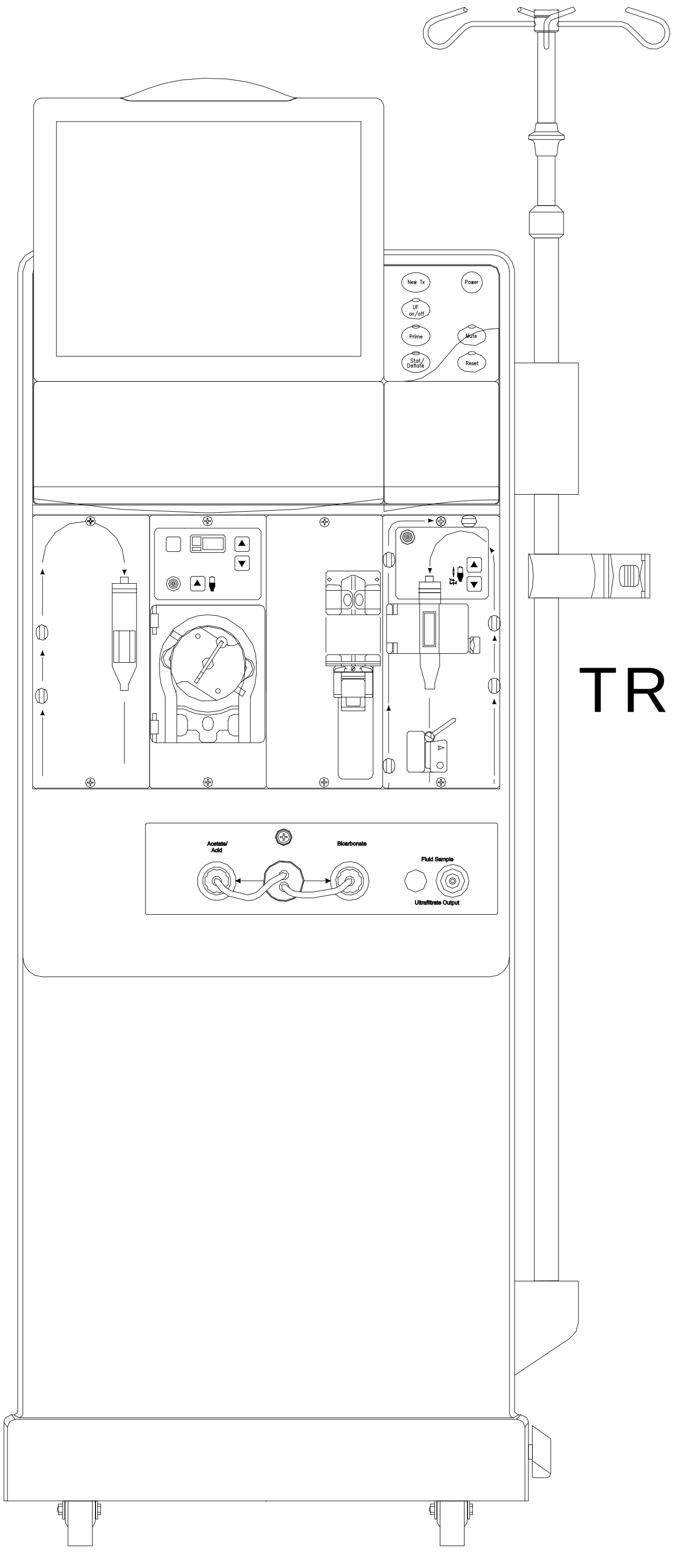
FRESENIUS
MEDICAL CARE



# 2008T
# HEMODIALYSIS SYSTEM

# TROUBLESHOOTING GUIDE

Part Number 490292 Rev. A

# FRESENIUS MEDICAL CARE NORTH AMERICA

**800-227-2572**

**Fresenius Medical Care North America**
**920 Winter St.**
**Waltham, MA 02451**

**Manufactured by:**
**Fresenius USA, Inc.**
**4040 Nelson Avenue**
**Concord, CA 94520**

REGIONAL EQUIPMENT SPECIALIST: ______________________________________

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**http://www.fmcna.com**

# 2008T Technical Troubleshooting Guide



*Caution: US Federal law restricts this device to sale only by or on the order of a physician. Frequency, duration, and parameters of treatment are to be determined by the prescribing physician.*

*Installation, maintenance, calibration and other technical information may be found in the 2008T Technician's Manual, P/N 490130*

*Contact Fresenius Medical Care Technical Support for applicable Field Service Bulletins. The spare parts manual for the model 2008T and other information may be found on our web site at www.fmcna.com*

*Indications for Use: The 2008T hemodialysis machine is indicated for acute and chronic dialysis therapy.*

# TABLE OF CONTENTS



**Continued on next page**

**TABLE OF CONTENTS (CONTINUED)**

# USING THE TROUBLESHOOTING GUIDE

A. ALWAYS turn the machine OFF before replacing a circuit board or unplugging ribbon cables.

B. Observe Electrostatic Discharge (ESD) Precautions when working inside the card cage!

C. It is assumed the troubleshooter is Certified and has working knowledge of the machine.

D. It is assumed the troubleshooter knows how to use a multimeter (Volts DC / Volts AC / Resistance).

E. DO NOT calibrate or swap parts unless instructed. **NEVER swap parts between malfunctioning machines!** Parts should be tested (known good) in another machine before swapping them in.

F. Calibration(s) may be required after replacing a component. Refer to Appendix B (page 758) and Appendix C (page 759).

G. Perform FINAL CHECKS (page 15) before returning the machine to clinical service.

H. Be CAREFUL to maintain your current location as you proceed AND read each procedure before performing it. **Pay attention to 'CAUTIONS' and 'NOTES'**!

I. Troubleshooting procedures are arranged as a 'flow chart'. ENSURE you go to the CORRECT procedure number as prompted. You CANNOT necessarily read down the page as sometimes procedures on that page are SKIPPED.

J. Sometimes procedures 'call' another procedure in a different Section. **NOTE** the current procedure and page number BEFORE proceeding to the 'called' procedure!

K. If multiple 'possibilities' are suggested (example: TWO (2) possible bad components: **1)** Bad Actuator-Test Board; **2)** Bad Functional Board), swap the listed components, with known good, one at a time, starting with the first component in the list. In between test the machine to see the new part fixes the problem. If NOT continue through the list until the machine is fixed.

L. Hydraulic components can be isolated via the DISTRIBUTION BOARD. Referring to Figure 1 (page 4):

- There are three (3) Distribution Board sections: **1)** Sensors; **2)** Pumps; **3)** Valves

- Electronic hydraulic components each have labeled connector positions as referenced in the 2008 Flow Diagram. Labels are printed above or below each position. For example, Float Switch #5 is labeled "X5, FLOAT-SW", temperature sensor NTC #2 is labeled "X2, CON-NTC", etc.

- From left-to-right, positions start at #2 [example: NTC #2, labeled "X2, CON-NTC"]. **There is no position #1! P**ost Dialyzer Temperature Sensor #44 plugs into position #14; Valve #41 plugs into position #27

- The plastic connector caps should be labeled to match the position

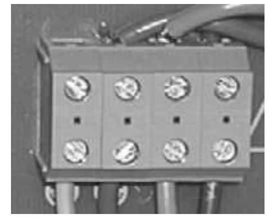
- There are several VACANT positions! When removing a connector **NOTE** its position and label. **Be CAREFUL to return all connectors to their correct positions!**

- Turn the machine off BEFORE unplugging OR plugging RIBBON cables. These include the SENSORS, ACTUATOR, Acid (#16) and Bicarbonate (#17) Pumps, Blood Leak Sensor (#8), Heparin Pump (#18) and the Blood Pressure Module

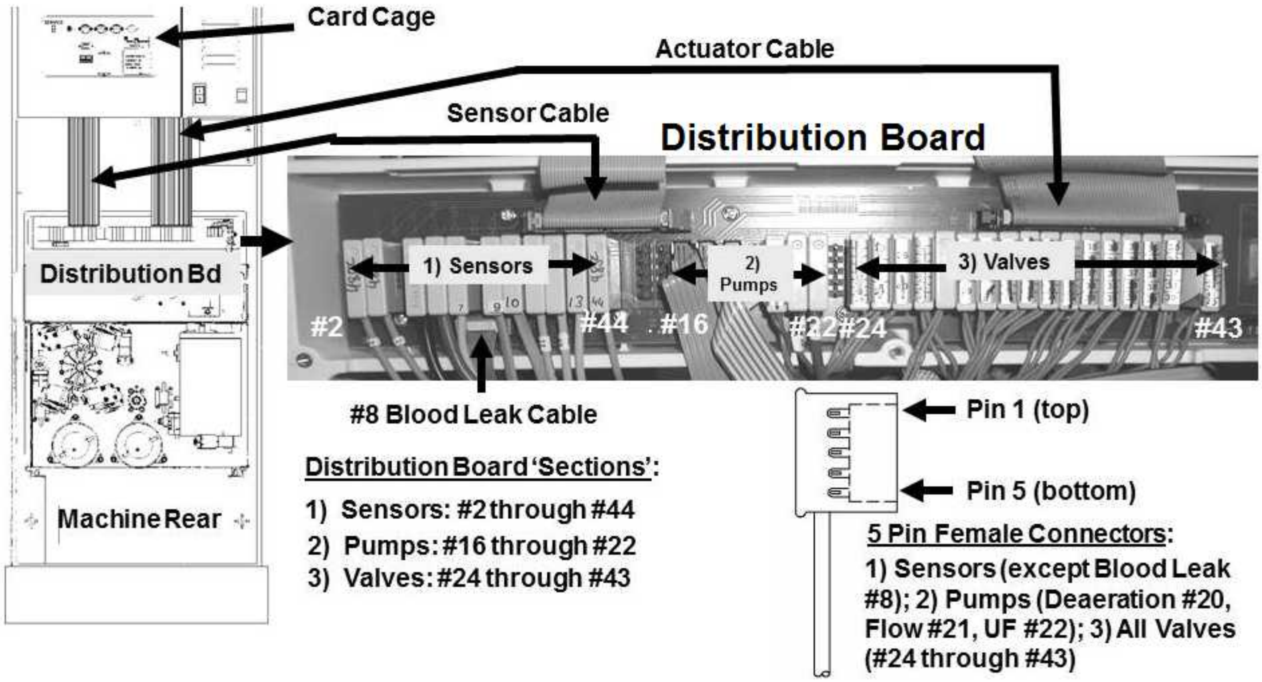
**Continued on next page**

- The 5-pin female connectors can be unplugged and returned with the power on without causing damage

- **CAUTION!** The green 8-pin Heater Connector (Figure right) is connected to 120 Volts AC.

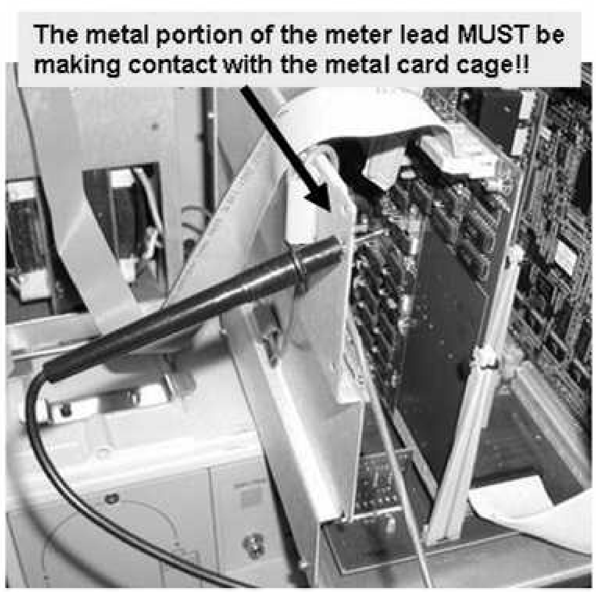


### Figure 1 – Distribution Board




M. Figure below, if asked to measure DC voltages ($V_{DC}$) and in some cases resistance (Ω) connect the meter's ground (black) lead to the card cage (i.e. chassis ground).

### Figure 2 – Chassis Ground

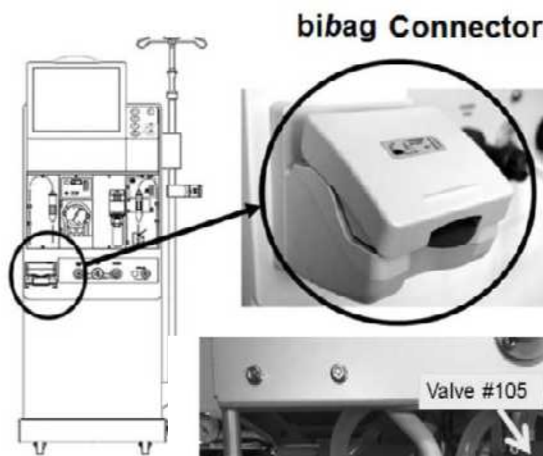



N. Procedures may vary depending on if the machine is equipped for bi*b*ag. See the following page:

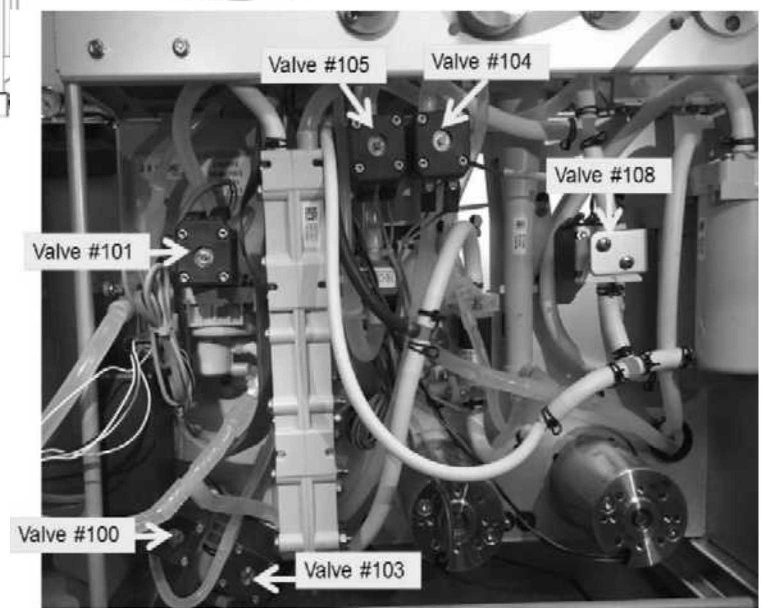
**bi*b*ag (on line bicarb preparation system) [refer to the Figure below]**

**Machine Front View**

**Equipped for bi*b*ag**




**Hydraulics Front View**
**bi*b*ag Valves**




**Hydraulics Front View**
**bi*b*ag Sensors**

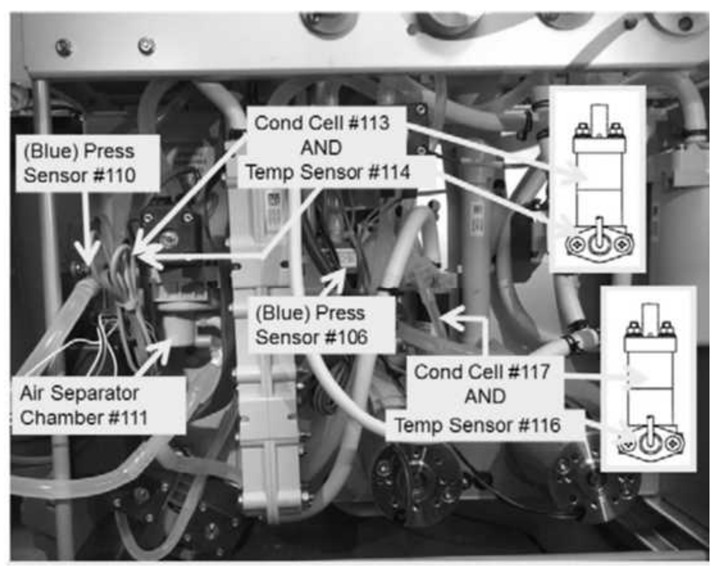



**Figure 3 – bi*b*ag Components**

End of 'Using the Troubleshooting Guide'

## THE (HYDRAULIC) 'ORDER' OF TROUBLESHOOTING

Understanding the 'Order of Troubleshooting' will lead to the ***root cause*** of a problem and NOT its **effects**.

1. External hydraulic leaks
2. No Water
3. Flow Errors
4. Temperature
5. Conductivity
6. Filling Programs (air sensed in the hydraulics)
7. TMP (Transmembrane Pressure)
8. Blood Leak
9. Pressure Test Failures

1. External HYDRAULIC LEAKS can cause all problems below it. If a leak is seen eliminate it before troubleshooting any problem below it!

   **NOTE!** Vent tubing overflow may occur with Flow Errors, Filling Programs, and "TMP is Low" alarms.

2. "NO WATER" alarms may cause Flow Errors. ENSURE a "No Water" alarm NEVER occurs before troubleshooting any problem below it.

3. FLOW ERRORS turn the heater off. Ensure the machine remains clear of FLOW ERRORS before troubleshooting temperature. If dialysate flow is unstable temperature will be unstable!

4. TEMPERATURE compensates conductivity. Ensure TEMPERATURE is between 35.5 and 38.5° C and stable i.e. not changing more than 0.2º C per minute before troubleshooting conductivity. If TEMPERATURE is unstable conductivity will be unstable which will also cause OLC to cancel!

5. In Dialysis Program, low CONDUCTIVITY will cause a false 'air in dialysate' signal from Chamber #69's Air Sensor #6 which causes Filling Programs. Do not troubleshoot a Filling Program unless CONDUCTIVITY is between 13.0 and 14.4 mS!

6. In Dialysis Program, if Chamber #69's Air Sensor #6 senses 'air in dialysate' a FILLING PROGRAM occurs. Valve #43 opens to vent Chamber #69 to drain and therefore TMP will decrease. Do not troubleshoot a "TMP is Low" alarm if the machine is in a FILLING PROGRAM!

   **NOTE!** In all Cleaning Programs 'air in dialysate' is invalid. FILLING PROGRAM does NOT occur!

7. TMP alarms may occur if there is an external leak or 'air in dialysate'. Do not troubleshoot TMP alarms unless you are sure there are no leaks AND good Temperature and Conductivity.

8. 'Air in dialysate' may cause false BLOOD LEAK alarms. Also, if Conductivity and/or a Temperature alarm are present 'bypass' occurs i.e. Valve #24 closed, Valve #26 open. In this event Blood Leak Sensor #8 is bypassed. Ensure all alarms above BLOOD LEAK remain clear before troubleshooting BLOOD LEAK.

9. PRESSURE TESTS may fail if any problem above it occurs. ENSURE the machine remains clear of all alarms before troubleshooting PRESSURE TEST FAILURES.

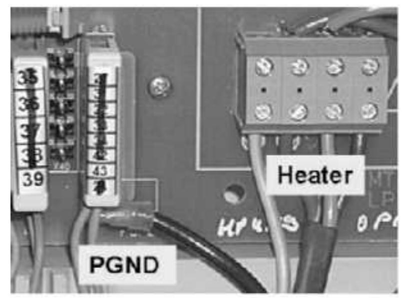
**Refer to the TABLE OF CONTENTS to locate the symptom.**

End of 'The Order of Troubleshooting'

## INITIAL CHECKS

1) **CAUTION!** To prevent shock, turn the machine OFF.

2) Figure below, remove the **DISTRIBUTION BOARD** cover:


   a) ENSURE the Sensors and Actuator ribbon cables are plugged in PROPERLY.

   b) Figure right, ENSURE position "X4-PH-PR" is VACANT!

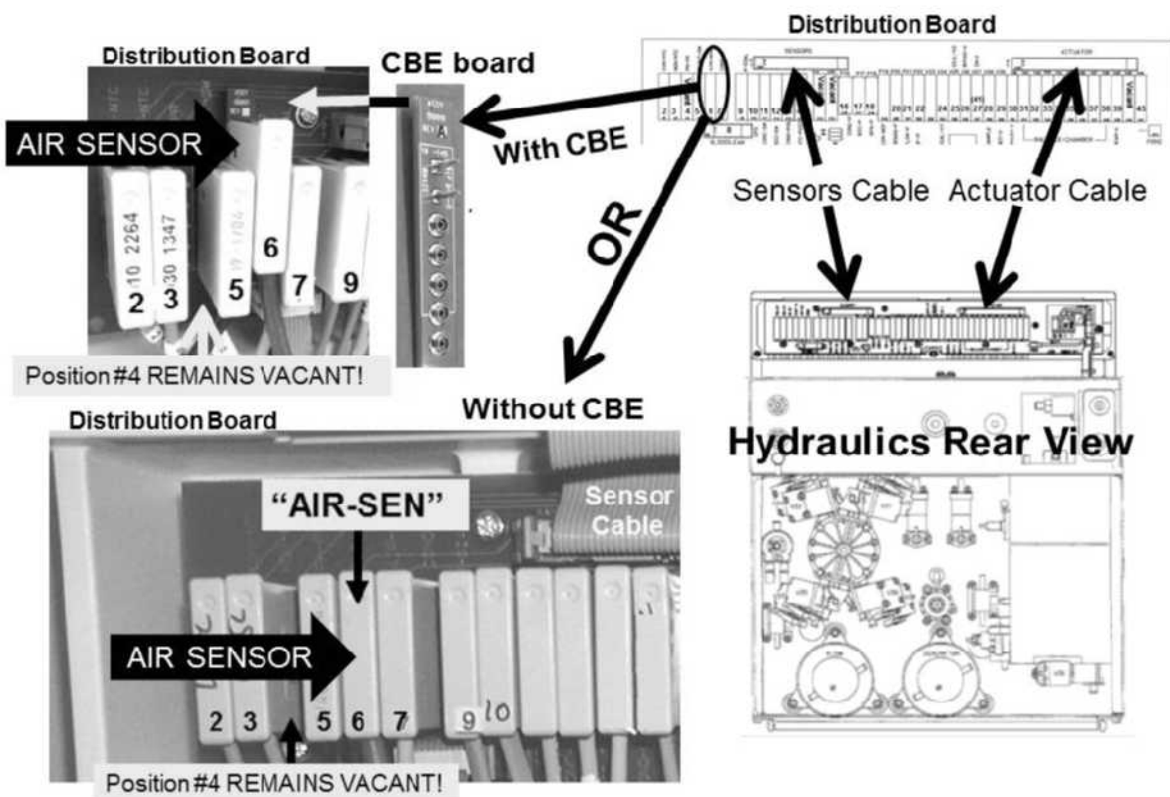
   c) Using a flashlight, inspect the Distribution Board surface for corrosion or burning.

   d) Figure right, ENSURE the black Power Ground (PGND) wire is plugged in securely and shows no signs of burning.

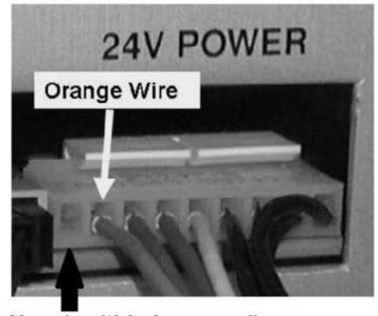
   e) Figure below, ENSURE all female distribution board connectors***** are plugged in PROPERLY to their correct positions!

   * **If CBE modified the Air Sensor's connector plugs into the CBE board under the connector. The CBE board moves the Air Sensor Connector two-pins higher than the others!** CBE = **C**hange **B**eing **E**ffected

**Parts 3 through 6 next page**



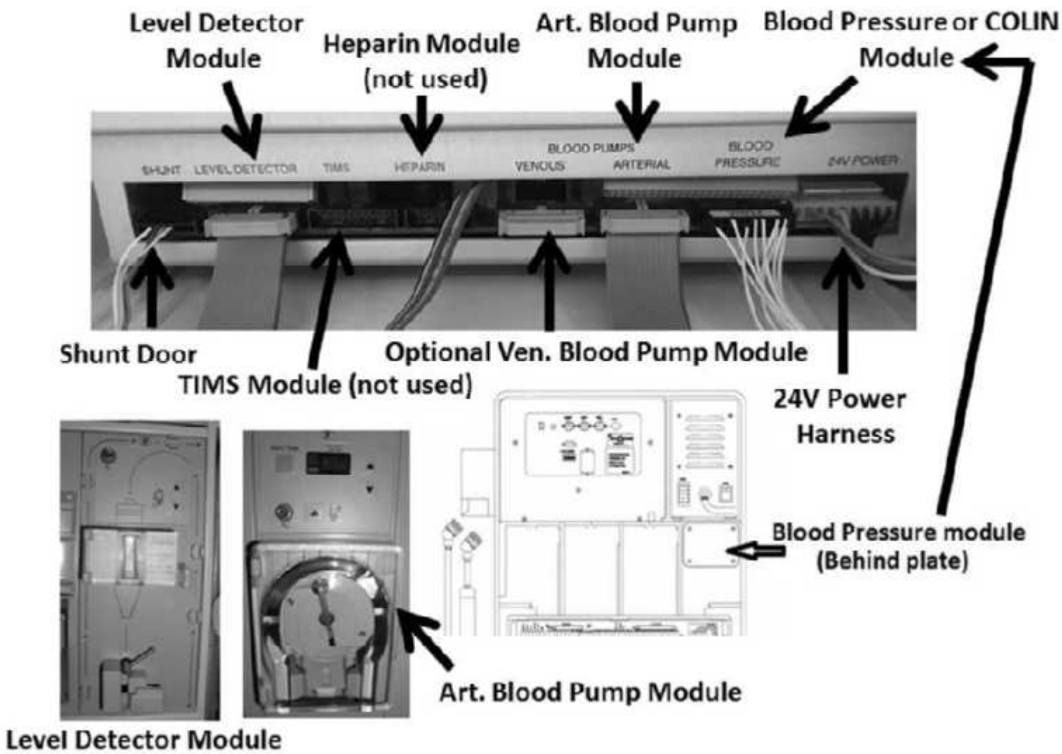
3) To avoid pulling cables loose, gently open the **CARD CAGE**:




a) Figure right, ENSURE the **24V POWER** harness is plugged in PROPERLY with the orange wire to the left!

b) Figure below, trace the cable from the Blood Pressure Module to ENSURE it is NOT reverse connected with another module!

c) Inspect the entire length of ALL module cables for damage!




4) Inside the card cage, perform parts a through f below:

a) ENSURE all ribbon cables are plugged in PROPERLY.

b) Inspect the entire length of ALL cables for damage.

c) Using air, clear excessive dust from the surface of the motherboard*****. *****To LOCATE the motherboard refer to Figure 4A (page 10).

d) ENSURE no foreign objects (screws, etc.) are laying on the surface of the motherboard!

e) Using a flashlight, inspect the surface of the motherboard for corrosion or burning!

f) Press down HARD on ALL circuit boards to ensure good connections to the motherboard.

5) **CAUTION! Close the card cage!**

**Part 6 next page**

6) Are you troubleshooting a voltage problem (example: “24V Low”) OR an Acid and / or Bicarb Pump “EOS” or ‘pink pump symbol’ problem?

Yes  Continue to step #7.

No  A problem located, and repaired, during INITIAL CHECKS may have solved the problem you were troubleshooting! If not, return to the procedure that brought you to INITIAL CHECKS!

7) To avoid electrical shock, unplug the machine!

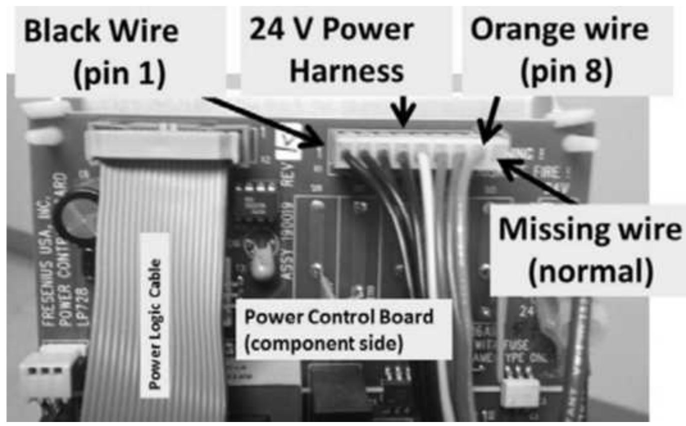
8) Slide the Power Supply ¼ way out away from the cabinet. DO NOT let it fall out!

9) Figure right, at the top of the Power Control board ensure the Power Logic and 24V Power cables are plugged in securely.

10) Using compressed air clear excessive dust from the board surfaces.

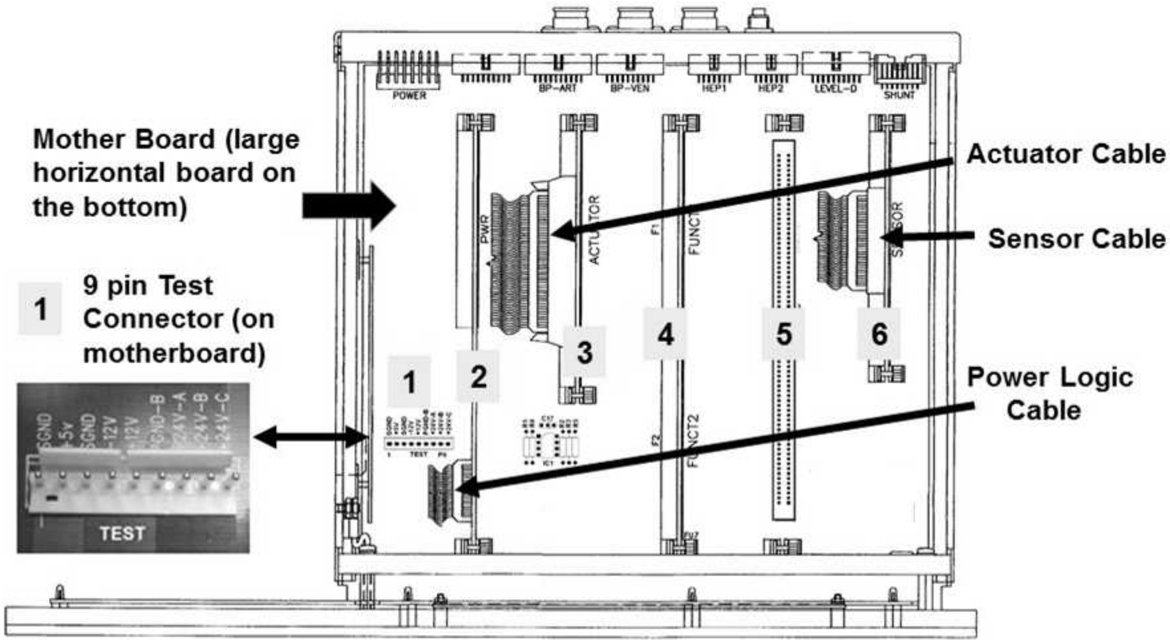
11) Slide the Power Supply back into the cabinet.

12) Plug the machine in.




13) A problem located, and repaired, during INITIAL CHECKS may have solved the problem you were troubleshooting! If not, return to the procedure that brought you to INITIAL CHECKS.

# Figure 4A – Card Cage




**1** – 9 pin Test Connector; **2** – Power Logic Board NOTE A (page 10); **3** – Actuator-Test Board NOTE B (page 11), **4** – Functional Board; **5** – User Interface (UI-MICS) Board; **6** – Sensor Board

**NOTE A - POWER LOGIC BOARD**

Figure below, ENSURE the correct Power Logic Board is installed!

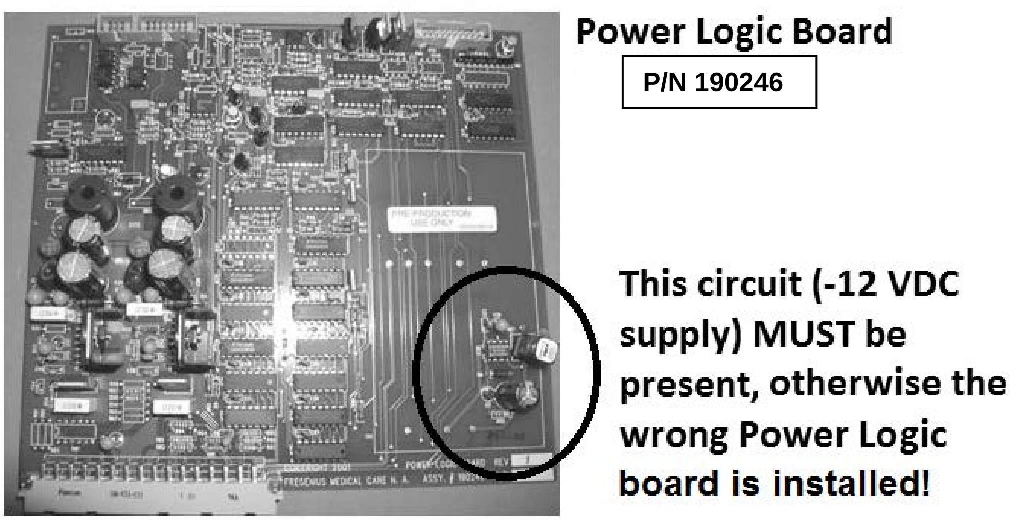



**Figure 4B – Power Logic Board**

**NOTE B – ACTUATOR-TEST BOARD AND IF bi*bag* EQUIPPED INTERFACE BOARD**

A) Unless whatever problem you are troubleshooting will not allow entering Service Mode, if the Actuator-Test Board is replaced, the Voltage Detector Calibration should be performed! See **VOLTAGE DETECTOR CALIBRATION** (page 17).

B) Figure below, if equipped with a bi*b*ag Connector the 'Interface Board' is piggy backed to the component side of the Actuator-Test Board. It interfaces the bi*b*ag hydraulic components, Actuator-Test Board and the bi*b*ag Distribution Board and Distribution Box 2.

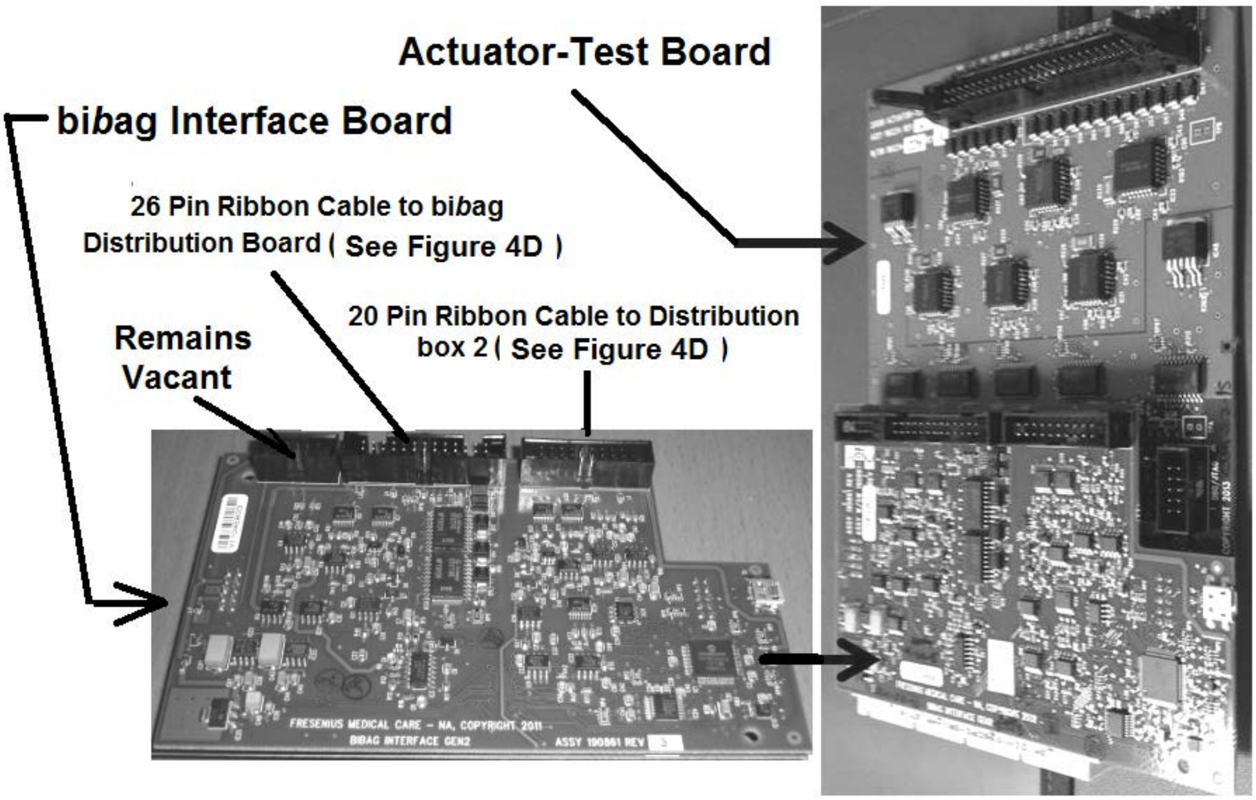



**Figure 4C – bi*b*ag Interface Board**

**bi*bag* Interface Board INSTRUCTIONS**:

A) TURN THE MACHINE OFF!

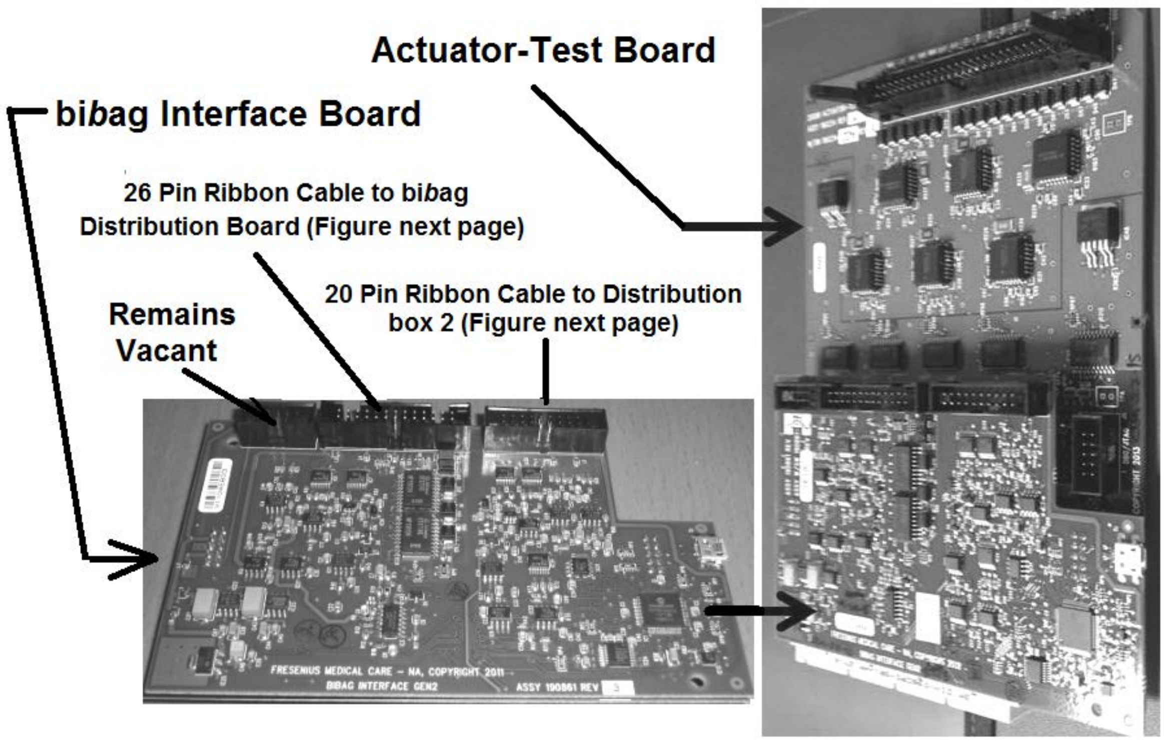
B) Figure below, inside the card cage, the bi*b*ag Interface circuit board piggybacks onto the Actuator-Test Board (2nd circuit board from the left)!

C) ENSURE the bi*b*ag Interface Board is connected securely to the Actuator-Test Board! **If not this may be the problem!**

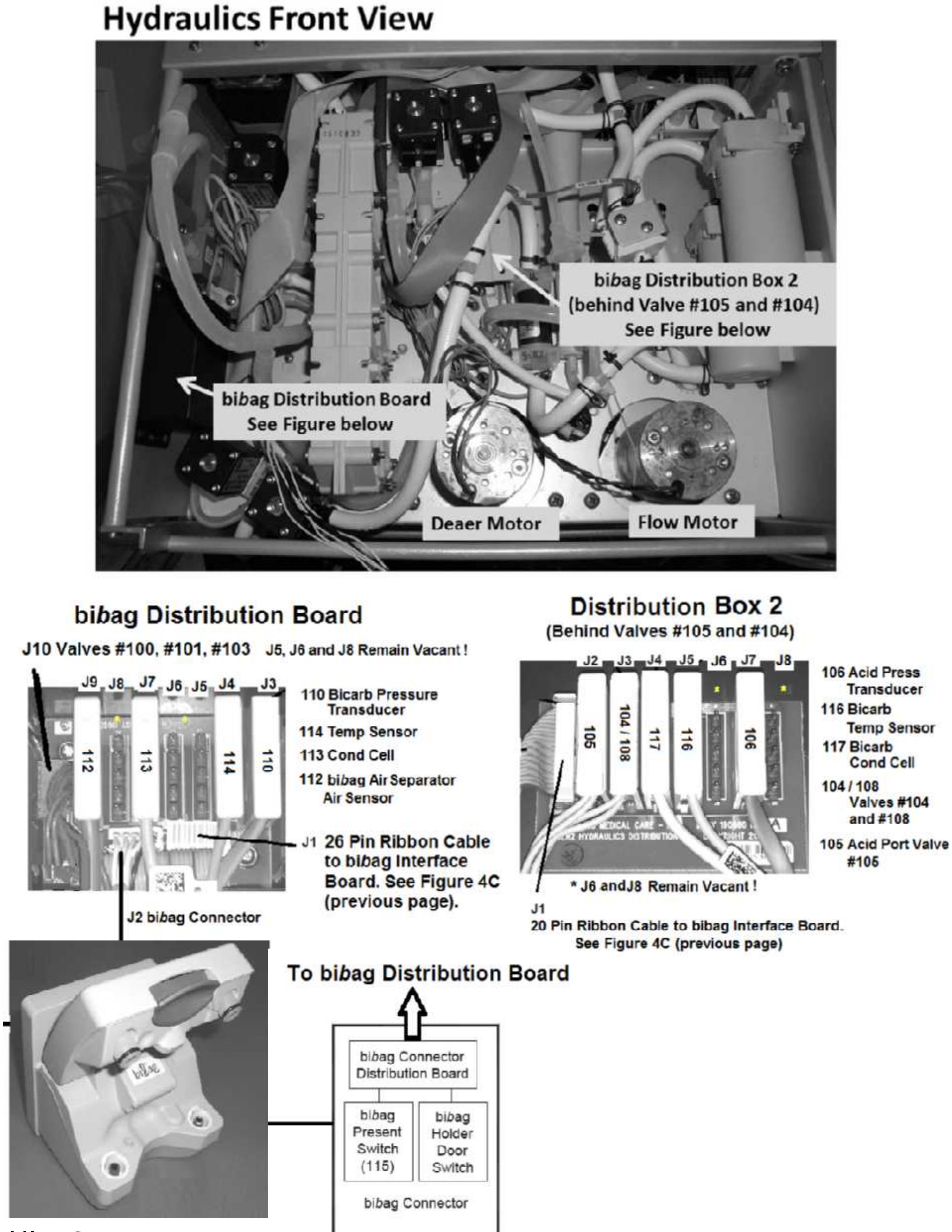
D) ENSURE the bi*b*ag Interface Board's 26 AND 20 Pin Ribbon cables are plugged in securely! **If not this may be the problem!**

E) Using a flashlight, inspect the 26 AND 20 Pin Ribbon cables for signs of damage. **If damage is located this may be the problem!**

F) If the Troubleshooting Guide has instructed you to 'swap in' the bi*b*ag Interface board use ESD protection AND ENSURE the new board is known good!



## Figure 4D - bibag Distribution Board and Distribution Box 2




**bi*bag* Connector**

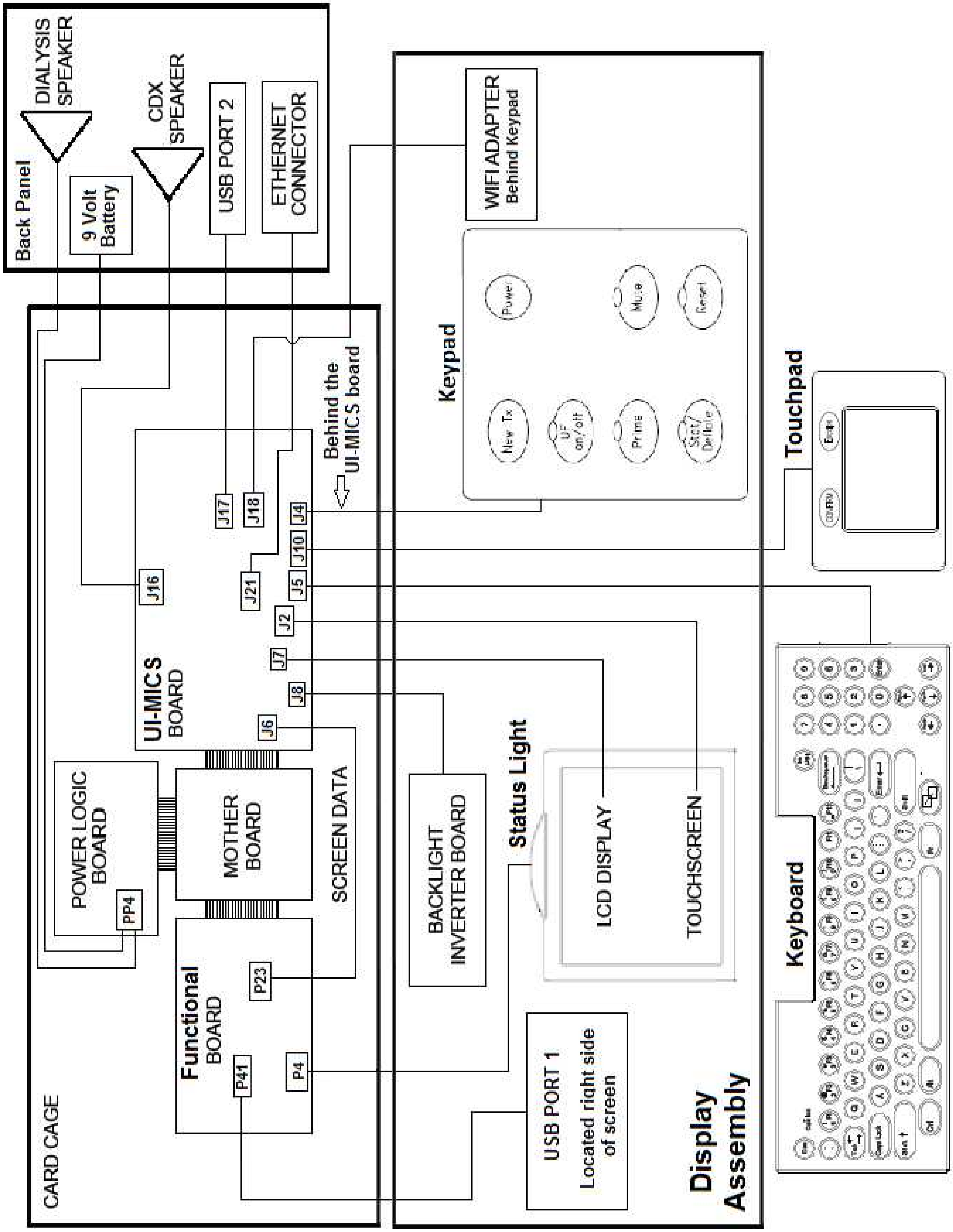



**Figure 4E - Block Diagram Card Cage to Display Assembly**

## FINAL CHECKS BEFORE RETURNING THE MACHINE TO CLINICAL SERVICE

1) Remove all test equipment from the distribution board and ENSURE all female connectors are plugged in properly.

2) Reinstall the distribution board cover.

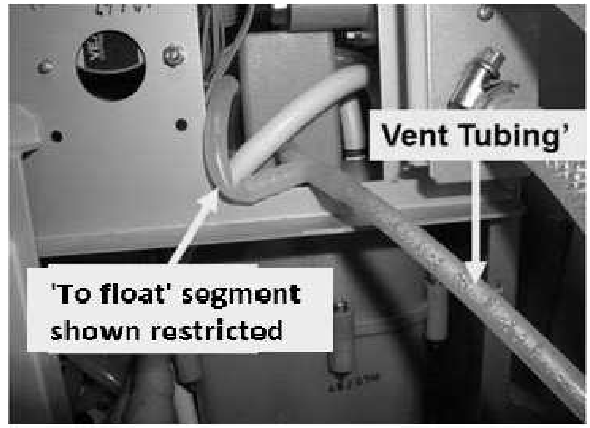
3) To help locate future leaks clean spills from hydraulic drawer and floor.

4) Figure right, ENSURE the 'To Float' Vent Tubing segment is NOT restricted as shown!

5) Return the rear panels ENSURING the Vent Tubing remains extended out about six (6) inches!

6) Turn the machine on and ENSURE the audible alarm reports during "System Initialization".

7) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!




8) Allow [**Temperature**] to stabilize between 35.1 and 38.9° C; [**Conductivity**] to between 13.0 and 14.2 mS.

9) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'!

10) ENSURE the external flow indicator's 'bob' is rising and falling in the sight tube!

11) Check Temperature, Conductivity and pH per the Preventative Maintenance Procedures booklet.

12) Perform the automated Alarms/Pressure Tests per Preventative Maintenance Procedures booklet. Do **NOT** return the machine to clinical service unless all tests pass!

13) Place the acid connector into a jug of water and allow [**Conductivity**] to fall to 10 mS.

14) ENSURE the external flow indicator's 'bob' is NOT moving (i.e. Valve #24 is closing).

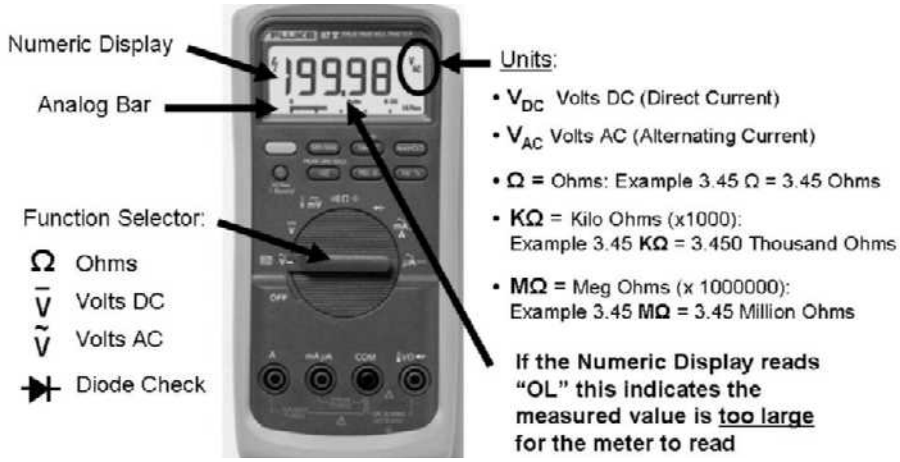
15) If clinic procedures requires it perform an electrical safety check (i.e. leakage current).

16) Perform Acid Clean and / or Bleach or Heat Disinfection per clinic policy.

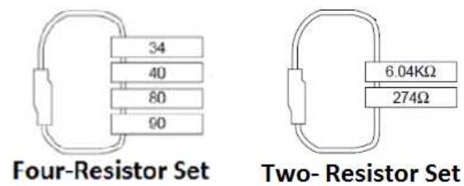
End of 'Final Checks'

# TEST EQUIPMENT

- CALIBRATED annually digital Multimeter (Fluke® recommended!)




- Test Gauge Kit (P/N 150034)
- Resistor Test Plugs: Four-Resistor Set (P/N 190060); Two-Resistor Set (P/N 190168).




- One (1) 1000 ml Graduated Cylinder; One (1) 100 ml Graduated Cylinder; One (1) 60 ml syringe
- One 25 ml burette with 0.1 ml graduations (P/N 290104)
- EXTENDER BOARD (P/N 190600)
- Flashlight
- Calibrated Temperature / Conductivity / Pressure (Dialysate) Meter
- Optional: Figure below, Magnetic (Mag) Probe to check valve solenoid magnetism. The Probe can be obtained from www.stanleysupplyservices.com (P/N 127-800).

**Figure 5 - Mag Probe**

END OF 'TEST EQUIPMENT'

# VOLTAGE DETECTOR CALIBRATION

A) Per the Figure below, the EXTENDER BOARD (P/N 190600) is required.

B) Turn the machine OFF and GENTLY open the card cage!

C) Behind the card cage, ENSURE the 24V POWER cable remained plugged in!

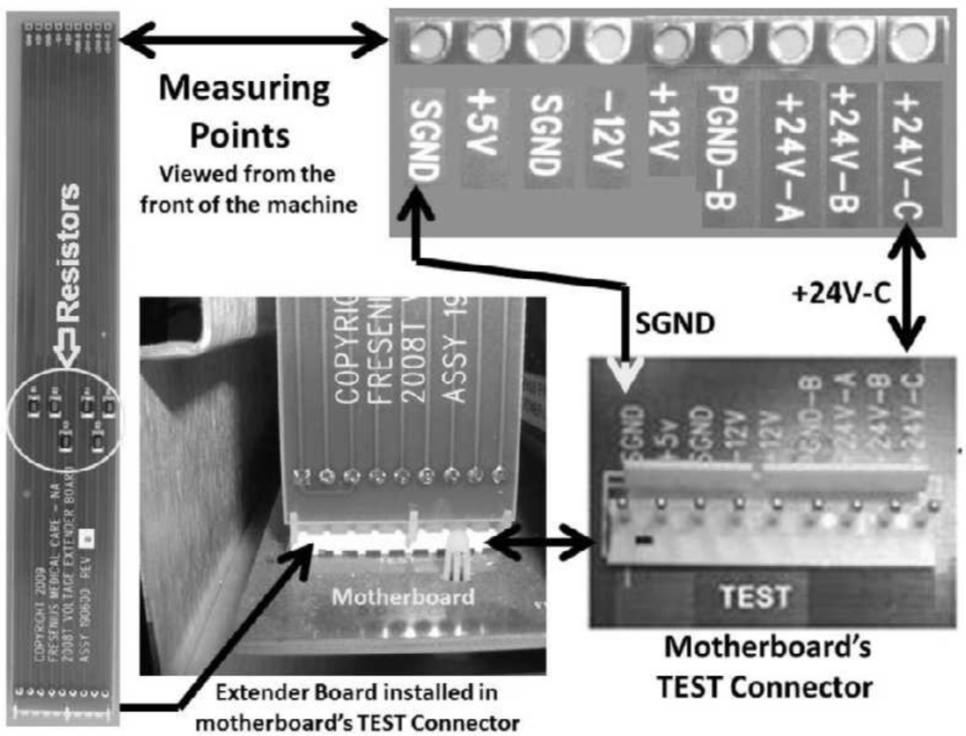
D) To avoid error, per the figure below**:**

**1)** Keeping the EXTENDER BOARD'S resistors towards the **FRONT OF THE MACHINE** install it into the motherboard's nine (9) pin TEST***** connector. *****To LOCATE refer to Figure 4A (page 10)).

**2)** ENSURE the board is matched pin for pin to the TEST connector! From the **FRONT OF THE MACHINE** SGND on the LEFT; 24V-C on the RIGHT!

**3)** Push the board down hard. It may resist a good connection into the motherboard.

**4)** Pull up on the board. If installed correctly it resists pulling out!




E) Enter Service Mode → Calibrate Monitor → Voltage Detection.

F) **Set your CALIBRATED volt meter to volts DC ($V_{DC}$)**.

G) **Connect the meter's black lead to chassis ground (refer to Figure 2, page 4).**

H) Measure at the Extender Board's +12V measuring point (five (5) pins from the left).

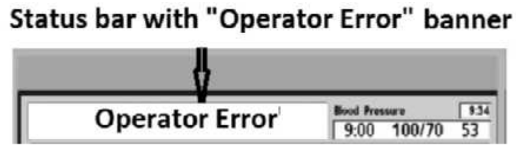
**Parts I through P next page**

I) Press the screen's **[12 volt set]** data box. It turns bright yellow.


J) Enter the MEASURED value in the box.

K) 'Sharply' press 'Enter'.

L) ENSURE the [**12 Volt Set]** data box is pale yellow /white. If not start over!




M) Sharply press 'Enter' again. Figure right, does an "Operator Error" banner appear?

Yes "Operator Error" occurs! Proceed to **page 675,** procedure number P- H.1.2.

No "Operator Error" DID NOT occur! See part N.

N) The screen should say **"4. Verify that 5V EST is between 4.8 to 5.2….".** If not start over!

O) Based on the **screen's** [5V EST] AND [12V EST] windows, TWO (2) CHECKS:


**Check #1:** Is **[5V EST]** between 4.8 and 5.2?

**Check #2:** Is **[12V EST]** between 11.7 and 12.3?

**Yes (to BOTH):** Press 'Enter' to save the calibration THEN see parts P and Q.

**No (to one OR both):** Proceed to **page 675**, procedure number P- H.1.2.

P) **Close the card cage!**

Q) If a previous procedure brought you to VOLTAGE DETECTOR CALIBRATION return to that procedure.

END OF 'VOLTAGE DETECTOR CALIBRATION'

# OPERATING MODES

**How to Enter Service Mode:**

a) Turn the machine OFF.

b) Turn the machine on. When the "Press CONFIRM for Service Mode" appears on the screen press 'Enter' or 'Confirm'. The screen says "Machine In Service Mode".

**How to Enter T and C (Test and Calibration) Mode:**

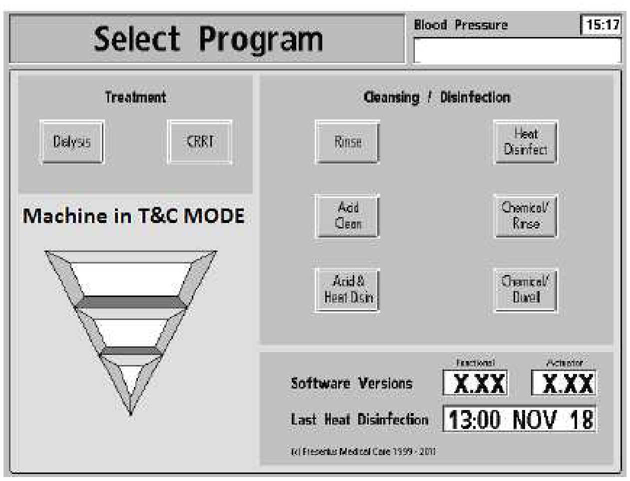
'Swapping' in a Sensor and / or a Functional Board may cause a "COND OFFSET FAILURE" during System Initialization. **T and C Mode** negates this Errors so these boards can be tested without having to perform calibrations.

a) Enter Service Mode → Options → Hardware Options.

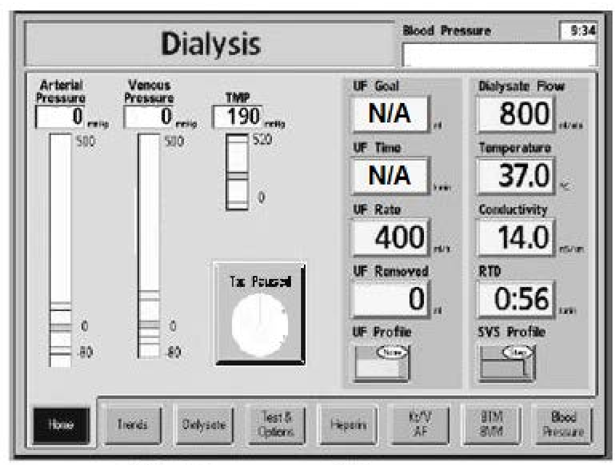
b) Next to **T and C Mode** place the 'X' in the "Yes" box then press 'Enter'. The 'X' MUST turn blue!


c) Turn the machine off then back on.

d) When the "Select Program" screen (1) appears, "Machine in T and C Mode" appears and upon returning to Dialysis Program, the Home Screen's (3) **[UF Goal]** and **[UF Time]** windows display "N/A".




1) Select Program Screen




3) Home Screen

End of 'How to Enter T and C Mode'

**How to Enter Dialysis Program:**

a) Turn the machine on and allow the "Select Program" screen **(1)** to appear.

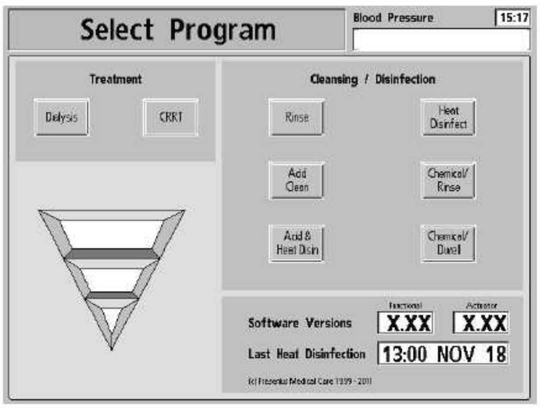
b) Press the screen's 'Dialysis' button to call the Dialysate ("Select Concentrate") screen **(2)**.

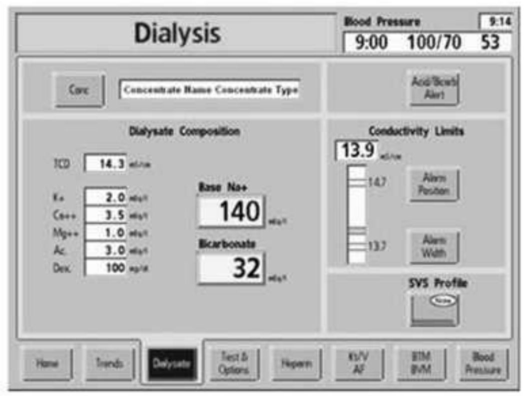
c) Press the screen's 'Conc' button and a list of, up to 10, ACID concentrates appears.

d) Using the arrow keypads, select the ACID that is connected to the machine.

e) Press the keyboard's 'Enter' key or the mousepad's 'Confirm' key to place the machine into Dialysis Program.

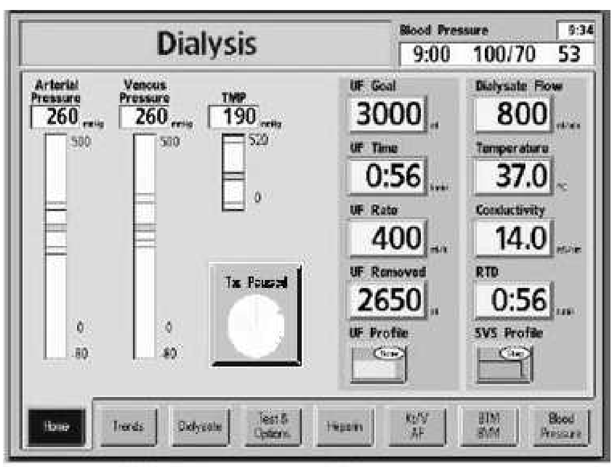
**NOTE! The machine remains in idle mode UNLESS 'Enter' or 'Confirm' is pressed!**



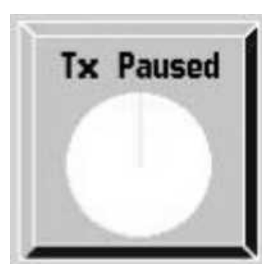




1) Select Program Screen 2) Select Concentrate Screen

f) Pressing the screen's 'Home' tab calls the 'Home' screen **(3)**.




3) Home Screen




g) While troubleshooting, the Treatment clock (Figure right) MUST be off i.e. "Tx Paused"!

**Part h next page**

h) The Dialysate screen can be called at any time by pressing the screen's lower [Dialysate] tab or the Home screen's [Conductivity] window.

**Auto Flow**

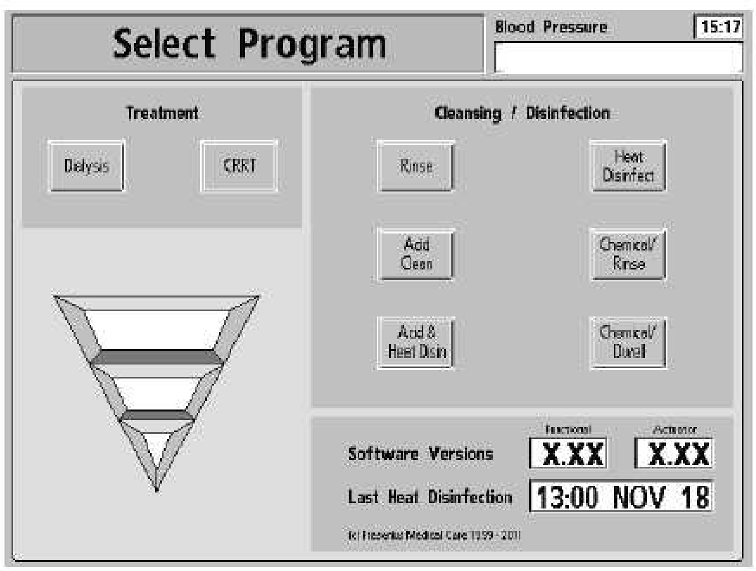
Selecting Dialysate Flow rates more than 800 ml/min enables ***auto flow*** (1.5x or 2x). At these settings Dialysate Flow rate will automatically adjust itself, in 100 ml/min increments, depending on blood pump rate. For example, at 2X, when the blood pump rate is set to 250 ml/min, Dialysate Flow will set itself to 500 ml/min (2 x 250) and the Home screen's [Dialysate Flow] window will display preceding "a" (i.e. a500"). **Do NOT select 1.5x or 2x while troubleshooting!**

## End of 'How to Enter Dialysis Program'

**How to Enter a Cleaning / Disinfection Program:**

a) Return both dialyzer connectors to the shunt and close the door.

b) Place both concentrate connectors into their rinse ports. This calls the "Select Program" screen **(1)**.



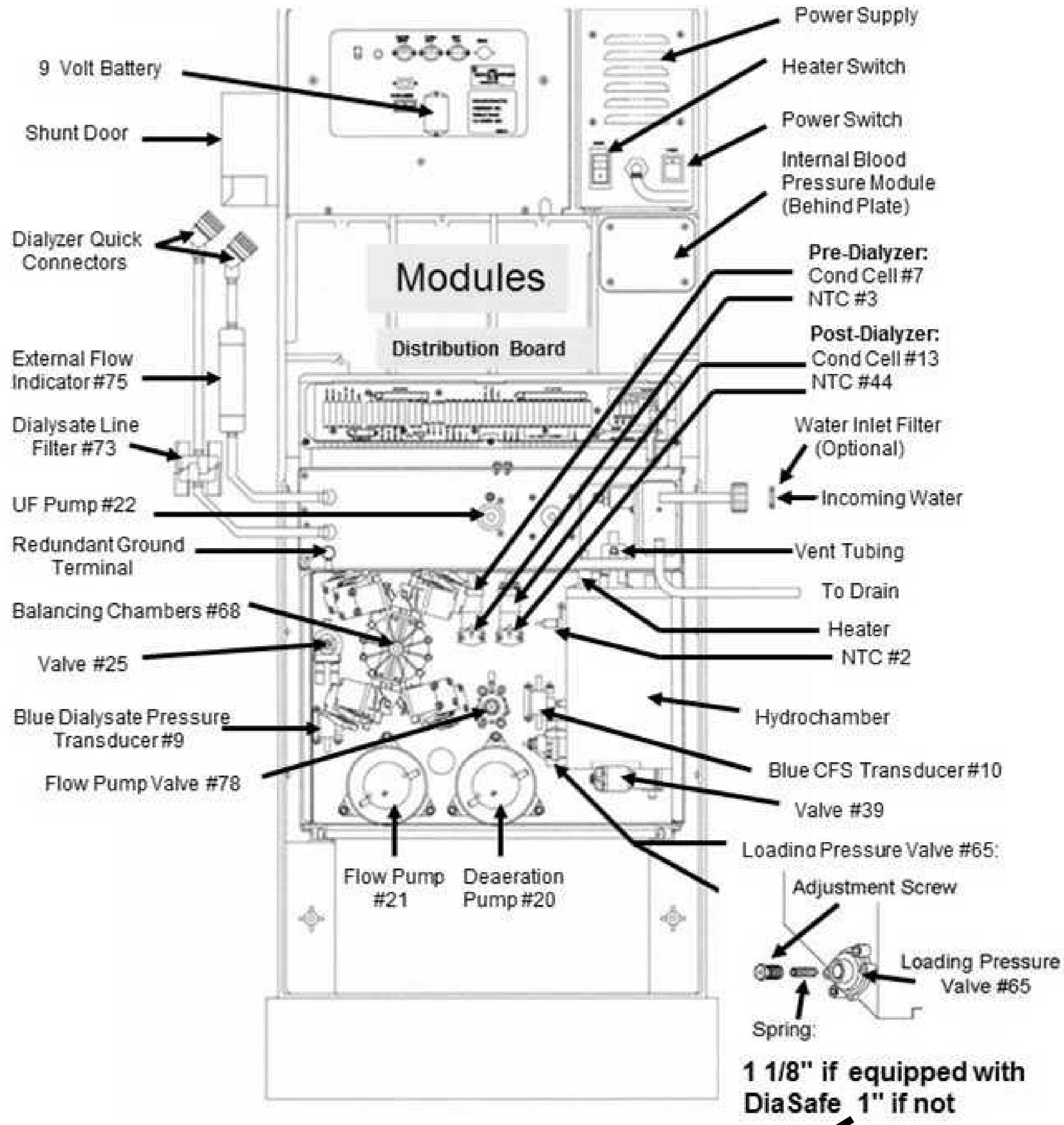

**1) Select Program Screen**

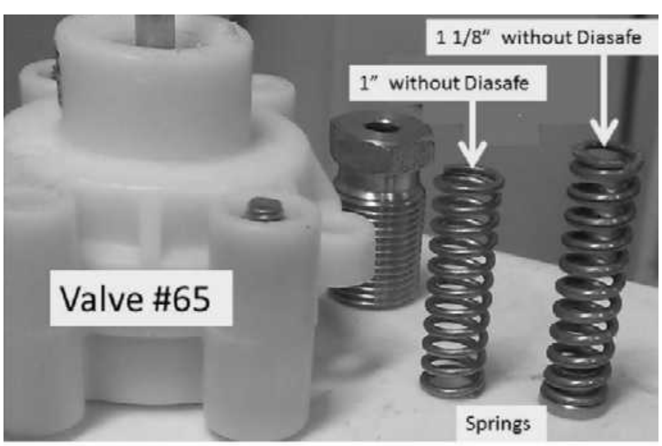
c) If bi*b*ag equipped the bi*b*ag Connector door MUST be closed!

d) Press the desired Cleaning / Disinfection Program button then follow screen prompts that may appear depending on what Cleaning Program is selected.

## End of 'How to Enter a Cleaning / Disinfection Program'

## Figure 6 – Machine Rear View




**Valve #65 spring with DiaSafe® P/N 642585**

**Valve #65 spring if no DiaSafe® P/N 640330**

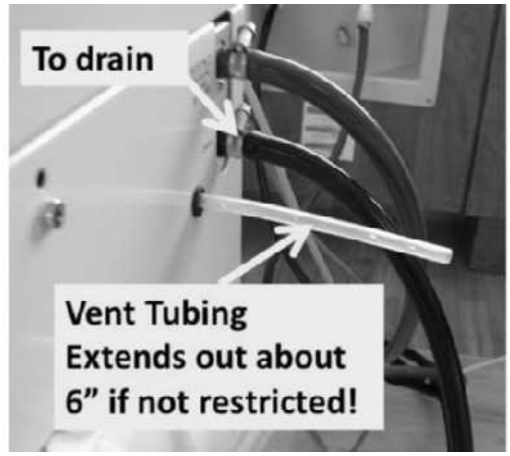
# SECTION 1 – FLOW ERRORS IN DIALYSIS PROGRAM

A) Figure right, TWO (2) checks:

**CHECK #1:** ENSURE the 'To drain' tubing is NOT kinked AND (if used) the 'quick connector' is attached PROPERLY to the station!

**CHECK #2:** ENSURE the Vent Tubing is NOT restricted!

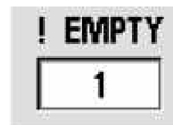
**NOTE!** Vent 'slow dripping' is normal with Flow Errors!




B) NEVER allow the DiaSafe® filter to hang from its tubing!

C) ENSURE BOTH dialyzer lines are in the shunt door AND the door is closed!

D) Call debug screen 2. Look at **! EMPTY**! (left column). TWO (2) possible scenarios:




**1) IF (and ONLY if) ! EMPTY = 1:** Continue to part E.

**2) IF ! EMPTY = 0:** Either the RED dialyzer line is NOT connected to the shunt properly OR FOUR (4) possible bad components: **1)** Actuator-Test Board; **2)** Functional Board; **3)** Arterial dialyzer line shunt door switch; **4)** Motherboard

E) If the Automated Tests are running (screen reads "Test:….") allow them to finish.

F) **Remove the 'dummy chamber' from the Level Detector**.

G) From the Home screen, set [Dialysate Flow][2] to 800 ml/min and press 'Enter'!

[2] If [Dialysate Flow] is blinking Flow is off! Flow **MUST** be on!

H) ENSURE FIRM connections to Acid AND Bicarb JUGS!

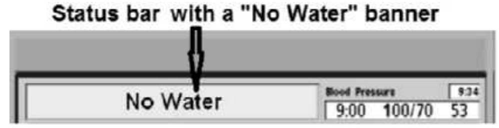
I) Any active external leaks seen inside the hydraulic compartment?

Yes Active leak located! Proceed to **page 598**, SECTION 21- HYDRAULIC LEAKS.

No leaks! Continue to part J.

J) WITHOUT LOOKING AWAY, Figure right, watch for a "No Water" banner for one (1) minute! Does "No Water" EVER appear, even if only once?

Status bar with a "No Water" banner



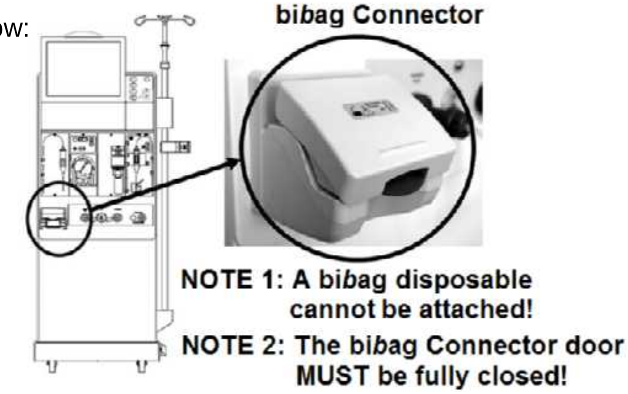

Yes "No Water" appears! Proceed to **page 152**, SECTION 2 – NO WATER ALARM.

No "No Water" NEVER* appears! See procedure number F- 1.0.0 (page 24).

*** NOTE!** From here forward, if (and ONLY if) a "No Water" banner EVER appears address it FIRST! "No Water" alarms cause Flow Errors.

## F- 1.0.0 "NO WATER" NEVER APPEARS / (OPTIONAL) BI*B*AG EQUIPPED?

Figure right, TWO (2) possible scenarios 1) or 2) below:




**1) IF equipped with a bi*bag* Connector:** See procedure number F- 1.0.1 (page 24).

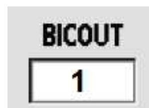
**2) IF (and ONLY if) NO bi*bag* Connector:** Proceed to **page 25**, procedure number F- 1.0.2.

## F- 1.0.1 EQUIPPED WITH BI*B*AG CONNECTOR

A) Connect the Bicarb (blue) connector FIRMLY to a JUG[1] of BICARB! **The Bicarb connector CANNOT be in its rinse port!**

[1] A bi*bag* disposable (pouch) CANNOT be attached while troubleshooting!

B) Call debug screen 2. **BICOUT** MUST = 1!




C) ENSURE the Bicarb jug is FULL. If it ever runs empty Loading Pressure becomes unstable!

D) Call debug screen 0. Figure below, ENSURE the bi*bag* Connector door is shown FULLY closed!


E) See procedure number F- 1.0.2 (page 25).

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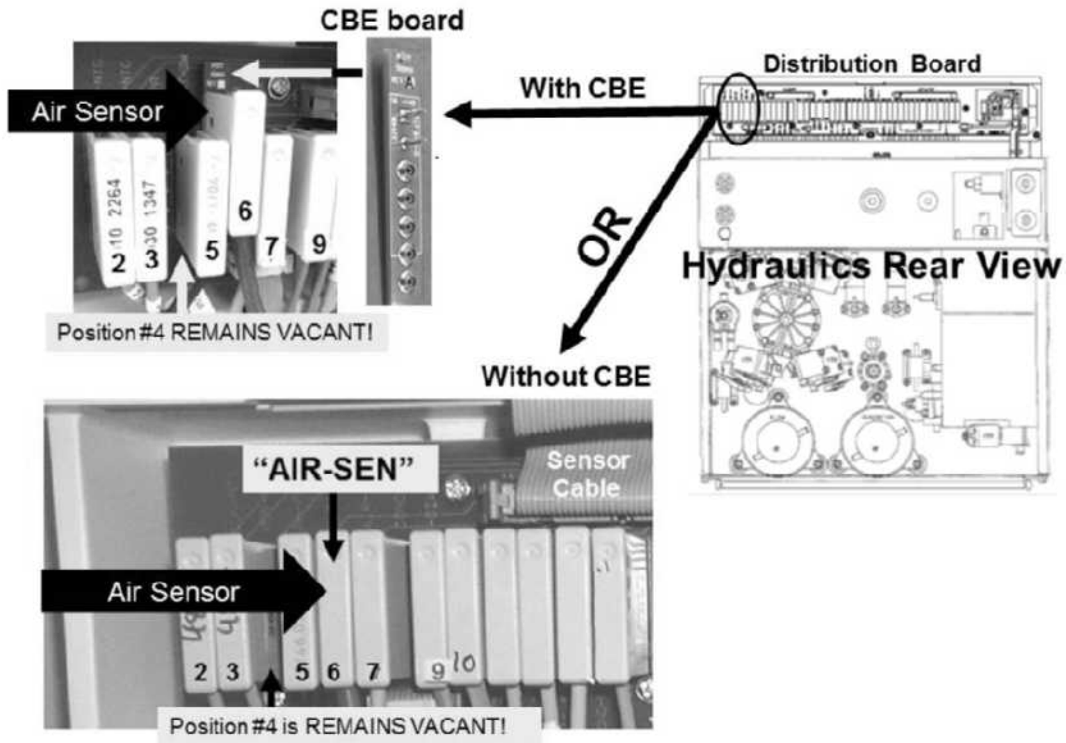
**F- 1.0.2 "NO WATER" NEVER APPEARS / ISOLATE "AIR IN DIALYSATE" FUNCTION**

A) **Figure below**, remove the Distribution Board cover.

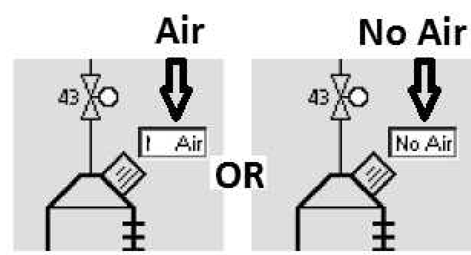
B) The female Air Sensor's connector is the **4th connector i.e. 5th position** FROM THE LEFT. If CBE modified the connector plugs into the 'CBE board' two pins higher than the others!




C) Unplug the female Air Sensor's connector but **DO NOT** remove the 'CBE board' under the connector!

D) **Leave the Air Sensor distribution board position vacant for now!**

E) Call debug screen 0.




F) **Figure right**, reading the text box above Chamber #69, TWO (2) possible scenarios:

1) **IF it says "Air" always:** See procedure number F- 1.0.2.11 (page 26).

2) **IF it says "No Air" OR toggles between "Air" and "No Air":** See parts a AND b next page:

**Chamber #69 says “No Air” OR toggles continued:**

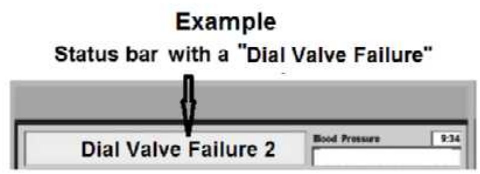

a) Figure right, inside the distribution board, ENSURE the Air Sensor’s connector is UNPLUGGED from **5th position** FROM THE LEFT**!**

b) TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Chamber #69 now says “Air” always:** See procedure number F- 1.0.2.11 (page 26).

**2)** **IF Chamber #69 continues to say “No Air” or toggles between “Air” and “No Air”:** Proceed to **page 27**, procedure number F- 1.0.3.

# F- 1.0.2.11 “AIR” ALWAYS




a) Figure right, from here forward, if (and ONLY if) a “Dial Valve Failure” OR “Act Byp Valve Fail” banner EVER appears proceed to **page 711**, Section 26.

b) Call debug screen 1.


c) Allow two (2) minutes OR until if **FILACT** (middle column) = 1?

Yes **FILACT** = 1! Proceed to **page 28**, procedure number F- 1.0.4.


No AFTER two (2) minutes **FILACT** REMAINS = 0! Look at **VERR** (lower right). TWO (2) possible scenarios:

**1)** **IF (and ONLY if) VERR = 0:** See procedure number F- 1.0.3 (page 27).

**2)** **IF VERR = 1 or more:** Proceed to **page 38**, procedure number F- 2.0.0.

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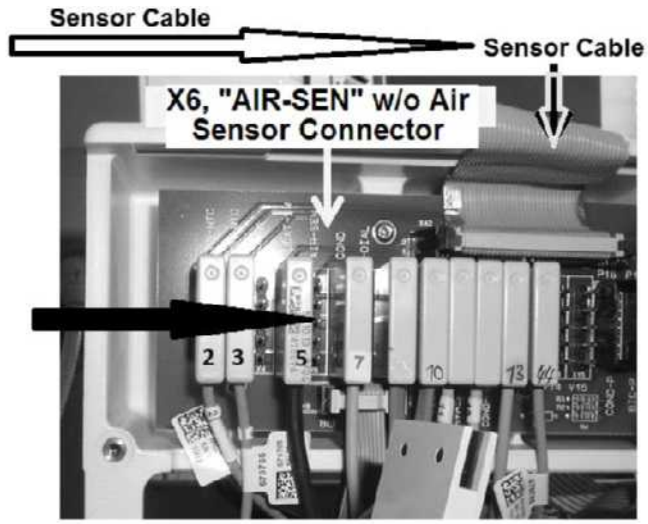
## F- 1.0.3 CHAMBER #69 SAYS "NO AIR" / TROUBLESHOOT FILLING PROGRAM FAILURE

a) **To avoid damage turn the machine OFF!**

b) Figure right, TWO (2) checks:

**Check #1:** At the top of the distribution board, ENSURE the Sensor Cable is plugged in SECURELY!

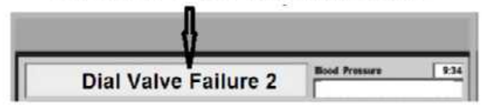
**Check #2:** ENSURE a resistor plug HAS NOT been prematurely plugged into the 5th position from the left!




c) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

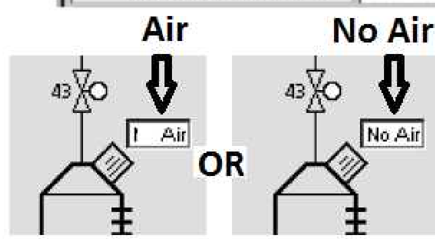
Example

Status bar with a "Dial Valve Failure"




d) Figure right, from here forward, if (and ONLY if) a "Dial Valve Failure" OR "Act Byp Valve Fail" banner EVER appears proceed to **page 711**, Section 26

e) Call debug screen 0. Based on Chamber #69's text box now, TWO (2) possible scenarios:




1) **IF it says "Air" always:** Return to ABOVE procedure number **F- 1.0.2.11** (**page 26**).

2) **IF it continues to EVER say "No Air":** Filling Program is not working! See parts a AND b below:

a) Before performing part b NOTE this page number THEN perform INITIAL CHECKS (page 7).

b) FIVE (5) possible bad components: **1)** CBE board[1]; **2)** Sensor Board[2]; **3)** Functional Board[3]; **4)** Distribution board; **5)** Motherboard.

[1] **A)** Swap in a known good CBE board; **B)** With the Air Sensor's connector **REMAINING UNPLUGGED** return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **C)** From debug screen 0, if Chamber #69's text box now says "Air" the previous CBE board is bad.

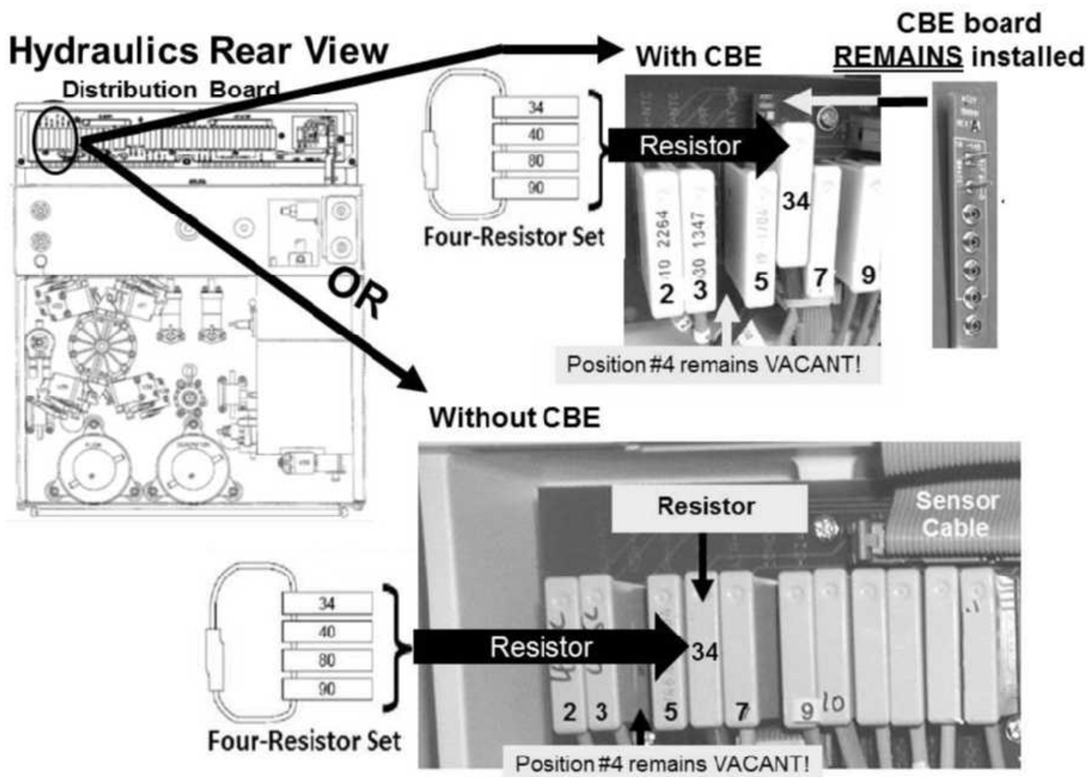
[2] **A)** With the machine off, swap in a known good Sensor Board; **B)** Place the machine into **T and C Mode** (refer to OPERATING MODES (page 19); **C)** With the Air Sensor's connector **REMAINING UNPLUGGED**, return to Dialysis Program; **D)** From debug screen 0, if Chamber #69's text box now says "Air" the previous Sensor Board is bad.

[3] **A)** With the machine off, swap in a known good Functional Board; **B)** Pace the new Functional Board into **T and C Mode; C)** With the Air Sensor's connector **REMAINING UNPLUGGED**, return to Dialysis Program; **D)** From debug screen 0, if Chamber #69's text box now says "Air" the previous Functional Board is bad.

## F- 1.0.4 FILACT = 1 OR CHAMBER #69 SAYS "AIR"

a) **FIGURE BELOW**, CAREFULLY place one of the plugs, from the **FOUR-RESISTOR SET**, into the Air Sensor's distribution board position i.e. **5th** position* from the LEFT.

*** NOTE!** If CBE modified the resistor MUST plug into the 'CBE board' pin for pin!




b) From debug screen 0, based on Chamber #69's text box now. TWO (2) possible scenarios:

**1) IF (and ONLY if) it says "No Air" always:** See procedure number F- 1.0.5 (page 30).

**2) IF is says "Air" OR toggles between "Air" and "No Air":** To avoid unnecessary work, perform parts a THROUGH e below:

a) **BE CERTAIN** the resistor plug is placed PROPERLY in the **5th position** from the left!

b) If CBE modified, using a flashlight, ENSURE the resistor plugs into the CBE board, pin for pin, especially the TOP pin!

c) If (and ONLY if) the text box now says "No Air" always see procedure number F- 1.0.5 (page 30). If it EVER says "Air" see part d next page**!**

**Parts d and e next page**

**Chamber #69 says "Air' continued:**

d) Use a different plug from the **four-resistor** set! If (and ONLY if) the text box now says "No Air" always see procedure number F- 1.0.5 (page 30). If it EVER says "Air" continue to part e.

e) The text box continues to say "Air" OR toggles between "Air" and "No Air". SIX (6) possible bad components: **1)** CBE board[1]; **2)** Sensor Board[2]; **3)** Sensor cable[3] **4)** Functional Board [4]; **5**) Distribution board; **6)** Motherboard.

[1] **A)** Swap in a known good CBE board; **B)** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **C)** Plug one of the resistors from the **four-resistor** set into the new CBE board; **D)** From debug screen 0, if the text box now says "No Air" always the previous CBE board is bad.

[2] **Leaving the resistor plug installed: A)** With the machine off, swap in a known good Sensor Board; **B)** To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19)); **C)** Return to Dialysis Program; **D)** From debug screen 0, if the text box now says "No Air" always the previous Sensor Board is bad.

[3] **Leaving the resistor plug installed:** The Sensor Board cable can be checked. **NOTE** that one (1) **AIR SENSOR** connection will be checked and proceed to **page 569**, SECTION 17 - CHECKING THE SENSOR BOARD CABLE.

[4] **Leaving the resistor plug installed: A)** With the machine off, swap in a known good Functional Board; **B)** To prevent "Cond Offset Failure" place the new Functional Board into **T and C Mode**; **C)** Return to Dialysis Program; **D)** From debug screen 0, if the text box now says "No Air" always the previous Functional Board is bad.

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## F- 1.0.5 RESET MACHINE / DEFEAT IDLE FLOW / CHECK PUMPS

A) **Turn the machine OFF!**

B) **Open the shunt door and leave it OPEN till instructed!**

C) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

D) From the Home screen, press the [Dialysate Flow] window.

E) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

F) Call debug screen 1. If **FILACT** = 0 continue to part G. If (and ONLY if) **FILACT** = 1 return to (ABOVE) procedure number F- 1.0.4 (page 28)

G) **Per the Figure below**, check the Flow AND Deaeration Motor shafts for counterclockwise (CCW) rotation. BOTH rotating CCW?

Yes BOTH motors rotating! See procedure number F- 1.0.6 (page 31).

No A motor is NOT rotating CCW. Perform parts a AND b below:

a) Close the shunt door!

b) **NOTING** which motor is not rotating properly, proceed to **page 141**, TROUBLESHOOTING MOTORS

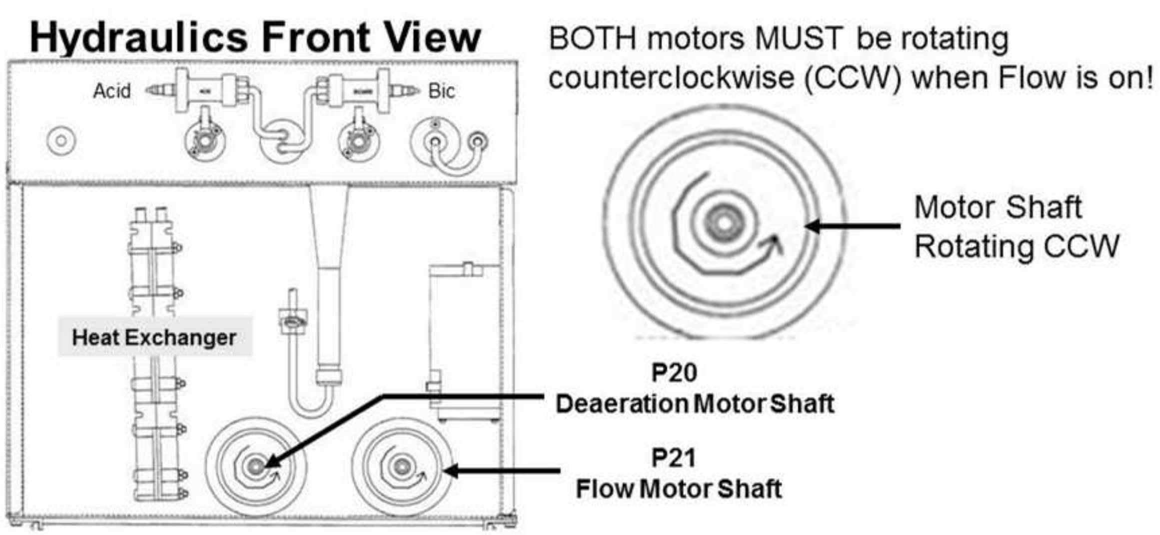



**Figure 7 – Deaeration AND Flow Motor**

**F- 1.0.6 ISOLATE LOADING PRESSURE**

A) ENSURE the Loading Pressure gauge (yellow connector) reads 0 psi BEFORE installing it **SLAM** it into the Acetate/Acid rinse port!

B) Loading Pressure may or may not cycle. TWO (2) possible scenarios:

1) **IF cycling, possibly every nine (9) seconds:** Pressure is 'OKAY' if it cycles to a PEAK of somewhere between 23 and 27 AND a low of NEVER LESS than 11 psi. Watch both levels for one (1) minute THEN see part C.

2) **IF NOT cycling:** Pressure is 'OKAY' if it STAYS between 23 and 27 psi. See part C.

C) TWO (2) possible scenarios:

1) **IF (and ONLY if) pressure REMAINS 'OKAY':** Leaving the gauge installed, see procedure number F- 1.0.6.11 (page 31).

2) **IF pressure is EVER NOT 'OKAY':** Close the shunt door THEN proceed to **page 33**, procedure number F- 1.0.7.

**F- 1.0.6.11 LOADING PRESSURE 'OKAY'**

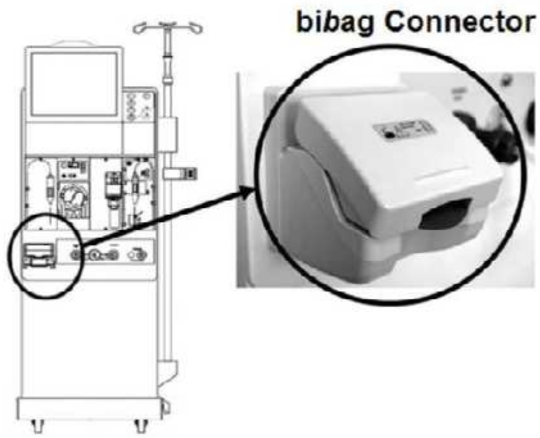



Figure right, TWO (2) possible scenarios:

1) **IF (and ONLY if) NOT equipped with a bi*b*ag Connector:** Proceed to **page 38**, procedure number F- 2.0.0.

2) **IF equipped with a bi*b*ag Connector:** This procedure checks Valve #101. If it is sticking open bicarb is rapidly drawn! Perform parts a AND b below:

a) **Leaving [Dialysate Flow] on**, disconnect the Bicarb (blue) connector from the jug and allow it to hang. DO NOT plug it into its rinse port!

b) Watch the Loading Pressure gauge for two (2) minutes! It may occasionally cycle below 15 psi but is 'OKAY' if it PEAKS to between 23 and 27 psi. TWO (2) possible scenarios:

1) **IF (and ONLY if) it PEAKS to between 23 and 27 psi!** Reconnect to the bicarb jug THEN proceed to **page 38**, procedure number F- 2.0.0

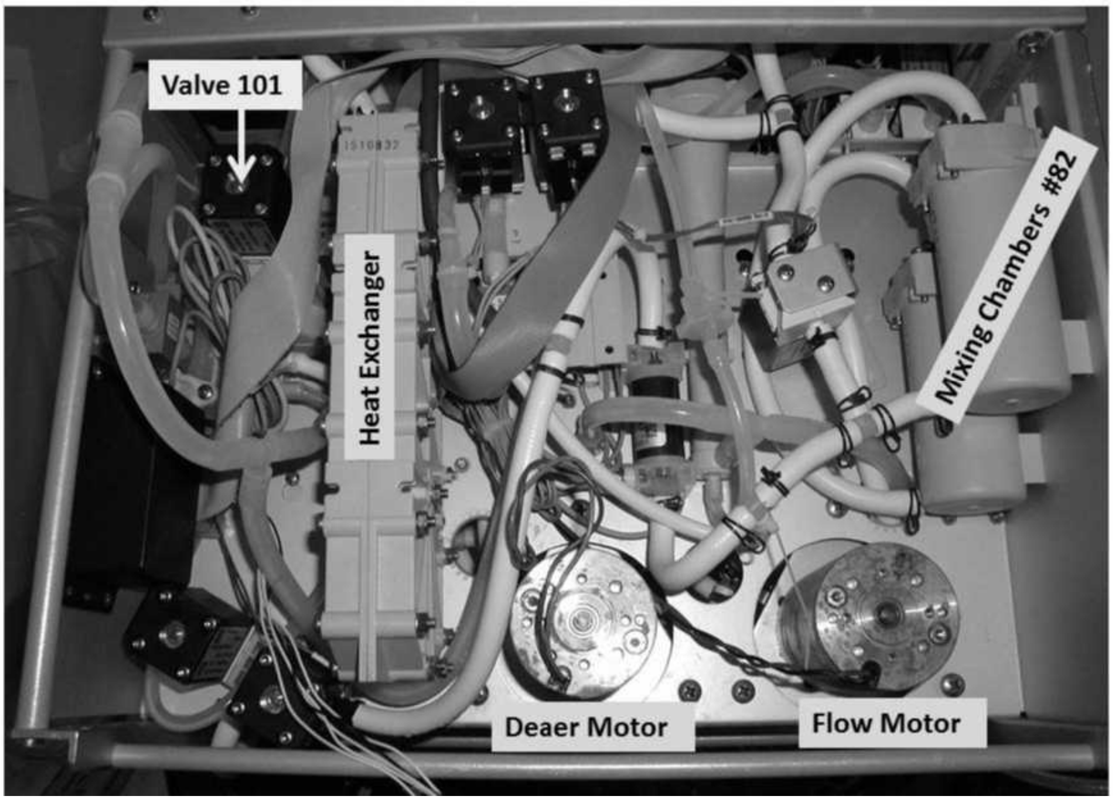
2) **IF DROPS to and REMAINS less than 18 psi:** See parts a THROUGH c next page:

a) ENSURE the Deaeration Motor is still rotating!

b) ENSURING the bicarb jug is FULL, plug the blue connector into it.

c) Allow up to three (3) minutes while watching the gauge. If pressure again begins to PEAK to between 23 and 27 psi this confirms THREE (3) possible problems: **1)** Loose or bad ribbon cable at the bi*b*ag Interface board (refer to Figure 4C (page 11)) OR **2)** Bad Valve #101 (see Figure below) OR **3)** Bad bi*b*ag Interface board.

## Hydraulics Front View

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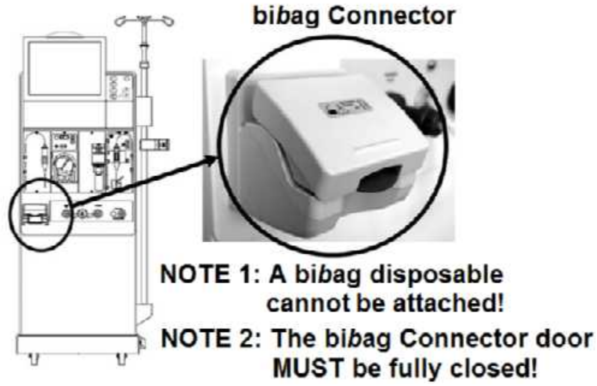
## F- 1.0.7 LOADING PRESSURE IS NOT 'OKAY' / BI*BAG* EQUIPPED?

Figure right, TWO (2) possible scenarios:

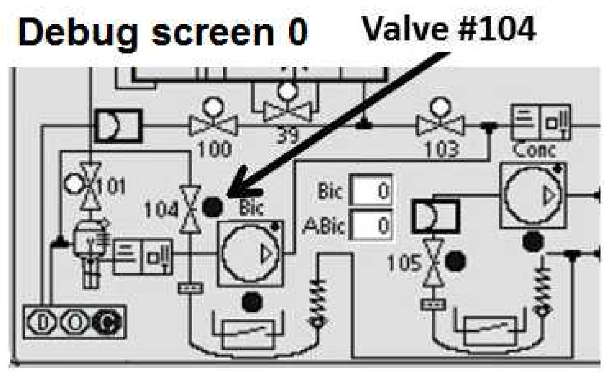



**1)** **IF (and ONLY if) NOT equipped with a bi*bag* Connector:** See procedure number F- 1.0.8 (page 34).

**2)** **IF equipped with a bi*bag* Connector:** See parts a AND b below:

a) Call debug screen 0.

b) Figure right, does Valve #104's symbol appear?




Yes Valve #104 appears! Refer to TABLE 1 below and respond as instructed.

No Valve #104 DOES NOT appear! THREE (3) possible problems: **1)** Loose bi*bag* Interface Board***** ribbon cable OR; **2)** Bad bi*bag* Interface Board OR; **3)** Bad Actuator-Test board.

***** To LOCATE the Interface Board refer to Figure 4C (page 11)

### Table 1 – DEBUG SCREEN 0 (VALVE #104)

| **Is Valve #104's 'dot' BLUE?** | **Your Response** |
|---|---|
| Yes (blue) | See procedure number F- 1.0.8 (page 34) |
| No (white) | Proceed to **page 37**, procedure number F- 1.0.10. |

**F- 1.0.8 LOADING PRESSURE IS NOT 'OKAY' (2)**

FIVE (5) possible scenarios 1) or 2) or 3) or 4) or 5) below:

1) **IF (and ONLY if) EVER MORE THAN 29 psi:** Proceed to **page 36**, procedure number F- 1.0.9.

2) **IF (and ONLY if) REMAINS LESS THAN 15 psi: A)** Remove the gauge THEN again **SLAM** it into the RINSE port; **B)** If still REMAINS less than 15 psi proceed to **page 124**, procedure number F- 15.0.0.

3) **IF (and ONLY if) PEAKS to between 15 and 22 psi but cycles below 11 psi:** See procedure number F- 1.0.8.11 (page 35).

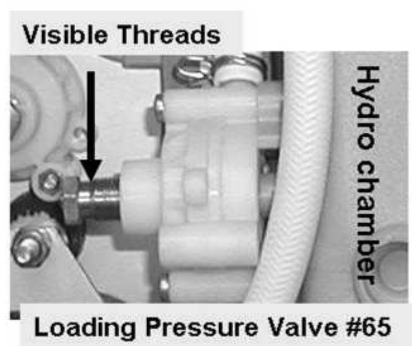
4) **IF (and ONLY if) PEAKS to between 23 and 27 psi but cycles below 11 psi:** See procedure number F- 1.0.8.11 (page 35).

5) **IF PEAKS to between 15 and 22 psi AND NEVER cycles below 11 psi:** NOTING how many turns, turn Loading Pressure Valve #65's nut* CLOCKWISE until if a PEAK pressure of between 23 and 25 psi is achieved. TWO (2) possible scenarios 1) or 2) below:

   * To LOCATE Valve #65 refer to Figure 6 (page 22)

   **1) IF (and ONLY if) between 23 and 25 psi CANNOT be achieved:** Return Valve #65's screw to its ORIGINAL location then proceed to **page 124**, procedure number F- 15.0.0.

   **2) IF between 23 and 25 psi CAN BE achieved:** See parts a THROUGH c below:




   a) Figure right, if threads ARE visible under Valve #65's nut see part b. If no threads are visible is installed either the wrong spring* is installed OR Valve #65 is bad.

   * Refer to Figure 6 (page 22)

   b) Call debug screen 0.

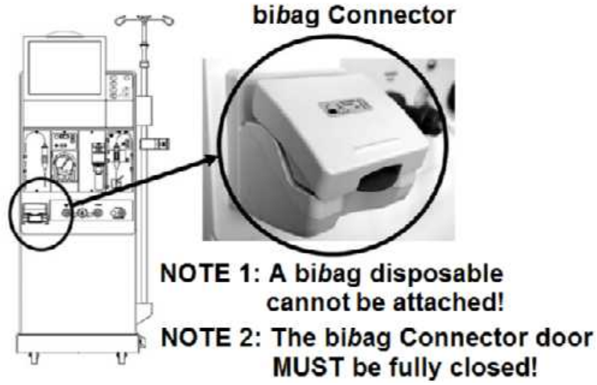
   c) WITHOUT LOOKING AWAY, watch **Flow Error** (Top window) for up to five (5) minutes OR until if it EVER = 1 indicating a Flow Problem. TWO (2) possible scenarios:

   **1) IF (and ONLY if) Flow Error EVER = 1, even just once:** Return to (ABOVE) procedure number F- 1.0.5 (**page 30**).

   **2) IF Flow Error REMAINS = 0:** A flow problem is NOT occurring at this time but other problems may be! Refer to the Table of Contents for whatever other problem may be occuring.

## F- 1.0.8.11 CYCLES TO LESS THAN 11 PSI

Figure right, TWO (2) possible scenarios:




1) **IF (and ONLY if) NOT equipped with a bibag Connector:** Proceed to **page 137**, procedure number F- 18.0.0.

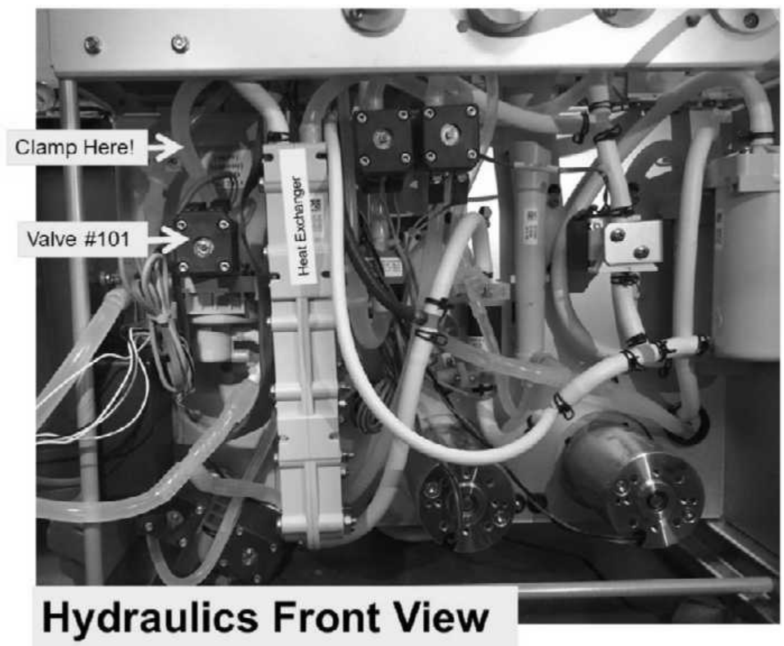
2) **IF equipped with a bibag Connector:** See parts A AND B below:

   A) Per the Figure below, clamp the tubing attached at the top of Valve #101.

   B) Does Loading Pressure continue to drop below 11 psi?

      Yes Continues to drop below 11 psi! Proceed to **page 137**, procedure number F- 18.0.0.

      No Does NOT drop below 11 psi now! See procedure number F- 1.0.8.2 (page 35).




## F- 1.0.8.2 PRESSURE DOES NOT DROP BELOW 11 PSI

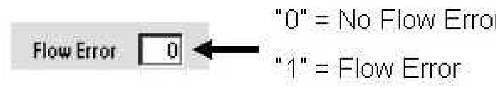
TWO (2) possible scenarios:

1) **IF (and ONLY if) PEAKS to between 23 and 27 psi:** Leaving the clamp in place for now, proceed to **page 38**, procedure number F- 2.0.0.

2) **IF PEAKS to between 15 and 22 psi:** Return to **page 34**, procedure number F- 1.0.8.

## F- 1.0.9 LOADING PRESSURE MORE THAN 29 PSI

Adjust Loading Pressure Valve #65's* nut counterclockwise but no more than a few turns. Can you adjust PEAK pressure to between 23 and 25 psi (Yes or No)? * To LOCATE Valve #65 refer to Figure 6 (page 22)




Yes Loading Pressure between 23 and 25 psi! Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** for five (5) minutes OR until if it **EVER** = 1 indicating a Flow problem. TWO (2) possible scenarios:

1) **IF (and ONLY if) Flow Error EVER = 1, even just once:** Return to (ABOVE) procedure number F- 1.0.5 (**page 31**).

2) **IF Flow Error REMAINS = 0:** A flow problem is NOT occurring at this time but other problems may be! Refer to the Table of Contents for whatever other problem may be occurring.

No Loading Pressure REMAINS more than 25 psi! **A)** Turn the machine OFF; **B)** Proceed to **page 613**, procedure number LEAKING- 6.0.0.

LEFT BLANK INTENTIONALLY

## F- 1.0.10 VALVE #104'S 'DOT' IS WHITE

The Deaeration Pressure calibration is used to check Loading Pressure ONLY (i.e. gauge in RINSE port)! **There is NO NEED to install the Deaeration gauge!**

**A)** Enter Service Mode → Calibrate Hydraulics → Deaeration Pressure.

**B)** Press 'Enter. Is Loading Pressure (Rinse port gauge) peaking to between 23 and 27 psi?

Yes Loading Pressure peaking to between 23 and 27 psi! Perform parts **C)** THROUGH **F)**.

No Loading pressure is REMAINING less than 23 OR more than 27 psi! THREE (3) possible scenarios 1) or 2) or 3) below:

1) **IF (and ONLY if) between 27 and 30 psi:** Adjust Valve #65***** until the peak pressure is between 23 and 25 psi THEN perform parts **C)** THROUGH **F)**. ***** To locate Valve #65 refer to Figure 6 (page 22)

2) **IF (if and ONLY if) between 15 and 22 psi:** Adjust Valve #65***** until the peak pressure is between 23 and 25 psi THEN perform parts **C)** THROUGH **F)**. ***** To locate Valve #65 refer to Figure 6 (page 22).

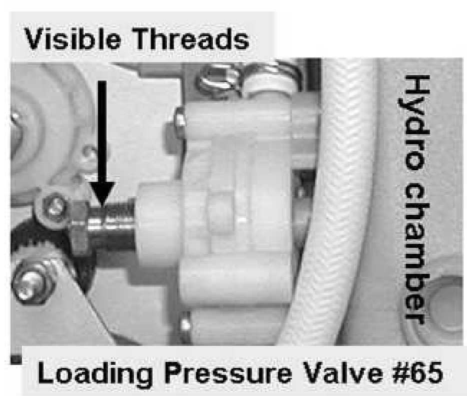
3) **IF ALWAYS less than 15 psi:** See parts #1 THROUGH #3 below:

**Part #1:** Turn the machine OFF then back on

**Part #2:** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

**Part #3:** Proceed to **page 124**, procedure number F- 15.0.0.

**C)** Figure right, if threads ARE visible under Valve #65's nut see part D. If NOT, either the wrong spring is installed (see Figure 6, page 22) OR Valve #65 is bad.




**D)** Turn the machine OFF then back on.

**E)** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

**F)** Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** for up to five (5) minutes OR until if it EVER = 1 indicating a Flow problem. TWO (2) possible scenarios:

1) **IF Flow Error EVER = 1: A)** Open the shunt door! **B)** Proceed to **page 38**, procedure number F- 2.0.0.

2) **IF Flow Error REMAINS = 0:** A Flow problem is NOT occurring at this time but other problems may be! Refer to the Table of Contents for whatever other problem may be occurring

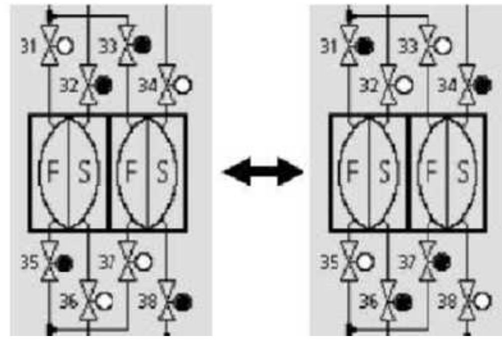
## F- 2.0.0 ISOLATE VALVE ERROR / BALANCING CHAMBER VALVES CYLING

a) Call debug screen 1 to <u>ENSURE</u> **FILACT** <u>REMAINS</u> = 0!

b) Call debug screen 0.

c) Figure right, watch the Balancing Chamber valve ‘dots’ for **<u>thirty (30) seconds</u>** or until if they <u>CYCLE</u> between white and blue.

d) TWO (2) possible scenarios below:



**1) IF (and ONLY if) the ‘dot’s cycle, <u>possibly</u> every nine (9) seconds:** Proceed to **page 40**, procedure number F- 2.5.0.

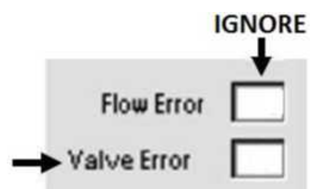
**2) IF the ‘dots’ <u>NEVER</u> cycle i.e. four (4) are STAYING blue <u>AND</u> four (4) STAYING white <u>OR</u> all eight (8) are STAYING white:** See procedure number F- 2.1.0 (page 38).

## F- 2.1.0 THE BALANCING CHAMBER (BC) ‘DOTS’ ARE NOT CYCLING

Call debug screen 1. Is **<u>VERR</u>** (right column, bottom) = 0?


Yes **VERR** = 0! See procedure number F- 2.2.0 (page 38).

No **VERR** = 1 <u>OR</u> more! See parts a AND b below:




a) Call debug screen 0 (Figure right) and locate **<u>Valve Error</u>** (2nd window down). IGNORE the top **Flow Error** window.

b) WITHOUT LOOKING AWAY, ignoring a ‘blink’ to 1 that lasts less than (2) two seconds, watch **<u>Valve Error</u>** for one (1) minute or until if it = 1 for <u>LONGER THAN</u> two (2) seconds. TWO (2) possible scenarios:

**1) IF (and ONLY if) Valve Error = 0 <u>OR</u> ‘blinks’ to 1 for less than two (2) seconds:** Proceed to **page 213**, <u>TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM</u>

**2) IF Valve Error EVER = 1 <u>LONGER THAN</u> two (2) seconds!** Proceed to **page 711,** Section 26.

## F- 2.2.0 BC VALVES NOT CYCLING / VERR = 0

Call debug screen 2. Is **! EMPTY** (left column) = 1?

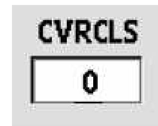
Yes **! EMPTY = 1:** See procedure number F- 2.3.0 (page 39).

No **! EMPTY = 0:** Either the arterial (red) dialyzer line IS NOT connected to the shunt properly OR FOUR (4) possible bad components: **1)** Actuator-Test Board[a] OR; **2)** Functional Board[a, b]; **3)** Arterial dialyzer line shunt door switch OR; **4)** Motherboard[a]

[a] To LOCATE the boards, refer to Figure 4A (page 10).

[b] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

**F- 2.3.0 ! EMPTY = 1 / BC VALVES NOT CYCLING**




a) To ENSURE the shunt door is OPEN, **CVRCLS** (2nd column from left) = 0 always!


b) Watch **DIALVLO** (2nd column from left) for thirty (30) seconds. TWO (2) possible scenarios:

1) **IF (and ONLY if) DIAVLO REMAINS ALWAYS = 0!** See procedure number F- 2.4.0 (page 39).

2) **IF DIALVLO cycles between 0 and 1 (possibly rapidly) OR is remaining = 1!** Valve #24 may be in a malfunctioning electrical state! Proceed to **page 711**, Section 26.

**F- 2.4.0 VERR = 0 / BC VALVES NOT CYCLING**


Call debug screen 1. Watch **FLWP** (upper right), for thirty (30) seconds! TWO (2) possible scenarios:

**1) IF (and ONLY if) FLWP REMAINS LESS THAN 255:** See procedure number F- 2.5.0 (page 40).

**2) IF FLWP is ALWAYS = 255!** The machine may NOT be going in Dialysis Program! Perform parts a THROUGH c below:

a) **Turn the machine OFF!**

b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) Call debug screen 1. ENSURING a "No Water" NEVER occurs watch **FLWP** for one (1) FULL minute! TWO (2) possible scenarios:

**1) IF (and ONLY if) FLWP IS NOT REMAINING = 255!** See procedure number F- 2.5.0 (page 40).

**2) IF FLWP is REMAINING ALWAYS = 255 (i.e. NEVER less than 255):** With the machine off, swap in the following components (Component List below) one at a time then, in between, repeat parts b and c to test each one in between until **FLWP** does NOT REMAIN 255.

**Component List: 1)** Actuator-Test Board[a]; **2)** Functional Board[a, b]; **3**) Motherboard[a].

[a] To LOCATE the boards, refer to Figure 4A (page 10). [b] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES, page 19))

## F- 2.5.0 BC VALVES CYCLING OR FLWP NOT REMAINING = 255

TWO (2) checks for an intermittent bad motor or Actuator Board:

**CHECK #1:** a) Using the handle end***** of a screwdriver, push on BOTH the FLOW AND DEAERATION MOTOR shafts, release, then push again.

*** Avoids potentially slicing your finger**

b) Can you make EITHER motor stop rotating and REMAIN stopped (Yes or No)?

Yes — If ABSOLUTELY SURE one or both of the motors stops! THREE (3) possible bad components: **1)** Bad Motor (probably brushes) OR; **2)** Bad pump head OR; **3)** Bad Actuator-Test Board[1].

[1] To LOCATE the Actuator-Test board refer to Figure 4A (page 10).

No — Neither motor stops! See **CHECK #2**.

**CHECK #2:** a) Call the Home screen.


b) Figure right, set [Dialysate Flow] to "OFF" and press 'Enter'.

c) Call debug screen 1. ENSURE **FLWP =** 255 i.e. Flow is off!


d) The Deaeration Motor should be running, the Flow Motor should be OFF! Check for FLOW MOTOR rotation again!

e) Refer to the TABLE below:

| Flow Motor Rotating? | Deaeration Motor Rotating? | Your Response |
|---|---|---|
| No | Yes | This is NORMAL! See procedure number F- 2.5.2 (page 40). |
| Yes | Does not matter | Flow Motor rotating! If **FLWP** is NOT = 255 you did not turn Flow off! If **FLWP** = 255, TWO (2) possibilities: **1) E**ither the motors are reverse connected at the distribution board OR **2)** The Actuator-Test Board[1] is bad!<br><br>[1] To LOCATE the board refer to Figure 4A (page 10) |

## F- 2.5.2 FLOW MOTOR NOT RUNNING / DEAERATION MOTOR RUNNING

a) Call the Home screen.

b) Set [Dialysate Flow] to 800 ml/min and press 'Enter'!

c) From debug screen 1, ENSURE **FLWP** (upper right) is LESS THAN 255 (i.e. Flow is on)!

d) See procedure number F- 2.6.0 (page 41).

## F- 2.6.0 MOTORS OKAY / ISOLATE 'OPTIONAL' DIALYSATE SAMPLER

a) **The shunt door MUST remain open till instructed!**

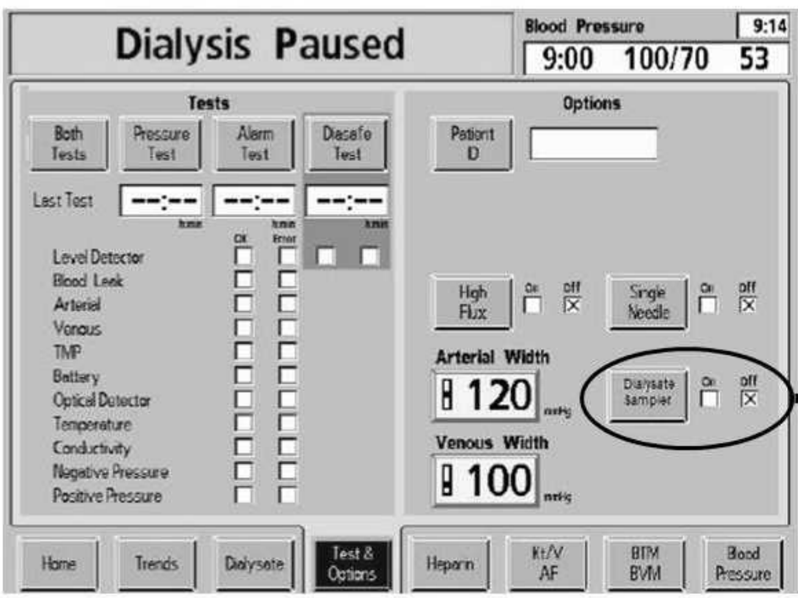
b) Press the keyboard's 'Esc' key.

c) At the bottom of the screen, press the Test & Options tab. DO NOT start the tests!

d) Per the Figure below, does the OPTIONAL **[Dialysate Sampler]** button appear?

Yes The **[Dialysate Sampler]** button should NOT appear! Refer to the NOTE below!

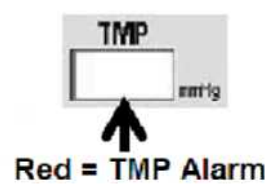
No The **[Dialysate Sampler]** does NOT appear! See procedure number F- 2.7.0 (page 41).




The **[Dialysate Sampler]** button appears if the Dialysate Sampler option has been accidently turned on. FIGURE3CThis may cause intermittent flow errors and/or tubing to blow off. This option MUST be set to "No" from Service Mode → Options → Hardware Options.


**Test & Options Screen / Optional Dialysate Sampler button**

## F- 2.7.0 [DIALYSATE SAMPLER] DOES NOT APPEAR




Call the Home screen. Figure right, if the **TMP** window is RED a TMP alarm is present. TWO (2) possible scenarios:

**1) IF (and ONLY if) the TMP window is WHITE:** See procedure number F- 2.8.0 (page 42).

**2) IF the TMP window is RED:** Perform parts A THROUGH D below:

A) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds.

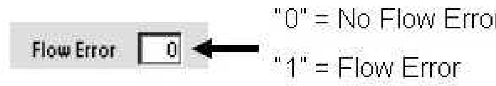
B) Allow thirty (30) seconds before going to part C.

C) If a TMP alarm reoccurs perform parts A and B up to twice more.

D) Allow twenty (20) seconds then see procedure number F- 2.8.0 (page 42).

## F- 2.8.0 ISOLATE FLOW ERROR

a) Call debug screen 0 to locate **Flow Error**. If EVER = 1, even just once, a Flow Error is present!



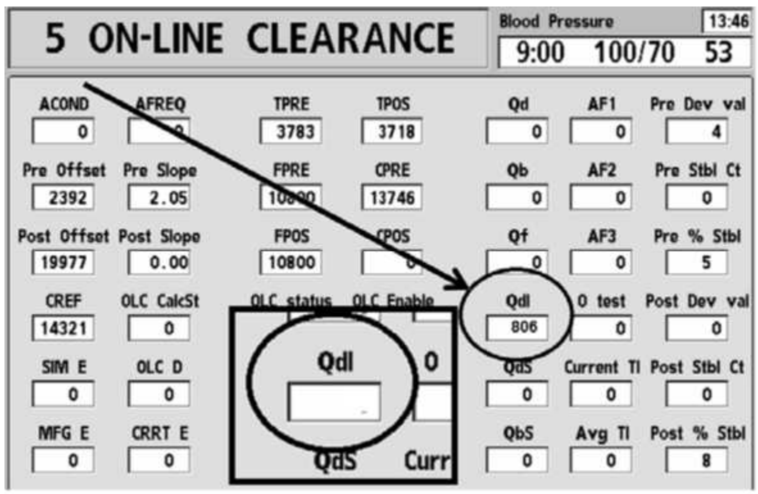

b) WITHOUT LOOKING AWAY, watch **Flow Error** for two (2) minutes OR until if it EVER = 1. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Flow Error = 1 even if just once:** A problem is indicated in the 'bypass circuit'! Proceed to **page 55**, procedure number F- 5.0.0.

**2)** **IF Flow Error ALWAYS = 0:** See procedure number F- 2.8.1 (page 42).

## F- 2.8.1 FLOW ERROR ALWAYS = 0

a) Press and hold the keyboard's "1" key for five (5) seconds!




b) **Allow forty-five (45) seconds BEFORE continuing to part c!**

c) Call debug screen 5.

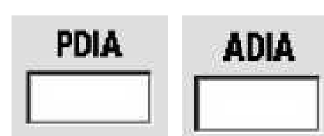
d) **Qdl** (Figure right) MUST REMAIN between 720 and 880. Watch it for one (1) minute or until if it EVER becomes less than 720 or more than 880!

e) TWO (2) possible scenarios:

1) **Qdl is NEVER LESS THAN 720 OR MORE THAN 880!** Leaving the shunt door OPEN, see procedure number F- 2.9.0 (page 42).

2) **Qdl** is OR becomes less than 720 OR more than 880! A problem is indicated in the 'bypass' circuit! Proceed to **page 55**, procedure number F- 5.0.0.

## F- 2.9.0 Qdl REMAINING BETWEEN 720 AND 880 / ISOLATE FOR A LEAKING BC VALVE




a) Call debug screen 4 and locate **PDIA** AND **ADIA** (Figure right).

b) BOTH should be between 2.0 and 8.5 AND STABLE i.e. DOES NOT change more than 0.4 per minute. WITHOUT LOOKING AWAY, watch for two (2) minutes! TWO (2) possible scenarios:

**1)** **IF (and ONLY if) PDIA AND ADIA are REMAINING stable between 2.0 and 8.5:** See procedure number F- 2.9.2 (page 44).

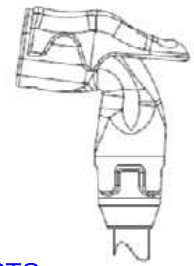
**2)** **IF PDIA AND / OR ADIA is NOT remaining stable between 2.0 and 8.5:** See parts a THROUGH f next page:

a) Momentarily plug JUST the acid (red) connector into its rinse port to call "Select Program"!

b) RETURN the acid connector to concentrate!

c) Press the 'Dialysis' button but **DO NOT** press 'Confirm' or 'Enter' **TILL INSTRUCTED**!

d) Call debug screen 0. If parts a through c were performed correctly the TOP balancing chamber valves 'dots', #31 through #34, are REMAINING BLUE!



e) Remove the RED DIALYZER connector from the shunt door and HOLD IT UP as seen in the Figure right!

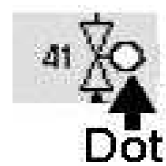
f) Continuous flow, more than 0.2 ml per minute from the connector?

Yes Continuous flow! Turn the machine off THEN proceed to **page 572**, SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

No No Flow! See parts a AND b below:

a) **Return the connector to the shunt and close the door!**

b) From debug screen 0, Figure right, watch valve #41's 'dot' for thirty (30) seconds. TWO (2) possible scenarios:




1) **IF (and ONLY if) valve #41's 'dot' cycles between white and blue:** Turn the machine off THEN proceed to **page 572**, SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

2) **IF valve #41's 'dot' STAYS white!** Call debug screen 4. Once again, watch **PDIA** AND **ADIA** for one (1) minute! TWO (2) possible scenarios i) or ii) below:

i) **IF (and ONLY if) PDIA AND / OR ADIA is NOT between 2.0 and 7.5 OR changes more than 0.1 i.e. is unstable:** Proceed to **page 505**, procedure number TMP- 3.0.0.

ii) **IF PDIA AND ADIA is between 2.0 and 7.5 AND does NOT change more than 0.1:** Proceed to **page 61**, procedure number F- 6.1.2.

F- 2.9.2 ISOLATE TEMPERATURE AND CONDUCTIVITY

a) **ENSURE NO HYDRAULIC LEAKS BEFORE CONTINUING!**

b) Call the Home screen. Is [**Temperature**] REMAINING between 35.5 and 38.5 °C AND **Conductivity** REMAINING between 13.0 and 14.5 mS? TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Temperature AND / OR Conductivity is NOT remaining in range:** Proceed to **page 47**, procedure number F- 2.0.15.

**2)** **IF Temperature AND Conductivity in range:** See parts a THROUGH f below:

a) At the bottom of the screen, press the 'Dialysate' tab.

b) If necessary, adjust the Conductivity Limits until the 'Actual' Conductivity is CENTERED between them (Figure right).

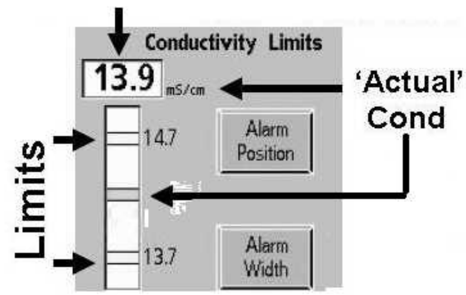
c) Press 'Enter'

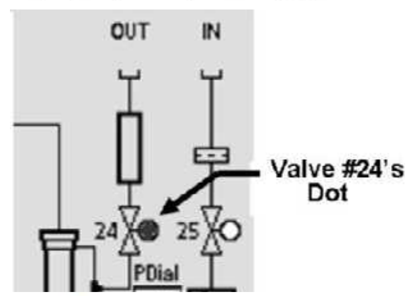
d) Allow three (3) minutes OR until if the Conductivity window remains white!

e) Call debug screen 0 (Figure right) and locate Valve #24's 'dot'. At this point it should be white.

f) See procedure number F- 2.9.4 (page 44).

Cond Window Example 13.9 white if no Cond alarm



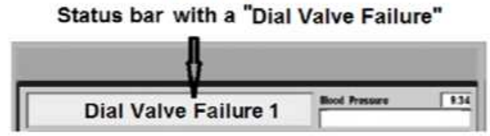




F- 2.9.4 ISOLATE 'OUT OF BYPASS' CIRCUIT

a) **CLOSE THE SHUNT DOOR COMPLETELY!**

b) Figure right, from here forward, if (and ONLY if) a "Dial Valve Failure" OR "Act Byp Valve Fail" banner appears proceed to **page 711,** Section 26.

Example
Status bar with a "Dial Valve Failure"



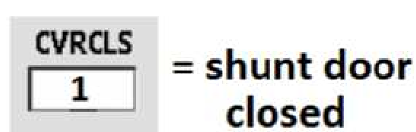

c) Is Valve #24's 'dot' BLUE?

Yes BLUE! See procedure number F- 2.0.10 (page 45).

No WHITE! See parts a THROUGH d below:

a) ENSURING the shunt door is closed, call debug screen 2.

b) ENSURE **CVRCLS** (2nd column from left) = 1!




c) Return to debug screen 0.

d) Allow up to three (3) minutes OR until if Valve #24's 'dot' turns blue. TWO (2) possible scenarios next page:

1) **IF (and ONLY if) it turns BLUE:** See procedure number F- 2.0.10 (page 45).

2) **IF after three (3) minutes it stays WHITE:** Proceed to **page 46**, procedure number F- 2.0.12.

## F- 2.0.10 VALVE #24'S 'DOT' IS BLUE

Does a leak develop? Refer to Table 2 below:

**Table 2**

| **Does a leak develop?** | **Your Response:** |
|---|---|
| Yes (a leak develops) | See parts a THROUGH c below:<br>a) Turn the machine OFF!<br>b) If tubing has blown off tie wrap these segments to where they belong!<br>c) Proceed to **page 120**, procedure number F- 14.0.0. |
| No leaks | TWO (2) possible scenarios based on if the external flow indicator's 'bob' is rising, at least ¼ way up, in the sight tube.<br>1) **IF (and ONLY if) rising at least ¼ way:** Proceed to **page 48**, procedure number F- 3.0.0.<br>2) **IF <u>NOT</u> rising at least ¼ way:** See procedure number F- 2.0.11 (page 45). |

## F- 2.0.11 VALVE #24'S 'DOT IS BLUE BUT BOB IS NOT MOVING


Call debug screen 1 to see **VERR** (right column, bottom). TWO (2) possible scenarios:

1) **IF (and ONLY if) VERR = 1 or more:** Proceed to **page 213**, TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM.

2) **IF VERR = 0:** Call the Home screen. Has [Dialysate Flow] REMAINED 800 ml/min?

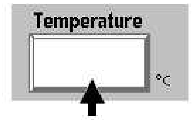
Yes [Dialysate Flow] is 800 ml/min! Proceed to **page 120**, procedure number F- 14.0.0.

No a) **Open the shunt door!**

b) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

c) Allow two (2) minutes THEN return to (ABOVE) procedure number F- 2.7.0 (**page 41**).

## F- 2.0.12 VALVE #24'S 'DOT' IS WHITE / IN BYPASS



**Red OR white?**

Call the Home screen. Is the [**Temperature**] window (Figure right) RED?

Yes [**Temperature**] window is red! See procedure number F- 2.0.13 (page 46).

No **[Temperature]** window is pale yellow/white! See parts a AND b below:

a) Return to the Home screen. ENSURING [**Conductivity**] is REMAINING between 13.0 and 14.5 mS ENSURE also the Conductivity window is REMAINING pale yellow/white!

b) Call debug screen 0. Allow up to three (3) minutes OR until Valve #24's 'dot' turns blue. TWO (2) possible scenarios:

1) **IF the 'dot' turns blue:** Immediately return to **page 45**, procedure number F- 2.0.10.

2) **IF it REMAINS white:** If certain you are seeing or saw a Flow Error proceed to **page 120**, procedure number F- 14.0.0 to check the 'out of bypass' circuit (i.e. Valve #24 AND Valve #25).

## F- 2.0.13 RED TEMPERATURE WINDOW

a) **Open the shunt door!**

b) Press the [**Temperature**] window to ENSURE "Temp Setting" is at 37° C.

c) Press 'Enter'.

d) Allow **[Temperature]** to stabilize to between 35.0 and 39.0 °C AND Conductivity to between 13.0 and 14.5 mS.

e) **Close the shunt door!**

f) Call debug screen 0 and watch Valve #24's 'dot' for up to three (3) minutes OR until if it turns blue. TWO (2) possible scenarios:

1) **IF the 'dot' turns blue:** Immediately return to **page 45**, procedure number F- 2.0.10.

2) **IF REMAINS white:** If certain you saw a Flow Error proceed to **page 120**, procedure number F- 14.0.0, to check the 'out of bypass' circuit (i.e. Valve #24 AND Valve #25).

**F- 2.0.15 [TEMPERATURE] NOT 35.0 - 39.0 °C AND / OR [CONDUCTIVITY] NOT 13.0 - 14.5 mS**

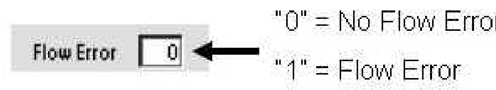
a) Call the Home screen.

b) Press the [**Temperature**] window. ENSURE “Temp Setting” is 37.0° C.

c) Press ‘Enter’.

d) With the shunt door REMAINING open, call debug screen 0.

e) WITHOUT LOOKING AWAY, watch **Flow Error** for one (1) minute. If it EVER = 1, even just once indicates a Flow Error. Is it EVER = 1?




Yes **Flow Error** EVER **=** 1! Proceed to **page 55**, procedure number F- 5.0.0.

No **Flow Error** ALWAYS = 0! See parts a AND b below:

a) Call debug screen 6.

b) WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for TWO (2) full minutes OR until if it EVER = 897 or more, even just once, indicating a Flow problem. TWO (2) possible scenarios:


1) **IF (and ONLY if) BC Switch is EVER = 897 or more even if only once:** Proceed to **page 55**, procedure number F- 5.0.0.

2) **IF BC Switch is NEVER = 897 or more:** See procedure number F- 2.0.16 (page 47).

**F- 2.0.16 NO FLOW ERRORS**

Call the Home screen. THREE (3) possible scenarios 1) or 2) or 3) below:

1) **IF (and ONLY if) the Temperature window is red:** Proceed to **page 232**, SECTION 4 – TEMPERATURE PROBLEMS.

2) **IF (and ONLY if) Conductivity is NOT between 13.0 and 14.5 mS:** Proceed to **page 335**, SECTION 5 – CONDUCTIVITY PROBLEMS.

3) **IF the Temperature window is pale yellow/white AND Conductivity is between 13.0 and 14.5 mS:** See (ABOVE) procedure number F- 2.9.2 (**page 44**).

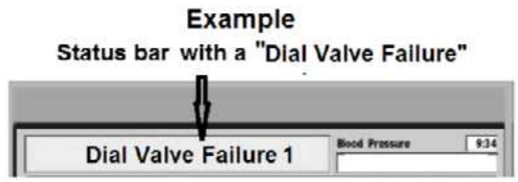
## F- 3.0.0 ISOLATE VALVE #43 (FILLING PROGRAM) DRAIN FLOW

A) WITHOUT returning the Air Sensor's female connector yet, remove the resistor plug from the distribution board.

B) ENSURE debug screen 0's Chamber #69 says "Air".

C) Obtain a 1000 ml graduated cylinder!

D) Figure right, ENSURE a "Dial Valve Failure" OR "Act Byp Valve Fail" banner NEVER appears!




E) Call debug screen 1. **FILACT MUST ALWAYS = 1 before continuing!**


F) See procedure number F- 3.1.0 (page 48).

## F- 3.1.0 FILACT = 1 / ISOLATE VALVE #43 FLOW

a) Figure right, if a 'Quick Connector' is present at the end of the drain tubing an **adaptor** is required!


b) Measure drain flow for two (2) minutes. 600 ml OR more collected?

Yes 600 ml or more! See procedure number F- 3.1.1 (page 48).

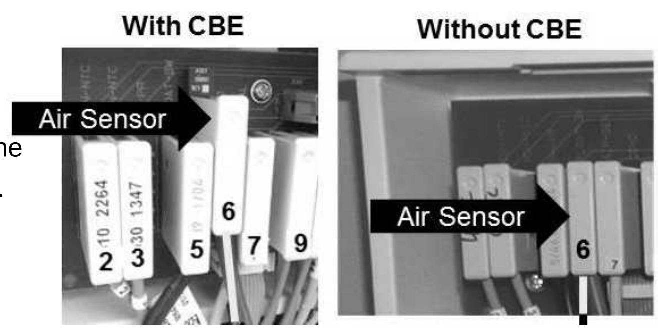
No Less than 600 ml! Proceed to **page 49**, procedure number F- 3.1.3.

## F- 3.1.1 ABOUT 600 ML COLLECTED FROM VALVE #43

a) Reconnect the drain.

b) ENSURE a good drain connection by listening for or visually veryfying flow!

c) Return the Air Sensor's female connector to the **5th** distribution board position from the LEFT.




d) Call debug screen 0. **If the connector is plugged in PROPERLY Chamber #69's text box says "No Air"!**

e) In THIS troubleshooting session, did a previous procedure have you 'swap in' a DiaSafe® filter?

Yes A DiaSafe® filter WAS swapped in! Watch **Flow Error** for five (5) minutes. If it EVER = 1 proceed to **page 50**, procedure number F- 3.2.0. If **Flow Error** REMAINS = 0 DO NOT continue.

No **DO NOT replace the DiaSafe® filter at this time!** Proceed to **page 50,** procedure number F- 3.2.0!

## F- 3.1.3 FLOW LESS THAN 600 / ISOLATE ACTUATOR-TEST BOARD / VALVE #43

a) Reconnect the drain PROPERLY!

b) ENSURE **FILACT** REMAINS = 1!

c) **Figure below**, using a flashlight, check through Valve #43's OUTPUT tubing for bio-growth restrictions. **If a restriction is located this may be the problem!**

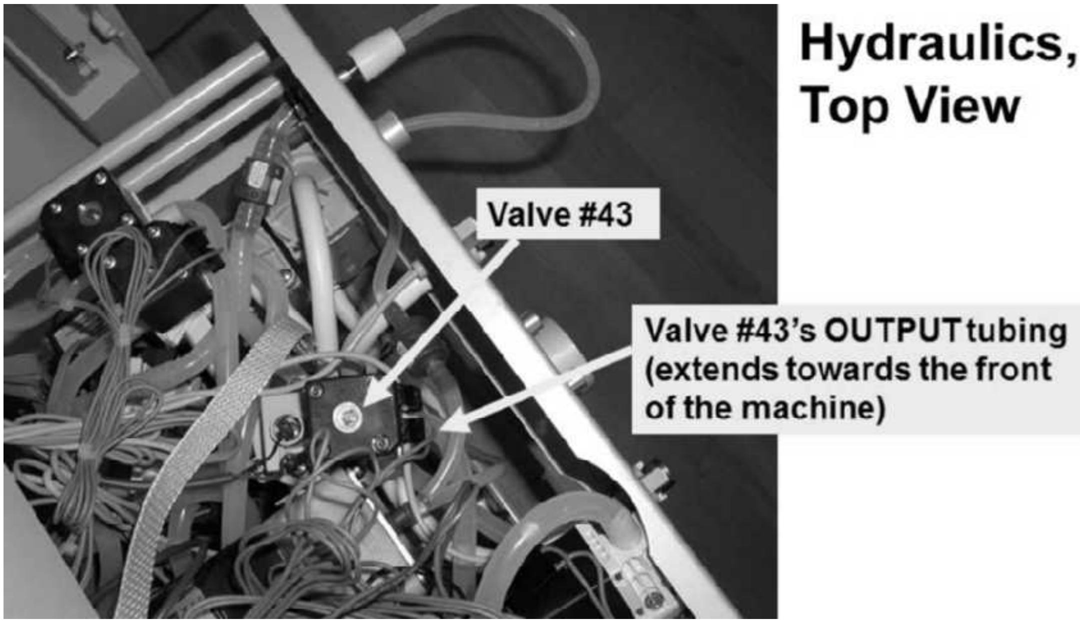



**Figure 8 – Hydraulics TOP View**

d) **Allow four (4) minutes for Valve #43's solenoid to become warm**.

e) Touch Valve #43's (black) solenoid. Is it warm (Yes or No)?

Yes — Warm solenoid! TWO (2) possible bad components: **1)** Actuator-Test***** board OR; **2**) Valve #43.

* To LOCATE the Actuator-Test board refer to Figure 4A (page 10).

No — The solenoid IS NOT warm! **NOTE** **ONLY VALVE #43** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.

**F- 3.2.0 SIX HUNDRED (600) ML OR MORE IN FILLING PROGRAM**

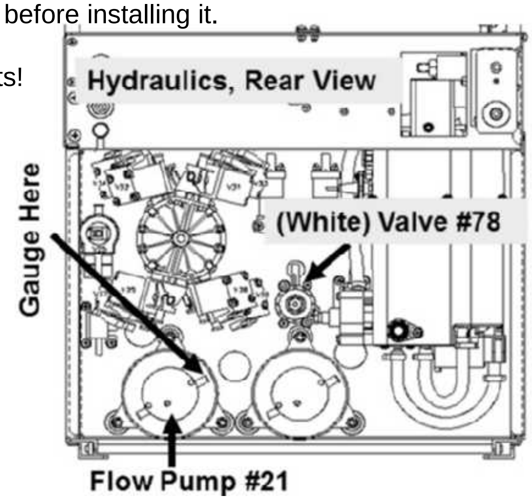
a) This procedure uses a psi gauge. ENSURE it reads 0 psi before installing it.

b) Return BOTH concentrate connectors to their RINSE ports!

c) Figure right, tee the gauge between the Flow Pump's OUTPUT nozzle and its WHITE tubing.

d) **To prevent leaks and false readings, tie wrap both sides of the gauge tubing.**

e) See procedure number F- 3.2.2 (page 50).



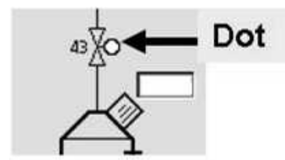

**F- 3.2.2 ISOLATE FLOW PUMP**

a) **IMPORTANT! Place the machine in RINSE!**

b) Watch for one (1) minute to ENSURE a “No Water” alarm NEVER occurs!

c) Call debug screen 0. If debug does not appear press ‘Esc’ then call screen 0.

d) Allow Valve #43’s ‘dot’ (Figure right) to turn blue then WHITE again! While white, does pressure CYCLE, about every three (3) seconds, to between 35 and 36 psi?




Yes Between 35 and 36 psi! See procedure number F- 3.3.0 (page 51).

No Is NOT between 35 and 36 psi! ENSURING the machine was in RINSE AND no leaks, TWO (2) possible scenarios below:

1) **IF (and ONLY if) pressure is too low:** DO NOT calibrate instead proceed to **page 101**, procedure number F- 9.0.2.

2) **IF pressure is too high:** Perform parts a AND b below:

a) Per the Figure above, adjust Valve #78 until pressure cycles to between 35 and 36 psi!

b) See procedure number F- 3.3.0 (page 51).

## F- 3.3.0 GOOD FLOW PUMP PRESSURE

a) Return the connectors to concentrate.

b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘Enter’!

d) Allow **Conductivity** to increase to at more than 13.0 mS!

e) TWO (2) possible TMP window scenarios below:

**1)** **IF (and ONLY if) the TMP window is NOT red:** See procedure number F- 3.6.0 (page 51).

**2)** **IF the TMP window is red (TMP alarm):** See parts a THROUGH c below:

a) Press and release the ‘Reset’ key then immediately press and hold it for three (3) seconds.

b) Allow thirty (30) seconds.

c) If a TMP alarm reoccurs, repeat parts a and b up to twice more BEFORE continuing to procedure number F- 3.6.0 (page 51).

## F- 3.6.0 ANALYZE FLOW ERROR

a) **Allow thirty (30) seconds before continuing.**


b) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for five (5) full minutes OR until if it EVER = 897 or more, even just once. THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) REMAINS ALWAYS = 897 or more:** Return to (ABOVE) procedure number F- 2.0.0 (**page 38).**

**2)** **IF (and ONLY if) NEVER = 897 or more:** The Flow Error must be VERY intermittent! Procedure number F- 3.8.0 (page 52) may locate it!

**3)** **IF EVER cycles to 897 or more but does NOT remain 897:** See parts a THROUGH e below:

a) Replace the DiaSafe® filter preferably with one from another machine that is not exhibiting Flow Errors.

b) Place the machine into RINSE for five (5) minutes to prime the filter.

c) Connect to concentrate and return to Dialysis Program (‘Dialysis’ → ‘Enter’).

d) From the Home screen, allow [**Conductivity**] to increase to more than 13.0 mS.

e) Call debug screen 6 to watch **BC Switch** for five (5) full minutes OR until if it EVER = 897 or more! THREE (3) possible scenarios next page:

**Procedure number F- 3.6.0 continued from previous page:**

1) **IF (and ONLY if) REMAINS = 897 or more:** Return to (ABOVE) procedure number F- 2.0.0 (**page 38**).

2) **IF (and ONLY if) NEVER 897 or more:** The Flow Error is not occurring now. Replacing the Diasafe® filter may have fixed the problem HOWEVER, watch for **BC Switch** for five (5) more minutes.

3) **IF EVER cycles to 897 or more but DOES NOT remain 897 or more:** See procedure number F- 3.8.0 (page 52).

## F- 3.8.0 INTERMITTENT FLOW ERRORS

a) It is RECOMMENDED to perform an acid clean as bicarb precipitate may restrict hydraulic pathways causing intermittent flow errors.

b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

c) **OPEN THE SHUNT DOOR and LEAVE IT OPEN till instructed!**

d) From the Home screen, press the [Dialysate Flow] window.

e) Set [Dialysate Flow] to 800 ml /min and press ‘Enter’.

f) Allow [**Conductivity**] to increase to at least 13.0 mS.

g) TWO (2) possible TMP window scenarios:

   **1)** **IF (and ONLY if) the TMP window is NOT red:** See procedure number F- 3.8.1 (page 53).

   **2)** **IF the TMP window is red (TMP alarm):** See parts a THROUGH c below:

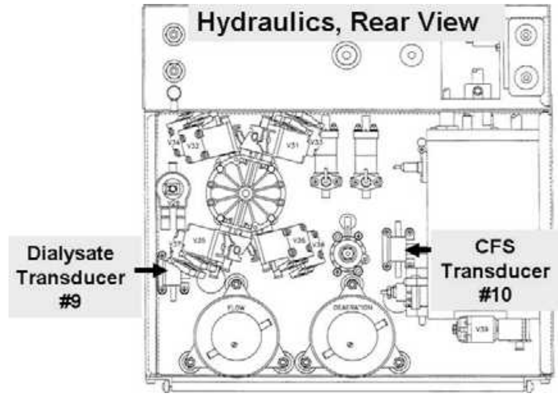
      a) Press and release the ‘Reset’ key then immediately press and hold it for three (3) seconds.

      b) Allow thirty (30) seconds.

      c) If a TMP alarm reoccurs, repeat parts a and b up to twice more BEFORE continuing to procedure number F- 3.8.1 (page 53).

## F- 3.8.1 TROUBLESHOOTING INTERMITTENT FLOW ERRORS

The following step-by-step procedures may locate an extremely intermittent Flow Error:




**1)** Figure right, check the (blue) CFS transducer #10 AND Dialysate Pressure #9 transducers for signs of a small external leak. If leakage is located replace the transducer.

**2)** To ensure the Deaeration Motor is not intermittently stopping, glance at Loading Pressure (Rinse port gauge) from time to time to ENSURE it ALWAYS PEAKS to between 23 and 27 psi!

**3)** If the DiaSafe® filter is LESS THAN 60 days old continue to step #4. If more than 60 days old:
**A)** Replace the filter; **B)** Return to Dialysis Program; **C)** Set [Dialysate Flow] to 800 ml/min; **D)** Allow eight (8) minutes; **D)** Call debug screen 0; **E)** Watching **Flow Error** for up to ten (10) minutes, if it EVER = 1 continue to step # 4.

### 4) Open the shunt door till instructed otherwise!

**5)** Call debug screen 0. Watching for up to ten (10) minutes, if **Flow Error** EVER = 1 continue to step #6.

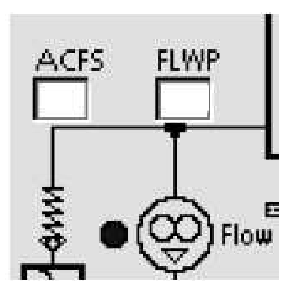
**6)** Call debug screen 1. If **VERR** EVER = 1 or more indicates an intermittent Valve Error. In this event ONLY see procedure number F- 2.0.0 (**page 38**). If **VERR** = 0 continue to step #7.


**7)** Call debug screen 0. **A)** ENSURE Chamber #69 says "No Air"; **B)** If drain flow and incoming water pressure is good almost every time the Balancing Chamber valve 'dots' cycle, Valve #41's 'dot' turns blue for about one (1) second.

**8)** Call debug screen 4. ENSURE **PDIA** (left column) is between 2.0 and 8.0 AND is IS NOT changing more than 0.3 per minute which may indicate a bad DiaSafe® filter OR a leaking balancing chamber valve.

**9)** Performing parts a through e below, may locate an intermittent bad CFS transducer:

a) From the Home screen, set [Dialysate Flow] to "OFF" and press 'Enter'.




b) Call debug screen 0. Figure right, ENSURE **FLWP** = 255 (Flow is off).

c) **ACFS** should instantaneously (within 0.5 seconds) go to between 4.0 and 5.9. If it EVER increases slower than this OR remains less than 4.0 OR goes to more than 5.9 CFS transducer #10* may be intermittent bad.

***** To LOCATE the CFS refer to Figure 6 (page 22)

d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

e) Repeat parts a through d at least eight (8) times. If **ACFS** goes to between 4.0 and 5.9 instantaneously, EVERY SINGLE TIME, continue to step #10 (next page).

**10)** Call debug screen 0. Watch **Flow Error** (TOP window) for five (5) minutes. If it EVER = 1 along with a "TMP is High" alarm and/or "Filling Program" AND Loading Pressure remains 'OKAY' may indicate a: **1)** Restricted DiaSafe® filter OR: **2)** Restricted Valve #26. If **Flow Error** is ALWAYS = 0 continue to step #11.

**11)** If **Conductivity** is remaining less than 14.3 mS continue to step #12. If **Conductivity** increases to 14.4 mS or more, ENSURING Loading Pressure remains 'OKAY' AND drain flow is GOOD (i.e. Valve #41's 'dot' cycling between blue and white) may indicate an intermittent 'stuck closed' balancing chamber valve. Diagnostic Valve Leak Tests will NOT help but procedure number F- 7.0.0 (**page 70**) may.

**12)** CLOSE THE SHUNT DOOR then continue to step #13.

**13)** From debug screen 0, allow Valve #24's 'dot' to turn blue i.e. no Temp, Cond or bi*b*ag alarms. Continue to step #14.

**14)** If **Flow Error** remains = 0 for five (5) minutes continue to step #15. If **Flow Error** EVER = 1 along with a possible "TMP is High" and/or "Filling Program" AND Loading Pressure remains 'OKAY' may indicate: **1)** A restricted DiaSafe® filter OR; **2)** Restricted external dialysate line filter #73 OR; **3)** Restricted Valve #24 OR; **4)** Restricted Valve #25.

**15)** BEFORE continuing to step #16, **NOTE** this page number as you may be prompted to return here.

**16)** Proceed to **page 580** to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM

**17)** If a leaking balancing chamber diaphragm was not located in step #16, return to Dialysis Program and allow five (5) minutes BEFORE continuing to step #18.

**18)** From the Home screen, press the [Dialysate Flow] window.

**19)** Set [Dialysate Flow] to 500 ml/min and press 'Enter'.

**20)** ENSURING debug screen 0's Chamber #69 says "No Air" constantly, if necessary, RESET a TMP alarm then continue to step #21.

**21)** **A)** Allow twenty (20) minutes or longer ENSURING TMP does NOT become more than 300 AND a TMP alarm NEVER occurs; **C)** Call debug screen 10. If **ACFS HI** = 6.0 or more may indicate a bad CFS transducer #10. If **ACFS HI** is NOT = 6.0 or more continue to step #22

**22)** If Deaeration motor brushes have not been replaced at 8000 hour intervals do so now. If Flow motor brushes have never been replaced do so now.

**Note:** ENSURE 'soft brushes' are installed in the Flow motor!

**23)** Call debug screen 0. Without resetting alarms, ENSURING **Flow Error** is NEVER = 1 watch **FLWP** for several minutes. If it changes by more than +/- 2 either the DiaSafe® filter may be bad OR the Flow Pump or motor may be bad!

**24)** If the preceding steps did not locate a problem the Troubleshooting Guide cannot locate a Flow Error!

## F- 5.0.0 FLOW ERROR ‘1’ OR QDL NOT BETWEEN 720 AND 880 OR BC SWITCH > 400


a) **IMPORTANT!** CLOSE THE SHUNT DOOR!

b) The following is ESPECIALLY IMPORTANT if the machine was worked on by someone who may have connected the BALANCING CHAMBER VALVES (#31 through #38) incorrectly between the distribution board and their solenoid terminals (Figure right)!

c) TWO (2) possible scenarios 1) or 2) below:

**1)** **IF (and ONLY if) SURE the machine was NOT worked on previously for this Flow problem:** See procedure number F- 5.1.0 (page 56).

**2)** **IF the machine WAS or MAY have been worked on:** See parts a THROUGH c below:

- a) Leave the machine in Dialysis Program and **DO NOT** turn Dialysate Flow “OFF”!
- b) **Per Figure 9 below**, **CAREFULLY** trace the wires from EACH valve to its distribution board position.
- c) If (and ONLY if) a wiring error is NOT located see procedure number F- 5.1.0 (page 56). If a wiring error was located this may be the problem.

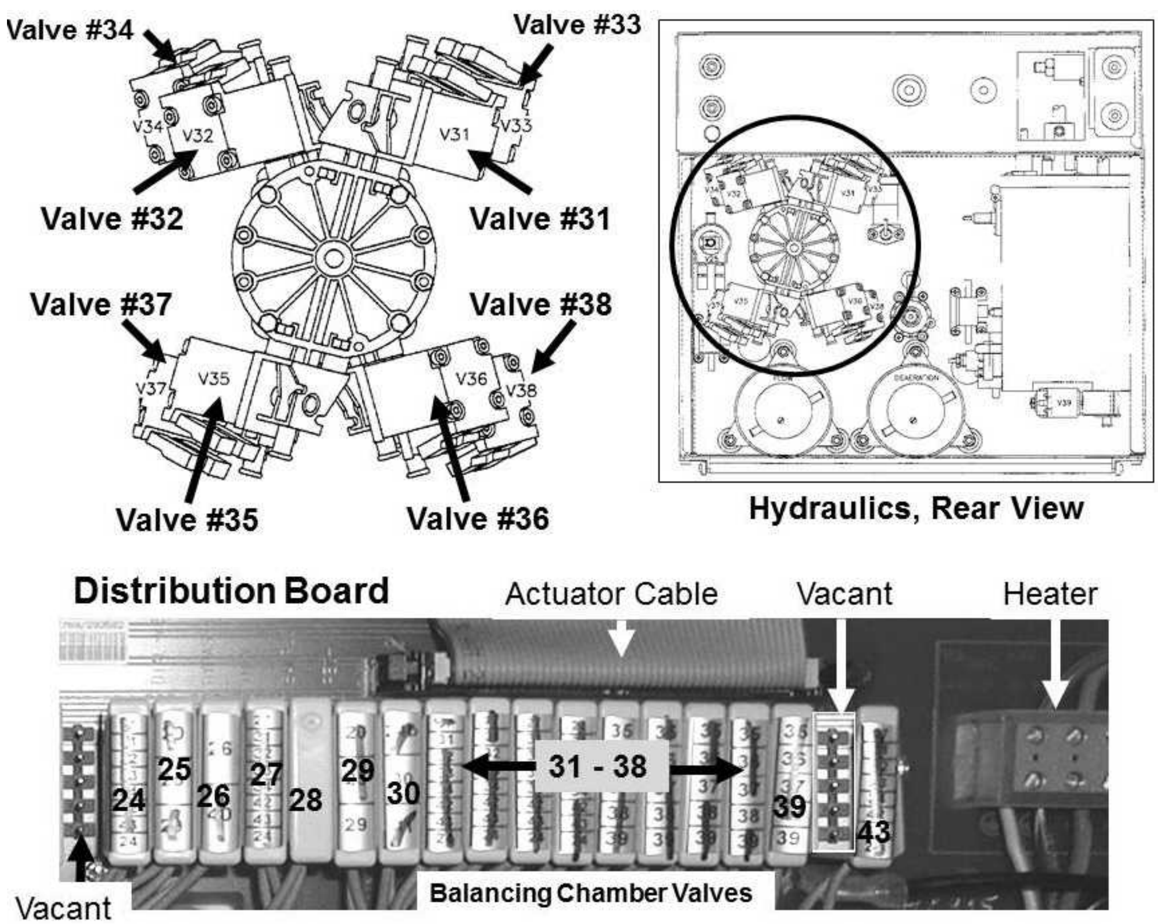



**Figure 9 – Distribution Board / Balancing Chamber Valves**

## F- 5.1.0 BALANCING CHAMBER VALVES WIRED CORRECTLY

a) Call debug screen 6.


b) Watch **BC Switch** (middle column) for thirty (30) FULL seconds. Does it <u>REMAIN ALWAYS</u> = 897?

Yes **BC Switch** ALWAYS = 897! See procedure number F- 5.1.1 (page 56).

No **BC Switch** <u>IS NOT</u> always = 897! Proceed to **page 57**, procedure number F- 5.2.0 (page 57).

## F- 5.1.1 BC SWITCH ALWAYS = 897 / ISOLATE PRESSURE SENSOR CONNECTIONS

a) **Figure below**, **<u>CAREFULLY</u>** trace <u>BOTH</u> wire harnesses from distribution board connectors “X9, P-Dial” <u>AND</u> “X10, CFS” to <u>ENSURE</u> they go to the correct (blue) Pressure Transducer.

b) Are <u>BOTH</u> Pressure Transducers connected properly?

Yes <u>BOTH</u> are connected properly! See procedure number F- 5.2.0 (page 57).

No Connect them properly i.e. CFS #10 → “X10, CFS”; Dialysate Pressure #9 → “X9, P-Dial” and allow one (1) minute. Call debug screen 1 to watch **Flow Error** for four (4) minutes. If it remains = 0 this may have fixed the problem. If it EVER = 1, even just once, continue procedure number F- 5.2.0 (page 57)

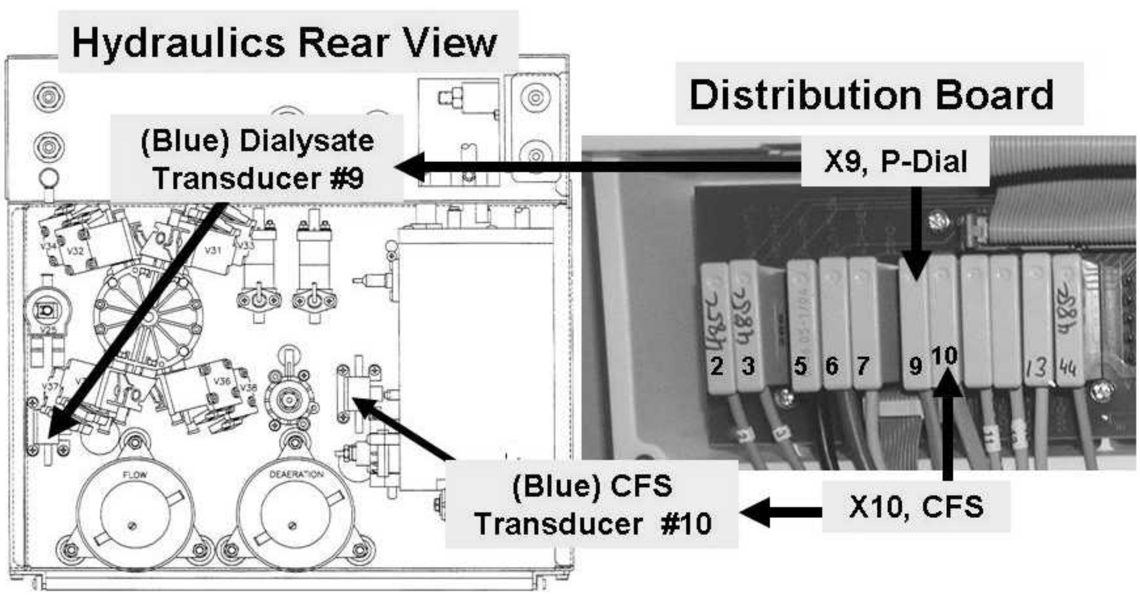



**Figure 10 – Pressure Sensors**

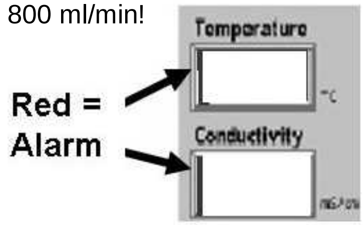
## F- 5.2.0 PREPARE TO ISOLATE VALVE #24 / VALVE #26

a) **IMPORTANT!** ENSURE the shunt door is CLOSED!

b) Call the Home screen to ENSURE [Dialysate Flow] is on* AND set to 800 ml/min!

* If [Dialysate Flow] is blinking Flow is off. Flow MUST BE on!

c) Figure right, is the [**Conductivity**] AND / OR the [**Temperature**] window REMAINING ALWAYS RED?

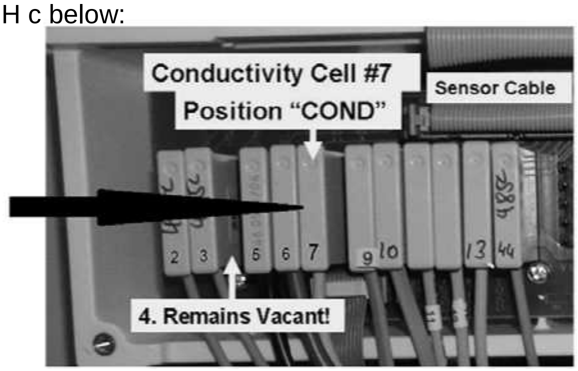



Yes REMAINING ALWAYS RED! See procedure number F- 5.3.0 (page 57).

No NOT REMAINING RED! See parts a THROUGH c below:

a) Figure right, inside the distribution board, unplug the **5th connector cap** i.e. 6th position from the LEFT. This is Cond Cell #7's connector.

b) ENSURE the [**Conductivity**] window is now always red i.e. Conductivity Cell #7 is unplugged.




c) Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

Yes 'Bob' moving! Proceed to **page 119**, procedure number F- 13.0.0.

No 'Bob' is NOT moving! See parts a AND b below:

a) Return Conductivity Cell #7's connector to distribution board position "X7 COND".

b) Proceed to **page 58**, procedure number F- 6.0.0.

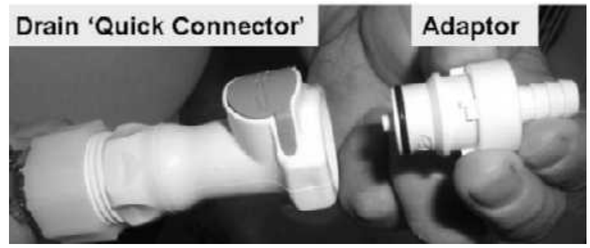
## F- 5.3.0 COND AND / OR TEMP WINDOWS ALWAYS RED / ISOLATE VALVE #24 / VALVE #26

Is the external flow indicator's 'bob' rising at least ¼ way in the sight tube?

Yes 'Bob' moving! If SURE the **Conductivity** AND / OR the **Temperature** window is ALWAYS RED proceed to **page 119**, procedure number F- 13.0.0.

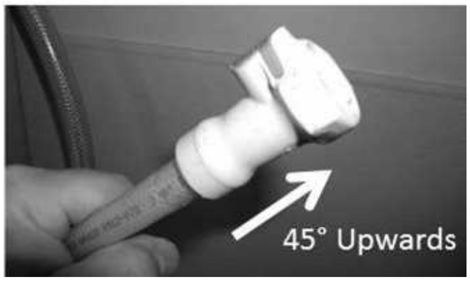
No 'Bob' NOT moving! See procedure number F- 6.0.0 (page 58).

**F- 6.0.0 DRAIN STREAM CHECKS**




a) Figure right, if a 'Quick Connector' is present at the end of the 'to drain' tubing an ADAPTOR is required!

b) Figure below, point the drain tube OPENING **UP at 45°**, at a level no higher than two (2) feet above the floor! **IF POINTED DOWN GRAVITY FLOW RESULTS IN ERROR!**

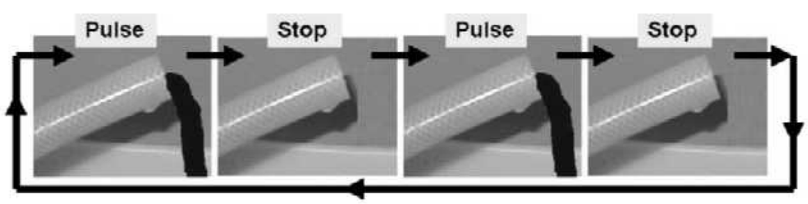



c) Watching for one (1) minute, flow MAY occur every nine (9) seconds!

d) Consider ALL FOUR (4) scenarios below AND proceed with the one that BEST MATCHES:

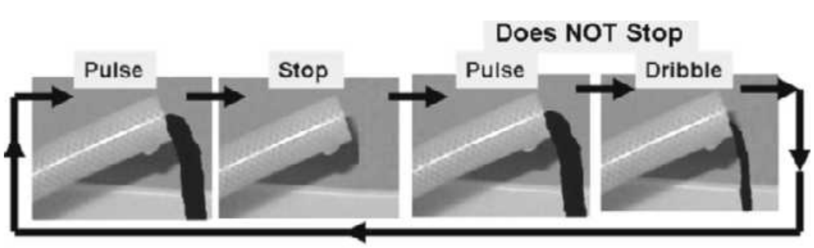
***Scenario #1*:** ***Referring to Figure A,*** **approximately 30 ml pulses that stops completely between each and every cycle i.e. Pulse → Stop → Pulse → Stop:** NOTE this drain stream for later then see procedure number F- 6.1.0 (page 59).

Figure A




***Scenario #2*:** **Referring to *Figure B,* approximately 30 ml Pulse → Stop → Pulse → 'Dribble' (a noticeably weaker stream that lasts about two (2) seconds) → etc. Flow does NOT stop completely between each and every cycle:** NOTE this drain stream (dribble) for later then see procedure number F- 6.1.0 (page 59).

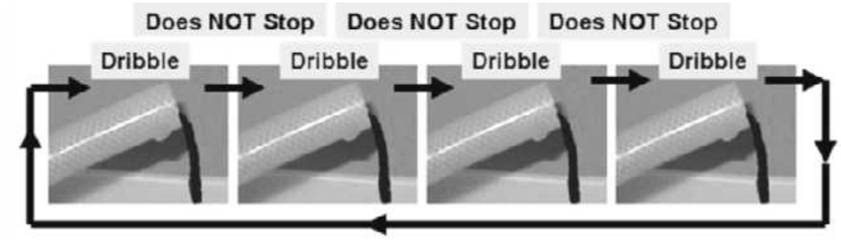
Figure B




**Scenarios 3 AND 4 next page**

*__Scenario #3:__* **Referring to *Figure C,* for a <u>ONE MINUTE PERIOD</u> if EVER a <u>continuous</u> weak stream that LASTS for five (5) seconds or longer:** ENSURING the drain tube OPENING was pointed up, proceed to **page 66,** procedure number F- 6.2.0.

Figure C




*__Scenario #4__*: **IF No Flow <u>EVER</u>:** If (and ONLY if) the [Dialysate Flow] window says "OFF" <u>OR</u> is blinking return to (ABOVE) procedure number F- 5.2.0 (**page 57**). If [Dialysate Flow] does NOT say "OFF" and is not blinking proceed to **page 67**, procedure number F- 6.3.0.

## <u>F- 6.1.0 PULSE – STOP – PULSE OR 'DRIBBLE' / ISOLATE FOR STUCK OPEN BC VALVE</u>

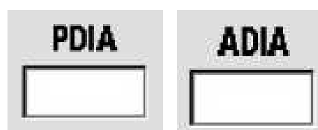
A) Reattach the drain tubing to the station!

B) ENSURING [Dialysate Flow] is on ENSURE a good drain connection by listening for or visually verifying flow.

C) If a TMP alarm is <u>NOT</u> present skip to part D. If a TMP alarm is present: **1)** Press and release the 'Reset' key then immediately press and hold it for three (3) seconds; **2)** Allow thirty (30) seconds; **3)** If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to part D.

D) Allow thirty (30) seconds BEFORE continuing to part E!

E) Call debug screen 4 to watch **PDIA** (left column) <u>AND</u> **ADIA** (right column) for TWO (2) minutes. <u>BOTH</u> should REMAIN between 1.5 and 8.5 <u>AND</u> STABLE i.e. does <u>NOT</u> change more than 0.3 per minute!




F) TWO (2) possible scenarios:

1) **IF (and ONLY if) PDIA <u>AND</u> ADIA is REMAINING between 1.5 and 8.5 <u>AND</u> is STABLE:** Proceed to **page 62**, procedure number F- 6.1.4.

2) **IF PDIA <u>and / or</u> ADIA is <u>NOT</u> remaining between 1.5 and 8.5 <u>and / or</u> is <u>NOT</u> stable:** See procedure number F- 6.1.1 (page 60).

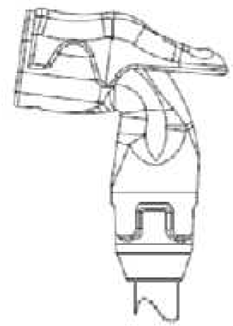
## F- 6.1.1 PDIA NOT BETWEEEN 1.5 AND 8.5 OR UNSTABLE

a) Momentarily plug the RED (acid) concentrate connector into its rinse port to call "Select Program".

b) Return the RED connector to acid concentrate!

c) Press the 'Dialysis' button but **DO NOT** press 'Confirm' or 'Enter' till instructed!

d) Call debug screen 0. If parts a through c were performed correctly the TOP balancing chamber valves 'dots' are REMAINING BLUE!



e) Remove the red DIALYZER connector from the shunt door and HOLD IT UP as seen in the Figure right.

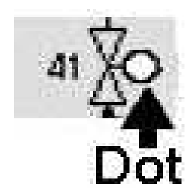
f) Continuous flow, more than 0.2 ml every minute, from the connector?

Yes Continuous flow! Turn the machine off THEN proceed to **page 572**, SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

No Flow! See parts a THROUGH c below:

a) **Return the connector to the shunt and close the door!**

b) ENSURE the TOP balancing chamber valves are REMAINING BLUE!




c) From debug screen 0, Figure right, watch valve #41's 'dot' for thirty (30) seconds. TWO (2) possible scenarios:

**1) IF (and ONLY if) valve #41's 'dot' cycles between white and blue:** Turn the machine off THEN proceed to **page 572**, SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS

**2) IF valve #41's 'dot' STAYS white:** Call debug screen 4. Watch **PDIA** AND **ADIA** again for one (1) minute, TWO (2) possible scenarios i) or ii) below:

**i) IF (and ONLY if) PDIA AND / OR ADIA is NOT between 3.0 and 7.5 OR changes more than 0.1 i.e. unstable:** Proceed to **page 505**, procedure number TMP- 3.0.0.

**ii) IF PDIA AND ADIA are between 3.0 and 7.5 and DOES NOT change more than 0.1 i.e. is stable:** See procedure number F- 6.1.2 (page 61).

## F- 6.1.2 PDIA AND ADIA STABLE BETWEEN 3.0 AND 7.5

A) **Turn the machine OFF!**

B) Preferably from another machine, that is not having Flow Errors, swap in a DiaSafe® filter!

C) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

D) **OPEN the shunt door till instructed OTHERWISE!**

E) Allow five (5) minutes OR until NO AIR bubbles are seen flowing through the DiaSafe housing tubing.

F) From the Home screen, press the [Dialysate Flow] window.

G) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

H) If a TMP alarm is NOT PRESENT skip to part J. If a TMP alarm is present: **1)** Press and release the 'Reset' key then immediately press and hold it for three (3) seconds; **2)** Allow thirty (30) seconds; **3)** If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to part I.

I) Allow thirty (30) seconds BEFORE continuing to part J.

J) Call debug screen 0. WITHOUT LOOKING AWAY watch **Flow Error** for four (4) minutes OR until it EVER = 1, even just once, indicating a Flow Error. TWO (2) possible scenarios 1) or 2) below:

1) **IF (and ONLY if) Flow Error ALWAYS = 0:** Possibly the Diasafe® filter fixed the problem OR the flow error is intermittent! Proceed to **page 44**, procedure number F- 2.9.2.

2) **IF Flow Error EVER = 1:** Call debug screen 4. **PDIA** should REMAIN between 1.5 and 8.0 AND STABLE i.e. DOES NOT change more than 0.3 per minute. Watch it for two (2) minutes. TWO (2) possible scenarios 3) or 4) below:

3) **IF (and ONLY if) PDIA is IS NOT remaining between 1.5 and 8.0 and / or is IS NOT stable:** See procedure number F- 6.1.3 (page 61).

**4) IF PDIA is STABLE between 1.5 and 8.0:** Close the shunt door THEN proceed to **page 62**, procedure number F - 6.1.4

## F- 6.1.3 PDIA NOT REMAINING BETWEEN 1.5 and 8.0 OR UNSTABLE

a) **CLOSE the shunt door!**

b) A procedure, in a different Section, is performed next. Before continuing to part c **NOTE** this page and procedure number (F- 6.1.3) as you may be prompted to return here.

c) BEFORE continuing to part d, proceed to **page 572**, to perform SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

d) If a leaking balancing chamber valve was NOT located in part c, proceed to **page 73**, procedure number F- 7.0.4.

## F- 6.1.4 PDIA STABLE BETWEEN 1.5 AND 8.0

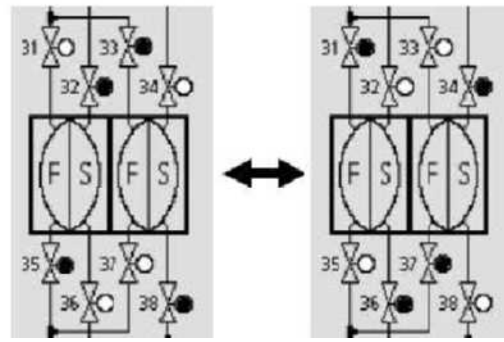
a) Call the Home screen. ENSURE [Dialysate Flow] is still set to 800 ml/min.

b) [**Conductivity**] MUST BE more than 11.0 mS indicating the Acid Pump is drawing!

c) Is [**Conductivity**] more than 14.7 mS?

Yes [**Conductivity**] more than 14.7 mS! Proceed to **page 70**, procedure number F- 7.0.0.

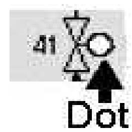
No [**Conductivity**] less than 14.7 mS! ENSURING [Dialysate Flow] is at **800 ml/min**, see parts A THROUGH F below:




A) Call debug screen 0. Figure right, the Balancing Chamber valve 'dots' MUST be cycling, possibly every nine (9) seconds.

B) If Valve #24's 'dot' is blue ENSURE the external flow indicator's 'bob' is rising and falling.

C) Valve #41's 'dot' should cycle between white and blue almost every time the Balancing Chamber valves cycle indicating drain flow

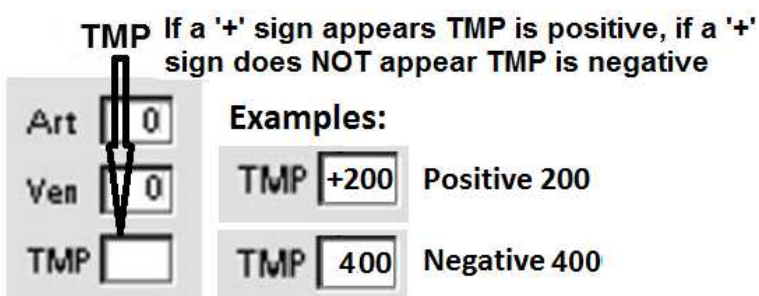


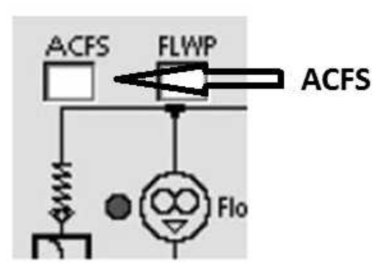

indicating 'to drain' flow.

D) **Figures below**, ENSURING TMP is STABLE between +200 and negative 400 (stable = does DOES NOT change more than 40 per minute), watch **ACFS** for two (2) minutes. TWO (2) possible scenarios below:

**Scenario #1:** **ACFS NORMAL behavior:** Mostly remains between 2.0 and 5.0 but may occasionally drop below 1.0 but for **NO MORE** than ten (10) seconds. If (and ONLY if) **ACFS** is behaving normally continue to part E.

**Scenario #2:** **ACFS ABNORMAL behavior:** If EVER 5.9 or more OR remains lower than 1.0 for LONGER THAN ten (10) seconds proceed to **page 97**, procedure number F- 8.0.0.




E) Call debug screen 6 to see **BC Switch** (middle column). It normally changes slightly (+/- 10) but if EVER more than 400 OR less than 203 indicates a flow problem. In any event see part F.


F) WITHOUT LOOKING AWAY, ENSURING a "No Water" banner NEVER appears, watch **BC Switch** for up to five (5) minutes OR until if it EVER is more than 400 OR less than 203. FOUR (4) possible scenarios 1) or 2) or 3) or 4) next page:

1) **IF (and ONLY if) BC Switch is <u>CONSTANTLY</u> 897 or more:** Proceed to **page 97**, procedure number F- 8.0.0.

2) **IF (and ONLY if) BC Switch is <u>NEVER</u> more than 400 <u>OR</u> less than 203:** See procedure number F- 6.1.5 (page 63).

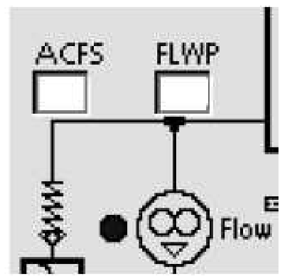
3) **IF (and ONLY if) BC Switch cycles <u>CONSISTENTLY</u> from about 220 for nine (9) seconds to more than 400 for two (2) seconds:** Proceed to **page 70**, procedure number F- 7.0.0!

4) **IF BC Switch is <u>EVER</u> more than 400 <u>OR</u> less than 203 but <u>NOT CONSISTENTLY</u> as in Scenario #3:** To locate an intermittent bad CFS Transducer perform parts a through e below:

   a) Call debug screen 0. If Valve #24's 'dot' is blue ENSURE the external flow indicator's bob is moving up and down

   b) From the Home screen, set [Dialysate Flow] to "OFF" and press 'Enter'.

   c) Call debug screen 0. Figure right, ENSURE **FLWP** = 255 (Flow OFF).




   d) **ACFS** should return to between 4.0 and 6.0 very quickly, within 0.5 seconds. If it <u>EVER</u> increases slower than this <u>OR</u> remains less than 4.0 <u>OR</u> more than 5.9 the (blue) CFS Transducer #10***** is intermittent bad.

   ***** To <u>LOCATE</u> the CFS refer to Figure 6 (page 22)

   e) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'. Repeat parts a through e at least eight (8) times. If **ACFS,** goes to between 4.0 and 5.9, within 0.5 seconds, <u>EVERY SINGLE TIME</u>, see procedure number F- 6.1.5 (page 63).

## F- 6.1.5 ACFS CYCLING / TMP ALARM?

Call the Home screen. TWO (2) TMP window scenarios:

1) **IF (and ONLY if) the TMP window is white:** See procedure number F- 6.1.6 (page 64).

2) **IF the TMP window is RED (TMP alarm):** See parts a THROUGH d below:

   a) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds;

   b) Allow thirty (30) seconds.

   c) If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to part d

   d) Allow thirty (30) seconds BEFORE continuing to procedure number F- 6.1.6 (page 64).

## F- 6.1.6 ISOLATE DIALYSATE PRESSURE (PDIAL)

Call debug screen 4 to again watch **PDIA** for TWO (2) FULL minutes. TWO (2) possible scenarios:

**1) IF (and ONLY if) PDIA increases to more than 8.0 OR drops to less than 2.0:** Return to **page 60**, procedure number F- 6.1.1.

**2) IF PDIA NEVER increases to more than 8.0 OR drops to less than 2.0**: As NOTED in procedure number F- 6.0.0 (page 58), drain flow was either: **1)** Pulse – Stop – Pulse – Stop – etc. (NO 'dribble') OR; 2**)** Pulse – Stop – Pulse – 'dribble' (a noticeably weaker stream) etc. TWO (2) possible scenarios i) or ii) below:

- **i) IF (and ONLY if) drain flow = Pulse – Stop – Pulse – Stop (NO 'dribble'):** See procedure number F- 6.1.7 (page 64).

- **ii) IF drain flow = Pulse – Stop – Pulse – 'Dribble' (two second slow stream):** A procedure, in a different Section, is performed next. **NOTE** this page and procedure number (F- 6.1.6), because you may prompted to return to here, THEN perform parts A through C below:

  A) BEFORE continuing to part b proceed to **page 580**, to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

  B) If a balancing chamber diaphragm leak was not located in part a, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

  C) See **part b** of procedure number F- 6.1.7 (page 64).

## F- 6.1.7 ISOLATE FLOW PUMP CONTROL (FLWP)

a) If (and ONLY if) you have EVER seen [**Temperature**] 'bounce' up and down, more than 0.5º C, with less than one (1) second in between, TWO (2) procedures: #**1) NOTE** this page and procedure number (F- 6.1.7) for as you may be prompted to return here; #**2)** BEFORE continuing to part b proceed to **page 580**, SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

b) Call debug screen 1. **FLWP** (upper right column) is a digital-to-analog value that controls Flow Pump speed. It should remain stable (+/- 2). Without looking away watch **FLWP** for up to THREE (3) minutes. Does it increase steadily more than 4, until a Flow Error occurs then falls only to increase again until a Flow Error occurs, etc.?

Yes **FLWP** ramping up and down more than +/- 2: Possibly a tubing restriction somewhere. Start with the Diasafe® filter possibly even inside the housing.

No **FLWP** remaining stable: See procedure number F- 6.1.8 (page 65).

## F- 6.1.8 VERIFY FLOW RATE (BC SWITCH)

a) **Do NOT reset alarms!**

b) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for two (2) FULL minutes OR until it EVER = 897 or more. FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:


**1)** **IF (and ONLY if) BC Switch REMAINS ALWAYS = 897:** ENSURING a "No Water" alarm has NEVER occurred proceed to **page 97**, procedure number F- 8.0.0.

**2)** **IF (and ONLY if) BC Switch 'cycles' to more than four-hundred (400) for two (2) seconds then to less than 3.0 for nine (9) seconds:** Proceed to **page 70**, procedure number F- 7.0.0.

**3)** **IF (and ONLY if) BC Switch 'cycles' to more than four-hundred (400) but NEVER to 897:** See procedure number F- 6.1.9 (page 65).

**4)** **IF BC Switch is NEVER more than four-hundred (400):** See parts a THROUGH c below:

a) Call debug screen 1. If **NPHT** (upper right) is decreasing press and hold the keyboard's "1" key until it is more than 600 then see part b If (and ONLY if) **NPHT** = 720 skip to part c.


b) **Allow forty-five (45) seconds BEFORE continuing to part c!**

c) Return to debug screen 6 and continue to watch **BC Switch** for two (2) minutes. It may change slightly but should **REMAIN ALWAYS** between 203 and 248?

Yes **BC Switch** is REMAINING between 203 and 248! The Flow Error is not presenting at this time. It may be extremely intermittent! Return to **page 52**, procedure number F- 3.8.0

No **BC Switch** is NOT remaining between 203 and 248! Call the Home screen. TWO (2) possible scenarios below:

**1)** **IF (and ONLY if) [Dialysate Flow] has remained at 800 ml/min:** See procedure number F- 6.1.9 (page 65).

**2)** **IF [Dialysate Flow] has NOT remained 800 ml/min**: Set it to 800, allow thirty (30) seconds, then return to (ABOVE) procedure number F- 6.1.8 (**page 65**).

## F- 6.1.9 DETERMINE FLOW ERROR

From the Home screen, is [**Conductivity**] more than 14.8 mS?

Yes [**Conductivity**] = More than 14.8 mS! Proceed to **page 70**, procedure number F- 7.0.0.

No [**Conductivity**] is less than 14.8 mS! Proceed to **page 69**, procedure number F- 6.5.0.

**F- 6.2.0 TROUBLESHOOT 'CONTINUOUS' DRAIN FLOW**

Drain flow NEVER stops! From the Home screen, is [**Conductivity**] more than 15.0 mS?

Yes [**Conductivity**] more than 15.0! ENSURING Loading Pressure (Rinse port gauge) is peaking to between 23 and 27 psi, see procedure number F- 6.3.0 (page 67).

No [**Conductivity**] remaining less 15.0! This procedure checks if Valve #43 is sticking open. See parts a AND b below:

a) **Per the Figure below**, double clamp valve #43's OUTPUT tubing. **NOTE!** The output tubing extends towards the front of the machine!

b) Recheck drain flow. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) drain flow becomes Pulse → Stop → Pulse → Stop**: Remove the clamps from valve #43. TWO (2) possible bad components: **1)** Bad Actuator-Test***** Board OR; **2**) Bad valve #43.

***** To LOCATE the Actuator-Test board, refer to Figure 4A (page 10)

**2)** **IF drain flow continues to be 'continuous':** Remove the clamps from valve #43 then proceed to **page 69**, procedure number F- 6.5.0.

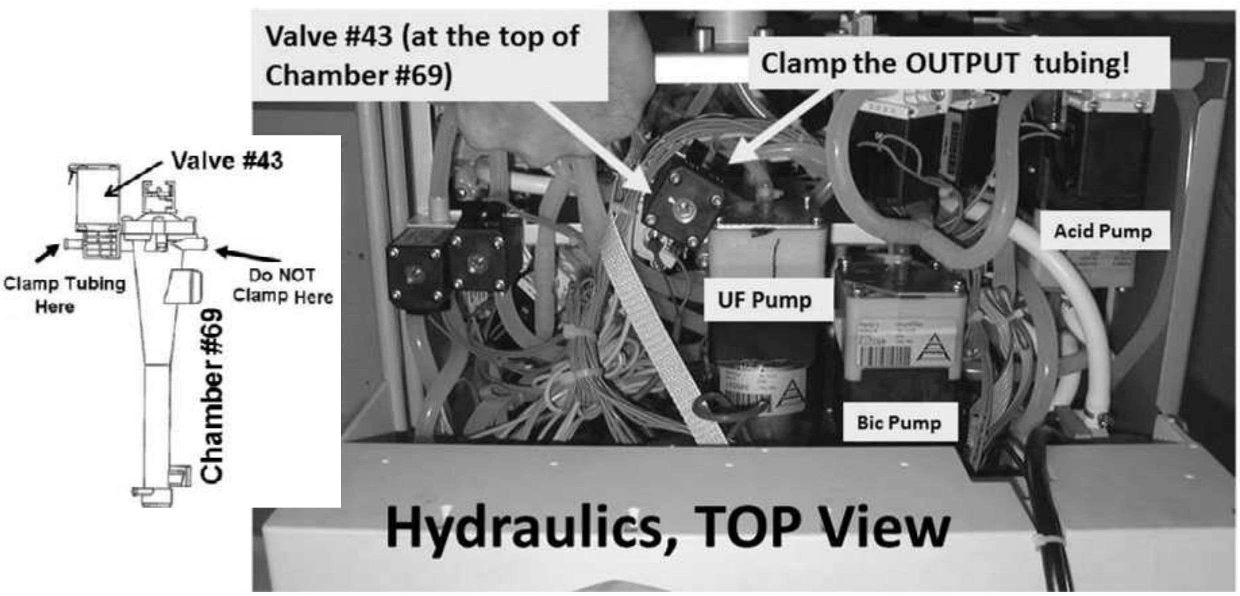



**Figure 11 – Valve #43 Location**

## F- 6.3.0 RESTRICTED DRAIN FLOW / ISOLATE 'DRAIN' VALVE #30 / ACTUATOR-TEST BOARD

Per the Figure below, touch valve #30's (black) solenoid. Is it HOT?

Yes Solenoid is hot! See procedure number F- 6.3.1 (page 67).

No Solenoid is NOT hot! **NOTE** **ONLY** VALVE #30 will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.

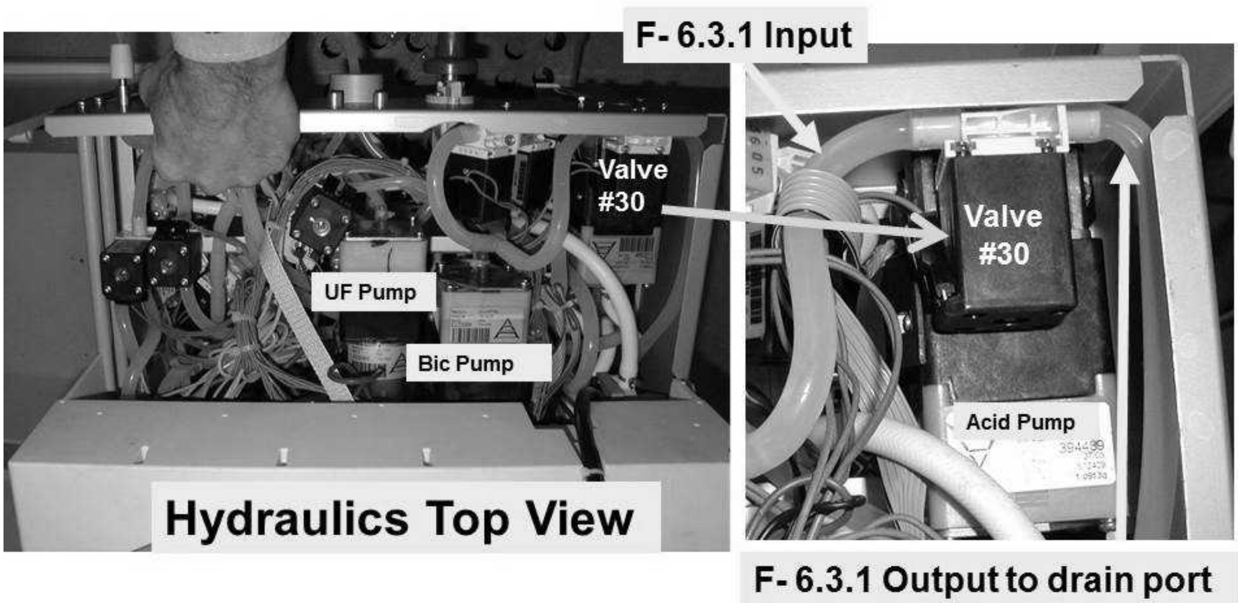



**Figure 12 – Valve #30**

### F- 6.3.1 ISOLATE DRAIN VALVE #30


a) From the Home screen, set [Dialysate Flow] to "OFF".

b) Press 'Enter'!

c) Check through Valve #30's input **AND** output tubing for bio-growth restrictions.

d) Figure right, at the rear of the machine, remove the tubing from the 'To Drain' (**BOTTOM!**) nozzle.

e) Check inside the nozzle for restrictions!

f) Per the Figure above, remove the tubing from Valve #30's INPUT nozzle.

g) Attach a syringe, with tubing attached that will fit SNUG over Valve #30's nozzle.

h) Push or pull on the syringe plunger. If Valve #30 is open the plunger moves with no resistance. TWO (2) possible scenarios next page:

1) **IF (and ONLY if) the plunger moves with <u>NO resistance</u>:** Valve #30 is open! See procedure number F- 6.4.0 (page 68).

2) **IF the plunger <u>OFFERS RESISTANCE</u>:** Valve #30 is restricted! TWO (2) possible bad components: **1)** Bad Valve #30 OR; **2)** Bad Actuator-Test Board. To <u>LOCATE</u> the board refer to Figure 4A (page 10).

## F- 6.4.0 VALVE #30 IS OPEN

a) Reconnect valve #30's <u>INPUT</u> tubing but **DO NOT** reattach the drain tubing to the rear the machine!

b) Obtain a 1000 ml graduated cylinder to measure flow subsequently.

c) Place a bucket at the drain nozzle to capture subsequent potential flow.

d) Set [Dialysate Flow] to 800 ml/min and press 'Enter'!

e) DO NOT turn flow off to ENSURE measurement accuracy below!

f) TWO (2) possible TMP window scenarios:

   1) **IF (and ONLY if) the TMP window is <u>NOT</u> red:** See procedure number F- 6.4.2 (page 68)

   2) **IF the TMP window is red (TMP alarm):** See parts A THROUGH C below:

      A) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds.

      B) Allow thirty (30) seconds.

      C) If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to procedure number F- 6.4.2 (page 68).

## F- 6.4.2 ISOLATE VALVE #30 OUTPUT FLOW

a) ALLOW one (1) minute BEFORE continuing to part b**!**

b) Measure flow from the REAR 'To Drain' port for <u>one (1) minute</u>. TWO (2) possible scenarios:

   1) **IF (and ONLY if) <u>LESS THAN</u> 725 ml:** Proceed to **page 70**, procedure number F- 7.0.0.

   2) **IF <u>MORE THAN</u> 725 ml:** Check the drain tubing and it's (if used) 'Quick Connector' for possible bio-growth restrictions.

## F- 6.5.0 TMP ALARM?

a) **IMPORTANT!** From the Home screen, set [Dialysate Flow] to **500 ml/min** and press 'Enter'!

b) TWO (2) possible TMP window scenarios:

   **1)** **IF the TMP window is NOT red:** See procedure number F- 6.5.2 (page 69).

   **2)** **IF the TMP window is RED (TMP alarm): A)** Press and release the 'Reset' key then press and hold it for three (3) seconds; **B)** Allow thirty (30) seconds; **C)** If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to procedure number F- 6.5.2 (page 69).

## F- 6.5.2 ISOLATE TMP STABILITY

TMP is STABLE if the TMP window remains white AND does NOT change more than 60 in three (3) minutes. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) TMP is UNSTABLE:** See procedure number F- 6.6.0 (page 69).

**2)** **IF TMP is STABLE:** A procedure, in a different Section, is performed next**. NOTE** this page and procedure number (F- 6.5.2) as you may be prompted to return to here. Perform parts A through C below:

   A) BEFORE continuing to part B, proceed to **page 580**, to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

   B) If a balancing chamber diaphragm leak was not located in part A, return to Dialysis Program ("Select Program→ 'Dialysis' → 'Enter')!

   C) Proceed to **page 70**, procedure number F- 7.0.0.

## F- 6.6.0 TMP IS UNSTABLE

a) A procedure, in a different Section, is performed next. **NOTE** this page and procedure number (F- 6.6.0) as you may prompted to return to here.

b) BEFORE continuing to part c, proceed to **page 572**, to perform SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS

c) If a leaking balancing chamber valve was not located in part b, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

e) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** for up to five (5) minutes. ENSURING a "No Water" alarm NEVER occurs does **BC Switch** EVER = 897 or more even just once?

   Yes **BC Switch** = 897 or more (constant or once in a while): Proceed to **page 70**, procedure number F- 7.0.0.

   No **BC Switch NEVER, EVER = 897 or more**: If TMP remains unstable proceed to **page 483**, SECTION 9- TMP PROBLEMS . If TMP is stable the flow problem is no longer presenting.

## F- 7.0.0 ISOLATE POSSIBLE RESTRICTIONS

a) Call the Home screen. ENSURE [Dialysate Flow] is on* at 800 ml/min!

***** If [Dialysate Flow] is blinking flow is off. Flow MUST BE on!

b) Recheck Loading Pressure (Rinse port gauge). It may not cycle but must PEAK to between 23 and 27 psi?

Yes Between 23 and 27 psi! See procedure number F- 7.0.1 (page 70).

No Less than 23 OR more than 27 psi! Return to **page 33**, procedure number F- 1.0.7.

## F- 7.0.1 LOADING PRESSURE OKAY (1)

A) Call debug screen 0. Watch **Flow Error** (TOP window) for one (1) minute. TWO (2) possible scenarios:

**1) IF Flow Error is ALWAYS = 1 (i.e. NEVER = 0):** See procedure number F- 7.0.2 (page 71).

**2) IF Flow Error = 0 OR cycles between 1 and 0:** See part B.

B) ENSURING the machine has been in Dialysis Program at least five (5) minutes. Call the Home screen. Is [Conductivity] = 17 mS?

Yes [Conductivity] = 17 mS! See procedure number F- 7.0.2 (page 71).

No [Conductivity] is less than 17 mS! Possibly even within range sometimes but then drifts high. See part C

C) As bicarb precipitate may be partially plugging hydraulic pathways perform (2) two subsequent Acid Cleans using vinegar or citric acid.

D) After the last Rinse cycle, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

E) Allow [Conductivity] to increase to more than 13.0 BEFORE continuing.

F) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

G) Call debug screen 0.

H) WITHOUT LOOKING AWAY, watch **Flow Error** for up to FIVE (5) minutes OR until it EVER = 1, even if just once! TWO (2) possible scenarios:

**1) IF (and ONLY if) Flow Error EVER = 1!** See procedure number F- 7.0.2 (page 71).

**2) IF Flow Error ALWAYS = 0!** A flow error is not presenting at this time! Possibly the Acid Clean fixed the problem!

**F- 7.0.2 LOADING PRESSURE 'OKAY' (2)**

A) **CAUTION! To prevent damage, turn the machine OFF!**

B) To avoid pulling cables loose, GENTLY open the card cage.

C) Per the Figure below, THREE (3) checks:

**CHECK #1** CAREFULLY check the ENTIRE LENGTH of the Actuator Cable for damage!

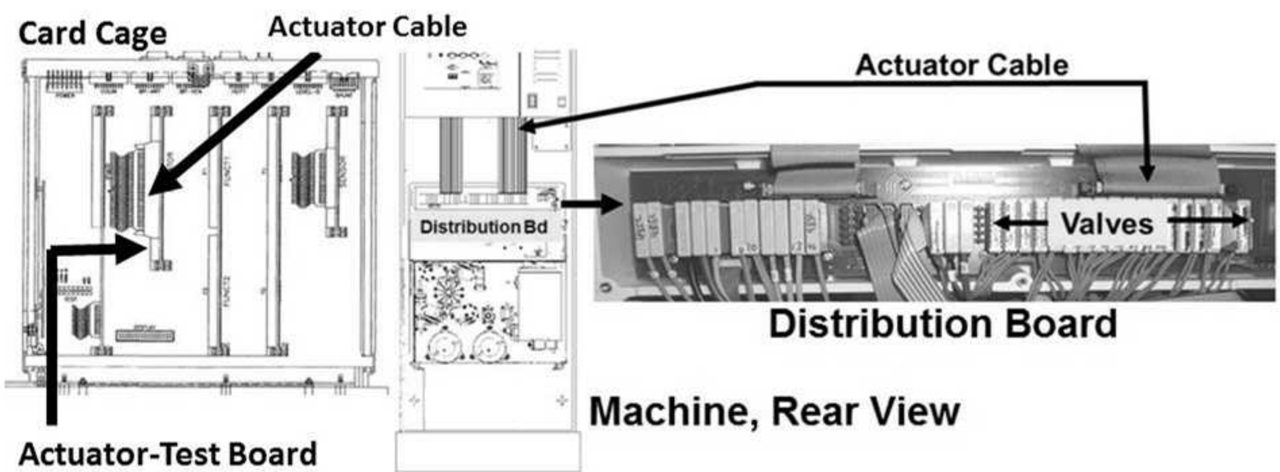
**CHECK #2** ENSURE the Actuator Cable is plugged in securely at both ends!

**CHECK #3** ENSURE the valves are plugged into their CORRECT distribution board positions!

D) Was a problem located during the above three (3) checks?

Yes ENSURING the problem was repaired, see procedure number F- 7.0.2.1 (page 71).

No No problem found! See procedure number F- 7.0.3 (**page 72**).




**F- 7.0.2.1 PROBLEM WITH ACTUATOR CABLE OR VALVE NOT PLUGGED IN WAS LOCATED**

a) **Close the card cage!**

b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) Allow five (5) minutes then set [Dialysate Flow] to 800 ml/min and press 'Enter'.

d) Call debug screen 0, WITHOUT LOOKING AWAY, watch **Flow Error** for up to FIVE (5) minutes OR until it EVER = 1, even if just once! TWO (2) possible scenarios:

**1) IF (and ONLY if) Flow Error EVER = 1!** See procedure number F- 7.0.3 (page 72).

**2) IF Flow Error ALWAYS = 0!** A flow error is not presenting at this time!

## F- 7.0.3 ISOLATE ACTUATOR-TEST BOARD

a) **To prevent damage, turn the machine OFF!**

b) Swap in a known good* Actuator-Test Board**.

* **Note:** Known good = has been tested in another machine that is NEVER issuing Flow Errors! If a known good Actuator-Test board is NOT used here AND the problem is a bad board you may perform unnecessary, and time consuming, component replacement!

** To LOCATE the Actuator-Test board refer to the Figure (previous page).

c) **Close the card cage!**

d) Turn the machine on return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

e) ENSURE a "No Water" alarm NEVER occurs!

f) Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** for up to FIVE (5) minutes OR until it EVER = 1, even if just once. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Flow Error EVER = 1!** See procedure number F- 7.0.4 (page 73) to test for a restricted Balancing Chamber valve!

**2)** **IF Flow Error ALWAYS = 0!** Problem solved! The previous Actuator-Test Board may be bad.

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## F- 7.0.4 FLOW ERROR = 1 / ISOLATE 'FRESH SIDE' FLOW PATHS

a) **Plug the red concentrate connector into its rinse port to call the "Select Program" screen but DO NOT press any keys.**


b) Balancing Chamber valve connectors will be switched to test 'fresh side' flow paths. Flow is measured into a 1000 ml **GRADUATED** cylinder for one (1) minute. Good flow = more than 800 ml every minute!

c) ENSURING "Select Program" REMAINS up, perform PARTS 1 AND 2 EVEN IF PART 1 yields bad flow!

**PART 1:** a) Remove the RED DIALYZER connector from the shunt door and place it into a bucket!

b) Plug valve #35's connector into valve #30's distribution board position, "V30". **Leave valve #30 unplugged!**

c) Hold the connector over the bucket and watch flow (if any) for one (1) minute. If good initially but significantly slows indicates an intermittent bad valve #31 or #35. If no flow, ENSURE valve #35's connector is placed properly in position "V30". If okay see part d!

d) Measure flow, from the RED connector, into the cylinder for one (1) minute.

e) Return valve #35's connector to its distribution board position!

f) Record Part 1's measurement **THEN perform PART 2!**

**PART 2:** a) Return the dialyzer connector to the bucket.

b) Plug valve #37's connector into valve #30's position, "V30".

c) Watch flow (if any) from the connector for one (1) minute. If good initially but significantly slows indicates a bad valve #33 or #37. If no flow, ENSURE valve #37's connector is placed properly in position "V30". If okay see part d.

d) Measure flow, from the RED connector, into the cylinder, for one (1) minute!

e) Return the connector to the shunt door.

f) Leaving valve #37 in valve #30's position for now, analyze BOTH Part 1 AND Part 2's measurements per Table 3 below:

### Table 3 – Parts 1 AND 2

| PART 1's measurement | PART 2's measurement | Your Response |
|---|---|---|
| Less than 800 ml | Less than 800 ml | See procedure number F- 7.0.5 (**page 79**) |
| Less than 800 ml | More than 800 ml | See procedure number F- 7.3.33 (**page 75**) |
| More than 800 ml | Less than 800 ml | See procedure number F- 7.4.44 (**page 77**) |
| More than 800 ml | More than 800 ml | See procedure number F- 7.3.1 (**page 83**) |

**FRESH SIDE THEORY:** Per the Figure below, when 'Select Program" is up, the top Balancing Chamber (BC) valves (V31 – V34) are supposed to be open, the bottom BC valves (V35 – V38) are closed. V30, V26 and V25 are open. Deaeration Pump #20 is running and can draw from hydrochamber C and D.

**PART 1 THEORY:** Plugging V35 into V30's distribution board position should open V35. If V31 AND V35 are open, as well as no other restrictions in the path, flow will be directed to the shunt where it is measured.

**PART 2 THEORY:** Plugging V37 into V30's distribution board position should open V37. If V37 AND V33 are open flow will be directed to the shunt

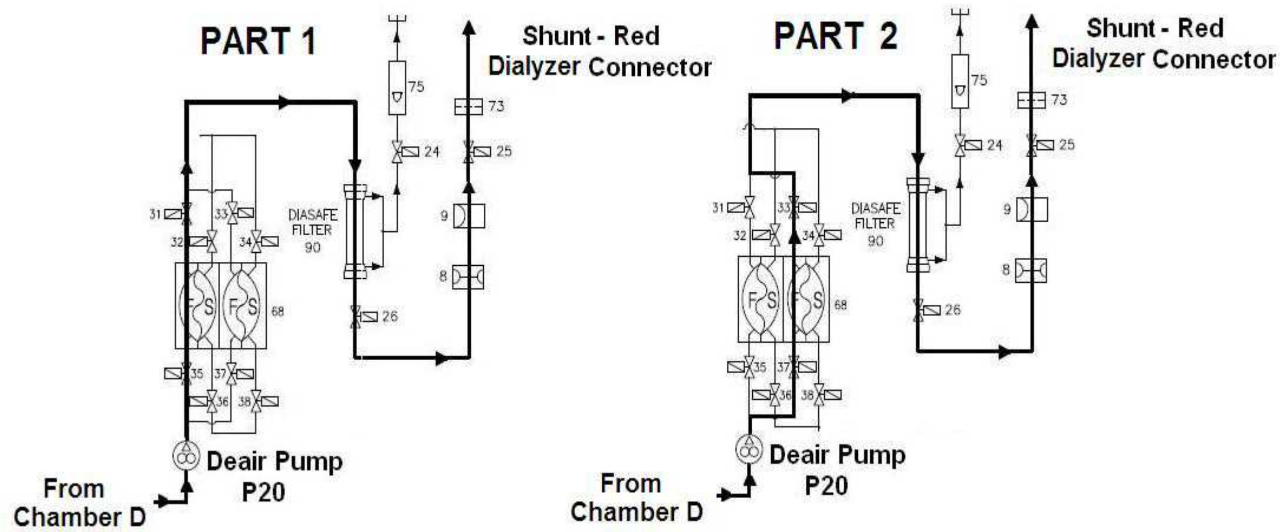


**Figure 13 – Parts 1 and 2**

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## F- 7.3.33 PART 1 BAD FLOW / PART 2 MORE THAN 800 ML / RESTRICTED VALVES #31 OR #35

Balancing Chamber Valve #35 and/or Valve #31 is not opening. Also, the Actuator Cable or distribution board may be bad. These procedures isolate between these components:

A) Turn the machine OFF!

B) Return #37 to its PROPER distribution board position.

C) **Per the Figure below**, replace **Valve #35** with a known good valve.

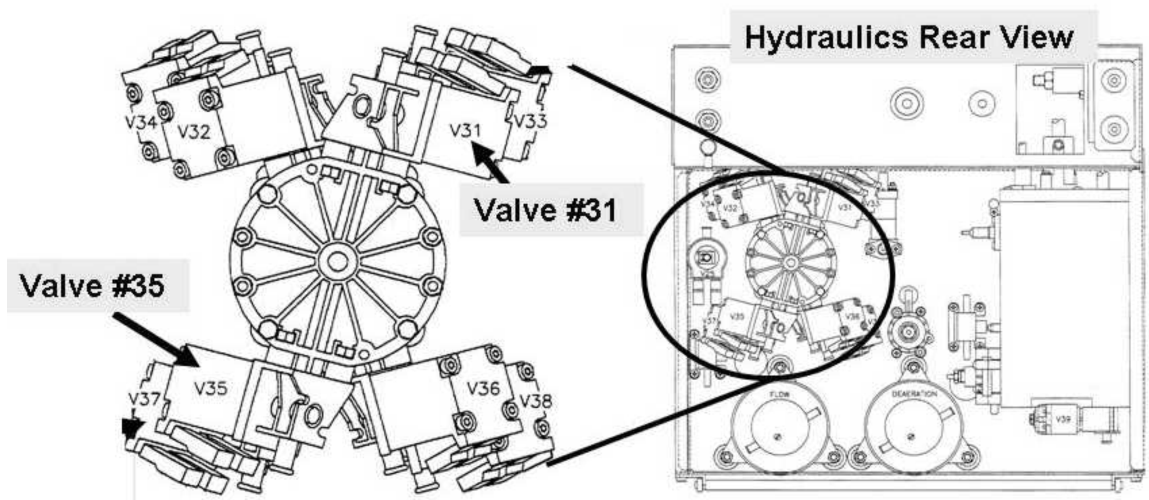
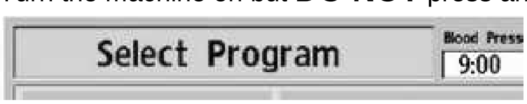



**Figure 14 – Balancing Chamber Valves #31 and #35**

D) Plug the new Valve #35's connector into Valve #30's distribution board position, "V30".

E) Turn the machine on but **DO NOT** press any other keys!




F) With "Select Program" up, measure flow, from the RED connector, into the cylinder for one (1) minute. More than 800 ml collected?

Yes More than 800 ml collected! Problem located! The previous Valve #35 is bad.

No Less than 800 ml collected! See procedure number F- 7.3.44 (page 75).

## F- 7.3.44 LESS THAN 800 ML COLLECTED / ISOLATE VALVE #31

A) Turn the machine OFF!

B) Plug valve #35's connector into its PROPER distribution board position, "V35".

C) **Per the Figure above**, replace **Valve #31** with a known good valve.

D) Plug the new Valve #31's connector into Valve #30's distribution board position, "V30".

**Parts E and F next page**

E) Turn the machine on but **DO NOT** press any other keys.


F) With “Select Program” up, measure flow, from the RED connector, for one (1) minute. More than 800 ml collected?

Yes More than 800 ml collected! Problem located! The previous Valve #31 is bad.

No Less than 800 ml collected! See parts a and b below:

a) Return all valves to their PROPER distribution board positions.

b) THREE (3) possible bad components: **1)** Bad Actuator-Test board**; 2)** Bad Actuator cable; **2)** Bad distribution board.

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## F- 7.4.44 PART 1 MORE THAN 800 ML / PART 2 BAD FLOW / RESTRICTED VALVE #37 OR #33

Balancing Chamber Valve #37 and/or Valve #33 is not opening. Also, the Actuator Cable or distribution board may be bad. These procedures isolate between these components:

A) Turn the machine OFF!

B) **Per the Figure below**, replace **Valve #37** with a known good valve.

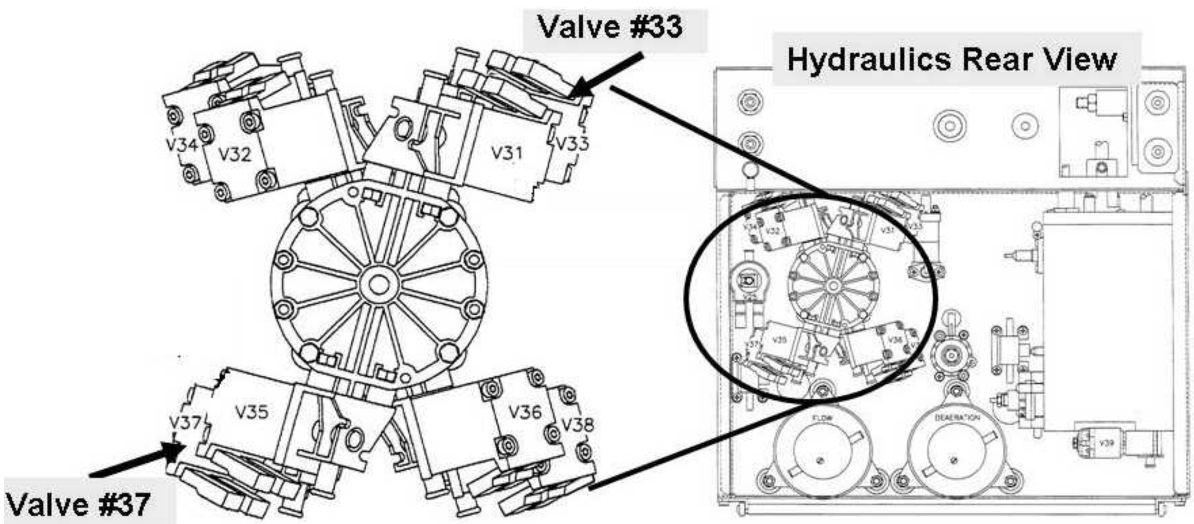
C) Plug the new Valve #37's connector into Valve #30's distribution board position, "V30".

D) Turn the machine on but **DO NOT** press any other keys!


E) With "Select Program" up, measure flow, from the RED connector, into the cylinder for one (1) minute. More than 800 ml collected?

Yes — More than 800 ml collected! Problem solved! The previous Valve #37 is bad.

No — Less than 800 ml collected! See procedure number F- 7.4.45 (page 77).




## F- 7.4.45 LESS THAN 800 ML COLLECTED / ISOLATE VALVE #33

A) Turn the machine OFF!

B) Plug the new valve #37's connector into its distribution board position, "V37"!

C) **Per the Figure above**, replace **Valve #33** with a known good valve.

D) Plug the new Valve #33 into Valve #30's distribution board position, "V30"!

**Parts E and F next page**

E) Turn the machine but **DO NOT** press any other keys!


F) With “Select Program” up, measure flow, from the RED connector, for one (1) minute. More than 800 ml collected?

Yes More than 800 ml collected! Problem solved! The previous Valve #33 is bad.

No Less than 800 ml collected! See parts a and b below:

a) Return all valves to their PROPER distribution board positions.

b) THREE (3) possible bad components: **1)** Bad Actuator-Test board*; **2)** Bad Actuator cable* OR; **3)** Bad distribution board.

* To LOCATE these components refer to Figure 4A (page 10)

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**F- 7.0.5 ISOLATE VALVE #26 / VALVE #25 ACTUATOR-TEST BOARD CONTROL**

a) **ENSURE "Select Program" REMAINS up.**

b) EXCEPT for valve #37 and valve #30, ENSURE ALL OTHER valves are plugged into their PROPER distribution board positions!

c) TWO (2) 'touch' checks on valve #26 AND #25's (black) solenoids:

**8TOUCH CHECK #1:** Per **Figure 15** below touch Valve #26's solenoid.

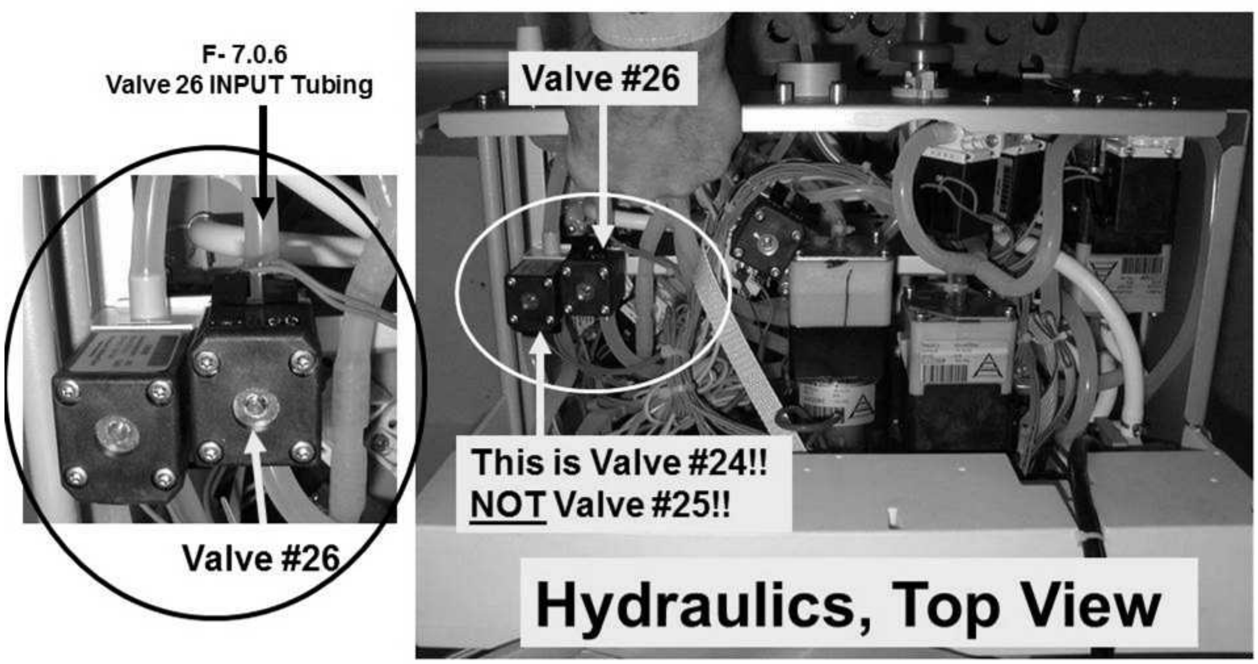
**TOUCH CHECK #2:** Per **Figure 16** (**next page**), above (blue) Dialysate Pressure Transducer #9, is **Valve #25**. Touch its solenoid then see part d.

d) Per Table J below, respond according to BOTH 'touch' checks:

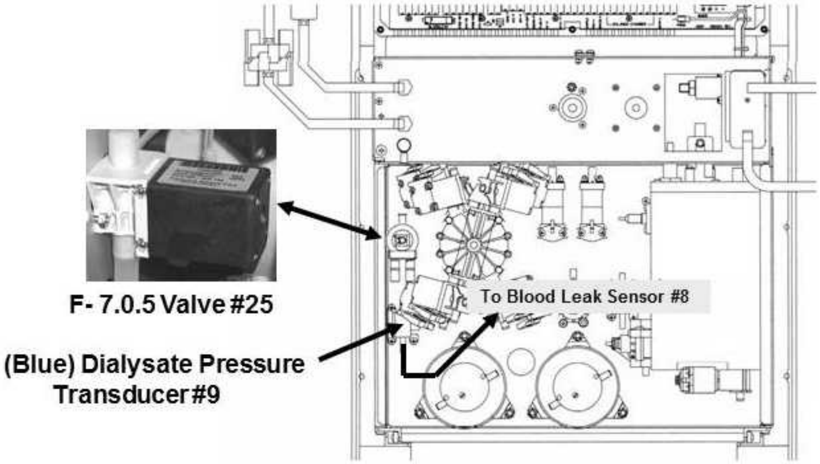
## Table J – Valve #26 / #25

| Valve #26's Solenoid | Valve #25's Solenoid | Your Response |
|---|---|---|
| Warm (or Hot) | Warm (or Hot) | See procedure number F- 7.0.6 (page 80) |
| Cold | Does not matter | **NOTE ONLY** VALVE #26 will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE |
| Does not matter | Cold | **NOTE ONLY** VALVE #25 will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE |

## Figure 15 – Valve #26



## Figure 16 – Valve #25




**F- 7.0.6 ISOLATE VALVE #26 INPUT FLOW**

a) Per **Figure 15 (previous page)**, clamp **VALVE #26's** INPUT tubing.

b) Remove the tubing and route it into the cylinder.

c) Remove the clamp and measure flow, from the tubing, for one (1) minute. 800 ml or more collected?

Yes 800 ml or more! **A)** Clamp and reattach the tubing; **B)** See procedure number F- 7.0.7 (page 80).

No Less than 800 ml! **A)** Clamp and reattach the tubing; **B)** Proceed to **page 82**, procedure number F- 7.0.9.

**F- 7.0.7 ISOLATE VALVE #26 OUTPUT FLOW**

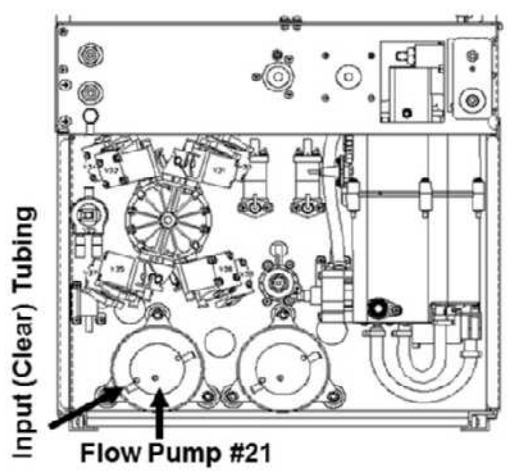
a) Figure right, remove the Flow Pump's INPUT (clear) tubing.

b) Remove the clamp from Valve #26 and measure from the Flow Pump tubing for one (1) minute. 800 ml or more collected?

Yes 800 ml or more! Clamp the tubing at VALVE #26, reattach it, and then see procedure number F- 7.0.8 (page 81).

No Less than 800 ml! See parts a through c below:

a) Reattach the Flow Pump's tubing AND return valves #37 AND #30 to their distribution board positions!




b) Using a flashlight, check for restrictions through the tubing between valve #26 and Air Removal Chamber #69.

c) Assuming all above procedures were performed correctly, TWO (2) possible bad components: **1)** Bad Actuator-Test* Board OR; **2)** Bad valve #26.

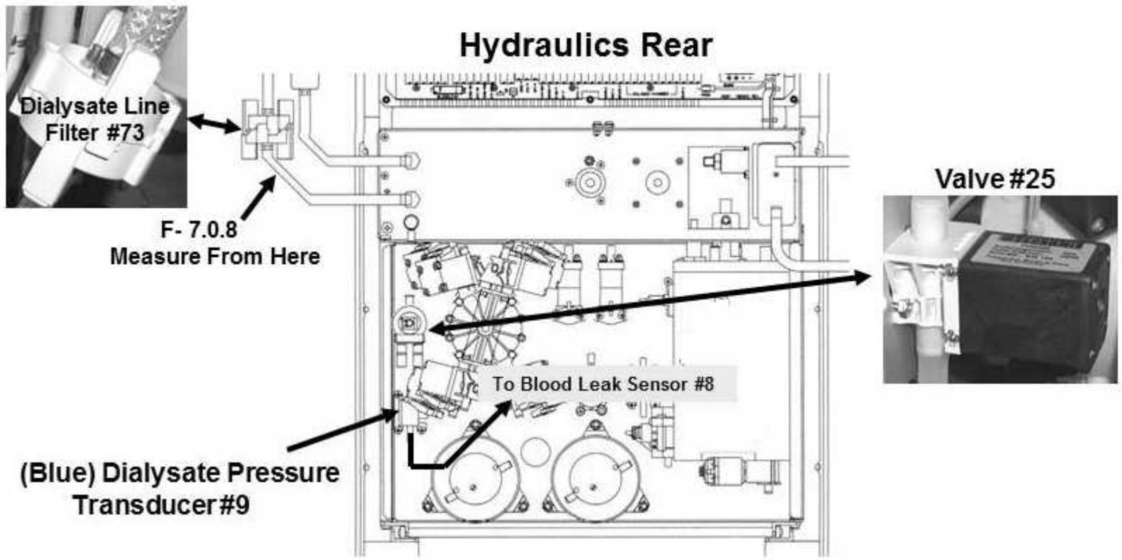
***** To LOCATE the board refer to Figure 4A (page 10).

**F- 7.0.8 800 ML OR MORE FROM FLOW PUMP'S INPUT TUBING**

a) **IMPORTANT!** Reattach the Flow Pump's tubing!

b) **IMPORTANT!** Remove the clamp from valve #26!

c) Figure below, open Dialysate Line Filter #73's housing and measure flow from the tubing segment shown for one (1) minute.




d) 800 ml or more collected?

Yes 800 ml or more! **A)** Return valve #37 and #30 to their distribution board positions; **B)** A restriction between Filter #73 and the red dialyzer connector is indicated.

No Less than 800 ml! See parts a through c below:

a) Return valves #37 AND #30 to their distribution board positions.

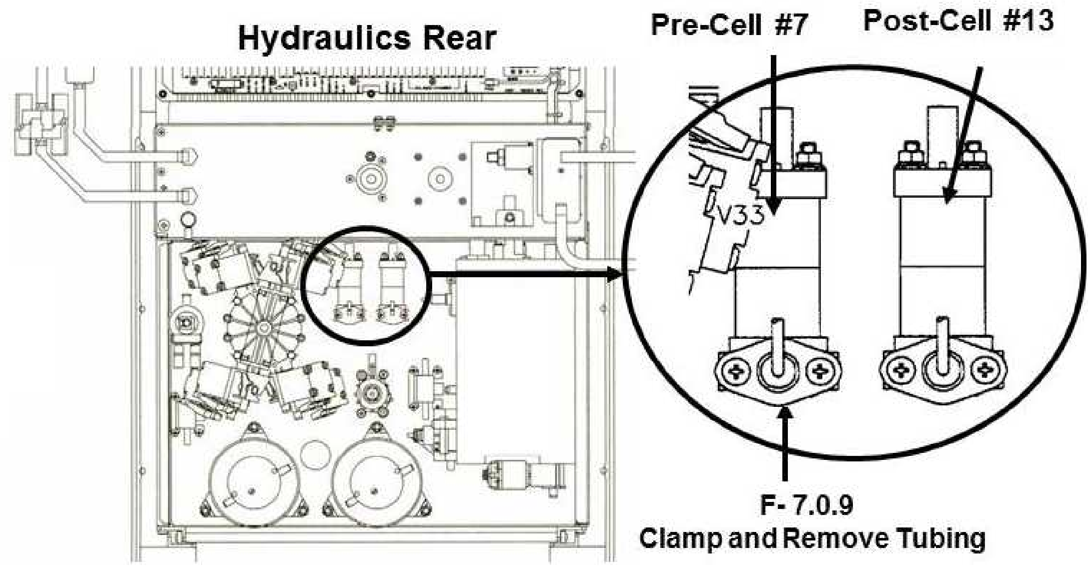
b) Figure above, using a flashlight, check for restrictions (possibly bio-growth) through the tubing to and from Valve #25, Dialysate Pressure Transducer #9, and Blood Leak Sensor #8. **If a restriction is located this is the problem!**

c) Assuming all above procedures were performed correctly, valve #25 is bad.

## F- 7.0.9 ISOLATE FLOW FROM THE BALANCING CHAMBERS

a) Figure below, clamp and remove the bottom tubing at Pre-Cell #7

b) Direct the tubing into the cylinder.




c) **IMPORTANT!** Remove the clamps from Pre-Cell #7 AND valve #26

d) Measure flow, from the tubing for one (1) minute. 800 ml or more collected?

Yes 800 or more! **A)** Clamp and reattach the tubing; **B)** See procedure number F- 7.1.0 (page 82).

No Less than 800 ml! See parts a and b below:

a) Return valves #30 and #37 to their respective distribution board positions.

b) **Read before performing!** CAREFULLY repeat from (ABOVE) procedure number F- 7.0.4 (**page 73**) but if you return here THREE (3) possible bad components: **1)** Bad Actuator-Test Board[1] OR; **2)** Bad Actuator-Test board cable OR; **3)** Multiple restricted balancing chamber valves[2] #31, #33, #35 and #37

[1] To LOCATE the Actuator-Test board refer to Figure 4A (page 10)

[2] To LOCATE valves #31, #33, #35 and #37 refer to Figure 14 (page 76)

## F- 7.1.0 ISOLATE DIASAFE® FILTER RESTRICTION

a) **IMPORTANT!** Remove the clamp from the Pre-Cell #7's tubing.

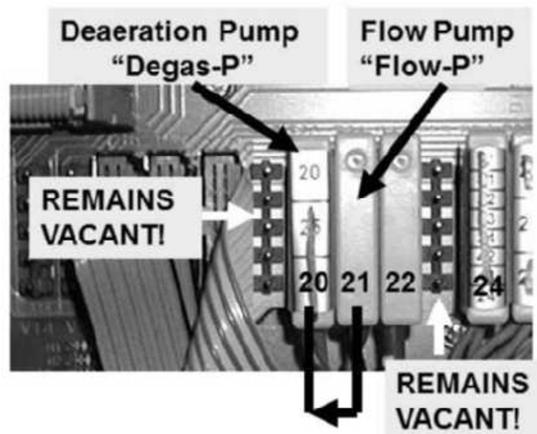
b) Using a flashlight, check for restrictions (possibly bio-growth), through the tubing, to and from the balancing chamber valves and the DiaSafe® filter. If no restrictions are located, replace the DiaSafe® filter per procedure.

## F- 7.3.1 ISOLATE FLOW PUMP ORIENTATION

a) **CAUTION!** Return valves #30 AND #37 to their PROPER distribution board positions.

b) **CAUTION!** "Select Program" MUST REMAIN up!


c) A bucket, filled with at least ten (10) liters (3.0 gallons) tap or RO water, is REQUIRED!




d) Remove the RED DIALYZER connector from the shunt door and place it into the filled bucket on the floor.

e) Figure right, plug the Flow Pump's distribution board connector into the Deaeration Pump's position "P20-DEGAS-P". **Leave the Deaeration Pump unplugged!**

f) If the Flow Pump is plugged in properly you should hear it running HARD.

g) Are LARGE air bubbles flowing from the SUBMERSED connector?

Yes — Air bubbles seen! The FLOW PUMP may be oriented incorrectly! Figure 17 below shows CORRECT orientation!

No bubbles! — Leaving the Flow Pump plugged in AND the dialyzer connector in the bucket, see procedure number F- 7.3.2 (page 84).

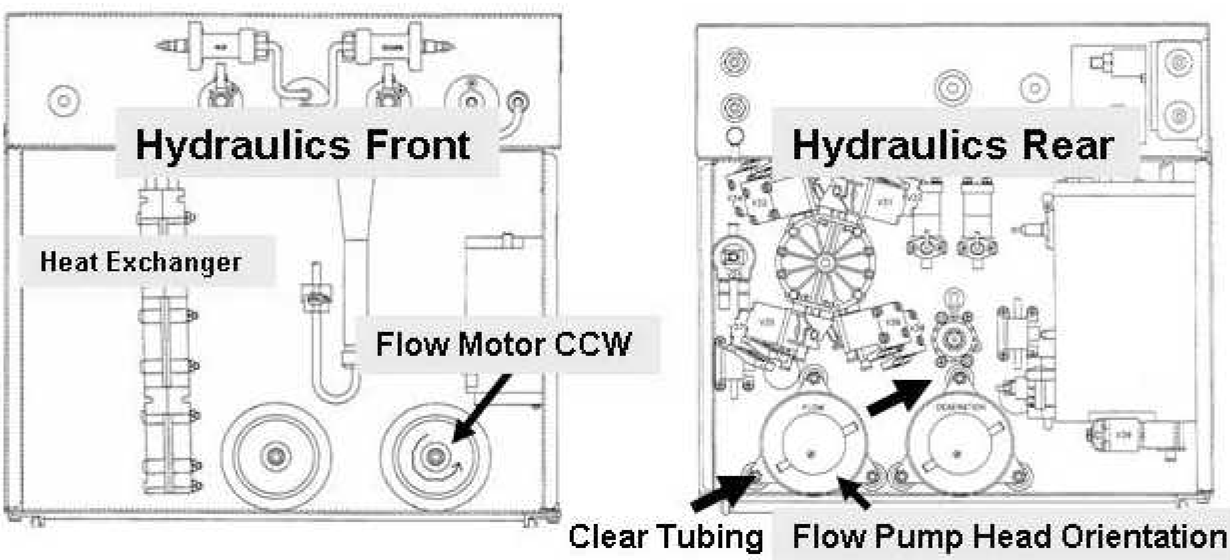



**Figure 17 – Flow Pump**

## F- 7.3.2 ISOLATE 'SPENT SIDE' FLOW PATHS


a) Valve connectors will be switched to test 'spent side' flow paths to drain. A second bucket and the 1000 ml cylinder is required!

b) Figure right, at the rear of the machine, remove the tubing from the Drain (**BOTTOM!**) nozzle. Flow from the nozzle will be measured. Good flow is more than 800 ml per minute!

c) ENSURING "Select Program" REMAINS up, perform **BOTH** PARTS 3 and 4 EVEN IF PART 3 yields bad flow!


**PART 3:**

a) Place the second bucket behind the dr**ain** nozzle.

b) Plug valve #36 into valve #33's distribution board position, "V33".

c) Watch drain flow (if any) for one (1) minute. If good initially but significantly slows down indicates an intermittent bad valve #32 or #36. If no flow ENSURE valve #36's connector is placed properly in position "V33". If okay see part d!

d) Measure flow, into the cylinder, for one (1) minute.

e) Return valves #36 AND #33 to their distribution board positions.

f) Record PART 3's measurement, **THEN perform PART 4!**

**PART 4:**

a) Refill the bucket that has the dialyzer connector in it! It **MUST NEVER run empty!**

b) Plug valve #38 into valve #31's distribution board position, "V31".

c) Watch drain flow (if any) for one (1) minute. If good initially but significantly slows down indicates an intermittent bad valve #34 or #38. If no flow, ENSURE valve #38's connector is placed properly in position "V31". If okay see part d.

d) Measure flow for one (1) minute.

e) Unplug valve #38 THEN analyze BOTH Part 3 AND Part 4's measurements per Table 4 below:

### Table 4 – Parts 3 AND 4

| PART 3's measurement | PART 4's measurement | Your Response |
|---|---|---|
| Less than 800 ml | Less than 800 ml | See procedure number F- 7.4.0 (page 86) |
| Less than 800 ml | More than 800 ml | See procedure number F- 7.6.10 (page 92) |
| More than 800 ml | Less than 800 ml | See procedure number F- 7.7.20 (page 94) |
| More than 800 ml | More than 800 ml | See procedure number F- 7.8.0 (page 96) |

**SPENT SIDE THEORY:** Per the Figure below, when "Select Program" is up the top balancing chamber (BC) valves (V31 – V34) are supposed to be open, the bottom BC valves (V35 – V38) are closed. Flow Pump #21 is off which is why it must be plugged into the Deaeration Pump's distribution board position. Also, the red dialyzer line is placed into a bucket of water to provide the Flow Pump with a source of water.

**PART 3 THEORY:** V36 is plugged into V33's position which should open V36. If both V36 and V32 are open the Flow Pump draws from the bucket and sends it through the spent side of the balancing chamber, through V30, to drain where it is measured.

**PART 4 THEORY:** V38 is plugged into V31's position which should open V38. If both V31 and V38 are open the Flow Pump draws from the bucket and sends it through the spent side of the balancing chamber to drain.

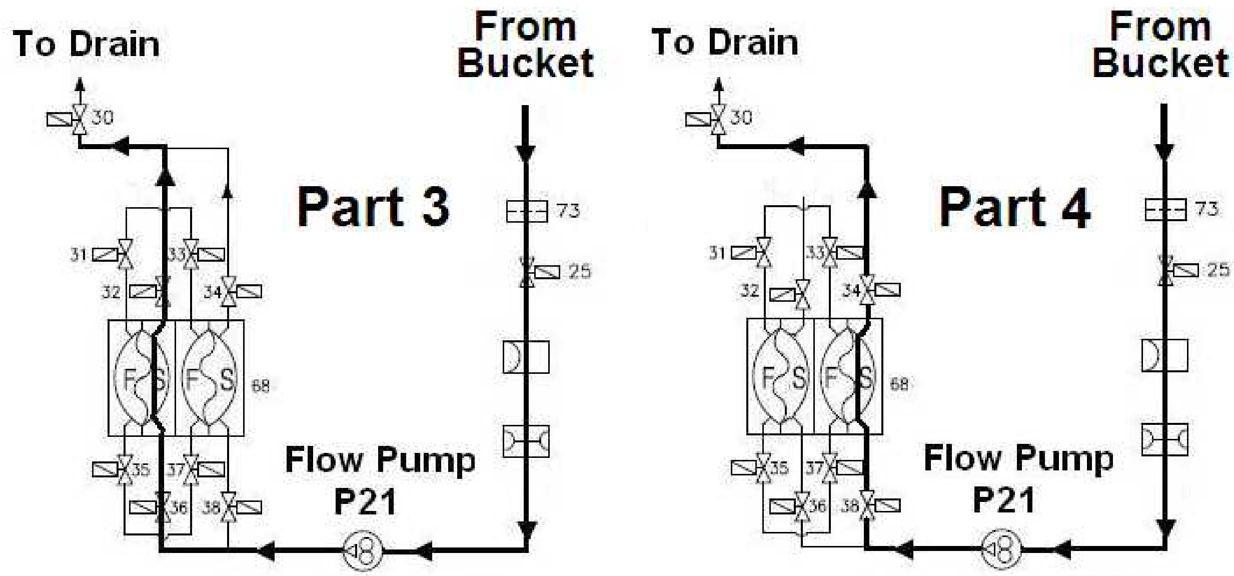



**Figure 18 – Parts 3 and 4**

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### F- 7.4.0 VERIFY DRAIN FLOW

a) **The "Select Program" banner remains up till instructed otherwise!**


b) Was there ANY drain flow at all?

Yes There was some flow! Proceed to **page 87**, procedure number F- 7.4.3

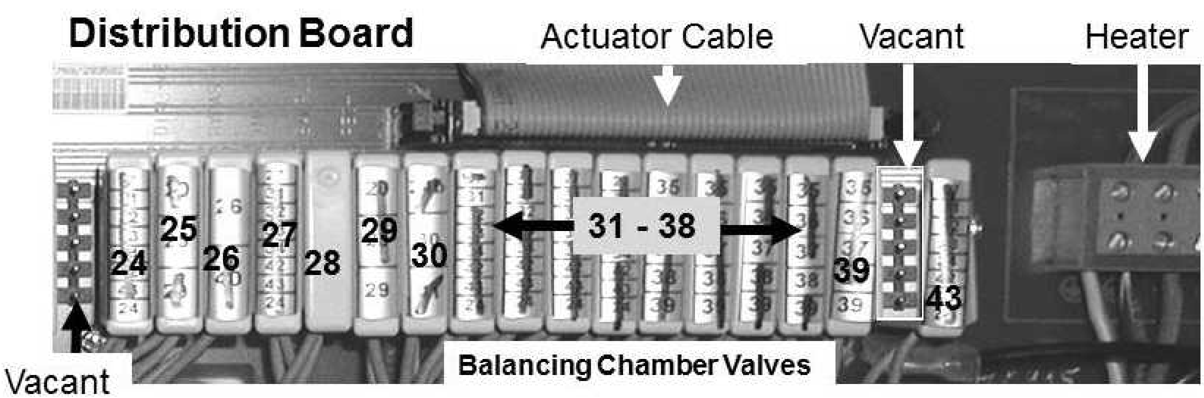
No There was no flow at all! See procedure number F- 7.4.2 (page 86).

### F- 7.4.2 NO DRAIN FLOW

Figure below, EXCEPT for valves #38 and #31, ENSURE are ALL OTHER valves, especially Valve #30, are plugged PROPERLY into their distribution board positions?

Yes Valves plugged in correctly! See procedure number F- 7.4.3 (page 87).

No You located a valve plugged wrong! Return ALL VALVES to their distribution board PROPER positions and return to **page 84**, procedure number F- 7.3.2.

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## F- 7.4.3 ISOLATE ACTUATOR-TEST BOARD

Per the Figure below, touch valve #30's (black) solenoid. Is it HOT?

Yes Valve #30's solenoid is hot! See procedure number F- 7.4.4 (page 87).

No Valve #30's solenoid is NOT hot! See parts a THROUGH c below:

a) Return valve #38 AND #31 to their distribution board positions.

b) Return the Deaeration AND Flow Pump to their distribution board positions.

c) NOTE **ONLY** VALVE #30 will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.

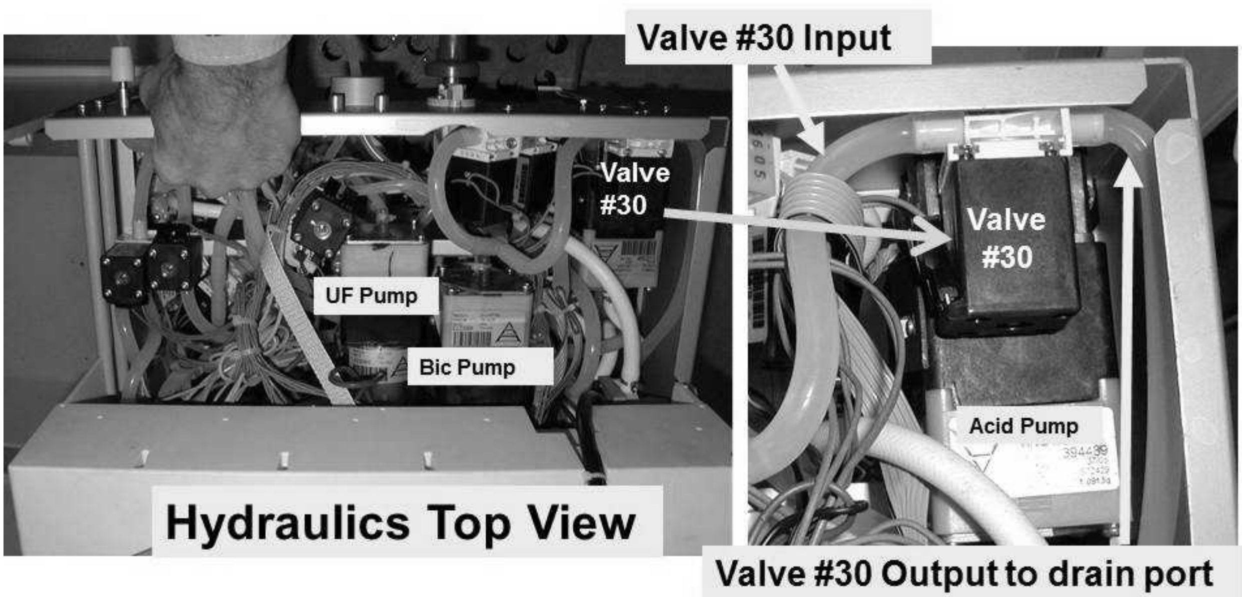



**Figure 19 – Valve #30**

## F- 7.4.4 ISOLATE VALVE #30

a) Per the Figure above, check through valve #30's INPUT and OUTPUT tubing for bio-growth restrictions.

b) Remove valve #30's INPUT tubing and attach a syringe, with tubing attached that will fit snug over the valve's nozzle.

c) Push or pull on the syringe plunger. If valve #30 is open the plunger moves with no resistance. TWO (2) possible scenarios next page:

1) **IF the plunger offers NO resistance i.e. valve #30 open:** See procedure number F- 7.4.5 (page 88).

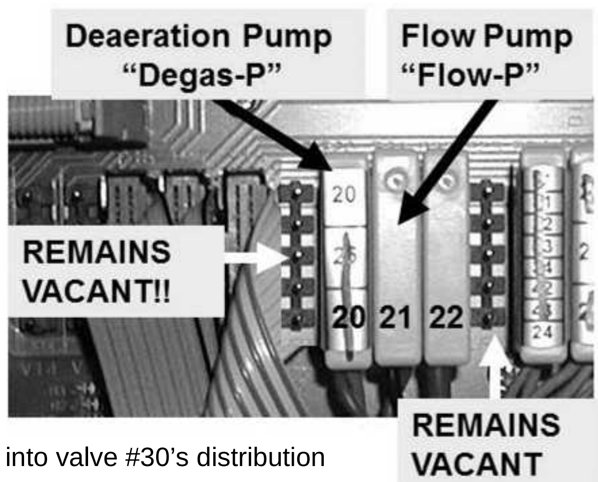
2) **IF the plunger offers resistance i.e. valve #30 restricted:** TWO (2) possible bad components: **1)** Valve #30 OR; **2)** Actuator-Test Board*. *To LOCATE the Actuator-Test board, refer to Figure 4A (page 10).

## F- 7.4.5 RE-CHECK 'FRESH SIDE' PATH

a) Reattach valve #30's tubing AND the tubing to the rear drain port.

b) **IMPORTANT!** Return valve's #38 AND #31 to their PROPER distribution board positions.

c) The "Select Program" remains up!


d) Figure right, return Deaeration Pump #20 AND Flow Pump #21 to their distribution board positions.

e) Ensure the Deaeration Motor is rotating!

f) Remove the RED DIALYZER connector from the shunt and place it in the graduated cylinder.

g) Start a one (1) minute timer as you plug valve #35 into valve #30's distribution board position "V30".

h) After one (1) minute, unplug valve #35's connector.

i) 800 ml or more collected?

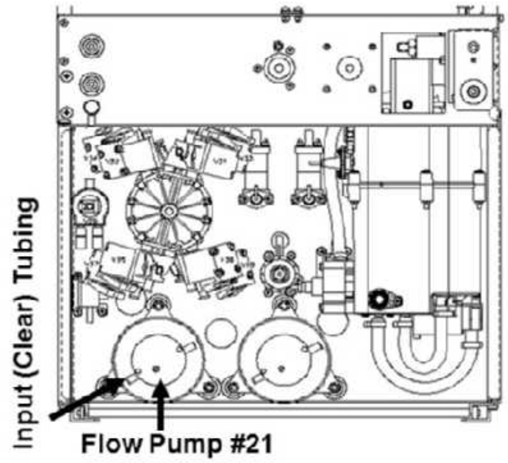
Yes 800 ml or more! See procedure number F- 7.4.6 (page 89).

No Less than 800 ml! There may be a valve restricting intermittently! See parts a AND b below:

a) This was Part 1! **RECORD** what you collected for later!

b) To perform Part 2, return to (ABOVE) procedure number F- 7.0.4 (**page 73**).

## F- 7.4.6 ISOLATE FLOW PUMP INPUT




a) Ensure "Select Program" remains up.

b) Return the dialyzer connector to the shunt door.

c) Return valve #35 to valve #30's distribution board position.

d) Figure right, remove the Flow Pump's clear INPUT tubing and measure from it for one (1) minute.

e) 800 ml or more collected?

Yes 800 ml OR more! See procedure number F- 7.4.6.1 (page 89).

No Less than 800 ml! See parts a THROUGH c below:

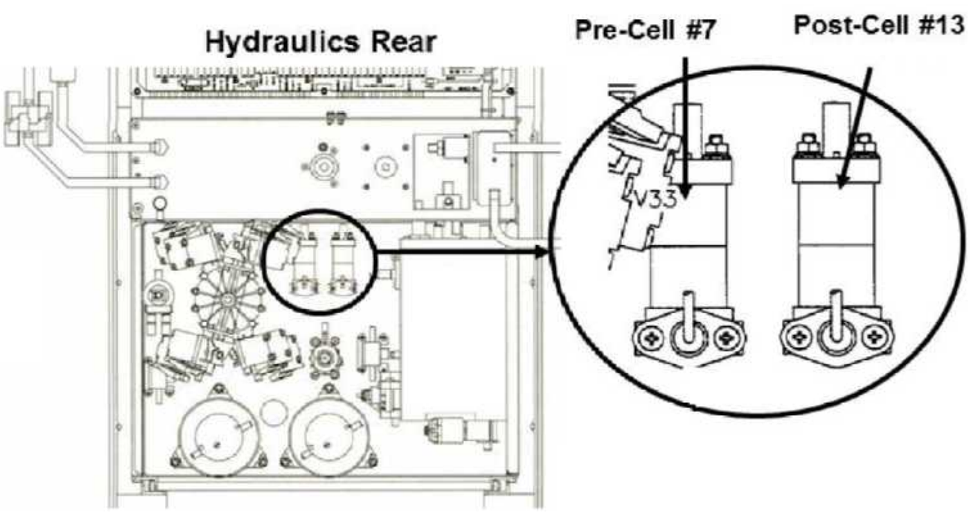
a) Reconnect the drain AND Flow Pump tubing.

b) Return valves #30 AND #35 to their distribution board positions.

c) TWO (2) checks below:

**CHECK #1** Per the Figure below, check for tubing restrictions to and from post-Cell #13.

**CHECK #2** There may be a restriction inside Air Removal Chamber #69!




## F- 7.4.6.1 800 ML OR MORE

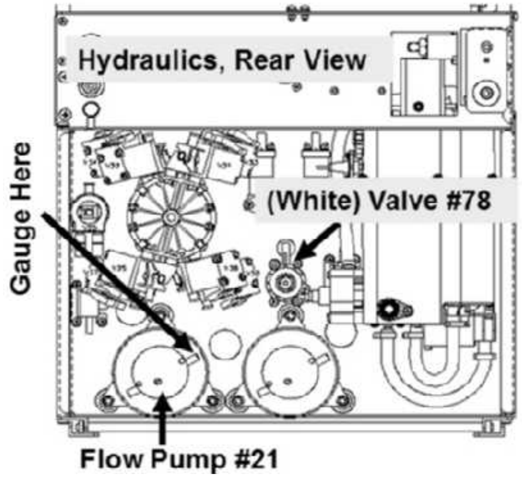
a) Reconnect the drain and Flow Pump tubing.

b) Return valves #30 AND #35 to their distribution board positions.

c) Plug BOTH concentrate connectors into their rinse ports!

d) See procedure number F- 7.5.0 (page 90).

## F- 7.5.0 ISOLATE FLOW PUMP #21




a) This procedure uses a psi pressure gauge. ENSURE it reads 0 psi before installing it.

b) Figure right, tee the gauge between the Flow Pump's OUTPUT NOZZLE and its WHITE tubing.

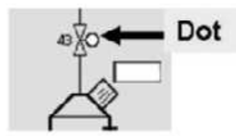
c) **To prevent leaks and false readings, tie wrap both sides of the gauge tubing**.

d) **Place the machine into RINSE!**

e) Watch for one (1) minute to ENSURE a “No Water” alarm NEVER appears!

f) Call debug screen 0. If debug does not appear press ‘Esc’ then call screen 0.

g) Figure right, allow Valve #43’s ‘dot’ to turn blue then WHITE again! While white, does pressure CYCLE, about every three (3) seconds, to between 35 and 36?




Yes Between 35 and 36 psi! See procedure number F- 7.5.2 (page 90).

No Is NOT between 35 and 36 psi! ENSURING the machine was in RINSE AND no leaks, TWO (2) possible scenarios below:

1) **IF (and ONLY if) pressure is too low:** DO NOT calibrate instead proceed to **page 101**, procedure number F- 9.0.2.

2) **IF pressure is too high:** Perform parts a AND b below:

b) Per the Figure above, adjust Valve #78 until pressure cycles to between 35 and 36 psi!

c) See procedure number F- 7.5.2 (page 90).

## F- 7.5.2 CHECK FLOW ERROR

a) Plug into acid and bicarb and return to Dialysis Program (“Select Program” →‘Dialysis’ → 'Enter')!

b) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘Enter’!

c) OPEN THE SHUNT DOOR till instructed otherwise!

d) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** for four (4) FULL minute OR until if it EVER = 897 or more, even just once. Does it **EVER** become 897 or more (Yes or No)?

Yes **BC Switch** goes t**o** 897 or more, even if only once! **Read before performing!** Return to **page 30**, procedure number F- 1.0.5 but if you return here, because of no drain flow, THREE (3) possible bad components (see COMPONENT LIST below):

**COMPONENT LIST:**

**1)** Bad Actuator-Test Board[1] OR; **2)** Bad actuator cable OR; **3)** Multiple intermittent restricted balancing chamber valves #32, #34, #36 and #38[2].

No **BC Switch** is NEVER 897 or more. A Flow Error is not presenting at this time! It may be extremely intermittent. Return to **page 52**, procedure number F- 3.8.0.

[1] To LOCATE the Actuator-Test board refer to Figure 4A (page 10);

[2] To LOCATE these valves refer to Figure 20 (page 92)

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**F- 7.6.10 PART 3 BAD FLOW / PART 4 MORE THAN 800 / RESTRICTED VALVES #36 AND/OR #32**

Balancing Chamber Valve #36 and/or Valve #32 is not opening. Also, the Actuator Cable or the distribution board may be bad. These procedures isolate between these components:

A) Turn the machine OFF!

B) Return valves #31 AND #38 to their PROPER distribution board positions.

C) The Flow Pump remains plugged into the Deaeration Pump's distribution board position!

D) **Per the Figure below**, replace **Valve #36** with a known good!

E) Plug the new valve #36's connector into valve #33's distribution board position, "V33".

F) ENSURE the bucket with the RED dialyzer connector submersed is full!

G) **Turn the machine but DO NOT press any other keys!**.


H) With "Select Program" up, measure drain flow for one (1) minute. More than 800 ml every minute?

Yes More than 800 ml! Problem located! The previous valve #36 is bad!

No Less than 800 ml collected! See procedure number F- 7.6.12 (page 92).

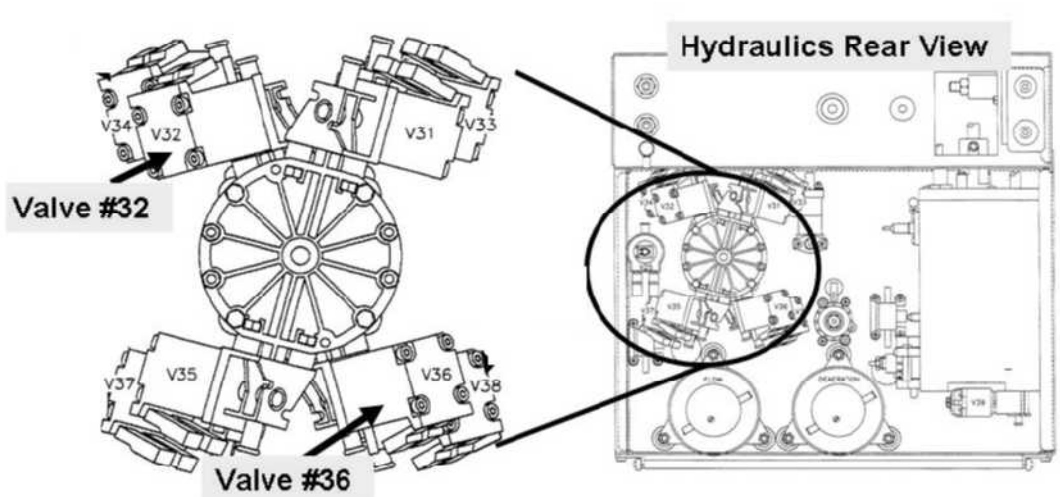


**Figure 20 – Balancing Chamber Valves**

**F- 7.6.12 LESS THAN 800 ML COLLECTED / ISOLATE VALVE #32**

A) Turn the machine OFF!

B) Return Valves #33 AND the new Valve #36 connectors to their PROPER distribution board positions!

C) **Per the Figure above**, replace **Valve #32** with a known good!

**Parts D through G next page**

D) Plug the new Valve #32's connector into Valve #33's distribution board position, "V33".

E) ENSURE the bucket with the RED dialyzer connector submersed is full.

F) Turn the machine on but **DO NOT** press any other keys.


G) With "Select Program" up, measure drain flow for one (1) minute. More than 800 ml every minute?

Yes More than 800 ml! Problem located! The previous Valve #32 is bad!

No Less than 800 ml! See parts a AND b below:

a) Return all valves to their PROPER distribution board positions.

b) THREE possible (3) bad components: **1)** Bad Actuator-Test board; **2)** Bad Actuator cable OR; **3)** Bad distribution board.

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## F- 7.7.20 PART 3 GOOD FLOW / PART 4 LESS THAN 800 ML / RESTRICTED VALVES #38 AND #34

Balancing Chamber Valve #38 and/or Valve #34 is not opening. Also, the Actuator Cable or the distribution board may be bad. These procedures isolate between these components:

a) Turn the machine OFF.

b) The Flow Pump remains plugged into the Deaeration Pump's distribution board position.

c) **Per the Figure below**, replace **Valve #38** with a <u>known good</u>.

d) Plug the new valve #38's connector into valve #31's distribution board position, "V31".

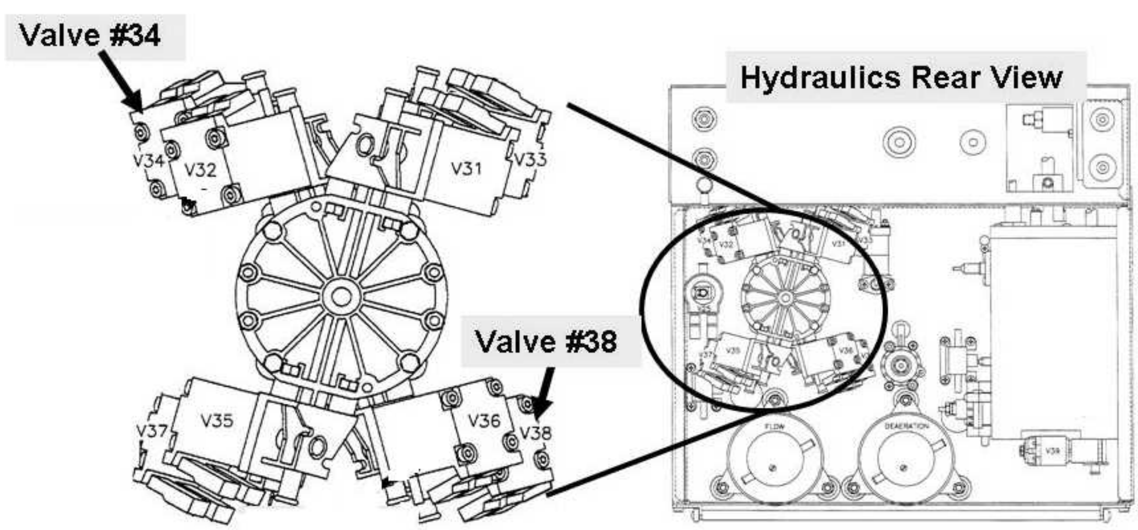
e) ENSURE the bucket with the RED dialyzer connector submersed in it is full!

f) **Turn the machine on but DO NOT press any other keys.**


g) With "Select Program" up, measure drain flow, into the cylinder, for one (1) minute. More than 800 ml every minute?

Yes More than 800 ml! Problem located! The previous valve #38 is bad!

No Less than 800 ml collected! See procedure number F- 7.7.22 (page 95).



**F- 7.7.22 LESS THAN 800 ML COLLECTED / ISOLATE VALVE #34**

A) Turn the machine OFF!

B) Return Valves #38 AND #31 to their PROPER distribution board positions.

C) **Per the Figure previous page**, replace **Valve #34** with a known good!

D) Plug the new valve #34's connector into valve #33's distribution board position, "V33".

E) ENSURE the bucket with the RED dialyzer connector submersed in it is full!

F) **Turn the machine on but DO NOT press any other keys**


G) With "Select Program" up, measure drain flow for one (1) minute. More than 800 ml every minute?

Yes More than 800 ml! Problem located! The previous valve #34 is bad!

No Less than 800 ml! See parts a and b below:

a) Return all valves to their PROPER distribution board positions.

b) THREE (3) possible bad components: **1)** Bad Actuator-Test board; **2)** Bad Actuator cable; **3)** Bad distribution board

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### F- 7.8.0 PARTS 3 AND 4 YIELDED 800 ML OR MORE / RETURN SYSTEMS

All secondary side components are checking good HOWEVER, the problem may be intermittent.

a) **Turn the machine OFF!**

b) Reattach the drain tubing, ENSURING it is properly attached to the station!

c) Return Valves #31 AND #38 to their distribution board positions.

d) Return Flow Pump #21 AND Deaeration Pump #20 to their distribution board positions.

e) **OPEN THE SHUNT DOOR till instructed otherwise**

f) See procedure number F- 7.8.1 (page 96).

### F- 7.8.1 CONFIRM SYSTEMS

a) Turn the machine ON but **DO NOT** press any keys yet!

b) From "Select Program", if the pumps are plugged in correctly, the Deaeration motor rotates but the Flow motor does NOT!

c) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) **SLAM** the Loading Pressure gauge in the Acid/Acetate Rinse port! ENSURE PEAK pressure is between 23 and 27 psi.

e) See procedure number F- 7.8.2 (page 96).

### F- 7.8.2 TROUBLESHOOT FLOW ERROR

a) From the Home screen, press the [Dialysate Flow] window.

b) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

c) ENSURE the FLOW motor is rotating i.e. plugged in properly!

d) ENSURE a "No Water" alarm NEVER occurs.

e) Call debug screen 6 to watch **BC Switch** for three (3) FULL minutes OR until if it ever becomes more than 400 OR less than 203 indicating a flow problem! TWO (2) possible scenarios below:

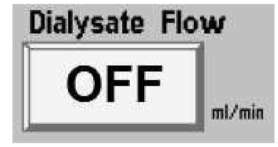
   **1)** **IF (and ONLY if) BC Switch is NEVER more than 400 OR less than 203: A)** Leaving the shunt door open, allow Temperature and Conductivity to become normal; **B)** Return to (ABOVE) procedure number F- 3.8.0 (**page 52**).

   **2)** **IF BC Switch is or becomes less more than 400 OR less than 203 even if only once:** See parts a AND b below:

      a) CLOSE THE SHUNT DOOR!

      b) Return to (ABOVE) procedure number F- 2.0.0 (**page 38**).

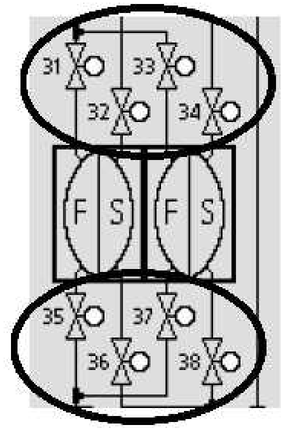
## F- 8.0.0 BC SWITCH = 897




a) From the Home screen, set the [Dialysate Flow] window to “OFF”.

b) Press ‘Enter’!

c) Call debug screen 0. If [Dialysate Flow] is OFF all eight Balancing Chamber valve ‘dots’ (Figure right) REMAIN white!




d) Call debug screen 4 to see **PDIA** (lower left column). TWO (2) possible scenarios:

**1)** **IF (and ONLY if) PDIA is between 2.0 and 7.5:** See procedure number F- 8.2.0 (page 98).

**2)** **IF PDIA is less than 2.0 <u>OR</u> more than 7.5:** See parts a THROUGH d below:

a) Press and release the ‘Reset’ key then press and hold it for three (3) seconds!

b) Allow thirty (30) seconds!

c) If **PDIA** is still less than 2.0 OR more than 7.5, repeat parts a and b up to twice BEFORE continuing to part d.

d) TWO (2) possible scenarios:

**1)** **IF PDIA (and ONLY if) is between 2.0 and 7.5:** See procedure number F- 8.2.0 (page 98).

**2)** **IF PDIA is less than 2.0 <u>OR</u> more than 7.5:** See parts A AND B below:

A) From the Home screen, set [Dialysate Flow] to 800 ml/min

B) Return to (ABOVE) procedure number F- 6.1.1 (page 60).

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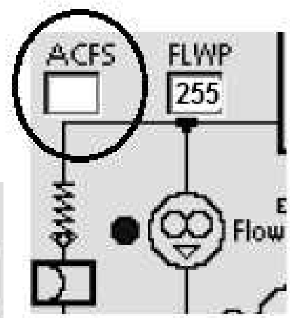
## F- 8.2.0 ANALYZE ACFS

a) Call debug screen 0. Figure right, look at **ACFS** THEN locate its value in **COLUMN** 1 of the Table below.

b) Call debug screen 10.

c) Look at **ACFS** (right column, bottom) THEN locate its value in **COLUMN 2** of the Table below next to screen 0's **ACFS** value seen in part a.


d) Based on BOTH **ACFS** readings, respond according to the Table's **COLUMN 3,**:

| **COLUMN 1**<br>Screen 0's **ACFS** | **COLUMN 2**<br>Screen 10's **ACFS** | **COLUMN 3**<br>**Your Response:** |
|---|---|---|
| Between 3.0 and 6.0<br>(Good) | Between 4.0 and 5.8<br>(Good) | BOTH **ACFS** values are good! The CFS circuit is good! See procedure number F- 8.3.0 (page 99) |
| Between 3.0 and 6.0<br>(Good) | Less than 4.0 OR more than 5.8<br>(Bad) | Screen 0's **ACFS** is good; Screen 10's **ACFS** is bad<br>THREE (3) possible bad components[1]: **1)** Sensor Board OR; **2)** Functional Board OR; **3)** Mother board connection between the Functional and Sensor Board |
| Less than 3.0 OR more than 6.0<br>(Bad) | Between 4.0 and 5.8<br>(Good) | Screen 0's **ACFS** is bad; Screen 10's **ACFS** is good<br>THREE (3) possible bad components[2]: **1)** Actuator-Test Board OR; **2)** Bad Sensor Board OR; **3)** Motherboard connection between the Actuator-Test and Sensor Board |
| Less than 3.0 OR more than 6.0<br>(Bad) | Less than 4.0 OR more than 5.8<br>(Bad) | BOTH bad! Proceed to **page 111**, procedure number F- 10.0.0 |

[1] Referring to OPERATING MODES (page 19), to prevent "Cond Offset Failure", place the machine into **T and C Mode** THEN , with the machine off, swap these components in, one at a time, and in between, when screen 10's **ACFS** goes to between 3.0 and 6.0 the last component swapped in is the culprit.

[2] Referring to OPERATING MODES (page 19), to prevent "Cond Offset Failure", place the machine into **T and C Mode** THEN, with the machine off, swap these components in, one at a time and in between, when screen 0's **ACFS** goes to between 3.0 and 6.0 the last component swapped in is the culprit.

## F- 8.3.0 BOTH ACFS VALUES ARE GOOD

a) Call the Home screen.

b) Press the [Dialysate Flow] window!

c) Set [Dialysate Flow] to 800 ml/min and press 'Enter'

d) Allow forty-five (45) seconds BEFORE continuing to part e.

e) Call debug screen 10 to watch **ACFS** for one (1) FULL minute. FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

1) **IF ACFS CYCLES between less than 0.5 to somewhere between 3.0 and 5.8, possibly every nine (9) seconds:** See procedure number F- 8.4.0 (page 99).

2) **IF (and ONLY if) ACFS REMAINS ALWAYS between 0 and 3.0:** Proceed to **page 112**, procedure number F- 11.0.0.

3) **IF (and ONLY if) ACFS REMAINS ALWAYS between 3.0 and 5.8:** Proceed to **page 100**, procedure number F- 9.0.0.

4) **IF (and ONLY if) ACFS REMAINS ALWAYS more than 5.8:** Proceed to **page 112**, procedure number F- 11.0.0.

## F- 8.4.0 ACFS CYCLING


Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for three (3) FULL minutes. If it EVER becomes more than 400 OR less than 203 even if only once indicates a Flow Problem?

Yes **BC Switch** becomes more than 400 OR less than 203. Return to (ABOVE) procedure number F- 2.0.0 (**page 38**).

No **BC Switch** NEVER more than 400 OR less than 203. A flow problem is not presenting at this time.

## F- 9.0.0 ACFS BETWEEN 3.1 AND 8.0 / ISOLATE FLOW PUMP

a) Return BOTH concentrate connectors to their rinse ports.

b) This procedure requires a psi gauge. **ENSURE** it reads 0 psi before installing it!

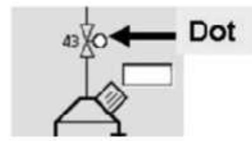
c) Per Figure 21 below, tee the gauge into the Flow Pump's WHITE (output) tubing.

d) **To prevent leaks and false readings, tie wrap both sides of the gauge tubing.**

e) **Place the machine into RINSE!**

f) ENSURING a "No Water" NEVER appears, call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

g) Allow Valve #43's 'dot' (Figure right) to turn blue then WHITE again! While white, does gauge pressure CYCLE, about every three (3) seconds, to between 35 and 36 psi?




Yes Between 35 and 36 psi! Proceed to **page 109**, procedure number F- 9.0.5.

No Is NOT between 35 and 36 psi! ENSURING the machine was in RINSE AND no leaks, TWO (2) possible scenarios:

**1)** **IF (and ONLY if) pressure is too low:** DO NOT calibrate instead proceed to **page 101**, procedure number F- 9.0.2.

**2)** **IF pressure is too high: A)** Per the Figure below, adjust Valve #78 until pressure cycles to between 35 and 36 psi; **B)** See procedure number F- 9.0.5 (**page 109**).

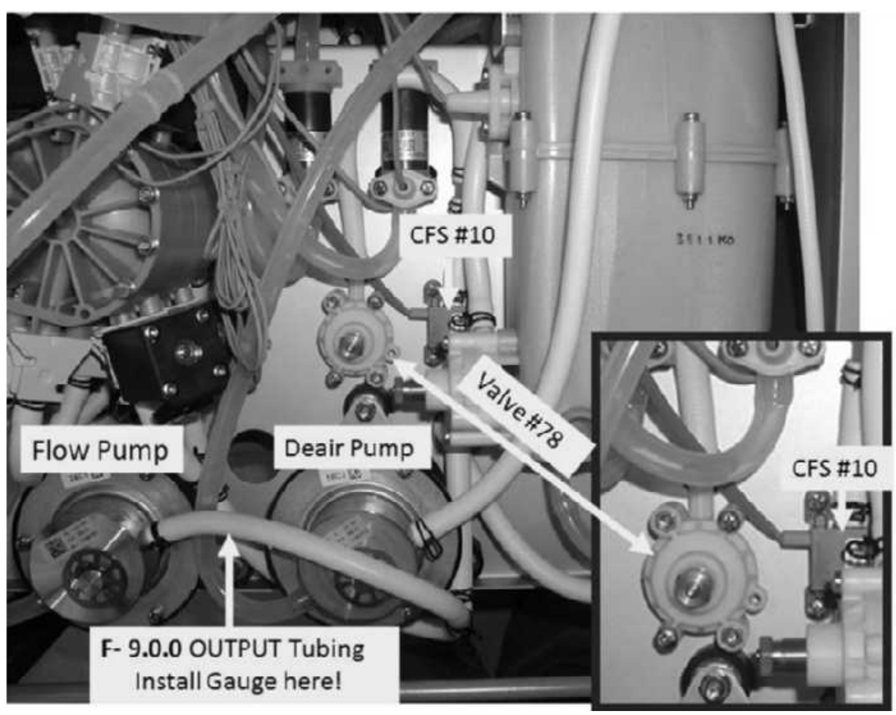



**Figure 21 – Hydraulics, Rear View**

## F- 9.0.2 LOW FLOW PUMP PRESSURE / ISOLATE VALVE #43

a) Still in RINSE, CAREFUL HERE! **Per Figure 22 (below)**, DOUBLE CLAMP Valve #43's OUTPUT tubing! **NOTE!** Valve #43's output tubing extends towards the front of the machine!

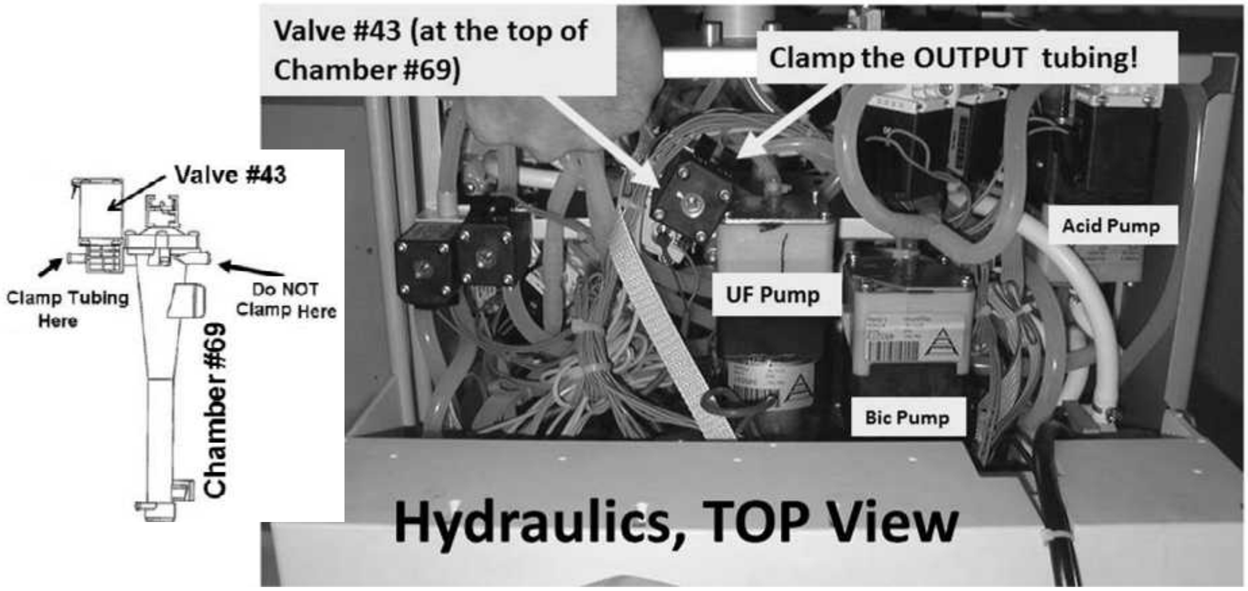



**Figure 22 - Isolate Valve #43**

b) Does gauge pressure NOW CYCLE to more than 35 psi about every three (3) seconds (Yes or No)?

