PLEXUS®
MEDICAL
A GAYMAR® COMPANY

Plexus P1500

Air Express LAL System

Service Manual

PN 11841-000

Plexus P1500 Air Express LAL Service Manual

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IMPORTANT

- Before using the Plexus C1500 please read and understand the *Plexus P1500 Operator's Manual* and the *SAFETY INSTRUCTIONS* prior to each application.
- In the event of any questions, contact our Technical Service Department for assistance:

USA Only:

Phone 1 800 828-7341

Fax 1 800 993-7890

Outside USA:

Phone (716) 662 8636

Fax (716) 662-0730

Attention: Consult "Operators Manual" for contraindications, indications for use, safety precautions, and operating requirements.

DANGER

- Risk of electric shock. Refer servicing to qualified service personnel.

WARNING

- Never drop or insert any object into any opening of the control unit. Doing so may cause fire or electrical shock by shorting internal components.
- Do not spill food or liquids into the Control Unit. If spillage does occur, turn off the unit, disconnect it from its power supply and allow at least 24 hours for drying.
- Keep unit away from radiators or other heat sources.
- Do not place objects on the power cable. Do not locate power cable where it can be stepped on or tripped over.
- The housing of the Control Unit should only be opened by qualified technical or service personnel. Before opening the housing, make sure the unit is turned off and unplugged from its power source.
- Before performing any maintenance or service to the Control Unit or electrical assemblies, always disconnect the power cord from the wall receptacle. Refer servicing to qualified personnel only.

CAUTION

- For grounding reliability, plug only into a grounded outlet.
- Repairs should be performed only by qualified personnel familiar with repair practices for servicing medical devices. Do not attempt to repair the Control Unit unless you possess these skills. Otherwise, damage to or malfunction of the control unit may result.

1.0 Receiving Inspection

Upon receipt, unpack the Control Unit and inspect for concealed damage. Save all packing material. If any damage is found, notify the carrier at once and ask for a written inspection. Prepare a written description of any damage. Photograph any damage.

Failure to take the above action within 15 days of receipt may result in loss of claim.

Do not return the Control Unit to Plexus Medical. Contact Plexus Medical's Technical Service Department for instructions.

USA only	**1 800 828-7341**
Outside USA	**(716) 662-8636**

2.0 Repair Policy

The Control Unit is warranted free of defects in material and workmanship for a period of two (2) years.

The Control Unit is warranted under the terms and conditions of the Plexus Medical warranty in place at the time of purchase. A copy of the warranty is available upon request. Plexus Medical disclaims all implied warranties including, but not limited to, the implied warranties of merchantability and of fitness for a particular purpose.

Control units may be returned to the factory for servicing (see section 2.3 - Return Authorization).

For customers who choose to repair Control Units at their location, this manual contains information to allow a qualified technician to make necessary repairs. For technical support, contact Plexus Medical's Technical Service Department.

2.1 In-Warranty Repairs

All in-warranty repairs must be authorized by Plexus Medical's Technical Service Department before proceeding.

2.2 Out-of-Warranty Repairs

The following repair options are available when servicing Control Units:

1. Defective Components - replacement parts may be ordered by specifying the Plexus Medical part number as shown in the parts lists.
2. Plexus Control Unit Repairs - If the Plexus Control Unit becomes inoperative and the cause cannot be determined, the complete control unit may be returned to the factory for servicing at the purchaser's expense (see section 2.3 - Return Authorization).

2.3 Return Authorization

Please be sure to obtain a return goods (RG) authorization number from Plexus Medical's Customer Service Department before returning the Control Unit or any component parts to Plexus Medical.

USA only	1 800 828-7341
Outside USA	(716) 662-8636

3.0 Specifications

Physcial

Dimensions	12" x 10 1/4" x 5"
	(30.5 cm x 26 cm x 13 cm)
Weight	7.63 lbs. (3.5 kg)
Operating Ambient Temperature Range	60°F to 80°F (15.5°C to 26.6°C)

Storage and Shipping Conditions

Ambient Temperature	40°F to 105°F Range (4.4°C to 40.5°C)
Relative Humidity	10% to 100% Non-condensing

Electrical

Power	120/230 VAC
Frequency	60/50 Hz
Current	2A

Type BF Equipment

Attention, Consult Accompanying Documents

IPXO Protection Against Harmful Ingress of Liquids Ordinary Protection (IPX0)

Agency Approval

TUV IEC 60601.1 (220V only)
UL 2601-1

4.0 Mattress Setup

1. If present, remove existing mattress from bed frame.
2. Replace existing mattress with the M1500 Mattress. Make sure to orient mattress so the air tubing exits the mattress at the foot of the bed.
3. Loop each of the black nylon straps to the bed frame and secure with the D-rings provided.

5.0 Control Unit Setup

1. Suspend control unit from the foot-board using the two hooks located on the back of the controller. If no foot-board exists, place control unit on a flat surface near the foot end of the bed. (Be careful not to position the control unit on the floor in such a manner that it may become a hazard to foot traffic).
2. Connect the free ends of the tubing to the respective mating connectors located on the side of the control unit. Proper connection of the tubing to the “quick connect” fittings will produce an audible click.
3. Pull gently on the hoses to assure proper connection. Ensure the air hoses are not kinked or tucked under the mattress.
4. Plug power cord into a properly grounded outlet.
5. Initiate mattress inflation by turning the dial, located on the face of the control unit, clockwise.
6. For mattress deflation (or for CPR), disconnect the hose connector from the controller. To re-inflate, reconnect the hose to the Control Unit.

6.0 Cleaning

WARNING

Disconnect the AC power cord from the wall outlet before attempting to clean the Control Unit. Do not heat or steam autoclave any component of the system.

1. To clean, use soap and water and a clean cloth to wipe down the control unit, power cord, hoses and mattress. Do not use abrasive cleaners on the mattress. Wipe dry with a clean, dry cloth. Note: Blood and other body fluids must be thoroughly cleaned from all surfaces before applying disinfectants.

2. Apply a FDA approved disinfectant to the external surfaces of the control unit, hoses and mattress. Allow to completely dry. The solution contact time determines the effectiveness of the disinfectant.

