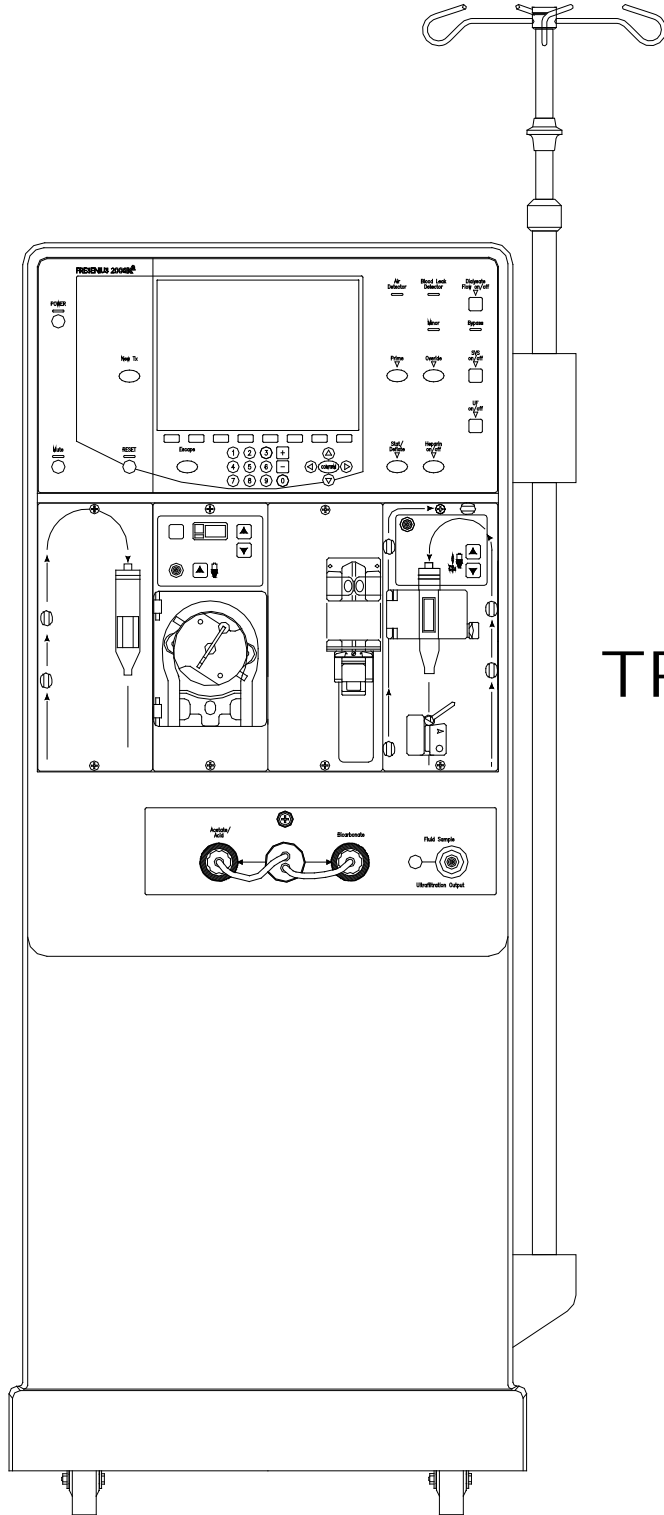




FRESENIUS MEDICAL CARE



2008K/K² HEMODIALYSIS SYSTEM

TROUBLESHOOTING GUIDE

Part Number 507298 Rev. H

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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MEDICAL CARE**

2008[®]K/K²

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GUIDE**

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<http://www.fmcna.com>

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2008K/K² Technical Troubleshooting Guide

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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 2008K Technician's Manual (P/N 490049) or the 2008K² Technician's Manual (P/N 490137).

Contact Fresenius Medical Care Technical Support for applicable Field Service Bulletins. The spare parts manual for the model 2008K and 2008K² other information may be found on our web site at www.fmzna.com

Indications for Use: The 2008K and 2008K² hemodialysis machines are indicated for acute and chronic dialysis therapy.

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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 668).
- G. Perform [FINAL CHECKS](#) (page 12) 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!** Post 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!

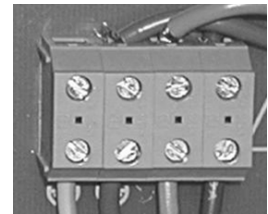
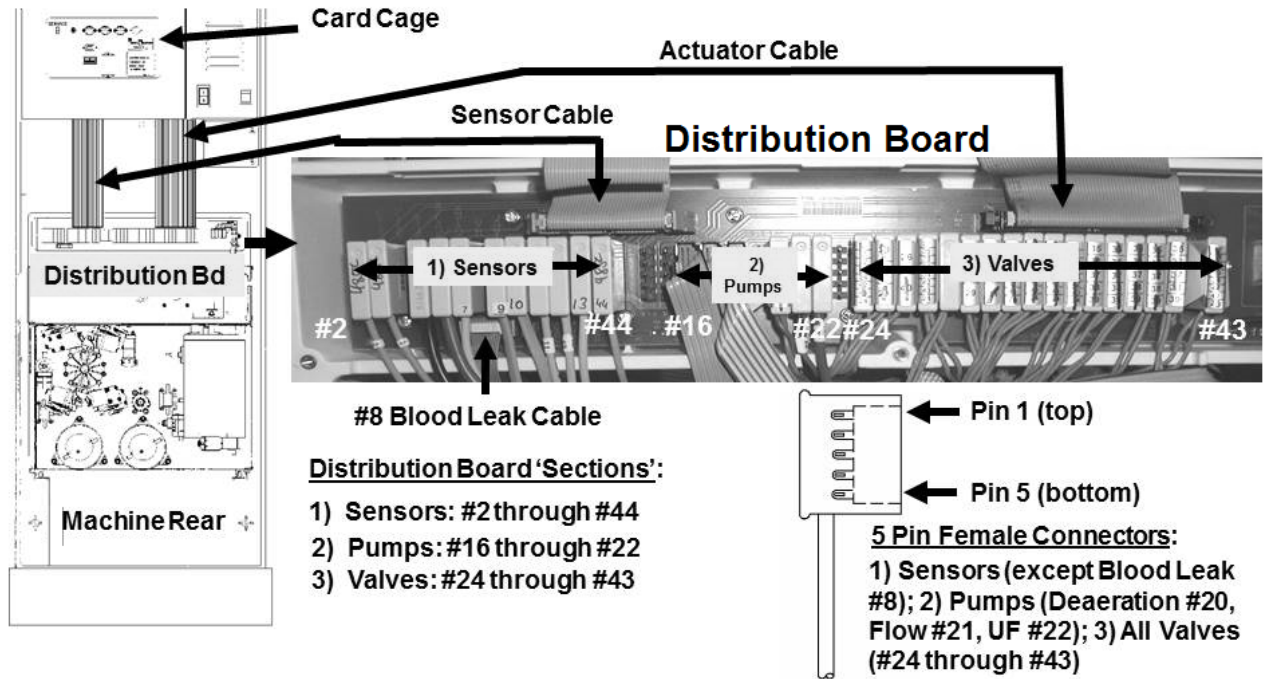
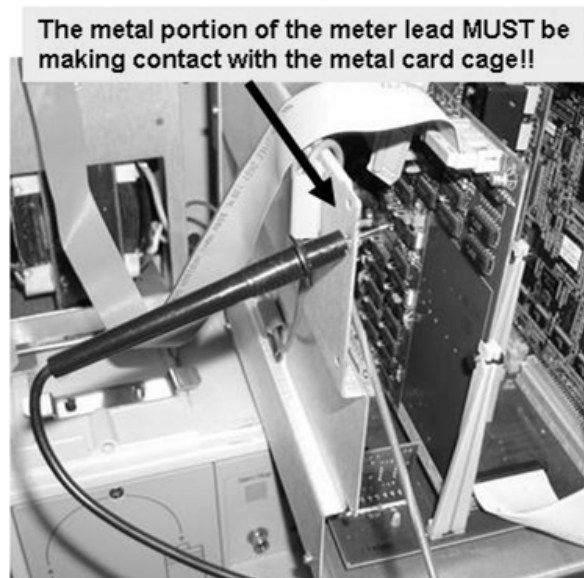


Figure 1 – Distribution Board



- 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



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. Hydraulic Leaks
2. No Water
3. Flow Errors
4. Temperature
5. Conductivity
6. Filling Programs
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 0.2° 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 other hydraulic alarms before troubleshooting PRESSURE TEST FAILURES.

Refer to the TABLE OF CONTENTS to locate the symptom.

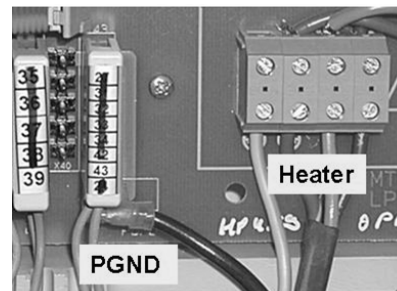
End of 'The Order of Troubleshooting'

INITIAL CHECKS

1) To prevent shock, turn the machine OFF!

2) Figure below, remove the DISTRIBUTION BOARD cover:

- a) ENSURE the Sensors and Actuator cables are plugged in securely AND are not damaged.
- b) Figure right, ENSURE position "X4-PH-PR" is VACANT!
- c) Using a flashlight, check the distribution board. **If corrosion is located replace it!**
- 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 positions the Air Sensor Connector two-pins higher than the other connectors! CBE = Change Being Effected

Parts 3 through 6 next page

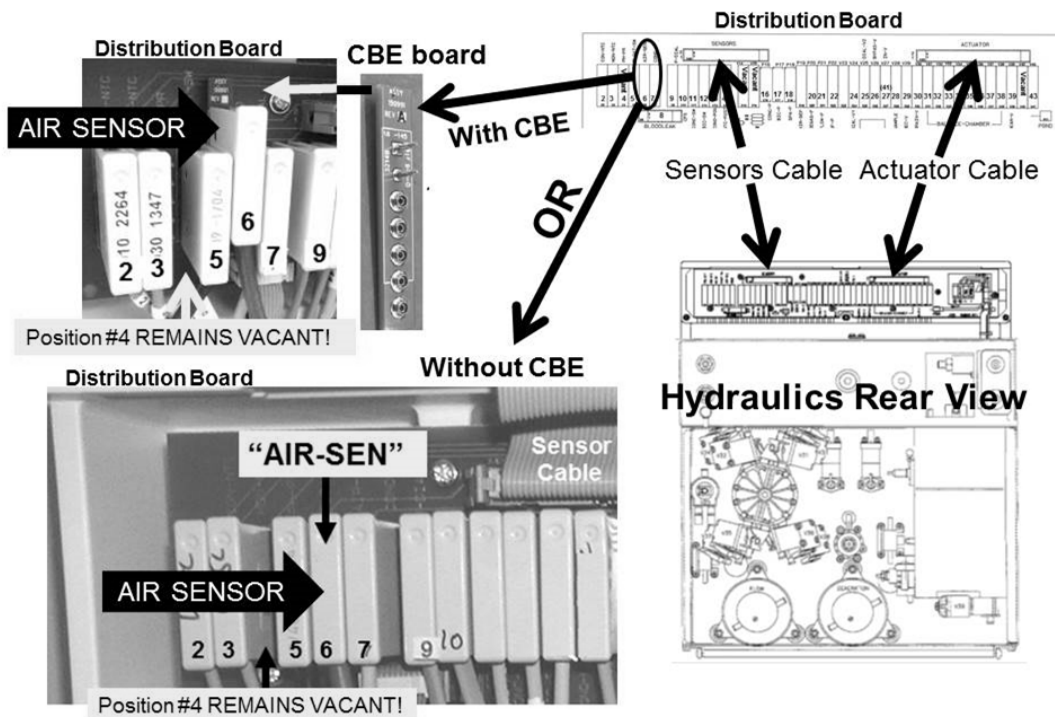
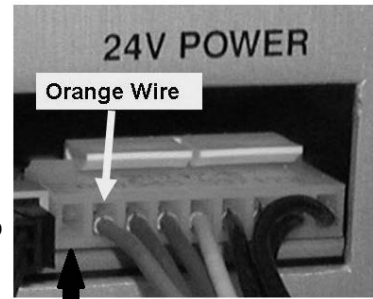


Figure 3 - CBE

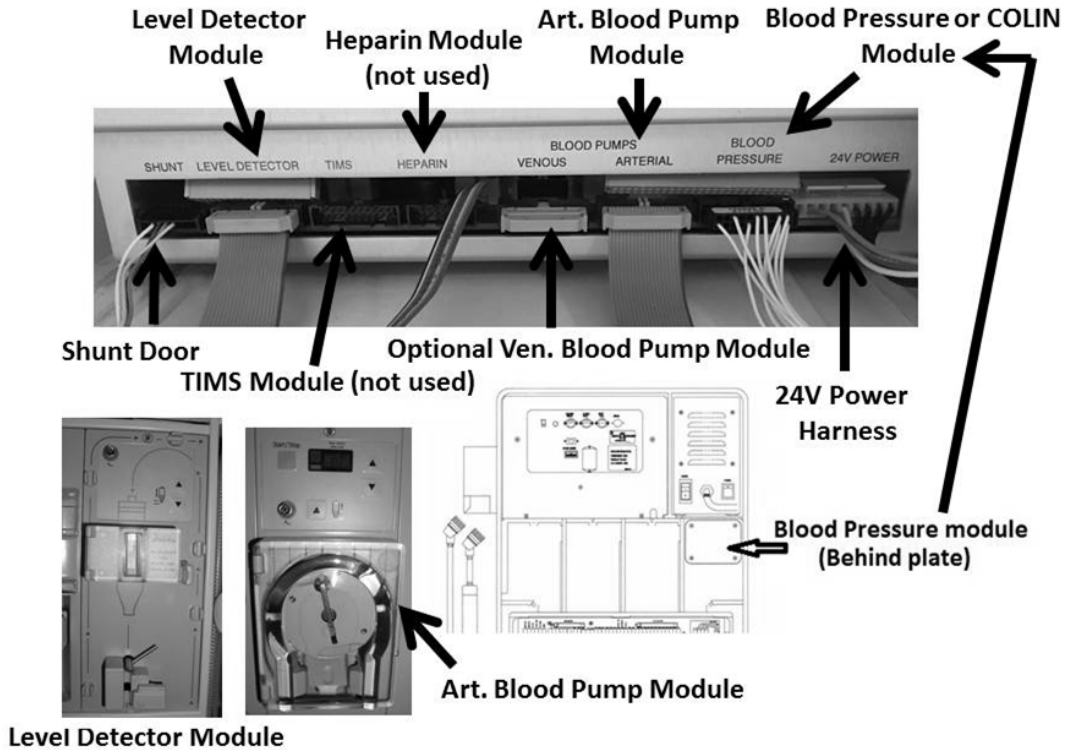
3) To avoid pulling cables loose, gently open the **CARD CAGE**:

a) Figure right, at the rear of the card cage, 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) ENSURE no damaged module cables!



4) Referring to [Figure 4A](#) (page 9) perform parts a through e:

- a) ENSURE the Actuator, Sensors and Power Logic Board ribbon cables are plugged in securely!
- b) ENSURE no foreign objects (screws, etc.) are laying on the surface of the motherboard!
- c) Using a flashlight, CAREFULLY check the surface of the motherboard. If corrosion or signs of burning is located the motherboard needs to be replaced!
- d) Clean dust from the surface of the motherboard.
- e) Press down HARD on the circuit boards to ensure good connections to the motherboard.

5) **Close the card cage!**

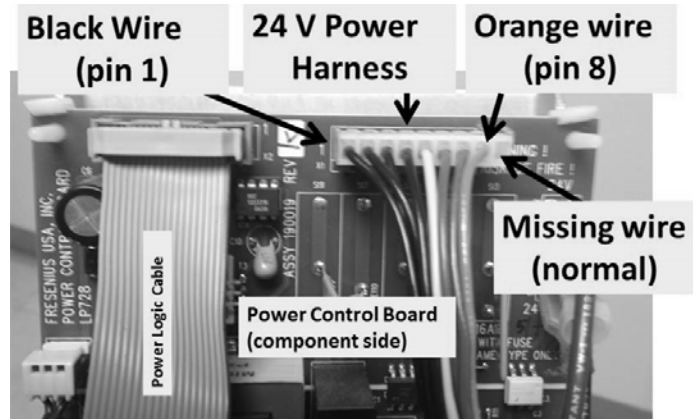
Continued on next page

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

Yes Continue to step #7.

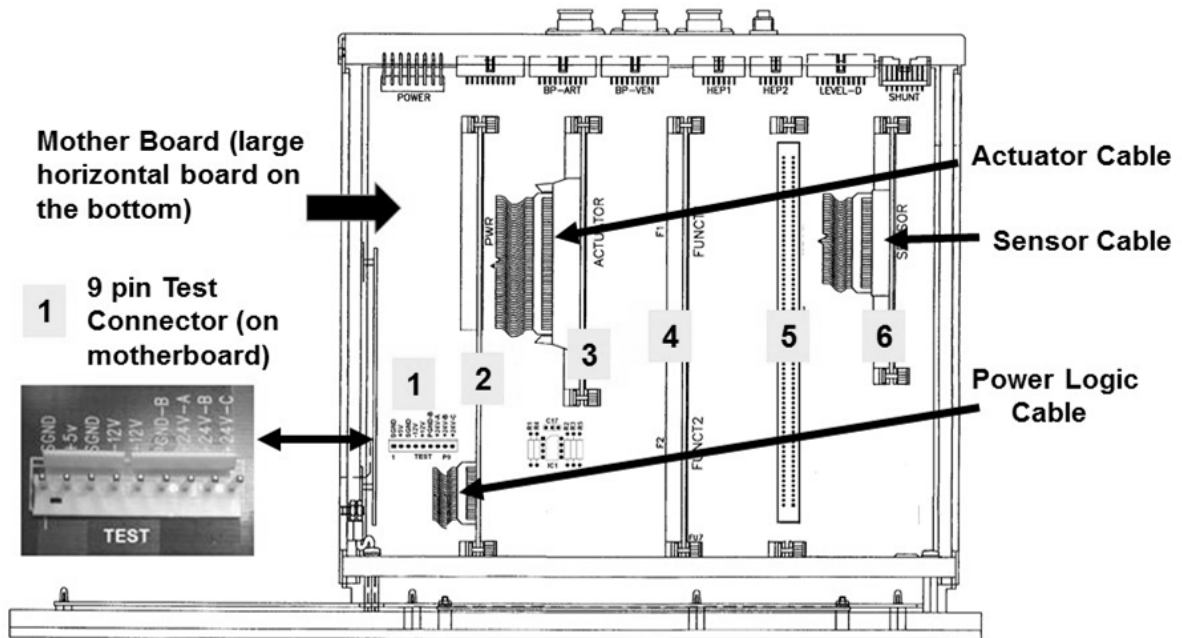
No A problem located, and repaired, during INITIAL CHECKS may have solved the problem you were troubleshooting! If not return to the procedure that brought you to INITIAL CHECKS!

- 7) Unmount and slide the Power Supply ¼ way out away from the cabinet. DO NOT let it fall out!
- 8) Figure right, at the top of the Power Control board ensure the Power Logic and 24V Power cables are plugged in securely.
- 9) Clean excessive dust from the rear (solder) side of the board.
- 10) Slide the Power Supply back into the cabinet.
- 11) Plug the machine in.
- 12) 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.



END OF 'INITIAL CHECKS'

Figure 4A – Card Cage



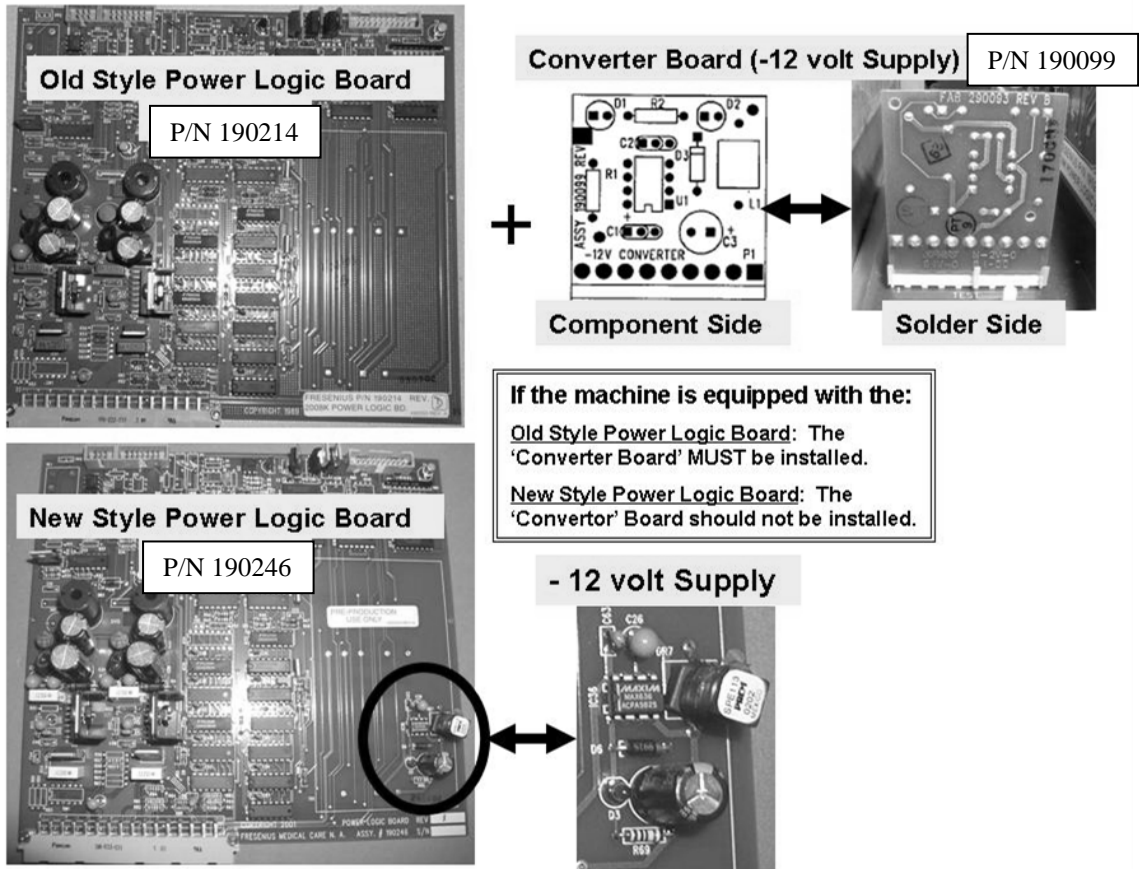
1 – Test Connector (9 pins) on motherboard; 2 – Power Logic Board SEE NOTE A (page 9) ; 3 – Actuator-Test Board SEE NOTE B (page 11); 4 – Functional Board; 5 – Vacant SEE NOTE B (page 11); 6 – Sensor Board

NOTE A

-12 volts DC is required for the Sensor Board's conductivity circuits and the Blood Pressure Module:

- Referring to the Figure 4B (next page), if the machine is equipped with the **Old Style Power Logic Board** the miniature -12 volt 'Converter Board' is required. This board plugs into the motherboard's nine (9) pin TEST Connector (#1).
- If equipped with the **New Style Power Logic Board** (released in 2008) the -12 volt supply is incorporated into the Power Logic Board and the 'Converter Board' is NOT necessary.
- Both the **Old** and **New Style Power Logic Boards** are compatible with 2008K and K² machines but CAUTION must be exercised. If an **Old Style Power Logic Board** is installed in a machine equipped with the **New Style Power Logic Board** the 'Converter Board' MUST ALSO be installed otherwise a "Cond Ref" or "Cond Offset" error will occur. If a **New style Power Logic Board** is placed into a machine equipped with the **Old Style Power Logic Board** the 'Converter Board' should be removed!

Figure 4B – Old / New Style Power Logic Board



NOTE B

Per the Figure below, machines produced prior to 2007 machines were equipped with separate **Actuator** and Test board. Machines produced in 2007 and after are equipped with an Actuator-Test board which is a single board:

- The K/K2 Troubleshooting Guide, REV H, assumes all machines are equipped with the new style Actuator-Test board i.e. REV H is NOT compatible with the old style Actuator board!
- The Actuator-Test Board combines the functions of the **Old Style Actuator** and **Test Board** and uses motherboard slot #3 (see Figure 4A, page 9). To use the 'combined' feature the machine must be equipped with Functional board software 3.29 or greater.
- If an different Actuator-Test Board is swapped in and will be left in the machine a VOLTAGE DETECTOR CALIBRATION (page 14) should be performed.

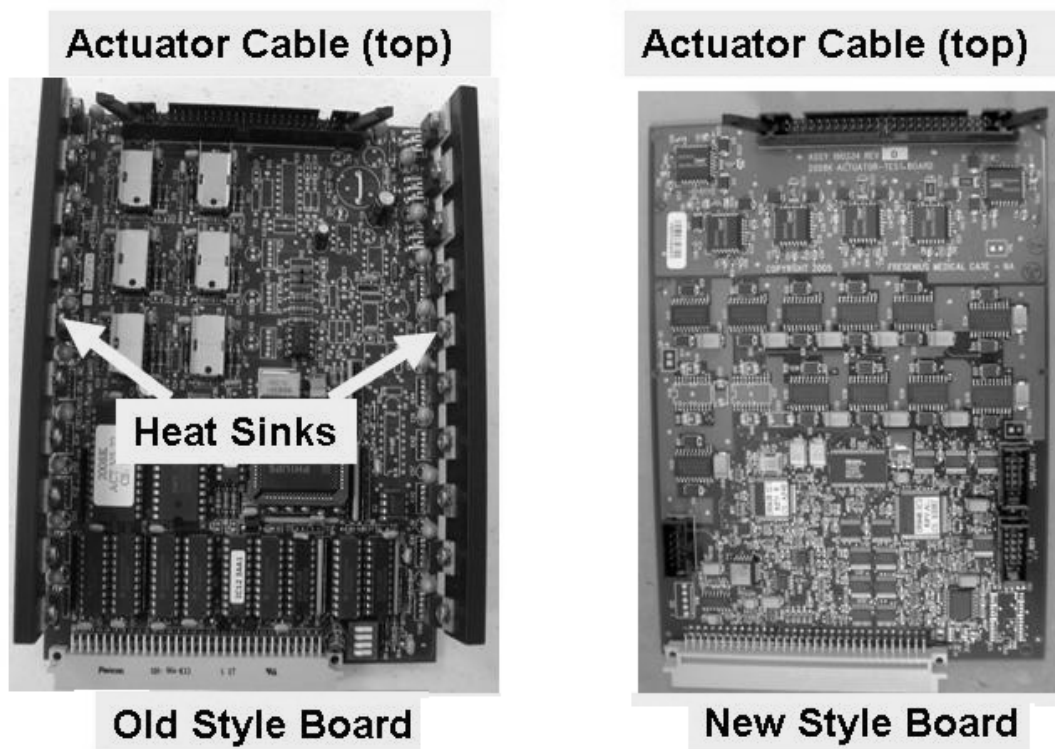
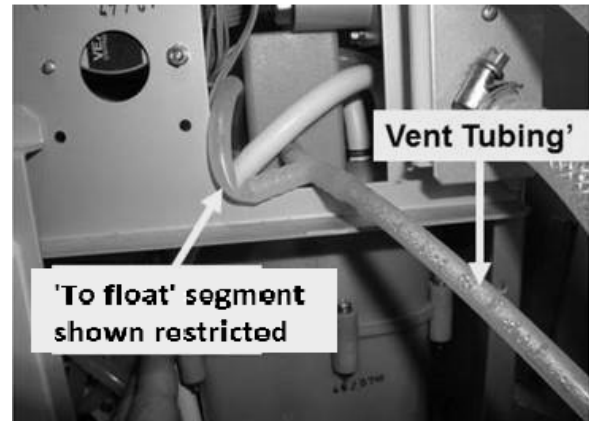


Figure 4C – Old / New Style Actuator Board

FINAL CHECKS BEFORE RETURNING THE MACHINE TO CLINICAL SERVICE

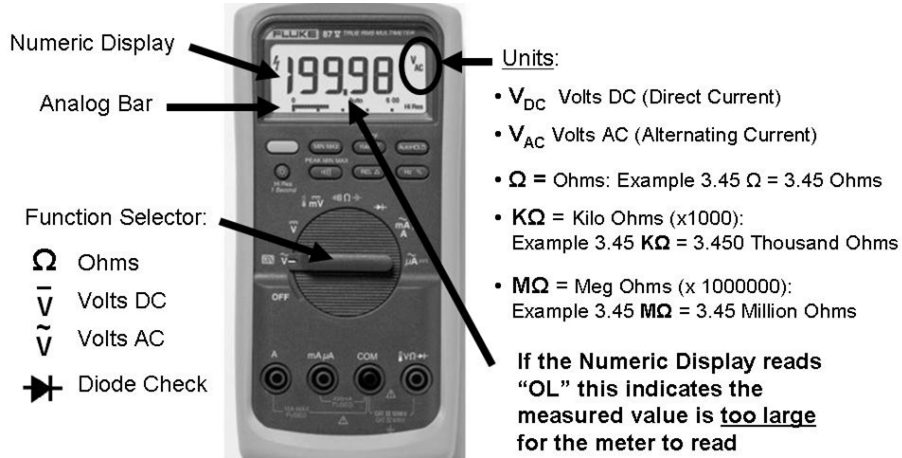
- 1) Remove all test equipment from the distribution board and ENSURE all connectors and cables are plugged in properly.
- 2) Reinstall the distribution board cover.
- 3) Clean spills from inside the hydraulic drawer and floor. This is helpful to locate leaks in the future.
- 4) Figure right, ENSURE the 'To Float' Vent Tubing segment is NOT restricted as shown!
- 5) Return the rear panels ENSURING the Vent Tubing remains extended out 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' → 'CONFIRM')!
- 8) Allow [**Temperature**] to stabilize between 35.5 and 38.5° C AND [**Conductivity**] to between 13.0 and 14.2 mS.
- 9) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- 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)
- 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).

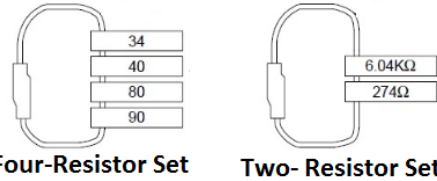


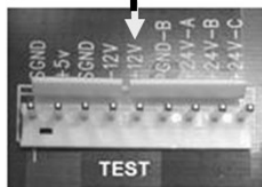
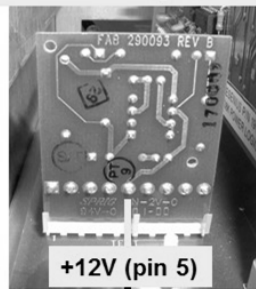
Figure 5 - Mag Probe

END OF 'TEST EQUIPMENT'

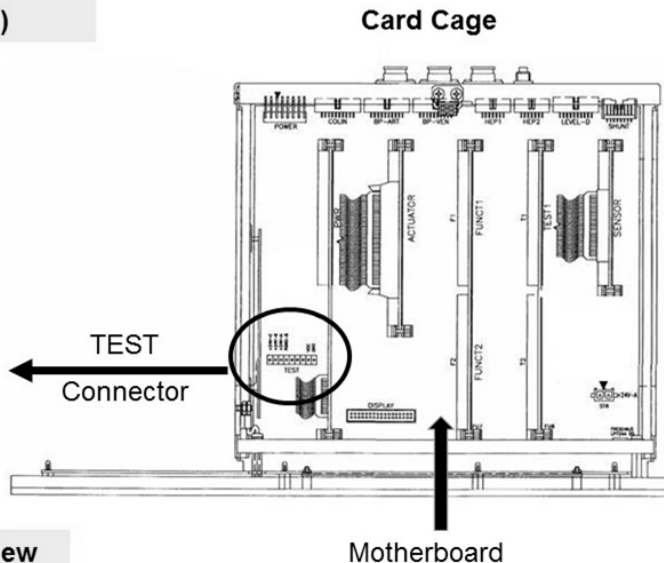
VOLTAGE DETECTOR CALIBRATION

- A) Turn the machine OFF.
- B) To prevent pulling cables loose, GENTLY open the card cage!
- C) Behind the card cage, ENSURE the 24V POWER cable is securely plugged in!
- D) Enter Service Mode → Calibrate Monitor → Voltage Detection.
- E) **Set your CALIBRATED volt meter to volts DC.**
- F) **Connect the meter's black lead to chassis ground (refer to [Figure 2](#), page 4).**
- G) Spread the card cage side panels open then gently drop the front panel down to access the motherboard's nine (9) pin TEST Connector (Figure below).
- H) Measure from the TEST Connector's +12V pin (pin 5, five pins from the left).

Converter Board (if equipped with Old Style Power Logic Board)



Empty Test Connector (if New Style Power Logic Board)



- I) Select the screen's **[12 volt set]** data box. It turns bright yellow
- J) Enter the MEASURED value in the box.
- K) 'Sharply' press 'CONFIRM'.
- L) ENSURE the **[12 Volt Set]** data box is pale yellow /white.
- M) Sharply press 'CONFIRM' again. Figure right, does an "Operator Error" banner appear?



Status bar with "Operator Error" banner



Yes “Operator Error” occurs! Proceed to **page 618**, procedure number [P- H.1.2](#).

No “Operator Error” DID NOT occur! See part N.

N) If done correctly, the screen says “**4. Verify that 5V EST is between 4.8 to 5.2....**”.

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 CONFIRM to save the calibration THEN see part P.

No (to one OR both): Proceed to **page 618**, procedure number [P- H.1.2](#).

END OF ‘VOLTAGE DETECTOR CALIBRATION’

OPERATING MODES

How to Enter Service Mode:

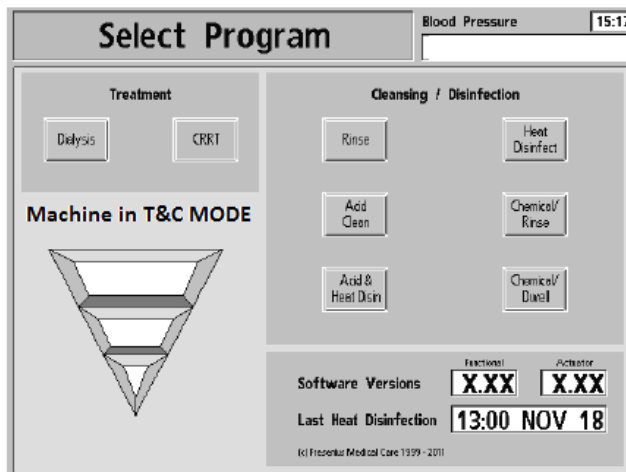
- Turn the machine OFF.
- Turn the machine on. When the “Press CONFIRM for Service Mode” appears on the screen press ‘CONFIRM’. The screen says “Machine In Service Mode”.

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

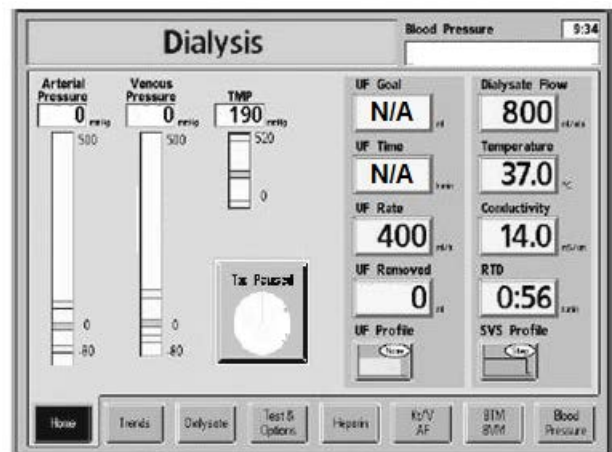
Swapping in a Sensor and / or a Functional Board for troubleshooting purposes may cause a “COND OFFSET FAILURE” during System Initialization. **T and C Mode** negates these Errors so these boards can be tested without having to perform calibrations.

- Enter Service Mode → Options → Hardware Options.
- Next to **T and C Mode** place the ‘X’ in the “Yes” box then press ‘CONFIRM’. The ‘X’ MUST turn blue!
- Turn the machine off then back on.
- 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”.

T and C Mode Yes No



1) Select Program Screen



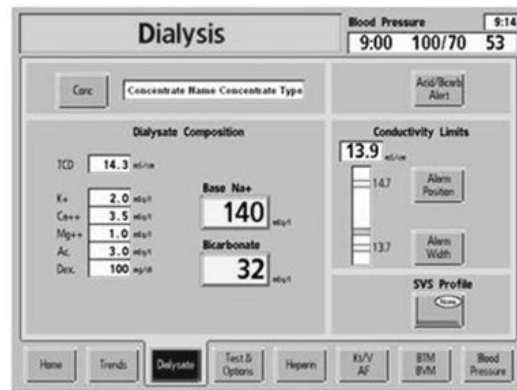
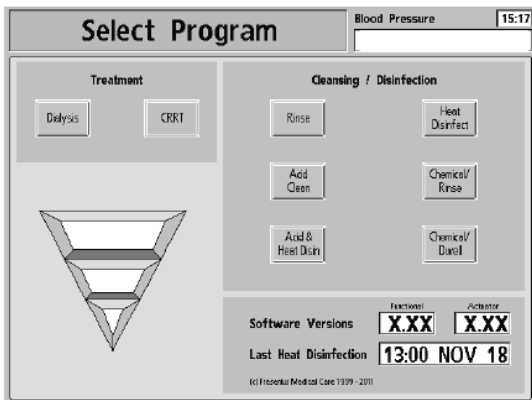
3) Home Screen

End of 'How to Enter T and C Mode'

How to Enter Dialysis Program:

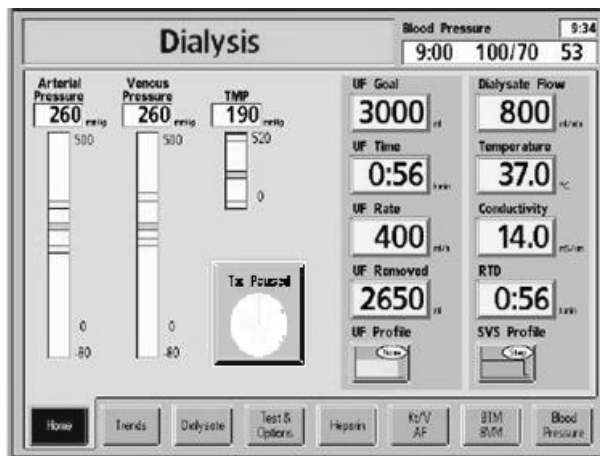
- a) Turn the machine on and allow the “Select Program” screen (1) to appear.
- b) Select the screen’s ‘Dialysis’ button to call the Dialysate (“Select Concentrate”) screen (2).
- c) Select the screen’s ‘Conc’ button. A list of up to 10 ACID concentrates appears.
- d) Using the arrow keypads, select the ACID that is connected to the machine.
- e) Press ‘CONFIRM’ to place the machine into Dialysis Program.

NOTE: The machine remains in idle mode UNLESS CONFIRM is pressed!



1) Select Program Screen 2) Select Concentrate Screen

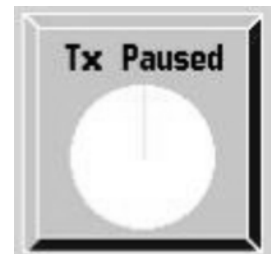
- f) Selecting the screen’s ‘Home’ tab calls the ‘Home’ screen (3).



3) Home Screen

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

Part h next page



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

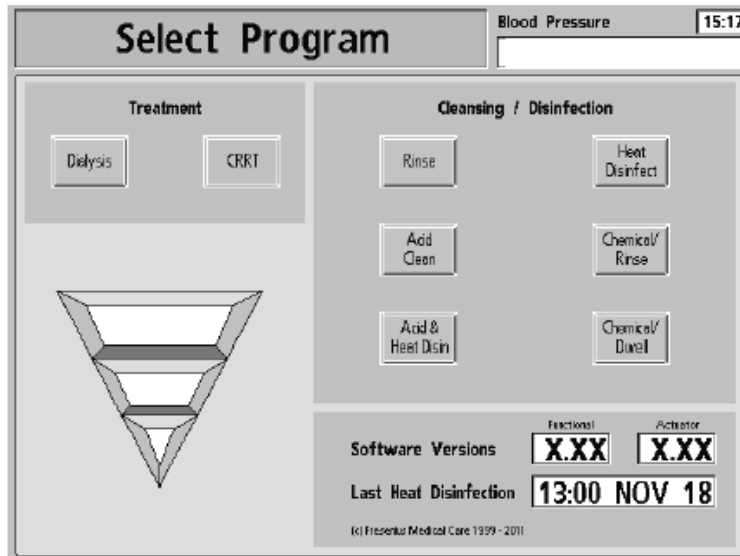
Auto Flow

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)**.

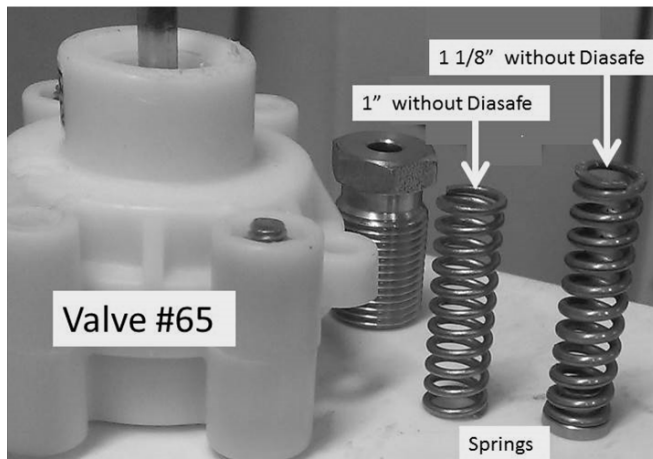
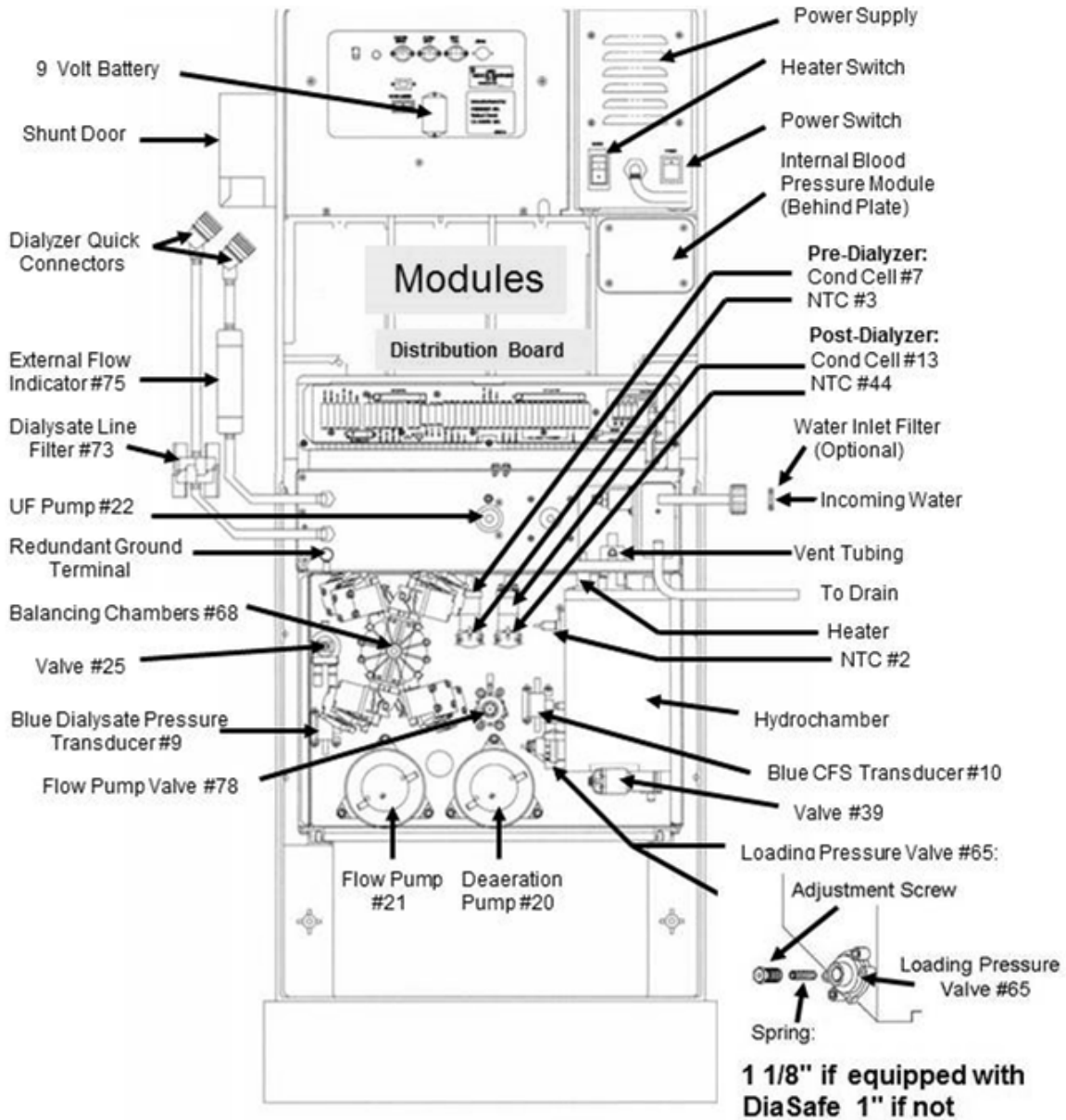


1) Select Program Screen

- c) Select the desired Cleaning / Disinfection Program button then follow screen prompts that may appear depending on what Cleaning Program is running.

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

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

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

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

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 OR; **2)** Functional Board OR; **3)** Arterial dialyzer line shunt door switch OR; **4)** Motherboard

F) ENSURE Dialysate flow is ON (Flow on/off lamp IS NOT blinking)!

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

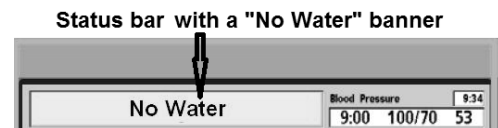
H) ENSURE FIRM connections to Acid AND Bicarb JUGS!

I) Any active external hydraulic leaks seen?

Yes Active leak located! Proceed to **page 553**, [SECTION 21- HYDRAULIC LEAKS](#).

No leaks! See 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?



Yes "No Water" appears! Proceed to **page 141**, [SECTION 2 – NO WATER ALARM](#).

No "No Water" NEVER* appears! See procedure number [F- 1.0.1](#) (page 21).

NOTE: From here forward, as "No Water" alarms cause Flow Errors if (and ONLY if) a "No Water" banner EVER appears address this alarm FIRST!

F- 1.0.1 NO WATER NEVER APPEARS / INITIAL LOADING PRESSURE CHECK

a) ENSURING the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it, **SLAM*** it into the red Acetate/Acid rinse port. *OR ELSE pressure will not be read correctly!

b) Loading Pressure MAY OR MAY NOT be cycling but is it PEAKING to MORE than 15 psi?

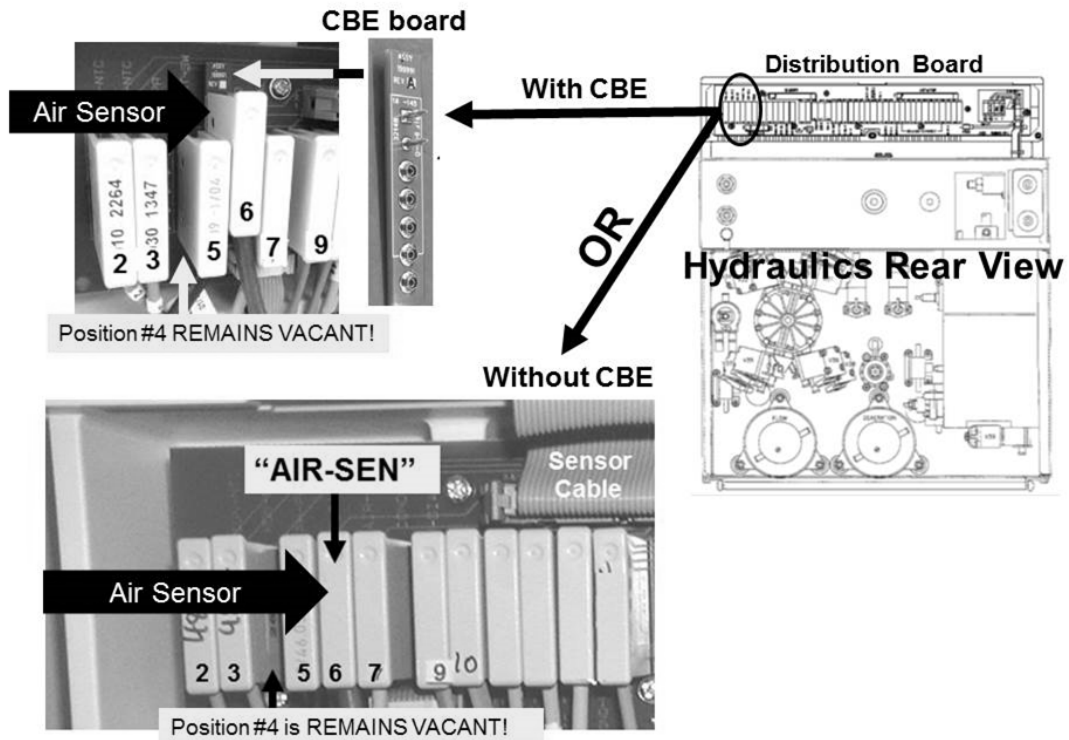
Yes More than 15 psi! Leaving the gauge installed, see procedure number **F- 1.0.2** (page 21).

No Remains LESS THAN 15 psi! ENSURING the gauge was SLAMMED into the RINSE port, if still less than 15 psi proceed to **page 116**, procedure number F- 15.0.0.

F- 1.0.2 LOADING PRESSURE MORE THAN 15 PSI / ISOLATE “AIR IN DIALYSATE” FUNCTION

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

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

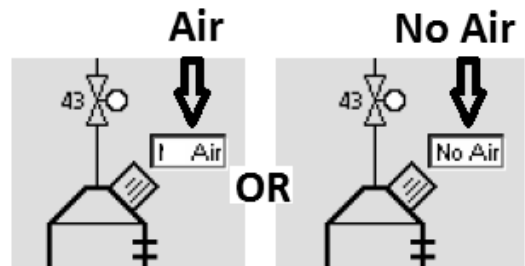


C) Unplug the female Air Sensor’s connector. **DO NOT** remove the ‘CBE board’ under the connector!

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

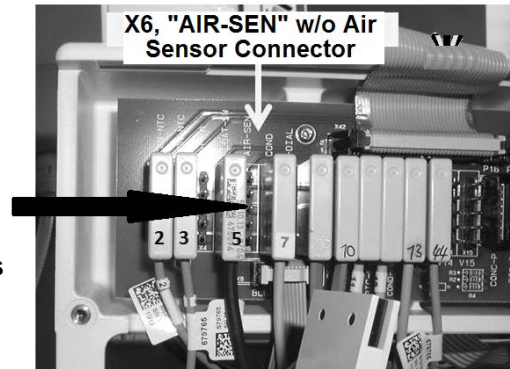
E) Call debug screen 0.

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



- 1) IF says “Air” always: See procedure number [F- 1.0.2.11](#) (page 22).
- 2) IF says “No Air” OR toggles between “Air” and “No Air”: See parts a AND b below:

- a) Inside the distribution board, ENSURE the Air Sensor’s female 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 22).
- 2) IF Chamber #69 continues to say “No Air” or toggles between “Air” and “No Air”: Proceed to **page 22**, procedure number [F- 1.0.3](#).

F- 1.0.2.11 CHAMBER #69 SAYS “AIR” ALWAYS

- a) Call debug screen 1.
- b) Allow two (2) minutes OR until if **FILACT** (middle column) = 1?



Yes **FILACT** = 1! Proceed to **page 24**, 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 22).
- 2) IF **VERR** = 1 or more: Proceed to **page 30**, procedure number [F- 2.0.0](#).

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

- a) **Turn the machine OFF!**

Parts b through f next page

b) Figure right, TWO (2) checks:

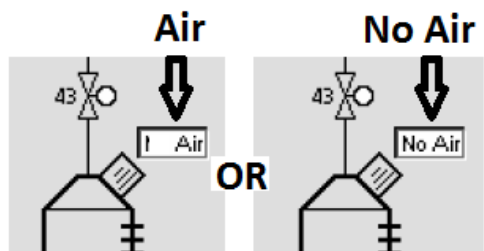
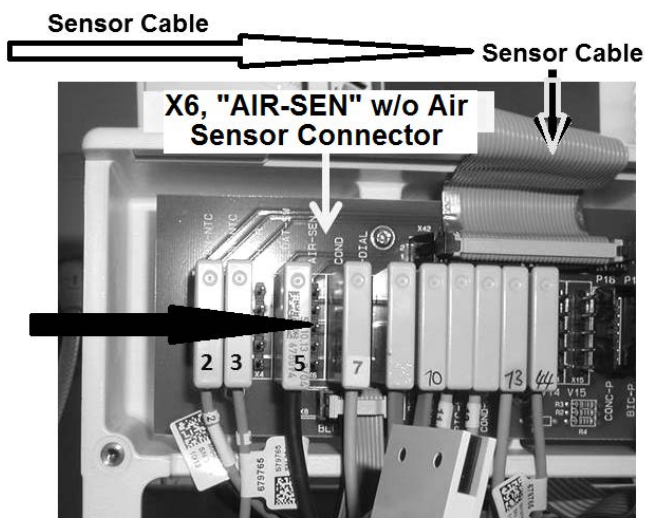
Check #1: At the top of the distribution board, ENSURE the Sensor Cable is plugged in SECURELY!

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' → 'CONFIRM')!

d) 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 22).
- 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 6).

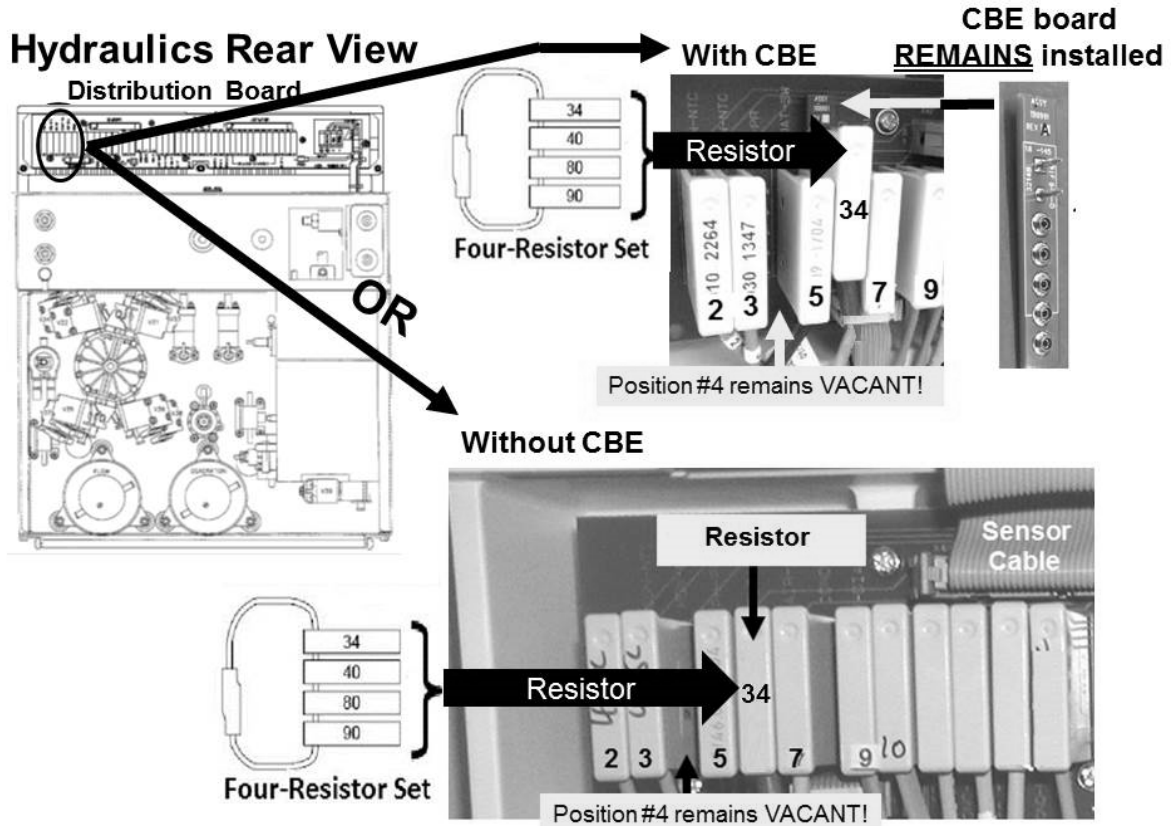
b) FIVE (5) possible bad components: **1)** CBE board¹; **2)** Sensor Board²; **3)** Functional Board³; **4)** Distribution board; **5)** Motherboard.

- 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' → 'CONFIRM'); **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 **Error! Bookmark not defined.**); **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)** 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 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**, 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 plugs into the CBE board pin for pin!



- b) 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 26).
- 2) **IF says “Air” OR toggles between “Air” and “No Air”:** To avoid unnecessary work, perform parts a THROUGH c 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. **ENSURE** the CBE board’s TOP pin is covered by the resistor plug!
 - c) If (and ONLY if) the text box now says “No Air” always see procedure number [F- 1.0.5](#) (page 26). If it EVER says “Air” see part d next page!

Part d 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 26). 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 board¹; **2)** Sensor Board²; **3)** Sensor cable³ **4)** Functional Board⁴; **5)** Distribution board; **6)** Motherboard.

¹ **A)** Swap in a known good CBE board; **B)** Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’); **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 **Error! Bookmark not defined.**)); **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 524**, [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.

LEFT BLANK INTENTIONALLY

F- 1.0.5 RESET MACHINE / DEFEAT IDLE FLOW

- 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’ → ‘CONFIRM’)!
- d) From the Home screen, select the [Dialysate Flow] window.
- e) Set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- f) 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 27).

No A motor is **NOT** rotating CCW! Perform parts a THROUGH c below:

- a) Close the shunt door!
- b) Call debug screen 1. ONLY if **FILACT** always = 0 see part c. If **FILACT** = 1 return to (ABOVE) procedure number [F- 1.0.4](#) (page 24).
- c) **NOTING** which motor is not rotating properly, proceed to **page 130**, [TROUBLESHOOTING MOTORS](#)

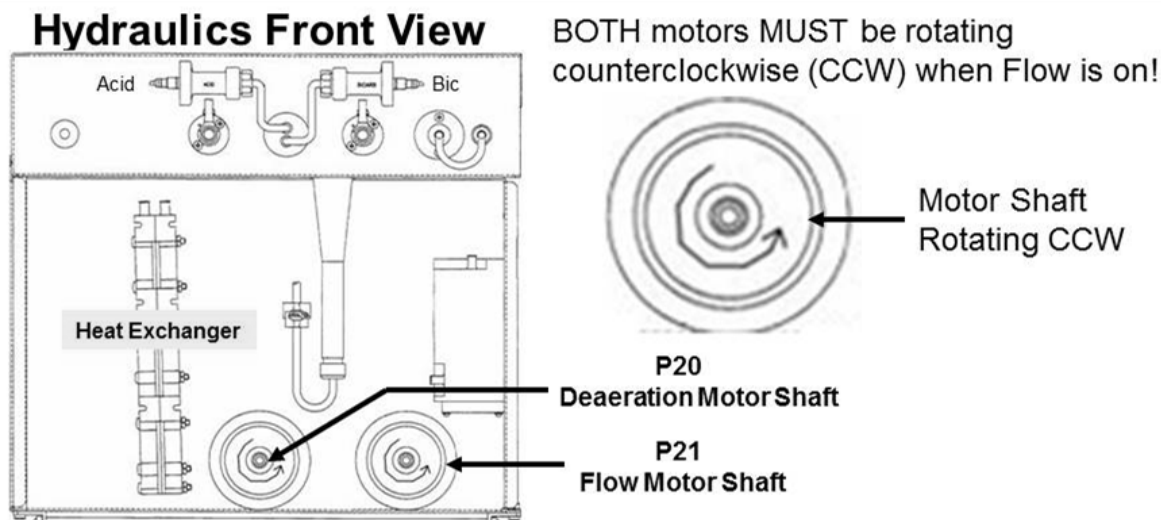


Figure 7 – Deaeration AND Flow Motor

F- 1.0.6 ISOLATE LOADING PRESSURE WITH FILACT = 0

- A) **SLAM** the Loading Pressure gauge (yellow connector) into the Acetate/Acid rinse port!
- B) Pressure may or may not cycle. TWO (2) possible scenarios:
- 1) **IF cycling, possibly every nine (9) seconds**: Loading 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) Loading Pressure REMAINS 'OKAY'**: Leaving the gauge installed, proceed to **page 30**, procedure number [F- 2.0.0](#).
 - 2) **IF pressure is EVER is NOT 'OKAY'**: See procedure number [F- 1.0.8](#) (page 27).

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

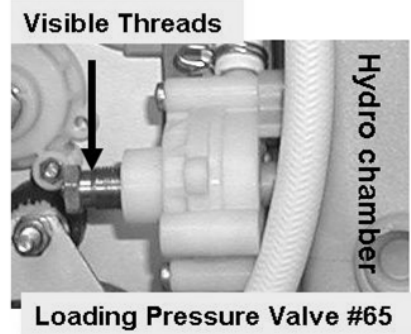
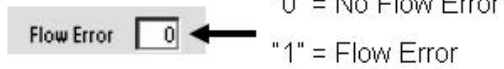
- a) Close the shunt door.
- b) FIVE (5) possible scenarios 1) or 2) or 3) or 4) or 5) below:
- 1) **IF (and ONLY if) EVER MORE THAN 29 psi**: Proceed to **page 29**, procedure number [F- 1.0.9](#).
 - 2) **IF (and ONLY if) REMAINS LESS THAN 15 psi**: **A)** Remove the gauge THEN again **SLAM** it into the RINSE port! **B)** If still less than 15 psi proceed to **page 116**, procedure number [F- 15.0.0](#).
 - 3) **IF (and ONLY if) PEAKS to between 15 and 22 psi but if EVER cycles below 11 psi**: Proceed to **page 126**, procedure number [F- 18.0.0](#).
 - 4) **IF (and ONLY if) PEAKS to between 23 and 27 psi but if EVER cycles below 11 psi**: Proceed to **page 126**, procedure number [F- 18.0.0](#).
 - 5) **IF PEAKS to between 15 and 22 psi AND NEVER cycles below 11 psi**: Referring to the Figure (next page), **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:

Scenario #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 116**, procedure number [F- 15.0.0](#).

Scenario #2: **IF between 23 and 25 psi CAN BE achieved**: See parts a THROUGH c next page:

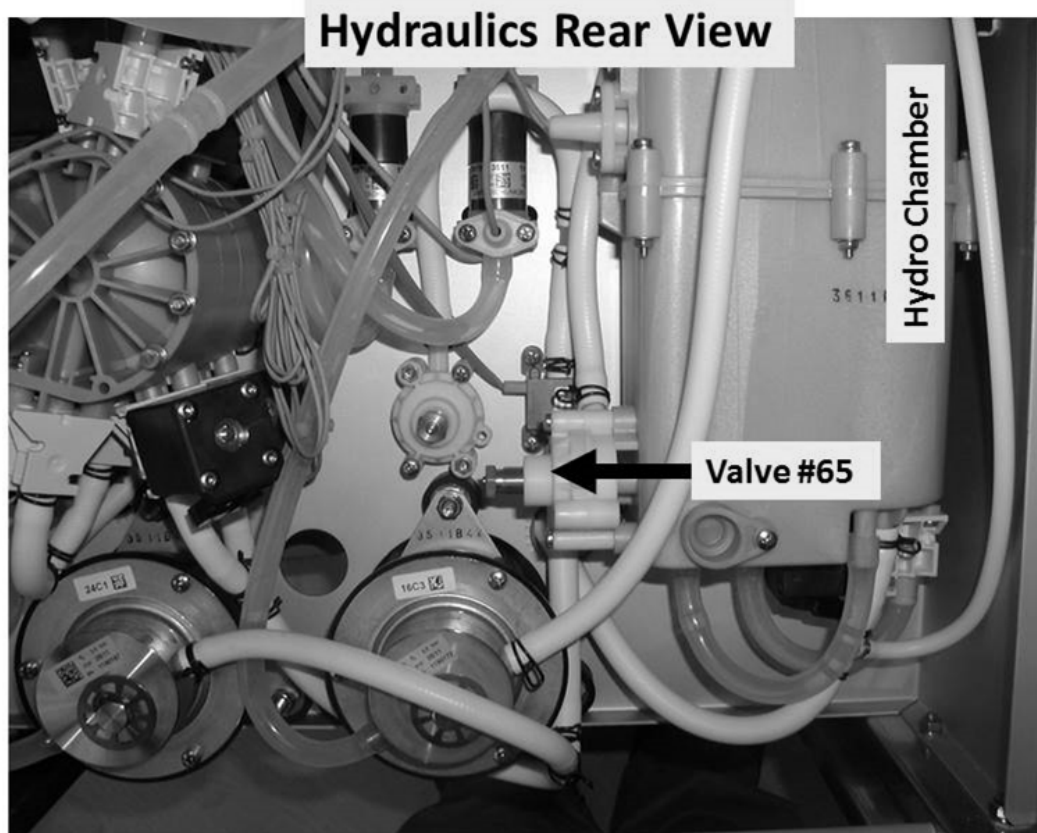
Scenario #2 continued, between 23 and 25 psi CAN BE achieved:

- a) Figure right, if threads ARE visible under Valve #65's nut see part b. If no threads are visible either the wrong spring is installed (see [Figure 6](#) (page 19)) OR Valve #65 is bad.
- b) Call debug screen 0.



- c) **WITHOUT LOOKING AWAY**, watch **Flow Error** for up to five (5) minutes. If (and **ONLY** if) EVER = 1, even just once, return to (ABOVE) procedure number [F- 1.0.5](#) (page 26). If **Flow Error** remains = 0 a flow problem is **NOT** occurring at this time but other problems may be!

LOADING PRESSURE VALVE #65



F- 1.0.9 SCENARIO #1 / LOADING PRESSURE MORE THAN 29 PSI

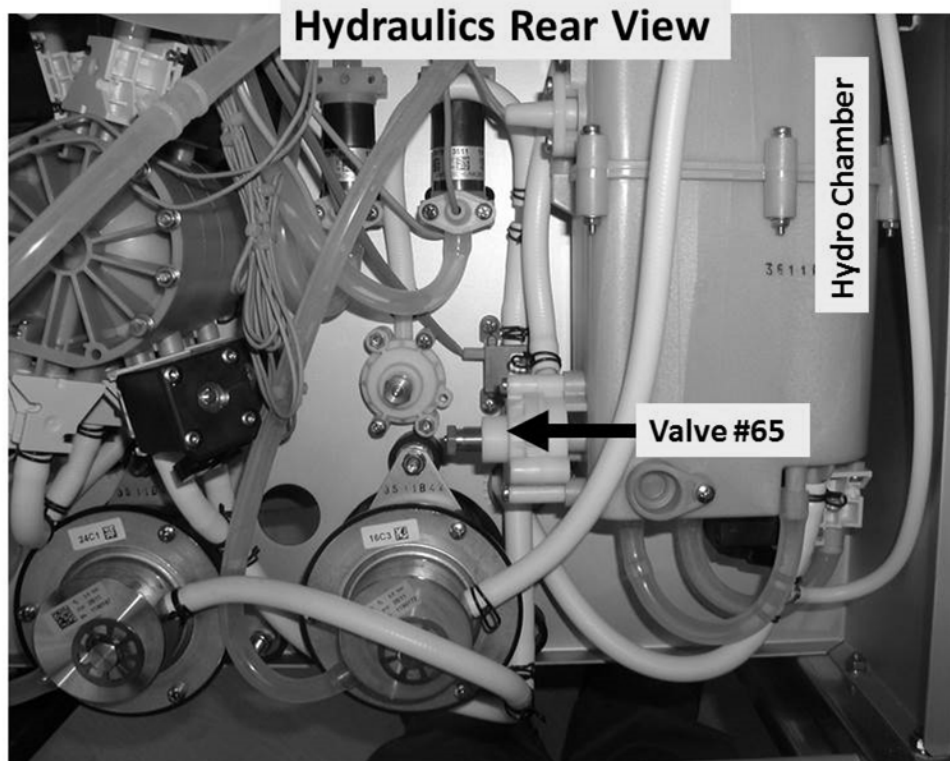
Referring to the Figure below, adjust Loading Pressure Valve #65's nut counterclockwise but no more than a few turns. Can you adjust PEAK pressure to between 23 and 25 psi (Yes or No)?

- Yes Between 23 and 25 psi! Call debug screen 0. **WITHOUT LOOKING AWAY**, watch **Flow Error** for five (5) minutes. If (and **ONLY** if) EVER = 1, even just once, return to (ABOVE) procedure number **F- 1.0.5 (page 26)**. If **Flow Error** remains = 0 a Flow problem is **NOT** occurring at this time but other problems may be.
- ↕
- No REMAINS more than 29 psi! See parts A and B below:

A) Turn the machine OFF.

B) Proceed to **page 568**, procedure number [LEAKING- 6.0.0](#).

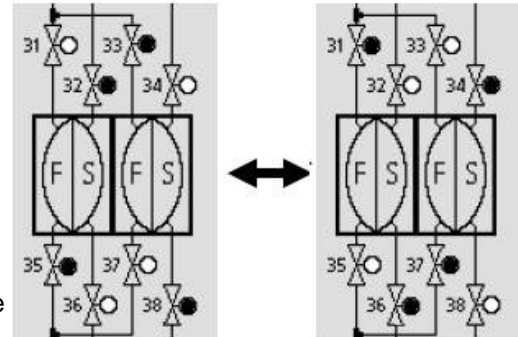
LOADING PRESSURE VALVE #65



F- 2.0.0 ISOLATE VALVE ERROR / BALANCING CHAMBER VALVES CYLING

- a) Call debug screen 1 to ENSURE FILACT REMAINS = 0!
- b) Call debug screen 0.

c) Figure right, watch the Balancing Chamber valve 'dots' for **thirty (30) seconds** or until if they CYCLE between white and blue.



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

- 1) **IF (and ONLY if) the 'dot's cycle, possibly every nine (9) seconds:** Proceed to **page 32**, procedure number [F- 2.5.0](#).
- 2) **IF the 'dots' NEVER cycle i.e. four (4) STAYING blue AND four (4) STAYING white OR all eight (8) STAYING white:** See procedure number [F- 2.1.0](#) (page 30).

F- 2.1.0 THE BALANCING CHAMBER (BC) 'DOTS' ARE NOT CYCLING

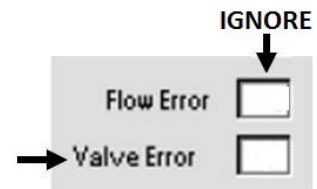
Call debug screen 1. Is VERR (right column, bottom) = 0?



Yes **VERR** = 0! See procedure number [F- 2.2.0](#) (page 30).

No **VERR** = 1 OR more! See parts a AND b below:

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

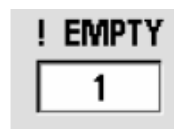


b) **WITHOUT LOOKING AWAY**, ignoring a 'blink' to 1 that lasts less than (2) two seconds, watch **Valve Error** for one (1) minute or until if it = 1 for LONGER THAN two (2) seconds. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) Valve Error = 0 OR 'blinks' to 1 for less than two (2) seconds:** Proceed to **page 195**, [TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM](#)
- 2) **IF Valve Error EVER = 1 LONGER THAN two (2) seconds!** Proceed to **page 652**, [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 31).

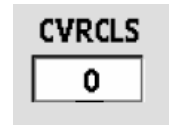
No ! **EMPTY = 0**: Either the arterial (red) dialyzer line is NOT connected to the shunt properly OR FOUR (4) possible bad components: **1) Actuator-Test Board^a OR; 2) Functional Board^{a, b} OR; 3) Arterial dialyzer line shunt door switch OR; 4) Motherboard^a**

^a To LOCATE the boards, refer to [Figure 4A](#) (page 9).

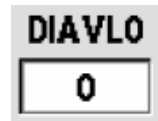
^b To prevent “Cond Offset Failure” place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

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

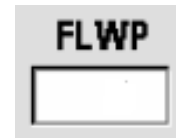


1) **IF (and ONLY if) DIAVLO REMAINS ALWAYS = 0!** See procedure number [F- 2.4.0](#) (page 31).

2) **IF DIAVLO cycles between 0 and 1 (possibly rapidly) OR is remaining = 1!** Valve #24 may be in a malfunctioning electrical state! Proceed to **page 652**, [Section 26](#).

F- 2.4.0 VERR = 0 / BC VALVES NOT CYCLING

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



1) **IF (and ONLY if) FLWP REMAINS LESS THAN 255:** See procedure number [F- 2.5.0](#) (page 32).

2) **IF FLWP is ALWAYS (CONSTANTLY) = 255!** Perform parts a THROUGH c below:

a) Turn the machine OFF!

b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!

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 32).

2) **IF FLWP is CONSTANTLY = 255 (i.e. NEVER, EVER 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 9). ^b To prevent “Cond Offset Failure” place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**)

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

- a) The shunt door **MUST** remain open till instructed!
- b) 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 Board¹.

↑ ¹ To LOCATE the Actuator-Test board refer to [Figure 4A](#) (page 9).

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

CHECK #2: a) **IMPORTANT!** Turn Dialysate Flow OFF (Flow on/off lamp blinks).

- b) Call debug screen 1. ENSURE **FLWP** (upper right) = 255 i.e. Flow is off!



- c) The Deaeration Motor may be running but the Flow Motor should be OFF! Check FLOW MOTOR rotation again!

