

Operation &
Service Manual

MODEL 6325

ASCD
SequelTM
COMPRESSION SYSTEM

tyco / Healthcare

KENDALL

Parts Listing

SCD Sequel Model 6325

To order repair parts listed here, call Kendall/Tyco Healthcare at (800) 765-4324. Contact Customer Service for availability of parts not listed below.

Description	Order Part Number
POWER SUPPLY PC BOARD	7774006780
CPU PC BOARD	7774006840
TRANSDUCER - PRESSURE	7774020504
COMPRESSOR (THOMAS, GAST)	7774010283
COMPRESSOR FILTER	7774031569
COMPRESSOR MUFFLER	7774031575
COMPRESSOR CABLE	7774090530
VALVE ASSEMBLY (KIP, SKINNER)	7774010300
TRANSFORMER	7774010301
FRONT ENCLOSURE ASSEMBLY (CASE, FOAM, LABELS)	7774109780
FRONT ENCLOSURE	7774031601
REAR ENCLOSURE ASSEMBLY (CASE, FOAM, LABELS)	7774109790
REAR ENCLOSURE	7774031600
NYLON HOOK PAD	7774170580
FAN GUARD	7774031602
FAN FILTER	7774031572
HOOK (BED)	7774031567
CASE RUBBER FEET	7774031570
ROCKER SWITCH	7774070156
BOARD TO BOARD CABLE	7774080385
POWER CORD ASSEMBLY	7774090529
STRAIN RELIEF	7774131980
TUBING, TRANSDUCER (1/8 X 1/4)	7774090551
TUBING, 5/32 X 9/32	7774090579
TUBING, (COMP- MUFFLER), 5.50"	7774090540
FUSEHOLDER	7774010289
FUSE, .75 AMP	7774010290
SHRINK TUBING (FUSEHOLDER)	7774090533
FAN ASSEMBLY	7774109190
MEMBRANE SWITCH	7774070163
CAUTION LABEL	7774181923
GROUNDING LABEL	7774181924
OPERATING INSTRUCTIONS LABEL	7774181947
QUIET FOAM, LOWER FRONT	7774031576
QUIET FOAM, MIDDLE FRONT	7774031577
QUIET FOAM, UPPER FRONT	7774031578
QUIET FOAM, BOTTOM	7774031579
QUIET FOAM, CHASSIS	7774031580
QUIET FOAM, END	7774031599

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■ FIGURE 7: Electrical Schematic

General Operating Instructions

The SCD SEQUEL Compression System Model 6325 is designed to apply sequential gradient compression to the lower limbs to prevent deep vein thrombosis in patients at risk.

■ PRE-OPERATION CHECK

Before using the SCD SEQUEL Compression System on the patient, verify that:

- The Tubing Set is properly connected to the System and the Sleeves. Both Sleeves must be connected. If the System can only be used on one leg (e.g., amputee), connect the second sleeve but leave it packaged in its plastic bag.
- There are no kinks or sharp bends in the Tubing Set.
- The left and right sides of the System are unobstructed for free air flow.
- The System power cord is plugged into a grounded AC receptacle of the correct voltage.
- No flammable anesthetic gases are present.

■ USE OF BED HOOK

The SCD SEQUEL Compression System features a bed hook. This feature may be used by placing the System on the footboard of the hospital bed with the System facing away from the patient (see Figure 1).

NOTE: After placing the System on the footboard, confirm that the System is securely held by the footboard, and does not interfere with patient care.

■ OPERATION

Turn the power switch on (located on the lower right side of the System). The System performs a self-diagnosis and LED check upon start-up. The LED segments illuminate, starting at the top of the display panel. The System then begins normal operation with ankle inflation. See Figure 2 for the location of each control and indicator.

NOTE: When the System is turned on, the Sleeve Cooling will be off. To activate Cooling, press the Cooling Button while the machine is operating. The Cooling LED will illuminate when the option is on.

In the case of a fault condition, the alarm will sound. The appropriate fault code will be displayed and the System will shut down.

■ CYCLE MONITOR

The SCD SEQUEL Compression System has a Cycle Monitor, which continuously displays the status of the System's compression sequence. The Monitor consists of two back-lit panels which, when illuminated, read INFLATE and VENT. These represent the two major divisions of one complete cycle. During operation, the INFLATE and VENT lights will illuminate to indicate which part of the cycle the system is in. If the Sleeve Cooling is off, the compressor will shut off during the Vent Cycle.

■ AUTOMATIC PRESSURE ADJUSTMENT

The SCD SEQUEL Compression System features micro-processor controlled automatic pressure adjustment. This feature automatically sets the pressure to 45mmHg and maintains this set pressure even when the patient moves or changes position.

After the start-up sequence, the System will set itself and display 45mmHg. During the first few inflation cycles the Controller will adjust itself to meet the 45mmHg. During the initial setting period the decimal points on each side of the 45 will display “.45.”

Within five cycles the System will stabilize between 43 and 47mmHg and the decimal points will turn off, leaving “45” displayed.

NOTE: Even after the initial 45mmHg pressure is reached, the System will continue to make small adjustments in order to maintain the 45mmHg.

■ POWER CORD STORAGE

Power cord storage for the SCD SEQUEL Compression System is provided by wrapping the power cord around the bed hook. This is shown in Figure 3.

■ SLEEVE COMPATIBILITY

The SCD SEQUEL Compression System is designed for use with SCD Sleeve Reorder #5330, 5329, 5480, 5345, and 5336.

Fault Conditions

Fault Messages ⁽¹⁾

CODE	FAULT TYPE	DESCRIPTION
SL	System Low	<p>There is less than 8mmHg pressure at the end of the first inflation cycle or at the end of two consecutive cycles thereafter.</p> <p>POTENTIAL CAUSES</p> <ul style="list-style-type: none"> • Tubing Set is not properly connected. • There is a leak inside the System. <p>CORRECTIVE ACTIONS</p> <ul style="list-style-type: none"> • Ensure proper Tubing connections. • Turn the System off and restart. If the System displays the same fault, the unit requires servicing.
LO	Low	<p>The System is unable to bring the pressure up above 43mmHg for five consecutive cycles. The pressure in the Sleeves is consistently below the set pressure.</p> <p>POTENTIAL CAUSES</p> <ul style="list-style-type: none"> • Tubing is not properly connected. • Sleeves are too loose. <p>CORRECTIVE ACTIONS</p> <ul style="list-style-type: none"> • Ensure proper Tubing connections. • Apply Sleeves so that only two fingers fit snugly between each Sleeve and the patient's leg. • Turn the System off and restart. If the System displays the same fault, the unit requires servicing.
SH	System High	<p>Pressure has exceeded 90mmHg after 1.2 seconds of thigh cycle:</p> <ul style="list-style-type: none"> • On first cycle, System will switch to vent mode and adjust flow control appropriately. • On subsequent cycles, System will switch to the fault mode and display this code.

(Continued on next page)

(1) When the microprocessor detects a fault condition, it interrupts the normal operation of the controller, deactivates all valves, displays a fault code, and sounds an audible alarm. This alarm will remain active until the System power switch is turned off.