7.0 Storage - Control Unit

The power cord may be wrapped around the unit for convenience. Wrap the unit in a plastic bag for dust resistance, then store the unit in an area appropriate for an electronic medical device.

8.0 Front Control Panel Features

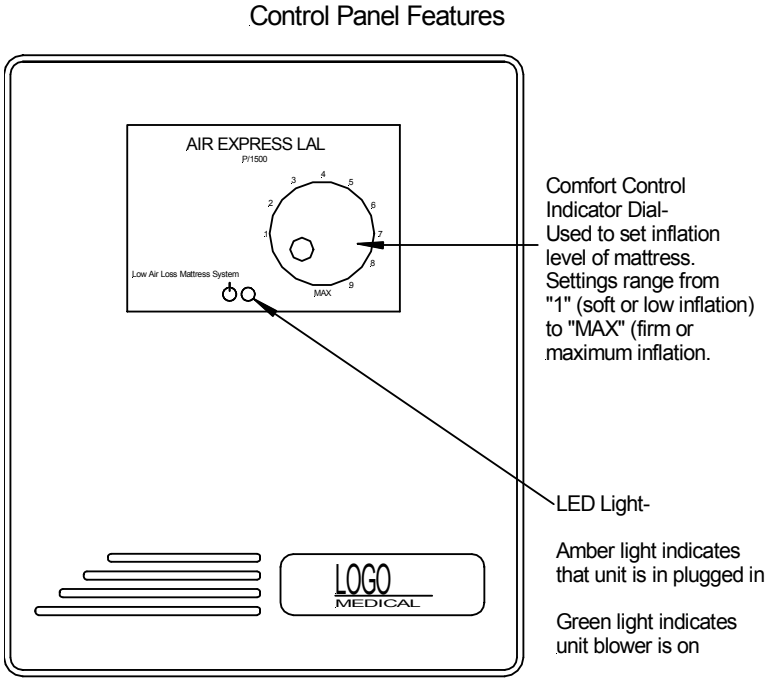


Figure 1 – Front Control Panel

9.0 Rear Panel Features

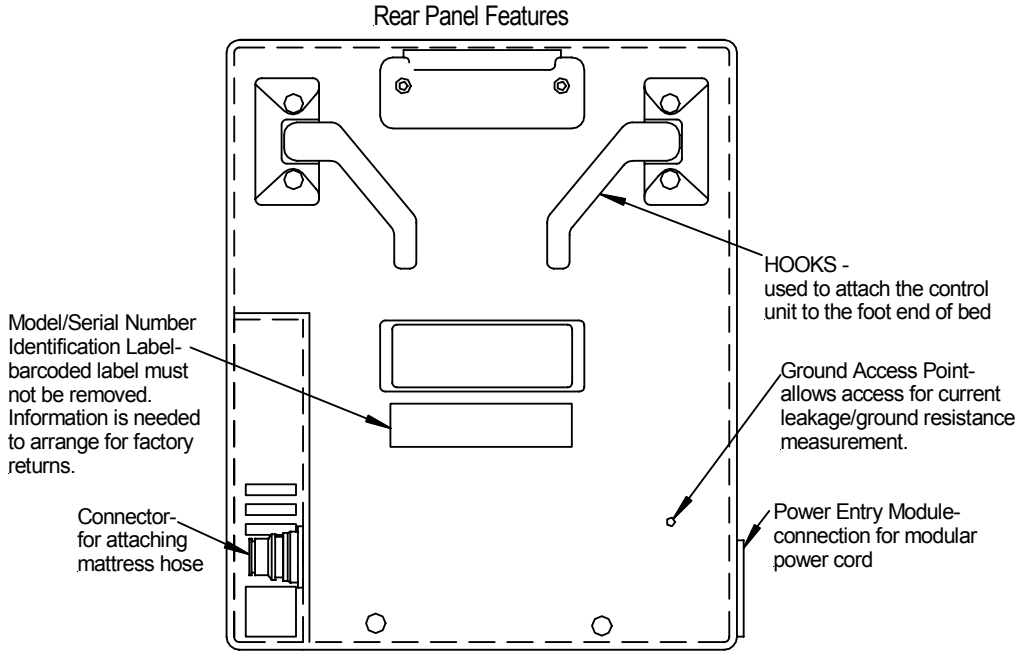


Figure 2 – Rear Panel Features

10.0 Maintenance and Function Testing

A qualified technician familiar with testing and maintaining medical products should perform the following maintenance and test procedure.

To insure proper testing results follow these procedures carefully paying close attention to setups and required test equipment. Failure to follow the procedures can lead to inaccurate or misleading results.

Document the testing results using the checklist at the end of this section. Keep a copy of the test results for your records.

Testing of the P2000T system should be performed annually or as prescribed by your facilities maintenance program.

Equipment requirements:

	Part No.
• Mattress Simulator	11666-15
• Manometer pressure gauges (0-100 mm Hg range)	10329
Or	
• Mattress	M1500
• Pressure test adapter	11668-000
• Manometer pressure gauge (0-100 mm Hg range)	10329

Electrical safety testing
- Electrical safety analyzer

10.1 Physical Inspection (Record results on the Function Test Check Sheet)

Check the Control Unit for cracks or breaks in the housing. Check the power cord connector for cracks/breaks. Check the on/off switch for proper operation. Verify that the bed hooks are in place and tight. Check the power cord for breaks and the blades on the plug for looseness.
Replace or repair any irregularities found during physical inspection.

10.2 C1500 Pressures verification (Record results on the Function Test Check Sheet)

10.2.1 Connect the unit as shown in Figure 3 or Figure 5.
10.2.2 Turn on control unit. If pressures will be measured on a mattress, wait for the cells to fully inflate. Note: Control unit must be warmed up for a minimum of 15 minutes prior to taking pressure readings.
10.2.3 Adjust comfort control dial to “Max” setting. Permit pressure to stabilize. Record and compare pressure to the specifications on the check sheet.
10.2.4 Adjust comfort control dial to setting “9”. Record and compare pressure to the specifications on the check sheet.
10.2.5 Adjust comfort control dial to setting “1”. Record and compare pressure to the specifications on the check sheet.