- d) 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 32).
Yes	Yes or No	Flow Motor rotating! If FLWP is <u>NOT</u> = 255 you did not turn Flow off! If FLWP = 255, TWO (2) possibilities: 1) Either the motors are reverse connected at the distribution board <u>OR</u> 2) The Actuator-Test Board ¹ is bad! ¹ To <u>LOCATE</u> the board refer to Figure 4A (page 9)

F- 2.5.2 FLOW MOTOR NOT RUNNING / DEAERATION MOTOR RUNNING

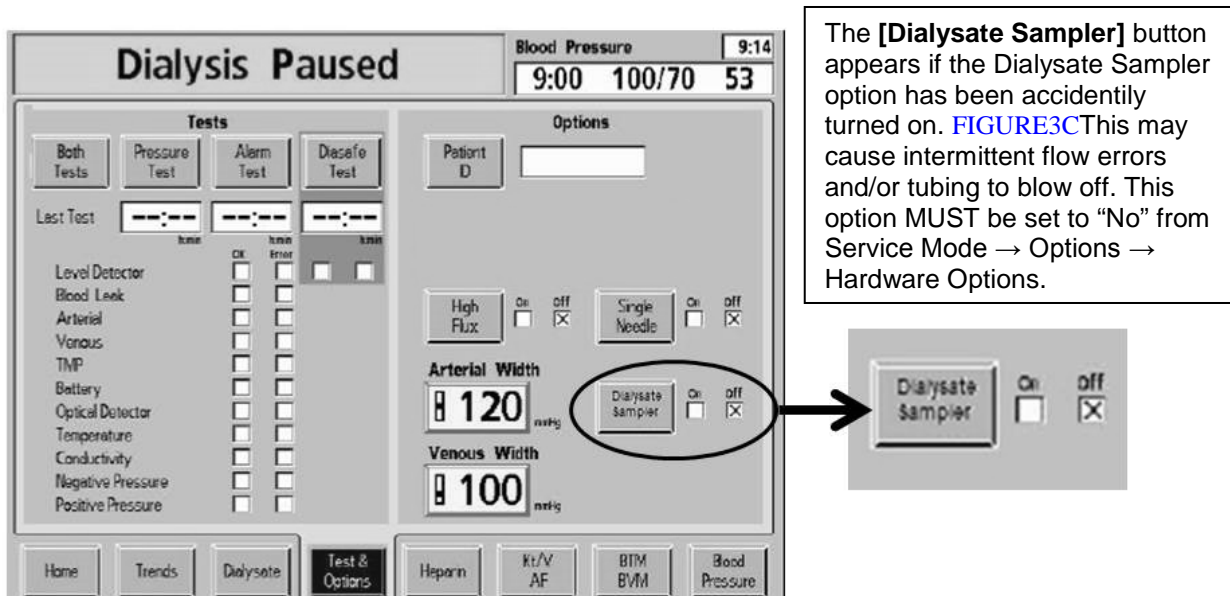
- a) Turn Dialysate Flow ON i.e. Flow on/off lamp NOT blinking!
- b) From debug screen 1, ENSURE **FLWP** (upper right) is LESS THAN 255 (i.e. Flow is on)!
- c) See procedure number [F- 2.6.0](#) (page 33).

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

- a) Press the 'Escape' key.
- b) At the bottom of the screen, select the Test & Options tab. DO NOT start the tests!
- c) Per the Figure below, does the OPTIONAL [Dialysate Sampler] button appear?

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

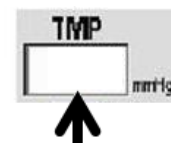
No The [Dialysate Sampler] does NOT appear! See procedure number F- 2.7.0 (page 33).



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:



Red = TMP Alarm

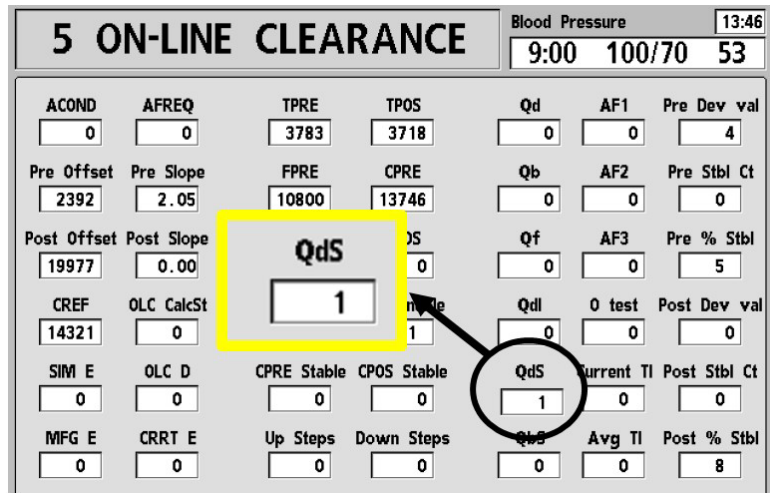
- 1) **IF (and ONLY if) the TMP window is WHITE**: See procedure number F- 2.8.0 (page 34).
- 2) **IF the TMP window is RED**: Perform parts a THROUGH d below:
 - a) Press and release the 'Reset' key then immediately press and hold it for three (3) seconds.
 - b) **Allow thirty (30) seconds!**
 - c) If a TMP alarm reoccurs perform parts a and b up to twice more before continuing to part d.
 - d) Allow twenty (20) seconds then see procedure number F- 2.8.0 (page 34).

F- 2.8.0 ISOLATE FLOW ERROR

- a) Call debug screen 0 to see **Flow Error**. If EVER = 1, even if just once, a Flow Error is present!  ← "0" = No Flow Error
"1" = Flow Error
- b) WITHOUT LOOKING AWAY, watch for two (2) minutes OR until **Flow Error** EVER = 1. TWO (2) possible scenarios:
- 1) **IF (and ONLY if) Flow Error EVER = 1 even if just once:** A problem is indicated in the 'bypass circuit'! Proceed to **page 47**, procedure number [F- 5.0.0](#).
 - 2) **IF Flow Error ALWAYS = 0 (NEVER = 1):** See procedure number [F- 2.8.1](#) (page 34).

F- 2.8.1 FLOW ERROR ALWAYS = 0

- a) Press and hold the "1" key for five (5) seconds!
- b) **Allow forty-five (45) seconds BEFORE continuing to part c!**
- c) Call debug screen 5.
- d) **QdS** (Figure right) REMAINS = 1 if flow is stable. Watch it for one (1) minute. TWO (2) possible scenarios:



- 1) **If QdS is ALWAYS = 1!** Leaving the shunt door OPEN, see procedure number [F- 2.9.0](#) (page 34).
- 2) **IF QdS is OR becomes = 0!** A problem is indicated in the 'bypass' circuit! Proceed to **page 47**, 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 remaining STABLE (i.e. does NOT change more than 0.5 per minute). WITHOUT LOOKING AWAY, watch for two (2) minutes! TWO (2) possible scenarios:



- 1) **IF (and ONLY if) PDIA AND ADIA REMAINING** between 2.0 and 8.5 AND stable: Proceed to **page 36**, procedure number [F- 2.9.2](#).
- 2) **IF PDIA AND / OR ADIA IS NOT** remaining between 2.0 and 8.5 AND / OR is NOT stable: 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) Select the 'Dialysis' button but **DO NOT** press 'CONFIRM' **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 527**, [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:



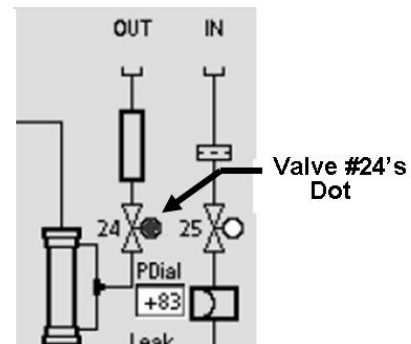
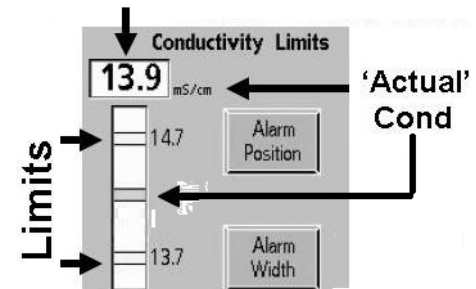
- 1) **IF (and ONLY if) valve #41's 'dot' cycles between white and blue:** Turn the machine off THEN proceed to **page 527**, [SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS](#).
- 2) **IF valve #41's 'dot' STAYS white!** Call debug screen 4. Once again, watch **PDIA AND ADIA** for one (1) minute! TWO (2) 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 462**, 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 53**, procedure number [F- 6.1.2](#).

F- 2.9.2 ISOLATE TEMPERATURE AND CONDUCTIVITY

- a) **ENSURE NO ACTIVE 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 39**, procedure number F- 2.0.15.
 - 2) **IF Temperature AND Conductivity are in range:** See parts a THROUGH g below:

- a) At the bottom of the screen, select the 'Dialysate' tab. **white if no Cond alarm**
- b) Figure right, if necessary, adjust the Conductivity Limits until the 'Actual' Conductivity is CENTERED between them.
- c) Press 'CONFIRM'!
- d) Allow three (3) minutes OR until 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 36).

Cond Window Example 13.9



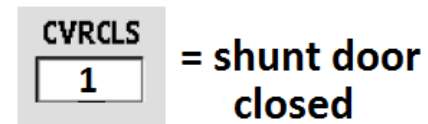
F- 2.9.4 ISOLATE 'OUT OF BYPASS' CIRCUIT

- a) **CLOSE THE SHUNT DOOR!**
- b) Is Valve #24's 'dot' BLUE?

Yes BLUE! See procedure number [F- 2.0.10](#) (page 37).

No WHITE! See parts a THROUGH d below:

- a) ENSURING the shunt door is FULLY 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:



- 1) **IF (and ONLY if) it turns BLUE:** See procedure number [F- 2.0.10](#) (page 37).
- 2) **IF after three (3) minutes it stays WHITE:** Proceed to **page 38**, procedure number [F- 2.0.12](#).

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

- a) Call the Home screen to ENSURE [Dialysate Flow] has REMAINED set to 800 ml/min!!
- b) Does a leak develop? Refer to [Table 2](#) below:

Table 1

Does a leak develop?	Your Response:
<p>Yes (a leak develops)</p>	<p>See parts a THROUGH c below:</p> <ul style="list-style-type: none"> a) Turn the machine OFF! b) If tubing has blown off tie wrap these segments to where they belong! c) Proceed to page 112, procedure number F- 14.0.0.
<p>No leaks</p>	<p>TWO (2) possible scenarios based on if the external flow indicator's 'bob' is rising, at least ¼ way up, in the sight tube.</p> <ul style="list-style-type: none"> 1) IF (and ONLY if) rising at least ¼ way: Proceed to page 40, procedure number F- 3.0.0. 2) IF <u>NOT</u> rising at least ¼ way: See procedure number F- 2.0.11 (page 37).

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

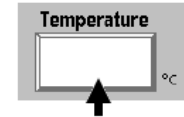


Call debug screen 1 to see VERR (right column, bottom). TWO (2) possible scenarios:

- 1) **IF (and ONLY if) VERR = 1 or more:** Proceed to **page 195**, [TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM](#).
- 2) **IF VERR = 0:** Proceed to **page 112**, procedure number [F- 14.0.0](#).

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

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



Red OR white?

Yes [Temperature] window is red! See procedure number [F- 2.0.13](#) (page 38).

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 its 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 37**, procedure number [F- 2.0.10](#).
 - 2) **IF the 'dot' REMAINS white:** If certain you are seeing or saw a Flow Error proceed to **page 112**, 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) Select the [Temperature] window to ENSURE "Temp Setting" is at 37° C.
- c) Press 'CONFIRM'.
- 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 37**, procedure number [F- 2.0.10](#).
 - 2) **IF REMAINS white:** If certain you saw a Flow Error proceed to **page 112**, 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) Select the [Temperature] window to ENSURE "Temp Setting" is 37.0° C.
- c) Press 'CONFIRM'.
- 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?

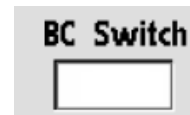


"0" = No Flow Error
"1" = Flow Error

Yes **Flow Error** EVER = 1! Proceed to **page 47**, 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 five (5) 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 47**, procedure number [F- 5.0.0](#).
- 2) **IF BC Switch is NEVER = 897 or more:** See procedure number [F- 2.0.16](#) (page 39).

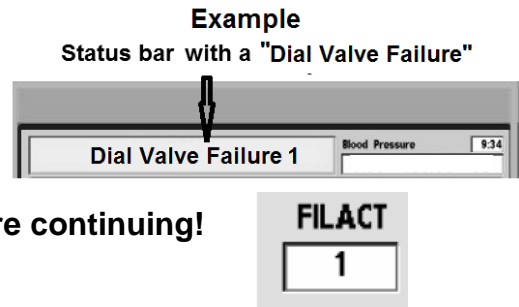
F- 2.0.16 NO FLOW ERRORS

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 214**, [SECTION 4 – TEMPERATURE PROBLEMS](#).
- 2) **IF (and ONLY if) Conductivity is NOT between 13.0 and 14.5 mS:** Proceed to **page 317**, [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 36**).

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

- A) WITHOUT returning the Air Sensor's 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 = 1 before continuing!**
- F) See procedure number [F- 3.1.0](#) (page 40).



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! Reconnect the drain then proceed to **page 42**, procedure number [F- 3.2.0](#).

No Less than 600 ml! See procedure number [F- 3.1.1](#) (page 41).

F- 3.1.1 FLOW LESS THAN 600 / ISOLATE ACTUATOR-TEST BOARD / VALVE #43

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

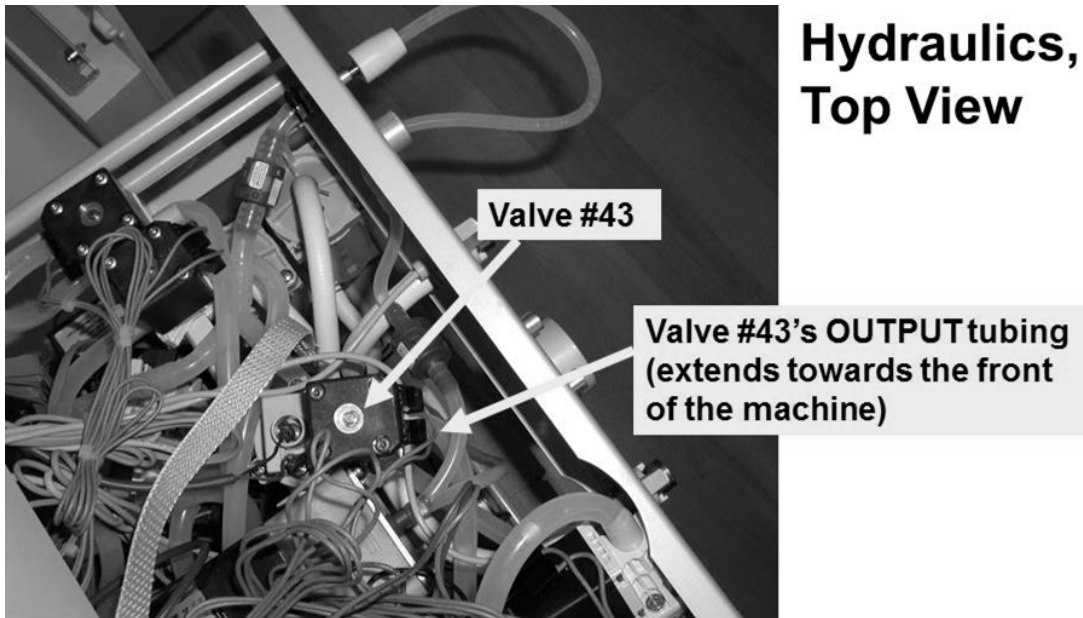


Figure 8 – Hydraulics TOP View

- c) **BEFORE continuing to part d allow four (4) minutes for Valve #43's solenoid to become warm!**
- d) 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.**

↑

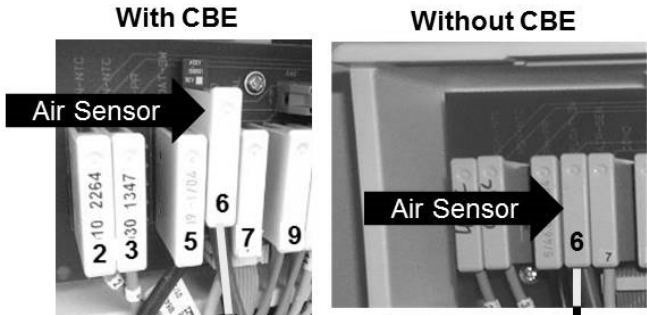
↓

* To LOCATE the Actuator-Test board refer to [Figure 4A](#) (page 9).

No The solenoid is NOT warm! **NOTE ONLY VALVE #43** will be checked and proceed to **page 192, [TROUBLESHOOTING A VALVE.](#)**

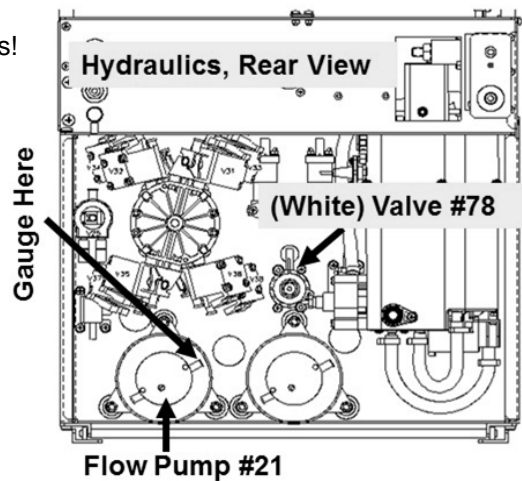
F- 3.2.0 SIX HUNDRED (600) ML OR MORE IN FILLING PROGRAM

- a) Return the Air Sensor's female connector to the 5th distribution board position from the left.
- b) Call debug screen 0. **If the Air Sensor is plugged in properly, Chamber #69's box says "No Air".**
- c) See procedure number [F- 3.2.1](#) (page 42).



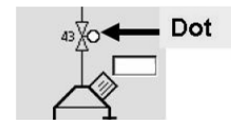
F- 3.2.1 CHAMBER #69 = "No Air"

- 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) **Tie wrap both sides of the gauge tubing to prevent leaks and false readings!**
- e) See procedure number [F- 3.2.2](#) (page 42).



F- 3.2.2 ISOLATE FLOW PUMP

- a) **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 'Escape' 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 43).

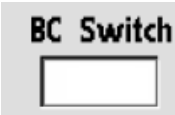
No NOT between 35 and 36 psi! ENSURING the machine was in RINSE AND no leaks, TWO (2) possible scenarios below:

- 1) **IF (and ONLY if) pressure is too low: DO NOT calibrate instead proceed to **page 93**, procedure number [F- 9.0.23](#).**
- 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 43).

F- 3.3.0 GOOD FLOW PUMP PRESSURE

- a) Return the connectors to acid and bicarbonate.
- b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’!
- d) Allow [**Conductivity**] to increase to 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 43).
 - 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 43).

F- 3.6.0 ANALYZE FLOW ERROR

- a) **Allow thirty (30) seconds BEFORE continuing to part b!**
- 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:

The image shows a rectangular box with the text 'BC Switch' above it. The box is empty, representing the BC Switch indicator on the debug screen.

 - 1) **IF (and ONLY if) REMAINS ALWAYS = 897 or more:** Return to (ABOVE) procedure number [F- 2.0.0](#) (page 30).
 - 2) **IF (and ONLY if) NEVER = 897 or more:** The Flow Error must be VERY intermittent! Procedure number [F- 3.8.0](#) (page 44) 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’ → ‘CONFIRM’).
 - 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 ALWAYS = 897 or more:** Return to (ABOVE) procedure number [F- 2.0.0 \(page 30\)](#).
- 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:** See procedure number [F- 3.8.0 \(page 44\)](#).

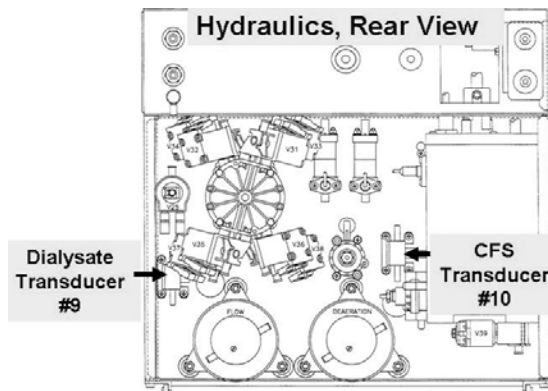
F- 3.8.0 INTERMITTENT FLOW ERRORS

- a) It is HIGHLY 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’ → ‘CONFIRM’).
- c) **OPEN THE SHUNT DOOR and LEAVE IT OPEN till instructed!**
- d) From the Home screen, select the [Dialysate Flow] window.
- e) Set [Dialysate Flow] to 800 ml /min and press ‘CONFIRM’.
- 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 \(page 45\)](#).
 - 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 before continuing to part c.
 - c) If a TMP alarm reoccurs, repeat parts a and b up to twice more BEFORE continuing to procedure number [F- 3.8.1 \(page 45\)](#).

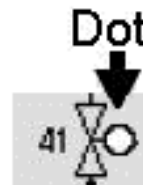
F- 3.8.1 TROUBLESHOOTING INTERMITTENT FLOW ERRORS

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

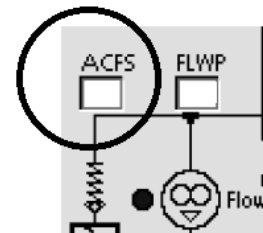
- 1) Figure right, check the (blue) CFS transducer #10 AND Dialysate Pressure #9 transducers for signs of a small external leak. If leakage is located replace the transducer.
- 2) To ensure the Deaeration Motor is not intermittently stopping, glance at Loading Pressure (Rinse port gauge) from time to 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 and press 'CONFIRM'; 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 30). If **VERR** = 0 continue to step #7.
- 7) Call debug screen 0. 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 then white again. Continue to step #8.
- 8) Call debug screen 4. ENSURE **PDIA** (left column) is between 2.0 and 8.0 AND is NOT changing more than 0.3 per minute which may indicate a bad DiaSafe® filter OR leaking balancing chamber valve.
- 9) Performing parts a through e below, may locate an intermittent bad CFS transducer:



- a) Turn Dialysate Flow OFF (Flow on/off lamp blinks).
- b) Call debug screen 0.
- c) Figure right, **ACFS** should increase to between 4.0 and 6.0 very quickly, within 0.5 seconds. If it EVER increases slower than this OR remains less than 4.0 OR goes to more than 5.9 CFS transducer #10* is intermittent bad.



* To LOCATE the CFS refer to Figure 6 (page 19)

- d) Turn Dialysate Flow ON (Flow on/off lamp NOT blinking).
- e) Repeat parts a through d at least eight (8) times. If **ACFS** goes to between 4.0 and 5.9, within 0.5 seconds, EVERY SINGLE TIME, continue to step #10 (next page).

- 10) Call debug screen 0. Watch **Flow Error** 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 \(page 62\)](#) 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 alarms THEN 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 535** to perform [SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM](#)
- 17) If a leaking balancing chamber diaphragm was not located in step #16 continue to step #18.
- 18) 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. ENSURE ‘soft brushes’ are installed in the Flow motor!
- 19) Return to Dialysis Program.
- 20) From the Home screen, select the [Dialysate Flow] window.
- 21) Set [Dialysate Flow] to 500 ml/min and press ‘CONFIRM’.
- 22) ENSURING debug screen 0’s Chamber #69 says “No Air” constantly, if necessary, RESET a TMP alarm then continue to step #21.
- 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 48).
- 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**, without unplugging valves from the distribution board, **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 48). If a wiring error was located this may be the problem.

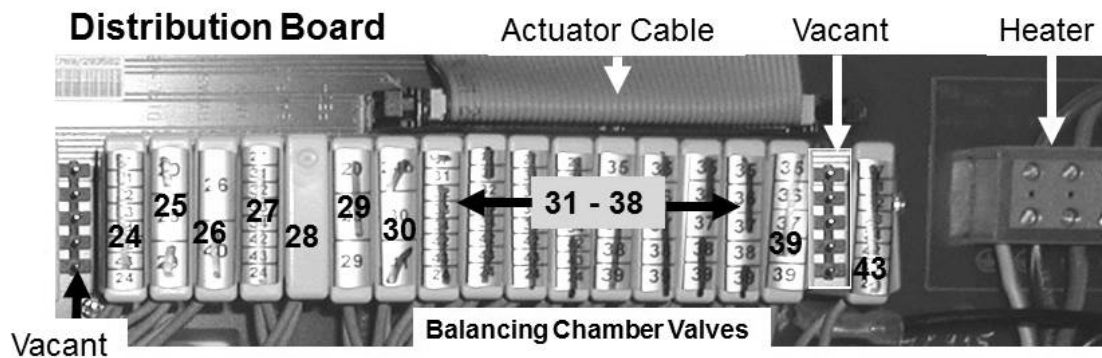
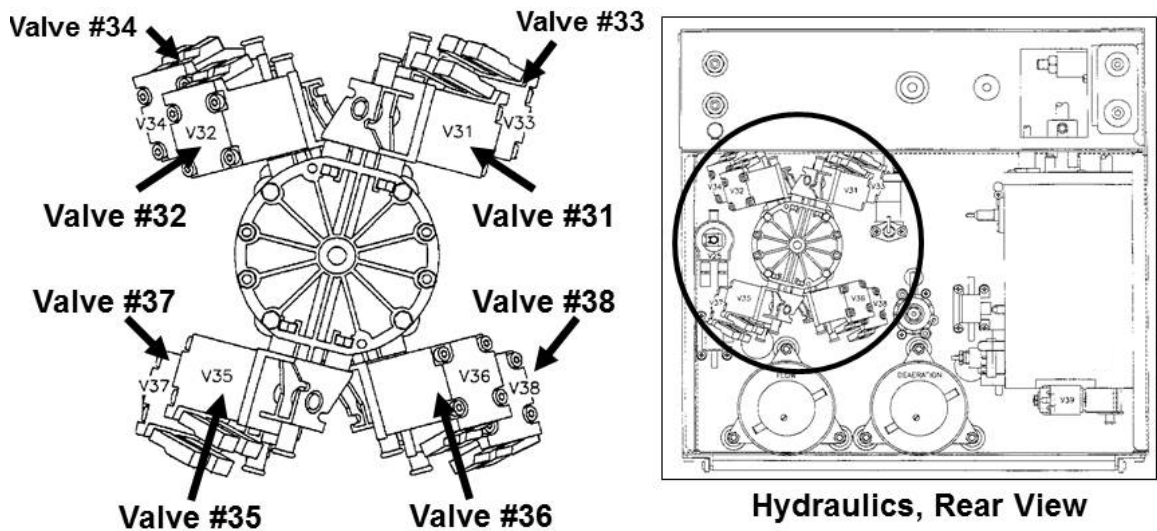
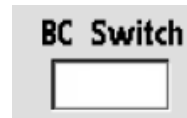


Figure 9 – Distribution Board / Balancing Chamber Valves

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 REMAIN ALWAYS = 897?



Yes **BC Switch** ALWAYS = 897! See procedure number [F- 5.1.1](#) (page 48).

No **BC Switch** is NOT always = 897! Proceed to **page 49**, procedure number [F- 5.2.0](#).

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

- a) **Figure below**, VERY CAREFULLY trace BOTH wire harnesses from distribution board connectors "X9, P-Dial" AND "X10, CFS" to ENSURE they go to the correct (blue) Pressure Transducer.
- b) Are BOTH Pressure Transducers connected properly?

Yes BOTH are connected properly! See procedure number [F- 5.2.0](#) (page 49).

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 49)

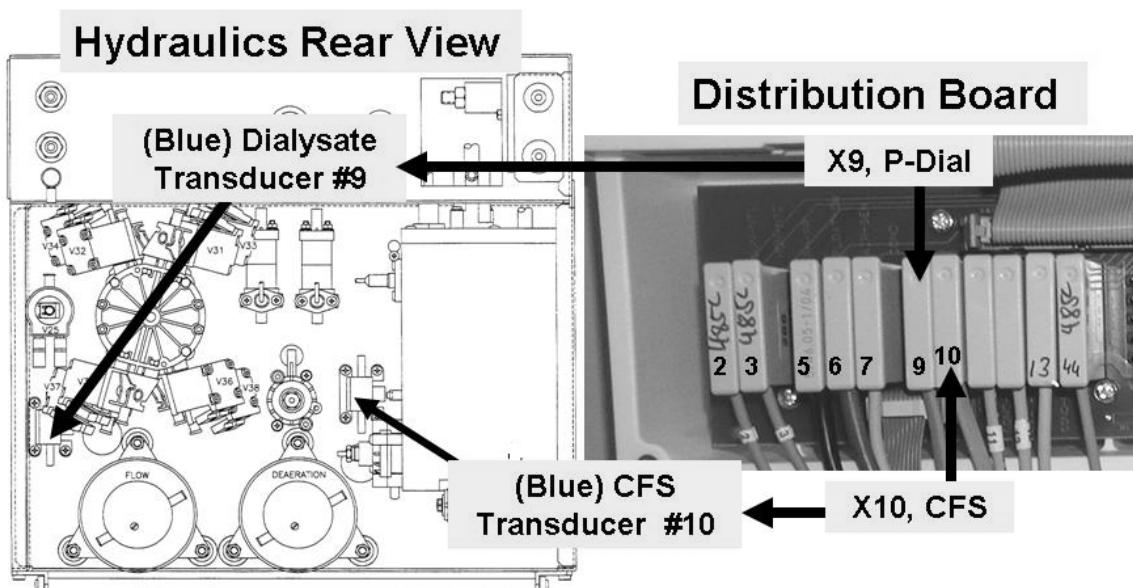
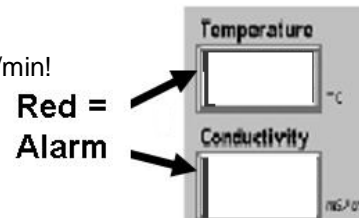


Figure 10 – Pressure Sensors

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

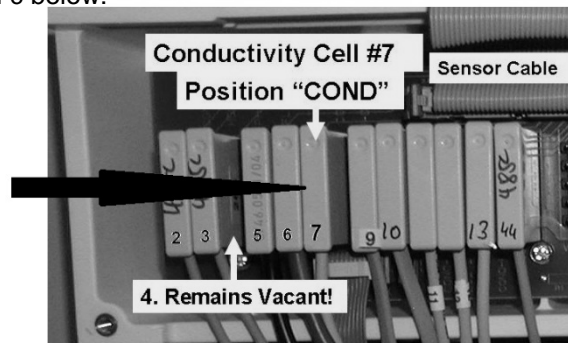
- a) **IMPORTANT!** ENSURE the shunt door is CLOSED!
- b) ENSURE Dialysate Flow is ON (Flow on/off lamp NOT blinking)!
- c) Call the Home screen and ENSURE [Dialysate Flow] is set to 800 ml/min!
- d) Figure right, is the [**Conductivity**] AND / OR the [**Temperature**] window REMAINING ALWAYS RED?



Yes REMAINING ALWAYS RED! See procedure number [F- 5.3.0](#) (page 49).

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.
- 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 111**, 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 50**, procedure number [F- 6.0.0](#).

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

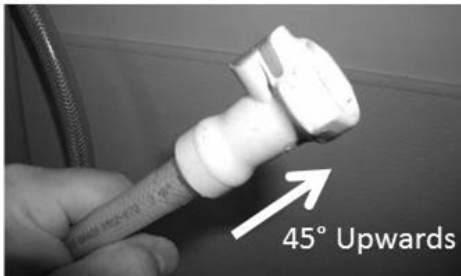
Is the external flow indicator's 'bob' rising at least ¼ way in the sight tube?

Yes 'Bob' moving! If SURE the **Conductivity AND / OR Temperature** window is ALWAYS RED proceed to **page 111**, procedure number [F- 13.0.0](#).

No 'Bob' NOT moving! See procedure number [F- 6.0.0](#) (page 50).

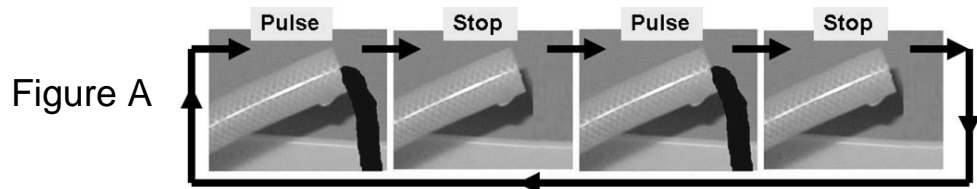
F- 6.0.0 DRAIN STREAM CHECKS

- 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!**

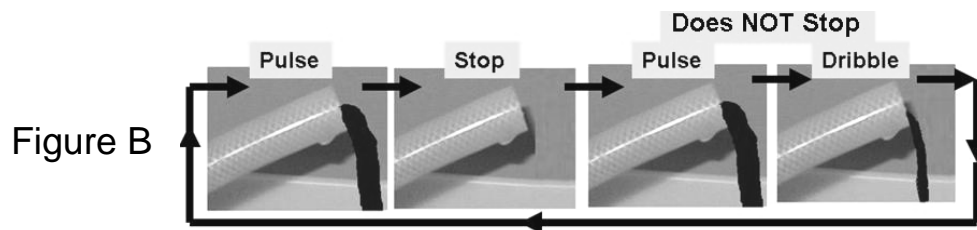


- c) Watching for one (1) minute, flow MAY occur every nine (9) seconds!
- d) Consider ALL FOUR (4) scenarios below AND proceed with the one that BEST MATCHES:

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 51).

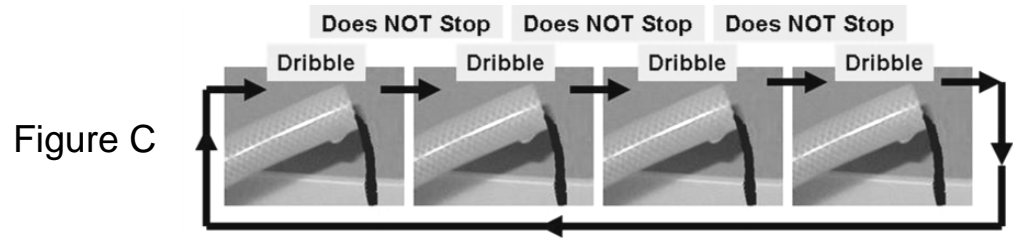


Scenario #2: Referring to Figure B, approximately 30 ml Pulse → Stop → Pulse → 'Dribble' (a noticeably weaker stream that lasts about two (2) seconds) → etc. **Flow does NOT stop completely between each and every cycle:** NOTE this drain stream (dribble) for later then see procedure number F- 6.1.0 (page 51).



Scenarios 3 AND 4 next page

Scenario #3: Referring to *Figure C*, for a **ONE MINUTE PERIOD** if **EVER** a **continuous weak stream that LASTS** for five (5) seconds or **longer**: ENSURING the drain tube OPENING was pointed up, proceed to **page 58**, procedure number [F- 6.2.0](#).



Scenario #4: **IF No Flow EVER:** If (and ONLY if) the Dialysate Flow on/off lamp is blinking return to (ABOVE) procedure number [F- 5.2.0](#) (**page 49**). If NOT blinking proceed to **page 59**, procedure number [F- 6.3.0](#).

F- 6.1.0 PULSE – STOP – PULSE OR ‘DRIBBLE’ / ISOLATE FOR STUCK OPEN BC VALVE

- A) Reattach the drain tubing to the station!
- B) ENSURING Dialysate Flow in ON (Flow on/off lamp is NOT blinking), ENSURE a good drain connection by listening for or visually verifying flow.
- C) If a TMP alarm is NOT 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) AND **ADIA** (right column) for TWO (2) minutes. BOTH should REMAIN between 1.5 and 8.5 AND STABLE i.e. DOES NOT change more than 0.6 per minute!



F) TWO (2) possible scenarios:

- 1) **IF (and ONLY if) PDIA AND ADIA is STABLE between 1.5 and 8.5:** Proceed to **page 54**, procedure number [F- 6.1.4](#).
- 2) **IF PDIA and / or ADIA IS NOT remaining between 1.5 and 8.5 and / or IS NOT stable:** See procedure number [F- 6.1.1](#) (page 52).

F- 6.1.1 PDIA NOT BETWEEN 1.0 AND 8.5 OR UNSTABLE

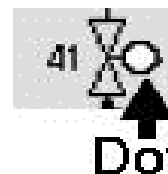
- a) Momentarily plug the RED (acid) concentrate connector into its rinse port to call "Select Program".
- b) Return the RED connector to acid concentrate!
- c) Select the 'Dialysis' button but **DO NOT** press 'CONFIRM'!
- d) Remove the red DIALYZER connector from the shunt door and HOLD IT as seen in the Figure right!
- e) Continuous flow, more than 0.2 ml every minute, from the connector?



Yes Continuous flow! Turn the machine off THEN proceed to **page 527**, [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 527**, [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 462**, 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:** See procedure number [F- 6.1.2](#) (page 53).

F- 6.1.2 PDIA AND ADIA STABLE BETWEEN 2.0 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, 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 36**, 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 0.5 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 53).
 - 4) **IF PDIA is STABLE between 1.5 and 8.0:** Close the shunt door THEN proceed to **page 54**, 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 527**, to perform [SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS](#).
- d) If a leaking balancing chamber valve was NOT located in part c, proceed to **page 65**, procedure number [F- 7.0.4](#).

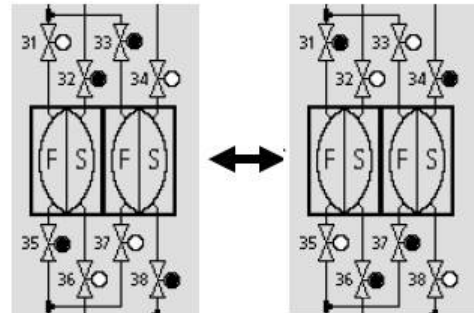
F- 6.1.4 PDIA STABLE BETWEEN 1.0 AND 8.5

- a) From the Home screen, ENSURE [Dialysate Flow] is 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 14.6 mS?

Yes [Conductivity] more than 14.6 mS! Proceed to **page 62**, procedure number F- 7.0.0.

No [Conductivity] less than 14.6 mS! See parts A THROUGH E 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.



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

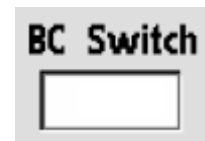
Scenario #1: ACFS NORMAL behavior: Mostly remains between 2.0 and 5.0 but may occasionally drop below 1.0 but for **NO MORE** than ten (10) seconds. If (and ONLY if) ACFS is behaving normally continue to part D.

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 89**, procedure number F- 8.0.0.

TMP If a '+' sign appears TMP is positive, if a '-' sign does NOT appear TMP is negative

<table border="1"> <tr><td>Art</td><td>0</td></tr> <tr><td>Ven</td><td>0</td></tr> <tr><td>TMP</td><td></td></tr> </table>	Art	0	Ven	0	TMP		<p>Examples:</p> <table border="1"> <tr><td>TMP</td><td>+200</td><td>Positive 200</td></tr> <tr><td>TMP</td><td>400</td><td>Negative 400</td></tr> </table>	TMP	+200	Positive 200	TMP	400	Negative 400	
Art	0													
Ven	0													
TMP														
TMP	+200	Positive 200												
TMP	400	Negative 400												

- D) 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 E next page.



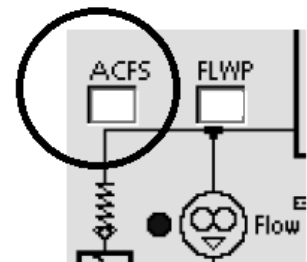
E) WITHOUT LOOKING AWAY, ENSURING a “No Water” banner NEVER appears, watch **BC Switch** for up to five (5) minutes OR until if it **EVER** is more than 400 OR less than 203. FOUR (4) possible scenarios 1) or 2) or 3) or 4):

- 1) **IF (and ONLY if) BC Switch is CONSTANTLY 897 or more:** Proceed to **page 89**, procedure number [F- 8.0.0](#).
- 2) **IF (and ONLY if) BC Switch is NEVER more than 400 OR less than 203:** See procedure number [F- 6.1.5](#) (page 55).
- 3) **IF (and ONLY if) BC Switch cycles CONSISTENTLY from about 220 for nine (9) seconds to more than 400 (possibly 897) for two (2) seconds:** Proceed to **page 62**, procedure number [F- 7.0.0!](#)
- 4) **IF BC Switch is EVER more than 400 OR less than 203 but NOT CONSISTENTLY as in Scenario #3:** 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 rising and falling.

b) Turn Dialysate Flow OFF (Flow on/off lamp blinks).

c) Figure right, if **ACFS** should return to between 4.0 and 6.0 instantaneously (within 0.5 seconds). If it EVER increases slower than this OR remains less than 4.0 OR more than 6.0 the CFS Transducer #10* is intermittent bad.



* To LOCATE the CFS refer to [Figure 6](#) (page 19)

d) Turn Dialysate Flow ON (Flow on/off lamp STOPS blinking).

e) Repeat parts a through e at least eight (8) times. If **ACFS**, goes to between 4.0 and 5.9, within 0.5 seconds, EVERY SINGLE TIME, see procedure number [F- 6.1.5](#) (page 55).

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 56).
- 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 56).

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 QR drops to less than 2.0:** Return to **page 52**, procedure number [F- 6.1.1](#).

- 2) **IF PDIA NEVER increases to more than 8.0 QR drops to less than 2.0:** As NOTED in procedure number [F- 6.0.0](#) (page 50), drain flow was either: **1) Pulse – Stop – Pulse – Stop – etc. (NO ‘dribble’) QR**; **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 56).

 - 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 part A through C below:
 - A) **BEFORE** continuing to part b proceed to **page 535**, 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’ → ‘CONFIRM’).

 - C) See **part b** of procedure number [F- 6.1.7](#) (page 56).

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 0.5° 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 535**, [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.?

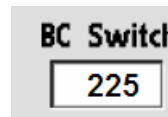
Yes **FLWP** ramping up and down more than +/- 2: Possibly a tubing restriction somewhere. Start with the Diasafe® filter possibly even inside the housing.

No **FLWP** remaining stable: See procedure number [F- 6.1.8](#) (page 57).

F- 6.1.8 VERIFY FLOW RATE (BC SWITCH)

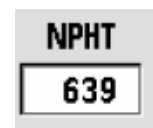
a) **Do NOT reset alarms!**

b) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for two (2) 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 89**, 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 62**, 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 57).
- 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 “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 44**, 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 57).
- 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 57**).

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 62**, procedure number [F- 7.0.0](#).

No [**Conductivity**] is less than 14.8 mS! Proceed to **page 61**, 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 59).

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:** Valve #43's 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 9)

2) **IF drain flow continues to be 'continuous':** Remove the clamps from valve #43 then proceed to **page 61**, procedure number [F- 6.5.0](#).

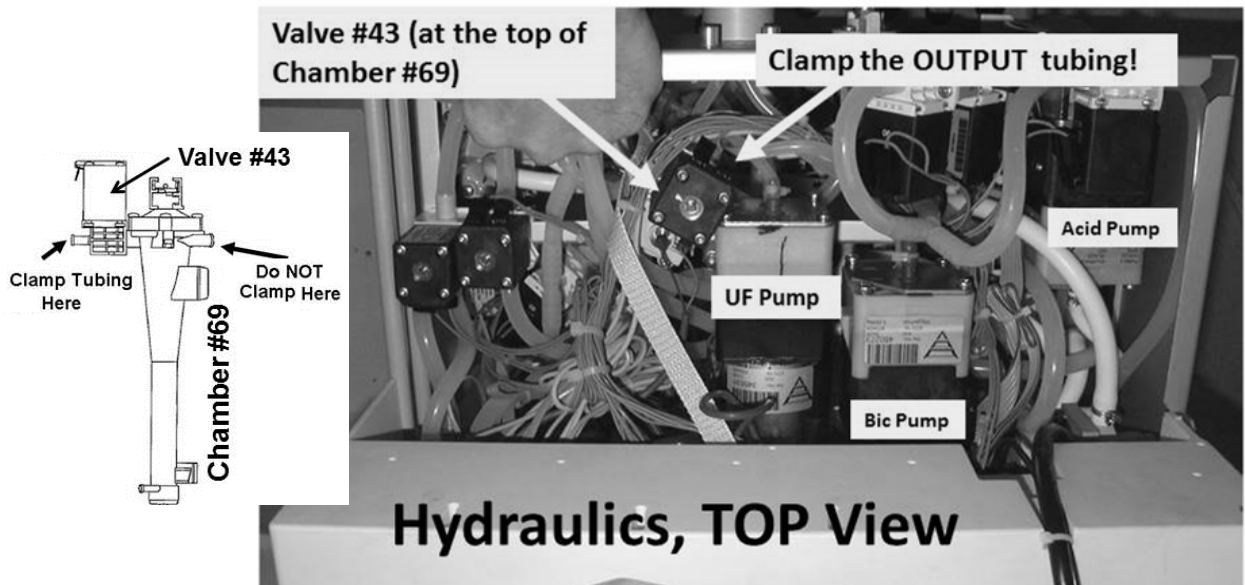


Figure 11 – Valve #43 Location

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 59).

No Solenoid is NOT hot! **NOTE ONLY** VALVE #30 will be checked and proceed to **page 192**, [TROUBLESHOOTING A VALVE](#).

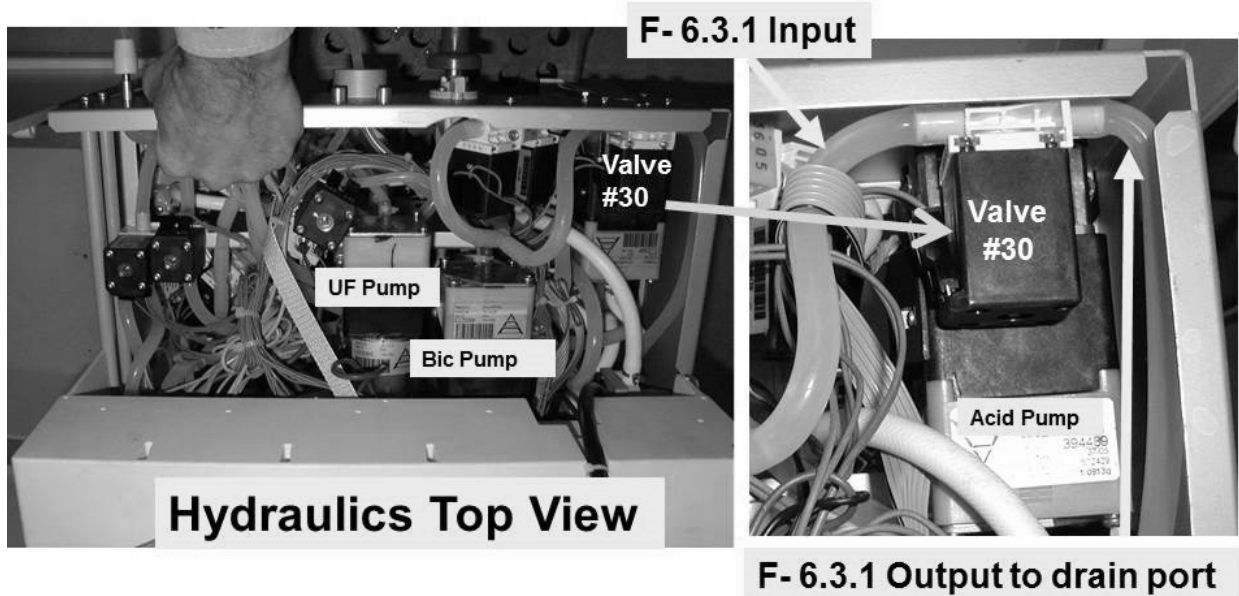
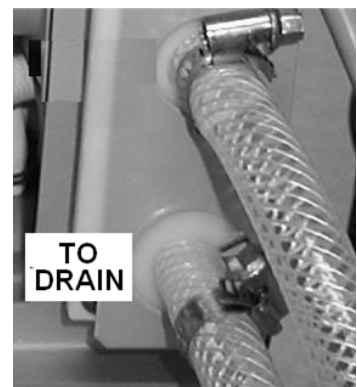


Figure 12 – Valve #30

F- 6.3.1 ISOLATE DRAIN VALVE #30

- Turn Dialysate Flow OFF (Flow on/off lamp blinks).
- Check through Valve #30's input **AND** output tubing for bio-growth restrictions.
- Figure right, at the rear of the machine, remove the tubing from the 'To Drain' (**BOTTOM!**) nozzle.
- Check inside the nozzle for restrictions!
- Per the Figure above, remove the tubing from Valve #30's INPUT nozzle.
- Attach a syringe, with tubing attached that will fit **SNUG** over Valve #30's nozzle.
- 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 NO resistance:** Valve #30 is open! See procedure number [F- 6.4.0](#) (page 60).
- 2) **IF the plunger OFFERS RESISTANCE:** Valve #30 is restricted! TWO (2) possible bad components: **1)** Bad Valve #30 OR; **2)** Bad Actuator-Test Board. To LOCATE the board refer to [Figure 4A](#) (page 9).

F- 6.4.0 VALVE #30 IS OPEN

- a) Reconnect valve #30's INPUT 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) Turn Dialysate Flow ON (Flow on/off lamp NOT blinking).
- e) From the Home screen, ENSURE [Dialysate Flow] is set to 800 ml/min!
- f) DO NOT turn flow off again to ENSURE measurement accuracy below!
- g) TWO (2) possible TMP window scenarios:

- 1) **IF (and ONLY if) the TMP window is NOT red:** See procedure number [F- 6.4.2](#) (page 60)
- 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 60).

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 one (1) minute. TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) LESS THAN 725 ml:** Proceed to **page 62**, procedure number [F- 7.0.0](#).
 - 2) **IF MORE THAN 725 ml:** Check the drain tubing and it's (if used) the 'Quick Connector' for possible bio-growth restrictions.

F- 6.5.0 TMP ALARM?

- a) From the Home screen, set [Dialysate Flow] to 500 ml/min and press CONFIRM!
- b) Allow thirty (30) seconds THEN TWO (2) possible TMP window scenarios:
 - 1) **IF the TMP window is NOT red:** See procedure number [F- 6.5.2](#) (page 61).
 - 2) **IF the window is RED (TMP alarm): RESET SEQUENCE: 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 the RESET SEQUENCE up to twice more BEFORE continuing to procedure number [F- 6.5.2](#) (page 61).

F- 6.5.2 ISOLATE TMP STABILITY

TMP is STABLE if its 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 61).
- 2) **IF TMP is STABLE:** A procedure, in a different Section, is performed next. **NOTE** this page and procedure number because you may be prompted to return to here. Perform parts A through C below:
 - A) BEFORE continuing to part b, proceed to **page 535**, 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' → 'CONFIRM'")!
 - C) Proceed to **page 62**, 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 be prompted to return to here.
- b) BEFORE continuing to part c, proceed to **page 527**, 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' → 'CONFIRM')!
- d) ENSURING Dialysate Flow is ON (Flow on/off lamp NOT blinking) call debug screen 6.
- e) 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 62**, procedure number [F- 7.0.0](#).
 - No **BC Switch NEVER, EVER** = 897 or more! If TMP remains unstable proceed to **page 440**, [SECTION 9- TMP PROBLEMS](#). If TMP is stable the flow problem is no longer presenting.

F- 7.0.0 ISOLATE POSSIBLE RESTRICTIONS

- a) **ENSURE** Dialysate Flow is ON (Dialysate Flow on/off lamp **NOT** blinking)!
- b) Recheck Loading Pressure (Rinse port gauge). It may not cycle but **MUST** reach a **PEAK** between 23 and 27 psi?

Yes Between 23 and 27 psi! See procedure number [F- 7.0.1](#) (page 62).

No Less than 23 **OR** more than 27 psi! Return to **page 27**, procedure number [F- 1.0.8](#).

F- 7.0.1 LOADING PRESSURE OKAY (1)

- A) Call debug screen 0. Watch **Flow Error** 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 63).
 - 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] = 17.0 mS**?

Yes **[Conductivity] = 17.0 mS!** See procedure number [F- 7.0.2](#) (page 63).

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’ → ‘CONFIRM’)!
- E) Allow [Conductivity] to increase to more than 13.0 **BEFORE** continuing!
- F) Set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- 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 63).
 - 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) **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!

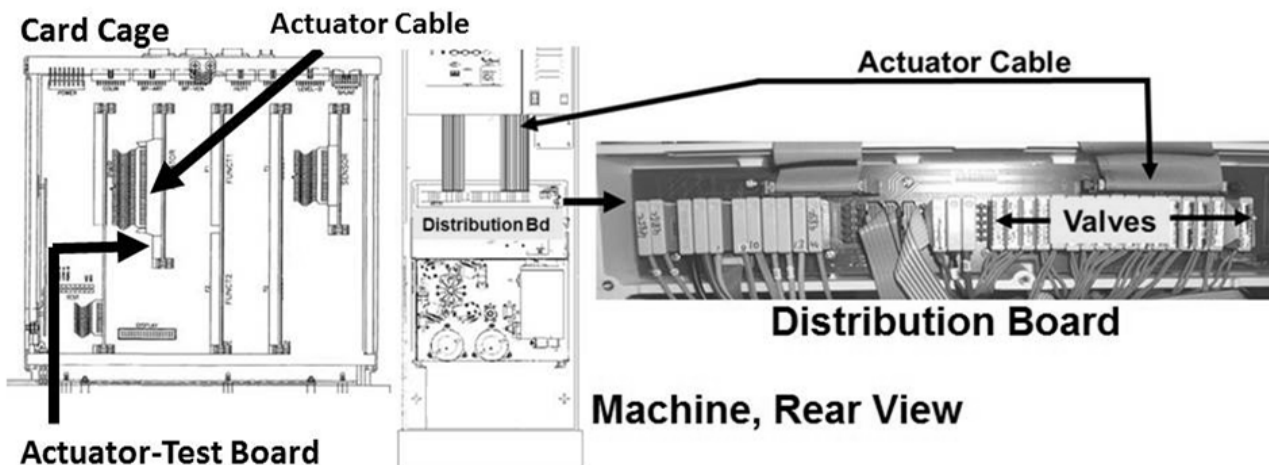
CHECK #2 ENSURE the Actuator Cable is plugged in securely at both ends!

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- 7.0.2.11](#) (page 63).

No problem found! Proceed to **page 64**, procedure number [F- 7.0.3](#).



F- 7.0.2.11 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' → 'CONFIRM')!

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

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 64).

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**.

* 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’ → ‘CONFIRM’)!

e) From the Home screen, set [Dialysate Flow] to 800 ml/min.

f) Call debug screen 0.

g) WITHOUT LOOKING AWAY, ensuring a “No Water” alarm NEVER occurs, 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 65) 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 acid 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 dialyzer connector up 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 dialyzer 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) Plug valve #37’s connector into valve #30’s distribution board position, “V30”.
 - b) Hold the dialyzer connector up and watch flow (if any) 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.
 - c) Measure flow, from the dialyzer connector, into the cylinder, for one (1) minute!
 - d) Return the connector to the shunt door.
 - e) Leaving valve #37 in valve #30’s position for now, analyze **BOTH** Part 1 **AND** Part 2’s measurements per **Table 3** below:

Table 2 – 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 71)
Less than 800 ml	More than 800 ml	See procedure number F- 7.3.33 (page 67)
More than 800 ml	Less than 800 ml	See procedure number F- 7.4.44 (page 69)
More than 800 ml	More than 800 ml	See procedure number F- 7.3.1 (page 75)

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

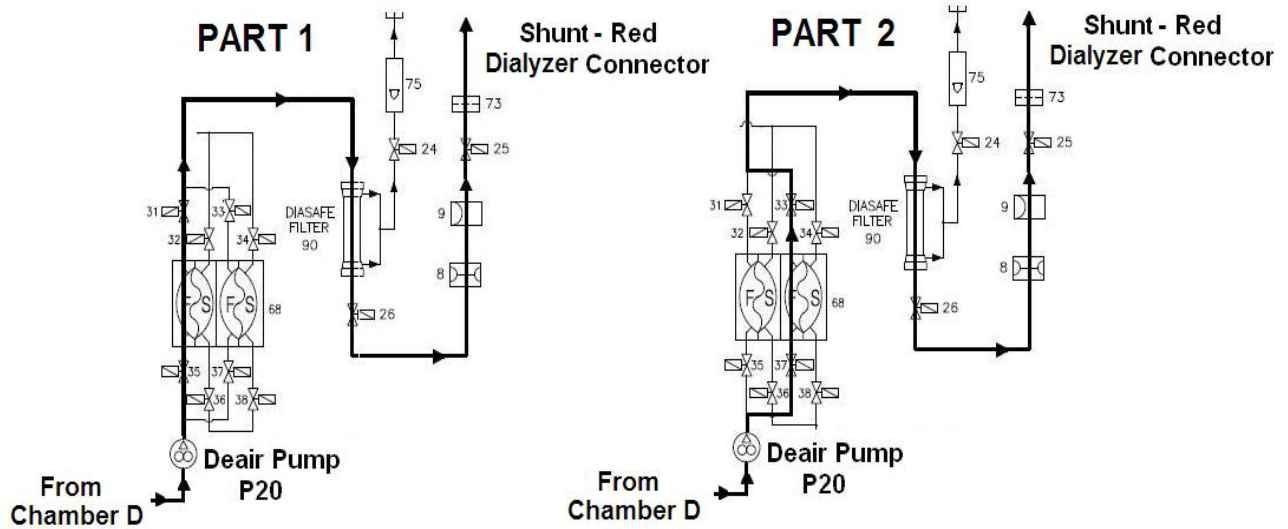


Figure 13 – Parts 1 and 2

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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.

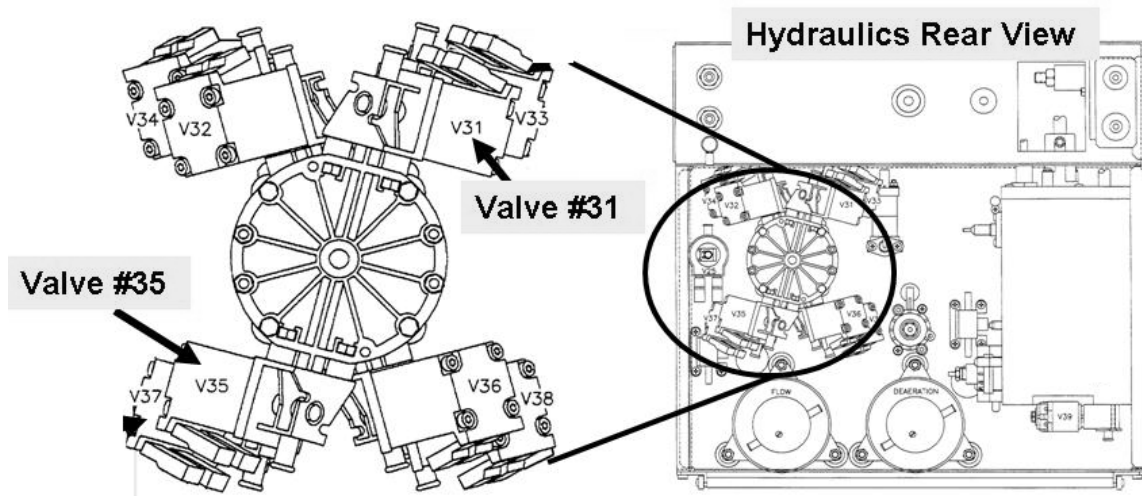


Figure 14 – Balancing Chamber Valves #31 and #35

- 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!



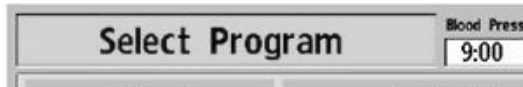
- F) With "Select Program" up, measure flow, from the RED connector, into the cylinder for one (1) minute. More than 800 ml collected?
 - Yes More than 800 ml collected! Problem located! The previous Valve #35 is bad.
 - No Less than 800 ml collected! See procedure number [F- 7.3.44](#) (page 67).

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:

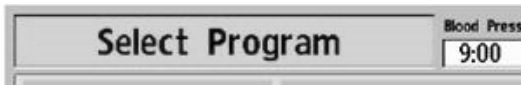
- a) Return all valves to their PROPER distribution board positions.
- b) THREE (3) possible bad components: **1)** Bad Actuator-Test board; **2)** Bad Actuator cable; **3)** Bad distribution board.

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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:

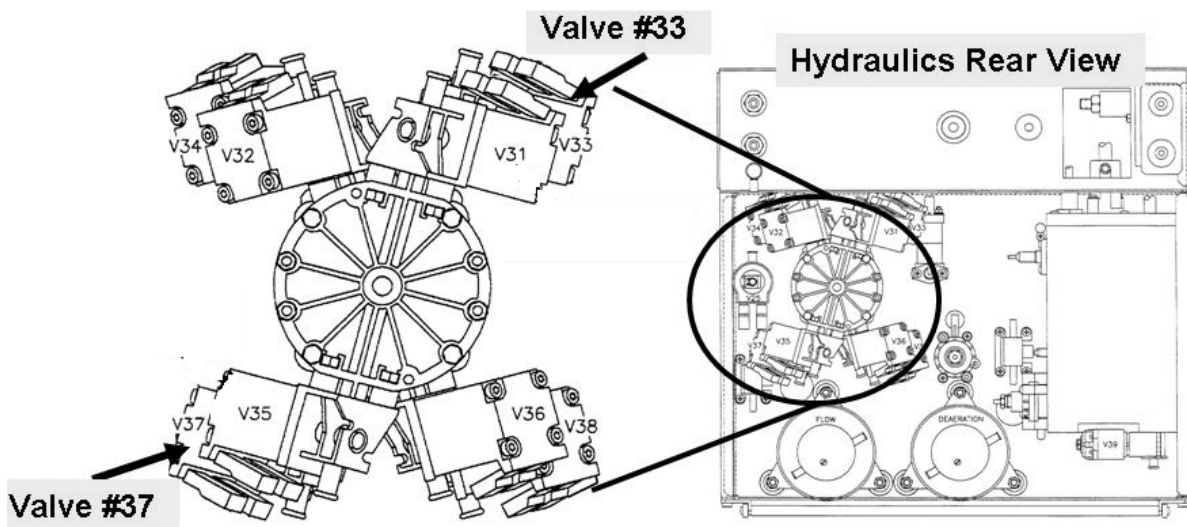
- A) Turn the machine OFF!
- B) **Per the Figure below**, replace **Valve #37** with a known good valve.
- C) Plug the new Valve #37's connector into Valve #30's distribution board position, "V30".
- D) Turn the machine on but **DO NOT** press any other keys!



- 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 69).

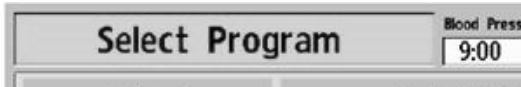


F- 7.4.45 LESS THAN 800 ML COLLECTED / ISOLATE VALVE #33

- 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 9)

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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:

TOUCH 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 72)
Cold	Does not matter	NOTE ONLY VALVE #26 will be checked and proceed to page 192 , TROUBLESHOOTING A VALVE
Does not matter	Cold	NOTE ONLY VALVE #25 will be checked and proceed to page 192 , TROUBLESHOOTING A VALVE

Figure 15 – Valve #26

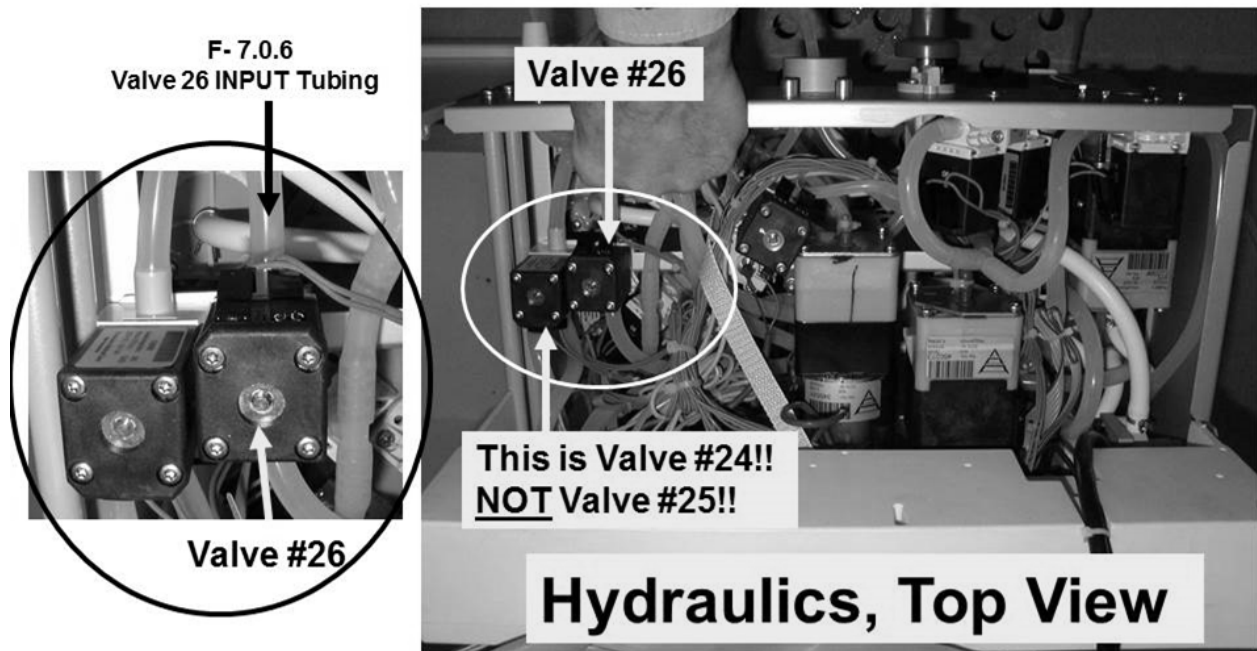
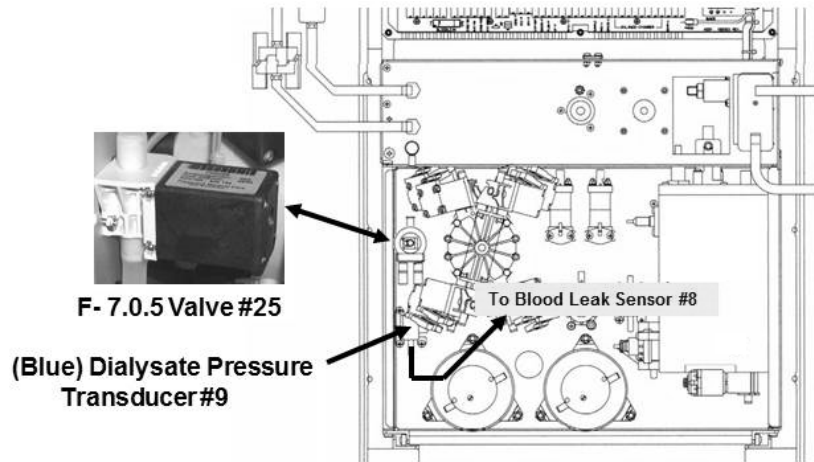


Figure 16 – Valve #25

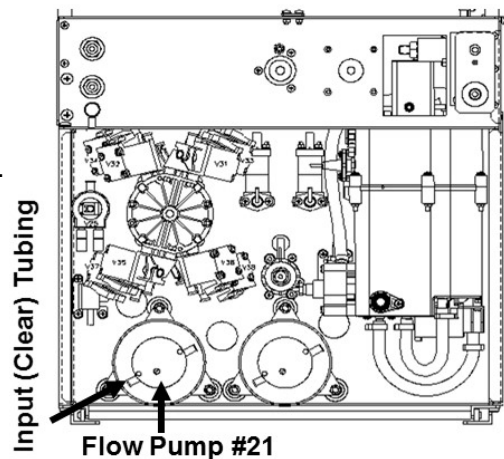


F- 7.0.6 ISOLATE VALVE #26 INPUT FLOW

- 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 72).
 - No Less than 800 ml! **A)** Clamp and reattach the tubing; **B)** Proceed to **page 74**, 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, then see procedure number **F- 7.0.8** (page 73).



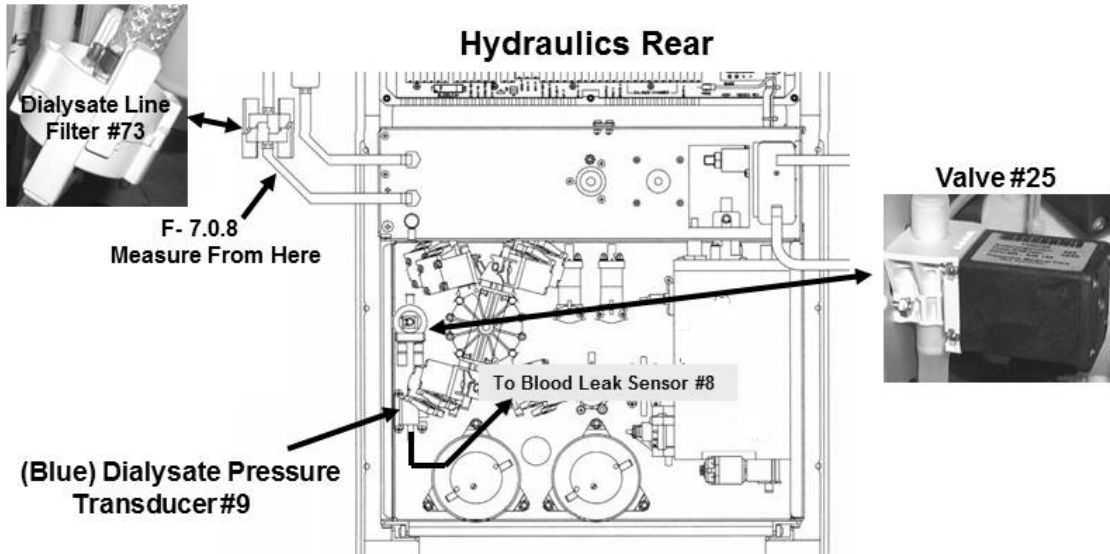
No Less than 800 ml! See parts a THROUGH c below:

- 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)** Actuator-Test* Board OR; **2)** Valve #26.

* To LOCATE the board refer to **Figure 4A** (page 9).

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?

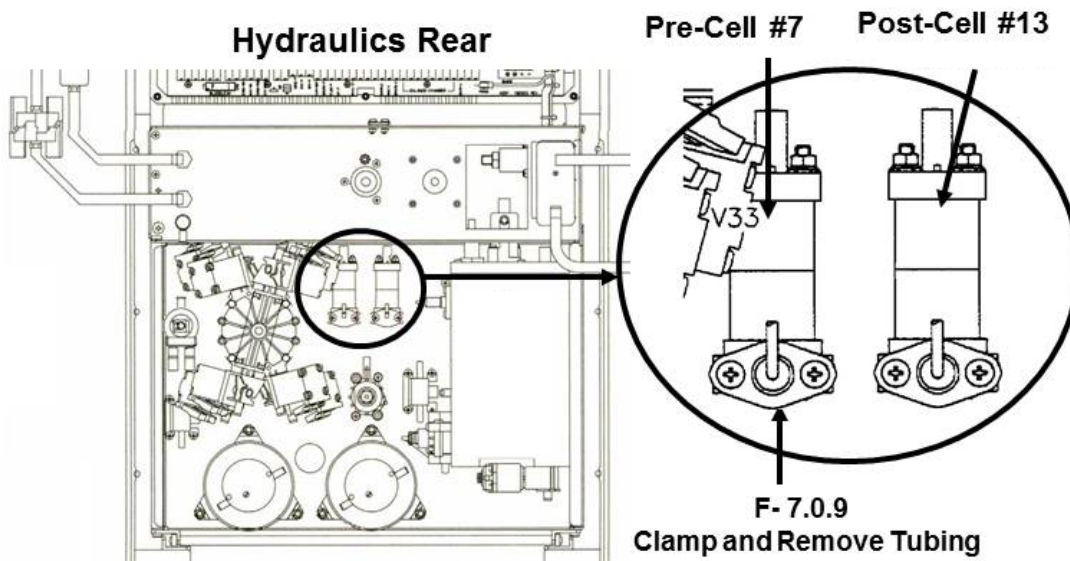
Yes 800 ml or more! **A)** Return valve #37 and #30 to their distribution board positions;
B) A restriction between Filter #73 and the red dialyzer connector is indicated.

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 74).

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 65**) but if (and ONLY if) you return here THREE (3) possible bad components: **1)** Bad Actuator-Test Board¹ OR; **2)** Bad Actuator-Test board cable OR; **3)** Multiple restricted balancing chamber valves² #31, #33, #35 and #37.

¹ To LOCATE the Actuator-Test board refer to [Figure 4A](#) (page 9)

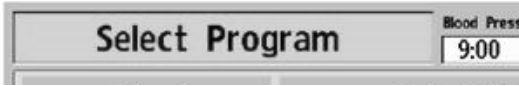
² To LOCATE valves #31, #33, #35 and #37 refer to [Figure 14](#) (page 68)

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.

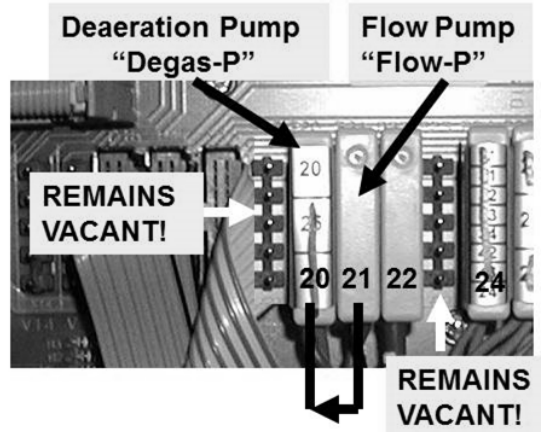
F- 7.3.1 ISOLATE FLOW PUMP ORIENTATION

- a) **Return valves #30 AND #37 to their proper distribution board positions.**
- b) "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 76).