Yes ↕ More than 35 psi! This may indicate Valve #43 is sticking open. **A)** Release the clamps; **B)** Allow Valve #43's 'dot' to turn blue then white again; **C)** While white, if pressure again does NOT cycle to more than 35 psi then TWO (2) possible bad components: **1)** Bad Actuator-Test Board[1] OR; **2**) Bad Valve #43. [1]To LOCATE the board refer to Figure 4A (page 10).

No Less than 35 psi! Leaving the clamps in place, see procedure number F- 9.0.24 (page 102).

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**F- 9.0.24 ISOLATE FLOW PUMP INPUT FLOW**

a) Obtain a 1000 ml (or larger) graduated cylinder!

b) **Service Mode's Flow Pressure is used to isolate the Flow Pump's input circuit! DO NOT follow the screen instructions! Perform no adjustments until instructed!**

c) Enter Service Mode → Calibrate Hydraulics → Flow Pressure.

d) Press 'Enter' THEN ENSURE the FLOW MOTOR shaft is rotating!

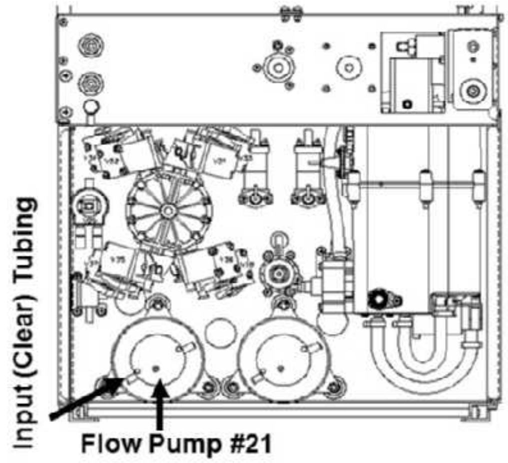
e) **NOTE** the gauge reading for later.

f) Figure right, remove the Flow Pump's INPUT (clear) tubing and measure flow from it for one (1) minute.

g) Press 'Enter' to return to "Calibrate Hydraulics".

h) Reattach the Flow Pump's tubing!

i) TWO (2) possible scenarios:




**1) IF (and ONLY if) MORE THAN 800 ml collected!** See procedure number F- 9.0.25 (page 102).

**2) IF LESS THAN 800 ml collected!** Proceed to **page 105**, procedure number F- 9.0.4.

**F- 9.0.25 INPUT FLOW PUMP MORE THAN 800 ML**

a) **Place the machine into RINSE!**

b) As noted above, was pressure between 35 and 36 psi?

Yes — Between 35 and 36 psi! Good static pressure but NOT dynamic! TWO (2) possible bad components: **1)** Bad Flow Pump head OR; **2)** Bad Flow Pump motor (possibly brushes).

No Less than 35 psi! See procedure number F- 9.0.26 (page 103).

## F- 9.0.26 BAD FLOW PUMP PRESSURE

a) Return to Calibrate Hydraulics → Flow Pressure.

b) Press ‘Enter’ THEN ENSURE the FLOW MOTOR shaft is rotating!

c) **Per the Figure below**, above the Deair Pump, locate Valve #78.

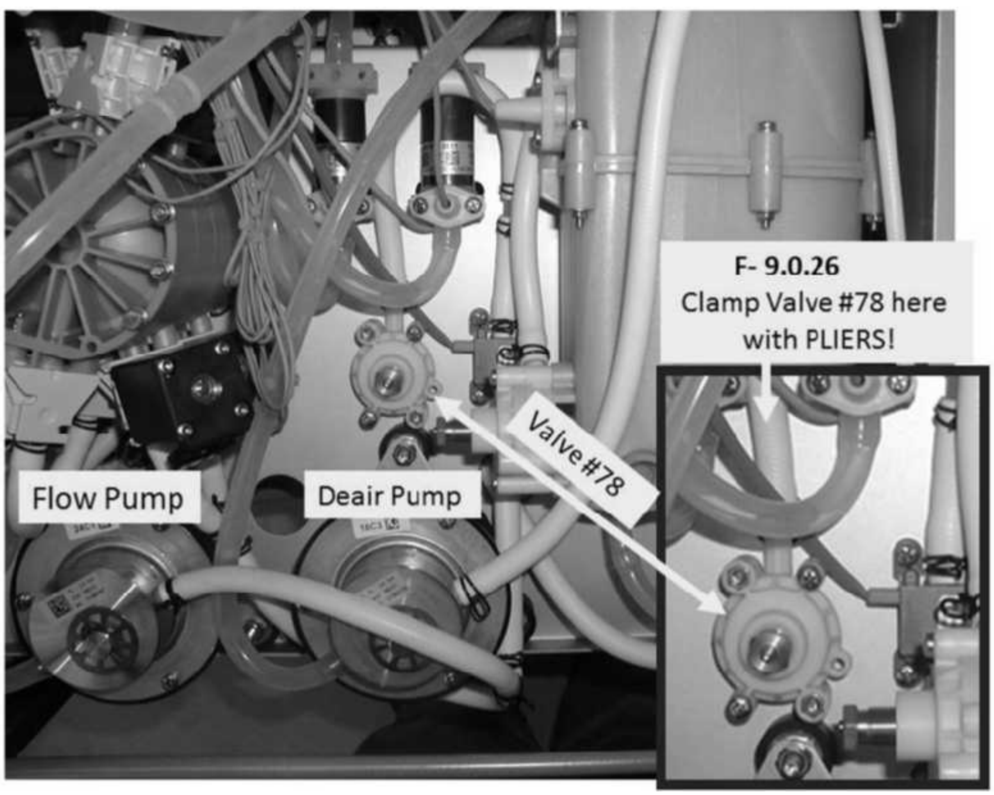
d) **WARNING! To avoid error DO NOT use a plastic clamp in part e! Use METAL NEEDLE NOSE PLIERS instead!**

e) While watching the gauge, **using PLIERS**, TIGHTLY clamp then QUICKLY unclamp the white tubing at the top of Valve #78 several times.

f) When clamped, does gauge pressure reach forty (40) psi or more?

Yes 40 psi or more! The Flow Pump is okay! See procedure number F- 9.0.27 (page 104).

No Less than 40 psi! TWO (2) possible bad components: **1)** Bad Flow Pump head OR; **2)** Bad Flow Pump motor (possibly brushes).



**F- 9.0.27 40 PSI OR MORE / ISOLATE VALVE #78**

a) **Turn the machine OFF!**

b) Replace Valve #78* with a known good!

*To LOCATE Valve #78 refer to the Figure previous page.

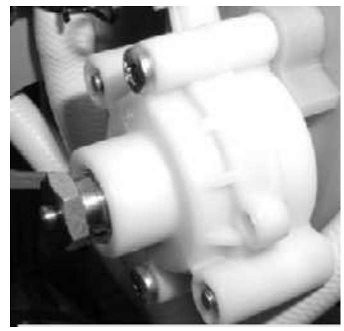
c) Enter Service Mode → Calibrate Hydraulics → Flow Pressure.

d) Press 'Enter' THEN ENSURE the FLOW MOTOR shaft is rotating!

e) Can you adjust the new Valve #78's screw to a gauge pressure of between 35 and 36 psi (Yes or No)?

Yes Pressure adjusts to between 35 and 36 psi! Figure right, if Valve #78's screw is turned so that no threads are visible TWO (2) possible bad components: **1)** Bad Flow Pump head OR; **2)** Bad Flow Pump motor (possibly brushes).

No CANNOT adjust to between 35 and 36 psi! TWO (2) possible bad components: **1)** Bad Flow Pump head OR; **2)** Bad Flow Pump motor (possibly brushes).



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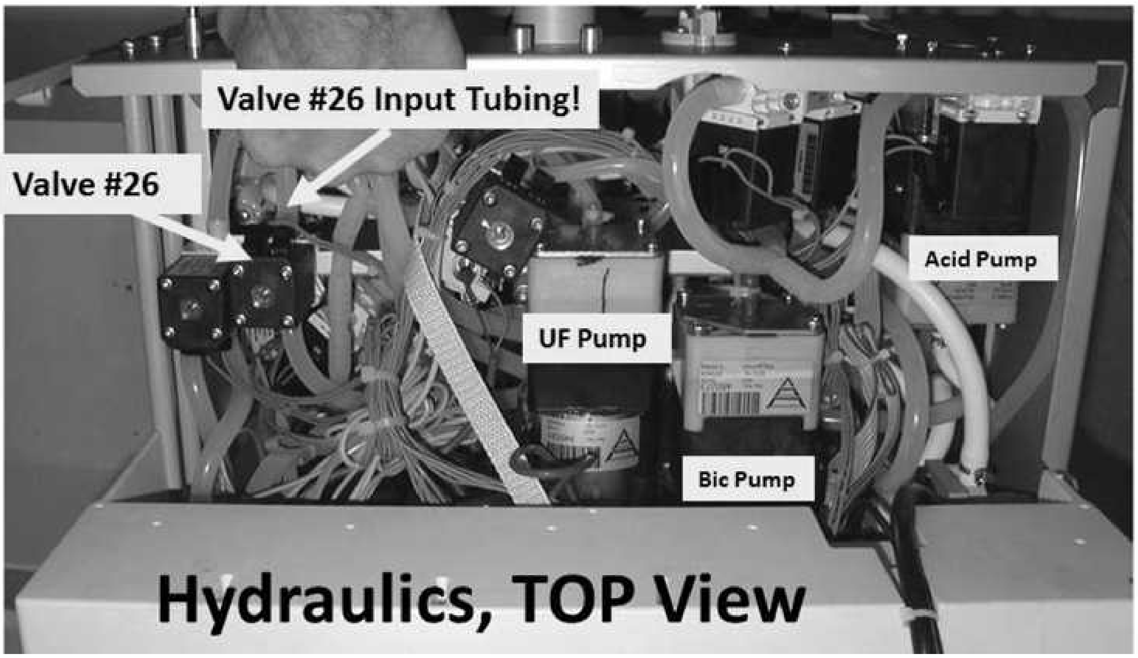
## F- 9.0.4 INPUT FLOW PUMP FLOW LESS THAN 800 ML / ISOLATE V26 INPUT FLOW

a) **CAUTION!** To prevent further damage, Remove the clamps from Valve #43.

b) Obtain an empty bucket.

c) **Figure below**, remove Valve #26's INPUT tubing and direct it into the bucket!




d) Return to Calibrate Hydraulics → Flow Pressure.

e) Press 'Enter' then <u>ENSURE</u> the Flow Motor is rotating!

f) Direct Valve #26's tubing into the graduated cylinder for one (1) minute.

g) Press 'Enter' to return to "Calibrate Hydraulics"!

h) Reattach Valve #26's tubing.

i) MORE than 800 ml collected?

Yes MORE than 800 ml! Proceed to **page 107**, procedure number F- 9.0.42.

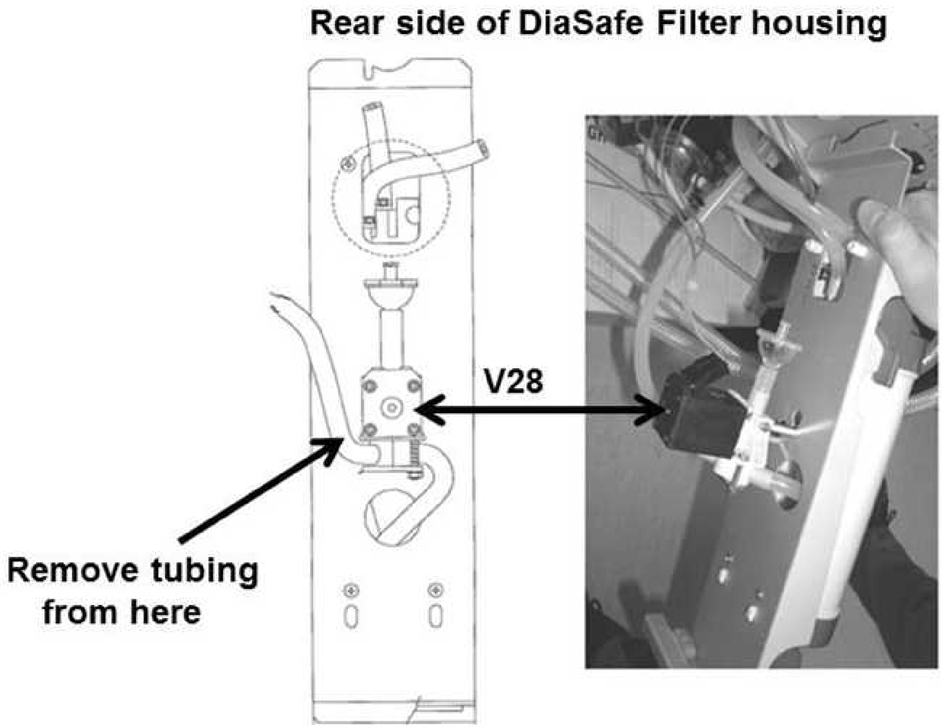
No Less than 800 ml! See procedure number F- 9.0.41 (page 106).

**F- 9.0.41 LESS THAN 800 ML TO VALVE #26**

a) ENSURE no restrictions or leaks between the DiaSafe® filter and the Balancing Chambers

b) ENSURE no restrictions between the DiaSafe® filter and Valve #26.

c) **Figure below**, at the rear of the DiaSafe® filter housing, remove the tubing from Valve #28 (V28) and direct it into the bucket.




d) Return to Calibrate Hydraulics → Flow Pressure.

e) Press 'Enter' and ENSURE the Flow Motor is rotating!

f) Direct the tubing into the graduated cylinder for one (1) minute.

g) Press 'Enter' to return to "Calibrate Hydraulics".

h) More than 800 ml collected?

Yes More than 800 ml collected! The DiaSafe® filter is restricted!

No Less than 800 ml collected! This indicates restricted 'Fresh Side' Balancing Chamber valve. See parts through c below:

a) Turn the machine OFF!.

b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → Enter).

c) Proceed to **page 70** procedure number F- 7.0.0

## F- 9.0.42 MORE THAN 800 ML INPUT FLOW TO VALVE #26 / ISOLATE VALVE #24

a) Return to Calibrate Hydraulics → Flow Pressure.

b) Press 'Enter' THEN ENSURE the Flow Motor is rotating!

c) Remove the BLUE dialyzer connector from the shunt door.

d) Measure from the dialyzer connector for one (1) minute!

e) Press 'Enter' to return to "Calibrate Hydraulics".

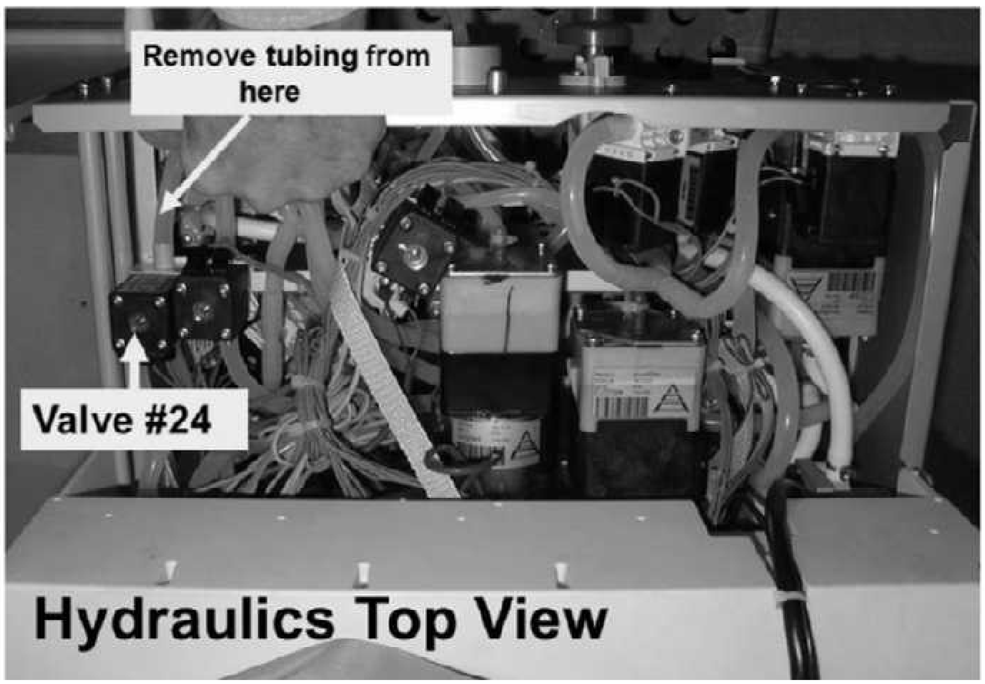
f) More than 800 ml collected?

Yes More than 800 ml! Good flow from Valve #24! See procedure number F- 9.0.43 (page 108).

No Less than 800 ml! See parts a THROUGH f below.

a) Per the Figure below, remove Valve #24's INPUT tubing!

b) Direct it into the bucket.




c) Return to Calibrate Hydraulics → Flow Pressure.

d) **P**ress 'Enter' THEN ENSURE the Flow Motor is rotating.

e) Measure from the tubing for one (1) minute.

f) Press 'Enter' to return to "Calibrate Hydraulics".

g) More than 800 ml collected?

Yes More than 800 ml! **A)** Reconnect Valve #24's tubing; **B)** NOTE **ONLY** VALVE #24 will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.

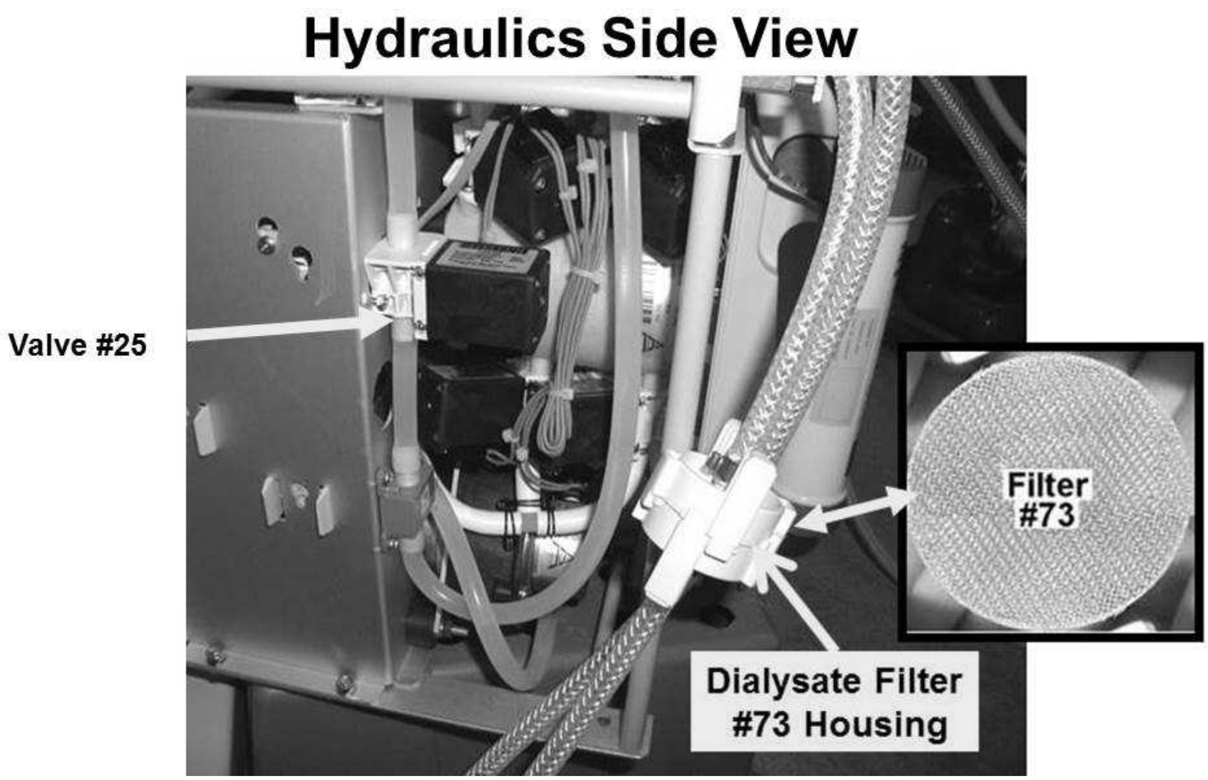
No TWO (2) possibilities: **1)** Bad (restricted) DiaSafe® filter OR **2)** Tubing restriction between the balancing chambers and Valve #24.

## F- 9.0.43 GOOD FLOW FROM VALVE #24

A restriction is indicated in the 'from (red) Dialyzer line'.

a) ENSURE no tubing restrictions at the DiaSafe® filter.

b) Figure BELOW, open Dialysate Filter #73 housing and ENSURE the filter is clean!




c) Figure above touch Valve #25's black solenoid. Is it warm?

Yes Solenoid warm! TWO possible bad components: 1) Bad Actuator-Test Board[1]; 2) Bad Valve #25. [1] To LOCATE the board refer to Figure 4A (page 10).

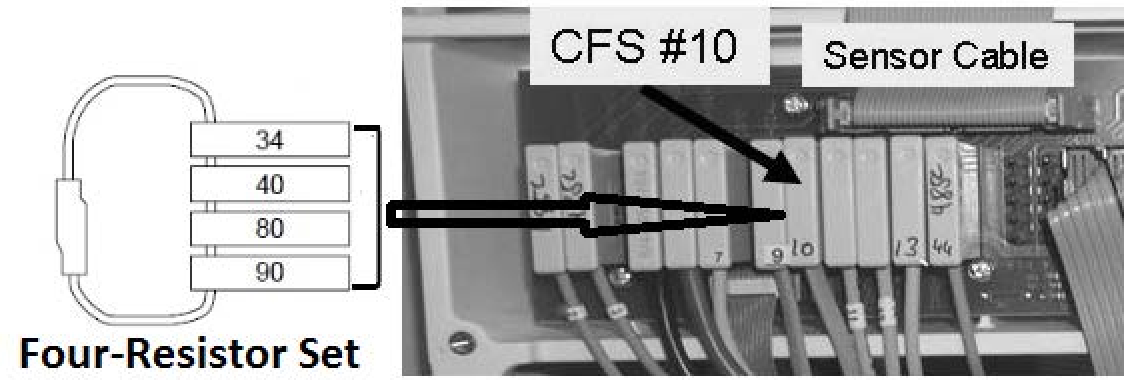
No Solenoid is not warm! **NOTE ONLY VALVE #25** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

**F- 9.0.5 GOOD FLOW PUMP PRESSURE / ISOLATE CFS CIRCUIT**

a) Return to Dialysis Program (“Select Program”→ ‘Dialysis’ → ‘Enter’)!

b) From the Home screen, set [Dialysate Flow] to **500 ml/min** and press ‘Enter’

c) Figure below, insert one of the resistor plugs, from the **FOUR-RESISTOR SET**, into CFS #10’s distribution board position, “x10, CFS”.




d) Call debug screen 10. Does **ACFS** go to 0.0?

Yes **ACFS** = 0.0! See procedure number F- 9.0.6 (page 110).

No **ACFS** DOES NOT = 0.0! See parts a AND b below:

a) ENSURE the resistor plug was placed correctly at position “CFS” before continuing! If not, repeat procedure number F- 9.0.5 (page 109) from part c.

b) Leaving the resistor plug installed for now, FOUR (4) possible bad components: **1)** Actuator-Test Board[1] OR; **2)** Sensor Board[2] OR **3)** Sensor Board cable[3] OR; **4)** Distribution board.

[1] **A)** With the machine off, swap in a known good Actuator-Test Board[a]; **B)** Return to Dialysis Program (“Select Program” → Dialysis’ → ‘Enter’); **C)** If **ACFS** = 0.0 the previous Actuator-Test Board is bad.

[a] To LOCATE the board refer to Figure 4A (page 10)

[2] **A)** With the machine off, swap in a known good Sensor Board[b]; **B)** Place the machine into **T and C Mode** (refer to OPERATING MODES (page 19); **C) IMPORTANT!** Return to Dialysis Program (“Select Program” → Dialysis’ → ‘Enter’). If **ACFS** = 0.0 the previous Sensor Board is bad.

[b] To LOCATE the board refer to Figure 4A (page 10)

[3] The Sensor Board cable can be checked. **NOTE** three (3) **CFS TRANSDUCER** connections will be checked and proceed to **page 569**, SECTION 17 - CHECKING THE SENSOR BOARD CABLE.

## F- 9.0.6 ACFS = 0

a) Return CFS #10's connector to distribution board position "x10, CFS". If returned properly **ACFS** = between 3.0 and 8.1.

b) From the Home screen, ENSURE Dialysate Flow is set at **500 ml/min**.

c) Is the TMP window RED?

Yes Red TMP window! **A)** Press and release the 'Reset' key then immediately press and hold it for three seconds; **B)** Allow thirty (30) seconds; **C)** If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to procedure number F- 9.0.7 (page 110).

No TMP window is pale yellow/white! See procedure number F- 9.0.7 (page 110).

## F- 9.0.7 ANALYZE TMP

TMP is STABLE if (and ONLY if) the TMP Window REMAINS white AND the TMP does NOT change more than +/- 60 mmHg in three (3) minutes. TWO (2) possible scenarios:

1) **IF (and ONLY if) TMP is STABLE:** See procedure number F- 9.0.8 (page 110).

2) **IF TMP is UNSTABLE:** A procedure, in a different Section, is performed next. **IMPORTANT! NOTE** this page and procedure number (F- 9.0.7) as you may prompted to return to here: Perform parts A and B below:

   A) BEFORE continuing to part B, proceed to **page 572**, SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

   B) If a balancing chamber valve leak was not located in part A, see procedure number F- 9.0.8 (page 110).

## F- 9.0.8 BALANCING CHAMBER DIAPHRAGM TEST

A procedure, in a different Section, is performed next. **IMPORTANT! NOTE** this page and procedure number (F- 9.0.8) as you may prompted to return to here:

a) BEFORE continuing to part b, proceed to **page 580**, to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

b) If a leaking diaphragm is not located in part a, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

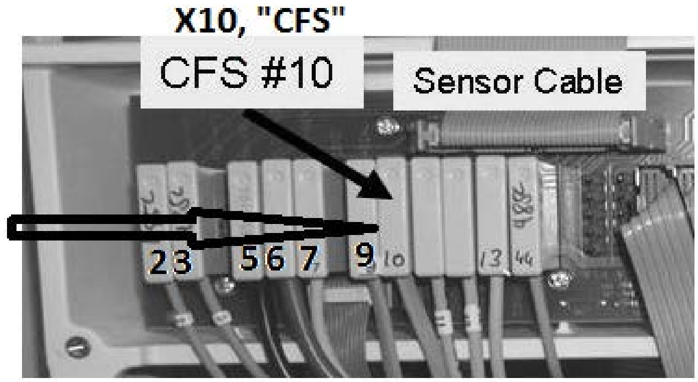
c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'

d) If **BC Switch** (debug screen 6) = 897 (constantly) AND **ACFS** (debug screen 10) remains between 3.0 and 8.0. TWO (2) possible bad components: **1)** CFS transducer #10[a] OR; **2)** Sensor board [b,c].

   [a] To LOCATE CFS transducer #10 refer to Figure 21 (page 100); [b]To LOCATE the Sensor board see Figure 4A (page 10).

   [c] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES page 19)).

## F- 10.0.0 BAD ACFS SIGNAL




a) Figure right, ENSURE the CFS #10 Pressure Transducer's connector is plugged PROPERLY into the distribution board.

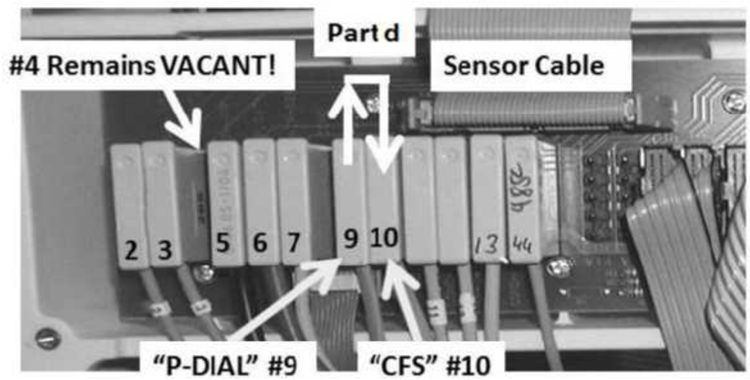
b) See procedure number F- 10.1.0 (page 111).

## F- 10.1.0 CFS PLUGGED IN PROPERLY


a) Call debug screen 10. If all procedures were performed correctly **PDIA** (middle column) = between 3.5 and 6.5.

b) Unplug the CFS's connector from position X10, "CFS".

c) Using a flashlight, check inside the vacant "X10" position. **If corrosion or damaged pins are located this may be the problem!**




d) Figure right, plug the Dialysate Pressure Sensor's (#9) connector into the CFS Pressure Sensor's. "P-DIAL" → "CFS".

e) Does **ACFS** (lower right) go to between 4.0 and 6.0?


Yes **ACFS** between 4.0 and 6.0! The CFS Pressure Sensor #10* is bad. *To LOCATE the CFS Pressure Sensor #10 refer to Figure 21 (page 100).

No **ACFS** is less than 4.0 OR more than 6.0! Leaving PDIA in CFS for now, FIVE (5) possible bad components: **1)** Bad Actuator-Test Board[a] OR; **2)** Bad Sensor Board[b] OR; **3)** Bad Sensor Board cable OR; **4)** Bad distribution board OR;**5)** Bad motherboard.

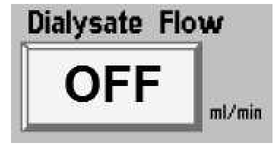
[a] **A)** With the power off, swap in a known good Actuator-Test[1] Board; **B) IMPORTANT!** Return Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **C)** If **ACFS** is between 4.0 and 6.0 the previous Actuator-Test Board is bad.

[1] To LOCATE the board refer to Figure 4A (page 10).

[b] **A)** With the power off, swap in a known good Sensor Board[2]; **B)** Place the machine into **T and C Mode** (refer to OPERATING MODES (page 19); **C) IMPORTANT!** Return to Dialysis Program)!; **D)** If **ACFS** now = between 4.0 and 6.0 the previous Sensor Board is bad.

[2] To LOCATE the Sensor board see Figure 4A (page 10).

## F- 11.0.0 ACFS = BETWEEN 0 AND 3.0




a) **IMPORTANT!** From the Home screen, set [Dialysate Flow] to "OFF".

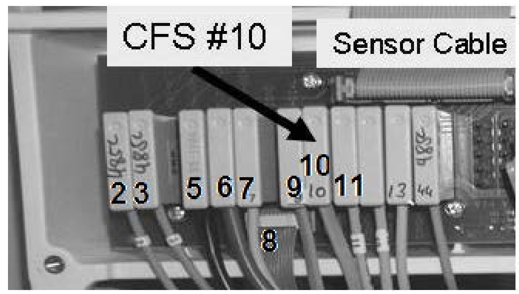
b) Press 'Enter'!

c) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds. Allow thirty (30) seconds. If a TMP occurs attempt RESET up to FIVE (5) times BEFORE continuing to part d.

d) Call debug screen 10. Is **ACFS** now = 3.5 or more?

Yes **ACFS** = 3.5 or more! See procedure number F- 11.0.4 (page 112).

No **ACFS** is NOT 3.5 or more! See parts a THROUGH c below:




a) Figure right, unplug the CFS (#10) transducer's connector from distribution board position "x10, CFS".

b) **IMPORTANT!** To avoid error, using the screen's clock (upper right), allow up to five (5) minutes as **ACFS** response is NOT instantaneous!

c) After no more than five (5) minutes **ACFS** should increase to 9.0 or more?

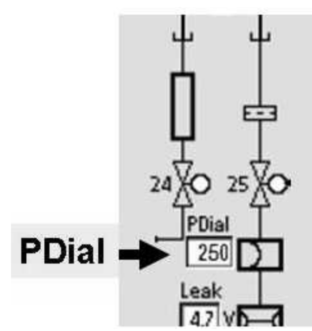
Yes **ACFS** 9.0 or more! **A)** Return the CFS transducer #10 to distribution board position "x10, CFS"; **B)** See procedure number F- 11.0.4 (page 112).

No **ACFS** is IS NOT 9.0 or more! **Leaving the CFS transducer unplugged,** FOUR (4) possible bad components: **1)** Actuator-Test Board[a] OR; **2)** Sensor Board[b] OR; **3)** Sensor Board cable OR; **4)** Distribution board.

[a] **A)** With the power off, swap in a known good Actuator-Test Board (to LOCATE the board refer to Figure 4A, page 10); **B) IMPORTANT!** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **C)** Allow **five (5) minutes**; **D)** If **ACFS** = more than 9.0 the previous Actuator-Test Board is bad.

[b] **A)** With the power off, swap in a known good Sensor Board (to LOCATE refer to Figure 4A, page 10); **B)** Place the machine into **T and C Mode** (refer to OPERATING MODES (page 19); **C)** Return to Dialysis Program; **D)** Allow up to **five (5) minutes**; **E)** If **ACFS** = more than 9.0 the previous Sensor Board is bad.

## F- 11.0.4 CHECK DIALYSATE PRESSURE




a) Leaving [Dialysate Flow] "OFF", remove the red dialyzer connector from the shunt and hold it at the level of the shunt door.

b) **CLOSE THE SHUNT DOOR!**

c) Call debug screen 0. Does the **PDial** window (Figure right) = between -40 and +40?

Yes **PDial** = 0 +/- 50! **A)** Return the dialyzer connector to the shunt and close the door! **B)** See procedure number F- 11.0.5 (page 113).

No **PDial** is NOT = 0 +/- 50! **A) IMPORTANT!** From the Home screen, set Dialysate Flow to 500 ml/min and press 'Enter'!; **B)** Proceed to **page 115,** procedure number F- 12.0.0.

# F- 11.0.5 TMP ALARM?

a) Call the Home screen. Set [Dialysate Flow] to **500 ml/min** and press Enter'!

b) Is the TMP window RED (TMP alarm)?

Yes TMP window IS RED! **A)** Press and release the 'Reset' key then immediately press and hold it for three (3) seconds. **B)** Allow thirty (30) seconds. **C)** If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to procedure number F- 11.0.6 (page 113).

No TMP window is white! See procedure number F- 11.0.6 (page 113).

## F- 11.0.6 ISOLATE FOR A LEAKING BALANCING CHAMBER VALVE

TMP is STABLE if (and ONLY if) the TMP window REMAINS white AND TMP does NOT change more than 60 mmHg in three (3) minutes. TWO (2) possible scenarios:

**1) IF (and ONLY if) TMP is STABLE:** See procedure number F- 11.0.7 (page 113).

**2) IF TMP is UNSTABLE:** A procedure in a different Section is performed next! **NOTE** this page and procedure number (F- 11.0.6) as you may be because you may be prompted to return here. See part A below:

A) Before continuing to part B, proceed to **page 572** to perform SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

B) If a balancing chamber valve leak was not located in part A turn the machine off then see procedure number F- 11.0.7 (page 113).

## F- 11.0.7 CHECK FOR SECONDARY SIDE RESTRICTION

a) Obtain a 1000 ml graduated cylinder.

b) Plug the red concentrate connector into its rinse port.

c) Turn the machine on but **DO NOT** press any keys! **"Select Program" remains up till instructed otherwise!**


d) Remove the red dialyzer connector from the shunt door and place it into a 1000 ml graduated cylinder.

e) Plug valve #37 into valve #30's distribution board position "V30". This opens valve #37. **Valve #30 remains unplugged!**

**Part f next page**

f) With “Select Program” up, measure flow, from the dialyzer connector, for one (1) minute. If no flow, **double check valve connector placement**. TWO (2) possible scenarios based on measured flow:

1) **IF (and ONLY if) less than 800 ml collected: A)** Return the dialyzer connector to the shunt but **DO NOT** unplug valve #37; **B)** See (ABOVE) procedure number F- 7.0.5 (**page 79**).

2) **IF 800 ml or more collected:** See parts a THROUGH c below:

a) Turn the machine off and return valves #37 and #30 to their distribution board positions.

b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

c) If the Flow Error reoccurs TWO (2) possible bad components: **1)** Bad DiaSafe® filter OR; **2)** Bad CFS transducer #10*. *To LOCATE the CFS transducer refer to Figure 21 (page 100).

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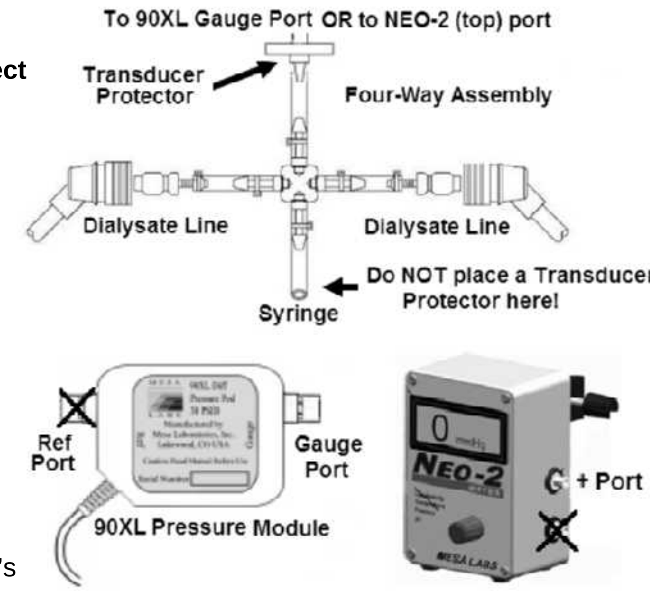
## F- 12.0.0 CALIBRATE/TROUBLESHOOT DIALYSATE PRESSURE

**This is NOT a routine calibration! Follow the instructions exactly to avoid error!**

a) **IMPORTANT! Open the shunt door!**




b) Enter Service Mode → Calibrate Sensors → Dialysate Pressure. The screen says **"1. Connect a pressure gauge in line…".**

c) Figure right, connect the Four-Way Assembly (P/N 150034) to the Dialyzer connectors.

d) ENSURE a transducer protector <u>IS NOT</u> in the 'to syringe' tubing segment!

e) Place the Four-Way in the dialyzer holderl!

f) If using a **NEO-2** attach to the <u>+Port</u> (top (red) port). If using a **90XL** attach to the Pressure Module's <u>Gauge Port</u>.

g) <u>DO NOT</u> allow tension or kinks in the Four-Way's tubing segments!

h) For now, clamp the 'to meter' tubing segment.

i) **Close the shunt door and ENSURE the flow indicator's 'bob' is moving up and down**.

j) Press 'Enter'. The screen says "**3. Press [Dialysate Flow on/off] key…"**

k) Press the screen's "Dialysate Flow On" button then press 'Enter'.

l) ENSURE the button says "Dialysate Flow Off" <u>AND</u> the external flow indicator is NOT moving (Flow is off).

m) Remove the clamp in the 'to meter' tubing segment.

n) Using the syringe, adjust pressure until the <u>external meter</u> = between -2 and 2 mmHg.

o) Press 'Enter' then see procedure number F- 12.1.0 (page 115).

## F- 12.1.0 PRESSURE TEST

a) The screen says **"6. Pressurize until dialysate pressure reads -250 mmHg…"** .

b) PULL on the syringe plunger. Can you achieve negative (-)250 +/- 5 mmHg on the <u>external meter</u>?

Yes -250 achieved! Clamp the 'to syringe' tubing to hotd this pressure then see procedure number F- 12.2.0 (page 116).

No -250 CANNOT be achieved! ENSURE the transducer protector, at the meter, is NOT wet OR consider replacing it! If OKAY, proceed to **page 117,** procedure number F- 12.3.0.

## F- 12.2.0 NEGATIVE 250 MMHG WAS ACHIEVED / PRESSURE TEST

Does meter pressure HOLD, +/- 15 mmHg, for one (1) minute?

Yes Pressure holds! See procedure number F- 12.2.2 (page 116).

No Pressure does DOES NOT hold! Proceed to **page 117,** procedure number F- 12.3.0.

## F- 12.2.2 PRESSURE HOLDS / VERIFY DIALYSATE PRESSURE

a) ENSURING the external meter is HOLDING negative (-)250 +/- 5 mmHg press 'Enter' twice to save the calibration.

b) Figure right, TWO (2) possible scenarios based on if an "Operator Error" banner occurs:


**1) IF (and ONLY if) "Operator Error" occurred:** See procedure number F- 12.4.0 (**page 118**).

**2) IF "Operator Error" did NOT occur:** See parts a THROUGH e below:

a) Turn the machine OFF!

b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) From the Home screen set [Dialysate Flow] to 500 ml/min and press 'Enter'.

d) Allow five (5) minutes BEFORE continuing to part e

e) Return to (ABOVE) procedure number **F- 11.0.5** (**page 113**).

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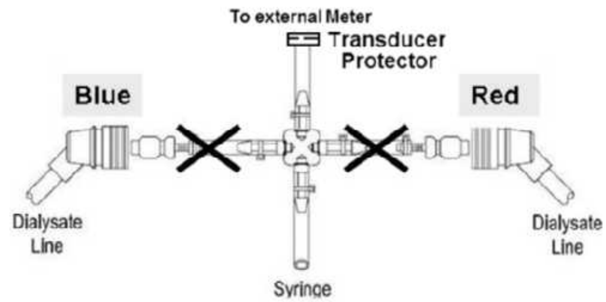
## F- 12.3.0 EITHER -250 MMHG COLUD NOT BE ACHIEVED OR IT DID NO HOLD / ISOLATE FOUR-WAY

a) Figure right, clamp BOTH Four-Way Dialyzer tubing segments.

b) Can you achieve -250 mmHg and HOLD it (+/- 15 mmHg) for one minute now (Yes or No)?




Yes -250 can be achieved AND it held! See procedure number F- 12.3.2 (page 117).

No -250 COULD NOT be achieved AND / OR could not be held! Either the transducer protector at the meter is wet OR a Four-Way tubing connection is leaking. See parts A through C below:

A) Turn the machine OFF!

B) Locate and repair the leak.

C) Return to (ABOVE) procedure number F- 12.0.0 (**page 115**).

## F- 12.3.2 -250 ACHIEVED AND HOLDS

a) **IMPORTANT!** Remove BOTH clamps from the Dialysate Line tubing segments.

b) Turn the machine OFF!

c) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) **IMPORTANT!** From the Home screen, set [Dialysate Flow] to "OFF" and press 'Enter'.

e) Proceed to **page 509**, procedure number TMP- 4.0.0 to locate a hydraulic leak.

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## F- 12.4.0 "OPERATOR ERROR" OCCURED / TROUBLESHOOT DIALYSATE PRESSURE

a) ENSURE the transducer protector, at the external meter, is not WET or consider replacing it!

b) Return the Dialysate lines to the shunt and close the door.

c) Turn the machine OFF!

d) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis'→ 'Enter).

e) From the Home screen press the [Dialysate Flow] window.

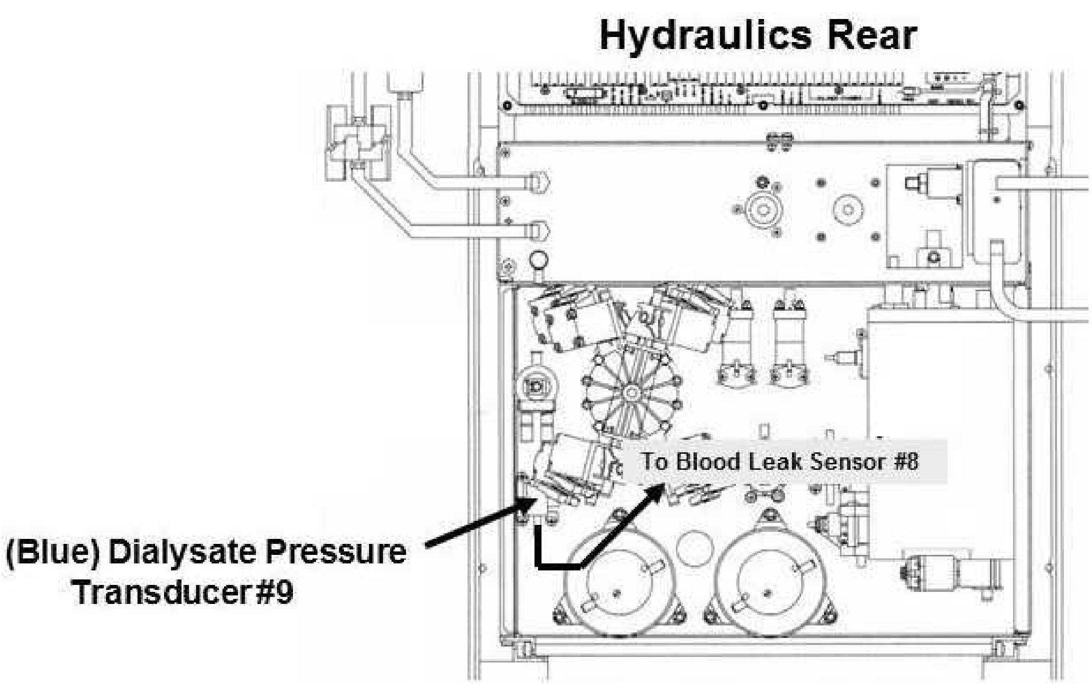
f) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

g) **Read before performing!** Repeat (ABOVE) procedure number F- 12.0.0 (**page 115**). If (and ONLY if) you return to F- 12.4.0, because "Operator Error" reoccurs, swap the listed components (see Component List below), one at a time, and in between repeating procedure number F- 12.0.0 (**page 115**) until "Operator Error" does not reoccur indicating the last component swapped in is bad!

**Component List:**

**1)** Dialysate Pressure Transducer #9*****; **2)** Sensor Board; **3)** Actuator-Test Board; **4)** Functional Board; **5)** Sensor Board cable; **6)** Distribution board.

***** To LOCATE Transducer #9 see Figure below

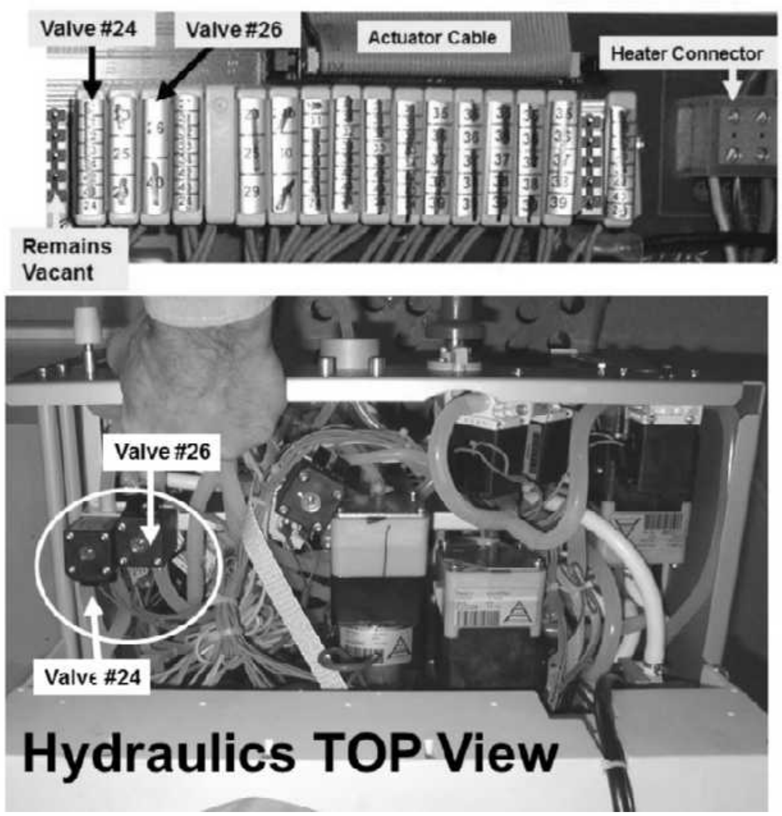


## F- 13.0.0 'BOB' IS MOVING WHEN IT'S NOT SUPPOSED TO

The **Temperature** AND / OR the **Conductivity** window is REMAINING RED BUT the external flow indicator's bob is moving!

a) Per the Figure BELOW, trace the wires from Valve #24's AND #26's distribution board connectors, to Valve #24 and #26 in the hydraulics to **ENSURE** they are wired to the CORRECT valve!

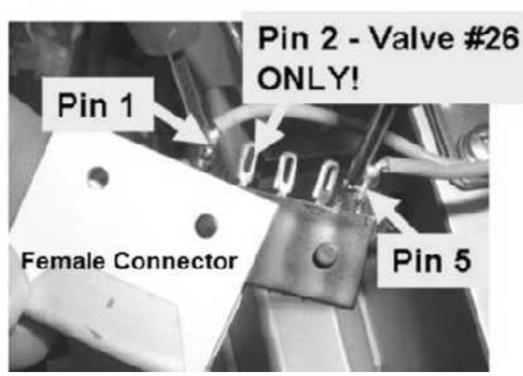
**Distribution Board**




b) Figure left, open the plastic female cover from Valve #26's distribution board connector.

c) Valve #26 wires MUST be soldered between *pins two (second from the top)* AND *five* (bottom). If between the top and bottom pins Valve #26 is probably connected to distribution board position "V24" and vice versa!

d) Return Valve #26's connector to distribution board position "V26".

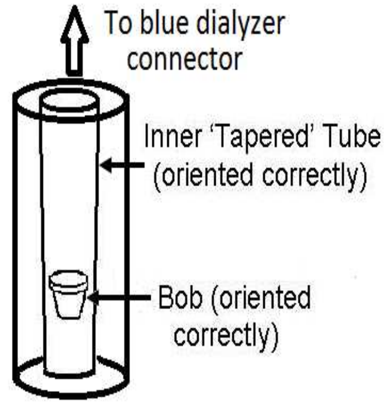



e) ENSURING [Dialysate Flow] is set to 800 ml/min AND is not blinking is the external flow indicator's 'bob' still rising?

Yes 'Bob' moving! TWO (2) possible bad components: **1)** Actuator-Test Board OR; **2)** Valve #24.

No 'Bob' NOT moving! If a Flow Error is still occurring, return to (ABOVE) procedure number F- 6.0.0 (**page 58**). If the Flow Error never occurs do not continue.

## F- 14.0.0 ISOLATE 'OUT OF BYPASS' CIRCUIT




a) Turn the machine OFF!

b) Figure right, ENSURE the flow indicator's INNER Tapered Tube AND its 'bob' is orientated narrow to wide from the bottom up.

c) See procedure number F- 14.0.2 (page 120).

## F- 14.0.2 ISOLATE VALVE #24 / TO DIALYZER CIRCUIT

a) Obtain a 1000 ml graduated cylinder!

b) **Service Mode's Flow Pressure is used to isolate the 'out of bypass' circuit. DO NOT follow the screen instructions! Instead following the procedures below!**

c) Enter Service Mode → Calibrate Hydraulics → Flow Pressure.

d) Press 'Enter' THEN ENSURE the FLOW MOTOR shaft is rotating!

e) Remove the BLUE dialyzer connector from the shunt door and measure from it for one (1) minute.

f) Press 'Enter' to return to "Calibrate Hydraulics"! TWO (2) possible scenarios:

1) **IF (and ONLY if) MORE THAN 800 ml collected!** Valve #24 is okay! See procedure number F- 14.0.4 (page 120).

2) **IF LESS than 800 ml collected!** Bad flow from Valve #24. Proceed to **page 122**, procedure number F- 14.0.6.

## F- 14.0.4 VALVE #24 IS OKAY / ISOLATE VALVE #25 / FROM DIALYZER CIRCUIT

a) Return the BLUE connector to the shunt and close the door.

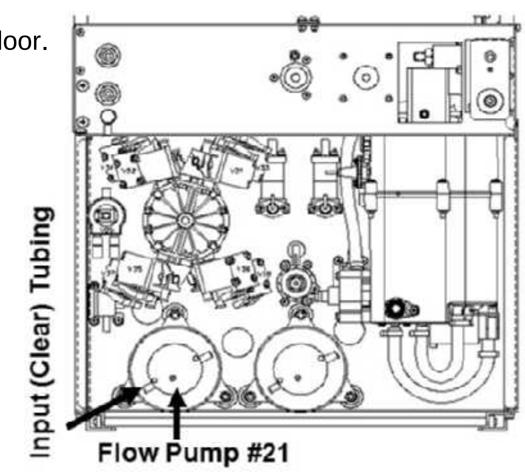
b) Return to Calibrate Hydraulics → Flow Pressure.

c) Press 'Enter' THEN ENSURE the FLOW MOTOR is rotating!

d) Figure right, remove the Flow Pump's clear INPUT tubing and measure from it for one (1) minute.

e) Press 'Enter' to return to "Calibrate Hydraulics"!

f) Reattach the tubing. TWO (2) possible scenarios:




1) **IF (and ONLY if) MORE THAN 800 ml collected!** The 'out of bypass' circuit checks good! See procedure number F- 14.0.5 (page 121).

2) **IF LESS THAN 800 ml collected!** A restriction in the 'from (red) Dialyzer' line is indicated! See parts a THROUGH c next page:

a) ENSURE no tubing restrictions at the DiaSafe® filter.

b) Per the Figure below, open Dialysate Filter #73's housing and ENSURE the filter inside is clean!

c) Per the Figure below, touch Valve #25's black solenoid. Is it warm?

Yes The solenoid is warm! TWO (2) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Valve #25

No The solenoid is NOT warm! **NOTE ONLY VALVE #25** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

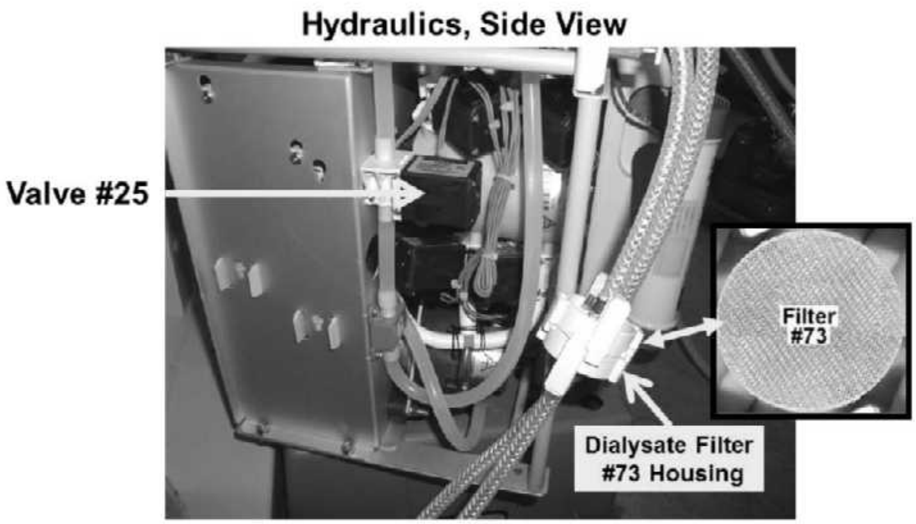



**Figure 23 – Filter #73 / Valve #25**

## F- 14.0.5 OUT OF BYPASS CIRCUIT IS OKAY

a) Turn the machine OFF!

b) Turn the machine on and return to Dialysis Program with [Dialysate Flow] set to 800 ml/min.

c) Open the shunt door and, if present, reset a TMP alarm up to twice before continuing.

d) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for five (5) miinutes or until it EVER = 897 or more. THREE (3) possible scenarios 1) or 2) or 3) below:


1) **IF BC SWITCH always = 897 or more:** Return to **page 38**, procedure number F- 2.0.0.

2) **IF BC SWITCH = 897 or more intermittently OR if a previously observed Flow Error was occuring very intermittently:** Return to **page 48,** procedure number F- 3.0.0.

3) **IF BC SWITCH NEVER = 897 or more:** The Troubleshooting Guide cannot locate a Flow problem at this time.

**F- 14.0.6 BAD FLOW FROM VALVE #24 / ISOLATE VALVE #26**

a) **Per the Figure below**, clamp Valve #26's INPUT tubing!

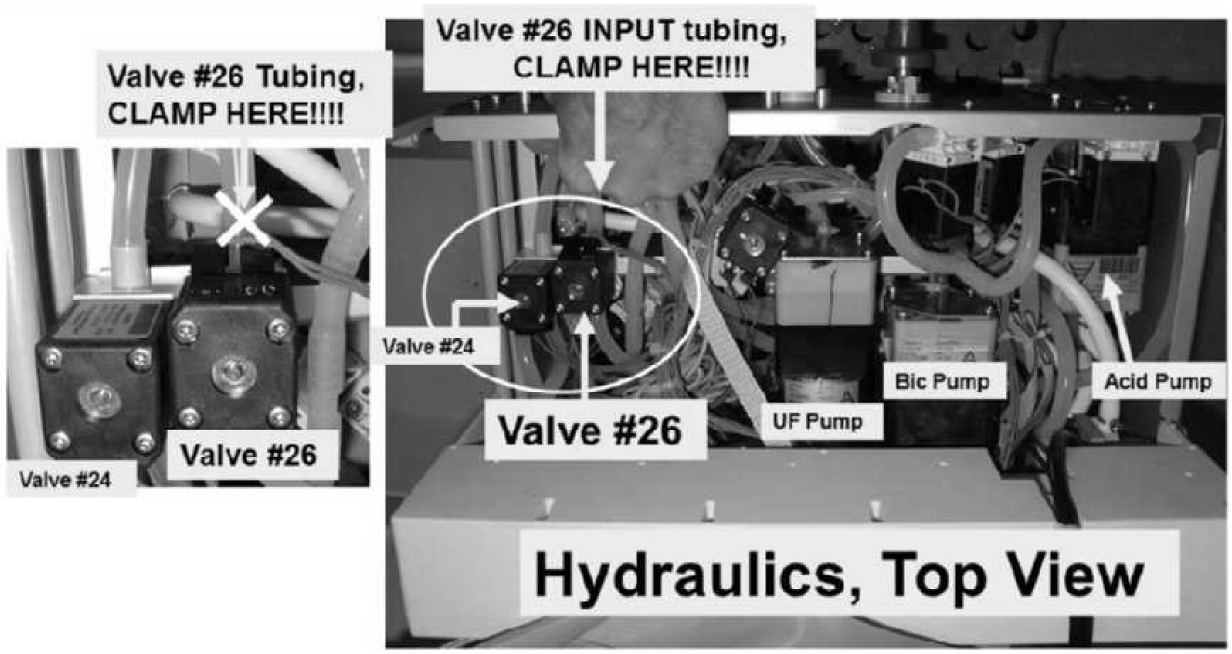



**Figure 24 – Valve #26**

b) Return to Calibrate Hydraulics → Flow Pressure.

c) Press 'Enter' THEN ENSURE the Flow Motor is rotating!

d) Measure again from the blue dialyzer connector for one (1) minute.

e) Press 'Enter' to return to "Calibrate Hydraulics". More than 800 ml collected (Yes or No)?

Yes More than 800 ml collected! Return the connector to the door. Valve #26 is sticking open. Return to procedure number F- 14.0.2 (page 120) to confirm this HOWEVER, if you return here: TWO (2) possible bad components: **1)** Actuator-Test Board OR **2)** Valve #26.

No Less that 800 ml collected! Valve #26 is okay! See procedure number F- 14.0.8 (page 123).

F- 14.0.8 VALVE #26 OKAY

a) **Remove the clamp from Valve #26!**

b) Obtain a bucket!

c) **Per the Figure below**, remove the tubing from Valve #24's INPUT and direct into the bucket

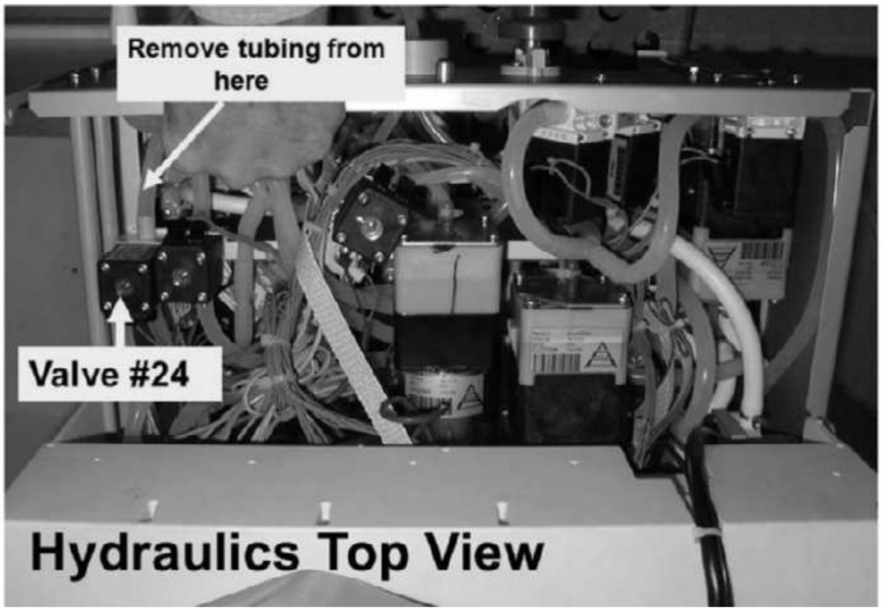



**Figure 25 – Valve #24**

d) From Calibrate Hydraulics → Flow Pressure.

e) Press 'Enter' THEN ENSURE the Flow Motor is rotating!

f) Measure from Valve #24's tubing for one (1) minute!

g) Press 'Enter' to return to "Calibrate Hydraulics". More than 800 ml collected?

Yes More than 800 ml! See procedure number F- 14.0.81 (page 123).

No **A)** Reconnect Valve #24's tubing. **B)** TWO (2) possible bad components: **1)** Restricted DiaSafe© filter OR **2)** Restricted tubing inside the DiaSafe© housing.

F- 14.0.81 GOOD FLOW FROM VALVE #24'S / ISOLATE ACTUATOR-TEST BOARD / VALVE #24

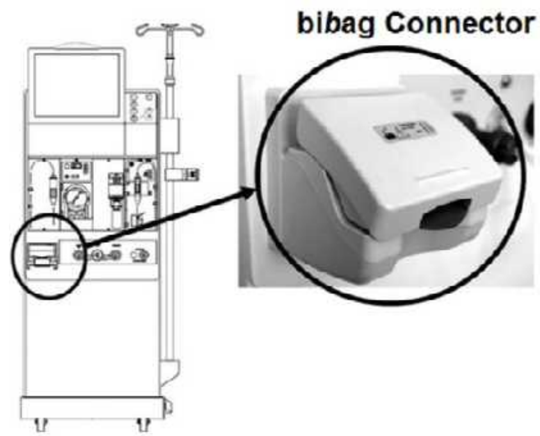
a) Reconnect Valve #24's tubing.

b) Per the Figure above, touch valve 24's (black) solenoid. Is it warm (i.e. energized)?

Yes Solenoid is warm! TWO (2) possible bad components: **1)** Actuator-Test Board; **2)** Valve #24.

No Solenoid in NOT warm! **NOTE** **ONLY** VALVE #24 will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.

## F- 15.0.0 ISOLATE DEAERATION MOTOR RATE (DEAP)




A) Turn the Heater Switch OFF for now!

B) Figure right, if equipped with a bi*b*ag Connector see part C. If NOT skip to part D.

C) Call debug screen 14 to see BOTH **Val1 Err** AND **Val2 Err** (2nd row from bottom). TWO (2) possible scenarios:

**1)** **IF (and ONLY if) BOTH Val1 Err AND Val2 Err = 0:** See part D.

**2)** **IF Val1 Err OR Val2 Err = 1:** Proceed to **page 727.** SECTION 29 – BIBAG: VALVE 1 OR 2 ERROR

D) Call debug screen 1 to see **DEAP** (upper right). TWO (2) possible scenarios:


**1)** **IF (and ONLY if) DEAP = 75 OR LESS!** See procedure number F- 15.2.0 (page 125).

**2)** **IF DEAP = 76 OR more:** Perform parts a THROUGH h below:

a) Enter Service Mode → Calibrate Hydraulics → Deaeration Pressure. **DO NOT follow the screen instructions! See part b instead!**

b) Press ‘Enter’. The screen’s **[Pump Rate]** window turns yellow.

c) Press the **[Pump Rate]** window to turn it bright yellow.

d) Set **[Pump Rate]** to “210”!

e) Press ‘Enter’ TWICE to save the calibration!

f) Turn the machine OFF!

g) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

h) Call debug screen 1. Is **DEAP** now = 45?


Yes **DEAP** = 45! See procedure number F- 15.2.0 (page 125).

No **DEAP** NOT = 45! CAREFULLY repeat the Deaeration Pressure calibration, from part a, but if (and ONLY if) after repeating **DEAP** STILL does not = 45, THREE (3) possible bad components: **1)** Actuator-Test Board OR; **2)** Functional Board EEPROM (IC2) OR; **3)** Functional Board.

## F- 15.2.0 DEAP LESS THAN OR = 75 / ISOLATE DEAERATION MOTOR

Per the Figure below, is the DEAERATION MOTOR shaft rotating COUNTERCLOCKWISE (CCW)?

Yes Rotating CCW! See procedure number F- 15.2.1 (page 125).

No IS NOT rotating CCW! **NOTE** **ONLY** the DEAERATION MOTOR will be checked then proceed to **page 141**, TROUBLESHOOTING MOTORS.

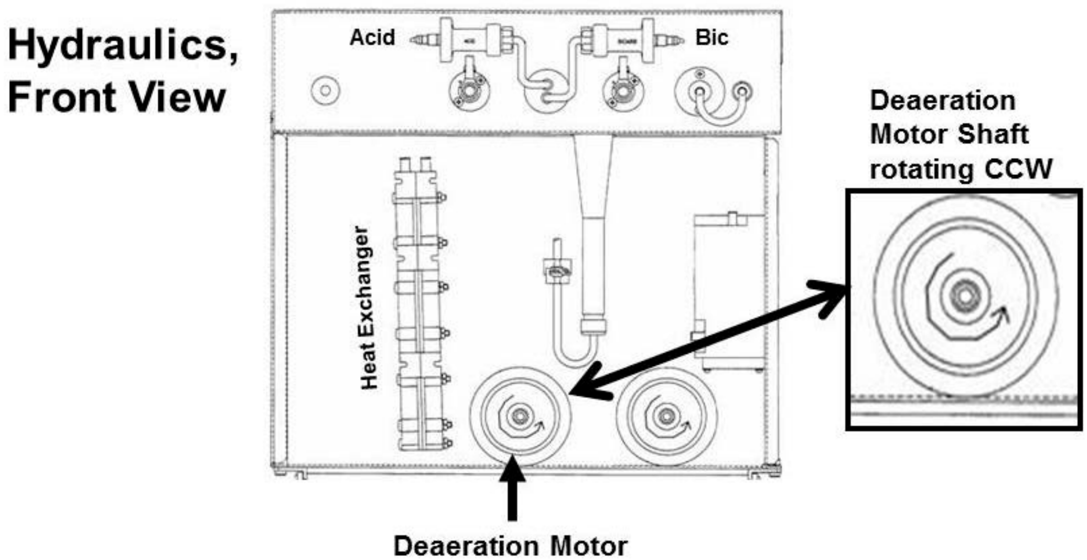



**Figure 26 – Deaeration Motor Rotating CCW**

## F- 15.2.1 DEAERATION MOTOR ROTATING CCW

Using the handle end* of a screwdriver, push HARD on and release the DEAERATION MOTOR'S shaft several times. Can you make it stop rotating and REMAIN stopped?

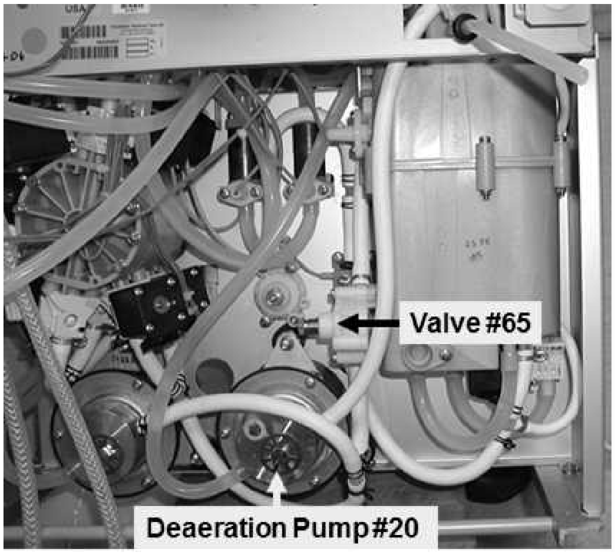
Yes If SURE the motor stops! TWO (2) possible bad components: **1)** Deaeration Motor (possibly brushes) OR; **2)** Deaeration Pump head.

No Motor continues to rotate! See procedure number F- 15.2.2 (page 126).

**F- 15.2.2 MOTOR CONTINUES TO ROTATE**

Recheck Loading Pressure (Rinse Port gauge). TWO (2) possible scenarios below:

**1)** **IF (and ONLY if) REMAINING LESS THAN 15 psi:** See procedure number F- 15.2.3 (page 127).




**2)** **IF peaking to at least 15 psi:** NOTING how many turns, turn Loading Pressure Valve #65's nut (Figure right) CLOCKWISE (inward) until if pressure reaches a PEAK of between 23 and 25 psi. TWO (2) possible scenarios i) or ii) below:

**i)** **IF (and ONLY if) a peak of between 23 and 25 psi CANNOT be achieved:** Return Valve #65's nut to its ORIGINAL location then see procedure number F- 15.2.3 (page 127).

**ii)** **IF between 23 and 25 psi CAN be achieved:** See parts a THROUGH d below:


a) Figure right, if threads are visible see part b. If no threads are visible under Valve #65's nut either the wrong spring is installed* OR Valve #65 is bad.

* Refer to Figure 6 (page 22)

b) From the Home screen, press the [Dialysate Flow] window.

c) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

d) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for five (5) FULL minutes OR until it EVER = 897, or more even if only once?

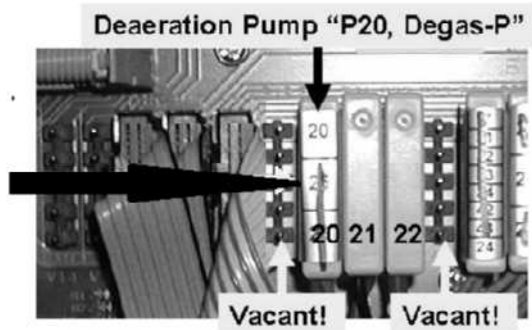

Yes **BC Switch** goes to 897 or more! Return to **page 38**, procedure number F- 2.0.0.

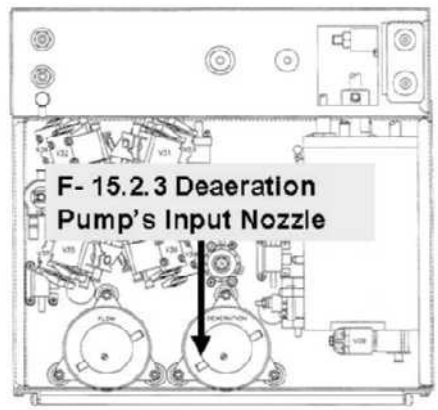
No **BC Switch** NEVER = 897 or more! See parts a AND b below:

a) Turn the Heater Switch on!

b) Check Deaeration Pressure per the Preventative Maintenance Procedures booklet.

## F- 15.2.3 LOW LOADING PRESSURE / ISOLATE POSSIBLE AIR LOCK




a) **Obtain a <u>1000 ml</u> graduated cylinder <u>and</u> the white drip bucket!**

b) Unplug the Bicarb (blue) connector from the jug and allow it to hang. **<u>DO NOT</u> plug the connector into its rinse port!**

c) Figure right, unplug the DEAERATION PUMP'S connector from distribution board position "P20-Degas-P!

d) Figure right, remove the <u>clear tubing</u> from the Deaeration Pump's INPUT nozzle. **Keep the tubing at pump level to encourage gravity flow!**

e) The tubing is from hydrochamber D. If ANY FLOW from it direct it into the bucket for <u>TWO (2) minutes</u> BEFORE continuing to part f.

f) Now direct the tubing into the cylinder for ONE (1) minute. MORE THAN one hundred thirty (130) ml collected?

Yes More than 130 ml! No airlock! See procedure number F- 15.2.4 (page 127).

No Less than 130 ml! There may be an airlock between hydrochamber C and the pump. Leaving the tubing off and the pump unplugged, proceed to **page 132**, procedure number F- 16.0.0.

## F- 15.2.4 MORE THAN 130 ML PER MINUTE COLLECTED

a) **Reattach the Deaeration Pump's tubing!**

b) Reconnect to Bicarb!

c) Return the Deaeration Pump's connector to distribution board position P20, "Degas-P".

d) **ENSURE the DEAERATION MOTOR is running!**

e) TWO (2) possible scenarios:

**1) IF equipped with a bi*bag* Connector:** See procedure number F- 15.3.0 (page 128).

**2) IF <u>NOT</u> equipped with a bi*bag* Connector:** Proceed to **page 130**, procedure number F- 15.5.0.

## F- 15.3.0 BI*B*AG CONNECTOR EQUIPPED

Figure right, open the bi*b*ag Connector door. Flow (more than 10 ml per minute) from one of the nozzles?

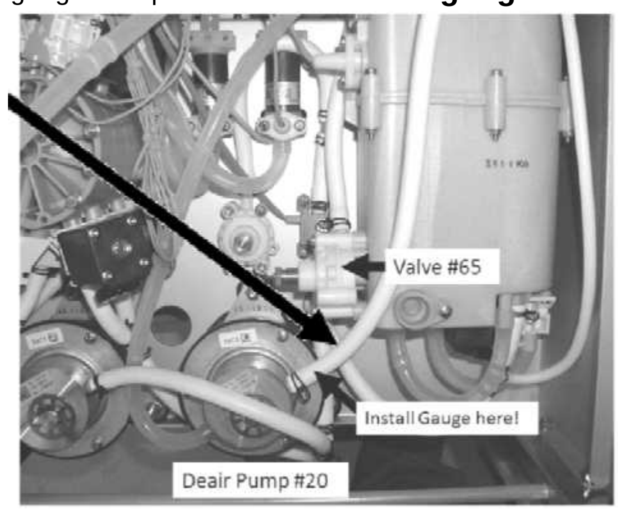

Yes Flow from a nozzle! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C, page 11) OR; **2)** Bad Valve #100***** OR; **3)** Bad bi*b*ag Interface board.

* To LOCATE Valve #100 refer to Figure 3 (page 5)

No flow Close the bi*b*ag door FULLY then see procedure number F- 15.3.2 (page 128).

## F- 15.3.2 NO FLOW FROM EITHER BI*B*AG NOZZLE

a) Leaving the gauge in the Rinse port, a second psi gauge is required. **ENSURE this gauge reads zero (0) psi BEFORE installing it.**




b) Turn the machine OFF!

c) Figure right, tee the gauge into the OUTPUT (white tubing) side of the Deaeration Pump.

d) **To prevent leaks and false readings, tie wrap both sides of the gauge tubing**.

e) See procedure number F- 15.3.4 (page 128).

## F- 15.3.4 ISOLATE LOADING PRESSURE

a) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

b) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘Enter’.

c) **Reading the gauge at the Deaeration Pump**, TWO (2) possible scenarios below:

**1)** **IF (and ONLY if) peaking to MORE than 26 psi:** Turn Valve #65’s nut (Figure above) counterclockwise (outward) to decrease pressure. If (and ONLY if) between 23 and 25 psi can be achieved see procedure number F- 15.3.6 (page 129). If between 23 and 25 psi CANNOT be achieved Valve #65 may be bad.

**2)** **ALL OTHER scenarios:** Turning Valve #65’s nut (Figure above) clockwise (inward), can you bring peak pressure to between 23 and 25 psi?

Yes Between 23 and 25 psi! See procedure number **F- 15.3.6** (page 129).

No Pressure remains lower than 23 psi! ENSURING no leaks, see parts a AND b next page:

**Loading Pressure remains lower than 23 psi continued:**

a) ENSURE more than 130 ml flow per minute to the Deaeration Pump (i.e. no airlock)!

b) If SURE of no air lock, proceed to **page 130**, procedure number F- 15.5.0.

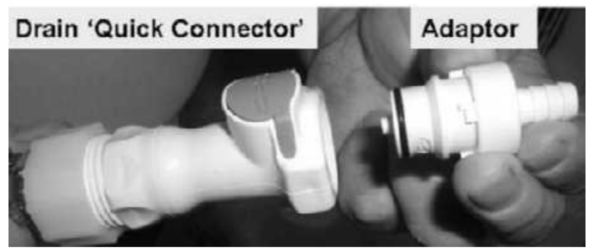
## F- 15.3.6 LOADING PRESSURE BETWEEN 23 AND 25 PSI

Compare the gauge reading at the Deaeration Pump to the gauge reading in the RINSE port. Are they within three (3) psi of each other?

Yes BOTH gauges within three (3) psi of each other! See procedure number F- 15.3.8 (page 129).

No Pressure at the RINSE port gauge is way less than pressure at the Deaeration Pump gauge! See parts a THROUGH c below:

a) At the end of the 'to drain' tubing, if a 'Quick Connector' (Figure right) is present, an ADAPTOR is required!




b) ENSURING [Dialysate Flow] is set to 800 ml/min, measure flow from the drain tubing, into a 1000 ml graduated cylinder, for ONE (1) MINUTE!

c) Drain flow more than 720 ml per minute?

Yes More than 720 ml per minute! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C, page 11)) OR; **2)** Bad Valve #108***** OR; **3)** Bad bi*b*ag Interface Board.

* To LOCATE Valve #108 refer to Figure 3 (page 5)

No Way less than 720 ml per minute! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C, page 11)) OR; **2)** Bad Valve #103***** OR; **3)** Bad bi*b*ag Interface Board.

* To LOCATE Valve #103 refer to Figure 3 (page 5)

## F- 15.3.8 BOTH GAUGES IN RANGE

Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for five (5) minutes OR until it EVER = 897 or more, even if only once. TWO (2) possible scenarios below:


1) **IF BC Switch EVER = 897 or more, even if only once:** Return to **page 38**, procedure number F- 2.0.0.

2) **IF BC Switch NEVER = 897 or more:** Turn the Heater Switch on THEN check Deaeration Pressure***** per the Preventative Maintenance Procedures booklet.

## F- 15.5.0 ISOLATE BETWEEN THE DEAERATON PUMP AND VALVE #65

a) **WARNING! Using a plastic clamp in part b will cause error! Use METAL NEEDLE NOSE PLIERS instead!**

b) **Per Figure 27 (below)**, using NEEDLE NOSE PLIERS, AND WHILE WATCHING THE GAUGE, clamp then QUICKLY release the white tubing at the TOP of Loading Pressure Valve #65!

c) When clamped, does gauge pressure PEAK to 35 psi OR more?

Yes Peaks to 35 psi or more! The Deaeration Pump is okay! TWO (2) possible bad components: **1)** Bad Loading Pressure Valve #65 OR; **2)** Bad Hydrochamber.

No Did NOT peak to at least 35 psi! See procedure number F- 15.5.2 (page 131).

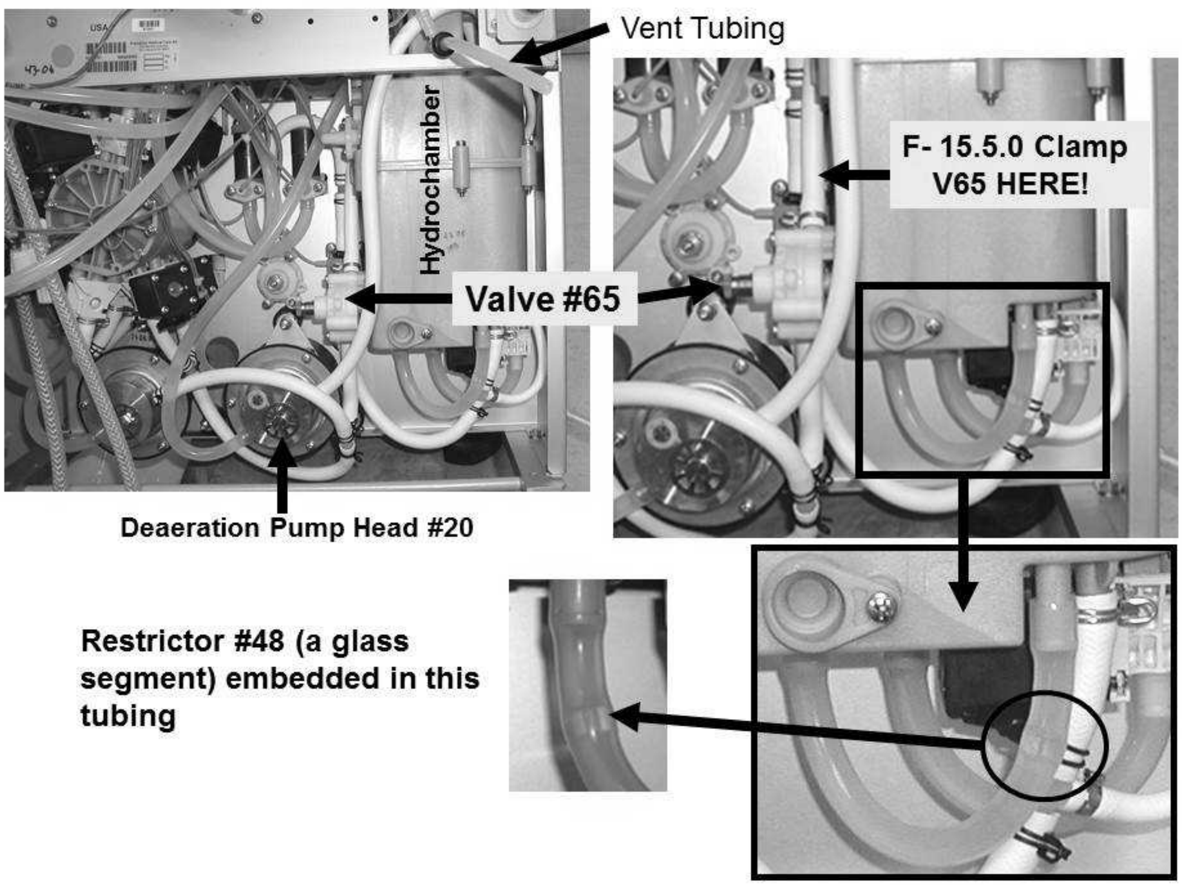
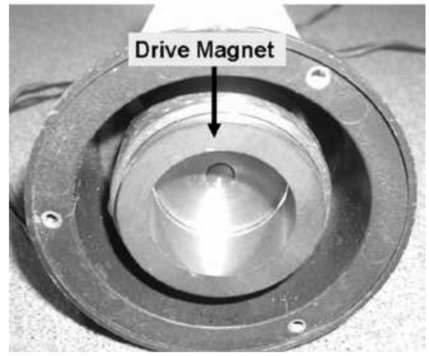



**Figure 27 – Hydrochamber / Valve #65 / Restrictor #48**

**F- 15.5.2 ISOLATE 'BINDING' DEAERATION MOTOR**




a) Turn the machine OFF!

b) Per the Figure right, remove the pump head from the deaeration motor to expose the 'Drive Magnet'.

c) Manually spin the 'Drive Magnet'. Does it rotate freely (Yes or No)?

Yes Rotates freely! See parts a AND b below!

a) Ensure the 'Drive Magnet' rotates the motor shaft. It may be uncoupled!

b) TWO (2) possible bad components: **1)** Bad Deaeration Pump head OR; **2)** Bad Deaeration motor.

No The magnet DOES NOT rotate freely! The motor is bad! **NOTE!** The 'binding motor' may have destroyed the Actuator-Test and/or Power Logic Board!

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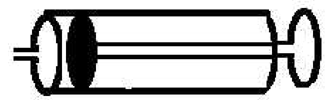
## F- 16.0.0 LESS THAN 150 ML COLLECTED / ISOLATE RESTRICTOR #48

This procedure attempts to clear an air lock. First Restrictor #48 is checked to see if it is plugged!

a) A **60 ml syringe**, with the plunger pushed all THE WAY IN, is REQUIRED! Using a smaller syringe may cause error!

60 ml Syringe with plunger all the way in



b) Figure right, attach the syringe, to the DEAERATION PUMP's **clear tubing** removed earlier.

c) PULL on the plunger to the end of the barrel! If Restrictor #48 is plugged you will feel very strong resistance and may not be able to pull the plunger all the way out. Very strong resistance (Yes or No)?

Yes — Strong resistance! Restrictor #48 is plugged with debris[1]. Replace the tubing segment that contains Restrictor #48. To LOCATE Restrictor #48 refer to Figure 27 (page 130)!

[1] Debris indicates FIVE (5) possibilities: **1)** Inadequate acid cleaning (white bicarbonate precipitate) OR; **2)** Excessive O-ring lubrication OR; **3)** Inadequately filtered incoming water OR; **4)** Degrading Deaeration Pump Head OR; **5)** Degrading Heater element.

No — Very little resistance! Restrictor #48 is open! Perform parts A THROUGH E below:

A) Remove the syringe and MEASURE flow from the tubing for one (1) minute. If less than 130 ml see part B. If (and ONLY if) more than 130 ml see procedure number F- 16.0.1 (page 132).

B) Push the plunger fully back into the syringe barrel.

C) Reattach the syringe to the Deaeration Pump's input tubing.

D) Pull the plunger to the end of the barrel!

E) Repeat parts A through E up to **TEN (10) TIMES** OR until if more than 130 ml every minute is MEASURED?

Yes — If SURE of more than 130 ml every minute! See procedure number F- 16.0.1 (page 132).

No — After ten (10) attempts you CANNOT get more than 130 ml every minute! Proceed to **page 133**, procedure number F- 16.0.5.

## F- 16.0.1 MORE THAN 130 ML COLLECTED / DOES IT CONTINUE?

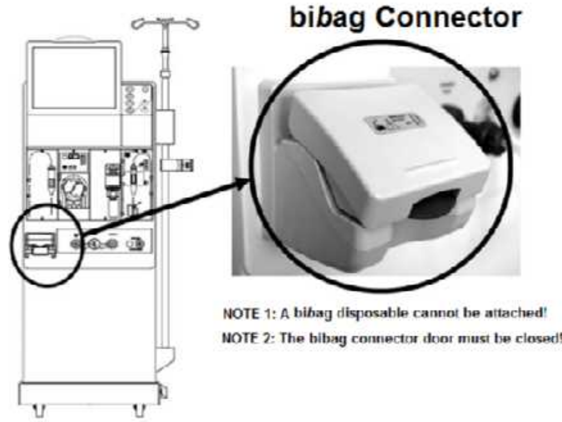
Direct the tubing into the bucket for FIVE (5) FULL minutes. Flow will either: **1)** Continue at more than 130 ml every minute (if float switch #5 is good) OR **2)** Stop. TWO (2) possible scenarios:

**1) IF (and ONLY if) flow continues at more than 130 ml every minute:** The air lock has been eliminated! Proceed to **page 136**, procedure number F- 16.2.0.

**2) IF flow STOPS:** Proceed to **page 134**, procedure number F- 16.0.7.

## F- 16.0.5 LESS THAN 130 ML

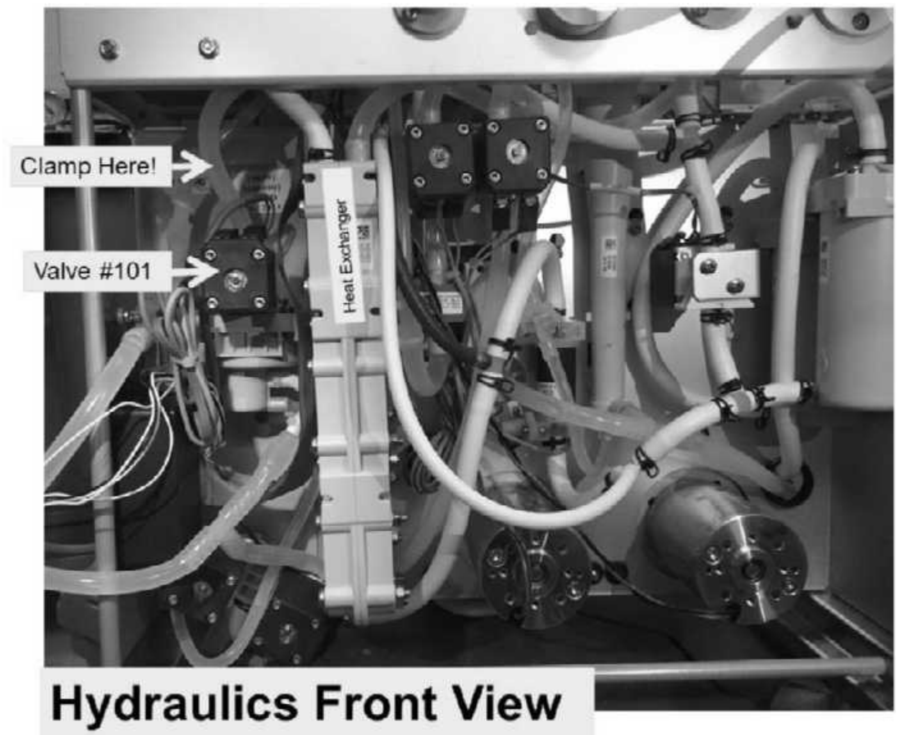
Figure right, TWO (2) possible scenarios:




1) **IF (and <u>ONLY</u> if) <u>NOT</u> equipped with a bi*bag* Connector:** See procedure number F- 16.0.7 (page 134).

2) **IF equipped with a bi*bag* Connector:** See parts a THROUGH e below:

   a) Per the **Figure below**, clamp the tubing attached at the top Valve #101.




   b) With the plunger pushed fully in, once again, attach the syringe to the Deaeration Pump's CLEAR tubing.

   c) Pull the plunger to the end of the barrel then remove the syringe.

   d) MEASURE flow from the tubing looking for more than 130 ml every minute!

   e) Repeat parts b through e up to **<u>TEN (10) TIMES</u>** . Do you EVER get than 130 ml every minute?

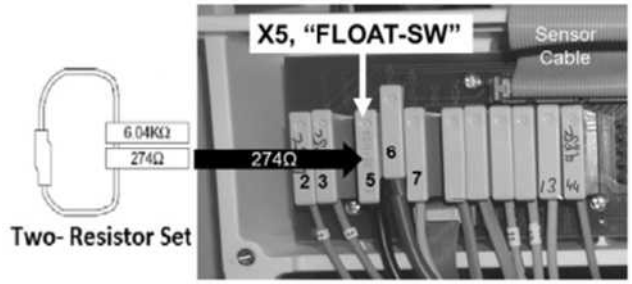
      Yes  IF SURE of more than 130 ml per minute! Remove the clamp from Valve #101! THREE (3) possible problems: **1)** Loose bi*bag* Interface Board ribbon cable (refer to Figure 4C, page 11)) OR; **2)** Bad Valve #101 OR; **3)** Bad bi*bag* Interface Board.

      No  After ten (10) attempts you DO NOT measure more than 130 ml per minute! Remove the clamp from Valve #101 then see procedure number F- 16.0.7 (page 134).

## F- 16.0.7 LESS THAN 130 ML PER MINUTE COLLECTED / ISOLATE INCOMING WATER

a) Figure right, place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into the float's distribution board position, "X5, FLOAT-SW".

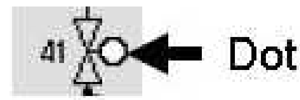
b) Allow forty (40) seconds or until flow from the Vent Tubing occurs indicating hydrochambers A through C are full!




c) MEASURE flow from the Vent Tubing for ONE (1) minute. More than eight hundred (800) ml collected?

Yes More than 800 ml per minute! See procedure number F- 16.0.8 (page 134).

No Less than 800 ml! Call debug screen 0. Figure right, is Valve #41's 'dot' BLUE?




Yes 'Dot'= Blue! **A)** Reattach the Deaeration Pump's input tubing; **B)** Proceed to **page 152**, SECTION 2 – NO WATER ALARM!

No 'Dot' = White'! See parts a AND b below

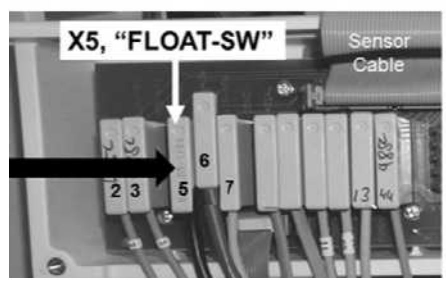
a) BE VERY SURE the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, is placed PROPERLY at distribution board position "FLOAT-SW"! If not, repeat (ABOVE) procedure number F- 16.0.7 (page 134).

b) FIVE (5) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Sensor Board cable OR **3)** Bad Sensor Board OR; **4)** Bad distribution board OR; **5)** Bad motherboard.

## F- 16.0.8 MORE THAN 800 ML / ISOLATE AIR LOCK

a) Figure right, avoiding the VACANT position on the left, return the float's connector to distribution board position, "X5, FLOAT-SW"!

b) Once again, attach the **60 ml syringe** , with its plunger pushed in fully, to the Deaeration Pump's CLEAR (Input) tubing.




c) PULL on the plunger! If Restrictor #48 is still open there is very little resistance and you will be able to pull the plunger to the end of the barrel.

d) Remove the syringe and MEASURE flow from the tubing for one (1) minute. If NOT more than 130 ml repeat parts b through d up to **TEN (10) TIMES**!

e) After no less than ten (10) attempts are you able to achieve more than 130 ml every minute?

Yes More than 130 ml every minute! See procedure number F- 16.0.9 (page 135).

No Cannot achieve more than 130 ml per minute! TWO (2) possible bad components: **1)** Bad Float Switch* OR; **2)** Bad hydrochamber.

* To LOCATE the Float Switch refer to Figure 28 (page 140)

## F- 16.0.9 MORE THAN 130 ML PER MINUTE / ISOLATE FLOAT SWITCH #5

a) This procedure requires up to **five (5) FULL minutes** to prevent labor-intensive error!

b) Direct the tubing into a bucket for up to **five (5) minutes**. It will either: **1)** Continue at more than 130 ml every minute OR **2)** Stop.

**1)** **IF (and ONLY if) flow continues at more than 130 ml every minute!** The float is okay! See procedure number F- 16.2.0 (page 136).

**2)** **IF flow STOPS!** TWO (2) possible bad components: **1)** Bad Float Switch #5[a] OR; **2)** Bad hydrochamber.

[a] To LOCATE Float Switch #5 refer to Figure 28 (page 140)

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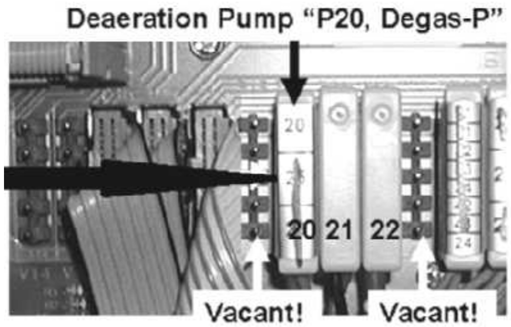
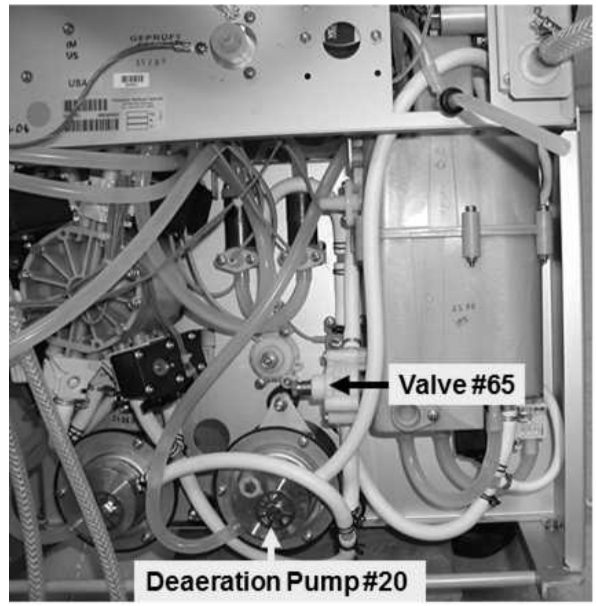
## F- 16.2.0 FLOW DOES NOT STOP




a) **Reattach the Deaeration Pump's input tubing!**

b) FIGURE right, return the Deaeration Pump's connector to position "P20, Degas-P".

c) **<u>ENSURE</u> the Deaeration Motor is running!**




d) Can you adjust Valve #65's nut (Figure right) clockwise (tighter) until PEAK Loading Pressure is between 23 and 25 psi?

Yes Between 23 and 25 psi! See procedure number F- 16.2.1 (page 136).

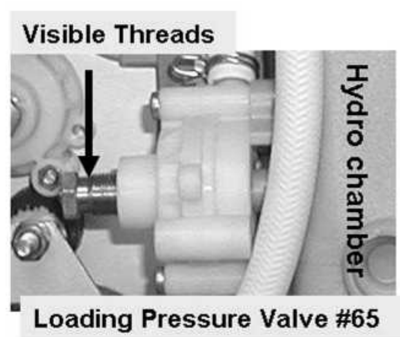
No Pressure remains below 23 psi! See parts a AND b below:

a) ENSURE more than 130 ml per minute to the Deaeration pump (i.e. no reoccurring air lock)!

b) If SURE of no air lock, swap the following components (see <u>Component List</u> below) one at a time attempting to adjust Loading Pressure in between to test each new component.

**<u>COMPONENT LIST (4 components):</u> 1)** Deaeration Pump head; **2)** Deaeration Motor; **3)** Valve #65; 4) Hydrochamber. **NOTE:** After good loading pressure achieved see procedure number F- 16.2.1 (page 136).

## F- 16.2.1 ISOLATE VALVE #65




a) Figure right, several threads should be visible under Valve #65's nut! If threads are visible see part b. If not either the wrong spring is installed under Valve #65's nut* <u>OR</u> Valve #65 is bad!

* Refer to Figure 6 (page 22))

b) From the Home screen, press the [Dialysate Flow] window.

c) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.


d) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for three (3) FULL minutes. If EVER = 897, even just once, indicates a Flow problem. Does it <u>EVER</u> = 897?

Yes **BC Switch** = 897 at least once! Return to (ABOVE) procedure number F- 2.0.0 (**page 38**).

No **BC Switch** is <u>NEVER</u> = 897! Check Deaeration Pressure per the <u>Preventative Maintenance Procedures</u> booklet.

## F- 18.0.0 LOADING PRESSURE CYCLES TO BELOW 11 psi


a) The following is ESPECIALLY IMPORTANT if the machine was worked on by someone who may have connected the BALANCING CHAMBER VALVES (#31 through #38) incorrectly between the distribution board and their solenoid terminals (Figure right).

b) TWO (2) possible scenarios:

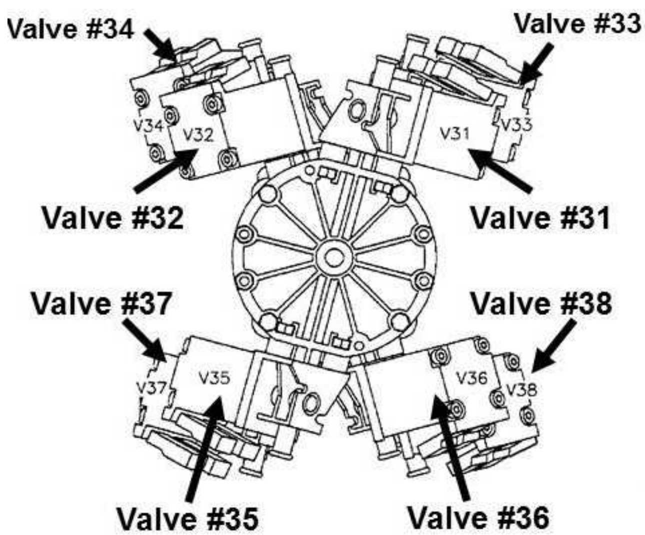
**1)** **IF (and ONLY if) SURE the machine was NOT worked on previously for this Flow problem:** See procedure number F- 18.1.0 (page 138).

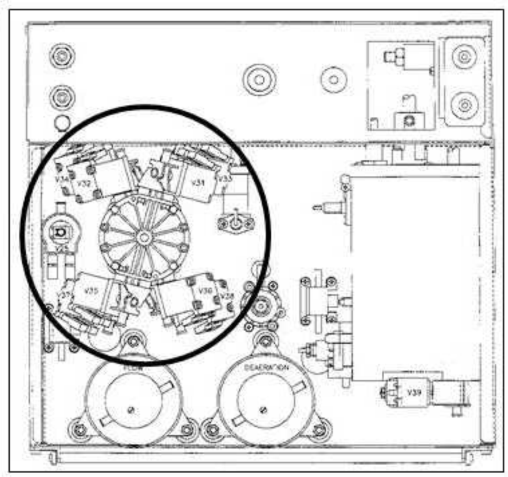
**2)** **IF the machine WAS or MAY have been worked on previously:** See parts a THROUGH c below:

a) Leave the machine in Dialysis Program and **DO NOT** turn Dialysate Flow "OFF"!

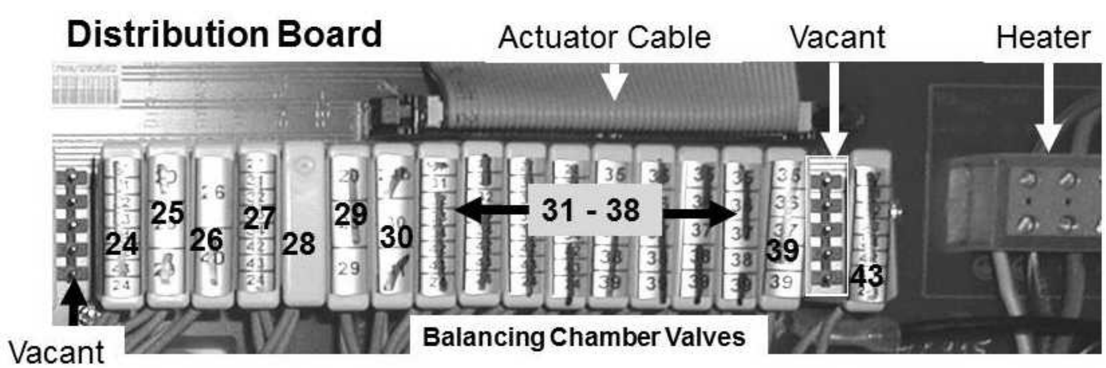
b) Figure below, without unplugging valves, **CAREFULLY** trace the wires from EACH valve to its SPECIFIC distribution board position. **If ANY do NOT terminate properly, at either end, this most likely is the problem!**

c) If (and ONLY if) a wiring error is NOT located see procedure number F- 18.1.0 (page 138).



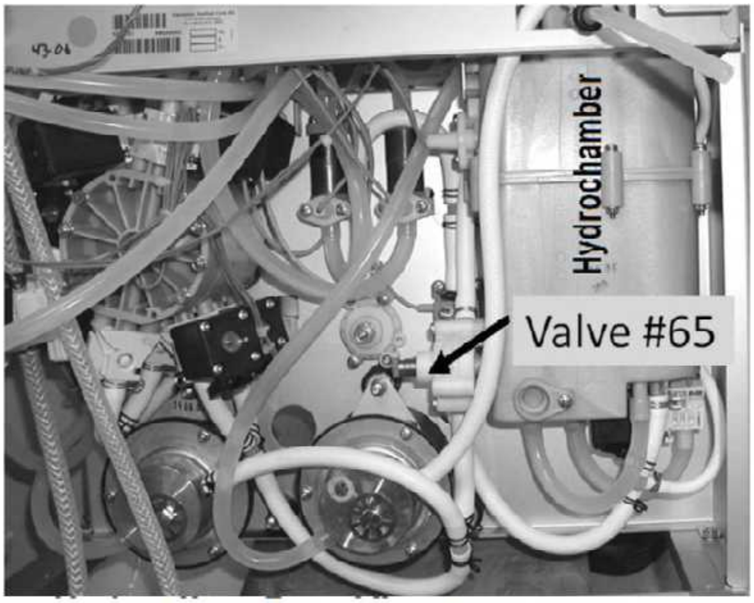



Hydraulics, Rear View



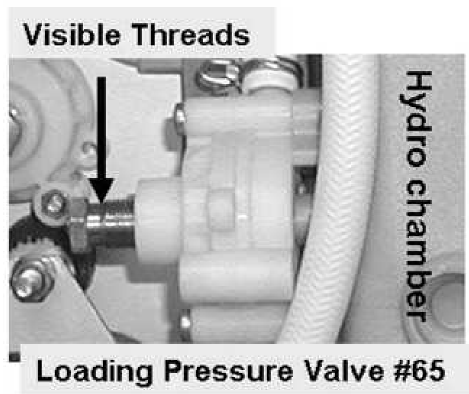
## F- 18.1.0 ISOLATE LOADING PRESSURE VALVE #65

a) Ignoring the MINIMUM pressure for now, if Loading Pressure is NOT achieving a PEAK of somewhere between 23 and 25 psi, adjust Loading Pressure Valve #65's nut (Figure below) until it does.




Hydraulics, Rear View

b) Figure right, if threads are visible under Valve #65's nut see part c. If no threads are visible either the wrong spring is installed* OR Valve #65 is bad. * Refer to Figure 6 (page 22)




Loading Pressure Valve #65

c) From the Home screen, set [Dialysate Flow] to **800 ml/min** and press 'Enter'!

d) TWO (2) possible TMP window scenarios:

**1)** **IF (and ONLY if) the TMP window is white:** See procedure number F- 18.2.0 (page 138).

**2)** **IF the TMP window is RED:** See parts a THROUGH d below**:**

a) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds.

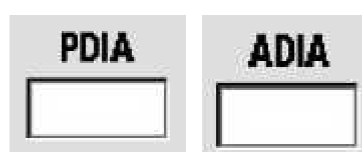
b) Allow thirty (30) seconds.

c) If a TMP alarm reoccurs attempt parts a through c up to twice more BEFORE continuing to part c.

d) Allow thirty (30) seconds BEFORE continuing to procedure number F- 18.2.0 (page 138).

## F- 18.2.0 ISOLATE POSSIBLE LEAKING BALANCING CHAMBER VALVE

Call debug screen 4 to simultaneously watch **PDIA** (left column) AND **ADIA** (right column) or two (2) FULL minutes. They may change slightly but should remain between 2.0 and 8.0. TWO (2) possible scenarios next page:



1) **IF (and ONLY if) PDIA AND ADIA REMAIN between 2.0 and 8.0:** See procedure number F- 19.0.0 (page 139).

2) **IF PDIA OR ADIA does NOT REMAIN between 2.0 and 8.0:** See parts A THROUGH C below:

   A) A procedure in a different Section is performed next. **NOTE** this page and procedure number (F- 18.2.0) because you may be prompted to return here.

   B) BEFORE continuing to part C, proceed to **page 572**, to perform SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

   C) If a leaking balancing chamber valve was NOT located in part B, see procedure number F- 19.0.0 (page 139).

## F- 19.0.0 TROUBLESHOOT BAD LOADING PRESSURE

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

b) The Deaeration motor shaft MUST be rotating COUNTERCLOCKWISE!

c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'!

d) WITHOUT LOOKING AWAY, simultaneously watch for a "No Water" alarm and Loading Pressure for five (5) minutes. Is Loading Pressure now cycling between a low of NEVER LESS THAN 11 psi and a PEAK of somewhere between 23 and 27 psi (Yes or No)?

   Yes — Between 23 and 27 psi! Assuming a Flow Error does not occur perform an acid clean! If (and ONLY if) the Loading Pressure problem reoccurs in the near future see procedure number F- 19.1.0 (page 139).

   No — Cycles to less than 23 psi! See procedure number F- 19.1.0 (page 139).

## F- 19.1.0 PRESSURE TEST HYDROCHAMBER

a) A procedure, in a different Section, is performed next. **IMPORTANT! NOTE** this page and procedure number (F- 19.1.0) as you may prompted to return to here.

b) BEFORE continuing to part c, proceed to **page 150** to perform PRESSURE TEST HYDROCHAMBER.

c) If the Hydrochamber leak was not located in part b return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) The Deaeration motor shaft MUST be rotating COUNTERCLOCKWISE!

e) WITHOUT LOOKING AWAY simultaneously watch for a "No Water" alarm AND Loading Pressure, for five (5) minutes. Is Loading Pressure now cycling to a PEAK of somewhere between 23 and 27 psi (Yes or No)?

Yes Peak between 23 and 27 psi! Call debug screen 0 to watch **Flow Error** for three (3) minutes. If it remains = 0 perform an ACID CLEAN. If (and ONLY if) the Loading Pressure problem reoccurs in the near future FIVE (intermittent) possible bad components (see Component List below). Swap in each, one at a time, and in between check if loading pressure of between 23 and 27 psi can be achieved.

No NOT between 23 and 27 psi! FIVE (5) possible bad components (see Component List below). Swap in each, one at a time, and in between, check if Loading Pressure PEAKING to between 23 and 27 psi can be achieved indicating the last component swapped in is the problem.

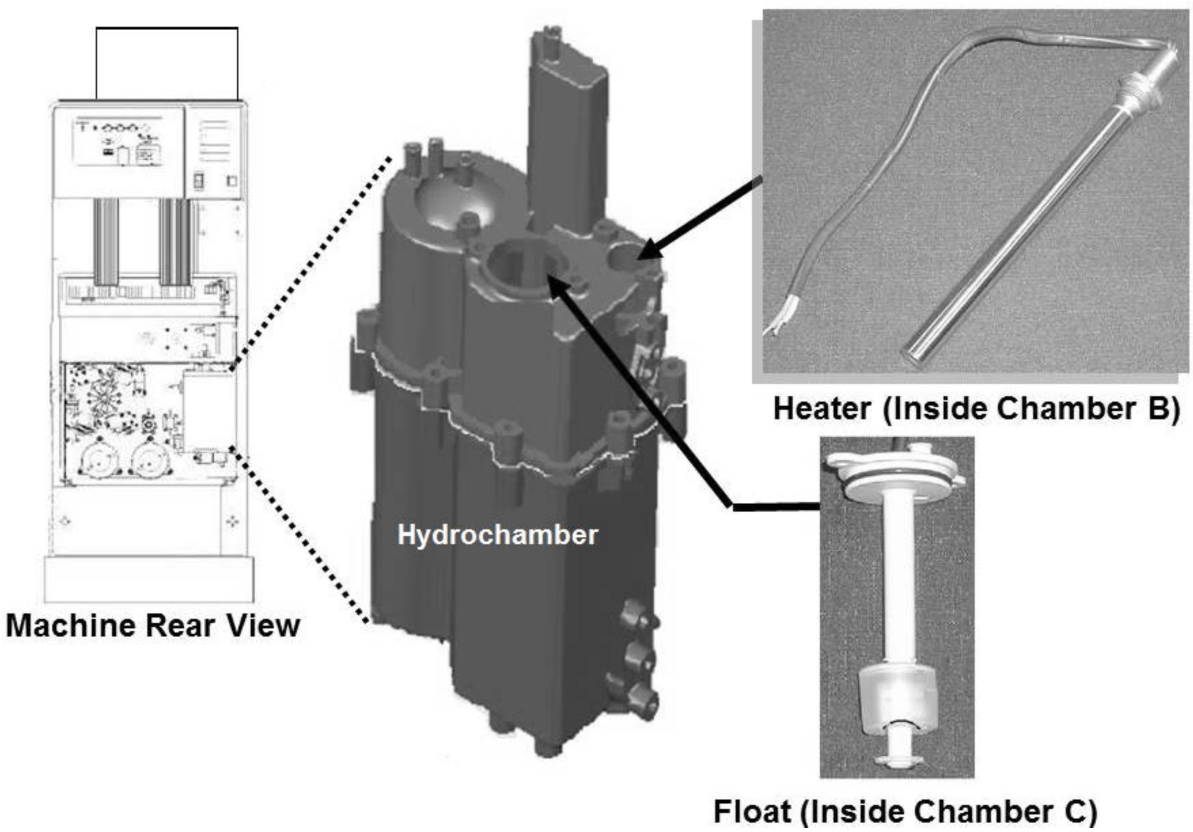
**COMPONENT LIST:**

**1)** Deaeration Pump head*****; **2)** Deaeration Pump motor*****; **3**) Loading Pressure Valve #65******;
**4)** Float switch (see Figure below); **5)** Hydrochamber (see Figure below).

* To LOCATE these components refer to Figure 6 (page 22)

** Attempt to calibrate the new Valve #65 to achieve a peak loading pressure of between 23 and 25 psi

### Figure 28 – Hydrochamber / Float Switch #5 / Heater



# TROUBLESHOOTING MOTORS

## MOTORS- 1.0.0 MOTOR TROUBLESHOOTING

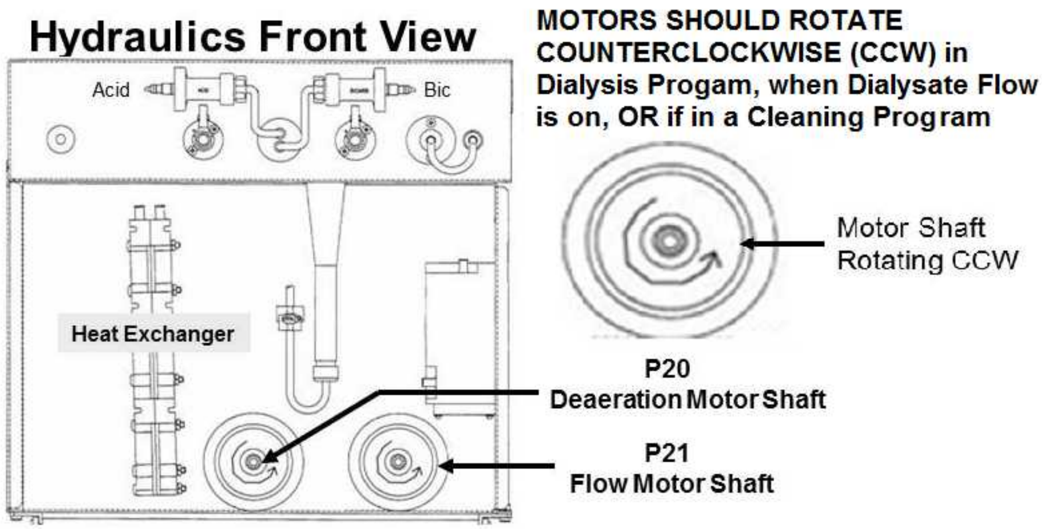
A) The procedure that directed had you **NOTE** which motor (**Deaeration** OR **Flow**) is to be checked. **CHECK ONLY this motor!**

B) Per the Figure below, the NOTED motor shaft is THREE (3) possible scenarios 1) or 2) or 3) below:

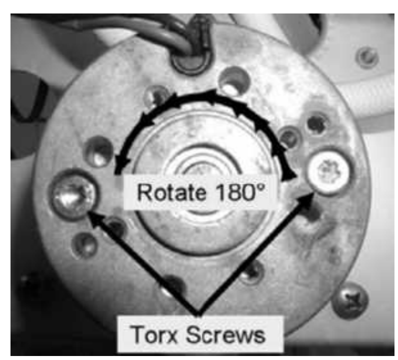
**1)** **IF (and ONLY if) NOT rotating at ALL:** Proceed to **page 144**, procedure number MOTORS- 4.0.0.

**2)** **IF (and ONLY if) rotating CLOCKWISE (i.e. backwards!):** See procedure number MOTORS- 2.0.0 (page 141).

**3)** **IF rotating counterclockwise (CCW):** Proceed to **page 142**, procedure number MOTORS- 3.0.0.




## MOTORS- 2.0.0 MOTOR ROTATING CLOCKWISE (BACKWARDS)




a) **IMPORTANT!** Turn the machine OFF!

b) Per Figure right, remove the Torx screws (T-25) BUT **DO NOT** remove the cap to maintain the brushes in position!

c) Rotate the cap 180° then reinstall the screws and tighten them.

d) Return to the Program (Dialysis or Cleaning / Disinfection) that originally brought you to TROUBLESHOOTING MOTORS!

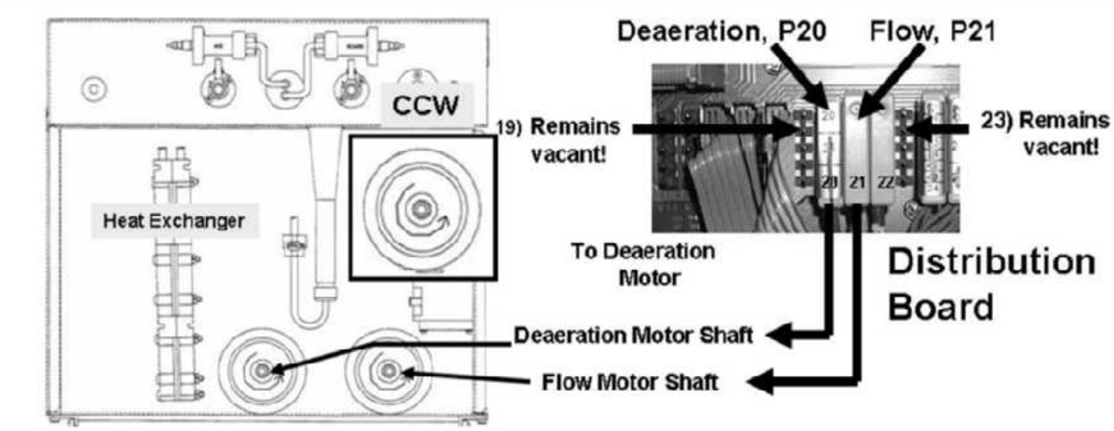
e) Is the motor rotating counterclockwise (CCW) now?

Yes Rotating CCW! Place the machine into Rinse for several minutes to eliminate a potential air lock.

No NOT rotating CCW! Return to (ABOVE) procedure number MOTORS- 1.0.0 (page 141).

**MOTORS- 3.0.0 MOTOR ROTATING COUNTERCLOCKWISE (CCW)**

a) Per the Figure below, to ENSURE a proper distribution board connection, trace the wires from the motor to the Distribution Board. Deaeration Pump → Distribution Board position “P20”; Flow Pump → Distribution Board position “P21”.




b) Per the Figure below, to ENSURE the pump head is oriented correctly, the ‘ID Decal’, MUST be either on the TOP <u>OR</u> FRONT of the pump head. If on the front, it MUST be <u>right side up</u>!

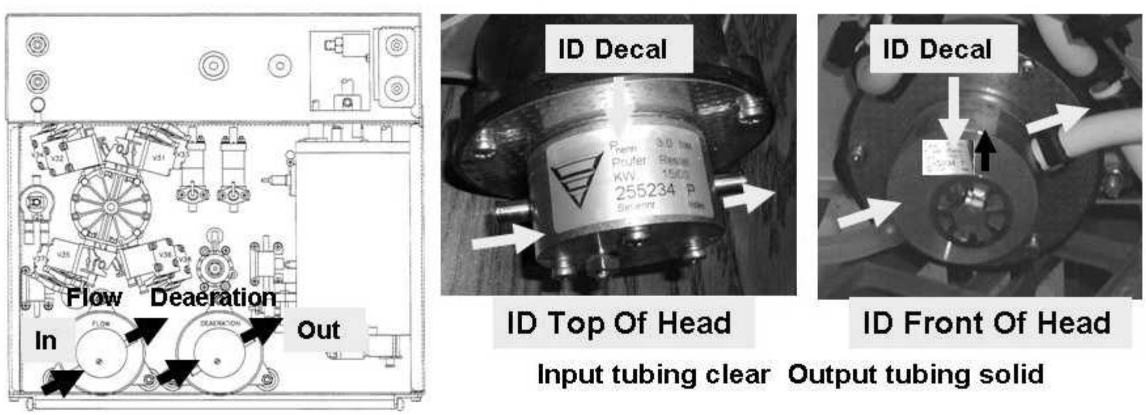



**Figure 29 – Deaeration and Flow Motor Location / Orientation**

c) If not already, place the machine into <u>DIALYSIS PROGRAM</u>!

d) Open the shunt door and <u>REMOVE BOTH</u> dialyzer connectors!

e) CLOSE THE DOOR.


f) Call debug screen 2 to see **! EMPTY** (left column). TWO (2) possible scenarios:

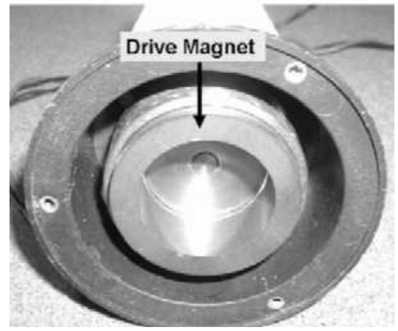
1) **IF (and ONLY if) ! EMPTY = 1:** See procedure number MOTORS- 3.1.0 (page 143).

2) **IF ! EMPTY = 0:** FOUR (4) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Functional Board OR; **3)** Bad arterial and/or venous line shunt door switch OR; **4)** Bad motherboard.

***** Swap in each component one at a time, with known good, until **! Empty** = 1

** To prevent “Cond Offset Failure”, place the machine into **T and C Mode** (refer to <u>OPERATING MODES</u> (page 19))

## MOTORS- 3.1.0 ISOLATE A POTENTIAL 'BINDING' MOTOR




a) Return the lines to the shunt!

b) **IMPORTANT! Turn the machine OFF!**

c) Figure right, remove the pump head from the **NOTED** motor to expose the 'Drive Magnet'.

d) Manually spin the 'Drive Magnet'! Does it rotate freely i.e. is NOT binding?

Yes  Rotates freely! **A)** Ensure rotating the drive magnet causes the motor shaft to rotate. **B)** If the shaft rotates a problem is not indicated at this time HOWEVER, the motor may be stalling intermittently. Consider replacing the brushes!

No  Does NOT rotate freely! The motor is bad***** and brushes WON'T help**.**

***** The binding motor may have destroyed the Actuator-Test and/or the Power Logic Board

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## MOTORS- 4.0.0 MOTOR NOT ROTATING

Hit the motor **HARD** with a screwdriver handle. Does it start rotating?

Yes Motor starts rotating! Proceed to **page 149**, procedure number MOTORS- 5.0.0.

No Motor does NOT start rotating! Perform parts a THROUGH e below:

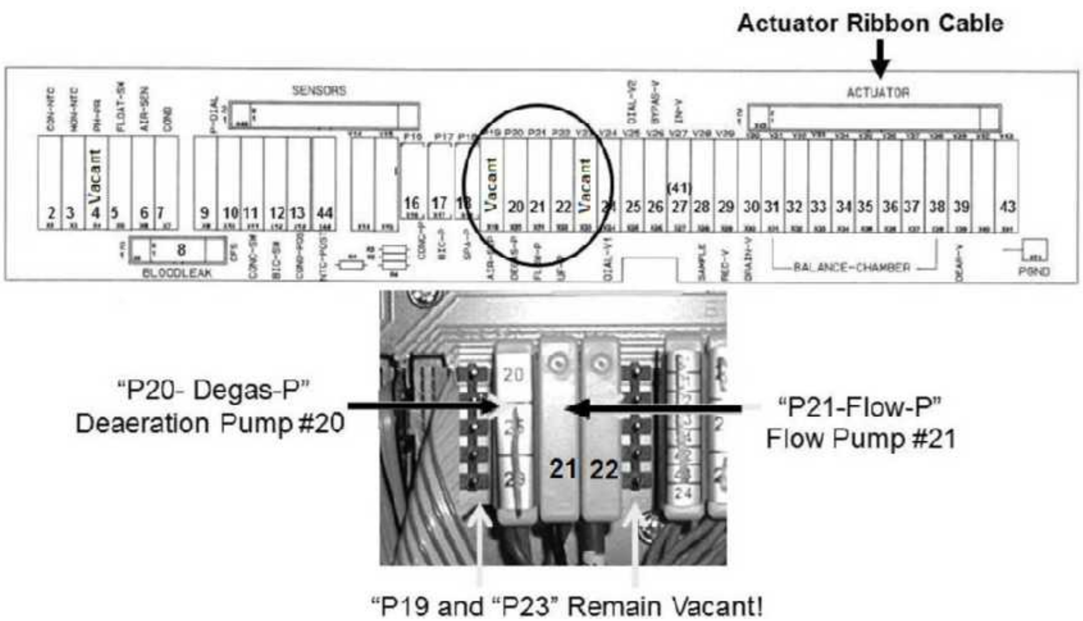
a) **To prevent damage TURN THE MACHINE OFF!**

b) Figure below, remove the distribution board cover.

c) TWO (2) checks:

**CHECK #1:** ENSURE the pump is plugged in PROPERLY!

**CHECK #2:** ENSURE the Actuator Ribbon Cable is plugged in securely!




d) Turn the machine on.

e) TWO (2) scenarios depending on what Program the machine was in when you ORIGINALLY started troubleshooting:

1) **IF (and ONLY if) a Cleaning Program (Heat Disinfect, Rinse, etc.):** Place the machine into RINSE then see procedure number MOTORS- 4.1.0 (page 145)

2) **IF Dialysis Program:** Perform parts A through C below:

**A)** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

**B)** From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

**C)** See procedure number MOTORS- 4.1.0 (page 145).

## MOTORS- 4.1.0 MOTOR ROTATING?

Is the motor rotating now (Yes or No)?

Yes Motor is rotating! If (and ONLY if) a bad connection was corrected above AND if a Flow Error occurs see the Table of Contents for whatever Program the machine is in! If a bad connection was NOT located above proceed to **page 149**, procedure number MOTORS- 5.0.0.

No Motor is NOT rotating! See procedure number MOTORS- 4.2.0 (page 145).

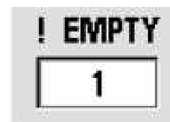
## MOTORS 4.2.0 ISOLATE PROGRAM

What Program is the machine CURRENTLY in **1)** Rinse OR **2)** Dialysis?

1) **IF (and ONLY if) in RINSE:** Proceed to **page 146,** procedure number MOTORS- 4.5.0.

2) **IF in Dialysis Program:** See procedure number MOTORS- 4.3.0 (page 145).

## MOTORS- 4.3.0 IN DIALYSIS PROGRAM / ISOLATE EMPTYING PROGRAM




Call debug screen 2 to see **! EMPTY** (left column). TWO (2) possible scenarios:

**1)** **IF (and ONLY if) ! EMPTY = 0:** Either the (red) arterial dialyzer connector is NOT connected to the shunt properly OR FOUR (4) possible bad components*; **1)** Bad Actuator-Test Board; **2)** Bad Functional Board** OR; **3)** Bad arterial line shunt door micro switch OR; **4)** Bad motherboard

**2)** **IF (and ONLY if) ! EMPTY = 1:** See parts a THROUGH c below:

a) Open the shunt door and remove BOTH DIALYZER connectors!

b) CLOSE THE SHUNT DOOR.

c) From debug screen 2, look at **! EMPTY** again! TWO (2) possible scenarios:

1) **IF (and ONLY if) ! EMPTY = 1:** **A)** Return the dialyzer connectors to the shunt. **B)** See procedure number MOTORS- 4.5.0 (page 146).

2) **IF ! EMPTY = 0:** FOUR (4) possible bad components*: **1)** Bad Actuator-Test board; **2)** Bad Functional Board** OR; **3)** Bad shunt door switches OR; **4)** Bad motherboard.

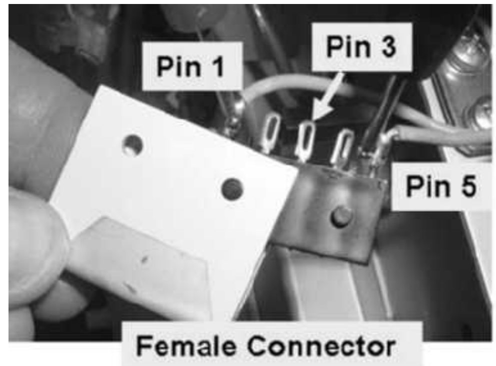
***** Swap in each component one at a time, with known good, until **! Empty** = 1

** To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19))

**MOTORS- 4.5.0 ! EMPTY = 1 / ISOLATE MOTOR BRUSH CONNECTION**

a) UNPLUG the **NOTED** motor from the distribution board!

b) Using a flashlight, check **inside** the motor's distribution board position for 'white' corrosion or damaged **male** pins. **Damage indicates the distribution board may need to be replaced!**




c) Figure right, remove the plastic cap from the female distribution connector. Based on the **NOTED** motor.

- **IF the Deaeration Motor:** It MUST be connected between pins 1 and 3 i.e. top and middle

- **IF the Flow Motor:** It MUST be connected between pins 1 and 5 i.e. top and bottom.

d) Set your CALIBRATED voltmeter to **RESISTANCE (Ω)**.

e) Touch the meter's leads together. The meter MUST read less than 1 **Ω**! Subtract this from the subsequent measurement.

f) Measure, **INSIDE** the female connector, BETWEEN the soldered terminals. Less than ten (10) **Ω**?

Yes Less than 10 Ω! See procedure number MOTORS- 4.6.0 (page 147).

No More than 10 Ω! Bad brushes or motor.

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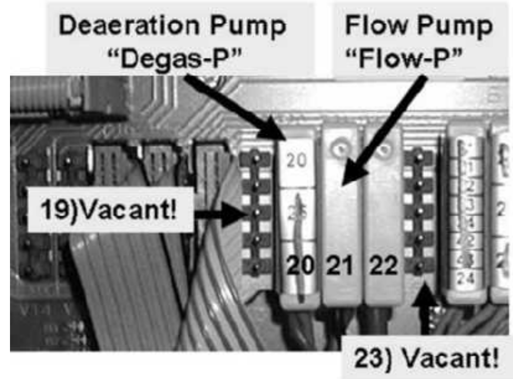
**MOTORS- 4.6.0 ISOLATE MOTOR VOLTAGE**




a) Figure right, avoiding the VACANT positions on the left and right, return the motor connector, **without the cap**, to its distribution board position.

b) ENSURE the connector is aligned properly!

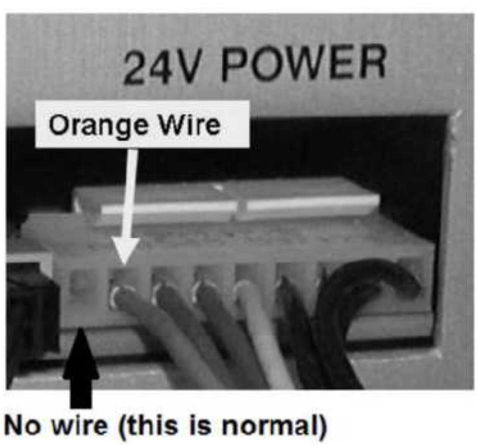
c) Set your CALIBRATED volt meter to **DC voltage ($V_{DC}$)**.

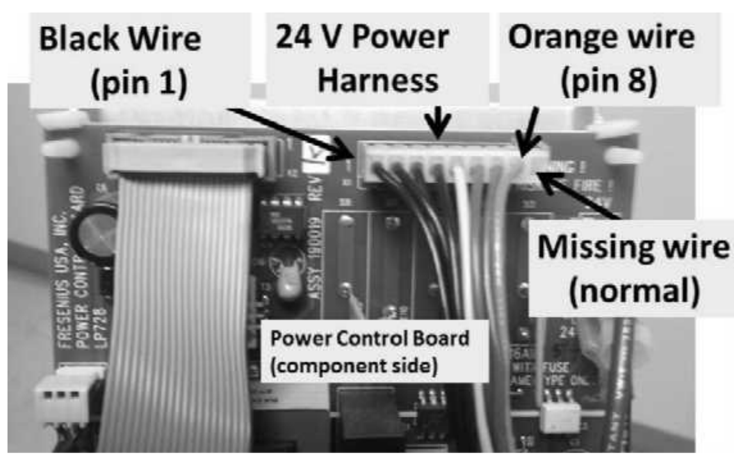
d) Measure, **inside the distribution board**, between the terminals where the wires are soldered. **IMPORTANT! ENSURE good contact with BOTH terminals!**

e) Per Table 5 below, perform the indicated Response based on measured voltage.

### Table 5 – Motor Troubleshooting

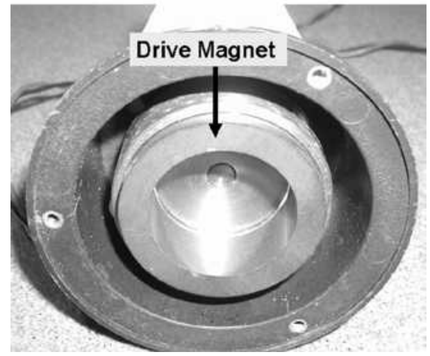
| MOTOR | DISTRIBUTION BOARD POSITION | DC VOLTAGE READING | Your RESPONSE |
|---|---|---|---|
| DEAERATION | P20, "DEGAS-P" | 15 volts DC or more | TWO (2) possible bad components:<br>**1)** Bad deaeration motor OR<br>**2)** Intermittent 24V Power Harness connection. See Figure below. |
| | | Less than 12 volts DC | Bad motor voltage! See procedure number MOTORS- 4.7.0 (page 148) |
| FLOW | P21, "FLOW-P" | 5 volts DC or more | TWO (2) possible bad components:<br>**1)** Bad flow motor OR<br>**2)** Intermittent 24V Power Harness connection. See Figure below. |
| | | Less than 5 volts DC | Bad motor voltage! See procedure number MOTORS- 4.7.0 (page 148) |




**24V Power Harness (Behind the card cage / Inside the Power Supply)**

## MOTORS- 4.7.0 BAD MOTOR VOLTAGE MEASUREMENT / ISOLATE A 'BINDING' MOTOR




a) **IMPORTANT! Turn the machine OFF!**

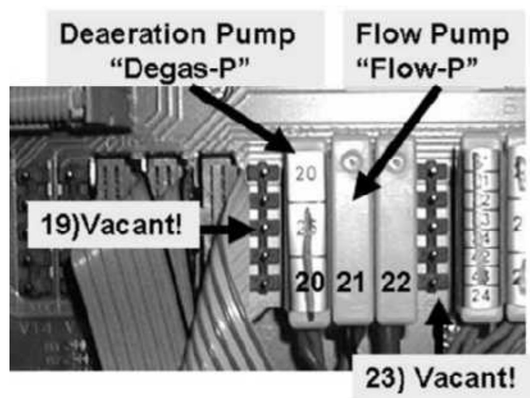
b) Figure right, remove the pump head from the **NOTED** motor to expose the 'Drive Magnet'.

c) Manually spin the 'Drive Magnet'. Does it rotate freely i.e. is NOT 'binding'?

Yes Rotates freely! See procedure number MOTORS- 4.8.0 (page 148).

No Does NOT rotate freely! The motor is bad and brushes won't help. **CAUTION!** The 'binding' motor may have damaged the Actuator-Test and/or Power Logic Board!

## MOTORS- 4.8.0 ISOLATE BAD MOTOR VOLTAGE




a) Return the pump head to the motor!

b) Figure right, ENSURE the motor is plugged properly into its CORRECT distribution board position!

c) Swap in the listed components (see **COMPONENT LIST** below), one at a time, with known good and in between continue to parts d and e to test the new component!

**COMPONENT LIST: 1)** Actuator-Test Board*; 2**)** Actuator board ribbon cable; **3)** Distribution board; **4)** Power supply connections.

* To LOCATE the board refer to Figure 4A (page 10)

d) Return to either RINSE OR Dialysis.

e) Check for motor for rotation to see if the new component causes it to run. If not turn the machine off and repeat parts c through e until it does run!

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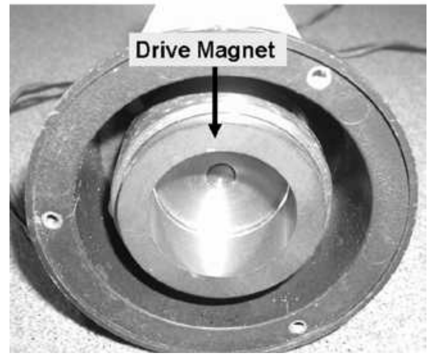
**MOTORS- 5.0.0 ISOLATE INTERMITTENT MOTOR**




a) **IMPORTANT! Turn the machine OFF!**

b) Figure right, remove the pump head from the motor to expose the 'Drive Magnet'.

c) Manually spin the 'Drive Magnet'. Does it rotate freely i.e. is NOT 'binding' (Yes or No)?

Yes Rotates freely! See procedure number MOTORS- 5.0.2 (page 149).

No Does NOT rotate freely! The motor is bad***** and brushes won't help. *** NOTE!** The binding motor may have destroyed the Actuator-Test and/or Power Logic Board

**MOTORS- 5.0.2 MOTOR ROTATES FREELY**

a) ENSURE rotating the drive magnet causes the motor shaft to rotate.

b) If the shaft rotates a problem is not indicated at this time HOWEVER, the motor may be stalling intermittently. Replace the brushes but if the motor stops again in the near future, THREE (3) possible bad components below:

**COMPONENT LIST:**

**1)** Bad Motor OR; **2)** Bad pump head OR; **3)** Bad Actuator-Test Board*. Swap in each one at a time with known good and test for a stalling motor in between.

* To LOCATE the board refer to Figure 4A (page 10)

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## PRESSURE TEST HYDROCHAMBER

This procedure pressurizes the Hydrochamber to locate a potential leak. Two (2) clamps are required:

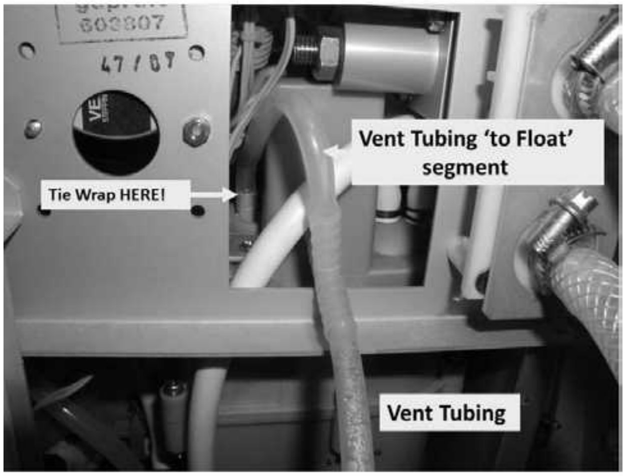
a) Return the red (acid) connector to its Rinse Port.

b) **DO NOT** place the machine into a program! The "Select Program" banner MUST remain up!

c) Figure right, locate the tubing segment that attaches to the port at the top of the Float.

d) Tie wrap the tubing to the Float port!

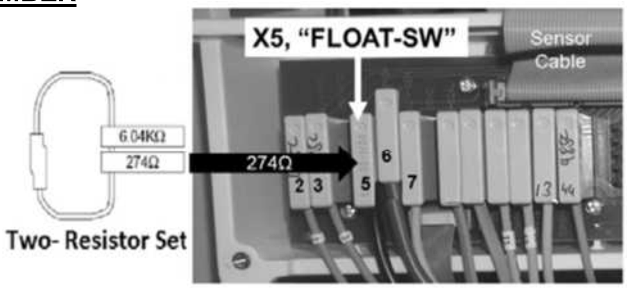
e) See BLOCK LEAK- 1.0.0 (page 150).




### BLOCK LEAK- 1.0.0 PRESSURIZE HYDROCHAMBER

a) Figure right, place the **274 Ω** plug, from the **TWO-RESISTOR SET**, into the float's distribution position, X5, "FLOAT-SW".

b) Vent tubing overflow should occur within thirty (30) seconds!



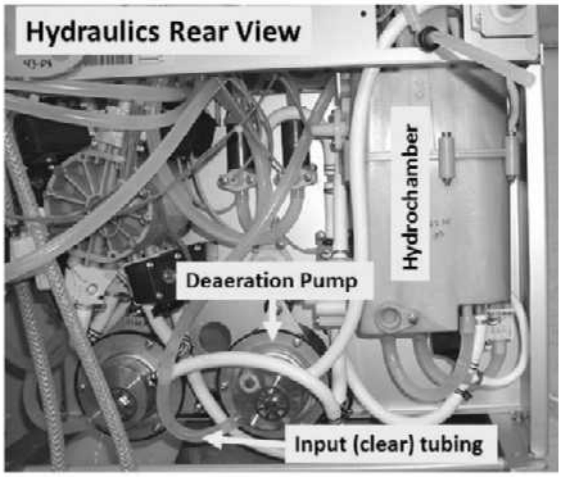

c) Clamp the Vent Tubing! **If tubing 'blows' off remove the resistor plug, tie wrap the tubing, then reinstall the plug!**

d) Figure right, remove the INPUT (clear) tubing from the Deaeration Pump. Strong flow from the tubing indicates Restrictor #48 is open!

e) Clamp the CLEAR Deaeration Pump tubing to pressurize the Hydrochamber.

f) Unless a leak is seen immediately, allow two (2) minutes THEN check the surface of and below the Hydrochamber for leaks.

g) Is a leak located?




Yes — Leak located! See BLOCK LEAK- 2.0.0 (page 151).

No leaks! — a) Return the float's connector to distribution board position X5, "FLOAT-SW"

b) Reconnect the Deaeration Pump's tubing.

c) Ensure you remove BOTH clamps!

d) Return to the procedure that brought you here as NOTED.

## BLOCK LEAK- 2.0.0 HYDROCHAMBER LEAK LOCATED

a) Return the float's connector to its distribution board position, "FLOAT-SW"

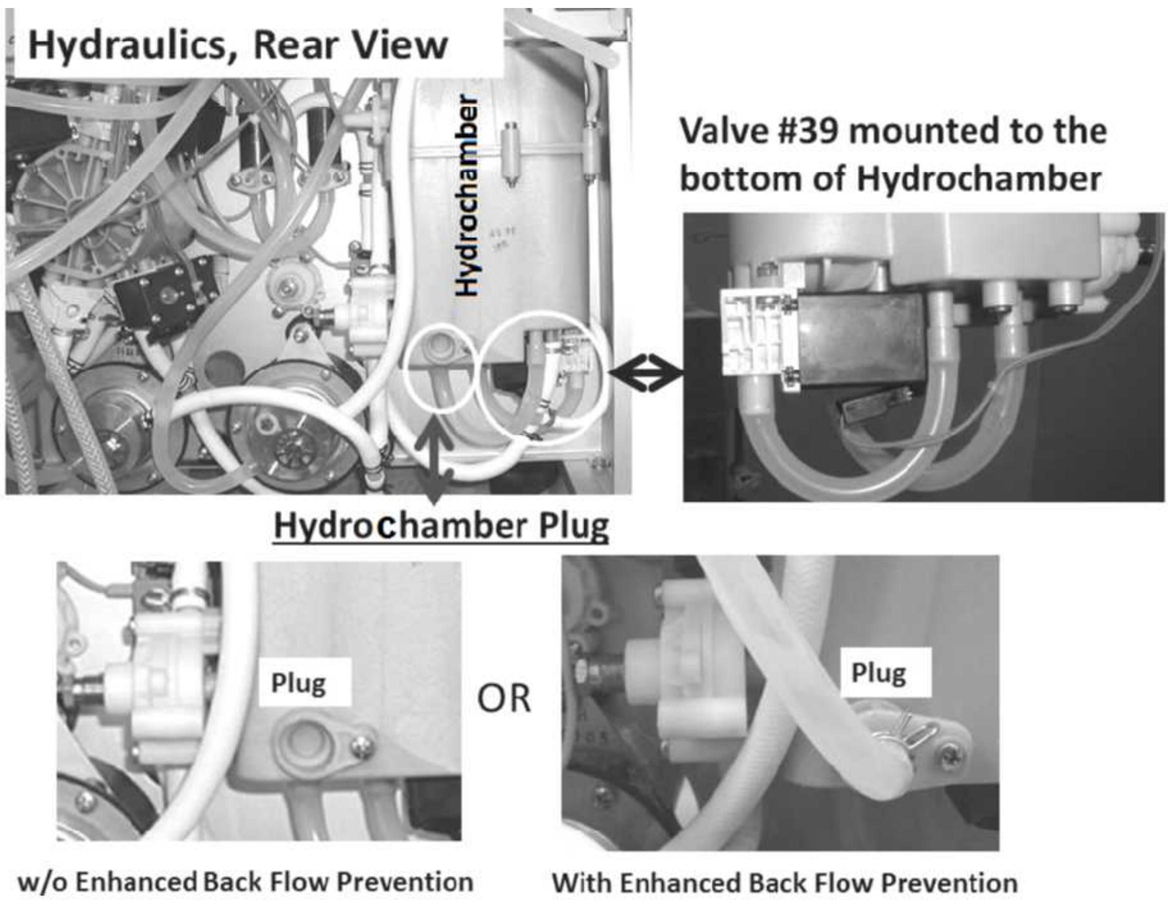
b) **IMPORTANT!** Unclamp the Vent Tubing.

c) **Per the Figure below**, based on where a leak was seen, THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) a tubing leak:** Repair (tie wrap, if possible) and retest for a leak.

**2) IF (and ONLY if) from Valve #39:** THREE (3) possibilities: **1)** Bad Valve #39 mounting bracket; **2)** Bad O-ring under Valve #39; **3)** Cracked Valve #39 body.

**3) ALL OTHER locations:** Per the Figure below, if the plug is leaking replace its O-ring. All other leaks, it may be necessary to replace the Hydrochamber.



## SECTION 2 – "NO WATER" ALARM

A) ENSURE the water is on! If attached to a PORTABLE RO ENSURE it is on, alarm free, AND NOT in product divert!

B) ENSURE the incoming water line, between the 2008T and the RO, is connected PROPERLY!

C) Call debug screen 0.


D) Ignoring the TOP **Flow Error** window, look at **Valve Error** (2nd window down). TWO (2) possible scenarios 1) or 2) below:

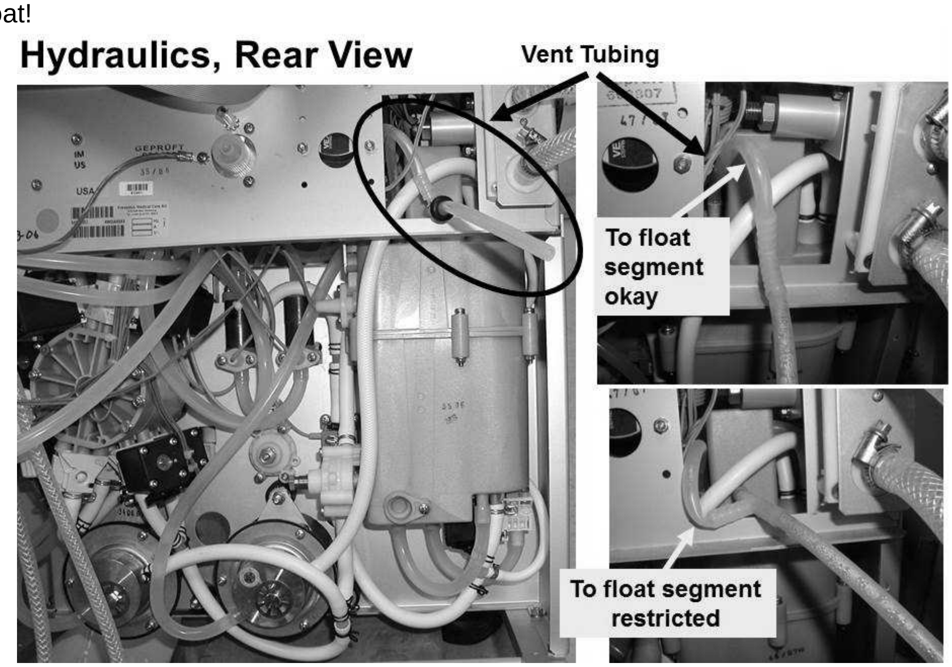
**1) IF (and ONLY if) Valve Error = 0:** See procedure number NW- 1.0.0 (page 152).

**2) IF Valve Error = 1 longer than two (2) seconds consistently:** Refer to the Table below:

| **If the machine is CURRENTLY in:** | **Your response** |
|---|---|
| Dialysis Program i.e. connected to Acid and Bicarb | Proceed to **page 711**, Section 26 |
| A Cleaning / Disinfection Program (Rinse, Heat Disinfect, etc.) | Proceed to **page 207**, procedure number CLEAN- 7.0.0 |

### NW- 1.0.0 VALVE ERROR = 0

a) Figure below, ENSURE the Vent Tubing is NOT kinked, **INCLUDING** the short segment going back to the Float!




b) Is the machine attached to a PORTABLE RO? TWO (2) possible scenarios 1) or 2) next page:

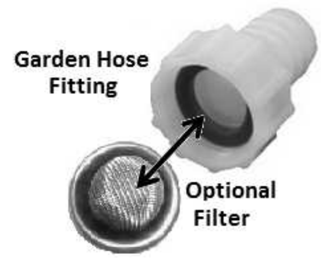
1) **IF (and ONLY if) NOT attached to a PORTABLE RO:** See procedure number NW- 1.0.1 (page 153).

2) **IF attached to a PORTABLE RO:** See parts a THROUGH g below:

a) If multiple machines are attached to the same RO the RO may not support this! At the OTHER machines turn [Dialysate Flow] “OFF” OR turn them off; allow two (2) minutes, then check if the “No Water” alarm reoccurs.

b) If the tap water, feeding the RO, is less than 10° C (50° F) this may decrease RO Product flow causing “No Water” alarms!

c) In the 2008T incoming water line, if a garden hose fitting is used (Figure right), AND the optional filter is present, ENSURE it is clean!




d) Measure product flow from the RO. It must be MORE THAN 1000 ml every minute!

e) Reattach the RO to the 2008T machine

f) If a valve is present, between the RO and the 2008T, ENSURE it is open!

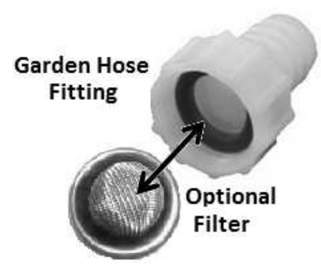
g) Proceed to **page 154**, procedure number NW- 1.0.2.

## NW- 1.0.1 NOT ATTACHED TO A PORTABLE RO

a) If multiple machines are indicating “No Water” alarms there is a problem with the RO!

b) Determine if circumstances such as “filling the bicarbonate tank” may be decreasing RO Product flow. 2008T machines require at least 1000 every minute!

c) In the incoming water line, if a garden hose fitting is used (Figure right) AND the optional filter is used, ENSURE it is clean!




d) Measure RO product flow from the station. It must be MORE THAN 1000 ml every minute!

e) Reattach the incoming water line to the 2008T machine.

f) ENSURE the station’s water valve is open!

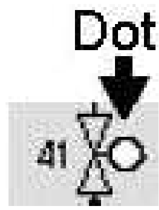
g) See procedure number NW- 1.0.2 (page 154).

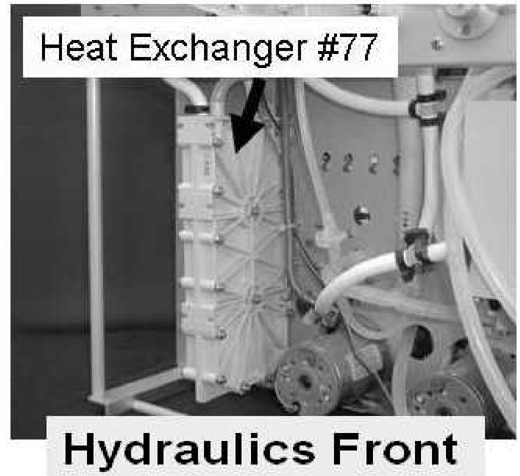
**NW- 1.0.2 “NO WATER” CHECKS**

a) ENSURE no leaks, ESPECIALLY from Heat Exchanger #77 (Figure right).

b) Call debug screen 0.

c) WITHOUT LOOKING AWAY, watch Valve #41’s ‘dot’ (Figure right) for ninety (90) seconds. TWO (2) possible scenarios:




1) **IF (and ONLY if) Valve #41’s ‘dot’ remains white OR cycles between white and blue:** See procedure number NW- 1.0.3 (page 154).

2) **IF Valve #41’s ‘dot’ is ALWAYS blue (NEVER white)!** ENSURING the water or portable RO is on AND the station’s incoming water valve is open, if the ‘dot’ still REMAINS blue, proceed to **page 159**, procedure number NW- 2.0.0.

**NW- 1.0.3 INTERMITTENT “NO WATER” ALARM**

**NOTE!** If (and ONLY if) in a CLEANING / DISINFECTION PROGRAM AND a “No Water” alarm is coming and going the PROGRAM will complete but takes longer than normal. If you can live with this, especially if using a portable RO, the machine is okay for now.

WITHOUT LOOKING AWAY, watch for four (4) FULL minutes OR until if a “No Water” alarm EVER reoccurs?

Yes “No Water” reoccurs! See procedure number NW- 1.0.4 (page 154).

No Does NOT reoccur! Do NOT continue!

**NW- 1.0.4 “NO WATER” ALARM REOCCURED**

Leaving the machine in whatever Program it is CURRENTLY in, TWO (2) possible scenarios:

1) **IF (and ONLY if) in HEAT DISINFECT Program:** See procedure number NW- 1.0.5 (page 155).

2) **ALL OTHER Programs including Dialysis:** Proceed to **page 157,** procedure number NW- 1.0.10.

## NW- 1.0.5 "NO WATER" IN HEAT DISINFECT / ISOLATE RINSE PROGRAM

a) Press 'Esc' TWICE then 'Enter' TWICE to call the "Select Program" screen!

b) Place the machine into RINSE (NOT HEAT DISINFECT)!

c) Allow one (1) full minute BEFORE continuing!

d) WITHOUT LOOKING AWAY, watch for four (4) minutes OR until if a "No Water" alarm EVER reoccurs?

Yes "No Water" reoccurs! Proceed to **page 157,** procedure number NW- 1.0.10.

No "No Water" does NOT reoccur! The alarm may be related to Heat Disinfect ONLY! See procedure number NW- 1.0.6 (page 155).

## NW- 1.0.6 IN RINSE "NO WATER" DOES NOT REOCCUR

a) Press 'Esc' then 'Enter' twice to call the "Select Program" screen.

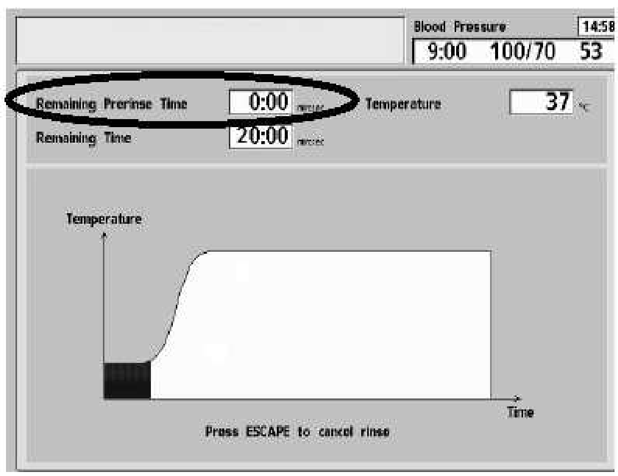
b) Place the machine into HEAT DISINFECT (NOT RINSE)!

**c) Open the shunt door and LEAVE IT OPEN until instructed!**

d) Figure right, from the Heat Disinfect screen, does the TOP **Remaining Prerinse Time** window = 0:00 min:sec (Yes or No)?

Yes **Remaining Prerinse Time** = 0:00! A "No Water" alarm should not be occurring unless the water is off!

No **Remaining Prerinse Time** does NOT = 0:00! See procedure number NW- 1.0.7 (page 155).




## NW- 1.0.7 REMAINING PRERINSE DOES NOT = 0:00

WITHOUT LOOKING AWAY, watch for four (4) FULL minutes OR until if a "No Water" alarm EVER reoccurs?

Yes "No Water" alarm reoccurs! See procedure number NW- 1.0.8 (page 156).

No "No Water" does NOT reoccur! Do NOT continue but close the shunt door!

## **NW- 1.0.8 IN HEAT DISINFFECT "NO WATER" REOCCURS**

a) Call debug screen 4. If debug does not appear press 'Escape' then call sceen 4.

b) When Valve #43 is closed*, **PDIA** (left column) NORMALLY cycles between 0.0 and to more than 0.1. When Valve #43 opens it stays more than 1.0 but NORMALLY for no more than sixteen (16) seconds.

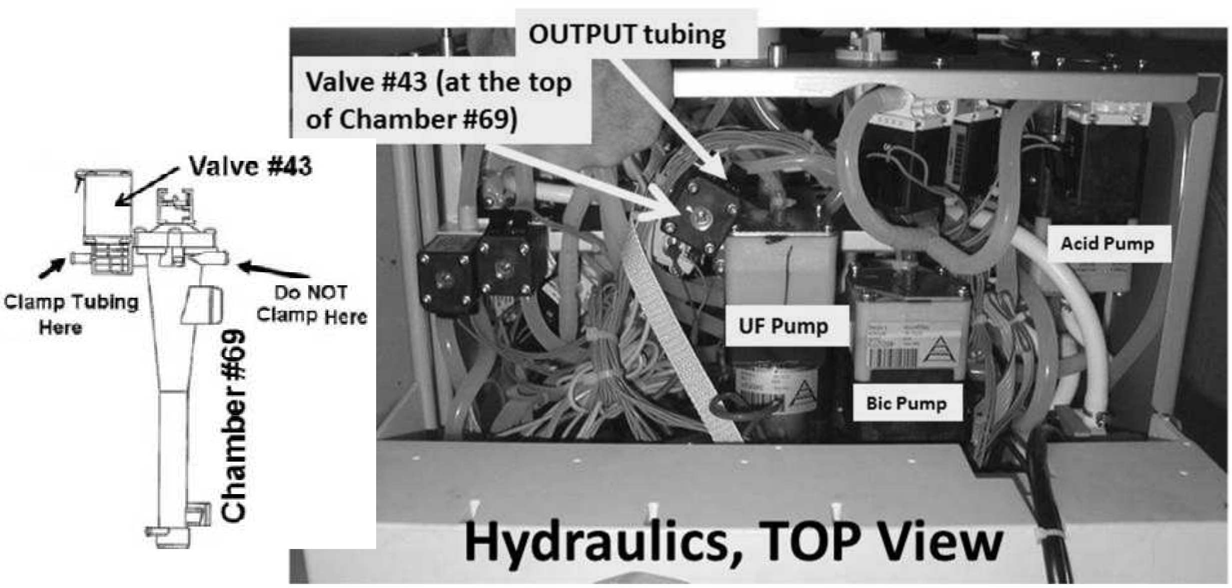

***** In Heat Disinfect Valve #43 automatically cycles between closed and open.

c) WITHOUT LOOKING AWAY, watch **PDIA** for forty-five (45) seconds. If it remains more than 0.1 continue to watch for forty five (45) more seconds. Does it EVER cycle to 0.0?

Yes **PDIA** cycles to 0.0! See procedure number NW- 1.0.10 (**page 157**).

No **PDIA** <u>REMAINS ALWAYS</u> more than 0.1! See parts a AND b below:

a) **Per the Figure below**, <u>double clamp</u> Valve #43's <u>OUTPUT</u> tubing. **NOTE!** Valve #43's output tubing extends towards the front of the machine!




b) Watch **PDIA** again for forty five (45) seconds. Does it NOW cycle to 0.0?

Yes **PDIA** now cycles to 0.0! Remove the clamps. Possible bad component: **1)** Bad Actuator-Test Board OR; **2)** Bad Valve #43.

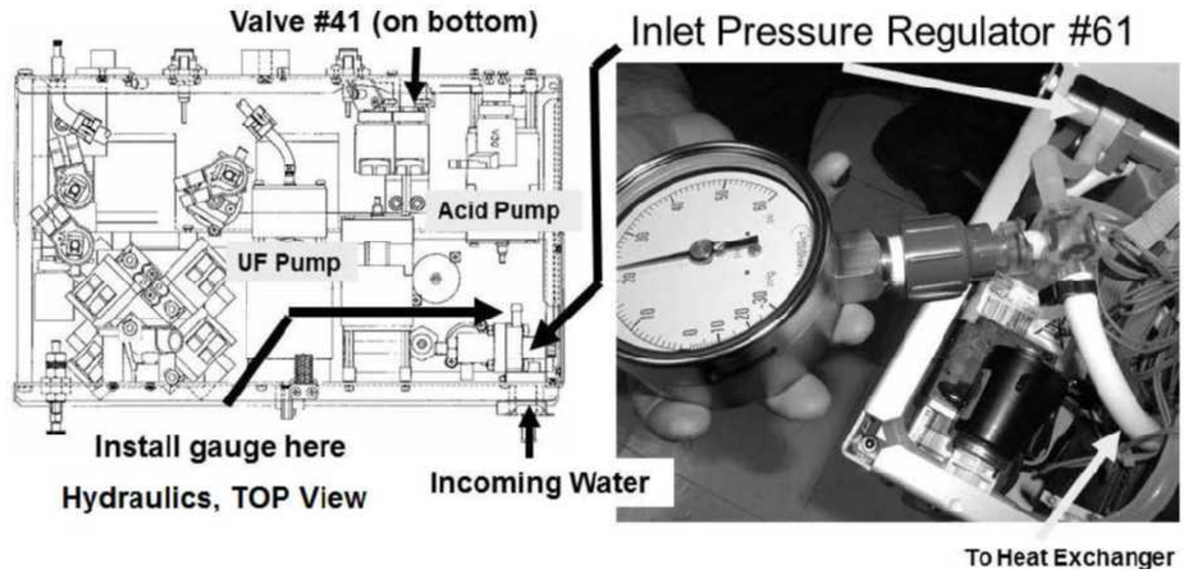
No **PDIA** still DOES NOT cycle to 0.0! **A)** ENSURE Valve #43 is double clamped properly; **B)** Return to Dialysis Program, allow eight (8) minutes, and then check for TMP problems.

## NW- 1.0.10 "NO WATER" ALARM REOCCURS

a) Leaving the machine on, turn the WATER OFF!

b) A psi pressure gauge is required. **ENSURE** it reads 0 psi before installing it!

c) Figure below, tee the gauge into Inlet Pressure Regulator #61.




d) Tie wrap both sides of the gauge tubing to prevent leaks and false readings!

e) **TURN THE WATER ON!**

f) See procedure number NW- 1.0.12 (page 157).

## NW- 1.0.12 GAUGE IN AND WATER ON / ISOLATE INLET PRESSURE

Call debug screen 0, to watch Valve #41's 'dot' for forty-five (45) seconds. TWO (2) possible scenarios:

1) **IF (and ONLY if) Valve #41's 'dot' is NEVER white (ALWAYS blue):** If ABSOLUTELY SURE the water is ON and the 'dot' still is NEVER white proceed to **page 159,** procedure number NW- 2.0.0.

2) **IF Valve #41's 'dot' is remaining white OR cycling between white and blue!** TWO (2) possible scenarios below:

**Scenario #1:** **IF (and ONLY if) REMAINING white:** If (and ONLY if) a "No Water" alarm NEVER reoccurs whatever was causing the problem is no longer present! If a "No Water" alarm does reoccur see Scenario #2 below.

**Scenario #2:** **IF cycling between white and blue:** Gauge pressure should cycle between a PEAK of more than 18 psi and to NEVER LESS than 8 psi. WITHOUT LOOKING AWAY, watch the gauge AND the screen two (2) minutes and preferably until a "No Water" alarm reoccurs. TWO (2) possible scenarios 1) or 2) next page:

1) **IF (and ONLY if) ALWAYS LESS THAN 18 psi:** See procedure number NW- 1.0.14 (page 158).

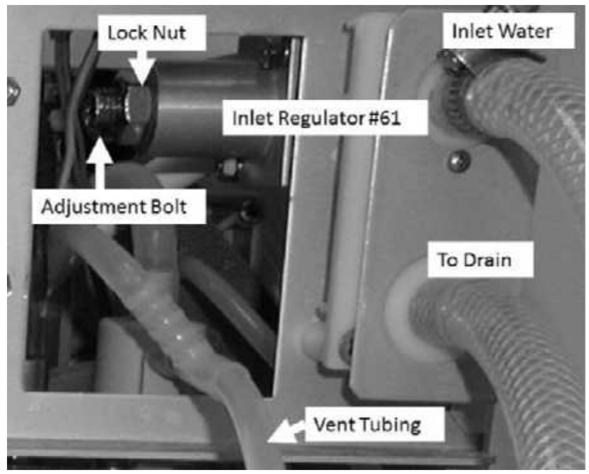
2) **IF the PEAK cycles to or remains MORE THAN 18 psi:** THREE (3) possible scenarios below:

**Scenario #1:** **IF (and ONLY if) the MINIMUM EVER falls lower than 8 psi**: This indicates a problem with RO Product flow or pressure!

**Scenario #2:** **IF (and ONLY if) the MINIMUM remains more than 8 psi AND a "No Water" alarm reoccurs:** Proceed to **page 162**, procedure number NW- 3.0.0.

**Scenario #3:** **IF the MINIMUM remains more than 8 psi AND a "No Water" does NOT reoccur:** The problem IS NOT presenting at this time!

**NW- 1.0.14 PRESSURE REMAINS LESS THAN 18 PSI**




a) Figure right, loosen Inlet Pressure Regulator #61's Lock Nut.

b) Watching the gauge, turn Regulator #61's center Adjustment Bolt clockwise (inward)! TWO (2) possible scenarios:

1) **IF (and ONLY if) MORE THAN 18 psi CAN be achieved: A)** Adjust Regulator #61 until the PEAK is between 18 and 20 psi**;** **B)** Return to (ABOVE) procedure number NW- 1.0.12 (**page 157**).

2) **IF MORE THAN 18 psi CANNOT be achieved:** ASSUMING incoming water has remained more than 1000 every minute, Inlet Pressure Regulator #61 may be bad.

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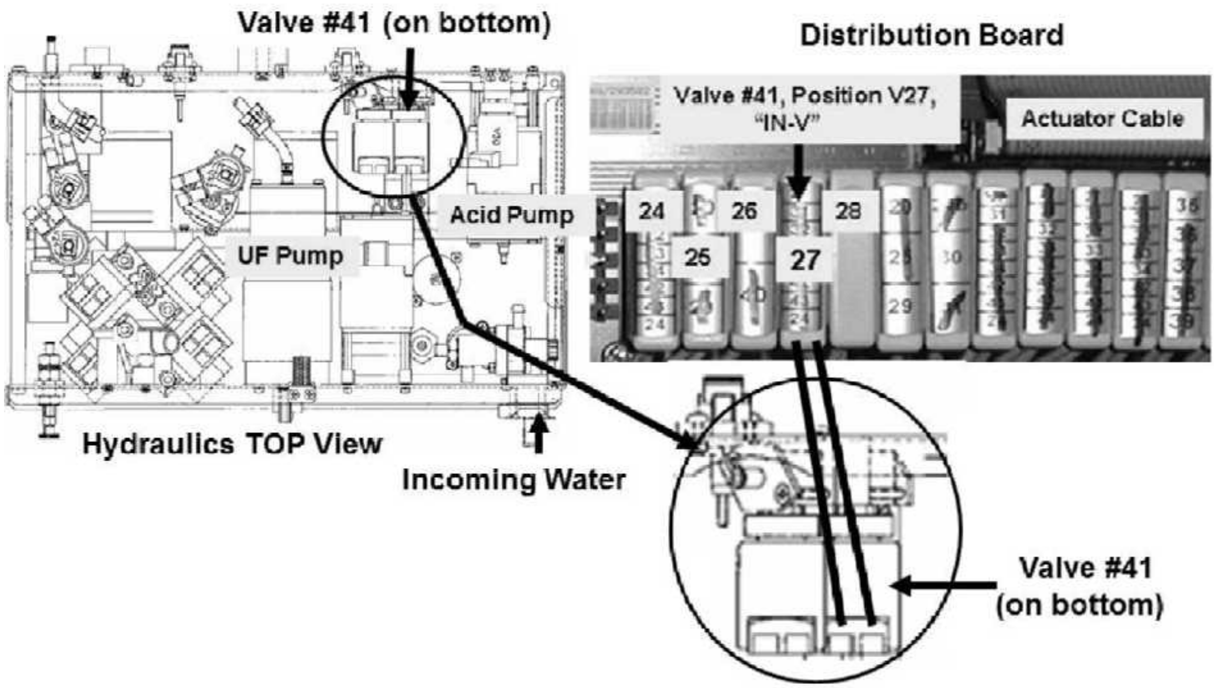
**NW- 2.0.0 VALVE #41'S 'DOT ALWAYS BLUE = CONSTANT "NO WATER" ALARM**

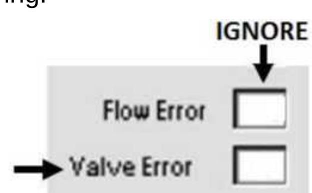
a) Figure below, ENSURE Valve #41's connector is plugged PROPERLY into distribution board position "V27, IN-V".




b) Call debug screen 0 to watch Valve #41's 'dot' for one (1) FULL minute. TWO (2) possible scenarios:

1) **IF (and ONLY if) Valve #41's 'dot' is now remaining white <u>OR</u> cycling between white and blue:** The constant "No Water" alarm is no longer occurring! If (and ONLY if) a "No Water" alarm occurs intermittently return to (ABOVE) procedure number NW- 1.0.10 (**page 157**). If a "No Water" alarms NEVER occurs the No Water problem is not occurring!

2) **IF Valve #41's 'dot' is still NEVER white i.e. ALWAYS blue:** Ignoring **Flow Error**, look at the 2nd window down, Valve **<u>Error!</u>** TWO (2) possible scenarios:




**Scenario #1: IF (and ONLY if) Valve Error = 0!** See procedure number NW- 2.0.1 (page 160).

**Scenario #2: IF Valve Error = 1 longer than two (2) seconds consistently!** Refer to the Table below:

| **If the machine is <u>CURRENTLY</u> in:** | **Your response** |
|---|---|
| Dialysis Program i.e. connected to acid and bicarbonate | Proceed to **page 711**, Section 26 |
| A Cleaning / Disinfection Program (Rinse, Heat Disinfect, etc.) | Proceed to **page 207**, procedure number CLEAN- 7.0.0 |

**NW- 2.0.1 VALVE ERROR = 0 / ISOLATE INLET WATER PRESSURE**

a) Leaving the machine in a program, TURN THE WATER OFF!

b) A psi pressure gauge is required. ENSURE it reads 0 psi before installing it!

c) Per the Figure below, tee the gauge into Inlet Pressure Regulator #61.

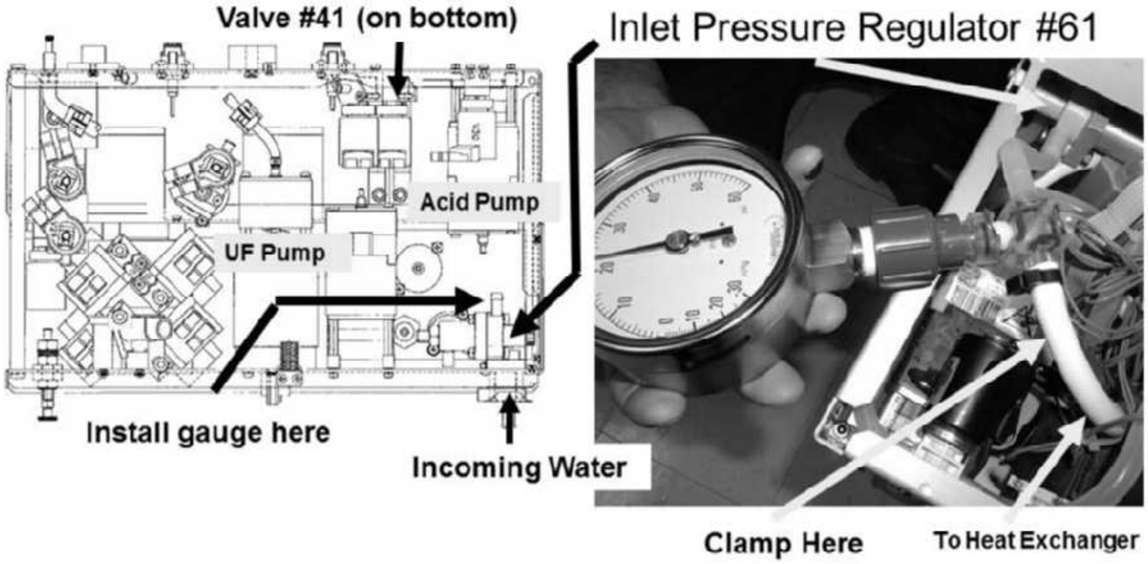



**Figure 30 – Hydraulics Top View**

d) **TURN THE WATER ON!**

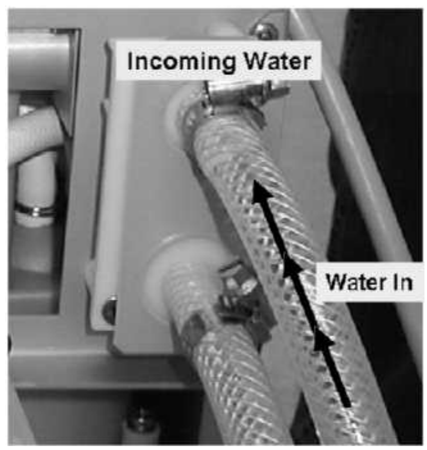
e) **WARNING! Do not use a plastic clamp in part e as this will cause error!**

f) Using METAL PLIERS, tightly clamp the tubing between the gauge and the Heat Exchanger at the location shown the Figure above. TWO (2) possible scenarios

1) **IF the gauge = 18 psi or more:** Remove the pliers then proceed to **page 162,** procedure number NW- 3.0.0

2) **IF the gauge = less than 18 psi:** ENSURING the water was on prior to checking pressure, remove the pliers then see procedure number NW- 2.0.2 (page 160).

**NW- 2.0.2 ISOLATE INCOMING WATER**




a) TURN THE WATER OFF!

b) This procedure requires a 1000 ml (or larger) graduated cylinder.

c) Reproduce the conditions when the "No Water" occurred. For example, multiple machines running attached to the same PORTABLE RO, filling the bicarbonate tank, etc.

d) Figure right, at the rear of the machine, remove the (TOP) Incoming Water tubing!

**Part e next page**

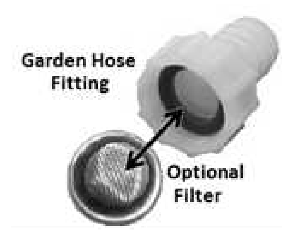
e) Directing the tubing into cylinder, TURN THE WATER ON and measure for one (1) minute. TWO (2) possible scenarios:

1) **IF (and ONLY if) 1000 ml or more collected:** See procedure number NW- 2.0.3 (page 161).

2) **IF less than 1000 ml:** This is the problem! TWO (2) checks:

**Check #1:** Figure right, if the (optional) incoming water filter is present ENSURE it is clean!

**Check #2:** ENSURE RO Product output is consistently more than 1000 ml every minute! If not there is a problem with the RO!




**NW- 2.0.3 1000 ML OR MORE / ISOLATE PRESSURE REGULATOR #61**

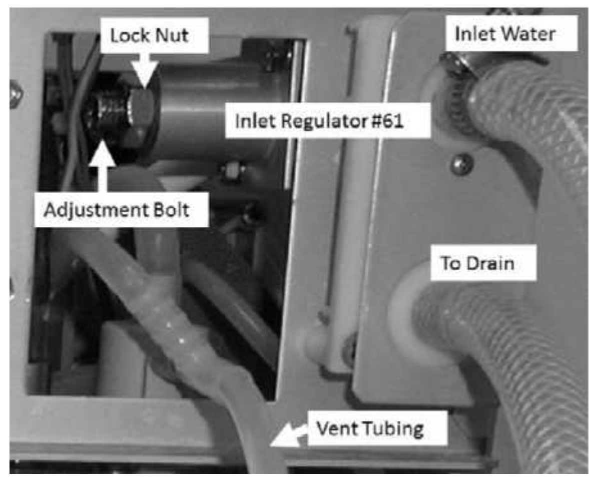
a) TURN THE WATER OFF and reattach the Incoming Water Tubing.

b) Figure right, loosen Inlet Pressure Regulator #61's Lock Nut.

c) **IMPORTANT! TURN THE WATER ON!**

d) Using METAL PLIERS, again clamp the tubing between the gauge and the Heat Exchanger at the location shown in Figure 30 (page 160).

e) With the pliers REMAINING in place, adjust Inlet Pressure Regulator #61's center Adjustment Bolt (Figure right) clockwise (inward) attempting to increase pressure to more than 18 psi. TWO (2) possible scenarios:

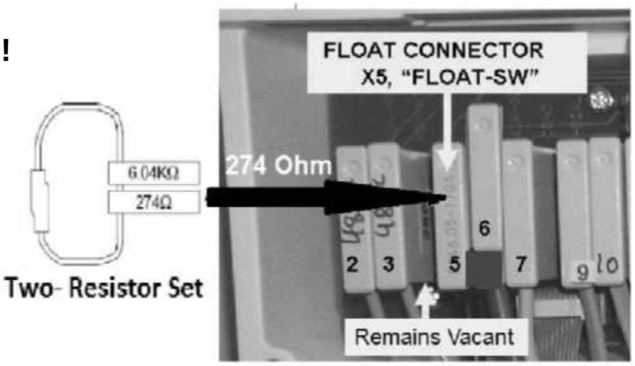



1) **IF (and ONLY if) more than 18 psi CAN be achieved**: Remove the pliers then allow one (1) FULL minute. If a "No Water" alarm reoccurs return to (ABOVE) procedure number NW- 1.0.2 (**page 154**). If the "No Water" alarm NEVER occurs there is no need to continue!

**2) IF 18 psi CANNOT be achieved:** Assuming incoming RO Product flow has remained more than 1000 ml every minute, Inlet Pressure Regulator #61 may be bad.

## NW- 3.0.0 ISOLATE FLOAT (#5) SIGNAL

a) **IMPORTANT! TURN THE WATER OFF!**




b) Figure right, place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into the float's distribution board position, "FLOAT-SW". This simulates a 'closed' float switch!

c) Call debug screen 0. WITHOUT LOOKING AWAY, watch VALVE #41's dot' for two (2) minutes. TWO (2) possible scenarios:

1) **IF (and ONLY if) Valve #41's 'dot' is BLUE always:** Valve #41 should be open. Leaving the plug installed, see procedure number NW- 4.0.0 (page 163).

2) **IF Valve #41's 'dot' is or EVER turns WHITE:** See parts a AND b below:

   a) ENSURE the **274 Ω** plug, from the **TWO-RESISTOR SET** is PROPERLY placed at distribution board position "FLOAT-SW"! If not, repeat procedure number NW- 3.0.0 (page 162) from part b.

   b) Leaving the plug installed, swap the following components in (Component List below) one at a time and, in between, test each new component until Valve #41's 'dot' remains blue.

   **Component List: 1)** Actuator-Test Board[1]; **2)** Sensor Board[1,2]; **3)** Sensor Board cable; **4)** Distribution board; **5)** Motherboard. .

   [1] To LOCATE the boards refer to Figure 4A (page 10).

   [2] To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)

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**NW- 4.0.0 ISOLATE INCOMING WATER VALVE #41**

a) Place a 1000 ml graduated cylinder under the Vent tubing it to capture overflow.

b) **IMPORTANT! TURN THE WATER ON**!

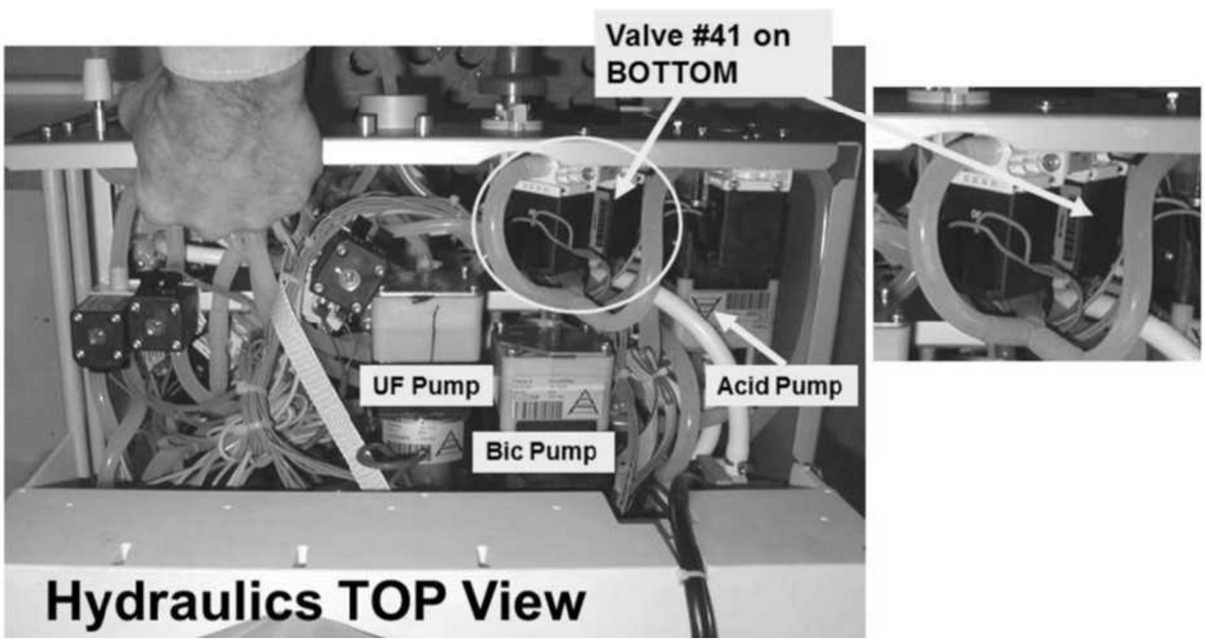
c) Valve #41 should be open. After no more than thirty (30) seconds more than 800 ml per minute measured from the Vent tubing?

Yes 800 ml or more! See procedure number NW- 5.0.0 (page 164).

No Not 800 ml or more! ENSURING the water was ON, Per the **Figure below**, touch **Valve #41's** (black) solenoid. TWO (2) possible scenarios:

1) **IF (and ONLY if) Valve #41's solenoid is warm:** TWO possible bad components: **1)** Bad Actuator-Test Board; **2)** Bad valve #41 and/or its blue wire harness.

2) **IF Valve #41's solenoid is cold: NOTE ONLY** VALVE #41 will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.



NW- 5.0.0 CHECK FLOAT AND VALVE #41

## a) IMPORTANT! TURN THE WATER OFF!

b) Obtain a 1000 ml graduated cylinder.

c) Per the Figure below, locate the clear tubing (from Valve #41) that enters the 'Air Gap Tower' vertically at the top of the Hydrochamber.

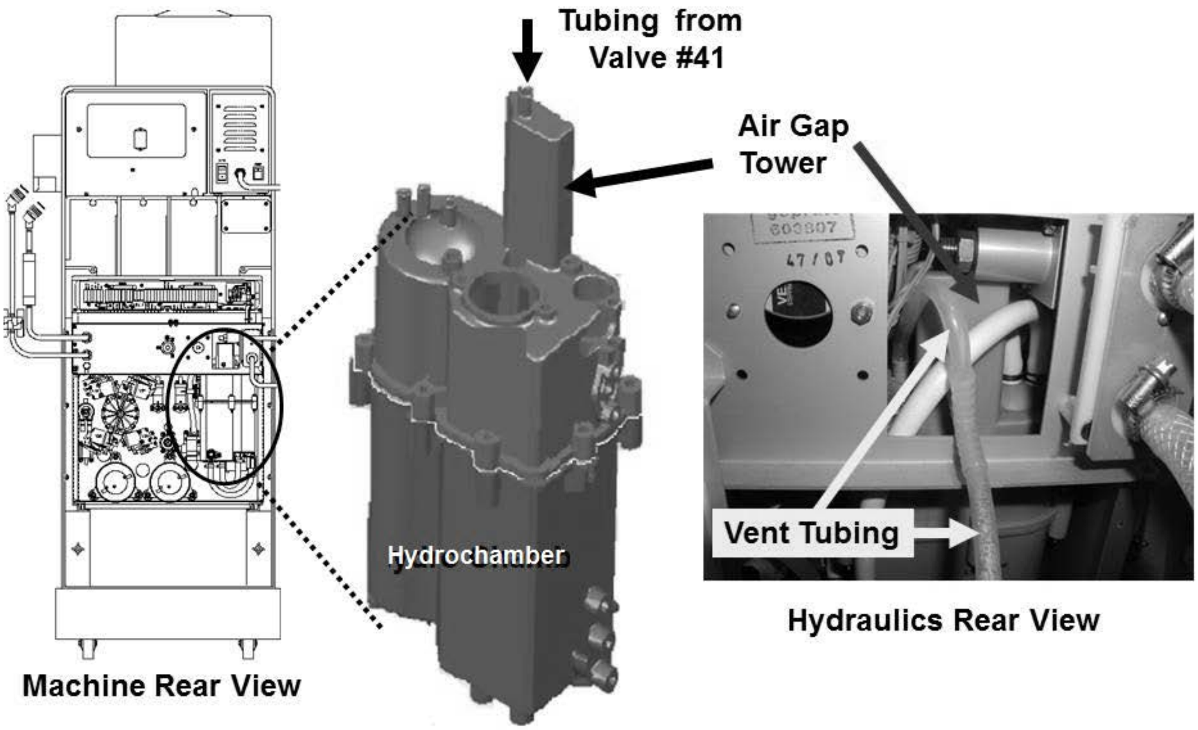



**Figure 31 – Inlet Water Tubing**

d) Pull the tubing off the 'Air Gap Tower' and direct it into the cylinder.

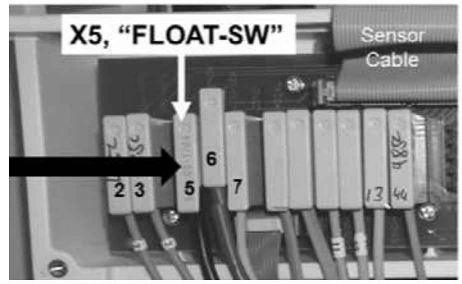
e) TURN THE WATER ON and measure for one (1) minute!

f) TWO (2) possible scenarios:

1) **IF (and ONLY if) more than 800 ml collected:** See procedure number NW- 5.1.0 (page 165).

2) **IF less than 800 ml collected:** There is not enough water from the RO OR a there is a restriction at, to or from Valve #41.

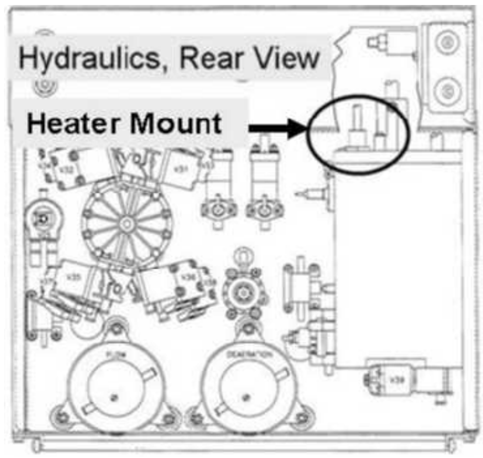
## NW- 5.1.0 CHECK WATER SYSTEMS




a) Turn the water OFF and reattach the tubing.

b) Figure right, a previous procedure may have placed the **274 Ω** resistor plug in the Float's distribution board position "X5- FLOAT-SW". If so, return the Float's connector.

c) Turn the machine OFF!




d) ENSURE the vent tubing is NOT kinked anywhere! If the short segment going back to the Float is not routed over the top this may be the problem!

e) Figure right, remove the Heater and check its port into the top of the hydrochamber for heat damage (i.e. melting). If (and ONLY if) damage is located replace the hydrochamber.

f) Reinstall the Heater!

g) **IMPORTANT!** Turn the water ON!

h) Turn the machine on and return to the Program where the "No Water" alarm occurred.

i) If the "No Water" alarm reoccurs, either inadequate incoming water flow (less than 1000 ml per minute OR TWO (2) possible bad components: **1)** (Intermittent) bad Float* Switch OR; **2)** Bad Actuator-Test Board

* To LOCATE the Float Switch refer to Figure 28 (page 140).

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## SECTION 3 - FLOW ERRORS IN A CLEANING / DISINFECTION PROGRAM

**NOTE!** If you placed the machine in RINSE because a Flow Error was occurring in Dialysis Program return to Dialysis Program and proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM

These procedures troubleshoot Flow Errors that occur in Heat Disinfect, Rinse, etc. Alarm banners include “Flow Error”, “Flow Inlet Error” and “Flow Recirc Error 1”.

A) Press ‘Esc’ then ‘Enter’ to “Interrupt” the Program (Figure right).


B) **Figure below**, did tubing ‘blow off’ a UF Check Valve OR was there an active leak prior to Interrupting?

Yes Tubing ‘blew’ off OR an active leak! See procedure number CLEAN- 1.0.0 (page 166).

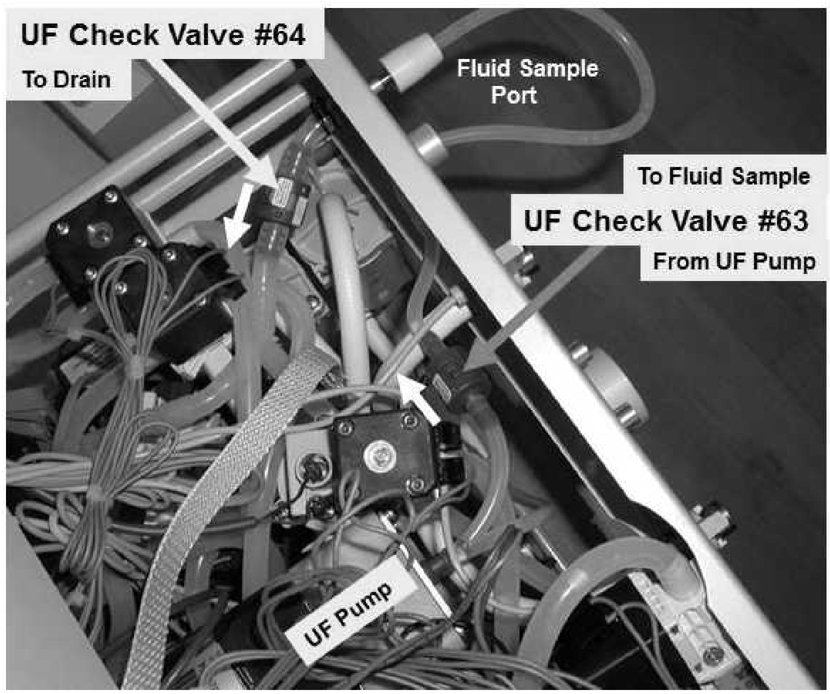
No Tubing did NOT blow off AND no active leaks! See parts a and b below:

a) If the Flow Error was occurring in Heat Disinfect return to it. If not place the machine in RINSE!

b) Proceed to **page 169**, procedure number CLEAN- 1.0.5.

**Hydraulics Top View**

**UF Check Valves #63 and #64**




**CLEAN- 1.0.0 UF CHECK VALVE TUBING ‘BLOWING OFF’ OR LEAK**

a) Reattach ‘blown off’ tubing and dry the area.

b) Per the Figure above, ENSURE the tubing to and from UF Check Valve #63 is NOT kinked!

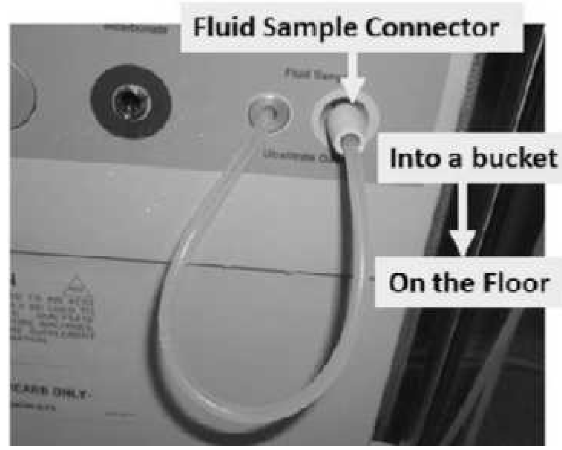
**Parts c through f next page**

c) ENSURE the 'to drain' tubing is not kinked AND (if used) the 'Quick connector' is attached PROPERLY to the station.

d) Figure right, **till INSTRUCTED OTHERWISE**, direct the Fluid Sample Connector into a bucket on the floor!

e) Subsequently the machine will be returned to a Cleaning Program. If (and ONLY if) a leak reoccurs **DO NOT** turn the machine off but instead press 'Esc' then 'Enter' to Interrupt the program!

f) See procedure number CLEAN- 1.0.1 (page 167).




## CLEAN- 1.0.1 ISOLATE RESTRICTION

a) If (and ONLY if) the problem was occurring in Heat Disinfect return to it. If not place the machine in RINSE.

b) TWO (2) checks:

**CHECK #1:** Figure right, water from the Fluid Sample port = UF Check Valve #64 is bad!

**CHECK #2:** No 'squirts' into the bucket = UF Check Valve #63 is bad!


c) Allow up to four (4) minutes **OR** until if a leak reoccurs. TWO (2) possible scenarios below:

1) **IF (and ONLY if) NO leaks!** Proceed to **page 169**, procedure number CLEAN- 1.0.5.

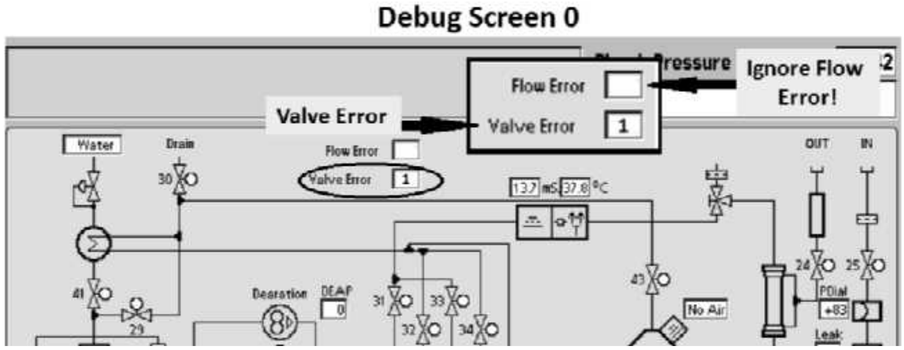
2) **IF a leak occurs!** Interrupt the Program! With the "Interrupted" banner up, see procedure number CLEAN- 1.0.3 (page 167).


## CLEAN- 1.0.3 LEAK OCCURS

a) Call debug screen 0 (Figure right). If debug does not appear press 'Esc' then call screen 0.

b) Ignoring **Flow Error** (TOP window) watch the **2nd window down**, **Valve Error** for one (1) minute. TWO (2) possible scenarios next page:

Debug Screen 0



1) **IF (and ONLY if) Valve Error = 0 <u>OR</u> 'blinks to 1' for LESS THAN two (2) seconds:** See procedure number CLEAN- 1.0.4 (page 168)

2) **IF (and ONLY if) Valve Error = 1 MORE THAN (2) seconds:** Proceed to **page 207**, procedure number CLEAN- 7.0.0.

**<u>CLEAN- 1.0.4 VALVE ERROR = 0 / BI*B*AG EQUIPPED?</u>**

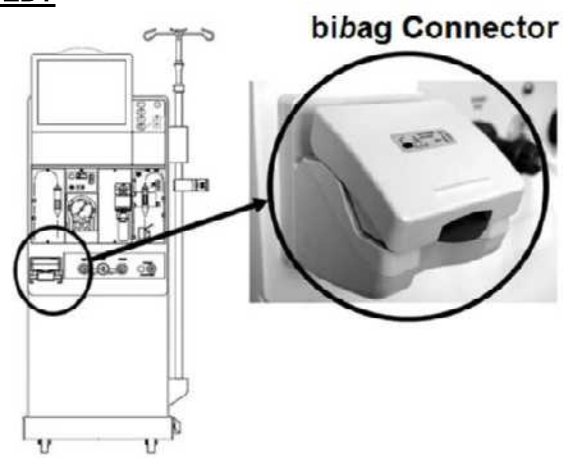
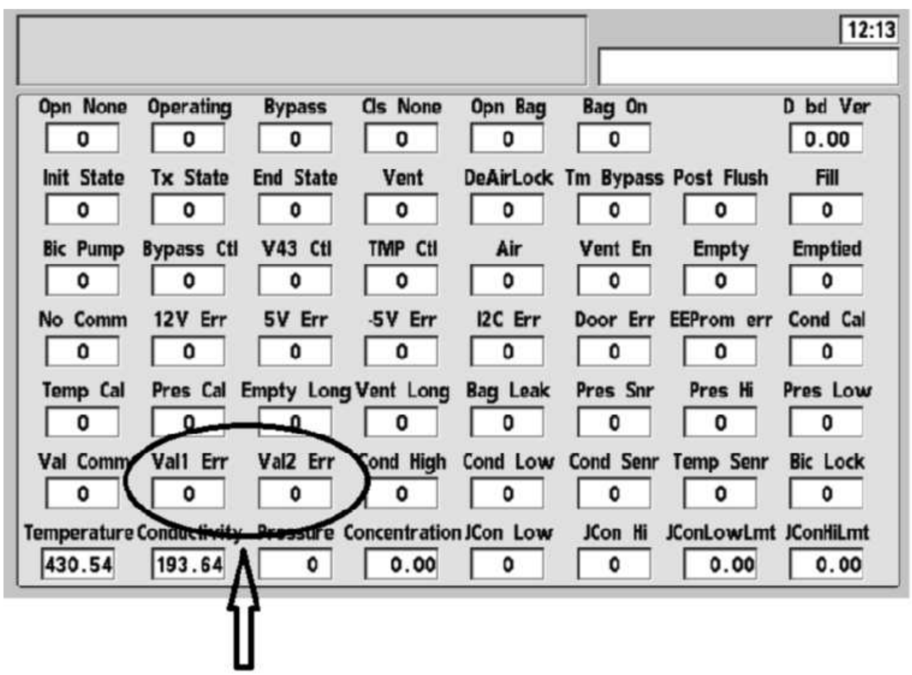



Figure right, TWO (2) possible scenarios:

**1) IF (and ONLY if) <u>NOT</u> equipped with a bi*b*ag Connector:** Turn the machine OFF then proceed to **page 607**, procedure number LEAKING- 4.0.0.

**2) IF equipped with a bi*b*ag Connector:** See parts a AND b below:

a) Call debug screen 14 (Figure below).




b) Locate **Val1 Err** <u>AND</u> **Val2 Err.** TWO (2) possible scenarios:

**1) IF (and ONLY if) <u>BOTH</u> Val1 Err AND Val2 Err = 0:** Turn the machine OFF then proceed to **page 607**, procedure number LEAKING- 4.0.0.

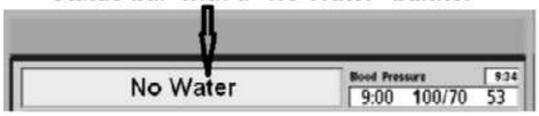
**2) IF Val1 Err <u>AND/OR</u> Val2 Err = 1:** Proceed to **page 727.** SECTION 29 – BIBAG: VALVE 1 OR 2 ERROR.

## CLEAN- 1.0.5 ISOLATE VERR

**NOTE!** From here forward, if (and ONLY if) a leak develops, address it first!

a) Figure right, ENSURE a “No Water” alarm* NEVER occurs!

Status bar with a "No Water" banner



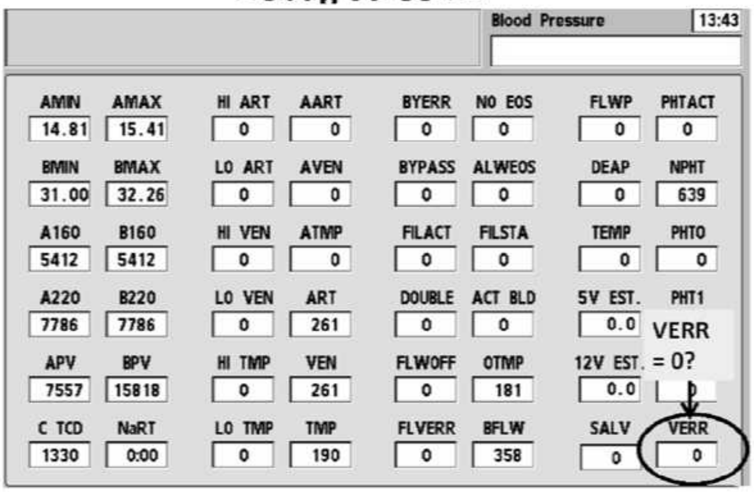

* If (and ONLY if) a “No Water” alarm EVER occurs address it first!

b) Call debug screen 1 (Figure right). Does **VERR** (lower right) = 0?

Yes **VERR** = 0! Proceed to **page 170**, procedure number CLEAN- 1.2.0

No **VERR** = 1 OR more! See procedure number CLEAN- 1.0.6 (page 169).

Debug Screen 1

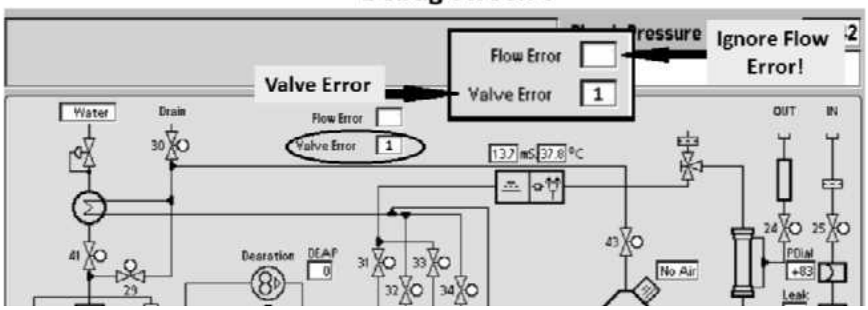



## CLEAN- 1.0.6 VERR = 1 OR MORE

a) Call debug screen 0 (Figure right).

b) Ignoring a ‘blink to 1’ that lasts less than two (2) seconds, watch the 2nd window down, **Valve Error** for one (1) minute!

Debug Screen 0




c) Does **Valve Error** EVER = 1 for LONGER THAN two (2) seconds! TWO (2) possible scenarios:

1) **IF (and ONLY if) Valve Error = 0 OR ‘blinks to 1’ for less than two (2) seconds!** ENSURING the shunt door is CLOSED, proceed to **page 224**, TROUBLESHOOTING VALVE ERRORS IN CLEANING PROGRAMS

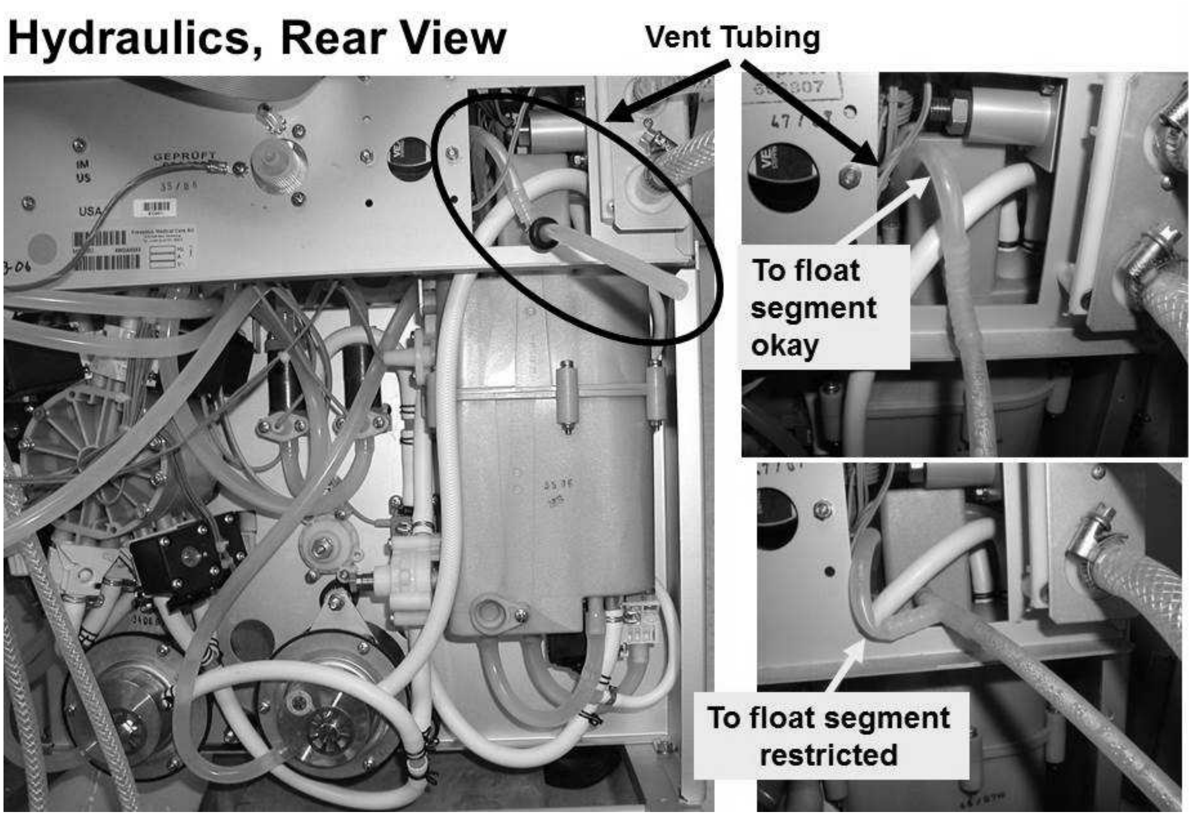
2) **IF Valve Error EVER = 1 LONGER THAN two (2) seconds:** See procedure number CLEAN- 7.0.0 (page 207).

**CLEAN- 1.2.0 NO LEAKS / VENT RESTRICTION?**

**NOTE!** Flow Errors may cause some Vent Tubing overflow. This is normal and can be ignored.

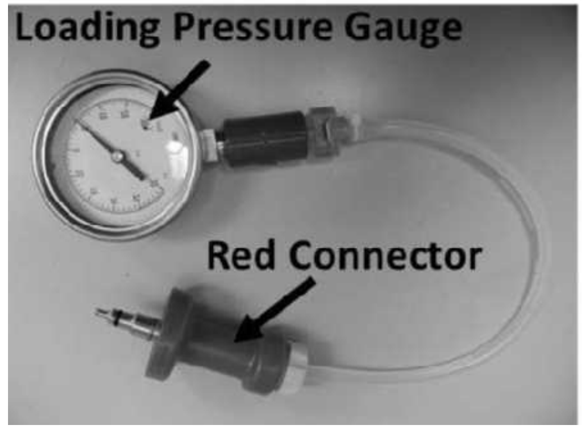
a) Per the Figure below, check for Vent Tubing kinks, **INCLUDING** the short segment going back to the float!

b) If a kink was located and eliminated allow three (3) minutes to see if this fixes the flow error. If (and ONLY if) the flow error reoccurs see procedure number CLEAN- 1.2.1 (page 171).



## CLEAN- 1.2.1 PREPARE TO ISOLATE LOADING PRESSURE

a) **Figure right**, remove the ACID (RED) connector from the acid inlet tubing AND attach the Loading Pressure gauge tubing to it.

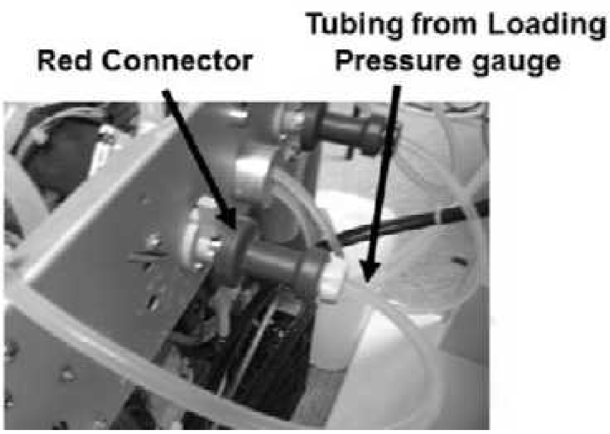



b) **ENSURE** the gauge reads 0 psi before inserting it in the Rinse Port!

c) Place the Acid Inlet tubing into water.

d) Figure below, **SLAM** the acid connector, with the gauge now attached, into the Acetate/Acid Rinse port.

e) See procedure number CLEAN- 1.2.1.1 (page 171).

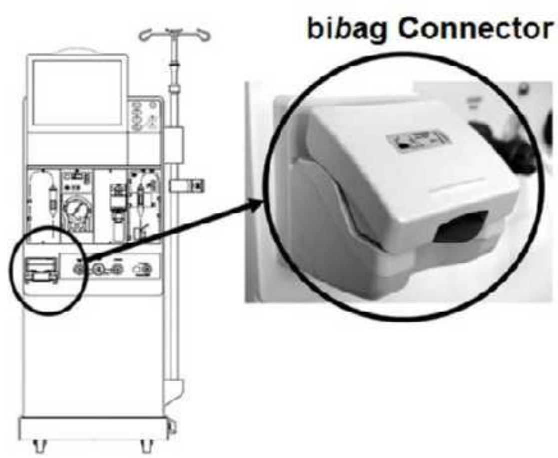



## CLEAN- 1.2.1.1 ISOLATE LOADING PRESSURE (1)


a) Figure right, if the "Interrupted" banner IS NOT up continue to part b. If "Interrupted" is up press 'Esc', then depending on where the Flow Error was occurring, return HEAT DISINFECT OR RINSE**!**

b) ENSURE no leaks at the gauge!

c) Figure right, TWO (2) possible scenarios:

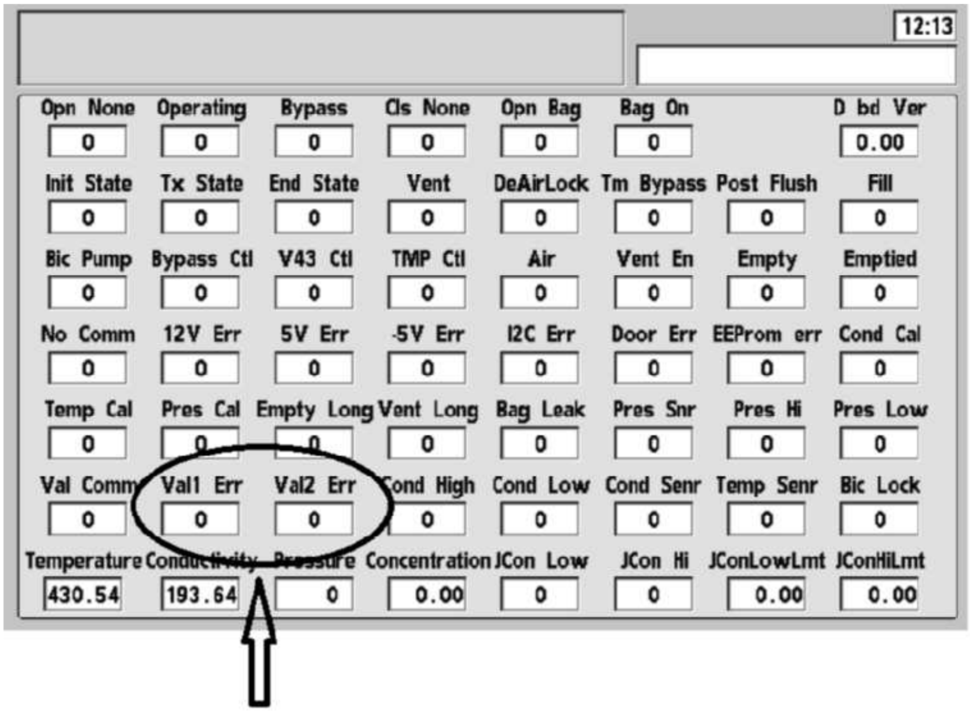



**1) IF equipped with the bi*bag* Connector:** See procedure number CLEAN- 1.2.2 (page 172).

**2) IF (and ONLY if) NOT equipped with a bi*bag* Connector:** Proceed to **page 173**, procedure number CLEAN- 1.2.3.

## CLEAN- 1.2.2 BI*B*AG EQUIPPED / ISOLATE LOADING PRESSURE (2)

A) Call debug screen 14 (Figure below). If debug does not appear press ‘Esc’ then call screen 14.




B) Do <u>BOTH</u> **Val1 Err** <u>AND</u> **Val2 Err**. = 0?

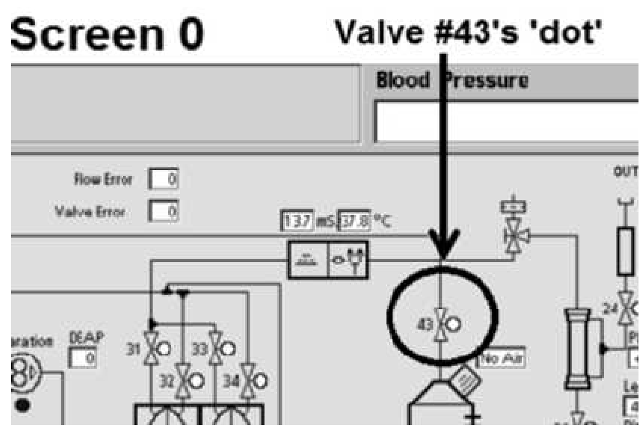
Yes BOTH **Val1 Err** <u>AND</u> **Val2 Err** = 0! Continue to part C.

No **Val1 Err** <u>AND /OR</u> **Val2 Err** = 1! Proceed to page **727**, SECTION 29 – BIBAG: VALVE 1 OR 2 ERROR

C) Call debug screen 0 (Figure right) to locate Valve #43’s ‘dot’. It cycles between white and blue every forty-five (45) seconds.

D) **Read the gauge <u>ONLY WHILE</u> Valve #43’s ‘dot’ is WHITE!**

E) See procedure number CLEAN- 1.2.3 (page 173).



## CLEN- 1.2.3 ISOLATE LOADING PRESSURE (3)

A) Loading Pressure may or may not be cycling. TWO (2) possible scenarios below:

**1)** **IF NOT cycling:** Pressure is 'OKAY' if it REMAINS between 22 and 27 psi. See part B!

**2)** **IF cycling:** It may cycle to but SHOULD NOT remain less than 15 psi. It is 'OKAY' if it EVER cycles to a PEAK between 22 and 27 psi. See part B!

B) FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

**1)** **IF (and ONLY if) Loading Pressure is 'OKAY':** Leaving the gauge installed, proceed **page 190**, procedure number CLEAN- 3.0.0

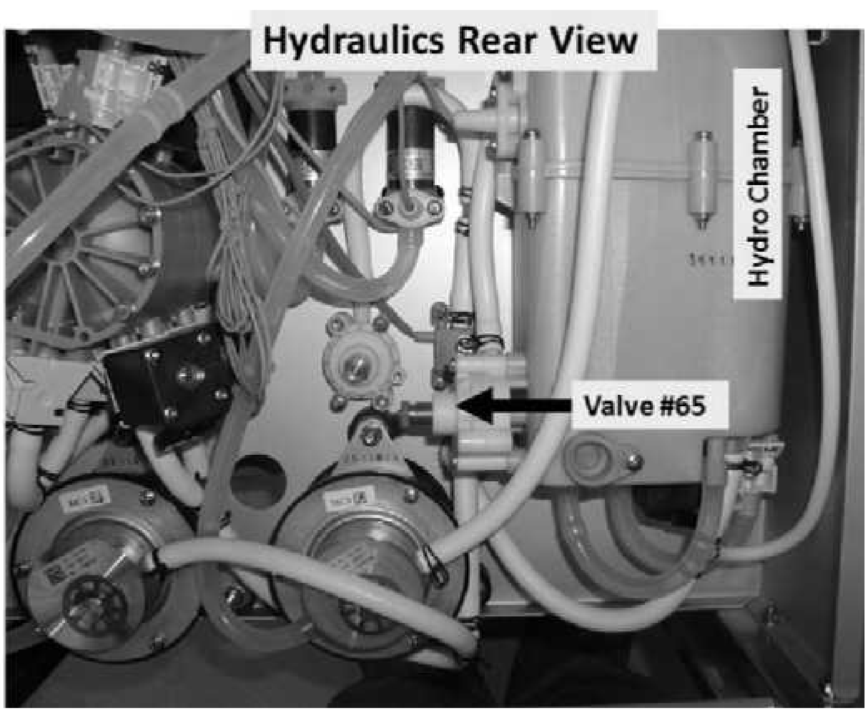
**2)** **IF (and ONLY if) REMAINS ALWAYS less than 15 psi:** ENSURING the gauge was SLAMMED into the Rinse port, Loading Pressure is low! See procedure number CLEAN- 1.2.33 (page 174).

**3)** **IF (and ONLY if) EVER MORE than 28 psi:** Turn Valve #65's nut (Figure below) counterclockwise (outward) to adjust to a PEAK of between 22 and 25 psi. If a Flow Error reoccurs proceed **page 190**, procedure number CLEAN- 3.0.0.

**4)** **IF cycling to a PEAK of between 15 and 21 psi:** ENSURING the gauge was SLAMMED into the Rinse port, turn Valve #65's nut (Figure below) clockwise (inward) attempting to adjust to a PEAK of between 22 and 25 psi. Can you?

Yes Pressure CAN be adjusted to its PEAK! Allow two (2) minutes then if a Flow Error reoccurs proceed **page 190**, procedure number CLEAN- 3.0.0.

No Loading Pressure remains low! See procedure number CLEAN- 1.2.33 (page 174).

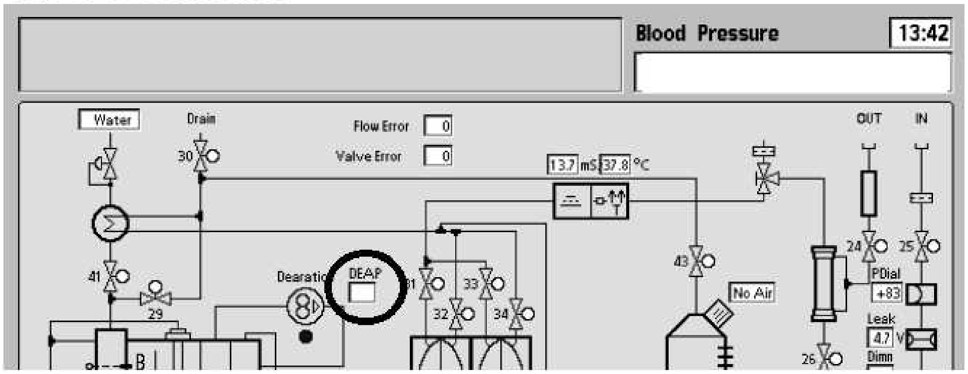


## CLEAN- 1.2.33 LOADING PRESSURE REMAINS LOW

a) **Place the machine into <u>RINSE</u> (<u>NOT</u> HEAT DISINFECT)!**

b) Call debug screen 0 (Figure below). If debug does not appear press ‘Esc’ then call screen 0

**DEBUG SCREEN 0**




c) Locate **DEAP**. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) DEAP = 75 <u>OR</u> less:** See procedure number CLEAN- 1.2.4 (page 175).

**2)** **IF DEAP = 76 <u>OR</u> more:** See parts a THROUGH i below:

a) Enter Service Mode → Calibrate Hydraulics → Deaeration Pressure. **DO NOT follow the screen instructions! See part b instead!**

b) Press ‘Enter’. The screen’s **[Pump Rate]** window turns yellow.

c) Press the **[Pump Rate]** window to turn it bright yellow.

d) Set the **[Pump Rate]** window to “210”.

e) **Press ‘Enter’ twice to save the calibration.**

f) Turn the machine off then back on.

g) **Place the machine into <u>RINSE</u> (<u>NOT</u> HEAT DISINFECT)**.

h) Call debug screen 0. If debug does not appear press the ‘Esc’ key then call debug screen 0.

i) Is **DEAP** now = 45?

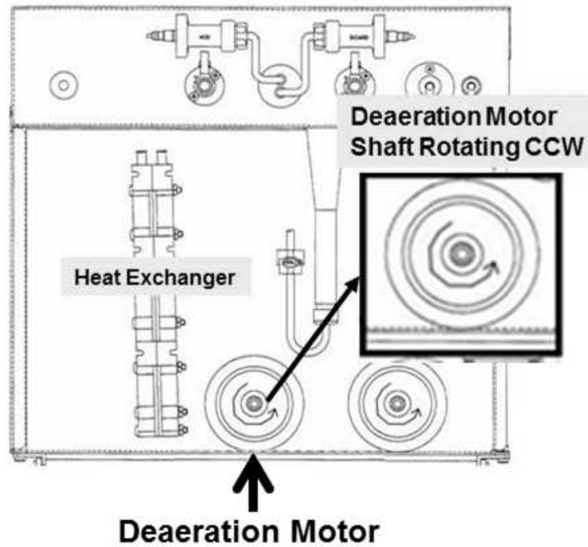
Yes **DEAP** = 45! See procedure number CLEAN- 1.2.4 (page 175).

No **DEAP** <u>NOT</u> = 45! CAREFULLY repeat the Deaeration Pressure Calibration from part a). After repeating, if (and ONLY if) **DEAP** STILL does not = 45, THREE (3) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Functional Board EEPROM (IC2) OR; **3)** Bad Functional Board.

**CLEAN- 1.2.4 DEAP = 75 OR LESS / ISOLATE DEAERATION MOTOR**

a) **If (and ONLY if) the problem was occurring in Heat Disinfect return to it. If not, remain in RINSE!**

b) Figure right, is the Deaeration Motor shaft rotating COUNTERCLOCKWISE (CCW)?




Yes Rotating CCW! See procedure number CLEAN- 1.2.5 (page 175).

No NOT rotating CCW! See parts a THROUGH c below:

a) ENSURE HEAT DISINFECT OR RINSE is running!

b) Turn the Heater Breaker Switch OFF!

c) **NOTING ONLY** the **DEAERATION MOTOR** will be checked proceed to **page 141**, TROUBLESHOOTING MOTORS**.**

**CLEAN- 1.2.5 DEAERATION MOTOR ROTATING CCW / ISOLATE MOTOR STABILITY**

Using the handle end of a screwdriver, push HARD on and release the DEAERATION MOTOR SHAFT several times. Can you make it stop rotating and REMAIN stopped?

Yes If ABSOLUTELY SURE the motor stops! TWO (2) possible bad components: **1)** Bad Deaeration Motor (likely bad brushes) OR; **2)** Bad Deaeration Pump head.

No The motor does NOT stop! See procedure number CLEAN- 1.2.6 (page 176).

## CLEAN- 1.2.6 MOTOR CONTINUES TO ROTATE

Recheck Loading Pressure (gauge in Rinse port). THREE (3) possible scenarios 1) or 2) or 3) below:

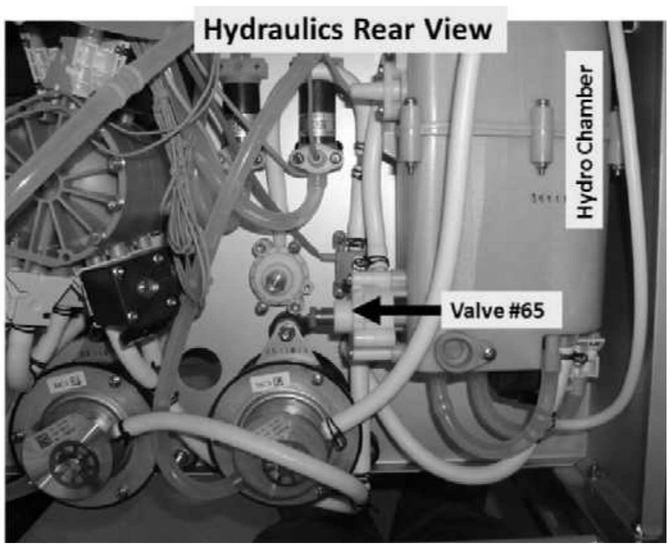
1) **IF (and ONLY if) ALWAYS less than 15 psi:** Leaving the machine in the Cleaning Program, see procedure number CLEAN- 1.5.0 (page 176).

2) **IF (and ONLY if) MORE than 25 psi:** Figure below, turn Valve #65's nut counterclockwise (outward) to adjust to between 23 and 25 psi then proceed **page 190**, procedure number CLEAN- 3.0.0.

3) **IF cycling to between 15 and 21 psi:** Figure below, turn Valve #65's nut clockwise (inward) attempting to adjust pressure to a PEAK between 23 and 25 psi. Can you?

Yes Pressure CAN be adjusted to its PEAK! Allow two (2) minutes then if a Flow Error reoccurs proceed **page 190**, procedure number CLEAN- 3.0.0.

No Loading Pressure remains low! Leaving the machine in the Cleaning Program, see procedure number CLEAN- 1.5.0 (page 176).



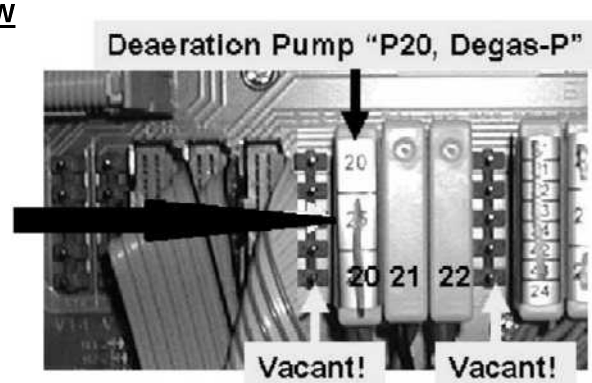

## CLEAN- 1.5.0 LOADING PRESSURE REMAINS LOW

a) Turn the Heater Breaker Switch OFF!

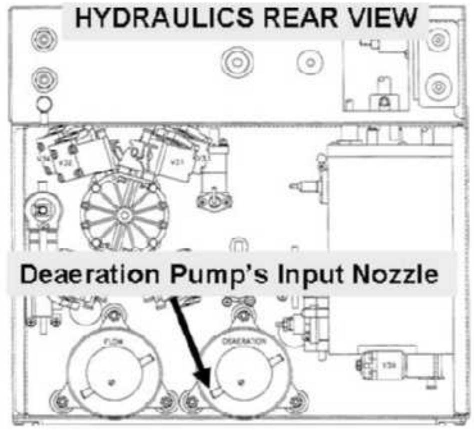
b) Figure right, unplug the Deaeration Pump from distribution board position, "P20, DEGAS-P".

c) Obtain a **1000 ml** graduated cylinder AND the white drip bucket.

d) See procedure number CLEAN- 1.5.1 (page 177).



**CLEAN- 1.5.1 ISOLATE POSSIBLE AIR LOCK**




a) **CAUTION!** Fluid and tubing may be HOT!

b) Figure right, remove the clear tubing from the Deaeration Pump's INPUT nozzle. **Keep the tubing at pump level to encourage gravity flow from it!**

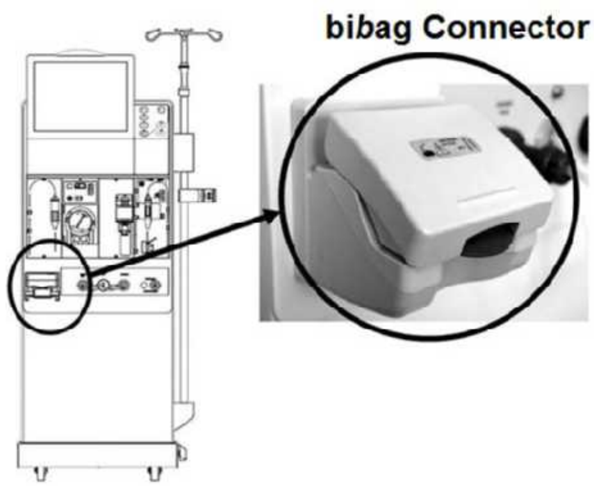
c) The tubing is from hydrochamber D. If any flow from it direct it into the bucket for TWO (2) minutes BEFORE continuing to part d.

d) Now direct the tubing into the cylinder for ONE (1) minute! More than three hundred (300) ml collected?

Yes More than 300 ml! See procedure number CLEAN- 1.5.2 (page 177).

No Less than 300 ml! Leaving the tubing off and the pump unplugged, proceed to **page 183**, procedure number CLEAN- 2.0.0.

**CLEAN- 1.5.2 MORE THAN 300 ML / BI*B*AG?**




**a) Reattach the Deaeration Pump's tubing!**

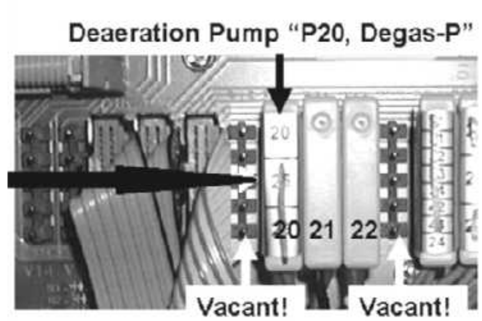
b) Figure right, TWO (2) possible scenarios:

1) **IF equipped with a bi*bag* Connector:** See procedure number CLEAN- 1.5.3 (page 178).

2) **IF NOT equipped with a bi*bag* Connector:** Proceed to **page 182**, procedure number CLEAN- 1.6.0.

LEFT BLANK INTENTIONALLY

## CLEAN- 1.5.3 BI*B*AG EQUIPPED

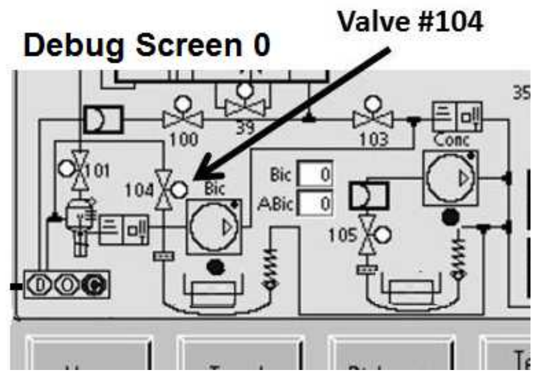



a) Figure right, return the Deaeration Pump to distribution board position "P20"!

b) **ENSURE THE DEAERATION MOTOR IS running!**

c) Call debug screen 0 (Figure right). If debug does not appear press 'Esc' then call screen 0.

d) Does Valve #104's symbol appear?

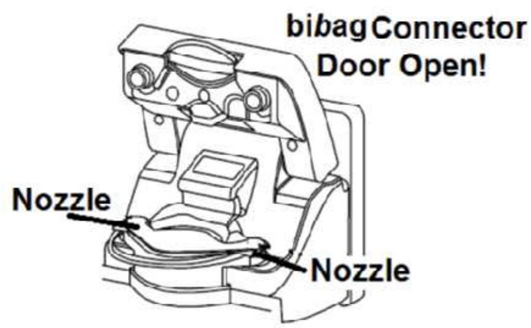



Yes Valve #104 appears! See procedure number CLEAN- 1.5.4 (page 178).

No Valve #104 does DOES NOT appear! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad bibag Interface Board OR; **3)** Bad Actuator-Test Board.

## CLEAN- 1.5.4 VALVE #104 APPEARS

Figure right, open the bi*b*ag Connector door! Flow (more than 10 ml per minute) from one of the nozzles?




Yes Flow from a bi*b*ag Connector nozzle! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board cable connection (refer to Figure 4C, page 11)) OR; **2)** Bad Valve #100****** OR; **3)** Bad bi*b*ag Interface Board.

**NOTE!** Swap the components in one at a time until no flow from the Connector nozzle.

** To LOCATE Valve #100 refer to Figure 3 (page 5)

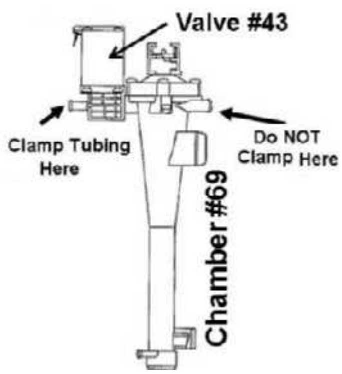
No flow a) Close the bi*b*ag Connector door.

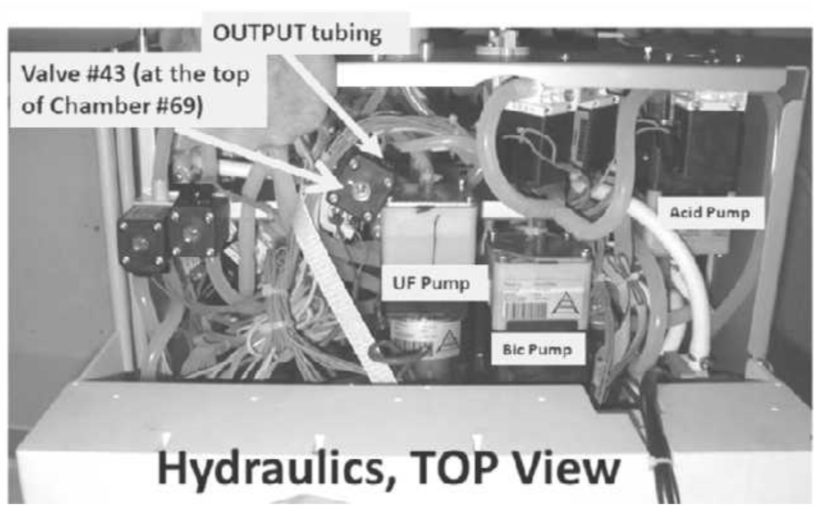
b) If the "Interrupted" banner (Figure below) IS NOT displayed continue to part c. If "Interrupted" is displayed press 'Esc' then, depending on where the Flow Error was occurring, return to HEAT DISINFECT OR RINSE!


c) See procedure number CLEAN- 1.5.41 (page 179).

**CLEAN- 1.5.41 ISOLATE VALVE #43**

A) **Per the Figures BELOW**, double clamp Valve #43's OUTPUT tubing.* *Valve #43's OUTPUT tubing extends towards the FRONT of the machine!

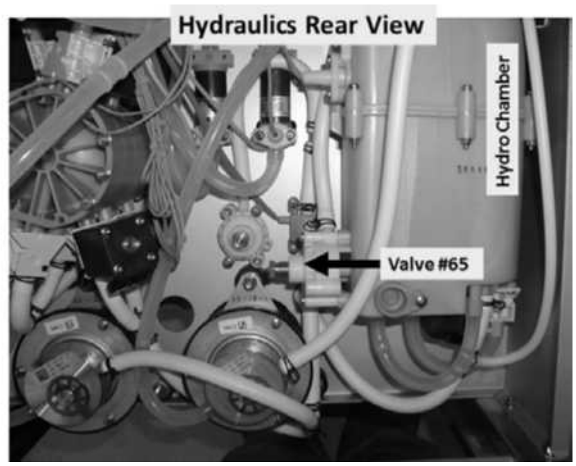



B) Figure right, adjust Valve #65 attempting to achieve a peak between 23 and 25 psi?

Yes **A)** Remove the clamps; **B)** From debug screen 0 allow Valve #43's 'dot' to turn WHITE; **C)** While white, if pressure becomes low again this confirms a problem with Valve #43! TWO (2) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Valve #43.

No See procedure number CLEAN- 1.5.5 (page 179).




**CLEAN- 1.5.5 LOADING PRESSURE REMAINS LOW**

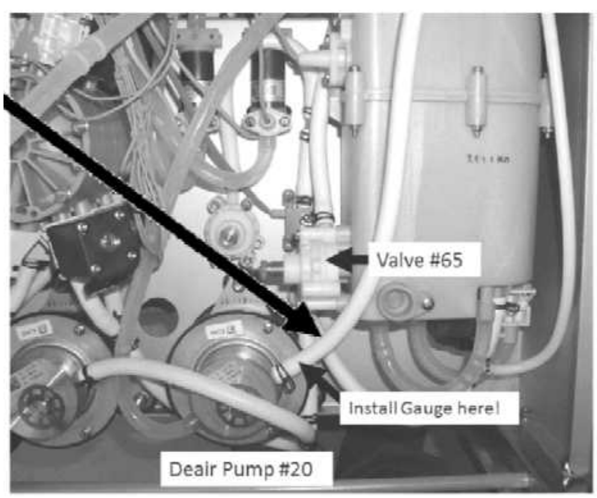
a) **Turn the machine OFF!**

b) Leaving the gauge in the Rinse port, a second psi gauge is required. **ENSURE it reads zero (0) psi BEFORE installing it.**

c) Figure right, tee the second gauge into the OUTPUT (white tubing) side of DEAERATION Pump #20.

d) **To prevent leaks and false readings tie wrap both sides of the gauge tubing**!

e) See procedure number CLEAN- 1.5.6 (page 180).



## CLEAN- 1.5.6 ISOLATE LOADING PRESSURE

a) If the Flow Error was occurring in Heat Disinfect return to it. If not place the machine in RINSE!

b) ENSURE the Deaeration Motor is running!

c) **Reading the gauge at the Deaeration Pump**, TWO (2) possible scenarios below:

**1)** **IF (and ONLY if) peaking to MORE than 27 psi:** Turn Valve #65's nut (Figure above) counterclockwise to bring PEAK pressure, at the Deaeration Pump gauge, to between 23 and 25 psi. If this pressure can be achieved see procedure number CLEAN- 1.5.7 (page 181). If it CANNOT be adjusted to between 23 and 25 psi Valve #65 may be bad.

**2)** **ALL OTHER scenarios:** Turn Valve #65's nut until a PEAK pressure, at the Deaeration Pump gauge, is between 23 and 25 psi. Can you achieve this pressure?

Yes Between 23 and 25 psi! See procedure number CLEAN- 1.5.7 (page 181).

No Pressure remains less than 22 psi! ENSURING no leaks, see parts a AND b below:

a) ENSURE more than 300 ml per minute input flow to the Deaeration Pump (i.e. no recurring air lock)!

b) Swap the following components (see Component List below) one at a time, with known good, and in between, attempting to adjust pressure at the Deaeration Pump gauge to a PEAK of between 23 and 25 psi. When between 23 and 25 psi can be achieved the last component swqapped in is the problem! .

**COMPONENT LIST (4 components):** **1)** Deaeration Pump head **2)** Deaeration Motor; **3)** Valve #65* **4)** Hydrochamber.

***** Ensure the correct spring is installed under Valve #65's nut! Refer to Figure 6 (page 22)

**NOTE!** When a PEAK of between 23 and 25 psi is achieved see procedure number CLEAN- 1.5.7 (page 181).

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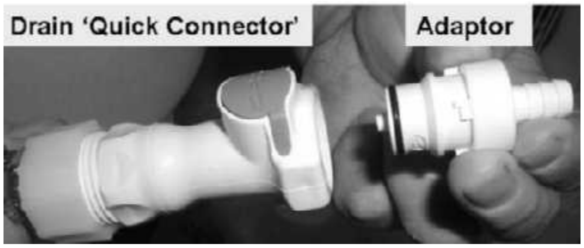
## CLEAN- 1.5.7 PRESSURE AT DEAERATION PUMP BETWEEN 23 AND 25 PSI

Compare the gauge at the Deaeration Pump to the gauge in the RINSE port. Are they within three (3) psi of each other?

Yes Within 3 psi of each other! Proceed to **page 189**, procedure number CLEAN- 2.4.0.

No Pressure at the RINSE port gauge is way less than pressure at the Deaeration Pump gauge! See parts a THROUGH d below:




a) A 1000 ml graduated cylinder is required!

b) At the end of the 'to drain' tubing, if a 'Quick Connector' (Figure right) is present, an ADAPTOR is required!

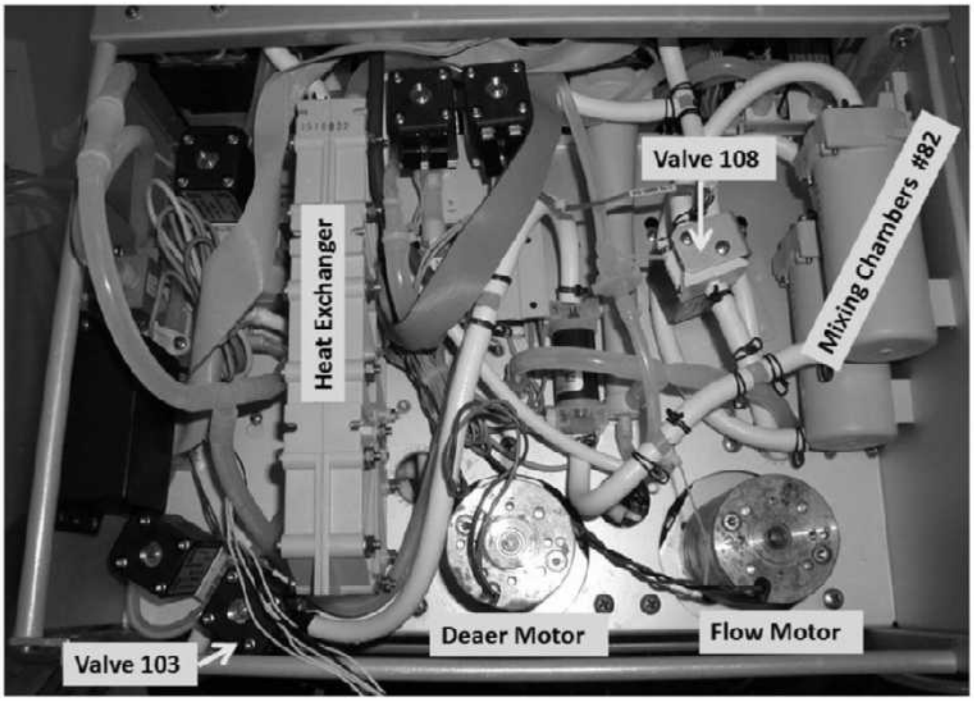
c) ENSURING Rinse OR Heat Disinfect is running, measure flow from the drain tubing, into the cylinder, for ONE (1) minute!

d) More than 500 ml collected?

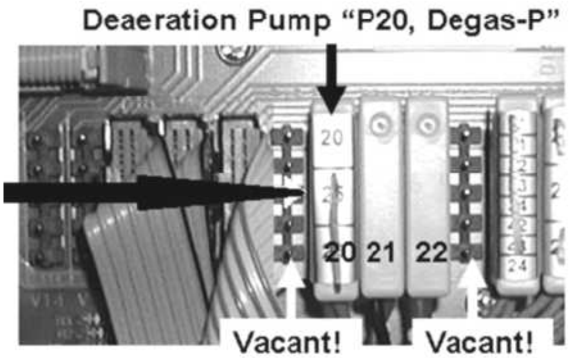
Yes More than 500 ml! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C, page 11)) OR; **2)** Bad Valve #108 (refer to Figure below) OR; **3)** Bad bi*b*ag Interface Board.

No Way less than 500 ml! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (see Figure 4C, page 11)) OR; **2)** Bad Valve #103 (refer to Figure below) OR; **3)** Bad bi*b*ag Interface Board

### Hydraulics, Front View



**CLEAN- 1.6.0 MACHINE NOT BI*B*AG EQUIPPED**




a) Figure right, return the Deaeration Pump to distribution board position, "P20"!

b) **ENSURE THE DEAERATION MOTOR IS RUNNING!**

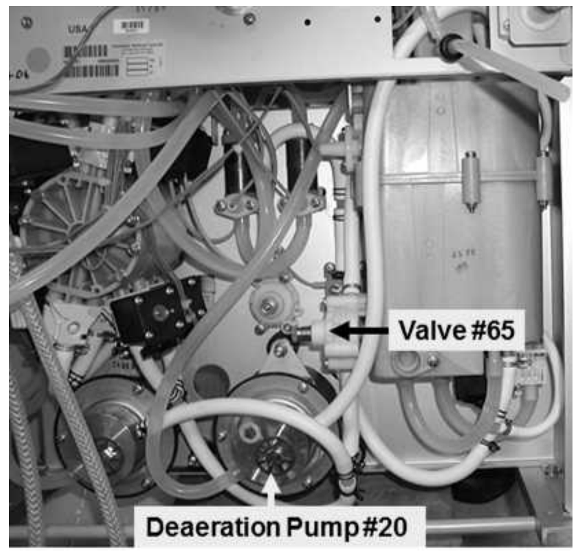
c) Figure right, turn Valve #65's nut clockwise (tighter) attempting to achieve a PEAK Loading Pressure of between 23 and 25 psi?

Yes    Between 23 and 25 psi! Proceed to **page 189**, procedure number CLEAN- 2.4.0.

No    Less than 22 psi!  See parts a AND b below:

a) ENSURE more than 300 ml per minute input flow to the Deaeration pump i.e. no recurring air lock!

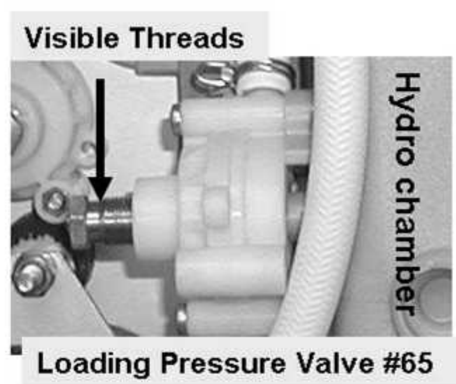
b) Swap the following components (see Component List below) one at a time, with known good then, in between attemp to adjust Loading Pressure. When a PEAK pressure of more than 23 psi can be achieved the last component swapped in is the problem.




**COMPONENT LIST: 1)** Deaeration Pump head; **2)** Deaeration Motor; **3)** Valve #65*; 4) Hydrochamber.

* Figure right, ensure threads are visible under Valve #65's nut. If no threads are visible either the wrong spring is installed** under Valve #65's nut OR Valve #65 is bad!

* * Refer to Figure 6 (page 22).



## CLEAN- 2.0.0 LESS THAN 300 ML PER MINUTE COLLECTED / ISOLATE RESTRICTOR #48

This procedure attempts to clear an air lock. First Restrictor #48 is checked to see if it is plugged!

a) Turn the machine off then back on.

b) Figure right, allow the “Select Program” banner to appear but **DO NOT** press any screen buttons! “Select Program” remains up **till INSTRUCTED OTHERWISE!**


**60 ml Syringe** with plunger all the way in

c) Figure right, a **60 ml syringe**, with the plunger pushed all THE WAY IN, is required! Using a smaller syringe may cause error!

d) Attach the syringe, to the DEAERATION PUMP’s **clear tubing** removed earlier.

e) PULL on the plunger to the end of the barrel! If Restrictor #48 is plugged you will feel very strong resistance and may not be able to pull the plunger all the way out. Very strong resistance (Yes or No)?

Yes Very strong resistance! Restrictor #48 is plugged with debris[1]. Replace the tubing segment that contains Restrictor #48*. *To LOCATE Restrictor #48 refer to the Figure, next page)!

[1] Debris indicates FIVE (5) possibilities: **1)** Excessive O-ring lubrication; **2)** Inadequate acid cleaning (bicarbonate precipitate); **3)** Inadequately filtered incoming water; **4)** Degraded Heater; **5)** Degrading Deaeration Pump Head.

No Very little resistance! Restrictor #48 is open! Perform parts A THROUGH E below:

A) Remove the syringe and MEASURE flow from the tubing. If less than 130 ml is collected see part B. If (and ONLY if) more than 130 ml is collected see procedure number CLEAN- 2.0.2 (page 184).

B) Push the syringe plunger fully back into the barrel.

C) Reattach the syringe to the Deaeration Pump’s tubing.

D) Pull on the plunger to the end of the barrel!

E) Repeat parts A through E up to **TEN (10) TIMES** OR until if you MEASURE more than 130 ml every minute?

Yes More than 130 ml every minute! No airlock! See procedure number CLEAN- 2.0.2 (page 184).

No After ten (10) attempts you CANNOT achieve more than 130 ml per minute! An airlock is present! Proceed to **page 186**, procedure number CLEAN- 2.0.5.

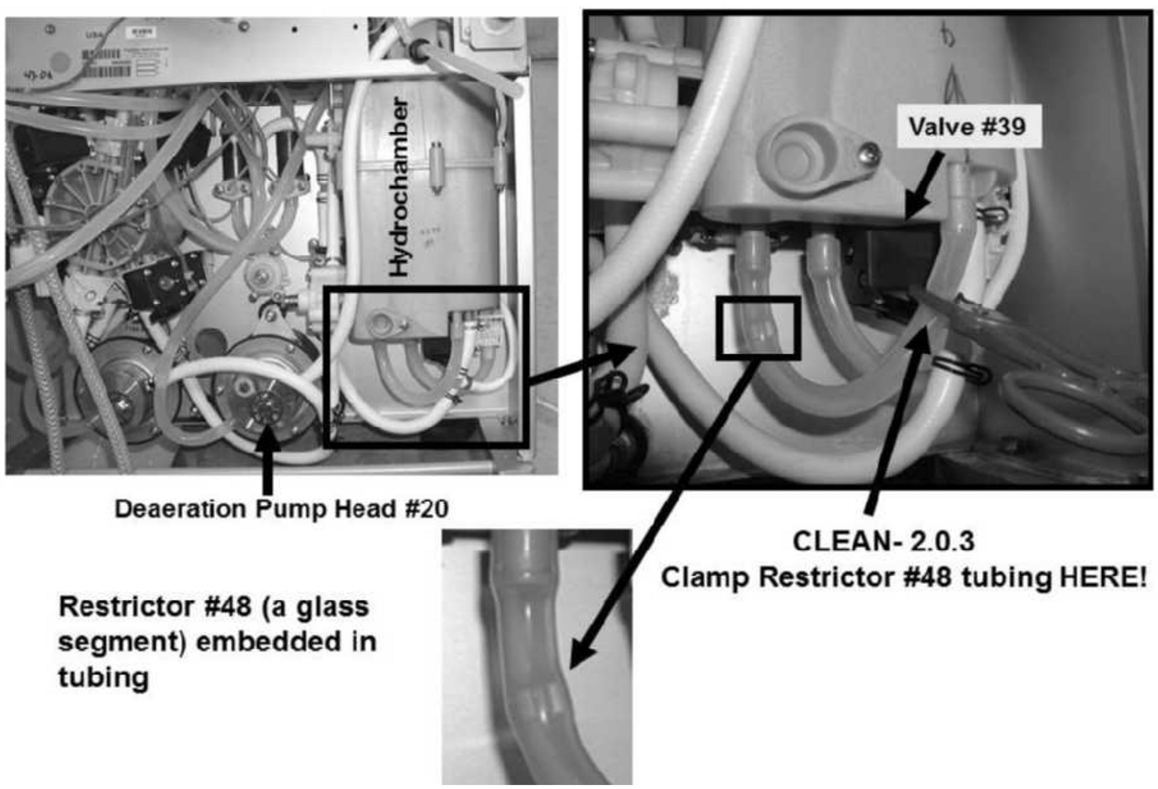
**CLEAN- 2.0.2 MORE THAN 130 ML**

Direct the tubing into a bucket for up to FIVE (5) minutes. Flow will either: **1)** Continue at more than 130 ml every minute OR **2)** Stop. TWO (2) possible scenarios:

1) **IF (and ONLY if) flow continues at 130 ml or more every minute:** Leaving the tubing off and the pump unplugged, see procedure number CLEAN- 2.0.3 (page 185).

2) **IF flow STOPS:** Proceed to **page 187**, procedure number CLEAN- 2.1.0.

## RESTRICTOR #48 LOCATION



## CLEAN- 2.0.3 FLOW CONTINUES AT MORE THAN 130 ML PER MINUTE / ISOLATE VALVE #39

Cleaning Programs open Valve #39. This procedure isolates Valve #39:

a) **Per the Figure above**, at the bottom of the Hydrochamber, clamp the tubing segment that contains Restrictor #48!

b) **If the Flow Error was occurring in Heat Disinfect return to it! If not place the machine in RINSE!**

c) Again direct the Deaeration Pump's CLEAR tubing into the **1000 ml** cylinder.

d) Measure for ONE (1) minute! More than **two hundred (200) ml** collected?

Yes More than 200 ml! Valve #39 is okay! See procedure number CLEAN- 2.0.4 (page 185).

No Less than 200 ml! See parts a AND b next page:

a) ENSURE Valve #39 is plugged properly into distribution board position V39!

b) Swap in the following components (see Component List below) one at a time, with known good, then repeat (ABOVE) procedure number CLEAN- 2.0.3 (page 185) until more than 200 ml is collected indicating the last component swapped in is the problem.

**COMPONENT LIST (4 components):** **1)** Actuator-Test Board; **2)** Valve #39 (located on the bottom of the hydrochamber, refer to the Figure above), including its blue wiring harness; **3)** ACTUATOR-TEST board ribbon cable; **4)** Distribution board.

## CLEAN- 2.0.4 MORE THAN 200 ML PER MINUTE/ VALVE #39 IS OKAY

If all procedures were performed correctly you have determined good flow through Restrictor #48 AND Valve #39 i.e. more than 300 ml every minute input flow to the Deaeration Pump. See parts a THROUGH c below:

a) **Remove the clamp from Restrictor #48's tubing!**

b) **Reattach the tubing to the Deaeration Pump's Inlet nozzle!**

c) Return to (ABOVE) **page 178**, procedure number CLEAN- 1.5.3.

## CLEAN- 2.0.5 CANNOT ACHIEVE 130 ML

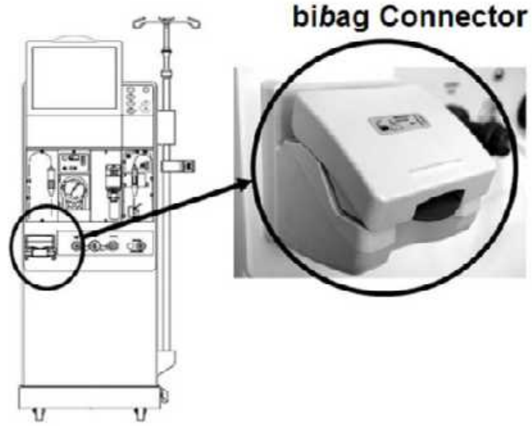



Figure right, TWO (2) possible scenarios:

1) **IF (and ONLY if) NOT equipped with a bi*b*ag Connector:** See procedure number CLEAN- 2.1.0 (page 187).

2) **IF equipped with a bi*b*ag Connector:** See parts a THROUGH e below:

   a) Figure below, clamp the tubing attached to the top of Valve #101.

   b) Again attach the 60 ml syringe, with the plunger pushed all the way in, to the Deaeration Pump's CLEAR tubing.

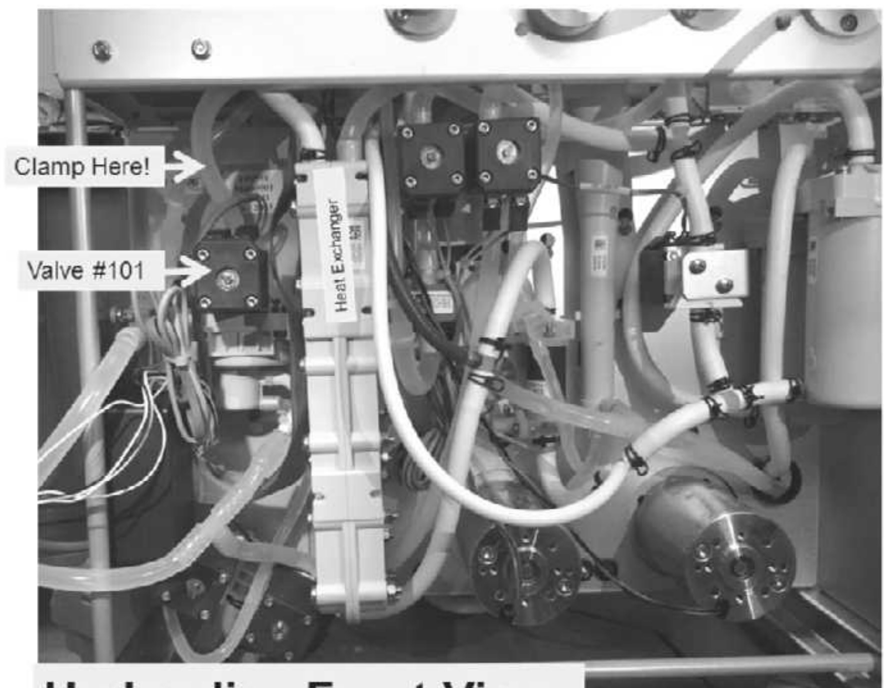
   c) Pull the plunger to the end of the barrel then remove the syringe.

   d) From the tubing, MEASURE flow for one (1) minute, looking for at least 130 ml!

   e) Repeat parts b THROUGH e up to **TEN TIMES** OR until if you measure at least 130 ml in one (1) minute?

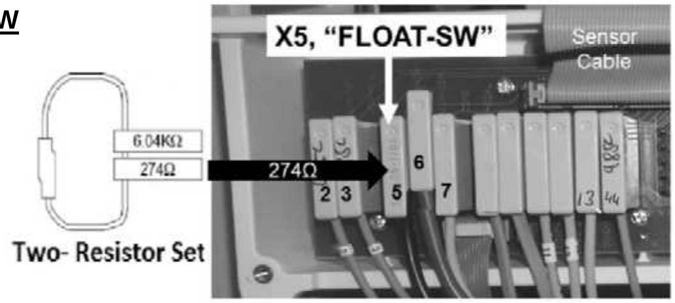
      Yes More than 130 ml per minute! THREE (3) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C, page 11)) OR; **2)** Bad Valve #101 OR; **3)** Bad bi*b*ag Interface Board.

      No After ten (10) attempts you DO NOT measure more than 130 ml per minute! Remove the clamp from Valve #101 then see procedure number CLEAN- 2.1.0 (page 187).




Hydraulics Front View

**CLEAN- 2.1.0 ISOLATE INCOMING WATER FLOW**



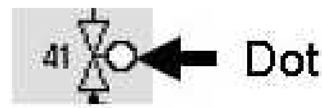

a) Figure right, place the **274 Ω** plug, from the **TWO-RESISTOR SET**, into the float's distribution board position, “X5, FLOAT-SW”.

b) Allow forty (40) seconds OR until flow from the Vent Tubing occurs indicating hydrochambers A through C are full!

c) MEASURE from the Vent Tubing for ONE (1) minute. More than eight hundred (800) ml collected?

Yes More than 800 ml! See procedure number CLEAN- 2.1.1 (page 187).

No Nowhere near 800 ml! Call debug screen 0. Figure right, is Valve #41's ‘dot’ BLUE?



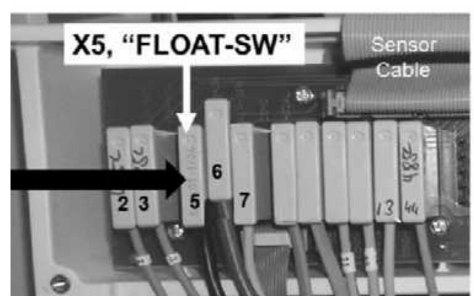

Yes ‘Dot’ = Blue! **A)** Reattach the Deaeration Pump's input tubing; **B)** Proceed to **page 152**, SECTION 2 – NO WATER ALARM

No ‘Dot’ = White!

a) BE VERY SURE the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, is placed PROPERLY in distribution board position, “FLOAT-SW”! If not, repeat procedure number CLEAN- 2.1.0 (page 187)!

b) FIVE (5) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Sensor Board cable OR; **3)** Bad Sensor Board OR; **4)** Bad distribution board OR; **5)** Bad motherboard

**CLEAN- 2.1.1 ISOLATE POTENTIAL AIR LOCK**




a) **Figure right**, return the float's connector to distribution board position, “X5, FLOAT-SW”.

b) Again attach the **60 ml syringe** to the Deaeration Pump's clear Input tubing.

c) PULL on the plunger. If Restrictor #48 is still open you will feel very little resistance and be able to pull the plunger to the end of the barrel!

d) Remove the syringe and MEASURE flow from the tubing for one (1) minute. If less than 130 ml is collected repeat parts b through d up to **TEN (10) TIMES**! After no less than ten (10) attempts do you MEASURE more than 130 ml every minute?

Yes More than 130 ml! See procedure number CLEAN- 2.1.2 (page 188).

No Nowhere near 130 ml! TWO (2) possible bad components: **1)** Bad Float Switch* OR; **2)** Bad Hydrochamber.

* To LOCATE the Float Switch refer to Figure 28 (page 140).

## CLEAN- 2.1.2 ISOLATE FLOAT SWITCH #5

a) This procedure requires up to **four (4) FULL minutes** to prevent labor-intensive error.

b) Direct the tubing into the bucket for up to four (4) minutes. Flow will either: **1)** Continue at more than 130 ml every minute OR **2)** Stop. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) flow continues at 130 ml every minute:** Return to (ABOVE) procedure number CLEAN- 2.0.3 (page 185).

**2)** **IF flow STOPS:** TWO (2) possibilities: **1)** Bad Float Switch #5***** OR; **2)** Bad Hydrochamber.

***** To LOCATE the Float Switch refer to Figure 28 (page 140)

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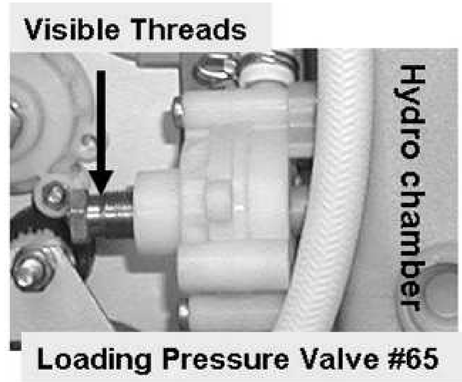
## CLEAN- 2.4.0 LOADING PRESSURE WITHIN RANGE




a) **IMPORTANT!** Turn the Heater Breaker Switch ON!

b) Figure right, several threads should be visible under Valve #65's nut. If threads ARE VISIBLE continue to part c. If no threads are visible either the wrong spring is installed under Valve #65's nut* OR Valve #65 is bad!

* Refer to Figure 6 (page 22)

c) To monitor for intermittent Loading Pressure problems leave the gauge installed in the Rinse port.

**NOTE!** Ignore Vent tubing overflow for now!

d) Watching for ten (10) minutes, does a Flow Error banner EVER reoccur? THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) a Flow Error does DOES NOT reoccur!** Problem solved! Check Loading and Deaeration Pressure per the Preventative Maintenance Procedures booklet.

**2) IF (and ONLY if) a Flow Error reoccurs AND Loading Pressure is peaking to between 23 and 27 psi:** See procedure number CLEAN- 3.0.0 (page 190).

**3) IF a Flow Error reoccurs AND peak Loading Pressure is below 22 psi:** Return to (ABOVE) procedure number CLEAN- 1.2.4 (page 175).

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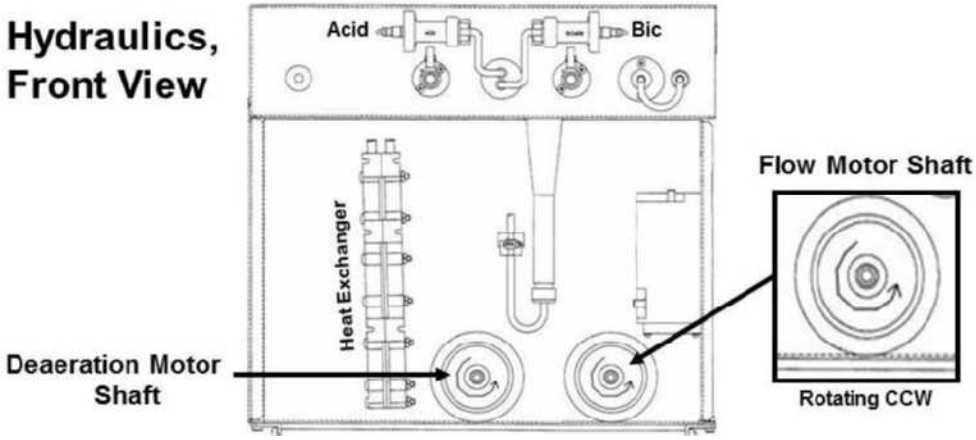
**CLEAN- 3.0.0 LOADING PRESSURE OKAY / ISOLATE MOTORS**

a) **If the "Interrupted" banner is on the screen return to Heat Disinfect OR Rinse!**

b) THREE (3) checks on the Flow AND Deaeration motors (Figure below):




**Check #1:** Is the FLOW MOTOR shaft rotating in the same direction as the Deaeration Motor i.e. counterclockwise (CCW)?

Yes Flow Motor rotating CCW! See CHECK #2.

No If (and ONLY if) it is NOT rotating CCW, **NOTING** ONLY the FLOW MOTOR will be checked proceed to **page 141**, TROUBLESHOOTING MOTORS

**Check #2:** Using the handle end of a screwdriver, push hard on the FLOW MOTOR'S shaft, release it, and then push again several times. Can you make stop rotating and REMAIN stopped?

Yes If ABSOLUTELY SURE the motor stops! TWO (2) possible bad components: **1)** Bad Flow Motor (probably brushes) OR; **2)** Bad Flow Pump head.

No Flow Motor does NOT stop! See CHECK #3.

**Check #3:** Push hard on and release the DEAERATION MOTOR shaft. Can you make it stop rotating?

Yes If ABSOLUTELY SURE the motor stops! TWO (2) possible bad components: **1)** Bad Deaeration Motor (possibly brushes) OR; **2)** Bad Deaeration Pump head.

No The motor DOES NOT stop! See parts a and b below:

a) Based upon if a debug screen is up, TWO (2) possible scenarios:

1) **IF a debug screen is up:** Call "Select Program" by pressing 'Esc' TWICE then 'Enter' TWICE.

2) **IF a debug screen is not up:** Call "Select Program" by pressing 'Esc' ONCE then 'Enter' TWICE.

b) See procedure number CLEAN- 3.2.0 (page 191).

## CLEAN- 3.2.0 MOTORS OKAY / ISOLATE FLOW PUMP PRESSURE (1)

a) ENSURE the “Select Program” banner is up!


b) A psi pressure gauge is required next. ENSURE it reads 0 before installing it!

c) Per the Figure below, tee the gauge into the OUTPUT (white tubing) side of the Flow Pump. CAUTION! Fluid may be hot but won’t scald you!

d) **Tie wrap both sides of the gauge tubing to prevent leaks and false readings!**

e) If (and ONLY if) the Flow Error was occurring in Heat Disinfect return to it. If not place the machine in RINSE!

f) See procedure number CLEAN- 3.2.1 (page 191).

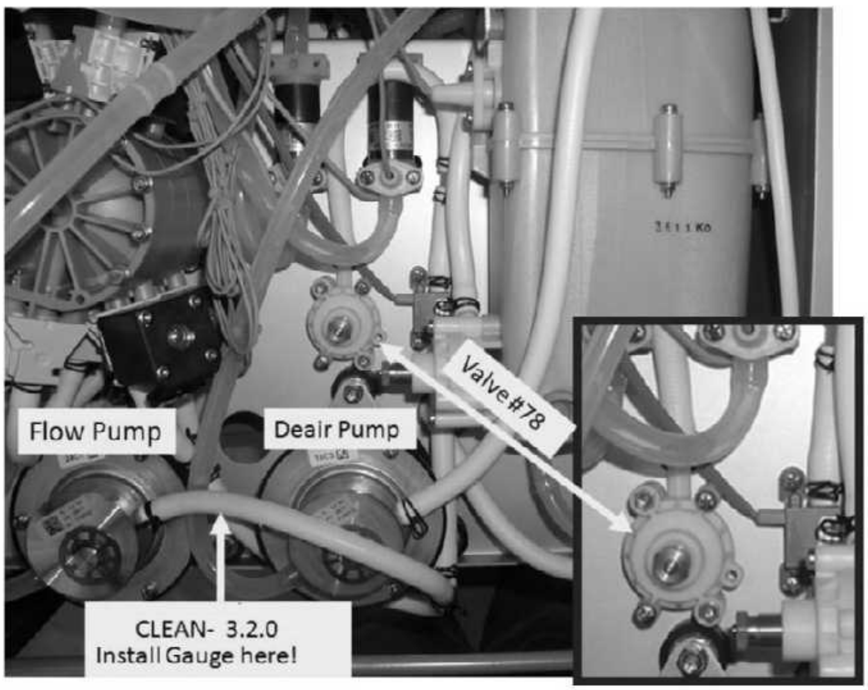
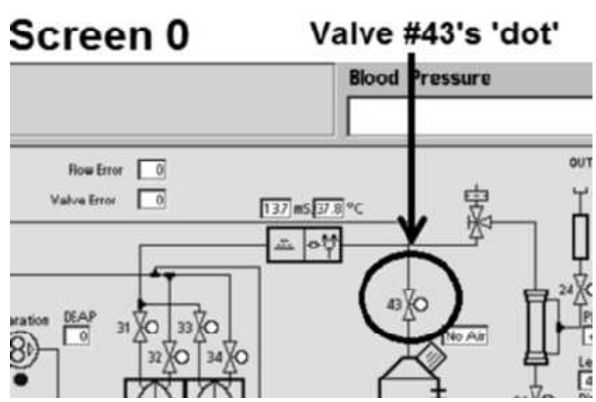



**Figure 32 – Flow Pump / Valve #78**

## CLEAN- 3.2.1 ISOLATE FLOW PUMP PRESSURE (2)

a) Call debug screen 0 (Figure right). If debug does not appear press ‘Esc’ then call screen 0.

b) Allow Valve #43’s ‘dot’ (Figure right) to turn blue then WHITE again! While white, does gauge pressure CYCLE, about every three (3) seconds, to between 34 and 36 psi?



Yes Between 34 and 36 psi! Proceed to **page 193**, procedure number CLEAN- 4.0.0.

No Remains less than 34 psi! ENSURING Heat Disinfect OR Rinse is running AND no leaks, see parts a THROUGH c below:

a) Watch for one (1) minute to ENSURE a "No Water" alarm NEVER occurs!

b) Referring to Figure 32 (page 170), behind the Deair Pump, locate **Valve #78**.

c) Can you adjust Valve #78 until the gauge cycles to a PEAK of between 34 and 36 psi?

Yes Pressure adjusts to between 34 and 36 psi! Allow two (2) minutes then, if a Flow Error reoccurs, Proceed to **page 193**, procedure number CLEAN- 4.0.0.

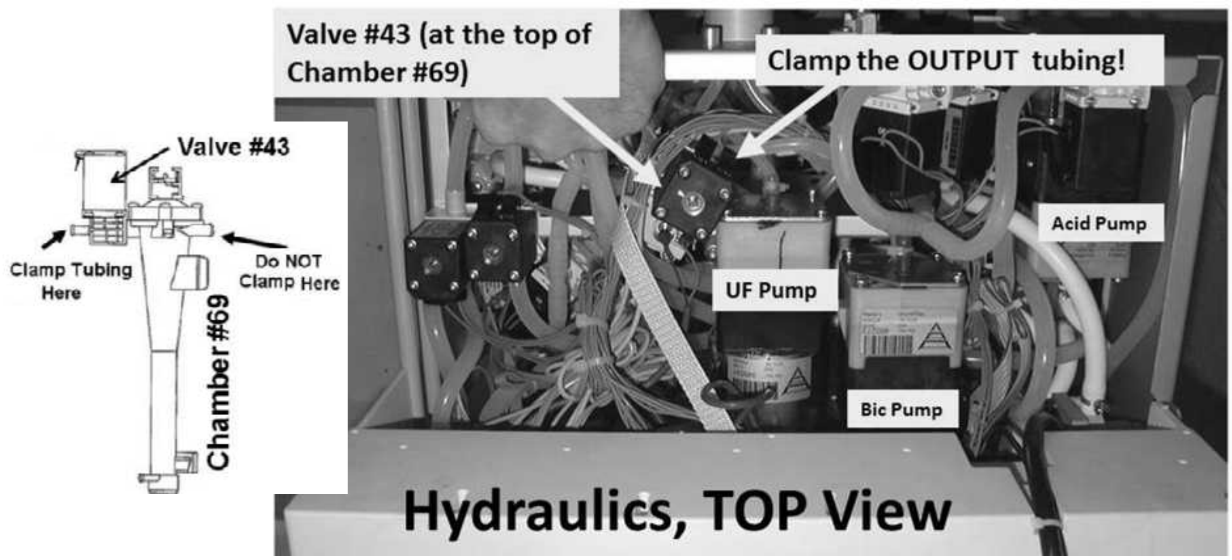
No Pressure will NOT adjust. TWO (2) possible scenarios:

**1) IF (and ONLY if) pressure remains low:** See procedure number CLEAN- 3.2.2 (page 192).

**2) IF pressure remains high:** Valve #78 may be bad!

**CLEAN- 3.2.2 LOW FLOW PUMP PRESSURE / ISOLATE VALVE #43**

a) **Per the Figures below**, DOUBLE clamp the OUTPUT tubing at Valve #43. **NOTE!** Valve #43's output tubing extends towards the front of the machine!




b) Can you now adjust Valve #78 until gauge pressure cycles to between 34 psi and 36 psi about every three (3) seconds (Yes of No)?

Yes Between 34 and 36 psi! This may indicate Valve #43 sticking open! **A)** Release the clamps! **B)** ENSURING Valve #43's 'dot' is white, if pressure again DOES NOT cycle to more than 34 psi then TWO (2) possible bad components: **1)** Actuator-Test Board OR; **2**) Valve #43.

No Remains less than 34 psi! Leaving the clamps in place, proceed to **page 102** procedure number F- 9.0.24.

## CLEAN- 4.0.0 GOOD FLOW PUMP PRESSURE / ISOLATE THE CLEANING PROGRAM

a) Leave the gauge installed **ENSURE** its tubing is NOT kinked (restricting flow)!

b) **Open the shunt door and LEAVE IT OPEN until instructed.**

c) Leaving the machine in whatever Program it is CURRENTLY in: **1)** Rinse? OR **2)** Heat Disinfect?