If control unit does not meet specifications, use the calibration procedure to adjust pressures.

10.3 Electrical safety inspection (Record results on the Function Test Check Sheet)

Connect the unit to an electrical safety analyzer. Using the analyzer manufacturer’s instructions verify that the unit does not exceed 100 μA at 110 V~ or 500 μA at 220 V~ of current leakage in any combination of settings. Verify the ground connection does not exceed .5 ohms of resistance.

If the unit passes all the steps described in the physical inspection, testing and electrical safety inspection sections above it should be considered ready for use. Any unit that does not pass all the requirements above should be serviced to correct the problem before being returned for use.

11.0 Function Test Check Sheet

Section	Test Spec.		Result
10.1	VISUAL		PASS / FAIL
10.2	Max Inflate	27 ± 4 mm Hg	_____ P / F
	Setting 9	25 ± 4 mm Hg	_____ P / F
	Setting 1	5 ± 3 mm Hg	_____ P / F

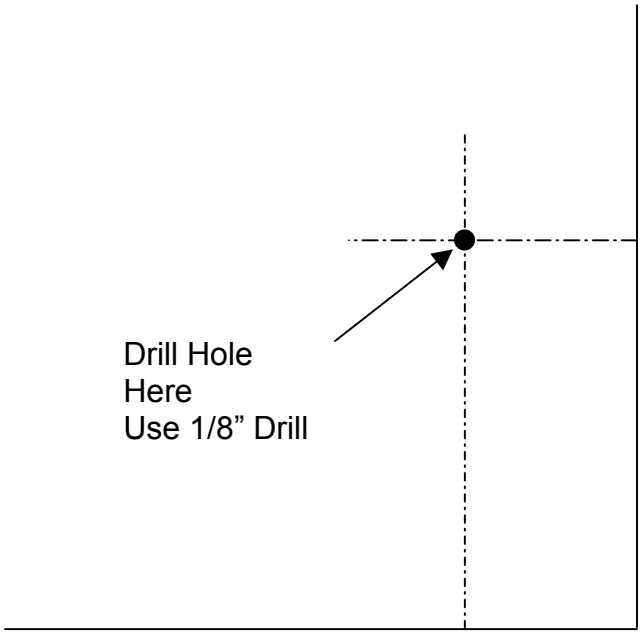
Electrical safety inspection results.

1. Max current leakage reading _____ μ amps

2. Ground resistance less than (<) .5 Ω
   Pass Fail

Tested By _____ Date_____

12.0 Curent Leakage Retrofit

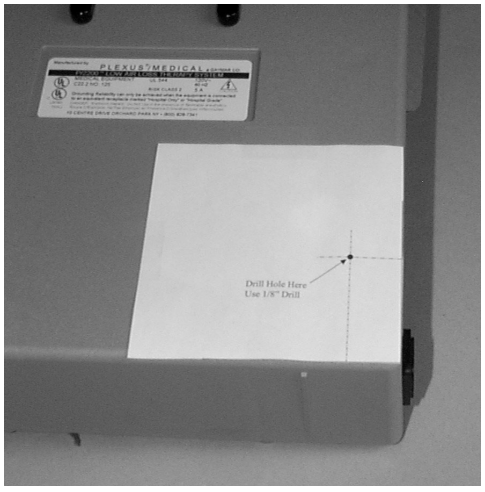


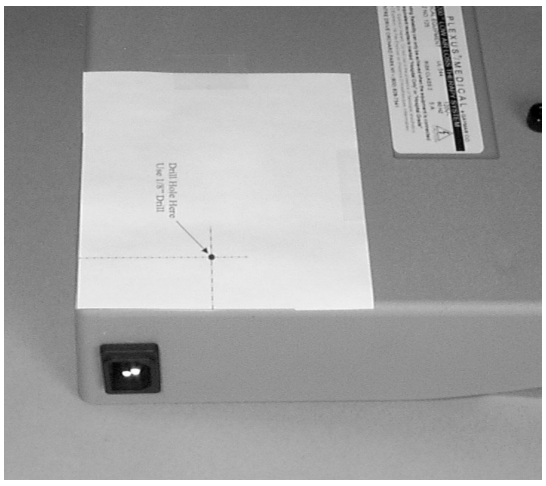
TEMPLATE

1) Cut along solid lines, to remove template from instructions.
2) Align template with bottom and side surface of enclosure in corner nearest the PEM (power entry module). If neccesary hold template in place with tape. (See pictures below)

NOTE: Template is actuall size. Do not reduce or enlarge this image.

3) Drill hole in area indicated. Housing is approximately 1/8” thick. Do not drill deeper than 3/8”. Hole will need to be cleared of debris before use for testing.





13.0 Calibration Procedure

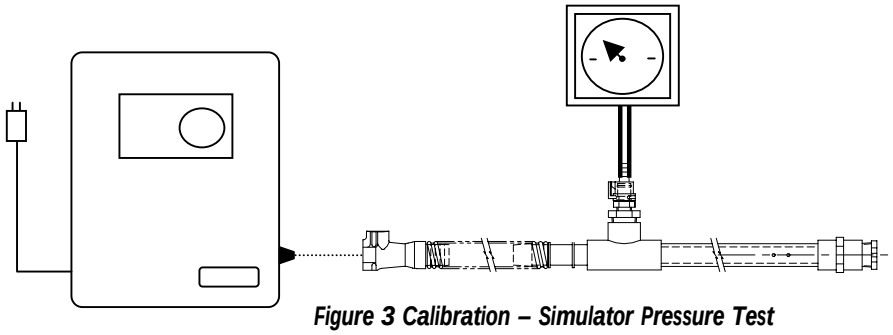


Figure 3 Calibration – Simulator Pressure Test

Attach a mattress or approved mattress simulator to the unit and allow 25 minutes of operation for the system to come to stable operating temperatures. If a mattress is used, insert two pressure gages between two adjacent cells and the manifold in the center of the mattress. Each gage must be attached to both the air cell and the manifold via a tee in order to develop appropriate back-pressure on the unit. If a mattress simulator is used, attach the simulator to the unit and attach pressure gage to the simulator using the fittings provided.

12.1 Calibration Procedure:

NOTE: The following calibration procedure is to be performed only if the machine does not pass function testing. Calibration is not necessary on a routine basis.