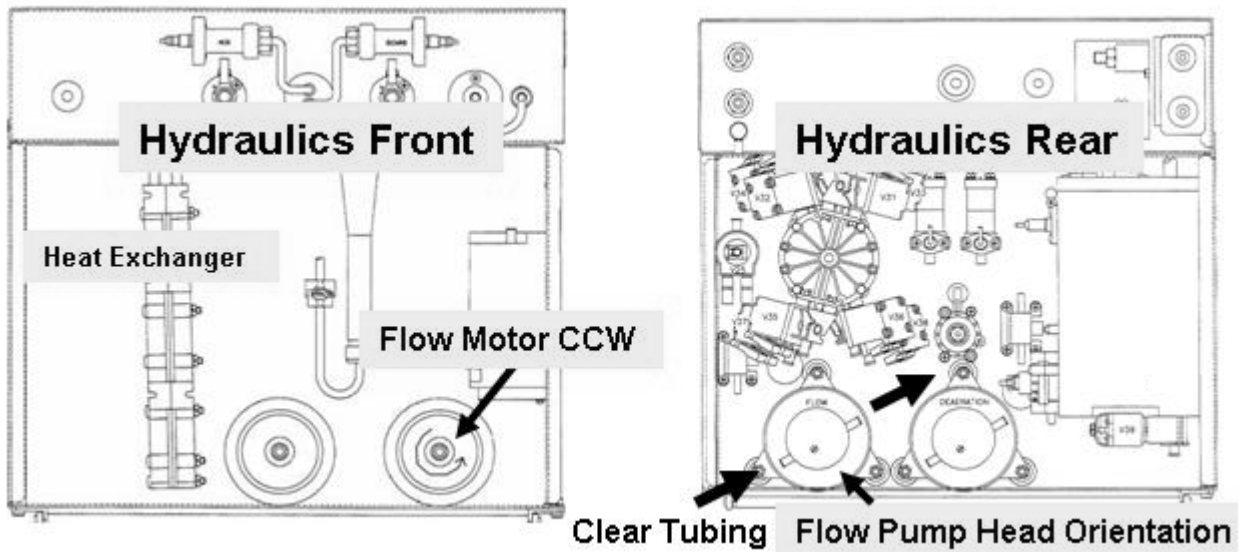
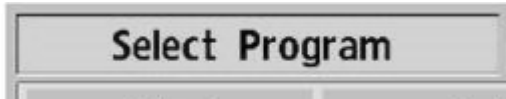
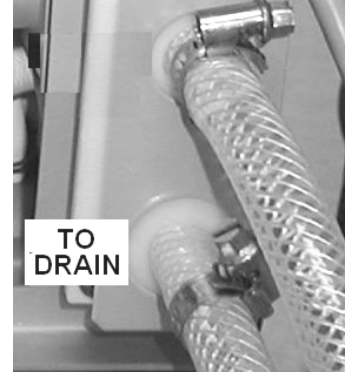


Figure 17 – Flow Pump

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 drain 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 3 – 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 78)
Less than 800 ml	More than 800 ml	See procedure number F- 7.6.10 (page 84)
More than 800 ml	Less than 800 ml	See procedure number F- 7.7.20 (page 86)
More than 800 ml	More than 800 ml	See procedure number F- 7.8.0 (page 88)

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.

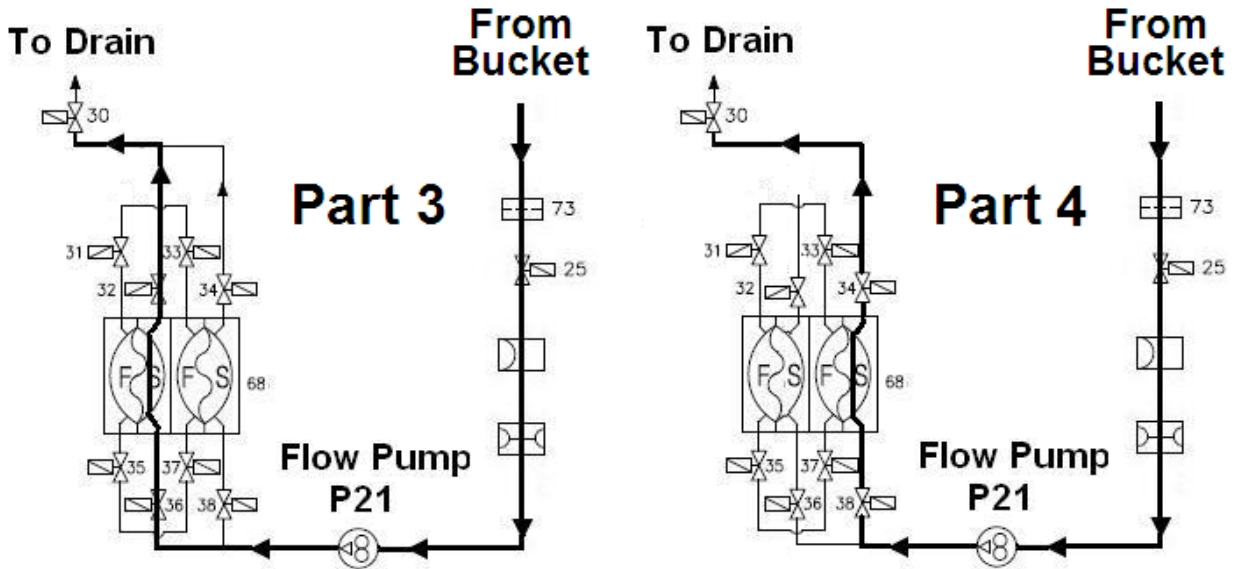


Figure 18 – Parts 3 and 4

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F- 7.4.0 VERIFY DRAIN FLOW

- a) The “Select Program” screen remains up till instructed otherwise!



- b) Was there ANY drain flow at all?

Yes There was some flow! Proceed to **page 79**, procedure number [F- 7.4.3](#)

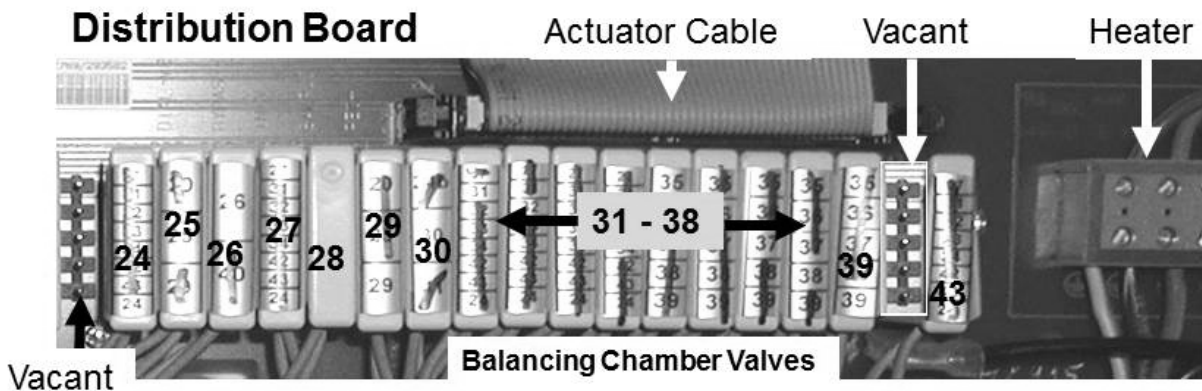
No There was no flow at all! See procedure number [F- 7.4.2](#) (page 78).

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 79).

No You located a valve plugged wrong! Return ALL VALVES to their distribution board PROPER positions and return to **page 76**, 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 79).

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 192**, [TROUBLESHOOTING A VALVE](#).

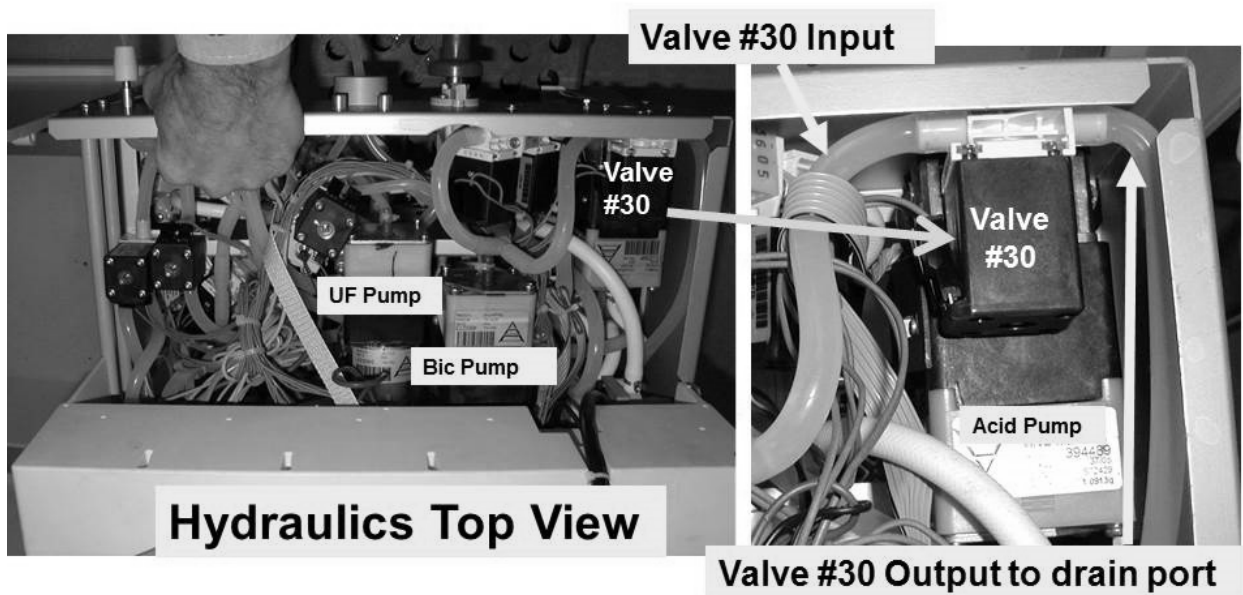


Figure 19 – Valve #30

F- 7.4.4 ISOLATE VALVE #30

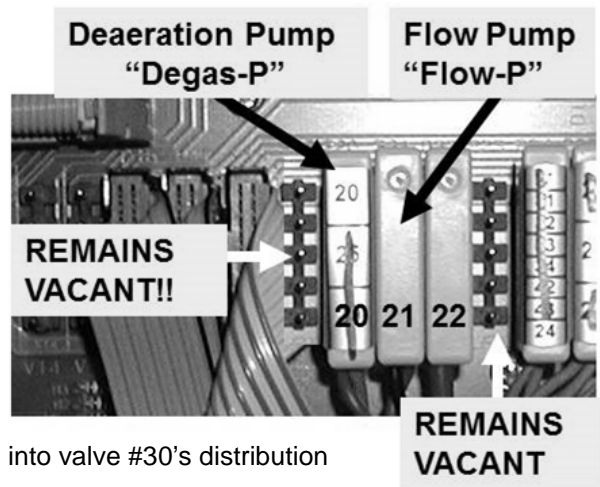
- a) Per the Figure above, check through valve #30's INPUT and OUTPUT tubing for bio-growth restrictions.
- b) Remove valve #30's INPUT tubing and attach a syringe, with tubing attached that will fit snug over the valve's nozzle.
- c) Push or pull on the syringe plunger. If valve #30 is open the plunger moves with no resistance. TWO (2) possible scenarios:
 - 1) **IF the plunger offers NO resistance i.e. valve #30 open:** See procedure number [F- 7.4.5](#) (page 80).
 - 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 9).

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?



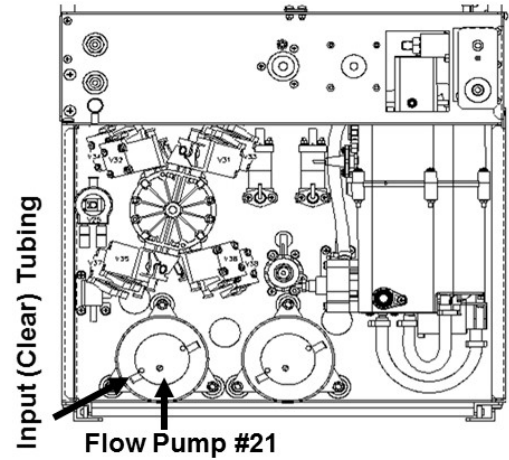
Yes 800 ml or more! See procedure number [F- 7.4.6](#) (page 81).

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 65**).

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. 800 ml or more collected?



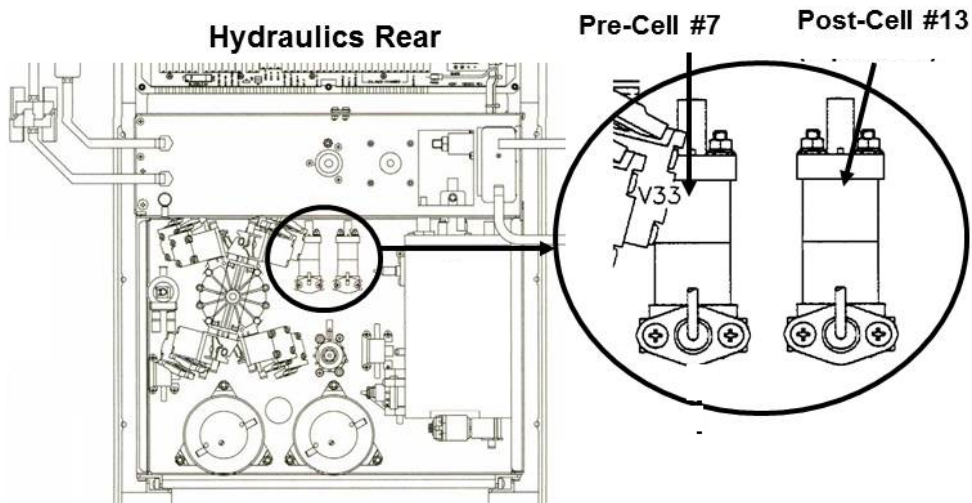
Yes 800 ml OR more! See procedure number [F- 7.4.6.1](#) (page 81).

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!

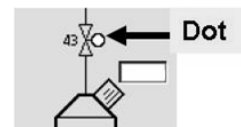
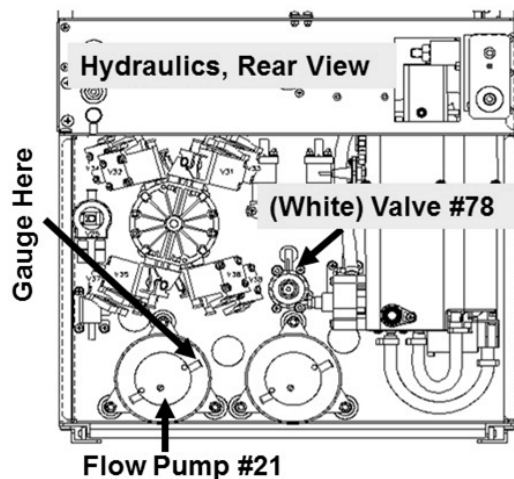


F- 7.4.6.1 800 ML OR MORE

- 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 82).

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) **Tie wrap both sides of the gauge tubing to prevent leaks and false readings!**
- 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 'Escape' 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 82).

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 93**, procedure number [F- 9.0.23](#).**
- 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- 7.5.2](#) (page 82).

F- 7.5.2 CHECK FLOW ERROR

- a) Plug into acid and bicarb.
- b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'!
- d) **OPEN THE SHUNT DOOR till instructed otherwise!**
- e) 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 = 897 or more (Yes or No)?

Yes

BC Switch goes to 897 or more, even if only once! **Read before performing!** Return to **page 26**, 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)** Actuator-Test Board¹ OR; **2)** Actuator cable OR; **3)** Multiple intermittent restricted balancing chamber valves #32, #34, #36 and #38².

¹ To LOCATE the Actuator-Test board refer to [Figure 4A](#) (page 9);

² To LOCATE these valves refer to [Figure 20](#) (page 84)

No **BC Switch** IS NEVER, EVER 897 or more. A Flow Error is not presenting at this time! It may be extremely intermittent. Return to **page 44**, procedure number [F- 3.8.0](#).

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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 84).

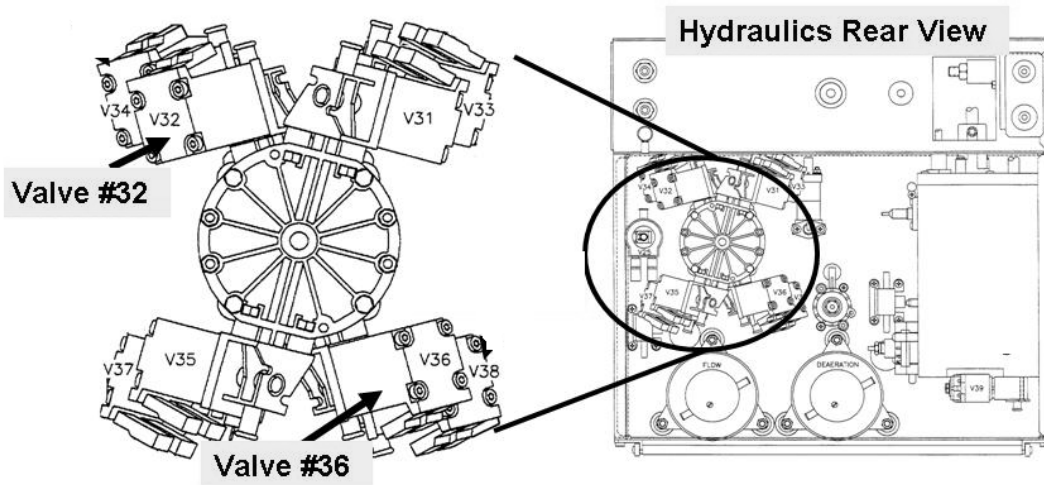


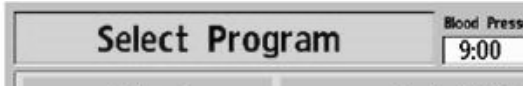
Figure 20 – Balancing Chamber Valves

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:

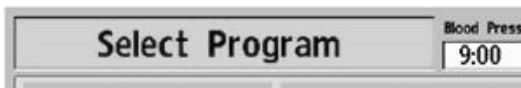
- a) Return all valves to their PROPER distribution board positions.
- b) THREE (3) possible bad components: **1)** Bad Actuator-Test board; **2)** Bad Actuator cable OR; **3)** Bad distribution board.

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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:

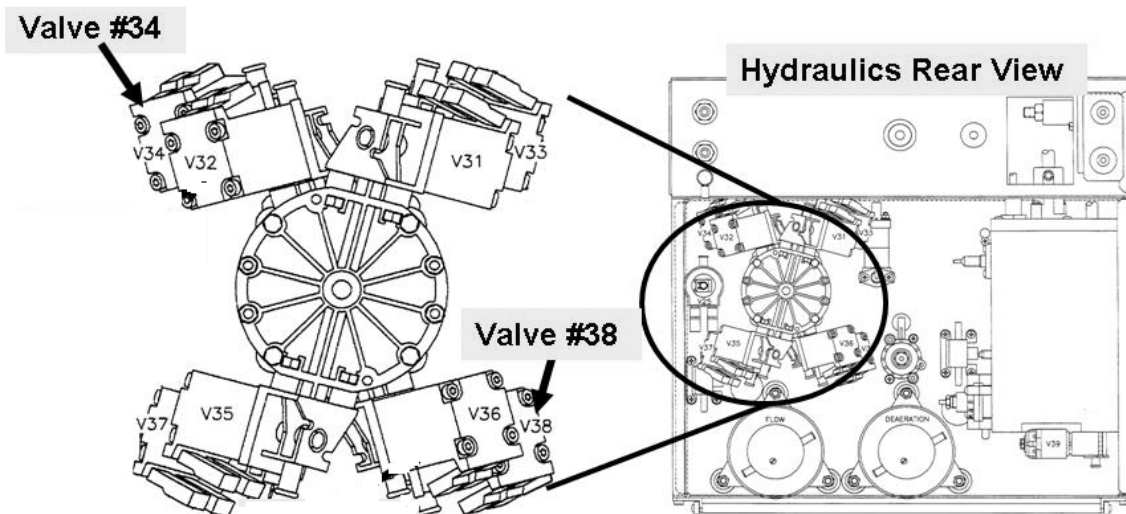
- a) Turn the machine OFF!
- b) The Flow Pump remains plugged into the Deaeration Pump's distribution board position!
- c) **Per the Figure below**, replace **Valve #38** with a known good!
- d) Plug the new valve #38's connector into valve #31's distribution board position, "V31".
- e) ENSURE the bucket 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 87).



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)** Actuator-Test board; **2)** Actuator cable; **3)** 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** then see procedure number [F- 7.8.1](#) (page 88).

F- 7.8.1 CONFIRM SYSTEMS

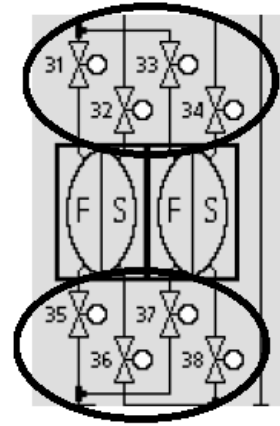
- a) Turn the machine ON but **DO NOT** press any keys yet!
- b) From “Select Program”, if the pumps are plugged in correctly, the Deaeration motor rotates but the Flow motor DOES NOT!
- c) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- d) **SLAM** the Loading Pressure gauge in the Acid/Acetate Rinse port! ENSURE PEAK pressure is between 23 and 27 psi.
- e) See procedure number [F- 7.8.2](#) (page 88).

F- 7.8.2 TROUBLESHOOT FLOW ERROR

- a) ENSURE Dialysate Flow is ON (Dialysate Flow lamp IS NOT blinking).
- b) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- 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 44**).
 - 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 30**).

F- 8.0.0 BC SWITCH = 897

- a) Turn Dialysate Flow OFF (Flow on/off lamp blinks)!
- b) Call debug screen 0. If Flow is OFF all eight (8) Balancing Chamber valve 'dots' REMAIN white (Figure right)!
- c) Call debug screen 4 to see **PDIA** (lower left column). TWO (2) possible scenarios:

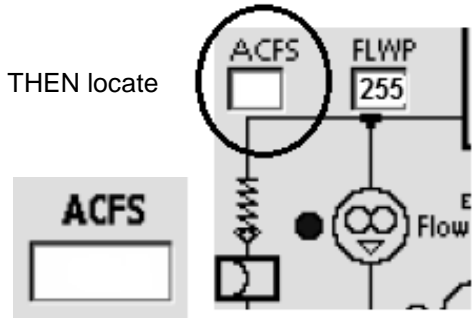


- 1) **IF (and ONLY if) PDIA is between 2.0 and 7.5:** See procedure number [F- 8.2.0](#) (page 90).
- 2) **IF PDIA is less than 2.0 OR more than 7.5:** See parts a THROUGH d below:
 - a) Press and release the 'Reset' key then press and hold it for three (3) seconds!
 - b) Allow thirty (30) seconds!
 - 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 90).
 - 2) **IF PDIA is less than 2.0 OR more than 7.5:** See parts a AND b below:
 - a) Turn Dialysate Flow ON (Dialysate Flow lamp STOPS blinking).
 - b) Return to (ABOVE) procedure number [F- 6.1.1](#) (**page 52**).

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F- 8.2.0 ANALYZE ACFS

- a) Call debug screen 0. Figure right, look at **ACFS** (Figure right) 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) Respond according to the Table's **COLUMN 3**, based on BOTH **ACFS** readings:



COLUMN 1 Screen 0's ACFS	COLUMN 2 Screen 10's ACFS	COLUMN 3 Your Response:
Between 3.0 and 6.0 (Good)	Between 4.0 and 5.8 (Good)	BOTH ACFS values are good! The CFS circuit is good! See procedure number F- 8.3.0 (page 91)
Between 3.0 and 6.0 (Good)	Less than 4.0 <u>OR</u> more than 5.8 (Bad)	Screen 0's ACFS is good; Screen 10's ACFS is bad THREE (3) possible bad components ¹ : 1) Sensor Board <u>OR</u> ; 2) Functional Board <u>OR</u> ; 3) Mother board connection between the Functional and Sensor Board
Less than 3.0 <u>OR</u> more than 6.0 (Bad)	Between 4.0 and 5.8 (Good)	Screen 0's ACFS is bad; Screen 10's ACFS is good THREE (3) possible bad components ² : 1) Actuator-Test Board <u>OR</u> ; 2) Bad Sensor Board <u>OR</u> ; 3) Motherboard connection between the Actuator-Test and Sensor Board
Less than 3.0 <u>OR</u> more than 6.0 (Bad)	Less than 4.0 <u>OR</u> more than 5.8 (Bad)	BOTH bad! Proceed to page 103 , procedure number F- 10.0.0

¹ Referring to OPERATING MODES (page **Error! Bookmark not defined.**), 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.

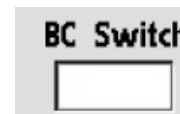
² Referring to OPERATING MODES (page **Error! Bookmark not defined.**), to prevent "Cond Offset Failure", place the machine into **T and C Mode THEN**, with the machine off, swap these components in, one at a time and in between, when screen 0's **ACFS** goes to between 3.0 and 6.0 the last component swapped in is the culprit.

F- 8.3.0 BOTH ACFS VALUES ARE GOOD

- a) Turn Dialysate Flow ON (Flow on/off lamp NOT blinking).
- b) From the home screen, select the [Dialysate Flow] window.
- c) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- d) Allow one (1) minute BEFORE continuing to part e.
- e) Call debug screen 10 to watch **ACFS** for one (1) minute. FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:
 - 1) **IF (and ONLY 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 91).
 - 2) **IF (and ONLY if) ACFS REMAINS ALWAYS between 0 and 3.0:** Proceed to **page 104**, procedure number [F- 11.0.0](#).
 - 3) **IF (and ONLY if) ACFS REMAINS ALWAYS between 3.0 and 5.8:** Proceed to **page 92**, procedure number [F- 9.0.0](#).
 - 4) **IF ACFS REMAINS ALWAYS more than 5.8:** Proceed to **page 104**, 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) minutes. If it EVER becomes more than 400 OR less than 203, even if only once, indicates a Flow Problem?

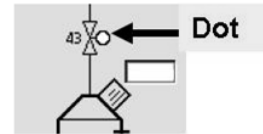


- Yes **BC Switch** becomes more than 400 OR less than 203. Return to (ABOVE) procedure number [F- 2.0.0](#) (**page 30**).
- No **BC Switch** IS NEVER more than 400 OR less than 203. A flow problem is not presenting at this time.

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) **Tie wrap both sides of the gauge tubing to prevent leaks and false readings!**
- e) **Place the machine in RINSE!**
- f) ENSURING a "No Water" NEVER appears, call debug screen 0. If debug does not appear press 'Escape' 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?

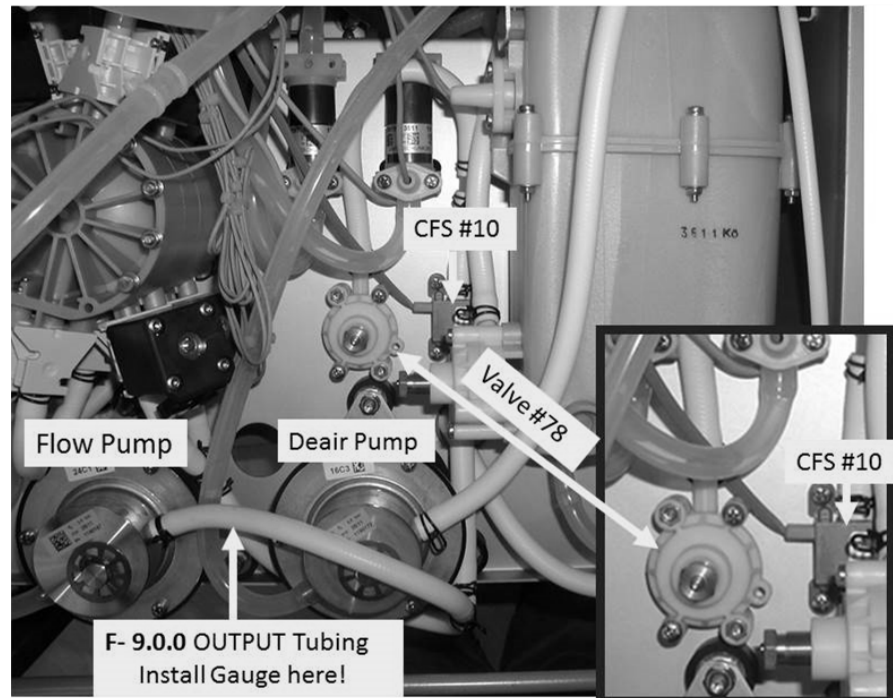


Yes Between 35 and 36 psi! Proceed to **page 101**, procedure number [F- 9.0.5](#).

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 **page 93**, procedure number [F- 9.0.23](#).
- 2) **IF pressure is too high:** **A)** Per the Figure below, adjust Valve #78 until pressure cycles to between 35 and 36 psi THEN; **B)** Proceed to **page 101**, procedure number [F- 9.0.5](#).

**Figure 21 –
Hydraulics, Rear View**



F- 9.0.23 LOW FLOW PUMP PRESSURE / ISOLATE VALVE #43

- a) Still in RINSE, per **Figure 22 (below)**, DOUBLE CLAMP Valve #43's OUTPUT tubing! **NOTE:** Valve #43's output tubing extends towards the front of the machine!

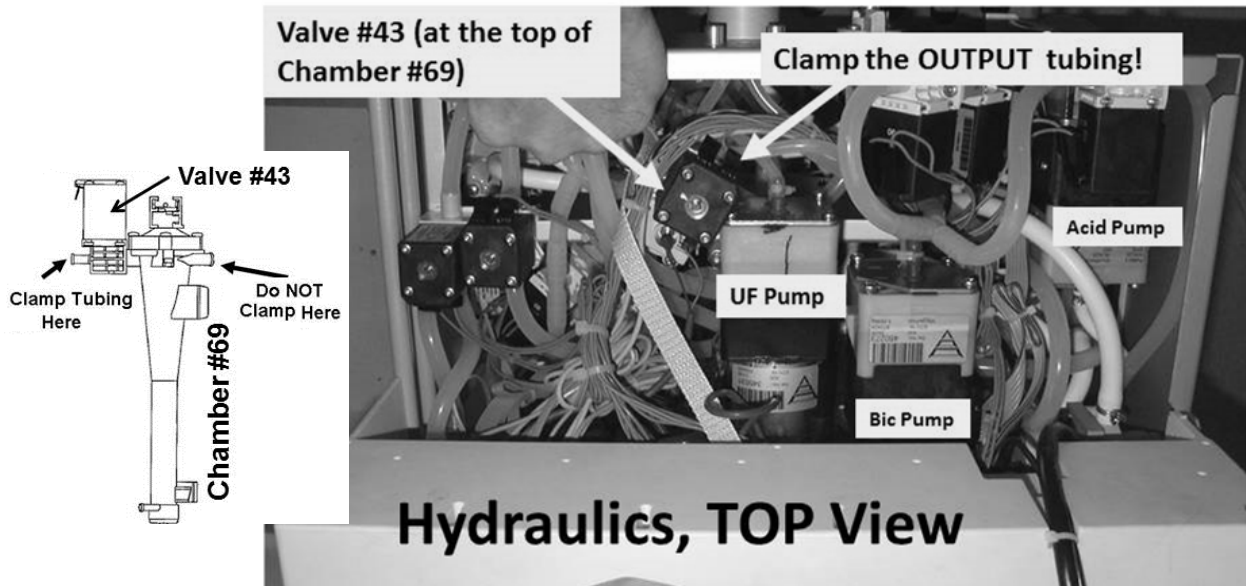


Figure 22 - Isolate Valve #43

- b) Does gauge pressure NOW CYCLE to more than 35 psi about every three (3) seconds (Yes or No)?

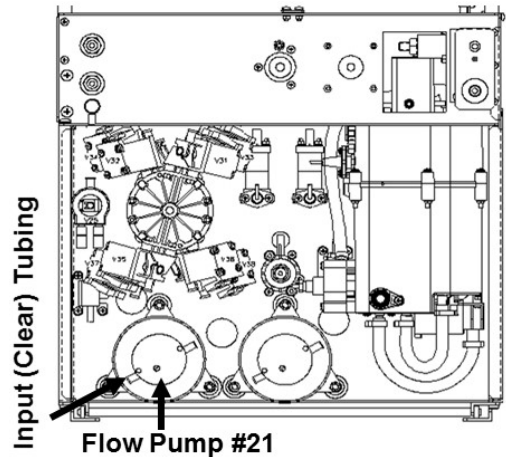
Yes ↑ More than 35 psi! This may indicate Valve #43 is sticking open. **A)** Release the clamps; **B)** Allow Valve #43's 'dot' to turn blue then white again; **C)** While white, if pressure again does NOT cycle to more than 35 psi then TWO (2) possible bad components: **1)** Bad Actuator-Test Board¹ OR; **2)** Bad Valve #43. ¹To LOCATE the board refer to **Figure 4A** (page 9).

No ↓ Less than 35 psi! Leaving the clamps in place, see procedure number **F- 9.0.24** (page 94).

LEFT BLANK INTENTIONALLY

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 'CONFIRM' 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 CONFIRM 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 94).
- 2) **IF LESS THAN 800 ml collected!** Proceed to **page 97**, procedure number [F- 9.0.4](#).

F- 9.0.25 INPUT FLOW PUMP MORE THAN 800 ML

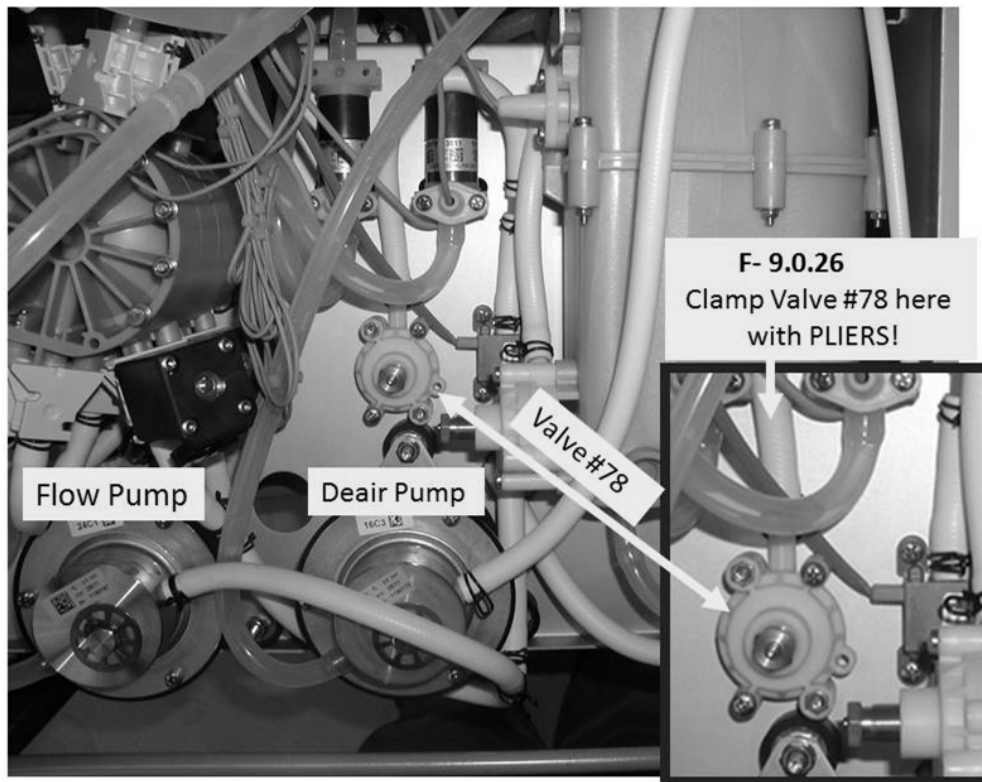
- a) **Remove the clamps from Valve #43!**
- b) As noted above, was pressure between 35 and 36 psi?
 - Yes Between 35 and 36 psi! Good static pressure but NOT dynamic! TWO (2) possible bad components: **1)** Flow Pump head OR; **2)** Flow Pump motor (possibly brushes).
 - No Less than 35 psi! See procedure number [F- 9.0.26](#) (page 95).

F- 9.0.26 BAD FLOW PUMP PRESSURE

- a) Return to Calibrate Hydraulics → Flow Pressure.
- b) Press 'CONFIRM' 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**, 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 96).

No Less than 40 psi! TWO (2) possible bad components: **1) Flow Pump head OR; 2) Flow Pump motor (possibly brushes).**



F- 9.0.27 40 PSI OR MORE / ISOLATE VALVE #78

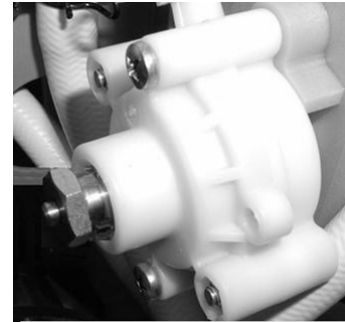
- a) **Turn the machine OFF!**
- b) Replace Valve #78* with a known good! *To LOCATE Valve #78 refer to the Figure previous page.
- c) Enter Service Mode → Calibrate Hydraulics → Flow Pressure.
- d) Press 'CONFIRM' THEN ENSURE the FLOW MOTOR shaft is rotating!
- e) Can you adjust the new Valve #78's 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).

↑

↓

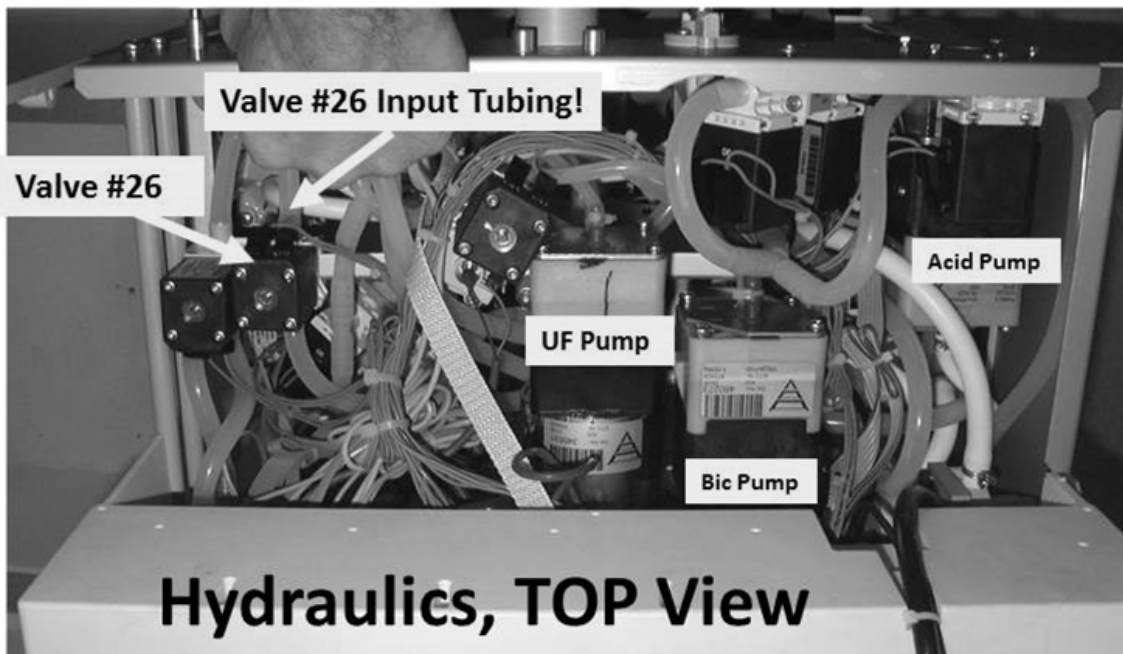
No CANNOT adjust to between 35 and 36 psi! TWO (2) possible bad components: **1)** Bad Flow Pump head OR; **2)** Bad Flow Pump motor (possibly brushes).



LEFT BLANK INTENTIONALLY

F- 9.0.4 INPUT FLOW PUMP FLOW LESS THAN 800 ML / ISOLATE V26 INPUT FLOW

- a) **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!



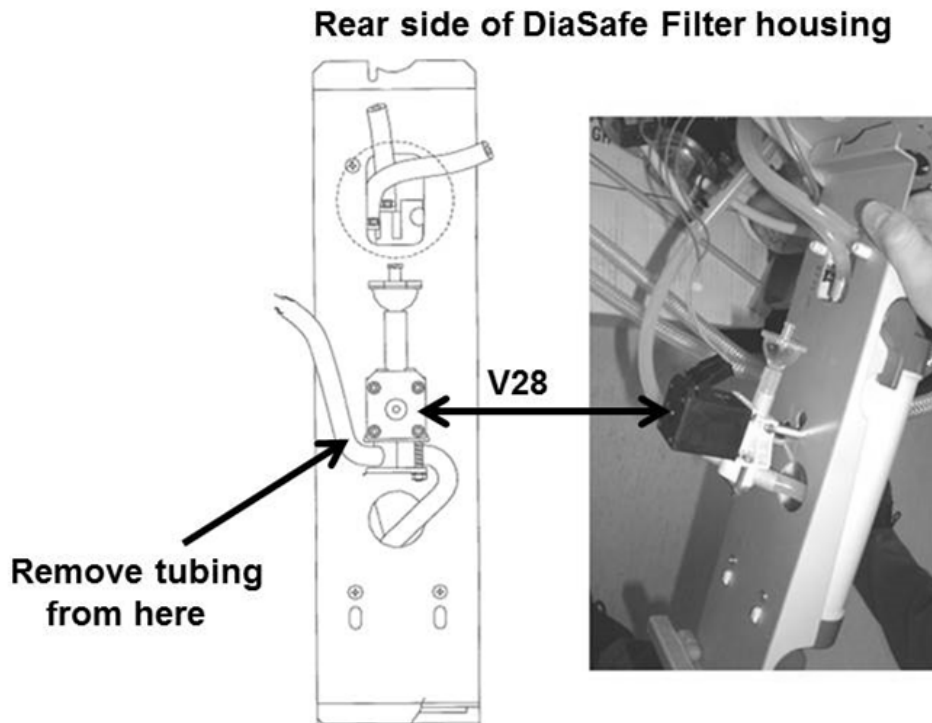
- d) Return to Calibrate Hydraulics → Flow Pressure.
- e) Press 'CONFIRM' then ENSURE the Flow Motor is rotating!
- f) Direct Valve #26's tubing into the graduated cylinder for one (1) minute.
- g) Press 'CONFIRM' to return to "Calibrate Hydraulics"!
- h) Reattach Valve #26's tubing.
- i) MORE than 800 ml collected?

Yes MORE than 800 ml! Proceed to **page 99**, procedure number [F- 9.0.42](#).

No Less than 800 ml! See procedure number [F- 9.0.41](#) (page 98).

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 'CONFIRM' then ENSURE the Flow Motor is rotating!
- f) Direct the tubing into the graduated cylinder for one (1) minute.
- g) Press 'CONFIRM' 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 a 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' → 'CONFIRM').
 - c) Proceed to **page 62** procedure number F- 7.0.0

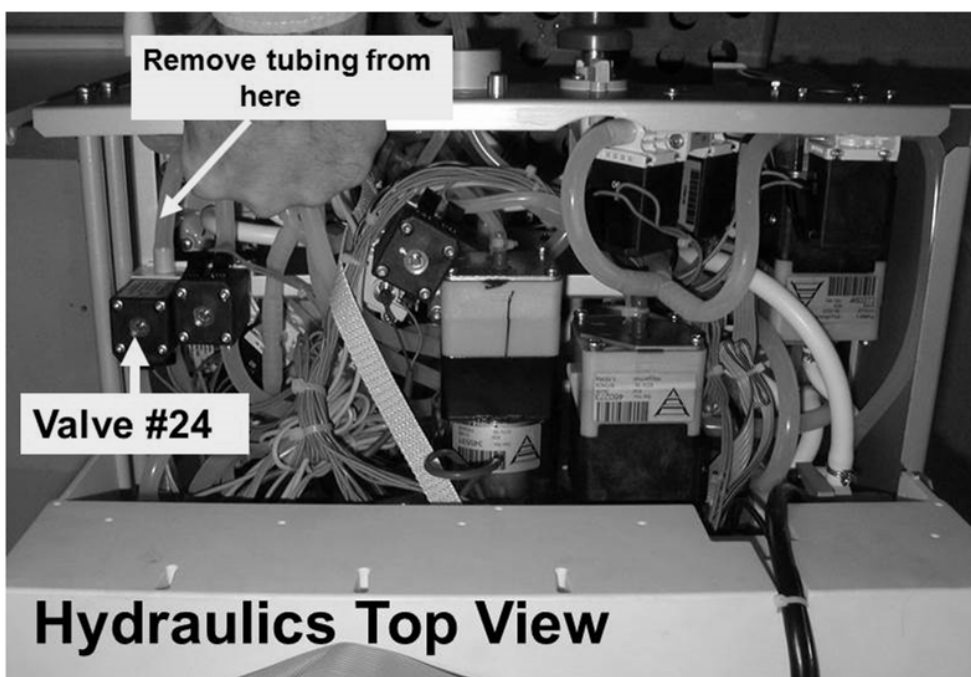
F- 9.0.42 MORE THAN 800 ML INPUT FLOW TO VALVE #26 / ISOLATE VALVE #24

- a) Return to Calibrate Hydraulics → Flow Pressure.
- b) Press 'CONFIRM' then ENSURE the Flow Motor is rotating!
- c) Remove the BLUE dialyzer connector from the shunt door.
- d) Measure flow from the dialyzer connector for one (1) minute!
- e) Press 'CONFIRM' 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 100).

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) Press 'CONFIRM' THEN ENSURE the Flow Motor is rotating.
- e) Measure from the tubing for one (1) minute.
- f) Press 'CONFIRM' 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 192, [TROUBLESHOOTING A VALVE](#)**.

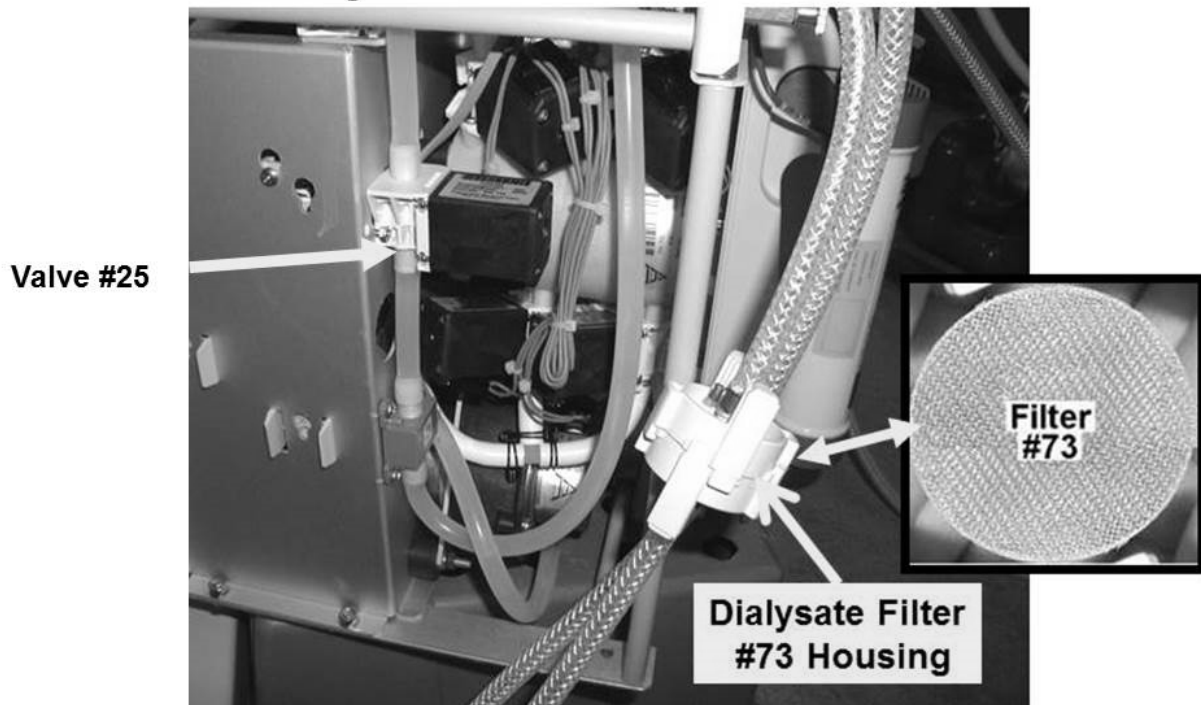
No TWO (2) possibilities: **1)** Bad (restricted) DiaSafe® filter OR **2)** Tubing restriction between the balancing chambers and Valve #24.

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's housing and ENSURE the filter is clean!

Hydraulics Side View



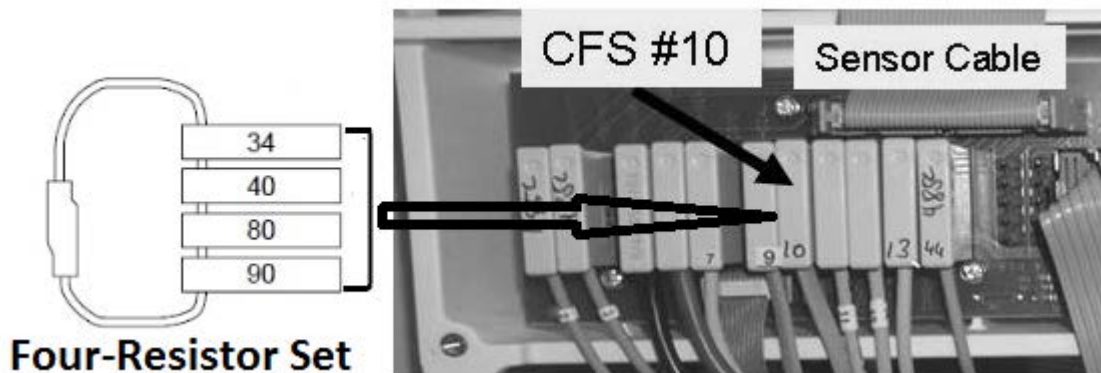
- c) Figure above touch Valve #25's black solenoid. Is it warm?

Yes Solenoid warm! TWO (2) possible bad components: 1) Bad Actuator-Test Board¹; 2) Bad Valve #25. ¹ To LOCATE the board refer to [Figure 4A](#) (page 9).

No Solenoid is not warm! **NOTE ONLY VALVE #25** will be checked and proceed to **page 192, [TROUBLESHOOTING A VALVE](#)**

F- 9.0.5 GOOD FLOW PUMP PRESSURE / ISOLATE CFS CIRCUIT

- a) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- b) From the Home screen, set [Dialysate Flow] to 500 ml/min and press ‘CONFIRM’.
- 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. **ACFS** should = 0.0?

Yes **ACFS** = 0.0! See procedure number F- 9.0.6 (page 102).

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 101) from part c.
- b) Leaving the resistor plug installed for now, FOUR (4) possible bad components:
1) Actuator-Test Board¹ OR; 2) Sensor Board² OR 3) Sensor Board cable³ 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’ → ‘CONFIRM’); **C)** If **ACFS** = 0.0 the previous Actuator-Test Board is bad.

^aTo LOCATE the board refer to Figure 4A (page 9)

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 **Error! Bookmark not defined.**); **C) IMPORTANT!** Return to Dialysis Program. If **ACFS** = 0.0 the previous Sensor Board is bad.

^bTo LOCATE the board refer to Figure 4A (page 9)

³ The Sensor Board cable can be checked. **NOTE** three (3) **CFS TRANSDUCER** connections will be checked and proceed to **page 524**, 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 to **500 ml/min**.
- c) Is the TMP window RED?

Yes Red TMP window! **RESET SEQUENCE: 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 the RESET SEQUENCE up to twice more BEFORE continuing to procedure number F- 9.0.7 (page 102).

No TMP window is pale yellow/white! See procedure number F- 9.0.7 (page 102).

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 102).
- 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 then perform parts A and B below:
 - A) BEFORE continuing to part B, proceed to **page 527**, [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 102).

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) because you may prompted to return to here:

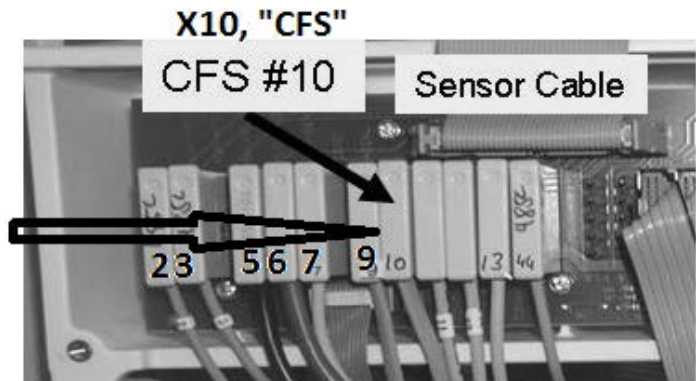
- a) BEFORE continuing to part b, proceed to **page 535**, to perform [SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM](#).
- b) If a leaking diaphragm is not located in part a, return to Dialysis Program ("Select Program" → 'Dialysis' 'CONFIRM')!
- c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- 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 92); ^bTo LOCATE the Sensor board see [Figure 4A](#) (page 9).

^c To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to [OPERATING MODES](#) page **Error! Bookmark not defined.**)).

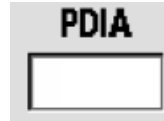
F- 10.0.0 BAD ACFS SIGNAL

- 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 103).

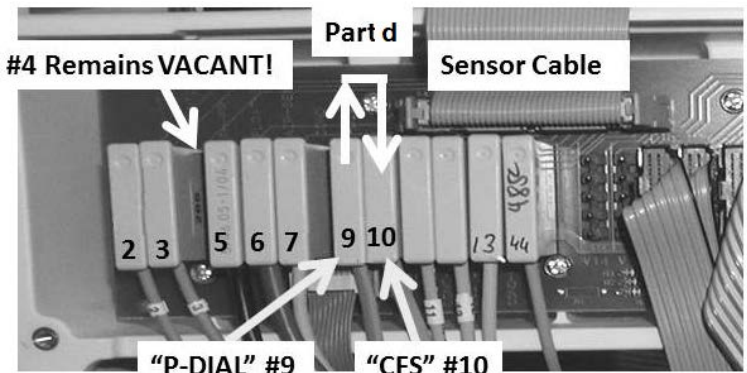


F- 10.1.0 CFS PLUGGED IN PROPERLY

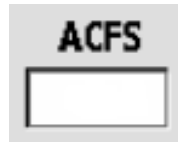
- a) Call debug screen 10. If all procedures were performed correctly **PDIA** (middle column) = between 3.5 and 6.5.
- b) Unplug the CFS's connector from distribution board position X10, "CFS".
- c) Using a flashlight, check inside the vacant "X10" position. **If corrosion or damaged pins are located 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) **ACFS** (lower right) should 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 92).
- No **ACFS** is less than 4.0 OR more than 6.0! Leaving PDIA in CFS for now, FIVE (5) possible bad components: **1)** Actuator-Test Board^a OR; **2)** Sensor Board^b OR; **3)** Sensor Board cable OR; **4)** Distribution board OR; **5)** Motherboard.

^a **A)** With the power off, swap in a known good Actuator-Test¹ Board. **B) IMPORTANT!** Return Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM'). **C)** If **ACFS** is now between 4.0 and 6.0 the previous Actuator-Test Board is bad.

¹ To LOCATE the board refer to Figure 4A (page 9).

^b **A)** With the power off, swap in a known good Sensor Board²; **B)** Place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**); **C)** **IMPORTANT!** Return to Dialysis Program!; **D)** If **ACFS** is now = between 4.0 and 6.0 the previous Sensor Board is bad.

² To LOCATE the Sensor board see Figure 4A (page 9).

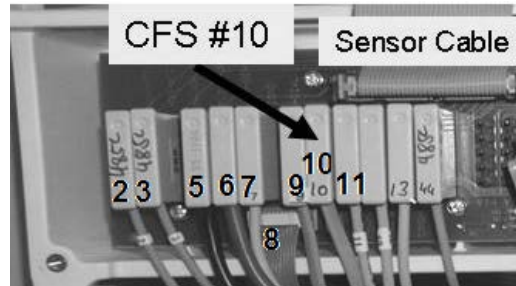
F- 11.0.0 ACFS = BETWEEN 0 AND 3.0

- a) Turn Dialysate Flow OFF (Flow on/off lamp blinks)!
- b) 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 c.
- c) 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 104).

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 104).

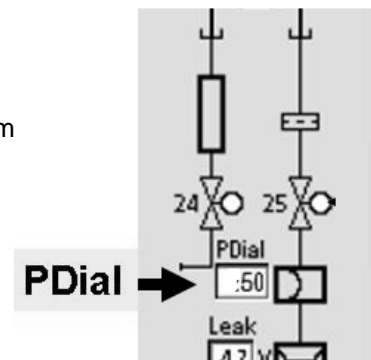
No **ACFS DOES NOT** = 9.0 or more! Leaving the CFS transducer unplugged for now, FOUR (4) possible bad components: **1)** Actuator-Test Board^a OR; **2)** Sensor Board^b OR; **3)** Sensor Board cable OR; **4)** Distribution board.

^a **A)** With the power off, swap in a known good Actuator-Test Board* (*to LOCATE the board refer to Figure 4A, page 9); **B)** Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM'); **C)** Allow up to five (5) minutes; **D)** If **ACFS** goes to 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 the board refer to Figure 4A, page 9); **B)** Place the machine into **T and C Mode** (refer to OPERATING MODES (page Error! Bookmark not defined.)); **C)** Return to Dialysis Program; **D)** Allow up to five (5) minutes; **E)** If **ACFS** goes to more than 9.0 the previous Sensor Board is bad.

F- 11.0.4 CHECK DIALYSATE PRESSURE

- a) Leaving Dialysate Flow OFF, remove both DIALYZER connectors from the shunt and hold them at the level of the shunt door.
- b) **Close the shunt door!**
- c) Call debug screen 0. Is the **PDial** window (Figure right) between -50 and +50?



Yes **PDial = 0 +/- 50! A)** Return the dialyzer connectors to the shunt and close the door!
B) See procedure number F- 11.0.5 (page 105).

No **PDial is NOT = 0 +/- 50! A) IMPORTANT!** Turn Dialysate flow ON (Flow on/off lamp NOT blinking); **B)** Proceed to **page 107**, procedure number **F- 12.0.0**.

F- 11.0.5 TMP ALARM?

- a) Turn Dialysate Flow ON (Dialysate Flow on/off lamp STOPS blinking).
- b) Call the Home screen.
- c) Set [Dialysate Flow] to **500 ml/min** and press 'CONFIRM'!
- d) Is the TMP window RED (TMP alarm)?

Yes TMP window IS RED! **RESET SEQUENCE: 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 perform the RESET SEQUENCE up to twice more BEFORE continuing to procedure number [F- 11.0.6](#) (page 105).

No TMP window is white! See procedure number [F- 11.0.6](#) (page 105).

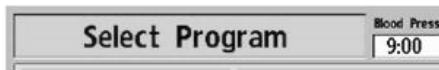
F- 11.0.6 ISOLATE FOR A LEAKING BALANCING CHAMBER VALVE

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 106).
- 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 527** 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 106). [F1106](#)

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!**
- 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 \(page 71\)](#).

2) **IF 800 ml or more collected:** See parts a THROUGH d below:

- a) Turn the machine OFF!
- b) Return valves #37 and #30 to their distribution board positions.
- c) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- d) Call debug screen 0. Watch **Flow Error** for six (6) minutes OR until it EVER = 1! TWO (2) possible scenarios:

1) **IF Flow Error EVER = 1:** TWO (2) possible bad components: **1)** DiaSafe® filter OR; **2)** transducer #10*. *To LOCATE the CFS transducer refer to [Figure 21](#) (page 92).

2) **IF Flow Error ALWAYS = 0.** The flow error is not occurring at this time!

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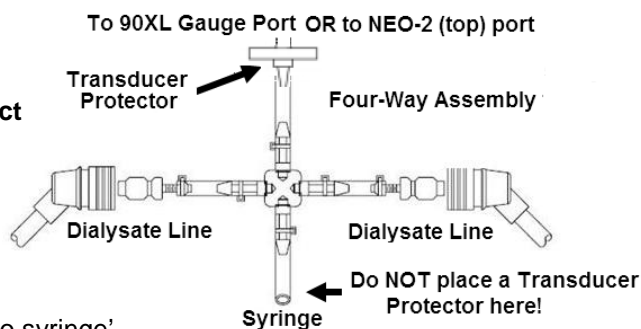
F- 12.0.0 CALIBRATE/TROUBLESHOOT DIALYSATE PRESSURE

This is NOT a routine calibration! Follow the instructions exactly to avoid error!

a) **Open the shunt door!**

b) Enter Service Mode → Calibrate Sensors → Dialysate Pressure. The screen says “**1. Connect a pressure gauge in line...**”.

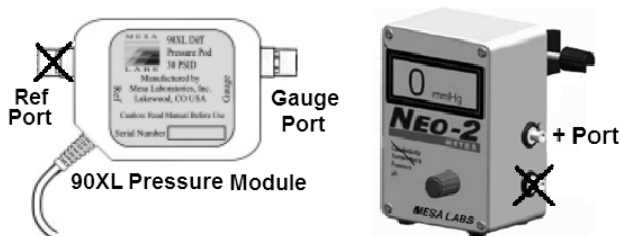
c) Figure right, connect the Four-Way Assembly (P/N 150034) to the dialyzer connectors.



d) ENSURE a transducer protector IS NOT in the ‘to syringe’ tubing segment!

e) Place the Four-Way at dialyzer level!

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 in the Four-Way’s tubing segments!

h) Clamp the ‘to meter’ tubing segment.

i) **CLOSE the shunt door** and ENSURE the external flow indicator’s ‘bob’ is moving up and down!

j) Press ‘CONFIRM’. The screen says “**3. Press [Dialysate Flow on/off] key...**”

k) Press the Dialysate Flow on/off key. The Dialysate Flow lamp blinks.

l) ENSURE the external flow indicator is NOT moving!

m) **Remove the clamp in the ‘to meter’ tubing segment!**

n) Using the syringe, adjust pressure until the external meter = between -2 and +2 mmHg.

o) Press ‘CONFIRM’ then see procedure number [F- 12.1.0](#) (page 107).

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 external meter?

Yes -250 achieved! Clamp the ‘to syringe’ tubing to hold this pressure then see procedure number [F- 12.2.0](#) (page 108).

No -250 CANNOT be achieved! ENSURE the transducer protector, at the meter, is NOT wet OR consider replacing it! If OKAY, proceed to **page 109**, 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 108).

No Pressure DOES NOT hold! Proceed to **page 109**, 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 'CONFIRM' 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 110**).

2) **IF "Operator Error" did NOT occur:** See parts a THROUGH e below:

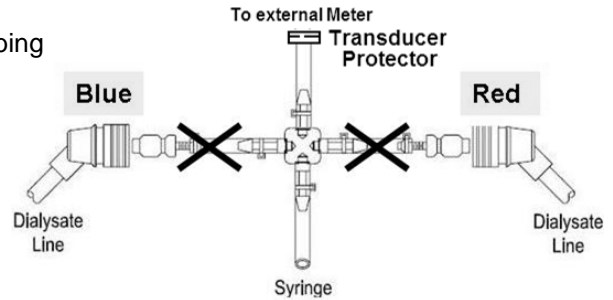
- a) Turn the machine OFF!
- b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- c) From the Home screen, set [Dialysate Flow] to 500 ml/min.
- d) **IMPORTANT!** Allow five (5) minutes BEFORE continuing to part e
- e) Return to **page 105**, procedure number [F- 11.0.5](#).

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F- 12.3.0 EITHER -250 MMHG COULD 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 (1) minute now?



Yes -250 can be achieved AND it held! See procedure number [F- 12.3.2](#) (page 109).

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 107**).

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' → 'CONFIRM')!

d) **IMPORTANT!** Turn Dialysate Flow OFF (Flow on/off lamp blinks).

e) Proceed to **page 466**, procedure number [TMP- 4.0.0](#) to locate a hydraulic leak.

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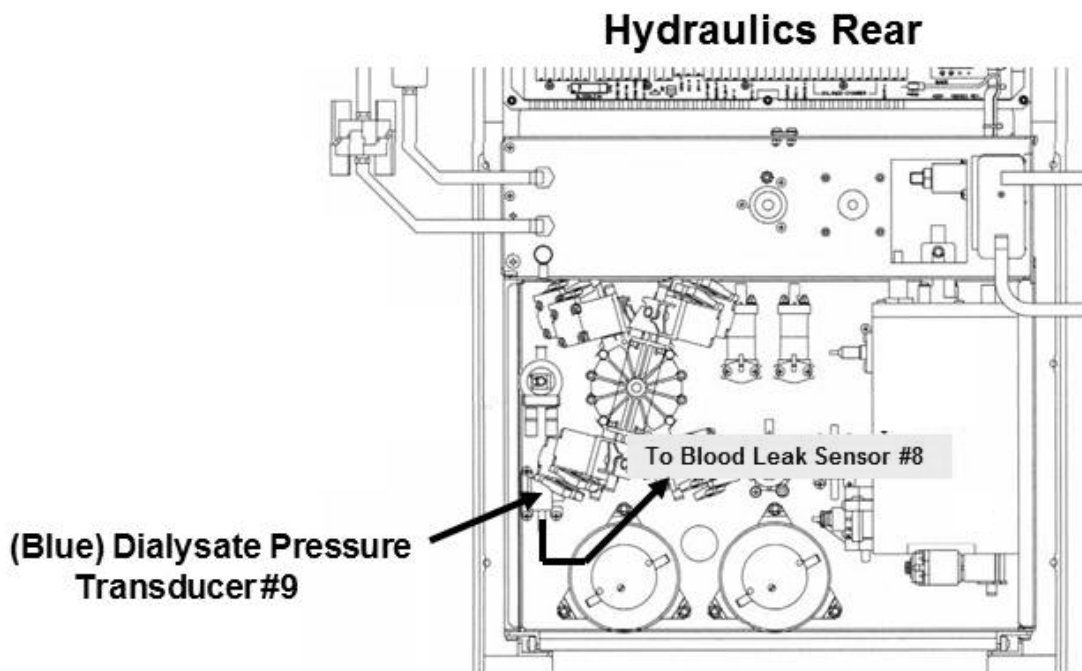
F- 12.4.0 “OPERATOR ERROR” OCCURED / TROUBLESHOOT DIALYSATE PRESSURE

- 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’→ ‘CONFIRM’).
- e) From the Home screen, select the [Dialysate Flow] window.
- f) Set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- g) **Read before performing!** Return to (ABOVE) procedure number **F- 12.0.0 (page 107)** but if (and ONLY if) “Operator Error” reoccurs, one at a time, swap the listed components (see Component List below), and in between return to procedure number **F- 12.0.0 (page 107)** until “Operator Error” DOES NOT reoccur indicating the last component swapped in is the problem!

Component List

- 1) Dialysate Pressure Transducer #9*;;
- 2) Sensor Board;
- 3) Actuator-Test Board;
- 4) Sensor Board cable;
- 5) Functional Board;
- 6) Distribution board.

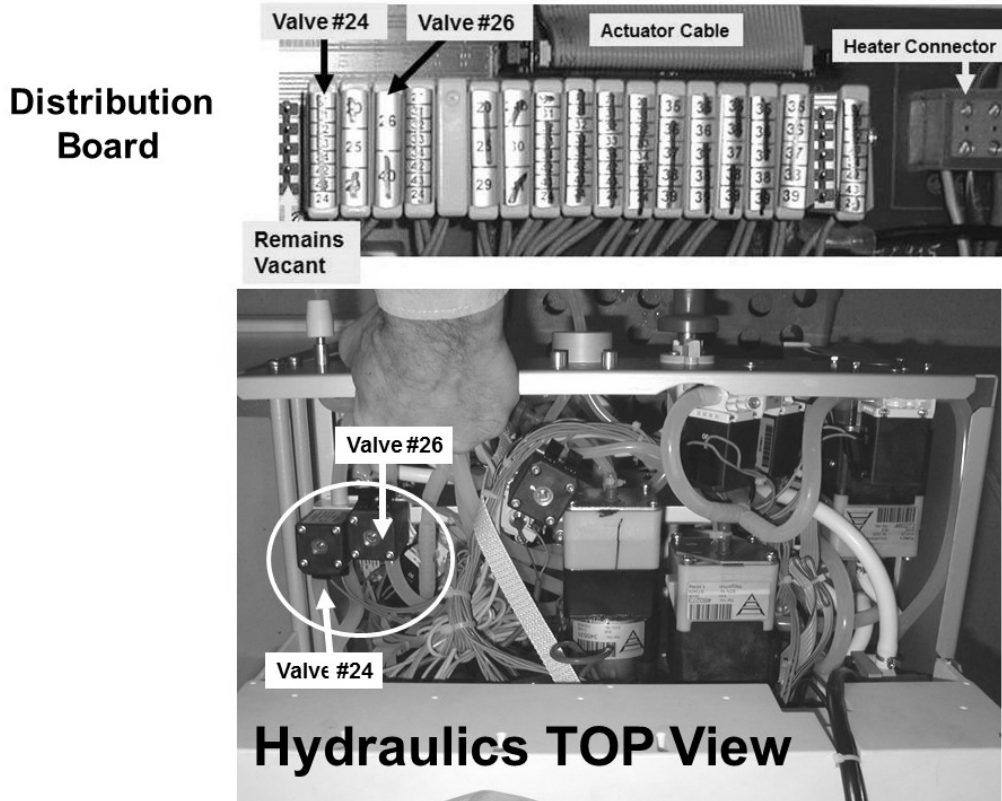
* To LOCATE Transducer #9 see Figure below



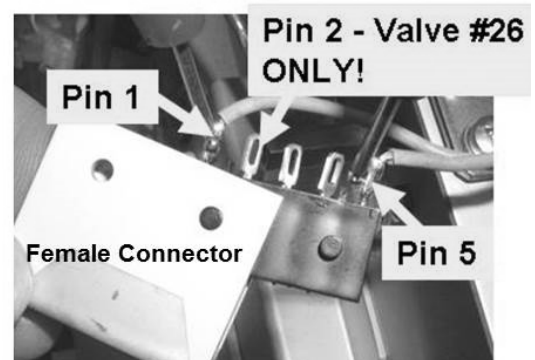
F- 13.0.0 'BOB' IS MOVING WHEN IT'S NOT SUPPOSED TO

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!



- 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 ON (Flow on/off lamp NOT blinking) AND is set to 800 ml/min is the external flow indicator's 'bob' still rising?

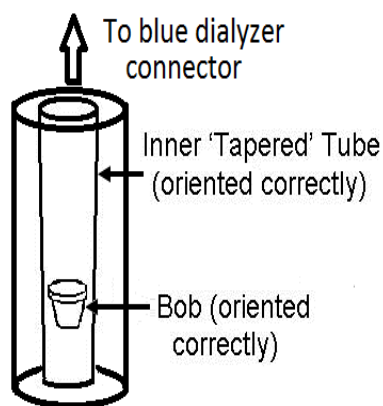


Yes 'Bob' moving! TWO (2) possible bad components: **1)** Actuator-Test Board OR; **2)** Valve #24.

No 'Bob' NOT moving! If a Flow Error is still occurring, return to (ABOVE) procedure number **F- 6.0.0 (page 50)**. 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 112).

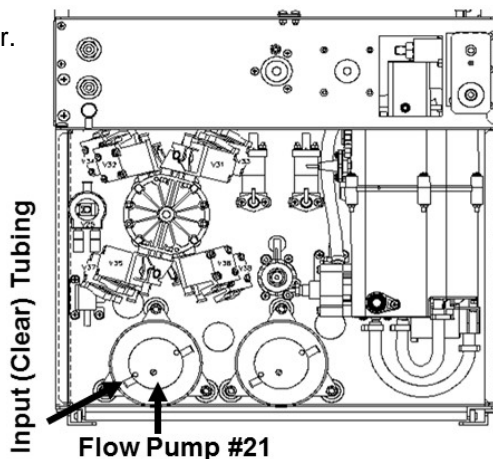


F- 14.0.2 ISOLATE VALVE #24 / TO DIALYZER CIRCUIT

- 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 'CONFIRM' 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 'CONFIRM' 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 112).
 - 2) **IF LESS than 800 ml collected!** Bad flow from Valve #24. Proceed to **page 114**, 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 'CONFIRM' 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 'CONFIRM' 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 113).
- 2) **IF LESS THAN 800 ml collected!** A restriction in the 'from (red) Dialyzer' line is indicated! See parts a THROUGH c next page:

LESS THAN 800 ml collected continued:

- a) ENSURE no tubing restrictions at the DiaSafe® filter.
- b) 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 192, [TROUBLESHOOTING A VALVE](#)**

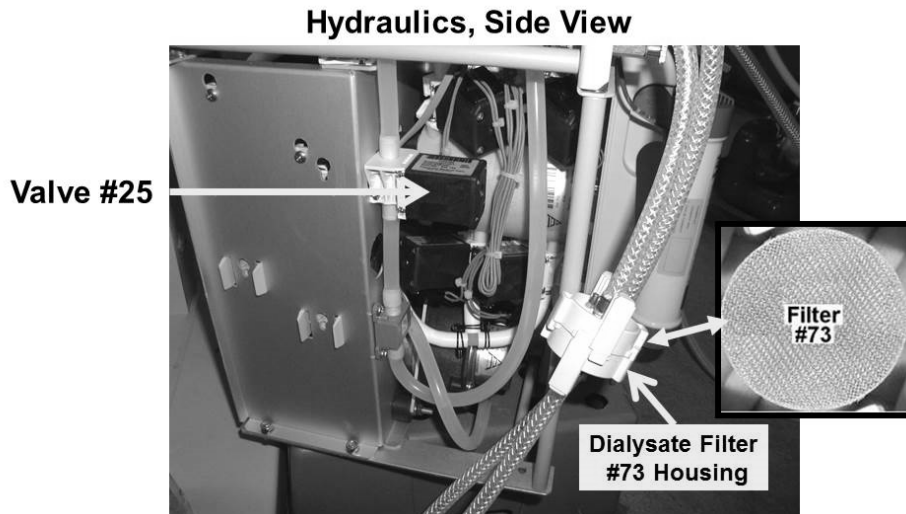
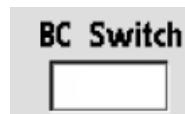


Figure 23 – Filter #73 / Valve #25

F- 14.0.5 MORE THAN 800 ml COLLECTED / 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 then, 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) minutes 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 30**, procedure number [F- 2.0.0](#).
- 2) **IF BC SWITCH = 897 or more intermittently OR if a previously observed Flow Error was occurring very intermittently:** Return to **page 40**, 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!

