to the two-way valve and the supply valves in case of a system failure.

The oxygen delivery system consists of two solenoid supply valves, and a regulator assembly. The preset regulator regulates the oxygen supply to 50 psi (345 kPa). Two supply valves, controlled by the Servo Oxygen board, control flow to the infant compartment. Both valves are opened until the measured level gets close to the desired set point then one valve is closed. One valve is then cycled on and off as needed to maintain the desired oxygen levels in the infant compartment. The valve selected is alternated so both valves cycle about the same number of times. There are 2 fuses between the Servo O2 board and the supply valves that prevent high current from the board entering the valve housing should a short occur in the supply valves.

**WARNINGS** ⚠ **Do not perform the preoperative checkout procedure while the patient occupies the unit.**

⚠ **Complete the preoperative checkout procedure section of this manual before putting the unit into operation. If the equipment fails any portion of the checkout procedure it must be removed from use and repaired.**

## 2.1 Mechanical checks

1. Disconnect the power cord for the mechanical portion of the preoperative checkout procedure.

2. Examine the power cord for any signs of damage. Replace the cord if damage is evident.

3. Check that both plug retaining brackets are in place.

4. Examine the unit overall for any damaged or missing parts.

5. Check that all the casters are in firm contact with the floor and that the unit is stable. Lock the caster brakes and check that they hold the unit in place. Release the brakes and check that the unit moves smoothly.

6. Check the operation of the side doors. Open the doors and check that they swing all the way down and hang perpendicular to the bed. Check that the doors are securely attached to the unit and that the hinge pins are properly seated. Check that the inner walls are securely fastened to the doors. Close the doors and check that the latches hold the doors securely shut. The orange latch open indicators should not be visible when the latches are engaged. Check that the hood is in the locked position.

7. Check the tubing acces door at the top of the ventilator slot in the back wall. It should flip up easily and smoothly, and stay in position anywhere on its travel path.

8. Check the portholes. Open the portholes by pressing on the latch. The cover should swing open. Close the porthole and check that the latch holds the cover securely shut and that the cover seals tightly against the porthole gasket. Check that all the porthole seals are in place and are in good condition.

9. If the unit is equipped with an iris porthole, check the iris is installed and in good condition. Check that the iris tightens when it is rotated.

10. Check that the tubing access covers in the four bed corners and the large slot grommet at the head of the bed are in place and are in good condition.

11. Check the operation of the bed. The bed should rotate easily without binding. If the bed is properly seated and locked in place, the mattress should be level. With the bed rotated back into the straight position, check to see that the bed platform extends and stops when it is pulled out on either side. Check the operation of the bed tilt mechanism. Squeeze the tilt control and push down on the foot of the bed. The head of the bed should raise easily, and should stay in position at any angle along its tilt path when the tilt control is released. Push down on the head of the bed. The foot of the bed should raise easily, and should stay in position at any angle along its tilt path when you the tilt control is released.

12. Check the operation of the hood lock. Release the lock and raise the hood. Make sure it locks in the open position. Release the lock and lower the hood. Make sure it locks in the closed position.

## 2.2 Controller checks

WARNING ⚠ Do not use the Incubator in the presence of flammable anesthetics: an explosion hazard exists under these conditions.

1. Connect the incubator power cord to a properly rated outlet.

2. Connect the patient probe to jack 1 on the probe panel.

3. Switch on the power at the mains switch on the back of the unit, and at the standby switch on the probe panel, while holding in the override button (>37) on the display during power up until the software revision screen appears. Release the button and the first service screen will appear.

4. Scroll to “Down” and select it to bring up the second service screen. Select Status to see Status screen. Check status of the software self tests. These include: heater on (INCHTRON), ) heater off (IHTROFF), humidifier heater on (RHHTR), remote monitoring data stream (RS232LOOP), incubator fan on (FANON), and incubator fan off (FANOFF). All test should say PASS except RS232 LOOP. If the RS232 option is not installed RS232LOOP will display N/A. To test the circuit if the option is installed, short pins 2 & 3 on the 9 pin connector on the back of the electrical enclosure.

5. Using the standby switch turn off the unit, then turn it back on.

   Verify the following:
   - All the displays and indicators light
   - The software revision appears
   - The prompt tone begins

   Note: If the unit has been used in the last 2 hours, the patient history query appears.

6. Adjust the set temperature to silence the prompt tone.

7. Check the patient probe. If the probe is below 30 C, the display will show -L-. Warm it by placing it between your fingers, and verify that the baby temperature reading increases.

8. Unplug the patient probe and check that both visual and audio alarms trigger in the Baby control mode.

9. If so equipped, check the operation of the bed elevating system. Raise and lower the bed along its entire travel range, checking that the mechanism operates smoothly. Check that the pedals on both sides of the unit raise and lower the bed.

10. Check the power failure alarm and the battery backed up memory. Make note of the current control mode and temperature settings and wait one minute, then unplug the Incubator from the wall outlet. An alarm should sound and the power failure indicator should light. Wait one to two minutes and plug the Incubator back in. Verify that the alarm cancels and that the Incubator returns to the same control mode and temperature settings it displayed before the power interruption.

    Note: A fully charged battery should supply the power failure alarm for approximately 10 minutes. If the alarm is tested for the full 10 minutes the Incubator must be run at least two hours to recharge the battery before it is used with a patient. Total recharge time is 8 to 10 hours.

12. Perform the Leakage Current and Ground Resistance checks in Chapter 3 of this manual.

## 2.3 Humidity check

Turn on the Giraffe unit and verify that the Servo Humidity icon is on the screen. Set the Humidity to 65%. Wait for 4 minutes. If no alarms are seen (except for a possible “Add Water” message) the humidifier is operational.

Note: It is not necessary to have water in the reservoir to perform this test.

## 2.4 Servo Controlled Oxygen check

Leak Check

This test checks for leaks between the O2 sensors and the Heat sink vent fitting.

1. Remove translation deck, tilt platform, upper pan, and fan.

2. Cover the heat sink vent near the fan shaft with adhesive tape. Make sure the tape will not interfere with fan rotation. Reinstall the fan, upper pan, tilt platform, and translation deck.

Note: If the conical shaped rubber grommet was removed with the fan, when reinstalling fan be sure that rubber grommet clicks into groove on fan shaft.

3. Power up the unit, hold down the ‘Air curtain’ button and press the ‘Down’ button to force the Giraffe into low fan speed.

4. Set O2 set point to 21%; the display will show the actual concentration in the larger numerals next to the set point. Open the doors until the actual concentration reaches 21% (ambient).

5. Run the Servo O2 calibration routine and wait for the calibration complete message. In approximately 20 seconds, the “Check O2 Supply” alarm should sound. If there is no alarm, the tubing between the sensor housing and the heat sink vent fitting has a leak or is disconnected. Repair the leak and repeat steps 1 through 4 of this procedure.

6. After performing the test, power off the unit. Remove the translation deck, tilt platform, upper pan, and the fan, and remove the adhesive tape. Be sure to remove any residue on the heat sink left by the tape.

7. Reassemble the system and run the calibration routine one final time.

Pre-use Checkout

This test checks for leaks between the chassis vent fitting and the O2 sensors.

1. Connect an acceptable hose from an oxygen supply to the oxygen inlet fitting on the unit. Supply pressure should be between 310 kPa (45 PSI) and 586 kPa (85PSI).

2. Select wrench icon on display screen to bring up setup menu. Select Cal Oxygen on the setup menu to initiate calibration.

3. When calibration is completed, 100% oxygen is delivered for approximately 20 seconds to ensure there are no occlusions in the system. Do not turn off the unit or disconnect the oxygen supply during this brief period after the ‘Calibration Complete’ screen appears. Exit calibration screen.

4. Select O2 icon on display screen to bring up Servo Control Oxygen menu. Hold down the ‘Air curtain’ button and press the ‘Down’ button to force the Giraffe into low fan speed.

5. Set O2 set point to 65%. Start timer and verify that unit reaches 60% in less than 10 minutes. If rise time is longer than 10 minutes check all tubing between the O2 sensors and the chassis vent fitting.

Note: The chassis vent may be identified by its mushroom cap shaped cover.

Supply Valve Leak Test

1. Connect oxygen supply to Servo Oxygen fitting.

2. Disconnect the 10mm hose from the expansion chamber.

3. Power up unit in Service Mode.

4. Scroll to Servo Oxygen service screen, and open V1 & V2 and verify that gas flows audibly .

5. Close V1 & V2 and place the 10mm hose in a cup of water. Verify that no more than 10 bubbles appear over a one minute period. If unit fails, replace supply valves.

When test is completed, reattach 10 mm hose to expansion chamber.

## 2.5 Accessory checks

1. Check that all accessories are securely mounted and out of the path of the hood in the open position.
2. Check the operation of any accessories with reference to their appropriate operation manuals.
3. Setup any required suction or gas supply systems. Check them for leaks as described in their respective operation manuals.

## 2.6 Cable Connections and Mechanical Controls

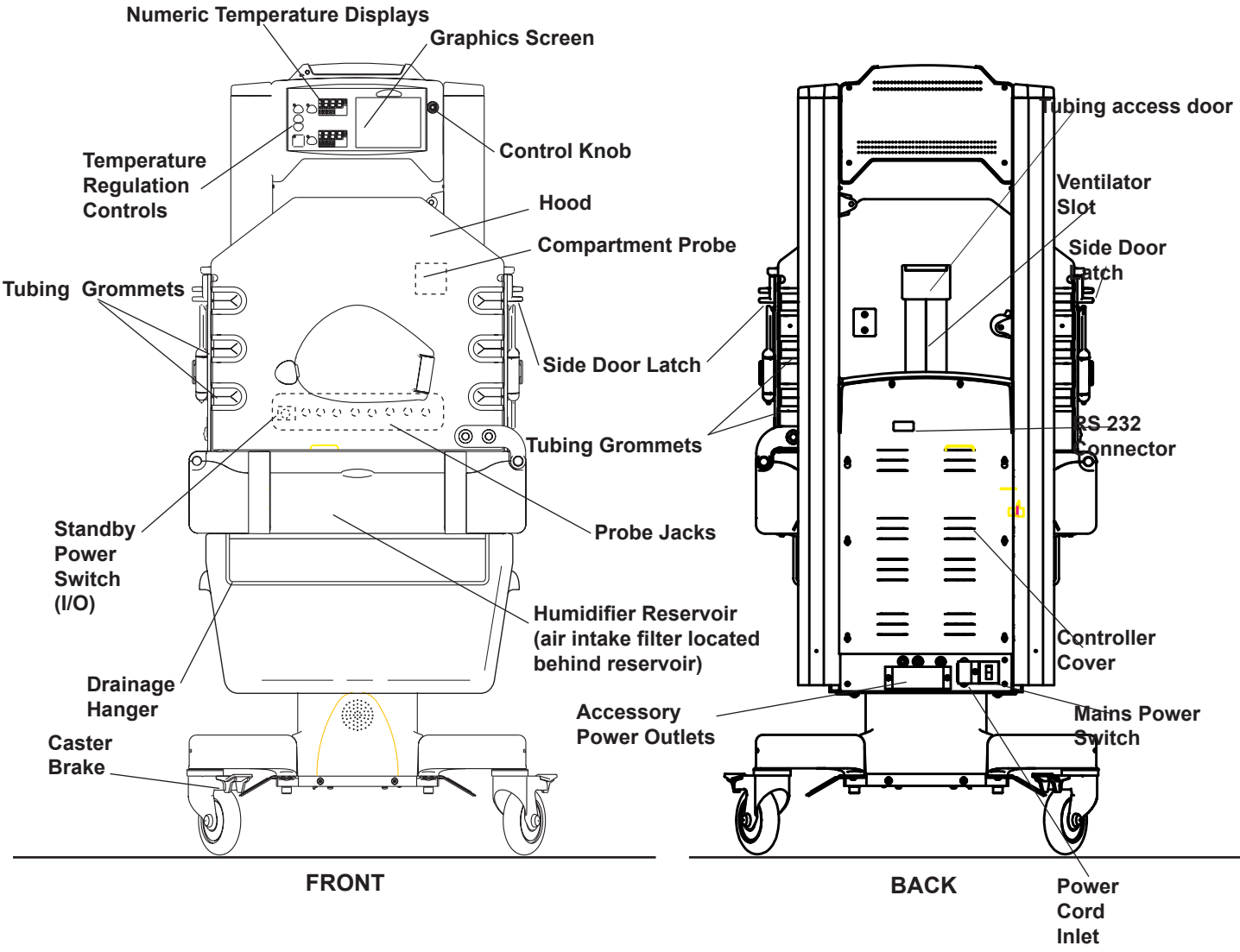
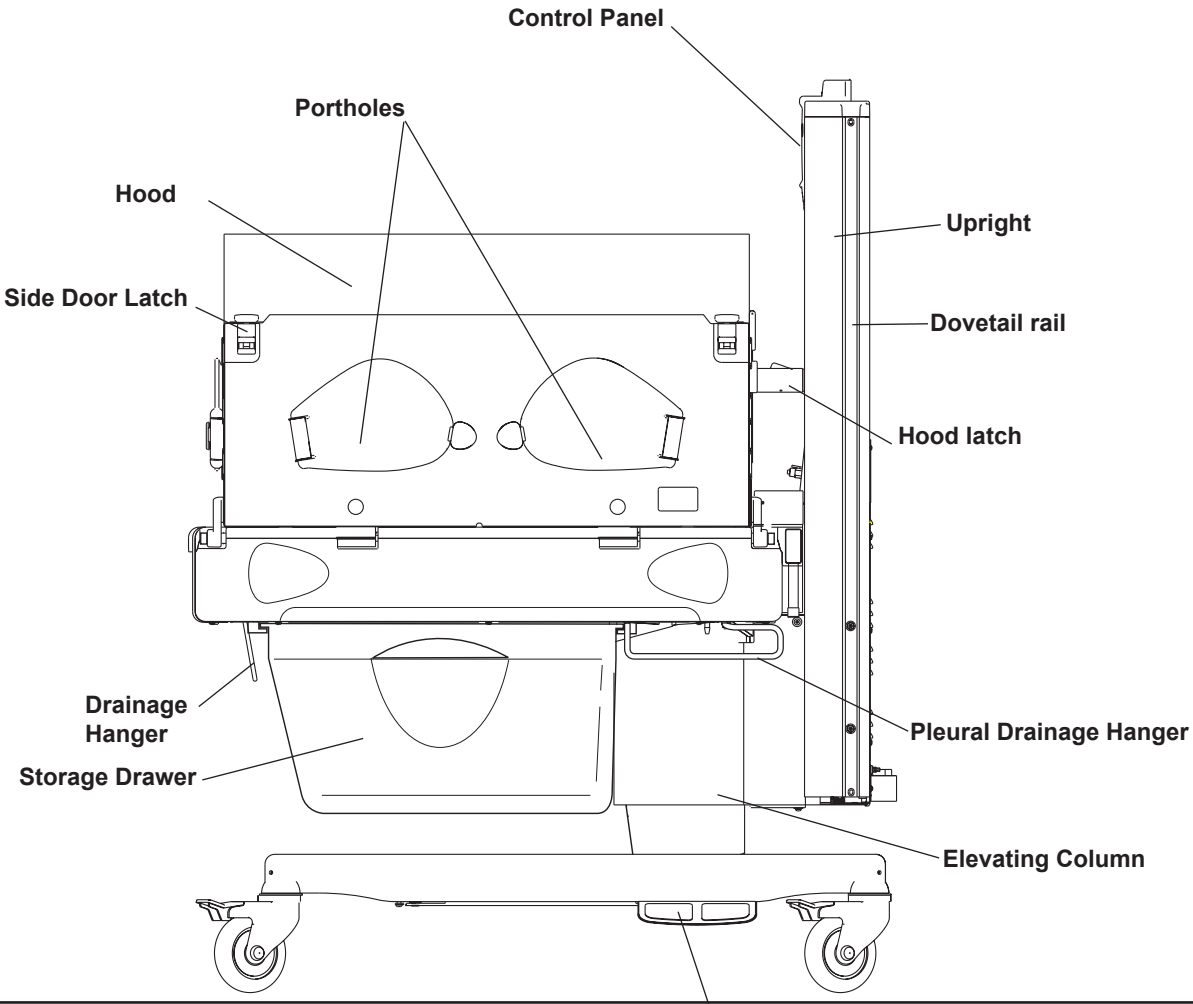



**Figure 2-1**
Connections and controls


Control Panel
Portholes
Hood
Upright
Side Door Latch
Dovetail rail
Hood latch
Drainage Hanger
Pleural Drainage Hanger
Storage Drawer
Elevating Column
Bed Height Pedal

**SIDE**

Use Static Control Work Station to help ensure static charges are safely conducted to ground. The velostat material is conductive; do not place electrically powered boards on it. Whenever this symbol appears beside a procedure, take static control precautions.

**WARNING ⚠ After performing any repair or calibration, always perform the Service Checkout Procedure before putting the unit back into service.**

## 3.1 Maintenance schedule

The unit should be maintained in accordance with the procedures detailed in this manual. Service maintenance must be performed by a technically competent individual.

### Service maintenance

This schedule lists the minimum frequencies. Always follow hospital and local regulations for required frequencies.

**Annually**

Perform the electrical safety and calibration procedure as described in the service manual.

Calibrate the scale.

**Every Two Years**

Replace the battery.

**Note:** The battery is used to sound the power failure alarm and to power memory circuits during a power failure.

**Every Three Years**

Calibrate the humidifier.

## 3.2 Special Tools

The following tools (or their functional equivalents) are required to complete the recommended service procedures:

Digital Multimeter, 4-1/2 digit
PLCC Extractor for removing socketed chips
Leakage Current Tester
Static Control Work Station (recommended)
Light gray touch-up paint (Munsell .16GY8.56-0.44 chroma)-18ml .....6600-0714-200
Servo Humidity Calibration Kit .....6600-0048-850
Scale calibration weight- 5kg .....6600-0209-800

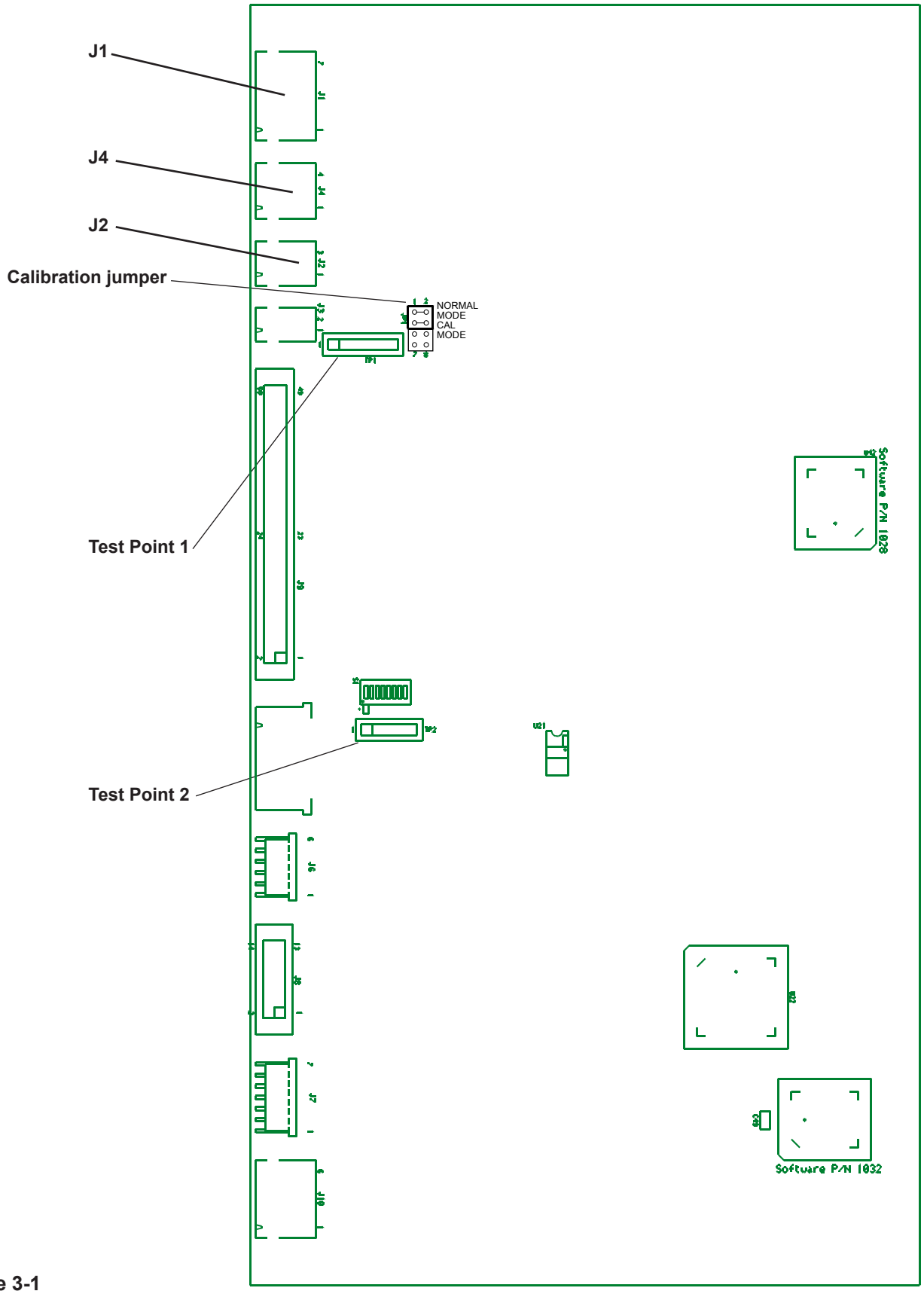



**Figure 3-1**
Control board test points

## 3.3 System Calibration

Note: If Only performing line voltage calibration, follow instructions in next section, 3.4.

Important: Be sure to perform System Calibration after replacing a control board.

1. Turn power off.
2. Remove electrical enclosure back panel.
3. Unplug the temperature sensors from J1, J4 and J2 on the control board.
4. Move jumper JP1 to the CAL MODE position on the control board (see Figure 3-1 on next page). Be sure to orient the jumper correctly so pins 5-6 and 7-8 are shorted.
5. Turn power on. After running the power-up testing INITIALIZING will be displayed and dots will move across the top of the screen.
6. After about 90 seconds CALIBRATION MODE, Enter “VREF”, and Enter “Mains” will be displayed.
7. Using a 4 ½ digit DVM (capable of measuring to 0.1 millivolt) measure VREF at TP1, pins 1 and 6 (pin 6 is ground) on the control board. Measure to the nearest 0.1 millivolt.
8. Dial in VREF using the control knob. Press the knob to enter the value.
9. Measure the Mains Voltage at the AC connectors at the bottom of the electronics enclosure cover.
10. Dial in the Mains voltage using the control knob. Press the knob to enter the value.
11. After a few seconds the dots will stop moving across the screen and DONE will appear on the top right of the display. Do not shut off the unit until the DONE message is displayed or the new calibration values will not be stored.

    If the message “Mains voltage calibration failed. Please enter the mains voltage again” appears this indicates the dialed in line voltage is 20% different than the measured value (not the nominal value).

12. Power down the unit and move the calibrate jumper to the NORMAL MODE position. Be sure to orient the jumper correctly so pins 1-2 and 3-4 are shorted.

## 3.4 Line Voltage Calibration

Important: Be sure to perform line voltage calibration after replacing a relay board.

1. Hold the overide button (>37) while powering up the unit to enter the service screen.
2. On the second service screen select CAL LV.
3. Measure the line voltage at the AC connectors located at the bottom of the electrical enclosure.
4. On the CAL LV screen, dial in the mains voltage value that you measured and push the knob to enter it.
5. When calibration is completed screen will say Mains Voltage Calibration Complete.

    If the message “Mains voltage calibration failed. Please enter the mains voltage again” appears this indicates the dialed in line voltage is 20% different than the measured value (not the nominal value).

## 3.5 Humidifier Calibration

Important: Be sure to re-calibrate the humidifier whenever either the sensor or the control board is replaced.

Important: In order for the water in the calibration bottle to be completely saturated, most of the salt should not be dissolved. There should be as little standing water above the salt line as possible to minimize the response time. The salt in the calibration bottle may only be used for a period of one year after it's initial mix with water then the kit should be discarded.

1. Take the cap off the humidity calibration bottle and add one half cap full of distilled water to the bottle. Shake the bottle to thoroughly mix the salt and water solution. Place the elbow on the bottle. The smaller end goes over the bottle.

2. Slide the elbow over the humidity sensor (mounted on the back wall) until it stops.

3. Hold the override key while powering up to enter the service screen.

4. On the second service screen, select Cal RH. The screen will prompt "Push knob when RH reading is stable." Wait for 20 minutes or until the RH display stabilizes (does not change by more than 1% in 5 minutes).

5. You have the option to select STABLE, SET TO DEFAULT or EXIT. STABLE initiates calibration. SET TO DEFAULT resets calibration values back to factory default settings. If you started calibration by mistake (without the calibration bottle in place, for example) you would select SET TO DEFAULT and then calibrate the unit. If you have entered the calibration routine by mistake, select EXIT to leave without initiating calibration

6. If "RH Sensor Calibration Completed." is displayed the calibration is complete. Depress the knob to exit the Cal RH routine.

7. If "RH Sensor Calibration Failed. Try Again." is displayed verify your setup and press the knob to try the calibration again.

## 3.6 Servo Controlled Oxygen Calibration

1. Select Set Up icon (wrench) to bring up Set Up screen.

2. Scroll down and select Cal Oxygen to initiate calibration. Calibration is automatic and takes less than five minutes. A bar graph indicates progress toward completing calibration. If for any reason you wish to discontinue calibration before it is completed, turning the control knob in either direction will cause the word Cancel to appear on the calibration screen. Pushing in the control knob will discontinue calibration.

   When calibration is completed, 100% oxygen is delivered for approximately 20 seconds to ensure there are no occlusions in the system. Do not turn off the unit or disconnect the oxygen supply during this brief period after the 'Calibration Complete' screen appears.

Note: The servo control oxygen system prompts for calibration every 24 hours, but the system may prompt for calibration if there is a large leak in the system (for example if a door is open) for half an hour.

CAUTION The servo-control system must be calibrated at the same atmospheric pressure in which it is to be used. Operation at atmospheric pressures other than that present during calibration may result in readings outside the stated accuracy for the unit.

## 3.7 Scale Calibration

NOTE: The scale is calibrated using a Class F calibration weight between 1 kilogram and 8 kilograms (accuracy of 0.01%).

1. Place the test weight on the center of the bed.

2. Hold the override key (>37) while powering up to enter the service screen.

3. On the second service screen, select Cal Scale.

4. Remove the weight and push the knob at the screen prompt “REMOVE THE WEIGHT AND PUSH KNOB”. The screen will prompt “INITIALIZING.....” for a few seconds.

5. Replace the weight and push the knob at the screen prompt “PLACE TEST WEIGHT AND PUSH KNOB”. The screen will prompt “MEASURING ....” for a few seconds.

6. When the screen prompts “ENTER TEST WEIGHT” Dial in the test weight to the nearest gram. Press the knob to enter. The screen will prompt “CALCULATING.” for a few seconds.

7. When the screen prompts:
   SAVE AND EXIT
   EXIT ONLY
   RESTORE DEFAULT

   Select and enter “SAVE AND EXIT”

   If the screen prompts:
   EXIT ONLY
   RESTORE DEFAULT
   Calibration has failed. Select “EXIT ONLY” and calibrate again. If failure persists, replace scale.

8. Turn off the power to exit the service mode.

## 3.8 Leakage Current

Use approved equipment and techniques to test the unit’s leakage current and ground continuity. Follow the directions supplied by the test equipment manufacturer to verify the following:

1. Less than 300 microamperes measured at any exposed metal surface for equipment rated at 120 Vac, 50/60 Hz.

2. Less than 500 microamperes measured at any exposed metal surface for equipment rated at 220 Vac, 50/60 Hz or 240 Vac, 50/60 Hz.

## 3.9 Ground Resistance Check

Use a electrical safety analyzer to measure the resistance between the ground pin on the line cord plug and exposed metal of the electronic enclosure. The ground resistance must be less than 0.2 ohms.

## 4.1 Service Screen

To access the service screen, hold in the override button (>37) during power up until the software revision screen appears. Release the button and the first service screen will appear.

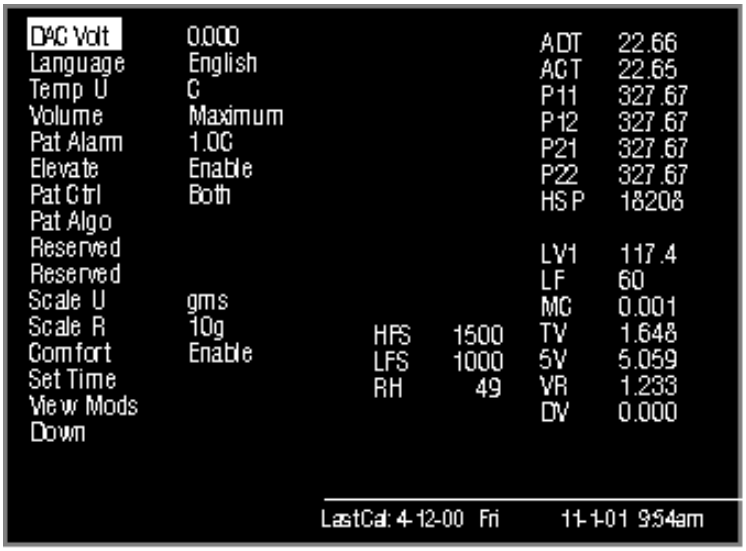



**Figure 4-1**
First service screen

Default options that may be selected from this screen appear along the left side of the screen

**DAC Volt** Digital/Analog Converter voltage. This is the over temperature voltage that is used by the system to verify the computer independent circuitry is working. To manually test this circuit enter voltages from 0 to .5 V. The DV value at the bottom right corner of the screen should match this value within 10mV.

**Language** English is the default language that appears on the EL screen, but you can select French, Spanish, etc., depending on what software is installed.

**Temp U** Changes temperature displays to show “Fahrenheit”, “Celsius” or “Celsius Only” so the Fahrenheit option is not present on the user Set-up screen (Celsius is factory set default).

**Volume** Select one of four volume settings; 1 is minimum, 4 is maximum.

**Pat Alarm** Set the default Hot Baby/Cold Baby alarm to activate when either 0.5ºC or 1.0ºC difference is read between a set temperature and the baby probe temperature.

**Elevate** Disable or enable the elevating column foot pedal switches.

**Pat Ctrl** Allows you to disable patient control.

**Pat Algo** To be used for future software options.

**Scale U** Select from “Grams”, “Pounds” or “Grams Only” so that the pounds option is not present on the user Scale screen (grams is the factory default).

**Scale R** Select from 2 scale resolution settings; 10 grams or 5 grams (10 grams is the factory default).

**Comfort** Allows you to remove the Comfort Screen feature.

**Set Time** Set real time clock for time, day and date. Choose how date is displayed (North American or European). Choose a 12 hour (AM/PM) or 24 hour time display.

**View Mods** Display the current software revision of the options installed on this specific unit (Humidifier, Scale, SPO2, etc.)

**Down** Go to second service screen.

**Up** Return to previous screen.

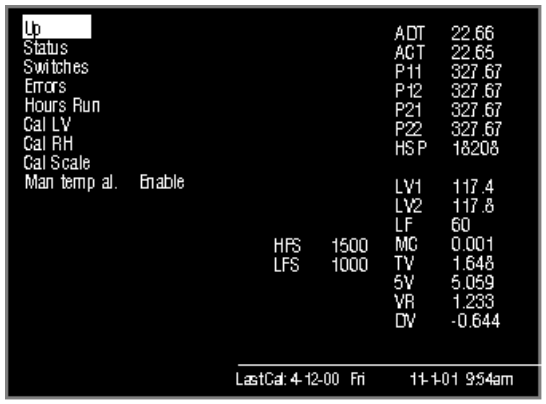



**Figure 4-2**
Second service screen

**Status** Check status of all self test the software runs continuously. These include: incubator heater on (INCHTRON), incubator heater off (I/HTROFF), humidifier heater on (RHHTR), remote monitoring data stream (RS232LOOP), incubator fan on (FANON), and incubator fan off (FANOFF).

If the RS232 option is not installed RS232LOOP will display fail. To test the circuit if the option is installed, short pins 2 & 3 on the 9 pin connector on the back of the electrical enclosure.

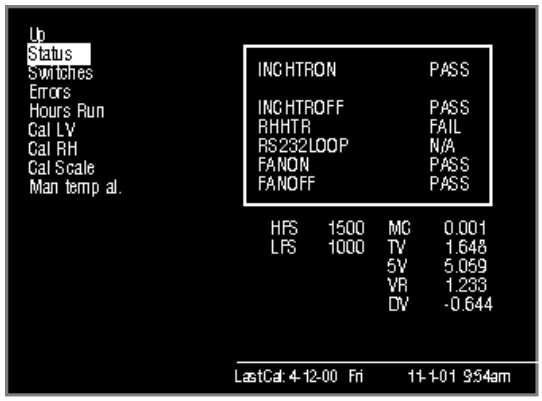



**Figure 4-3**
Status menu

**Switches** Select to bring up a diagnostic diagram of the unit that displays the status of all the switches. If the circle next to the switch is lit, the switch is closed; if it's not lit, the switch is open. Also, while the switch status screen is active, you can hold down the alarm silence button to light the alarm light, system failure light and all LED segments to test them.

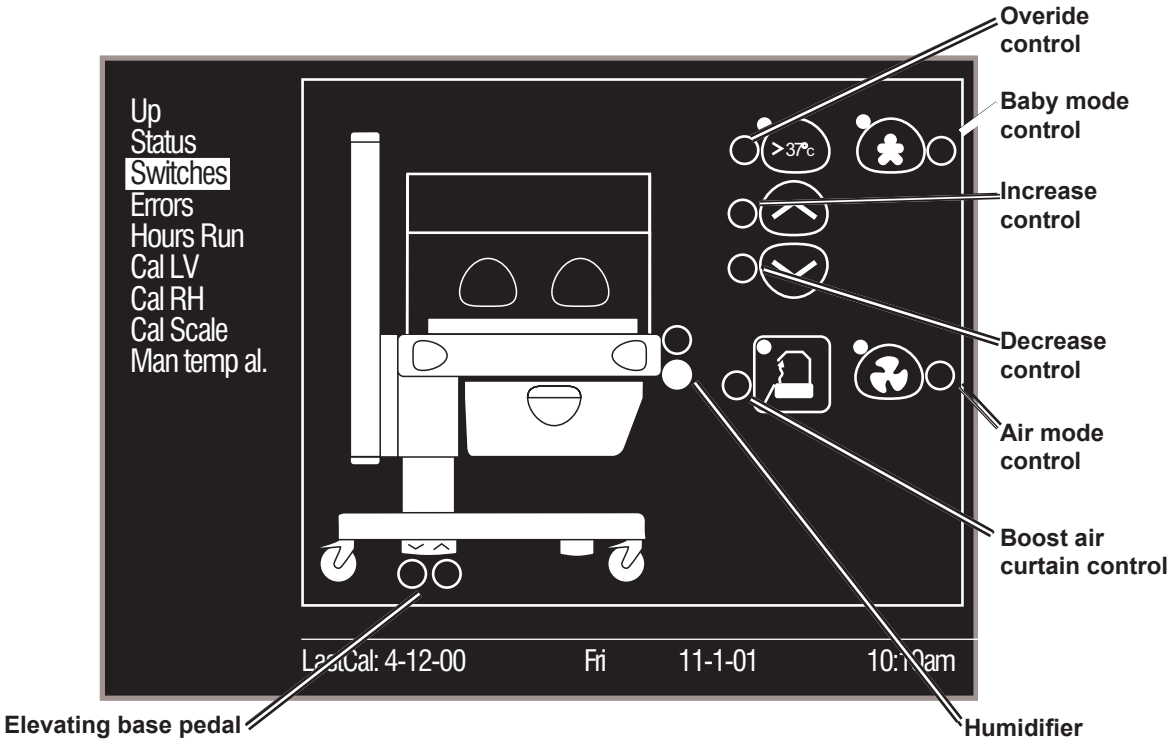



**Figure 4-4**
Switch diagnostic diagram

**Errors** — Lists a chronological log of the last 8 system errors that occurred. Shows error number and date. It is possible to clear the list.

**Hours Run** — Brings up a screen with 2 hour meters; one that is resetable and one that is not. To reset the resetable hour meter, highlight CLEAR and push the control knob.

**Cal LV** — Use to calibrate line voltage at the factory. To calibrate line voltage follow the procedure in calibration section (chapter 3) of this manual

**Man temp al.** — Use to enable or disable the patient temperature alarms in the air mode.

Pedals — In the event of an elevating base pedal switch failure, selecting pedals allows the bed to be raised or lowered (revision 1.5 software and higher).

**BatLoad** — Used for manufacturing only, not for service use.

**Cal RH** — Brings up humidifier calibration screen. See calibration section for information on how this screen is used.

**Cal Scale** — Brings up scale calibration screen. See calibration section for information on how this screen is used.

A number of diagnostic readings appear on the right side of the service screens.

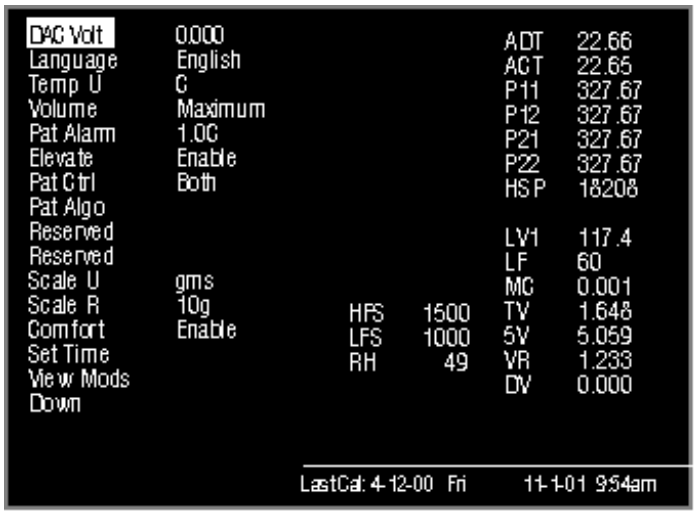



**Figure 4-6**
First service screen
Diagnostics

| | |
|---|---|
| **HFS** | High fan speed. Should be 1500 ± 100 (measured at power up only) |
| **LFS** | Low fan speed. Should be 1000 ± 100 (measured at power up only) |
| **RH** | Relative Humidity. % humidity read in the patient chamber |
| **SR** | Scale counts raw |
| **SC** | Scale counts corrected |
| **ADT** | Air display temperature. Temperature read by the first thermistor in the compartment probe. Should be ± 0.3°C of ACT temperature. |
| **ACT** | Temperature read by second thermistor in the compartment probe**.** Should be ± 0.3°C of ADT temperature. |
| **P11** | Reading from the first thermistor in patient jack 1. Should be ± 0.5°C of P12 temperature. |
| **P12** | Reading from the second thermistor in patient jack 1. Should be ± 0.5°C of P11 temperature. |
| **P21** | Reading from the first thermistor in patient jack 2. Should be ± 0.5°C of P22 temperature. |
| **P22** | Reading from the second thermistor in patient jack 2. Should be ± 0.5°C of P21 temperature. |
| **HSP** | Heat sink probe resistance**.** Should be approximately 20000 ohms @ 25°C. See section 4.5 for resistannce verses temperature values. |
| **LV1** | Line voltage in first mains circuit. |
| **LF** | 60Hz or 50Hz |
| **MC** | Motor current. Shows current drawn by the e-base motor |
| **TV** | Thermistor voltage. Voltage of thermistor circuits located on the mother board. |
| **5V** | Power supply voltage. Should be ± 0.25V of 5V |
| **VR** | Voltage reference. Independent voltage reference. Should be 1.235V ± 1% |
| **DV** | DAC output voltage. It should match the DAC volt value within 10 mV. |
| **BV** | Used for manufacturing only, not for service use. |

Across the bottom of the screen the date of last time the temperature and line voltage calibration was performed appears plus the current time settings of the unit.