Adjustments must be made for the high end of the ranges called out in the procedure, as the pressures will drop slightly when the unit is closed. Final pressure readings should be taken with the unit closed.

1 Connect unit to mattress simulator or appropriate mattress. Insure the connections used on the manifold do not contain orifices.

3 Set comfort control dial on Control Unit for “Max”. Change pressure using adjustment potentiometer located on the blower under the cap shown in the figure below. Max should be set for 27 ± 4mmHg.

3 Set the dial to “1” (or lowest setting that blower turns on) and adjust right-hand potentiometer on the main PCB. The “1” setting should be set for 5 ± 3 mm Hg.

4 Close unit and verify readings are within specifications.

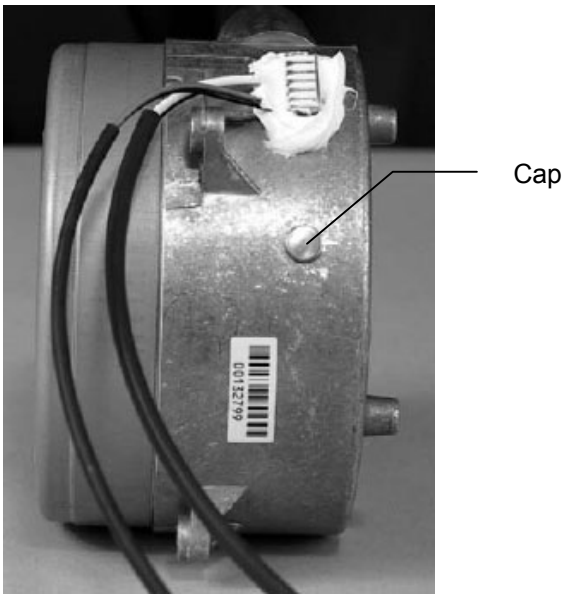


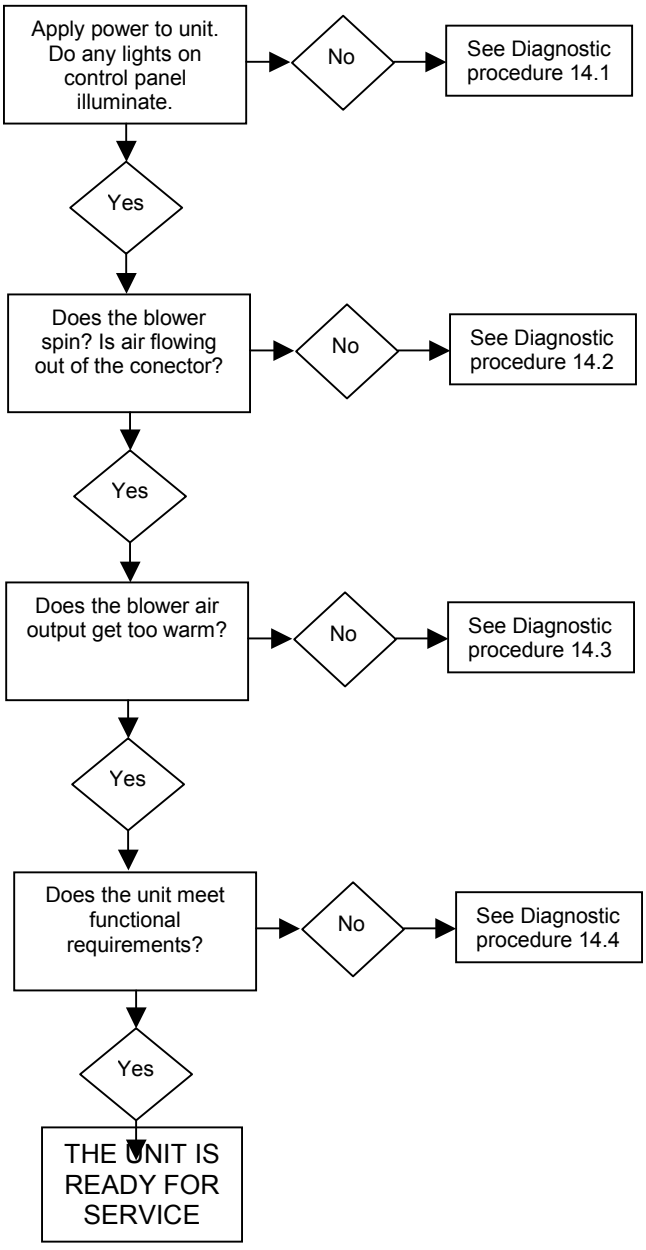
Figure 4 - Blower Side View

14.0 Troubleshooting

In general, it is best to approach a problem or malfunction by first determining if the problem is due to either the mattress or the control unit. In other words, test each independently first. Use a known good control unit to test the mattress or a known good mattress or simulator to test the control unit.

DANGER

- Risk of electric shock. Refer servicing to qualified service personnel.



Diagnostic Procedure 14.1 – Unit does not power up.

1. Check the power cord for damage, contact customer service for replacements as necessary.
2. Open control unit and check fuses. See parts list for replacement. If the fuse breaks frequently, the unit may need factory service.
3. Verify connections on the transformer, inspect wiring for damage, or shorts.
4. Approximately 14 V~ should be present at the power connector on the main PCB. *If the fuses are good, and wires are secure, but no voltage is present at the power connector, replace the transformer.*

Diagnostic Procedure 14.2 – No air flow, blower does not spin.

1. Check the power cord for damage, Open control unit and check fuses. See parts list for replacement. If the fuse breaks frequently, the unit may need factory service.
2. Verify power (120 / 220 volt) is correct for the control unit.
3. Verify blower control voltage on the main PCB at the blower connector. This voltage must be checked with the blower connected. A voltmeter set for DC voltage readings should display approximately 7V when the unit is set on MAX. This voltage will drop as the comfort setting is reduced. *If voltage fails to change when comfort setting changes the main PCB will need to be replaced. (Changing the PCB will require calibrating the control unit)*

Diagnostic Procedure 14.3–Blower air too warm?