Fault Conditions (CONTINUED)

CODE	FAULT TYPE	DESCRIPTION
SH	System High (continued)	<p>POTENTIAL CAUSES</p> <ul style="list-style-type: none"> • Tubing Set is kinked. • Sleeves are too tight. <p>CORRECTIVE ACTIONS</p> <ul style="list-style-type: none"> • Straighten out kinked Tubing Set. • Apply the Sleeves so that two fingers can fit snugly between each Sleeve and the patient's leg. • Turn the System off and restart. If the System displays the same fault, the unit requires servicing.
HI	High	<p>The System is unable to bring the pressure down below 47mmHg for five consecutive cycles. The pressure in the Sleeves is consistently above the set pressure.</p> <p>POTENTIAL CAUSES</p> <ul style="list-style-type: none"> • Sleeves are too tight. <p>CORRECTIVE ACTIONS</p> <ul style="list-style-type: none"> • Apply the Sleeves so that two fingers can fit snugly between each Sleeve and the patient's leg. • Turn the System off and restart. If the System displays the same fault, the unit requires servicing.
SP	System Pressure	<p>The System has not controlled to 35 - 55mmHg for 12 consecutive cycles.</p> <p>POTENTIAL CAUSES</p> <ul style="list-style-type: none"> • Sleeves are too tight. <p>CORRECTIVE ACTIONS</p> <ul style="list-style-type: none"> • Apply the Sleeves so that two fingers can fit snugly between each Sleeve and the patient's leg. • Turn the System off and restart. If the System displays the same fault, the unit requires servicing.
d1	Internal Diagnostic One	<p>If the solenoid valve stays open, the microprocessor will detect this condition, shut the System off, and display this code.</p> <p>The System should be returned to the manufacturer for repair.</p>

Fault Conditions (CONTINUED)

CODE	FAULT TYPE	DESCRIPTION
d2	Internal Diagnostic Two	<p>Upon start-up, the microprocessor performs diagnostic tests. If the System fails to pass all of these tests, it will not start and this fault code will be displayed.</p> <p>The System should be returned to the manufacturer for repair.</p>
d3, d4	Internal Diagnostic Three, Four	<p>These faults are indicated only during special test conditions and should not occur during normal operation.</p> <p>The System should be returned to the manufacturer for repair.</p>
d5	Internal Diagnostic Five	<p>This fault is indicated if the pump speed is not what is expected.</p> <p>The Compressor Outlet Filter should be replaced or the Muffler should be cleaned. If fault reoccurs after replacement, the System should be returned to the manufacturer for repair.</p>
d6	Internal Diagnostic Six	<p>This fault is detected if the pressure exceeds 25 mmHg after 54 seconds of the vent cycle.</p> <p>The System should be returned to the manufacturer for repair.</p>
d7 - d9	Internal Diagnostic Seven, Eight, Nine	<p>These codes have not been implemented. They have been reserved for future use.</p>

WATCHDOG CIRCUIT

If the Microprocessor cannot continue normal function, the watchdog circuit will trip. This causes the System to go into reset and restart normal operation.

If the cause of the disruption is still present, the unit will continue to attempt to reset, which will cause the alarm to sound once every second.

If the cause of the disruption was transient, such as a high energy RF pulse, the System will restart with the COOLING OFF.

Contraindications

The SCD SEQUEL Compression System may not be recommended for patients with the following:

1. Any local leg condition in which sleeves would interfere such as:
 - a. Dermatitis
 - b. Vein ligation (immediate postoperative)
 - c. Gangrene
 - d. Recent skin graft
2. Severe arteriosclerosis or other ischemic vascular disease.
3. Massive edema of legs or pulmonary edema from congestive heart failure.
4. Extreme deformity of leg.
5. Suspected existing deep venous thrombosis.

Cautions

1. When this device is used in the Operating Room, keep Comfort Cooling OFF to maintain air quiescence.
2. Federal (U.S.A.) law restricts this device to sale by or on the order of a physician.
3. Explosion Hazard. Do not use in the presence of flammable anesthetics.

WARNING: Do not attempt to repair or replace broken tubing connectors as hazardous inflation of the sleeves may occur.

This product is a component of Kendall's SCD System that is covered by various U.S. Patents. The use of non-Kendall components in place of and/or in combination with this Kendall component may constitute infringement of Kendall U.S. Patent(s). Kendall expressly states that no implied license with respect to use of non-Kendall components is granted by the sale or lease of this component.

Other Patents Applied For

Service and Maintenance

■ INTRODUCTION

The service technician should be familiar with the operator's portion of this manual and the operating principles of the SCD SEQUEL Compression System. The fault codes displayed by the System are useful in diagnosing service problems. If a System is to be returned for service, a description of the operating conditions and the fault code displayed should accompany the unit.

This manual describes service procedures to the board level, with an exploded view of the System shown in Figure 5. If a component failure on a circuit board is suspected, the unit should be returned for service. It is recommended that the instrument be returned with the circuit board in place, as removal of the board(s) involves additional risk of mechanical damage and damage from electrostatic discharge (ESD).

■ WARRANTY AND FACTORY SERVICE

The Kendall Healthcare Products Company warrants that your SCD SEQUEL Compression System is free from defective material and workmanship. Our obligation under this warranty is limited to the repair of Controllers returned to the service address indicated at right, transportation charges prepaid, within one year of delivery to the original purchaser. Specifically, we agree to service and/or adjust any Controller as required if returned for that purpose, and to replace and repair any part which, upon our examination, is proven to have been defective. This warranty does not apply to the Tubing Set or the individual disposable leg Sleeves, or to equipment damaged through shipping, tampering, negligence, or misuse, including liquid immersion, autoclaving, or ETO sterilization.

This limited warranty does not cover, and is intended to exclude, any and all liability on the part of the Company, whether this limited warranty or any warranty implied by law, for any indirect or consequential damages for breach hereof or thereof. Except as expressly provided above in the limited warranty, the Company hereby negates and disclaims all express and implied warranties, including the warranties of merchantability and fitness for a particular purpose.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the foregoing limitation or exclusion regarding damages may not apply. Also, this Limited Warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

This service manual is intended for use as a guide to technically-qualified personnel when evaluating instrument malfunctions. It is not to be construed as authorization to perform warranty repairs. Unauthorized service will void the warranty.

Controllers requiring warranty repairs must be shipped, prepaid and insured, to the Service Center. The Kendall Healthcare Products Company maintains service facilities with the capability to promptly repair the SCD SEQUEL Compression System. In the event of any service maintenance problem, contact Customer Service. The toll-free number is (800) 765-4324. If the instrument is to be returned for service, please call the above number to obtain an authorization return number and send it prepaid and insured, in the original carton, to:

TYCO HEALTHCARE GROUP LP
98.6 Faichney Drive
Watertown, NY 13601

■ MAINTENANCE

CAUTION:

Unplug the System before filter maintenance.

There are two filters used in the SCD SEQUEL Compression System — a fan filter and a compressor outlet filter.

It is very important that the fan filter be cleaned frequently to ensure continued trouble-free operation. The Controller should never be run without the fan filter in place. To clean the fan filter, gently pry the fan cover off the left side of the System. Carefully remove the filter from the fan cover and brush loose dust and lint from the surface. Wash the filter in a mild detergent solution, dry thoroughly, and reinstall.