## 4.2 Alarm Messages

| | CAUSE | ACTION |
|---|---|---|
| FAN FAILURE | Fan is missing or not turning. | Verify the fan is installed and turning. During powerup it should spin at low speed for a few seconds, stop for a second, then start again at high speed. If the fan is not turning replace the fan motor. |
| | Old design fan. | Replace with new design fan. The new fan can be identified by the grooves molded in the 2 black areas on the bottom of the fan (side facing the heat sink). The old fan has smooth surfaced black areas. |
| | Defective optical sensor. | If the fan is turning replace the optical sensor. |
| | Defective relay board. | If the problem persists replace the relay board. |
| FAN ALWAYS IN HIGH SPEED | The heat sink temperature sensor thermistor is defective. | Check heat sink temperature sensor thermistor. See tips. |
| | Defective control board. | If the thermistor is OK replace the control board. |
| AIR PROBE FAILURE | Probe thermistors show difference > 0.5C (0.3C before Rev 1.50 software) | If problem persists intermittently, replace with version 1.50 software of higher. |
| | The air sensor is defective. One of the thermistors is open or shorted. | Check ACT and ADT on service screen. Check the air sensor. See tips. |
| | Defective control board. | If the sensor is OK replace the control board. |
| BAD MEMBRANE SWITCH | Alarm Silence has been on for more than 20 seconds or one of the temp control switches has been on for more than 50 seconds. | Verify switches. See tips.<br>If these switches are OK replace the graphics driver board. |
| POWER FAILURE | The 5 volt signal is not present. | Check that power is coming into the unit. Check the power supplies. See tips. |
| BED HEATER FAILURE | The t-stat is open (possibly because the unit was shut down when the heater was hot) or the heater or t-stat is defective. | If the unit was shut off when the heater was hot, allow the fan to run for several minutes to cool below 40 then power down and back up. If the failure still persists check the t-stst and heater resistance. See tips. |
| | Defective cable between the relay and control board. | Check cable pins 37, 38, 39, and 40 for continuity. |
| | Defective incubator solid state relay. | Replace the incubator solid state relay. |
| | Defective relay board. | Replace relay board. |

| | CAUSE | ACTION |
|---|---|---|
| HUMIDIFIER FAILURE | Humidifier heater will not turn on, because safety T-stat is open or heater is defective. | Wait for the heater to cool. Check safety T-stat and heater resistance. See tips. |
| BED UP/DOWN PEDAL FAILURE | One of the elevating base up/ down switches is shorted.<br><br>One of the pedals were touched during power up. | Check the switches. See tips.<br><br>Shut off unit and power up again to clear alarm. |
| MOTOR DRIVE FAILURE | The elevating base motor was running when not turned on. | Replace the relay board. |
| BABY PROBE 1 FAILURE and BABY PROBE 2 FAILURE | Probe thermistors show difference > 0.5C (0.3C before Rev 1.50 software).<br><br>Uncalibrated control board.<br><br>Defective cable.<br><br>Defective control board. | Replace patient skin probe.<br><br>Calibrate the control board. If failure persists, check cable from panel to board and check control board. If problem persists intermittently, replace with version 1.50 software or higher. |
| BED HEIGHT PEDAL DISABLED | Pedals have been diabled on nurse setup or service screen and pedal is pressed. | When pedal is released, the alarm deactivates. |
| UP PEDAL PRESSED or DOWN PEDAL PRESSED | Pedal pressed during power up. | When pedal is released, the alarm deactivates. If alarm silence button is pressed while the pedal is pressed, a pedal failure alarm activates and the pedals will be disabled. Shut down the unit and power up to clear failure. |
| BABY MODE DISABLED | Baby mode has been disable on service screen and mode button is pressed. | Press alarm silence button to deactivate the alarm. |
| TEMPERATURE OUT OF CALIBRATION | Calibration data is lost. | Replace control board with revision 17 or higher. If a rev 17 control board is already installed, calibrate according to procedure in Section 3. |

## 4.3 Error Codes

| ERROR # | MEANING | CAUSE(S) | ACTION(S) |
|---|---|---|---|
| 0 | Battery failure. | Battery cannot hold charge. | Turn unit on for at least 10 minutes, ignoring all alarms and errors to charge battery. Turn unit off for at least 3 seconds then turn it back on. If the unit powers up, continue to use unit. If not, disconnect the battery, located in the electrical enclosure, and power up the unit. If the unit powers up correctly, the battery is bad and should be replaced. |
| | Defective scale. | Bad connection to scale or scale failure. | Disconnect scale. |
| | Timing problem | Software timing revision 1.20 control board software. | If revision 1.20 error occurs during startup in service mode, replace with current revision software (kit 6600-0234-850). |
| | Display driver board not responding. Communication error between the display driver board and the control board. | Defective control board, cable, or display driver board. | If the error occurs occasionally, may be random causes; e.g., static discharge. If failure persists, check or replace the cable between display driver and control boards. If failure persists, replace the display driver board. If failure persists, replace the control board. |
| 1 | No Timer2 | The Timer2 circuit of the Microprocessor on control board is defective. | Replace the control board. |
| 2 | Scale harness defective. | Scale harness defective. | Check connection at board and behind probe panel. Replace scale harness. |
| | Timer2 Too Fast | There is no line frequency signal to feed timer0 & timer1 of the micro on control board, or the timer2 of the micro on control board is defective. | Power cycle the unit. If it shows “system failure 8” see the instruction below for “system failure 8”. If it still shows “system failure 2”, replace the control board. |
| 3 | During ADC calibration the software detected a channel out of range | All of the thermistors were not unplugged during calibration.<br>Defective circuit on control board. | Before calibrating make sure J1, J2 and J4 on the control board are disconnected. Verify JP1 is correctly positioned. Try calibrating again. If the error persists, replace the control board. |
| 5 | The 1.235 volt reference is out of the 1.171V - 1.259V range. | ADC out of calibration.<br>Defective control board. | Recalibrate the ADC.<br>Replace control board. |
| 6 | Bad overtemp DAC circuit on the control board. | ADC out of calibration.<br>Defective control board. | If the error occurs occasionally, may be random-causes; e.g., static discharge. If failure persists, recalibrate the ADC. If failure still persists, replace the control board. |

| ERROR # | MEANING | CAUSE(S) | ACTION(S) |
|---|---|---|---|
| 7 | 1.0 V Thermistor reference voltage is out of 0.951V- 1.049V range. | ADC out of calibration.<br><br>Defective control board. | Recalibrate the ADC. If the failure still persists, replace control board. |
| 8 | No Line Frequency | Defective cable between the control board and the relay board.<br><br>Defective relay board.<br><br>Defective control board. | Measure the signal on the control board between J9 pin 43, and TP1-6 (Ground). It should be a 120 hertz square wave. If the signal is OK replace the control board. If no signal check the 50 pin cable, pin 43. If bad replace the cable. If cable is OK, replace relay board. |
| 11 | The ADC on the control board is not operating to spec. (too slow) | The humidifier sensor or cable is shorted. Bad control board. | Disconnect J1 on the control board. If the error persists replace the control board. If it powers up OK either the cable or the humidity sensor is bad. Reconnect J1 and disconnect the humidity sensor at the compartment probe. If the unit now powers up OK the humidity sensor is bad, or the cable is bad. |
| 12 | Bad Checksum | Defective control board PROM. | Change socketed IC U42 on the control board. If failure persists, replace control board. |
| 13 | Bad SRAM | Defective SRAM circuit on control board. | If the error occurs occasionally, may be random causes; e.g., static discharge. If failure persists, replace control board. |
| 14 | Bad WDOG | Defective control board Watch Dog | Replace control board. |
| 15 | Heater Safety Relay test failure. Unable to turn incubator heater on or off by switching the safety relay. | Bed in incubator mode, but having relay problems.<br><br>Air temperature sensor is above 40C at powerup.<br><br>Air display sensor is shorted.<br><br>Defective relay board.<br><br>Defective DAC circuit on control board.<br><br>If the error occurs during ADC calibration it could be caused by failure to unplug the probes during calibration. | Replace eprom with 1.6 software or higher.<br><br>If the unit was shut off when the heater was hot, allow the fan to run for several minutes to cool to below 40 then power down and back up.<br><br>Check the air sensor. See tips.<br><br>If failure persists, replace relay board.<br><br>If failure persists, replace control board.<br><br>Make sure the J1, J2 and J4 on the control board are disconnected. Verify JP1 is correctly positioned, then recalibrate. |

| ERROR # | MEANING | CAUSE(S) | ACTION(S) |
|---|---|---|---|
| 16 | Unable to turn off incubator heater by switching the solid state relay. | The bed Tstat is open (possibly because the unit was shut down when the heater was hot) or the heater or t-stat is defective.<br><br>Defective cable between the relay and control board.<br><br>Defective incubator solid state relay.<br><br>Defective relay board. | If the unit was shut off when the heater was hot, allow the fan to run for several minutes to cool to below 40 then power down and back up. If the failure still persists check the t-stat and heater resistance. See tips.<br><br>Check cable pins 37, 38, 39, and 40 for continuity.<br><br>Replace the incubator solid state relay.<br><br>Replace relay board. |
| 17 | Not used | | |
| 18 | Bad Variables | Defective SRAM circuit on control board. | Replace the control board. |
| 19 | No Audio Frequency | Battery failure<br><br>Bad connection to scale or scale failure.<br><br>Microprocessor was not appropriately reset.<br><br>Defective audio circuit on control board. | Turn unit on for at least 10 minutes ignoring all alarms and errors to charge battery. Turn unit off for at least 3 seconds then turn it back on. If the unit powers up, continue to use unit. If not, disconnect the battery, located in the electrical enclosure, and power up the unit. If the unit powers up correctly, the battery is bad and should be replaced.<br><br>Disconnect scale.<br><br>Replace control board with revision 17 or higher.<br><br>Replace socketed IC U22 on control board. If failure persists, replace the control board. |
| 20 | Display WDOG Time Out | Display driver board software upset. | If the error occurs occasionally, may be random causes; e.g., static discharge. If failure persists, replace display board. |
| 22 | During operation the system was unable to turn ON the incubator heater | See other errors.<br><br>Distorted line frequency. | Power down the unit. During the system tests, after power-up, the unit should detect system failure 15, bed heater failure. Follow the tips for those failures.<br><br>**Note**: If the unit has 1.42 software, replace with higher revision software.<br><br>If the relay board is revision 9 or lower (see Chapter 6 for location of rev level code), replace with revision 10 or higher relay board. |

| ERROR # | MEANING | CAUSE(S) | ACTION(S) |
|---|---|---|---|
| 23 | Relay board trip point too low<br><br>During operation the system was unable to turn OFF either the radiant heater or the incubator heater | Heater duty cycle problem.<br><br>Relay board revision level 6 or 7.<br><br>Defective solid state relay. | Replace U42 on control PCB with 1.61 software or higher.<br><br>If Relay board is revision 6 or 7 (to locate board assembly revision label, see Relay board layout in chapter 6) replace board.<br><br>**Note**: If the unit has 1.42 software, replace with higher revision software.<br><br>Replace the SSR. |
| 24 | Bad Air Temperature Sensor. The system detected a difference in the two air thermistors of >0.3 degrees C. | Bad air sensor.<br>Bad control board. | This failure is normally caused by a faulty air temperature sensor. When the error occurs, observe the difference between the air control and air display thermistor readings on the service screen. If the difference exceeds 0.5°C, replace the air temperature sensor and repeat the test. If the error persists, replace the control board. |
| 25 | Bad Air Flow | Fan is missing or not turning.<br><br>Old design fan.<br><br>Defective optical sensor.<br><br>Defective relay board. | Verify the fan is installed and turning. During power up it should spin at low speed for a few seconds, stop for a second, then start again at high speed. If the fan is not turning replace the fan motor.<br><br>Replace with new design fan. The new fan can be identified by the grooves molded in the 2 black areas on the bottom of the fan (side facing the heat sink). The old fan has smooth-surfaced black areas.<br><br>If the fan is turning, replace the optical sensor.<br><br>If the problem persists, replace the relay board. |
| 26 | During the power up tests, the system was unable to turn off the RH safety relay. | Defective relay board. | Replace the relay board. |
| 27 | Bad non-volatile memory | Defective circuit on control board. | Replace the control board. |
| 28 | The display driver board lost communication with control board | Defective cable<br><br>Defective control board. | Verify the cable between control board J8 and display driver board is installed properly and is pin to pin connected.<br><br>Replace control board. |
| 29 | Bad 5VAN signal on control board. | Defective cable, control board, power supply, or relay board. | Check the system power supplies. See tips. |

| ERROR # | MEANING | CAUSE(S) | ACTION(S) |
|---|---|---|---|
| 30 | Line voltage reading LV1 is outside of the expected range | High or low line voltage. The unit software alarms if LV1 is outside the following ranges:<br>100V: 80-115V<br>115V: 95-132V<br>230V: 195-270V | Use the service screen to check if "LV1" is within no alarm range of the unit. If it is, measure the actual line voltage at the power socket. It must be within the following ranges:<br>100 volt range 90-110 volts<br>115 volt range 104-132 volts<br>230 volt range 198-264 volts |
| | | Line Voltage Comp Circuit is not calibrated correctly. (1.4 Software or higher). | Calibrate the unit. |
| | | Defective relay board. | If the failure persists, measure the voltage at the relay board, J37 pin 48 to J37 pin 45. 4 volts. Line voltage 230 = 7-10 volts, difference within 0.8. If not, replace the relay board. |
| | | Defective cable. | If the failure persists, measure the same voltages at the control board, J9 pin 48 to J9 pin 45. If the voltages are bad, the cable is bad. |
| | | Defective control board. | If the voltages are OK replace the control board. |
| 33 | Bad RH Solid State Relay | Defective RH Solid State Relay. | Replace relay board. |
| 34 | Software revision level does not match | The software revision of the control board and the display board does not match. | This error may occur after replacing the control or display board. Check Software revision on power up. Replace the software EPROM. |
| 35 | Wrong dipswitch set up | | Check the 8 position dipswitch on the control board. Verify that Switch 1 and Switch 2 is on. |
| 50 | Display Bad Checksum | Defective PROM on the display driver board. | Replace socketed IC U5 on display driver board. If failure persists, replace display driver board. |
| 51 | Display Bad SRAM | Defective SRAM circuit on the display driver board. | If the error occurs occasionally, may be random causes; e.g., static discharge. If failure persists, replace display driver board. |
| 52 | Display No Timer2 | Defective display driver board micro circuit. | If the error occurs occasionally, may be random causes; e.g., static discharge. If failure persists, replace display driver board. |
| 53 | Display Timer2 Too Fast | Defective display driverboard micro circuit. | Replace the display driver board. |
| 55 | Display board On Line Self Test Failure | Defective display driver board SRAM circuit. | If the error occurs occasionally, may be random causes; e.g., static discharge. If failure persists, replace display driver board. |
| 98 | Overflow | Software upset. | If the error occurs occasionally, may be random causes; e.g., static discharge. If failure persists replace the control board. |
| 99 | Logic problem on the control board | Software upset. | Replace the control board. |

## 4.4 Troubleshooting Table

| SYMPTOM | POSSIBLE CAUSE | ACTION |
|---|---|---|
| No audio alarm | Defective speaker. | Use an ohmmeter to verify the speaker resistance is about 8 ohms. (J40, pins 5-6) |
| | Audio driver circuitry is defective. | Replace the control board. |
| Unit equipped with servo-humidity but unable to set RH setpoint above 10 and % indicator is not displayed. | Unit is functioning as a manual humidifier. Look at the air sensor and verify the humidity sensor is installed. | If the sensor is not installed the unit is operating correctly, no action is required. |
| | Defective humidity sensor. | Replace the humidity sensor. |
| | Defective control board. | If problem persists, replace control board. |
| ADD WATER message stays on even after water has been added | Humidifier reservoir switch is jammed. | Remove reservoir, but take care because surface may be hot! Check that the white button on the reservoir switch moves freely. Listen for switch to click when the button is depressed. (6600-1298-500). |
| | Defective ribbon cable. | Check continuity of positions 4 and 6. If bad, replace cable. |
| | Defective relay board. | Replace relay board. |
| | Defective control board. | Replace control board. |
| Elevating base will not go up or down | Pedals disabled on Setup screen or service screen. | Check Setup screen (wrench symbol) or service screen to see if pedals are disabled. |
| | Open fuse in the toroidal transformer. | Remove the configuration plug (primary windings). Measure the resistance between yellow and blue and between orange and brown. They should be less than 10 ohms. If one of these is open, replace the transformer. |
| | Defective switch. | Check switches. See tips. |
| | Defective e-base motor. | Check voltage to the e-base. See tips. If OK, replace the e-base motor. |
| | Defective relay board. | If bad check the input signals on the relay board. See tips. If OK, replace the relay board. |
| | Defective cable. | If bad check the output signals from the control board. If OK, then the cable is bad. |
| | Defective control board. | If signals are incorrect replace the control board. |
| Unit will not switch to Baby Control Mode | A patient probe is plugged into Jack 2 on the probe panel. | Disconnect probe from Jack 2 (unit will only allow Baby Control operation with a single probe in Jack 1). |
| | Baby Control is disabled on Service screen. | Select BOTH for Patient Control on service screen to activate Baby Control. |

| SYMPTOM | POSSIBLE CAUSE | ACTION |
|---|---|---|
| Unit will not power up | Defective scale. | Disconnect scale. If unit powers up, scale is defective. |
| | Defective battery. | Remove the electrical enclosure cover and disconnect the battery. Power down and power up aqain. If the unit powers up, replace the 9V battery (6600-1024-600). |
| | Defective power supply. | Check voltages on power supply. See tips. |
| | Microprocessor was not appropriately reset. | Replace control board with revision 17 or higher. |
| Baby Hot or Baby Cold alarms activated while unit is in Air Mode | MANUAL TEMP alarm is selected on the Setup screen | Select OFF for MANUAL TEMP alarm on Setup screen. |
| Bed will not reach set temp but there is no alarm | One of the bed heater cartridges is defective. | Feel the heat sink to see if one side is cooler than the other. Use care, since the heat sink can reach temperatures as great as 121C (250F). Replace the cartridge on the cool side. |
| Air Temp >38C or Air Temp >40C alarm activated and heater is operating even though compartment temp is < alarm | Alarm is not designed to automatically reset after alarm condition is resolved. | Push the alarm silence button to clear the alarm. |
| Screen refreshes every few seconds while scale is attached | Unbiased RS485 bus during idle state. | Replace control board with revision 17 or higher. |
| | Defective scale. | Repair scale. |
| Noise from speaker on power down | Microprocessor does not hold reset during power off. | If noise is excessive, replace control board with revision 17 or higher. |
| Higher level of fan noise (approx. 55db), but no FAN ALWAYS IN HIGH SPEED message | Fan in high speed for 90 min. after power up. | To check fan speed, power up the unit, hold down the Air Curtain button and press the Down button to force the unit into low fan speed. |
| | Fan in high speed for minimum of 20 min. when bed heater heatsink is too hot. | |
| | Air curtain button pushed. | |
| Bed will not lock in tilt position | Tilt ball not engaged in finger pocket latch. | Tilt the head of the bed platform all the way down while holding the latch open, then let the latch close to capture the tilt ball (see “Disassembly for complete cleaning” in the O&M manual). |
| | Tilt brake failure. | Repair brake according to “Bed tilt brake shoe replacement” in the Repair Procedures chapter of this manual. |
| Baby Cold or Baby Hot Alarm does not trigger at 0.5C even though Patient Alarm is set at 1.0 C. | Manual Temp. Alarm is disabled on Service Screen. | Enable Manual Temp. alarm. Refer to description on pages 4-1 and 4-2. |

## 4.5 Additional Troubleshooting Tips

Following are tips on taking many of the measurements and diagnosing the failures that are referred to in the troubleshooting charts. For some tips, it may be necessary to determine the revision level of the relay board. The revision code is located in a triangle printed on the component side of the PCB. See figures 6-32 and 6-33.

**INCUBATOR AIR HEATER AND THERMOSTAT**

There are two separate incubator heaters. They are connected in parallel for 115 volt operation and in series for 230 volt operation. If the unit has been updated with the bed heater ISO harness, the heaters are connected in parallel for 230 operation also. Measure between the black wire on the incubator SSR and J49 pin 2 on the relay boards revision 9 or lower or J54 pin 4 on revision 10 and higher.

The resistance of each heater is about 48 ohms so it should measure about 24 ohms for 115 units, 96 ohms for 230 units. The heater and t'stat are in series so if the reading is open circuit you must determine which is defective.

**POWER SUPPLIES**

The 5V and 12V supplies are generated on the power supply. Measure the power supply output at the input to the relay board.

| Signal | Location | Value |
|---|---|---|
| +5V | J41 pins 1-5 | 4.75 to 5.25 |
| +12V | J41 pins 8-5 | 10.8 to 13.2 |

+5STBY is generated on the relay board. The output of the relay board can be measured on the power supply bus cable coming off J42 on the relay board.

| Signal | Location | Value |
|---|---|---|
| +5V | J42 pins 2-1 | 4.75 to 5.25 |
| +5VSTBY | J42 pins 4-1 | 4.75 to 5.25 |
| +12V | J42 pins 3-1 | 10.8 To 13.2 |

+5VAN and -5VAN are generated on the control board and can be measured on the test points on the control board.

| Signal | Location | Value |
|---|---|---|
| +5V | TP2 pins 1-4 | 4.75 to 5.25 |
| +5VSTBY | TP2 pins 3-4 | 4.75 to 5.25 |
| +5AN | TP1 pins 5-6 | 4.75 To 5.25 |
| -5AN | TP1 pins 4-6 | -4.0 To -5.5 |

**SWITCHES/TSTAT**

Use switch status diagram on the second service screen to assist in troubleshooting the switches.

| | | |
|---|---|---|
| Humidity reservoir | Relay bd J32 pins 2-3 | Closed when reservoir is closed |
| Add water t-stat | Relay bd J32 pins 1-3 | Opens when reservoir needs water |

The following switches are membrane switches. When closed the resistance should be less than 200 ohms.

DISPLAY TOUCH PANEL SWITCHES

| | | |
|---|---|---|
| Alarm Silence | Graphics Driver bd J21 pins1-2 | Closed when switch is pressed |
| >37 degrees | Graphics Driver bd J21 pins1-3 | Closed when switch is pressed |
| Servo Control | Graphics Driver bd J21 pins1-4 | Closed when switch is pressed |
| Up | Graphics Driver bd J21 pins1-5 | Closed when switch is pressed |
| Down | Graphics Driver bd J21 pins1-6 | Closed when switch is pressed |
| Intervention | Graphics Driver bd J21 pins1-8 | Closed when switch is pressed |
| Manual Mode Inc. | Graphics Driver bd J21 pins1-9 | Closed when switch is pressed |

E'base

| | | |
|---|---|---|
| Left or right up | Relay bd J40 pins 2-4 | Closed when either switch is pressed |
| Left or right down | Relay bd J40 pins 1-4 | Closed when either switch is pressed |

**HUMIDIFIER HEATER/SAFETY T-STAT**

The humidifier has two separate heaters that are connected in parallel for 115 volt operation and in series for 230 volt operation. The safety t-stat is in series with the heater. Measure at J53.1 to J53.3

The resistance of each heater is about 144 ohms so it should measure about 72 ohms for 115 units, 288 ohms for 230 units.

**AIR PROBE and PATIENT PROBE**

There are two thermistors in each air probe or patient probe. During stable temperature conditions the thermistors should read the same resistance within a few ohms.

| | |
|---|---|
| Patient probe #1 | Control bd J4 pins 1-3, 2-3 |
| Patient probe #2 | Control bd J2 pins 1-3, 2-3 |
| Air probe | Control bd J1 pins 1-2, 3-4 |

| Temperature (C) | Resistance (Ohms) |
|---|---|
| 20 | 12527 |
| 25 | 10000 |
| 30 | 8037 |
| 35 | 6500 |

INCUBATOR HEAT SINK TEMPERATURE SENSOR THERMISTOR

| | |
|---|---|
| Thermistor | Control bd J3 pins 1-2 |

| Temperature (C) | Resistance (Ohms) |
|---|---|
| 20 | 25000 |
| 25 | 20000 |
| 30 | 16102 |
| 35 | 13048 |
| 40 | 10636 |
| 80 | 2506 |
| 90 | 1827 |
| 100 | 1353 |
| 110 | 1017 |
| 120 | 775 |

**E-BASE MOTOR**

If you must replace a footswitch when the bed is all the way down, disconnect the shorted footswitch, then short switch pins on the relay board. On units with 1.5 software or higher, use pedal screen on service screen to raise or lower the bed.

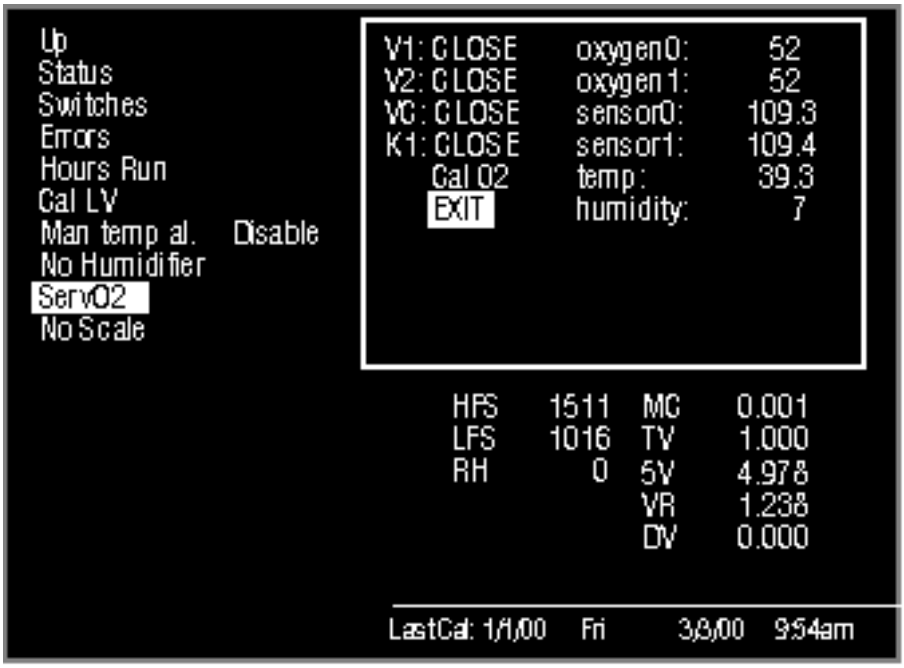
The e-base is driven at 24 volts DC (acceptable range 24-32). The following chart shows the control signal values and the output voltages for each of the motor conditions.

| Switch | Control Signals, Relay Board | | | | E-base | |
|---|---|---|---|---|---|---|
| | J37 pin 23 | J37 pin 26 | J37 pin 24 | J37 pin 27 | | |
| | 24V SELECT | E/H ACTIVATE | NVERTPOLARITY | E/H SELECT | J45-1 | J45-2 |
| Raise E-base | 0 | 0 | 1 | 0 | +24V | Gnd |
| Lower E-base | 0 | 0 | 0 | 0 | Gnd | +24V |
| None | NA | 1 | NA | NA | NA | NA |

## 4.6 Servo Controlled Oxygen

### 4.6.1 Servo Controlled Oxygen Service Screen

To access the service screens, hold in the override button (>37) during power up until the software revision screen appears. Release the button and the first service screen will appear. Select DOWN on the first screen to go to the second service screen. Select Servo O2 to bring up the Servo Controlled Oxygen service screen.




| | |
|---|---|
| V1 | Select to open or close supply valve one in the valve housing located beneath the electrical enclosure. |
| V2 | Select to open or close supply valve two in the valve housing located beneath the electrical enclosure. |
| VC | Select to open or close calibration valve in the sensor housing located beneath the bed. Open is calibration position and closed is the normal operation position. The calibration fan is on and the cooling fan is off when VC is open.<br>**Note**: The cooling fan is on whenever the Servo Controlled Oxygen service screen is selected and VC is closed. |
| K1 | Select to open or close the relay on Relay PCB that powers the valves. |
| Cal 02 | Initiates calibration routine. |
| oxygen0 | Oxygen reading in percent from first sensor cell (23 - 280 mv = 21 - 100% O2). |
| oxygen1 | Oxygen reading in percent from second sensor cell (23 - 280 mv = 21 - 100% O2). |
| sensor0 | Voltage output in millivolts from first sensor cell. |
| sensor1 | Voltage output in millivolts from second sensor cell. |
| temp | Temperature in degrees Celsius read from a sensor inside the sensor housing located beneath the bed. See R/T curve in Tips. |
| humidity | Relative humidity in percent read from a sensor inside the sensor housing located beneath the bed. |

### 4.6.2 Servo Controlled Oxygen Alarm Messages

| Alarm Message | Meaning | Cause | Action |
|---|---|---|---|
| Low Oxygen | Sensor1 reading is> 3% below the oxygen set point 7 minutes after a set point change or the Omnibed canopy was closed. | Low O2 supply pressure or flow. | Be sure supply is greater than 45psi (310 kPa) and flow rate is greater than 45 lpm. If flow rate is <45 check that the inlet screen in the regulator is not occluded. Clean or replace screen. |
| | | Inlet screen occluded. | |
| | | Air leaks into infant compartment. | Be sure all doors and portholes are closed |
| | | Supply Valve not opening. | Check supply valves, see tips. |
| | | Endcap safety valve not opening. | Check valve and spring assembly. See tips. |
| | | Calibration valve is not closing. | Check the calibration valve. See tips. |
| | | Infant compartment vents occluded. | Check to be sure that the two vents in the infant compartment under the bed are not occluded. |
| High Oxygen | Sensor1 reading-more than 3% above set point | Oxygen set point recently lowered. | Allow time for oxygen level to drop. |
| | | Supply valve(s) not closing. | Check supply valves and kinked hoses. See tips. |
| Oxygen Probe Failure | One of the sensors is reading out of range (23-280 millivolts) or the difference between the two O2 sensors is above 3%. | Defective Sensor(s) | In service mode sensor0 and sensor1 should be 23-280. If outside this range replace the sensors. If in range ensure oxygen0 and oxygen1 read within 3% of each other or replace the sensors. |
| | | Leak or occlusion in sensor housing area. | Be sure sensor housing is seated properly and the retaining screws are tight. Be sure sensor gaskets are in place and the tubing is seated correctly in the connectors. Check to be sure that the two vents in the infant compartment under the bed are not occluded. |
| | | Defective cable or connection. | Measure the voltage at J85.8-J85.7(sensor0) and J85.6-J85.7(sensor1) and compare them to displayed sensor0 and sensor1. If the measurement is the same as the displayed, check the cable and sensor contacts. |
| | | Defective Servo O2 board. | If the measurement is not the same as the displayed, replace the Servo O2 board. |
| O2 Cal Lost-No O2 | Servo oxygen unit has never been calibrated. Unit will not operate until initial calibration is performed. | Perform oxygen calibration. | Run calibration. |
| | Cell voltage less than 33 mV. | Earlier software versions did not store voltages this low. | Replace display software with 1.62 or higher. |

| Alarm Message | Meaning | Cause | Action |
|---|---|---|---|
| Oxygen System Failure 1 | The sensor plug thermistor temperature reading is out of the range: 15C-55C. | Unit is cold: <15 degrees C.<br><br>Cooling fan is not running when the sensor housing temperature gets above 50 degrees.<br><br>Defective sensor plug thermistor or cable.<br><br>Defective servo O2 board. | Allow unit to warm up.<br><br>Test the cooling fan. See tips. Disconnect the cable and measure the resistance of the thermistor between J85.4&J85.5. See R/T chart in tips. If sensor is shorted, open, or values don't agree with the R/T chart, replace the sensor plug assembly or the cable.<br><br>If resistance is in range replace the servo O2 board. |
| Oxygen System Failure 2 | The RH reading is out of valid range: 1-99. When out of range it displays 0 in service mode. | Defective sensor plug.<br><br>Defective servo O2 board. | Measure the humidity sensor voltage between J85.2 & J85.1. If the voltage is outside the range of 0.7V- 4.0V, replace the sensor plug assembly.<br><br>If it is in the correct range, replace the servo O2 Board. |
| Oxygen System Failure 3 | The checksum test performed during power up testing failed. | Defective Microcontroller. | Replace microcontroller U6 on the Servo O2 board. |
| Oxygen System Failure 4 | Analog to digital converter circuit self test failed. The reading of Vtest is out of the valid range: 1.216V-1.254V. | Defective Servo O2 board. | Replace servo O2 board. |
| Check O2 supply | After calibration, both supply valves are opened and and after approximately 20 seconds, sensor1 reading is not greater than 23%. | O2 supply is not connected. | Verify O2 supply, minimum 45psi (310kPa) is connected to the inlet. |
| Oxygen System Failure 5 | Check O2 Supply alarm has been silenced twice and the sensor1 reading is still not greater-than 23%. | O2 supply is not connected.<br><br>Calibration valve stuck in calibration position.<br><br>Supply valves not opening.<br><br>Leak or occlusion in sensor housing area. | Verify O2 supply, minimum 45psi (310 kPa) and 45 lpm is connected to the inlet.<br><br>Check the calibration valve, see tips.<br><br>Check supply valves. See tips.<br><br>Be sure sensor housing is seated properly and the retaining screws are tight. Be sure sensor gaskets are in place and the tubing is seated correctly in the connectors. Check to be sure that the two vents in the infant compartment under the bed are not occluded. |
| Oxygen System Failure 6 | The Giraffe control board cannot communicate with Servo O2 board. | Defective Servo O2 board.<br><br>Defective Cable. | Replace servo O2 board.<br><br>Check that the cable between the Giraffe control board and the Servo O2 board is seated properly. |

| Alarm Message | Meaning | Cause | Action |
|---|---|---|---|
| Oxygen System Failure 7 | Power up test detected a problem with the watchdog circuit. | Defective Servo O2 board. | Replace Servo O2 board. |
| Calibration failed | In calibration mode, after 5 minutes, both sensors are not reading between 23 and 55 millivolts so the unit cannot calibrate. | Calibration valve is not opening or the calibration fan is not turning on.<br><br>Bad sensors. | Check the calibration valve and fan. See tips.<br><br>Replace the sensors. |
| FiO2>26% | Elevated O2 levels but Servo O2 is not turned on. | If other sources of oxygen are not in use, leak in Serv O2 system. | Check for valve leak. See tips. |

Use Static Control Work Station to help ensure static charges are safely conducted to ground. The velostat material is conductive; do not place electrically powered boards on it. Whenever this symbol appears beside a procedure, take static control precautions.

### 4.6.3 Servo Controlled Oxygen Troubleshooting Tips

**Check Supply Valves**

Power up unit in service mode. Select Servo O2 on second page. Be sure O2 is connected. Open V1. You should hear gas flow. Close V1, open V2. You should hear gas flow. Close V2, gas flow should stop.

If both valves are not opening, test the fuses and supply valves. Disconnect J83 at the Servo O2 board. Measure the resistance on harness pin 1 to pin 2. It should be the supply valve resistance (50 to 100 ohms). If not, the fuse is opened or the supply valve is defective. Repeat for the second supply valve with pins 3 to 4. If the valves check OK, the Servo O2 board is defective.

**Note**: With one supply valve open the flow rate should me be a minimum of 35 lpm. With both supply valves open, the minimum flow rate should be 40 lpm. If the flowrate is low, check that the regulator inlet screen is not occluded.

**Check Calibration Valve/Calibration Fan**

The calibration valve is located beneath the chassis in the sensor housing. The calibration fan is mounted in the sensor housing next to the calibration valve. Power up unit in service mode. Select Servo O2 on second page. Open VC. This should open the calibrate valve and turn on the calibration fan. Verify the calibration fan is running. If the fan is running then the Servo O2 board is OK and the calibration valve may be defective. If the fan is not running check the control signal from the Servo O2 board to verify voltage is present when VC is opened to determine if the fan or board is defective.

**Check cooling fan**

The cooling fan is mounted to the sensor housing door on the chassis cover. Power up unit in service mode. Select Servo O2 on second page. The cooling fan should be running.

If fan is not running verify 10.0 - 13.2 Volts at J86-1 to J86-2. If voltage is present the fan is defective. If voltage is not present the Servo O2 board is defective. Open VC, you should hear a click and the cooling fan should stop. If the fan does not stop the Servo O2 board is defective.

### Sensor housing temperature sensor temperature to resistance curve

| Temperature | Resistance |
|---|---|
| 15C | 15.720 kohm |
| 25C | 10.000 kohm |
| 30C | 8.056 kohm |
| 35C | 6.530 kohm |
| 40C | 5.326 kohm |
| 45C | 4.369 kohm |
| 50C | 3.604 kohm |
| 60C | 2.491 kohm |

Use Static Control Work Station to help ensure static charges are safely conducted to ground. The velostat material is conductive; do not place electrically powered boards on it. Whenever this symbol appears beside a procedure, take static control precautions.

WARNING ⚠ After performing any repair or calibration, always perform the Service Checkout Procedure before putting the unit back into service.

## 5.1 Hood Removal for Replacement (Figure 5-1 and 5-3)

1.. Open both side doors.

2. Using a small straight blade screwdriver, remove the 2 snap fasteners from the inside of the hood that secure the hood to each of its hinges. Each fastener has two halves that snap together and can be pried apart.

3. Remove the compartment probe and cable clip on the hood backwall as descibed in section 5.3.

4. Push the trigger on the hood latch post to disengage the latch and carefully lift the hood off the chassis.

### 5.1.1 Porthole Door Replacement (Figure6-5)

1. Use a flat edge screwdriver to pry off the hinge cover.

2. Open the door to unload the springs.

3. Slide the hinge pin down, out the hole at the bottom of the hinge.

4. Remove the porthole door.

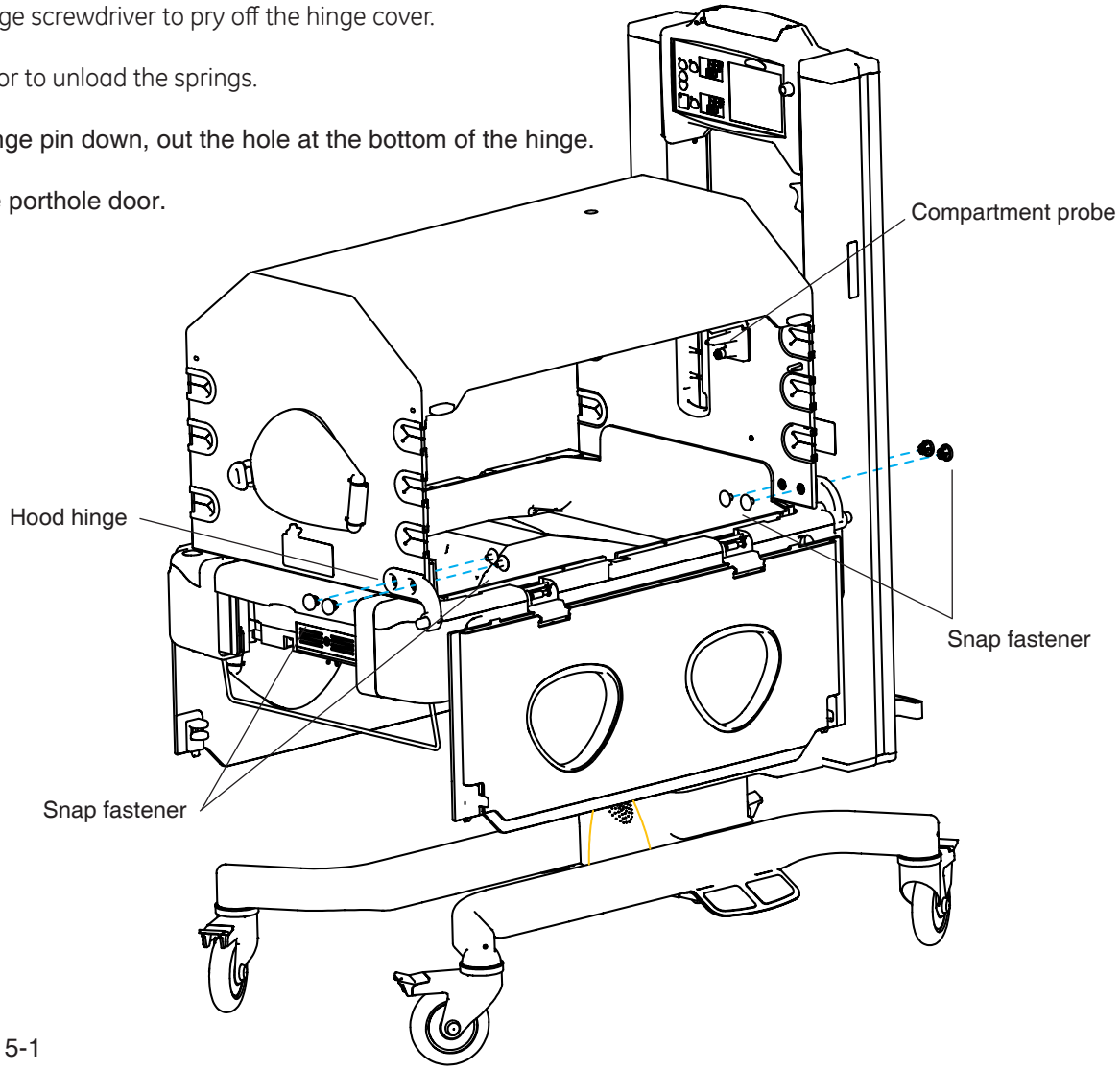



Figure 5-1
Hood

5. Now the door springs can be accessed along with screws that secure the inside half of the hinge cover.

6. To replace the porthole door, put the door back in place in the open position, install the springs, then slide the hinge pin back in place.

7. Close the door and snap the hinge cover back in place, keeping the thin side of cover closest to the porthole.

## 5.2 Uprights and End Caps (Figure 5-2)

1. Slide the decorative strip up about 1/2" in the groove on the outside of the upright to access hardware that secures the lower end cap. You may wish to use a piece of tape to grip the strip. Use a 2.5mm hex key to remove the screw, then remove the bottom cap. Slide the decorative strip down to access the two screws that secure the upper end cap, then remove the top end cap.

2. Using a 2mm hex key, remove the 4 button head socket screws and split ring washers that secure the back cover to the display module and remove the cover.

3. Remove the 2 screws that secure the hood latch receptacle to the upright and remove the receptacle.

4. Using a 2mm hex key, remove the screw that secures the wire cover to the side of the upright.

5. To remove the wire cover, slide the wire cover up about ½", and then pull it straight back by grasping its back edge.

6. Using a 3mm hex key, remove the 2 screws that secure the display module to the nut bar and pull the nut bar up and out of the upright. Using a 3mm hex key, remove the screw that attaches the ground wire. Be careful not to drop the star washers down into the upright.

7. Hold on to the upright, and using a 4mm hex key, remove the 2 screws in the holes in the lower side of the upright . Remove the entire upright.

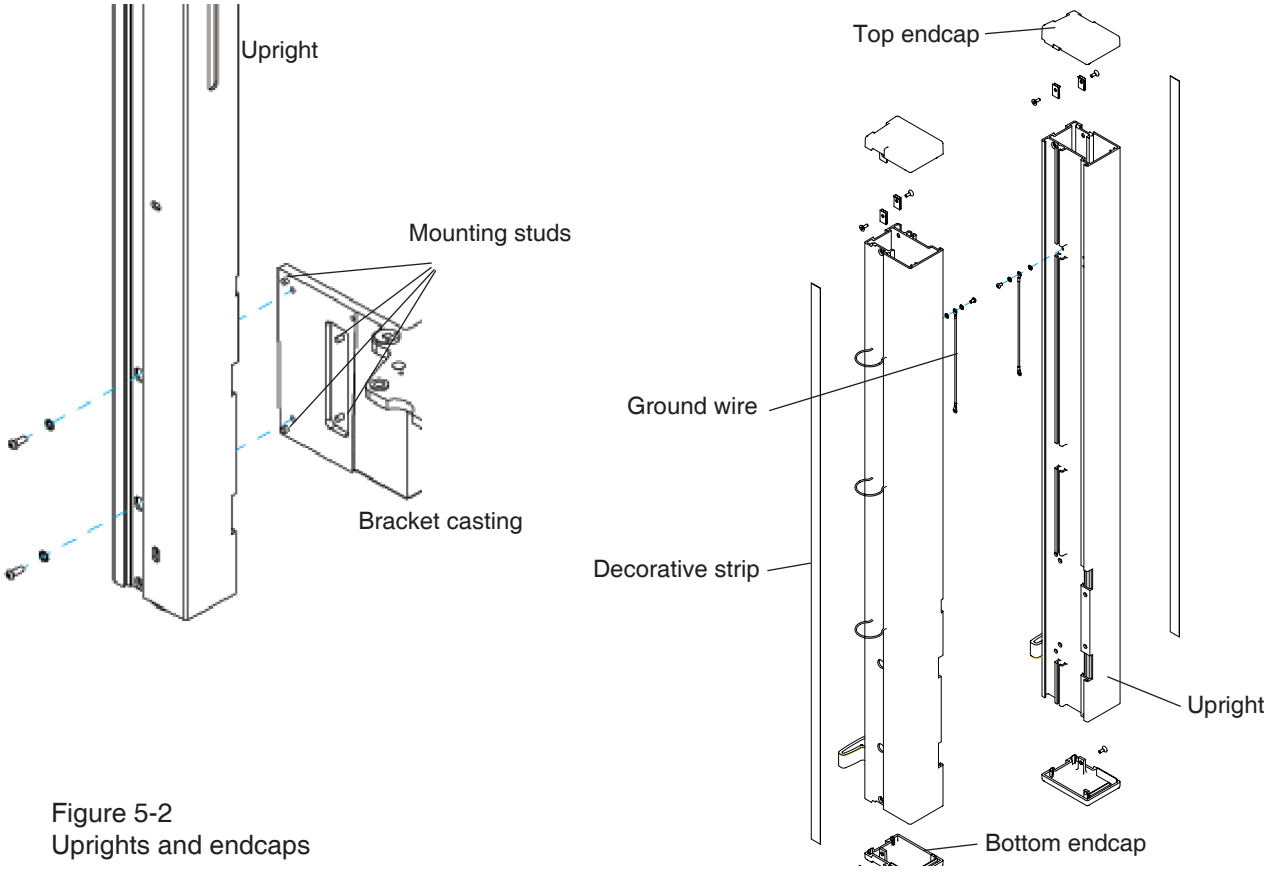



Figure 5-2
Uprights and endcaps

Re-installing the upright

1. To assist in reattaching the upright to the unit, there are four mounting studs on the bracket casting that mate with four holes in the upright. Place the upright on the studs. Be careful not to pinch any wires between the unit and the upright.