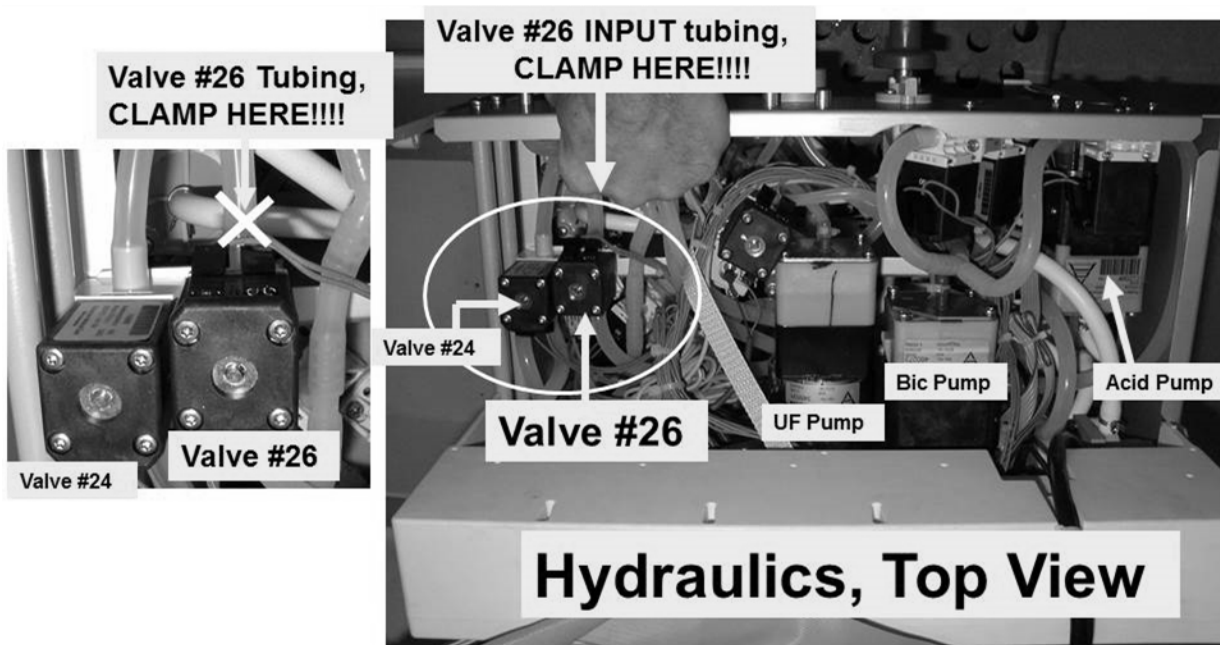


Figure 24 – Valve #26

- b) Return to Calibrate Hydraulics → Flow Pressure.
- c) Press 'CONFIRM' THEN ENSURE the Flow Motor is rotating!
- d) Measure again from the blue dialyzer connector for one (1) minute.
- e) Press 'CONFIRM' 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 112) to confirm this but 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 115).

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

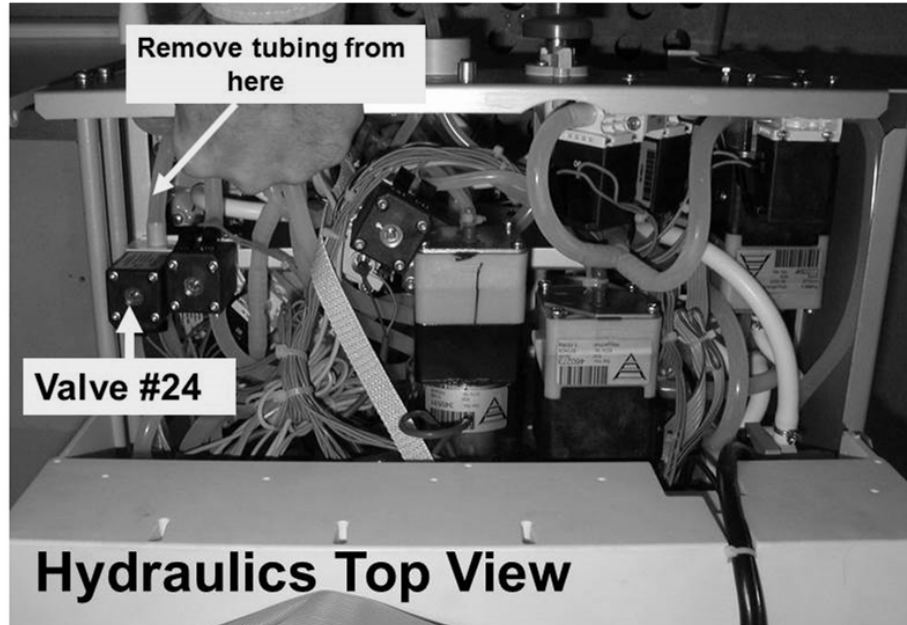


Figure 25 – Valve #24

- d) From Calibrate Hydraulics → Flow Pressure.
- e) Press 'CONFIRM' THEN ENSURE the Flow Motor is rotating!
- f) Measure from Valve #24's tubing for one (1) minute!
- g) Press 'CONFIRM' to return to "Calibrate Hydraulics". More than 800 ml collected?
Yes More than 800 ml! See procedure number [F- 14.0.81](#) (page 115).
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.

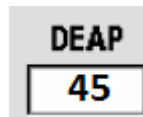
F- 14.0.81 GOOD FLOW FROM VALVE #24'S / ISOLATE ACTUATOR-TEST BOARD / VALVE #24

- 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 192, TROUBLESHOOTING A VALVE.**

F- 15.0.0 LOADING PRESSURE LOW / ISOLATE DEAERATION MOTOR RATE (DEAP)

- A) Turn the Heater Switch OFF for now!
- B) 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 117).
 - 2) **IF DEAP = 76 OR more:** See 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 'CONFIRM'. The screen's [**Pump Rate**] window turns yellow.
 - c) Select the [**Pump Rate**] window to turn it bright yellow.
 - d) Set [**Pump Rate**] to "210"!
 - e) **Press 'CONFIRM' TWICE to save the calibration!**
 - f) Turn the machine OFF!
 - g) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').

- h) Call debug screen 1. Is **DEAP** now = 45?



Yes **DEAP = 45!** See procedure number [F- 15.2.0](#) (page 117).

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 117).

No NOT rotating CCW! **NOTE ONLY** the DEAERATION MOTOR will be checked then proceed to **page 130**, [TROUBLESHOOTING MOTORS](#).

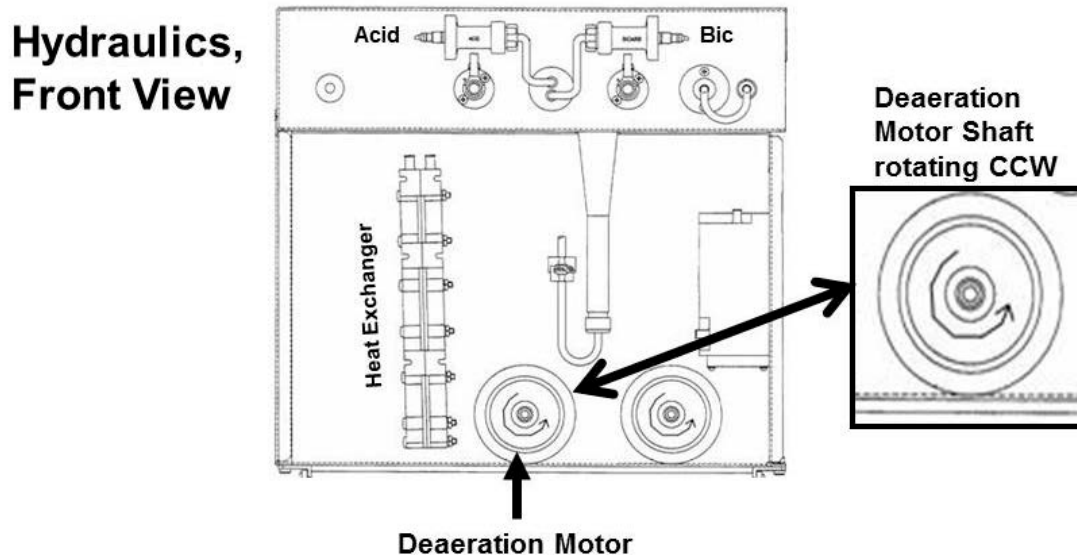


Figure 26 – Deaeration Motor Rotating CCW

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?

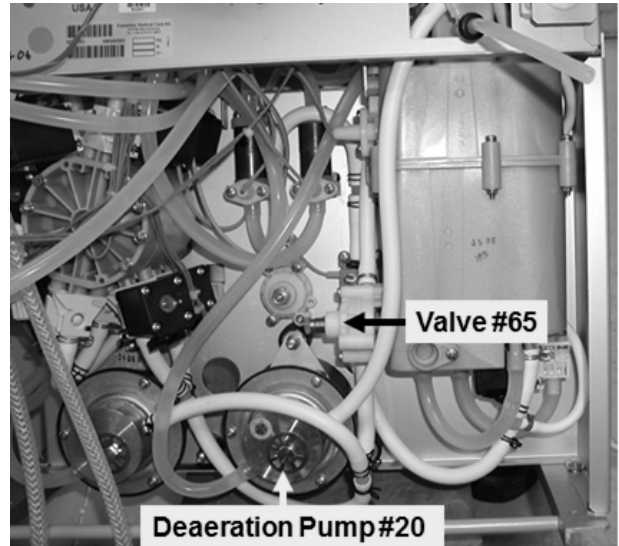
Yes If **SURE** the motor stops! **TWO (2)** possible bad components: **1)** Bad Deaeration Motor (possibly brushes) **OR;** **2)** Bad Deaeration Pump head.

No Motor continues to rotate! See procedure number [F- 15.2.2](#) (page 118).

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 119).
- 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:



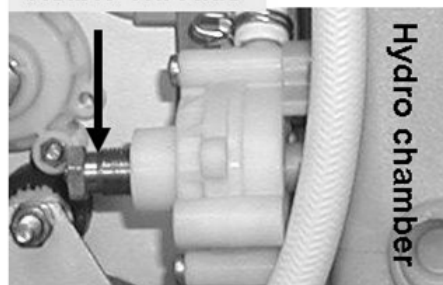
- i) **IF (and ONLY if) a high of between 23 and 25 psi CANNOT be achieved:** Return Valve #65's nut to its ORIGINAL location then see procedure number [F- 15.2.3](#) (page 119).
- ii) **IF between 23 and 25 psi CAN be achieved:** See parts a THROUGH d below:

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

* Refer to [Figure 6](#) (page 19)

- b) From the Home screen, select the [Dialysate Flow] window.
- c) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- d) Call debug screen 6.
- e) **WITHOUT LOOKING AWAY**, watch **BC Switch** (middle column) for five (5) minutes OR until it EVER = 897, or more even if only once?

Visible Threads



Loading Pressure Valve #65

BC Switch



Yes **BC Switch** goes to 897 or more! Return to **page 30**, procedure number [F- 2.0.0](#).

No **BC Switch** NEVER = 897 or more! See parts a AND b below:

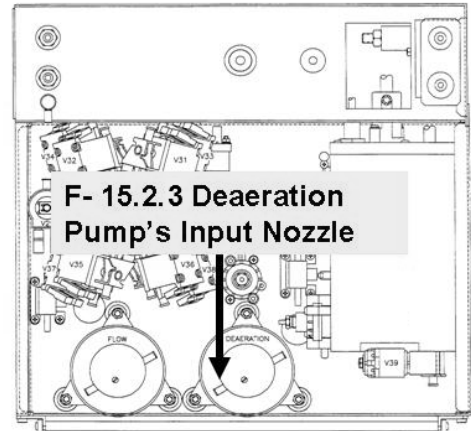
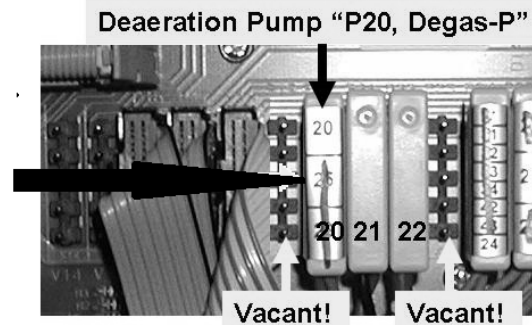
- a) Turn the Heater Switch on!
- b) Check Deaeration Pressure per the Preventative Maintenance Procedures booklet.

F- 15.2.3 LOW LOADING PRESSURE / ISOLATE POSSIBLE AIR LOCK

- a) **Obtain a 1000 ml graduated cylinder AND a bucket!**
- b) Figure right, unplug the DEARATION PUMP's, connector from distribution board position "P20-Degas-P"!
- c) Figure right, remove the clear tubing from the Deaeration Pump's INPUT nozzle. **Keep the tubing below the pump to encourage gravity flow!**
- d) The tubing is from hydrochamber D. If ANY FLOW from it direct it into the bucket for TWO (2) minutes BEFORE continuing to part e.
- e) Now direct the tubing into the cylinder for ONE (1) minute. MORE THAN one hundred thirty (130) ml collected?

Yes More than 130 ml per minute! See procedure number [F- 15.2.4](#) (page 119).

No Less than 130 ml per minute! The Deaeration Pump may be air locked! Leaving the tubing off AND the pump unplugged, proceed to **page 122**, procedure number [F- 16.0.0](#).



F- 15.2.4 MORE THAN 130 ML PER MINUTE COLLECTED I.E NO AIR LOCK

- a) **Reattach the Deaeration Pump's tubing!**
- b) Return the Deaeration Pump's connector to distribution board position P20, "Degas-P".
- c) **ENSURE the DEAERATION MOTOR is running!**
- d) See procedure number [F- 15.5.0](#) (page 120).

F- 15.5.0 ISOLATE BETWEEN THE DEAERATION 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**, tightly clamp then **QUICKLY** release the white tubing at the **TOP** of Loading Pressure Valve #65!
- c) When clamped, does 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) Loading Pressure Valve #65 OR; 2) Hydrochamber.**

No DID NOT peak to at least 35 psi! See procedure number [F- 15.5.2](#) (page 121).

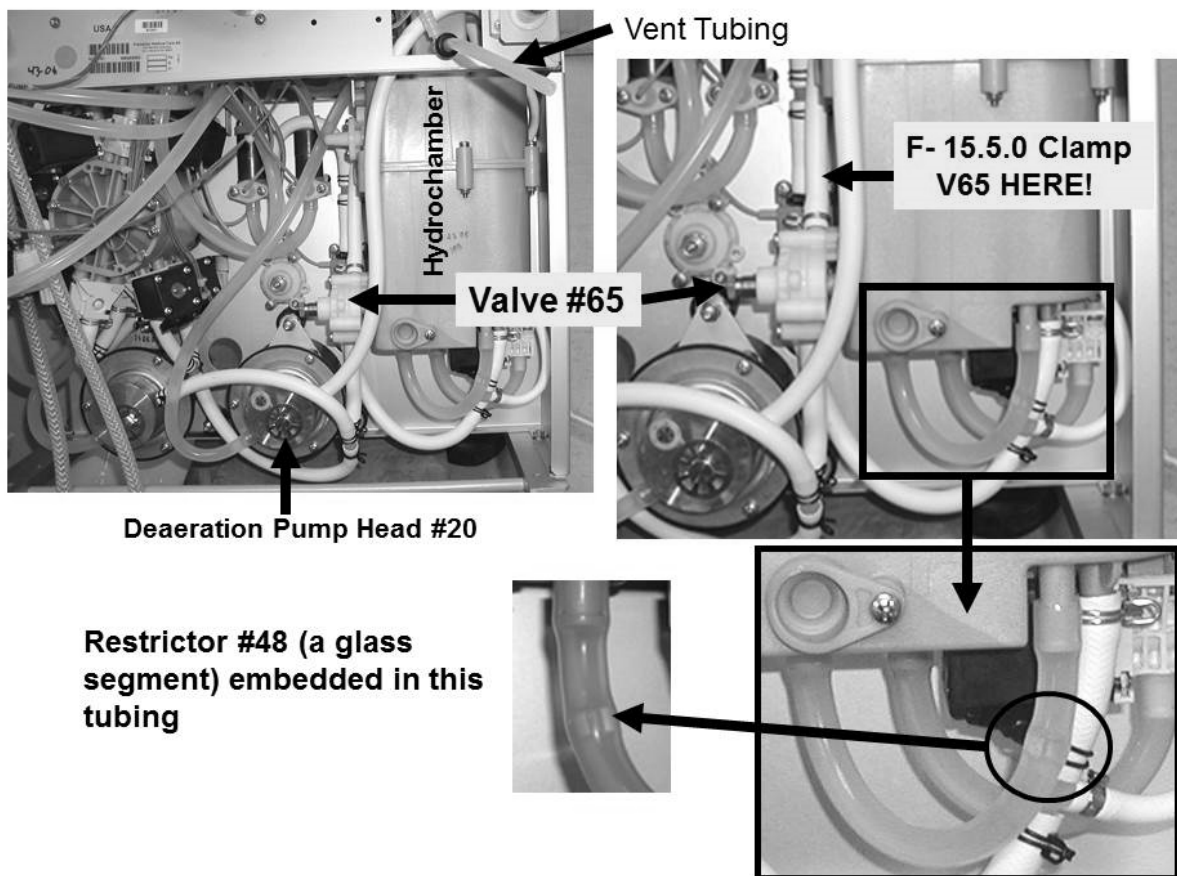
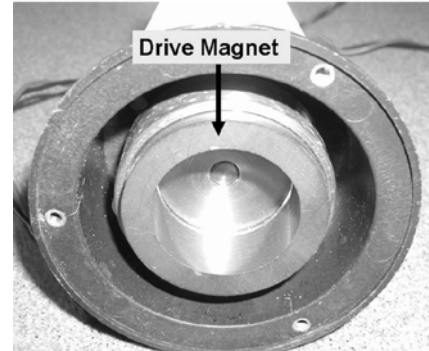


Figure 27 – Hydrochamber / Valve #65 / Restrictor #48

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)** Deaeration Pump head OR; **2)** 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!

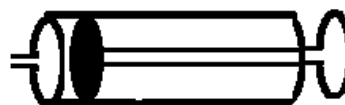
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F- 16.0.0 LESS THAN 150 ML COLLECTED / ISOLATE RESTRICTOR #48

This procedure attempts to clear an air lock. First Restrictor #48 is checked to see if it is plugged.

- a) Figure right, a **60 ml syringe***, with its plunger pushed ALL THE WAY IN is required!

60 ml Syringe with plunger all the way in



*** Using a smaller syringe may cause error!**

- b) Attach the syringe, to the DEAERATION PUMP's clear (INPUT) 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 may be plugged with debris¹. Replace the tubing segment that contains Restrictor #48*. *To LOCATE Restrictor #48 refer to [Figure 27](#) (page 120)!



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 okay! See part A below:

- A) Remove the syringe and, from the tubing, MEASURE flow for one (1) minute. More than 130 ml collected?

Yes More than 130 ml! See procedure number [F- 16.0.1](#) (page 122).

No Less than 130 ml! See part B.

- B) Push the plunger back into the syringe barrel then reattach the syringe to the Deaeration Pump's input tubing.
- C) Pull the plunger to the end of the barrel!
- D) Repeat parts A through D up to **TEN (10) TIMES** OR until if more than 130 ml every minute is MEASURED?

Yes More than 130 ml every minute! See procedure number [F- 16.0.1](#) (page 122).

No After ten (10) attempts you CANNOT achieve more than 130 ml every minute! Proceed to **page 123**, procedure number [F- 16.0.7](#).

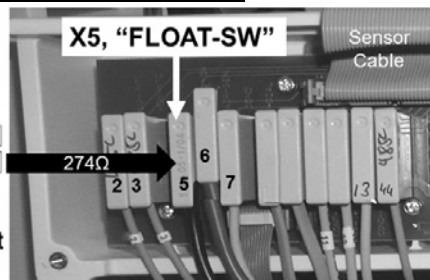
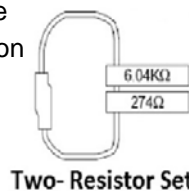
F- 16.0.1 MORE THAN 130 ML COLLECTED / DOES IT CONTINUE?

Direct the tubing into the bucket for up to FIVE (5) FULL minutes. Flow will either: **1)** Continue at more than 130 ml per minute 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 for now! Proceed to **page 125**, procedure number [F- 16.2.0](#).
- 2) IF flow stops:** Proceed to **page 123**, procedure number [F- 16.0.7](#).

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".

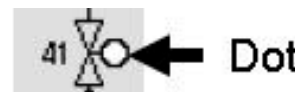


b) Allow forty (40) seconds or until flow from the Vent Tubing occurs indicating hydrochambers A through C are full!

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 123).

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 141, SECTION 2 – NO WATER ALARM!**

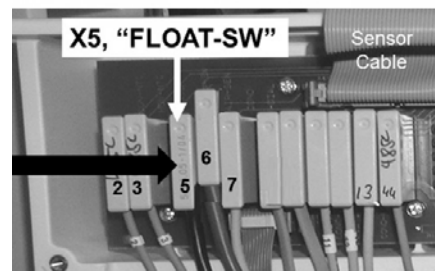
No 'Dot' = White! See parts a AND b below

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 123).

b) FIVE (5) possible bad components: **1)** Actuator-Test Board OR; **2)** Sensor Board cable OR **3)** Sensor Board OR; **4)** Distribution board OR; **5)** 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) Attach the **60 ml syringe**, with its plunger pushed all the way in, to the Deaeration Pump's clear (INPUT) tubing.

c) PULL on the syringe plunger to the end of the barrel! If Restrictor #48 is still open you should feel very little resistance!

d) Remove the syringe and MEASURE flow from the tubing for one (1) minute. If less than 130 ml repeat parts b through d. After no less than **ten (10) attempts** do you MEASURE more than 130 ml every minute?

Yes More than 130 ml every minute! See procedure number [F- 16.0.9](#) (page 124).

No Cannot achieve more than 130 ml per minute! THREE (3) possible bad components: **1)** Reoccurring debris at Restrictor #48 OR; **2)** Bad Float Switch* OR; **3)** Bad hydrochamber.

* To LOCATE the Float Switch refer to [Figure 28](#) (page 129)

F- 16.0.9 MORE THAN 130 ML EVERY MINUTE / ISOLATE FLOAT SWITCH #5

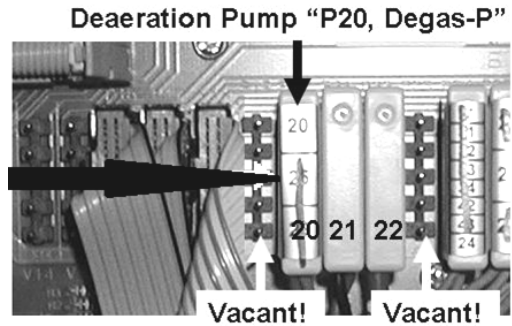
- a) This procedure requires up to **five (5) minutes** to prevent labor-intensive error!
- b) Direct the tubing into the bucket for up to **five (5) minutes**. Flow will either: **1) Continue** at more than 130 ml every minute OR **2) Stop**.
- 1) IF (and ONLY if) flow continues at more than 130 ml per minute!** The float is okay! See procedure number [F- 16.2.0](#) (page 125).
- 2) IF flow STOPS! THREE (3) possible bad components: 1) Reoccurring debris in Restrictor #48 OR; 2) Bad Float Switch^a OR; 3) Bad hydrochamber**

^a To LOCATE the Float Switch refer to [Figure 28](#) (page 129)

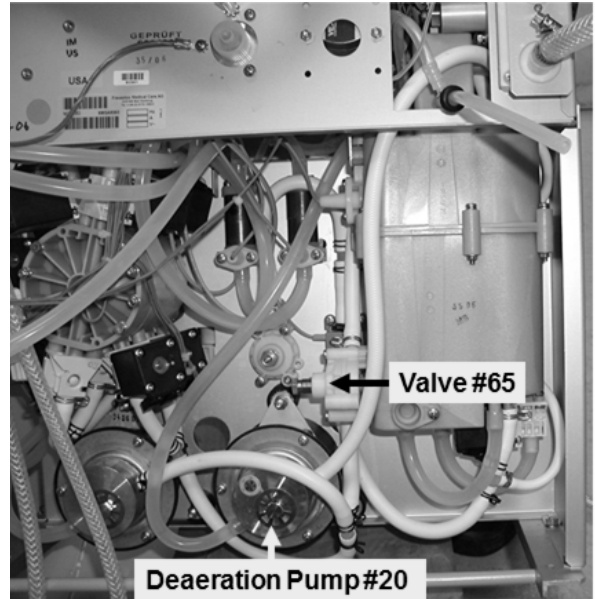
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F- 16.2.0 FLOW DOES NOT STOP

- a) **Reattach the Deaeration Pump's input tubing!**
- b) FIGURE right, return the Deaeration Pump's connector to position "P20, Degas-P".
- c) **ENSURE 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 125).
- 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 air lock)!
 - b) Swap the following components (see [Component List](#) below) one at a time attempting to adjust Loading Pressure in between to test each new component.



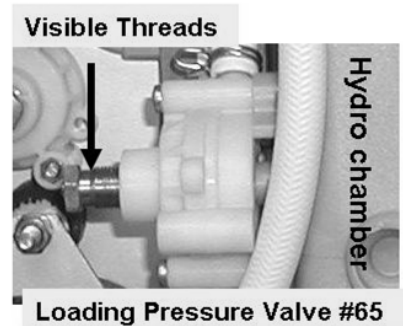
COMPONENT LIST: 1) Deaeration Pump head; 2) Deaeration Motor; 3) Valve #65; 4) Hydrochamber. **NOTE:** After good loading pressure achieved see procedure number [F- 16.2.1](#) (page 125).

F- 16.2.1 ISOLATE VALVE #65

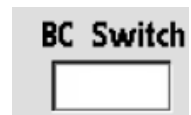
- a) Figure right, several threads should be visible under Valve #65's nut! If threads are visible see part b. If no threads are visible either the wrong spring is installed under Valve #65's nut* OR Valve #65 is bad!

* Refer to [Figure 6](#) (page 19)

- b) From the Home screen, select the [Dialysate Flow] window.
- c) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.



- d) Call debug screen 6. WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for three (3) minutes. If EVER = 897, even just once, indicates a Flow problem. Does it EVER = 897?



Yes **BC Switch** = 897 at least once! Return to (ABOVE) procedure number [F- 2.0.0](#) (page 30).

No **BC Switch** is NEVER = 897! Check Deaeration Pressure per the [Preventative Maintenance Procedures](#) booklet.

F- 18.0.0 LOADING PRESSURE CYCLES BELOW 11 psi



a) The following procedure 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:

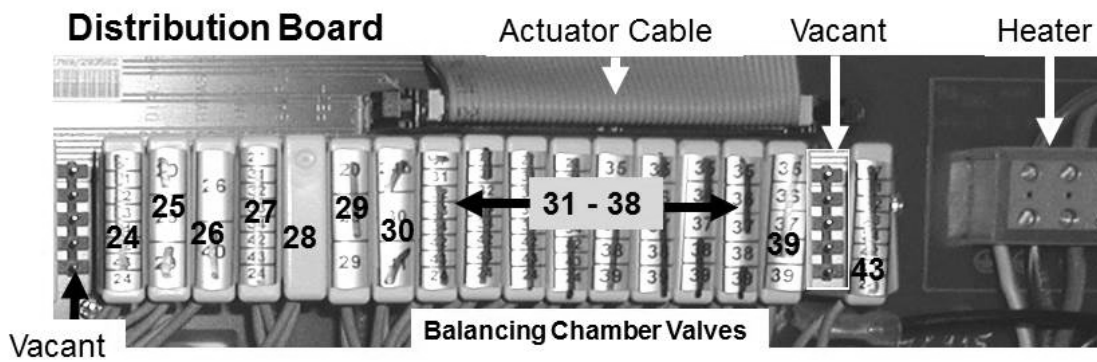
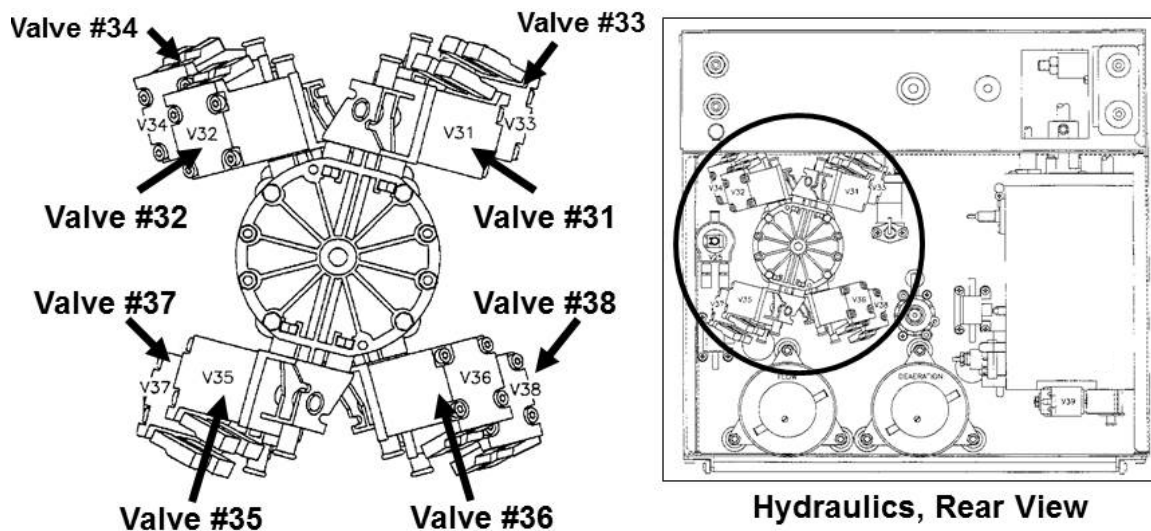
1) **IF (and ONLY if) SURE the machine was NOT worked on previously for this Flow problem:** See procedure number [F- 18.1.0](#) (page 127).

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!

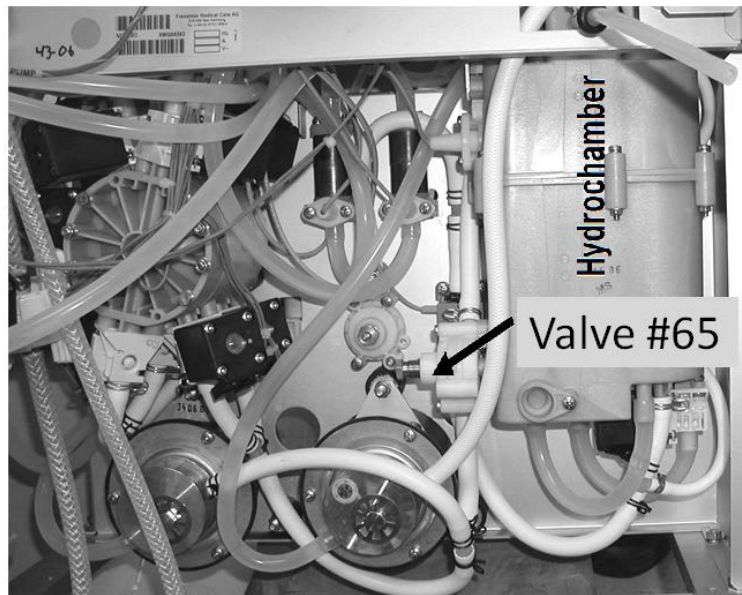
b) Figure below, without unplugging valves, **CAREFULLY** trace the wires from EACH valve to its SPECIFIC distribution board position. **If ANY do NOT terminate properly, at either end, this most likely is the problem!**

c) If (and ONLY if) a wiring error **IS NOT** located see procedure number [F- 18.1.0](#) (page 127).



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 under Valve #65's nut* OR Valve #65 is bad.

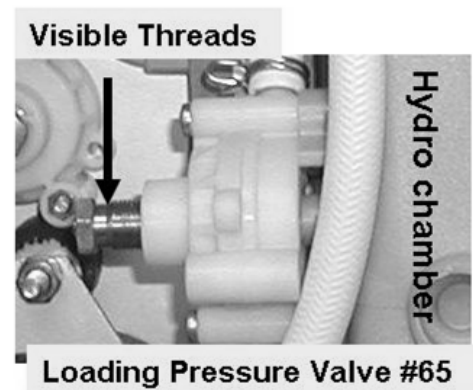
* Refer to [Figure 6](#) (page 19)

- c) From the Home screen, set [Dialysate Flow] to 800 ml/min!
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 127).

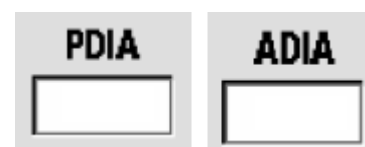
2) IF the TMP window is RED (TMP alarm present): See parts a THROUGH c below:

- Press and release the 'Reset' key then immediately press and hold it for three (3) seconds.
- Allow thirty (30) seconds. If a TMP alarm reoccurs attempt RESET up to twice more BEFORE continuing to part c.
- Allow thirty (30) seconds BEFORE continuing to procedure number [F- 18.2.0](#) (page 127).



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 128).
- 2) **IF PDIA OR ADIA does 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 527**, 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 128).

F- 19.0.0 TROUBLESHOOT BAD LOADING PRESSURE

- a) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM!’)
- b) The Deaeration motor shaft MUST be rotating COUNTERCLOCKWISE!
- c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM!’
- 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 PEAK of somewhere between 23 and 27 psi and low of NEVER LESS THAN 11 psi and (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 128).
 - No Cycles to less than 23 psi! See procedure number [F- 19.1.0](#) (page 128).

F- 19.1.0 PRESSURE TEST HYDROCHAMBER

- a) A procedure, in a different Section, is performed next. **NOTE** this page and procedure number (F- 19.1.0) because you may be prompted to return to here.
- b) BEFORE continuing to part c, proceed to **page 139** to perform [PRESSURE TEST HYDROCHAMBER](#).
- c) If the Hydrochamber leak was not located in part b return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM!’)
- 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 between a PEAK of somewhere between 23 and 27 psi and low of NEVER LESS THAN 11 psi and (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 ↓ Peak IS 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 PEAKS to between 23 and 27 psi can be achieved indicating the last component swapped in was the problem.

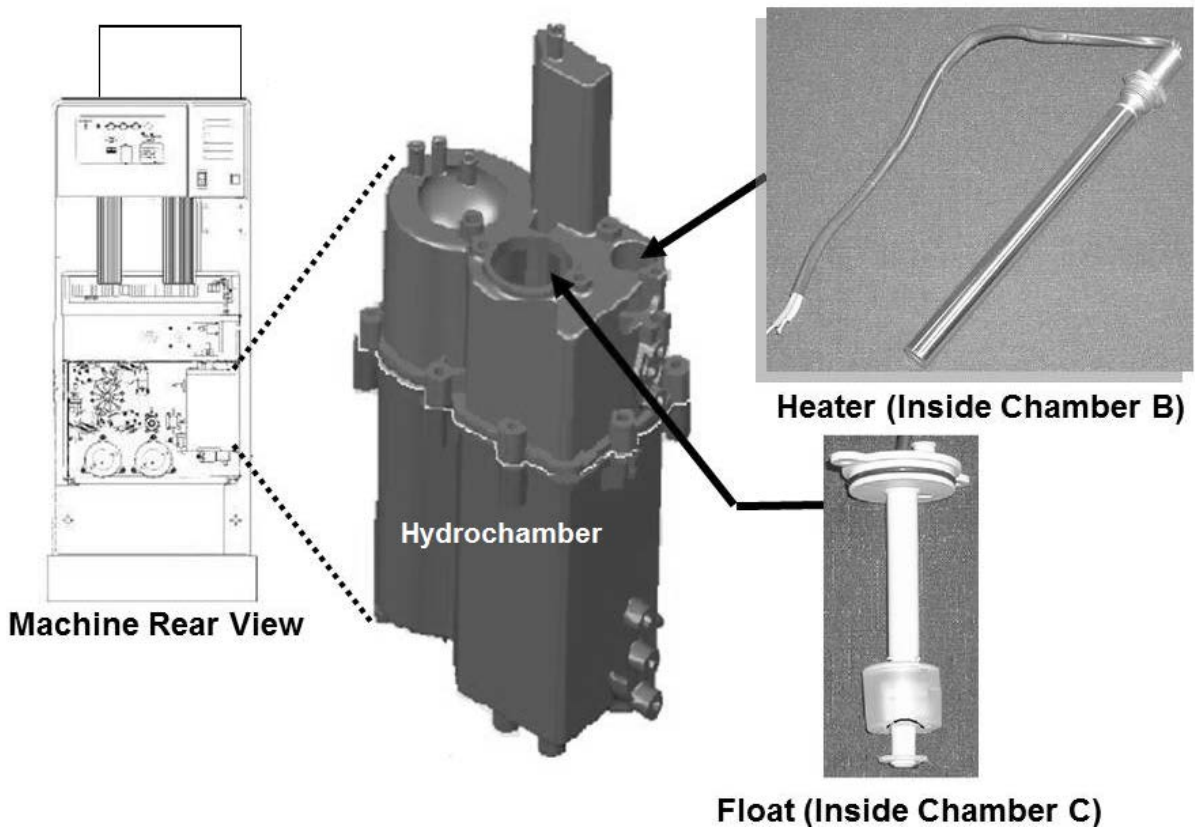
COMPONENT LIST:

- 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 19)

** Attempt to calibrate the new Valve #65 to achieve a peak loading pressure of between 23 and 25 psi

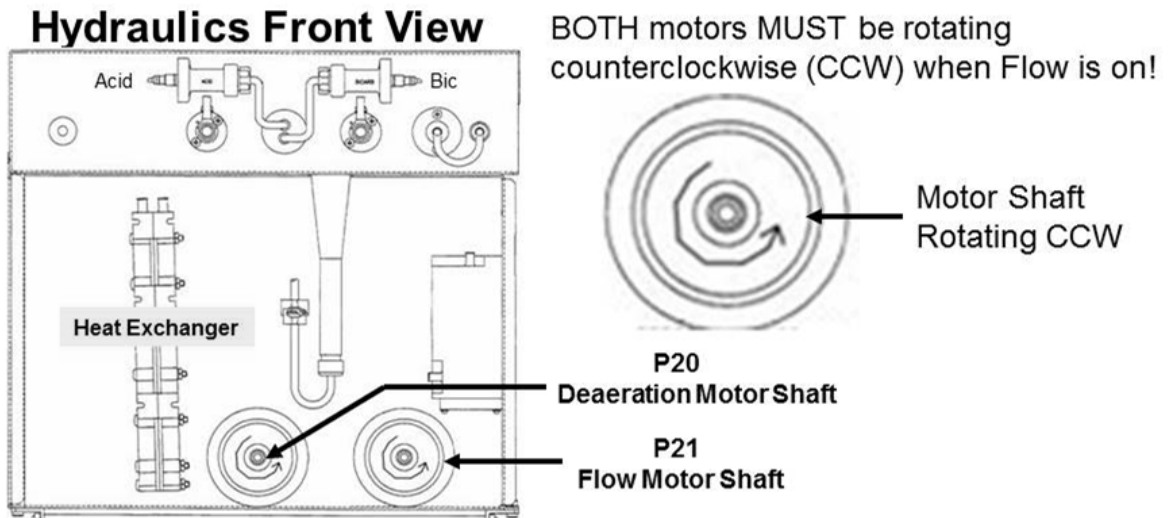
Figure 28 – Hydrochamber / Float Switch #5 / Heater



TROUBLESHOOTING MOTORS

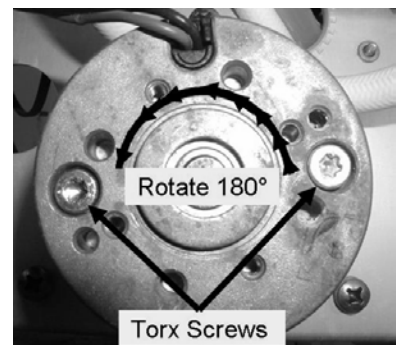
MOTORS- 1.0.0 MOTOR TROUBLESHOOTING

- A) The procedure that directed you here asked you to **NOTE** which motor (**Deaeration** OR **Flow**) to be checked. **CHECK ONLY this motor!**
- B) Per the Figure below, the 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 133**, procedure number [MOTORS- 4.0.0](#).
 - 2) **IF (and ONLY if) rotating CLOCKWISE (i.e. backwards!):** See procedure number [MOTORS- 2.0.0](#) (page 130).
 - 3) **IF rotating counterclockwise (CCW):** Proceed to **page 131**, procedure number [MOTORS- 3.0.0](#).



MOTORS- 2.0.0 MOTOR ROTATING CLOCKWISE (BACKWARDS)

- IMPORTANT!** Turn the machine OFF!
- Per Figure right, remove the Torx screws (T-25) BUT **DO NOT** remove the cap to maintain the brushes in position!
- Rotate the cap 180° then reinstall the screws and tighten them.
- Return to the Program (Dialysis or Cleaning / Disinfection) that originally brought you to TROUBLESHOOTING MOTORS!
- Is the motor rotating counterclockwise (CCW) now?

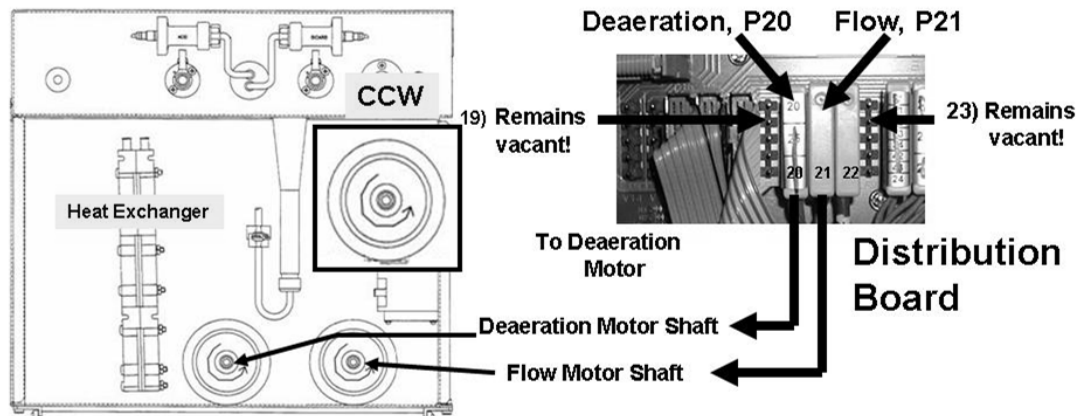


Yes Rotating CCW! Place the machine into Rinse for several minutes to eliminate a potential air lock.

No NOT rotating CCW! Return to (ABOVE) procedure number [MOTORS- 1.0.0](#) (page 130).

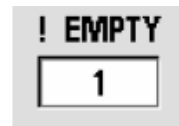
MOTORS- 3.0.0 MOTOR ROTATING COUNTERCLOCKWISE (CCW)

- a) To ENSURE a proper connection, per the Figure below, trace the wires from the **NOTED** motor to the Distribution Board. Deaeration Pump → Distribution Board position “P20”; Flow Pump → distribution board position “P21”.



- b) To ENSURE the pump head is oriented correctly, per the [Figure 29](#) below, the 'ID Decal', MUST be either on the TOP OR FRONT of the pump head. If on the front, it MUST be right side up!
- c) If not already, place the machine in DIALYSIS PROGRAM!
- d) Open the shunt door and remove both dialyzer connectors!

- e) CLOSE THE DOOR then 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 132).
- 2) **IF ! EMPTY = 0:** Either the (red) arterial dialysate connector is NOT connected to the shunt door properly OR 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 [OPERATING MODES](#), page **Error! Bookmark not defined.**

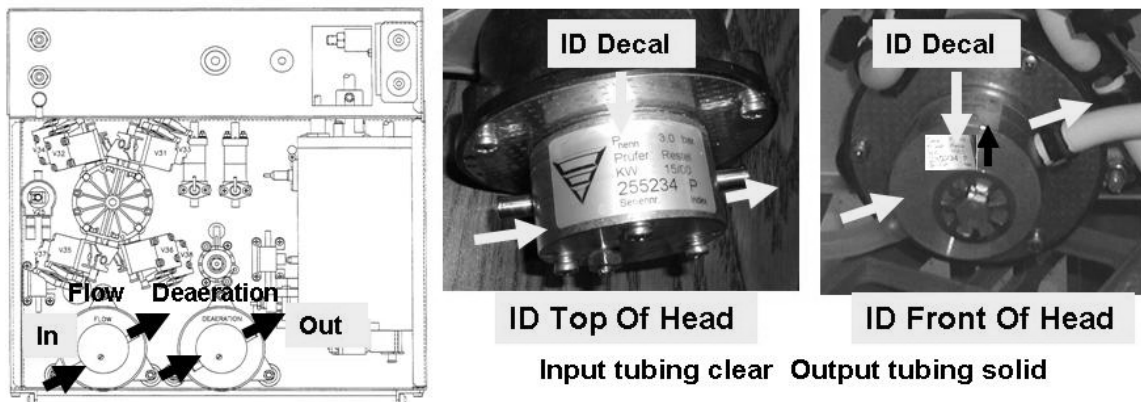
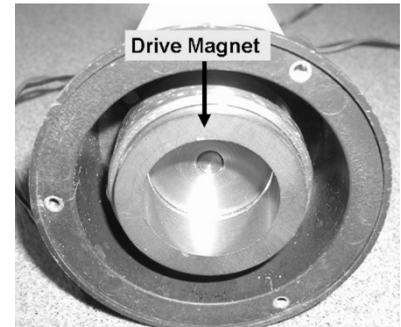


Figure 29 – Deaeration and Flow Motor Location / Orientation

MOTORS- 3.1.0 ISOLATE A POTENTIAL 'BINDING' MOTOR

- a) Return the lines to the shunt!
- b) **IMPORTANT!** To prevent damage 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 but 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 **NOTED** motor **HARD** with a screwdriver handle. Does it start rotating?

Yes Motor rotating! Proceed to **page 138**, procedure number [MOTORS- 5.0.0](#).

No Motor does **NOT** start rotating! Perform parts a THROUGH e below:

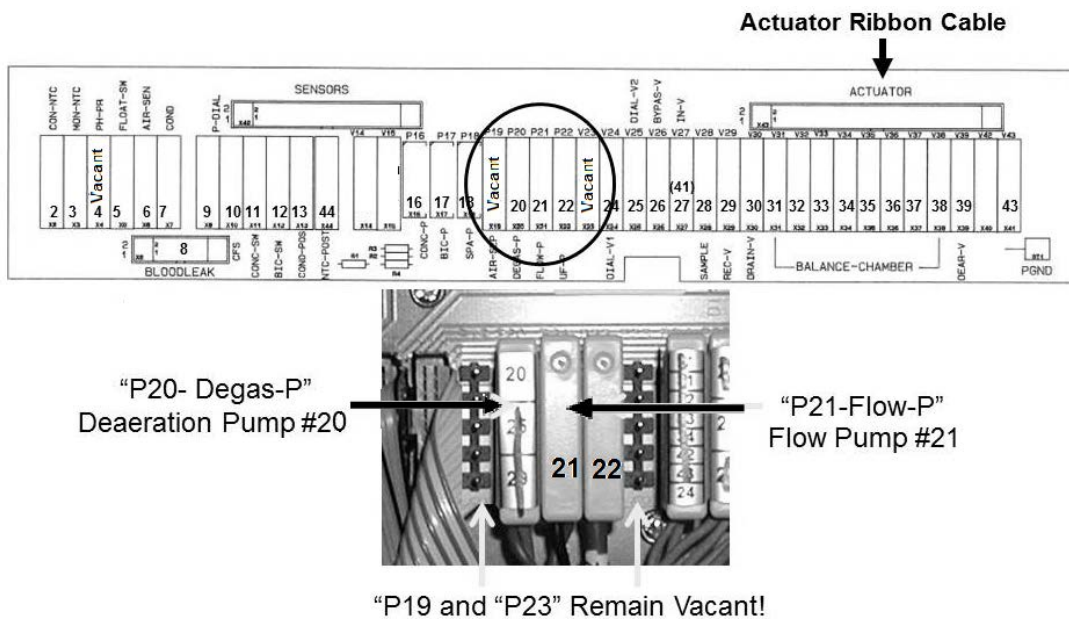
a) **To prevent damage TURN THE MACHINE OFF!**

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) Depending on what Program the machine was in when you ORIGINALLY started troubleshooting:

1) **IF a Cleaning Program (Heat Disinfect, Rinse, etc.):** Place the machine in RINSE then see procedure number [MOTORS- 4.1.0](#) (page 134).

2) **IF Dialysis Program:** Perform parts A through C below:

A) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').

B) From the Home screen, set [Dialysate Flow] to 800 ml/min.

C) See procedure number [MOTORS- 4.1.0](#) (page 134).

MOTORS- 4.1.0 MOTOR ROTATING?

Is the **NOTED** motor rotating now (Yes or No)?

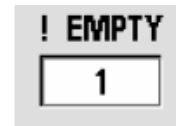
- Yes Motor is rotating! If (and ONLY if) a bad connection was corrected above AND if a Flow Error occurs see the Table of Contents for whatever Program the machine is in! If a bad connection was NOT located above proceed to **page 138**, procedure number [MOTORS- 5.0.0](#).
- ↕
- No Motor is NOT rotating! See procedure number [MOTORS- 4.2.0](#) (page 134).

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 135**, procedure number [MOTORS- 4.5.0](#).
- 2) **IF in Dialysis Program:** See procedure number [MOTORS- 4.3.0](#) (page 134).

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 ! EMPTY = 1:** See parts a AND b below:
 - a) Open the shunt door and remove both dialyzer connectors!
 - b) CLOSE THE DOOR. 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 135).**
 - 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**

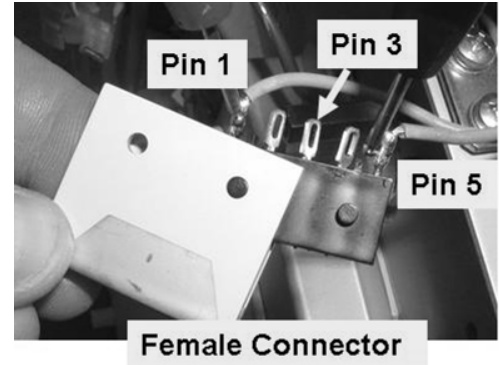
** To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**)

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.

- If the **NOTED** motor is the **Deaeration Motor** it **MUST** be connected between pins 1 and 3 i.e. top and middle
- If the **NOTED** motor is 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 0.4 Ω ! Subtract this from the subsequent measurement.
- f) Measure, **INSIDE the female connector**, BETWEEN the soldered terminals. Less than ten (10) Ω ?

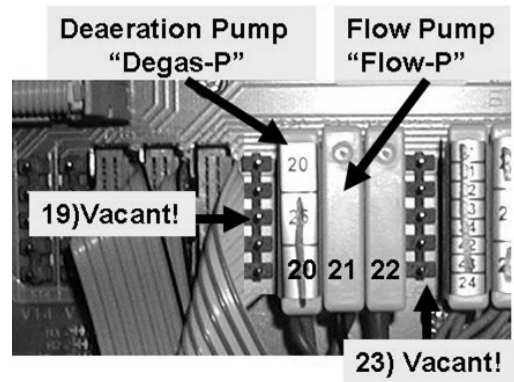
Yes Less than 10 Ω ! See procedure number [MOTORS- 4.6.0](#) (page 136).

No More than 10 Ω ! Bad brushes or motor.

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MOTORS- 4.6.0 ISOLATE MOTOR VOLTAGE

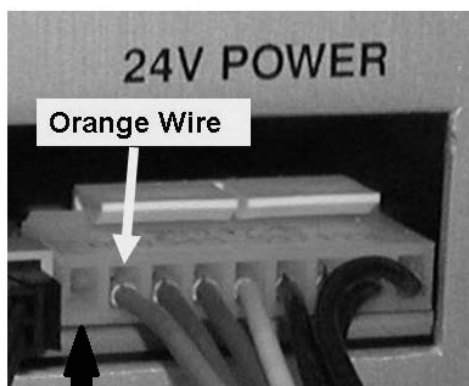
- a) Figure right, avoiding the VACANT positions on the left and right, return the motor connector, **without the cap**, to its distribution board position.
- b) **ENSURE** the connector is aligned properly!
- c) Set your **CALIBRATED** volt meter to **DC voltage (V_{DC})**.
- d) Measure, **inside the distribution board**, between the terminals where the wires are soldered.
IMPORTANT! ENSURE good contact with BOTH terminals!



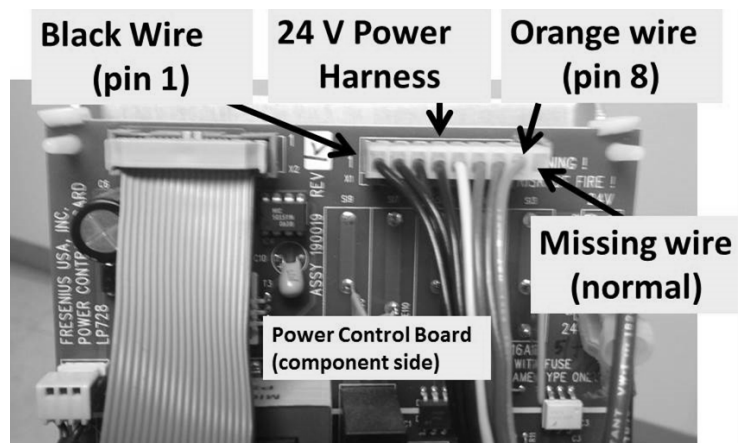
- e) Per [Table 5](#) below, perform the indicated Response based on measured voltage.

Table 4 – 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: 1) Bad deaeration motor <u>OR</u> 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 137)
FLOW	P21, "FLOW-P"	5 volts DC or more	TWO (2) possible bad components: 1) Bad flow motor <u>OR</u> 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 137)



No wire (this is normal)



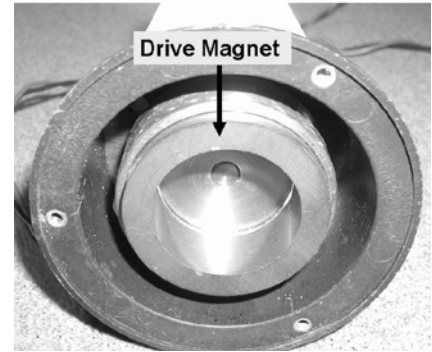
24V Power Harness (Behind the card cage / Inside the Power Supply)

MOTORS- 4.7.0 BAD MOTOR VOLTAGE MEASUREMENT / ISOLATE A 'BINDING' MOTOR

- IMPORTANT! Turn the machine OFF!**
- Figure right, remove the pump head from the **NOTED** motor to expose the 'Drive Magnet'.
- Manually spin the 'Drive Magnet'. Does it rotate freely i.e. is NOT 'binding'?

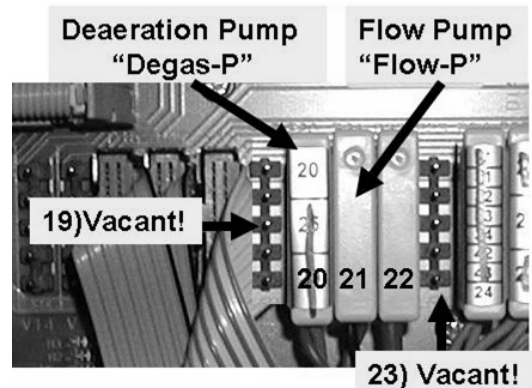
Yes Rotates freely! See procedure number [MOTORS- 4.8.0](#) (page 137).

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

- Return the pump head to the motor!
- Figure right, ENSURE the motor is plugged properly into its CORRECT distribution board position!
- 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.

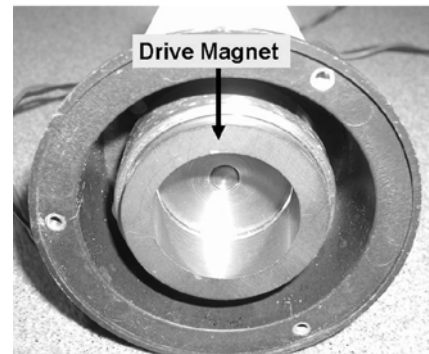
* To LOCATE the board refer to [Figure 4A](#) (page 9)

- Return to either RINSE OR Dialysis.
- 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!

LEFT BLANK INTENTIONALLY

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 138).

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.

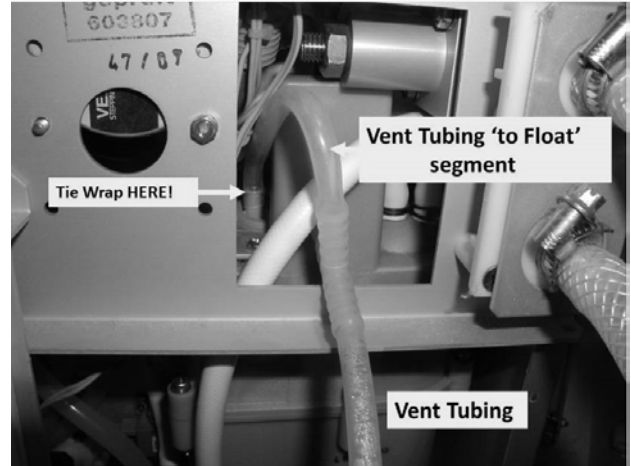
* To LOCATE the board refer to [Figure 4A](#) (page 9)

LEFT BLANK INTENTIONALLY

PRESSURE TEST HYDROCHAMBER

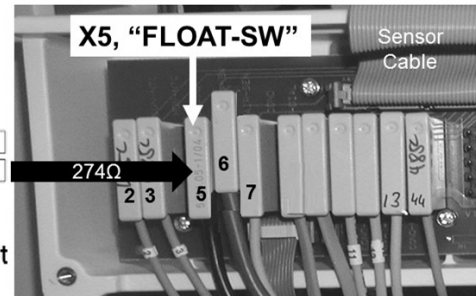
This procedure pressurizes the Hydrochamber to locate a potential leak. Two (2) clamps are required:

- 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 139).



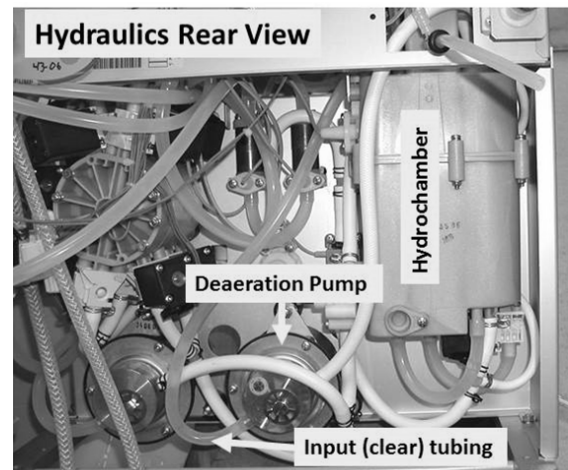
BLOCK LEAK- 1.0.0 PRESSURIZE HYDROCHAMBER

- 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 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. Is a leak located?

Yes Leak located! See [BLOCK LEAK- 2.0.0](#) (page 140).

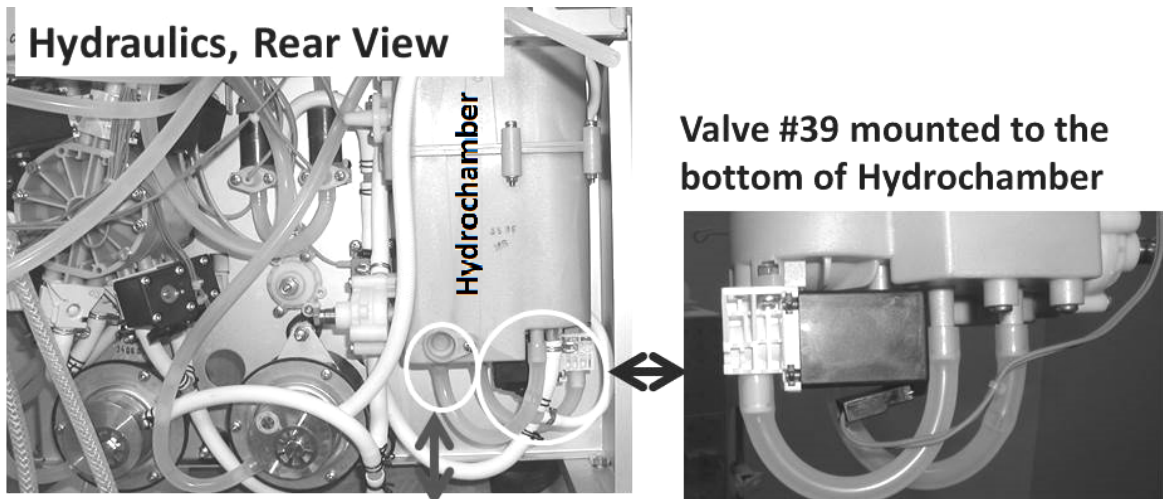


No leaks! a) Return the float's connector to distribution board position X5, "FLOAT-SW"

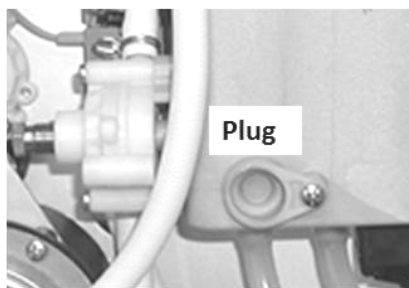
- b) Reconnect the Deaeration Pump's tubing.
- c) **Remove BOTH clamps!**
- d) Return to the procedure that brought you here as NOTED.

BLOCK LEAK- 2.0.0 HYDROCHAMBER LEAK LOCATED

- a) Return the float's connector to 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.

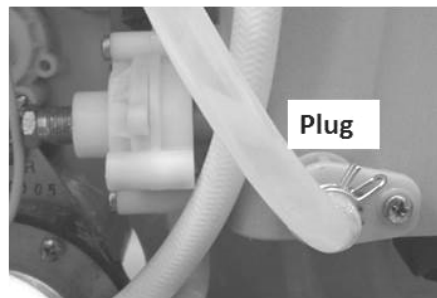


Hydrochamber Plug



w/o Enhanced Back Flow Prevention

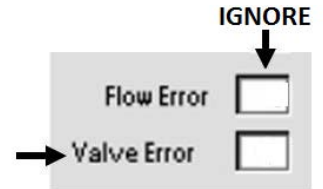
OR



With Enhanced Back Flow Prevention

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 2008K/K² 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:

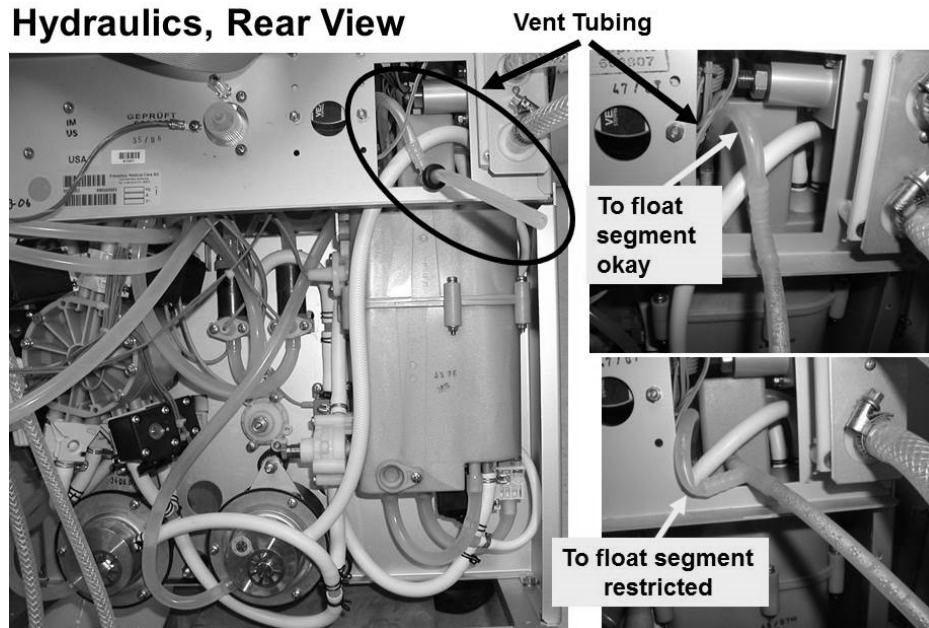


- 1) **IF (and ONLY if) Valve Error = 0:** See procedure number [NW- 1.0.0](#) (page 141).
- 2) **IF Valve Error = 1 longer than two (2) seconds consistently:** Refer to the Table below:

If the machine is <u>CURRENTLY</u> in:	Your response
Dialysis Program i.e. connected to Acid and Bicarb	Proceed to page 652 , Section 26
A Cleaning / Disinfection Program (Rinse, Heat Disinfect, etc.)	Proceed to page 189 , procedure number CLEAN- 7.0.0

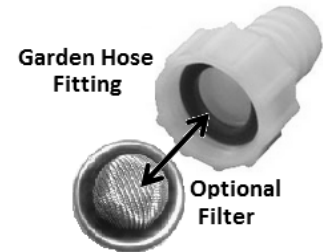
NW- 1.0.0 VALVE ERROR = 0

- a) Figure below, ENSURE the Vent Tubing is NOT kinked, INCLUDING the short segment going back to the Float!



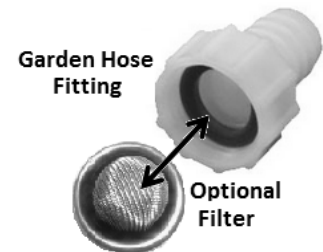
- b) Is the machine attached to a PORTABLE RO? TWO (2) possible scenarios 1) or 2) next page:

- 1) **IF (and ONLY if) NOT attached to a PORTABLE RO:** See procedure number [NW- 1.0.1](#) (page 142).
- 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 2008K/K² 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 2008K/K² machine.
 - f) If a valve is present, between the RO and the 2008K/K², ENSURE it is open!
 - g) Proceed to **page 143**, procedure number [NW- 1.0.2](#).



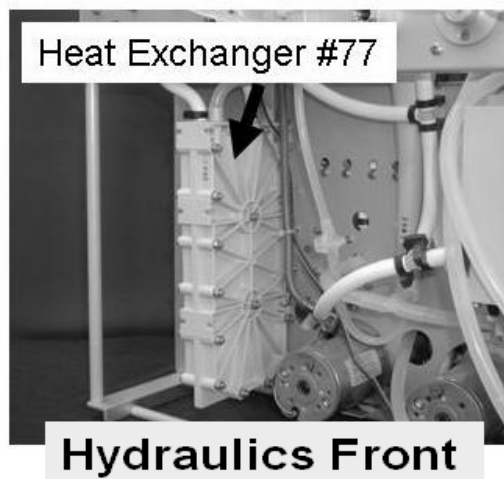
NW- 1.0.1 NOT ATTACHED TO A PORTABLE RO

- 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. 2008K/K² 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 2008K/K² machine.
- f) ENSURE the station’s water valve is open!
- g) See procedure number [NW- 1.0.2](#) (page 143).



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 143).
- 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 148**, 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 143).

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 144).
- 2) **ALL OTHER Programs including Dialysis:** Proceed to **page 146**, procedure number [NW- 1.0.10](#).

NW- 1.0.5 “NO WATER” IN HEAT DISINFECT / ISOLATE RINSE PROGRAM

- a) Press ‘Escape’ TWICE then ‘CONFIRM’ TWICE to call the “Select Program” screen!
- b) Place the machine into RINSE (NOT HEAT DISINFECT)!**
- c) Allow one (1) 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 146**, 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 144).

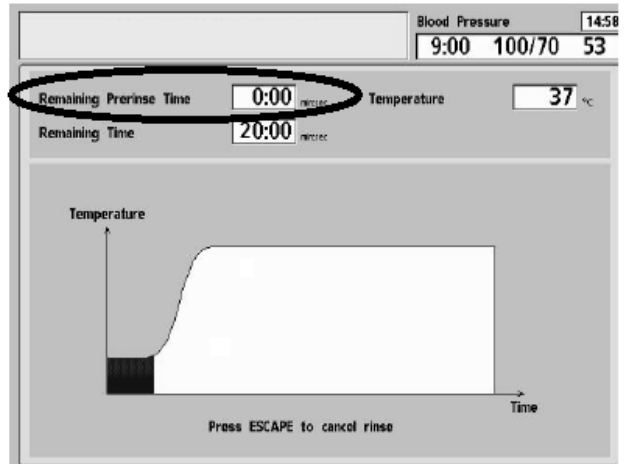
NW- 1.0.6 IN RINSE “NO WATER” DOES NOT REOCCUR

- a) Press ‘Escape’ then ‘CONFIRM’ twice to call the “Select Program” screen.
- b) Place the machine in 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 144).



NW- 1.0.7 REMAINING PRERINSE DOES NOT = 0:00

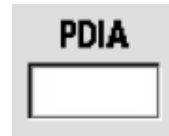
WITHOUT LOOKING AWAY, watch for four (4) FULL minutes OR until if a “No Water” alarm EVER reoccurs?

Yes “No Water” alarm reoccurs! See procedure number [NW- 1.0.8](#) (page 145).

No “No Water” DOES NOT reoccur! DO NOT continue but close the shunt door!

NW- 1.0.8 IN HEAT DISINFECT “NO WATER” REOCCURS

- a) Call debug screen 4. If debug does not appear press ‘Escape’ then call screen 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.



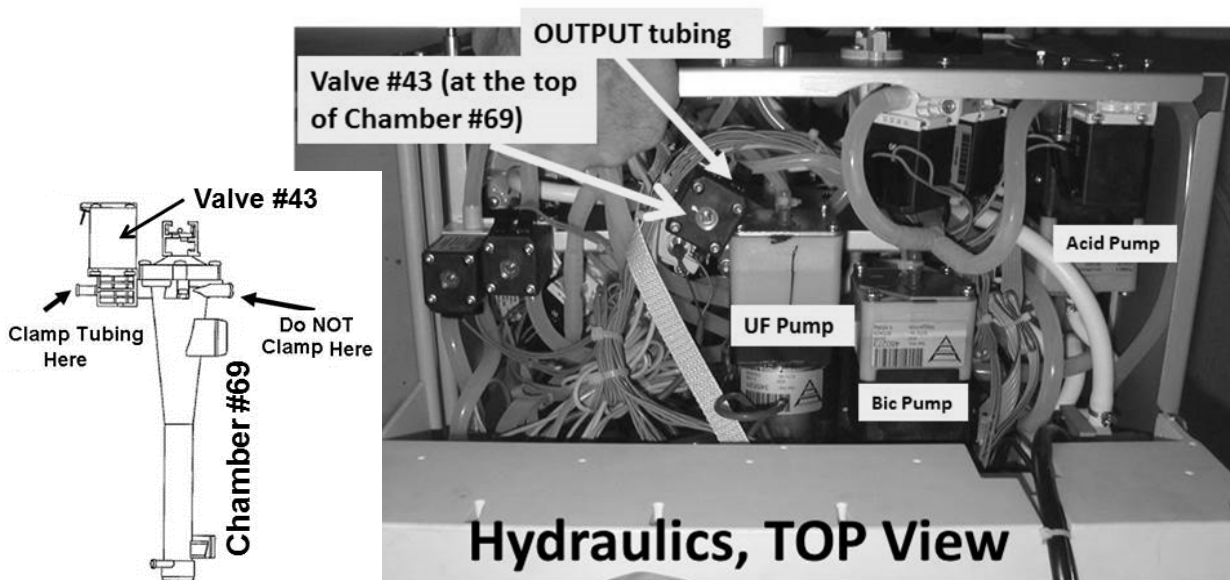
* In Heat Disinfect Valve #43 automatically cycles between closed and open

- 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 146).

No **PDIA** REMAINS ALWAYS more than 0.1! See parts a AND b below:

- a) **CAREFUL HERE! Per the Figure below** double clamp Valve #43's OUTPUT tubing. **NOTE:** Valve #43's output tubing extends towards the front of the machine!