1. Use a thermocouple to measure the output temperature of the airflow exiting the blower inside the connector. The unit must be fully assembled, attached to a properly functioning mattress, allow at least 15 minutes for normal operating temperature to be reached. Ambient temperature must be between 65-75°F or 18-24°C for any temperature measurement to be valid. Blower air temperature under these conditions should not exceed 120°F or 49°C (Temperatures in the mattress will be substantially lower due to convection and radiation from the manifold and air cells). If the exhaust temperature is below this limit, the unit is operating normally.

2. If the blower air temperature exceeds this limit, Inspect the air filter for dirt and lint accumulation. If the filter is dirty, clean it according to the instructions in the operator's manual. A failing blower that is generating excessive heat due to failing bearings or other internal problem will generally be noisy as well as hot.
3. If the filter is clean, check for any obstruction to airflow. Obstructions will cause excessive heat in the control unit and greatly shorten the life of the blower.
4. Inspect for an obstruction to airflow in the manifold of the mattress. If an obstruction is present, remove it. *If no restriction to airflow is found and temperatures exceed the limit stated above, the blower should be replaced. If cleaning the filter, or clearing an obstruction lowers the operating temperature to an acceptable value, the unit may be put back into service.*

Diagnostic Procedure 14.4 – Failed function requirement.

1. If the control unit does not meet the pressure specification, unit should be checked for leaks. Check for connectors with cracks or missing "O" rings, disconnected or loose tubing inside the case. If no leaks are detected, calibration should be attempted (see section 13).
2. Verify connection of wire between main PCB and blower is secure.
3. If the unit fails current leakage or ground resistance, verify contact to ground access point. Insure that point is clear of any debris. Insure that connections between ground terminal on the power entry module and ground point are secure.

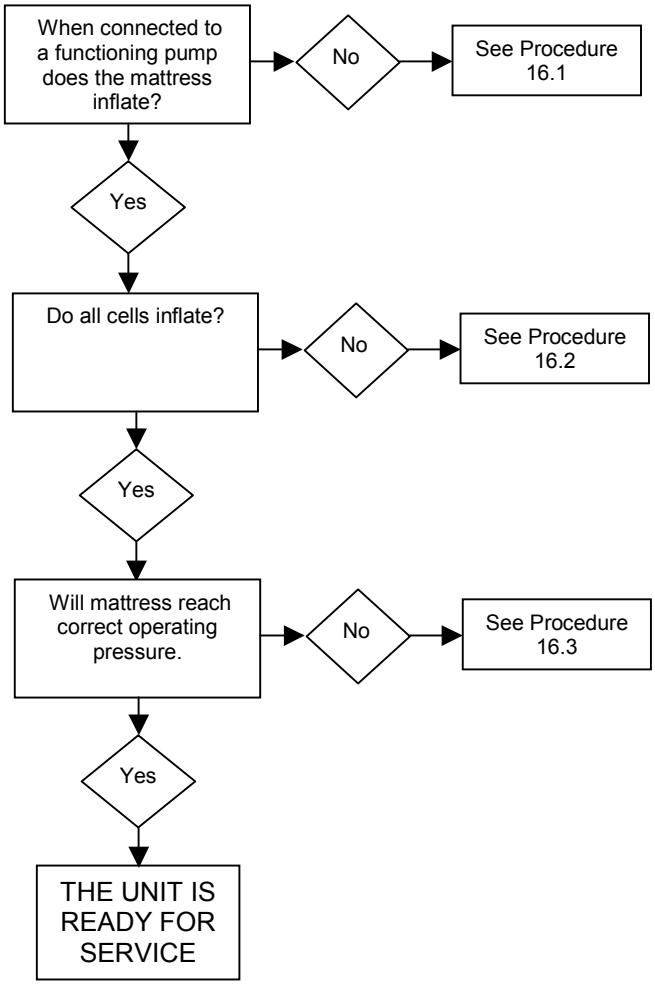
15.0 Mattress Storage and Care

See Operators manual for cleaning instructions

Once the mattress has been thoroughly cleaned and dried, carefully roll it up starting at the Head end and rolling towards the Foot section. Straps located on the bottom surface may be used to secure the mattress or overlay. Placing the surface in a plastic bag is recommended for temporary storage. If mattress has been stored at temperatures below freezing, allow adequate time for it to warm up to temperatures above 32 °F before attempting to unroll.

16.0 Mattress Troubleshooting

Mattress testing requires the use of a good control unit to inflate the mattress. The only possible problem conditions are unintended leaks or obstructions in the system (i.e. disconnected cells, punctures and kinked or twisted hoses or manifold). Connect the mattress to a functional control unit, and permit the system to inflate.



Diagnostic Procedure 16.1 - Mattress does not inflate.

1. Kinked or twisted manifolds and hoses will restrict airflow. Check for twisting, and correct as necessary.
2. Disconnected cells should be reconnected. Occasionally the white quick connect fittings can come out of the red/orange flanges in either the cells or the manifold. These fittings can be re-inserted with a small amount of cyanoacrylate (super glue) gel adhesive on the barbs. Wipe off any excess after insertion. CAUTION: Excessive glue can damage the manifold, or air cells. Avoid contaminating these surfaces.

Diagnostic Procedure 16.2 - Cells not inflating.

1. Insure air cells are connected to the manifold.
2. Insure the cell is secured to both sides of mattress, and that the cell is not twisted.

Diagnostic Procedure 16.3 - Leaks in Mattress, Manifold, cells hoses or connectors

1. Leaks in the system can be verified by connecting a pressure gauge between the manifold, and air cell as shown in figure 5. Using a properly functioning control unit set at MAX Inflate, the pressure in the cells should reach 27 ± 4 mm Hg. *Note: control unit must be warmed up for 15 minutes before performing this test.*
2. Each cell will have 2 low air loss holes approximately 6” from each end (total of 4 holes). Any cells with more holes, or rips should be replaced. Check the manifold leaks or holes. Replace damaged manifolds.