2. Secure the upright to the unit by reinstalling the 2 screws in the holes inside the upright. Apply LOCTITE™ 242 to the screws. Be careful not to drop the screws into the upright.

3. Attach ground wire to rail. Fasten the dispaly module to the upright with the two screws and nut bar removed earlier.

4. Reinstall the wire cover. Take care to route the wires in the upright channels and not to pinch them with the cover when securing with the screw.

5. Reinstall the hood latch receptacle with the two screws removed earlier.

6. Attach ground wire to rail. Fasten the display module to the upright with the two screws and nut bar removed earlier.

7. Fasten the back panel to the display module with its 4 mounting screws.

8. Slide the decorative strip up and install the end caps.

## 5.3 Compartment Probe Repairs (Figure 5-3)

1. Using a 2.5mm hex key, remove the screw that secures the jack cable clip to the hood back wall.

2. Remove the 2 screws (2mm hex key) that secure the probe housing cover and remove it. The top screw secures the probe shield, so that it can now be removed from the inside front of the probe housing.

3. Disconnect the electrical connectors for the temperature and humidity sensor (if installed) wires and remove the front of the probe housing.

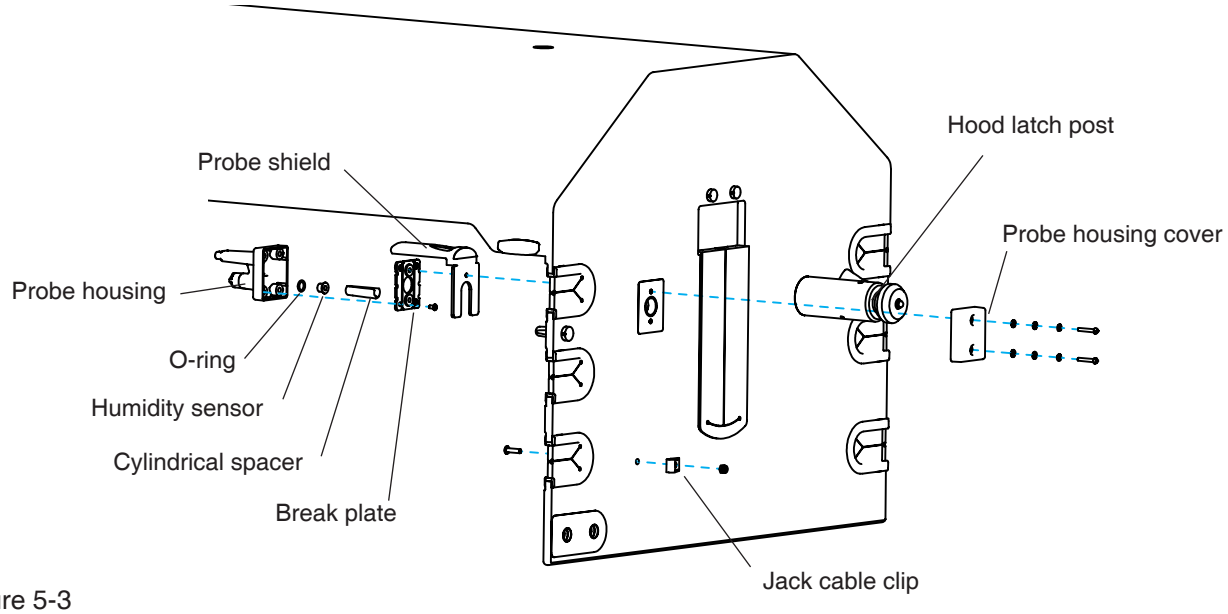



Figure 5-3
Compartment probe

Note: Some early units have temperature probes with jack connectors at the probe panel and should be disconnected there.

4. Remove the 4 screws in the break plate and remove the plate.

5. To replace humidity sensor, pull it back out of the probe housing. Slide the wires out of the cylindrical spacer. Place the O-ring over the tip of the new sensor, and gently push it back into the housing using the cylindrical spacer until the O-ring seats. The sensor tip should be visible, but not up against its guard. Check to ensure that the O-ring did not roll over the sensor flange during insertion.

   Note: Always perform Humidifier Calibration after replacing the humidifier sensor.

6. To replace the temperature sensor, you must replace the entire probe housing.

7. When reassembling the probe housing make sure the groove in the break plate faces the probe housing cover. Also check that the temperature sensor is oriented so that it is on top.

## 5.4 Lower Unit Repairs

### 5.4.1 Removing the chassis cover with the storage drawer in place (Fig. 5-8)

1. Slide the drawer all the way over in one direction, and use a 2.5 mm hex key to remove the 3 chassis cover screws on one side.

2. Slide the drawer to the other side and remove the 3 remaining screws from the cover.

3. Remove the humidifier reservoir.

4. Remove the bottom 2 screws (2mm hex key) that secure the right end of the wire raceway cover.

5. Flex the raceway cover and carefully slide the cover panel forward until it drops off the back drawer slide.

6. Rotate the cover slightly and push it out the right side of the unit.

7. Remove the ground wire.

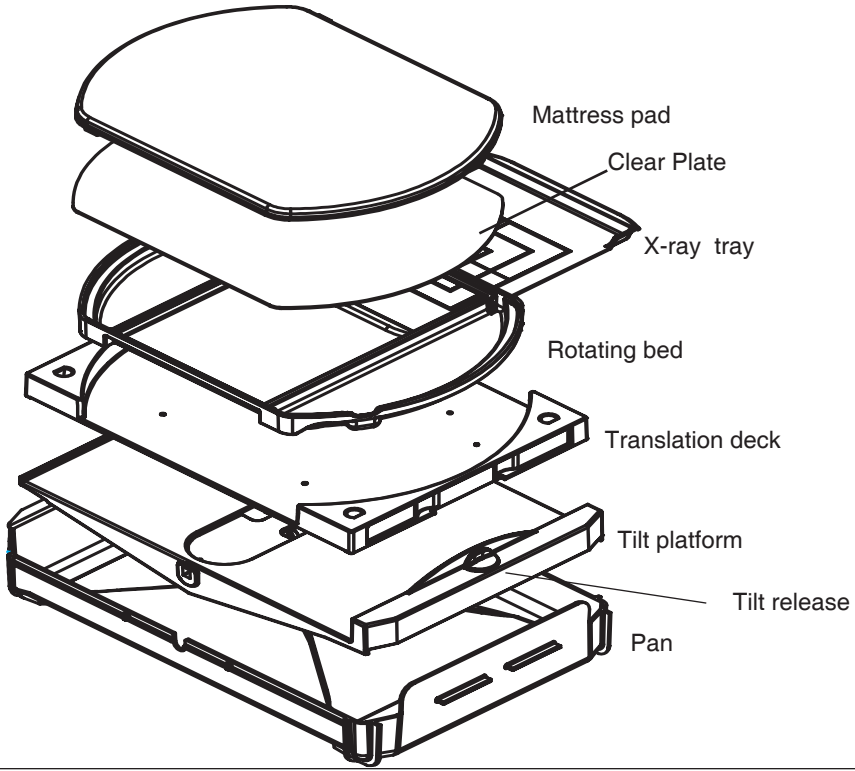



Figure 5-4
Bed disassembly

### 5.4.2 Incubator fan/motor/optical sensor (Figure 5-5 and 5-6)

1. Remove the rotating bed, translation deck, tilt platform and pan.
2. Remove the fan, rubber adapter and fan seal from the top of the fan motor shaft.
3. Remove the chassis cover (see section 5.41).
4. Disconnect the motor leads.
5. Remove the 4 screws in the motor bracket and remove the motor assembly.
6. The motor isolators pop out of the holes in the bracket.
7. To replace the optical sensor, disconnect its connector, remove the screw from the boss in the chassis that holds it in place, and remove the assembly.

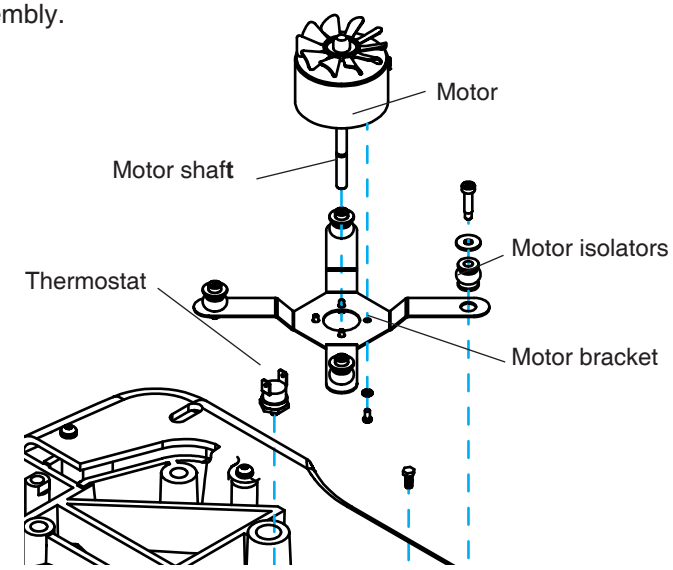



Figure 5-5
Fan motor

### 5.4.3 Cartridge heater replacement (Figures 5-6 and 6-9)

To remove the heater closest to the foot of the bed:

1. Remove the chassis cover (see section 5.41).
2. Remove the screw (4mm hex key) in the heatsink directly in front of the heater cartridge.
3. Disconnect the heater's electrical connector.
4. Remove the retaining clip and slide the cartridge out of the heat sink.

Note: On early units, the heater cartridge screwed into a threaded hole in the heat sink. For these units you must order kit 6600-0228-850 to replace both the heater cartridges and heat sink.

To remove the heater closest to the head of the bed:

1. Remove the rotating bed, translation deck, tilt platform and pan.
2. Remove the fan, rubber adapter and fan seal from the top of the fan motor shaft.
3. Remove the chassis cover (see section 5.61).
4. Disconnect the heater's electrical connector, the thermostat connections and the heat sink probe connector.

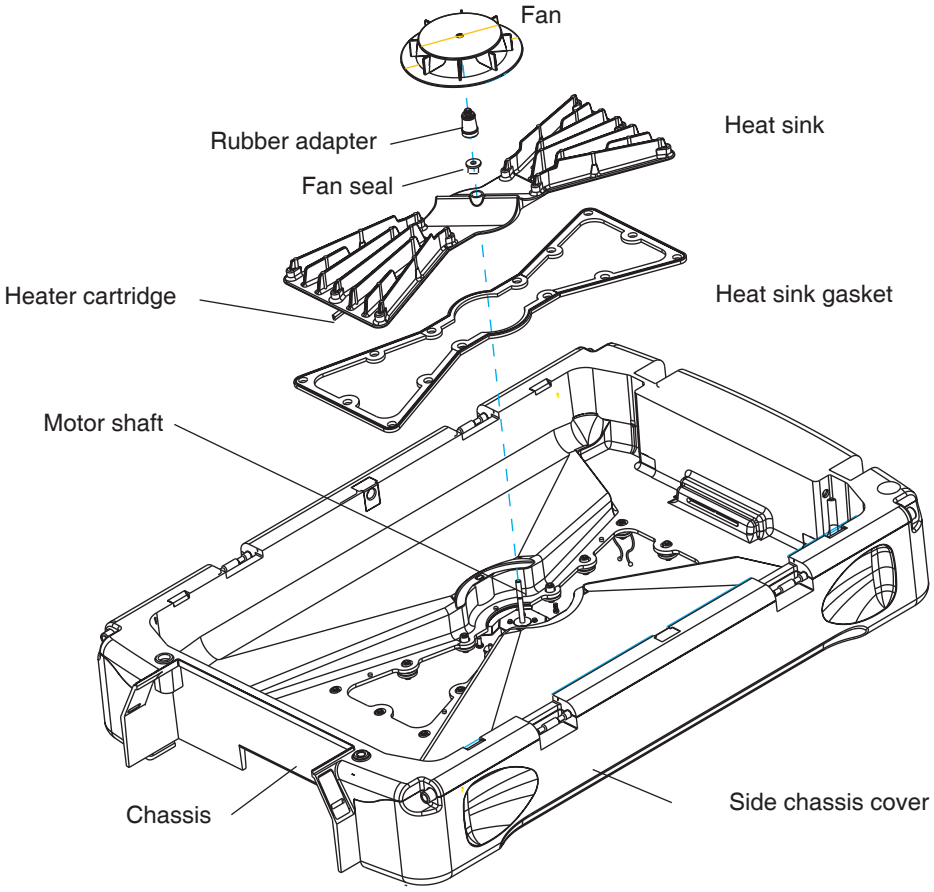



Figure 5-6
Heat sink and fan

5. Remove the upper shroud.

6. Remove the 14 mounting screws that secure the heat sink. Remove the heatsink.

7. Remove the retaining clip and slide the cartridge out of the heat sink.

Note: On early units, the heater cartridge screwed into a threaded hole in the heat sink. For these units you must order kit 6600-0228-850 to replace both the heater cartridges and heat sink.

8. To reassemble, seat the fan seal in the center bore of the heatsink and use it to align the fan shaft before fully securing the heat sink with its mounting screws. It may be necessary to wet the motor shaft rubber adapter to allow it to slide all the way onto the fan shaft and seat properly.

### 5.4.4 Elevating Base (Figures 5-4 and 5-7)

1. Run the elevating base to its top travel limit then switch off and unplug the unit.

2. Remove the mattress, bed and translation deck.

3. Remove the chassis cover (see section 5.41).

4. Disconnect the elevating base electrical connector at J-45 on the relay board, and tie a wire to it so you can fish it back through during reassembly.

5. Connect the replacement elevating column to the relay board, switch the unit back on and using the foot pedals fully extend the new column. Switch off and unplug the unit.

6. Using a 4mm hex key remove the 4 screws (at the bottom of the base- 2 in back and 2 in front) that secure the lower shroud and slide it up past the speaker.

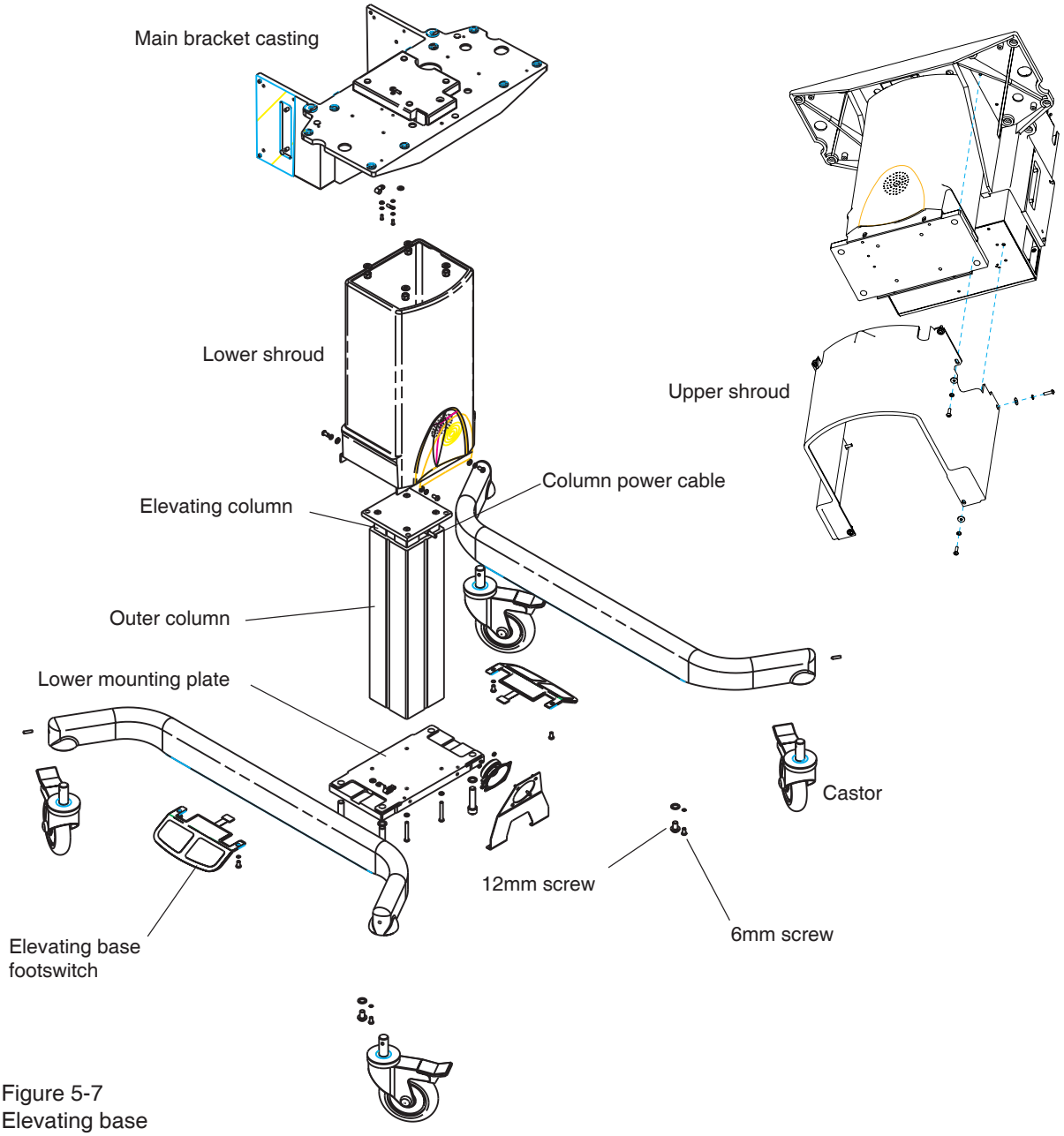



Figure 5-7
Elevating base

7. Using 3mm hex key remove the 8 screws that secure the upper shroud and remove it.

8. Pull the base wire harness out from the bracket casting.

9. Lock the back castors and lay the unit down on its back (controller on the floor). Place blocks under the uprights so the back castors are off the floor.

10. Using a 4mm hex key, remove the four socket head screws in the bottom of the elevating column that secure the lower mounting plate to the column, and remove the mounting plate/leg assembly.

Note: Should the elevating column fail in the completely retracted position, the outer column will prevent access to the 4 column mounting nuts. To remove the outer column, you must first remove the lower mounting plate and slide the outer column out. This requires a T-30 Torx key (service tool number 6600-1204-400).

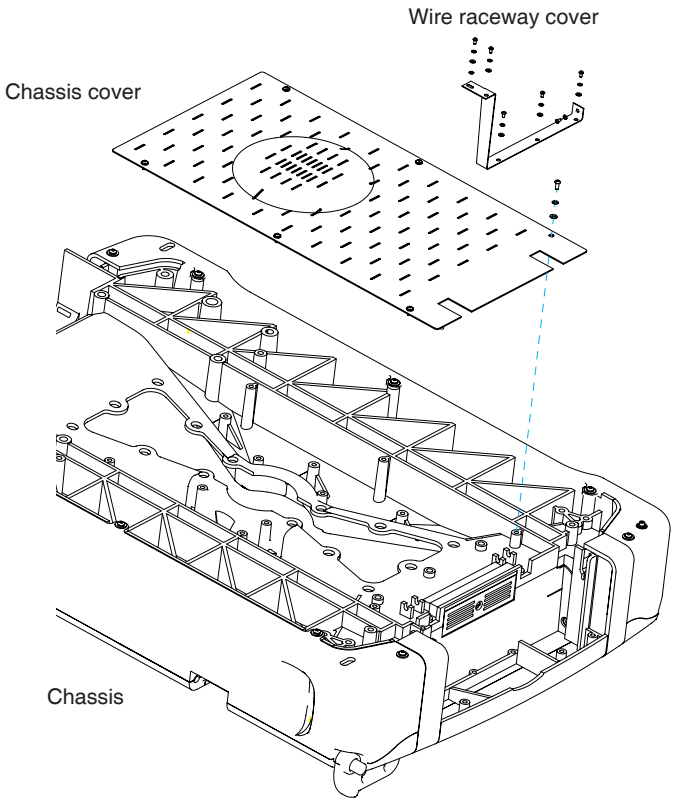



Figure 5-8
Chassis bottom cover

11. Using a 13mm socket, remove the 4 nuts that secure the elevating column to the casting and remove the column.

    Note: Should the elevating column fail in the completely retracted position, the outer column will prevent access to the 4 column mounting nuts. To remove the outer column, you must first remove the lower mounting plate and slide the outer column out. This requires a T-30 Torx key (service tool number 6600-1204-400).

12. To replace the column, reverse the assembly steps above. Check that the castors are still locked before lifting the unit back into its upright position. If you are returning the old elevating column in it's original packaging, attach it to the relay board and run it down to it's fully retracted position. Release the shipping locks.

    Note: With the unit on its back, be sure the column power cable is pointing up before you attach the column.

### 5.4.5 Chassis Replacement (Figure 5-4, 5-5, 5-6, 5-8, and 6-11)

1. Remove the side doors, hood (see section 5.1), rotating bed, translation deck, tilt platform and pan.

2. Remove the bottom chassis cover, (see Section 5.41) and remove the two side chassis covers (3 mm hex key)

3. Disconnect the wiring harnesses.

4. Remove the two screws at the bottom corners that secure the probe panel to the enclosure (see 5.72)

WARNING ⚠ Be sure the front of the chassis is supported before removing the screws from the bracket to prevent the chassis from falling.

5. While supporting the chassis, remove the 5 bolts on either side of the bracket casting that secure the chassis to the bracket and remove the chassis.

6. Remove all the components from the old chassis (bed tilt; fan and motor; heatsink; humidifier; front hinge covers, side panels, etc.) and install them on the new chassis.

### 5.4.6 Elevating Footswitch (Figure 5-7)

1. Run the bed up to the elevating base's top travel limit. Unplug the unit.
2. Using a 4 mm hex key remove the 4 screws (at the bottom of the base- 2 in back and 2 in front) that secure the lower shroud and slide it up past the speaker.
3. Make note of the switches' electrical wire routing; the cable from the replacement switch must feed up through the same slot.
4. Using a 4 mm hex key, remove the button head socket screws on either side of the foot pedal.
5. Disconnect the switch electrical connector and pull the pedal out. Discard old footswitch/pedal assembly.
6. Install new footswitch/pedal assembly. Make sure that you do not pinch the electrical wires.

### 5.4.7 Humidifier Repairs (Figures 5-8 and 5-9)

A design change was made to the humidifier assembly to make it easier to remove the screws during disassembly. Units shipped since about March 2002 have this revised design. The earlier design can be identified by the button head cap screws used in the assembly. The later design uses phillips head screws to make disassembly easier.

When working on the earlier design if you have difficulty with disassembly you may wish to replace the entire humidifier assembly with the later design 6600-0245-850 . When disassembling the older design, we recommend that you replace the old screws with the new screws listed below. You may also require the other parts listed below if they are damaged during disassembly (see tips below).

The reservoir switch button was also redesigned to prevent it from jamming in the closed position. You should also replace this button when working on an old style humidifier.

| Qty. per assy. | Description | Part Number |
|---|---|---|
| 3 | Screw, M3 X 8, phillips head, Teflon coated | 6600-1255-401 |
| 4 | Screw, M3 X 10, phillips head, Teflon coated | 6600-1255-402 |
| 4 | Screw, M3 X 12, phillips head | 6600-1255-403 |
| 2 | Screw, M3 X 16, phillips head | 6600-1255-404 |
| 4 | Spacer, .125 ID | 6600-1779-500 |
| 1 | Ramp block | 6600-1777-500 |
| 1 | Heater mount | 6600-1291-500 |
| 1 | Button, reservoir switch | 6600-1298-500 |

Tips for repairing an old style unit:
Some of the hex head screws may be difficult to remove. To minimize the chances of stripping the heads, be sure that the 1.5 mm Allen key you are using is not worn, and is not a ball head style. If you strip the heads, you may need to drill them out. If you drill out the heads, you may need to replace the ramp block and/or the heater mount if you have difficulty in removing the body of the screw.

Disassembly

1. Remove the humidifier reservoir.
2. Remove the 6 screws that secure the wire raceway cover and remove the cover.
3. Remove the chassis cover (see section 5.41).
4. Disconnect the 3 electrical connectors.
5. Remove the 2 screws on either side of the heater assembly.
6. Remove the heater assembly.

7. Use a 2mm hex key to remove the 2 screws from the reservoir switch and remove the switch.
8. Remove the 4 screws that secure the top bracket. Back the bracket off, feeding the wire harnesses through as you remove it.
9. Remove the top gasket, feeding the wire harnesses through as you remove it. The thermostat wire harness can slide through the slots in the gasket.
10. Remove the 4 screws in the heater mount and remove the bottom bracket.
11. Remove the socket head cap screw next to the add water thermostat, then remove the bottom gasket, insulating cylinder, and protective insert.
12. Remove the 3 screws in the heater cartridge sheath.
13. To remove the heater cartridge, unscrew it from it's threaded hole.
14. The thermostats can be replaced by removing the nuts securing them to the ramp block.

    If either thermostat or the heater cartridge is being replaced, check all components (especially the plastic ones) for signs of heat damage or corrosion. We recommend replacing the sheath when replacing the heater cartridge.

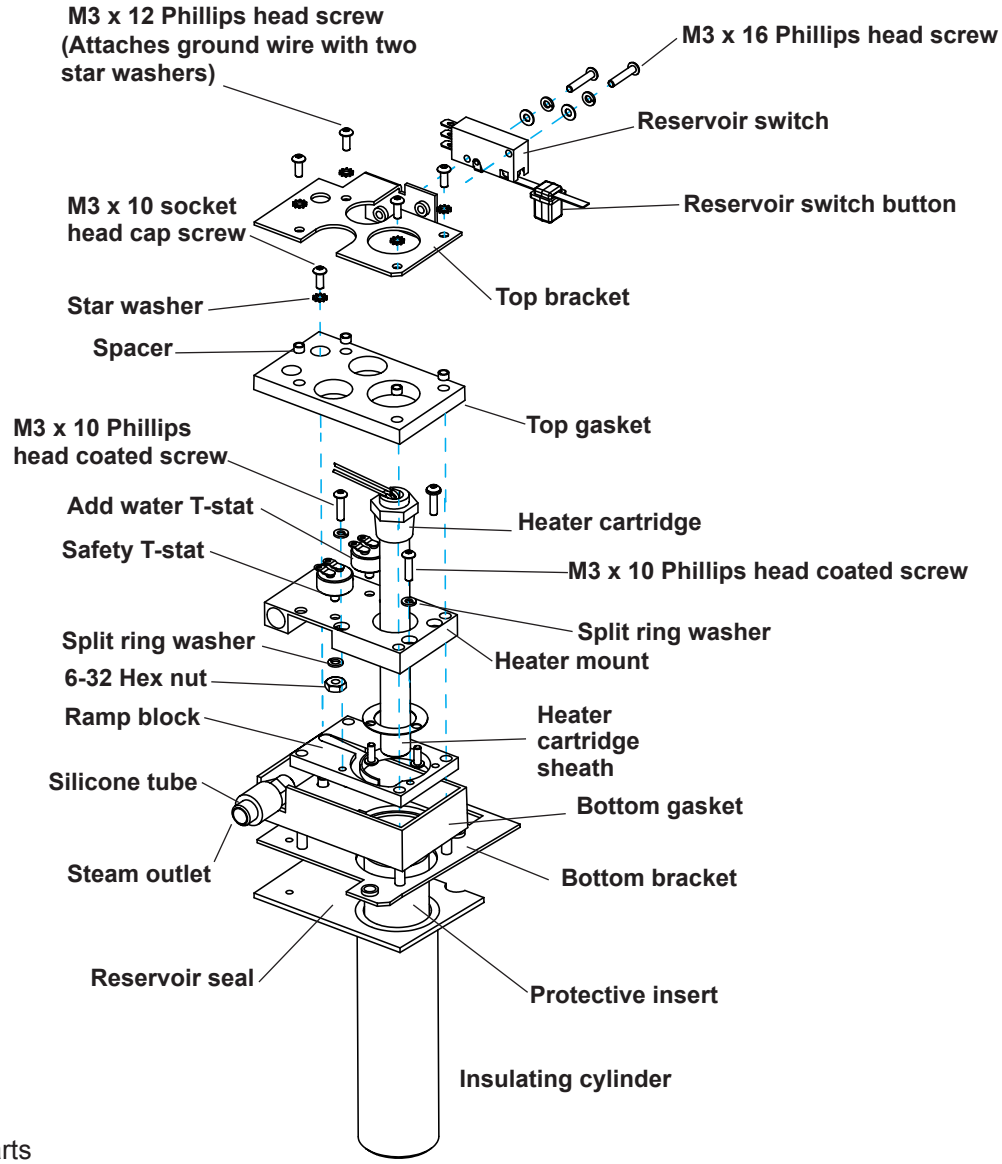



**Figure 5-26**
Humidifier parts

## Reassembly

1. Screw the steam outlet in the threaded hole on the heater mount.
2. Slide the silicone tube on the steam outlet flush to the hex.
3. Screw the heater cartridge assembly into the heater mount, then back it off so the harness exits between the two thermostat mounting holes.
4. Attach the heater sheath with the three M3 x 8 Phillips Teflon coated screws and split ring lock washers to the bottom of the heater mount.
5. Place two M3 x 10 Phillips Teflon coated screws and split ring lock washers into the heater mount counter bore holes next to the thermostat mounting holes.
6. Attach the two thermostats to the mounting block with the 6-32 hex nuts and split ring lock washers, being careful not to position the thermostat wires over the mounting holes in the heater mount. The add water thermostat has the micro-switch attached to the harness.
7. Attach the ramp block to the heater mount with the two screws placed in the counter bore holes above, and with two additional M3 x 10 Phillips Teflon coated screws and split ring lock washers.
8. Place the protective insert inside the insulating cylinder. Slide the bottom gasket over the insulating cylinder then over the ramp block.
9. Align and slide the posts of the bottom bracket through the bottom gasket, then through the ramp block.
10. Install an M3 x 10 socket head cap screw and star washer through the hole in the heater mount next to the add water thermostat. This screw grounds the bottom bracket so do not use a Teflon coated screw.
11. Route the heater and thermostat wire harnesses through the top gasket.
12. Install the top gasket and place the 4 0.125ID x 0.107L spacers into the gasket holes.
13. Route the heater and thermostat wire harnesses through the holes in the top bracket.
14. Install the reservoir switch button up through the bottom bracket and slide the switch actuator lever through the button slot.
    **NOTE**: Old style button installs down through the bracket.
15. Attach the reservoir switch to the top bracket using the two M3 x 16 Phillips screws, flat washers, and split ring lock washers.
16. Align the top bracket with the mounting holes and install the four M3 x 12 Phillips screws and star washers through the 4 holes in the top bracket. Attach the ground wire to the screw closest to the switch, using two star washers.
17. Dress the wire harnesses and install a cable tie.
18. Slide the reservoir seal into place.
19. When installing the humidifier, rotate the cylinder so the max line is visible.

## 5.5 Bed tilt brake shoe replacement (Figures 5-4 and 5-10)

1. Remove the mattress, clear plate, rotating bed and translation deck.

2. To release the tilt screw ball, squeeze the tilt release and slide open the finger pocket latch until you hear the ball drop.

3. Release the tilt platform from the chassis by pushing the pivot pin tabs in on both sides, then lifting the tilt platform out of the chassis.

4. Turn the tilt platform over and remove the 4 screws (2.5mm hex key) that secure the tilt assembly cover.

5. Remove the two plastic inserts. The long insert holds a positioning spring and the smaller ball insert holds the screw ball in position.

6 Press back the brake lever to provide access to the brake pad, then use pliers or a thin 14mm open end wrench to remove the nut to which the brake pad is fastened. Replace the brake pad assembly.

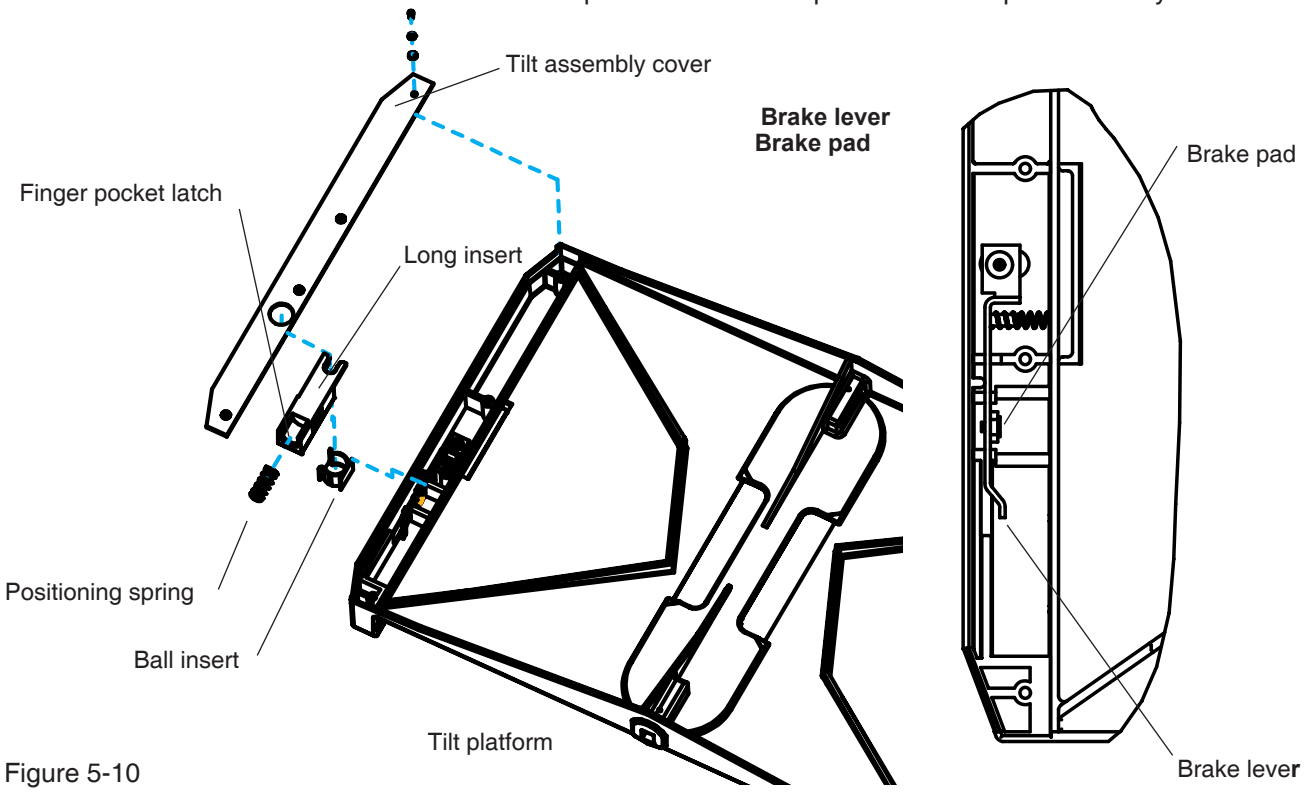



Figure 5-10
Replacing the tilt brake

## 5.6 Castor Replacement (Figure 5-7)

The castors may be replaced with the unit upright or carefully placed on its back.

1. Lock all the other castors.

2. Lift the castor off the floor and use blocks to support the leg near the castor you are replacing.

3. Remove the screw on the side of the leg that holds the castor in its mounting hole. Remove the castor.

   On older castors with a set screw on the side of the leg casting, remove the screw on the side of the leg that holds the castor in its mounting hole. Remove the castor.

   Note: The new style castor with a mounting plate has a different shaft diameter than the older castor and will not fit on the older set screw style leg casting.

4. Line up the hole in the castor stem with the set screw hole in the leg and insert the castor. As you tighten the screw the castor should be drawn into the leg.

   On older castors, line up the hole in the castor stem with the set screw hole in the leg and insert the castor. Apply Loctite #242 to the screw. As you tighten the screw, the castor should be drawn into the leg.

   Note: If you are replacing a castor hub cover, you must use a 1/8” drill to remove the old cover stem before snapping the new hub cover in place.

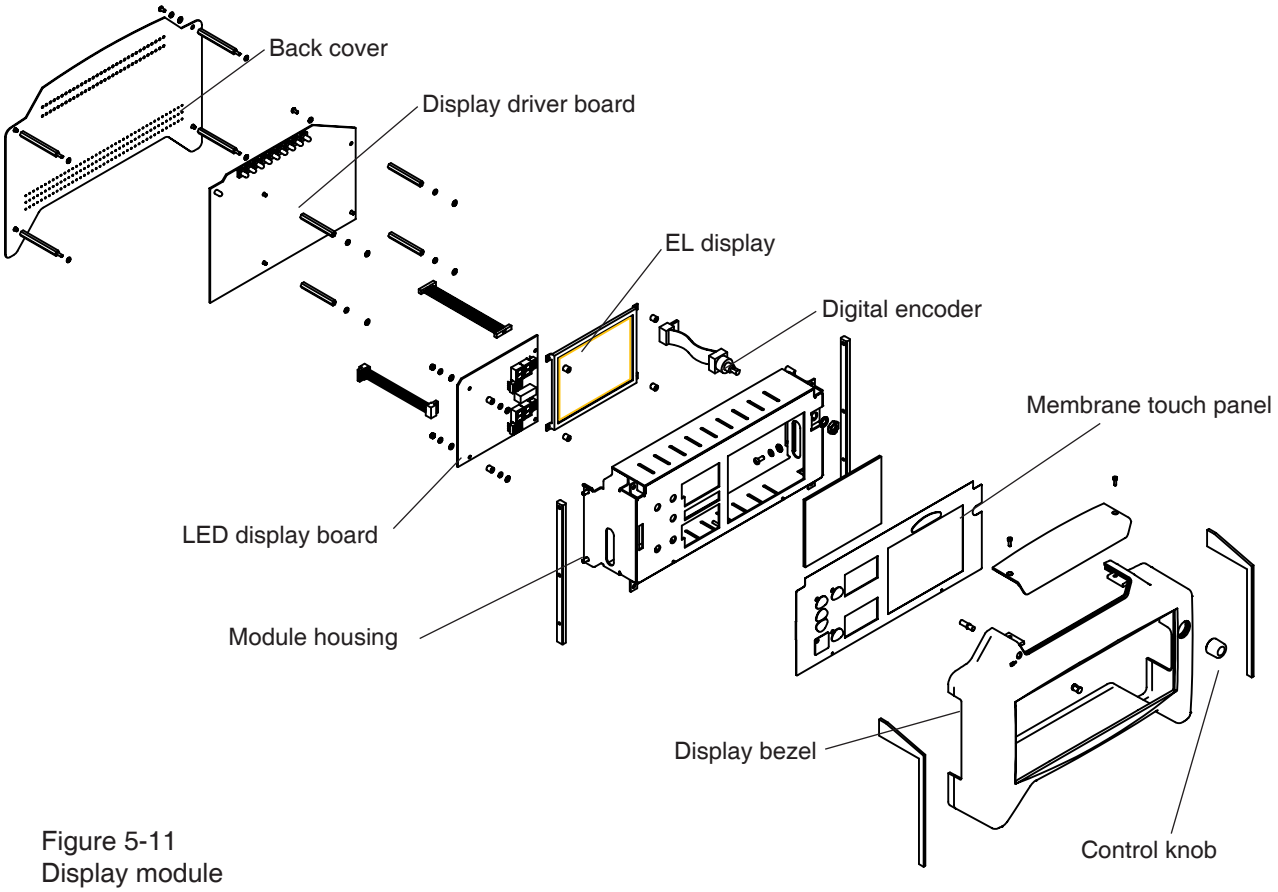



Figure 5-11
Display module

## 5.7 Controller and Display Module Procedures

### 5.7.1 Display module (Figure 5-11)

1. Using a 2mm hex key, remove the 4 button head socket screws and lock washers that secure the back cover to the display module and remove the panel.

2. To remove the display driver board, first remove the 4 screws the hold the board to the standoffs, then disconnect the electrical connectors.

3. To replace the digital encoder for the EL display, pull the control knob off the shaft, disconnect the electrical connector, remove the nut that secures the encoder, and remove the encoder.

4. To remove the LED display board, disconnect the electrical connectors, then remove the 2 standoffs (6mm wrench) that hold the board in place, and then the 2 nuts with hardware.

5. To remove the EL display, disconnect the electrical connectors, then remove the 2 nuts that hold the display in place. Be careful not to get finger prints on the display and be sure it is clean before replacing it.

6. The standoffs that hold the back cover also secure the bezel to the front of the module housing. Remove the standoffs (6mm wrench) and remove the bezel. To replace the membrane switch panel, first disconnect its electrical connector and then peel it off the display module housing. Be careful to remove all residue adhesive from the module before installing a new membrane panel. The membrane panel cannot be repositioned once it has been applied without damaging it.

### 5.7.2 Probe panel (Figure 5-12 and 6-1)

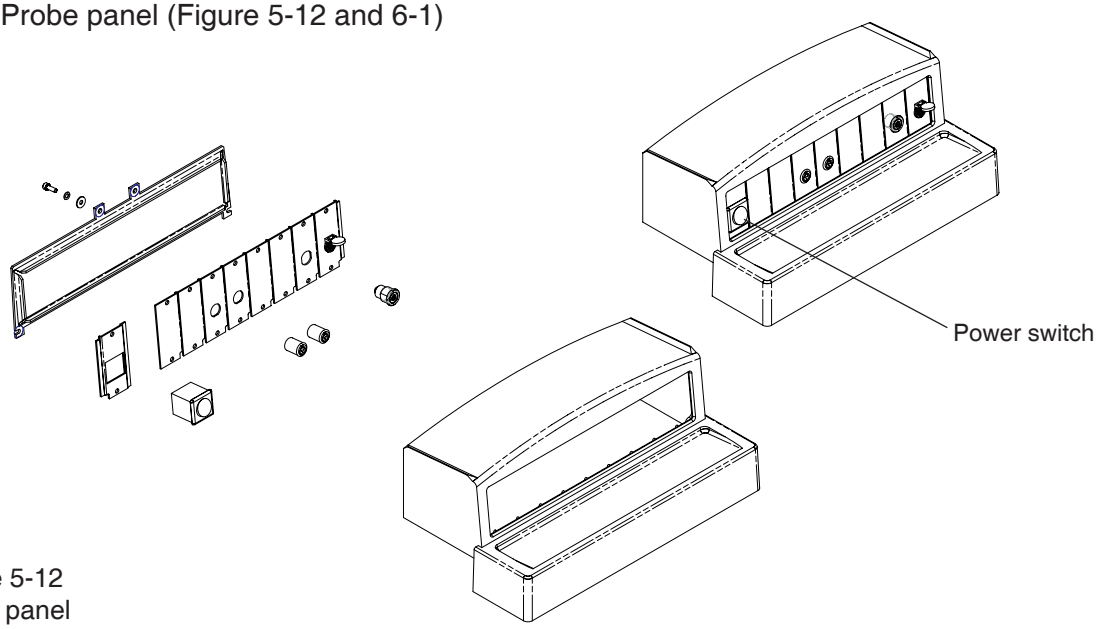



Figure 5-12
Probe panel

1. Using a 2.5 mm hex key, loosen the 2 screws in the keyhole slots and remove the 6 remaining screws that secure the controller cover, then remove the cover. Disconnect the wire harnesses coming from the probe panel.

2. Remove the 2 screws at the bottom corners that hold the probe panel to the enclosure.

3. Remove the probe panel assembly.

4. While tilting the panel enclosure forward, use a 3mm hex key to remove the 4 screws that hold the panel frame in place. Add new jacks through the panel frame as appropriate.

   Note: The power switch panel must be on the far left. The position of the remaining panels is not critical.