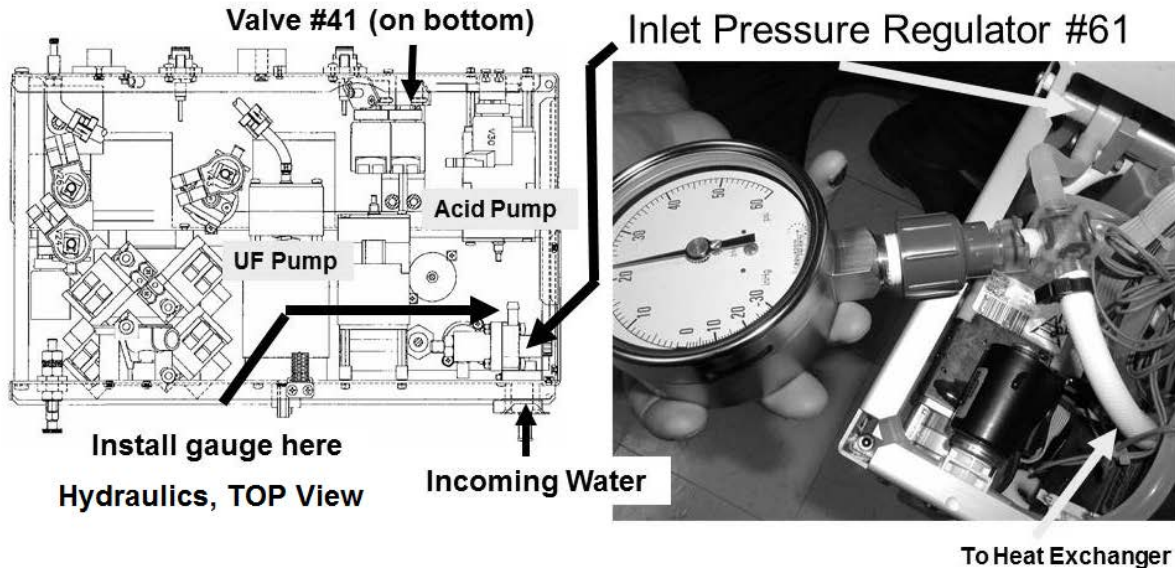
- b) Watch **PDIA** again for forty five (45) seconds. Does it NOW cycle to 0.0?

Yes **PDIA** now cycles to 0.0! **Remove the clamps!** TWO (2) possible bad components: **1)** Valve #43; **2)** Actuator-Test Board.

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 146).

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 148**, procedure number [NW- 2.0.0](#).
- 2) **IF Valve #41's 'dot' is remaining white OR cycles between white and blue!** TWO (2) possible scenarios below:

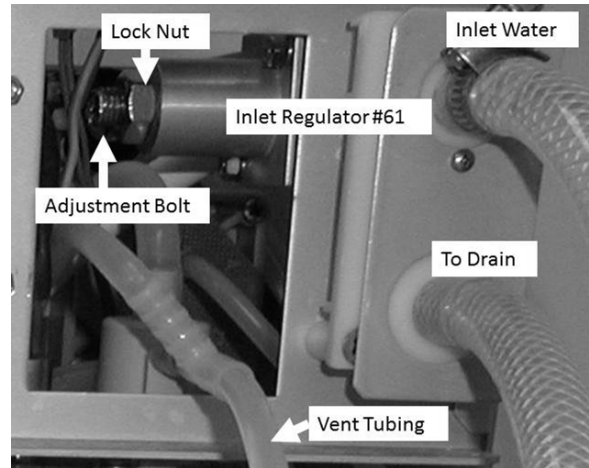
Scenario #1: IF (and ONLY if) REMAINING white: If (and ONLY if) a "No Water" alarm NEVER reoccurs whatever was causing the problem is no longer present! If a "No Water" alarm does reoccur see Scenario #2 below.

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) FULL minutes 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 147).
- 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 151**, 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:

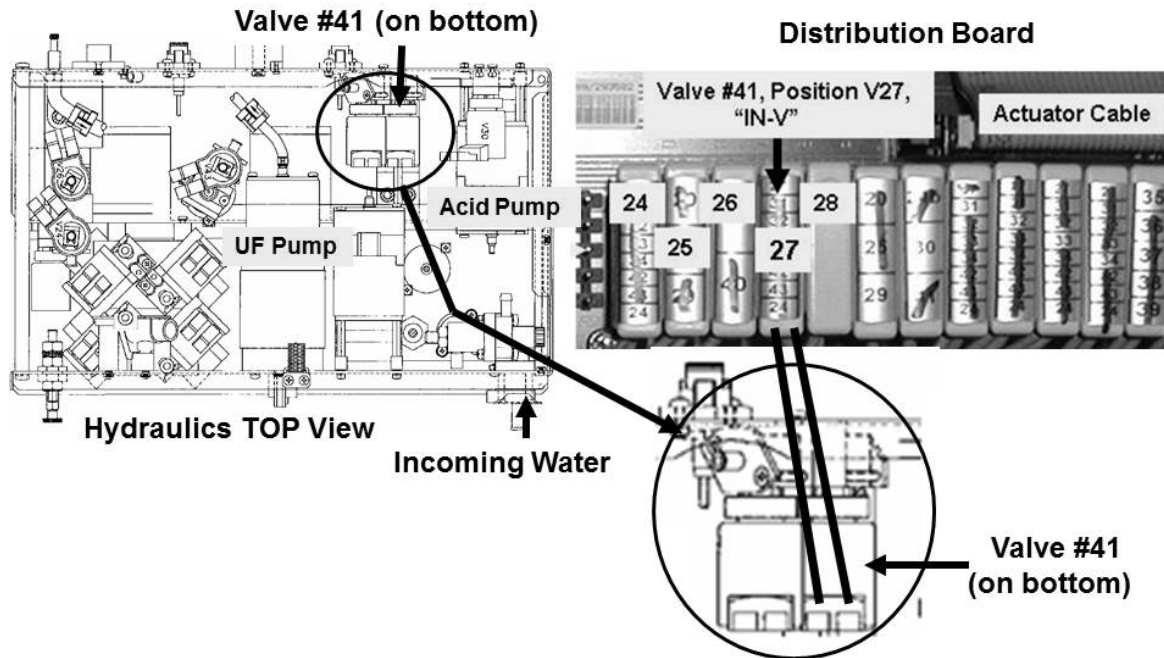


- 1) **IF (and ONLY if) MORE THAN 18 psi CAN BE achieved**: **A)** Adjust Regulator #61 until the PEAK is between 18 and 20 psi; **B)** Return to (ABOVE) procedure number [NW- 1.0.12](#) (**page 146**).
- 2) **IF MORE THAN 18 psi CANNOT be achieved**: ASSUMING incoming water has remained more than 1000 every minute, Inlet Pressure Regulator #61 may be bad.

LEFT BLANK INTENTIONALLY

NW- 2.0.0 VALVE #41'S 'DOT ALWAYS BLUE = CONSTANT "NO WATER" ALARM

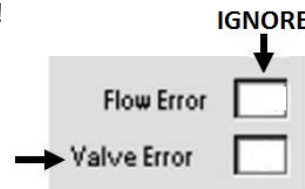
a) Figure below, ENSURE Valve #41's connector is plugged PROPERLY into distribution board position "V27, IN-V".



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 OR 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 146)**. 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 **Error!** TWO (2) possible scenarios:



Scenario #1: IF (and ONLY if) Valve Error = 0! See procedure number **NW- 2.0.1 (page 149)**.

Scenario #2: IF Valve Error EVER = 1 longer than two (2) seconds! Refer to the Table below:

If the machine is CURRENTLY in:	Your response
Dialysis Program i.e. connected to acid and bicarbonate	Proceed to page 652, Section 26
A Cleaning / Disinfection Program (Rinse, Heat Disinfect, etc.)	Proceed to page 189 , 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.
- d) **TURN THE WATER ON!**
- e) **WARNING! Using a plastic clamp here will cause error!** 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 151**, 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 149).

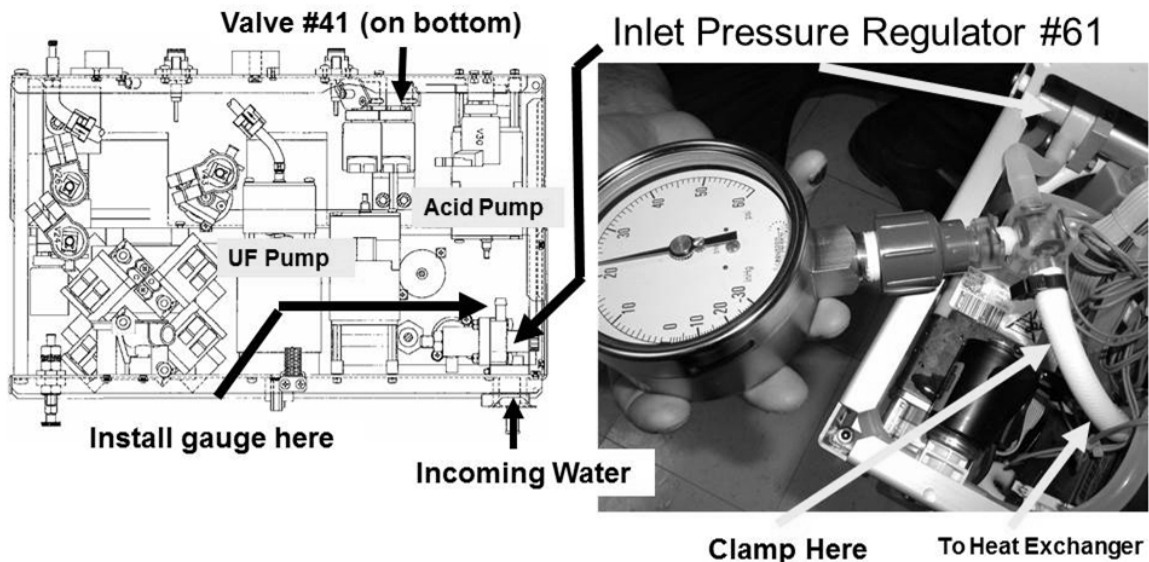
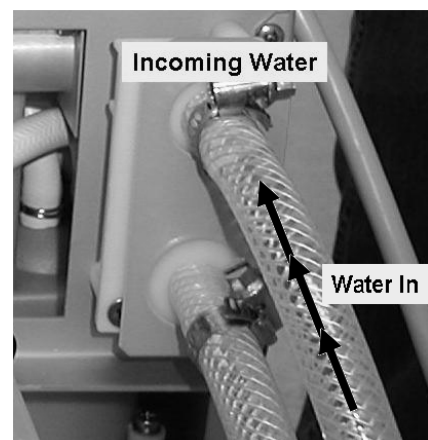


Figure 30 – Hydraulics Top View

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 150).

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

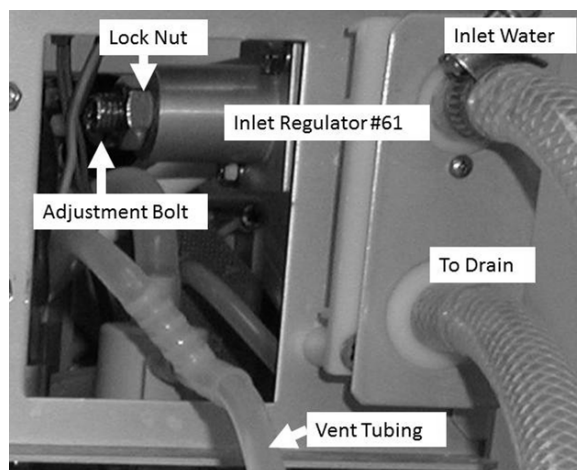
a) TURN THE WATER OFF and reattach the Incoming Water Tubing.

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 149).

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 143**). If the "No Water" alarm NEVER occurs there is no need to continue!

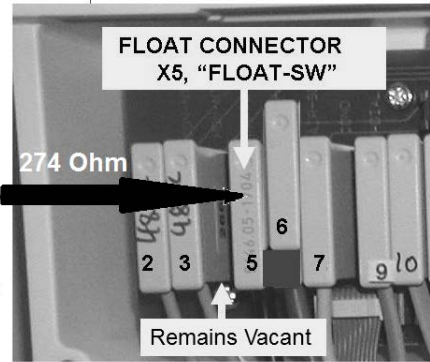
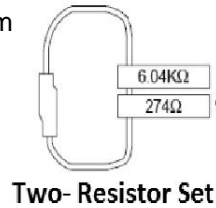
2) **IF 18 psi CANNOT be achieved:** Assuming incoming RO Product flow has remained more than 1000 ml every minute, Inlet Pressure Regulator #61 may be bad.

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 152).

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 151) 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 indicating the last component swapped in is the problem.

Component List: 1) Actuator-Test Board¹; 2) Sensor Board^{1,2}; 3) Sensor Board cable; 4) Distribution board; 5) Motherboard. .

¹ To LOCATE the boards refer to [Figure 4A](#) (page 9).

² To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**)

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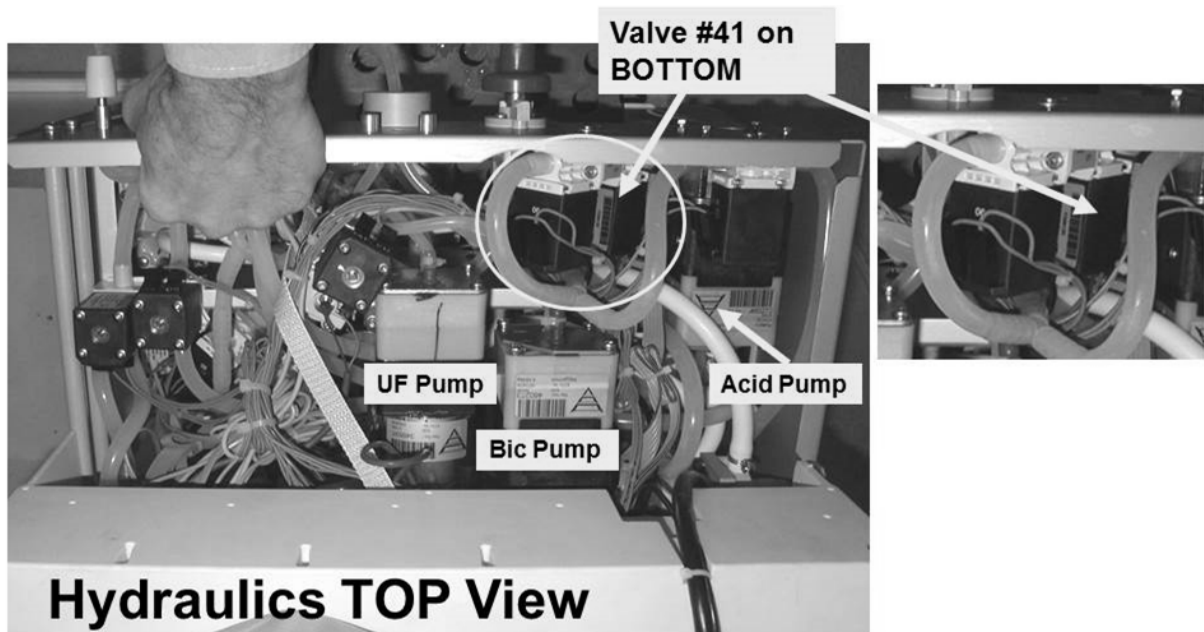
NW- 4.0.0 ISOLATE INCOMING WATER VALVE #41

- 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 153).

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 192**, [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.

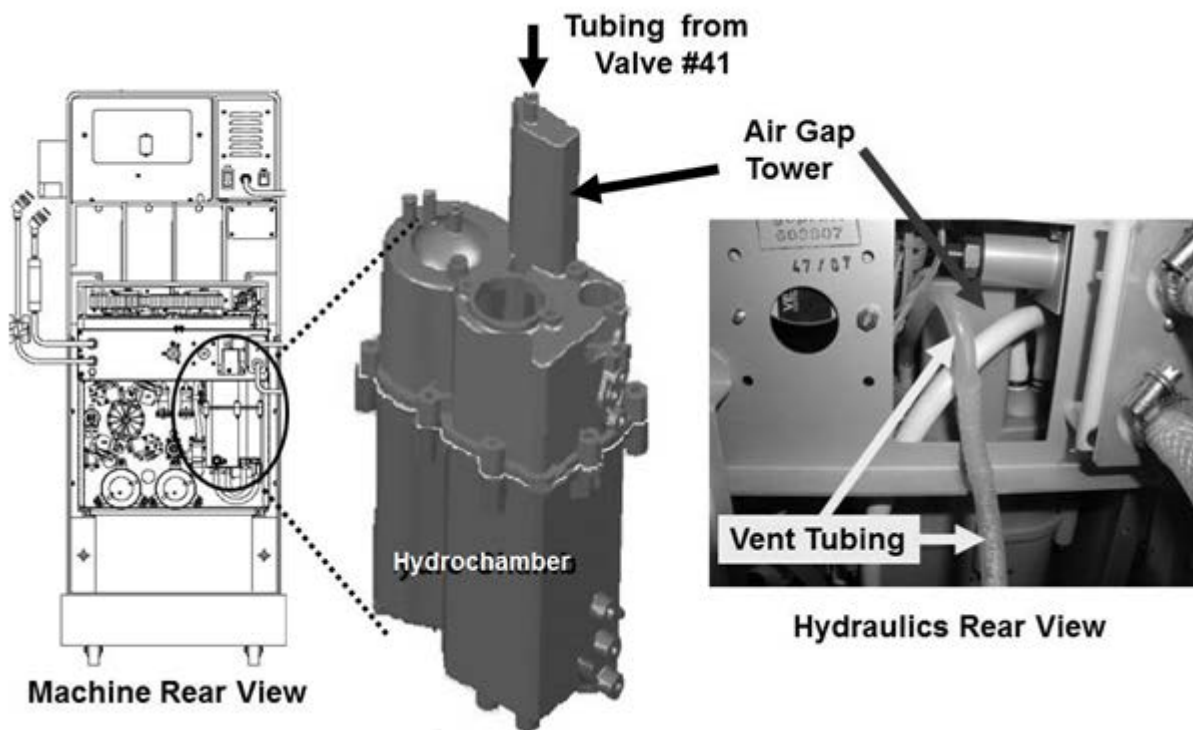
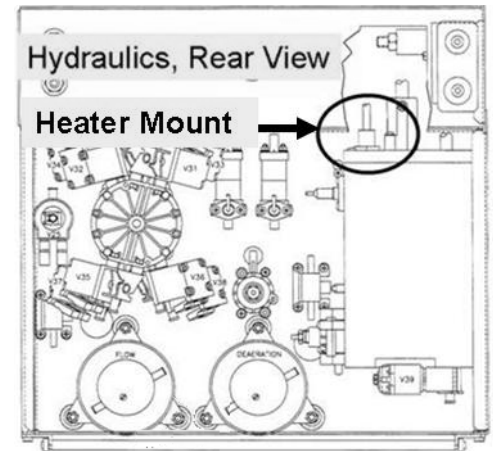
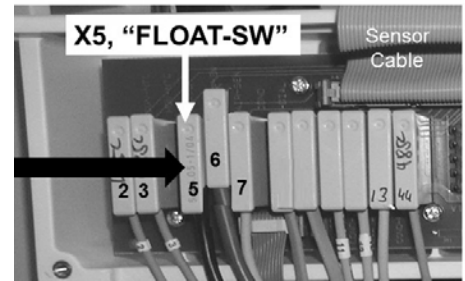


Figure 31 – Inlet Water Tubing

- 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 154).
 - 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 129).

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 20**, [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 ‘Escape’ then ‘CONFIRM’ 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?

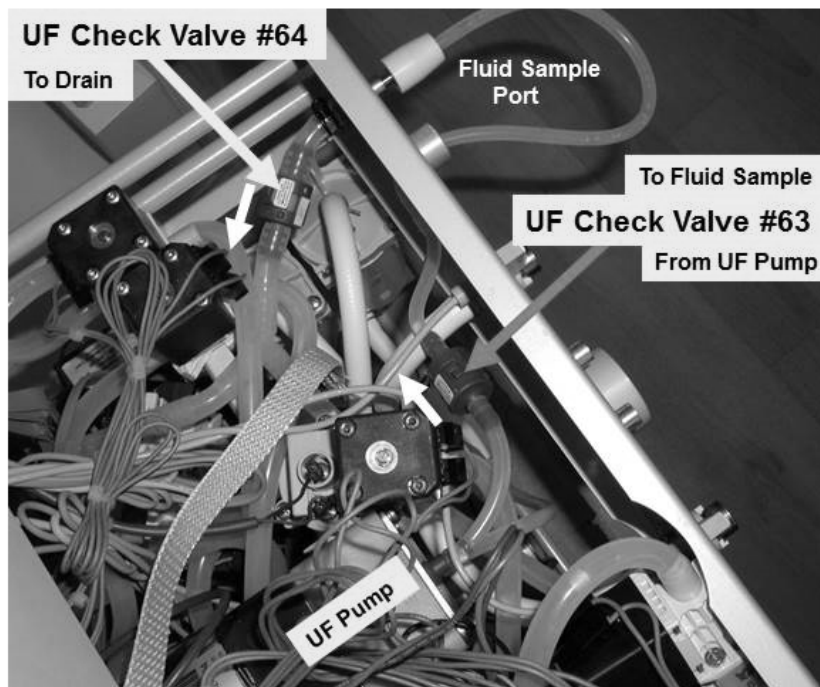
Yes Tubing ‘blew’ off OR an active leak! See procedure number [CLEAN- 1.0.0](#) (page 155).

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 157**, procedure number [CLEAN- 1.0.5](#).

Hydraulics Top View

**UF Check Valves
#63 and #64**

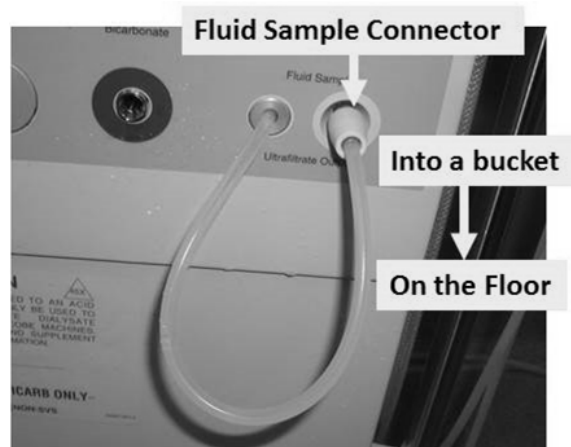


CLEAN- 1.0.0 UF CHECK VALVE TUBING ‘BLOWING OFF’ OR LEAK

- 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) Below 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 'Escape' then 'CONFIRM' to Interrupt the program!
- f) See procedure number [CLEAN- 1.0.1](#) (page 156).



CLEAN- 1.0.1 ISOLATE RESTRICTION

- a) 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!



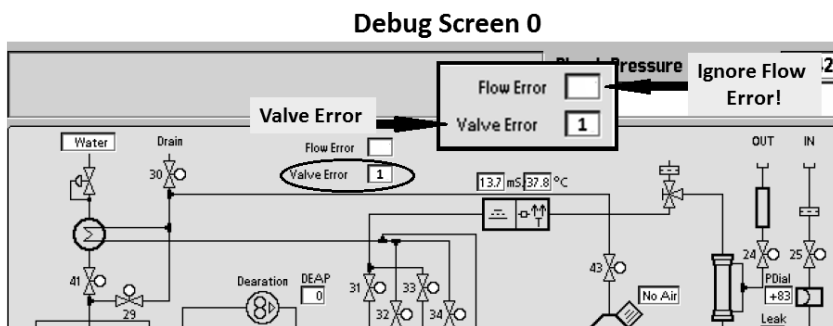
- c) Allow up to four (4) minutes OR until if a leak reoccurs. TWO (2) possible scenarios below:

- 1) **IF (and ONLY if) NO leaks!** Proceed to **page 157**, procedure number [CLEAN- 1.0.5](#).
- 2) **IF a leak reoccurs!** With the "Interrupted" banner up, see procedure number [CLEAN- 1.0.3](#) (page 156).



CLEAN- 1.0.3 LEAK OCCURS

- a) Call debug screen 0 (Figure right). If debug does not appear press 'Escape' then call screen 0.
- b) Ignoring **Flow Error** watch the **2nd window down, Valve Error** for one (1) minute. TWO (2) possible scenarios:



- 1) **IF (and ONLY if) Valve Error = 0 OR 'blinks to 1' for LESS THAN two (2) seconds:** proceed to **page 562**, procedure number [LEAKING- 4.0.0](#).
- 2) **IF (and ONLY if) Valve Error EVER = 1 MORE THAN (2) seconds:** Proceed to **page 189**, procedure number [CLEAN- 7.0.0](#).

CLEAN- 1.0.5 ISOLATE VERR

NOTE: From here forward, if (and ONLY if) a leak develops, address it first by proceeding to **page 553**, [SECTION 21- HYDRAULIC LEAKS](#)

- a) Figure right, ENSURE a “No Water” alarm* NEVER occurs!

Status bar with a “No Water” banner



* From here forward, 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?

Debug Screen 1

AMIN		AMAX		HI ART	AART	BYERR	NO EOS	FLWP	PHTACT
14.81	15.41	0	0	0	0	0	0	0	0
BMIN		BMAX		LO ART	AVEN	BYPASS	ALWEOS	DEAP	NPHT
31.00	32.26	0	0	0	0	0	0	0	639
A160		B160		HI VEN	ATMP	FILACT	FILSTA	TEMP	PHTO
5412	5412	0	0	0	0	0	0	0	0
A220		B220		LO VEN	ART	DOUBLE	ACT BLD	5V EST.	PHT1
7786	7786	0	261	0	0	0	0	0.0	VERR
APV		BPV		HI TMP	VEN	FLWOFF	OTMP	12V EST.	= 0?
7557	15818	0	261	0	181	0	0	0.0	0
C TCD		NaRT		LO TMP	TMP	FLVERR	BFLW	SALV	VERR
1330	0:00	0	190	0	358	0	0	0	0

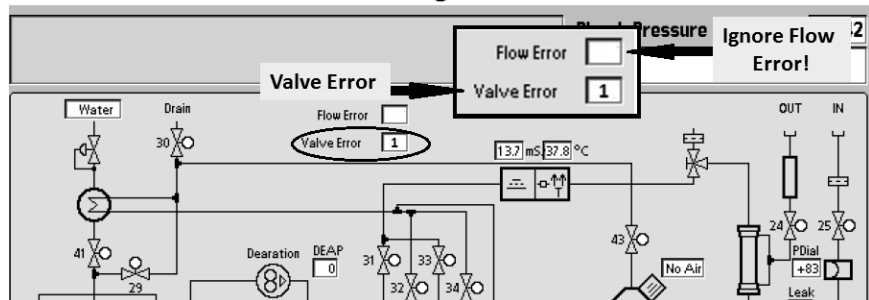
Yes **VERR** = 0! Proceed to **page 158**, procedure number [CLEAN- 1.2.0](#)

No **VERR** = 1 OR more! See procedure number [CLEAN- 1.0.6](#) (page 157).

CLEAN- 1.0.6 VERR = 1 OR MORE

- a) Call debug screen 0 (Figure right).

Debug Screen 0



- b) Ignoring a ‘blink to 1’ that lasts less than two (2) seconds, watch the 2nd window down, **Valve Error** for one (1) minute!

- c) Does **Valve Error** EVER = 1 for LONGER THAN two (2) seconds! TWO (2) possible scenarios:

- 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 206**, [TROUBLESHOOTING VALVE ERRORS IN CLEANING PROGRAMS](#)
- IF Valve Error EVER = 1 LONGER THAN two (2) seconds:** Proceed to **page 189**, procedure number [CLEAN- 7.0.0](#).

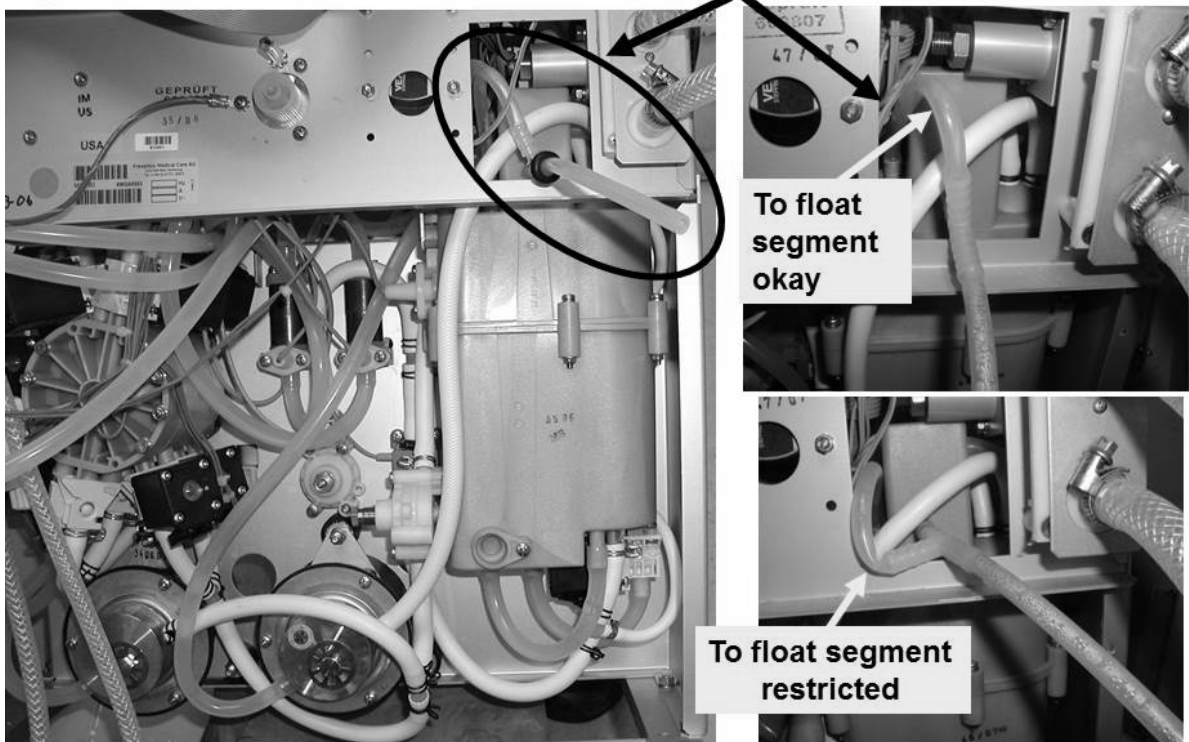
CLEAN- 1.2.0 NO LEAKS / VENT RESTRICTION?

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 159).

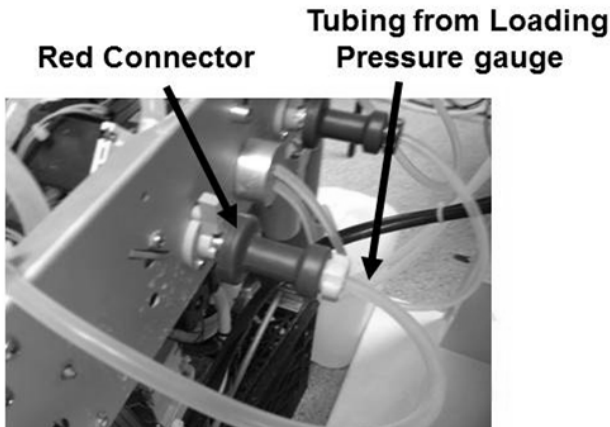
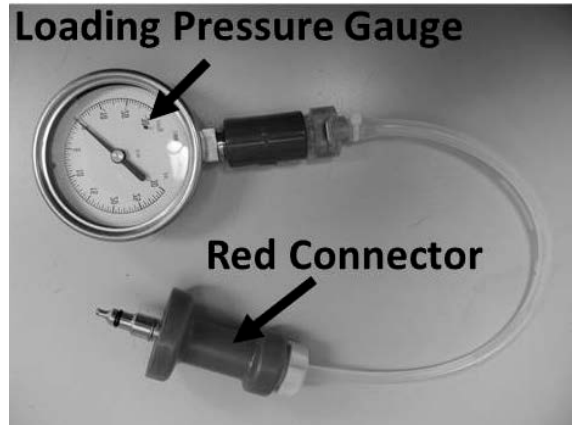
Hydraulics, Rear View

Vent Tubing



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 159).



CLEAN- 1.2.1.1 ISOLATE LOADING PRESSURE (1)

- a) If the "Interrupted" banner (Figure right) IS NOT up continue to part b. If "Interrupted" is up press 'Escape', then depending on where the Flow Error was occurring, return HEAT DISINFECT OR RINSE!
- b) ENSURE no leaks at the gauge!
- c) See procedure number [CLEAN- 1.2.3](#) (page 160).



CLEAN- 1.2.3 ISOLATE LOADING PRESSURE (3)

A) Loading Pressure may or may not be cycling. TWO (2) possible scenarios below:

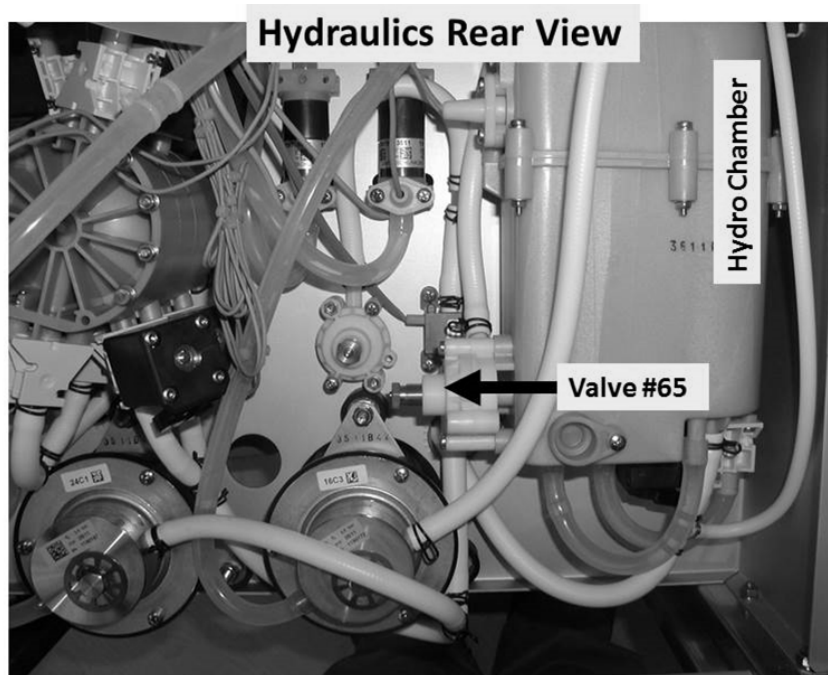
- 1) **IF NOT cycling:** Pressure is 'OKAY' if it REMAINS between 22 and 27 psi. See part B!
- 2) **IF cycling:** It may cycle to but SHOULD NOT remain less than 15 psi. It is 'OKAY' if it EVER cycles to a PEAK of somewhere between 22 and 27 psi. See part B!

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 172**, 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 161).
- 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 172**, 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?

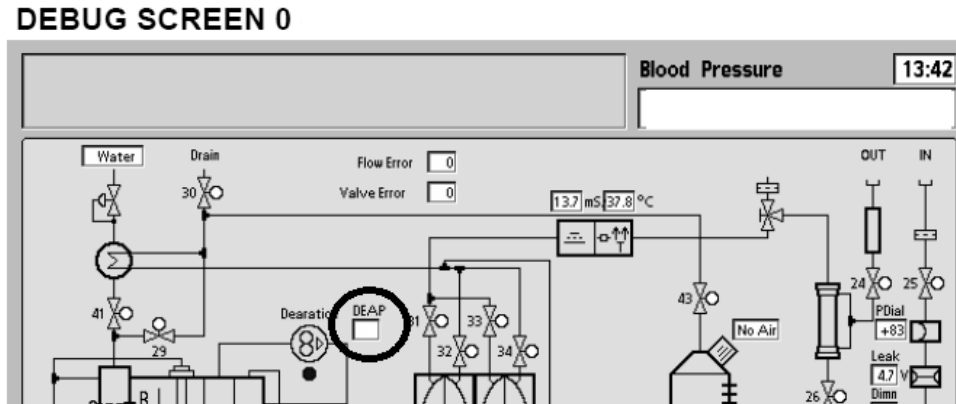
Yes Pressure CAN be adjusted to its PEAK! Allow two (2) minutes then if a Flow Error reoccurs proceed **page 172**, procedure number [CLEAN- 3.0.0](#).

No Loading Pressure remains low! See procedure number [CLEAN- 1.2.33](#) (page 161).



CLEAN- 1.2.33 LOADING PRESSURE REMAINS LOW

- a) Place the machine into RINSE (NOT HEAT DISINFECT)!
- b) Call debug screen 0 (Figure below). If debug does not appear press 'Escape' then call screen 0.



- c) Locate **DEAP**. TWO (2) possible scenarios:

1) **IF (and ONLY if) DEAP = 75 OR less:** See procedure number [CLEAN- 1.2.4](#) (page 162).

2) **IF DEAP = 76 OR more:** See parts a THROUGH i below:

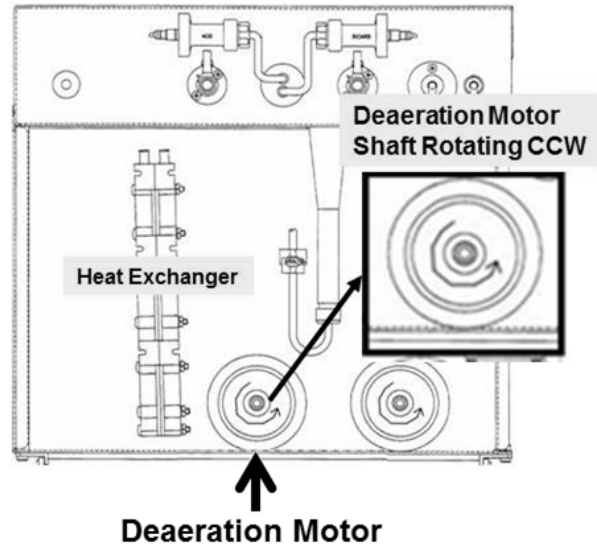
- a) Enter Service Mode → Calibrate Hydraulics → Deaeration Pressure. **DO NOT follow the screen instructions! See part b instead!**
- b) Press 'CONFIRM'. The screen's [**Pump Rate**] window turns yellow.
- c) Select the [**Pump Rate**] window to turn it bright yellow!
- d) Set the [**Pump Rate**] window to "210"!
- e) **Press 'CONFIRM' twice to save the calibration!**
- f) Turn the machine off then back on.
- g) **Place the machine in RINSE (NOT HEAT DISINFECT).**
- h) Call debug screen 0. If debug does not appear press 'Escape' then call debug screen 0.
- i) Is **DEAP** now = 45?

Yes **DEAP** = 45! See procedure number [CLEAN- 1.2.4](#) (page 162).

No **DEAP NOT** = 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) Actuator-Test Board OR; 2) Functional Board EEPROM (IC2) OR; 3) 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 stay in RINSE!**
- b) Figure right, is the Deaeration Motor shaft rotating COUNTERCLOCKWISE (CCW)?



Yes Rotating CCW! See procedure number [CLEAN- 1.2.5](#) (page 162).

No IS 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 130, [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 163).

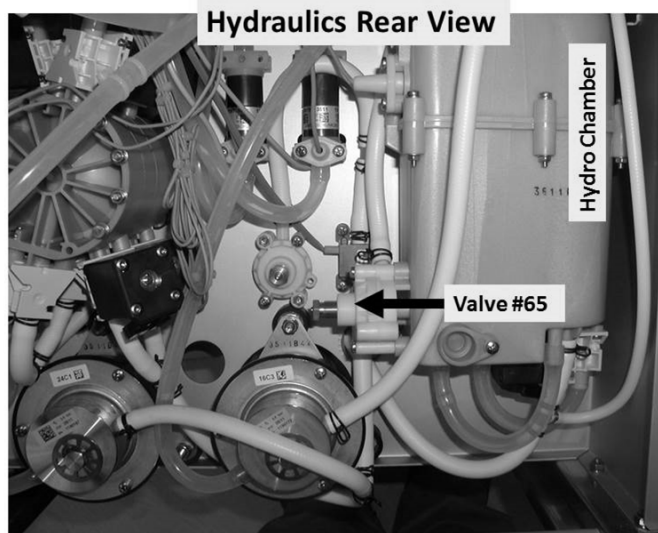
CLEAN- 1.2.6 MOTOR CONTINUES TO ROTATE

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 163).
- 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 172**, 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?

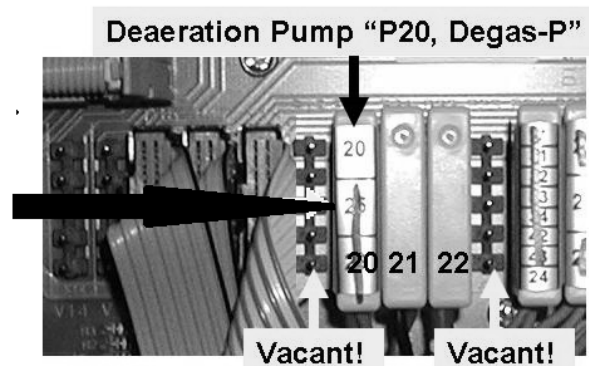
Yes Pressure CAN be adjusted to between 23 and 25 psi! Allow two (2) minutes then if a Flow Error reoccurs proceed **page 172**, procedure number [CLEAN- 3.0.0](#).

No Loading Pressure remains low! Leaving the machine in the Cleaning Program, see procedure number [CLEAN- 1.5.0](#) (page 163).



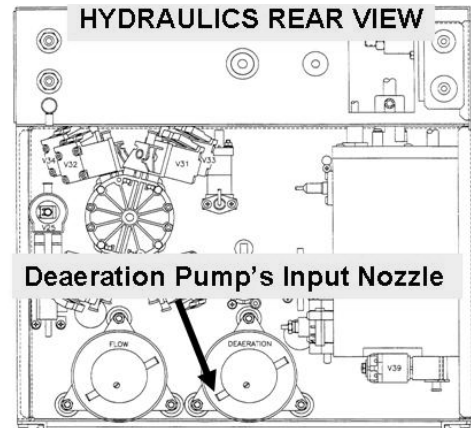
CLEAN- 1.5.0 LOADING PRESSURE REMAINS LOW

- a) Turn the Heater Breaker Switch OFF!
- b) Figure right, unplug the Deaeration Pump from distribution board position, "P20, DEGAS-P".
- c) ENSURE the Deaeration Motor has stopped rotating! **The pump remains unplugged till instructed!**
- d) Obtain a **1000 ml** graduated cylinder and a bucket.
- e) See procedure number [CLEAN- 1.5.1](#) (page 164).



CLEAN- 1.5.1 ISOLATE POSSIBLE AIR LOCKK

- a) **CAUTION!** Fluid and tubing may be HOT!
- b) Figure right, remove the CLEAR TUBING from the Deaeration Pump's Input Nozzle. **To encourage gravity flow, keep the tubing at the level of the pump head!**
- 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- 1.6.0](#) (page 165).

No Less than 300 ml! There may be an airlock between hydrochamber D and the pump. Proceed to **page 166**, procedure number [CLEAN- 2.0.0](#).

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CLEAN- 1.6.0 MORE THAN 300 ML

- a) **Return the tubing to the DEAERATION pump.**
- b) Figure right, return the Deaeration Pump to distribution board position, "P20"!
- c) **ENSURE the DEAERATION MOTOR is running!**
- c) Turn Valve #65's nut (Figure right) clockwise (tighter) attempting to achieve a PEAK Loading Pressure of between 22 and 25 psi?

Yes Between 22 and 25 psi! Proceed to **page 171**, procedure number [CLEAN- 2.4.0](#).

No Less than 22 psi! See parts a AND b below:

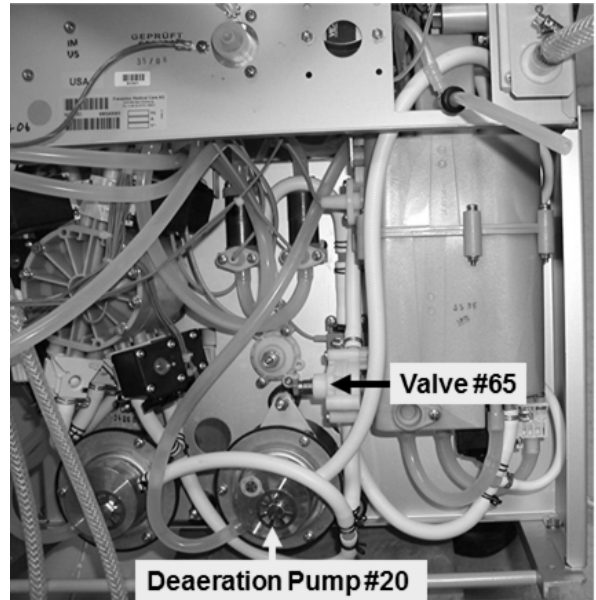
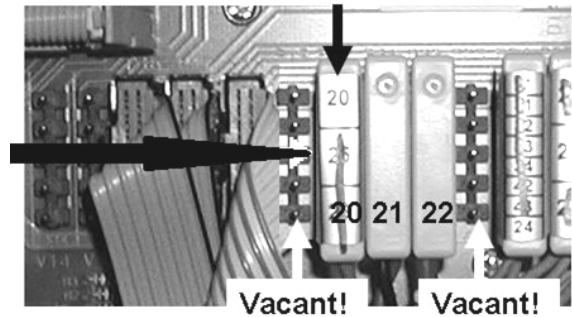
- a) ENSURE more than 300 ml per minute to the Deaeration pump i.e. no recurring air lock!
- b) Swap the following components (see [Component List](#) below) one at a time, with known good, attempting to adjust Loading Pressure. When loading pressure can be adjusted to more than 22 psi the last component swapped in is the problem.

COMPONENT LIST: 1) Deaeration Pump head; 2) Deaeration Motor; 3) Valve #65*; 4) Hydrochamber.

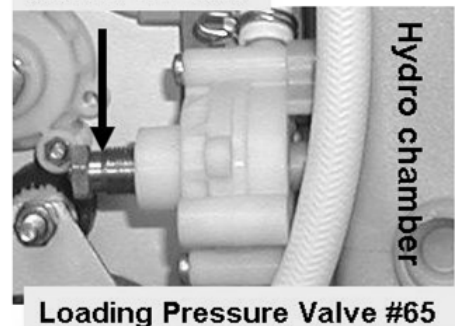
* Figure right, several threads should be visible under Valve #65's nut. If no threads are visible either the wrong spring is installed** under Valve #65's nut OR Valve #65 is bad!

** Refer to [Figure 6](#) (page 19).

Deaeration Pump "P20, Degas-P"



Visible Threads



CLEAN- 2.0.0 LESS THAN 300 ML PER MINUTE COLLECTED / ISOLATE RESTRICTOR #48

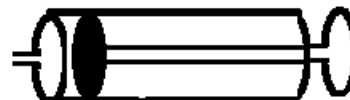
This procedure attempts to clear a DEAERATION PUMP air lock. First Restrictor #48 is checked to see if it is plugged:

- a) Turn the machine off then back on.
- b) Allow the "Select Program" banner to appear but **DO NOT** select any screen buttons! "Select Program" remains up until **INSTRUCTED OTHERWISE!**



- c) Figure right, a **60 ml syringe**, with its plunger pushed in fully, is **REQUIRED!** Using a smaller syringe may cause error!

60 ml Syringe with plunger all the way in



- d) Attach the syringe to the Deaeration Pump's CLEAR (INPUT) 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 felt?

Yes ↑ Very strong resistance! Restrictor #48 is plugged with debris¹. 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.

NOTE: After the repair (i.e. good loading pressure achieved) see procedure number [CLEAN- 2.4.0](#) (page 171).

No ↓ Very little resistance! See part A below:

- A) Remove the syringe and, from the tubing, MEASURE flow for one (1) minute. More than 130 ml collected?

Yes More than 130 ml collected! See procedure number [CLEAN- 2.0.2](#) (page 167).

No Less than 130 ml collected! Perform parts B through D below.

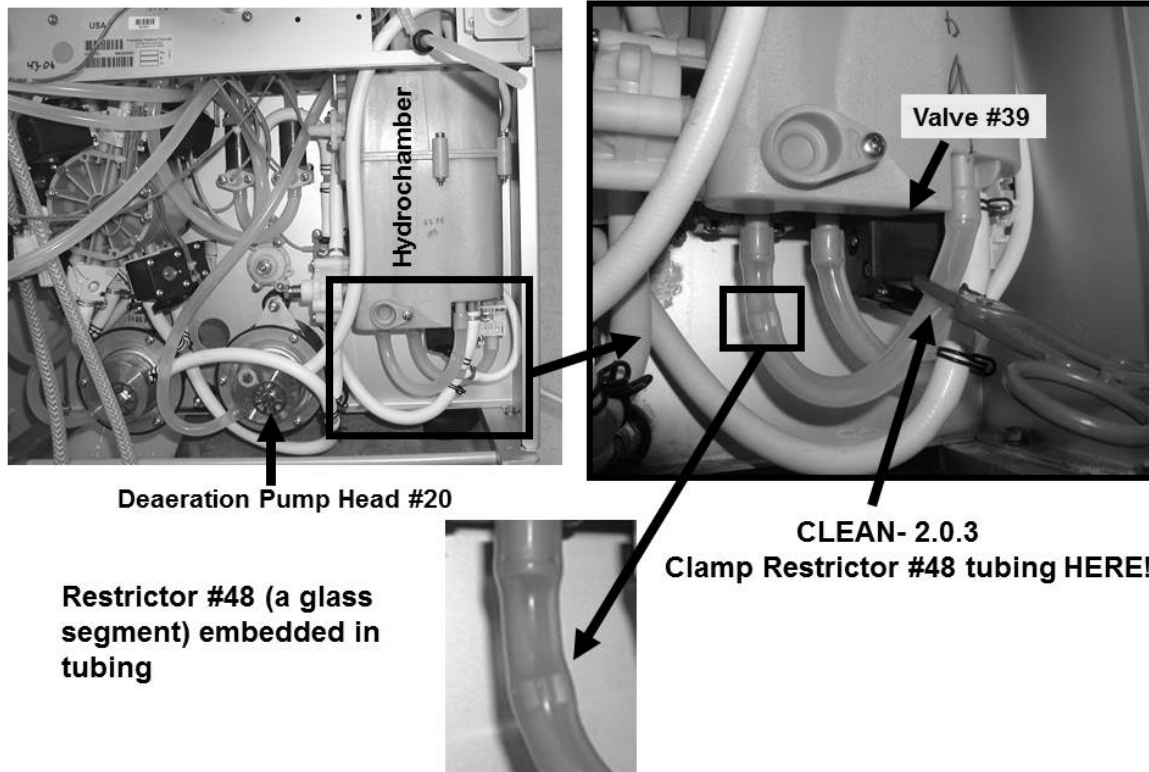
- B) Push the plunger back into the barrel then reattach the syringe to the Deaeration Pump's tubing.

- C) Pull on the plunger to the end of the barrel!

- D) Repeat parts A through D up to **TEN (10) TIMES OR** until you MEASURE more than 130 ml in one minute?

Yes More than 130 ml per minute! See procedure number [CLEAN- 2.0.2](#) (page 167).

No After ten (10) attempts you **CANNOT** achieve more than 130 ml per minute! Proceed to **page 169**, procedure number [CLEAN- 2.1.0](#).



CLEAN- 2.0.2 MORE THAN 130 ML

Direct the tubing into a bucket for up to FIVE (5) FULL minutes. Flow will either: **1) Continue** at more than 130 ml per minute OR **2) Stop**. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) flow continues at 130 ml per minute:** See procedure number [CLEAN- 2.0.3](#) (page 167).
- 2) **IF flow STOPS:** Proceed to **page 169**, procedure number [CLEAN- 2.1.0](#).

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 at the LOCATION SHOWN!
- b) Direct the Deaeration Pump's clear tubing into the 1000 ml cylinder.
- c) **If the Flow Error was occurring in Heat Disinfect return to it! If not place the machine in RINSE!**
- 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 168).

No Less than 200 ml! Valve #39 may be bad! See parts a AND b below:

- 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 167). Whhen more than 200 ml is collected 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 board ribbon cable; **4)** Distribution board.

CLEAN- 2.0.4 MORE THAN 200 ML PER MINUTE/ VALVE #39 IS OKAY

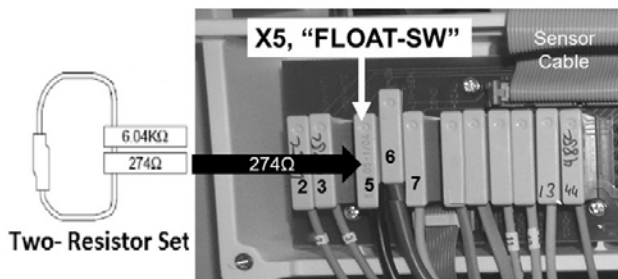
If all procedures were performed correctly you have determined good flow through Restrictor #48 AND Valve #39 i.e. more than 300 ml per minute to the Deaeration Pump. See parts a and b below:

- a) **Remove the clamp from Restrictor #48's tubing!**
- b) Return to **page 165**, procedure number [CLEAN- 1.6.0](#).

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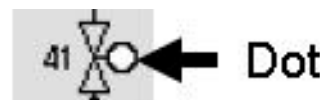
CLEAN- 2.1.0 ISOLATE INCOMING WATER FLOW

- Figure right, place the **274 Ω** plug, from the **TWO-RESISTOR SET**, into the float's distribution board position, "X5, FLOAT-SW".
- Allow forty (40) seconds OR until flow from the Vent Tubing occurs indicating hydrochambers A through C are full!
- MEASURE 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 [CLEAN- 2.1.1](#) (page 169).

No Nowhere near 800 ml per minute! Call debug screen 0. Figure right, is Valve #41's 'dot' BLUE?

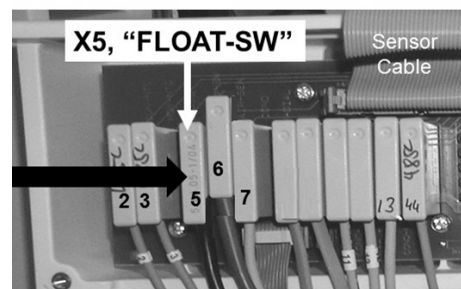


Yes 'Dot' = Blue! **A)** Reattach the Deaeration Pump's tubing; **B)** Proceed to **page 141**, [SECTION 2 – NO WATER ALARM](#)

- No 'Dot' = White!
- 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 (ABOVE) procedure number [CLEAN- 2.1.0](#) (page 169)!
 - 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

- Figure right**, return the float's connector to distribution board position, "X5, FLOAT-SW".
- Attach the **60 ml syringe**, with the plunger pushed fully in, to the Deaeration Pump's clear (INPUT) tubing.
- PULL on the plunger. If Restrictor #48 is still open, you will feel very little resistance and can pull the plunger to the end of the barrel!
- 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!** After no less than ten (10) attempts do measure more than 130 ml per minute?



Yes More than 130 ml! See procedure number [CLEAN- 2.1.2](#) (page 170).

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 129).

CLEAN- 2.1.2 ISOLATE FLOAT SWITCH #5

- a) This procedure requires up to **four (4) 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 per minute **OR** **2)** Stop. TWO (2) possible scenarios:
- 1) IF (and ONLY if) flow continues at 130 ml or more every minute:** Return to (ABOVE) procedure number [CLEAN- 2.0.3](#) (page 167).
 - 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 129)

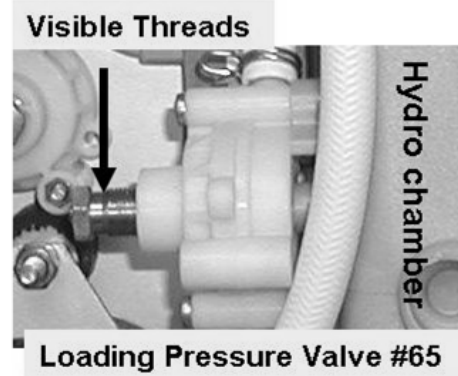
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CLEAN- 2.4.0 LOADING PRESSURE WITHIN RANGE

- 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 19)

- c) To monitor for intermittent Loading Pressure problems leave the gauge installed in the Rinse port.



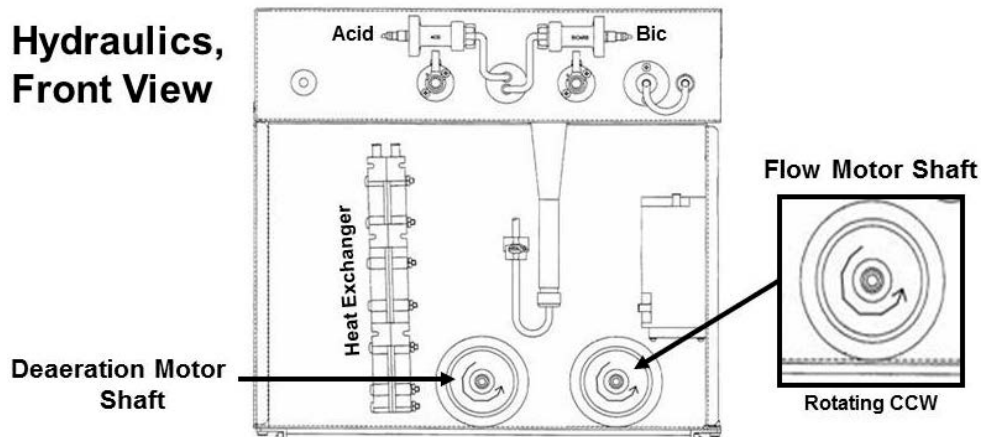
NOTE: Ignore Vent tubing overflow for now!

- 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 NEVER reoccurs!** 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 172).
 - 3) **IF (and ONLY if) a Flow Error reoccurs AND Loading Pressure goes below 22 psi:** Return to (ABOVE) procedure number [CLEAN- 1.2.4](#) (**page 162**).

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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 130**, [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 possible bad components: **1)** Bad Deaeration Motor (possibly brushes) OR; **2)** Bad Deaeration Pump head.

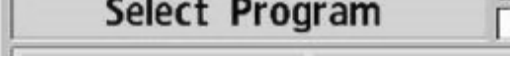
No The motor does NOT stop! Perform parts a AND b below:

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 ‘Escape’ TWICE then ‘CONFIRM’ TWICE.
- 2) **IF a debug screen is not up:** Call “Select Program” by pressing ‘Escape’ ONCE then ‘CONFIRM’ TWICE.

b) See procedure number [CLEAN- 3.2.0](#) (page 173).

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. Fluid and tubing 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 173).

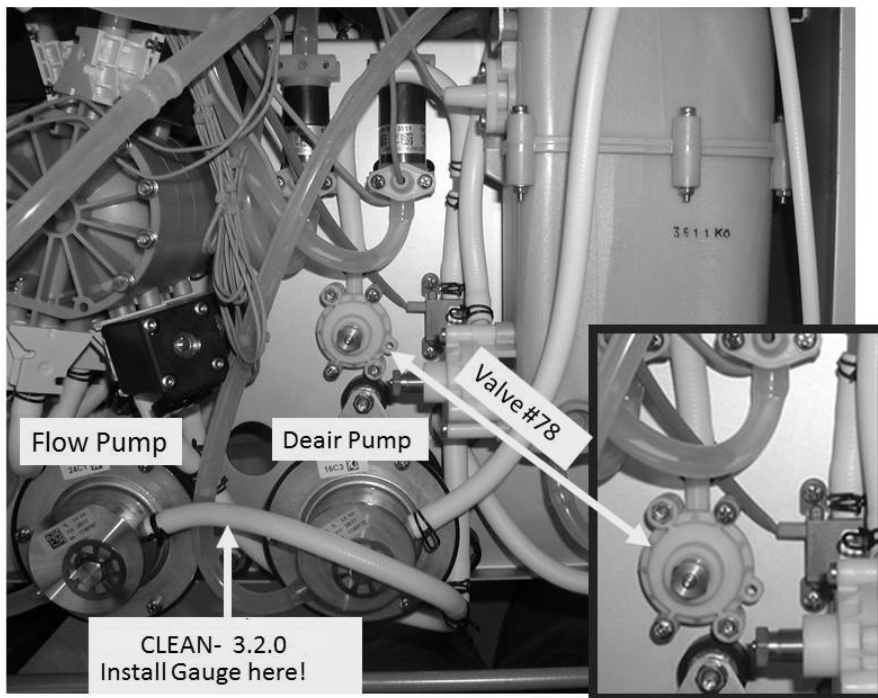
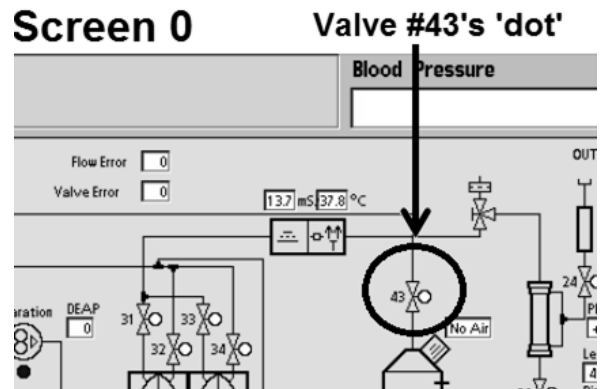


Figure 32 – Flow Pump / Valve #78

CLEAN- 3.2.1 ISOLATE FLOW PUMP PRESSURE (2)

- a) Call debug screen 0 (Figure right). If debug does not appear press ‘Escape’ 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 175**, 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 158), 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?

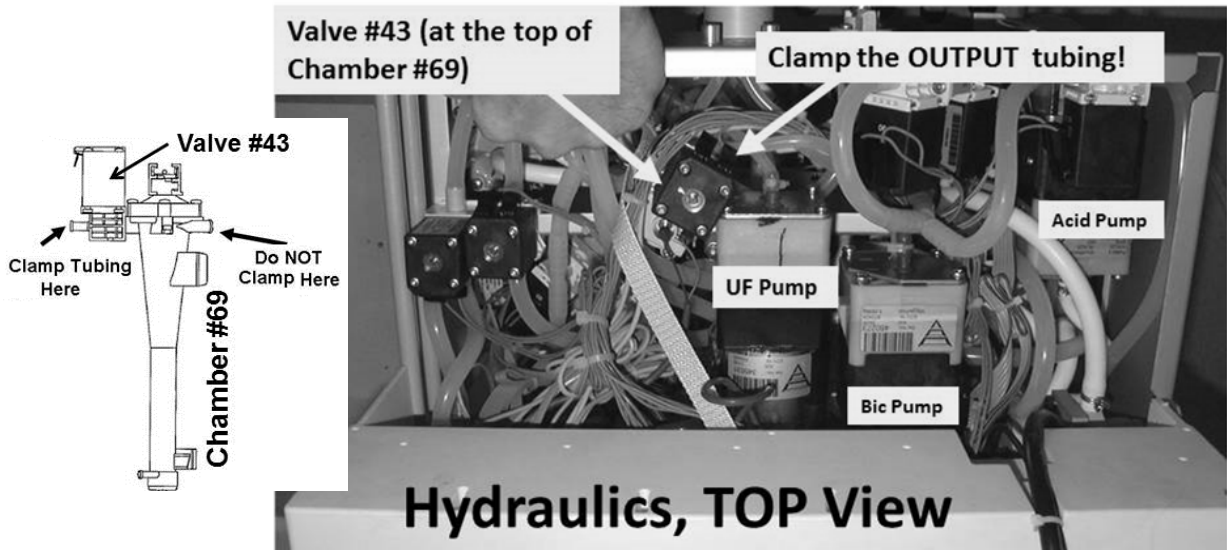
Yes Pressure between 34 and 36 psi! Allow two (2) minutes then, if a Flow Error reoccurs, proceed to **page 175**, procedure number [CLEAN- 4.0.0](#).

No Pressure DOES NOT adjust. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) pressure remains low:** See procedure number [CLEAN- 3.2.2](#) (page 174).
- 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) Bad Actuator-Test Board OR; 2) Bad Valve #43.

No Remains less than 34 psi! Leaving the clamps in place, proceed to **page 94** procedure number [F- 9.0.24](#).

CLEAN- 4.0.0 GOOD FLOW PUMP PRESSURE / ISOLATE THE CLEANING PROGRAM

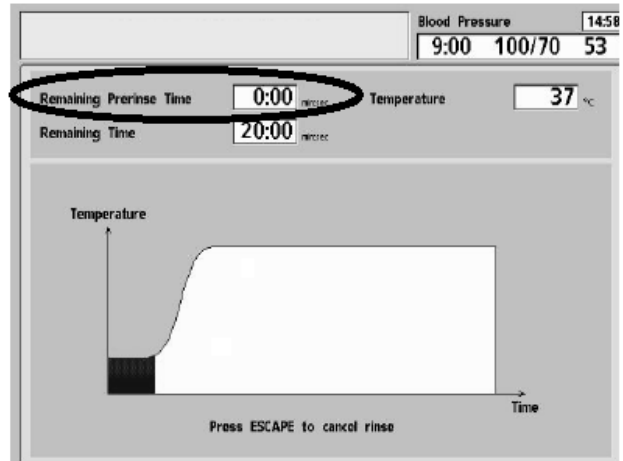
- a) Leave the gauge installed **ENSURE** its tubing is NOT kinked (restricting flow)!
- b) **Open the shunt door and LEAVE IT OPEN until instructed!!**
- c) Leaving the machine in whatever Program it is CURRENTLY in: **1) Rinse? OR 2) Heat Disinfect?**
 - 1) **IF (and ONLY if) in RINSE:** Proceed to **page 184**, procedure number CLEAN- 5.0.0.
 - 2) **IF in HEAT DISINFECT:** See parts a AND b below:

a) Press 'Escape' 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 175).

No **Remaining Prerinse Time** does NOT = 0:00! Proceed to **page 184**, procedure number CLEAN- 5.0.0.

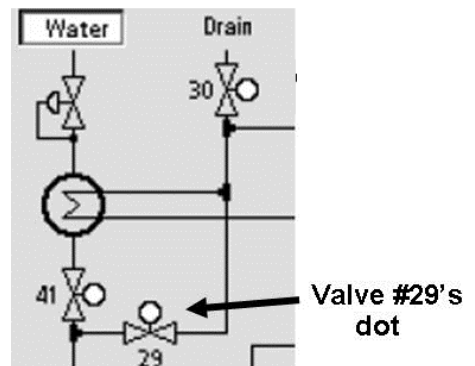


CLEAN- 4.2.0 REMAINING PRERINSE TIME = 0:00

- a) Call debug screen 0. If the debug screens do not appear press 'Escape' 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 176).

2) **IF Valve #29's 'dot' is EVER = white:** Proceed to **page 184**, 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 177**, procedure number [CLEAN- 4.3.2](#).

No **VERR** = 1 OR more! See procedure number [CLEAN- 4.3.1](#) (page 176).

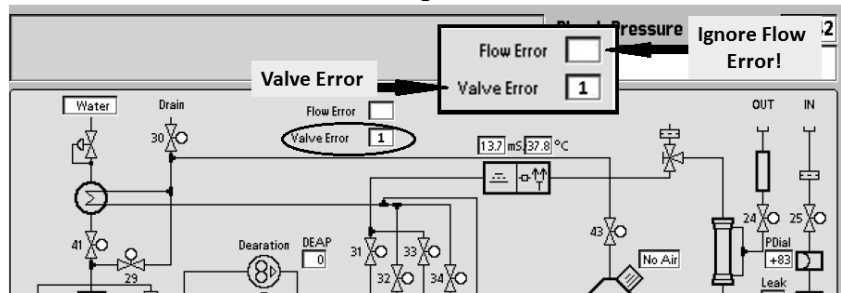
Debug Screen 1

Blood Pressure								13:43
AMIN	AMAX	HI ART	AART	BYERR	NO EOS	FLWP	PHTACT	
14.81	15.41	0	0	0	0	0	0	
BMIN	BMAX	LO ART	AVEN	BYPASS	ALWEOS	DEAP	NPHT	
31.00	32.26	0	0	0	0	0	639	
A160	B160	HI VEN	ATMP	FILACT	FILSTA	TEMP	PHTO	
5412	5412	0	0	0	0	0	0	
A220	B220	LO VEN	ART	DOUBLE	ACT BLD	5V EST.	PHT1	
7786	7786	0	261	0	0	0.0	VERR	
APV	BPV	HI TMP	VEN	FLWOFF	OTMP	12V EST.	= 0?	
7557	15818	0	261	0	181	0.0	0	
C TCD	NaRT	LO TMP	TMP	FLVERR	BFLW	SALV	VERR	
1330	0:00	0	190	0	358	0	0	

CLEAN- 4.3.1 VERR = 1 OR MORE

- Call debug screen 0 (Figure right).
- Ignoring the top **Flow Error** window, in part c, you will watch the 2nd window down, **Valve Error**.

Debug Screen 0



- 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** EVER = 1 LONGER THAN two (2) seconds! Proceed to **page 189**, 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 206**, [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 180**, procedure number [CLEAN- 4.6.0](#).

No 'Bob' NOT moving! See parts a THROUGH d below:

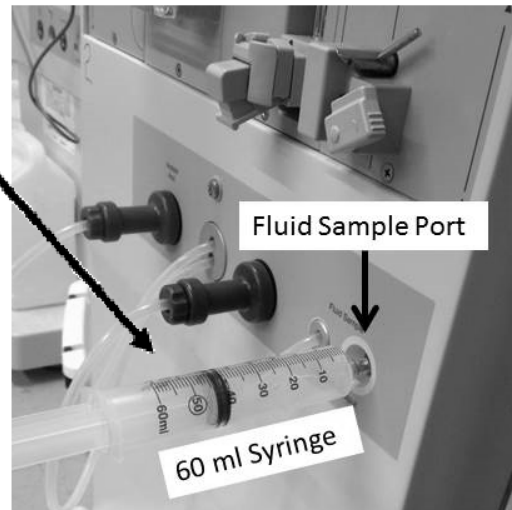
- a) ENSURE no tubing restrictions at the Flow Pump and DiaSafe® filter!
- b) ENSURE Flow Pump Pressure (gauge at Flow Pump) is still PEAKING to between 34 and 38 psi.
- c) ENSURE Loading Pressure (gauge in Rinse port) PEAK pressure remains between 22 and 27 psi
- d) A restriction is indicated! See procedure number [CLEAN- 4.4.0](#) (page 177).

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 178).

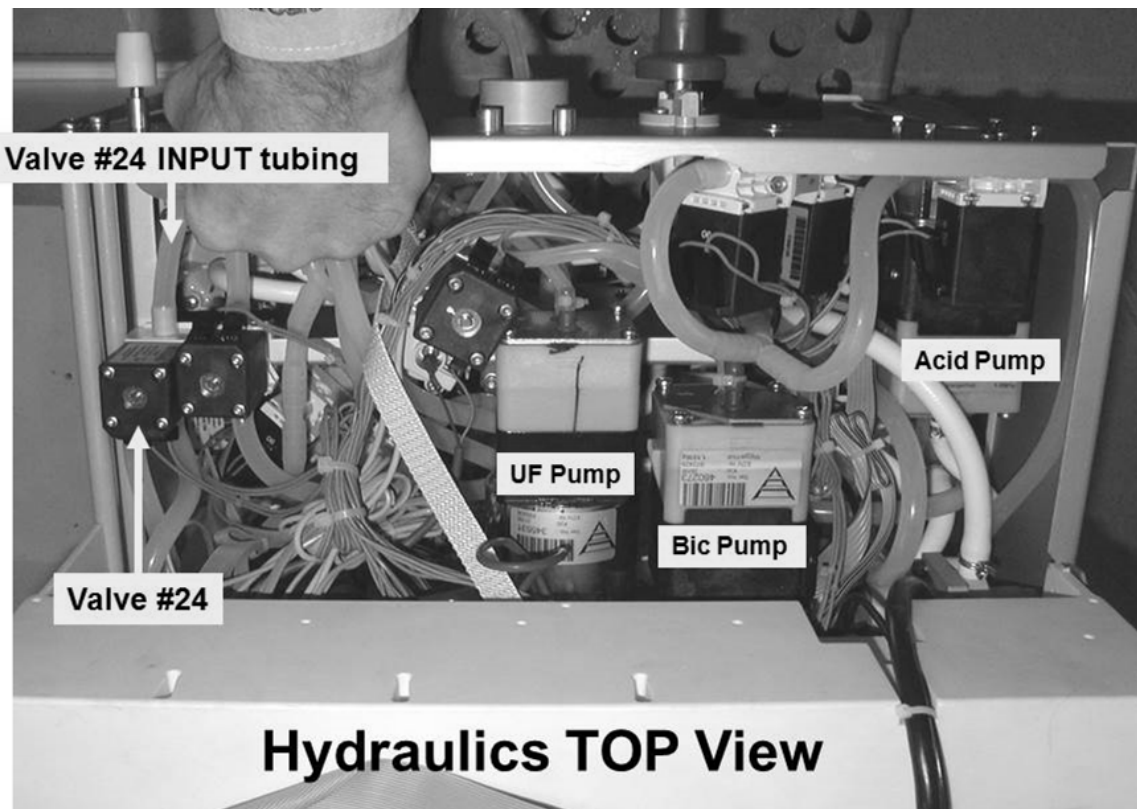
No Significant resistance encountered! **NOTE ONLY VALVE #29** will be checked and proceed to **page 192**, [TROUBLESHOOTING A VALVE](#)



CLEAN- 4.4.1 VALVE #29 OPEN / ISOLATE VALVE #24

- a) A 1000 ml (or larger) graduated cylinder is required below.
- 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 three-hundred (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 179).
- No Less than 300 ml! ENSURING the “Interrupted” banner IS NOT up, see parts a THROUGH c below:
- Return the dialyzer connector to the shunt but **DO NOT** close the door!
 - Per the Figure below**, routing Valve #24’s **INPUT** tubing so that spillage into the hydraulics does NOT occur, REMOVE the tubing and measure from it for thirty (30) seconds.
 - More than three-hundred (300) ml every thirty (30) seconds?
 - More than 300 ml! **A)** Return Valve #24’s tubing. **B) NOTE ONLY** VALVE #24 will be checked and proceed to **page 192, TROUBLESHOOTING A VALVE**
 - Less than 300 ml! See parts a AND b below:
 - Return Valve #24’s tubing.
 - If Loading AND Flow Pressure are still good, FOUR (4) 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 180).

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 192**, **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 'Escape' TWICE then 'CONFIRM' ONCE!



- b) ENSURING the "Interrupted" banner is 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).