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Service and Maintenance (CONTINUED)

■ MAINTENANCE (Continued)

Removal of the front cabinet exposes the compressor filter. The filter is mounted below the compressor. The filter is designed to exceed the life of the System. In the event the filter becomes loaded, flow will become obstructed and the System will repeatedly trigger a d5, LO, or SL alarm. When this occurs replace the filter as follows:

Remove the inlet and outlet tube from the filter. Take the filter off the Nylon hook pad, replace with a new filter, and then reattach the tubing. Make sure the tube exiting the compressor is connected to the inlet side of the filter. Direction of flow is from the compressor to filter to valves (see Figure 4), and is identified on the filter housing (avoid kinking any tubing). Carefully replace front cabinet.

■ VENTILATION

Obstruction of the left fan cover and right vents should be avoided. Free flow of air is necessary to prevent overheating and premature component failure.

■ FUSES

CAUTION: *Unplug the System before removing the fuse.*

A blown fuse should only be replaced with a 3AG Slo Blo fuse, 0.75 ampere.

If a fuse blows a second time, it should be presumed that the instrument is defective and requires further service.

■ ELECTRICAL SAFETY

CAUTION: *Be sure the System is disconnected from the power source before removing the front cover. A potential SHOCK HAZARD exists when the front cover is removed even with the unit turned off.*

Periodic inspection should include a resistance check from the power plug grounding prong to the metal chassis inside

the instrument. The chassis can be accessed by removing the fan cover. This resistance should not exceed 0.1 ohm. If ground resistance exceeds this value or the insulation integrity of the unit has been compromised through mechanical damage, the System should be returned to the Service Center for testing and repair.

■ CLEANING

The System cabinet can be cleaned as necessary with a soft cloth dampened with water. If necessary, a mild disinfectant and/or detergent can be used; excess fluid should be avoided. The System should be wiped with a clean, dry cloth afterward. Do not immerse in water.

The SCD SEQUEL Compression System cannot be effectively sterilized by liquid immersion, autoclaving, or ETO sterilization, as irreparable damage to the System will occur.

■ ELECTRICAL/ELECTRONICS DESCRIPTION

The electronics of the controller are located on two PC boards (see Figures 6 and 7). The first board can be found beneath the membrane switch panel in the front case cover. There is no high voltage on the PC boards. The CPU board contains the LEDs and associated electronics which display information about the state of the System during normal operation, as well as in the fault mode or the various calibration and diagnostic modes. This board also contains the pressure transducer, the microprocessor, the buzzer, and the valve control.

The second board is the Power board. It contains voltage regulation circuits, analog conditioning circuits, and motor control circuitry.

Operator input is provided through the membrane switch panel. Component or System failure will result in de-energizing the valves and the compressor. This will release pressure from the attached leg sleeves.

Service and Maintenance (CONTINUED)

■ PNEUMATIC DESCRIPTION

The rotary vane compressor, driven by a low-noise brushless DC motor, runs only when needed. Air can be directed from the compressor to the sleeve cooling chambers during the 60-second vent phase by pressing the Sleeve Cooling button on the membrane switch panel. This causes the compressor to turn on and the solenoid valve V to be energized during the VENT phase (See Figure 4).

Air flow through the solenoid manifold assembly is controlled by the motor control circuitry working with the brushless DC motor. From the manifold assembly, the air is gated to the sleeve chambers during the 11-second compression phase by energizing solenoid valves A,C, and T in sequence. At the end of this period, all three solenoid valves are de-energized simultaneously which disconnects the compressor from the sleeves and allows the valves to release sleeve pressure to the atmosphere. The ankle pressure transducer monitors the pressure in the ankle portion of the circuit and provides data input to the microprocessor for feedback control (see Figure 6).

■ PORT IDENTITY

The Tubing Set connecting the Sleeves to the System is attached to the fitting on the rear of the System in the upper left hand corner (as viewed from behind the System). Inside this fitting are four ports which are, from left to right: ANKLE, VENT (COOLING), CALF, and THIGH (see Figure 4).

■ SYSTEM START-UP ROUTINE

◆ PHASE I:

When the System is turned on, a series of tests is commenced lasting three seconds⁽²⁾:

1. All LEDs illuminate and the beeper sounds for 0.5 seconds.

2. The two seven-segment LEDs illuminate (displaying “.88.”) and then they go off.
3. The COOLING LED illuminates. The beeper sounds briefly and the COOLING LED goes off.
4. The Cycle Monitor LEDs (INFLATE and VENT) illuminate then go off.

◆ PHASE II:

The 45 mmHg set pressure is displayed. During this phase, the compressor flow is adjusted to a predetermined start value.

◆ PHASE III:

The normal operating cycle begins with ankle inflation.

■ PRESSURE MONITORING

The LED display that is used to display the 45 mmHg set pressure and the fault codes can also be used to display the actual pressure. Press the left end of the white horizontal line of the control panel for two seconds. This will cause the display to change to Pressure Monitor Mode. The System will stay in this mode throughout the compression and deflation portions of the current cycle (or the next compression cycle if the button is pressed during the VENT portion of the cycle). The last reading of the compression portion of the cycle will be displayed for 30 seconds. At the beginning of the next inflation cycle the display will revert to displaying 45 mmHg pressure.

When the System is in the Pressure Monitor Mode, a decimal point will flash on either side of the 7-segment display, indicating that the actual pressure is being displayed.

NOTE: While in the Pressure Monitor Mode, it is normal for the displayed pressure to change rapidly during the compression portion of the cycle.

(2) Detection of inoperative LEDs and the audible alarm function is the user's responsibility. The start-up routine also tests microprocessor function and system memory. If a fault condition is detected, either a fault code will be displayed or the unit will repeatedly go into reset which will result in a long beep at a 1 Hz rate.

Calibration/Test Methods

See Disassembly/Reassembly procedure before testing.

■ INTRODUCTION

The SCD SEQUEL Compression System has a special test mode for pressure transducer Calibration Verification, pressure transducer Calibration, and a general function test that can verify microprocessor, solenoid valve, and pneumatic functionality.

1. Factory calibration certification is void if the unit is opened.
2. The unit should only be opened by persons trained in Electrostatic Discharge prevention methods and equipment.

■ CALIBRATION VERIFICATION PROCEDURE

Equipment Required: A regulated air source with a constant output pressure set at 45.0 mmHg \pm 0.2 mmHg.

NOTE: The pressure transducers used in the SCD SEQUEL Compression System are state-of-the-art, highly precise, and virtually drift-free devices.

Complete the following steps to verify System Calibration:

1. Unplug the System.
2. Turn the System on its face and remove the five screws located on the rear cabinet.
3. Carefully turn the System right side up so the front cabinet is facing you.
4. Gently lower the front cabinet toward you until the components inside are accessible. (Make sure the various electrical and pneumatic connections between the CPU Board and the rest of the unit are not dislodged.)
5. Carefully disconnect the Tubing that is attached to the Pressure Transducer on the Control Board.
6. Plug the System into a wall outlet.
CAUTION: ELECTRICAL SHOCK HAZARD.
Do not touch the electrical components on the chassis. The PC Boards are not at line voltage.
7. Place the System in the Calibration Verification Mode by first pressing the Hidden and Cooling Buttons simultaneously while turning on the System. (The Hidden Button is located on the control panel at the very left end of the horizontal white line.) This places the System in the Test Access Mode. The display will show "01." Press the Hidden Button until "04" appears in the System display.