### 5.7.3 Controller Components (Figure 5-13)

Using a 2.5 mm hex key, loosen the 2 screws in the keyhole slots and remove the 6 remaining screws that secure the controller cover, then remove the cover. Now you can access the electrical components listed below.

Control Board

Slide the control board out about an inch and disconnect all the electrical connectors along its outside edge, then remove the board.

Dipswitch configeration on replacement control boards:

Switch 1 must be ON
Switch 2 must be OFF
Switch 3 must be ON if servo humidifier is installed
Switches 4,5, 6 and 7 are unused and should be OFF
Switch 8 must be OFF

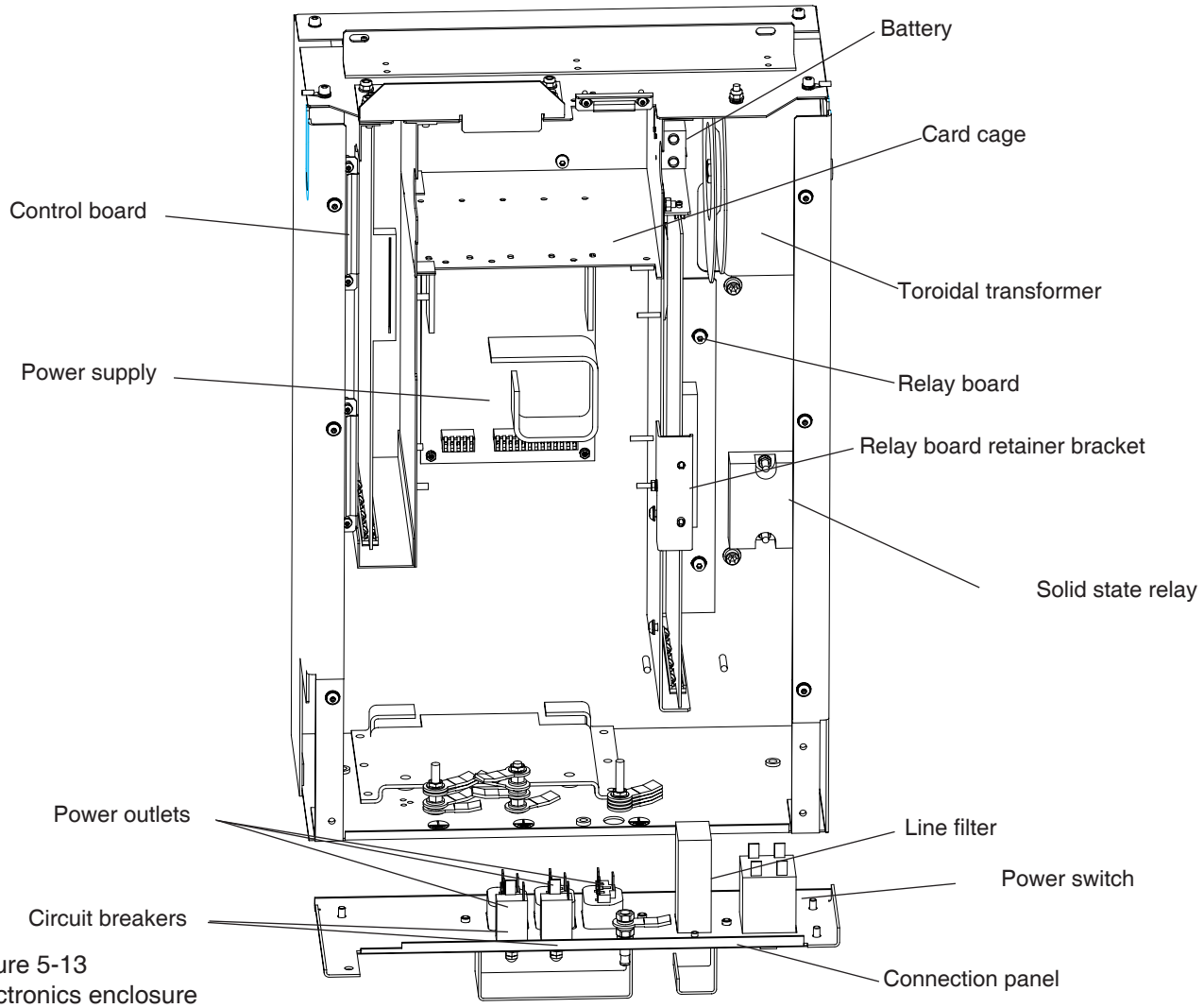



Figure 5-13
Electronics enclosure

Note: Always perform System Calibration and Humidifier calibration after replacing the control board.

Relay Board

Remove the two M3 hex nuts that secure the relay board retainer bracket with a 5.5 mm socket, then pull the board out a little and disconnect the electrical connectors on the outer edge. Then pull it out a little more and disconnect the connectors at the bottom end of the board. Now the board can be pulled out the rest of the way so the back connectors can be disconnected. You can now access the 4 fuses on the board.

Note: Always perform Line Voltage Calibration after replacing the relay board.

Solid State Relay

To replace the solid state relay, disconnect the electrical connections, and using a 7mm wrench remove the 2 nuts that secure it to the enclosure.

Power Supply

To access the power supply, disconnect the 50 pin ribbon cable that crosses in front of it. To remove the power supply, use a 5.5mm nutdriver to remove the nuts that secure it.

Note: The fuses on the power supply cannot be replaced. If the fuses are open, there will be component damage that necessitates replacing the entire power supply.

After installing the replacement power supply perform the following tests:

To verify the power supply outputs are correct measure the following voltages on one of the unused connectors that feed power to the option boards. The voltages are not adjustable. If they are out of specification the power supply must be replaced.

| Signal | Measure at | Acceptable Range |
|---|---|---|
| 5 Volts | Pins 2 to 1 | 4.75 volts to 5.25 volts |
| 12 volts | Pins 3 to 1 | 10.80 volts to 13.20 volt |

Battery

The battery snaps into a holder on the side of the card cage. It has two snap connectors at its top. When replacing the battery, its easier to first connect the terminals then push the battery into its holder.

Toroidal transformer

To replace the elevating base toroidal transformer:

1. Disconnect the wire harnesses connected to the relay board and remove the board.
2. Using an 1/2" open end wrench loosen transformer retaining bolt.
3. Remove both the toroidal transformer and the retaining bolt. Save the bolt for installing the replacement transformer.
4. Disconnect the old transformer from it's wire harness.
5. The replacement toroidal transformer comes with two 4" diameter rubber insulating washers that are installed on both sides of the transformer like a sandwich, and a 4" diameter metal mounting washer that is installed on the same side of the transformer as the head of the retaining bolt. To make aligning these parts easier during installation, you may wish to use electrical tape to attach the 3 large washers to the transformer.
6. Install the new transformer by passing the retaining bolt through the washers and transformer and into the threaded hole in the side of the electrical enclosure. Turn the transformer so you can see the label on the side transformer to orient the wire harness so it exits toward you, then finish tightening the retaining bolt.
7. Connect the transformer wire harness.
8. Reinstall the relay board and reconnect its wire harnesses.

Circuit breakers, Power switches and Power outlets

The circuit breakers, power switches and power outlets can all be more easily accessed by removing the connection panel at the bottom of the enclosure by removing the 3 screws that secure it with a 2.5 mm hex key.

## 5.8 Servo Controlled Oxygen Service Procedures

### 5.8.1 Installing oxygen sensors (Figure 5-14)

1. Slide the drawer to one side and using a 3mm hex key, loosen the captive screws in the chassis cover sensor housing door and swing the door down to access the sensor housing.
2. Using a 3mm hex key, loosen the two M4 socket head screws that secure the sensor housing cover, and remove the cover.
3. Remove the old oxygen sensors. Replace with two new sensors (6600-0120-850).

**Note**: the date on the sensor is a discard date; the sensor should be removed from service on this date. All sensors are shipped from Ohmeda at least 12 months prior to this date; sensors should be installed immediately to ensure maximum operating life.

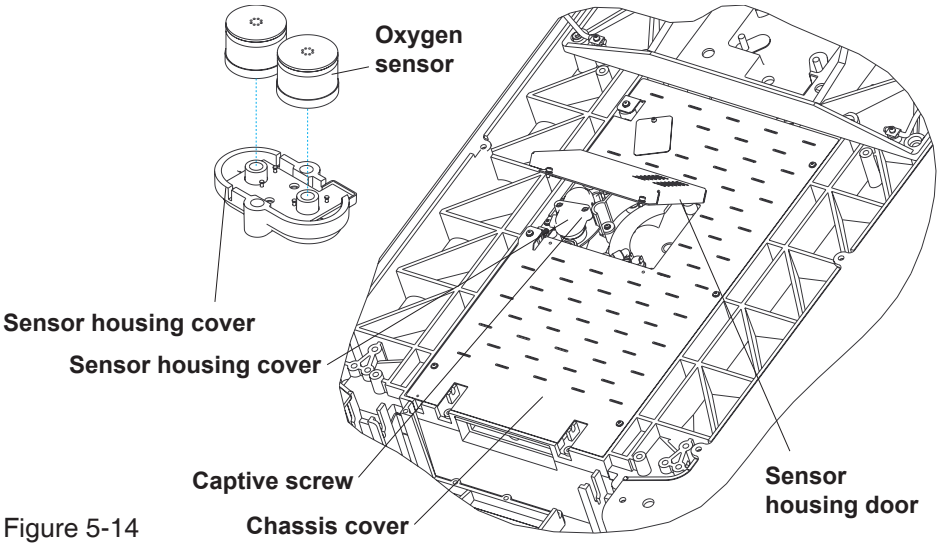



Figure 5-14
Installing sensors

4. Reinstall the sensor housing cover and close and secure the door in the chassis cover.

5. Perform the Pre-use Checkout.

### 5.8.2 Replacing the vent screen

1. Remove rotating mattress tray, tilt platform and upper pan.
2. Remove the vent cover by turning it counter clockwise.
3. Remove and discard the ring shaped vent filter screen from the chassis vent.
4. Install a new vent screen and reinstall the vent cover.
5. Perform the Pre-use Checkout.

### 5.8.3 Sensor housing repairs (Figure 5-15)

**Sensor housing boards, calibration fan assembly, and sensor plug assembly.**

1. Slide the drawer to one side and using a 3mm hex key, loosen the captive screws in the chassis cover sensor housing door and swing the door down to access the sensor housing.

2. Using a 3mm hex key, loosen the two M4 socket head screws that secure the sensor housing cover, and remove the cover.

3. To replace the half of the PC board inside the sensor housing cover, use 2.5mm hex key to remove the 2 M4 button head screws that secure it to the cover.

4. To replace the half of the PC board inside the sensor housing, disconnect from the wire harness and remove the single M4 button head screw that holds it to the housing. Perform the Pre-use Checkout.

5. To replace the calibration fan, disconnect its electrical connector and remove the 4 self tapping screws that secure it to the sensor housing. Install replacement fan so flow arrow on side points up into chassis. Perform the Pre-use Checkout.

6. To replace sensor housing plug assembly, disconnect it from the sensor cable, and use a 7/16” open wrench to unscrew it from the housing, then disconnect its other electrical connector. In addition to taking static sensitive precautions, take care not to touch the sensor portion of the assembly with your fingers to avoid contaminating it. After you replace the plug assembly, perform the Pre-use Checkout.

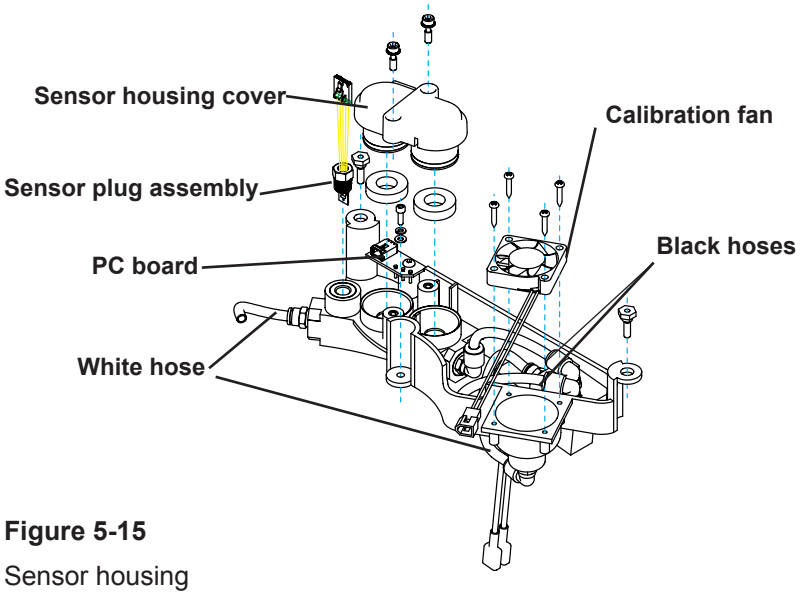



**Figure 5-15**

Sensor housing

### Calibration valve

1. Slide drawer to one side and remove three M4 screws that secure bottom cover to chassis.
2. Remove the humidifier reservoir by pulling forward from bottom. A sheet metal ground strap is located behind the reservoir. Remove the M3 screw that secures the strap to the bottom cover. Slide drawer to other side and remove remaining three M4 screws that secure bottom cover to chassis. Remove the cover by sliding out toward the right side of the unit.
3. Disconnect the ground cable from bottom cover. The ground cable is secured to a 4mm stud in the bottom cover with a nut and two internal tooth lock washers.
4. Disconnect the cooling fan cable.
5. Use a 2.5mm hex key to remove the M3 screw that secures the center of the sensor housing to the chassis. See figure 5-15.
6. Use a 10mm nut driver to remove the two stand-off fasteners that secure the sensor housing to the chassis.
7. Disconnect tubing from chassis and heat-sink vent fittings.
8. Disconnect all harnesses from sensor housing, and remove sensor housing from unit.
9. Remove the two M4 flat head screws that secure the calibration valve to the sensor housing, and remove calibration valve assembly.
10. Install new calibration valve assembly. Connect the black wire to the - terminal and the red to the + terminal.
11. Perform the Pre-use Checkout and Leak Check.

## 5.8.4 Valve housing repairs

### Regulator assembly

1. Using a 3mm hex key, remove the 4 screws that secure the valve housing bottom cover and remove the cover.
2. Disconnect the tubing from the straight push-in fitting on the regulator assembly.

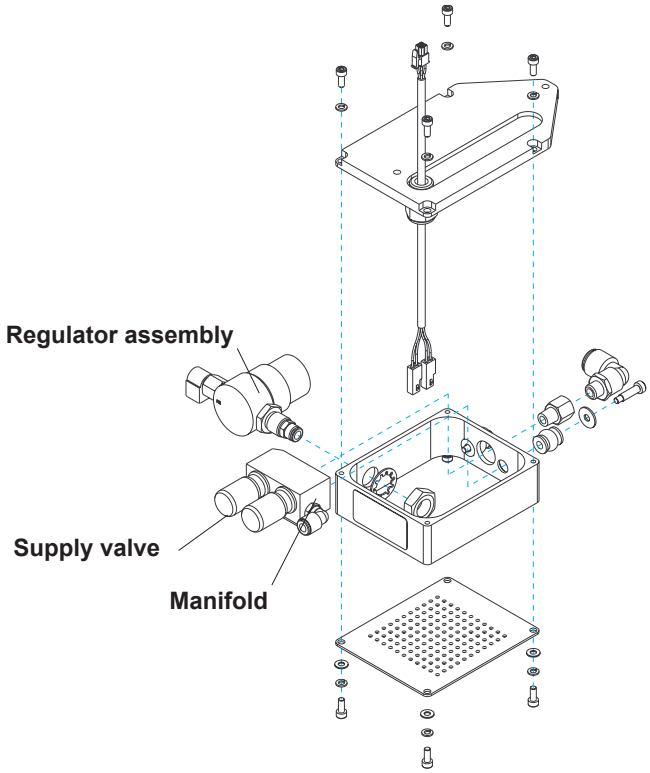



**Figure 5-16**

Valve housing

3. Using two adjustable wrenches, turn the 14mm hex nut on the inside of the housing while holding the hex on the regulator on the outside of the housing to loosen the assembly. Remove the regulator assembly.

4. To replace the regulator inlet filter, use a wrench to remove the elbow fitting, then turn the filter fitting off the regulator. Before installing a new filter, make sure all old PTFE tape remnants are removed and new tape is applied.

5. When installing the new regulator assembly, be sure to replace the M14 lock washer under the 14mm hex nut. Hold the regulator so that when it is installed the oxygen supply fitting points straight down at the floor. Perform the Pre-use Checkout.

**Supply valves**

1. Remove the regulator assembly as described in steps 1 through 3 above.
2. Disconnect the supply valves electrical connector.
3. Use a pair of pliers to turn the valve out of the manifold block.
4. When installing a new valve, finger tighten it into the manifold. Perform the Pre-use Checkout Supply Valve Leak Test.

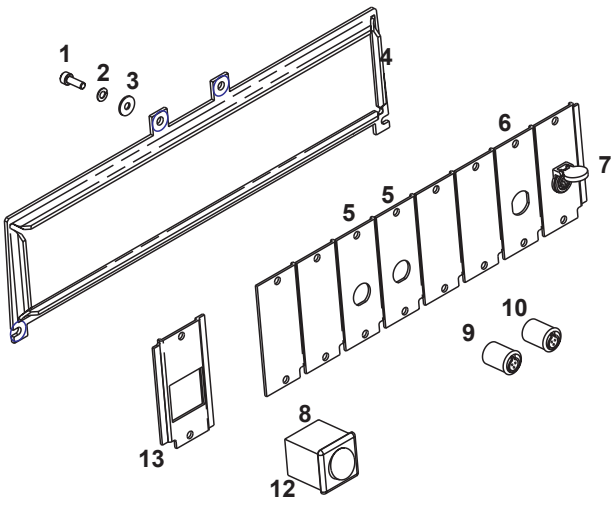
### 5.8.5 Servo O2 Board Repairs

1. Use a 2.5 mm hex key to loosen the 2 screws in the keyhole slots and remove the 6 remaining screws that secure the electrical enclosure cover, then remove the cover.

2. The Servo O2 Board is located in the second slot of the option card cage. The 485 data cable, sensor housing cable, calibration cable and cooling fan cable are attached to it. The board can be slid part way out of its guide to access it's connectors or to replace the U6 EPROM. Perform Pre-use Checkout.

## 6.1 Exploded Views

### 6.1.1 Probe Housing, Display Module, and Electrical Enclosure




1. Screw, M4 x 8 Socket Head..... 6600-0707-408
2. Washer, M4 Split Ring ..... 6600-0713-403
3. Washer, M4 Flat..... 6600-0712-403
4. Retaining Frame ..... 6600-1288-500
5. Patient Probe Connector Plate ..... 6600-1287-502
   Patient Probe Label* ..... 6600-2325-102
6. Compartment Air Probe Connector Plate ..... 6600-1287-506
   Compartment Air Probe Label* ..... 6600-2325-109
   Strain relief nut..... 6600-0884-400
7. Scale Wire Harness ..... 6600-0822-700
   Scale connector plate ..... 6600-1287-504
   Scale label ..... 6600-2325-104
8. Blank Connector Plate ..... 6600-1287-501
   Blank Label ..... 6600-2325-101
9. Patient Probe 1 Panel Harness..... 6600-0716-701
10. Patient Probe 2 Panel Harness..... 6600-0716-702
11. Probe Panel Housing..... 6600-1290-500
12. Rocker Switch ..... 6600-1216-600
    Power Switch Wire Harness ..... 6600-0707-700
13. Switch Mounting Plate ..... 6600-1844-500
    Switch Plate Label* ..... 6600-2325-108

*See labels near the end of this section.

Figure 6-1
Probe Panel Assembly

1. Rear Cover..... 6600-1134-500
2. Screw, M3 x 8 Button Head ..... 6600-0706-405
3. Washer, M3 Spit Ring ..... 6600-0713-402
4. Washer, M3 Flat..... 6600-0712-402
5. Standoff, M3 x 2.25”..... 6600-1070-400
6. PCA Display Driver ..... 6600-0213-850
7. Standoff, M3 x 2.0”..... 6600-1068-400
8. EL Display Harness ..... 6600-0725-700
9. Display Cage..... 6600-0222-850
10. Round Spacer ..... 6600-1191-400
11. Rotary Encoder Switch
    (includes cable, lockwasher, and nut)..... 6600-1026-600
12. ESD Cage*..... 6600-1133-500
13. Nut Plate ..... 6600-1276-500
14. Plate..... 6600-1771-500
15. Touch Panel Assembly ..... 6600-1254-600
16. Screw, M2.5 x 8 Socket Head..... 6600-0715-403
17. Alarm Lens..... 6600-1132-500
18. Right (east) Seal ..... 6600-1736-501
19. Control knob ..... 6600-1480-500
20. Power Fail Lens ..... 6600-1065-400
21. Display Bezel ..... 6600-1131-500
22. Left (west) Seal ..... 6600-1736-502
23. Light Pipe ..... 6600-1066-400
24. Washer, M4 Flat..... 6600-0712-403
25. Washer, M4 Spilt ring..... 6600-0713-403
26. Screw, M4 x 10 Socket Head..... 6600-0707-409
27. Nut, M3 ..... 6600-0711-403
28. PCA LED..... 6600-0215-850
29. LED Display Harness..... 6600-0739-700
30. Washer, M3 Internal lock ..... 6600-0713-431

*When replacing, must also order touch panel item 15.

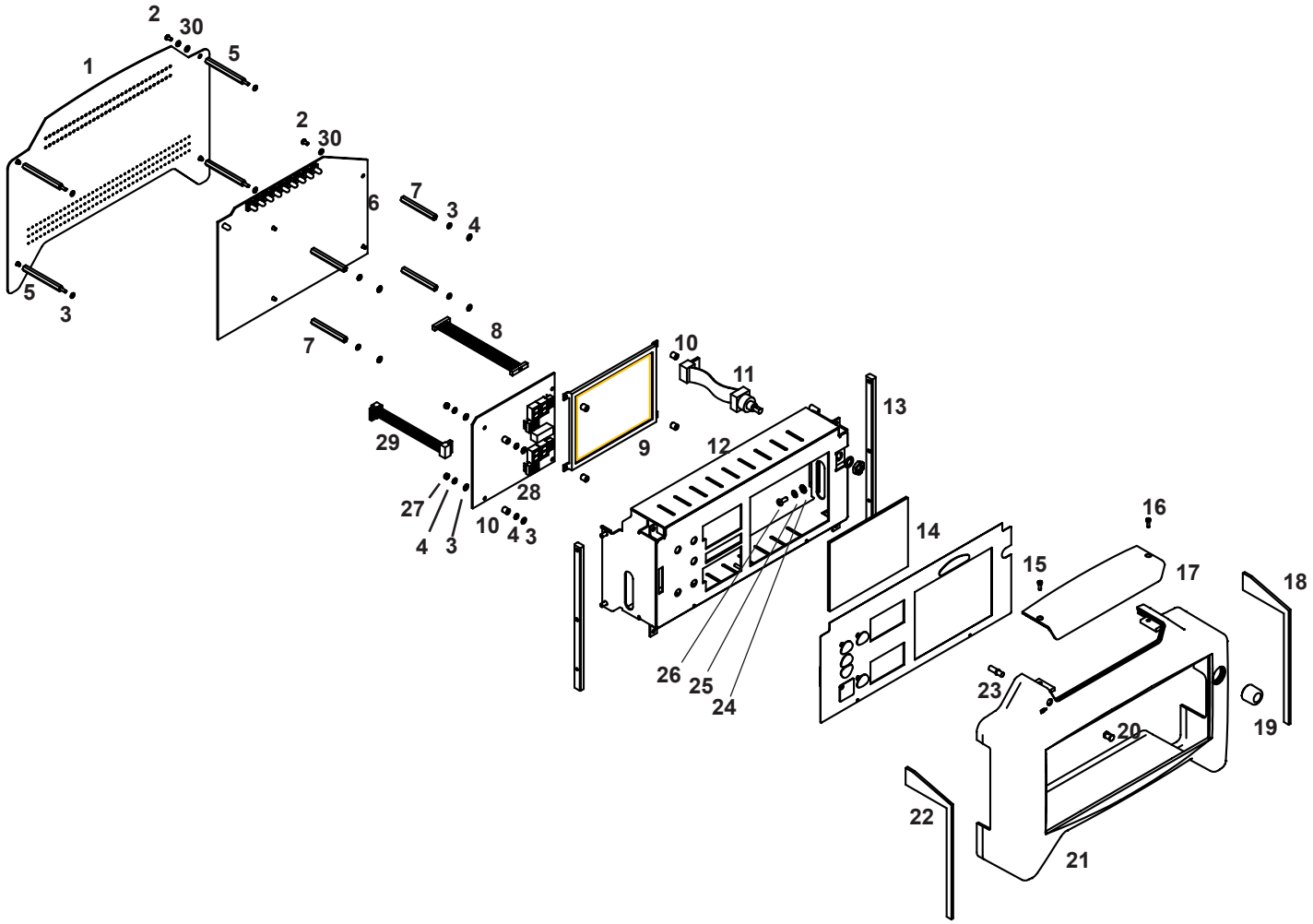



Figure 6-2
Display Module

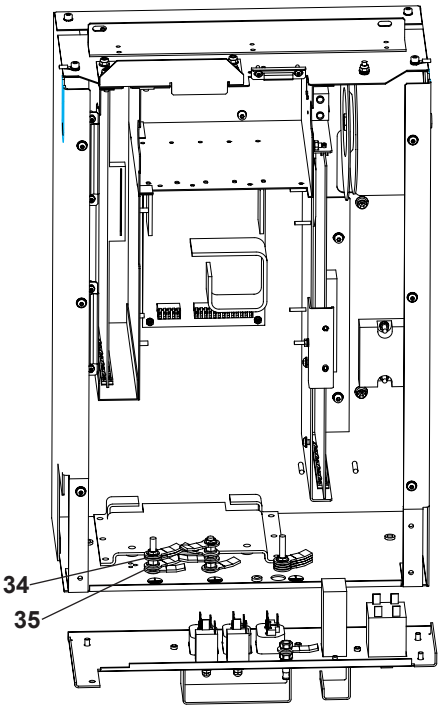
1. RS232 blank plate ..... 6600-1752-500
2. Cable twist lock ..... 6600-1197-600
3. Card cage ..... 6600-1347-500
4. Battery* ..... 6600-1024-600
   Battery adapter harness@ ..... 6600-0617-700
5. Relay board bracket ..... 6600-1166-500
6. Relay board ..... 6600-0214-850
   120 V 2 amp fuse (relay brd. 10 or higher) ... 6600-0877-600
   230 V 1 amp fuse (relay brd. 10 or higher) ... 6600-0882-600
   3.5 amp fuse (relay brd. 10 or higher) ..... 6600-0878-600
   Interface board@ (relay brd. 9 or lower) ..... 6600-0260-850
      120V 2 amp fuse@ ..... 6600-1324-602
      230V 1 amp fuse@ ..... 6600-1324-601
7. E-base toroidal transformer ..... 6600-0746-700
8. Screw, 5/16-18 x 2 ½ ..... 6600-1111-400
9. Solid state relay ..... 6600-1003-600
10. Screw, M6 x 16 ..... 6600-0707-421
11. Star washer, M6 internal tooth ..... 6600-0713-434
12. Flat washer. M6 ..... 6600-0712-405
13. Star washer, M6 external tooth ..... 6600-0713-445
14. Wire shield@ ..... 6600-1798-500
15. Bed heater isolation transformer@ ..... 6600-0815-700
16. Power switch (115V) ..... 6600-1014-602
    Power switch (230V) ..... 6600-1014-601
17. Line filter ..... 6600-1006-600
18. Single plug guard
    U.S., U.K., Italian, Swiss, Australian (short) .. 6600-1701-500
    C.E. cord (long) ..... 6600-1857-500
19. Accessories plug guard ..... 6600-1711-500
20. Flat washer, M4 ..... 6600-0712-403
21. Lock washer, M4 internal tooth ..... 6600-0713-432
22. Screw, M4 x 8 ..... 6600-0706-408
23. Washer, color code ..... 6600-0338-400
24. Plug ground ..... 6600-0337-400
25. Power outlet ..... 6600-0583-600
26. Connection panel ..... 6600-1746-500
27. Circuit breaker ..... 6600-0562-603
28. Nut, M6 ..... 6600-0340-400
29. Lock washer ..... 6600-0339-400
30. Electrical enclosure ..... 6600-1346-500
31. Card tension rack (bottom) ..... 6600-1064-400
32. Control board ..... 6600-0212-850
33. Card guide (top) ..... 6600-1183-400
34. Hex nut, M5 ..... 6600-0711-408
35. Lock washer, M5 ..... 6600-0713-444
36. Card guide (rear) ..... 6600-1105-400
37. Board retaining bracket ..... 6600-1822-500

**Parts not shown**

Enclosure door ..... 6600-1349-500
Door hardware-
Screw, SEMS M4 x 10 btn hd skt ..... 6600-0908-401

*Battery is a 7 cell, 8.4v Nickel Metal Hydride battery.

@Not present on all units.



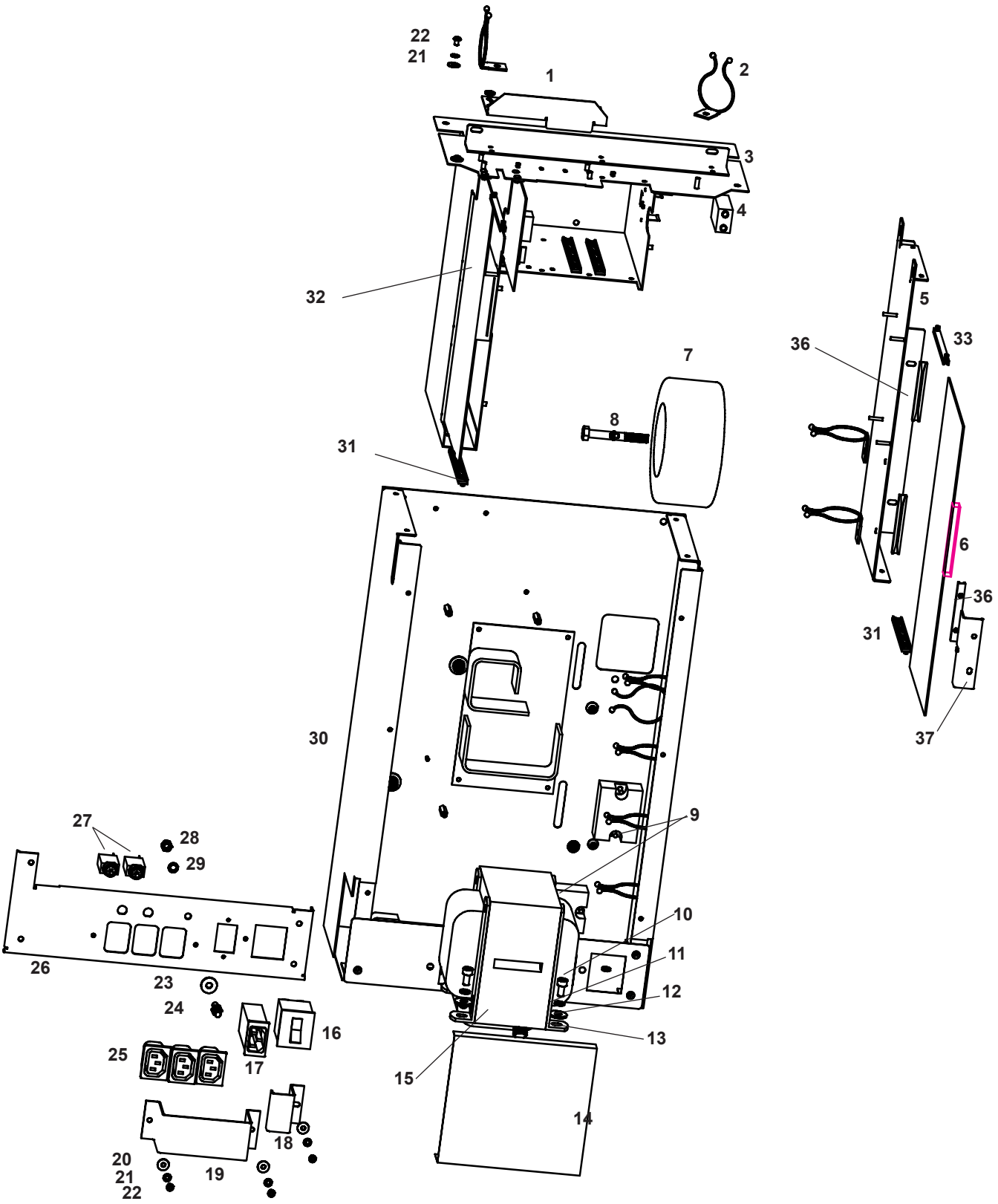



Figure 6-3
Electrical enclosure
6.1.2 Bed and side doors

1. Power supply* ..... 6600-0221-850
   Mounting hardware-
   Spacer, M3 x 8 ..... 6600-1192-400
   Star washer, M3 ..... 6600-0713-442
   Nut, M3 ..... 6600-0711-403
2. Nut, M3 ..... 6600-0711-403
3. Star washer, M3 ..... 6600-0713-442
4. Nut, M4 ..... 6600-0711-407
5. Split ring washer, M4..... 6600-0713-403
6. Washer, M4 ..... 6600-0712-403
7. Humidifier isolation transformer ..... 6600-1328-600
8. Spacer, M3 x 18 ..... 6600-1192-400
9. Screw, M6 skt. hd..... 6600-0707-420
10. Lockwasher, M6 int. tooth ..... 6600-0713-434
11. Mounting bracket ..... 6600-1587-500
12. Washer. M4 ..... 0402-1133-300
13. Nylon lock nut, M4 ..... 6600-0714-402
14. Lockwasher, M3 ext. tooth ..... 6600-0713-442
15. Nylon lock nut, M3 ..... 6600-0714-401
16. Wire harness. ISO transformer ..... 6600-1526-700
17. Screw, M4 x 6 ..... 6600-0706-407
18. Lockwasher, M4 int. tooth ..... 6600-0713-432
19. Cable twist lock ..... 6600-1197-600
20. RS232 chassis ..... 6600-1479-500
21. Screw lock, female ..... 6600-0673-400
22. Retaining clip ..... 6600-0672-400
23. Wire harness (with 9 pin D connrctor)..... 6600-1531-700
24. RS232 PC board..... 6600-0243-702
25. Wire harness (connects to Control PCB) ..... 6600-1530-700

*The fuses on the power supply cannot be replaced. If the fuses are open there will be component damage that necessitates replacing the entire power supply.

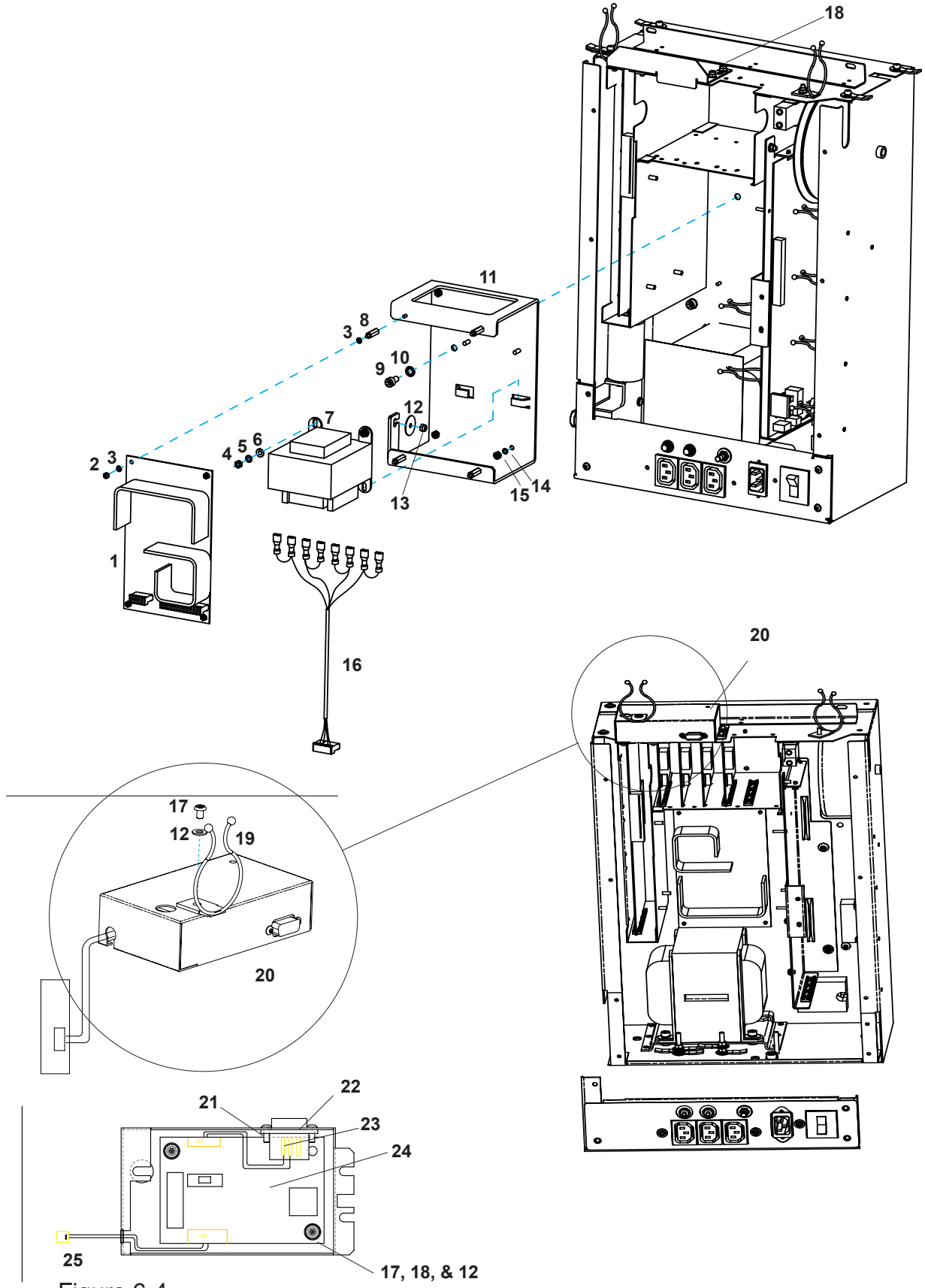
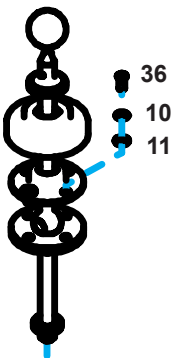
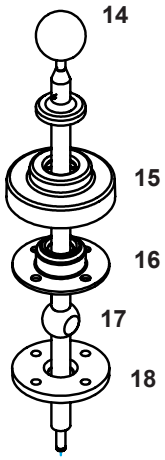
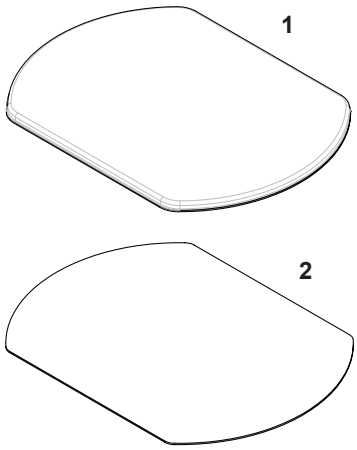


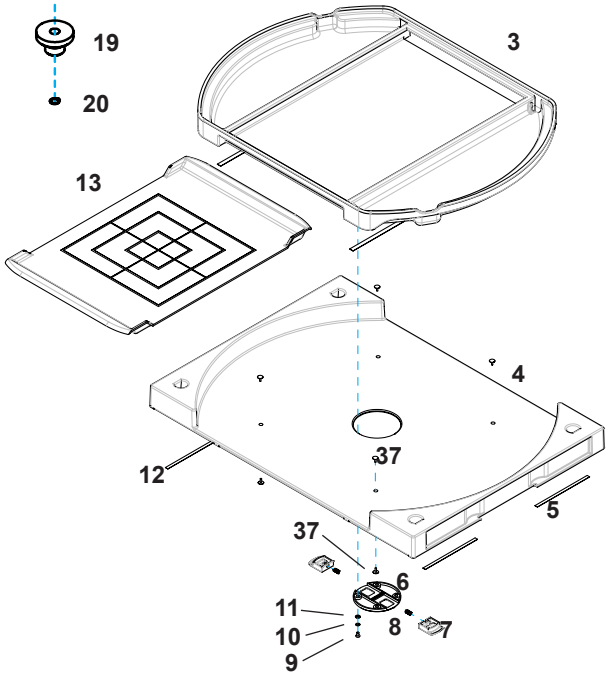

Figure 6-4
Humidifier Transformer and RS232 option

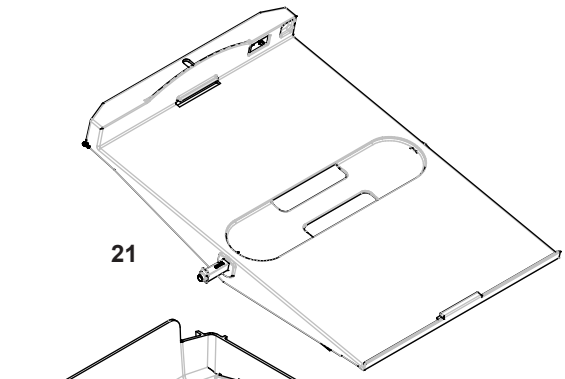
1. Mattress ..... 6600-1116-500

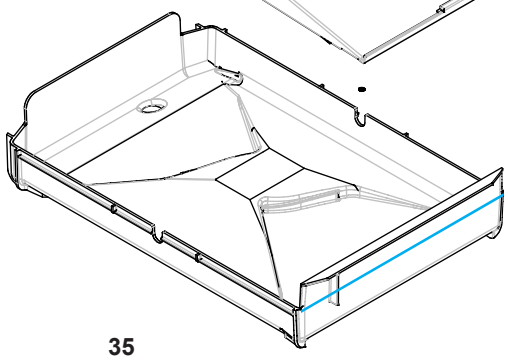



2. Plate ..... 6600-1365-500
3. Mattress Tray Support ..... 6600-1353-500
4. Translation Deck ..... 6600-1352-500
5. Tape (5.4 in.) ..... 6600-1758-502
6. Latch Cover ..... 6600-1364-500
7. Locking Latch ..... 6600-1363-500
8. Spring ..... 6600-1079-400
9. Screw M4* ..... 6600-0706-409
10. Washer, M4 split ring* ..... 6600-0713-403
11. Washer, M4 flat* ..... 6600-0712-403
12. Tape (19.3 in.) ..... 6600-1758-501
13. X-ray Tray ..... 6600-1334-500
14. Tilt Ball and Screw Assembly ..... 6600-0814-700
15. Cover ..... 6600-1329-500
16. Top Plate ..... 6600-1328-500
17. Nut ..... 6600-1330-500
18. Plate ..... 6600-1457-500
19. Stop ..... 6600-1366-500
20. O-ring ..... 6600-1080-400
21. Tilt platform* ..... 6600-1313-500
22. Washer* ..... 0202-4520-340
23. Spring* ..... 6600-1009-400
24. Brake bracket* ..... 6600-1225-500
25. Brake pad assembly* ..... 6600-0853-700
26. Knob* ..... 6600-1158-500
27. Cover* ..... 6600-1327-500
28. Slide* ..... 6600-1227-500
29. Spring* ..... 6600-1083-400
30. Ball bearing* ..... 6600-1228-500
31. Pin*@ ..... 6600-2023-500
32. Pin retaining clip*@ ..... 6600-0240-400
33. Plunger* ..... 6600-1325-500
34. Spring* ..... 6600-1043-400
35. Pan ..... 6600-1168-500
36. Screw, M4 ..... 6600-0706-407
37. Rivet, small ..... 6600-1078-400
38. Rivet, large ..... 6600-1203-400
39. Washer, brake* ..... 6600-1335-500

**Parts not shown**

Tilt platform assembly (includes all items with *) ..... 6600-0771-700

@New pin and retaining clip replaces earlier roll pin and fits platform without modifiying the hole.