**1)** **IF (and ONLY if) in RINSE:** Proceed to **page 202**, procedure number CLEAN- 5.0.0.

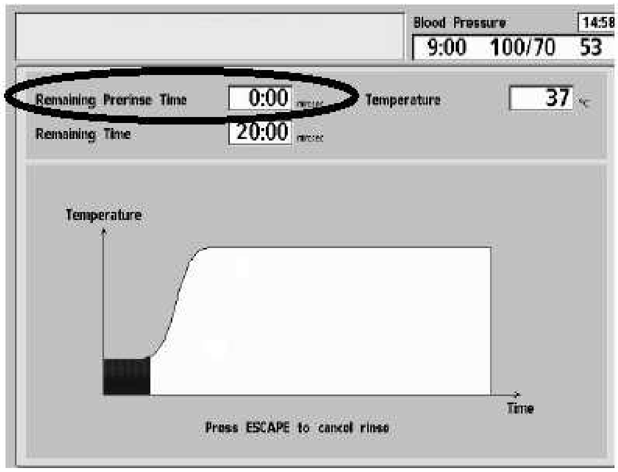
**2)** **IF in HEAT DISINFECT:** See parts a AND b below:

a) Press 'Esc' to call the Heat Disinfect screen (Figure right).

b) Ignoring the **Remaining Time** window, does the VERY TOP window, **Remaining Prerinse Time**, = 0:00 min:sec?

Yes **Remaining Prerinse Time** = 0:00! See procedure number CLEAN- 4.2.0 (page 193).

No **Remaining Prerinse Time** DOES NOT = 0:00! Proceed to **page 202**, procedure number CLEAN- 5.0.0.



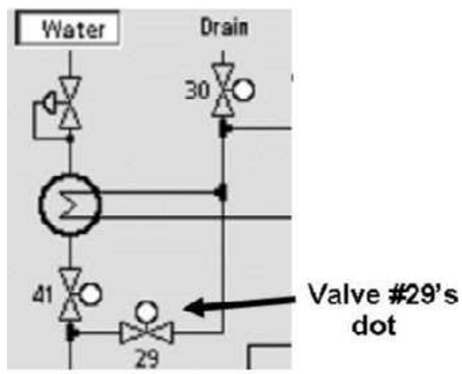

## CLEAN- 4.2.0 REMAINING PRERINSE TIME = 0:00

a) Call debug screen 0. If the debug screens do not appear press 'Esc' then call screen 0.

b) When **Remaining Prerinse Time** = 0:00 Valve #29's 'dot' (Figure right) REMAINS blue. WITHOUT LOOKING AWAY, watch it for twenty (20) FULL seconds.

c) TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Valve #29's 'dot' is ALWAYS blue:** See procedure number CLEAN- 4.3.0 (page 194).




**2)** **IF Valve #29's 'dot' is EVER = white:** Proceed to **page 202**, procedure number CLEAN- 5.0.0.

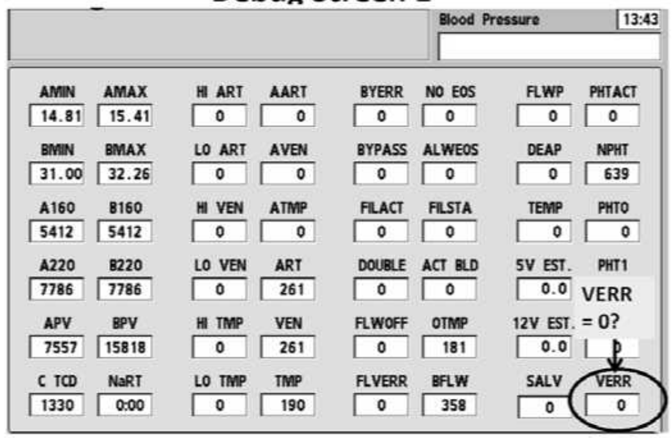
## CLEAN- 4.3.0 VALVE #29'S 'DOT' ALWAYS BLUE

Call debug screen 1 (Figure right). Does **VERR** (lower right column) = 0?

Yes **VERR** = 0! Proceed to **page 195**, procedure number CLEAN- 4.3.2.

No **VERR** = 1 OR more! See procedure number CLEAN- 4.3.1 (page 194).

**Debug Screen 1**

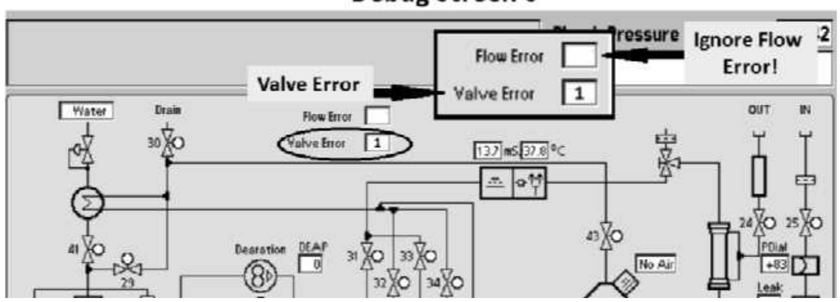



## CLEAN- 4.3.1 VERR = 1 OR MORE

a) Call debug screen 0 (Figure right).

b) Ignoring the top F**low Error** window, in part c, you will watch the $2^{nd}$ window down, **Valve Error**.

**Debug Screen 0**




c) Watching for one (1) minute, ignoring a 'blink to 1' that lasts less than one (1) second, does **Valve Error** EVER = 1 for LONGER THAN two (2) seconds?

Yes **Valve Error** = 1 LONGER THAN two (2) seconds! Proceed to **page 207**, procedure number CLEAN- 7.0.0.

No **Valve Error** = 0 OR 'blinks to 1' for less than one (1) second! Close the shunt door THEN proceed to **page 224**, TROUBLESHOOTING VALVE ERRORS IN CLEANING PROGRAMS

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## CLEAN- 4.3.2 VERR = 0 / VERIFY TOTAL FLOW

Watching for fifteen (15) seconds, does the external flow indicator's 'bob' EVER rise at least ¼ way up in the sight tube?

Yes 'Bob' moving! Proceed to **page 198**, procedure number CLEAN- 4.6.0.

No 'Bob' NOT moving! See parts a THROUGH d below:

a) ENSURE no tubing restrictions at the Flow Pump and DiaSafe® filter!

b) ENSURE Flow Pump Pressure (gauge at Flow Pump) is still PEAKING to between 34 and 38 psi.

c) ENSURE Loading Pressure (gauge in Rinse port) PEAK pressure remains between 22 and 27 psi.

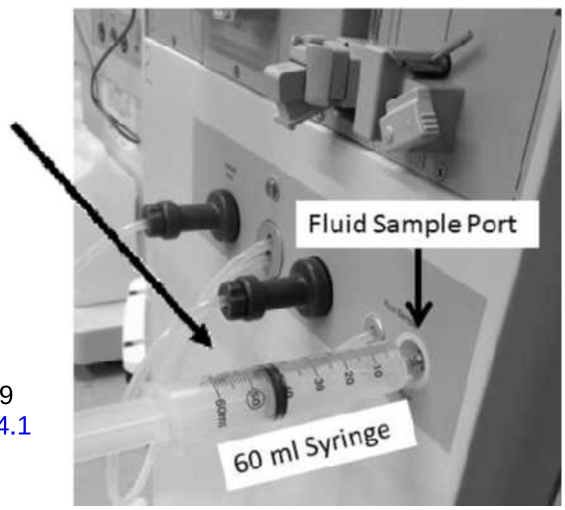
d) A restriction is indicated! See procedure number CLEAN- 4.4.0 (page 195).

## CLEAN- 4.4.0 'BOB' NOT MOVING / ISOLATE VALVE #29

a) Screw a 60 ml syringe, COMPLETELY filled with water, onto the Fluid Sample Port (Figure right).

b) Start a SIX (6) second timer, in your head, as you begin to push **AS HARD AS YOU CAN** on the syringe plunger! You should feel very little resistance!

c) Can you push ALL of the water through the Sample Port within SIX (6) seconds?




Yes Very little resistance encountered! Valve #29 is open! See procedure number CLEAN- 4.4.1 (page 196).

No Significant resistance encountered! **NOTE ONLY VALVE #29** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

## CLEAN- 4.4.1 VALVE #29 OPEN / ISOLATE VALVE #24

a) A 1000 ml (or larger) graduated cylinder is required below. **CAUTION!** Fluid may be hot!

b) ENSURE the water is ON!

c) **Open the shunt door and LEAVE it OPEN until instructed!**

d) Remove the BLUE dialyzer connector but **DO NOT CLOSE THE DOOR!**

e) Measure from the dialyzer connector for thirty (30) seconds! More than 300 ml collected?

Yes More than 300 ml! Valve #24 is open! Without returning the connector to the shunt, see procedure number CLEAN- 4.4.2 (page 197).

No Less than 300 ml! ENSURING the "Interrupted" banner is NOT up, see parts a THROUGH c below:

a) Return the dialyzer connector to the shunt but **DO NOT** close the door!

b) **Per the Figure below**, routing Valve #24's **INPUT** tubing so that spillage into the hydraulics does NOT occur, REMOVE the tubing and measure flow from it for thirty (30) seconds.

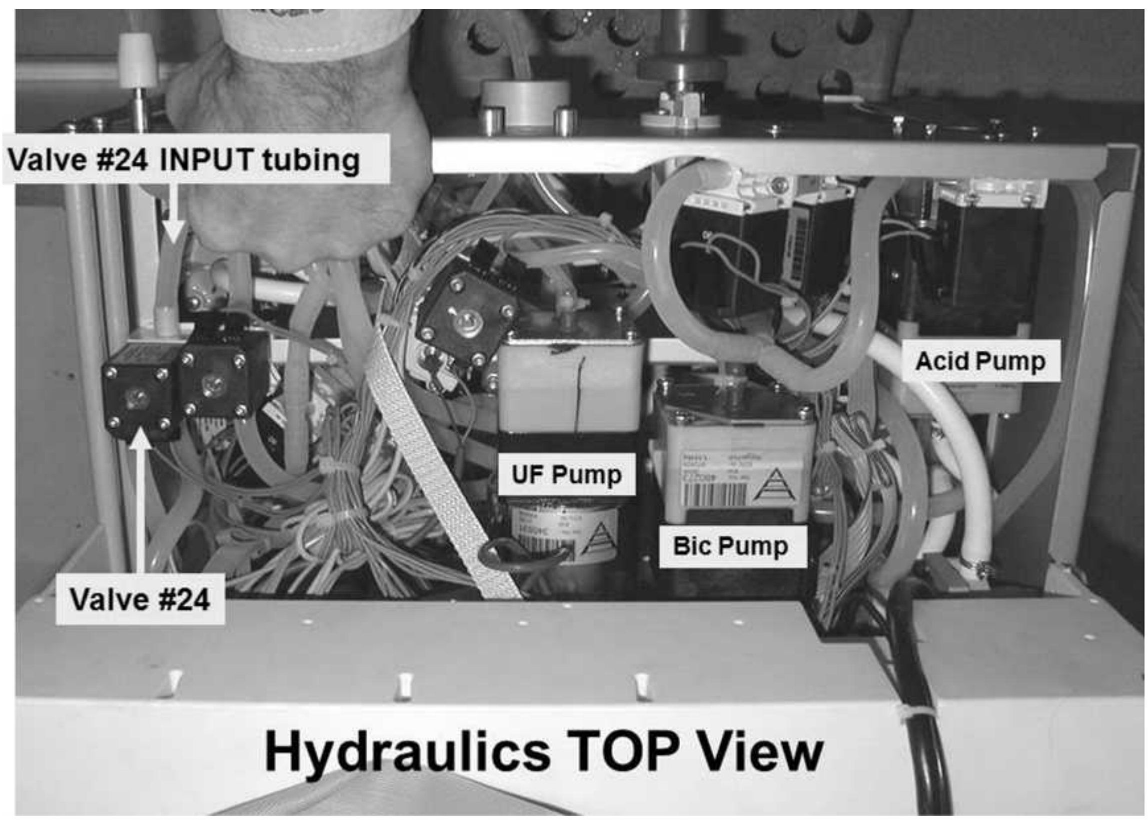
c) More than 300 ml every thirty (30) seconds?

Yes More than 300 ml! **A)** Return Valve #24's tubing. **B)** **NOTE ONLY VALVE #24** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

No Less than 300 ml! See parts a AND b below:

a) Return Valve #24's tubing.

b) If Loading AND Flow Pressure are still good, FOUR possible bad components: **1)** Restricted DiaSafe® filter; **2)** Bad Actuator-Test Board OR **3)** Bad Actuator Cable; OR **4)** Multiple stuck closed balancing chamber valves.



## CLEAN- 4.4.2 MORE THAN 300 ML / VALVE #24 OPEN / ISOLATE VALVE #25

a) With the dialyzer connector out of the shunt ENSURE the external flow indicator's 'bob' is rising at least ¼ way up in the sight tube!

b) Return the connector to the shunt and close the door.

c) Does the external flow indicator's 'bob' now rise at least ¼ way up?

Yes 'Bob' moving now! See procedure number CLEAN- 4.6.0 (page 198).

No 'Bob' NOT moving! See parts a AND b below!

a) ENSURE no restrictions in the 'from dialyzer (red) line' especially the external filter!

b) If no restrictions, **NOTE ONLY VALVE #25** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

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## CLEAN- 4.6.0 VERR = 0 / ISOLATE DIALYSATE PRESSURE SENSOR

When **Remaining Prerinse Time** = 0:00, Valve #29 stays open and Valve #30 stays closed. The Actuator-Test Board watches for Dialysate Pressure Sensor #9 (debug screen 4's **PDIA** and **ADIA**) transitions to sense flow.

a) Call the "Interrupted" banner (Figure right) by pressing 'Esc' <u>TWICE</u> then 'Enter' <u>ONCE</u>!

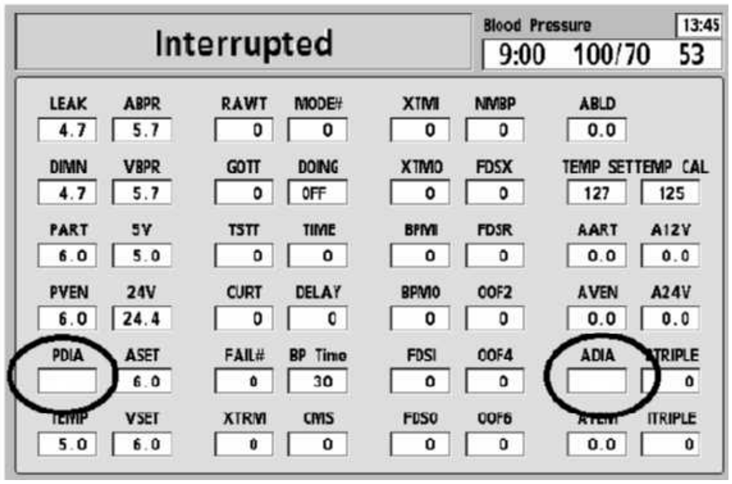

b) Wwith the "Interrupted" banner up, remove the red dialyzer connector from the shunt door and hold it at the level of the dialyzer holder. ENSURE no flow from dialyzer connector!

c) Call debug screen 4 (Figure right).

d) Locate **PDIA** then its value in Column 1 of the Table below.

e) Locate **ADIA** then its value in Column 2 of the Table next to the value seen at **PDIA**.

f) Per Column 3 respond based on <u>BOTH</u> **PDIA** <u>AND</u> **ADIA**:




| Column 1<br>PDIA | Column 2<br>ADIA | Column 3<br>Your Response |
|---|---|---|
| Between 3.0 and 6.0<br>(Good) | Between 2.0 and 6.0<br>(Good) | <u>BOTH</u> **PDIA** and **ADIA** are good! The Dialysate Pressure sensor is good! See procedure number CLEAN- 4.6.1 (page 199). |
| Between 3.0 and 6.0<br>(Good) | Less than<br>2.0 <u>OR</u> more than 6.0<br>(Bad) | **PDIA** good; **ADIA** bad. THREE (3) possibilities:<br>1) Bad Actuator-Test Board OR<br>2) Bad Sensor Board OR<br>3) Bad Motherboard connection at the Sensor and / or the Actuator-Test Board |
| Less than<br>3.0 <u>OR</u> more than 6.0<br>(Bad) | Between 2.0 and 6.0<br>(Good) | **PDIA** bad; **ADIA** good! THREE (3) possibilities:<br>1) Bad Sensor Board OR<br>2) Bad Functional Board OR<br>3) Bad Motherboard |
| Less than<br>3.0 <u>OR</u> more than 6.0<br>(Bad) | Less than<br>2.0 <u>OR</u> more than 6.0<br>(Bad) | BOTH **PDIA** <u>AND</u> **ADIA** are bad! Leaving the "Interrupted" banner up, proceed to **page 505**, procedure number TMP- 3.0.0 |

## CLEAN- 4.6.1 BOTH PDIA AND ADIA ARE GOOD

a) Return the dialyzer connector to the shunt and close the door!

b) Press 'Enter' then **return to HEAT DISINFECT!**

c) To isolate between four (4) possible bad valves read part d's two-part description BEFORE performing part e!

d) Return to debug screen 4. **PDIA** NORMALLY behaves as follows:

**PART 1: When Valve #43 is closed* PDIA** cycles between 0.0 (for 3 to 5 seconds) to more than 0.1 (for about one second). It is abnormal for **PDIA** to cycle to 6.0 or more OR remain 0.0 for more than seven (7) seconds!

***** Valve #43 cycles between closed for forty five (45) seconds and open for sixteen (16) seconds

**PART 2: When Valve #43 is open* PDIA** stays between 1.0 and 5.0. When Valve #43 closes **PDIA** resumes cycling. If (and ONLY if) **PDIA** REMAINS between 1.0 and 5.0 for MORE THAN ninety (90) seconds see procedure number CLEAN- 4.6.22 (page 200).

e) WITHOUT LOOKING AWAY, watch **PDIA** AND for "Flow Recirc Error 1" for five (5) minutes OR until if "Flow Recirc Error 1" appears. Proceed according to one of the TWO (2) possible scenarios below:

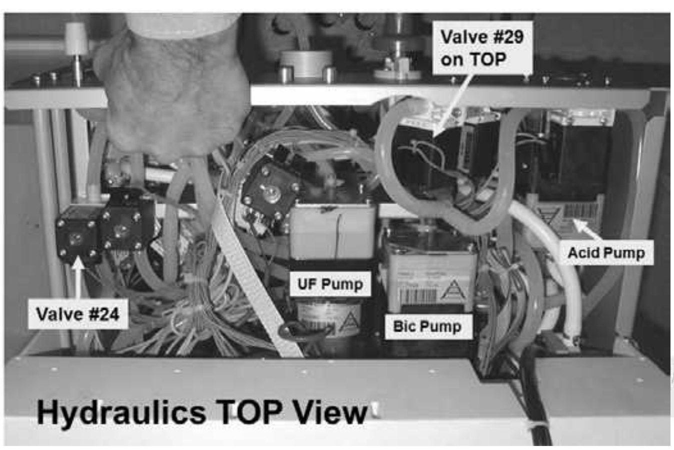
**1) IF (and ONLY if) "Flow Recirc Error 1" NEVER occurs:** Whatever was causing the Flow Error is not exhibiting yet! Watch **PDIA** until either a Flow Error occurs OR Heat Disinfect finishes.

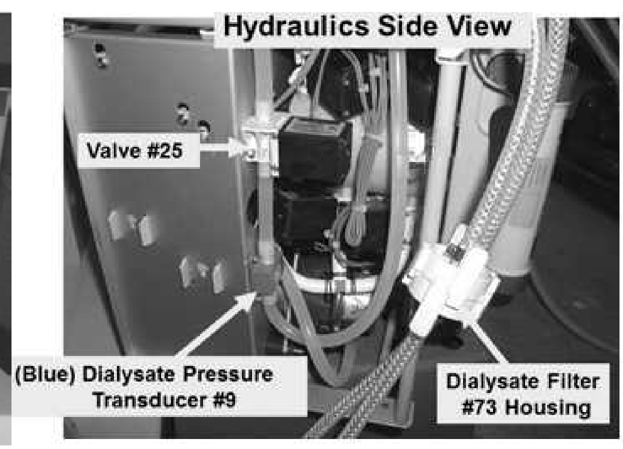
**2) IF "Flow Recirc Error 1" occurs AND also one of THREE (3) scenarios below:**

**Scenario #1: IF (and ONLY if) PDIA was EVER = 6.0 OR more:** A restriction at Valve #24 OR Valve #25 is indicated. See the Figures below to locate these valves!

**Scenario #2: IF (and ONLY if) PDIA EVER stayed 0.0 for longer than seven (7) seconds:** A restriction at Valve #29 is indicated! See the left Figure below to locate Valve #29!

**Scenario #3: IF PDIA NEVER = 6.0 OR more AND NEVER 0.0 more than seven (7) seconds:** To isolate Valve #43, proceed to **page 201**, procedure number CLEAN- 4.6.33.



**CLEAN- 4.6.22 PDIA STAYING BETWEEN 1.0 AND 5.0 / ISOLATE VALVE #43 'STICKING OPEN'**

a) **PDIA** is staying between 1.0 AND 5.0. This procedure (parts b and c) confirms a problem with Valve #43 or the Actuator-Test Board.

b) **Per the Figure below**, double clamp the OUTPUT tubing at Valve #43. **Note!** Valve #43's output tubing extends towards the FRONT of the machine.

c) If **PDIA** begins to cycle to 0.0 this indicates, TWO (2) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Valve #43 (sticking open).

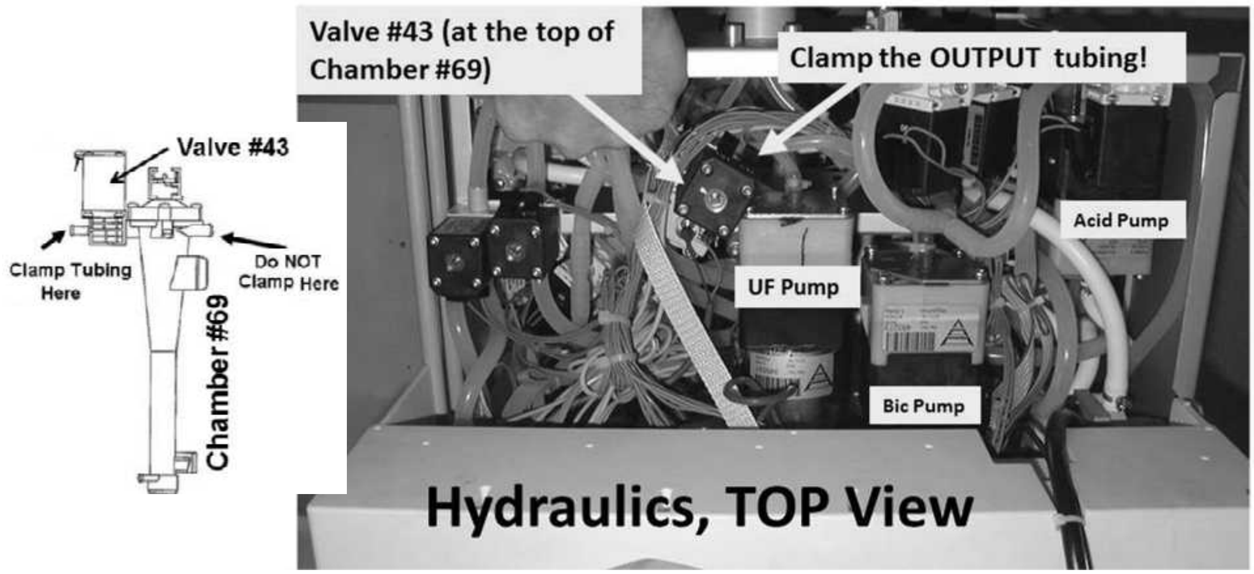



**Figure 33 – VALVE #43 Location**

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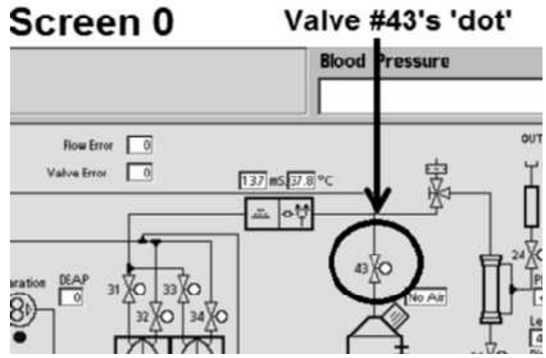
## CLEAN- 4.6.33 ISOLATE VALVE #43 POSSIBLY STICKING CLOSED

**PDIA** is NEVER 6.0 or AND NEVER 0.0 longer than seven (7) seconds!

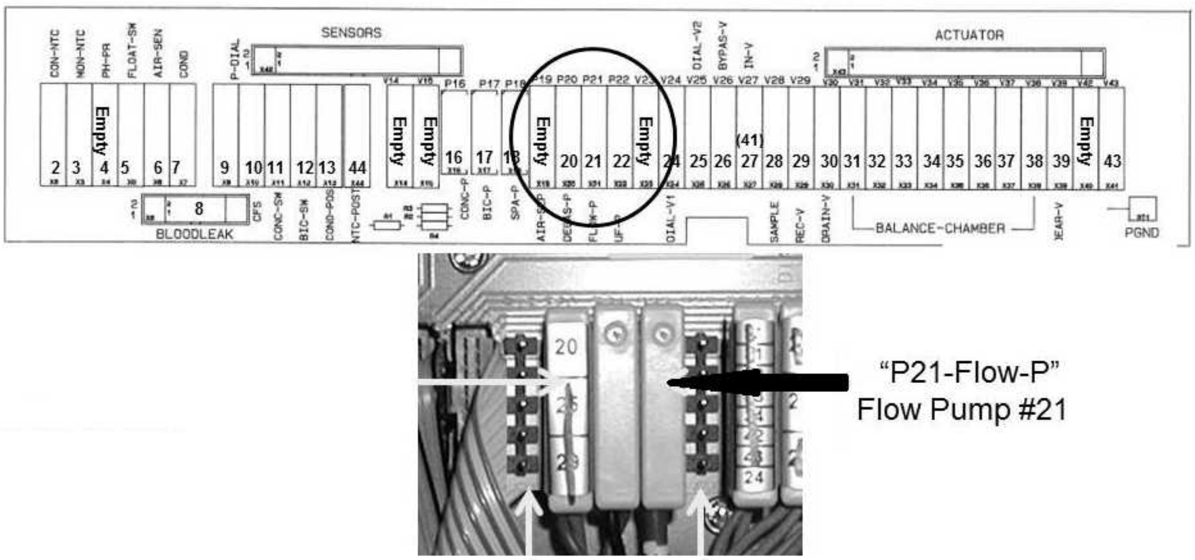
a) Call debug screen 0 (Figure right).

b) Allow Valve #43's 'dot' to turn blue then white again.

c) As seen earlier, ENSURE the external Flow Indicator's 'bob' is rising at least ¼ way up in the sight tube!




d) Per the Figure below, unplug the Flow Pump from Distribution Board position "P21-Flow-P".




"P19 and "P23" Remain Vacant!

e) **ENSURE the FLOW MOTOR shaft stops rotating!**

f) Every forty five (45) seconds Valve #43's 'dot' turns blue for sixteen (16) seconds. WHILE IT IS BLUE, does the external flow indicator's 'bob' rise at least ¼ way up in the sight tube?

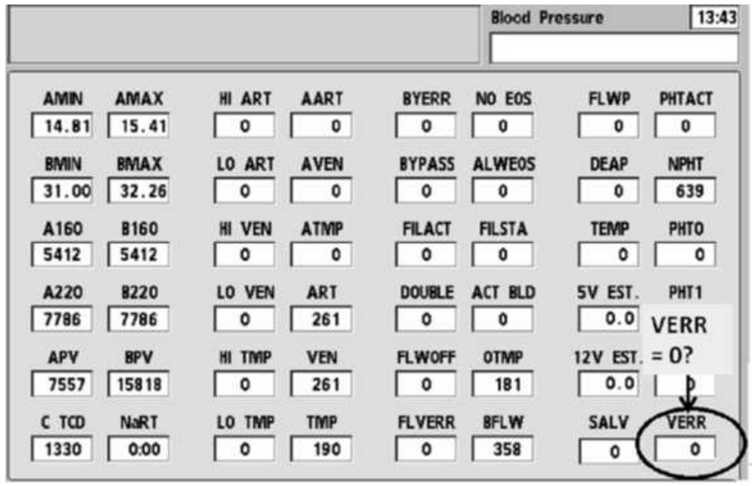
Yes 'Bob' moving! Valve #43 is okay! **A)** Return the Flow Pump's connector to distribution board position" P21- Flow-P"; **B)** ENSURE the Flow Motor rotates; **C)** If **"Flow Recirc Error 1"** continues to occur you may have made an error somewhere!

No 'Bob' NOT moving! ENSURING Loading Pressure (gauge in the rinse port) remains good, TWO (2) possible bad components: **1)** Bad Actuator-Test Board OR **2)** Bad Valve #43 (sticking closed).

**NOTE!** When troubleshooting is complete be sure to return the Flow Pump's connector to distribution board; position" P21- Flow-P";

## CLEAN- 5.0.0 ISOLATE POSSIBLE VALVE ELECTRICAL PROBLEM

Leaving the shunt door OPEN:



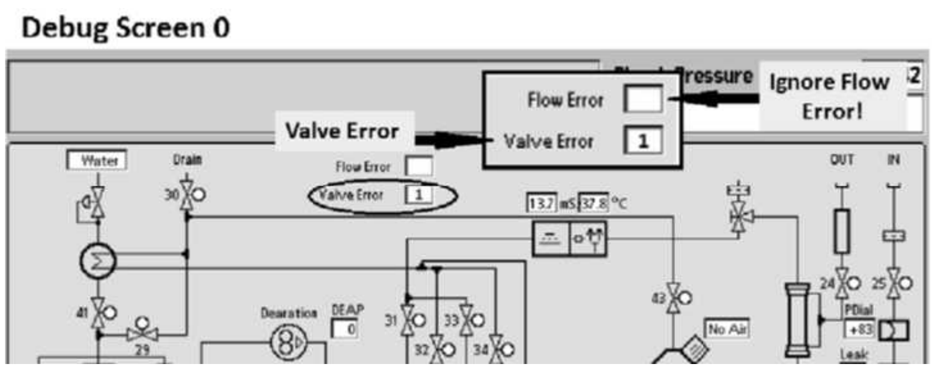

a) Call debug screen 1 (Figure right). If debug does not appear press 'Esc' then call screen 0.

b) Does **VERR** (lower right column) = 0?

Yes **VERR** = 0**!** Proceed to **page 203**, procedure number CLEAN- 5.2.0.

No **VERR** = 1 OR more! See procedure number CLEAN- 5.0.1 (page 202).

## CLEAN- 5.0.1 VERR DOES NOT = 0 / ISOLATE SPECIAL VALVE ERROR




a) Call debug screen 0 (Figure right).

b) Ignoring the TOP window, **Flow Error,** in part c you will watch the 2nd window down, **Valve Error**!

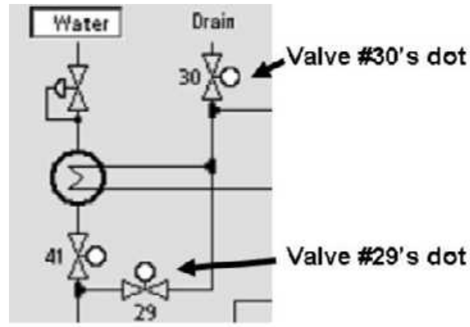
c) Ignoring a 'blink to 1' that lasts less than one (1) second, watch for one (1) minute. Does **Valve Error** EVER = 1 for LONGER THAN two (2) seconds CAREFUL HERE! TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Valve Error = 0 OR 'blinks to 1' for less than one (1) second!** Close the shunt door then proceed to **page 224**, TROUBLESHOOTING VALVE ERRORS IN CLEANING PROGRAMS

**2)** **IF Valve Error EVER = 1 LONGER THAN two (2) seconds:** Turn the machine OFF then proceed to **page 207**, procedure number CLEAN- 7.0.0.

**CLEAN- 5.2.0 VERR = 0 / ISOLATE DIALYSATE SAMPLING OPTION**

a) Call debug screen 0 to locate Valve #29's and Valve #30's 'dots' (Figure right). NORMALLY when one turns white the other turns blue almost immediately.




b) WITHOUT LOOKING AWAY, watch BOTH 'dots' for three (3) FULL minutes to see if they EVER **BOTH** turn white, at the **SAME TIME**, for **LONGER THAN** thirty (30) seconds! TWO (2) possible scenarios:

1) **IF (and ONLY if) BOTH 'dots' turn WHITE, at the SAME TIME, for LONGER THAN thirty (30) seconds!** See procedure number CLEAN- 5.2.1 (page 203).

2) **IF BOTH dots, at the SAME TIME, are NEVER white LONGER THAN thirty (30) seconds!** Proceed to **page 204**, procedure number CLEAN- 5.3.0.

**CLEAN- 5.2.1 VALVE #30 AND VALVE #29 'DOTS' REMAINING WHITE LONGER THAN 30 SECONDS**

a) Place the machine into Service Program.

b) From Service Program → Options → Hardware Options does the No box, next to **Dialysate Sampling** (Figure right), have a blue 'X' it?


Yes **Dialysate Sampling** = No! See procedure number CLEAN- 5.2.2 (page 203).

No a) Move the 'X' to the No box THEN press 'Enter'. The 'X' MUST turn blue!

b) If (and ONLY if) the Flow Error was occurring in Heat Disinfect return to it. If not place the machine in RINSE!

c) Watching for five (5) FULL minutes, TWO (2) possible scenarios:

1) **IF (and ONLY if) a Flow Error reoccurs:** Return to **page 202**, procedure number CLEAN- 5.0.0.

2) **IF a Flow Error does NOT reoccur:** Problem solved! The **Dialysate Sampling** Hardware Option was set to "Yes" accidently.

**CLEAN- 5.2.2 ISOLATE FUNCTIONAL BOARD**

When the **Dialysate Sampling** Hardware Option = "No" then having Valve #30's AND #29's 'dots' white at the same time is UNLIKELY and, if you made and error, could result in unnecessary work! See parts a THROUGH c below!

a) Place the machine in RINSE.

b) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

c) WITHOUT LOOKING AWAY, watch Valve #30's AND #29's 'dots' again for four (4) FULL minutes. Do they BOTH EVER turn WHITE again, at the SAME TIME, for more than thirty (30) seconds?

Yes BOTH 'dots' turn white for more than thirty (30) seconds again! If ABSOLUTELY SURE the **Dialysate Sampling** Hardware Option has a blue 'X' in the No box the Functional Board may be bad.

No BOTH dots do NOT turn white at the same time. See parts A AND B below:

A) If the flow error was originally occurring in Heat Disinfect return to it! If not leave the machine in RINSE.

B) See procedure number CLEAN- 5.3.0 (page 204).

**CLEAN- 5.3.0 VERR = 0 / ISOLATE TOTAL FLOW**

a) Leaving the shunt door OPEN, ENSURE a "No Water" alarm NEVER occurs!

b) Watching for thirty (30) FULL seconds, does the external flow indicator's 'bob' EVER rise about ½ way up OR higher in the sight glass?

Yes 'Bob' moving! See procedure number CLEAN- 5.4.0 (page 204).

No 'Bob' NOT moving! See parts a through d below:

a) ENSURE no tubing restrictions at the Flow Pump AND the DiaSafe® filter.

b) ENSURE Flow Pump Pressure (gauge at Flow Pump) is PEAKING to between 34 and 37 psi.

c) ENSURE Loading Pressure (gauge in Rinse port) is peaking to between 22 and 27 psi.

d) Proceed to **page 607** to troubleshoot this restriction using procedure number LEAKING- 4.0.0!

**CLEAN- 5.4.0 ISOLATE FLOW ERROR**

WITHOUT LOOKING AWAY, watch specifically for a "Flow Error" AND / OR a "Flow Inlet Error" for four (4) minutes **OR** until if either one EVER occurs?

Yes "Flow Inlet Error" AND / OR "Flow Error" occurs! Proceed to **page 205**, procedure number CLEAN- 6.0.0.

No Neither alarm occurs! See parts a THROUGH c below:

a) **Close the shunt door!**

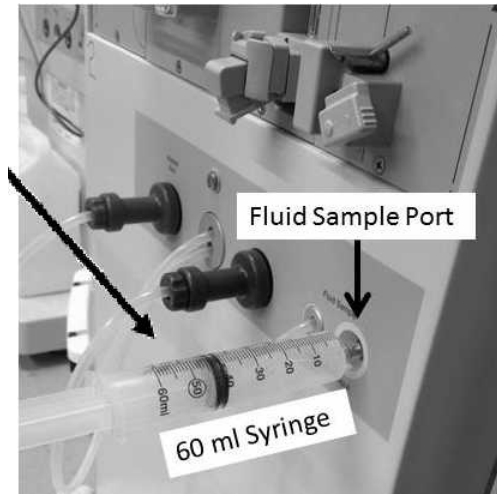
b) Assuming neither alarm EVER occurs, allow **Remaining Prerinse Time** to reach 0:00!

c) Watch until if a **"Flow Recirc Error 1"** occurs OR until if the program completes! TWO (2) possible scenarios (next page):

1) **IF (and ONLY if) "Flow Recirc Error 1" does NOT occurs:** Whatever was causing the Flow Error is no longer occurring! Do NOT continue to troubleshoot a Flow Error.

2) **IF "Flow Recirc Error 1" occurs:** See (ABOVE) procedure number CLEAN- 4.2.0 (**page 193**).

## CLEAN- 6.0.0 'BOB' MOVING / ISOLATE VALVE #29 STICKING OPEN




a) Turn the machine OFF!

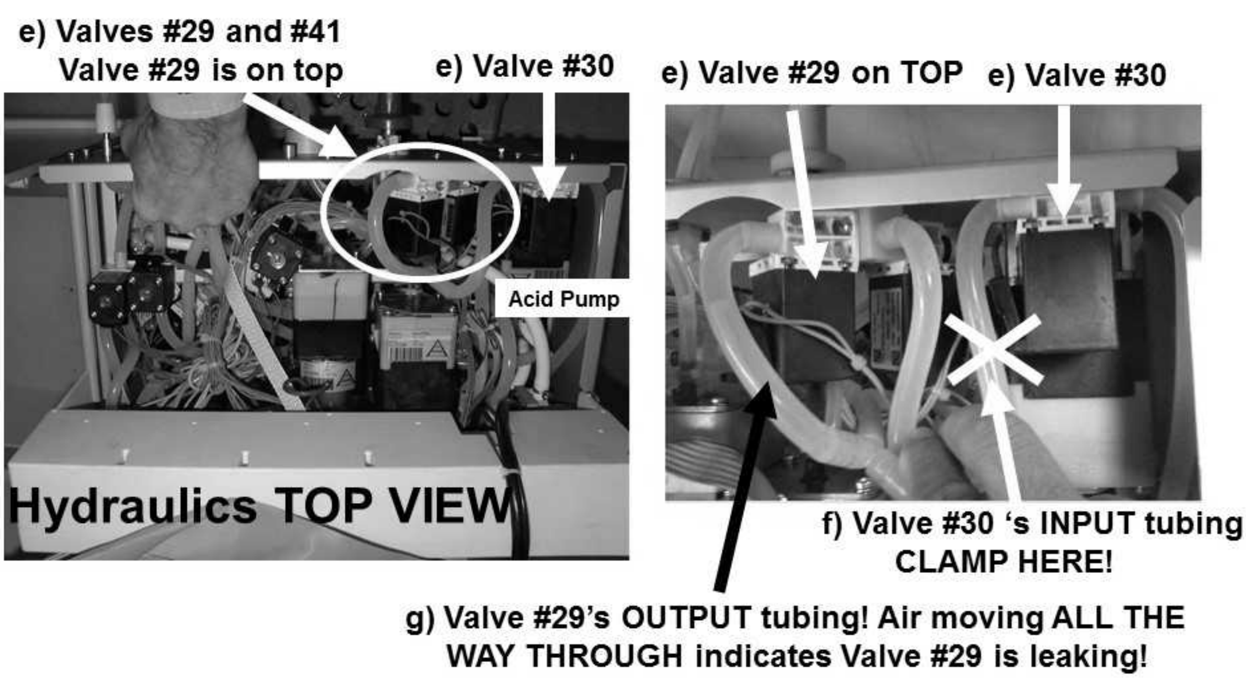
b) Turn the machine on but **DO NOT** press 'Enter' OR CONFIRM!

c) **The "Select Program" banner MUST remain up for this procedure!**


d) Figure right, screw a 60 ml syringe, COMPLETELY FILLED WITH AIR, onto the Fluid Sample Port.

e) **Per the Figure below**, locate Valves #29 and #30.

f) **Tightly clamp** Valve #30's INPUT tubing.




g) Push hard on the syringe plunger while watching **Valve #29's** OUTPUT tubing. Resistance is normal! If Valve #29 is sticking open you will see air moving ALL THE WAY through it?

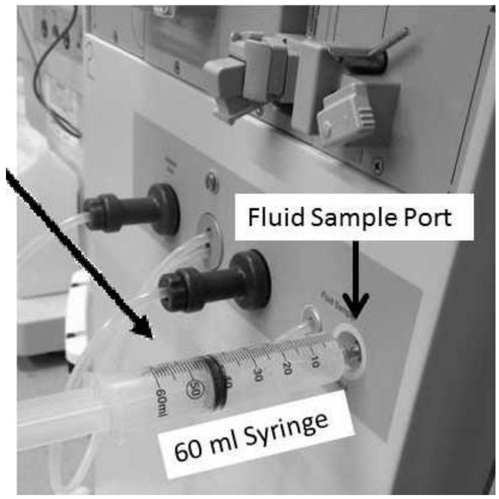
Yes Air moving ALL THE WAY through Valve #29! See procedure number CLEAN- 6.1.0 (page 206).

No Air is NOT moving through Valve #29! See parts A AND b below:

A) Remove the clamp from Valve #30!

B) The Troubleshooting Guide cannot locate an immediate problem. Return to Dialysis Program and troubleshoot potential hydraulic problems from there!

**CLEAN- 6.1.0 'AIR' MOVING THROUGH VALVE #29**




a) **Turn the machine OFF and LEAVE IT OFF!**

b) Screw a 60 ml syringe, COMPLETELY FILLED WITH AIR, onto the Fluid Sample Port.

c) Push hard on the syringe plunger while watching Valve #29's OUTPUT tubing. Do you see air moving through Valve #29?

Yes Air moving through Valve #29! Valve #29 is bad (sticking open).

No Air IS NOT moving through Valve #29! The Actuator-Test Board is bad!

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**CLEAN- 7.0.0 VALVE ERROR = 1 LONGER THAN TWO SECONDS**

A) **To avoid damage turn the machine OFF!**

B) Figure below, remove the distribution board cover.

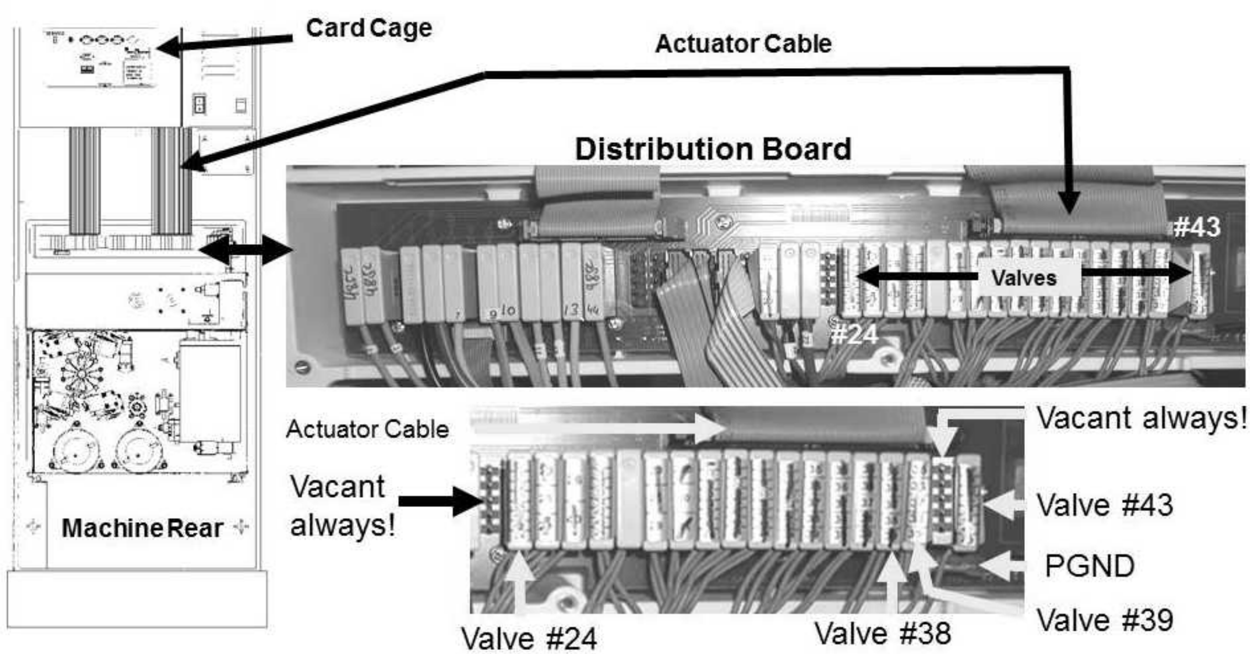
C) FOUR (4) checks.

**CHECK #1** ENSURE the ACTUATOR CABLE is plugged in **SECURELY**!

**CHECK #2** Check the entire length of the ACTUATOR CABLE for damage!

**CHECK #3** ENSURE all Valves are plugged PROPERLY into their distribution board positions!

**CHECK #4** ENSURE the black PGND wire is plugged in and shows no signs of burning.




D) Was a problem located above?

Yes Problem located! After the repair see procedure number CLEAN- 7.0.1 (page 207).

No problem located! Proceed to **page 208**, procedure number CLEAN- 7.3.0.

**CLEAN- 7.0.1 PROBLEM LOCATED**

a) **Return to Heat Disinfect OR Rinse!**

b) Call debug screen 0. If debug does not appear press ‘Esc’ then call screen 0.

c) Watch the 2nd window down, **Valve Error**, for five (5) minutes. If it **DOES NOT** = 1 for longer than two (2) seconds the repair solved the problem HOWEVER, if (and ONLY if) a Flow Error reoccurs see (ABOVE) procedure number CLEAN- 1.0.5 (**page 169**).

**CLEAN- 7.3.0 ISOLATE VALVE CIRCUITS**

a) Figures below, you will check **four (4) Valves**: **1)** Valve #24; **2)** Valve #38; **3)** Valve #39; **4)** Valve #43.

b) THREE (3) checks on EACH Valve! Trace the blue wires from between the distribution board to their solenoid terminals:

**CHECK #1** ENSURE no 'pinched' or damaged wire insulation

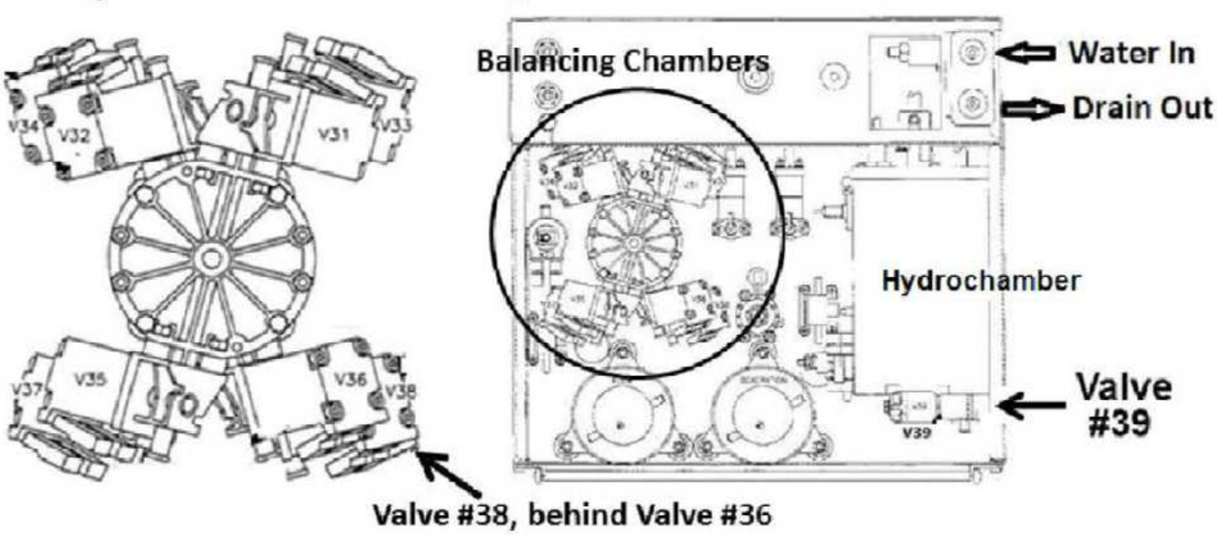
**CHECK #2** ENSURE the wires terminate properly at the solenoid terminals

**CHECK #3** ENSURE the terminals show no signs of 'green' corrosion

c) If a problem was found (and repaired) this may have solved the problem. If a problem was NOT located see procedure number CLEAN- 7.4.0 (page 209).


**Hydraulics TOP View, Valve #24 and #43**


**Hydraulic REAR view, Valves #38 and #39**

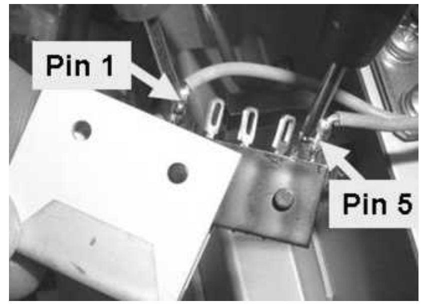


## CLEAN- 7.4.0 ISOLATE VALVE SOLENOIDS

a) **Set your volt meter to RESISTANCE (Ω).**

b) **Four (4) Valve solenoids** will be checked. Perform parts c through h on: **1)** Valve #24; **2)** Valve #38; **3)** Valve #39; **4)** Valve #43.

c) Unplug one of the four (your choice) from the distribution board.



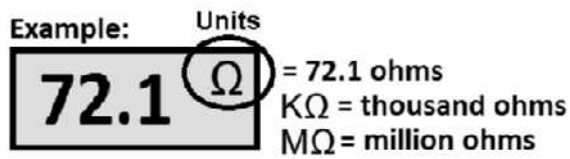

d) Using a flashlight, check inside its vacant distribution board position for **corrosion or damage!**

e) Figure right, open the female connector cap.

d) **The wires MUST be connected between the TOP and BOTTOM terminals! If NOT, this is the problem!**

e) Where the wires are connected, place one meter lead on one terminal and the other lead on the other terminal.

f) Figure right, a good solenoid measures between 40 and 100 Ω! READ the UNITS display also!




g) If the valve checks good plug it back into its distribution board position!

h) Does this solenoid check between 40 and 100 Ω?

Yes Solenoid between 40 and 100 Ω! Repeat parts b THROUGH h for ALL FOUR valves! **If (and ONLY if) ALL FOUR solenoids are between 40 and 100 Ω**, see procedure number CLEAN- 7.4.1 (page 209).

No The valve solenoid OR its blue wire harness is bad. Replace the valve then return to Heat Disinfect OR Rinse and check for a Valve Error!

## CLEAN- 7.4.1 ALL SOLENOIDS BETWEEN 40 AND 100 OHMS

a) **Return to Heat Disinfect OR Rinse!**

b) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

c) Watch the 2nd window down, **Valve Error**, for up to five (5) minutes. Does it EVER = 1 for longer than two (2) seconds?

Yes **Valve Error** = 1 longer than two (2) seconds! THREE (3) possible bad components: **1)** Bad Actuator-Test Board OR; **2**) Bad Actuator cable OR; **3)** Bad distribution board.

No **Valve Error** REMAINS = 0. You may have solved the Valve Error problem above. If (and ONLY if) a Flow Error reoccurs see (ABOVE) procedure number CLEAN- 1.0.5 (**page 169**).

## TROUBLESHOOTING A VALVE

A) **To avoid damage, turn the machine OFF!**

B) **Check only the valve as previously noted!**

C) See procedure number TSV- 1.0.0 below:

**TSV- 1.0.0 CHECK DISTRIBUTION BOARD CONNECTIONS**

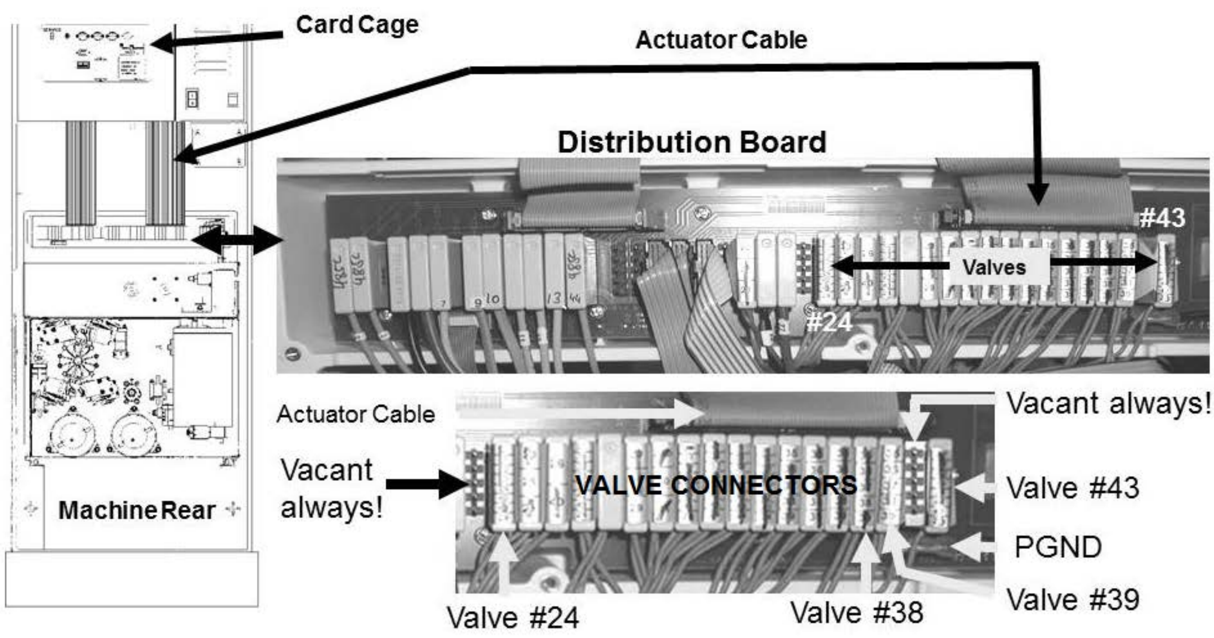
a) **Per the Figure below**, remove the distribution board cover.

b) TWO (2) checks to ENSURE:

**Check #1:** The ACTUATOR CABLE is plugged in SECURELY AND is not damaged!

**Check #2:** The **NOTED** valve is plugged PROPERLY into its position. **If not, this most likely is the problem!**

**Figure 34 – Distribution Board**




c) Before continuing to procedure number TSV- 2.0.0 (page 212), refer to Figure 35 (page 211) OR Figure 36 (page 211) to LOCATE the **NOTED** valve.

**Figure 35 – Hydraulics Top View**

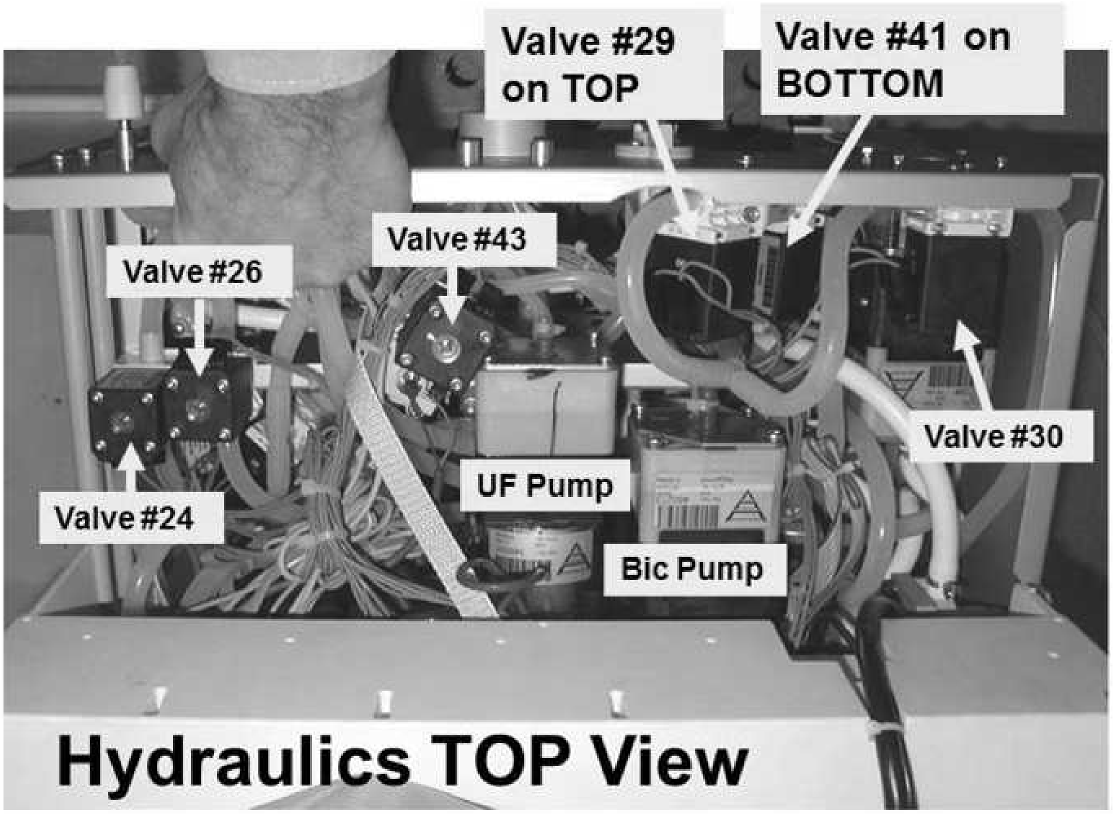
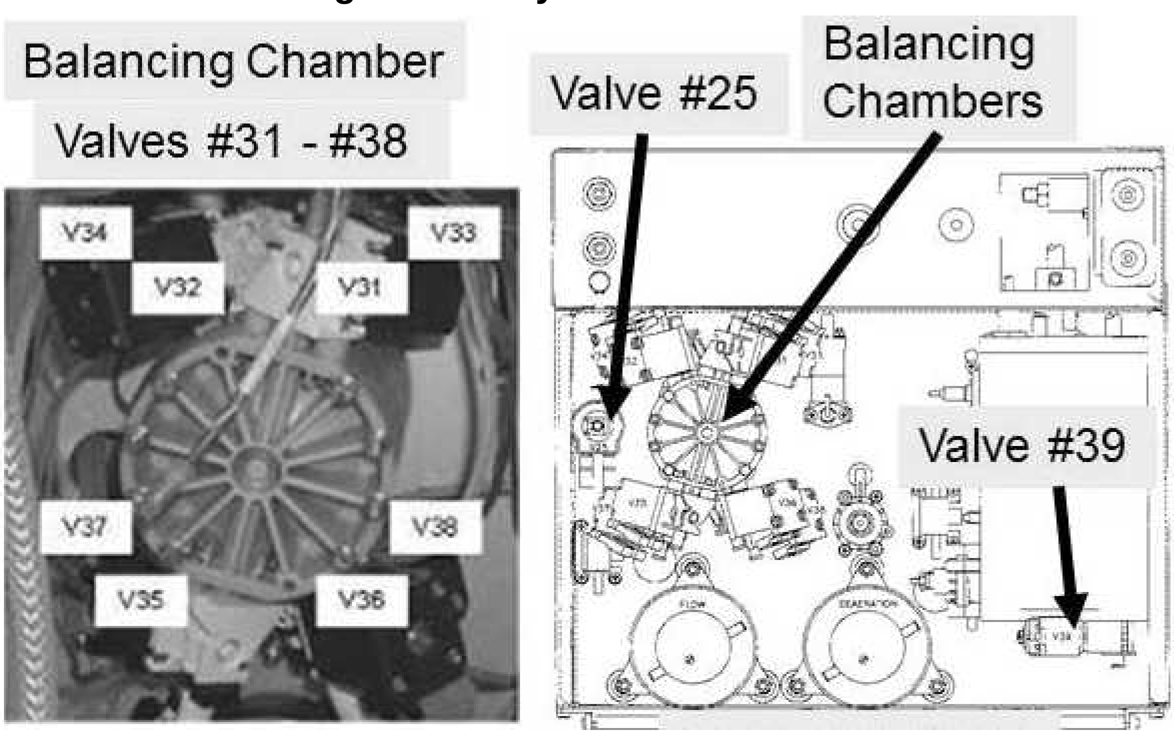



**Figure 36 – Hydraulics Rear View**



## TSV- 2.0.0 ISOLATE VALVE WIRES


a) THREE (3) checks, WHILE tracing the **NOTED** valve's wires from the distribution board to the solenoid terminals (Figure right):

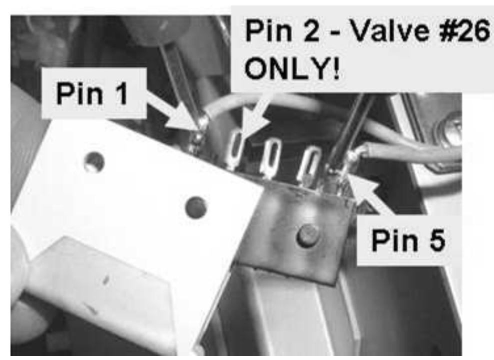
**Check #1:** ENSURE no pinched or bare wires!

**Check #2:** ENSURE both wires terminate PROPERLY at the valve's solenoid terminals!

**Check #3:** ENSURE no corrosion at the solenoid terminals!

b) If no problems were located, see procedure number TSV- 2.1.0 (page 212).

## TSV- 2.1.0 ISOLATE VALVE SOLENOID



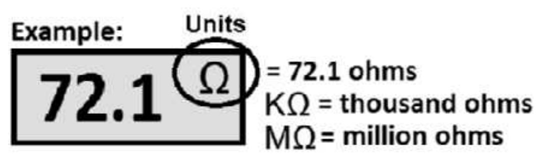

a) Figure right, open the cap from the NOTED valve's distribution board connector.

b) **Except for Valve #26, the wires MUST BE connected between the top and bottom terminals. Valve #26 (ONLY!) MUST BE connected between the second from top and bottom terminals! If wired incorrectly this is the problem!**

c) **Set your CALIBRATED volt meter to RESISTANCE (Ω)!**

d) Where the wires are connected, place one meter lead on one terminal and the other lead on the other.

e) Figure right, reading the meter's numeric AND UNITS (Ω), between 40 and 100 **Ω** [Yes or No]?




Yes Between 40 and 100 Ω! FIVE (5) possible bad components (see Component List below). Swap in one at a time and in between test the machine.

**Component List:** **1)** The **NOTED** valve; **2)** Actuator-Test Board; **3)** Actuator cable; **4)** Functional Board*; **5)** Distribution board

* To prevent "Cond Offset Failure" place the machine into T and C (refer to OPERATING MODES (page 19))

No Less than 40 Ω OR more than 100 Ω! See procedure number TSV- 3.0.0 (page 212).

## TSV- 3.0.0 CHECK SOLENOID

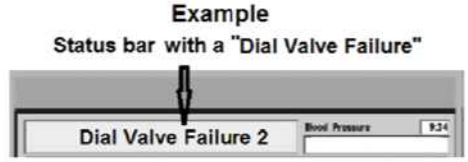

Figure right, place one meter lead on one solenoid terminal and the other lead on the other terminal. Between 40 and 100 **Ω**?

Yes Between 40 and 100 Ω! The valve's wiring harness is bad.

No Less than 40 Ω OR more than 100 Ω! The valve's solenoid is bad.

# TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM

If **VERR** = one (1) or more and / or is continuing to increase indicates a valve circuit resistance of less than 20 Ω and is used for troubleshooting. HOWEVER, if **VERR** reaches it maximum of 255 it becomes useless!



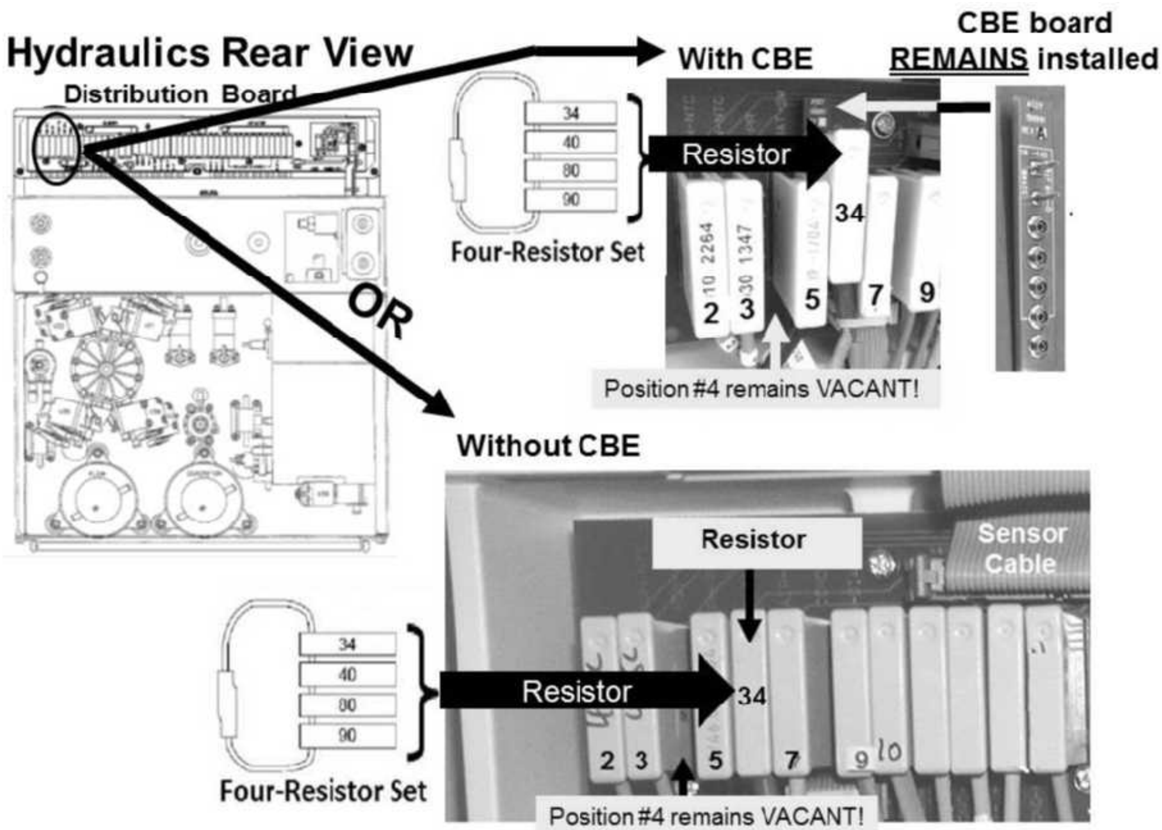

A) From here forward, Figure right, if (and ONLY if) a "Dial Valve Failure" OR "Act Byp Valve Fail" banner EVER appear proceed to **page 711**, Section 26

B) For now, ignore a "V104/108 Stuck Closed" or "V105 Stuck Closed" alarm if one occurs!

C) **CLOSE the SHUNT door!**

D) ENSURE a "No Water" alarm NEVER appears!

E) FIGURE BELOW, a previous procedure may have already placed a resistor plug in the distribution board's AIR SENSOR position **4th connector cap i.e. 5th position** FROM THE LEFT!

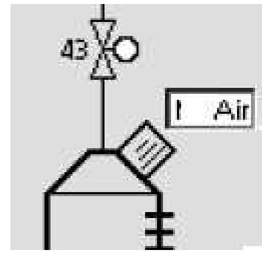



F) TWO (2) possible scenarios below:

1) **IF (and ONLY if) a resistor plug is ALREADY in place:** See procedure number **VE- 1.0.0** (page 214).

2) **IF a resistor plug IS NOT in place:** See parts a THROUGH e next page:

a) Unplug the female Air Sensor's connector, **4th** cap, **5th** position, from the LEFT!

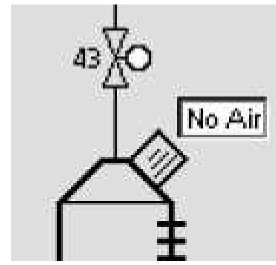



b) Call debug screen 0. Figure right, the text box above Chamber #69 MUST say "Air"!

c) Place one of the plugs, from the **FOUR-RESISTOR SET**, into the Air Sensor's distribution board position*!

- ***** If CBE modified the resistor MUST plug into the CBE board pin for pin. ENSURE the TOP CBE board pin is covered by the resistor!

d) If the resistor plug was placed properly, Chamber #69 MUST now say "No Air"!




e) See procedure number VE- 1.0.0 (page 214).

## VE- 1.0.0 INITIALIZE ACTUATOR-TEST BOARD VALVE CYCLES

a) **Turn the machine OFF!**

b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) From the Home screen, set [Dialysate Flow] to 300 ml/min and press 'Enter'.

d) See procedure number VE- 1.0.2 (page 215).

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**VE- 1.0.2 ISOLATE VERR**

a) Call debug screen 0.

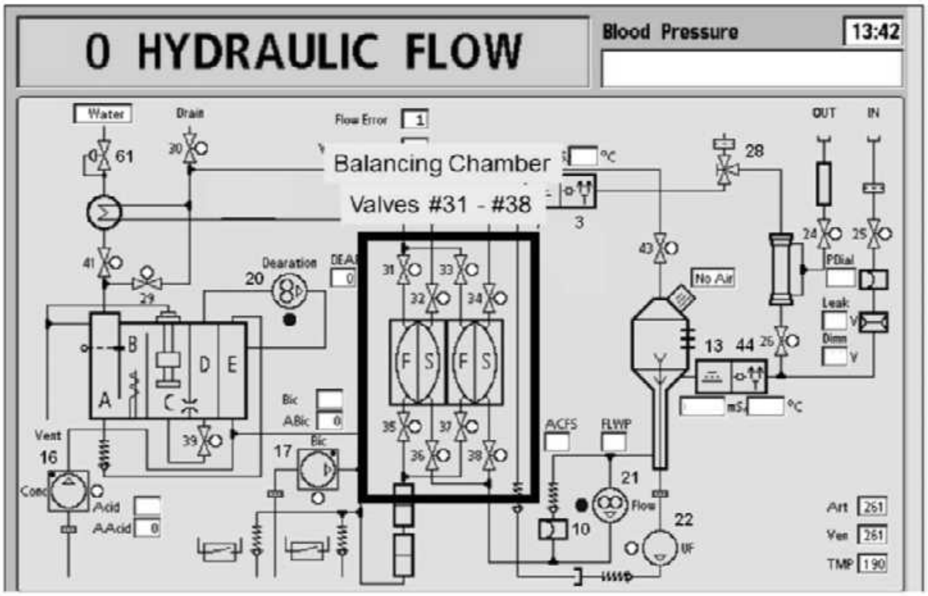



**Figure 37 – Debug Screen 0**

b) **Figure above**, watch the Balancing Chamber Valve 'dots', for one (1) minute. THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) ALL EIGHT are REMAINING white:** See procedure number VE- 2.0.0 (page 215).

**2)** **IF (and ONLY if) four (4) are REMAINING blue AND four (4) are REMAINING white:** Proceed to **page 218**, procedure number VE- 4.0.0.

**3)** **IF ALL EIGHT are CYCLING between white and blue:** Proceed to **page 217**, procedure number VE- 3.0.0.

**VE- 2.0.0 ALL EIGHT BALANCING CHAMBER VALVES REMAINING WHITE**

**NOTE!** One of the valve circuits whose 'dots' are blue is the problem! These procedures isolate between them:

a) **Open the shunt door till instructed othewise.**

b) Allow up to thirty (30) seconds. Do the Balancing Chamber Valve 'dots' begin to cycle between white and blue?

Yes The Balancing Chamber Valve 'dots' cycle! Valve #25 OR its blue wire harness is bad! To LOCATE Valve #25 refer to Figure 36 (page 211).

No All Balancing Chamber Valve 'dots' REMAIN white! Leaving the shunt door open, TWO (2) possible scenarios next page:

1) **IF (and ONLY if) ONLY Valves #30 AND #26 'dots' are blue AND all others are white:** See procedure number VE- 2.0.1 (page 216).

2) **ALL other scenarios:** Proceed to **page 223**, procedure number VE- 7.0.0.

**VE- 2.0.1 ONLY VALVES #30 AND #26 'DOTS' ARE BLUE**

a) At the distribution board (Figure below), unplug **Valve #26's** connector.

b) Watch the Balancing Chamber Valve 'dots' for thirty (30) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves to cycle! Valve #26 OR its blue wire harness is bad.

No The Balancing Chamber Valve 'dots' REMAIN white! See procedure number VE- 2.0.2 (page 216).

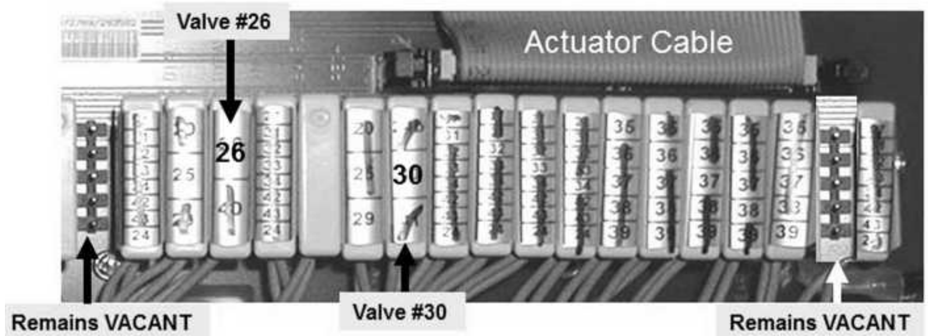



**Figure 38 – Valves #26 AND #30**

**VE- 2.0.2 VALVE #26 UNPLUGGED AND THE BALANCING CHAMBER VALVES REMAIN WHITE**

a) At the distribution board, Figure above, unplug **Valve #30's** connector.

b) Watch the Balancing Chamber Valve 'dots' for up to thirty (30) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle! Valve #30 OR its blue wire harness is bad.

No **A)** CAREFULLLY return ALL Valve connectors to the distribution board.

**B)** Turning the machine off first, swap in each component (see Component List below), one at a time, returning to Dialysis Program in between, until **VERR** remains = 0 for ten (10) minutes indicating the last component swapped in is the

**Component List:**

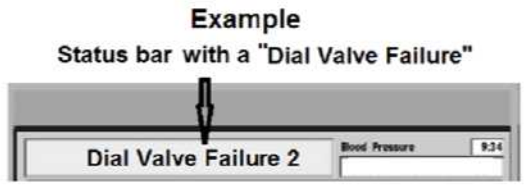
**1)** Actuator-Test Board; **2)** Actuator Cable; **3)** Distribution board

## VE- 3.0.0 ALL BALANCING CHAMBER VALVES CYCLING BETWEEN WHITE AND BLUE

a) Call debug screen 1.

b) NOTE **VERR's** value for reference. If **VERR** EVER reaches 255 return to procedure number VE- 1.0.0 (**page 214**) to reset it.

c) Figure right, if (and ONLY if) a "Dial Valve Failure" OR "Act Byp Valve Fail" banner EVER appears proceed to **page 711**, Section 26.



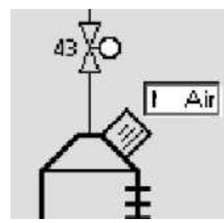

d) Watch **VERR** until if it increases above what was noted OR for ten (10) minutes whichever comes first! TWO (2) possible scenarios:

1) **IF (and ONLY if) VERR increases above what was noted:** Return to ABOVE procedure number VE- 1.0.0 (**page 214**).

2) **IF VERR does NOT increase:** See procedure number VE- 3.5.0 (page 217).

## VE- 3.5.0 ISOLATE VALVE #43

a) Remove the resistor plug from the Air Sensors distribution board position but **DO NOT return the Air Sensor's connector yet!**

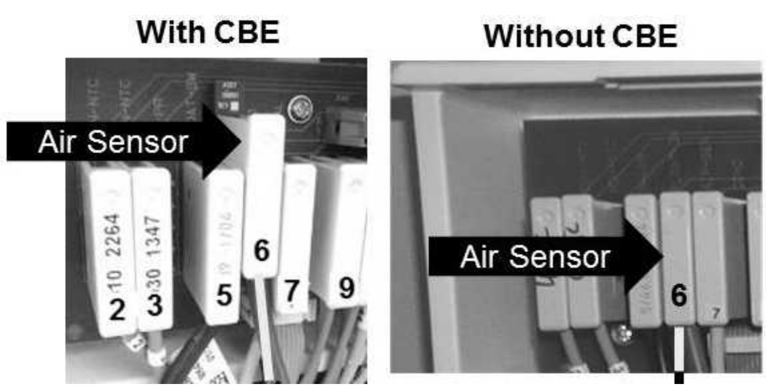



b) Call debug screen 0. Chamber #69 MUST say "Air".

c) Call debug screen 1. Watch **VERR** until if it increases above what was noted in procedure number VE- 3.0.0 OR for five (5) minutes whichever comes first! Does **VERR** increase?

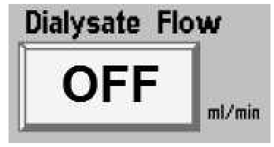
Yes **VERR** increases! See ABOVE procedure number VE- 1.0.2 (page 215).

No **VERR** DOES NOT increase! Return the Air Sensor's connector to it distribution board position. A valve error is not occurring at this time! If a Flow Error reoccurs proceed to **page 38,** procedure number F- 2.0.0!



## VE- 4.0.0 FOUR BALANCING CHAMBER VALVES REMAINING BLUE, FOUR REMAINING WHITE

**NOTE!** One of the valve circuits whose 'dots' are blue is the problem. These procedure isolate between them:




a) From the Home screen, set [Dialysate Flow] to "OFF".

b) Press' Enter'!

c) Return to screen 0. If flow is off all eight (8) Balancing Chamber Valves remain white.

d) Call debug screen 1! **NOTE** **VERR's** value for reference later. If **VERR** EVER reaches 255 return to procedure number VE- 1.0.0 (**page 214**) to reset it.

e) Watch **VERR** until if it increases above what you noted in part d OR for five (5) minutes whichever comes first! TWO (2) possible scenarios:

   1) **IF (and ONLY if) VERR increases above what was noted in part d:** Leaving [Dialysate Flow] "OFF", proceed to **page 223**, procedure number VE- 7.0.0.

   2) **IF VERR does NOT increases above what was noted in part d:** This indicates a problem with a Balancing Chamber Valve circuit. See procedure number VE- 4.0.1 (page 218).

## VE- 4.0.1 ISOLATE VALVES

a) From the Home screen, set [Dialysate Flow] to 300 ml/min.

b) Press 'Enter' THEN call debug screen 0.

c) Allow the Balancing Chamber Valve 'dots' to STOP cycling i.e. four (4) REMAINING blue! Four (4) REMAINING white! This may take a while so be patient!

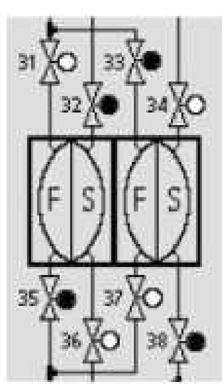
d) Per the Figures below, TWO (2) possible scenarios:

   1) **IF (and ONLY if) V32, V33, V35 AND V38 are REMAINING blue:** The problem is in Balancing Chamber Valve Cycle 1! See procedure number VE- 5.0.0 (page 219).

   2) **IF V31, V34, V36 AND V37 are REMAINING blue:** The problem is in Balancing Chamber Valve Cycle 2! Proceed to **page 221**, procedure number VE- 6.0.0.

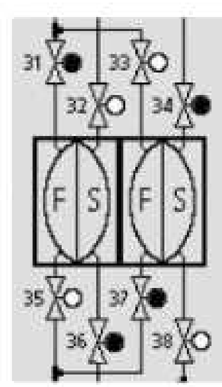
**BC Valve Cycle 1:**

**V32, V33, V35, V38 Remaining BLUE**

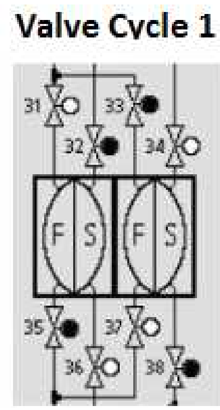



**BC VALVE CYCLE 2:**

**V31, V34, V36, V37 Remaining BLUE**



## VE- 5.0.0 VALVE ERROR AT BALANCING CHAMBER CYCLE 1



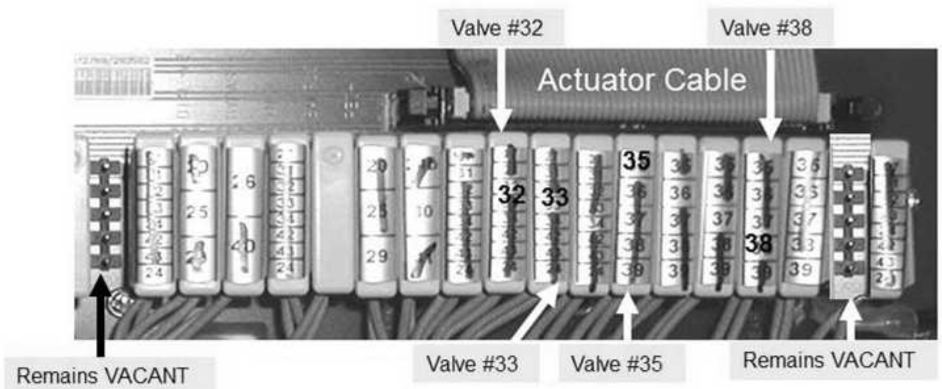

Valves #32, #33, #35, and #38 'dots' REMAINING blue. One of these valve circuits is causing the problem and these procedures isolate between them!

a) At the distribution board (Figure below), unplug **Valve #32's** connector.

b) Call debug screen 0 and watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle between white and blue! Valve #32 OR its blue wire harness is bad.

No Valves do NOT cycle! See procedure number VE- 5.0.1 (page 219).




## VE- 5.0.1 VALVE #32 UNPLUGGED AND VALVES DO NOT CYCLE

a) At the distribution board (Figure above), unplug **Valve #33's** connector.

b) Watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle between white and blue! Valve #33 OR its blue wire harness is bad.

No Valves do NOT cycle! See procedure number VE- 5.0.2 (page 219).

## VE- 5.0.2 VALVE #33 UNPLUGGED AND VALVES DO NOT CYCLE

a) At the distribution board (Figure above), unplug **Valve #35's** connector.

b) Watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle between white and blue! Valve #35 OR its blue wire harness is bad.

No Valves do NOT cycle! See procedure number VE- 5.0.3 (page 220).

**VE- 5.0.3 VALVE #35 UNPLUGGED AND VALVES DO NOT CYCLE**

a) At the distribution board (Figure above), unplug **Valve #38's** connector.

b) Watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle between white and blue! Valve #38 OR its blue wire harness is bad.

No The Balancing Chamber Valves do not cycle after Valves #32, #33, #35, and #38 have all been unplugged! See parts A and B below:

**A)** CAREFULLLY return ALL Valve connectors to the distribution board;

**B)** Turning the machine off first, swap in each component (see Component List below), one at a time, returning to Dialysis Program in between, until **VERR** remains = 0 for ten (10) minutes indicating the last component swapped in is the problem.

**Component List**

**1)** Actuator-Test Board; **2)** Actuator Cable; **3)** Distribution board

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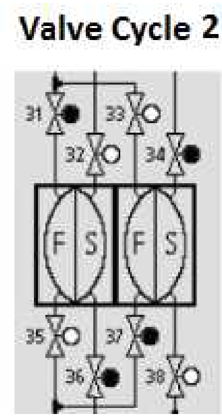
## VE- 6.0.0 VALVE ERROR AT BALANCING CHAMBER CYCLE 2




Valves #31, #34, #36, and #37 'dots' REMAINING blue. One of these valve circuits is causing the problem and these procedures isolate between them.

a) At the distribution board (Figure below), unplug **Valve #31's** connector.

b) Call debug screen 0 and watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle between white and blue! Valve #31 OR its blue wire harness is bad.

No Valves do NOT cycle! See procedure number VE- 6.0.1 (page 221).

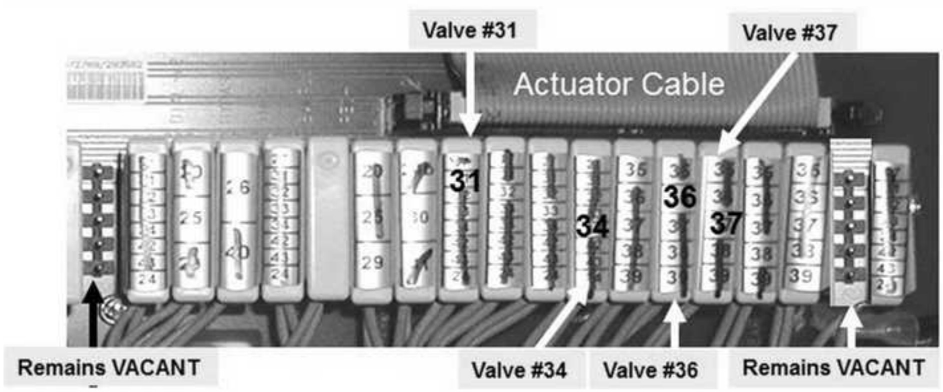



**Figure 39 – Valve Cycle 2**

## VE- 6.0.1 VALVE #31 UNPLUGGED AND VALVES DO NOT CYCLE

a) At the distribution board (Figure above), unplug **Valve #34's** connector.

b) Watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle between white and blue! Valve #34 OR its blue wire harness is bad.

No Valves do NOT cycle! See procedure number VE- 6.0.2 (page 221).

## VE- 6.0.2 VALVE #34 UNPLUGGED AND VALVES DO NOT CYCLE

a) At the distribution board (Figure above), unplug **Valve #36's** connector.

b) Watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle! Valve #36 OR its blue wire harness is bad.

No Valves do NOT cycle! See procedure number VE- 6.0.3 (page 222).

## VE- 6.0.3 VALVE #36 UNPLUGGED AND VALVES DO NOT CYCLE

a) At the distribution board (Figure above), unplug **Valve #37's** connector.

b) Watch the Balancing Chamber Valve 'dots' for forty-five (45) seconds. Do they begin to cycle between white and blue?

Yes The Balancing Chamber Valves begin to cycle between white and blue! Valve #37 OR its blue wire harness is bad.

No The Balancing Chamber Valves do not cycle after Valves #31, #34, #36, and #37 have all been unplugged! See parts A and B below:

**A)** CAREFULLLY return ALL Valve connectors to the distribution board.

**B)** Turning the machine off first, swap in each component (see Component List below), one at a time, returning to Dialysis Program in between, until **VERR** remains = 0 for ten (10) minutes indicating the last component swapped in is the problem.

**Component List**

**1)** Actuator-Test Board; **2)** Actuator Cable; **3)** Distribution boaroard

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## VE- 7.0.0 ISOLATE VERR

a) From debug screen 0, RECORD the valve numbers of the valves whose 'dots' are BLUE! **One of these valve circuits may be the problem!** These procedures isolates them.

b) Call debug screen 1. NOTE **VERR's** value for reference later. If **VERR** EVER reaches 255 return to procedure number VE- 1.0.0 (**page 214**) to reset it.

c) Watch **VERR** until if it increases above what was noted in part b OR for five (5) minutes whichever comes first! TWO (2) possible scenarios:

   1) **IF VERR does NOT increase above what was noted in part b:** A valve error is not occurring at this time! Turn Dialysate Flow on. If a Flow Error reoccurs proceed to **page 38,** procedure number F- 2.0.0.

   2) **IF VERR increases above what was noted in part b:** See procedure number VE- 7.0.1 (page 223).

## VE- 7.0.1 ISOLATE VERR

a) At the distribution board (Figure below), unplug one of the RECORDED valves. This isolates the valves solenoid and its wire harness.

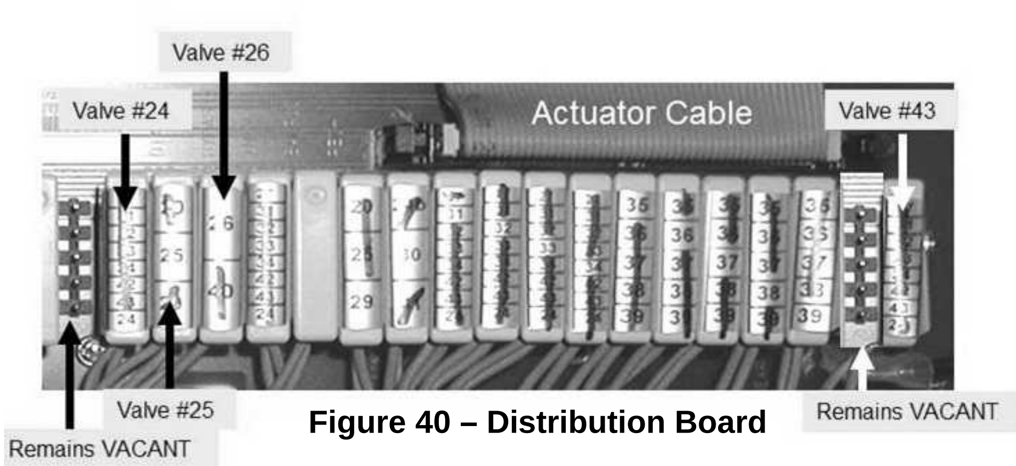



**Figure 40 – Distribution Board**

b) Watch **VERR** until if it increases above what was noted in procedure number VE- 7.0.0, part b OR for five (5) minutes whichever comes first! TWO (2) possible scenarios:

   1) **IF VERR does NOT increase:** The last valve unplugged OR its blue wire harness is the problem!

   2) **IF VERR increases:** Repeat procedure number VE- 7.0.1 until all RECORDED valves have been unplugged. If after all these valve(s) are unplugged AND **VERR** is still increasing, THREE (3) possible bad components, see the Component List below:

   **Component List:** Swap in each, one at a time, returning to Dialysis Program in between, until **VERR** remains = 0 for 10 minutes indicating the last component swapped in is the problem!

   **1)** Actuator-Test Board; **2)** Actuator Cable; **3)** Distribution board

## TROUBLESHOOTING VALVE ERRORS IN CLEANING PROGRAMS

A) **To prevent damage, turn the machine OFF!**

B) **Per the Figure below**, at the distribution board, THREE (3) checks:

**Check #1:** ENSURE the ACTUATOR CABLE is plugged in securely AND is not damaged!

**Check #2:** ENSURE the black PGND is plugged in securely AND shows no sign of burning!

**Check #3:** ENSURE all Valves are plugged PROPERLY into their distribution board positions

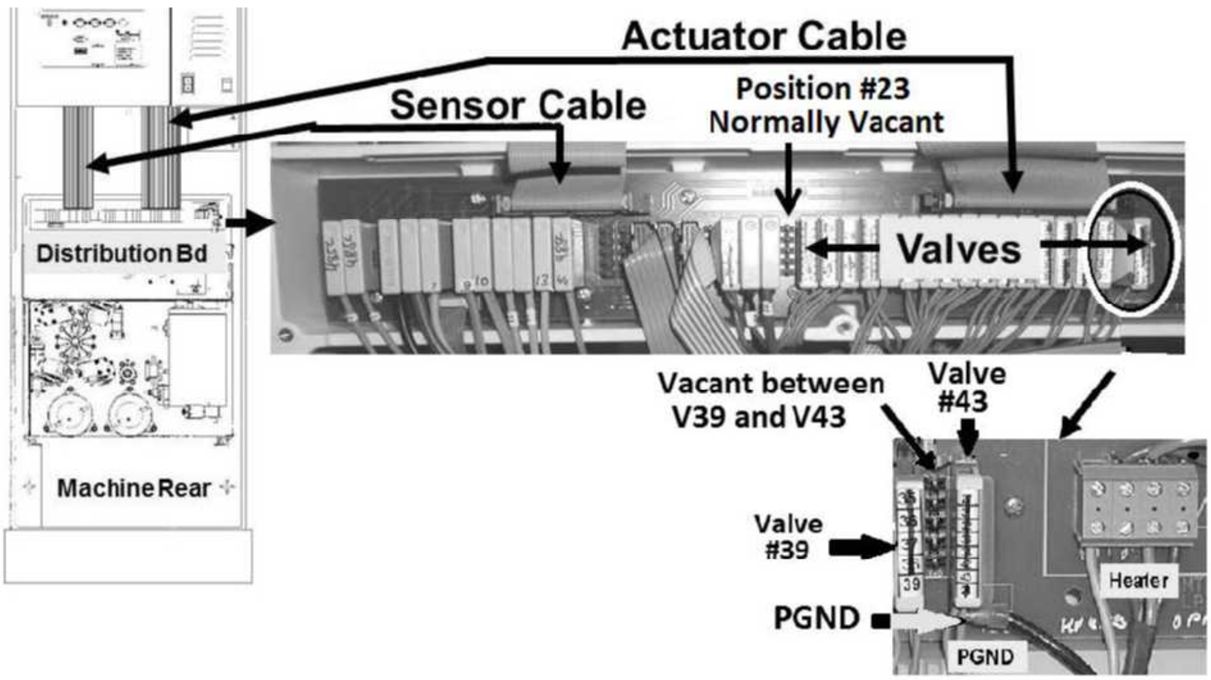



**Figure 41 – Distribution Board**

B) If a problem was NOT located in part A, see procedure number VEC- 1.0.0 (page 224). If a problem was located AND REPAIRED return to Heat Disinfect OR Rinse. If **VERR** (debug screen 1) remains = 0 for five (5) minutes the problem has been eliminated. If VERR does NOT remain = 0 see procedure number VEC- 1.0.0 (page 224).

### VEC- 1.0.0 ISOLATE THE VALVE ERROR / FLOW THROUGH 'BOB'?

a) Return to Heat Disinfect OR Rinse!

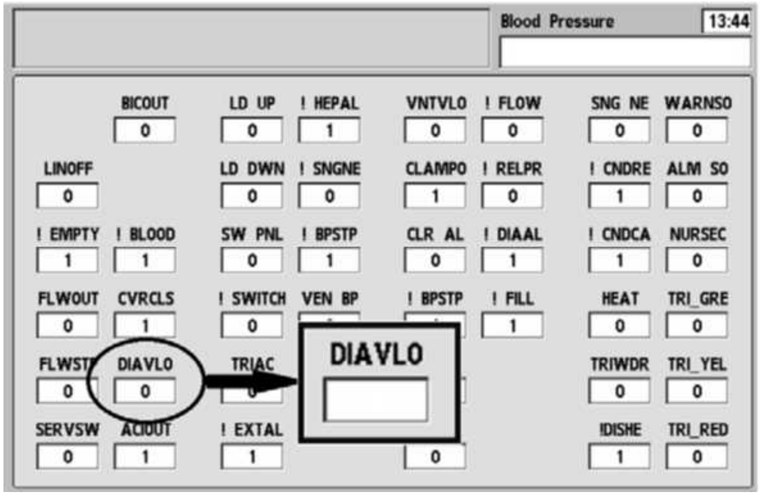
b) Watching for one (1) minute, does the flow indicator's 'bob' EVER rise, at least ¼ way up, in the sight tube?

Yes 'Bob' moving! Proceed to **page 230**, procedure number VEC- 2.0.0

No 'Bob' NOT MOVING! See procedure number VEC- 1.1.0 (page 225).

## VEC- 1.1.0 BOB NOT MOVING / ISOLATE VALVE # 24

a) Call debug screen 2 (Figure below). If debug does not appear press 'Esc' then call screen 2.




b) Watch **DIAVLO** (lower left) for forty-five (45) seconds. BE CAREFUL, THREE (3) possible scenarios 1) or 2) or 3) below:

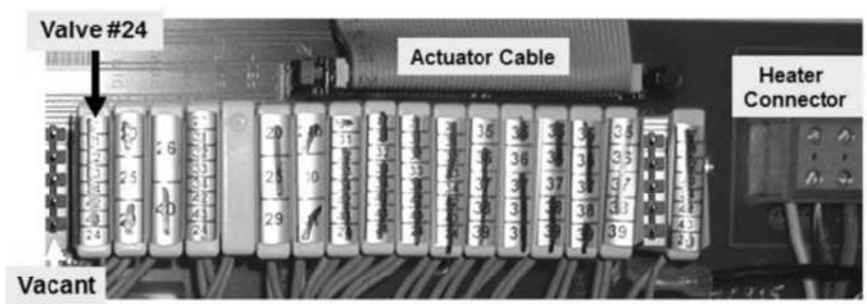
**1) IF (and ONLY if) DIAVLO cycles between 1 (for three seconds), and 0 (for one second):** See procedure number VEC- 1.2.0 (page 226).

**2) IF (and ONLY if) DIAVLO 'blinks rapidly' to 0 but for way less than one second: NOTE ONLY VALVE #24** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

**3) IF DIALVLO REMAINS 0 OR 1 i.e. NEVER cycles:** See parts a THROUGH d below

a) **Turn the machine OFF!**

b) Figure right, unplug Valve #24's from its distribution board position.




c) **Return to Heat Disinfect OR Rinse Program!**

d) From debug screen 2, watch **DIALVLO** for forty five (45) seconds, does it now cycle between 0 and 1?

Yes — Cycles between 0 and 1. Valve #24 or its blue wire harness is bad (to LOCATE Valve #24 refer to Figure 35 (page 211)).

No Does NOT cycle! **A)** Return valve #24 to the distribution board; **B) NOTE ONLY VALVE #24** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE .

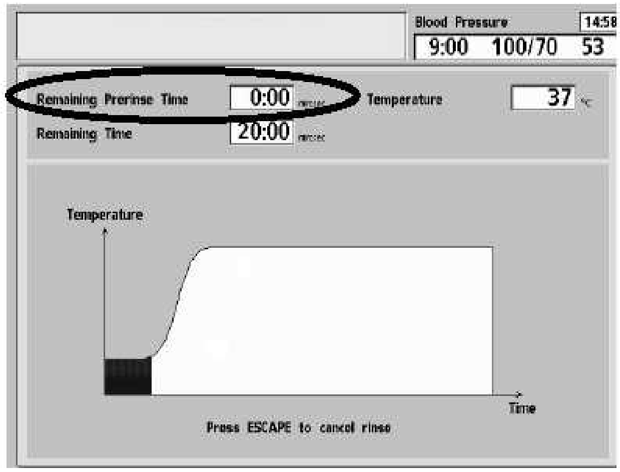
**<u>VEC- 1.2.0 'BOB' NOT MOVING / DIAVLO CYCLING BETWEEN 1 AND 0</u>**

a) Press 'Esc' to return to the Cleaning Program's Main screen!

b) Leave the machine in whatever Program it is <u>CURRENTLY</u> in: 1) In Rinse? <u>OR</u> 2) In Heat Disinfect?

**1) IF (and ONLY if) in RINSE:** See procedure number VEC- 1.3.0 (page 227).

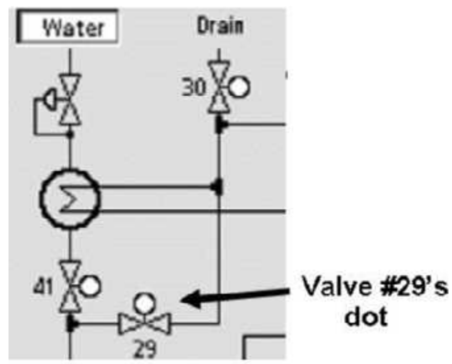
**2) IF in HEAT DISINFECT:** Per the Figure right, does the VERY TOP Window, **<u>Remaining Prerinse Time</u>** = 0:00 min:sec (Yes or No)?




Yes **Remaining Prerinse Time** = 0:00! See procedure number VEC- 1.2.1 (page 226).

No **Remaining Prerinse Time** does <u>NOT</u> = 0:00! See procedure number VEC- 1.3.0 (**page 227**).

**<u>VEC- 1.2.1 IN HEAT DISINFECT / REMAINING PRERINSE = 0:00</u>**



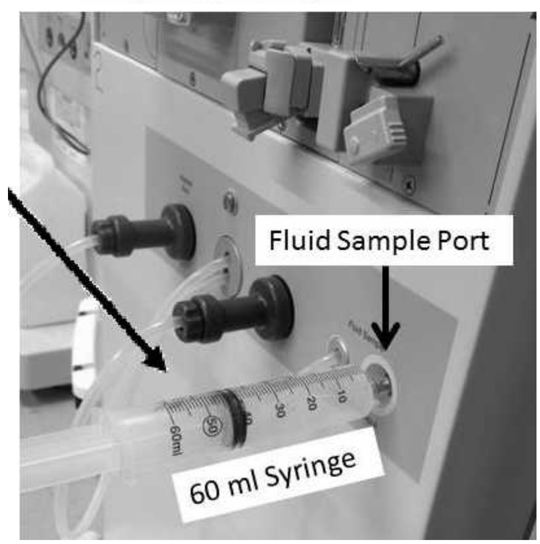

a) Call debug screen 0. If the screens do not appear press 'Esc' then call screen 0.

b) Only when **Remaining Prerinse Time** = 0:00, does Valve #29's 'dot' (Figure right) <u>REMAIN</u> blue (i.e. NEVER white). ENSURE this by watching it for fifteen (15) FULL seconds.

c) Figure right, screw a 60 ml syringe, filled COMPLETELY with water, onto the Fluid Sample Port.

d) Start a SEVEN (7) second timer in your head as you begin to push **<u>as HARD as you can</u>** on the syringe plunger! You should feel very little resistance!

e) Can you push ALL of the water through the Sample Port within SEVEN seconds?

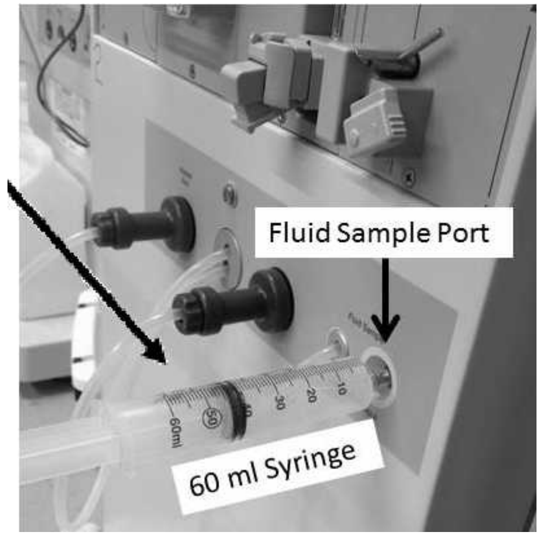



Yes Very little resistance is encountered! Valve #29 is okay! See procedure number VEC- 1.3.0 (page 227).

No Significant resistance when pushing! **<u>NOTE ONLY VALVE #29</u>** will be checked and proceed to **page 210**, <u>TROUBLESHOOTING A VALVE</u>

## VEC- 1.3.0 ISOLATE DRAIN VALVE #30

a) Turn the machine OFF then back on. Allow the "Select Program" screen to appear but **DO NOT** press any keys till instructed!


b) With "Select Program" up, Figure right, screw a 60 ml syringe, filled COMPLETELY with water, onto the Fluid Sample Port.

c) Start a SEVEN (7) second timer, in your head, as you begin to push **as HARD as you can** on the syringe plunger! You should feel very little resistance!

d) Can you push ALL of the water through the Sample Port within SEVEN (7) seconds?

Yes Good flow through Valve #30! See procedure number VEC- 1.4.0 (page 227).

No Significant resistance! **NOTE ONLY VALVE #30** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

## VEC- 1.4.0 GOOD FLOW THROUGH VALVE #30 / ISOLATE VALVE #24

a) Obtain a 1000 ml graduated cylinder.

b) **Return to Heat Disinfect OR Rinse!**

c) Open the shunt door and **LEAVE IT OPEN TILL INSTRUCTED!**

d) Remove the BLUE dialyzer quick connector from the shunt but **DO NOT CLOSE THE DOOR!** The Program MUST NOT Interrupt!

e) Measure from the blue dialyzer connector, for thirty (30) seconds! More than 300 ml collected?

Yes More than 300 ml! Without returning the connector to the shunt yet, see procedure number VE- 1.5.0 (page 229).

No Less than 300 ml! ENSURING the machine was in Heat Disinfect OR Rinse see parts a THROUGH c below:

a) Return the dialyzer connector to the shunt but **DO NOT** close the door.

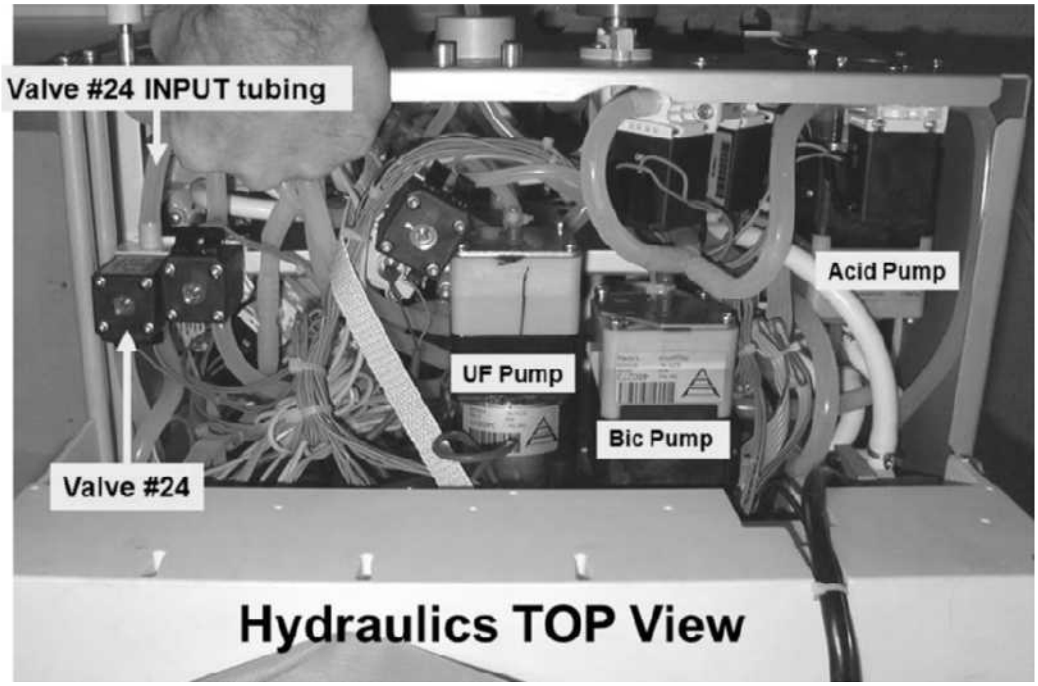
**Parts b and c next page**

b) Figure below, routing Valve #24's **INPUT** tubing so that spillage into the hydraulics will NOT occur, remove it and measure flow from it for thirty (30) seconds.

c) More than 300 ml every 30 seconds?

Yes More than 300 ml! **A)** Return Valve #24's tubing; **B)** **NOTE ONLY VALVE #24** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

No Less than 300 ml! Return Valve #24's tubing THEN see procedure number VE- 1.4.1 (page 228).




## VEC- 1.4.1 BAD FLOW TO VALVE #24

a) ENSURE Loading Pressure (gauge in Rinse port) is still PEAKING to between 22 and 27 psi.

b) ENSURE Flow Pump Pressure (gauge at Flow Pump) is still PEAKING to between 34 and 38 psi.

c) If Loading AND Flow Pressure are good, THREE (3) possible bad components: **1)** Bad Actuator-Test Board OR **2)** Bad Actuator Cable OR **3)** Multiple bad balancing chamber valves.

**VEC- 1.5.0 VALVE #24 OKAY / ISOLATE VALVE #25**

a) With the shunt door open, the dialyzer connector NOT in the shunt AND still in Heat Disinfect OR Rinse, ENSURE the external flow indicator's 'bob' is rising!

b) Return the dialyzer connector to the shunt but **DO NOT** close the door!

c) Watching for thirty (30) seconds, does the external flow indicator's 'bob' rise at least ½ way up now?

Yes Bob moving! Something changed! **A)** Turn the machine OFF; **B)** Close the door; **C)** Turn the machine on and return to Heat Disinfect OR Rinse; **D)** If a Flow Error reoccurs return to (ABOVE) procedure number CLEAN- 1.2.2 (page 172).

No 'Bob' not moving! **NOTE ONLY VALVE #25** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

LEFT BLANK INTENTIONALLY

**VEC- 2.0.0 'BOB' MOVING UP AND DOWN**

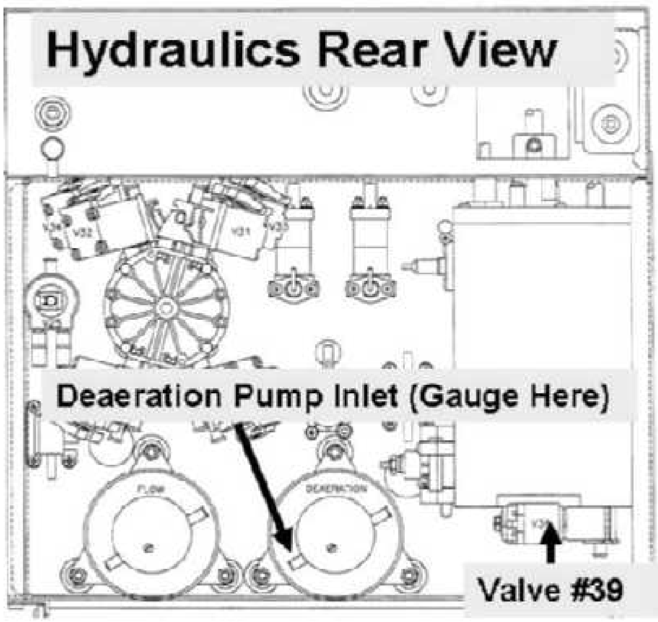
A) Turn the machine OFF!

B) This procedure checks Valve #39 in RINSE. If it opens, as it should, deaeration pressure will be between 0 and -13 inHg i.e. nowhere near -24 inHg. See parts a THROUGH e below:

a) The deaeration gauge is here. ENSURE it reads 0 inHg before installing it.

b) Fluids and tubing may be HOT but won't scald you!

c) Figure below, tee the gauge into the Inlet (clear) tubing of the Deaeration Pump.




d) **Place the machine in RINSE!**

e) Reading the gauge, TWO (2) possible scenarios:

1) **IF (and ONLY if) between 0 and -13 inHg:** Valve #39 is open! See procedure number VEC- 2.2.0 (page 231)!

2) **IF between -13 and -30 inHg:** ENSURING the machine was in RINSE prior to checking pressure, Valve #39 IS NOT opening! FOUR (4) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Valve #39 (see Figure above) OR; **3)** Bad ACTUATOR cable OR; **4)** Bad distribution board.

## VEC- 2.2.0 VALVE #39 IS OPEN

A) Turn the machine OFF and remove the gauge!


B) Turn the machine on and allow the “Select Program” screen to appear. What color is the ‘Dialysis’ button (Gray or Blue)?

   **1) IF GRAY:** Place the machine in RINSE. Most Valve Errors will not stop Program timing for very long. Allow RINSE to complete i.e. [Remaining Time] = 0:00, then see part C.

   **2) IF BLUE:** See part C.

C) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

D) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘Enter’

E) Allow five (5) minutes BEFORE continuing to part F.

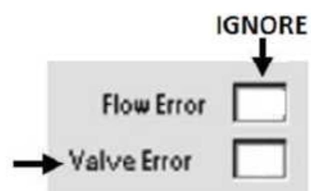
F) Call debug screen 1 to see **VERR** (right column, bottom). TWO (2) possible scenarios:

   **1) IF (and ONLY if) VERR = 0:** For some reason the Valve Error is not occurring at this time.

   **2) IF VERR = 1 OR more:** See parts a AND b below:

      a) Call debug screen 0.

      b) Ignoring the **Flow Error** window, WITHOUT LOOKING AWAY, watch the 2nd window down, **Valve Error** for one (1) minute. Ignoring a ‘blink to 1’, that lasts less than one (1) second, does for **Valve Error** EVER = 1 for LONGER THAN two (2) seconds?

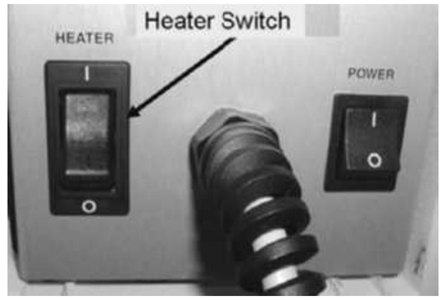



Yes **Valve Error** = 0 OR ‘blinks’ to 1 for less than one second! Proceed to **page 213**, TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM

No **Valve Error** = 1 LONGER THAN two (2) seconds! Proceed to **page 711**, Section 26.

# SECTION 4 - TEMPERATURE PROBLEMS

**NOTE!** Temperature does not change instantaneously. Observe all stated times to avoid error!




A) Figure right, ENSURE the Heater Switch is in the "1" or "ON" position!

B) External leaks, "No Water" and Flow Error alarms cause temperature problems. If any of these occur at ANY TIME address them FIRST!

C) Depending on what Program the problem is occurring in, TWO (2) possible scenarios below:

1) **IF in Dialysis Program i.e. connected to concentrate:** See parts a AND b below:

   a) From the Home screen, ENSURE [Dialysate Flow] is on***** AND set to 800 ml/min.

      ***** If [Dialysate Flow] is blinking flow is off! Flow **MUST** be on!

   b) ENSURING the Heater Switch and Dialysate Flow has been on for six (6) minutes if the temperature problem still exists see procedure number T- 1.0.0 (page 233).

2) **IF in Heat Disinfect:** THREE (3) possible scenarios i) or ii) or iii) below:

   **i) IF (and ONLY if) the "TEMP OVER 95 DEGREES" banner occurred: A)** Turn the machine off then back on; **B)** RETURN TO DIALYSIS PROGRAM ("Select Program" → 'Dialysis' → 'Enter')! **C)** From the Home screen set [Dialysate Flow] to 800 ml/min and press 'Enter'; **D)** See procedure number T- 1.0.0 (page 233).

   **ii) IF the Heater Switch was "OFF":** Allow twenty (20) minutes ENSURING a Flow Error soe not occur! If [Temperature] does NOT increase to more than 80° C see scenario iii below.

   **iii) ALL OTHER scenarios:** ENSURING Heat Disinfect has been running for at least twenty (20) minutes, with the shunt door CLOSED, no leaks AND no Flow Errors! TWO (2) possible scenarios:

   1) **IF (and ONLY if) [Temperature] REMAINS more than 80° C AND the [Remaining Time] window has 'frozen' at less than one (1) minute:** ENSURING no external leaks, TWO (2) possible bad components: **Component #1:** Power Logic Board OR; **Component #2:** Functional Board.

   2) **ALL OTHER scenarios:** See parts a THROUGH d below:

      a) Plug into acid and LIQUID bicarbonate.

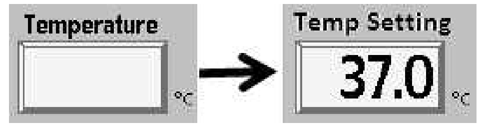
      b) RETURN TO DIALYSIS PROGRAM ("Select Program" → 'Dialysis' → 'Enter')!

      c) From the Home screen, set [Dialysate Flow]***** to 800 ml/min and press 'Enter'.

         ***** If [Dialysate Flow] is blinking flow is off! Flow **MUST** be on!

      d) See procedure number T- 1.0.0 (page 233).

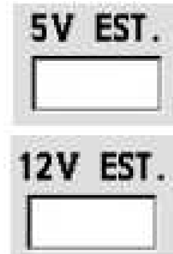
## T- 1.0.0 IN DIALYSIS PROGRAM / TROUBLESHOOTING TEMPERATURE




a) Press the [**Temperature**] window and set it to 37.0° C!

b) **Press 'Enter'.**

c) Call debug screen 1. TWO (2) checks:




**Check #1: 5V EST (right column):** Between 4.7 and 5.3?

**Check #2: 12V EST (right column):** Between 11.7 and 12.3?

d) TWO (2) possible scenarios:

**1)** **IF (and ONLY if) BOTH are in range AND stable i.e. not changing more than 0.1:** See procedure number T- 1.0.1 (page 233).

**2)** **IF one OR both is NOT REMAINING in range OR is unstable:** See parts a THROUGH e below:

a) Turn the machine OFF!

b) Using ESD precautions, reseat all card cage circuit boards.

c) Turn the machine on.

d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

e) Call debug screen 1. If (and ONLY if) **5V EST** and/or **12 EST** are still NOT in range OR unstable proceed to **page 642**, procedure number P- B.0.0. If **5V EST** and/or **12 EST** are in range see procedure number T- 1.0.1 (page 233).

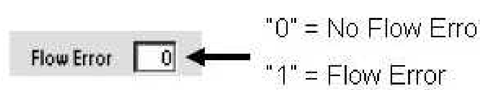
## T- 1.0.1 ISOLATE FLOW ERROR

a) If the Automated Tests are running (screen reads "Test:....") allow them to finish.

b) Remove the 'dummy venous chamber' from the Level Detector.

c) **Do NOT reset alarms!**

d) Call debug screen 0. If **Flow Error EVER** = 1, indicates a masked Flow Error. WITHOUT LOOKING AWAY, watch **Flow Error** for one (1) minute. Is it EVER = 1?




Yes **Flow Error** = 1, even if only once! Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM

No **Flow Error** ALWAYS = 0! See parts a THROUGH c below:

a) Return the concentrate connnectors to their rinse ports.

**Parts b and c next page**

b) **Place the machine in RINSE!**

c) In RINSE, is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

Yes 'Bob' moving! See procedure number T- 1.0.2 (page 234).

No In RINSE, 'bob' is NOT moving! See parts a THROUGH c below:

a) Connect to acid and LIQUID bicarb.

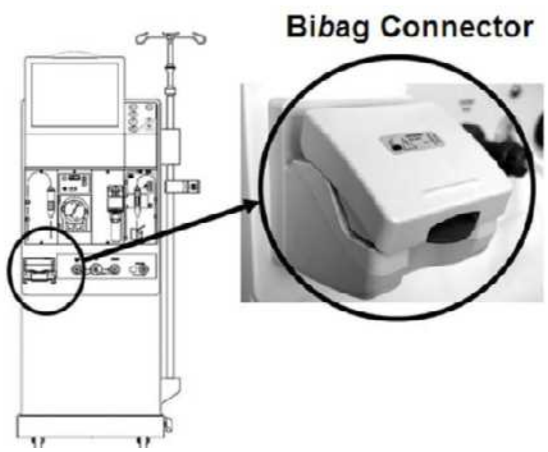
b) RETURN TO DIALYSIS PROGRAM ("Select Program" → 'Dialysis' → 'Enter')!

c) Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM

**T- 1.0.2 'BOB' MOVING**

A) **Press 'Esc' then 'Enter' twice to call "Select Program" but DO NOT press 'Dialysis' till instructed!**


B) Figure right, TWO (2) possible scenarios:




**1) IF (and ONLY if) NOT equipped with a bi*bag* Connector:** See procedure number T- 1.0.3 (page 235).

**2) IF equipped with a bi*bag* Connector:** See parts a AND b below:

a) A bi*bag* disposable CANNOT be attached. Instead connect to a jug of known good liquid bicarb!

b) With "Select Program" remaining up, see procedure number T- 1.0.3 (page 235).

**NOTE!** Temperature problems may cause the bi*bag* system to seemingly malfunction.

**T- 1.0.3 ISOLATE HEATER**

A) **To avoid shock “Select Program” REMAINS up till instructed!**

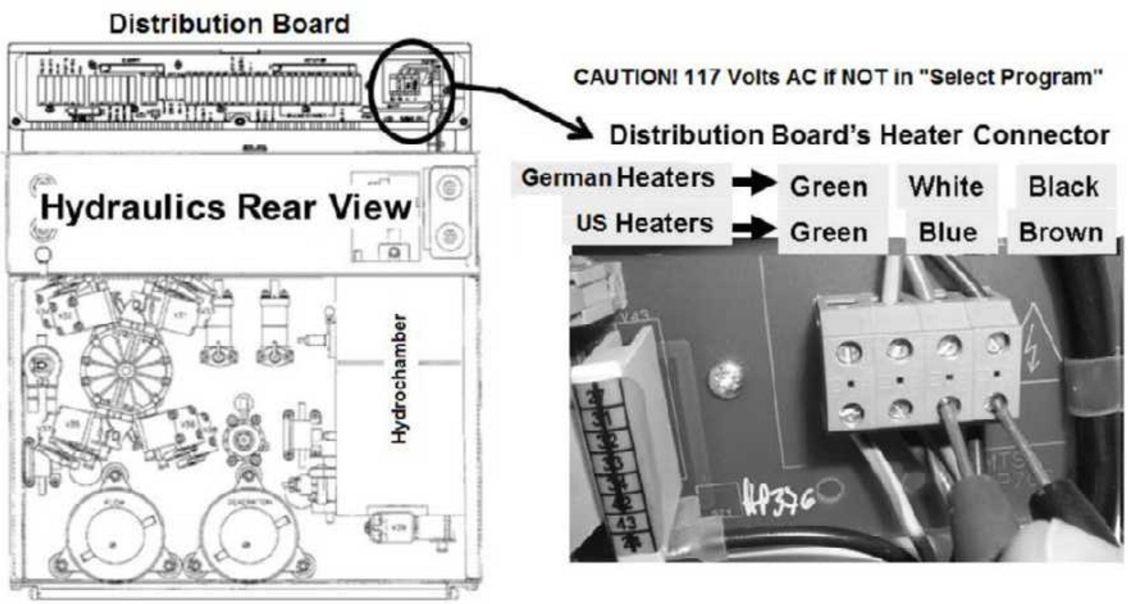

B) Figure below, remove the distribution board cover.

C) At the green eight-pin Heater Connector, THREE (3) checks:

**CHECK #1:** From RIGHT-TO-LEFT, the BOTTOM four (4) wires MUST BE brown, blue, green/yellow OR black, white, green; the TOP three (3) wires MUST BE brown, blue, green/yellow!

**CHECK #2:** Yank on all of the wires to ENSURE they are SECURELY attached.

**CHECK #3:** If (and ONLY if) signs of burning is seen indicate the wires may not have been securely attached AND the distribution board needs to be replaced**!**




D) **Set your CALIBRATED volt meter to resistance (Ω)!**

E) Touch the leads together. The meter MUST read less than 0.3 **Ω**!

F) Figure above, measure BETWEEN the Heater Connector’s **BLUE** and **BROWN** wires. TWO (2) possible scenarios:

1) **IF (and ONLY if) between 8.0 and 13.0 Ω:** The heater is good! See procedure number T-1.0.4 (page 236).

2) **ALL OTHER scenarios (possibly about 20 Ω or “OL”):** The heater* is bad! *To LOCATE the heater refer to Figure 28 (page 140).

## T- 1.0.4 HEATER GOOD / ISOLATE TEMPERATURE SENSORS (NTCs')

A) **Per the Figure BELOW**, trace NTC #2 AND NTC #3's cables from their distribution board connectors to the sensors. TWO (2) checks:

**CHECK #1** ANY insulation damage indicates the sensor need to be replaced!

**CHECK #2** ENSURE the sensors are not reverse connected with another component!

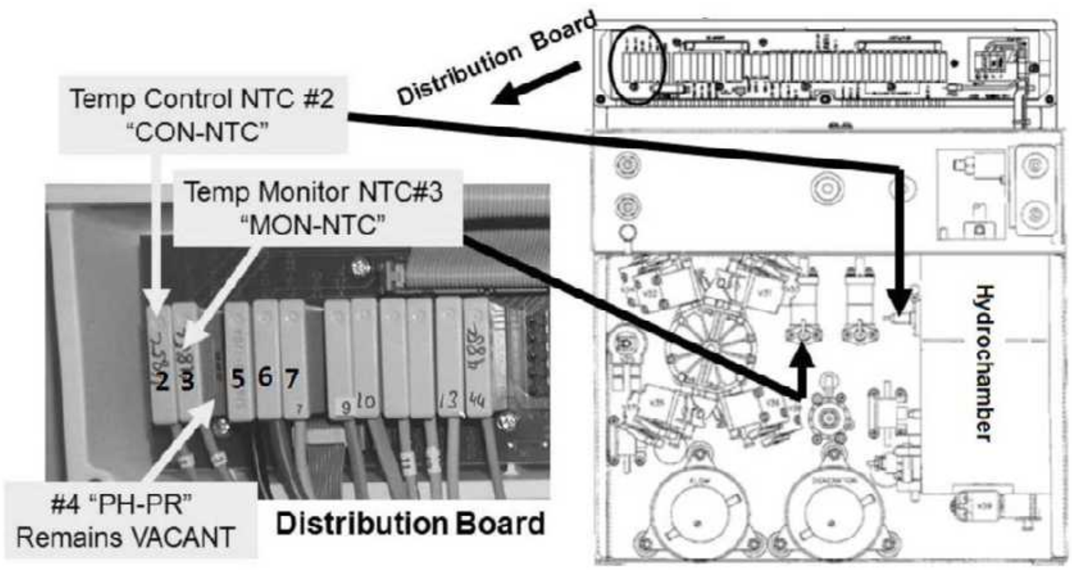



**Figure 42 – Temperature Sensors (NTC)**

B) During Checks #1 and #2, THREE (3) possible scenarios 1) or 2) or 3) below:

1) **IF (and ONLY if) NO PROBLEMS were located:** Proceed to **page 237**, procedure number T- 1.0.6.

2) **IF (and ONLY if) insulation damage was located:** Replace the sensor(s) then see procedure number T- 1.0.5 (page 236).

3) **IF a sensor was reverse connected:** AFTER correcting the problem see procedure number T- 1.0.5 (page 236).

## T- 1.0.5 PROBLEM LOCATED DURING CHECKS 1 AND 2

Depending on where the problem ORIGINALLY occurred, TWO (2) possible scenarios:

**1)** **IF in Dialysis Program: A)** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter); **B)** Set [Dialysate Flow] to 800 ml/min; **C)** Allow six (6) minutes before continuing to part D; **D)** If the temperature problem reoccurs see procedure number T- 1.0.6 (page 237).

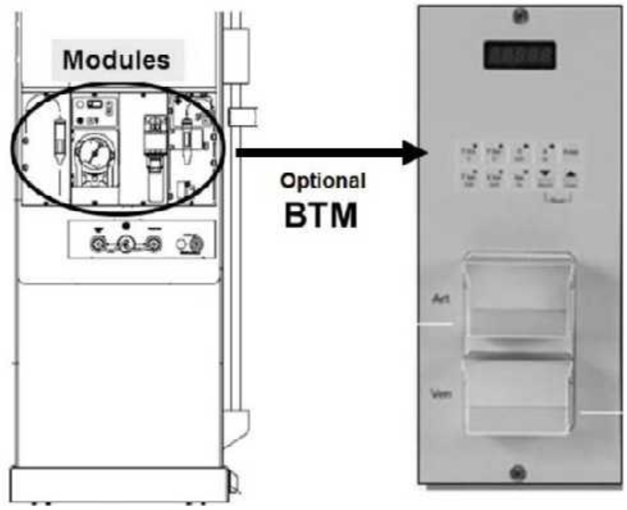
**2)** **IF in Heat Disinfect: A)** Return to Heat Disinfect; **B)** Allow up to thirty (30) minutes. **C)** If the problem reoccurs, before continuing to part D, put the machine in RINSE for fifteen (15) minutes to cool it down rapidly; **D)** See procedure number T- 1.0.6 (page 237).

## T- 1.0.6 OPTIONAL BLOOD TEMPERATURE MODULE (BTM) EQUIPPED?

Per the Figure right, TWO (2) possible scenarios:

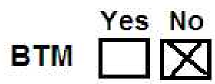
1) **IF <u>NOT</u> equipped with the <u>optional</u> Blood Temperature Module (BTM):** See procedure number T- 1.0.7 (page 239).

2) **IF equipped with a Blood Temperature Module (BTM):** See parts a THROUGH g below:




a) Place the machine into Service Mode → Options → Hardware Options.

b) Next to '**BTM**', place the 'X' into the "No" box.

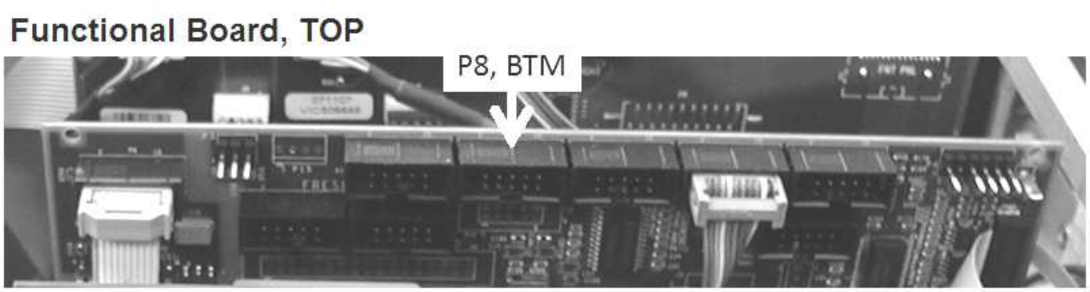



c) Press 'Enter' to turn the "X" blue!

d) **To prevent damage turn the machine OFF!**

d) To avoid pulling cables loose, GENTLY open the card cage.

e) The Functional Board is the 3rd circuit board from the right! Figure below, unplug the ten (10) pin ribbon cable from the P8 connector.




f) **Close the card cage!**

g) Where was the problem <u>ORIGINALLY</u> occurring, ***1) In Dialysis Program i.e. connected to concentrate***? <u>OR</u> ***2) In Heat Disinfect***? TWO (2) possible scenarios:

**1) IF (and ONLY if) in <u>Dialysis Program</u>:** See procedure number T- 1.0.7 (page 239).

**2) IF in <u>Heat Disinfect</u>:** Return to <u>Heat Disinfect</u> and allow up to thirty (30) minutes. TWO (2) possible scenarios next page:

**Scenario #1: IF (and ONLY if) the temperature problem <u>REOCCURS</u>:** The BTM is not causing the problem. See parts a AND b below:

a) To cool the machine quickly, place it into RINSE for fifteen (15) minutes!

b) See procedure number T- 1.0.7 (page 239)!

**Scenario #2: IF the temperature problem <u>NEVER</u> reoccurs:** See parts a AND b below:

a) To cool the machine quickly, place it into RINSE for fifteen (15) minutes!

b) See procedure number T- 1.0.7 (page 239).

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## T- 1.0.7 TEMPERATURE PROBLEM

A) Connect to known good acid***** and LIQUID bicarbonate*****! ***** Tested per clinic procedures!

B) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter).

C) From the Home screen, press the [Dialysate Flow] window.

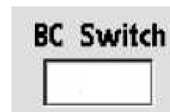
D) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

E) Call debug screen 0. If **Flow Error** EVER = 1, even just once, there is a masked Flow Error. WITHOUT LOOKING AWAY, watch it for two (2) minutes. TWO (2) possible scenarios:

   **1) IF (and ONLY if) Flow Error ALWAYS = 0:** See part F.

   **2) IF (and ONLY if), Flow Error EVER = 1:** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

F) Call debug screen 6. If **BC Switch** (middle column) is EVER = 897 or more, even just once, indicates a masked Flow Error. Watch it for two (2) minutes or until if it EVER = 897 or more. TWO (2) possible scenarios:




   **1) IF (and ONLY if), BC Switch EVER = 897 or more:** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM

   **2) IF BC Switch NEVER, EVER = 897 or more:** Call the Home screen to see [**Temperature**]. TWO (2) possible scenarios below:

      **Scenario #1: IF (and ONLY if) remains less than 35.1° C:** Proceed to **page 245**, procedure number T- 1.0.142.

      **Scenario #2: IF EVER more than 35.1° C:** See procedure number T- 1.0.8 (page 240).

**T- 1.0.8 ISOLATE TEMPERATURE PROBLEM**

a) Watch [**Temperature**] for one (1) minute. **If UNSTABLE** i.e. changes more than 0.2° C watch for three (3) more minutes BEFORE continuing to part b. **If STABLE** i.e. does NOT change more than 0.2° C see part b.

b) FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

**1)** **IF (and ONLY if) unstable AND, at least once, becomes more than 38.9° C:** Proceed to **page 256**, procedure number T- 1.3.0.

Pale yellow/white or RED?

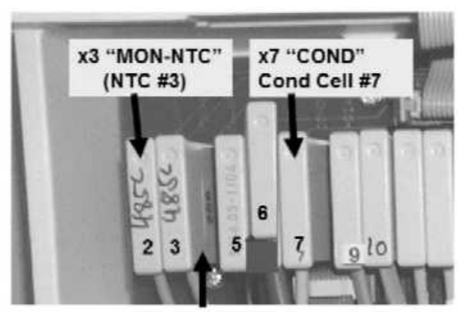
**2)** **IF (and ONLY if) STABLE between 35.1 and 38.9° C:** Figure right. is the [**Temperature**] window pale yellow / white OR red?

- **IF (and ONLY if) pale yellow / white!** Proceed to **page 243**, procedure number T- 1.0.130.
- **IF RED!** See procedure number T- 1.0.9 (page 240)

**3)** **IF (and ONLY if) unstable and falls to OR remains less than 35.1° C:** Proceed to **page 245**, procedure number T- 1.0.142.

**4)** **IF UNSTABLE BUT remains more than or goes to 35.1° C BUT IS NEVER more than 38.9° C:** Proceed to **page 247**, procedure number T- 1.0.155.

**T- 1.0.9 [TEMPERATURE] BETWEEN 35.1 AND 38.9 BUT ITS WINDOW IS STILL RED**

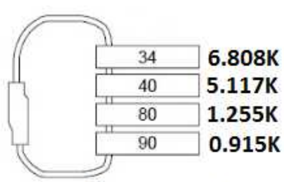


Position #4 "PH-PR" MUST always be VACANT

a) Figure right, at the distribution board, ENSURE position #4 ("PH-PR") is VACANT.

b) ENSURE Cond Cell #7 is plugged into position "X7, COND"!

c) Figure right, the **FOUR-RESISTOR SET** is required.



Four-Resistor Set

d) Enter Service Mode → Calibrate Sensors → Temp Sensor

e) Proceed to **STEP #1** (page 240).

## STEP #1

a) The screen should say **"Connect a 6.808 K ohm resistor…"**.

b) Per the Figure (above, right), avoiding VACANT position #4, place the 34° C (6.808 KΩ) plug, from the **FOUR-RESISTOR SET**, into the 2nd distribution board position from the left, "MON-NTC".

c) Is the screen's **[Pre-Temperature Reference]** between 64 and 76 (Yes or No)?

Yes Between 64 and 76! ‘Sharply’ press ‘Enter’ <u>ONCE</u>. If no Error banners* appear see **STEP #2** (page 241).

* If an “Operator Error” <u>OR</u> “Actuator Board Error” banner appears see procedure number T- 1.0.10 (page 241).

Example: Status bar showing "Operator Error"


No <u>NOT</u> between 64 and 76! ENSURE the 34° C plug is placed properly at the **2nd** position from the LEFT! If okay see procedure number T- 1.0.10 (page 241).

## STEP #2

The screen should say **“Connect a 5.117 K ohm resistor...”**. Place the 41° C (5.117 KΩ) plug into the **2nd** distribution board position from the left. Is **[Pre-Temperature Reference]** between 157 and 169?

Yes Between 157 and 169! ‘Sharply’ press ‘Enter’ ONCE and see **STEP #3** (page 241).

No <u>NOT</u> between 157 and 169! ENSURE the 41° C plug is placed properly at the **2nd** position from the LEFT! If okay see procedure number T- 1.0.10 (page 241).

## STEP #3

The screen should say **“Connect a 1.255 K ohm resistor...”**. Place the 80° C (1.255 KΩ) plug into the **2nd** distribution board position from the left. Is **[Pre-Temperature Reference]** between 191 and 203?

Yes Between 191 and 203! ‘Sharply’ press ‘Enter’ ONCE and see **STEP #4** (page 241).

No <u>NOT</u> between 191 and 203! ENSURE the 80° C plug is placed properly at the **2nd** position from the LEFT! If okay see procedure number T- 1.0.10 (page 241).

## STEP #4

The screen should say **“Connect a 0.915 K ohm resistor...”**. Place the 90° C (0.915 KΩ) plug into the **2nd** distribution board position from the left. Is **[Pre-Temperature Reference]** between 204 and 216?

Yes Between 204 and 216! **A)** Press ‘Enter’ twice to SAVE the calibration; **B)** Proceed **page 242**, procedure number T- 1.0.122.

No <u>NOT</u> between 204 and 216! ENSURE the 90° C plug is placed properly at the **2nd** position from the LEFT! If okay see procedure number T- 1.0.10 (page 241).

## T- 1.0.10 ERROR DURING TEMP SENSOR CALIBRATION

A) **Read before performing!** Turn the machine off! Using a different **<u>FOUR-RESISTOR SET</u>** return to (ABOVE) procedure number T- 1.0.9 (page 240) <u>HOWEVER,</u> if you return here see part B.

B) **Read before performing!** Referring to <u>COMPONENT LIST</u> (below), swap in each, one at a time, with <u>known good</u> and in between return to (ABOVE) procedure number T- 1.0.9 (page 240) to test each. If you return here swap in the next component in the list until the error no longer occurs.

**<u>COMPONENT LIST</u>: 1)** Actuator-Test Board*****; **2)** Sensor Board*****; **3)** Functional Board*****; 4**)** Motherboard*****

***** To <u>LOCATE</u> these boards refer to Figure 4A (page 10)

## T- 1.0.122 TEMP SENSOR CALIBRATION SUCESSFUL / VERIFY TEMPERATURE ALARM

a) Return NTC #3's connector to the **2nd** distribution board position from the left, "MON-NTC".

b) Turn the machine OFF.

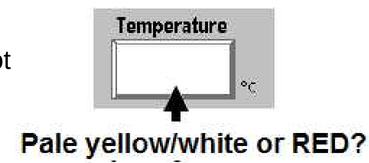
c) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) From the Home screen, press the [Dialysate Flow] window.

e) Set the [Dialysate Flow] to 500 ml/min and press 'Enter'.

f) Allow five (5) minutes BEFORE continuing to part g.

g) ENSURING [**Temperature**] is between 35.1 and 38.9° C, AND is not changing more than 0.2° C per minute, what color is the [**Temperature**] window now? TWO (2) possible scenarios:




**1) IF (and ONLY if) pale yellow / white:** See procedure number T- 1.0.130 (page 243).

**2) IF RED: Read this procedure before performing it.** Swap in the listed components (see **COMPONENT LIST** below), one at a time, with known good, and in between return to (ABOVE) procedure number T- 1.0.9 (page 240) to test each new component. If you return here swap in the next component until the [**Temperature**] window is pale yellow/white!

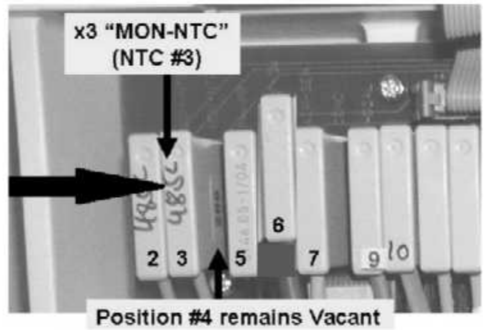
**COMPONENT LIST: 1)** Actuator-Test Board[a]; **2)** Functional Board[a,b].

[a] To LOCATE these boards refer to Figure 4A (page 10)

[b] With the Functional board, to prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19))

LEFT BLANK INTENTIONALLY

### T- 1.0.130 [TEMPERATURE] WINDOW IS PALE/YELLOW




a) Figure right, at the distribution board, unplug the **2nd** connector from the LEFT, "MON-NTC"! This is temp sensor NTC #3.

b) Based on the [**Temperature**] window, TWO (2) possible scenarios:

1) **IF (and ONLY if) LESS THAN 30.0° C:** See procedure number T- 1.0.131 (page 243).

2) **IF MORE THAN 30° C:** If **ABSOLUTELY SURE** the connector at the **2nd** position from the LEFT, "MON-NTC", is unplugged AND [**Temperature**] is STILL more than 30.0° C proceed to **page 262**, procedure number T- 1.4.0.

### T- 1.0.131 [TEMPERATURE] WINDOW LESS THAN 30.0° C

a) Return NTC #3's connector to the **2nd** distribution board position from the LEFT, "MON-NTC".

b) If NTC #3 was plugged in correctly **[Temperature]** RETURNS to between 35.1 and 38.9° C!

c) See procedure number T- 1.0.132 (page 243).

### T- 1.0.132 VERIFY CONDUCTIVITY

a) **ENSURE the shunt door is FULLY closed!**

b) Based on the [**Conductivity**] window, THREE (3) possible scenarios 1) or 2) or 3) below:

1) **IF (and ONLY if) STABLE* between 13.0 and 14.5 mS AND the window is pale yellow/white:** See procedure number T- 1.0.133 (page 244).

* STABLE = NOT changing more than 0.2 mS per minute

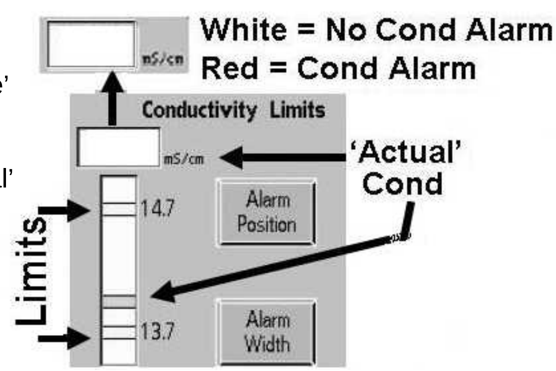
2) **IF (and ONLY if) less than 13.0 OR more than 14.5 mS:** Proceed to **page 335**, SECTION 5 – CONDUCTIVITY PROBLEMS.

3) **IF STABLE* between 13.0 and 14.5 mS AND the window IS RED:** See parts a THROUGH c below:

a) At the bottom of the screen, press the 'Dialysate' tab (Figure right).

b) If necessary, adjust the Alarm Limits until 'Actual' Conductivity is CENTERED between them.

c) Press 'Enter'! Is the [**Conductivity**] window white?



Yes [**Conductivity**] window is WHITE! See procedure number T- 1.0.133 (page 244).

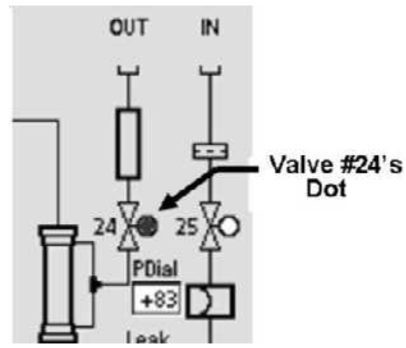
No [**Conductivity**] window is RED Allow up to three (3) minutes <u>OR</u> until if the [**Conductivity**] window turns WHITE. TWO (2) possible scenarios below:

1) **IF the window turns WHITE:** See procedure number T- 1.0.133 (page 244).

2) **IF after three (3) minutes the window remains RED:** Proceed to **page 320**, procedure number T- 7.0.0.

## T- 1.0.133 VERIFY 'OUT OF BYPASS'

Call debug screen 0. Figure right, is Valve #24's 'dot' blue <u>OR</u> white?




**1) IF (and ONLY if) BLUE:** See procedure number T- 1.0.134 (page 244).

**2) IF WHITE:** See parts a THROUGH c below:

a) Call debug screen 2. To ENSURE the shunt door is CLOSED, **CVRCLS** (2nd column from left) = 1!


b) From the Home screen, ENSURE the [**Conductivity**] <u>AND</u> [**Temperature**] windows are pale yellow/white!

c) Call debug screen 0. Watch Valve #24's 'dot' for up to (2) more minutes <u>OR</u> until if it turns blue. TWO (2) possible scenarios:

**1) IF (and <u>ONLY</u> if) the 'dot' turns blue**: See procedure number T- 1.0.134 (page 244).

**2) IF the 'dot' remains white <u>AND</u> the [Temperature] window is white:** Proceed to **page 320**, procedure number T- 7.0.0.

## T- 1.0.134 VALVE #24'S 'DOT' IS BLUE / VERIFY 'OUT OF BYPASS' CIRCUIT

Call the Home screen. ENSURING [Dialysate Flow] is set to 500 ml/min, is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

Yes 'Bob' moving! Proceed to **page 250**, procedure number T- 1.0.20.

No 'Bob' NOT moving! See parts a THROUGH c below:

a) ENSURE the shunt door is <u>CLOSED</u>!

b) ENSURE the [**Temperature**] <u>AND</u> [**Conductivity**] windows are <u>NOT RED</u>!

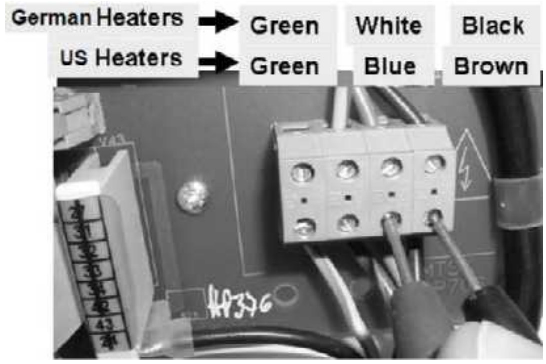
c) If 'bob' still is not moving <u>AND</u> Valve #24's 'dot' is blue there may be masked Flow Error.

## T- 1.0.142 [TEMPERATURE] LESS THAN 35.1° C / ISOLATE HEATER CONTROL

a) **Turn the Heater Switch OFF!**

b) **Set your CALIBRATED volt meter to AC volts (~ V, $V_{AC}$)!**

c) Allow **NINETY (90) SECONDS BEFORE** continuing to part d!




d) Figure right, TIGHTLY HOLD the meter leads BETWEEN the Heater Connector's BROWN and BLUE wires.

e) Watching the meter, **turn the Heater Switch on!**

f) If EVEN JUST ONCE more than 100.0 volts is seen the heater is on! TWO (2) possible scenarios:

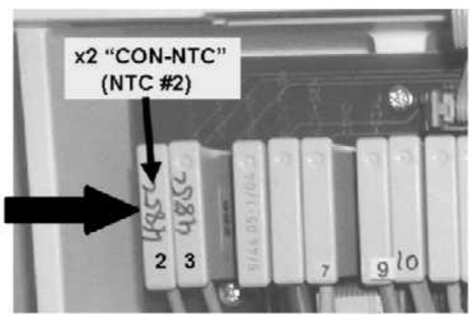
1) **IF (and ONLY if) ALWAYS LESS THAN 100.0 volts AC:** The heater is staying off! See procedure number T- 1.0.144 (page 245).


2) **IF EVER MORE THAN 100.0 volts AC:** Call debug screen 4 to see **TEMP CAL** (right column). More than one hundred and twenty (120)?

Yes **TEMP CAL** more than 120! See Proceed to **page 247**, procedure number T- 1.0.155.

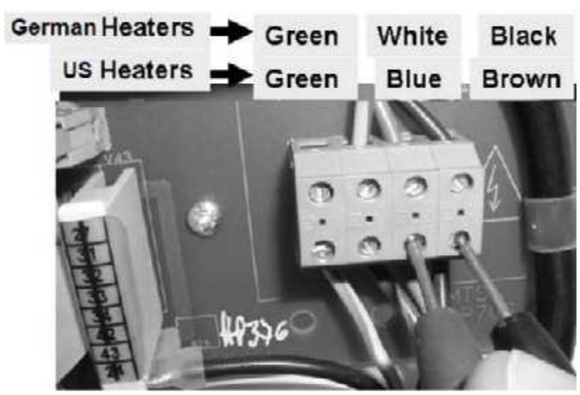
No **TEMP CAL** less than 120! Proceed to **page 320**, procedure number T- 7.0.0.

## T- 1.0.144 HEATER STAYING OFF




a) Figure right, inside the distribution board, UNPLUG the **1st** connector from the left. This is NTC #2 and unplugging it should turn the heater on full time!

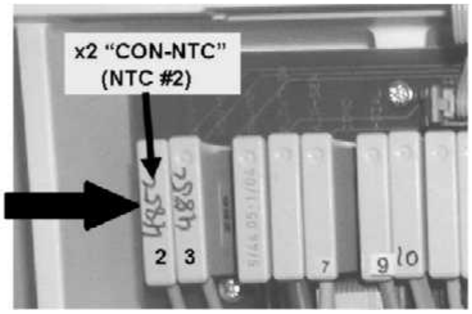
b) Measure again BETWEEN the Heater Connector's BROWN and BLUE wires! TWO (2) possible scenarios:




1) **IF (and ONLY if) more than 100.0 volts AC: Turn the Heater Switch OFF** then see procedure number T- 1.0.146 (page 246

2) **IF ALWAYS less than 100.0 volts AC:** Leaving NTC #2 unplugged till instructed, proceed to **page 281**, procedure number T- 2.0.0.

## T- 1.0.146 MORE THAN 100.0 VOLTS AC / ISOLATE NTC #2




a) Using a flashlight, check inside NTC #2’s distribution board position, **if corrosion or damage is located this may be the problem!**

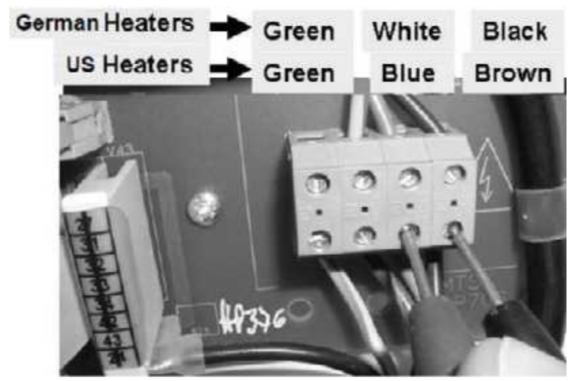
b) Return NTC #2’s connector to the **1st** distribution board position from the left, “CON-NTC”.

c) Call debug screen 4 to see **TEMP CAL** (right column). More than one hundred and twenty (120)?


Yes **TEMP CAL** more than 120! See procedure number T- 1.0.147 (page 246).

No **TEMP CAL** less than 120! Proceed to **page 320**, procedure number T- 7.0.0.

## T- 1.0.147 TEMP CAL MORE THAN 120




a) Call the Home screen. If not already, allow [**Temperature**] to fall to below 35.0º C.

b) Figure right, at the Heater Connector, HOLD the meter leads between the BROWN and BLUE wires.

c) While watching the meter for ten (10) seconds, **turn the Heater Switch on!** TWO (2) possible scenarios:

1) **IF (and ONLY if) always less than 10.0 volts AC ($V_{AC}$):** Replace NTC #2***** with a known good THEN proceed to **page 320**, procedure number T- 7.0.0.

   ***** To LOCATE NTC #2 refer to Figure 42, (page 236)

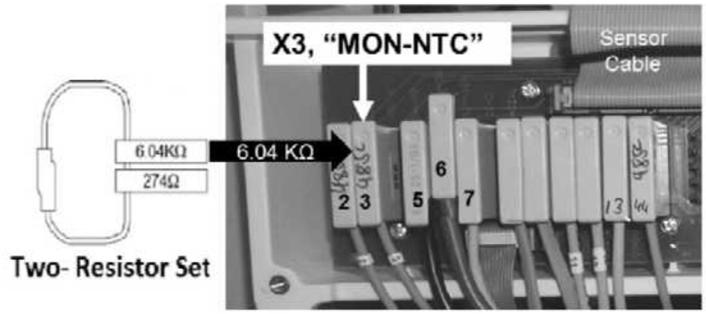
2) **IF EVER more than 100.0 volts AC ($V_{AC}$):** Allow five (5) minutes! TWO (2) possible scenarios:

**Scenario #1:** **IF (and ONLY if) [Temperature] increases to 35.1º C OR more:** Problem solved! NTC #2 may not have been connected properly.

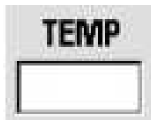
**Scenario #2:** **IF [Temperature] does DOES NOT increase to 35.1º C OR more:** See procedure number T- 1.0.155 (page 247).

## T- 1.0.155 ISOLATE TEMPERATURE MONITOR

a) Figure right, plug the **<u>6.04 KΩ</u>** resistor plug, from the **<u>TWO-RESISTOR SET</u>** into **2nd** distribution board position from the left, "MON-NTC"!




b) Call debug screen 4.




c) Watching **TEMP** (lower left) for one (1) minute, THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) between 4.0 and 6.0 <u>AND</u> STABLE i.e. does <u>NOT</u> change more than 0.2:** See procedure number T- 1.0.16 (page 247).

**2) IF (and ONLY if) less than 4.0 <u>OR</u> more than 6.0:** Perform parts a AND b below:

a) Remove the plug then <u>reinsert it</u> into the **2nd** position from the left, "MON-NTC". If **TEMP** is still less than 4.0 <u>OR</u> more than 6.0 see part b. If now between 4.0 and 6.0 <u>AND</u> STABLE (not changing more than 0.2 per minute) see procedure number T- 1.0.16 (page 247).

b) Use the **<u>6.04 KΩ</u>** plug from a different **<u>TWO-RESISTOR SET</u>**. If (and ONLY if) **TEMP** is still less than 4.0 <u>OR</u> more than 6.0 proceed to **page 313**, procedure number T- 5.0.0. If **TEMP** between 4.0 and 6.0 <u>AND</u> STABLE (not changing more than 0.2 per minute) see procedure number T- 1.0.16 (page 247).

**3) IF between 1.0 AND 8.0 <u>BUT</u> changes more than 0.2 per minute:** Perform parts A through C below:

A) Leaving the plug in place, turn the machine OFF.

B) FOUR (4) possible bad components, see <u>COMPONENT LIST</u> below. Swap in each, one at a time, and in between continue to part C) to test the new component! <u>COMPONENT LIST</u>: **1)** Sensor Board*; **2)** Functional Board*; **3)** Power Logic Board; **4)** Distribution board

* For each board, to prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to <u>OPERATING MODES</u>, page 19))

C) Return to Dialysis Program. Watch debug screen 4's **TEMP** for one (1) minute. If now between 4.0 and 6.0 and stable the last component swapped in is bad. If still not between 4.0 and 6.0 or unstable return to part A to try the next component in the list!

## T- 1.0.16 TEMP STABLE BETWEEN 4.0 AND 6.0 / VERIFY TEMPERATURE

Call the Home screen. Based on the [**Temperature**] window, TWO (2) possible scenarios:

**1) IF (and ONLY if) between 35.1 and 38.9 °C:** ENSURING the [**Temperature**] window is pale yellow/white, see procedure number T- 1.0.17 (page 248).

**2) IF less than 35.1 <u>OR</u> more than 38.9 °C:** Proceed to **page 320**, procedure number T- 7.0.0.

## T- 1.0.17 SIMULATE CONDUCTIVITY


a) Figure right, leaving the 6.04 KΩ resistor in, plug the **274 Ω** resistor plug, from the **TWO-RESISTOR SET** into the Cond Cell's distribution board position, "X7, COND".

b) Watch the [**Conductivity**] window for one (1) minute. THREE (3) possible scenarios 1) or 2) or 3) below:

1) **IF (and ONLY if) BETWEEN 12.9 and 14.5 mS AND is stable (i.e. does NOT change more than 0.2):** See procedure number T- 1.0.18 (page 248).

2) **IF (and ONLY if) BETWEEN 12.9 and 14.5 BUT changes MORE than 0.2:** THREE (3) possible bad components (see COMPONENT LIST below). Turn the machine off and swap in each, one at a time, in between returning to Dialysis Program, until [**Conductivity**] is STABLE between 12.9 and 14.5 mS.

   **COMPONENT LIST: 1)** Sensor Board [a]; **2)** Power Logic Board; **3)** Functional Board [a].

   [a] To prevent "Cond Offset Failure" place the machine in **T and C Mode** (refer to OPERATING MODES, page 19))

3) **IF less than 12.9 OR more than 14.5 mS:** See parts a AND b below:

   a) Remove the **274 Ω** plug then reinsert it OR consider using the **274 Ω** plug from a different TWO-RESISTOR SET.

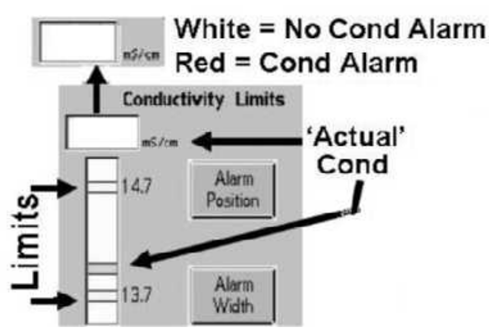
   b) If (and ONLY if) [**Conductivity]** is still is less than 12.9 OR more than 14.5 proceed to **page 320**, procedure number **T- 7.0.0.** If NOW STABLE between 12.9 and 14.5 see procedure number T- 1.0.18 (page 248).

## T- 1.0.18 CONDUCTIVITY IS BETWEEN 12.9 AND 14.5 / VERIFY CONDUCTIVITY

Based on the [**Conductivity**] window's color, TWO (2) possible scenarios:

1) **IF (and ONLY if) pale / yellow white:** See procedure number T- 1.0.19 (page 249).

2) **IF RED:** See parts a THROUGH d below:




   a) At the bottom of the screen, press the 'Dialysate' tab (Figure right).

   b) If necessary, adjust the Limits until the 'Actual' Conductivity CENTERED is between them.

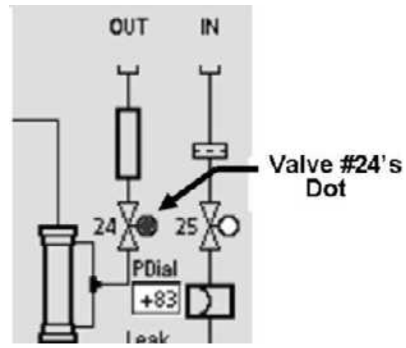
   c) Press 'Enter'!

   d) Allow three (3) minutes OR until if the **[Conductivity]** window turns white. TWO (2) possible scenarios next page:

1) **IF (and ONLY if) the [Conductivity] window turns white:** See procedure number T- 1.0.19 (page 249)

2) **IF AFTER three (3) minutes the [Conductivity] window remains RED:** Proceed to **page 320**, procedure number T- 7.0.0.

**T- 1.0.19 VERIFY 'OUT OF BYPASS'**




Call debug screen 0. Figure right, is Valve #24's 'dot' blue OR white?

1) **IF (and ONLY if) BLUE:** See procedure number T- 1.0.191 (page 249).

2) **IF WHITE:** See parts a THROUGH d below:

   a) Call debug screen 2.


   b) To ENSURE the shunt door is CLOSED, **CVRCLS** (2nd column from left) = 1!

   c) Call the Home screen to ENSURE the [**Temperature**] AND [**Conductivity**] windows are pale yellow/white.

   d) Return to debug screen 0. Allow up to three (3) minutes OR until if Valve #24's 'dot' turns blue. TWO (2) possible scenarios:

      **1)** **IF (and ONLY if) the 'dot' turns blue:** See procedure number T- 1.0.191 (page 249).

      **2)** **IF the 'dot' turns REMAINS white:** Proceed to **page 320**, procedure number T- 7.0.0.

**T- 1.0.191 VALVE #24'S 'DOT' BLUE / VERIFY 'OUT OF BYPASS' CIRCUIT**

a) Call the Home screen.

b) Set [Dialysate Flow] to 500 ml/min and press 'Enter'.

c) Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

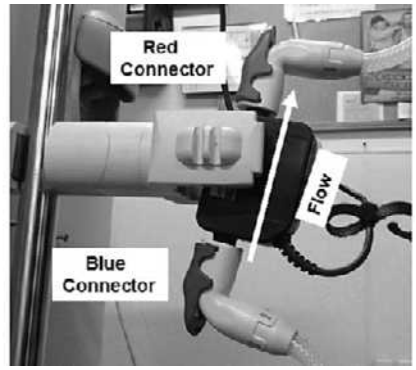
   Yes 'Bob' moving! See procedure number T- 1.0.20 (page 250).

   No 'Bob' IS NOT moving! See parts a AND b below:

      a) From the Home screen, ENSURE the [**Temperature]** AND [**Conductivity]** windows are pale yellow/white.

      b) Call debug screen 0. If Valve #24's 'dot' is still blue AND the 'bob' still is not moving there may be masked Dialysate Flow Error.

## T- 1.0.20 FLOW THROUGH THE EXTERNAL INDICATOR




a) Leaving Dialysate Flow on, install a Temperature meter (°C) into the dialyzer lines. **Figure right, Flow MUST be bottom to top!**

b) **CLOSE THE SHUNT DOOR!**

c) ENSURING the flow indicator's 'bob' is moving, see procedure number T- 1.0.21 (page 250).

## T- 1.0.21 ISOLATE 'ACTUAL' (MEASURED) TEMPERATURE

Is the meter's 'measured' temperature LESS THAN 35.1° C?

Yes Temperature is LESS THAN 35.1° C! See procedure number T- 1.0.22 (page 252).

No Temperature is MORE THAN 35.1° C! See parts a THROUGH e below:

a) Call debug screen 1.

b) **Do NOT reset alarms!**

c) Press and hold the keyboard's "1" key for five (5) seconds.

d) Allow FORTY-FIVE (45) seconds BEFORE continuing!

e) Watch the meter for one (1) minute. TWO (2) possible scenarios:

**1) IF between 35.1° C and 38.9° C AND STABLE i.e. does NOT change more than 0.2° C per minute:** Proceed to **page 253**, procedure number T- 1.0.255.

**2) IF UNSTABLE i.e. changes more than 0.2 °C per minute:** Allow ninety (90) more seconds THEN, ENSURING the 'bob' is moving up and down*****, watch the meter for one (1) more minute. Does it STOP changing more than +/- 0.2 °C (Yes or No)?

***** **Note!** If the 'bob' has stopped moving call debug screen 0. If **Flow Error** remains = 0 return to (ABOVE) procedure number T- 1.0.155 (page 247).

**Yes** Measured temperature STABLIZES. If (and ONLY if) between 35.1 and 38.9º C proceed to **page 253**, procedure number T- 1.0.255. If not between 35.1 and 38.9°C return to (ABOVE) procedure number T- 1.0.21 (page 250).

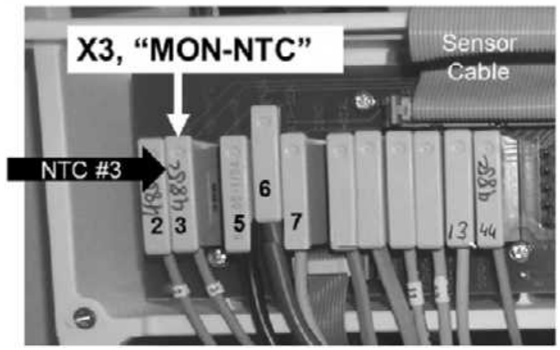
**No** Measured temperature continues to be unstable. Watch the meter for five (5) more minutes. THREE (3) possible scenarios 1) or 2) or 3) next page:

1) **IF (and ONLY if) falls to less than 35.1 °C:** See procedure number T- 1.0.22 (page 252).

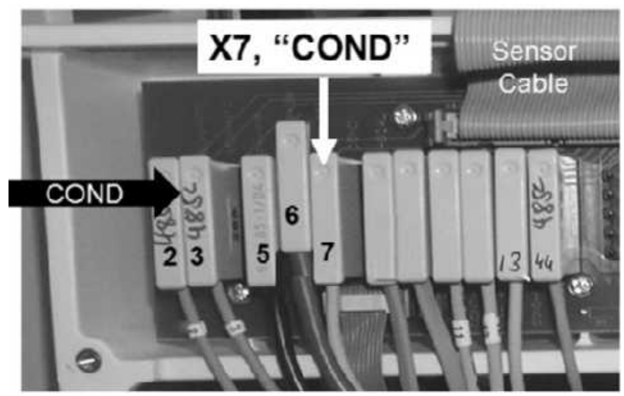
2) **IF remains more than 35.1° <u>BUT NEVER</u> more than 38.8° C:** Proceed to **page 316**, procedure number T- 6.0.0.

3) **IF EVER more than 38.8° C even if only once:** Perform parts a THROUGH d below:

a) If a 6.04 KΩ plug was previously placed in distribution board position, "MON-NTC" remove it then, avoiding the VACANT position on the right ("PH'PR") return NTC #3's connector to the **2nd** position from the left ("MON-NTC").



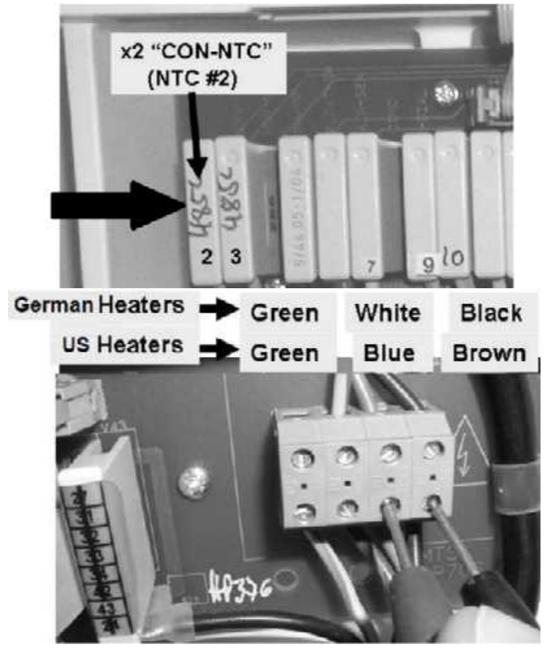

b) If a 274 Ω plug was previously placed in distribution board position, "X7, COND", remove it and return the Cond Cell's connector.




c) Using a calibrated temperature meter ENSURE the incoming water (from the RO) is less than 35.0º C.

d) If (and ONLY if) incoming water is less than 35.0° C proceed to **page 259**, procedure number T- 1.3.40.

**T- 1.0.22 TEMPERATURE LESS THAN 35.1° C**




a) **Set your volt meter to AC volts (~ V, $V_{AC}$)!**

b) Figure right, unplug the connector from the **1st** distribution board position from the left, "CON-NTC". This is NTC #2.

c) Figure right, measure at the distribution board's Heater Connector, BETWEEN the **BROWN** and **BLUE** wires.

d) TWO (2) possible scenarios:

**1) IF (and ONLY if) less than 100.0 volts AC:** Leaving NTC #2 unplugged till instructed, proceed to **page 281**, procedure number T- 2.0.0.

**2) IF MORE THAN 100.0 volts AC:** Leaving NTC #2 unplugged, see parts a AND b below:

a) ENSURE the external flow indicator's 'bob' is moving up and down.

b) WITHOUT LOOKING AWAY, watch the meter for UP TO SEVEN (7) minutes **OR** until if it EVER reaches more than 35.5° C even if only once?

Yes 35.5° C OR more! See procedure number T- 1.0.23 (page 252).

No Less than 35.5° C! Either incoming water is EXTREMELY cold OR you made an error and heater voltage is NOT more than 100 volts AC OR the heater is intermittent bad.

**T- 1.0.23 MEASURED TEMPERATURE, WITH NTC #2 UNPLUGGED, EXCEEDS 35.5° C**

a) **Return NTC #2's connector to 1st distribution board position from the left, "CON-NTC".**

b) If a 6.04 KΩ plug was previously placed at NTC #3's distribution board position ("MON-NTC") remove it and return NTC #3's connector to the **2nd** position from the left!


c) Call debug screen 4 to see **TEMP** (lower left). TWO (2) possible scenarios:

**1) IF (and ONLY if) 4.0 or more:** NTC #3 is okay. See procedure number T- 1.0.24 (page 252).

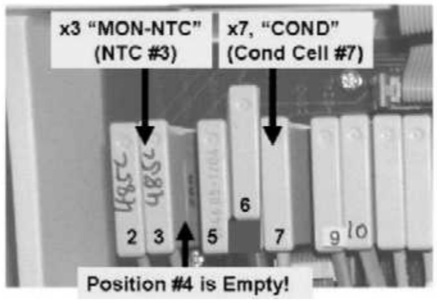
**2) IF LESS THAN 4.0:** NTC #3 is plugged in incorrectly OR is bad. To LOCATE NTC #3 refer to Figure 42 (page 236).

**T- 1.0.24 TEMP IS 4.0 OR MORE**

a) If a 274 Ω plug was previously placed at the Cond Cell's distribution board position, "X7, COND", remove it and return the Cond Cell's connector.

b) Proceed to **page 278**, procedure number T- 1.8.0.

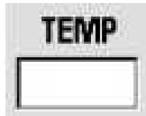
## T- 1.0.255 'MEASURED' TEMPERATURE REMAINS BETWEEN 35.1 AND 38.9° C




a) Figure right, if a 274 Ω plug was previously placed at the Cond Cell's distribution board position, "X7, COND", remove it and RETURN the Cond Cell's connector.

b) If a 6.04 KΩ plug was previously placed at NTC #3's position, "MON-NTC", remove it then, avoiding the VACANT position on the right ("PH-PR"), RETURN NTC #3's connector to the **2nd** position from the left,

c) Call debug screen 4. Is **TEMP** (lower left) 4.0 or more?




Yes **TEMP** is 4.0 OR more! See procedure number T- 1.0.26 (page 253).

No **TEMP** is less than 4.0. NTC #3* is plugged in incorrectly OR is bad. *To LOCATE NTC #3 refer to Figure 42 (page 236).

## T- 1.0.26 TEMP IS 4.0 OR MORE / VERIFY TEMPERATURE DISPLAY

From the Home screen, the [**Temperature**] window is, TWO (2) possible scenarios:

**1)** **IF (and ONLY if) less than 35.1 OR more than 38.9° C:** Proceed to **page 320**, procedure number T- 7.0.0.

**2)** **IF between 35.1 and 38.9° C:** Is the external indicator's 'bob' moving?

Yes 'Bob' moving! See procedure number T- 1.0.27 (page 253)T1026.

No 'Bob' IS NOT moving! Return to (ABOVE) procedure number T- 1.0.132 (**page 243**).

## T- 1.0.27 'BOB' IS MOVING UP AND DOWN

Is the machine's [**Temperature]** window within +/- 0.3 of the meter's reading?

Yes Within +/- 0.3° C of each other! See procedure number T- 1.0.28 (page 254).

No NOT within +/- 0.3° C of each other! Proceed to **page 320**, procedure number T- 7.0.0.

**T- 1.0.28 METER VERSUS THE MACHINE'S [TEMPERATURE] DISPLAY IN RANGE**

Proceed according to why you ORIGINALLY started troubleshooting. THREE (3) possible scenarios 1) or 2) or 3) below:

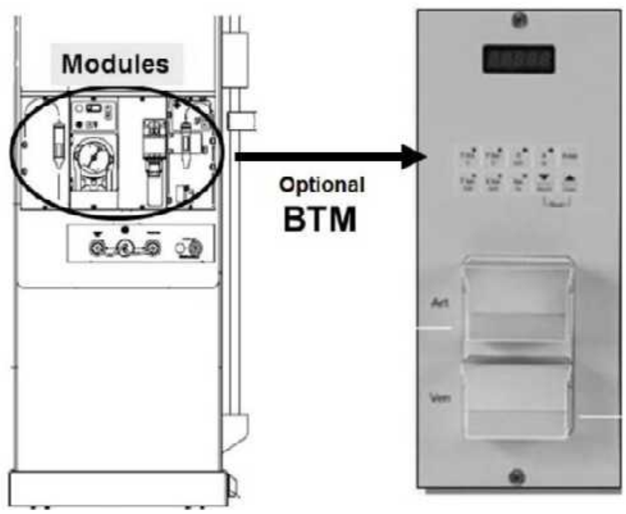
1) **IF the problem was in a Heat Disinfect AND a "TEMP OVER 95 DEGREES" occurred:** Proceed to **page 264**, procedure number T- 1.5.0.

2) **IF the problem was in a Heat Disinfect AND [Temperature] did NOT reach 80° C:** Proceed to **page 300**, procedure number T- 3.0.0

3) **IF the problem was in Dialysis Program:** Per the Figure below, TWO (2) possible scenarios:

**Scenario #1:** **IF NOT equipped with the Blood Temperature Module (BTM):** A temperature problem is not occurring at this time.

**Scenario #2:** **IF equipped with the Blood Temperature Module (BTM):** Allow the machine to run for several hours to see if a temperature problem reoccurs. TWO (2) possible scenarios:




1) **IF the temperature problem reoccurs** The BTM is okay! See (ABOVE) procedure number T- 1.0.7 (**page 239**).

2) **IF a temperature problem DOES NOT reoccur:** See parts a THROUGH i below:

   a) Place the machine into Service Mode → Options → Hardware Options.

   b) Next to '**BTM**', place the 'X' into the "Yes" box then press 'Enter'. The "X" turns blue!

   c) **To prevent damage, turn the machine OFF!**

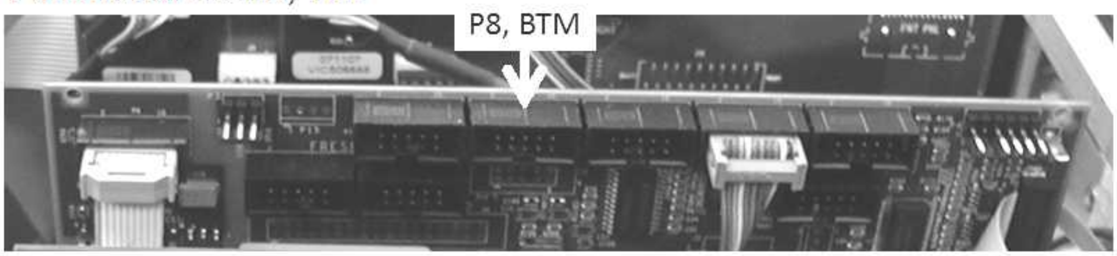
   d) Open the card cage.

   e) For part f, the Functional board is the 3rd board from the right!

   **Parts f through i next page**

f) Figure below, plug in the 10 pin ribbon cable to Functional Board's P8 connector.

Functional Board, TOP




g) **Close the card cage!**

h) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

i) Allow the machine to run for several hours to see if a temperature problem reoccurs:

  1) **IF a temperature problem DOES NOT reoccur:** A temperature problem is not occurring at this time. DO NOT continue!

  2) **IF a temperature problem reoccurs:** The BTM MAY be bad. Check its dip switch settings per its Operator's Manual.

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## T- 1.3.0 TEMPERATURE EXCEEDS 38.9°C

This procedure isolates between uncontrollable temperature, unstable monitoring or high incoming RO water temperature.

a) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

b) Allow [**Temperature**] to increase to more than 38.9° C!

c) **TURN THE HEATER SWITCH OFF TILL INSTRUCTED!**

d) Watch [**Temperature**] for up to **FIVE (5)** minutes until it either, **1)** Starts falling OR **2)** NEVER starts falling:

   **1) IF (and ONLY if) it starts falling:** Allow it to fall **0.3° C** BEFORE continuing to part e.

   **2) [Temperature] NEVER stops falling:** See procedure number T- 1.3.11 (page 256).

e) NOTE [**Temperature**] THEN, WITHOUT LOOKING AWAY, watch it for up to **FIVE (5)** minutes for one (1) of the following THREE (3) possible scenarios:

**Scenario #1:** **IF it STEADILY falls, until less than 35.5° C i.e. NEVER, EVER increases:** Proceed to **page 259**, procedure number T- 1.3.40.

**Scenario #2:** **IF it EVER INCREASES 0.2° C or more above what was noted in part e:** See procedure number T- 1.3.11 (page 256).

**Scenario #3:** **IF AFTER five (5) minutes, REMAINS more than 35.5° C:** See procedure number T- 1.3.11 (page 256).

## T- 1.3.11 ISOLATE INCOMING WATER TEMPERATURE

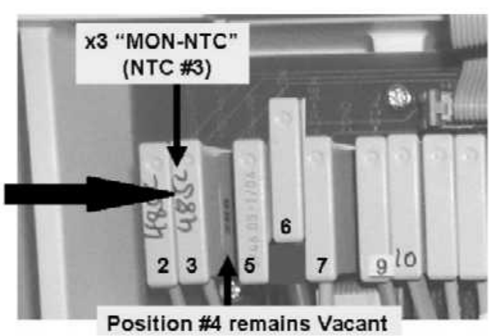
a) Using a calibrated temperature meter check the incoming water (RO) source.

b) Measured RO temperature less than 34.0º C?

   Yes Less than 34.0º C! See procedure number T- 1.3.12 (page 256).

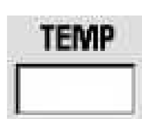
   No More than 34.0º C! The temperature of the tap water feeding the RO is too high!

## T- 1.3.12 RO TEMP LESS THAN 34.0º C




a) Figure right, unplug the connector from the **2nd** distribution board position from the left, "MON-NTC". This is temperature monitor NTC #3.

b) Call debug screen 4. Is **TEMP** (lower left) LESS THAN 0.3?



Yes **TEMP** LESS THAN 0.3! See procedure number T- 1.3.13 (page 257).

No **TEMP** is NOT less than 0.3! See parts a AND b below:

a) ENSURE NTC 3's connector is unplugged from the **2nd** distribution board position from the left, "MON-NTC". If NOT, return to (ABOVE) procedure number T- 1.3.12 (page 256).

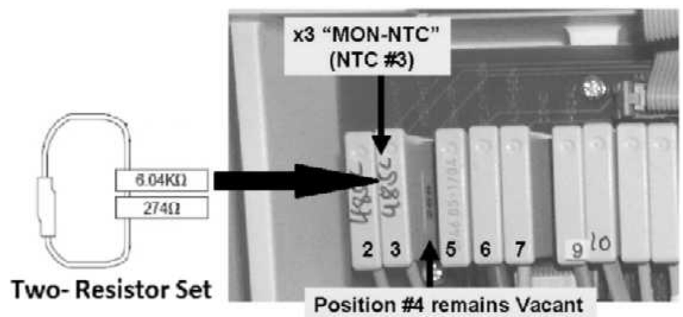
b) Leaving NTC #3 unplugged, with the machine off, one at a time, swap in the listed components (see COMPONENT LIST below) with known good, then in between returning to Dialysis Program, to test each new component until screen 4's **TEMP** is less than 0.3 indicating the last component swapped in is the problem.

**COMPONENT LIST**: **1)** Actuator-Test Board[1]; **2)** Power Logic Board[1]; **3)** Functional Board[1,2] (possibly IC20); **4)** Sensor Board[2]; **5)** Distribution board; **6)** Motherboard[1].

[1] To LOCATE these boards refer to Figure 4A (page 10)

[2] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES, (page 19))

## T- 1.3.13 TEMP LESS THAN 0.3




a) Figure right, place the **6.04 KΩ** resistor plug, from the **TWO-RESISTOR SET**, into the **2nd** distribution board position from the left, "MON-NTC".

b) From debug screen 4, is **TEMP** 6.0 or lower?

Yes **TEMP** 6.0 or lower! See procedure number T- 1.3.14 (page 258).

No **TEMP** more than 6.0! See parts a AND b below:

a) ENSURE the **6.04 KΩ** plug from the **TWO-RESISTOR SET** is placed properly at the **2nd** position from the left, "MON-NTC". If **TEMP** is still more than 6.0 see part b.

b) Leaving the plug in place, with the machine off, swap in the listed components (see COMPONENT LIST below), one at a time, with known good, in between returning to Dialysis Program each UNTIL screen 4's T**EMP** is 6.0 or lower indicating the last component swapped in is the problem.

**COMPONENT LIST: 1)** Actuator-Test Board[1]; **2)** Sensor Board cable; **3)** Sensor Board[1, 2]; **4)** Functional Board (possibly IC20)[1,2]; **5)** Distribution board; **6)** Motherboard[1].

[1] To LOCATE these boards refer to Figure 4A (page 10).

[2] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES, page 19).

**T- 1.3.14 TEMP 6.0 OR LOWER / ISOLATE NTC# 3 CIRCUIT**

Call debug screen 5. WITHOUT LOOKING AWAY, watch **TPRE** (top, middle column) for one (1) minute noting the highest and lowest values seen. TWO (2) possible scenarios 1) or 2) below:

**1)** **IF (and ONLY if) TPRE changes more than twenty (20)! TPRE is unstable:** Leaving the 6.04 KΩ plug installed, one at a time, swap in the listed components (see COMPONENT LIST below), with known good, then return to Dialysis Program and repeat procedure number T- 1.3.14 (page 258) to test each new component until **TPRE** DOES NOT change more than +/- 20 indicating the last component swapped in is the problem.

**COMPONENT LIST**: **1)** Power Logic Board[a]; **2)** Sensor Board[a,b]; **3)** Deaeration motor; **4)** Flow motor.

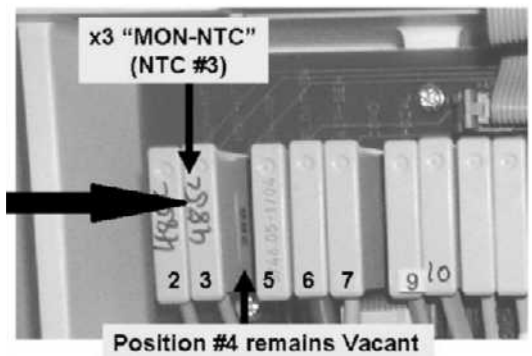
[a] To LOCATE these boards refer to Figure 4A (page 10). [b] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

**2)** **IF TPRE does NOT change more than 20 (twenty)! TPRE is stable!** Perform parts a through g below:

a) **Turn the HEATER Switch ON!**

b) To avoid error, read parts c THROUGH g BEFORE performing them.

c) Turn the machine off and replace NTC #3* with a known good. *To LOCATE NTC #3 refer to Figure 42 (page 236).




d) Figure right, ENSURE the new NTC #3 is plugged into the **2nd** distribution board position from the left, "MON-NTC"!

e) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

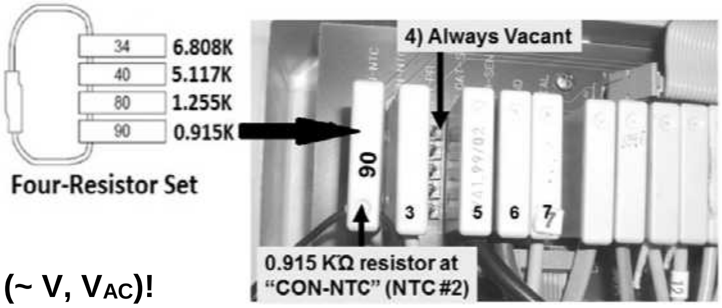
f) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter'.

g) WITHOUT LOOKING AWAY, watch the [**Temperature]** window for up to ten (10) minutes to see if it EVER exceeds 39.0° C even if only once?

Yes Exceeds 39.0° C! See procedure number T- 1.3.40 (page 259). The old NTC #3 is probably okay!

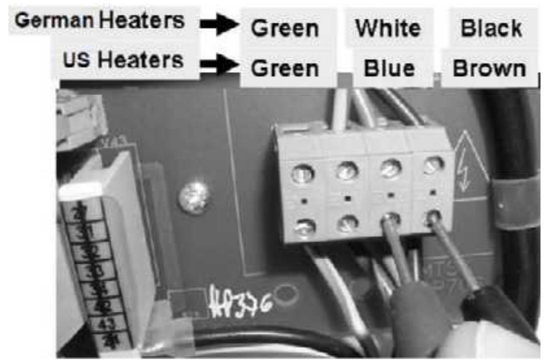
No NEVER exceeds 39.0° C! The original problem (High Temperature) is no longer occurring HOWEVER, see (ABOVE) procedure number T- 1.0.8 (page 240).

## T- 1.3.40 ISOLATE TEMPERATURE CONTROL




a) Figure right, place the **<u>90° C</u>** (0.915 KΩ) plug, from the **<u>FOUR-RESISTOR SET</u>** into the **1st** distribution board position from the left, "CON-NTC".

b) **Set your volt meter to <u>AC voltage</u> (~ V, $V_{AC}$)!**




c) **Turn the HEATER Switch ON!**

d) Figure right, measure at the distribution board's Heater Connector, <u>BETWEEN</u> the **<u>BLUE</u>** and **<u>BROWN</u>** wires. TWO (2) possible scenarios:

1) **IF (and ONLY if) 100.0 volts AC or more:** Leaving the 90° C plug installed, proceed to **page 306**, procedure number T- 4.0.0.

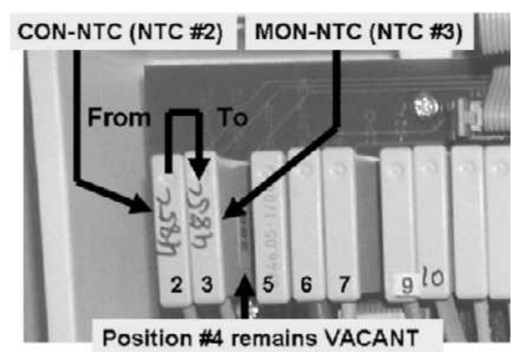
2) **IF <u>LESS THAN</u> 10.0 volts AC:** ENSURING the HEATER Switch was on <u>AND</u> the meter was set to **<u>AC voltage</u>** prior to measuring, see procedure number T- 1.3.60 (page 259).

## T- 1.3.60 ISOLATE NTC #2

a) Call the Home screen to see the machine's [**Temperature**] display.

b) Remove the 90° C plug from distribution board position, "CON-NTC".

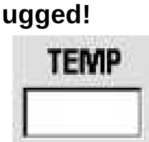
c) LEAVING "CON-NTC" VACANT, allow [**Temperature**] to <u>increase</u> to more than 38.0° C <u>BEFORE</u> continuing to part d!




d) **Set [Dialysate Flow] to "OFF" and press 'Enter'!**

e) Figure right, avoiding VACANT position #4, plug NTC #2's connector, into NTC #3's position, **2nd** position from left, "MON-NTC". **Leave NTC #3 unplugged!**

f) Call debug screen 4 to see **TEMP** (lower left). TWO (2) possible scenarios:



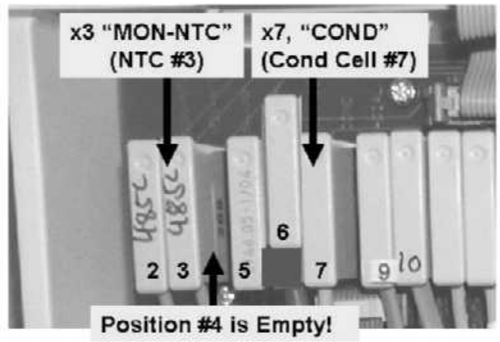

**1) IF (and ONLY if) TEMP is more than 3.0:** See procedure number T- 1.3.70 (page 260).

**2) IF TEMP is less than 3.0:** See parts A and B below:

A) Replace NTC#2* it with a <u>known good.</u> *To <u>LOCATE</u> NTC #2 refer to Figure 42 (page 236).

B) See procedure number T- 1.3.70 (page 260).

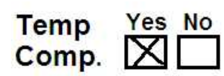
## T- 1.3.70 RETURN SYSTEMS / TEMP COMP?

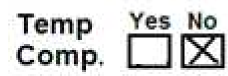



a) **IMPORTANT!** Plug NTC #2's connector into the **1st** distribution board position from the left, "CON-NTC"!

b) **IMPORTANT!** Avoiding VACANT position #4, RETURN <u>NTC #3's</u> connector to the **2nd** distribution board position from the left, "MON-NTC".

c) Enter Service Mode → Options → Hardware Options. Does the "Yes" box at **'Temp Comp'** have a blue 'X' in it? (Yes or No)




Yes Place the 'X' in the "No" box and press 'Enter'. The 'X' turns blue! Post a note that '**Temp Comp**' is off then see procedure number T- 1.3.80 (page 260).

No Temp Comp = No! See procedure number T- 1.3.80 (page 260).

## T- 1.3.80 ISOLATE TEMPERATURE INTERNAL LIMITS

a) Select Calibrate Sensors → Temp Control.

b) Connect a temperature meter to the dialyzer connectors.

c) Sharply press 'Enter' TWICE to turn the **[TEMP DAC]** data box pale yellow / white.

d) Press **[TEMP DAC]**, it turns bright yellow.

e) Set **[TEMP DAC]** to "130" and press 'Enter'. ENSURE the **[TEMP DAC]** is pale yellow / white. If gray exit the calibration then return to part a!

f) **IMPORTANT!** Allow five (5) minutes BEFORE continuing to part g!

g) Press 'Enter' twice to activate the **[Monitor Reference]** data box. It turns bright yellow.

h) <u>IGNORING</u> the external meter adjust the **[Monitor Reference]** data box to 34.0° C!

i) Press and release 'Enter' twice to save the calibration.

j) See procedure number T- 1.3.90 (page 261).

## T- 1.3.90 ISOLATE NTC #2 / TEMP CONTROL

a) Return to Calibrate Sensors → Temp Control

b) Press 'Enter' to turn the **[TEMP DAC]** data box pale yellow / white.

c) ENSURING the shunt door is CLOSED the external flow indicator's 'bob' MUST be moving up and down!

d) WITHOUT LOOKING AWAY, watch the external meter for seven (7) minutes OR until if it EVER exceeds 39°.0 C even if only once. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) the meter NEVER exceeds 39.0° C!** Press and release 'Enter' twice to save the calibration THEN proceed to **page 320**, procedure number T- 7.0.0.

**2)** **IF the meter EVER exceeds 39.0° C!** TWO (2) possible scenarios i or ii below:

**i.** **IF NTC #2 WAS NOT replaced in THIS troubleshooting session:** See parts a AND b below:

a) Turn the machne off and replace **NTC #2*** with a known good. *To LOCATE NTC #2 refer to Figure 42 (page 236).

b) Repeat procedure number T- 1.3.90 (page 261)

**ii.** **IF NTC #2 WAS replaced in THIS session:** TWO (2) possible bad components (see COMPONENT LIST below). One at a time, replace each, with known good, and in between repeat procedure number T- 1.3.90 (page 261) until the meter DOES NOT exceed 39.0° C.

**COMPONENT LIST: 1)** Sensor Board[1,2]; **2)** Functional Board[1,2]

[1] To LOCATE these boards refer to Figure 4A (page 10)

[2] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

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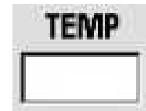
## T- 1.4.0 [TEMPERATURE] NOT LESS THAN 30º C / ISOLATE DEBUG TEMP

With NTC #3 REMAINING unplugged, call debug screen 4. Is **TEMP** (lower left) less than 0.3?




Yes **TEMP** less than 0.3! See procedure number T- 1.4.1 (page 262).

No **TEMP** more than 0.3! Read before performing: **A)** Turn the machine off; **B)** Swap in the listed components (see COMPONENT LIST below) one at a time, with known good, then in between; **C)** Return to Dialysis Program and repeat procedure number T- 1.4.0 (page 262) until screen 4's **TEMP** is less than 0.3 indicating the last component swapped in is the problem.

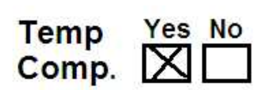
**COMPONENT LIST: 1)** Actuator-Test Board[1]; **2)** Sensor Board[1, 2]; **3)** Sensor Board cable; **4)** Functional Board (possibly IC20)[1,2]; **6)** Distribution board; **7)** Motherboard[1].

[1] To LOCATE these boards refer to Figure 4A (page 10)

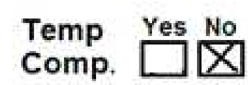
[2] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

## T- 1.4.1 CHECK 'TEMP COMP' OPTION

Enter Service Mode → Options → Hardware Options. Does the "Yes" box next to **'Temp Comp'** have an 'X' in it (Yes or No)?




Yes Place the 'X' in the "No" box and press 'Enter'. The 'X' turns blue. Post a note that '**Temp Comp**' is off then see procedure number T- 1.4.2 (page 262).




No Temp Comp = No! See procedure number T- 1.4.2 (page 262).

## T- 1.4.2 TEMP COMP = NO / ATTEMPT TO SET TEMP LOW RANGE / TEMP CONTROL

**NOTE!** **This procedure is NOT a calibration! There is NO NEED to install a meter yet! DO NOT touch the screen's [Temp DAC] data box!**

a) With NTC #3 remaining unplugged, select Calibrate Sensors → Temp Control.

b) Press and release 'Enter' until the screen's **[Monitor Reference]** box turns pale yellow / white.

c) Press **[Monitor Reference]**, it turns bright yellow.

d) Adjust **[Monitor Reference]** to as low as it will go then increase it 0.2° C ABOVE that.

e) Press and release the 'Enter' key until the calibration is saved.

f) Turn the machine OFF!

g) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

h) With NTC #3 remaining unplugged, call the Home screen. Is [**Temperature**] less than 30.0° C now?

Yes Less than 30.0° C! See procedure number T- 1.4.3 (page 263).

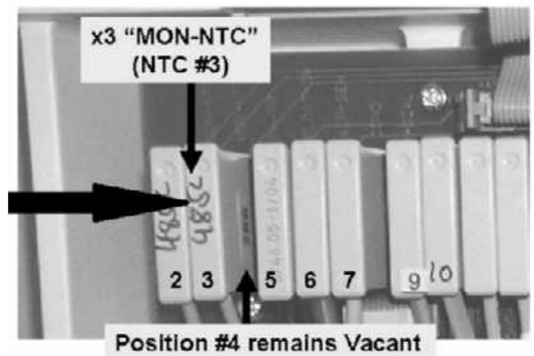
No More than 30.0° C! **Read before performing!** With the machine off, one at a time, swap in the listed components (COMPONENT LIST below) with known good THEN in between repeat (ABOVE) procedure number T- 1.4.2 (page 262) until [**Temperature]** remains less than 30.0° C indicating the last component swapped in is the problem.

**COMPONENT LIST: 1)** Actuator-Test Board[1]; **2)** Sensor Board[1,2]; **3)** Sensor Board cable; **4)** Functional Board (possibly IC20)[1,2]; **5)** Distribution board; **6)** Motherboard.

[1] To LOCATE these boards refer to Figure 4A (page 10)

[2] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

## T- 1.4.3 TEMPERATURE LESS THAN 30.0° C / CALIBRATE TEMP CONTROL / CONFIRM SOLUTION




a) Return NTC #3's connector to the **2nd** distribution board position from the left, "MON-NTC".

b) Perform BOTH procedures below:

**Procedure #1:** This time installing a temperature meter, calibrate Temp Control per the Calibration Procedures booklet!

**Procedure #2:** When the calibration is complete, continue to part c.

c) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) Again unplug NTC #3 from the **2nd** distribution board position from the left, "X3, MON-NTC".

e) Call the Home screen. Based on [**Temperature**], TWO (2) possible scenarios:

**1)** **IF less than 30.0° C: A)** Leaving NTC #3 unplugged, allow six (6) minutes; **B)** Set [Dialysate Flow] to 500 ml/min; C) If [**Temperature**] remains less than 30.0° C return NTC #3's connector to 2nd distribution board position from the left, "X3, MON-NTC" THEN refer to Appendix B (page 758) to perform other necessary calibrations.

**2)** **IF more than 30.0° C:** Read before performing! One at a time, swap the listed components (see COMPONENT LIST below), with known good, and in between repeat procedure number T- 1.4.3 (page 263) until the [**Temperature]** window is less than 30.0° C indicating the last component swapped in was the problem.

**COMPONENT LIST: 1)** Actuator-Test Board[a]; **2)** Sensor Board cable; **3)** Sensor Board[a,b]; **4)** Functional Board (possibly IC20)[a,b]; **5)** Distribution board; **6)** Motherboard.

[a] To LOCATE these boards refer to Figure 4A (page 10).

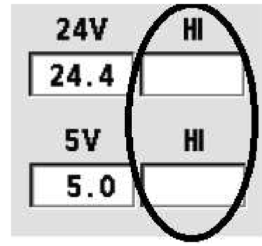
[b] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19)).

## T- 1.5.0 “TEMP OVER 95 DEGREES” ALARM OCCURRED

A) Install the hydraulics into the cabinet but **DO NOT** screw the rear panels in yet!

B) Place the machine into HEAT DISINFECT.

C) Call debug screen 10. If debug doesn’t appear press ‘Esc’ then call screen 10.



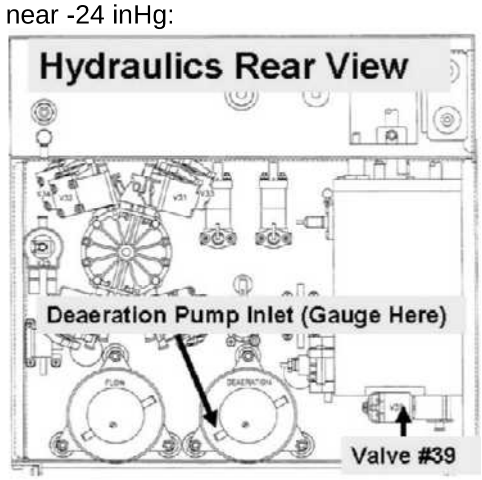

D) Figure right, **5V HI** should NEVER = 5.3 or more; **24V HI** should NEVER = 28.0 or more. If either goes high it may cause “TEMP OVER 95 DEGREES”.

E) Allow thirty (30) minutes OR until if “TEMP OVER 95 DEGREES” reoccurs. THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) “TEMP OVER 95 DEGREES” DOES NOT reoccur:** The problem is not occurring at this time. DO NOT continue!

**2)** **IF (and ONLY if) IF “TEMP OVER 95 DEGREES” reoccurs AND 5V HI = 5.3 OR more and / or 24V HI = 28.0 OR more:** Proceed to **page 271**, procedure number T- 1.5.51.

**3)** **IF “TEMP OVER 95 DEGREES” reoccurs BUT 5V HI OR 24V HI DID NOT go high:** This procedure, parts a THROUGH e below, checks Valve #39. If it opens, as it should, deaeration pressure will be between 0 and -10 inHg i.e. nowhere near -24 inHg:




a) Turn the machine OFF!

b) The deaeration gauge is used next. ENSURE it reads 0 inHg before installing it!

c) Figure right, tee the gauge into the Inlet (clear) tubing of the Deaeratieon Pump.

d) **Place the machine into RINSE (NOT Heat Disinfect)!**

e) Based on the gauge reading, TWO (2) possible scenarios below:

**1)** **IF (and ONLY if) between 0 and -10 inHg:** Allow the screen’s **[Remaining Time]** window to reach 0:00 BEFORE continuing to procedure number T- 1.5.1 (page 265).

**2)** **IF between -11 and -30 inHg:** Read before performing! ENSURING the machine was in RINSE prior to checking pressure, Valve #39 is not opening! **A)** Turn the machine off;
**B)** One at a time, swap in the listed components (see COMPONENT LIST below) with known good then in between; **C)** Return to RINSE; **D)** If the gauge is now between 0 and -10 inHg the last component swapped in is the problem.

**COMPONENT LIST: 1)** Actuator-Test Board **2)** Valve #39*; **3)** ACTUATOR cable; **4)** Distribution board.

* To LOCATE Valve #39 refer to the Figure previous page

## T- 1.5.1 [REMAINING TIME] = 0:00

a) Place the machine in HEAT DISINFECT.

b) Is the screen's TOP **[Remaining Prerinse Time]** window = 0:00?


Yes **[Remaining Prerinse Time]** = 0:00! See procedure number T- 1.5.2 (page 265).

No a) Escape HEAT DISINFECT and place the machine in RINSE!

b) Allow **[Remaining Time]** = 0:00 BEFORE continuing to part c!

c) Return to HEAT DISINFECT!

d) See procedure number T- 1.5.2 (page 265).

## T- 1.5.2 [Remaining Prerinse Time] = 0:00

a) Being aware that flow does not stop, remove the dialyzer connectors from the shunt and connect them to a calibrated Temperature (°C) meter* but **DO NOT shut the door!**

* **WARNING!** A **NEO-1** meter CANNOT be used! The NEO-2 and other meters, capable of measuring more than 90° C, can be used! Refer to the meter's Operator's manual

b) A "Flow Recirc Error" may occur but MUST go away within forty five (45) seconds!

c) The "Cover is Open" banner appears but the flow indicator's 'bob' MUST be moving up and down!

d) Allow thirty (30) minutes OR until if "TEMP OVER 95 DEGREES" reoccurs.

e) Noting the screen's **[Temperature]** window, THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) screen [Temperature] = 95° C or more:** Proceed to **page 269**, procedure number T- 1.5.5.

**2)** **IF (and ONLY if) screen [Temperature]** is **LESS THAN 95° C BUT "TEMP OVER 95 DEGREES" reoccurs:** Proceed to **page 268**, procedure number T- 1.5.4.

**3)** **IF screen [Temperature]** is **LESS THAN 95° C AND "TEMP OVER 95 DEGREES" DID NOT reoccur:** Perform parts A AND B below:

A) A) ENSURING screen **[Temperature]** remains between 80° C and 92° C, without looking away, watch it for one (1) minute noting its highest and lowest values.

B) To determine **[Temperature]** stability subtract the lowest value seen from the highest value seen. TWO (2) possible scenarios 1) or 2) below:

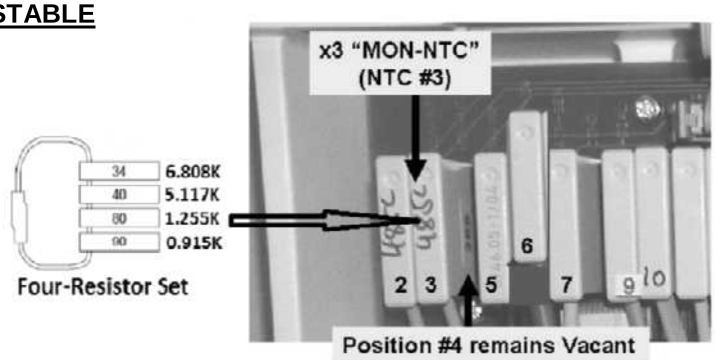
**1)** **IF (and ONLY if) the result is MORE THAN two (2) i.e. UNSTABLE:** ENSURING "TEMP OVER 95 DEGREES" HAS NOT reoccured see procedure number T- 1.5.3 (page 266).

**2)** **IF the result is two (2) or less i.e. STABLE:** The problem is not occurring at this time!

## T- 1.5.3 SCREEN [TEMPERATURE] IS UNSTABLE

a) Figure right, insert the 80° C (1.255 KΩ) plug, from the **FOUR- RESISTOR SET**, into the **2nd** distribution board position from the LEFT, “MON-NTC”.

b) If the plug is placed properly the screen’s **[Temperature]** window should read more than 75° C!




c) To prevent damage DO NOT leave the machine. The external meter MUST NEVER reach 95° or more!

d) Once again, watch the screen’s **[Temperature]** for one (1) minute noting its highest and lowest values.

e) Subtract the lowest value seen from the highest. TWO (2) possible scenarios 1) or 2) below:

**1) IF (and ONLY if) the result is more than one (1) i.e. unstable:** Proceed to **page 272**, procedure number T- 1.5.52.

**2) IF the result is zero (0) or one (1) i.e. STABLE:** Perform parts A and B below:

A) ENSURING the flow indicator’s ‘bob’ is moving up and down, watch the external meter for one (1) minute noting its highest and lowest values.

B) Determine stability by subtracting the lowest value seen from the highest. Is the result more than two (2.0)?

Yes More than two (2.0)! For future use, NOTE METER STABILITY is more than two (2.0) THEN see procedure number T- 1.5.3.10 (page 267).

No Less than two (2.0)! For future use, NOTE METER STABILITY is less than two (2.0) THEN see procedure number T- 1.5.3.10 (page 267).

## T- 1.5.3.10 METER STABILITY MAY OR MAY NOT BE MORE THAN TWO

a) Incoming RO water temperature, less than 20.0° C, may cause unstable temperature. In any event, continue to part b.

b) Return NTC #3's connector to the **2nd** distribution board position from the LEFT, "MON-NTC"!

c) If NTC #3 is plugged in properly screen [**Temperature**] returns to 80° C or more!

d) Press 'Esc' then 'Enter' twice to call the "Select Program" screen.

e) Return the dialyzer connectors to the shunt door!

f) Return to HEAT DISINFECT.

g) Allow up to thirty (30) minutes! TWO (2) possible scenarios:

**1)** **IF "TEMP OVER 95 DEGREES" alarm DOES NOT reoccur:** The problem is not occurring at this time! DO NOT continue.

**2)** **IF "TEMP OVER 95 DEGREES" reoccurs:** As NOTED previously, based on the METER'S stability, TWO (2) possible scenarios i) or ii) below:

**i)** **IF (and ONLY if) METER stability was MORE than two (2.0): READ before performing!** **A)** With the machine off, one at a time, swap in the listed components (see Component List A below), with known good THEN; **B)** In between, return to **page 265**, procedure number T- 1.5.1 until stability is less than two (2) indicating the last component swapped in is the problem.

**COMPONENT LIST A: 1)** NTC #2[1]; **2)** Sensor Board[2,3]; **3)** Functional Board[2,3]

[1] To LOCATE NTC #2 refer to Figure 42 (page 236)

[2] To LOCATE the boards refer to Figure 4A (page 10)

[3] Calibrate Temp Sensor AND Temp Control AND Cond Cells BEFORE testing these components!

**ii)** **IF METER stability was two (2.0) OR LESS: READ before performing! A)** With the machine off, one at a time, swap in the listed components (see Component List B below) with known good THEN; **B)** In between, return to **page 265**, procedure number T- 1.5.1 until "TEMP OVER 95 DEGREES" DOES NOT occur indicating the last component swapped in was the problem.

**COMPONENT LIST B: 1)** NTC #3[1]; **2)** Sensor Board[2,3]; **3)** Functional Board[2,3]

[1] To LOCATE NTC #3 refer to Figure 42 (page 236)

[2] To LOCATE the boards refer to Figure 4A (page 10)

[3] Calibrate Temp Sensor AND Temp Control AND Cond Cells BEFORE testing these components

**T- 1.5.4 [TEMPERATURE] DOES NOT = 95° C BUT "TEMP OVER 95 DEGREES" REOCCURED**


A) **Read this step before performing it!**
Calibrate **Temp Sensor** per the Calibration Procedures booklet but does "Operator Error" OR "Actuator Board Error" occur during the calibration?

Yes An "Error" banner occurs! CAREFULLY repeat the **Temp Sensor** calibration but if an "Error" banner reoccurs proceed to **page 320**, procedure number T- 7.0.0. If an Error banner DOES NOT reoccur see part B.

No An "Error" banner DOES NOT occur! See part B.

B) **Read before performing!** Return to **page 265**, procedure number T- 1.5.1 to see if the calibration fixed the problem. If (and ONLY if) you return to procedure number T- 1.5.4 continue to part C.

C) BEFORE continuing to part D calibrate **Temp Control** per the Calibration Procedures booklet.

D) **Read before performing!** Return to **page 265**, procedure number T- 1.5.1 to see if the calibration fixed the problem. If (and ONLY if) you return to procedure number T- 1.5.4 continue to part E.

E) BEFORE continuing to part F turn the machine off and swap in a known good Actuator-Test Board*. *To LOCATE the board refer to Figure 4A (page 10).

F) BEFORE continuing to part G, note this page number then proceed to **page 17** to perform the **VOLTAGE DETECTOR CALIBRATION**

G) **Read before performing!** Return to **page 265**, procedure number T- 1.5.1 to see if the new board fixed the problem. If (and ONLY if) you return to procedure number T- 1.5.4 replace the Functional Board* and perform all calibrations. *To LOCATE the board refer to Figure 4A (page 10)

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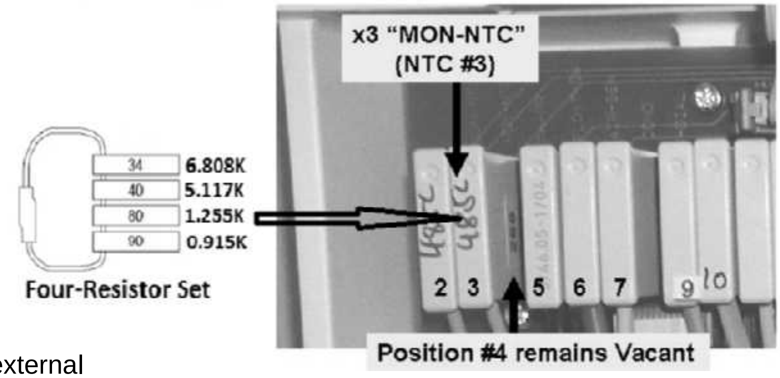
## T- 1.5.5 SCREEN [TEMPERATURE] = 95° C

A) Turn the machine OFF!

B) Figure right, insert the 80° C (1.255 KΩ) plug, from the **FOUR-RESISTOR SET**, into the **2nd** distribution board position from the LEFT, “MON-NTC”. This simulates approximately 80° C.




C) Return to HEAT DISINFECT with an external temperature meter attached as described previously!

D) IMMEDIATELY call debug screen 10. If debug does not appear press ‘Esc’ then call screen 10.

E) Watch **5V HI** AND **24V HI** for three (3) minutes OR until if **5V HI** = 5.3 or more and / or **24V HI** = 28.0 or more?

Yes **5V HI** exceeds 5.3 and / or **24V HI** exceeds 28.0! Proceed to **page 271**, procedure number T- 1.5.51.

No **5V [HI]** remains less than 5.3 AND **24V HI** remains less than 28.0! Continue to parts F through H.

F) To prevent damage DO NOT leave the machine! The external meter MUST NEVER exceed 95° C!

G) Press ‘Esc’ to call the main Heat Disinfect screen.

H) Watch the screen’s [**Temperature**] window for one (1) minute. THREE (3) possible scenarios:

1) **IF (and ONLY if) screen [Temperature] is between 77 and 83° C AND stable i.e. does NOT change more than 1.0:** Leaving the resistor plug installed, proceed to **page 273**, procedure number T- 1.5.53.

2) **IF (and ONLY if) screen [Temperature] is unstable i.e. changes more than 1.0:** Leaving the resistor plug installed, proceed to **page 272**, procedure number T- 1.5.52.

3) **IF screen [Temperature] is stable i.e. DOES NOT change more than 1.0 but IS NOT between 77 and 83° C:** As prompted perform parts A THROUGH L below:

A) ENSURE the 80° C (1.255 KΩ) plug, from the FOUR-RESISTOR SET, was placed properly at the **2nd** distribution board position from the left, “MON-NTC”! If not, repeat procedure number T- 1.5.5 (page 269).

B) Consider using the 80° C (1.255 KΩ) plug, from another FOUR-RESISTOR SET. If screen [**Temperature**] is still NOT between 77 and 83° C continue to part C.

C) Remove the resistor plug and return NTC #3’s connector to the **2nd** distribution board position from the left, “MON-NTC”.

D) BEFORE continuing to part E (next page), place the machine into RINSE for fifteen (15) minutes to cool it down rapidly.

E) Per the Calibration Booklet, perform TWO (2) calibrations: **Cal 1)** Temp Sensor AND **Cal 2)** Temp Control. After BOTH calibrations are complete continue to part F.

F) **Read before performing!** Return to **page 265**, procedure number T- 1.5.1 to see if the calibrations fixed the problem. If (and ONLY IF) you return to part E continue to part G.

G) Turn the machine off and swap in a known good Sensor Board*. *To LOCATE the Sensor board refer to Figure 4A (page 10).

H) Perform THREE (3) calibrations**: Cal 1)** Temp Sensor AND **Cal 2)** Temp Control AND **Cal 3)** Cond Cells. After the calibrations are complete continue to part I.

I) **Read before performing!** Return to **page 265**, procedure number T- 1.5.1 to see if the new board fixed the problem. If (and ONLY if) you return to part E continue to part J.

J) **Read before performing!** Turn the machine off and swap in a known good Functional Board. *To LOCATE the Functional board refer to Figure 4A (page 10).

K) Perform THREE (3) calibrations**: Cal 1)** Temp Sensor; **Cal 2)** Temp Control; **Cal 3)** Cond Cells. After the calibrations are complete continue to L.

L) Return to **page 265**, procedure number T- 1.5.1 to see if the new board fixed the problem.

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## T- 1.5.51 5V HI MORE THAN 5.3 AND / OR 24 V HI MORE THAN 28.0

A) Turn the machine OFF.

B) Open the card cage and push down HARD on ALL circuit boards!

C) Using compressed air, clean the motherboard's surface of excessive dust.

D) Using a flashlight, inspect the surface of the motherboard for corrosion or burning.

E) BEFORE going to part F, note this page number, then proceed to **page 17** to perform the **VOLTAGE DETECTOR CALIBRATION**.

F) Return to HEAT DISINFECT then IMMEDIATELY call debug screen 10. If debug doesn't appear press 'Esc' then call screen 10.

G) Allow thirty (30) minutes OR until if "TEMP OVER 95 DEGREES" reoccurs. THREE (3) possible scenarios 1) or 2) or 3) below:

   **1)** **IF (and ONLY if) "TEMP OVER 95 DEGREES" DOES NOT reoccur:** DO NOT continue!

   **2)** **IF (and ONLY if) 5V HI = 5.3 OR MORE AND / OR 24V = 28.0 OR MORE:** Continue to part H.

   **3)** **IF "TEMP OVER 95 DEGREES" reoccured BUT 5V HI REMAINED less than 5.3 AND 24V HI REMAINED less than 28.0:** Proceed to **page 264**, procedure number's T- 1.5.0, **SCENARIO #3**.

H) **Read before performing!** With the machine off, swap in one of the listed components (see COMPONENT LIST below) with known good THEN, in between, perform parts I and J to see if the new component fixes the high voltage problem.

   **COMPONENT LIST: 1**) Power Logic Board[1]; **2)** Actuator-Test Board[1, 2]; **3)** Sensor Board[1, 3]; **4)** Functional Board[1, 2, 3] ; **5)** Power Supply; **6)** Motherboard[1].

   [1] To LOCATE these boards refer to Figure 4A (page 10)

   [2] BEFORE performing part I, note this page number then proceed to **page 17** to perform the **VOLTAGE DETECTOR CALIBRATION**

   [3] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES, page 19))

I) Return to HEAT DISINFECT THEN IMMEDIATELY call debug screen 10. If debug does not appear press 'Esc' then call screen 10.

J) Allowing up to thirty (30) minutes. Based on 5V HI AND 24V HI, TWO (2) possible scenarios:

   **1)** **IF (and ONLY if) 5V HI = 5.3 OR MORE AND / OR 24V = 28.0 OR MORE:** Return to part H above.

   **2)** **IF 5V HI REMAINS LESS THAN 5.3 AND 24V HI REMAINS LESS THAN 28.0:** The last component 'swapped in' solved the high voltage problem.

## T- 1.5.52 SCREEN [TEMPERATURE] WINDOW UNSTABLE

A) Turn the machine OFF!

B) Return the dialyzer lines to the shunt and close the door!

C) Leave the 80° resistor plug installed until the problem is solved.

D) **Read before perform!** THREE (3) possible bad components (COMPONENT LIST below). **A)** With the machine off, one at a time, swap in each, with known good* THEN; **B)** In between, perform parts E AND F below to see if the new component makes the screen's [**Temperature**] stable indicating the last component swapped in is the problem.

**COMPONENT LIST:** **1)** Power Logic Board[1]; **2)** Sensor Board[1, 2]; **3)** Functional Board[1, 2] **4)** Distribution board.

[1] To LOCATE the boards refer to Figure 4A (page 10)

[2] To prevent a "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES, page 19))

E) Return to HEAT DISINFECT and allow one (1) minute.

F) Is screen [**Temperature**] stable now i.e. DOES NOT not change more than 1.0?

Yes [**Temperature**] is stable! The last component fixed the problem. Calibrate the machine as instructed per Appendix B (page 758).

No [**Temperature**] remains unstable! Repeat above parts C through F until [**Temperature**] remains stable!

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## T- 1.5.53 [TEMPERATURE] IS STABLE

WITHOUT LOOKING AWAY (to avoid damage), watch the external meter for up to twenty-five (25) minutes or until if it exceeds 95° C! TWO (2) possible scenarios:

1) **IF (and ONLY if) the meter exceeds 95° C:** See procedure number T- 1.5.677 (page 274).

2) **IF the meter does NOT exceed 95° C:** Perform parts A THROUGH I below as prompted:

A) Remove the 80° C resistor plug from the distribution board.

B) Turn the machine off and replace **NTC #3*** with a known good, and plug it into the **2nd** distribution board position from the left, "MON-NTC". ***** To LOCATE NTC #3 refer to Figure 42 (page 236)

C) **Read before performing!** Return to (ABOVE) procedure number T- 1.5.1 (page 265) to see if the new NTC #3 fixed the problem. If (and ONLY if) you return to procedure number T- 1.5.53 continue to part D.

D) Turn the machine off and swap in a known good Sensor Board* then continue to part E. *To LOCATE the board refer to Figure 4A (page 10).

E) Perform TWO (2) calibrations: **Cal 1)** Temp Control; **Cal 2)** Cond Cells. After the calibrations continue to part F.

F) **Read before performing!** Return to (ABOVE) procedure number T- 1.5.1 (page 265) to see if the new Sensor board fixed the problem. If (and ONLY if) you return to procedure number T- 1.5.53 continue to G.

G) **Read before performing!** Turn the machine off and swap in a known good Functional Board THEN see part H.

H) Perform FOUR (4) calibrations: **Cal 1)** Voltage Detection; **Cal 2)** Temp Sensor; **Cal 3)** Temp Control; **Cal 4)** Cond Cells. After the calibrations see part I.

I) Return to (ABOVE) procedure number T- 1.5.1 (page 265) to see if the new board fixed the problem.

## T- 1.5.677 EXTERNAL METER EXCEEDS 95° C

A) Return NTC #3's connector to the **2nd** distribution board position from the left, "MON-NTC".

B) Replace Temperature control sensor **NTC #2*** with a known good.THEN continue to part C. ***To** LOCATE NTC #2 refer to Figure 42 (page 236).

C) **Read before performing!** Return to procedure number T- 1.5.1 (page 265) to see if the new NTC #2 fixed the problem. If (and ONLY if) you return to procedure number 1.5.677 continue to part D.

D) Swap in a known good Sensor Board* THEN continue to part E. *To LOCATE the board refer to Figure 4A (page 10)

E) Perform TWO (2) calibrations: **Cal 1)** Temp Control; **Cal 2)** Cond Cells THEN continue to part F.

F) **Read before performing!** Return to (ABOVE) procedure number T- 1.5.1 (page 265) to see if the new board fixed the problem. If (and ONLY if) you return to procedure number 1.5.677 continue to part G.

G) Swap in a known good Functional Board THEN see part G

H) Perform FOUR (4) calibrations**: Cal 1)** Voltage Detection; **Cal 2)** Temp Sensor; **Cal 3)** Temp Control; **Cal 4)** Cond Cells THEN continue to part I.

I) **Read before performing!** Return to (ABOVE) procedure number T- 1.5.1 (page 265) to see if the new board fixed the problem. If (and ONLY if) you return to procedure number 1.5.677 the motherboard may be bad.

## T- 1.7.0 TEMPERATURE IS LOW / ISOLATE TEMPERATURE MONITOR CIRCUIT

a) Return the concentrate connectors to their rinse ports

b) **Place the machine into HEAT DISINFECT!**

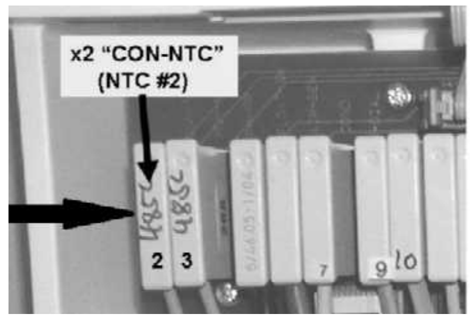
c) Being aware that flow does not stop, remove the dialyzer connectors from the shunt and connect them to a Temperature (° C) meter but **DO NOT** shut the door

d) Ignoring a possible temporary "Flow Recirc Error" the "Cover is Open" banner presents.

e) ENSURING a "No Water" alarm NEVER occurs, the external flow indicator's 'bob' MUST be moving up and down!

f) See procedure number T- 1.7.1 (page 275).

## T- 1.7.1 ISOLATE NTC #2




a) Figure right, unplug the connector from the **1st** distribution board position from the left, "CON-NTC". This is NTC #2 and unplugging it should turn the heater on fully.

b) **WARNING!** To avoid damage, DO NOT leave the machine.

c) The meter's temperature should eventually increase. If incoming water is very cold response may take up to seven (7) minutes. If incoming water is at normal temperature usually within three (3) minutes.

d) WITHOUT LOOKING AWAY, watch the external meter for UP TO seven (7) minutes **OR** until if it reaches 36.0° C OR more?

Yes 36.0° C OR more! See procedure number T- 1.7.4 (page 275).

No Remains less than 36.0° C! Leaving NTC #2 unplugged, proceed to **page 276**, procedure number T- 1.7.5.

## T- 1.7.4 TEMPERATURE MORE THAN 36.0° C / ISOLATE MONITOR (NTC #3)


a) Call debug screen 4. If debug does not appear press 'Esc' then call screen 4.

b) From debug screen 4, is **TEMP** (lower left) 4.0 OR more?

Yes **TEMP** 4.0 or more. Proceed to **page 277**, procedure number T- 1.7.72.

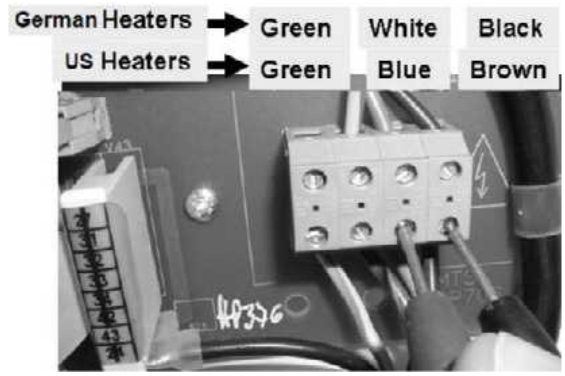
No **TEMP** less than 4.0! See parts THROUGH c below:

a) Turn the machine OFF!

b) Replace NTC #3***** with a known good.***** To LOCATE NTC #3 refer to see Figure 42 (page 236).

c) Proceed to **page 320**, procedure number T- 7.0.0.

## T- 1.7.5 TEMPERATURE IS LESS THAN 36.0° C / CHECK AC HEATER VOLTAGE




a) **Set your CALIBRATED volt meter to AC voltage (~ V, $V_{AC}$)!**

b) **High voltage possible!** Figure right, measure at the distribution board's Heater Connector, between the BROWN and BLUE wires. More than 100.0 volts AC?

Yes More than 100.0 volts AC! See procedure number T- 1.7.6 (page 276).

No Less than 100.0 volts AC! See parts A THROUGH D below:

A) Press 'Esc' then 'Enter' twice to call the "Select Program" screen.

B) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

C) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter'!

D) Leaving NTC #2 unplugged, proceed to **page 281**, procedure number T- 2.0.0.

## T- 1.7.6 HEATER VOLTAGE MORE THAN 100 VOLTS AC / VERIFY INCOMING WATER TEMP

a) Using a temperature meter, measure INCOMING WATER temperature from the RO!

b) More than 20.0° C?

Yes Incoming water more than 20.0° C! The heater* may be bad. *To LOCATE the heater refer to Figure 28 (page 140).

No Incoming water is less than 20.0°C! Too low! AFTER this problem is corrected the Temperature problem may not exist!

LEFT BLANK INTENTIONALLY

**T- 1.7.72 TEMP = 4.0 OR MORE**

a) **Turn the Heater Switch OFF!**

b) Return NTC #2 to the **1st** distribution board position from the left, “CON-NTC”.

c) Temperature may continue to increase for a few minutes! Allow the external meter to fall below 35.0° C BEFORE continuing to procedure number T- 1.7.8 (page 277).

**T- 1.7.8 VERIFY TEMPERATURE**

a) **Turn the Heater Switch ON!**

b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)

c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘Enter’.

d) Allow five (5) minutes BEFORE continuing to part e!

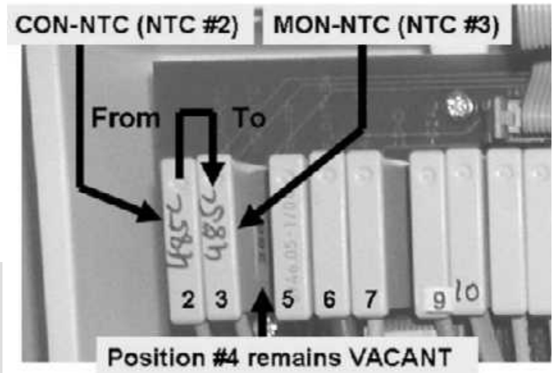
e) Based on the Home screen’s [**Temperature**] reading. TWO (2) possible scenarios:

   **1) IF LESS THAN 35.1° C:** See procedure number T- 1.8.0 (page 278).

   **2) IF BETWEEN 35.1 and 38.9° C:** A Temperature problem is not present at THIS time. To check possible intermittent temperature problems proceed to **page 240**, procedure number **T- 1.0.8**.

LEFT BLANK INTENTIONALLY

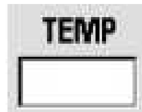
## T- 1.8.0 ISOLATE NTC #2




a) **Turn the Heater Switch OFF!**

b) Figure right, move NTC #2's connector from the **1st** distribution board position from the left, "CON-NTC" to the **2nd** position from the left, "MON-NTC", AVOIDING the VACANT position at the right,

c) Call debug screen 4. Allow up to <u>seven (7) minutes</u> **<u>OR</u>** until if **TEMP** (lower left) falls to 2.5 <u>OR</u> less?




Yes **TEMP** = 2.5 <u>OR</u> less! NTC #2 appears to be okay. See procedure number T- 1.8.1 (page 278).

No **TEMP** more than 2.5! See parts a AND b below:

a) ENSURING the HEATER Switch was OFF, return NTC #3's connector to **2nd** distribution board position from the left, "MON-NTC"!

b) NTC #2 is bad! To <u>LOCATE</u> NTC #2 refer to Figure 42 (page 236).

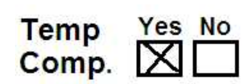
## T- 1.8.1 NTC #2 OKAY / VERIFY 'TEMP COMP' OPTION

a) Return NTC #2's connector to **1st** distribution board position from the left, "CON-NTC".

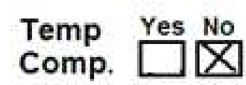
b) Avoiding the VACANT position at the right ("PH-PR"), return NTC #3's connector to the **2nd** distribution board position from the left, "MON-NTC".

c) **Turn the Heater Switch ON!**

d) Enter Service Mode → Options → Hardware Options. Does the "Yes" box next to **'Temp Comp'** have a blue 'X' in it (Yes or No)?



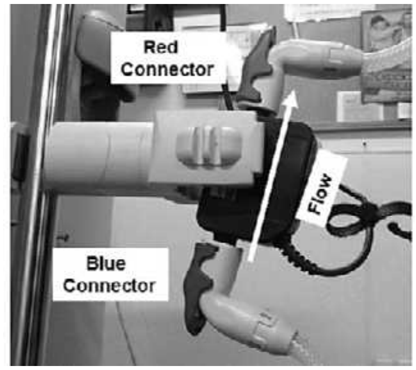

Yes Place the 'X' in the "No" box and press 'Enter'. The 'X' turns blue. Post a note that '**Temp Comp**' is off then see procedure number T- 1.8.2 (page 279).




No Temp Comp = No! See procedure number T- 1.8.2 (page 279).

## T- 1.8.2 VERIFY TEMERATURE CONTROL

This is NOT a routine Temperature calibration. Follow the procedure exactly to avoid error.




a) Install a calibrated Temperature meter (° C) in the dialyzer lines.**Figure right, flow must MUST be bottom to top.**

b) Confirm SHUNT DOOR is closed.

c) From the Service menu select Calibrate Sensors → Temp Control.

d) 'Sharply' press 'Enter' TWICE to turn the screen's **[TEMP DAC]** data box pale yellow / white.

e) Press **[TEMP DAC]** to turn it bright yellow.

f) Set **[TEMP DAC]** to "180".

g) 'Sharply' press 'Enter'. **[TEMP DAC]** MUST remain pale yellow/ white i.e. NOT gray.

h) ENSURING flow through the external indicator AND the Heater Switch is on, allow up to five (5) minutes OR until the external meter reaches 35.5° C or more?

Yes Meter 35.5° C or more! See procedure number T- 1.8.3 (page 279).

No Meter less than 35.5° C! With **[TEMP DAC]** pale yellow / white, see procedure number **T- 1.8.4** (page 279).

## T- 1.8.3 METER MORE THAN 35.5°C / VERIFY [TEMP DAC]

a) Allowing five (5) minutes after each **[TEMP DAC]** adjustment, continue until the external meter is between 36.9 and 37.1° C.

b) Does **[TEMP DAC]** have to be set to 190 or more to bring meter temperature to 36.9 and 37.1° C?

Yes **[TEMP DAC]** is 190 or more! See procedure number T- 1.8.4 (page 279).

No **[TEMP DAC]** less than 190! Proceed to **page 327**, procedure number T- 7.5.0.

## T- 1.8.4 METER LESS THAN 35.5° C / ISOLATE INCOMING WATER TEMPERATURE

If incoming water is less than 20.0° C (from the RO) the machine may not be able to maintain temperature.

a) Using a calibrated temperature meter measure INCOMING WATER from the RO!

b) More than 20.0° C?

Yes More than 20° C! See procedure number T- 1.8.5 (page 280).

No Less than 20.0° C! Incoming water temperature is too low! Once this problem is fixed, most likely, temperature can be calibrated.

## T- 1.8.5 INCOMING WATER MORE THAN 20.0 ° C / TROUBLESHOOT LOW TEMPERATURE

a) **Turn the machine OFF!**

b) Open the card cage and reseat the Sensor, Power Logic and Functional Boards!

c) See procedure number T- 1.8.6 (page 280).

## T- 1.8.6 REATTEMPT TEMP CONTROL CALIBRATION

a) Return to Service Mode → Calibrate Sensors → Temp Control.

b) 'Sharply' press 'Enter' TWICE to turn the screen's **[TEMP DAC]** data box pale yellow/white.

c) Press **[TEMP DAC]**, it turns bright yellow.

d) Set **[TEMP DAC]** to "170".

e) Press 'Enter'. **[TEMP DAC]** MUST return to pale yellow / white i.e. NOT gray.

f) ENSURING flow through the external indicator, allow up to six (6) minutes OR until if the external meter reaches 35.5° C or more?

Yes 35.5° C or more! Proceed to **page 324**, procedure number T- 7.2.2.

No Remains less than 35.5° C! Perform parts a AND b below:

a) **Turn the machine OFF!**

b) **Read before performing!** Swap in the listed components (see COMPONENT LIST below), one at a time, with known good, then in between, repeat procedure number T-1.8.6 (page 280) to test each new component until the meter's temperature is more than 35.5° C indicating the last component swapped in was the problem!

**COMPONENT LIST: 1)** NTC #2[1]; **2)** Power Logic Board; **3)** Sensor Board[2, 3], **4)** Actuator-Test Board; **5)** Functional Board[2, 3] **6)** Sensor Board cable; **7)** Power Control board (located inside the power supply); **8**) Distribution board; **9)** Motherboard.

[1] To LOCATE NTC #2, refer to Figure 42 (page 236)

[2] To LOCATE the board, refer to Figure 4A (page 10)

[3] To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

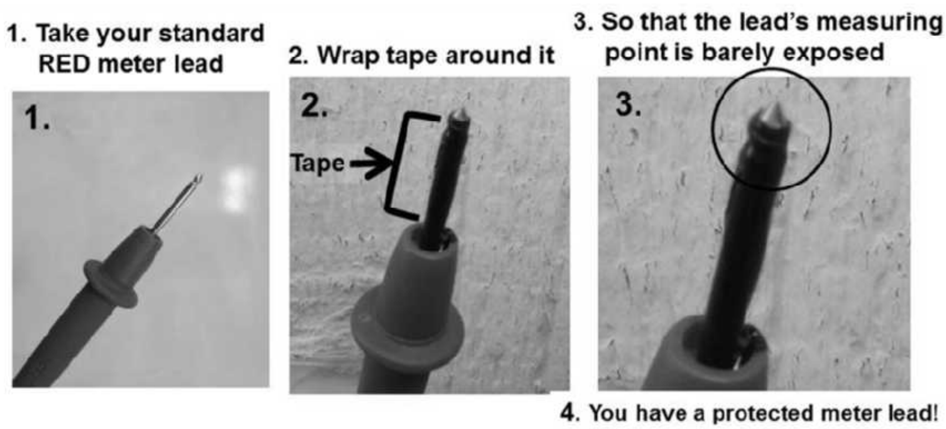
**T- 2.0.0 HEATER VOLTAGE LESS THAN 10.0 VOLTS AC**

a) Remaining in Dialysis Program or Heat Disinfect, to prevent pulling cables loose, GENTLY open the card cage.

b) **Set your volt meter to DC voltage ($V_{DC}$).**

c) **Connect the black lead to chassis ground (see Figure 2, page 4).**

d) **CAUTION!** Signals are about to be measured at pins that are VERY close to others and touching pins together with a standard meter lead **could cause massive DAMAGE**. As directed below, make your RED meter lead PROTECTED. **DO NOT CONTINUE UNTIL YOU HAVE DONE THIS!**




e) Figure below, at the top of the Power Logic board, closest to the screen, locate its twenty-pin X2 cable.

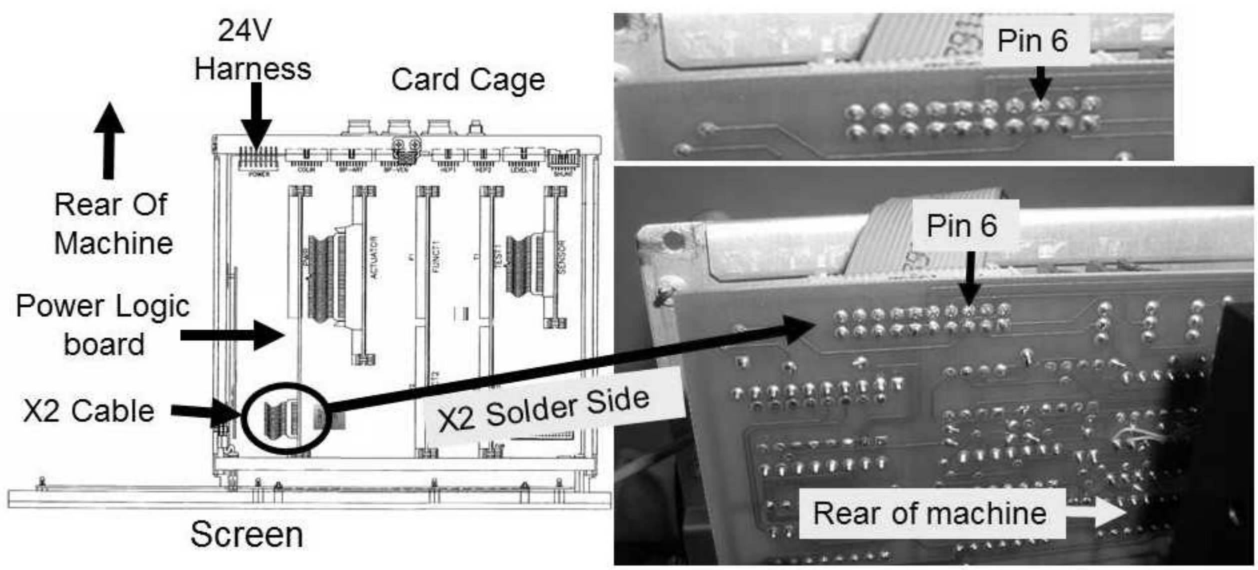



**Figure 43 – Power Logic Cable X2 / Pin 6**

f) Measure from the solder (rear) side of the X2 cable, at **pin 6** (TOP row, three pins from the REAR of the machine). 9.5 volts DC OR MORE?

Yes **Pin 6** is 9.5 volts OR MORE! See procedure number T- 2.0.1 (page 282).

No **Pin 6** LESS THAN 9.5 volts! Proceed to **page 292**, procedure number T- 2.2.0.

**T- 2.0.1 PIN 6 MORE THAN 9.5 VOLTS**

a) If in Heat Disinfect see part b. If in Dialysis Program ENSURE [Dialysate Flow] is on*****!

***** If [Dialysate Flow] is blinking flow is off. It MUST be on!

b) Figure below, at the top front edge of the Power Logic board, locate transistor **T5**.

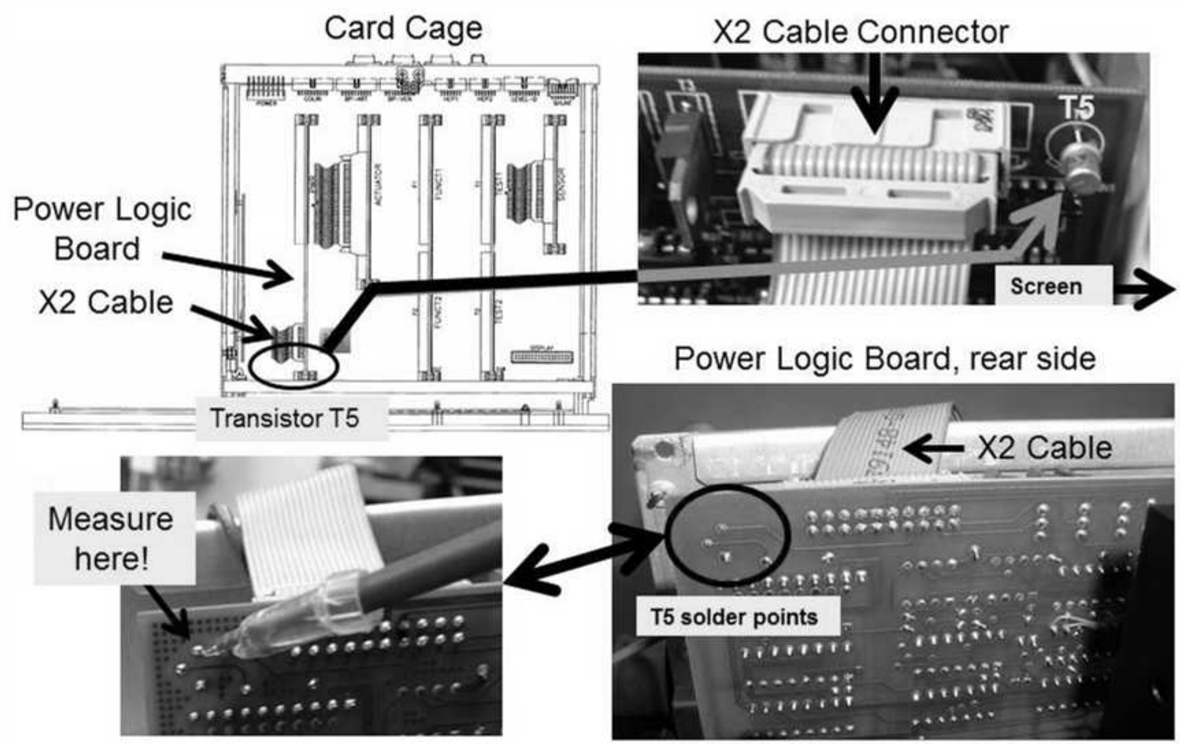


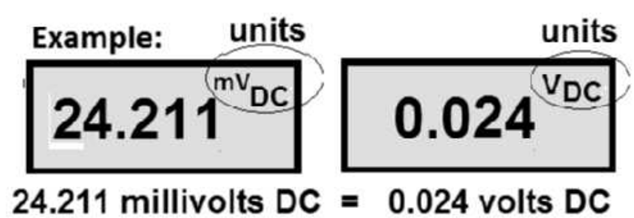

**Figure 44 – Power Logic Board / Transistor T5**

c) Expecting almost 0 volts DC, measure at **T5's TOP** solder point as shown above. Less than twenty (20.0) volts DC*****?

Yes **T5** LESS THAN 20.0 volts DC*****! See procedure number T- 2.0.2 (page 283).

No **T5** between 20.0 and 28.0 volts DC*****! Proceed to **page 285**, procedure number T- 2.0.5.

*** Pay attention to the meter's units!**

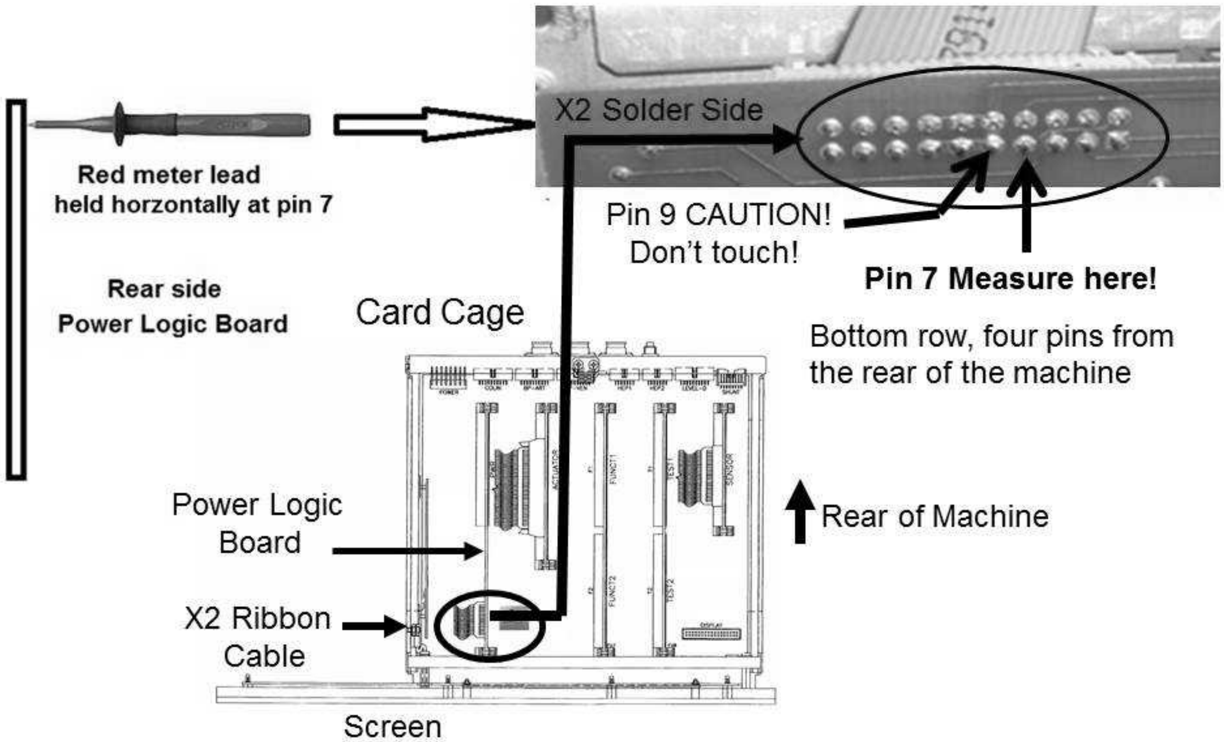


## T- 2.0.2 T5 LESS THAN 20.0 VOLTS

a) **CAUTION!** The next measurement will be from the Power Logic board's twenty-pin X2 cable, at **pin 7**. Pin 9, next door, is connected to 24 volts DC and **touching pins 7 and 9 together <u>WILL DAMAGE</u> several boards!** To prevent this, TWO (2) precautions:

**1) Use the <u>protected</u> red meter lead!**

**2) Figure below, place the lead horizontally on pin 7**




b) Measure at **PIN 7**, (BOTTOM row, four pins from the REAR of the machine). 4.0 volts DC or MORE?

Yes Pin 7 is 4.0 volts <u>OR</u> MORE! See procedure number T- 2.0.3 (page 283).

No Pin 7 is LESS THAN 4.0 volts! Proceed to **page 286**, procedure number T- 2.0.6.

## T- 2.0.3 PIN 7 IS 4.0 VOLTS OR MORE

All card cage signals appear to be good.

a) **Set your meter AC voltage (~ V, $V_{AC}$)!**

b) NTC #2 remains unplugged till instructed.

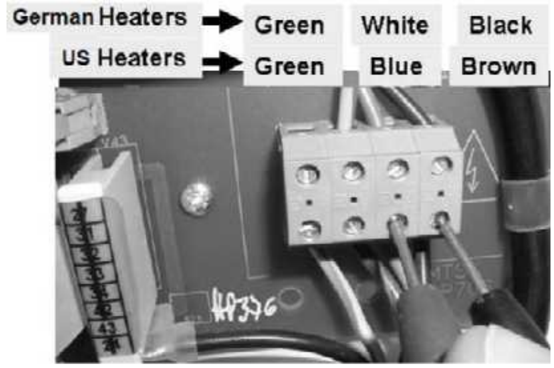
**Parts c and d next page**

c) ENSURE [**Temperature**] is still less than 35.0° C.

d) Figure right, measure BETWEEN the Heater Connector's BROWN and BLUE wires. TWO (2) possible scenarios:

**1) IF MORE THAN 100.0 volts!** The heater is on! See procedure number T- 2.0.4 (page 284).

**2) IF LESS than 100.0 volts AC!** Proceed to **page 295**, procedure number T- 2.6.0.




## T- 2.0.4 HEATER ON (MORE THAN 100 VOLTS)

a) **Return NTC #2's connector to the 1st distribution board position from the left, "CON-NTC".**

b) Call debug screen 0. Watch for six (6) minutes to ENSURE **Flow Error** is NEVER = 1 and a "No Water" NEVER occurs.

c) From the Home or Heat Disinfect screen, [**Temperature**] should increase to:

- **IF in Dialysis Program:** Between 35.0 and 39.0° C.
- **IF in Heat Disinfect:** After no more than thirty (30) minutes, more than 80° C!

d) The low temperature problem may be intermittent and occurs ONLY after the machine has been running for a while with good temperature. In this event **DO NOT** turn the machine off!

e) ENSURING a "No Water" alarm OR a Flow Error are NOT occurring AND there is less than 10 volts AC at the heater, unplug NTC #2. If heater voltage returns to more than 100 volts AC replace NTC #2. If (and ONLY if) heater voltage remains less than 10.0 volts AC, TWO (2) DC voltage measurements isolates the entire heater circuit:

**Measurement #1:** Per Figure 43 (page 281) at x2, **pin 6**. Good = more than 9.6 volts DC.

**Measurement #2:** Per Figure 44 (page 282), at **T5's TOP** pin. Good = less than 2.0 volts DC.

f) TWO (2) possible scenarios:

**Scenario #1:** **IF (and ONLY if) BOTH measurements are GOOD:** All card cage signals are okay. There is an intermittent problem with the Triac or the Power Control Board in the power supply.

**Scenario #2:** **IF a BAD signal is measured:** TWO (2) possibilities: If (and ONLY if) the **pin 6** measurement is less than 9.6 volts DC see procedure number T- 2.2.0 (page 292). If the **T5** measurement is more than 2.0 volts DC see procedure number T- 2.0.5 (page 285).

**T- 2.0.5 T5 BETWEEN 20.0 AND 28.0 VOLTS DC**

a) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

b) Watching for one (1) minute, if **Flow Error** EVER = 1 OR a "No Water" alarm EVER appears DO NOT troubleshoot temperature!

c) **CAUTION!** The next measurement is from the Power Logic board's twenty-pin X2 cable, at **pin 7**. Pin 9, next door, is connected to 24 volts DC and **touching pins 7 and 9 together WILL DAMAGE several boards!** To prevent this, TWO (2) precautions:

**1) Use the protected red meter lead!**

**2) Per the Figure below, place the lead horizontally onto pin 7** (BOTTOM row, four pins from the REAR of the machine). 4.0 volts DC or MORE?

Yes **Pin 7** is 4.0 volts OR MORE! Proceed to **page 287**, procedure number T- 2.1.0.

No **Pin 7** is LESS THAN 4.0 volts! See procedure number T- 2.0.6 (page 286).

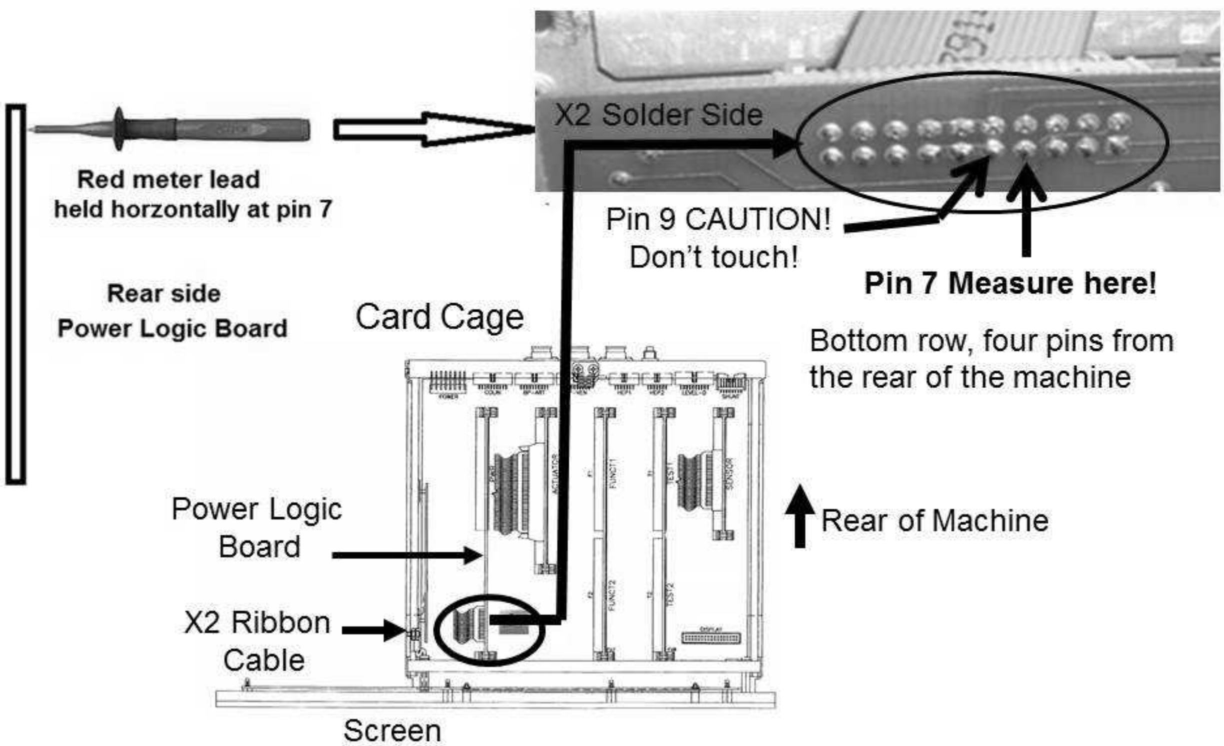



**Figure 45 - Power Logic Board X2 / Pin 7**

**T- 2.0.6 PIN 7 LESS THAN 4.0 VOLTS**

a) Turn the machine OFF!

b) **IMPORTANT!** Return NTC #2's connector to the **1st** distribution board position from the left, "CON-NTC".

c) Swap in known good Actuator-Test board. To LOCATE the board refer to Figure 4A (page 10).

d) With the known good board in, see procedure number T- 2.0.7 (page 286).

**T- 2.0.7 GOOD ACTUATOR-TEST BOARD WAS SWAPPED IN**

a) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it ("Select Program" → 'Dialysis' → 'Enter'). If a HEAT DISINFECT problem return to HEAT DISINFECT.

d) **CAUTION!** The measurement at the Power Logic board's twenty-pin X2 cable, at **pin 7**, is repeated. To avoid damage:

**1) Use the protected red meter lead!**

**2) Place the lead horizontally on pin 7** (BOTTOM row, four pins from the REAR of the machine). 4.0 volts DC or MORE now?

Yes **Pin 7** now 4.0 volts OR more! The new Actuator-Test board fixed the problem.

No **Pin 7** still 3.9 volts DC or less! Turning the machine off in between, one at a time, swap in the following boards, see the APPROPIATE BOARD LIST below, and in between repeat procedure number T- 2.0.7 (page 286) to test each until **pin 7** is 4.0 volts DC or more.

## BOARD LIST if machine is equipped with a bi*bag* Connector:

**1)** bi*bag* Interface board[1] **2)** Functional Board[2,3]; **3)** Power Logic Board[2]; **4)** Power Control board (inside the power supply); **5)** Motherboard[2]

[1] To LOCATE the bi*bag* Interface board refer to Figure 4C (page 11)

[2] To LOCATE these boards refer to Figure 4A (page 10)

[3] To prevent a "Cond Offset Failure" alarm place the machine into **T and C Mode** (refer to OPERATING MODES, page 19))

## BOARD LIST if machine is NOT equipped with a bi*bag* Connector:

**1)** Functional Board[1,2]; **2)** Power Logic Board[1]; **3)** Power Control board (inside the power supply); **4)** Motherboard[1].

[1] To LOCATE these boards refer to Figure 4A (page 10)

[2] To prevent a "Cond Offset Failure" alarm place the machine into T and C Mode (refer to OPERATING MODES (page 19))

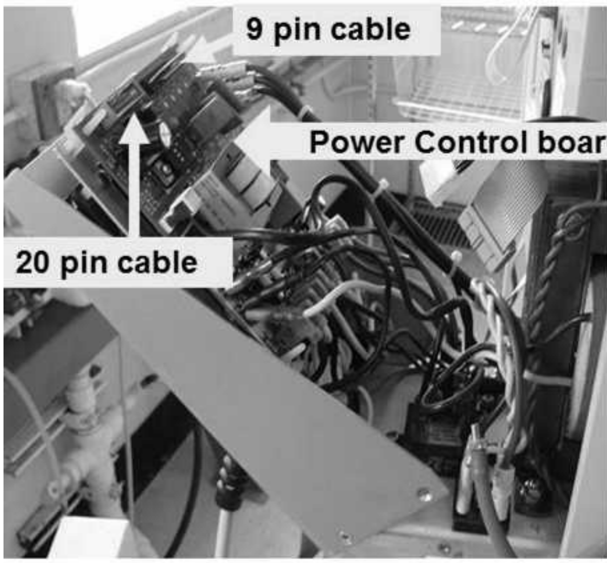
## T- 2.1.0 POWER LOGIC BOARD PIN 7 4.0 VOLTS OR MORE / ISOLATE DIODE 17 (D17)

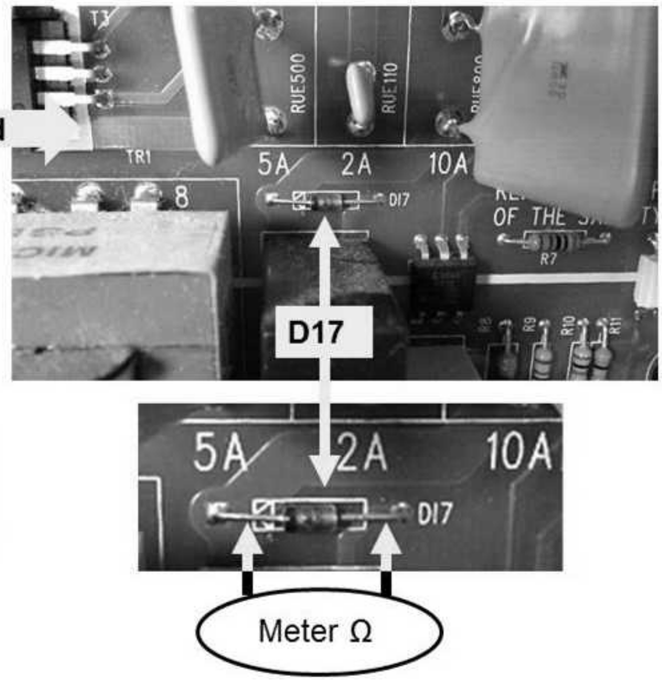
A bad diode 17 (D17) destroys Power Logic Boards. Its RESISTANCE (Ω) is checked here:

a) **CAUTION!** To prevent electrocution, turn machine OFF and unplugged.

b) Per the Figure below, open the power supply to see the component side of the Power Control board.

c) Confirm the twenty (20) and nine (9) pin***** cables MUST be unplugged! BEFORE unplugging the nine pin cable NOTE its polarity (i.e. orange wire on the right).

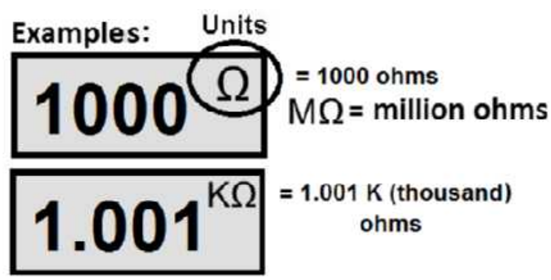



d) **Set your volt meter to RESISTANCE (Ω).**

e) Per the Figure above, check D17 by placing one meter lead on one side of it and the other lead on the other side.

f) Figure right, reading the meter's numeric AND units display! TWO (2) possible scenarios:




**1) IF (and ONLY if) between 900 and 1500 Ω (0.900 and 1.5 KΩ)!** Diode 17 is good! See procedure number T- 2.1.4 (page 288).

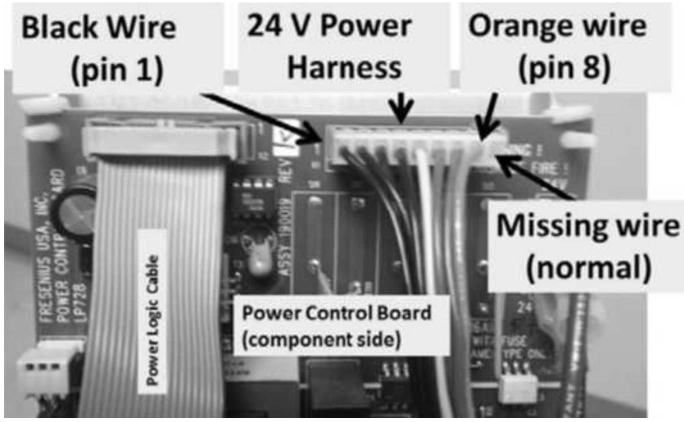
**2) IF less than 900 Ω (0.900 KΩ) OR more than 1500 Ω (1.5 KΩ):** Diode 17 is bad! Perform parts a AND b below:

a) Replace BOTH the Power Control board***** (inside the power supply) AND the Power Logic board (inside the card cage) with known good. *It is a good idea to check diode 17 on the new Power Control board.

b) After BOTH boards are replaced, leaving NTC #2 unplugged, see procedure number T- 2.1.4 (page 288).

## T- 2.1.4 DIODE 17 CHECKED GOOD OR POWER CONTROL BOARD WAS REPLACED

a) **IMPORTANT!** Figure below, ENSURE all cables are PROPERLY connected to the Power Control board!

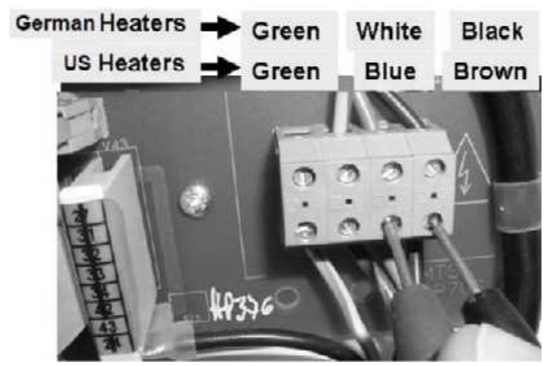



**NOTE!** A good diode 17 does NOT necessarily mean the Power Control board is good

b) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it (“Select Program” → ‘Dialysis’ → ‘Enter’). If a HEAT DISINFECT problem return to HEAT DISINFECT.

c) **Set to volt meter to AC voltage (~ V, $V_{AC}$).**

d) Figure right, measure <u>BETWEEN</u> the Heater Connector’s **<u>BROWN</u>** and **<u>BLUE</u>** wires. TWO (2) possible scenarios:




**1)** **IF more than 100.0 volts AC!** Return NTC #2’s connector to the **1st** distribution board position from the left, “CON-NTC”. The new boards fixed the problem!

**2)** **IF less than 100.0 volts AC!** See procedure number T- 2.1.5 (page 288).

## T- 2.1.5 HEATER VOLTAGE LESS THAN 10 VOLTS AC

a) **Set your meter to DC voltage ($V_{DC}$).**

b) **Connect the black lead to chassis ground**.

c) Measure again at the Power Logic board’s **<u>T5</u>** TOP pin. If necessary, refer to Figure 44 (page 282).

d) LESS THAN two (2.0) volts DC?

Yes T5 LESS THAN 2.0 volts! Proceed to **page 291**, procedure number T- 2.1.8.

No T5 between 2.0 and 28.0 volts! See procedure number T- 2.1.6 (page 289).

## T- 2.1.6 T5 BETWEEN 2.0 AND 28.0 VOLTS .

a) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

b) Watching for one (1) minute, if **Flow Error** EVER = 1 OR a "No Water" alarm EVER appears DO NOT troubleshoot temperature!

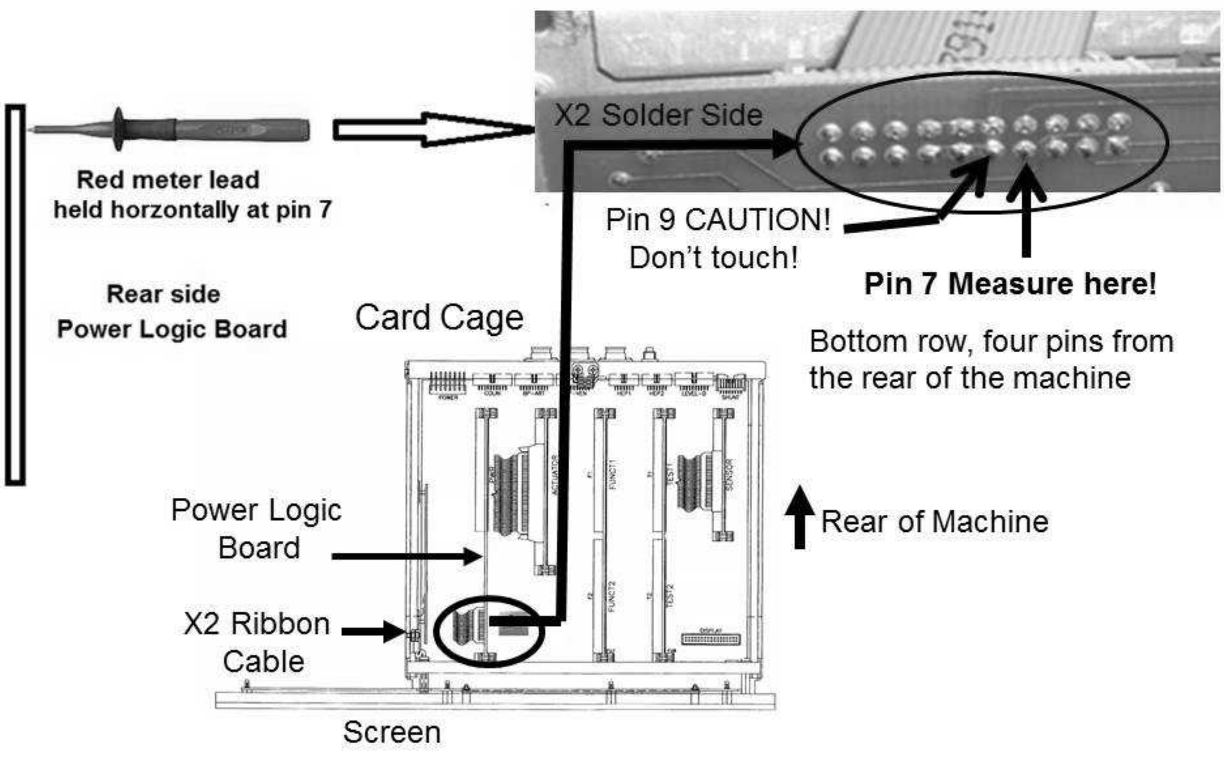
c) **CAUTION!** The measurement at the Power Logic board's twenty-pin X2 cable, at **pin 7** is repeated To avoid damage, TWO (2) precautions:

**1) Use the protected red meter lead!**

**2) Per the Figure below, place the lead horizontally onto pin 7** (BOTTOM row, four pins from the REAR of the machine). 4.0 volts DC or MORE now?

Yes Pin 7 is more than 4.0 volts. See procedure number T- 2.1.7 (page 290).

No Pin 7 is 3.9 volts OR LESS! See (ABOVE) procedure number T- 2.0.6 (**page 286**).



## T- 2.1.7 T5 BETWEEN 2.0 AND 28 VOLTS AND PIN 7 MORE THAN 4.0 VOLTS

a) Turn the machine OFF!

b) Referring to the Component List below, swap them in, one at a time, then in between continue to part c to see if the new component fixed the problem.

**Component List: 1)** Twenty pin Power Logic Cable; **2)** Power Control board (inside the power supply); **3)** Power Logic Board; **4)** Functional Board[1]; **5)** Motherboard

[1] To prevent a "Cond Offset Failure" alarm place the machine into T and C Mode (refer to OPERATING MODES, page 19)

c) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it ("Select Program" → 'Dialysis' → 'Enter'). If a HEAT DISINFECT problem return to HEAT DISINFECT.

d) Measure again at the Power Logic board's **T5** TOP pin. If necessary, refer to Figure 44 (page 282). LESS THAN two (2.0) volts DC now?

Yes T5 LESS THAN 2.0 volts! The new component fixed the problem

No T5 between 2.0 and 28.0 volts! Repeat parts a through d until T5 is LESS than 2.0 volts DC.

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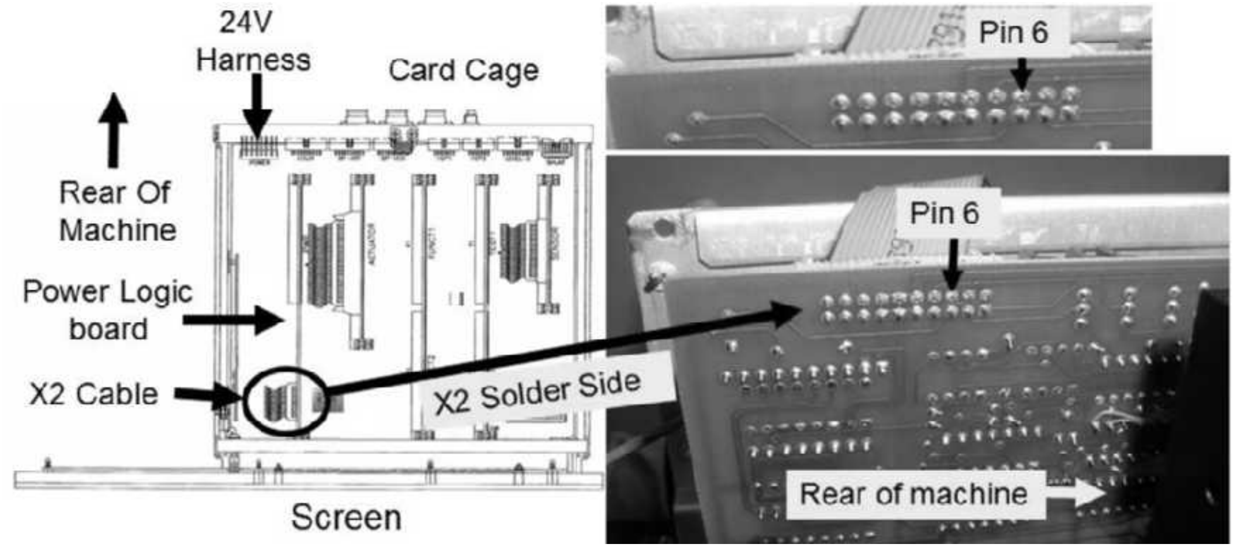
## T- 2.1.8 T5 LESS THAN 2.0 VOLTS

Per the Figure below, measure again at the Power Logic Board's X2 cable, **pin 6** (TOP row, three pins from the REAR of the machine). TWO (2) possible scenarios:

1) **IF (and ONLY if) 9.6 volts DC OR MORE:** Proceed to **page 295**, procedure number T- 2.6.0.

2) **IF LESS THAN 9.6 volts DC:** See procedure number T- 2.2.0 (page **292**).

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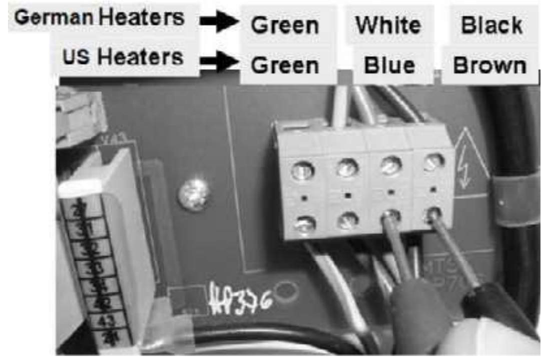
## T- 2.2.0 PIN 6 LESS THAN 9.5 VOLTS DC / ISOLATE POWER LOGIC BOARD

a) **Turn the machine OFF!**

b) Swap in a known good Power Logic Board.

c) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it ("Select Program" → 'Dialysis' → 'Enter'). If a HEAT DISINFECT problem return to HEAT DISINFECT.




d) Confirm your meter is set to AC voltage (~ V, $V_{AC}$).

e) Figure right, measure heater voltage again between the Heater Connectors BROWN and BLUE wires. More than 100 volts AC now?

Yes More than 100 volts AC! The heater is on! The previous Power Logic Board is bad. **IMPORTANT!** Return NTC #2's connector to the **1st** distribution board position from the left, "CON-NTC".

No Less than 100 volts AC! With the new Power Logic board in the heater is still off! See parts a THROUGH c below:

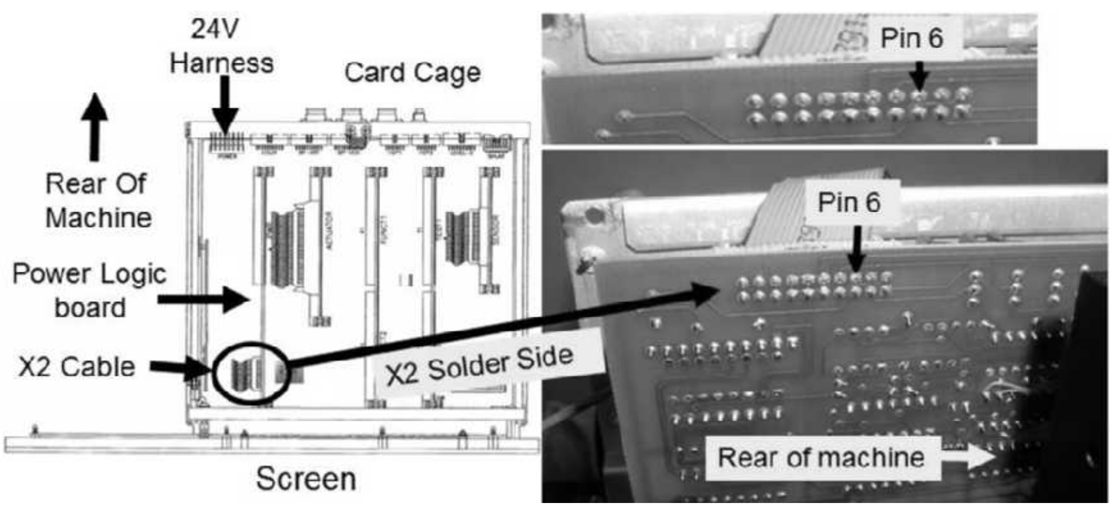
a) **Set your volt meter to DC voltage ($V_{DC}$).**

b) Confirm you connect the meter's black lead to chassis ground.

c) Figure below, measure AGAIN at the Power Logic Board's X2 cable, pin 6 (TOP row, three pins from the REAR of the machine). TWO (2) possible scenarios:

**1) IF (and ONLY if) 9.5 volts DC OR MORE:** This signal is good so the previous Power Logic Board is bad but the 'heater off' problem still exists. Return to **page 282**, procedure number T- 2.0.1 to check other relevant signals.

**2) IF less than 9.5 volts DC:** The signal continues to be 'bad'! See procedure number T- 2.2.1 (page 293).



## T- 2.2.1 LESS THAN 9.5 VOLTS AT PIN 6 / ISOLATE SENSOR BOARD

a) **Set your volt meter to AC voltage (~ V, $V_{AC}$)!**

b) **Turn the machine is OFF**.

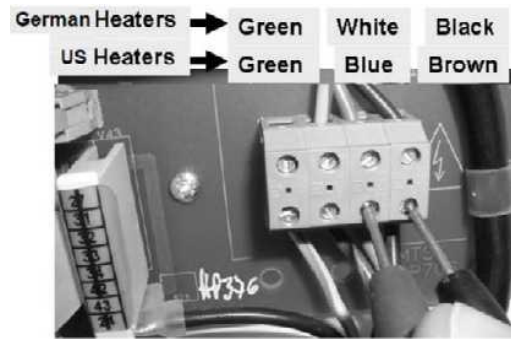
c) Swap in a known good Sensor Board*****. ***** To LOCATE the board see Figure 4A (page 10).

d) Enter Service Mode → Options → Hardware Options. Place the 'X' into the "Yes" box and press 'Enter'. The 'X' turns blue.

**T and C Mode** Yes ☒ No ☐

d) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it ("Select Program" → 'Dialysis' → 'Enter'). If a HEAT DISINFECT problem return to HEAT DISINFECT.

e) Figure right, measure again BETWEEN the Heater Connector's **BROWN** and **BLUE** wires! More than 100 volts AC now (Yes or No)?




Yes — More than 100.0 volts AC! The previous Sensor Board is bad! **IMPORTANT!** Return NTC #2's connector to the **1st** distribution board position from the left, "CON-NTC".

No — Less than 100.0 volts AC! The heater is still off! See parts a THROUGH c below:

a) **Set your volt meter to measure DC voltage ($V_{DC}$).**

b) Confirm the meter's black lead to chassis ground is connected.

c) Measure again at the Power Logic Board's X2 cable, pin 6 (TOP row, three pins from the REAR of the machine). TWO (2) possible scenarios:

**1) IF (and ONLY if) 9.5 volts DC or more:** This is a good signal so the previous Sensor Board is bad HOWEVER, the heater off problem still exists. See (ABOVE) procedure number T- 2.0.1 (page 282) to check other relevant signals.

**2) IF 9.4 volts DC or lower:** This signal continues to be 'bad' so the previous Sensor Board is probably good! See parts a THROUGH d below:

a) **CAUTION! Turn the machine OFF!**

b) Set the volt meter to measure **RESISTANCE (Ω)**. Measurement(s) will be taken at the SENSOR BOARD!