NOTE: Test Access Modes "01," "02," "05," and "07" require dedicated manufacturing test equipment and are not intended for customer use. Do not use.

8. Press the Cooling Button to initiate the Calibration Verification Mode. (The System will continuously display the pressure sensed at the pressure transducer.)
9. Connect the calibrated air pressure source to the Pressure Transducer using a piece of Tubing.
10. Apply 45.0 \pm 0.2 mmHg. Read the pressure on the display.
11. Disconnect Tubing. With no pressure applied read the display.
12. The display readings should be compared to the pressure applied to verify proper calibration.
13. To exit Calibration Verification Mode, turn off the System.
14. If the System requires calibration, proceed to the Calibration Procedure step 7.
15. Unplug the Controller.
16. Reconnect the Tubing. Particular care should be taken to avoid stressing or kinking the tubing.
17. Carefully replace the front cabinet and turn the Controller on its face. Check for proper placement of feet, foam, and tubing.
18. Refasten the five screws. (Do not over-tighten.)

■ CALIBRATION PROCEDURE

Equipment Required: A regulated air source with a constant output pressure set at 45.0 mmHg \pm 0.2 mmHg.

NOTE: The pressure transducers used in the SCD SEQUEL Compression System are state-of-the-art, highly precise, and virtually drift-free devices. It is not expected to require recalibration for several years or more of continuous use.

Complete the following steps to Calibrate the System:

1. Unplug the System.
2. Turn the System on its face and remove the five screws located on the rear cabinet.
3. Carefully turn the System right side up so the front cabinet is facing you.
4. Gently rotate the front cabinet toward you until the components inside are accessible. (Make sure the various electrical and pneumatic connections between the CPU Board and the rest of the unit are not dislodged.)
5. Carefully disconnect the Tubing that is attached to the Pressure Transducer on the Control Board.

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Calibration/Test Methods (CONTINUED)

■ CALIBRATION PROCEDURE (Continued)

6. Plug the System into a wall outlet.
CAUTION: ELECTRICAL SHOCK HAZARD.
Do not touch the electrical components on the chassis. The PC Boards are not at line voltage.
7. Place the System in the Calibration Mode by pressing the Hidden and Cooling Buttons simultaneously while turning on the System. (The Hidden Button is located on the control panel at the very left end of the horizontal white line.) This places the System in the Test Access Mode. The display will show "01." Press the Hidden Button until "03" appears in the System display.
NOTE: Test Access Modes "01," "02," "05," and "07" require dedicated manufacturing test equipment and are not intended for customer use. Do not use.
8. Press the Cooling Button to initiate the Calibration Mode. The System will now display the pressure in the line.
9. The INFLATE LED will be illuminated.
10. Connect the calibrated air pressure source to the Pressure Transducer using a piece of tubing.
11. With 45.0 ± 0.2 mmHg applied, press the Cooling Button. (This will record the 45 mmHg set point in System software.)
12. The Vent LED will be illuminated.
13. Disconnect the tubing. With no pressure applied, press the Cooling Button. (This will record the 0 mmHg set point in System software.)
14. Turn the System off.
15. Reconnect the tubing. Particular care should be taken to avoid stressing or kinking the tubing.
16. Carefully replace the front cabinet and turn the System on its face. Check for proper placement of feet, foam, and tubing.
17. Refasten the five screws. (Do not over-tighten.)
CAUTION: If the Cooling Button is pressed inadvertently during the Calibration other than when specified in steps 8, 11, and 13, the System must be recalibrated.

■ GENERAL FUNCTION TEST

The following describes a General Function Test which can be used to exercise the System. This test is not part of the

normal testing and maintenance routine, but can be used in the event of disassembly to verify:

- The correct wiring and connection of the solenoid valves.
- The correct orientation and connection of the pneumatic circuit.
- There is no blockage or leaking in the pneumatic circuit.

■ PROCEDURE

1. Press the Hidden and Cooling Buttons simultaneously while turning on the System. (The Hidden Button is located on the control panel at the very left end of the white horizontal line.) This places the System in the Test Access Mode. The display will show "01."
2. Press the Hidden Button until "06" is on the System display.
NOTE: Test Access Modes "01," "02," "05," and "07" require dedicated manufacturing test equipment and are not intended for customer use. Do not use.
3. During the procedure you will gently hold a finger near each air outlet port on the back of the System to verify air flow is present for each cycle at the correct port. The order of the ports from left to right, looking at the back of the System, is Ankle, Vent (Cooling), Calf, and Thigh (see Figure 4). The flow will gradually increase for the Ankle, Calf, and Thigh. The flow will start a maximum and stop abruptly for the Vent.
4. To initiate the test, press the Cooling Button.
 - ◆ The ankle solenoid valve will open, the System will beep, and the compressor will run at minimum flow for five seconds.
 - ◆ The compressor will ramp up to maximum flow in two seconds.
 - ◆ The System will beep and remain at full speed for five seconds.
 - ◆ The ankle valve will close.
 - ◆ The sequence will be repeated for the calf and thigh portions.
 - ◆ At the end of the thigh portion, the thigh valve will shut and the vent valve will open. The vent valve will go immediately into maximum flow. This will last for five seconds.
 - ◆ When the vent circuit has completed its cycle, the System will return to the Test Access Mode.

Disassembly/Reassembly

■ CASE REMOVAL

CAUTION: SHOCK HAZARD. Disconnect line cord from the power supply.

CAUTION: Disassembly of the case and particularly the disconnection of pneumatic and/or electronic components can disrupt the function and calibration of the instrument. It is strongly recommended that the Calibration and General Valve Function Tests be performed upon reassembly.

ESD WARNING: Unit should only be opened by person trained in ESD methods and equipment.

Remove the case components in the following sequence: (see Figures 5 and 6 located in the Appendix).

1. Remove front cover.

To remove the front cover, place the System on its face and remove the five screws located on the back of the unit.

2. With the System standing upright and facing you, carefully rotate the front cover toward you.
3. Note the location and orientation of the connectors from the rear case components on the CPU Board. Remove the connectors by gently pulling on each individual connector. Some connectors have locking clips that must be gently squeezed to disengage.
4. Very gently disconnect the Tubing at the pressure transducers on the CPU Board.

■ CIRCUIT BOARD REMOVAL

The CPU Board is located on the front case. The Power Board is located on the rear case directly above the compressor.

CAUTION: Use a grounded strap when handling any electronic components.

1. Note the location and orientation of all the pneumatic and electrical connections to the PC Boards (see Figure 7). (Label cables and tubing if necessary.)
2. Disconnect all the pneumatic and electronic leads to the PC Boards.
3. Remove the six mounting screws located on the CPU Board.
4. Carefully slide the Power Board out of the System from between the compressor and top of rear cabinet.

CAUTION: Components on the PC Boards should not be removed or replaced. If a circuit board is suspected of being faulty, the unit should be returned for repair by calling the toll-free service number (800) 765-4324.

■ CIRCUIT BOARD INSTALLATION

CAUTION: Use a grounded strap when handling any electronic components.