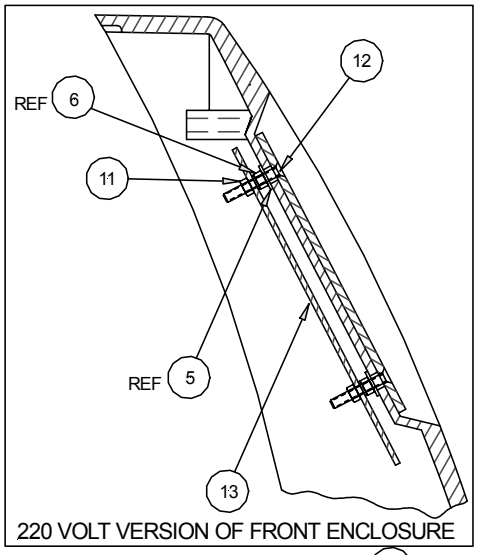
Figure 5 – Mattress Pressure Test

17.0 Parts List

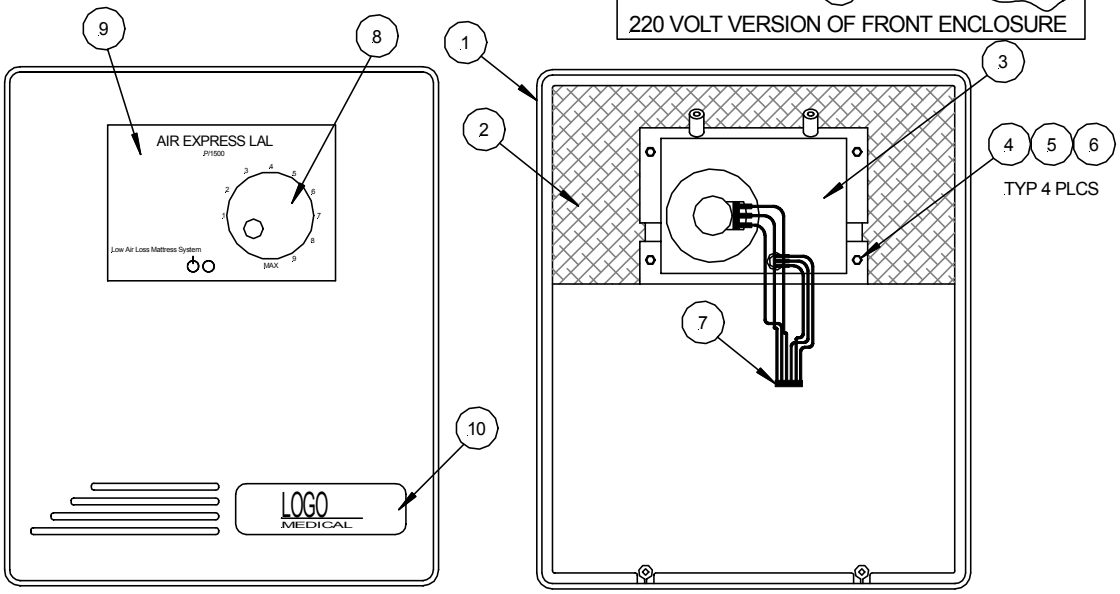
17.1 Front Enclosure Bill of Materials

PART NO. 220 V	PART NO. 120 V	DESCRIPTION	ITEM
11632-000		Alt Board Assy	13
91275-032		SCREW, 4-40,3/4 PH	12
10087		NUT, 4-40, NYLON BLK	11
* 20224	20224	LABEL, LOGO, RECT. WINDOW	10
* 20223	20223	OVERLAY, RECT. WINDOW	9
20067-1500	20067-1500	KNOB, SILVER, MOLDED	8
	30161	ASSY. WIRE HARNESS	7
10385	10385	NUT, LOCK, #40, NYLON INSERT	6
10088	10088	WASHER, FLAT, #4, ZINC PLATED	5
10384	10384	SCREW, MACHINE, #4-40 x 1/2" LG, FH	4
20222	20222	FACEPLATE, BOLT-IN	3
20218	20218	FOAM, SOUND	2
20213	20213	HOUSING, FRONT, INJ. MOLDED	1

* NOTE: for private label components contact customer service.