Interrupted							Blood Pressure		13:45
							9:00	100/70	53
LEAK	ABPR	RAWT	MODE#	XTMI	NMBP	ABLD			
4.7	5.7	0	0	0	0	0.0			
DIMN	VBPR	GOTT	DOING	XTMO	FDSX	TEMP SET	TEMP	CAL	
4.7	5.7	0	OFF	0	0	127	125		
PART	5V	TSTT	TIME	BPMI	FDSR	AART	A12V		
6.0	5.0	0	0	0	0	0.0	0.0		
PVEN	24V	CURT	DELAY	BPMO	OOF2	AVEN	A24V		
6.0	24.4	0	0	0	0	0.0	0.0		
PDIA	ASET	FAIL#	BP Time	FDSI	OOF4	ADIA	TRIPLE		
5.0	6.0	0	30	0	0	0.0	0.0		
TEMP	VSET	XTRM	CMS	FDSO	OOF6	ATEM	ITRIPLE		
5.0	6.0	0	0	0	0	0.0	0.0		

- 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 BOTH PDIA AND ADIA:

Column 1 PDIA	Column 2 ADIA	Column 3 Your Response
Between 3.0 and 6.0 (Good)	Between 2.0 and 6.0 (Good)	<u>BOTH PDIA</u> and <u>ADIA</u> are good! The Dialysate Pressure sensor is good! See procedure number CLEAN- 4.6.1 (page 181).
Between 3.0 and 6.0 (Good)	Less than 2.0 <u>OR</u> more than 6.0 (Bad)	PDIA good; ADIA bad. THREE (3) possibilities: 1) Bad Actuator-Test Board OR 2) Bad Sensor Board OR 3) Bad Motherboard connection at the Sensor and/or the Actuator-Test Board
Less than 3.0 <u>OR</u> more than 6.0 (Bad)	Between 2.0 and 6.0 (Good)	PDIA bad; ADIA good! THREE (3) possibilities: 1) Bad Sensor Board OR 2) Bad Functional Board OR 3) Bad Motherboard
Less than 3.0 <u>OR</u> more than 6.0 (Bad)	Less than 2.0 <u>OR</u> more than 6.0 (Bad)	BOTH <u>PDIA AND ADIA</u> are bad! Leaving the "Interrupted" banner up, proceed to page 462 , 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 'CONFIRM' 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 182).

- 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:

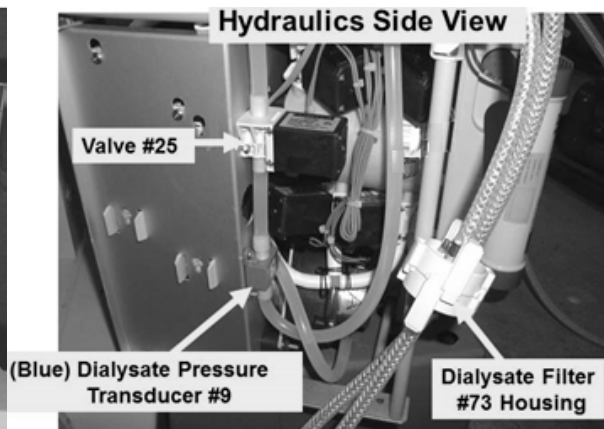
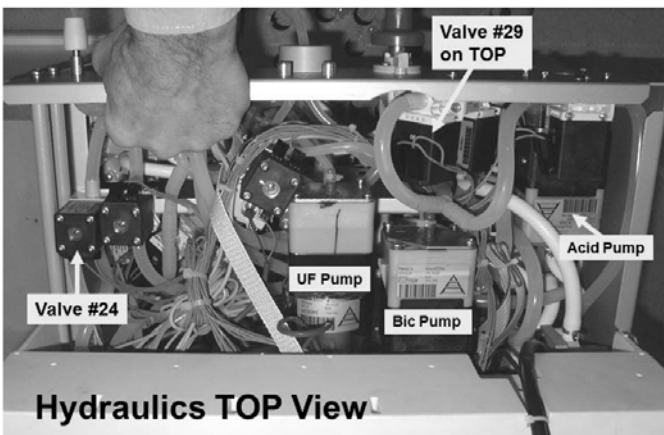
- 1) **IF (and ONLY if) "Flow Recirc Error 1" NEVER occurs:** Whatever was causing the Flow Error is not exhibiting yet! Watch PDIA until either a Flow Error occurs OR Heat Disinfect finishes.

- 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 183**, 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. 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).

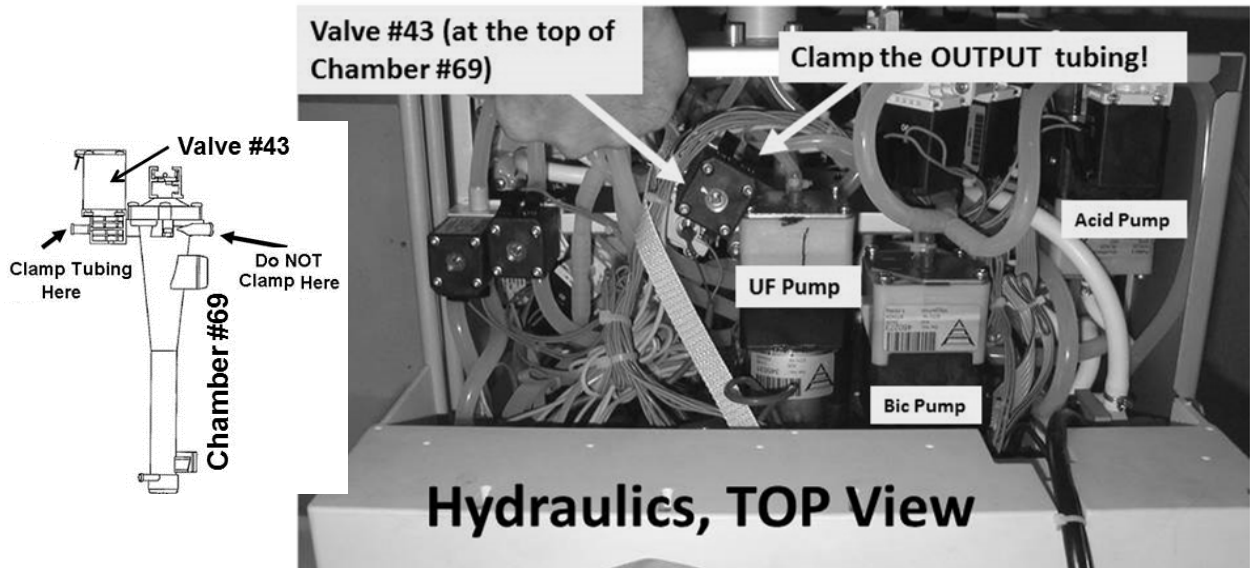


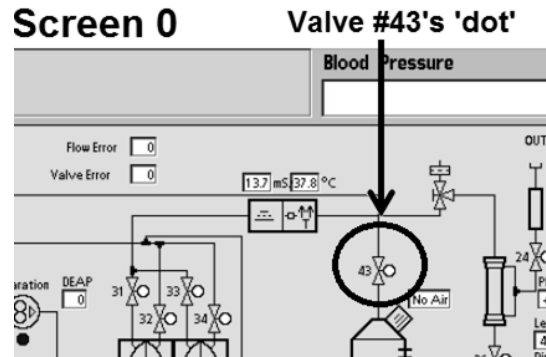
Figure 33 – VALVE #43 Location

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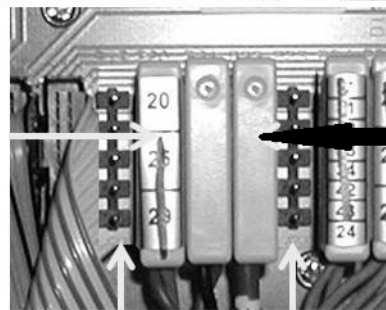
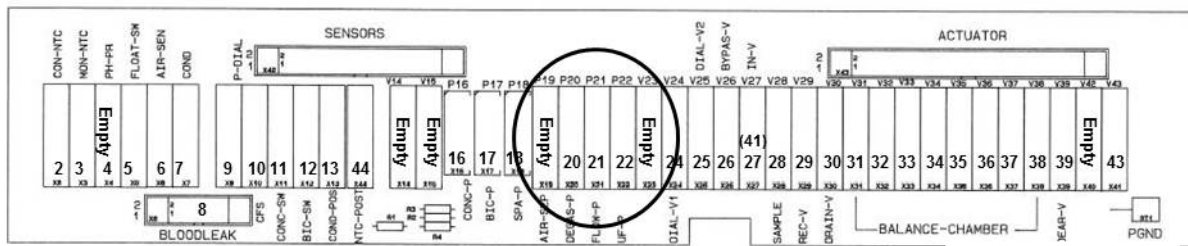
CLEAN- 4.6.33 ISOLATE VALVE #43 POSSIBLY STICKING CLOSED

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 is running; **C)** If "**Flow Recirc Error 1**" continues to occur you may have made an error somewhere!

No 'Bob' IS 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:

- Call debug screen 1 (Figure right).
If debug does not appear press 'Escape' then call screen 0.
- Does **VERR** (lower right column) = 0?

Yes **VERR** = 0! Proceed to **page 185**, procedure number [CLEAN- 5.2.0](#).

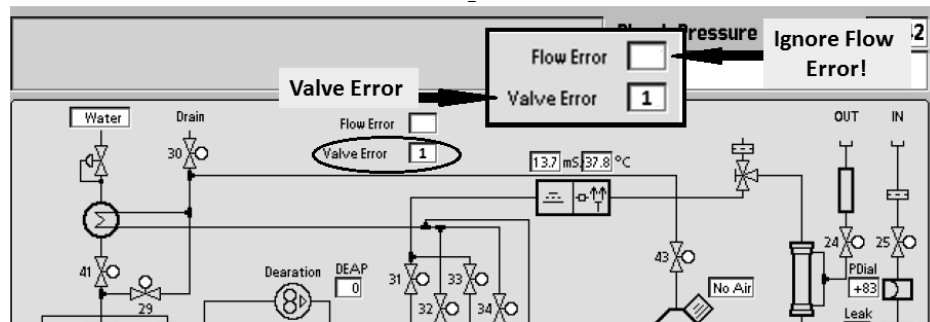
No **VERR** = 1 OR more! See procedure number [CLEAN- 5.0.1](#) (page 184).

		Blood Pressure		13:43			
AMIN	AMAX	HI ART	AART	BYERR	NO EOS	FLWP	PHTACT
14.81	15.41	0	0	0	0	0	0
BMIN	BMAX	LO ART	AVEN	BYPASS	ALWEOS	DEAP	NPHT
31.00	32.26	0	0	0	0	0	639
A160	B160	HI VEN	ATMP	FILACT	FILSTA	TEMP	PHTO
5412	5412	0	0	0	0	0	0
A220	B220	LO VEN	ART	DOUBLE	ACT BLD	5V EST.	PHT1
7786	7786	0	261	0	0	0.0	VERR
APV	BPV	HI TMP	VEN	FLWOFF	OTMP	12V EST.	= 0?
7557	15818	0	261	0	181	0.0	↓
C TCD	NaRT	LO TMP	TMP	FLVERR	BFLW	SALV	VERR
1330	0.00	0	190	0	358	0	0

CLEAN- 5.0.1 VERR DOES NOT = 0 / ISOLATE SPECIAL VALVE ERROR

Debug Screen 0

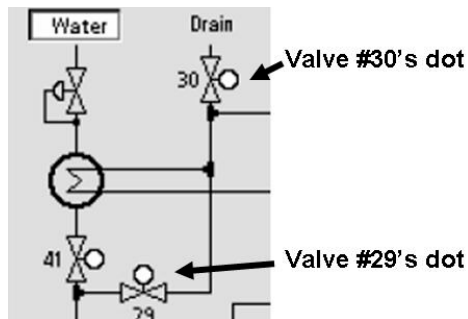
- Call debug screen 0 (Figure right).
- Ignoring the TOP window, **Flow Error**, in part c you will watch the 2nd window down, **Valve Error!**



- 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:
 - 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 206**, [TROUBLESHOOTING VALVE ERRORS IN CLEANING PROGRAMS](#)
 - IF Valve Error EVER = 1 LONGER THAN two (2) seconds:** Turn the machine OFF then proceed to **page 189**, 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 185).
- 2) **IF BOTH dots, at the SAME TIME, are NEVER white LONGER THAN thirty (30) seconds!** Proceed to **page 186**, 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 185).
- No
- a) Move the 'X' to the No box THEN press 'CONFIRM'. 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 184**, 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" accidentally.

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 an 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 'Escape' 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, at the SAME TIME, EVER turn WHITE again 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 186).

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 186).

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 562** 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 187**, 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:

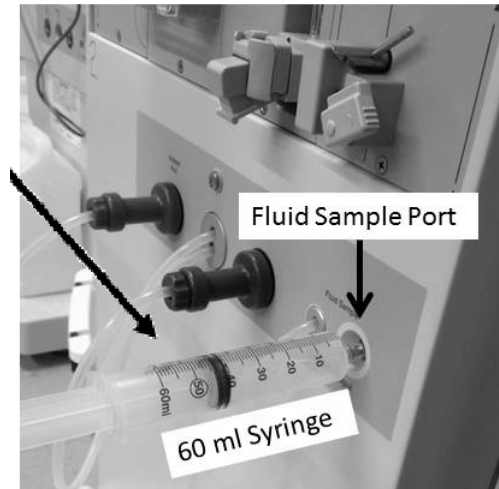
- 1) **IF (and ONLY if) “Flow Recirc Error 1” DOES NOT occur:** Whatever was causing the Flow Error is no longer occurring! Do NOT continue to troubleshoot a Flow Error.
- 2) **IF “Flow Recirc Error 1” occurs:** See (ABOVE) procedure number [CLEAN- 4.2.0](#) (page 175).

CLEAN- 6.0.0 ‘BOB’ MOVING / ISOLATE VALVE #29 STICKING OPEN

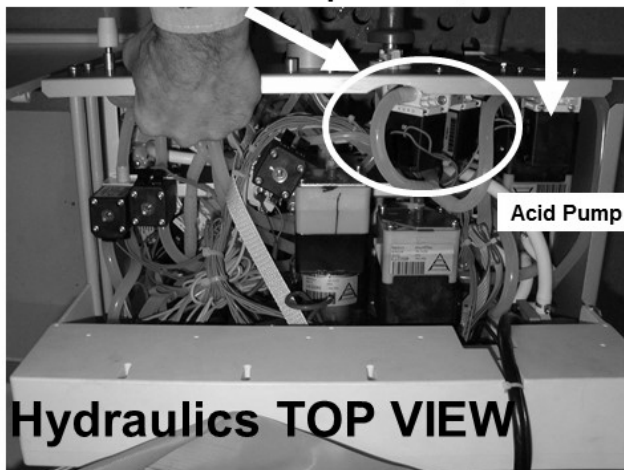
- a) **Turn the machine OFF!**
- b) Turn the machine on but **DO NOT** press CONFIRM!
- c) **The “Select Program” banner MUST remain up for this procedure!**



- 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.



- e) **Valves #29 and #41**
Valve #29 is on top



- e) Valve #30

- e) Valve #29 on TOP
- e) Valve #30



- f) Valve #30 's INPUT tubing
CLAMP HERE!

- g) Valve #29's OUTPUT tubing! Air moving ALL THE WAY THROUGH indicates Valve #29 is leaking!

- 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 188).

No Air is NOT moving through Valve #29! See parts a AND b below:

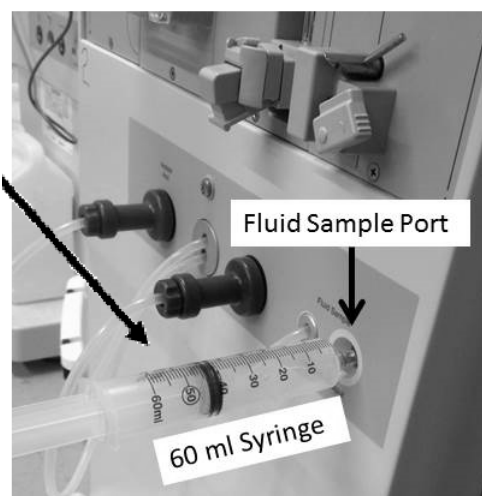
- a) **Remove the clamp from Valve #30!**
- b) The Troubleshooting Guide cannot locate an immediate problem. Return to Dialysis Program and troubleshoot potential hydraulic problems from there!

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!

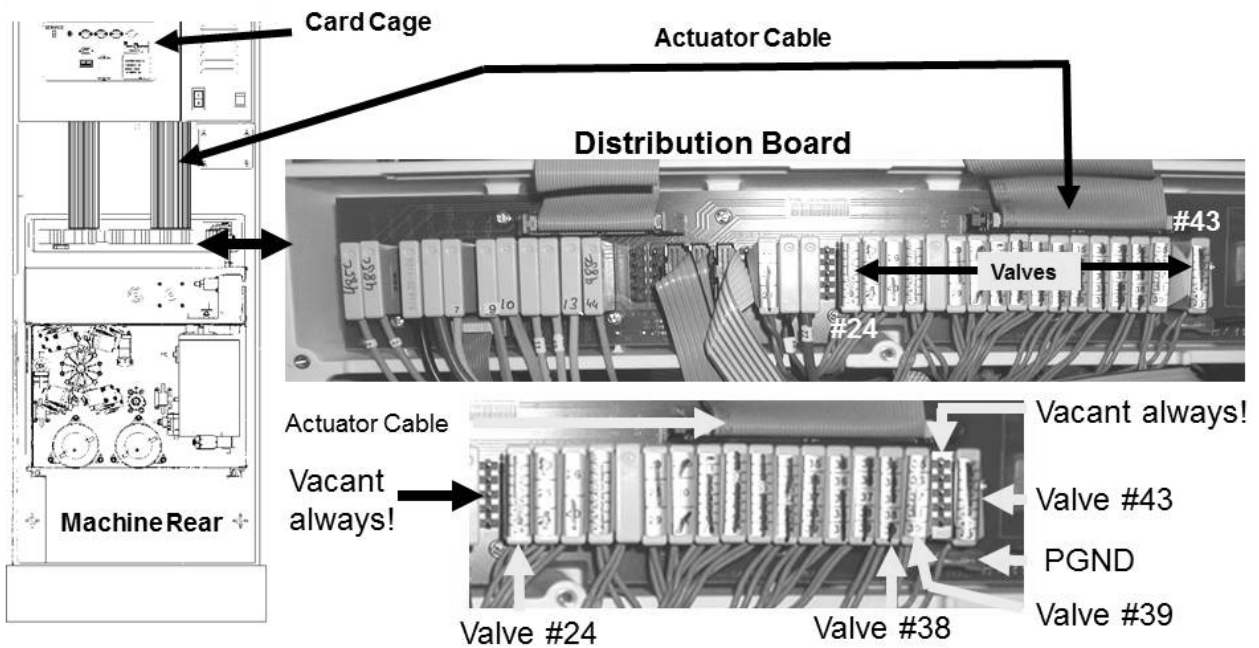


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CLEAN- 7.0.0 VALVE ERROR = 1 LONGER THAN TWO SECONDS

- A) **To avoid damage turn the machine OFF!**
- B) Figure below, remove the distribution board cover.
- C) FOUR (4) IMPORTANT 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 189).

No problem located! Proceed to **page 190**, 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 'Escape' 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 157**).

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:

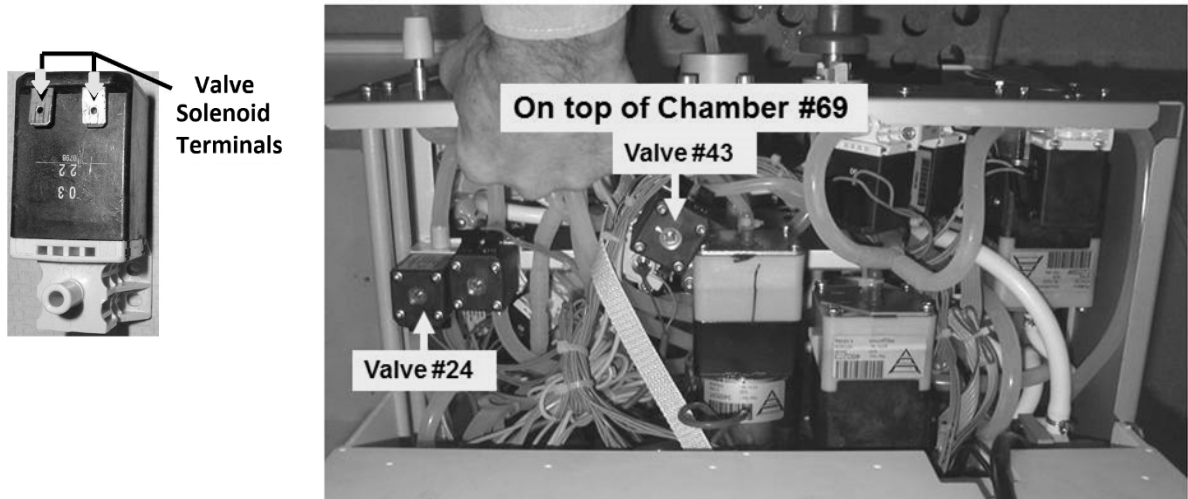
CHECK #1 ENSURE no 'pinched' or damaged wire insulation

CHECK #2 ENSURE the wires terminate properly at the solenoid terminals

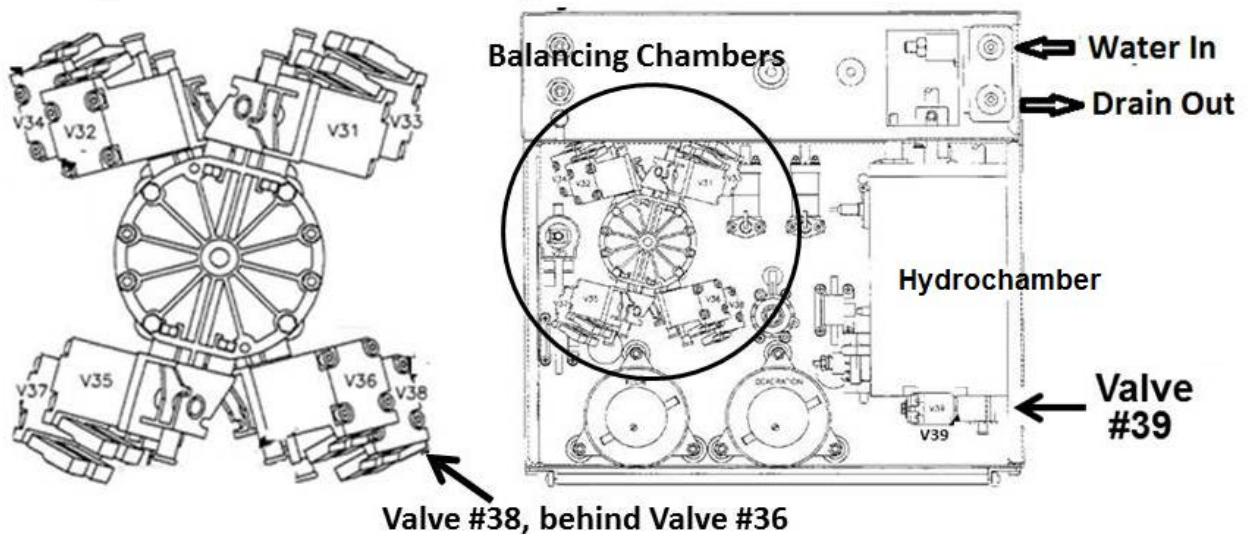
CHECK #3 ENSURE the terminals show no signs of 'green' corrosion

- 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 191).

Hydraulics TOP View, Valve #24 and #43

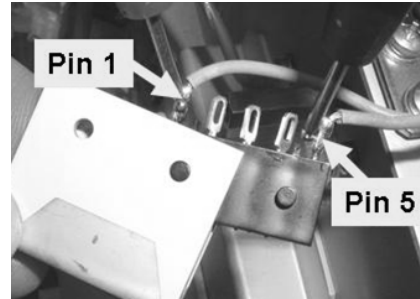


Hydraulic REAR view, Valves #38 and #39



CLEAN- 7.4.0 ISOLATE VALVE SOLENOIDS

- a) **Set your CALIBRATED 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 ?

Example:

72.1 Ω

Units

= 72.1 ohms
K Ω = thousand ohms
M Ω = million ohms

Yes Solenoid between 40 and 100 Ω ! Repeat parts b THROUGH h for ALL FOUR valves! If (and ONLY if) ALL FOUR (4) solenoids are between 40 and 100 Ω see procedure number [CLEAN- 7.4.1](#) (page 191)

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 'Escape' 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 157).

TROUBLESHOOTING A VALVE

- A) To avoid damage, turn the machine OFF!
- B) There is **NO NEED** to check all 17 valves! Check **ONLY** the valve as **NOTED** in the procedure that brought you here!!
- C) See procedure number TSV- 1.0.0 below:

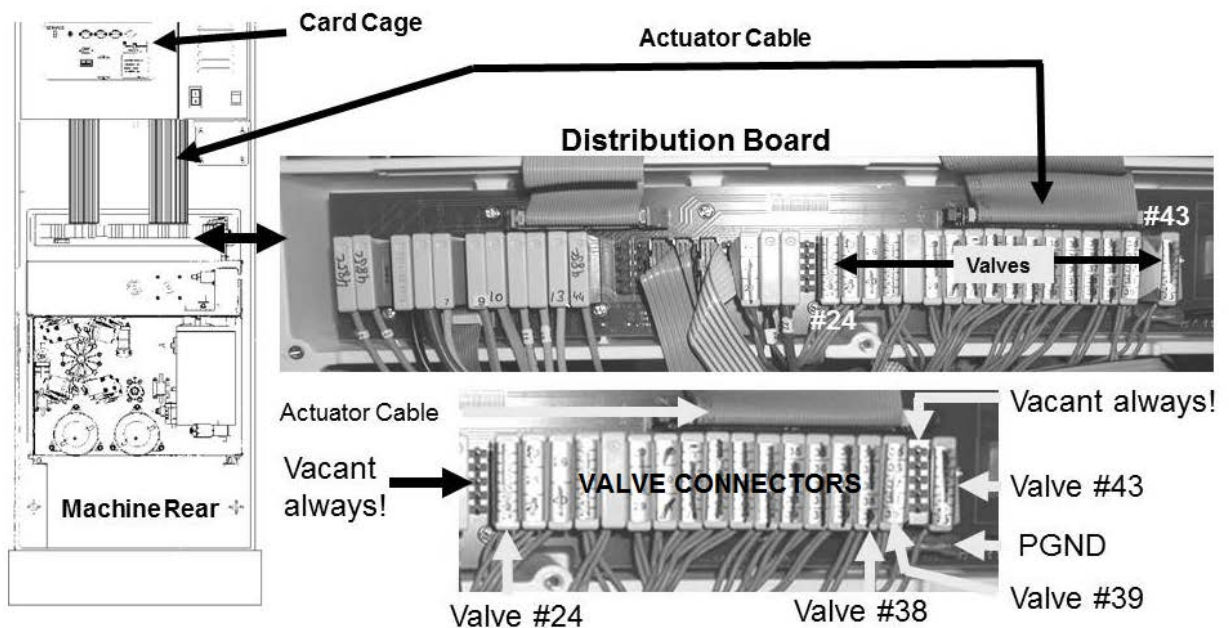
TSV- 1.0.0 CHECK DISTRIBUTION BOARD CONNECTIONS

- 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 194), refer to [Figure 35](#) (page 193) OR [Figure 36](#) (page 193) to LOCATE the **NOTED** valve.

Figure 35 – Hydraulics Top View

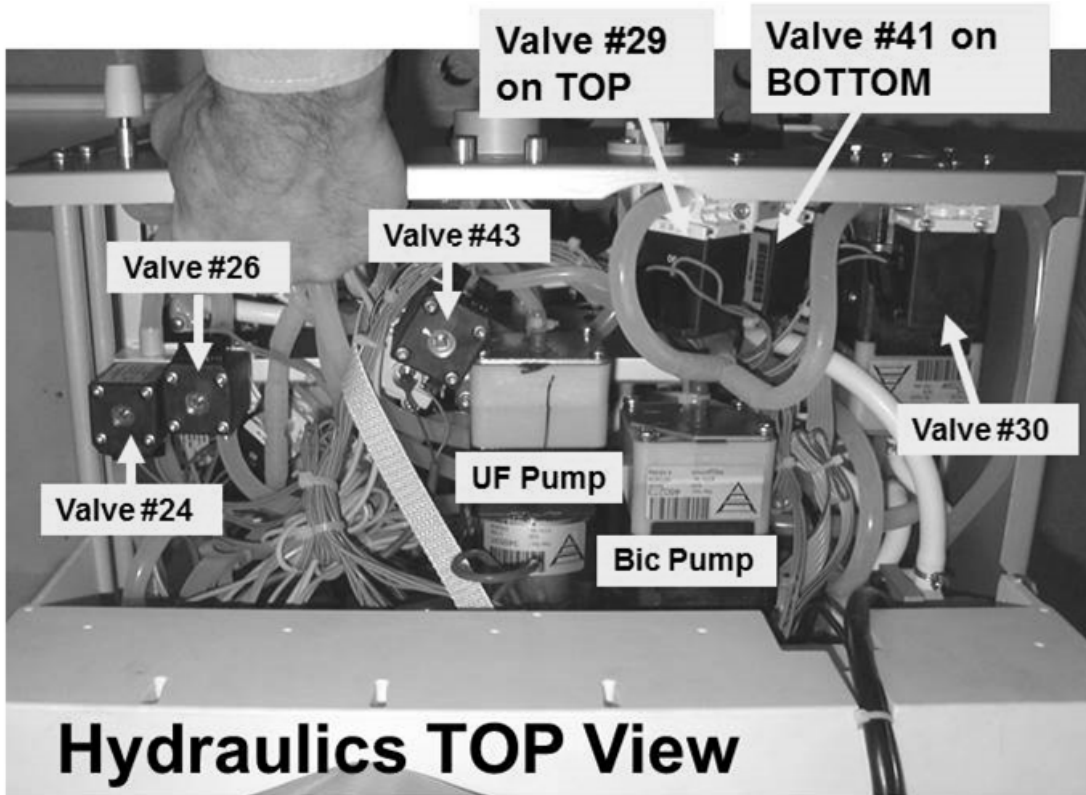
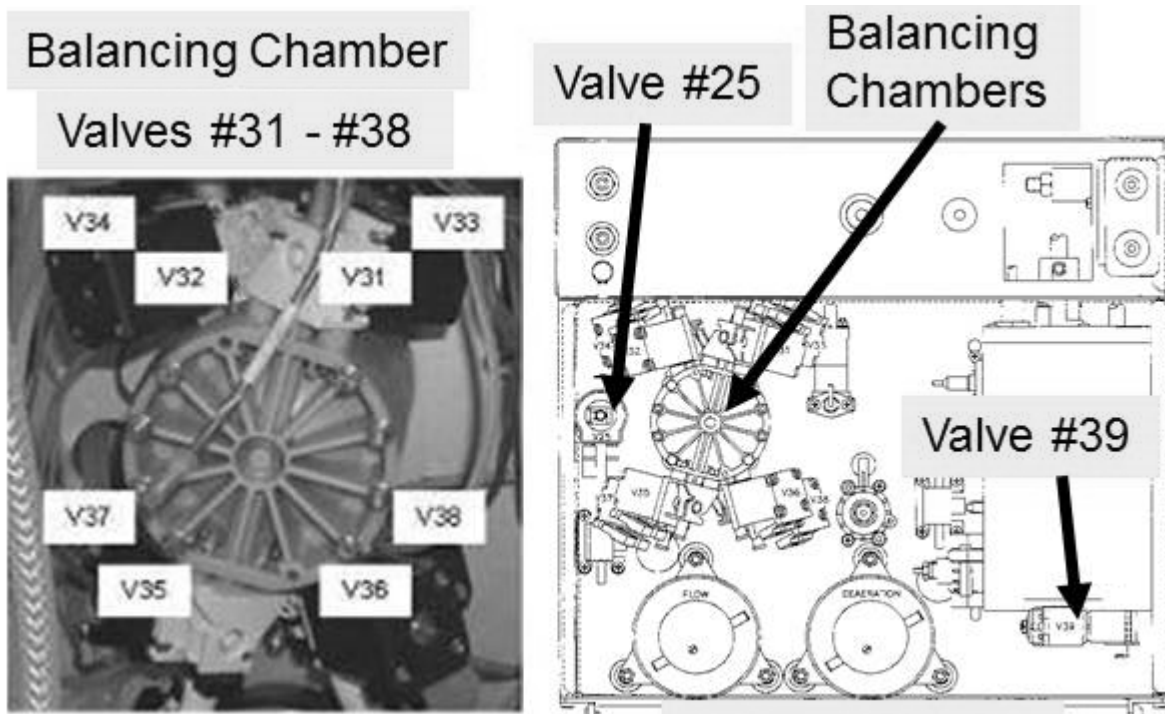


Figure 36 – Hydraulics Rear View



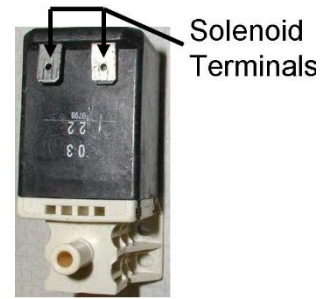
TSV- 2.0.0 ISOLATE VALVE WIRES

- 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!

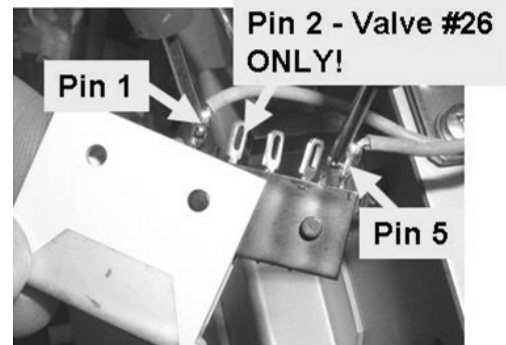


- b) If no problems were located, see procedure number [TSV- 2.1.0](#) (page 194).

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]?

Example: Units

72.1 Ω = 72.1 ohms
 K Ω = thousand ohms
 M Ω = million ohms

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 **Error! Bookmark not defined.**))

No Less than 40 Ω OR more than 100 Ω ! See procedure number [TSV- 3.0.0](#) (page 194).

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 652**, [Section 26](#)

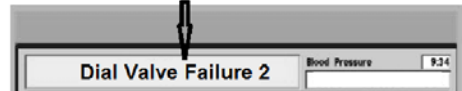
B) **CLOSE the SHUNT door!**

C) ENSURE a “No Water” banner NEVER appears!

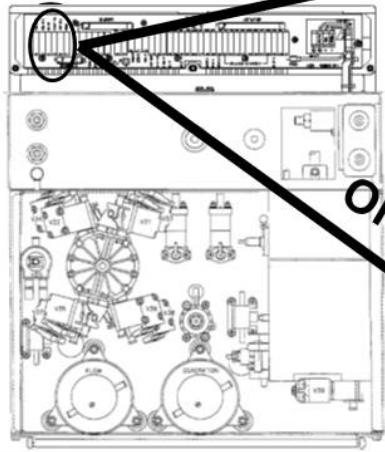
D) FIGURE BELOW, a previous procedure may have already placed a resistor plug into the distribution board’s AIR SENSOR position **4th connector cap i.e. 5th position FROM THE LEFT!**

Example

Status bar with a “Dial Valve Failure”

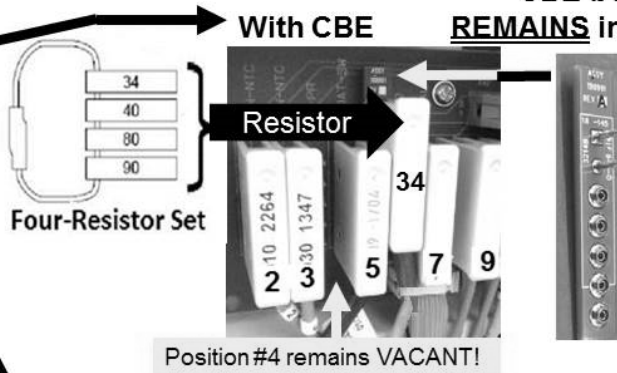


Hydraulics Rear View Distribution Board

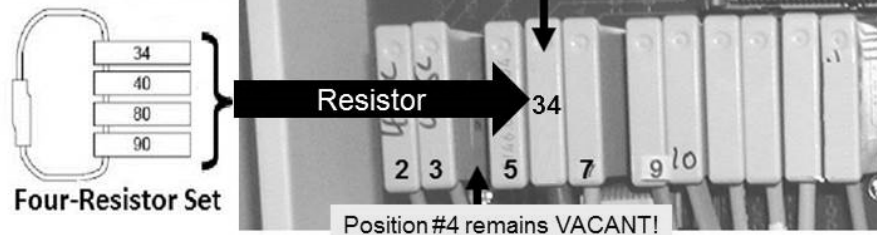


OR

CBE board
REMAINS installed



Without CBE

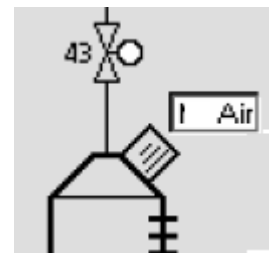


E) TWO (2) possible scenarios below:

- 1) **IF (and ONLY if) a resistor plug is ALREADY in place:** See procedure number **VE- 1.0.0** (page 196).
- 2) **IF a resistor plug IS NOT in place:** See parts a THROUGH e next page:

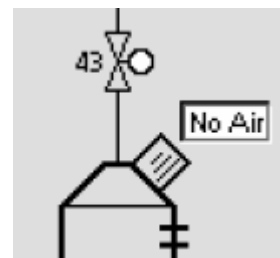
A resistor plug IS NOT ALREADY in place continued:

- a) Unplug the female Air Sensor's connector, **4th** connector 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 plugs 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 196).



VE- 1.0.0 INITIALIZE ACTUATOR-TEST BOARD VALVE CYCLES

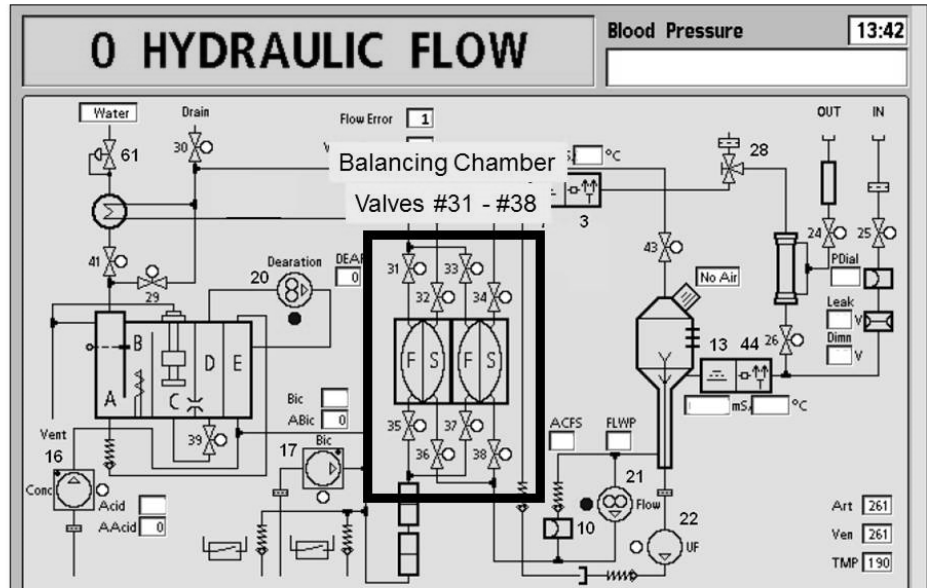
- a) **Turn the machine OFF!**
- b) Turn the machine ON and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- c) From the Home screen, set [Dialysate Flow] to 300 ml/min.
- d) See procedure number [VE- 1.0.2](#) (page 197).

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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 197).
 - 2) **IF (and ONLY if) four (4) are REMAINING blue AND four (4) are REMAINING white:** Proceed to **page 200**, procedure number [VE- 4.0.0](#).
 - 3) **IF ALL EIGHT are CYCLING between white and blue:** Proceed to **page 199**, procedure number [VE- 3.0.0](#).

VE- 2.0.0 ALL EIGHT BALANCING CHAMBER VALVES REMAINING WHITE

One of the valve circuits whose 'dots' are blue is the problem! These procedures isolate between them:

- a) **Open the shunt door and leave it open till instructed!!**
- 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 193).
- 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 198).
- 2) **ALL other scenarios:** Proceed to **page 205**, 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 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 198).

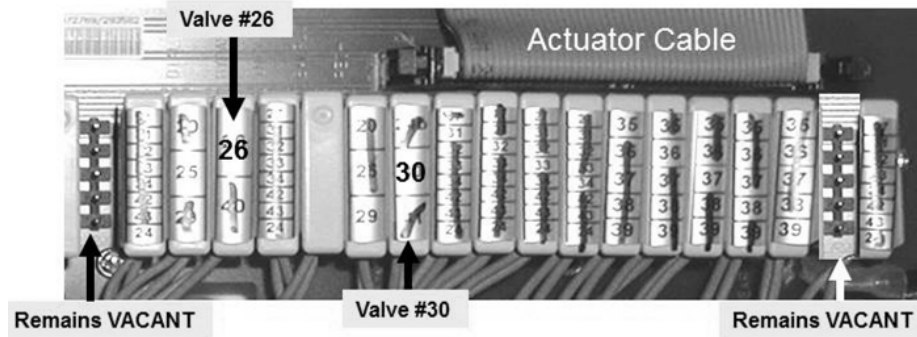


Figure 38 – Valves #26 AND #30

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) THREE (3) possible bad components, see the [Component List](#) below:

Component List

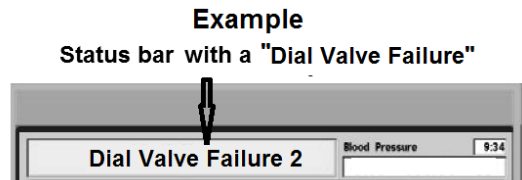
Turning the machine off first, swap in each component, one at a time, returning to Dialysis Program in between, until **VERR** remains = 0!

- 1) Actuator-Test Board; 2) Actuator-Test board 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 future reference. If **VERR** EVER reaches 255 return to procedure number [VE- 1.0.0 \(page 196\)](#) to reset it.

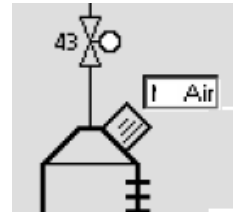
- c) Figure right, if (and ONLY if) a "Dial Valve Failure" OR "Act Byp Valve Fail" banner EVER appears proceed to [page 652, Section 26](#).



- 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 in part b:** Return to ABOVE procedure number [VE- 1.0.0 \(page 196\)](#).
 - 2) **IF VERR does DOES NOT increase:** See procedure number [VE- 3.5.0 \(page 199\)](#).

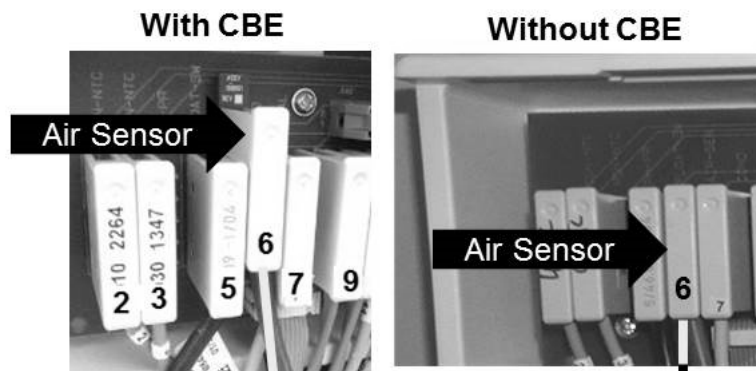
VE- 3.5.0 ISOLATE VALVE #43

- 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, part b OR for five (5) minutes whichever comes first! Does **VERR** increase?



Yes **VERR** increases! See ABOVE procedure number [VE- 1.0.2 \(page 197\)](#).

No **VERR** does 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 30](#), procedure number [F- 2.0.0!](#)



VE- 4.0.0 FOUR BALANCING CHAMBER VALVES REMAINING BLUE, FOUR REMAINING WHITE

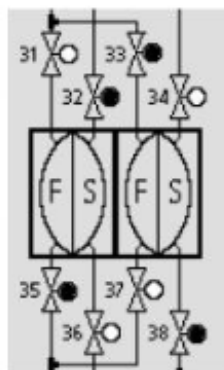
NOTE: One of the valve circuits whose 'dots' are blue is the problem. These procedure isolate between them:

- a) Turn Dialysate Flow off (lamp above the Flow on/off button blinks).
- b) Return to screen 0. If flow is off all eight (8) Balancing Chamber Valves remain white.
- c) Call debug screen 1! **NOTE** **VERR's** value for reference later. If **VERR** EVER reaches 255 return to procedure number [VE- 1.0.0 \(page 196\)](#) to reset it.
- d) 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 205**, 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 \(page 200\)](#).

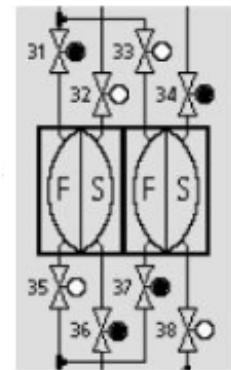
VE- 4.0.1 ISOLATE VALVES

- a) **Turn Dialysate flow on (flow on/off lamp stops blinking).**
- b) 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 \(page 201\)](#).
 - 2) **IF V31, V34, V36 AND V37 are REMAINING blue:** The problem is in Balancing Chamber Valve Cycle 2! Proceed to **page 203**, 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

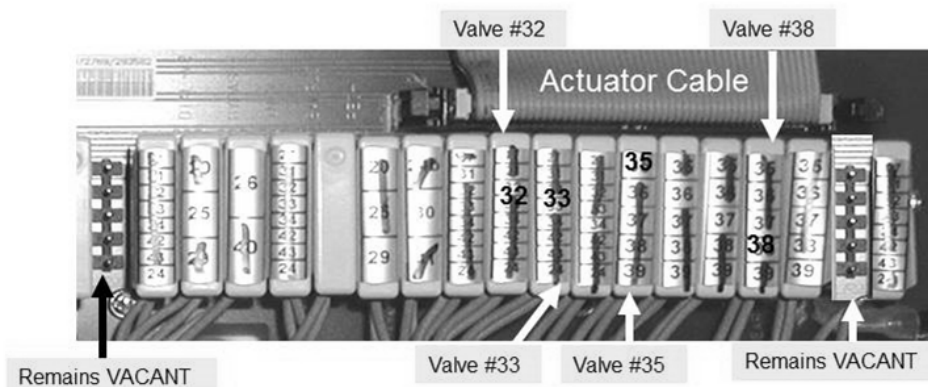
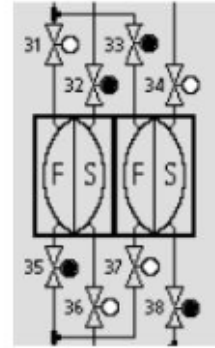
Valves #32, #33, #35, and #38 'dots' REMAINING blue. One of these valve circuits is causing the problem and these procedures isolate between them!

- At the distribution board (Figure below), unplug **Valve #32's** connector.
- 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 201).

Valve Cycle 1



VE- 5.0.1 VALVE #32 UNPLUGGED AND VALVES DO NOT CYCLE

- At the distribution board (Figure above), unplug **Valve #33's** connector.
- 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 201).

VE- 5.0.2 VALVE #33 UNPLUGGED AND VALVES DO NOT CYCLE

- At the distribution board (Figure above), unplug **Valve #35's** connector.
- 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 202).

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 in between, swap in each component (see the [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.

- At the distribution board (Figure below), unplug Valve #31's connector.
- 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 203).

Valve Cycle 2

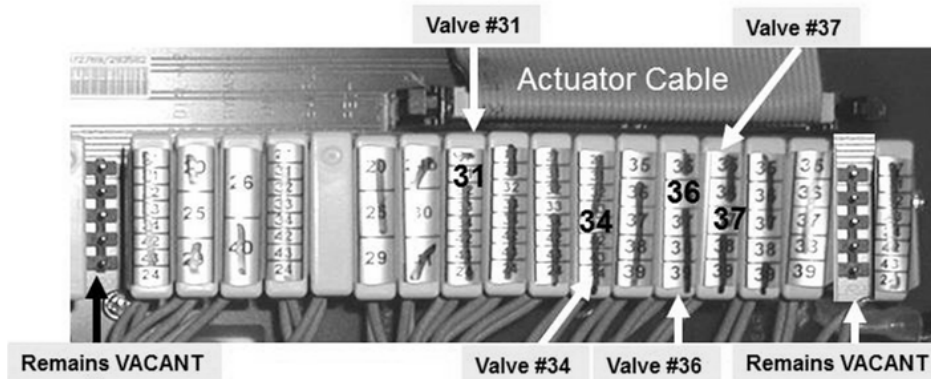
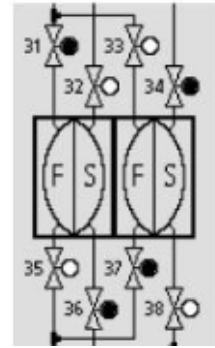


Figure 39 – Valve Cycle 2

VE- 6.0.1 VALVE #31 UNPLUGGED AND VALVES DO NOT CYCLE

- At the distribution board (Figure above), unplug Valve #34's connector.
- 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 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 203).

VE- 6.0.2 VALVE #34 UNPLUGGED AND VALVES DO NOT CYCLE

- At the distribution board (Figure above), unplug Valve #36's connector.
- 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 cycle! Valve #36 OR its blue wire harness is bad.

No Valves DO NOT cycle! See procedure number [VE- 6.0.3](#) (page 204).

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 cycle! 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 in between, swap in each component (see the [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- 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 isolate between 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 196) 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 30**, 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 205).

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.

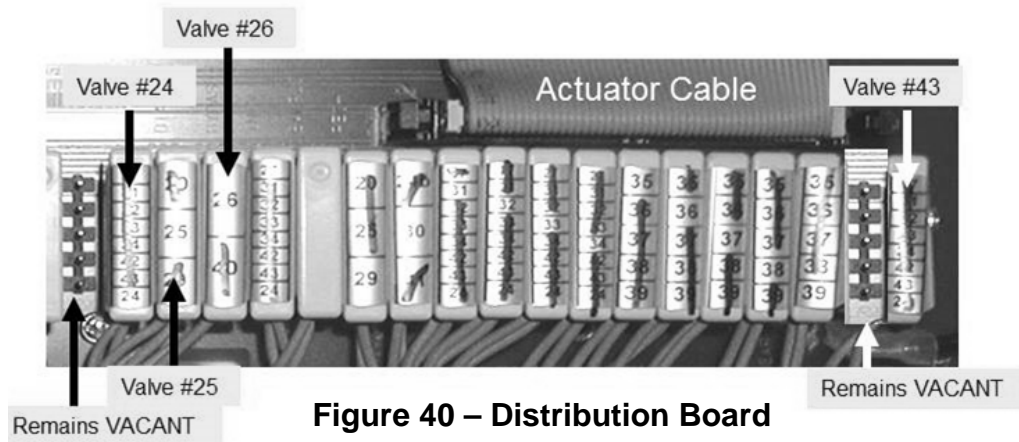


Figure 40 – Distribution Board

- 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 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 if **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! **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

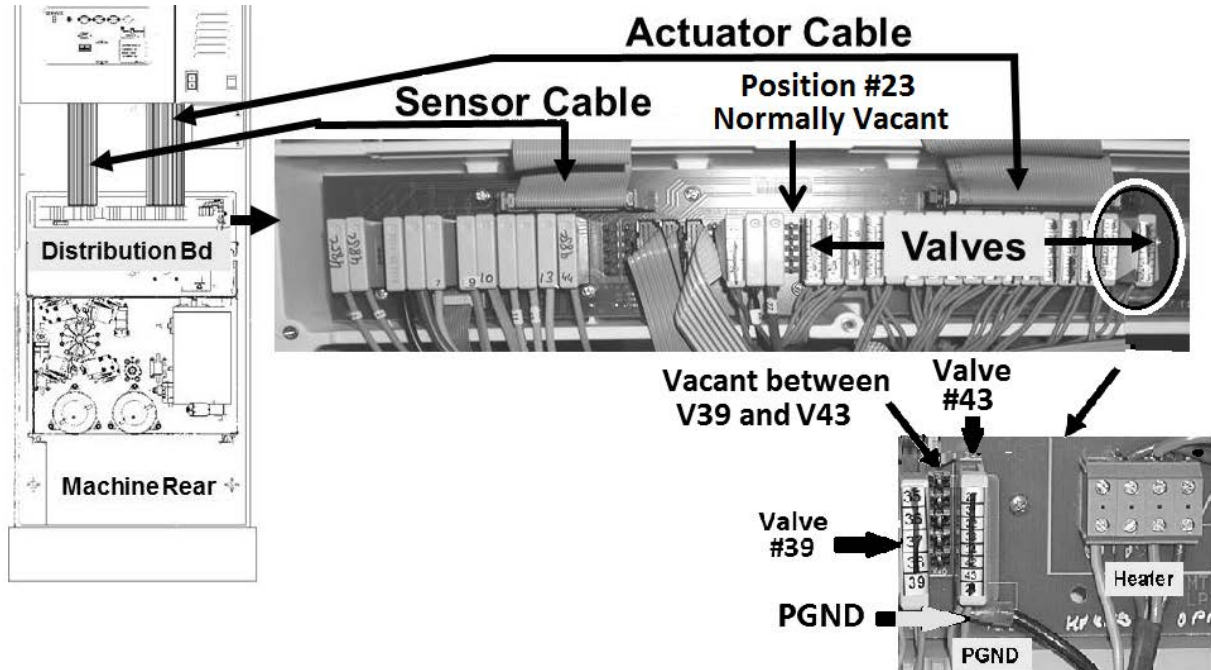


Figure 41 – Distribution Board

- B) If a problem was NOT located in part A, see procedure number [VEC- 1.0.0](#) (page 206). 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 206).

VEC- 1.0.0 ISOLATE THE VALVE ERROR / FLOW THROUGH 'BOB'?

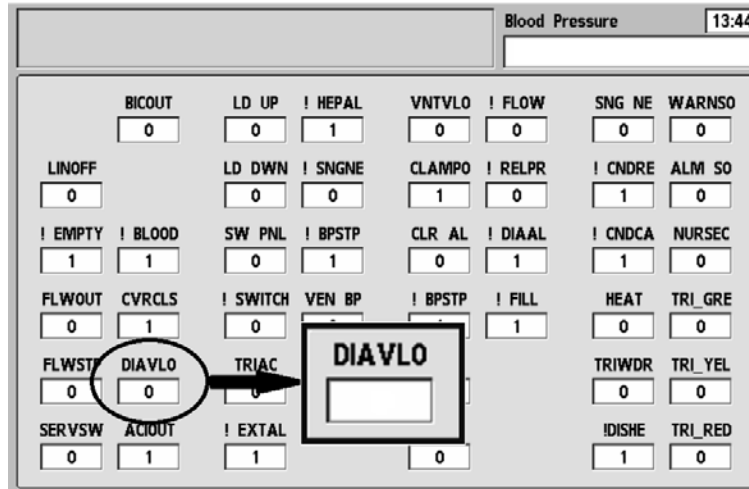
- a) Return to Heat Disinfect OR Rinse!
- b) Watching for one (1) minute, does the flow indicator's 'bob' EVER rise, at least ¼ way up, in the sight tube?

Yes 'Bob' moving! Proceed to **page 212**, procedure number [VEC- 2.0.0](#)

No 'Bob' NOT MOVING! See procedure number [VEC- 1.1.0](#) (page 207).

VEC- 1.1.0 BOB NOT MOVING / ISOLATE VALVE # 24

a) Call debug screen 2 (Figure below). If debug does not appear press 'Escape' then call screen 2.

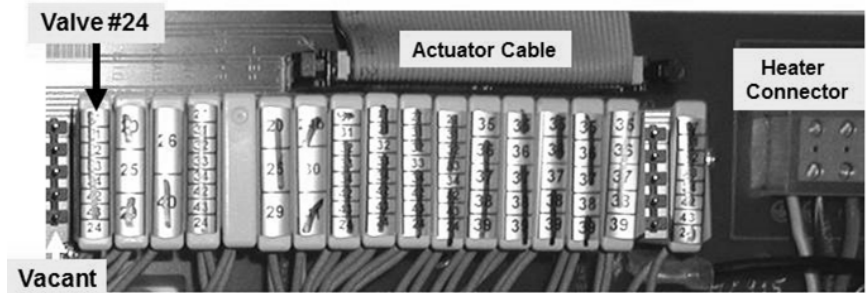


b) Watch **DIAVLO** (lower left) for forty-five (45) seconds. BE CAREFUL, THREE (3) possible scenarios 1) or 2) or 3) below:

- 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 208).
- 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 192**, [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 193)).

No Does NOT cycle! **A)** Return valve #24 to the distribution board; **B) NOTE ONLY VALVE #24** will be checked and proceed to **page 192**, [TROUBLESHOOTING A VALVE](#) .

VEC- 1.2.0 'BOB' NOT MOVING / DIAVLO CYCLING BETWEEN 1 AND 0

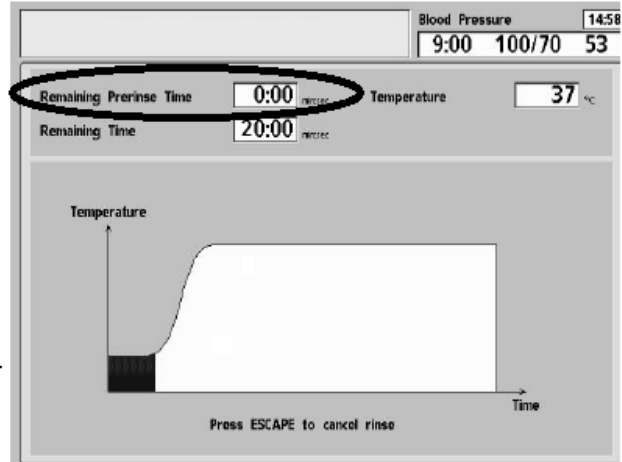
- a) Press 'Escape' to return to the Cleaning Program's Main screen!
- b) Leave the machine in whatever Program it is CURRENTLY in: 1) In Rinse? OR 2) In Heat Disinfect?

1) **IF (and ONLY if) in RINSE:** See procedure number [VEC- 1.3.0](#) (page 209).

2) **IF in HEAT DISINFECT:** Per the Figure right, does the VERY TOP Window, **Remaining Prerinse Time** = 0:00 min:sec (Yes or No)?

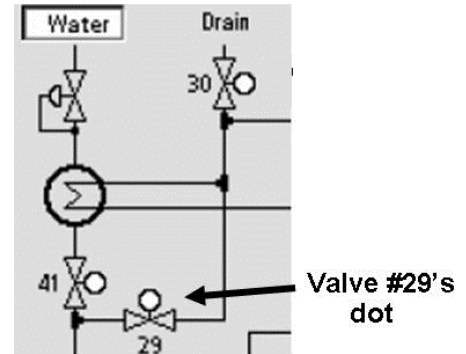
Yes **Remaining Prerinse Time** = 0:00! See procedure number [VEC- 1.2.1](#) (page 208).

No **Remaining Prerinse Time** does NOT = 0:00! See procedure number [VEC- 1.3.0](#) (page 209).



VEC- 1.2.1 IN HEAT DISINFECT / REMAINING PRERINSE = 0:00

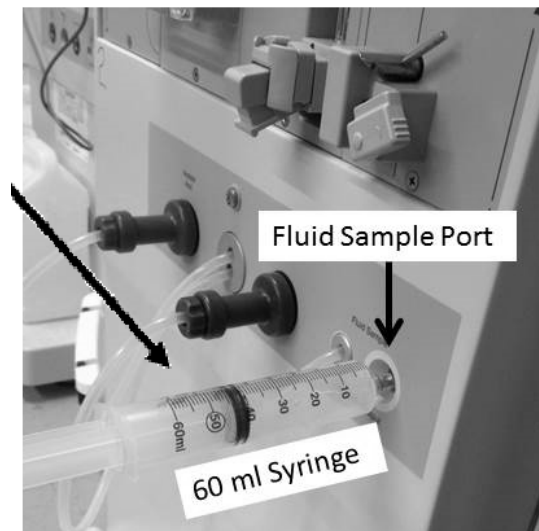
- a) Call debug screen 0. If the screens do not appear press 'Escape' then call screen 0.
- b) Only when **Remaining Prerinse Time** = 0:00, does Valve #29's 'dot' (Figure right) REMAIN blue (i.e. NEVER white). ENSURE this by watching it for fifteen (15) FULL seconds.
- c) Figure right, screw a 60 ml 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 **as HARD as you can** 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?

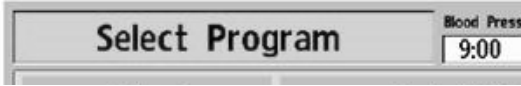
Yes Very little resistance is encountered! Valve #29 is okay! See procedure number [VEC- 1.3.0](#) (page 209).

No Significant resistance when pushing! **NOTE ONLY VALVE #29** will be checked and proceed to **page 192, TROUBLESHOOTING A VALVE**

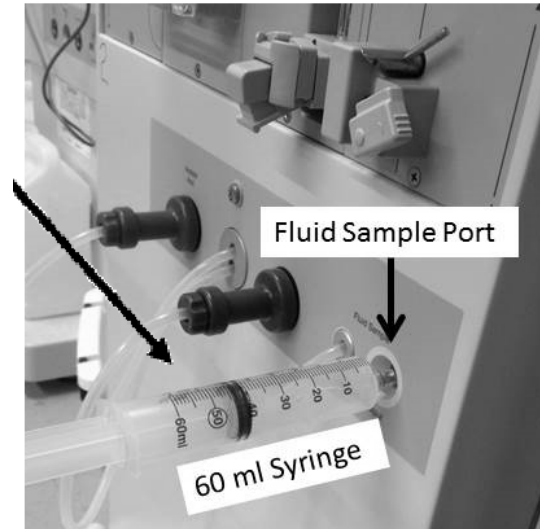


VEC- 1.3.0 ISOLATE DRAIN VALVE #30

- 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 209).
- No Significant resistance! **NOTE ONLY VALVE #30** will be checked and proceed to **page 192, [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 211).

No Less than 300 ml! **ENSURING** the machine was in Heat Disinfect OR Rinse see parts a THROUGH c below:

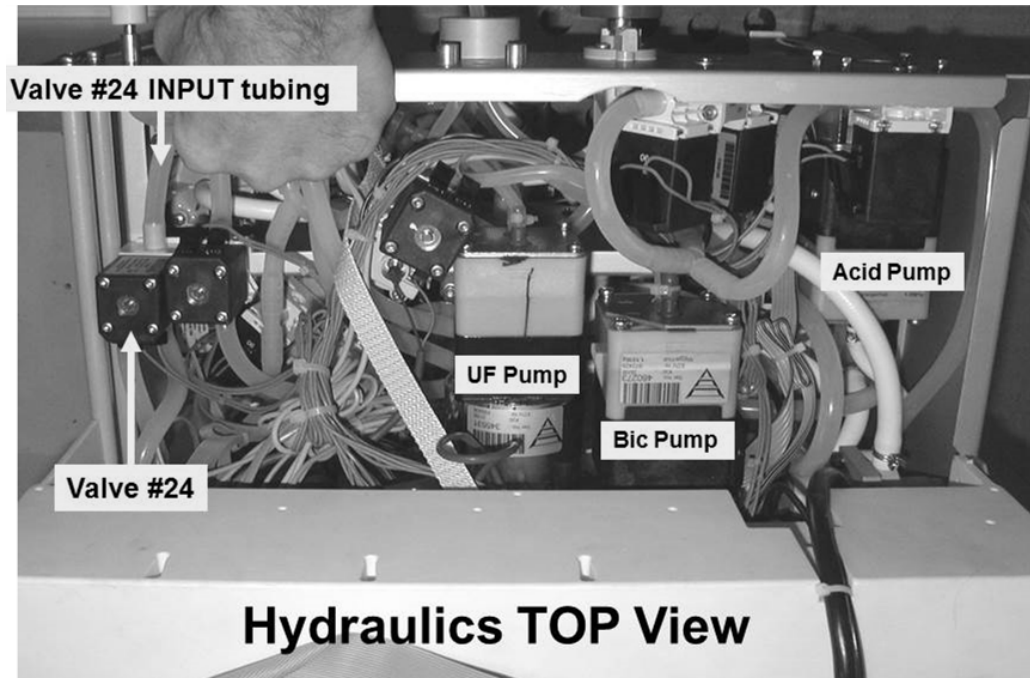
- a) Return the dialyzer connector to the shunt but **DO NOT** close the door.

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 192, [TROUBLESHOOTING A VALVE](#)**

No Less than 300 ml! Return Valve #24's tubing THEN see procedure number **VE- 1.4.1** (page 210).



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) Actuator-Test Board OR 2) Actuator board 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?

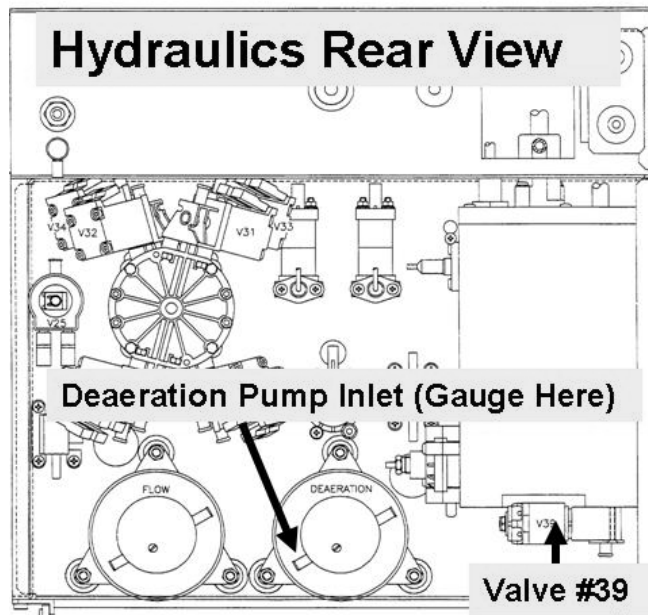
Yes Bob moving! Something changed! **A)** Turn the machine OFF; **B)** Close the door; **C)** Turn the machine on and return to Heat Disinfect OR Rinse; **D)** If a Flow Error reoccurs return to (ABOVE) procedure number [CLEAN- 1.2.2](#) (page 159).

No 'Bob' not moving! **NOTE ONLY VALVE #25** will be checked and proceed to **page 192**, [TROUBLESHOOTING A VALVE](#)

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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. 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 213)!
 - 2) **IF between -13 and -25 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

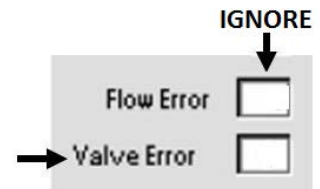
- A) Turn the machine OFF and remove the gauge!
- B) Turn the machine on and allow the “Select Program” screen to appear. What color is the ‘Dialysis’ button (Gray or Blue)?



- 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’ → ‘CONFIRM’).
- D) From the Home screen, set [Dialysate Flow] to 800 ml/min
- 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 TOP **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?



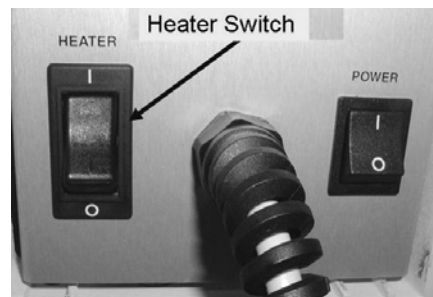
Yes **Valve Error** = 0 OR ‘blinks’ to 1 for less than one second! Proceed to **page 195**, [TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM](#)

No **Valve Error** = 1 LONGER THAN two (2) seconds! Proceed to **page 652**, [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 at least 500 ml/min.
 - * If the lamp above the Dialysate Flow on/off is blinking flow is off! Flow MUST be on!
- b) ENSURING the Heater Switch and Flow has been on for at least six (6) minutes if the temperature problem still exists see procedure number [T- 1.0.0](#) (page 215).

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 for two (2) seconds then back on; **B)** RETURN TO DIALYSIS PROGRAM (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)! **C)** From the Home screen, set [Dialysate Flow] to 800 ml/min; **D)** See procedure number [T- 1.0.0](#) (page 215).

- ii) **IF the Heater Switch was “OFF”:** Allow twenty (20) minutes! 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 AND no leaks! TWO (2) possible scenarios:

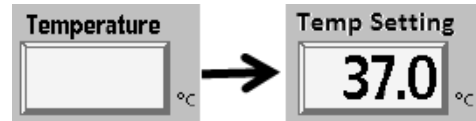
- 1) **IF (and ONLY if) [Temperature] REMAINS more than 80° C, AND the [Remaining Time] window has ‘frozen’ at less than one (1) minute:** ENSURING no external leaks, TWO (2) possible bad components: **Component #1:** Power Logic Board OR; **Component #2:** Functional Board.

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’ → ‘CONFIRM’)!
- c) From the Home screen, set Dialysate Flow* to 800 ml/min and press ‘CONFIRM’.
 - * If the lamp above the Dialysate Flow on/off key is blinking flow is off! Flow MUST be on!
- d) See procedure number [T- 1.0.0](#) (page 215).

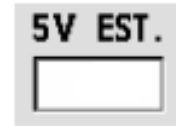
T- 1.0.0 IN DIALYSIS PROGRAM / TROUBLESHOOTING TEMPERATURE

- a) Select the [Temperature] window and set it to 37.0° C!
b) Press 'CONFIRM'.

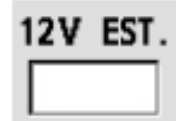


- c) Call debug screen 1. TWO (2) checks:

Check #1: 5V EST (right column): Between 4.7 and 5.3?



Check #2: 12V EST (right column): Between 11.7 and 12.3?



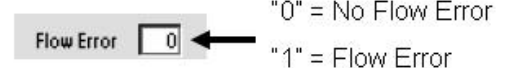
- d) TWO (2) possible scenarios:

- 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 215).
- 2) **IF one or both is NOT REMAINING in range OR is unstable:** See parts A THROUGH D below:
 - A) Turn the machine OFF!
 - B) Using ESD precautions, reseal all card cage circuit boards.
 - C) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').
 - D) Call debug screen 1. If (and ONLY if) **5V EST** and/or **12 EST** are still not in range OR unstable proceed to **page 597**, procedure number [P- B.0.0](#). If **5V EST** and/or **12 EST** are in range see procedure number [T- 1.0.1](#) (page 215).

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 to locate **Flow Error**. If it **EVER** = '1', even just once, indicates a masked Flow Error.



- e) 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 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#)

No **Flow Error** ALWAYS = 0! See parts a THROUGH c below:

- a) Return the concentrate connectors 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 216).

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' → 'CONFIRM')!

c) Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#)

T- 1.0.2 'BOB' MOVING

A) Press 'Escape' then 'CONFIRM' twice to call "Select Program" but **DO NOT** press 'Dialysis' till instructed!



B) See procedure number [T- 1.0.3](#) (page 217).

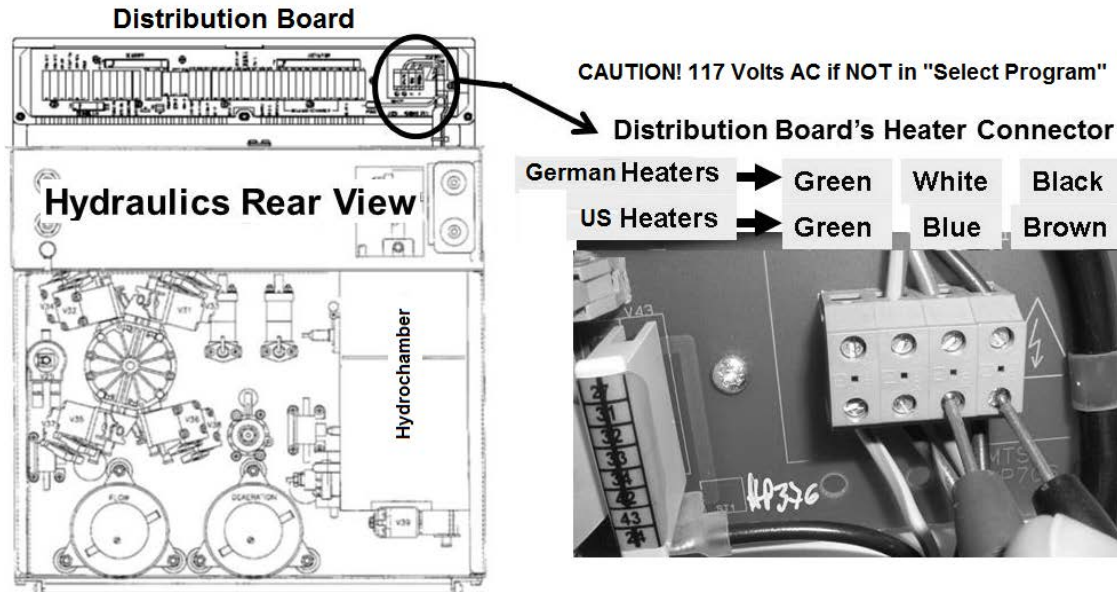
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T- 1.0.3 ISOLATE HEATER

A) To avoid shock “Select Program” REMAINS up till instructed!



B) Figure below, remove the distribution board cover.



C) Figure above, 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: 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!

CHECK #3: Yank on all of the wires to ENSURE they are SECURELY attached. **If not, this may be the problem!**

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 218).

2) **ALL OTHER scenarios (possibly about 20 Ω or “OL”):** The heater* is bad! *To LOCATE the heater refer to [Figure 28](#) (page 129).

T- 1.0.4 HEATER GOOD / ISOLATE TEMPERATURE SENSORS (NTCs)

- A) **Figure BELOW**, trace NTC #2 AND NTC #3's cables from their distribution board connectors to the sensors. TWO (2) IMPORTANT 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!