**Parts c and d next page**

c) Per the Figure below, measure at the back side of the SENSOR BOARD'S X2 connector at *pin 13* (bottom row, 7 pins from the rear of machine).

d) Figure right, does the meter's numeric <u>AND</u> units display read more than 12,000 **<u>Ω</u>** (12.0 **<u>KΩ</u>**)?


Yes — More than 12,000 Ω (12.0 **<u>KΩ</u>**)! See part A through D below:

A) Turn the machine OFF!

B) Swap in <u>known good</u> Power Logic board.

C) Place the machine in Heat Disinfect Program.

D) Set the meter to read AC and check for voltage again <u>BETWEEN</u> the Heater Connector's **<u>BROWN</u>** and **<u>BLUE</u>** wires. If the "no voltage to the heater" problem continues the motherboard may be a bad.

No — Less than 12,000 Ω! See parts a THROUGH c below:

a) ENSURE the machine was OFF prior to the measurement!

b) Referring to the Figure below, unplug the Sensor Board cable.

c) Repeat the measurement at the SENSOR BOARD'S X2 connector at pin 13. More than 12,000 Ω (12 **<u>KΩ</u>**) now?

Yes — More than 12,000 Ω. TWO (2) possible bad components; **1)** Bad Sensor Board cable OR; **2)** Bad distribution board.

No — The Sensor Board is bad

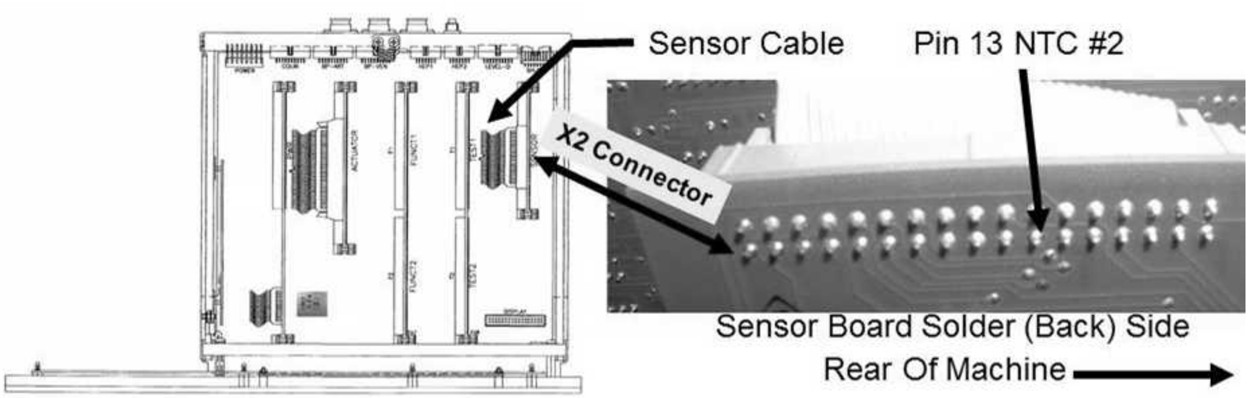



**Figure 46 – Sensor Board / NTC #2 Check**

## T- 2.6.0 HEATER VOLTAGE LESS THAN 10.0 VOLTS / ISOLATE POWER SUPPLY COMPONENTS

a) Turn the machine OFF and **UNPLUG** it. **CAUTION! Electrocution hazard if NOT unplugged!**

b) Figure below, open the power supply to see the Power Control board.

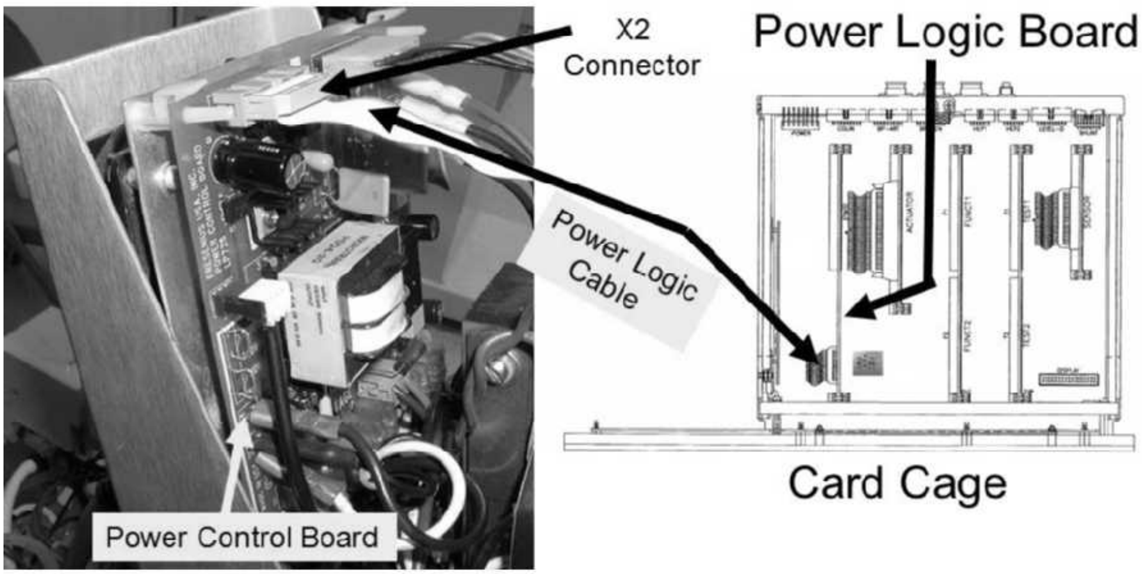



**Figure 47 – Power Control Board / Power Logic Cable**

c) Figure above, the 20-pin X2 Power Logic cable runs between the Power Control and Power Logic boards. TWO (2) checks:

**CHECK #1:** ENSURE it is plugged in securely at both ends!

**CHECK #2:** Inspect the cable's entire length. If damage is located replace the cable as this may be the problem!

d) See procedure number T- 2.6.2 (page 296).

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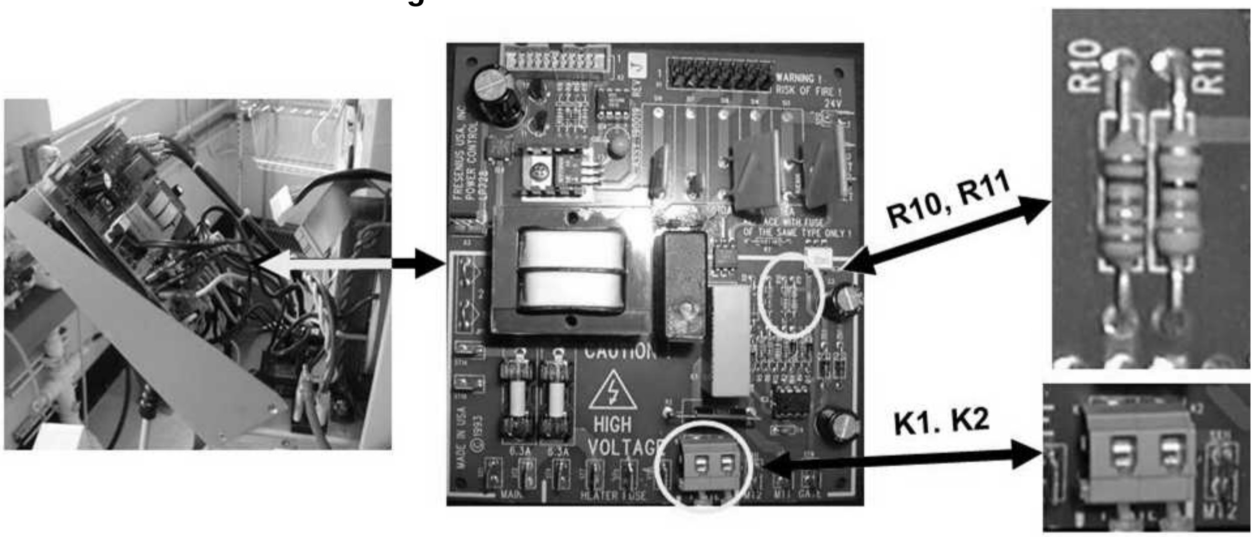
## T- 2.6.2 ISOLATE POWER CONTROL BOARD

A) Figure below, lay the power supply panel down to see the component side of the Power Control board.

**Figure 48 – Power Control Board**




B) **Per the Figure above**, TWO (2) checks:

**CHECK #1:** At connector K1 and K2, gently yank on both wires to ENSURE they are securely attached!

**CHECK #2:** Do resistors R10 and R11 show signs of burning?

Yes — Burning located! Replace BOTH the Power Control Board AND the Triac*. *To LOCATE the Triac refer to the Figure below.

No burning! See procedure number T- 2.6.5 (page 297).

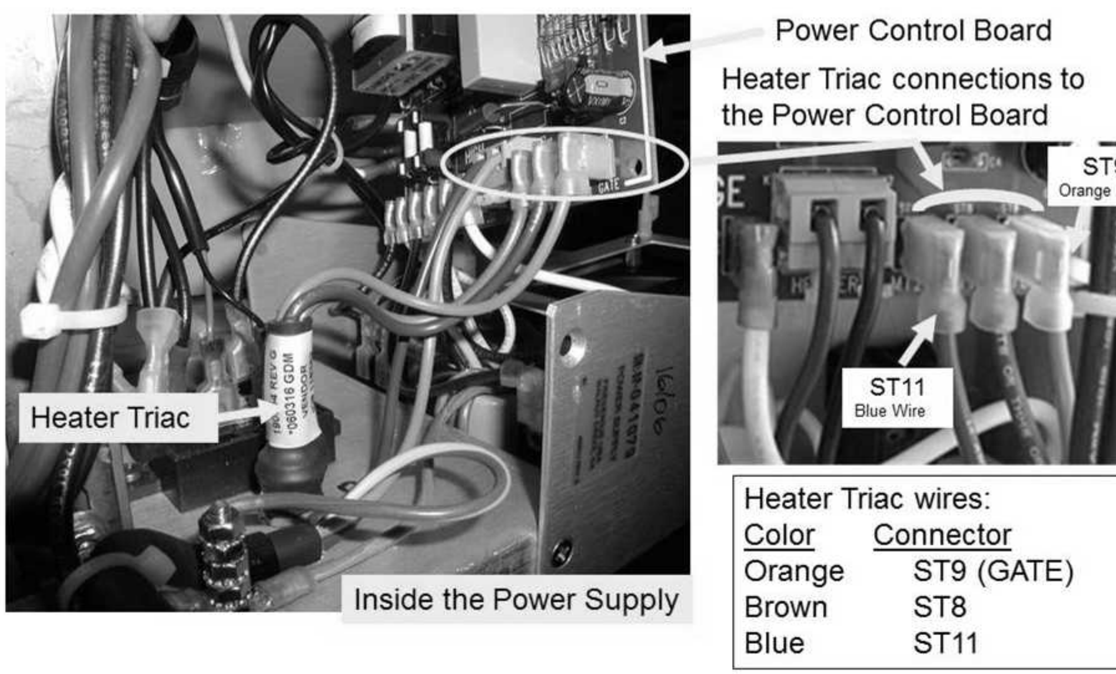



**Figure 49 – TRIAC LOCATION**

**T- 2.6.5 NO BURNING AT R10 AND R11 / ISOLATE HEATER SWITCH**

A) **Set your volt meter to RESISTANCE (Ω).**

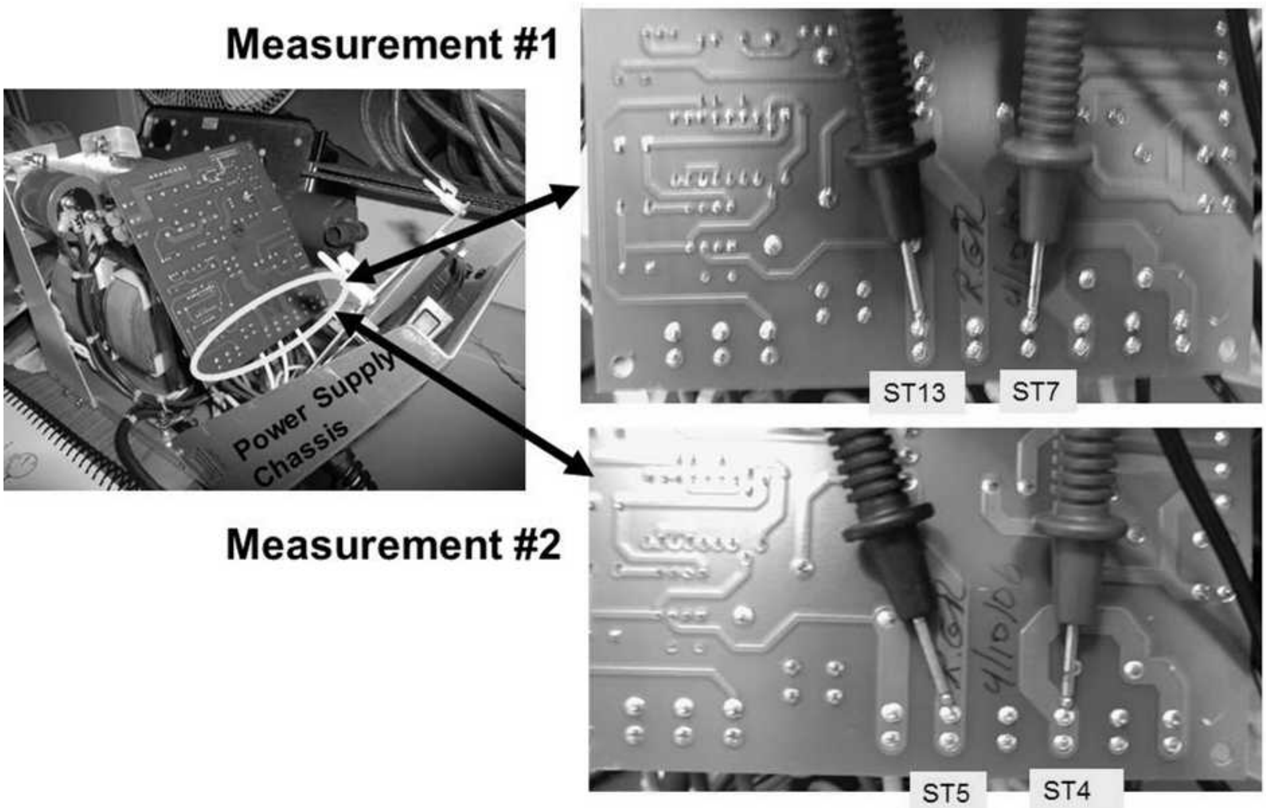
B) Remove the Power Control board from its white clips.

C) Lay the power supply panel down to see the rear (solder) side of the board.

D) **PER the Figure below**, TWO (2) measurements:

**Measurement #1:** BETWEEN ST13 AND ST7. Good = less than 2.0 Ω.

**Measurement #2:** BETWEEN ST5 AND ST4. Good = less than 2.0 Ω.




E) BOTH measurements LESS THAN 2.0 Ω?

Yes BOTH LESS than 2.0 Ω! The Heater Switch is OKAY! See procedure number T- 2.6.6 (page 298).

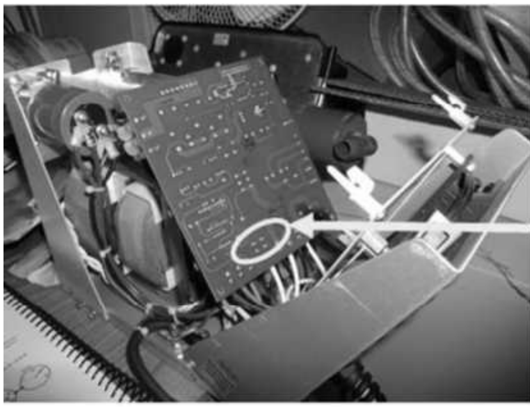
No One OR both MORE THAN 2.0 Ω! The Heater Switch is bad.

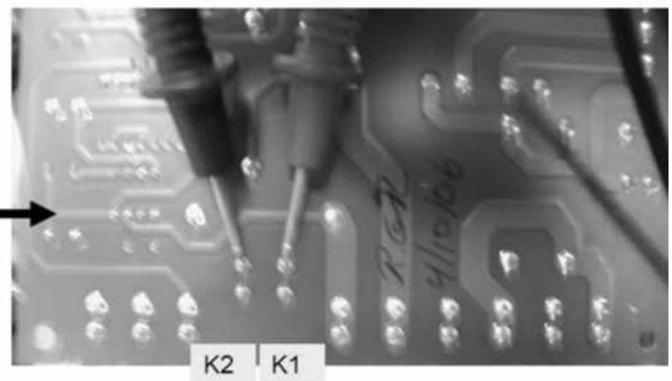
## T- 2.6.6 HEATER SWITCH OKAY / ISOLATE HEATER CONNECTIONS

**Per the Figure below**, measure BETWEEN K1 and K2. Between 9.0 and 15.0 **Ω**?

Yes Between 9.0 and 15.0 **Ω**! The Heater Connections are OKAY! See procedure number T- 2.6.7 (page 298).

No More than 15.0 **Ω**! Check the heater wires for a 'broken circuit' between the Power Control Board's K1 and K2 and the distribution board's Heater Connector.





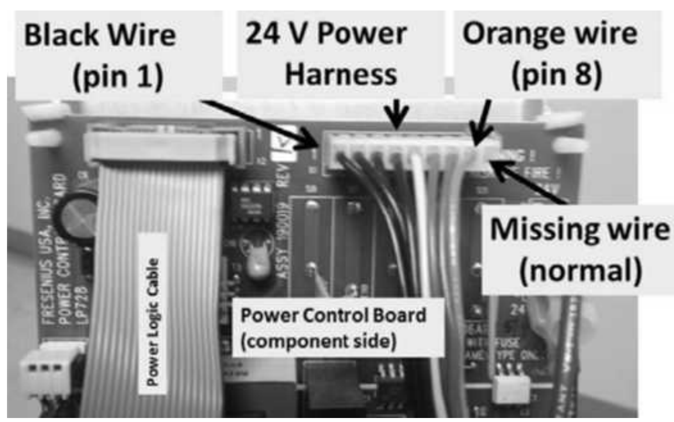

## T- 2.6.7 HEATER CONNECTIONS OKAY

a) Figure right, reattach all cables PROPERLY to the Power Control board!

b) Remount the Power Control board to its clips

c) Slide the power supply into the cabinet but do not bolt it in yet!

d) For now all Power Supply heater components are checking okay. See procedure number T- 2.6.8 (page 299).

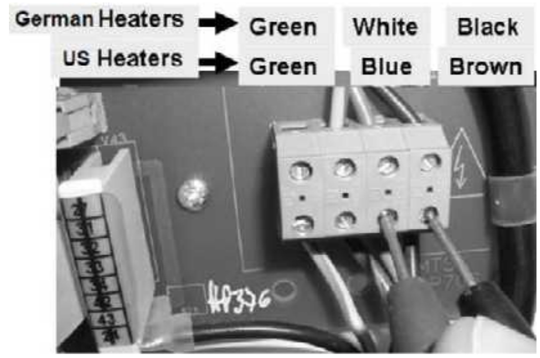


## T- 2.6.8 HEATER COMPONENTS SO FAR OKAY

a) If troubleshooting a Dialysis Program problem return to DIALYSIS PROGRAM ("Select Program" → 'Dialysis' → 'Enter'). If a Heat Disinfect problem return to HEAT DISINFECT.

b) **Set your volt meter to AC voltage (~ V, $V_{AC}$).**

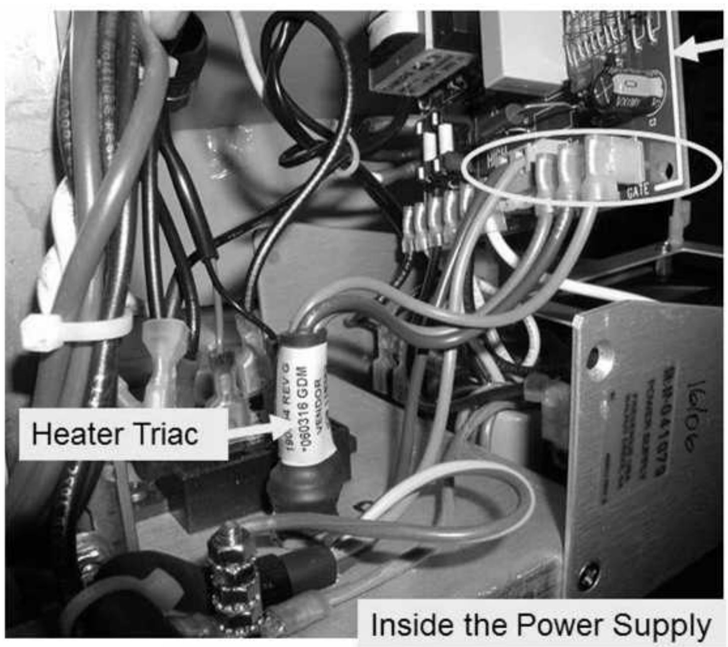
c) Figure right, at the distribution board's Heater Connector, measure again BETWEEN the **BLUE** and **BROWN** wires! More than 100 volts AC now?



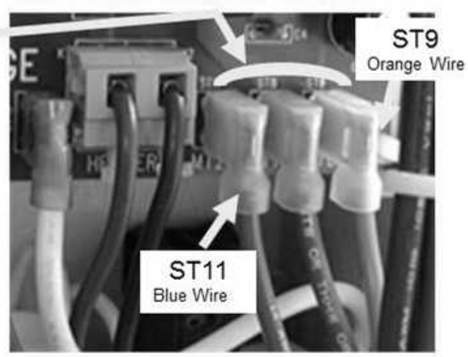

Yes More than 100 volts! The heater is on! See (ABOVE) procedure number T- 2.0.4 (**page 284**).

No THREE (3) possible bad components (see Component List below). With the machine off swap them in, one at a time, THEN in between return to procedure number T- 2.6.8 (page 299) to test the new component until the heater is on!

**Component List: 1)** 20-pin (X2) Power Logic cable; **2)** Triac (see Figure below); **3)** Power Control board (inside the power supply).




Heater Triac connections to the Power Control Board




Heater Triac wires:

| Color | Connector |
|---|---|
| Orange | ST9 (GATE) |
| Brown | ST8 |
| Blue | ST11 |

## T- 3.0.0 IN HEAT DISINFECT TEMPERATURE DID NOT REACH 80° C

a) Without screwing in the rear panels, install the hydraulics into the cabinet.

b) Place the machine into HEAT DISINFECT.

c) Watch the screen's **[Temperature]** window for fifteen (15) minutes **OR** until if it increases to 50° C or more. TWO (2) possible scenarios:

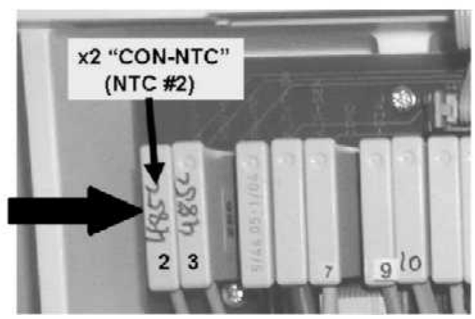
**1)** **IF (and ONLY if) [Temperature] NEVER reaches at least 50° C:** See procedure number T- 3.0.1 (page 300).

**2)** **IF [Temperature] INCREASES to 50° C or more:** Allow twenty (20) minutes OR until if Heat Disinfect finishes. TWO (2) possible scenarios i) or ii) below:

**i)** **IF (and ONLY if) [Temperature] DOES NOT reach 80° C OR does but then falls and REMAINS less than 79° C for at least three (3) minutes:** See procedure number T- 3.0.1 (page 300).

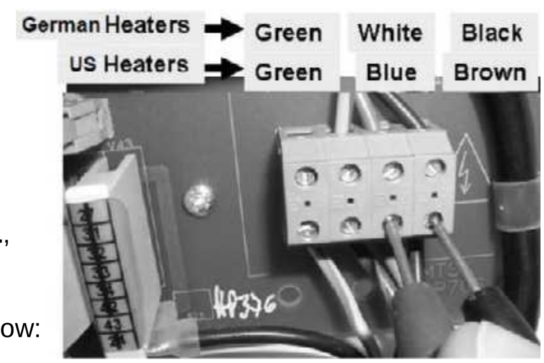
**ii)** **IF [Temperature] reaches and remains 80° C or more:** The machine may have turned itself off. The problem ("Temperature does not reach 80° C) is no longer occurring!

## T- 3.0.1 ISOLATE HEATER VOLTAGE




a) Figure right, unplug the connector from the **1st** distribution board position from the left, "CON-NTC". This is NTC #2's connector and unplugging it should turn the heater on!

b) **Set your CALIBRATED volt meter to AC voltage (~ V, $V_{AC}$)!**




c) Figure right, measure at the distribution board's Heater Connector, between the **BROWN** and **BLUE** wires.

d) TWO (2) possible scenarios:

**1)** **IF (and ONLY if) LESS THAN 100.0 volts AC!** Leaving NTC #2 unplugged, proceed to **page 281**, procedure number T- 2.0.0.

**2)** **IF more than 100.0 volts AC:** See parts a AND b below:

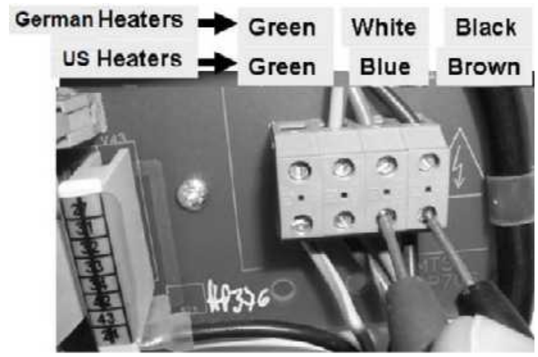
a) Return NTC #2's connector to the **1st** distribution board position from the left "CON-NTC".

b) See procedure number T- 3.0.2 (page 301).

## T- 3.0.2 ISOLATE HEATER RESISTANCE

a) **Turn the HEATER Switch OFF!**

b) Confirm you set the volt meter to RESISTANCE (Ω).




c) Figure right, measure again at the Heater Connector, between the **BLUE** and **BROWN** wires. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) less than 8.0 Ω OR more than 13.0 Ω:** ENSURING the HEATER Switch was OFF before measuring, the heater* is bad. * To LOCATE the heater, refer to Figure 28 (page 140).

**2)** **IF between 8.0 and 13.0 Ω:** See parts a THROUGH c below:

a) **Turn the HEATER Switch on!**

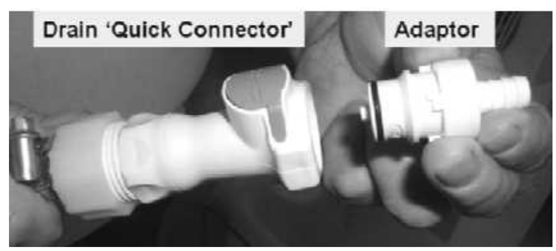
b) To prevent issues with Pre Rinse, allow the screen's TOP **[Remaining Prerinse Time]** window = 0:00


c) ENSURING the HEATER Switch is on AND **[Remaining Prerinse Time]** = 0:00, see procedure number T- 3.0.3 (page 301).

## T- 3.0.3 ISOLATE RECIRCULATION

When **[Remaining Prerinse Time]** = 0:00 drain Valve #30 closes and Valve #29 opens resulting in no drain flow. If Valve #30 is sticking open Heat Disinfect can take a long time to reach 80° C!

a) Reference figure on right, if a 'Quick Connector' is present at the end of the 'to drain tubing' an **adaptor** is required.




b) Watching drain flow, allow forty five (45) seconds THEN watch for thirty (30) seconds. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) drain flow HAS stopped:** This is normal! Reconnect the drain THEN see procedure number **T- 3.0.4** (page 302).

**2)** **IF drain flow DID NOT stop:** This may or may not cause this temperature problem but must be fixed before continuing! Perform parts a through c below:

a) Turn the machine OFF and swap in a known good, Valve #30*. *To LOCATE Valve #30 refer to Figure 35 (page 211).

b) Place the machine into RINSE until it finishes i.e.**[Remaining Time]** = 0:00.

c) Return to Heat Disinfect! ENSURING **[Remaining Prerinse Time]** = 0:00 is there drain flow now (Yes or No)?

Yes ↕ No

Yes — Drain Flow continues! **Read this before performing!** The previous Valve #30 is probably good. The Actuator-Test Board is bad*. After replacing the board with a known good return to (ABOVE) procedure number T- 3.0.0 (page 300) to see if this fixes the temperature problem! *To LOCATE the board refer to Figure 4A (page 10)

No — Drain flow stopped! Return to (ABOVE) procedure number T- 3.0.0 (page 300) to see if this fixes the temperature problem.

## T- 3.0.4 DRAIN FLOW STOPPED / PREPARE TO MEASURE 'ACTUAL' TEMPERATURE

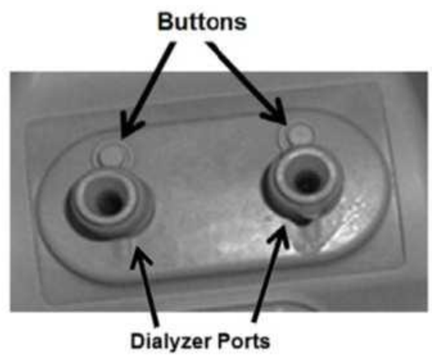
a) **IMPORTANT!** Press 'Esc' then 'Enter' twice to call the "Select Program" screen.

b) Remove the dialyzer lines from the shunt and attach them to a calibrated Temperature (°C) meter*****.

* **CAUTION!** DO NOT USE a Mesa® NEO-1 as it CANNOT measure temperature more than 40°C. The NEO-2 and most other meters can be used! Refer to the meter's Operator's Manual!

c) Figure right, under the shunt door locate the spring-loaded buttons

d) See procedure number T- 3.0.5 (page 302).


## T- 3.0.5 HEAT DISINFECT / MEASURE 'ACTUAL' TEMPERATURE

This procedure simulates the dialyzer connectors in the shunt door to allow the Heat Disinfect to start!

a) With your right hand PUSH IN AND HOLD BOTH buttons.

b) While CONTINUING TO HOLD the buttons CLOSE THE DOOR over your hand.

c) With your left hand, press the screen's **HEAT DISINFECT** button to start HEAT DISINFECT.

d) While CONTINUING TO HOLD the buttons open the door!

e) WITHOUT closing the door RELEASE the buttons.

f) The "Cover is Open" banner appears! A "Flow Recirc Error" may occur but MUST go away within forty five (45) seconds!

g) ENSURING the flow indicator's 'bob' is moving up and down, see procedure number T- 3.0.6 (page 303).

## T- 3.0.6 VERIFY TEMPERATURE

a) "No Water" OR Flow Error alarms turn the heater off! From here forward, if (and ONLY if) either occurs address the alarm first!

b) Allow fifteen (15) FULL minutes **OR** until if the external meter reads 50° C or more. Based on the external meter reading, TWO (2) possible scenarios below:

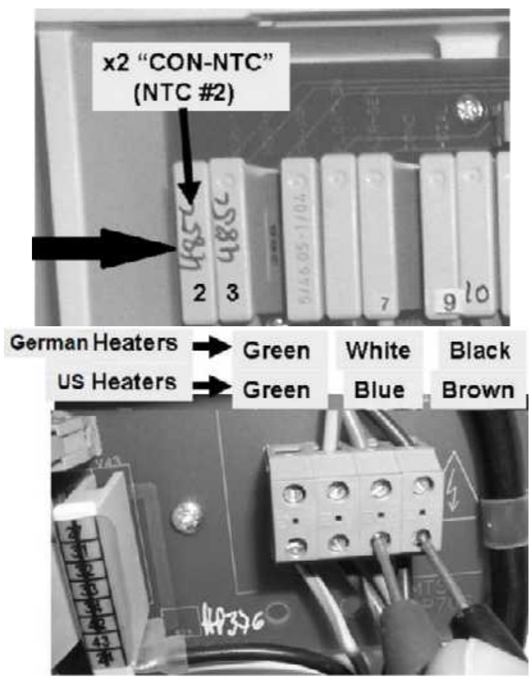
**1)** **IF (and ONLY if) DOES NOT achieve 50° C or more:** See procedure number T- 3.0.7 (page 303).

**2)** **IF 50° C or more:** Allow up to fifteen (15) minutes longer. TWO (2) possible scenarios i) or ii) below:

**i)** **IF (and ONLY if) the meter NEVER ACHIEVES 80° C OR does but then falls and REMAINS less than 79° C for three (3) minutes:** See procedure number T- 3.0.7 (page 303).

**ii)** **IF the meter STAYS at 80° C or more:** Proceed to **page 305**, procedure number T- 3.0.9.

## T- 3.0.7 NEVER 80° C / ISOLATE HEATER VOLTAGE




a) Figure right, unplug the connector from the **1st** distribution board position from the left, "CON-NTC". This is temp control sensor's NTC #2's connector!

b) ENSURE the HEATER Switch is on.

c) **Set your volt meter to AC voltage (~ V, $V_{AC}$)!**

d) Figure right, measure at the distribution board's Heater Connector BETWEEN the **BLUE** and **BROWN** wires. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) less than 20 volts AC:** Leaving NTC #2 unplugged, proceed to **page 281**, procedure number T- 2.0.0.

**2)** **IF more than 100 volts AC:** Leaving NTC #2 unplugged, perform parts a AND b below:

a) **CAUTION!** To avoid damage DO NOT leave the machine. The external meter MUST NOT be allowed to go higher than 95° C.

b) Watch the external meter for up to fifteen (15) minutes OR until if it achieves more than 80° C?

Yes 80° C or more! The Heater is good! See procedure number T- 3.0.8 (page 304).

No Does NOT achieve 80° C or more! Either incoming water is extremely cold (less than 12° C) OR you made an error and Heater voltage is NOT more than 100 volts AC OR the Heater is bad!

## T- 3.0.8 HEATER IS GOOD / TROUBLESHOOT HEAT DISINFECT 'ACTUAL' TEMPERATURE

a) **To avoid damage, turn the machine OFF!**

b) One of the listed components (see COMPONENT LIST below) may be bad. Swap in one, starting with NTC #2 then, in between, perform parts c through h to test the new component.

**COMPONENT LIST: 1)** NTC #2[1] **2)** Actuator-Test Board[2] ; **3)** Sensor Board[2, 3]; **4)** Functional Board[2, 3]; **5)** Motherboard[2].

[1] To LOCATE NTC #2 refer to Figure 42 (page 236)

[2] To LOCATE the boards see Figure 4A (page 10)

[3] Calibrate Temperature Control AND Cond Cells before testing these components!

c) Return to **HEAT DISINFECT** without the Temperature meter attached for now.

d) **BEFORE continuing to part e, allow the screen's [Remaining Prerinse Time] window = 0:00.**

e) Connect the Temperature meter to the dialysate lines as previously described.

f) ENSURING the flow indicator's 'bob' is moving up and down in the sight tube, check distribution board Heater Connector heater voltage (more than 100 volts AC) between each component!

g) Allow thirty (30) minutes OR until if the external meter's reading maintains 80° C or more before continuing to part h!

h) Based on the external meter's reading, TWO (2) possible scenarios:

1) **IF (and ONLY if) achieves 80° C or more:** The new component fixed the problem! If a Functional or Sensor Board was replaced perform all calibrations.

2) **IF does NOT reach 80° C:** Repeat procedure number T- 3.0.8 (page 304) swapping in known good component from the list, one at a time, until the meter achieves 80° C or more. When (and NOT until) the meter reaches 80° C or more see procedure number T- 3.0.9 (page 305).

## T- 3.0.9 METER TEMPERATURE REACHES 80° C / ISOLATE DISPLAY

ENSURING the meter's reading maintains at 80° C or more, TWO (2) possible scenarios:

1) **IF (and ONLY if) the screen's [Temperature] window is 80° C or more:** The temperature problem is no longer occurring!

2) **IF the screen's [Temperature] window is NOT 80° C or more:** Perform parts a THROUGH h below:

   a) **To avoid damage, turn the machine OFF!**

   b) One of the listed components (see COMPONENT LIST below) may be bad. Swap in one, starting with NTC #3, then perform parts c through h to test the new component.

      **COMPONENT LIST: 1)** NTC #3[1]; **2)** Sensor Board[2, 3]; **3)** Functional Board[2, 3]; **4)** Motherboard[2]

      [1] To LOCATE NTC #3 refer to Figure 42 (page 236)

      [2] To LOCATE the boards see Figure 4A (page 10)

      [3] Calibrate Temperature Control AND Cond Cells before testing these components!

   c) Return to **HEAT DISINFECT** without the Temperature meter attached for now.

   d) **BEFORE continuing to part e, allow the screen's [Remaining Prerinse Time] window = 0:00!**

   e) Connect the Temperature meter to the dialysate lines as previously described!.

   f) ENSURE the flow indicator's 'bob' is moving up and down in the sight tube!

   g) Allow up to thirty five (35) minutes OR until if the meter's reading achieves 80° C or more before continuing to part h!

   h) Based on the external meter reading, TWO (2) possible scenarios:

      **1) IF (and ONLY if) the meter does NOT reach 80° C or does NOT maintain at 80° C or more:** Return to (ABOVE) procedure number T- 3.0.6 (page 303).

      **2) IF the meter reaches AND maintains 80° C or more, TWO (2) possible scenarios i or ii:**

         i) **IF (and ONLY if) the screen's [Temperature] display reaches 80° C or more:** The new component fixed the problem.

         ii) **IF the [Temperature] display does NOT reach 80° C:** Repeat procedure number T- 3.0.9 (page 305) parts a THROUGH h until the **[Temperature]** display does reach 80° C.

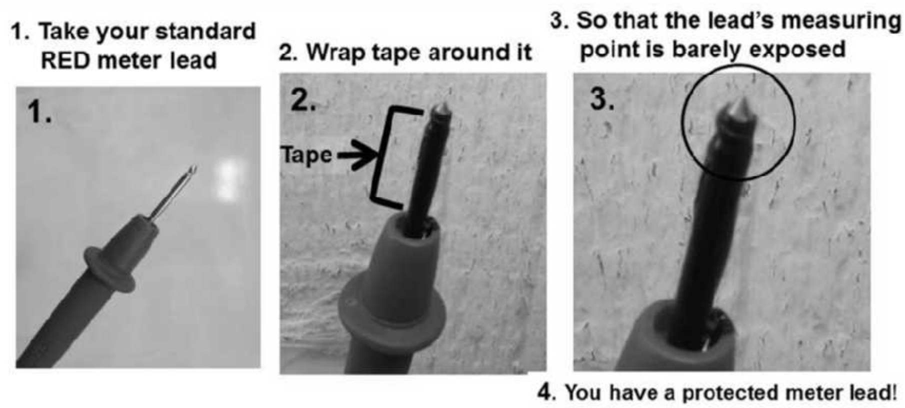
## T- 4.0.0 TEMPERATURE EXCEEDS 39.0° C / ISOLATE TEMPERATURE CONTROL

a) So as NOT to pull cables loose, **GENTLY** open the card cage.

b) **Set your CALIBRATED volt meter to DC volts ($V_{DC}$)!**

c) Confirm you attach the meter's black lead to chassis ground (see Figure 2, page 4).

d) **CAUTION!** A signal is about to be measured from a pin that is VERY close to others and touching pins together with a standard meter lead may cause massive DAMAGE. As directed below, make your RED meter lead PROTECTED. **DO NOT CONTINUE UNTIL YOU HAVE DONE THIS**




e) Per the Figure below, at the top of the Power Logic Board, closest to the screen, locate its 20-pin X2 cable.

f) Measure at **pin 6** (TOP row, 3 pins from the rear of machine). TWO (2) possible scenarios:

1) **IF (and ONLY if) more than 1.0 volts DC:** See procedure number T- 4.0.1 (page 307).

2) **IF less than 1.0 volts DC:** Proceed to **page 310**, procedure number T- 4.3.0.

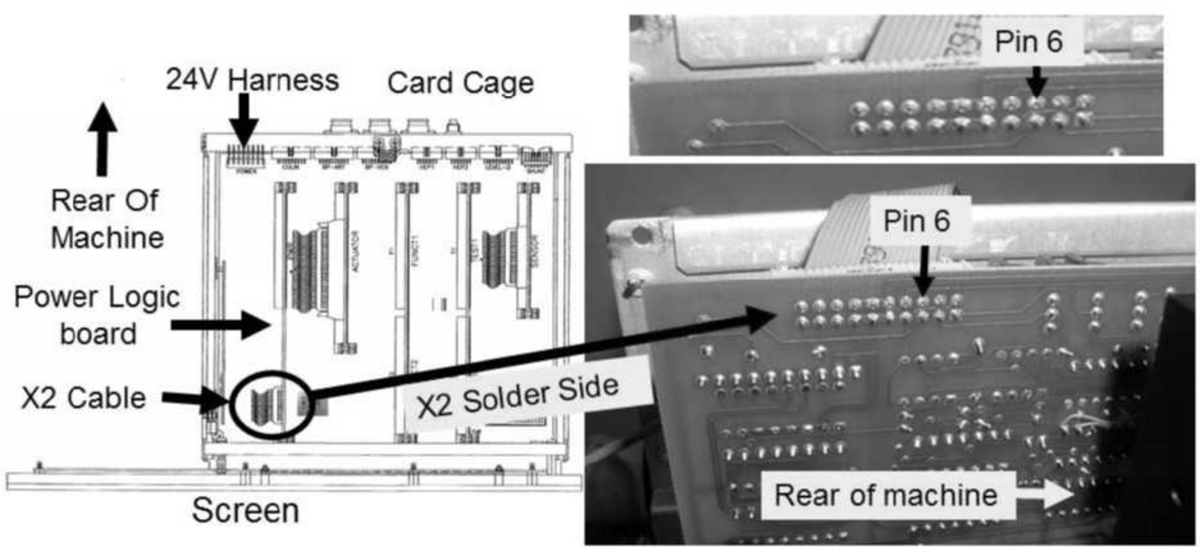



**Figure 50 – Power Logic Board X2 / Pin 6**

## T- 4.0.1 PIN 6 MORE THAN 1.0 VOLTS DC / ISOLATE POWER LOGIC BOARD

a) **To prevent damage, turn the machine OFF!**

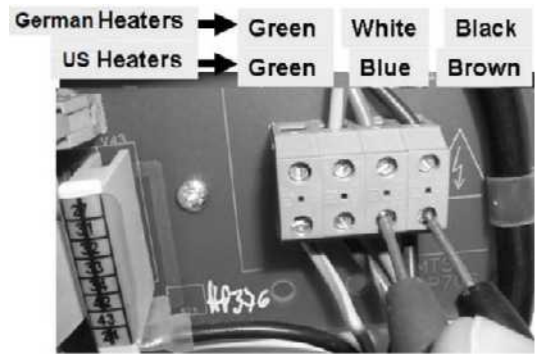
b) Swap in a known good* Power Logic Board**. ** To LOCATE the board see Figure 4A (page 12)

* Known good = tested in another machine that does not allow temperature to exceed 39°.0 C!

c) **Set your volt meter to measure AC voltage (~ V, $V_{AC}$).**

d) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

e) Figure right, measure at the distribution board's Heater Connector, between the **BLUE** and **BROWN** wires. TWO (2) possible scenarios:




**1)** **IF (and ONLY if) more than 100.0 volts AC:** See procedure number T- 4.0.2 (page 307).

**2)** **IF less than 10.0 volts AC:** Problem solved! The previous Power Logic Board is bad.

## T- 4.0.2 ISOLATE THE SENSOR BOARD

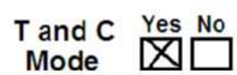
**NOTE:** The previous Power Logic Board is probably good!

a) **To prevent damage, turn the machine OFF!**

b) Swap in a known good Sensor Board*. * To LOCATE the board see Figure 4A (page 10)

c) Enter Service Mode → Options → Hardware Options.

d) Set **T and C Mode** to "Yes" and press 'Enter'. The 'X' turns blue!




e) Turn the machine OFF!

f) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

g) From the Home screen, ENSURING [**Temperature]** is less than 40,0° C, again measure BETWEEN the Heater Connector's **BLUE** and **BROWN** wires. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) more than 100.0 volts AC:** See procedure number T- 4.0.4 (page 308). **NOTE:** The previous Sensor Board is probably good.

**2)** **IF less than 10.0 volts AC:** Problem solved! The previous Sensor Board is bad. Perform parts A through C below:

A) Return to Service Mode → Options → Hardware Options.

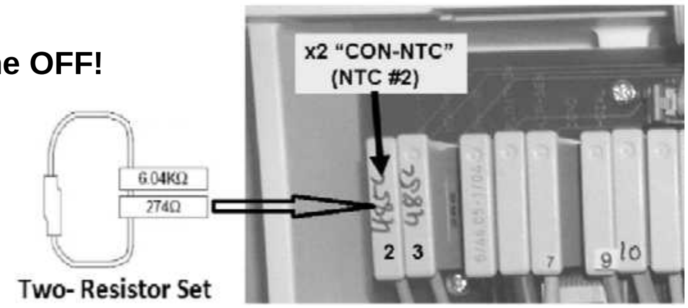
B) Set **T and C** mode to "No".

C) Perform ALL calibrations.

## T- 4.0.4 ISOLATE NTC #2 CONNECTIONS

a) **To prevent damage, turn the machine OFF!**

b) Per the Figure right, place the **<u>274 Ω</u>** plug, from the **<u>TWO-RESISTOR SET</u>**, into the **1st** distribution board position from the left, "CON-NTC".




c) **Set your volt meter to measure resistance (Ω)**

d) **Attach the meter's black lead to chassis ground!**

e) Per Figure 51 below, measure at the solder side of <u>SENSOR BOARD'S</u> 'X2' connector at *pin 13* (bottom row, 7 pins from the rear of machine).

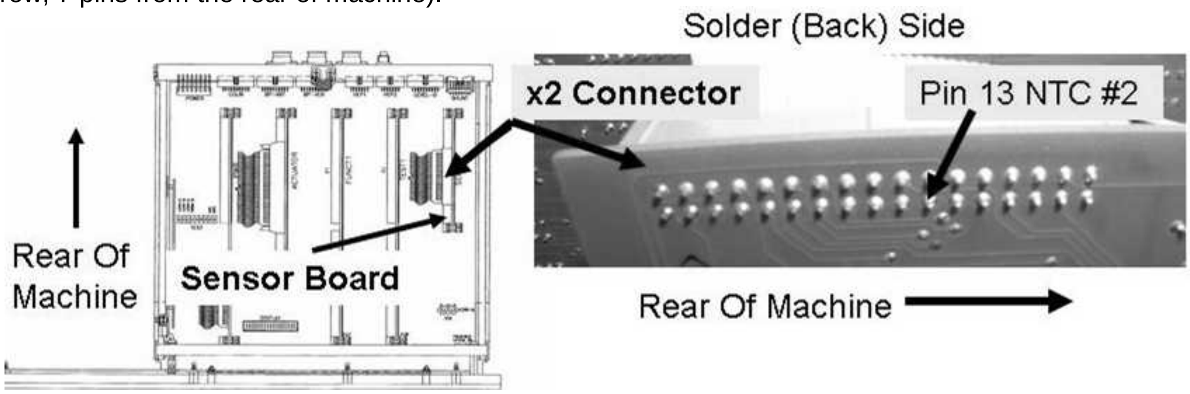
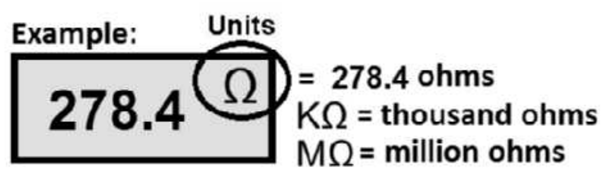



**Figure 51 – NTC #2 Checks**

f) Figure right, reading the meter's numeric <u>AND</u> units display, TWO (2) possible scenarios:




**1)** **IF (and ONLY if) LESS THAN 300 <u>Ω</u> (0.300 <u>KΩ</u>):** ENSURING the machine was OFF before measuring <u>AND</u> assuming all procedures were performed correctly the mother board may be bad.

**2)** **IF more than 300 <u>Ω</u>:** Perform parts a THROUGH d below:

a) ENSURE the machine was OFF prior to the measurement!

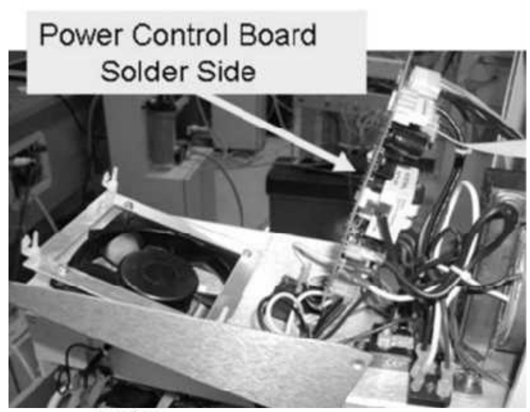
b) <u>ENSURE</u> the **<u>274 Ω</u>** plug, from the **<u>TWO-RESISTOR SET</u>**, is placed properly in the **1st** distribution board positon from the left, "CON-NTC"! If not, repeat procedure number T- 4.0.4 (page 308).

c) ENSURE the meter was set to resistance (**Ω**) <u>AND</u> its black lead was connected to chassis ground If not, repeat procedure number T- 4.0.4 (page 308).

d) TWO (2) possible bad components: 1) Sensor Board***** cable OR; 2) Distribution board.

*NOTE! The Sensor Board cable can be checked!  <u>**NOTE**</u> that one (1) **NTC #2** connection will be checked and proceed to **page 569**, SECTION 17- CHECKING THE SENSOR BOARD CABLE.

**T- 4.3.0 PIN 6 LESS THAN 1.0 VOLT / ISOLATE FOR A 'SHORTED' HEATER TRIAC**




a) Turn the machine OFF and **UNPLUG** it! **CAUTION! Electrocution hazard if not unplugged!**

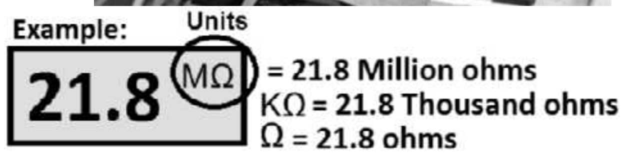
b) Figure right, lay the Power Supply's rear panel down.

c) Remove the Power Control board from the white plastic clips to access the board's rear (solder) side.

d) **Set your volt meter to resistance (Ω)!**

e) As seen in the Figure below, measure BETWEEN connectors ST 8 and ST 11.

f) Figure right, reading the meter's numeric AND units display, TWO (2) possible scenarios:




1) **IF MORE THAN 10 Million ohms (10.0 MΩ), possibly "OL":** ENSURE the Heater Switch REMAINS ON, see procedure number T- 4.4.0 (page 311).

2) **IF LESS THAN 10 Million ohms (10.0 MΩ) most likely WAY less (example: 300 Ω):** See parts a AND b below:

   a) Return NTC #2 to the **1st** position from the left, "CON-NTC".

   b) TWO (2) possible bad components: **1)** Bad Triac***** OR; **2)** Bad Power Control Board.

      ***** To LOCATE the Triac trace the brown and blue wires connected to ST8 and ST11 to it! **CAUTION!** The Triac's wires are position sensitive! Plugging into the wrong terminal can damage the Power Control board or the new Triac

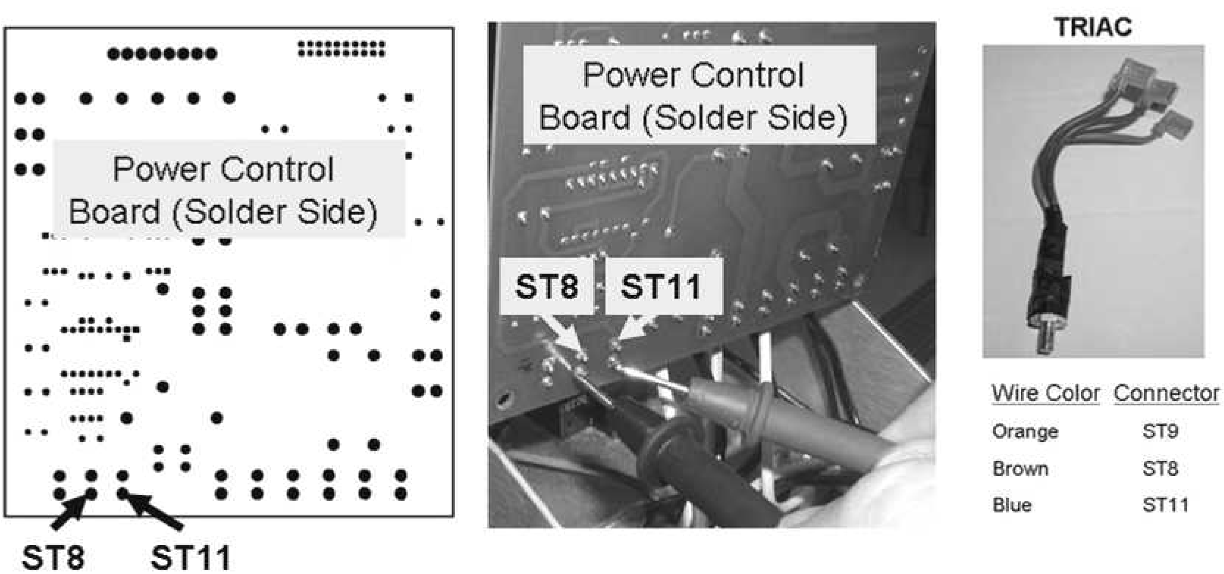


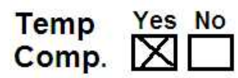

**Figure 52 – Solder Side Power Control Board / Triac Wiring**

## T- 4.4.0 CHECK TEMP DISPLAY CALIBRATION (1)

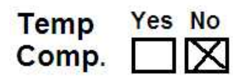
a) Place the machine into Service Mode → Options → Hardware Options.

b) Does the ‘Yes’ box at ‘**Temp Comp**’ have a blue ‘X’ in it?

Yes Place the ‘X’ in the “No” box and press ‘Enter’ (the ‘X’ turns blue). Post a note that ‘**Temp Comp**’ is off then see procedure number T- 4.4.1 (page 311).




No Temp Comp = No! See procedure number T- 4.4.1 (page 311).




## T- 4.4.1 CHECK TEMP DISPLAY CALIBRATION (2)

a) From the Service screen menu → Calibrate Sensors → Temp Control.

b) Press ‘Enter’ TWICE. The screen’s **[TEMP DAC]** data box turns pale yellow / white.

c) Press **[TEMP DAC].** It turns bright yellow and set its value to “20”

d) Press ‘Enter’. **[TEMP DAC]** returns to pale yellow / white.

e) **Set your volt meter to AC voltage (~ V, $V_{AC}$).**

f) Allow the screen’s **[Monitor Reference]** data box drop to 39.0° C or less.

g) Measure again at the distribution board’s Heater Connector between the **BLUE** and **BROWN** wires. More than 100.0 volts AC now?

Yes More than 100.0 volts AC! See procedure number T- 4.5.0 (page 312).

No Less than 10 volts! See parts a through c below:

a) Press the **[TEMP DAC]** window and set it to “130”!

b) Save the calibration.

c) Proceed to **page 320**, procedure number T- 7.0.0.

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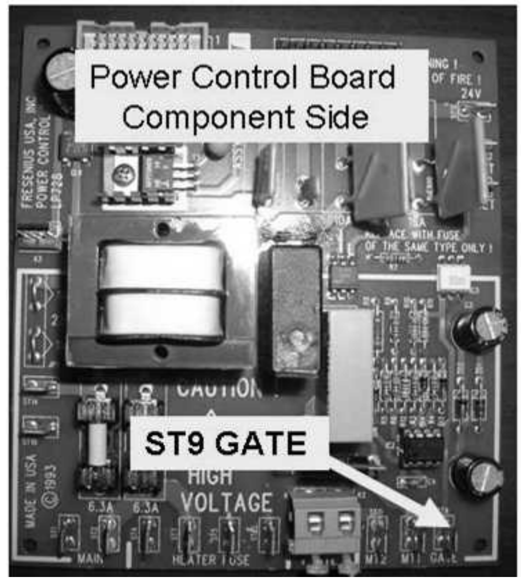
**T- 4.5.0 ISOLATE TRIAC / POWER CONTROL BOARD**




a) Turn the machine OFF and **UNPLUG** it. **CAUTION! Electrocution hazard if not unplugged!**

b) Figure right, unplug the Triac's orange wire from the Power Control board's GATE connector ST 9.

c) To avoid **damage** wrap black tape **around** the Triac's **female** orange wire terminal!

d) Plug the machine in. **CAUTION! High voltage now present!**

e) Turn the machine on!

f) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

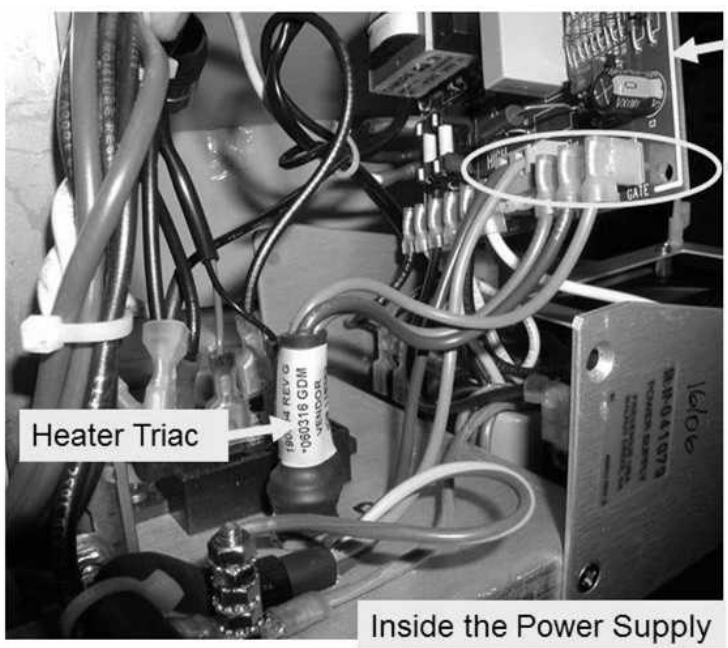
g) From the Home screen, allow [**Temperature**] to fall to below 39°.0 C

h) Measure at the Heater Connector between the **BLUE** and **BROWN** wires. More than 100 volts AC?

Yes More than 100.0 volts AC! **Electrocution hazard if the machine is NOT unplugged before continuing!** The Triac* is bad. *To LOCATE the Triac refer to the Figure below.

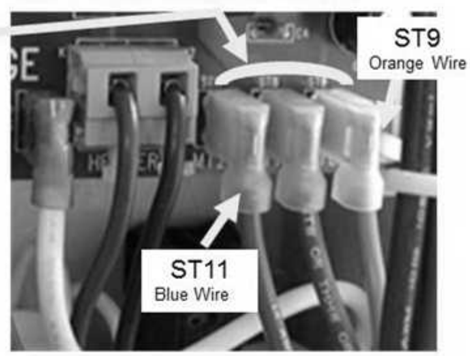
No **Electrocution hazard if NOT unplugged before continuing!** The Power Control Board (inside the power supply) is bad.

## HEATER TRIAC LOCATION (inside the power supply)




Power Control Board

Heater Triac connections to the Power Control Board

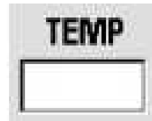



Heater Triac wires:

| Color | Connector |
|---|---|
| Orange | ST9 (GATE) |
| Brown | ST8 |
| Blue | ST11 |

## T- 5.0.0 CHECK TEMP (SCREEN 4)

From debug screen 4, is **TEMP** LESS THAN 1.0?




Yes **TEMP** is less than 1.0! See procedure number T- 5.0.1 (page 313).

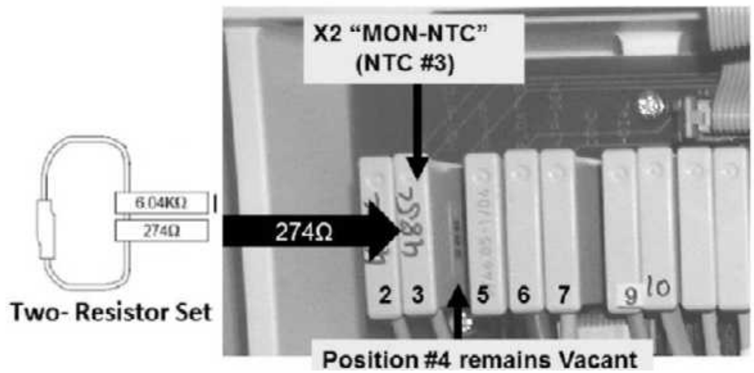
No **TEMP** is more than 1.0! Proceed to **page 315**, procedure number T- 5.0.3.

## T- 5.0.1 TEMP LESS THAN 1.0

a) Turn the machine OFF!

b) Open the card cage.

c) Figure right, now place the **274 Ω** from the **TWO-RESISTOR SET** in the **2nd** distribution board position from the left, "MON-NTC".




d) **Set your <u>CALIBRATED</u> volt meter to resistance (Ω).**

e) **Connect the meter's black lead to chassis ground (see Figure 2, page 4).**

f) Per Figure 53 below, measure at the solder side of Sensor Board's 'X2' connector at *pin 12* (top row, 6 pins from the rear of the machine).

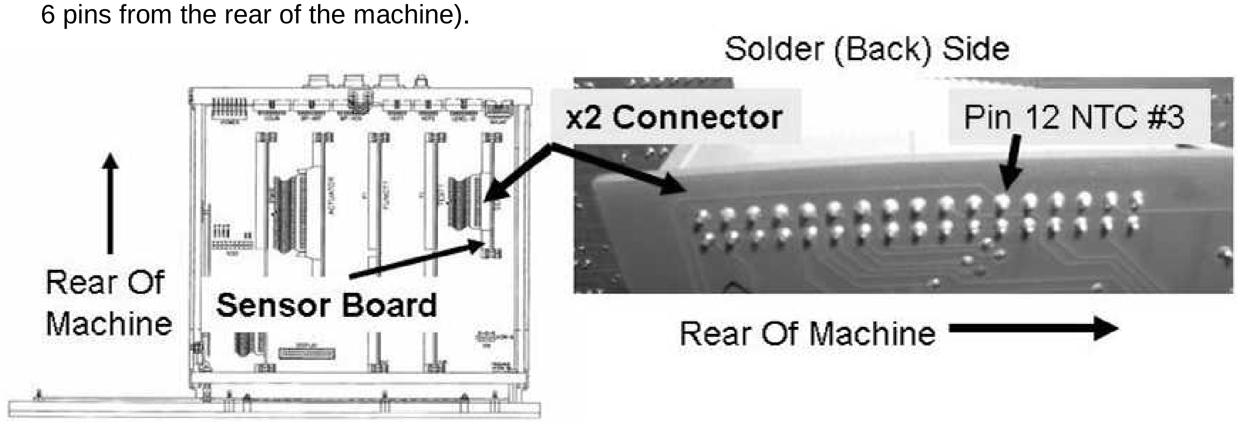
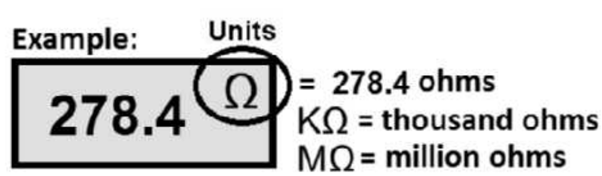



**Figure 53 – NTC #3 Checks**

g) Figure right, reading the meter's numeric <u>AND</u> units display <u>LESS than</u> 300 **Ω** (Yes or No)?



Yes LESS than 300 Ω! See procedure number T- 5.0.2 (page 314).

No MORE than 300 Ω! ENSURING the machine was OFF, prior to measuring, see parts a THROUGH d below:

a) ENSURE the **274 Ω** plug, from the **TWO-RESISTOR SET**, is in the **2nd** position, from the left, “MON-NTC”.

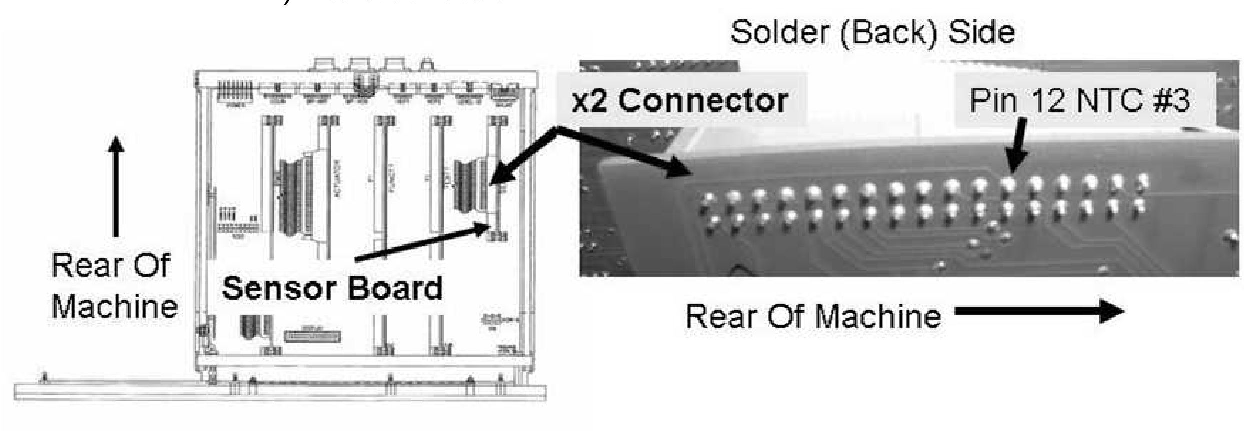
b) ENSURE the plug is aligned with the other connectors.

c) Use the **274 Ω** plug from a different **TWO-RESISTOR SET!**

d) Per the Figure below, measure again at pin 12 ENSURING good contact with the pin! Is the meter’s numeric AND units display less than 300 **Ω** now (Yes or No)?

**Yes** LESS than 300 Ω! See procedure number T- 5.0.2 (page 314).

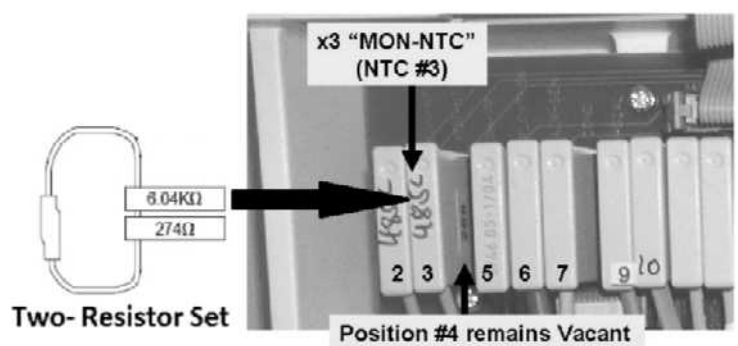
**No** MORE than 300 Ω! TWO (2) possible bad components: 1) Sensor cable OR 2) Distribution board




**T- 5.0.2 LESS THAN 300 Ω**

A) Remove the **274 Ω** plug.

B) Return the **6.04 KΩ** plug, from the **TWO-RESISTOR SET**, to the **2nd** distribution board position from the left, “MON-NTC”.




C) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

D) Proceed to **page 315**, procedure number T- 5.0.3.

**T- 5.0.3 CHECK DEBUG SCREEN 4 VALUES**

Leaving the **6.04 KΩ** plug installed, call debug screen 4. Is **TEMP** (lower left) between 4.0 and 6.0?

Yes **TEMP** between 4.0 and 6.0! Proceed to **page 320**, procedure number T- 7.0.0.

No **TEMP** IS NOT between 4.0 and 6.0! It should be! See parts a and b below:

A) ENSURE the **6.04 KΩ** plug, from the TWO-RESISTOR SET, is placed correctly at the **2nd** distribution board position from the left, “MON-NTC”. If NOT, repeat procedure number T-5.0.3 (page 315).

B) Leave the resistor plug installed until the problem is solved.

C) **Read before performing!** With the machine off, swap in the listed components (see COMPONENT LIST below) one at a time, with known good and in between, to test each new component, perform parts D and E until **TEMP** is between 4.0 and 6.0.

**COMPONENT LIST: 1)** Actuator-Test Board; **2)** Power Logic Board; **3)** Functional Board (possibly IC20)[1]; **4)** Sensor Board[1]; **5)** Distribution board; **6)** Motherboard

[1] To prevent “Cond Offset Failure”, place the machine into **T and C Mode** for EACH board (refer to OPERATING MODES, page 19).

D) Return to Dialysis Program (“Select Program → ‘Dialysis’ → ‘Enter’).

E) Call debug screen 4. If **TEMP** is now between 4.0 and 6.0 the last component swapped in was the problem. If NOT return to part C.

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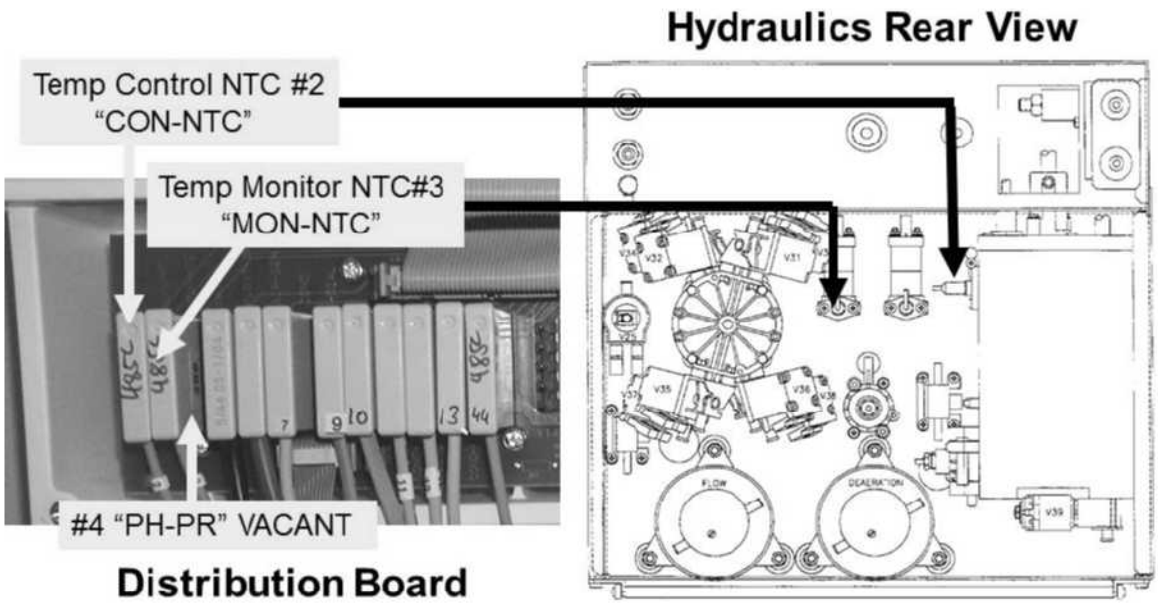
## T- 6.0.0 UNSTABLE TEMPERATURE / ISOLATE NTC'S

a) Per the Figure below, ENSURE both NTCs' are plugged into their distribution board positions. They may have been unplugged in a previous procedure!

b) Trace EACH CABLE, from the distribution board to the NTC, to once again **THOROUGHLY** check for insulation damage! **Insulation damage causes instability!**

c) See procedure number T- 6.1.0 (page 316).




## T- 6.1.0 ISOLATE FLOW ERROR

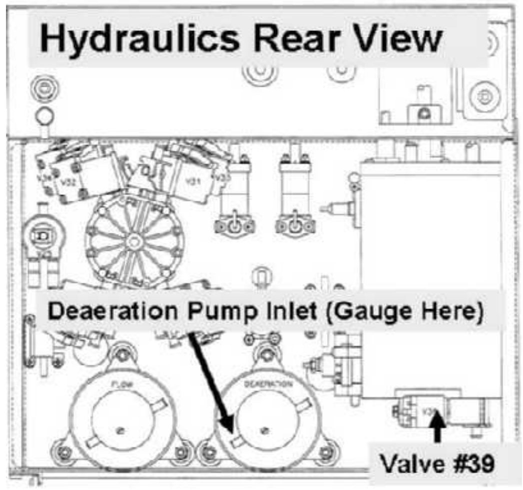
a) From the Home screen, ENSURE [Dialysate Flow] is set at the rate where the temperature instability is occurring.

b) Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** for <u>three (3) minutes</u> or until if it <u>EVER</u> = 1, even if only once, indicating a Flow problem. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Flow Error EVER = 1:** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

**2)** **IF Flow Error REMAINS = 0:** See procedure number T- 6.2.0 (page 317)

## T- 6.2.0 ISOLATE AIR REMOVAL SYSTEM




a) Turn the water OFF.

b) The Deaeration gauge is used next. **ENSURE** it reads 0 before installing it!

c) After the No Water" alarm appears allow one (1) minute for the Deaeration motor to stop.

d) Figure right, tee the Deaeration gauge into the Input (clear tubing) side of Deaeration Pump #20.

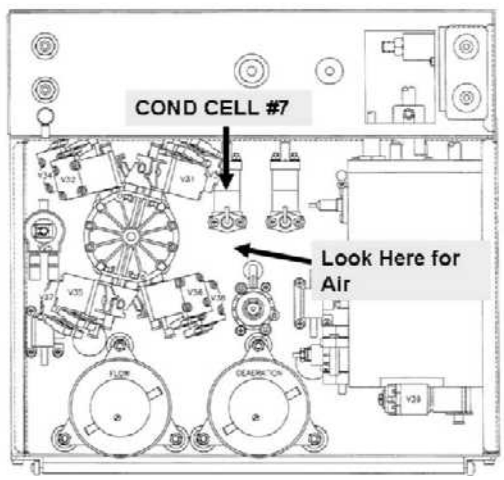
e) Turn the water on and allow the "No Water" alarm to go away.

f) Is Deaeration Pressure OKAY? Refer to Appendix A (page 757) for what pressure should be.

Yes   Deaeration pressure is okay. Position the gauge so that its tubing is not pinched THEN see procedure number T- 6.3.0 (page 317).

No   Deaeration pressure is NOT OKAY! ENSURING the "No Water" alarm is NOT presenting, NOTE this page number, as you will return here, THEN proceed to **page 543**, SECTION 13 - DEAERATION PROBLEMS.

## T- 6.3.0 ISOLATE POTENTIAL AIR LEAKS



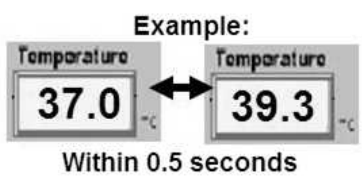

Per the Figure right, using a flashlight, WITHOUT LOOKING AWAY for two (2) minutes watch for air bubbles through the tubing at Conductivity Cell #7!. Air seen?

Yes   Air seen! Proceed to **page 539**, procedure number AIR- 1.0.5.

No air seen! See procedure number T- 6.5.0 (page 317).

## T- 6.5.0 ISOLATE BALANCING CHAMBER DIAPHRAGM

Was [**Temperature**] EVER observed 'bouncing wildly' up for ½ second then returning to near normal (Yes or No)?




Yes   Another procedure in different Section is performed next. **NOTE** this page and procedure number as you may prompted to return to here. See parts a and b below

a) BEFORE continuing to part b, proceed to **page 580**, to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

b) If a torn balancing chamber diaphragm was not located in part a see procedure number T- 6.6.0 (page 318).

No   See procedure number T- 6.6.0 (page 318).

## T- 6.6.0 VERIFY INCOMING WATER SOURCE

Is the machine connected to the: **1) *SAME water source as other currently RUNNING machines*** that have good stable temperature OR **2) *Its OWN water source***, possibly a portable RO. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) connected to the SAME water source as other machines:** See procedure number T- 6.8.0 (page 318).

**2)** **IF connected to its OWN water source:** Using a calibrated temperature meter check the incoming water temperature (i.e. from the RO). If NOT between 10 and 33° C (50 and 86° F) this may be the problem! If (and ONLY if) between 10 and 33° C see procedure number T- 6.8.0 (page 318).

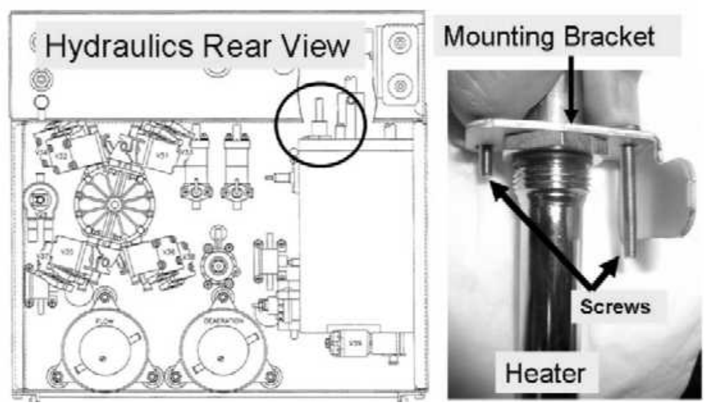
## T- 6.8.0 CHECK / ROTATE HEATER

a) **CAUTION!** Turn the machine OFF!

b) Figure right, loosen the heater mounting bracket and pull the heater out. **AVOID touching it!**

c) Replace the heater if badly discolored or if corrosion or pitting is located.

d) Rotate the heater 180° and reinstall it. **Tighten BOTH* bracket screws evenly!** The heater **MUST** be positioned perfectly vertical to maintain proper flow geometry.




***** A missing screw or mounting nut may be the problem!

e) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

f) Allow ten (10) minutes before continuing to part g.

g) If **Temperature** instability continues i.e. changes more than 0.2 °C per minute, see procedure number T- 6.9.0 (page 318).

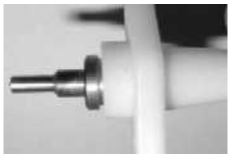
## T- 6.9.0 UNSTABLE TEMPERATURE CHECKS

Other procedures, in different Sections of the Guide, are performed next. **NOTE** this page and procedure number as you may prompted to return to here:

a) BEFORE continuing to part b, **page 580,** to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

b) If leaking diaphragm was not located in part a, turn the machine OFF!

**Parts c and d next page**

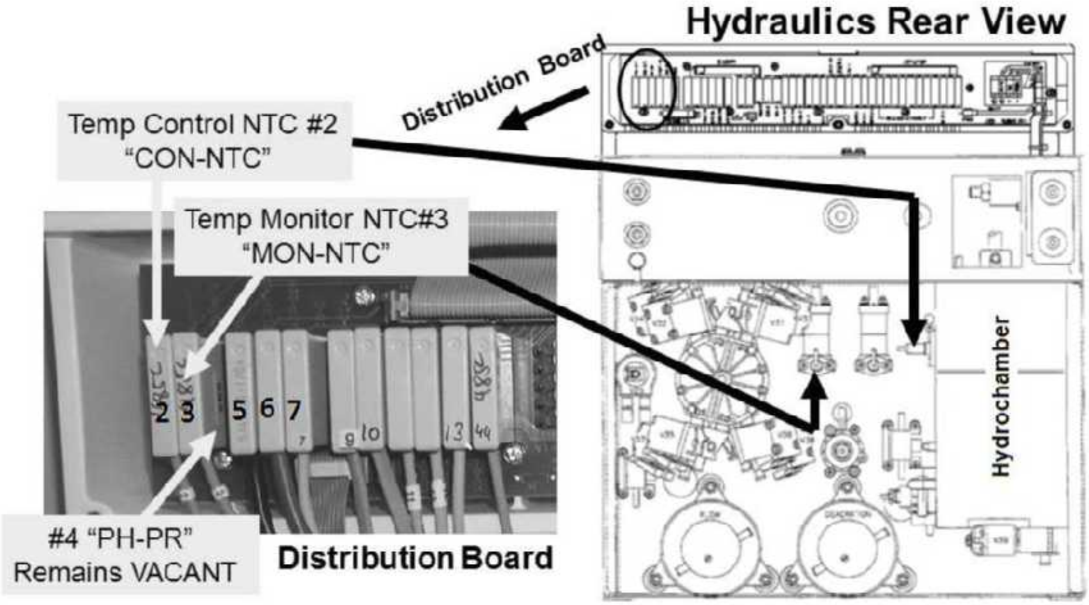


c) Figure below, one at a time, remove NTC #2 and NTC #3 from their hydraulic locations and check their 'probe ends' (Figure right). If corrosion is located replace the NTC.

d) Has procedure number T- 7.0.0 been performed in THIS troubleshooting session?

Yes See procedure number T- 6.9.1 (page 319).

No Proceed to **page 320**, procedure number T- 7.0.0.




**T- 6.9.1 UNSTABLE TEMPERATURE CHECKS**

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

b) Call debug screen 0 to watch **Flow Error** AND for a "No Water" alarm. A "No Water" alarm must NEVER occur and **Flow Error** must NEVER = 1. Watch for fifteen (15) minutes!

c) Based on temperature stability, TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Temperature is NEVER unstable:** The Troubleshooting Guide cannot locate a problem at this time!

**2)** **IF Temperature is or becomes unstable:** With the machine turned off, one at a time swap in the listed components (see Component List below) with known good then, in between, repeat procedure number T- 6.9.1 (page 319) to test each new component.

**Component List:** **1)** Power Logic Board[a]; **2)** NTC #2; **3)** Heater [b]; **4)** Sensor Board (with a new Sensor board you must calibrate Temp Sensor AND Temp Control); **5)** TWO (2) power supply components: **i)** Power Control board; **ii)** Heater Triac .

[a] To LOCATE the board refer to Figure 4A (page 10)

[b] To LOCATE refer to Figure 28 (page 140);

[c] To LOCATE the Heater Triac REFER to the Figure at the bottom of page 312

## T- 7.0.0 ISOLATE TEMPERATURE SENSOR

**These are non-routine TROUBLESHOOTING procedures! Follow them exactly to avoid error!**
**WARNING! Hydraulic alarms are not announced in Service Mode!**

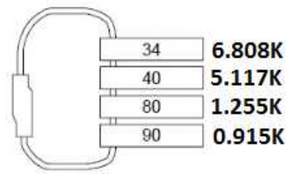
A) Figure right, ENSURE distribution board position #4, "PH-PR", remains VACANT!

B) ENSURE Cond Cell #7 is plugged into distribution board position "X7, COND"!

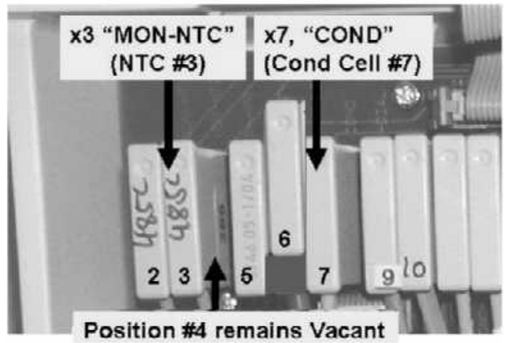
C) Figure right, the **FOUR-RESISTOR SET** is required.

D) Enter Service Mode → Calibrate Sensors → Temp Sensor.

E) Proceed to **STEP #1** (page 320).



Four-Resistor Set

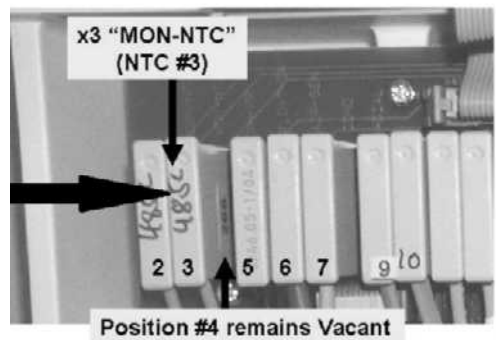



## STEP #1

a) The screen should say **"Connect a 6.808 K ohm resistor…"**

b) Figure right, avoiding VACANT position #4, place the 34° C (6.808 KΩ) plug into the **2nd** distribution board position from the left, "MON-NTC".

c) Is the screen's [**Pre-Temperature Reference]** between 64 and 76 (Yes or No)?




Yes Between 64 and 76! 'Sharply' press 'Enter'. If no Error banners[1] appear see **STEP #2** (page 320).

[1] If an "Operator Error" OR "Actuator Board Error" banner appears proceed to **page 321**, procedure number T- 7.1.0.

**Example: Status bar showing "Operator Error"**


No NOT between 64 and 76! ENSURE the 34° C plug is placed properly at the **2nd** position from the left! If okay, see procedure number T- 7.1.0 (page 321).

## STEP #2

a) The screen should say **"Connect a 5.117 K ohm resistor..."**.

b) Place the 41° C (5.117 KΩ) plug into the **2nd** distribution board position from the left. Is **[Pre-Temperature Reference]** between 157 and 169?

Yes Between 157 and 169! 'Sharply' press 'Enter' then see **STEP #3** (page 321).

No NOT between 157 and 169! ENSURE the 41° C plug is placed properly at the **2nd** position from the left! If okay, see procedure number T- 7.1.0 (page 321).

## STEP #3

a) The screen should say **"Connect a 1.255 K ohm resistor..."**

b) Place the 80° C (1.255 KΩ) plug into the **2nd** distribution board position from the left. Is **[Pre-Temperature Reference]** between 191 and 203?

Yes Between 191 and 203! 'Sharply press 'Enter' then see **STEP #4** (page 321).

No NOT between 191 and 203! ENSURE the 80° C plug is placed properly at the **2nd** position from the left! If okay, see procedure number T- 7.1.0 (page 321).

## STEP #4

a) The screen should say **"Connect a 0.915 K ohm resistor..."**.

b) Place the 90° C (0.915 KΩ) plug into the **2nd** distribution board position from the left. Is **[Pre-Temperature Reference]** between 204 and 216?

Yes Between 204 and 216! Save the calibration then proceed to **page 322**, procedure number T- 7.2.0.

No NOT between 204 and 216! ENSURE the 90° C plug is placed properly at the **2nd** position from the left! If okay, see procedure number T- 7.1.0 (page 321).

### T- 7.1.0 ERROR DURING TEMP SENSOR CALIBRATION

Perform this procedure if (and ONLY if) "Operator Error" OR "Actuator Board Error" banner occurred OR a **[Pre-Temperature Reference]** value was not in range.

a) Turn the machine OFF!

b) Using a different **FOUR-RESISTOR SET** return to (ABOVE) procedure number T- 7.0.0 (page 320) HOWEVER, if you return here see part c.

c) **Read before performing!** With the machine off, swap in the listed components (see COMPONENT LIST below), one at a time, with known good then, in between, return to (ABOVE) procedure number T- 7.0.0 (page 320) to test each new component until the error banner does NOT occur indicating the last component swapped in is the problem.

**COMPONENT LIST: 1)** Actuator-Test Board*****; **2)** Sensor Board*****; **3)** Functional Board*****; **4)** Sensor Board cable; **5)** Distribution board; **6)** Motherboard*****.

***** To LOCATE these boards refer to Figure 4A (page 10)

## T- 7.2.0 TEMPERATURE CONTROL CHECKS

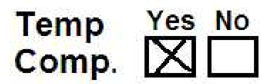
a) Return NTC #3’s connector to the **2nd** distribution board position from the left, “MON-NTC”.

b) ENSURE NTC #2’s connector is in the **1st** distribution board position from the left, “CON-NTC”.

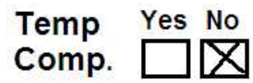
c) **Turn the Heater Switch ON!**

d) Install the hydraulics into the cabinet however, there is no need to screw the rear panels in yet!

e) Enter Service Mode → Options → Hardware Options. Does the “Yes” box at ‘**Temp Comp’** have an ‘X’ in it (Yes or No)?




Yes Place the ‘X’ in the “No” box and press ‘Enter’. The ‘X’ turns blue. Post a note that ‘**Temp Comp**’ is off THEN see procedure number T- 7.2.1 (page 323).




No **Temp Comp** = No, See procedure number T- 7.2.1 (page 323).

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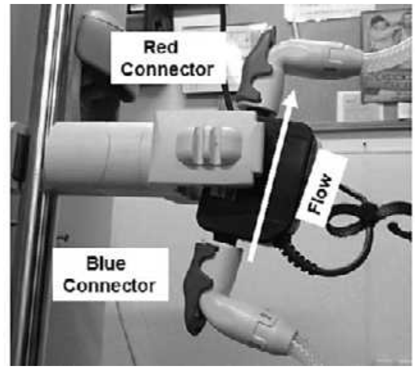
**T- 7.2.1 TEMPERATURE CONTROL**

a) ENSURE the concentrate connectors are attached to acid and **LIQUID** bicarb.

b) From Service Mode → Calibrate Sensors → Temp Control.




c) ‘Sharply’ press ‘Enter’. The screen should say “**3. Connect an external temperature meter to the dialysate lines”.**

d) Install a Temperature (°C) meter into the dialysate lines.
**Figure right, flow MUST be bottom to top.**

e) **CLOSE THE SHUNT DOOR!**

f) ‘Sharply’ press ‘Enter’. The screen says **“5. Adjust the TEMP DAC…”** and the screen’s **[TEMP DAC]** data box (Figure right) turns pale yellow / white.


g) Based on the **[TEMP DAC]** data box, TWO (2) possible scenarios:

**1) IF (and ONLY if) between 120 and 180:** See procedure number T- 7.2.2 (page 324).

**2) IF NOT between 120 and 180:** Perform parts a THROUGH d below:

a) Press **[TEMP DAC]**, it turns bright yellow.

b) Set **[TEMP DAC]** to “140”.

c) ‘Sharply’ press ‘Enter’ ONCE. **[TEMP DAC]** MUST be pale yellow/white (NOT gray).

d) See procedure number T- 7.2.2 (page 324).

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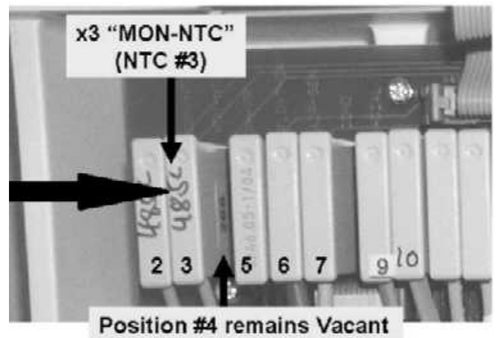
## T- 7.2.2 [TEMP DAC] BETWEEN 120 AND 180 / VERIFY FLOW

The flow indicator's 'bob' will be watched to see if it EVER, even once, stays down longer than four (4) seconds AND the external meter will be watched to see if it EVER, even once, exceeds 38.9° C. WITHOUT LOOKING AWAY watch 'bob' AND the meter for five (5) minutes. TWO (2) possible scenarios:

1) **IF (and ONLY if) 'bob' NEVER stays down longer than four (4) seconds:** Proceed to **page 326**, procedure number T- 7.4.0.

2) **IF 'bob', even if only once, stays down longer than four (4) seconds:** See procedure number T- 7.2.4 (page 324).

## T- 7.2.4 'BOB' DOWN LONGER THAN FOUR SECONDS / ISOLATE INTERNAL ALARM LIMIT




a) Figure right, remove the connector from the **2nd** distribution board position from the left, "MON-NTC". This is temperature sensor NTC #3.

b) The screen's **[Monitor Reference]** window should be less than 30°C if NTC #3 was unplugged!

c) Does 'bob' start to move up and down?

Yes 'Bob' moving! Leaving NTC #3 unplugged, see procedure number T- 7.2.5 (page 324).

No 'Bob' not moving! **A)** Return NTC #3's connector to **2nd** position from the left, "MON-NTC"; **B)** There is an unannounced "No Water" OR Flow Error present; **C)** Turn the machine off; **D)** Turn the machine back on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter') to troubleshoot these problems!

## T- 7.2.5 'BOB' WAS NOT RISING BUT IS NOW / ISOLATE POSSIBLE HIGH TEMPERATURE

**TO PREVENT DAMAGE,** WITHOUT LOOKING AWAY, watch the external meter for six (6) minutes or until if it, even if only once, exceeds 38.9° C! TWO (2) possible scenarios:

1) **IF (and ONLY if) the meter NEVER reaches 38.9° C:** See procedure number T- 7.2.6 (page 325).

2) **IF the meter DOES reach 38.9° C, even if only ONCE:** See parts a THROUGH e below:

a) Turn the machine OFF.

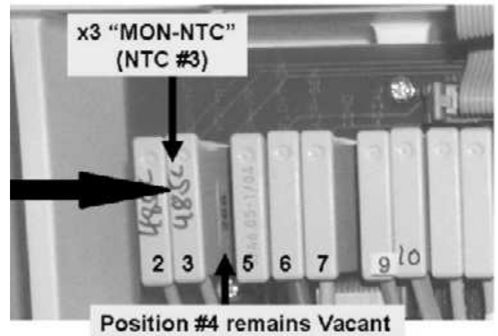
b) RETURN NTC #3's connector to the **2nd** distribution board position from the left, "MON-NTC".

c) Using a temperature meter measure incoming (RO) water temperature. If (and ONLY if) less than 37.0º C see part d. If more than 37.0° C incoming water is too high and this may be the problem.

d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

e) Proceed to **page 259**, procedure number T- 1.3.40.

## T- 7.2.6 'BOB' WAS NOT RISING BUT IS NOW / RESET INTERNAL ALARM LIMIT




a) **IMPORTANT!** RETURN NTC #3's connector to **2nd** distribution board position from the left "MON-NTC".

b) Press the **[TEMP DAC]** data box, it turns bright yellow.

c) Set **[TEMP DAC]** to "130" then 'sharply' press 'Enter' ONCE.

d) **IMPORTANT!** Allow five (5) minutes BEFORE continuing to part e!

e) 'Sharply' press 'Enter' TWICE. The **[Monitor Reference]** data box turns pale yellow / white.

f) **DO NOT press 'Confirm' or 'Enter' until instructed!**

g) Press **[Monitor Reference]** to turn it bright yellow.

h) Ignoring the external meter adjust **[Monitor Reference]** to 34.0° C.

i) 'Sharply' press 'Enter' TWICE to turn **[Monitor Reference]** GRAY! Does the GRAY **[Monitor Reference]** box remain less than 35.0° C?

Yes **[Monitor Reference]** remains less than 35.0° C! Press and release the 'Enter' key until the calibration is saved then proceed to **page 323**, procedure number T- 7.2.1.

No **[Monitor Reference]** DOES NOT remain less than 35.0°C! **Read before performing!** With the machine off, swap the listed components (see COMPONENT LIST below) one at a time, with known good, and in between return to (ABOVE) procedure number T- 7.2.1 (**page 323**) and test the new component until **[Monitor Reference]** remains less than 35.0° C indicating the last component swapped in was the problem.

**COMPONENT LIST:** **1)** NTC #3*; **2 )** Actuator-Test Board**; **3)** Sensor Board**; **4)** Sensor Board cable; **5)** Functional Board** (possibly IC20).

***** To LOCATE NTC #3 refer to Figure 42 (page 236)

****** To LOCATE these boards refer to Figure 4A (page 10)

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## T- 7.4.0 ‘BOB’ IS RISING AND FALLING / CHECK ‘ACUAL’ TEMPERATURE

Based on the external meter’s reading, THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) remaining less than 33.0° C:** See procedure number T- 7.4.1 (page 326).

**2) IF (and ONLY if) remaining between 33.1 and 38.9° C:** Proceed to **page 327**, procedure number T- 7.5.0.

**3) IF EVER WAS more than 38.9° C, even if only ONCE:** Perform parts a THROUGH c below:

   a) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

   b) ENSURE incoming water temperature (from the RO) is less than 35.0º C.

   c) If (and ONLY if) incoming water temperature is less than 35.0° C proceed to **page 259**, procedure number T- 1.3.40.

## T- 7.4.1 TEMPERATURE LESS THAN 33° C

a) **CAUTION! To avoid damage turn the machine OFF**!

b) **Read before performing!** If not already done, reseat the Power Logic, Sensor and Functional Boards then proceed **page 323**, procedure number T- 7.2.1. If (and ONLY if) you return here continue to part c.

c) **Read before performing! THIS TIME setting [TEMP DAC] to “180”**, return to (ABOVE) procedure number T- 7.2.1 (**page 323**). If (and ONLY if) you return here see proceed to **page 275**, procedure number T- 1.7.0.

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## T- 7.5.0 VERIFY MEASURED TEMPERATURE

At this point it does not matter if the external meter is 37.0° C! WITHOUT LOOKING AWAY, watch it for one (1) minute noting its highest and lowest values. TWO (2) possible scenarios:

1) **IF (and ONLY if) temperature changes more than 0.2° C:** ENSURING the external flow indicator's 'bob' is rising and falling, see procedure number T- 7.5.2 (page 327).

2) **IF temperature does DOES NOT change more than 0.2° C: DO NOT** press 'Enter' or 'Confirm' until instructed! Based on the external meter's reading, TWO (2) possible scenarios i) or ii) below:

   **i) IF (and ONLY if) between 36.9 and 37.1° C:** See procedure number T- 7.6.0 (**page 329**).

   **ii) IF NOT between 36.9 and 37.1° C:** See parts a THROUGH c below:

      a) Press the **[TEMP DAC]** data box, it turns bright yellow.

      b) Adjust **[TEMP DAC]** (+/- 2 = +/- 0.1° C) then sharply press 'Enter'. **[TEMP DAC] MUST be** pale yellow/white (NOT GRAY) to continue!

      c) Allow **FIVE (5)** minutes while watching the external flow indicator's 'bob'. Does it EVER remain down for longer than four (4) seconds?.

         Yes 'Bob' stays down longer than four (4) seconds! Proceed to **page 324**, procedure number T- 7.2.4.

         No 'Bob' never stays down longer than four (4) seconds! Repeat procedure number T- 7.5.0 (page 327) until the external meter is between 36.9 and 37.1° C.

## T- 7.5.2 TEMPERATURE IS UNSTABLE

a) Continue to watch the meter for up to six (6) minutes ENSURING the external flow indicator's 'bob' is rising and falling. If the external meter does NOT fall to less than 33° C continue to part b. If it DOES proceed to **page 326**, procedure number T- 7.4.1.

b) Was procedure number T- 6.0.0 (page 316) performed in THIS troubleshooting session?

   Yes Procedure number T- 6.0.0 was already performed! See procedure number T- 7.5.3 (page 328).

   No a) Turn the machine OFF!

   b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

   c) Proceed to **page 316**, procedure number T- 6.0.0.

## T- 7.5.3 TEMPERATURE CHANGES MORE THAN +/- 0.2° C / NTC #2 CHECK

THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) NTC #2 was NEITHER checked NOR replaced in THIS troubleshooting session:** See procedure number T- 8.0.0 (page 333) to check (or replace) NTC #2*.

* To LOCATE NTC #2 refer to Figure 42 (page 236)

**2) IF (and ONLY if) NTC #2 was checked in THIS troubleshooting session:** Turn the machine off and replace NTC #2* with a known good THEN return to (ABOVE) procedure number T- 7.2.1 (page 323) to see NTC #2 was the problem.

* To LOCATE NTC #2 see Figure 42 (page 236)

**3) IF NTC #2 was replaced in THIS troubleshooting session: READ before continuing!** With the machine off, one at a time, swap in the listed components (see COMPONENT LIST), and in between, return to (ABOVE) procedure number T- 7.2.1 (page 323) to test each new component.

**COMPONENT LIST: 1)** Sensor Board*; **2)** Power Logic Board*; **3)** Heater**; **4)** Functional Board*; **5)** TWO (2) power supply components: **i)** Power Control Board (inside the power supply); **ii)** Heater Triac***.

* To LOCATE these boards refer to Figure 4A (page 10)

** To LOCATE the heater refer Figure 28 (page 140)

*** To LOCATE the Heater Triac REFER to the Figure at the bottom of page 312.

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## T- 7.6.0 METER TEMPERATURE IS STABLE AT 37°C / CHECK NTC #3 STABILITY

The screen's **[Monitor Reference]** data box should be gray AND at this point it does not matter if it = 37° C! WITHOUT LOOKING AWAY, watch it one (1) minute noting its highest and lowest value. TWO (2) possible scenarios 1) or 2) below:

**1) IF (and ONLY if) [Monitor Reference] changes more than +/- 0.2° C:** ENSURING the external meter is STABLE between 36.9 and 37.1° C, proceed to **page 332**, procedure number T- 7.8.0.

**2) IF [Monitor Reference] does NOT change more than +/- 0.2° C:** See parts a AND b below:

a) 'Sharply' press 'Enter' to turn the **[Monitor Reference]** data box pale yellow / white.

b) Activate **[Monitor Reference]**, it turns bright yellow. Without pressing 'Enter' or 'Confirm' until instructed can you adjust **[Monitor Reference]** to match the external meter?

Yes **[Monitor Reference]** should be bright yellow AND between 36.9 and 37.1° C. See procedure number T- 7.6.2 (page 329).

No With the machine off, swap in the listed components (see COMPONENT LIST below), one at a time, with known good, and in between return to (ABOVE) procedure number T- 7.2.1 (page 323) to test each new component.

**COMPONENT LIST: 1)** NTC #3*. *To LOCATE NTC #3 refer to Figure 42, page 236); **2)** Functional Board.

## T- 7.6.2 TEMPERATURE CHECKS / SLOW FLOW CALIBRATION?

CAREFUL HERE! This procedure determines if a 'Slow Flow' temperature calibration is necessary:

a) 'Sharply' press 'Enter'! **[Monitor Reference]** MUST return to pale yellow / white!

b) 'Sharply' press 'Enter' again. TWO (2) possible scenarios:

**1) IF the screen says "9. Connect an external temperature meter…":** A 'Slow Flow' calibration is required! See procedure number T- 7.6.4 (page 330).

**2) IF the screen says "Calibration saved. Press CONFIRM":** If the procedures were done correctly the **[Monitor Reference]** data box is GRAY. Does it continue to read between 36.9 and 37.1° C?

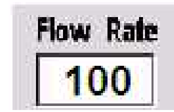
Yes The GRAY data box = between 36.9 and 37.1° C. This completes the calibration HOWEVER, if you started out troubleshooting a "TEMP OVER 95 DEGREES" alarm in Heat Disinfect proceed to **page 265**, procedure number T- 1.5.1. If not, return to Dialysis Program.

No The GRAY data box DOES NOT = between 36.9 and 37.1. Swap in the listed components (see COMPONENT LIST below), one at a time, with known good then return to (ABOVE) procedure number T- 7.2.1 (page 323) to test each new component.

**COMPONENT LIST: 1)** NTC #3*. *To LOCATE NTC #3 refer Figure 42, page 236); **2)** Functional Board.

## T- 7.6.4 'SLOW FLOW' CALIBRATION

**NOTE!** This calibration requires PATIENCE to avoid error!




a) **[TEMP DAC]** = 255 and Flow Rate (Figure right) = 100 (ml/min)! The external flow indicator's 'bob' may look like it is NOT moving! This is NORMAL here!

b) 'Sharply' press 'Enter'. The screen reads **"11. Adjust the TEMP DAC…"** and **[TEMP DAC]** turns pale yellow / white.

c) Press **[TEMP DAC].** It turns bright yellow. Initially set it to "210" then 'sharply' press 'Enter' ONCE!

d) ENSURING **[TEMP DAC]** is pale yellow / white continue to part e. If (and ONLY if) **[TEMP DAC] is** GRAY escape the calibration and unfortunately return to (ABOVE) procedure number T- 7.2.1 (page 323).

e) WITHOUT LOOKING AWAY, simultaneously watch the external meter AND the screen's **[Monitor Reference]** data box for thirteen (13) minutes. TWO (2) possible scenarios:

   **1)** **IF (and ONLY if) one OR both exceed 40.0° C even ONCE:** This time adjusting **[TEMP DAC]** 10 lower than it already is and pressing 'Enter', repeat parts d and e.

   **2)** **IF neither NEVER exceeds 40.0° C:** See procedure number T- 7.6.5 (page 330).

## T- 7.6.5 CALIBRATE SLOW FLOW TEMPERATURE

The external meter fluctuates SLOWLY, approximately +/- 0.4° C, between a high and a low. WITHOUT LOOKING AWAY, watch fifteen (15) high to low cycles. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) the high is consistently between 36.9 and 37.1° C!** See procedure number T- 7.6.6 (page 331).

**2)** **IF the high is IS NOT consistently between 36.9 and 37.1° C:** See parts a THROUGH c below:

   a) Activate **[TEMP DAC]**, it turns bright yellow and adjust its value (+/- 2 = +/- 0.1° C).

   b) 'Sharply' press 'Enter' to return **[TEMP DAC]** to pale yellow / white. It must NOT turn gray until the meter consistently cycles to a high of between 36.9 and 37.1° C.

   c) Repeat procedure number T- 7.6.5 (page 330).

## T- 7.6.6 ADJUST 'SLOW FLOW' MONITOR REFERENCE

a) 'Sharply' press 'Enter' to turn **[Monitor Reference]** pale yellow / white!

b) Adjust **[Monitor Reference]** to match the meter's highest reading (i.e. between 36.9 and 37.1° C).

c) CAREFUL HERE! Sharply 'Enter' TWICE to turn **[Monitor Reference]** GRAY!

d) Does the GRAY **[Monitor Reference]** data box read between 36.4 and 37.6° C?

Yes The data box is between 36.4 and 37.6° C! This completes the calibration HOWEVER, if you started out troubleshooting a "TEMP OVER 95 DEGREES" in Heat Disinfect proceed to **page 265**, procedure number T- 1.5.1. If not, return to Dialysis Program.

No The data box IS NOT between 36.4 and 37.8! With the machine off, swap in the listed components (see COMPONENT LIST below), one at a time, with known good, in between returning to (ABOVE) procedure number T- 7.2.1 (page 323) to test each new component.

**COMPONENT LIST: 1)** NTC #3[1]; **2)** Functional Board.

[1] To LOCATE NTC #3 refer to Figure 42 (page 236)

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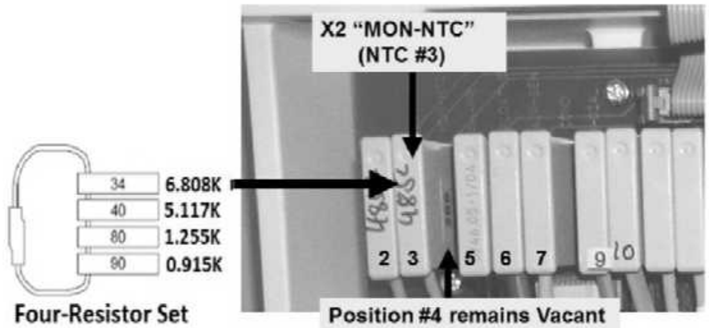
## T- 7.8.0 [MONITOR REFERENCE] CHANGES MORE THAN +/- 0.2° C

a) Figure right, place the 34° C (6.808 KΩ) plug from the **FOUR RESISTOR SET** into the **2nd** distribution board position from the left "MON-NTC".

b) TWO (2) possible scenarios , based on the screen's **[Monitor Reference]** data box:




1) **IF (and ONLY if) [Monitor Reference] continues to change more than 0.2 °C per minute:** THREE (3) possible bad components**: 1)** Unstable +12 and / or -12 volt DC voltage (i.e. possible bad Power Logic Board); **2)** Bad Sensor Board; **3)** Bad Functional Board.

2) **IF [Monitor Reference] does DOES NOT change more than 0.2 °C per minute:** NTC #3 may be bad: See parts a AND b below:

   a) Replace NTC #3* with a known good! *To LOCATE NTC #3 refer to Figure 42 (page 236).

   b) Return to (ABOVE) procedure number T- 7.2.1 (page 323).

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## T- 8.0.0 ISOLATE NTC #2

This procedure checks NTC #2 resistance (Ω) response. An accurate thermometer is required. If one is not available replace NTC #2 (see Figure 54, page 333) with a **known good** then return to (ABOVE) procedure number **T- 7.2.1** (page 323).

a) **IMPORTANT!** Turn the machine OFF!

b) Per the Figure below, unplug NTC #2's connector from the **1st** position from the left, "CON-NTC".

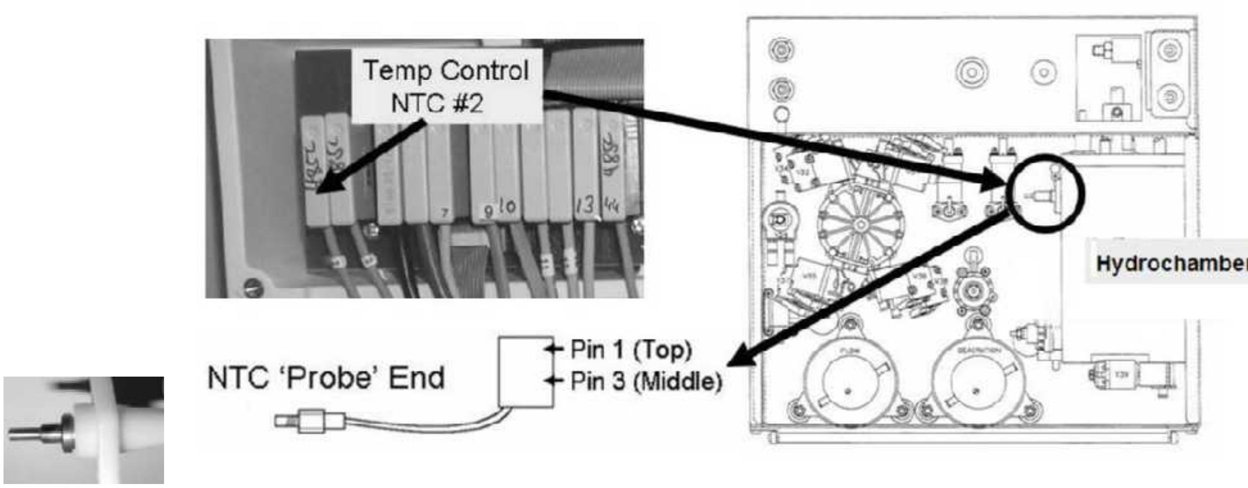



**Figure 54 – Hydraulics Rear View – NTC #2**

c) **CAREFULLY** (**thin wires involved!**) open NTC #2's female distribution board connector.

d) Per the Figure above, remove NTC #2 from the hydrochamber to expose its 'probe end'.
**NOTE!** Do NOT misplace the O-ring!

e) If (and ONLY if) NTC #2 appears 'rusty' replace it then return to (ABOVE) procedure number T- 7.2.1 (page 323). If NOT rusty continue to part f.

f) Clean with paper towel. **Do not touch it from this point forward to avoid fouling it!**

g) Fill a Styrofoam cup with water, accurately measured, between 36 and 38° C!

h) Per the Figure right, drop NTC #2's 'probe end' into the cup.

i) Per the Figure right, measure RESISTANCE (Ω) between the connector's green and white wires. Referring to Table 6 (page 334), between the minimum and maximum (**KΩ**) range?

Yes Return to (ABOVE) procedure number T- 7.2.1 (page 323).

No Replace NTC #2 with a tested known good then return to (ABOVE) procedure number T- 7.2.1 (page 323).

## Table 6 – NTC RESISTANCE

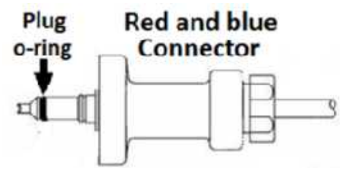
| Cup Temperature ( °C) | Minimum Resistance | Nominal Resistance | Maximum Resistance |
|---|---|---|---|
| 36.0 | 6.142 KΩ | 6.267 KΩ | 6.392 KΩ |
| 36.1 | 6.117 KΩ | 6.242 KΩ | 6.367 KΩ |
| 36.2 | 6.092 KΩ | 6.217 KΩ | 6.342 KΩ |
| 36.3 | 6.067 KΩ | 6.192 KΩ | 6.317 KΩ |
| 36.4 | 6.042 KΩ | 6.167 KΩ | 6.292 KΩ |
| 36.5 | 6.017 KΩ | 6.142 KΩ | 6.267 KΩ |
| 36.6 | 5.992 KΩ | 6.117 KΩ | 6.242 KΩ |
| 36.7 | 5.967 KΩ | 6.092 KΩ | 6.217 KΩ |
| 36.8 | 5.942 KΩ | 6.067 KΩ | 6.192 KΩ |
| 36.9 | 5.917 KΩ | 6.042 KΩ | 6.167 KΩ |
| 37.0 | 5.892 KΩ | 6.017 KΩ | 6.142 KΩ |
| 37.1 | 5.868 KΩ | 5.993 KΩ | 6.118 KΩ |
| 37.2 | 5.844 KΩ | 5.969 KΩ | 6.094 KΩ |
| 37.3 | 5.820 KΩ | 5.945 KΩ | 6.070 KΩ |
| 37.4 | 5.796 KΩ | 5.921 KΩ | 6.046 KΩ |
| 37.5 | 5.772 KΩ | 5.897 KΩ | 6.022 KΩ |
| 37.6 | 5.748 KΩ | 5.873 KΩ | 5.998 KΩ |
| 37.7 | 5.724 KΩ | 5.849 KΩ | 5.974 KΩ |
| 37.8 | 5.700 KΩ | 5.825 KΩ | 5.950 KΩ |
| 37.9 | 5.676 KΩ | 5.801 KΩ | 5.926 KΩ |
| 38.0 | 5.652 KΩ | 5.777 KΩ | 5.902 KΩ |

## SECTION 5 - CONDUCTIVITY / ON LINE CLEARANCE PROBLEMS

External leaks, “No Water” and Flow Errors cause Conductivity problems. If either occur at ANY TIME address them first! To avoid error observe ALL stated times below!

A) From the Home screen, ENSURE [Dialysate Flow] is on***** and has been set to 800 ml/min for five (5) minutes!

***** If [Dialysate Flow] is blinking flow is off! Flow **MUST** be on!

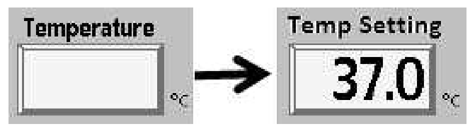



B) If [**Conductivity**] is less than 12.6 mS, Figure right, ENSURE BOTH connector plug O-rings are present! If not this may be the problem!

C) If the Automated Tests are running (screen reads “Test:….”) allow them to finish.

D) **Remove the ‘dummy chamber’ from the Level Detector**.

E) Press the [**Temperature**] window. Is “Temp Setting” ALREADY = 37.0° C?



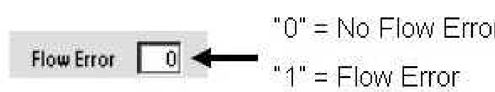

Yes “Temp Setting” already = 37.0° C! See part F.

No Adjust “Temp Setting” to 37.0° C THEN continue to part F.

F) Press ‘Enter’ to return to [**Temperature**].


G) **DO NOT RESET ALARMS!**

H) Call debug screen 0. If **Flow Error** **EVER** = 1, even just once, there is a Flow Error! WITHOUT LOOKING AWAY watch it for, TWO (2) possible scenarios:




**Scenario #1:** FOUR (4) minutes, if it was necessary to adjust “Temp Setting” to 37.0° C in part E.

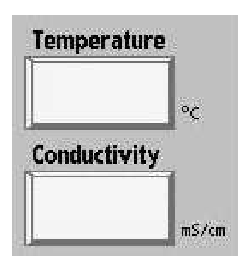
**Scenario #2:** TWO (2) minutes, if it WAS NOT necessary to adjust “Temp Setting” to 37° C in part E.

I) Is **Flow Error** is ALWAYS = 0?

Yes **Flow Error** ALWAYS = 0! See part J.

No **Flow Error =** 1 even if just once! Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM

J) Using a flashlight, ENSURE large air bubbles are NOT moving into the machine through the acid and bicarb inlet tubing! If air is seen check the connector(s).




K) Call the Home screen. WITHOUT LOOKING AWAY, watch [**Temperature**] AND [**Conductivity**] for one (1) minute. Based first on [**Temperature**], TWO (2) possible scenarios next page:

1) **IF (and ONLY if) STABLE between 35.5 and 38.5° C (stable = did NOT change more than 0.2 °C):** Going forward, if [**Temperature**] becomes unstable address it FIRST! For now see part L.

2) **ALL OTHERS:** Proceed to **page 232**, SECTION 4 – TEMPERATURE PROBLEMS

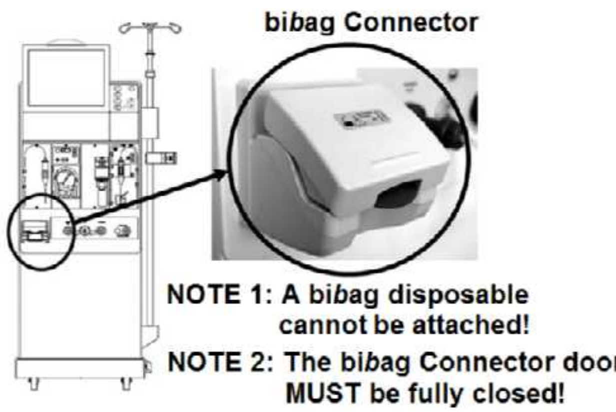
L) Based on **[Conductivity]**, TWO (2) possible scenarios 1) or 2) below:

1) **IF (and ONLY if) STABLE between 13.0 and 14.3 mS (stable = did NOT change more than 0.2):** See procedure number CO- 1.0.0 (page 337).

2) **ALL OTHERS:** See part M.

M) Figure right, if NOT equipped with a bi*bag* Connector skip to part O. If equipped with a bi*bag* Connector AND a disposable bi*bag* (pouch) is attached remove it THEN continue to part N.

N) Call debug screen 0. Figure below, ENSURE the bibag Connector door is shown closed.


O) **Firmly connect to JUGS* of known good** bicarb AND acid!**

* **WARNING!** To isolate between the 2008T and your Central Concentrate Delivery System (SDS) system, if connected to SDS, disconnect from it and connect to JUGS!

* **WARNING!** If equipped with a bi*bag* Connector, to isolate the bi*bag* system, for now connect to JUGS!

******Tested good per clinic procedures!

P) From the Home screen, ENSURE [Dialysate Flow] is set to AT LEAST 500 ml/min!

R) If the acid AND / OR bicarb source was changed above allow five (5) minutes BEFORE continuing to part S.

S) Based on [**Conductivity**] now, THREE (3) possible scenarios below:

1) **IF (and ONLY if) LESS THAN 12.6 mS:** Proceed to **page 338** procedure number CO- 1.0.1.

2) **IF (and ONLY if) MORE THAN 15.7 mS:** Proceed to **page 353**, procedure number CO- 1.0.4.

3) **ALL OTHERS:** See procedure number CO- 1.0.0 (page 337).

## CO- 1.0.0 ISOLATE DIALYSATE SETTINGS

A) At the bottom of the screen, press the 'Dialysate' tab.

B) Figure below, ENSURE the 'Selected Acid' matches the acid connected to the machine.

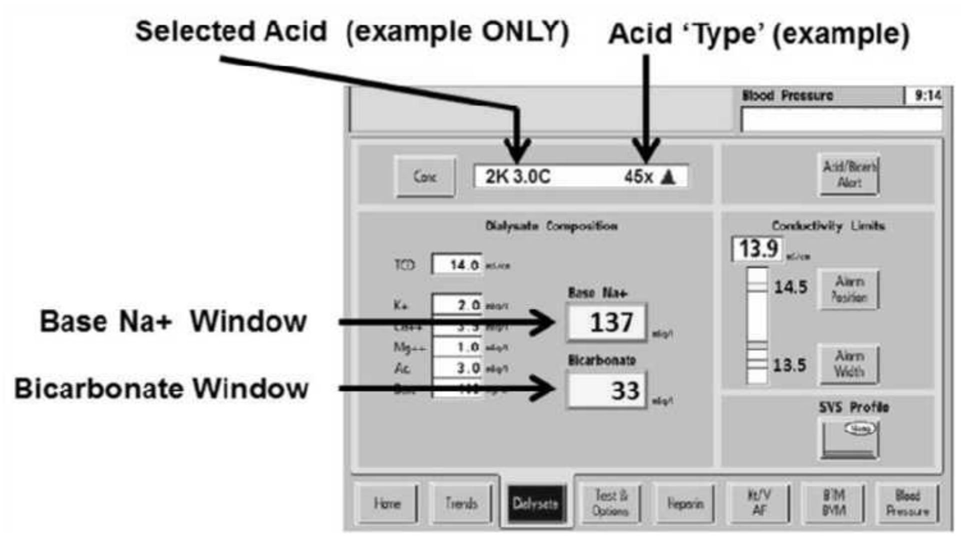



**Figure 55 – Dialysate Screen**

C) Set [**Base Na+**] to 137 and press 'Enter'.

D) Set [**Bicarbonate**] to 33 and press 'Enter'.

E) From the Home screen, ENSURE [Dialysate Flow] is on to at 500 ml/min or more.

F) If the 'Selected Acid' AND / OR [**Base Na+**] AND / OR [**Bicarbonate**] was changed, allow five (5) minutes BEFORE continuing to part G.


G) Based on [**Conductivity**] now, THREE (3) possible scenarios:

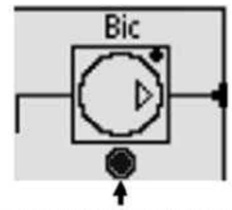
1) **IF (and ONLY if) LESS THAN 13.0 mS:** See procedure number CO- 1.0.1 (page 338).

2) **IF (and ONLY if) STABLE between 13.0 and 14.3:** Proceed to **page 363**, procedure number CO- 1.0.9.

3) **ALL OTHERS:** Proceed to **page 353**, procedure number CO- 1.0.4.

## CO- 1.0.1 CONDUCTIVITY IS LOW / ISOLATE BICARB PUMP CONTROL

Call debug screen 0. Figure right, what color is the **Bic** pump's 'dot', BLUE or WHITE?




'DOT' MUST BE BLUE!

**1)** **IF BLUE:** Proceed to **page 339**, procedure number CO- 1.0.3.

**2)** **IF WHITE:** a) Press the 'Dialysate' tab to call the Dialysate screen.

b) Figure below, is the **[Bicarbonate]** window MORE THAN zero (0)?

Yes **[Bicarbonate]** window more than zero (0)! Proceed to **page 409**, procedure number CO- 9.0.0.

No **[Bicarbonate]** window = zero (0)! Acetate concentrate is selected! See procedure number CO- 1.0.2 (page 338).

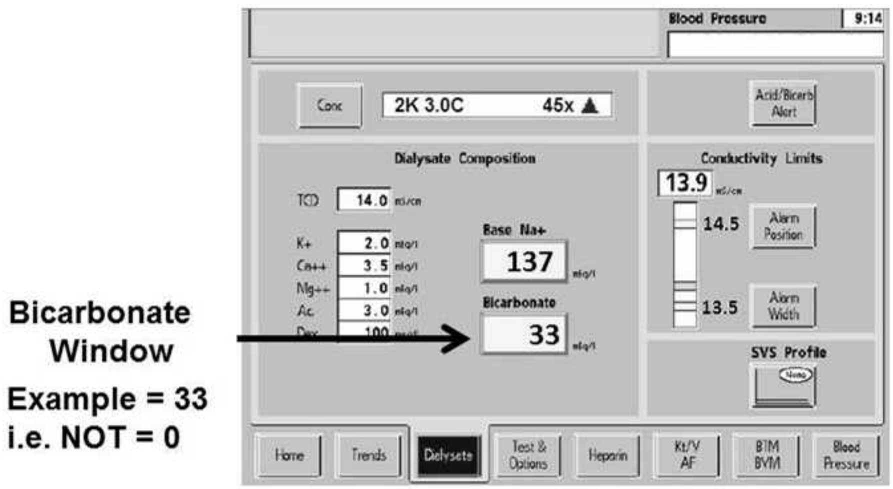



**Figure 56 – Dialysate Screen**

## CO- 1.0.2 [Bicarbonate] WINDOW = 0 / ACETATE IS SELECTED!

1:34 Acetate is rarely used and uses ONLY one concentrate, ACETATE. Troubleshooting must be performed using bicarb i.e. the **[Bicarbonate]** window MUST be more than zero (0). See parts a THROUGH c below:

a) Firmly connect to **ACID** AND known good bicarb!

b) Press the screen's 'Conc' button THEN select the **ACID** that is attached to the machine.

c) Press 'Enter'! ENSURING the **[Bicarbonate]** window is now MORE THAN zero (0), call debug screen 0. What color is the **Bic** pump's 'dot' now, BLUE or WHITE?

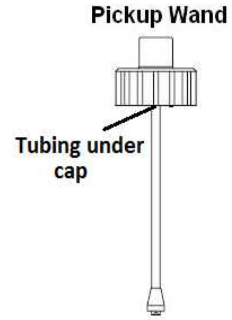
**1)** **IF BLUE:** ENSURING [Dialysate Flow] is on at 800 ml/min, allow five (5) full minutes. If [**Conductivity**] remains less than 13.0 mS see procedure number CO- 1.0.3 (page 339).

**2)** **IF WHITE:** Proceed to **page 409**, procedure number CO- 9.0.0.

## CO- 1.0.3 CONDUCTIVITY IS LOW / ISOLATE PUMP INPUTS

A) Plug BOTH connectors **HARD** into their rinse ports but DO NOT press any screen keys!

B) Figure right, two (2) checks on BOTH wands:




**Check #1:** ENSURE the wands are attached to the cap AND reach to the bottom of the jug(s)!

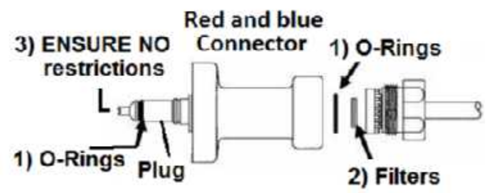
**Check #2:** ENSURE the wand tubing is NOT kinked!

C) Figure right, THREE (3) checks on BOTH concentrate CONNECTORS:

**Check #1:** ENSURE the O-rings are present.

**Check #2:** ENSURE the filters are clean**.**

**Check #3:** ENSURE the plug opening is not restricted.




D) **Place the machine in RINSE**.

E) ENSURING no external leaks ANYWHERE, is the external flow indicator's 'bob' moving at least ¼ up in the sight tube?

Yes 'Bob' moving! See part F.

No 'Bob' NOT moving! Return to Dialysis Program THEN proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM

F) Call debug screen 1. If debug does not appear press 'Esc' then call screen 1.


G) WITHOUT LOOKING AWAY, watch **NO EOS** AND **ALWEOS** for one (1) minute. They should NEVER = 1, not even once! Proceed per Table 7 below:

### Table 7 - EOS (End Of Stroke) Values

| NO EOS | ALWEOS | YOUR RESPONSE |
|---|---|---|
| **0** (ALWAYS) | **0** (ALWAYS) | See part H next page |
| **1** (EVER) | Does not matter | Proceed to **page 441**, SECTION 6 – CONCENTRATE PUMP ERRORS. |
| Does not matter | **1** (EVER) | Proceed to **page 441**, SECTION 6 - CONCENTRATE PUMP ERRORS. |

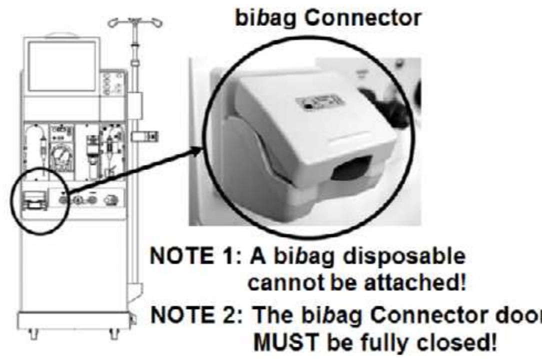
## Procedure # CO- 1.0.3 continued:

H) FIRMLY connect BOTH concentrate connectors to **JUGS.**

I) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

J) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘Enter’.

K) Figure right, equipped with a bi*bag* Connector?



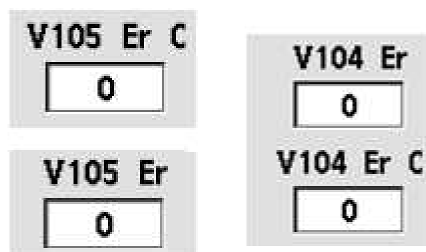

Yes See procedure number CO- 1.0.3.1 (page 340).

No <u>NOT</u> equipped with a bi*bag* Connector! Proceed to **page 350**, procedure number CO- 1.0.3.7.

### <u>CO- 1.0.3.1 EQUIPPED WITH BI*BAG* CONNECTOR</u>

A) Call debug screen 15. Locate:

- **V105 Er C** (1st column from left). Should = 0 always!
- **V105 Er** (2nd column from left). Should = 0 always!
- **V104 Er C** (3rd column from left). Should = 0 always!
- **V104 Er** (3rd column from left). Should = 0 always!




B) WITHOUT LOOKING AWAY, watch <u>ALL FOUR</u>, for four (4) minutes. If a ‘1’ appears, even just once, indicates a problem. Do **<u>ALL FOUR (4)</u>** REMAIN = 0?

Yes <u>ALL FOUR</u> ALWAYS = 0! From the Home screen, if [**Conductivity**] is more than 13.4 mS do not continue. If [**Conductivity**] remains less than 13.4 see part C next page.

No One or more = 1! FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

1) **IF (and ONLY if) V105 Er C <u>EVER</u> = 1 = Valve #105 possibly stuck closed:** Proceed to **page 435**, procedure number <u>CO- 13.0.00.</u>

2) **IF (and ONLY if) V105 Er <u>EVER</u> = 1:** Proceed to **page 744**, <u>SECTION 31– VALVE 104 OR VALVE 105 ERROR</u>.

3) **IF (and ONLY if) V104 Er C <u>EVER</u> = 1 = Valve #104 possibly stuck closed:** Proceed to **page 438**, procedure number <u>CO- 14.0.00.</u>

4) **IF V104 Er <u>EVER</u> = 1:** Proceed to **page 744**, <u>SECTION 31– VALVE 104 OR VALVE 105 ERROR</u>

C) Call debug screen 0. Figure below, are BOTH Valve #104's AND Valve #105's 'dots' remaining BLUE?

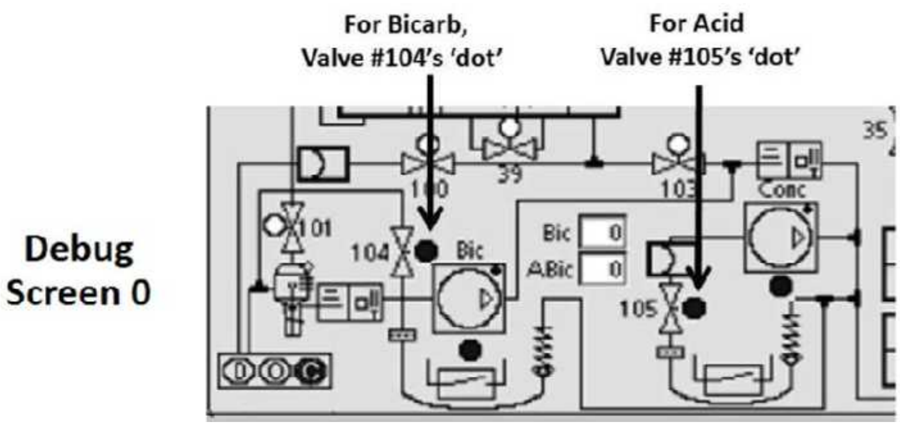
Yes BOTH 'dots' remaining BLUE! See part D.

No Valve #104 and / or Valve #105 'dot' is WHITE! THREE (3) possible scenarios below:

**Scenario #1:** **IF (and ONLY if) Valve #104's 'dot' is WHITE:** See procedure number CO- 1.0.3.4 (**page 343**).

**Scenario #2:** **IF (and ONLY if) Valve #105's 'dot' is WHITE:** See procedure number CO- 1.0.3.6 (**page 347**).

**Scenario #3:** **IF BOTH are WHITE:** See procedure number CO- 1.0.3.4 (**page 343**).

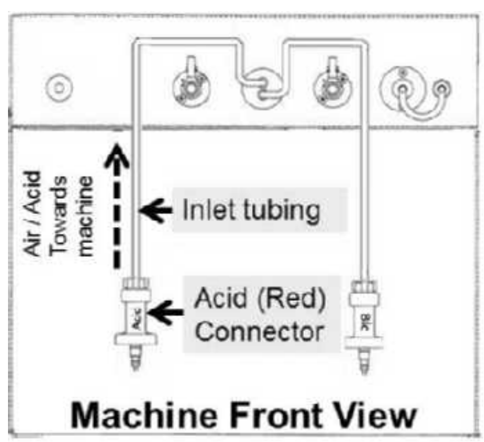



D) From the Home screen, is [**Conductivity**] MORE THAN 11.0 mS?

Yes MORE THAN 11.0 mS! See part G next page.

No LESS THAN 11.0 mS! See part E.

E) Figure right, while watching through the inlet tubing, disconnect the ACID connector from the jug, for seven (7) seconds **THEN** FIRMLY reconnect!

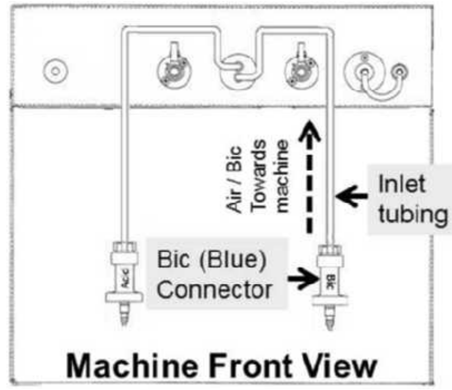



F) Watching for thirty (30) seconds, TWO (2) possible scenarios:

1) **IF (and ONLY if) air / acid is moving, in one direction ONLY, towards the machine!** See part G next page.

2) **IF air / acid is NOT moving OR is moving back and forth!** Proceed to **page 347**, procedure number CO- 1.0.3.6.

G) Figure right, watching through the inlet tubing, disconnect the <u>BICARB</u> connector from the jug for seven (7) seconds **<u>THEN</u>** FIRMLY reconnect!




H) Watching for thirty (30) seconds, TWO (2) possible scenarios:

1) **IF (and ONLY if) air / bicarb is moving, in one direction <u>ONLY</u>, towards the machine!** Proceed to **page 351**, procedure number CO- 1.0.3.8

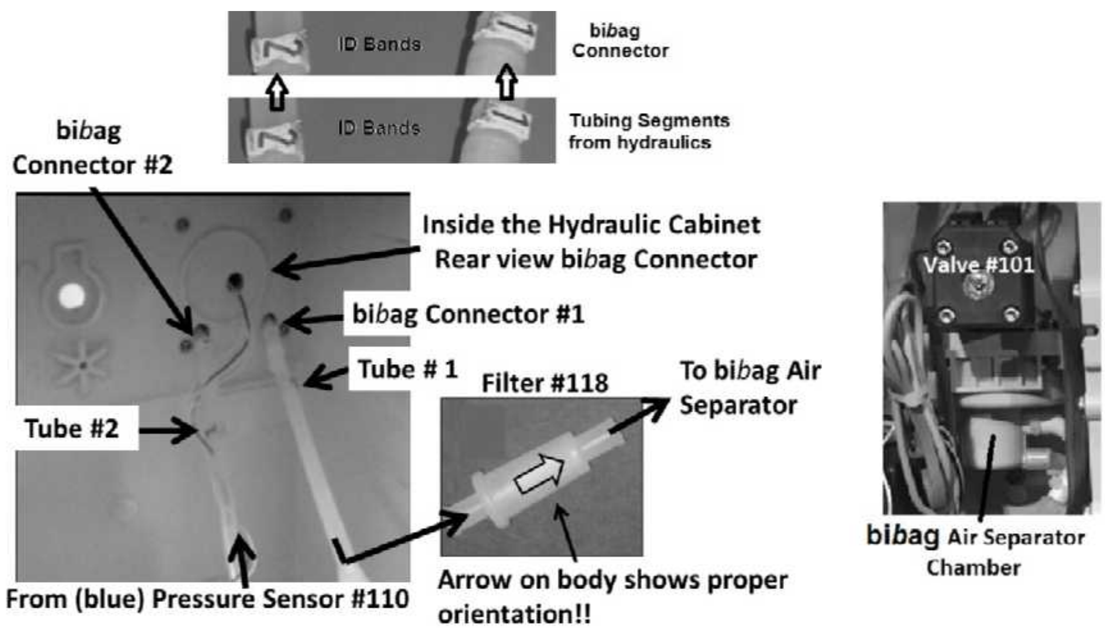
2) **IF air / bicarb is <u>NOT</u> moving <u>OR</u> moving back and forth!** See part I.

I) Turn the machine OFF and pull the hydraulics away from the cabinet.

J) Per the Figures below, locate the bi*b*ag Connector's tubing segments. TWO (2) checks:

**CHECK #1:** ENSURE no external leaks in the tubing segments and Filter #118!

**CHECK #2:** Per the tubing identification (ID) bands, ENSURE the segments have not been reversed.




K) Leaving the hydraulics out, ENSURE FIRM connections to the acid and bicarb jugs

L) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

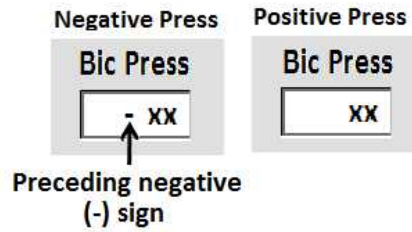
M) ENSURING [Dialysate Flow] is on allow one (1) minute.

N) Check again through the bicarb inlet tubing. Is bicarb / air now moving, in one direction <u>ONLY</u>, towards the machine now?

Yes Bicarb / air moving into machine now! The bi*b*ag tubing segments may have been kinked.

No See procedure number CO- 1.0.3.4 (**page 343**).

## CO- 1.0.3.4 ISOLATE BICARB PUMP INPUT SYSTEM

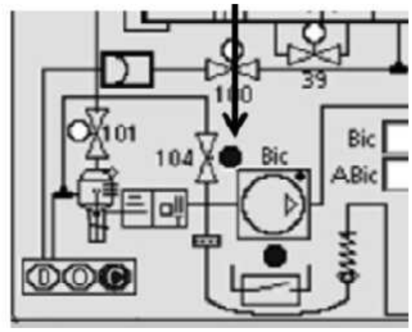



A) Call debug screen 15. **Bic Press** is from Pressure Sensor #110.

B) Figure right, if a negative (‘-‘) sign ever appears pressure is negative. If no ‘-‘ sign it is positive. In any event see part C.

C) Turn the machine OFF!

D) Turn the machine on. When the screen says “Press CONFIRM For Service Mode” press ‘Enter’. The screen MUST say “Machine In Service Mode”.

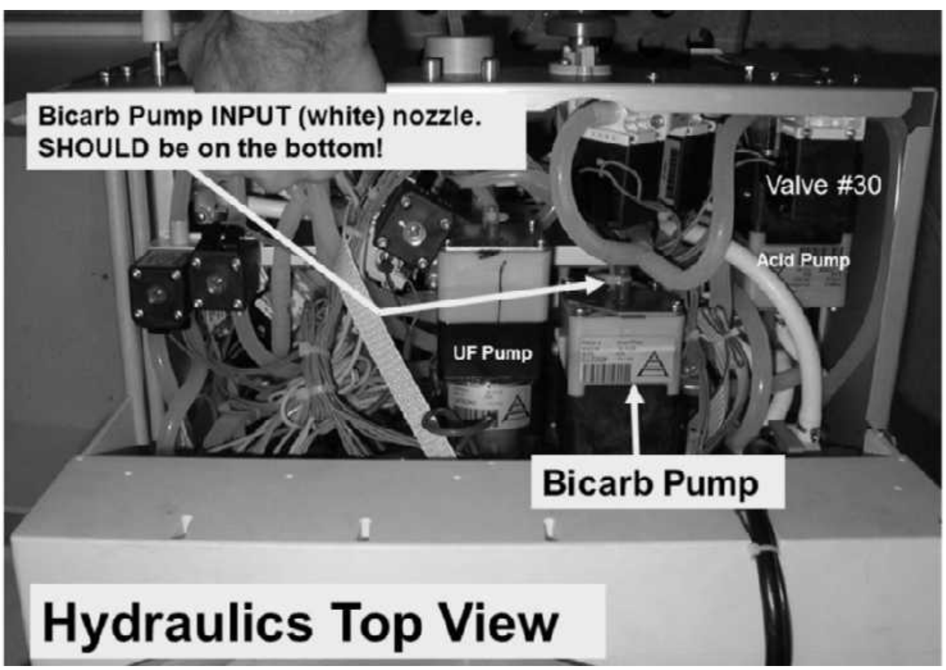



E) Press the Service Mode Menu’s lower left ‘Options’ button.

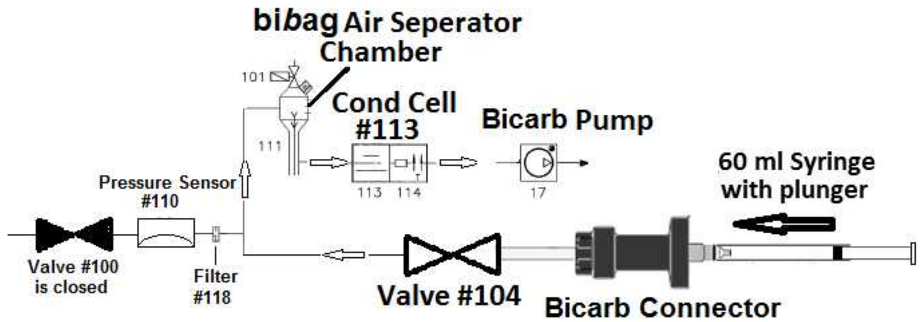
F) Call debug screen 0. Figure right, ENSURE Valve #104’s ‘dot’ is BLUE!

G) **Per the Figure below**, REMOVE the clear tubing from the **Bicarb Pump’s** bottom (INPUT, WHITE) nozzle and direct it into a cup.

**Parts H through J continued on next page**



H) Figure below, attach a water filled 60 ml syringe, <u>WITH</u> THE PLUNGER installed, to the Bicarb (blue) connector.




I) <u>GENTLY</u> push on the plunger. Can you push water through Valve #104 into the cup?

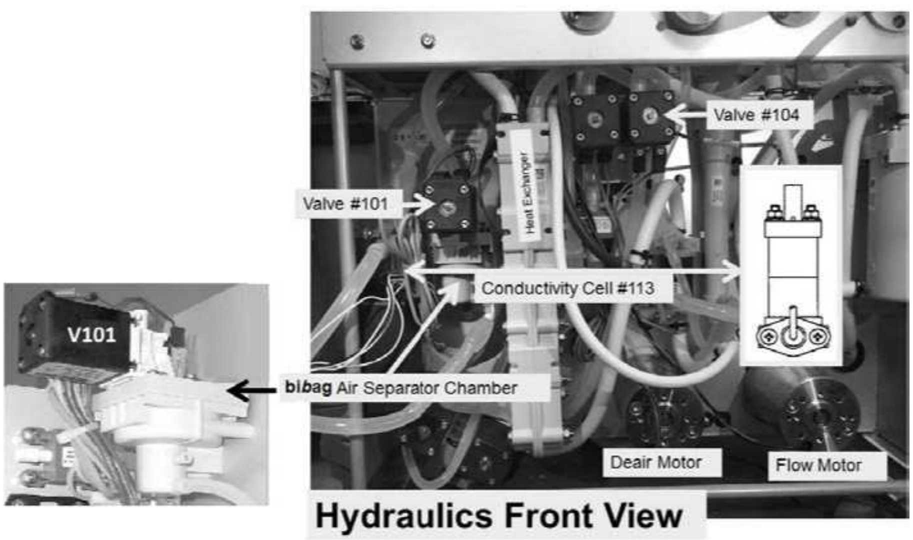
Yes Able to push water into the cup! Proceed to **page 345**, procedure number CO- 1.0.3.5.

No Cannot push water into the cup! Ensuring Valve #104's 'dot' is still blue, a restriction between the Bicarb Pump and the Blue Connector is indicated! Leaving the syringe attached, see part J

J) Per the Figures below, using a flashlight, TWO (2) checks:

**Check #1:** ENSURE no tubing restrictions between the Bicarb connector and the TOP, INPUT side of Valve #104.

**Check #2:** ENSURE no tubing restrictions between the BOTTOM, OUTPUT side of Valve #104 and the second from the bottom port of the bi*b*ag Air Separator Chamber.




K) Pull the BOTTOM, OUTPUT tubing off Valve #104. Can you push water through Valve #104?

Yes Can push through Valve #104! There is a restriction between the bibag Air Separator Chamber and the input of the Bicarb Pump.

No THREE (3) possible problems: 1**)** Loose bibag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Valve #104 OR; **3)** Bad connection, from Valve #104, inside Distribution Box 2 (refer to Figure 4D (page 13)).

### CO- 1.0.3.5 ABLE TO PUSH THROUGH VALVE #104

a) **Reattach the Bicarb Pump's input tubing!**

b) CLAMP and remove the Bicarb Pump's TOP, (solid) OUTPUT tubing. Place a cup under the vacant nozzle.

c) Fill the syringe with water and reattach it to the blue connector.

d) Press the keyboard's 'Esc' key THEN → Calibrate Hydraulics → Bic Pump Volume.

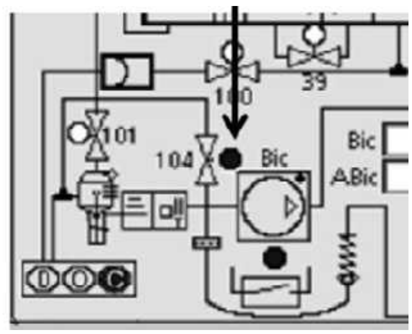
e) Press the blinking 'Prime' key. The lamp above the key turns on solid.

f) As the screen's [Target] window counts down, indicating individual pump strokes, GENTLY push on the syringe plunger. After no more than six (6) strokes, at each stroke, do you see 'spitting' from the pump's output nozzle?

Yes Pump spitting, See procedure number CO- 1.0.3.5.1 (page 345).

No No spitting, There is a problem with the Bicarb Pump.

### CO- 1.0.3.5.1 PUMP 'SPITTING' = THE BICARB PUMP PRIMED




A) Remove the clamp and reattach the Bicarb Pump's output tubing.

B) Connect to the jugs and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

C) Set [Dialysate Flow] to 800 ml/min then allow one (1) minute.

D) Call debug screen 0. Figure right, based on Valve #104's dot color:

1) **IF (and ONLY if) WHITE:** See procedure number CO- 1.0.3.5.2 (page 345).

2) **IF REMAINING BLUE:** Check through the bicarb inlet tubing. If bicarb is drawn, in one direction only, towards the machine, return to (ABOVE) procedure number CO- 1.0.3.1 (page 340). If bicarb is NOT being drawn there is a problem with the Bicarb Pump.

### CO- 1.0.3.5.2 VALVE #104 WHITE / ISOLATE PRESSURE TRANSDUCER #110

A) Return to Service Mode.

B) Press the screen's 'Options' button then call debug screen 0 to ENSURE Valve #104's 'dot' is now blue!

C) Call debug screen 15 to see **Bic Press**:

1) **IF a negative sign (-) appears:** Attach a syringe, with its plunger pulled out, to the BLUE connector, then push on the plunger attempting to create at least positive 90.

2) **IF a negative sign DOES NOT appear:** Attach a syringe, with its plunger pushed all the way in, to the BLUE connector, then pull on the plunger attempting to create at least negative (-)90.

D) Are you able to make **Bic Press** at least positive OR negative (-) 90?

Yes **Bic Press a**t least 90 OR -90! There may still be a problem with the Bicarb Pump.

No Could not make **Bic Press** at least 90 OR -90! See procedure number CO- 1.0.3.5.3 (page 346).

**CO- 1.0.3.5.3 COULD NOT MAKE BIC PRESS 90 OR - 90**

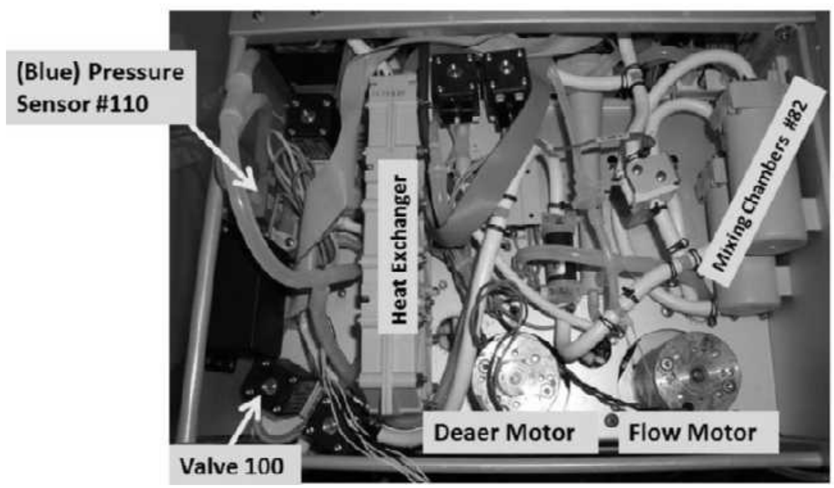
A) Figure below, attach the syringe, to the tube that goes to (blue) pressure Sensor #110 (i.e. tube #2).

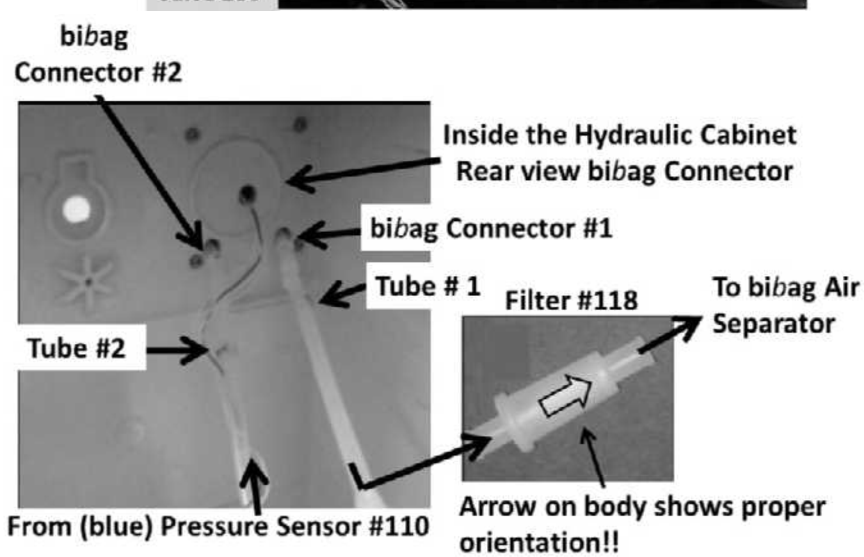
B) If **Bic Press** is negative (-) push on the plunger attempting to achieve at least positive 90. If **Bic Press** is positive pull on the plunger attempting to achieve at least -90?

Yes **Bic Press** at least 90 OR -90! See part C.

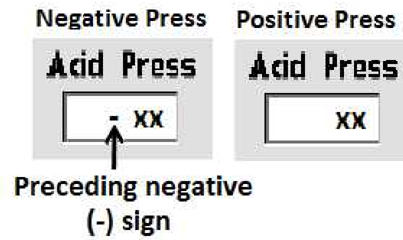
No FOUR (4) possible problems: **1)** Loose bibag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #110 (top Figure below) OR; **3)** Bad bi*b*ag Interface board OR; **3)** Bad connection, from Pressure Sensor #110, inside the bi*b*ag Distribution Board (refer to Figure 4D (page 13)).

C) Filter #118 (bottom Figure below) can be checked by attaching a water filled syringe to it and pushing in the direction of the arrow on its body. If able to push air water through there may be is a leak between the bi*b*ag Connector and / or Valve #104 and / or the bibag Air Separator Chamber.



## CO- 1.0.3.6 ISOLATE ACID PUMP INPUT SYSTEM




A) Call debug screen 15. **Acid Press** is from Pressure Sensor #106.

B) Figure right, if a negative (‘-‘) sign appears **Acid Press** is NEGATIVE. If no ‘-‘ sign it is POSITIVE. In any event see part C.

C) Turn the machine OFF!

D) Pull the hydraulics away from the cabinet.

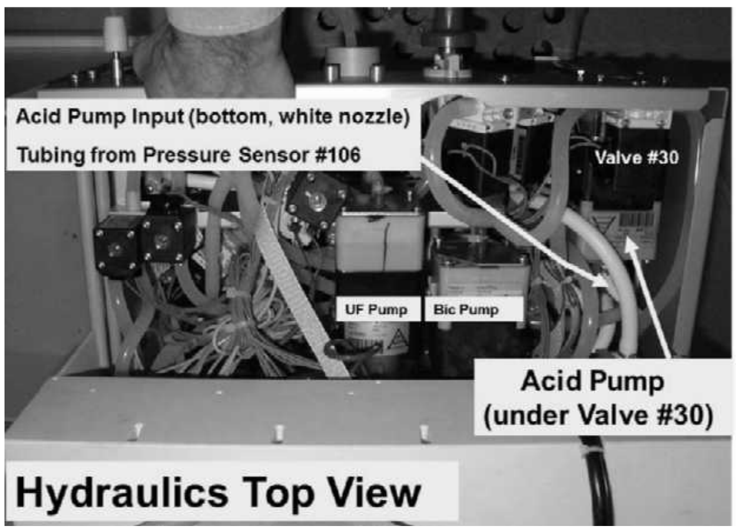
E) **Per the Figures below**, THREE (3) checks for external leaks:

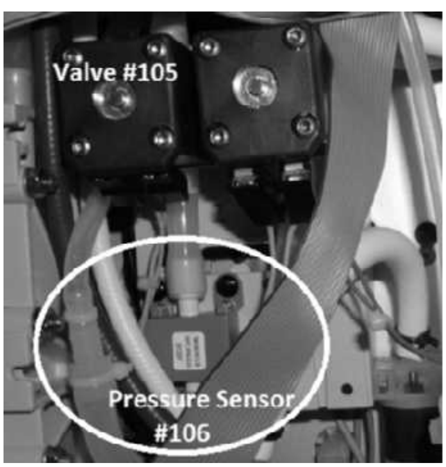
**Check #1:** Between the Acid (red) connector and Valve #105’s INPUT (TOP) tubing.

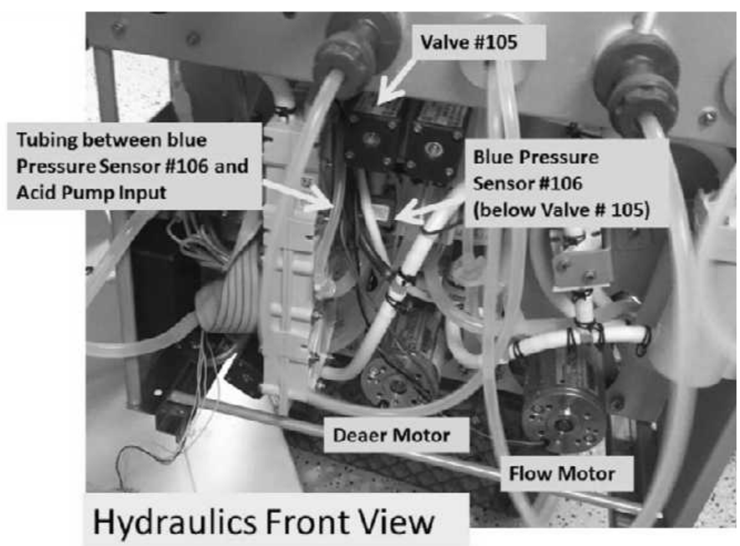
**Check #2:** Between Valve #105’s OUTPUT (BOTTOM) tubing and Pressure Sensor #106.

**Check #3:** Between Pressure Sensor #106 and the **Acid Pump** input (BOTTOM) white nozzle.

**Parts F through K next page**



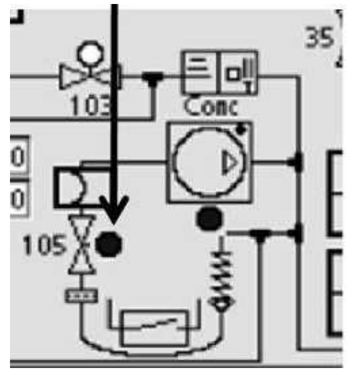
F) Turn the machine on. When the screen says “Press CONFIRM For Service Mode” press ‘Enter’. The screen MUST say “Machine In Service Mode”.

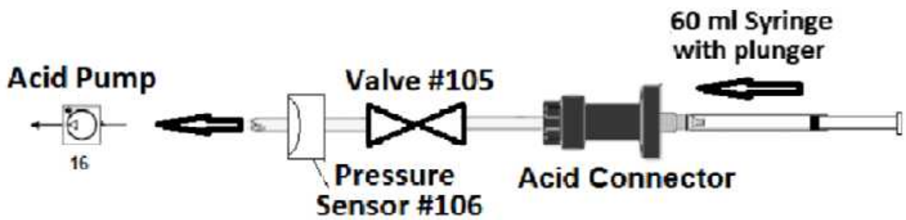
G) Press the Service Mode Menu’s lower left ‘Options’ button.

H) Call debug screen 0. Figure right, ENSURE Valve #105’s ‘dot’ is BLUE!

I) Pull the tubing off the Acid Pump’s INPUT (bottom) white nozzle. Place a cup under the nozzle to capture output.

J) Per the Figure below, attach a water filled 60 ml syringe to the Acid (red) Connector.




K) GENTLY push on the syringe plunger. Can you push water through Valve #105 into the cup?

Yes Able to push water into the cup! See procedure number CO- 1.0.3.6.2 (page 348).

No Cannot push water into the cup! Pull the BOTTOM, OUTPUT tubing off Valve #105. Can you push water through Valve #105?

Yes Can push water through Valve #105! There is a restriction between the Pressure Sensor #106 and the Acid Pump.

No CANNOT push water through Valve #105! FOUR (4) possible problems: **1)** Loose bibag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Valve #105; OR; **3)** Bad bibag Interface board OR; **4)** Bad connection, from Valve #105, inside Distribution Box 2 (refer to Figure 4D (page 13)).

## CO- 1.0.3.6.2 ABLE TO PUSH THROUGH VALVE #105

A) Reattach the Acid Pump’s input tubing.

B) CLAMP and remove the Acid Pump’s TOP, (solid) OUTPUT tubing. Place a cup under the nozzle to capture output.

C) Fill the syringe with water and attach it to the Acid connector.

D) Press the keyboard’s ‘Esc’ key THEN → Calibrate Hydraulics → Acid Pump Volume.

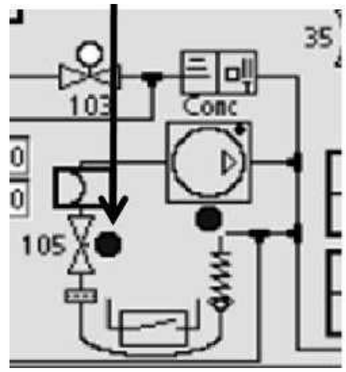
E) Press the blinking ‘Prime’ key. The lamp above the key turns on solid.

F) As the screen’s [Target] window counts down, indicating pump strokes, GENTLY push on the syringe plunger. After no more than six (6) strokes, at each stroke, do you see ‘spitting’ from the pump’s output nozzle?

Yes Pump spitting! It primed! See procedure number CO- 1.0.3.6.3 (page 349).

No spitting! There is a problem with the Acid Pump!

## CO- 1.0.3.6.3 ACID PUMP SPITTING = IT PRIMED




A) Remove the clamp and reattach the Acid Pump's output tubing.

B) Connect to the jugs and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

C) Set [Dialysate Flow] to 800 ml/min then allow one (1) minute

D) Call debug screen 0. Figure right, based on Valve #105's dot color:

1) **IF WHITE:** See procedure number CO- 1.0.3.6.4 (page 349).

2) **IF REMAINING BLUE:** Check through the Acid Inlet tubing. If acid is drawn, in one direction only, towards the machine, return to (ABOVE) procedure number CO- 1.0.3.1 (page 340). If acid is NOT being drawn there is a problem with the Acid Pump.

## CO- 1.0.3.6.4 VALVE #105'S 'DOT' IS WHITE

A) Return to Service Mode.

B) Press the Service Mode screen's 'Options' button.

C) Call debug screen 0 and ENSURE Valve #105's 'dot' is now blue!

E) Call debug screen 15 to see **Acid Press**:

**1) IF (and ONLY if) a negative sign (-) appears:** Attach a syringe, with its plunger pulled out, to the RED connector, then push on the plunger attempting to create at least positive 90.

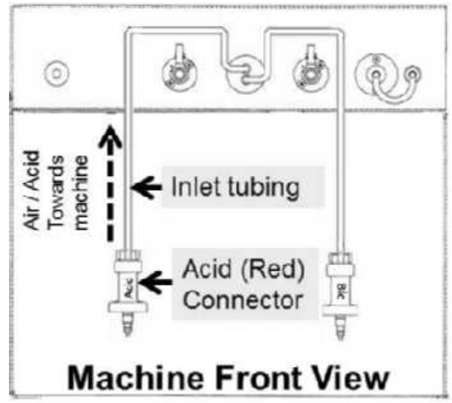
**2) IF a negative sign (-) DOES NOT appear:** Attach a syringe, with its plunger pushed all the way in, to the RED connector, then pull on the plunger attempting to create at least negative (-)90

F) Are you able to make **Acid Press** at least positive OR negative (-)90?

Yes **Acid Press** goes to at least positive 90 OR negative (-)90! There may still be a problem with the Acid Pump.

No Could not make **Acid Press** positive 90 OR negative (-)90! FOUR (4) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #106 OR; **3)** Bad bi*b*ag Interface Board OR; **4)** Bad connection, from Pressure Sensor #106, inside the Distribution Box 2 (refer to Figure 4D (page 13)).

## <u>CO- 1.0.3.7 NOT EQUIPPED WITH BI*B*AG / CONDUCTIVITY LOW</u>

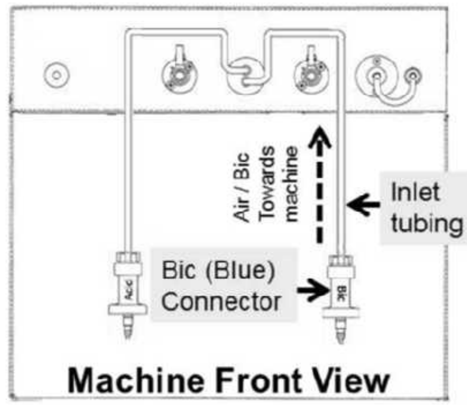



A) Figure right, while watching through the inlet tubing, disconnect the <u>ACID</u> connector from the jug, for seven (7) seconds **<u>THEN</u>** FIRMLY reconnect!

B) Watching for thirty (30) seconds, TWO (2) possible scenarios:

**1) IF (and ONLY if) air / acid is moving in one direction <u>ONLY</u>, towards the machine!** See part C.

**2) IF air / acid is <u>NOT</u> moving <u>OR</u> moving back and forth!** See procedure number CO- 4.1.0 (page 375).




C) Figure right, watching through the inlet tubing, disconnect the <u>BICARB</u> connector from the jug, for seven (7) seconds **<u>THEN</u>** FIRMLY reconnect!

D) Watching for thirty (30) seconds, TWO (2) possible scenarios:

**1) IF (and ONLY if) air / bicarb is moving, in one direction <u>ONLY</u>, towards the machine!** See procedure number CO- 1.0.3.8 (**page 351**).

**2) IF air / bicarb is <u>NOT</u> moving <u>OR</u> moving back and forth!** See procedure number CO- 4.1.0 (page **375**).

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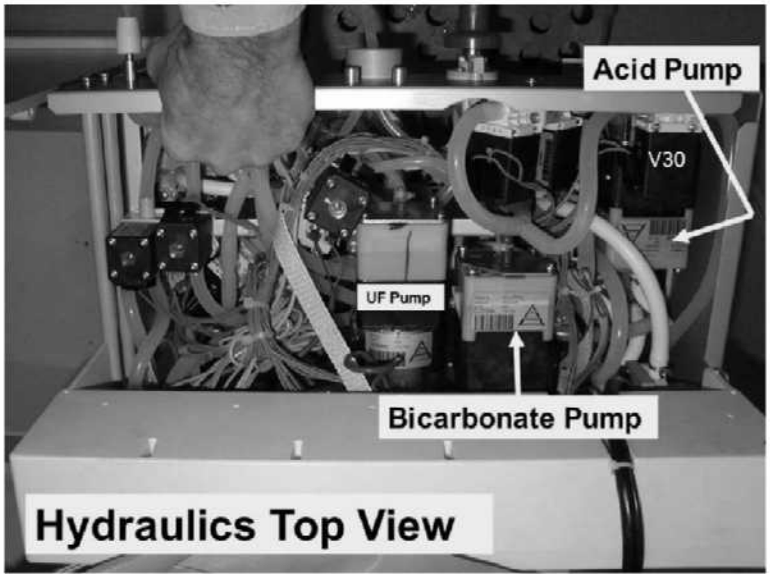
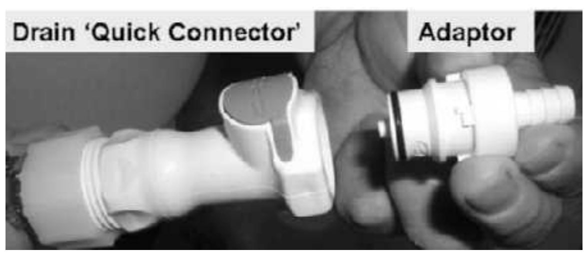
**CO- 1.0.3.8 BOTH PUMPS DRAWING CONCENTRATE / ISOLATE LEAKS**

A) ENSURE FIRM connections to the acid and bicarb jugs.

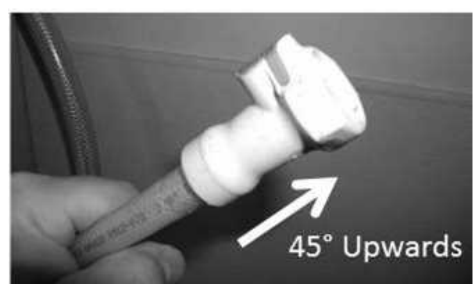
B) Figure below, ENSURE no leaks from the ACID and BICARB pumps.




C) Figure below, if a 'Quick Connector' is present, at the end of the drain tubing, an ADAPTOR is required!




D) As seen in the Figure right, point the drain tubing OPENING **UP at 45°** and no higher than two (2) feet above the floor! **IF POINTED DOWN GRAVITY FLOW RESULTS IN ERROR!**



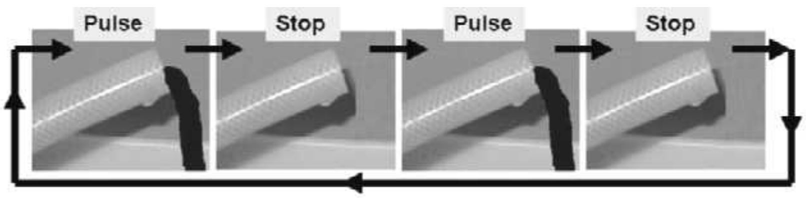

E) Watch for **ONE (1) FULL MINUTE** THEN consider BOTH scenarios next page:

***Scenario #1*:** **Per *Figure A (below)*, approximately 30 ml pulses that stop <u>completely</u> between <u>each and every</u> cycle i.e. Pulse → Stop → Pulse → Stop:** See parts a AND b below***:***

a) Reconnect the drain then ensure good drain flow by either seeing or hearing it.

b) ENSURING [Dialysate Flow] is set to 800 ml/min and on, see procedure number CO- 1.0.4 (page 353).

Figure A




***Scenario #2*:** **Per to *Figure B (below)*, approximately 30 ml Pulse → Stop → Pulse → 'Dribble' (a noticeably weaker stream that last about two (2) seconds) → etc.** Perform parts a and b below:

a) A procedure in another section is performed next. NOTE this page number as you may be prompted to return here!

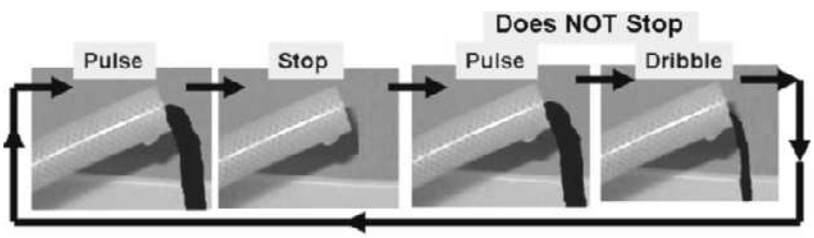
b) BEFORE continuing to part c proceed to **page 580,** to perform <u>SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM</u>.

c) If a leaking Balancing Chamber diaphragm was not located in part b, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!.

d) Allow four (4) minutes then see procedure number CO- 1.0.4 (page 353).

.

Figure B

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## CO- 1.0.4 ISOLATE ACID PUMP CONTROL

a) **Open the shunt door and <u>LEAVE IT OPEN</u> till instructed!**

b) Call debug screen 0. Figure (right), WITHOUT LOOKING AWAY, watch **Acid** versus **AAcid** for one (1) minute. Are they <u>remaining always</u> within +/- 3 of each other?

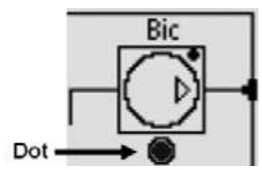

Yes **AAcid** = **Acid!** See procedure number CO- 1.0.4.2 (page 353).

No **AAcid** is <u>NOT</u> remaining within 3 of **Acid!** There is a problem with Acid Pump control! Close the shunt door THEN proceed to **page 441**, <u>SECTION 6 - CONCENTRATE PUMP ERRORS</u>...

## CO- 1.0.4.2 AACID = ACID / ISOLATE BICARB PUMP CONTROL


Figure right, watch **Bic** versus **ABic** for one (1) minute. Are they <u>remaining always</u> within +/- 3 of each other?

Yes **ABic** = **Bic!** See procedure number CO- 1.0.5 (page 353).



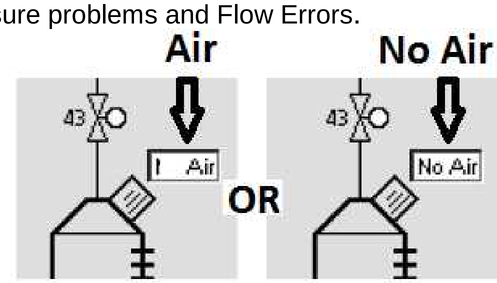

No. **ABic** is <u>NOT</u> remaining within +/- 3 of **Bic!** Figure right, watch the Bicarb (BIC) pump's 'dot' for THREE (3) minutes. It should <u>REMAIN</u> blue. TWO (2) possible scenarios:

1) **IF (and ONLY if) the 'dot' is <u>EVER</u> white:** See procedure number **CO- 9.0.0** (page 409).

2) **IF the 'dot' REMAINS BLUE:** There is a problem with Bicarb Pump control. Close the shunt door <u>THEN</u> proceed to **page 441**, <u>SECTION 6 - CONCENTRATE PUMP ERRORS</u>.

## CO- 1.0.5 ABIC = BIC / ISOLATE FILLING PROGRAM

Filling Programs ("Air" in dialysate) may mask Loading Pressure problems and Flow Errors.




a) From debug screen 0, Figure right, watch the text box above Chamber #69 for thirty (30) seconds for it to **<u>EVER</u>** say "Air", even just once!

b) TWO (2) possible scenarios:

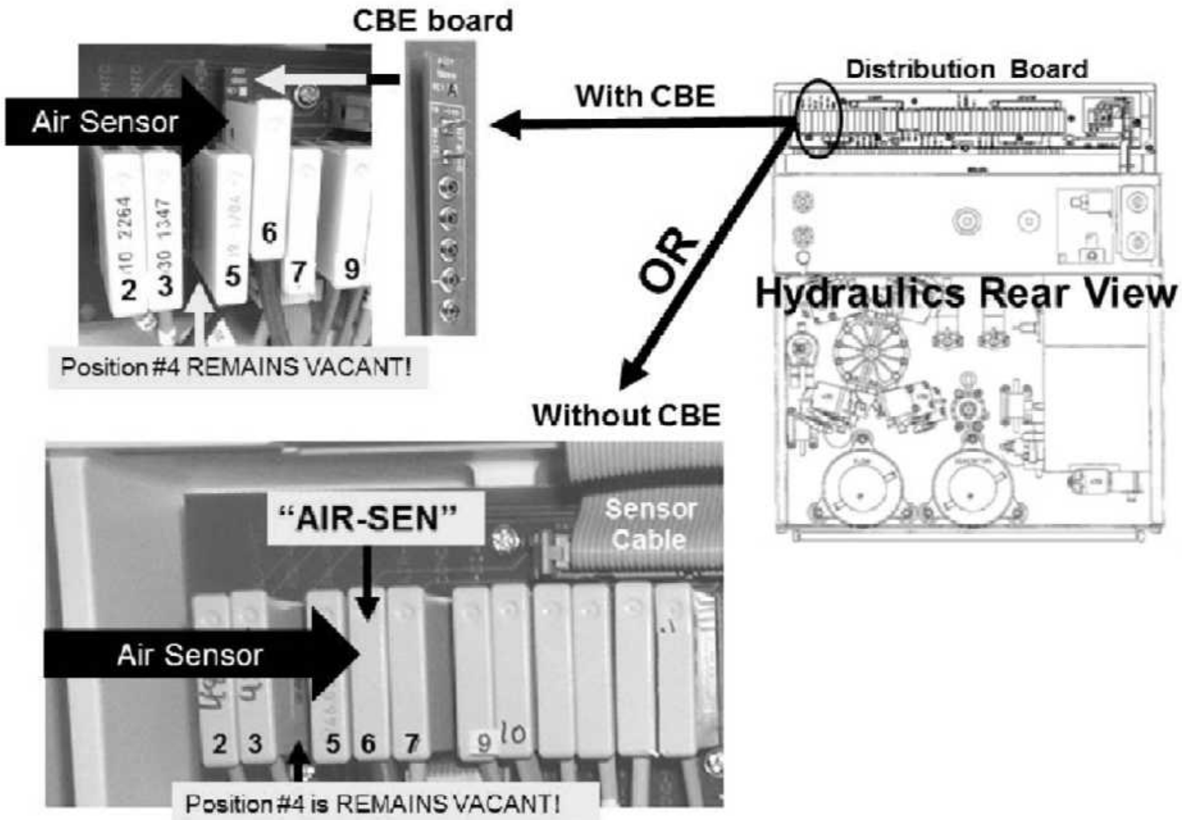
1) **IF it <u>EVER</u> says "Air" even just once:** See procedure number CO- 1.0.5.2 (page 354).

2) **IF (AND ONLY if) it <u>ALWAYS</u> says "No Air"!** Proceed to **page 356**, procedure number CO- 1.0.6.

**CO- 1.0.5.2 CHAMBER #69 SAYS "AIR"**:

A) **Figure below**, inside the distribution board, locate the Air Sensor's female connector! **4th connector i.e. 5th position** FROM THE LEFT. If CBE modified it plugs into the 'CBE board' two pins higher than the others!

**Continue to part B next page**

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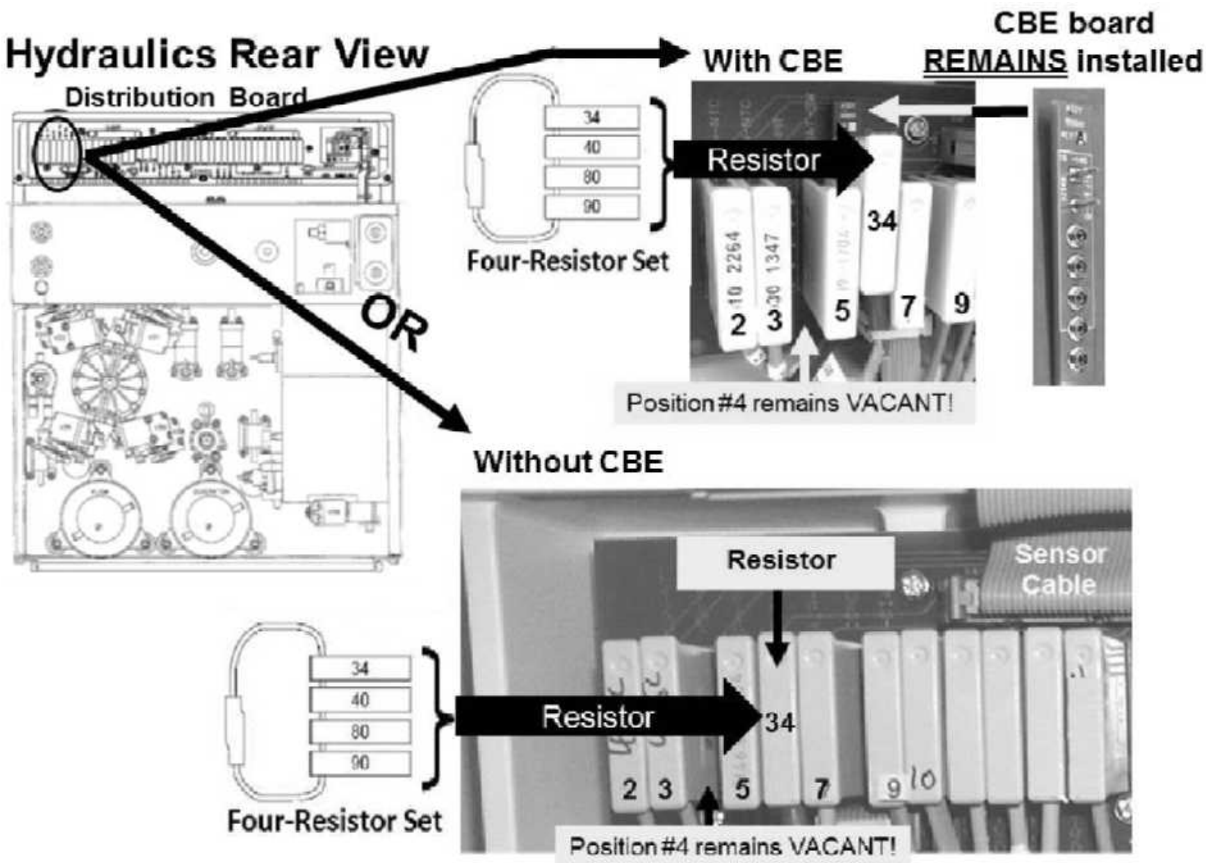
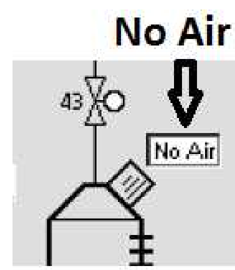
B) **FIGURE BELOW**, place one of the plugs, from the **<u>FOUR-RESISTOR SET</u>** into the Air Sensor's distribution board position i.e. **5th position*** from LEFT

*** NOTE!** If CBE modified the resistor MUST plug into the CBE board pin for pin! ENSURE the top CBE board pin is covered by the resistor!




C) If the resistor plug was placed PROPERLY, watching to thirty (30) seconds, Chamber #69's box <u>MUST</u> now say "No Air" always!




D) See procedure number CO- 1.0.6 (page 356).

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## CO- 1.0.6 “NO AIR” ALWAYS / ISOLATE LOADING PRESSURE

a) **ENSURING** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it **SLAM*** it into the Acetate/Acid rinse port. * or else pressure always read low

b) Loading Pressure may not cycle but is ‘OKAY’ if it achieves a peak of between 23 and 26 psi. TWO (2) possible scenarios:

   **1)** **IF (and ONLY if) pressure is ‘OKAY’:** Leaving the gauge installed, see procedure number CO- 1.0.6.2 (page 356).

   **2)** **IF pressure is <u>NOT</u> ‘OKAY’:** Leaving the gauge installed, proceed to **page 33**, procedure number F- 1.0.7.

## CO- 1.0.6.2 LOADING PRESSURE OKAY / ISOLATE INTERMITTENT FLOW ERROR

a) Call debug screen 0.

b) WITHOUT LOOKING AWAY, watch **Flow Error** for three (3) minutes **<u>OR</u>** until if it <u>EVER</u> = 1, even just once, indicating a Flow Error:

   **1)** **IF (and ONLY if) Flow Error ALWAYS = 0!** Proceed to **page 357**, procedure number CO- 1.0.7

   **NOTE!** If [**Conductivity**] has been ‘drifting’ between good and high watch **Flow Error** for up to six (6) minutes to catch a potentially VERY intermittent Flow Error!

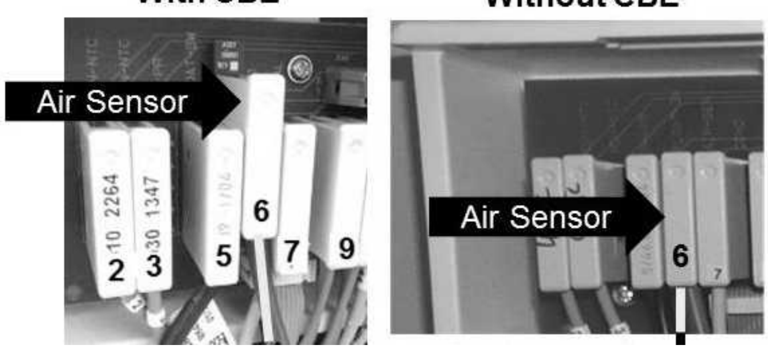
   **2)** **IF Flow Error EVER = 1 even just once:** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

## CO- 1.0.6.4 BC SWITCH NEVER = 897 PART 1

a) If previously removed, return the Air Sensor’s female connector to **5th distribution board position** <u>FROM THE LEFT</u>. Figure below, if CBE modified it plugs into the CBE board pin for pin!

b) See procedure number CO- 1.0.7 (page 357).

**With CBE** **Without CBE**



## CO- 1.0.7 BC SWITCH NEVER = 897 PART 2

a) BE SURE the blue connector is in KNOWN GOOD bicarb; the red connector in KNOWN GOOD acid.

b) Consider using the acid and bicarb from another machine that has good Conductivity!

c) From the Home screen, ENSURE [Dialysate Flow] is on at AT LEAST 500 ml/min!

d) If a problem was located in part a OR the acid AND / OR bicarb was changed in part b allow six (6) minutes BEFORE continuing to part e.


e) Based on [**Conductivity**] now, THREE (3) possible scenarios:

**Scenario #1:** **IF (and ONLY if) LESS THAN 13.3 mS:** Proceed to **page 365**, procedure number CO- 2.0.0.

**Scenario #2:** **IF (and ONLY if) MORE THAN 14.3 mS:** See procedure number CO- 1.0.8 (page 358)

**Scenario #3:** **IF STABLE between 13.3 and 14.3 mS:** Something changed! If the original problem is no longer occurring DO NOT continue.

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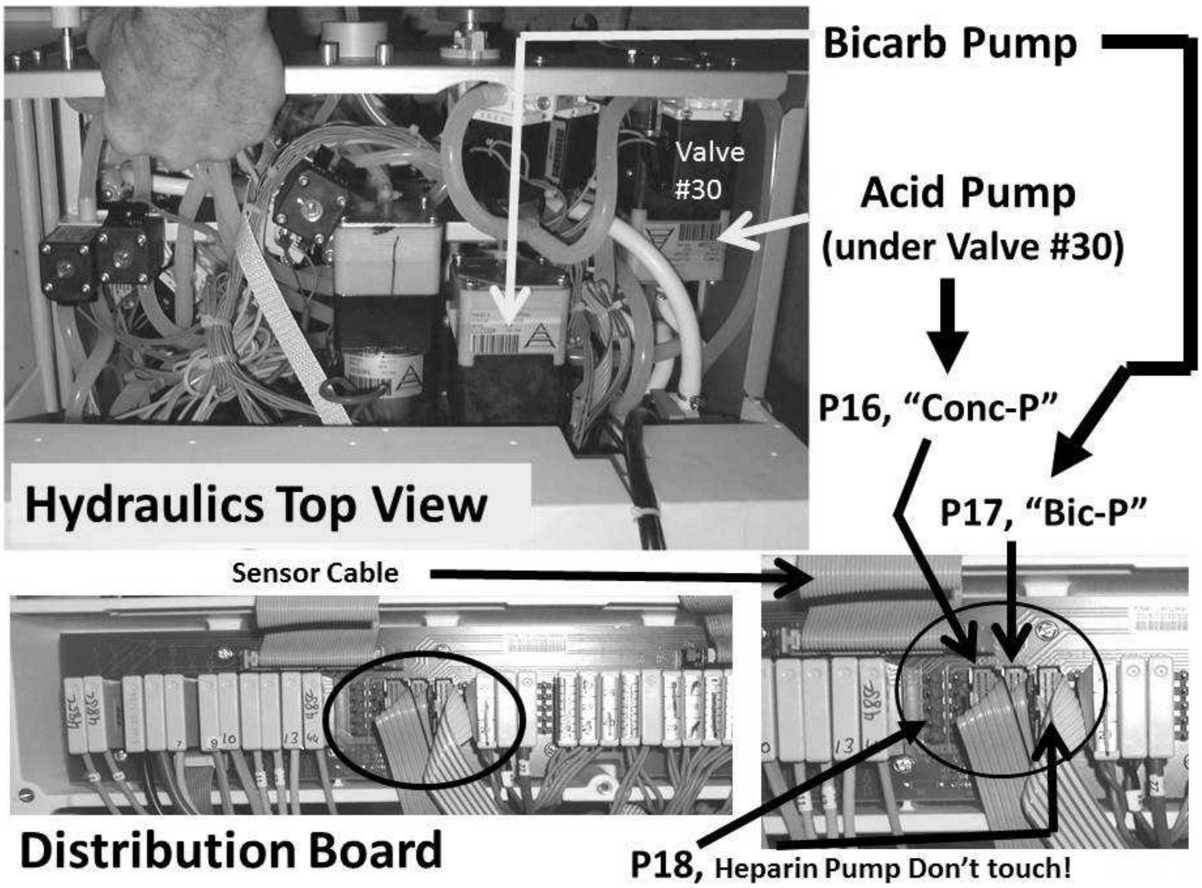
## CO- 1.0.8 [CONDUCTIVITY] MORE THAN 14.5 mS / ISOLATE PUMP ELECTRICAL CONNECTIONS

A) **WARNING!** To prevent patient harm, follow this procedure carefully!

B) **Figure BELOW**, touch the top of the **ACID** AND **BICARB** pumps to feel them mechanically stroking about every three (3) seconds!




C) **Return the BICARB (blue) connector to its rinse port!**


D) Call debug screen 2 and ENSURE **BICOUT** = 0.

E) Touch the **ACID AND BICARB PUMPS** again. TWO (2) possible scenarios:

1) **IF (and ONLY if) the ACID PUMP continues to stroke BUT the BICARB PUMP stops:** This is normal! See procedure number CO- 1.0.8.1 (page 359).

2) **IF the BICARB PUMP is stroking AND the ACID PUMP stops:** See parts a AND b below:

a) **CAUTION! To prevent damage turn the machine OFF**!

b) Figure above the acid (“Conc-P”) and bicarbonate pump (“Bic-P”) distribution board connectors are reversed!

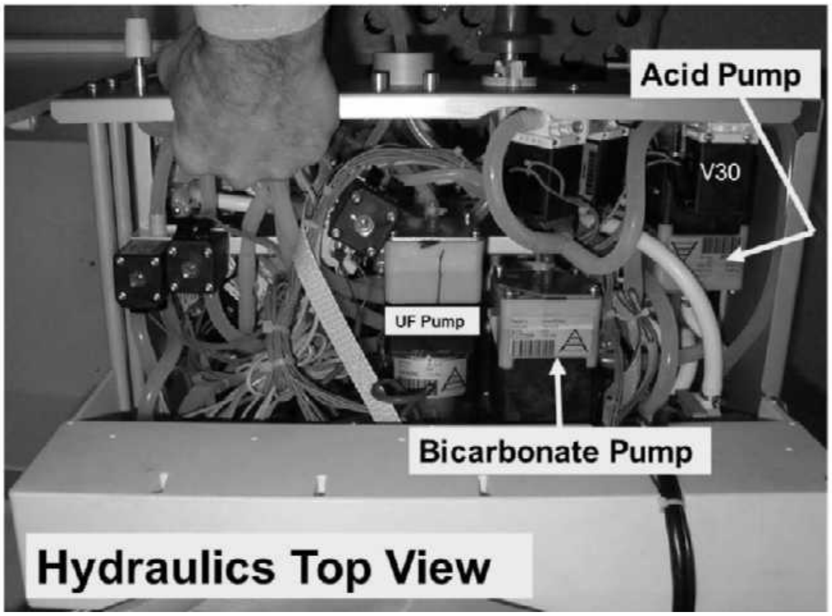
**<u>CO- 1.0.8.1 [CONDUCTIVITY] MORE THAN 14.5 mS / ISOLATE PUMP TUBING CONNECTIONS</u>**

a) TWO (2) possible scenarios to <u>ENSURE</u> the Acid and Bicarb pump tubing is <u>NOT</u> reversed!

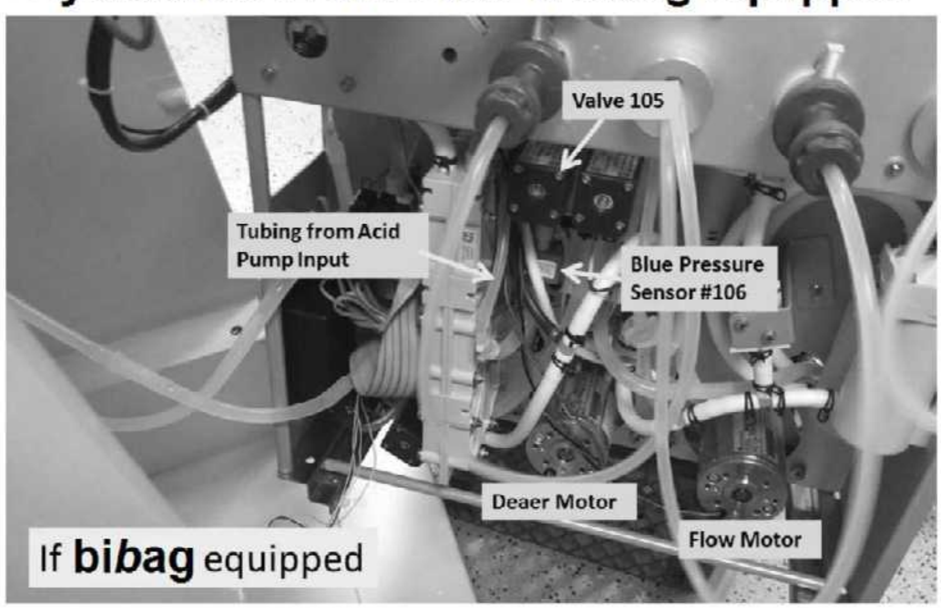
1) **IF equipped with a bi*bag* Connector:** Per the Figures below, trace the clear (INPUT) tubing from the **<u>ACID PUMP</u>** to ENSURE it comes from (blue) Pressure Sensor #106.

2) **IF <u>NOT</u> equipped with a bi*bag* Connector:** Per the top Figure below, trace the tubing from the red (ACID) connector to ENSURE it goes to the input of the **<u>ACID PUMP</u>**!

b) If <u>ABSOLUTELY SURE</u> the pumps are plumbed correctly, see procedure number CO- 1.0.8.2 (page 360).




**Hydraulics Front View if bi*bag* equipped**



CO- 1.0.8.2 CONDUCTIVITY] MORE THAN 14.5 mS / ISOLATE DRAIN STREAM.

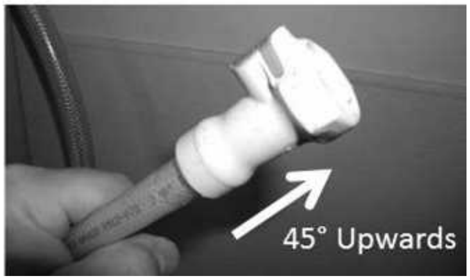
a) ENSURE Loading Pressure (Acid Rinse Port gauge) continues to reach a peak more than 22 psi.

b) **If a 'Quick Connector' (Figure right) is present at the end of the drain tubing an ADAPTOR is required**.

c) As seen in the Figure (below right), point the drain tubing opening **UP at 45°** holding it no higher than two (2) feet above the floor. **IF POINTED DOWN GRAVITY FLOW RESULTS IN ERROR!**

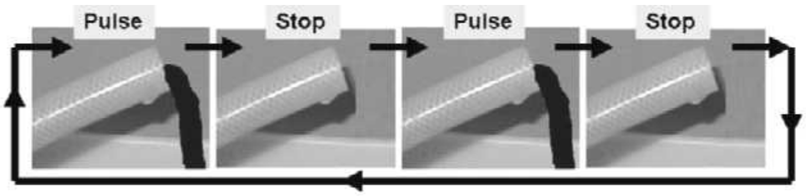
d) Watch for **ONE (1) FULL MINUTE**.

e) Consider BOTH scenarios below AND proceed accordingly:

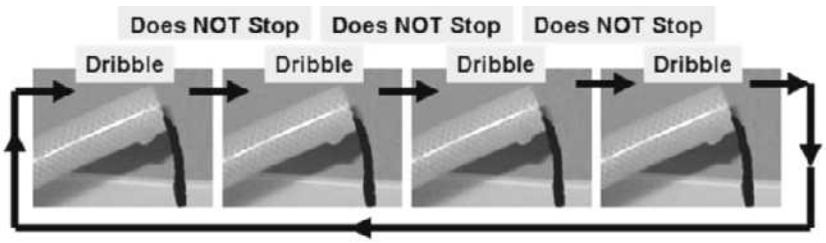

***Scenario #1*****:** **See *Figure A.* Approximately 30 ml pulses that stop between each and every cycle i.e. Pulse → Stop → Pulse → Stop → etc.** Reconnect the drain then see procedure number CO- 1.0.8.3 (page 360).

Figure A




***Scenario #2:*** **See *Figure B*. If a continuous weak stream that LASTS for several seconds or longer!** ENSURING the drain tubing opening was pointed up, proceed to **page 66**, procedure number F- 6.2.0.

Figure B




CO- 1.0.8.3 DRAIN FLOW PULSE → STOP / [CONDUCTIVITY] MORE THAN 14.5 mS

A) Return BOTH concentrate connectors to their RINSE ports

B) Close the shunt door.

C) Place the machine into RINSE.

D) Is the external flow indicator's 'bob' moving at least ¼ up in the sight tube?

Yes 'Bob' moving! See part E.

No 'Bob' NOT moving! ENSURING the machine was in RINSE, return to Dialysis Program THEN proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM

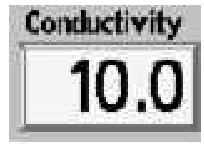
E) Watch for **ten (10)** minutes ENSURING a "No Water" or a Flow Error NEVER occurs.

F) See procedure number CO- 1.0.8.4 (page 361).

**CO- 1.0.8.4 AFTER 10 MINUTE RINSE / ISOLATE COND CELL #7**

a) Connect to acid and bicarb.

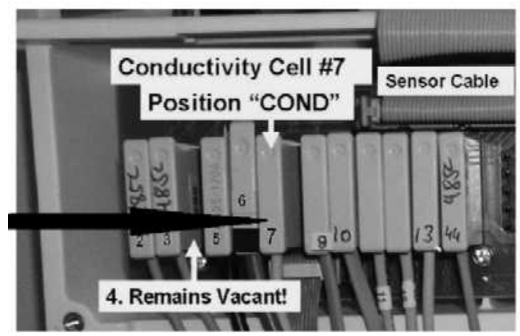
b) Return to Dialysis Program (Select Program" → 'Dialysis' → 'Enter')!




c) **IMMEDIATELY** call the Home screen. Is [**Conductivity**] = 10 mS?

Yes **[Conductivity]** = 10.0 mS! See procedure number CO- 1.0.8.5 (page 362).

No **[Conductivity] =** MORE THAN 10.0 mS! See parts a THROUGH c below:




a) **Not likely!** BE VERY SURE the machine was in RINSE for ten (10) FULL minutes!

b) Figure right, inside the distribution board, unplug the 5th CONNECTOR CAP from the LEFT, 6th position from the LEFT i.e., position "COND"!

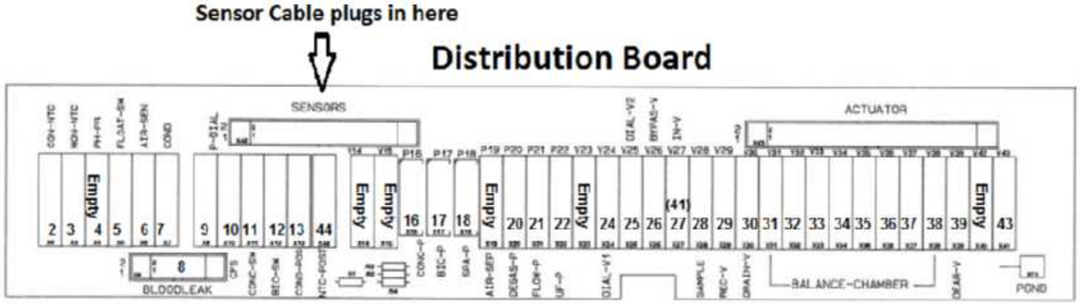
c) Is [**Conductivity**] = 10 mS now?

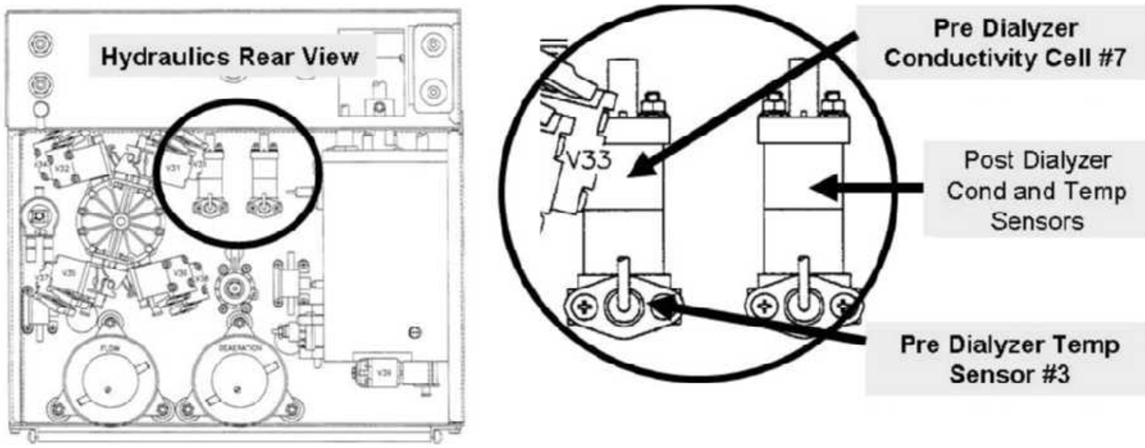
Yes [**Conductivity**] = 10.0 mS! Pre-Dialyzer Conductivity Cell # 7* is bad. *To LOCATE Cell #7, refer to the Figure next page).

No [**Conductivity**] **=** more than 10.0 mS! See parts a AND b below

a) **Not likely!** BE VERY SURE you unplugged Conductivity Cell #7's connector from position, "X7, COND"! If [**Conductivity]** is STILL more than 10.0 mS continue to part b.

b) Figure below, TWO (2) possible bad components: **1)** Bad Sensor Board cable OR **2)** Bad distribution board.






**<u>CO- 1.0.8.5 AFTER RINSE CONDUCTIVITY = 10.0 MS</u>**

a) Press the [Dialysate Flow] window and set it to 800 ml/min.

b) Press ‘Enter’.

c) Allow six (6) minutes BEFORE proceeding to **page 365**, procedure number CO- 2.0.0.

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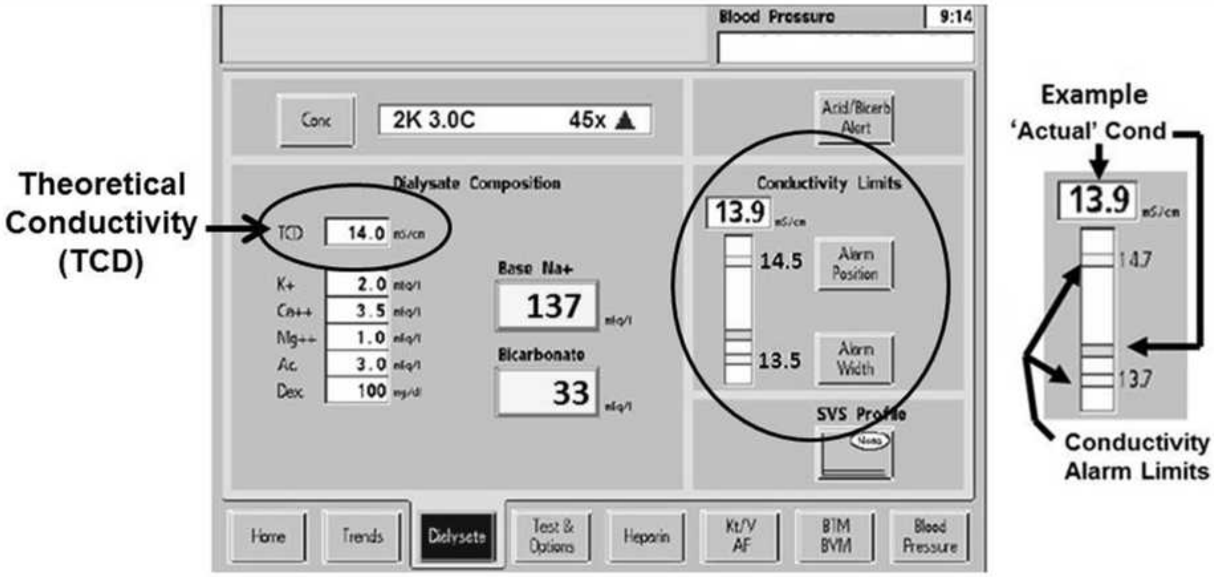
## CO- 1.0.9 VERIFY DIALYSATE LIMITS

a) Press the 'Dialysate' tab (Figure below).



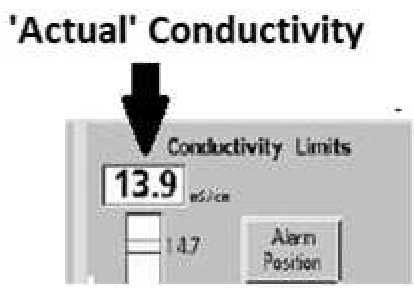

**Dialysate SCREEN**

b) **TCD** is based on Dialysate Composition and indicates what the 'Actual' Conductivity would be if everything was perfect.

c) Using [Alarm Width], spread Conductivity Limits as wide as they will go and press 'Enter'.

d) Using [Alarm Position], set the upper Limit to 0.5 above **TCD** and press 'Enter'.

e) Based on the 'Actual' [**Conductivity**] window (Figure right), TWO (2) possible scenarios:



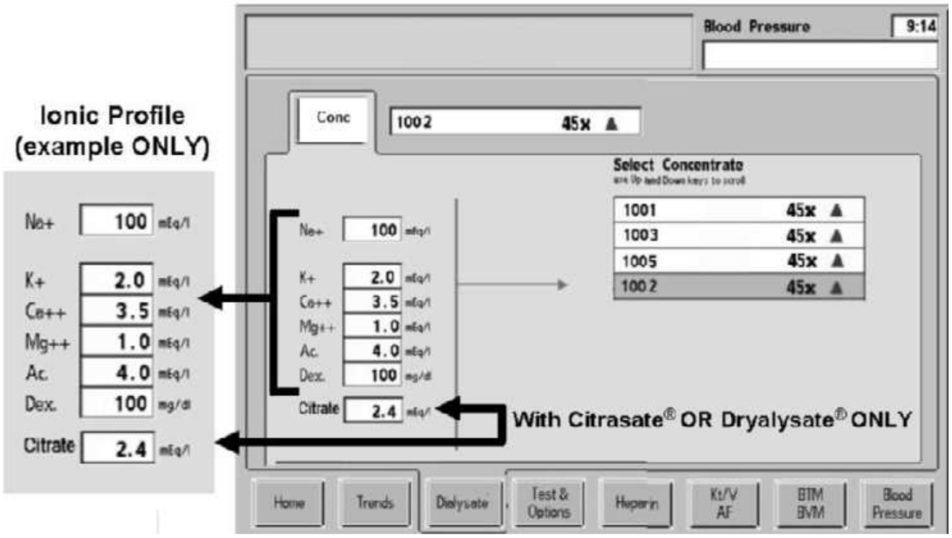

**1) IF (and ONLY if) [Conductivity] is <u>STABLE</u> between 13.4 and 14.3 mS:** See procedure number CO- 1.0.10 (page 364).

**2) ALL OTHERS:** Proceed to **page 365**, procedure number CO- 2.0.0.

## CO- 1.0.10 VERIFY ACID SETTINGS

a) Press the upper left 'Conc' button to call the ACID Sub Screen (Figure below). This screen indicates the 'Selected Acid's' ***Ionic Profile***.

**ACID Sub Screen**




b) Does the label on the connected ACID match the Sub Screen's ***Ionic Profile*** (Yes or No)?

Yes The label = the screen's Ionic Profile. See parts a AND b below:

a) Per its label, ENSURE the bicarb is the same 'Type' as the acid.

b) See procedure number CO- 2.0.0 (page 365).

No Referring to NOTES 1 through 4 below, THREE (3) possibilities: **1)** The connected acid may NOT be the 'Selected Acid'; **2)** You made an error and the levels are correct; **3)** The connected acid was entered incorrectly in Service mode.

**NOTE 1:** If a Granuflo® acid is selected the screen's **Acetate (Ac)** value should be ½ the value on the ACID'S label. EXAMPLE: 4.0 on the screen = 8.0 on the label. If Granuflo® IS NOT selected the screen's **Ac** value should = exactly the value on the label!

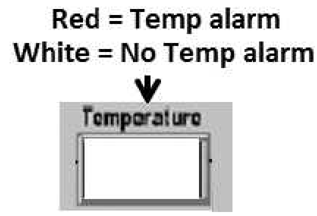
**NOTE 2:** Sub Screen values are rounded! EXAMPLE: 2.30 on the screen may = 2.25 on the label.

**NOTE 3:** **Na+** = Sodium. If the sodium level on the label is 110 or less it indicates sodium contributed by the acid alone. If more than 110 it indicates the TOTAL or FINAL Sodium.

**NOTE 4:** **K+** = Potassium; Ca**++** = Calcium; Mg**++** = Magnesium; **Ac** = Acetate; **Citrate** is NOT ALWAYS present; **Dex** = Dextrose (mg/dL*****).

***** If the label states Dextrose in mmol/L THEN 5.5 mmol/L = 100 mg/dL;11 mmol/L = 200 mg/dL

## CO- 2.0.0 VERIFY PRIMARY TEMPERATURE ALARM LIMITS



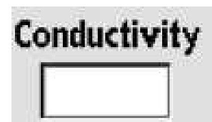

a) Call the Home screen.

b) ENSURING [**Temperature**] REMAINS between 35.5 and 38.5° C, what color is its window (Figure right)?

   **1) IF pale yellow/white:** If equipped with a bi*b*ag Connector see procedure number CO- 2.0.1 (page 365). If (and ONLY if) NO bi*b*ag Connector proceed to **page 368**, procedure number CO- 2.0.6.

   **2) IF RED:** Proceed to **page 240**, procedure number **T- 1.0.9**.

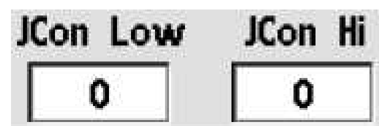
## CO- 2.0.1 BI*B*AG EQUIPPED / ISOLATE BICARB ALARM LIMITS




a) Call debug screen 14 ("bibag").

b) **Conductivity** (bottom row) is the Bicarb's Conductivity, as reported by Conductivity Cell #113. Example: 50.11 = 50.11 mS.


c) **JConLowLmt** AND **JConHiLmt** (bottom row) are the Bicarb alarm limits when using bicarb from a jug.



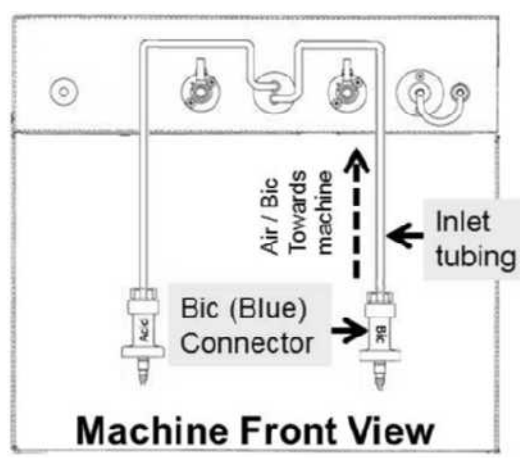

d) **JCon Low** = 1 if **Conductivity** is lower than the **JConLowLmt**. If NOT it = 0!

e) **JCon Hi** = 1 if **Conductivity** is more than the **JConHiLmt**. If NOT it = 0.

f) **CAUTION!** If **JCon Low** OR **JCon Hi** EVER = 1 BE VERY SURE the bicarb connected to the machine has tested good per clinic procedures.

g) WITHOUT LOOKING AWAY, watch **JCon Low** AND **JCon Hi** for one (1) minute. TWO (2) possible scenarios:

   **1) IF (and ONLY if) BOTH JCon Low AND JCon Hi ALWAYS = 0:** The Bicarb's Conductivity is good! Proceed to **page 368**, procedure number CO- 2.0.6.



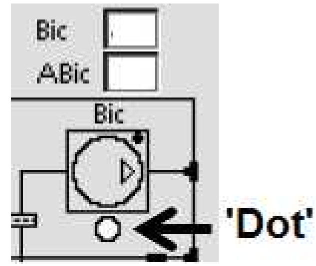

   **2) IF JCon Low OR JCon Hi EVER = 1 (always OR once in a while):** Figure right, are air bubbles seen MOVING INTO the machine through the Bicarb Inlet Tubing (Yes or No)?

   Yes — Air seen! THREE (3) checks: **1)** ENSURE the bicarb jug is full; **2)** Check the bicarb pickup wand; **3)** Check the blue connector's O-rings and plug.

   No air seen! — See procedure number CO- 2.0.2 (page 366).

## CO- 2.0.2 ISOLATE BICARBONATE PUMP (bi*bag*)

a) Call debug screen 0.




b) Figure right, WITHOUT LOOKING AWAY, simultaneously watch the BIC pump's 'dot' <u>AND</u> **ABic** versus **Bic** for TWO (2) minutes. THREE (3) possible scenarios 1) or 2) or 3) below:

   **1) IF (and ONLY if) the Bic 'dot' is <u>EVER</u> white:** See procedure number CO- 9.0.0 (page 409).

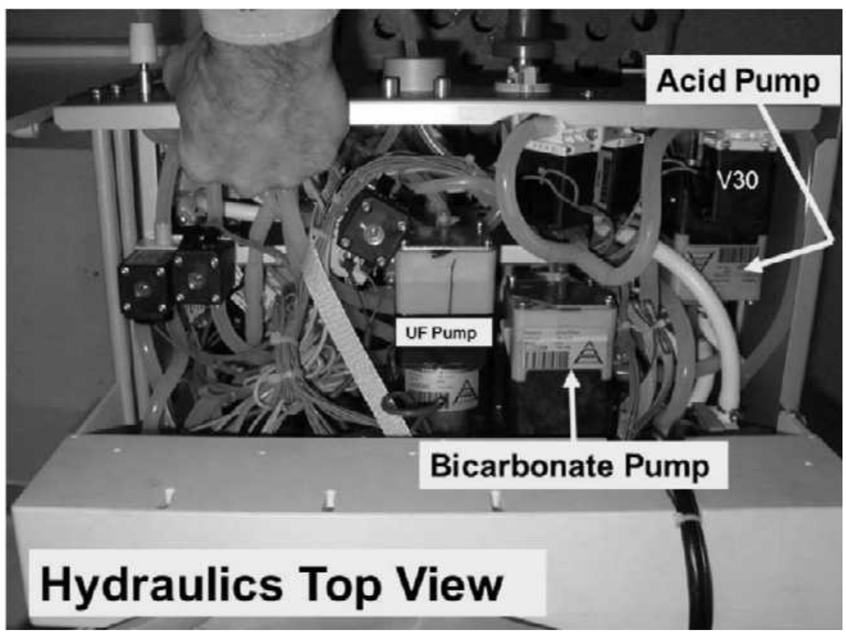
   **2) IF (and ONLY if) the 'dot' is <u>ALWAYS</u> blue <u>AND</u> ABic is REMAINING within three (3) of Bic:** See procedure number CO- 2.0.3 (page 366).

   **3) IF the 'dot' is <u>ALWAYS</u> blue <u>BUT</u> ABic is <u>NOT</u> REMAINING within three (3) of Bic:** TWO (2) possible bad components: **1)** Bicarbonate Pump OR; **2)** Actuator-Test Board.

## CO- 2.0.3 ABIC WITHIN THREE (3) OF BIC

a) Note this page and procedure number (CO- 2.0.3) THEN perform an Acid clean per procedure.

b) After the acid clean see procedure number CO- 2.0.4 (page 366).


## CO- 2.0.4 VERIFY BI*BAG* ALARM LIMITS (1)

a) Connect to acid and bicarb JUGS.

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

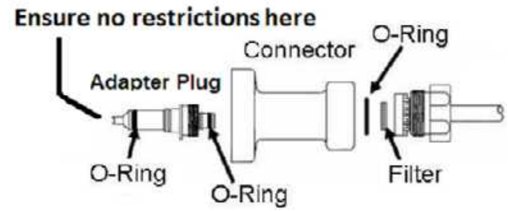
c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

d) **IMPORTANT!** Allow six (6) minutes BEFORE continuing to part e next page!

e) Call debug screen 14. WITHOUT LOOKING AWAY, watch BOTH **JCon Low** AND **JCon Hi** for two (2) minutes. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) JCon Low** AND **JCon Hi = 0 ALWAYS:** Bicarb Conductivity is no longer violating its limits. Problem solved!

2) **IF JCon Low OR JCon Hi EVER = 1 (always OR once in a while):** Turn the machine OFF then perform parts a THROUGH d below:




a) Figure right, THREE (3) checks: **1)** The Bicarb Connector's O-rings; **2)** ENSURE the filter is clean; **3)** ENSURE adaptor plug is screwed in tight!

b) Read parts c AND d BEFORE performing them.

c) Perform the BICARBONATE PUMP VOLUME CALIBRATION per the Calibration Procedures booklet.

d) Were you able to enter burette volumes without an "Operator Error" banner (Figure right) occurring?


Yes "Operator Error" DID NOT occur! See procedure number CO- 2.0.5 (page 367).

No "Operator Error" occurred! Proceed to **page 379**, procedure number CO- 4.9.0

**CO- 2.0.54 VERIFY BI*BAG* ALARM LIMITS (2)**

a) Connect to acid and bicarb JUGS.

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

d) **IMPORTANT!** Allow six (6) minutes BEFORE continuing to part e.

e) Call debug screen 14. WITHOUT LOOKING AWAY, watch **JCon Low** AND **JCon Hi** for two (2) minutes. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) JCon Low** AND **JCon Hi = 0 (always):** Bicarb conductivity is no longer violating the limits. Problem solved!

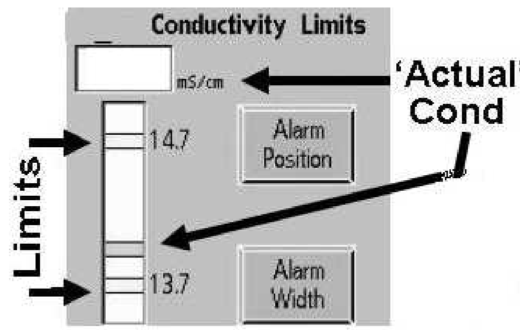
**2)** **IF JCon Low OR JCon Hi = 1 (always OR once in while):** If you are ABSOLUTELY SURE the bicarb is good There may be a problem related to a loose ribbon cable at the bi*bag* Interface Board (refer to Figure 4C, page 11)) AND / OR a bad bi*bag* Interface Board AND / OR the bi*bag* Cond Cell #113 AND / OR bi*bag* Temp Sensor #114.

## CO- 2.0.6 VERIFY PRIMARY CONDUCTIVITY ALARM LIMITS


Call the Home screen. What color is the [**Conductivity**] window (Figure right)? TWO (2) possible scenarios:

**1) IF (and ONLY if) pale yellow / white:** See procedure number CO- 2.0.8 (**page 370**).

**2) IF RED:** See parts a AND b below:




a) At the bottom of the screen, press the 'Dialysate' tab.

b) Figure right, can the Limits be adjusted so that 'Actual' **Conductivity** is between them?

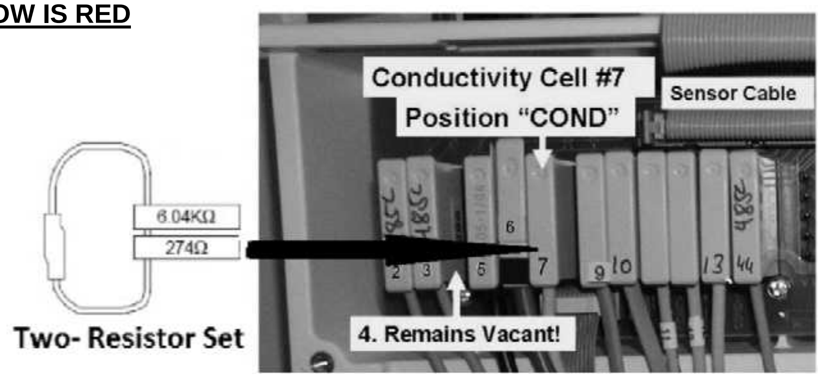
Yes 'Actual' Conductivity between the Limits! Proceed to **page 369**, procedure number CO- 2.0.7.

No See procedure number CO- 2.0.61 (page 368).

## CO- 2.0.61 [CONDUCTIVITY] WINDOW IS RED

a) Figure right, place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into distribution board position, "X7, COND".

b) Can the Limits now be adjusted so that 'Actual' **Conductivity** is between them?




Yes 'Actual' Conductivity between the Limits! See procedure number CO- 2.0.7 (page 369).

No See parts a THROUGH d below:

a) Return Conductivity Cell #7's connector to distribution board position "X7, COND".

b) Return the concentrate connectors and close the shunt door.

c) **Place the machine into RINSE!**

d) Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

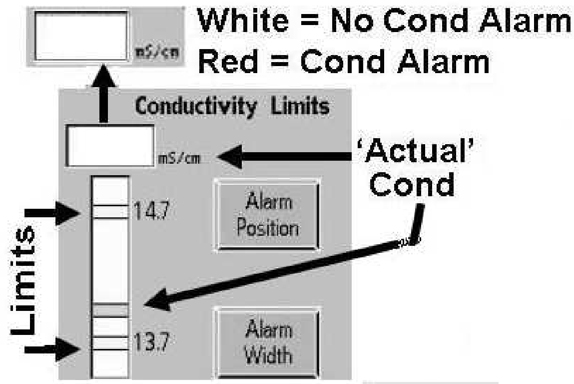
Yes 'Bob' moving! Proceed to **page 383**, procedure number CO- 6.0.0.

No 'Bob' NOT moving! See parts a AND b below:

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

b) Proceed to **page 23**, SECTION 1 – FLOW ERRORS IN DIALYSIS PROGRAM.

## CO- 2.0.7 ‘ACTUAL’ CONDUCTIVITY BETWEEN THE ALARM LIMITS




a) Confirm you Press ‘Enter’

b) Figure right, ensuring ‘Actual’ Conductivity is REMAINING BETWEEN the Limits, what color is the Conductivity window now?

1) **IF (and ONLY if) WHITE:** Proceed to **page 370**, procedure number CO- 2.0.8.

2) **IF RED:** Call debug screen 3 to see **HICOND** AND **LOCOND** (lower right). TWO (2) possible scenarios:


**Scenario #1:** **IF (and ONLY if) BOTH HICOND AND LOCOND = 0.** Press the ‘Dialysate’ tab then see procedure number CO- 2.0.7.1 (page 369).

**Scenario #2:** **IF HICOND = 1 OR LOCOND = 1!** THREE (3) possible bad components: **1)** Actuator-Test Board; **2)** Functional Board; **3)** Motherboard.

## CO- 2.0.7.1 BOTH HICOND AND LOCOND = 0 AND THE CONDUCTIVITY WINDOW IS RED

Allowing up to three (3) minutes, does the Conductivity window eventually turn white?

Yes Conductivity window white! See procedure number CO- 2.0.8 (page 370).

No After three (3) minutes the Conductivity window STAYS RED! Perform parts a THROUGH d below:

a) If a previous procedure placed the 274Ω resistor plug into the Conductivity Cell’s distribution board position remove it and return Conductivity Cell #7’s connector to distribution board position “X7, COND”.

b) Close the shunt door and return the concentrate connectors to their rinse ports.

c) **Place the machine into RINSE**!

d) Is the external flow indicator’s ‘bob’ rising at least ¼ way up in the sight tube?

Yes ‘Bob’ moving! See procedure number CO- 6.0.0 (page 383).

No Bob NOT moving! See parts a THROUGH c below:

a) Plug into acid and bicarb jugs.

b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

c) Proceed to **page 23**, SECTION 1 – FLOW ERRORS IN DIALYSIS PROGRAM

## CO- 2.0.8 [CONDUCTIVITY] WINDOW IS WHITE / ISOLATE 'OUT OF BYPASS' FLOW

A) **Close the shunt door!**

B) From the Home screen, ENSURE [Dialysate Flow] remains set to at least 500 ml/min!

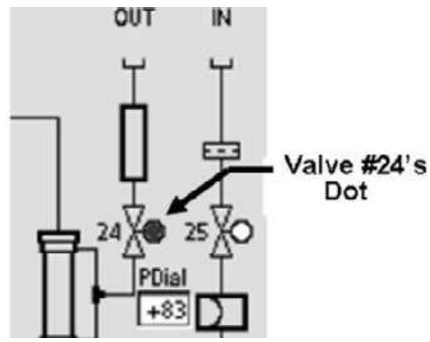
C) **DO NOT reset alarms!**

D) Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

Yes 'Bob moving! Proceed to **page 372**, procedure number CO- 2.0.9.

No 'Bob' NOT moving! Continue to part E.

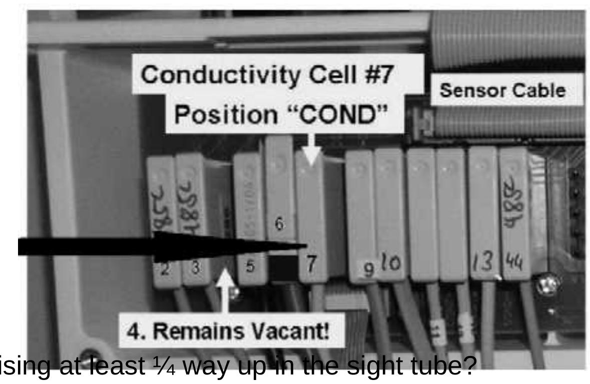

E) Call debug screen 2. To ENSURE the shunt door is really closed **CVRCLS** (2nd column from left) = 1!




F) Call debug screen 0. Allowing up to three (3) more minutes, does Valve #24's 'dot' (Figure right) turn BLUE?

Yes Valve #24's dot' is BLUE! See procedure number CO- 2.0.8.1 (page 371).

No After three (3) minutes Valve #24's 'dot' stays WHITE! See parts a THROUGH d below:




a) If removed from a previous procedure, return Conductivity Cell #7's connector to distribution board position "X7, COND" (Figure right).

b) Return the concentrate connectors to their rinse ports.

c) Place the machine in RINSE.

d) Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

Yes 'Bob' moving! Proceed to **page 383**, procedure number CO- 6.0.0.

No 'Bob' NOT moving! ENSURING the machine is in RINSE see parts a AND b below:

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

b) Proceed to **page 23**, SECTION 1 – FLOW ERRORS IN DIALYSIS PROGRAM

**CO- 2.0.8.1 VALVE #24'S 'DOT' IS BLUE**

Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

Yes 'Bob' moving! See procedure number CO- 2.0.9 (page 372).

No 'Bob' NOT moving. See parts a THROUGH d below:

a) From the Home screen, ENSURE [Dialysate Flow] remains set to at least 500 ml/min!

b) ENSURE the [**Temperature**] AND [**Conductivity**] windows are pale yellow/white.

c) If (and ONLY if) NOT equipped with a bi*b*ag Connector see part d. If equipped with a bi*b*ag Connector call debug screen 14. If BOTH **JCon Low** AND **JCon Hi** are REMAINING = 0***** see part d.


***** If EITHER **JCon Low** OR **JCon Hi** = 1 return to (ABOVE) procedure number CO- 2.0.1 (**page 365**).

d) If 'bob' STILL is not moving AND if (and ONLY if) debug screen 0's, Valve #24's 'dot' is still blue, proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

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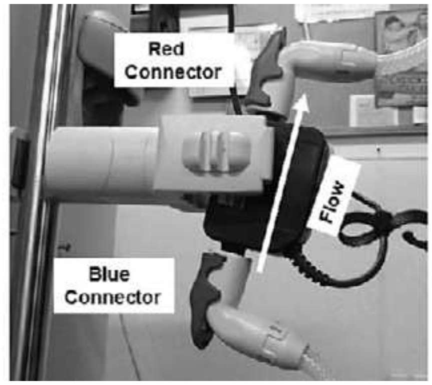
## CO- 2.0.9 'BOB MOVING' / MEASURE TEMPERATURE




a) WITHOUT turning [Dialysate Flow] off, install a Temperature / Conductivity meter into the dialysate lines. Follow figure to the right carefully, MUST be from bottom to top**.**

b) Confirm the shunt door is closed.

c) Set the meter to measure temperature (° C).

d) Call debug screen 1.

e) Press and hold the keyboard's "1" key for five (5) seconds.

f) Allow TWO (2) full minutes BEFORE continuing to part g.

g) ENSURING the flow indicator's 'bob' is moving up and down, is the external meter stable between 35.5 and 38.5° C?

Yes  Between 35.5 and 38.5° C! See procedure number CO- 2.0.10 (page 372).

No  NOT between 35.5 and 38.5! Proceed to **page 320**, procedure number T- 7.0.0.

## CO- 2.0.10 TEMPERATURE BETWEEN 35.5 AND 38.5 / MEASURE CONDUCTIVITY

a) Set the meter to measure Conductivity (mS).

b) Measured Conductivity is compared to **TCD** as seen in screen 1's, **C TCD** (lower left column). Example: 1360 = 13.60 mS.


c) ENSURING 'bob' is still moving up and down, based on the external meter's (measured) reading versus **TCD**, THREE (3) possible scenarios 1) or 2) or 3) below:

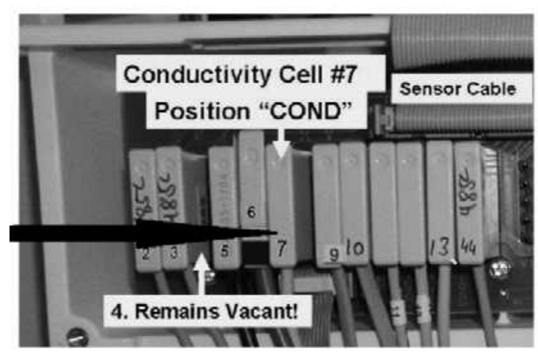
**1) IF (and ONLY if) measured conductivity is within 0.4 of TCD AND stable i.e. does NOT change more than +/- 0.15 per minute:** See procedure number CO- 3.0.0 (page 373).

**2) IF (and ONLY if) measured conductivity IS NOT within 0.4 of TCD:** Proceed to **page 398**, procedure number CO- 8.0.0.

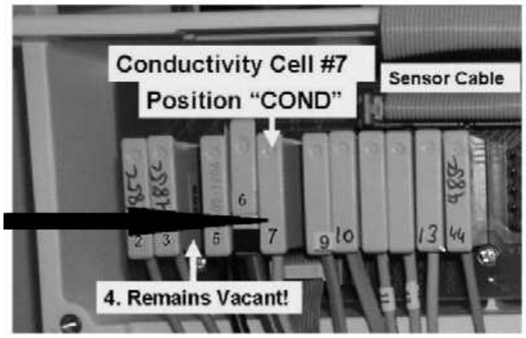
**3) IF measured conductivity IS MOSTLY within 0.4 of TCD BUT unstable i.e. changes more than 0.2 per minute:** See parts a AND b below:

a) If removed previously, return Conductivity Cell #7's connector to distribution board position "X7, COND" (Figure right).

b) Proceed to **page 380**, procedure number CO- 5.0.0.



## CO- 3.0.0 CONDUCTIVITY IS GOOD / VERIFY DISPLAY




a) If removed from a previous procedure, return Conductivity Cell #7’s connector to distribution board position “X7, COND” (Figure right).

b) Call the Home screen.

c) Based on the machine’s [**Conductivity**] window now, THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) = 17.0 mS:** See procedure number CO- 3.1.0 (page 373).

**2) IF (and ONLY if) = 10.0 mS:** See procedure number CO- 3.2.0 (page 373).

**3) ALL OTHER scenarios:** Is the [**Conductivity**] window within 0.4 mS of **TCD**?

Yes [**Conductivity**] is within 0.4 of TCD! Proceed to **page 374**, procedure number CO- 3.4.0.

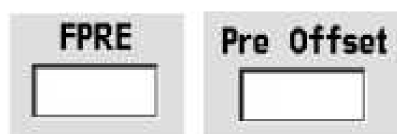
No [**Conductivity**] is <u>NOT</u> within 0.4 of TCD! Proceed to **page 383**, procedure number CO- 6.0.0.

## CO- 3.1.0 [CONDUCTIVITY] WINDOW = 17.0 mS

a) Return the concentrate connectors to their rinse ports!

b) **IMPORTANT!** Place the machine into <u>RINSE!</u>

c) ENSURING a Flow Error NEVER occurs allow ten (10) FULL minutes BEFORE continuing to part d!



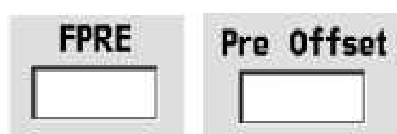

d) Call debug screen 5. If debug does not appear press ‘Esc’ then call debug screen 5.

e) Is **FPRE** within four-hundred (400) of **Pre Offset**?

Yes **FPRE** within 400 of **Pre Offset**! See procedure number CO- 6.0.0 (page 383).

No **FPRE** is <u>NOT</u> within 400 of **Pre Offset**! Pre Dialyzer Conductivity Cell #7***** is bad
* To LOCATE cell #7 refer to Figure 57 (page 374).

## CO- 3.2.0 [CONDUCTIVITY] WINDOW = 10.0 mS




Call debug screen 5. Is **FPRE** within +/- 10 of **Pre Offset**?

Yes **FPRE** within +/- 10 of **Pre Offset** +/- 10! Either Conductivity Cell #7* was not plugged into distribution board position “X7-COND” properly <u>OR</u> is bad. *To <u>LOCATE</u> Cell #7 refer to Figure 57 (page 374).

No **FPRE** is <u>NOT</u> within +/- 10 of **Pre Offset**! Proceed to **page 383**, procedure number CO- 6.0.0.

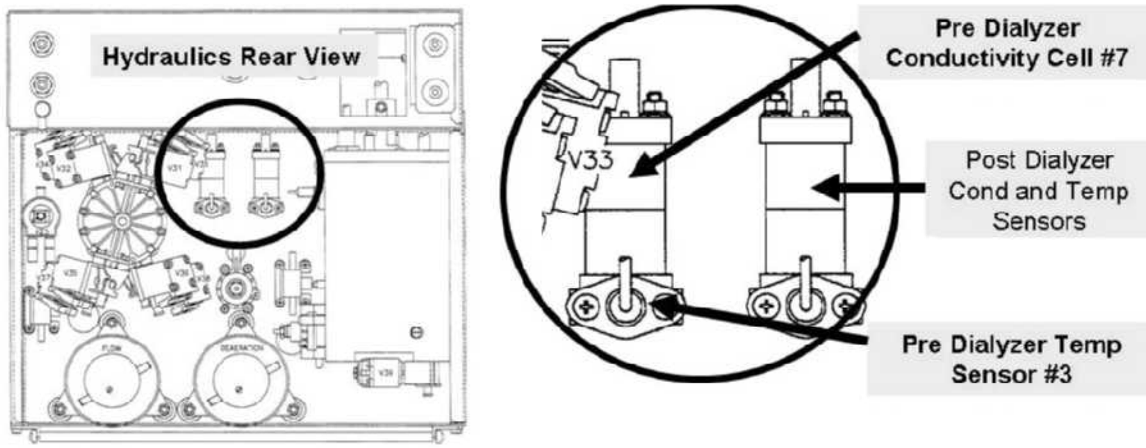



**Figure 57 – Hydraulics Rear View**

## CO- 3.4.0 [CONDUCTIVITY] WITHIN 0.4 OF TCD / VERIFY CONDUCTIVITY ALARM LIMITS

What color is the Home screen's [**Conductivity**] window now? TWO (2) possible scenarios:

**1) IF (and ONLY if) pale yellow / white:** See procedure number CO- 3.5.0 (page 374).

**2) IF RED:** See parts a THROUGH e below:

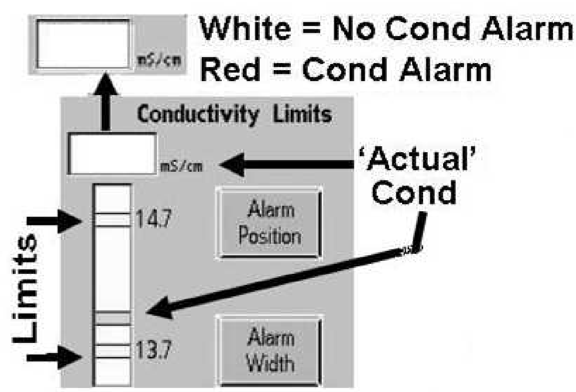
a) At the bottom of the screen, press the 'Dialysate' tab.

b) Figure right, if necessary adjust the Limits so that the 'Actual' **Conductivity** is CENTERED between them.

c) Press 'Enter'!

d) Allow up to two (2) additional minutes for the 'Actual' Conductivity window to turn white!

e) See procedure number CO- 3.5.0 (page 374).




## CO- 3.5.0 VERIFY MEASURED CONDUCTIVITY

a) Allow up to two (2) additional minutes OR until the external flow indicator's 'bob' starts to move up and down!

b) Based on the meter's reading versus the machine's [**Conductivity**] window. TWO (2) possible scenarios:

**1) IF (and ONLY if) the meter and the [Conductivity] window are within 0.15 of each other:** Proceed to **page 410**, procedure number CO- 9.8.0.

**2) IF the meter and the [Conductivity] window are NOT within 0.15 of each other!** Proceed to **page 383**, procedure number CO- 6.0.0.

## CO- 4.1.0 CENTRAL DELIVERY (SDS) CHECK VALVES INSTALLED?

a) Remove the hydraulics from the cabinet!

b) Figure (below), if check valves (with white inserts) are installed in the Acid and / or Bicarb Pump input and/or output tubing REMOVE them completely and reattach all tubing with straight fittings!

**CAUTION!** The check valves at the UF PUMP must NEVER be removed.

c) See procedure number CO- 4.2.0 (page 376).

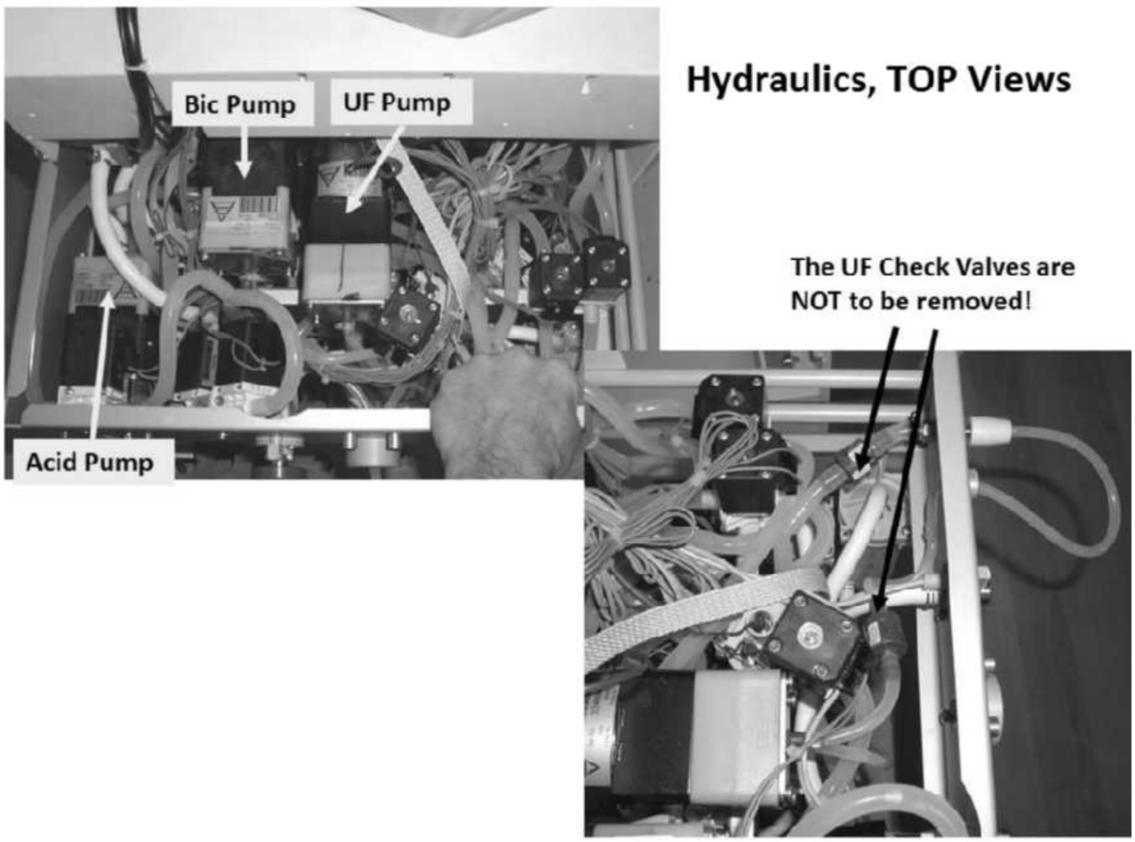



**Figure 58 – UF Check Valves**

## CO- 4.2.0 ISOLATE CONCENTRATE INLET SYSTEMS (2).

a) Return the acid and bicarb CONNECTORS **HARD** into their rinse ports.

b) Place into RINSE.

c) ENSURING no external leaks, see procedure number CO- 4.2.1 (page 376).

## CO- 4.2.1 ISOLATE PUMP FEEDBACK

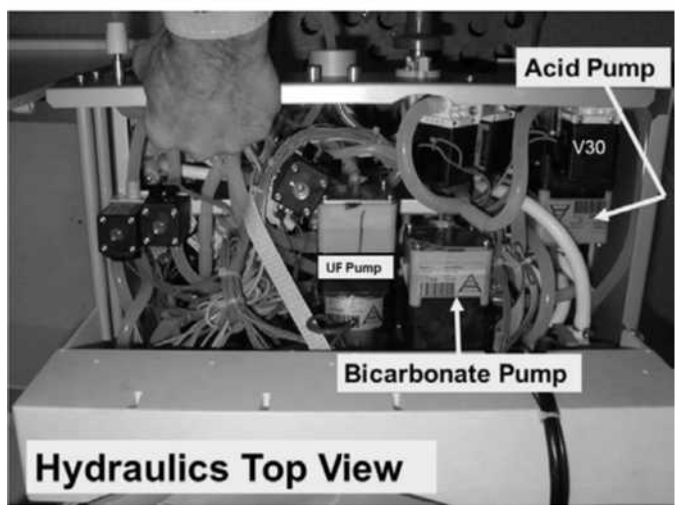

a) Call debug screen 1. Watch **NO EOS** AND **ALWEOS** (third column from right) for one (1) FULL minute.

b) Proceed per Table 8 below:

### Table 8 – EOS

| NO EOS | ALWEOS | YOUR RESPONSE |
|---|---|---|
| **0** (always) | **0** (always) | See procedure number CO- 4.2.2 (page 376). |
| Does not matter | **1** (EVER) | Proceed to **page 441**, SECTION 6 - CONCENTRATE PUMP ERRORS. |
| **1** (EVER) | Does not matter | Proceed to **page 441**, SECTION 6 - CONCENTRATE PUMP ERRORS. |

## CO- 4.2.2 ISOLATE POTENTIAL LEAKS




a) Figure right, ENSURE NO external LEAKS at the Acid AND Bicarb Pumps.

b) Plug into acid and bicarb!

c) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

d) Allow forty-five (45) seconds BEFORE continuing to part e.

e) Is air / concentrate now drawn, **TOWARDS THE MACHINE, in ONE direction ONLY**?

Yes Air / concentrate now drawn into the machine in ONE DIRECTION ONLY! See procedure number CO- 4.2.3 (page 377).

No Air / concentrate NOT seen OR moving back and forth! Proceed to **page 378**, procedure number CO- 4.4.0.

## CO- 4.2.3 VERIFY CONDUCTIVITY

a) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘Enter’.

b) Allow six (6) minutes before continuing to part c.

c) Does [**Conductivity]** REMAIN less than 13.0 mS?

Yes REMAINS LESS than 13.0 mS! Return to **page 353**, procedure number CO- 1.0.4.

No Conductivity MORE than 13.0 mS! The low Conductivity problem is solved.

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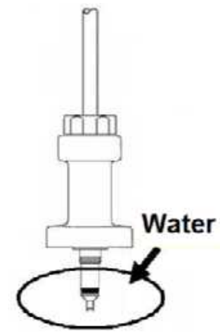
## CO- 4.4.0 ISOLATE CONCENTRATE PICKUP SYSTEMS




a) Place the concentrate connectors **HARD** into their rinse ports

b) **Return to Rinse Program! ALLOW one (1) minute to prime the pumps.**

c) Per the Figure (right), place the connector's 'adapter plug' **ONLY** into a container of water i.e**. do NOT submerse the whole connector!**

d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

e) Is AIR FREE concentrate drawn steadily in one direction now?

Yes Concentrate drawn! There is a problem with the pickup wand

No See procedure number CO- 4.4.1 (page 378).

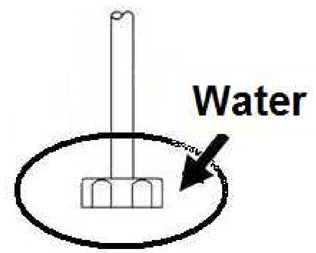
## CO- 4.4.1 ISOLATE THE CONNECTOR

a) Place the concentrate connectors **HARD** into their rinse ports

b) Return to Rinse Program!

c) ALLOW one (1) minute to prime the pumps

d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').




e) Per the Figure right, remove the connector from the inlet tubing and submerse the tubing, **without the filter,** into a container of water.

f) Is AIR FREE concentrate being drawn steadily in one direction now?

Yes Concentrate drawn! Per the Figure below, there is a problem with the concentrate connector.

No See procedure number CO- 4.9.0 (page 379).

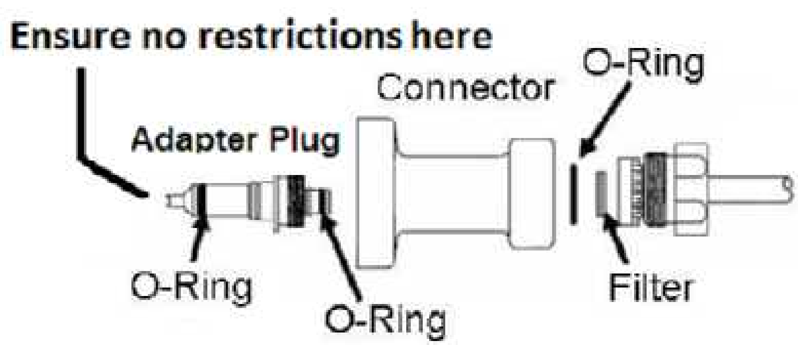



**Figure 59 – Concentrate Connectors**

## CO- 4.9.0 ISOLATE THE ACID / BIC PUMP(S)

a) Per the Figure below, ENSURE no tubing restriction at the Acid and /or Bicarb pump.

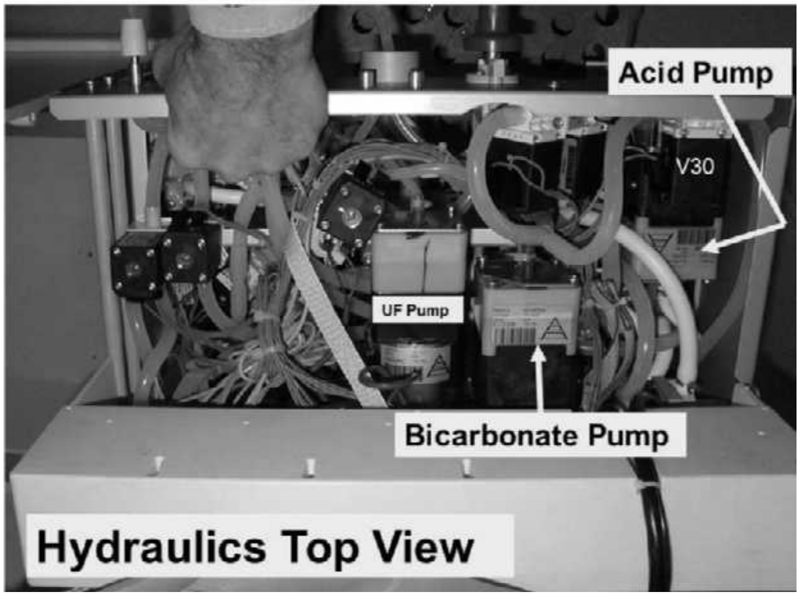
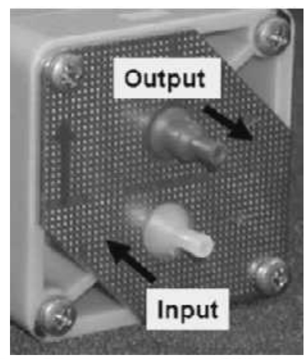



**Figure 60 – Acid and Bic Pumps**

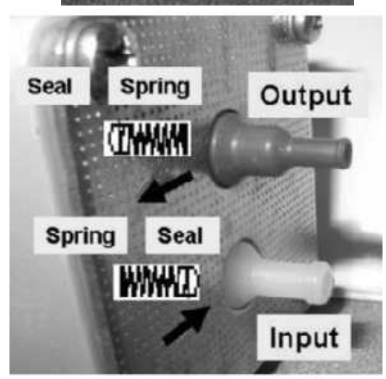
b) At the suspect pump(s), Per the Figure (right), TWO checks:




**Check #1:** The metal plate has arrows to identify the Input (←) and Output (→) ports. ENSURE the colored nozzle is at the Output port AND is towards the TOP of the machine

**Check #2:** ENSURE the Input (clear) and Output (solid) tubing is connected to the appropriate nozzles per check #1.

c) Per the Figures (right), disassemble the suspect pump(s). SIX (6) more checks:




**Check #3:** ENSURE the seals are oriented correctly.

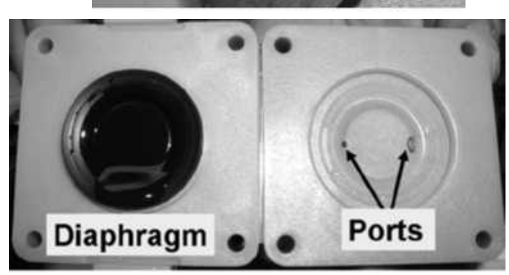
**Check #4:** Check for debris and for broken or bent springs.

**Check #5:** ENSURE BOTH springs are 'weak' type.

**Check #6:** Compare BOTH springs to new and replace one that appears shorter than a new one.

**Check #7:** Check or replace the seals and O-rings.

**Check #8:** Check for a torn diaphragm.




f) If a problem was not located above, TWO (2) possible bad components: **1)** Bad Acid or Bicarb Pump OR; 2**)** Bad Actuator-Test Board.

## CO- 5.0.0 UNSTABLE CONDUCTIVITY / ISOLATE PRESSURES

a) ENSURE Loading Pressure (Rinse port gauge) is cycling to a PEAK of somewhere between 23 and 25 psi.

b) [Temperature] influences Conductivity. If [Temperature] changes more than +/- 0.2° C per minute address the temperature problem first!

c) Turn the machine OFF to avoid air locking the deaeration pump!

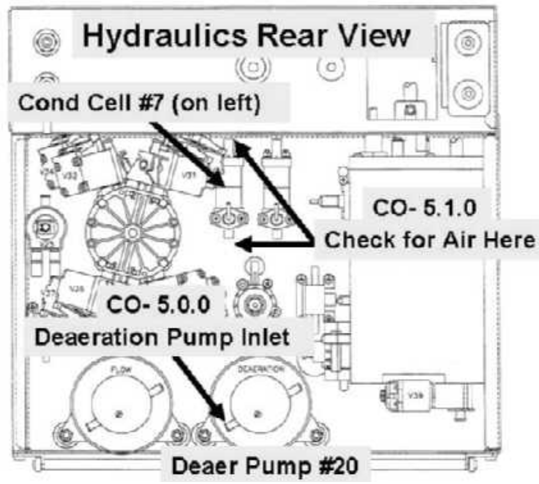
d) The deaeration gauge is used next. ENSURE it reads 0 inHg before installing it!

e) Figure right, tee the gauge into the INLET (clear) tubing of the Deaeration Pump.

f) **IMPORTANT!** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

g) Is Deaeration Pressure OKAY? Refer to Appendix A (page 757) for what pressure should be.

Yes Deaeration OKAY! Position the gauge so that its tubing in NOT pinched then see procedure number CO- 5.1.0 (page 380).




No NOTE this page number, as you will return here, THEN proceed to **page 543**, SECTION 13 - DEAERATION PROBLEMS.

## CO- 5.1.0 CHECK FOR AIR LEAK

Per the Figure (above, right), using a flashlight, for ONE (1) MINUTE, and WITHOUT LOOKING AWAY, watch for air bubbles flowing through Conductivity Cell #7. Is air seen?

Yes Air seen! Proceed to **page 539**, procedure number AIR- 1.0.5.

No No air seen! See procedure number CO- 5.3.0 (page 380).

## CO- 5.3.0 NO AIR SEEN / ISOLATE ACID PUMP CONTROL


Call debug screen 0. Watch **AAcid** versus **Acid** for one (1) minute. Remaining within three (3) of each other?

Yes **AAcid = Acid!** See procedure number CO- 5.3.1 (page 380).

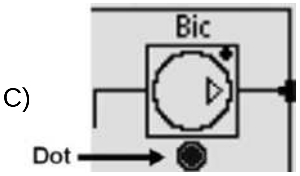
No **AAcid** is NOT remaining within three (3) of **Acid!** Proceed to **page 441**, SECTION 6 - CONCENTRATE PUMP ERRORS.

## CO- 5.3.1 ISOLATE BICARB PUMP CONTROL


Watch **ABic** versus **Bic** for one (1) minute. Remaining within three (3) of each other?

Yes **ABic** = **Bic!** See procedure number CO- 5.4.0 (page 381).

No **ABic** is <u>NOT</u> remaining within three (3) of **Bic!** Watch the Bicarb (BIC) Pump's 'dot' (Figure right) for TWO (2) minutes. TWO (2) possible scenarios:

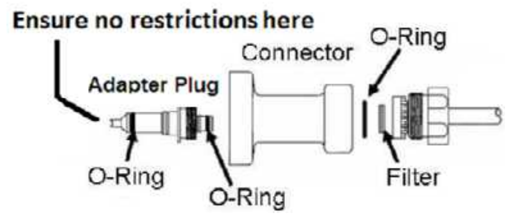



**1) IF (and ONLY if) the 'dot' <u>EVER</u> turns white:** Proceed to **page 409**, procedure number CO- 9.0.0.

**2) IF the 'dot' <u>REMAINS CONSTANTLY</u> BLUE:** Proceed to **page 441**, SECTION 6 - CONCENTRATE PUMP ERRORS.

## <u>CO- 5.4.0 ISOLATE ACID PUMP</u>

a) Figure right, ENSURE the Acid (red) AND Bicarbonate (blue) Connector's O-rings are present




b) ENSURE the filters is clean <u>AND</u> the adaptor plug is screwed in tight!

c) Read parts d AND e BEFORE performing them.

d) Perform the ACID (CONCENTRATE) PUMP VOLUME CALIBRATION per the <u>CALIBRATION PROCEDURES</u> booklet.

e) Can you <u>accurately</u> enter the burette volumes <u>without</u> an "Operator Error" banner (Figure right) occurring?


Yes "Operator Error" did <u>NOT</u> occur! See procedure number CO- 5.5.0 (page 381).

No "Operator Error" occurred! Proceed to **page 379**, procedure number CO- 4.9.0.

## <u>CO- 5.5.0 ISOLATE BICARB PUMP</u>

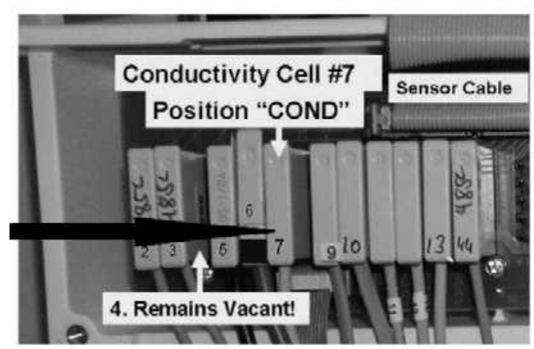
a) Read parts b AND c before performing them.

b) Perform the BICARBONATE PUMP VOLUME CALIBRATION.

c) Can you <u>accurately</u> enter the burette volumes <u>without</u> an "Operator Error" banner occurring (Yes or No)?

Yes Operator Error" did <u>NOT</u> occur. Per the Figure right, CAREFULLY trace Cond Cell #7's wire harness from distribution board position "X7, COND" to the cell #7 checking for insulation damage. If no damage, see procedure number CO- 5.6.0 (page 382).

No "Operator Error" occurred. Proceed to **page 379**, procedure number CO- 4.9.0.



## CO- 5.6.0 TROUBLESHOOTING UNSTABLE CONDUCTIVITY

Proceed through the following SEVEN STEPS until a problem is located:

1. ENSURE a 'strong' spring was NOT accidently installed at the output ports of the acid AND bicarbonate pump. BOTH pumps get 'weak' springs!

2. Compare both springs to new springs. Replace any that are shorter than a new spring.

3. Other procedures, in different Sections of the Guide, are performed next. **NOTE** this page and procedure number (CO- 5.6.0) because you may be prompted to return here.

4. If not already performed in THIS Troubleshooting session, BEFORE continuing to step #5, proceed to **page 580**, to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

5. If a bad balancing chamber diaphragm was not located in step #4, BEFORE continuing to step #6, proceed to **page 150**, to perform PRESSURE TEST HYDROCHAMBER.

6. If the Hydrochamber was not leaking (per step #5), ENSURE Deaeration Motor brushes have been replaced at 8000 hour intervals AND Flow Motor brushes have been replaced approximately at 16,000 hour intervals.

7. Assuming ALL procedures were performed thoroughly AND Conductivity remains unstable the Troubleshooting Guide is unable to locate the problem.

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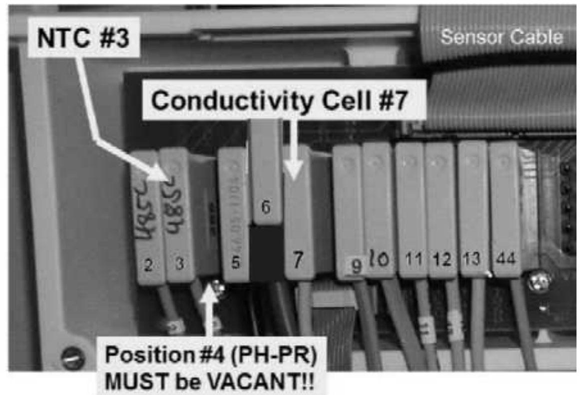
## CO- 6.0.0 DISTRIBUTION BOARD CHECKS / ON LINE CLEARANCE (OLC) ENABLED?

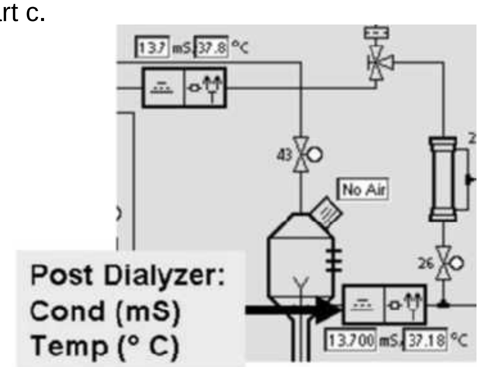



a) Figure right, inside the distribution board, TWO checks:

**CHECK #1:** ENSURE position #4, "PH-PR" is VACANT!

**CHECK #2:** ENSURE Conductivity Cell #7 AND NTC #3's connectors are plugged in properly.

b) If troubleshooting an Online Clearance (OLC) problem see part c. If NOT, see procedure number CO- 6.2.0 (**page 384**).



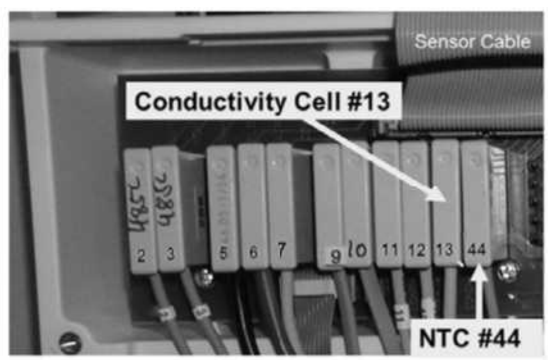

c) Call debug screen 0.

d) Figure right, do the **Post Dialyzer Cond** and **Temp** symbols appear (Yes or No)?

Yes — The OLC option is enabled! See procedure number CO- 6.1.0 (page 383).

No — The OLC option is off! **A)** Enter Service mode → Options → Hardware Options; **B)** Set OLC to "Yes" and press 'Enter'; **C)** Return to debug screen 0 to ENSURE the **Post Dialyzer Cond** and **Temp** symbols now appear; **D)** Proceed to **page 384**, procedure number CO- 6.2.0.

## CO- 6.1.0 OLC OPTION ENABLED




a) Figure right, ENSURE Conductivity Cell #13's AND NTC #44's connectors are plugged in PROPERLY.

b) Open the shunt door.

c) Allow thirty (30) seconds. Is screen 0's **Post Dialyzer Temp** more than 34.00° C?

Yes — **Post Dialyzer Temp** is more than 34.00° C! See procedure number CO- 6.2.0 (page 384).

No **Post Dialyzer Temp** LESS THAN 34.00° C! Proceed to **page 418**, procedure number CO- 10.0.20.

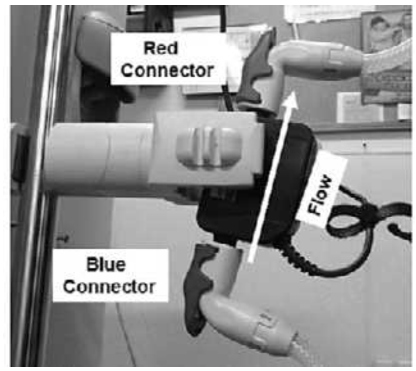
## CO- 6.2.0 CALIBRATE / TROUBLESHOOT COND CELLS

> **While in Dialysis, ENSURE the machine is clear of "No Water", Flow Errors and Temperature alarms. Hydraulic alarm banners are not displayed in Service mode!**
>
> **These are TROUBLESHOOTING procedure! Perform EXACTLY as written to avoid error!**

a) Install the hydraulics but do not screw in the rear panels.

b) ENSURING plenty of known good acid and LIQUID Bicarb plug FIRMLY into each.

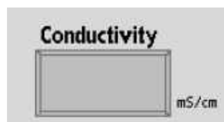
c) Place the machine into Service Mode → Calibrate Sensors → Cond Cells → (if equipped with a bi*bag* Connector) Dialysate Cells. **DO NOT select Bicarb Cell!**




d) Install a Temperature / Conductivity meter into the dialysate lines. Figure right, flow through the meter MUST directed from bottom to top.

e) **Close the shunt door completely!**

f) Follow the screen's instructions through: **"4. Waiting until the Conductivity value is stable."** The screen's **[Conductivity]** data box is initially gray.




g) ENSURING the external flow indicator's 'bob' is moving at least ¼ way up the sight tube ALLOW six (6) minutes before continuing to STEP #1 below:

**STEP #1:** Set the external meter to measure Temperature (°C). Watch it for thirty (30) seconds. Between 35.1 and 39.9° C AND stable i.e. DOES NOT change more than +/- 0.25° C?

Yes Temperature between 35.1 and 39.9° C! Continue to STEP #2.

No a) Return to DIALYSIS PROGRAM ("Select Program" → 'Dialysis' → 'Enter')!

b) Proceed to **page 232**, SECTION 4 – TEMPERATURE PROBLEMS

**STEP #2:** Set the meter to measure Conductivity (mS). Its reading MUST BE between 13.0 and 14.5 mS?

Yes Between 13.0 and 14.5 mS! Continue to STEP #3 next page.

No NOT between 13.0 and 14.5 mS! See parts a AND b below.

a) **SLAM** the Loading Pressure gauge into the Acetate/Acid rinse port. If no masked "No Water" or Flow Error alarms the gauge cycles, approximately EVERY three (3) seconds, to about 25 psi. If not cycling return to Dialysis Program!

b) Proceed to **page 391**, procedure number CO- 6.8.0.

**NOTE!** If an "Operator Error" banner appears but the flow indicator's 'bob' continues to move up and down ignore the banner. If the 'bob' NOT moving 'Escape' calibration THEN return to procedure number CO- 6.2.0 (page 384).

**STEP #3:** Watch the external meter for thirty (30) seconds. Its reading MUST BE stable i.e. does NOT change more than +/- 0.15 mS?

Yes Conductivity is stable! Continue to STEP #4.

No a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

b) Proceed to **page 380**, procedure number CO- 5.0.0.

**STEP #4:** Is the screen's **Frequency** window between ten-thousand (10000) and twelve-thousand (12000) Hz (Hertz)?

Yes **Frequency** between 10000 and 12000 Hz! Continue to STEP #5.

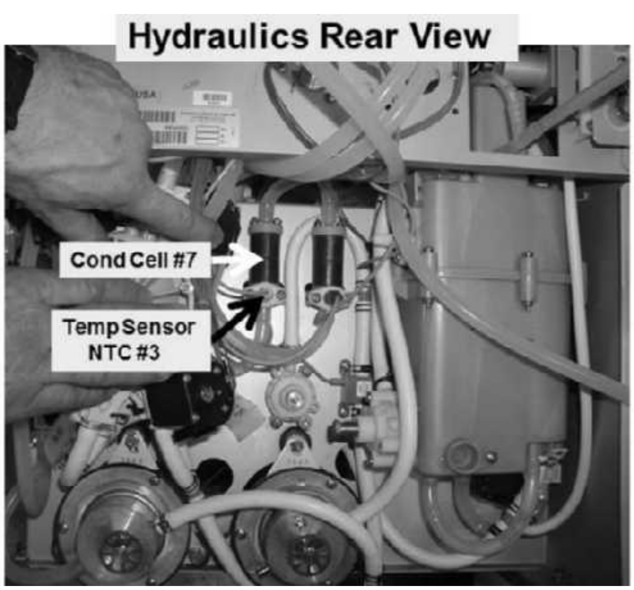
No **Frequency** is NOT between 10000 and 12000 Hz! Perform parts a AND b below:

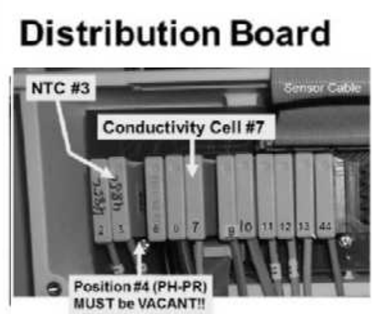
a) Figure below, trace Cond Cell #7's cable to ENSURE it plugs into the Distribution board PROPERLY. **If not, this is the problem!**

b) Read before performing! One at a time, swap in the listed components (see Component List below). with known good and in between repeat (ABOVE) procedure number CO- 6.2.0 (page 384) until **Frequency** is between 10000 and 12000 Hz indicating the last component swapped in is bad.

**COMPONENT LIST:**

**1)** Conductivity Cell #7; **2)** Sensor Board cable; **3)** Functional Board; **4)** Distribution board; **5)** Motherboard




**STEP #5:** If Cond Cell #7's reading stabilizes, **"5. Conductivity value is stable…."** appears and the **[Conductivity]** data box turns pale yellow / white?

Yes [Conductivity] box pale yellow! See procedure number CO- 6.3.0 (page 386).

No [Conductivity] box remains gray! Possible problem with the Cond Cell #7 circuit. Proceed to **page 395**, procedure number CO- 7.0.0.

## CO- 6.3.0 COND CELL #7 STABILIZES

a) Press the **[Conductivity]** data box, it turns bright yellow.

b) Enter the external meter's reading into the **[Conductivity]** box.

c) 'Sharply' press 'Enter' to turn **[Conductivity]** pale yellow / white. Does **[Conductivity]** remain within 0.2 of the external meter?

Yes **[Conductivity]** remains within +/- 0.2 of the meter! See procedure number CO- 6.3.2 (page 386).

No **Read BEFORE performing!** Acid Clean the machine THEN return to (ABOVE) procedure number CO- 6.2.0 (page 384). If (and ONLY if) you return here, with the machine off, one at a time, swap the listed components (see COMPONENT LIST below) with known good THEN, return to (ABOVE) procedure number CO- 6.2.0 until **[Conductivity]** remains within 0.2 of the meter indicating the last component swapped in is bad!

**COMPONENT LIST: 1)** Conductivity Cell #7* *To LOCATE Cell #7 refer to the Figure previous page); **2)** Sensor Board; 3**)** Functional Board (IC 20?).

## CO- 6.3.2 'CONFIRM' THE [CONDUCTIVITY[ DATA BOX

'Sharply' press 'Enter'. Does the screen say "**7. Connect the Lines to a Large Dialyzer…"**?

Yes "**Connect the Lines…"** appears! See procedure number CO- 6.4.0 (page 387).

No a) If (and ONLY if) the screen says **"8. Reading first point for post conductivity cell."** see procedure number CO- 6.4.0 (page 387).

b) 'Sharply press 'Enter' again to save the calibration. Does any type of an "Error" banner occur (Yes or No)?

Yes "Error" banner occurs!. **Read before performing!** Acid clean the machine then return to (ABOVE) procedure number CO- 6.2.0 (page 384) HOWEVER, if you RETURN HERE swap the listed components (see COMPONENT LIST below) one at a time and repeat procedure number CO- 6.2.0 until an "Error" does NOT appear! Indicating the last component swapped in is the problem.

**COMPONENT LIST: 1)** Conductivity Cell #7 (see Figure 57, page 374); **2)** Sensor Board; **3)** Functional Board (IC 20?).

No a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

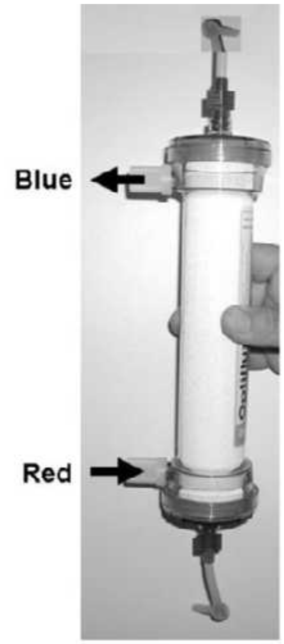
b) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'!

c) Allow six (6) minutes before continuing to part d!

d) If you started out troubleshooting an OLC problem proceed to **page 424**, procedure number CO- 10.0.41.

**CO- 6.4.0 OLC (COND CELL #13) CALIBRATION**

This four-point calibration sets slope for Post Dialyzer (OLC) Cond Cell #13.
See parts a THROUGH e below:




a) Figure right, connect the dialyzer lines to a PRIMED dialyzer[1,2]. The dialyzer MUST be positioned vertically with the red dialyzer quick connector AT THE BOTTOM.

[1] If a dialyzer is not used OLC problems may occur!

[2] ENSURE the blood ports are tightly sealed to prevent air leaks! **WARNING!** Do NOT use the blood port caps from the dialyzer's packaging. Blood tubing (Figure right) is BEST.

b) **CLOSE the shunt door**!.

c) Allow one (1) FULL minute!

d) Press 'Enter'. The screen says "**8. Reading first point for post conductivity cell."**

e) After no more than ten (10) minutes, does the **[Conductivity]** data box stabilize between 15.00 and 15.90 mS causing the screen to advance to: **"9. Reading second point for post conductivity cell."**?

Yes Screen advances to the second point! See procedure number CO- 6.4.2 (page 388).

No Screen DOES NOT advance to the second point! TWO (2) possible scenarios below:

**1) IF (and ONLY if) "COND LESS THAN 10.0" OR "COND LESS THAN 15.0" banner occurred:** Proceed to **page 389**, procedure number **CO- 6.5.0**.

**2) All OTHER scenarios:** See parts a AND b below:

a) If a new dialyzer was used and it was not PRIMED it may cause an unannounced Flow Error which makes the external indicator's 'bob' stop rising and falling. In this event 'Escape' the calibration THEN return to (ABOVE) procedure number CO- 6.2.0 (page 384).

b) If the external flow indicator's bob is moving up and down proceed to **page 390**, procedure number **CO- 6.6.0**.

**CO- 6.4.2 SECOND / THIRD / FOURTH OLC POINTS**

a) Unless a "COND LESS THAN…" banner appears OR an announced Flow Error occurs. the remaining three steps advance as below:

- **"9. Reading second point for post conductivity cell."** Within six (6) minutes the **[Conductivity]** box should stabilize between 13.00 and 14.00 mS causing advancement to step #10 (third point)
- **"10. Reading third point for post conductivity cell."** Within six (6) minutes the **[Conductivity]** box should stabilize between 15.00 and 15.90 mS causing advancement to step #11 (fourth point)
- **"11. Reading fourth point for post conductivity cell."** Within six (6) minutes the **[Conductivity]** box should stabilize between 13.00 and 14.00 mS

b) If all steps advance successfully the screen says: **"Press 'CONFIRM' to complete the calibration."**?

Yes **"Press 'CONFIRM' to complete the calibration"** appears! See procedure number CO- 6.4.4 (page 388).

No **"Press 'CONFIRM' to complete the calibration"** does NOT appear. TWO (2) possible scenarios:

**1) IF (and ONLY if) "COND LESS THAN 10.0" OR "COND LESS THAN 15.0" banner occurred:** Proceed to **page 389**, procedure number **CO- 6.5.0**.

**2) ALL OTHERS:** Proceed to **page 390**, procedure number **CO- 6.6.0**.

**CO- 6.4.4 ALL FOUR OLC POINTS ADVANCED SUCESSFULLY**

Press 'Enter' to save the calibration. Does an "Error" banner occur?

Yes Error banner! **Read before performing!** Acid clean the machine then return to (ABOVE) procedure number CO- 6.2.0 (page 384) to see if the acid clean fixes the problem. If (and ONLY if) you return to procedure number CO- 6.4.4 the Functional Board may be bad (IC20)?

No a) Turn the machine off then back on.

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'

d) Allow five (5) minutes before continuing to part e!

e) If you were troubleshooting an OLC problem proceed to **page 424**, procedure number CO- 10.0.41.

## CO- 6.5.0 "COND LESS THAN 10 or 15" BANNER OCCURING

a) Recheck Loading Pressure (gauge in Rinse port). Unless there is a masked "No Water" or a Flow Error alarm pressure cycles, to a PEAK of about 25 psi. Do NOT continue UNLESS pressure is cycling approximately EVERY THREE SECONDS!

b) ENSURING the shunt door is CLOSED, if the external flow indicator's 'bob' is NOT moving up and down there may be an unannounced "No Water" alarm or a Flow Error. Do NOT continue UNLESS the 'bob' is moving up and down!

c) Look through the clear acid and bicarb inlet tubing to ENSURE the pumps are drawing into the machine with NO AIR! If a problem is located and fixed allow six (6) FULL minutes before continuing to part d!

d) Does the screen's **[Conductivity]** box go to between 13.0 and 14.0 at steps 9 or 10 OR between 15.0 and 15.9 at steps 8 or 10 now?

Yes **[Conductivity]** box is good! See procedure number **CO- 6.5.6** (page 389).

No **[Conductivity]** box IS NOT good! See procedure number CO- 6.5.4 (page 389).

## CO- 6.5.4 [CONDUCTIVITY] BOX IS NOT GOOD (2)

a) Swap acid and bicarb with a machine that has good conductivity.

b) Allow six (6) FULL minutes.

c) Does the **[Conductivity]** box stabilize between 13.0 and 14.0 mS at steps 9 or 10 OR between 15.0 and 15.9 mS at steps 8 or 10?

Yes See procedure number CO- 6.5.6 (page 389).

No Return to (ABOVE) procedure number CO- 6.2.0 (page 384).

## CO- 6.5.6 [CONDUCTIVITY] BOX IS GOOD

Does the "COND LESS THAN 10 or 15…" alarm go away?

Yes Alarm goes away! Return to (ABOVE) procedure number CO- 6.4.2 (page 388).

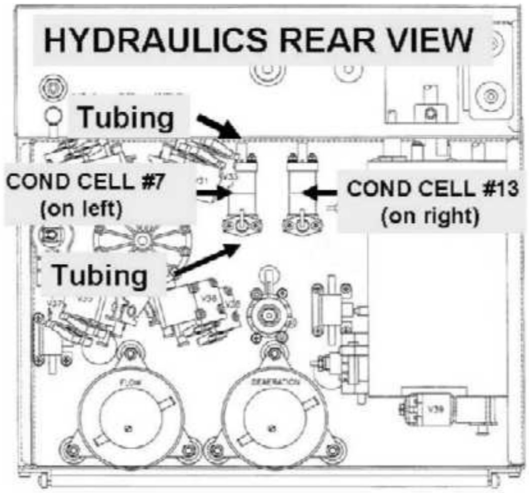
No a) 'Escape' the calibration

b) Return to (ABOVE) procedure number CO- 6.2.0 (page 384).