1. Carefully align the CPU Board with the mounting bosses and fasten the six mounting screws.
2. Carefully slide the Power Board into the System between the compressor and top of rear cabinet.

■ COMPRESSOR

The Rotary Vane Compressor is driven by a state-of-the-art brushless DC motor. Flow is controlled by adjusting the rotational speed of the motor. The higher the speed, the greater the flow. The motor control circuit which controls the motor speed is located on the Power Board and is not integral to the motor on the Compressor.

NOTE: The Compressor used in the instrument is not a user serviceable component. Special jigs and fixtures are required to ensure proper alignment during reassembly.

Do not disassemble.

Do not oil.

Disassembly/Reassembly (CONTINUED)

■ SOLENOID VALVES

- ◆ All four solenoid valves are arranged in a 2-by-2 single manifold.
- ◆ The solenoid valve that connects the pump to the Sleeve Cooling (Vent) Port is a 2-way, normally closed type. When energized, it passes air to the port; when de-energized, flow is blocked.
- ◆ The solenoid valve connecting air flow from the flow control valve to the ANKLE, CALF, and THIGH ports are of the 3-way, normally closed type. When energized, these valves pass air to their respective Sleeve ports. When de-energized, pump air is blocked and air pressure in the Sleeves is released through the port on the top of that particular valve.
- ◆ The coils on all four valves are removable by removing the nut at the top of the valve.
- ◆ Any debris in the air lines could cause mechanical malfunction of the solenoid valves. If this is suspected, the valve tubing should be disconnected and the valve flushed with filtered compressed air through the port while energizing the valves respectively from a 24-volt supply. Filtration of incoming air guards against debris entering the compressor. If debris is present, it may indicate:
 - a. Failure to clean the filters when needed.
 - b. Physical breakdown of some component of the pneumatic circuit, for example, degradation of a section of tubing.

■ UNIT REASSEMBLY⁽³⁾

1. Place the rear case with the complete chassis installed, on the bench in front of you with the front of the System towards you.
2. Place the front case on its side with the bottom edge of the front case against the rear base. The front case should be toward you with the rear case behind.
 - ◆ Reconnect all of the electrical connections in the proper location and orientation of the leads from the System components. Replace the connectors by gently pushing straight in.
 - ◆ Reconnect the Tubing on the pressure transducers. Particular care should be taken to avoid stressing the fittings on the pressure transducer.
3. Rotate the front case and place it over the rear case base. Carefully align the two halves, making sure the rubber feet are in place and aligned properly.
 - ◆ Turn the closed System on its face and reinstall the five screws.
 - ◆ Turn the unit right side up and perform the General Function Test.

(3) NOTE: It is recommended, before case reassembly, that any disassembly which involves the electrical or pneumatic circuit requires a recalibration. (See Calibration Procedure.)

Specifications

■ MODEL #6325

UL ListingBuilt to UL 544 Standard
Listing KFBQ File #E116754

Compression TypeSequential, Gradient Pressure

Compression Cycle11 Seconds Compression,
60 Seconds Decompression

Set Pressure45 mm Hg

Bed HookYes

Power Cord StorageYes

Audible/Visual AlarmsLow Pressure, High Pressure,
Internal Electronics Malfunction

Sleeve Cooling FunctionYes

Cycle MonitorYes

Power CordHospital Grade Plug

Controller Height6 inches

Controller Width10³/₄ inches

Controller Depth4¹/₂ inches

Weight8.9 lbs.

Power Requirements115 VAC, 86 VA, 60 Hz

Shipping UnitEach

Shipping Case DimensionsLength - 13³/₈ inches
Width - 11 inches
Depth - 10³/₈ inches

Shipping Weight12.2 lbs.

Tubing SetIncluded

Operating InstructionsAttached to unit
under handle

Operation & Service ManualIncluded

Quality Specifications

■ MODEL #6325

The following information is a brief description of the tests performed on all SCD SEQUEL Compression Systems to ensure compliance to the prescribed System quality specifications and does not include clinical performance.

1.0 Electrical Tests

1.1 Power and Control Printed Wiring Board Assemblies

The boards are tested on a board test fixture for the following functions:

- 1.1.1 Individual component integrity
- 1.1.2 Component installation
- 1.1.3 Board calibration

1.2 Controller

- 1.2.1 Correct sequential activation of Inflate and Vent LEDs
- 1.2.2 Cooling Button and LED function
- 1.2.3 Dielectric Voltage Withstand Test (Hi-Pot)
- 1.2.4 Power Switch function
- 1.2.5 Indicator lights and button functions

2.0 Pneumatic Functional Tests

- 2.1 Controller calibration at 45 ± 2 mmHg
- 2.2 Airflow supporting compression in the ankle, calf, and thigh
- 2.3 System high pressure fault detection
- 2.4 System low pressure fault detection

3.0 Burn-In Requirements

While operating in the Burn-In Mode, the System is run for 48 hours to enhance unit reliability.

4.0 Visual Attributes Inspection

- 4.1 Case parts appearance and alignment
- 4.2 Labeling

5.0 Final Product Inspection

Final release criteria utilizes 100% testing of Systems for the following:

- 5.1 Calibration
- 5.2 Air flow levels
- 5.3 Cosmetic defects

Figure 1

Diagram of Bed Hook Use

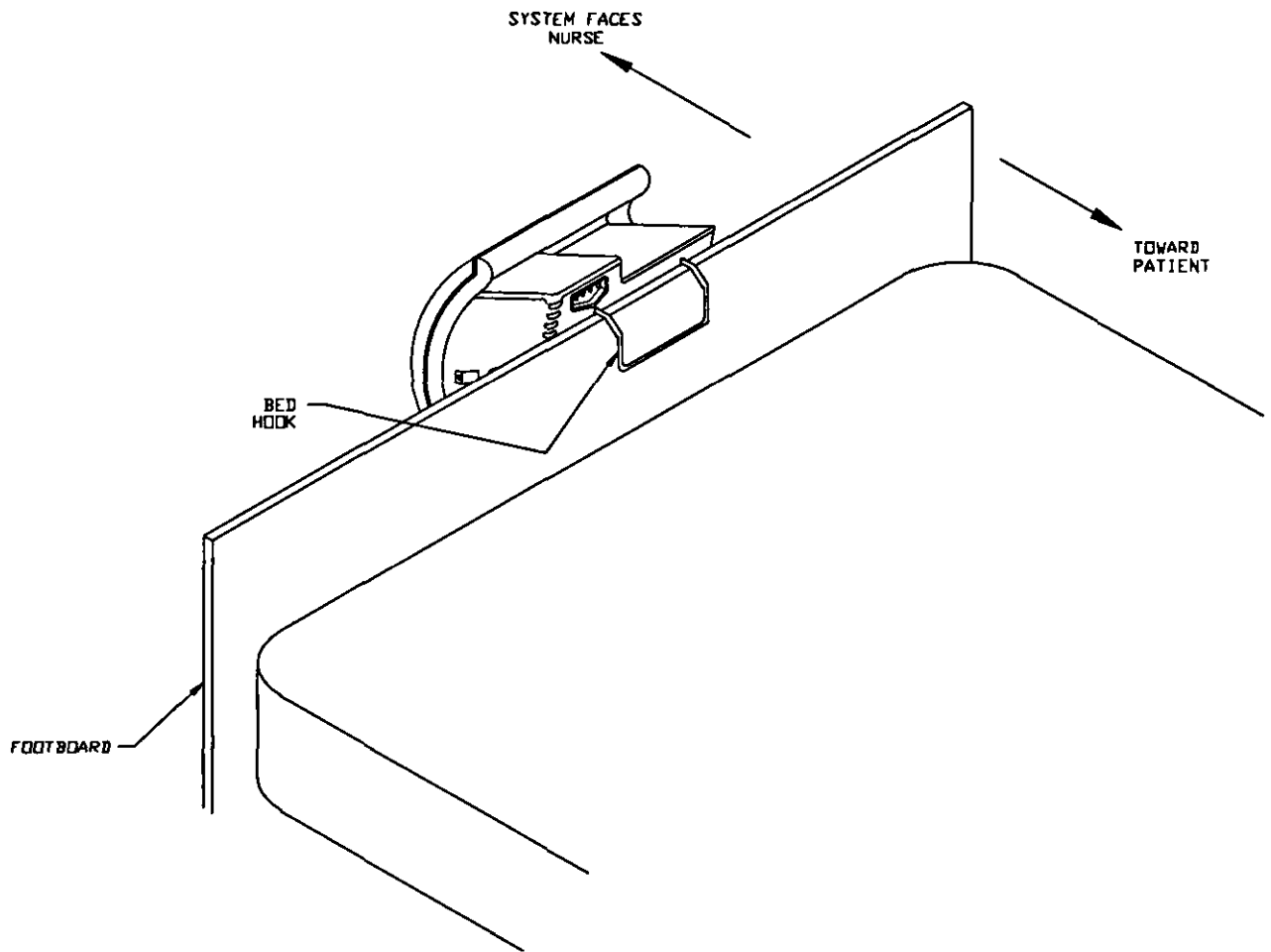


Figure 2

System – View of Controls & Indicators

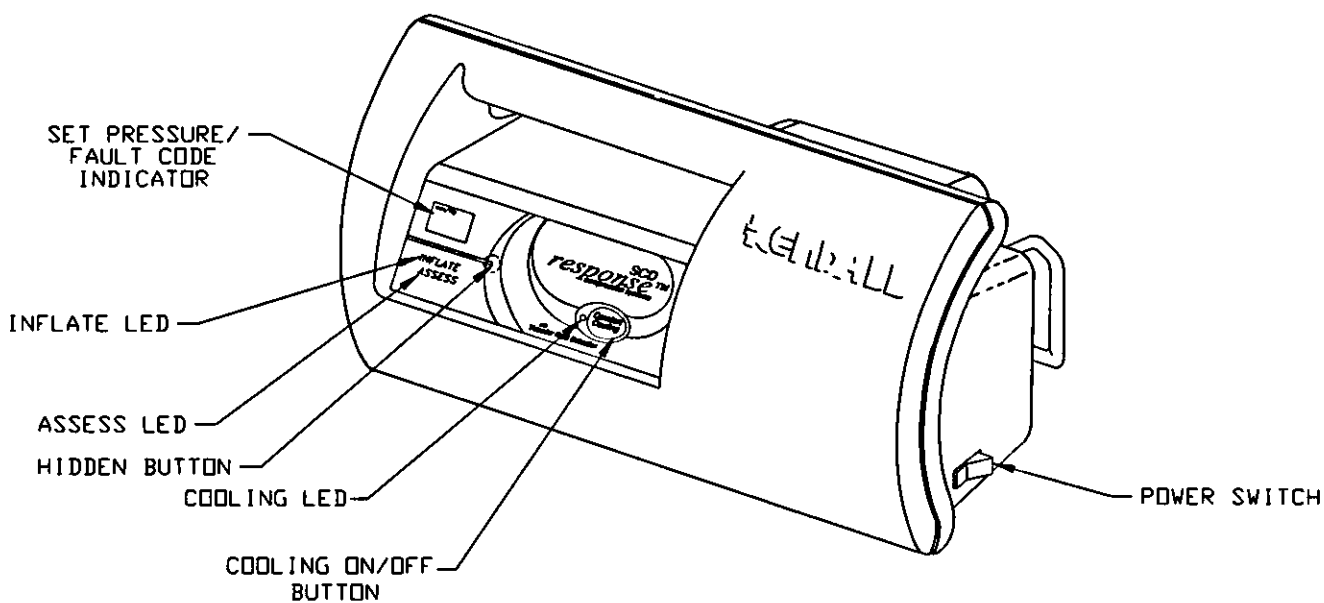