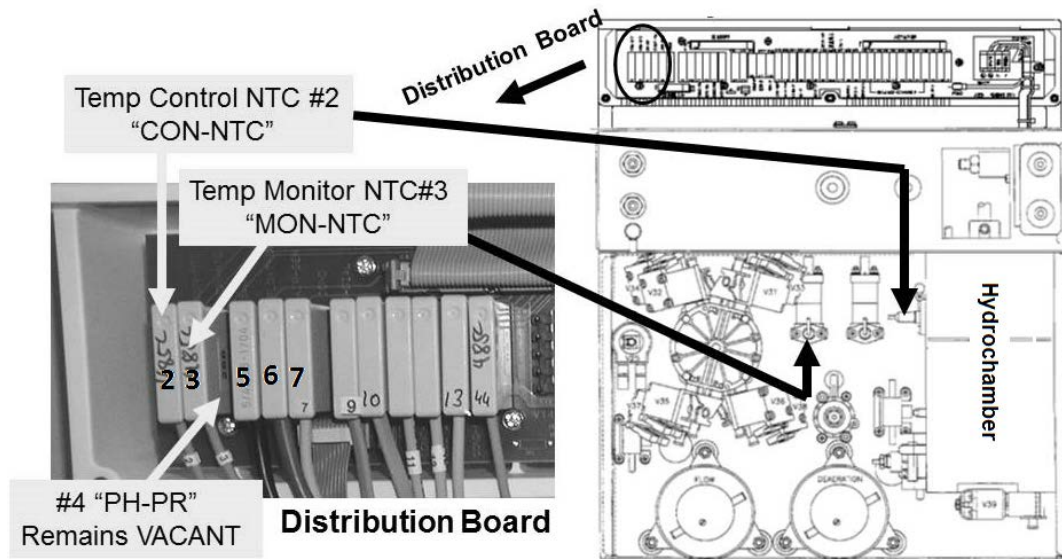


Figure 42 – Temperature Sensors (NTC)

- 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 219**, 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 218).
- 3) **IF a sensor was reverse connected:** AFTER correcting the problem see procedure number [T- 1.0.5](#) (page 218).

T- 1.0.5 PROBLEM LOCATED DURING CHECKS 1 AND 2

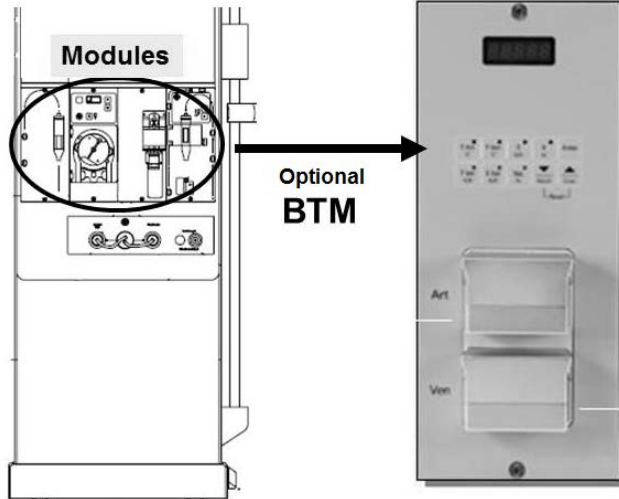
Depending on where the problem ORIGINALLY occurred, TWO (2) possible scenarios:

- 1) **IF in Dialysis Program:** **A)** Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’); **B)** Set [Dialysate Flow] to 800 ml/min; **C)** Allow six (6) minutes; **D)** If the temperature problem reoccurs see procedure number [T- 1.0.6](#) (page 219).
- 2) **IF in Heat Disinfect:** **A)** Return to Heat Disinfect; **B)** Allow up to thirty (30) minutes; **C)** If the problem reoccurs put the machine in RINSE for fifteen (15) minutes then see procedure number [T- 1.0.6](#) (page 219).

T- 1.0.6 OPTIONAL BLOOD TEMPERATURE MODULE (BTM) EQUIPPED?

Per the Figure right, TWO (2) possible scenarios:

- 1) **IF NOT equipped with the optional Blood Temperature Module (BTM):** See procedure number [T- 1.0.7](#) (page 221).
- 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.

	Yes	No
BTM	<input type="checkbox"/>	<input checked="" type="checkbox"/>

c) Press 'CONFIRM' to turn the "X" blue!

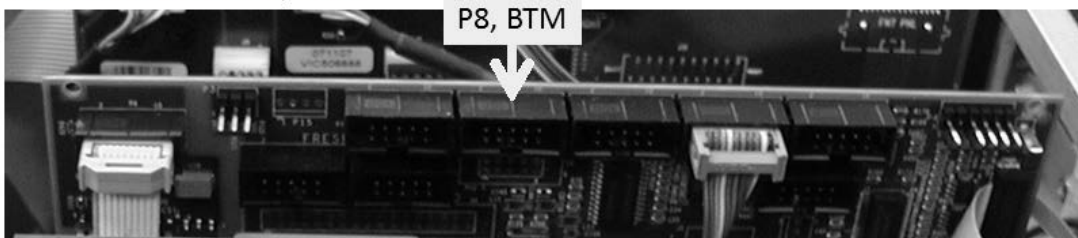
d) **To prevent damage turn the machine OFF!**

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

e)

f) The Functional Board is the 3rd circuit board from the right! Figure below, unplug the ten (10) pin ribbon cable from the P8 connector.

Functional Board, TOP



g) **Close the card cage!**

h) Where was the problem ORIGINALLY occurring, **1) In Dialysis Program i.e. connected to concentrate?** OR **2) In Heat Disinfect?** TWO (2) possible scenarios:

1) IF (and ONLY if) in Dialysis Program: See procedure number [T- 1.0.7](#) (page 221).

2) IF in Heat Disinfect: Return to [Heat Disinfect](#) and allow up to thirty (30) minutes. TWO (2) possible scenarios next page:

Scenario #1: IF (and ONLY if) the temperature problem REOCCURS: The BTM is not causing the problem. See parts a AND b below:

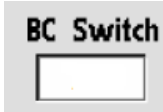
- a) To cool the machine quickly, place it into RINSE for fifteen (15) minutes!
- b) See procedure number [T- 1.0.7](#) (page 221)!

Scenario #2: IF the temperature problem NEVER 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 221).

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T- 1.0.7 TEMPERATURE PROBLEM

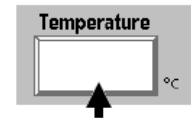
- A) Remove a 'dummy chamber' from the Level Detector module.
- B) Connect to known good acid* and LIQUID bicarbonate*! * Tested per clinic procedures!
- C) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').
- D) From the Home screen, select the [Dialysate Flow] window.
- E) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- F) Call debug screen 0. If **Flow Error EVER** = 1, even just once, indicates a 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 G.
 - 2) **IF (and ONLY if), Flow Error EVER = 1:** Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#).
- G) Call debug screen 6. If **BC Switch** (middle column) is EVER = 897 or more, even just once, indicates a Flow Error. Watch it for two (2) minutes or until it EVER = 897 or more. TWO (2) possible scenarios:
- 
- 1) **IF (and ONLY if), BC Switch EVER = 897 or more:** Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#)
- 2) **IF BC Switch is NEVER, EVER = 897 or more:** Call the Home screen to see [Temperature]. TWO (2) possible scenarios:
- Scenario #1: IF (and ONLY if) remains less than 35.1° C:** Proceed to **page 227**, procedure number [T- 1.0.142](#).
- Scenario #2: IF EVER more than 35.1° C:** See procedure number [T- 1.0.8](#) (page 222).

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 238**, procedure number [T- 1.3.0](#).

2) **IF (and ONLY if) STABLE between 35.1 and 38.9° C:** Figure right. is the [Temperature] window pale yellow / white OR red?

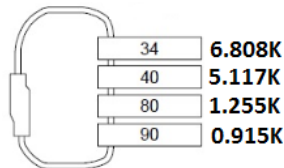


Pale yellow/white or RED?

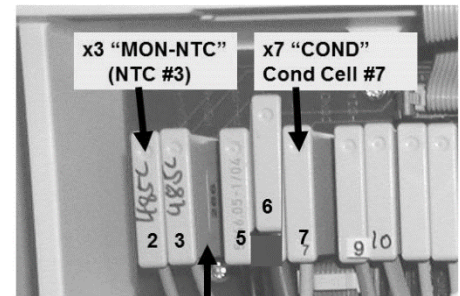
- **IF (and ONLY if) pale yellow / white!** Proceed to **page 225**, procedure number [T- 1.0.130](#).
 - **IF RED!** See procedure number [T- 1.0.9](#) (page 222)
- 3) **IF (and ONLY if) unstable and falls to OR remains less than 35.1° C:** Proceed to **page 227**, procedure number [T- 1.0.142](#).
- 4) **IF UNSTABLE BUT remains more than or goes to 35.1° C BUT NEVER more than 38.9° C:** Proceed to **page 229**, procedure number [T- 1.0.155](#).

T- 1.0.9 [TEMPERATURE] BETWEEN 35.1 AND 38.9 BUT ITS WINDOW IS STILL RED

- 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.
- d) Enter Service Mode → Calibrate Sensors → Temp Sensor



Four-Resistor Set



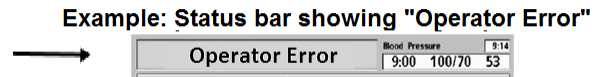
Position #4 "PH-PR" MUST always be VACANT

- e) Proceed to **STEP #1** (page 222).

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 'CONFIRM' ONCE. If no Error banners* appear see **STEP #2** (page 223).
- * If an "Operator Error" OR "Actuator Board Error" banner appears see procedure number [T- 1.0.10](#) (page 223).
- 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- 1.0.10](#) (page 223).



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 'CONFIRM' ONCE and see **STEP #3** (page 223).
- 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- 1.0.10](#) (page 223).

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 'CONFIRM' ONCE and see **STEP #4** (page 223).
- 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- 1.0.10](#) (page 223).

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 'CONFIRM' twice to SAVE the calibration; **B)** Proceed **page 224**, procedure number [T- 1.0.122](#).
- 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- 1.0.10](#) (page 223).

T- 1.0.10 ERROR DURING TEMP SENSOR CALIBRATION

- A) **Read before performing!** Turn the machine off! Using a different **FOUR-RESISTOR SET** return to (ABOVE) procedure number [T- 1.0.9](#) (page 222) HOWEVER, if you return here see part B.
- B) **Read before performing!** Referring to COMPONENT LIST (below), swap in each, one at a time, with known good and in between return to (ABOVE) procedure number [T- 1.0.9](#) (page 222) to test each. If you return here swap in the next component in the list until the error no longer occurs.

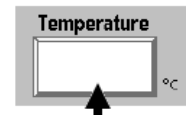
COMPONENT LIST: **1)** Actuator-Test Board*; **2)** Sensor Board*; **3)** Functional Board*; **4)** Motherboard*

* To LOCATE these boards refer to [Figure 4A](#) (page 9)

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' → 'CONFIRM')!
- d) From the Home screen, select the [Dialysate Flow] window.
- e) Set the [Dialysate Flow] to 500 ml/min and press 'CONFIRM'.
- 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:



Pale yellow/white or RED?

- 1) **IF (and ONLY if) pale yellow / white:** See procedure number [T- 1.0.130](#) (page 225).
- 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 222) 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}.

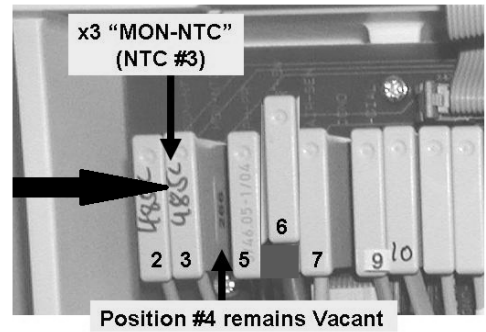
^a To LOCATE these boards refer to [Figure 4A](#) (page 9)

^b With the Functional board, to prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error!** **Bookmark not defined.**)

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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 225).
- 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 244**, procedure number [T- 1.4.0](#).

T- 1.0.131 [TEMPERATURE] WINDOW LESS THAN 30.0° C

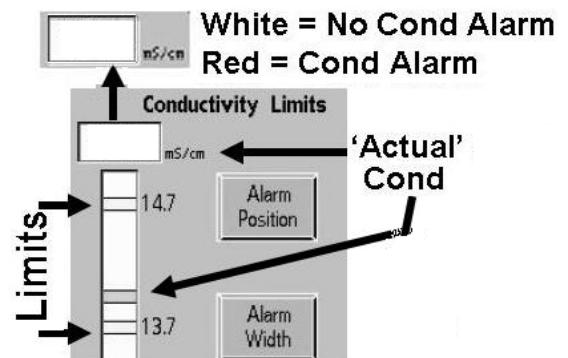
- a) Return NTC #3's connector to the 2nd distribution board position from the LEFT, "MON-NTC".
- b) If NTC #3 was plugged in correctly [Temperature] RETURNS to between 35.1 and 38.9° C!
- c) See procedure number [T- 1.0.132](#) (page 225).

T- 1.0.132 VERIFY CONDUCTIVITY

- a) **ENSURE the shunt door is 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 226).

* 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 317**, [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, select the 'Dialysate' tab (Figure right).
- b) Figure right, if necessary, adjust the Alarm Limits until 'Actual' Conductivity is CENTERED between them.
- c) Press 'CONFIRM!' Is the [Conductivity] window white?



Yes [Conductivity] window is white! See procedure number [T- 1.0.133](#) (page 226).

No [Conductivity] window is red! Allow up to three (3) minutes OR 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 226).
- 2) **IF after three (3) minutes the window remains RED:** Proceed to **page 302**, procedure number [T- 7.0.0](#).

T- 1.0.133 VERIFY 'OUT OF BYPASS'

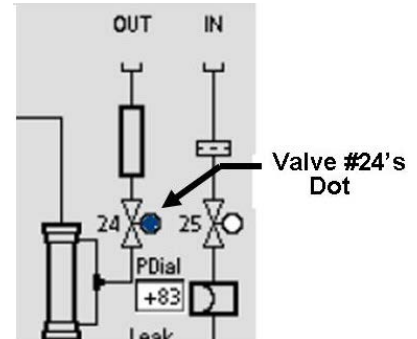
Call debug screen 0. Figure right, is Valve #24's 'dot' blue OR white?

1) **IF (and ONLY if) BLUE:** See procedure number [T- 1.0.134](#) (page 226).

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!

CVRCLS
1 = shunt door closed



b) From the Home screen, ENSURE the [Conductivity] AND [Temperature] windows are pale yellow/white!

c) Call debug screen 0. Watch Valve #24's 'dot' for up to (2) more minutes OR until if it turns blue. TWO (2) possible scenarios:

1) **IF (and ONLY if) the 'dot' turns blue:** See procedure number [T- 1.0.134](#) (page 226).

2) **IF the 'dot' remains white AND the [Temperature] window is white:** Proceed to **page 302**, 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 232**, procedure number [T- 1.0.20](#).

No 'Bob' NOT moving! See parts a THROUGH c below:

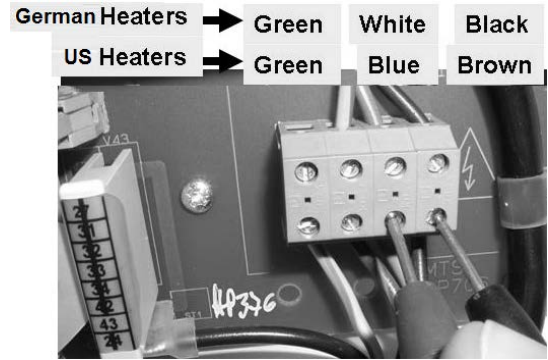
a) ENSURE the shunt door is CLOSED!

b) ENSURE the [Temperature] AND [Conductivity] windows are NOT RED!

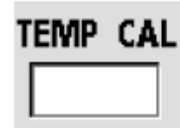
c) If 'bob' still is not moving AND Valve #24's 'dot' is blue there may be masked Flow Error.

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) FULL 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 227).
- 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)?

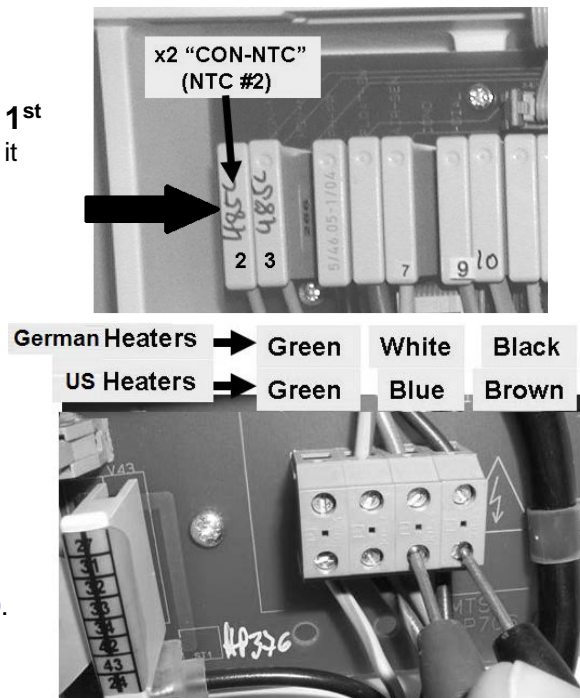


Yes **TEMP CAL** more than 120! See Proceed to **page 229**, procedure number [T- 1.0.155](#).

No **TEMP CAL** less than 120! Proceed to **page 302**, procedure number [T- 7.0.0](#).

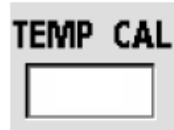
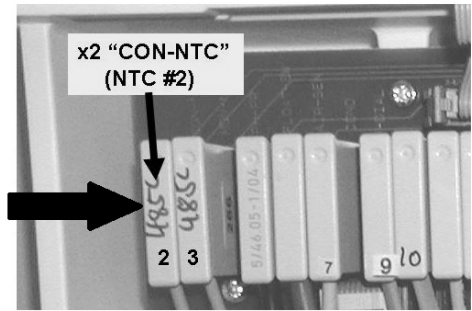
T- 1.0.144 HEATER STAYING OFF

- 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 228)
 - 2) **IF (and ONLY if) ALWAYS less than 100.0 volts AC:** Leaving NTC #2 unplugged till instructed, proceed to **page 263**, 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)?

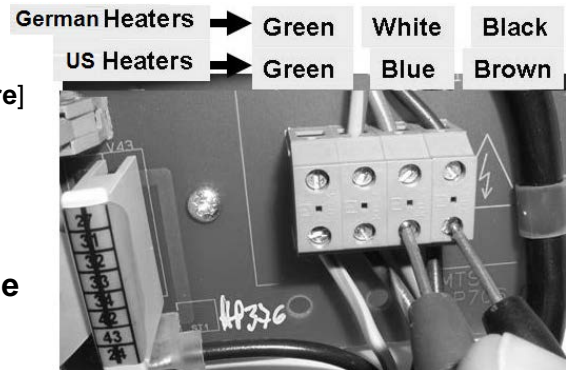


Yes **TEMP CAL** more than 120! See procedure number [T- 1.0.147](#) (page 228).

No **TEMP CAL** less than 120! Proceed to **page 302**, 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 35.0° 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 302**, procedure number [T- 7.0.0](#).

* To LOCATE NTC #2 refer to [Figure 42](#), (page 218)

- 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 35.1° C OR more: Problem solved! NTC #2 may not have been connected properly.

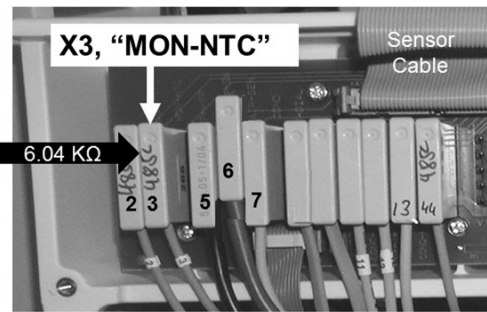
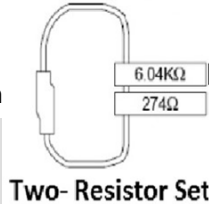
Scenario #2: IF [Temperature] does NOT increase to 35.1° C OR more: See procedure number [T- 1.0.155](#) (page 229).

T- 1.0.155 ISOLATE TEMPERATURE MONITOR

a) Figure right, plug the **6.04 K Ω** resistor plug, from the **TWO-RESISTOR SET** 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 AND STABLE** i.e. does **NOT** change more than 0.2: See procedure number [T- 1.0.16](#) (page 229).

2) **IF (and ONLY if) less than 4.0 OR more than 6.0:** Perform parts a AND b below:



a) Remove the plug then reinsert it into the **2nd** position from the left, "MON-NTC". If **TEMP** is still less than 4.0 OR more than 6.0 see part b. If now between 4.0 and 6.0 AND STABLE (not changing more than 0.2 per minute) see procedure number [T- 1.0.16](#) (page 229).

b) Use the **6.04 K Ω** plug from a different **TWO-RESISTOR SET**. If (and ONLY if) **TEMP** is still less than 4.0 OR more than 6.0 proceed to **page 295**, procedure number [T- 5.0.0](#). If **TEMP** between 4.0 and 6.0 AND STABLE (not changing more than 0.2 per minute) see procedure number [T- 1.0.16](#) (page 229).

3) **IF between 1.0 AND 8.0 BUT 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 [COMPONENT LIST](#) below. Swap in each, one at a time, and in between continue to part C) to test the new component! [COMPONENT LIST](#):

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 [OPERATING MODES](#), page **Error! Bookmark not defined.**)

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 230).

2) **IF less than 35.1 OR more than 38.9 °C:** Proceed to **page 302**, procedure number [T- 7.0.0](#).

T- 1.0.17 SIMULATE CONDUCTIVITY

- a) Figure right, leaving the 6.04 K Ω 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 does NOT change more than 0.2:** See procedure number T- 1.0.18 (page 230).
- 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 Error! Bookmark not defined.)

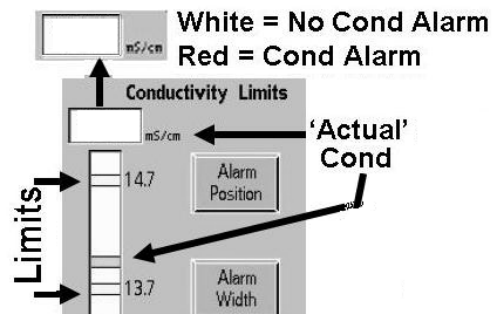
- 3) **IF less than 12.9 OR more than 14.5 mS:** See parts a AND b below:
 - a) Remove the **274 Ω** plug then reinsert it OR consider using the **274 Ω** plug from a different TWO-RESISTOR SET.
 - b) If (and ONLY if) [Conductivity] is still is less than 12.9 OR more than 14.5 proceed to **page 302**, procedure number T- 7.0.0. If NOW STABLE between 12.9 and 14.5 see procedure number T- 1.0.18 (page 230).

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 231).
- 2) **IF RED:** See parts a THROUGH d below:

- a) At the bottom of the screen, select the 'Dialysate' tab.
- b) Figure right, if necessary adjust the Limits until the 'Actual' Conductivity is CENTERED between them.
- c) **IMPORTANT!** Press 'CONFIRM'.



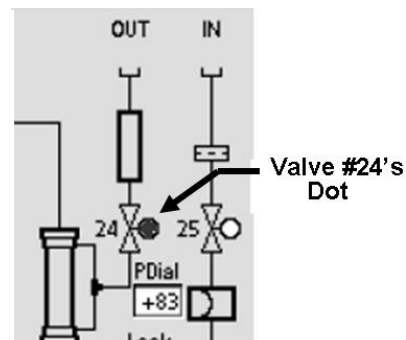
- d) Allow two (2) minutes or until if the [Conductivity] window turns white. TWO (2) possible scenarios next page:

- 1) **IF (and ONLY if) the [Conductivity] window turns white:** See procedure number [T- 1.0.19](#) (page 231)
- 2) **IF AFTER three (3) minutes the [Conductivity] window remains RED:** Proceed to **page 302**, procedure number [T- 7.0.0](#).

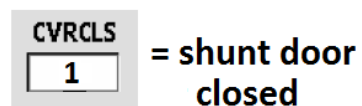
T- 1.0.19 VERIFY 'OUT OF BYPASS'

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 231).
- 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 231).
- 2) **IF the 'dot' turns REMAINS white:** Proceed to **page 302**, 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 'CONFIRM'.
- c) Is the external flow indicator's 'bob' rising at least ¼ way up in the sight tube?

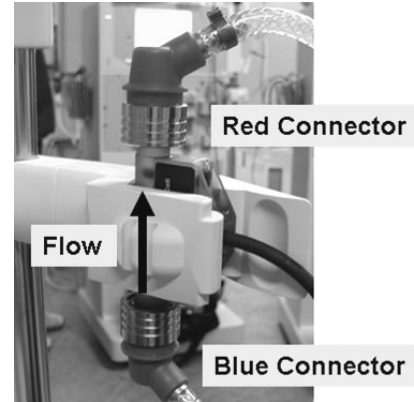
Yes 'Bob' moving! See procedure number [T- 1.0.20](#) (page 232).

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 Flow Error.

T- 1.0.20 FLOW THROUGH THE EXTERNAL INDICATOR

- a) Leaving Dialysate Flow on, install a Temperature meter (°C) into the dialysate lines. **IMPORTANT! 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 232).



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 234).

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 "1" key for five (5) seconds.
- d) Allow FORTY-FIVE (45) seconds BEFORE continuing to part e.
- e) Watch the meter for one (1) minute. TWO (2) possible scenarios:

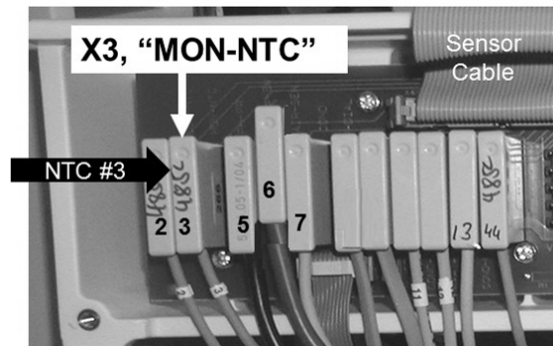
- 1) **IF between 35.1° C and 38.9° C AND STABLE i.e. does NOT change more than 0.2° C per minute:** Proceed to **page 235**, procedure number [T- 1.0.255](#).
- 2) **IF UNSTABLE i.e. changes more than 0.2 °C per minute:** Allow ninety (90) more seconds THEN, ENSURING the 'bob' is moving up and down*, 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** = 0 return to (ABOVE) procedure number [T- 1.0.155](#) (page 229).

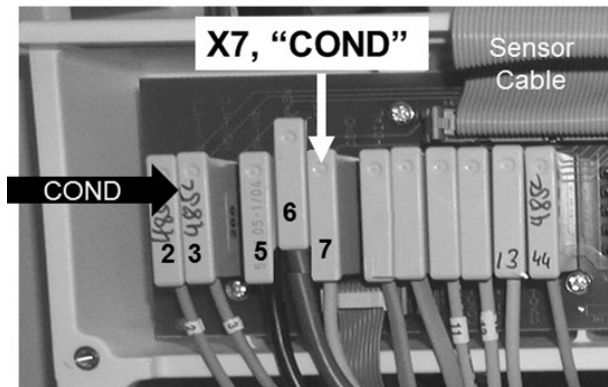
Yes Measured temperature STABILIZES. If (and ONLY if) between 35.1 and 38.9° C proceed to **page 235**, procedure number [T- 1.0.255](#). If not between 35.1 and 38.9°C return to (ABOVE) procedure number [T- 1.0.21](#) (page 232).

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 234).
- 2) **IF remains more than 35.1° BUT NEVER more than 38.8° C:** Proceed to **page 298**, 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 K Ω 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”).



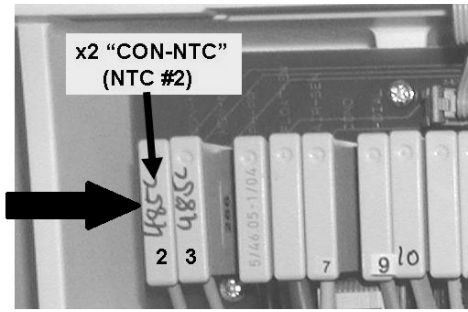
- b) If a 274 Ω plug was previously placed in distribution board position, “X7, COND”, remove it and return the Cond Cell’s connector.



- c) **Using a calibrated temperature meter ENSURE the incoming water (from the RO) is less than 35.0° C.**
- d) If (and ONLY if) incoming water is less than 35.0° C proceed to **page 241**, procedure number [T- 1.3.40](#).

T- 1.0.22 TEMPERATURE LESS THAN 35.1° C

- a) **Set your CALIBRATED 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 263**, procedure number [T- 2.0.0](#).
 - 2) **IF MORE THAN 100.0 volts AC:** Leaving NTC #2 unplugged, see parts a AND b below:



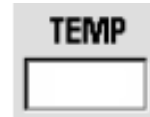
- a) ENSURE the external flow indicator's 'bob' is moving up and down.
- b) WITHOUT LOOKING AWAY, watch the meter for UP TO SEVEN (7) minutes OR until if it EVER reaches more than 35.5° C even if only once?

Yes 35.5° C OR more!. See procedure number [T- 1.0.23](#) (page 234).

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) **IMPORTANT!** 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 in 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 234).
 - 2) **IF LESS THAN 4.0:** NTC #3* is plugged in incorrectly OR is bad. *To LOCATE NTC #3 refer to [Figure 42](#) (page 218).

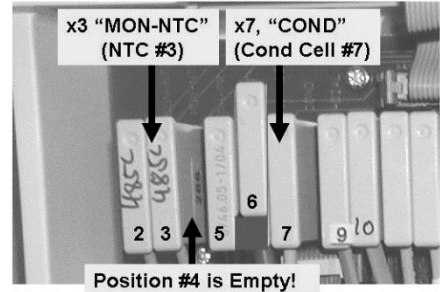


T- 1.0.24 TEMP IS 4.0 OR MORE

- 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 260**, 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 K Ω 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 235).

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 218).

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 302**, 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 235) **T1026**.

No 'Bob' is NOT moving! Return to (ABOVE) procedure number [T- 1.0.132](#) (**page 225**).

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 236).

No IS NOT within +/- 0.3° C of each other: Proceed to **page 302**, procedure number [T- 7.0.0](#).

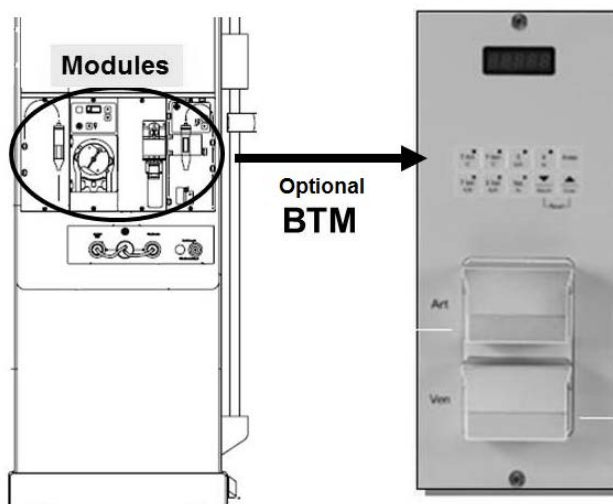
T- 1.0.28 METER VERSUS THE MACHINE'S [TEMPERATURE] DISPLAY IN RANGE

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 246**, 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 283**, 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:

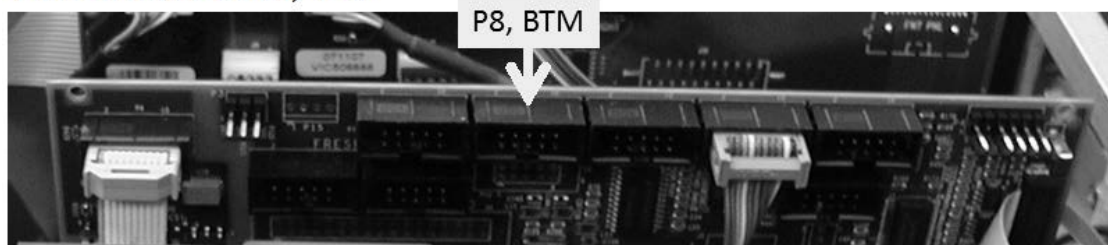


- 1) **IF the temperature problem reoccurs** The BTM is okay! See (ABOVE) procedure number [T- 1.0.7 \(page 221\)](#).
- 2) **IF a temperature problem DOES NOT reoccur:** See parts a THROUGH i below:
 - a) Place the machine into Service Mode → Options → Hardware Options.
 - b) Next to 'BTM', place the 'X' into the “Yes” box then press 'CONFIRM'. 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' → 'CONFIRM')!
- 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.

LEFT BLANK INTENTIONALLY

T- 1.3.0 TEMPERATURE EXCEEDS 38.9°C

This procedure isolates between uncontrollable temperature, unstable monitoring, or high incoming water temperature. BE CAREFUL!

- a) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- 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) **IF [Temperature] NEVER falls:** See procedure number [T- 1.3.11](#) (page 238)!
- e) NOTE [Temperature] THEN, WITHOUT LOOKING AWAY, watch it again for up to **FIVE (5)** minutes for one of the following THREE (3) scenarios:

Scenario #1: IF (and ONLY if) it **STEADILY** falls, until less than 35.5° C i.e. **NEVER, EVER** increases: Proceed to **page 241**, procedure number [T- 1.3.40](#).

Scenario #2: IF (and ONLY if) **EVER INCREASES** 0.2° C or more above what was noted in part e: See procedure number [T- 1.3.11](#) (page 238).

Scenario #3: IF **AFTER** five (5) minutes, **REMAINS** more than 35.5° C: See procedure number [T- 1.3.11](#) (page 238).

T- 1.3.11 ISOLATE INCOMING WATER TEMPERATURE

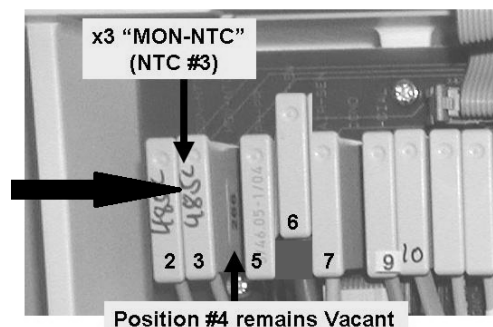
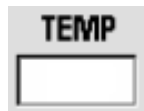
- a) Using a calibrated temperature meter check the incoming water (RO) source.
- b) Measured temperature less than 34.0° C?

Yes Less than 34.0° C! See procedure number [T- 1.3.12](#) (page 238).

No More than 34.0° C! The temperature of the tap water feeding the RO is too high!

T- 1.3.12 RO TEMP LESS THAN 34.0° 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 239).

No **TEMP** is NOT less than 0.3! See parts a and b below:

- 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 238).
- Leaving NTC #3 unplugged, 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, to test each component until screen 4's **TEMP** is less than 0.3.

COMPONENT LIST: **1)** Actuator-Test Board¹; **2)** Power Logic Board¹; **3)** Functional Board^{1,2} (possibly IC20); **4)** Sensor Board²; **5)** Distribution board; **6)** Motherboard.

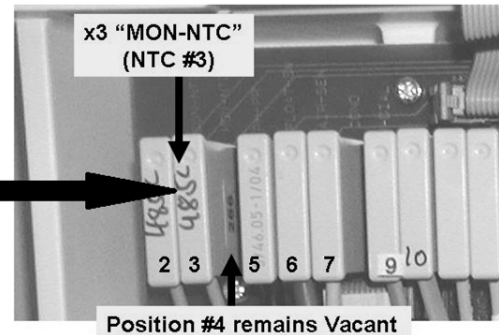
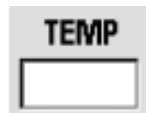
¹ To LOCATE these boards refer to [Figure 4A](#) (page 9)

² To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to [OPERATING MODES](#), (page **Error! Bookmark not defined.**))

T- 1.3.13 TEMP LESS THAN 0.3

- Figure right, place the **6.04 K Ω** resistor plug, from the **TWO-RESISTOR SET**, into the **2nd** distribution board position from the left, "MON-NTC".

- From debug screen 4, is **TEMP** 6.0 or lower?



Yes **TEMP** 6.0 or lower! See procedure number [T- 1.3.17](#) (page 240).

No **TEMP** more than 6.0! See parts a and b below:

- ENSURE the **6.04 K Ω** 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.
- Leaving the resistor 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 **TEMP** is 6.0 or lower indicating the last component swapped in is the problem.

COMPONENT LIST: **1)** Actuator-Test Board¹; **2)** Sensor Board cable; **3)** Sensor Board^{1,2}; **4)** Functional Board (possibly IC20)^{1,2}; **5)** Distribution board; **6)** Motherboard.

¹ To LOCATE these boards refer to [Figure 4A](#) (page 9).

² To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**).

T- 1.3.17 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 its highest and lowest values. 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 K Ω plug installed, swap in the listed components (see COMPONENT LIST below), one at a time, with known good, then return to Dialysis Program and repeat procedure number T- 1.3.17 (page 240) to test each new component until **TPRE** does not change more than +/- 20.



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 9). ^b To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to OPERATING MODES (page **Error! Bookmark not defined.**))

- 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!**

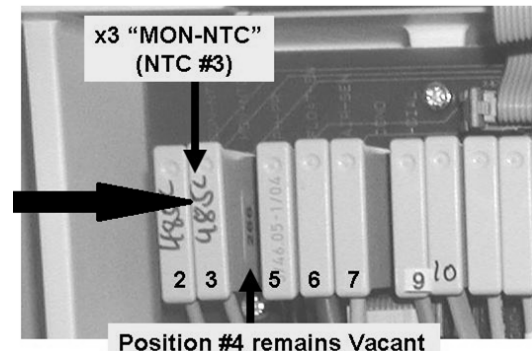
b) To avoid error, read parts c THROUGH h below BEFORE performing them

c) Turn the machine off and replace NTC #3* with a known good . *To LOCATE NTC #3 refer to Figure 42 (page 218).

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' → 'CONFIRM')!

f) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'CONFIRM'.



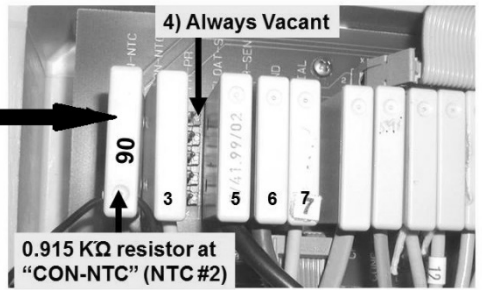
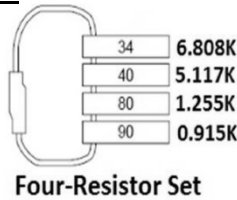
g) WITHOUT LOOKING AWAY, watch the [**Temperature**] window for up to ten (10) minutes. Does it EVER exceed 39.0° C even if only once?

Yes Exceeds 39.0° C! See procedure number T- 1.3.40 (page 241). The old NTC #3 is probably okay!

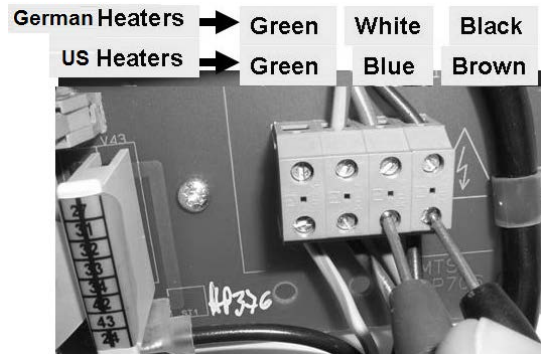
No NEVER exceeds 39.0° C! The original problem (High Temperature) is no longer occurring! See (ABOVE) procedure number T- 1.0.8 (page 222).

T- 1.3.40 ISOLATE TEMPERATURE CONTROL

- a) Figure right, place the **90° C** (0.915 KΩ) plug, from the **FOUR-RESISTOR SET** into the **1st** distribution board position from the left, “CON-NTC”.



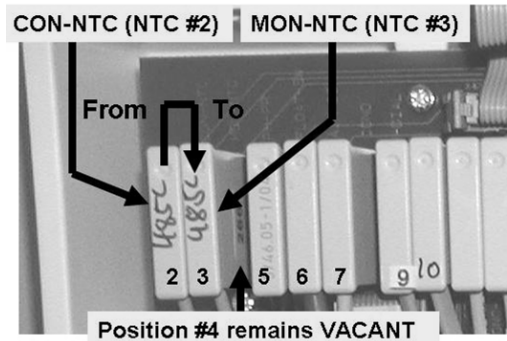
- b) **Set your CALIBRATED volt meter to AC voltage** (~ V, V_{AC})!
- c) **Turn the HEATER Switch ON!**
- d) Figure right, measure at the distribution board's Heater Connector, between the **BLUE** and **BROWN** wires. TWO (2) possible scenarios:



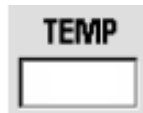
- 1) **IF (and ONLY if) 100.0 volts AC or more:** Leaving the 90° C plug installed, proceed to **page 289**, procedure number [T- 4.0.0](#).
- 2) **IF LESS THAN 10.0 volts AC:** ENSURING the HEATER Switch was on **AND** the meter was set to **AC voltage** prior to measuring, see procedure number [T- 1.3.60](#) (page 241).

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 increase to more than 38.0° C **BEFORE** continuing to part d!
- d) **Turn [Dialysate Flow] OFF (Dialysate Flow on/off lamp blinks)!**
- 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!



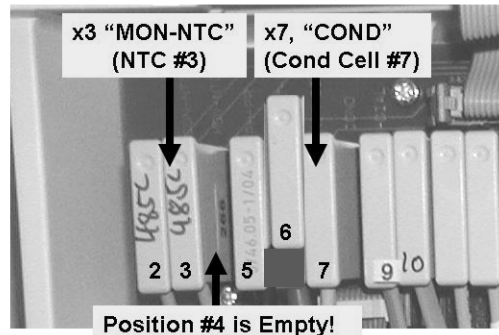
- f) Call debug screen 4 to see **TEMP** (lower left). TWO (2) possible scenarios:



- 1) **IF (and ONLY if) TEMP is more than 3.0:** See procedure number [T- 1.3.70](#) (page 242).
- 2) **IF TEMP is less than 3.0:** See parts A and B below:
 - A) Replace NTC #2* with a known good. *To LOCATE NTC #2 refer to [Figure 42](#) (page 218).
 - B) See procedure number [T- 1.3.70](#) (page 242).

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 NTC #3's 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 'CONFIRM'. The 'X' turns blue!
 Post a note that 'Temp Comp' is off then see procedure number
 T- 1.3.80 (page 242).

↕

No Temp Comp = No! See procedure number T- 1.3.80 (page 242).

Temp Comp. Yes No

Temp Comp. Yes No

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 'CONFIRM' TWICE to turn the [TEMP DAC] data box pale yellow / white.
- d) Select [TEMP DAC], it turns bright yellow.
- e) Set [TEMP DAC] to "130" and press 'CONFIRM'. 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 'CONFIRM' twice to activate the [Monitor Reference] data box. It turns bright yellow.
- h) IGNORING the external meter adjust the [Monitor Reference] data box to 34.0° C!
- i) Press 'CONFIRM' twice to save the calibration.
- j) See procedure number T- 1.3.90 (page 243).

T- 1.3.90 ISOLATE NTC #2 / TEMP CONTROL

- a) Return to Calibrate Sensors → Temp Control
- b) Press 'CONFIRM' 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 'CONFIRM' twice to save the calibration THEN proceed to **page 302**, procedure number [T- 7.0.0](#).

2) **IF the meter 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) Replace **NTC #2*** with a known good. *To LOCATE NTC #2 refer to [Figure 42](#) (page 218).
- b) Repeat procedure number [T- 1.3.90](#) (page 243)

ii. **IF NTC #2 WAS replaced in THIS session:** TWO (2) possible bad components (see COMPONENT LIST below). Replace each, with known good, one at a time and in between repeat procedure number [T- 1.3.90](#) (page 243) to test the new component.

COMPONENT LIST: 1) Sensor Board^{1,2}; 2) Functional Board^{1,2}

¹ To LOCATE these boards refer to [Figure 4A](#) (page 9)

² To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

LEFT BLANK INTENTIONALLY

T- 1.4.0 [TEMPERATURE] NOT LESS THAN 30° 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 244).

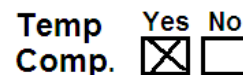
No **TEMP** more than 0.3! Swap in the following components (see [COMPONENT LIST 1](#) below) one at a time, with known good, and in between repeat procedure number [T- 1.4.0](#) (page 244) until screen 4's **TEMP** is less than 0.3.

COMPONENT LIST 1: **1)** Actuator-Test Board¹; **2)** Sensor Board^{1,2}; **3)** Sensor Board cable; **4)** Functional Board (possibly IC20)^{1,2}; **6)** Distribution board; **7)** Motherboard.

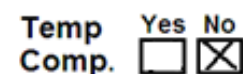
¹ To LOCATE these boards refer to [Figure 4A](#) (page 9). ²To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

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 'CONFIRM'. The 'X' turns blue. Post a note that '**Temp Comp**' is off then see procedure number [T- 1.4.2](#) (page 244).



No **Temp Comp** = No! See procedure number [T- 1.4.2](#) (page 244).

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! **DO NOT** touch the calibration screen's [Temp DAC] data box!

- With NTC #3 remaining unplugged, select Calibrate Sensors → Temp Control.
- Press and release 'CONFIRM' until the screen's [**Monitor Reference**] data box turns pale yellow / white.
- Select [**Monitor Reference**], it turns bright yellow.
- Adjust [**Monitor Reference**] it to as low as it will go then increase it 0.2° C ABOVE that.
- Press and release 'CONFIRM' until the calibration is saved.
- Turn the machine OFF!
- Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- With NTC #3 remaining unplugged, call the Home screen.
- Is the [**Temperature**] window less than 30.0° C now?

Yes Less than 30.0° C! See procedure number [T- 1.4.3](#) (page 245).

No More than 30.0° C! Swap the following components (see [COMPONENT LIST](#) below) in one at a time, with known good, in between repeating (ABOVE) procedure number [T- 1.4.2](#) (page 244) until **Temperature** remains less than 30.0° C.

COMPONENT LIST: **1)** Actuator-Test Board¹; **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 9)

² To prevent “Cond Offset Failure” place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

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: Calibrate Temp Control per the Calibration Procedures booklet!

Procedure #2: When the calibration is complete continue to part c.

c) Turn the machine OFF!

d) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!

e) Again unplug NTC #3 from the **2nd** distribution board position from the left, “X3, MON-NTC”..

f) Call the Home screen. Based on the [**Temperature**] window, TWO (2) possible scenarios:

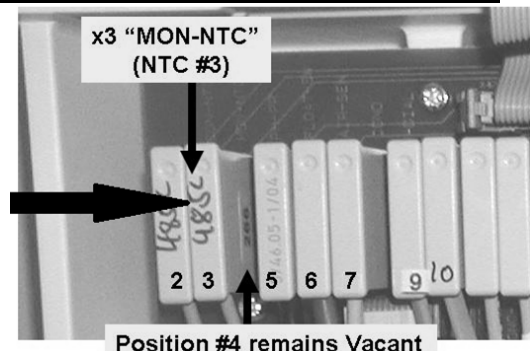
1) IF now less than 30.0° C: Return NTC #3's connector to distribution board position “X3, MON-NTC” then allow ten (10) full minutes. If a temperature problem reoccurs return to (ABOVE) procedure number [T- 1.0.0](#) (page 215). If not perform the alarms test. If the tests pass the problem is solved!

2) IF more than 30.0° C: Swap the following components (see [COMPONENT LIST](#) below) in one at a time, with known good, and in between repeat procedure number [T- 1.4.3](#) (page 245) until the [**Temperature**] window is less than 30.0° C.

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.

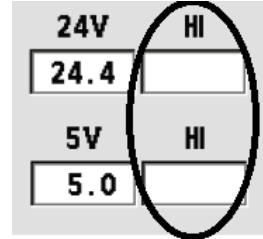
^a To LOCATE these boards refer to [Figure 4A](#) (page 9).

^b To prevent “Cond Offset Failure” place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**)).



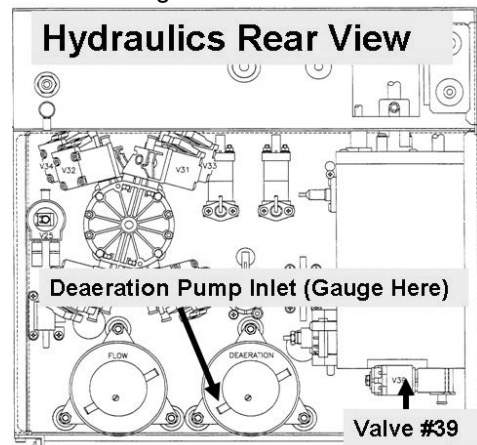
T- 1.5.0 “TEMP OVER 95 DEGREES” ALARM OCCURRED

- 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 253**, 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 Deaeration Pump).
- d) **Place the machine into RINSE (NOT Heat Disinfect)!**
- e) Based on the gauge reading, TWO (2) possible scenarios below:



- 1) **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 247)!
- 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 (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?

Remaining Prerinse Time 0:00 min:sec

Yes **[Remaining Prerinse Time] = 0:00!** See procedure number [T- 1.5.2](#) (page 247).

- 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 247).

T- 1.5.2 [Remaining Prerinse Time] = 0:00

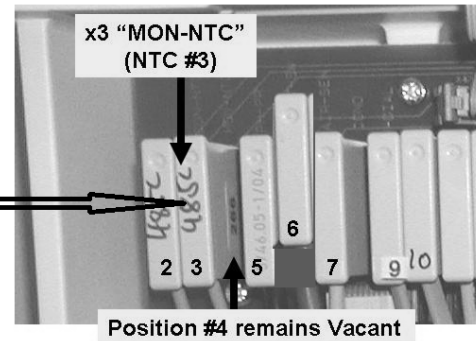
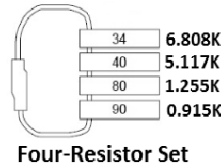
- a) Being aware that flow does not stop, remove the dialyzer connectors from the shunt and connect them to a calibrated Temperature (°C) meter* but **DO NOT shut the door!**

* **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 251**, 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 250**, 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 248).
 - 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 K Ω) 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 254**, 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 249).

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 249).

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 'CONFIRM' 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 247**, 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 #2¹; 2) Sensor Board^{2,3}; 3) Functional Board^{2,3}

¹ To LOCATE NTC #2 refer to [Figure 42](#) (page 218)

² To LOCATE the boards refer to [Figure 4A](#) (page 9)

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 247**, 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 #3¹; 2) Sensor Board^{2,3}; 3) Functional Board^{2,3}

¹ To LOCATE NTC #3 refer to [Figure 42](#) (page 218)

² To LOCATE the boards refer to [Figure 4A](#) (page 9)

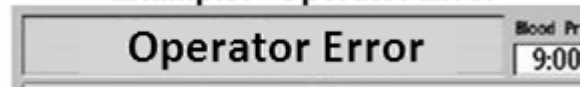
³ Calibrate Temp Sensor AND Temp Control AND Cond Cells BEFORE testing these components

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?

Example: "Operator Error"



Yes An “Error” banner occurs! CAREFULLY repeat the **Temp Sensor** calibration but if an “Error” banner reoccurs proceed to **page 302**, 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 247**, 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 247**, 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 9).

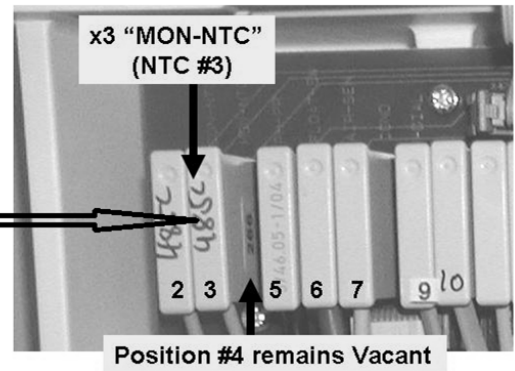
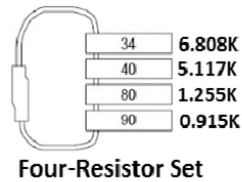
F) BEFORE continuing to part G, note this page number then proceed to **page 14** to perform the **VOLTAGE DETECTOR CALIBRATION**

G) **Read before performing!** Return to **page 247**, 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 9)

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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 253**, 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 255**, 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 254**, 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 251).
 - 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 247**, 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 9).
- 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 247**, 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 9).
- 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 247**, 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 14** 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 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 246**, 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 Board¹; 2) Actuator-Test Board^{1, 2}; 3) Sensor Board^{1, 3}; 4) Functional Board^{1, 2, 3}; 5) Power Supply; 6) Motherboard¹.
- ¹ To LOCATE these boards refer to [Figure 4A](#) (page 9)
 - ² BEFORE performing parts I and J note this page number then proceed to **page 14** 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 **Error! Bookmark not defined.**)
- 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 above part H.**
 - 2) **IF 5V HI REMAINS LESS THAN 5.3 AND 24V HI REMAINS LESS THAN 28.0: The last component 'swapped' in solved the 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 Board¹; 2) Sensor Board^{1, 2}; 3) Functional Board^{1, 2} 4) Distribution board.

¹ To LOCATE the boards refer to [Figure 4A](#) (page 9)

² To prevent a "Cond Offset Failure" place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**)

- 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 668).

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 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 256).

- 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 218)

 - c) **Read before performing!** Return to (ABOVE) procedure number [T- 1.5.1](#) (page 247) 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 9).

 - 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 247) 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 247) to see if the new board fixed the problem.

T- 1.5.677 EXTERNAL METER EXCEEDS 95° C

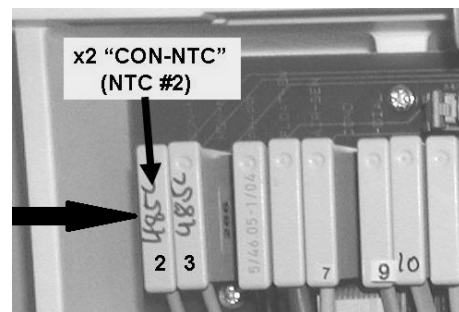
- a) Return NTC #3's connector to the **2nd** distribution board position from the left, "MON-NTC".
- b) Replace Temperature control sensor **NTC #2*** with a known good. THEN continue to part C. *To LOCATE NTC #2 refer to [Figure 42](#) (page 218).
- c) **Read before performing!** Return to procedure number [T- 1.5.1](#) (page 247) 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 9)
- 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 247) 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 247) 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 in 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 257).

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.
- b) **To avoid damage, DO NOT leave the machine!**
- c) The meter’s temperature should eventually increase. If incoming water is really 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?

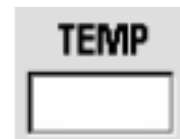


Yes 36.0° C **OR** more! See procedure number [T- 1.7.4](#) (page 257).

No Remains less than 36.0° C! Leaving NTC #2 unplugged, proceed to **page 258**, 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 ‘Escape’ then call screen 4.
- b) From debug screen 4, is **TEMP** (lower left) 4.0 **OR** more?



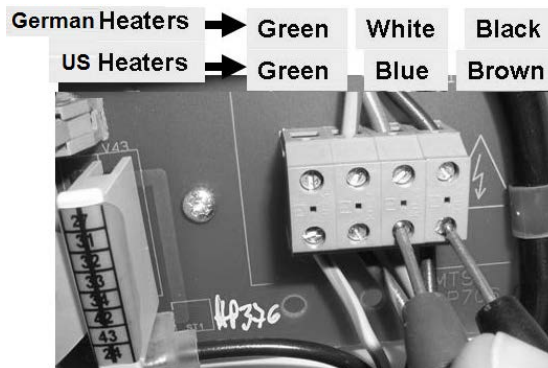
Yes **TEMP** 4.0 or more. Proceed to **page 259**, procedure number [T- 1.7.72](#).

No **TEMP** is less than 4.0! See parts THROUGH c below:

- b) Replace NTC #3* with a known good.* To LOCATE NTC #3 refer to see [Figure 42](#) (page 218).
- c) Proceed to **page 302**, 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 258).

No Less than 100.0 volts AC! See parts a through e below:

- Press 'Escape' then 'CONFIRM' twice to call the "Select Program" screen.
- Plug into concentrate.
- Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- From the Home screen, set [Dialysate Flow] to 500 ml/min and press "CONFIRM"!
- Leaving NTC #2 unplugged till instructed, proceed to **page 263**, 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 is more than 20.0° C! The heater* may be bad. *To LOCATE the heater refer to [Figure 28](#) (page 129).

No Incoming water is less than 20.0°C! Too low! After this problem is corrected the Temperature problem may not exist!

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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 259).

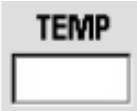
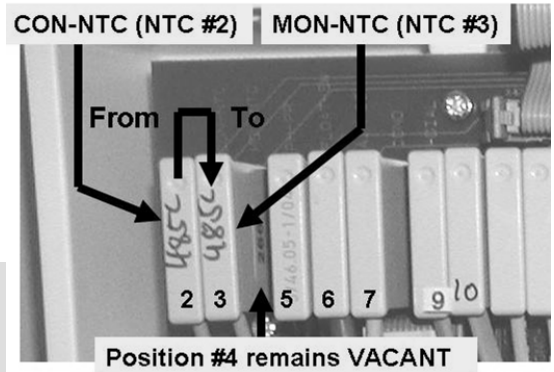
T- 1.7.8 VERIFY TEMPERATURE

- a) **Turn the HEATER Switch ON!**
- b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- c) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- 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 260).
 - 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 222**, procedure number [T- 1.0.8](#).

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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 seven (7) minutes OR until if **TEMP** (lower left) falls to 2.5 OR less?



Yes **TEMP** = 2.5 OR less! NTC #2 appears to be okay. See procedure number [T- 1.8.1](#) (page 260).

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 LOCATE NTC #2 refer to [Figure 42](#) (page 218).

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)?

Temp Comp.	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
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Yes Place the 'X' in the "No" box and press 'CONFIRM'. The 'X' turns blue. Post a note that '**Temp Comp**' is off then see procedure number [T- 1.8.2](#) (page 261).

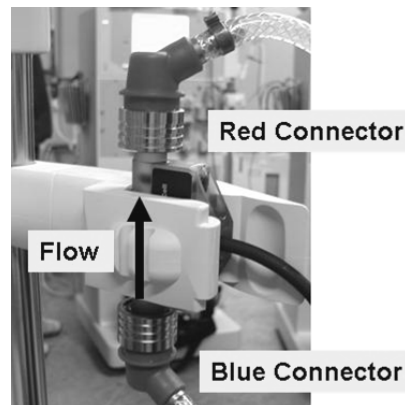
Temp Comp.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
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No **Temp Comp** = No! See procedure number [T- 1.8.2](#) (page 261).

T- 1.8.2 VERIFY TEMPERATURE CONTROL

This is NOT a routine Temperature calibration. Follow the procedure exactly to avoid error!

- a) Install a Temperature meter (° C) in the dialysate lines and!
Figure right, flow through the meter MUST be bottom to top!
- b) **CLOSE THE SHUNT DOOR!**
- c) From the Service menu select Calibrate Sensors → Temp Control.
- d) 'Sharply' press 'CONFIRM' TWICE to turn the screen's [TEMP DAC] data box pale yellow / white.
- e) Select [TEMP DAC] to turn it bright yellow
- f) Set [TEMP DAC] to "180".
- g) 'Sharply' press 'CONFIRM'. [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 261).

No Meter less than 35.5° C! With [TEMP DAC] pale yellow / white, see procedure number [T- 1.8.4](#) (page 261).

T- 1.8.3 METER MORE THAN 35.5°C / VERIFY [TEMP DAC]

- a) Allowing five (5) minutes after each [TEMP DAC] adjustment, continue the calibration 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 between 36.9 and 37.1° C?

Yes [TEMP DAC] is 190 or more! See procedure number [T- 1.8.4](#) (page 261).

No [TEMP DAC] less than 190! Proceed to **page 309**, 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 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 262).

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) **To avoid damage 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 262).

T- 1.8.6 REATTEMPT TEMP CONTROL CALIBRATION

- a) Return to Service Mode → Calibrate Sensors → Temp Control.
- b) ‘Sharply’ press ‘CONFIRM’ TWICE to turn the screen’s **[TEMP DAC]** data box pale yellow/white.
- c) Select **[TEMP DAC]**, it turns bright yellow.
- d) Set **[TEMP DAC]** to “170”.
- e) Press ‘CONFIRM’. **[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 306**, procedure number [T- 7.2.2](#).

No Remains less than 35.5° C! Perform parts a AND b below:

- a) **To prevent damage, 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 262) to test each new component until the meter’s temperature is more than 35.5° C!

COMPONENT LIST: **1)** NTC #2¹; **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.

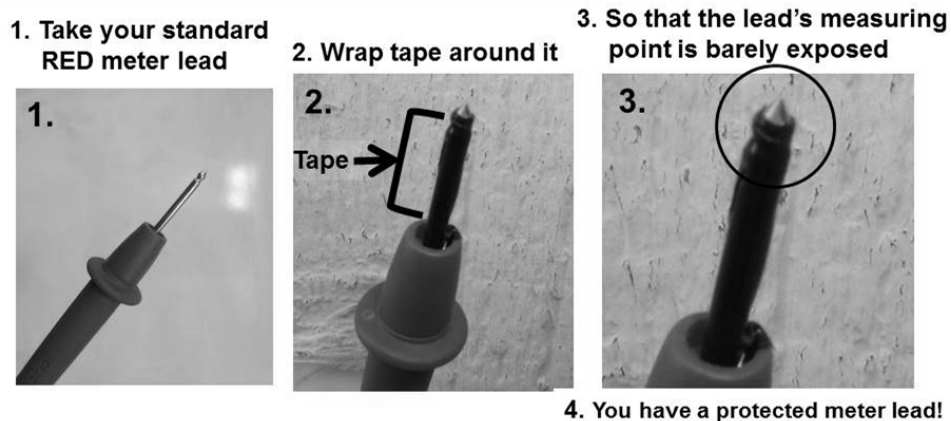
¹ To LOCATE NTC #2, refer to Figure 42 (page 218)

² To LOCATE the board, refer to [Figure 4A](#) (page 9)

³ To prevent “Cond Offset Failure”, place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

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 will be measured at pins that are VERY close to others and touching them together, with a standard meter lead, **WILL CAUSE 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.

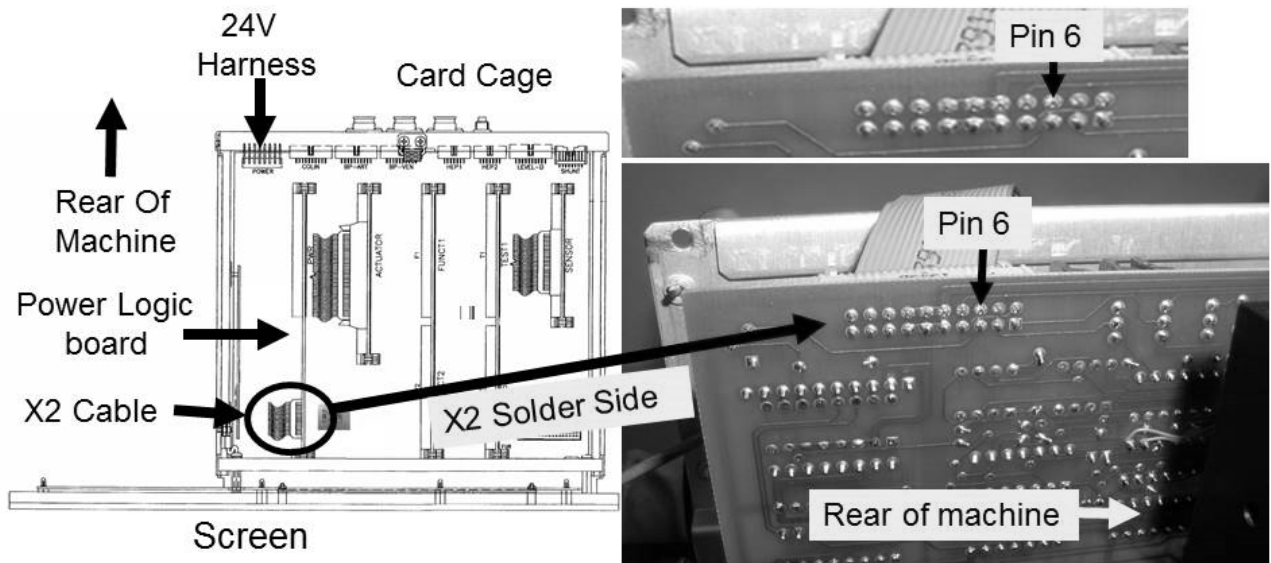


Figure 43 – Power Logic Cable X2 / Pin 6

- f) Measure from the solder (rear) side of the X2 cable, at **pin 6** (TOP row, three pins from the REAR of the machine). A good signal is 9.0 volts DC OR MORE?

Yes **Pin 6** is 9.0 volts OR MORE! See procedure number [T- 2.0.1](#) (page 264).

No **Pin 6** LESS THAN 9.0 volts (bad signal from the Power Logic Board)! Proceed to **page 274**, procedure number [T- 2.2.0](#).

T- 2.0.1 PIN 6 MORE THAN 9.0 VOLTS

a) If in Heat Disinfect see part b. If in Dialysis Program ENSURE Dialysate Flow is on*!

* If the Dialysate Flow on/off lamp 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**.

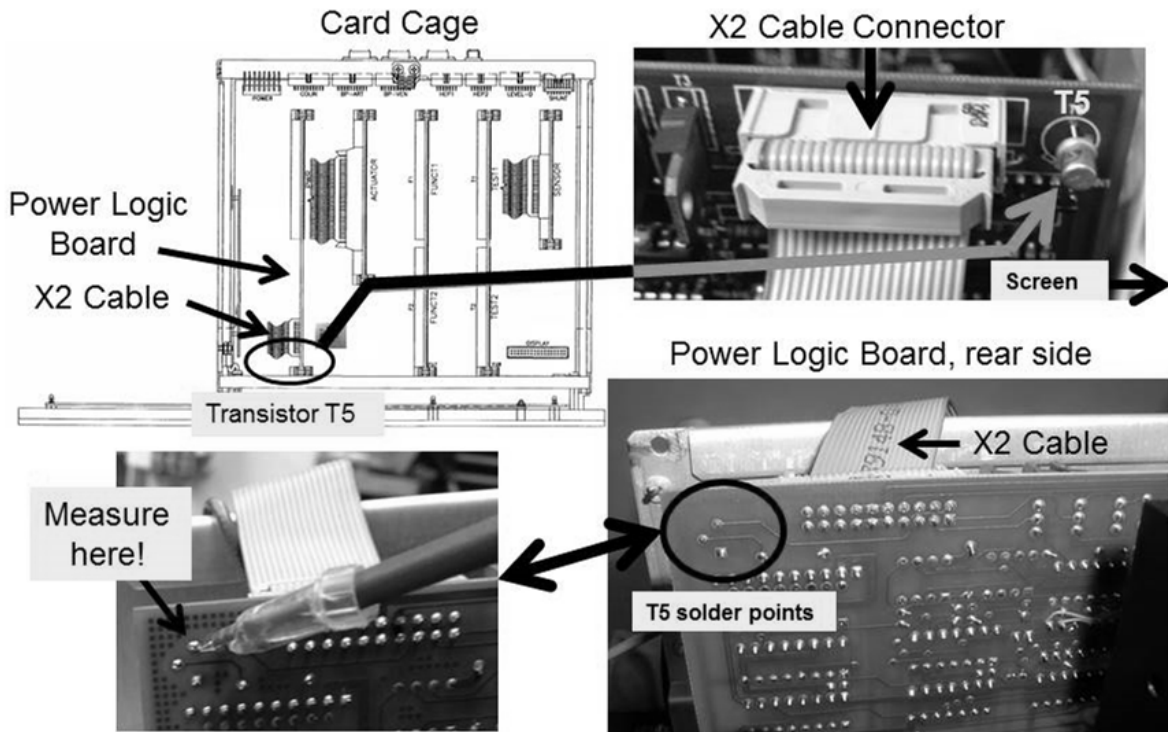


Figure 44 – Power Logic Board / Transistor T5

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 265).

No **T5** between 20.0 and 28.0 volts DC*! Proceed to **page 267**, procedure number [T- 2.0.5](#).

* **Pay attention to the meter's units!**

Example: units units

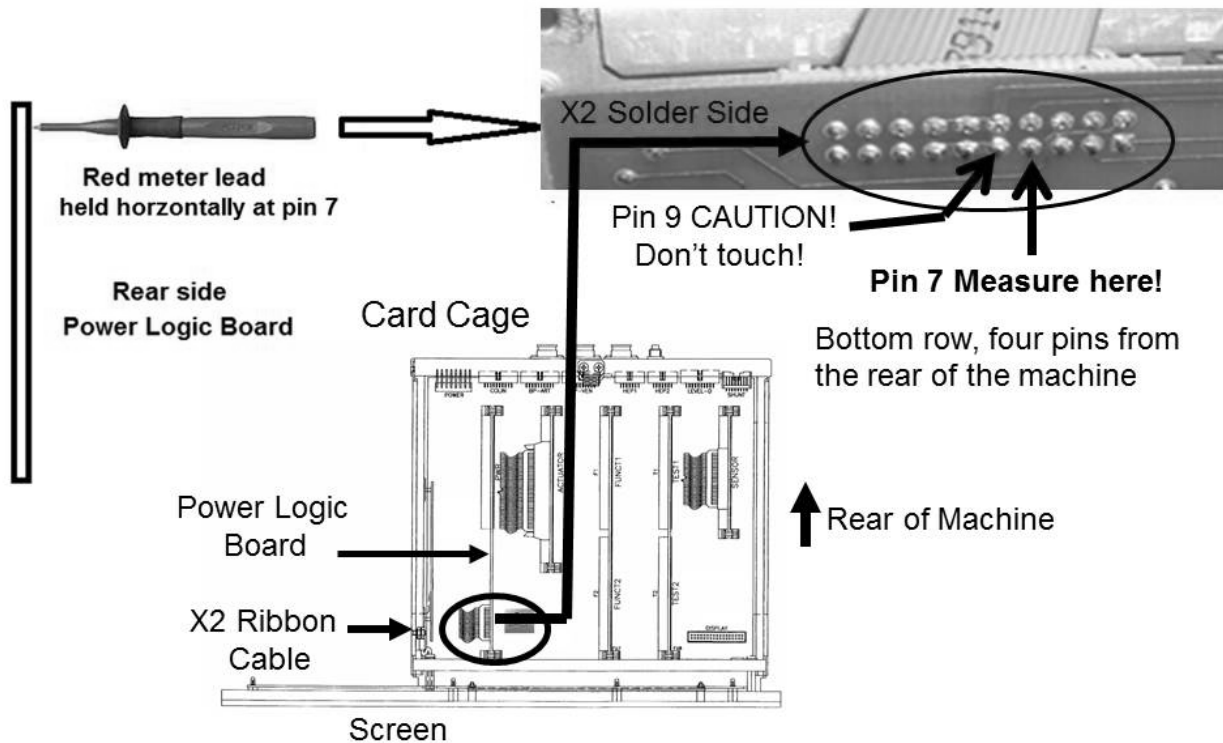
24.211	mV _{DC}	0.024	V _{DC}
--------	------------------	-------	-----------------

24.211 millivolts DC = 0.024 volts DC

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 WILL DAMAGE several boards!** To prevent this, TWO (2) precautions:

- 1) Use the protected 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 OR MORE! See procedure number [T- 2.0.3](#) (page 265).

No Pin 7 is LESS THAN 4.0 volts! Proceed to **page 268**, procedure number [T- 2.0.6](#).

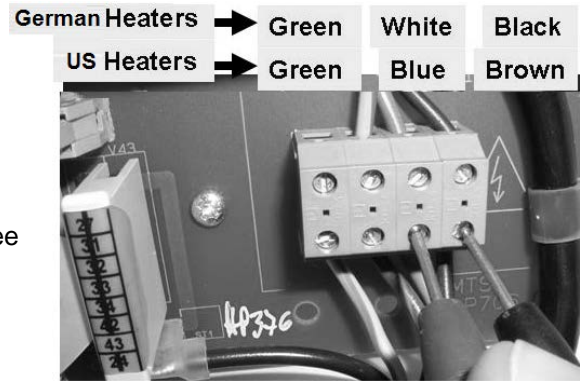
T- 2.0.3 PIN 7 IS 4.0 VOLTS OR MORE

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 266).
 - 2) **IF LESS than 100.0 volts AC!** Proceed to **page 278**, 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 DC voltage measurements isolates the entire heater circuit:

Measurement #1: Per [Figure 43](#) (page 263) at x2, **pin 6**. Good = more than 9.6 volts DC.

Measurement #2: Per [Figure 44](#) (page 264), 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 **pin 6** is less than 9.6 volts DC see procedure number [T- 2.2.0](#) (page 274). If **T5** is more than 2.0 volts DC see procedure number [T- 2.0.5](#) (page 267).

T- 2.0.5 T5 BETWEEN 20.0 AND 28.0 VOLTS DC

- a) Call debug screen 0. If debug does not appear press 'Escape' 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 meter 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 269**, procedure number **T- 2.1.0**.

No **Pin 7** is LESS THAN 4.0 volts! See procedure number **T- 2.0.6** (page 268).