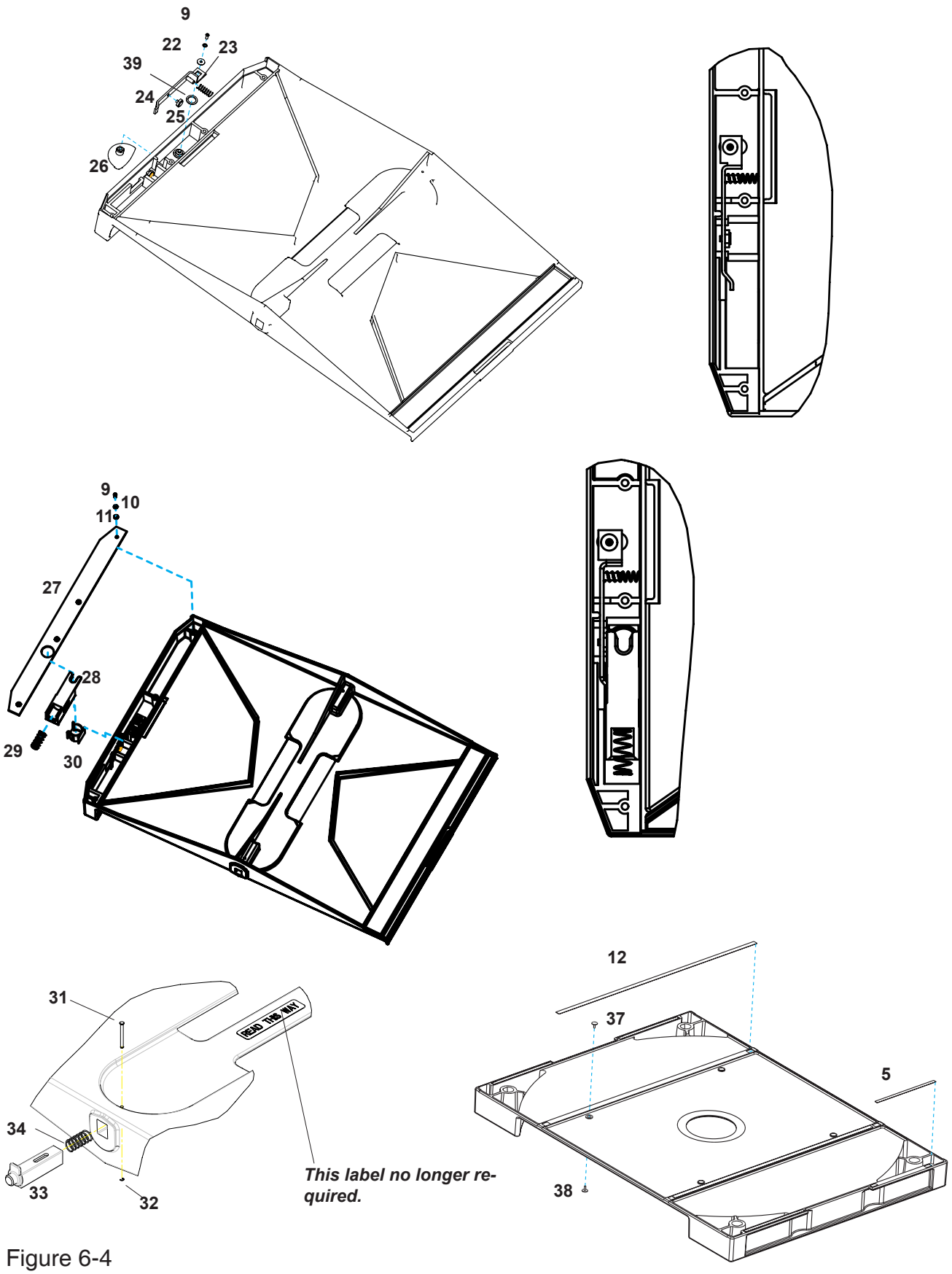
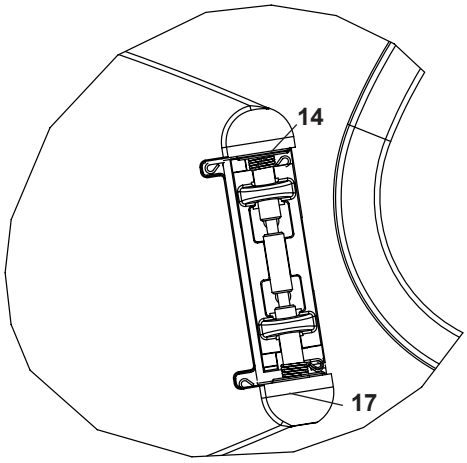
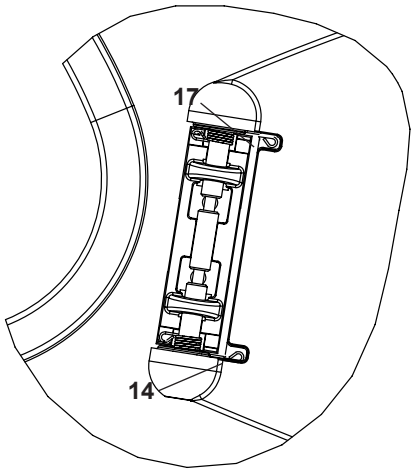



Figure 6-4
Bed




**LEFT DOOR**




**RIGHT DOOR**

1. Door with porthole cutouts@ ..... 6600-1807-500
2. Inner wall ..... 6600-1792-500
3. Porthole seal ..... 6600-1249-500
4. Wall hinge snap ..... 6600-1436-500
5. Side wall hinge ..... 6600-1149-500
6. Side wall hinge mask label ..... 6600-2321-100
7. Side wall inside latch cover ..... 6600-1826-500
8. Porthole hinge bottom ..... 6600-1239-500
9. Side wall latch ..... 6600-1403-500
10. Screw, M2.9 x 9.5 ..... 6600-0709-409
11. Side wall latch spring ..... 6600-1405-500
12. Side wall latch cover ..... 6600-1404-500
13. Wall hinge snap post ..... 6600-1429-500
14. Porthole hinge right (East) spring* ..... 6600-1026-400
15. Porthole middle hinge ..... 6600-1240-500
16. Hinge pin ..... 6600-1041-400
17. Porthole hinge left (west) spring* ..... 6600-1040-400
18. Flat washer ..... 6600-0712-403
19. Spit ring lock washer, M4 ..... 6600-0713-403
20. Screw, M4 x 16 ..... 6600-0706-411
21. Porthole hinge cover ..... 6600-1242-500
22. Porthole door ..... 6600-1238-500
23. Porthole latch cover* ..... 6600-1246-500
24. Porthole latch spring ..... 6600-1245-500
25. O-ring ..... 6600-1049-400
26. Porthole latch base* ..... 6600-1244-500
27. Delrin washer ..... 6600-1050-400
28. Screw, M2.9 ..... 6600-0709-407
29. Porthole latch spacer ..... 6600-1257-500
30. Screw, M4 x 12 ..... 6600-0706-410
31. Porthole Latch Assembly (Includes 23-28) ... 6600-0738-700
32. Ohemeda logo label@(see section 6.3) ..... 6600-2384-101
33. Giraffe logo label@(see section 6.3) ..... 6600-2382-101
34. Iris frame ..... 6600-0696-500
35. Iris ring ..... 6600-0464-700
36. Iris gasket ..... 6600-0699-500

* Use Vac Kote (6700-0092-200) sparingly on the porthole door springs (items 14 & 16) and on the surfaces where the door latch pieces (items 23 & 26) slide together.

@ Order items #32 and 33 when ordering item #1.

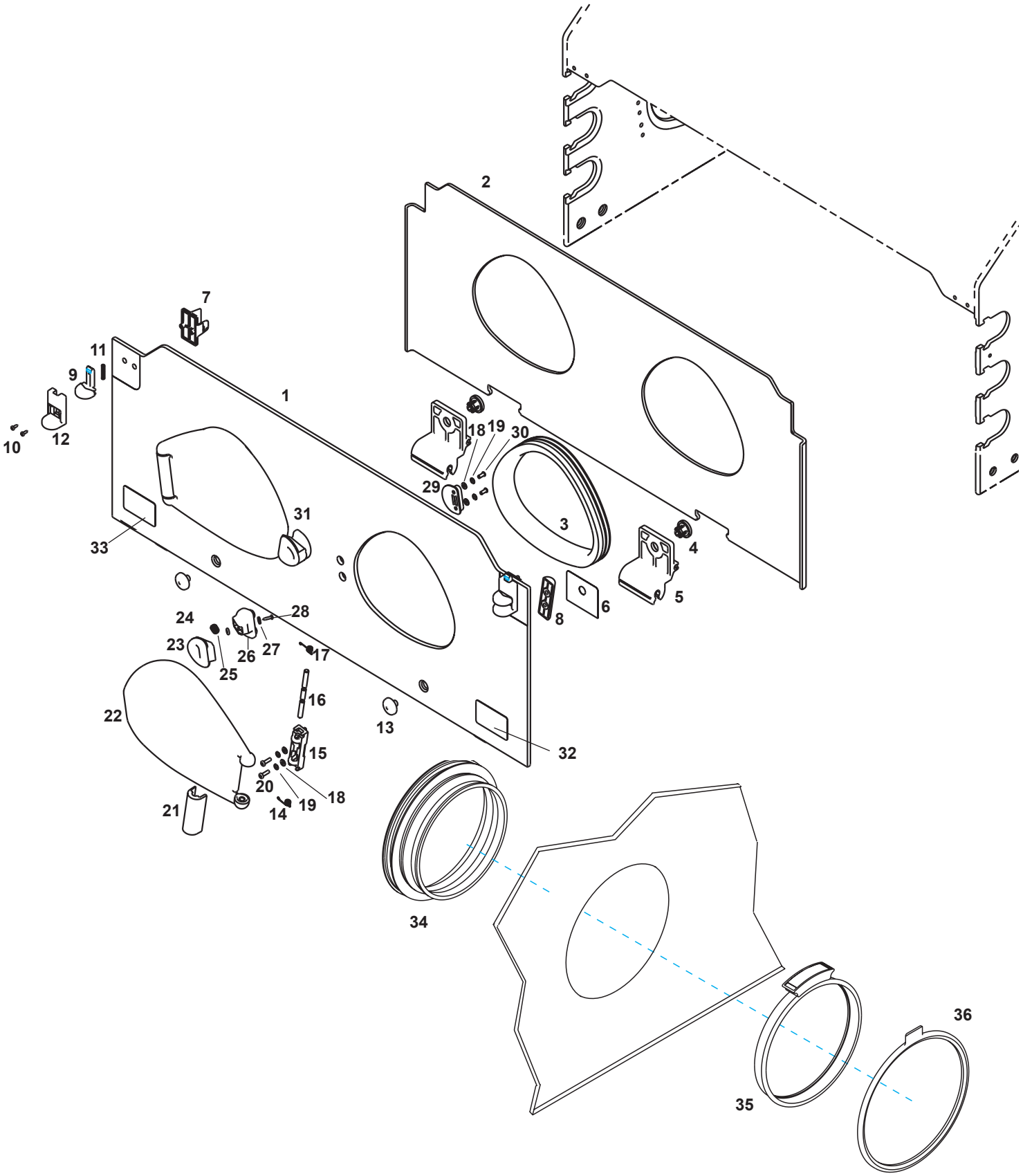
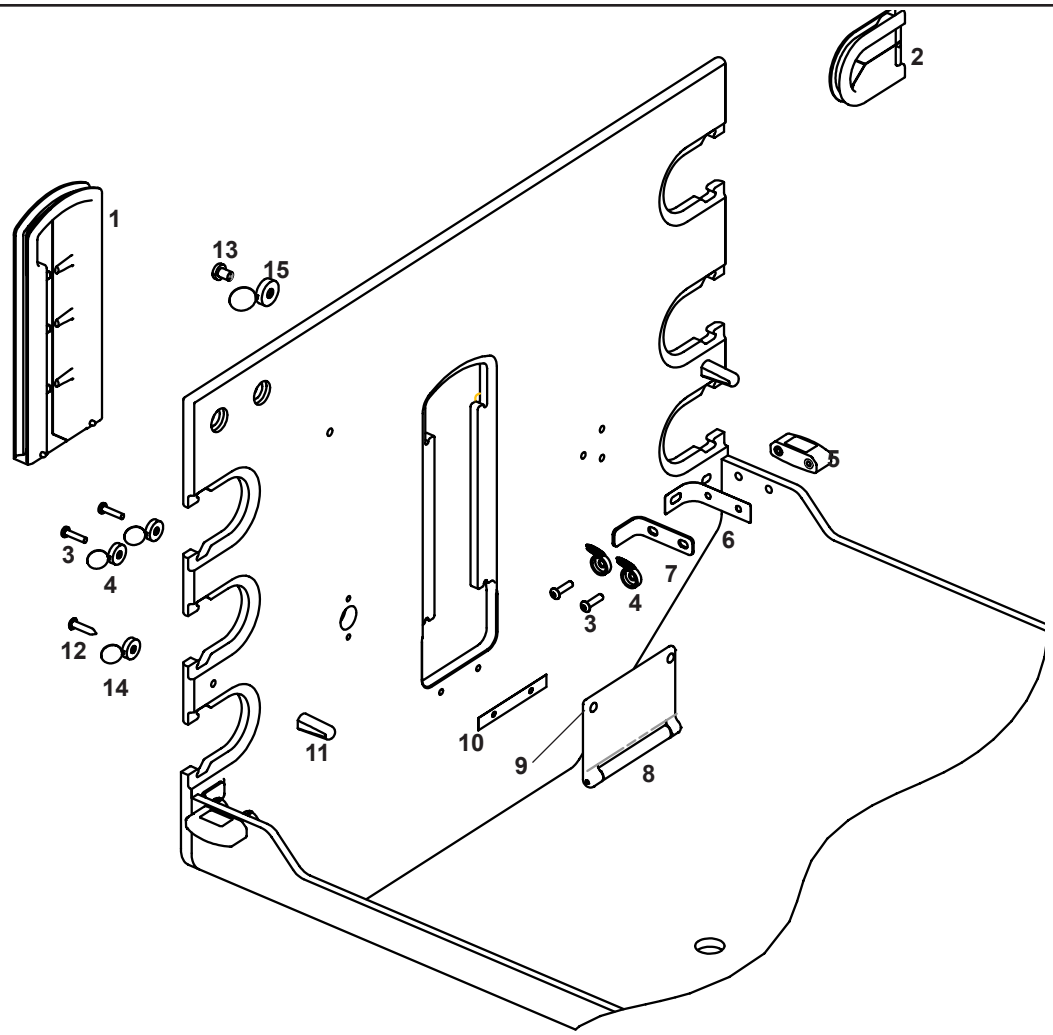



Figure 6-5
Side Door (East/west)

1. Ventilator slot grommet ..... 6600-1231-500

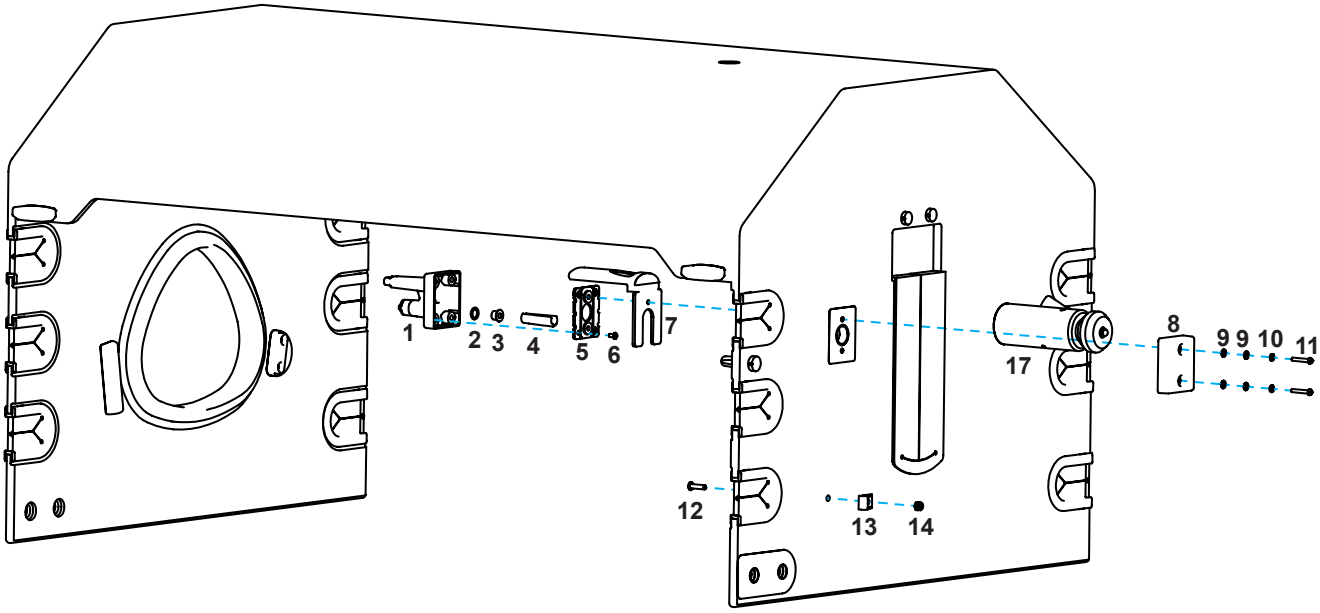



2. Corner grommet ..... 6600-1248-500
3. Screw, M4 x 16 Bt. Hd. ..... 6600-0706-411
4. Hinged screw cover, small ..... 6600-1206-402
5. Door latch receiver ..... 6600-1819-500
6. Door latch label ..... 6600-2423-100
7. Corner bracket ..... 6600-1939-500
8. Flip Door kit
   (includes items 3,4 and 9) ..... 6600-0119-850
9. Flip door bumper ..... 6600-1580-500
10. Mask label ..... 6600-2424-100
11. Inner wall bumper ..... 6600-1485-500
12. Screw, M4.2 x 19 Pn. Hd. ..... 6600-0709-404
13. Corner bracket nut ..... 6600-1940-500
14. Hinged screw cover, medium ..... 6600-1206-401
15. Hinged screw cover, large ..... 6600-1206-403

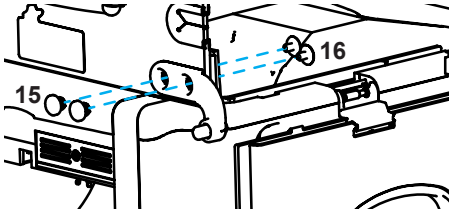
Figure 6-7
Flip door, corner brackets and grommets

## 6.1.3 Hood & Compartment Air Probe

1. Compartment air probe@ ..... 6600-1512-700
   Probe harness cable@ ..... 6600-1513-700
2. O-ring..... 6600-0540-400




3. Humidity sensor assembly* ..... 6600-0784-700
   Plug (no humidity sensor installed)..... 6600-1476-500
4. Retainer..... 6600-1475-500
5. Break plate ..... 6600-1473-500
6. Screw, M3 x 6 button hd..... 6600-0706-406
7. Probe shield..... 6600-1864-500
8. Back plate..... 6600-1474-500
9. Flat washer, M3..... 6600-0712-402
10. Split ring lock washer..... 6600-0713-402
11. Screw, M3 x 25 button hd..... 6600-0706-450
12. Screw, M4 x 16 button hd..... 6600-0706-411
13. Cable clamp..... 6600-0144-400
14. Lock nut, M4..... 6600-0714-402
15. Hinge snap ..... 6600-1436-500
16. Hinge post ..... 6600-1429-500
17. Hood latch kit..... 6600-0231-850




Parts not shown

Humidifier Calibration Kit*..... 6600-0048-850
Hood replacement kit (includes hood,
4 each of items 15 &16, 10 each of
item 14, 2 each of item 4 and 4 each of
item 15 shown on previous page,and labels)
Ventilator slot & porthole ..... 6600-0232-850
Ventilator slot & iris porthole..... 6600-0270-850
Ventilator slot & ventilator slot ..... 6600-0269-850

* Unit must be recalibrated using Humidifier Calibration Kit whenever sensor is replaced.

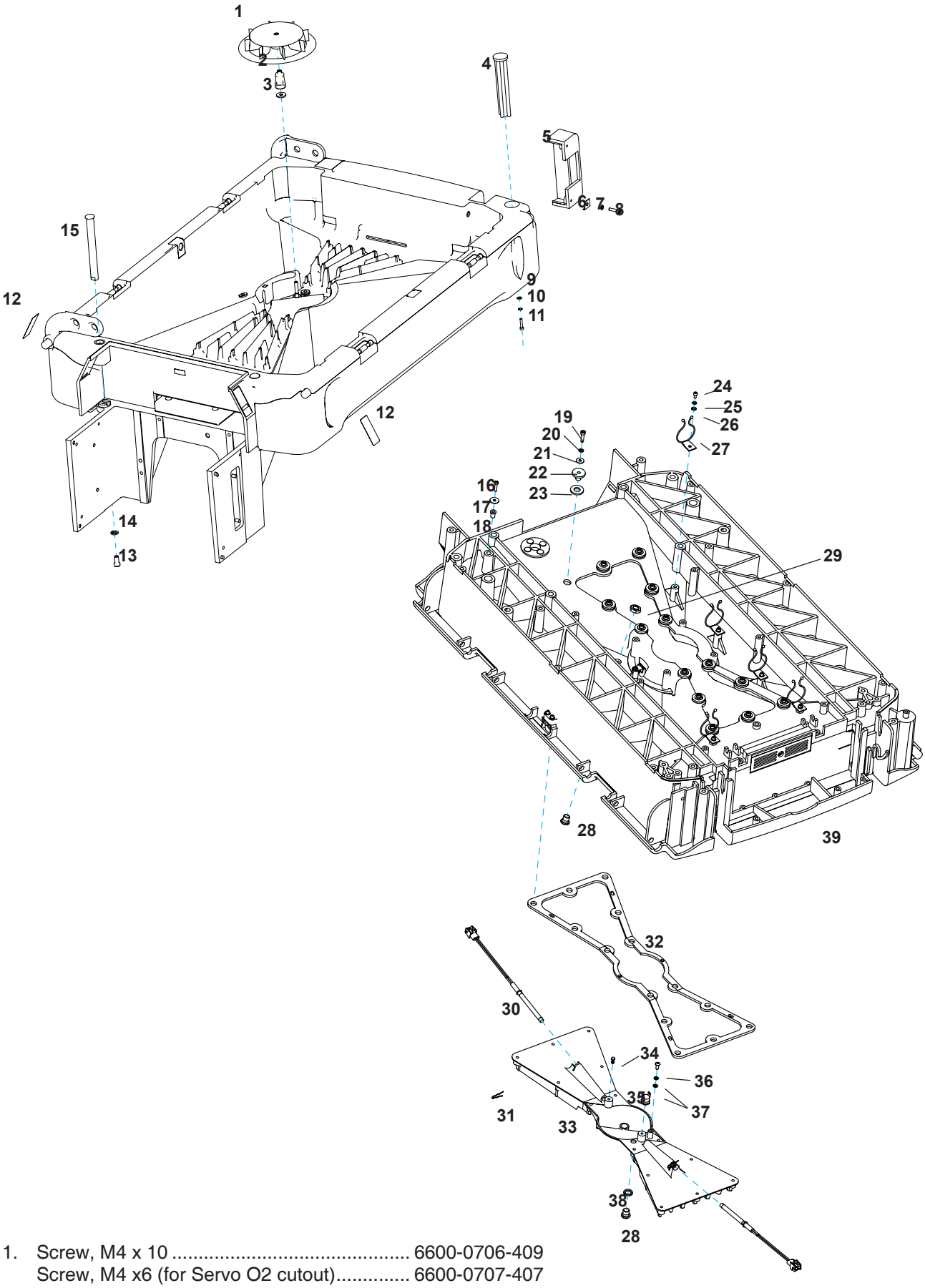
@ For earlier units with a compartment air probe cable that disconnected at the probe panel, order service kit 6600-0241-850.

Figure 6-8
Compartment Air Probe

## 6.1.4 Chassis

| | | |
|---|---|---|
| 1. | Fan | 6600-1738-500 |
| 2. | Fan hub | 6600-1440-500 |
| 3. | Fan seal | 6600-1557-500 |
| 4. | I.V. Pole Filler | 6600-1726-500 |
| 5. | Hinge cover | 6600-1802-500 |
| 6. | Tab washer | 6600-1801-500 |
| 7. | Lock washer, split ring M5 | 6600-0713-404 |
| 8. | Screw, M5 x 20, Skt. Hd. | 6600-0707-417 |
| 9. | Washer, M4 | 6600-0712-403 |
| 10. | Lock washer, Split ring, M4 | 6600-0713-403 |
| 11. | Screw, M4 x 25 Btn. Hd. | 6600-0706-413 |
| 12. | Blank label | 6600-2410-100 |
| 13. | Screw, M8 x 16 Skt. Hd. | 6600-0707-427 |
| 14. | Lock washer, split ring M8 | 6600-0713-406 |
| 15. | Tie down cylinder | 6600-1795-500 |
| 16. | Screw, 8 - 32 x 7/8, Phillips | 0140-6527-114 |
| 17. | Washer, .193ID x .687 OD x .032 | 0402-0739-300 |
| 18. | Well nut, neoprene | 6600-1218-400 |
| 19. | Screw, M5 x 25 | 6600-0707-418 |
| 20. | Spit ring lock washer, M5 | 6600-0713-404 |
| 21. | Flat washer, M5 | 6600-0712-409 |
| 22. | Bushing | 6600-1434-500 |
| 23. | Silicon washer | 6600-1778-500 |
| 24. | Screw, M4 x 8 | 6600-0707-408 |
| 25. | Split ring lock washer, M4 | 6600-0713-403 |
| 26. | Flat washer, M4 | 6600-0712-403 |
| 27. | Wire routing clip | 6600-1197-600 |
| 28. | Socket plug | 6600-1214-400 |
| 29. | Jam nut | 6600-1216-400 |
| 30. | Incubator heater and harness assembly | 6600-1041-700 |
| 31. | Retaining clip | 6600-1211-500 |
| 32. | Heat sink gasket | 6600-0300-300 |
| 33. | Heat sink | 6600-1858-500 |
| 34. | Heat sink probe | 6600-0226-850 |
| 35. | Thermostat | 6600-1019-600 |
| 36. | Screw, M5 Bt, Hd. | 6600-0706-418 |
| 37. | Star washer, M5 | 6600-0713-433 |
| 38. | Seal washer | 6600-1872-500 |
| 39. | Chassis (order 2pcs. item 12) | 6600-0278-850 |

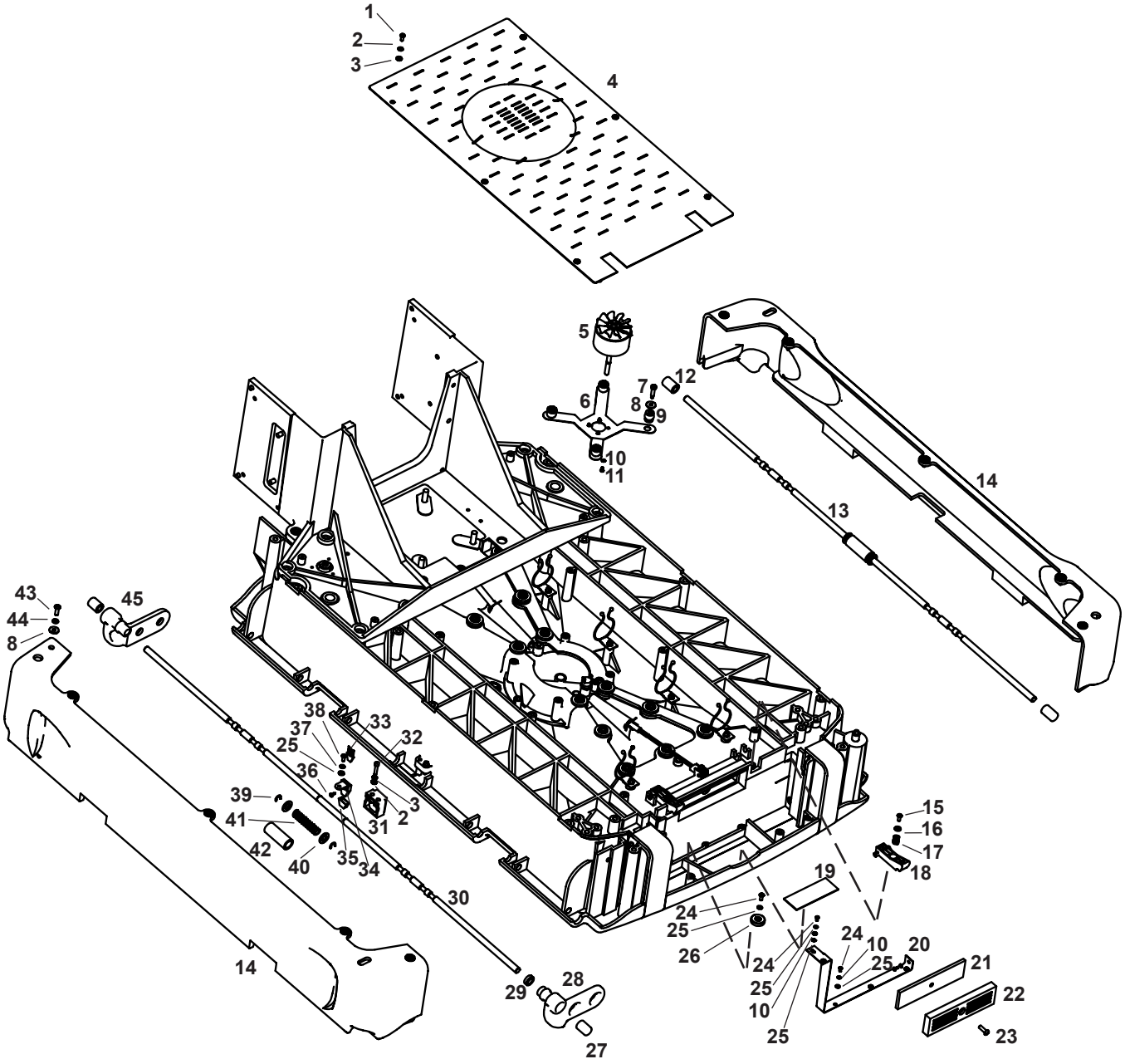
Figure 6-8
Upper chassis and heat sink




1. Screw, M4 x 10 ..... 6600-0706-409
   Screw, M4 x6 (for Servo O2 cutout)..... 6600-0707-407
2. Split ring lock washer ..... 6600-0713-403
3. ~~Washer, M4~~..... ~~6600-0712-403~~

| | | |
|---|---|---|
| 4. | Chassis cover | 6600-1888-500 |
| 5. | Fan motor | 6600-1057-600 |
| 6. | Fan motor bracket | 6600-1162-500 |
| 7.. | Screw, M4 shoulder | 6600-1051-400 |
| 8. | Flat washer, M5 | 6600-0712-409 |
| 9. | Motor mount | 6600-1000-400 |
| 10. | Star washer, M3, Int. | 6600-0713-431 |
| 11. | Screw, M3 x 6 | 6600-0707-401 |
| 12. | Left door hinge button | 6600-1285-500 |
| 13. | Left hinge pin | 6600-1284-500 |
| 14. | Chassis side panel | 6600-0131-850 |
| 15. | Screw, shoulder | 6600-1033-400 |
| 16. | Flat washer, M5 | 6600-0712-404 |
| 17. | Spring | 6600-1299-500 |
| 18. | Spring clip | 6600-1300-500 |
| 19. | Humidifier sound damper | 6600-1494-500 |
| 20. | Wire raceway cover | 6600-1303-500 |
| 21. | Filter (10 pcs) | 6600-0207-850 |
| 22. | Filter cover assy. (includes knob & washer).. | 6600-1533-700 |
| 23. | Knob | 6600-0894-400 |
| | Push washer | 6600-0895-400 |
| 24. | Screw, M3 x 6 button head | 6600-0706-406 |
| 25. | Flat washer, M3 | 6600-0712-402 |
| 26. | Humidifier spacer | 6600-1814-500 |
| 27. | Right door hinge button | 6600-1853-500 |
| 28. | Hood hinge, front (south) | 6600-1817-500 |
| | Hinge snap | 6600-1436-500 |
| | Hinge post | 6600-1429-500 |
| | Hinge mask label | 6600-2670-100 |
| 29. | Washer | 6600-0860-400 |
| 30. | Right hinge pin | 6600-1803-500 |
| 31. | Bed pivot block | 6600-1326-500 |
| 32. | Screw, M4 x 20 | 6600-0707-412 |
| 33. | Air flow sensor (includes wire harness) | 6600-0820-700 |
| 34. | Sensor holder | 6600-1435-500 |
| 35. | Sensor gasket | 6600-1437-500 |
| 36. | Screw, M2.9 x 6.5 | 6600-0709-405 |
| 37. | Split ring lock washer, M3 | 6600-0713-402 |
| 38. | Screw, M3 x 6 | 6600-0707-401 |
| 39. | E-clip | 6600-1045-400 |
| 40. | Washer | 6600-1100-400 |
| 41. | Door spring | 6600-1044-400 |
| 42. | Pin stop | 6600-1730-500 |
| 43. | Screw, M5 x 12 | 6600-0706-418 |
| 44. | Lock washer, splitring M5 | 6600-0713-403 |
| 45. | Hood hinge, rear (north) | 6600-1816-500 |

Figure 6-9
Lower chassis




## 6.1.5 Humidifier

1. Flat washer, M3 x 3.2, ID .5 ..... 6600-0712-402
2. Split ring lock washer, M3 x 3.1, ID .8..... 6600-0713-402
3. Screw, M3 x 16 Cheese head Phillips..... 6600-1255-404

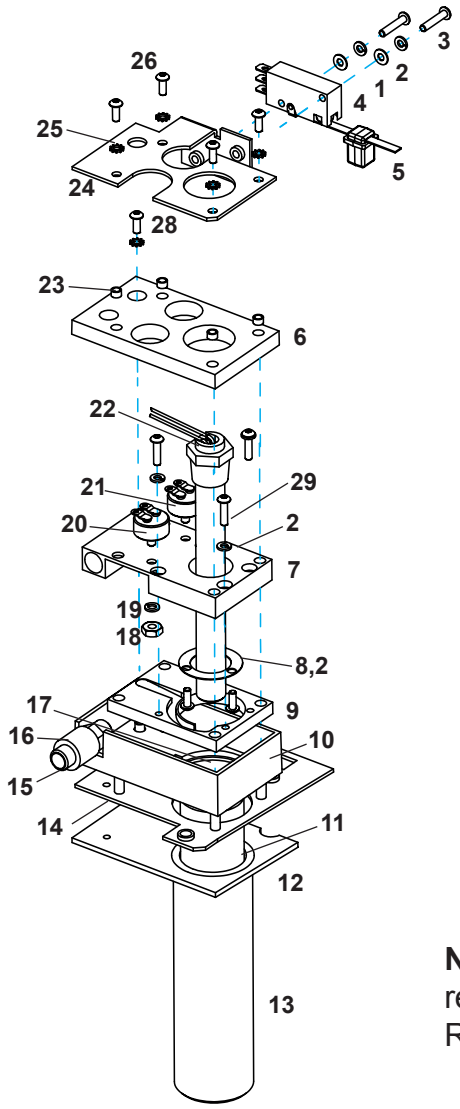
4. Reservoir switch (included in item 21)
5. Button, reservoir switch..... 6600-1298-500

6. Top humidifier gasket..... 6600-1293-500
7. Heater mount..... 6600-1291-500
8. Screw, M3 x 8 Cheese head Phillips, teflon coated..... 6600-1255-401
9. Ramp block..... 6600-1777-500
10. Humidifier gasket bottom..... 6600-1294-500
11. Protective insert..... 6600-1714-500
12. Reservoir seal..... 6600-1495-500
13. Insulating cylinder..... 6600-1182-500
14. Bottom bracket..... 6600-1181-500
15. Steam outlet..... 6600-1296-500
16. Silicone tube..... 6600-1780-500
17. Heater sheath*..... 6600-1292-500
18. Nut, hex 6 -32..... 0144-3324-113
19. Split ring lock washer, #6..... 6600-0345-400
20. Safety thermostat assembly..... 6600-0225-850
21. Add water thermostat assembly (includes item 4)..... 6600-0803-700
22. Heater cartridge assembly*..... 6600-0224-850
23. Spacer, .125 ID..... 6600-1779-500
24. Humidifier top bracket..... 6600-1295-500
25. Star washer, M3 x 3.2 ID..... 6600-0713-442
26. Screw, M3 x 12 Cheese head Phillips..... 6600-1255-403
27. Humidifier reservoir..... 6600-0216-850
    Reservoir bottom..... 6600-1493-500
    Reservoir lid..... 6600-1492-500
28. Screw, M3 x 10 skt. hd..... 6600-0707-403
29. Screw, M3 x 10 Cheese hd. Phillips Teflon coated..... 6600-1255-402

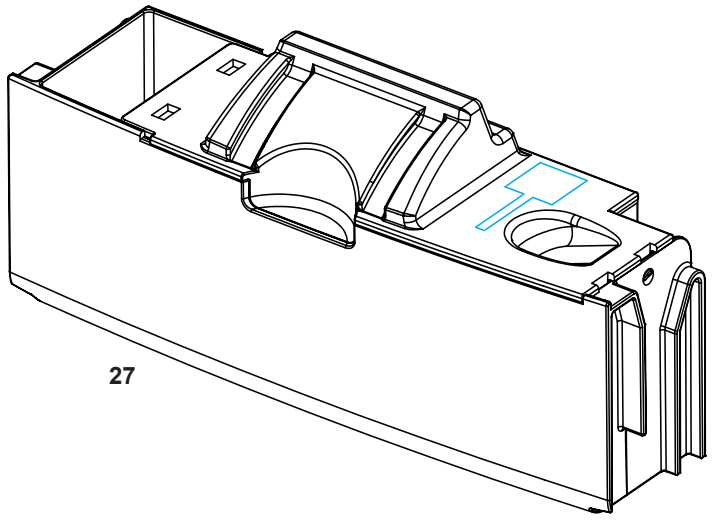
Parts not shown
Humidifier heater kit
(includes all parts above except reservoir)..... 6600-0245-850

* Always replace item 17 when replacing item 22.

Figure 6-10
6.1.6 Elevating base




**NOTE**: Due to design changes, see replacing the humidifier heater in Repair Procedures before ordering parts.




1. Main bracket ..... 6600-1183-500
2. Flat washer ..... 6600-0712-406

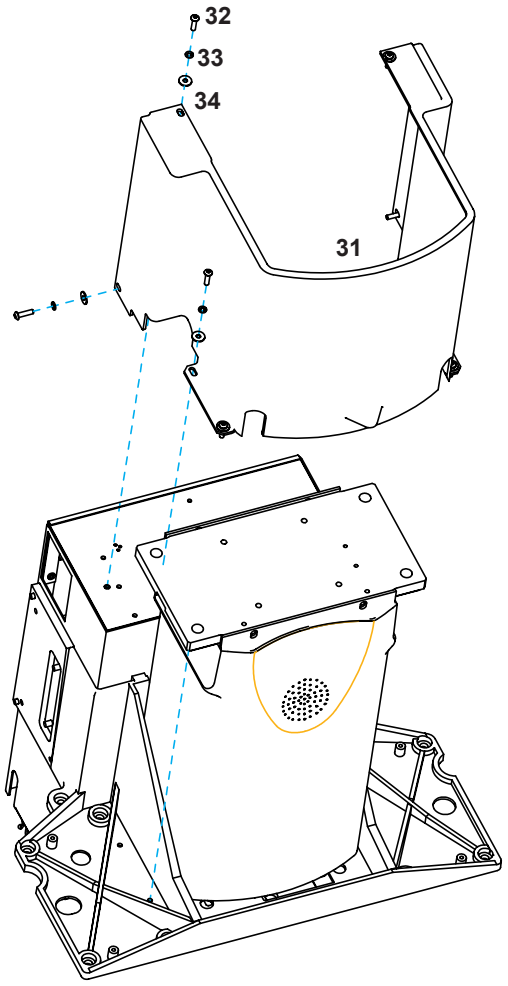
3. Lock nut, M8 x 1.25 ..... 6600-0714-405
4. Inner shroud ..... 6600-1489-500
5. Leg (new) ..... 6600-1599-500
6. Leg (old) ..... 6600-1323-500
7. E-base footswitch assembly (new) ..... 6600-0285-850
8. E-base footswitch assembly (old)* ..... obsolete
9. Lock nut, M4 x .7 ..... 6600-0714-402
10. Speaker ..... 6600-1168-600
11. Caster, all (new) ..... 6600-0890-400
12. Caster, front (old) ..... 6600-1039-401
13. Screw, M4 socket head ..... 6600-0706-409
14. Screw, M8 x 16 Btn. Hd. skt. (new) ..... 6600-0706-435
15. Lockwasher, M8 (new) ..... 6600-0712-406
16. Speaker bracket ..... 6600-1462-500
17. Screw, M12 socket head ..... 6600-0706-449
18. Lock washer M12 ..... 6600-0713-408
19. Screw, M6 ..... 6600-1117-402
20. Split ring lock washer, M6 ..... 6600-0713-405
21. Star washer ..... 6600-0713-445
22. Screw, M6 x 12 button head ..... 6600-0706-427
23. Cone point set screw, M6 (old)@ ..... 6600-0715-405
24. Mounting plate ..... 6600-1186-500
25. Elevating column ..... 6600-0753-701
26. Washer ..... 6600-0712-405
27. Screw, M6 ..... 6600-0706-427
28. External star washer ..... 6600-0713-443
29. Flat washer ..... 6600-0712-403
30. Clamp, 5/16 ..... 0208-0335-300
31. Outer shroud ..... 6600-1324-500
32. Screw, M5 ..... 6600-0706-420
33. Split ring lock washer ..... 6600-0713-404
34. Flat washer ..... 6600-0712-409
35. Caster with shield, rear (old) ..... 6600-1039-402
36. Caster cap ..... 6600-1600-500
37. Wire routing clip ..... 6600-0866-600

Parts not shown

Blue plastic connector clip for footswitch ..... 6600-1163-600

* If you unit is still equipped with these parts, contact customer service for new style footswitch kit.