## CO- 6.6.0 POST DIALYZER COND / TROUBLESHOOTING POST DIALYZER COND

a) Recheck Loading Pressure (gauge in Rinse port). Unless there is an unannounced "No Water" or a Flow Error alarm pressure cycles, to about 25 psi about every three (3) seconds! Do NOT continue UNLESS cycling!

b) ENSURING the shunt door is CLOSED, if the external flow indicator's 'bob' is NOT moving up and down there may be an unannounced "No Water" or Flow Error. Do NOT continue UNLESS 'bob' is moving up and down!




c) Check for air bubbles flowing through the dialyzer AND the dialyzer lines. Air does NOT allow conductivity to stabilize!

d) Figure right, using a flashlight, and WITHOUT LOOKING AWAY for ONE (1) MINUTE watch for air bubbles through the tubing at Cond Cell #7.

e) DO NOT continue UNLESS ABSOLUTELY SURE there are NO AIR leaks!

f) See procedure number CO- 6.6.2 (page 390).

## CO- 6.6.2 ISOLATE THE DIALYZER

a) Remove the dialyzer and reinstall the external meter to measure conductivity.

b) Close the shunt door then return to Service Mode → Calibrate Sensors → Cond Cells.

c) Follow the screen's instructions through: **"4. Waiting until the Conductivity value is stable."**

d) ENSURING the external flow indicator's 'bob' is moving up and down, ALLOW six (6) FULL minutes to ENSURE measured conductivity is between 13.0 and 14.4 mS.

e) Enter the measured conductivity into the **[Conductivity]** box and press 'Enter' twice.

f) This time do **NOT** install a dialyzer!

g) Press 'Enter'. Allow up to twenty-five (25) FULL minutes OR until if an alarm occurs. If all FOUR 'OLC points' advance successfully the screen says: **"Press 'CONFIRM' to complete the calibration?"**

Yes **"Press 'CONFIRM…"** appears! There may be a problem with the original dialyzer! 'Escape' the calibration. This time using a DIFFERENT PRIMED dialyzer return to **page 384**, procedure number **CO- 6.2.0**.

No **"Press 'Confirm…"** does NOT appear! TWO (2) possible scenarios:

1) **IF (and ONLY if) "COND LESS THAN 10.0" OR "COND LESS THAN 15.0" banner occurred:** See (ABOVE) procedure number CO- 6.5.0 (page 389).

2) **All OTHERS:** A possible problem with the Cond Cell #7 Circuit. Proceed to **page 395**, procedure number **CO- 7.0.0**.

CO- 6.8.0 CONDUCTIVITY IS NOT BETWEEN 13.0 AND 14.2

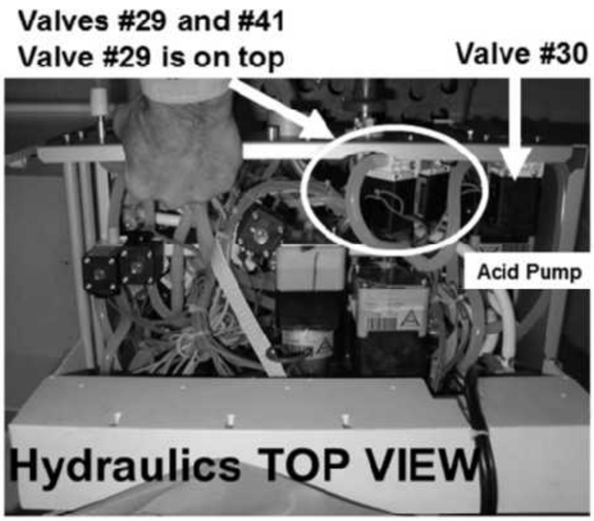
Based on the external meter's reading, TWO (2) possible scenarios:

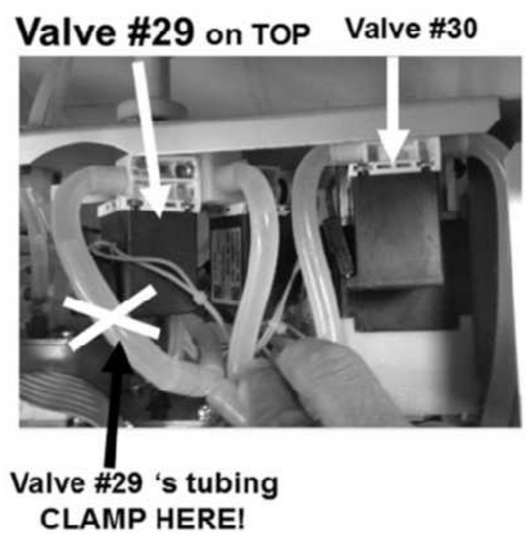
1) **IF (and ONLY if) LESS THAN 14.5 mS:** Proceed to **page 394** procedure number CO- 6.8.6.

2) **IF MORE THAN 14.5 mS:** See parts a THROUGH d below:

a) ENSURE the blue (bicarb) connector is not accidently plugged into acid; the red (acid) connector MUST be in acid!

b) Figure below, clamp the tubing at Valve #29.




c) ENSURE the external flow indicator's 'bob' continues to move up and down

d) Allowing up to fifteen (15) minutes, does the external meter's reading stabilize between 13.0 and 14.4 (Yes or No)?

Yes Conductivity between 13.0 and 14.4! Remove the clamp and allow (7) seven minutes. If the meter's reading becomes more than 14.5 mS again this confirms a problem with Valve #29. TWO (2) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Valve #29.

No Conductivity is NOT between 13.0 and 14.4! TWO (2) possible scenarios:

**1)** **IF equipped with a bi*b*ag Connector:** See procedure number CO- 6.8.2 (page 392)

**2)** **IF (and ONLY if) NOT equipped with a bi*b*ag Connector:** Proceed to **page 394**, procedure number CO- 6.8.6.

## CO- 6.8.2 MACHINE BI*B*AG EQUIPPED / CONDUCTIVTY IS NOT BETWEEN 13.0 AND 14.4

a) ENSURE no air bubbles flowing through the clear Bicarb inlet tubing!

b) Press the screen's lower left 'Options' key to escape the calibration.


c) Call debug screen 14. Is **Air** ($4^{th}$ column from left, $3^{rd}$ window down) = 1?

**1) IF (and ONLY if) Air = 0!** See procedure number CO- 6.8.3 (page 393).

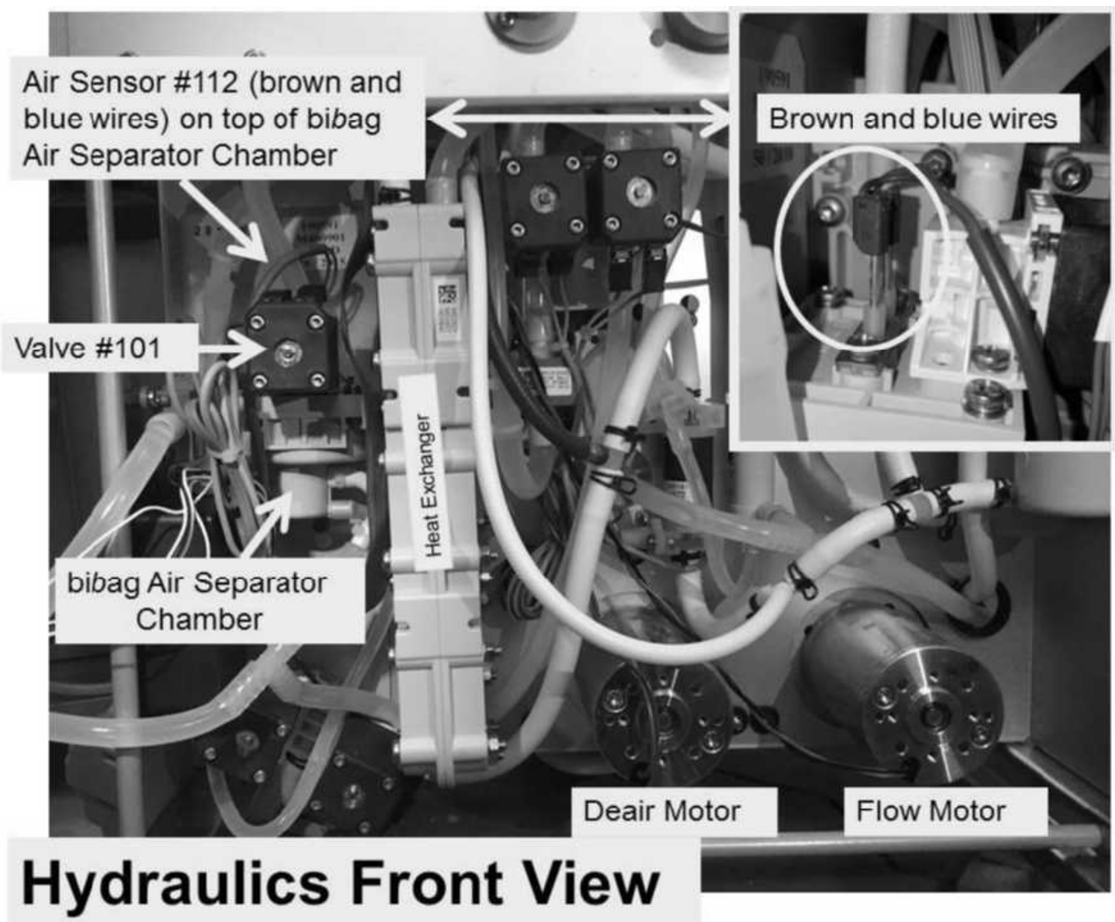
**2) IF Air = 1:** See parts a THROUGH d below:

a) ENSURE screen 14's **Conductivity** ($2^{nd}$ column from left, bottom row) is MORE THAN 48.00 indicating the bicarb AND the Bicarb Pump is good. Bad bicarb will cause **AIR** = 1!

b) Remove the hydraulics from the cabinet!

c) Figure below, ENSURE the blue and brown wires are attached securely to their probes on top of the bi*b*ag Air Separator Chamber! If not this will cause **AIR** = 1!

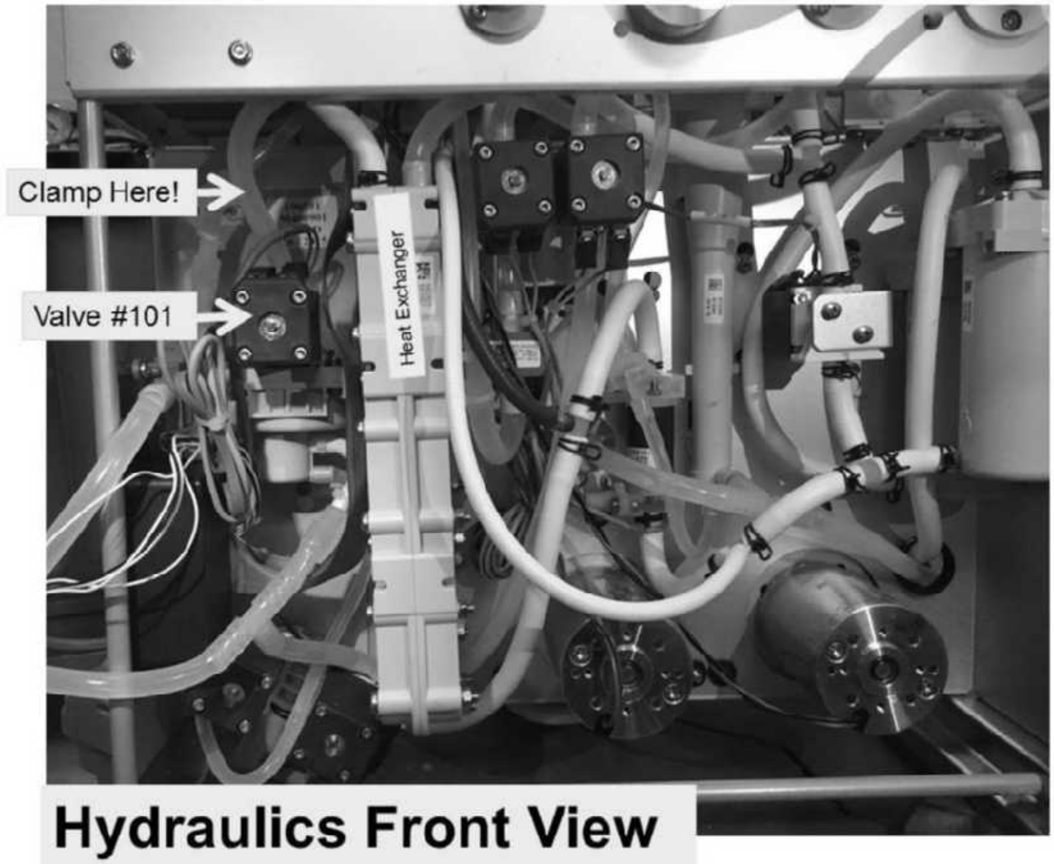
d) If **Air** still = 1 FOUR (4) possible problems: **1)** Loose bi*b*ag Interface Board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad bi*b*ag Interface Board OR; **3)** Bad connection, from Air Sensor #112, inside the bi*b*ag Distribution Board (refer to Figure 4D (page 13) OR; **4)** Bad bi*b*ag Air Separator Chamber.



**CO- 6.8.3 AIR = 0**

a) Remove the hydraulics from the cabinet.

b) Per the Figure below, clamp the tubing attached at the top of Valve #101.



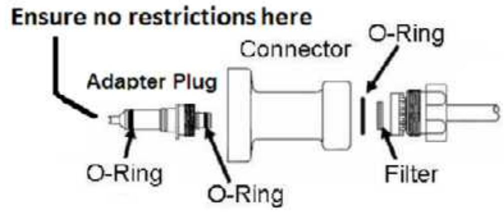

c) Return to the Cond Cells calibration.

d) Allow up to fifteen (15) minutes OR until if the external meter stabilizes between 13.0 and 14.4 (Yes or No)?

Yes — Stabilizes between 13.0 and 14.4! Remove the clamp from Valve #101 and allow ten (10) minutes. If measured conductivity becomes more than 14.5 again this confirms a problem with Valve #101. THREE (3) possible problems: **1)** Loose ribbon cable at the bibag Interface Board (refer to Figure 4C (page 11)) OR; **2)** Bad Valve #101 OR; **3)** Bad bi*b*ag Interface Board (refer to Figure 4D (page 13)).

No — Does NOT stabilize between 13.0 and 14.4. Remove the clamp then see procedure number CO- 6.8.6 (page 394).

## CO- 6.8.6 ISOLATE ACID PUMP




a) Figure right, check the Acid Connector's O-rings AND ENSURE the filter is clean AND the adaptor plug is screwed in tight!

b) Read parts c and d before performing them.

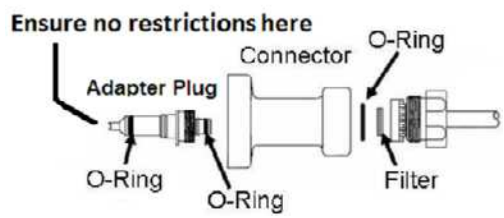
c) Perform the ACID (CONCENTRATE) PUMP VOLUME CALIBRATION per the CALIBRATION PROCEDURES booklet.

d) Are you able to accurately enter the burette volumes without an "Operator Error" banner occurring (Figure right)?


Yes "Operator Error" did NOT occur! See procedure number CO- 6.8.8 (page 394).

No "Operator Error" occurred! Problem with the acid pump! See (ABOVE) procedure number CO- 4.9.0 (page 379).

## CO- 6.8.8 ISOLATE BICARBONATE PUMP




a) Figure right, check the Concentrate Connector's O-rings AND ENSURE the filter is clean AND the adaptor plug is screwed in tight!

b) Perform the BICARBONATE PUMP VOLUME CALIBRATION per the CALIBRATION PROCEDURES manual**!**

c) Are you able to enter the burette volumes without an "Operator Error" banner occurring (Yes of No)?

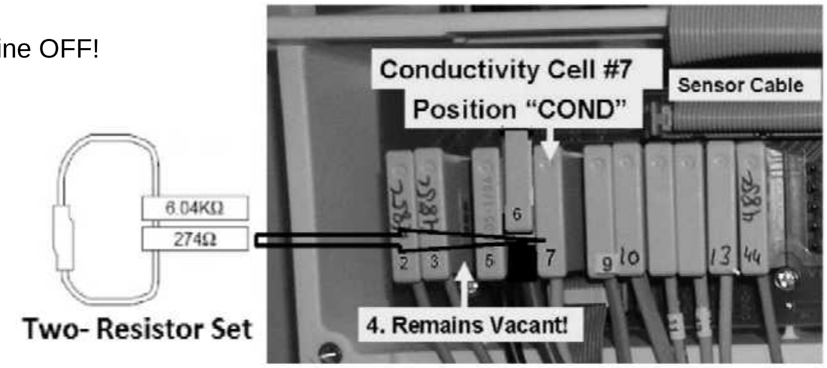

Yes "Operator Error" did NOT occur! Repeat the Cond Cells calibration. If the external meter' conductivity is NOW between 13.0 and 14.4 return to ABOVE procedure number CO- 6.3.0 (page 386). If NOT, assuming you performed all procedures correctly, the Troubleshooting Guide cannot locate the problem.

No "Operator Error" occurred! Problem with the bicarb pump! See (ABOVE) procedure number CO- 4.9.0 (page 379).

## CO- 7.0.0 TROUBLESHOOTING COND CELL #7 CIRCUIT

a) **IMPORTANT!** Turn the machine OFF!

b) Figure right, place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into Conductivity Cell's #7 distribution board position, "X7, COND".




c) Install a conductivity meter into the dialysate lines to measure 'actual' conductivity subsequently!

d) Place the machine into Service Mode → Calibrate Sensors → Cond Cells. Follow the screen's instructions through: **"4. Waiting until the Conductivity value is stable."**

e) ALLOW six (6) minutes before continuing!

f) Verify measured Conductivity is between 13.0 and 14.3!

g) If Cond Cell #7's reading stabilizes, **"5. Conductivity value is stable…."** appears?

Yes **"5. Conductivity value is stable…"** DO NOT continue with the calibration! Cond Cell #7 may be bad. To LOCATE Cell #7 refer to Figure 57 (page 374).

No See procedure number CO- 7.3.0 (page 396).

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## CO- 7.3.0 ISOLATE POSITIVE (+)12 VOLT DC SUPPLY

a) CAREFULLY return Cond Cell #7 to distribution board position "X7, COND".

b) **Turn the machine OFF!**

c) To avoid pulling cables loose, GENTLY open the card cage.

d) Per the Figure below, the EXTENDER BOARD (P/N 190600) is required!

e) To avoid error, per the Figure below, **FOUR NOTES** below**:**

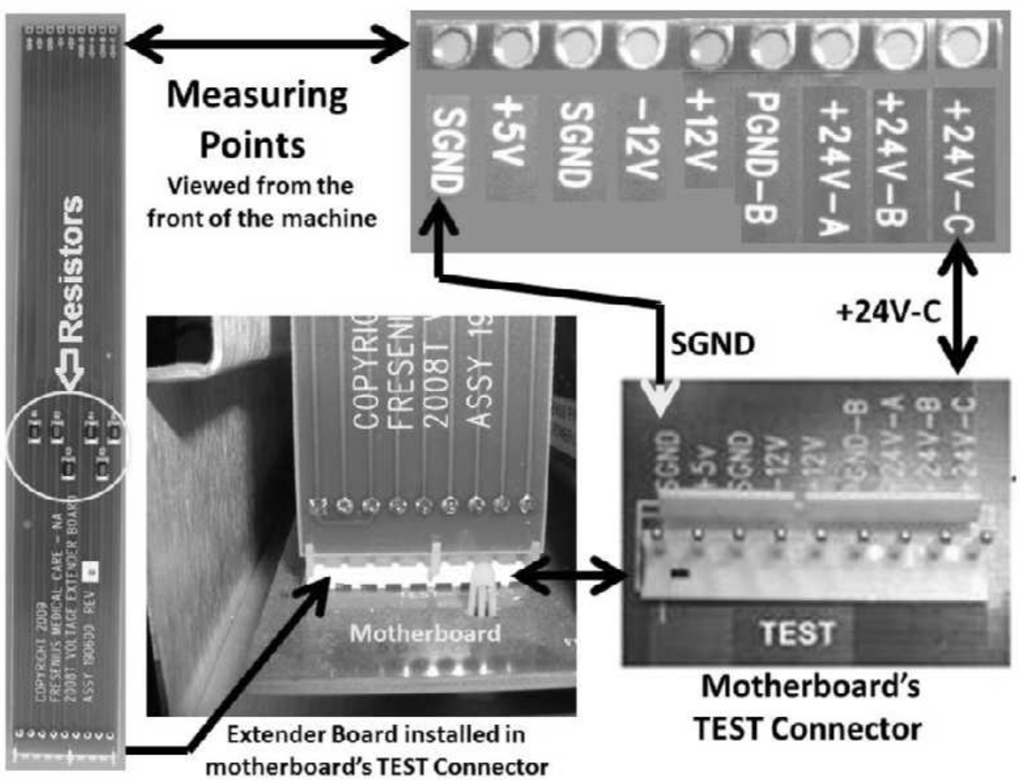
   **1)** Keeping the EXTENDER BOARD'S resistors towards the **FRONT OF THE MACHINE** install it into the motherboard's 9 pin TEST***** connector. *****To LOCATE refer to Figure 4A (page 10))

   **2)** ENSURE the board is matched pin for pin to the TEST connector! From the **FRONT OF THE MACHINE** SGND on the LEFT; 24V-C on the RIGHT!

   **3)** Push the board down hard. It may resist a good connection!

   **4)** Pull up on the board. If installed correctly it resists pulling out!

f) See procedure number CO- 7.3.1 (page 397).



**CO- 7.3.1 ISOLATE +12 VOLT DC SUPPLY**

a) Return to concentrate connectors to their rinse ports.

b) Place the machine into RINSE!

c) **Set your CALIBRATED volt meter to DC volts ($V_{DC}$)!**

d) **Connect the meter's black lead to chassis ground (see Figure 2 (page 4)).**

e) Measure at the EXTENDER BOARD'S **+12V** measuring point. TWO (2) possible scenarios:

   1) **IF (and ONLY if) between 11.7 and 13.3 volts DC:** See procedure number CO- 7.3.4 (page 397).

   2) **IF NOT between 11.7 and 12.3 volts DC:** ENSURE the extender board is installed pin for pin to the TEST connector. If OKAY, replace the Power Logic Board***.**

      ***** To LOCATE the board refer to Figure 4A (page 10).

**CO- 7.3.4 ISOLATE NEGATIVE 12 VOLT DC SUPPLY**

Measure at the EXTENDER BOARD'S **-12V** (negative 12V) measuring point. TWO (2) possible scenarios:

1) **IF (and ONLY if) between -11.0 and -13.0 volts DC:** Swap in the listed components (see COMPONENT LIST below) one at a time and in between return to (ABOVE) procedure number CO- 6.2.0 (page 384) to test each component

   **COMPONENT LIST: 1)** Sensor Board OR; **2)** Actuator-Test Board OR; **3)** Functional Board (IC20?) OR; **4)** Sensor Board cable; **5)** Distribution board.

2) **IF NOT between -11.7 and -12.3 volts DC:** ENSURE the extender board is installed correctly! If OKAY, proceed to **page 451**, procedure number CR- 1.0.9.

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## CO- 8.0.0 MEASURED CONDUCTIVITY IS BAD / 'ACTUAL' CONDUCTIVITY CHECKS

TWO (2) possible scenarios based on the external meter's reading versus TCD:

1) **IF (and ONLY if) LESS THAN TCD - (minus) 0.4 i.e. Conductivity is LOW:** Proceed to **page 401**, procedure number CO- 8.2.0.

2) **IF MORE THAN TCD + 0.4 i.e. Conductivity is HIGH:** See procedure number CO- 8.1.0 (page 398).

## CO- 8.1.0 CONDUCTIVITY IS HIGH (MORE THAN TCD + 0.4 mS)

TWO (2) possible scenarios based on the external meter's reading:

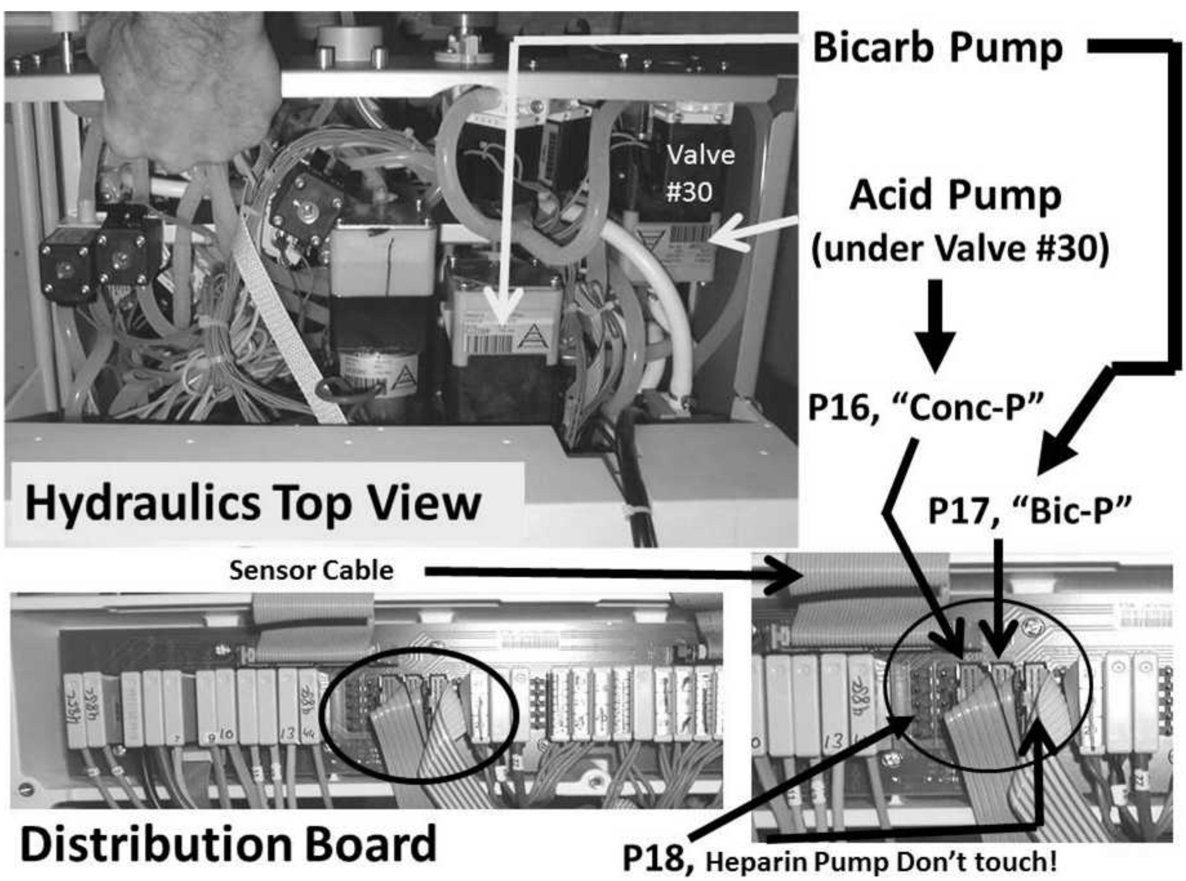
1) **IF (and ONLY if) LESS THAN 15.0 mS:** See procedure number CO- 8.1.1 (page 400).

2) **IF 15.0 mS OR MORE:** See parts a THROUGH f below:

a) Turn the machine OFF!

b) Figure below, ENSURE the ACID AND BICARB PUMPS are not reverse connected at the distribution board!

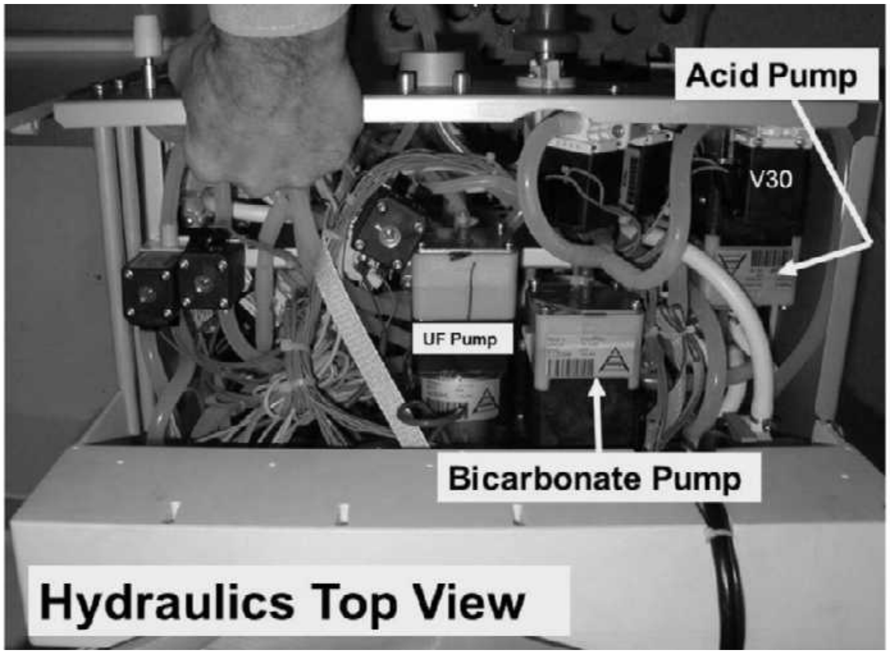
**Continue to part c next page**



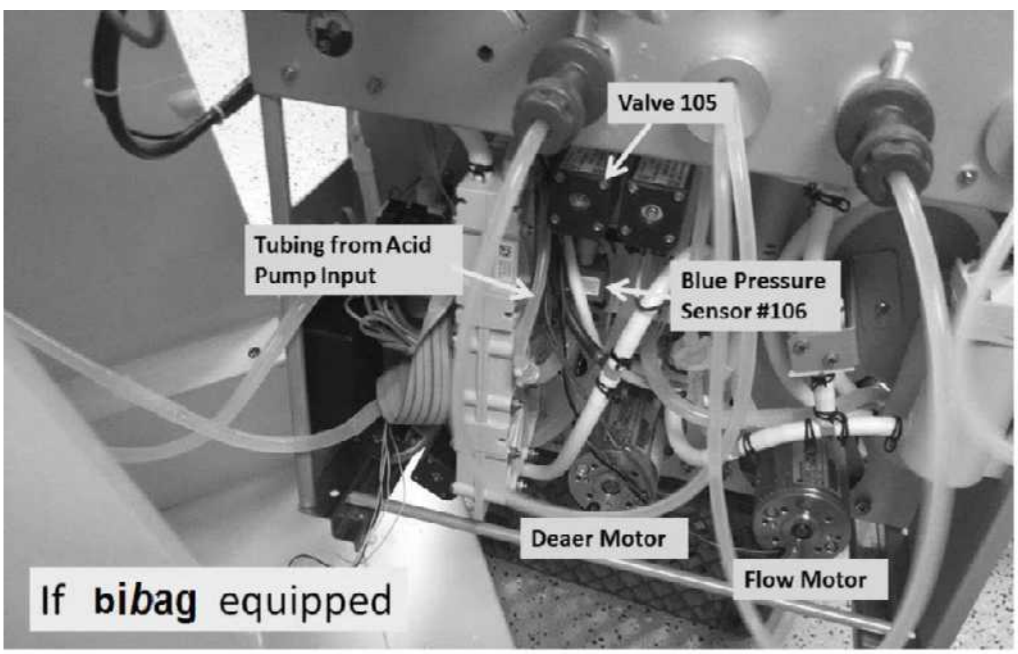
c) TWO (2) possible scenarios to ENSURE the Acid and Bicarb pump tubing is NOT reversed:

- **IF NOT equipped with bi*b*ag Connector:** Per the TOP Figure below, trace the tubing from the red (ACID) connector to ENSURE it goes to the ACID pump
- **IF equipped with a bi*b*ag Connector:** Per the Figures below, trace clear (input) tubing from the ACID pump to ENSURE it comes from (blue) Pressure Sensor #106!

**Parts d through f next page**




**Hydraulics, Front View**



d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

e) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

f) See procedure number CO- 8.1.1 (page 400).

## CO- 8.1.1 ISOLATE POSSIBLE VERY INTERMITTENT FLOW ERROR

a) Call debug screen 6.

b) WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for THREE (3) MINUTES If it EVER = 897 or more, even just once, indicates a masked Flow Error! Is it EVER = 897 or more?

Yes **BC Switch** = 897 even if just once! Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

No **BC Switch** is NEVER, EVER = 897 or more! See procedure number CO- 8.2.0 (page 401)

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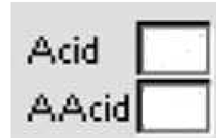
## CO- 8.2.0 ISOLATE VERY INTERMITTENT ACID PUMP CYCLES

Call debug screen 0. Figure (right), WITHOUT LOOKING AWAY, watch **Acid** versus **AAcid** for one (1) minute. Are they remaining always within +/- 3 of each other?




Yes **AAcid** = **Acid!** See procedure number CO- 8.2.1 (page 401).

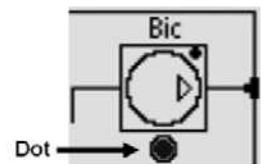
No **AAcid** is NOT remaining within 3 of **Acid!** Proceed to **page 441**, SECTION 6 - CONCENTRATE PUMP ERRORS...

## CO- 8.2.1 AACID = ACID / ISOLATE BICARB PUMP CYCLES

Figure right, watch **Bic** versus **ABic** for one (1) minute. Are they remaining always within +/- 3 of each other?


Yes **ABic** = **Bic!** See procedure number CO- 8.2.2 (page 401).

No. **ABic** is NOT remaining within +/- 3 of **Bic!** Figure right, watch the Bicarbonate (BIC) pump's 'dot' for THREE (3) minutes. It should REMAIN blue. TWO (2) possible scenarios:




1) **IF (and ONLY if) the 'dot' is EVER white:** Proceed to **page 409**, procedure number **CO- 9.0.0**.

2) **IF the 'dot' REMAINS BLUE:** Proceed to **page 441**, SECTION 6 - CONCENTRATE PUMP ERRORS.

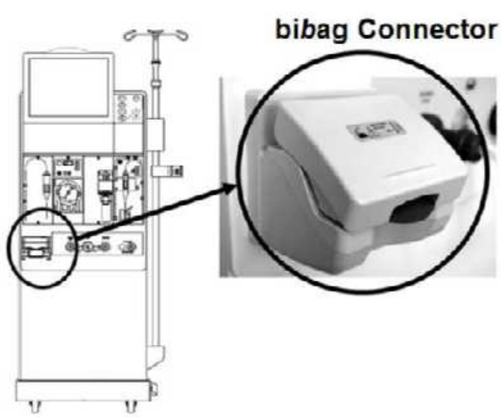
## CO- 8.2.2 ABIC = BIC

a) If not already, allow the external flow indicator's 'bob' to begin moving up and down.

b) Based on the external meter's reading versus TCD, TWO (2) possible scenarios:

1) **IF (and ONLY if) LESS THAN TCD - (minus) 0.4:** See procedure number CO- 8.3.0 (page 404).

2) **IF MORE THAN TCD + 0.4 i.e.:** Figure right, if equipped with a bi*bag* Connector see procedure number CO- 8.2.3 (page 402). If NOT, see procedure number CO- 8.3.0 (**page 404**).



## CO- 8.2.3 BI*BAG* EQUIPPED.


Call debug screen 14. WITHOUT LOOKING AWAY watch **Air** (4th column from left, 3rd window down) for one (1) minute. Does **Air** ever = 1?

**3) IF (and ONLY if) Air = 0 ALWAYS (NEVER = 1):** See procedure number CO- 8.2.4 (page 403).

**4) IF Air = 1:** See parts a THROUGH e below:

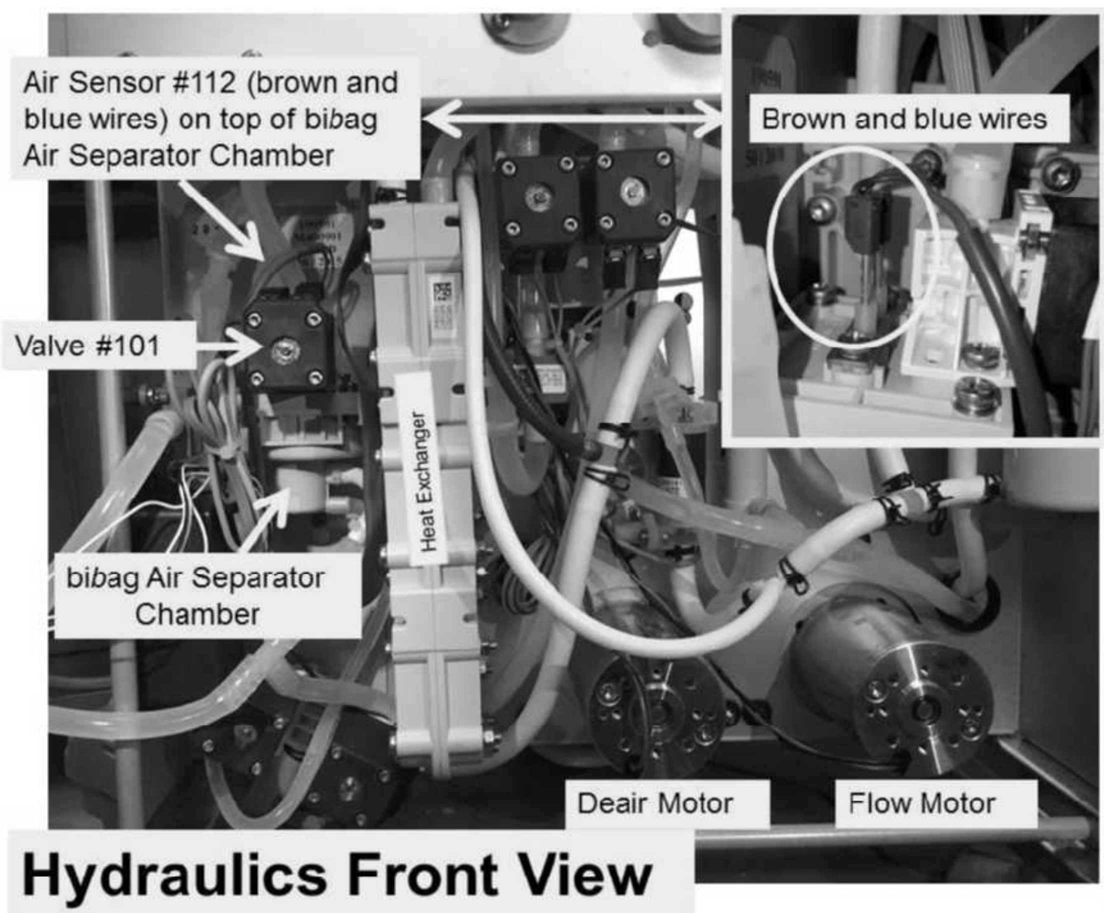
a) ENSURE no air through the clear Bicarbonate inlet tubing! This may cause **Air** = 1!

b) ENSURE screen 14's **Conductivity** (2nd column from left, bottom row) is MORE THAN 48.00 indicating the bicarb AND Bicarb Pump is good. Bad bicarbonate will cause **AIR** = 1!

c) Remove the hydraulics from the cabinet!

d) Figure below, ENSURE the blue and brown wires are attached securely to their probes on top of the bi*bag* Air Separator Chamber! If not this will cause **AIR** = 1!

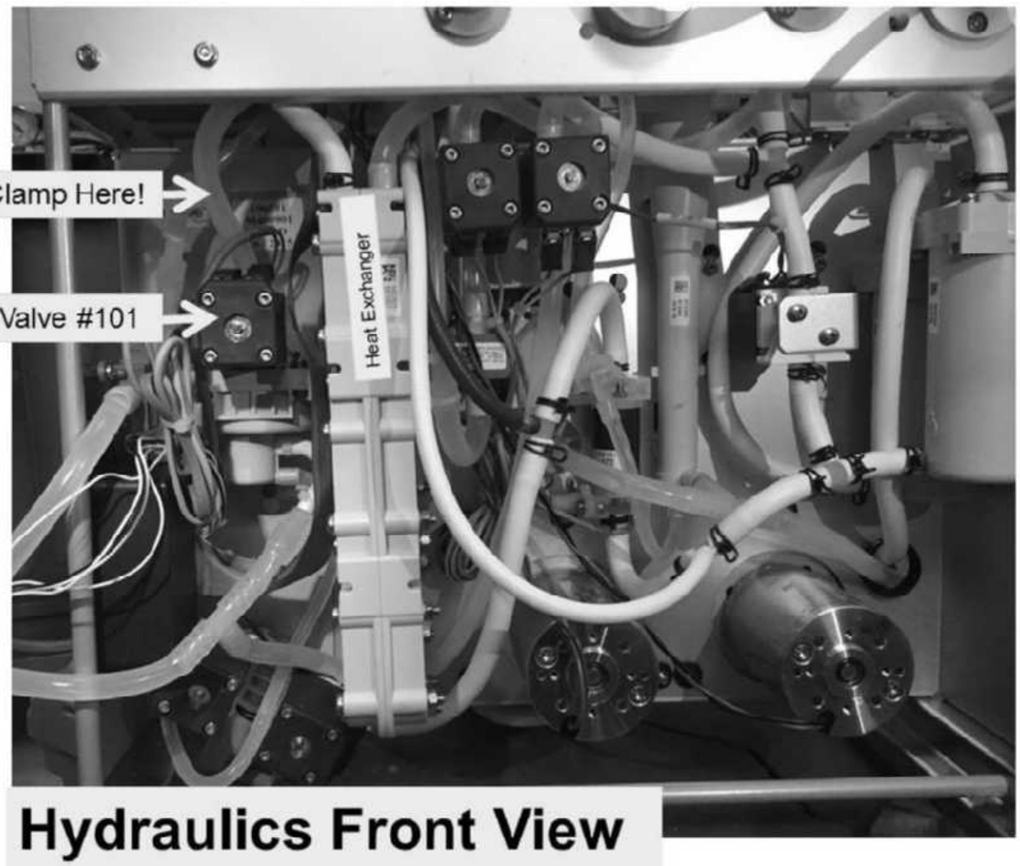
e) If **Air** still = 1 FOUR (4) possible problems: **1)** Loose bi*bag* Interface Board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad bi*bag* Interface Board OR; **3)** Bad connection, from Air Sensor #112, inside the bi*bag* Distribution Board (refer to Figure 4D (page 13) OR; **4)** Bad bi*bag* Air Separator Chamber.



## CO- 8.2.4 AIR = 0 ALWAYS

a) Remove the hydraulics from the cabinet.

b) Per the Figure below, clamp the tubing attached at the top of Valve #101.




c) Reconnect to acid and bicarbonate!

d) From the Home screen, ENSURE [Dialysate Flow] is set at 800 ml/min!

e) Allow fifteen (15) minutes OR until if the external meter's reading to within +/- 0.4 of TCD?

Yes — Within +/- 0.4 of TCD! Remove the clamp from Valve #101 and allow ten (10) minutes. If measured conductivity becomes high again this confirms a problem with Valve #101. TWO (2) possible problems: **1)** Bad Valve #101 OR **2)** Bad bi*b*ag Interface Board (refer to Figure 4C (page 11)).

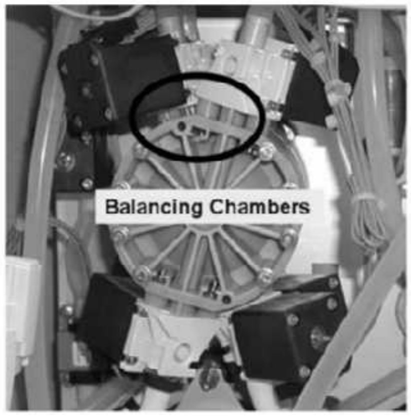
No — NOT within +/- 0.4 of TCD! Remove the clamp then see procedure number CO- 8.3.0 (page 404).

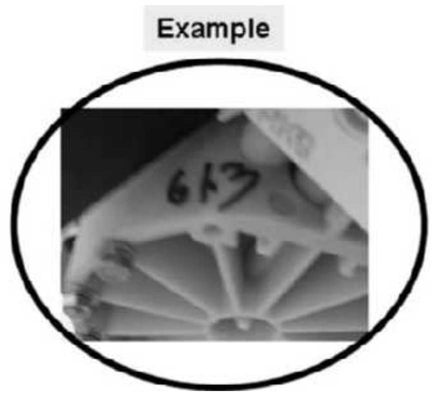
## CO- 8.3.0 BALANCING CHAMBER VOLUME (BCV)

Figure below, the **B**alancing **C**hamber(s) **V**olume (BCV) MAY HAVE BEEN factory recorded, a three-digit number (example **61.3**), written on the top or side of the balancing chambers (Yes or No)?

Yes ↕ BCV is recorded! See procedure number CO- 8.3.1 (page 404).

No BCV is NOT recorded! Proceed to **page 405**, procedure number **CO- 8.4.0**.




## CO- 8.3.1 BCV IS RECORDED


Call debug screen 3. **BCV** (upper right) is the stored **B**alancing **C**hamber **V**olume, of BOTH chambers (**example:** 613 = 61.3 ml). Does screen 3's **BCV** = the factory recorded value?

Yes **BCV** = the factory volume! See procedure number CO- 8.4.0 (page 405).

No Read parts a THROUGH f below BEFORE performing them!

a) Perform BALANCING CHAMBER VOLUME CALIBRATION, per the CALIBRATION PROCEDURES booklet, **BUT enter the factory recorded volume**!

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) Call debug screen 3. If the calibration was performed correctly **BCV** = the factory value.

d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

e) Allow fifteen (15) minutes BEFORE continuing to part f!

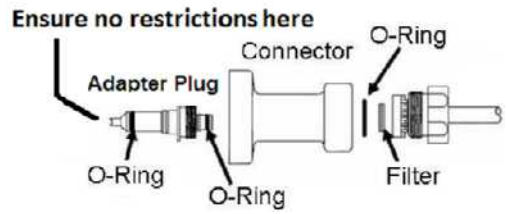
f) Is the external meter's reading now within +/- 0.4 mS of TCD?

Yes Conductivity within +/- 0.4 mS of TCD. **BCV** was incorrect! Do NOT continue!

No See procedure number CO- 8.4.0 (page 405).

**CO- 8.4.0 ISOLATE ACID PUMP**

a) Turn the machine OFF!




b) Figure right, ENSURE the Acid (red) AND Bicarbonate (blue) Connector's O-rings AND ENSURE the filters are clean AND the adaptor plugs are screwed in tight

c) Read parts d and e before performing them!

d) Perform the ACID (CONCENTRATE) PUMP VOLUME CALIBRATION per the Calibration booklet.

e) Are you able to enter measured burette volumes without an "Operator Error" (Figure right) occurring?


Yes "Operator Error" did NOT occur! See procedure number CO- 8.5.2 (page 405).

No "Operator Error" occurred! Acid pump problem! See (ABOVE) procedure number CO- 4.9.0 (page 379).

**CO- 8.5.2 ISOLATE BICARBONATE PUMP**

a) Perform the BICARBONATE PUMP VOLUME CALIBRATION.

b) Are you able to enter measured burette volumes without an "Operator Error" occurring?

Yes "Operator Error" did NOT occur. See procedure number CO- 8.5.4 (page 405).

No "Operator Error" occurred! Bicarb Pump problem! See (ABOVE) procedure number **CO- 4.9.0** (page 379).

**CO- 8.5.4 VERIFY CONDUCTIVITY**

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → "Enter')!

b) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'!

c) Allow fifteen (15) minutes BEFORE continuing to part d.

d) ENSURING the external flow indicators' 'bob' is moving up and down, is the external meter now within +/- 0.4 mS of TCD?

Yes Conductivity within 0.4 of TCD! The pump calibrations fixed the problem!

No Conductivity is NOT within 0.4 of TCD! TWO (2) possible scenarios:

1) **IF (and ONLY if) measured conductivity is LESS THAN TCD - (minus) 0.4 (i.e. Cond is Low):** Proceed to **page 407**, procedure number CO- 8.7.0

2) **IF measured conductivity is MORE THAN TCD + 0.4 (i.e. Cond is High):** See procedure number CO- 8.6.0 (page 406).

## CO- 8.6.0 COND MORE THAN TCD + 0.4 / ISOLATE VALVE #29

a) Per the Figure below, clamp the tubing at Valve #29.

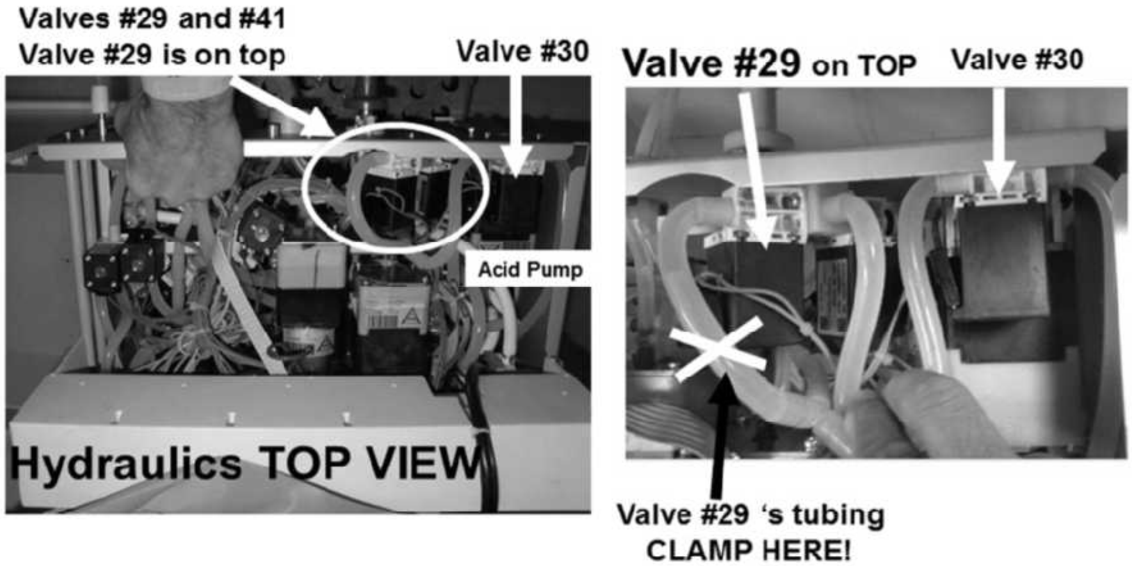



**Figure 61 – Valve #29**

b) Allow fifteen (15) minutes OR until if the external meter returns to within +/- 0.4 of TCD (Yes or No)?

Yes External meter within 0.4 of TCD! Remove the clamp from Valve #29 and allow seven (7) minutes. If conductivity becomes high again this confirms a problem with Valve #29. TWO (2) possible bad components: **1)** Bad valve #29; OR **2)** Bad Actuator-Test Board.

No External meter is NOT within 0.4 of TCD! See procedure number CO- 8.7.0 (page 407).

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## CO- 8.7.0 ISOLATE BALANCING CHAMBER DIAPHRAGMS

a) BEFORE continuing to part b, **NOTE** this page and procedure number as you may be prompted to return here THEN proceed to **page 580**, SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM.

b) If a leaking balancing chamber diaphragm WAS NOT located in part a return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) See procedure number CO- 8.8.0 (page 407).

## CO- 8.8.0 VERIFY VOLUMETRIC SYSTEM

**A 100 ml** graduated cylinder (preferably glass) is REQUIRED! **CAUTION! Using a larger cylinder results in gross error.** If a CALIBRATED scale is available use it (1 gram = 1 ml)!


a) WITHOUT turning flow off, remove the tubing from the 'To Drain' (**BOTTOM***) nozzle at the REAR OF THE MACHINE.

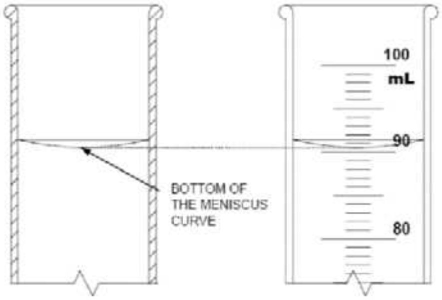
*** Do NOT measure from the drain tubing to prevent gross error.**

b) **Allow ten (10) drain 'pulses' to ENSURE stability!**

c) **ACCURATELY,** collect two consecutive drain 'pulses' into the 100 ml cylinder.

d) Per the Figure right, read the bottom of the meniscus curve.

e) Call debug screen 3.




f) **BCV** (upper right, **B**alancing **C**hamber **V**olume) was entered during the last calibration and is the volume of both chambers (**example:** 603 = 60.3 ml).


g) Does **BCV** AND the measured volume match?

Yes **BCV** = measured volume! See procedure number CO- 8.9.0 (page 408).

No a) **Read before performing!** Perform BALANCING CHAMBER VOLUME CALIBRATION, per the CALIBRATION PROCEDURES booklet but enter your above measured volume.

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) Allow ten (10) minutes before continuing to part d.

d) Is the external meter's conductivity within +/- 0.4 mS of TCD?

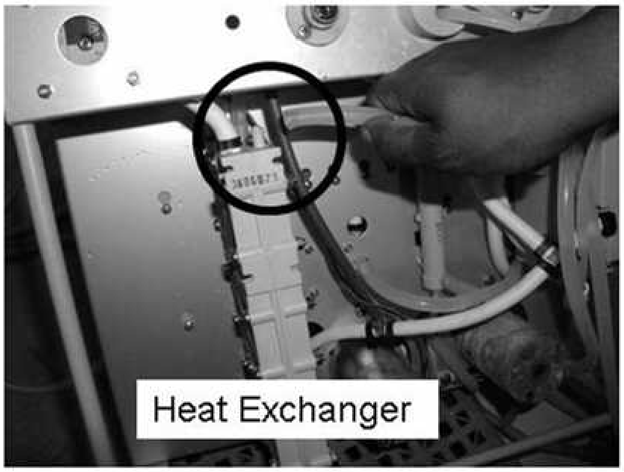
Yes Conductivity within +/- 0.4 mS of TCD! The balancing chamber was out of calibration. Do NOT continue!

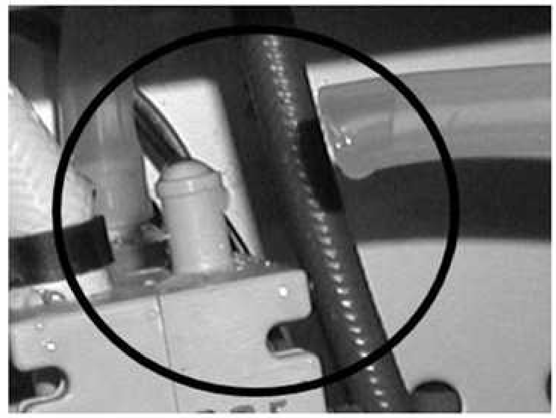
No See procedure number CO- 8.9.0 (page 408).

## CO- 8.9.0 ISOLATE POSSIBLE LEAKING HEAT EXCHANGER

a) Maintain the water on but turn the machine OFF.

b) Per the Figure below, remove the front clear tubing from the Heat Exchanger's nozzle. Ignore a small water crown that may appear.



c) Watch the open heat exchanger nozzle for up to three (3) minutes. Is water continually dripping, possibly VERY slowly, from the Heat Exchanger's nozzle (Yes or No)?

Yes Dripping from Heat Exchanger! TWO (2) procedures MUST be performed!

**Procedure #1:** With the water turned OFF, REPLACE the Heat Exchanger;

**Procedure #2:** Proceed to **page 596**, procedure number OVER- 8.0.0.

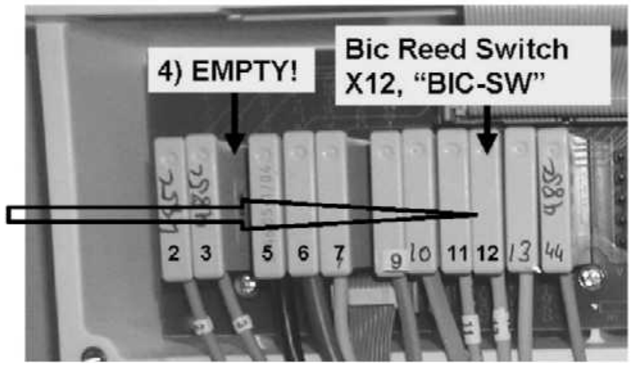
No dripping seen
a) Return the tubing to the Heat Exchanger.

b) From the Home screen, set the [Dialysate Flow] window to 500 ml/min.

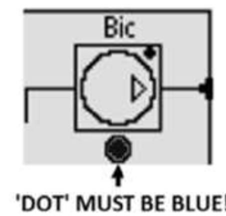
c) Press 'Enter' THEN see (ABOVE) procedure number **CO- 5.6.0** (**page 382**).

## CO- 9.0.0 BIC DOT IS WHITE / ISOLATE BICARB DEBUG SIGNAL

A) Per the Figure below, inside the distribution board, unplug the **9th** CONNECTOR CAP from the left! This is the Bicarb Reed Switches Connector, "X12, BIC-SW".




B) Using a flashlight, check **inside** the "BIC-SW" position for corrosion or damaged male pins as this may be the problem!

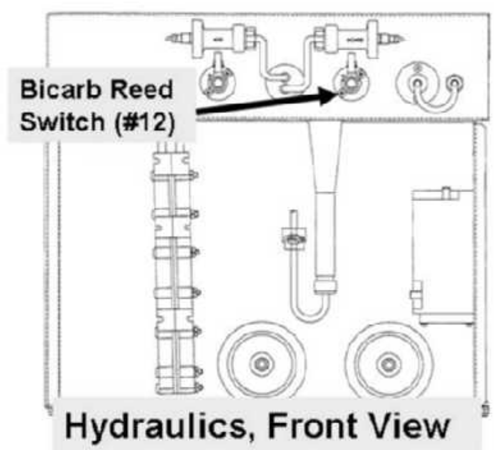



C) Call debug screen 0.

D) WITHOUT LOOKING AWAY, watch the bicarbonate (BIC) pump's 'dot' (Figure right) for two (2) minutes. Does it REMAIN AWAYS blue?

Yes Bic 'dot' remains blue! Referring to the Figure right, the Bicarb Reed Switch (#12) is bad.

No Bic 'dot' remains white OR cycles between white and blue! Continue to part E.




E) **Leave the BIC Reed Switch unplugged till the problem is solved (i.e. until the Bic 'dot' stays blue)**!

F) Turn the machine OFF!

G) One at a time, swap in the listed components (see COMPONENT LIST below) with known good THEN perform parts H and I to test the new component.

**COMPONENT LIST: 1)** Actuator-Test Board; **2)** Sensor Board*****; **3)** Sensor Board cable; **4)** Functional Board*****; **5)** Distribution board; **6)** Motherboard.

***** For each board, to prevent "COND OFFSET" alarms place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)

H) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

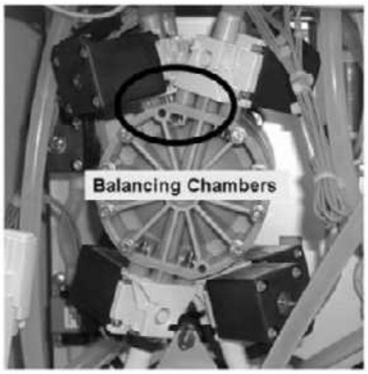
I) Call debug screen 0. If the Bic 'dot' REMAINS blue the last component swapped in was the problem. If still white or cycling between white and blue return the to part F to swap in the next component.

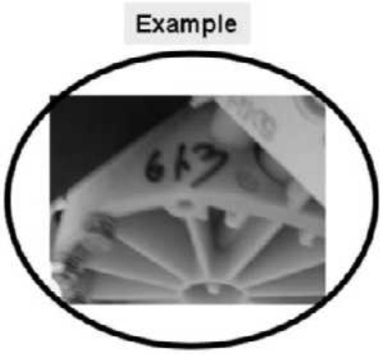
## CO- 9.8.0 VERIFY BALANCING CHAMBER VOLUME

Figure below, the **B**alancing **C**hamber(s) **V**olume (BCV) MAY BE factory recorded, a three-digit number (example **61.3**), written on the top of the Balancing Chambers (Yes or No)?

Yes BCV is factory recorded! See procedure number CO- 9.8.11 (page 410).

No **BCV** not recorded! If troubleshooting bad lab values proceed to **page 411**, procedure number CO- 9.8.3. All other problems see procedure number CO- 9.8.2 (page 410).




## CO- 9.8.11 BALANCING CHAMBER VOLUME IS FACTORY RECORDED


Call debug screen 3. **BCV** (upper right) is the stored **B**alancing **C**hamber **V**olume, of BOTH chambers (example: 613 = 61.3 ml). Does **BCV** = the factory value?

Yes **BCV** = the factory value! If troubleshooting bad lab values proceed to **page 412**, procedure number CO- 9.8.4. All other problems see procedure number CO- 9.8.2 (page 410).

No **BCV** does NOT = the factory value! See parts a THROUGH e below:

a) Perform the BALANCING CHAMBER VOLUME CALIBRATION, **BUT instead of measuring from the drain enter the factory volume!**

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) Call debug screen 3. If the calibration took **BCV** now = the factory value.

d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'!

e) Allow six (6) minutes. Does the machine's [**Conductivity**] window stabilize to within +/- 0.4 mS of TCD?

Yes If troubleshooting bad lab values proceed to **page 412**, procedure number CO- 9.8.4. All other problems see procedure number CO- 9.8.2 (page 410).

No Proceed to **page 405**, procedure number CO- 8.4.0.

## CO- 9.8.2 VERIFY ORIGINAL PROBLEM

Did you originally start troubleshooting On Line Clearance (OLC) problems?

Yes Troubleshooting OLC problems! Proceed to **page 416**, procedure number CO- 10.0.00.

No Proceed to **page 413**, procedure number CO- 9.9.0.

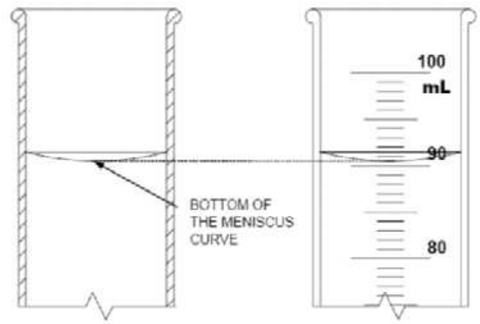
## CO- 9.8.3 BALANCING CHAMBER VOLUME IS NOT FACTORY RECORDED


A clear, preferably glass, 100 ml graduated cylinder OR even MUCH more preferable a calibrated scale is required! **DO NOT** use a larger cylinder or gross error will occur.

a) **WITHOUT turning flow off**, figure right, remove the tubing from the 'To Drain' (***BOTTOM!**) nozzle at the REAR OF THE MACHINE. ***CAUTION! Measuring from the end of the 'to drain' tubing causes gross error!**

b) **Allow ten (10) drain 'pulses' to ENSURE flow stability!**

c) **ACCURATELY,** collect two (2) consecutive drain 'pulses' into the cylinder. If a scale is used 1 ml = 1 gram. If a scale is not used read the bottom of the cylinder's meniscus curve (Figure right).




d) Reattach the drain tubing! TWO (2) possible scenarios:

   **1) IF (and ONLY if) measured volume is NOT consistent between 58 and 62 ml:** Proceed to **page 580**, to perform SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM

   **2) IF measured volume is consistent between 58 and 62 ml:** See parts a AND b below:


   a) Call debug screen 3. **BCV** (upper right, **B**alancing **C**hamber **V**olume) was entered during the last BCV calibration (example: 603 = 60.3 ml)

   b) Does **BCV** AND the measured volume match?

Yes **BCV** and the RECORDED volume match! See procedure number CO- 9.8.4 (page 412).

No **BCV** and the RECORDED volume do NOT match! Read parts a THROUGH c below before performing them:

a) Perform the BALANCING CHAMBER VOLUME CALIBRATION, **BUT instead of measuring again enter your RECORDED volume.**

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) Call debug screen 3. If the calibration took **BCV** = your RECORDED volume.

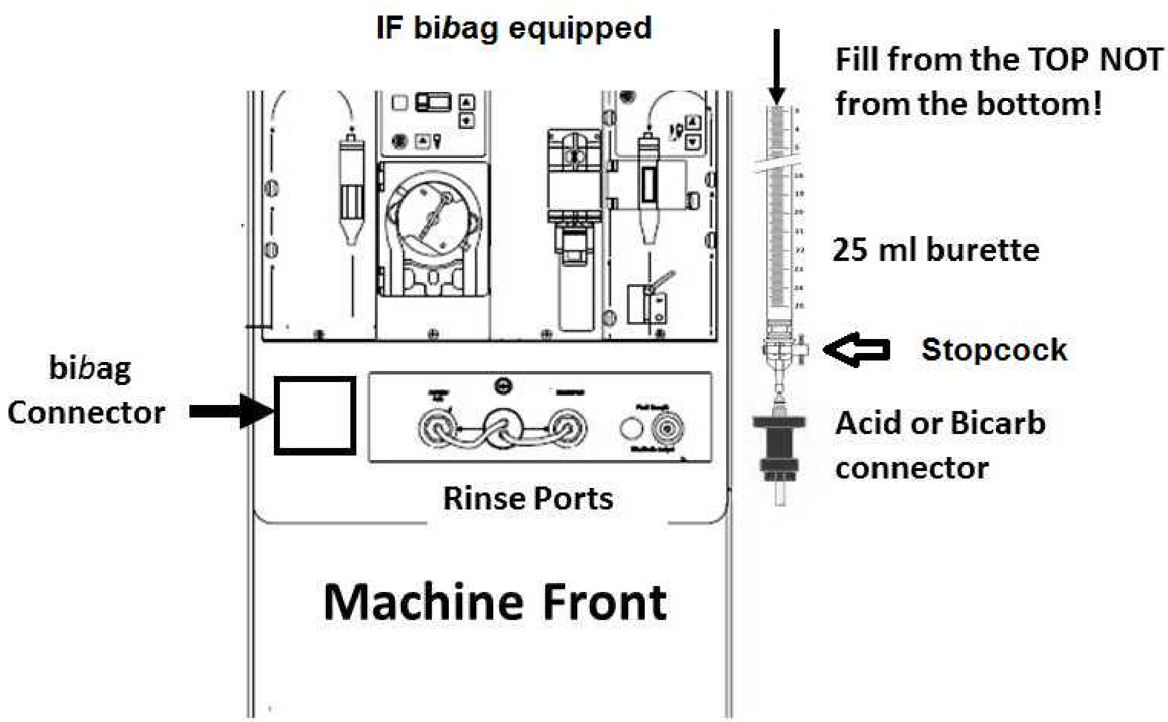
d) See procedure number CO- 9.8.4 (page 412).

## CO- 9.8.4 BAD LAB VALUES

**For additional information about the Acid and Bicarb Pump CHECKS read parts a through f below BEFORE performing them:**

a) To ENSURE the Acid and Bicarb Pump volumes are delivering within +/- 2%, you MUST perform the Test Concentrate and Bicarbonate Pumps[1] per the Preventative Maintenance Procedures as described in Section 4.3. This **IS NOT** the CALIBRATIONS. It is a CHECK.

[1] **NOTE:** If equipped with a bi*b*ag Connector, to prevent problems with the 'active regulation' feature, per the Figure below: **1)** Fill the 25 ml burette from the TOP (DO NOT fill from the bottom); **3)** When checking twenty (20) stroke volumes hold the burette so the connectors are at the level of the rinse ports.




b) NEVER use a 50 ml burette. The additional pressure from the column may influence pump volume.

c) When pump strokes reach twenty (20) turn the burette's stopcock off THEN quickly turn [Dialysate Flow] off.

d) **ACID PUMP VOLUME:** If the twenty (20) stroke volume of the Acid Pump is not between **AMIN** and **AMAX** calibrate the Acid Pump THEN return to Dialysis and repeat the check on the ACID Pump.

e) **BICARB PUMP VOLUME:** If the twenty (20) stroke volume of the Bicarb Pump is not between **BMIN** and **BMAX** calibrate the Bicarb Pump THEN return to Dialysis and repeat the check on the BICARB Pump.

f) If either pump needed to be calibrated this may have been the problem. If neither pump required calibration ensure the Acid and Bicarb is good per clinic procedures.

## CO- 9.9.0 BI*B*AG EQUIPPED?

Is the machine equipped with a bi*b*ag Connector?

Yes EQUIPPED with bi*b*ag Connector! If your facility is using disposable b*ib*ags see procedure number CO- 9.9.1 (page 413). If NOT a Conductivity problem is not indicated at this time.

No NOT equipped with a bi*b*ag Connector! A Conductivity problem is not indicated at this time! DO NOT continue!

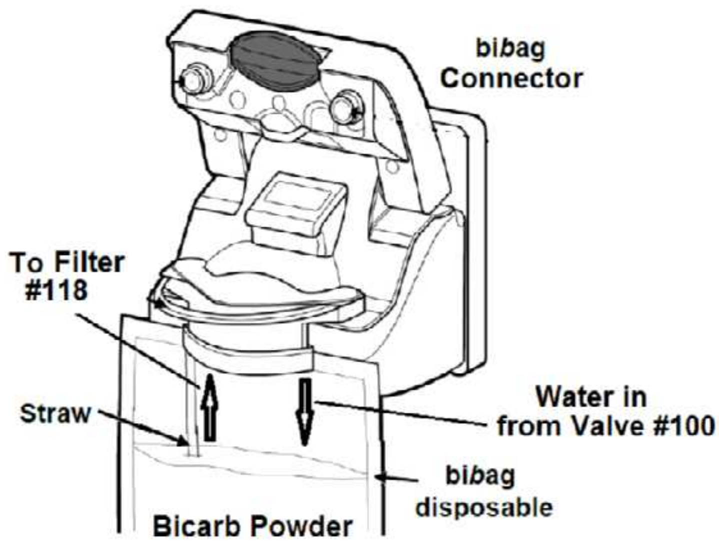
## CO- 9.9.1 ISOLATE BI*B*AG SYSTEM

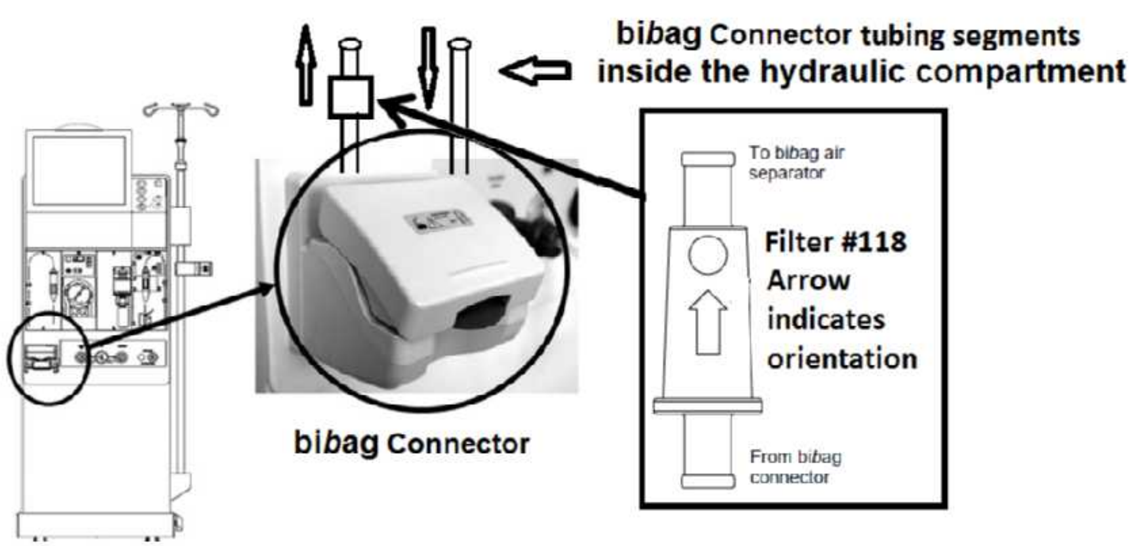
a) Plug the blue (bicarb) connector into its Rinse port.

b) Attach a bi*b*ag disposable and close the bibag Connector door.

c) Figures below, bi*b*ag Valve #100 'pulses' open / closed to, from the right hand side, fill the bag with water.

**Parts d through f next page**

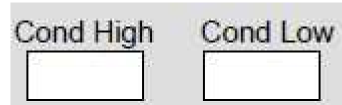


d) **IMPORTANT!** Allow ten (10) minutes BEFORE continuing to part e!

e) Call debug screen 14.

f) WITHOUT LOOKING AWAY, watch **Cond High** AND **Cond Low** for one (1) minute. One or the other will = 1 (constant or once in a while) if bi*bag* conductivity is not within limits OR becomes unstable. TWO (2) possible scenarios:




**1)** **IF (and ONLY if) Cond High AND Cond Low = 0 (always):** Reset all alarms! Is a "Cond 2 High" OR "Cond 2 Low" alarm banner occurring?

Yes See procedure number CO- 9.9.2 (page 415).

No A Conductivity problem is not indicated at this time**!**

**2)** **IF Cond High OR Cond Low = 1 (always or once in a while):** Turn the machine OFF then perform parts a THROUGH h below:

a) Pull the hydraulics away from the cabinet.

b) Figure below, kinked bi*bag* Connector tubing will cause Conductivity to be unstable!

c) Figure below, ENSURE bi*bag* Filter #118 is oriented correctly! The arrow on its body MUST point away from the bi*bag* Connector towards the hydraulics!

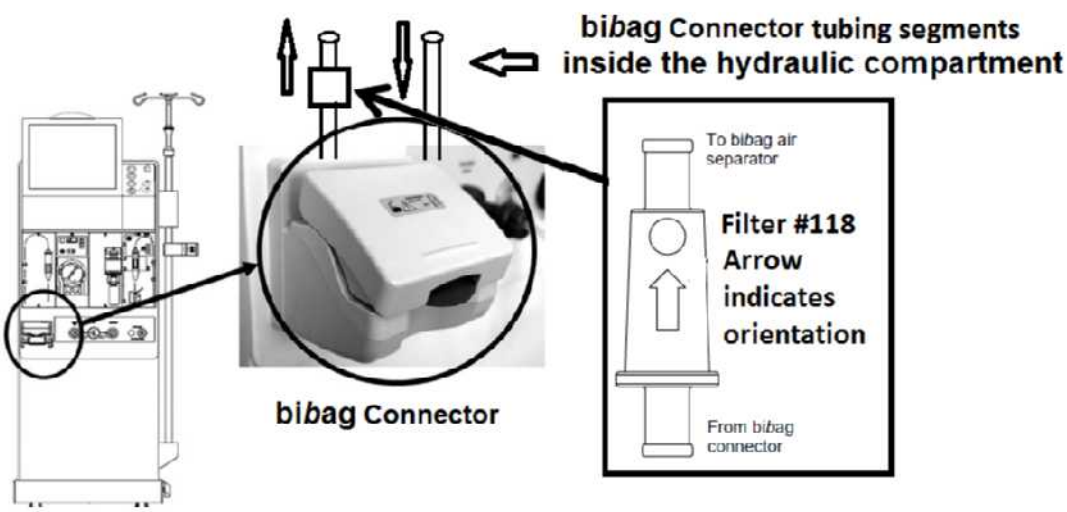
d) Filter #118 can be checked for by attaching a syringe to it and pulling or pushing in the direction of the arrow on its body. If air moves freely the filter is okay!

e) Reconnect Filter #118 ENSURING proper orientation!

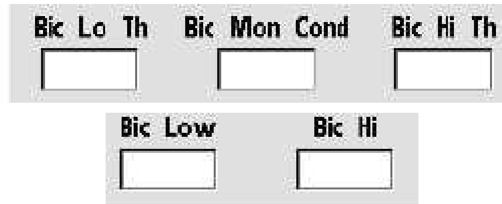
f) Acid clean the machine then see part g.

g) With the hydraulics remaining out of the cabinet, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

h) **Read before performing!** Return to (ABOVE) procedure number CO- 9.9.1 (page 413) but if (and ONLY if) you return here because **Cond High** OR **Cond Low** continues to = 1 there may be a problem with the bi*bag* Interface Board (refer to Figure 4C, page 11)).



## CO- 9.9.2 COND 2 HIGH OR COND 2 LOW




A) Call debug screen 15. “Cond 2 High” or “Cond 2 Low” occurs because **Bic Mon Cond,** from bi*b*ag Cell #117, is outside the **Bic Lo Th** and **Bic Hi Th** limits causing either **Bic Low** = 1 <u>OR</u> **Bic Hi** = 1. <u>BOTH</u> MUST = 0 for two (2) minutes BEFORE the alarm clears!

B) If the alarm does not clear within five (5) minutes:

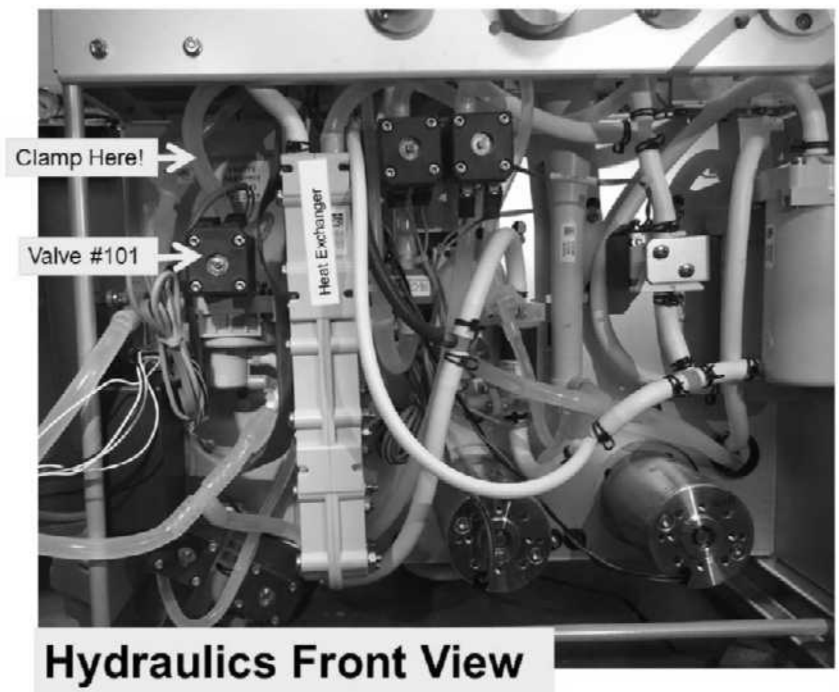
a) Acid clean the machine.

b) Return to Dialysis Program and allow ten (10) minutes.

c) Call debug screen14. If **Air** = 0 continue to part d. If **Air** = 1 indicates a problem with bi*b*ag Air Sensor #112 i.e. the brown and blue wires that plug into the top of the bi*b*ag air separator chamber

d) Reattach a bi*b*ag disposable and allow fifteen (15) minutes. If “Cond 2 Hi” occurs see part e. If “Cond 2 Low” occurs calibrate the Bicarb Cell per procedure i.e. Service Mode → Calibrate Sensor → Cond Cells → **Bicarb Cell**.

e) Per the Figure below, clamp Valve #101 at the location shown then see part f.




**Hydraulics Front View**

f) Allow (15) fifteen minutes does “Cond 2 High” reoccur?

Yes Remove the clamp and calibrate the Bicarb Cell per procedure i.e. Service Mode → Calibrate Sensor → Cond Cells → **Bicarb Cell**.

No Possible leaking Valve #101! This can be confirmed by releasing the clamp and if “Cond 2 High” or “Cond 2 Low” reoccurs within fifteen (15) minutes.

CO- 10.0.00 TROUBLESHOOTING ONLINE CLEARANCE (OLC)

OLC estimates UREA clearance (Kt/V) by measuring Conductivity pre and post dialyzer:

a) Return the dialyzer connectors to the shunt but LEAVE THE DOOR OPEN till instructed.

b) **Per the Figure below**, trace the wires from distribution board positions #13 (Post Dialyzer Cond Cell #13) AND #44 (Post Temperature Sensor NTC #44), to the sensors to perform TWO (2) checks:

**CHECK #1:** Check the entire length for insulation damage. **Damage will cause OLC problems and, if damaged, the sensor should be replaced!**

**CHECK #2:** ENSURE the connectors ARE NOT reverse connected another component!

c) From the Home screen, set [Dialysate Flow] to **500 ml/min** and press 'Enter'.

d) See procedure number CO- 10.0.10 (page 417).

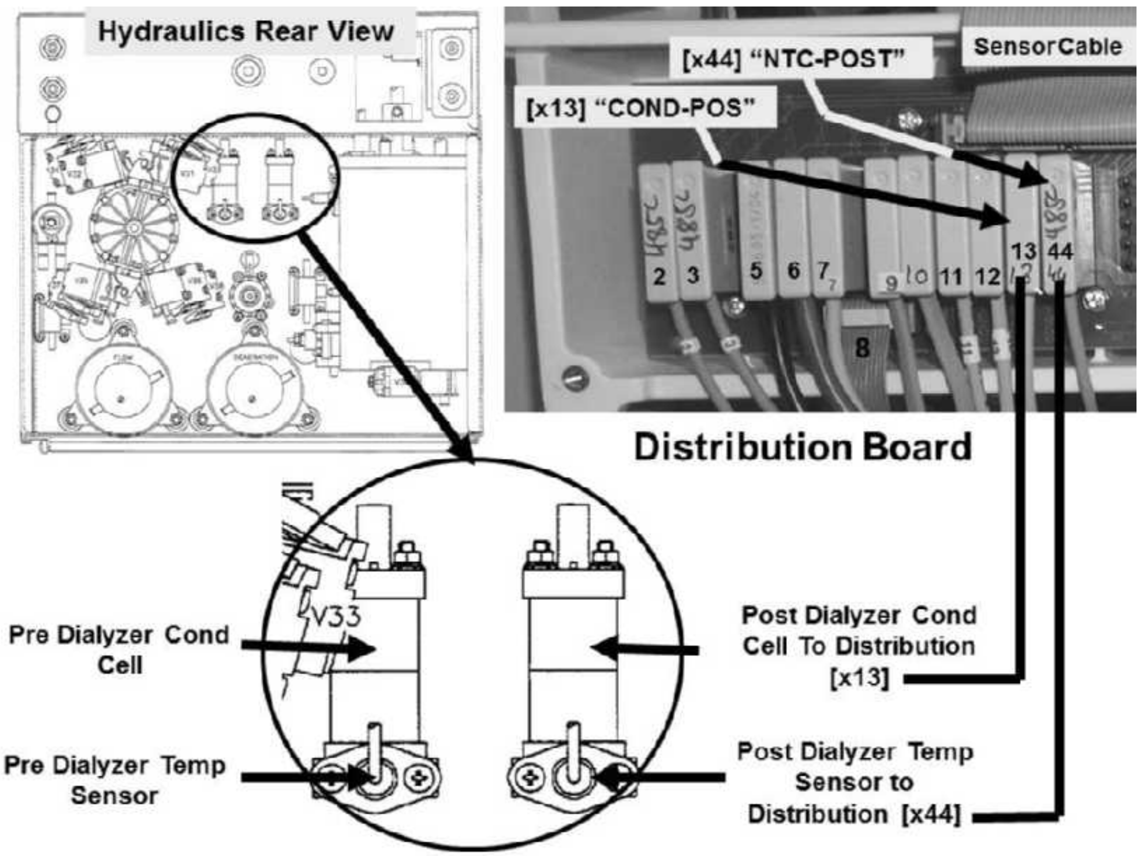
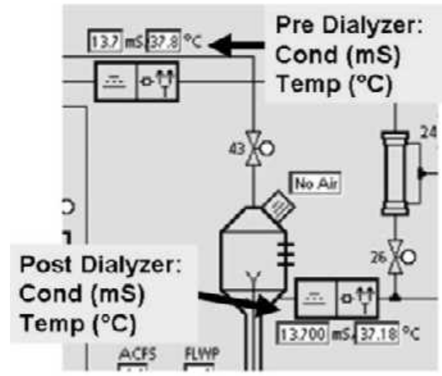



**Figure 62 – Conductivity / OLC Components**

## CO- 10.0.10 ISOLATE TEMP




a) Call debug screen 0. Figure right, ENSURE **Pre Dialyzer Cond (mS)** is within 0.4 of **TCD**.

b) ENSURE **Pre Dialyzer Temp** is between 35.5 and 38.5° C.

c) Is **Post Dialyzer Temp** within 1.2° C of **Pre Dialyzer Temp**?

Yes Post Temp within 1.2 of Pre Temp! See procedure number CO- 10.0.11 (page 417).

No Post Temp IS NOT within 1.2 of Pre Temp! Proceed to **page 418**, procedure number CO- 10.0.20.

## CO- 10.0.11 POST TEMP WITHIN 1.2 OF PRE TEMP / ISOLATE POST DIALYZER COND

**Post Dialyzer Cond** changes but overall is it remaining within 0.4 mS of **Pre Dialyzer Cond**?

Yes Post Cond within 0.4 of Pre Cond! Proceed to **page 423**, procedure number **CO- 10.0.40**.

No Post Cond is NOT within 0.4 of Pre Cond! Proceed to **page 421**, procedure number CO- 10.0.30.

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## CO- 10.0.20 PROBLEM WITH POST DIALYZER TEMP / ISOLATE TEMP SENSOR #44

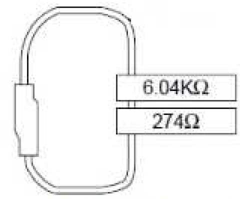
a) Figure right, from the distribution board, unplug the **11th** Connector cap from the left. This is Temperature Sensor NTC #44, "x44, NTC-POST"!

b) Screen 0's **Post Dialyzer Temp** MUST be LESS THAN 34.0° C at this time! If NOT, ENSURE Post Dialyzer Temperature Sensor #44 was unplugged!

c) Using a flashlight, check the vacant "x44" position. **If corrosion or damage is located this may be the problem!**


**Distribution Board**

d) Figure right, install the **6.04 KΩ** plug, from the **TWO-RESISTOR SET**, into the Post Dialyzer Temp Sensor's #44 distribution board position, "x44, NTC-POST".




**Two- Resistor Set**

e) Is screen 0's **Post Dialyzer Temp** between 35.5 and 38.5° C?

Yes Post Temp between 35.5 and 38.5! Proceed to **page 420**, procedure number CO- 10.0.26.

No Post Temp is NOT between 35.5 and 38.5! See parts a and b below:

a) ENSURE the **6.04 KΩ** plug from the **TWO-RESISTOR SET** is placed properly at position "x44, NTC-POST". If NOT, repeat (ABOVE) procedure number CO- 10.0.20 (page 418) AND / OR CONSIDER using the **6.04 KΩ** plug from another **TWO-RESISTOR SET**.

b) If SURE the plug is placed correctly see procedure number CO- 10.0.22 (page 418).

## CO- 10.0.22 POST DIALYZER TEMP IS NOT BETWEEN 35 AND 38°C

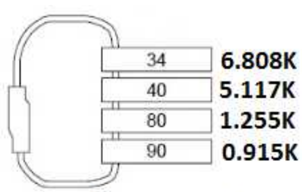
a) ENSURE connector labeled #7 (Pre Cond Cell #7) is in position "X7, COND".

b) Enter Service Mode → Calibrate Sensors → **Post Temp Sensor**. **NOTE!** This is a non-routine troubleshooting procedure! Follow the instructions carefully to avoid error!

c) Press 'Enter'. The screen says **"1. Connect a 6.808 K ohm resistor…"**.

d) Per the Figure right, place the **34° C** (6.808 KΩ) plug, from the **FOUR-RESISTOR SET** into distribution board position, "x44, NTC-POST".

e) Is the screen's [**Post-Temperature Reference]** more than 20?




**Four-Resistor Set**

Yes **[Post-Temperature Reference]** more than 20! Without pressing 'Confirm' yet, see procedure number CO- 10.0.24 (page 419).

No **[Post-Temperature Reference]** is less than 20! See parts a and b below:

a) ENSURE the **34° C** (6.808 KΩ) plug is placed properly at position "x44, NTC-POST". If NOT, repeat (ABOVE) procedure number CO- 10.0.22 (page 418) AND/ OR consider using the **34° C** plug from another **FOUR-RESISTOR SET!**

b) If SURE the plug is placed correctly proceed to **page 432**, procedure number CO- 11.0.00.

## CO- 10.0.24 POST TEMPERATURE REFERENCE MORE THAN 20

'Sharply' press 'Enter' ONCE. Does an "Error" banner appear?

Yes "Error" banner appears! **Read before performing!** Turn the machine off then CAREFULLY repeat (ABOVE) procedure number CO- 10.0.22 (page 418). CONSIDER using the **34° C** plug from another **FOUR-RESISTOR SET**. If the "Error" banner reoccurs see procedure number **CO- 11.0.00** (**page 432**).

No "Error banner does NOT appear. See parts a through e below:

a) The screen says **"2. Connect a 5.117 K ohm resistor…"**.

b) Place the 41° C (5.117 KΩ) plug, from the **FOUR-RESISTOR SET**, into distribution board position, "x44, NTC-POST".

c) The screen's [**Post-Temperature Reference]** box will be more than 150 if the 41° C plug is placed properly.

d) Press 'Enter'. The screen says "**3. Calibration saved"** and the screen's [**Post-Temperature]** data box should = 41° +/- 0.1 °C. Press 'Enter' again to save the calibration...

e) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

f) See procedure number CO- 10.0.26 (page 420).

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## CO- 10.0.26 TROUBLESHOOTING POST DIALYZER TEMP / POST ISOLATE NTC #44

a) Return NTC #44's connector to distribution board position "X44, NTC-POST".

b) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter'.

c) Allow the Home screen's [**Temperature]** display to stabilize between 35.5 and 38.5° C.

d) Call debug screen 0. Is **Post Dialyzer Temp** more than 33° C?

Yes Post Temp more than 33! See procedure number CO- 10.0.28 (page 420).

No Post Temp is less than 33! Post Dialyzer Temp Sensor NTC #44* may be bad. *To LOCATE NTC #44 refer to Figure 62 (page 416).

## CO- 10.0.28 TROUBLESHOOTING POST DIALYZER TEMP SENSOR / CALIBRATE TEMP

a) **Read parts b through f before performing!**

b) Perform the TEMPERATURE CONTROL calibration per the CALIBRATION PROCEDURES booklet.

c) After the calibration, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) From the Home screen, allow [**Temperatur**e] to stabilize between 35.5 and 38.5° C.

e) Open the shunt door and allow one (1) minute.

f) From debug screen 0, is **Post Dialyzer Temp** now within +/- 0.6° C of **Pre Dialyzer Temp**?

Yes Post Temp within 0.6 of pre Temp. Problem solved! The Post Dialyzer Temp Sensor NTC #44 was out of calibration.

No Post Temp is NOT within 0.6 of pre Temp. Post Dialyzer Temp Sensor NTC #44* may be bad. *To LOCATE NTC #44 refer to Figure 62 (page 416).

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## CO- 10.0.30 PROBLEM WITH POST DIALYZER COND

ENSURING the shunt door is open, is screen 0's **Post Dialyzer Cond** more than 10.000 mS?

Yes    Post Cond more than 10.000! See procedure number CO- 10.0.32 (page 421),

No    Post Cond less than 10.000! See procedure number CO- 10.0.34 (page 421),

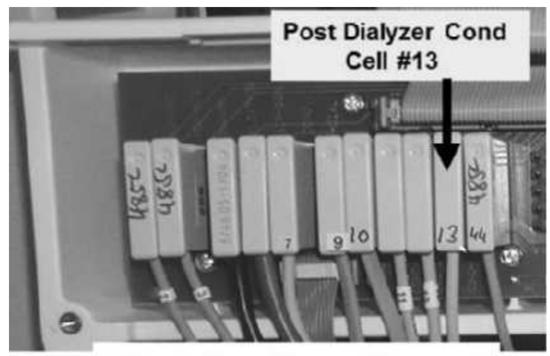
## CO- 10.0.32 POST DIALYZER COND MORE THAN 10.000

Is screen 0's **Post Dialyzer Cond** more than 20.000 mS?

Yes    Post Cond more than 20.000! See procedure number **CO- 10.0.34** (page 421).

No    Post Cond less than 20.000! Proceed to **page 384**, procedure number **CO- 6.2.0**.

## CO- 10.0.34 ISOLATE POST COND CIRCUIT




Distribution Board

a) Figure right, from the distribution board, unplug the **10th** connector cap from the LEFT. This is Post Dialyzer Cond Cell #13, "x13, COND-POS"!

b) Using a flashlight, check inside the "x13" position for **damage or corrosion.**

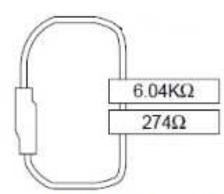
c) Call debug screen 5. Is **FPOS** more than 4000 (four thousand)?


Yes    **FPOS** more than 4000! Either Post Dialyzer Cond Cell #13 was not unplugged from position "x13" or there is a problem with its circuit. THREE (3) possible bad components': **1)** Sensor Board[1] OR; **2)** Sensor Board cable OR; **3)** distribution board.

[1] To prevent "Cond Offset Failure" place the machine into T and C mode. Refer to OPERATING MODES, (page 19).

No    **FPOS** less than 4000! See parts a AND b below:

a) Per the Figure right, place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into the Post Dialyzer Cond Cell's #13 vacant distribution board position, "x13, COND-POS".




Two- Resistor Set

b) Is **FPOS** between 13500 and 14500?

Yes    **FPOS** between 13500 and 14500! See procedure number CO- 10.0.36 (page 422).

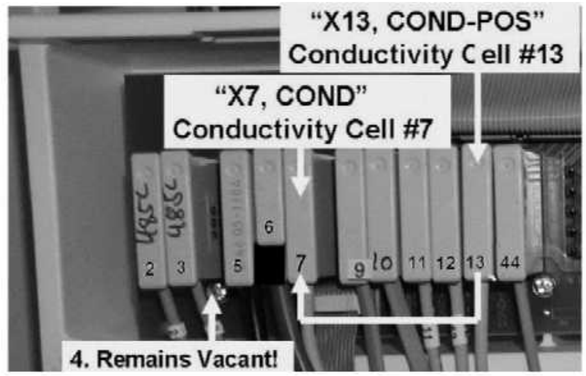
No    Either the **274 Ω** resistor plug was not placed properly or there is a problem with the Post Dialyzer Cond Circuit: THREE (3) possible bad components: **1)** Sensor Board[a] OR **2)** Sensor Board cable OR; **3)** Distribution board.

[a] To prevent "Cond Offset Failure" place the machine into T and C mode. Refer to OPERATING MODES (page 19).

## CO- 10.0.36 ISOLATE POST COND CELL #13


a) From debug screen 5, **FPRE** changes continuously. RECORD its approximate value for reference later!

b) Figure right, place Cond Cell's #13 connector into Conductivity Cell #7's distribution board position "X7, COND".




c) Is **FPRE** within +/- 200 of what was recorded in part a?

Yes **FPRE** within +/- 200 of what was recorded! See procedure number CO- 10.0.38 (page 422).

No **FPRE** IS NOT within +/- 200 of what was recorded. Either Cond Cell #13 is not in distribution board position "X7, COND" OR it is bad. To LOCATE Cond Cell #13 refer to Figure 62 (page 416).

## CO- 10.0.38 VERIFY SENSOR BOARD

a) Return Cond Cell #13 to distribution board position "x13, COND-POS".

b) Return Cond Cell #7 to distribution board position "x7, COND".

c) Was a COND CELLS calibration performed in THIS troubleshooting session (Yes or No)?

Yes Cond Cells calibration was already performed! **Read before performing!** Swap in a known good Sensor Board then see (ABOVE) procedure number CO- 6.2.0 (**page 384**). If you return here swap in a known good Functional Board and calibrate Cond Cells.

No Cond Cells calibration was not performed! See (ABOVE) procedure number CO- 6.2.0 (**page 384**).

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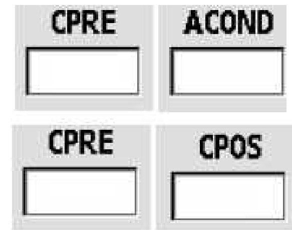
## CO- 10.0.40 VERIFY SENSOR VERSUS ACTUATOR

Call debug screen 5. TWO (2) checks! Proceed according to the Yes – No choice at check #2.




**Check #1** **CPRE (middle column) versus ACOND (upper left):** They change continually but MUST REMAIN within +/- 500 of each other?

**Check #2** **CPRE versus CPOS (middle column):** Change continually but MUST REMAIN within +/- 500 of each other?

**Yes (to both):** CLOSE THE SHUNT DOOR then see procedure number CO- 10.0.41 (page 424).

**No (to either OR both):** **Read before performing!** Proceed to **page 384**, procedure number CO- 6.2.0 to calibrate COND CELLS. If (and ONLY if) you return here see procedure number CO- 10.0.41 (page 424).

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## CO- 10.0.41 PREPARE TO ANALYZE PRE AND POST CONDUCTIVITY STABILITY

a) Install a 'dummy chamber' in the Level Detector module and RESET ALL alarms!

b) Watch the screen for thirty (30) seconds. If a "Filling Program" banner EVER occurs, allow thirty (30) seconds before continuing!

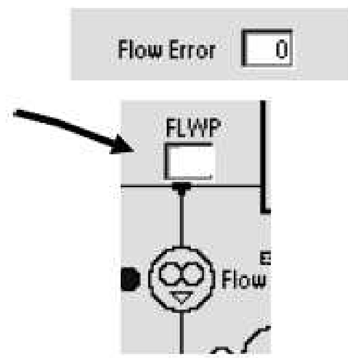
**NOTE!** Multiple "Filling Programs" occurrences indicate a hydraulic air leak that **MUST** be located and repaired or else OLC tests cancel.

c) If screen says "Standby For Test" OR the screen says "Test:…" allow the tests to finish THEN allow three (3) minutes BEFORE continuing to procedure number CO- 10.0.42 (page 424).

## CO- 10.0.42 ISOLATE FLOW PUMP DIGITAL CONTROL (FLWP)

a) Call debug screen 1. Press the keyboard's "1" keypad for five (5) seconds.

b) Allow forty-five (45) seconds BEFORE continuing to part c.

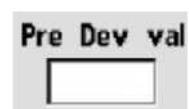



c) Call debug screen 0. Without resetting alarms, ENSURING **Flow Error** REMAINS = 0 ALSO watch **FLWP** for two (2) minutes. TWO (2) possible scenarios:

**1) IF (and ONLY if) FLWP continually changes more than +/- 2 (two):** Proceed to **page 52**, procedure number **F- 3.8.0**.

**2) IF FLWP does NOT change more than +/- 2 (two):** Reset ALL alarms THEN see procedure number CO- 10.0.43 (page 424).

## CO- 10.0.43 PRE CONDUCTIVITY STABILITY




a) Call debug screen 5. **Pre Dev val** (right column) is the conductivity difference between now and one (1) minute ago from Conductivity Cell #7. If no alarms it changes continually!

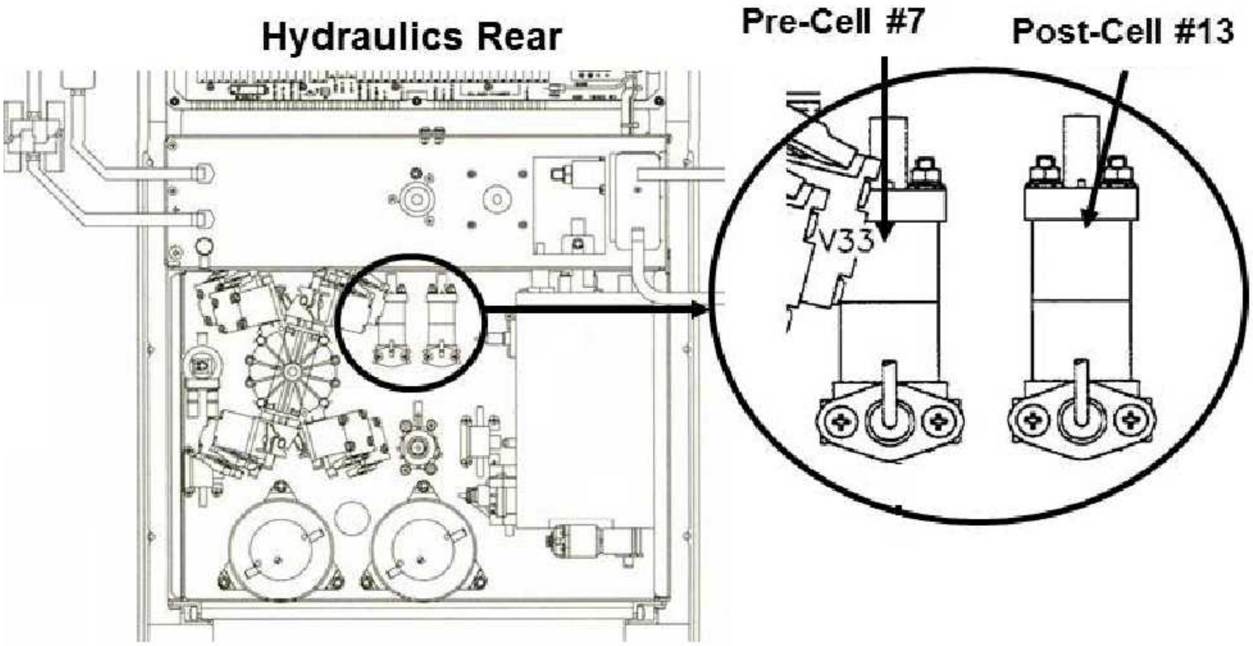
b) After no more than two (2) minutes, if not already, **Pre Dev val** should fall to less than 135. TWO (2) possible scenarios:

**1) IF (and ONLY if) Pre Dev val is OR falls to less than 135:** See procedure number CO- 10.0.44 (page 425).

**2) IF Pre Dev val NEVER falls below 135:** Pre Cond is unstable! ENSURING no alarms occurred see parts a AND b below:

a) Per the Figure next page, using a flashlight and WITHOUT LOOKING AWAY, for one (1) minute, if air bubbles are flowing through **Pre Dialyzer Cond Cell #7's** tubing locate and repair the air leak!

b) If (and ONLY if) absolutely sure of no air, proceed to **page 429**, procedure number CO- 10.0.60.




**CO- 10.0.44 PRE DEV VALUE LESS THAN 135 / CONDUCTIVITY STABILITY**


a) **Post Dev val** (right column) is the conductivity difference between now and one (1) minute ago from Post-Conductivity Cell #13. If no alarms it changes continually!

b) After no more than three (3) minutes, if not already, **Post Dev val** should fall to less than 70. TWO (2) possible scenarios:

1) **IF Post Dev val is <u>OR</u> falls to less than 70:** See procedure number CO- 10.0.46 (page 426).

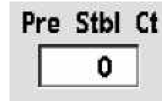
2) **IF Post Dev val <u>NEVER</u> falls below 70:** Post Cond is unstable! ENSURING no alarms occurred see parts a and b below:

   a) Per the Figure above, using a flashlight and WITHOUT LOOKING AWAY, for one minute, if air bubbles are flowing through the <u>Post Dialyzer Cond Cell #13's</u> locate and repair the air leak!

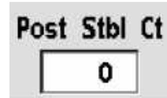
   b) If (and ONLY if) absolutely sure of no air proceed to **page 429**, procedure number **CO- 10.0.60**.

## CO- 10.0.46 BOTH PRE AND POST COND ARE STABLE

a) **Pre Stbl Ct** (pre-conductivity stability counter) starts at 90 and decreases one unit per second if **Pre Dev val** remains less than 135. If not already, after no more than two (2) minutes it should fall to 0!




b) **Post Stbl Ct** (post-conductivity stability counter) starts at 70 and decreases one unit per second if **Post Dev val** remains less than 70. If not already, after no more than two (2) minutes it should fall to 0.




c) Call the Home screen and press the **[Kt/V AF]** button at the bottom of the screen.

d) Press the **[OLC Self-Test]** button then 'Enter'. Does the "**Online Clearance Self-Test"** banner appear?



Yes The "**Online Clearance Self-Test"** banner appeared! IMMEDIATELY proceed to **page 428**, procedure number CO- 10.0.50.

No The OLC Test did NOT start! ENSURING no alarms AND the shunt door is CLOSED, TWO (2) possible scenarios:

**1)** **IF "Can't Run OLC Test" banner appeared:** See procedure number CO- 10.0.48 (page 426).

**2)** **IF "OLC steps not calculated" appeared:** Allow two (2) minutes then attempt to start the OLC Test again. TWO (2) possible scenarios i) or ii) below:

**i)** **IF "Online Clearance Self-Test" banner appears:** IMMEDIATELY proceed to **page 428**, procedure number CO- 10.0.50.

**ii)** **IF "OLC steps not calculated" banner reoccurs:** Read before performing! Proceed to **page 384**, procedure number CO- 6.2.0 to calibrate COND CELLS. If (and ONLY if) you return here (**"OLC steps not calculated")**, TWO (2) possible bad components: **1)** Actuator-Test Board OR; **2)** Functional Board.

## CO- 10.0.48 "CAN'T RUN OLC TEST" APPEARED

a) **Reset all alarms!**

b) Call debug screen 5.

c) If **Pre Stbl Ct** AND **Post Stbl Ct** are BOTH = 0 OR goes to 0 within two (2) minutes proceed through the following three (3) steps until if the OLC Test starts. If (and ONLY if) one or the other DOES NOT go to 0 within two (2) minutes proceed to **page 429**, procedure number **CO- 10.0.60**.

**Step #1:** Allow two (2) minutes then attempt to start the OLC Self-Test again. If **"Online Clearance Self-Test"** banner appears proceed to **page 428**, procedure number CO- 10.0.50. If **"Can't Run OLC Test"** reoccurs continue to step #2 next page.

**Step # 2: Read before parts a THROUGH e BEFORE performing them:**

a) Turn the machine OFF then back on.

b) Return to Dialysis Program with [Dialysate Flow] set to 500 ml/min.

c) Allow six (6) minutes ENSURING the Home screen's [Conductivity] stabilizes between 13.0 and 14.3 mS.

d) **Reset all alarms!**

e) Read before performing! Return to **page 423**, procedure number CO- 10.0.40. If (and ONLY if) you return here continue to step #3.

**Step #3**: **Read parts a THROUGH e below BEFORE performing them!**

a) Perform an Acid Clean per procedure.

b) Return to Dialysis Program with [Dialysate Flow] set to 500 ml/min.

c) Allow six (6) minutes, ENSURING the Home screen's [Conductivity] stabilizes between 13.0 and 14.3 mS.

d) **Reset all alarms!**

e) **Read before performing**! Return to **page 423**, procedure number CO- 10.0.40. If (and ONLY if) you return here proceed to **page 384**, procedure number CO- 6.2.0 to calibrate COND CELLS. After the calibration if (and ONLY if) you return here, THREE (3) possible bad components listed below:

**Component List: 1)** Power Logic Board; 2) Actuator-Test Board; **3)** Functional Board.

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## CO- 10.0.50 OLC TEST STARTED / OLC SELF TEST DESCRIPTION / TROUBLESHOOTING

a) Call debug screen 5. When **OLC Status** = 1, Conductivity Pre-Dialyzer (**CPRE**) followed a minute or so later by Conductivity Post-Dialyzer (**CPOS**) SHOULD gradually increase to more than 15000 (15.000 mS)! The initial instability causes **Pre Stbl Ct** AND **Post Stbl Ct** to increase to respectively 90 and 70.


b) After no more than four (4) minutes, if **CPRE** stabilizes at more than 15.0 mS, **Pre Dev val** falls. If it falls to and remains less than 135* then **Pre Stbl Ct** counts down.

c) After no more than (5) five minutes, if **CPOS** stabilizes at more than 15.0 mS, **Post Dev val** falls. If it falls to and remains less than 70* then **Post Stbl Ct** counts down.

***** If a BLOOD ALARM OR a red banner Conductivity alarm occurs the counters stop! In this event, see NOTES 1 and 2 below!

**NOTE 1:** Resetting Blood Alarms is okay but multiple resets may cause OLC to cancel. Having to perform multiple Blood alarm RESETS indicates a problem unrelated to Conductivity!

**NOTE 2: IF a red banner Conductivity alarm occurs: A)** Turn the machine OFF; **B)** ENSURE the acid and bicarb is GOOD; **C)** Return to Dialysis Program with [Dialysate Flow] set to 500 ml/min; **D)** Allow six (6) minutes; **E)** Return to (ABOVE) procedure number CO- 10.0.41 (page 424). If (and ONLY if) you return to here, because a Conductivity alarm reoccurs, see (ABOVE) procedure number CO- 6.2.0 (page 384).

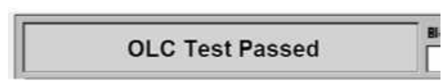
d) When (and if) BOTH **Pre Stbl Ct** AND **Post Stbl Ct** = 0 then **OLC Status** = 2.

e) **CPRE** followed a minute or so later **CPOS** SHOULD gradually fall until less than 14.0 mS. The initial instability causes **Pre Stbl Ct** **AND** **Post Stbl Ct** to increase. After a few minutes, if **CPRE** stabilizes **Pre Stbl Ct** counts down. A couple of minutes later, if **CPOS** stabilizes, **Post Stbl Ct** counts down.

f) When **Pre Stbl Ct** AND **Post Stbl = 0** then **OLC Status** = 0 indicating the OLC test is complete!

g) THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) "OLC Test Passed":** See procedure number CO- 12.0.00 (**page 433**).

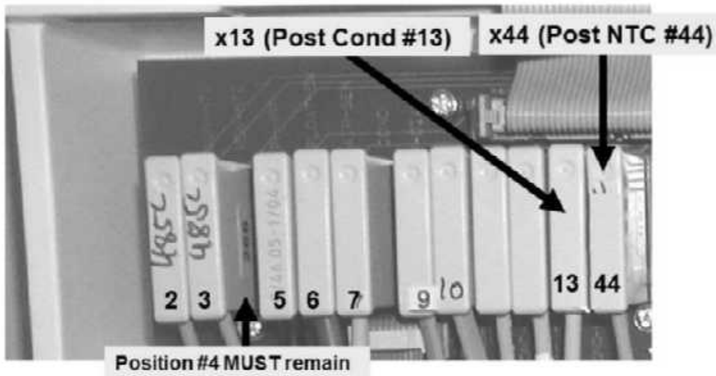



**2)** **IF (and ONLY if) "OLC Test Failed" AND a Conductivity alarm DID NOT occur during the test:** See procedure number CO- 10.0.60 (page 429).

**3)** **IF "OLC Test Cancelled":** Call debug screen 6 to see the **OLC Cancels 1 – 6** data boxes. If code "1" and / or "2" appear in any of the boxes see procedure number CO- 10.0.60 (page 429). Codes "3" through "7" refer to Table A (page 433) for their meaning.

## CO- 10.0.60 ISOLATE POST SENSORS STABILITY

a) Per the Figure below, remove Post Dialyzer Temp Sensor NTC #44's connector from distribution board position "x44, NTC-POST".




b) Using a flashlight, check the "x44" position for 'white' corrosion and / or damaged **male** pins. **If damage is located this may be the problem!**

c) Per the Figure right, place the **6.04 KΩ** plug, from the **TWO-RESISTOR SET** into the Post Dialyzer Temp Sensor's distribution board position "x44, NTC-POST".

Two- Resistor Set

d) Per the Figure above, remove Post Dialyzer Cond Cell #13's connector from distribution board position "x13, COND-POS".

e) Check the "x13" position for 'white' corrosion and / or damaged **male** pins.

f) Leaving the 6.04 KΩ plug installed, place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into Post Dialyzer Cond Cell's #13's distribution board position "x13, COND-POS".

g) Call debug screen 5. TWO (2) checks then proceed according to the TWO (2) scenarios after check #2:

**CHECK #1 (TPOS):** WITHOUT LOOKING AWAY, watch **TPOS** for one (1) minute noting its highest and lowest values. Subtract the lowest value seen from the highest. Two (2) or less = GOOD! More than two (2) = BAD!


**CHECK #2 (CPOS):** Now watch **CPOS** for one (1) minute noting its highest and lowest values. Subtract the lowest value seen from the highest. Eight (8) or less = GOOD! More than eight (8) = BAD!


**1) IF (and ONLY if) TPOS AND / OR CPOS ARE 'BAD':** Proceed to **page 432**, procedure number CO- 11.0.00.

**2) IF TPOS AND CPOS are 'GOOD':** See parts a through d below:

a) Return Post Dialyzer Temp Sensor NTC #44's connector to position "x44, NTC-POST".

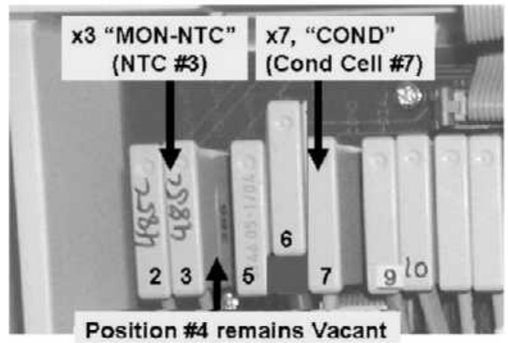
**Parts b through d next page**

b) Return Post Dialyzer Cond Cell #13 connector to position “x13, COND-POS”.

c) From debug screen 0, ENSURE Post Dialyzer Temp reads more than 35° C AND Post Dialyzer Cond MUST more than 10.000.

d) See procedure number CO- 10.0.66 (page 430).

## CO- 10.0.66 ISOLATE PRE SENSORS STABILITY




a) Figure right, remove Pre Dialyzer Temp Sensor (NTC #3’s) connector from the **2nd** distribution board position from the left, “MON-NTC”.

b) Using a flashlight, check the “x3” position for corrosion and / or damaged pins. **If damage is located this may be the problem!**

c) Avoiding vacant position #4, place the **6.04 KΩ** plug, from the **TWO-RESISTOR SET**, into the Pre Dialyzer Temp Sensor’s NTC #3 distribution board position “x3, MON-NTC”.

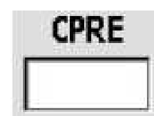
d) Remove Pre Dialyzer Cond Cell #7’s connector from distribution board position “x7, COND”.

e) Check the “x7” position for corrosion and / or damaged pins.

f) Leaving the 6.04 KΩ plug installed, place the **274 Ω** plug, from the **TWO-RESISTOR SET**, into Pre Dialyzer Cond Cell #7’s distribution board position, “x7, COND”.

g) From debug screen 5, TWO (2) checks then proceed according to the TWO (2) possible scenarios after check #2.


**CHECK #1 (TPRE):** WITHOUT LOOKING AWAY, watch **TPRE** for one minute noting its highest and lowest values. Subtract the lowest value seen from the highest. Two (2) or less = GOOD! More than two (2) = BAD.




**CHECK #2 (CPRE):** Watch **CPRE** (4th column from right, second box down) for exactly one minute noting its highest and lowest values Subtract the lowest value seen from the highest. Eight (8) or less = GOOD! More than eight (8) = BAD.

**1) IF (AND ONLY IF) TPRE AND / OR CPRE are ‘BAD’:** Proceed to **page 432**, procedure number CO- 11.0.00.

**2) IF TPRE AND CPRE are ‘GOOD’:** See parts a through c below.

a) Return Pre Dialyzer Temp Sensor NTC #3s connector to position “x3, MON-NTC”. From debug screen 0, ENSURE Pre Dialyzer Temp reads more than 35° C.

b) Return Pre Dialyzer Cond Cell #7 connector to position “x7, COND”. From debug screen 0, ENSURE Pre Dialyzer Cond reads more than 10.0.

c) See procedure number CO- 10.0.705 (page 431).

## CO- 10.0.705 ISOLATE OLC PROBLEM

a) **IMPORTANT!** TURN the machine OFF!

b) Place the concentrate connectors into their rinse ports

c) Turn the machine on and place it into Acid Clean.

d) After rinse is complete, connect to known good concentrate and return to Dialysis Program.

e) Allow six (6) minutes for Temperature and Conductivity to stabilize.

f) **Read before performing!** Return to (ABOVE) procedure number CO- 10.0.40 (page 423). If (and ONLY if) you return to procedure number CO- 10.0.705 see procedure number CO- 10.0.706 (page 431).

## CO- 10.0.706 ISOLATE OLC PROBLEM

a) **Read before performing!** Proceed to (ABOVE) procedure number CO- 6.2.0 (**page 384**) to calibrate COND CELLS. If (and ONLY if) you return here see part b.

b) **Read before performing!** Swap the following components in (see COMPONENT LIST below) one at a time, with known good then return to (ABOVE) procedure number **CO- 10.0.40** (page 423) to test the new component. If (and ONLY if) you return here continue through the list until the OLC problem is solved.

**COMPONENT LIST: 1)** Power Logic Board OR; 2) Actuator-Test Board OR; 3) Functional Board[1]

[1] Cond Cells MUST be calibrated after the Functional board is swapped in before its OLC functions can be tested!

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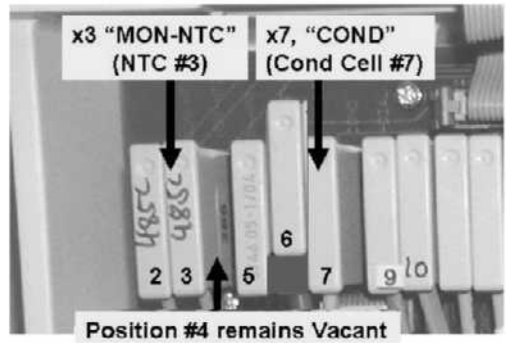
## CO- 11.0.00 RETURN SYSTEMS




a) Return Pre Dialyzer Temp Sensor NTC #3s connector to **2nd** distribution board position from the LEFT, "MON-NTC".

b) From debug screen 0, ENSURE Pre Dialyzer Temp reads more than 35.0° C.

c) If removed from a previous procedure, return Pre Dialyzer Cond Cell #7 connector to distribution board position "x7, COND".

d) From debug screen 0, ENSURE Pre Dialyzer Cond reads more than 10.0 mS.

e) The following components (see **COMPONENT LIST** below) are to be swapped in, with known good, one at a time then, in between, continue to parts f through i to see if the new component fixes the problem.

**COMPONENT LIST: 1)** Power Logic Board; **2)** Sensor Board[1]; **3)** Sensor Board cable; **4)** Functional Board[2]; **5)** Distribution board.

[1] To prevent "Cond Offset Failure" place the machine into T and C mode. Refer to OPERATING MODES, (page 19).

[2] To prevent "Cond Offset Failure" the machine MUST AGAIN be placed into T and C mode!

f) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

g) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter'!

h) Allow six (6) FULL minutes, for Temperature and Conductivity to stabilize BEFORE continuing to part i!

i) **Read before performing!** Return to (ABOVE) procedure number CO- 10.0.10 (page 417) to see if the new component fixed the problem. If (and ONLY if) you return to procedure number CO- 11.0.00 swap in the next component and return to procedure number CO- 10.0.10 (page 417) until the OLC problem is fixed.

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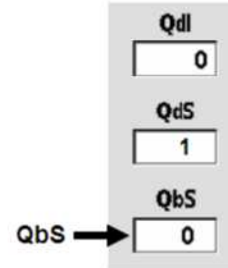
## CO- 12.0.00 OLC SELF TEST PASSED / CHECK BLOOD PUMP / ADDITIONAL TROUBLESHOOTING

A conductivity-related problem is not indicated HOWEVER, unstable Blood Pump rate may also cause OLC Tests to cancel.




a) **IMPORTANT!** Reset ALL alarms. The machine MUST remain alarm free!

b) Turn the Blood Pump on to 400 ml/min and allow **two (2) FULL** minutes without changing its rate again!

c) From debug screen 5, if (and ONLY if) the Pump is stable[1], **QbS** (BOTTOM window, Figure right) will settle to and remain between 0 and 3.

[1] Resetting multiple blood alarms cause Blood Pump instability **(OLC cancel code** = “3”). In this event the problem may be related to the patient’s access.

d) ENSURE ALL treatment parameters (below) were entered prior to treatment initiation. Changes made just prior to OR while an OLC Test is running cause instability AND OLC Test cancelations.

- Remaining Time of Dialysis (RTD)
- UF Goal UF Time
- Fluid Removed (UF Removed)
- Sodium Variation (SVS) should be activated just after UF is turned on
- Dialysate Flow Rate
- Blood Flow Rate
- Temperature
- Concentrate (bath)
- Na+ and Bicarbonate settings

e) For additional OLC diagnostics call debug screen 6 and refer to Table A (below)

f) For even more OLC diagnostics call debug screen 5 and refer to Table B (page 434).

**Table A - Debug Screen 6 OLC Values**

| Parameter | Description | Value |
|---|---|---|
| Max QBS | Maximum **QbS** (screen 5) during the OLC test | Less than 20 indicates stable Blood Pump rate. If more than 20 the OLC test cancels. See also **QB Cancel** and **OLC Cancels 1 - 6**. |
| QD Begin | Dialysate Flow Rate at beginning of OLC Test | Valid ONLY if patient is on machine<br>8 = 800 ml/min; 5 = 500 ml/min, etc |
| QD Cancel | Dialysate Flow if OLC test canceled | Valid ONLY if patient is on machine<br>5 = 500 ml/min, 3 = 300 ml/min, etc |
| **OLC Cancels 1- 6**[a]<br><br><br>[a] **NOTE:** If the machine is turned off the **OLC Cancels 1 – 6** codes default to 0! | | **0** = No OLC cancellation<br>**1** = Unable to reach or stabilize @15.5 mS<br>**2** = Unable to reach or stabilize @13.5 mS<br>**3** = Blood pump rate changed or was turned off or multiple blood alarms occurred<br>**4** = Dialysate Flow was unstable or turned off or multiple TMP alarm resets or Filling Programs or Conductivity or Temperature alarms occurred (i.e. bypass)<br>**5** = OLC was turned OFF<br>**6** = Dialysate Flow was turned off<br>**7** = OLC test started |

**NOTE: Table B readings are affected by changing the [Dialysate Flow] rate, or turning it off, Filling Programs, Pressure Tests and Temperature or Conductivity alarms (i.e. bypass). ENSURE the machine is stable before responding to variations!**

**Table B – Debug Screen 5 OLC Values**

| Parameter | Description | Value |
|---|---|---|
| Qd | Dialysate Flow Rate | Should be within +/- 10 ml/min of the selected Dialysate Flow rate |
| QdS | Dialysate Flow Stability | **0 =** Dialysate Flow is unstable<br>**1** = Dialysate Flow is stable.<br>**NOTE:** QdS may = 0 if a Temp or Cond alarm occurs OR if Dialysate Flow rate was changed OR if a Filling Program occurs OR if a TMP alarm is reset |
| Current TI | Pre Dialyzer Temp sensor NTC #3 stability | Ranges from 0 (unstable) to 100 (very stable) |
| QbS | Blood Pump Stability Counter | Normally 0 or 1. If QbS reaches 20, the OLC test will not start OR will cancel |
| Avg TI | Pre Dialyzer Temp stability over the last 12 minutes | When Dialysate Flow = 500 ml/min, should be more than 70%. May be lower at other flow rates. |
| Pre Stbl Ct | Pre Dialyzer counter | Defaults to 90. Decreases to 0 if Pre Dialyzer Cond is stable |
| Pre % Stbl | Percentage of time Pre Dialyzer Cond was stable over the last 12 minutes | If OLC test is NOT running should be more than 90%. Instability (i.e. less than 90%) is NORMAL within 12 minutes of an OLC test. |
| Post Stbl Ct | Post Dialyzer Cond counter | Defaults to 70. Decreases to 0 if Post Dialyzer Cond is stable. |
| Post % Stbl | Percentage of time Post Dialyzer Cond was stable over the last 12 minutes | If OLC test is NOT running should be more than 90%. Instability (less than 90%) is NORMAL within 12 minutes of an OLC test. |
| OLC status | Current stage of OLC test | **0** = An OLC test is NOT running<br>**1** = At or going to approx.15.5 mS<br>**2** = At or going to the approx. 13.5 mS |
| OLC Enable | OLC Enabled | **0** = OLC is turned off (OLC will NOT run).<br>**1** = If OLC is turned on. |
| CPRE Stable | Pre Dialyzer Conductivity when stable during OLC test<br>**Example:** 15318 = 15.318 mS | Not valid UNLESS an OLC test was performed. |
| CPOS Stble | Post Dialyzer Conductivity when stable during OLC test<br>**Example:** 15318 = 15.318 mS | Not valid UNLESS an OLC was performed. |

**CO- 13.0.00 V105 Er C = 1**


**NOTE!** These procedures assume the filter, inside the red (acid) connector, has been checked and is clean!

a) Turn the machine OFF!

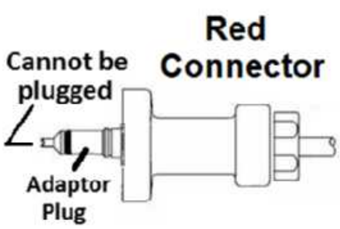
b) **Per the Figures below**, THREE (3) checks for a tubing kink and / or a restriction between:

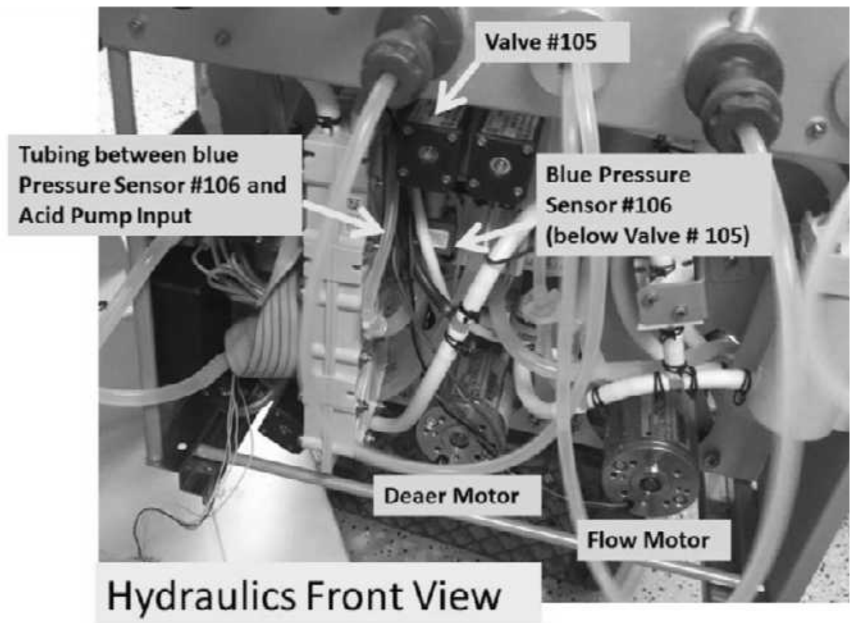
**Check #1:** The red (acid) concentrate connector and Valve #105.

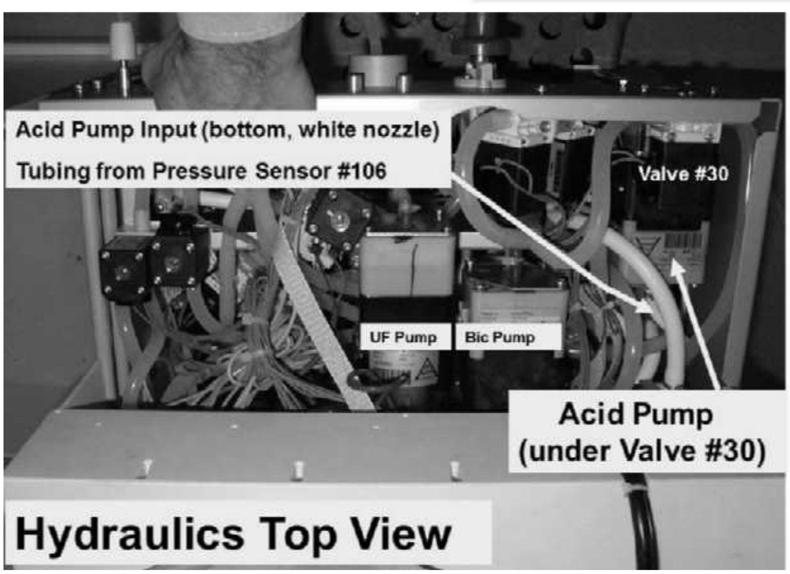
**Check #2:** Valve #105 and Pressure Sensor #106.

**Check #3:** Pressure Sensor #106 and Acid Pump's input (bottom, WHITE) nozzle**.**

c) If no restrictions are located, see procedure number CO- 13.0.01 (page 436).



**CO- 13.0.01 NO RESTRICTIONS LOCATED**

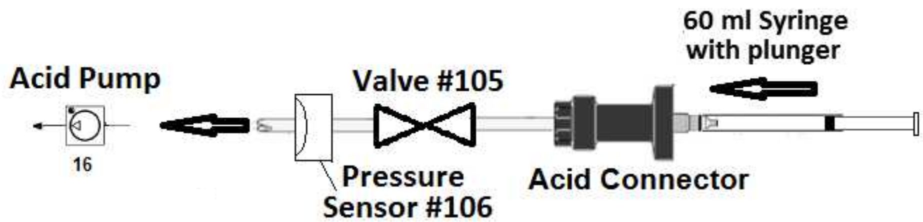
a) Turn the machine on. When “Press CONFIRM For Service Mode” appears press ‘Enter’. The screen MUST say “Machine In Service Mode”.

b) Press the ‘Screen’s Options key.

c) Call debug screen 0 and ensure Valve 105’s ‘dot’ is blue.

d) Per the Figure previous page, REMOVE the clear tubing from the **Acid Pump’s** INPUT (white) nozzle and direct it into a cup.

e) Figure below, attach a water filled 60 ml syringe, WITH THE PLUNGER installed, to the acid (red) connector.




f) GENTLY push on the plunger. Can you EASILY push water through Valve #105 into the cup?

Yes Can push water into cup! Valve #105 is at least partially open! See procedure number CO- 13.0.02 (page 437).

No Significant resistance encountered! Perform parts a and b below:

a) ENSURE the **Acid Pump’s** input tubing was removed previously!

b) FOUR (4) possible problems (see PROBLEM LIST below). Check each and / or swap in each component, one at a time and in between repeat procedure number CO- 13.0.01 (page 436) until you are able to push water through Valve #105.

**PROBLEM LIST: 1)** Loose bi*b*ag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Valve #105 OR; **3)** Bad bi*b*ag Interface Board OR; **4)** Bad electrical connection, from Valve #105, inside Distribution Box 2 (refer to Figure 4D (page 13)).

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**<u>CO- 13.0.02 VALVE #105 OKAY</u>**

a) Press the keyboard's 'Esc' key.

b) From Service Mode → Calibrate Sensors → Pressure Transducers → **Regulator Pressure**.

c) Just enough to hold them there, place the acid and bicarbonate connectors ¼ way into their rinse ports.

d) Press 'Enter' and allow the calibration to complete. If successful the "Calibrate Regulator Pressure" banner appears (Figure below), and the screen will say "Calibration Complete, press CONFIRM to save".


e) Was the calibration successful?

Yes An Error banner DID NOT occur! Press 'Enter' Reconnect all tubing and test the machine for "V105 Stuck Closed". **If it reoccurs there is a restriction between the red connector and the Acid Pump that was not located OR Valve #105 may be partially restricted!**

No An Error banner occurred! Repeat the calibration but if the Error banner reoccurs, FOUR (4) possible problems (see <u>PROBLEM LIST</u> below). Check and / or swap in each component one at a time until the Regulator Pressure calibration is successful.

**<u>PROBLEM LIST</u>**: **1)** Loose bi*b*ag Interface ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #106 OR; **3)** Bad bi*b*ag Interface board OR; **4)** Bad connection, from Pressure Sensor #106, inside Distribution Box 2 (refer to Figure 4D (page 13)).

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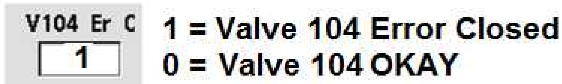
**CO- 14.0.00 V104 Er C = 1**




**NOTE!** These procedures assume the filter, inside the Bicarb connector, is clean!

a) Turn the machine OFF!

b) **Per the Figures below**, FOUR (4) checks for tubing kinks and / or restrictions between:

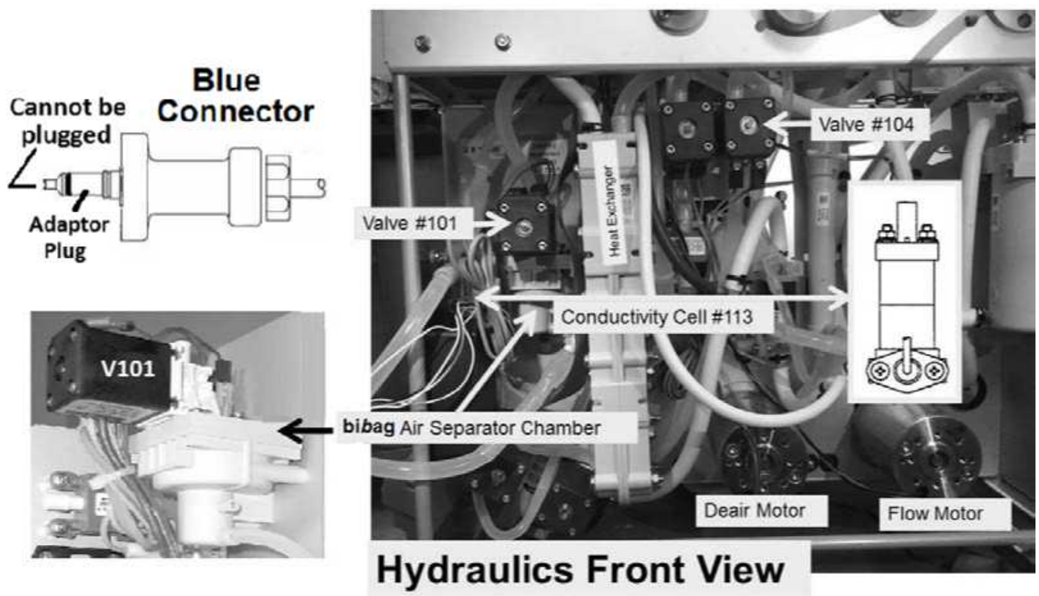
**Check #1** The Bicarb (blue) concentrate connector and the TOP, INPUT side of Valve #104.

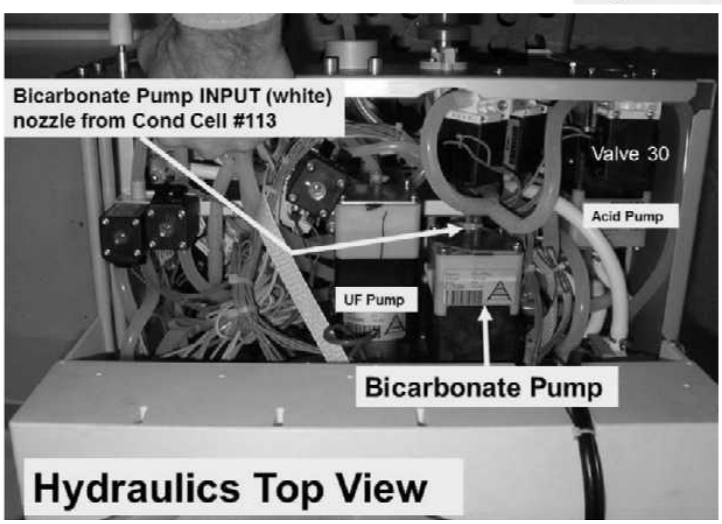
**Check #2** Valve #104's BOTTOM, OUTPUT side and the second from the bottom port of the bi*b*ag Air Separator Chamber

**Check #3** The very bottom port of bi*b*ag Air Separator Chamber and Conductivity Cell #113.

**Check #4** Conductivity Cell #113 and the Bicarb Pump's input BOTTOM, WHITE nozzle**.**

c) If no restrictions were located, see procedure number CO- 14.0.01 (page 440).



## CO- 14.0.01 NO RESTRICTIONS LOCATED

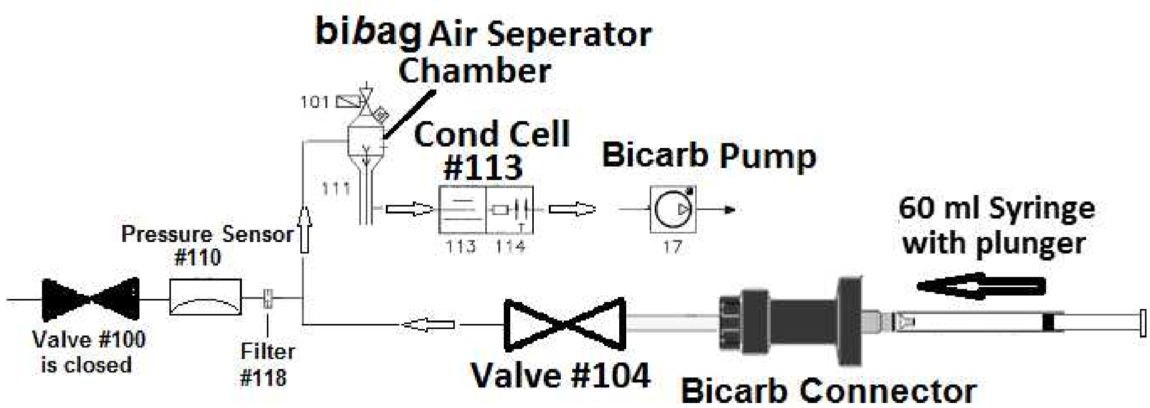
a) **Per the Figure previous page**, REMOVE the clear tubing from the **Bicarb Pump's** INPUT (white) nozzle and direct it into a cup.

b) Turn the machine on. When the screen says "Press CONFIRM For Service Mode" press 'Enter'. The screen MUST say "Machine In Service Mode".

c) Press the Service Menu screen's lower left 'Options' key

d) Call debug screen 0 and ensure Valve 104's 'dot' is BLUE

e) Figure below, attach a water filled 60 ml syringe, WITH THE PLUNGER installed, to the blue (Bicarb) connector.




f) GENTLY push on the plunger. Can you EASILY push water through Valve #104 into the cup?

Yes Can easily push water through Valve #104 is at least partially open! See procedure number CO- 14.0.02 (page 440).

No Significant resistance encountered! Perform parts a and b below:

a) ENSURE the **Bicarb Pump's** input tubing was removed previously!

b) FOUR (4) possible problems (see PROBLEM LIST below). Check each and / or swap in each component, one at a time and in between repeat procedure number CO- 14.0.01 (page 439) until you are able to push water through Valve #104.

**PROBLEM LIST: 1)** Loose bi*b*ag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Valve #104 OR; **3)** Bad bi*b*ag Interface Board OR; **4)** Bad connection, from Valve #104, inside Distribution Box 2 (see Figure 4D (page 13)).

## CO- 14.0.02 VALVE #104 OKAY / ISOLATE TRANSDUCER #106

a) Press the keyboard's 'Esc' key

b) Just enough to hold them there, place the acid and bicarbonate connectors ¼ way into their rinse ports.

c) Press 'Enter' and allow the calibration to complete. If successful the "Calibrate Regulator Pressure" banner appears (Figure below), and the screen will say "Calibration Complete, press CONFIRM to save".

d) Was the calibration successful?

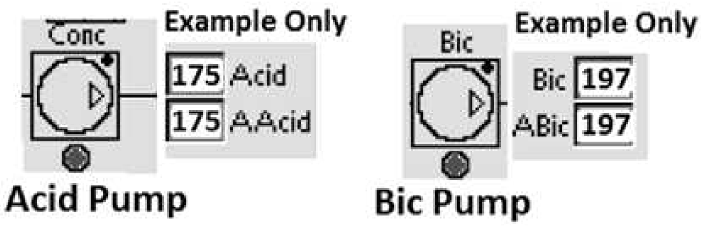

Yes An Error banner DID NOT occur! Press 'Enter'. Reconnect all tubing and test the machine for "V104/V108 Stuck Closed". **If it reoccurs there is a restriction between the blue connector and the Bicarb Pump that was not located OR Valve #104 may be partially restricted!**

No An Error banner occurred! Repeat the calibration but if the Error banner reoccurs, FOUR (4) possible problems (see PROBLEM LIST below). Check and / or swap in each component one at a time until the Regulator Pressure calibration is successful.

**PROBLEM LIST**: **1)** Loose bi*b*ag Interface ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #110 OR; **3)** Bad bi*b*ag Interface board OR; **4)** Bad connection, from Pressure Sensor #110, inside the bibag Distribution Board (refer to Figure 4D (page 13)).

# SECTION 6 – CONCENTRATE PUMP ERRORS

The CONC (Acid) and Bic (Bicarbonate) pumps each have optical End Of Stroke (EOS) sensors that monitors the pump pistons when transported back and forth by their stepper motors. From debug screen 0, per the Figure below, if all systems are okay, the **'Actual'** number of steps (**AAcid**, **ABic**) REMAIN within three (3) of the **'Required'** number of steps (**Acid**, **Bic**). If not the pump symbol may turn pink.




**EOS- 1.0.0 DETERMINE THE EOS ERROR**

A) Per Figure 63 (page 442), ENSURE the pumps are installed with their output (red or blue) nozzles towards the top and the cables extend from the side. **If not, this may be the problem!**

B) BEFORE continuing to part C, NOTE this page number then perform INITIAL CHECKS (page 77).

C) If the problem was occurring in a Cleaning Program (Heat Disinfect, Rinse, etc.) return to it. If the problem was occurring in Dialysis Program: **1)** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **2)** From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'!

D) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

E) Allow thirty (30) seconds THEN, WITHOUT LOOKING AWAY, watch the pump symbols for up to two (2) minutes OR until if one turns pink! FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

**1) IF the CONC (acid)** Conc **symbol is EVER pink (solid or blinking) AND the BIC** Bic **symbol is ALWAYS white:** ACID pump system problem! See procedure number EOS- 2.0.0 (page 442).

**2) IF the CONC (acid)** Conc **symbol is ALWAYS white AND the BIC symbol** Bic **is EVER pink (solid or blinking):** BIC pump system problem!. Proceed to **page 443**, procedure number EOS- 3.0.0.

**3) IF BOTH the CONC (acid)** Conc **AND the BIC** Bic **symbols are EVER pink (solid or blinking):** Proceed to **page 446**, procedure number EOS- 5.0.0.

**4) IF BOTH pump symbols are ALWAYS white (i.e. NEVER pink):** See parts a AND b below:

a) WITHOUT LOOKING AWAY, watch **AAcid** versus **Acid** for up to five (5) minutes. If **AAcid** REMAINS within three (3) of **Acid** the Acid Pump System is okay. In this event continue to part b. If **AAcid** does NOT remain within three (3) of **Acid** then TWO (2) possible bad components: **1)** Bad ACID pump OR; **2)** Bad Actuator-Test Board.

b) Watch **ABic** versus **Bic** for up to five (5) minutes. **NOTE**: If a disposable bi*b*ag is attached it is normal for **Bic** AND **ABic** to change slightly but should remain within three (3) of each other. If **ABic** REMAINS within three (3) of **Bic** the Bicarb Pump System is okay! If **ABic** does NOT remaining within three (3) of **Bic** then TWO (2) possible bad components: **1)** Bad BICARB pump OR; **2)** Bad Actuator-Test Board.

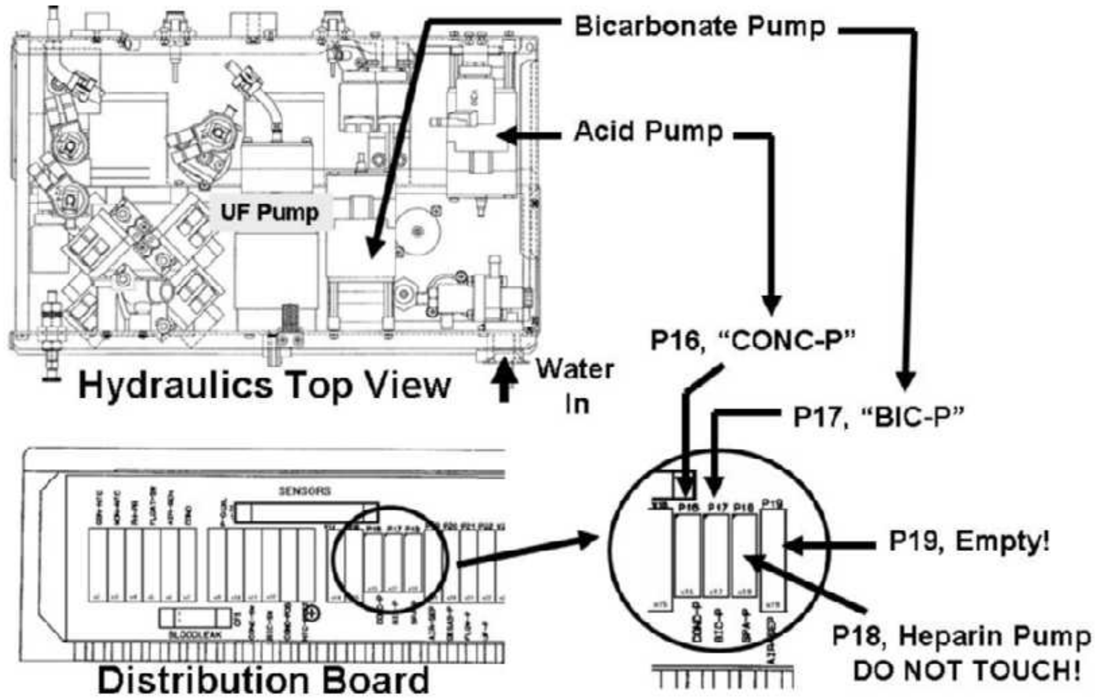



**Figure 63 – Distribution Board / Hydraulics Top View (Pumps)**

## EOS- 2.0.0 ACID SYSTEM PROBLEM / ISOLATE THE ACID PUMP

This procedure uses the known good Bicarb Pump to check the Acid Pump.

A) **To prevent damage, turn the machine OFF.**

B) Per Figure 63 above, unplug the Acid Pump cable from distribution board position "P16, CONC-P". **CAUTION! Avoid the Heparin Pump connector at position "P18".**

C) Plug the Bicarb Pump's cable into the Acid Pump's position "P16, CONC-P".

D) **CAUTION! The connector should insert easily if the pins are okay.**

E) If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.

F) Call debug screen 0. If debug does not appear press 'Esc' then call debug 0.

G) Allow thirty (30) seconds THEN, **ignoring the BIC symbol**, watch the CONC symbol for up to two (2) minutes: **1) EVER pink (solid or blinking)?** OR **2) ALWAYS white**?

1) **IF ever pink:** The Acid Pump is probably okay. See procedure number EOS- 4.0.0 (page 444).

2) **IF ALWAYS white:** See parts a THROUGH c below:

a) **CAUTION!** To prevent damage, Turn the machine OFF.

b) Return the bicarbonate pump's cable to position "P17, BIC-P".

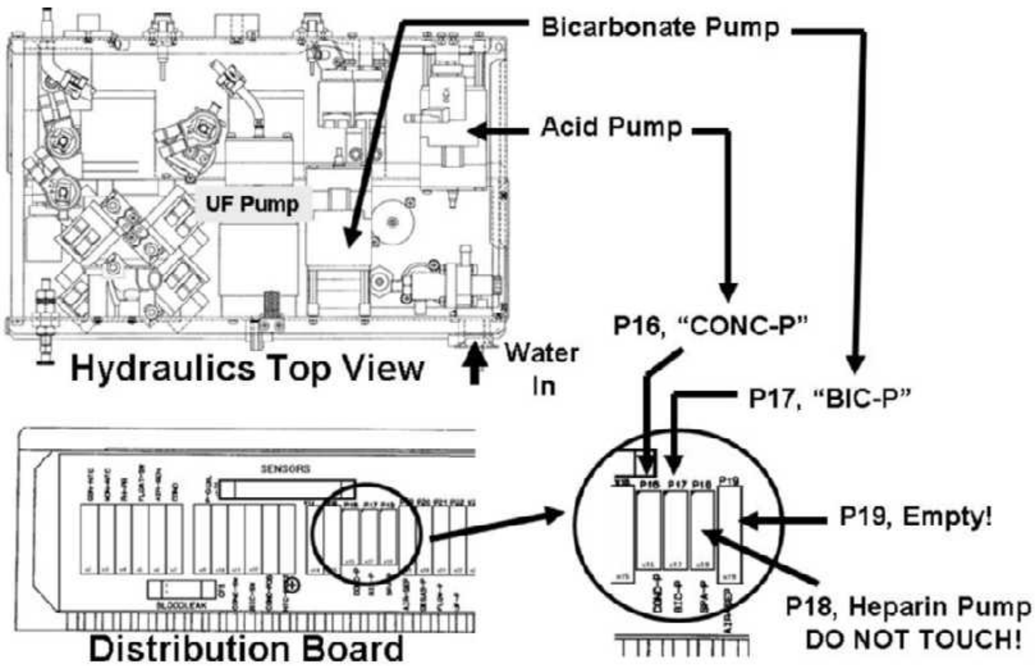
c) Per Figure 63 above, the Acid Pump is bad.

## EOS- 3.0.0 BICARBONATE (BIC) SYSTEM PROBLEM / ISOLATE THE BIC PUMP

This procedure uses the known good Acid Pump to check the bicarbonate pump.

A) **CAUTION! To prevent damage, turn the machine OFF!**

B) Per the Figure below, unplug the bicarbonate pump's cable from distribution board position "P17, BIC-P". **CAUTION! Avoid the Heparin Pump connector at position "P18".**




C) Plug the <u>Acid Pump's</u> cable, into the bicarbonate pump's position "P17, BIC-P". **CAUTION! The connector should insert easily if the pins are okay!**

D) If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.

E) Call debug screen 0. If debug does not appear 'Esc' then call screen 0.

F) Allow thirty (30) seconds <u>THEN,</u> **ignoring the CONC symbol**, watch the <u>BIC</u> symbol for up to two minutes: **1) EVER pink (solid or blinking)?** <u>OR</u> **2) Remaining ALWAYS white**?

**1) IF Pink:** The bicarbonate pump is probably okay. Proceed to **page 444**, procedure number EOS- 4.0.0.

**2) IF remaining White:** See parts a THROUGH c below:

a) **CAUTION!** To prevent damage, turn machine OFF.

b) Return the Acid Pump's cable to position "P16, CONC-P".

b) Per the Figure (above), the bicarbonate pump is bad.

## EOS- 4.0.0 PUMP SYMBOL REMAINS PINK / ISOLATE THE PUMP CIRCUITS

a) **CAUTION!** To prevent damage, turn machine OFF.

b) Per Figure 63 (page 442), return both pump cables to their distribution board positions.

c) See **EOS- 4.0.0, STEP #1** below:

## EOS- 4.0.0, STEP #1 Isolate Actuator-Test Board

a) **CAUTION!** To prevent damage, turn machine OFF.

b) Swap in a known good Actuator-Test Board*. *To LOCATE the board refer to Figure 4A (page 10).

c) If the problem was occurring in a Cleaning Program return to it. If not, return to Dialysis Program.

d) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

e) Allow thirty (30) seconds THEN, WITHOUT LOOKING AWAY, watch for pump symbol for up two (2) minutes. Does it REMAIN white now?

Yes Remains white! The previous Actuator-Test Board is bad.

No Turns pink! Continue to **EOS- 4.0.0, STEP #2** (the previous Actuator-Test Board is okay).

## EOS- 4.0.0, STEP #2 Isolate the Sensor Board cable:

a) **CAUTION! To prevent damage, turn the machine OFF.**

b) Swap in (or check[1]) a known good Sensor Board cable*. *To LOCATE the cable refer to Figure 4A (page 10).

[1] To check the Sensor Board cable, which pump is issuing the EOS error?

**IF ACID:** **NOTE** that one (1) ACID EOS connection (ONLY) will be checked and proceed to **page 569**, SECTION 17- CHECKING THE SENSOR BOARD CABLE. If the cable checks good continue to procedure number EOS- 4.0.0, step #3 next page.

**IF BICARB:** **NOTE** that one (1) BICARB EOS connection (ONLY) will be checked and proceed to **page 569**, SECTION 17 - CHECKING THE SENSOR BOARD CABLE. If the cable checks good continue to procedure number EOS- 4.0.0, step #3 next page.

c) If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.

d) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

e) Allow thirty (30) seconds THEN, WITHOUT LOOKING AWAY, watch for pump symbol for up two (2) minutes. Does it REMAIN white now??

Yes Remains white! The previous Sensor Board cable is bad

No Turns pink! Continue to **EOS- 4.0.0, STEP #3** next page.

## EOS- 4.0.0, STEP #3  Isolate the Actuator Cable

a) **Turn the machine OFF to prevent damage!**

b) Swap in (or check[2]) a known good actuator cable*. *To LOCATE the cable refer to Figure 4A (page 10).

[2] To check the actuator cable, which pump is issuing the EOS error?

**IF ACID:** **NOTE** that four (4) ACID PUMP connections (ONLY) will be checked and proceed to **page 566**, SECTION 16 - CHECKING THE ACTUATOR BOARD CABLE. If the actuator cable checks good continue to procedure number EOS- 4.0.0, step #4.

**IF BICARB:** **NOTE** that four (4) BICARB PUMP connections (ONLY) will be checked and proceed to **page 566**, SECTION 16 - CHECKING THE ACTUATOR BOARD CABLE. If the actuator cable checks good continue to procedure number EOS- 4.0.0, step #4.

c) If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.

d) Call debug screen 0. If debug does not appear press 'Esc' then call debug screen 0.

e) Allow thirty (30) seconds THEN, WITHOUT LOOKING AWAY, watch for pump symbol for up two (2) minutes. Does it REMAIN white now??

Yes   Remains white! The previous actuator cable is bad.

No   Turns pink! See **EOS- 4.0.0, STEP #4**.  **NOTE:** The previous actuator cable is probably good!

**EOS- 4.0.0, STEP #4:** If sure all above checks were performed correctly, THREE (3) possible bad components (see COMPONENT LIST below). Swap in, one at a time, testing the machine in between to see if the new component fixed the problem:

**COMPONENT LIST: 1)** Sensor Board[1]; **2)** Distribution board; **3)** Motherboard

[1] To prevent a "Cond Offset Failure" place the machine into **T and C Mode.** Refer to OPERATING MODES (page 19)

LEFT BLANK INTENTIONALLY

## EOS- 5.0.0 BOTH PUMP SYMBOLS ARE PINK

a) **Turn the machine OFF to prevent damage!**

b) Per the Figure below, ENSURE BOTH pumps are installed with their output nozzles (red or blue) towards the top and the ribbon cables extending from the side. **If not, this may be the problem!**

c) Swap in a known good Actuator-Test Board* *To LOCATE the board refer to Figure 4A (page 10).

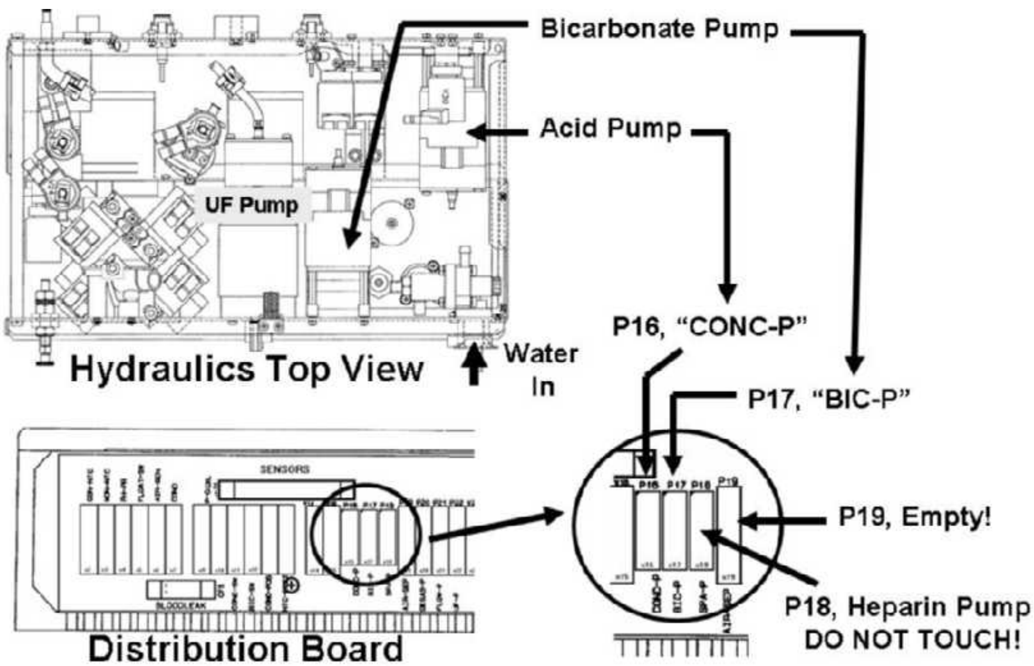
d) If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.

e) Call debug screen 0. If debug does not appear press ‘Esc’ then call screen 0.

f) Allow thirty (30) seconds THEN WITHOUT LOOKING AWAY, watch BOTH pump symbols for two (2) minutes. Are BOTH still pink?

Yes Both pink! See procedure number EOS- 5.0.1 (page 446).

No Neither pump pink! The previous Actuator-Test Board is bad.




## EOS- 5.0.1 ISOLATE THE PUMPS

a) **Turn the machine off to prevent damage!**

b) Per the Figure above, plug in a known good pump into distribution board position “P16, “Conc-P” (Acid Pump)***** OR “P16, Bic-P” (bicarbonate pump)***.** * Your choice.

c) If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.

d) Call debug screen 0. If debug does not appear press ’Esc’ then call screen 0.

**Part e next page**

e) Allow thirty (30) seconds THEN, WITHOUT LOOKING AWAY, watch the pump's symbol for two (2) minutes. Does it REMAIN white?

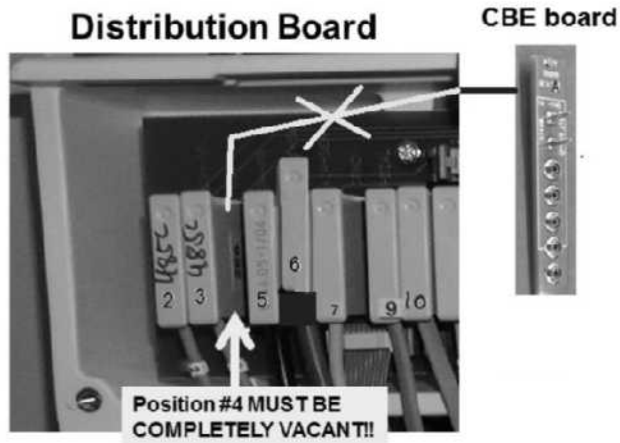
Yes — Pump symbol remains white! The previous pump is bad. Repeat procedure number EOS- 5.0.1 to test the alternate pump. **IF BOTH symbols remain white:** BOTH previous pumps are bad. **IF one pump is pink and the other is white:** Proceed to **page 441**, procedure number EOS- 1.0.0.

No — Pump symbol pink! If sure all above checks were performed correctly, FIVE (5) possible bad components (see COMPONENT LIST below). Swap in, one at a time, testing the machine in between to see if the new component fixed the problem

**COMPONENT LIST:** Referring to Figure 4A (page 10): **1)** Actuator cable; **2)** Sensor Board cable; **3)** Sensor Board; **4)** Distribution board; **5)** Motherboard

# SECTION 7 - COND REF FAILURE OR COND OFFSET FAILURE

## CR- 1.0.0 ISOLATE DISTRIBUTION BOARD




a) **Turn the machine OFF!**

b) Figure right, ENSURE distribution board position "X4, PH-PR" is COMPLETELY VACANT!

**NOTE!** If the CBE board is accidentily plugged into position "PH-PR" it may destroy the Power Logic board!

c) Turn the machine ON.

d) If the "Cond Ref Failure" OR "Cond Offset Failure" reoccurs see procedure number CR- 1.0.1 (page 448).

## CR- 1.0.1 VERIFY COND FAILURE

Has a Sensor and / or a Functional Board been recently been 'swapped' in?

Yes If 'swapping' for troubleshooting purposes, **other than** "Cond Ref Failure" OR "Cond Offset Failure" refer to OPERATING MODES (page 19) to place the machine into **T and C Mode**.

No See parts a THROUGH e below:

a) BEFORE continuing to part b, NOTE this page number then perform INITIAL CHECKS (page 7).

b) Turn the machine OFF and open the card cage.

c) **Referring to Figure 64** (page 449), the EXTENDER BOARD (P/N 190600) is required.

d) To avoid error, **FOUR NOTES** below**:**

**1)** Keeping the EXTENDER BOARD'S resistors towards the **FRONT OF THE MACHINE** install it into the motherboard's nine (9) pin TEST***** connector. *****To LOCATE refer to Figure 4A (page 10).

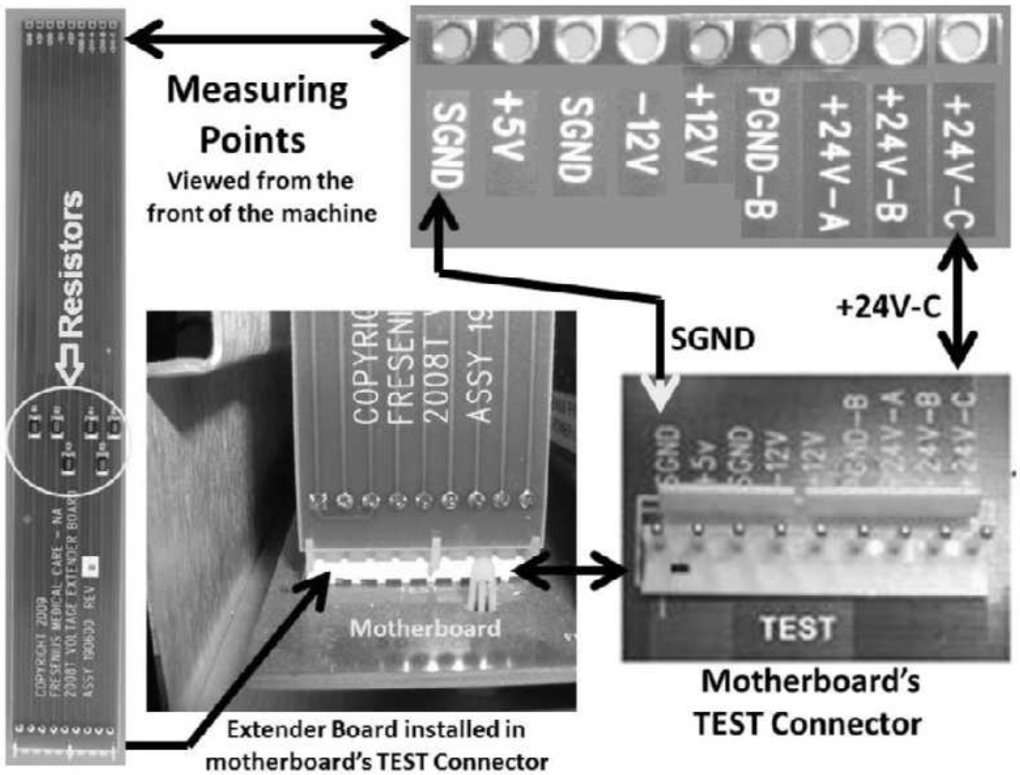
**2)** ENSURE the board is matched pin for pin to the TEST connector! From the **FRONT OF THE MACHINE** SGND on the LEFT; 24V-C on the RIGHT!

**3)** Push the board down hard. It may resist a good connection to the motherboard!

**4)** Pull up on the board. If installed correctly it resists pulling out!

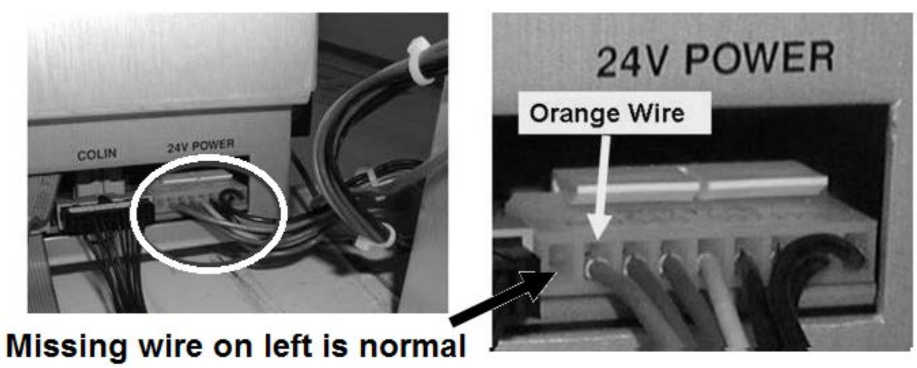
e) See procedure number CR- 1.0.2 (page 449).

Figure 64 – Extender Board




**CR- 1.0.2 ISOLATE (-) 12 VOLT DC SUPPLY**

a) Figure below, at the rear of the machine, ENSURE the 24V POWER harness has remained plugged in!




b) **Set your <u>CALIBRATED</u> volt meter to DC Voltage ($V_{DC}$).**

c) **Connect the meter's black lead to chassis ground (see Figure 2 (page 4)).**

d) **Turn the machine ON (Fan running)!**

e) Measure at the EXTENDER BOARD'S **-12V** measuring point. Between -11.0 and -13.0 volts DC?

Yes Between -11.0 and -13.0 volts DC! See procedure number CR- 1.0.4 (page 450).

No If ABSOLUTELY SURE the extender board is installed properly AND you are measuring at the correct point now measure at the EXTENDER BOARD'S **+12V** pin measuring point. Between 11.7 and 12.3 volts DC?

Yes Between 11.7 and 12.3 volts DC! Proceed to **page 451**, procedure number CR- 1.0.9.

No Less than 11.7 OR more than 12.3 volts! If ABSOLUTELY SURE the extender board is installed properly, proceed to **page 647** and refer to **Table 17**.

**CR- 1.0.4 BETWEEN -11.0 AND -13.0 VOLTS / ISOLATE CELLS CALIBRATION**

A) **Connect to FULL JUGS of known good acid and bicarb!**

B) Place the machine into Service Mode → Calibrate Sensors → Cond Cells.

C) With an external dialysate meter attached AND the shunt door closed ENSURE the flow indicator's 'bob' is moving up and down in the sight tube.

D) ALLOW five (5) minutes BEFORE continuing to part E.

E) Set the external meter to temperature (°C). If between 35.1 and 39.9° C see part F. If (and ONLY if) NOT between 35.1 and 39.9° C proceed to **page 320**, procedure number T- 7.0.0.

F) The screen's **Conductivity** window SHOULD eventually turn pale yellow/white. If not an "Error" banner appears on the screen. In this event skip to part H.

G) With the **Conductivity** window pale yellow/white set the external meter to measure Conductivity (mS). ENSURING it reads between 13.0 and 14.5 mS proceed per the screens instructions.

H) Is the calibration successful? i.e. an "Error" banner DID NOT occur.

Yes An "Error" banner NEVER occured! See procedure number CR- 1.0.5 (page 450).

No An "Error" occured! Swap in the listed component (see **Component List** below), one at a time, with known good then, in between, repeat procedure number CR- 1.0.4 (page 450) to test each new component.

**Component List: 1)** Sensor Board; **2)** Actuator-Test Board; **3)** Functional Board's EEPROM (IC20); **5)** Functional Board.

**CR- 1.0.5 ISOLATE CONDUCTIVITY CIRCUIT**

Turn the machine OFF then back on. Does the "Cond Ref Failure" OR "Cond Offset Failure" reoccur?

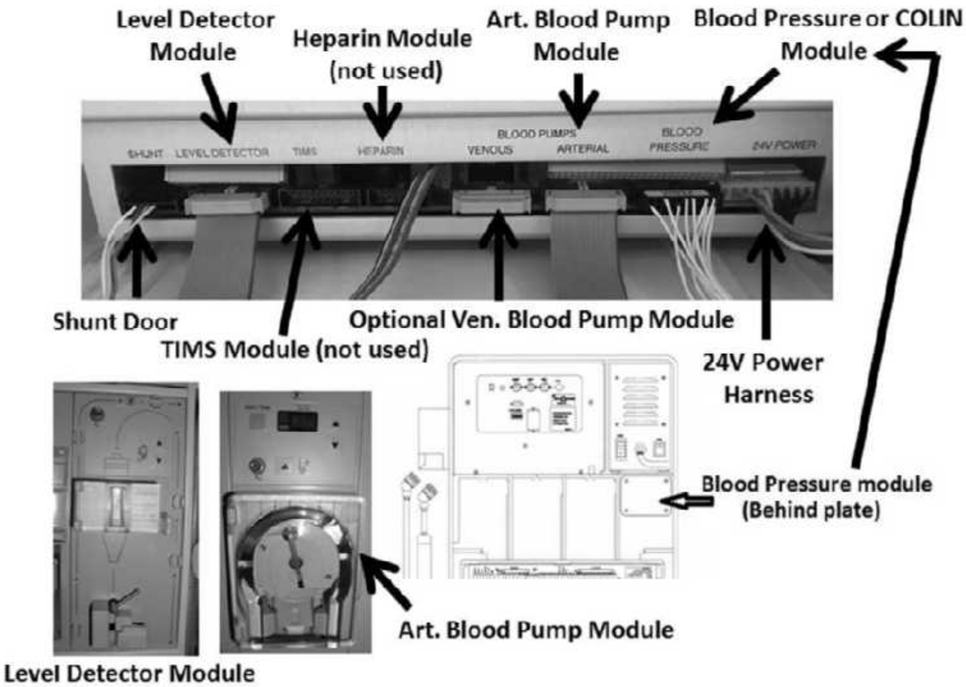
Yes Problem reoccurs! Swap in the listed component (see the **Component List** above) one at a time, with known good then, in between, repeat procedure number CR- 1.0.4 (page 450) to test the new component. When a Failure DOES NOT reoccur the last component swapped in is the problem.

No Problem does NOT reoccur! If the Sensor Board and / or Functional Board and / or Functional Board's EEPROM (IC20) was replaced it is necessary to perform ALL calibrations.

**CR- 1.0.9 ISOLATING NEGATIVE (-) TWELVE VOLTS**

a) **To avoid damage turn the machine OFF!**

b) Figure below, at the rear of the card cage, ENSURE the Blood Pressure Module cable, is NOT reverse connected with another module! **If it is, correct this situation and re-measure -12 volts as this may be the problem!**




c) Unplug the **Blood Pressure** module from the card cage.

d) **Turn the machine ON (fan running)!**

e) Remeasure -**12V** at the EXTENDER board. Between -11.0 and -13.0 volts DC now?

Yes Between -11.0 and -13.0 DC! The Blood Pressure module OR its cable may be bad OR a wrong module was plugged in originally.

No NOT between -11.0 and -13.0 DC! See procedure number CR- 1.0.10 (page 451).

**CR- 1.0.10 NEGATIVE 12 VOLTS NOT WITHIN RANGE**

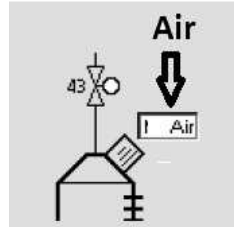
a) Replace the Power Logic board with a known good then see part b. To LOCATE the Power Logic board refer to Figure 4A (page 10).

b) Remeasure **-12V** at the EXTENDER board. If still NOT between -11.0 and -13.0 volts DC see part c.

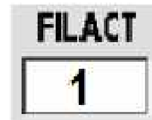
c) Possible -12 volt short! Except for the Power Logic and UI-MICS boards the other cage boards can be isolated by pulling them out, one at a time and repeating the -12V measurement in between. If still NOT between -11.0 and -13.0 volts see part d.

d) Possible bad UI-MICS board. Swap in with a known good and repeat the **-12V** measurement. If still NOT between -11.0 and -13.0 volts possible bad motherboard.

# SECTION 8 - FILLING PROGRAM (AIR LEAK) PROBLEMS




Filling Programs NORMALLY occur when air is sensed by Chamber #69's Air Sensor #6 i.e. Chamber #69's text box says "Air". They are indicated with a "Filling Program" or "10 Fill Pgm in 1 Hr" or "TMP Is Low" banner. Also, debug screen 1's **FILACT** = 1.

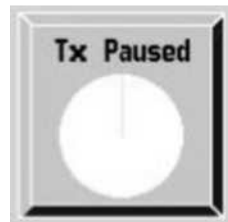



A) ENSURE the dialyzer connectors are attached PROPERLY to shunt door!

B) Close the shunt door!

C) ENSURE the external flow indicator's (sight tube) fittings are tight!

D) From the Home screen, ENSURE [Dialysate Flow] has been set to at least 500 ml/min for six (6) minutes.



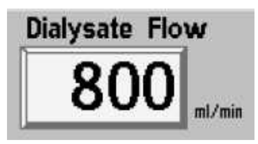

E) The Treatment Clock (Figure right) must be left off i.e. "Tx Paused".

F) USING A FLASHLIGHT, ENSURE no air bubbles MOVING into the machine through the Acid and Bicarb inlet tubing indicating a leaking concentrate connector!

G) [**Conductivity**] MUST BE more than 13.0 mS BEFORE continuing to part H!

H) If the Automated Tests are running (screen reads "Test:….") allow them to finish.

I) **Remove the 'dummy venous chamber' from the Level Detector, till instructed otherwise!**




J) Press the [Dialysate Flow] window.

K) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

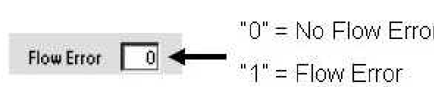
L) **DO NOT reset alarms!**

M) Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

Yes 'Bob' moving! See procedure number FIL- 1.0.0 (page 453).

No a) Call debug screen 0.

b) WITHOUT LOOKING AWAY, watch **Flow Error** for two (2) minutes. If EVER = 1, even if only once, indicates a Flow Error! TWO (2) possible scenarios 1) or 2) below:




**1)** **IF (and ONLY if) Flow Error ALWAYS = 0!** Call the Home screen. [**Temperature**] MUST BE between 35.1 and 38.9° C; [**Conductivity**] more than 13.0 mS BEFORE continuing to procedure number FIL- 1.0.0 (page 453).

**2)** **IF Flow Error EVER = 1!** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

**FIL- 1.0.0 ISOLATE AIR SENSOR CIRCUIT / POSSIBLE LEAKS**

Going forward, if a “No Water”, Flow Error, Temperature or a Conductivity alarm EVER occur address them first!

a) Figure below, remove the Distribution Board’s cover.

b) Using a flashlight, ENSURE the Air Sensor’s female connector is plugged PROPERLY***** into its Distribution Board position i.e. 4th connector, 5th position, from the LEFT!

* Figure below, if the machine is CBE modified the female Air Sensor connector plugs into the ‘**CBE board’** which rises the connector two (2) pins higher than the others! **The female connector MUST plug into the CBE board pin for pin!**

* **IMPORTANT!** Using a flashlight, **ENSURE** the TOP CBE board pin is covered by the Air Sensor’s female connector! If not, **FILACT** will always = 1!

**NOTE!** If NOT CBE modified do so immediately as this may solve Filling Program problems. For questions call 1-800-227-2572 and reference Field Action FA2014-01

**Parts c through e next page**

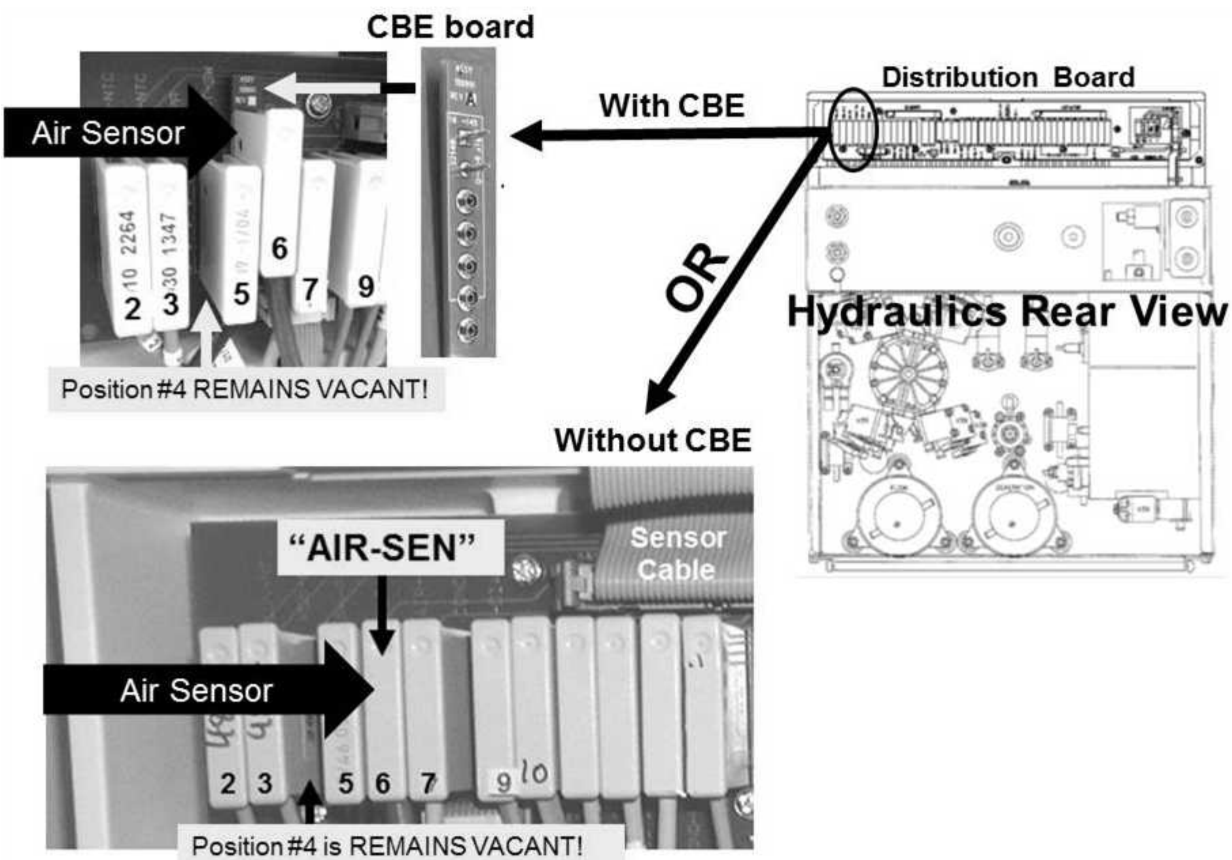
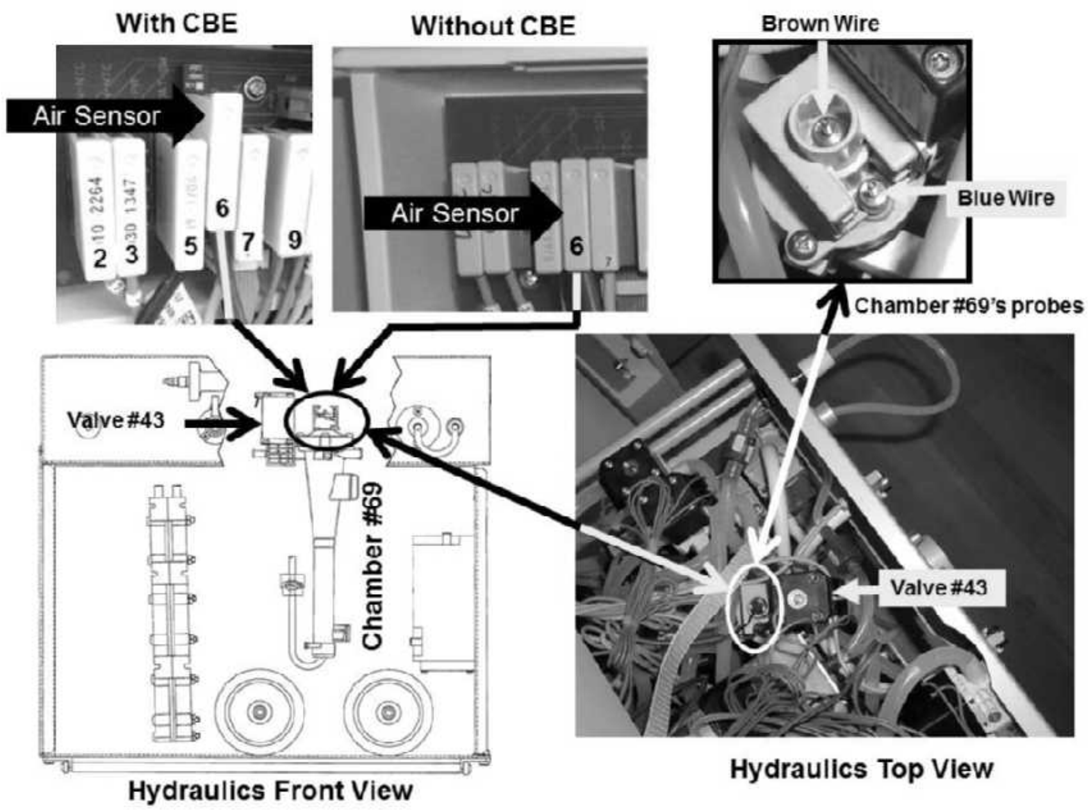



**Figure 65 – Chamber #69 / Air Sensor**

c) **Figure below**, ENSURE the female Air Sensor Connector's brown and blue wires terminate PROPERLY* onto the male probes at the top Chamber #69, brown wire to the top probe; blue to the bottom!

*** NOTE! If the wires are loose <u>OR are NOT</u> connected properly this may be the problem!**

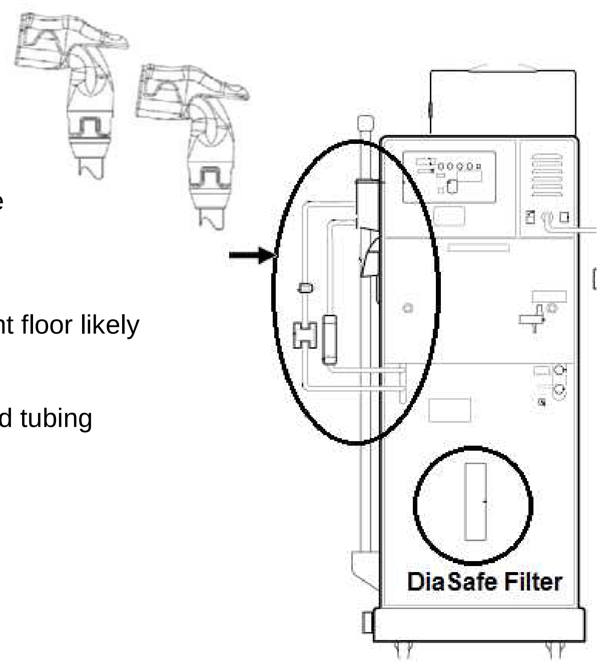



d) Very small external leaks cause BIG problems! Be THROUGH! <u>THREE</u> (3) leak checks:

**CHECK #1** Figure right, the ENTIRE length of the dialyzer lines ESPECIALLY the quick connectors!

**CHECK #2:** Puddles on the hydraulic compartment floor likely indicate a leak!

**CHECK #3:** Figure right, the DiaSafe® housing and tubing connections!



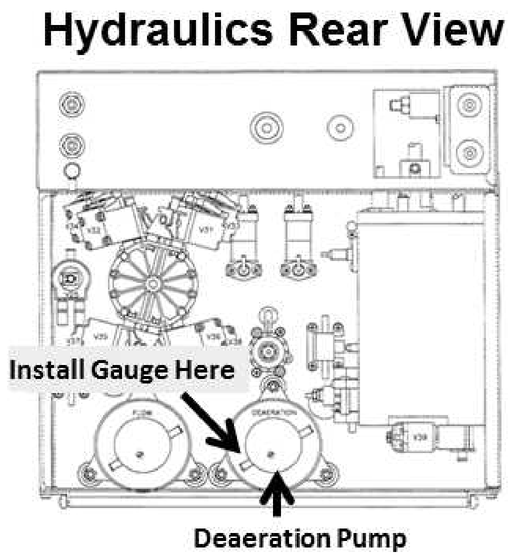

e) See procedure number FIL- 1.0.1 (page 455).

## FIL- 1.0.1 ISOLATE AIR REMOVAL SYSTEM

a) The Deaeration gauge is used next. **ENSURE** it reads 0 inHg before installing it!

b) Turn the machine OFF!

c) Figure below, tee the gauge into the Inlet (clear tubing) side of the Deaeration Pump!




d) Turn the machine on and return to Dialysis Program ("Select Program → "Dialysis' → 'Enter).

e) Is Deaeration Pressure OKAY? Refer to Appendix A (page 757) for what pressure should be.

Yes Deaeration Pressure OKAY! See procedure number FIL- 1.0.2 (page 455).

No Deaeration Pressure IS NOT OKAY! ENSURING a "No Water" alarm is NOT presenting, NOTE this page number, as you will return here, THEN proceed to **page 543,** SECTION 13 - DEAERATION PROBLEMS.

## FIL- 1.0.2 DEAERATION PRESSURE OKAY

a) Turn the machine OFF.

b) Remove the gauge and reattach the tubing.

c) Turn the machine on and return to Dialysis Program ("Select Program → "Dialysis' → 'Enter').

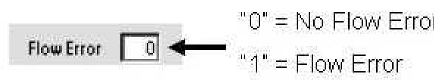
d) See procedure number FIL- 1.0.3 (page 456).

**FIL- 1.0.3 DEAERATION PRESSURE OKAY (2)**

Because the machine was off, [**Conductivity**] will be unstable! The following procedure requires three (3) minutes during when [**Conductivity**] MUST stabilize to between 13.0 and 14.4 mS!

a) **OPEN THE SHUNT DOOR AND LEAVE IT OPEN TILL INSTRUCTED!**

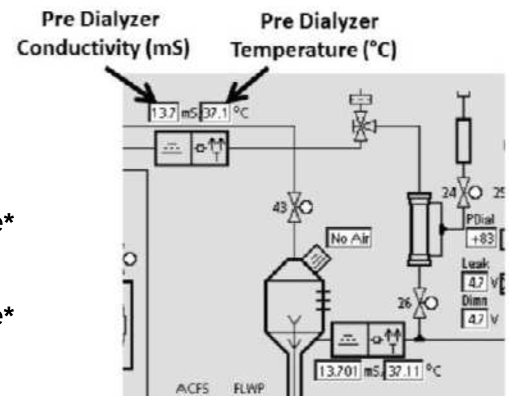
b) Call debug screen 0. WITHOUT LOOKING AWAY watch **Flow Error** for **three (3) minutes**! If EVER = 1, even just once, indicates a masked Flow Error! TWO (2) possible scenarios:




**1)** **IF (and ONLY if) Flow Error ALWAYS = 0!** See procedure number FIL- 1.0.4 (page 456).

**2)** **IF Flow Error EVER = 1:** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

**FIL- 1.0.4 ISOLATE 'OUT OF BYPASS' CIRCUIT**




a) From debug screen 0, Figure right, TWO (2) checks:

**CHECK #1:** **Pre Dialyzer Temperature** MUST BE stable* BETWEEN 35.0 and 39.0° C!

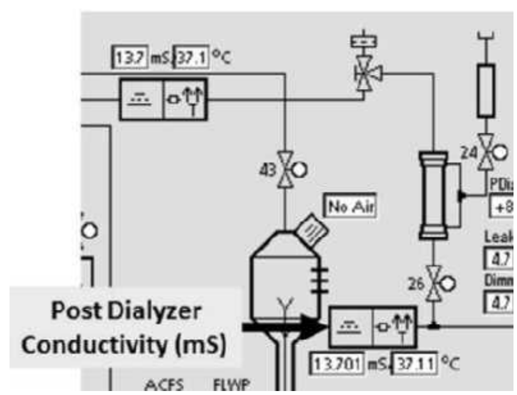
**CHECK #2:** **Pre Dialyzer Conductivity** MUST BE stable* BETWEEN 13.0 and 14.4 mS!

***** Stable = NOT changing more than 0.1 per minute! If **Temperature** is about 37.0° C and **Conductivity** about 14.0 mS but either one bounces' more than 0.3 may indicate a large hydraulic air leak that must be located and repaired!

b) See procedure number FIL- 1.0.5 (page 456).

**FIL- 1.0.5 STABLE CONDUCTIVITY / ISOLATE OLC**

A bad On Line Clearance (OLC) component may cause Filling Programs EVEN if OLC is not activated or used! From debug screen 0:




a) **Figure right**, if the **POST Dialyzer Cond** symbol appears see part b. If NOT skip to procedure number FIL- 1.0.6 (page 457).

b) Are **PRE AND POST** Dialyzer Conductivity within 0.4 mS of each other (Yes or No)?

Yes PRE AND POST Conductivity within 0.4 mS of each other! Proceed to **page 459**, procedure number FIL- 2.0.0.

No PRE AND POST Conductivity ARE NOT within 0.4 mS of each other! See procedure number FIL- 1.0.6 (page 457).

## FIL- 1.0.6 PRE AND POST COND NOT WITHIN 0.4 OF EACH OTHER

Figure below, to the right of Pre Dialyzer Cond Cell #7, is Post Dialyzer Cond Cell #13 present?

Yes Cond Cell #13 present! See procedure number FIL- 1.0.7 (page 457).

No Cond Cell #13 NOT present! Proceed to **page 459**, procedure number FIL- 2.0.0.

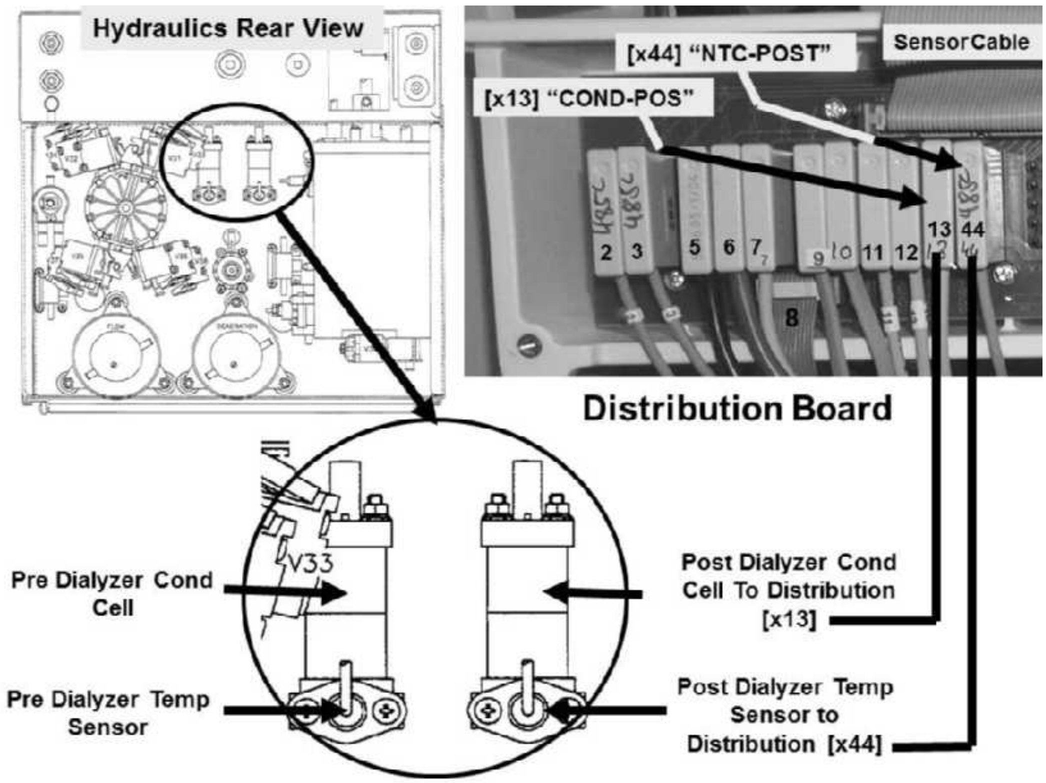



**Figure 66 – OLC Pre AND Post Components**

## FIL- 1.0.7 ISOLATE OLC SENSORS CONNECTIONS AND CABLES

a) Per the Figure above, **FOUR (4) CHECKS**:

**CHECK #1:** ENSURE the Sensor ribbon cable is plugged in PROPERLY!

**CHECK #2:** ENSURE the cable from position "x13, COND-POS" terminates at Post Conductivity Cell #13!

**CHECK #3:** ENSURE the cable from position "x44, NTC-POS" terminates at Post Temp Sensor #44!

**CHECK #4:** ENSURE ALL cables show no signs of insulation damage!

b) Were the cables OKAY?

Yes Cables were OKAY! See procedure number FIL- 1.0.8 (page 458).

No Problem with a cable! After the repair, perform parts a THROUGH d below:

a) Turn the machine OFF then allow seven (7) minutes BEFORE continuing to part b.

b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

c) Allow [Conductivity] to increase to more than 13.0 mS.

d) Call debug screen 1.Watch **FILACT** for two (2) minutes. If <u>REMAINING</u> = 0 the problem is solved. If still going ever = 1 return to (ABOVE) procedure number FIL- 1.0.3 (page 456).

**<u>FIL- 1.0.8 OLC ACTIVATED?</u>**

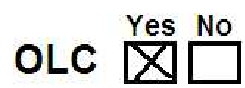
From debug screen 0, once again, does the OLC **<u>POST Dialyzer Cond</u>** symbol appear?

Yes **<u>POST Dialyzer Cond</u>** symbol appears! A problem with Post Dialyzer Cond. Close the shunt door THEN proceed to **page 417**, procedure number CO- 10.0.10.

No The OLC option will have to be activated as a bad OLC reading may cause Filling Programs <u>EVEN IF</u> the OLC option is not activated! Perform parts a THROUGH i below:

a) Enter Service Mode → Options → Hardware Options.

b) Next to **OLC** (upper right) place the ‘X’ in the “Yes” box and press the keyboard’s ‘Enter’ key. The ‘X’ turns blue.




c) Turn the machine off then bacl on.

d) Return to Dialysis Program (“Select Program”→ ‘Dialysis’ → ‘Enter’)!

e) Call debug screen 0 and confirm the Post Dialyzer OLC symbols now appear.

f) **The shunt door MUST be open!**

g) From the Home screen, ENSURING [Dialysate Flow] is set at 800 ml/min, allow **Conductivity** to reach between 13.0 and 14.5 mS!

h) Allow two (2) additional minutes for Post Conductivity to stabilize!

i) Call debug screen 0. Are PRE <u>AND</u> POST Cond within 0.4 of each other now?

Yes PRE <u>AND</u> POST Conductivity within 0.4 mS of each other! See procedure number FIL- 2.0.0 (page 459).

No PRE <u>AND</u> POST Conductivity <u>ARE NOT</u> within 0.4 mS of each other! A problem with Post Dialyzer Cond. Close the shunt door and proceed to **page 417**, procedure number CO- 10.0.10 (page 417).

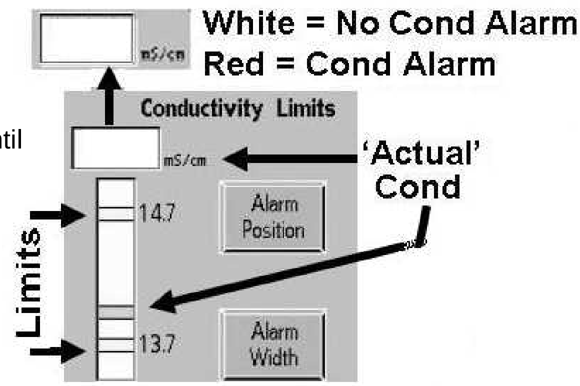
## FIL- 2.0.0 VERIFY DIALYSATE SETTINGS

a) **CLOSE THE SHUNT DOOR!**

b) Is the external flow indicator's 'bob' moving up and down in the sight tube?

Yes 'Bob' moving! See procedure number FIL- 2.0.1 (page 459).

No a) At the bottom of the screen, press the 'Dialysate' tab.

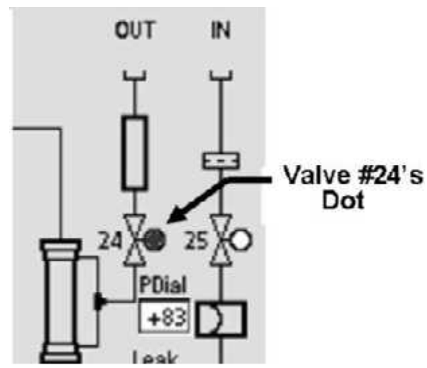



b) Figure right, adjust the Conductivity Limits until 'Actual' Conductivity is CENTERED between them.

c) Press 'Enter'.

d) Allow up to three (3) minutes for the Conductivity window to turn white (i.e. No Cond or bi*b*ag alarm).

e) Call debug screen 0. Figure right, allow Valve #24's 'dot' to turn BLUE BEFORE continuing to part f!



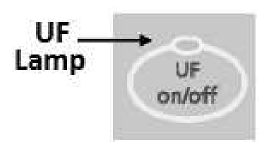

f) Is the flow indicator's 'bob' moving up and down now?

Yes 'Bob' moving!' See procedure number FIL- 2.0.1 (page 459).

No 'Bob' NOT moving! **ENSURING:** **1)** From the Home screen, [Dialysate Flow] is set to 800 ml/min! AND; **2)** Screen 0's Valve #24's 'dot' is blue! If (and ONLY if) 'bob' is still not moving proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM!

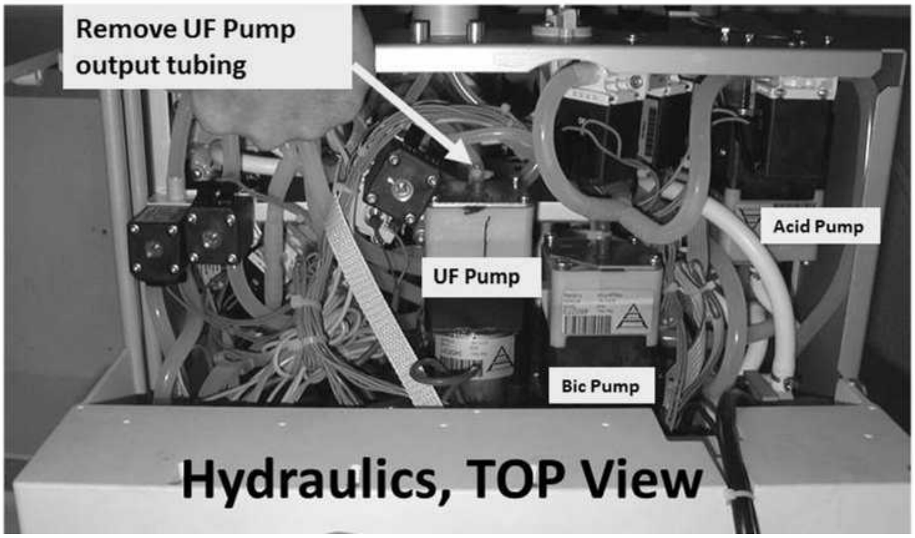
## FIL- 2.0.1 'BOB' MOVING / ISOLATE POSSIBLE UF PUMP LEAK

a) Figure right, ENSURE the lamp above the front panel's UF on/off key is **OFF** i.e. UF is OFF!




**Parts b and c next page**

b) Figure below, remove the UF Pump's output (TOP) tubing from the location shown!




c) Looking at the UF Pump's vacant OUTPUT nozzle, TWO (2) possible scenarios:

**1)** **IF (and ONLY if) no fluid from the UF Pump:** Reattach the tubing then see procedure number FIL- 2.0.2 (page 461).

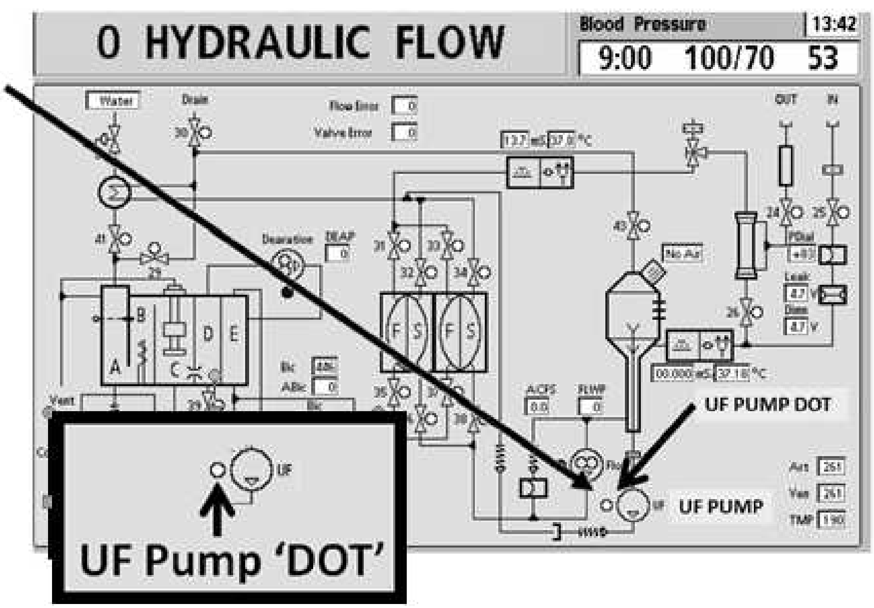
**2)** **IF you see fluid output from the UF Pump:** See parts a AND b below:

a) Call debug screen 0.

b) Per the Figure below, WITHOUT LOOKING AWAY, watch the UF Pump's 'dot' for ONE (1) minute. Does it EVER BLINK between white and blue?

Yes The UF 'dot' blinks! The Actuator-Test Board may be bad!

No The UF 'dot' DOES NOT blink! Fluid from the UF Pump indicates bad or incorrectly installed internal seals/springs OR the pump is upside down!



**FIL- 2.0.2 'BOB' MOVING / ISOLATE POSSIBLE AIR LEAK (1)**

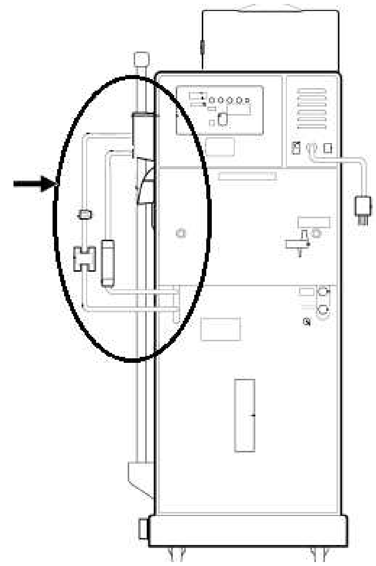


Figure right, USING A FLASHLIGHT, look for air bubbles MOVING through the dialyzer lines. Air seen?

Yes Air seen! Proceed to **page 534**, SECTION 11 - INDUCED AIR LEAK TESTS.

No air! See procedure number FIL- 2.0.3 (page 461).

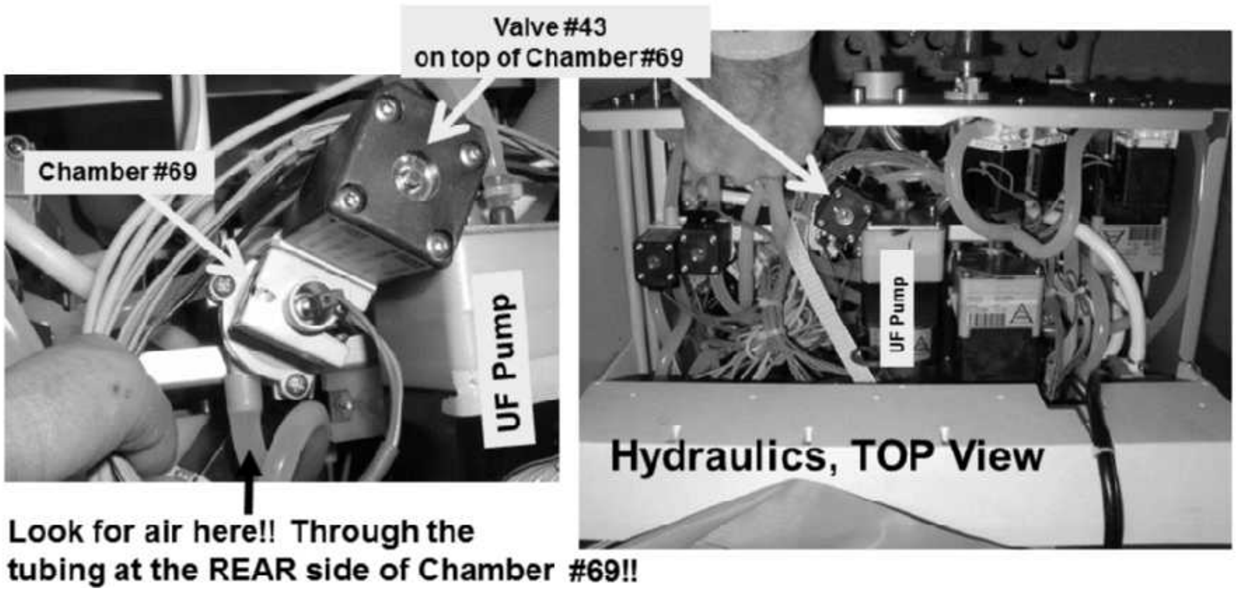



**Figure 67 – Chamber #69 Air Check**

**FIL- 2.0.3 NO AIR IN DIALYZER LINES**

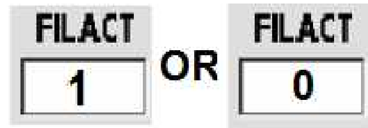
**Figure above**, USING A FLASHLIGHT, FOR TWO (2) MINUTES, watch for air bubbles MOVING into Chamber #69**!** Air seen?

Yes Air seen! Proceed to **page 534**, SECTION 11 - INDUCED AIR LEAK TESTS.

No air seen! See procedure number FIL- 2.0.4 (page 462).

## FIL- 2.0.4 NO AIR SEEN / ISOLATE FILLING PROGRAM

Call debug screen 1. WITHOUT LOOKING AWAY watch **FILACT** (middle column) for up to two (2) minutes. If EVER = 1, even just once, indicates a Filling Program! TWO (2) possible scenarios:




**1)** **IF (and ONLY if) FILACT EVER = 1:** Proceed to **page 464,** procedure number FIL- 2.1.0.

**2)** **IF FILACT <u>ALWAYS</u> = 0:** See parts a THROUGH d below**:**

a) **Open the shunt door and <u>LEAVE IT OPEN</u> till <u>instructed otherwise</u>!**

b) **Place a 'dummy venous chamber' in the Level Detector module.**

c) Press and release 'Reset' key then immediately press and hold it for three (3) seconds. Allow thirty (30) seconds. If any alarm reoccurs attempt reset up to twice more BEFORE continuing to part d.

d) Can you RESET ALL alarms?

Yes All alarms reset! See procedure number FIL- 2.0.5 (page 462).

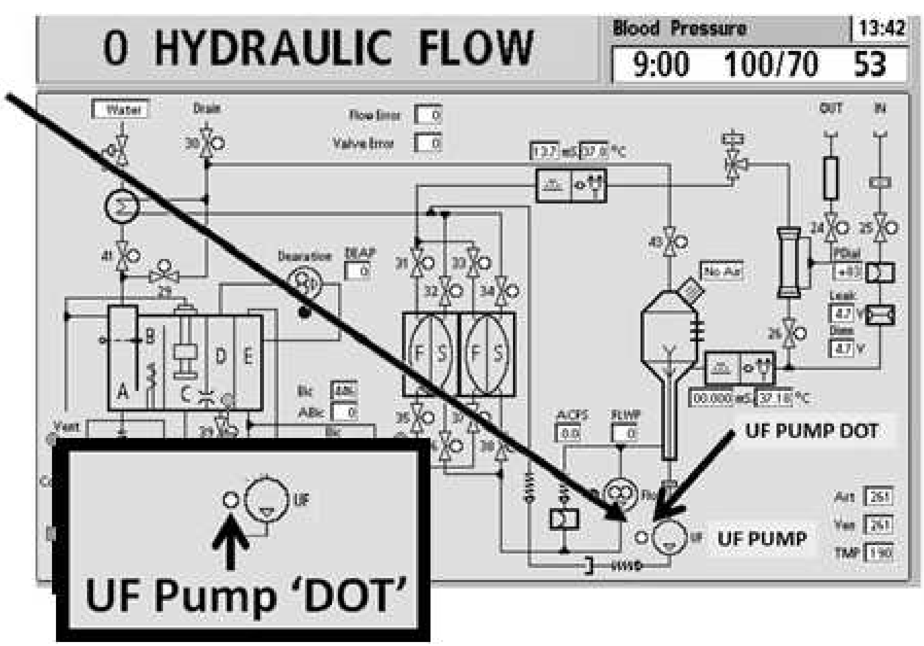
No Address the alarm that cannot be reset!

## FIL- 2.0.5 ALARMS RESET

Call debug screen 0. Per the Figure below, WITHOUT LOOKING AWAY, watch the UF Pump's 'dot' for forty five (45) seconds. Does it <u>EVER</u> BLINK between white and blue?

Yes The UF 'dot' blinks! The Actuator-Test Board may be bad!

No The UF 'dot' does NOT blink! See procedure number FIL- 2.0.6 (page 463).



## FIL- 2.0.6 ALARMS RESET / ISOLATE PRESSURE TEST

a) CLOSE the shunt door!

b) During this procedure you will look for air again through the INPUT TUBING at Chamber #69 but THIS TIME while the Pressure Test's "Get Neg TMP" AND "Neg Flow On" banners are up as this is when air may be pulled in through a leak somewhere!

c) **RESET all alarms!**

d) At the bottom of the screen, press the **[Test & Options]** tab. TWO (2) possible scenarios:

**1)** **IF the [Pressure Test] button is BLUE: A)** Press [Pressure Test]; **B)** Press 'Enter'; **C)** Allow the "Test: (Remove Air)" banner to expire THEN; **D)** IMMEDIATELY watch for air bubbles at Chamber #69 for two (2) minutes!

**2)** **IF the [Pressure Test] button is GRAY: A)** Press [Both Tests]; **B)** Press 'Enter'; **C)** Allow the Conductivity Test to complete; **D)** Allow the "Test (Remove Air)" banner to expire THEN; **E)** IMMEDIATELY watch for air bubbles at Chamber #69 for two (2) minutes!


e) Are air bubbles seen MOVING into Chamber #69?

Yes  Air seen! Proceed to **page 475**, procedure number FIL- 5.0.0.

No air seen! Allow the tests to finish then one (1) more minute BEFORE performing parts A through H below:

A) Call the Home screen. Set **[UF GOAL]** to 1000 ml; Set **[UF Time]** to 1:00 hr.

B) Press 'Enter'.

C) **RESET ALL alarms!**

D) Turn the Blood Pump on so that it is rotating at more than 100 ml/min.


E) To avoid error, read parts F through H BEFORE performing them!

F) Press the front panel's UF on/off key. The green lamp MUST stay on solid!

G) When **TMP*** reaches 280 turn UF off IMMEDIATELY (i.e. UF lamp OFF)!

***** If a "Filling Program" banner appears: 1**)** Repeat parts C) through G); **3)** If "Filling Program" reoccurs more than twice, indicates a large hydraulic air leak. In this event ONLY proceed to **page 475**, procedure number FIL- 5.0.0

H) At Chamber #69's INPUT tubing, IMMEDIATELY watch for air again. Air seen?

Yes  Air seen! Proceed to **page 475**, procedure number FIL- 5.0.0

No air seen! If you were prompted to Troubleshooting Filling Programs the original problem may still be occurring OTHERWISE do NOT continue!

**FIL- 2.1.0 NO AIR SEEN BUT FILACT = 1 / ISOLATE SUPPLY VOLTAGES**


a) Call debug screen 1, TWO (2) voltage checks:

**Check #1: 5V Est. (right column):** Between 4.7 - 5.3?

**Check #2: 12V Est. (right column):** Between 11.7 - 12.3?

b) Are BOTH in range AND stable i.e. not changing more than 0.1 per minute?

Yes BOTH 5V and 12V within range AND stable! See procedure number FIL- 2.3.0 (page 464).

No One or both NOT in range OR unstable! See parts A) through C) below:

A) To avoid pulling cables loose, GENTLY open the card cage.

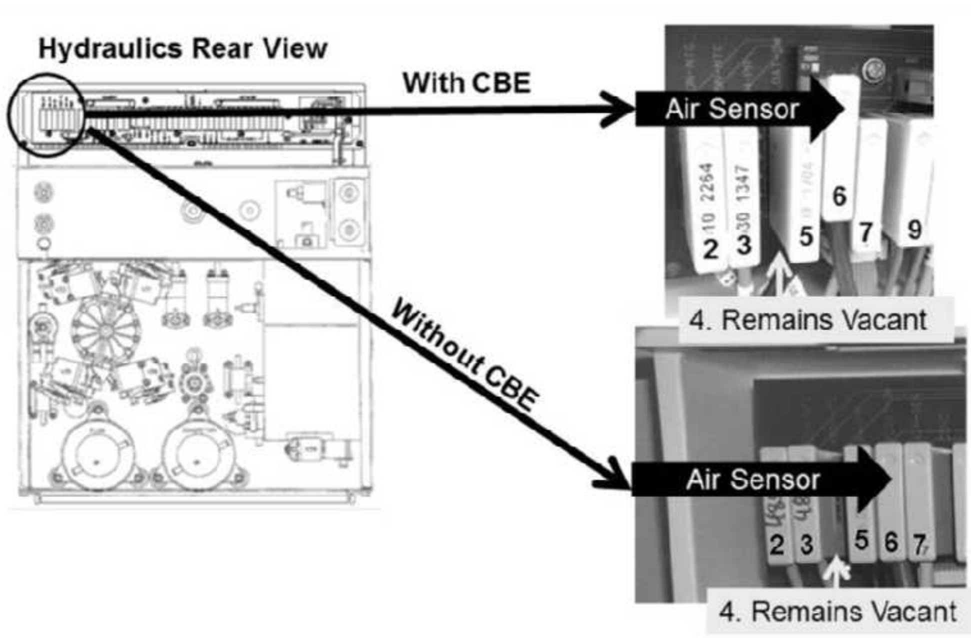
B) Behind the card cage, ENSURE the 24V POWER harness has remained plugged in.

C) Proceed to **page 646**, procedure number P- E.0.0.

**FIL- 2.3.0 VOLTAGES IN RANGE / ISOLATE AIR SENSOR CIRCUIT**

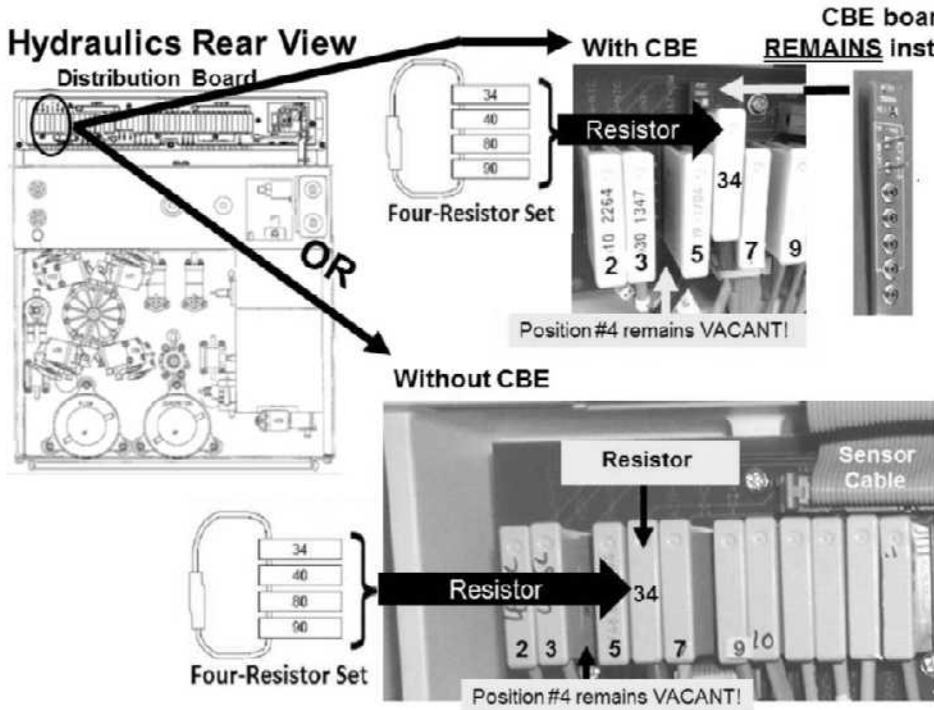
a) FIGURE BELOW, inside the distribution board, unplug the female Air Sensor's connector i.e. **4th** Connector, **5th** position from the left. If present, DO NOT unplug the CBE board, under the connector!

b) Using a flashlight, ENSURE no corrosion or damaged pins inside the distribution board!




c) **Per the Figure next page**, place a resistor plug, from the **FOUR-RESISTOR SET** into the Air Sensor's distribution board position! **If CBE equipped, using a flashlight, ENSURE the resistor covers ALL CBE board pins, especially the top pin!**

**Parts d and e next page**




d) Allow thirty (30) seconds BEFORE continuing to part e.

e) Based on debug screen 1's **FILACT** now, TWO (2) possible scenarios:

**1) IF (and ONLY if) FILACT <u>ALWAYS</u> = 0:** See procedure number FIL- 2.4.0 (page 466).

**2) IF FILACT = 1 or cycles between 0 and 1:** Perform parts A THROUGH C below:

A) <u>ENSURE</u> the plug is placed <u>PROPERLY</u> in the Air Sensor's position! If CBE equipped, using a flashlight, ENSURE the plug covers ALL CBE board pins, especially the top pin! If **FILACT** remains = 1 see part B**!** If **FILACT** now = 0 always see procedure number FIL- 2.4.0 (page 466).

B) Use a different plug! If **FILACT** remains = 1 see part C. If **FILACT** = 0 always see procedure number FIL- 2.4.0 (page 466).

C) SIX (6) possible bad components: **1)** CBE board [a]; **2)** Sensor Board[b]; **3)** Sensor Board cable[c] ; **4)** Functional Board [b]; **5**) Distribution board; **6)** Motherboard.

[a] **A)** Swap in a <u>known good</u> CBE board; **B)** Return the resistor plug <u>PROPERLY</u> to the Air Sensor's distribution board position! **C)** Return to Dialysis Program ('Dialysis' → 'Enter'); **C)** From debug screen 1, if **FILACT** now = 0 the previous CBE board may be bad.

[b] **A)** Swap in a <u>known good</u> board; **B)** For each board, to prevent "Cond Offset" Failure", place the machine into **T and C Mode** (refer to <u>OPERATING MODES</u>, page 19); **C)** Return to Dialysis Program; **D)** From debug screen 1, if **FILACT** now = 0 the previous board is bad.

[c] Swap in a <u>known good</u> cable OR it can be checked. **<u>NOTE</u>** that one (1) **AIR SENSOR** connection will be checked and proceed to **page 569**, <u>SECTION 17 - CHECKING THE SENSOR BOARD CABLE</u>

## FIL- 2.4.0 FILACT = 0 / ISOLATE POSSIBLE FLOW PROBLEM

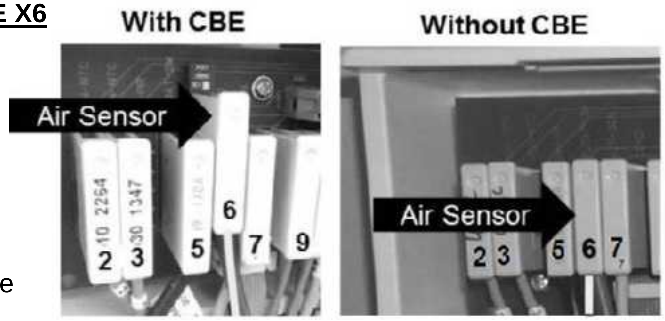

a) Call debug screen 6 to locate **BC Switch** (middle column). If EVER = 897 or more, even just once, indicates a Flow Error! In any event see part b.

b) WITHOUT LOOKING AWAY, watch **BC Switch** for two (2) minutes. TWO (2) possible scenarios:

**1)** **IF BC Switch is NEVER 897 or more!** See procedure number FIL- 2.4.2 (page 466).

**2)** **IF BC Switch = 897 or more, even just once!** Proceed to **page 23**, SECTION 1- FLOW ERRORS IN DIALYSIS PROGRAM.

## FIL- 2.4.2 BC SWITCH NEVER = 897 / ISOLATE X6




a) **Figure right**, return the Air Sensor's female connector to the distribution board. If CBE equipped, using a flashlight, ENSURE the connector covers ALL CBE board pins, especially the top pin!

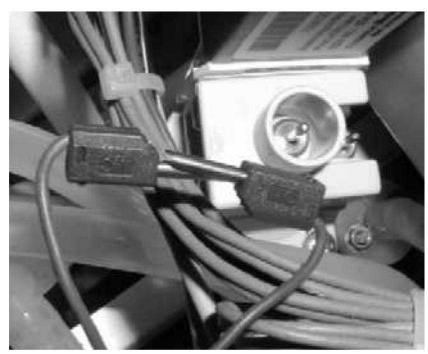
b) Allow thirty (30) seconds as **FILACT** response is not instantaneous!

c) Call debug screen 1. WITHOUT LOOKING AWAY, watch **FILACT** for two (2) minutes OR until if it EVER = 1! TWO (2) possible scenarios:

**1)** **IF FILACT ALWAYS = 0:** Proceed to **page 468**, procedure number FIL- 3.0.0.

**2)** **IF FILACT EVER = 1:** See parts a THROUGH e below:

a) **ENSURE** the female Air Sensor's Connector is plugged in PROPERLY! **If CBE equipped ENSURE the connector MUST cover ALL CBE board pins, especially the top pin!**



b) **WITHOUT pulling on the wires**, unplug the blue and brown wires from the probes at the top of Chamber #69.

c) Figure right, connect the wires together.

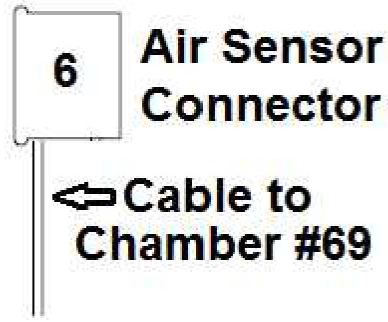
d) Allow thirty (30) seconds.

e) WITHOUT LOOKING AWAY, watch **FILACT** for one (1) minute! Does it remain always = 0?

Yes **FILACT** remains = 0! Leaving the wires connected together proceed to **page 468**, procedure number FIL- 3.0.0.

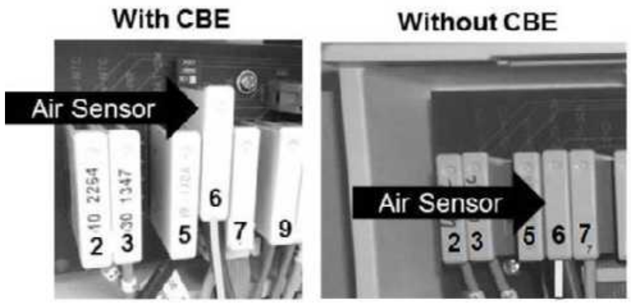
No **FILACT** = 1! See procedure number FIL- 2.4.4 (page 467)

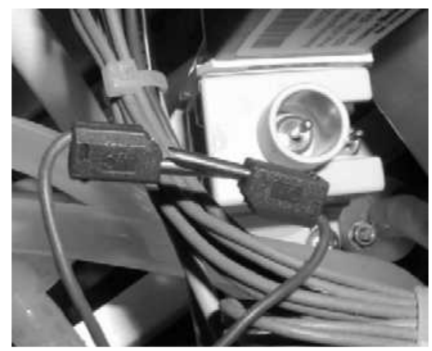
## FIL- 2.4.4 FILACT = 1




a) Swap in a known good Air Sensor Connector (Figure right).

b) **Figure below**, be **SURE** to plug the new Air Sensor's Connector into its distribution board position PROPERLY! If CBE equipped, using a flashlight, ENSURE the connector **covers ALL CBE board pins, especially the top pin!**



c) Figure right, connect the new Connector's wires together.

d) Return to Dialysis Program ("Select Program →'Dialysis' → 'Enter').

d) Allow thirty (30) seconds BEFORE continuing to part e.

e) Call debug screen 1. WITHOUT LOOKING AWAY, watch **FILACT** for two (2) minutes or until if it EVER = 1. TWO (2) possible scenarios:

**1)** **IF FILACT ALWAYS = 0:** Problem solved! The previous Air Sensor Connector is bad!

**2)** **IF FILACT EVER = 1:** Leaving the wires connected together perform parts A through E below:

A) **To avoid damage turn the machine OFF!**

B) SIX (6) possible bad components (see Component List below). One at a time, with the machine OFF, swap in each with known good then, in between, continue with parts C through E to test each new component until **FILACT** always = 0.

**Component List:** **1)** CBE board; **2)** Sensor board; **3)** Sensor board cable; **4)** Functional board ; **5**) Distribution board; **6)** Motherboard

C) If the time comes to swap in the Sensor or Functional board, for each board, to prevent "Cond Offset" Failure", place the machine into **T and C Mode** (refer to OPERATING MODES (page 19)).

D) Turn the machine on and return to Dialysis Program ("Select Program →'Dialysis' → 'Enter').

E) Call debug screen 1. Watch **FILACT** for three (3) minutes. If it REMAINS = 1 return to part A and swap in the next component in the list. When **FILACT** remains = 0 the last component swapped in is the problem.

**FIL- 3.0.0 FILACT = 0 / CREATE VENOUS PRESSURE**

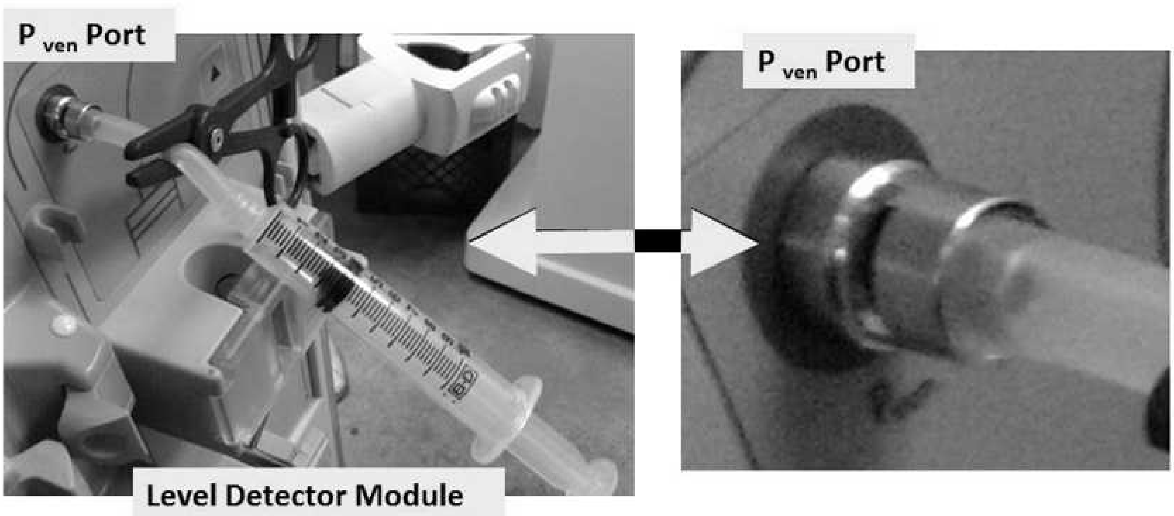
This procedure creates Venous Pressure to ensure Valve #25 remains open for the subsequent test:

a) **From the Home screen, set [Dialysate Flow] to "OFF" and press 'Enter'!**

b) Call debug screen 0. ENSURE all eight (8) balancing chamber valves (#31 through #38) 'dots' are REMAINING white (Flow is Off)!

c) **Dialysate Flow MUST REMAIN OFF till <u>instructed otherwise</u>!**

d) **Figure below**, attach a syringe, with a piece of tubing attached that will fit SNUG to the Level Detector's INNER $P_{ven}$ port.




e) Call debug screen 1.

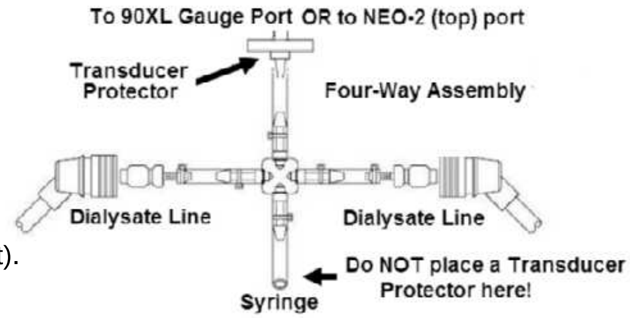
f) Push on the syringe plunger until **VEN** (middle column) is between 400 and 450.


g) Clamp the syringe tubing to keep the pressure!

h) If **VEN** falls more than three (3) mmHg in thirty (30) seconds there is a leak at the $P_{ven}$ port <u>OR</u> inside the module.

i) Leaving the clamp in place to keep **VEN** at more than 400, see procedure number FIL- 3.1.0 (page 469).

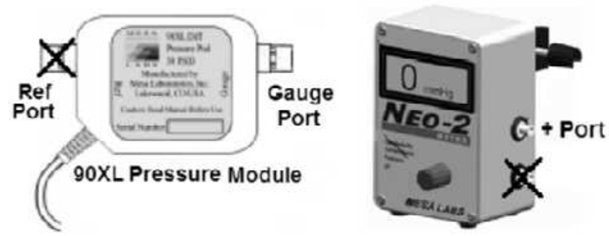
## FIL- 3.1.0 PRESSURE TEST HYDRAULICS (1)




a) Figure right, connect the Four-Way Assembly (P/N 150034) to the dialyzer connectors.

b) Place the Four-Way in the dialyzer holderl! ENSURE a transducer protector IS NOT in the 'to syringe' tubing segment!

c) If using a **NEO-2** attach to the +Port (top, red port). If using a **90XL** attach to the Pressure Module's Gauge Port.




d) DO NOT allow tension or kinks in the Four-Way tubing segments!

e) **CLOSE THE SHUNT DOOR!**

f) Call debug screen 2. To ENSURE the shunt door is closed **CVRCLS** (2nd column from left) = 1!


g) PULL on the syringe plunger. Can you achieve between -245 and -255 mmHg on the external meter?

Yes -250 mmHg achieved. Clamp the Four Ways's 'to syringe' tubing segment to hold the pressure then see procedure number FIL- 3.2.0 (page 469).

No -250 mmHg COULD NOT be achieved! ENSURE the transducer protector, at the meter, is not wet OR consider replacing it! If OKAY, see procedure number **FIL- 3.3.0X** (page 469).

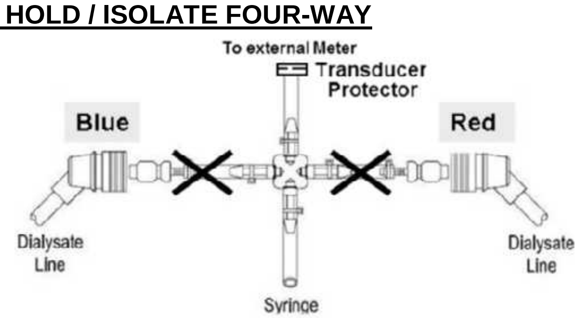
## FIL- 3.2.0 -250 ACHIEVED / PRESSURE TEST HYDRAULICS (2)

Watch the meter for one (1) minute. Does pressure HOLD +/- 15 mmHg for one (1) minute?

Yes Pressure holds! Proceed to **page 470,** procedure number FIL- 3.5.0.

No Pressure DOES NOT hold! See procedure number FIL- 3.3.0X (page 469).

## FIL- 3.3.0X PRESSURE NOT ACHIEVED OR DID NOT HOLD / ISOLATE FOUR-WAY




a) Figure right, clamp BOTH Four-Way Dialyzer Line tubing segments.

b) Can you achieve -250 mmHg and HOLD it (+/- 15 mmHg for one minute) now?

Yes -250 achieved and HOLDS! **IMPORTANT!** Remove BOTH clamps from both Four-Way Dialysate Line segments and proceed to **page 509**, procedure number TMP- 4.0.0

No Either the transducer protector at the meter is wet OR a Four-Way tubing connection is leaking. Locate and repair the problem then return to (ABOVE) procedure number FIL- 3.0.0 (**page 468**).

## FIL- 3.5.0 -250 MMHG HELD / ISOLATE VALVE #43 FLOW

a) **Return the dialyzer lines to the shunt and close the door!**

b) **From the Home screen, set [Dialysate Flow] to 300 ml/min and press 'Enter'!**

c) Figure right, separate the Air Sensor Connector's brown and blue wires. This eventually causes a Filling Program!

d) Obtain a 1000 ml (or larger) graduated cylinder!

e) Call debug screen 1. **Allow FILACT = 1!**


f) Figure right, if a 'Quick Connector' is used, at the end of the 'to drain' tubing an **adaptor** is required!

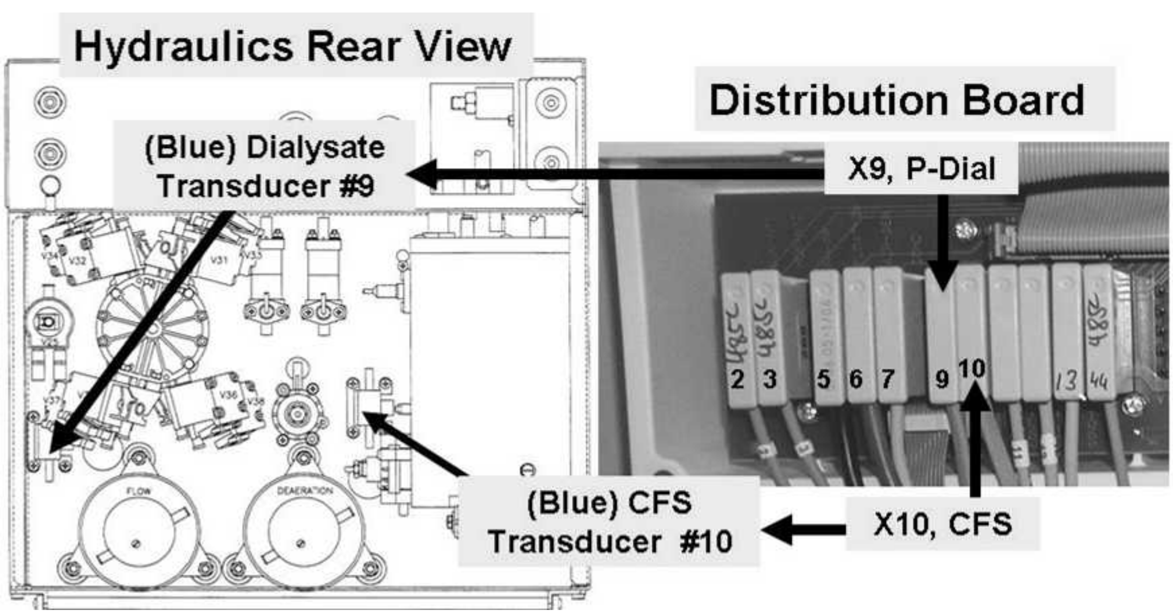
g) Measure drain flow for two (2) minutes. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) 600 ml or more collected:** See procedure number FIL- 3.6.0 (page 471).

**2)** **IF less than 600 ml collected:** ENSURING [Dialysate Flow] is set to 300 ml/min, perform parts a AND b below:

a) Figure below, CAREFULLY trace the wire harness from distribution board positions "X9, P-Dial" <u>AND</u> "X10, CFS" to ENSURE they terminate at the correct Pressure Transducer. **If NOT, this may be the problem!**

b) Proceed to **page 49,** procedure number F- 3.1.3



## FIL- 3.6.0 600 ML/MIN COLLECTED / VERIFY FILLING PROGRAM

a) Reconnect the machine's drain tubing to the station drain!

b) With [Dialysate Flow] set to 300 ml/min, ENSURE a good drain connection by either 'listening' for drain flow or visually verifying it!

c) **Return the Air Sensor Connector's wires to their male probes on top of Chamber #69 i.e. brown on top; blue on bottom!**

d) Set [Dialysate Flow] to **800 ml/min** and press 'Enter'!

e) Allow [**Conductivity**] to stabilize between 13.0 and 14.4 mS

f) Call debug screen 0. Allow Valve #24's 'dot' to turn blue.

g) Allow one (1) minute BEFORE continuing to part h.

h) Call debug screen 1. WITHOUT LOOKING AWAY, watch **FILACT** for up to two (2) minutes or until it EVER = 1 even just once. TWO (2) possible scenarios:

   **1)** **IF (and ONLY if) FILACT EVER = 1:** See procedure number FIL- 3.6.2 (page 472).

   **2)** **IF FILACT ALWAYS = 0:** Proceed to **page 474**, procedure number FIL- 4.0.0.

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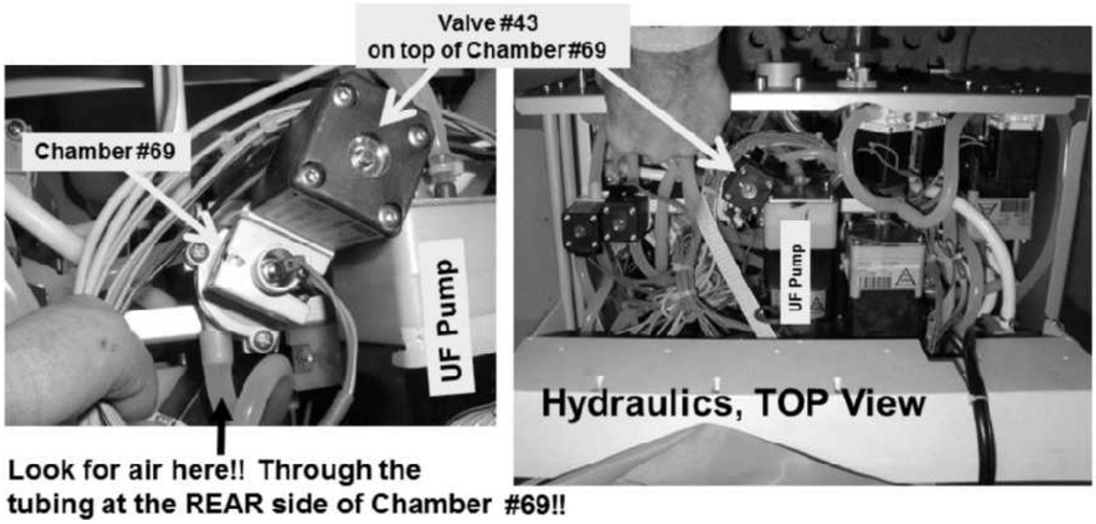
## FIL- 3.6.2 FILACT = 1 / CHECK FOR AIR AT CHAMBER #69

Figure below, watching for two (2) minutes, are air bubbles seen MOVING INTO Air Removal Chamber #69 now?




Yes Air seen! Proceed to **page 534,** SECTION 11 - INDUCED AIR LEAK TESTS to locate the source of the air leak!

No No air seen! Watch **FILACT** again for one (1) minute or until it EVER = 1! THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) FILACT always = 1 (NEVER = 0):** See procedure number FIL- 3.7.0 (page 473).

**2) IF (and ONLY if) FILACT now REMAINS = 0:** Proceed to **page 474**, procedure number FIL- 4.0.0

**3) IF FILACT cycles between 0 and 1:** A procedure, in different Section, is performed next. **NOTE** this page and procedure number (FIL- 3.6.2) as you may prompted to return here. Perform parts a THROUGH c below:

a) BEFORE continuing to part a, proceed to **page 572** to perform SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

b) If a leaking Balancing Chamber valve was not located in part a, return to Dialysis Program and, with [Dialyysate Flow] at 800 ml/min, wait until the external flow indicator's bob moves up and down (i.e. good Temp and Cond).

c) Call debug screen 1. Watch **FILACT** again for one (1) minute or until it EVER = 1. TWO (2) possible scenarios:

**1) IF FILACT EVER = 1:** See procedure number FIL- 3.7.0 (page 473).

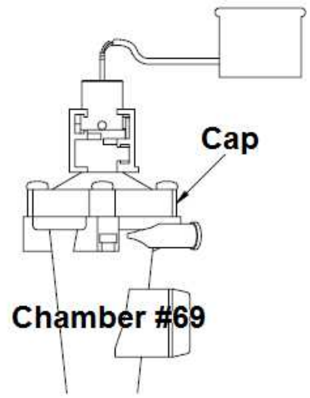
**2) IF FILACT ALWAYS = 0:** Proceed to **page 474**, procedure number FIL- 4.0.0

## FIL- 3.7.0 FILACT = 1 CONSTANT OR INTERMITTENT

A) **To avoid damage turn the machine OFF!**

B) SEVEN (7) possible bad components (see Component List below). One at a time, swap in each with known good then, in between, continue with parts C through H to test each new component until **FILACT** REMAINS = 0.

**Component List:** **1)** CBE board ; **2)** Sensor Board; **3)** Sensor Board cable; **4)** Functional Board ; **5**) Chamber #69's cap (Figure right); **6)** Distribution board; **7)** Motherboard




C) If the time comes to swap in the Sensor or Functional board, to prevent "Cond Offset" Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)).

D) If the time comes to swap in Chamber #69's cap BE SURE to attach the female Air Sensor's Connector's blue and wires to the new caps male probes.

E) Turn the machine on and return to Dialysis Program ("Select Program →'Dialysis' → 'Enter').

F) From the Home screen, allow [**Conductivity**] to increase to at least 13.0 mS.

G) Allow thirty (30) seconds BEFORE continuing to part H!

H) Call debug screen 1. Watch **FILACT** for three (3) minutes. If EVER = 1 return to part A and swap in the next component in the list. When **FILACT** remains = 0 the last component swapped in is the problem.

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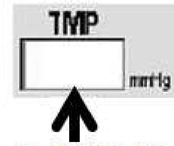
## FIL- 4.0.0 FILACT = 0 / FINAL 'FILLING PROGRAM' CHECKS



Red = TMP Alarm

Call the Home screen. If the **TMP** window is RED (Figure right) a TMP alarm is present. TWO (2) possible scenarios:

**1) IF (and ONLY if) the TMP window is WHITE:** See procedure number FIL- 4.0.2 (page 474).

**2) IF the TMP window is RED:** Perform parts a THROUGH d below:

a) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds.

b) Allow thirty (30) FULL seconds before continuing to part c!

c) If a TMP alarm reoccurs perform parts a and b up to twice more BEFORE continuing to part d.

d) Allow thirty (30) seconds then see procedure number FIL- 4.0.2 (page 474).

## FIL- 4.0.2 ISOLATE SPENT SIDE BALANCING CHAMBER LEAK

TMP is STABLE if the TMP window REMAINS white AND does NOT change more than 60 mmHg in three (3) minutes. TWO (2) possible scenarios:

**1) IF (and ONLY if) TMP is STABLE:** ASSUMING all procedures were performed correctly (i.e. no air seen at Chamber #69) AND if (and ONLY if) **FILACT** continues to = 1 intermittently, see (ABOVE) procedure number FIL- 3.7.0 (**page 473**).

**2) IF TMP is UNSTABLE:** See parts a THROUGH c below:

a) A procedure, in different Section, is performed next. **NOTE** this page and procedure number (FIL- 4.0.2) as you may prompted to return here.

b) Before continuing to part b, proceed to **page 572**, to perform SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

c) If balancing chamber valve leak WAS NOT located in part b, proceed to **page 483,** SECTION 9- TMP PROBLEMS

## FIL- 5.0.0 AIR SEEN AT CHAMBER #69

Call debug screen 1. Look at **FILACT** (middle column). TWO (2) possible scenarios:

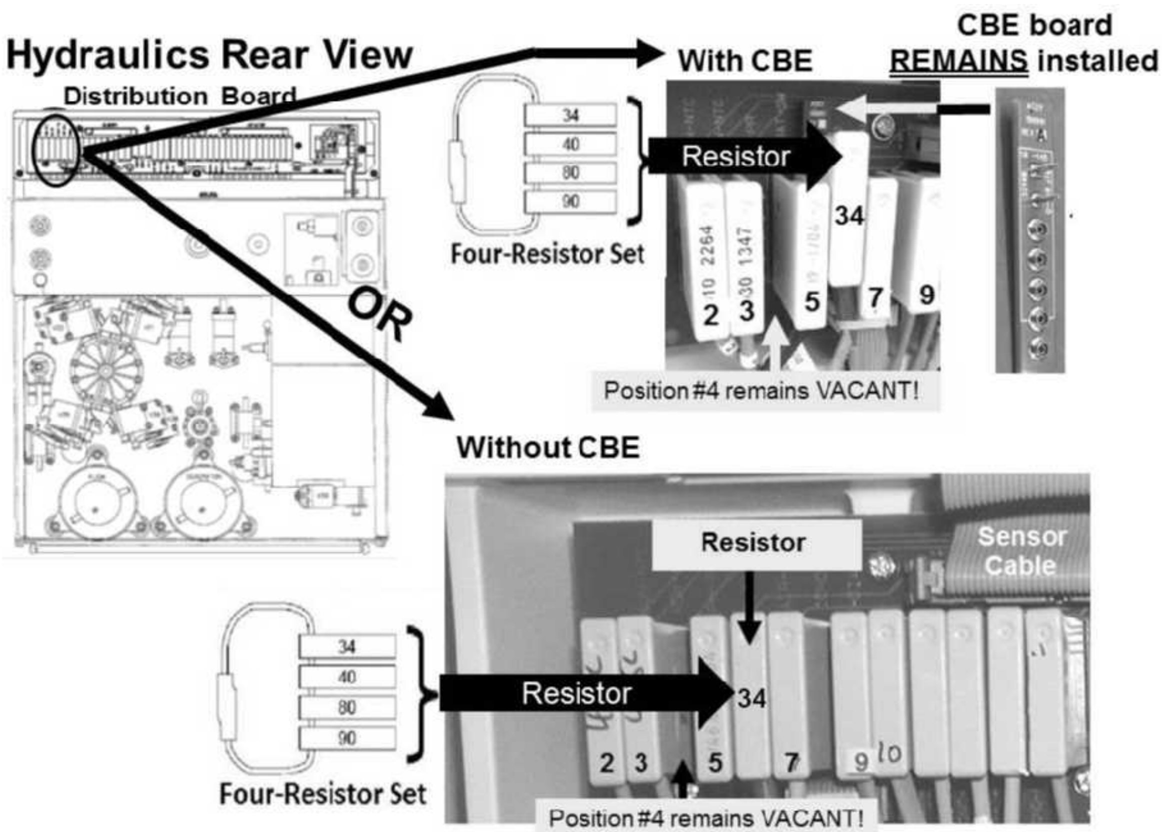
**1)** **IF (and ONLY if) FILACT = 0:** See procedure number FIL- 5.1.0 (page 476).

**2)** **IF FILACT = 1:** See parts a THROUGH c below:

a) **Figure below**, place one of the resistor plugs, from the **FOUR-RESISTOR SET** into Air Sensor Connector's distribution board position.

b) If (and ONLY if) the plug is placed PROPERLY **FILACT,** within two(2) minutes = 0 ALWAYS!

c) See procedure number FIL- 5.1.0 (page 476).



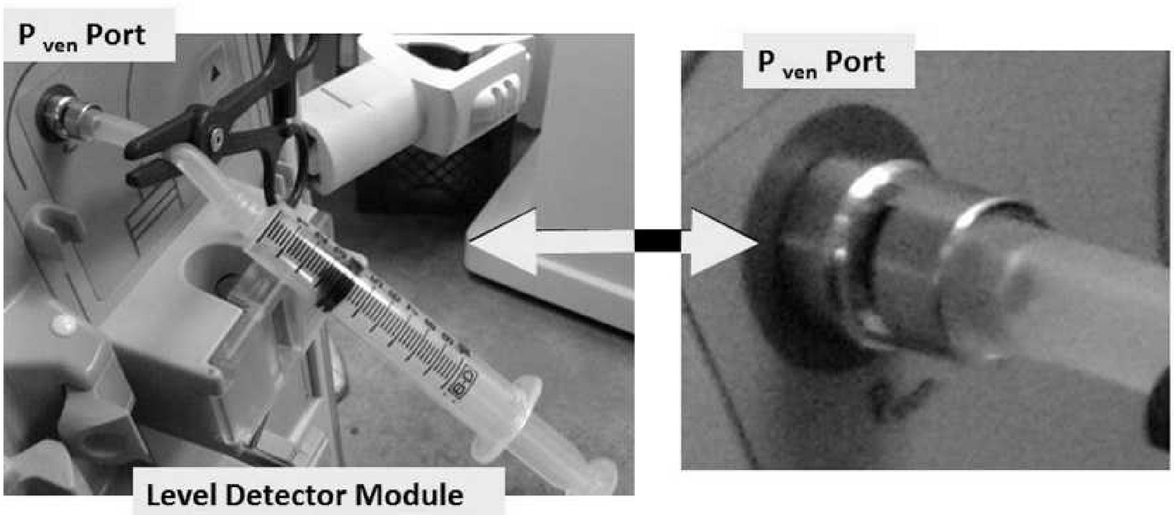
**FIL- 5.1.0 FILACT = 0 / ISOLATE VENOUS PRESSURE (VEN)**

a) **From the Home screen, set [Dialysate Flow] to "OFF" and press 'Enter'!**

b) Call debug screen 0. ENSURE all eight balancing chamber valves (#31 through #38) 'dots' are REMAINING white (Flow is Off)!

c) **Dialysate Flow MUST REMAIN OFF till instructed otherwise!**

d) **Per the Figure below**, attach a syringe with a piece of tubing attached that will fit SNUG to the Level Detector's INNER $P_{ven}$ port.




e) Call debug screen 1. Push on the syringe plunger until **VEN** (middle column) is between 400 and 450.


f) Clamp the syringe tubing to HOLD the pressure!

g) If **VEN** falls more than 3 mmHg in 30 seconds there is a leak at the $P_{ven}$ port OR inside the module.

h) Leaving the clamp in place to keep **VEN** at more than 400, see procedure number FIL- 5.2.0 (page 477).

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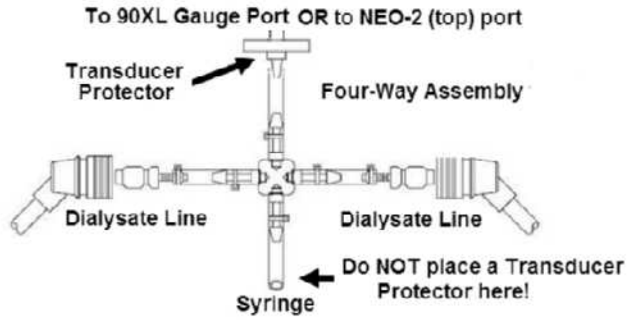
**FIL- 5.2.0 VEN MORE THAN 400**

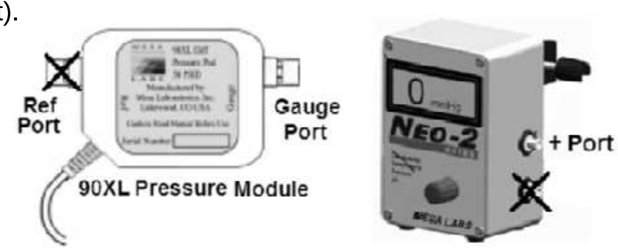



a) Figure right, connect the Four-Way Assembly (P/N 150034) to the dialyzer connectors.

b) Place the Four-Way in the dialyzer holder!

c) ENSURE a transducer protector IS NOT in the 'to syringe' tubing segment!

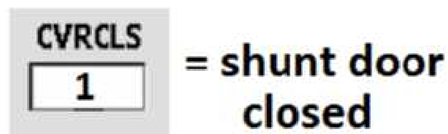
d) If using a **NEO-2** attach to the +Port (top, red port). If using a **90XL** attach to the Pressure Module's Gauge Port.




e) DO NOT allow tension or kinks in the Four-Way tubing segments!

f) **CLOSE THE SHUNT DOOR!**

g) Call debug screen 2. To ENSURE the shunt door is closed **CVRCLS** ($2^{nd}$ column from left) = 1!




h) PULL on the syringe plunger. Can you achieve between -245 and -255 mmHg on the external meter?

Yes -250 mmHg achieved! Clamp the four ways's 'to syringe' tubing segment to keep the pressure then see procedure number FIL- 5.3.0 (page 477).

No COULD NOT achieve 250 mmHg! ENSURE the transducer protector, at the meter, is not wet OR consider replacing it. If OKAY, proceed to **page 478**, procedure number FIL- 5.4.0.

**FIL- 5.3.0 -250 ACHIEVED / PRESSURE TEST HYDRAULICS (2)**

Watch for one (1) FULL minute. Does pressure HOLD +/- 15 mmHg?

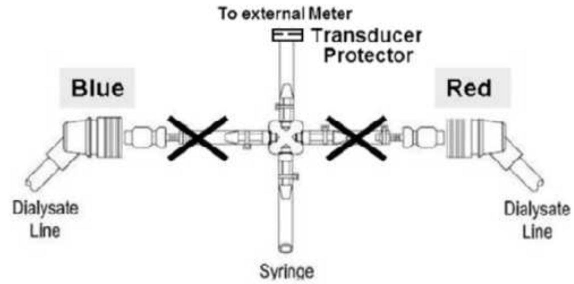
Yes Pressure holds! Proceed to **page 479**, procedure number FIL- 5.5.0.

No Pressure DOES NOT hold! See procedure number FIL- 5.4.0 (page 478).

**FIL- 5.4.0 -250 NOT ACHIEVED OR IT DID NOT HOLD / ISOLATE FOUR-WAY**

a) Figure right, clamp BOTH Four-Way Dialyzer Line tubing segments.

b) Can you achieve -250 mmHg and HOLD it (+/- 15 mmHg for one minute) now?




Yes -250 achieved and HOLDS! **IMPORTANT!** Remove BOTH clamps from both Four-Way Dialysate Line segments and, leaving [Dialysate Flow] off, proceed to **page 509**, procedure number TMP- 4.0.0.

No CANNOT achieve or hold -250! Either the transducer protector at the meter is wet OR a Four-Way tubing connection is leaking! See parts A and B below!

A) Locate and repair the leak.

B) Return to (ABOVE) procedure number FIL- 5.2.0 (**page 477**).

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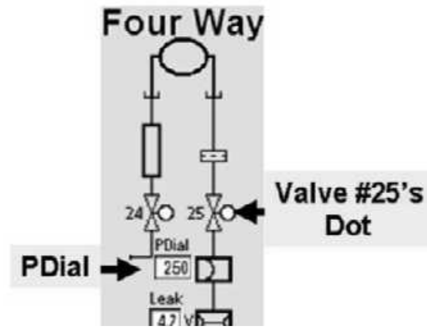
**FIL- 5.5.0 -250 MMHG HOLDS**




a) Call debug screen 0.

b) Figure right, if (and ONLY if) Valve #25's 'dot' is BLUE continue to part c. If NOT blue return to (ABOVE) procedure number FIL- 5.1.0 (page 476).

c) Figure right, look at screen 0's **PDial** data window. TWO (2) possible scenarios:

1) **IF (and ONLY if) PDial AGREES with the external meter within +/- 35:** Proceed to **page 482**, procedure number FIL- 7.0.0.

2) **IF PDial DOES NOT agree with the external meter within +/- 35:** See procedure number FIL- 6.0.0 (page 480).

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## FIL- 6.0.0 PDIAL DOES NOT AGREE WITH THE METER

a) To prevent wetting the meter's transducer protector clamp the 'to meter' tubing segment!

b) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter'.

c) Enter Service Mode → Calibrate Sensors → Dialysate Pressure. The screen says **"1. Connect a pressure gauge in line…"**. The "gauge" (meter) is ALREADY connected!

d) ENSURE the external flow indicator's 'bob' is moving up and down.

e) Press 'Enter'. The screen says **"3. Press the [Dialysate Flow on/off] key…".**

f) Press the screen's "Dialysate Flow On" button, it turns dark blue

g) Press 'Enter'! ENSURE the button says "Dialysate Flow Off" AND the external flow indicator is NOT moving (Flow is off).

h) Remove the clamp from the external meter's tubing segment!

i) Using the syringe, adjust pressure until the external meter reads 0 +/- 2 mmHg.

j) See procedure number FIL- 6.1.0 (page 480).

## FIL- 6.1.0 CREATE NEGATIVE PRESSURE

a) Press 'Enter'. The screen now says **"6. Pressurize until dialysate pressure reads -250 mmHg….".**

b) PULL on the syringe plunger to achieve between – 245 and -255 mmHg on the external meter.

c) Clamp the Four-Way's syringe tubing to **hold** this pressure!

d) ENSURE the external meter = -250 +/- 5 mmHg

e) Press 'Enter'.

f) Figure right, TWO (2) possible scenarios based on if an "Operator Error" banner occurs:


**1) IF (and ONLY if) an "Operator Error" occurred:** See procedure number FIL 6.2.0 (page 481).

**2) IF "Operator Error" did NOT occur:** See parts a AND b below:

a) Press 'Enter' twice to save the calibration.

b) Proceed to **page 482**, procedure number FIL- 7.0.0.

## FIL- 6.2.0 "OPERATOR ERROR" OCCURRED / TROUBLESHOOT DIALYSATE PRESSURE

a) ENSURE the transducer protector, at the external meter, is not WET or consider replacing it!

b) Return the Dialysate lines to the shunt and close the door.

c) Turn the machine OFF.

d) Turn the machie on and return to Dialysis Program ("Select Program" →'Dialysis' → 'Enter')!

e) From the Home screen, press the [Dialysate Flow] window.

f) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

g) **Read before performing!** Return to (ABOVE) procedure number FIL- 6.0.0 (**page 480**). If (and ONLY if) you return to FIL- 6.2.0, because "Operator Error" reoccurs, one at a time, swap in the listed components (see Component List below), and in between, return to procedure number FIL- 6.0.0 (page 480) until "Operator Error" does not reoccur indicating the last component swapped in is the problem.

**Component List**: **1)** Dialysate Pressure Transducer #9[a]; **2)** Sensor Board[b]; **3)** Actuator-Test Board; **4)** Functional Board; **5)** Sensor Board cable; **6)** Distribution board.

[a] To LOCATE Transducer #9 refer to Figure 6 (page 22).

[b] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

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**FIL- 7.0.0  ISOLATE AIR LEAK**

a) Remove the Four-Way.

b) **Return the Dialyzer lines to the shunt door!**

c) Turn the machine OFF then back on!

d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

e) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'

f) Allow [Conductivity] to increase to more than 13.0 mS!

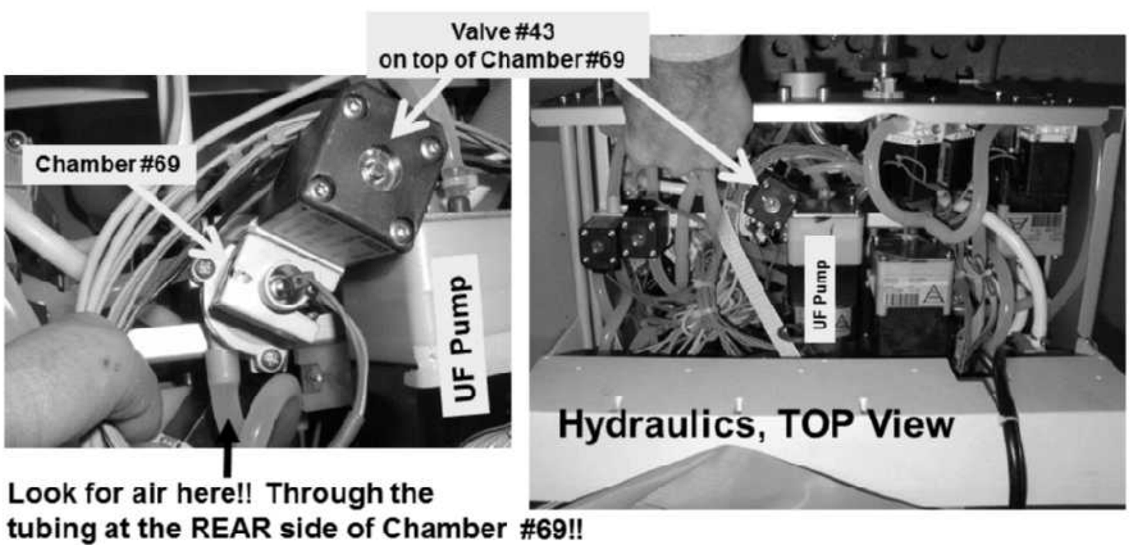
g) Figure below, is air still seen at Chamber #69?

Yes   Air seen! Proceed to **page 534**, SECTION 11 - INDUCED AIR LEAK TESTS

No air seen!  Call debug screen 1. WITHOUT LOOKING AWAY watch **FILACT** (middle column) for up to two (2) minutes. If EVER = 1, even just once, indicates a Filling Program! TWO (2) possible scenarios:

**1) IF FILACT EVER = 1:** Return to ABOVE procedure number FIL- 2.1.0 (**page 464**).

**2) IF FILACT <u>ALWAYS</u> = 0:** Problem solved!

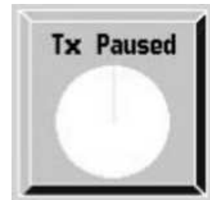


# SECTION 9 - TMP PROBLEMS

A) If the drain tubing is transparent, look through its ENTIRE length for bio-growth restrictions.

B) Call the Home screen. [**Venous Pressure**] MUST BE between -10 and 10 mmHg!

C) The Treatment Clock (Figure right) MUST be off i.e. “Tx Paused”!

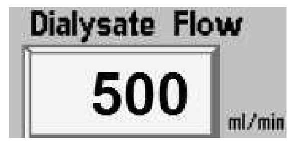



D) ENSURE [Dialysate Flow] has been on and set to at least 500 ml/min, for six (6) minutes.

E) If the Automated Tests are running (screen reads “Test:….”) allow them to finish!

F) **Remove the ‘dummy venous chamber’ from the Level Detector module till instructed!**

G) Press the [Dialysate Flow] window!




H) Set [Dialysate Flow] to 500 ml/min and press ‘Enter’.

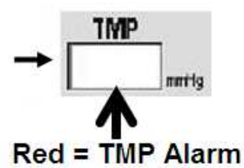
I) **DO NOT reset alarms till instructed!**

J) Is the external flow indicator’s ‘bob’ moving at least ¼ up the sight tube?

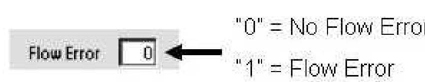
Yes ‘Bob’ moving! See procedure number TMP- 1.0.0 (page 485).

No a) **OPEN THE SHUNT DOOR AND LEAVE IT OPEN TILL INSTRUCTED!**

b) If the TMP window is NOT RED see part K. If RED: **A)** Press and release the ‘Reset’ key then immediately press and hold it for three (3) seconds; **B)** Allow thirty (30) seconds; **B)** If a TMP alarm reoccurs attempt RESET up to twice BEFORE continuing to part K!




K) Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** for two (2) minutes. If EVER = 1, even just once, indicates a masked Flow Error! TWO (2) scenarios:




**1)** **IF (and ONLY if) Flow Error ALWAYS = 0!** See part L!

**2)** **IF Flow Error EVER = 1:** Proceed to **page 23**, SECTION 1, FLOW ERRORS IN DIALYSIS PROGRAM.

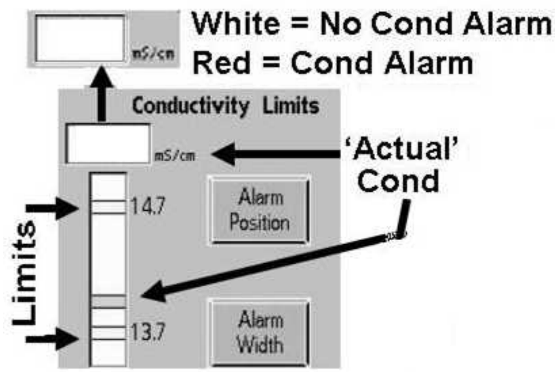
L) Call the Home screen. [**Temperature**] MUST be STABLE***** between 35.0 and 38.9° C; [**Conductivity**] MUST be STABLE***** between 13.0 and 14.5 mS!

***** STABLE = NOT changing more than 0.2 per minute!

M) At the bottom of the screen, press the ‘Dialysate’ tab!

**Parts N through U next page**

N) Figure right, if necessary adjust the Conductivity Limits until ‘Actual’ Conductivity is CENTERED between them.

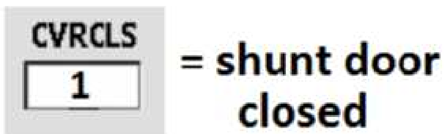



O) Press ‘Enter’.

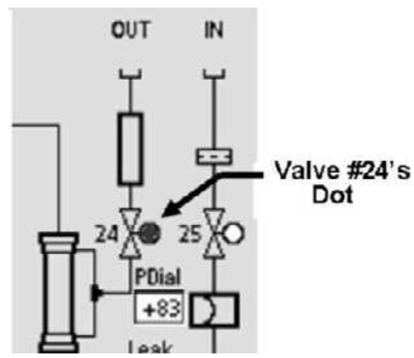
P) Allow up to three (3) minutes for the Conductivity window to turn white i.e. no Cond alarms!

Q) **CLOSE THE SHUNT DOOR!**

R) Call debug screen 2. To ENSURE the shunt door is indicated closed **CVRCLS** (2nd column from left) = 1!




S) Call debug screen 0.




T) Figure right, allow Valve #24’s ‘dot’ to REMAIN blue BEFORE continuing to part U indicating no Temp, Cond or bi*b*ag alarms!

U) Is the flow indicator’s ‘bob’ moving at least ¼ way up in the sight tube now?

Yes ‘Bob’ moving! See procedure number TMP- 1.0.0 (page 485).

No ‘Bob’ NOT moving! See parts a THROUGH c below:

a) From the Home screen, ENSURE [Dialysate Flow] remained at 500 ml/min!

b) From debug screen 0. ENSURE Valve #24’s ‘dot’ is **REMAINING** BLUE!

c) Is the flow indicator’s ‘bob’ rising now?

Yes ‘Bob’ moving! See procedure number TMP- 1.0.0 (page 485).

No ‘Bob’ NOT moving! ENSURE Valve #24’s ‘dot’ is REMAINING BLUE! If (and ONLY if) ‘bob’ is still NOT moving, proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

**TMP- 1.0.0 'BOB MOVING' / ISOLATE POSSIBLE AIR LEAK**

a) Small air leaks cause BIG problems! TWO (2) checks. Be THROUGH!

**CHECK #1:** Using a flashlight, ENSURE no air bubbles, moving into the machine, through the acid and bicarb inlet tubing! If air is seen there is a problem with a concentrate connector!

**CHECK #2:** ENSURE the external flow indicator's (sight tube) fittings are tight!

b) Call debug screen 1. WITHOUT LOOKING AWAY, watch **FILACT** (middle column) for two (2) minutes. It EVER = 1, even just once, indicates a Filling Program! TWO (2) possible scenarios:


1) **IF (and ONLY if) FILACT EVER = 1:** Proceed to **page 453**, procedure number FIL- 1.0.0.

2) **IF FILACT ALWAYS = 0:** Call debug screen 4 to see **PDIA** (left column) AND **ADIA** (right column). BOTH must be REMAINING between 2.0 and 7.5. TWO (2) possible scenarios:


1) **IF (and ONLY if) PDIA AND ADIA REMAINING between 2.0 and 7.5:** Proceed to **page 487**, procedure number TMP- 1.0.3.

2) **IF PDIA AND / OR ADIA is IS NOT remaining between 2.0 and 7.5:** See parts a THROUGH e below:

a) Momentarily plug the acid concentrate into its rinse port to call "Select Program"!

b) Return the connector FIRMLY to acid!

c) Press the screen's 'Dialysis' button but **DO NOT press 'Confirm' or 'Enter' till instructed!**

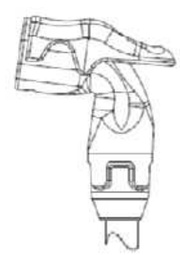
d) Call debug screen 0. If parts a through c were performed correctly the TOP balancing chamber valves, #31 through #34, 'dots' REMAIN BLUE!

e) Call debug screen 4 to watch **PDIA** (left column) AND **ADIA** (right column) for one (1) minute. TWO (2) possible scenarios:

1) **IF (and ONLY if) PDIA AND ADIA are remaining between 3.0 and 6.0 AND DO NOT change more than 0.1 i.e. stable:** See procedure number TMP- 1.0.2 (page 486).

2) **IF PDIA AND / OR ADIA is IS NOT between 3.0 and 6.0 OR is NOT stable:** See parts a AND b below:

a) Remove the red DIALYZER connector from the shunt door and HOLD IT UP as seen in the Figure right!



**Part b next page**

**PDIA OR ADIA is IS NOT between 3.0 and 6.0 OR is NOT stable continued:**

b) Continuous flow, more than 0.2 ml per minute, from the connector?

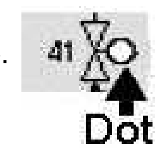
Yes Continuous flow! **A)** Return the connector to the shunt and close the door; **B)** Turn the machine OFF; **C)** Proceed to **page 572**, SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

No flow! See parts a THROUGH c below:

a) **Return the connector to the shunt AND close door!**

b) Call debug screen 0 to ENSURE the TOP balancing chamber valves are REMAINING BLUE!

c) Figure right, watch Valve #41's 'dot' for one (1) minute. It should stay white! TWO (2) possible scenarios:




**1)** **IF (and ONLY if) Valve #41's 'dot' STAYS white!** Proceed to **page 505**, procedure number TMP- 3.0.0.

**2)** **IF Valve #41's 'dot' cycles between white and blue:** **A)** Turn the machine OFF! **B)** Proceed to **page 572**, SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

## TMP- 1.0.2 PDIA AND ADIA STABLE BETWEEN 3.0 AND 7.0

a) At the bottom of the screen, press the 'Dialysate' tab.

b) Press 'Enter'.

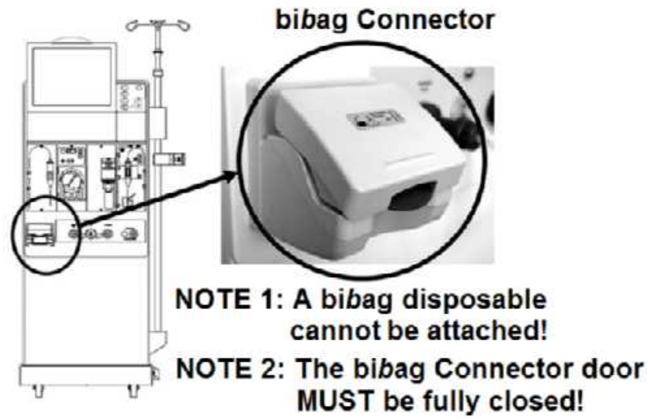
c) Figure right, if (and ONLY if) the screen's 'status' bar is NOT BLANK see procedure number TMP- 1.0.3 (page 487). If BLANK repeat parts a and b!

**Blank Status Bar (no text)**


LEFT BLANK INTENTIONALLY

## TMP- 1.0.3 BI*BAG* EQUIPPED?

Figure right, TWO (2) possible scenarios:




1) **IF (and ONLY if) NOT equipped with bi*bag* Connector:** See procedure number TMP- 1.0.4 (page 487).

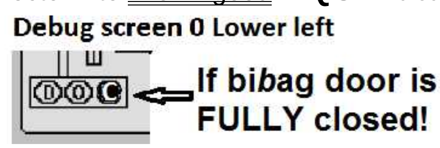
2) **IF equipped with a bi*bag* Connector:** Is a disposable bi*bag* (pouch) attached? (Yes or No)?

Yes bi*bag* attached!

a) Without turning [Dialysate Flow] off, remove the bi*bag*!

b) Plug the BLUE concentrate connector into known good **LIQUID** bicarb!

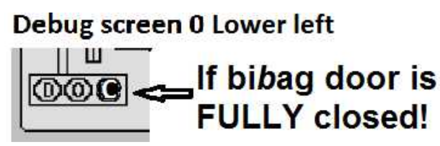
c) Call debug screen 0. Figure right, ENSURE the bi*bag* door is shown closed!




d) See procedure number TMP- 1.0.4 (page 487).

No

a) Call debug screen 0. Figure right, ENSURE the bi*bag* door is shown closed!




b) See procedure number TMP- 1.0.4 (page 487).

## TMP- 1.0.4 ISOLATE LOADING PRESSURE

a) **ENSURE** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it!

b) **SLAM*** the gauge into the red Acetate/Acid rinse port. * ELSE pressure will not be read correctly!

c) Loading Pressure is 'OKAY' if it achieves a PEAK of between 23 and 25 psi AND never cycles below 11 psi.

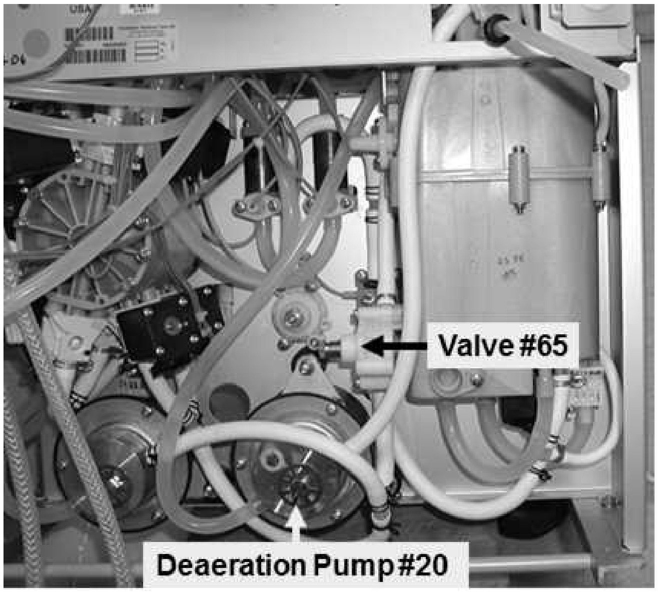
d) Watch the gauge for one (1) FULL minute. FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

**1) IF (and ONLY if) pressure REMAINS 'OKAY':** See procedure number TMP- 1.0.5 (page 488).

**2) IF (and ONLY if) peaking to MORE THAN 26 psi:** Turn Valve #65's nut (see Figure next page) counterclockwise (outward). If PEAK pressure CAN be adjusted to between 23 and 26 psi, see procedure number TMP- 1.0.5 (page 488). If (and ONLY if) it CANNOT Valve #65 may be bad.