Figure 3

Diagram of Power Cord Storage

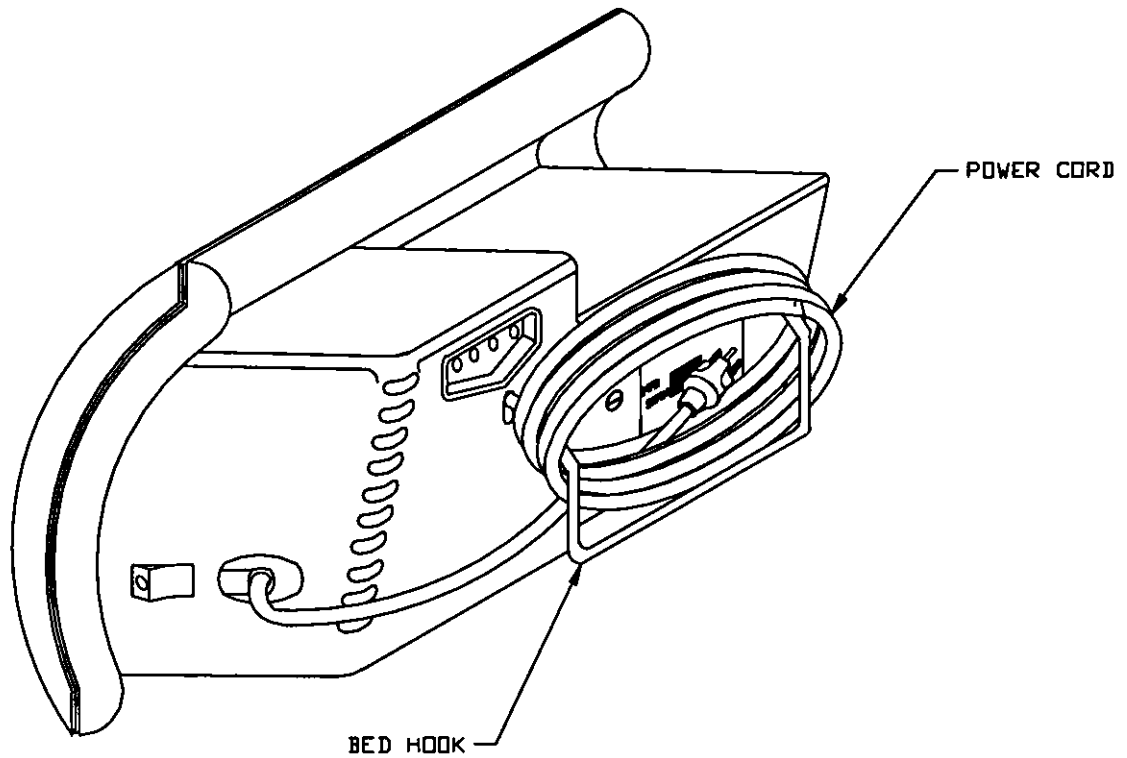


Figure 4

Pneumatics Schematic

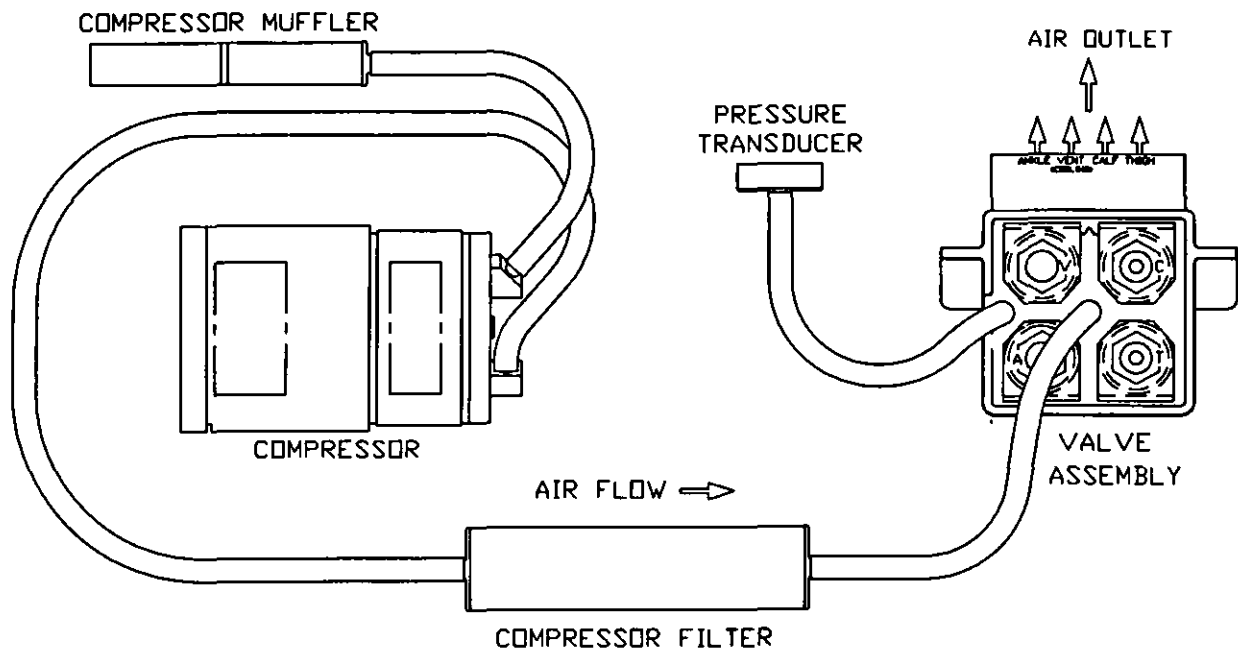


Figure 5

System — Exploded View

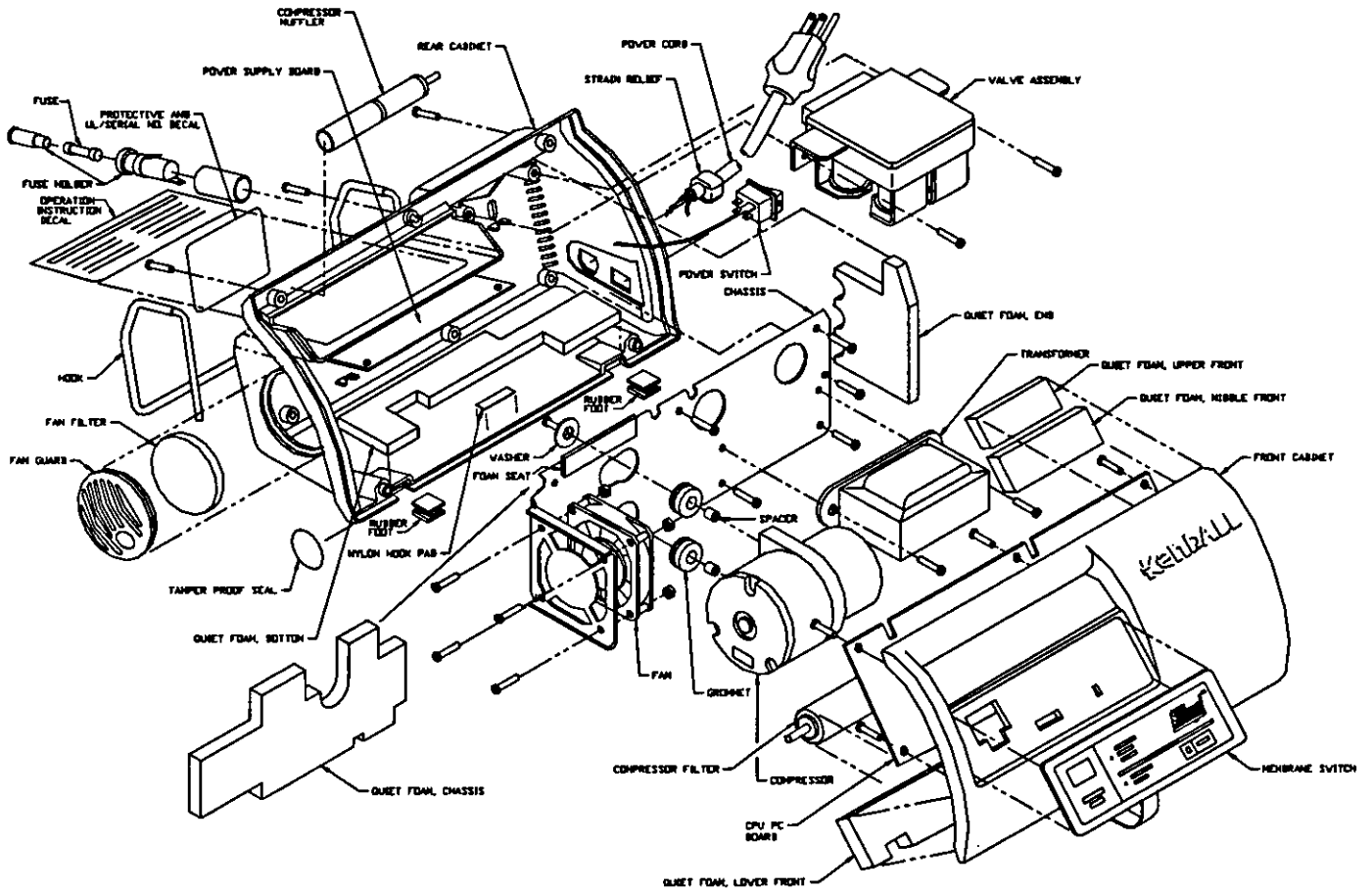