@Apply Loctite #242




## 6.1.7 Hood latch, wire covers and uprights

1. Hood latch kit ..... 6600-0231-850
2. Hood latch receptacle ..... 6600-1825-500
3. Screw, M4 x 16L, Fl. Hd. Skt. ..... 6600-0715-413

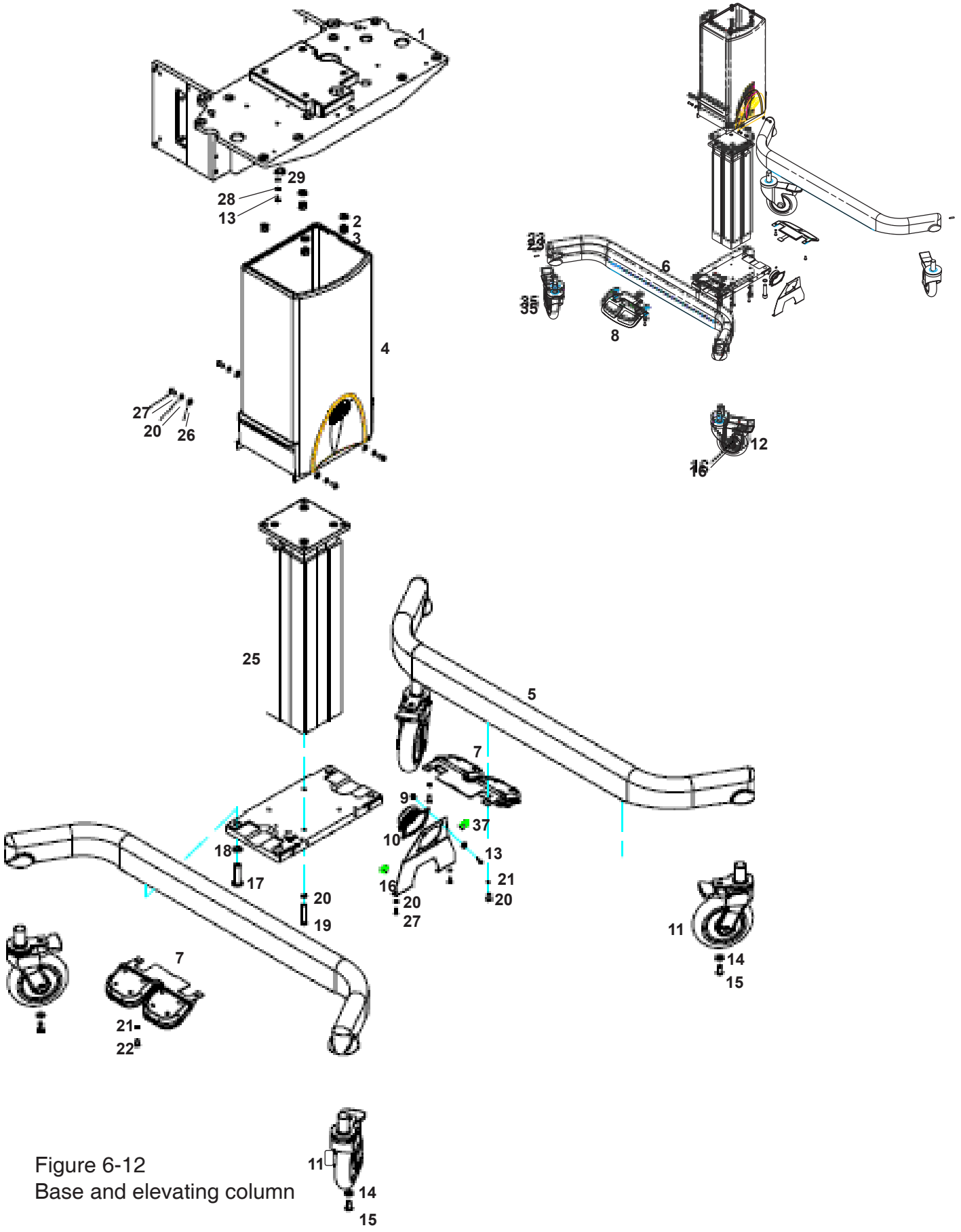
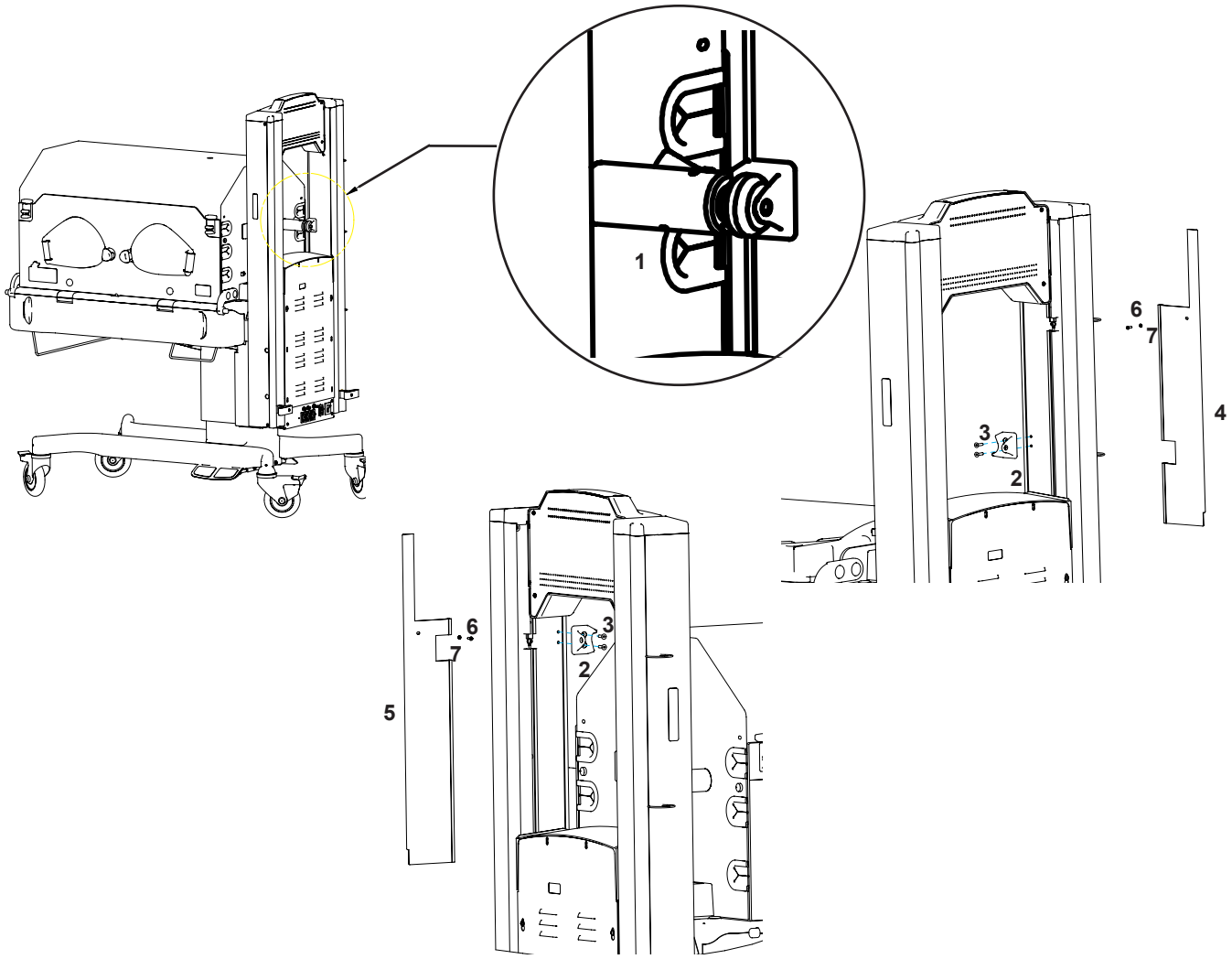



Figure 6-12
Base and elevating column

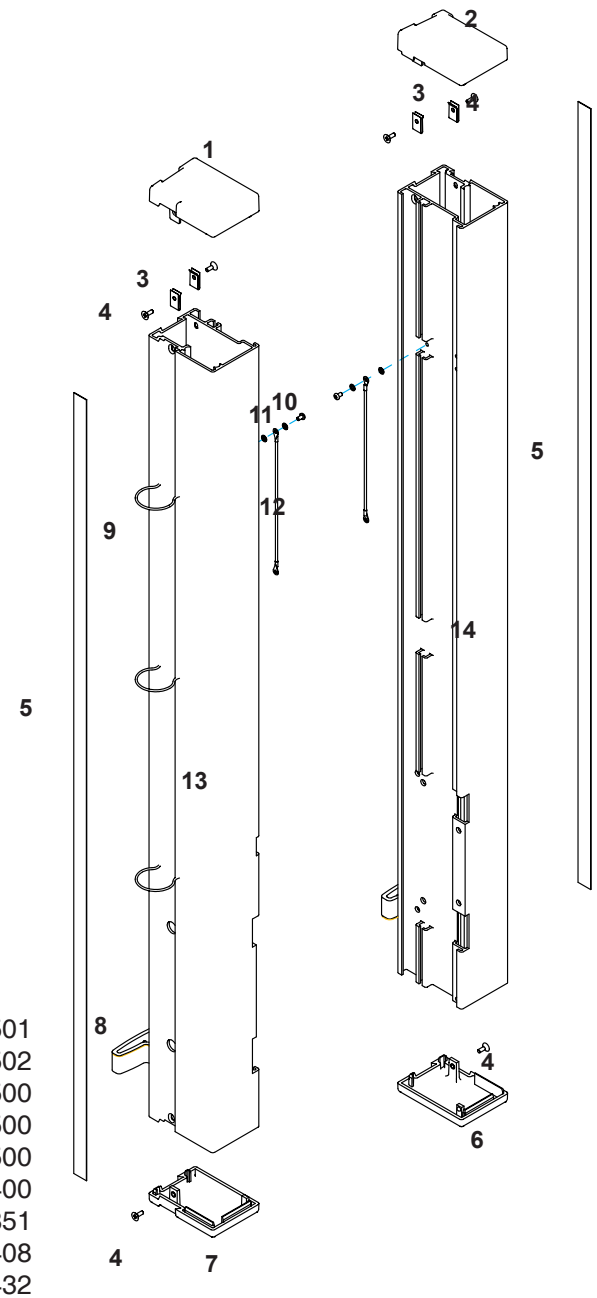
4. Right (east) wire cover..... 6600-0918-700




5. Left (west) wire cover ..... 6600-0919-700
6. Screw, M3 x 10L, Bt. Hd..... 6600-0706-401
7. Star washer ..... 6600-0713-431

Figure 6-13
Hood latch and wire covers

1. End cap, top left (West) ..... 6600-1799-500
2. End cap,top right (East)..... 6600-1800-500
3. Speed nut ..... 0402-2003-300
4. Screw, M4..... 6600-0708-409




| | | |
|---|---|---|
| 5. | Decorative strip (teal) | 6600-1456-501 |
| | Decorative strip (gray) | 6600-1456-502 |
| 6. | End cap, bottom right (East) | 6600-1463-500 |
| 7. | End cap, bottom left (West) | 6600-1341-500 |
| 8. | Cord wrap | 6600-1482-500 |
| | Dog point set screw | 6600-1124-400 |
| 9. | Routing clips (6) | 6600-0055-851 |
| 10. | Screw, M4 | 6600-0707-408 |
| 11. | Star washer | 6600-0713-432 |
| 12. | Ground wire | 6600-0883-700 |
| 13 | Upright, left (West)* | 6600-0280-500 |
| 14. | Upright, right (East)@ | 6600-0280-501 |

* When replacing this upright you must also order labels 6600-2347-107, see section 6.3 Labels later in this chapter.

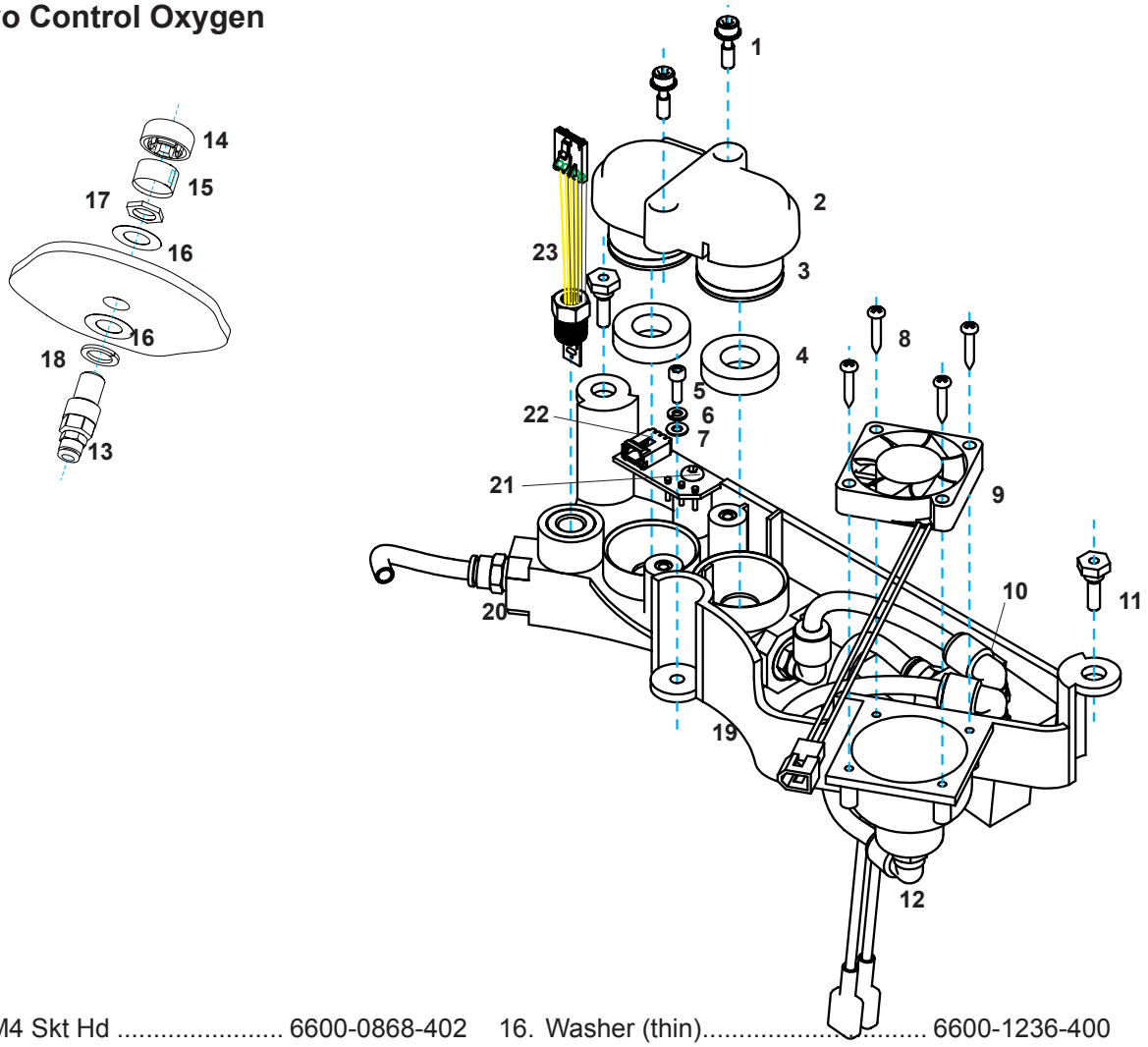
@ When replacing this upright you must also order labels 6600-2347-101 and 6600-2341-1XX: see section 6.3 Labels later in this chapter.

Figure 6-14
Uprights and End caps

## 6.1.9 Accessory hangers

| | | |
|---|---|---|
| 1. | Front pluerevac hanger (south) | 6600-1202-500 |
| 2. | Side pluerevac hanger (E/W) | 6600-1703-500 |

## 6.1.8 Servo Control Oxygen



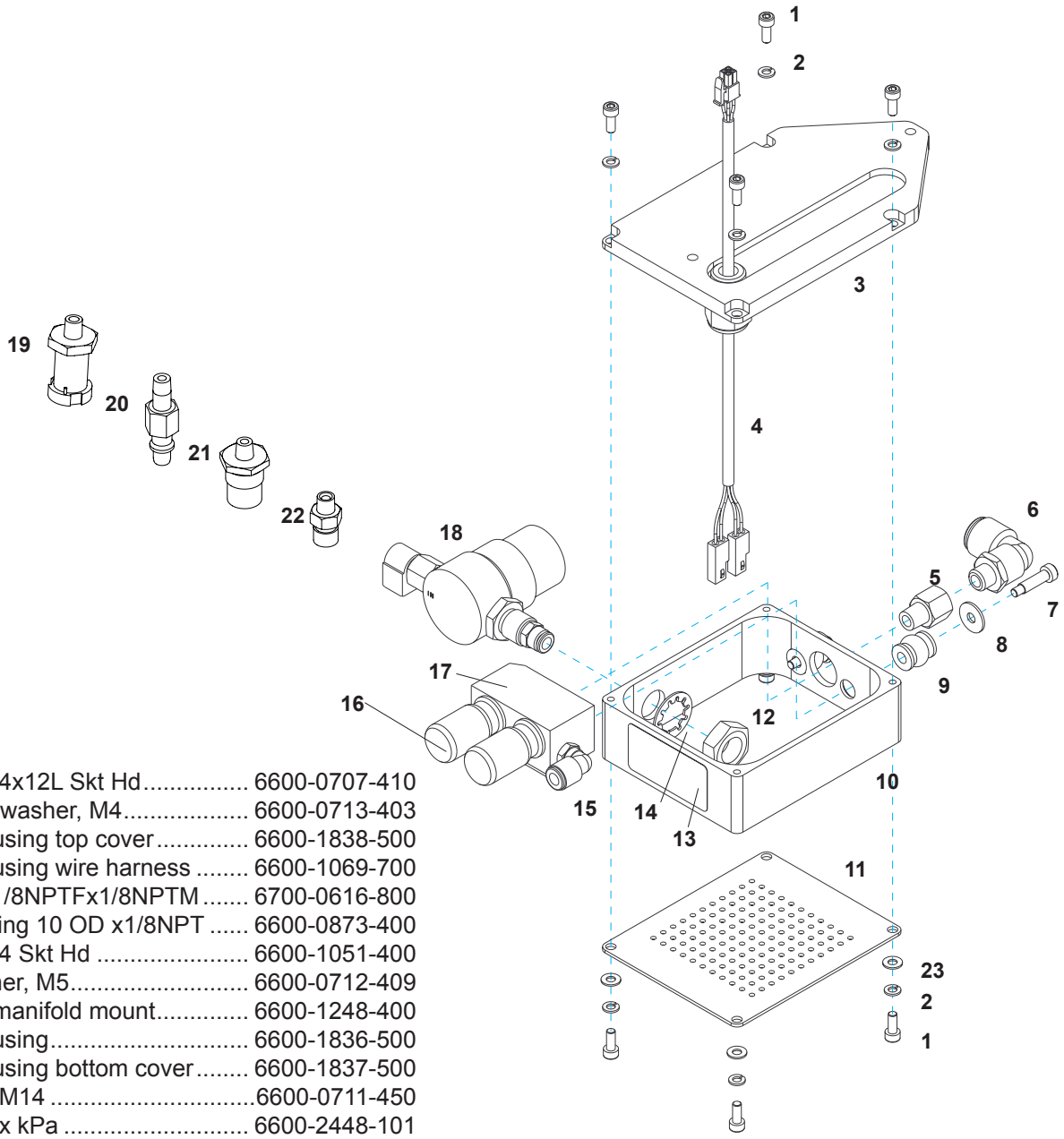

1. Screw, M4 Skt Hd ..... 6600-0868-402
2. Sensor housing cover ..... 6600-1876-500
3. Oxygen sensor kit (2 pcs.)@ ..... 6600-0120-850
4. Sensor gasket ..... 6600-1887-500
5. Screw, M3x10L Skt Hd ..... 6600-0707-403
6. Split ring washer, M3 ..... 6600-0713-402
7. Flat washer, M3 ..... 6600-0712-402
8. Screw, M2.9x16L, self tap .....6600-0709-411
9. Calibration fan with harness* ..... 6600-1510-700
10. Calibration valve assembly (includes gasket) ..... 6600-1539-700
    Calibration valve mounting screws (2)- M4x12L Fl Hd Skt ..... 6600-0708-409
11. Male/female shoulder screw ..... 6600-0862-400
12. Push fitting, 90 degree elbow ..... 6600-0865-400
13. Chassis Vent ..... 6600-2017-500
14. Vent cover ..... 6600-2018-500
15. Vent screen ..... 6600-2020-500
    Vent screens (5) ..... 6600-0271-850

*Install fan so flow arrow on side points up into chassis.
@ The date on the sensor is a discard date; the sensor should be removed from service on that date.

16. Washer (thin) ..... 6600-1236-400
17. Panel hex nut ..... 6600-1275-400
18. M12 Split ring washer ..... 6600-0713-408
19. Sensor housing ..... 6600-1875-500
20. Push fitting, straight ..... 6600-0877-400
21. Screw, M4x6L Button Hd ..... 6600-0706-407
22. Sensor housing board (also includes the board inside the sensor housing cover) .....6600-1511-700
23. Sensor plug assembly ..... 6600-0604-700
    Sensor housing assembly (includes all parts above except item 3) ..... 6600-1506-700

Tubing (order by inch)
- 6mm black, from sensors to manifold, 3.9” ..... 6600-0129-300
- 6mm black, from chassis vent to manifold, 3.9” ..... 6600-0129-300
- 6mm white, from cal fan to manifold, 4.7” ..... 6600-0866-400
- 6mm white, from manifold to heatsink vent, 4.7” .... 6600-0866-400

**Figure 6-15**
Servo Control Oxygen Sensor housing assembly



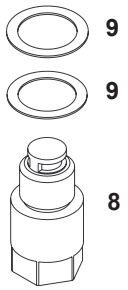

1. Screw, M4x12L Skt Hd ..... 6600-0707-410
2. Split ring washer, M4 ..... 6600-0713-403
3. Valve housing top cover ..... 6600-1838-500
4. Valve housing wire harness ..... 6600-1069-700
5. Adapter 1/8NPTFx1/8NPTM ..... 6700-0616-800
6. Elbow fitting 10 OD x1/8NPT ..... 6600-0873-400
7. Screw, M4 Skt Hd ..... 6600-1051-400
8. Flat washer, M5 ..... 6600-0712-409
9. Damper manifold mount ..... 6600-1248-400
10. Valve housing ..... 6600-1836-500
11. Valve housing bottom cover ..... 6600-1837-500
12. Jam nut, M14 .....6600-0711-450
13. Label Max kPa ..... 6600-2448-101
    Label Max PSI ..... 6600-2448-102
14. Lock washer, M14 Int tooth ..... 6600-0713-438
15. Push-in fitting, 90° Elbow ..... 6600-0865-400
16. Supply valve ..... 6600-0602-700
17. Manifold ..... 6600-1839-500
    plug ..... 0413-3510-335
    gasket ..... 6600-1950-500
18. Regulator assembly ..... 6600-0254-850
    In-line screen fitting ..... 6600-1249-400
19. O2 adapter, Air Liquide ..... 6600-0725-400
20. O2 adapter, DIN ..... 6700-0050-700
21. O2 adapter, NIST ..... 6600-0100-400
22. O2 adapter, DISS ..... 6700-0522-800
23. Washer, M4 ..... 6600-0712-403

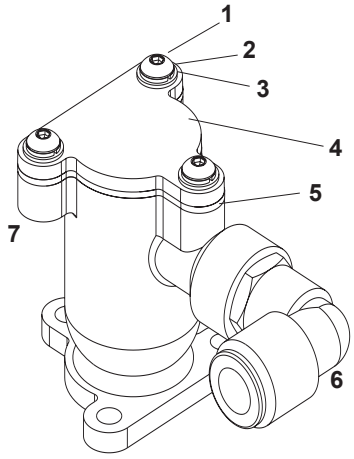
Parts not shown

Oxygen inlet label (green) .....6600-2611-101
Oxygen inlet label (white) .....6600-2611-102

Valve housing assembly (includes all parts above except items 11, 13 and mounting hardware) ..... 6600-1507-700
6mm Tubing (order by inch) ..... 6600-0866-400
From regulator to manifold, 3.9”
Tubing/sleeve assembly..... 6600-0262-850
10mm tube from valve housing to expansion chamber, 27”

**Figure 6-16**
Servo Control Oxygen Valve housing



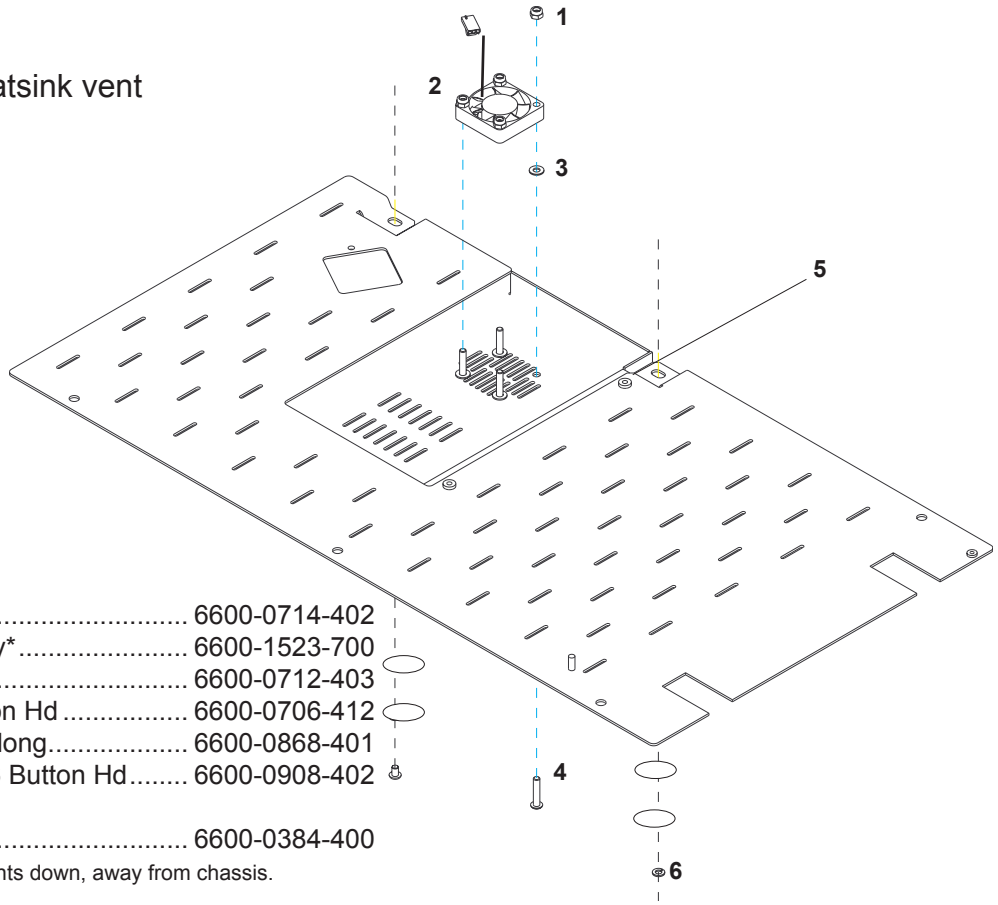




1. Screw, M4 Skt Hd ..... 6600-0706-409
2. Split ring washer, M4 ..... 6600-0713-403
3. Flat washer, M4 ..... 6600-0712-403
4. Expansion chamber cover ..... 6600-1878-500
5. Cover gasket ..... 6600-1883-500
6. Elbow fitting ..... 6600-0873-400
7. Expansion chamber assembly (includes items 1-6) ..... 6600-0256-850
8. Vent ..... 6600-1881-500
9. Washer (thick)..... 6600-1219-400

Parts not shown

P-clamp (under Pluerevac holder)..... 0690-1240-331
Washer, M6 (under Pluerevac holder)..... 6600-0712-405
Expansion chamber inlet gasket..... 6600-1884-500

**Figure 6-17**
Expansion Chamber/heatsink vent



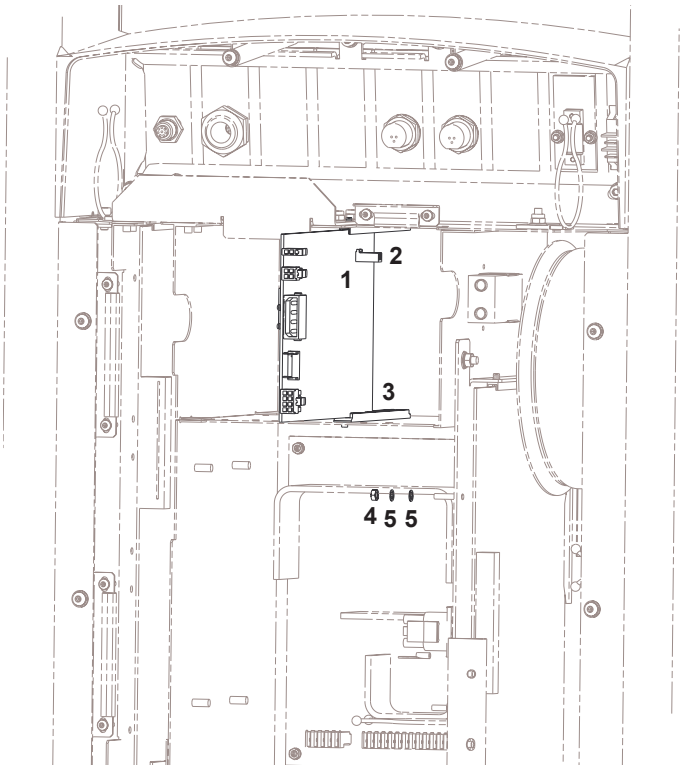

1. Nylock nut, M4..... 6600-0714-402
2. Cooling fan assembly*..... 6600-1523-700
3. Flat washer, M4 ..... 6600-0712-403
4. Screw, M4x20L Button Hd ..... 6600-0706-412
5. Screw, captive 8mm long..... 6600-0868-401
6. Screw, SEMS M4 x 6 Button Hd..... 6600-0908-402

Parts not shown

Cable tie ..... 6600-0384-400

*Install fan so flow arrow on side points down, away from chassis.

**Figure 6-18**
Servo Control Oxygen Cooling Fan




1. Servo Oxygen PCB ..... 6600-0233-850
2. Card guide, black..... 6600-1064-400
3. Card guide, white.....6600-1183-400
4. Nut, M3.....6600-0711-403
5. Lock washer, int. tooth..... 6600-0713-431

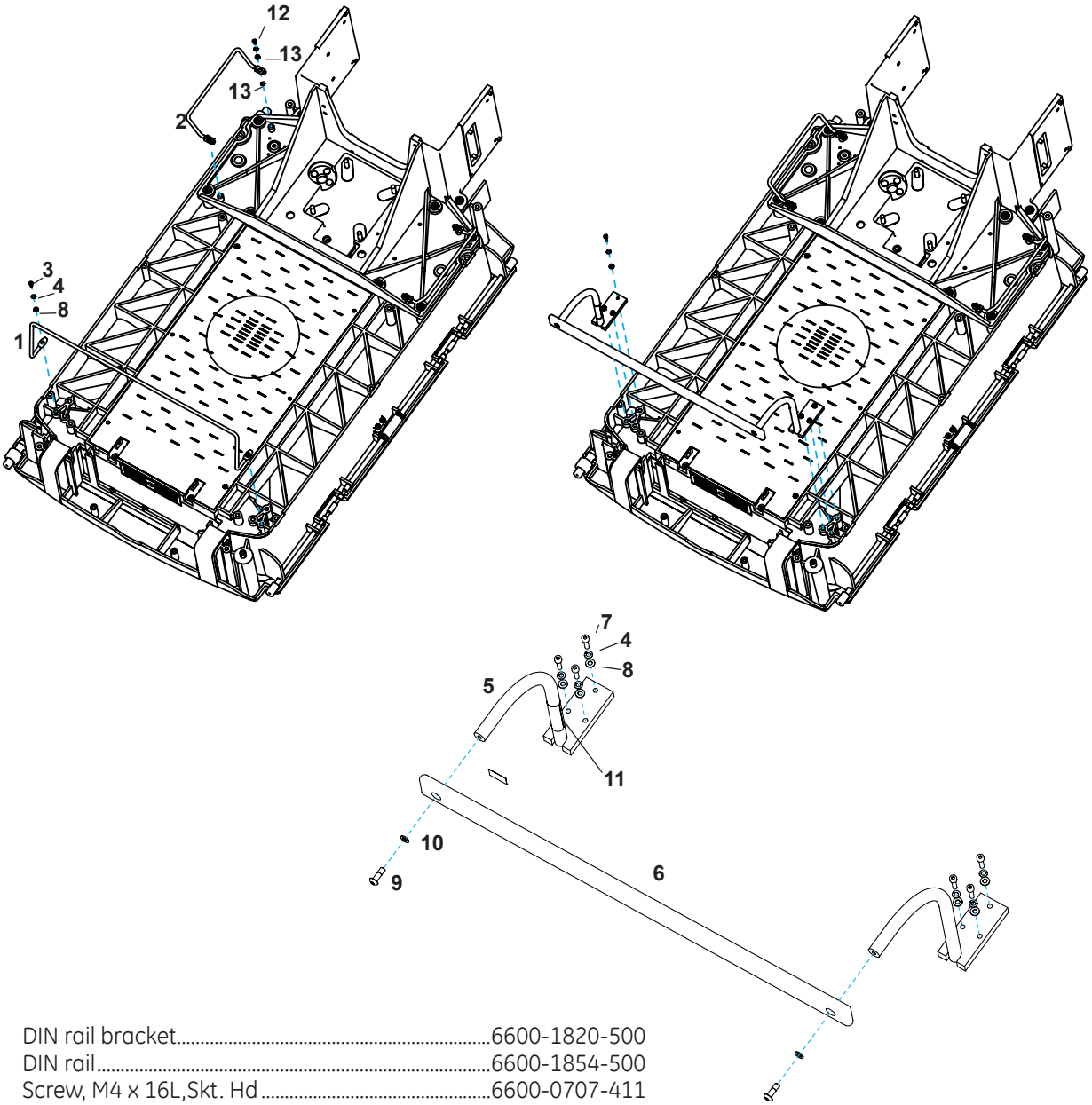
Parts not shown

EPROM (U3) ..... 6600-0255-850
In-line fuse cable* ..... 6600-0618-700

Fuse is not replaceable; you must order cable to replace fuse.

**Figure 6-19**
Servo Control Oxygen PC board

3. Screw, M4 x 10 ..... 6600-0707-409
4. Split ring lock washer, M4 ..... 6600-0713-403

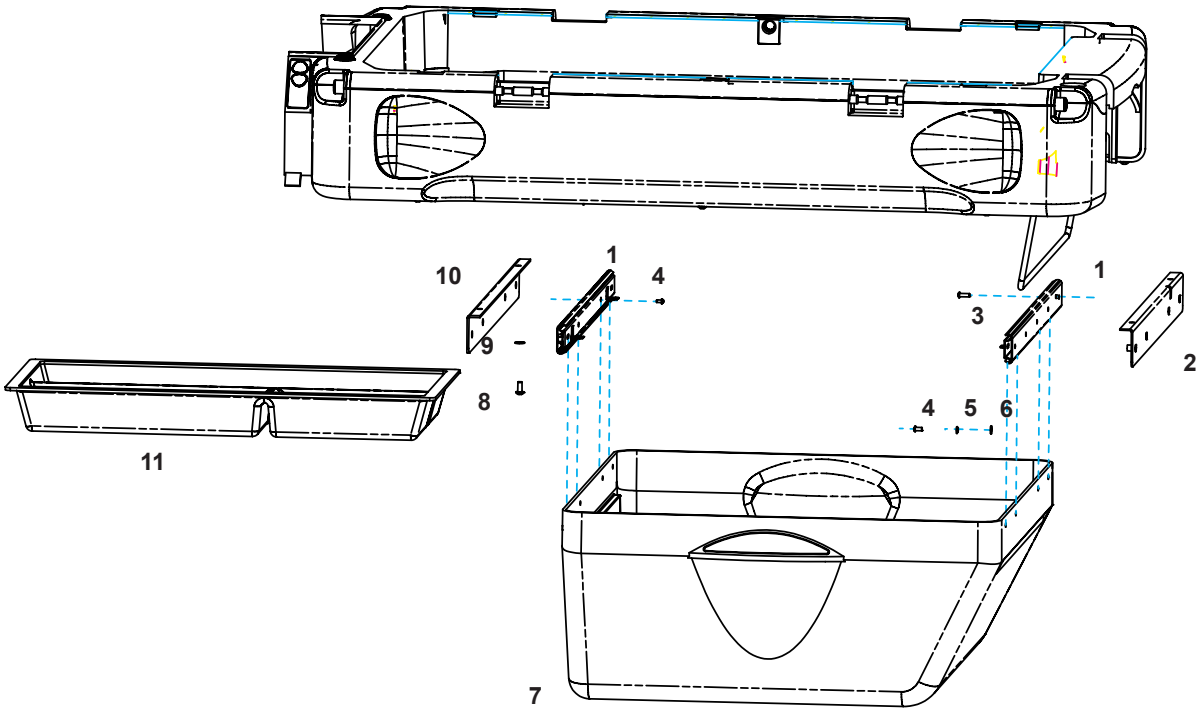



5. DIN rail bracket..... 6600-1820-500
6. DIN rail..... 6600-1854-500
7. Screw, M4 x 16L,Skt. Hd ..... 6600-0707-411
8. Washer, M4..... 6600-0712-403
9. Screw, M5 x 16L, Btn. Hd..... 6600-0706-419
10. Split ring lock washer, M5 ..... 6600-0713-404
11. Label weight limit ..... 6600-2426-100
12. Screw, M6 x 12, Btn. Hd. ..... 6600-0706-427
13. Star Washer ..... 6600-0713-445

DIN rail kit (includes items 5-11 and hex key) ..... 6600-0855-800

Figure 6-20
Drainage hangers and DIN rail

1. Drawer slide..... 6600-1717-500
2. Drawer mounting bracket*, front (south). 6600-1781-500

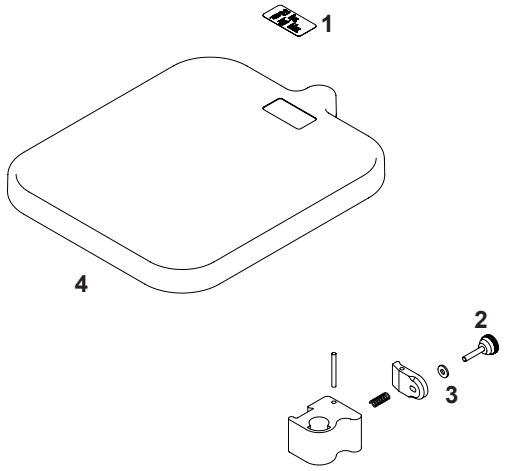



3. Screw, M4 x 12 Button HD ..... 6600-0706-410
4. Screw, M4 x 8 Button HD ..... 6600-0706-408
5. Split ring lock washer, M4 ..... 6600-0713-403
6. Flat washer, M4 ..... 6600-0712-446
7. Storage drawer ..... 6600-1279-500
8. Screw, M5 x 12 Button HD nylock ..... 6600-0715-410
9. Star washer, M5 internal tooth ..... 6600-0713-433
10. Drawer mounting bracket*, rear (north) ..... 6600-1716-500
11. Tray ..... 6600-1718-500

*Note: In order to remove the drawer, you must disassemble the drawer from the drawer slides.