**3) IF (and ONLY if) peaks to between 18 and 22 AND is NEVER less than 11 psi:** Adjust Valve #65's nut (see Figure next page). Clockwise increases pressure! If (and ONLY if) PEAK pressure CAN be adjusted to between 23 and 25 psi proceed to **page 489**, procedure number TMP- 2.0.0. If it CANNOT proceed to **page 33,** procedure number F- 1.0.7.

**4) ALL other scenarios:** ENSURING the gauge was SLAMMED into the Rinse Port proceed to **page 33**, procedure number F- 1.0.7.




**TMP- 1.0.5 LOADING PRESSURE OKAY / ISOLATE AIR REMOVAL SYSTEM**

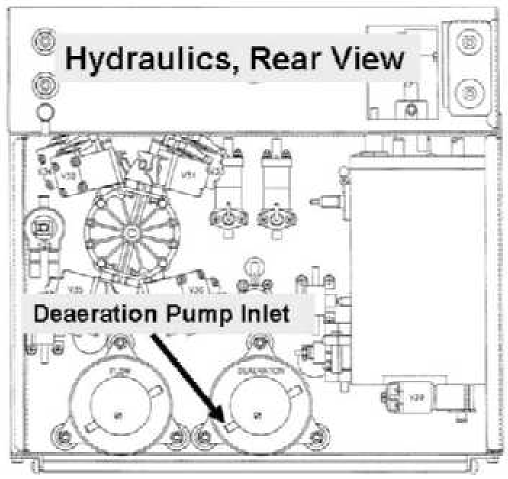
a) **Turn the water OFF!**

b) The Deaeration gauge is used next. **ENSURE** it reads 0 inHg before installing it!

c) Allow a “No Water” alarm to occur THEN, after one (1) minute, the deaeration motor stops.

d) Figure right, tee the gauge into the Inlet (clear tubing) side of the Deaeration Pump.

e) **Turn the water on and allow the “No Water” alarm to go away!**




f) Is Deaeration Pressure OKAY? Refer to Appendix A (page 757) for what pressure should be.

Yes Deaeration pressure OKAY! See procedure number TMP- 2.0.0 (page 489).

No Deaeration Pressure in NOT OKAY! ENSURING a “No Water” alarm is NOT presenting, NOTE this page number, as you will return here, THEN proceed to **page 543**, SECTION 13 - DEAERATION PROBLEMS.

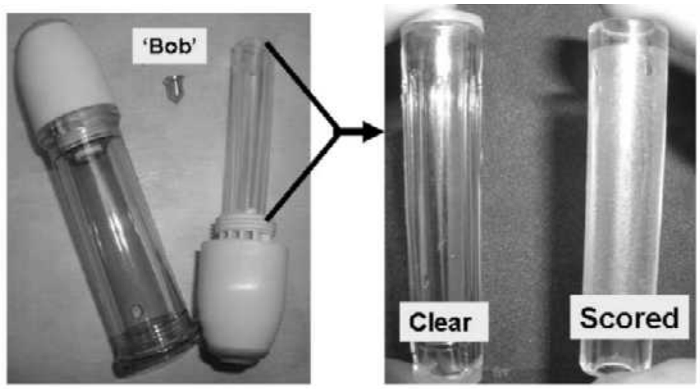
TMP- 2.0.0 DEAERATION PRESSURE OKAY

a) **Turn the water OFF!**

b) Figure right, ENSURE the external flow indicator's inner tapered tube is NOT scored (i.e. tube really 'cloudy'). **If scored, replace it!**

c) Allow a "No Water" alarm to occur THEN, after one (1) minute, the deaeration motor stops.

d) Remove the Deaeration gauge and reattach the tubing!




e) **Turn the water on and allow the "No Water" alarm to go away!**

f) Remove the hydraulic compartment from the cabinet!

g) Return BOTH concentrate connectors to their rinse ports.

h) **Place the machine into RINSE to pressurize the secondary hydraulic circuit! ENSURE a "No Water" alarm does NOT occur!**

i) Unless a leak is immediately seen allow one (1) minute BEFORE continuing to procedure number TMP- 2.0.1 (page 490).

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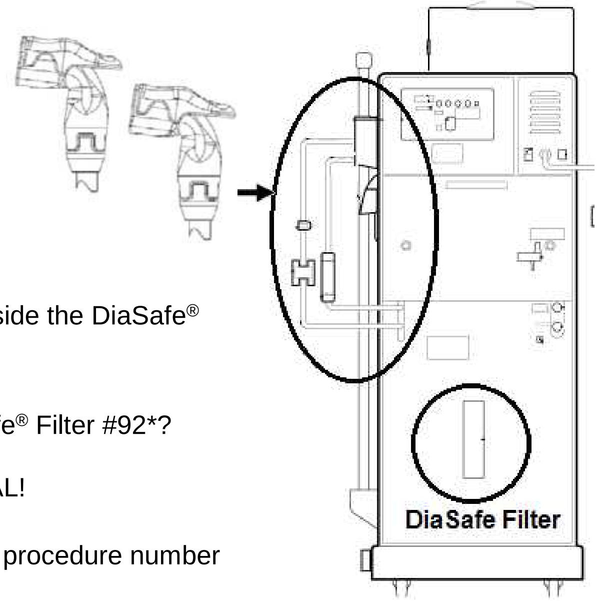
**TMP- 2.0.1 POSITIVE PRESSURE LEAK CHECKS**

Small external leaks cause BIG problems! For the following USE A FLASHLIGHT! FEEL AROUND!
**NOTE!** Not being THROUGH may cost unnecessary troubleshooting time!




a) THREE (3) external leak checks:

**CHECK #1:** Figure right, the ENTIRE LENGTH of the dialyzer lines and ESPECIALLY the Dialyzer connectors!

**CHECK #2:** The ENTIRE hydraulic compartment!

**CHECK #3:** Figure right, ENSURE no leaks from inside the DiaSafe® Filter housing and its tubing

b) Figure below, any water seen coming through Diasafe® Filter #92*?

* Water staying inside the filter is NORMAL!

Yes Valve #28 is leaking! Proceed to **page 516**, procedure number TMP- 9.0.0.

No fluid seen! See procedure number TMP- 2.0.2 (page 491).

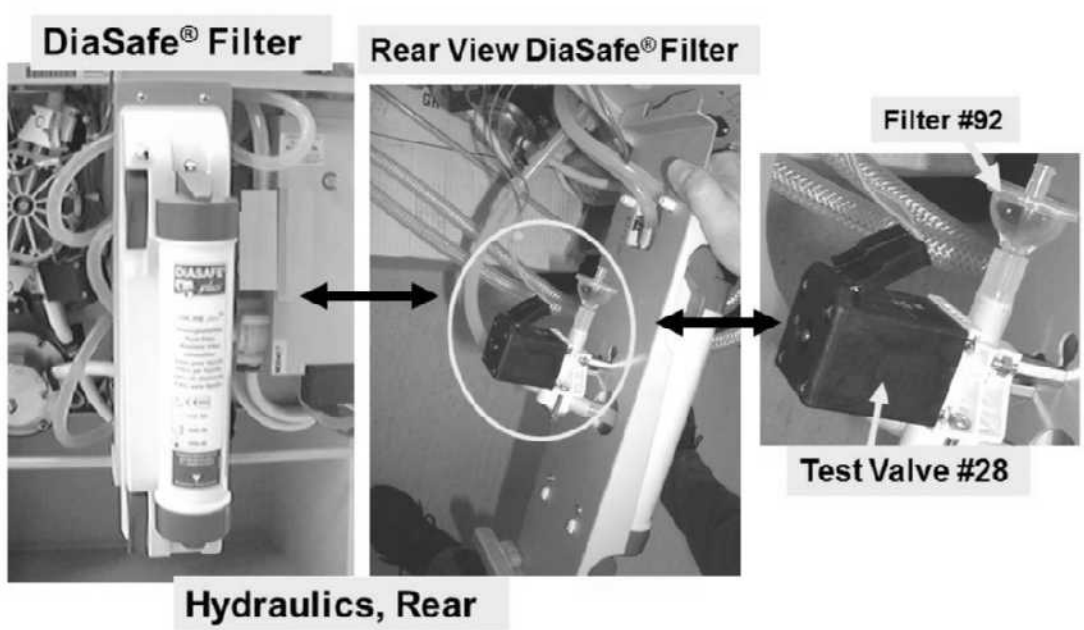



**Figure 68 – DiaSafe® Filter / Test Valve #28 / Filter #92**

## TMP- 2.0.2 POSITIVE PRESSURE LEAK TEST CONTINUED

a) Figure below, ENSURE no leaks at the UF, Acid and Bicarbonate (Bic) Pumps!

b) See procedure number TMP- 2.0.3 (page 492).

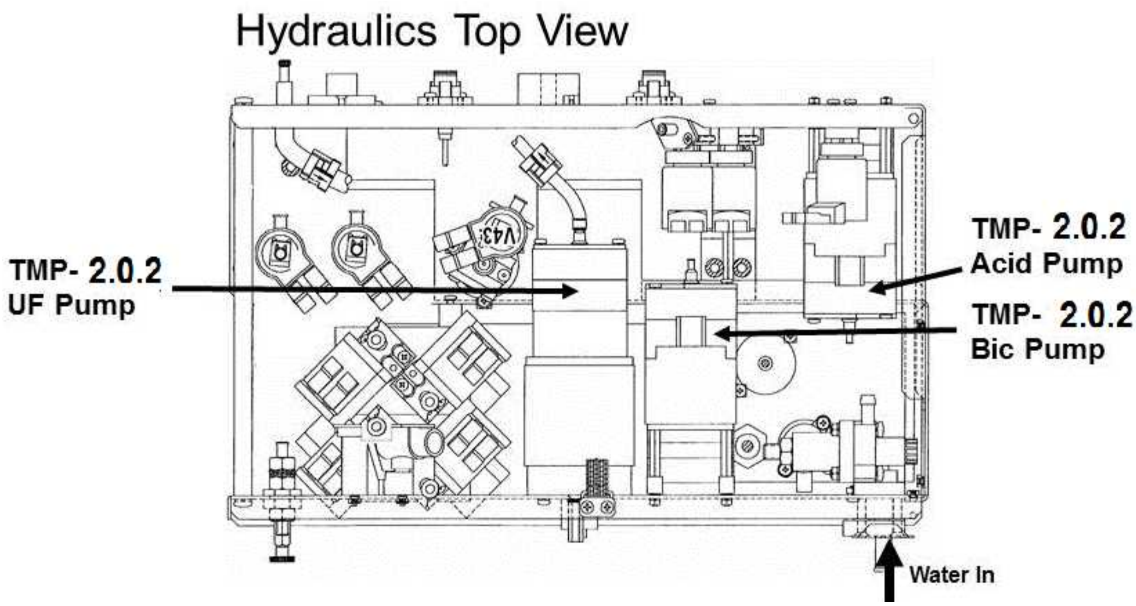



**Figure 69 – Hydraulics Top View, Pumps**

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## TMP- 2.0.3 NO EXTERNAL PUMP LEAKS / ISOLATE FILLING PROGRAM (FILACT)

a) Return the connectors to acid and bicarb.

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter)!


c) Call debug screen 1. Is **FILACT** (middle column) = 1?

Yes **FILACT** = 1! Proceed to **page 495**, procedure number TMP- 2.0.5.

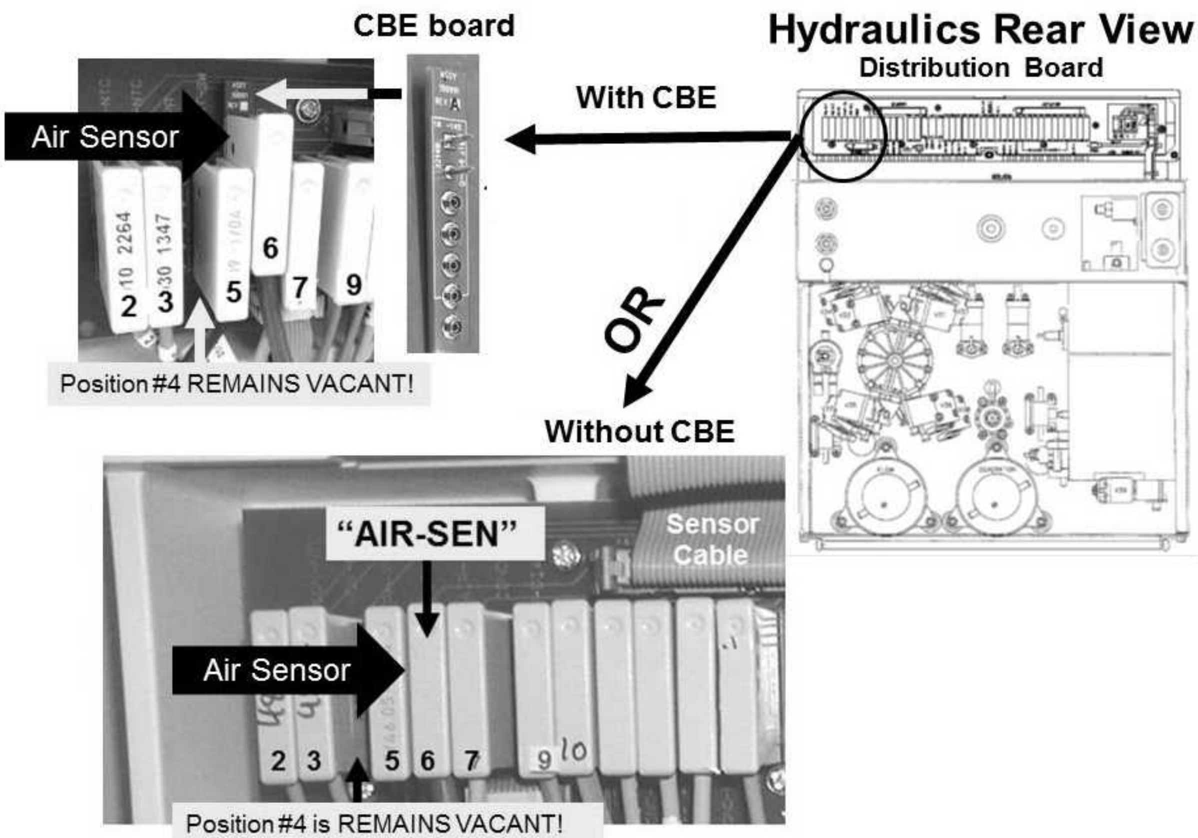
No **FILACT** = 0! See parts a THROUGH e below:

a) **Figure below,** inside the distribution board, the Air Sensor's female Connector i.e. **4th** CONNECTOR, **5th** position from the LEFT. **NOTE!** If the machine is CBE equipped the Connector plugs into the CBE board which positions it two pins higher than the other connectors!

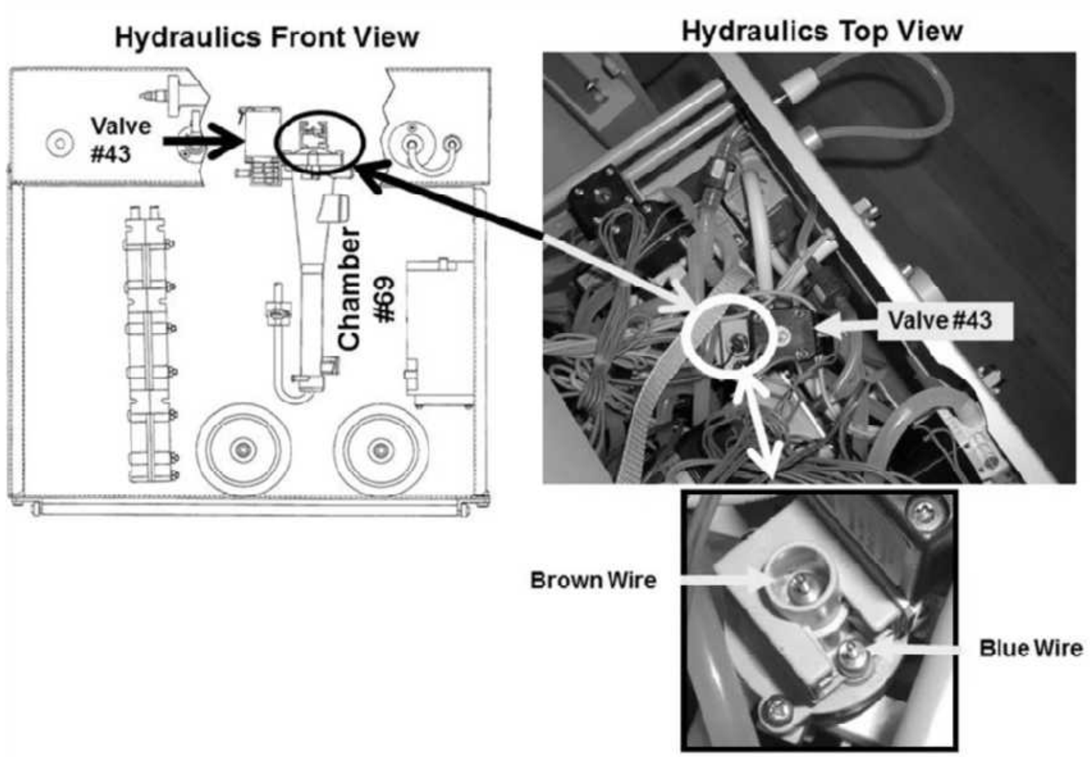
b) Unplug the female Air Sensor's connector but **DO NOT** remove the 'CBE board'!

c) **Leave the Air Sensor's connector unplugged till instructed!**

**Parts d and e next page**



d) Figure below, at Chamber #69, ENSURE the Air Sensor Connectors wires terminates with the brown wire to the TOP male probe; the blue wire to the bottom probe**!**




b) Allow up to three (3) minutes. Does **FILACT** go to 1?

Yes **FILACT** = 1! Perform part A and B below:

**A)** Return the Air Sensor's female connector PROPERLY to its distribution board position! If CBE equipped, using a flashlight, ENSURE the top CBE board pin is covered by the connector!

**B)** Proceed to **page 495**, procedure number TMP- 2.0.5

No **FILACT** remains = 0! **NOT LIKELY!** ENSURE the Air Sensor's distribution board position (5th position from the left) is VACANT! After three (3) minutes, if (and ONLY if) **FILACT** remains = 0 see procedure number TMP- 2.0.4 (page 494).

**TMP- 2.0.4 FILACT REMAINING = 0**

a) **Turn the machine OFF to prevent damage!**

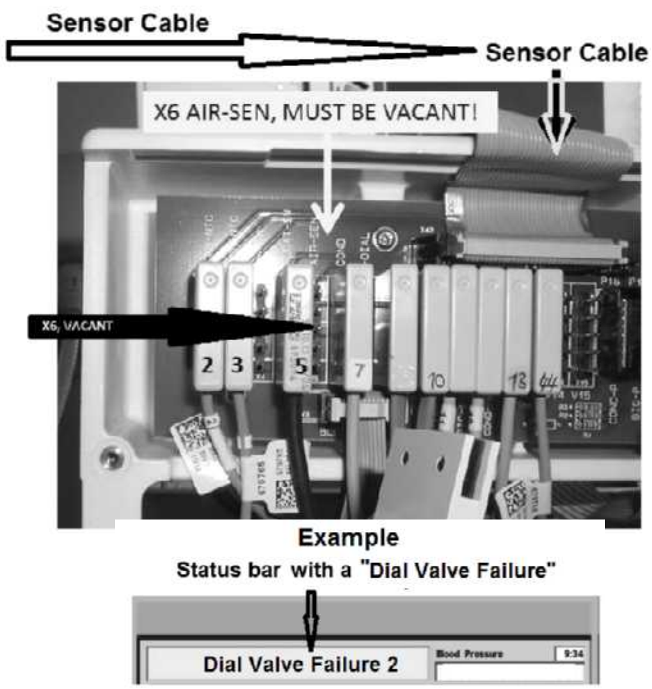
b) **Figure right**, at the TOP of the distribution board, ENSURE the Sensor ribbon cable is plugged in SECURELY.

c) **Figure right**, ENSURE Female Air Sensor's CONNECTOR is NOT plugged in!

d) Turn the machine on and return to Dialysis Program ("Select Program → 'Dialysis' → 'Enter')!

e) Allow three (3) minutes BEFORE continuing to part g!

f) Figure right, from here forward, if (and ONLY if) a "Dial Valve Failure" OR "Act Byp Valve Fail" banner EVER appears proceed to **page 711**, Section 26




g) Call debug screen 1 to see **FILACT**. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) FILACT now = 1: A)** Return the Air Sensor's female connector PROPERLY to its distribution board position; **B)** See procedure number TMP- 2.0.5 (page 495).

**2)** **IF FILACT REMAINS = 0:** Perform parts a AND b below:

a) BEFORE continuing to part b, NOTE this page number then perform INITIAL CHECKS (page 7)!

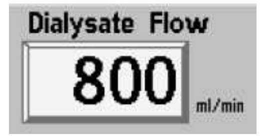
b) **With the Air Sensor's Connector remaining unplugged until FILACT = 1**!, FIVE (5) possible bad components: **1)** CBE board; **2)** Sensor Board *; **3)** Functional Board**; **4)** Distribution board; **5)** Motherboard.

* **A)** With the machine off, swap in a known good Sensor Board (see Figure 4A, page 10): **B)** Place the machine into **T and C Mode** (refer to OPERATING MODES, page 19); **C)** With the Air Sensor's Connector remaining unplugged, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **D)** From debug screen 1, if **FILACT** = 1 now the previous Sensor Board is bad.

** **A)** With the machine off, swap in a known good Functional Board (see Figure 4A, page 10) then; **B)** Place the new Functional Board into **T and C Mode; C)** With the Air Sensor's Connector remaining unplugged, return to Dialysis Program; **D)** From debug screen 1, if **FILACT** = 1 now the previous Functional Board is bad.

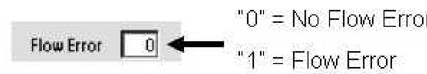
**TMP- 2.0.5 FILACT WAS OR IS = 1**

This procedure ENSURES Valve #43 is not sticking closed AND allows **Conductivity** to increase:




a) From the Home screen, press the [Dialysate Flow] window!

b) Set [Dialysate Flow] to 800 ml/min and press 'Enter'!




c) Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** for three (3) minutes. It should NEVER = 1! TWO (2) possible scenarios:

**1)** **IF (and ONLY if) Flow Error EVER = 1 even if only once:** Proceed to **page 23**, SECTION 1, FLOW ERRORS IN DIALYSIS PROGRAM.

**2)** **IF Flow Error ALWAYS = 0!** See parts a THROUGH e below

a) From the Home screen, allow [**Conductivity]** to stabilize between 13.0 and 14.5 mS!

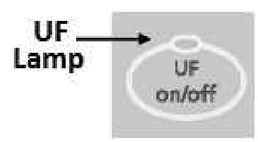
b) Call debug screen 1. Allow **FILACT** = 0 ALWAYS. **NOTE!** If **FILACT** DOES NOT = 0, after two (2) minutes, most likely the female Air Sensor connector IS NOT plugged in PROPERLY!

c) **Open the shunt door and LEAVE IT OPEN till instructed!**

d) **Install a 'dummy venous chamber' in the Level Detector module!**

e) ***TMP ALARM RESET SEQUENCE*: i)** Press and release the 'Reset' key then immediately press and hold it for three (3) seconds; **ii)** Allow thirty (30) seconds; **iii)** If ANY alarm occurs attempt RESET up to twice more BEFORE continuing to procedure number TMP- 2.0.6 (page 495)).

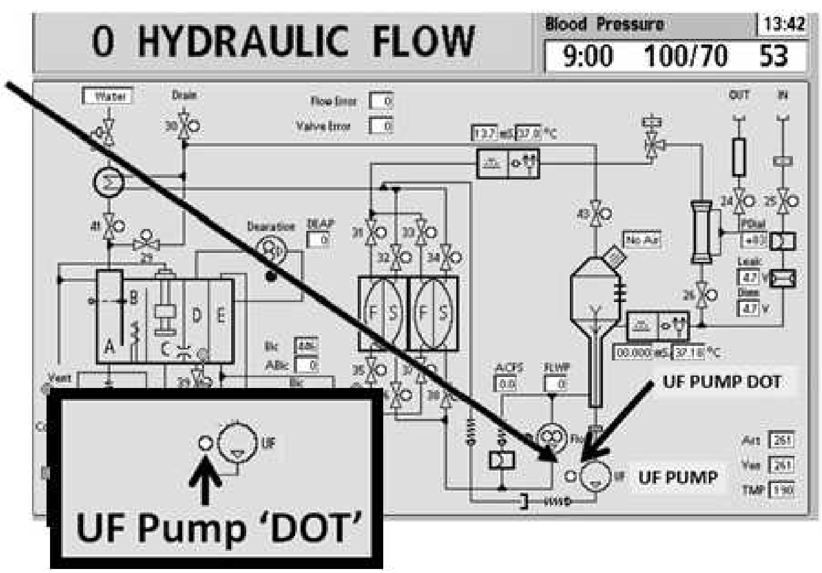
**TMP- 2.0.6 ISOLATE UF PUMP CONTROL / UF PUMP LEAK**




a) Figure right, ENSURE the lamp above the front panel's UF on/off key is **OFF** i.e. UF is OFF!

b) Call debug screen 0.

c) **Figure right**, WITHOUT LOOKING AWAY, watch the UF Pump's 'dot' for forty five (45) seconds. It should REMAIN white. Does it EVER 'blink' to blue (Yes or No)?



Yes UF 'dot' blinks blue! If SURE the green UF lamp was OFF, the Actuator-Test Board may be bad!

No The 'dot' REMAINS white! See parts a and b below:

a) **Figure below**, remove the UF Pump's output (TOP) tubing!

b) Look at the UF Pump's nozzle! TWO (2) possible scenarios:

**1)** **IF (and ONLY if) NO fluid output from the nozzle! A)** Reattach the tubing! **B)** See procedure number TMP- 2.0.7 (page 496).

**2)** **IF fluid output from the nozzle!** TWO (2) possibilities: **1)** The UF Pump is upside down! OR; **2)** Incorrectly installed OR bad UF Pump seals/springs.

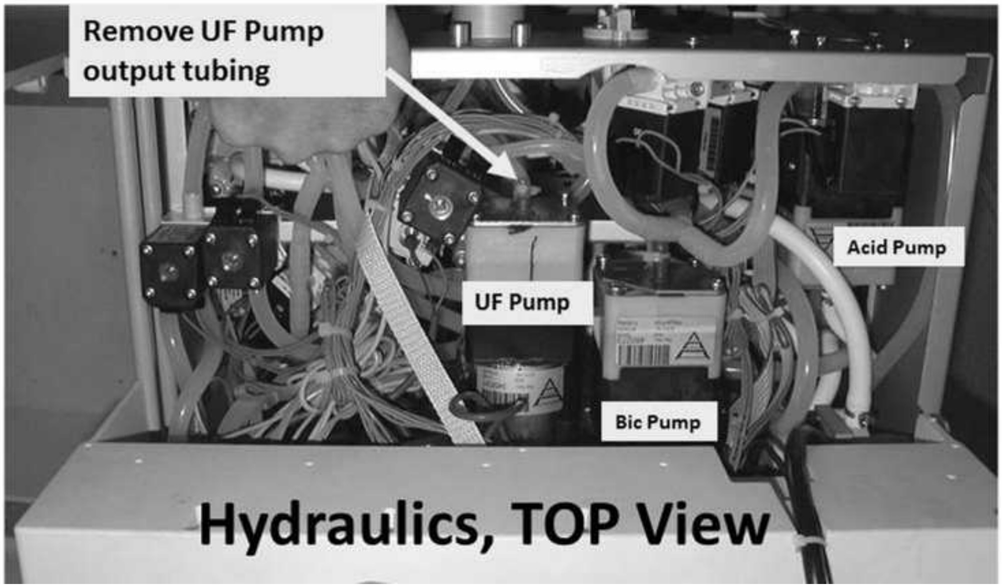



**Figure 70 – UF Pump OUTPUT**

**TMP- 2.0.7 NO UF PUMP LEAKS**

a) **CLOSE the shunt door!**

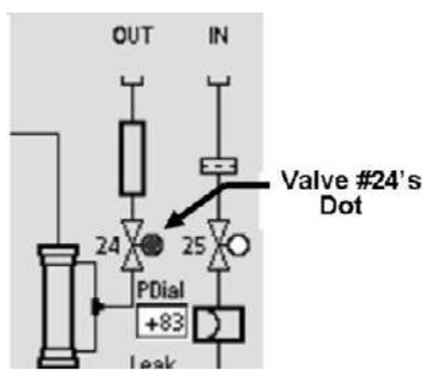
b) **Remove the 'dummy chamber' from the Level Detector module!**

c) From debug screen 0, Figure right, allow Valve #24's 'dot' to REMAIN BLUE i.e. normal AND stable Temp, AND shunt door closed!

d) The external flow indicator's 'bob' MUST be moving up and down (out of bypass)!

e) Call debug screen 1. Watch **FILACT** for thirty (30) seconds to ENSURE it = 0 ALWAYS.

f) See procedure number TMP- 2.0.8 (page 497).



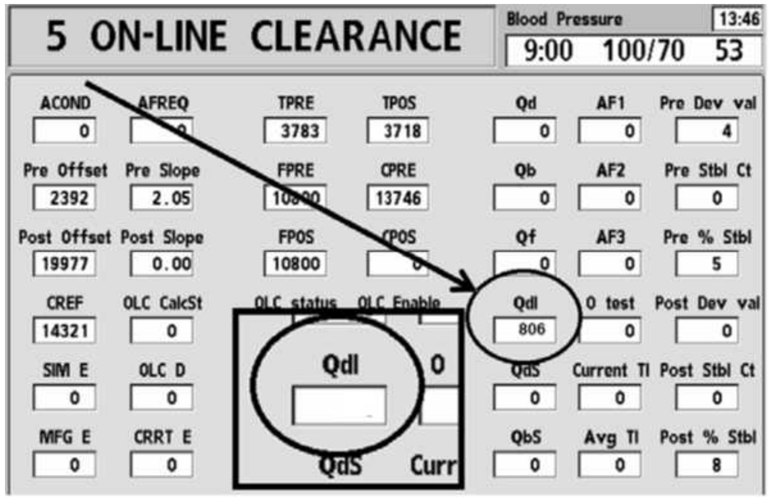
## TMP- 2.0.8 ISOLATE ACCURATE DIALYSATE FLOW

a) Press the keyboard's "1" key for five (5) seconds.

b) **Allow forty five (45) seconds, BEFORE continuing to part c!**

c) Call debug screen 5. Figure right, **Qdl** REMAINS between 720 and 880 unless there is a Flow problem

d) Watch **Qdl** for two (2) minutes OR until if it EVER becomes less than 720 or more than 880! Does it REMAIN between 720 and 880?




Yes **Qdl** REMAINS between 720 and 880! See procedure number TMP- 2.0.9 (page 497).

No **Qdl** DOES NOT REMAIN between 720 and 880! See parts a THROUGH c below:

a) Call the Home screen to ENSURE [Dialysate Flow] remains at 800 ml/min!

b) Press the "1" key for five (5) seconds THEN allow forty five (45) seconds BEFORE continuing to part c!

c) Return to debug screen 5. Does **Qdl** NOW REMAIN between 720 and 880 ml/min?

Yes REMAINS between 720 and 880! See procedure number TMP- 2.0.9 (page 497).

No DOES NOT remain between 720 and 880! Call debug screen 0 to watch **Flow Error** for three (3) minutes. If it EVER = 1 proceed to **page 23**, SECTION 1- FLOW ERRORS IN DIALYSIS PROGRAM. If ALWAYS = 0 a restriction is indicated. Try replacing the DiaSafe® filter, rinse the machine for five (5) minutes, then return to (ABOVE) procedure number TMP- 2.0.5 (page 495). If you return here there may a restriction to the drain.

## TMP- 2.0.9 QDL REMAINING BETWEEN 720 AND 880

Call the Home screen. Is the TMP window REMAINING white?

Yes REMAINING white! Proceed to **page 499**, procedure number TMP- 2.0.16.

No TMP window is RED! See parts a AND b below:

a) Attempt the TMP ALARM RESET SEQUENCE up to twice BEFORE continuing to part b.

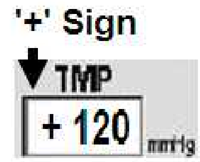
b) Allow thirty (30) seconds! What color is the TMP window now? TWO (2) possible scenarios next page:

1) **IF REMAINING WHITE:** Proceed to **page 499**, procedure number TMP- 2.0.16.

2) **IF RED:** See procedure number TMP- 2.0.10 (page 498).

**TMP- 2.0.10 TMP WINDOW RED**

a) TMP is UNSTABLE if ANY one or more of the three (3) following conditions occur:




**Condition #1:** Figure right, if a positive ('+') sign***** appears.

***** If a '+' sign DOES NOT appear TMP is negative!

**Condition #2:** If TMP DOES NOT remain between 0 and negative 450 mmHg (i.e. no '+' sign)

**Condition #3:** If TMP changes more than 40 mmHg in one (1) minute

b) Is TMP UNSTABLE?

Yes **TMP** is unstable! Proceed to **page 499**, procedure number TMP- 2.0.16.

No **TMP** is STABLE! i.e. no '+' sign AND TMP is between 0 and 450 AND DOES NOT change more than 40. See procedure number TMP- 2.0.11 (page 498).

**TMP- 2.0.11 TMP IS STABLE BUT ITS WINDOW IS RED**

a) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds.

b) Allow thirty (30) seconds. What color is the TMP window now? TWO (2) possible scenarios:

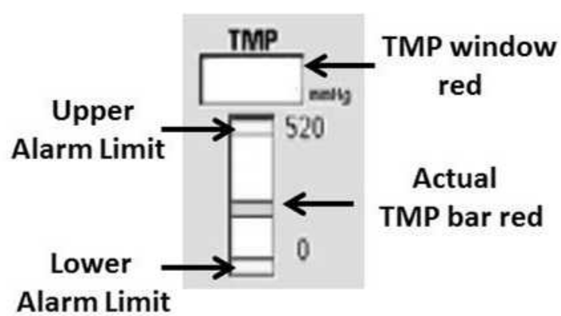
**1) IF WHITE:** See procedure number TMP- 2.0.16 (page 499).

**2) IF RED:** See parts a AND b below:

a) Per the Figure right, ENSURE **BOTH CONDITIONS** below exist**:**

**Condition #1:** The Actual TMP bar is remaining BETWEEN the Upper (@ 520) and Lower (@ 0) Alarm Limits!

**Condition #2:** The TMP window is RED!




b) If (and ONLY if) BOTH conditions exist AND after multiple RESET attempts the TMP window remains RED, FOUR (4) possible bad components: **1)** Actuator-Test Board OR; **2)** Sensor Board[1] OR; **3**) Functional Board[1] OR; **4)** Motherboard.

[1] To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page 19).

## TMP- 2.0.16 ISOLATE TMP

a) Call the Home screen!

b) **Set the [Dialysate Flow] window to "OFF" and press 'Enter'!**

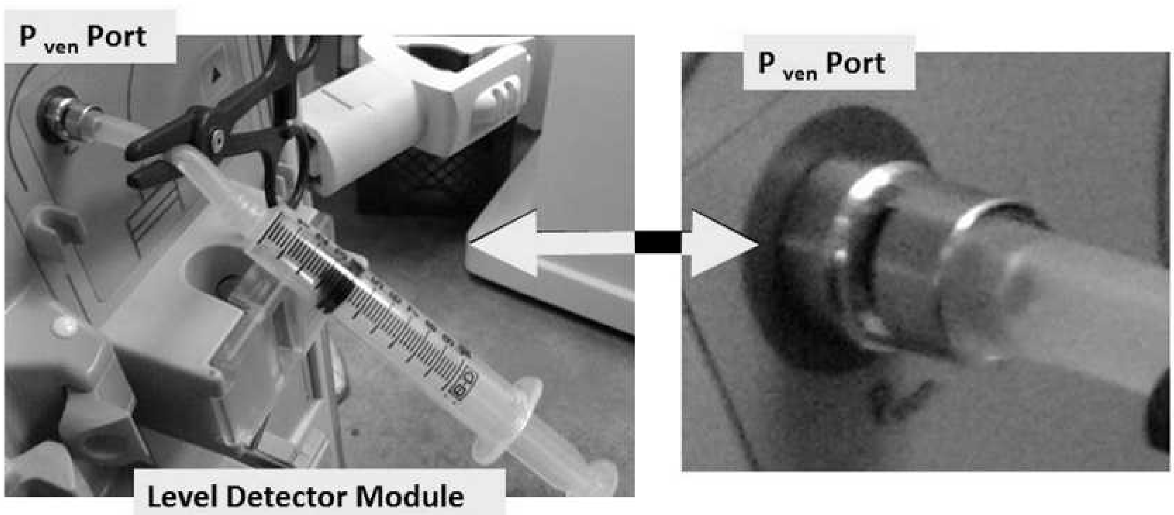
c) Call debug screen 0. If all (8) Balancing Chamber Valve 'dots' (#31 - #38) are REMAINING WHITE i.e. Dialysate Flow is "OFF" see part d! If the Balancing Chamber Valve 'dots' are NOT remaining white allow debug screen 1's **FILACT** = 0 then they will!

d) **Leaving Flow OFF <u>till instructed</u>**, see procedure number TMP- 2.0.17 (page 499).

## TMP- 2.0.17 ISOLATE VENOUS PRESSURE

This procedure creates Venous Pressure (**VEN**) to keep Valve #25 open for subsequent tests!

a) Figures below, attach a syringe with a piece of tubing attached that will fit SNUG to the Level Detector's INNER $P_{ven}$ port.




b) Call debug screen 1. Push on the syringe plunger until **VEN** (middle column) is between 400 and 450.


c) Clamp the 'to syringe' tubing segment to HOLD the pressure!

d) If **VEN** falls more than 3 mmHg in thirty (30) seconds there is a leak at the $P_{ven}$ port OR inside the module.

e) Leaving the clamp in place to keep **VEN** more than 400 see procedure number TMP- 2.2.5 (page 500).

**TMP- 2.2.5 ACHIEVE NEGATIVE PRESSURE**

a) Figure right, connect the Four-Way Assembly (P/N 150034) to the dialyzer connectors.

b) ENSURE a transducer protector IS NOT in the Four-Way's 'to syringe' tubing segment.

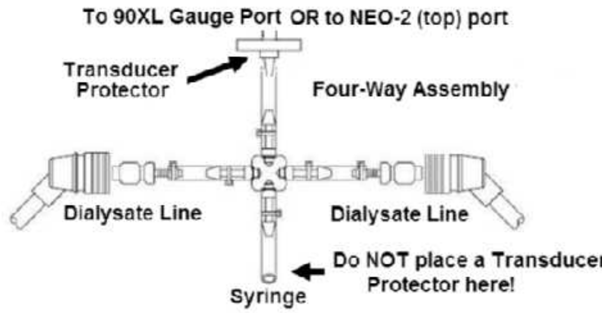
c) Place the Four-Way into the dialyzer holder!

d) If using a **NEO-2** attach to the + (top, red) port. If using a **90XL** attach to the module's Gauge Port!

e) DO NOT allow tension or kinks in the Four-Way tubing segments!

f) **CLOSE THE SHUNT DOOR!**

g) Call debug screen 2. To ENSURE the shunt door is indicated closed **CVRCLS** = 1!






h) PULL on the syringe plunger. Can you achieve between -245 and -255 mmHg on the meter?

Yes -250 +/- 5 mmHg achieved! Clamp the 'to syringe' tubing segment to HOLD the pressure then see procedure number TMP- 2.2.6 (page 500).

No CANNOT achieve -250 +/- 5 mmHg! ENSURE the transducer protector, at the meter, is not wet OR consider replacing it! If OKAY, see procedure number **TMP- 2.2.7X** (page 500).

**TMP- 2.2.6 NEGATIVE (–)250 ACHIEVED / NEGATIVE PRESSURE HOLDING TEST**

Does meter pressure HOLD, +/- 15 mmHg, for one (1) minute?

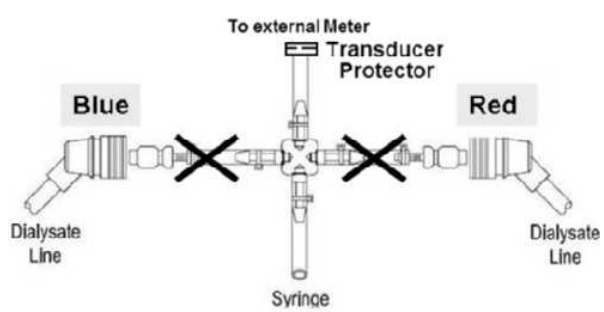
Yes Pressure HOLDS! Proceed to **page 502**, procedure number TMP- 2.2.8.

No Pressure DOES NOT hold! See procedure number TMP- 2.2.7X (page 500).

**TMP- 2.2.7X -250 COULD NOT BE ACHIEVED OR IT DID NOT HOLD / ISOLATE FOUR-WAY**

a) Figure right, clamp BOTH Four-Way Dialyzer Line tubing segments.

b) Can you achieve between -245 and -255 mmHg AND HOLD it (+/- 15 mmHg) for one (1) minute now?



Yes -250 mmHg holds! **A) IMPORTANT!** Remove the clamps from both Four-Way tubing segments then; **B)** Leaving [Dialysate Flow] off, proceed to **page 509**, procedure number TMP- 4.0.0.

No -250 could not be achieved or it DID NOT hold! Either the transducer protector is wet OR a Four-Way assembly tubing connection is leaking! See parts A and B below:

A) Locate and repair the leak. Consider using another Four-Way assembly!

B) Return to (ABOVE) procedure number TMP- 2.0.16 (page 499).

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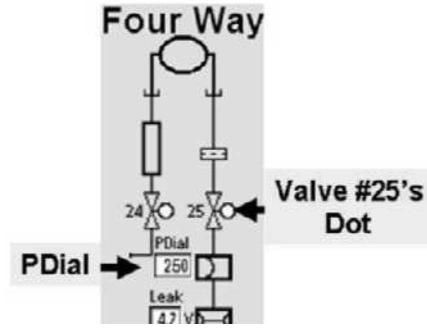
### TMP- 2.2.8 -250 mmHg HOLDING / ISOLATE DIALYSATE PRESSURE (PDIAL)




a) ENSURING the external meter remains about -250 mmHg, call debug screen 0.

b) Figure right, if (and ONLY if) Valve #25's 'dot' is BLUE continue to part c. If NOT blue, return to (ABOVE) procedure number TMP- 2.0.17 (**page 499**).

c) Figure right, look at screen 0's **PDial** data window. TWO (2) possible scenarios:

1) **IF (and ONLY if) PDial AGREES with the external meter within +/- 30:** See procedure number TMP- 2.3.0 (page 502).

2) **IF PDial DOES NOT agree with the external meter within +/- 30:** Proceed to **page 513**, procedure number TMP- 6.0.0.

### TMP- 2.3.0 CHECK PDIAL TO 520 mmHg

a) PULL on the syringe plunger to create negative pressure.

b) Clamp the 'to syringe' tubing segment.

c) Remove the syringe then reattach it.

d) PULL again. Can you make screen 0's **PDial** reach at least **-**520 mmHg?

Yes -520 at **PDial!** See procedure number TMP- 2.3.1 (page 502).

No Cannot achieve -520! Proceed to **page 513**, procedure number TMP- 6.0.0.

### TMP- 2.3.1 CHECK PDIAL ZERO

a) Remove the syringe and ALL clamps to open the four way to atmosphere!

b) ENSURING the transducer protector, at the meter, is NOT wet, does screen 0's **PDial =** 0 +/- 40?

Yes **PDial** = 0 +/- 40! See procedure number TMP- 2.3.2 (page 503).

No **PDial** IS NOT between 0 and 40! Proceed to **page 513**, procedure number TMP- 6.0.0.

## TMP- 2.3.2 POSITIVE PRESSURE TEST

a) CLAMP the external meter's tubing segment! **The external meter is invalid during the next test!**

b) SLOWLY PUSH on the syringe plunger until screen 0's **PDial** is between positive (+)300 and (+)325! **WARNING! DO NOT exceed +325 mmHg!**

c) Clamp the Four-Way Assemblies 'to syringe' tubing segment. Does **PDial** HOLD +/- 25 for one (1) minute (Yes or No)?

Yes **PDial** HOLDS +/- 25 mmHg per minute! See parts a AND b below:

a) **Return the dialyzer lines to the shunt and CLOSE THE DOOR!**

b) Proceed to **page 504**, procedure number TMP- 2.3.4.

No **PDial** does DOES NOT hold! See procedure number TMP- 2.3.3 (page 503).

## TMP- 2.3.3 PDIAL DOES NOT HOLD / ISOLATE POSITIVE PRESSURE LEAK

a) Return the dialyzer lines to the shunt AND CLOSE THE DOOR!

b) A procedure, in a different Section, is performed next. **NOTE** this page and procedure number (TMP- 2.3.3) as you may prompted to return here.

c) BEFORE continuing to part d, proceed to **page 541**, to perform SECTION 12 - INDUCED POSITIVE PRESSURE TESTS.

d) If a leak was not located in part c, check the Four Way for a positive pressure leak!

e) Place the machine in HEAT DISINFECT and allow Temperature to increase to more than 70° C!

f) CAREFULLY check the hydraulic compartment, the ENTIRE LENGTH of the dialyzer lines, and the DiaSafe® housing for external leaks.

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## TMP- 2.3.4 PDIAL HOLDS / ISOLATE BALANCING CHAMBER VALVES

a) A procedure, in different Section of the Guide, is performed next. **NOTE** this page and procedure number (TMP 1.3.4) as you may prompted to return to here.

b) BEFORE continuing to part c, proceed to **page 572**, to perform SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS.

c) If a leaking Balancing Chamber Valve was not located in part b, was the DiaSafe® filter replaced in THIS troubleshooting session?

Yes The DiaSafe® filter was replaced! See procedure number TMP- 2.3.5 (page 504).

No The DiaSafe® filter WAS NOT replaced! See parts a THROUGH c below:

a) Replace the DiaSafe® filter.

b) Place the machine in RINSE for FIVE (5) minutes.

c) See procedure number TMP- 2.3.5 (page 504).

## TMP- 2.3.5 DIASAFE FILTER WAS REPLACED PREVIOUSLY

a) Return to Dialysis Program ("Select Program" → 'Dialysis → 'Enter').

b) **IMPORTANT!** From the Home screen, set [Dialysate Flow] to **500 ml/min** and press 'Enter'!

c) Allow [**Conductivity]** to stabilize between 13.0 and 14.5 mS.

d) ENSURING [Dialysate Flow] remains at 500 ml/min, allow the flow indicator's 'bob' to begin rising and falling in the sight tube.

e) Call debug screen 1. **FILACT** must REMAIN = 0 before continuing to part f!

f) If necessary, reset a TMP alarm up to twice, allowing thirty (30) seconds between each reset, BEFORE continuing to part g.

g) **TMP** is STABLE if (and ONLY if) the TMP window REMAINS white AND TMP does NOT change more than 60 mmHg in three (3) minute. TWO (2) possible scenarios:

**1) IF (and ONLY if) TMP is STABLE:** See procedure number TMP- 2.3.6 (page 504).

**2) IF TMP is UNSTABLE:** Assuming ALL procedures were performed correctly AND ENSURING debug screen's **Flow Error** is NEVER, EVER = 1, Dialysate Pressure Transducer #9* may be bad intermittent.

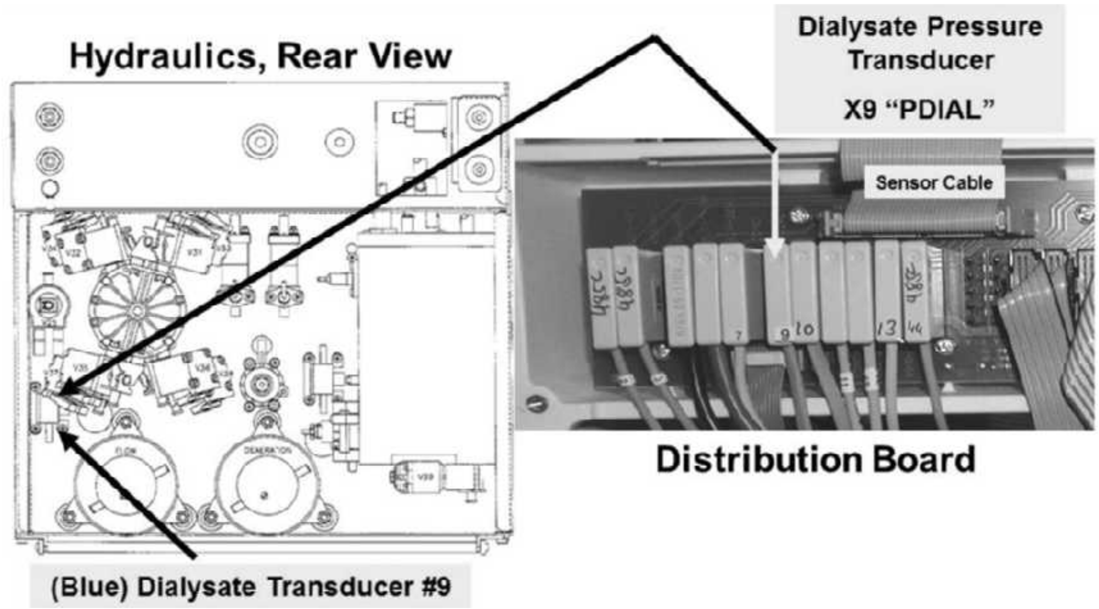
***** To LOCATE Transducer #9 refer to Figure 6 (page 22).

## TMP- 2.3.6 TMP STABLE

An immediate problem cannot be located. If the ORIGINAL problem was Failing the TMP alarms test consider replacing the Dialysate Pressure Transducer #9.*** *** To LOCATE Transducer #9 refer to Figure 6 (page 22).

**TMP- 3.0.0 ISOLATE DIALYSATE PRESSURE TRANSDUCER**

a) Figure below, trace the cable from distribution board position X9, “PDIAL” to the (blue) Dialysate Pressure Transducer (#9) to ENSURE it has not been reversed connected with another hydraulic component.




b) From the Home screen, set [Dialysate Flow] to “OFF” and press ‘Enter’

c) Call debug screen 1. ENSURE **FLWP** = 255 constant i.e. Dialysate Flow is “OFF”.

d) Remove BOTH dialyzers connector from the shunt door and place them at dialyzer level.

e) Close the shunt door!


f) Call debug screen 10. Is **ACFS** (right corner) between 3.5 and 6.0?

Yes **ACFS** between 3.5 and 6.0! See procedure number TMP- 3.1.0 (page 506).

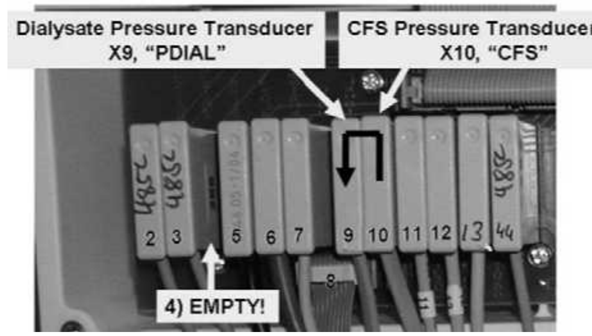
No **ACFS** IS NOT between 3.5 and 6.0! Proceed to **page 507**, procedure number TMP- 3.4.0.

**TMP- 3.1.0 ACFS BETWEEN 3.5 AND 6.0 / ISOLATE DIALYSATE PRESSURE TRANSDUCER**

This procedure uses the CFS transducer (known good) to check the dialysate pressure transducer circuit.

a) Leave the diayzer lines out of the shunt!

b) Figure right, unplug the Dialysate Pressure Transducer #9 from distribution board position “x9, PDIAL”.




c) Using a flashlight, check inside the vacant x9 position for corrosion and/or damaged male pins.

d) Figure right, plug the CFS Transducer’s connector (#10) into the Dialysate Pressure Transducer’s position “x9, “PDIAL”.

e) From debug screen 10, is **PDIA** (middle column) between 3.5 and 6.0?

Yes **PDIA** between 3.5 and 6.0! Dialysate Pressure Transducer #9 is bad.

No **PDIA** is NOT between 3.5 and 6.0! Perform parts A THROUGH E below:

A) Leave CFS (#10) plugged into “X9, PDIAL” for parts B through E.

B) Turn the machine OFF!

C) One at a time, swap in the listed components, (see **COMPONENT LIST** below), with known good and in between, until **PDIA** is between 3.5 and 6.0 indicating the last component swapped in is bad!

**COMPONENT LIST: 1)** Sensor Board[1, 2] ; **2)** Actuator-Test Board[1]; **3)** Sensor Board cable; **4)** Functional Board[1, 2]; **5)** Distribution board[1]; **6)** Motherboard.

[1] To LOCATE the boards, refer to Figure 4A (page 10)

[2] To prevent “Cond Offset Failure”, place the machine into **T and C Mode** (refer to OPERATING MODES (page 19)

D) Return to Dialysis Program but leave [Dialysate Flow] off!

E) If screen 10’s **PDIA** is now between 3.5 and 6.0 the last component swapped in was the problem. If **PDIA** is NOT between 3.5 and 6.0 return to part B.

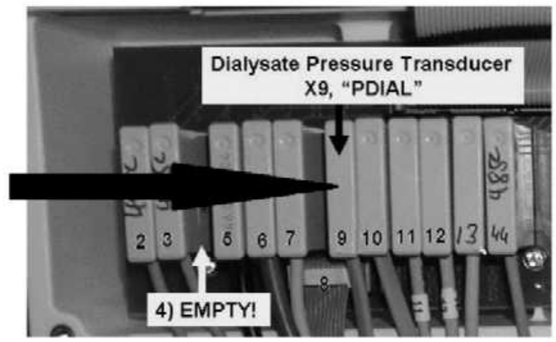
**TMP- 3.4.0 ACFS NOT BETWEEN 3.5 AND 6.0 / ISOLATE PDIA**

From debug screen 10, based on **PDIA** (middle column). TWO (2) possible scenarios:

**1) IF (and ONLY if) PDIA = less than 4.0:** See procedure number TMP- 3.5.0 (page 507).

**2) IF PDIA = more than 6.0:** Proceed to **page 508**, procedure number TMP- 3.6.0.

**TMP- 3.5.0 PDIA LESS THAN 4.0 / ISOLATE TRANSDUCER #9**




a) Figure right, unplug the Dialysate Pressure Transducer #9 from distribution board position X9, "P-DIAL".

b) To avoid unnecessary work, using the screen's clock (upper right), allow up to five (5) minutes as **PDIA** response is NOT instantaneous. **PDIA** should increase to 9.0 or more?

Yes **PDIA** increases to 9.0 or more! See procedure number TMP- 3.6.0 (page 508).

No **PDIA** DOES NOT increase to 9.0 or more! See parts A through E below:

A) Leave the Dialysate Pressure Transducer unplugged.

B) Turn the machine OFF.

C) One at a time, swap in the listed components (see **COMPONENT LIST** below), with known good and in between perform parts D and E until **PDIA** is 9.0 or more indicating the last component swapped in is bad!

**COMPONENT LIST: 1)** Sensor Board[1, 2] ; **2)** Actuator-Test Board[1]; **3)** Sensor Board cable; **4)** Functional Board[1, 2]; **5)** Distribution board; **6)** Motherboard.

[1] To LOCATE the boards, refer to Figure 4A (page 10)

[2] To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

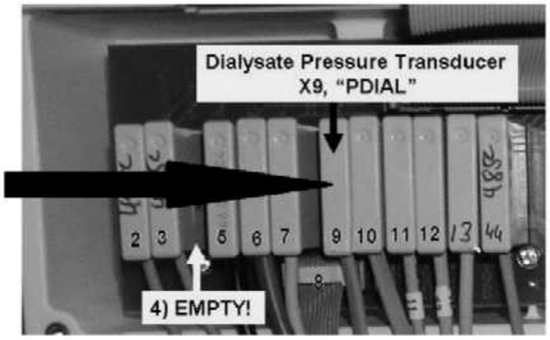
D) Return to Dialysis Program.

E) If screen 10's **PDIA** is 9.0 or more the last component swapped in was the problem. If **PDIA** is NOT 9.0 or more return to part A!

**TMP- 3.6.0 PDIA MORE THAN 6.0 / ISOLATE TRANSDUCER #9 / POSSIBLE OPEN**

a) Referring to the note below, a **known good**[1] pressure transducer, from your spare parts, is required to isolate the dialysate pressure circuit.

[1] On ANOTHER machine, that is not having TMP problems, without attaching the tubing OR mounting the spare parts transducer into the hydraulics: **1)** Plug it into distribution board position X9, “PDIAL” (Figure right); **2)** Call debug screen 10 and look at **PDIA.** A **GOOD** transducer will make it read between 3.5 and 6.0.




c) Figure right, plug the **good** pressure transducer into the malfunctioning machine’s distribution board position X9, “PDIAL”. There is NO NEED to attach the tubing OR mount it into the hydraulics yet!

d) Leave the malfunctioning machine’s diayzer lines out of the shunt.

e) Leave Dialysate Flow OFF.

f) On the malfunctioning machine, call debug screen 10. Is **PDIA** (middle column) between 3.5 and 6.0?

Yes **PDIA** between 3.5 and 6.0! The malfunctioning machine’s Dialysate Pressure Transducer #9 is bad.

No **PDIA** IS NOT between 3.5 and 6.0! Perform parts A THROUGH E below:

A) Leave the **known good** transducer plugged in.

B) Turn the machine OFF.

C) One at a time, swap in the following components (see **COMPONENT LIST** below), with known good then, in between perform parts D and E below until **PDIA** is between 3.5 and 6.0 indicating the last component swapped in is the problem.

**COMPONENT LIST: 1)** Sensor Board[1, 2]; **2)** Actuator-Test Board[1]; **3)** Sensor Board cable; **4)** Functional Board[1, 2]; **5)** Distribution board; **6)** Motherboard

[1] To LOCATE the boards, refer to Figure 4A (page 10)

[2] To prevent “Cond Offset Failure”, place the machine into **T and C Mode** (refer to OPERATING MODES (page 19))

D) Return to Dialysis Program.

E) If screen 10’s **PDIA** is between 3.5 and 6.0 the last component swapped in is bad. If **PDIA** still NOT between 3.5 and 6.0 return to part A.

## TMP- 4.0.0 ISOLATE VALVE #43

a) Call debug screen 0. ENSURE all eight balancing chamber valves (#31 through #38) 'dots' are REMAINING white i.e. Dialysate Flow OFF!

b) **CAREFUL HERE!** Per Figure 71 A (below), DOUBLE clamp the OUTPUT tubing at Valve #43's nozzle. **NOTE!** Valve #43's output tubing extends towards the front of the machine!

c) Can you achieve between -245 and -255 mmHg and HOLD it (+/- 15 mmHg per minute) now?

Yes -250 mmHg achieved and HOLDS! TWO (2) possible bad components: **1)** Valve #43; **2)** Actuator-Test Board;

No -250 cannot be achieved and / or held! See procedure number TMP- 4.2.0 (page 510).

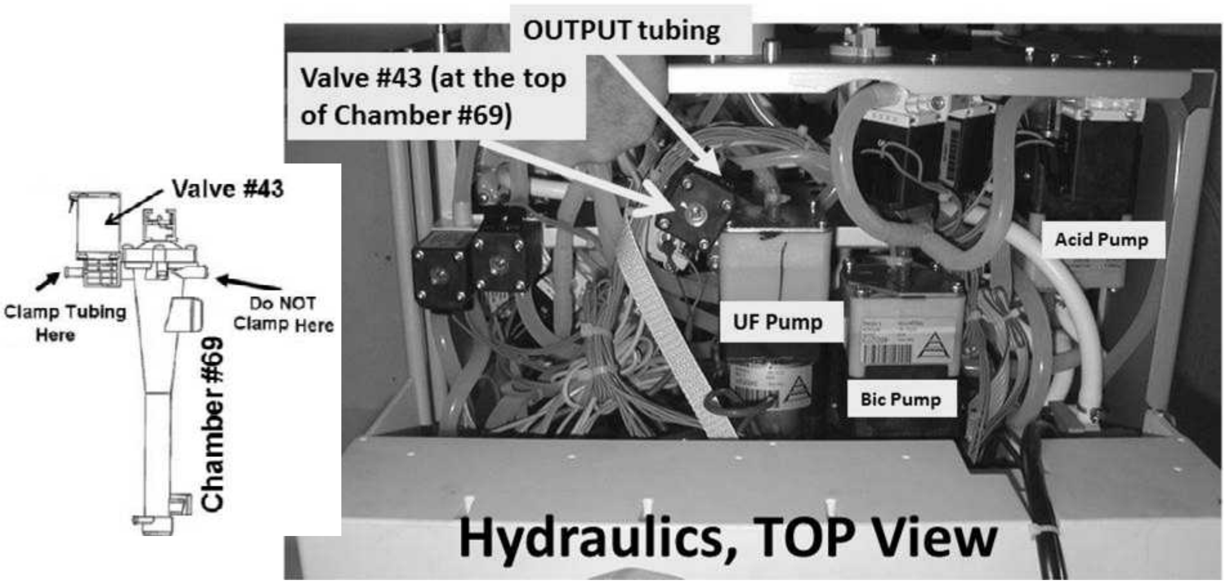



**Figure 71 A – Valve #43**

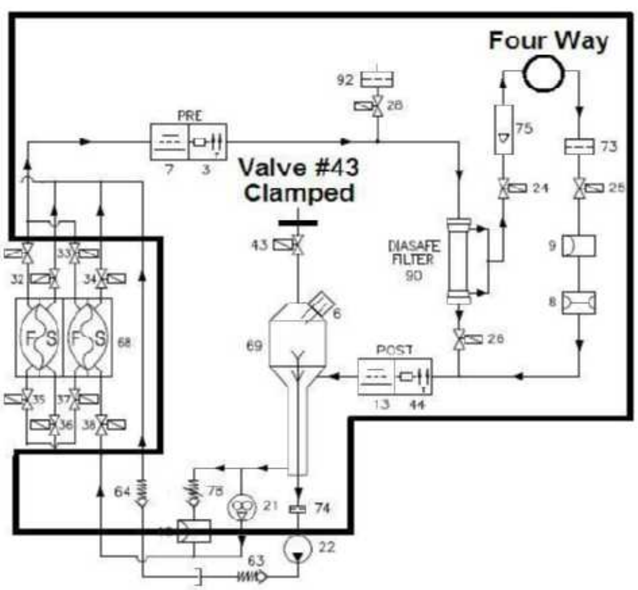



**Figure 71 B – Isolation Area (includes dialysate lines)**

## TMP- 4.2.0 ISOLATE SECONDARY CIRCUIT

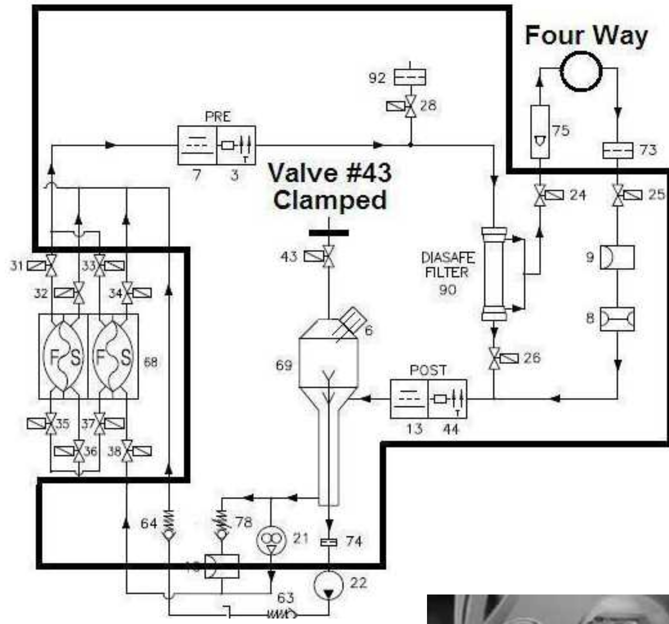
a) Open the shunt door to close valve #24 and #25. This isolates the external dialysate lines (see Figure 71 C (below)).

b) Attempt to achieve -250 mmHg then clamp the syringe tubing. Can you achieve -250 and HOLD it (+/- 15 mmHg per minute) now?

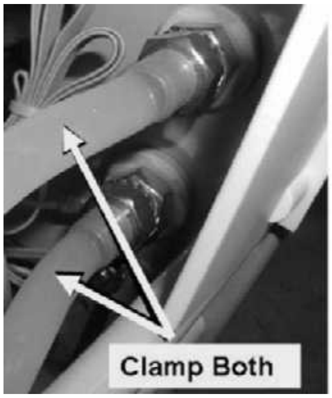
Yes -250 mmHg achieved and HOLDS! Proceed to **page 511**, procedure number TMP- 4.4.0.

No -250 cannot be achieved and / or held! See procedure number TMP- 4.3.0 (page 510).

**Figure 71 C - Isolation Area (excludes dialysate lines)**




## TMP- 4.3.0 -250 LEAKING / ISOLATE DIALYSATE LINES




a) Trace the to and from dialyzer lines to where they attach to the rear of the machine.

b) INSIDE the machine, clamp the clear (non-braided) tubing, at BOTH dialysate line connectors.

c) Can you achieve -250 mmHg and HOLD it (+/- 15 mmHg per minute) now?

Yes -250 mmHg achieved and HOLDS! **IMPORTANT!** Remove the clamps then see procedure number TMP- 4.4.0 (page 511).

No -250 cannot be achieved and / or held! FIVE (5) possibilities, **1)** Leaking dialyzer quick connectors and/or O-rings; **2)** Leaking external flow indicator fittings; **3**) Leaking optional fluid sample port; **4)** Leaking dialyzer line connections at the rear of the machine; **5)** Leaking external dialysate line filter O-ring/housing.

**TMP- 4.4.0 -250 HOLDS / ISOLATE CHAMBER #69**

a) **IMPORTANT!** Close the shunt door!

b) CAREFUL HERE! Per Figure 72 A below, clamp the tubing attached to the rear side of Chamber #69

c) Can you achieve -250 mmHg and HOLD it (+/- 15 mmHg per minute) now (Yes or No)?

Yes -250 mmHg achieved and HOLDS! Remove ALL clamps! Chamber #69 OR its tubing OR valve #43's O-ring is leaking. Placing the machine in Rinse may help locate the leak. While in Rinse allow ten (10) minutes to see a small leak then CAREFULLY check!

No --250 cannot be achieved and / or held! See procedure number TMP- 4.5.0 (page 512).

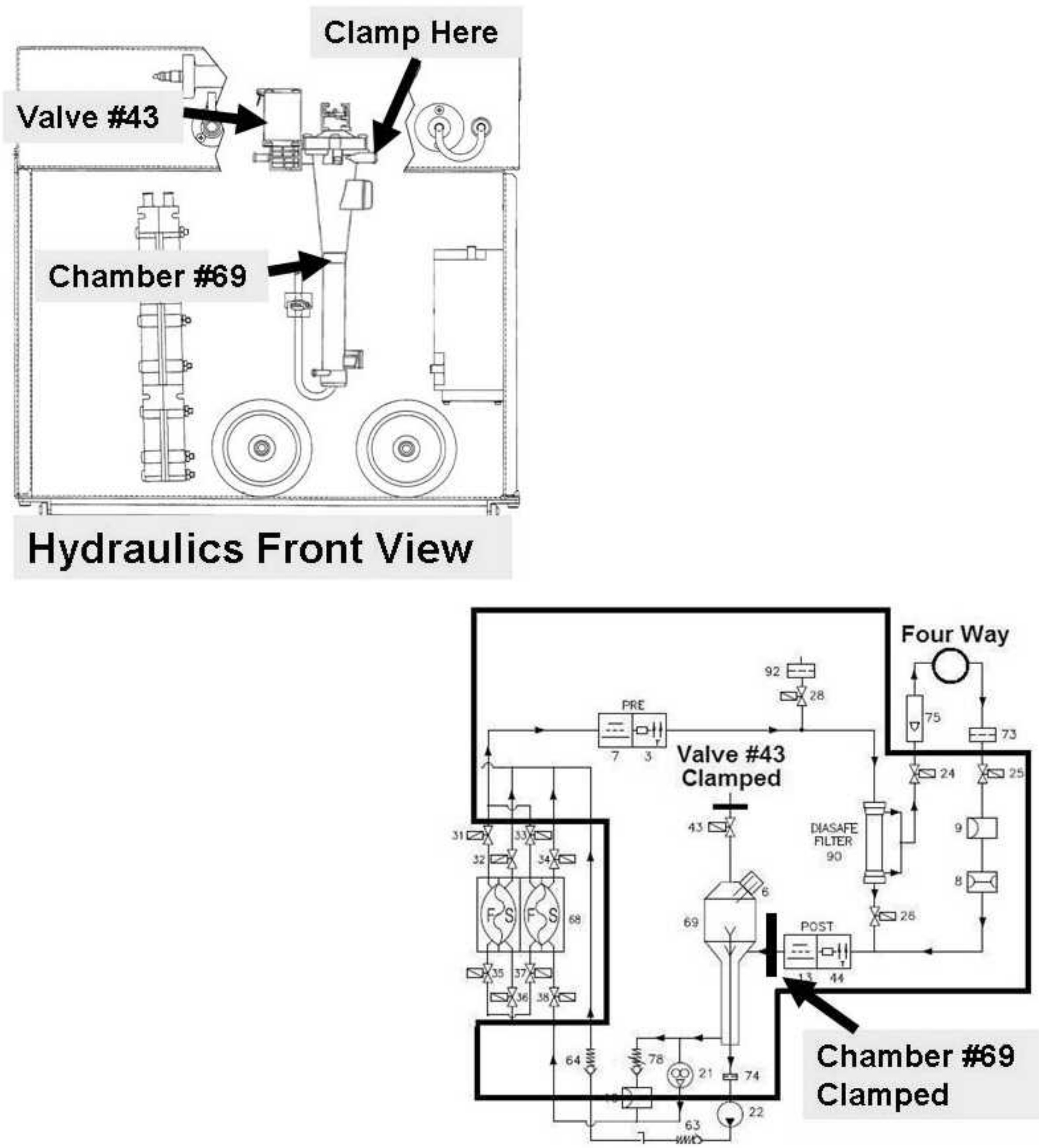
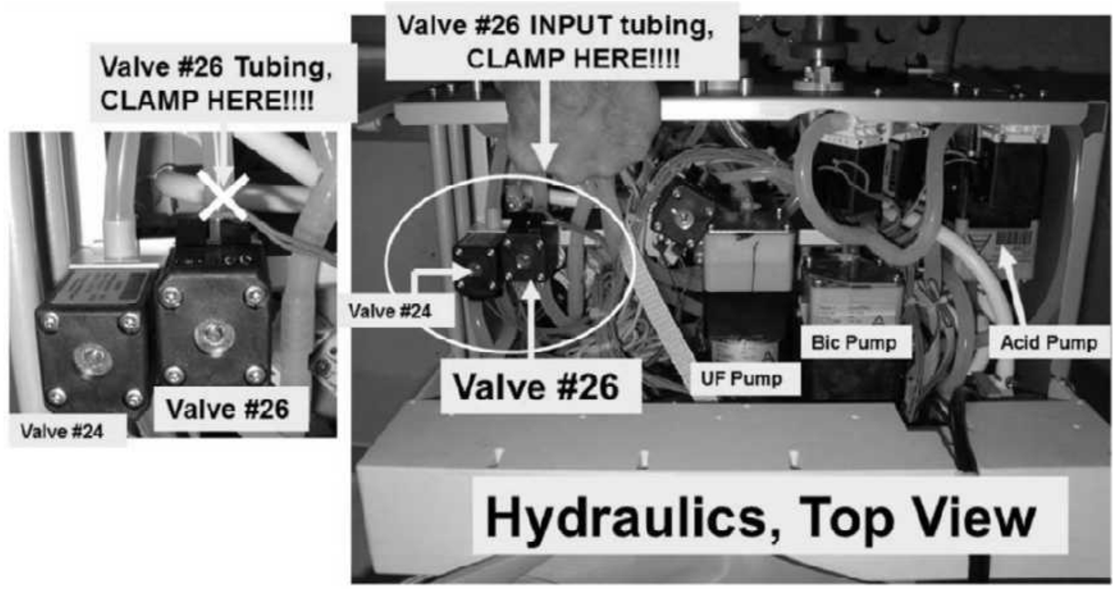



**Figure 72 A – Isolate Chamber #69**

**TMP- 4.5.0 ISOLATE ‘FROM BALANCING CHAMBER’ CIRCUIT**

a) Figure below, (CAREFUL HERE!) clamp VALVE #26’s INPUT tubing.

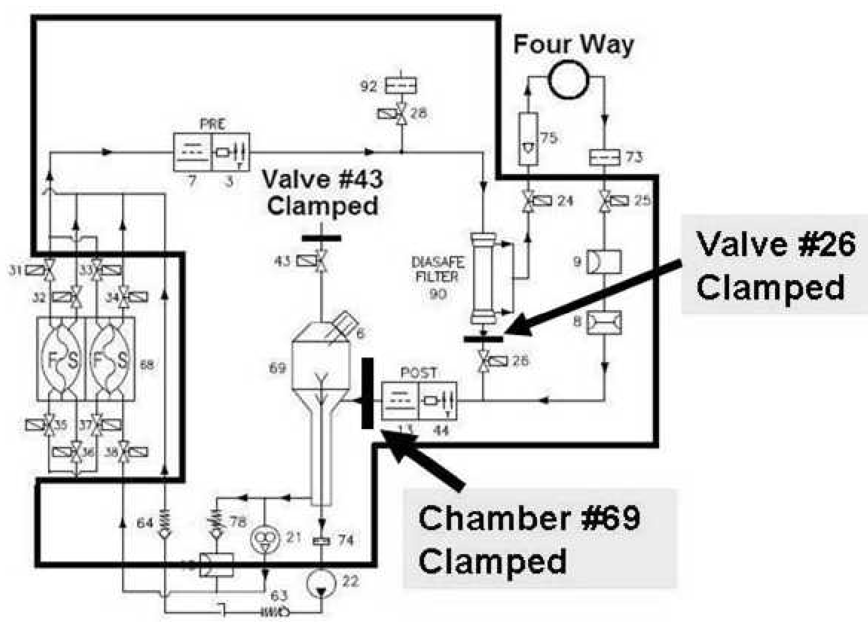



b) Can you achieve -250 mmHg and HOLD it (+/- 15 mmHg per minute) now (Yes or No)?

Yes ↕ -250 mmHg achieved and HOLDS! There is a leak between the top balancing chamber valves (#31 through #34) and the DiaSafe® filter. Remove ALL clamps! Placing the machine in RINSE may locate the leak but allow ten (10) minutes to see a small leak! If a leak is not located, proceed to **page 534**, SECTION 11 - INDUCED AIR LEAK TESTS.

No -250 cannot be achieved and / or held! There is a leak between Chamber #69 and the valves #24 and #25. Remove ALL clamps. SECTION 11 - INDUCED AIR LEAK TESTS (page 534) may help locate the leak.

**Figure 72 C – Isolation Area**



**TMP- 6.0.0 CALIBRATE DIALYSATE PRESSURE**

This is NOT a routine Dialysate Pressure calibration. Follow the procedures exactly to prevent making an error!

a) To prevent wetting the meter's transducer protector clamp the 'to meter' tubing segment!

b) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter'.

c) Enter Service Mode → Calibrate Sensors → Dialysate Pressure. The screen says **"1. Connect a pressure gauge in line…"**. The "gauge" (meter) is ALREADY connected!

d) ENSURE the external flow indicator's 'bob' is moving up and down.

e) Press 'Enter'. The screen says **"3. Press the [Dialysate Flow on/off] key…".**

f) Press the screen's "Dialysate Flow On" button, it turns dark blue and press 'Enter'!

g) ENSURE the button says "Dialysate Flow Off" AND the external flow indicator is NOT moving i.e.Flow is off).

h) **Remove the clamp from the external meter's tubing segment!**

i) Using the syringe, adjust pressure until the external meter reads 0 +/- 2 mmHg.

j) The screen's **[Dial Pressure Reference]** window should be between 90 and 110?

Yes **[Dial Pressure Reference]** is between 90 and 110! Press 'Enter' then see procedure number TMP- 6.1.0 (page 514).

No **[Dial Pressure Reference]** is IS NOT between 90 and 110! Proceed to **page 515**, procedure number TMP- 6.5.0.

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## TMP- 6.1.0 CREATE NEGATIVE PRESSURE

A) The screen says **“6. Pressurize until dialysate pressure reads -250 mmHg….”**.

B) PULL on the syringe plunger to achieve negative between (-)245 and -255 mmHg on the external meter.

C) Clamp the Four-Way’s syringe tubing segment to **HOLD** this pressure.

D) ENSURE the external meter = -250 +/- 5 mmHg.

E) The screen’s **[Dial Pressure Reference]** window should be between 130 and 150?

Yes **[Dial Pressure Reference]** is between 130 and 150! See part F.

No **[Dial Pressure Reference]** is IS NOT between 130 and 150! Proceed to **page 515**, procedure number TMP- 6.5.0.

F) Press “Enter’. Figure right, TWO (2) possible scenarios based on if an “Operator Error” banner occurs:


**1) IF (and ONLY if) an “Operator Error” occurs:** See procedure number TMP- 6.5.0 (page 515).

**2) IF an “Operator Error” DID NOT occur:** See parts a THROUGH f below:

a) Press ‘Enter’ twice to save the calibration then turn the machine off.

b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

c) Call debug screen 1. If not already, allow **FILACT** = 0.

d) Call the Home screen. Set [Dialysate Flow] to “OFF” and press ‘Enter’.

e) Call debug screen 0. ENSURE all eight balancing chamber valves (#31 through #38) are REMAINING white (Dialysate Flow is OFF)! .

f) Return to **page 503**, procedure number TMP- 2.3.2.

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## TMP- 6.5.0 PROBLEM OCCURRED / TROUBLESHOOT DIALYSATE PRESSURE

a) ENSURE the transducer protector, at the external meter, is not WET or consider replacing it!

b) Return the Dialysate lines to the shunt and close the door.

c) Turn the machine OFF.

d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

e) From the Home screen, press the [Dialysate Flow] window.

f) Set [Dialysate Flow] to 500 ml/min and press 'Enter'!

g) **Read before performing!** Repeat (ABOVE) procedure number TMP- 6.0.0 (**page 513**). If (and ONLY if) you return to TMP- 6.5.0, because the problem reoccurs, swap in the listed components (see Component List below), one at a time, in between returning to procedure number **T**MP- 6.0.0 (page 513) until the problem does not occur indicating the last component swapped in is bad!

**Component List**

**1)** Dialysate Pressure Transducer #9*; **2)** Sensor Board; **3)** Actuator-Test Board; **4)** Functional Board; **5)** Sensor Board cable; **6)** Distribution board.

* To LOCATE Transducer #9 refer to Figure 6 (page 22).

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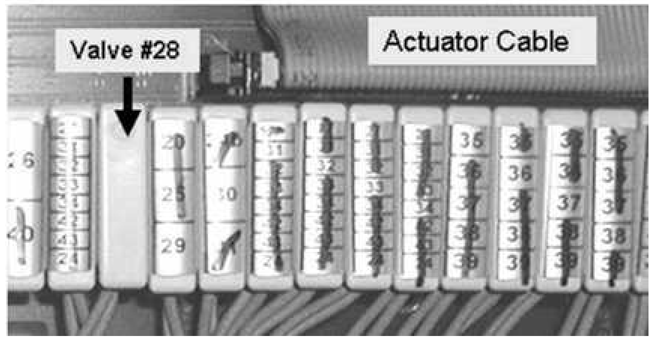
## TMP- 9.0.0 VALVE #28 LEAKING / ISOLATE ACTUATOR-TEST BOARD



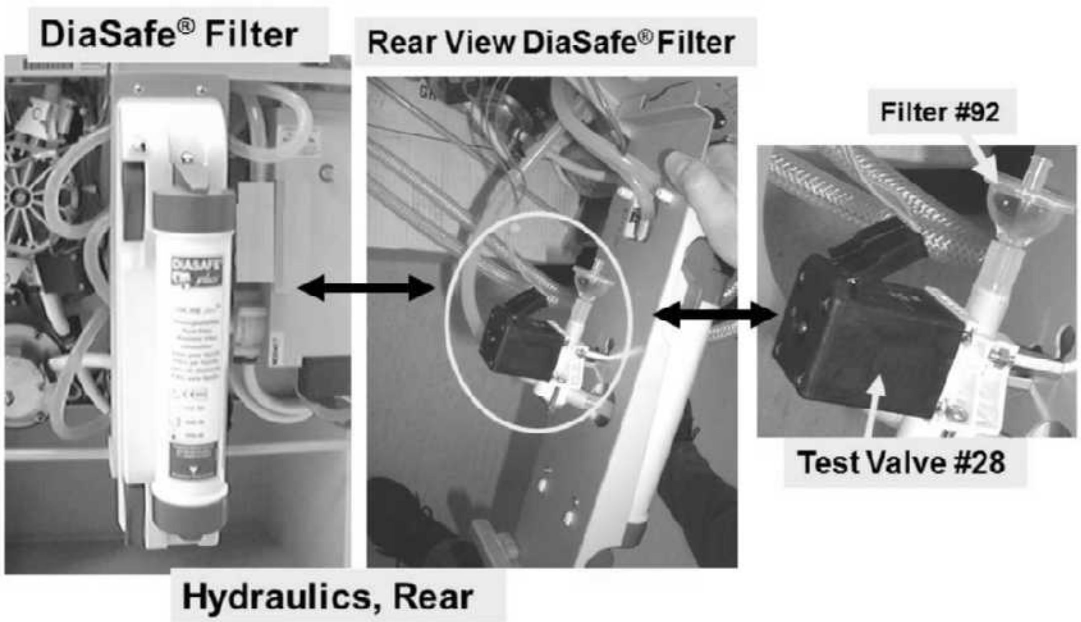

DiaSafe® filter 'Test Valve' #28 is leaking:

a) Figures right and below, trace the wires from Valve #28's distribution board position ("V28, SAMPLE") to ensure it connects to Valve #28.

b) Unplug Valve #28 from distribution board position "V28, SAMPLE". Does the Valve continue to leak?

Yes Valve #28 continues to leak. Valve #28 is bad!

No Valve #28 stops leaking! Turn the machine off and replace the Actuator-Test Board.

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# SECTION 10 - PRESSURE TESTS FAILING

The **Pressure (Holding) Tests** (PHT) checks the hydraulic system for leaks which could compromise patient fluid removal! These procedures troubleshoot ALL PHT failures:

A) Per the Figure below, the Automated Tests consist of two (2) discrete tests: **1) *Alarms Tests*** AND ***2) Pressure Holding Tests*** (Negative and Positive). If a Pressure Test fails one or more of the following messages are listed in the Test & Options screen:

*Fail Remove Air, *Fail Get Neg TMP, *Fail Neg Stabilize, *Fail Neg Flow On, *Fail Get Pos TMP, *Fail Pos Stabilize, *Fail Pos Flow Off".

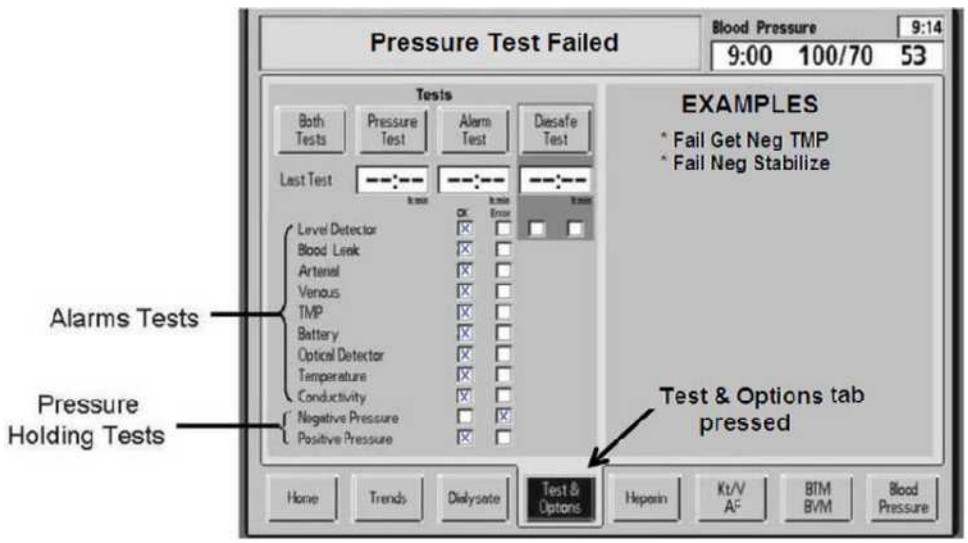



**Figure 73 – Test & Options Screen**

B) Are the Tests CURRENTLY running i.e. screen says " Test:…" OR "Testing"?

Yes Tests are running! See part C!

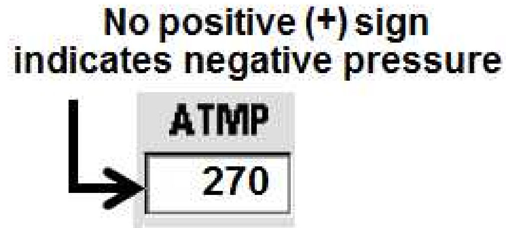
No **DO NOT start the tests!** Proceed to **page 519**, procedure number PHT- 1.5.0.

C) Figure right, has the "Get Neg TMP" banner been presenting for LONGER THAN ninety (90) seconds?


Yes "Get Neg TMP" longer than ninety (90) seconds! See procedure number PHT- 1.0.0 (page 518).

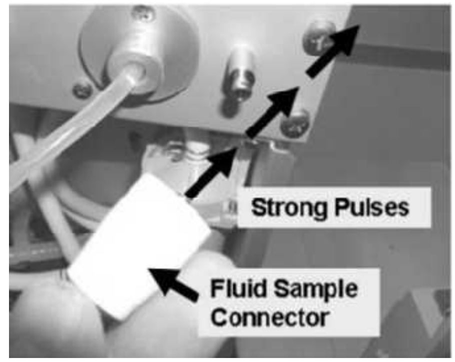
No Allow the Tests to finish THEN proceed to **page 519**, procedure number PHT- 1.5.0.

## PHT- 1.0.0 "GET NEG TMP" LASTING FOREVER / ISOLATE UF PUMP




A) Call debug screen 1. During "Get Neg TMP", Figure right, **ATMP** should increase to about -250 and if it does "Neg Flow On" appears.

B) If "Get Neg TMP" is still presenting see part C. If NOT allow the Tests to finish THEN proceed to **page 519**, procedure number PHT- 1.5.0.




C) Figure right, remove the Fluid Sample Connector from its port and hold it UP as shown!

D) ENSURING "Get Neg TMP" is still presenting, watch for TWO (2) minutes OR until you see at least one (1) strong pulse that squirts into the room more than six (6) feet?

Yes Strong pulse(s)! See procedure number PHT- 1.0.2 (page 518).

No No strong pulse! TWO (2) possible scenarios 1) or 2) below:

**1)** **IF (and ONLY if) the "Get Neg TMP" banner is still presenting** Proceed to **page 548**, SECTION 14 – UF PUMP PROBLEMS

**2)** **ALL OTHER banners:** Allow the Tests to finish THEN proceed to **page 519**, procedure number PHT- 1.5.0.

## PHT- 1.0.2 STRONG PULSE(S) SEEN


ENSURING "Get Neg TMP" is still presenting, watch **FILACT** (middle column) for one (1) minute. TWO (2) possible scenarios:

**1)** **IF FILACT EVER = 1!** A hydraulic air leak may be indicated! See procedure number PHT- 1.0.3 (page 518).

**2)** **IF FILACT ALWAYS = 0:** Is "Get Neg TMP" still presenting?

Yes "Get Neg TMP" presenting! See procedure number PHT- 1.0.3 (page 518).

No Allow the Tests to finish THEN proceed to **page 519**, procedure number PHT- 1.5.0.

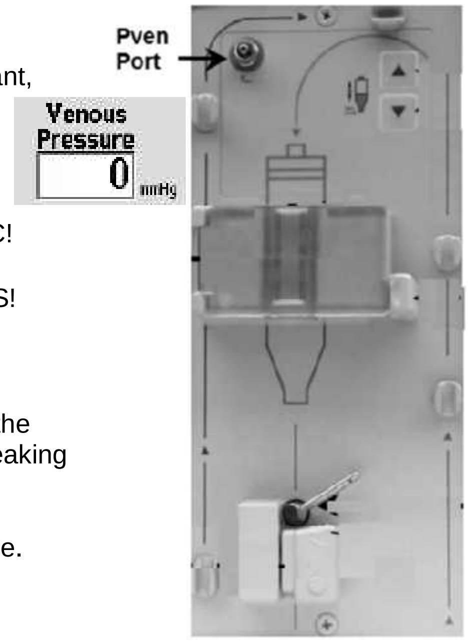
## PHT- 1.0.3 "GET NEG TMP" STILL PRESENTING

a) Turn the machine off and remove the dummy chamber from the Level Detector module.

b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

c) Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

## PHT- 1.5.0 INITIAL PHT CHECKS




a) Call the Home screen. With the Level Detector's $P_{ven}$ port vacant, (Figure right) **Venous Pressure** MUST = 0 mmHg!

b) With [Dialysate Flow] set to 500 ml/min or more:

- [Temperature] MUST be stable* between 35.0 and 39.0° C!
- [Conductivity] MUST be stable* between 13.0 and 14.3 mS!

  ***** Stable = NOT changing more than 0.2 per minute

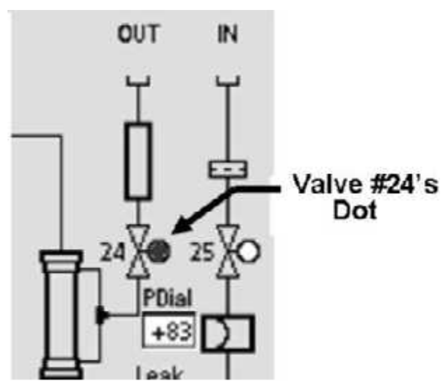
c) Using a flashlight, ENSURE no air bubbles MOVING towards the machine through the acid and bicarb inlet tubing indicating a leaking concentrate connector!

d) Install a 'dummy venous chamber' in the Level Detector module.

e) RESET ALL alarms!

f) If screen says "Standby For Test" OR the tests are running (screen says "Test:…") allow the tests to finish then, **even if they pass**, see procedure number PHT- 1.5.1 (page 519).

## PHT- 1.5.1 INITIAL PHT CHECKS CONTINUED

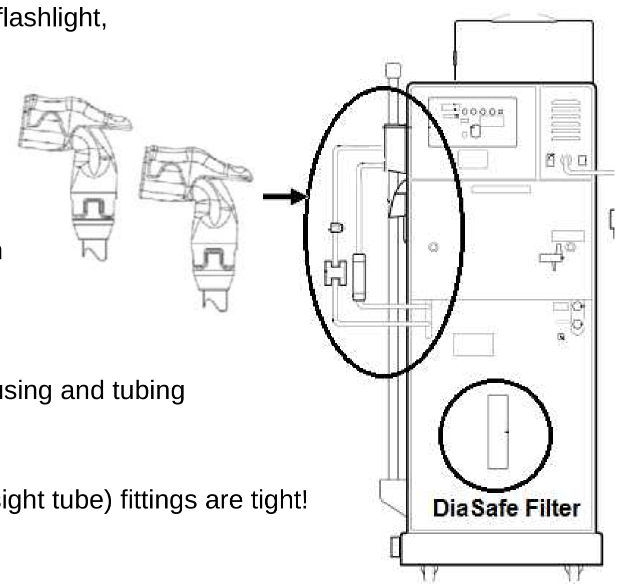



From here forward, if a "No Water" or Flow Error alarm EVER occur address them first!

a) Call debug screen 0. Valve #24's 'dot' (Figure right) MUST be BLUE BEFORE continuing to part b!

b) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter''.

c) Small external leaks cause BIG problems! Using a flashlight, FOUR (4) checks. BE THROUGH!




**Check #1:** Figure right, the ENTIRE length of the dialyzer lines ESPECIALLY the dialyzer quick connectors!

**Check #2:** The hydraulic compartment! Puddles on the compartment floor may indicate an active leak!

**Check #3:** Figure right, from the DiaSafe® filter housing and tubing connections!

**Check #4:** ENSURE the external flow indicator's (sight tube) fittings are tight!

f) See procedure number PHT- 1.5.2 (page 520).

**PHT- 1.5.2 PRESSURE HOLDING TEST (PHT) THEORY**

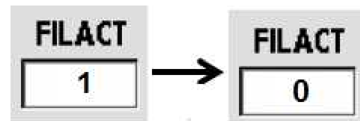
A) **DO NOT START THE TESTS TILL INSTRUCTED!**

B) Understanding Pressure Holding Test (PHT) theory (steps 1 – 5 below) aids troubleshooting. If already familiar with PHT theory see procedure number PHT- 2.0.0 (page 521)

C) Call debug screen 1 to locate **ATMP** AND **FILACT.**



**1)** The Pressure Tests begin with “Remove Air”. This is a sixteen (16) second Filling Program to purge air from the hydraulics. During this time **FILACT** = 1 then should go to and remain = 0.





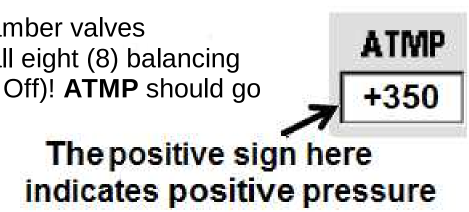
**2)** During “Get Neg TMP” the UF Pump strokes, every eight (8) seconds, to achieve NEGATIVE PRESSURE. **ATMP** (Figure right) should increase to its TARGET of more than negative 250 which causes the UF Pump to stop.


**NOTE:** All **ATMP** readings (in mmHg) are from Dialysate Pressure Transducer #9


**3)** When “Neg Flow On” appears a thirty (30) second STABILIZATION period begins followed immediately by a thirty (30) second HOLD period. During STABILIZATION **ATMP** should settle between negative 250 and 450. During the HOLD period **ATMP** should not change more than +/- 20!

**IMPORTANT NOTE!** If **ATMP** DOES NOT STABILIZE or HOLD the tests automatically repeat steps #1 through #3 once.


**4)** During the brief “Get Pos TMP” the fresh side balancing chamber valves momentarily open to achieve POSITIVE PRESSURE then all eight (8) balancing chamber valves close and the flow pump turns off (i.e. Flow Off)! **ATMP** should go to about positive (+)350.





**5)** When “Pos Flow Off” appears a twenty (20) second STABILIZATION period begins followed by a thirty (30) second HOLD period. During STABILIZATION **ATMP** should settle between +180 and +350. During the HOLD period **ATMP** should not change more than +/- 30!

**IMPORTANT NOTE! FILACT** should NOT = 1 during the Positive Tests!

D) See procedure number PHT- 2.0.0 (page 521).

**PHT- 2.0.0 START PRESSURE TESTS**

a) RESET ALL alarms!

b) At the bottom of the screen, press the **[Test & Options]** tab. TWO (2) possible scenarios:

**1)** **IF the [Pressure Test] button is BLUE:** Press **[Pressure Test]** THEN 'Enter' then IMMEDIATELY see procedure number PHT- 2.0.1 (page 521).

**2)** **IF the [Pressure Test] button is GRAY:** Press **[Both Tests]** THEN 'Enter' THEN QUICKLY read parts a AND b below:

a) **Both Tests** start with "Get Neg TMP". If (and ONLY if) this initial "Get Neg TMP" period lasts LONGER THAN two (2) minutes see ABOVE procedure number PHT- 1.0.0 (page 518). If "Get Neg TMP" lasts less than two (2) minutes continue to part b.

b) ENSURE all tests above Negative Pressure Tests pass***.** When "Conductivity Low Soft" appears IMMEDIATELY see procedure number PHT- 2.0.1 (page 521).

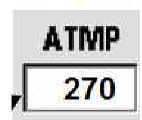
***** Other than Battery all other test failures above Negative Pressure may cause the Pressure Tests to fail.

**PHT- 2.0.1 PRESSURE TESTS RUNNING / ANALYZE TMP**

a) Call debug screen 1.

b) The Pressure Tests start with "Remove Air" (**FILACT** = 1) followed by "Get Neg TMP". The UF Pump strokes until **ATMP** reaches about -250 mmHg then "Neg Flow On" appears followed by "Pos Flow Off".

**No positive (+) sign indicates negative pressure**




c) Is **"Get Neg TMP"** lasting longer than ninety (90) seconds?

Yes "Get Neg TMP" longer than 90 seconds! See procedure number PHT- 2.0.2 (page 521).

No Proceed to **page 523**, procedure number PHT- 3.0.0.

**PHT- 2.0.2 "GET NEG TMP" LASTING LONGER THAN 90 SECONDS**

ENSURING "Get Neg TMP" is still presenting watch **FILACT** for one (1) minute. Does **FILACT** EVER = 1 indicating a possible hydraulic air leak?


Yes **FILACT =** 1 WHILE "Get Neg TMP" is up! Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

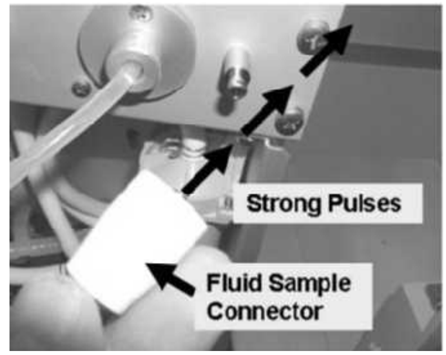
No **FILACT** REMAINS = 0! See procedure number PHT- 2.0.3 (page 522).

**PHT- 2.0.3 FILACT REMAINS = 0**

TWO (2) possible scenarios:

1) **IF (and ONLY if) "Get Neg TMP" is NOT presenting!** See procedure number PHT- 3.0.0 (page 523).

2) **IF "Get Neg TMP" is still presenting!** See parts a AND b below:




a) Figure right, remove the Fluid Sample Connector from its port and hold it UP as shown!

b) Watch for TWO (2) minutes or until you see at least one strong pulse that squirts into the room more than six (6) feet (Yes or No)?

Yes Strong pulse(s) seen! TWO (2) possible scenarios:

1) **IF (and ONLY if) the "Get Neg TMP" banner is still presenting:** Proceed to **page 483**, SECTION 9 – TMP PROBLEMS.

2) **ALL OTHER banners:** See procedure number PHT- 3.0.0 (page 523).

No Strong pulse(s) NEVER seen! Is the "Get Neg TMP" banner still presenting?

Yes "Get Neg TMP" still presenting! Proceed to **page 548**, SECTION 14 – UF PUMP PROBLEMS

No See procedure number PHT- 3.0.0 (page 523).

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## PHT- 3.0.0 THE “GET NEG TMP” BANNER IS NOT UP

Allow the tests to finish! Do BOTH Pressure Tests (Positive and Negative) pass?

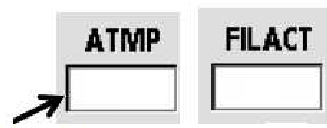
Yes BOTH pass! Proceed to **page 527**, procedure number PHT- 4.0.0.

No “Pressure Test Failed”! At the bottom of the screen, press the [Test & Options] tab. TWO (2) possible scenarios:

**1)** **IF “Fail: Remove Air” is listed:** NOTE this THEN continue to procedure number PHT- 3.1.0 (page 523).

**2)** **ALL OTHER failure listings:** See procedure number PHT- 3.1.0 (page 523).

## PHT- 3.1.0 PRESSURE TEST(S) FAILED




**No positive (+) sign indicates negative pressure**

a) Call debug screen 1 to locate **ATMP** and **FILACT** (Figure right). Below you will watch these while ALSO watching the screen banners!

b) Reset ALL alarms!

c) Press the [Test & Options] tab THEN the [Pressure Test] button.

d) Press ‘Enter’ THEN call debug screen 1.

e) During the sixteen (16) second “Remove Air” period **FILACT** = 1.

f) When “Neg Flow On” first appears a thirty (30) second STABILIZATION period begins. **ATMP** may be initially unstable but should settle between -250 and -440!

**NOTE:** If “Remove Air” reappears the tests are REPEATING themselves AND **FILACT** will = 1 again. In this event, allow “Neg Flow On” to reappear i.e. the repeat STABILIZATION period.

**NOTE:** If **FILACT** EVER = 1 (air sensed in the dialysate) during the repeat STABILIZATION period NOTE this!

**NOTE:** If **ATMP** does not remain between -250 and -440 “Fail Neg Stabilize” will be listed in the Test & Options screen possibly indicating a large air leak.

g) If **ATMP** remains between -250 and -440 a thirty (30) second HOLD period begins. “Neg Flow On” remains up AND **ATMP** should not change more than +/- 20!

**NOTE:** If **ATMP** increase to more than -440 NOTE this!

**NOTE:** If “Remove Air” reappears the tests are REPEATING themselves AND **FILACT** will = 1 again! In this event, allow “Neg Flow On” to reappear then thirty (30) seconds for the HOLD period to begin again.

**NOTE:** If **FILACT** EVER = 1 (air sensed in the dialysate) during the repeat HOLD period NOTE this!

**NOTE:** If **ATMP** does not HOLD +/- 21 “Fail Neg Flow On” will be listed in the Test & Options screen possibly indicating a small air leak.

**Parts h through k next page**

h) When “Get Pos TMP” momentarily appears **ATMP** normally drop to between +300 and +500.

i) When “Pos Flow Off” appears a twenty (20) second stabilization period begins. **ATMP** should settle between +180 and +350.

**NOTE:** If **FILACT** EVER = 1, even if only once, during “Pos Flow Off” NOTE this!

**NOTE:** If **ATMP** does not remain between +180 and +350 “Fail Pos Stabilize” will be listed in the Test & Options screen possibly indicating an external fluid leak OR **FILACT** went to ‘1’.

j) If **ATMP** remained between +180 and +350 in part i a thirty (30) second HOLD period begins. “Pos Flow Off” remains up AND **ATM**P should not change more than +/- 30

**NOTE:** If **ATMP** changes more than +/- 30 “Fail Pos Flow Off” will be listed in the Test & Options screen possibly indicating a small external leak.

k) When the “Testing” banner appears IGNORE **ATMP** and **FILACT**. Do BOTH pass?

Yes BOTH pass! Proceed to **page 527**, procedure number PHT- 4.0.0.

No “Pressure Test(s) Failed”! See procedure number PHT- 3.1.2 (page 524).

## PHT- 3.1.2 PRESSURE TEST(S) FAILED AGAIN

Press the Test & Options tab. FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

1) **IF (and ONLY if) “Fail Remove Air” is listed:** Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

2) **IF (and ONLY if) “Fail Neg Stabilize” is listed.** TWO (2) possible scenarios i) or ii) below:

   i) **IF FILACT EVER = 1 during the repeat 30 second STABILIZATION “Neg Flow On” period:** Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

   ii) **IF FILACT ALWAYS = 0 during the repeat 30 second “Neg Flow On” STABILIZATION period:** Proceed to **page 483**, SECTION 9 – TMP PROBLEMS!

3) **IF (and ONLY if) “Fail Neg Flow On” is listed:** THREE (3) possible scenarios i) or ii) or iii) below:

   i) **IF ATMP increased to more than -440:** See procedure number PHT- 3.1.3 (page 525).

   ii) **IF FILACT EVER = 1 during the repeat 30 second HOLD “Neg Flow On” period:** Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

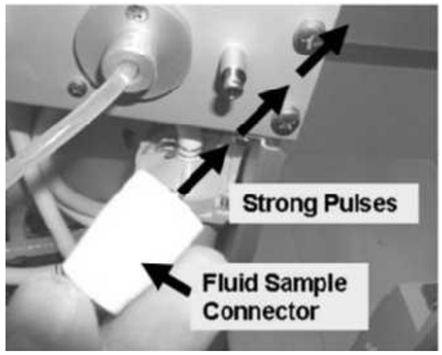
   iii) **IF FILACT ALWAYS = 0 during the repeat 30 second “Neg Flow On” STABILIZATION period:** Proceed to **page 483**, SECTION 9 – TMP PROBLEMS

4) **ALL Positive Test Failure listings i.e. “Fail Get Pos TMP”, “Fail Pos Stabilize”, “Fail Pos Flow Off”:** Negative Pressure Test failures have priority over Positive Test failures. If any Negative Pressure test failed see above Scenarios 2 or 3. If a Negative test DID NOT fail, TWO (2) possible scenarios i) or ii) next page:

**i)** **IF FILACT EVER = 1 (even if only once):**. Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

**ii)** **IF FILACT ALWAYS = 0!** Proceed to **page 483**, SECTION 9 – TMP PROBLEMS.

**PHT- 3.1.3 PRESSURE TEST FAILS AND ATMP INCREASED TO MORE THAN -400**




a) Figure right, remove the UF Sample Connector AND hold UP as seen!

b) Below you will **simultaneously** watch screen banners, debug screen 1's **ATMP** AND the UF Sample Connector!

c) Reset ALL alarms. From the Test & Options screen press the [Pressure Tests] button then 'Enter'.

d) During "Get Neg TMP" the UF Pump sends 'strong pulses' through the Sample Connector every eight (8) seconds until the "Neg Flow On" banner appears THEN the UF Pump SHOULD stop!

e) ENSURING "Neg Flow On" is presenting AND **ATMP** is REMAINING more than -270 does the UF Pump CONTINUE to send strong pulses(s) through the UF Sample Connector (Yes or No)?

Yes If ABSOLUTELY SURE the UF Pump sent a pulse WHILE the "Neg Flow On" banner was up! Turn the machine off then see the TWO (2) possibilities below. Repeat the Pressure Tests to see if either solved the problem.

**Possibilities**: **1)** Card cage circuit board not seated properly OR **2)** Bad Actuator-Test Board.

No If the Pressure Tests Fail, from the Tests & Options screen, if a Negative Pressure Test listing appears see procedure number PHT- 3.1.4 (page 525). If a Positive Pressure Test listing appears return to Scenario #4 of ABOVE procedure number PHT- 3.1.2 (page 524). If (and ONLY if) the Pressure Tests pass proceed to **page 527**, procedure number PHT- 4.0.0.

**PHT- 3.1.4 NEGATIVE PRESSURE TESTS FAIL**

**1)** **IF (and ONLY if) "Fail Neg Stabilize" is listed.** TWO (2) possible scenarios i) or ii) below:

**i)** **IF FILACT EVER = 1 (even if only once) during the repeat 30 second STABILIZATION "Neg Flow On" period:** Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

**ii)** **IF FILACT ALWAYS = 0 during the repeat 30 second "Neg Flow On" STABILIZATION period:** Proceed to **page 483**, SECTION 9 – TMP PROBLEMS!

**2)** **IF "Fail Neg Flow On" is listed:** TWO (2) possible scenarios i) or ii) below:

**i)** **IF FILACT EVER = 1 (even if only once) during the repeat 30 second HOLD "Neg Flow On" period:** Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

**ii)** **IF FILACT ALWAYS = 0 during the repeat 30 second HOLD "Neg Flow On" period:** Proceed to **page 483**, SECTION 9 – TMP PROBLEMS

## PHT- 3.1.5 ALL OTHER SCENARIOS / PRESSURE TEST FAILED

Has the DiaSafe® filter been replaced in THIS Troubleshooting session?

Yes The DiaSafe® filter has been replaced! Proceed to **page 483**, SECTION 9 – TMP PROBLEMS

No
a) Replace the DiaSafe® filter preferably with one from another machine that is passing Pressure Tests.

b) Place the machine into RINSE for five (5) minutes!

c) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'!

e) Call debug screen 0 and allow Valve #24's 'dot' to stay blue!

f) Allow two (2) minutes BEFORE continuing to part g.

g) Reset all alarms and repeat the Pressure Tests. Do they BOTH pass?

Yes Both Pass! The DiaSafe® filter MAY have been causing the problem **HOWEVER,** see procedure number PHT- 4.0.0 (page 527).

No Pressure test(s) Fail! Proceed to **page 483**, SECTION 9 – TMP PROBLEMS

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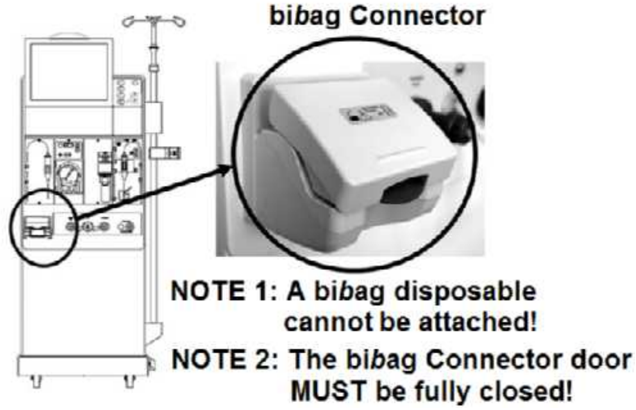
## PHT- 4.0.0 BOTH PRESSURE TESTS PASS

A) Figure right, if the machine is equipped with a bi*bag* Connector see part B. If NOT see procedure number PHT- 4.1.0 (page 527).

B) Is a disposable bi*bag* (pouch) attached (Yes or No)?



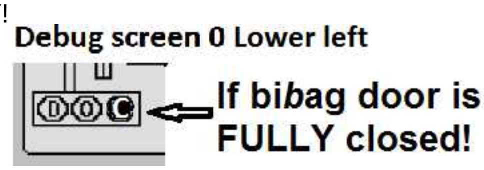

Yes Bi*bag* attached!

a) Remove the bi*bag*!

b) Plug the bicarb (blue) concentrate connector into **LIQUID** bicarbonate!

c) Close the bi*bag* door FULLY!

d) Call debug screen 0 (Figure right) to ENSURE the bi*bag* door is shown closed!

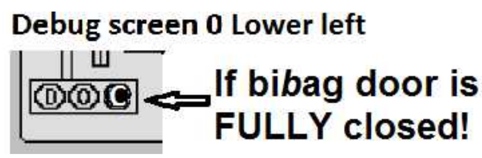



e) See procedure number PHT- 4.1.0 (page 527).

No

a) ENSURE the bicarbonate (blue) connecter is attached to **LIQUID** bicarbonate.

b) Call debug screen 0 (Figure right) to ENSURE the bi*bag* door is shown closed!




c) See procedure number PHT- 4.1.0 (page 527).

## PHT- 4.1.0 ISOLATE LOADING PRESSURE

a) **ENSURE** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it!

b) **SLAM** the gauge into the red Acetate/Acid rinse port. ***ELSE** pressure will not be read correctly

c) Loading Pressure is ‘OKAY’ if it cycles between a PEAK of somewhere between 23 and 25 psi.

d) FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

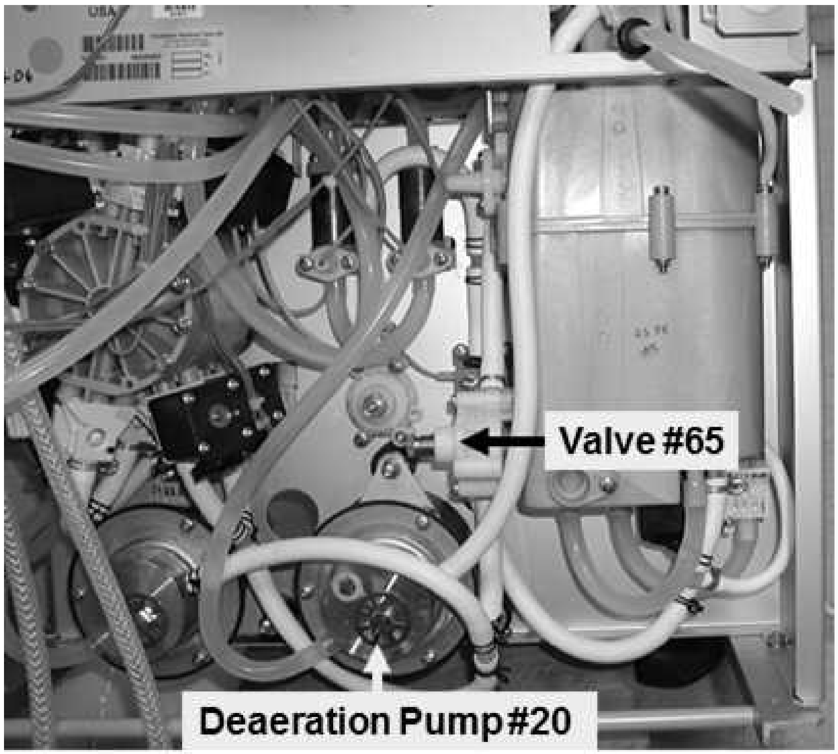
**1) IF (and ONLY if) pressure REMAINS ‘OKAY’:** Proceed to **page 529**, procedure number PHT- 4.2.0.

**Scenarios 2 through 4 next page**

2) **IF (and ONLY if) peaking to MORE THAN 26 psi:** Turn Valve #65's nut (Figure below) counterclockwise (outward). If a PEAK pressure between 23 and 25 psi CAN be achieved see procedure number PHT- 4.2.0 (page 529). If NOT Valve #65 may be bad.

3) **IF (and ONLY if) peaking to between 15 and 22 psi:** Adjust Valve #65's nut (Figure below), clockwise until a PEAK of between 23 and 25 is achieved! If pressure CAN be adjusted to between 23 and 25 psi see procedure number PHT- 4.2.0 (page 529). If (and ONLY if) it CANNOT proceed to **page 33**, procedure number F- 1.0.7

4) **ALL other scenarios:** ENSURING the gauge was SLAMMED into the Rinse Port proceed to **page 33**, procedure number F- 1.0.7.

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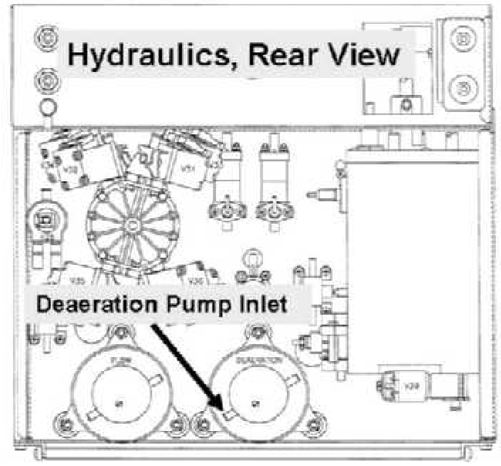
## PHT- 4.2.0 LOADING PRESSURE OKAY




a) **Turn the water OFF!**

b) The Deaeration gauge is used next. ENSURE it reads 0 inHg BEFORE installing it!

c) Allow a "No Water" alarm to occur THEN one (1) minute for the deaeration motor to stop.

d) Figure right, tee the gauge to the Inlet (clear tubing) of the Deaeration Pump.

e) **Turn the water on and allow the "No Water" alarm to go away!**

f) Deaeration Pressure OKAY? Refer to Appendix A (page 757) for what pressure should be.

Yes Deaeration pressure is OKAY. See procedure number PHT- 4.3.0 (page 529).

No Deaeration Pressure in NOT OKAY! ENSURING a "No Water" alarm is NOT presenting, NOTE this page number, as you will return here, THEN proceed to **page 543**, SECTION 13 - DEAERATION PROBLEMS

## PHT- 4.3.0 DEAERATION PRESSURE OKAY

a) Turn the water OFF and allow a "No Water" alarm to occur.

b) Allow one (1) minute for the deaeration motor to stop.

c) Remove the gauge and reattach the tubing!

d) **Turn the water on and ENSURE the "No Water" alarm goes away!**

e) Allow the machine to come out of bypass i.e. the external flow indicator's 'bob' moving up and down in the sight glass!

f) Allow three (3) minutes BEFORE continuing to part g.

g) Reset all alarms then press the **[Test & Options]** tab. TWO (2) possible scenarios.

**1) IF the [Pressure Test] button is BLUE:** Press the **[Pressure Test]** button THEN 'Enter' THEN IMMEDIATELY see procedure number PHT- 4.4.0 (page 530).

**2) IF the [Pressure Test] button is GRAY:** Press **[Both Tests]** THEN 'Enter THEN IMMEDIATELY see procedure number PHT- 4.4.0 (page 530).

## PHT- 4.4.0 REPEAT PRESSURE TESTS

Call debug screen 1. While watching the screen banners[1], **ATMP**[1] AND **FILACT**[2] allow the tests to finish. Do BOTH (Negative and Positive) pass?

Yes BOTH pass! See procedure number PHT- 4.5.0 (page 530).

No Pressure Test Failed! Return to (ABOVE) procedure number PHT- 3.1.2 (**page 524**) to analyze the failure(s).

[1] If **ATMP** changes more than 20 during "Neg Flow On's" HOLD period indicates a leak

[2] After "Remove Air", if **FILACT** EVER = 1 indicates a hydraulic air leak.

## PHT 4.5.0 BOTH TESTS PASS / PERFORM UF INTEGRITY TEST

The UF INTEGRITY TEST, performed here, isolates the UF Pump for leaks:

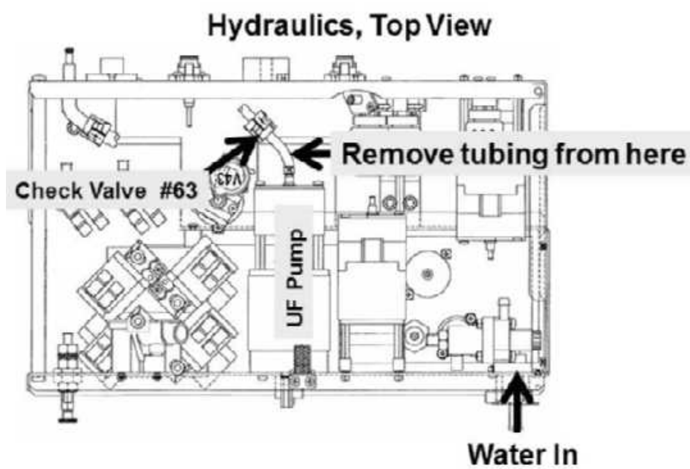
a) **Figure right**, remove the TOP (output) tubing from between the UF Pump and Check Valve #63.

b) Attach a tubing segment to the vacant Pump nozzle that is long enough to route it away from the hydraulics.

c) RESET all alarms!

d) From the **[Test & Options]** screen repeat the Pressure Tests.

e) Do BOTH Pressure Tests pass?

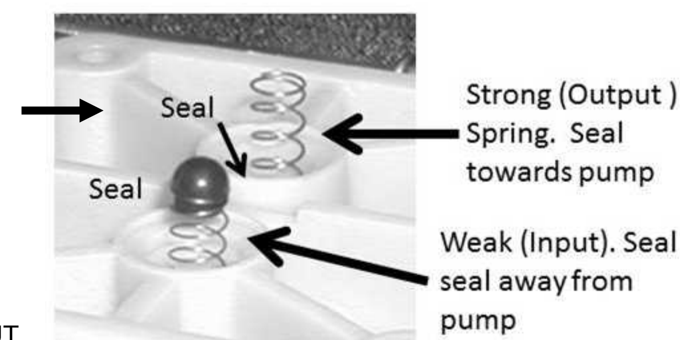



Yes BOTH Tests pass! See procedure number PHT- 4.6.0 (page 531).

No a) Rebuild the UF Pump per the Preventative Maintenance Procedures booklet ENSURING the springs and seals are properly installed!

b) Return to Dialysis Program.

c) Repeat the Pressure Tests. They MUST pass with AND without the UF Pump OUTPUT tubing attached!



## PHT- 4.6.0 UF INTEGRITY TEST PASSED

a) **IMPORTANT!** Return the UF Pump's tubing.

b) Was the machine originally pulled for service because of a reported "*On Line PHT Failed"?*

Yes On Line PHT Failed! See procedure number PHT- 4.7.0 (page 531).

No Proceed to **page 532**, procedure number PHT- 5.0.0.

## PHT- 4.7.0 ON LINE PHT FAILED / DIAGNOSTIC VALVE LEAK TESTS / VALVE #24 AND #25

ONLY two (2) valves will be tested, Valves #24 and #25:

a) Place the machine into Service Mode → Diagnostics → Valve Leak Test. Allow the **[Test Status]** data box = "Ready".

b) Press the screen's **[Valve Number]** data box, it turns bright yellow. Using the keyboard's Pg Up (↑) key set **[Valve Number]** to say "Valve #24".

c) Press 'Enter'. Allow "Prep" and "Testing" to complete.

d) Read the screen's **[TEST STATUS]** box, TWO (2) possible scenarios:

**1)** **IF "Failed": REPEAT** the test on the leaking valve. If (and ONLY if) it fails **AGAIN** TWO (2) possibilities: **1)** Replace the Actuator-Test Board with a known good then repeat the Valve Leak Test to test on the valve. If (and ONLY if) the valve fails again: **2)** Leaking valve! To locate the valve refer to Figure 35 (page 211).

**2)** **IF "Passed": REPEAT** the Valve Leak Test on "Valve #25". Do BOTH valves #24 and #25 pass?

Yes BOTH Valves #24 AND #25 pass! See procedure number PHT- 5.0.0 (page 532).

No A valve fails! TWO (2) possibilities: **1)** Replace the Actuator-Test Board with a known good then repeat the Valve Leak Test to test it. If (and ONLY if) the test fails again: **2)** Bad valve! To locate the valve refer to Figure 35 (page 211).

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## PHT- 5.0.0 ALL PRESSURE TESTS PASSED

BOTH Pressure Tests and the UF INTEGRITY TEST passed. See steps 1 through 6 below:

1) Check UF PUMP (1 ml/stroke volume) per the Preventative Maintenance Procedures booklet.

2) Verify accurate TMP by performing the Venous and Transmembrane Pressure checks in the Preventative Maintenance Procedures booklet!

3) Read step 3 completely BEFORE performing it! Check Flow Pressure Calibration per the Calibration Procedures booklet. **It MUST be set to between 35 and 36 psi!**

4) If (and ONLY if) you originally started out troubleshooting an "On Line PHT Failed" and not already consider replacing the DiaSafe® filter.

5) The Troubleshooting Guide is unable to locate an immediate problem HOWEVER, if (and ONLY if) you originally started out troubleshooting an "On Line PHT Failed" see step #6

6) Please call Technical Services (800-227-2572) for further troubleshooting information.

### Automated Pressure Holding Test (PHT) Theory:

A) **Negative Pressure:** With the balancing chamber (BC) valves cycling and the Flow Pump #21 running these tests begin with "Get Neg TMP". The UF Pump (#22) strokes until approximately -260 mmHg (TMP = 260 mmHg) is achieved as monitored by Dialysate Pressure Transducer (#9). This normally takes less than one (1) minute. When -160 mmHg is reached the UF Pump stops and **"Neg Flow On"** appears. A thirty (30) second stabilization period begins followed by a thirty (30) second hold period. If pressure remains stable (+/- 20 mmHg) for one minute the test passes.

B) **Positive Pressure:** All four 'fresh side' BC valves open briefly to drive positive (loading) pressure into the secondary circuit then all eight BC valves close and Flow Pump stops. Because target pressure (approximately +300 mmHg) is overshot the UF Pump strokes until the target (+300 mmHg) is achieved. **"Pos Flow Off"** appears and a thirty (30) second stabilization period begins followed by a thirty (30) second hold period. If pressure remains stable (+/- 30 mmHg) for one (1) minute the test passes.

C) **On Line Pressure Holding Tests (On Line PHT)**, if activated are performed automatically every 720 seconds (12 minutes). They monitor current Dialysate Pressure (i.e. pressure is not created as it is during Negative Flow On/Positive Flow Off Tests). Dialysate Flow is momentarily set to 500 ml/min, Valve #26 opens and Valves #24 and #25 close (to isolate the dialyzer circuit). Dialysate pressure is monitored for two (2) consecutive balancing chamber cycles, approximately seven (7) seconds. If pressure remains stable the On Line PHT passes.

D) Related to On Line PHT, from debug screen 1 (see next page):

- **NPHT:** A count down timer that begins at 720 seconds (12 minutes). When it reaches 0 On Line PHT tests are performed.
- **PHTACT:** = 1 when the On Line PHT is running; 0 when not running
- **PHT0:** Leak test results of the first BC valve cycle, depending upon which valve cycle was active when the test began. If less than 25 the valves in this cycle are not leaking.
- **PHT1:** Leak test results of the second BC valve cycle, depending upon which valve cycle was active when the test began. If less than 25 the valves in this cycle are not leaking.

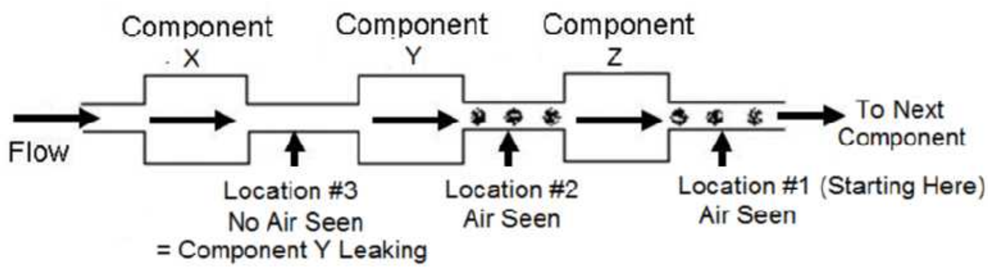
| **PHT0** | **PHT1** | **Meaning** |
|---|---|---|
| Less than 25 | Less than 25 | All BC valves are okay |
| More than 25 | Less than 25 | BC valve leak (first valve cycle) |
| Less than 25 | More than 25 | BC valve leak (second valve cycle) |
| More than 25 | More than 25 | Leak (probably) external to the BC valves |

**<u>Probable Causes of Pressure Test Failures</u>**:

- Air entering or dialysate escaping through a bad O-ring, bad connection, tubing leak, etc.
- DiaSafe® filter leaking or DiaSafe® filter test valve leaking internally
- Valves #43 leaking internally
- Valve #24, #25 leaking internally (if failing On Line PHT ONLY)
- Balancing chamber valve (#31 through #38) leaking internally
- Deaeration Pressure too high or too low
- Dialysate Pressure (Transmembrane Pressure (TMP)) out of calibration specifications
- Bad UF Pump #22 (with “Fail Get Neg TMP”, “Fail Neg Stabilize”, “Fail Neg Flow On”)

# SECTION 11 – INDUCED AIR LEAK TESTS

The following procedures use negative dialysate pressure to locate a potential air leak. Use a flashlight to look THROUGH tubing. If air is seen continue, against the direction of flow (Figure below), to the next component until air bubbles are not seen.




**NOTE!** Air is NORMAL in some locations, for example through the input tubing of Deaeration Pump #20 AND in the 'To Drain' circuit.

A) Referring to Figure 75 (page 535), look through the Flow Pump's (clear) input tubing for air bubbles that START in the middle of the tubing segment. **If bubbles are located this may be the problem!**

B) **Temperature** and **Conductivity** MUST remain normal and the external flow indicator's 'bob' MUST be rising and falling!

C) RESET ALL alarms!

D) If not already, run the alarms and pressure tests. At this point it does not matter if they pass!

E) Turn the blood pump on so that is is rotating at least 100 ml/min.

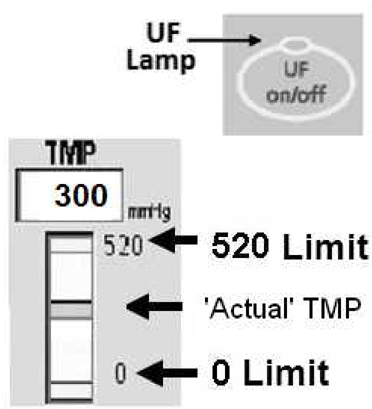
F) From the Home screen, set **[UF Goal]** to 1000; set **[UF Time]** to 1:00 Hr.

G) Press 'Enter'

H) See procedure number AIR- 1.0.0 (page 534).

## AIR- 1.0.0 ACHIEVE NEGATIVE DIALYSATE PRESSURE

This procedure describes how to acheive negative pressure (TMP). TMP MUST be kept between 300 and 360 mmHg for ALL subsequent tests. If it EVER falls below 300 perform parts a THROUGH c below:




a) RESET ALL alarms!

b) Press the front panel's UF on/off key. Figure right, the UF Lamp MUST stay on solid indicating UF is on.

c) Allow **TMP** (Figure right) to reach 280 then IMMEDIATELY turn UF off (UF Lamp off)!

d) See procedure number AIR- 1.0.1 (page 535).

## AIR- 1.0.1 CHECK FOR AN AIR LEAK AT FILTER #73

Figure below, **ENSURING** TMP is between 300 and 360 mmHg, for one (1) minute, watch through the OUTPUT (to machine) side of Dialysate Filter #73. This is **Location #1 (L1)**. Air bubbles seen?

Yes  Air seen at L1! See procedure number AIR- 1.0.2 (page 536).

No air seen at L1!  Proceed to **page 537**, procedure number AIR- 1.0.3.

**Figure 74 – Leak Checks (1) / Abbreviated Flow Diagram**

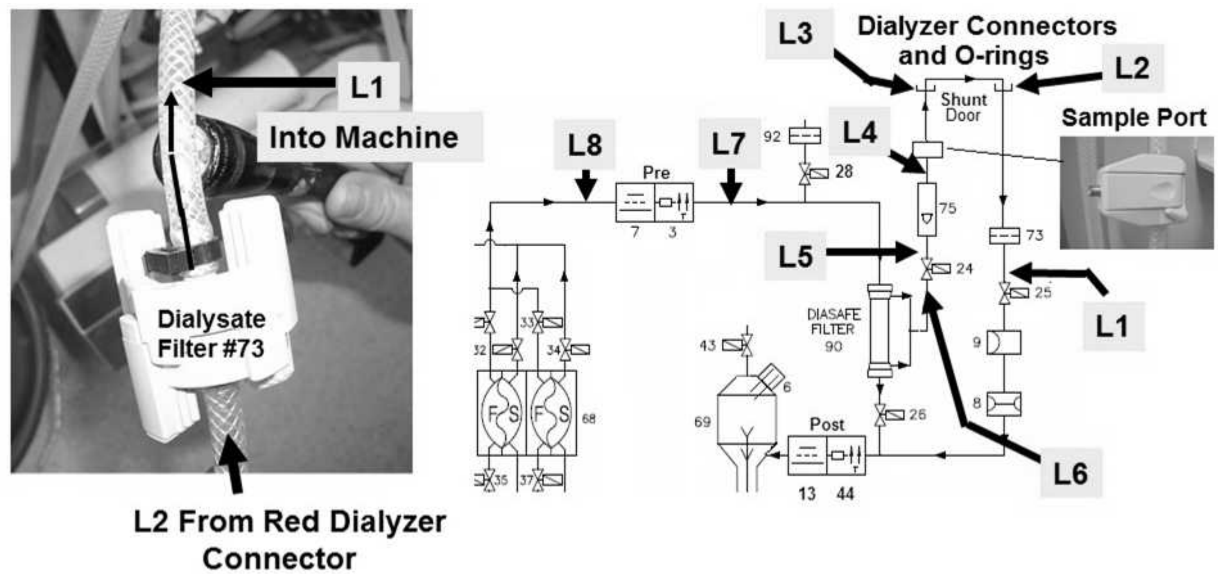
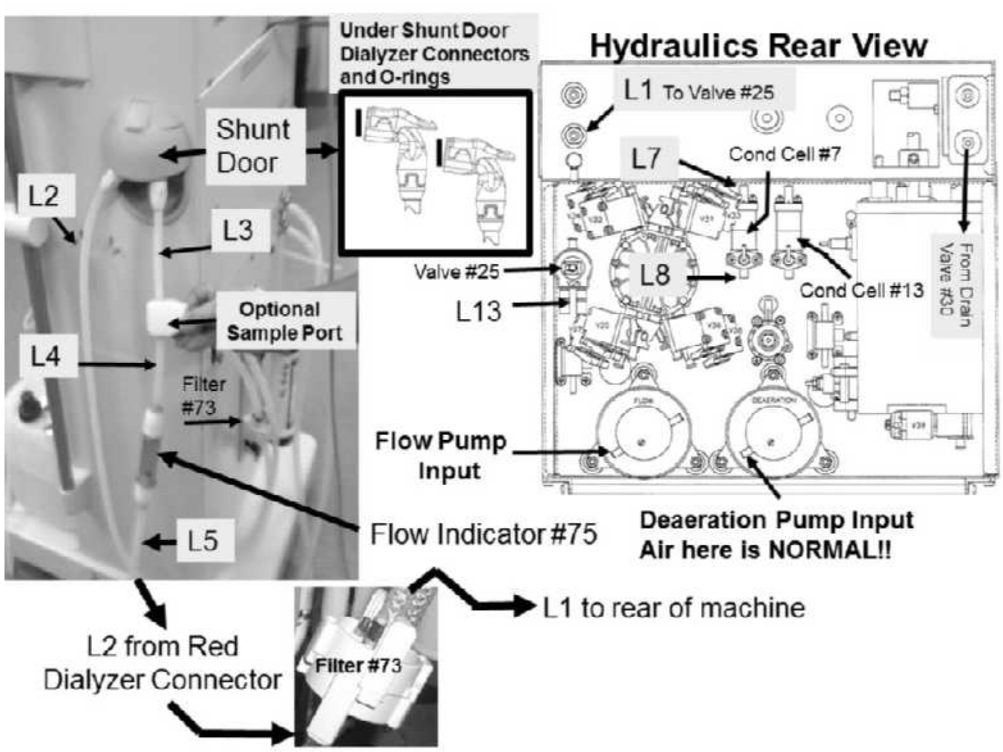



**Figure 75 – Hydraulics (External & Rear Views)**



## AIR- 1.0.2 AIR SEEN AT L1 (OUTPUT FILTER #73)

Referring to Table 9 below, ENSURING TMP is between 300 and 360 mmHg:

**Table 9 – Air Checks (1)**

| Location | Description | If air is seen go to: | If NO AIR is seen the leak is from: |
|---|---|---|---|
| L2 | From Red Dialyzer Connector (see Figure 75, page 535) | L3 (next row) | Dialysate Filter #73 |
| L3 | To Blue Dialyzer Connector (see Figure 75) | If the Sample Port is present L4. If Sample Port is NOT present L5 | Dialyzer Connector O-Ring(s) OR Dialyzer Connector(s) |
| L4 | Top of Flow Indicator #75 (see Figure 75) | L5 (next row) | The Sample Port |
| L5 | Bottom of Flow Indicator #75 (see Figure 75) | L6 (next row) | Flow Indicator #75 |
| L6 | Input Valve #24 / Valve #26 (see Figure 76, page 536). | L7 (next row) | Valve #24 / Valve #26 mounting O-Ring(s) |
| L7 | Output Pre-Dialyzer Cond. Cell #7 (see Figure 75) | L8 (next row) | DiaSafe® Filter #90 OR Valve #24 / Valve #26 mounting O-Ring(s) OR DiaSafe® Test Valve #28 |
| L8 | Input Pre-Dialyzer Cond. Cell #7 (see Figure 75) | Proceed to **page 539**, procedure number AIR- 1.0.5 | Pre-Dialyzer Cond. Cell |

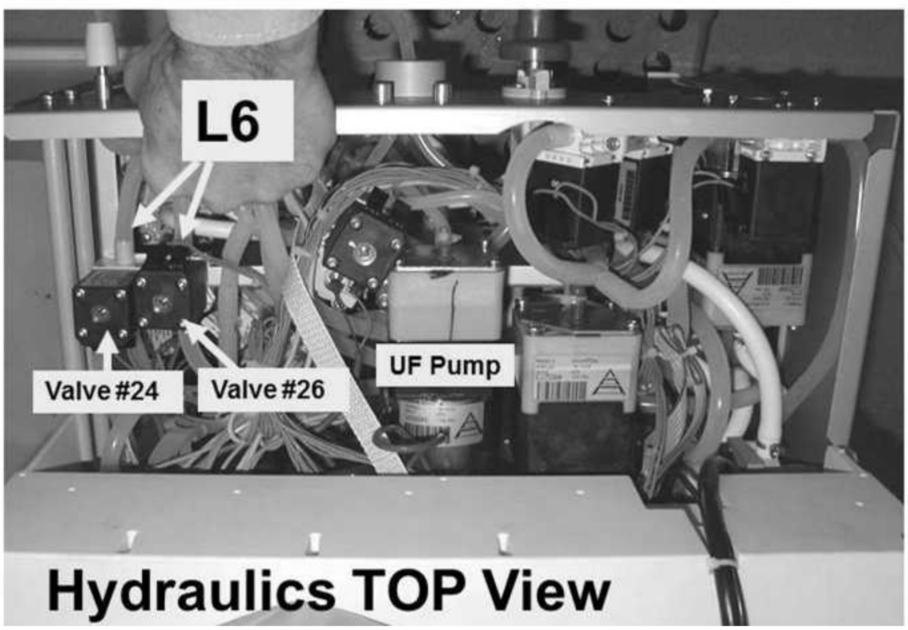



**Figure 76 – Hydraulics Top View**

## AIR- 1.0.3 AIR AT L1 / CHECK FOR AIR INPUT CHAMBER #69

Figure below, ENSURING TMP is between 300 and 360 mmHg, for one (1) minute, watch through the INPUT tubing at the **rear side** of Chamber #69 (Location #10 (L10)). Air bubbles seen?

Yes Air seen at L10! See procedure number AIR-1.0.4 (page 538).

No air seen at L10! Return to the procedure that brought you here.

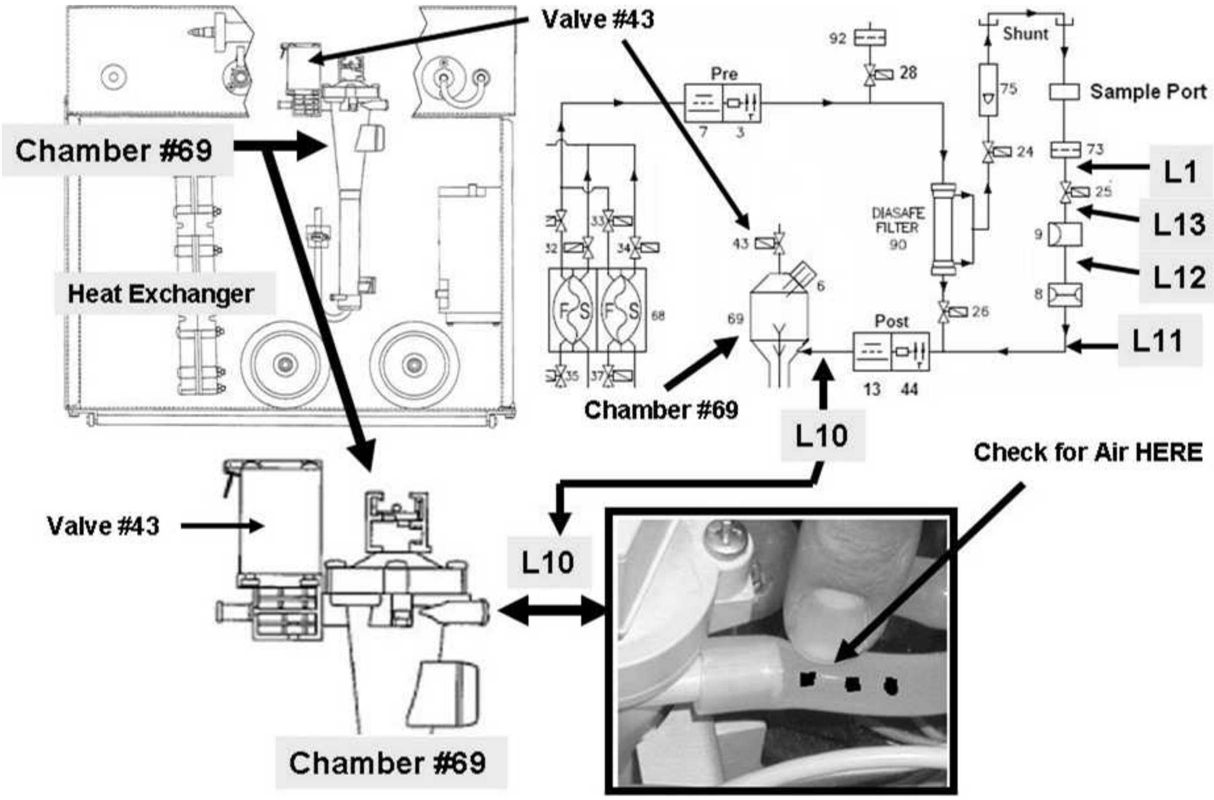



**Figure 77 – Leak Checks (2) / Abbreviated Flow Diagram**

## AIR- 1.0.4 AIR SEEN AT L10 / TRACE UPSTREAM FROM CHAMBER #69

Per Table 10 below, ENSURING TMP is between 300 and 360 mmHg, for one (1) minute, watch for air starting at Location #11 (L11).

### Table 10 – Air Checks (2)

| Location | Description | If air is seen go to: | If NO AIR is seen the leak is from: |
|---|---|---|---|
| L11 | Output Blood Leak Sensor #8 (see Figure 78, page 538) | L12 (next row) | Valve #24 / Valve #26 mounting O-Ring(s) (to LOCATE refer to Figure 76, page 536) OR DiaSafe® Filter Tubing connection |
| L12 | Input Blood Leak Sensor #8 (see Figure 78) | L13 (next row) | Blood Leak Sensor #8 |
| L13 | Output Valve #25 (see Figure 75, page 535) | L1 (next row) | Dialysate Pressure Transducer #9 |
| L1 | OUTPUT (to machine) side of Dialysate Filter #73 (see Figure 74, page 535) | See (ABOVE) procedure number **AIR- 1.0.2** (**page 536**). | Valve #25 |

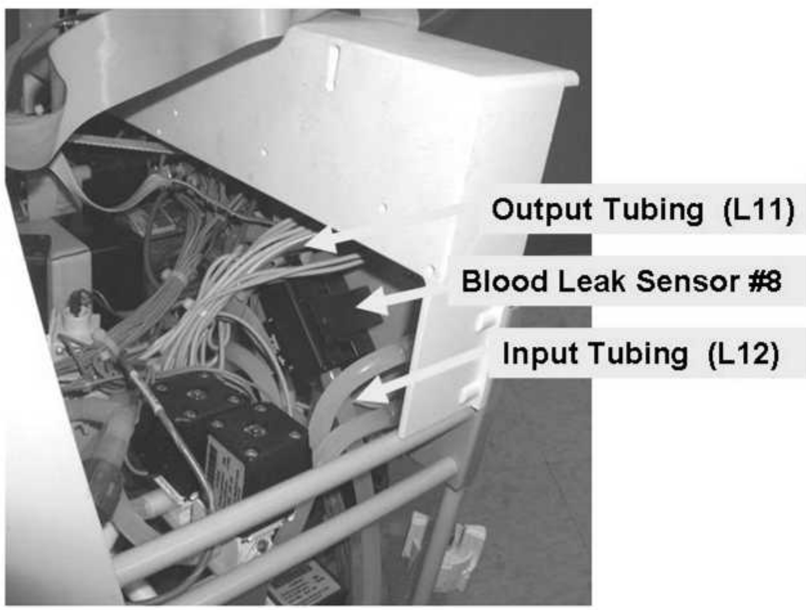



**Figure 78 – Blood Leak Tubing**

**AIR- 1.0.5 AIR SEEN FROM PRE-DIALYZER COND CELL #7**

ENSURING TMP is between 300 and 360 mmHg, for one (1) minute, watch through the outlet (clear) tubing at BOTH balancing chamber valves #31 AND #33. Is air coming from **1) ONE** OR **2) BOTH** valves?

**1)** **IF ONLY ONE:** TWO (2) possibilities: **1)** Bad O-ring connection between the valve and the balancing chamber; **2)** Cracked valve body.

**2)** **IF BOTH:** See procedure number AIR- 1.0.6 (page 539).

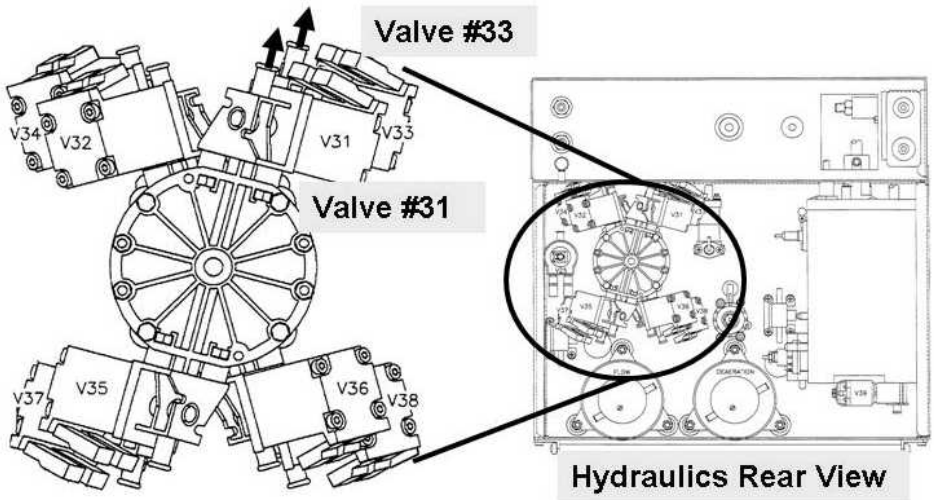



**Figure 79 – Balancing Chamber Valves #31 and #33**

**AIR- 1.0.6 CHECK FOR COMMON AIR LEAK**

Using a flashlight. are air bubbles MOVING INTO the machine through the clear acid and / or bicarbonate Inlet Tubing?

Yes  Air seen! **A)** Check the acid and / or the bicarbonates O-rings and plug; **B)** If using jugs ensure they are full; **C)** Check the pickup wand(s) O-rings.

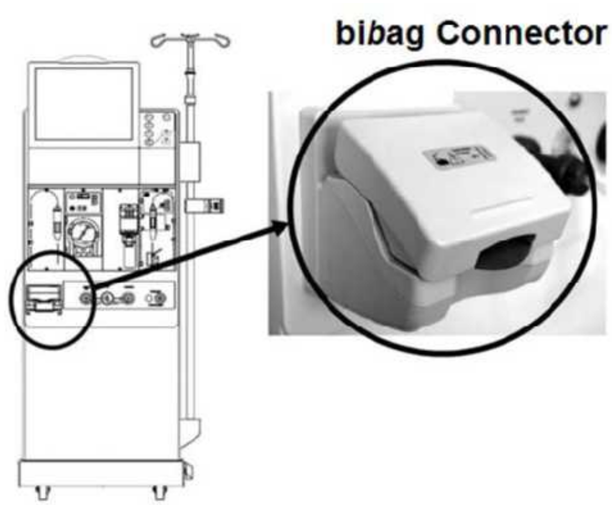
No air seen! See procedure number AIR- 1.0.7 (page 539).

**AIR- 1.0.7 BI*B*AG EQUIPPED?**

Figure right, equipped with a bi*bag* Connector?

Yes  bi*bag* Connector EQUIPPED! See procedure number AIR- 1.0.8 (page 540).

No  NO bi*bag* Connector! See procedure number **AIR- 1.0.102** (page 540).



**AIR- 1.0.8 BI*B*AG EQUIPPED**

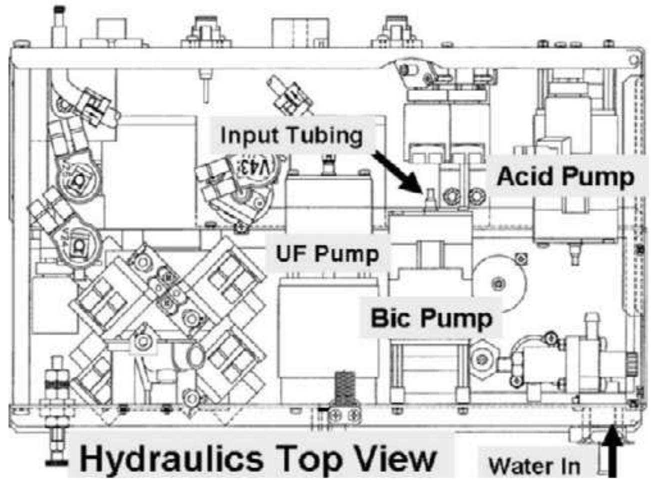



Figure right, watch for air through the (clear) BIC PUMP Inlet Tubing for one (1) minute Air seen (Yes or No)?

Yes a) Return the concentrate connectors to their rinse ports.

b) Place the machine into Rinse for three (3) minutes.

c) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

d) Check the BIC PUMP tubing again. If the air leak continues the bi*b*ag Air Separator Chamber may be leaking.

No No air seen! See procedure number AIR- 1.0.102 (page 540).

**AIR- 1.0.102 LEAK TEST HYDROCHAMBER**

a) A procedure, in a different Section, is performed next. **IMPORTANT! NOTE** this page and procedure number (AIR- 1.0.102) as you may prompted to return to here!

b) BEFORE continuing to part c, proceed to **page 150** to perform PRESSURE TEST HYDROCHAMBER.

c) If a leaking Hydrochamber was not located in part b return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

d) Return to (ABOVE) procedure number AIR- 1.0.0 (**page 534**) to continue looking for an air leak.

## SECTION 12 – INDUCED POSITIVE PRESSURE TESTS

During these procedures hydraulic systems are checked for external leaks. **USE A FLASHLIGHT! BE THOROUGH! FEEL AROUND!** Small leaks may take several minutes to become obvious and can cause BIG problems!

1. **Place the machine into RINSE!** This creates positive pressure in the secondary circuit!
2. Figure below check for leaks at: **1)** Top and bottom of Air Removal Chamber #69; **2)** Filter #74; **3)** UF Pump #22. If no leaks continue to step #3.

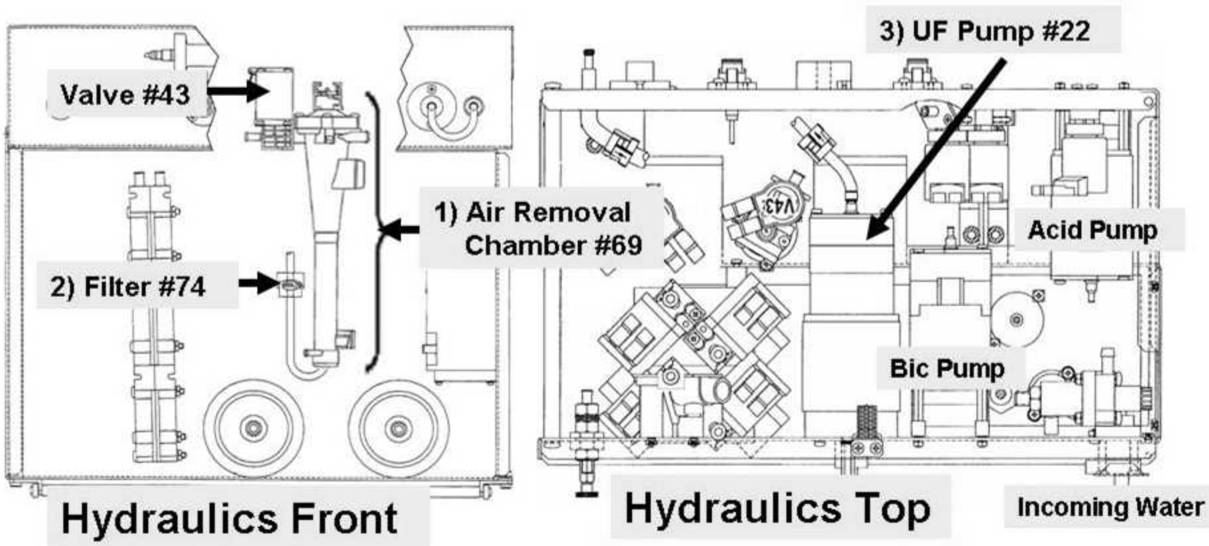



**Figure 80 – Internal Dialysate Circuit Leak Checks**

3. Figure below, check for leaks at: **1)** Valve #78; **2)** Dialyzer Quick Connectors and O-rings; **3)** External Flow Indicator #75; **4)** Dialysate Line Filter #73; **5)** (Optional) Fluid Sample Port; **6)** Dialysate line connections at the rear of the machine. If no leaks continue to step #4 (next page).

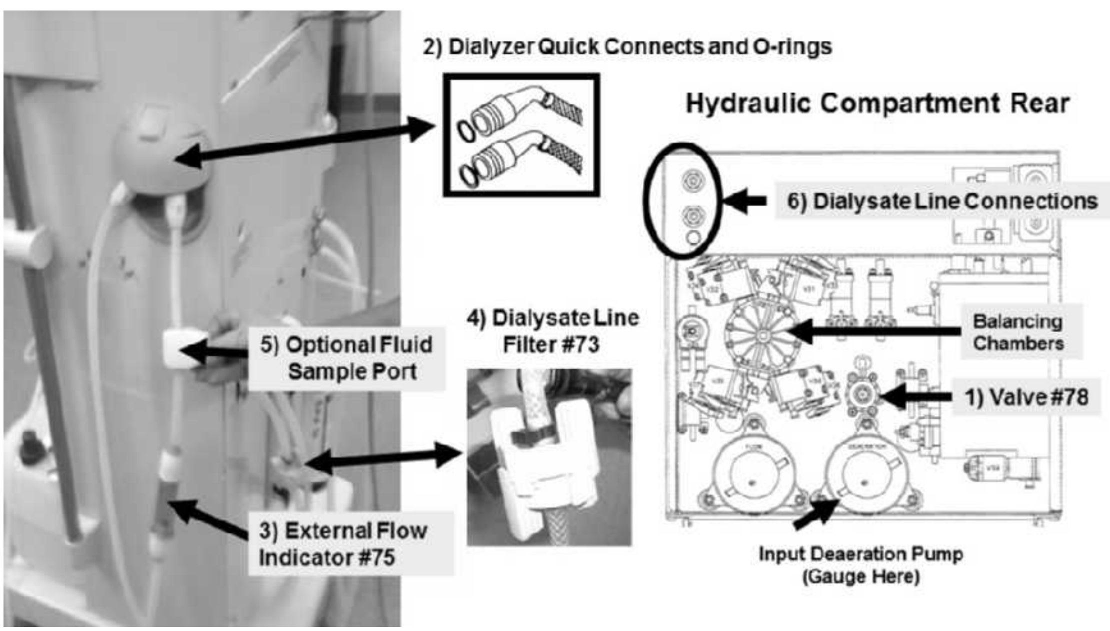



**Figure 81 – External Dialysate Circuit Leak Tests**

4. Per the Figure below, check the DiaSafe® filter's headers. If no leaks continue to step #5.

5. Look for small leaks, from the tubing and tubing fittings, INSIDE the DiaSafe® housing! If no leaks continue to step #6.

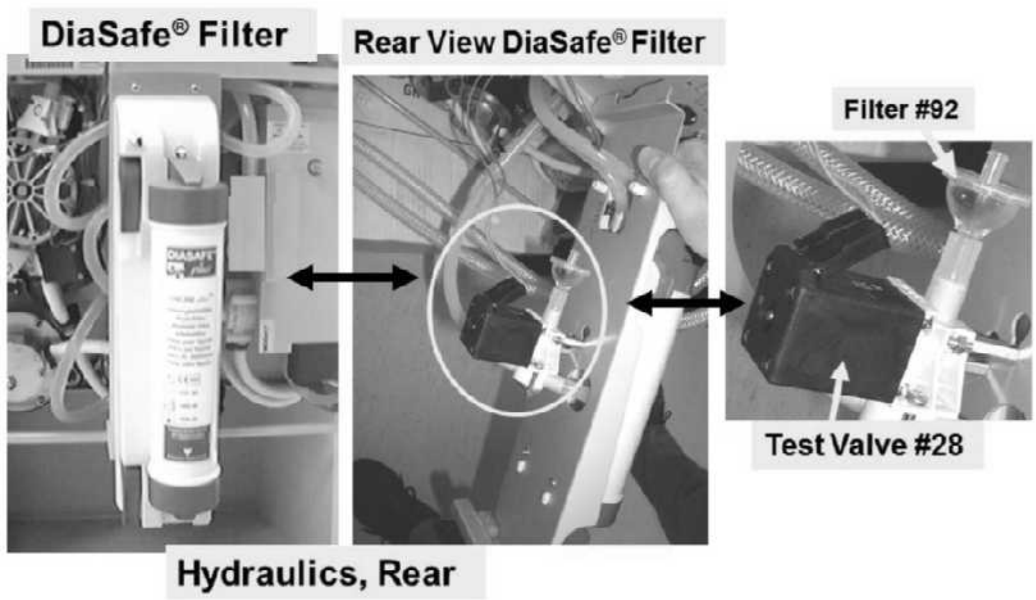



**Figure 82 – DiaSafe® Filter / Housing Leak Tests**

6. Per the Figure above, disconnect Filter #92's***** tubing from Test Valve #28 to see the valve nozzle. Fluid output from the nozzle?

   ***NOTE** Water inside Filter #92 does NOT NECESSARILY mean Valve #28 is leaking!.

   Yes Valve #28 leaking! Proceed to **page 516**, procedure number **TMP- 9.0.0**.

   No Reattach Filter #92 then continue to step #7.

7. Allow three (3) minutes then REPEAT steps #2 through #6 to locate a potential VERY slow leak. If no leaks are located continue to step #8.

8. If referred to INDUCED POSITIVE PRESSURE TESTS return to the procedure that brought you here as NOTED.

# SECTION 13 - DEAERATION PROBLEMS

## DAIR- 1.0.0 ISOLATE ACTUATOR-TEST BOARD CONTROL

a) Enter Service Mode → Calibrate Hydraulics → Deaeration Pressure but **DO NOT** press any keys yet!

b) Per the Figure below, ENSURE the **[PUMP RATE]** box = 0!

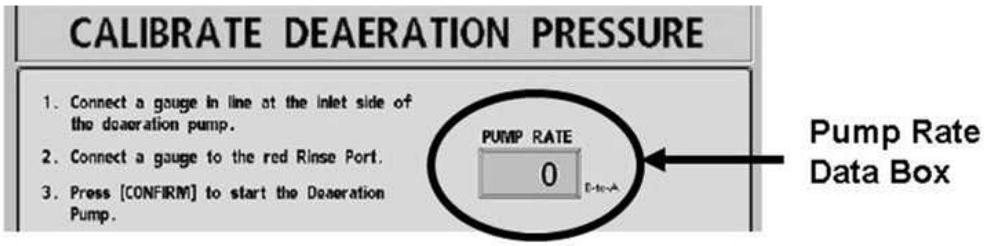
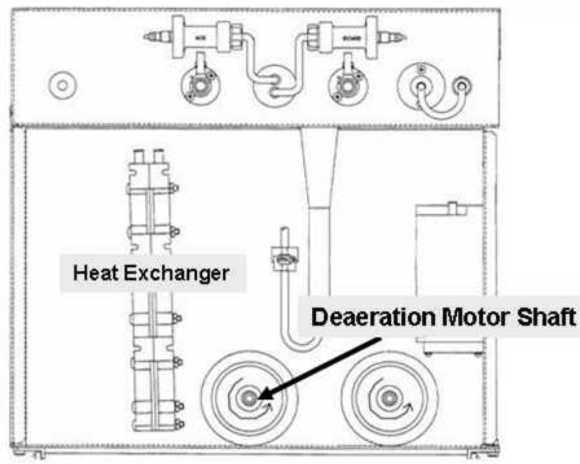



**Figure 83 – Calibrate Deaeration Pressure Screen**

c) Figure right, is the DEAERATION MOTOR'S shaft rotating (Yes or No)?

Yes — Shaft rotating! If **[PUMP RATE]** DOES NOT = 0 return to part a. If (and ONLY if) **[PUMP RATE]** = 0 replace the Actuator-Test Board.

No NOT rotating! See procedure number DAIR- 1.1.0 (page 543).




## DAIR- 1.1.0 CHECK DEAERATION MOTOR

a) **ENSURE** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it,

b) **SLAM*** the gauge into the Acetate/Acid rinse port. ***ELSE** pressure will not be read correctly!

c) Press 'Enter'. The screen says "**4. Adjust PUMP RATE…**" AND the **[Pump Rate]** box is yellow!

d) Does Loading Pressure (Rinse port gauge) PEAK to at least 16 psi?

Yes — 16 psi or more! See procedure number DAIR- 2.0.0 (page 544).

No — Less than 16 psi! Perform parts a THROUGH e below:

a) If the **[Pump Rate]** window box is less than 210 set it to 210 and press 'Enter'. If Loading Pressure remains less than 16 psi see part b. If more than 16 psi see procedure number DAIR- 2.0.0 (page 544).

b) Press 'Enter' to save the calibration then turn the machine OFF.

c) Tunr the machine on and return to Dialysis Program ("Select Program" →'Dialysis' → 'Enter')!

**Parts d and e next page**

**Loading Pressure less than 16 psi continued:**

d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

e) Proceed to **page 124**, procedure number F- 15.0.0.

## DAIR- 2.0.0 LOADING PRESSURE 16 PSI OR MORE

a) This is NOT a routine calibration! Follow the instructions to avoid error!

**NOTES:** 1) Loading and Deaeration pressure are calibrated until BOTH are in range. LOADING between 23 and 25 psi; DEAERATION refer to Appendix A (page 757).

2) The value in the **[Pump Rate]** data box determines the speed of the Deaeration Motor and thus Deaeration pressure! **[Pump Rate]** should NEVER be set to less than 180!

3) The BYPASS valve, on the Deaeration Pump (see Figure 84 (page 545)), should be adjusted ONLY if Deaeration pressure is too high when **[Pump Rate]** = 180.

4) Loading Pressure is mechanically calibrated using Valve #65 (see Figure 84 (page 545))!

5) 'Sharply' press the 'Enter' key after each **[Pump Rate]** adjustment. The data box MUST be pale yellow/white (NOT bright yellow or gray!) for the rate adjustment to take effect.

b) Press the **[PUMP RATE]** data box, it turns bright yellow.

c) Adjust its value, then sharply press 'Enter' ONCE. The box MUST return to pale yellow / white i.e. not bright yellow or gray!

d) Repeat parts b and c until if target pressures can be achieved?

Yes Target pressures achieved! **A)** Press 'Enter' to save the calibration; **B)** Turn the machine off then on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **C)** The Deaeration problem is solved but return to the procedure that prompted you here!

No Target pressures CANNOT be achieved! See procedure number DAIR- 4.0.0 (page 545)

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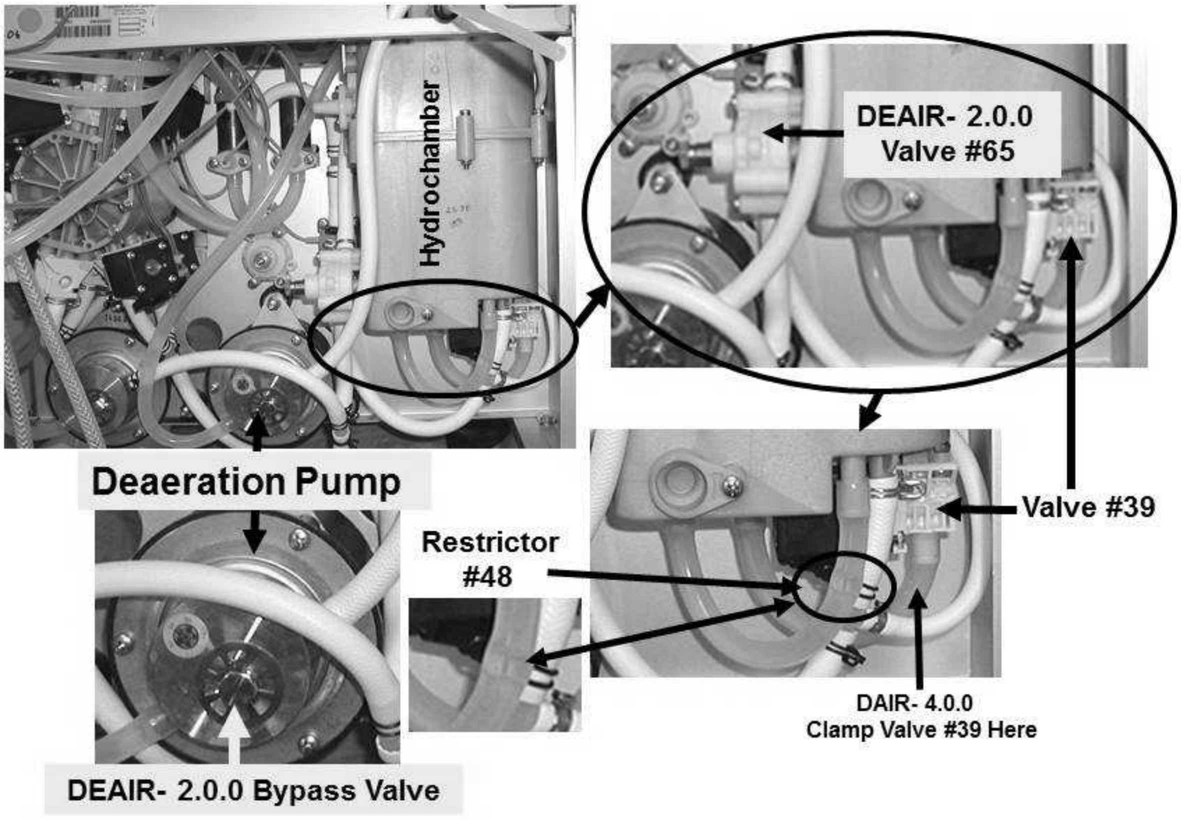



**Figure 84 – Hydraulics Rear View**

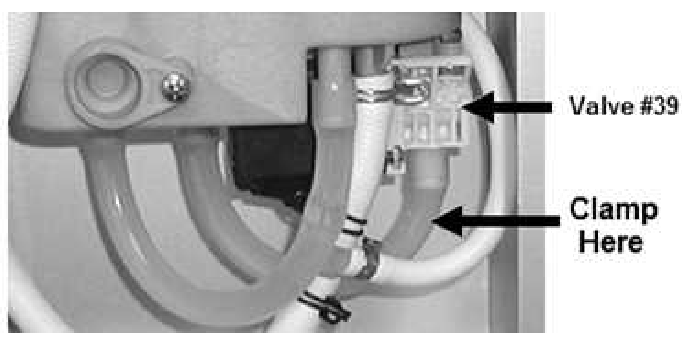
**<u>DAIR- 4.0.0 ISOLATE VALVE #39</u>**

If Valve #39 is sticking open target Deaeration Pressure CANNOT be achieved:

a) Per the Figures above <u>AND</u> right locate Valve #39 is located on the BOTTOM of the hydrochamber.

b) Clamp Valve #39's tubing at the location seen Figure right.

c) Can **[PUMP RATE]** now be adjusted to achieve <u>target</u> pressures?




Yes  Target pressures achieved! See procedure number DAIR- 4.0.1 (page 546).

No  Target pressures CANNOT be achieved! See procedure number **DAIR- 5.0.0** (**page 547**).

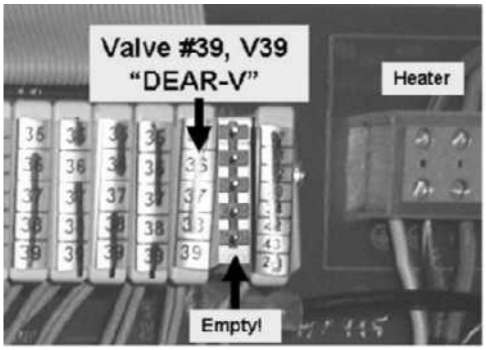
**DAIR- 4.0.1 RECHECK VALVE #39**

**IMPORTANT!** Remove the clamp from Valve #39. Do pressures remain at target?

Yes Target pressures remain! **A)** Press 'Enter' to save the calibration; **B)** Turn the machine off then on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'); **C)** The Deaeration problem is solved but return to the procedure that prompted you here.

No Pressures DO NOT remain at target! See procedure number DAIR- 4.0.2 (page 546).

**DAIR- 4.0.2 ISOLATE ACTUATOR BOARD / VALVE #39**




a) Figure right, unplug Valve #39 from distribution board position "V39, DEAR-V".

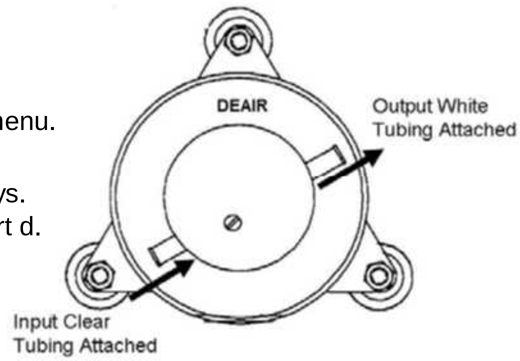
b) Do pressures go to target?

Yes Pressures go to target! The Actuator-Test Board is bad.

No Pressures DO NOT go to target! Valve #39 is bad.

LEFT BLANK INTENTIONALLY

**DAIR- 5.0.0 ISOLATE THE DEAERATION PUMP HEAD**




a) **IMPORTANT!** Remove the clamp from Valve #39.

b) Press 'Enter' twice to return to the "Calibrate Hydraulics" menu.

c) Select Deaeration Pressure but **DO NOT** press any keys.
The **[PUMP RATE]** box MUST = 0 before continuing to part d.

d) Referring to the Figure right, swap in a KNOWN good deaeration pump head.

e) Can **[PUMP RATE]** now be adjusted to achieve target pressures?

Yes Target pressures achieved! **A)** Press 'Enter' to save the calibration! **B)** Return to Dialysis Program. **C)** The Deaeration problem is solved but return to the procedure that prompted you here.

No Target pressures CANNOT be achieved! See procedure number DAIR- 6.0.0 (page 547). **NOTE! The previous pump head may be good!**

**DAIR- 6.0.0 ISOLATE THE DEAERATION MOTOR**

a) Press 'Enter' twice to return to the "Calibrate Hydraulics" menu.

b) Select "Deaeration Pressure" but **DO NOT** press any keys!

c) Swap in a known good deaeration motor.

d) 'Sharply' press 'Enter'. Can **[PUMP RATE]** be adjusted to achieve target pressures?

Yes Target pressures achieved! Target pressures achieved! **A)** Press 'Enter' to save the calibration; **B)** Return to Dialysis Program; **C)** The Deaeration problem is solved but return to the procedure that prompted you here!

No Target pressures CANNOT be achieved! See parts THROUGH d below:

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

b) BEFORE continuing to part c, a procedure in a different Section is performed next. **NOTE** this page and procedure number (DAIR- 6.0.0) as you may prompted to return to here.

c) Before continuing to part d, proceed to **page 150** to perform PRESSURE TEST HYDROCHAMBER.

d) If a Hydrochamber leak was WAS NOT located in part c, THREE (3) possible bad components: **1)** Deaeration motor OR; **2)** Deaeration restrictor #48* (*to LOCATE #48 refer to Figure 84 (page 545)) OR; **3)** Bad Hydrochamber.

# SECTION 14 - UF (ULTRAFILTRATION) PUMP PROBLEMS

## UF- 1.0.0 ISOLATE UF CIRCUIT

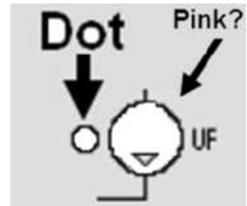
**The UF Pump ‘dot’ toggles between white and blue when the UF Pump strokes. It should NOT be constantly blue!**

THREE checks! Answer for all three at Check #3:

**Check #1:** Does the “UF Pump Alarm” banner appear?

**Check #2:** Call debug screen 0. Figure right, is the UF Pump ‘dot’ ALWAYS blue? (i.e. NEVER white)

**Check #3:** Figure right, is the UF Pump symbol PINK?



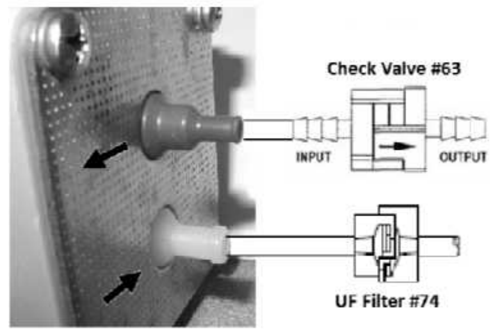

**Yes (to any of the three):** Proceed to **page 553**, procedure number UF- 5.0.0.

**No (to ALL three):** Perform parts a AND b below:

a) Per the Figures below AND right, TWO more checks:

**Check #4:** ENSURE the UF Pump is installed with its output, red or blue, nozzle at the TOP AND is mated to the mounting plate’s output (→) arrow.

**Check #5:** ENSURE the OUTPUT tubing is connected to UF Check Valve #63; INPUT tubing, at the white nozzle, to UF Filter #74.




b) If no problems were located above see procedure number UF- 1.4.0 (page 549).

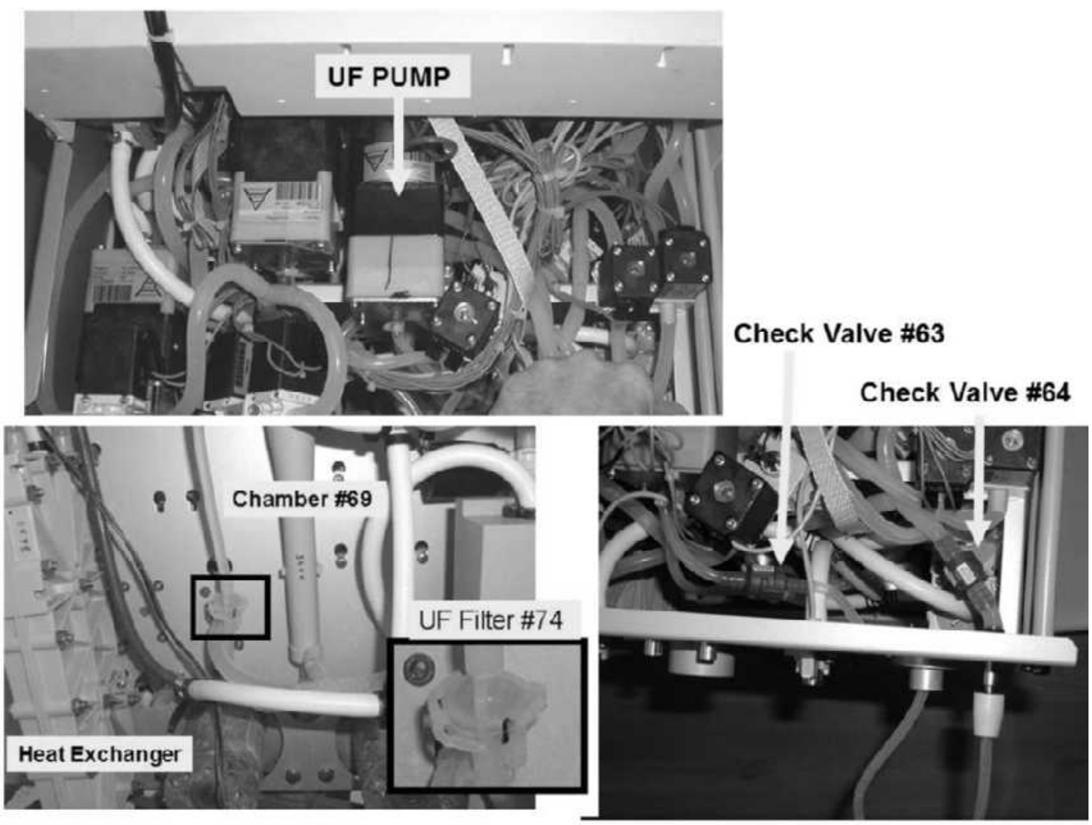



**Figure 85 – Hydraulics Top / Front Views**

UF- 1.4.0 ALL FIVE CHECKS OKAY / ISOLATE UF HYDRAULICS

a) If the Automated Tests are running (screen reads "Test:….) turn the machine OFF!

b) Return the concentrate connectors to their rinse ports and place the machine in **RINSE!**

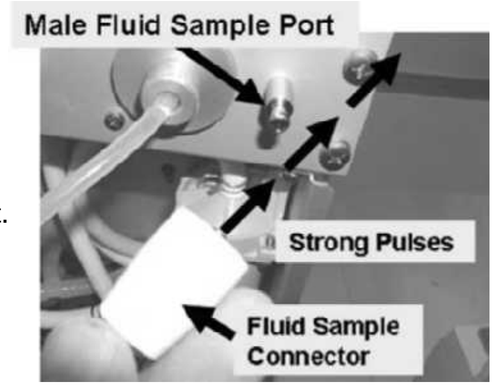
c) ENSURE the external flow indicator 'bob' is moving up and down!

d) If (and ONLY if) the UF pump is 'clicking' loudly ENSURE the wear button* and shim washers* are installed properly! * To LOCATE the button and washers refer to Figure 88 (page 552).

e) Referring to Figure 85 (page 548), TWO (2) checks:

**Check #1:** ENSURE no leaks from UF Check Valves #63 and #64.

**Check #2:** ENSURE no leaks from the UF Pump AND UF Filter #74.

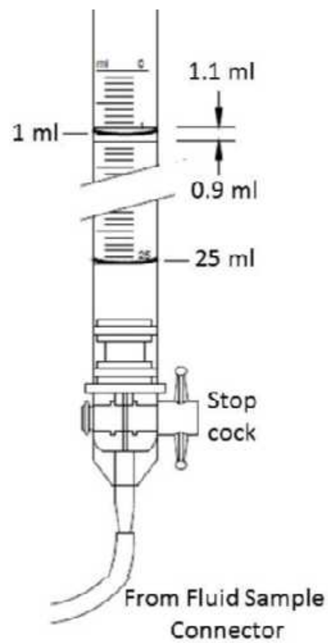



f) Figure right, remove the Fluid Sample Connector from its port. Strong individual 'pulses' that 'squirt' out at least six (6) feet?

Yes Strong pulses! See procedure number UF- 2.0.0 (page 549).

No Weak or no pulses! Proceed to **page 551**, procedure number UF- 3.0.0.

UF- 2.0.0 STRONG PULSES / ISOLATE UF PUMP CONSISTENCY




a) Enter Service Mode → Calibrate Hydraulics → UF Pump Volume.

b) Follow the screen's instructions through step #4. The screen's **[Target]** box defaults to 24 strokes. DON'T CHANGE IT!

c) Per the Figure right, attach the Fluid Sample Connector to a 25 ml burette. ENSURE the burette's stopcock is OPEN!

d) Press 'Prime' and allow the **[Target]** box to reach 0!

e) Drain the burette to EXACTLY the 25 ml scale mark.

f) REPEAT parts c and d. Does burette volume read between the 0.9 and 1.1 ml scale i.e. UF Pump delivered between 23.9 and 24.1 ml?

Yes Between 23.9 and 24.1 ml! See procedure number UF- 2.1.0 (page 550).

No TWO (2) possible scenarios:

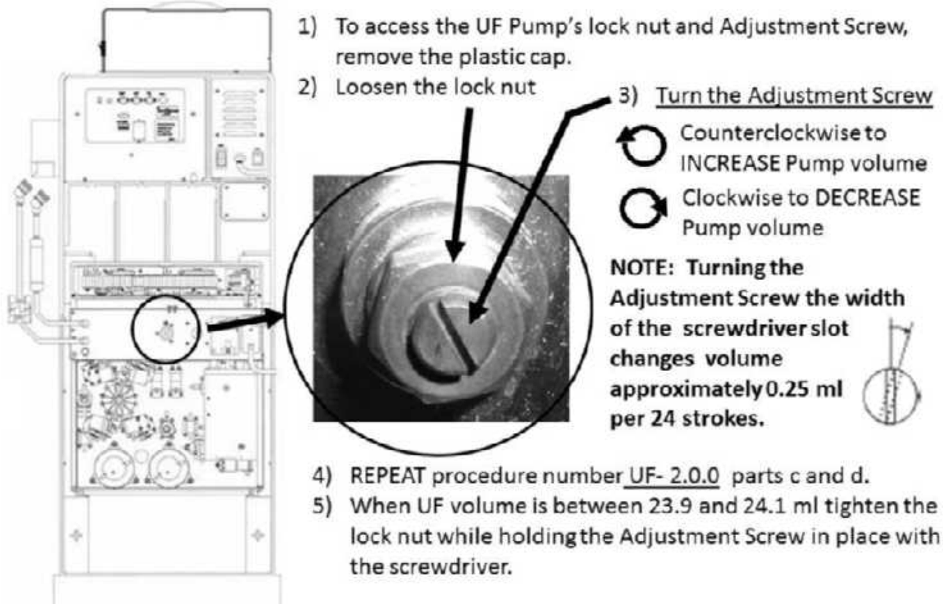
1) **IF (and ONLY if) BELOW the burette's 4 ml scale mark i.e. less than 21 ml delivered:** Proceed to **page 551**, procedure number UF- 3.0.0.

2) **IF ABOVE the burette's 4 ml scale mark i.e. more than 21 ml delivered:** Referring to Figure 86 (page 550), attempt to calibrate UF Pump Volume. Does UF Pump volume calibrate to between 23.9 and 24.1 ml after 24 strokes?

Yes Pump calibrates okay! See procedure number UF- 2.1.0 (page 550).

No Pump DOES NOT calibrate! Proceed to **page 552**, procedure number UF- 4.0.0.

**Figure 86 – UF Pump Adjustment**




## UF- 2.1.0 UF PUMP CALIBRATES OKAY / ISOLATE UF CIRCUIT IN DIALYSIS

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')

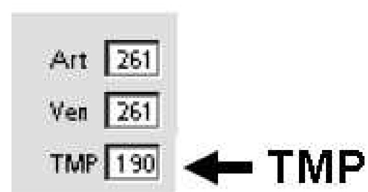
b) From the Home screen, allow [Temperature] and [Conductivity] to become normal!

c) Reset ALL alarms and press the screen's **[Test & Options]** button.

d) Press **[Both Tests**] then 'Enter'. Allow the 'Conductivity' test to pass.


e) Remove the Fluid Sample Connector to subsequently observe UF output.

f) Call debug screen 0 to see the UF Pump's 'dot' and TMP (Figure right).




g) WHEN **"Test: (Get Neg TMP)"** is up AND TMP is less than 240, watch the Fluid Sample Connector. When the UF Pump's 'dot' blinks between white and blue, about every eight (8) seconds, there should be strong pulses through the Sample Connector that squirt out into the room at least six (6) feet .

Yes Strong pulses! The UF Pump is good. See procedure number UF- 2.2.0 (page 550).

No Weak or no pulses! Proceed to **page 552**, procedure number UF- 4.0.0.

## UF- 2.2.0 STRONG PULSES / VERIFY PRESSURE TESTS

a). TMP should increase to more than 240 causing the "Test: Neg Flow On" banner to appear. Allow both (Negative and Positive) pressure test to complete.

b). Do BOTH pressure tests pass?

Yes BOTH pressure Tests pass! Proceed to **page 555**, procedure number UF- 7.0.0.

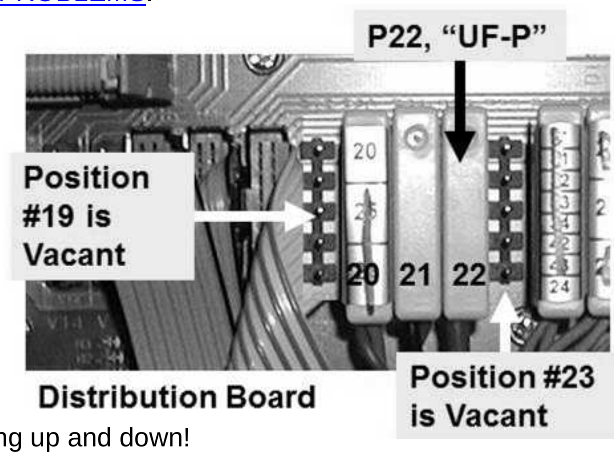
No Proceed to **page 483**, SECTION 9- TMP PROBLEMS.

**UF- 3.0.0 INADEQUATE UF PUMP OUTPUT**

a) Per the Figure right, trace the UF Pump's cable to distribution board position "P22, UF-P".

b) ENSURE the connector is placed properly AND the cable is not damaged see part c

c) **Place the machine in RINSE!**

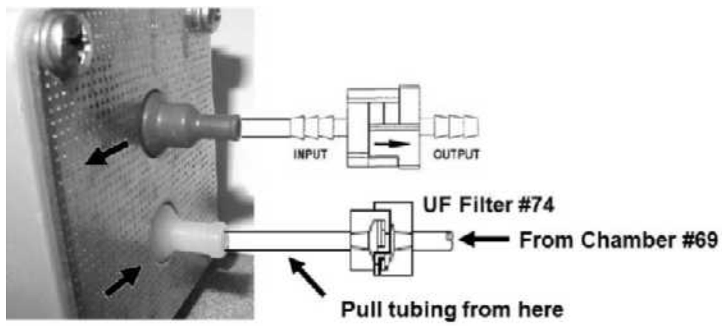



d) Ensure the external flow indicator's 'bob' is moving up and down!

e) Per the Figure right, remove the tubing from the UF Pump white INPUT (bottom) nozzle. Is there flow through Filter #74 (Yes or No)?

Yes Flow through the filter! See procedure number UF- 4.0.0 (page 552).

No No flow! This may be the problem! Replace UF Filter #74.



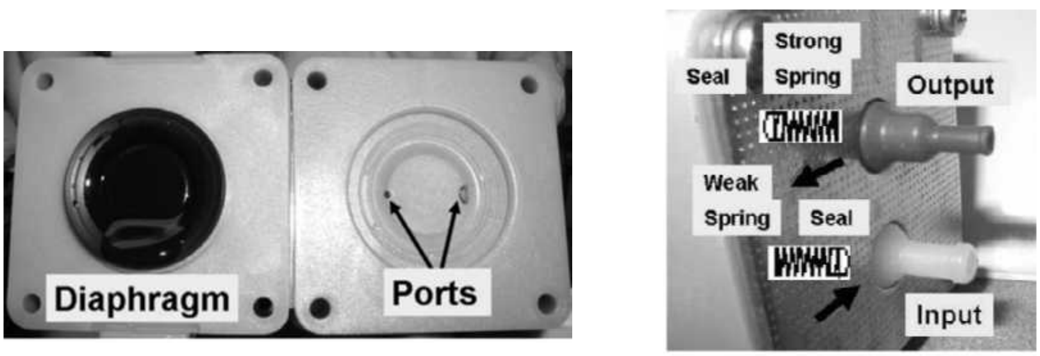




**Figure 87 – UF Pump Springs / Seals/ Diaphragm**

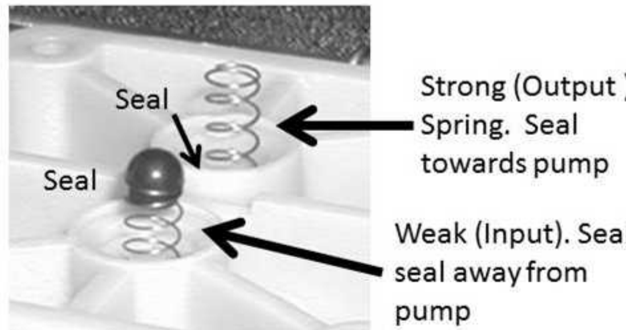
## UF- 4.0.0 ISOLATE UF PUMP (#22) MECHANICS

a) Turn the machine OFF and disassemble the UF Pump.

b) Per the Figure right, TWO (2) checks:

**Check #1:** ENSURE a STRONG spring is under the OUTPUT (colored) nozzle AND its seal is pointing INTO the pump; Replace the spring if damaged or bent.

**Check #2:** ENSURE a WEAK spring is under the INPUT (white) nozzle AND its seal is pointing AWAY from the pump. Replace the spring if damaged or bent




c) Per the Figure below, FOUR (4) more checks:

**Check #3:** ENSURE the diaphragm is NOT torn and for debris in the ports!

**Check #4:** ENSURE the Retaining Clip is in the slot to hold the 'Heavy Spring' at its maximum compression

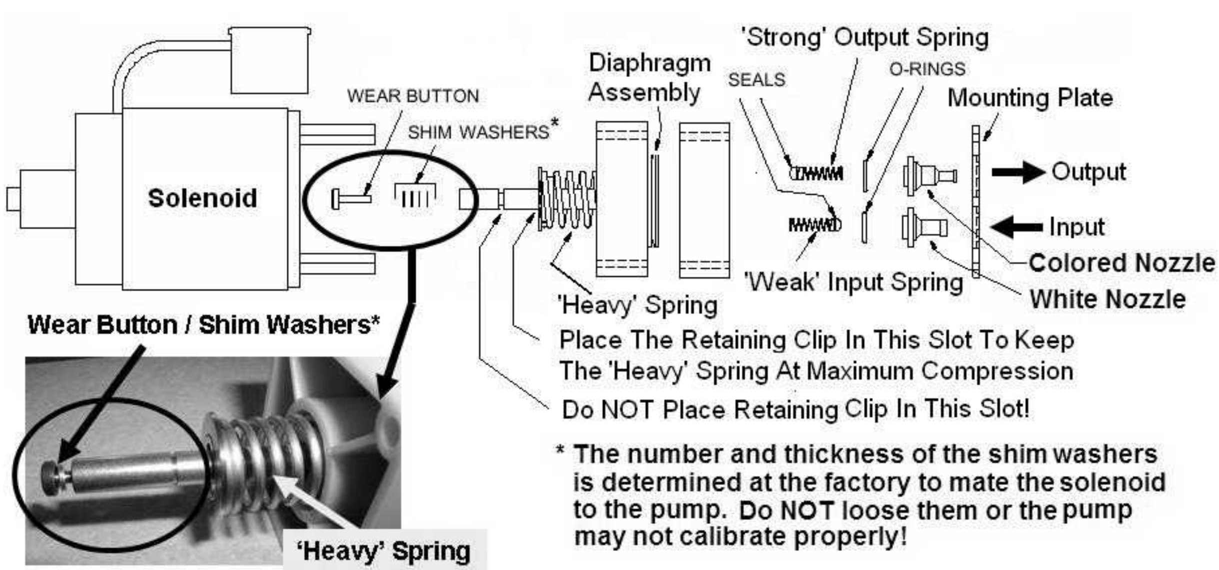
**Check #5:** ENSURE a 'shim washer' has not fallen into the solenoid cavity which may 'jam' the diaphragm shaft! **WARNING!** While checking keep track of ALL 'shim washers'

**Check #6:** Check the solenoid and diaphragm assembly for corrosion.

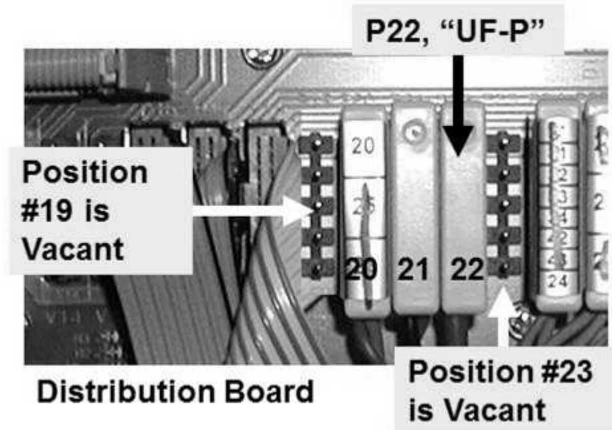
d) Reassemble the pump and attach the tubing but DO NOT mount the pump to the cabinet yet!

e) Proceed to **page 554**, procedure number UF- 6.0.0.

## Figure 88 – UF Pump Exploded



## UF- 5.0.0 CHECK UF PUMP FOR ‘OPEN CIRCUIT’



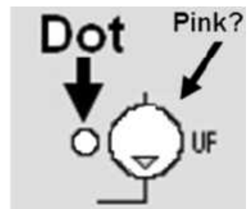

a) Turn the machine OFF!

b) Per the Figure right, ENSURE the UF Pump is plugged PROPERLY into distribution board position “P22, UF-P”**!**

c) Trace the UF Pump’s wiring to distribution board position “P22, UF-P” checking for pinching and / or insulation damaged.

d) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)

e) Allow five (5) FULL minutes THEN THREE (3) checks. Answer for all three at check #3:




**Check #1:** Does the “UF Pump Alarm” banner appear?

**Check #2:** Call debug screen 0. Is the UF Pump symbol pink?

**Check #3:** Is the UF Pump’s ‘dot’ ALWAYS blue? (i.e. NEVER white)

**Yes (to any of the three):** See procedure number UF- 5.1.0 (page 553).

**No (to <u>ALL</u> three):** The problem is not occuring at this time but **1)** Check the UF Pump per the Calibration Procedures AND **2)** Perform the Alarms and Pressure Holding Tests <u>AND</u> the UF Pump Integrity Test as described in the PM booklet!

**NOTE!** If a “UF Pump Alarm” banner EVER reappears see procedure number **UF- 5.1.0** (page 553)

## UF- 5.1.0 ISOLATE UF PUMP CIRCUIT

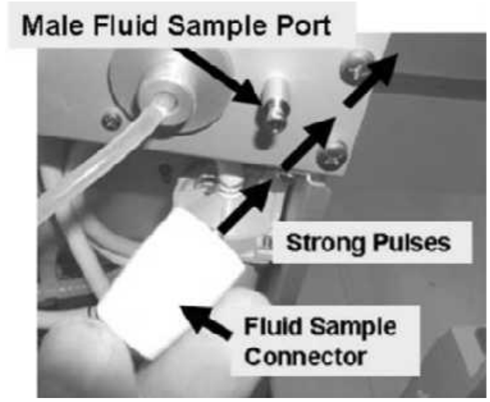
One at a time swap in the listed components (see <u>COMPONENT LIST</u> below) but in between, to check if the new component fixes the problem, return to (ABOVE) procedure number UF- 5.0.0 (page 553).

**<u>COMPONENT LIST</u>: 1)** UF Pump[1]; **2)** Actuator-Test Board; **3)** Actuator cable[2]; **4)** Distribution board; **5)** Motherboard.

[1] With a <u>known good</u> UF Pump, attach all tubing but there is no need to mount it to the hydraulic compartment unless it checks good.

[2] The cable can be checked. **<u>NOTE</u>** that four (4) **UF PUMP** connections will be checked and proceed to **page 566**, SECTION 16 - CHECKING THE ACTUATOR BOARD CABLE

## UF- 6.0.0 CHECK UF PUMP FUNCTION




a) Place the machine into RINSE and ENSURE the external flow indicator's 'bob' is moving up and down.

b) Ensuring NO LEAKS, per the Figure right, remove the Ultrafiltrate Output Sample Connector from its port to observe UF Pump output.

c) Are there 'strong individual pulses' through the Fluid Sample Connector that 'squirt' into the room at least six (6) feet?

Yes Strong pulses! See procedure number UF- 6.1.0 (page 554).

No Weak or no pulses! Swap in the listed components (see Component List below), one at a time, and in between, to see if the new component fixes the problem, return to (ABOVE) procedure number UF- 6.0.0 (**page 554**).

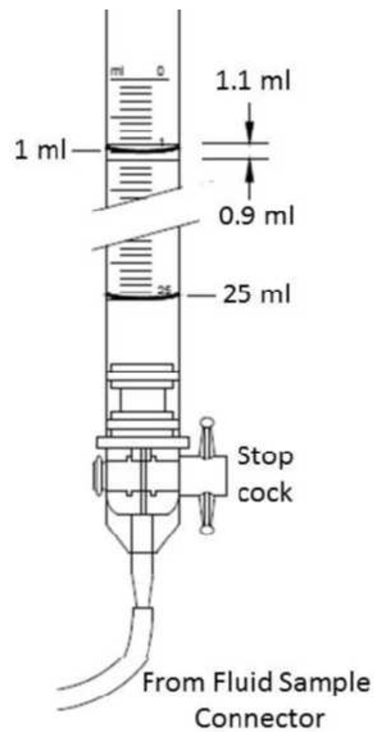
**Component List: 1)** UF Pump[1]; **2)** Actuator-Test Board[2]; **3)** Actuator cable[3]; **4)** Distribution board; **5)** Motherboard.

[1] Without mounting the pump into the cabinet YET, plug a known good pump into distribution board position "P22, UF-P".

[2] Turn the machine OFF before swapping in a known good Actuator-Test Board.

[3] The Actuator cable can be checked. **NOTE** that four (4) **UF PUMP** connections will be checked and proceed to **page 566**, SECTION 16 - CHECKING THE ACTUATOR BOARD CABLE

## UF- 6.1.0 STRONG PULSES / ISOLATE UF PUMP CONSISTENCY




a) Place the machine into Service Mode → Calibrate Hydraulics → UF Pump Volume.

b) Follow the screen's instructions through step #4. The screen's **[Target]** box defaults to 24 strokes. DON'T CHANGE IT!

c) Per the Figure right, attach the Fluid Sample Connector to a 25 ml burette. Ensure the burette's stopcock is OPEN!

d) Press 'Prime' and allow the **[Target]** box to reach 0.

e) Drain the burette to EXACTLY the 25 ml scale mark.

f) REPEAT parts c and d. Does burette volume read between the 0.9 and 1.1 ml scale i.e. UF Pump delivered between 23.9 and 24.1 ml?

Yes Between 23.9 and 24.1 ml! Return to (ABOVE) procedure number UF- 2.1.0 (**page 550**).

No Referring to Figure 86 (page 550), attempt to calibrate UF Pump volume. Does it calibrate to between 23.9 and 24.1 ml after 24 strokes?

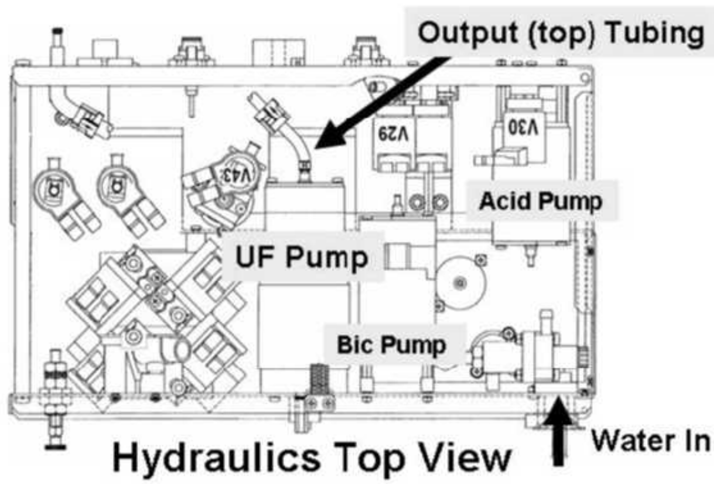
**Procedure UF- 6.1.0 continued (Does the UF Pump calibrate to between 23.9 and 24.1 ml?):**

Yes Pump calibrates! See (ABOVE) procedure number UF- 2.1.0 (page 550).

No Replace the UF Pump with a known good and repeat (ABOVE) procedure UF- 6.0.0 (**page 554**).

## UF- 7.0.0 BOTH PRESSURE TESTS PASS / UF PUMP INTEGRITY TEST

This procedure isolates the UF Pump's 'strong' output spring:




a) **Figure right**, remove the UF Pump's solid (TOP) OUTPUT tubing.

b) Attach a tubing segment to the vacant nozzle that is long enough to route it away from the hydraulics.

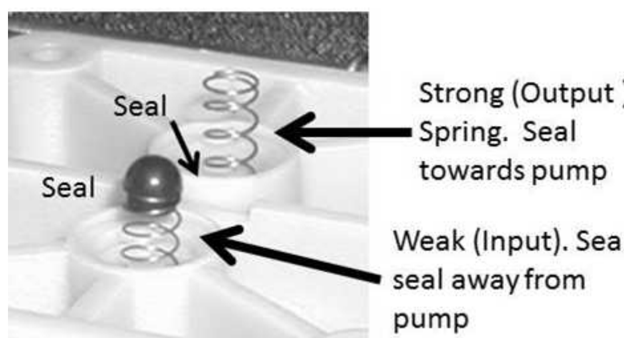
c) RESET all alarms!

d) From the **[Test & Options]** screen repeat the Pressure Tests.

e) Do BOTH Pressure Tests (Neg Flow On, Positive Flow Off) pass?

Yes BOTH Tests pass! **A)** Reattach the UF Pump's tubing then; **B)** Perform the UF Pump Calibration per the 2008 Calibration Procedures booklet.

No One or BOTH tests fail! Perform parts a THROUGH d below:




a) Rebuild the UF Pump per the Preventative Maintenance Procedures booklet

b) Return to Dialysis Program and allow the machine to stabilize.

c) ENSURE the external flow indicators' bob is moving up and down.

d) Repeat the UF Integrity Pump Check! It MUST pass!

# SECTION 15 - BLOOD LEAK PROBLEMS

The Blood Leak Detector #8 detects blood as little as 0.35 ml / Liter! If a patient is on the machine, before considering service, check for a 'real' blood leak using a Hemastix® strip or equivalent per clinic procedure.

A) ENSURE the dialyzer connectors are connected PROPERLY to the shunt!

B) CLOSE THE SHUNT DOOR! **DO NOT** reset alarms until instructed!

C) ENSURING the machine has been in Dialysis Program for six (6) minutes, [**Temperature**] MUST be between 35.0 and 39.0 °C; [**Conductivity**] between 13.2 and 14.5 mS. BOTH MUST BE STABLE i.e. NOT changing more than +/- 0.2!

D) From the Home screen, set [Dialysate Flow] to **500 ml/min** and press 'Enter'.

E) If automated tests EVER start (screen reads "Test:….) allow them to finish BEFORE continuing!

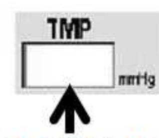
F) Call debug screen 0 to see **Flow Error**. If it EVER = 1, even once, indicates a masked Flow Error! WITHOUT LOOKING AWAY, watch **Flow Error** for two (2) minutes or until if it EVER = 1! TWO (2) possible scenarios 1) or 2) below:

Yes **Flow Error EVER = 1:** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

No **Flow Error ALWAYS = 0:** See parts a AND b below:

a) Valve #24's 'dot' MUST be BLUE BEFORE continuing to part b!

b) Call the Home screen. Figure right, what color is the TMP Window?




Red = TMP Alarm

**1)** **IF (and ONLY if) pale yellow / white:** See procedure number BL- 1.0.4 (page 556).

**2)** **IF RED (TMP alarm present): A)** Press and release the 'RESET' key then immediately press and hold it for three (3) seconds; **B)** Allow thirty (30) seconds; **C)** If a TMP alarm reoccurs, attempt RESET up to twice more BEFORE continuing to procedure number BL- 1.0.4 (page 556).

## BL- 1.0.4 ISOLATE TMP

**TMP** is STABLE ONLY if the **TMP** Window stays white AND its value does NOT change more than +/- 60 mmHg in three (3) minutes! TWO (2) possible scenarios:

**1)** **IF (and ONLY if) TMP is UNSTABLE:** Proceed to **page 483,** SECTION 9- TMP PROBLEMS.

**2)** **IF TMP is STABLE:** See procedure number BL- 1.0.5 (page 557).

**Do NOT troubleshoot Blood Leak if a "No Water", Flow Error, Temperature, or Conductivity alarm EVER occur! The machine MUST NOT be 'in bypass'!**

**BL- 1.0.5 BLOOD LEAK ALARM?**

Is the Blood Leak alarm still present (Yes or No)?

Yes Press and release the 'RESET' key up to three (3) times in twenty (20) second intervals. TWO (2) possible scenarios:

1) **IF the Blood Leak alarm resets:** See procedure number BL- 1.0.6 (page 557).

2) **IF the Blood Leak alarm does NOT reset:** Proceed to **page 558**, procedure number BL- 2.0.0.

No See procedure number BL- 1.0.6 (page 557).

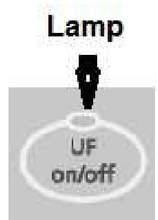
**BL- 1.0.6 BLOOD LEAK ALARM NOT PRESENT (CHECK FOR AIR)**

a) RESET ALL alarms and turn the blood pump on to 100 ml/min or more. **NOTE!** If the blood pump will not run perform the alarms and pressure tests.

b) From the Home screen, set **[UF GOAL]** to 1000 ml; Set **[UF Time]** to 1:00 hr.

c) Press 'Enter'.

d) Press the front panel's UF on/off key. Figure right, the UF lamp MUST stay on solid indicating UF is on.




e) Allow **TMP** to increase to 260 mmHg* THEN IMMEDIATELY turn UF off (UF on/off lamp off). **TMP** should increase to no more than 320 mmHg.

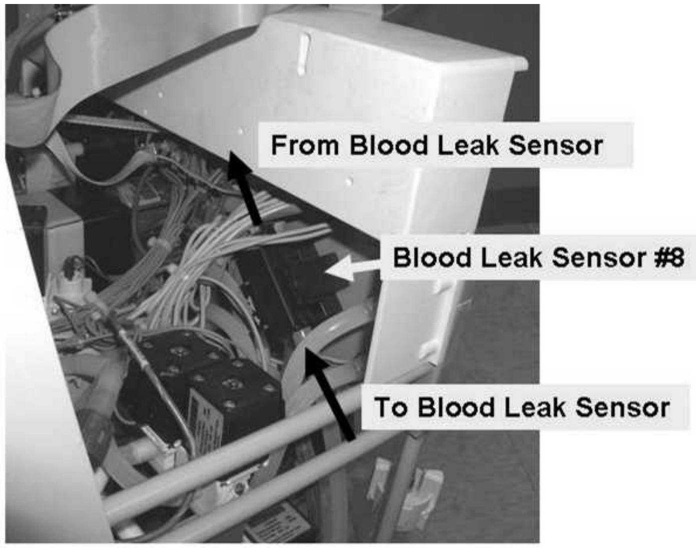
* If **TMP** NEVER reaches 260 AND a "Filling Program" banner occurs more than twice a hydraulic air leak is indicated. In this event ONLY proceed to **page 559,** procedure number BL- 3.0.0**.**

f) Per the Figure right, **using a flashlight**, watch for air bubbles through the Blood Leak Sensor's TO AND FROM tubing for one (1) minute each.

g) TWO (2) possible scenarios:

1) **IF (and ONLY if) air is seen!** Proceed to **page 559**, procedure number BL- 3.0.0.

2) **IF no air seen:** Proceed to **page 565**, procedure number BL- 6.0.0.



## BL- 2.0.0 BLOOD LEAK ALARM PRESENT (CHECK FOR AIR)

Air in dialysate cause false blood leak alarms. Per the Figure below, **using a flashlight**, watch for air bubbles through the Blood Leak Sensor's TO AND FROM tubing for one (1) minute each?

Yes Air seen! See procedure number BL- 3.0.0 (page 559).

No air seen! Proceed to **page 561**, procedure number BL- 4.0.0.

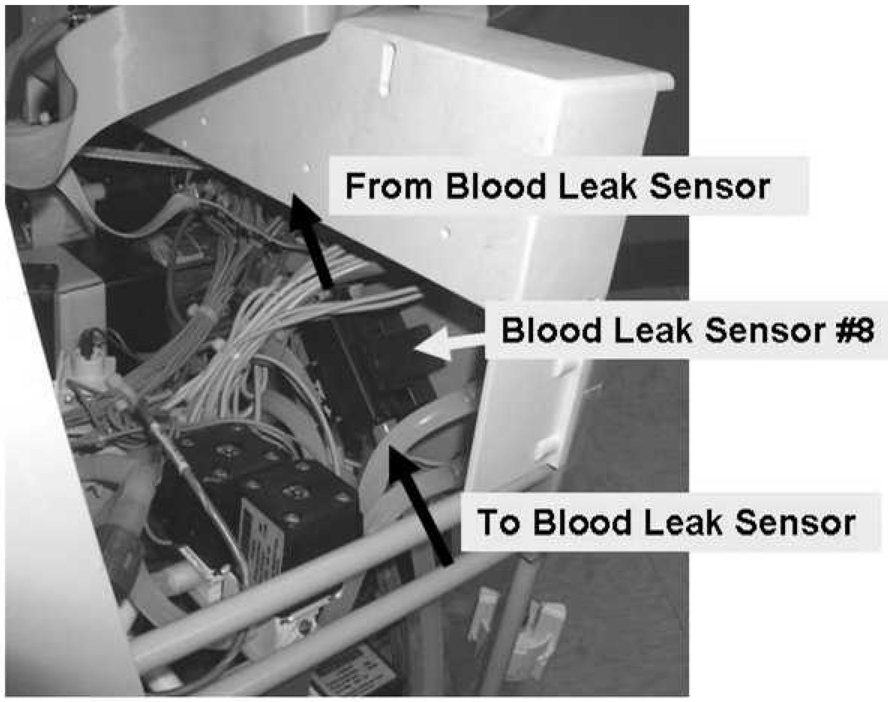



**Figure 89 – Hydraulics Side View**

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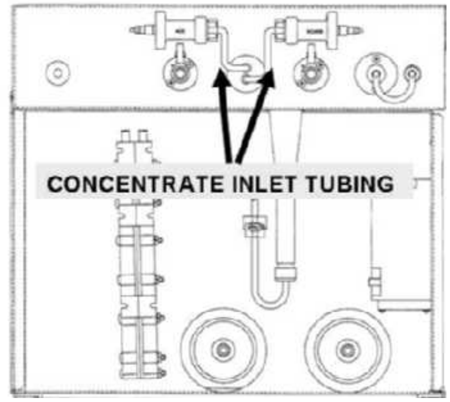
## BL- 3.0.0 AIR SEEN

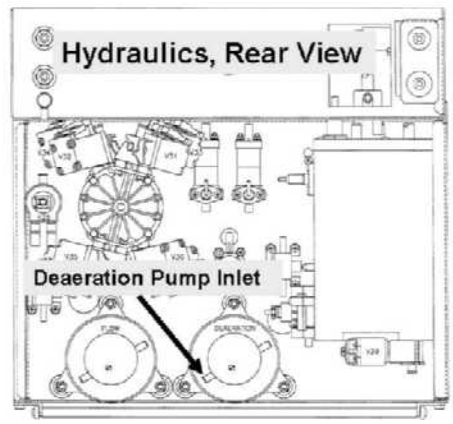



Per the Figure right, using a flashlight, are air bubbles MOVING into the machine through the clear acid and / or bicarb Inlet Tubing?

Yes Air seen! **A)** If using a jugs ensure they are full AND the wands reach the bottom of the jugs; **B)** Check the acid and / or bicarb connector's O-rings and plug; **C)** Check the pickup wand(s) tubing.

No air seen! See procedure number BL- 3.0.1 (page 559).

## BL- 3.0.1 ISOLATE AIR REMOVAL SYSTEM




a) Turn the water off and allow a "No Water" alarm to occur!

b) The Deaeration gauge is used next. **ENSURE** it reads 0 inHg before installing it!

c) Allow one (1) minute for the deaeration motor to stop running!

d) Figure right, tee the gauge to the INPUT (clear tubing) of the Deaeration Pump.

e) Turn the water on and allow the "No Water" alarm to go away!

f) Is Deaeration Pressure OKAY? Refer to Appendix A (page 757) for what pressure should be.

Yes Deaeration Pressure is OKAY! See procedure number BL- 3.0.4 (page 559).

No Deaeration Pressure in NOT OKAY! ENSURING a "No Water" alarm is NOT occuring, NOTE this page number, as you will return here, THEN proceed to **page 543,** SECTION 13 - DEAERATION PROBLEMS.

## BL- 3.0.4 DEAERATION PRESSURE OKAY

a) Turn the water OFF and allow a "No Water" alarm to occur!

b) Allow one (1) minute for the deaeration motor to stop running!

c) Remove the gauge and reattach the tubing.

d) **Turn the water on and allow the "No Water alarm to go away!**

e) See procedure number BL- 3.0.5 (page 560).

## BL- 3.0.5 AFTER INDUCED POSITIVE PRESSURE TESTS

a) Other procedures, in different Sections of the Guide, are performed next. **IMPORTANT!** **NOTE** this page and procedure number (BL- 3.0.5) as you may prompted to return to here.

b) Before continuing to part c, proceed to **page 541,** to perform SECTION 12 - INDUCED POSITIVE PRESSURE TESTS

c) If no leaks were located in part b return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) ALLOW six (6) minutes for [**Temperature**] AND [**Conductivity**] to STABLIZE to normal.

e) ENSURING the external flow indicator's 'bob' is moving up and down, press and release the 'RESET' key up to three (3) times, in twenty (20) second intervals, attempting to clear a Blood Leak alarm BEFORE continuing to part f.

f) Once again, using a flashlight, watch for air bubbles through the Blood Leak Sensor. THREE (3) possible scenarios 1) or 2) or 3) below.

1) **IF (and ONLY if) the Blood Leak alarm can be RESET AND air is seen:** Proceed to **page 534**, SECTION 11 - INDUCED AIR LEAK TESTS.

2) **IF (and ONLY if) the Blood Leak alarm CANNOT be RESET AND air is seen:** Locate and repair the air leak!

3) **IF no air is seen:** See procedure number BL- 4.0.0 (page 561).

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## BL- 4.0.0 NO AIR SEEN / ISOLATE BLOOD LEAK DETECTOR #8


a) If automated tests are running (screen reads "Test: …) allow them to finish before continuing!

b) Call debug screen 4 to see **LEAK** and **DIMN**. FIVE (5) possible scenarios, 1) or 2) or 3) or 4) or 5) below:

   **1)** **IF LEAK is between 4.5 and 5.2 AND DIMN between 4.0 and 6.0:** This is normal! Acid clean then Bleach Disinfect. If (and ONLY if) a false Blood Leak reoccurs in the near future see procedure number BL- 6.0.0 (**page 565**).

   **2)** **IF LEAK AND / OR DIMN are less than 0.2:** See procedure number BL- 4.1.0 (page 561).

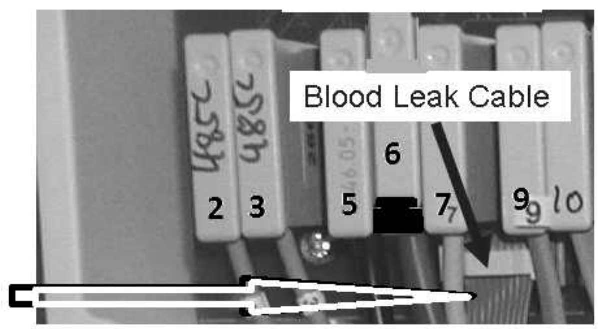
   **3)** **IF LEAK is more than 5.2; DIMN does not matter:** Proceed to **page 562**, procedure number BL- 4.4.4.

   **4)** **IF DIMN is more than 6.0; LEAK does not matter:** Proceed to **page 562**, procedure number BL- 4.4.4.

   **5)** **All OTHER scenarios:** Proceed to **page 565**, procedure number BL- 6.0.0.

## BL- 4.1.0 ISOLATE 'OPEN CIRCUIT' BLOOD LEAK DETECTOR

a) **Turn the machine OFF!**




b) Figure right, at the distribution board, ENSURE the Blood Leak Sensor's ribbon cable is plugged in properly. **If not, this may be the problem!**

c) A procedure, in different Section, is performed next. **IMPORTANT! NOTE** this page and procedure number (BL- 4.1.0 ) because you may prompted to return to here.

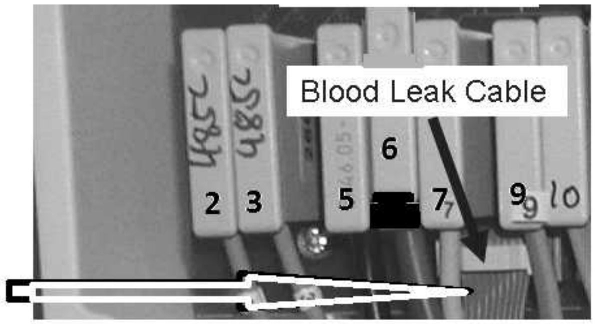
d) BEFORE continuing to part e the Sensor Board cable MAY be bad. **NOTE** that five (5) BLOOD LEAK connections will be checked and proceed to **page 569**, to perform SECTION 17 - CHECKING THE SENSOR BOARD CABLE.

e) If the Sensor Board cable checks return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

f) Allow six (6) minutes for stabilization!

g) ENSURING the external flow indicator's 'bob' is rising and falling, proceed to **page 563**, procedure number BL- 5.0.0.

**BL- 4.4.4 ISOLATE BLOOD LEAK DETECTOR**




a) **Turn the machine OFF!**

b) **Figure right**, at the distribution board, between and below positions #7 and #9, unplug the Blood Leak ribbon Cable!

c) Using a flashlight, check the vacant connector. If 'white' corrosion or damaged **male** pins are located the distribution board may need to be replaced**!**

d) Leaving the cable unplugged, return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter)!'

e) Call debug screen 4. Is **LEAK** AND **DIMN** BOTH = 0.0?

Yes **LEAK** and **DIMN** BOTH = 0.0! See procedure number BL- 4.5.0 (page 562).

No **LEAK** and/or **DIMN** are more than 0.0! THREE (3) possible bad components (Component List below). Swap the components in, one at a time, and in between repeat procedure number BL- 4.4.4 (page 562), parts d and e, to test each new component until **LEAK** and **DIMN** are BOTH 0.0 indicating the last component swapped in is the problem!

**Component List: 1)** Sensor Board cable; **2)** Sensor Board[1] (see Figure 4A, page 10); **3)** Distribution board.

[1] To prevent a "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)).

**BL- 4.5.0 RETURN BLOOD LEAK SYSTEMS**

a) **To prevent damage turn the machine OFF!**

b) Return the Blood Leak Sensor's ribbon cable to the distribution board.

c) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

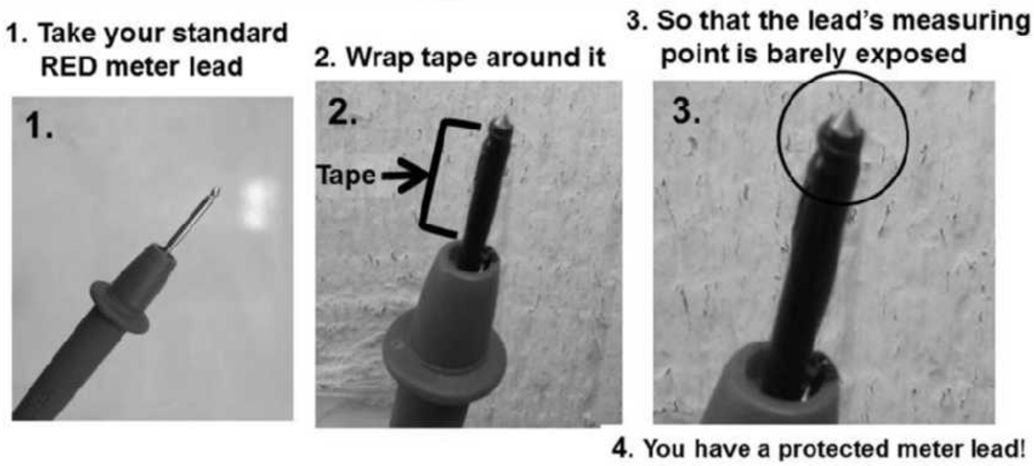
d) Allow six (6) minutes for stabilization!

e) ENSURING the external flow indicator's 'bob' is rising and falling see procedure number BL- 5.0.0 (page 563).

**BL- 5.0.0 CHECK BLOOD LEAK**

A) **CAUTION!** Signals are about to be measured at pins that are VERY close to others and touching them together with a standard meter lead may cause massive DAMAGE to the Sensor board. As instructed below make your RED meter lead a PROTECTED lead! **DO NOT perform the measurements* until you have done this!**

*** If you DO NOT wish to measure see procedure number BL- 6.0.0 (page 565).**




B) To avoid pulling cables loose GENTLY open the card cage.

C) **Set your CALIBRATED volt meter to DC voltage ($V_{DC}$)!**

D) **Connect the meter's ground (black) lead to chassis ground (see Figure 2, page 4).**

**Continue to part E next page**

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E) Per the Figure below AND as directed in Table 11 below, measure from the solder (back) side of the Sensor Board's X2 connector starting at pin #2:

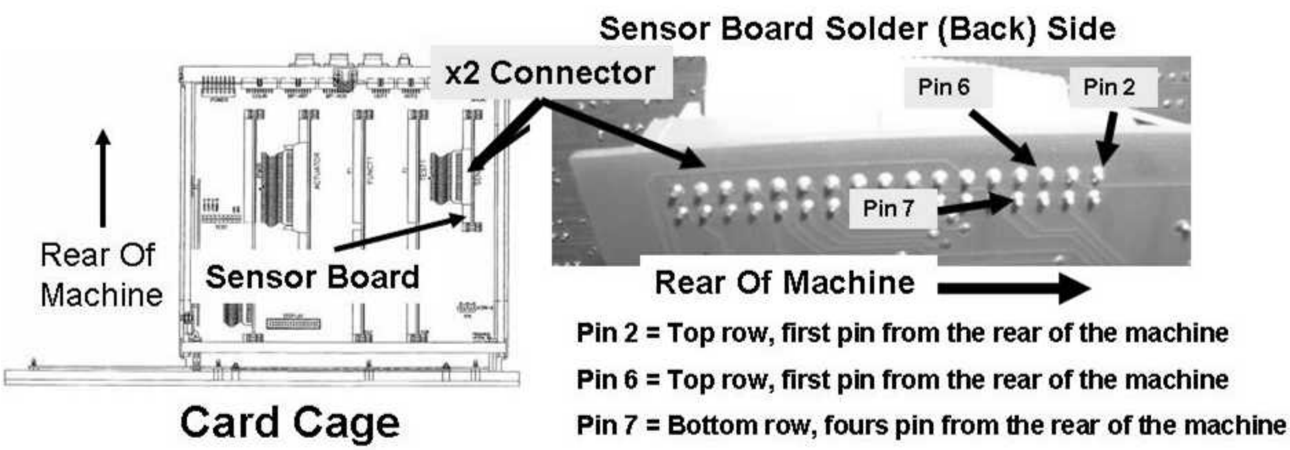



**Figure 90 – Electronic Card Cage (Sensor Board)**

### Table 11 – Sensor Board 'X2' DC Voltage Checks (Refer also to Figure 90)

| X2 Pin | X2 Pin Location | Your Response: |
|---|---|---|
| 2 | Top row, first pin from the REAR of the machine | • **IF less than 0.5 volts DC:** Measure at pin 6 (next row in table)<br>• **IF more than 0.5 volts DC:** Bad Actuator-Test Board (see page 10). |
| 6 | Top row, third pin from the REAR of the machine | • **IF less than 4.5 volts DC:** See procedure number BL- 6.0.0 (page 565).<br>• **IF more than 5.2 volts DC:** See procedure number BL- 6.0.0 (page 565).<br>• **IF between 4.5 and 5.2 volts DC:** From debug screen 4, does **LEAK** = the pin 6 measurement within +/- 0.3 volts DC?<br>Yes **LEAK** = pin 6 (+/- 0.3). Measure at pin 7 (next row in table).<br>No **LEAK** NOT within +/- 0.3 of pin 6 = Bad Sensor Board (see page 10). |
| 7 | Bottom row, fourth pin from the REAR of the machine | • **IF less than 4.0 volts DC:** See procedure number BL- 6.0.0 (page 565).<br>• **IF more than 6.0 volts DC:** See procedure number BL- 6.0.0 (page 565).<br>• **IF between 4.0 and 6.0 volts DC:** From debug screen 4, does **DIMN** = the pin 7 measurement within +/- 0.3 volts DC?<br>Yes **DIMN** = pin 7 (+/- 0.3). See procedure number BL- 6.0.0 (page 565).<br>No **DIMN** does NOT within +/- 0.3 of pin 7= Bad Sensor Board (see page 10). |

## BL- 6.0.0 BLOOD LEAK ALARM WILL RESET?

Press and release the 'RESET' key up to three (3) times in twenty (20) second intervals. TWO (2) possible scenarios below:

**1)** **IF the Blood Leak alarm CAN be reset:** The most likely cause of a false blood leak alarm is "air in dialysate" possibly caused when priming a dialyzer or moving the lines between the shunt and the dialyzer. If SURE there is no air flowing through the Blood Leak Sensor see procedure number BL- 6.1.0 (page 565).

**2)** **IF the Blood Leak alarm cannot be reset:** See procedure number BL- 6.1.0 (page 565).

## BL- 6.1.0 CLEAN / CALIBRATE BLOOD LEAK SENSOR #8

a) Turn the machine OFF!

b) Using ESD precautions push down HARD on ALL circuit boards to ensure good connections to the motherboard. ENSURE all boards are locked in!

c) ENSURE the Sensor and Actuator board ribbon cables are plugged in SECURELY

d) **IMPORTANT!** Perform ACID CLEAN followed by BLEACH DISINFECT to ensure the Blood Leak Detector's glass tube is clean of bicarb residue!

**WARNING!** Calibrating Blood Leak without first performing a Bleach Disinfect may lead to unnecessary parts replacement and / or cause an inaccurate Blood Leak calibration!

e) See procedure number BL- 6.2.0 (page 565).

## BL- 6.2.0 CALIBRATE BLOOD LEAK SENSOR #8

a) Place the machine into Service mode → Calibrate Sensors → Blood Leak Detector.

b) Press 'Enter' to start the calibration then see part c.

c) NORMALLY the calibration, one at a time, takes the screen's **Leak** then **Dimness** windows to approximately 5.00 and should stabilize within FOUR (4) minutes.

d) Does the screen advance to step #5 "**Calibration complete, press the [CONFIRM] key to save**" within FOUR (4) minutes (Yes or No)?

Yes Calibration completes! Press 'Enter' twice to save the calibration. Problem solved for now **HOWEVER,** if a false Blood Leak alarm reoccurs in the near future swap the listed components (see **Component List** below) one at a time with known good and repeat procedure number BL- 6.2.0 (page 565) until a Blood Leak does NOT reoccur.

No Turn the machine off and swap the following components (see **Component List** below), one at time, with known good, and in between attempting the Blood Leak calibration until it calibrates normally.

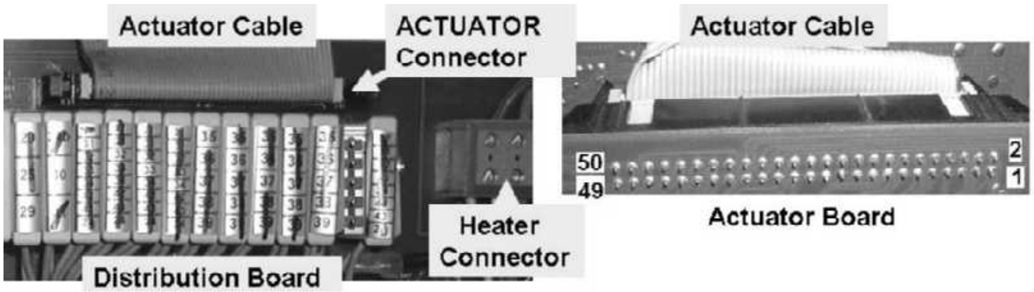
**Component List: 1)** Blood Leak Sensor #8[1]; **2)** Actuator-Test Board[2]; **3)** Sensor Board[2]; **4)** Sensor Board cable; **5)** Functional Board[2]; **6)** Distribution board.

[1] **NOTE!** To LOCATE the Blood Leak Sensor see Figure 89 (page 558)

# SECTION 16 - CHECKING THE ACTUATOR BOARD CABLE

The 50-conductor actuator cable runs between the distribution board and the Actuator-Test Board. **Check ONLY the NOTED above component connection(s)!**

a) Per the Figure below, this procedure checks the cable by measuring conductor resistance (Ω) from one end (distribution board) to the other (Actuator-Test Board). Good conductors measure 2 **Ω** or less.




b) **IMPORTANT!** Turn the machine OFF and open the card cage!

c) Check the cable's entire length (distribution board to Actuator-Test Board) for bare wires or other damage!

d) Per the Figure above, unplug the cable from the distribution board's ACTUATOR connector. Check inside the vacant ACTUATOR connector for 'white' corrosion or damaged **male** pins. **Damage ANYWHERE may be the problem!**

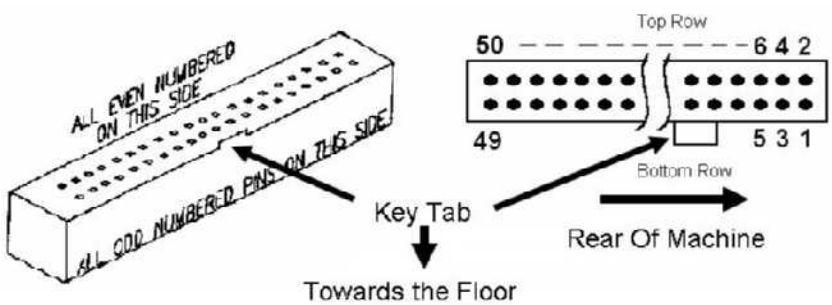
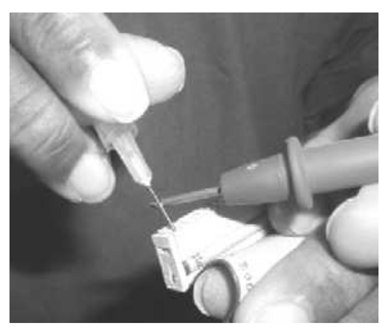



**Figure 91 – Female Distribution Board Connector**

e) To determine your ohm (Ω) meter's internal resistance touch the leads together. The meter MUST read less than 1 **Ω**! Subtract the reading from ALL subsequent measurements!

f) Per the Figure above, the cable's **female** connector has two rows of **PLUGS**. Hold it with its **KEY TAB** DOWN. This puts the even numbered **PLUGS** in the top row AND the 'Rear of Machine' to the right.



g) Refer to Table 12 (page 567), to LOCATE the appropriate numbered **PLUG(S)** for the NOTED PUMP **or** the NOTED VALVE Table 13 (page 568).

h) A meter probe will NOT penetrate deep enough and a paper clip may cause damage! Use 25 gauge non-stranded wire as a 'probe'. Per the Figure (right), insert the 'probe' into the appropriate **PLUG**, then place (or clip) one of the meter leads onto it.

i) Per Figure 92 (page 567), the cable terminates at the actuator board's P2 connector. The rear side **PINS** are in two rows. Odd numbered in the bottom row, even in the top. NOTING the reference to the 'Rear of Machine' locate the appropriate **PIN** per Table 12 or Table 13.

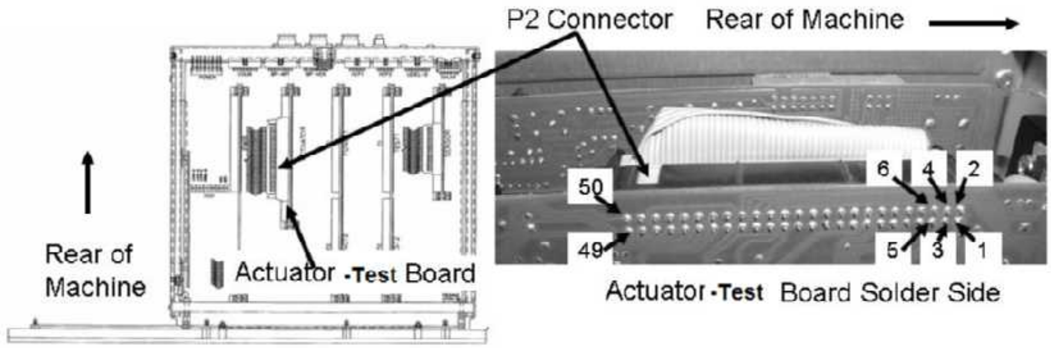



**Figure 92 – Electronic Card Cage (Actuator-Test Board)**

j) Place the second meter on the matching numbered **PIN** on the solder (rear) side of the P2 connector. **Some components require checking multiple conductors**. 2.0 **Ω** or less for ALL required conductors?

Yes The cable is good! Return it the distribution board. If referred to CHECKING THE ACTUATOR BOARD CABLE, return to the procedure that brought you here.

No Unplug the cable from the Actuator-Test Board's P2 connector. Check inside the connector for damaged **male** pins. If the pins are okay, replace the cable.

## Table 12 – PUMPS Cable Plug / Actuator-Test Board P2 Pin Locations

| PUMP | PLUG/PIN # | PLUG / PIN LOCATION |
|---|---|---|
| DEAERATION PUMP (1 of 2) | 15 | Bottom row, 8 pins from the rear of machine |
| DEAERATION PUMP (2 of 2) | 16 | Top row, 8 pins from the rear of machine |
| FLOW PUMP (1 of 2) | 19 | Bottom row, 10 pins from the rear of machine |
| FLOW PUMP (2 of 2) | 20 | Top row, 10 pins from the rear of machine |
| ACID PUMP (1 of 4) | 1 | Bottom row, first pin from the rear of machine |
| ACID PUMP (2 of 4) | 2 | Top row, first pin from the rear of machine |
| ACID PUMP (3 of 4) | 3 | Bottom row, 2 pins from the rear of machine |
| ACID PUMP (4 of 4) | 4 | Top row, 2 pins from the rear of machine |
| BICARB PUMP (1 of 4) | 5 | Bottom row, 3 pins from the rear of machine |
| BICARB PUMP (2 of 4) | 6 | Top row, 3 pins from the rear of machine |
| BICARB PUMP (3 of 4) | 7 | Bottom row, 4 pins from the rear of machine |
| BICARB PUMP (4 of 4) | 8 | Top row, 4 pins from the rear of machine |
| UF PUMP (1 of 4) | 23 | Bottom row, 12 pins from the rear of machine |
| UF PUMP (2 of 4) | 24 | Top row, 12 pins from the rear of machine |
| UF PUMP (3 of 4) | 25 | Bottom row, 13 pins from the rear of machine |
| UF PUMP (4 of 4) | 26 | Top row, 13 pins from the rear of machine |

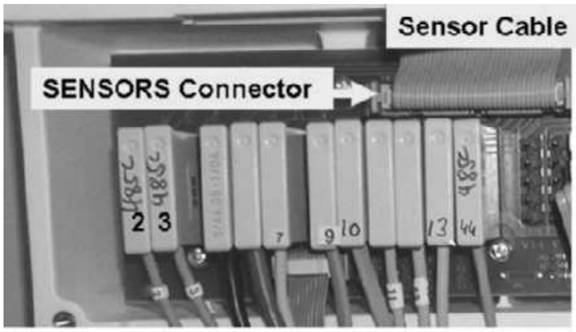
## Table 13 – VALVES Cable Plug / Actuator-Test Board P2 Pin Locations

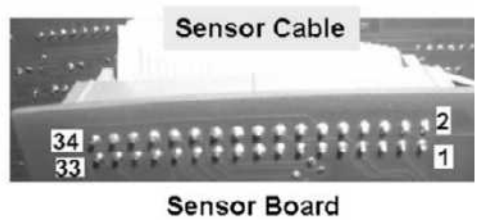
| VALVE# | PLUG/PIN # | PLUG / PIN LOCATION |
|---|---|---|
| 41 (27) | 32 | Top row, 10 pins from the screen |
| 24 | 29 | Bottom row, 11 pins from the screen |
| 25 | 30 | Top row, 11 pins from the screen |
| 26 | 31 | Bottom row, 10 pins from the screen |
| 29 | 34 | Top row, 9 pins from the screen |
| 30 | 35 | Bottom row, 8 pins from the screen |
| 31 | 36 | Top row, 8 pins from the screen |
| 32 | 37 | Bottom row, 7 pins from the screen |
| 33 | 38 | Top row, 7 pins from the screen |
| 34 | 39 | Bottom row, 6 pins from the screen |
| 35 | 40 | Top row, 6 pins from the screen |
| 36 | 41 | Bottom row, 5 pins from the screen |
| 37 | 42 | Top row, 5 pins from the screen |
| 38 | 43 | Bottom row, 4 pins from the screen |
| 39 | 44 | Top row, 4 pins from the front machine |
| 43 | 46 | Top row, 3 pins from the front of machine |

## SECTION 17 - CHECKING THE SENSOR BOARD CABLE

The 34-conductor Sensor Board cable runs between the distribution board and the Sensor Board. **Check ONLY the NOTED component connection(s)!**

a) Per the Figure below, this procedure checks the cable by measuring conductor resistance (Ω) from one end (distribution board) to the other (Sensor Board). Good conductors measure 2 **Ω** or less.




b) **IMPORTANT!** Turn the machine OFF and open the card cage.

c) Check the cable's entire length (distribution board to Sensor Board) for bare wires or other damage.

d) Per the Figure above, unplug the cable from the distribution board's SENSORS connector. Check inside the vacant SENSORS connector for 'white' corrosion or damaged **male** pins. **Damage ANYWHERE may be the problem!**

e) To determine your ohm (Ω) meter's internal resistance touch the leads together. The meter MUST read less than 1 **Ω**! Subtract the reading from ALL subsequent measurements.

f) Per the Figure below, the cable's **female** connector has two rows of **PLUGS**. Hold it with its **KEY TAB** towards the floor. This puts the even numbered **PLUGS** in the top row, odd numbered in the bottom row AND the 'Rear of Machine' is towards the right.

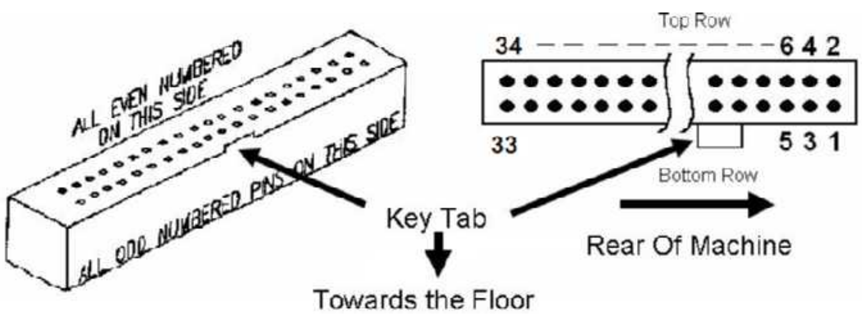
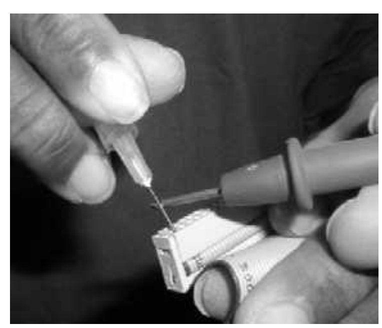



**Figure 93 – Female Distribution Board Connector**

g) Referring to Table 14 (page 570), LOCATE the appropriate **PLUGS** for the NOTED component.

h) A regular meter probe will not penetrate deep enough and a paper clip may cause damage! **INSTEAD**, use 25 gauge non-stranded wire as a 'probe'. Referring to the Figure (right), insert the 'probe' into the appropriate PLUG then place (or clip) one of the meters leads onto the 'probe'.



**Parts i and j next page**

i) **Per** the Figure below, the cable terminates at the Sensor Board's X2 connector. The solder (rear) side **PINS** are in two rows. Odd numbered in the bottom, even numbered in the top. NOTING the reference to the 'Rear of Machine' locate the appropriate **PIN** number per Table 14 (page 570

j) Place the second meter on the matching numbered **PIN** on the solder (rear) side of the P2 connector. **Some components require checking multiple conductors**. 2.0 **Ω** or less for ALL required conductors?

Yes The cable is good! Return it to the distribution board. If referred to CHECKING THE SENSOR BOARD CABLE, return to the procedure that brought you here as noted.

No Unplug the cable from the Sensor Board's X2 connector. Check inside the connector for damaged **male** pins. If the pins are okay, replace the cable.

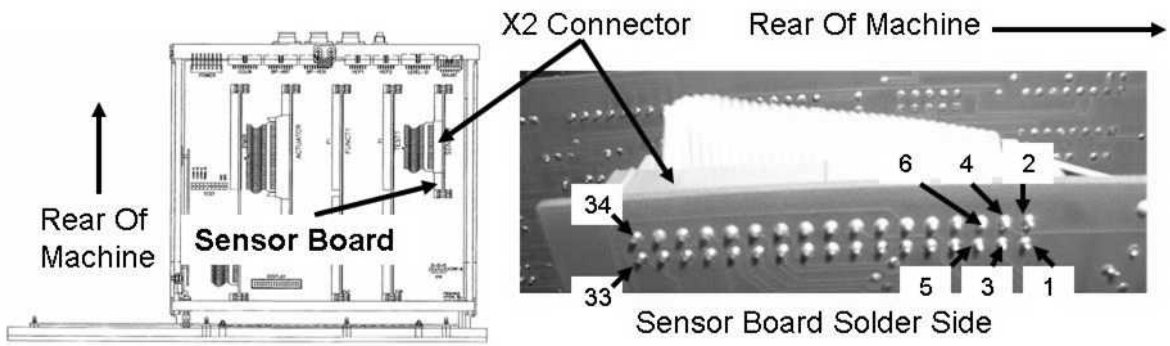



**Figure 94 – Electronic Card Cage (Sensor Board)**

**Table 14 – Cable Plug / Sensor Board X2 Pin Locations**

| HYDRAULIC COMPONENT | Cable Plug / X2 PIN # | Cable Plug / X2 PIN LOCATION |
|---|---|---|
| NTC #3 | 12 | Top row, 6 pins from the rear of machine |
| NTC #2 | 13 | Bottom row, 7 pins from the rear of machine |
| FLOAT | 21 | Bottom row, 7 pins from the front of machine |
| CFS TRANSDUCER (1 of 3) | 11 | Bottom row, 6 pins from the rear of machine |
| CFS TRANSDUCER (2 of 3) | 14 | Top row, 7 pins from the rear of machine |
| CFS TRANSDUCER (3 of 3) | 15 | Bottom row, 8 pins from the rear of machine |
| COND CELL | 16 | Top row, 8 pins from the rear of machine |
| ACID EOS | 25 | Bottom row, 5 pins from the front of machine |

**Table 14 continued next page**

**Table 14 continued:**

| | | |
|---|---|---|
| BICARB EOS | 23 | Bottom row, 6 pins from the front of machine |
| AIR SENSOR | 5 | Bottom row, 3 pins from the rear of machine |
| BLOOD LEAK TEST (1 of 5) | 2 | Top row, first pin from the rear of machine |
| BLOOD LEAK CAL DIMNESS (2 of 5) | 3 | Bottom row, 2 pins from the rear of machine |
| BLOOD LEAK CAL BL (3 of 5) | 4 | Top row, 2 pins from the rear of machine |
| BLOOD LEAK OUTPUT (4 of 5) | 6 | Top row, 3 pins from the rear of machine |
| BLOOD LEAK OUTPUT (5 of 5) | 7 | Bottom row, 4 pins from the rear of machine |
| DIALYSATE TRANSDUCER (1 of 3) | 8 | Top row, 4 pins from the rear of machine |
| DIALYSATE TRANSDUCER (2 of 3) | 10 | Top row, 5 pins from the rear of machine |
| DIALYSATE TRANSDUCER (3 of 3) | 11 | Bottom row, 6 pins from the rear of machine |

# SECTION 18A - DIAGNOSTIC VALVE LEAK TESTS

Perform these tests ONLY as directed previously. Arbitrary performance may yield erroneous results!

**ONLY the Balancing Chamber Valves, #31 through #38, will be tested! DO NOT run "auto" which tests all valves!**

## A. AUTOMATED LEAK TEST PREPARATION

a) Return both dialyzer connectors to the shunt and close the door!

b) **Return the concentrate connectors to the rinse ports**

c) **Place the machine in RINSE PROGRAM**.

d) Using a flashlight, THROUGHLY check for and repair ANY leak!

e) Enter Service Mode → Diagnostics → Valve Leak Test. When the **[Test Status]** data box says "Ready" proceed to B. PERFORM IOS TEST (page 572).

## B. PERFORM IOS TEST

The **IOS** (**I**ntegrity **O**f **S**ystem) isolates Chamber #69 and its tubing for leaks AND an **IOS** failure may cause multiple valves to fail falsely! **IOS must pass BEFORE testing the valves!**

a) Press the screen's **[Valve Number]** data box, it turns bright yellow.

b) Using the keyboard's Pg Up (↑) key set the **[Valve Number]** box to **"IOS".**

c) Press 'Enter' then allow "Prep" and "Testing" to complete.

d) Reading the screen's **[TEST STATUS]** box, TWO (2) possible scenarios:

   **1)** **IF "Failed" appears:** REPEAT the **IOS** test. If (and ONLY if) it passes see Scenario #2 below. If it fails again turn the machine off then see AUTOTEST- 1.0.0 (page 573).

   **2)** **IF "Passed" appears:** Perform parts a THROUGH d below until **ALL EIGHT (8)** Balancing Chamber Valves, #31 through #38, have been tested:

      a) Press the screen's **[Valve Number]** box. Using the Pg Up (↑) key select a Balancing Chamber Valve*****.

      ***** The 'fresh' valves #31, #33, #35 and #37 are tested first followed by the 'spent' valves #32, #34, #36 and #38.

      b) Press 'Enter'. Allow "Prep" and "Testing" to complete.

      c) If a valve passes ONCE consider it "passed" and continue to part d. If a valve fails repeat parts a and b on THAT valve. If it fails again consider it "failed" THEN **NOTE** the valve number(s) AND continue to part d.

      d) Repeat parts a through d until **ALL EIGHT (8)** balancing chamber valves have been tested then refer to Table 15 next page:

### Table 15 – Leak Test Scenarios

| Observed Scenario: | Your Response: |
|---|---|
| If ALL valves PASS | Return to the NOTED procedure that brought you here |
| If ONLY one valve fails | See procedure number AUTOTEST- 7.0.0 (page 577) |
| If ONLY Valves #31 and #35 fail | See procedure number AUTOTEST- 7.0.0 (page 577) |
| If ONLY Valves #32 and #36 fail | See procedure number AUTOTEST- 7.0.0 (page 577) |
| If ONLY Valves #33 and #37 fail | See procedure number AUTOTEST- 7.0.0 (page 577) |
| If ONLY Valves #34 and #38 fail | See procedure number AUTOTEST- 7.0.0 (page 577) |
| ALL OTHER scenarios | Turn the machine OFF then see procedure number AUTOTEST- 1.0.0 (page 573) |

**AUTOTEST- 1.0.0 IOS FAILED / POSITIVE PRESSURE LEAK TESTS**

**ANY external leak, however small, MAY be causing IOS failures and MUST be repaired!**

a) Place the machine into RINSE PROGRAM.

b) Using a flashlight, THROUGHLY check for external leaks.

c) Check the **ENTIRE** length of the dialyzer lines for leaks (i.e. dialyzer quick connectors, external flow indicator, connections at the rear of the machine and (if equipped) the sample port.

d) Check the DiaSafe® filter tubing AND DiaSafe® housing for external leaks.

e) If a leak is NOT located allow two (2) minutes then repeat parts a THROUGH d! If still NO LEAKS see procedure number AUTOTEST- 2.0.0 (page 573).

**AUTOTEST- 2.0.0 NO EXTERNAL LEAKS LOCATED / CHECK UF PUMP**

The UF Pump creates negative pressure for the Valve Leak Test. If it is malfunctioning multiple valves fail:

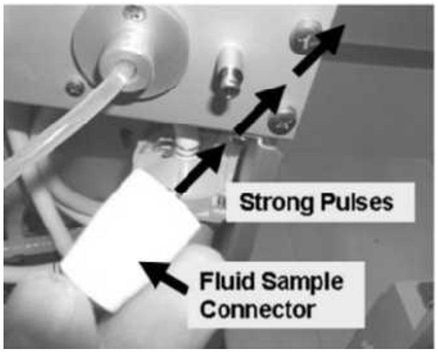
a) Enter Service Mode → Calibrate Hydraulics → UF Pump Volume.

b) Place the dialyzer connectors into a bucket of water on the floor.

c) Close the shunt door.

d) Figure right, remove the Ultrafiltrate Output Sample Connector from its port and hold it up as seen in the Figure!

e) Press 'Enter'. The screen changes.




f) Press the 'Prime' key. IGNORE five (5) strokes then watch five (5). Does the UF Pump deliver 'strong pulses' through the Fluid Sample Connector (Figure right) that 'squirt' out at least six (6) feet?

Yes Strong pulses! See procedure number AUTOTEST- 3.0.0 (page 574).

No Very weak or no pulses! See parts a THROUGH c below:

a) Turn the machine OFF.

b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

c) Proceed to **page 548**, UF PUMP PROBLEMS.

**AUTOTEST- 3.0.0 STRONG PULSES / ISOLATE DIALYSATE PRESSURE**

**This is NOT a routine calibration. Follow the instructions exactly to avoid error!**

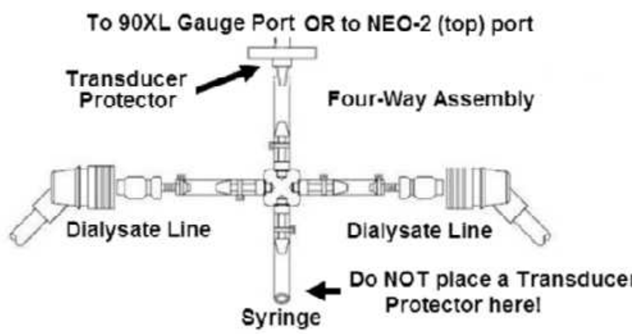
a) Press the ‘Options’ key → Calibrate Sensors → Dialysate Pressure. The screen says **“1. Connect a pressure gauge in line…”**

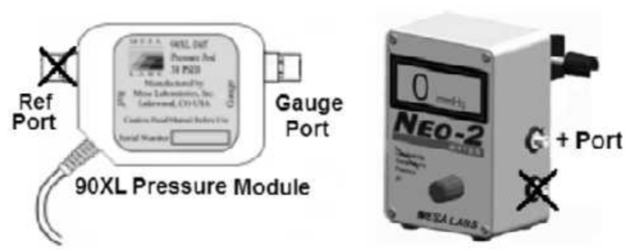
b) Figure right, connect the Four-Way Assembly into the dialysate lines BUT **DO NOT close the shunt door yet!**

c) A transducer protector **MUST NOT** be installed in the ‘to syringe’ tubing segment!

d) Place the Four-Way Assembly in the dialyzer holder.

e) **IMPORTANT!** Clamp the ‘to meter’ tubing segment for now!




f) If using a **NEO-2** attach to the +Port (top (red) port). If using a **90XL** attach to the Pressure Module’s Gauge Port.

g) DO NOT allow tension or kinks in the Four-Way’s tubing segments!

h) **CLOSE the shunt door AND ENSURE the flow indicator’s ‘bob’ is moving at least ¼ way up in the sight tube**.

i) Press ‘Enter’. The screen says **“3. Press the [Dialysate Flow on/off] key”.**

j) Press the screen’s “Dialysate Flow On” button. It turns dark blue.

k) Press ‘Enter’ then ENSURE the button says “Dialysate Flow Off” AND the external flow indicator ‘bob’ is NOT moving i.e. Flow is off.

l) **Remove ALL clamps!**

m) Using the syringe, adjust pressure until the external meter reads between -2 and 2 mmHg.

n) Press ‘Enter’ then see procedure number AUTOTEST- 3.1.0 (page 575).

## AUTOTEST- 3.1.0 CREATE NEGATIVE PRESSURE

a) The screen says **"6. Pressurize until dialysate pressure reads -250 mmHg**…".

b) PULL on the syringe plunger. Can you achieve between -245 and -255 mmHg on the external meter?

Yes Between -245 and -255 on the meter! See procedure number AUTOTEST- 3.2.0 (page 575).

No Between -245 and -255 CANNOT be achieved! ENSURE the Transducer Protector, at the meter is not wet OR consider replacing it. If OKAY, see procedure number **AUTOTEST- 4.0.0X** (page 575).

## AUTOTEST- 3.2.0 NEGATIVE PRESSURE HOLDING TEST

a) CLAMP the 'to meter' tubing segment.

b) Does the meter pressure HOLD, +/- 15 mmHg, for one (1) minute?

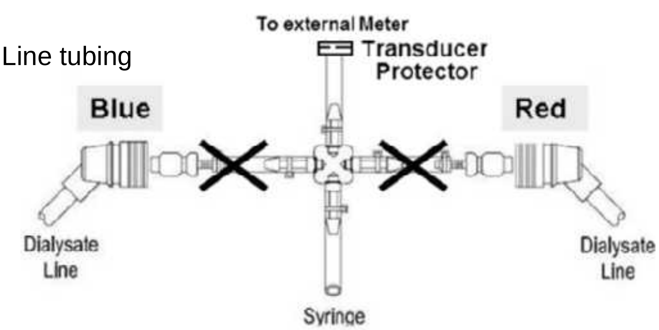
Yes Pressure HOLDS! Proceed to **page 576**, procedure number AUTOTEST- 5.0.0.

No Pressure does NOT hold! See procedure number AUTOTEST- 4.0.0X (page 575).

## AUTOTEST- 4.0.0X PRESSURE CANNOT BE ACHIEVED OR IT DID NOT HOLD/ ISOLATE FOUR WAY

a) Figure right, clamp BOTH Four-Way Dialysate Line tubing segments!

b) Can you achieve -250 mmHg and does it HOLD it, +/- 15 mmHg, for one (1) minute now. TWO (2) possible scenarios below:




1) **IF still CANNOT achieve -250 OR it does NOT HOLD:** Either the transducer protector at the meter is wet OR a Four-Way tubing connection is leaking. Locate and repair the problem then return to (ABOVE) procedure number AUTOTEST- 3.1.0 (page 575).

2) **IF you CAN achieve -250 AND it HOLDS:** See parts A THROUGH E below:

A) Turn the machine OFF!

B) **Remove BOTH clamps from the Four -Way dialysate line segments!**

C) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

D) From the Home screen, set [Dialysate Flow] to "OFF" and press 'Enter'.

E) Proceed to **page 509**, procedure number TMP- 4.0.0.

**AUTOTEST- 5.0.0 EXTERNAL METER PRESSURE IS GOOD / CONTINUE CALIBRATION**

a) ENSURING the meter is between -245 and -255 mmHg, press ‘Enter’.

b) Figure right, TWO (2) possible scenarios based on if an “Operator Error” banner occurs:


**1) IF (and ONLY if) “Operator Error” occurs:** See procedure number AUTOTEST- 6.0.0 (page 576).

**2) IF “Operator Error” does __NOT__ occur:** All systems that may cause multiple valve leaks are checking okay! Perform parts a THROUGH h below:

a) Remove the Four- Way Assembly and return the dialyzer connectors to the shunt door.

b) Press the screen’s ‘Dialysate Off’ button. Set it to ‘Dialysate Flow On’ and press ‘Enter’

c) Press ‘Enter’ to save the calibration.

d) Turn the machine OFF!

e) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

f) From the Home screen, set the [Dialysate Flow] window to 800 ml/min and press ‘Enter’!

g) ENSURE the flow and deaeration motors are rotating.

h) **Read this step before performing!** Repeat the Diagnostic Leak Tests on the balancing chamber valves (#31 through #38) **__HOWEVER,__** this time if multiple valves fail. TWO (2) possible bad problems: **1)** Bad Actuator-Test Board; **2)** Multiple leaking valves.

**AUTOTEST- 6.0.0 “OPERATOR ERROR” OCCURRED / TROUBLESHOOT DIALYSATE PRESSURE**

a) Turn the machine OFF.

b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’)!

c) From the Home screen, press the [Dialysate Flow] window.

d) Set [Dialysate Flow] to 800 ml/min and press ‘Enter’!

e) Return to Service mode.

f) **Read before performing!** Return to (ABOVE) procedure number AUTOTEST- 3.0.0 (**page 574**). If (and ONLY if) you return to AUTOTEST- 6.0.0, because “Operator Error” reoccurs, swap in the listed components (see __Component List__ below), one at a time, in between returning to procedure number AUTOTEST- 3.0.0 (page 574) until “Operator Error” DOES NOT indicating the last component swapped in is bad!

**__Component List__**

**1)** Dialysate Pressure Transducer #9[a]; **2)** Sensor Board; **3)** Actuator-Test Board; **4)** Functional Board; **5)** Sensor Board cable; **6)** Distribution board.

[a] To __LOCATE__ Transducer #9 refer to Figure 6 (page 22);

## AUTOTEST- 7.0.0 ISOLATE ACTUATOR-TEST BOARD / VALVES(S)

TWO (2) possibilities: **1)** Bad Actuator-Test Board OR; **2)** Bad valve(s) i.e. mechanically 'stuck open'.

a) Turn the machine off and swap in a known good Actuator-Test Board (see Figure 4A, page 10).

b) Repeat the Diagnostic Valve Leak Test on the leaking valve(s). TWO (2) possible scenarios:

   **1) IF passes:** The previous Actuator-Test Board is bad

   **2) IF fails:** Replace the leaking valve(s). To LOCATE the valve refer to Figure 96 (page 579). **NOTE!** The previous Actuator-Test Board is probably good!

**Diagnostic Valve Leak Tests Theory:** These Tests isolate two 'systems': **System #1)** During the "IOS" Test, Air Removal Chamber #69 (IOS) and **System #2)** Valves for potential leaks to atmosphere:

a) Pressure is monitored by Dialysate Pressure Sensor #9.

b) Pressures are achieved during each "Prep" phase using either the UF Pump to achieve negative pressure or Loading Pressure to achieve positive pressure. Refer to the Table below.

c) During IOS all valves are closed which isolates Chamber #69 for a leak. IOS MUST pass to ensure the valve leak tests are valid. If it fails all valves may fail

d) During each "Testing" phase the tested valve is closed and an alternate path to atmosphere is open for thirty (30) seconds. If the valve is truly closed pressure holds (+/- 25 mmHg) for thirty (30) seconds and the valve passes.

### Leak Test Pressures

| Tests Requiring Negative Pressure (approx. -300 mmHg) | Tests Requiring Positive Pressure (approx. +300 mmHg) |
|---|---|
| Valve #43 | IOS |
| Valve #31 | Valve #32 |
| Valve #33 | Valve #34 |
| Valve #35 | Valve #36 |
| Valve #37 | Valve #38 |
| Valve #26 | Valve #29 |
| Valve #24 | ----------- |
| Valve #25 | ----------- |

## SECTION 18B - MANUAL BALANCING CHAMBER VALVE LEAK TESTS

A. These tests should be performed if a leaking balancing chamber valve is strongly suspected and Diagnostic Valve leak test did not identify it or to validate an Diagnostic Valve leak failure.

B. **Intensive work is done inside the distribution board, plugging and unplugging valves**. Referring to Figure 95 (page 578), ensure that all balancing chamber valves (#31 through #38) have their distribution board connectors labeled correctly and are plugged into their correct positions.

C. A leak is verified through the top balancing chamber valve OUTPUT nozzles (after the tubing is removed). **Ignore small water crowns that may appear**. If a valve is leaking it will continually drip.

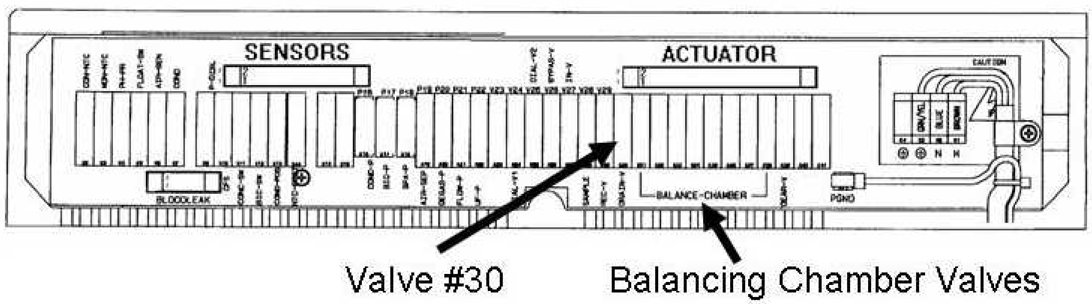



**Figure 95 – Distribution Board**

**TOP SIDE LEAK PROCEDURE (Valves #31 through #34)**

a) Referring to Figure 96 (page 579), turn the machine off and remove the clear OUTPUT tubing from all four top-side balancing chamber valves (#31 through #34).

b) Unplug valve #30 from distribution board position labeled V30, “DRAIN-V” and leave it unplugged until instructed OTHERWISE.

c) Place both dialyzer quick connects into a bucket of water and close the shunt door.

d) Unplug all eight balancing chamber valves from the distribution board positions “V31” through “V38”.

e) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’).

f) Ignoring Flow Errors, call debug screen 1. ENSURE that **DEAP** AND **FLWP** are less than 255.

Theory: All eight balancing chamber valves are closed (unless one is leaking). The following procedures open the bottom valves, one at a time, using 24 volts from valve 30’s distribution board connector. Since the deaeration pump (P20) and Flow Pump (P21) are running the bottom valves are pressurized. If a top side valve is not sealing properly, a water leak will be seen through its exposed nozzle.

g) Plug valve #35 into valve #30’s distribution board position (V30, DRAIN-V). Watch the top side balancing chamber valve nozzles. Replace any valve that is seen leaking (either valve #31 or valve #32).

h) Unplug valve #35 leave it unplugged and plug valve #36 into valve #30’s position (V30, DRAIN-V). Watch the top side balancing chamber valve nozzles. Replace any valve that is seen leaking (either valve #31 or valve #32).

i) Unplug valve #36 leave it unplugged and plug valve #37 into valve #30’s position (V30, DRAIN-V). Watch the top side balancing chamber valve nozzles. Replace any valve that is seen leaking (either valve #33 or valve #34).

j) Unplug valve #37 leave it unplugged and plug valve #38 into valve #30’s position (V30, DRAIN-V). Watch the top side balancing chamber valve nozzles. Replace any valve that is seen leaking (either valve #33 or valve #34).

k) Unplug valve #38 and leave it unplugged. None of the top side balancing chamber valves are leaking. Continue with BOTTOM SIDE LEAK PROCEDURE (page 579).

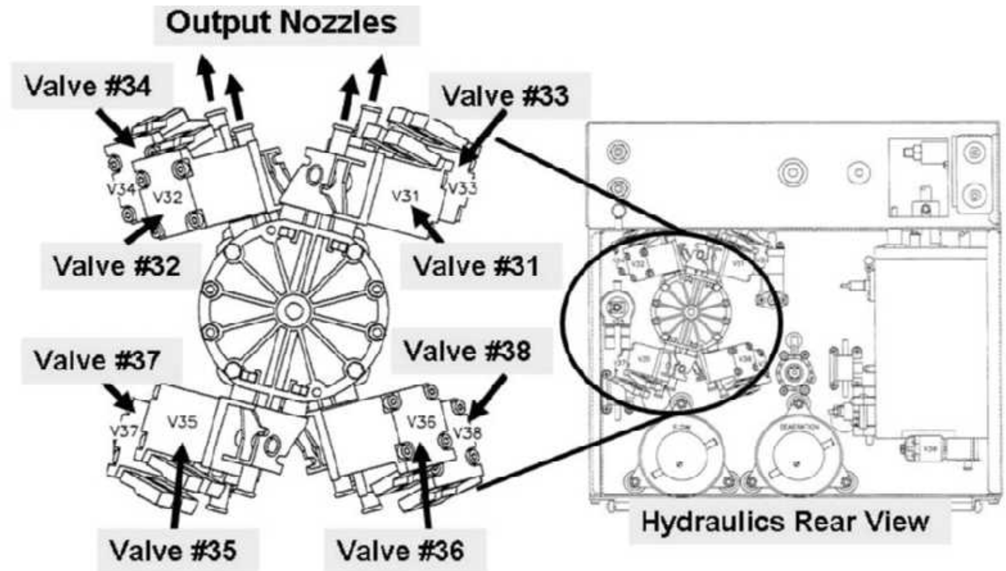



**Figure 96 – Balancing Chamber Valves**

**BOTTOM SIDE LEAK PROCEDURE (Valves #35 through #38)**

Theory: The following procedures open the top side valves, one at a time, using 24 volts from valve 30's distribution board connector. Because the deaeration pump and Flow Pump are running the bottom balancing chamber valves are pressurized.

NOTE: **Needle nose pliers** are required (DO NOT use a plastic clamp) to QUICKLY clamp valve #35's or valve #37's white (bottom) tubing IF a leak is seen. Referring to Figure 96 (page 579), locate these valves at this time (left side, bottom).

a) Plug valve #31 into valve #30's distribution board position (V30, "DRAIN-V") and watch valve #31's nozzle. Is a leak seen?

   Yes QUICKLY clamp valve #35's white tubing. If the leak stops replace valve #35. If not, replace valve #36.
   No Unplug valve #31 and leave it unplugged. See part b.

b) Plug valve #32 into valve #30's position (V30, "DRAIN-V") and watch valve #32's nozzle. Is a leak seen?

   Yes QUICKLY clamp valve #35's white tubing. If the leak stops replace valve #35. If not, replace valve #36.
   No Unplug valve #32 and leave it unplugged. See part c.

c) Plug valve #33 into valve #30's position (V30, "DRAIN-V") and watch valve #33's nozzle. Is a leak seen?

   Yes QUICKLY clamp valve #37's white tubing. If the leak stops replace valve #37. If not, replace valve #38.
   No Unplug valve #33 and leave it unplugged. See part d.

d) Plug valve #34 into valve #30's position (V30, "DRAIN-V") and watch valve #34's nozzle. Is a leak seen?

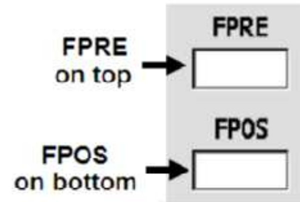
   Yes QUICKLY clamp valve #37 white tubing. If the leak stops replace valve #37. If not, replace valve #38.

   No A balancing chamber valve leak is not obvious using this test. Turn the machine off and CAREFULLY plug all valves back into the distribution board. Return to Dialysis Program and perform automated Alarms / Pressure tests.

## SECTION 19 - TESTING FOR LEAKING BALANCING CHAMBER DIAPHRAGM

A torn balancing chamber diaphragm will cause Flow Errors and/or Temperature and/or Conductivity problems and/or OLC problems

### BC LEAK- 1.0.0 PREPARATION




a) Call debug screen 5. If the debug screens do not appear press the 'Esc' key then call screen 5.

b) IGNORING **FPRE** for now, is **FPOS** (Figure right, middle column, BELOW **FPRE**) more than nine thousand (9000)?

Yes **FPOS** more than 9000! See procedure number BC LEAK- 3.0.0 (page 583).

No **FPOS** is NOT more than 9000. See procedure number BC LEAK- 1.1.0 (page 580).

### BC LEAK- 1.1.0 ISOLATE FLOW PUMP (#21)

a) Plug the concentrate connectors into their rinse ports to call the "Select Program" screen.

b) This procedure uses a psi pressure gauge. **ENSURE it reads 0 psi before installing it!**

c) Per the Figure below, tee the gauge between the Flow Pump's OUTPUT nozzle and its WHITE tubing.

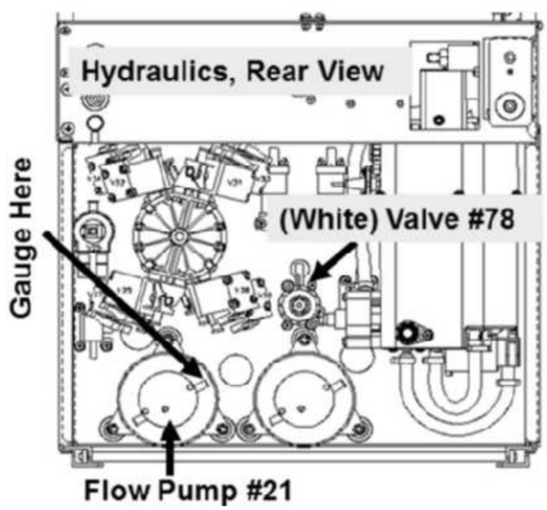
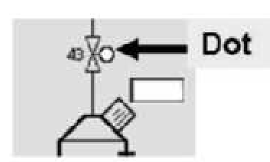



**Figure 97 – Flow Pump Output**

d) **Tie wrap both sides of the gauge tubing to prevent leaks and false readings!**

e) Place the machine into **RINSE!** Watch for one (1) minute to ENSURE a "No Water" or a Flow Error DO NOT occur!




f) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

g) Allow Valve #43's 'dot' (Figure right) to turn blue then WHITE again! While white, does pressure CYCLE, about every three (3) seconds, to between 35 and 36 psi?

Yes Between 35 and 36 psi! See procedure number BC LEAK- 2.0.0 (page 581).

No Is NOT between 35 and 36 psi! ENSURING the machine was in RINSE AND no leaks, TWO (2) possible scenarios:

1) **IF (and ONLY if) pressure is too low:** DO NOT calibrate instead proceed to **page 101**, procedure number F- 9.0.2.

2) **IF pressure is too high!** Perform parts a AND b below:

   a) Adjust Valve #78***** until pressure cycles to between 35 and 36 psi! *****To LOCATE #78 refer to Figure 97 (page 580).

   b) Leaving the machine in RINSE, see procedure number BC LEAK- 2.0.0 (page 581).

**BC LEAK- 2.0.0 DIAPHRAGM LEAK TEST**

Two (2) buckets are required, one empty and the other filled with one gallon of **ACID CONCENTRATE**. Place both buckets on the floor and read the procedure before continuing:

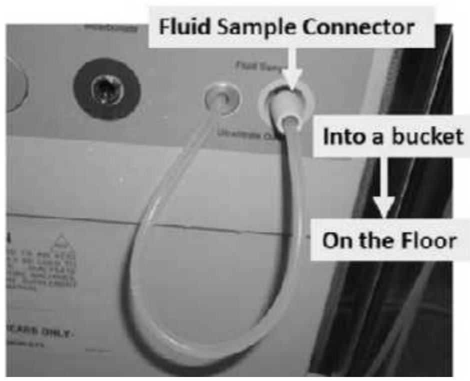
a) Call debug screen 5. Allow **FPRE** (middle column) to reach LESS THAN two thousand eight hundred (2800). This verifies all conductive fluids have been rinsed out.

b) ENSURING RINSE is running (i.e. Remaining Time is NOT = 0:00) open the shunt door.

c) Figure right, direct the Ultrafiltrate Sample Connector tubing into the EMPTY BUCKET to prevent UF circuit pressure.

d) **Per the Figure below, TIGHTLY clamp the tubing at Valve #29. Ignore Flow Errors for now!**

**Parts e through g next page**



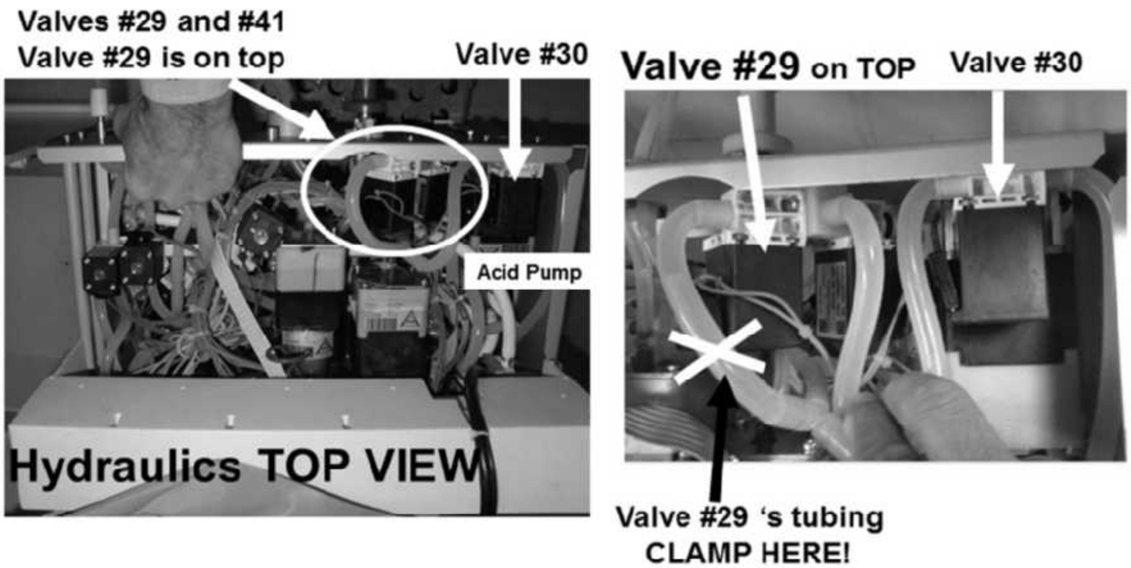




**Figure 98 – Valve #29 Location**

e) Remove the blue dialyzer connector from the shunt door and drop it into the empty bucket.

f) Place the red dialyzer connector into the bucket of acid concentrate but **DO NOT** close the shunt door! Rinse must NOT interrupt! The blue connector MUST be delivering flow into its bucket!

g) WITHOUT LOOKING AWAY, watch **FPRE** for up to three (3) minutes. Does it EVER, even if only once, increase or fluctuate to MORE THAN four thousand (4000)?

Yes **FPRE** increases to more than 4000! A torn balancing chamber diaphragm is indicated. Remove the clamp from valve #29 then replace BOTH balancing chamber diaphragms.

No **FPRE** remains ALWAYS about 2300! See parts a AND b below:

a) A torn diaphragm is NOT indicated! **IMPORTANT!** Remove the clamp from valve #29 and return the dialyzer lines to the shunt!

b) If referred to TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM, return to the procedure that brought you here as NOTED!

LEFT BLANK INTENTIONALLY

**<u>BC LEAK- 3.0.0 DIAPHRAM LEAK TEST</u>**

Two (2) buckets are required, one empty and the other filled with one gallon of **<u>ACID CONCENTRATE</u>**. Place both buckets on the floor and read the procedures before continuing:

a) Place the machine into RINSE. **If the external flow indicator's 'bob' is not moving up and down these tests are invalid!**

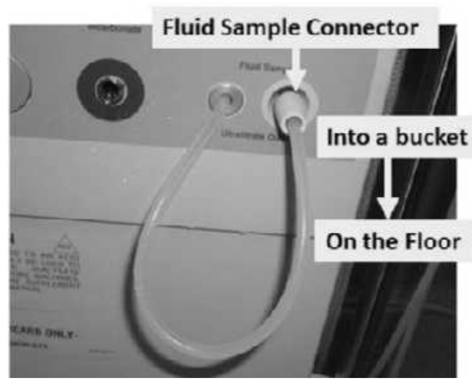
b) Call debug screen 5. Allow **FPRE** (middle column, ABOVE **FPOS**), to become less than two thousand eight hundred (2800). This verifies all conductive fluids have been rinsed out.