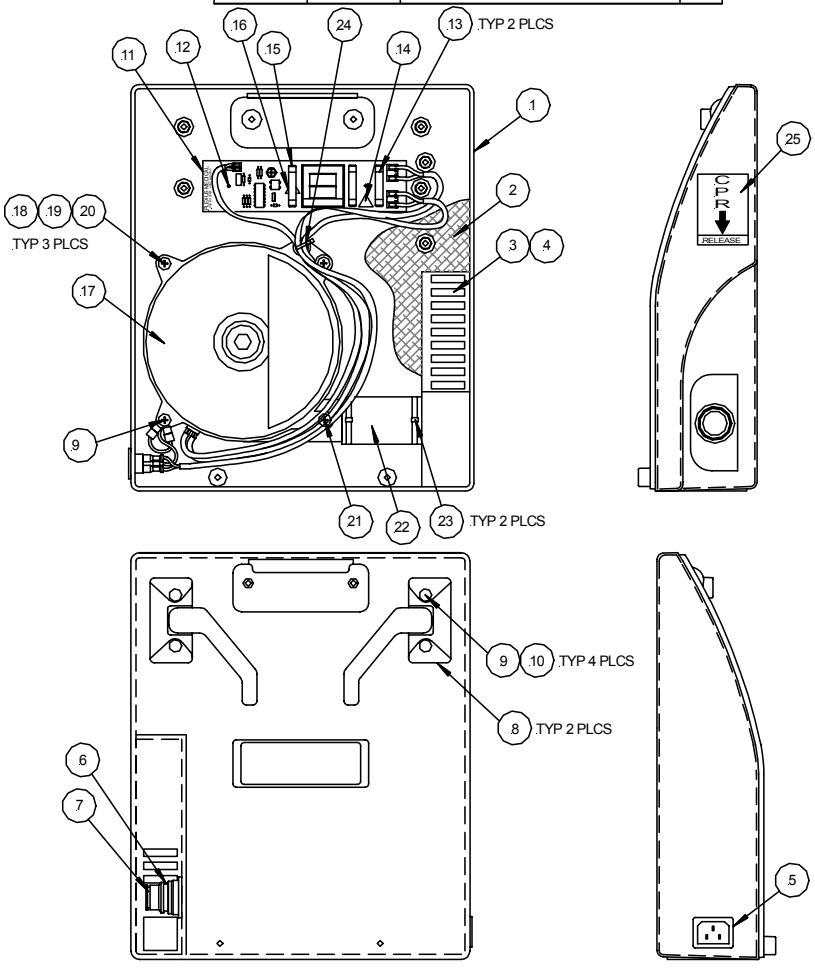
220 VOLT VERSION OF FRONT ENCLOSURE



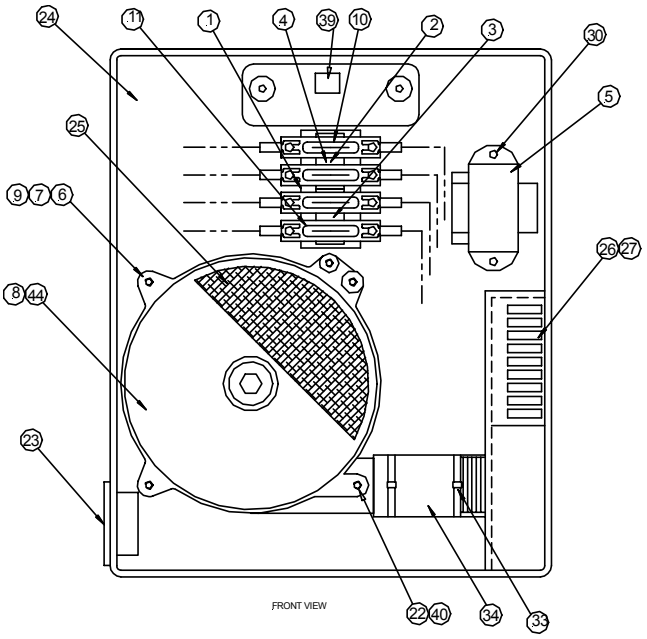
17.2 Rear Enclosure Bill of Materials C1500

PART NO. 220 V	PART NO. 120 V	DESCRIPTION	ITEM
50041	50041	LABEL, CPR LARGE	25
10200	10200	CABLE TIE, NYLON (5 1/2" LONG)	24
10380	10380	CLAMP, HOSE 1 5/8"	23
10381	10381	HOSE, CLEARFLOW 1 1/4" x 1 1/2" (3" LONG)	22
10254	10254	SCREW, 10-32 x 1/2" PHILLIPS PAN HD	21
10070	10070	SCREW, 10-32 x 5/8" PHILLIPS PAN HD	20
10048	10048	MOUNT, VIBRATION	19
10047-.7	10047-.7	STANDOFF 1/2" x 0.7" 10-32 ALUM.	18
not available *	11496-1500	ALTERED BLOWER, C1500	17
50039	20227	LABEL, FUSE .15 AMP (120V) or 1 AMP (220V)	16
10064	10146	FUSE, .15 AMP (120V) or 1 AMP (220V)	15
50038-2.5	50038	LABEL, FUSE 5 AMP (120V) or 2.5 AMP (220V)	14
10265	10065	FUSE, 5 AMP (120V) or 2.5 AMP (220V)	13
10383	10383	SCREW, 4-24 x 3/8", T-10 TORX TAPPING	12
30105	30105	BOARD, PCB	11
10070-BOSS	10070-BOSS	SCREW, 10-32 x 5/8" PHILLIPS BLACK OX	10
10387	10387	WASHER, LOCK INTERNAL TOOTH #10	9
30297	30297	HOOK ASSY. MOLDED	8
10081	10081	O RING, 3/4" ID	7
20004	20004	CONNECTOR, HOSE, MALE	6
10259-SNAP	10049-SNAP	POWER ENTRY MODULE, SNAP-IN	5
20215	20215	BAFFLE	4
20228	20228	FILTER, FOAM	3
20218	20218	FOAM, SOUND FOR INJ-MOLDED HOUSING	2
20214-2200	20214-2200	ENCLOSURE, REAR	1

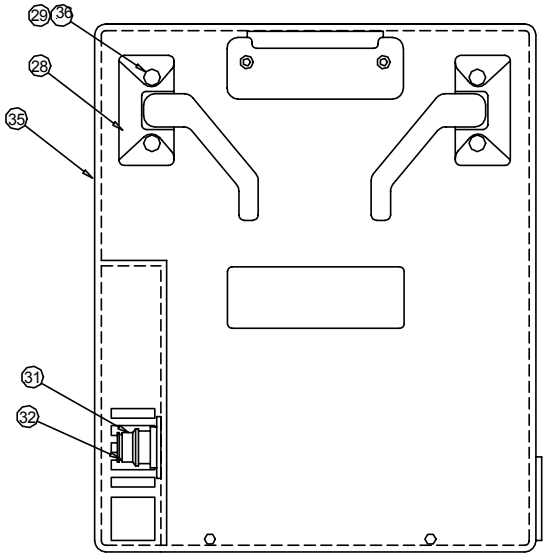
* NOTE: contact customer service



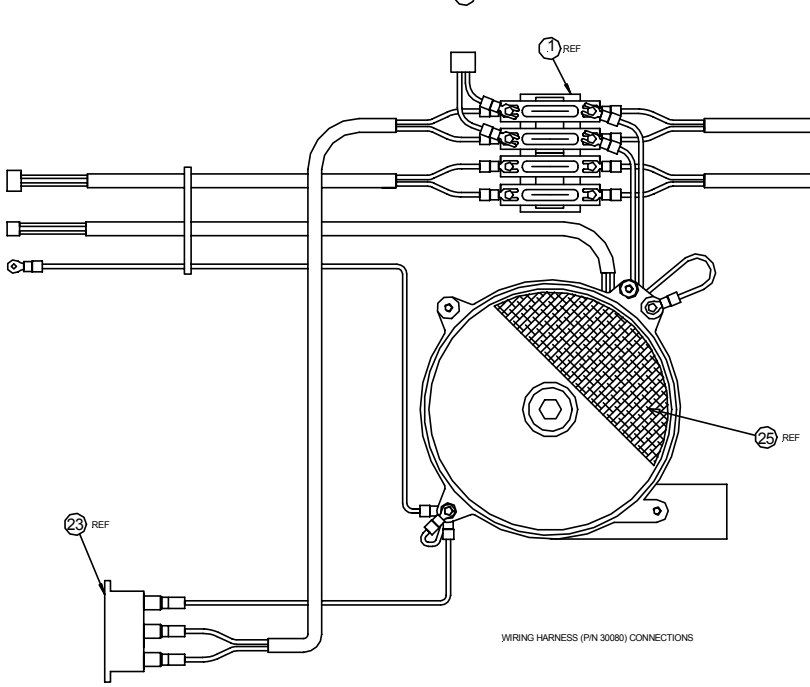
17.3 Rear Enclosure Bill of Materials C1500-E (220 volt)