## Figure 6-21
## Storage Drawer

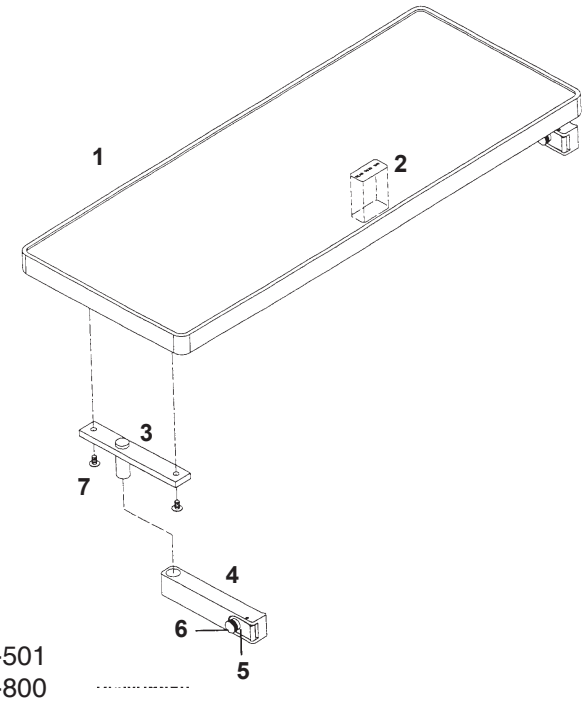
1. Weight limit label ..... 6600-1839-101
2. Knob ..... 0217-5335-300
3. Washer ..... 0202-0095-300




4. Shelf (order item 1 when replacing shelf) 6600-1733-500

Figure 6-22
Instrument shelf (6600-0865-700)

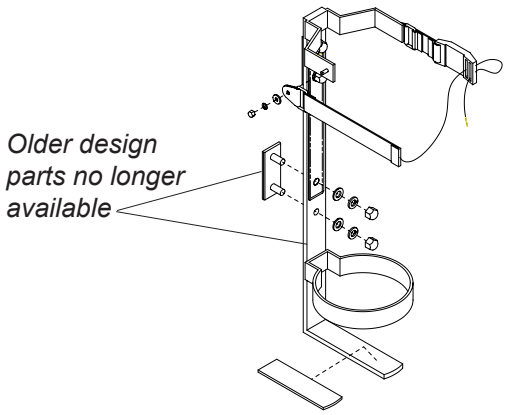
1. Shelf (order item 2 when replacing shelf) 6600-0481-501
2. Weight limit label ..... 6600-1941-101

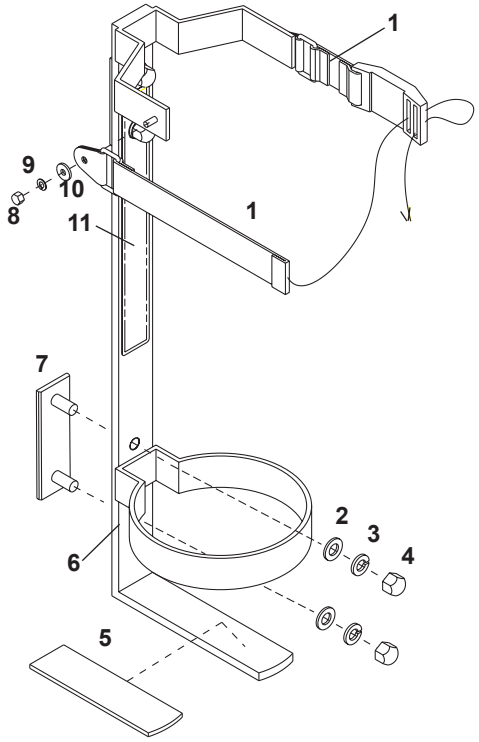



3. Shelf support ..... 6600-0811-501
4. Mounting block assembly ..... 6600-0290-800
5. Washer ..... 0202-0095-300
6. Knob ..... 0217-5335-300
7. Screw, 1/4 - 20 x 5/8..... 6600-0394-400

Figure 6-23
Monitor shelf (6600-0824-800)

1. Tank strap (includes both sides)..... 6600-1869-500
2. Washer, M8 x 8.4 ..... 6600-0712-406

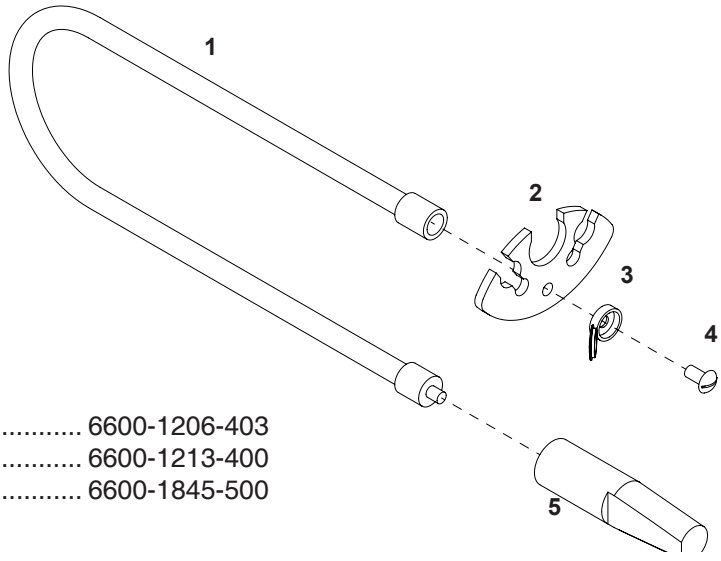



3. Split ring lock washer, M8..... 6600-0713-406
4. Cap nut, M8..... 6600-1215-400
5. Rubber pad..... 6600-1867-500
6. Holder frame..... 6600-1623-500
7. Rail lug assembly ..... 6600-0621-700
8. Cap nut, M4..... 6600-1217-400
9. Split ring lock washer, M4..... 6600-0713-403
10. Washer, M4 x 12mm ..... 6600-0712-446
11. Label..... 6600-2550-100

Figure 6-24
E-Cylinder holder (6600-0836-800)

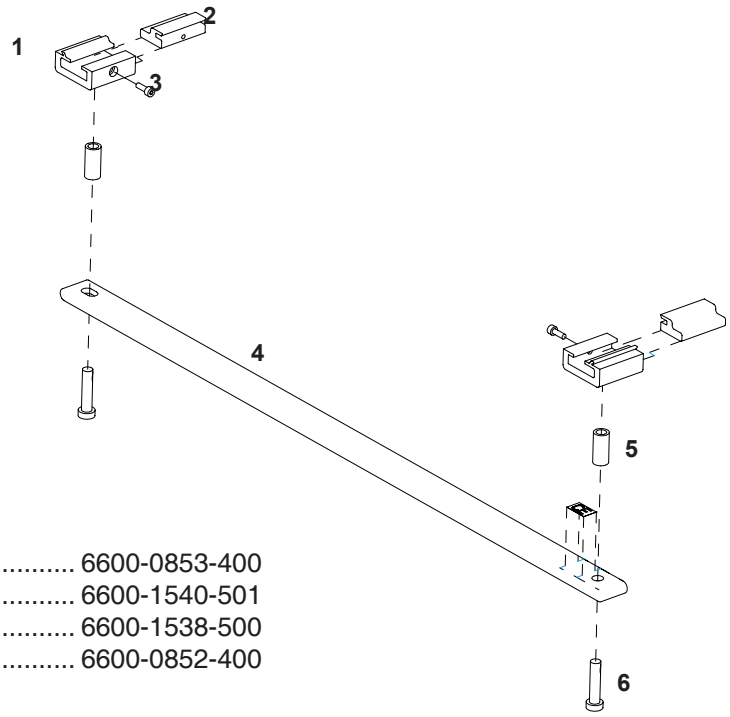
1. Goose neck ..... 6600-1866-500
2. Tubing plate..... 6600-1862-500




3. Screw cover..... 6600-1206-403
4. Screw, pan hd..... 6600-1213-400
5. Mount..... 6600-1845-500

Figure 6-25
Tubing management arm (6600-0837-800)

1. Mounting bracket housing ..... 6600-1451-500
2. Mounting bracket lock..... 6600-1542-500




3. Screw, M4 x12..... 6600-0853-400
4. DIN rail..... 6600-1540-501
5. Spacer ..... 6600-1538-500
6. Screw, M8 x 35 Skt Hd..... 6600-0852-400

Figure 6-26
Dovetail mount DIN rail (6600-0659-803)

1. Dovetail rail..... 6600-1946-500
2. Bottom end cap ..... 6600-0366-500
3. Screw, 4-40 x 1/2, Skt. Hd..... 0144-2117-208

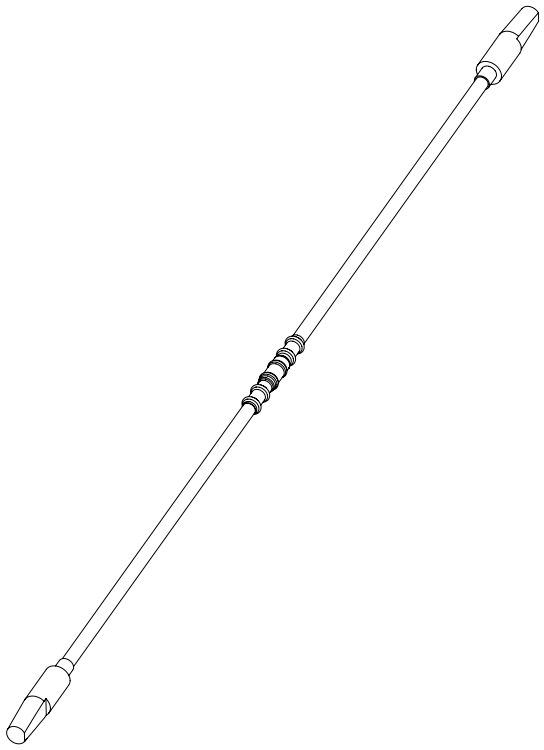
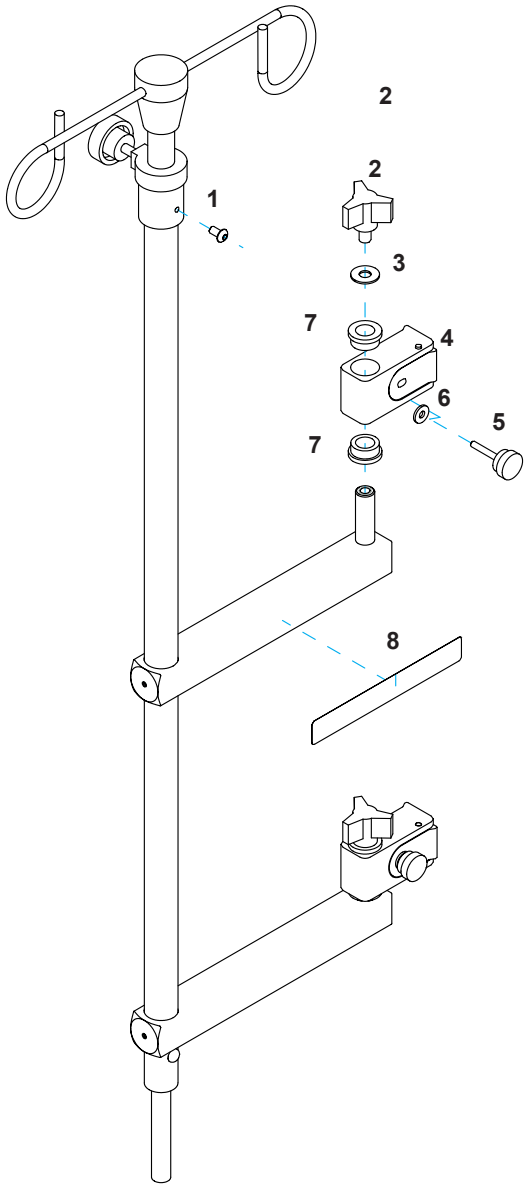
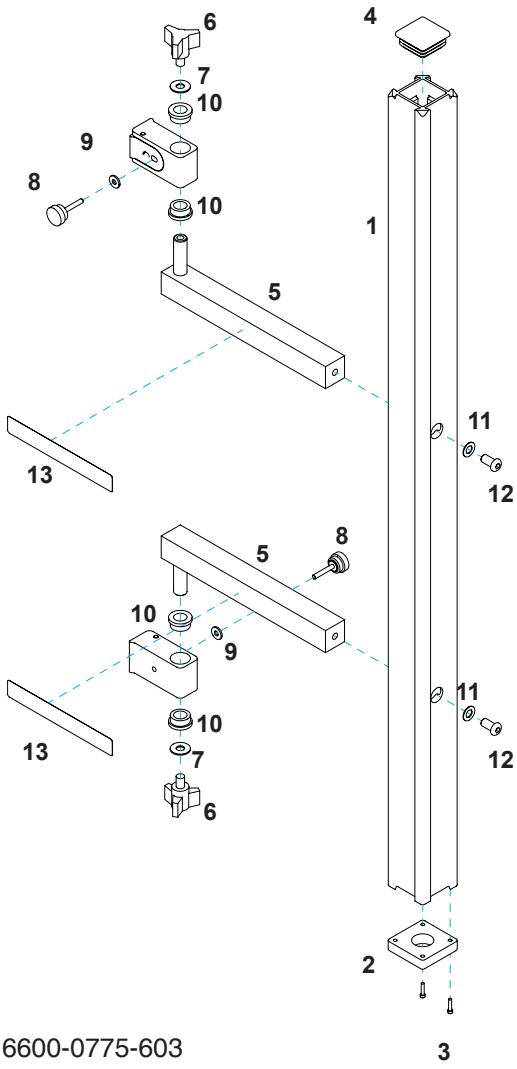


Figure 6-27
Silo Support Assembly (6600-0853-800)




| | | |
|---|---|---|
| 1. | Screw, 10-32 Button Hd. | 6600-1258-400 |
| 2. | Knob | 6600-0020-400 |
| 3. | Teflon washer | 6600-1238-400 |
| 4. | Bracket Assembly (includes items 5&6) | 6700-0080-800 |
| 5. | Knob, block | 0217-5335-300 |
| 6. | Washer | 0202-0095-300 |
| 7. | Bushing | 6700-0030-400 |
| 8. | Label | 6600-2497-101 |

Figure 6-28
Rotating I.V. Pole Assembly (6600-0851-800)



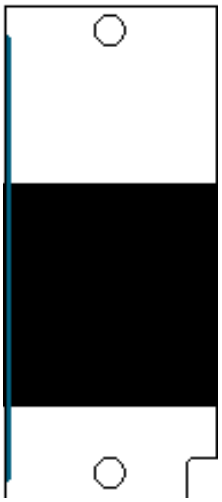

| | | |
|---|---|---|
| 4. | Top end cap | 6600-1946-500 |
| 5. | Swing arm assembly | 6600-1516-700 |
| 6. | Knob | 6600-0020-400 |
| 7. | Teflon washer | 6600-1238-400 |
| 8. | Knob, block | 0217-5335-300 |
| 9. | Washer | 0202-0095-300 |
| 10. | Bushing | 6700-0030-400 |
| 11. | Lock washer, int. tooth | 0202-3418-300 |
| 12. | Screw, 5/16 - 18 Skt. Hd | 6600-0787-400 |
| 13. | Label | 6600-2497-102 |

Figure 6-29
Dovetail extension (6600-0852-800)

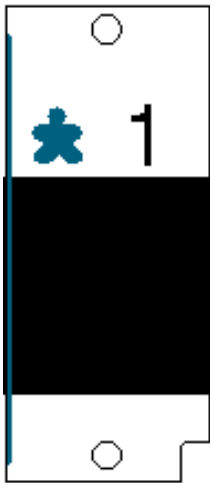
## 6.2 Accessories

| | |
|---|---|
| Power cord, North America | 6600-0775-603 |
| Power cord, Europe | 6600-0574-612 |
| Touch-up paint, light gray (Munsell .16GY8.56-0.44 chroma) | 6600-0714-200 |
| Patient probe, disposable (10 pcs.) | 6600-0873-700 |
| Patient probe, disposable (50 pcs.) | 6600-0874-700 |
| Patient probe, reusable | 6600-0875-700 |
| Porthole wristlets (8 pcs.) | 6600-0211-850 |
| Air intake filter (10 pcs.) | 6600-0207-850 |
| Fabric hood cover | 6600-0846-800 |
| Internal shelf- | |
| front right(SE) and rear left (NW) | 6600-1793-500 |
| rear left (NE) and front right (SW) | 6600-1794-500 |
| Scale | M1125056 |
| Oscillator port cover | 6600-0838-800 |

## 6.3 Labels

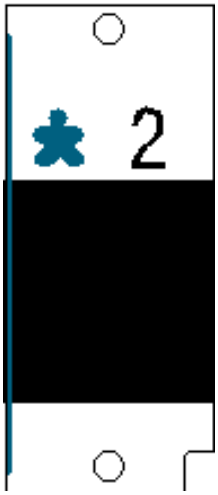


6600-2325-101



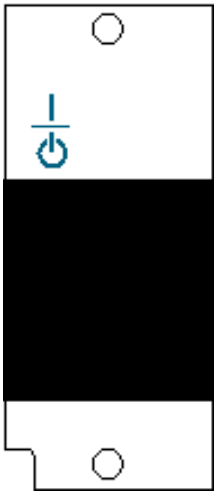

6600-2325-102

6600-2325-109




6600-2325-107

6600-2325-104

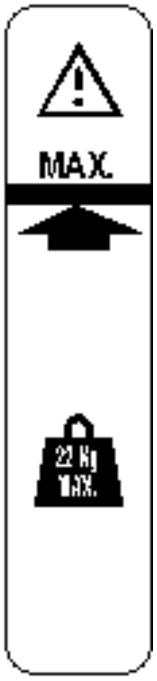


6600-2325-108

6600-2343-101

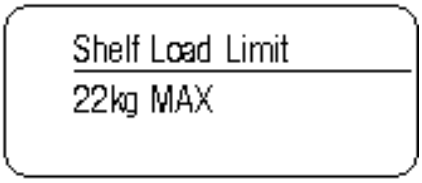
6600-2426-100


6600-1839-101




6600-2347-101


6600-2384-101



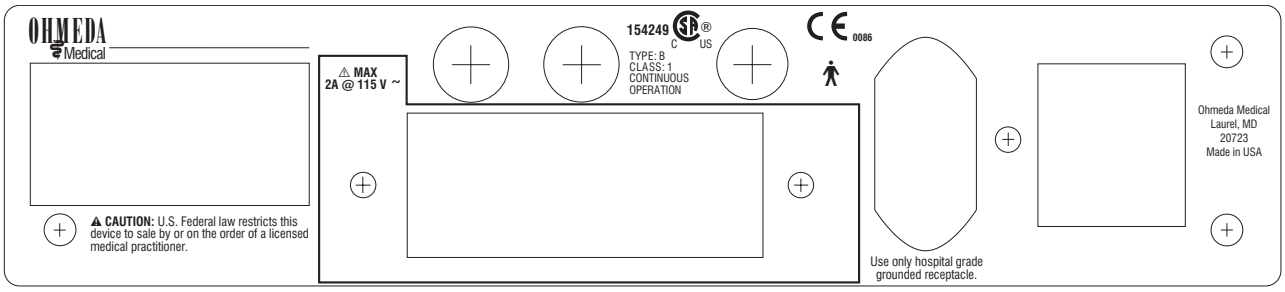

6600-1941-101


| | |
|---|---|
| Clear | 6600-2382-102 |
| Opaque | 6600-2402-102 |

**⚠ WARNING:**

**Oxygen concentrations may vary with fan speed. Use ONLY a servo control oxygen delivery system.**

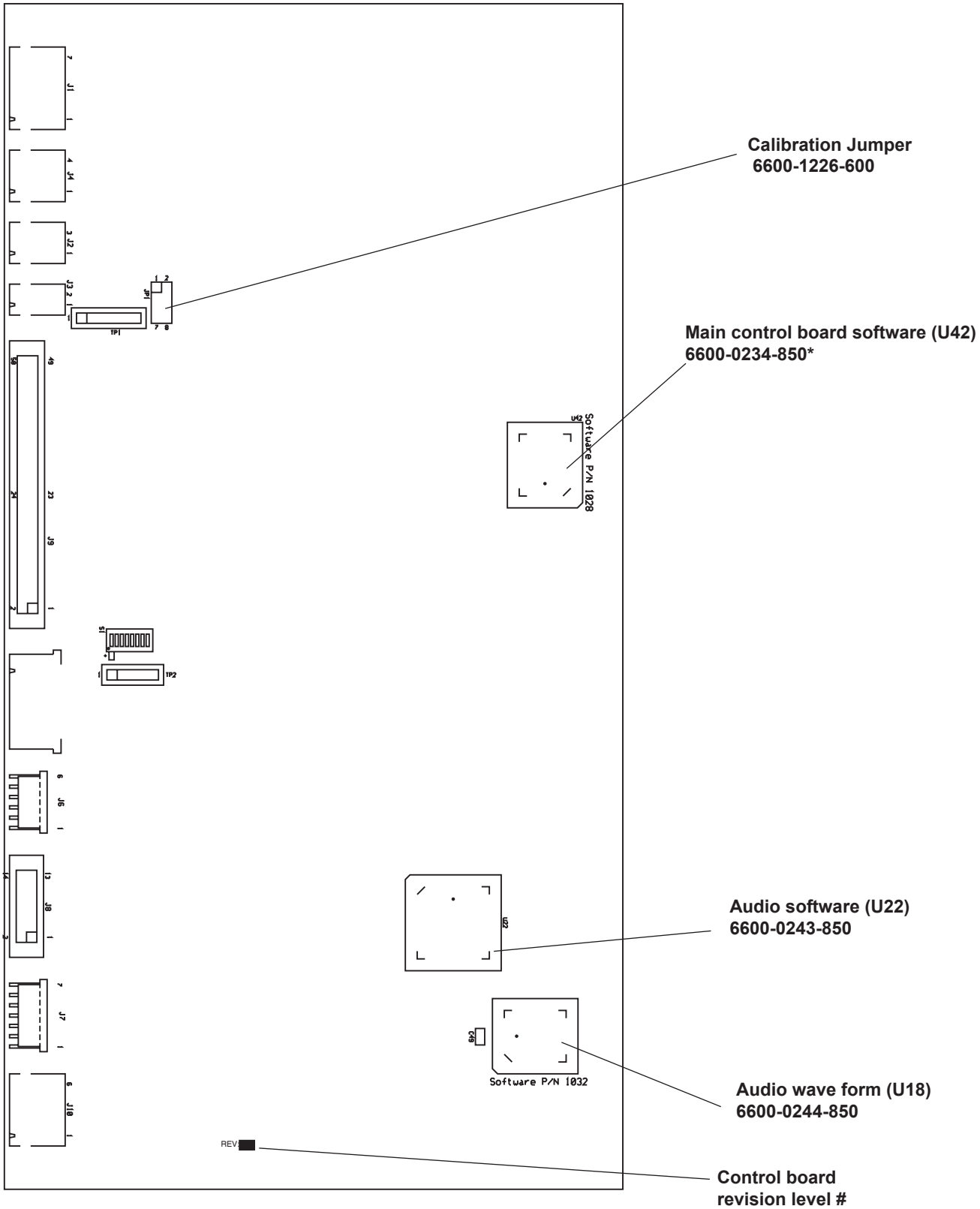
| | |
|---|---|
| English | 6600-2341-101 |
| French | 6600-2341-102 |
| Spanish | 6600-2341-103 |
| German | 6600-2341-104 |
| Italian | 6600-2341-105 |
| Dutch | 6600-2341-110 |




6600-2345-101

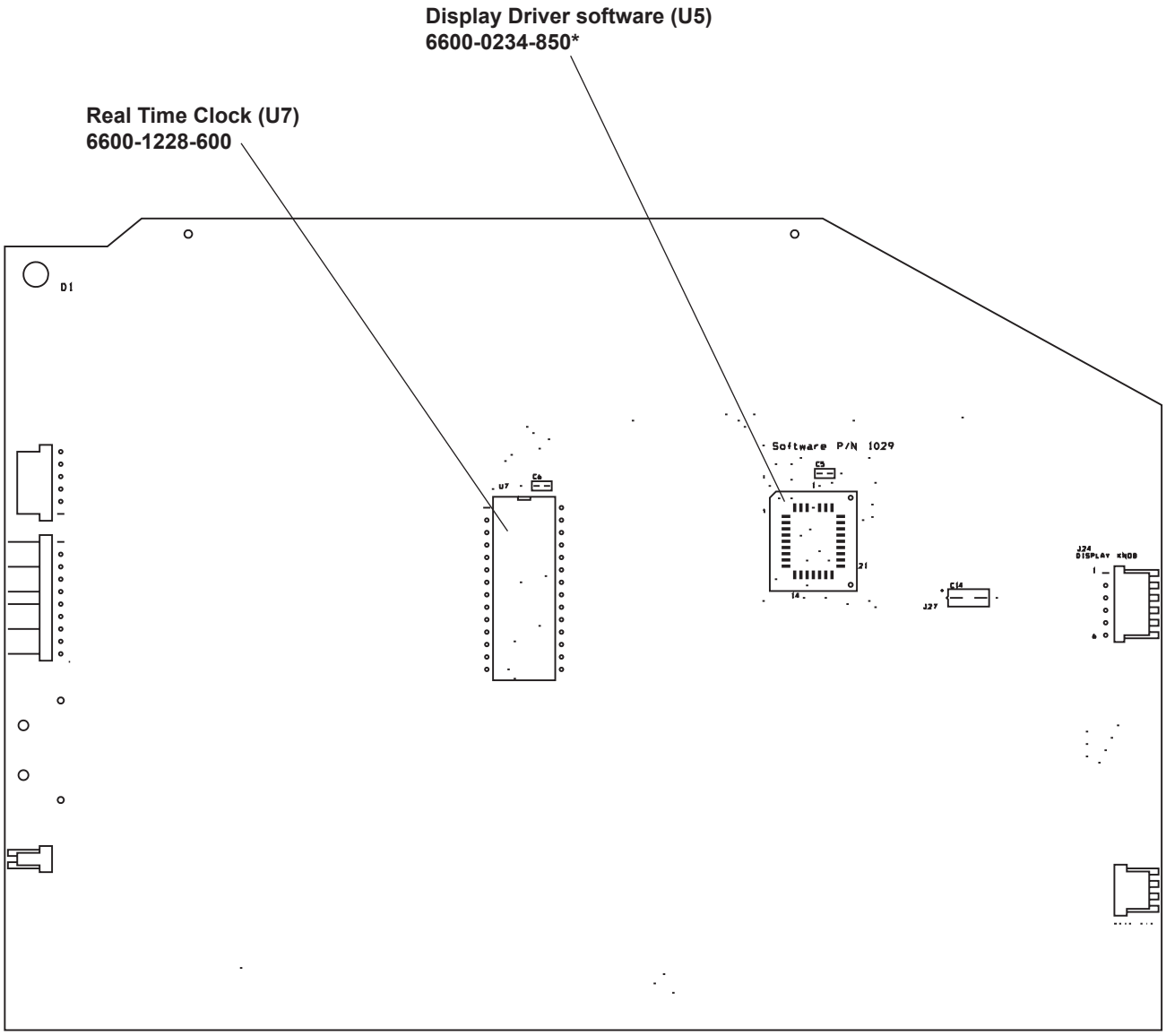
| | |
|---|---|
| Rating label 115V | 6600-2345-101 |
| Rating label 220V | 6600-2345-102 |
| Rating label 100V | 6600-2345-103 |

## 6.4 PCB Layouts




*Kit includes display driver software.

Figure 6-30
Control Board (6600-0212-850)




*Kit includes main control board software.

Figure 6-31
Display Driver Board (6600-0215-850)

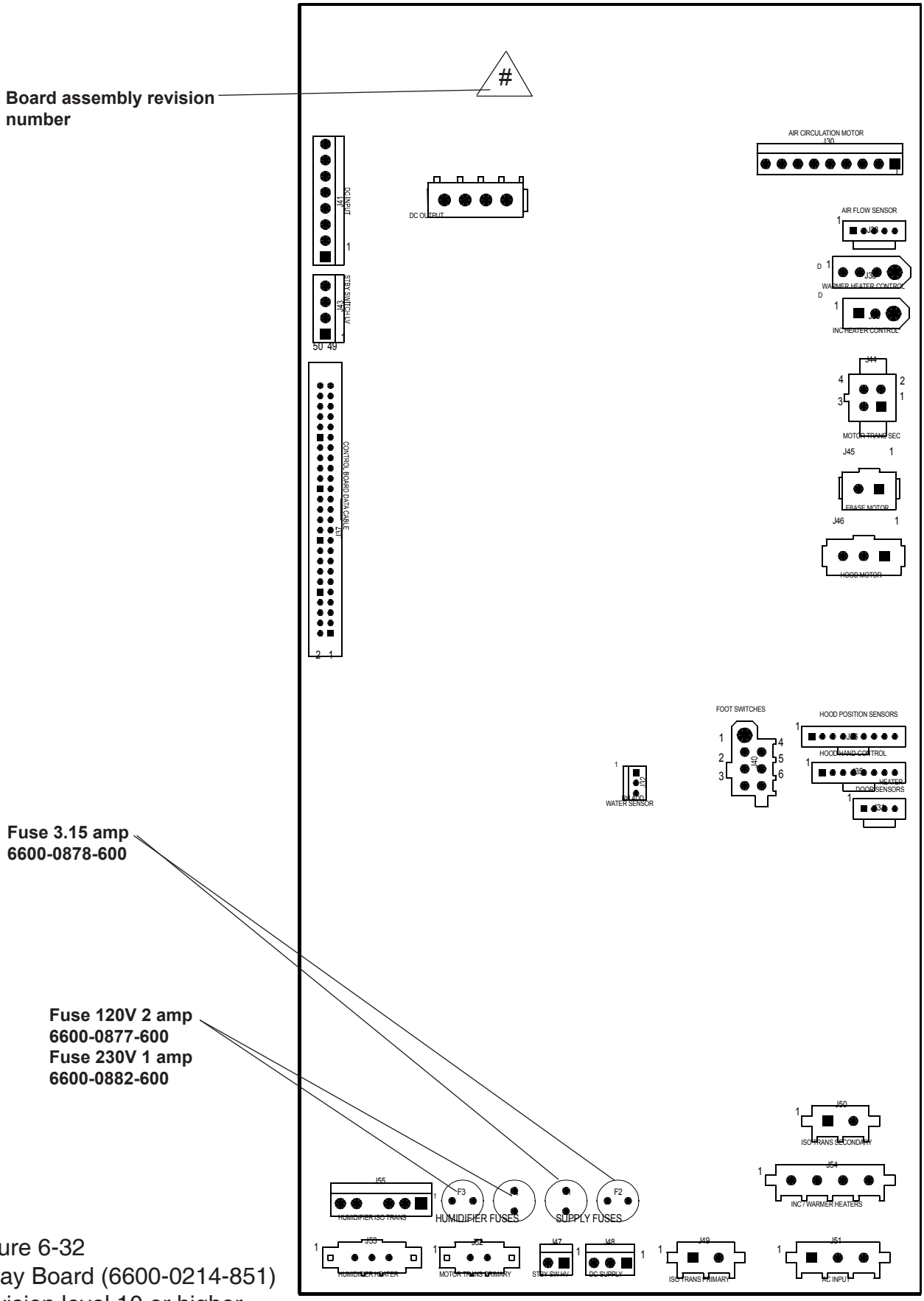



Figure 6-32
Relay Board (6600-0214-851)
Revision level 10 or higher

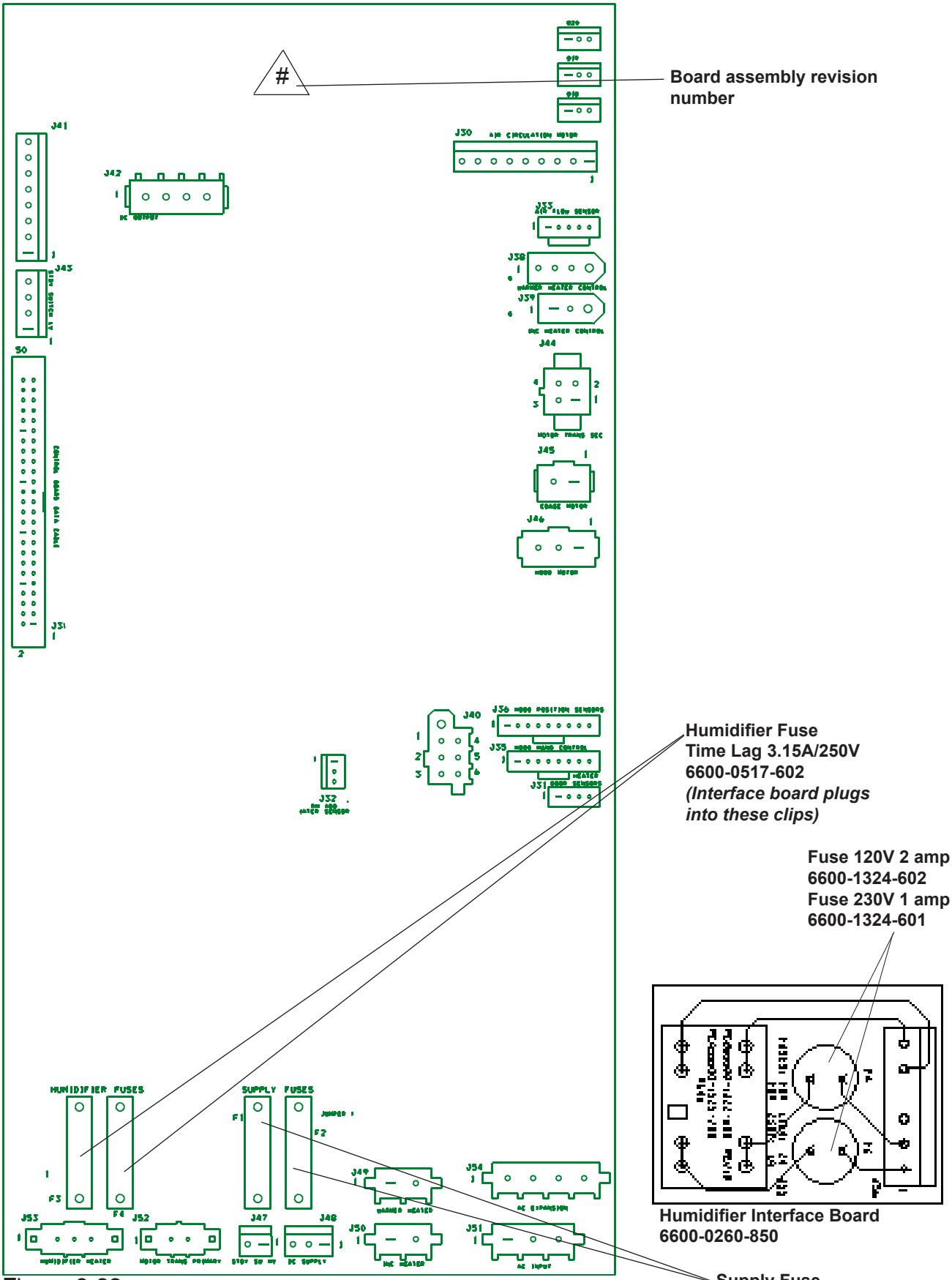



Figure 6-33
Relay Board (6600-0214-851)
Revision level 9 or lower

## 6.5 Wiring Diagrams

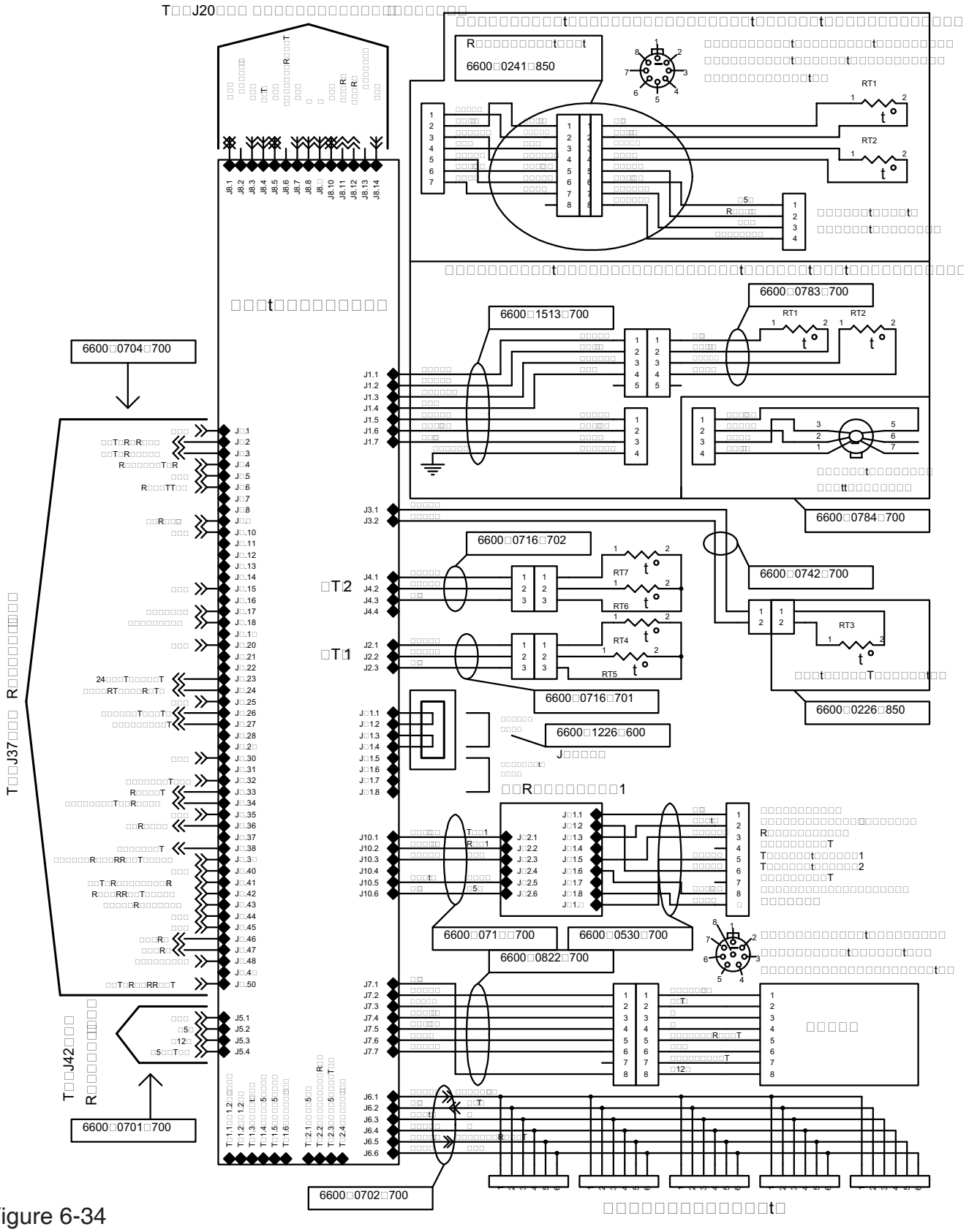
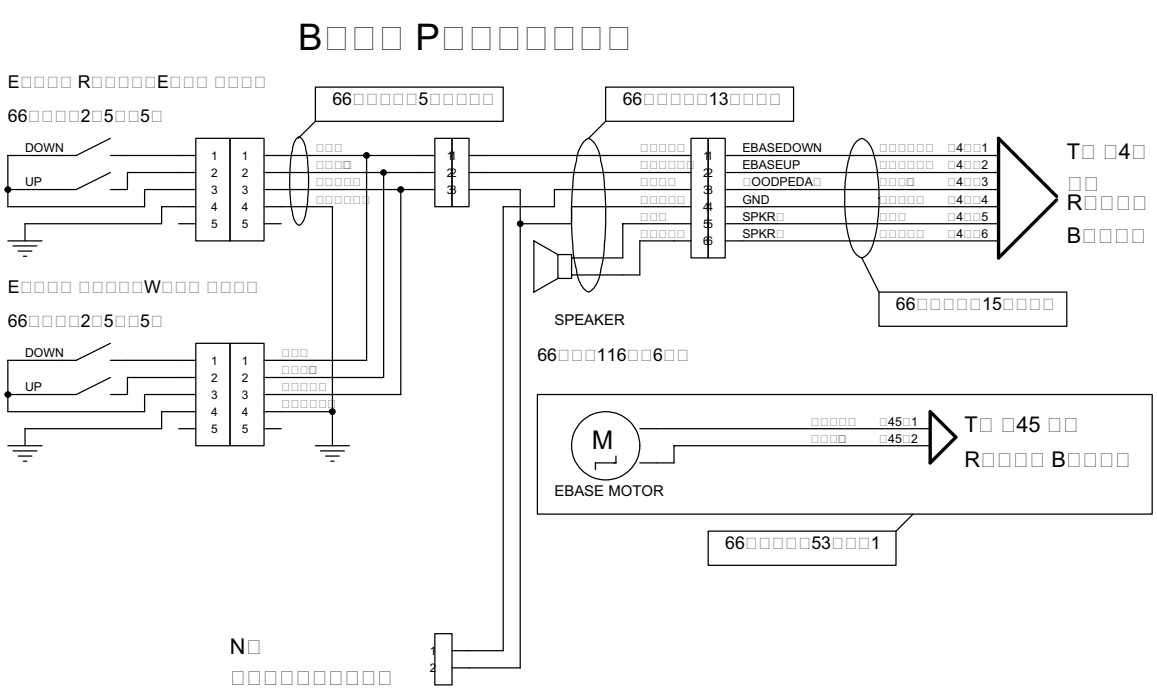
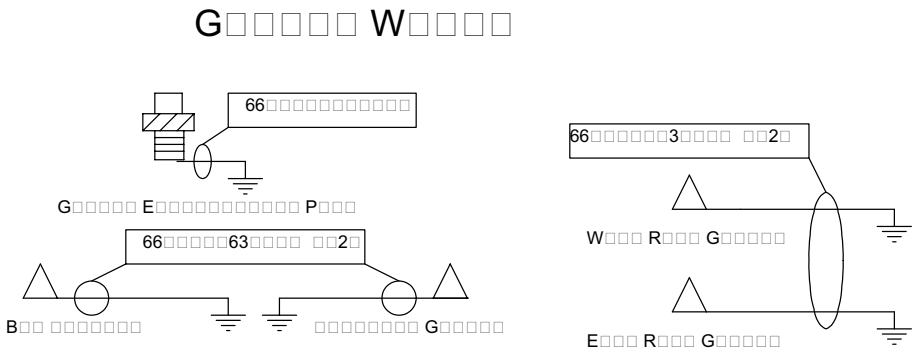