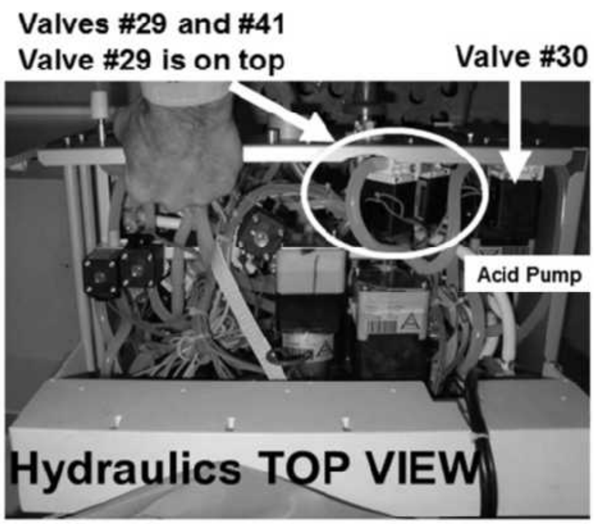
c) ENSURING RINSE is running (Remaining Time is <u>NOT</u> = 0:00) open the shunt door.

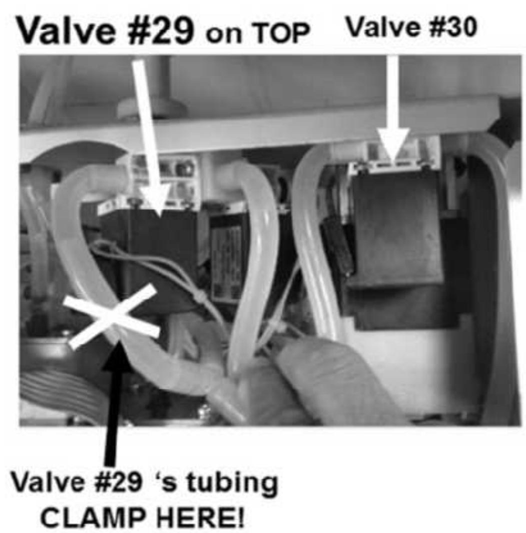
d) NOTE **FPOS**! Typically between 2000 and 4000.

e) Per the Figure right, direct the Ultrafiltrate Output Sample Connector into the EMPTY BUCKET to prevent excessive UF circuit pressure.

f) **Per the Figure below, <u>TIGHTLY</u> clamp the tubing at Valve #29's. Ignore Flow Errors for now!**




g) Remove the blue dialyzer connector from the shunt door and place it into the empty bucket.

h) Place the red dialyzer connector into the bucket of acid concentrate but **DO NOT** close the shunt door! Rinse must NOT interrupt! The blue connector MUST be delivering water into its bucket!

i) <u>WITHOUT LOOKING AWAY</u>, watch **FPOS** for up to 45 seconds. Does it EVER, even if only once, increase or fluctuate to more than seven thousand (7000)?

Yes FPOS more than 7000! See procedure number BC LEAK- 3.2.0 (page 584).

No **FPOS** less than 7000. Proceed to **page 580**, procedure number BC LEAK- 1.1.0 to check the Flow Pump.

**BC LEAK- 3.2.0 PERFORM DIAPHRAGM LEAK TEST**

WITHOUT LOOKING AWAY, NOW watch **FPRE** for up to three (3) minutes. Does it EVER, even if only once, increase or fluctuate to MORE THAN four thousand (4000)?

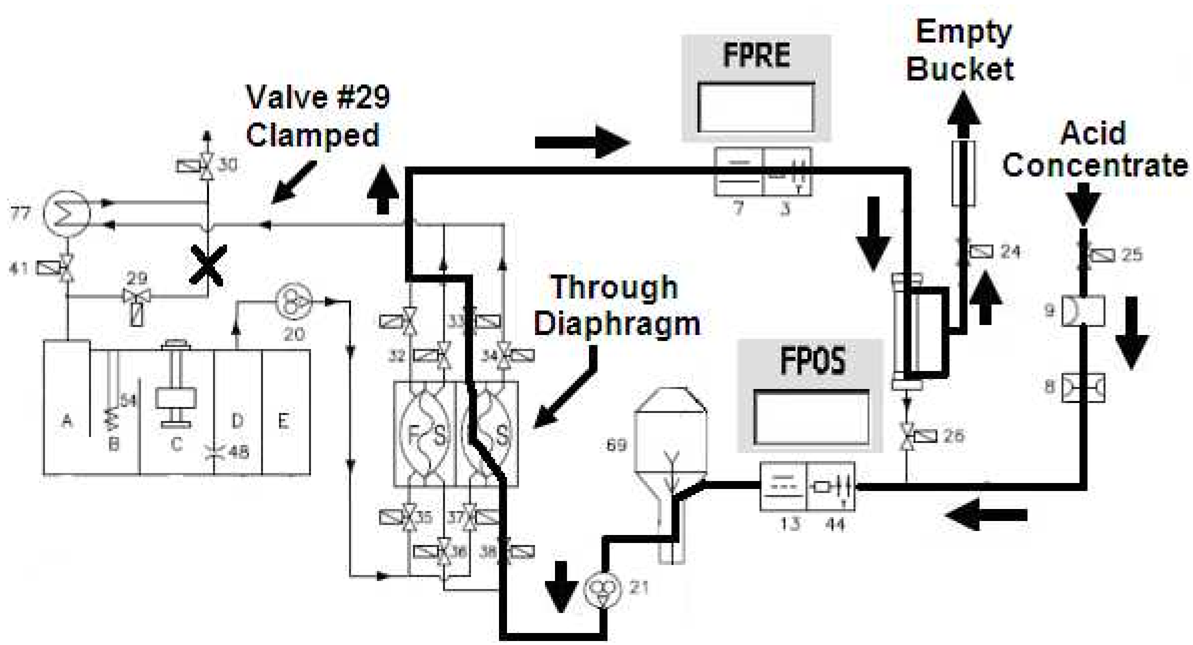
Yes **FPRE** fluctuates to 4000 or more! A torn balancing chamber diaphragm is indicated. Remove the clamp from valve #29 then replace BOTH balancing chamber diaphragms.

No **FPRE** remains ALWAYS approximately 2300! See parts a AND b below:

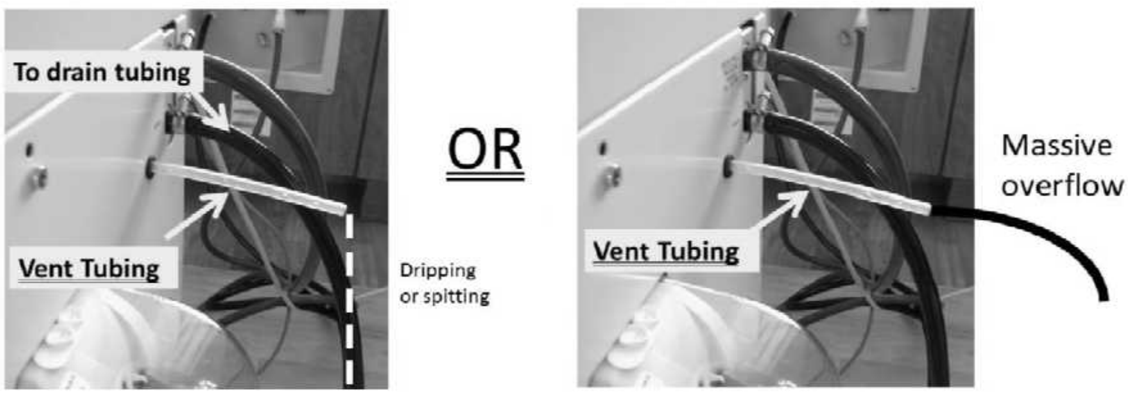
a) A torn diaphragm is NOT indicated! **IMPORTANT!** Remove the clamp from valve #29 and return the dialyzer lines to the shunt!

b). If referred to TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM, return to the procedure that brought you here as NOTED!

**Balancing Chamber Diaphragm Leak Test Theory:** Referring to the Figure below, the Flow Pump #21 delivers a highly conductive acid solution into the 'spent' (S) side of the balancing chambers at high pressure. Both balancing chamber 'fresh' (F) sides are open to low pressure because the blue (to dialyzer connector) line is in a bucket open to atmosphere. If a balancing chamber diaphragm is torn (right side in this case) the conductive acid solution is forced through the hole, into the fresh side, through Conductivity Cell #7 causing **FPRE** to increase. If neither diaphragm is torn they prevent the acid solution from entering the fresh side and **FPRE** will not increase. Recirc valve #29 must be clamped to prevent its eventual opening from recirculating the acid solution back into the hydrochamber causing **FPRE** to increase falsely.



## SECTION 20 – TROUBLESHOOTING OVERFLOW FROM THE VENT TUBING




A) **Turn the machine OFF!**

B) ENSURE the Vent Tubing is NOT clamped!

C) Plug BOTH the ACID AND BICARB connectors into their rinse ports.

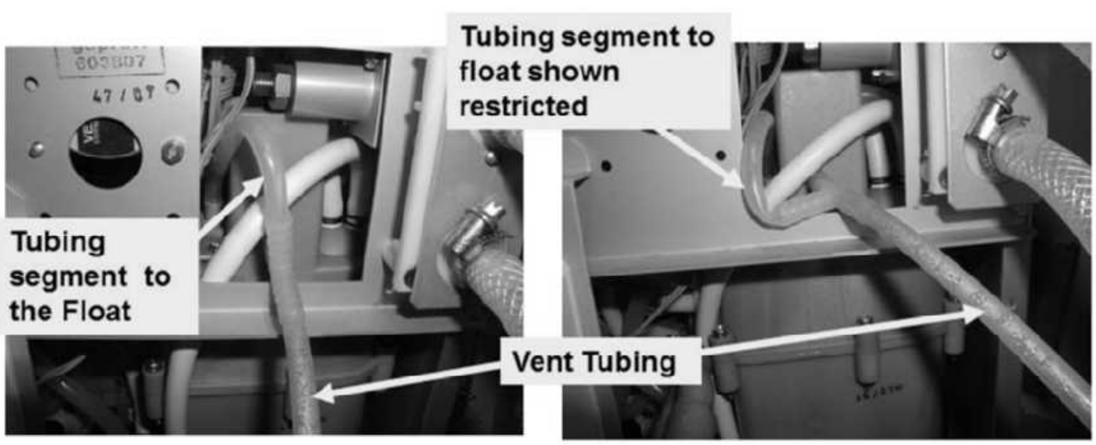
D) **TURN THE MACHINE ON!**

E) Figures above, does MASSIVE OVERFLOW, more than 600 ml per minute, occur (Yes or No)?

Yes Massive overflow! Turn the machine OFF then proceed to **page 593**, procedure number OVER- 6.0.0.

No Massive overflow does NOT occur! See part F.

F) Figure below, ENSURE the Vent Tubing, ESPECIALLY the segment going to the Float is NOT restricted

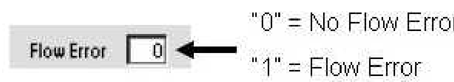



G) Place the machine into the Program the overflow was occurring in i.e. **i)** Cleaning/Disinfection (Heat Disinfect, Rinse, etc.) OR **ii)** Dialysis.

H) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

**Part I next page**

I) If **Flow Error** EVER = 1, even just once, a masked Flow Error is occurring! WITHOUT LOOKING AWAY watch it for three (3) minutes or until it EVER = 1. TWO (2) possible scenarios:




**1)** **IF Flow Error EVER = 1, even just once!** DO NOT troubleshoot overflow instead troubleshoot the flow error! Refer to the Table of Contents for whatever program the machine is in.

**2)** **IF Flow Error ALWAYS = 0!** Is the machine in: **i)** A Cleaning Program OR **ii )** Dialysis Program:

**i)** **IF in a Cleaning Program:** Proceed to **page 587**, procedure number OVER- 2.0.0.

**ii)** **IF in Dialysis Program:** Perform parts a AND b below:

a) From the Home screen, allow [Conductivity] to increase to more than 12.0 mS.

b) Call debug screen 1. Is **FILACT** REMAINING ALWAYS = 1 (Yes or No)?


Yes **FILACT** REMAINING = 1! Proceed to **page 452**, SECTION 8 – FILLING PROGRAM PROBLEMS

No **FILACT** = 0! See procedure number OVER- 1.0.0 (page **Error! Bookmark not defined.**).

**OVER- 1.0.0 ISOLATE CENTRAL (SDS) CONCENTRATE DELIVERY SYSTEM**

a) **Turn the machine OFF!**

b) When the machine is off OR if [Dialysate Flow] is “OFF” and the machine is attached to a Central Concentrate Delivery System (SDS), over time, SDS pressure too high may force the concentrate pumps open causing overflow.

c) Is the red AND / OR blue concentrate connectors currently attached to a SDS system?

Yes Attached to a central system! **Allowing up to ½ hour**, if (and ONLY if) overflow still occurs see procedure number OVER- 1.0.1 (page 586). If overflow is NOT occurring maybe the problem was occurring when attached to a particular station in the clinic where the pressure is too high.

No NOT attached to a central system. If (and ONLY if) overflow is still occurring see procedure number OVER- 2.0.0 (page 587). If overflow is NOT occurring maybe it was occurring ONLY when attached to a SDS where the pressure is too hig.

**OVER- 1.0.1 ATTACHED TO A CENTRAL SYSTEM / ISOLATE HIGH PRESSURE (Slow Overflow)**

a) Disconnect the red AND blue concentrate connector(s) from the central supply.

b) Allowing one (1) minute does vent tubing overflow stop?

Yes Overflow stops! Acid and/or bicarbonate central pressure is too high!

No Overflow does NOT stop! See procedure number OVER- 2.0.0 (page 587).

**OVER- 2.0.0 ISOLATE POTENTIAL FLOW RECIRC ERROR**

Is the machine currently in Heat Disinfect?

Yes In Heat Disinfect! See procedure number OVER- 2.0.1 (page 587):

No NOT in Heat Disinfect! See procedure number OVER- 2.0.2 (page 587).

**OVER- 2.0.1 IN HEAT DISINFECT**

a) Press ‘Esc’ to return to the Main Heat Disinfect screen.

b) Allow Remaining **Prerinse Time** to = 0:00.


c) Allow up to five (5) more minutes. If a **“**Flow Recirc Error 1” banner appears DO NOT troubleshoot overflow. If (and ONLY if) a **“**Flow Recirc Error 1” does NOT occur see procedure number OVER- 2.0.2 (page 587).

**OVER- 2.0.2 ISOLATE HEAT EXCHANGER #77 (Slow Overflow)**

a) **Turn the machine OFF but leave the water ON!**

b) Per the Figure below, remove the front CLEAR tubing (to drain) from the Heat Exchanger.

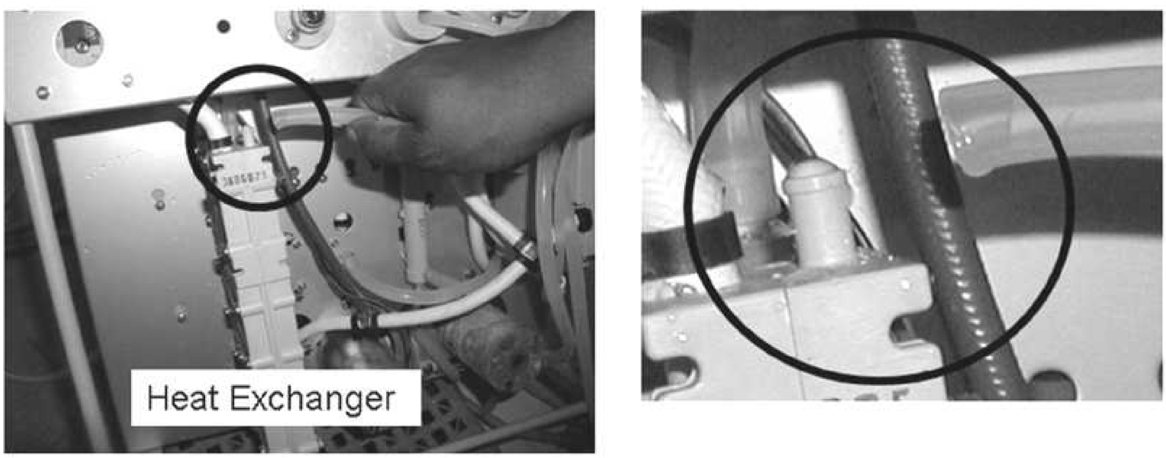



**Figure 99 – Hydraulics Front View / Heat Exchanger Check**

c) Watch the vacant Heat Exchanger nozzle for up to THREE (3) minutes. or until you see dripping, possibly VERY slowly (Yes or No)?

Yes Dripping seen! **YOU MUST** perform the following TWO (2) procedures: **Procedure #1:** Turn the water OFF and replace the Heat Exchanger; **Procedure #2:** To prevent damaging the new Heat Exchanger, see procedure number **OVER- 8.0.0** (page 596) IMMEDIATELY.

No dripping! Reattach the tubing then see procedure number OVER- 3.0.0 (page 588).

**OVER- 3.0.0 ISOLATE INLET WATER PRESSURE (Slow Overflow)**

a) **IMPORTANT!** Turn the water OFF!

b) This procedure uses a psi pressure gauge. **ENSURE it** reads 0 psi before installing it.

c) Per the Figure below, install the gauge at Inlet Pressure Regulator #61.

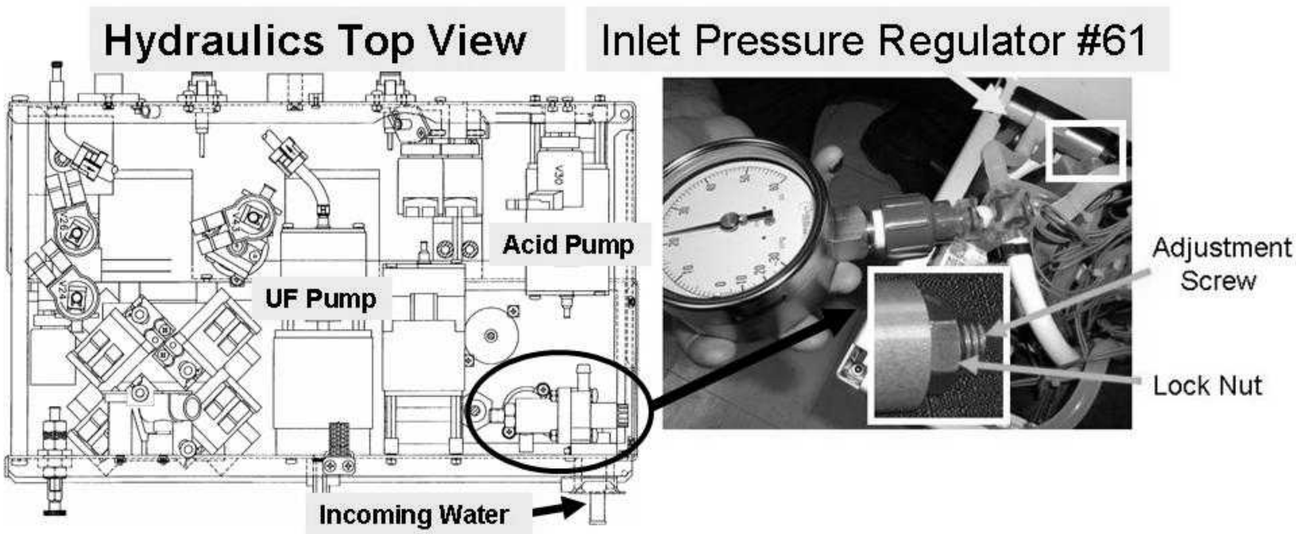


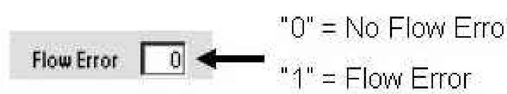

**Figure 100 – Inlet Pressure Regulator #61**

d) **IMPORTANT! Turn the water ON!**

e) Place the machine into RINSE and allow one (1) minute!

f) Call debug screen 0. If debug does not appear press ‘Esc’ then call screen 0.

g) ENSURE **Flow Error** (TOP window) = ‘0’ ALWAYS!




h) Is gauge pressure cycling to a Peak of between 18 and 20 psi?

Yes Between 18 and 20 psi! See procedure number OVER- 3.0.1 (page 589).

No Per Figure 100 above: **a)** Loosen Regulator’s #61’s lock nut. **b)** Can the center screw be adjusted until a PEAK between 18 and 20 psi is achieved? TWO (2) possible scenarios:

**1)** **IF (and ONLY if) between 18 and 20 psi is achieved!** See procedure number OVER- 3.0.1 (page 589).

**2)** **IF between 18 and 20 psi CANNOT be achieved:** TWO (2) possibilities: **1)** Incoming water pressure more than 105 psi OR; **2)** Bad Regulator #61. **NOTE!** A Regulator #61 Rebuild kit is available, P/N 190934.

**OVER- 3.0.1 ISOLATE INLET PRESSURE REGULATOR (Slow Overflow)**

This procedure checks the Regulator #61's ability to maintain pressure over time.

a) **IMPORTANT!** Leaving the water on, turn the machine **OFF**!

b) NOTE gauge pressure for use later. It MUST NOT be more than 22 psi!

c) Allow up to fifteen (15) minutes! Does pressure increase more than 2 psi above what was noted in part b (Yes or No)?

Yes — Pressure increased more than 2 psi! TWO (2) possibilities: **1)** Incoming water pressure more than 105 psi OR; **2)** Bad Regulator #61. There is a Rebuild kit available for Regulator #61, P/N 190934.

No — Pressure did NOT increase! See procedure number OVER- 4.0.0 (page 589).

**OVER- 4.0.0 ISOLATE INLET WATER VALVE #41 (Slow Overflow)**

a) ENSURE the machine is off AND the water is on!

b) **Per the Figure below**, at the top of the hydrochamber, locate the clear tubing that vertically enters the Air Gap tower. This tubing is from Inlet Water Valve #41.

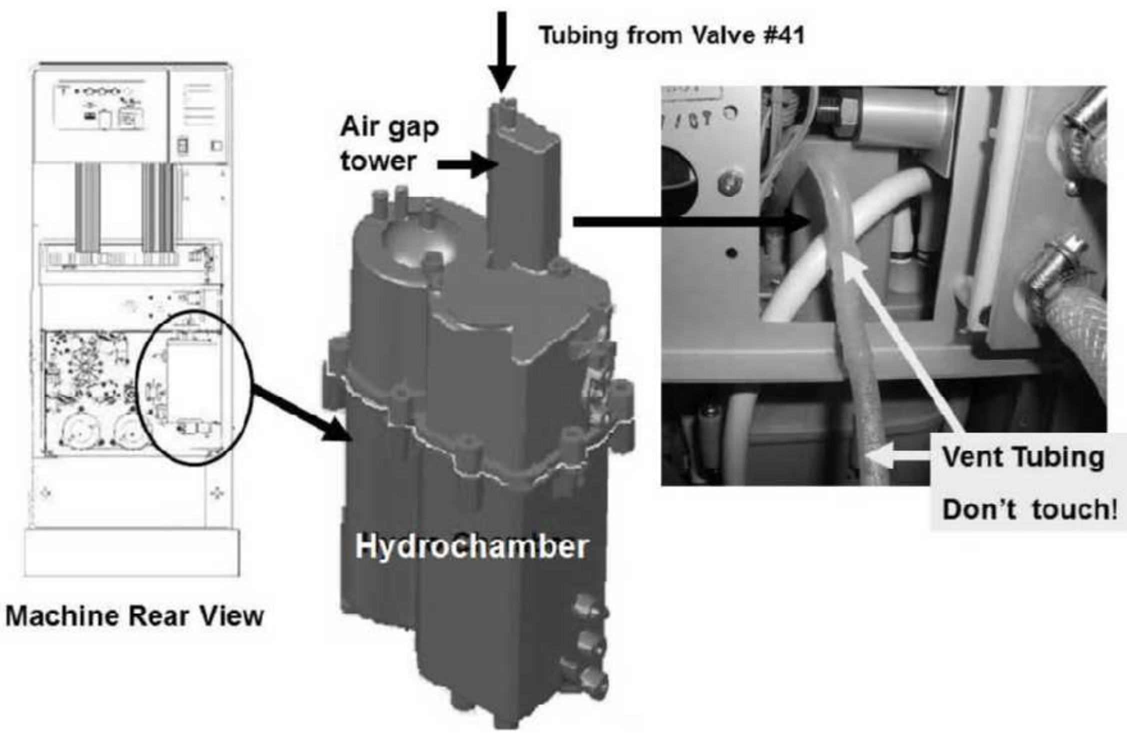



**Figure 101 – Valve #41 Check**

c) **DO NOT touch the Vent Tubing** but pull the tubing off the Air Gap Tower.

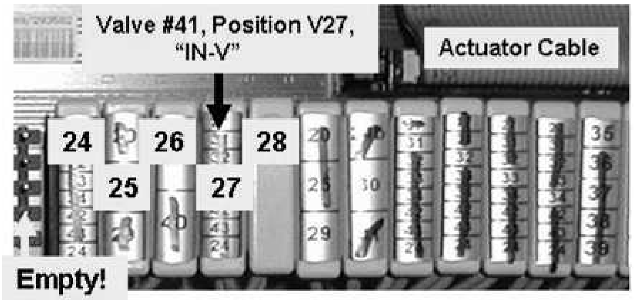
**Part d next page**

d) **IMPORTANT!** Allow fifteen (15) seconds then watch the tubing opening for up to five (5) minutes. Is there flow or dripping (possibly slowly) from it?

Yes Flow or dripping seen! See procedure number OVER- 4.0.1 (page 590).

No No flow OR dripping seen! Proceed to **page 591**, procedure number OVER- 5.0.0.

**OVER- 4.0.1 FLOW OR DRIPPING**

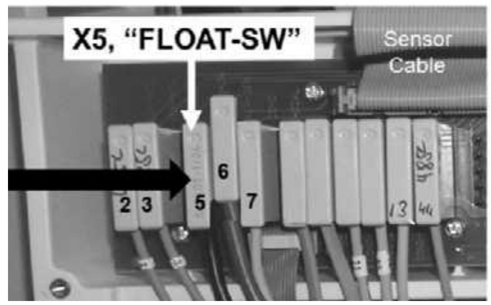



a) Figure right, unplug Valve #41 from distribution board position labeled "**V27, IN-V**".

b) Does flow or dripping continue from the Air Gap tubing?

Yes Flow or dripping continues! Valve #41 is leaking and must be replaced! To LOCATE Valve #41 refer to Figure 35 (page 211).

No Flow or dripping stops! Perform parts a THROUGH c below:




a) Figure right, unplug the Float's connector from distribution board position "X5, FLOAT-SW".

b) Check inside the vacant "X5" position for corrosion or damage. **Damage indicates the distribution board needs to be replaced!**

c) Watch for up to five (5) minute. Does flow or dripping continue?

Yes Flow or dripping continues! The Actuator-Test Board is bad. To located the board refer to Figure 4A (page 10).

No Flow or dripping stops! Float Switch #5 is bad! To LOCATE Float Switch #5 refer to Figure 28 (page 140).

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**OVER- 5.0.0 ISOLATE VALVE #39 (Slow Overflow)**

Valve #39 opens in Cleaning Programs and Deaeration pressure should be NOWHERE NEAR -24 inHg! This is especially important for Heat Disinfect to prevent boiling which would cause overflow!

a) **Re-attach Valve #41's the 'air gap tower' tubing.**

b) The deaeration gauge is used next. ENSURE it reads 0 inHg before installing it!

c) Per the Figure below, tee the gauge between the inlet (clear tubing) side and the Deaeration Pump's input nozzle.

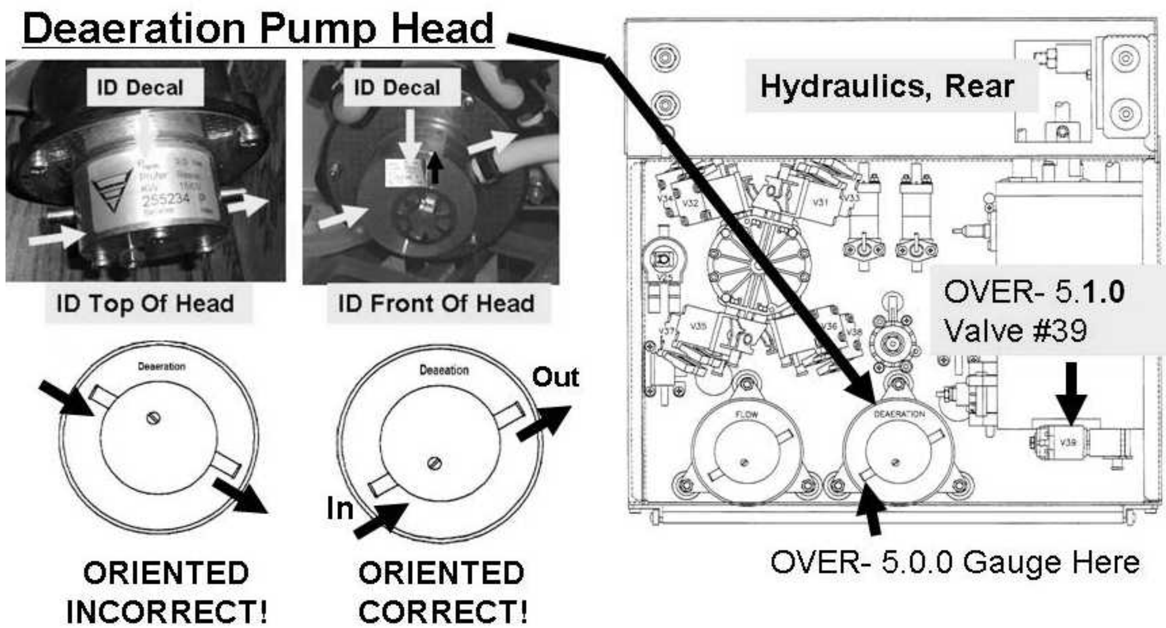



**Figure 102 – Deaeration Pump Head**

d) Return the concentrate connectors to their rinse ports

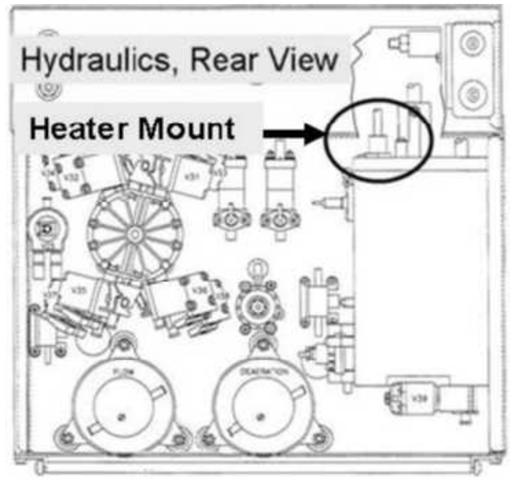
e) **Place the machine into RINSE!** TWO (2) possible scenarios:

**1)** **IF (and ONLY if) pressure is between 0 and negative (-)12 inHg.** Valve #39 is okay. See procedure number OVER- 5.2.0 (page 592).

**2)** **IF pressure is between negative (-)18 and negative (-)25 inHg:** Valve #39 is NOT opening! FOUR (4) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad Valve #39* OR; **3)** Bad ACTUATOR cable OR; **4)** Bad distribution board!

* To LOCATE Valve #39 refer to Figure 102 (page 591)

**OVER- 5.2.0 HEAT DAMAGE CHECKS**




a) **Turn the machine OFF to prevent electrocution!**

b) Per the Figure right, remove the heater and check its opening into the top of the hydrochamber for damage i.e. melting. If (and ONLY if) damage is LOCATED replace the hydrochamber. If (and ONLY if) damage is NOT located continue to part c.

c) All systems that may cause overflow are checking okay. Assuming all above procedures above were performed correctly the Troubleshooting Guide cannot locate the problem!

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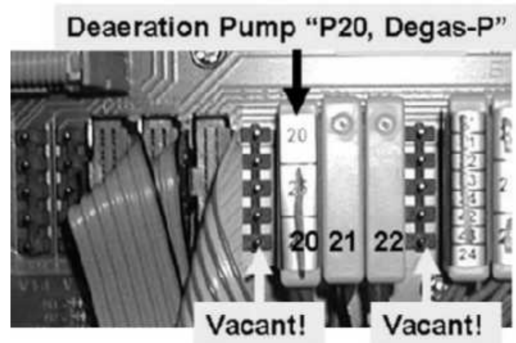
**OVER- 6.0.0 MASSIVE OVERFLOW (More than 600 ml per minute)**

a) BEFORE continuing to part b, NOTE this page number then perform INITIAL CHECKS (page 7).

b) Figure right, unplug the Deaeration Pump #20 from distribution board position "P20, Degas-P".




c) If (and ONLY if) an "Actuator Board No Echo" OR "Failed Sending Data To Actuator Board" banner EVER appear there may be a problem with the Actuator-Test Board!

d) **Turn the machine on!**

e) Per the Figure below, ENSURE the Deaeration Motor is NOT rotating i.e. is unplugged!

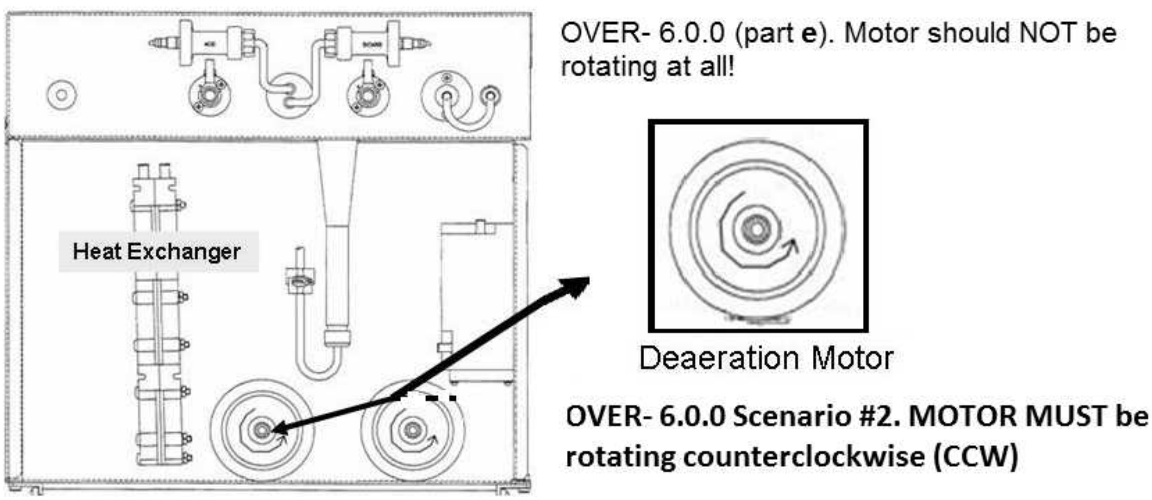



**Figure 103 – Hydraulics FRONT View / Deaeration Motor**

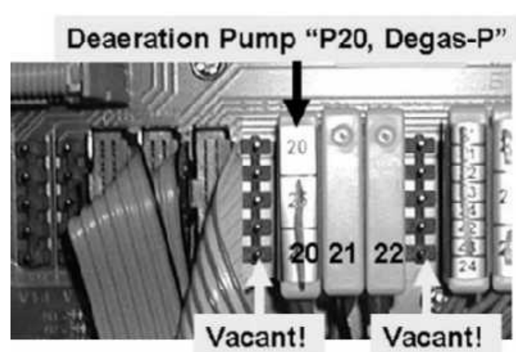
f) With the machine AND water ON allow thirty (30) seconds. TWO (2) possible scenarios 1) or 2) below:

1) **IF (and ONLY if) massive overflow continues:** With the machine AND water ON, see procedure number OVER- 7.0.0 (page 595).

2) **IF massive overflow STOPS:** Perform parts a AND b below:

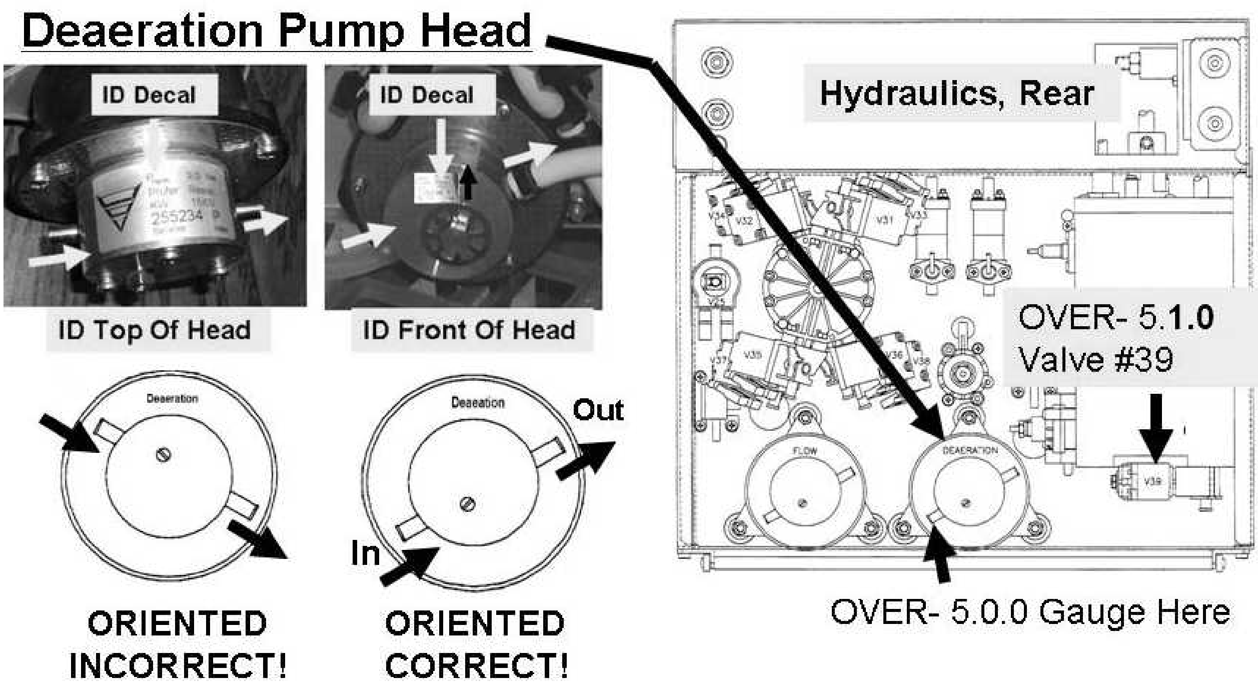
a) AVOIDING the VACANT positions, return the Deaeration Pump's connector to distribution board position "P20, "Degas-P". The Deaeration Motor shaft rotates if plugged in properly!

b) Per Figure 103 (above), is the DEAERATION motor shaft rotating **COUNTERCLOCKWISE (CCW)** (Yes or No)?



Yes  Figure below, if the deaeration pump head is oriented properly its 'ID Decal' is either on top or front. If on the front it MUST be right side up. If the head is oriented correctly see (ABOVE) procedure number OVER- 5.2.0 (page 592):

No  Deaeration motor is rotating clockwise! **NOTE** ONLY the DEAERATION MOTOR will be checked then proceed to **page 141**, **TROUBLESHOOTING MOTORS**.

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**<u>OVER- 7.0.0 ISOLATE VALVE #41</u>**

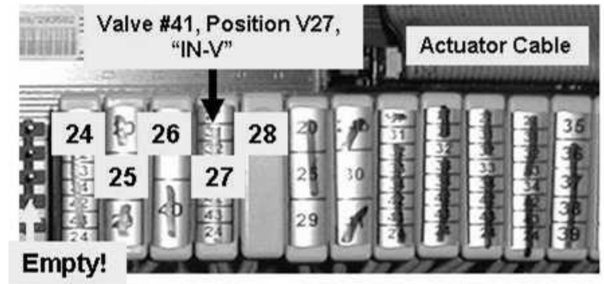



Figure right, unplug valve #41 from distribution board position #27 ("V27, "IN-V"). TWO (2) possible scenarios:

1) **IF massive overflow STOPS:** See procedure number OVER- 7.0.1 (page 595).

2) **IF massive overflow continues:** ENSURING Valve #41 was unplugged, perform parts THROUGH c below:

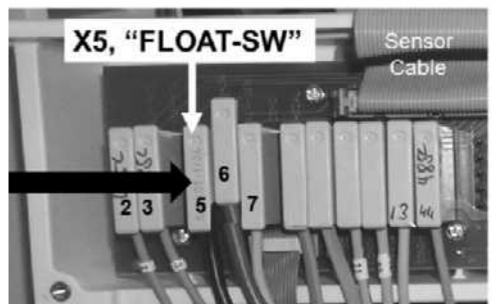
   a) Turn the water OFF!

   b) Referring Figure 35A (page 211), trace valve #41's wiring harness from the distribution board to ENSURE it terminates at valve #41's solenoid terminals.

   c) If the harness terminates at valve #41, valve #41* is bad * To LOCATE valve #41 refer to Figure 35 (page 211).

**<u>OVER- 7.0.1 ISOLATE FLOAT SWITCH</u>**

a) With the machine AND water ON, CAREFULLY return valve #41 to distribution board position "IN-V". If (and ONLY if) 'massive' overflow continues see part b.



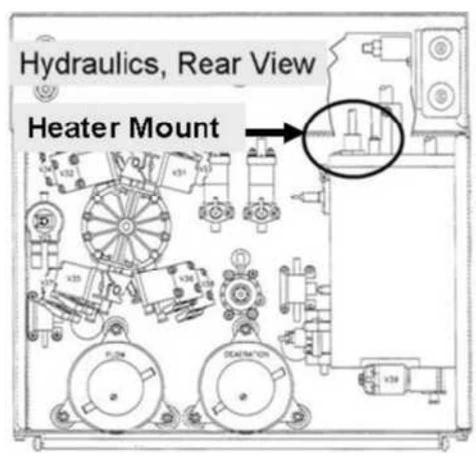

b) Figure right, unplug the float's connector from distribution board position "X5, FLOAT-SW". Does 'massive' overflow continue?

Yes — Overflow continues! ENSURING the float was unplugged, the Actuator-Test Board is bad (see Figure 4A, page 10).

No
   a) Trace the float's wiring harness from the distribution board to ENSURE it terminates at the float. NOTE! To LOCATE the Float refer to Figure 28 (page 140).

   b) If the harness terminates correctly replace the float.

   c) With the machine AND water ON, if (and ONLY if) massive overflow continues see part d.




   d) **Turn the machine OFF to prevent electrocution.**

   e) Figure right, remove the heater and check its port into the top of the Hydrochamber for heat damage (i.e. melting). If (and ONLY if) damage is located it is replace the Hydrochamber. If damage is NOT located see part e.

   e) Reinstall the heater.

   f) With the machine AND water ON, if (and ONLY if) massive overflow continues see part g.

   g) FOUR (4) possible bad components: **1)** Bad actuator cable OR; **2)** Bad Sensor Board cable OR; **3)** Bad distribution board OR; 4**)** Bad motherboard.

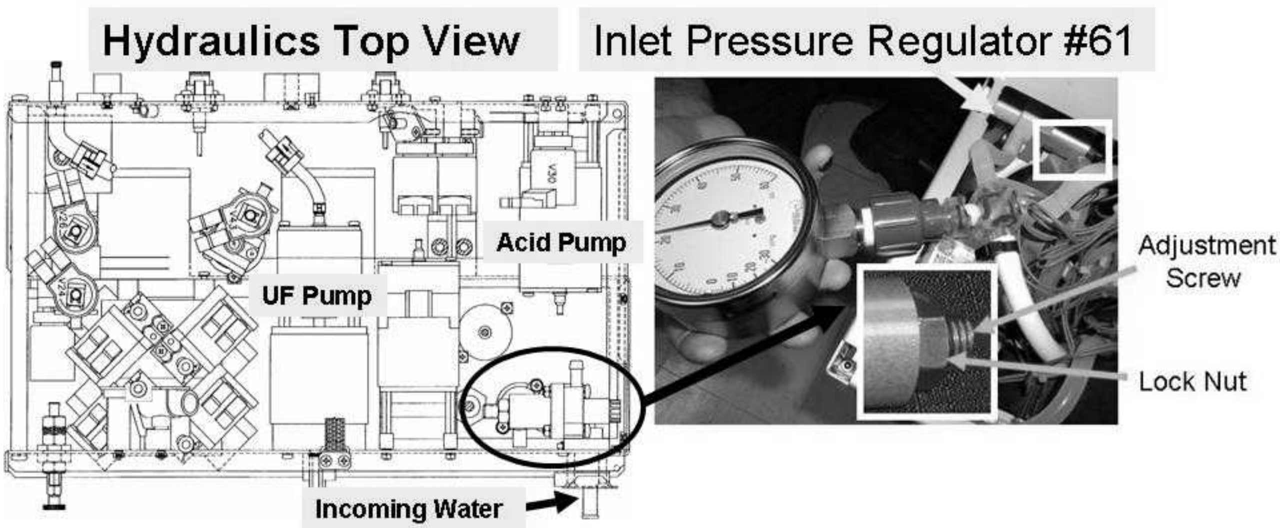
## OVER- 8.0.0 ISOLATE INLET WATER PRESSURE

High inlet water pressure can damage a Heat Exchanger!

a) **IMPORTANT!** Turn the water OFF!

b) This procedure uses a psi pressure gauge. **ENSURE** it reads 0 psi before installing it!

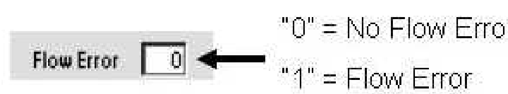
c) Per the Figure below, install the gauge at Inlet Pressure Regulator #61.




d) **IMPORTANT!** Turn the water ON!

e) **Place the machine into RINSE!**

f) Allow one (1) minute then call debug screen 0 to ENSURE **Flow Error** = 0 ALWAYS!




g) Pressure should be <u>cycling</u> to a **<u>maximum</u>** of between 18 and 20 psi?

Yes Maximum is between 18 and 20 psi! See procedure number OVER- 8.2.0 (page 597).

No Per the Figure above: **A)** Loosen Regulator's #61's lock nut; **B)** Can the center screw be adjusted until <u>a maximum</u> of between 18 and 20 psi is achieved? **NOTE!** Counterclockwise decreases pressure. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) between 18 and 20 psi is achieved!** See procedure number OVER- 8.2.0 (page 597).

**2)** **IF between 18 and 20 psi CANNOT be achieved:** TWO (2) possibilities: **1)** Incoming water pressure is more than 105 psi OR; **2)** Bad Regulator #61. NOTE: Regulator #61 can be rebuilt (Rebuild kit, P/N 190934).

## OVER- 8.2.0 MAXIMUM PRESSURE IS BETWEEN 18 AND 20 PSI / ISOLATE PRESSURE REGULATOR

This procedure checks Pressure Regulator #61's ability to maintain pressure over time.

a) **IMPORTANT!** Turn the machine **OFF**!

b) Leave the water ON!

c) NOTE gauge pressure then allow fifteen (15) minutes before continuing!

d) Does pressure increase more than 2 psi over what was noted in part c?

Yes — Pressure increased more than 2 psi! TWO (2) possibilities: **1)** Incoming water pressure is more than 105 psi OR; **2)** Bad Regulator #61. Regulator #61 can be rebuilt (Rebuild kit, P/N 190934).

No — Pressure did NOT increase over time. Pressure regulator #61 is okay. The overflow problem should be solved!

# SECTION 21 – HYDRAULIC LEAKS

NOTE! T**hese procedures do NOT troubleshoot Vent Tubing overflow!**

A) **Turn the machine OFF!**

B) ENSURE the 'Incoming Water' and 'To Drain' tubing (Figure right) are not reversed connected!

C) ENSURE the 'To Drain' tubing is not kinked AND, if using a drain 'Quick Connector', it is attached PROPERLY to the station drain!

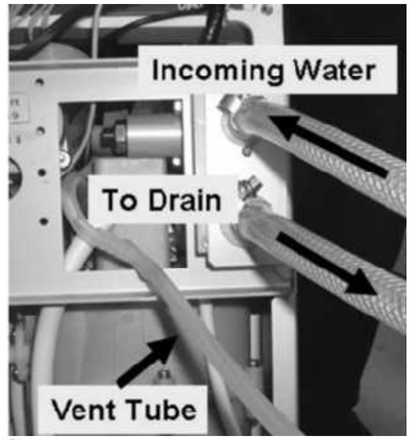
D) Reattach any 'blown off' tubing and dry the area!

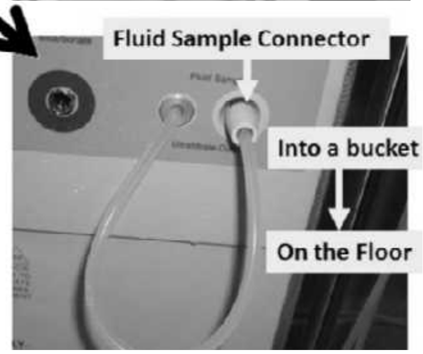
E) Until **INSTRUCTED OTHERWISE**, direct the Fluid Sample Connector (Figure right) FIGURE104into a bucket!

F) Per Figure 104 below, was tubing 'blowing off' a UF Check Valve?

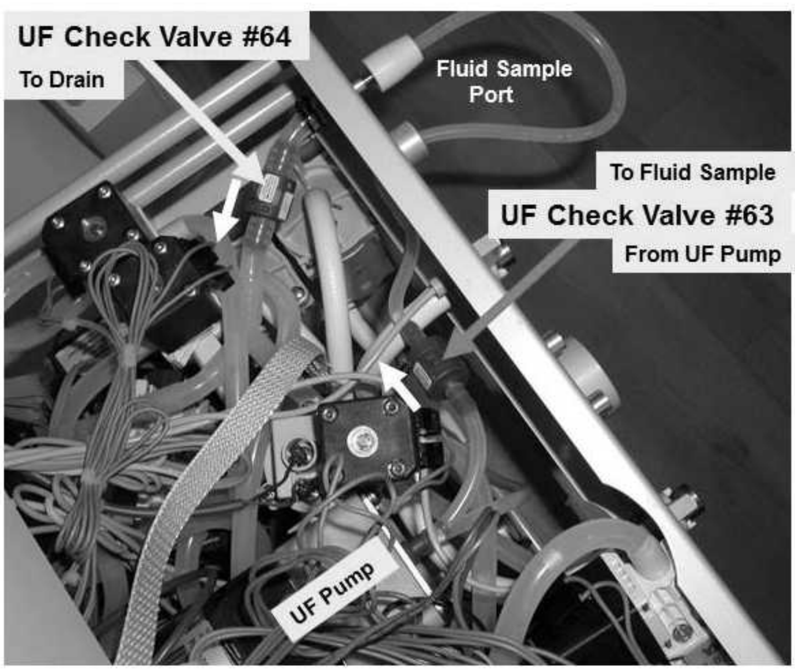
Yes UF Check Valve tubing 'blowing off'! See procedure number LEAKING- 1.0.0 (page 599).

No UF Check Valves okay! Proceed to **page 600**, procedure number LEAKING- 1.1.0.




### HYDRAULICS TOP VIEW





NOTE! Arrows on the valve bodies indicate flow direction!


**Figure 104 – UF Check Valves #63 AND #64**

## LEAKING- 1.0.0 UF TUBING BLOWING OFF

a) ENSURE the tubing to and from UF Check Valve #63 is NOT restricted!

b) In the next procedure, but NOT YET, the machine will be placed into RINSE **HOWEVER,** if a leak occurs **DO NOT** turn the machine off but instead, "Interrupt" Rinse by pressing the 'Esc' key then 'Enter' twice!

c) See procedure number LEAKING- 1.0.2 (page 599).

## LEAKING- 1.0.2 ISOLATE RESTRICTION


a) Following there should be:

- No leaks from the Fluid Sample port (Figure right) ONLY if UF Check Valve #64 is okay!
- 'Squirts' into the bucket ONLY if UF Check Valve #63 is okay!

b) Place the acid and bicarbonate connectors into their rinse ports.

c) Turn the machine on **THEN** go to RINSE PROGRAM!

d) Allow up to four (4) minutes **OR** until if a leak occurs. TWO (2) possible scenarios:

1) **IF (and ONLY if) NO leaks!** Unless UF Check Valve #63's tubing 'blew off' whatever was causing the leak is no longer present!

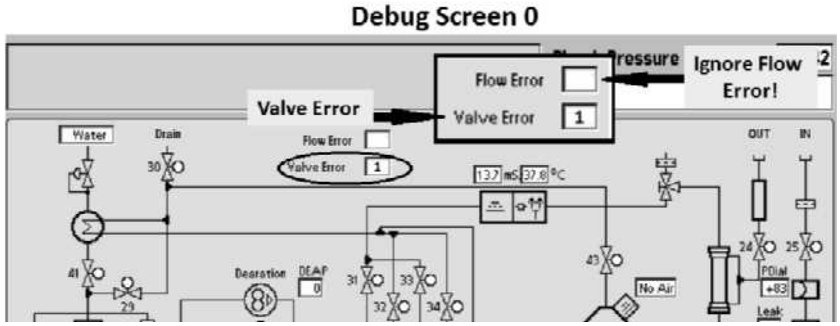
2) **IF a leak occurs!** With the "Interrupted" banner up perform parts AND b below:


a) If (and ONLY if) UF Check Valve's tubing 'blew off' it is oriented incorrectly.

b) See procedure number LEAKING- 1.0.4 (page 599).

## LEAKING- 1.0.4 LEAK OCCURS

Debug Screen 0




a) Call debug screen 0 (Figure right). If debug does not appear press 'Esc' then call screen 0.

b) Ignoring **Flow Error** (TOP window) look at **Valve Error** the **2nd window down!**

1) **IF (and ONLY if) Valve Error = 1 LONGER THAN two (2) seconds:** Proceed to **page 207**, procedure number CLEAN- 7.0.0.

2) **IF Valve Error = 0 OR 'blinks to 1' for less than one (1) second:** Turn the machine OFF then proceed to **page 607**, procedure number LEAKING- 4.0.0

**LEAKING- 1.1.0 ISOLATE FOR HIGH LOADING PRESSURE**

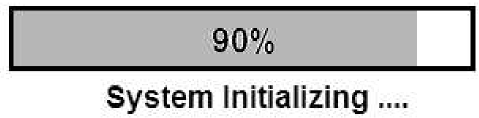
ENSURING the water is on, this procedure checks if VERY HIGH Loading Pressure may be causing a leak!

a) **ENSURING** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it, **SLAM*** it into the red Acetate/Acid rinse port.

b) **To avoid error read parts c AND d BEFORE performing them!**

c) Turn the machine on. When "Press CONFIRM For Service Mode" appears press 'Enter'.

d) Figure right, WHEN "System Initialization" reaches 90% does the gauge EXCEED 30 psi OR 'peg' the gauge's needle i.e. much more than 30 psi?




Yes Pressure more than 30 psi! Turn the machine OFF then proceed to **page 613**, procedure number LEAKING- 6.0.0.

No Pressure less than 30 psi! With the Main Service Mode menu REMAINING up, allow two (2) FULL minutes OR until if an active leak reoccurs. TWO (2) possible scenarios 1) or 2) below:

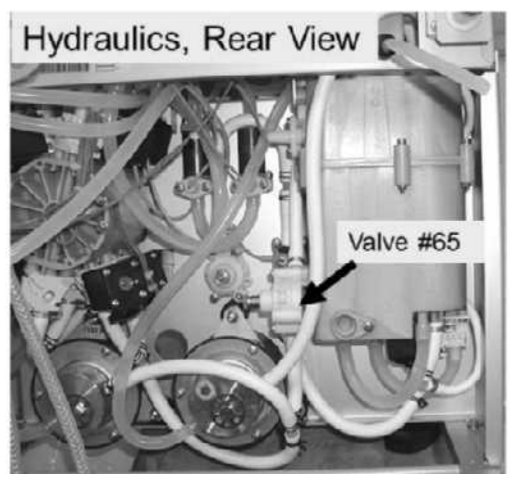
1) **IF (and ONLY if) a leak DOES NOT reoccur:** A possible Secondary Side Leak. See procedure number LEAKING- 2.0.0 (**page 603**).

2) **IF leak reoccurs:** Listed under **PRIMARY SIDE LEAK** (below) are TWELVE (12) possible scenarios (not inclusive):

# PRIMARY SIDE LEAK:

Per Figure 106 (**page 602**), proceed according to where the leak is seen:

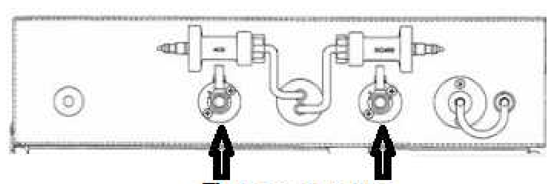
1) **IF from Loading Pressure Valve #65 (Figure right):** Tighten the Valve's Phillips screws. If the leak continues replace Valve #65.




2) **IF from the Heat Exchanger BODY:** Proceed to page **725**, HEAT EXCHANGER LEAKING EXTERNALLY

3) **IF from the Heat Exchanger's TUBING:** **A)** Secure the tubing with tie wraps; **B)** Check Inlet Water Pressure Regulator per the CALIBRATION PROCEDURES; **C)** Leaving the gauge installed, turn the machine off and allow twenty (20) minutes. If pressure exceeds 22 psi then Regulator #61 may be bad (to LOCATE #61 refer to Figure 106 (**page 602**)).

4) **IF from a RINSE PORT (Figure right):** Insert a dull probe into the port to move the poppet valve back and forth several times. If the leak continues replace the rinse port.




**Scenarios 5 THROUGH 12 next page**

5) **IF from RINSE PORT tubing:** Secure tubing connections with tie wraps.

6) **IF from Regulator #61 <u>OR</u> Valve #41 (not including the Heat Exchanger): A)** Ensure incoming water pressure is not exceeding 100 psi; **B)** Check Inlet Water Pressure Regulator per the <u>CALIBRATION PROCEDURES</u> booklet; **C)** Check tubing connections tie wraps or replace tubing; **4)** If Valve #41 is leaking externally the tubing connection, O-ring, or the valve body may be cracked.

7) **IF from Valve #39: A)** Check the tubing connection; **B)** Possible bad O-ring between the valve and the Hydrochamber; **C)** The valve body may be cracked.

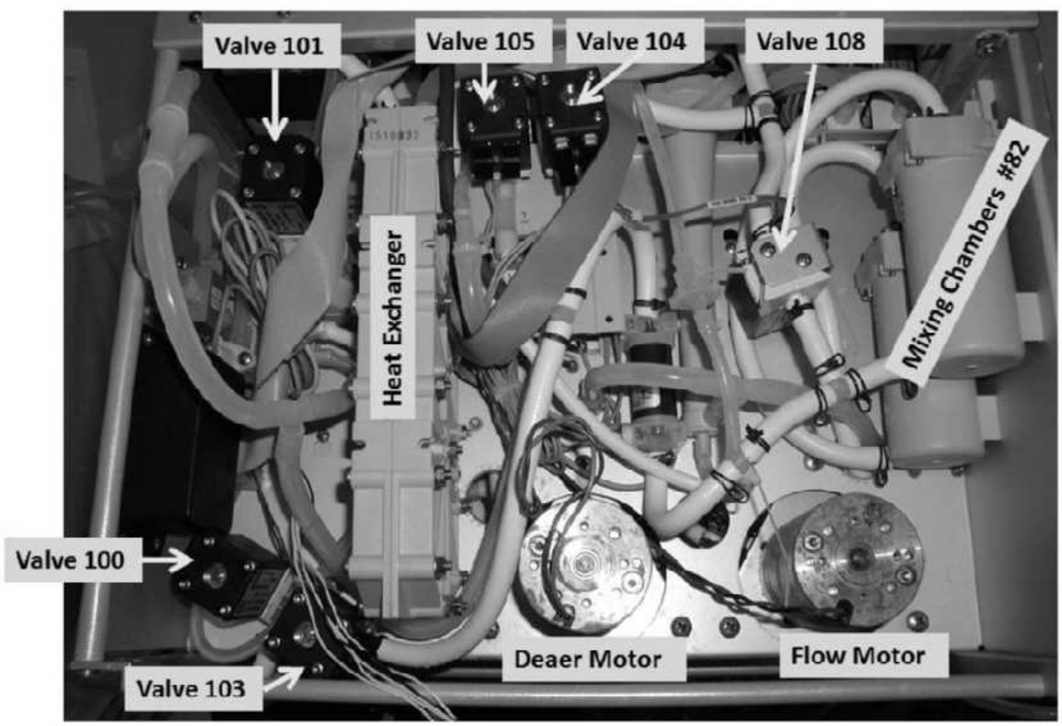
8) **IF from the Acid or Bic pump reinforced (output) tubing:** Secure tubing connections with tie wraps.

9) **IF between Deaeration Pump #20 and the Hydrochamber including Mixing Chambers #82:** Secure tubing connections with tie wraps.

10) **IF between BOTTOM BALANCING CHAMBER VALVES, #35 / #37 and the Hydrochamber:** **A)** Secure tubing connections with tie wraps; **B)** Possible bad O-ring between the valve and the balancing chamber; **C)** A valve body may be cracked.

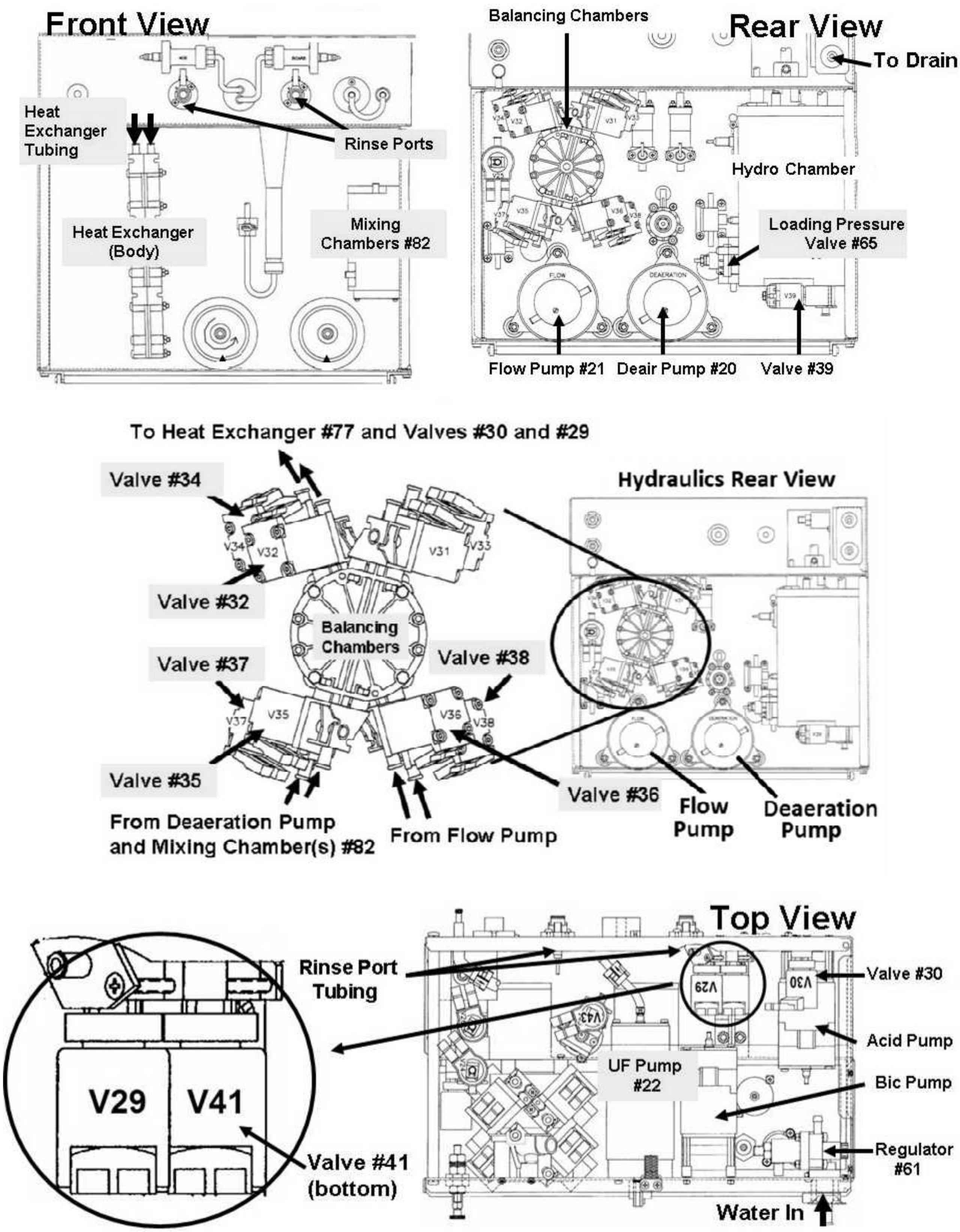
11) **IF between TOP BALANCING CHAMBER VALVES #32 / #34 and the HEAT EXCHANGER:** **A)** Secure tubing connections; **B)** Possible bad O-ring between the valve and the balancing chamber; **C)** A valve body may be cracked.

12) Per the Figure below, if the machine is equipped for bi*b*ag AND leaking from a bi*b*ag component: **A)** Secure tubing connections with tie wraps; **B)** If the component itself is leaking replace it!




## Figure 105 – Hydraulics Front View / bi*b*ag Components

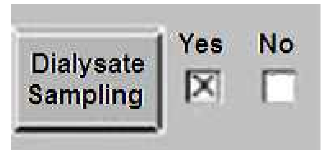
# Figure 106 – Various Hydraulic Views



## LEAKING- 2.0.0 SECONDARY SIDE LEAK / DIALYSATE SAMPLING OPTION?

a) From the Service Mode menu, press the 'Options' button.

b) Press the 'Hardware Options' button.




c) Does the "Yes" box at **Dialysate Sampling** (Figure right) have a blue 'X' in it?

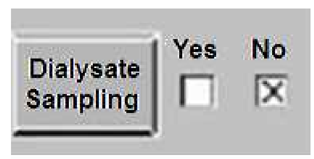
Yes **Dialysate Sampling** = "Yes"! See procedure number LEAKING- 2.1.0 (page 603).

No **Dialysate Sampling** = "No"! This is NORMAL! In what Program, **1)** Dialysis OR **2)** A Cleaning Program (Rinse, Heat Disinfect, etc.) was the leak ORIGINALLY seen?

**1)** **IF (and ONLY if) in Dialysis Program:** Turn the machine OFF then see procedure number LEAKING- 3.2.0 (**page 605**).

**2)** **IF in a Cleaning Program:** Proceed to **page 604**, procedure number LEAKING- 3.0.0.

## LEAKING- 2.1.0 DIALYSATE SAMPLING = "YES"




a) Place the 'X' in the "No" box and press 'Enter'.

b) ENSURE the "No" box at **Dialysate Sampling** now has a blue 'X' in it!


c) Turn the machine OFF then back on!

d) Return to the Program (Cleaning OR Dialysis) where the leak was seen! If squirting into the bucket occurs UF Check Valve #63 is okay!

e) Figure right, if (and ONLY if) no leaks from the Fluid Sample port = UF Check Valve #64 is okay!

f) Watch for up to four (4) minutes OR until an active leak reoccurs. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) an active leak reoccurs:** Turn the machine OFF then see procedure number LEAKING- 3.2.0 (**page 605**).

**2) IF an active leaks does NOT reoccur AND THREE (3) possible scenarios i) or ii) or iii below:**

**i)** **IF in a Cleaning Program AND a Flow Error occurs:** Proceed to **page 170**, procedure number CLEAN- 1.2.0.

**ii)** **IF in Dialysis Program AND a Flow Error occurs:** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

**iii)** **IF a Flow Error does NOT occur:** The leak was probably due to the incorrect Dialysate Sampling setting! This option should always be left at "No"!

**LEAKING- 3.0.0 LEAK IN CLEANING PROGRAM / ISOLATE SPECIAL VALVE ERROR**

a) Press 'Enter' to return to the Main Service Mode menu.

b) Press the screen's 'Options' button.


c) Call debug screen 0. IGNORING the top window (Flow Error) look at **Valve Error** (2nd window down). TWO (2) possible scenarios:

**1) IF (and ONLY if) Valve Error = 1 LONGER THAN two (2) seconds:** Proceed **page 207**, procedure number CLEAN- 7.0.0.

**2) IF Valve Error does NOT = 1 for LONGER THAN two (2) seconds:** Was the leak ORIGINALLY caused because UF Check Valve tubing was 'blowing off'?

Yes UF Check Valve tubing was 'blowing off'! See procedure number LEAKING- 3.1.0 (page 604).

No UF Check Valves were okay! Turn the machine OFF then proceed to **page 605**, procedure number LEAKING- 3.2.0).

**LEAKING- 3.1.0 LEAK IN CLEANING PROGRAM / UF CHECK VALVE TUBING BLOWING OFF**

a) Turn the machine off then back on!

b) Subsequent squirting into the bucket occurs if (and ONLY if) UF Check Valve #63 is okay!

c) If the screen's Heat Disinfect button is BLUE go to Heat Disinfect. If GRAY go to RINSE!


d) Figure right, if (and ONLY if) no leaks from the Fluid Sample port = UF Check Valve #64 okay.

e) Call debug screen 0 to watch **Valve Error** (2nd window down) until if it =1 for LONGER THAN two (2) seconds OR until an active leak reoccurs OR for three (3) FULL minutes, whichever comes first. TWO (2) possible scenarios below:

**1) IF (and ONLY if) Valve Error EVER = 1 for LONGER THAN two (2) seconds:** Proceed page **207**, procedure number CLEAN- 7.0.0.

**2) IF Valve Error does NOT = 1 for longer than two (2) seconds:** THREE (3) possible scenarios i) or ii) or iii) below:

**i) IF (and ONLY if) an active leak reoccurs:** Turn the machine OFF then see procedure number LEAKING- 3.2.0 (page 605).

**ii) IF (and ONLY if) an active leak does NOT reoccur HOWEVER, a Flow Error occurs:** Proceed to **page 170**, procedure number CLEAN- 1.2.0 (page 170).

**iii) IF an active leaks DOES NOT reoccur AND a Flow Error NEVER occurs:** Reconnect the Fluid Sample If UF tubing blows off again one or both of the UF Check Valves may be bad!

## LEAKING- 3.2.0 CONTINUE TO ISOLATE LEAK

With the machine OFF! FIVE (5) possible scenarios 1) or 2) or 3) or 4) or 5) below:

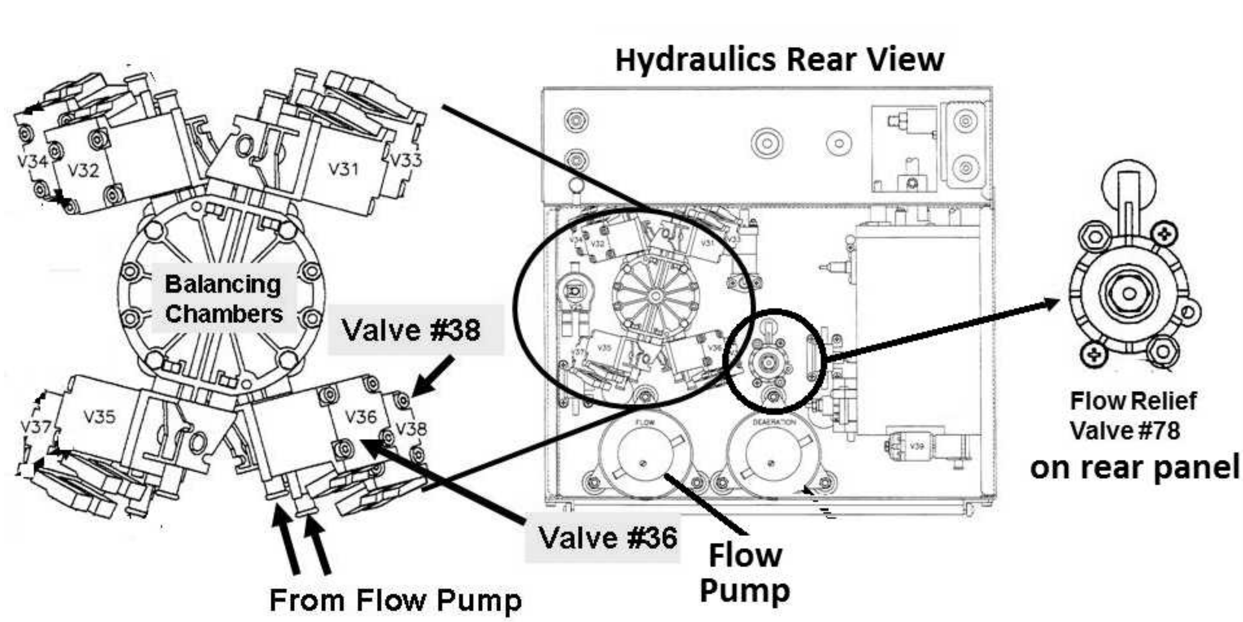

**1)** **Figure right, if (and ONLY if) the DiaSafe® filter was leaking from its blue headers: A)** ENSURE the packing tabs are not present; **B)** Replace the filter!

**2)** Per the Figure below, **IF (and ONLY if) Flow Relief Valve #78 was leaking:** See procedure number LEAKING- 3.3.0 (page 606)

**3)** **IF (and ONLY if) the leak was from inside the DiaSafe® filter housing:** Inside the housing, tie wrap ALL tubing connections THEN see procedure number LEAKING- 4.0.0 (page 607).

**4)** Per the Figure below, **IF (and ONLY if) the leak was between the Flow Pump and BALANCING CHAMBER VALVES #36 and/or #38:** See procedure number LEAKING- 3.3.0 (page 606).

**5)** **All OTHER scenarios:** See procedure number LEAKING- 4.0.0 (page 607).

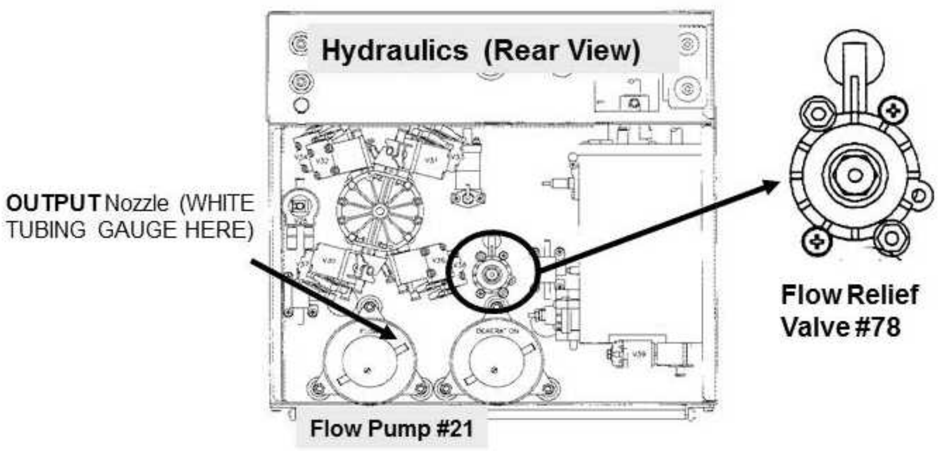


**LEAKING- 3.3.0 LEAK BETWEEN FLOW PUMP AND BALANCING CHAMBER VALVES #36 or #38**

a) Secure the tubing clamps at Valves #36* and #38*. * To LOCATE these Valves refer to the Figure previous page!

b) A psi gauge is used next. ENSURE it reads 0 psi before installing it!

c) Per the Figure below, install the gauge at the Flow Pump's OUTPUT (white) tubing.




## d) Tie wrap both side of the gauge tubing to prevent leaks and false readings.

e) Enter Service Mode → Calibrate Hydraulics → Flow Pressure but **DO NOT** follow the screen's instructions!

f) While watching the gauge, press 'Enter' ONCE.

g) Normal pressure is between 35 and 36 psi. Does pressure EXCEED 38 psi OR 'peg' its needle i.e. much more than 38 psi?

Yes More than 38 psi! Per the Figure above, turn Valve #78's nut COUNTERCLOCKWISE (outward) attempting to adjust to between 35 and 36 psi. If it will not adjust Valve #78 may be bad.

No Between 29 and 38 psi. TWO (2) possible scenarios:

1) **IF (and ONLY if) Flow Relief #78 is leaking from its body!** Tighten the Phillips screws on the Valve body then watch for four (4) minutes. If the leak continues replace Valve #78 and calibrate it.

2) **IF Flow Relief Valve #78 is NOT leaking!** If the leak continues, there may be a bad O-ring seal between the Balancing Chamber and Valve #36 and/or #38 OR Valve #36 and / or #38 valve body is cracked.

## LEAKING- 4.0.0 ISOLATE DRAIN FLOW (VALVE #30)

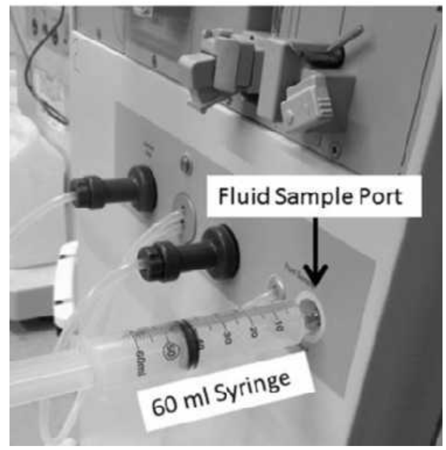
**NOTE!** A **60 ml luer lock syringe**, FILLED with water is REQUIRED here!

a) Without causing tension on cables and tubing, move the hydraulics as far away from the cabinet as possible!

b) ENSURE the distribution board cover is on!

c) Per Figure 107 below, check through Valve #30's INPUT and OUTPUT tubing for restrictions.

d) **Turn the machine but when "Select Program" appears DO NOT press 'Dialysis' or start a Cleaning program!**




e) Figure right, screw the 60 syringe onto the Fluid Sample Port.

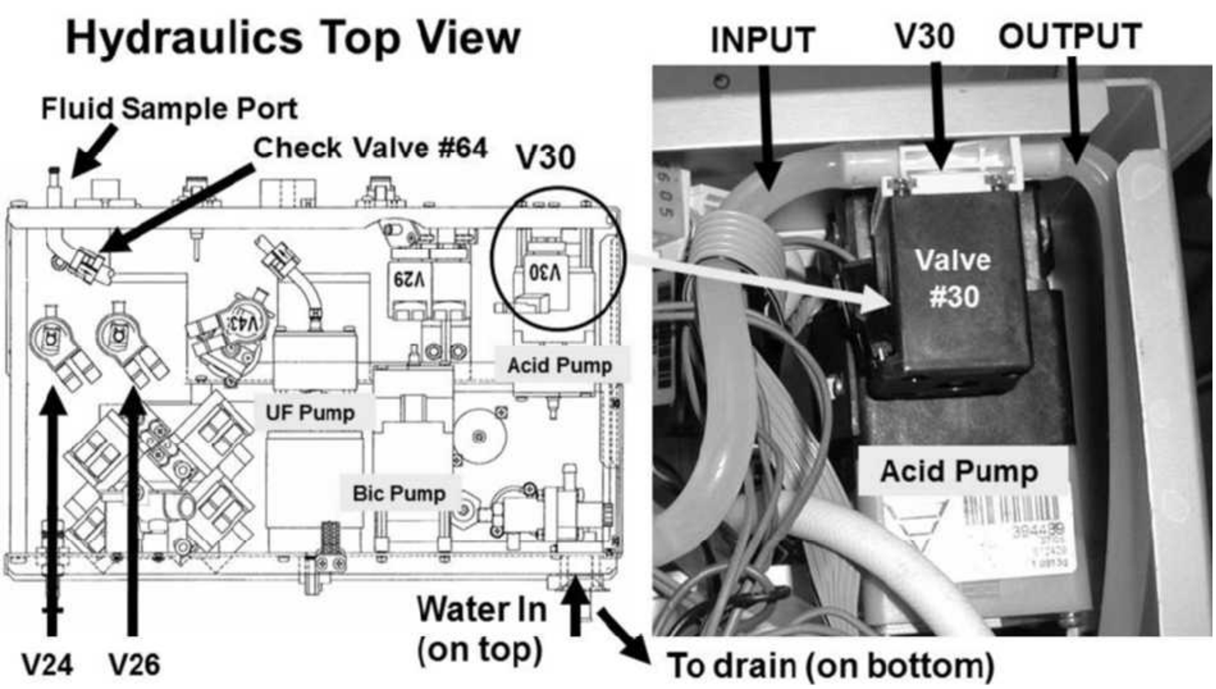
f) Start a SIX (6) second timer, in your head, as you begin to push AS **HARD AS YOU CAN** on the syringe plunger! You should feel very little resistance!

g) Can you push ALL 60 ml, WITHOUT 'blowing' tubing off UF Check Valve #64, within six (6) seconds?

Yes All 60 ml can be pushed! The Drain path is okay! See procedure number LEAKING- 5.0.0 (page 609).

No Cannot push all water out! See procedure number LEAKING- 4.0.1 (page 608).

**Figure 107 – Hydraulics Top View**



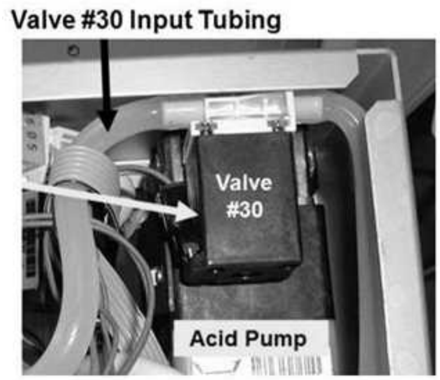
## LEAKING- 4.0.1 CANNOT PUSH ALL 60 ML THROUGH THE SAMPLE PORT

a) Remove the syringe from the Sample Port and fill it with water.

b) Per the Figure right, remove Valve #30's INPUT tubing!

c) Attach a tubing segment to the syringe that will fit snug onto the syringe AND Valve #30's INPUT nozzle.

d) Attach the syringe to Valve #30. Push the plunger **AS HARD AS YOU CAN**! Can you push ALL 60 ml through Valve #30 within SIX (6) seconds?




Yes All 60 ml can be pushed out! UF Check Valve #64* may be restricted. *To LOCATE Check Valve #64 refer to Figure 107 (page 607).

No Cannot push all water out! See procedure number LEAKING- 4.0.2 (page 608).

## LEAKING- 4.0.2 CANNOT PUSH THROUGH VALVE #30 / ISOLATE VALVE #30

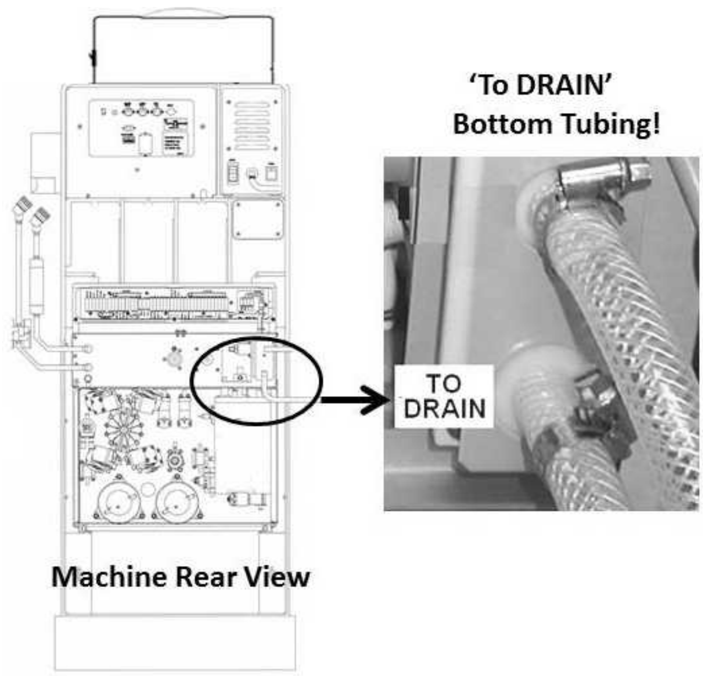
a) Per the Figure right, remove the **BOTTOM** 'To DRAIN' tubing from the rear of the machine!

b) Fill the syringe with 60 ml of water and reattach it to Valve #30's INPUT nozzle.

c) Push **AS HARD AS YOU CAN**. Can you now push 60 ml through Valve #30 within SIX (6) seconds? You should feel very little resistance!

Yes All 60 ml can be pushed! The drain tubing OR the "Quick Connector" (if present) is restricted!

No Cannot push all water out! **NOTE ONLY VALVE #30** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.



## LEAKING- 5.0.0 'TO DRAIN' PATH OKAY / ISOLATE VALVE #24

a) A 1000 ml graduated cylinder is required!

b) ENSURE the external flow indicator's 'bob' is at the bottom of the sight tube!

c) Flow from the shunt door and the flow through the indicator will be checked. Parts d through f MUST be performed QUICKLY so read them BEFORE performing!

d) Place the machine into RINSE!

e) Remove the RED dialyzer connector from the shunt door but **DO NOT** shut the door!

f) Figure right, strong flow, more than 300 ml every thirty (30) seconds?

Yes More than 300 ml! BEFORE returning the connector to the shunt and while rinse is still running ENSURE the external indicator's 'bob' is moving, at least ½ way up, through the sight tube. See procedure number LEAKING- 5.1.0 (page 609).

No Not more than 300 ml per 30 seconds! Turn the machine OFF then perform parts a THROUGH c below:

a) ENSURE no tubing restrictions to and from the DiaSafe® filter including inside its housing!

b) Replace the DiaSafe® filter with a primed one from another machine*****!

* **NOTE**! Using a new unprimed filter may cause error!

c) Repeat (ABOVE) procedure number **LEAKING- 5.0.0** (page 609). If still not more than 300 ml per thirty (30) seconds! **NOTE ONLY VALVE #24** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.

## LEAKING 5.1.0 VALVE #24 OKAY / ISOLATE VALVE #25

a) Press the 'Esc' key then 'Enter' twice to call the "Select Program" screen.

b) Return the dialyzer connector to the shunt and close the door!

c) Parts d and e MUST be performed quickly! Read them BEFORE performing!

d) **Return to RINSE Program**!

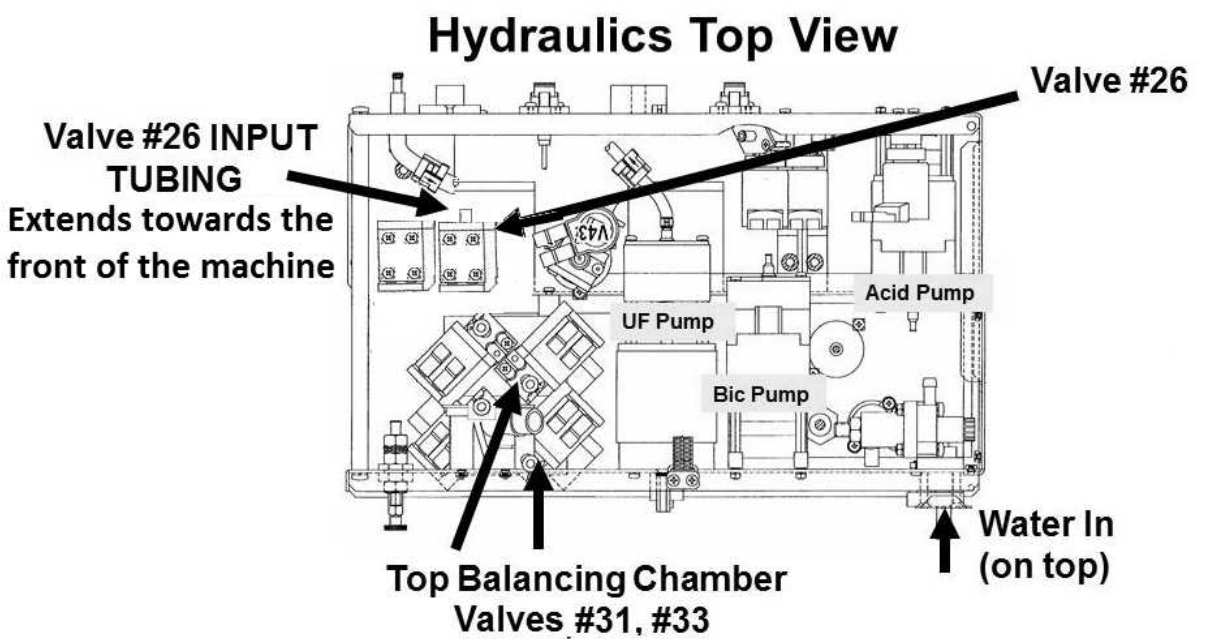
e) Is the external flow indicator's 'bob' rising at least ½ way?

Yes 'Bob' moving! Valve #25 is okay! See procedure number LEAKING- 5.2.0 (page 610).

No 'Bob' NOT moving! TWO (2) possible scenarios 1) or 2) next page:

1) **IF (and ONLY if), during this procedure, tubing 'blew off' the DiaSafe® filter or the top side Balancing Chamber Valves (see Figure below): A)** Turn the machine off; **B)** Reattach and tie wrap all tubing; **c)** Repeat (ABOVE) procedure number LEAKING- 5.1.0 (page 609).

2) **IF tubing DID NOT 'blow off': A)** Reconnect the drain tubing; **B) NOTE ONLY VALVE #25** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.




**LEAKING 5.2.0 VALVE #25 OKAY / ISOLATE VALVE #26**

a) Press 'Esc' then 'Enter' twice to call the "Select Program" screen!

b) Remove the red dialyzer connector from the shunt door and place it on the floor!

c) Close the door!

d) Per the Figure above, clamp and remove Valve #26's **INPUT tubing**!

e) Fill the 60 ml syringe with water then attach it to Valve #26's INPUT nozzle.

f) Push **AS HARD AS YOU CAN** on the syringe plunger. Can you push ALL 60 ml through Valve #26 within FIVE (5) seconds?

Yes Valve #26 is okay! Return the dialyzer connector to the shunt then see procedure number **LEAKING- 5.3.0** (page 611).

No Significant resistance felt! **NOTE ONLY VALVE #26** will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE.

## LEAKING- 5.3.0  VALVE #26 OKAY / ISOLATE VALVE #29

a) **Reattach Valve #26' its tubing!**

b) Figure right, screw the 60 ml syringe, filled with water, onto the Fluid Sample Port.

c) This procedure is time sensitive! Read parts d through g BEFORE performing them.

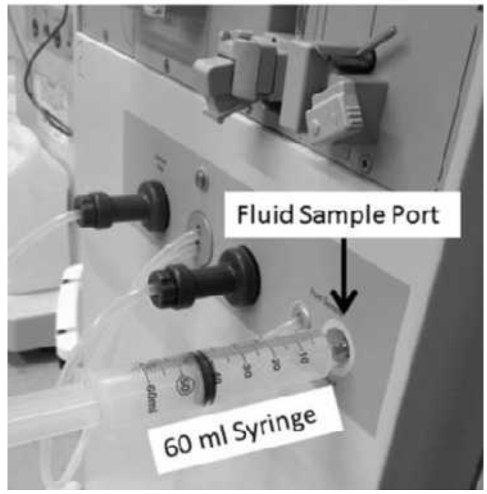
d) **Return to RINSE Program!**

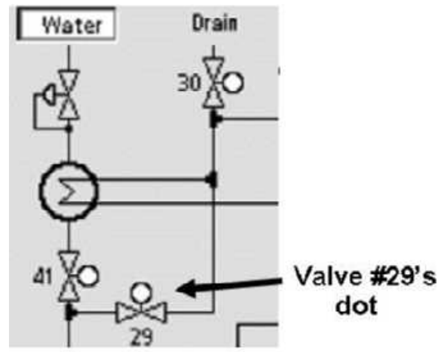
e) Call debug screen 0. If the debug screens do not appear press 'Esc' then call screen 0.

f) Figure right, locate Valve #29's 'dot'. It cycles from white to blue every two (2) minutes and stays blue (valve open) for nine (9) seconds.

g) When Valve #29's 'dot' **FIRST** turns BLUE push **HARD** on the plunger!  You should feel very little resistance!

h) Were you able to push water through the Sample Port WHILE Valve #29's 'dot' is blue?

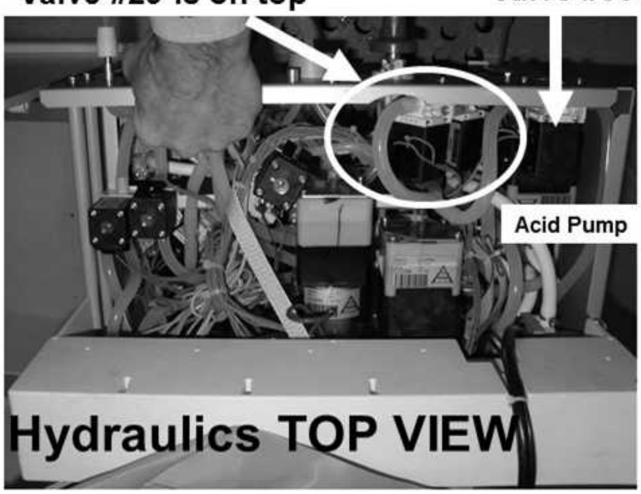


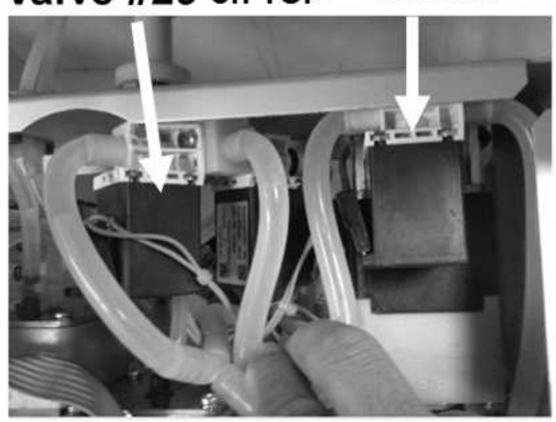

Yes    All water pushed out! Flow through Valve #29! See procedure number LEAKING- 5.5.0 (page 612).

No    Significant resistance felt!  **NOTE ONLY VALVE #29** (Figure below) will be checked and proceed to **page 210**, TROUBLESHOOTING A VALVE

**Valves #29 and #41**
**Valve #29 is on top**    **Valve #30**




**Valve #29 on TOP**    **Valve #30**



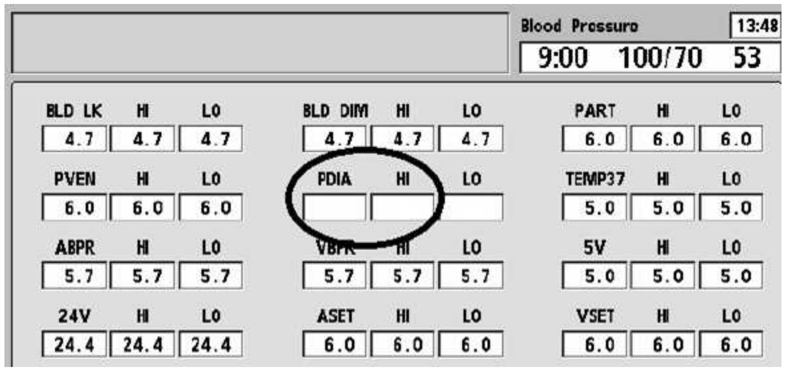
**LEAKING- 5.5.0 VALVE #29 IS OKAY / ISOLATE FOR A 'PARTIAL'RESTRICTION**

a) **Turn the machine OFF then back on.**

b) If the screen's Heat Disinfect button is BLUE go to Heat Disinfect. If gray go to RINSE!

c) Allow ONE (1) FULL minute for debug screens to update!

d) Call debug screen 10 (Figure right) to locate **PDIA**

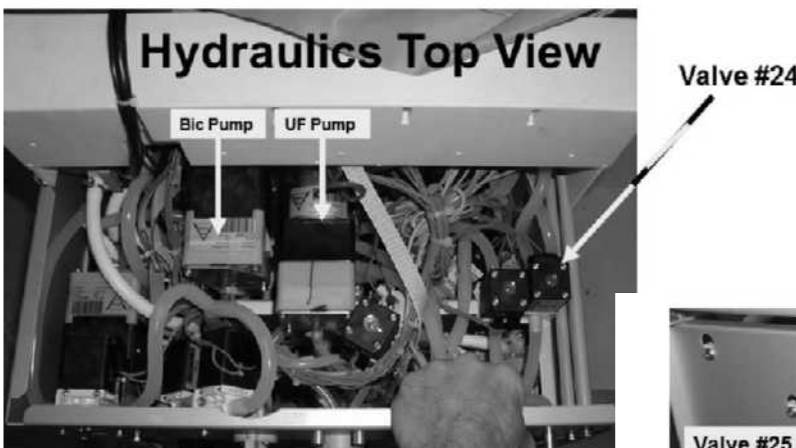


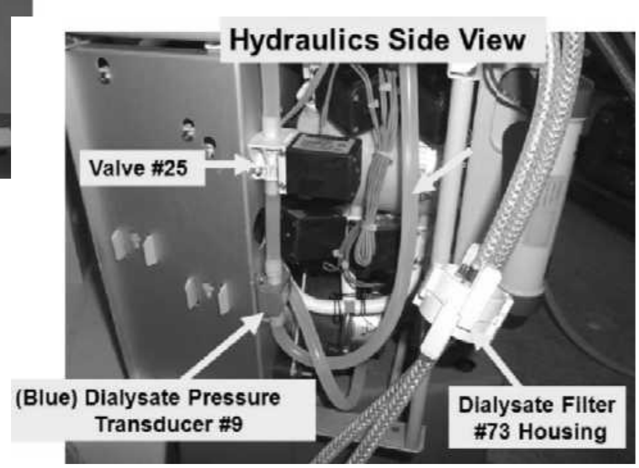

e) WITHOUT LOOKING AWAY, watch **PDIA** for FIVE (5) full minutes. It is NORMAL it cycle between 0.0 (for about three seconds to more than 0.1 for about one (1) second. It should NEVER be more than 6.0! THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) PDIA CYCLES from between 0.0 to more than 0.1 BUT NEVER more than 6.0l**! A problem is not present at this time. Tie wrap or replace ALL tubing connections that were leaking and ENSURE the machine passes the alarms and pressure tests!

**2)** **IF (and ONLY if) PDIA REMAINS less than 1.0 for longer than 10 seconds:** If a Flow Error occurs OR a leak reoccurs there MAY be a partial restriction to the drain (Valve #30, Valve #29).

**3)** **IF PDIA goes to more than 6.0 AND a Flow Error occurs:** Referring to the Figures (below) Valve #24 OR #25 is partially restricted!



## LEAKING- 6.0.0 LOADING PRESSURE IS HIGH / ISOLATE VALVE#65 FOR DEBRIS

a) **With the machine OFF** turn Loading Pressure Valve's #65's (located on the left side of the hydrochamber) nut COUNTERCLOCKWISE to the point that it is almost all the way out i.e. maximum number of threads showing!

b) Reconnect and tie wrap ALL 'blown off' tubing segments!

c) Read parts d and e BEFORE performing them!

d) Turn the machine on. When "Press CONFIRM for Service Mode" appears press 'Enter'. The screen says "Machine in Service Mode".

e) Keeping an eye on the gauge, When 'System Initialization' reaches 90% does pressure again EXCEED 30 psi OR 'peg' the gauge's needle (i.e. much more than 30 psi!)?

Yes  Pressure exceeds 30 psi! See procedure number LEAKING- 6.1.0 (page 613).

No  Pressure less than 30 psi! Perform the Loading and Deaeration Pressure calibration per the Calibration Procedures booklet!

## LEAKING- 6.1.0 PRESSURE EXCEEDS 30 PSI

a) Turn the machine OFF!

b) Remove Loading Pressure Valve #65 from the hydrochamber. **NOTE! There will be leakage but leave the water on!**

c) Debris may be restricting Valve #65's Hydrochamber return port. Referring to the 2008T Flow Diagram, debris can be ANYWHERE between Deaeration Pump's #20 output and Loading Pressure Valve #65. Is debris located?

Yes  Debris* located! See procedure number LEAKING- 6.2.0 (page 613).

No  a) Reinstall Valve #65

b) Return to Service Mode.

c) Attempt to set Loading Pressure maximum to between 23 and 25 psi. If maximum pressure will not adjust below 30 psi, TWO (2) possibilities: **1)** Debris that was not located or reoccurred OR; **2)** Bad Loading Pressure Valve #65.

*** Possible debris sources: 1)** Excessive O-ring lubrication; **2)** Inadequate acid clean cycles (i.e. excessive bicarbonate precipitate); **3)** Inadequately filtered incoming water; 4) Possible degrading Deaeration Pump head gears.

## LEAKING- 6.2.0 DEBRIS LOCATED (IMPORTANT CHECKS)

a) Remove the debris and reinstall Valve #65

b) Return to Service Mode.

c) Attempt to set Loading Pressure maximum to between 23 and 25 psi. If maximum pressure will not adjust below 30 psi, TWO (2) possibilities: **1)** Debris that was not located or reoccurred OR; **2)** Bad Loading Pressure Valve #65.

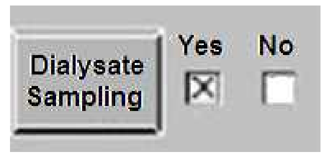
## LEAKING- 7.0.0 “SAMPLE BAG CONNECTED?” / ISOLATE DIALYSATE SAMPLING OPTION

A leak was occurring in a Cleaning Program (Rinse, Heat Disinfect, etc.) and you saw the “Sample Bag Connected?” banner on the screen.

a) Turn the machine on. When “Press CONFIRM For Service Mode” appears press ‘Enter’. The screen says “Machine In Service Mode”.

b) Press the screen’s ‘Options’ button.

c) Press the screen’s ‘Hardware Options’ button.




d) Does the “Yes” box at **Dialysate Sampling** (Figure right) have a blue ‘X’ in it?

Yes **Dialysate Sampling** = “Yes”! See procedure number LEAKING- 7.1.0 (page 614).

No **Dialysate Sampling** = “No”! This is NORMAL and is not causing the leak! Turn the machine OFF then return to (ABOVE) procedure number LEAKING- 1.1.0 (page 600).

## LEAKING- 7.1.0 DIALYSATE SAMPLING = “YES”

a) Place the ‘X’ in the “No” box and press ‘Enter’.

b) ENSURE the “No” box at **Dialysate Sampling** now has a blue ‘X’ in it!

c) Reattach and all ‘blown off’ tubing but **LEAVE** the Fluid Sample Connector in the bucket!

d) Turn the machine OFF then back on!

e) From the ‘Select Program’ screen press RINSE. The “Sample Bag Connected” banner should NOT appear!

f) With the machine in RINSE Program **NOTE!** Squirting from the Fluid Sample Connector is NORMAL = UF Check Valve #63 is oriented correctly!

g) If (and ONLY if) an active leak reoccurs turn the machine OFF then return to (ABOVE) procedure number LEAKING- 1.1.0 (page 600).

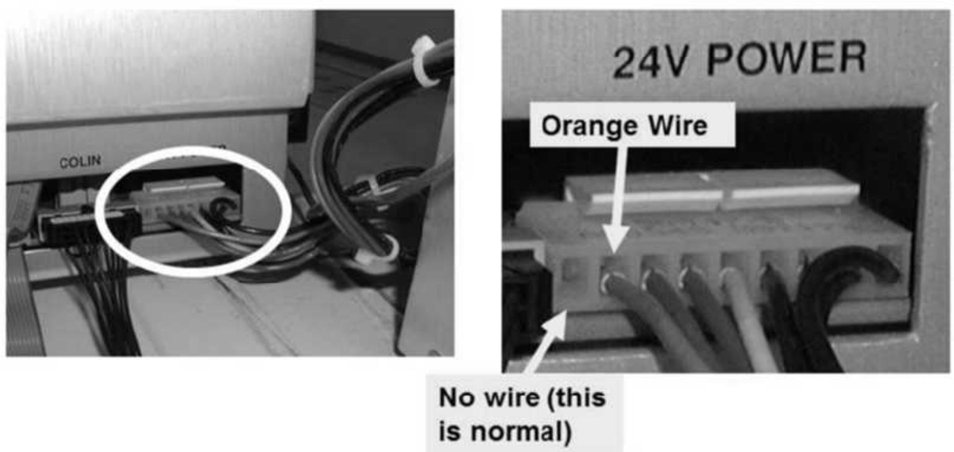
## SECTION 22 - "WD: FAIL LONG PULSE" OR "WD: FAIL SHORT PULSE"

Turn the machine OFF for two (2) seconds, then back on. TWO (2) possible scenarios 1) or 2) below:

1) **IF "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" does NOT reoccur:** Turn the machine off and on ten (10) times allowing twenty (20) seconds in between as the problem may be intermittent! If "WD" alarm reoccurs see scenario #2.

2) **IF "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" REOCCURS:** Perform parts a THROUGH d below:

   a) Figure below, being **CAREFUL** to **NOT** pull the 24V Power Harness loose, open the card cage!




   b) **Set your CALIBRATED volt meter DC voltage ($V_{DC}$)**

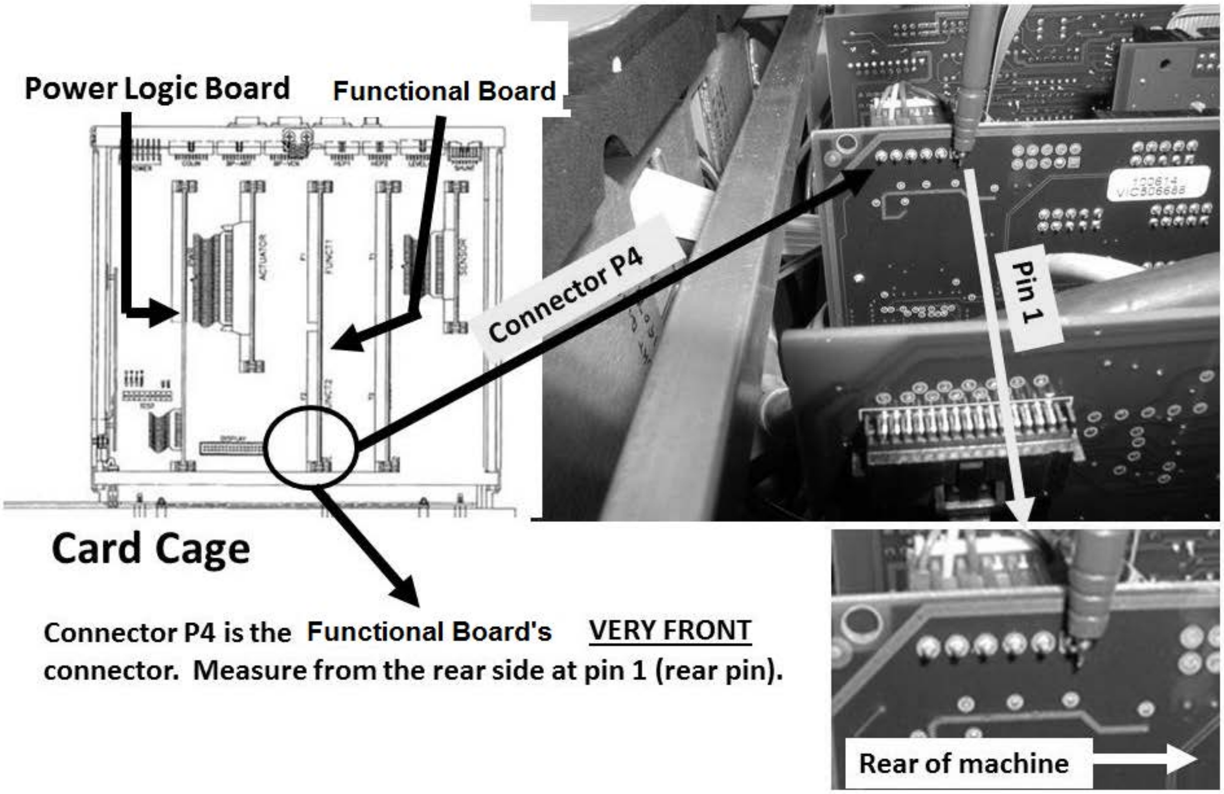
   c) **Connect the meter's ground (black) lead to chassis ground (see Figure 2, page 4)).**

   d) **ENSURING** the **"WD: Fail Long Pulse" OR "WD: Fail Short Pulse"** banner is on the screen, see procedure number WD- 1.0.0 (page 616).

LEFT BLANK INTENTIONALLY

**WD- 1.0.0 ISOLATE 24V- B POWER SUPPLY**

a) Per the Figure below, locate the Functional Board's six (6) pin 'P4' connector at the top, front edge of the board closest to the screen.




b) Measure at the rear side of the P4 connector, at **pin 1** (rear pin), as seen in the Figure above. TWO (2) possible scenarios:

**1) IF (and ONLY if) more than 3.0 volts DC:** Leaving the "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" banner up see procedure number WD- 1.0.1 (page 617).

**2) IF less than 3.0 volts DC:** Read before performing! Turning the machine off in between, one at a time, swap in the listed components (see Component List (below)) with known good, **Turn the machine off and on several times, allowing twenty (20) seconds in between, to test new each component!**

**Component List: 1)** Sensor Board[1;] **2)** Actuator-Test Board; **3)** Functional Board[2]

[1, 2] To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)) for each board.

WD- 1.0.1 ISOLATE CONTROL SIGNAL

a) Per the Figure below, locate IC2 at the top edge of the Power Logic Board.

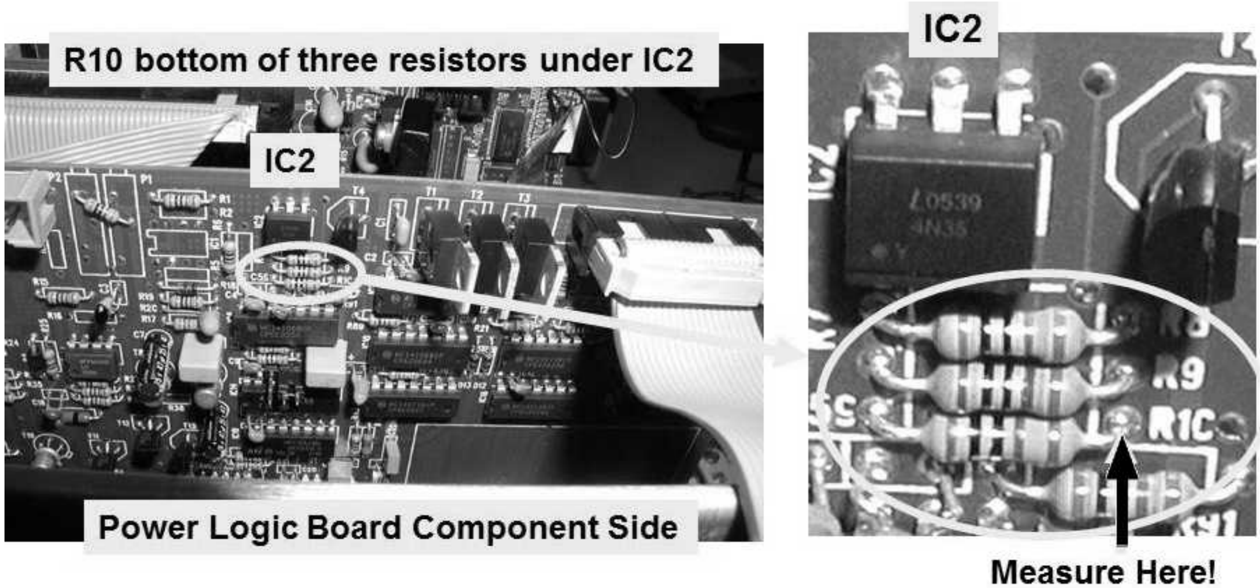



**Figure 108 – Power Logic Board / R10**

b) Under IC2 are three resistors, top to bottom R8, R9 and **R10**.

c) Measure at the RIGHT side of **R10**, at the location shown in Figure 108. TWO (2) possible scenarios:

**1) IF (and ONLY if) 3.6 volts DC or more:** The Functional Board is bad (to locate see Figure 4A, page 10)).

**2) IF <u>less than</u> 3.6 volts DC:** See procedure number WD- 1.0.3 (page 617).

WD- 1.0.3 ISOLATE THE POWER LOGIC BOARD

a) Turn the machine OFF and swap in a known good Power Logic Board***. ***To LOCATE the board refer to Figure 4A AND NOTE A (page 10).

b) Turn the machine on. TWO (2) possible scenarios:

1) **IF "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" does NOT reoccur:** Turn the machine off and on several times, allowing 40 seconds in between, as the problem may be intermittent! If it does not reoccur the new Power Logic Board fixed the problem.

2) **IF "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" REOCCURS:**: Perform parts a THROUGH d below:

a) Turn the machine OFF! The previous Power Logic Board is probably okay!

**Parts b through d next page**

b) Per the Figure below, open the power supply. TWO (2) checks:

**CHECK #1**: Inspect the entire length of the 24V Power Harness. **If burning or damage is located this may be the problem!**

**CHECK #2:** Inspect the surface of and all wires attached to the Power Control Board. **If burning or damage is located this may be the problem!**

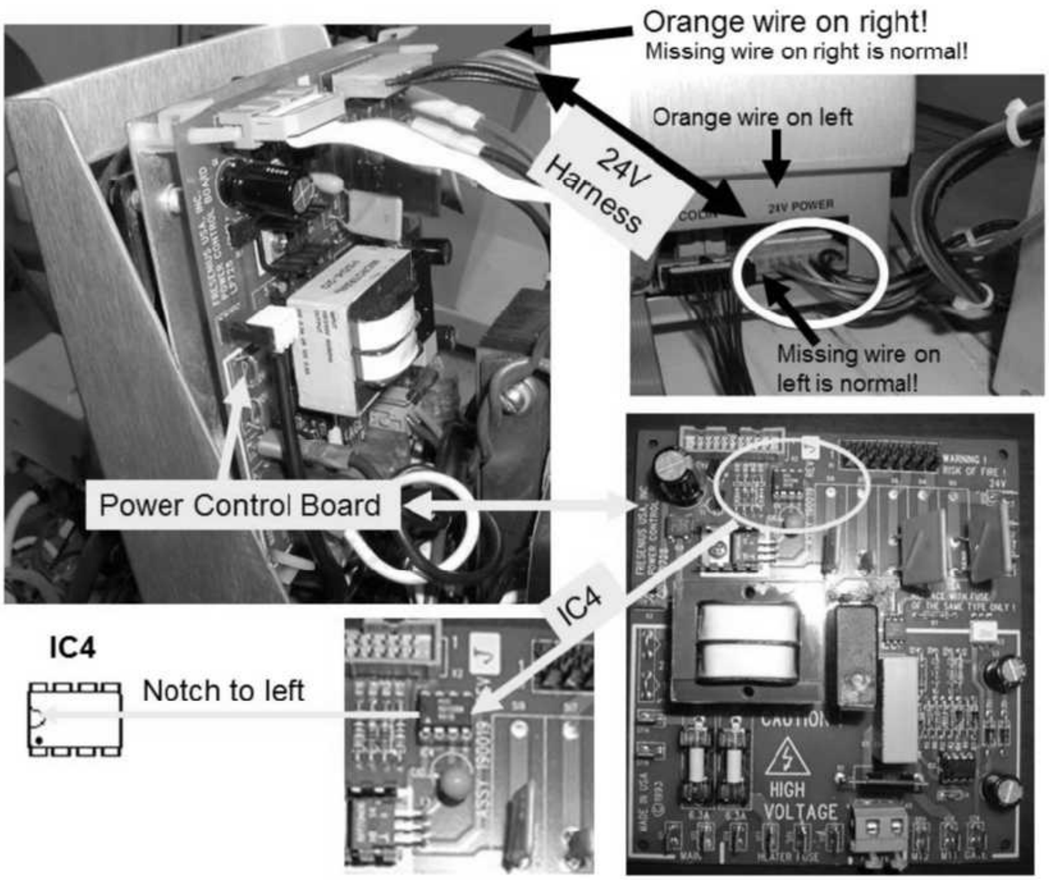



**Figure 109 – Power Control Board / 24V Power Harness / IC4**

c) Locate IC4 on the Power Control board..

d) IC4 (see Figure above) is socketed and can be removed without desoldering! **CAUTION!** Being careful NOT to install it upside down swap in a <u>known good</u> IC4 chip BEFORE continuing to procedure number WD- 1.0.4 (page 619).

**WD- 1.0.4 CHECK FOR POWER CONTROL BOARD 'SHORT"**

Turn the machine ON. TWO (2) possible scenarios:

1) **IF (and ONLY if) "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" does NOT reoccur:** Turn the machine off and on several times, allowing 40 seconds in between, If "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" does NOT reoccur the new IC4 fixed the problem!

2) **IF "WD: Fail Long Pulse" OR "WD: Fail Short Pulse" REOCCURS:** See procedure number WD- 1.0.5 (page 619).

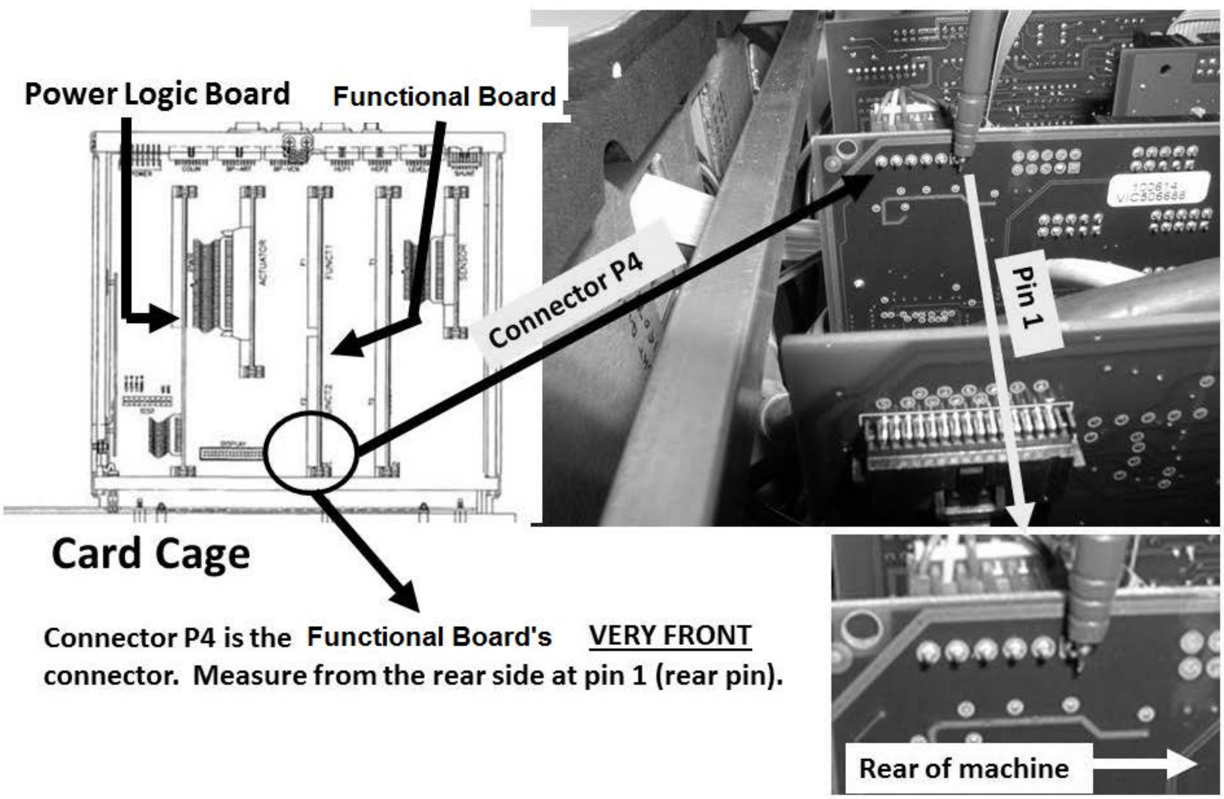
**WD- 1.0.5 ISOLATE POWER SUPPLY / CARD CAGE**

a) ENSURE the **"WD: Fail Long Pulse" OR "WD: Fail Short Pulse"** banner is up BEFORE continuing to part b.

b) Referring to the Figure below, measure again at the rear side of the Functional Board's P4 connector, at pin 1. TWO (2) possible scenarios:

   1) **IF (and ONLY if) more than 3 volts DC:** Assuming all above procedures were performed correctly, there may be a 24 volt 'short circuit' inside the power supply or the card cage. See procedure number WD- 1.0.6 (page 620).

   2) **IF less than 3 volts DC:** The symptom changed from what originally brought you here. It appears the new IC4 is working. Return to (ABOVE) procedure number WD- 1.0.0 (page 616) to re-measure voltage and proceed as directed.



## WD- 1.0.6 TROUBLESHOOT POWER SUPPLY / CARD CAGE

Referring to the Component List below, perform parts a and b:

a) Turn the machine OFF and swap in each component, one at a time, starting with the 24V Harness.

b) Turn the machine on. If (and ONLY if) the **WD: Fail Long Pulse" OR "WD: Fail Short Pulse"** reoccurs AND there is more than 3.0 volts at the Functional Board's P4 connector pin 1, continue through the list until the WD alarm no longer occurs.

**Component List**: **1)** 24V Harness*****; **2)** Power Control Board (inside the power supply). **3)** All card cage boards. **4)** Motherboard.

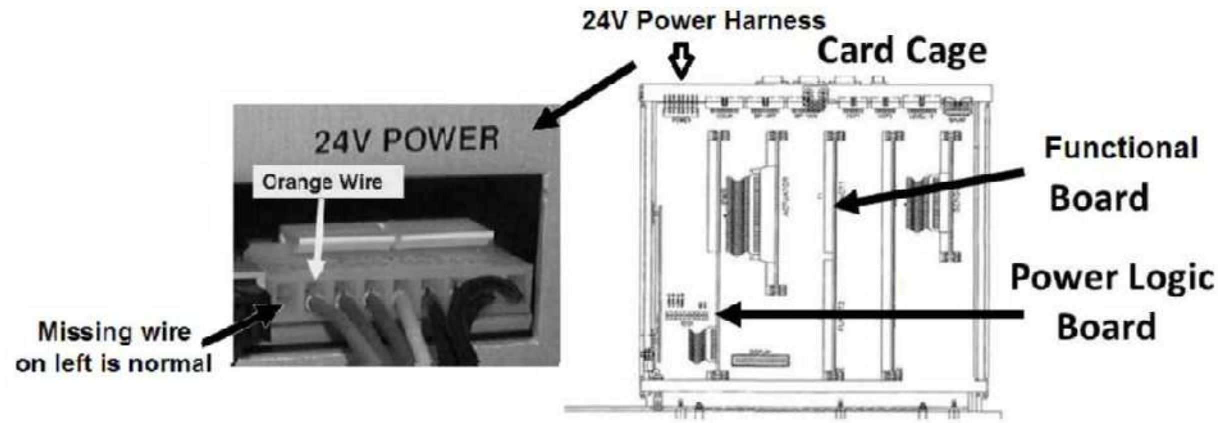
***** To LOCATE the 24V Harness refer to Figure 109 (page 618)

# SECTION 23 – HEATER RELAY TEST FAIL

**This is NOT a Heater or Triac problem!** From "Select Program", for eight (8) seconds after pressing 'Dialysis' then 'Confirm' or 'Enter', the Function Board turns the heater circuit off using Heater Relay (RL3) located on the Power Control board. If the Function Board receives a signal that heater current is present during this period it issues a "HEATER RELAY TEST FAIL".

A) **Turn the machine OFF!**

B) Figure below, being careful NOT to pull the 24V Power Harness loose, GENTLY open the card cage.

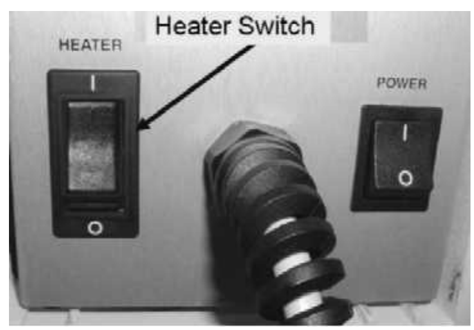



C) Push down **HARD** on the Power Logic and Functional Boards to ENSURE good connections to the motherboard.

D) Close the card cage.

E) Figure right, ENSURE the Heater Switch is on!

F) See procedure number HEATER RELAY- 1.0.0 (page 621).




**HEATER RELAY- 1.0.0 ISOLATE INTERMITTENT ALARM**

a) Turn the machine on and return to Dialysis Program ("Select Program"→ 'Dialysis' → 'Enter')!

b) Does "HEATER RELAY TEST FAIL" reoccur?

Yes "HEATER RELAY TEST FAIL" reoccurs! Turn the machine OFF THEN see procedure number HEATER RELAY- 1.0.1 (page 622).

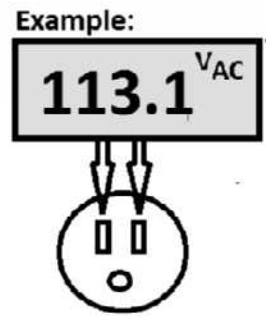
No "HEATER RELAY TEST FAIL" did NOT reoccur! Reseating the boards may have fixed the problem HOWEVER, see procedure number HEATER RELAY- 3.0.0 (**page 628**).

## HEATER RELAY- 1.0.1 TEST YOUR VOLT METER

a) **Set your CALIBRATED volt meter to AC voltage (~ V, $V_{AC}$).**

b) Figure right, measure at the wall plug. The meter MUST read more than 100 volts AC!

c) See procedure number HEATER RELAY- 1.0.2 (page 622).




## HEATER RELAY- 1.0.2 ISOLATE HEATER 'OFF' CONTROL

a) ENSURING the machine is off, TWO (2) people are required for this procedure!

b) Turn the machine on but when "Select Program" appears **DO NOT** push 'Dialysis' yet!

c) **Read this step BEFORE going to part d!** For eight (8) seconds, after pressing 'Dialysis' then 'Confirm' (or 'Enter') heater voltage **SHOULD BE** less than 10.0 volts. After eight (8) seconds, it MAY go to more than 100.0 volts!

d) Figure below, at the distribution board's Heater Connector, have Person #1 (you) HOLD the meter leads between the BROWN and BLUE wires!

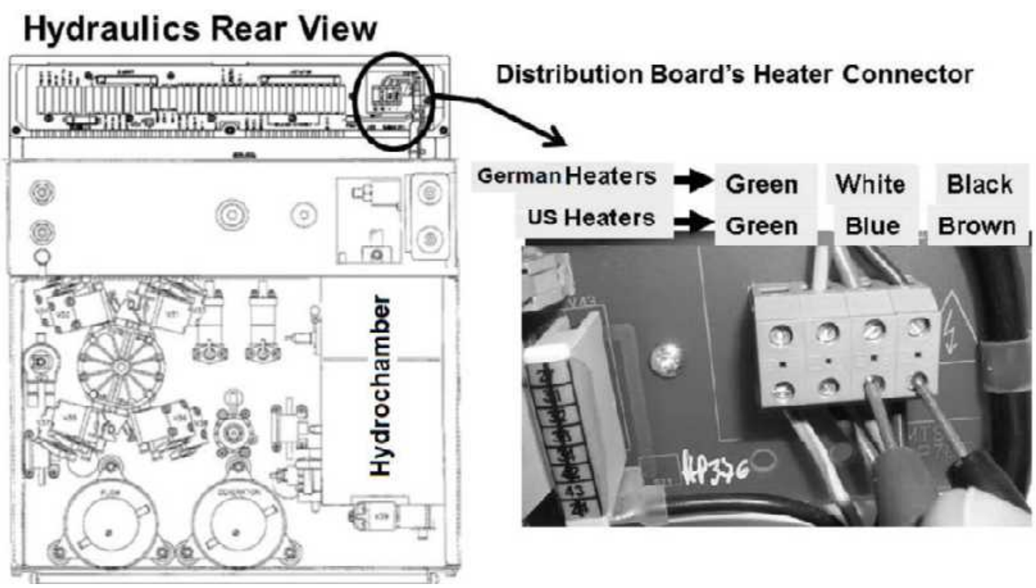



**Figure 110 – Heater Connector**

e) Person #2: **Step #1** Press 'Dialysis'; **Step #2** Saying "Now" press 'Enter' to start Dialysis Program!

f) For the **FIRST EIGHT (8) SECONDS**, after hearing "Now", more than 100.0 volts measured at the heater?

Yes More than 100.0 volts! "HEATER RELAY TEST FAIL" MUST be up! See procedure number HEATER RELAY- 2.0.0 (**page 624**).

No Less than 10.0 volts! Consider repeating procedure number HEATER RELAY- 1.0.2 (page 622) just to be sure! Does **"**HEATER RELAY TEST FAIL" reoccur?

Yes "HEATER RELAY TEST FAIL" reoccurs! See procedure number HEATER RELAY- 1.0.3 (page 623).

No "HEATER RELAY TEST FAIL" did NOT reoccur! See procedure number HEATER RELAY- 3.0.0 (**page 628**).

## HEATER RELAY- 1.0.3 ISOLATE HEATER OFF LOGIC

a) Turn the machine OFF!

b) **Turn the HEATER Switch off!**

c) Turn the machine on AND return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

d) Does **"**HEATER RELAY TEST FAIL" reoccur?

Yes "HEATER RELAY TEST FAIL" reoccurs! ENSURING the Heater Switch was off, see procedure number HEATER RELAY- 1.0.4 (page 623).

No "HEATER RELAY TEST FAIL" did NOT reoccur! See parts a AND b below:

a) **Turn the Heater Switch on!**

b) CAREFULLY repeat (ABOVE) procedure number HEATER RELAY- 1.0.2 (page 622) but if (and ONLY if) you return here proceed to **page 628**, procedure number HEATER RELAY- 3.0.0.

### HEATER RELAY- 1.0.4 HEATER SWITCH OFF BUT "HEATER RELAY TEST FAIL" REOCCURS

a) **Leave the Heater Switch OFF until the problem is located!**

b) Turn the machine off and swap in a known good Power Logic Board*. *To LOCATE the board refer to Figure 4A AND NOTE A (page 10).

c) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'). If (and ONLY if) "HEATER RELAY TEST FAIL" reoccurs see procedure number HEATER RELAY- 1.0.5 (page 623). If it DOES NOT reoccur the new Power Logic board solved the problem!

### HEATER RELAY- 1.0.5 HEATER RELAY TEST FAIL REOCCURS

**NOTE!** The previous Power Logic Board is probably okay.

a) Turn the machine off. THREE (3) possibilities (see COMPONENT LIST below). Swap each in, one at a time then in between, see part b to see if the new component fixed the problem.

**COMPONENT LIST: 1)** Power Control board (inside the power supply); **2)** Functional Board (to prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)); **3)** Motherboard.

b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter'). If **"**HEATER RELAY TEST FAIL" reoccurs swap in the next component in the list **"**HEATER RELAY TEST FAIL" does NOT occur.

## HEATER RELAY- 2.0.0 ISOLATE DIODE 17 (D17)

A bad diode 17 (D17) destroys Power Logic Boards. See parts a THROUGH h below:

a) Turn the power off and unplug the machine! **Caution! Electrocution hazard if not unplugged!**

b) Per Figure 111 below, open the power supply to see the component side of the Power Control board.

c) The twenty (20) and nine (9) pin***** cables MUST be unplugged**!** *****BEFORE unplugging the nine pin cable NOTE its polarity (i.e. orange wire on the right)!

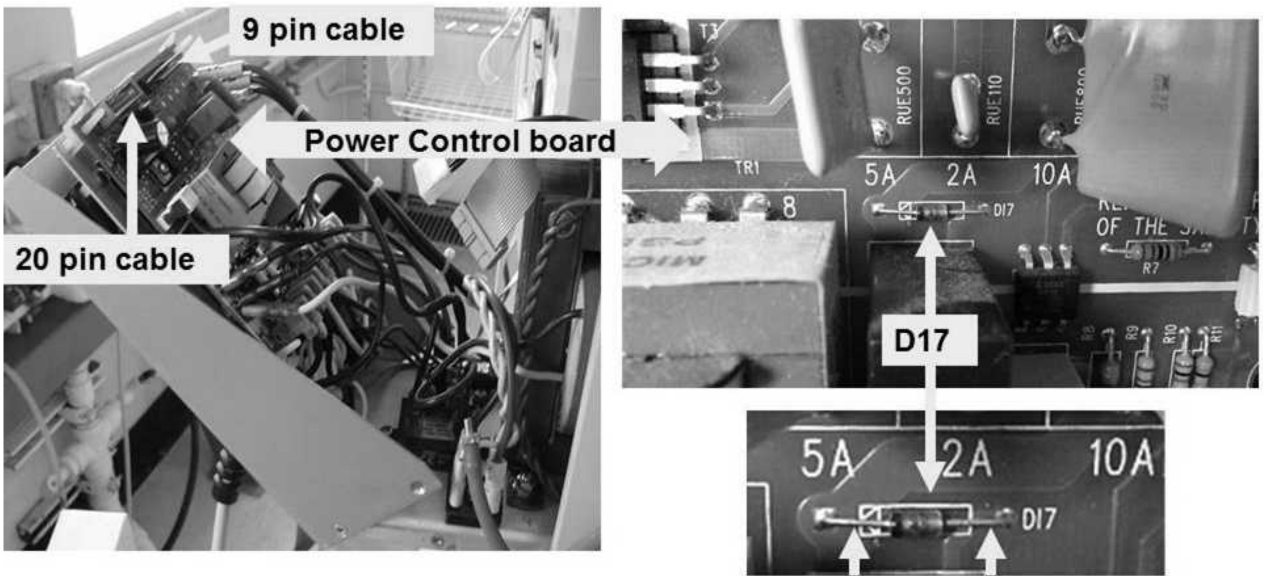
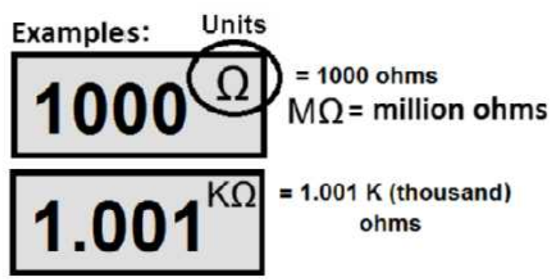



**Figure 111 – Power Control Board (Diode 17)**

d) **Set your volt meter to RESISTANCE (Ω)!**




g) Per Figure 111, check diode 17 (D17) by placing one meter lead on one side of it and the other lead on the other side.

h) Figure right, reading the meter's numeric AND units display, TWO (2) possible scenarios:

**1) IF (and ONLY if) between 900 and 1500 Ω! (0.900 and 1.5 KΩ):** Diode 17 is good! Proceed to **page 626**, procedure number HEATER RELAY- 2.0.1.

**2) IF less than 900 Ω (0.900 KΩ) OR more than 1500 Ω (1.5 KΩ):** Diode 17 is bad! Perform parts a THROUGH e below:

a) Replace **BOTH** the Power Control AND Power Logic***** boards with known good! *****To LOCATE the board refer to Figure 4A AND NOTE A (page 10).

**Parts b through e next page**

**Diode 17 is BAD continued:**

b) After BOTH boards are replaced, slide the power supply in but do not screw it in yet!

c) Plug the machine in.

d) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

e) TWO (2) possible scenarios:

1) **IF (and ONLY if) "Heater Relay Test Fail" reoccurs:** The bad diode, now replaced, may have caused other damage. See procedure number HEATER RELAY- 2.0.2 (page 627).

2) **IF "Heater Relay Test Fail" DOES NOT reoccur:** Problem solved! The previous diode 17 AND Power Logic Board is bad!

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## HEATER RELAY- 2.0.1 DIODE 17 IS GOOD

a) Reconnect the Power Control board's cables.

b) Slide the power supply back into the cabinet but DO NOT mount it yet!

c) Turn the machine off and swap in a known good Power Logic Board*. *To LOCATE the Power Logic Board refer to Figure 4A AND NOTE A (page 10).

d) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

e) TWO (2) possible scenarios:

1) **IF "Heater Relay Test Fail" reoccurs:** Turn the machine off then see procedure number HEATER RELAY- 2.0.2 (page 627).

2) **IF "Heater Relay Test Fail" does NOT reoccur:** Problem solved. The previous Power Logic Board was bad.

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**HEATER RELAY- 2.0.2 HEATER RELAY TEST FAIL REOCCURED / RETEST HEATER CONTROL**

a) Ensuring the machine is off, two (2) people are required for this procedure!

b) **Set your volt meter to AC voltage (~ V, $V_{AC}$)!**

c) Turn the machine on but, when "Select Program" appears, **DO NOT** push "Dialysis' yet!

d) At the distribution board, have Person #1 (you) HOLD the meter leads between the Heater Connector's BROWN and BLUE wires.

e) Person #2: **Step #1** Press 'Dialysis'; **Step #2** Saying "Now" press 'Enter' to start Dialysis Program.

f) For the **FIRST EIGHT (8) SECONDS**, after hearing "Now", more than 100.0 volts AC measured?

Yes More than 100.0 volts! It appears the Power Control board (inside the power supply) is bad.

No Less than 10.0 volts! TWO (2) possible scenarios below:

1) **IF (and ONLY if) "HEATER RELAY TEST FAIL" occurred:** See (ABOVE) procedure number HEATER RELAY- 1.0.3 (**page 623**).

2) **IF "HEATER RELAY TEST FAIL" did NOT reoccur:** See procedure number HEATER RELAY- 3.0.0 (**page 628**).

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## HEATER RELAY- 3.0.0 “HEATER RELAY TEST FAIL” INTERMITTENT

A) Turn the machine off for two (2) seconds then back on.

B) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’). If (and ONLY if) “HEATER RELAY TEST FAIL” reoccurs see procedure number HEATER RELAY- 3.1.0 (page 628). If “HEATER RELAY TEST FAIL” DOES NOT occur see part C.

C) Repeat parts A and B four (4) times. If (and ONLY if) “HEATER RELAY TEST FAIL” does not reoccur whatever was causing the problem has cleared!

## HEATER RELAY- 3.1.0

D) Turn the machine off and swap in a known good Power Logic board*. *To LOCATE the Power Logic board refer to Figure 4A AND NOTE A (page 10).

E) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’). If (and ONLY if) “HEATER RELAY TEST FAIL” reoccurs see procedure number HEATER RELAY- 3.2.0 (page 628) otherwise see part F.

F) Turn the machine off then repeat parts E and F four (4) times. If “HEATER RELAY TEST FAIL” does not reoccur the new Power Logic board fixed the problem!

## HEATER RELAY- 3.2.0

**NOTE!** The first Power Logic Board is probably okay.

G) Turn the machine off. THREE (3) possible bad component (see COMPONENT LIST below). Swap in one (your choice), one at a time, then see part H to test the new component.

**COMPONENT LIST: 1)** Power Control board (inside the power supply) ; **2)** Functional Board (to prevent a “Cond Offset Failure”, place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)); **3)** Motherboard.

H) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘Enter’). If (and ONLY if) “HEATER RELAY TEST FAIL” reoccurs repeat part G until HEATER RELAY TEST FAIL” does not reoccur indicating the last component swapped in fixed the problem

# SECTION 24 – "DIASAFE TEST FAILED"

A) If a DiaSafe® test is running allow it to finish BEFORE CONTINUING to part B. It is NORMAL for **Flow Error** = 1 WHILE a DiaSafe® test is running

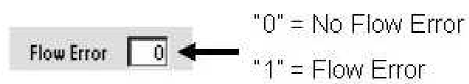
B) Using a flashlight, ENSURE no air bubbles are flowing into the machine through the Acid and Bicarbonate inlet tubing. **If air is seen there is a problem with a concentrate connection.**

C) From the Home screen, press the [Dialysate Flow] window.

D) Set [Dialysate Flow] to 800 ml/min and press 'Enter'.

E) ENSURE a "No Water" alarm NEVER occurs!

F) Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** for two (2) minutes. If EVER = 1 indicates a Flow problem. TWO (2) possible scenarios below:




**1) IF (and ONLY if) Flow Error REMAINS = 0!** Continue to part G.

**2) IF Flow Error EVER = 1!** Proceed to **page 23**, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.

G) From the Home screen, [**Temperature**] MUST be between 35.5 and 38.5° C; [**Conductivity**] between 13.0 and 14.3 mS! BOTH MUST be stable i.e. NOT changing more than 0.2 per minute.

H) See procedure number DIASAFE- 2.0.0 (page 629).

## DIASAFE- 2.0.0 FLOW ERROR ALWAYS = 0 / ISOLATE PRESSURE TESTS

a) Using a flashlight, ENSURE no air bubbles flowing through the external flow indicator's sight tube*!

* Air is normal after a Diasafe® test but should clear within four (4) minutes! Prolonged air cause Filling Programs (i.e. **FILACT** = 1) and TMP will NOT stabilize!

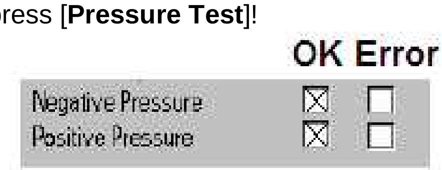
b) **Reset ALL alarms!**

c) At the bottom of the screen, press the **[Test & Options]** tab.

d) If the **[Pressure Test]** key is gray press **[Both Tests]**. If blue press [**Pressure Test**]!

e) Press 'Enter' and allow the tests to finish!

f) Do BOTH Negative AND Positive Pressure Tests pass?

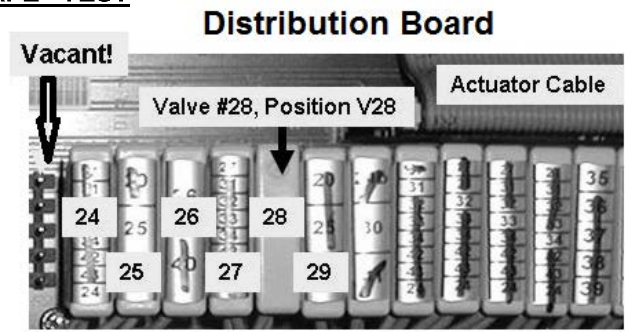



Yes BOTH Pressure Tests pass! See procedure number DIASAFE- 3.0.0 (page 630).

No A pressure test fails*! Proceed to **page 517**, SECTION 10 – PRESSURE TESTS FAILING.

*** DO NOT troubleshoot "Diasafe Test Failed" if a Negative OR Positive pressure test fails!**

## DIASAFE- 3.0.0 PRESSURE TESTS PASS / DIASAFE® TEST




a) Figure right, ENSURE Valve #28 is plugged PROPERLY into distribution board position "V28"!

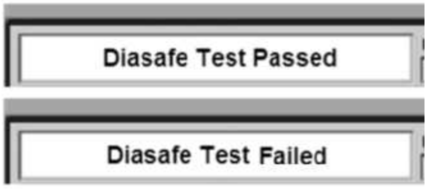
b) From the Home screen, allow [**Conductivity**] to stabilize.

c) **Reset <u>ALL</u> alarms!**

d) Press the screen's lower **[Test & Options]** tab.

e) Press the 'Diasafe Test' button.

f) Press 'Enter' to start the test then allow it to finish! TWO (2) possible scenarios:




**1)** **IF (and ONLY if) "Diasafe Test Passed":** Repeat the test once more as the failure may be intermittent! If it passes again DO NOT continue!

**2)** **IF "Diasafe Test Failed":** a) Call the Home screen.

b) Set **[UF GOAL]** to 1000 ml; Set **[UF Time]** to 1:00 hr.

c) Press 'Enter'.

d) Allow four (4) minutes BEFORE continuing to part e.

e) Using a flashlight, ENSURE no air bubbles flowing through the external flow indicator's sight tube.

f) See procedure number DIASAFE- 4.0.0 (page 631).

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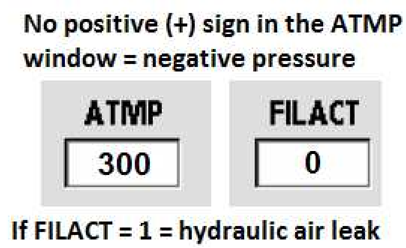
## DIASAFE- 4.0.0 DIASAFE TEST FAILED / ISOLATE ATMP AND FILLING PROGRAM

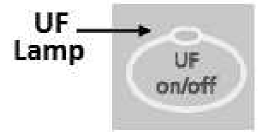



A) **RESET <u>ALL</u> alarms**!

B) Turn the Blood Pump on so that it is rotating at more than 100 ml/min.

C) Call debug screen 1. **ATMP** <u>AND</u> **FILACT** (Figure right) will be watched below. If **FILACT** <u>EVER</u> = 1 **ATMP** will not reach its specified goal of negative 300 or it will be unstable.

D) To avoid error read parts E and F BEFORE performing them.




E) To turn UF on, press the front panel's UF on/off key. The UF lamp (Figure right) <u>MUST STAY ON SOLID</u>!

F) Without looking away, watch **FILACT** <u>AND</u> **ATMP**. If **ATMP** reaches 300, within forty (40) seconds, turn UF off **<u>IMMEDIATELY</u>** i.e. UF lamp OFF! TWO (2) possible scenarios:

**1) IF ATMP reached 300 within 40 seconds:** See procedure number DIASAFE- 4.0.2 (page 631).

**2) IF ATMP <u>DOES NOT</u> reach 300 within 40 seconds:** Based on **FILACT**, TWO (2) possible scenarios below:

**Scenario #1:** **IF FILACT <u>WAS EVER</u> = 1: A)** Turn UF OFF then! **B)** Allow four (4) minutes then; **C)** Repeat parts E and F of procedure number DIASAFE- 4.0.0 then; **D)** If (and ONLY if) **FILACT** = 1 reoccurs turn UF OFF and proceed to **page 452**, <u>SECTION 8 – FILLING PROGRAM PROBLEMS</u>.

**Scenario #2:** **IF FILACT was <u>ALWAYS</u> = 0: A)** To check the UF Pump, perform the UF Pump Calibration per the <u>2008 Calibration Procedures</u> booklet then; **B)** If (and ONLY if) UF volume is okay perform the Dialysate Pressure Calibration per the <u>2008 Calibration Procedures</u> booklet.

## DIASAFE- 4.0.2 ATMP REACHED 300

Watching **FILACT** <u>AND</u> **ATMP**, allowing ten (10) seconds for stabilization, **ATMP** should stay more than 300 for twenty (20) seconds. TWO (2) possible scenarios below.

1) **IF ATMP stays 300 <u>OR</u> more:** See procedure number DIASAFE- 5.0.0 (page 632).

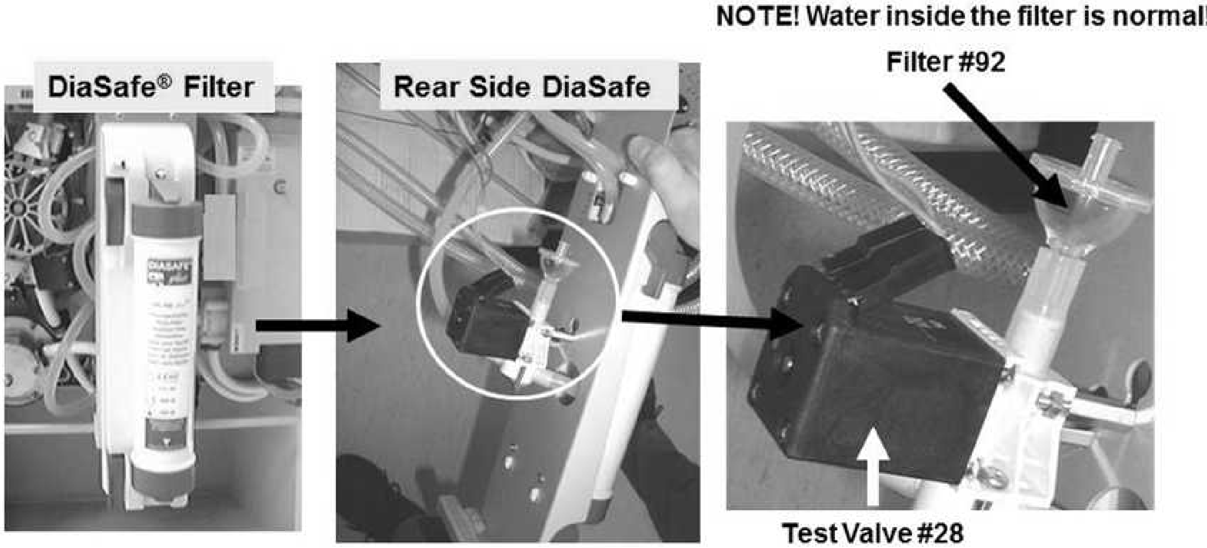
2) **IF ATMP <u>DOES NOT</u> stay more than 300:** Based on **FILACT**, TWO (2) possible scenarios:

**Scenario #1:** **IF FILACT was <u>EVER</u> = 1: A)** Allow four (4) minutes then; **B)** Repeat procedure number DIASAFE- 4.0.0 (page 631); **C)** If (and ONLY if) **FILACT** = 1 reoccurs proceed to **page 452**, <u>SECTION 8 – FILLING PROGRAM PROBLEMS</u>.

**Scenario #2:** **IF FILACT was <u>ALWAYS</u> = 0:** <u>ENSURING</u> UF is off proceed to **page 483,** <u>SECTION 9 - TMP PROBLEMS.</u>

## DIASAFE- 5.0.0 ATMP STAYS 300 OR MORE / ISOLATE DIASAFE FILTER #92

a) Figure below, remove FILTER #92 from Valve #28's tubing.




**DiaSafe® Filter / Valve #28 / Filter #92**

b) **Reset ALL alarms.**

c) Press the **[Test & Options]** tab.

d) Press the 'Diasafe Test' button then 'Enter' then allow the test to finish! TWO (2) possible scenarios:

**1)** **IF (and ONLY if) "Diasafe Test Passed":** FILTER #92 MAY be restricted! Repeat the test once more as the failure may be intermittent!

**2)** **IF "Diasafe Test Failed":** See procedure number DIASAFE- 6.0.0 (page 633).

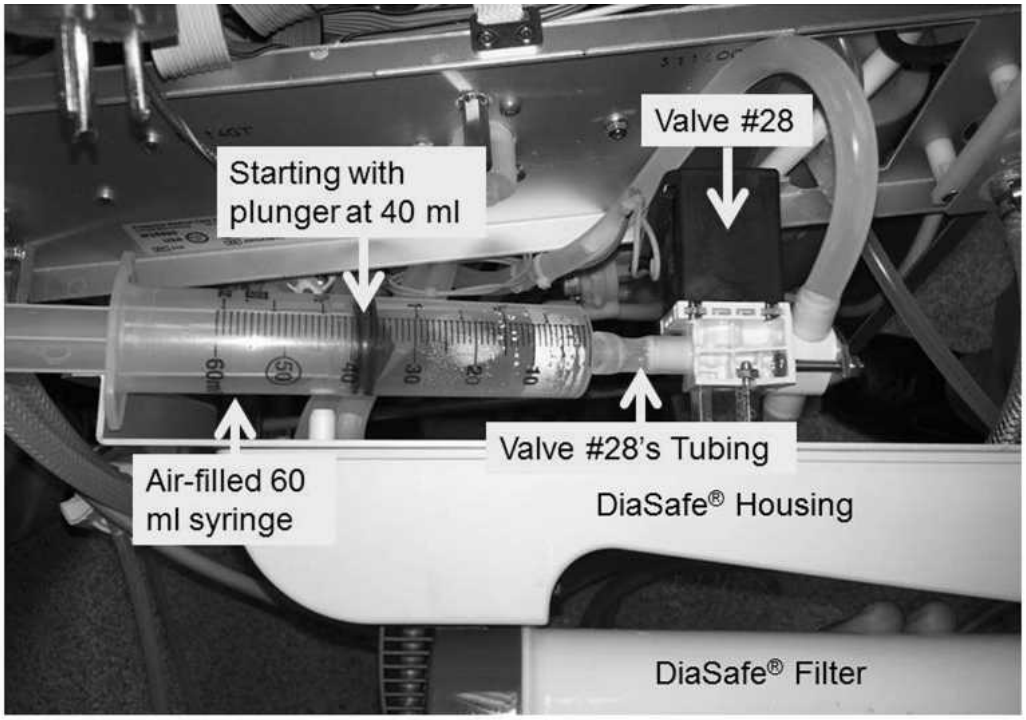
## DIASAFE- 6.0.0 ISOLATE DIASAFE® TEST VALVE #28

a) An **air-filled** 60 ml syringe is REQUIRED!

b) ENSURE the syringe plunger moves freely back and forth inside the barrel!

c) Move the syringe plunger to the 40 ml mark.

d) Figure below, attach the syringe to Valve #28's tubing.




e) **Reset ALL alarms!**

f) Repeat the DiaSafe® Test while watching the syringe for **one (1) minute**. Is the plunger drawn into the barrel?

Yes Plunger drawn! Valve #28 is OKAY! Proceed to **page 635**, procedure number DIASAFE- 7.0.0.

No Plunger IS NOT drawn! See procedure number DIASAFE- 6.1.0 (page 633).

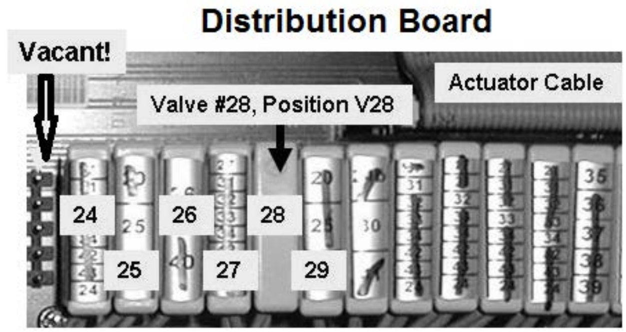
## DIASAFE- 6.1.0 PLUNGER IS NOT DRAWN IN / ISOLATE FOR VALVE #28 SOLENOID ACTIVATION

Per the Figure above, touch Valve #28's (black) solenoid. Is it warm?

Yes Solenoid is warm! TWO (2) possible bad components: **1)** Bad Actuator-Test Board OR **2)** Bad Valve #28 (replace the valve AND its blue wire harness).

No Solenoid IS NOT warm! Perform parts a THROUGH d next page:

a) Trace Valve #28's blue wires from the distribution board to the valve's (black) solenoid. THREE (3) checks:

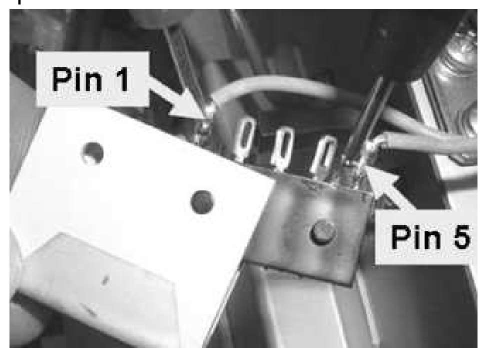



**Check #1:** If a wire is pinched or insulation is damaged this may be the problem!

**Check #2:** If the wires DO NOT terminate properly at the solenoid terminals this may be the problem!

**Check #3:** If the solenoid terminals are corroded replace the valve!

b) Figure right, open Valve #28's female distribution board connector cap.




c) If the blue wires ARE NOT connected between the TOP and BOTTOM terminals this is the problem!

d) Measure resistance (Ω), between the TOP and BOTTOM terminals. Between 40 and 100 Ω?

Yes Between 40 and 100 Ω! THREE (3) possible bad components (see COMPONENT LIST below). Swap in each component, one at a time, and in between perform the DiaSafe® test until the syringe plunger is drawn indicating the last component swapped in was the problem.

COMPONENT LIST: **1)** Actuator-Test Board; **2)** Actuator cable; **3)** Distribution board.

No Less than 40 Ω OR more than 100 Ω. TWO (2) possible bad components: **1)** Bad valve #28 blue wire harness OR; **2)** Bad valve #28.

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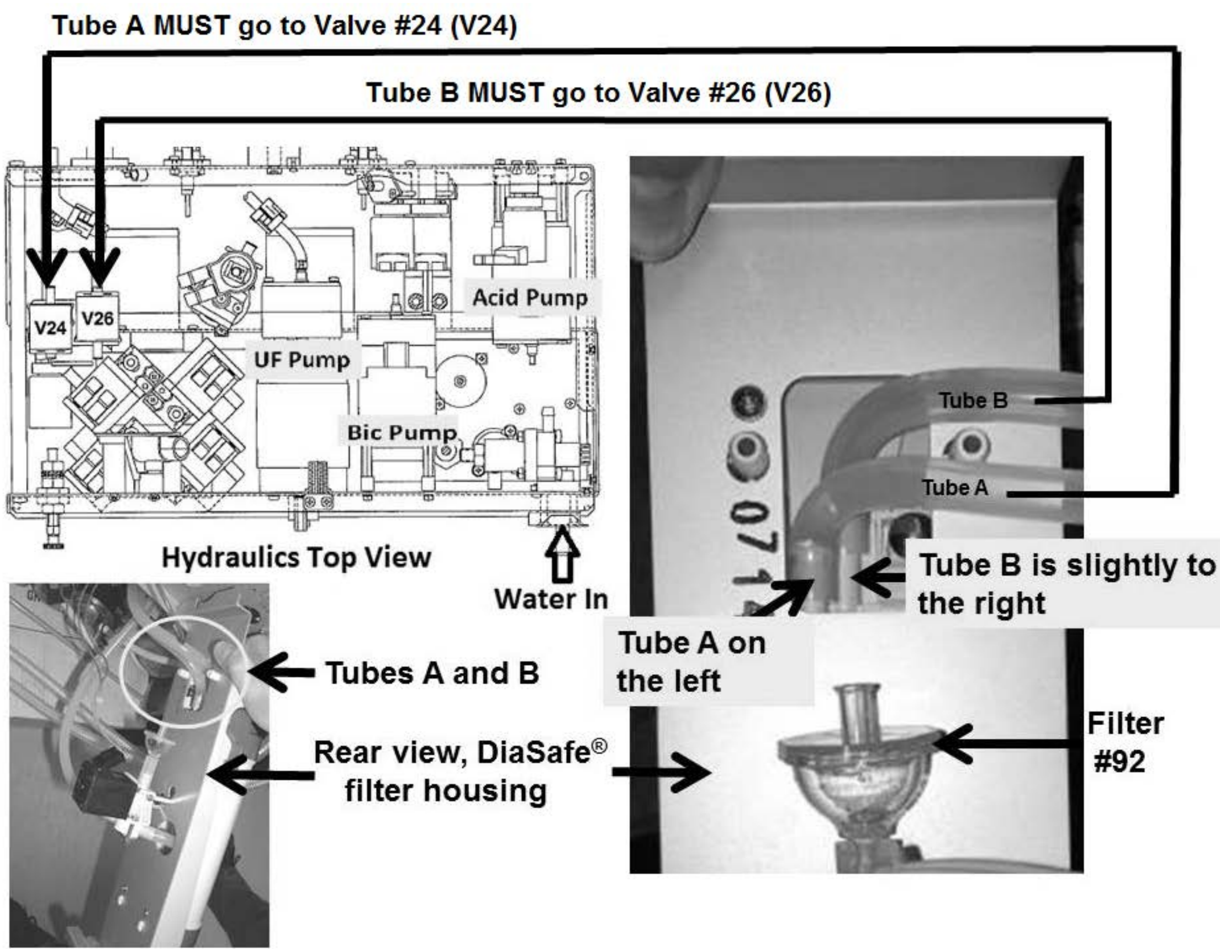
## DIASAFE- 7.0.0 VALVE #28 OKAY

a) Return FILTER #92 to Valve #28!

b) **Per the Figure below**, ENSURE ‘TUBE A’ goes to VALVE #24 <u>AND</u> ‘TUBE B’ goes to VALVE #26!

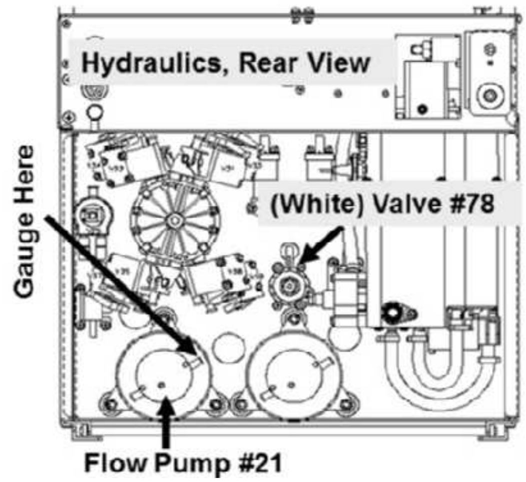



c) Are you <u>ABSOLUTELY SURE</u> the DiaSafe® tubing is plumbed correctly?

Yes  Tubing is plumbed properly! See procedure number DIASAFE- 8.0.0 (page 636).

No  Tubing is backwards! Per the Figure, attach the tubing properly and repeat the test.

## DIASAFE- 8.0.0 DIASAFE TUBING ATTACHED PROPERLY




a) This procedure uses a psi pressure gauge. **ENSURE** it reads 0 psi before installing it!

b) Figure right, tee the gauge between the Flow Pump's OUTPUT nozzle and its WHITE tubing.

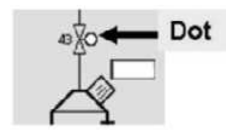
c) Clamp both sides of the gauge tubing to prevent leaks and false readings!

d) **Place the machine in RINSE!**

e) Watch for one (1) minute to ENSURE a "No Water" alarm NEVER occurs!

f) Call debug screen 0. If the debug screens do not appear press the 'Esc' key then call screen 0.

g) Allow Valve #43's 'dot' (Figure right) to turn blue then WHITE again! While white, does pressure CYCLE, about every three (3) seconds, to between 35 and 36 psi?




Yes Between 35 and 36 psi! See procedure number DIASAFE- 9.0.0 (page 637).

No Is NOT between 35 and 36 psi! ENSURING the machine was in RINSE AND no leaks, TWO (2) possible scenarios:

1) **IF (and ONLY if) pressure is too low:** DO NOT calibrate instead proceed to **page 101**, procedure number F- 9.0.2

2) **IF pressure is too high:** Perform parts a AND b below:

a) Per the Figure (above, right) adjust Valve #78 until pressure cycles to between 35 and 36 psi!

b) See procedure number DIASAFE- 9.0.0 (page 637).

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## DIASAFE- 9.0.0 GOOD FLOW PUMP PRESSURE / PRESSURE TEST VALVE #26

a) Place the machine into Service Mode → Diagnostics → Valve Leak Test then allow the screen's **[Test Status]** data box = "Ready".

b) Press the **[Valve Number]** data box, it turns bright yellow.

c) Use the keyboard's Pg Up (↑) key until **[Valve Number]** = "Valve #26".

d) Press 'Enter''! When the test completes read the screen's **[TEST STATUS]** data box. TWO (2) possible scenarios:

**1)** **IF Valve 26 "Failed": REPEAT** the test on Valve #26. If (and ONLY if) it fails **AGAIN** TWO (2) possible bad components: **1)** Replace the Actuator-Test Board with a known good then repeat the Valve Leak Test on Valve #26! If Valve #26 fails again: **2)** Bad Valve #26 (to LOCATE Valve #26 refer to Figure 15 (page 79)).

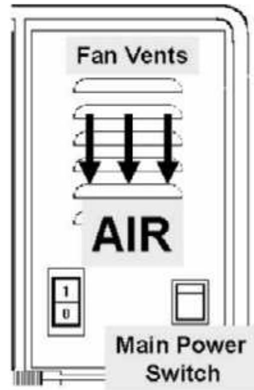
**2)** **IF Valve #26 "Passed":** Perform parts a THROUGH d below:

a) Perform the UF Pump Calibration per the 2008 Calibration Procedures booklet.

b) Perform the TRANSMEMBRANE PRESSURE check per the 2008 Preventative Maintenance Procedure booklet.

c) Repeat the Diasafe® test. If it fails replace the Diasafe® Filter per procedure and repeat the test. If it continues to fail the Troubleshooting Guide is unable to locate the problem.

# SECTION 25 - TROUBLESHOOTING POWER DISTRIBUTION




A) BEFORE continuing to part B, perform INITIAL CHECKS (page 7).

B) If troubleshooting the screen 'remaining black', if air is felt from the Power Supply vents (Figure right) = fan running = MACHINE IS ON!

C) Figure right, the Main Power Switch does not turn the machine on but must be on to turn the machine on! It MUST REMAIN ON for all procedures!

D) Proceed according to the OBSERVED symptom ONLY! Listed below are ten (10) possible symptoms!

1) **IF Machine 'blows' the wall breaker (GFI): A)** Unplug ALL OTHER equipment that is connected to the GFI circuit; **B)** Reset the GFI circuit; **C)** Plug a known good machine into it; **D)** Place the known good machine into Heat Disinfect; **E)** Allow up to thirty (30) minutes to see if the GFI 'blows' again! TWO (2) possible scenarios **i)** or **ii)** below:

   i) **IF the GFI 'blows' again:** Either the GFI is not rated for the current drawn when a machine is in Heat Disinfect OR the GFI is bad.

   ii) **IF the GFI does DOES NOT 'blow' again:** There may have been too many machines plugged into the same GFI circuit. Plug the suspected malfunctioning machine into the GFI and (if possible) place it into Heat Disinfect. If (and ONLY if) the GFI 'blows' again proceed to **page 640**, procedure number P- A.0.0.

2) **IF a "24V Low" OR "24V High" OR "WD: 24V Rcvr Err Short" OR "WD: 24V Rcvr Err Long" banner:** Leaving the machine on, proceed to **page 642**, procedure number P- B.0.0.

3) **IF "5V Low" OR "5V High" banner:** Leaving the machine on, proceed to **page 642**, procedure number P- B.0.0.

4) **IF "12V POWER FAIL" banner:** Leaving the machine on, proceed to **page 642**, procedure number P- B.0.0.

5) **IF "Failed Sending Data To Actuator Board" banner:** Leaving the machine on, proceed to **page 642**, procedure number P- B.0.0

6) **IF after being on (fan running) for fifty (50) seconds the screen REMAINS BLACK:** Proceed to **page 643**, procedure number P- C.0.0.

7) **IF after being on (fan running) for fifty (50) seconds the screen REMAINS fully OR partially white and possibly displays nothing:** Proceed to **page 643**, procedure number P- C.0.0.

8) **IF after being on (fan running) for fifty (50) seconds the screen displays 'weird' i.e. scrambled, weird colors, abnormal lines, upside down etc.:** Proceed to **page 643**, procedure number P- C.0.0.

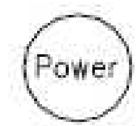
**Scenarios 9 and 10 next page**

**9) <u>IF the machine turns on (fan runs) BUT THEN turns itself off</u>:** ENSURING the GFI did not 'blow', proceed to **page 706**, procedure number P- 3.0.0.

**10) <u>IF the machine NEVER turns on i.e. fan NEVER runs:</u>** Perform parts a THROUGH d below:

a) If the fan <u>IS NOT</u> running continue to part b. If the fan <u>IS RUNNING</u> but, after fifty (50) seconds, the screen REMAINS BLACK proceed to **page 643**, procedure number P- C.0.0.

b) Press the Power button for two (2) seconds! If the fan <u>IS NOT</u> running perform parts c and d. If the fan is running but, after fifty (50) seconds, the screen REMAINS BLACK proceed to **page 643**, procedure number P- C.0.0.




c) Plug into a **<u>KNOWN GOOD</u>** GFI power outlet.

d) Press the Power button for two (2) seconds! If the machine still <u>DOES NOT</u> turn on (fan <u>NEVER</u> runs), ENSURING the GFI did not 'blow', proceed to **page 640**, procedure number P- A.0.0.

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## P- A.0.0 ISOLATE POWER CORD / PLUG / STRAIN RELIEF

a) Inspect the power plug and cord. **Replace if burning or damage is located!**

b) Per the Figure below, inspect the Strain Relief. **Replace if damage is located!**

c) Plug into a **KNOWN GOOD** GFI outlet but **DO NOT** attempt to turn the machine on yet!

d) See procedure number P- A.2.0 (page 640).

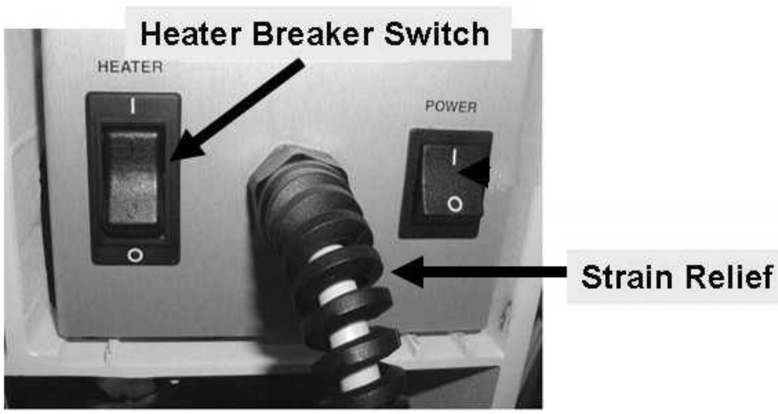



**Figure 112 – Heater Breaker Switch / Strain Relief**

## P- A.2.0 ISOLATE HEATER CIRCUIT

A) **Per the Figure above, turn the Heater Breaker Switch OFF!**

B) Press the Power button for two (2) seconds. If the machine STAYS ON (fan running) perform parts C through E. If the machine DOES NOT TURN ON (fan NEVER runs) OR if it TURNS ON but THEN 'blows' the GFI skip to part E.

C) Place the machine in Rinse Program.

D) Allow up to thirty (30) minutes, for the symptom to reoccur, BEFORE continuing to part E.

E) Per the ORIGINAL symptom, FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

1) **IF was 'blowing' the GFI but DOES NOT now:** See procedure number P- A.4.0 (page 641).

2) **IF was and continues to 'blow' the GFI:** Proceed to **page 708**, procedure number P- 4.0.0.

3) **IF was NEVER turning on (fan NEVER runs) AND still NEVER turns on:** Proceed to **page 686**, procedure number P- 1.0.0.

4) **IF was NEVER turning on but is on now (fan running):** The heater***** may be bad. This can be confirmed by turning the machine off, turning the Heater Switch on, and attempting to turn the machine on again.

   ***** To LOCATE the Heater refer to Figure 28 (page 140).

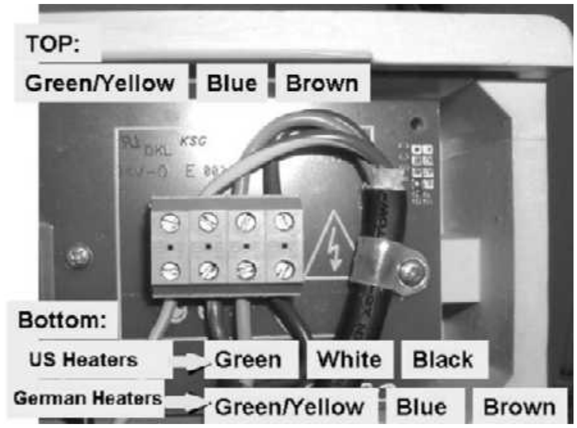
**P- A.4.0 ISOLATE 'HEATER CIRCUIT'**

a) **CAUTION! Turn the machine OFF and unplug it! Electrocution hazard if NOT unplugged!**

b) Figure right, at the Distribution board's green Heater Connector, TWO (2) checks:

**Check #1: TOP:** From right-to-left, wires MUST be brown (hot), Blue (neutral), Green/yellow stripped (ground).

**Check #2: BOTTOM:** From right-to-left, wires MUST be brown, blue, green/yellow stripped (**US Heater**) OR black, white, green (**German Heater**).




c) From the BOTTOM of the Heater Connector: If a **US Heater** DISCONNECT the brown wire; if a **German Heater** DISCONNECT the black wire.

d) **Turn the Heater Breaker Switch on!**

e) **Plug the machine in!**

f) If possible, turn the machine on (fan running).

g) If possible, place the machine in Rinse Program then allow up to thirty (30) minutes.

h) Does the GFI 'blow' again?

Yes GFI 'blows' again! FOUR (4) possible bad components: **1)** Bad Fan OR; **2)** Bad Power Control board (inside the power supply) OR; **3)** Bad power supply (or power cord / plug) OR; **4**) Bad distribution board.

No Does NOT 'blow' again! Perform parts a THROUGH c below:

a) Turn the machine OFF!

b) Replace the heater***** with a known good. *To LOCATE the heater refer to Figure 28 (page 140).

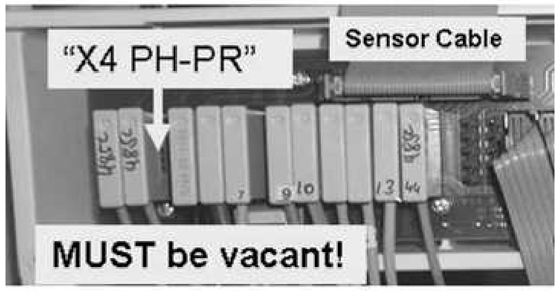
c) Place the machine in Rinse Program then allow up to thirty (30) minutes. If the GFI 'blows' again FOUR (4) possible bad components: **1)** Bad Fan OR; **2)** Bad Power Control board (inside the power supply) OR; **3)** Bad power supply (or power cord / plug) OR; **4**) Bad distribution board.

## P- B.0.0 ISOLATE POWER SYSTEMS

a) **WITH THE MACHINE ON** i.e. banner on the screen, ENSURE the fan is running. If no air from the vents the fan is bad and this allows excessive heat to build up which causes electronic failures!

b) Figure right, ENSURE the **3rd** distribution board position from the left, "x4, PH-P", **IS VACANT!** **If NOT, this may be the problem!**

c) To avoid pulling cables loose, GENTLY open the card cage.




d) Per Figure 113A below, at the rear of the card cage, ENSURE the 24V POWER harness is plugged in securely with the orange wire to the left.

e) Per Figure 113B below, inspect the power plug, cord and strain relief for signs of burning or other damage!

f) Proceed to **page 646**, procedure number P- E.0.0

**Figure 113A – 24V POWER Harness**

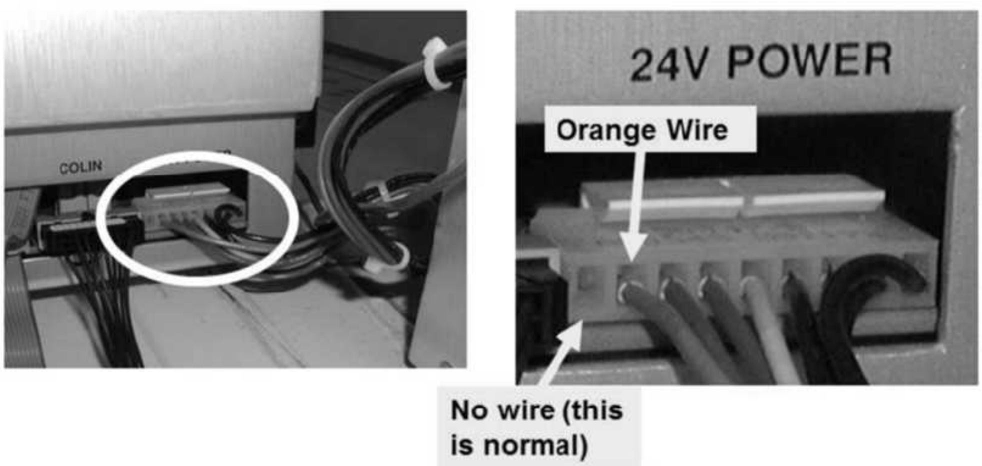
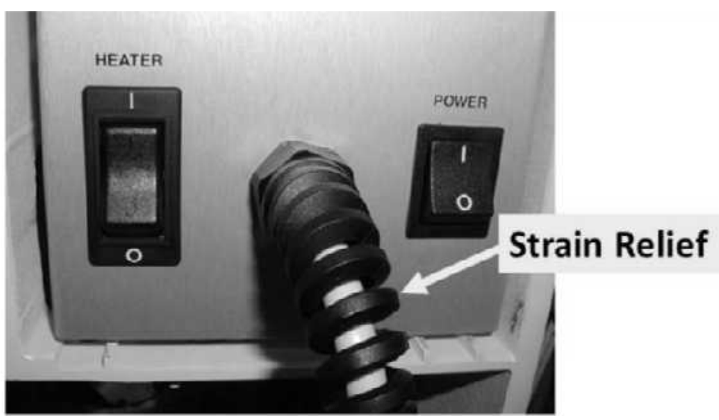



**Figure 113B – Power Supply Rear View**

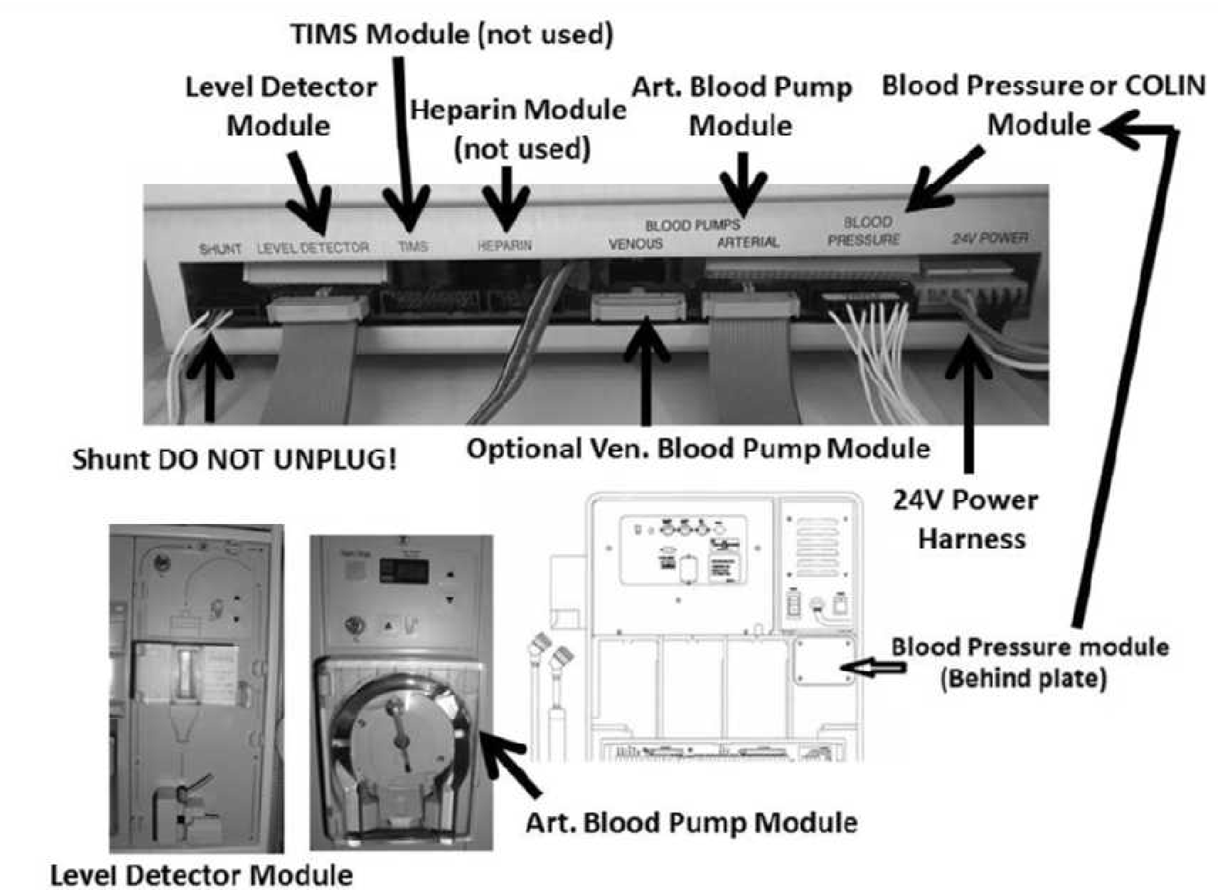


**P- C.0.0 ISOLATE SCREEN PROBLEMS (1)**

a) **To prevent damage turn the machine OFF!**

b) Figure below, at the rear of the card cage, trace the cable from **Blood Pressure Module** to ENSURE it is NOT reverse connected with another module! If it is correct the situation as this may be the problem!

c) See procedure number P- C.1.0 (page 644).

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**P- C.1.0 ISOLATE SCREEN PROBLEMS (2)**

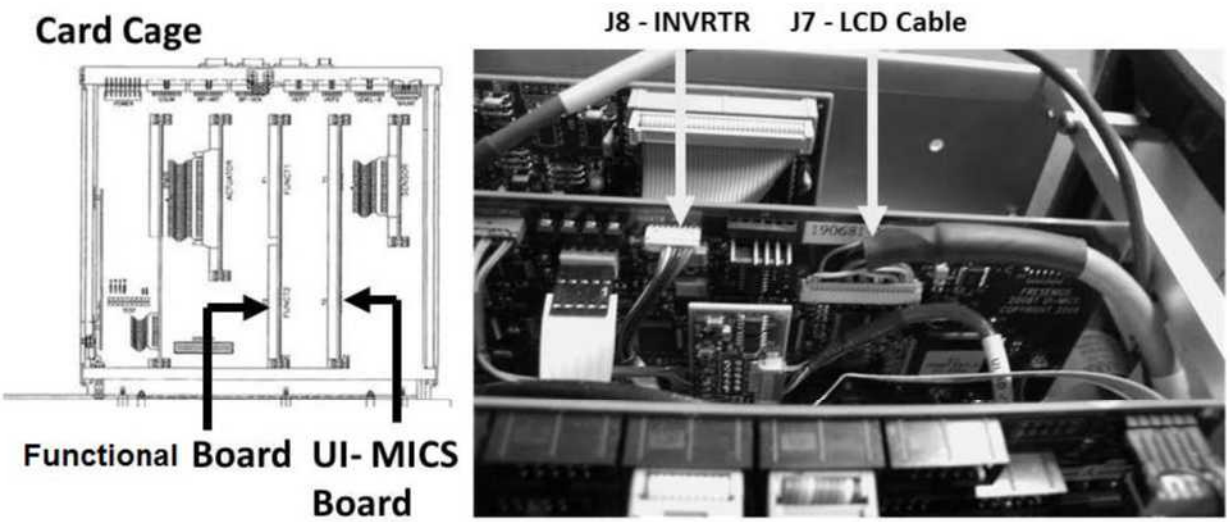
a) **With the machine OFF**, to avoid pulling cables loose, GENTLY open the card cage.

b) **Per the Figure below**, THREE (3) checks:

**CHECK #1** Push DOWN HARD on the UI-MICS board to ensure a good connection to the motherboard.

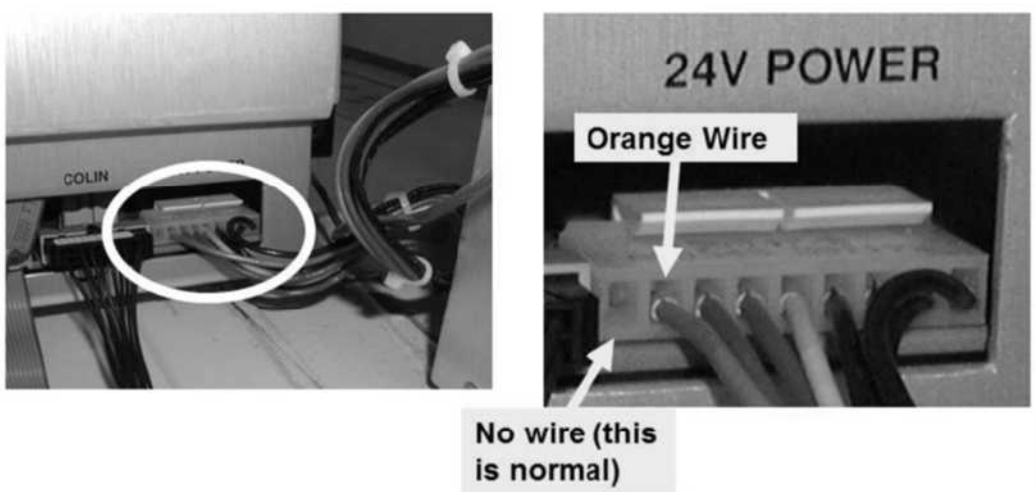
**CHECK #2** **CAUTION!** The J7 LCD Cable micro-pins can be damaged if unplugged. INSPECT it to ENSURE it is plugged in properly!

**CHECK #3** ENSURE the J8 INVRTR Cable is plugged in SECURELY.



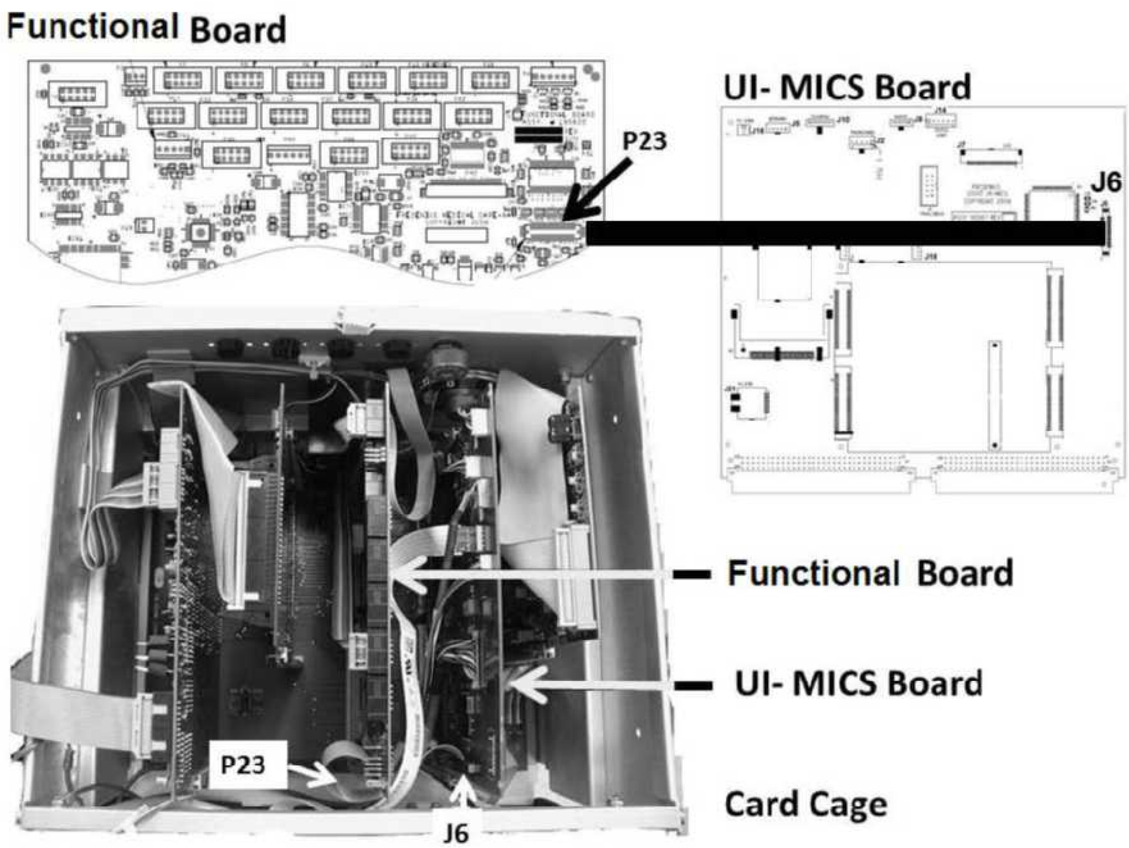

c) Per the Figure below, behind the card cage, ENSURE the 24V POWER harness is plugged in securely.

d) See procedure number P- C.2.0 (page 645).



**P- C.2.0 ISOLATE SCREEN PROBLEMS (3)**

a) Per the Figure below, ENSURE the ribbon cable BETWEEN the Functional and UI-MICS board is plugged in securely i.e. P23 Functional board ↔ J6 UI-MICS board!




b) **Turn the machine on (fan running).**

c) Allow fifty (50) seconds! If (and ONLY if) the screen problem continues, proceed to **page 646**, procedure number P- E.0.0

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## P- E.0.0 PREPARE TO ISOLATE +12 AND +5 VOLT DC SUPPLIES

a) Per the Figure below, the EXTENDER BOARD (P/N 190600) is required.

b) To avoid error, **FOUR NOTES** below:

   **1)** Keeping the EXTENDER BOARD'S resistors towards the **FRONT OF THE MACHINE** plug it into the motherboard's nine (9) pin TEST***** connector.

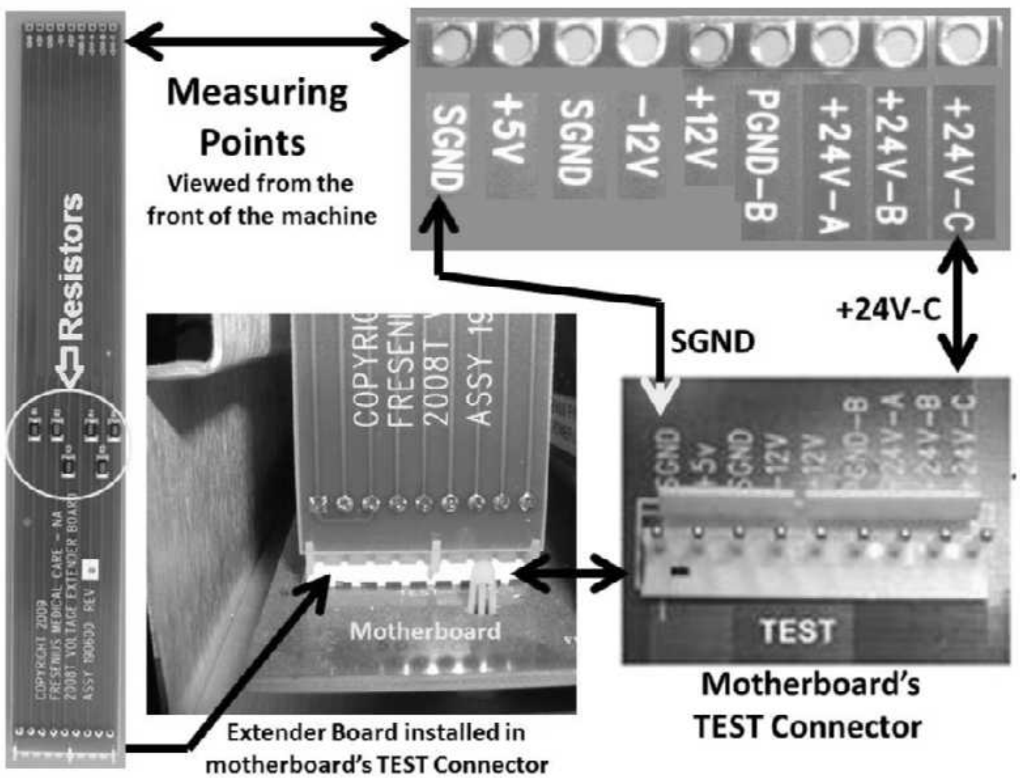
   ***** To LOCATE the TEST connector refer to Figure 4A (page 10).

   **2)** ENSURE the board is matched pin for pin to the TEST connector! From the **FRONT OF THE MACHINE** SGND on the LEFT; 24V-C on the RIGHT!

   **3)** Push the board down hard. It may resist a good connection into the motherboard!

   **4)** Pull up on the board. If installed correctly it resists pulling out!

c) See procedure number P- E.2.0 (page 646).




## P- E.2.0 ISOLATE POWER LOGIC +12 AND +5 VOLT DC

a) **Set a CALIBRATED volt meter to DC Voltage ($V_{DC}$)!**

b) **Connect the meter's black lead to chassis ground (see Figure 2 (page 4)).**

**Parts c through e next page**

c) **Turn the machine on (fan running)!**

d) If possible, return to Dialysis Program OR Heat Disinfect!

e) From the **REAR OF THE MACHINE**, per Table 16 below, **TWO** (2) measurements at the EXTENDER BOARD's +12V AND +5V measuring points. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) BOTH are IN RANGE:** RECORD the +12 volt measurement for later then see procedure number P- F.0.0 (page 648).

**2)** **ANY BAD measurement: A) ENSURE** the extender board is installed properly! **B)** CAREFULLY re-measure! **C)** If the measurement is still bad see Table 17 below.

### Table 16 – Measurement Locations / Expected Good

| **Measurement** | ***Pin* # and location** | **Expected (GOOD) range** |
|---|---|---|
| +12 volts DC | *5* (five pins from right) | 11.7 – 12.3 $\mathbf{V_{DC}}$ |
| + 5 volts DC | *2* (second pin from right) | 4.8 – 5.2 $\mathbf{V_{DC}}$ |

### Table 17 – Any BAD Measurement(s)

| **Measured +12 Volts ($V_{DC}$)** | **Measured +5 Volts ($V_{DC}$)** | **Your Response** |
|---|---|---|
| 0 – 11.6 (i.e. low) | 4.8 – 5.2 (i.e. good) | +12 volts LOW; +5 volts GOOD. Proceed to **page 658**, procedure number P- G.0.0 |
| 11.7 – 12.3 (i.e. good) | 0 – 4.7 (i.e. low) | +12 volts GOOD; +5 volts LOW. Proceed to **page 658**, procedure number P- G.0.0 |
| 11.7 – 12.3 (i.e. good) | 5.3 or more (i.e. high) | +12 volts GOOD; +5 volts HIGH. Proceed to **page 658**, procedure number P- G.0.0 |
| 12.4 or more (i.e. high) | 4.8 – 5.2 (i.e. good) | +12 volts HIGH; +5 volts GOOD. Proceed to **page 658**, procedure number P- G.0.0. |
| 12.4 or more (i.e. high) | 5.3 or more (i.e. high) | BOTH +12 AND +5 volts HIGH! Proceed to **page 658**, procedure number P- G.0.0. |
| 0 – 11.6 (i.e. low) | 0 – 4.7 (i.e. low) | BOTH +12 AND +5 volts LOW. Proceed to **page 653**, procedure number P- F.4.0 |

## P- F.0.0 MEASURED +12 AND +5 VOLTS ARE GOOD / VERIFY SYMPTOM

Proceed according to the OBSERVED symptom ONLY! Nine (9) possible symptoms:

1) **IF "24V Low" OR "24V High" OR "WD: 24V Rcvr Err Short" OR "WD: 24V Rcvr Err Long":** From here on these are called "24V" alarms! Proceed to **page 670**, procedure number P- H.0.0.

2) **IF "5V Low" OR "5V High":** Proceed to **page 670**, procedure number P- H.0.0.

3) **IF "12V POWER FAIL":** Proceed to **page 670**, procedure number P- H.0.0.

4) **IF the screen REMAINS BLACK:** Proceed to **page 650**, procedure number P- F.2.0.

5) **IF the original symptom was a black screen but it is on now:** If this problem reoccurs in the near future swap in a known good Power Logic board*****. If (and ONLY if) the problem reoccurs, with a known good Power Logic board, proceed to **page 650**, procedure number P- F.2.0.

   *To LOCATE the Power Logic board refer to Figure 4A AND NOTE A (page 10)

6) **IF the screen REMAINS FULLY OR PARTIALLY white and possibly displays nothing:** See procedure number P- F.1.0 (**page 649**).

7) **IF the screen displays 'weird' i.e. scrambled, weird colors, abnormal lines, upside down etc.:** See procedure number P- F.1.0 (**page 649**).

8) **IF "TEMP OVER 95 Degrees" in Heat Disinfect:** Proceed to **page 670**, procedure number P- H.0.0.

9) **IF "Failed Sending Data To Actuator Board":** Perform parts A through E below:

   A) **To prevent damage, turn the machine OFF!**

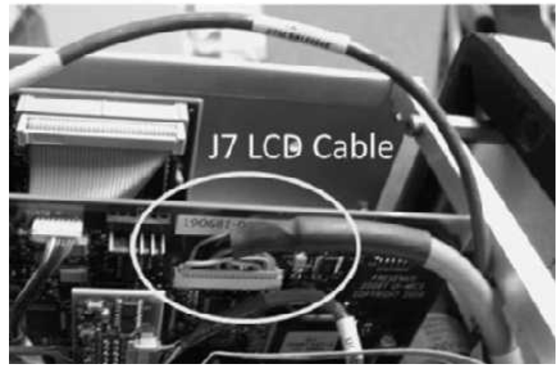
   B) Inside the card cage, reseat the Actuator-Test Board (2nd board from the left).

   C) Reseat the Functional Board (3rd board from the left).

   D) Reseat the Sensor Board (1st board from right).

   E) Turn the machine on. If a "24" volt alarm OR "Failed Sending Data…" occurs proceed to **page 670**, procedure number P- H.0.0.

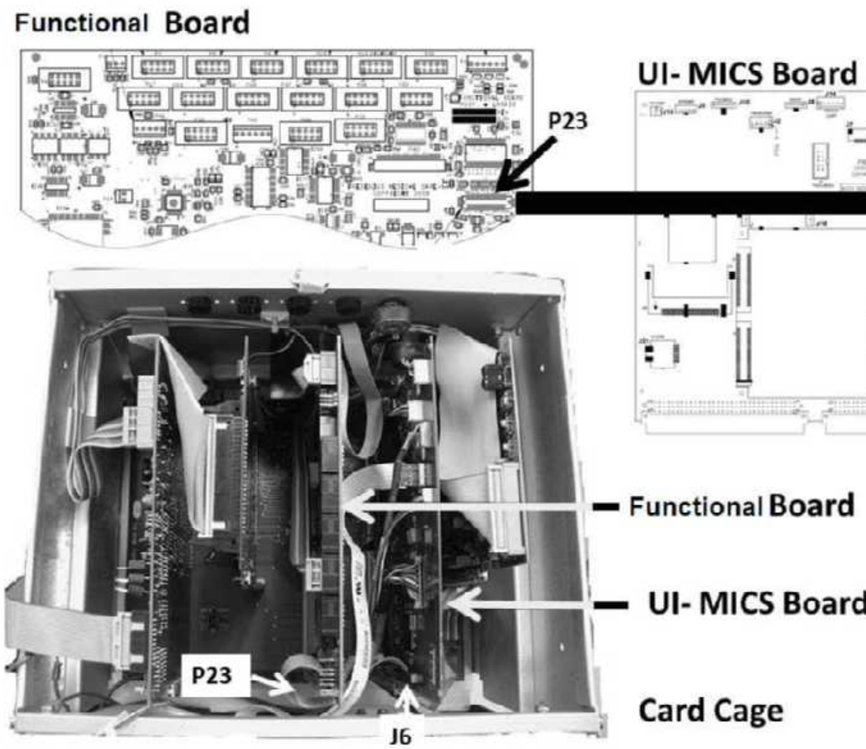
## P- F.1.0 TROUBLESHOOT SCREEN PROBLEM




a) Figure right, ENSURE the UI-MICS board's J7 LCD cable is plugged in. If the screen displays upside-down it may be the wrong revision.

b) If the screen problem continues see part c.

c) Turn the machine off. Figure below, swap in the cable that runs BETWEEN the Functional and UI-MICS board with a known good. i.e. P23 Functional board ↔ J6 UI-MICS board.




d) Turn the machine on and allow fifty (50) seconds. If the screen problem reoccurs continue to part e.

e) Turn the machine off and swap in a known good Functional Board.

f) Turn the machine on and allow fifty (50) seconds. If a "Cond Offset Failure" banner appears the screen is displaying normally but the machine needs to be calibrated. If the screen problem reoccurs continue to part g.

g) Turn the machine off and swap a known good UI-MICS board.

h) Turn the machine on and allow fifty (50) seconds. If the screen problem reoccurs continue to part i.

i) Turn the machine off and swap in a known good J7 LCD cable.

j) Turn the machine on and allow fifty (50) seconds. If the screen problem reoccurs see continue to k.

k) The LCD screen may be bad OR a cable is unplugged inside the screen assembly.

**P- F.2.0 PURE BLACK SCREEN**

a) **ENSURE the machine is on (fan running)!**

b) **ENSURE the volt meter's black lead is connected to chassis ground!**

c) Figure below, at the top edge of the UI-MICS board, measure at its connector **J14** at the pin shown i.e. REAR pin. TWO (2) possible scenarios

1) **IF (and ONLY if) MORE THAN 23.0 volts DC:** See procedure number P- F.2.2 (page 651).

2) **IF LESS THAN 23.0 volts DC:** Proceed to **page 652**, procedure number P- F.3.0.

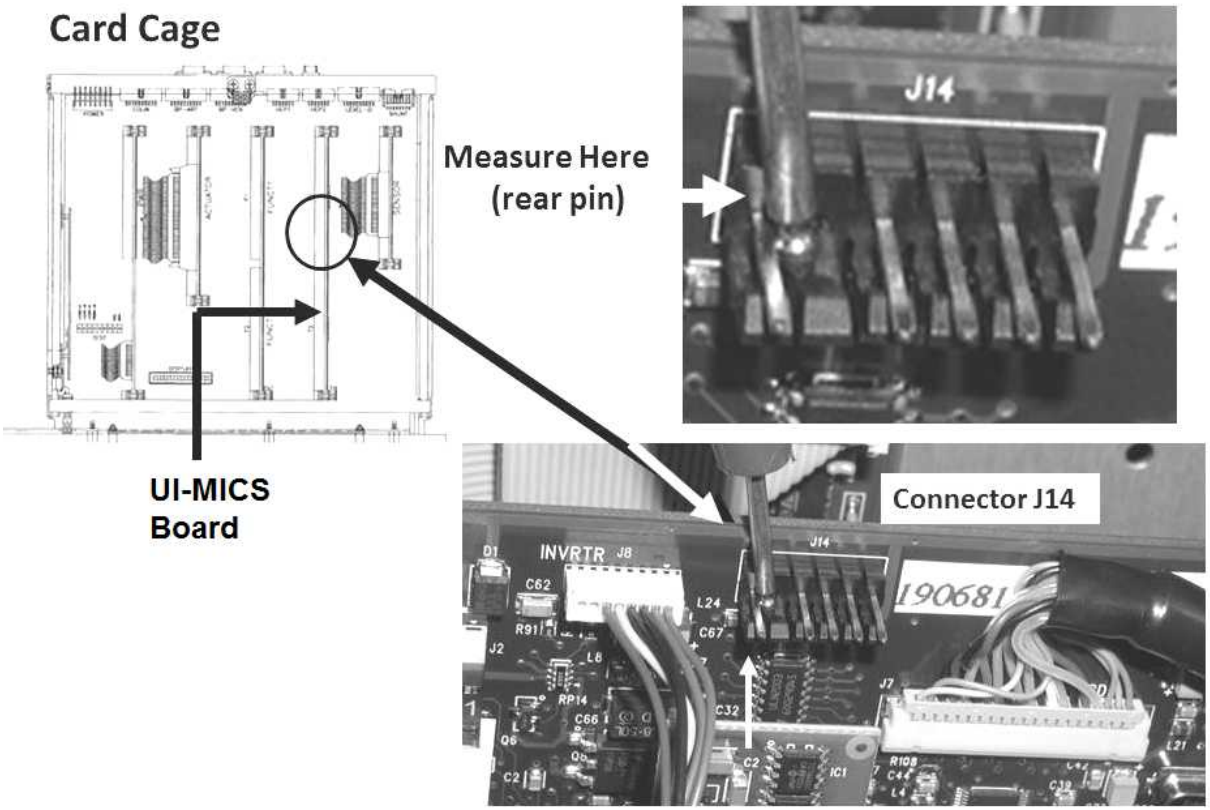


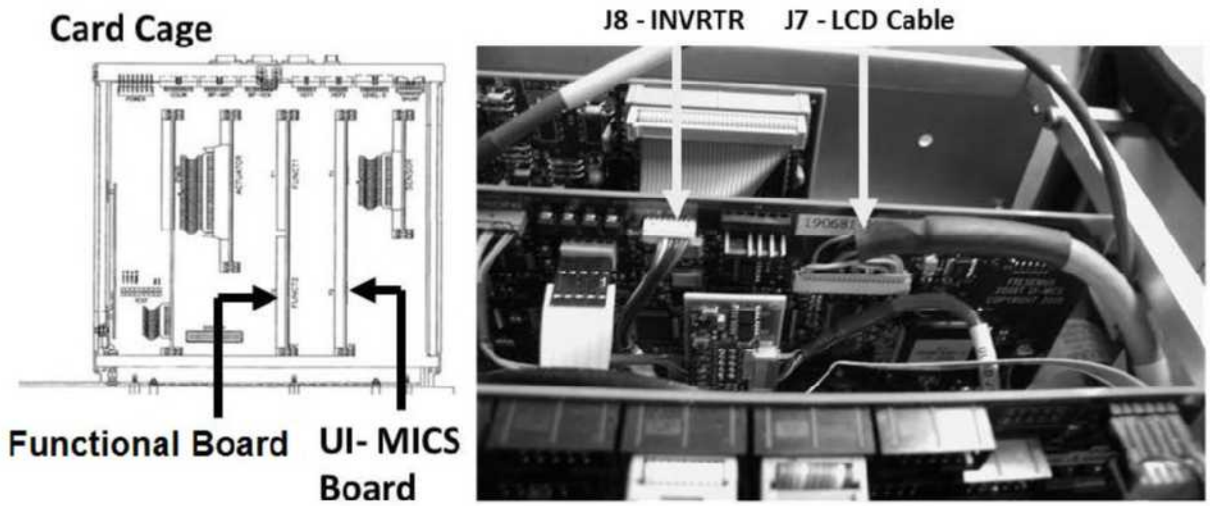

**Figure 114 – +24 volts A**

## P- F-2.2 TWENTY-FOUR VOLTS-A  MORE THAN 23.0 VOLTS DC

a) Figure below, at the UI-MICS board, TWO (2) checks:

**CHECK #1:** ENSURE the UI-MICS board's J7 LCD cable is plugged in PROPERLY!

**CHECK #2:** ENSURE the J8 – INVRTR cable is plugged in PROPERLY!




b) Turn the machine on (fan runs) and allow fifty (50) seconds. If screen remains black continue to part c.

c) Turn the machine off and swap in the cable that runs BETWEEN the Functional and UI-MICS board***** with a known good i.e. P23 Functional board ↔ J6 UI-MICS board.

***** To LOCATE this cable refer to the Figure at the bottom of page 649

d) Turn the machine on (fan runs) and allow fifty (50) seconds. If screen remains black continue to part e.

e) Turn the machine off. Per the Figure above, swap in a known good J8-INVRTR cable.

f) Turn the machine on (fan runs) and allow fifty (50) seconds. If the screen remains black, see part g.

g) Turn the machine off. Per the Figure above, swap in a known good J7- LCD cable. **CAUTION!** Be VERY careful to not bend or break the UI-MICS board's J7 connector's micro-pins!

h) Turn the machine on (fan runs) and allow fifty (50) seconds. If the screen remains black, see part i.

i) Turn the machine off and swap in a known good Functional Board.

j) Turn the machine on and allow fifty (50) seconds. If a "Cond Offset Failure" banner appears the screen is displaying normally but the machine needs to be calibrated. If the screen remains black continue to part k.

k) Turn the machine off and swap a known good UI-MICS board.

l) Turn the machine on (fan runs) and allow fifty (50) seconds. If the screen remains black the screen may be bad OR a cable is unplugged inside the screen assembly.

## P- F.3.0 TWENTY-FOUR VOLTS-A AT J14 LESS THAN 23.0 VOLTS


**ENSURING the machine is on (fan running)**, measure at the EXTENDER BOARD'S **+24V-A** measuring point. TWO (2) possible scenarios:

**1) IF (and ONLY if) less than 23.0 volts DC:** See procedure number P- F.3.2 (page 652).

**2) IF between 23.0 and 28.0 volts DC:** See parts a THROUGH c below:

a) Turn the machine OFF and swap in a known good 24V POWER Harness*****.

***** To LOCATE the harness refer to Figure 113 (page 642).

b) Turn the machine on (fan running). If the screen remains black see part c.

c) Measure again at the EXTENDER BOARDS **24V-A** measuring point. If between 23.0 and 28.0 volts is present at the extender board BUT IS NOT present at the UI-MICS board's J14 connector AND the screen remains black, TWO (2) possible bad components: **1)** Bad UI-MICS board OR **2)** Bad motherboard.

## P- F.3.2 EXTENDER BOARD +24V-A IS NOT BETWEEN 23.0 AND 28.0 VOLTS

a) **To prevent damage, turn the machine OFF!**

b) Swap in a known good 24V POWER harness*****.

***** To LOCATE the harness refer to Figure 113 (page 642)

c) Turn the machine on (fan running).

d) Measure again at the EXTENDER BOARDS **+24V-A** measuring point. TWO (2) possible scenarios:

**1) IF (and ONLY if) between 23.0 and 28.0 volts DC:** The previous 24V POWER harness is bad. The screen should be on now.

**2) IF NOT between 23.0 and 28.0 volts DC AND the screen is still black:** Several possible bad components: **1)** Bad thermal (BROWN) fuse S17***** (2 Amp); **2)** Possible bad circuit board in the card cage******; **3)** Possible bad motherboard.

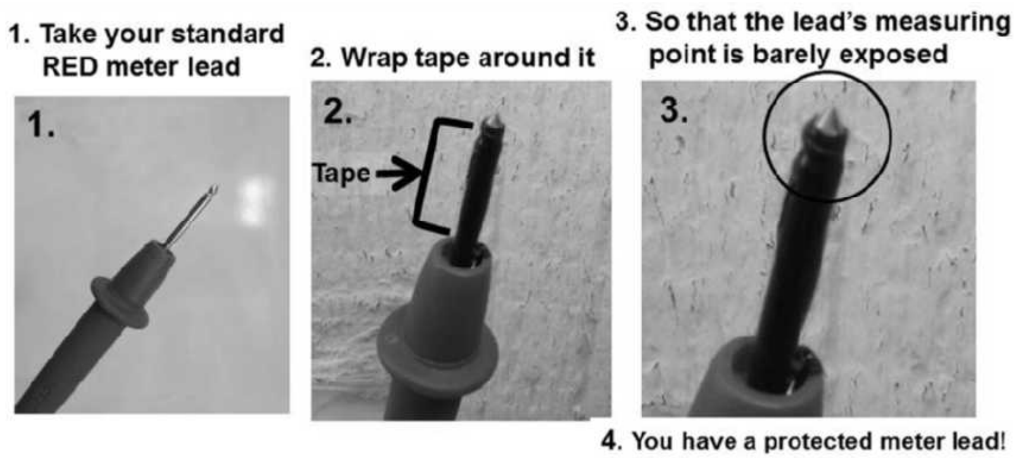
***** To LOCATE fuse S19 refer to Figure 132 (page 710)! With the machine off, it can be checked by measuring RESISTANCE (Ω) BETWEEN its two terminals. A good fuse measures less than 0.5 Ω!

****** With the machine off, swap in the card cage circuit boards, one at a time, and in between turn the machine on and recheck +**24V-A**. More than 23.0 volts indicates the last board swapped in is the problem.

## P- F.4.0 BOTH +12 AND +5 VDC LOW / ISOLATE 24 VOLTS DC AT POWER LOGIC BOARD

a) **ENSURE the machine is on (fan running)!**

b) **CAUTION!** DC voltages ($V_{DC}$) are about to be measured at pins that are VERY close to others and touching pins together with a standard meter lead could cause massive DAMAGE! As directed below make your RED meter lead a PROTECTED lead! **DO NOT CONTINUE UNTIL YOU HAVE DONE THIS!**




c) **ENSURE the meter's black lead REMAINS connected to chassis ground!**

d) Figure below, at the top edge of the Power Logic Board, closest to the screen, locate its 20-pin X2 ribbon cable.

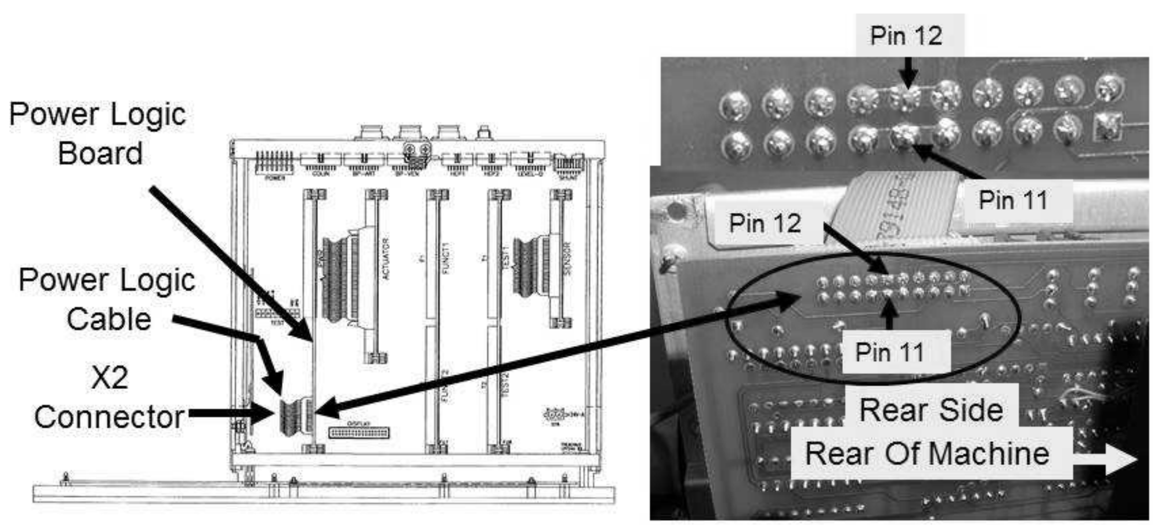



**Figure 115 – Power Logic Board Pins 11/ 12 / 13**

e) TWO (2) measurements at the rear side of the X2 cable:

***MEASUREMENT #1:*** *At pin 12* (TOP row, 6 pins from the REAR of machine)

***MEASUREMENT #2:*** *At pin 11* (BOTTOM row, 6 pins from the REAR of machine)

f) Are BOTH more than 23.0 volts DC?

Yes    BOTH more than 23.0 volts! Proceed to **page 658**, procedure number P- G.0.0.

No   BOTH are less than 23.0 volts! TWO (2) possible scenarios:

1) **IF (and ONLY if) BOTH are less than 23.0 volts:** See procedure number P- F.5.0 (page 654).

2) **IF AT LEAST one more than 23.0 volts:** The Power Logic X2 ribbon cable may be bad.

## P- F.5.0 ISOLATE +24V-A

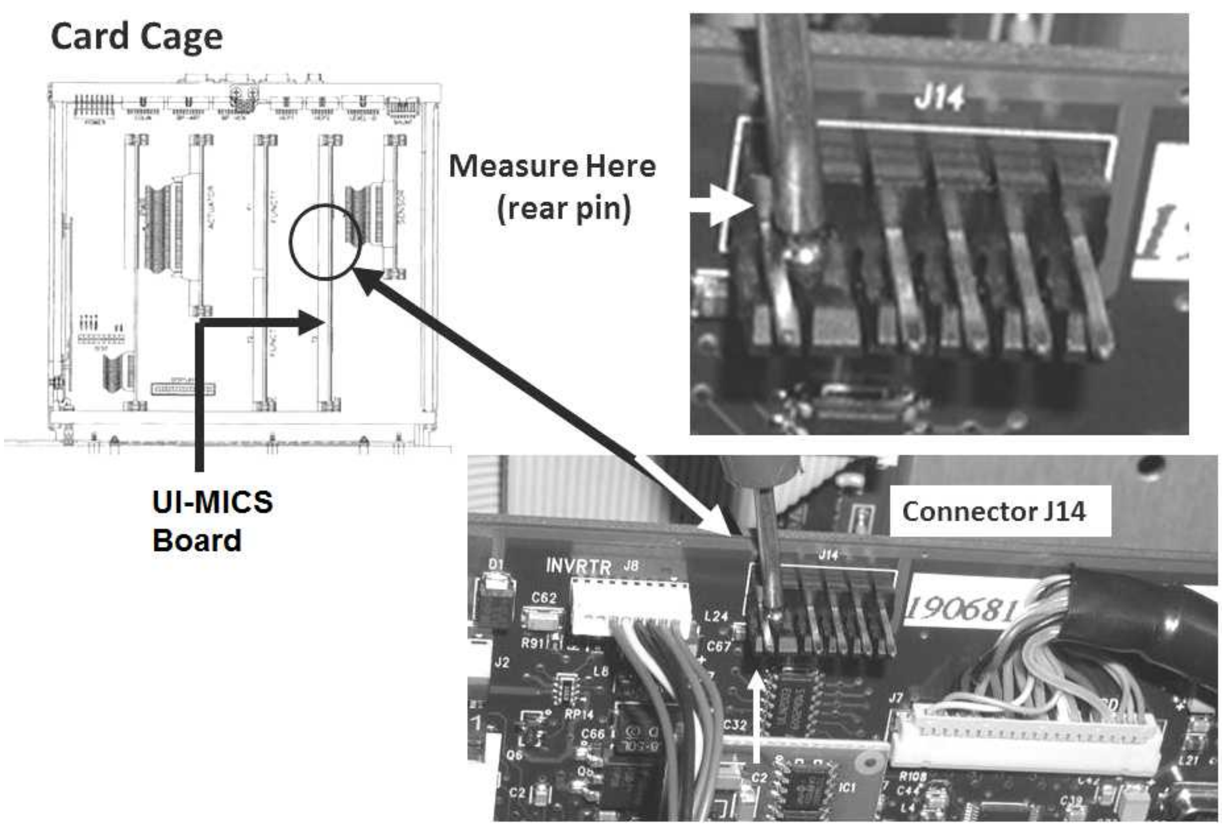
a) **ENSURE the machine is on (fan running)!**

b) **Per the Figure below**, at the top edge of the UI-MICS board, measure at connector J14 at the pin shown. More than 23.0 volts DC (Yes or No)?

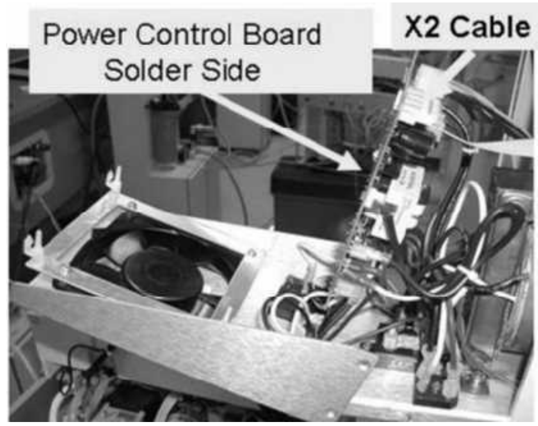
Yes    More than 23.0 volts DC! TWO possible bad components: **1)** Power logic cable OR; **2)** Bad thermal (BROWN) fuse S19***** (5 Amp).

***** To LOCATE fuse S19 refer to Figure 132 (page 710)! With the machine off, it can be checked by measuring RESISTANCE (Ω) BETWEEN its two terminals. A good fuse measures less than 0.5 Ω!

No   Less than 23.0 volts DC!  See procedure number P- F.6.0 (page 655).



**P- F.6.0 ISOLATE MAIN TRANSFORMER OUTPUT**




a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocution hazard if not unplugged!**

b) Slide the power supply away from the cabinet.

c) ENSURE all cables are plugged in securely! **If not, this may be the problem!**

d) Remove the two **front** screws, un-mount the Power Control Board from its four plastic clips

e) Lay the supply's rear panel down to access to the rear side of the board.

f) Plug the machine in. **CAUTION! High voltage now present!**

g) **Turn the machine ON (fan running)!**

h) **Per the Figure below**, measure from the rear (solder) side of the Power Control Board's ST12 connector. More than 23.0 volts DC (Yes or No)?

Yes More than 23.0 volts! See parts a AND b below:

a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocution hazard if not unplugged!**

b) Bad thermal (BROWN) fuse S13 (16 Amp). To LOCATE S13 refer to Figure 132 (page 710).

No Less than 23.0 volts! See procedure number P- F.7.0 (page 656).

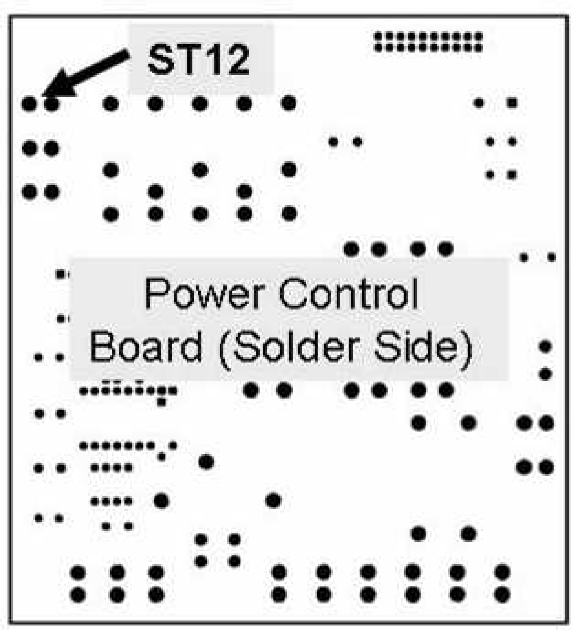
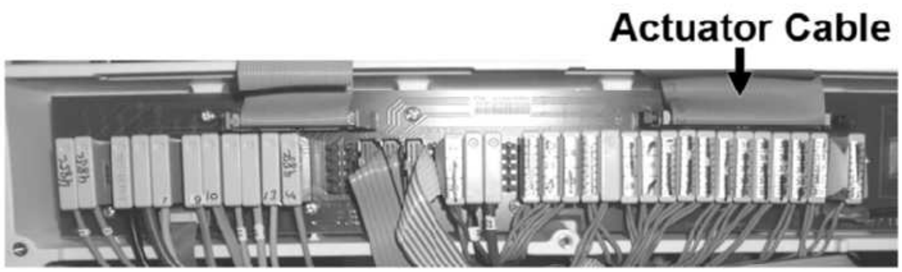



**Figure 116 – Power Control Board (ST12)**

P- F.7.0 ST 12 LESS THAN 23.0 VOLTS/ ISOLATE MODULES / PUMPS

a) **IMPORTANT! To prevent damage, turn the machine OFF!**

b) Figure below, unplug the ACTUATOR Cable from the distribution board.



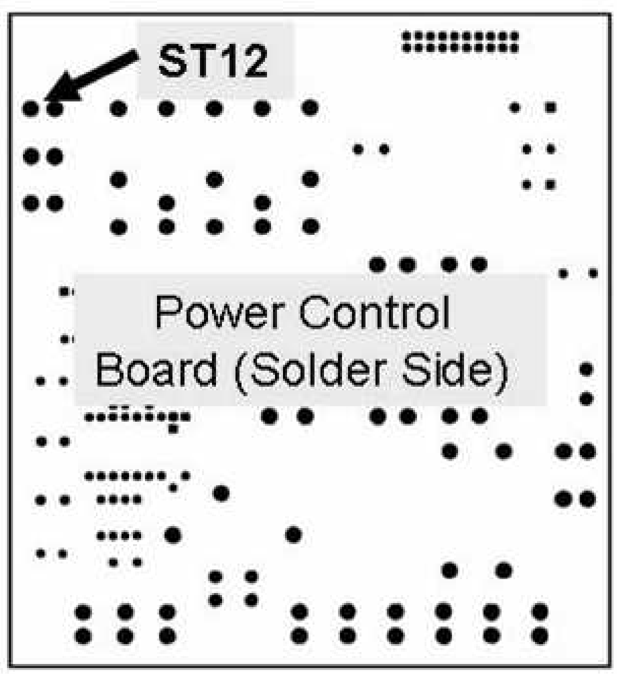

c) **ENSURE the meter's black lead remains connected to ground!**

d) **Turn the machine ON (fan running)!**

e) Figure below, measure again from the rear side of the Power Control Board's ST12 connector. More than 23 volts DC now?

Yes More than 23.0 volts! Possible bad Acid, Bicarbonate, Flow or Deaeration Pump. Check their distribution board connectors and wire harnesses for damage.

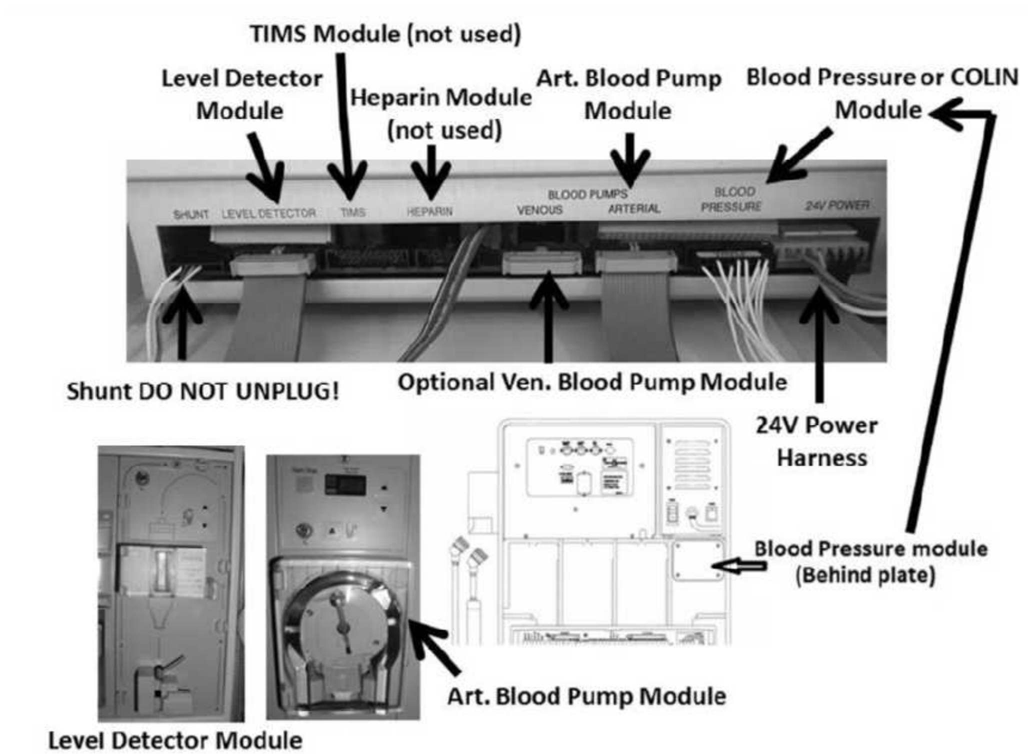
No Less than 23.0 volts! See procedure number P- F.8.0 (page 657).



**P- F.8.0 ST 12 STILL LESS THAN 23.0 VOLTS**

a) **To avoid damage, turn the machine OFF!**

b) Figure below, unplug the modules ONLY, **including the Blood Pressure module! DO NOT unplug the 24V Harness or shunt!**




c) **Reconnect the Actuator Cable!**

d) **Turn the machine on (fan running)!** Ignore “Art BP No Comm” OR “Blood Still Sensed!” if they occur!

f) Measure again from the <u>rear side</u> of the Power Control Board’s ST12 connector. More than 23.0 volts DC now? TWO (2) possible scenarios:

**1)** **IF (and ONLY if) still less than 23.0 volts!** TWO (2) possible bad components: **1)** Bad Power Control board (inside the power supply) OR **2)** Bad power supply.

**2)** **IF now more than 23.0 volts!** One of the modules (or its cable) may be bad. To locate the bad module perform parts A through D below:

A) **To prevent damage turn the machine OFF!**

B) Your choice, plug in <u>one</u> of the modules*****.

C) Turn the machine on and measure again at ST12. If less than 23.0 volts the last module plugged in is the problem.

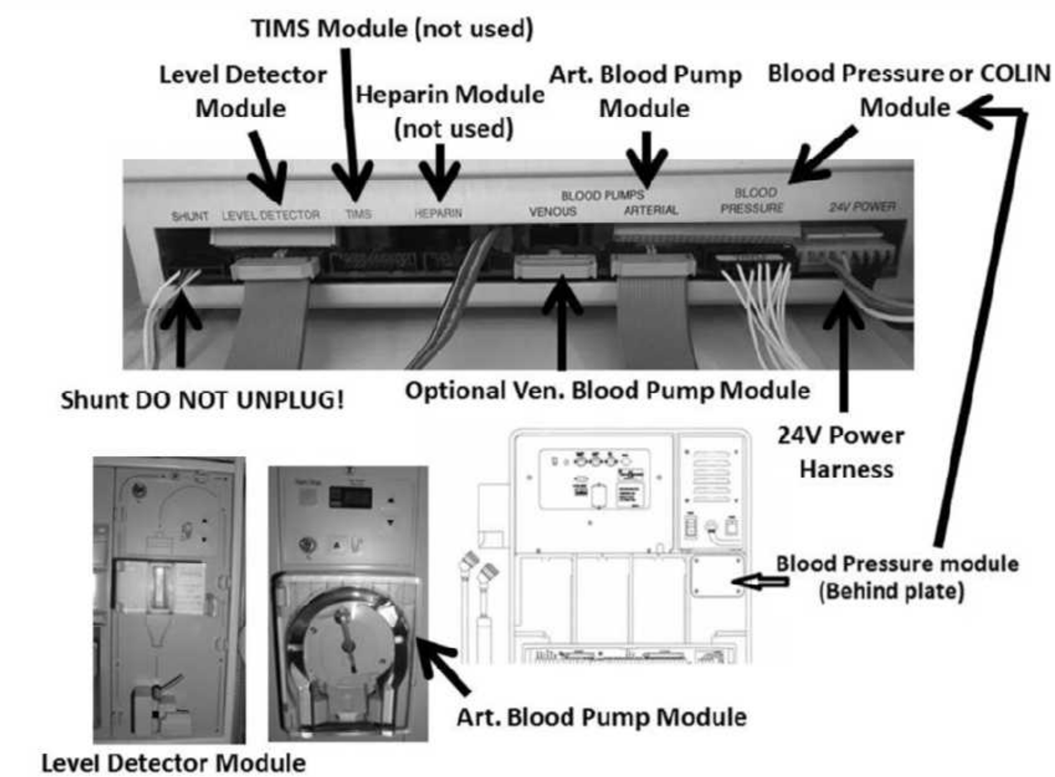
D) Repeat parts A) through D) until you locate the bad module.

## P- G.0.0 ISOLATE POWER LOGIC BOARD

a) **IMPORTANT! To prevent damage turn the machine OFF!**

b) Figure below, trace the cable from the Blood Pressure Module to ENSURE it is NOT reverse connected with another module! If it is correct this situation and re-measure +5 and +12 volts as this may be the problem!

c) See procedure number P- G.2.0 (page 658).




## P- G.2.0 MODULES OKAY / ISOLATE POWER LOGIC BOARD

a) **Swap in a known good** Power Logic Board**.** **To LOCATE the Power Logic Board refer to Figure 4A AND NOTE A (page 10). The board is known good ONLY if +5 and +12 volts are within range in another machine!

b) **Turn the machine on (fan running)!**

c) **ENSURE the black lead remains connected to ground!**

d) If possible, return to Dialysis OR Heat Disinfect.

e) Re-measure +12 and / or +5 volts (within range now?). If the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! See procedure number P- G.5.0 (page 659).

No Screen on and/or good voltage(s) now! The previous Power Logic Board may be bad.

## P- G.5.0 PROBLEM REOCCURS / ISOLATE MODULES

From here forward these procedures determines if a component may be 'dragging' +12 and / or +5 high or low! The previuos Power Logic board is probably good!

a) **To prevent damage turn the machine OFF!**

b) Per the Figure previous page, unplug the MODULES ONLY including the Blood Pressure Module! **DO NOT unplug the 24V Harness or shunt!**

c) **IMPORTANT!** Turn the machine ON (fan running)!

d) If possible, return to Dialysis OR Heat Disinfect.

e) Ignore "Art BP No Comm" OR "Blood Still Sensed!" if they occur!

f) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! **A)** Turn the machine OFF! **B)** BEING VERY CERTAIN the Blood Pressure module cable **ONLY** is returned to the Blood Pressure or Colin connector, reconnect ALL module cables**; C)** See procedure number P- G.5.2 (**page 660**).

No Screen on and/or good voltage(s) now! To locate the bad module see procedure number P- G.5.1 (page 659).

## P- G.5.1 SYMPTOM DOES NOT REOCCUR / ISOLATE POTENTIAL BAD MODULE

a) **To prevent damage turn the machine OFF!**

b) Your choice, plug* ONE of the modules back in. ***CAUTION!** BE VERY CERTAIN to plug the Blood Pressure module into the Blood Pressure or Colin position and NOT ANOTHER module!

c) **IMPORTANT!** Turn the machine on (fan running)!

d) If possible, return to Dialysis OR Heat Disinfect!

e) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! The last module plugged in (or its cable) is causing the problem!

No Screen on and/or good voltage(s)! Repeat parts a THROUGH e until ALL modules and have been plugged back in. If the symptom does NOT reoccur, reseating the cables MAY have eliminated the problem or a module was reverse connected with another.

P- G.5.2 SYMPTOM STILL PRESENT / ISOLATE FUNCTIONAL / POWER LOGIC BOARD DEVICES

a) **Turn the machine OFF to prevent damage!**

b) **Per the Figure below**, device cables along the TOP EDGE ONLY of the Functional Board AND Power Logic Boards will be unplugged next. To prevent damage when eventually returning them, **RECORD** where they belong BEFORE continuing to part c!

c) Unplug the cables BUT **DO NOT** unplug the Power Logic board's front cable (closest to the screen)!

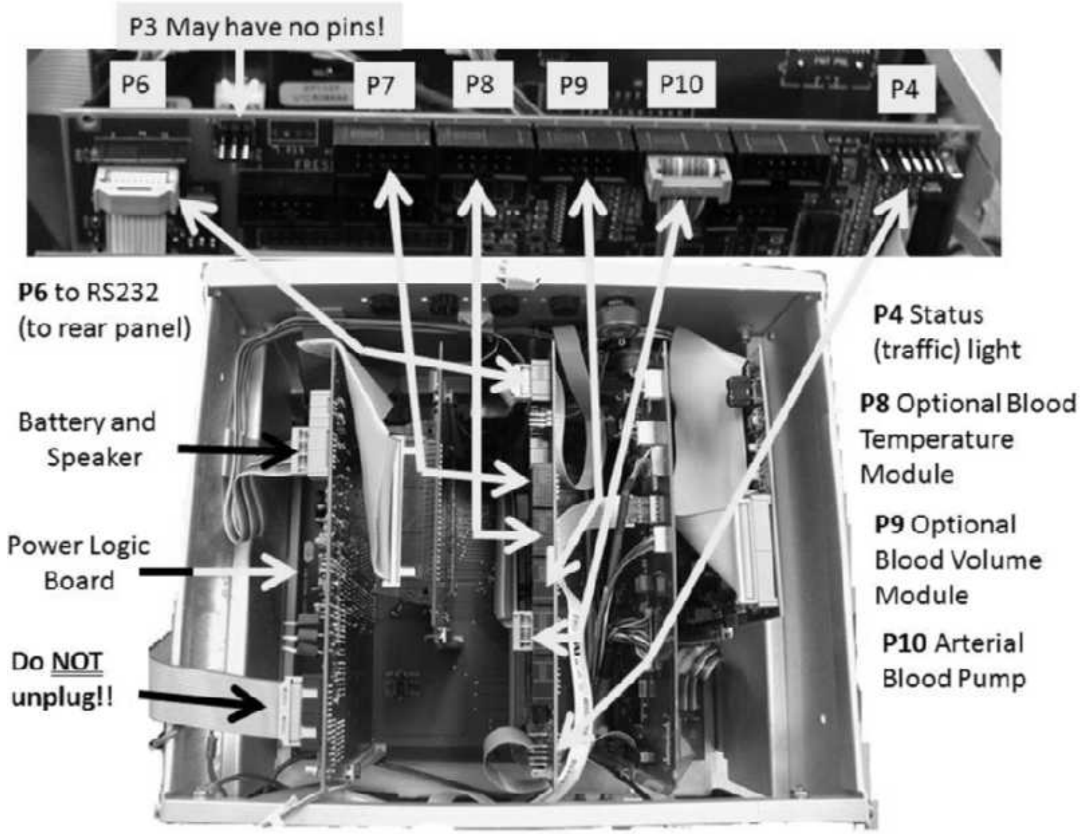



**Figure 117 – Card Cage / Functional and Power Logic Board Devices**

d) **IMPORTANT!** Turn the machine on (fan running)!

e) **ENSURE the black lead remains connected to ground!**

f) If possible, return to Dialysis OR Heat Disinfect.

g) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! Proceed to **page 662**, procedure numbet P- G.5.3.

No Screen on and / or good voltages! To locate the bad device, perform parts a THROUGH e next page.

**Screen on and / or good voltages continued:**

a) **Turn the machine OFF!**

b) Your choice, plug ONE of the device cables back in where it belongs. Refer to Figure 117 (previous page)).

c) **Turn the machine on (fan running)!**

d) If possible, return to Dialysis Program OR Heat Disinfect.

e) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! The last device plugged in (or its cable) may be causing the problem OR the wrong device is plugged in the wrong connector. Refer to Figure 117 (previous page)!

No Screen on and/or good voltage(s)! Repeat parts a THROUGH e until a cable is plugged in and the symptom reoccurs indicating the last device plugged in (or its cable) is causing the problem! If after ALL cables are plugged in AND the problem does not reoccur either it is very intermittent or reseating a connector solved the problem.

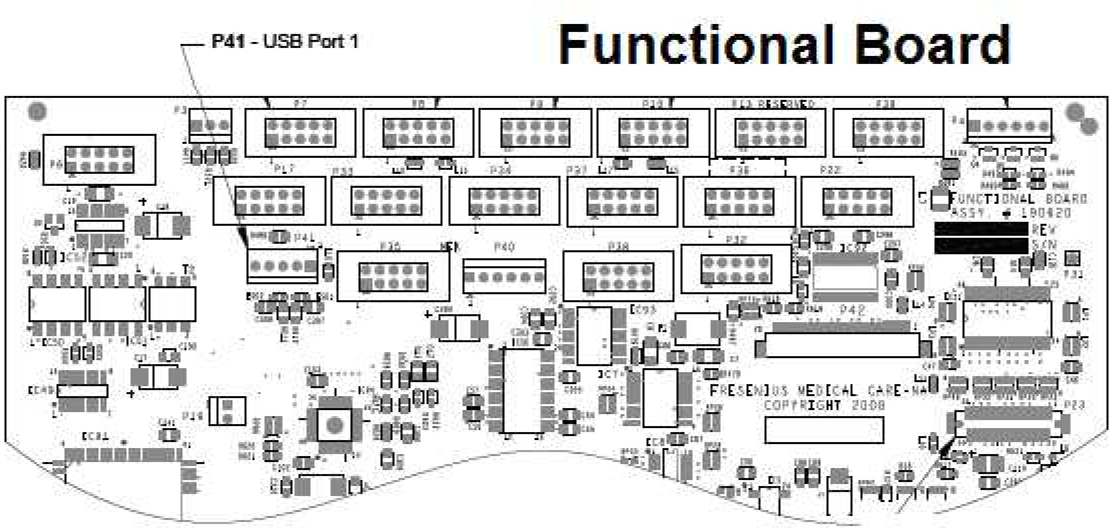
LEFT BLANK INTENTIONALLY

## P- G.5.3 SYMPTOM STILL PRESENT / ISOLATE USB PORT #1

a) **To prevent damage turn the machine OFF!**

b) Plug the Functional board device cables back in EXACTLY* where they belong. *To LOCATE where they belong refer to Figure 117 (page 660).

c) Figure below, unplug the Functional board's P41 cable (to USB Port 1).




d) **Turn the machine on (fan running)!**

e) If possible, return to Dialysis OR Heat Disinfect.

f) **ENSURE the black lead remains connected to ground!**

g) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! See procedure number P- G.5.4 (page 663).

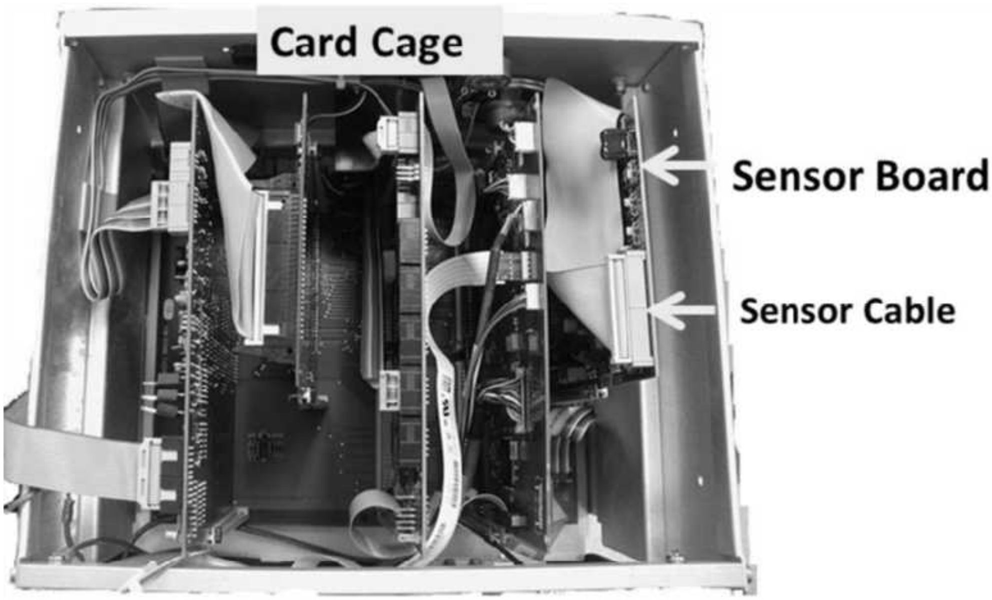
No Screen on and / or good voltage(s)! The USB port, on the right hand side of the screen, may be bad. To confirm this plug the P41 cable back in. If the symptom you were troubleshooting reoccurs the USB port is bad.

## P- G.5.4 SYMPTOM REOCCURS / ISOLATE HYDRAULIC SENSORS

a) **To prevent damage turn the machine OFF!**

b) Return the Functional board's P41 connector!

c) To isolate ALL hydraulic sensors at the same time, Figure below, unplug the Sensor board's ribbon cable!




d) **Turn the machine on (fan running)!**

e) If possible, go to **Dialysis Program** (DO NOT go to Heat Disinfect!)

**NOTE! IGNORE acid and / or bicarb pump EOS alarms or grinding!**

f) **ENSURE the black lead remains connected to ground!**

g) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! Proceed to **page 665**, procedure number P- G.5.6.

No Screen on and / or good voltage(s)! See procedure number P- G.5.5 (page 664).

**P- G.5.5 SYMPTOM NOT PRESENT / ISOLATE SENSORS AND PUMPS**

a) **To prevent damage turn the machine OFF!**

b) **Reconnect the Sensor Board cable!**

c) One of 13 Sensors (NTC #2 - NTC #44) or one of five (5) Pumps (#16 - #22) may be causing the problem. This procedure locates which one.

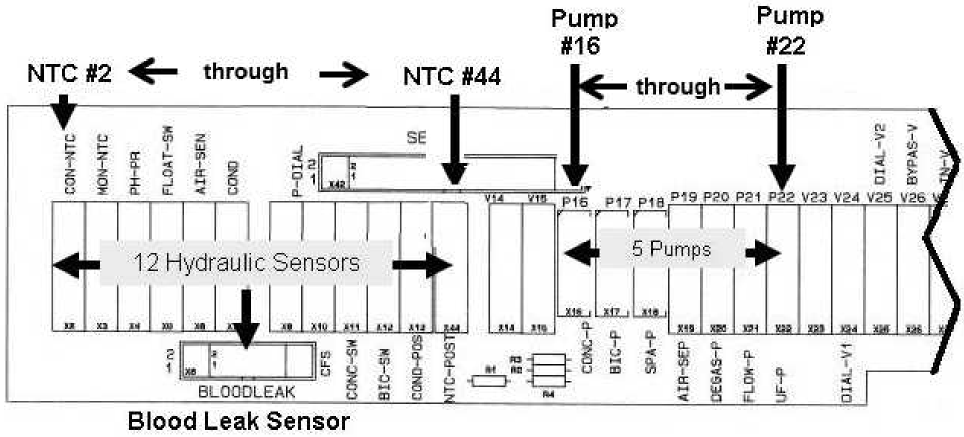



**Figure 118 – Distribution Board**

d) WITH THE MACHINE OFF, per the Figure above, your choice, unplug ONE of the Sensors or ONE of the Pumps from the Distribution board.

e) **ENSURE the meter's black lead remains connected to ground!**

f) **Turn the machine ON (fan running)!**

g) If possible, return to Dialysis OR Heat Disinfect.

**NOTE!** IGNORE grinding and / or UF and / or acid and / or bicarb pump alarms and / or Flow Errors.

h) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur (Yes or No)?

Yes Symptom reoccurs! Repeat parts d through h until ALL 13 Sensors (including Blood Leak) AND ALL 5 pumps have been unplugged OR until the symptom does NOT reoccur indicating the last component plugged in is the problem.

**NOTE!** If after ALL components have been unplugged AND the symptom reoccurs, turn the machine off and replace the Sensor Board cable with a known good then repeat parts e through h. If the symptom reoccurs see procedure number P- G.5.6 (page 665).

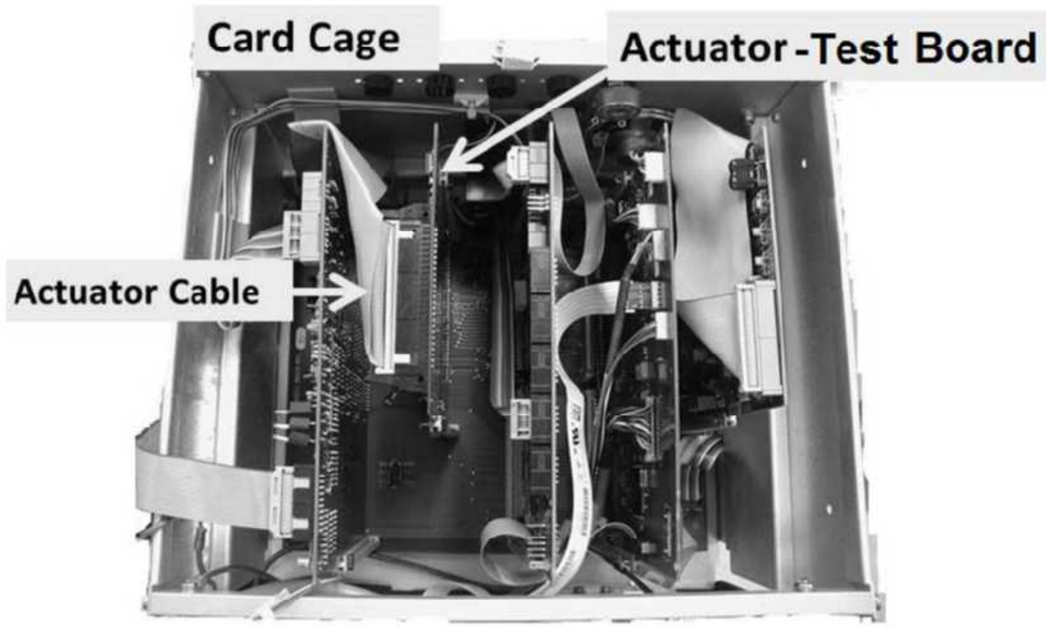
No Screen on and / or good voltages! The last component unplugged or its cable may be causing the problem.

P- G.5.6 SYMPTOM STILL PRESENT / ISOLATE THE ACTUATOR CABLE

a) **To prevent damage turn the machine OFF!**

b) **Return the ribbon cable to the Sensor Board.**

c) Figure below, unplug the Actuator-Test board's ribbon cable.




d) **Turn the machine on (fan running)!**

e) If possible, return to Dialysis OR Heat Disinfect.

**NOTE! Ignore all hydraulic alarms and possible grinding!**

f) **ENSURE the black lead remains connected to ground!**

g) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur?

Yes Symptom reoccurs! See procedure number P- G.5.7 (page 666).

No Screen on and / or good voltages! The actuator cable may be causing the problem.

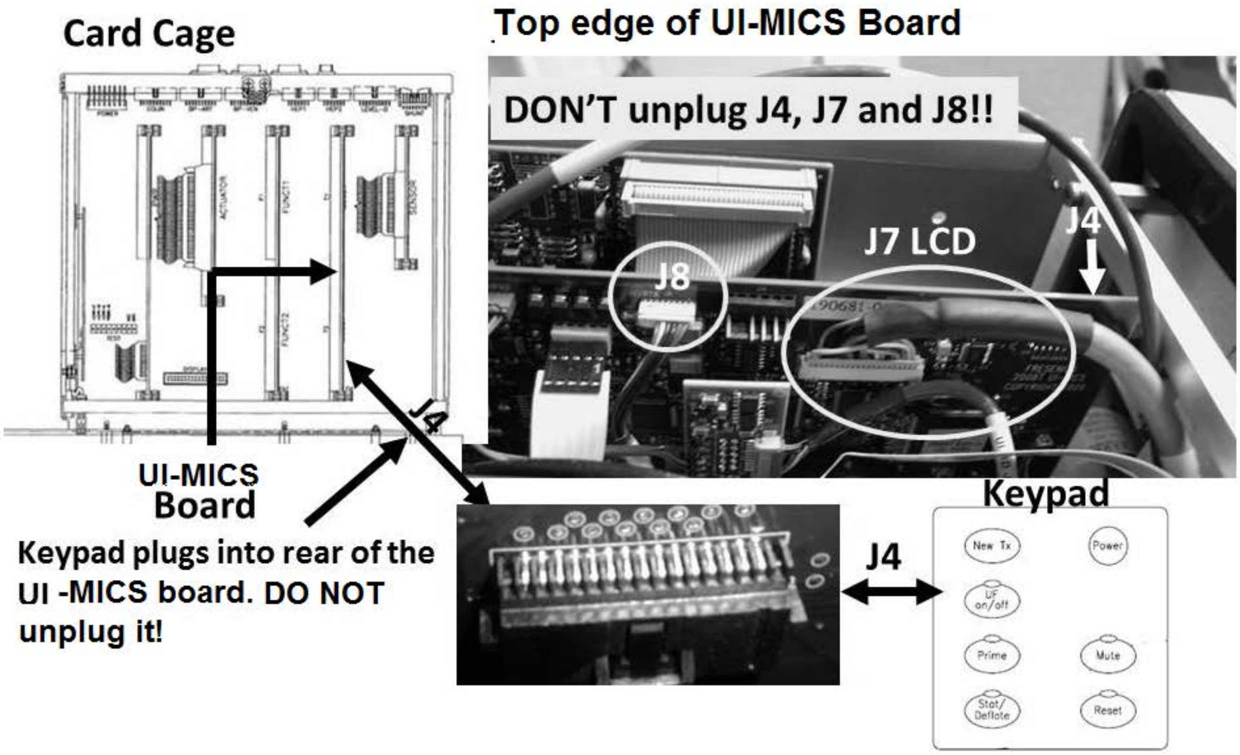
## P- G.5.7 SYMPTOM STILL PRESENT / ISOLATE UI-MICS BOARD DEVICES

a) **To prevent damage turn the machine OFF!**

b) Reconnect the Actuator-Test board's ribbon cable.

c) Figure below, EXCEPT FOR the LCD cable (J7), the keypad's cable (J4), and the backlight invertor cable (J8), in part d, UI-MICS board cables will be unplugged, one at a time, and the machine tested in between. **NOTE the cables and the connecors labeling.**

**See part d below**

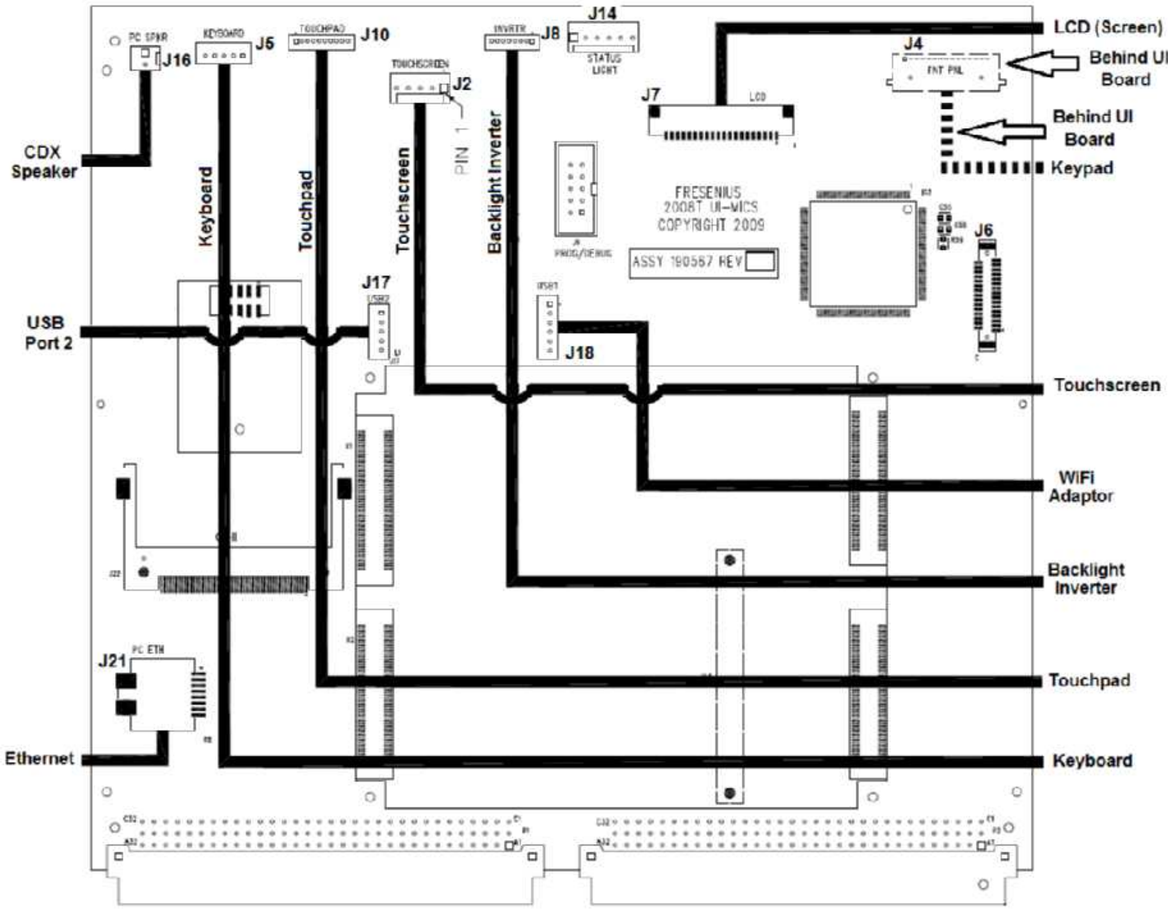



d) With the machine OFF, per the table below AND the Figure next page, unplug one (your choice) of the listed UI-MICS board device cables.

| UI-MICS Connector | Device |
|---|---|
| J16 | CDX Speaker (rear panel) |
| J5 | Keyboard |
| J10 | Mousepad |
| J17 | USB Port #2 (rear panel) |
| J18 | WIFI Adaptor (behind touchpad) |
| J21 | Ethernet (rear panel) |

**Parts e through h next page**

## UI-MICS BOARD




e) **Turn the machine on (fan running)!**

f) **ENSURE the black lead remains connected to ground!**

g) If possible, return to Dialysis OR Heat Disinfect.

h) Either re-measure +12 and / or +5 volts (within range?) OR if the symptom was intermittent call debug screen 1 to watch **5V Est** and / or **12V Est.** Allowing sufficient time, does the symptom you were troubleshooting reoccur (Yes or No)?

Yes Symptom still present! Perform parts A THROUGH C below:

A) Turn the machine off and plug the UI-MICS cable back into the CORRECT position per the labels.

B) Repeat part d through h until all UI-MICS device cables listed in the table have been unplugged.

C) If after ALL cables have been unplugged AND the symptom continues, leaving the machine on, see procedure number P- G.5.8 (page 669).

No Screen on and / or good voltages! The last UI-MICS device unplugged or its cable is causing the problem!

## P- G.5.8 SYMPTOM STILL PRESENT

TWO (2) possible scenarios:

1) **IF (and ONLY if) the screen is NOT remaining black:** Proceed to **page 669**, procedure number P- G.5.9.

2) **IF the screen is remaining black AND the measured +5 and / or +12 volts was not in range:** See parts a through f below:

   a) Turn the machine OFF and, per their labels, plug the UI-MICS cables back in.

   b) Per the Figure previous page, unplug the cable at the UI-MICS board's **J8** connector

   c) **ENSURE the black lead remains connected to ground!**

   d) **Turn the machine on (fan running)!**

   e) Per the table below, measure +12 and +5 volts again. BOTH now within range?

      Yes +12 and +5 in range now! The backlight inverter board, inside the front panel assembly, AND / OR the J8 cable is bad.

      No +12V and / or +5 still not in range! See procedure number P- G.5.8.2 (page 668).

| Measurement | *Pin* # (Location) | Expected (GOOD) range |
|---|---|---|
| +12 volts DC | *5* (five pins from right) | 11.7 – 12.3 $\mathbf{V_{DC}}$ |
| + 5 volts DC | *2* (second pin from right) | 4.8 – 5.2 $\mathbf{V_{DC}}$ |

## P- G.5.8.2 SCREEN REMAINING BLACK

a) Turn the machine OFF and, per its label, plug the UI-MICS J8 cable back in.

b) Per the Figure previous page, unplug the LCD cable at the UI-MICS board's connector **J7**.

c) **Turn the machine on (fan running)!**

d) Re-measure for +12 and / or +5 volts. Both voltages now within range?

   Yes +12 and +5 in range now! There is a problem with the LCD (the screen)

   No +12V and / or +5 still not in range! See parts a and b below:

   a) CAREFULLY plug the LCD cable back in. **CAUTION!** The J7 connector has micro pins which can easily be bent or broken!

   b) See procedure number P- G.5.9 (page 669).

## P- G.5.9 SYMPTOM STILL PRESENT

a) Turn the machine OFF and, per their labels, plug the UI-MICS cables back in!

b) **To prevent damage ENSURE the machine is OFF for now!**

c) Using ESD precautions, per the Board List below, your choice swap in ONE of the card cage circuit boards with known good, then in between perform parts d through f to see if the new board fixes the problem.

**BOARD LIST: 1)** Actuator-Test Board; **2)** bi*b*ag Interface Board[1]; **3)** Sensor Board[2]; **5)** Functional Board[2]; **6)** UI-MICS Board.

[1] If equipped with a bibag Connector. To LOCATE the Interface board refer to Figure 4C (page 11).

[2] To prevent "Cond Offset Failure", place the machine in **T and C Mode**. Refer to OPERATING MODES (page 19).

d) **Turn the machine on (fan running)!**

e) If possible, return to Dialysis OR Heat Disinfect.

f) THREE (3) possible scenarios below:

**1)** **IF (and ONLY if) the screen was staying black but it is on now:** The last board swapped in is the problem!

**2)** **IF (and ONLY if) the screen was staying black and still is staying black:** Repeat parts b THROUGH f. After ALL boards have been replaced with known good AND the screen remains black possible bad: **1)** Distribution board OR; **2)** Motherboard.

**3)** **IF the screen has ALWAYS been on:** ENSURING the black lead remains connected to chassis ground, either re-measure +12 and/or +5 volts (within range?) OR if the symptom you were troubleshooting was intermittent, if possible, call debug screen 1 to monitor **5V Est** and/or **12V Est.** Does the symptom you were troubleshooting reoccur (Yes or No)?

Yes Repeat parts b THROUGH f until ALL circuit boards in the BOARD LIST have been replaced with known good. If after ALL boards have been replaced AND the symptom is still present possible bad: **1)** Distribution board OR; **2)** Motherboard.

No Screen on and / or good voltages! The last board swapped in may be causing the problem.

## P- H.0.0 VERIFY SERVICE MODE

This procedure attempts to place the machine into Service Mode. Some problems may not allow it!

a) Turn the machine off then back on. When “Press CONFIRM for Service Mode” appears press ‘Enter’. The screen says “Machine in Service Mode”.

b) Allow forty (40) seconds! Does the Main Service Program menu appear?

Yes Service menu appears! See procedure number P- H.1.0 (page 670).

No The Service menu does <u>DOES NOT</u> appear! Proceed to **page 697**, procedure number P- 2.0.0.

## P- H.1.0 SERVICE MENU APPEARS / ISOLATE VOLTAGE DETECTION

A) Select Calibrate Monitor → Voltage Detection. **DO NOT follow the screen prompts!** Perform parts B through G instead!

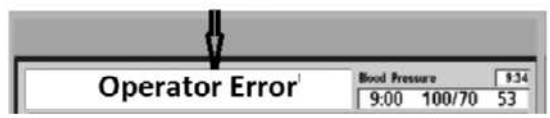

B) Press the **[12 Volt Set]** data box. It turns bright yellow!

C) Enter the <u>MEASURED</u> +12 Volt value previously recorded.

D) Sharply press ‘Enter’ ONCE.

E) <u>ENSURE</u> the **[12 Volt Set]** box is pale yellow/white. If its gray return to part A)!

**Status bar with "Operator Error" banner**




F) Sharply press ‘Enter’ again.

G) Figure right, does an “Operator Error” appear?

Yes “Operator Error” occurs! Proceed to **page 675,** procedure number P- H.1.2.

No “Operator Error” <u>DID NOT</u> occur! Perform parts a AND b below:

a) The screen should say **“4. Verify that 5V EST is between 4.8 to 5.2….”.** If not return to part A)!

b) Look at the **screen’s [5V EST]** <u>AND</u> **[12V EST]** windows (Figure right)! <u>TWO (2) CHECKS</u>:


**CHECK #1:** Is the **[5V EST]** window between 4.8 and 5.2?

**CHECK #2:** Is **[12V EST]** window between 11.7 and 12.3?

**Yes (to BOTH):** Press ‘Enter’. Leaving the machine in Service Mode, see procedure number P- H.0.144 (page 671).

**No (to one OR both):** Proceed to **page 675,** procedure number P- H.1.2.

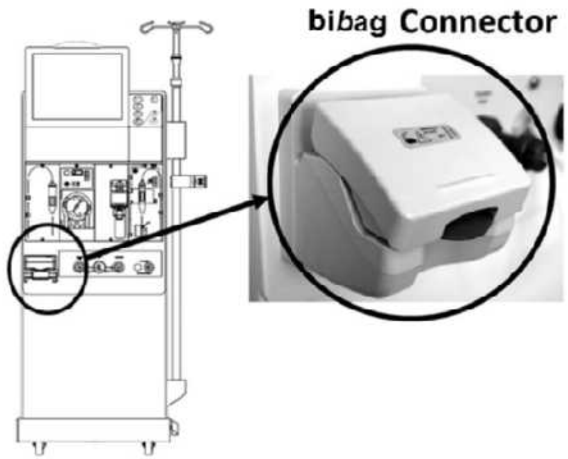
## P- H.0.144 5V EST AND 12V EST ARE GOOD

Per the ORIGINALLY OBSERVED symptom, THREE (3) possible scenarios:

1) **IF (and ONLY if) "5V Low" OR "5V High":** Proceed to **page 681**, procedure number P- H.3.0.

2) **IF (and ONLY if) "12V POWER FAIL":** Proceed to **page 681**, procedure number P- H.3.0.

3) **ALL OTHERS scenarios:** Figure right, equipped with a bi*bag* Connector?




Yes bi*bag* Connector equipped! See procedure number P- H.0.2 (page 671).

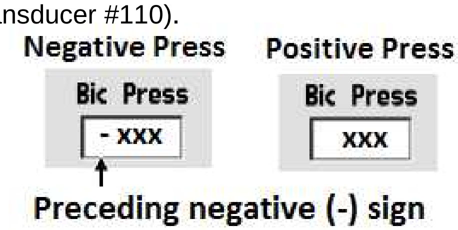
No NO bi*bag* Connector! Proceed to **page 681**, procedure number P- H.3.0.

## P- H.0.2 BI*BAG* EQUIPPED

a) Press the screen's lower left 'Options' tab.

b) Call debug screen 15 and locate **Bic Press** (from pressure transducer #110).

c) Figure right, if a preceding negative ('-') sign appears pressure is negative. If a '-' sign does not appear it is POSITIVE. If NEGATIVE this is okay BUT if POSITIVE it MUST NOT be 249 or more! THREE (3) possible scenarios below:




1) **IF (and ONLY if) Bic Press is negative (-):** Proceed to **page 681**, procedure number P- H.3.0.

2) **IF (and ONLY if) Bic Press is positive but LESS THAN 249:** Proceed to **page 681**, procedure number P- H.3.0.

3) **IF Bic Press is positive 249 OR more:** See procedure number P- H.0.4 (page 671).

## P- H.0.4 BIC PRESS MORE THAN POSITIVE 249

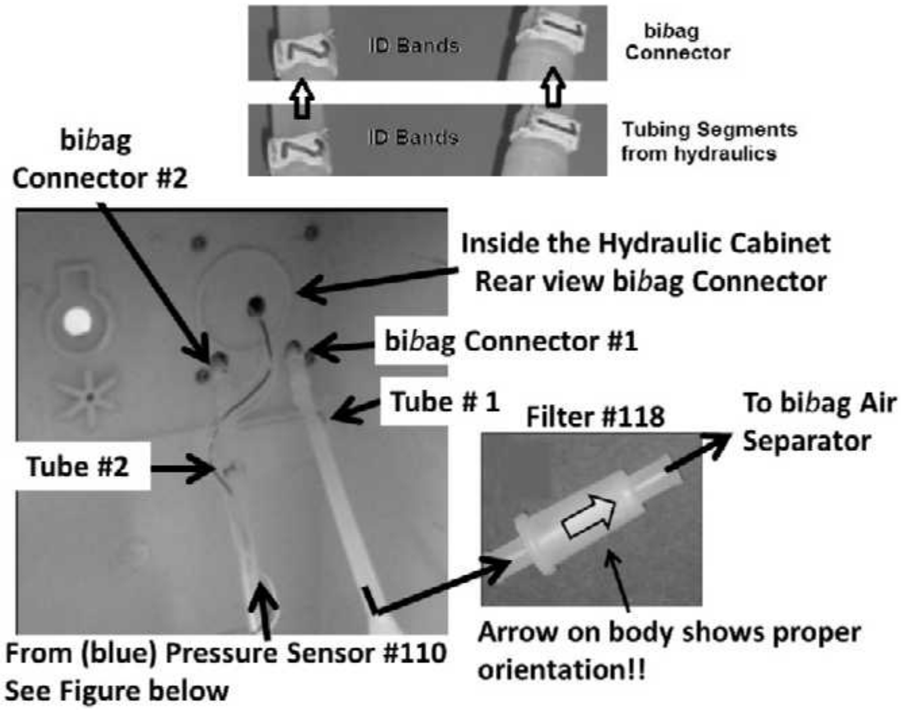
A) Leaving the machine on, pull the hydraulics away from the cabinet.

**Part B next page**

B) Per the Figure below, TWO (2) checks at the bi*b*ag Connector tubing segments:

**Check #1:** ENSURE the segments are not kinked!

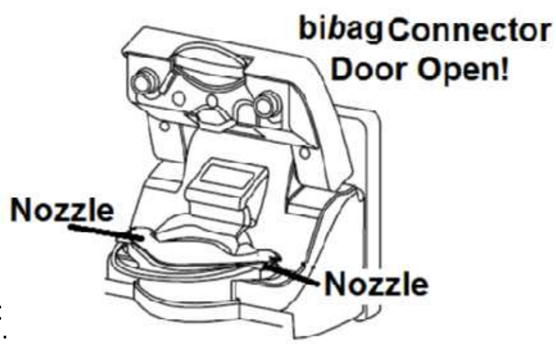
**Check #2:** Per the identification (ID) bands ENSURE the tubing segments are not reversed!




C) Figure right, open the bi*b*ag Connector door!

D) If a bi*b*ag disposable (pouch) is attached remove it!

E) Continuous flow (more than 5 ml per minute) from one of the bi*b*ag Connector nozzles (Yes or No)?




Yes Continuous flow! THREE (3) possible problems: **1)** Loose bi*b*ag Interface board[1] ribbon cable OR; **2)** Bad Valve #100 OR; **3)** Bad bi*b*ag Interface Board[1].

[1] To LOCATE the Interface board refer to Figure 4C (page 11)

[2] To LOCATE Valve #100 refer to the **Hydraulics Front View** Figure next page!

No flow! Leaving the door open, see part F.

F) From screen 15, is **Bic Press** still MORE THAN positive 249?

**Bic Press still MORE THAN positive 249 continued:**

Yes **Bic Press** still MORE THAN positive 249. See procedure number P- H.0.5 (page 673).

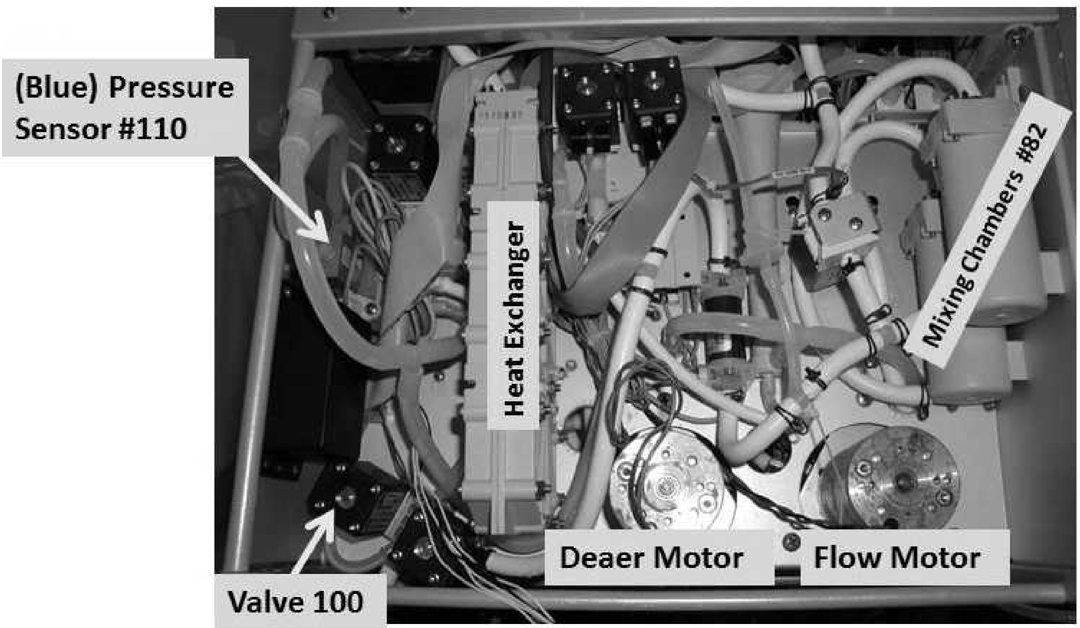
No **Bic Press** is now LESS THAN 249. There may have been a bi*b*ag Connector tubing kink! Perform parts a THROUGH c below:

a) Close the bibag Connector door!

b) Place the machine in Dialysis Program or Rinse. If a voltage alarm occurs return to (ABOVE) procedure number P- H.0.144 (page 671).

c) Reinstall the hydraulics ENSURING the bi*b*ag Connector tubing segments remain unkinked!

## HYDRAULICS FRONT VIEW




**P- H.0.5 BIC PRESSURE STILL MORE THAN 249**

A) Per the Figure above, pull Tube segment #2 off the bi*b*ag Connector i.e. from (blue) Pressure Sensor #110.

B) Continuous flow (more than 5 ml per minute) through Pressure Sensor #110 (Yes or No)?

Yes Continuous flow! THREE (3) possible problems: **1)** Loose bi*b*ag Interface board[1] ribbon cable OR; **2)** Bad Valve #100[2] OR; **3)** Bad bi*b*ag Interface Board[1].

[1] To LOCATE the Interface board refer to Figure 4C (page 11)

[2] To LOCATE Valve #100 refer to the Figure above.

No flow! See procedure number P- H.0.6 (page 674).

**P- H.0.6 BIC PRESS STILL MORE THAN 249 / ISOLATE PRESSURE SENSOR #110**

a) From Service Mode → Calibrate Sensors → **Regulator Pressure**.

b) Just enough to hold them there, place the acid and bicarbonate connectors ¼ way into their rinse ports.

c) Press 'Enter' and allow the calibration to complete. If successful the "Calibrate Regulator Pressure" banner appears (Figure below), and the screen will say "Calibration Complete, press CONFIRM to save".

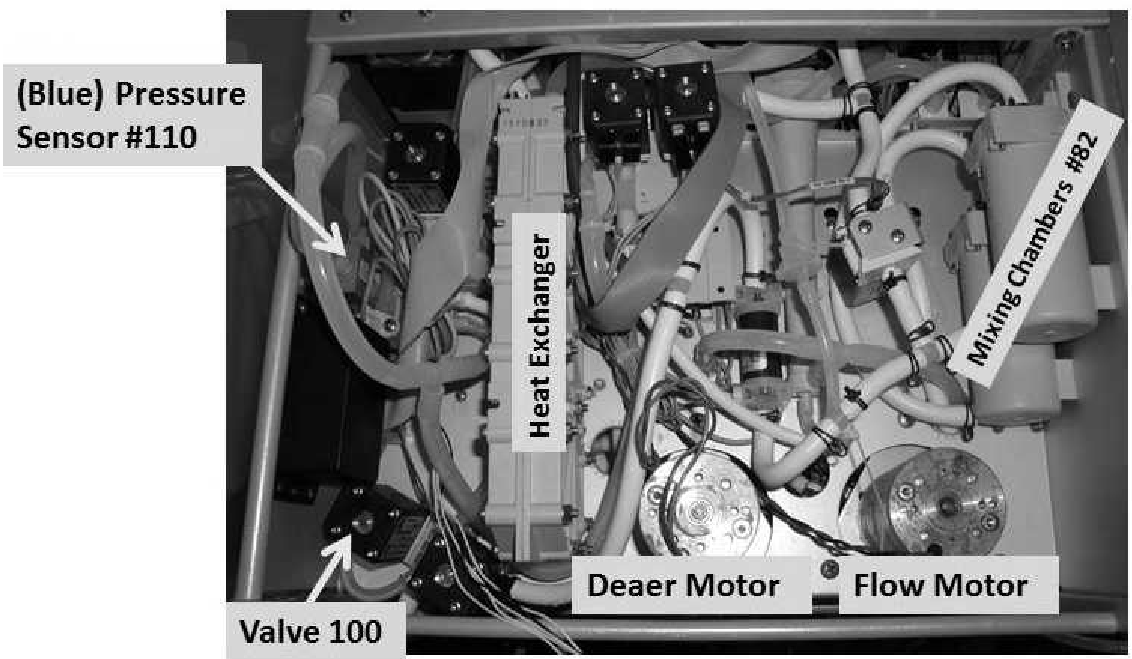
d) Was the calibration successful?