FRONT VIEW



REAR VIEW

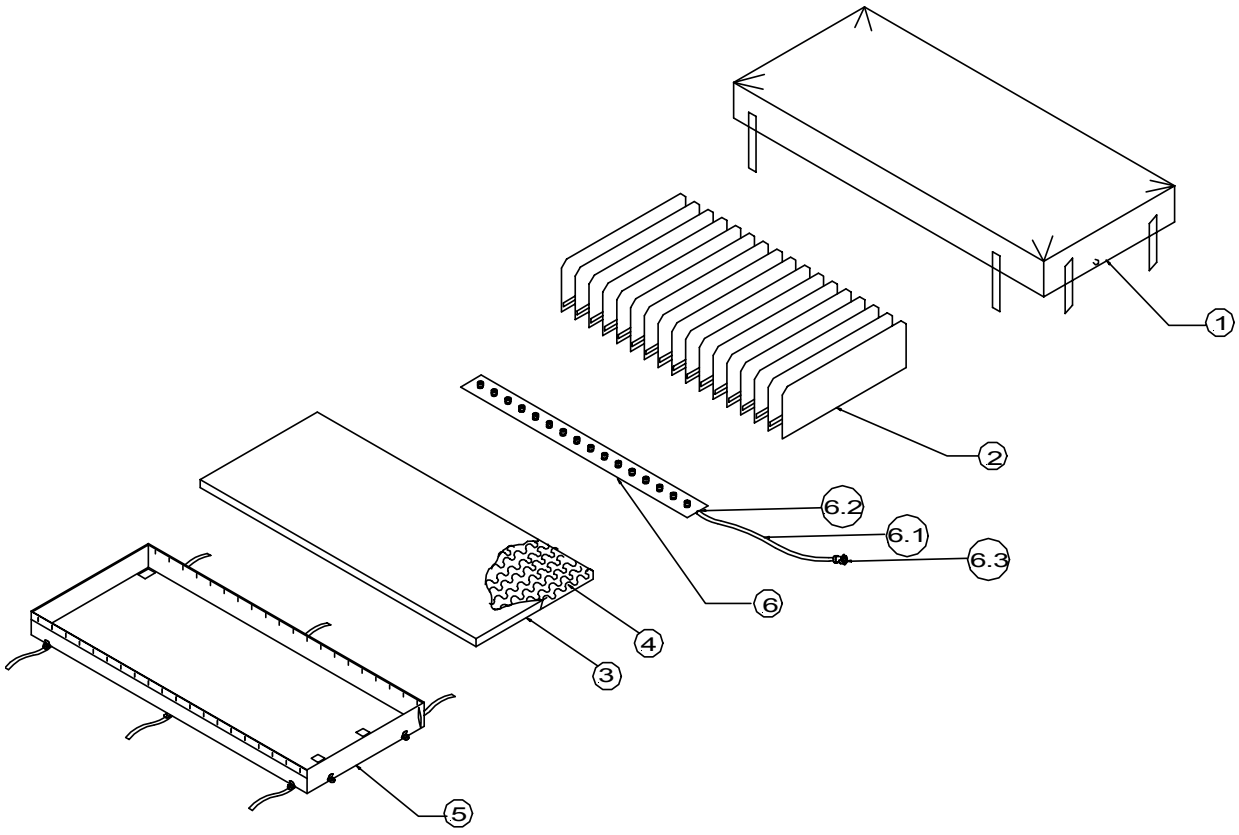


WIRING HARNESS (P/N 30080) CONNECTIONS

	PART NO.	DESCRIPTION	ITEM
	10118	PLUG, STEEL, 1/4 ID	44
	30080	WIRE HARNESS	N/A
	10256	LOCKER, THREAD	40
	11556-000	CAPACITOR ASSY	39
	10387	WASHER, LOCK	36
	50041	LABEL, CPR, LARGE	35
	10381	HOSE, CLEARFLOW	34
	10380	CLAMP, HOSE, ONE EAR	33
	10081	O RING, 3/4 ID	32
	20004	CONNECTOR, HOSE	31
	10362	SCREW, PHILLIPS	30
	10070-BOSS	SCREW, PAN HD, PHILLIPS	29
	30297	HOOK ASSY, MOLDED	28
	20215	BAFFLE	27
	20228	FILTER, FOAM	26
	20218	FOAM SOUND	25
	20214-2200	ENCLOSURE, REAR	24
	10259-SNAP	POWER ENTRY MODULE	23
	10254	SCREW,10-32 PHILLIPS	22
	10064	FUSE, 1 AMP	11
	10265	FUSE, 2.5 AMPS	10
	10070	SCREW,10-32 x 5/8	9
	10082	BLOWER, 2 STAGE, 220V	8
	10048	MOUNT, VIBRATION	7
	10047-.7	STANDOFF, 1/2 x 0.7, 10-32	6
	10055	TRANSFORMER, 24V	5
	10069	SCREW, 6-32 x 1/4PHILLIPS	4
	50039	LABEL, FUSE, 1 AMP	3
	A 50038-2.5	LABEL, FUSE, 2.5A	2
	A 10056	HOLDER, FUSE	1

Mattress Bill of Materials

Item #	Description	Part Numbers
1	Top sheet	30006
2	Air Cells	78387
3	Foam Cover	30065-FC
4	Foam	20001
5	Base	30154
6	Manifold Assembly (includes components listed below)	30155
6.1	Spiral Tubing	10035
6.2	3 / 4 Coupler	10113
6.3	Female Hose Coupling	10057



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