Figure 6-34
Wiring Diagram Control Board



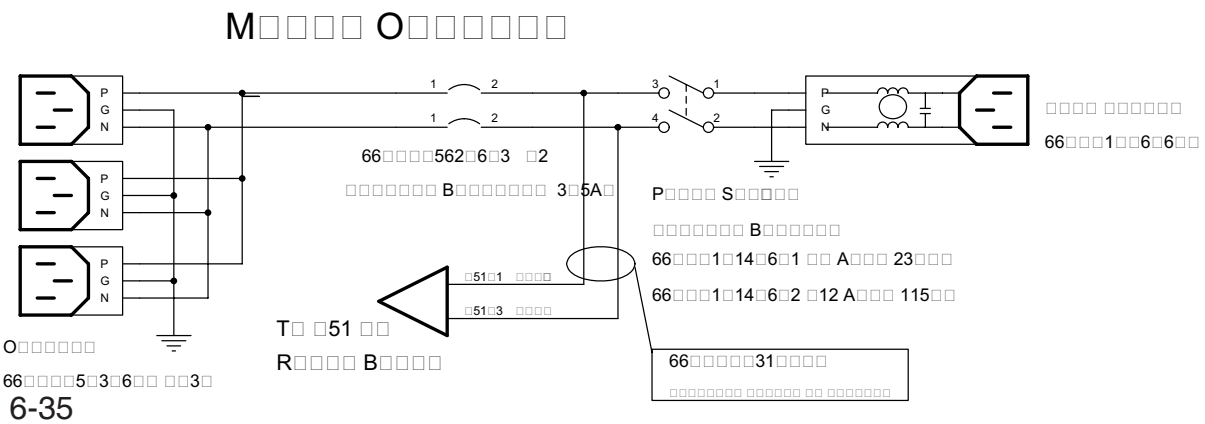




Figure 6-35
Wiring Diagram Elevating Base

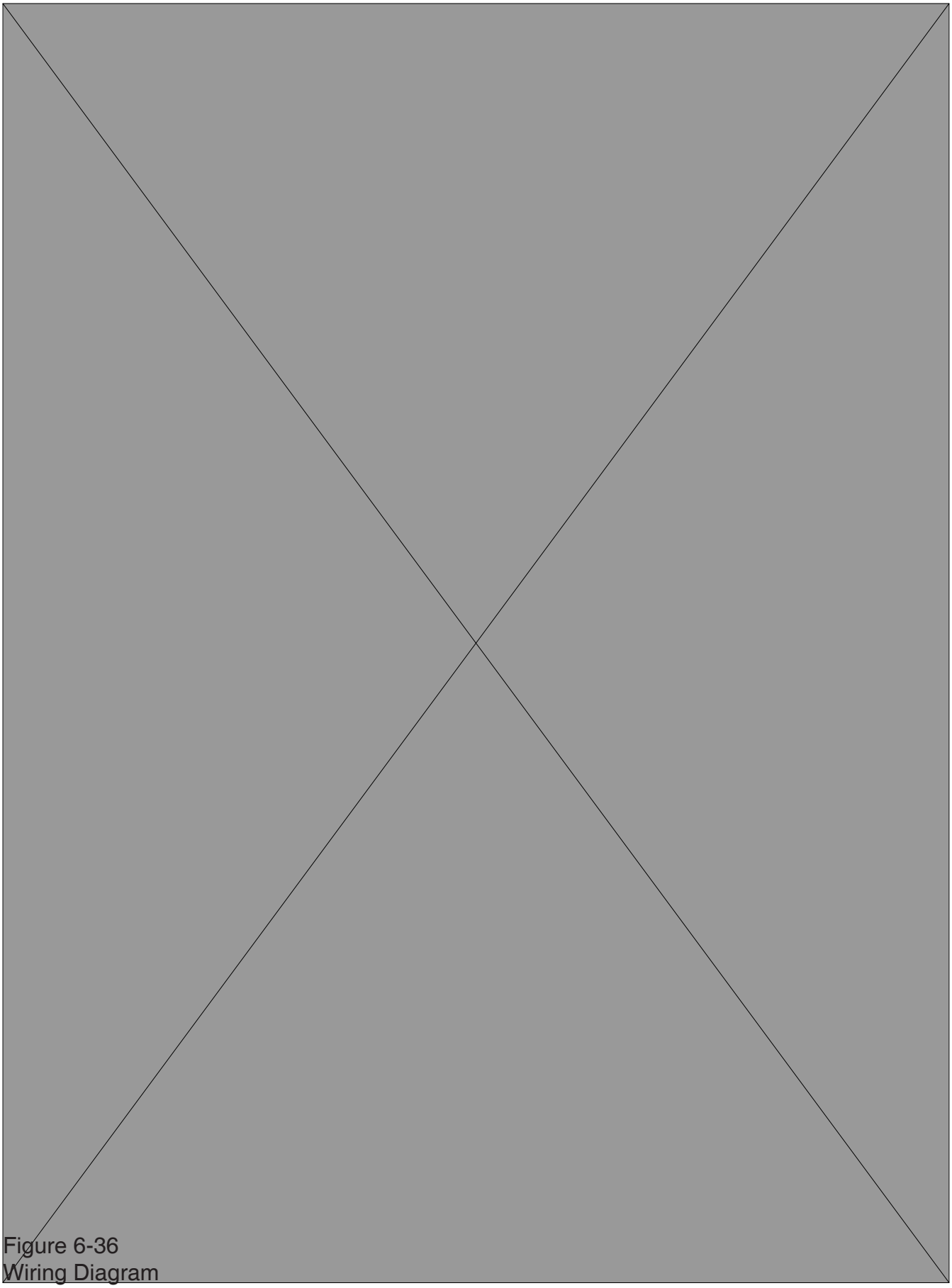


Figure 6-36
Wiring Diagram
Electrical Enclosure

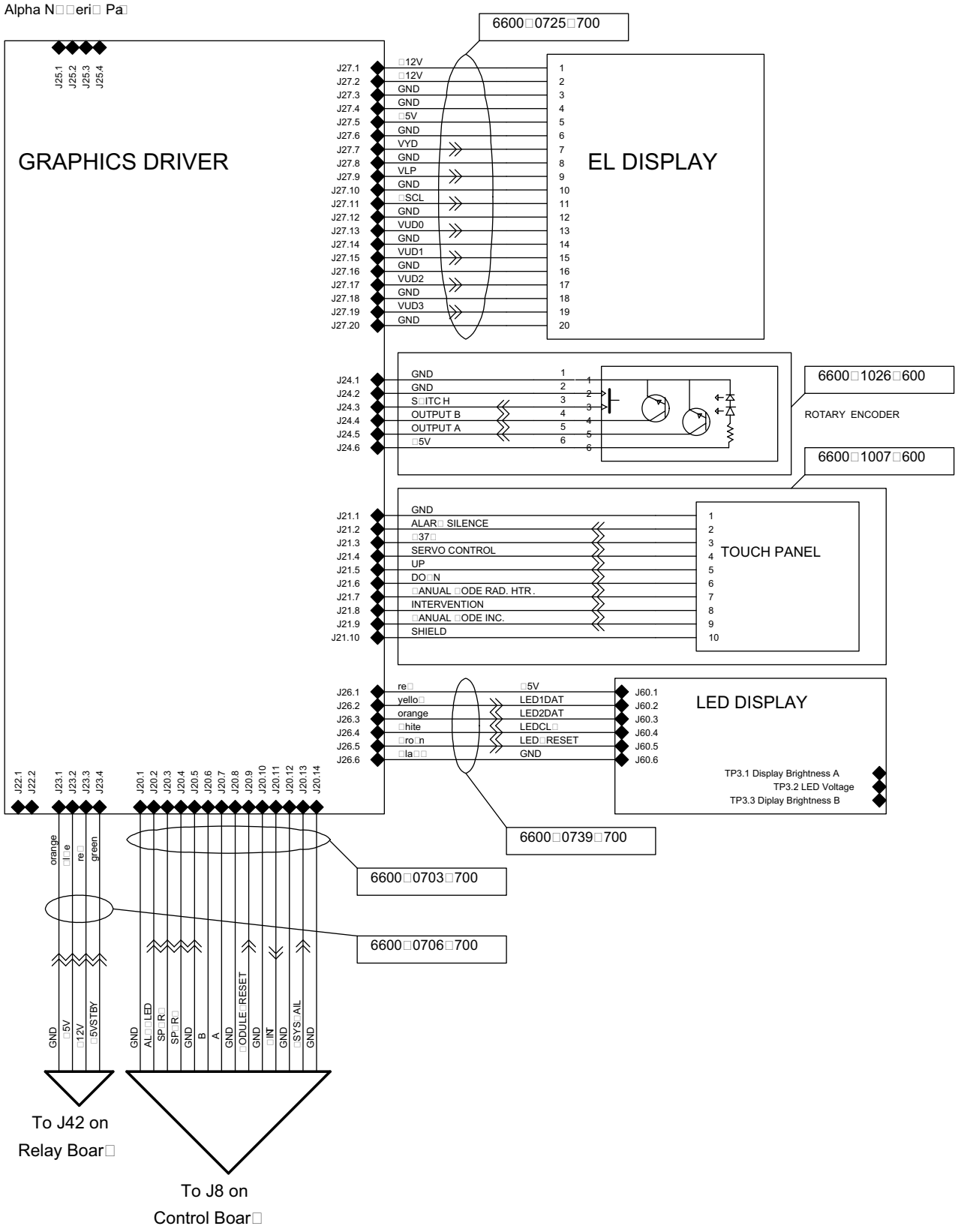



Figure 6-37
Wiring Diagram
Graphics Display

## Incubator Heater □ith Isolation Transformer

## Re□ision 10 and abo□e Relay Boards

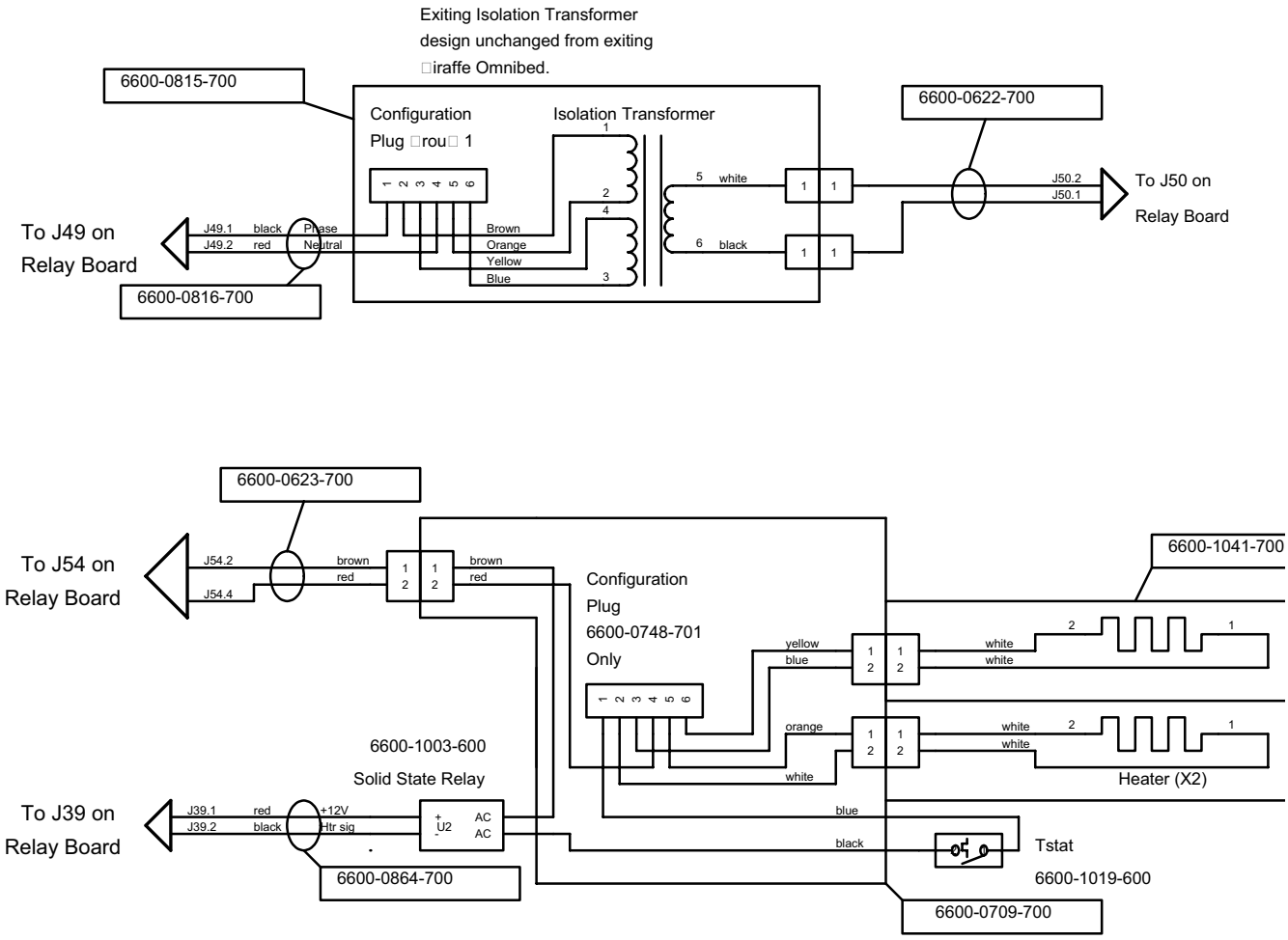



Figure 6-38
Wiring Diagram
Incubator Heater
Relay Board rev. level 10 or higher

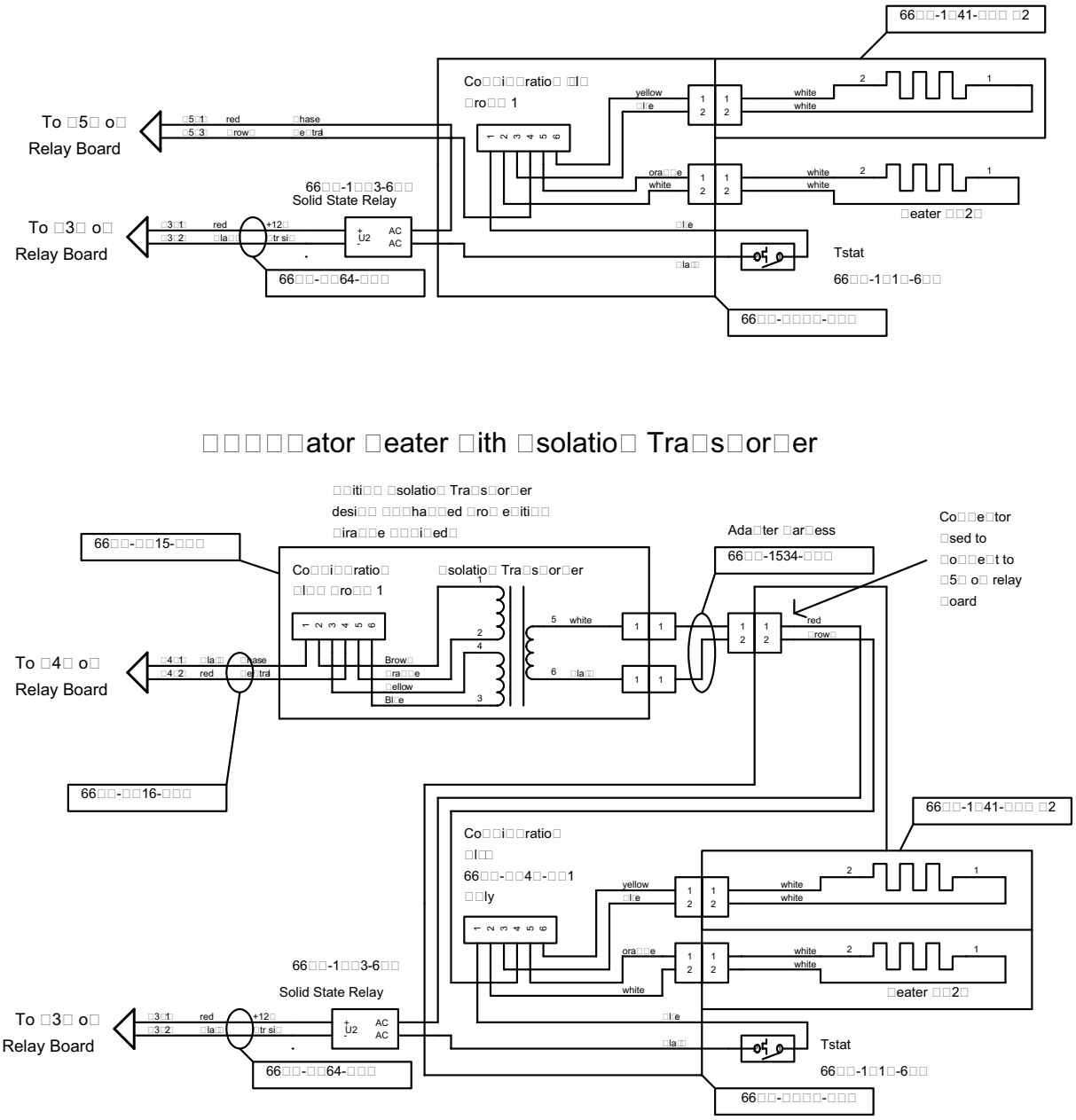
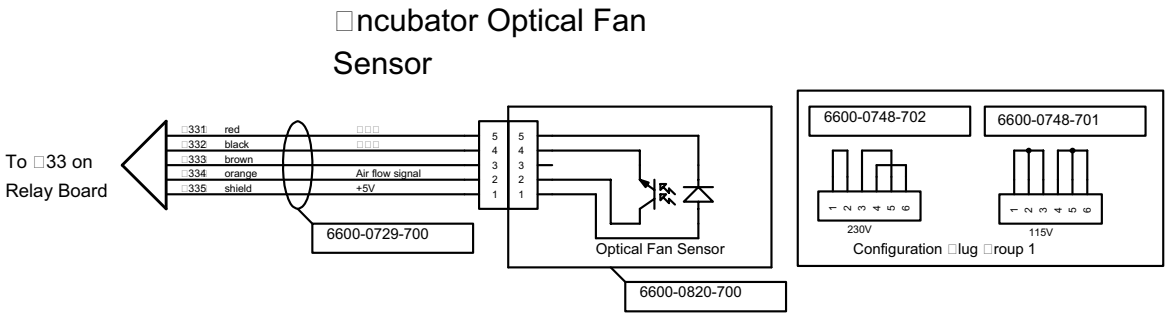
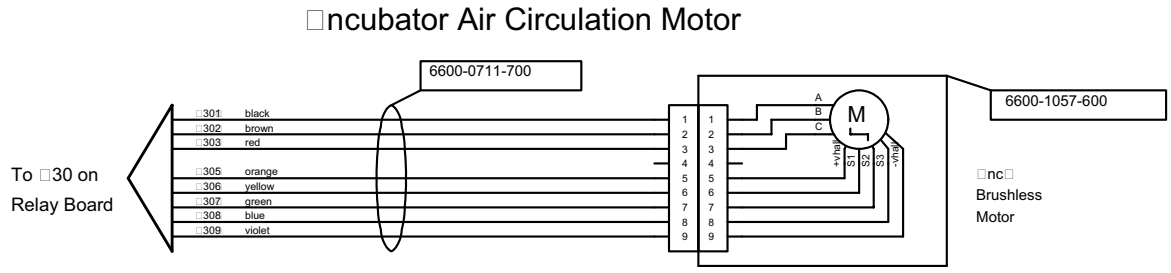



Figure 6-39
Wiring Diagram
Incubator Heater
Relay Board rev. level 9 or lower



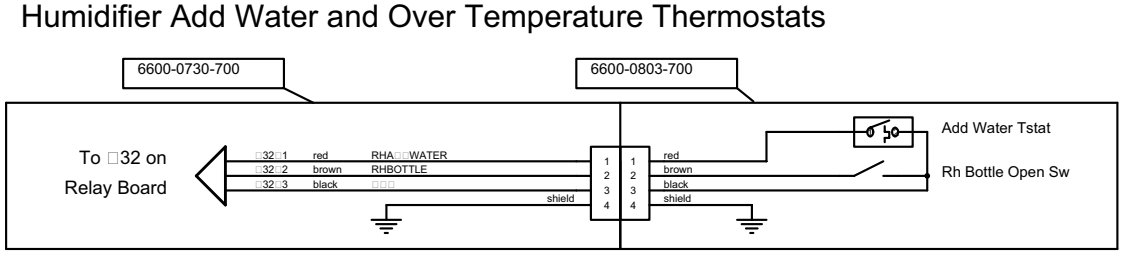




Figure 6-40
Wiring Diagram
Incubator Fan and Sensor

## □u□i□ifie□ □eate□ □it□ □solation T□ansfo□□e□

## Re□ision 10 an□ a□o□e Relay Boa□□s

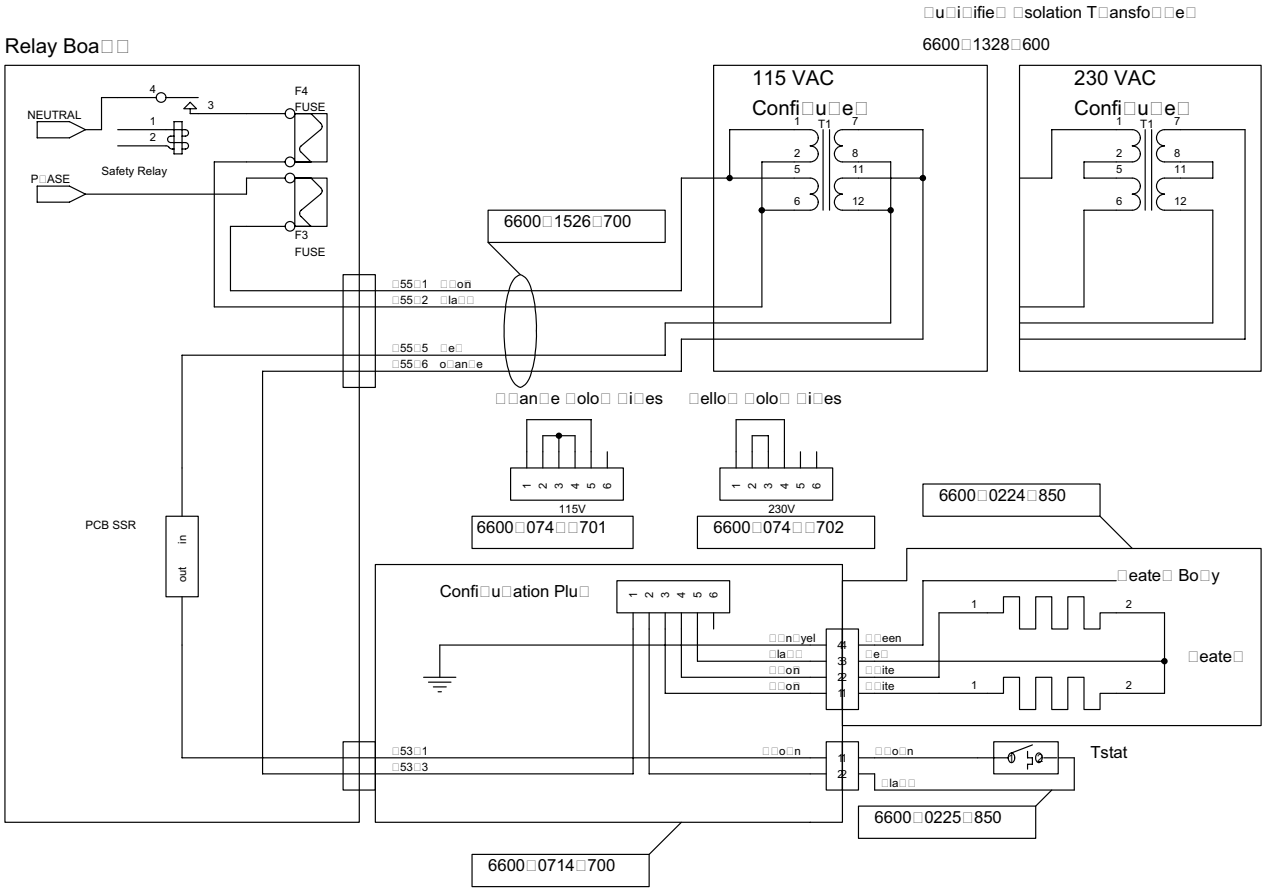
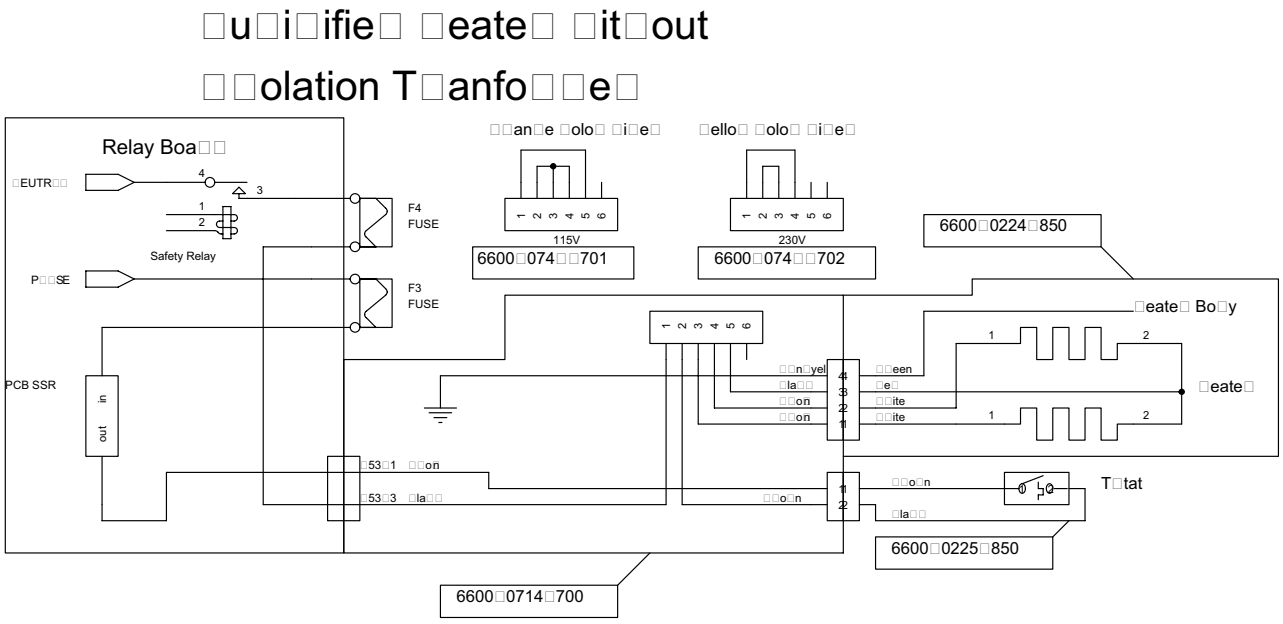



Figure 6-41
Wiring Diagram Servo Humidifier
Relay Board rev. level 10 or higher



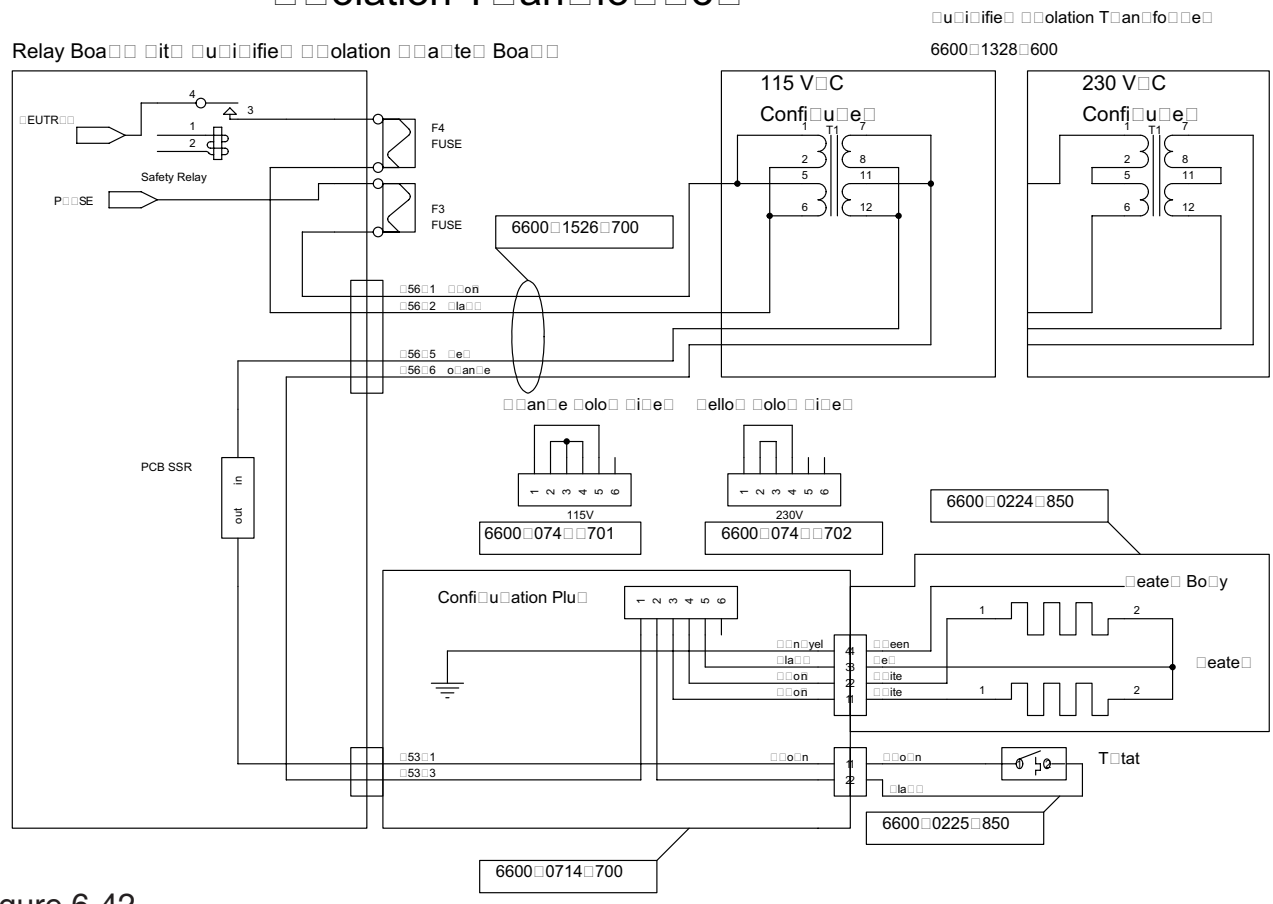




Figure 6-42
Wiring Diagram Servo Humidifier
Relay Board rev. level 9 or lower

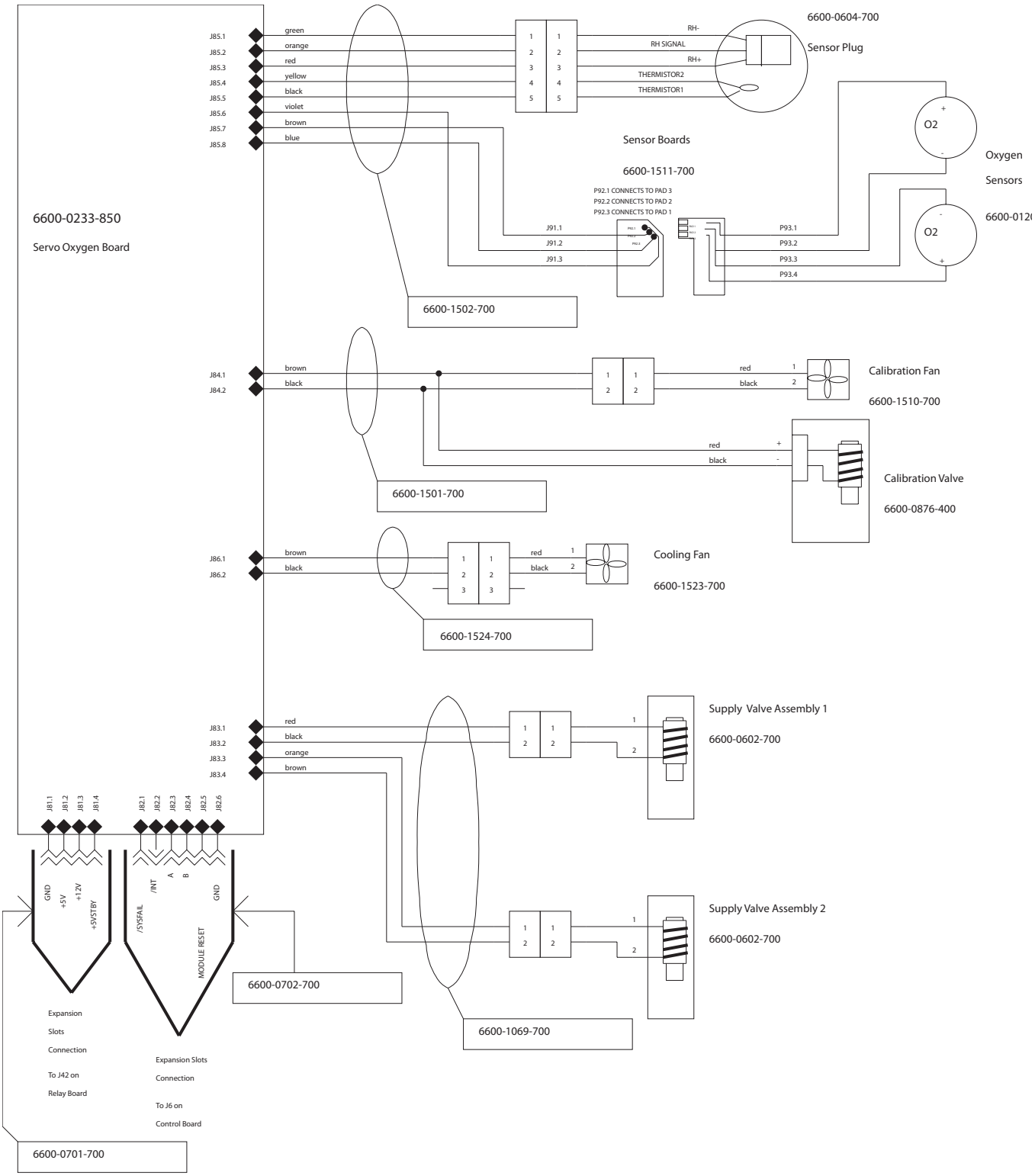



Figure 6-43
Wiring Diagram Servo Control Oxygen

## Compartment and Skin Probe Characteristics

| Temp °C | Res. Ohms | Temp °C | Res. Ohms | Temp °C | Res. Ohms | Temp °C | Res. Ohms |
|---|---|---|---|---|---|---|---|
| 29.9 | 8071.2 | 34.0 | 6778.2 | 38.1 | 5716.0 | 42.2 | 4839.5 |
| 30.0 | 8036.5 | 34.1 | 6749.8 | 38.2 | 5692.5 | 42.3 | 4820.1 |
| 30.1 | 8002.0 | 34.2 | 6721.5 | 38.3 | 5669.2 | 42.4 | 4800.8 |
| 30.2 | 7967.6 | 34.3 | 6693.3 | 38.4 | 5646.0 | 42.5 | 4781.6 |
| 30.3 | 7933.4 | 34.4 | 6665.3 | 38.5 | 5622.9 | 42.6 | 4762.5 |
| 30.4 | 7899.4 | 34.5 | 6637.3 | 38.6 | 5599.9 | 42.7 | 4743.5 |
| 30.5 | 7865.6 | 34.6 | 6609.6 | 38.7 | 5577.0 | 42.8 | 4724.5 |
| 30.6 | 7831.9 | 34.7 | 6581.9 | 38.8 | 5554.3 | 42.9 | 4705.7 |
| 30.7 | 7798.3 | 34.8 | 6554.4 | 38.9 | 5531.6 | 43.0 | 4686.9 |
| 30.8 | 7765.0 | 34.9 | 6527.0 | 39.0 | 5509.0 | 43.1 | 4668.3 |
| 30.9 | 7731.7 | 35.0 | 6499.8 | 39.1 | 5486.6 | 43.2 | 4649.7 |
| 31.0 | 7698.7 | 35.1 | 6472.6 | 39.2 | 5464.2 | 43.3 | 4631.2 |
| 31.1 | 7665.8 | 35.2 | 6445.7 | 39.3 | 5441.9 | 43.4 | 4612.7 |
| 31.2 | 7633.1 | 35.3 | 6418.8 | 39.4 | 5419.8 | 43.5 | 4594.4 |
| 31.3 | 7600.5 | 35.4 | 6392.1 | 39.5 | 5397.7 | 43.6 | 4576.1 |
| 31.4 | 7568.1 | 35.5 | 6365.4 | 39.6 | 5375.8 | 43.7 | 4558.0 |
| 31.5 | 7535.9 | 35.6 | 6339.0 | 39.7 | 5354.0 | 43.8 | 4539.9 |
| 31.6 | 7503.8 | 35.7 | 6312.6 | 39.8 | 5332.2 | 43.9 | 4521.9 |
| 31.7 | 7471.8 | 35.8 | 6286.4 | 39.9 | 5310.6 | 44.0 | 4503.9 |
| 31.8 | 7440.0 | 35.9 | 6260.3 | 40.0 | 5289.0 | 44.1 | 4486.1 |
| 31.9 | 7408.4 | 36.0 | 6234.3 | 40.1 | 5267.6 | 44.2 | 4468.3 |
| 32.0 | 7376.9 | 36.1 | 6208.4 | 40.2 | 5246.2 | 44.3 | 4450.6 |
| 32.1 | 7345.6 | 32.2 | 6182.7 | 40.3 | 5225.0 | 44.4 | 4433.0 |
| 32.2 | 7314.4 | 36.3 | 6157.0 | 40.4 | 5203.9 | 44.5 | 4415.5 |
| 32.3 | 7283.4 | 36.4 | 6131.5 | 40.5 | 5182.8 | 44.6 | 4398.1 |
| 32.4 | 7252.5 | 36.5 | 6106.2 | 40.6 | 5161.9 | 44.7 | 4380.7 |
| 32.5 | 7221.8 | 36.6 | 6080.9 | 40.7 | 5141.0 | 44.8 | 4363.4 |
| 32.6 | 7191.2 | 36.7 | 6055.8 | 40.8 | 5120.2 | 44.9 | 4346.2 |
| 32.7 | 7160.8 | 36.8 | 6030.7 | 40.9 | 5099.6 | 45.0 | 4329.1 |
| 32.8 | 7130.5 | 36.9 | 6005.8 | 41.0 | 5079.0 | | |
| 32.9 | 7100.4 | 37.0 | 5981.1 | 41.1 | 5058.5 | | |
| 33.0 | 7070.4 | 37.1 | 5956.4 | 41.2 | 5038.2 | | |
| 33.1 | 7040.5 | 37.2 | 5931.8 | 41.3 | 5017.9 | | |
| 33.2 | 7010.8 | 37.3 | 5907.4 | 41.4 | 4997.7 | | |
| 33.3 | 6981.3 | 37.4 | 5883.1 | 41.5 | 4977.6 | | |
| 33.4 | 6951.8 | 37.5 | 5858.9 | 41.6 | 4957.6 | | |
| 33.5 | 6922.6 | 37.6 | 5834.8 | 41.7 | 4937.7 | | |
| 33.6 | 6893.4 | 37.7 | 5810.8 | 41.8 | 4917.9 | | |
| 33.7 | 6864.4 | 37.8 | 5786.9 | 41.9 | 4898.1 | | |
| 33.8 | 6835.5 | 37.9 | 5763.1 | 42.0 | 4878.5 | | |
| 33.9 | 6806.8 | 38.0 | 5739.5 | 42.1 | 4858.9 | | |

# Specifications

## Power Requirements

10.5 A @100v ~, 50/60 Hz
9 A @115v ~, 50/60 Hz
4.5 A @ 220v ~, 50/60 Hz
4.5 A @ 230v ~, 50/60 Hz
4.5 A @ 240v ~, 50/60 Hz

Inrush for 1/2 cycle current < 80 A

Accessory outlets
2 A @100v ~, 50/60 Hz
2 A @115v ~, 50/60 Hz
1 A @ 220v ~, 50/60 Hz
1 A @ 230v ~, 50/60 Hz
1 A @ 240v ~, 50/60 Hz

## Standards

Designed to meet requirements of
IEC 601-2-19 (Amendment 1) 1991
IEC 601-1
IEC 601-1-2
21 CFR CH-1, section 1020.30 (n)

## Operating Environment

| | |
|---|---|
| Temperature | 20 to 30ºC |
| Humidity | 10 to 95% Non-condensing relative humidity |
| Pressure | 50 to 106 kPa |

## Storage Conditions

| | |
|---|---|
| Temperature | -25 to 60ºC |
| Humidity | 5 to 95% Non-condensing relative humidity |
| Pressure | 50 to 106 kPa |

## User Control Settings

| | |
|---|---|
| Patient control temperature | 35-37.5ºC in 0.1ºC increments |
| Air control temperature | 20-39ºC in 0.1 increments |
| Radiant heat power | 0-100% in 5% increments |
| Humidity | |
| Servo- % relative humidity | 30-95% in 5% increments |

## Alarms

| | |
|---|---|
| High Air Temp | 1.5ºC over AST (air set temperature) |
| Low Air Temp | 3.0ºC under AST |
| Baby Hot | 1.0ºC* over BST (baby set temperature) |
| Baby Cold | 1.0ºC* under BST |
| Fan Failure | Failure of blower system |
| Air Temp >38ºC | >38ºC for AST ≤37ºC |
| Air Temp >40ºC | >40ºC air temperature for AST >37ºC |
| Air Probe Failure | Compartment air probe failure |
| Air Probe Disconnect | Disconnection of compartment air probe |
| Power failure | Power switch on but no power |
| System failure | Non-recoverable system failure |
| Add Water | Humidifier water level low |
| Scale | |
| Weight Exceeds Maximum | Greater than 8kg load (visual only) |
| Scale Failure | Detectable system failure (visual only) |

* Can be re-set on the Service screen to 0.5ºC

## Performance

### System

| | | |
|---|---|---|
| Control accuracy | +/- 1.0°C | Control Temp vs. Avg. Incubator Temp with level bed in manual mode. |
| Variability | +/- 0.5°C | Incubator Temp vs. Avg. Incubator Temp |
| Warm-up time | < 50 min. | Time to reach 38.5°C control temp from cold start in 25ºC 50% RH room ambient |
| Patient measurement 42°C accuracy | +/- 0.3°C @ 30°C to | Accuracy of patient temperature measurement system within range of temperature measurement |
| Air Velocity | ≤ 10 cm/sec | In Whisper Quiet™ mode, velocity measured 10 cm above the center of the mattress, closed bed |
| $CO_2$ level | 0.3% | Maximum $CO_2$ level measured per IEC 601-2-19, clause 105.1 |
| Sound level | ≤ 50 dbA | In Whisper Quiet™ mode, sound level measured 10 cm above the center of the matress |

### Humidity

| | | |
|---|---|---|
| Servo control accuracy | +/- 10 % of full range for settings up to 85%; minimum 75% for settings >85% | Humidity control setting vs. average humidity at 10 cm above center of bed |
| Ramp-up time | <50 minutes | Time to reach 75% RH with a 39°C control temp from cold start in 25°C 50% RH room ambient |
| Operating time without refill | >12 hours | Operational time at 65% RH control setting with one filling of reservoir in 25°C 50% RH room ambient |

## Servo Control Oxygen

| | |
|---|---|
| Control range | 21 to 65% in 1% increments |
| Resolution | 1 % |
| Accuracy | 5%* |
| Rise time | 10 minutes from 21% to 5% below set point |
| Recovery from opening porthole | 5 minutes from closing porthole to 5% below set point |

*Over the life of the sensor

## Mechanical Specifications

| | |
|---|---|
| Height | 147 cm |
| Width: | 66 cm |
| Depth: | 114 cm |
| Weight: | 138 kg |

### Accessories

| | Maximim load |
|---|---|
| Storage drawer | 7 kg |
| Monitor shelf | 23 kg |
| Instrument shelf | 9 kg |
| Total each accesssory rail | 23 kg |
| DIN rail | 15 kg |

### RS-232 Serial data

WARNING ⚠ The computer or RS-232 monitor's user program must continuously check the data link. The program should constantly verify connection to the incubator controller and check for updated data.

**Note:** In the event of a power failure, all serial communication will cease until power is restored.

**RS-232 Connector**

The Nurse Call and the serial data output share the same female, nine pin, d-type connector.

Pin 2: Receive Data (incubator input)
Pin 3: Transmit Data (incubator output)
Pin 5: Gnd (Signal Ground)

**Cable requirements**

The user interface cable must have capacitance less than 1500 pF. It should be a shielded cable such as Belden 9611 with AMP shielding kit 748046-1 and ferrule 747579-8.

### Data Stream

The data stream from the Giraffe products is repeated every two seconds. The RS-232 parameters are 19200bps baud rate, no parity, 8 data bits, and one stop bit. The data is in ASCII format; the string is described below.

HYB_1.40,36.1,OPEN,28.3,33.0,36.5,100,N,N,C,00,063,D,L,02043,0000,00,43,000,000,03,00

| | |
|---|---|
| HYB | This is the product code. A "HYB" represents an OmniBed; a "INC" represents an incubator. |
| 1.40 | This is the control board software revision (thermoregulation in the startup screen). |
| 36.1 | Temperature from Patient Probe #1. |

| | |
|---|---|
| OPEN | Temperature from Patient Probe #2. “OPEN” represents no probe connected. |
| 28.3 | Air display temperature from the compartment probe. |
| 33.0 | Desired Environmental Temperature (DET). In air mode, this is also the air control temperature. |
| 36.5 | Patient control temperature. |
| 100 | Heater power. |
| N | Patient mode. This is either a “P” or “N.” |
| N | Open bed mode. This is either an “O” or “N.” |
| C | Closed bed mode. This is either an “C” or “N.” |
| 00 | Set point for humidity. The “00” means the humidifier is not on. |
| 063 | Relative humidity in the infant compartment as measured by the compartment probe. |
| D | Boost air curtain button LED status. This is either a “D”, “A” or “L”. ( “D” means the air curtain button LED is off. “A” means the LED is on. “L” means the fan speed is forced to low speed by the user using the air curtain button and the down arrow. ) |
| L | Fan speed. This is either an “L” or “H.” |
| 02043 | Heat sink sensor resistance. The resistance-temperature curve is located in the service manual. |
| 0000 | Last scale weight in grams. The zeros mean that no weight was taken in this patient session. |
| 00 | Oxygen set point. If the software revision is lower than 1.42, this parameter is not shown. |
| 43 | Oxygen measurement. If the software revision is lower than 1.42, this parameter is not shown. If both “Oxygen set point” and “oxygen measurement” are 0, the GSOCS module is not installed. |
| 000 | $SpO_2$ measurement. If the software revision is lower than 1.42, this parameter is not shown. |
| 000 | Pulse rate measurement. If the software revision is lower than 1.42, this parameter is not shown. |
| 03 | Alarms. This is the alarm code 03. If there are multiple alarms, then all of the codes will be listed here. |
| 00 | The string ends with “00”. |

## Nurse Call

**Contact ratings**
Maximum resistive load: 4 VA
Maximum DC switching voltage: 100 Vdc
Maximum switching current: 0.25 A
Maximum carrying current: 0.50 A.

**Connector**

The Nurse Call contacts and the serial data output share the same female, nine pin, d-type connector.

| | |
|---|---|
| Pin 6: | Closed contact under normal conditions, i.e. power on, no alarm (recommended configuration) |
| Pin 1: | Common contact |
| Pin 9: | Open contact under normal conditions, power on, no alarm<br>These contacts are not powered. They only provide closure. |

**Nurse Call signals**

| **Incubator Status** | **Nurse Call Signal** | |
|---|---|---|
| | **Pins 1&6** | **Pins 1&9** |
| Normal | Closed | Open |
| Alarm | Open | Closed |
| Pwr switch off or pwr fails | Open | Closed |
| Nurse Call cable disconnected | Open | Open |

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Giraffe Incubator
Service Manual
Printed in USA



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Revision ZAA

Printing instructions:
Black on white
8.5" x 11" paper size
Two (2) sides print
Three (3) hole punch
Shrink-wrapped