Yes An Error banner DID NOT occur! Press 'Enter'. Reattach all tubing then place the machine in Dialysis Program or Rinse. If the voltage alarm reoccurs return to **page 671**, procedure number P- H.0.144.

No An Error banner occurred! Repeat the calibration but if the Error banner reoccurs, FOUR (4) possible problems (see PROBLEM LIST below). Check and / or swap in each component one at a time until the Regulator Pressure calibration is successful.

**PROBLEM LIST**: **1)** Loose bi*b*ag Interface ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #110 (Figure below) OR; **3)** Bad bi*b*ag Interface board OR; **4)** Bad electrical connection from Pressure Sensor #110 inside the bibag Distribution Board (refer to Figure 4D (page 13)).

**HYDRAULICS FRONT VIEW**

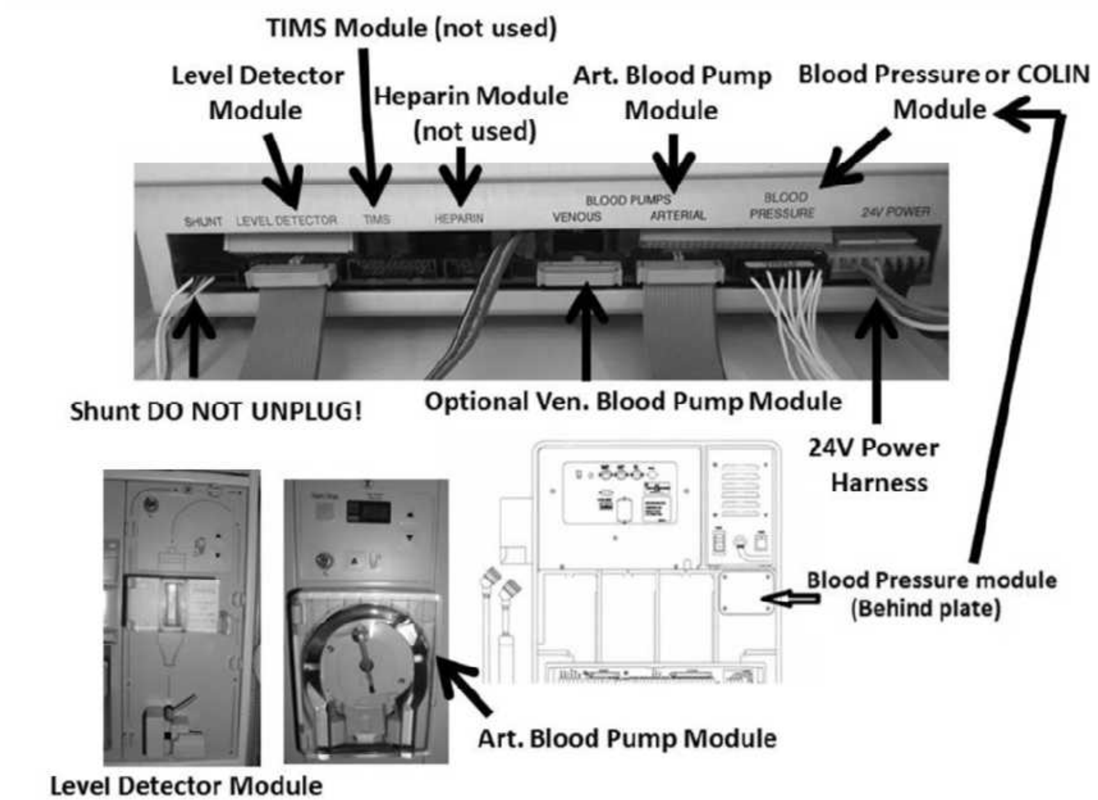


## P- H.1.2 TROUBLESHOOT VOLTAGE DETECTION PROBLEM

From here forward these procedures determine if a component may be 'dragging' +12 and / or +5 high or low:

a) **To prevent damage turn the machine OFF!**

b) Figure below, unplug ALL **MODULES ONLY**, including the Blood Pressure module! **DO NOT unplug the 24V Harness or shunt!**




c) Ignore "Art BP No Comm" OR "Blood Still Sensed!" if they occur.

d) Repeat the Voltage Detection Calibration. THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF (and ONLY if) "Operator Error" reoccurs:** See procedure number P- H.1.3 (page 676).

**2) IF (and ONLY if) 5V EST AND / OR 12V EST are not in range:** See procedure number P- H.1.3 (page 676).

**3) IF "Operator Error" did NOT occur AND 5V EST AND 12V EST are in range:** TURNING THE MACHINE OFF IN BETWEEN reconnect the module cables*****, one at a time, and repeat the Voltage Detection Calibration until the problem reoccurs indicating the last module plugged is the problem.

* **CAUTION! Never plug a module, other than the Blood Pressure module, into the Blood Pressure or Colin position!**

* **CAUTION! Never plug the Blood Pressure module into another module's position!**

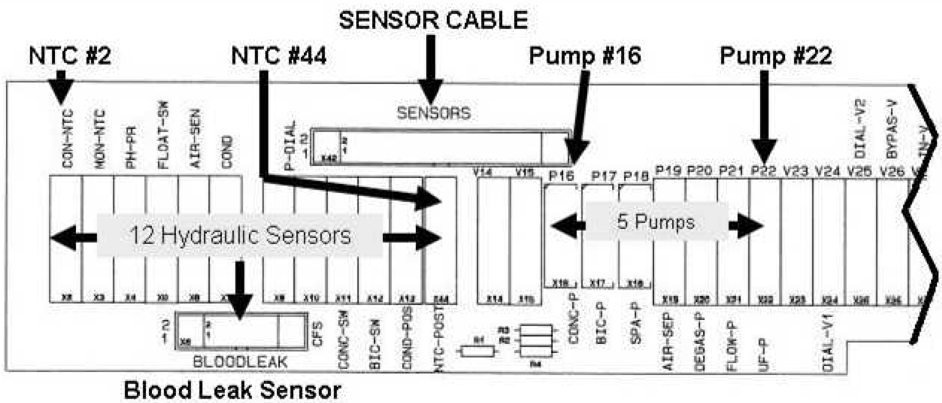
## P- H.1.3 ISOLATE HYDRAULIC SENSORS

a) **To prevent damage turn the machine OFF!**

b) CAREFULLY* return the module cables to their positions.

*** CAUTION! DO NOT a plug a module, other than the Blood Pressure Module, into the Blood Pressure or Colin position! DO NOT plug the Blood Pressure Module into another module's position! NEVER plug the Bood Pressure module in with the machine on!**

c) CAREFUL HERE! **Per the Figure below**, unplug the SENSOR cable from the Distribution board!




d) Repeat the Voltage Detection Calibration. THREE (3) possible scenarios 1) or 2) or 3):

1) **IF (and ONLY if) "Operator Error" reoccurs:** See procedure number P- H.1.4 (page 677).

2) **IF (and ONLY if) 5V EST AND / OR 12V EST are not in range:** See procedure number P- H.1.4 (page 677).

3) **IF "Operator Error" did NOT occur AND 5V EST AND 12V EST are in range:** One of (12) twelve Sensors or one of five (5) Pumps may be causing the problem! Perform parts A THROUGH C below to locate which one:

   A) **IMPORTANT! Turn the machine OFF and reconnect the Sensor Board cable.**

   B) Per the Figure above, your choice, unplug ONE of thirteen (13) hydraulic Sensors or ONE of five (5) Pumps from the Distribution board.

   C) Attempt the Voltage Detection Calibration. TWO (2) possible scenarios:

      1) **IF "Operator Error" does NOT occur AND 5V EST AND 12V EST are in range:** The last component unplugged may be causing the problem.

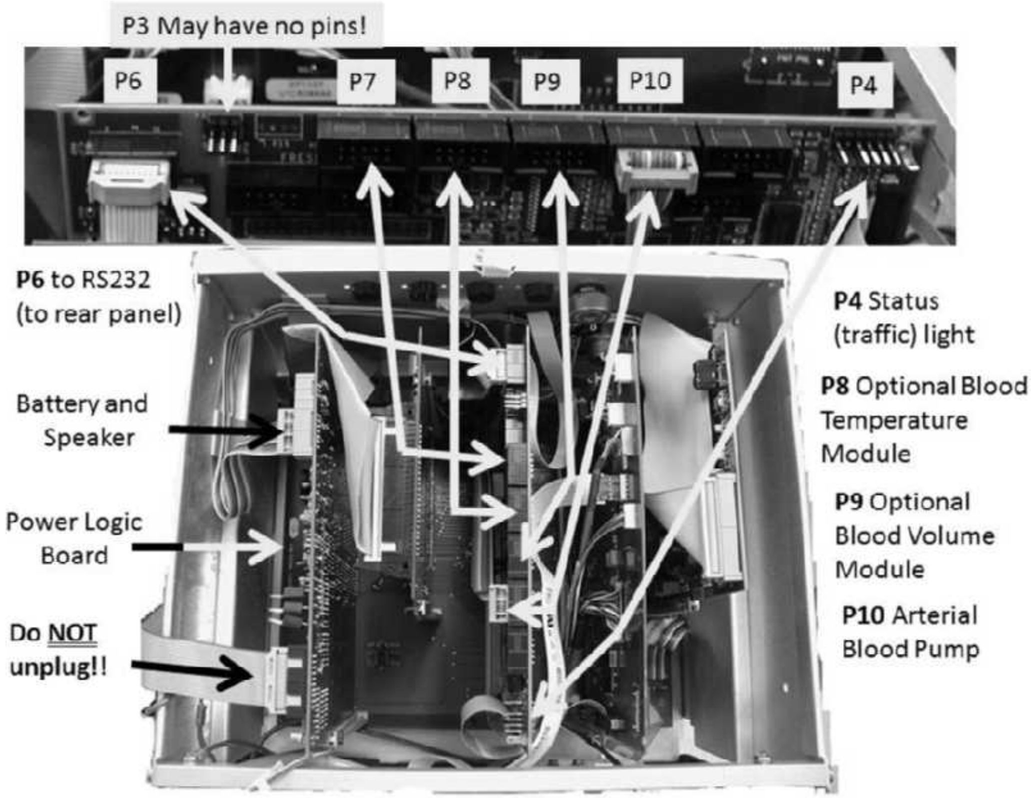
      2) **IF "Operator Error" occurs OR 5V EST OR 12V EST are NOT in range:** Repeat parts B through C until ALL thirteen (13) sensors (NTC #2 through NTC #44 AND the Blood Leak Sensor) AND ALL five (5) pumps (#16 through #22), have been unplugged.

      **NOTE!** AFTER all components have been unplugged AND the problem reoccurs swap the Sensor Board cable with a known good. If (and ONLY if) the problem reoccurs see procedure number P- H.1.4 (page 677).

## P- H.1.4 ISOLATE FUNCTIONAL BOARD DEVICES

a) **To prevent damage turn the machine OFF!**

b) Device cables along the TOP EDGE ONLY of the Functional Board AND Power Logic Board will be unplugged next. **Per the Figure below**, to prevent damage when eventually returning them, **RECORD** where they are plugged in BEFORE continuing to part c.




c) Unplug the device cables BUT **DO NOT** unplug the Power Logic Board's front ribbon cable!

d) From here forward, ignore "Art BP No Comm" OR "Blood Still Sensed!" if they occur!

e) Repeat the Voltage Detection Calibration. THREE (3) possible scenarios 1) or 2) or 3):

**1) IF "Operator Error" reoccurs:** See procedure number P- H.1.5 (page 678).

**2) IF 5V EST AND/OR 12V EST are not in range:** See procedure number P- H.1.5 (page 678).

**3) IF "Operator Error" did NOT occur AND 5V EST AND 12V EST are in range:** One of the devices may be causing the problem. To locate which one perform parts A through C below:

A) Turn the machine OFF!

B) Your choice, return ONE of the device cables to WHERE IT BELONGS.

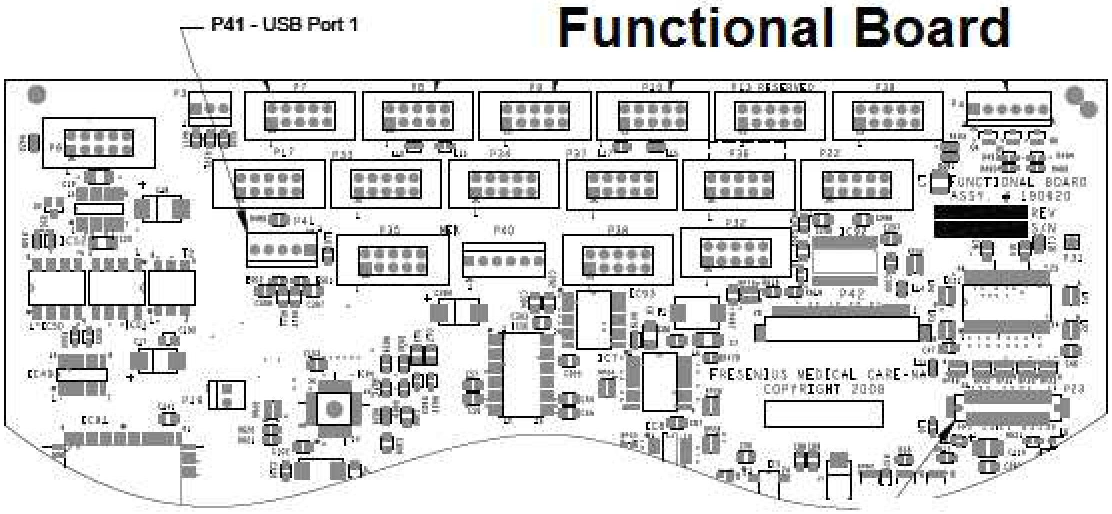
C) Repeat the Voltage Detection Calibration. When the problem reoccurs the last device plugged in or its cable is causing the problem!

**P- H.1.5 ISOLATE FUNCTIONAL BOARD USB PORT**

a) **To avoid damage, turn the machine OFF!**

b) Return the Function board device cables to EXACTLY as recorded above!

c) Figure below, unplug the **Functional board's P41** cable (to USB Port 1).




d) Repeat the Voltage Detection Calibration. THREE (3) possible scenarios 1) or 2) or 3):

**1)** **IF "Operator Error" reoccurs:** See procedure number P- H.1.6 (page 679).

**2)** **IF 5V EST AND/OR 12V EST are not in range:** See procedure number P- H.1.6 (page 679).

**3)** **IF "Operator Error" did NOT occur AND 5V EST AND 12V EST are in range:** The USB port, on the side of the screen may be bad. To confirm this, plug it back in and do the Voltage Detection Calibration again.

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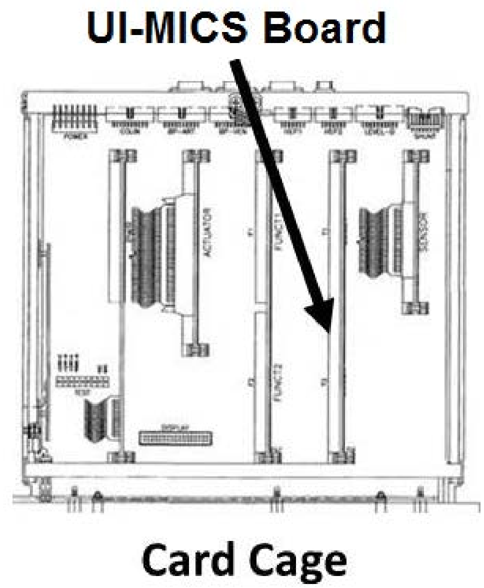
## P- H.1.6 ISOLATE UI-MICS BOARD DEVICES




a) **To avoid damage, turn the machine OFF!**

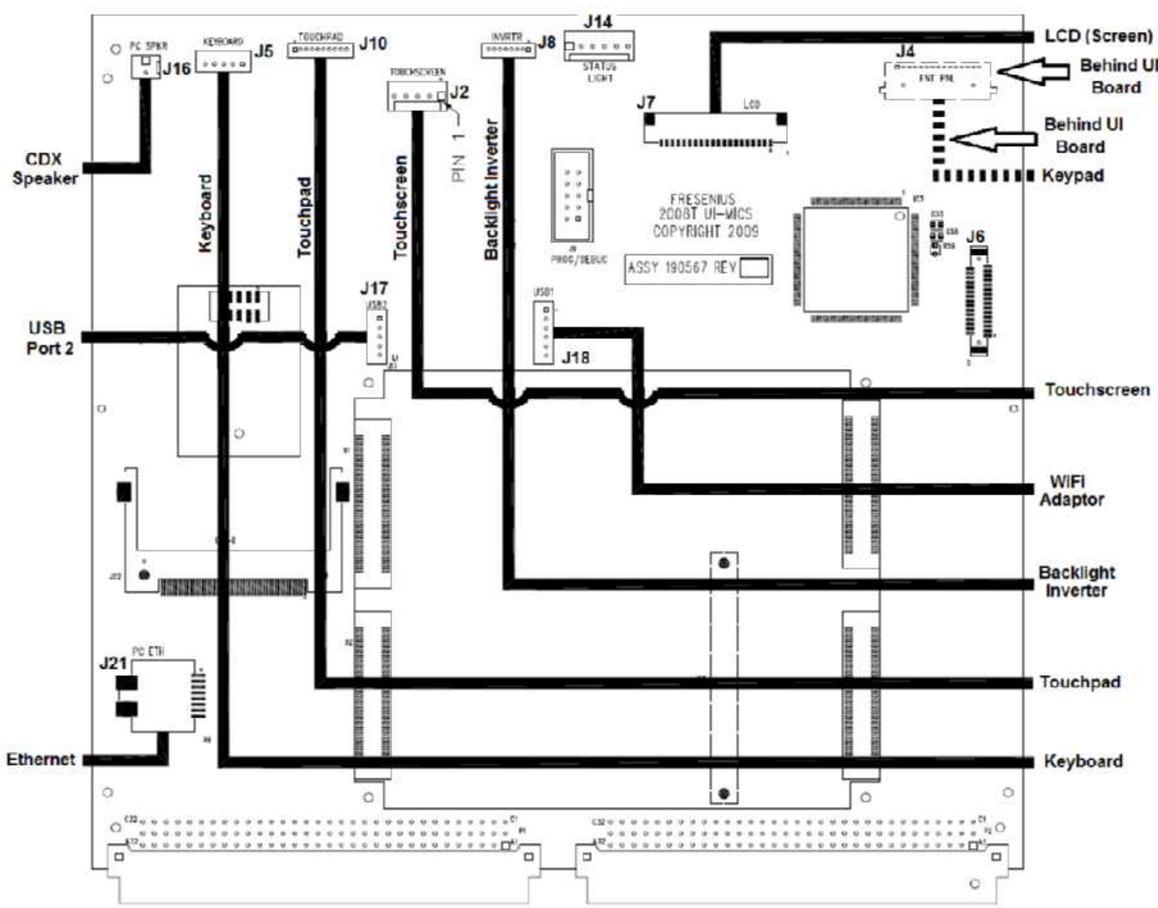
b) Return the Functional board's P41 cable.

c) Figures right and below, unplug all five (5) UI-MICS board component connectors per the table below:

| UI–MICS Connector | Component |
|---|---|
| J16 | CDX Speaker (on rear panel) |
| J10 | Mousepad |
| J17 | USB Port #2 (on rear panel) |
| J18 | WIFI Adaptor (behind the touchpad) |
| J21 | Ethernet (on rear panel) |

**Continue to part d next page**

## UI-MICS BOARD



d) Repeat the Voltage Detection Calibration. THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF "Operator Error" reoccurs:** See procedure number P- H.1.7 (page 680).

**2) IF 5V EST AND/OR 12V EST are not in range:** See procedure number P- H.1.7 (page 680).

**3) IF "Operator Error" did NOT occur AND 5V EST AND 12V EST are in range:** One of the five (5) components connected to the UI-MICS board may be causing the problem. To isolate which one perform parts A through C below:

A) Turn the machine OFF!

B) Your choice, reconnect ONE of the UI-MICS component cables to where it belongs.

C) Repeat the Voltage Detection Calibration. TWO (2) possible scenarios I or II below:

**I. IF "Operator Error" DOES NOT occur AND 5V EST AND 12V EST are in range:** Repeat parts A through C until all five (5) components have been plugged back in.

II. **IF "Operator Error" reoccurs OR 5V EST AND / OR 12V EST are NOT in range:** The last component plugged in is causing the problem.

## P- H.1.7 ISOLATE CARD CAGE

a) **To prevent damage turn the machine OFF!**

b) Using ESD precautions, your choice, per the Board List below, swap in ONE of the card cage circuit boards with known good, then see part c to test the new board.

**BOARD LIST: 1)** Actuator-Test Board; **2)** bi*b*ag Interface Board[1]; **3)** Sensor Board; **5)** Functional Board[2]; **6)** UI-MICS Board.

[1] If equipped with a bibag Connector. To LOCATE the Interface board refer to Figure 4C (page 11).

[2] To prevent "Cond Offset Failure", place the machine in **T and C Mode**. Refer to OPERATING MODES (page 19)

c) Repeat the Voltage Detection Calibration. THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF "Operator Error" reoccurs:** Repeat parts a through c until "Operator Error" does NOT occur indicating the last board swapped in was the problem. If after all boards have been swapped in AND if "Operator Error" reoccurs the motherboard may be bad.

**2) IF 5V EST AND/OR 12V EST are not in range:** Repeat parts a through c until **5V EST AND/OR 12V EST** are in range indicating the last board swapped in was the problem. If after all boards have been swapped in AND if the problem is still present the motherboard may be bad.

**3) IF "Operator Error" did NOT occur AND 5V EST AND 12V EST are within range:** The last board swapped in was causing the problem!

## P- H.3.0 ISOLATE 24 VOLT CONNECTIONS

a) **TURN THE MACHINE OFF!**

b) Turn the machine on (fan running).

**100%**

**System Initializing ....**

c) Allowing forty (40) seconds, does System Initialization reach 100%?

Yes System Initialization reaches 100%! See procedure number P- H.3.2 (page 681).

No Does NOT reach 100%! Proceed to **page 697**, procedure number P- 2.0.0.

## P- H.3.2 SYSTEM INITIALIZATION REACHES 100%

a) Depending on what Program the problem was originally observed place the machine into Dialysis OR Heat Disinfect OR Rinse Program.

b) Does a voltage alarm (“24V”, “12V”, “5V”) OR “Temp Over 95 Degrees” OR “Failed Sending Data…” alarm occur?

Yes Problem occurs! See procedure number P- H.3.3 (page 681)

No Allow thirty (30) minutes or longer. If a voltage alarm OR “Temp Over 95 Degrees” OR “Failed Sending Data…” alarm occurs see procedure P- H.3.3 (page 681). If these alarms DO NOT occur the Troubleshooting Guide the original symptom cannot be located.

## P- H.3.3 PROBLEM REOCCURS

A) Turn the machine OFF!

B) Turn the machine on HOWEVER, if ”System Initialization” reaches 100% **DO NOT** press any keys yet!

C) TWO (2) possible scenarios:

**1) IF (and ONLY if) a voltage alarm has NEVER occurred but “Failed Sending Data…” has:** Proceed to **page 683**, procedure number P- H.4.5.

**2) ALL other scenarios:** See part D.

D) Per the OBSERVED symptom, THREE (3) possible scenarios 1) or 2) or 3) below:

**1) IF “5” OR “12V” alarm was occuring:** See procedure number P- H.4.1 (page 682).

**2) IF ANY “24V” alarm was occuring:** Proceed to **page 683**, procedure number P- H.4.5.

**3) ALL other scenarios:** See procedure number P- H.4.1 (page 682).

**P- H.4.1 ISOLATE "5V High" OR "5V Low OR "12V Power Fail"**

The following procedure describes how to use the debug screens to monitor +5 and +12 volts:



a) Press the screen's 'Dialysis' button but **DO NOT** press 'Enter' or 'CONFIRM' yet!

b) Call debug screen 1 and locate **5V Est** AND **12V Est**:

- **5V Est:** Should stay STABLE between 4.8 and 5.3 (stable = does NOT change more than +/- 0.1). If NOT, see procedure number P- H.4.2 (page 682).
- **12V Est:** Should stay STABLE between 11.7 and 12.3 (stable = does NOT changes more than +/- 0.1). If NOT, see procedure number P- H.4.2 (page 682).

c) At the bottom of the screen, press the 'Dialysate' tab.

d) Press 'Enter' to return to Dialysis Program!

e) Call debug screen 1. WITHOUT LOOKING AWAY, watch **5V Est** AND/OR **12V Est** for ten (10) minutes or longer. Does **5V Est** OR **12V Est** become UNSTABLE (changes more than +/- 0.1)?

Yes  Unstable! See procedure number P- H.4.2 (page 682).

No  a) Place the machine into Heat Disinfect then QUICKLY call debug screen 1. If debug does not appear press 'Esc' then call screen 1.

b) If **5V Est** OR **12V Est** BECOMES unstable see procedure number P- H.4.2 (page 682). If Heat Disinfect runs, without the symptom you were troubleshooting reoccurring, the Troubleshooting Guide cannot locate the original problem!

**P- H.4.2 ISOLATE POWER AND SENSOR BOARD**

a) Referring to Figure 4A and NOTE A (page 10), swap in a known good Power Logic board board then see part b.

b) Repeat procedure number P- H.4.1 (page 682) to watch **5V Est** AND/OR **12V Est.**. ALLOW SUFFICIENT TIME for symptom to reoccur! If it does see part c.

c) Referring to OPERATING MODES (page 19), place the machine into **T and C mode**;

d) Swap in a known good Sensor board*. *To LOCATE the board refer to Figure 4A (page 10)

e) Repeat procedure number P- H.4.1 (page 682) to watch **5V Est** AND / OR **12V Est.**. ALLOW SUFFICIENT TIME! If the problem reoccurs proceed to **page 659**, procedure number P- G.5.0.

**P- H.4.5 ISOLATE +24 VOLT- A**

a) **ENSURE the black lead remains attached to ground!**

b) ENSURE the machine is ON (fan running)!

c) **Figure below**, locate the UI-MICS board's 'J14' connector at the top edge of the UI-MICS board.

d) Place the red meter lead onto the 'J14' pin AS SHOWN below. TWO (2) possible scenarios:

**Scenario #1:** **IF (and ONLY if) NOT between 23.0 and 28.0 volts DC ($V_{DC}$):** Proceed to **page 708**, procedure number P- 4.0.0.

**Scenario #2:** **IF between 23.0 and 28.0 volts DC ($V_{DC}$).** TWO (2) possible scenarios 1) or 2) below:

1) **IF (and ONLY if voltage alarm has NEVER occurred but "Failed Sending Data…" has:** The most likely culprit is the Actuator-Test Board HOWEVER if Failed Sending Data…" reoccurs any one of the card cage boards may be interfering with the communication between the Actuator-Test and the Functional Boards.

2) **ALL OTHER scenarios: A)** To measure voltage over a period of time now CLIP the red meter lead onto the 'J14' pin; **B)** See procedure number P- H.4.6 (page 684).

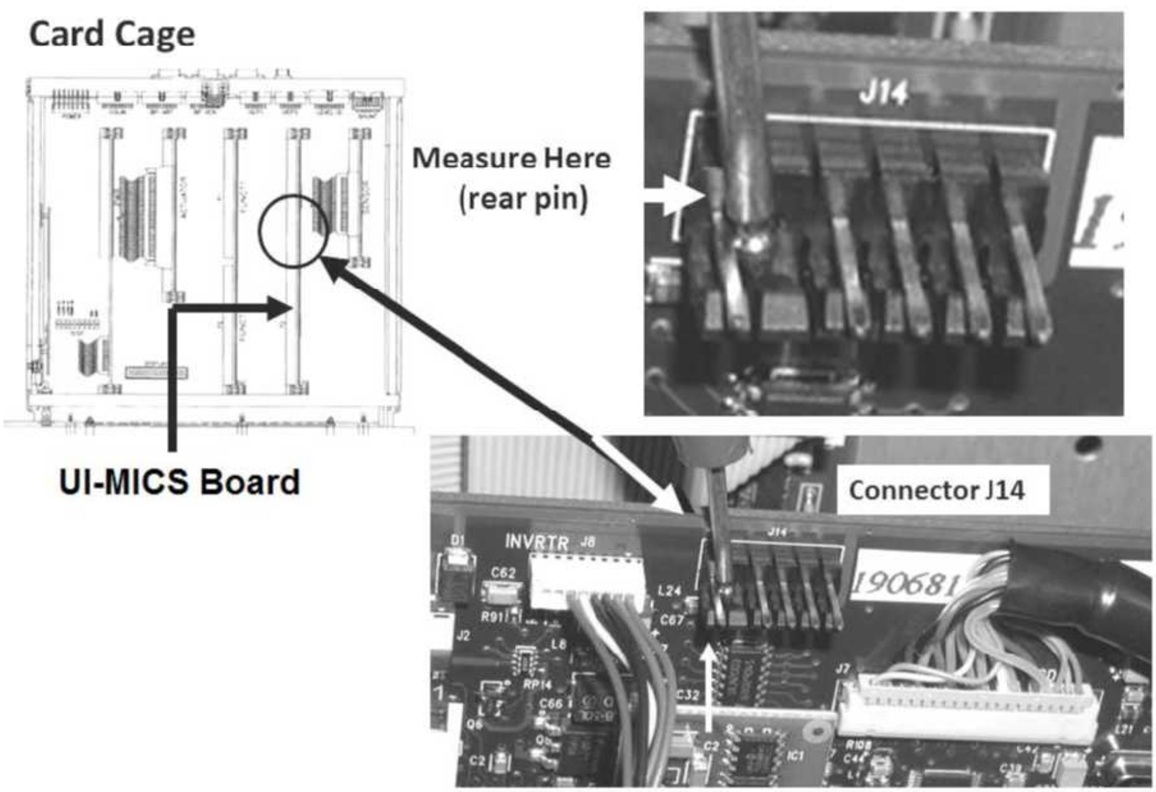



**Figure 119 – UI-MICS Board Connector J14 / +24V-A**

## P- H.4.6 BETWEEN 23.0 AND 28.0 VOLTS / MONITOR 24 VOLTS

a) With the “Select Program” banner up press the ‘Dialysis’ button but **DO NOT** press ‘Enter’ OR “CONFIRM’ yet!

b) Call debug screen 10. Figure right, the **24V** window is the ‘real time’ reading from the +24 volt DC supply. The **HI** and **LO** windows record the highest and lowest starting one (1) minute after the machine is turned on. **Initially all windows = 0.0 then update after ONE (1) MINUTE!**


c) At the bottom of the screen, press the ‘Dialysate’ tab .

d) Press ‘Enter’ to return to Dialysis Program!

e) Call debug screen 10. The **24V** window IS NORMALLY UNSTABLE but a problem does not occur unless it falls below 23.0 volts or rises above 28.0 volts for eight (8) seconds.

f) WITHOUT LOOKING AWAY, watch the volt meter for ten (10) minutes. Does the MEASUREMENT become unstable (i.e. change more than +/- 0.5) OR does the symptom you were troubleshooting reoccur?

Yes Measurement unstable and / or symptom reoccurs! See procedure number P- H.4.7.1 (page 684).

No Measurement stable AND the symptom does NOT reoccur! Proceed to **page 685**, procedure number P- H.4.8.

## P- H.4.7.1 UNSTABLE MEASUREMENT OR SYMPTOM REOCCURS

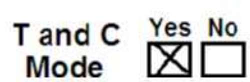
TWO (2) possible scenarios based on the stability of the MEASURED voltage:

**1) IF MEASURED voltage became UNSTABLE:** Proceed to **page 708**, procedure number P- 4.0.0.

**2) IF MEASURED voltage remained STABLE:** Perform parts A THROUGH F below:

A) Place the machine into Service Mode → Options → Hardware Options.

B) Next to **T and C Mode** place the ‘X’ in the “Yes” box and press the ‘Enter’ key. The ‘X’ MUST turn blue! This prevents a “COND OFFSET FAILURE” from occurring!




C) With the machine off, one at a time, swap in the card cage circuit boards with known good, (starting with the Actuator-Test Board) then continue to part D to see if the new board fixes the problem. **NOTE!** If equipped with a bibag Connector include the Interface board***** among the boards swapped in. ***** To LOCATE the Interface board refer to Figure 4C (page 11)

D) Turn the machine on but but **DO NOT** press ‘Enter’ OR “CONFIRM’ yet.

E) Return to (ABOVE) procedure number P- H.4.6 (**page 684**).

F) After replacing ALL boards if the problem reoccurs proceed to **page 708**, procedure number P- 4.0.0.

## P- H.4.8 REMAINS STABLE AND NO ALARMS OCCUR / HEAT-RELATED PROBLEM?

a) Place the machine into Heat Disinfect then call debug screen 10. If debug does not appear press 'Esc' then call screen 10.

b) WITHOUT LOOKING AWAY, watch the the meter AND the **24V HI AND LO** windows until if the symptom you were troubleshooting reoccurs.

c) Does the MEASUREMENT become unstable and / or does the symptom you were troubleshooting reoccur before Heat Disinfect finishes?

Yes Symptom reoccurs! See procedure number P- H.4.9 (page 685).

No Symptom DOES NOT reoccur! Return to Dialysis Program and allow sufficient time for the symptom to reoccur. Does it (Yes or No)?

Yes With the machine off, one at a time swap in the card cage circuit boards, with known good (starting with the Actuator-Test Board). In between, repeat procedure number P- H.4.8 (page 685) to see if the new board fixes the problem. **NOTE!** If equipped with a bibag Connector include the Interface board* among the boards swapped in. After replacing ALL boards if the problem reoccurs proceed to **page 708**, procedure number P- 4.0.0.

***** To LOCATE the Interface board refer to Figure 4C (page 11)

No The Troubleshooting Guide cannot locate the problem that caused the problem you were troubleshooting.

## P- H.4.9 UNSTABLE OR SYMPTOM REOCCURS / ANALYZE PROBLEM

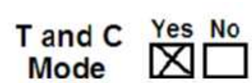
TWO (2) possible scenarios, based on MEASURED voltage:

**1) IF (and ONLY if) MEASURED voltage became UNSTABLE:** Proceed to **page 708**, procedure number P- 4.0.0.

**2) IF MEASURED voltage remained STABLE:** Perform parts A THROUGH E below:

A) Place the machine into Service Mode → Options → Hardware Options.

B) Next to **T and C Mode** place the 'X' in the "Yes" box and press the 'Enter' key. The 'X' turns blue. This prevents a "COND OFFSET" alarm from occurring!

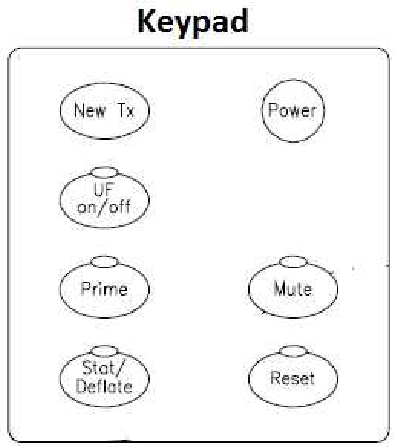



C) With the machine off, one at a time, swap in the card cage circuit boards, with known good, starting with the Actuator-Test Board then continue to part D to see if the new board fixes the problem. **NOTE!** If equipped with a bibag Connector include the Interface board***** among the boards swapped in. *****To LOCATE the Interface board refer to Figure 4C (page 11)

D) Return to Heat Disinfect and allow sufficient time for the symptom you were troubleshooting to reoccur. If it does swap in the next card cage board until it DOES NOT reoccur.

E) After replacing ALL boards, if the symptom you were troubleshooting reoccurs, proceed to **page 708**, procedure number P- 4.0.0.

**P- 1.0.0 MACHINE NEVER TURNS ON (FAN NEVER RUNS)**

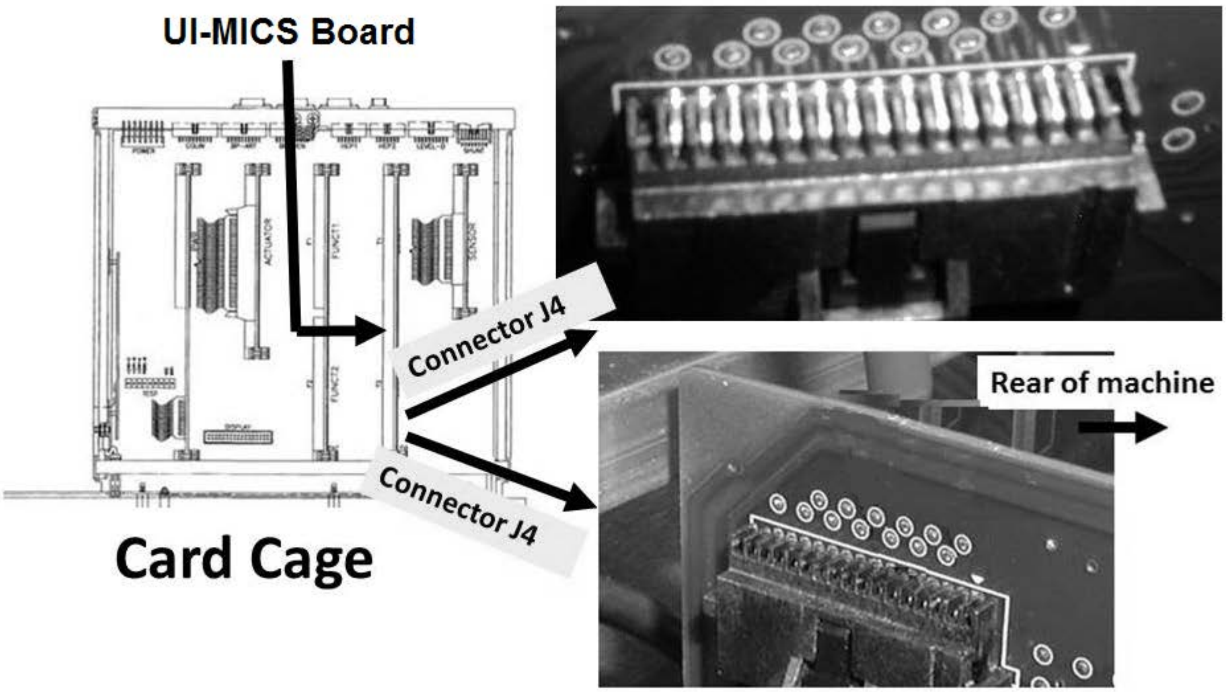



a) To avoid pulling cables loose GENTLY open the card cage.

b) Figure below, locate the UI-MICS board's 'J4' Connector on the rear (solder) side at the top, front edge of the board.

c) Figure right, ENSURE the keypad's green ribbon cable is plugged in securely at 'J4'!

d) Push the UI-MICS board down <u>HARD</u> to ENSURE a good connection to the motherboard!




e) Push the Power button. Does the machine turn on <u>AND REMAIN</u> on (fan running) now?

Yes Machine turns on and REMAINS on! Allow adequate time to see if the machine turns itself off. If (and ONLY if) it DOES turn off proceed to **page 706**, procedure number P- 3.0.0.

No Machine does <u>NOT</u> turn on! See parts a THROUGH d below:

a) **Set your CALIBRATED volt meter to DC voltage ($V_{DC}$)!**

b) **Connect the black lead to chassis ground (see Figure 2 (page 4)).**

**Parts c and d next page**

c) Per the Figure below, locate regulator **T1** at the TOP EDGE of the Power Logic Board. TWO (2) measurements may be made depending on the first!

d) **MEASUREMENT #1:** From the REAR side of T1's **TOP pin** (pin 1, see Figure). TWO (2) possible scenarios:

1) **IF (and ONLY if) more than 10.0 volts DC:** The white fuses are okay! See procedure number P- 1.0.1 (page 687).

2) **IF LESS THAN 10.0 volts DC (most likely way less):** Proceed to **page 693**, procedure number P- 1.1.02.

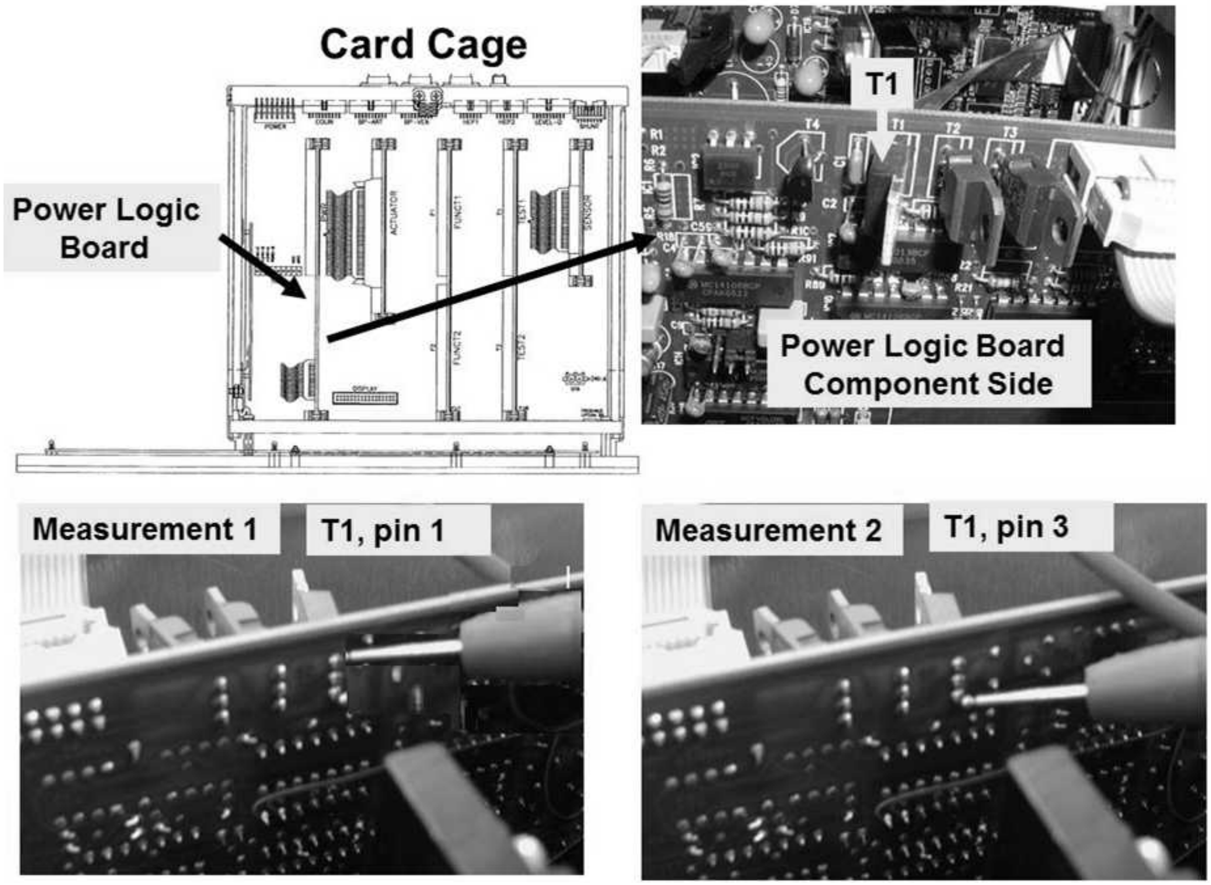



**Figure 120 – Power Logic Board (T1)**

## P- 1.0.1 TOP PIN MORE THAN 10 VOLTS / MEASUREMENT #2

**MEASUREMENT #2:** From the rear side of T1's **BOTTOM pin** (pin 3, see Figure). TWO (2) possible scenarios:

1) **IF (and ONLY if) more than 4.0 volts DC:** See procedure number P- 1.0.2 (page 688).

2) **IF NOT more than 4.0 volts DC:** The Power Logic Board is bad.

## P- 1.0.2 ISOLATE POWER ON/OFF CIRCUIT

a) Per the Figure below, locate IC2 at the top edge of the Power Logic Board.

b) Under IC2 are three (3) resistors, top to bottom, R8, R9 and R10.

c) Under R10 and slightly to the right locate resistor **R91**.

d) Measure from the right side of **R91**, AT THE LOCATION SHOWN. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) between 4.0 and 6.0 volts:** Proceed to **page 690**, procedure number P- 1.0.4.

**2)** **IF NOT between 4.0 and 6.0 volts!** See procedure number P- 1.0.3 (page 689).

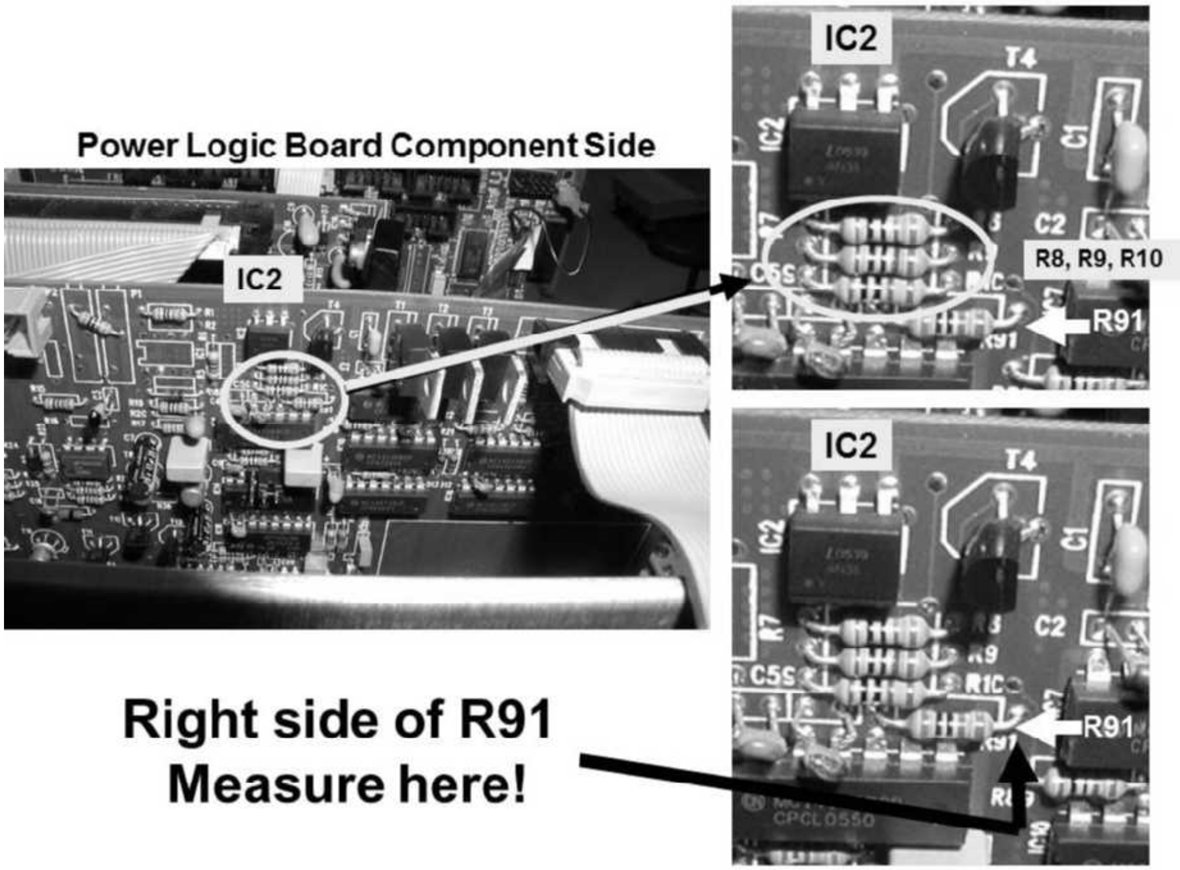



**Figure 121 – Resistor (R91)**

**P- 1.0.3 NOT BETWEEN 4.0 AND 6.0 VOLTS / ISOLATE KEYPAD'S POWER SWITCH**

a) Figure below, unplug the keypad's green ribbon cable from the UI-MICS board's J4 connector.

b) Measure again at **R91**, at the location shown in Figure 121 (previous page). TWO (2) possible scenarios:

**1)** **IF (and ONLY if) between 4.0 and 6.0 volts:** The keypad is bad.

**2)** **IF <u>NOT</u> between 4.0 and 6.0 volts:** See procedure number P- 1.0.3.2 (page 689).

.

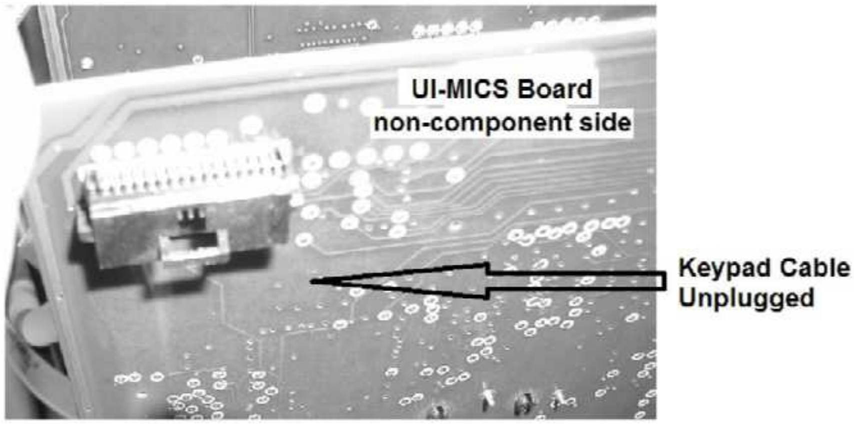



**Figure 122 – Keypad's J4 Cable Unplugged**

**P- 1.0.3.2 NOT BETWEEN 4.0 AND 6.0 VOLTS**

a) Unlock the UI-MICS board THEN pull it ½ up i.e. remove it from its motherboard connector.

b) Measure again at **R91**, per Figure 121 (previous page). TWO (2) possible scenarios:

**1)** **IF (and ONLY if) between 4.0 and 6.0 volts:** The UI-MICS board is bad!

**2)** **IF <u>NOT</u> between 4.0 and 6.0 volts:** See parts a AND b below:

a) Swap in a <u>known good</u> Power Logic board (<u>known good</u> = from another machine that is turning on)!

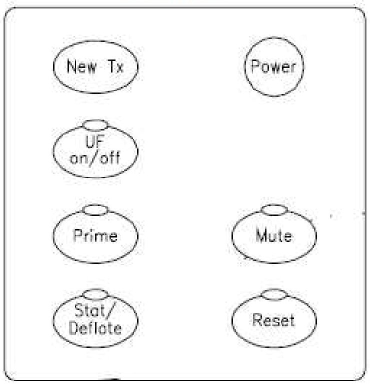
b) **ENSURING the black lead remains connected to ground**, measure again at **R91.** Between 4.0 and 6.0 volts DC now?

Yes You should be able to turn the machine on now! The previous Power Logic board is bad!

No NOT between 4.0 and 6.0 volts AND the machine will still not turn on! The motherboard is bad.

## P- 1.0.4 R91 BETWEEN 4.0 AND 6.0 VOLTS / ISOLATE KEYPAD'S POWER KEY

Keypad




a) Continuing to measure at resistor **R91** press and release the Power button (Figure right) two (2) or three (3) times.

b) Does voltage drop to LESS THAN 0.5 volts DC WHILE THE BUTTON IS PRESSED?

Yes Drops to LESS THAN 0.5 volts! The Power button is okay. See procedure number P- 1.0.5 (page 690).

No Does NOT drop to less than 0.5 volts! THREE (3) possible bad components: **1)** Most likely, bad keypad (Figure right); **2)** Bad UI-MICS board; **3)** Bad motherboard.

## P- 1.0.5 POWER BUTTON OKAY / ISOLATE POWER LOGIC BOARD

a) Unplug the machine then plug it back in but **DO NOT** press the Power button yet!

b) Figure below, locate the Power Logic Board's 20-pin X2 ribbon cable at the front, top edge of the board nearest the screen.

c) Measure at the rear side of the X2 cable at *pin 3* (bottom row, second pin from the rear of the machine). TWO (2) possible scenarios:

**1) IF (and ONLY if) MORE THAN 6.0 volts:** See procedure number P- 1.0.6 (page 691).

**2) IF LESS THAN 6.0 volts:** Proceed to **page 692**, procedure number P- 1.0.9.

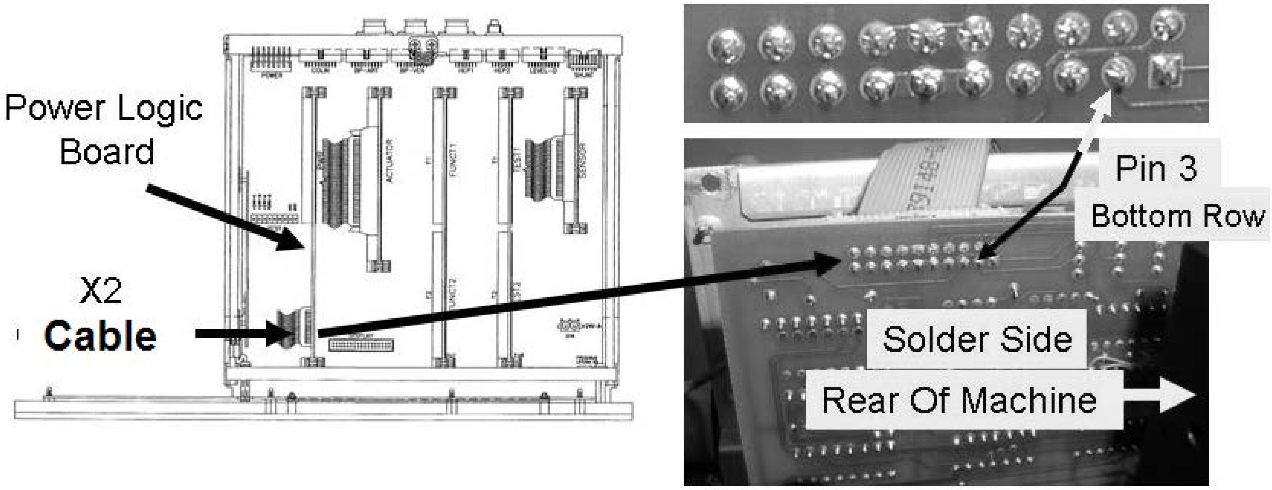



**Figure 123 – Power Logic Board / X2 pin 3**

## P- 1.0.6 X2 / PIN 3 MORE THAN 6.0 VOLTS / ISOLATE POWER LOGIC BOARD

Continuing to measure at X2, *pin 3* press and release the Power button. TWO (2) possible scenarios:

1) **IF (and ONLY if) goes to less than 1.4 volts DC:** See procedure number P- 1.0.7 (page 691).

2) **IF REMAINS more than 1.4 volts DC:** The Power Logic Board is bad.

## P- 1.0.7 ISOLATE FAN AIR OUTPUT i.e. IS THE MACHINE ON?

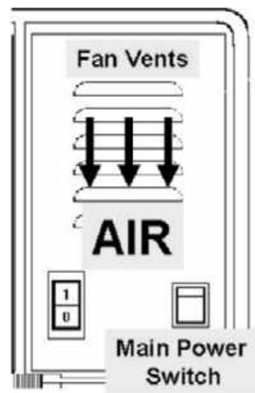



Figure right, is the fan running i.e. air felt from the fan vents?

Yes Fan running! The machine is on! See procedure number P- 1.0.8 (page 691).

No Fan is NOT running! Is the screen on OR is it remaining black (TWO (2) possible scenarios)?

1) **IF (and ONLY if) the screen is on:** The fan is bad!

2) **IF the screen is remaining black:** Unplug the machine and replace Main Relay K1***** AND its four pin cable.

***** To LOCATE K1 and its cable refer to Figure 132 (page 710).

.

## P- 1.0.8 FAN RUNNING / ISOLATE INTERMITTENT POWER ON PROBLEM

a) ENSURING the fan continues to run, if (and ONLY if) the screen REMAINS or turns BLACK after forty (40) seconds see (ABOVE) procedure number P- B.0.0 (**page 642**).

b) ENSURING the fan continues to run, allow adequate time to see if the machine turns itself off. If (and ONLY if) it does see procedure number P- 3.0.0 (**page 706**).

c) If the screen remains on address any alarm banners that appear.

## P- 1.0.9 X2 / PIN 3 LESS THAN 6.0 VOLTS / ISOLATE MAIN RELAY (K1)

a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocution hazard if not unplugged!**

b) Slide the power supply away from the cabinet to see the Power Control board.

c) ENSURE the cables, along the top edge of the board, are plugged in securely. **If not this may be the problem!**

d) Figure right, remove the two (2) **front** screws and lay power supplies rear panel down

e) To access to the rear (solder) side of the board un-mount it from its four plastic clips.

f) **Plug the machine in. CAUTION! High voltage now present!**

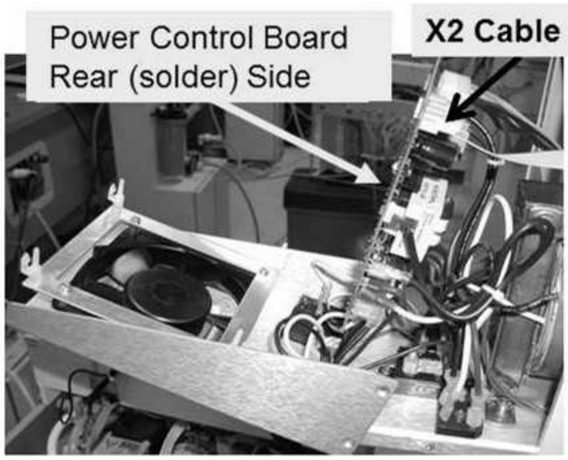



**Figure 124**

g) **Per the Figure below**, measure from the rear side of the Power Control board's four-pin X3 connector at **pin 1**. More than 6.0 volts DC?

Yes More than 6.0 volts! TWO (2) possible bad components: **1)** Most likely the twenty-pin Power Logic cable (X2) OR; **2)** Main Relay K1[1] OR possibly its four-pin cable[1].

No Less than 6.0 volts! Unplug the machine then TWO (2) possible bad components: **1)** Most likely, bad main Relay K1 (possibly it four-pin cable)[1] OR **2)** Bad Power Control board.

[1] To LOCATE K1 and its cable refer to Figure 132 (page 710).

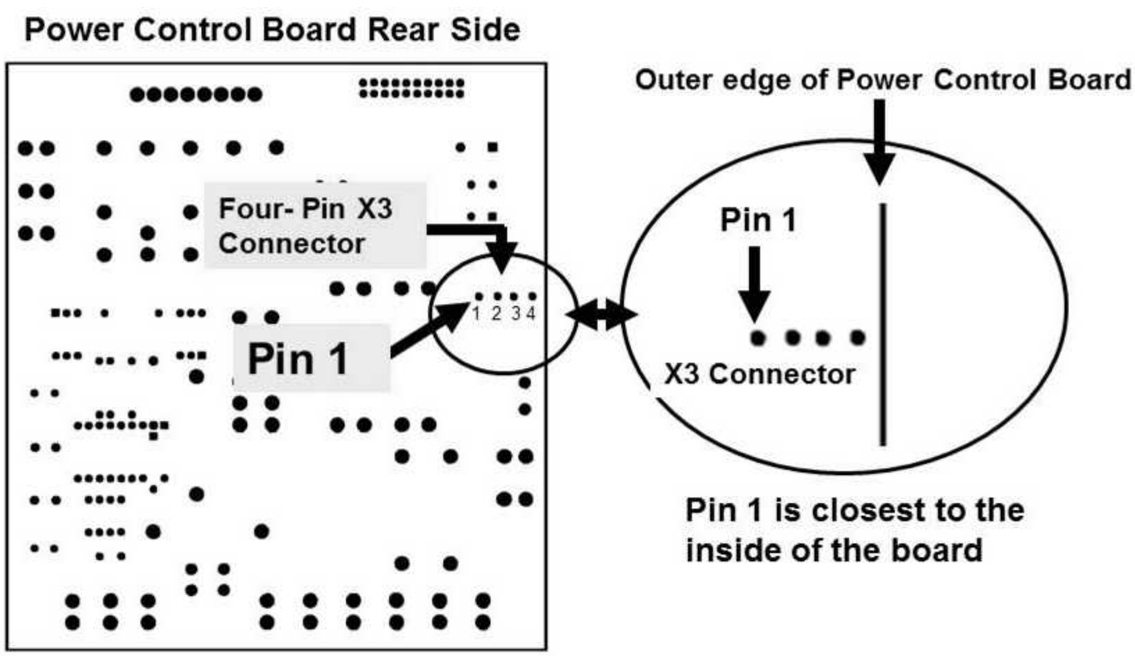



**Figure 125 – Power Control Board / X3 Connector, Pin 1**

## P- 1.1.02 ISOLATE POWER LOGIC BOARD CABLE (PIN 4)

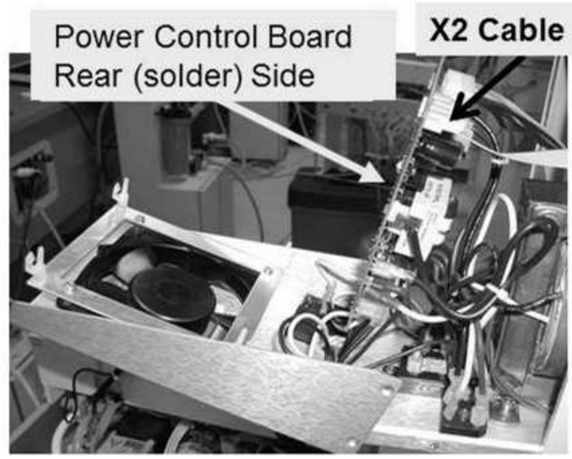
a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocution hazard if not unplugged!**

b) Slide the power supply away from the cabinet to see the Power Control Board.

c) ENSURE ALL cables are plugged in securely. **If not, this may be the problem!**

d) Figure right, un-mount the board from its white plastic clips.

e) Remove the two **front** screws and lay the rear power supplies panel down to access to the rear (solder) side of the X2 cable.




f) **Plug the machine in! CAUTION! High voltage now present!**

g) **Per the Figures below**, measure DC voltage **($V_{DC}$)** at the rear (solder) side of the Power Control board's X2 connector, at ***pin 4*** (BOTTOM row, SECOND pin from the left).

h) More than 10.0 volts DC?

Yes More than 10.0 volts! TWO (2) possible bad components: **1)** Bad 20-pin Power Logic ribbon cable (X2) OR; **2)** Bad Power Control board.

No Less than 10 volts! See procedure number P- 1.2.0 (page 694).

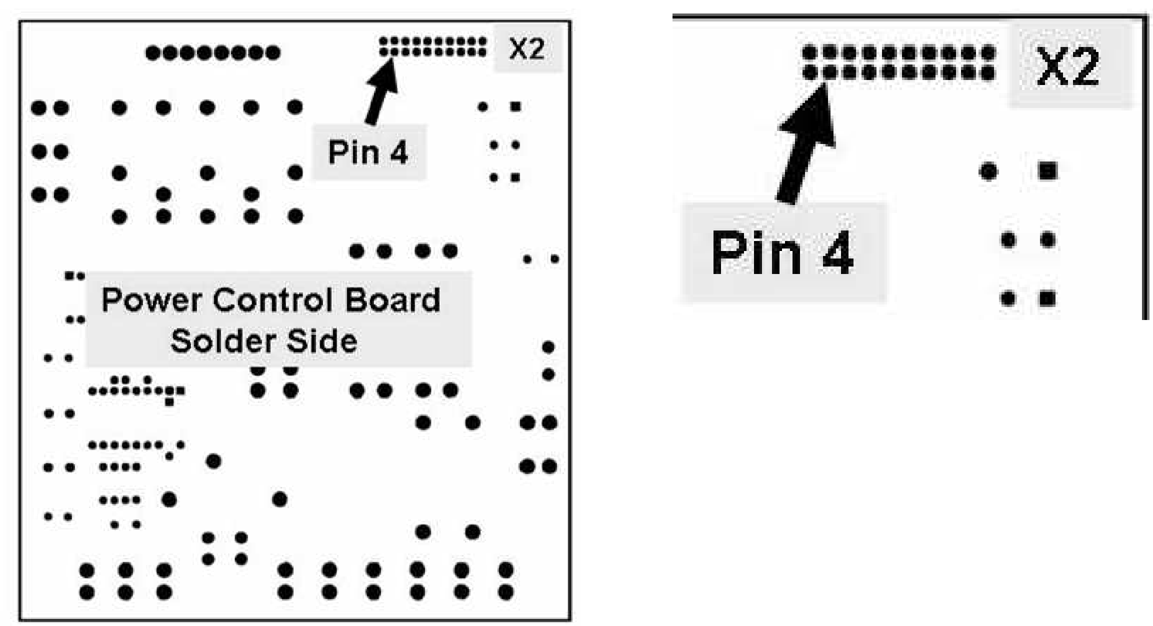



**Figure 126 – Power Control Board Solder Side**

**P- 1.2.0 PIN 4 LESS THAN 10 VOLTS / ISOLATE MAIN LINE FUSES 6.3 AMP FUSES**

a) **Unplug the machine**! **CAUTION!** Electrocution hazard if not unplugged!

b) **Set your CALIBRATED volt meter to RESISTANCE (Ω)!**

c) To determine the meter's resistance touch its leads together. The meter MUST read less than 0.3 **Ω**! Subtract this reading from subsequent measurements!

d) On the Power Control board, **Figure below**, measure **ACROSS BOTH** 6.3 Amp fuses. **NOTE! "OL" = bad fuse!**

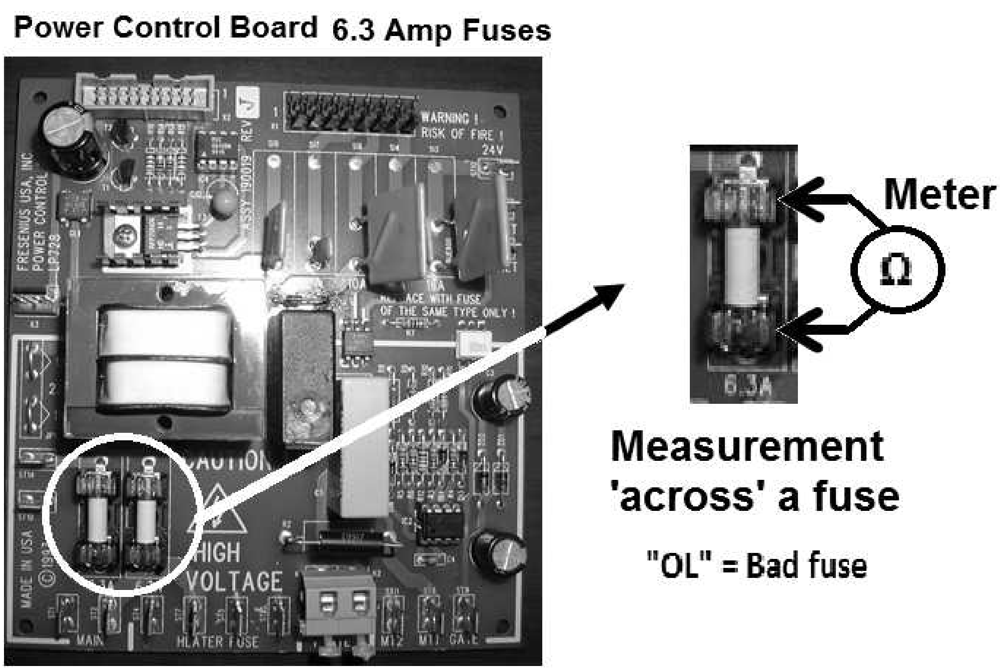



**Figure 127 – Power Control Board / Fuses S12 and S16 / ST2 and ST1**

e) Are BOTH fuses less than 1.0 **Ω**?

Yes BOTH less than 1.0 Ω! See procedure number P- 1.2.1 (page 694).

No One or both fuses "OL" OR MORE THAN 1.0 Ω! Proceed to **page 696,** procedure number P- 1.2.2.

**P- 1.2.1 BOTH FUSES LESS THAN 1.0 Ω / ISOLATE INCOMING (LINE) VOLTAGE**

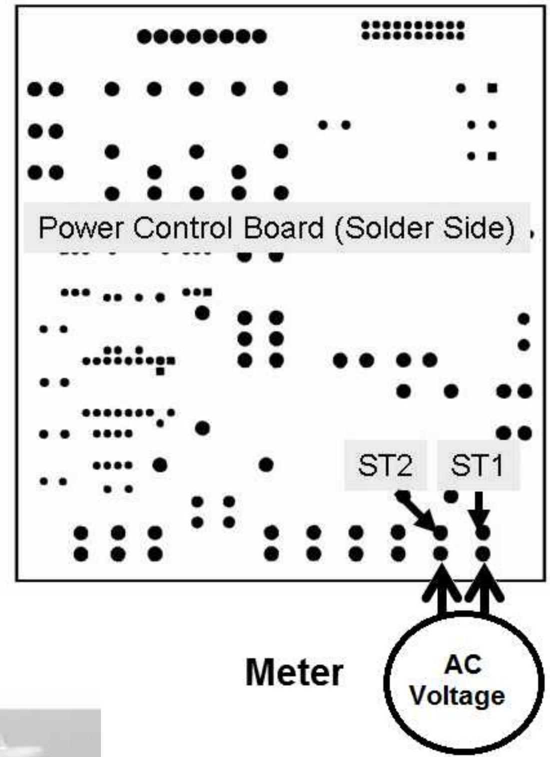
a) Plug the machine in. **Caution! High Voltage now present!**

b) ENSURE the Power Supply's Main Power Switch is **ON** (i.e. rocker switch pushed into the "1" position)!

**Parts c through e next page**

c) **Set your volt meter to measure AC (~) voltage**

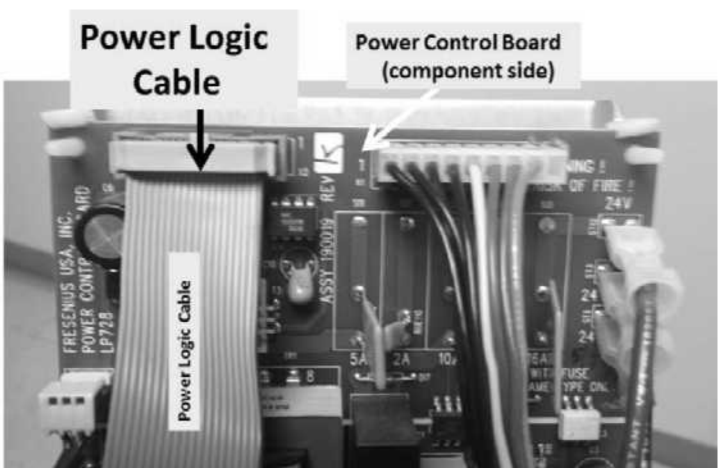
d) As seen in the Figure right, measure at the solder side of the Power Control Board, BETWEEN ST1 and ST2. This is the power cord after the Main Power Switch.




e) More than 100.0 volts AC (Yes or No)?

Yes — More than 100 volts AC! Figure below, ENSURE the Power Logic Cable is plugged in securely AND is NOT damaged! If okay, and the machine still will not turn on the Power Control board may be bad.

No — Less than 100 volts AC! TWO (2) possible bad components: **1)** Bad power cord/plug; **2)** Bad Main Power Switch at the Power Supply.

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## P- 1.2.2 FUSE(S) "OL" OR MORE THAN 1Ω / TROUBLESHOOT BAD FUSES

a) Replace the bad 6.3 Amp fuse(s) with the new***** 'slow blow' fuses approved in 2016. Call Technical Servces (1-800-227-2572), if necessary, to ENSURE you have the new fuses i.e. correct part number!

*** NOTE!** The 'slow blow' fuses should remedy the majority of fuse problems!

b) **Plug the machine in!**

c) Push and hold the Power button for two (2) seconds. Does the machine turn on now (fan running)?

Yes Machine turns on! Problem solved. The fuse(s) were bad.

No Does NOT turn on! See parts a THROUGH d below:

a) **CAUTION!** To prevent damage, unplug **the machine**.

b) Measure resistance (Ω) across the fuses again. If one or both are bad then one of the diodes inside Main Bridge Rectifier (BR1)[1] may be bad and destroying the fuse(s).

[1] To LOCATE BR1 refer to Figure 132 (page 710).

c) Diode check[2] or replace the Main Bridge Rectifier (BR1).

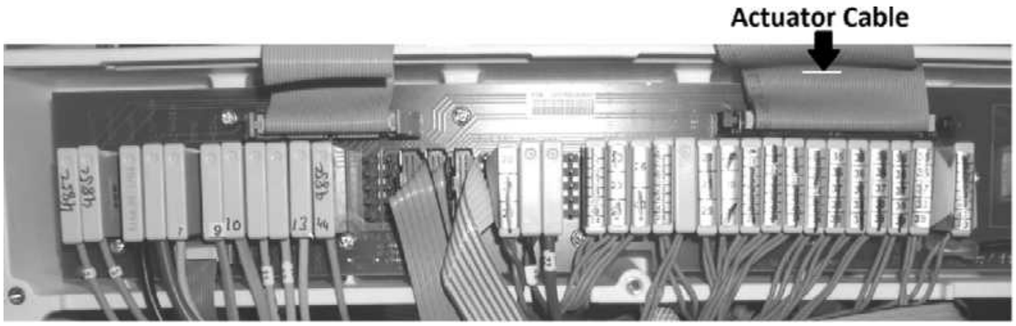
[2] **NOTE: All Bridge Rectifier wires must be unplugged before performing a diode check. The wires are position sensitive. RECORD where they plug into BEFORE unplugging to prevent damage!**

d) If the Bridge Rectifier checks good, or was previously replaced and the fuse(s) continue to 'blow' immediately proceed to **page 708**, procedure number P- 4.0.0.

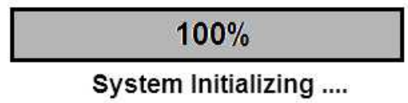
**P- 2.0.0 INITIALIZATION DOES NOT COMPLETE / ISOLATE PUMPS**

a) **To prevent damage, turn the machine OFF!**

b) Figure below **unplug the ACTUATOR CABLE** from the distribution board.




c) Turn the machine on (fan running). Does System Initialization reach 100%?




Yes System Initialization reaches 100%! See **ISOLATING THE PUMPS** this page.

No System Initialization does NOT reach 100%! See procedure number P- 2.0.1 (page 698).

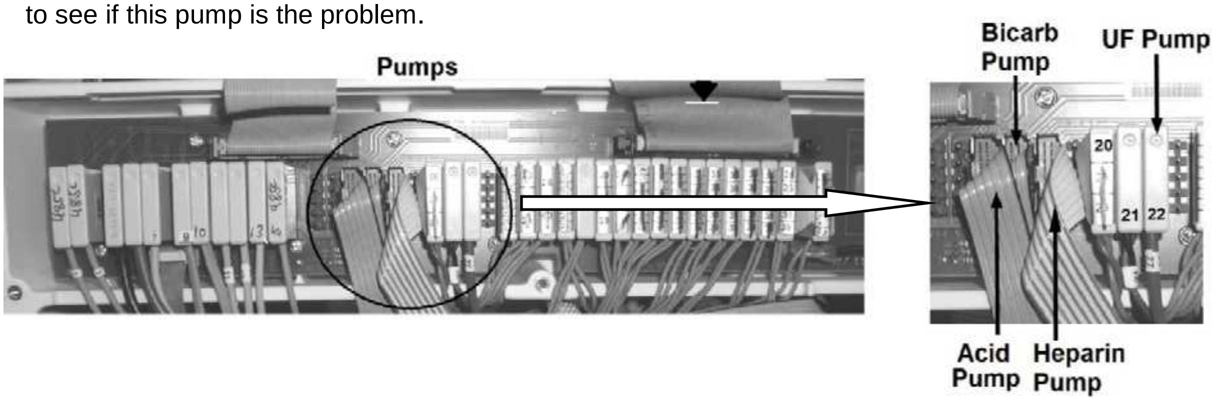
## ISOLATING THE PUMPS

Possible 24 volt 'short circuit' at the Acid, Bicarb, Heparin OR UF Pump.

A) **Turn the machine OFF!**

B) **Reconnect the ACTUATOR cable!**

C) Figure below, from the distribution board, unplug one of the pumps (your choice) then continue to part C to see if this pump is the problem.




D) Turn the machine on (fan running). Does System Initialization reaches 100%?

Yes System Initialization reaches 100%! The unplugged pump may be causing the problem! To confirm this turn the machine off, plug the pump back in, and turn the machine on. If System Initialization does NOT reach 100% the pump is bad.

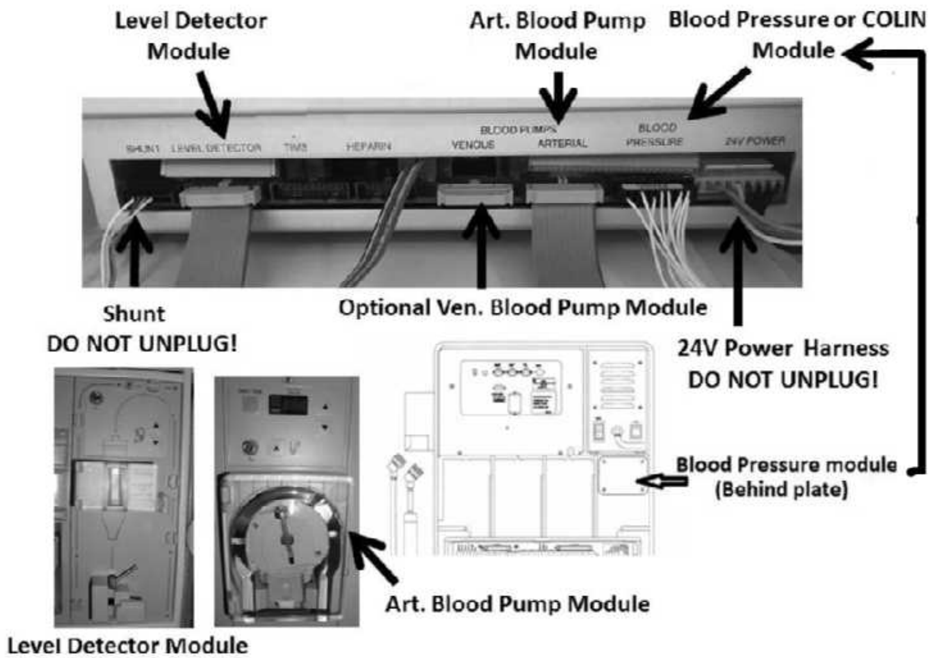
No System Initialization does NOT reach 100%! Turn the machine off and repeat parts B AND C until System Initialization DOES reach 100%. If after ALL pumps have all been unplugged and System Initialization still does NOT reach 100% the Actuator Cable OR the distribution board may be bad.

**P- 2.0.1 SYSTEM INITIALIZATION DOES NOT REACH 100%**

a) **To prevent damage, turn the machine OFF!**

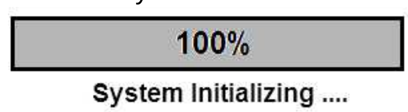
b) **Reconnect the ACTUATOR cable!**

c) **Figure below**, unplug **ALL MODULES ONLY** including the Blood Pressure module! **DO NOT unplug the 24V Harness or shunt!**




d) From here forward, ignore “Art BP No Comm” OR “Blood Still Sensed!” if they occur!

e) Turn the machine ON (fan running). Does System Initialization reach 100%?




Yes System Initialization reaches 100%**!** See **ISOLATING THE MODULES** this page.

No System Initialization does NOT reach 100%! See procedure number P- 2.0.2 (page 699).

## ISOLATING THE MODULES

A) **Turn the machine OFF!**

B) Your choice, plug one of the modules back in TO WHERE IT BELONGS*****.

*** CAUTION! Damage may occur if any module is reverse connected with another. NEVER plug the Blood Pressure module in with the machine on!**

C) Turn the machine on (fan running).

D) Repeat parts A through D until System Initialization DOES NOT reach 100% indicating the last module plugged in (or its cable) is causing the problem. If after plugging in ALL modules and System Initialization reaches 100% either one of the modules was originally plugged in wrong OR the problem may be heat related and requires running the machine in Heat Disinfect to locate it.

## P- 2.0.2 SYSTEM INITIALIZATION DOES BOT REACH 100% / ISOLATE +24 V-A

a) **ENSURE the meter's black lead REMAINS attached to chassis ground!**

b) **Per the Figure below**, locate the UI-MICS board's J14 connector at the top edge of the board.

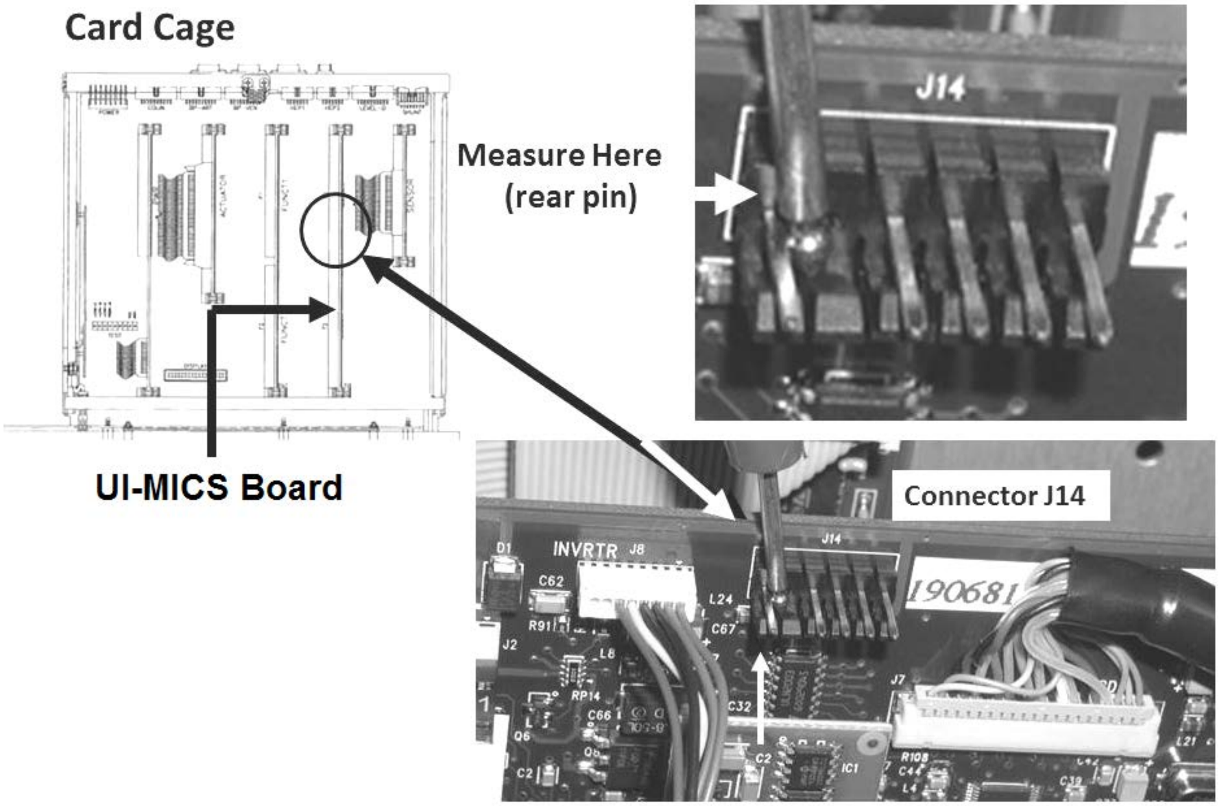



**Figure 128 – Card Cage (UI-MICS Board, J14, PIN 1)**

c) **Turn the machine is ON (fan running)!**

d) Measure at the J14 pin as seen in the Figure above. Between 23.0 and 28.0 volts DC AND STABLE i.e. does NOT change more than +/- 0.5 per minute?

Yes  Between 23.0 and 28.0 volts and stable! See procedure number P- 2.0.3 (page 700).

No  NOT between 23.0 and 28.0 volts OR unstable! See parts A and B below:

A) ENSURE the UI-MICS board is inserted tight into its motherboard connector. If not this may be the problem!

B) If the board was inserted tight, proceed to **page 708**, procedure number P- 4.0.0.

**P- 2.0.3 ISOLATE 'SWITCHED' 24 V-B**

a) **TURN THE MACHINE OFF!**

b) **Figure below**, locate the **Functional Board's** six-pin P4 connector at the top front edge of the board, closest to the screen.

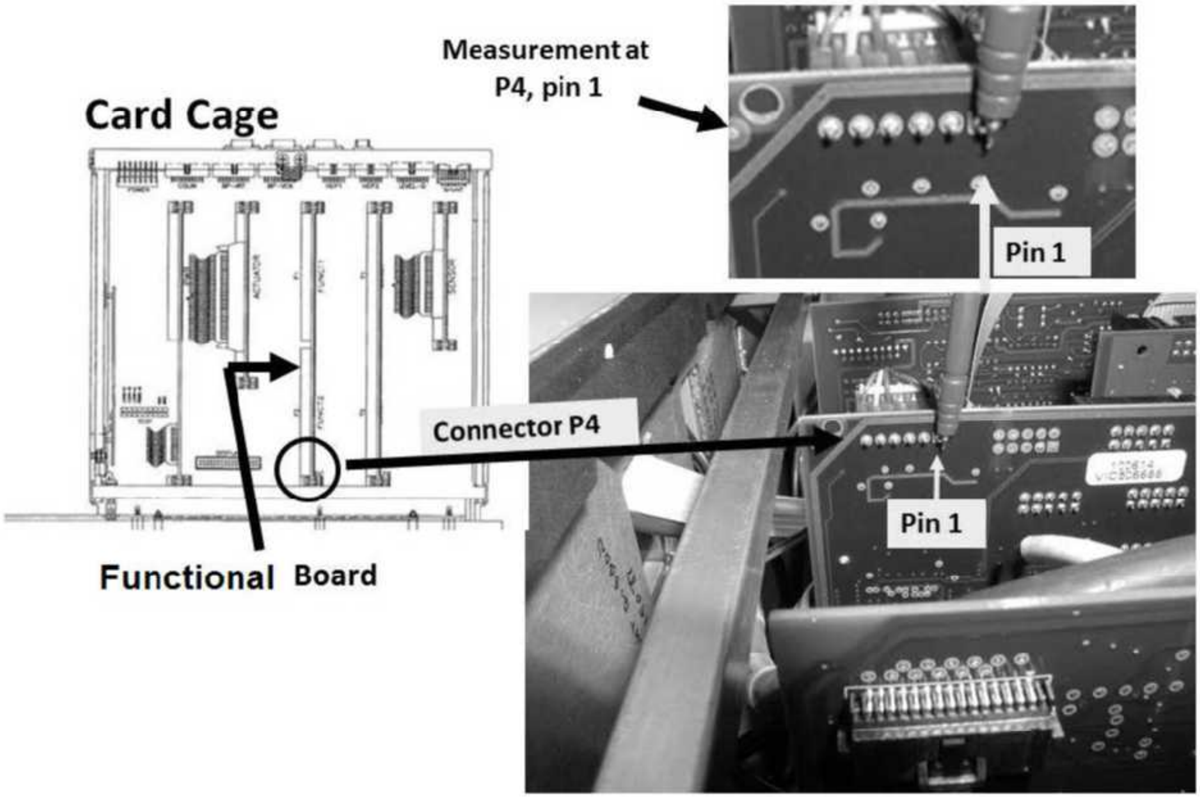



**Figure 129 – Functional Board +24 Volt-B Pin**

c) TIGHTLY HOLD the red meter lead on P4's **pin 1** (see Figure above, rear pin).

d) Looking for approximately 24.0 volts to momentarily pulse on and off more than once, turn the machine ON (fan running), then WITHOUT LOOKING AWAY FROM THE METER, watch it for thirty (30) seconds!

e) FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

**1) IF (and ONLY if) momentarily was more than 23.0 volts but after about thirty (30) seconds fell to AND remained less than 3.0 volts:** See procedure number P- 2.0.4 (page 701).

**2) IF (and ONLY if) ALWAYS less than 3.0 volts i.e. NEVER more than 23.0 volts** Leaving the machine ON, proceed to **page 702**, procedure number P- 2.0.5.

**Scenarios 3 and 4 next page**

**3)** **IF (and ONLY if) REMAINS BETWEEN 3.0 and 23.0 volts:** TWO (2) possibilities: **1)** Bad 24 volt switch (IC4)***** OR **2)** Bad thermal (BROWN) fuse S18

> ***** To LOCATE IC4 AND fuse S18 refer to Figure 132 (page 710). With the machine off, the fuse can be checked by measuring RESISTANCE (Ω) BETWEEN its two terminals. A good fuse measures less than 0.5 Ω

**4)** **IF AFTER thirty (30) seconds REMAINS between 23.0 and 28.0 volts:** Proceed to **page 683**, procedure number P- H.4.5.

## P- 2.0.4 MOMENTARILY MORE THAN 23.0 VOLTS DC

a) **Turn the machine OFF!**

b) ENSURE ALL card cage circuit boards are inserted tightly into their motherboard connectors. **If not this may be the problem!**

c) Swap in a known good Sensor board*. *To LOCATE the board refer to Figure 4A (page 10)

d) Turn the machine on. When “Press CONFIRM for Service Mode” appears press ‘Enter’. The screen says “Machine in Service Mode”.

e) Allow forty (40) seconds! Does the Main Service Program menu appear?

Yes — Main Service Program menu appears! The previous Sensor board may be bad! To confirm this: **A)** Turn the machine OFF; **B)** Put the original Sensor board back in; **C)** Turn the machine on and to go to Service mode. If the Main Service Program menu does DOES NOT appear the Sensor board is bad!

No — Main Service Program menu does NOT appear! See parts A through E below:

A) Turn the machine OFF!

B) One at a time, swap in the remaining card cage boards with known good, then continue to part C to see if the new board allows the Main Service menu to appear. **NOTE!** If the machine is equipped with a bi*b*ag Connector include the Interface board***** among the boards swapped in. *****To LOCATE the Interface board refer to Figure 4C (page 11)).

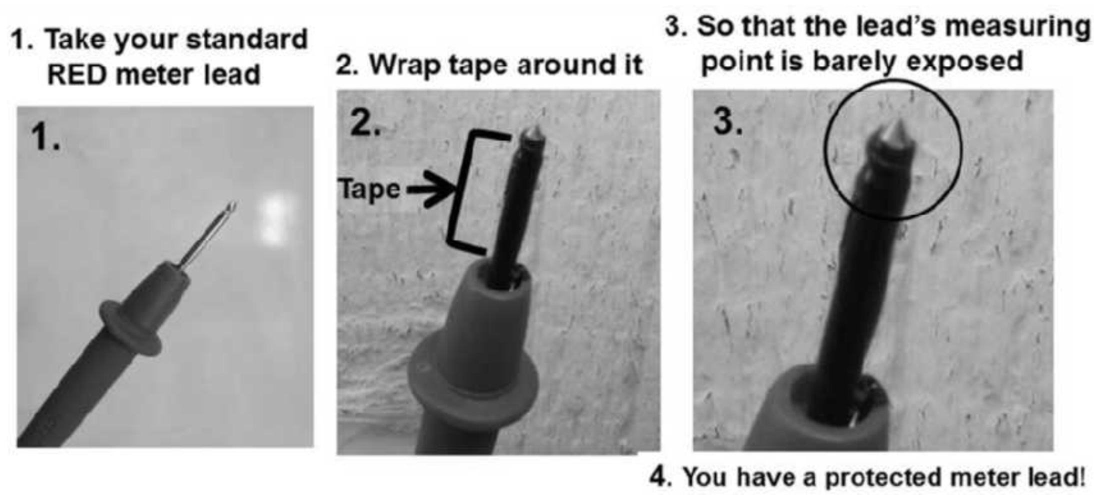
C) Turn the machine on. When “Press CONFIRM for Service Mode” appears press ‘Enter’.

D) If the Main Service Program appears the last board swapped in may be causing the problem. To confirm this: **A)** Turn the machine OFF; **B)** Put the original board back in. **C)** Turn the machine on and go to Service mode. If the Main Service Program menu DOES NOT appear the board is bad.

E) After replacing ALL boards if Main Service Program menu still DOES NOT appear proceed to **page 708**, procedure number P- 4.0.0.

## P- 2.0.5 ISOLATE POWER LOGIC CABLE

a) **CAUTION!** Signals are about to be measured at pins that are VERY close to others and touching them together with a standard meter lead **MAY CAUSE massive damage**! As directed below, make your RED meter lead PROTECTED! **DO NOT CONTINUE UNTIL YOU HAVE DONE THIS!**




b) **Per the Figure below**, at the top of the Power Logic Board, closest to the screen, locate its 20-pin 'X2' ribbon cable.

c) Measure at the rear (solder) side of the X2 connector at ***pin 1*** (bottom row, first pin from the REAR of the machine). More than 10.0 volts DC?

Yes More than 10 volts! See procedure number P- 2.0.6 (page 703).

No Less than 10 volts! Replace the 20-pin Power Logic X2 ribbon cable.

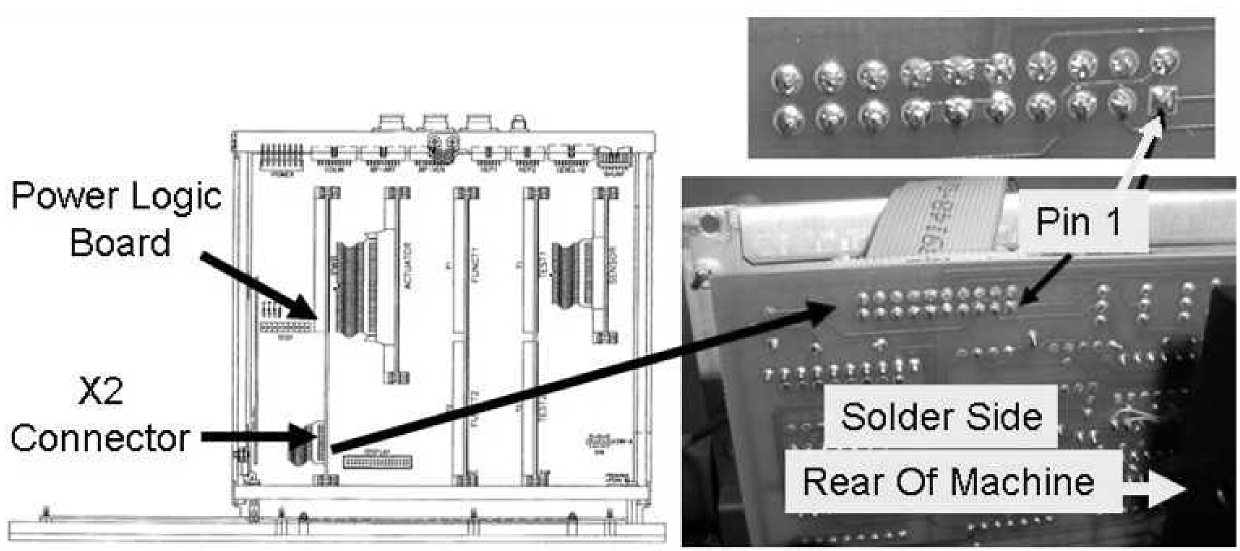



**Figure 130 – Electronic Card Cage / Power Logic Board / Pin1**

## P- 2.0.6 ISOLATE 24 VOLT SWITCH

a) **Turn the machine OFF!**

b) Per the Figure previuos page, **HOLD** the meter lead on the solder (rear) side of Power Logic Board's 'X2' connector, ***pin 1*** (bottom row, first pin from the REAR of the machine).

c) Looking for pin 1 to fall below 1.0 volts AT LEAST ONE (1) TIME, **WITHOUT LOOKING AWAY FROM THE METER**, turn the machine ON (fan running) and watch it for thirty (30) seconds!

d) TWO (2) possible scenarios:

1) **IF (and ONLY if) pin 1 REMAINED ALWAYS more than 10.0 volts i.e. NEVER fell to less than 1.0 volt.** Repeat procedure P- 2.0.6. If pin 1 STILL NEVER drops to less than 1.0 volt see procedure number P- 2.0.7 (page 704).

2) **IF, AT LEAST ONCE, pin 1 DID FALL to less than 1.0 volts:** If System Initialization DOES NOT reach 100%, TWO (2) possibilities: **1)** Bad 24 volt switch (IC4)***** on the Power Control Board (inside the power supply) OR; **2)** Bad thermal (BROWN) fuse S18*****

***** To LOCATE IC4 and fuse S18 refer to Figure 132, (page 710)

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**P- 2.0.7 ISOLATE 'WATCH DOG OUTPUT'**

a) **Turn the machine OFF!**

b) Per the Figure below, locate IC2 at the top edge of the Power Logic Board.

c) Under IC2 are three (3) resistors, top to bottom R8, R9 and R10.

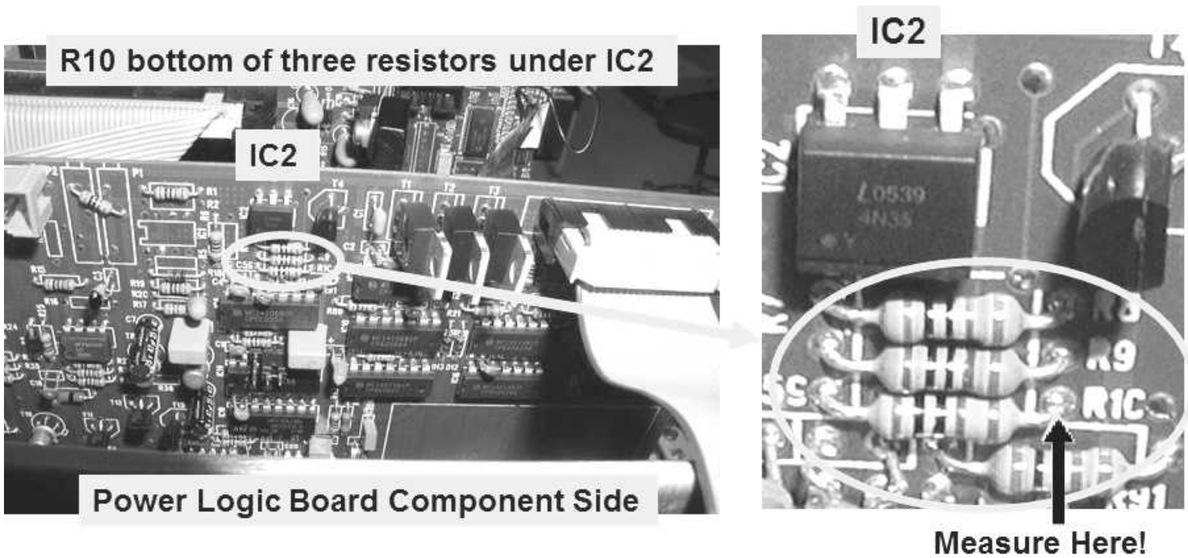



**Figure 131 – Power Logic Board/ R10**

d) HOLD the meter lead at resistor #10 (R10) at the location shown in the Figure above.

e) Looking for the measurement to more than 4.0 volts AT LEAST once**, WITHOUT LOOKING AWAY FROM THE METER**, turn the **machine ON (fan running)** and watch for thirty (30) seconds!

f) TWO (2) possible scenarios:

**1) IF (and ONLY if) the measurment IS NEVER more than 4.0 volts:** Repeat procedure P- 2.0.7. If still NEVER more than 4.0 volts see procedure number P- 2.0.8 (page 705).

**2) IF more than 4.0 volts at least once!** See parts A through D below:

A) Turn the machine OFF!

B) Swap in known good Power Logic Board*****. *****To LOCATE the board refer to Figure 4A AND NOTE A (page 10)

C) Turn the machine on (fan running).

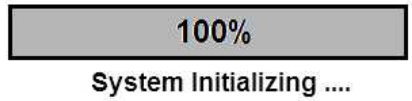
D) If System Initialization DOES NOT reach 100% see procedure number P- 2.0.8 (page 705). If System Initialization does reach 100% the previous Power Logic Board is bad!

**P- 2.0.8 ISOLATE ACTUATOR-TEST BOARD ‘SET’ SIGNAL**

a) **Turn the machine OFF!**

b) Swap in a known good Actuator-Test Board***. ***To LOCATE the Actuator-Test board refer to Figure 6 (page 22).

c) Turn the machine on (fan running) and allow forty (40) seconds. Does System Initialization reach 100%?




Yes System Initialization reaches 100%! The previous Actuator-Test Board is bad.

No System Initialization DOES NOT reach 100%! The previous Actuator-Test Board is good. THREE (3) possible bad components: **1)** Functional Board[1]; **2)** UI-MICS board; **3)** Motherboard. With the machine off, swap in each, one at a time, and repeat procedure P- 2.0.8 until System Initialization reaches 100% indicating the last component swapped in is the problem.

[1] To avoid “Cond Offset Failure”, place the machine into T and C mode! Refer to OPERATING MODES (page 19),

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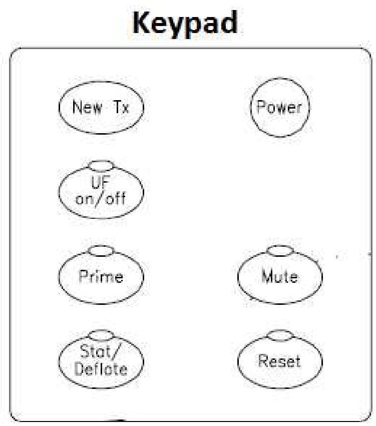
## P- 3.0.0 MACHINE TURNS ITSELF OFF



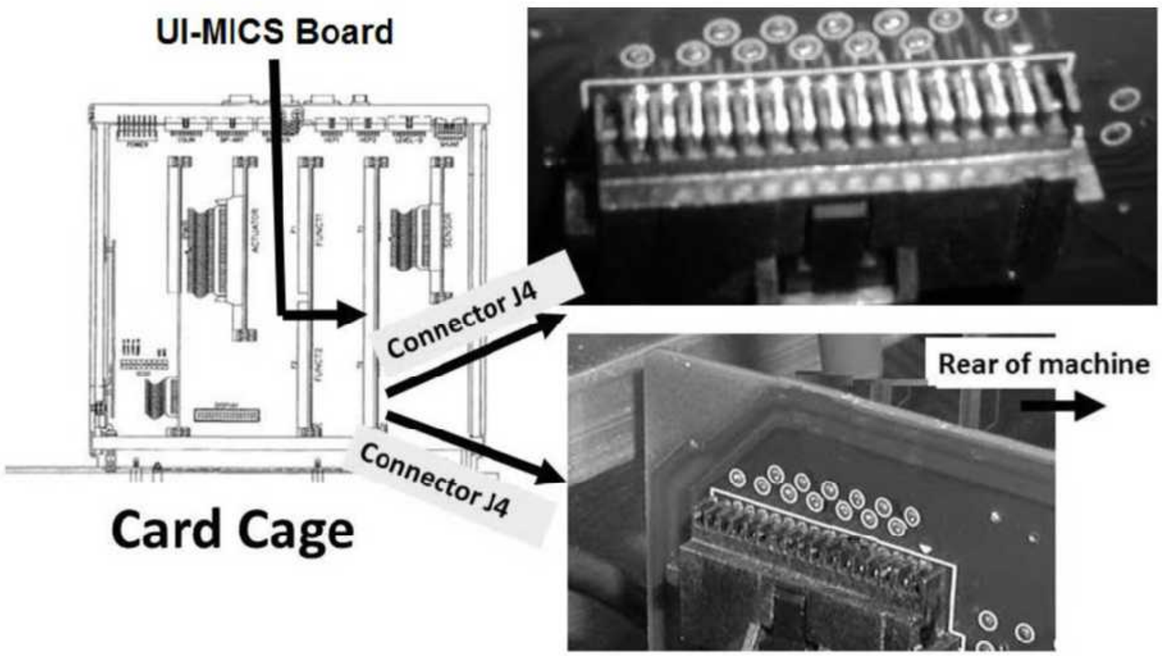

a) ENSURE the machine is OFF!

b) To avoid pulling cables loose GENTLY open the card cage.

c) Figure below, locate the UI-MICS board's J4 Connector, on the rear side of the board, near the top, front edge.

d) Figure right, ENSURE the keypad's green ribbon cable is plugged in securely!

e) Push the UI-MICS board down HARD to ENSURE a good connection to the motherboard!




f) Press the Power button. In an attempt to isolate the keypad, TWO (2) possible scenarios:

**1) IF the machine is REMAINING on (fan running) for at least thirty (30) seconds:** See procedure number P- 3.0.1 (page 707).

**2) IF the machine turns on (fan running) but turns itself off almost immediately:** The most likely cause of this is the keypad. Replace it HOWEVER, if the problem reoccurs see OTHER POSSIBILITIES below:

**OTHER POSSIBILITIES**: Swap in the following components (see Component List below) one at a time, with known good, and in between, if the machine remains on the last component swapped in was the problem!

**Component List:**

**1)** Power Logic Board; **2)** Power Logic Board cable; **3)** Main Relay (K1)*. *****To LOCATE K1 refer to Figure 132 (page 710).

## P- 3.0.1 REMAINIING ON FOR AT LEAST 30 SECONDS

With the machine on, QUICKLY unplug the keypad's green ribbon cable from the UI-MICS Board's J4 connector. TWO (2) possible scenarios:

**1)** **IF the machine stays on after unplugging the cable:** Place the machine into Heat Disinfect and with the shunt door open allow up to one (1) hour. If the machine STAYS on see procedure number P- 3.0.2 (page 707). If it turns itself off again see OTHER POSSIBILITIES below.

**OTHER POSSIBILITIES**: Swap in the following components (see Component List below) one at a time, with known good, and in between if the machine remains on the last component swapped in was the problem.

**Component List:**

**1)** Power Logic Board; **2)** Power Logic Board cable; **3)** Main Relay (K1). To LOCATE K1 refer to Figure 132 (page 710).

**2)** **IF the machine turns off before unplugging the cable:** The most likely culprit is the keypad itself. Replace it HOWEVER, if the problem reoccurs see OTHER POSSIBILITIES below:

**OTHER POSSIBILITIES**: Swap in the following components (see Component List below) one at a time, with known good, and in between, if the machine remains on the last component swapped in was the problem:

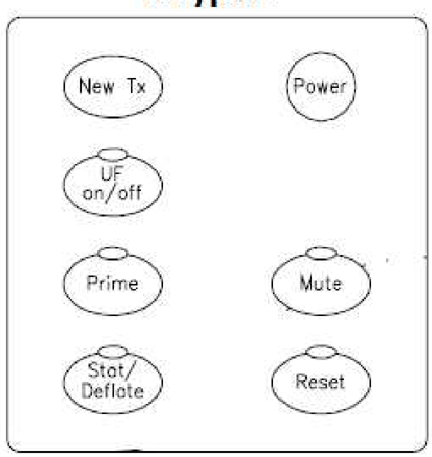
**Component List:**

**1)** Power Logic Board; **2)** Power Logic Board cable; **3)** Main Relay (K1)*. ***To** LOCATE K1 refer to Figure 132 (page 710).

## P- 3.0.2 MACHINE REMAINS ON

The most likely culprit is the keypad HOWEVER, this can be confirmed by, while leaving the machine on plug the keypad back in. Allowing up to one (1) hour, if the machine turns itself off again the keypad (Figure below) is for bad!

**Keypad**



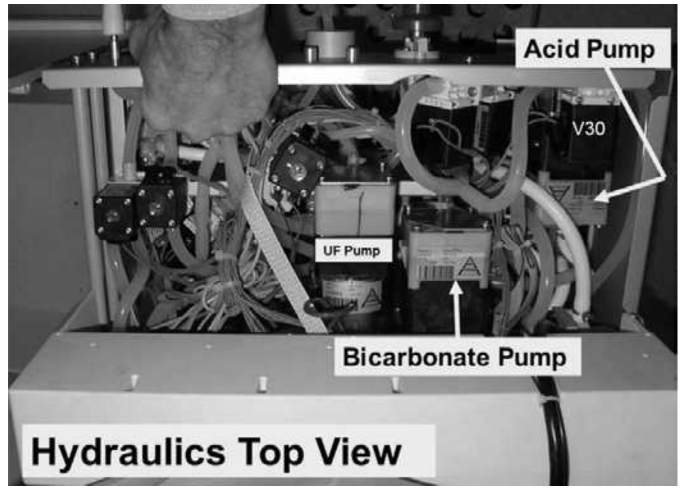
**P- 4.0.0 ISOLATE THE POWER SUPPLY**

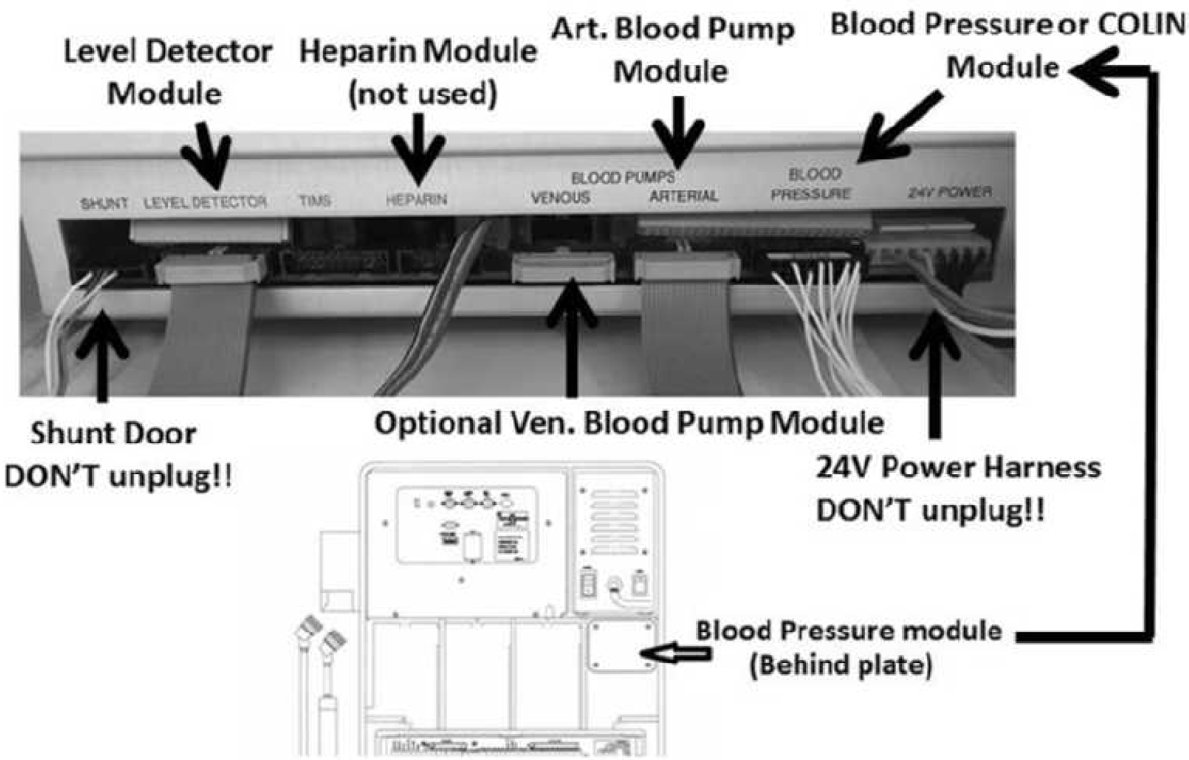
a) **CAUTION! To prevent an electrocution hazard unplug the machine!**

b) Figure right, trace the cables between the Acid, Bicarb <u>AND</u> UF Pumps and the distribution board to ENSURE they are NOT pinched or damaged!

c) Figure below, trace the cables between the modules and the rear of the card cage to ENSURE they are not pinched or damaged!

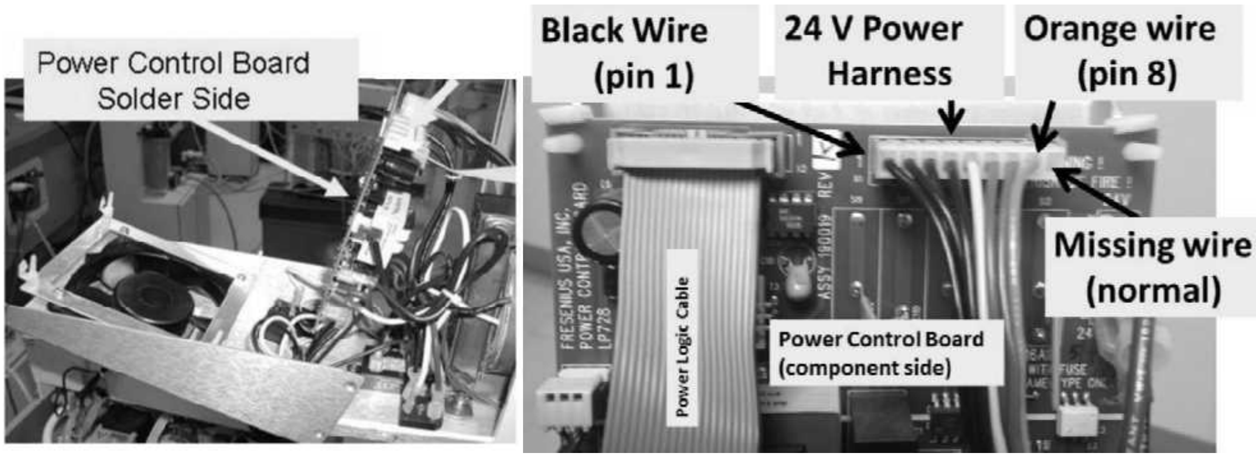
**Part d through j next page**



d) Open the power supply to see the Power Control board.

e) Figure below, ENSURE ALL cables are plugged in securely. **If not, this is may be the problem!**




f) Inspect the cables. If signs of burning or damage are located **this may be the problem!**

g) Inspect the board's component (front) and solder (rear) surfaces. If signs of burning or damage are located **this may be the problem!**

h) Using compressed air, remove dust from the component and solder side of the Power Control board. **Excessive dust may be the problem!**

i) Referring to Figure 132 (page 710), using a Phillips screw driver ensure that Capacitor C1's terminal screws are tight. **If not, this may be the problem!**

j) If possible, turn the machine on (fan running) then, if possible, place it into Dialysis or Rinse or Heat Disinfect Program. Does the problem reoccur (Yes or No)?

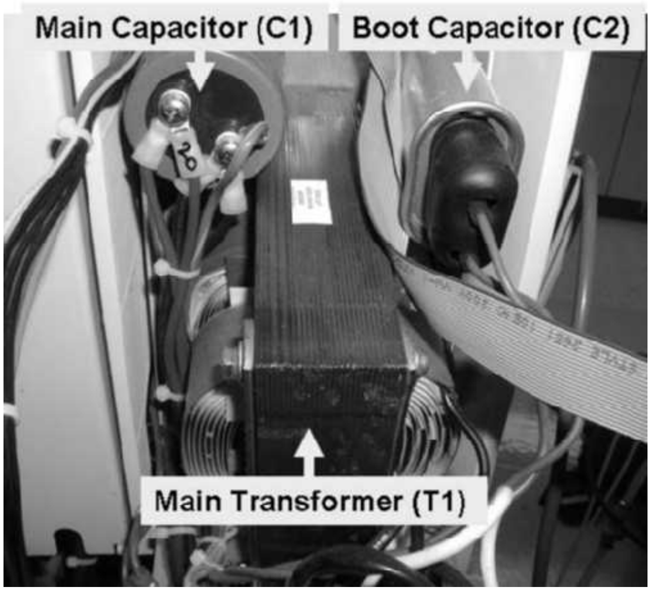
Yes — Problem reoccurs! Replace the power supply with a known good supply (P/N 190011) **OR** repair with known good components. SIX (6) possible bad components: **1)** Bad main capacitor***** (C1, 24,000 µF, P/N 361216-01); **2**) Bad main bridge rectifier***** (BR1, P/N 362009-04); **3)** Bad boot capacitor***** (C2, 10 µF, P/N 361216-03); **4)** Bad Power Control board***** (P/N 190019); **5)** Bad main transformer***** (P/N 290030); **6)** Bad motherboard******.

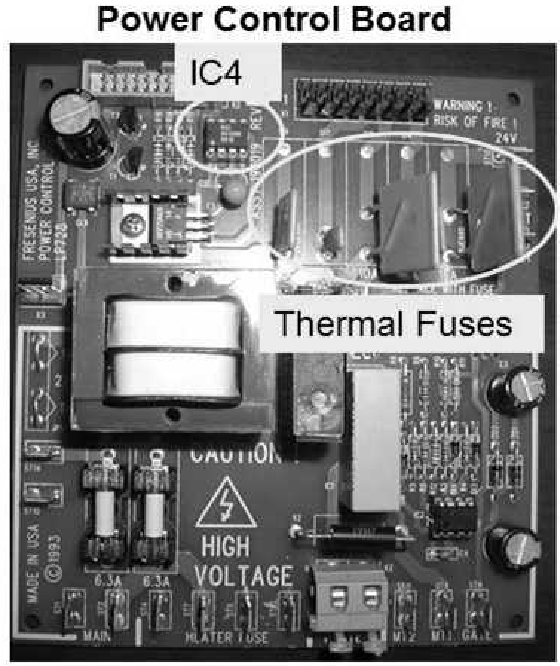
No — Problem does NOT reoccur! Allow up to thirty (30) minutes as the problem may be intermittent. An intermittent problem more than likely is FIVE (5) possible bad component): **1)** Main capacitor ***** (C1, 24,000 µF, P/N 361216-01) OR; **2)** Main bridge rectifier***** (BR1, P/N 362009-04) OR; **3)** Boot capacitor***** (C2, 10 µF, P/N 361216-03) OR; **4)** Bad motherboard****.**

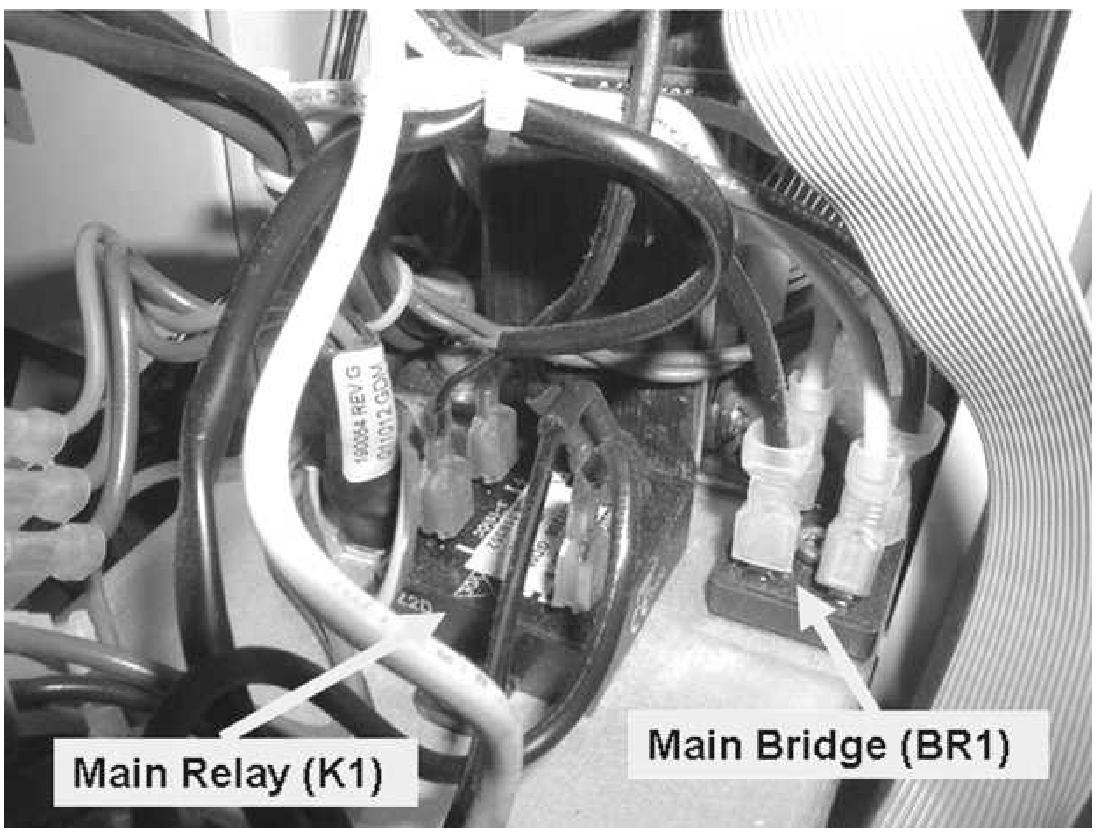
***** To LOCATE these components refer to Figure 132 (page 710)

****** To LOCATE the motherboard refer to Figure 6 (page 22)

## Figure 132 – Inside the Power Supply



## SECTION 26 – VALVE #1 OR VALVE #2 FAIL

**NOTE!** If the shunt door is partially open may cause "Dialyze Valve Fail 1".

**NOTE!** The problem may be heat related. Observe all stated times to avoid error!

A) **To avoid damage, turn the machine OFF!**

B) Figure below, remove the distribution board cover.

C) FOUR (4) CHECKS:

**CHECK #1:** ENSURE Valves #24 AND #43 AND #38 are plugged into their PROPER distribution board positions!

**CHECK #2:** ENSURE the Actuator Cable is plugged in SECURELY!

**CHECK #3:** CHECK the entire length of the Actuator Cable for damage!

**CHECK #4:** ENSURE the black **PGND** wire is plugged in SECURELY AND shows no signs of burning!

D) If a problem was located (and REPAIRED) during the above checks this may have been the problem! If no problems were located see procedure number DVF- 1.0.0 (page 712).

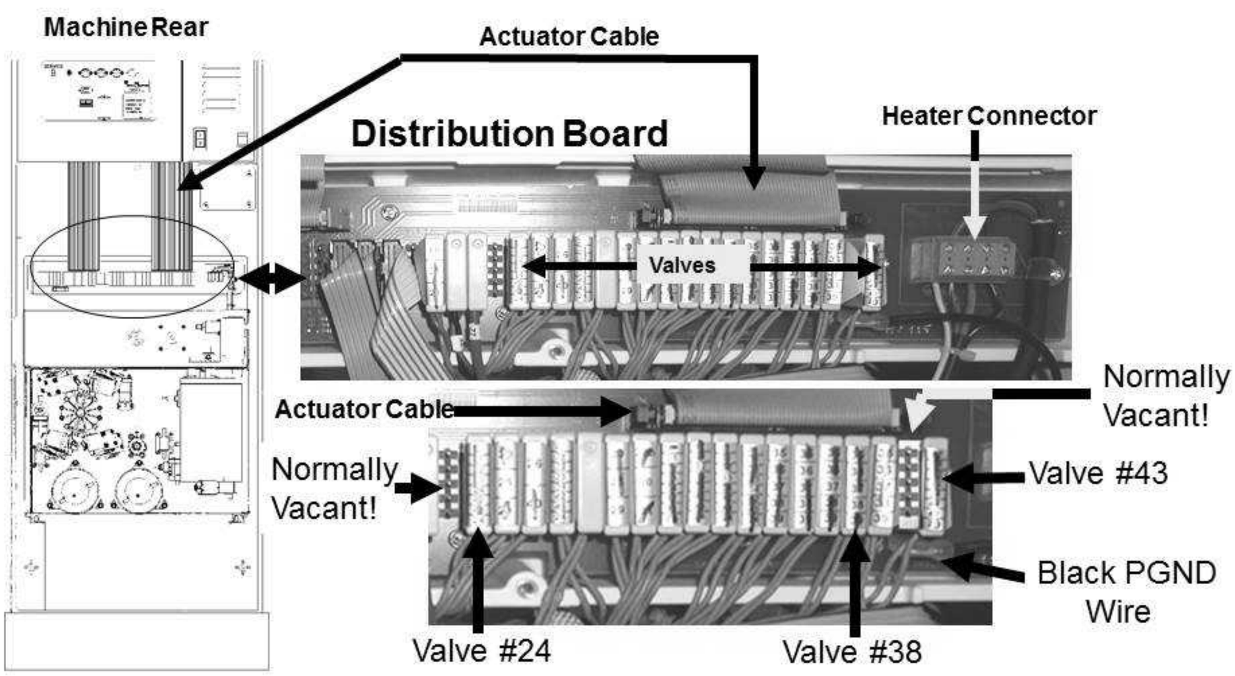



**Figure 133 – Distribution Board / Valves #24, #43, #38 / PGND**

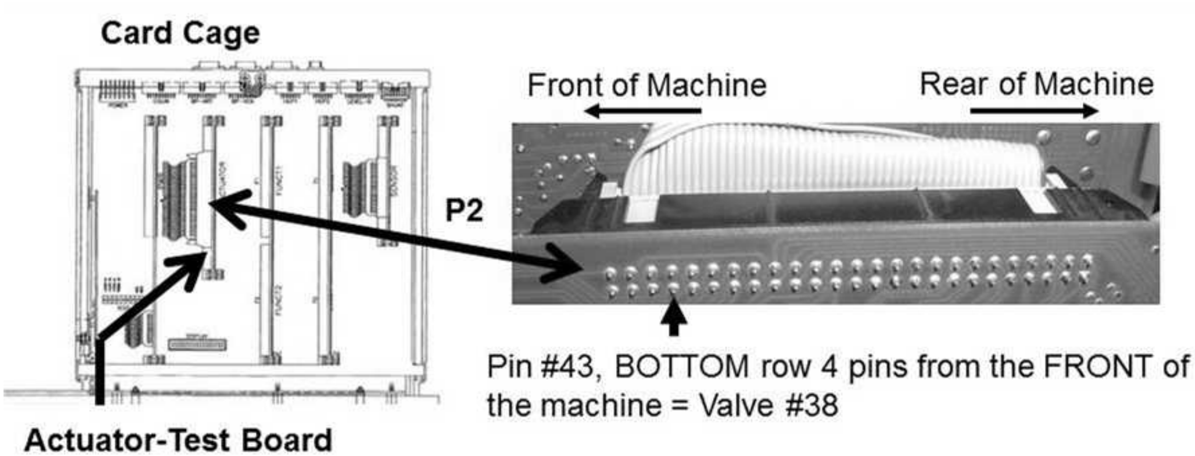
**DVF- 1.0.0 ISOLATE VERR / SPECIAL VALVE ERROR #38**

a) ENSURING the machine is OFF, to avoid pulling cables loose, GENTLY open the card cage!

b) **Set your CALIBRATED volt meter to RESISTANCE (Ω).**

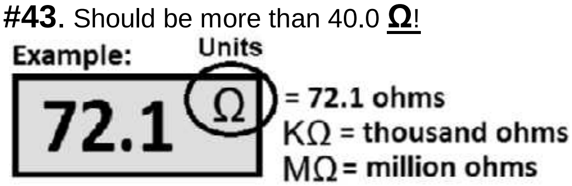
c) **Connect the meter's black lead to chassis ground (see Figure 2 (page 4)).**

d) Figure below, at the top of the Actuator-Test Board locate its 50-pin P2 connector. ENSURE the ACTUATOR ribbon cable is plugged in securely here! **If not this may be the problem!**




e) Figure above, measure from the rear side of P2 at **pin #43**. Should be more than 40.0 **Ω**!

f) Figure right, reading the meter's numeric AND UNITS display, more than 40.0 **Ω**?




Yes MORE THAN 40 Ω! See procedure number DVF- 1.1.0 (page 712).

No LESS THAN 40 Ω! Proceed to **page 719**, procedure number DVF- 5.0.0

**DVF- 1.1.0 PIN 43 MORE THAN 40 OHMS**

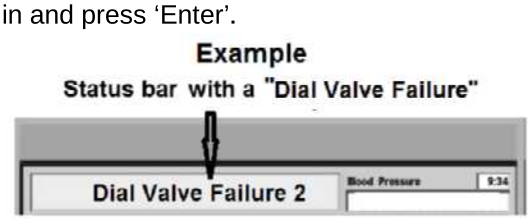
a) Close the card cage for now.

b) **Open the shunt door and <u>LEAVE IT OPEN</u> till <u>instructed otherwise</u>!**

c) Turn the machine on <u>AND</u> return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!

d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

e) Allowing up to five (5) minutes, Figure right, does a "Dial Valve Failure" <u>OR</u> "Act Byp Valve Fail" alarm banner OCCUR?



Yes "Dial Valve Failure" OR "Act Byp Valve Fail" OCCURS! Proceed to **page 716**, procedure number DVF- 4.0.0

No "Dial Valve Failure" OR "Act Byp Valve Fail" DOES NOT occur! See procedure number DVF- 1.2.0 (page 713).

**DVF- 1.2.0 DIAL VALVE FAILURE OR ACT BYP VALVE FAIL DOES NOT OCCUR**

a) **Do not reset alarms!**

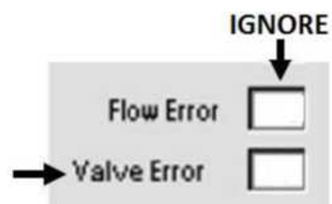
b) Call debug screen 1.


c) Watch **VERR** (right column) for five (5) minutes OR until if it becomes more than zero (0). Does **VERR** REMAIN = 0 for five minutes?

Yes **VERR** REMAINS = 0! Proceed to **page 714**, procedure number DVF- 2.0.0.

No **VERR** = 1 OR more! See procedure number DVF- 1.3.0 (page 713).

**DVF- 1.3.0 VERR = 1 OR MORE / ISOLATE 'SPECIAL' VALVE ERROR**




a) Call debug screen 0.

b) Ignoring the TOP **Flow Error** window, in part c, you will watch the 2nd window down, **Valve Error** for one (1) minute.

c) WITHOUT LOOKING AWAY, ignoring 'blinks to 1' that last less than one (1) second, does **Valve Error** EVER = 1 LONGER THAN two (2) seconds? TWO (2) possible scenarios:

**1) IF Valve Error = 0 OR 'blinks to 1' for less than one (1) second!** Proceed to **page 213**, TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM

**2) IF (and ONLY if) Valve Error = 1 for LONGER THAN two (2) seconds!** With the shunt door remaining open, proceed to **page 716**, procedure number DVF- 4.0.0.

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**DVF- 2.0.0 VERR = 0  /  ISOLATE VALVE #24 OPEN CIRCUIT**

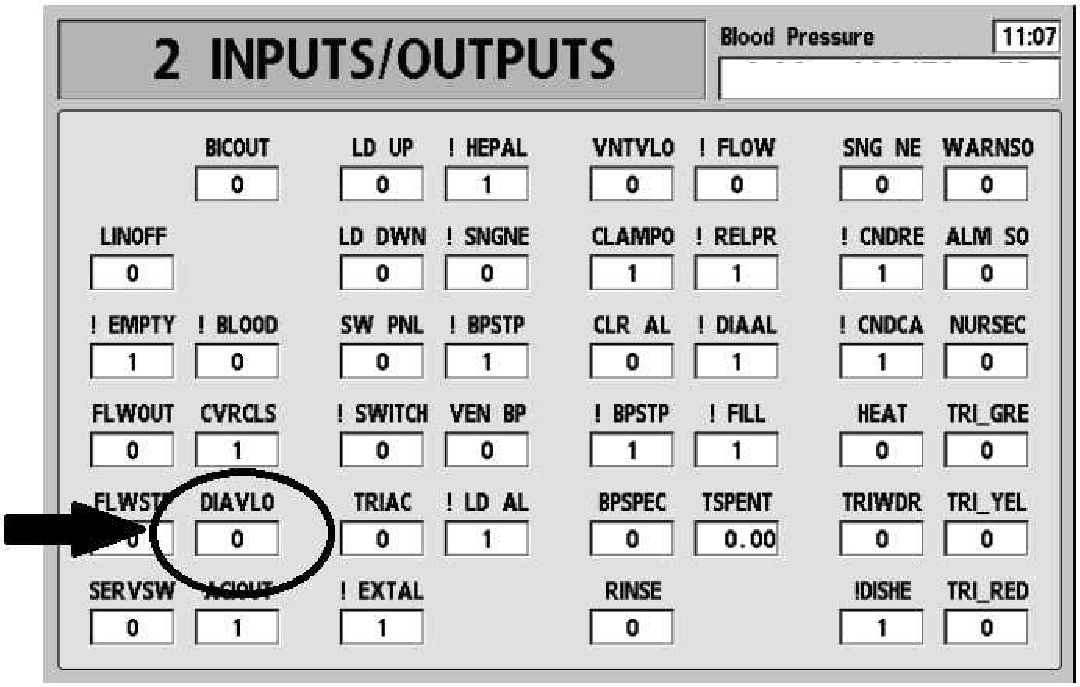
Call debug screen 2 to see **DIAVLO** (Figure below). THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) DIALVLO <u>REMAINS ALWAYS</u> = 1:** Electrical problem with Valve #24. Proceed to **page 716**, procedure number DVF- 4.0.0.

**2)** **IF DIAVLO <u>REMAINS ALWAYS</u> = 0:** With the shunt door REMAINING open, see procedure number DVF- 2.1.0 (page 715).

**3)** **IF (and ONLY if) DIAVLO blinks rapidly between 0 and 1:** Electrical problem with Valve #24. Proceed to **page 716**, procedure number DVF- 4.0.0.

**DIAVLO**



**DVF- 2.1.0 ISOLATE VALVE #24 SHORT CIRCUIT**

a) ENSURE a “No Water” alarm NEVER appears!

b) Call debug screen 0. WITHOUT LOOKING AWAY, watch **Flow Error** (TOP window), for three (3) minutes. If EVER = 1, even if only once, indicates a Flow Error. TWO (2) possible scenarios:


**1) IF (and ONLY if) Flow Error EVER = 1:** Return to **page 31**, procedure number F- 1.0.6.

**2) IF Flow Error ALWAYS = 0: P**erform parts a THROUGH h below

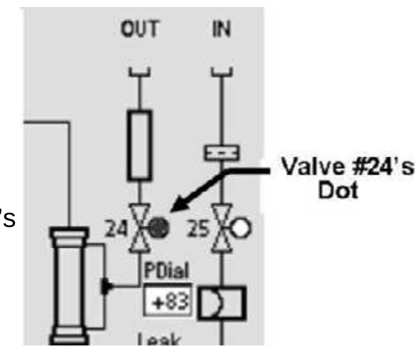
a) Call the Home screen.

b) Allow **Temperature** to reach between 35.0 and 39.0 °C; **Conductivity** between 13.0 and 14.5 mS!

c) Press the ‘Dialysate’ tab at the bottom of the screen.

d) Adjust the Conductivity Limits until ‘Actual’ Conductivity is between the Limits.

e) Press ‘Enter’ then call debug screen 0 to locate Valve #24’s ‘dot’ (Figure right).




f) **CLOSE THE SHUNT DOOR!**

g) Allow up to two (2) minutes OR until Valve #24’s ‘dot’ turns blue

h) Allow five (5) MORE minutes! Does “Dialyze Valve Fail” OR “Act Byp Valve Fail” alarm banner occur?

Yes “Dialyze Valve Fail” OR a “Act Byp Valve Fail” occurs! Electrical problem with Valve #24. Proceed to **page 716**, procedure number DVF- 4.0.0.

No Whatever was causing the problem is no longer present! Watch for ten (10 minutes). If a Flow Error reoccurs return to procedure number F- 1.0.6 (page 31).

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**DVF- 4.0.0 ISOLATE VALVES #24 AND #43 SOLENOID CIRCUITS (1)**

a) **Turn the machine OFF!**

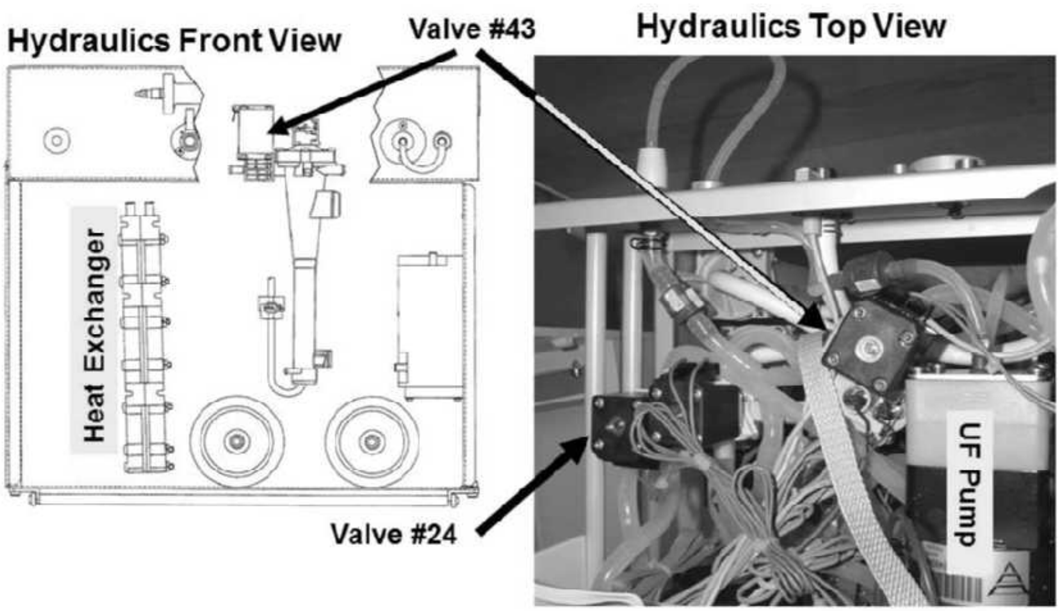
b) Per the Figure below, THREE (3) checks while tracing Valve #43's AND #24's wires from the distribution board to BOTH valves inside the hydraulics.


**CHECK #1:** ENSURE no 'pinched' or damaged wires!

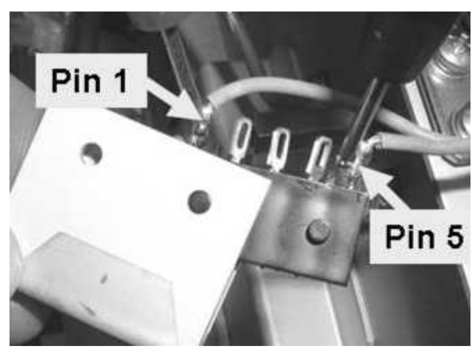
**CHECK #2:** Figure right, ENSURE the wires terminate PROPERLY at the valve's solenoid terminals)!

**CHECK #3:** ENSURE the terminals show no signs of 'green' corrosion!

c) See procedure number DVF- 4.1.0 (page 716).




**DVF- 4.1.0 ISOLATE VALVES #24 AND VALVE #43 SOLENOID CIRCUITS (2)**

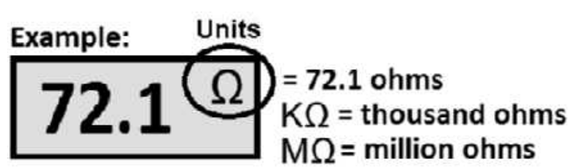



a) Figure right, open Valve #24's AND #43's female distribution board connector caps.

b) **The wires MUST connect between the TOP and BOTTOM terminals! If NOT, this is the problem!**

c) **Set your CALIBRATED volt meter to RESISTANCE (Ω)!**

d) Where a blue wires are attached, place one meter lead on one of the terminals and the other lead on the other terminal.




e) Figure right, reading the meter's numeric AND units display! TWO (2) possible scenarios next page:
**1)**

2) **IF (and ONLY if) BOTH valves between 40 and 100 Ω:** See procedure number DVF- 4.2.0 (page 717).

3) **IF ONE OR BOTH is less than 40 OR more than 100 Ω:** Replace the valve AND its blue wiring harness.

**DVF- 4.2.0 BOTH VALVES BETWEEN 40 AND 100 Ω / ISOLATE TOTAL CIRCUIT RESISTANCE (Ω)**

a) Return BOTH valves connectors to their PROPER distribution board positions!

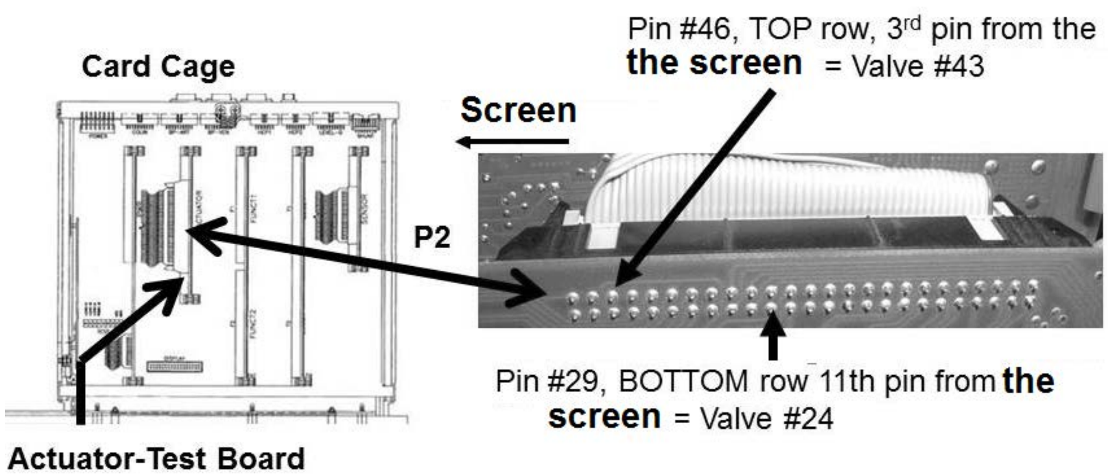
b) GENTLY open the card cage!

c) **Connect the volt meter's black lead to chassis ground (see Figure 2 (page 4)).**

d) Figure below, TWO (2) measurements below, from the solder (rear) side of the Actuator-Test board's P2 connector. Both should be between 40 and 100 **Ω**!

***Measurement #1:*** ***Pin #46*** (TOP row, 3rd *pin* from the screen) = Valve #43

***Measurement #2:*** ***Pin #29*** (BOTTOM row, 11th *pin* from the screen) = Valve #24




e) TWO (2) possible scenarios:

1) **IF (and ONLY if) BOTH are between 40 and 100 Ω:** See procedure number DVF- 4.2.2 (page 718).

2) **IF ONE OR BOTH LESS THAN 40 Ω OR MORE THAN 100 Ω:** Perform parts a THROUGH c below:

   a) ENSURE the machine was OFF AND valves #24 and #43 were returned to the distribution board properly! If NOT, return to (ABOVE) procedure number DVF- 4.2.0 (page 717).

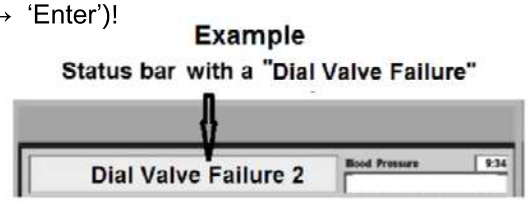
   b) ENSURE both measurements were made at the correct Actuator-Test Board P2 pins!

   c) THREE (3) possible bad components: **1)** Bad Actuator-Test Board OR; **2)** Bad actuator cable OR; **3)** Bad distribution board.

### DVF- 4.2.2 BOTH MEASUREMENTS BETWEEN 40 AND 100 Ω

a) Turn the machine on.

b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!




c) If (and ONLY if) a "Dial Valve Failure" OR "Act Byp Valve Fail" alarm banner reoccurs see procedure number DVF- 4.3.0 (page 718). If neither alarm occurs allow five (5) FULL minutes BEFORE continuing to part d!

d) Call debug screen 1. Is **VERR** (right column, bottom) = 0?

Yes **VERR** = 0! See (ABOVE) procedure number DVF- 2.1.0 (**page 715**).

No **VERR** = 1 OR more! Call debug screen 0. Ignoring **Flow Error** (TOP window), for one (1) minute, watch the 2nd window down, **Valve Error!** Ignoring a 'blink to 1' that lasts less than one (1) second, does **Valve Error** EVER = 1 for LONGER THAN two (2) seconds?

Yes **Valve Error** = 1 for LONGER THAN two (2) seconds! See procedure number DVF- 4.3.0 (page 718).

No **Valve Error** = 0 OR 'blinks to 1' for less than one second! Proceed to **page 213**, TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM

### DVF- 4.3.0 VALVE ERROR = 1 LONGER THAN TWO SECONDS

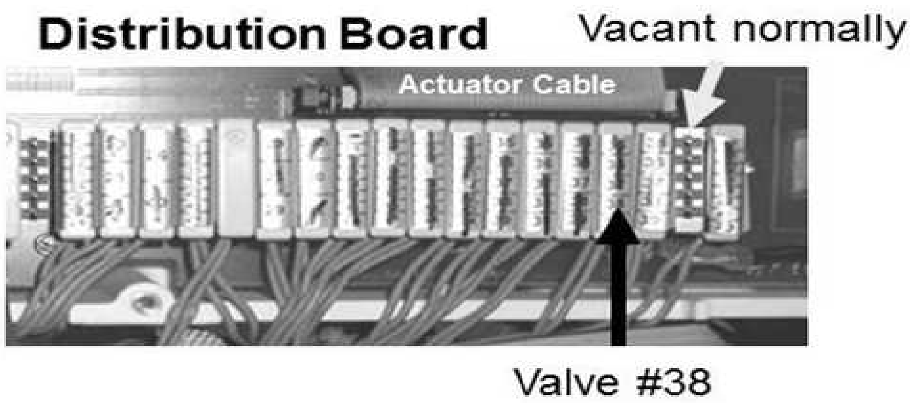
Assuming all procedures were performed correctly, THREE (3) possible bad components (see COMPONENT LIST below). Swap in each, one at a time, and in between return to Dialysis Program to test the new component until debug screen 1's **VERR** remains = 0 indicating the last component swapped in is the problem.

**COMPONENT LIST: 1)** Actuator-Test Board; **2)** Functional Board[1]; **3)** Distribution board.

[1] To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to OPERATING MODES, page 19)).

DVF- 5.0.0 PIN 43 (VALVE #38) LESS THAN 40 Ω

a) **Figure below**, unplug **Valve #38** from the distribution board.




b) Using a flashlight, check inside the vacant distribution board position. **If corrosion or damage is located the distribution board needs to be replaced!**

c) **Leave Valve #38 unplugged until instructed**.

d) Turn the machine on AND **return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter')!**

e) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'Enter'.

f) Call debug screen 0 then allow thirty (30) seconds.

g) Do the balancing chamber 'dots' begin to cycle between blue and white?

Yes — The balancing chamber 'dots' are cycling! Balancing Chamber Valve #38***** OR its blue wire harness is bad!

***** To LOCATE Valve #38 refer to Figure 36 (page 211).

No — a) Return Valve #38 to its distribution board position

b) See (ABOVE) procedure number DVF- 1.2.0 (page 713).

# SECTION 27 - "ACT BLOOD PUMP FAILED"

A) BEFORE continuing to part B, NOTE this page number and perform INITIAL CHECKS (page 7))

B) Turn the machine off and on. If (and ONLY if) "Act Blood Pump Failed" alarm reoccurs see procedure number ABPF- 1.0.0 (page 720).

## ABPF- 1.0.0 INSTALL EXTENDER BOARD

a) Referring to the Figure below, the EXTENDER BOARD (P/N 190600) is required.

b) Turn the machine OFF and, to prevent pulling cables loose, GENTLY open the card cage!

c) **To avoid error, per the Figure below, FOUR (4) NOTES below:**

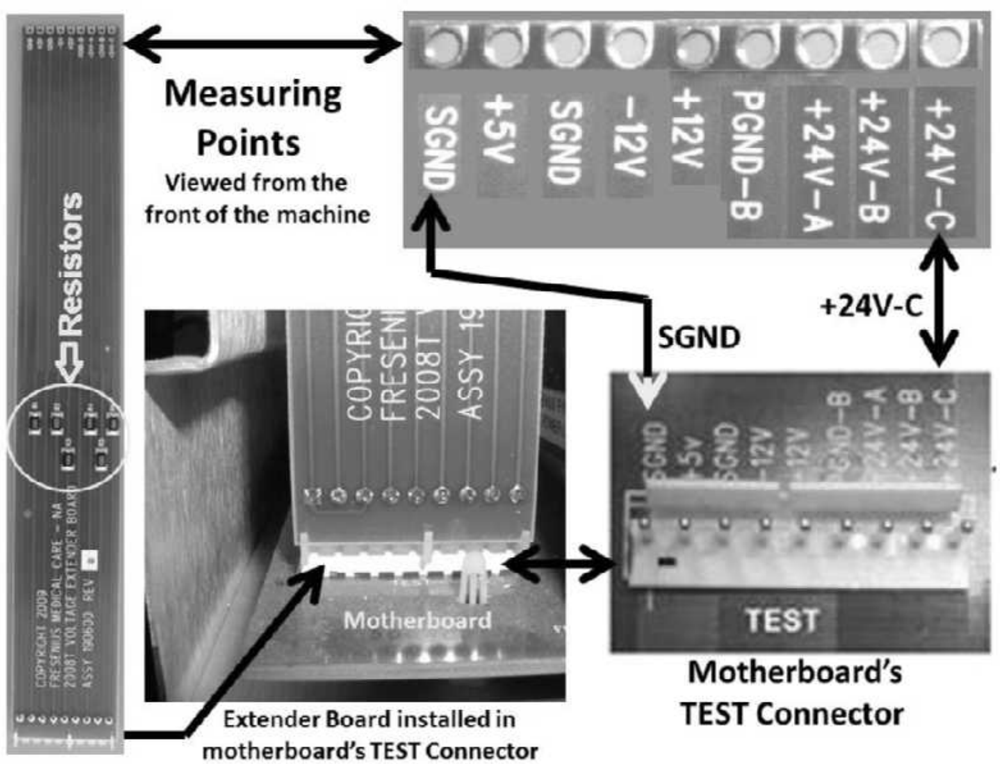
   **1)** Keeping the EXTENDER BOARD'S resistors towards the **FRONT OF THE MACHINE** install it into the motherboard's nine (9) pin TEST***** connector. *****To LOCATE refer to Figure 4A (page 10)).

   **2)** ENSURE the board is matched pin for pin to the TEST connector! From the **FRONT OF THE MACHINE** SGND on the LEFT; 24V-C on the RIGHT!

   **3)** Push the board down hard. It may resist a good connection into the motherboard!

   **4)** Pull up on the board. If installed correctly it resists pulling out!

d) See procedure number ABPF- 1.0.1 (page 721).



**ABPF- 1.0.1 ISOLATE 24V- C**

a) **Set your CALIBRATED volt meter to Volts DC ($V_{DC}$).**

b) **Connect the meter's ground (black) lead to chassis ground (see Figure 2, page 4).**

c) TIGHTLY HOLD the red meter lead at the EXTENDER BOARD'S **+24V-C** measuring point.

d) Looking for approximately 24.0 volts to 'pulse' on and off several times, **WITHOUT LOOKING AWAY FROM THE METER**, turn the machine on (fan running), and watch for thirty (30) seconds.

e) More than 23.0 volts seen at ANY TIME (Yes or No)?

Yes — More than 23.0 volts DC seen! If (and ONLY if) the "Act Blood Pump Failed" reoccurred, THREE (3) possible bad components (see Component List below). Swap in each component in one at a time and, in between, see if the "Act Blood Pump Failed" reoccurs. Continue through the list until "Act Blood Pump Failed" does not reoccur!

**Component List: 1)** Arterial Pump Ribbon cable; **2)** Arterial Blood Pump Module; **3)** Motherboard

No — NEVER more than 23.0 volts seen! To avoid time consuming work, to ENSURE the extender board is installed correctly, measure at its +5V and +12V points. If the board is installed correctly these voltages will be present. If SURE the board is installed correctly AND you are measuring at the correct points see procedure ABPF- 1.0.3 (page 722).

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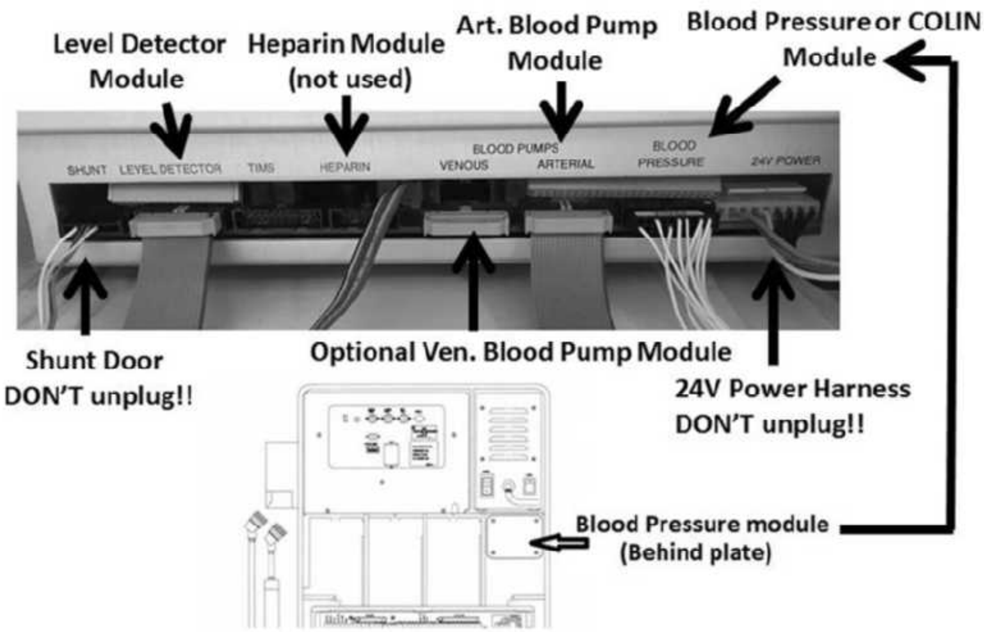
## ABPF- 1.0.3 APPROXIMATELY 24 VDC NOT PRESENT

a) **To avoid damage turn the machine OFF!**

b) **Figure below**, unplug the MODULES ONLY, including the Blood Pressure module. **DO NOT unplug the 24V Harness or shunt!**




c) Again <u>TIGHTLY HOLD</u> the red meter lead at the EXTENDER BOARD'S **+24V-C** measuring point.

d) WITHOUT LOOKING AWAY from the meter, **turn the machine on (fan running)**, and watch for thirty (30) second. More than 23.0 volts DC seen at <u>ANY TIME DURING</u> (Yes or No)?

Yes — More than 23.0 volts DC seen! One of the modules is causing the problem: **Read parts A through C before performing them! A)** Turn the machine off and plug the one of the modules in (your choice); **B)** Turn the machine on while measuring at the EXTENDER BOARD'S **+24V-C** measuring point; **C)** When more than 23.0 volts is again not seen the last module plugged in or its cable is causing the problem.

No — Never more than 23.0 volts! See procedure number ABPF- 1.0.4 (page 723).

## ABPF- 1.0.4 ISOLATE POWER CONTROL BOARD OUTPUT

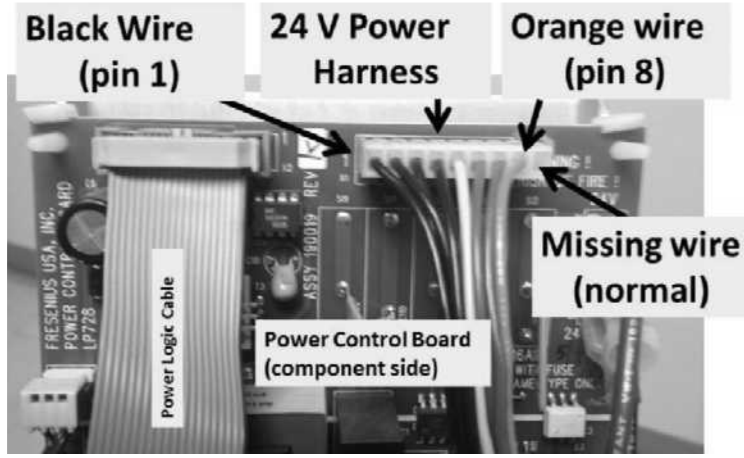
a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocution hazard if not unplugged**

b) Slide the power supply away from the cabinet. Figure right, inside is the Power Control Board where the 24V Power Harness terminates.

c) ENSURE harness is plugged in securely. **If NOT, this may be the problem!**

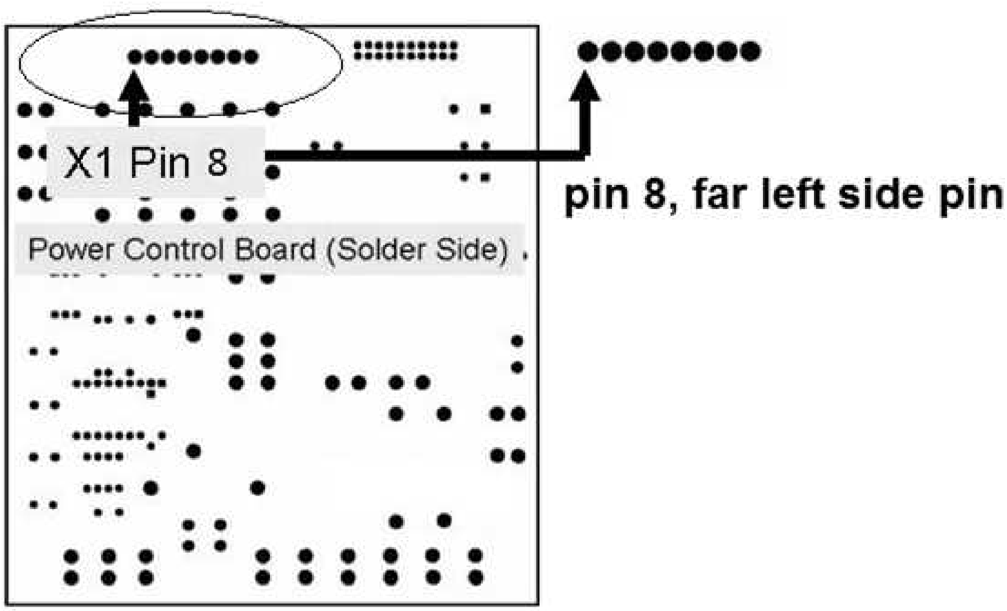
d) Remove the board from its four plastic clips and remove the two **front** screws.

e) Lay the rear panel down to access to the rear (solder) side of the board Power Control Board.




f) Plug the machine in. **CAUTION! High voltage now present!**

g) **Per the Figure below**, HOLD the red meter lead at the rear (solder) side, at **pin 8**, of the 24 V Power Harness connector X1.




h) WITHOUT LOOKING AWAY from the meter, turn the machine ON (fan running) and watch for forty (40) FULL seconds.

i) More than 23.0 volts DC **($V_{DC}$)** seen at ANY TIME EVER during the 40 seconds?

Yes More than 23.0 volts DC seen. Referring to Figure 134 (page 724), the 24 V Power Harness is bad.

No Never more than 23.0 volts! The Power Control Board may be bad.

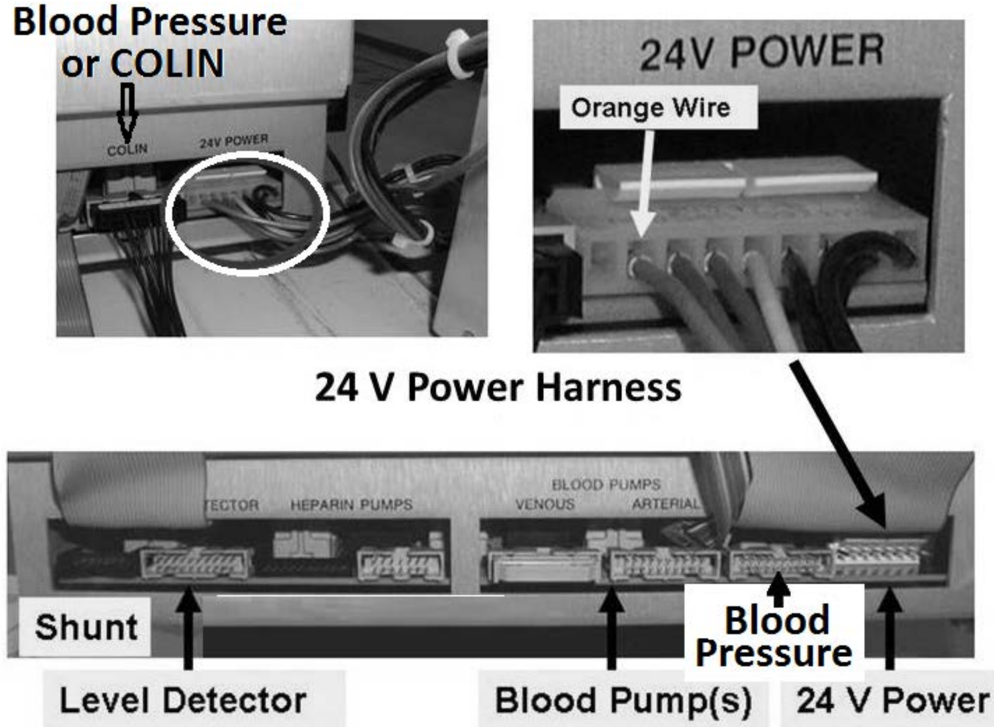



**Figure 134 – 24 V Power Harness**

## SECTION 28 – HEAT EXCHANGER LEAKING EXTERNALLY

A) Per the Figure below, if the HEAT EXCHANGER'S 'center screws' and nuts are not tight this may be problem!

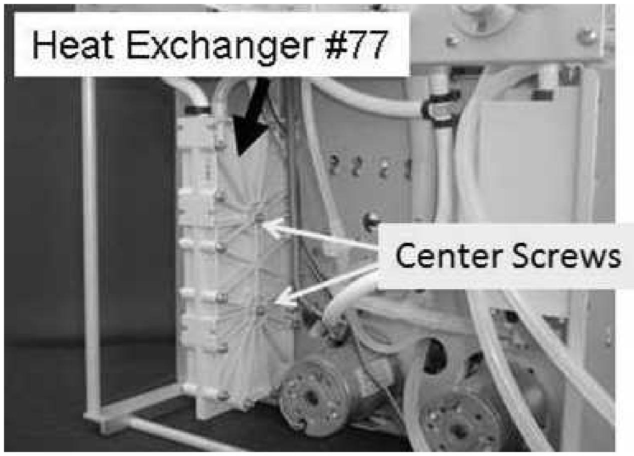
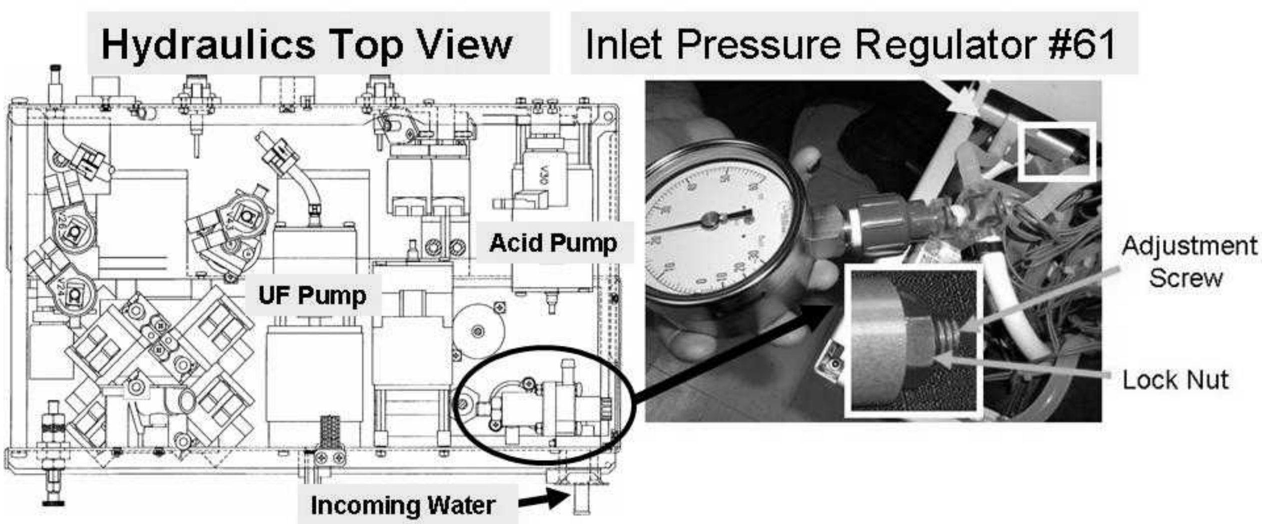



**Figure 135 - Hydraulics Front View**

B) A psi pressure gauge is required! **ENSURE it reads 0 psi before installing it!**

C) **IMPORTANT!** Turn the water OFF.

D) Per the Figure below, install the gauge at Inlet Pressure Regulator #61.




E) **IMPORTANT!** Turn the water on!

F) ENSURE NO LEAKS at the gauge!

G) Plug the concentrate connectors into their rinse ports AND place the machine into **RINSE**!

**Part H next page**

H) Watching for thirty (30) seconds to ENSURE a "No Water" or Flow Error NEVER occurs, is gauge pressure cycling to a consistent **peak** of between 18 and 20 psi?

Yes Peak between 18 and 20 psi! See procedure number HEATEX- 2.0.0 (page 726).

No NOT between 18 and 20 psi! Referring to the Figure (previous page), loosen Regulator's #61's lock nut and turn the center screw until a consistent peak of between 18 and 20 psi is achieved. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) pressure adjusts to between 18 and 20 psi:** See procedure number HEATEX- 2.0.0 (page 726).

2) **IF pressure will NOT adjust to between 18 and 20 psi:** TWO (2) possibilities: **1)** Incoming water pressure is more than 105 psi OR; 2**)** Regulator #61 is bad. Regulator #61 can be rebuilt (Rebuild kit, P/N 190934). **NOTE!** Previous high pressure may have been already damaged the Heat Exchanger causing it to leak!

## HEATEX- 2.0.0 ISOLATE INLET PRESSURE REGULATOR #61

This procedure checks that Inlet Pressure Regulator #61 maintains pressure over time:

a) **IMPORTANT!** Leaving the water **ON**, turn the machine **OFF**.

b) Watch the gauge for two (2) minutes. Pressure should not increase to more than 20 psi! If it does Regulator #61 is bad but can be rebuilt (Rebuild kit, P/N 190934). If it does NOT increase to more than 20 psi NOTE this pressure then see part c.

**NOTE!** Previous high pressure may have been already damaged the Heat Exchanger causing it to leak!

c) Allow twenty (20) minutes. Does pressure increase **more than** 2 psi above what was noted in part b?

Yes Pressure increases! TWO possibilities: **1)** Incoming water pressure is more than 105 psi OR; **2)** Bad Regulator #61. Regulator #61 can be rebuilt (Rebuild kit, P/N 190934). **NOTE!** The Heat Exchanger may have already been damaged causing it to leak!

No Pressure does NOT increase! Per the Figure below, repair or replace the Heat Exchanger.

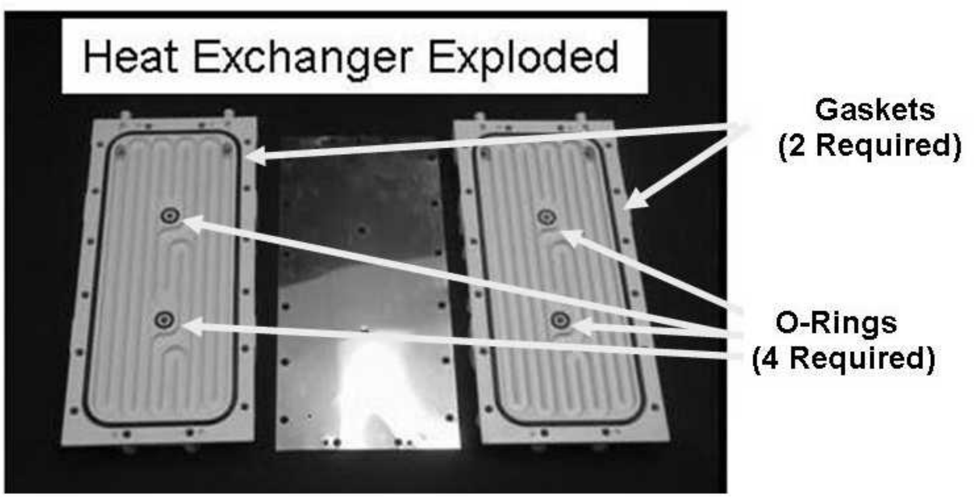



**Figure 136 – Heat Exchanger (Exploded)**

## SECTION 29 – "BIBAG: VALVE 1 OR 2 ERROR"

Per the **Hydraulics Front View** figure below, a "Bibag: Valve 1 Err", indicates an electrical problem with Valve #100 OR Valve #101. A "Bibag: Valve 2 Err" indicates an electrical problem with Valve #103

A) **Turn the machine OFF!**


B) Per Figure 4C (page 11), ENSURE the 20 and 26 pin ribbon cables are plugged SECURELY into the bibag Interface Board!

C) Pull the hydraulics away from the cabinet.

D) ENSURE the blue wires at Valve #100, #101 and #103 terminate properly at their solenoid terminals (Figure right).

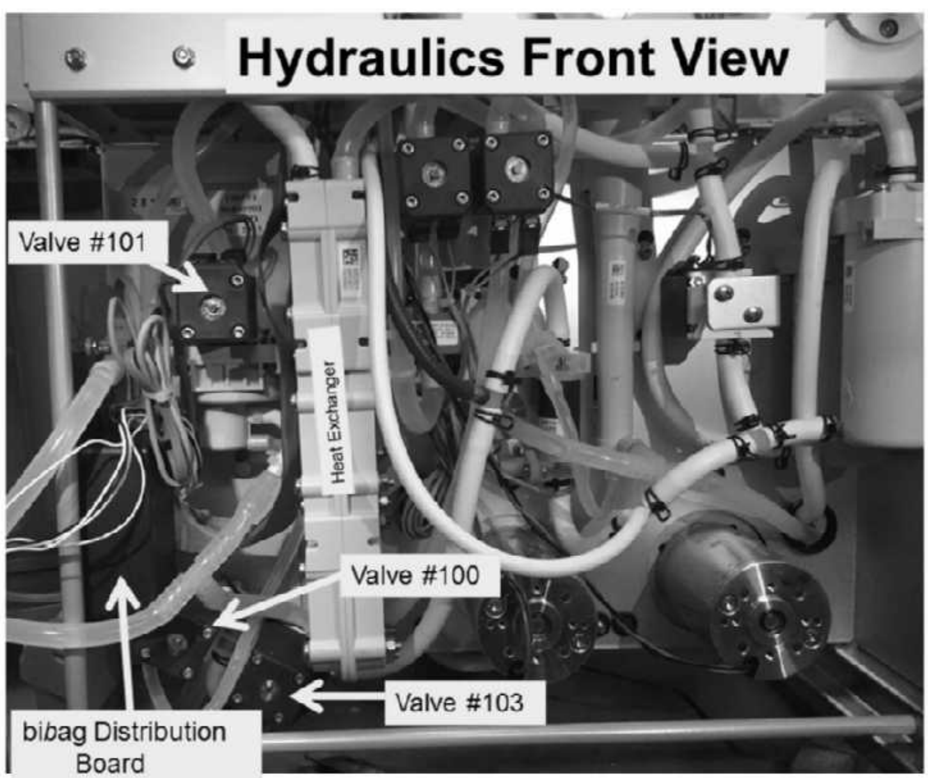
E) ENSURE the solenoids and their terminals show no signs of rust or corrosion!

F) Set your CALIBRATED volt meter to read RESISTANCE (Ω).


G) To avoid error, one valve at a time, unplug both wires from its solenoid terminals and, Figure right, measure resistance (Ω) BETWEEN the terminals. Between 40 and 100 Ω?

Yes Between 40 and 100 Ω! Plug the wires back into the solenoid terminals then repeat part G for all three (3) valves. If all three valve solenoids are between 40 and 100 Ω see part H next page.

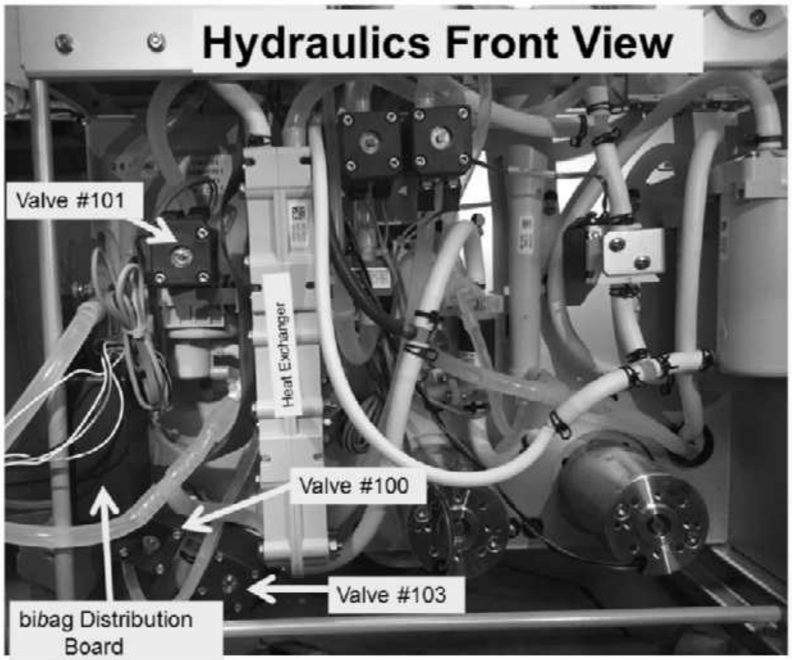
No Less than 40 Ω OR more than 100 Ω! Replace the Valve.

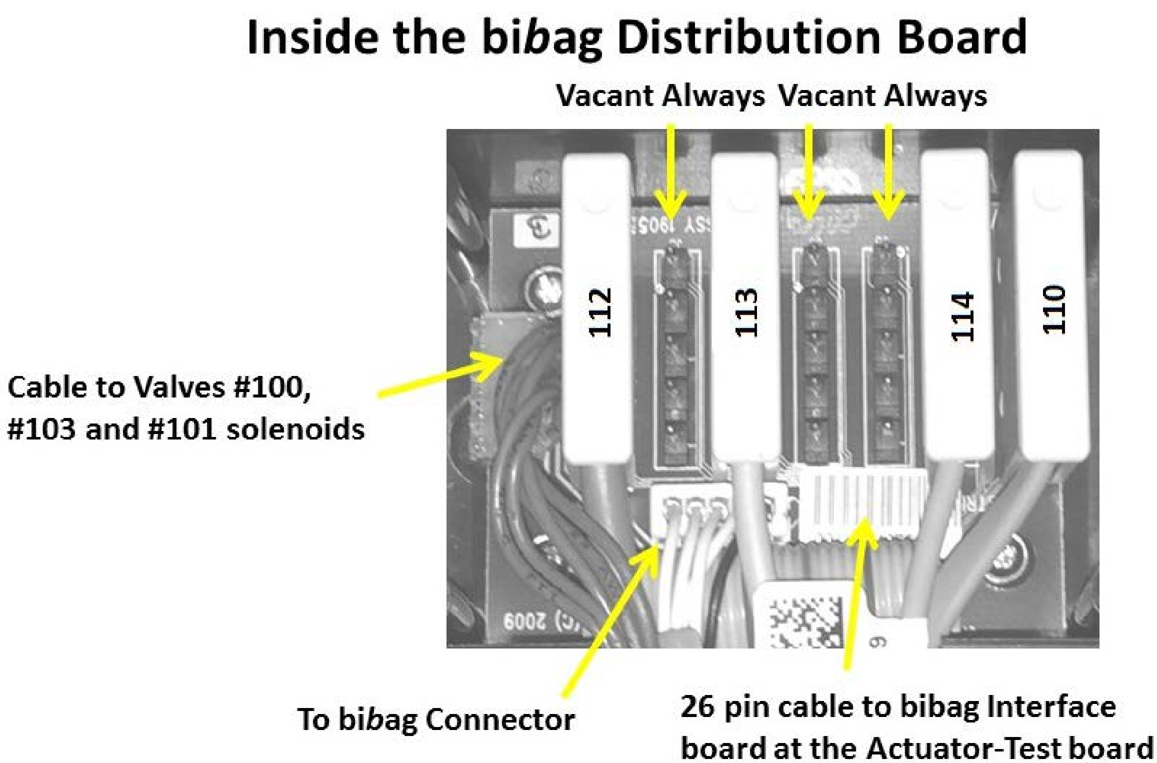


H) Per the Figures below, open the bibag Distribution board

I) ENSURE the cable to Valve #101, #100 and #103 is plugged in securely!

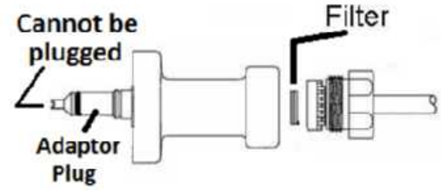
J) Place the machine into Dialysis or Rinse. If the “BiBag: Valve 1 Error” OR “BiBag: Valve 2 Error” reoccurs, referring to the Figure below, there may be a problem with the 26 pin ribbon cable, between the bi*b*ag Interface Board and the bi*b*ag Distribution Board, OR the the BBibag Interface Board.



# SECTION 30 – "V104/V108 STUCK CLOSED" OR V104 ER C = 1

"V104/108 Stuck Closed" OR **V104 Er C** =1 indicates a possible restriction in the Bicarb inlet system, as sensed by Pressure Sensor #110 (**Bic Press**)



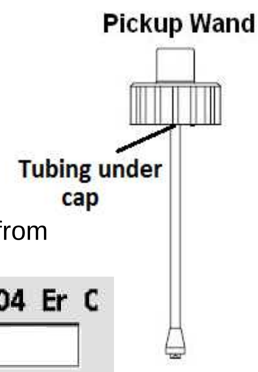

A) ENSURE the Bicarb inlet tubing is NOT restricted!

B) Figure right, ENSURE the Bicarb connector's filter is clean AND the adaptor plug opening is not plugged!

**NOTE!** If external leaks, "No Water", or a Flow Error EVER occur address them FIRST!

C) TWO (2) possible scenarios 1) or 2) below:

**1) IF occurring during OR after a Cleaning / Disinfection Program (Rinse, Heat Disinfect, etc.) has stopped:** See procedure number V104SC- 1.0.0 (page 730).




**2) IF occurring in Dialysis Program:** Perform parts a THROUGH c below:

a) If attached to a Bicarb jug ENSURE the Pick Up wand tubing (Figure right) is NOT kinked!

b) If attached to a Central Bicarb Delivery System (SDS) ENSURE good flow from the station valve! The valve MUST be left open!


c) Call debug screen 15. Watch **V104 Er C** (bottom row. 3rd column from left) for three (3) minutes OR until if it EVER = 1, even just once?

Yes **V104 Er C** = 1, even just once! Proceed to **page 438**, procedure number CO- 14.0.0.

No **V104 Er C** REMAINS = '0'! Whatever was causing "V104/108 Stuck Closed" has cleared for now! Perform parts a THROUGH c below:

a) Call debug screen 0 to watch **Flow Error** (TOP window) for two (2) minutes. If EVER = 1 a masked Flow Error is occurring! In this event, DO NOT continue to troubleshoot "V104/108 Stuck Closed".

b) If pulling from a Bicarb jug or a Central Bicarb Delivery System (SDS) AND [**Conductivity**] increases to more than 13.0 mS Valve #104 is, at least, partially open!

c) Install a venous dummy chamber in the Level Detector module and attempt to reset all alarms. Does "V104/108 Stuck Closed" appear?

Yes "Valve 104/108 Stuck Closed" appears! Proceed to **page 438**, procedure number CO- 14.0.0.

No Whatever was causing the alarm has cleared.

**V104SC- 1.0.0 "V104/108 STUCK CLOSED"**

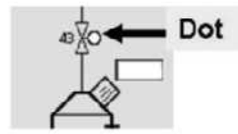
**NOTE!** A poorly inserted Bicarb connector, into its Rinse port, is the most common cause of "V104/108 Stuck Closed"!


A) Figure right, ENSURE the RINSE ports extend out about ¼ inches away from the cabinet! If not this may be the problem!

B) **SLAM the ACID and BICARB connectors into their rinse ports!**

C) **PLACE THE MACHINE IN RINSE!**

D) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

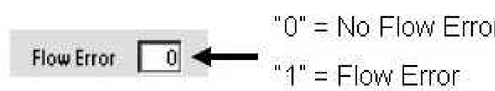



E) Figure right, if Valve #43's 'dot' is blue allow it to turn white!

F) Is the external flow indicator's 'bob' rising at least ½ way in the sight tube?

Yes 'Bob' moving! See part G.

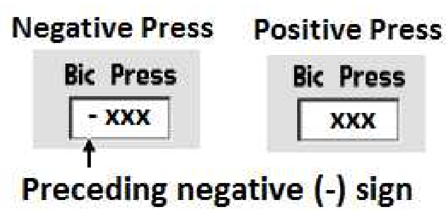
No 'Bob' NOT moving! Proceed to **page 166,** SECTION 3 - FLOW ERRORS IN CLEANING / DISINFECTION PROGRAMS




G) If **Flow Error** EVER = 1, even just once, indicates a masked Flow Error! Watch it for two (2) minutes. TWO (2) possible scenarios below:

**1)** **IF (and ONLY if) Flow Error ALWAYS = 0:** See part H.

**2)** **IF (and ONLY if) Flow Error EVER = 1, even just once:** Proceed to **page 166,** SECTION 3 - FLOW ERRORS IN CLEANING / DISINFECTION PROGRAMS!




H) Call debug screen 15. **Bic Press** (Figure right) is from Pressure Sensor #110. If a negative ('-') sign appears pressure is NEGATIVE. If no '-' sign it is POSITIVE! In any event see procedure number V104SC- 1.0.1 (page 730).

**V104SC- 1.0.1 ISOLATE PRESSURE SENSOR #110**


A) **Figure right, open the bi*bag* Connector door!** This Interrupts rinse and vents Pressure Sensor #110.

B) Is **Bic Press** between negative (-)50 and positive 30?

Yes **Bic Press** between negative 50 and positive 30! See part C.

No **Bic Press** is NOT between negative 50 and positive 30! Leaving the door OPEN, see procedure number V104SC- 1.0.22 (**page 732**).

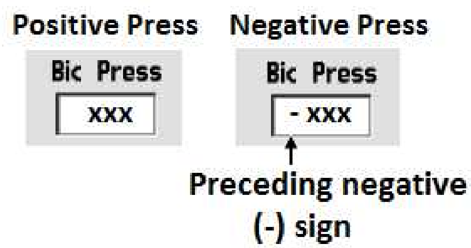
C) Close the bi*b*ag Connector door!

D) **RETURN TO RINSE!**

E) Call debug screen 15. If debug does not appear press ‘Esc’ then call screen 15.

F) **Bic Press** may fluctuate but MUST, at least once, achieve more than POSITIVE 400. It may exceed 800 and this is okay!

G) Watch **Bic Press** for one (1) minute OR until if it achieves at least 400. TWO (2) possible scenarios:




1) **IF NEVER achieves POSITIVE 400:** Proceed to **page 736**, procedure number V104SC- 2.0.0.

2) **IF achieves POSITIVE 400 or more at least once:** See part A below:

A) Press ‘Esc’ to return to the main RINSE screen. THREE (3) possible scenarios:

1) **IF (and ONLY if) the [Remaining Time] window is NOT ‘blinking’:** See part B.

2) **IF (and ONLY if) [Remaining Time] is ‘blinking’ AND the “V104/108 Stuck Closed” banner is up:** Proceed to **page 739**, procedure number V104SC- 2.0.3.

3) **IF [Remaining Time] is ‘blinking’ AND the “V104/108 Stuck Closed” banner is NOT up:** Address whatever alarm banner is showing.

B) The first part of clearing “V104/108 Stuck Closed”, is successful. Now, when rinse finishes, **Bic Press** must significantly decrease through Valves #104 and #108.

C) Watch carefully until if [**Remaining Time**] = 0:00. Does “V104/108 Stuck Closed” reappear?

Yes “V104/108 Stuck Closed” reappears! Proceed to **page 739**, procedure number V104SC- 2.0.3.

No V104/108 Stuck Closed” NEVER reappears! When RINSE finishes return to Dialysis Program (“Select Program” →.’Dialysis’ → ‘Enter’). TWO (2) possible scenarios:

1) **IF (and ONLY if) “V104/108 Stuck Closed” reappears**: Proceed to **page 438**, procedure number CO- 14.0.0.

2) **IF V104/108 Stuck Closed” does NOT reappear:** The alarm has been cleared! Possibly the blue connector was not inserted properly into its rinse port when last rinsed.

**V104SC- 1.0.22 BIC PRESS NOT BETWEEN -50 AND 30**

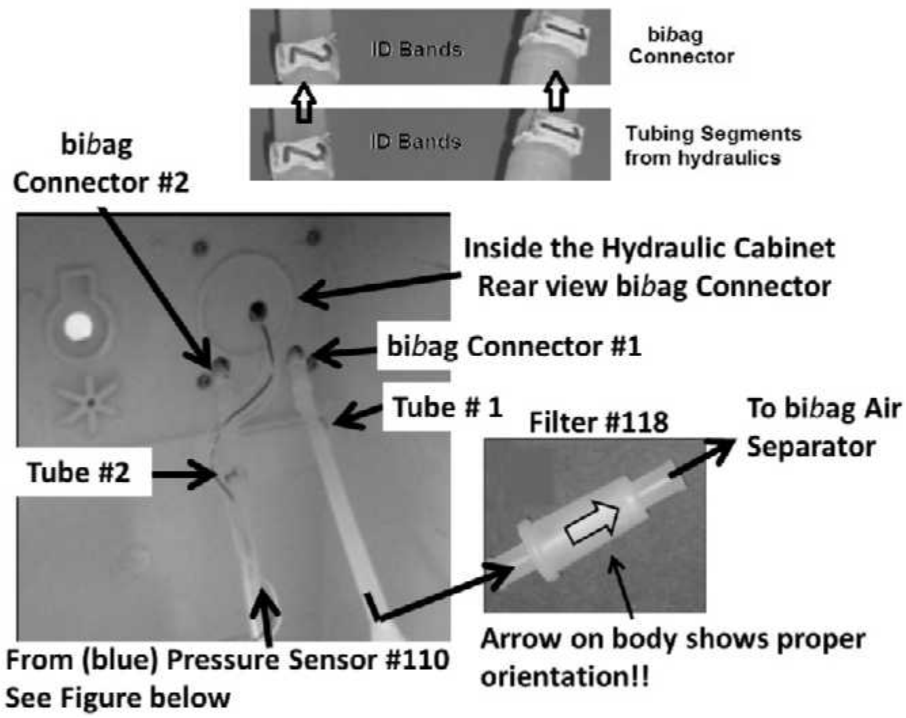
A) Leaving the machine on, pull the hydraulics away from the cabinet to.

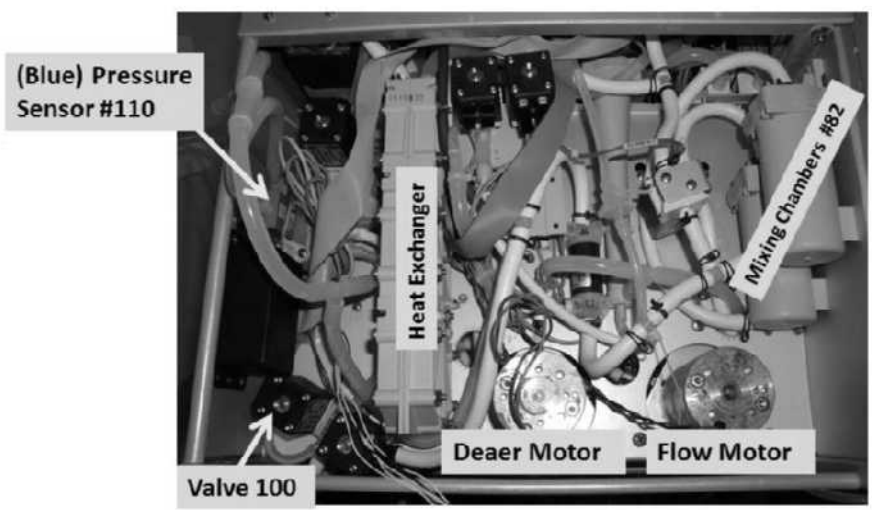
B) Figures below, per the numeric tubing identification (ID) bands, ENSURE the bi*b*ag Connector tubing segments are not reversed or kinked!

C) Is **Bic Press** now between negative (-)50 and positive 30 (Yes or No)?

Yes **Bic Press** between negative 50 and positive 30! The tubing may have been restricted: **A)** Reinstall the hydraulics ENSURING the tubing remain unrestricted! **B)** Return to (ABOVE) procedure number V104SC- 1.0.0 (page 730).

No **Bic Press** still is NOT between negative 50 and positive 30! See part D next page.



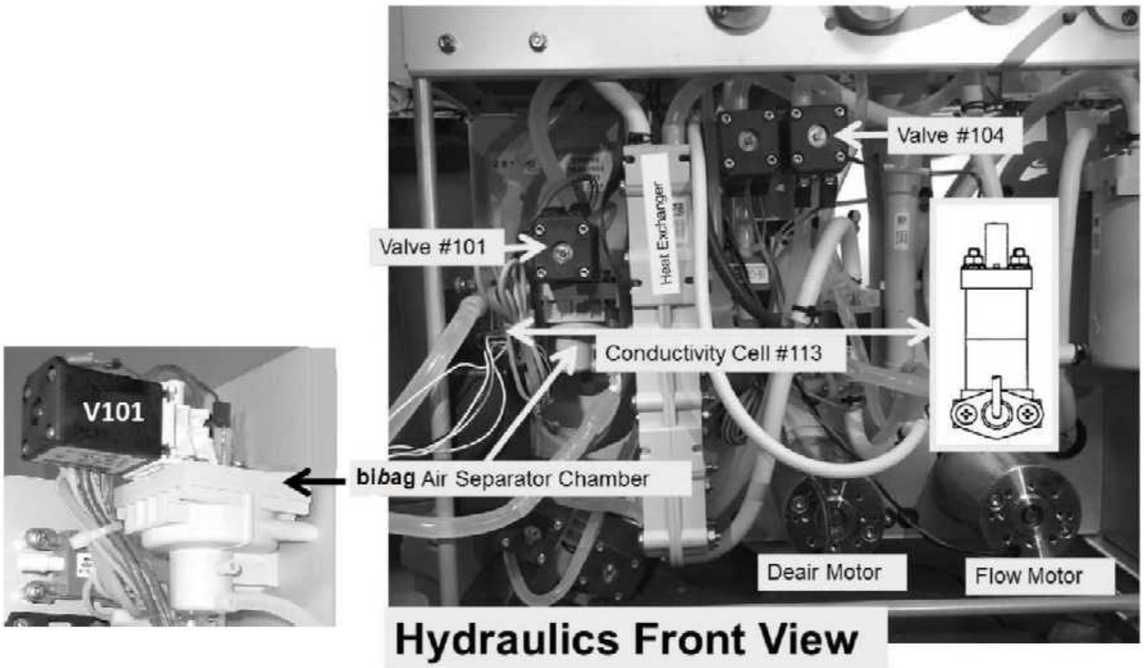



D) Per the **Figure (previous page)** pull Tube #2 off the rear side of the bi*b*ag Connector i.e. the segment between (blue) Pressure Sensor #110 and the bi*b*ag Connector.

E) Is **Bic Press** now between negative 50 and positive 30 (Yes or No)?

Yes **Bic Press** between negative 50 and positive 30! **a)** Reattach Tube #2! **b)** Figure below, check for restrictions between Valve #104 and the bi*b*ag Air Separation Chamber AND between the bi*b*ag Air Separation Chamber and the Bicarb Pump!

No **Bic Press** is NOT between negative 50 and positive 30! Leaving Tube #2 off, see procedure number V104SC- 1.0.3 (page 734).




NO TEXT INTENIONALLY

## V104SC- 1.0.3 ISOLATE PRESSURE SENSOR #110

a) Enter Service Mode → Calibrate Sensors → Pressure Transducers → **Regulator Pressure**.

b) Just enough to hold them there, place BOTH concentrate connectors ¼ way into their rinse ports.

c) Press 'Enter' and allow the calibration to complete. If successful the "Calibrate Regulator Pressure" banner appears (Figure below), and the screen will say "Calibration Complete, press CONFIRM to save".

d) Was the calibration successful?


Yes An Error banner DID NOT occur! Press 'Enter' then see procedure number V104SC-1.0.3.1 (page 734).

No An Error banner occurred! Repeat the calibration but if the Error banner reoccurs, FOUR (4) possible problems (see PROBLEM LIST below). Check and / or swap in each component one at a time until the Regulator Pressure calibration is successful.

**PROBLEM LIST**: **1)** Loose bi*b*ag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #110 OR; **3)** Bad bi*b*ag Interface board OR; **4)** Bad electrical connection, from Pressure Sensor #110, inside the bibag Distribution Board (refer to Figure 4D (page 13)).

## V104SC- 1.0.3.1 CALIBRATION SUCESSFUL

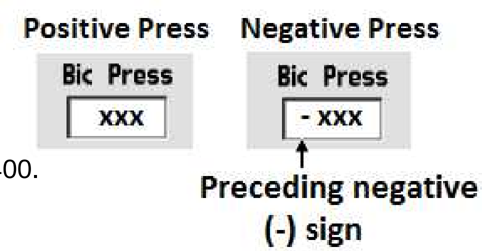
a) Turn the machine off and reattach Tube #2!

b) **SLAM the ACID and BICARB connectors into their rinse ports!**

c) **Return to RINSE!**

d) Call debug screen 15. If the debug screens do not appear press 'Esc' then call screen 15.

e) **Bic Press** may fluctuate but MUST, at least once, achieve more than POSITIVE 400. It may exceed 800 and this is okay!




f) Watch **Bic Press** for two (2) minutes OR until if it achieves 400. TWO (2) possible scenarios:

**1)** **IF (and ONLY if) NEVER achieves POSITIVE 400:** See procedure number V104SC- 2.0.0 (page 736).

**2)** **IF reaches POSITIVE 400 or more at least once:** See part A) next page:

A) Press ‘Esc’ to return to the main RINSE screen. THREE (3) possible scenarios below:

1) **IF (and ONLY if) the [Remaining Time] window is <u>NOT</u> ‘blinking’:** See parts B) and C).

2) **IF (and ONLY if) [Remaining Time] is ‘blinking’ <u>AND</u> the “V104/108 Stuck Closed” banner is up:** Proceed to **page 739**, procedure number V104SC- 2.0.3.

3) **IF [Remaining Time] is ‘blinking’ <u>AND</u> the “V104/108 Stuck Closed” banner is <u>NOT</u> up:** Address whatever alarm banner is showing.

B) The first part of clearing “V104/108 Stuck Closed”, is successful. Now when rinse finishes, **Bic Press** must significantly decrease through Valves #104 and #108.

C) Watch carefully until if [Remaining Time] = 0:00. Does “V104/108 Stuck Closed” reappear?

Yes “V104/108 Stuck Closed” reappears! Proceed to **page 739**, procedure number V104SC- 2.0.3.

No “V104/108 Stuck Closed” NEVER reappears! When RINSE finishes return to Dialysis Program (“Select Program” →.’Dialysis’ → ‘Enter’). TWO (2) possible scenarios:

1) **IF (and ONLY if) “V104/108 Stuck Closed” reoccurs**: Proceed to **page 438**, procedure number CO- 14.0.0.

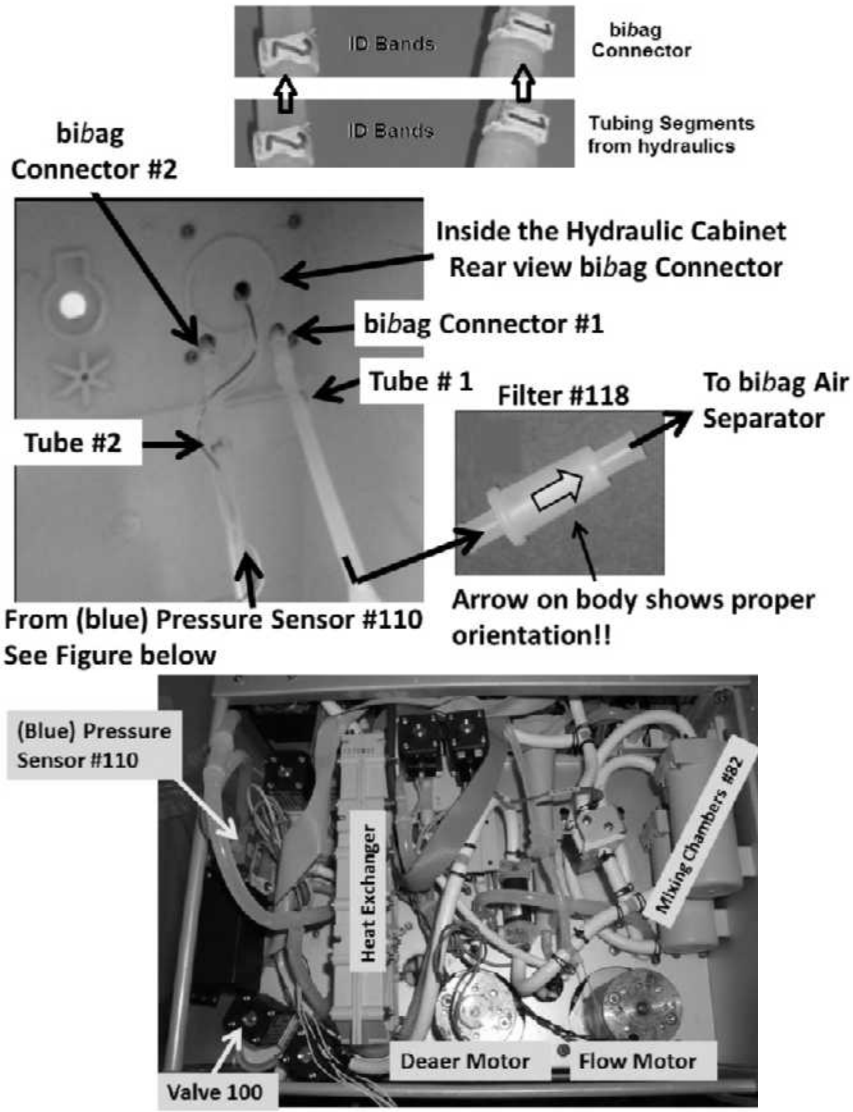
2) **IF V104/108 Stuck Closed” does <u>NOT</u> reoccur:** The alarm has been cleared from memory! Possibly the blue connector was not inserted properly into its rinse port when last rinsed.

NO TEXT INTENIONALLY

## V104SC- 2.0.0 BIC PRESS DOES NOT ACHIEVE 400

A) Pull the hydraulics away from the cabinet.

B) Figures below, per the identification (ID) bands on the tubing, ENSURE the bi*b*ag Connector tubing segments have not been reversed or kinked




C) **Leaving the hydraulics out, return to RINSE!**

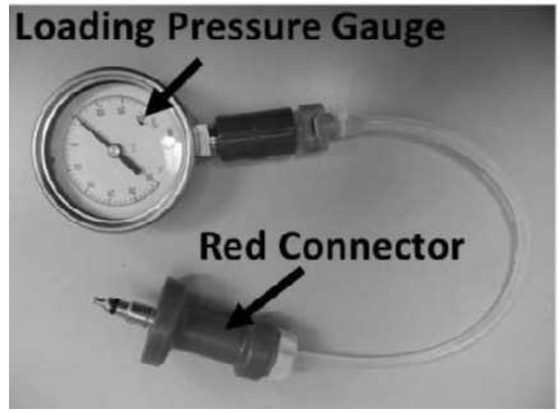
D) Call debug screen 15. If debug does not appear press 'Esc' then call screen 15.

E) Watch **Bic Press** for one (1) minute. Does it achieve more than POSITIVE 400 now (Yes or No)?

Yes **Bic Press** achieves POSITIVE 400! A tubing segment may have been kinked! Reinstall the hydraulics ENSURING the tubing remains unrestricted!

No **Bic Press** does NOT achieve POSITIVE 400! See procedure number V104SC- 2.0.1 (page 737).

## V104SC- 2.0.1 ISOLATE LOADING PRESSURE

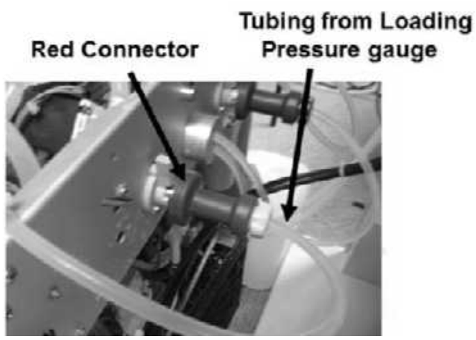



A) **Figure right**, remove the ACID (RED) connector from the acid inlet tubing AND attach the Loading Pressure gauge tubing to it**.**

B) Place the Acid Inlet tubing into water.

C) **ENSURE** the gauge reads 0 psi before inserting it in the Rinse Port!

D) Figure below, right **SLAM** the acid connector into the Acetate/Acid Rinse port.




E) **Return to RINSE! NOTE!** Ignore vent tubing overflow for now.

F) Watch the gauge for one (1) minute as it may cycle below 15 psi at times but does it EVER PEAK to at least 23 psi?

Yes  Cycles to at least 23 psi! Continue to part G next page!

No  NEVER cycles to at least 23 psi! TWO (2) possible scenarios below:

1) **IF REMAINS ALWAYS less than 15 psi**: Proceed to **page 174**, procedure number CLEAN- 1.2.33.

2) **IF CYCLING to between 15 and 21 psi:** Adjust Valve #65***** attempting to achieve a PEAK of between 23 and 25 psi. ***** To LOCATE Valve #65 refer to Figure 6 (page 22). TWO (2) possible scenarios I or II below:

I. **IF (and ONLY if) unable to adjust to at least 23 psi:** Proceed to **page 174**, procedure number CLEAN- 1.2.33

II. **IF you can adjust to between 23 and 25 psi:** Perform parts a THROUGH c below:

a) Return the red connector to the acid inlet tubing.

b) **Return to RINSE!**

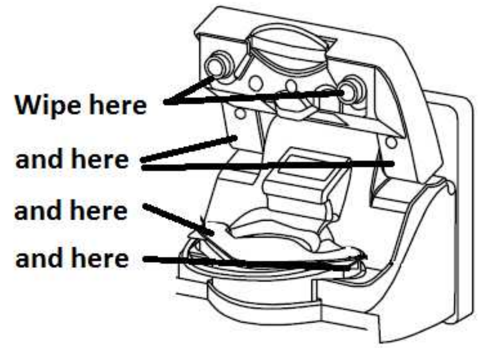
c) Call debug screen 15. If **Bic Press** is achieving POSITIVE 400 this may have solved the problem! If **Bic Press** still is not achieving 400 see part G next page.

G) Open the bi*b*ag Connector door to interrupt rinse

H) Return the red connector to the acid inlet tubing!

I) Clamp the external Bicarb connector (blue) inlet tubing. This isolates Valve #100 subsequently.

J) Figure right, wipe all the water away from the door nozzles and the door.




K) **Return to RINSE for one (1) minute!**

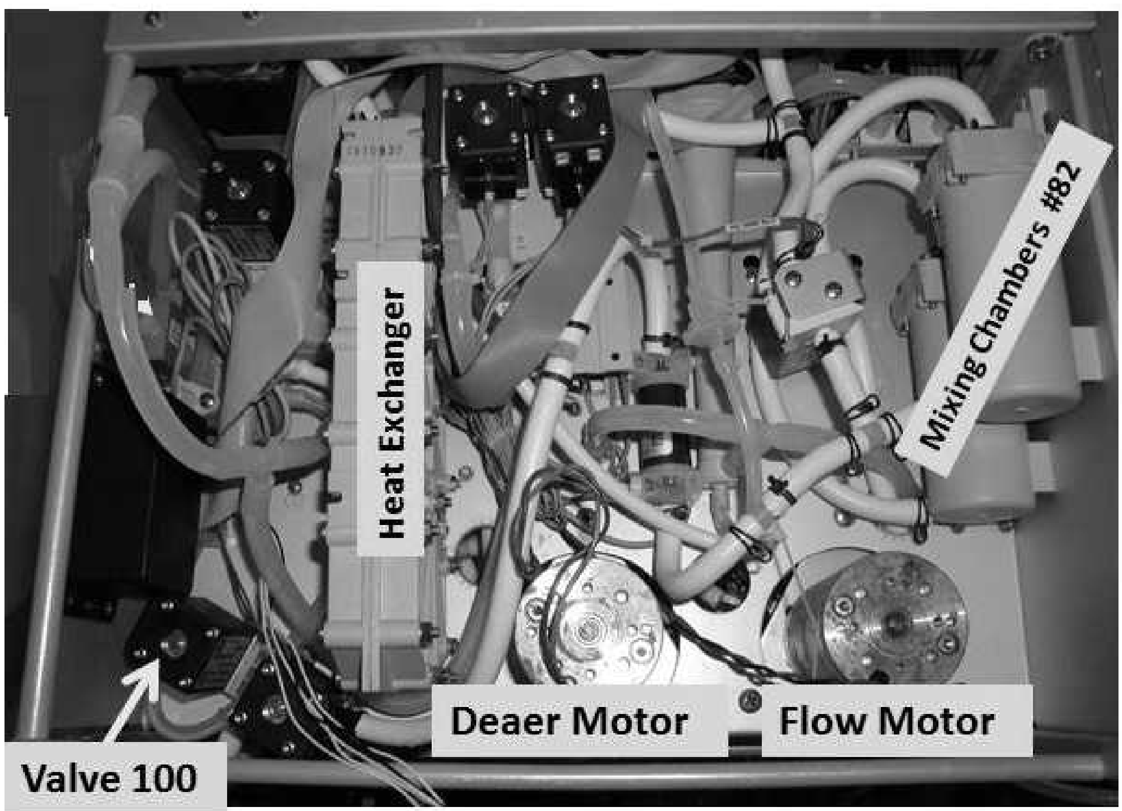
L) Open the bi*b*ag Connector door to interrupt rinse!

M) Is there is more water around the door nozzles than when you dried it earlier?

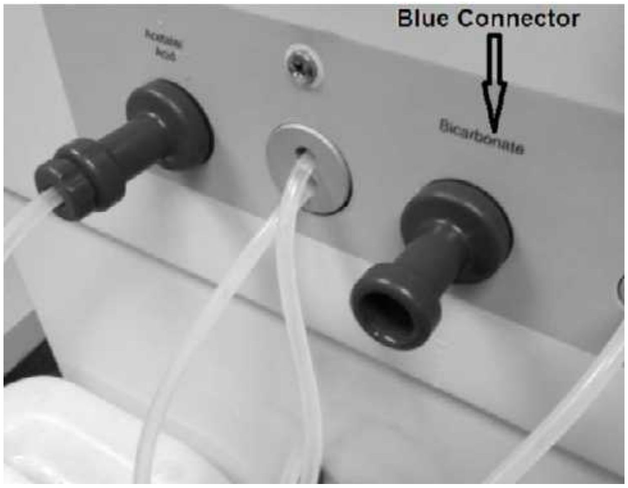
Yes Remove the clamp! Valve #100 is opening at least partially. Return to RINSE but if **Bic Press** still is not achieving POSITIVE 400 <u>AND</u> "V104/V108 Stuck Closed" reoccurs replace Valve #100 (see the Figure below to locate Valve #100)

No Remove the clamp! TWO (2) possible bad components: **1)** Bad Valve #100 (see Figure below); <u>OR</u> **2)** Bad bi*b*ag Interface Board (refer to Figure 4C (page 11)).

**Hydraulics Front View**



### V104SC- 2.0.3 BIC PRESSURE ACHEIVES POSITIVE 400




A) 1000 ml graduated cylinder is required!

B) Disconnect the Inlet tubing from the Bicarb (BLUE) concentrate connector.

C) Figure right, **SLAM** the Bicarb connector into the Bicarbonate Rinse port.

D) See procedure number V104SC- 2.0.4 (page 739).

### V104SC- 2.0.4 ISOLATE VALVE #108

A) Expecting flow from the blue connector, **return to RINSE!**

B) If flow, allow three (3) pulses then measure TEN (10) pulses into the cylinder!

C) Interrupt Rinse by pulling the connector out of the Rinse port!

D) More than 180 ml collected?

Yes More than 180 ml! Proceed to **page 741**, procedure number V104SC- 3.0.0.

No Less than 180 ml! ENSURING the machine was in RINSE prior to checking flow, perform parts a THROUGH c below:

a) ENSURE RINSE is now Interrupted.

b) If a restriction is located inside the BLUE connector or its adaptor plug this may be the problem!

c) See procedure number V104SC- 2.0.6 (page 740).

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## V104SC- 2.0.6 LESS THAN 180 ML COLLECTED

A) Return the blue connector the Bicarbonate Rinse port.

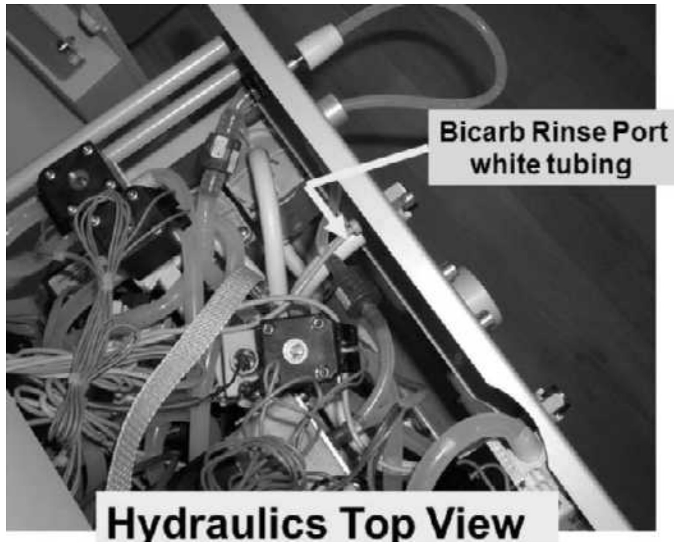
B) Figure right, REMOVE the **WHITE** tubing from the hydraulic side of the **BICARB RINSE PORT** and direct it into the cylinder.

C) Expecting flow from the tubing, **return to RINSE!**

D) If flow, allow three (3) pulses THEN measure ten (10) pulses.

E) Interrupt Rinse by pulling the blue connector out of the Rinse port!

F) More than 180 ml collected?

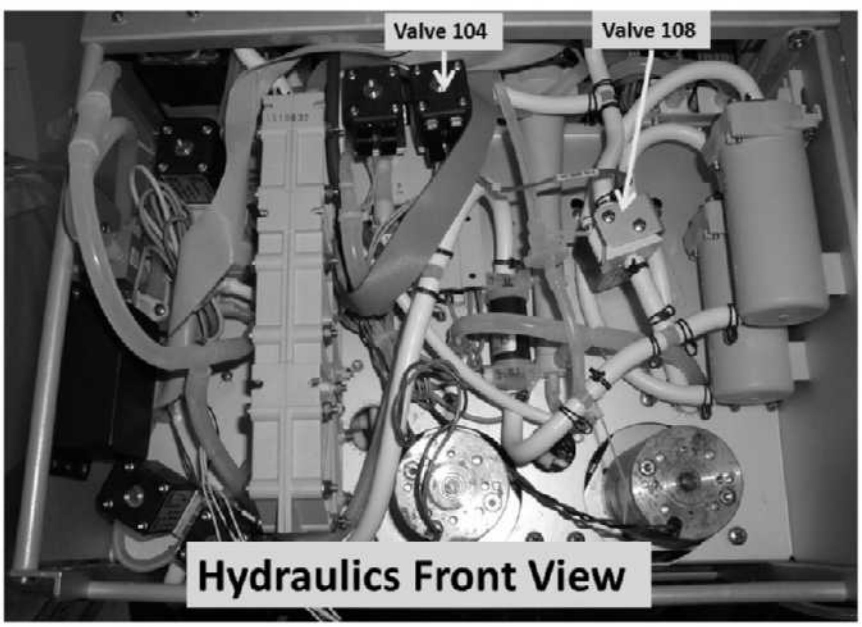



Yes More than 180 ml! TWO (2) possible bad components: **1)** Restricted Bicarb concentrate connector OR; **2)** Bad Bicarb Rinse port.

No Less than 180 ml! ENSURING the machine was in RINSE prior to checking flow, perform parts a AND b below:

a) With RINSE now interrupted, reattach the Bicarb rinse port tubing!

b) FIVE (5) possible problems: **1)** Figure below, bad wire connection(s) between Valve #108 and Valve #104 OR; **2)** Loose ribbon cable at the bibag Interface board (refer to Figure 4C (page 11)) OR; **3)** Bad Valve #108 OR; **4)** Bad bi*b*ag Interface Board OR; **5)** Bad electrical connection, from Valve #108/Valve #104, inside Distribution Box #2 (see Figure 4D (page 13)).



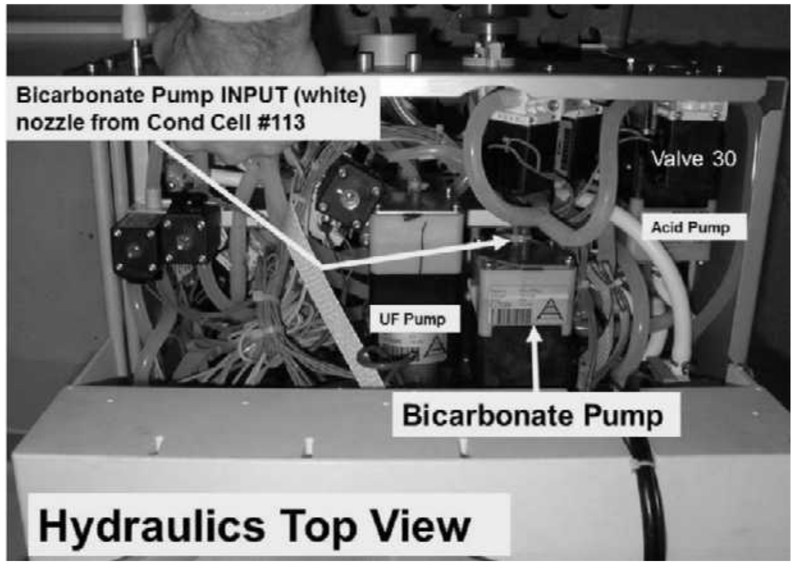
**V104SC- 3.0.0 ISOLATE VALVE #104**

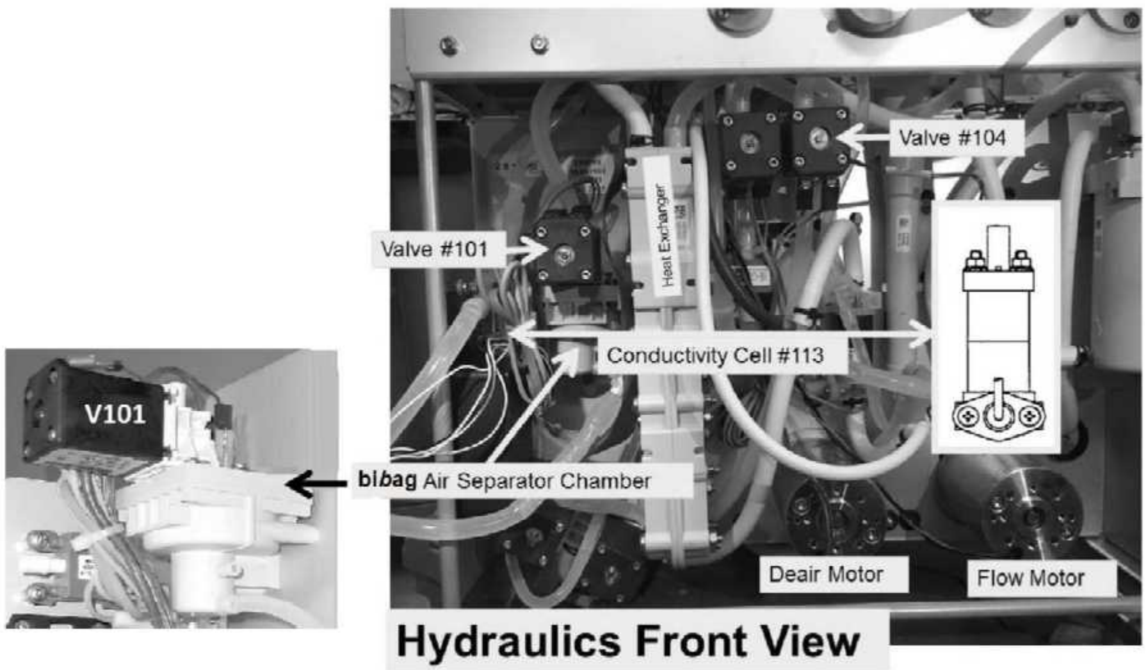
A) **Turn the machine OFF!**

B) Reattach the Bicarb connector's inlet tubing!

C) **Per the Figures right**, ENSURE the **Bicarb Pump's** INPUT, BOTTOM (clear) tubing is attached to Conductivity Cell #113.

D) See procedure number V104SC- 3.1.0 (page 741).




**V104SC- 3.1.0 ISOLATE V104 CONTINUED**

A) Turn the machine on. When "Press CONFIRM For Service Mode" appears press 'Enter'. The screen says "Machine In Service Mode".

B) Press the Service Screen's lower left 'Options' key!

**Parts C – H next page**

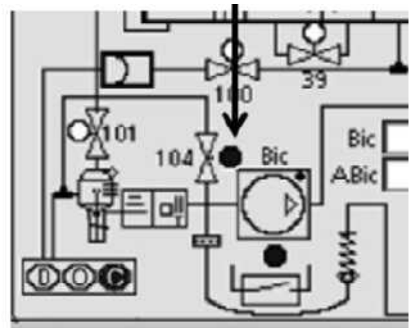
C) Call debug screen 0

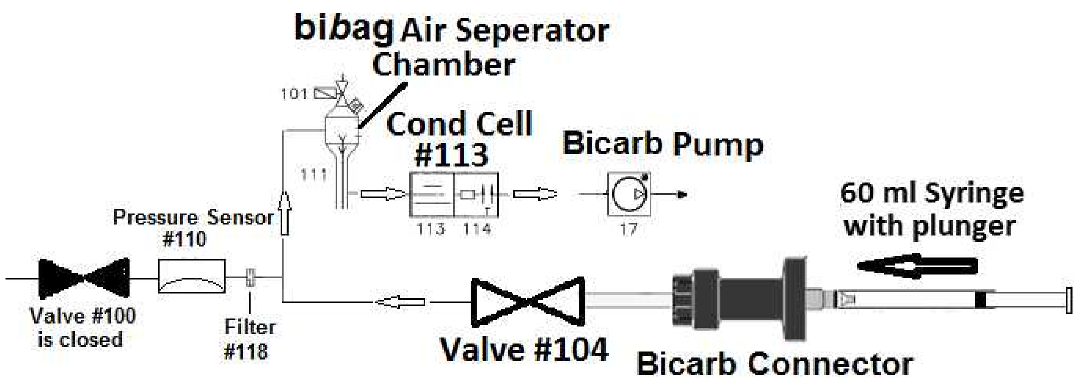
D) Figure right, ENSURE Valve #104's 'dot' is BLUE!

E) REMOVE the clear tubing from the **Bicarb Pump's** INPUT (white) nozzle.

F) Direct the tubing into a cup.

G) Figure below, attach a water filled 60 ml syringe, WITH THE PLUNGER installed, to the Bicarb (blue) connector.




H) GENTLY push on the syringe's plunger. Are you able to easily push water all the way through and into the cup?

Yes Able to push water through Valve #104 into the cup! Valve #104 is okay! See procedure number V104SC- 3.2.0 (page 743).

No Resistance encountered! Perform parts a THROUGH e below:

a) ENSURE the **Bicarb Pump's** input tubing was removed previously!

b) ENSURE the Bicarb connector's adaptor plug opening is not plugged!

c) Figure, previous page, ENSURE no tubing restrictions between Valve #104 and the bi*bag* Air Separator Chamber.

d) Per the Figure, previous page. ENSURE no restrictions between bi*bag* Conductivity Cell #113 and the Bicarb Pump's input.

e) If no restrictions were located above, THREE (3) possible problems (see PROBLEMS LIST below. Swap in each component, one at a time and repeat procedure number V104SC- 3.1.0 (page 741), until you are able to push water through Valve #104.

**PROBLEMS LIST**

**1)** Bad Valve #104 (refer to the Figure, previous page) OR; **2)** bi*bag* Interface Board (refer to Figure 4C (page 11)) OR; **3)** Bad electrical connection, from Valve #104, inside Distribution Box #2 (refer to Figure 4D (page 13)).

## V104SC- 3.2.0 VALVE #104 IS OKAY

a) Reattach the Bicarb Pump's inlet tubing!

b) Press the keyboard's 'Esc' key.

c) From the Service Mode menu press Calibrate Sensors → Pressure Transducers → **Regulator Pressure**.

d) Just enough to hold them there, place BOTH concentrate connectors ¼ way into their rinse ports.

e) Press 'Enter' and allow the calibration to complete. If successful the "Calibrate Regulator Pressure" banner appears (Figure below), and the screen will say "Calibration Complete, press CONFIRM to save".


f) Was the calibration successful?

Yes An Error banner DID NOT occur! See procedure number V104SC- 3.2.0.1 (page 743).

No An Error banner occurred! Repeat the calibration but if the Error banner reoccurs, FOUR (4) possible problems (see PROBLEM LIST below). Check and / or swap in each component one at a time until the Regulator Pressure calibration is successful.

**PROBLEM LIST**: **1)** Loose bi*b*ag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #110 OR; **3)** Bad bi*b*ag Interface board OR; **4)** Bad electrical connection from Pressure Sensor #110 inside the bibag Distribution Board (refer to Figure 4D (page 13)).

## V104SC- 3.2.0.1 CALIBRATION SUCCESSFUL

a) Press 'Enter' then turn the machine off.

b) **Turn the machine on then return to RINSE!**

c) Call debug screen 15. If the debug screens do not appear press 'Esc' then call screen 15.

d) Watch **Bic Press**. If it behaves as previously it MUST at least once, achieve POSITIVE 400 or more!.

e) If "V104/108 Stuck Closed" reoccurs, **there may be a restriction between the blue connector and the Bicarb Pump that was not located OR Valve #104 may be partially restricted!**

## SECTION 31 – VALVE 104 OR VALVE 105 ERROR



A) Call debug screen 15. THREE (3) possible scenarios 1) or 2) or 3) below:

**1)** **IF (and ONLY if) V104 Er** (3rd column from left) **= 1:** Referring to the Figure below, there is a problem with Valve #104 and / or Valve #108. See part B.

**2)** **IF (and ONLY if) V105 Er** (2nd column from left) **= 1:** Referring to the Figure below, there is a problem with Valve #105. See part B.

**3)** **IF BOTH V105 Er AND V104 Er = 0:** You are in the wrong Section! Neither valve is reporting a problem!

B) **Turn the machine OFF!**

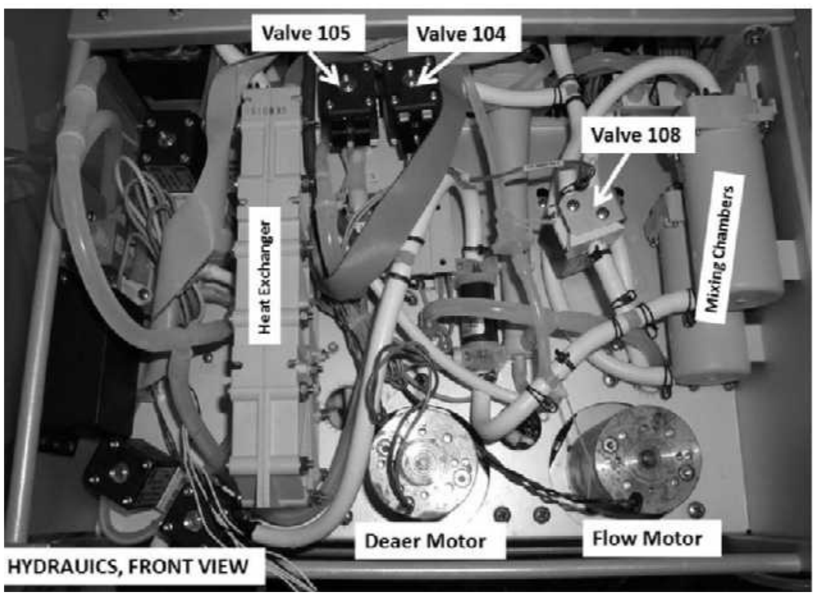
C) **Set your CALIBRATED volt meter to RESISTANCE (Ω)!**

D) TWO (2) possible scenarios:

**1)** **IF (and ONLY if) V104 Er = 1:** Problem with Valve #104 AND / OR Valve 108! See procedure number V- 1.0.0 (page 744).

**2)** **IF V105 Er = 1:** Problem with Valve #105! Proceed to **page 745**, procedure number **V- 2.0.0**.

### Hydraulics Front View, Valves #105, #104 and #108 Locations




**V- 1.0.0 V104 Er = 1 / PROBLEM WITH VALVE #104 AND / OR VALVE #108**


A) ENSURE Valve #104's and #108 wires terminate properly at their solenoid terminals (Figure right). **If not, this is may be the problem!**

B) **Unplug both Valve #104's wires from its solenoid!**

**Parts C through E continued on next page**

**V- 1.0.0 V104 Er = 1 / PROBLEM WITH VALVE #104 AND / OR VALVE #108 continued:**


C) Check the solenoid terminals. **If corrosion is located replace Valve #104!**

D) As Valve #104 and #108 are wired in parallel, unplug also Valve #108's wires from its solenoid. **If corrosion is located replace Valve #108!**

E) Leaving the wires unplugged, Figure right, measure BETWEEN the solenoid terminals of BOTH Valves (#104 and #108). BOTH solenoids between 40 and 100 Ω?

Yes BOTH solenoids between 40 and 100 Ω! **A)** Return the wires to the solenoid terminals! **B)** TWO (2) possible problems: **1)** Bad bi*b*ag Interface Board (refer to Figure 4C (page 11)) OR; **2)** Electrical connection, from Valve #104/Valve #108, inside Distribution Box 2 (refer to Figure 4D (page 13)).

No Less than 40 Ω OR more than 100 Ω! Replace the Valve with the bad resistance measurement!

# V- 2.0.0 V105 Er = 1 / PROBLEM WITH VALVE #105


a) ENSURE Valve #105's wires terminate properly at the solenoid terminals (Figure right). **If not, this is may be the problem!**

b) **Unplug Valve #105's wires from its solenoid!**

c) Check the solenoid. **If corrosion is located replace Valve #105!**

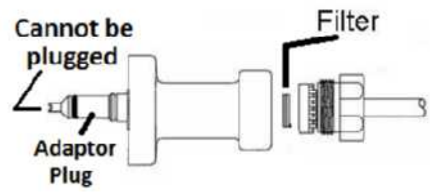
d) Leaving the wires unplugged, Figure right, measure BETWEEN the solenoid terminals. Between 40 and 100 Ω?


Yes Between 40 and 100 Ω! **A)** Return the wires to the solenoid terminals! **B)** TWO (2) possible problems: **1)** Bad bi*b*ag Interface Board (refer to Figure 4C (page 11)) OR; 2**)** Electrical connection, from Valve #105, inside Distribution Box 2 (refer to Figure 4D (page 13)).

No Less than 40 Ω OR more than 100 Ω! Replace Valve #105!

# SECTION 32 – "V105 STUCK CLOSED" OR  V105 ER C = 1

"V105 Stuck Closed"  OR **V105 Er C** = 1 indicates a possible restriction in the Acid inlet system as sensed by Pressure Sensor #106 (**Acid Press**).



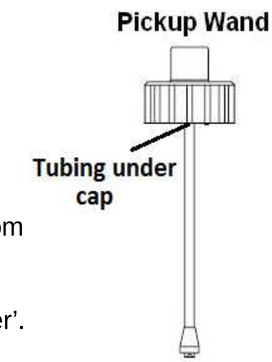

A) ENSURE the external Acid inlet tubing is NOT kinked!

B) Figure right, ENSURE the Acid (red) connector's filter is clean AND its adaptor plug opening is not plugged!

**NOTE!** If external leaks, "No Water", or a Flow Error EVER occur address them FIRST!

C) TWO (2) possible scenarios 1) or 2) below:

**1) IF occurring during OR after a Cleaning/Disinfection Program (Rinse, Heat Disinfect, etc.) has stopped:** See procedure number V105SC- 1.0.0 (page 747).



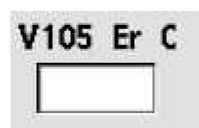

**2) IF occurring in Dialysis Program:** Perform parts a THROUGH e below:

a) If attached to an Acid jug ENSURE the Pick Up wand tubing (Figure right) is NOT kinked!

b) If attached to a central Acid delivery system (SDS) ENSURE good flow from the station valve! The valve MUST be left open!

c) From the home screen, set [Dialysate Flow] to 800 ml/min and press 'Enter'.

d) Call debug screen 15.




e) Watch **V105 Er C** (left column, bottom window) for four (4) minutes OR until if it EVER = 1, even just once?

Yes **V105 Er C** = 1 even just once! Proceed to **page 435**, procedure number CO- 13.0.00.

No **V105 Er C** REMAINS ALWAYS = '0'!  Whatever was causing "V105 Stuck Closed" has cleared for now! See parts THROUGH c below:

a) Call debug screen 0 to watch **Flow Error** (TOP window) for two (2) minutes. If EVER = 1 a masked Flow Error is occurring! In this event, DO NOT continue to troubleshoot "V105 Stuck Closed".

b) If [**Conductivity**] increases to more than 12.6 mS Valve #105 is at least partially open! **There may still be a restriction!**

c) Install a venous dummy chamber in the Level Detector module and attempt to reset all alarms. Does the "V105 Stuck Closed" banner appear?

Yes "V105 Stuck Closed" reappears! Proceed to **page 435**, procedure number CO- 13.0.0.00.

No Whatever was causing the alarm has cleared completely,

## V105SC- 1.0.0 “V105 STUCK CLOSED”

**NOTE!** A poorly inserted Acid connector, into its Rinse port, is the most common cause of “V105 Stuck Closed”!

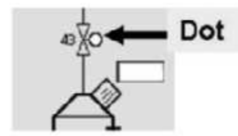

A) Figure right, ENSURE the RINSE ports extend out about ¼ inch away from the cabinet! If not this may be the problem!

B) **SLAM the ACID and BICARB connectors into their rinse ports!**

C) **PLACE THE MACHINE IN RINSE!**

D) Call debug screen 0. If debug does not appear press ‘Esc’ then call screen 0.

E) Figure right, if Valve #43’s ‘dot’ is blue allow it to turn white!

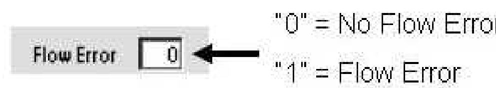



F) Is the external flow indicator’s ‘bob’ rising at least ½ way up in the sight tube?

Yes ‘Bob’ moving! See part G.

No ‘Bob’ NOT moving! Proceed to **page 166,** SECTION 3 - FLOW ERRORS IN CLEANING / DISINFECTION PROGRAMS

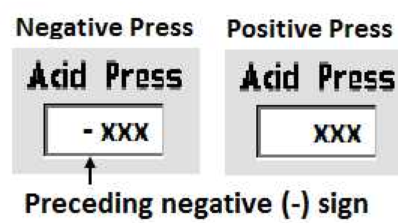
G) If **Flow Error** (TOP window) EVER = 1, even just once, there is a masked Flow Error! WITHOUT LOOKING AWAY, watch it for two (2) minutes. TWO (2) possible scenarios:




1) **IF Flow Error ALWAYS = 0:** See part H.

2) **IF Flow Error EVER = 1, even just once:** Proceed to **page 166,** SECTION 3 - FLOW ERRORS IN CLEANING / DISINFECTION PROGRAMS!

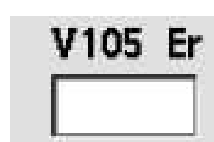
H) Call debug screen 15. Locate **Acid Press** (Figure right). If a negative (‘-‘) sign appears pressure is NEGATIVE. If no ‘-‘ sign it is POSITIVE! In any event see part I.




I) **Acid Press** may fluctuate HOWEVER, it MUST, at least once, become more than POSITIVE 400. It may exceed 800 and this is okay! TWO (2) possible scenarios:

1) **IF (and ONLY if) achieves POSITIVE 400 or more at least once:** Proceed to **page 752**, procedure number V105SC- 5.0.0.

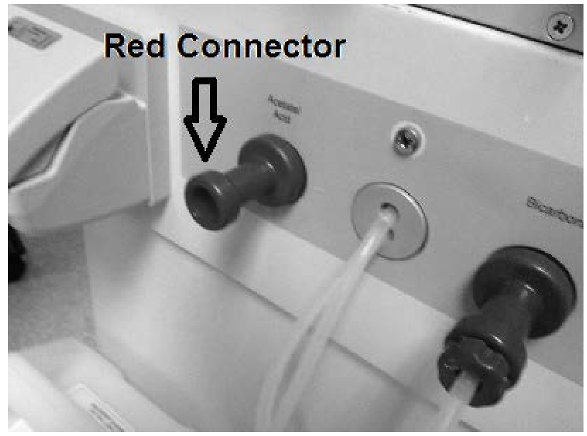
2) **IF NEVER achieves at least POSITIVE 400!:** See part J.




J) Call debug screen 15. Does **V105 Er** (2nd column from left) = ‘0’?

Yes **V105 Er** = '0'! See part K.

No **V105 Er = '**1'! There is a problem with Valve #105! Proceed to **page 744**, SECTION 31 – VALVE 104 OR VALVE 105 ERROR.




K) A 1000 ml graduated cylinder is required!

L) Figure right, disconnect the tubing from the Acid (red) connector THEN **SLAM** it into the Acetate/Acid port!

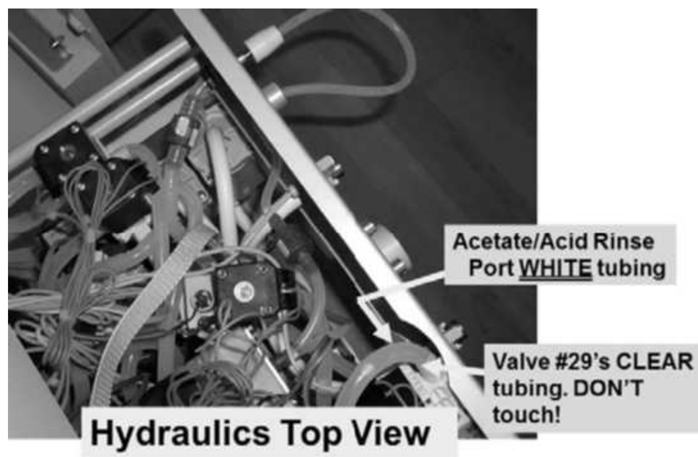
M) Expecting flow, from the red connector, **return to RINSE!**

N) If flow, allow three (3) pulses THEN collect TEN (10) pulses into the cylinder.

O) Pull the red connector out to Interrupt Rinse. More than 180 ml collected?

Yes More than 180 ml! See procedure number V105SC- 2.0.0 (**page 749**).

No Less than 180 ml! ENSURING the machine was in RINSE prior to checking flow, see part P.




P) Figure right, REMOVE the **WHITE** tubing from the rear side of the **Acetate/Acid** Rinse port

Q) Direct the tubing into the cylinder then **return to RINSE!**

R) If flow, allow three (3) pulses THEN collect ten (10) pulses.

S) Interrupt Rinse! More than 180 ml collected?

Yes More than 180 ml! **A)** Reattach the tubing to the red connector! **B)** TWO (2) possible bad components: **1)** Restricted Bicarb (blue) concentrate connector OR; **2)** Bad Acetate/Acid Rinse port.

No Less than 180 ml! Perform parts a AND b below:

a) Reattach the Acetate/Acid rinse port tubing!

b) FIVE (5) possible problems: **1)** Bad wire connection(s) between Valve #108[1] and Valve #104[1] OR; **2)** Loose ribbon cable at the bibag Interface board (refer to Figure 4C (page 11)) OR; **3)** Bad Valve #108 OR; **4)** Bad bi*b*ag Interface Board OR; **5)** Bad electrical connection, from Valve #104/Valve #108, inside Distribution Box #2 (refer to Figure 4D (page 13)).

[1] To LOCATE Valve #108 and Valve #104 refer to Figure 3 (page 5)

## V105SC- 2.0.0 ISOLATE ACID PUMP INPUT

a) **Reattach the Acid connector's inlet tubing**!

b) Remove the hydraulics from the cabinet.

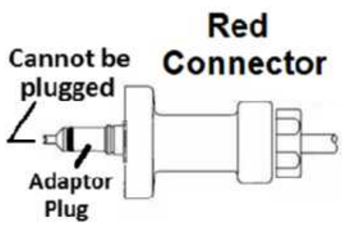
c) Per the Figures below, THREE (3) checks:

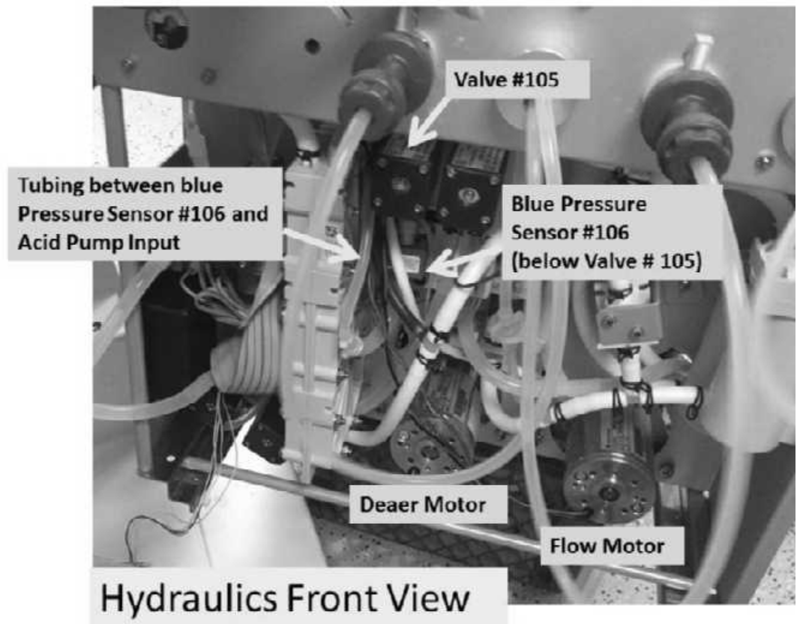
**CHECK #1:** Check for restrictions between the acid (red) connector and Valve #105.

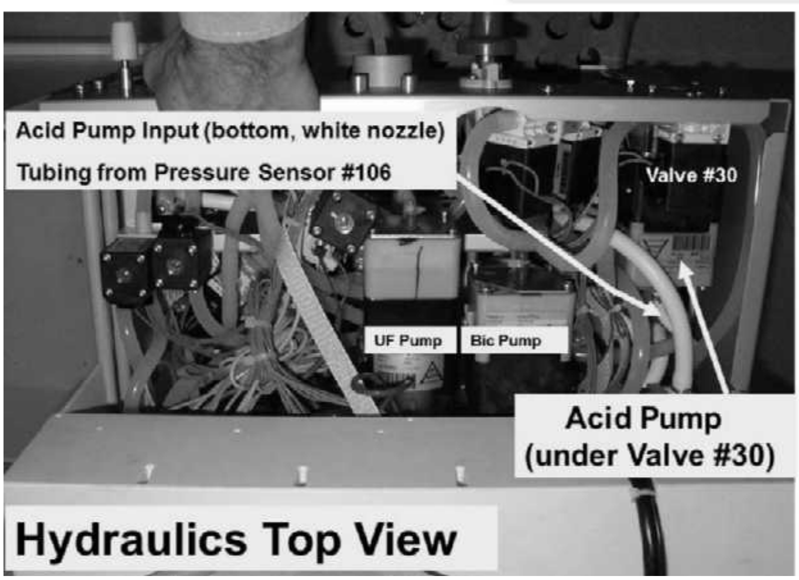
**CHECK #2:** ENSURE the **Acid Pump's** INPUT (white) nozzle is on the bottom.

**CHECK #3:** ENSURE the Acid Pump's INPUT tubing is clear AND goes, unrestricted, to the bottom of Pressure Sensor #106.

d) See procedure number V105SC- 2.1.0 (page 750).

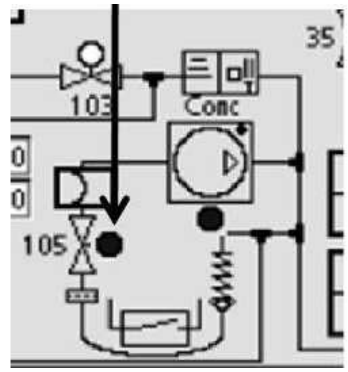


## V105SC– 2.1.0 ISOLATE VALVE #105

a) Turn the machine on. When the screen says "Press CONFIRM For Service Mode" press 'Enter'. The screen MUST say "Machine In Service Mode".



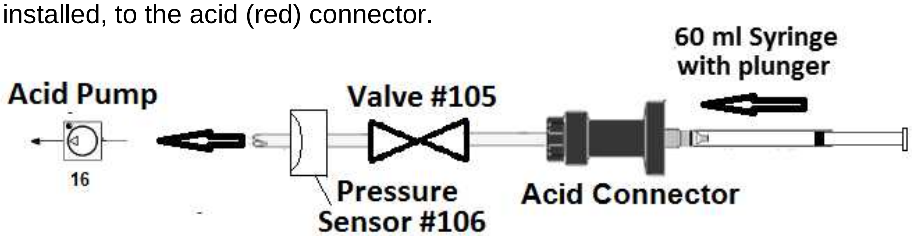

b) Press the Service screen's lower left 'Options' key.

c) Call debug screen 0.

d) Figure right, ENSURE Valve #105's 'dot' is BLUE!

e) REMOVE the clear tubing from the **Acid Pump's** INPUT (white) nozzle. Place a cup under the vacant nozzle.

f) Figure below, attach a water filled 60 ml syringe, WITH THE PLUNGER installed, to the acid (red) connector.




g) GENTLY push on the plunger. Can you push water through Valve #105 into the cup?

Yes EASILY able to push water into the cup! Valve #105 is okay! See procedure number V105SC- 2.3.0 (page 751).

No Significant resistance encountered! Problem with Valve #105! Perform parts a THROUGH c below:

a) ENSURE the **Acid Pump's** input tubing was removed previously!

b) ENSURE the acid connector itself is NOT restricted with debris!

c) FOUR (4) possible problems (see PROBLEM LIST below). Check each and / or swap in each component, one at a time and in between repeat procedure number V105SC- 2.1.0 (page 750) until you are able to push water through Valve #105.

**PROBLEM LIST: 1)** Loose bi*b*ag Interface board ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Valve #105 OR; **3)** Bad bi*b*ag Interface Board OR; **4)** Bad electrical connection, from Valve #105, inside Distribution Box 2 (see Figure 4D (page 13)).

## V105SC- 2.3.0 VALVE #105 IS OKAY

a) **Leave the <u>Acid Pump's</u> INPUT tubing disconnected for now!**

b) Call debug screen 15. Is **Acid Press** now between -30 and 30?

Yes **Acid Press** is between -30 and 30. Pressure Sensor #106 seems to be okay! See procedure number V105SC- 2.4.0 (page 751).

No **Acid Press** IS NOT between -30 and 30! Possible problem with Pressure Sensor #106! See procedure number V105SC- 2.4.0 (page 751).

## V105SC- 2.4.0 ISOLATE PRESSURE SENSOR #106

a) Press the keyboard's 'Esc' key.

b) From the Service Mode menu press Calibrate Sensors → Pressure Transducers → **Regulator Pressure.**

c) Just enough to hold them there, place BOTH concentrate connectors ¼ way into their rinse ports.

d) Press 'Enter' and allow the calibration to complete. If successful the "Calibrate Regulator Pressure" banner appears (Figure below), and the screen will say "Calibration Complete, press CONFIRM to save".

e) Was the calibration successful?


Yes An Error banner DID NOT occur! Press 'Enter'. Reconnect all tubing and test the machine for "V105 Stuck Closed". **If it reoccurs there is a restriction between the acid connector and the Acid Pump that was not located above <u>OR</u> Valve #105 is partially restricted!**

No An Error banner occurred! Repeat the calibration but if the Error banner reoccurs, FOUR (4) possible problems (see <u>PROBLEM LIST</u> below). Check and / or swap in each component one at a time until the Regulator Pressure calibration is successful.

**<u>PROBLEM LIST</u>**: **1)** Loose bi*b*ag Interface ribbon cable (refer to Figure 4C (page 11)) OR; **2)** Bad Pressure Sensor #106 OR; **3)** Bad bi*b*ag Interface board OR; **4)** Bad Pressure Sensor #106 electrical connection inside Distribution Box 2 (refer to Figure 4D (page 13)).

LEFT BLANK INTENTIONALLY

## V105SC- 5.0.0 ACID PRESS ACHIEVED MORE THAN 400 (1)

a) Remove the hydraulics from the cabinet.

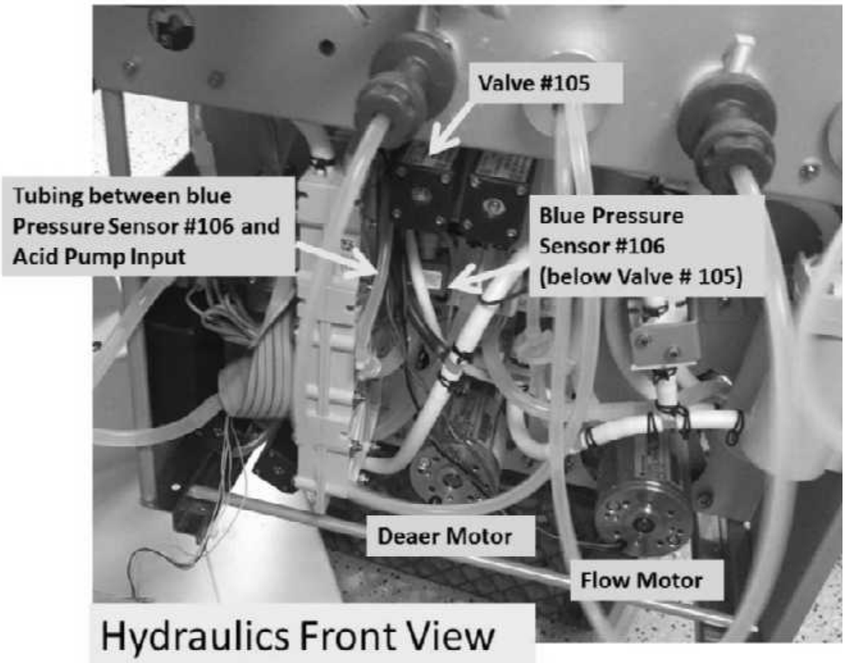
b) Per the Figures below, THREE (3) checks:

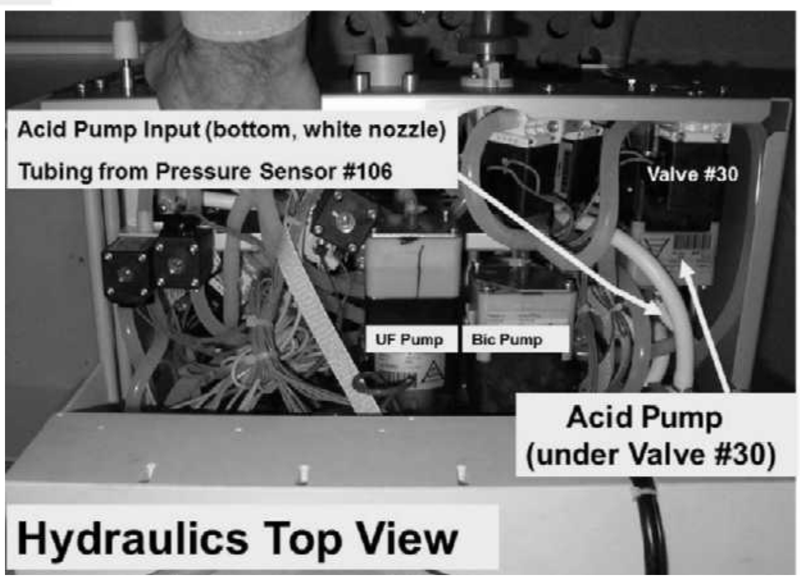
**CHECK #1:** Check for restrictions between the acid connector and Valve #105.

**CHECK #2:** ENSURE the Acid Pump's INPUT (white) nozzle is on the bottom.

**CHECK #3:** ENSURE the Acid Pump's INPUT tubing is clear AND goes, unrestricted, to the bottom of Pressure Sensor #106.

c) See procedure number V105SC- 5.1.0 (page 753).



## V105SC- 5.1.0 ACID PRESS ACHIEVED MORE THAN 400 (2)

a) Place the machine into Service Mode.

b) From the Service Mode menu press Calibrate Sensors → Pressure Transducers → **Regulator Pressure**.

c) Just enough to hold them there, place BOTH concentrate connectors ¼ way into their rinse ports.

d) Press 'Enter' and allow the calibration to complete. If successful the "Calibrate Regulator Pressure" banner appears (Figure below), and the screen will say "Calibration Complete, press CONFIRM to save".


e) Was the calibration successful?

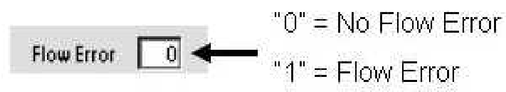
Yes An Error banner DID NOT occur! Press 'Enter' Reconnect all tubing and test the machine for "V105 Stuck Closed". **If it reoccurs there is a restriction between the acid connector and the Acid Pump that was not located above OR Valve #105 is partially restricted**!

No An Error banner occurred! Turn the machine off THEN return to **page 750**, procedure number V105SC- 2.1.0.

# SECTION 33 - "BIBAG: VENT TOO LONG"

The "Bibag: Chamber Venting" banner is normal but if lasts longer than ten (10) minutes the "Bibag: Vent Too Long" banner occurs!

Call debug screen 0. If Flow **Error** <u>EVER</u> = 1, even just once, indicates a masked Flow Error! Watch it for two (2) minutes. TWO (2) possible scenarios:




**1) IF (and ONLY if) Flow Error <u>ALWAYS</u> = 0:** Call the Home screen. ENSURE [**Temperature**] is more than 35.5° C BEFORE continuing to procedure number BBAGVENT- 1.0.0 (page 754).

**2) IF Flow Error EVER = 1, even just once:** Proceed to **page 23,** <u>SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM</u>!

**<u>BBAGVENT- 1.0.0 TROUBLESHOOT "BIBAG: VENT TOO LONG"</u>**

If bi*b*ag Air Sensor #112 senses air Valve #101, located on top of bi*b*ag Air Seperator Chamber #111, pulses open every thirty (30) seconds allowing Deaeration Pump #20 to pull air out of the Chamber. From debug screen 14, if **Air** = 1 = air sensed. If = 0 = no air. During and after a bi*b*ag disposable is filled with water it is normal for **Air** = 1 ("Chamber Venting") HOWEVER, if **Air** = 1 longer than ten (10) minutes "Vent Too Long" occurs.


A) Call debug screen 14 to ENSURE **Conductivity** (bottom row) is more than 48. If not there may be a problem with the bicarb pump.

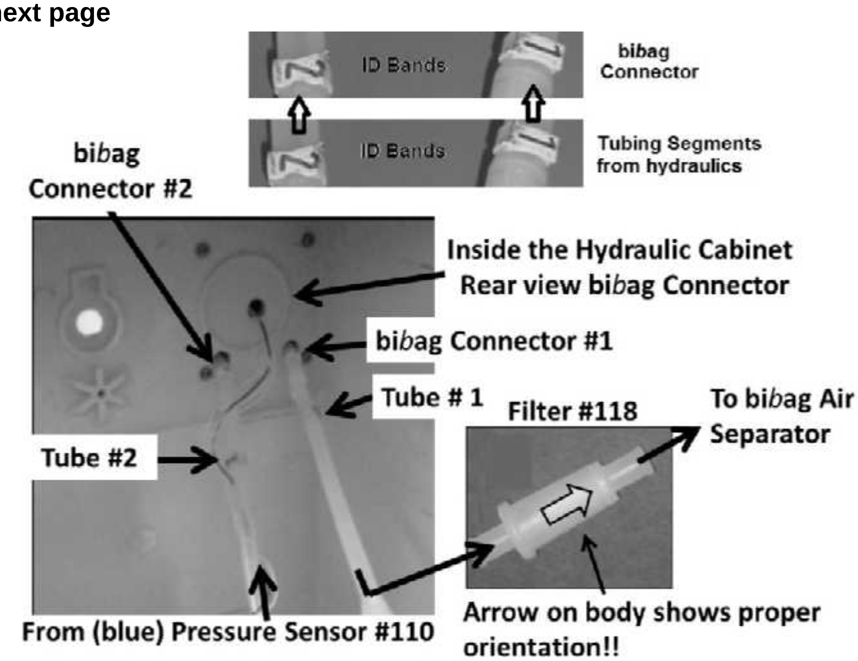
B) Pull the Bicarb (blue) connector out of the rinse port and allow one (1) minute. Press the Reset key. If "BiBag: Vent Too Long" does not clear within one (1) minute see part B.

C) Turn the machine OFF!

D) Slide the hydraulic drawer away from the cabinet.

E) Per the Figures below, check for bi*b*ag Connector tubing kinks!

**Continued on next page**

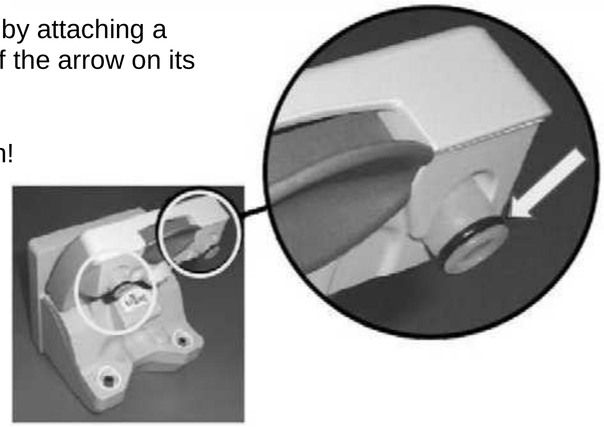


F) Per the Figure (previous page), per the tubing identification (ID) bands, ENSURE the bi*b*ag Connector segments have not been reversed!

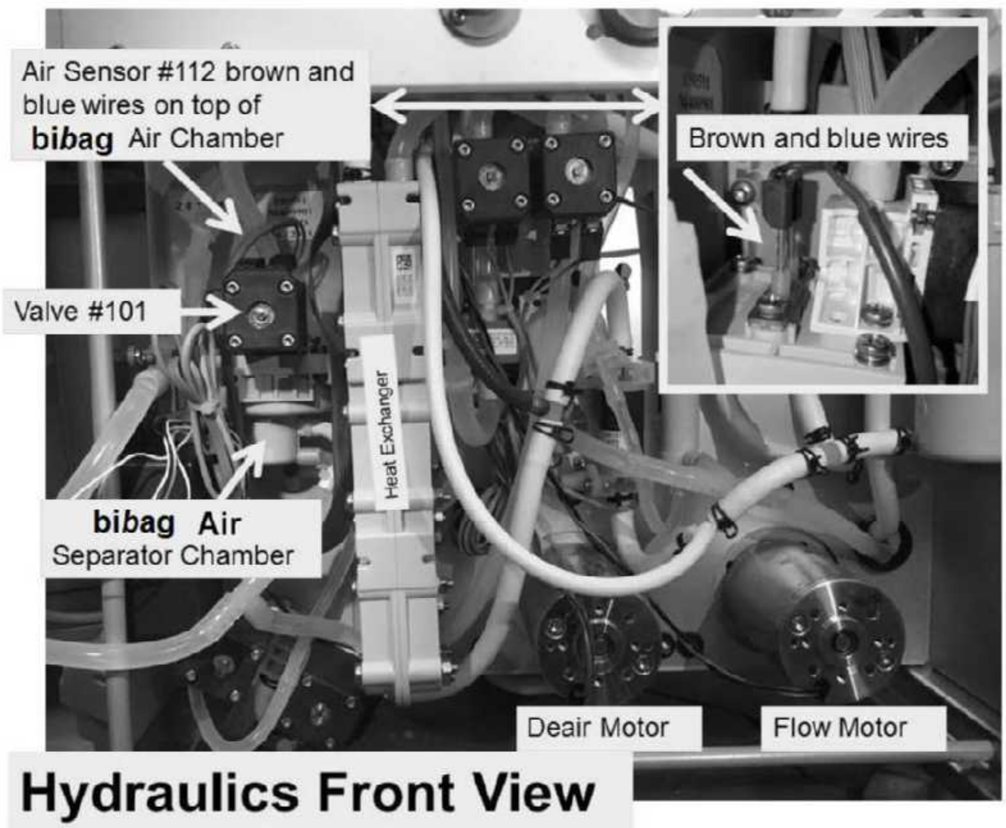
G) Filter #118 (Figure, previous page) can be checked by attaching a syringe to it and pushing or pulling in the direction of the arrow on its body. If air moves through the filter it is okay!

H) Reconnect filter #118 ENSURING proper orientation!

I) Open the bi*b*ag Connector door (Figure right) and ENSURE BOTH O-rings are okay.



J) Figure below, ENSURE the bi*b*ag Air Separator Chamber's brown and blue wires (Sensor #112), at the top of the bi*b*ag Air Separator Chamber, are connected SECURELY to the probes.




K) Check Deaeration Pressure per the 2008 Preventative Maintenance Procedures booklet.

L) Leaving the hydraulics out, connected to acid with a bi*b*ag disposable (pouch) attached.

M) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'Enter').

N) From the Home screen set [Dialysate Flow] to 800 ml/min and press 'Enter'.

O) Allow five (5) minutes, then attach a disposable bi*b*ag (pouch).

P) If "BiBag: Vent Too Long" reoccurs continue to part Q next page.

Q) Place the machine into RINSE!

R) For two (2) minutes check for external leaks in the bi*b*ag hydraulic system (refer to the Figure, previous page) and also in the tubing segments to and from the bi*b*ag Connector. **If a leak is located this may be the problem!**

S) Interrupt RINSE!

T) Clamp and remove the tubing segment that is attached to the top of Valve #101* * To LOCATE Valve #101 refer to the Figure, previous page).

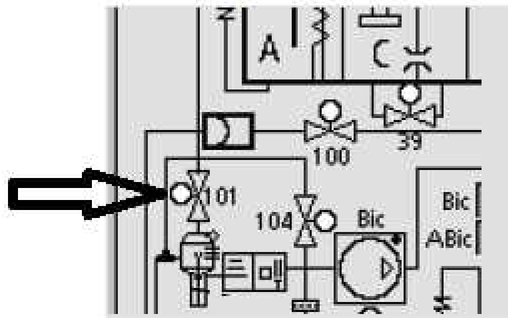
U) Attach a tubing segment to Valve #101's nozzle that is long enough to allow it to be directed into a 1000 ml graduated cylinder!

V) **Return to Rinse!**

W) Call debug screen 0. If debug does not appear press 'Esc' then call screen 0.

X) Figure right, watch Valve 101's 'dot' until it turns BLUE. When BLUE there should be flow of AT LEAST 30 ml from Valve #101 into the cylinder?

Debug screen 0
Valve #101's 'dot'




Yes 30 ml or more from Valve #101! The troubleshooting guide cannot locate an immediate problem! **A)** Remove the clamp! then; **B)** Return to Dialysis Program with a bi*b*ag pouch attached; **C)** If "BiBag: Vent Too Long" reoccurs possibly either the bi*b*ag Interface Board (refer to Figure 4C (page 11) OR the bi*b*ag Air Removal Seperator #111 is bad.

No Way less than 30 ml from Valve #101! TWO (2) possible bad components: **1)** Bad Valve #101 OR; **2)** Bad bi*b*ag Interface Board (refer to Figure 4C (page 11)).

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# **APPENDIX A - TARGET** DEAERATION PRESSURES PER GEOGRAPHICAL AREA

| Elevation | Approx. atmospheric pressure | Minimum target deaeration pressure relative to atmospheric pressure |
|---|---|---|
| feet | mmHg | inches of Hg |
| 0 | 760 | -24.0 |
| 1000 | 728 | -23.0 |
| 2000 | 697 | -22.0 |
| 3000 | 667 | -21.0 |
| 4000 | 639 | -20.0 |
| 5000 | 612 | -19.0 |
| 6000 | 585 | -18.5 |
| 7000 | 561 | -17.5 |
| 8000 | 537 | -16.9 |
| 9000 | 514 | -16.2 |
| 10000 | 492 | -15.5 |

| CITY | FT. ELEVATION | CITY | FT. ELEVATION |
|---|---|---|---|
| Albuquerque, NM | 5,311 | Little Rock, AR | 257 |
| Atlanta, GA | 1,010 | Los Angeles, CA | 97 |
| Atlantic City, NJ | 7 | Louisville, KY | 477 |
| Baltimore, MD | 148 | Memphis, TN | 258 |
| Bismarck, ND | 1,647 | Miami, FL | 7 |
| Boise, ID | 2,838 | Milwaukee, WI | 672 |
| Boston, MA | 15 | Minneapolis, MN | 834 |
| Buffalo, NY | 705 | Nashville, TN | 590 |
| Burlington, VT | 332 | New Orleans, LA | 4 |
| Charleston, SC | 40 | New York, NY | 132 |
| Chicago, IL | 658 | Norfolk, VA | 24 |
| Cleveland, OH | 777 | Oklahoma City, OK | 1,285 |
| Concord, NH | 342 | Omaha, NE | 997 |
| Dallas, TX | 551 | Philadelphia, PA | 5 |
| Denver, CO | 5,283 | Phoenix, AZ | 1,110 |
| Des Moines, IA | 938 | Pittsburgh, PA | 1,137 |
| Detroit, MI | 633 | Portland, ME | 43 |
| Hartford, CT | 169 | Portland, OR | 21 |
| Helena, MT | 3,828 | Providence, RI | 51 |
| Honolulu, HI | 7 | Reno, NV | 4,404 |
| Houston, TX | 96 | St. Louis, MO | 535 |
| Indianapolis, IN | 792 | Salt Lake City, UT | 4,221 |
| Jackson, MS | 291 | San Francisco, CA | 8 |
| Jacksonville, FL | 26 | Seattle, WA | 400 |
| Kansas City, MO | 1,014 | Springfield, MO | 1,268 |
| Las Vegas, NV | 2,020 | Washington, DC | 10 |
| Little Rock, AR | 257 | Wilmington, DE | 74 |

## APPENDIX B - CALIBRATE IF REPLACED (non-bi*bag* components)

Components may need to be replaced to repair the machine. The following table indicates calibrations that must be performed in this event.

| Replaced Component | Then Calibrate | T Calibration Procedures Section # |
|---|---|---|
| - Display Assembly (i.e. screen) | - Touch Screen Calibration | 2.1 |
| - Deaeration Pump Head (#20)<br>- Deaeration Motor (or if brushes are replaced)<br>- Loading Pressure Relief Valve (#78) | - Deaeration and Loading Pressure | 2.2.1 |
| - Flow Pump Head (#21)<br>- Flow Motor (or if brushes are replaced)<br>- Flow Pressure Relief Valve (#78) | - Flow Pressure | 2.2.2 |
| - Inlet Water Pressure Regulator (#61) | - Inlet Water Pressure Regulator | 3.1 |
| - Entire Balancing Chamber | - Balance Chamber Volume | 2.2.3 |
| - Acid Pump (#16) | - Acid Pump Volume | 2.2.4 |
| - Bicarbonate Pump (#17) | - Bicarbonate Pump Volume | 2.2.5 |
| - UF Pump (#22) | - UF Pump Volume | 2.2.6 |
| - Dialysate Pressure Transducer (#9) | - Dialysate Pressure | 2.3.3 |
| - Temperature Sensor (NTC #2 or NTC #3)<br>- Post Dialyzer Temperature Sensor (NTC #44) | - Temperature Control | 2.3.6 |
| - Heater (#54) | - Temperature Control | 2.3.6 |
| - Blood Leak Detector (#8) | - Blood Leak | 2.3.7 |
| - Pre Dialyzer Conductivity Cell (#7) | - Conductivity Cells | 2.3.8 |
| - Post Dialyzer Conductivity Cell (#13) | - Conductivity Cells | 2.3.8 |
| - Functional Board (with new EEPROM) | - All Calibrations | All Sections |
| - Actuator-Test Board | - Voltage Detection | 2.4.2 |
| - Sensor Board | - Arterial Pressure | 2.3.1 |
| | - Venous Pressure | 2.3.2 |
| | - Dialysate Pressure | 2.3.3 |
| | - Temperature Sensor | 2.3.4 |
| | - Post Temperature Sensor | 2.3.5 |
| | - Temperature Control | 2.3.6 |
| | - Blood Leak | 2.3.7 |
| | - Conductivity Cells | 2.3.8 |
| | - Arterial Pump Rate | 2.4.3 |
| | - Venous Pump Rate | 2.4.4 |
| - Arterial Blood Pump Module | - Arterial Pressure | 2.3.1 |
| | - Arterial Pump Rate | 2.4.3 |
| - Level Detector Module | - Venous Pressure | 2.3.2 |
| | - Level Detector | 3.2 |

## APPENDIX C CALIBRATE IF REPLACED (bi*b*ag components)

Components may need to be replaced to repair the machine.  The following table indicates calibrations that must be performed if a bi*b*ag component is replaced.

| Replaced bi*b*ag Component | bi*b*ag Technicians Manual |
|---|---|
| - Conductivity Cell #113 | - Not applicable |
| - Conductivity Cell #117 | - Bicarbonate Conductivity Cell |
| - Temperature Sensor #114 | - Not applicable |
| - Temperature Sensor #116 | - Not applicable |
| - Bicarbonate Pressure Sensor #110 | - Pressure Transducers |
| - Acid Pressure Sensor #106 | - Pressure Transducers |
| - Interface Board (piggy-backed to the Actuator-Test Board) | - Bicarbonate Conductivity Cell<br>- Pressure Transducers |

# APPENDIX D - BLOOD PUMP ERROR CODES

| Alarm Code | Cause | Solution |
|---|---|---|
| **A.11** | Pump is not reaching speed. | Check or replace in the following order:<br>• Rotor Hall Sensor<br>• LP955<br>• LP956 |
| **A.13** | Pump rotor is turning in the wrong direction. | Check or replace in the following order:<br>• Rotor Hall Sensor<br>• LP955<br>• LP956 |
| **A.16** | Key stuck or held in too long. | Check or replace in the following order:<br>• User holding key too long<br>• BP Keypad<br>• LP955<br>• LP956 |
| **A.20** | Set speed-read back analog voltage at X348/14 is out of limits (set speed). | Check or replace LP955. |
| **A.21** | Actual speed-read back analog voltage at X348/10 is out of limits (actual speed). | Check or replace LP955. |
| **A.22** | Arterial pressure-read back analog voltage at X348/7 is out of limits. | Check or replace LP955. |
| **A.24** | Optical sensor frequency (tach) not in range. | Check or replace in the following order:<br>• Motor/Tachometer Assy.<br>• LP955<br>• LP956 |
| **A.25** | Pressure increases too quickly when the Level Up key is pressed. | Check or replace in the following order:<br>• Vent Valve<br>• LP955<br>• LP956 |
| **A.26** | Pressure was adjusted too much in calibration mode. | Check or replace in the following order:<br>• Pre/Post Pump set wrong<br>• LP955 |
| **A.27** | Timeout when receiving Intel-Hex-line or overflowed receive buffer. | Check or replace LP955. |
| **A.28** | Error in received Intel-Hex-line. | Check or replace LP955. |
| **A.29** | Pump rotor turning when it should not be (first revolution). | Check or replace in the following order:<br>• Rotor Hall Sensor<br>• LP955<br>• LP956 |

## APPENDIX C CONTINUED

| Error Code | Cause | Solution |
|---|---|---|
| **E.01** | EPROM CRC error. | Check or replace LP955. |
| **E.02** | Flash ROM CRC error. | Check or replace LP955. |
| **E.03** | RAM check error. | Check or replace LP955. |
| **E.04** | Reference Voltage error. | Check or replace LP955. |
| **E.05** | Serial EEPROM error. | Check or replace LP955. |
| **E.06** | Watchdog timeout. | Check or replace LP955. |
| **E.07** | + 12 volts is outside the allowable range of 10.8 to 13.2 volts. | Check or replace in the following order:<br>• Machine voltage (+12V)<br>• Ribbon cable from machine<br>• LP955 |
| **E.08** | + 24 volts is outside the allowable range of 22.8 to 28.0 volts. | Check or replace in the following order:<br>• Machine voltage (+24V)<br>• Ribbon cable from machine<br>• LP955 |
| **E.09** | - 12 volts is outside the allowable range of -9.6 to -13.2 volts. | Check or replace LP955. |
| **E.10** | + 5 volts is outside the allowable range of 4.75 to 5.25 volts. | Check or replace LP955. |
| **E.14** | 50 ms time period exceeded. | Check or replace LP955. |
| **E.15** | Software task was not completed correctly. | Check or replace LP955. |
| **E.23** | Pump rotor turning when it should not be (second revolution). | Check or replace in the following order:<br>• Rotor Hall Sensor<br>• LP955<br>• LP956 |
| **E.97** | Error copying data into Flash ROM. | Check or replace LP955. |
| **E.98** | Error erasing Flash ROM. | Check or replace LP955. |
| **E.99** | Transmit error during Flash update. | Check or replace LP955. |

**RED LED**

The large red LED is next to the blood pump display. It will light if the door is open longer than the preset time of 15 or 30 seconds. This is set using dip-switch 4 on the LP955 board. The default setting is 30 seconds.

| LED | Cause | Solution |
|---|---|---|
| **RED LED LIT** | Pump door is open longer than 30 seconds. | Check or replace in the following order:<br>• Door Hall Sensor<br>• LP955<br>• LP956 |

NOTE! Additional Blood Pump Dip-Switch settings can be found in the Arterial Pressure Calibration of the 2008T Calibration booklet

NOTES:

# COMMON CONVERSIONS

## PRESSURE

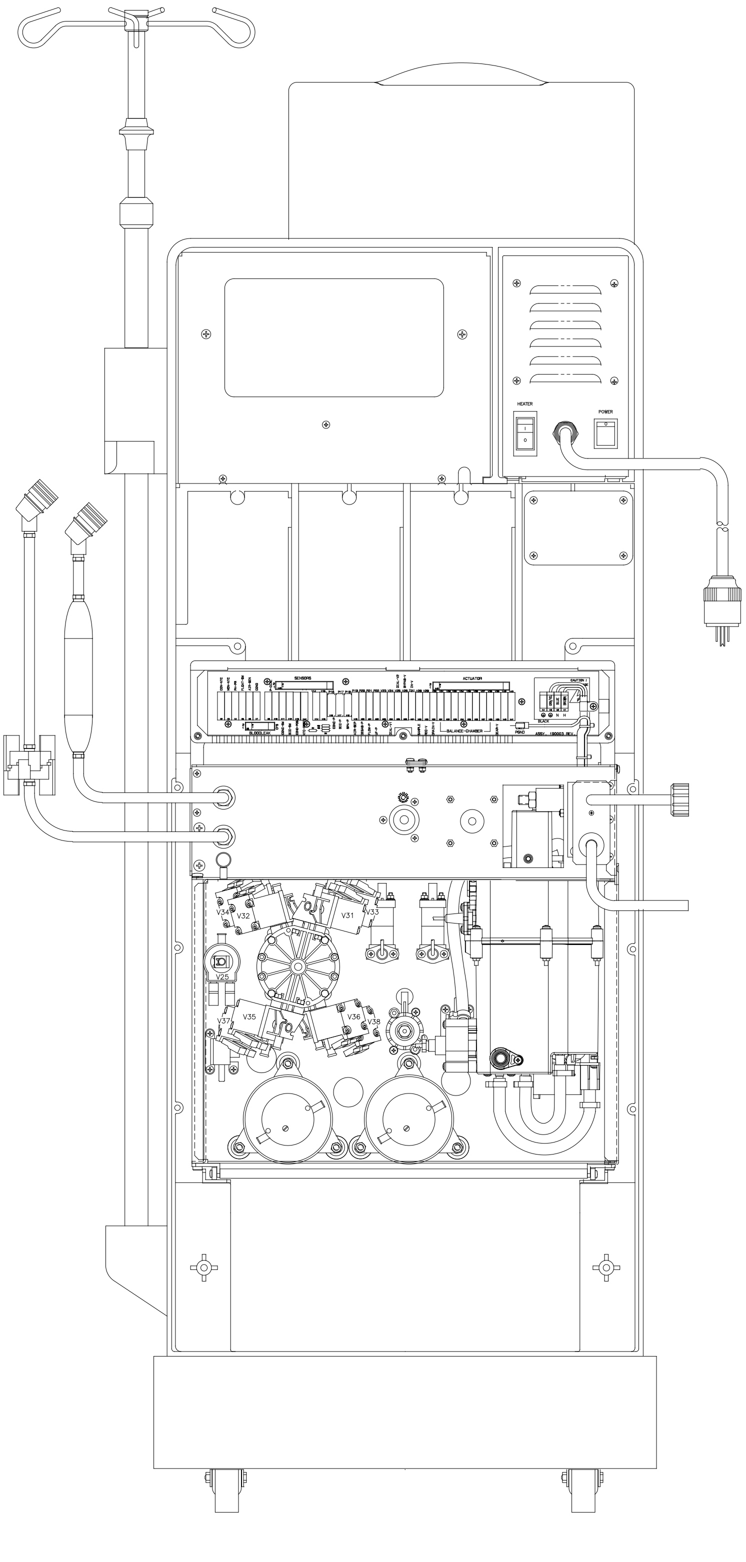
| | |
|---|---|
| 1 Bar | 29.53 inHg |
| 1 inHg | 25.4 mmHg |
| 1 Psi | 51.72 mmHg |

## VOLUME

| | |
|---|---|
| 1 FLUID OUNCE | 29.6 MILLILITERS |
| 1 U.S QUART | 0.946 LITERS |
| 1 U.S. GALLON | 3.8 LITERS |
| 0.034 FLUID OUNCES | 1 MILLILITER |
| 1.057 QUARTS | 1 LITER |
| 0.26 U.S. GALLON | 1 LITER |

## MASS

| | |
|---|---|
| 1 OUNCE (avdp.) | 28.35 GRAMS |
| 1 POUND (avdp.) | 0.45 KILOGRAM |
| 0.035 OUNCE (avdp.) | 1 GRAM |

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