Figure 6

Pneumatics & Electrical Circuits

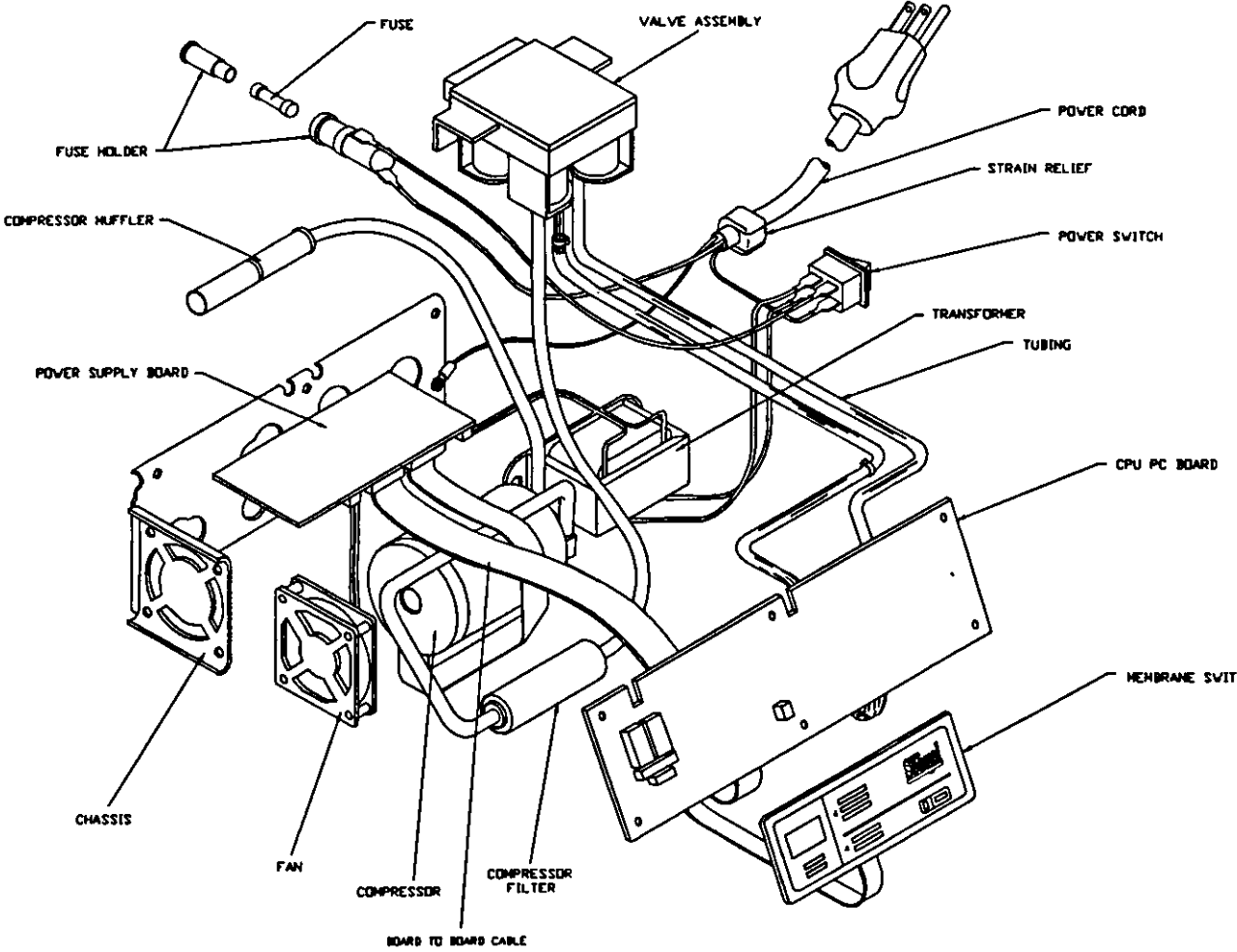
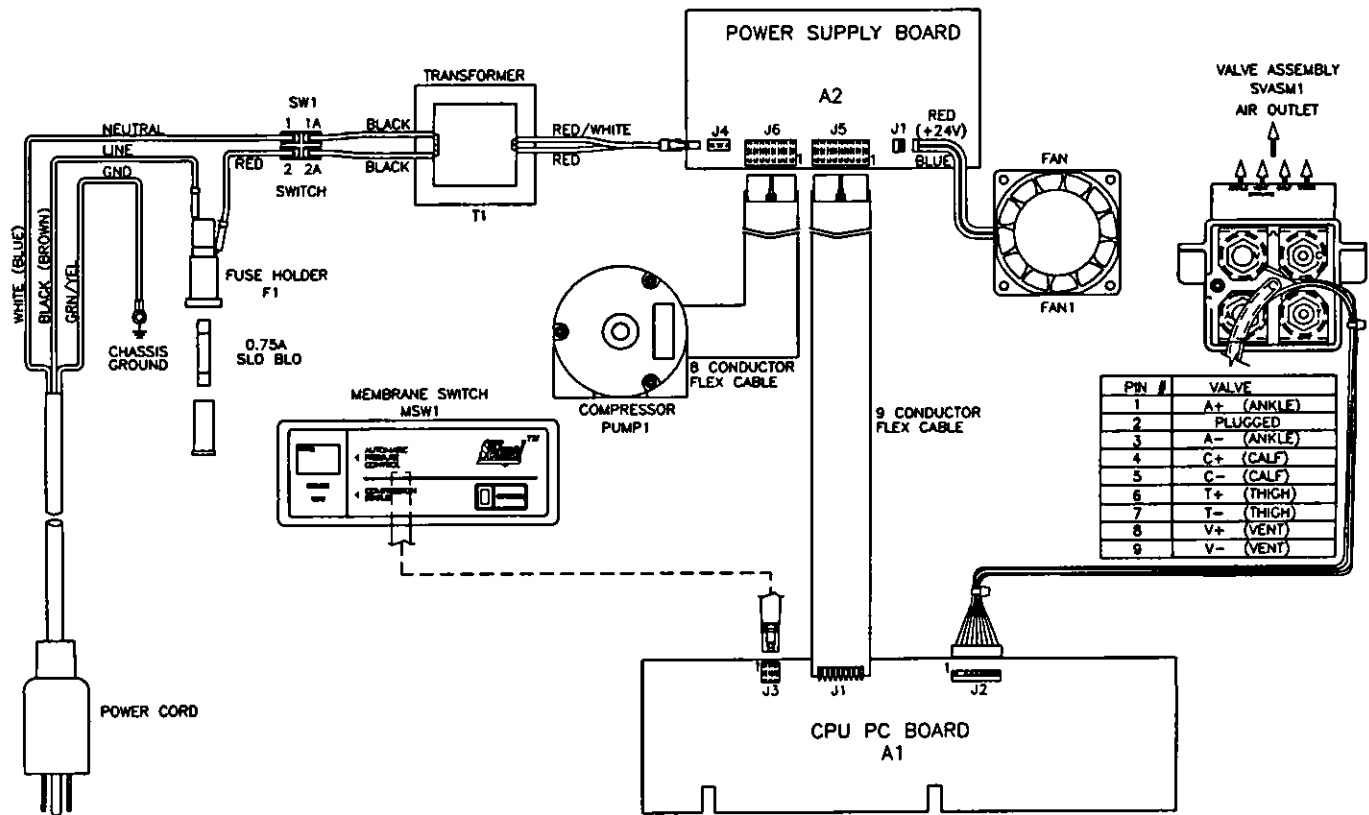


Figure 7

Electrical Schematic



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