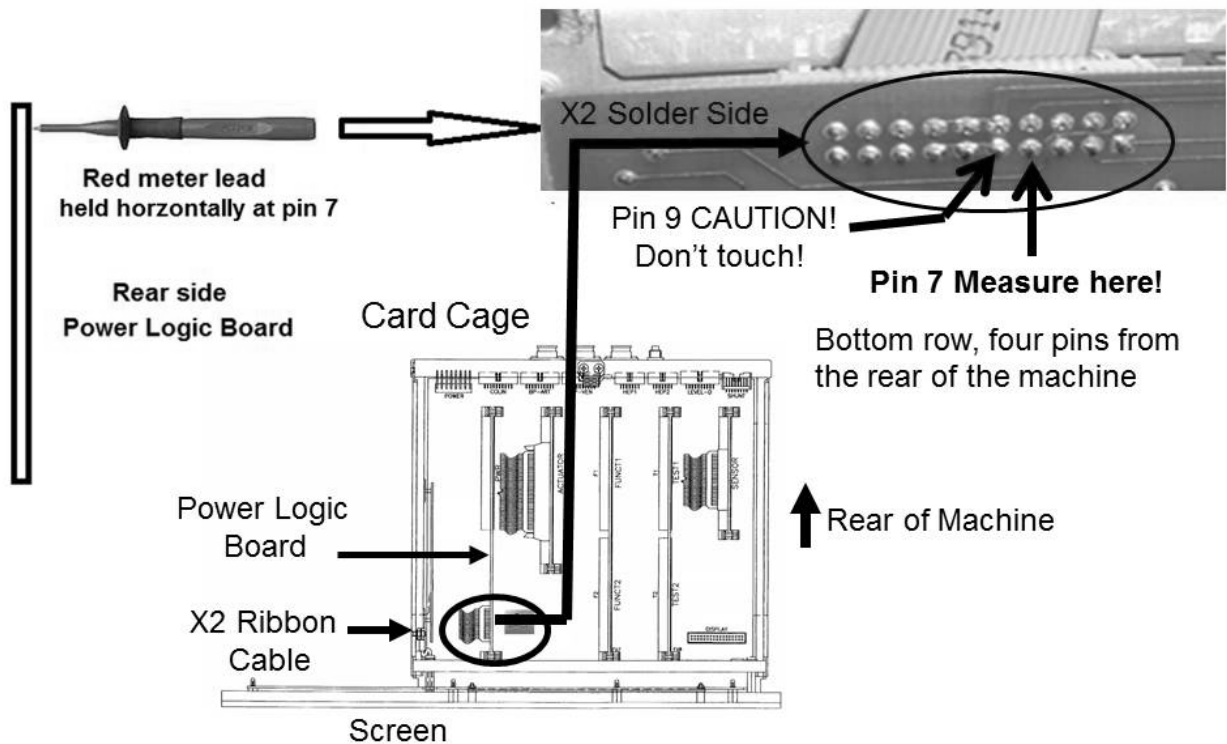


Figure 45 - Power Logic Board X2 / Pin 7

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 9).
- d) With the known good board in, see procedure number [T- 2.0.7](#) (page 268).

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' → 'CONFIRM'). 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 meter 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 BOARD LIST below, and in between repeat procedure number [T- 2.0.7](#) (page 268) to test each until **pin 7** is 4.0 volts DC or more.

BOARD LIST: **1)** Functional Board^{1,2}; **2)** Power Logic Board¹; **3)** Power Control board (inside the power supply); **4)** Motherboard¹.

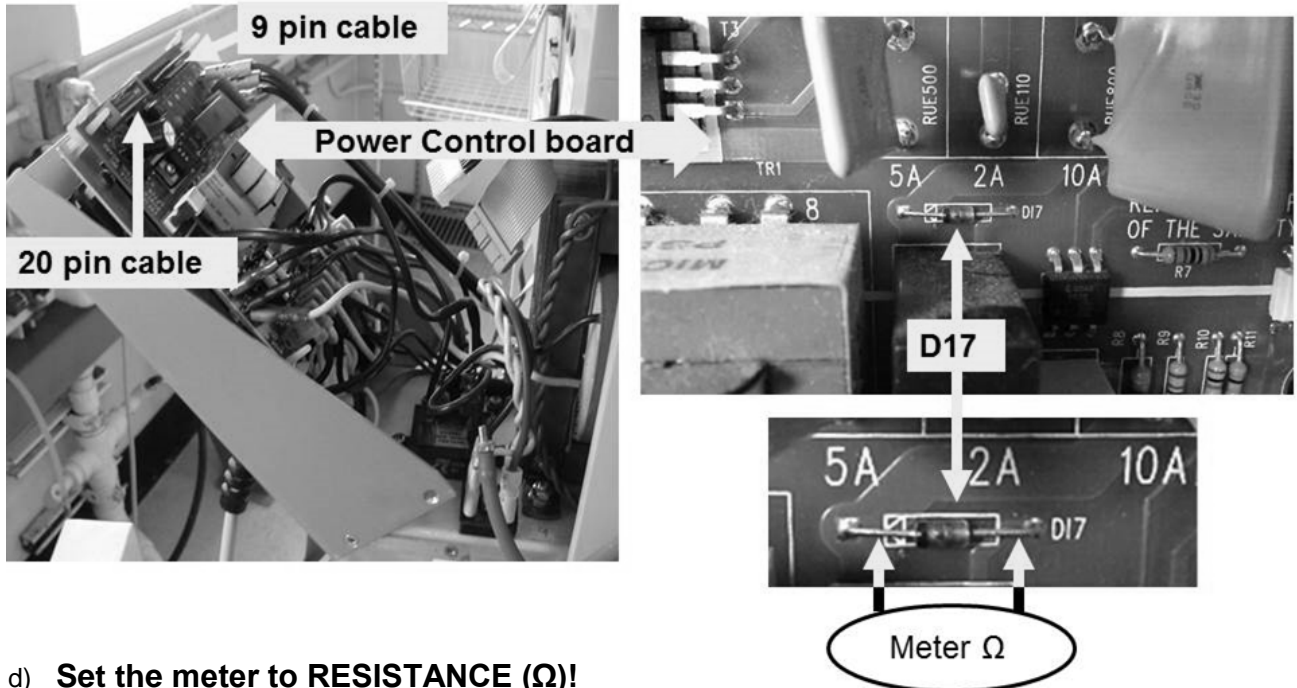
¹ To LOCATE these boards refer to [Figure 4A](#) (page 9)

² To prevent a "Cond Offset Failure" alarm place the machine into T and C Mode (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

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!** Turn the machine OFF and unplug it! Electrocutation hazard if NOT unplugged!!
- b) Per the Figure 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)!



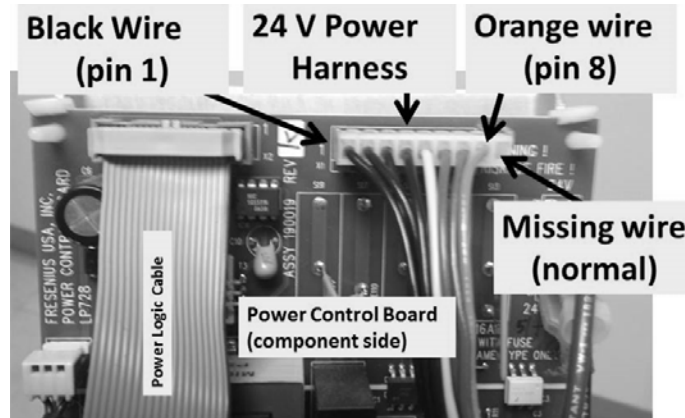
- d) **Set the meter to RESISTANCE (Ω)!**
- e) Per the Figure above, check D17 by placing one meter lead on one side of it and the other lead on the other side.
- f) Figure right, reading the meter's numeric AND units display! TWO (2) possible scenarios:

Examples:	Units	
1000	Ω	= 1000 ohms
		M Ω = million ohms
1.001	K Ω	= 1.001 K (thousand) ohms

- 1) **IF (and ONLY if) between 900 and 1500 Ω (0.900 and 1.5 K Ω)!** Diode 17 is good!
See procedure number [T- 2.1.4](#) (page 270).
- 2) **IF less than 900 Ω (0.900 K Ω) OR more than 1500 Ω (1.5 K Ω):** Diode 17 is bad!
Perform parts a THROUGH c 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 270).

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!

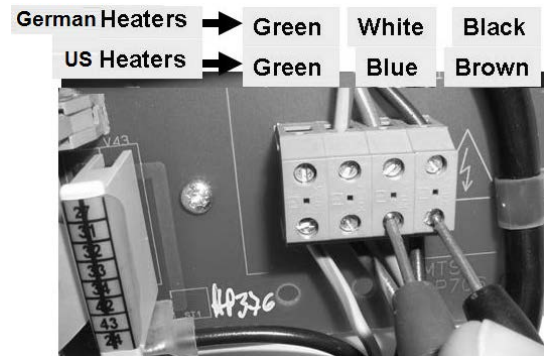


NOTE: A good diode 17 does NOT necessarily mean the Power Control board is good

- b) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it ("Select Program" → 'Dialysis' → 'CONFIRM'). If a HEAT DISINFECT problem return to HEAT DISINFECT.
- c) **Set your meter AC voltage (~ V, V_{AC}).**

- d) Figure right, measure BETWEEN the Heater Connector's BROWN and BLUE 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 270).



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 **T5** TOP pin. If necessary, refer to [Figure 44](#) (page 264).
- d) LESS THAN two (2.0) volts DC?

Yes T5 LESS THAN 2.0 volts! Proceed to **page 273**, procedure number [T- 2.1.8](#).

No T5 between 2.0 and 28.0 volts! See procedure number [T- 2.1.6](#) (page 271).

T- 2.1.6 T5 BETWEEN 2.0 AND 28.0 VOLTS .

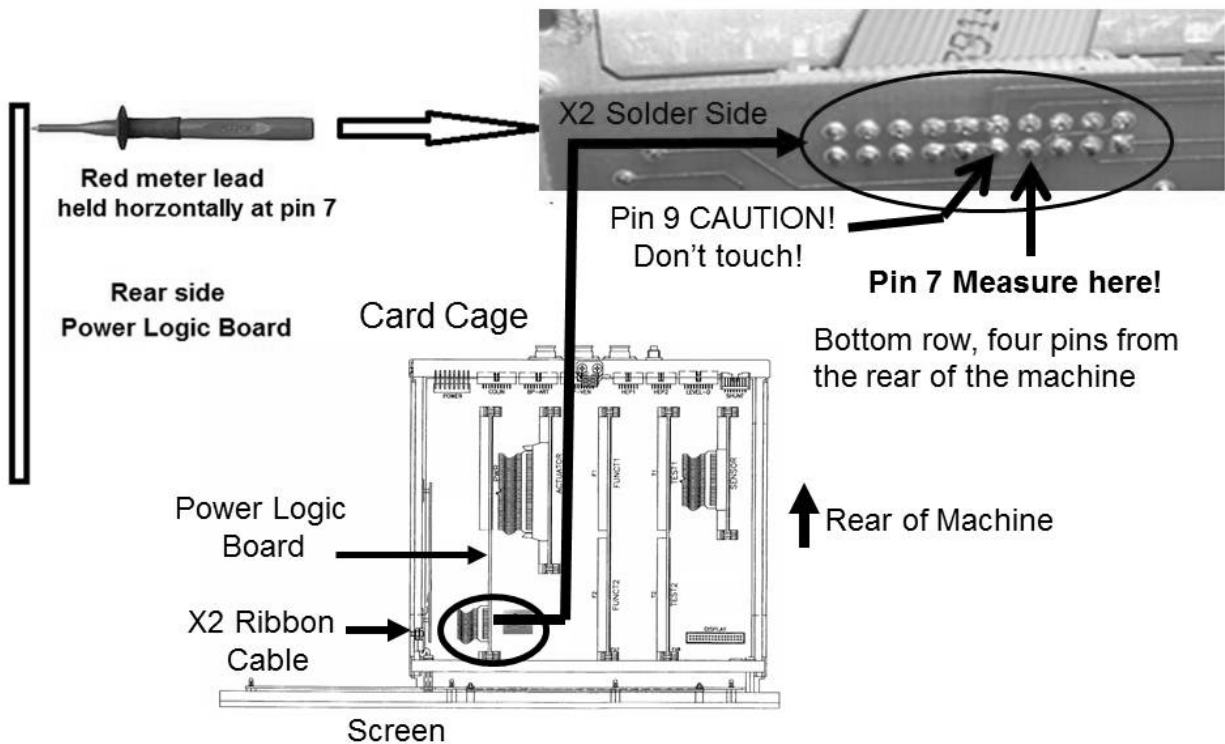
- a) Call debug screen 0. If debug does not appear press 'Escape' then call screen 0.
- b) Watching for one (1) minute, if **Flow Error** EVER = 1 OR a "No Water" alarm EVER appears DO NOT troubleshoot temperature!
- c) **CAUTION!** The measurement at the Power Logic board's twenty-pin X2 cable, at **pin 7** is repeated To avoid damage, TWO (2) precautions:

1) Use the protected red meter lead!

2) Per the Figure below, place the meter 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 272).

No Pin 7 is 3.9 volts OR LESS! See (ABOVE) procedure number [T- 2.0.6 \(page 268\)](#).



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 Board¹; **5)** Motherboard

¹ To prevent a "Cond Offset Failure" alarm place the machine into T and C Mode (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**)

- c) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it ("Select Program" → 'Dialysis' → 'CONFIRM'). 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 264). LESS THAN two (2.0) volts DC now?

Yes T5 LESS THAN 2.0 volts! The new component fixed the problem

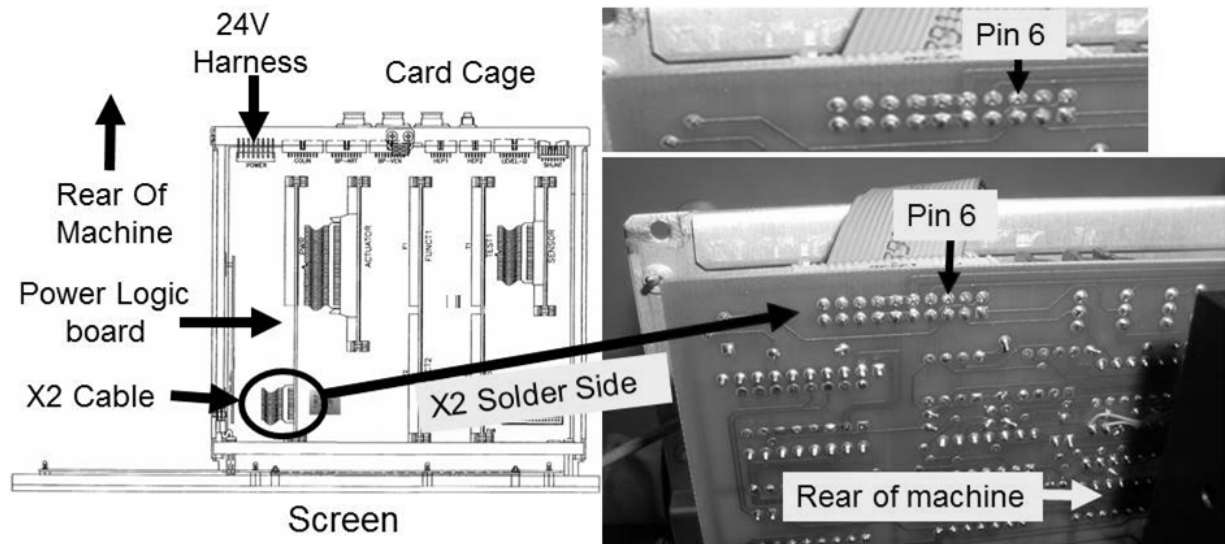
No T5 between 2.0 and 28.0 volts! Repeat parts a through d until T5 is LESS than 2.0 volts DC.

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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:

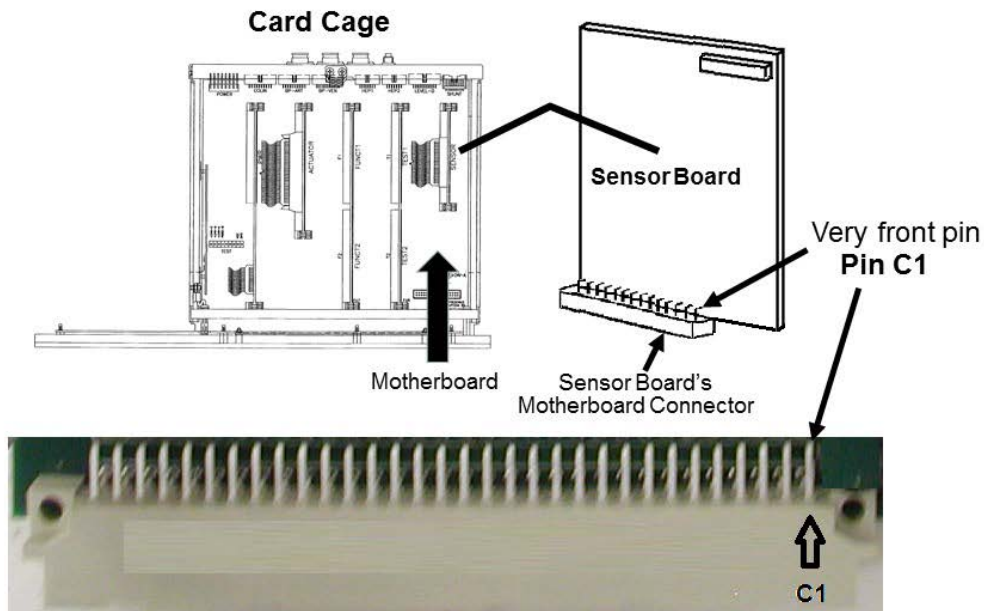
- 1) **IF (and ONLY if) 9.0 volts DC OR MORE**: Proceed to **page 278**, procedure number T- 2.6.0.
- 2) **IF LESS THAN 9.0 volts DC**: See procedure number [T- 2.2.0](#) (page 274).



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T- 2.2.0 PIN 6 LESS THAN 9.0 VOLTS DC / ISOLATE POWER LOGIC BOARD

- a) Spread the card cage side panels open then gently drop the front panel down!
- b) Per the Figure below, at the bottom of the **Sensor Board**, a row of pins extend horizontally, turn 90 degrees downward, and connect to the Sensor Board's motherboard connector. This is the "C" row, numbered 1 through 32 (from front-to-rear).



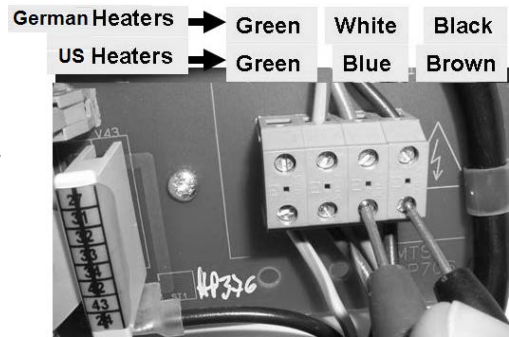
- c) Expecting 3.6 volts or LESS, measure at pin C1 (very FRONT pin). THREE (3) possible scenarios below:
 - 1) **IF 9.0 volts or more:** See procedure number T- 2.2.1 (page 275).
 - 2) **IF between 3.7 and 9.0 volts:** ENSURING no accidental contact with adjacent pin C2 see procedure number T- 2.2.1 (page 275).
 - 3) **IF 3.6 volts or LESS:** See parts a THROUGH d below:
 - a) Turn the machine OFF!
 - b) TWO (2) possible bad components (see Component List below). Swap in one at a time, with known good, and continue to part c to test the component.
 - c) Place the machine into Dialysis or Heat Disinfect.
 - d) Measure again at the Power Logic Board's X2 cable, **pin 6**. When 9.0 volts OR MORE is measured the last component swapped in is bad. If still LESS THAN than 9.0 volts repeat parts a through d.

COMPONENT LIST: 1) Power Logic Board (see Figure 4A and NOTE A, page 9);
2) Motherboard.

T- 2.2.1 SENSOR BOARD PIN C1 MORE THAN 9.0 VOLTS

- a) **Turn the machine OFF!**
- b) **Set the meter to AC voltage (~ V, V_{AC})!**
- c) Swap in a **known good** Sensor Board (see [Figure 4A](#), page 9).
- d) Enter Service Mode → Options → Hardware Options. Place the 'X' into the "Yes" box and press 'CONFIRM'. The 'X' turns blue! **T and C Mode** Yes No
- d) If troubleshooting a DIALYSIS PROGRAM temperature problem return to it. If a HEAT DISINFECT problem return to HEAT DISINFECT then skip to part f.
- e) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'CONFIRM'.

f) 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 the volt meter to measure DC voltage (V_{DC}).**
- b) **Connect the meter's black lead to chassis ground.**
- c) Measure again at the Sensor Board's motherboard connector pin C1 (VERY front pin).
 - 1) **IF (and ONLY if) 3.6 volts DC or less:** This is a good signal so the previous Sensor Board is bad but the heater off problem still exists. Proceed to **page 277**, procedure number [T- 2.2.2](#).
 - 2) **IF more than 3.6 volts DC:** This signal continues to be 'bad' so the previous Sensor Board may be good! See parts a THROUGH d below:

- a) **Turn the machine OFF!**
- b) **Set the volt meter to measure RESISTANCE (Ω).**

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 AND units display read more than 12,000 Ω (12.0 **K Ω**)?



Yes

More than 12,000 Ω (12.0 **K Ω**)! Assuming all procedures were performed correctly and the “no voltage to the heater” problem continues, see parts a through c below:



- a) Swap in a **known good** Power Logic Board!
- b) Place the machine into Dialysis Program or Heat Disinfect!
- c) Measure for DC voltage again at the Sensor Board's motherboard connector pin C1 (VERY front pin). A good signal is 3.6 volts DC or less. If a bad signal is measured the motherboard may be 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 Cable.
- C) Repeat the measurement at the SENSOR BOARD'S X2 connector at **pin 13**. More than 12,000 Ω (12 **K Ω**) 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

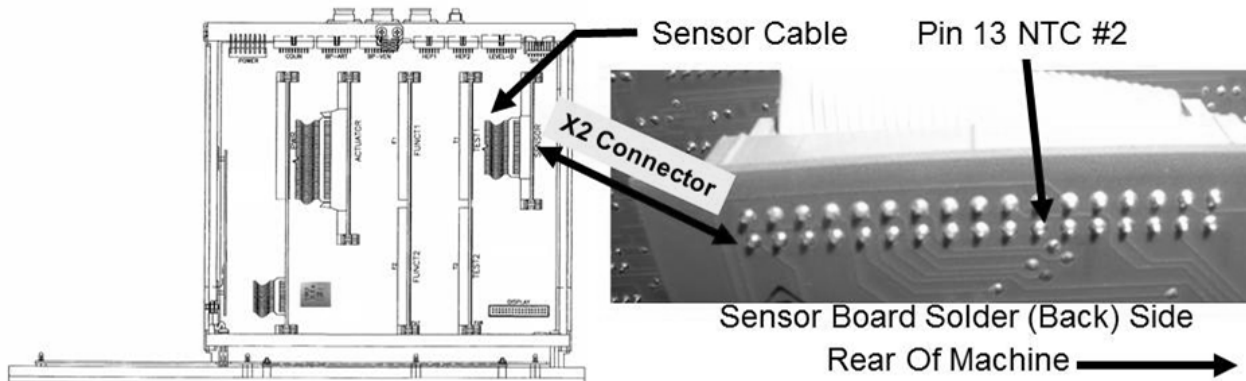


Figure 46 – Sensor Board / NTC #2 Check

T- 2.2.2 GOOD SIGNAL FROM SENSOR BOARD PIN C1

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). A good signal is 9.0 volts OR MORE. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) 9.0 volts DC OR MORE:** Proceed to **page 264**, procedure number [T- 2.0.1](#).

- 2) **IF LESS THAN 9.0 volts DC:** See parts a through d below:
 - a) Turn the machine OFF!

 - b) TWO (2) possible bad components (see [Component List](#) below). Swap in one at a time, with known good, and continue to part c to test the component.

 - c) Place the machine into Dialysis or Heat Disinfect.

 - d) Measure again at the Power Logic Board's X2 cable, **pin 6**. When 9.0 volts OR MORE is measured the last component swapped in is bad. If still LESS THAN 9.0 volts repeat parts a through d.

COMPONENT LIST: 1) Power Logic Board (see Figure 4A and NOTE A, page 9);
2) Motherboard

T- 2.6.0 HEATER VOLTAGE LESS THAN 10.0 VOLTS / ISOLATE POWER SUPPLY COMPONENTS

- a) Turn the machine OFF and **UNPLUG** it. **CAUTION! Electrocutation hazard if NOT unplugged!**
- b) Figure below, open the power supply to see the Power Control board.

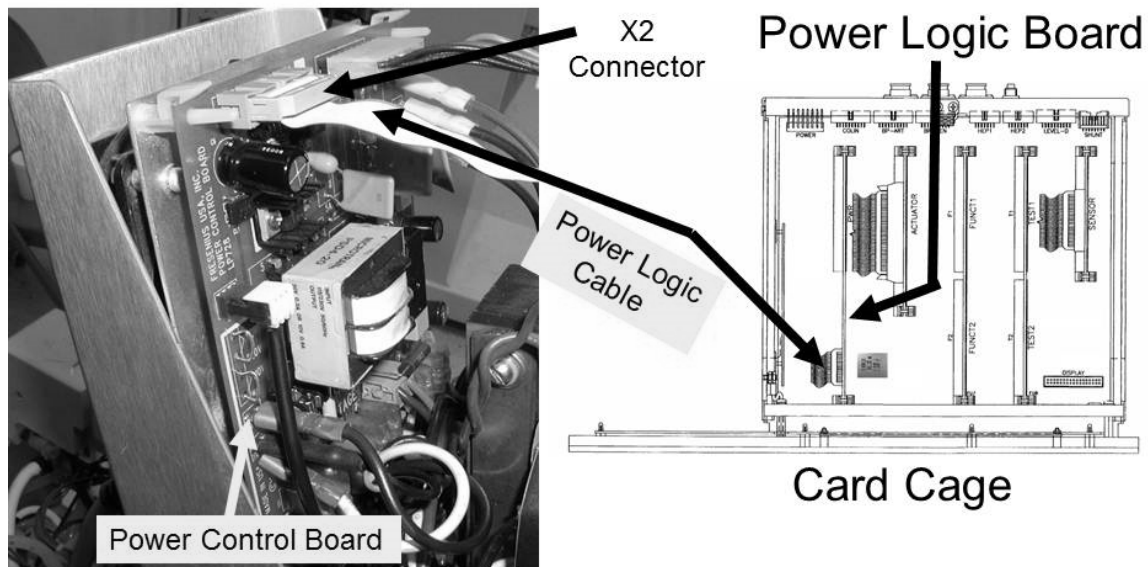


Figure 47 – Power Control Board / Power Logic Cable

- 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!

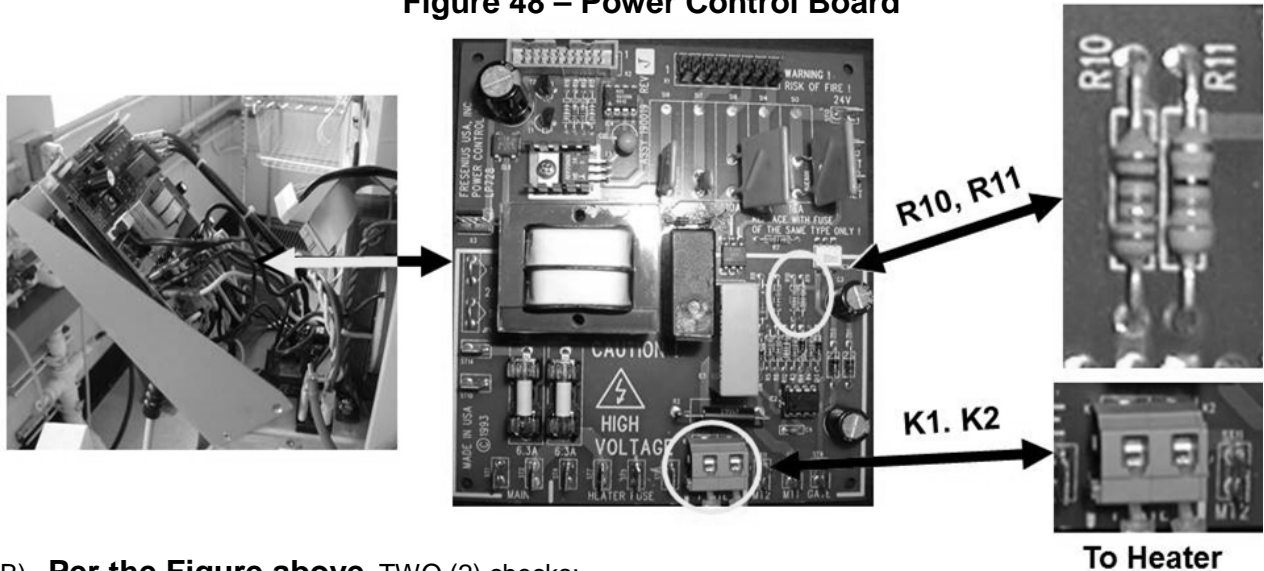
- d) See procedure number [T- 2.6.2](#) (page 279).

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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 280).

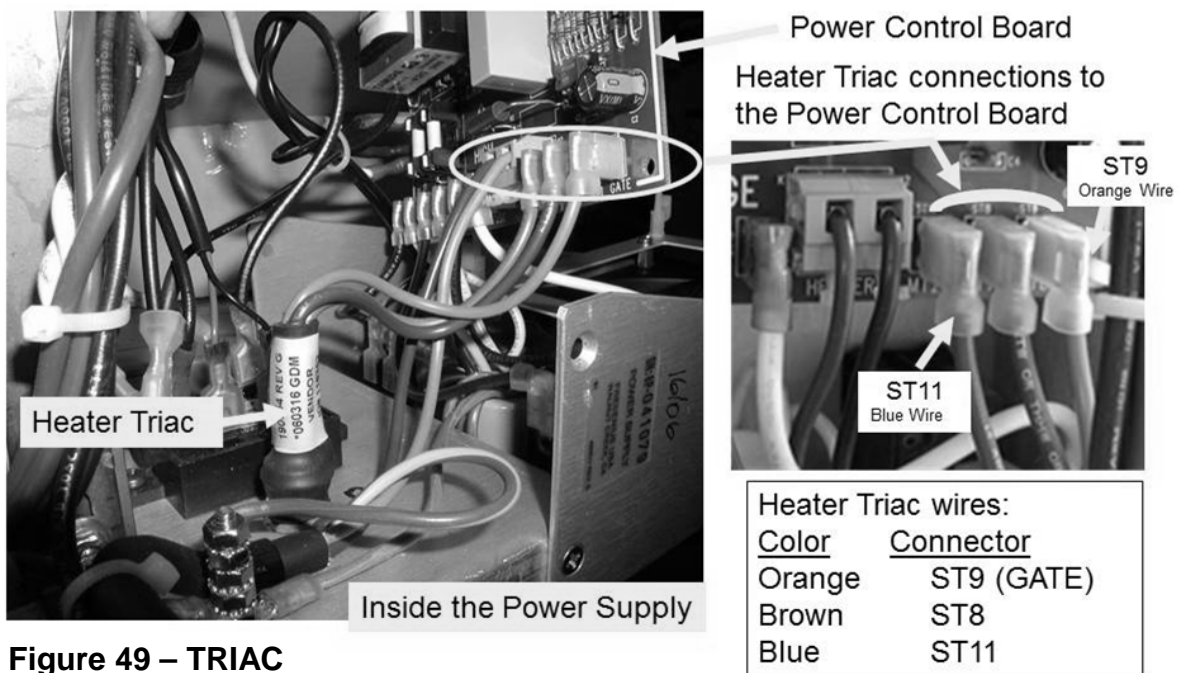


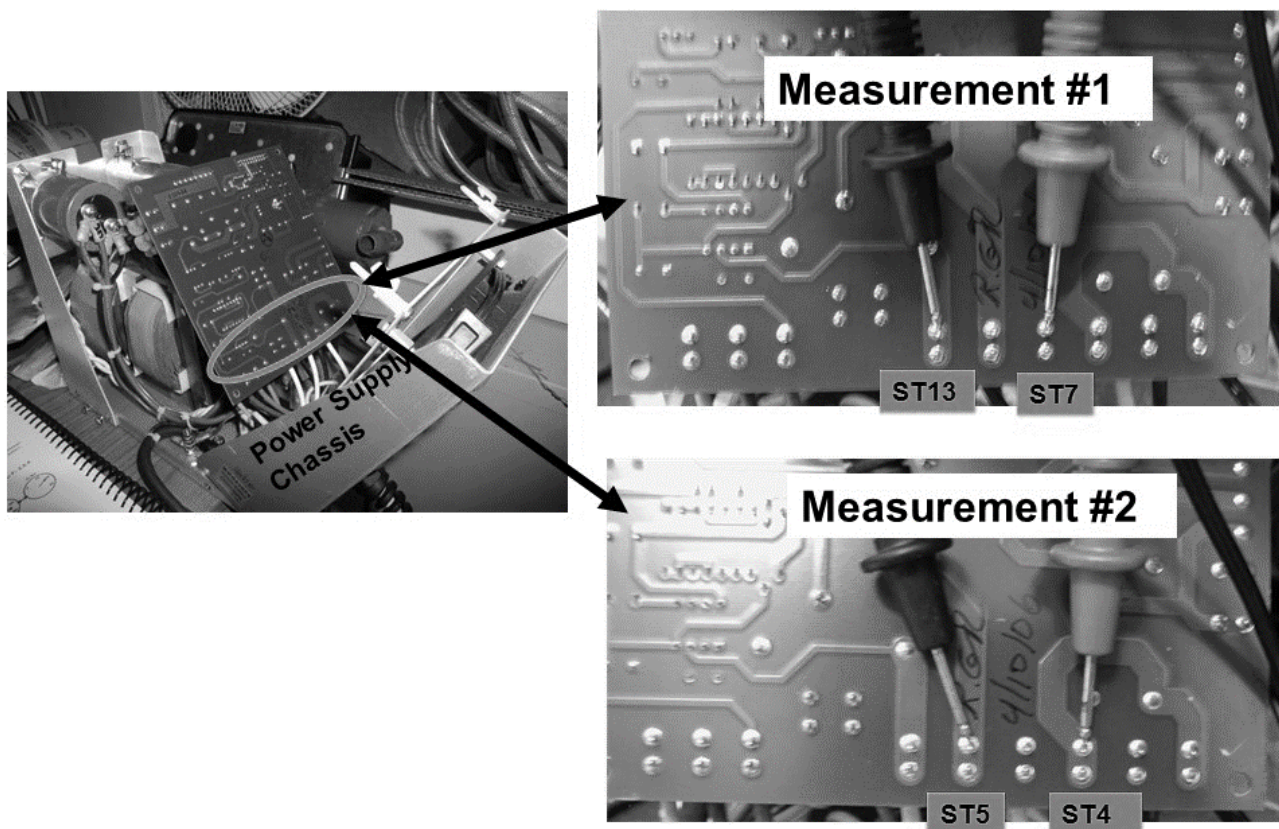
Figure 49 – TRIAC

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 . "OL" = way more than 2.0 Ω !

Measurement #2: BETWEEN ST5 AND ST4. Good = less than 2.0 Ω . "OL" = way more 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 281).

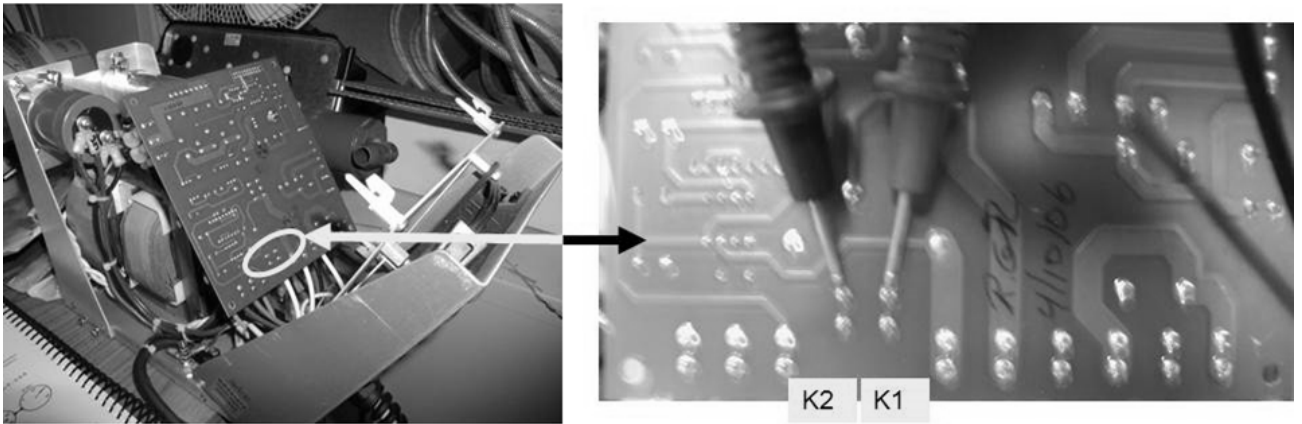
No One OR both MORE THAN 2.0 Ω ! The Heater Switch is bad!

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 ?

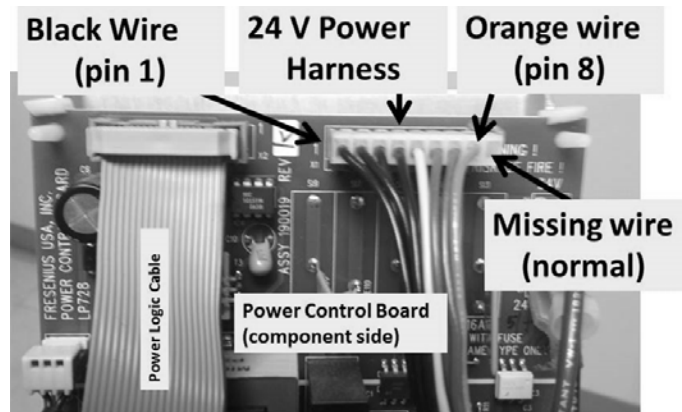
Yes Between 9.0 and 15.0 Ω ! The Heater Connections are OKAY! See procedure number [T- 2.6.7](#) (page 281).

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

- Figure right, reattach all cables PROPERLY to the Power Control board!
- Remount the Power Control board to its clips
- Slide the power supply into the cabinet but do not bolt it in yet!
- For now all Power Supply heater components are checking okay. See procedure number [T- 2.6.8](#) (page 282).



T- 2.6.8 HEATER COMPONENTS SO FAR OKAY

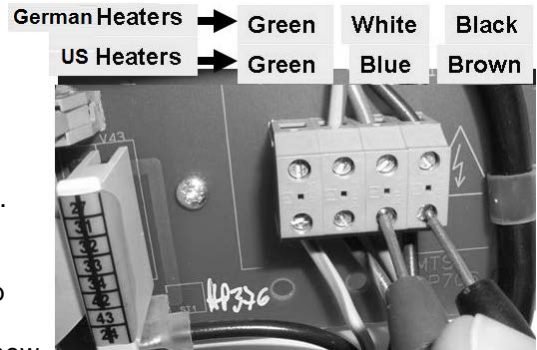
a) If troubleshooting a Dialysis Program problem return to DIALYSIS PROGRAM (“Select Program” → ‘Dialysis’ → ‘CONFIRM’). If a Heat Disinfect problem return to HEAT DISINFECT

b) **Set your volt meter to AC voltage (~ V, V_{AC})!**

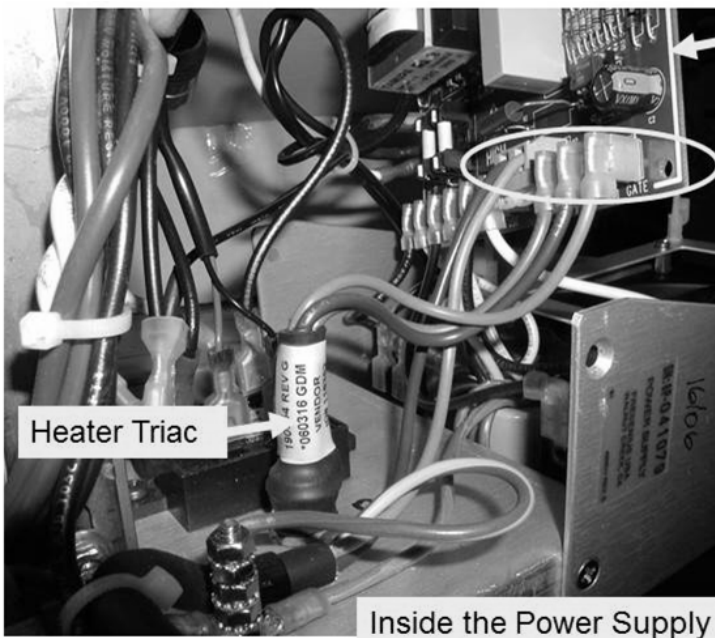
c) Figure right, at the distribution board’s Heater Connector, measure again between the BLUE and BROWN wires! More than 100 volts AC now?

Yes More than 100 volts! The heater is on! See (ABOVE) procedure number [T- 2.0.4](#) (page 266).

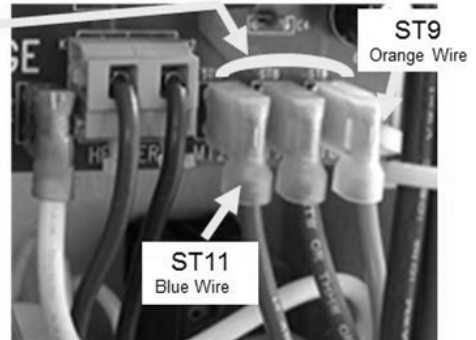
No THREE (3) possible bad components (see [Component List](#) below). With the machine off swap them in, one at a time, in between repeating procedure number [T- 2.6.8](#) (page 282) to test the new component until the heater is on!



Component List: **1)** 20-pin (X2) Power Logic cable; **2)** Triac (see Figure below); **3)** Power Control board (inside the power supply)



Power Control Board
Heater Triac connections to the Power Control Board



Heater Triac wires:	
<u>Color</u>	<u>Connector</u>
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 in HEAT DISINFECT!**
- c) Watch the screen's [Temperature] window for fifteen (15) minutes OR until 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 283).
 - 2) **IF [Temperature] INCREASES to 50° C or more:** Continue to watch for up to twenty (20) FULL 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 283).
 - ii) **IF [Temperature] reaches 80° C or more and remains:** The problem ("Temperature does not reach 80° C) is no longer occurring!

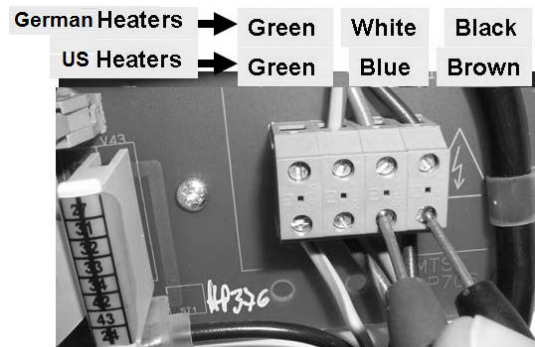
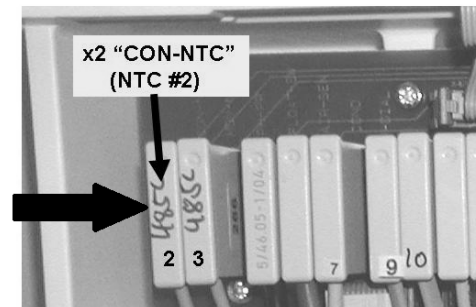
T- 3.0.1 ISOLATE HEATER VOLTAGE

- 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 Heater Connector's 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 263**, procedure number [T- 2.0.0](#).

- 2) **IF more than 100.0 volts AC:** See parts a AND b below:

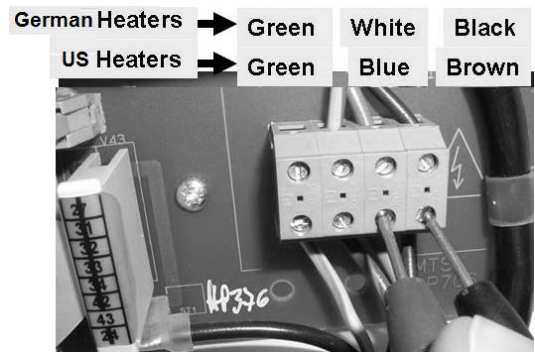
- a) **Return NTC #2's connector to the 1st distribution board position from the left "CON-NTC"!**
- b) See procedure number [T- 3.0.2](#) (page 284).



T- 3.0.2 ISOLATE HEATER RESISTANCE

- a) Turn the HEATER Switch OFF!
- b) Set your 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 129).

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 284).

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) Figure 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 285).
- 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 193).
 - 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)?

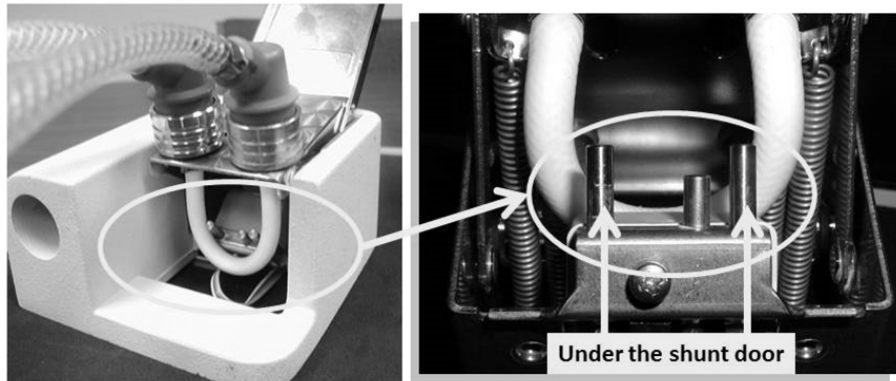
- Yes Drain Flow continues! **Read this step before performing it!** The previous Valve #30 is probably good. The Actuator-Test Board is bad. After replacing the board return to (ABOVE) procedure number [T- 3.0.0](#) (page 283) to see if this fixes the temperature problem!
- No Drain flow stopped! Return to (ABOVE) procedure number [T- 3.0.0](#) (page 283) to see if this fixes the temperature problem.

T- 3.0.4 DRAIN FLOW STOPPED / PREPARE TO MEASURE ‘ACTUAL’ TEMPERATURE

- a) **IMPORTANT!** Press ‘Escape’ then ‘CONFIRM’ twice to call the “Select Program” screen.
- b) Remove the dialyzer lines from the shunt and attach them to a calibrated Temperature (°C) meter*.

* 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 three (3) spring loaded switches
- d) See procedure number [T- 3.0.5](#) (page 285).



T- 3.0.5 HEAT DISINFECT / MEASURE ‘ACTUAL’ TEMPERATURE

This procedure simulates the dialyzer connectors in the shunt door to allow the Heat Disinfect Program to start!

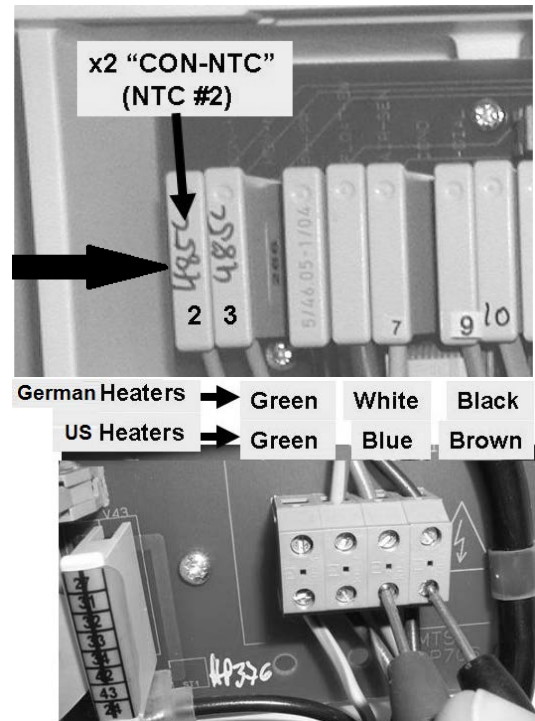
- a) With your right hand PUSH IN AND HOLD ALL THREE (3) switches.
- b) With your left hand, place the machine in **HEAT DISINFECT**.
- c) WITHOUT closing the door **RELEASE** the buttons.
- d) The “Cover is Open” banner appears! A “Flow Recirc Error” may occur but MUST go away within forty five (45) seconds!
- e) **ENSURING** the flow indicator’s ‘bob’ is moving up and down, see procedure number T- 3.0.6 (page 286).

T- 3.0.6 VERIFY TEMPERATURE

- a) "No Water" OR Flow Error alarms turn the heater off! If either occur from here forward address them **FIRST!!**
- b) Allow fifteen (15) FULL minutes OR until if the external meter reads 50° C or more. 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 286).
 - 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 286).
 - ii) **IF the meter STAYS at 80° C or more:** Proceed to **page 288**, 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:** ENSURING the Heater Switch was on prior to checking voltage, leaving NTC #2 unplugged, see (ABOVE) procedure number [T- 2.0.0](#) (**page 263**).
 - 2) **IF more than 100 volts AC:** Leaving NTC #2 unplugged, perform parts a AND b below:
 - a) **To avoid damage DO NOT leave the machine. The external meter MUST NOT be allowed to get 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 287).

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, continue to parts c through h to test the new component.

COMPONENT LIST: 1) NTC #2¹ 2) Actuator-Test Board; 3) Sensor Board²; 4) Functional Board²; 5) Motherboard.

¹ To LOCATE NTC #2 refer to [Figure 42](#) (page 218)

² It is necessary to calibrate Temperature Control AND Cond Cells before testing these components!

c) Return to **HEAT DISINFECT** without the Temperature meter attached for now.

d) **IMPORTANT!** If not already, allow the screen's [**Remaining Prerinse Time**] window = 0:00 before continuing to part e!

e) Connect the Temperature meter to the dialysate lines as previously described. NOTE: If necessary refer to procedures [T- 3.0.4](#) (page 285) AND [T- 3.0.5](#) (page 285).

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 287) 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 288).

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:** See 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 continue through parts b – h to test the new component.

COMPONENT LIST: 1) NTC #3¹; 2) Sensor Board²; 3) Functional Board²; 4) Motherboard

¹ To LOCATE NTC #3 refer to [Figure 42](#) (page 218)

² It is necessary to calibrate Temperature Control AND Cond Cells before testing these components!

c) Return to **HEAT DISINFECT** without the Temperature meter attached for now.

d) **IMPORTANT!** Allow the screen's [**Remaining Preinse Time**] window = 0:00 before continuing to part e!

e) Connect the Temperature meter to the dialysate lines as previously described! **NOTE:** If necessary refer to procedures [T- 3.0.4](#) (page 285) AND [T- 3.0.5](#) (page 285).

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 286).

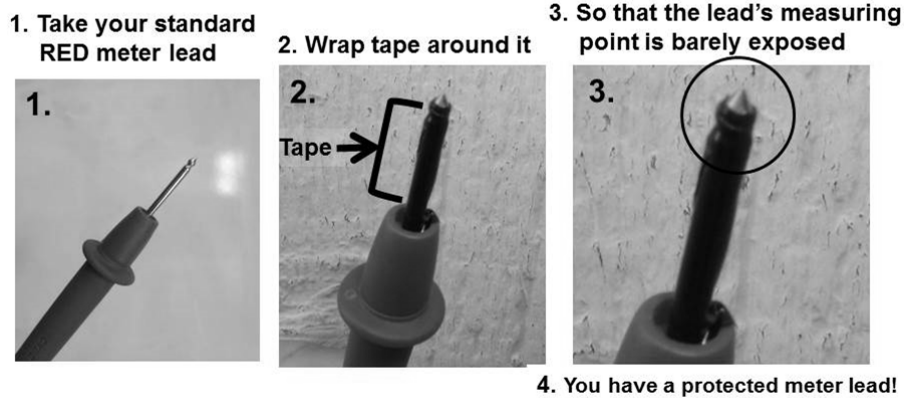
2) **IF the meter reaches AND maintains 80° C or more, TWO (2) possible scenarios i or ii:**

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 288) 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) **Attach the meter's black lead to chassis ground (see [Figure 2](#), page 4).**
- d) **CAUTION!** A signal will be measured from a pin that is VERY close to others and touching pins together with a standard meter lead WILL CAUSE 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). More than 1.0 volts DC?
 - Yes MORE THAN than 1.0 volt DC! See procedure number [T- 4.0.1](#) (page 290).
 - No LESS than 1.0 volt DC! Proceed to page 292, procedure number [T- 4.3.0](#).

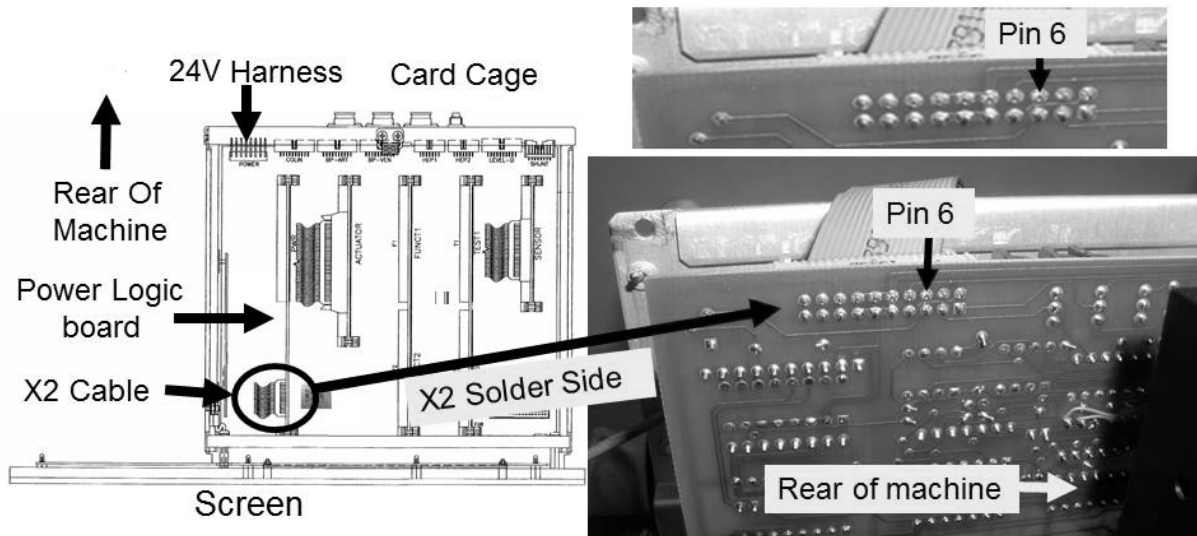


Figure 50 – Power Logic Board X2 / Pin 6

T- 4.0.1 PIN 6 MORE THAN 1.0 VOLTS DC / ISOLATE POWER LOGIC BOARD

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

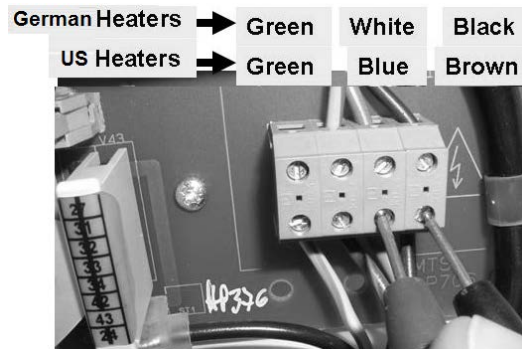
b) Swap in a known good* Power Logic Board.

* 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’ → ‘CONFIRM’)!

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 290).

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.

c) Enter Service Mode → Options → Hardware Options.

d) Set **T and C Mode** to “Yes” and press ‘CONFIRM’ (the ‘X’ turns blue)

T and C Mode	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>

e) Turn the machine OFF!

f) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!

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 291).
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.

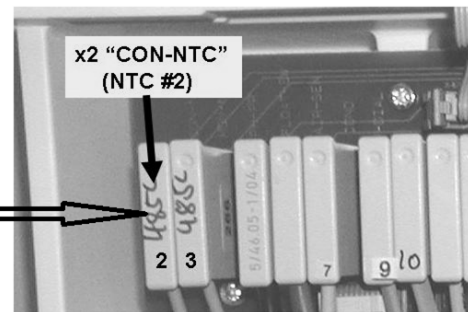
B) Set **T and C** mode to “No”.

C) Perform ALL calibrations.

T- 4.0.4 ISOLATE NTC #2 CONNECTIONS

a) **Turn the machine OFF!!**

b) Per the Figure right, place the **274 Ω** plug, from the **TWO-RESISTOR SET**, into the **1st** distribution board position from the left, "CON-NTC".



c) **Set your volt meter to measure resistance (Ω)!**

d) **ENSURE** the black lead remains attached to chassis ground (see [Figure 2](#), page 4)!

e) Per [Figure 51](#) below, measure at the solder side of SENSOR BOARD'S 'X2' connector at *pin 13* (bottom row, 7 pins from the rear of machine).

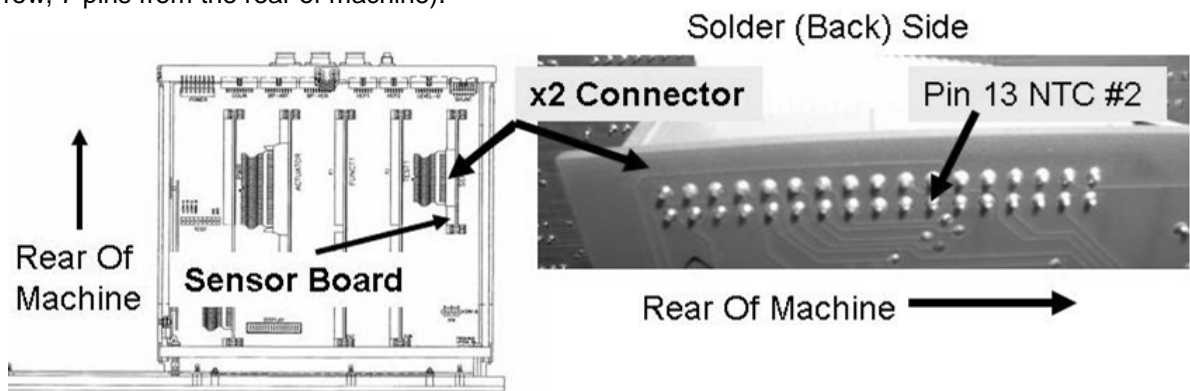
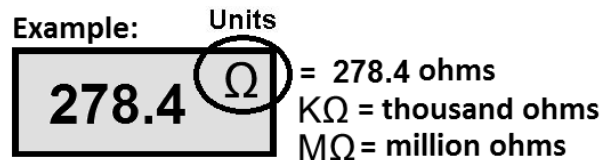


Figure 51 – NTC #2 Checks

f) Figure right, reading the meter's numeric AND units display, TWO (2) possible scenarios:



1) **IF (and ONLY if) LESS THAN 300 Ω (0.300 KΩ):** ENSURING the machine was OFF before measuring AND assuming all procedures were performed correctly the mother board may be bad.

2) **IF more than 300 Ω:** See parts a THROUGH d below:

a) ENSURE the machine was OFF prior to the measurement!

b) **ENSURE** the **274 Ω** plug, from the **TWO-RESISTOR SET**, is placed properly in the **1st** distribution board position from the left, "CON-NTC"! If not, repeat procedure number [T- 4.0.4](#) (page 291).

c) ENSURE the meter was set to measure resistance (Ω) AND its go-round lead is at chassis! If not, repeat procedure number [T- 4.0.4](#) (page 291).

d) TWO (2) possible bad components: 1) Sensor Board* cable OR; 2) Distribution board. ***NOTE:** The Sensor Board cable can be checked! **NOTE** that one (1) **NTC #2** connection will be checked and proceed to **page 524**, [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! Electrocutation 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 the 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:

Example: Units

21.8	MΩ	= 21.8 Million ohms
		K Ω = 21.8 Thousand ohms
		Ω = 21.8 ohms

- 1) **IF MORE THAN 10 Million ohms (10.0 M Ω)**, possibly "OL": **IMPORTANT! ENSURING** the Heater Switch REMAINS ON, see procedure number T- 4.4.0 (page 293).
- 2) **IF LESS THAN 10 Million ohms (10.0 M Ω)** 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

Power Control Board (Solder Side)

ST8 ST11

Power Control Board (Solder Side)

ST8 ST11

TRIAC

Wire Color	Connector
Orange	ST9
Brown	ST8
Blue	ST11

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 'CONFIRM' (the 'X' turns blue). Post a note that ' Temp Comp ' is off then see procedure number T- 4.4.1 (page 293).	Temp Comp.	Yes	No
No			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Temp Comp = No! See procedure number T- 4.4.1 (page 293).	Temp Comp.	Yes	No
				<input type="checkbox"/>	<input checked="" type="checkbox"/>

T- 4.4.1 CHECK TEMP DISPLAY CALIBRATION (2)

- a) From the Service screen menu → Calibrate Sensors → Temp Control.
- b) Press 'CONFIRM' TWICE. The screen's [**TEMP DAC**] data box turns pale yellow / white.
- c) Select [**TEMP DAC**]. It turns bright yellow and set its value to "20"
- d) Press 'CONFIRM'. [**TEMP DAC**] returns to pale yellow / white.
- e) **Set your volt meter to AC voltage (~ V, V_{AC})!**
- f) **IMPORTANT!** 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 294).

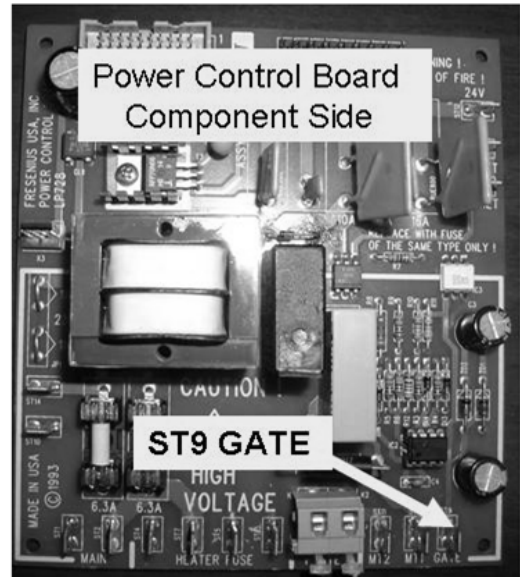
No Less than 10 volts! See parts a THROUGH c below:

- a) Select the [**TEMP DAC**] window and set it to "130"!
- b) Save the calibration.
- c) Proceed to **page 302**, procedure number [T- 7.0.0](#).

LEFT BLANK INTENTIONALLY

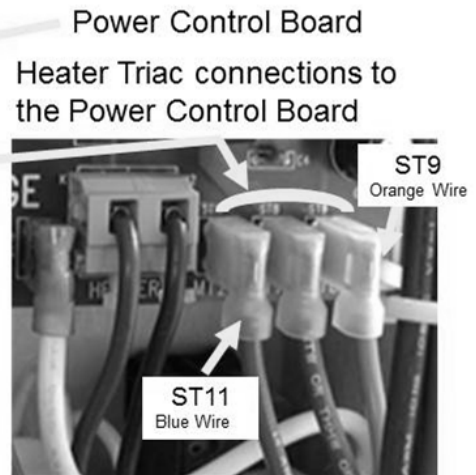
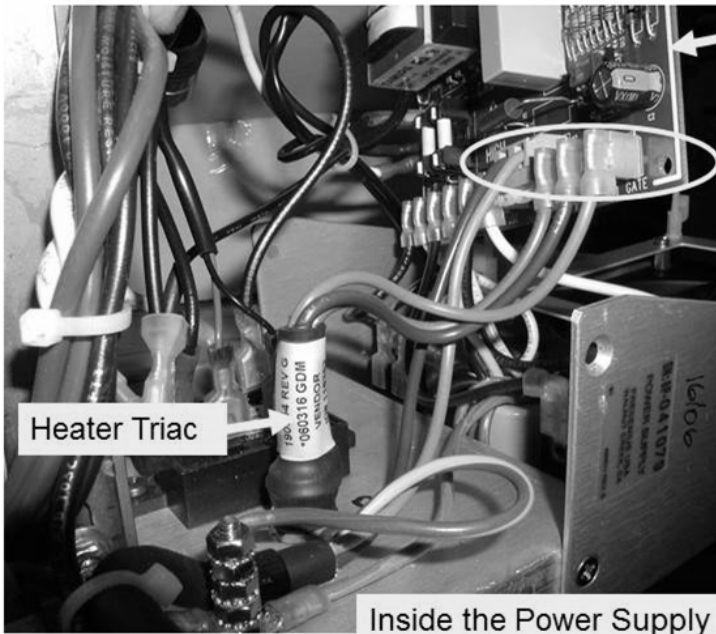
T- 4.5.0 ISOLATE TRIAC / POWER CONTROL BOARD

- a) Turn the machine OFF and **UNPLUG** it.
CAUTION! Electrocutation 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 and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- f) From the Home screen, allow [Temperature] to fall to below 39°.0 C
- g) Measure again at the distribution board's Heater Connector between the BLUE and BROWN wires. More than 100 volts AC?



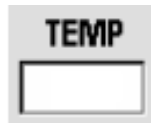
Yes More than 100.0 volts AC! **Electrocutation hazard if the machine is NOT unplugged before continuing!** The Triac is bad (see Figure below).

No **Electrocutation hazard if NOT unplugged before continuing!** The Power Control Board (inside the power supply) is bad.



Heater Triac wires:	
<u>Color</u>	<u>Connector</u>
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 295).

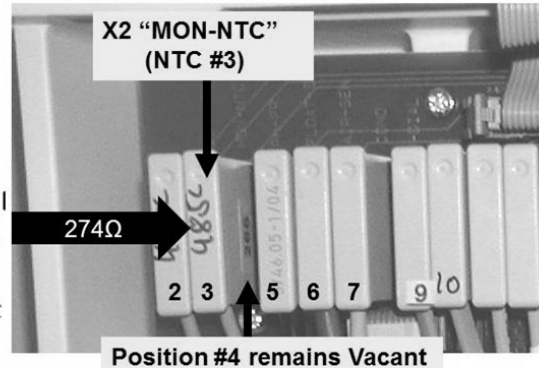
No **TEMP** is more than 1.0! Proceed to **page 297**, procedure number **T- 5.0.3**.

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 CALIBRATED 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).

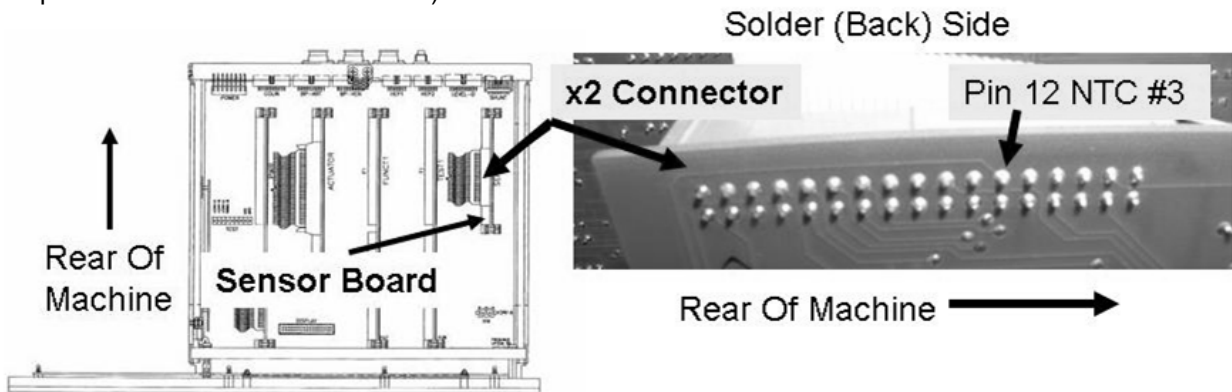


Figure 53 – NTC #3 Checks

g) Figure right, reading the meter's numeric AND units display LESS than 300 **Ω** (Yes or No)?

Example: Units

278.4	Ω	= 278.4 ohms KΩ = thousand ohms MΩ = million ohms
--------------	----------	---

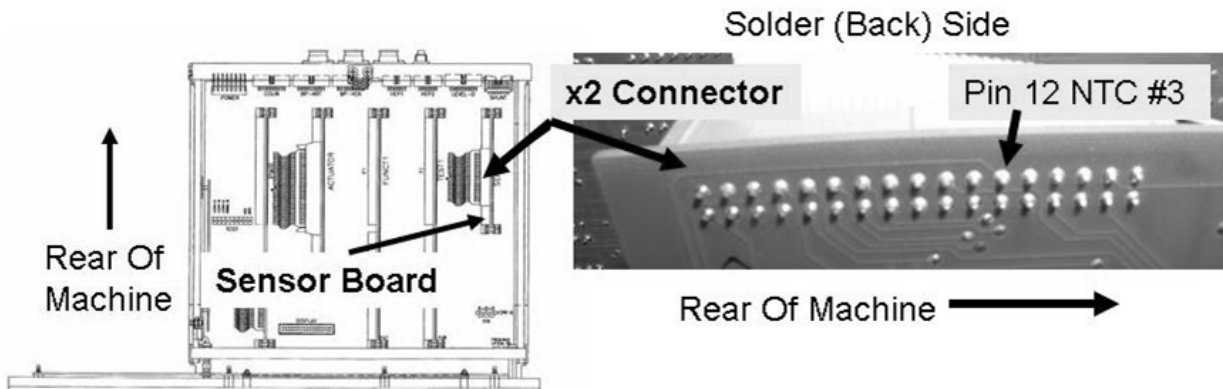
Yes LESS than 300 Ω ! See procedure number [T- 5.0.2](#) (page 296).

No MORE than 300 Ω ! ENSURING the machine was OFF, prior to measuring, see parts a THROUGH d:

- ENSURE the **274 Ω** plug, from the **TWO-RESISTOR SET**, is in the **2nd** position, from the left, "MON-NTC".
- ENSURE the plug is aligned with the other connectors.
- Use the **274 Ω** plug from a different **TWO-RESISTOR SET**
- 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)?

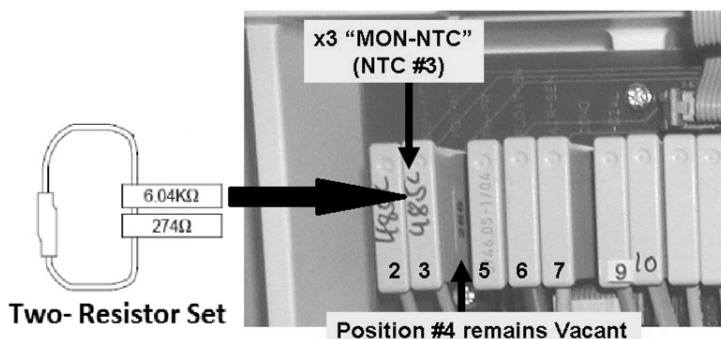
Yes LESS than 300 Ω ! See procedure number [T- 5.0.2](#) (page 296).

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

- Remove the **274 Ω** plug.
- Return the **6.04 K Ω** plug, from the **TWO-RESISTOR SET**, to the **2nd** distribution board position from the left, "MON-NTC".
- Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').
- See procedure number [T- 5.0.3](#) (page 297).



T- 5.0.3 CHECK DEBUG SCREEN 4 VALUES

Leaving the **6.04 K Ω** 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 302**, procedure number [T- 7.0.0](#).

No **TEMP** is NOT between 4.0 and 6.0! See parts a and b below:

- a) ENSURE the **6.04 K Ω** plug, from the TWO-RESISTOR SET, is placed correctly at the **2nd** distribution board position from the left labeled "MON-NTC". If NOT, repeat procedure number [T- 5.0.3](#) (page 297) from part b.
- b) **Read before performing!** One at a time, swap in the listed components (see COMPONENT LIST below), with known good and in between repeat procedure number [T- 5.0.3](#) (page 297). When TEMP is between 4.0 and 6.0 the last component swapped in is the problem.

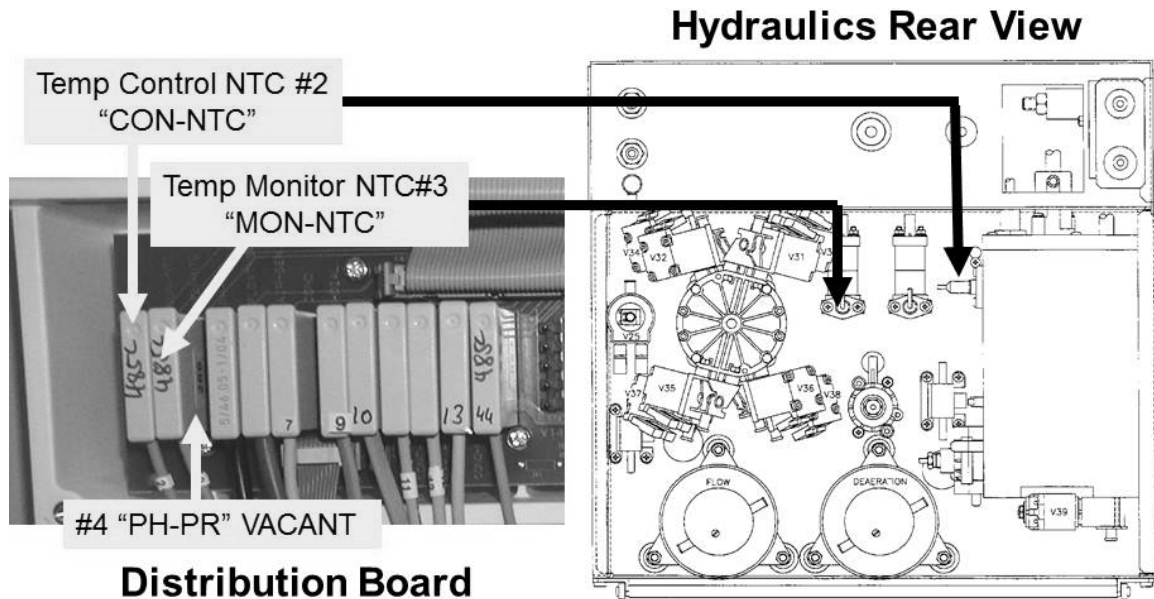
COMPONENT LIST: **1)** Actuator-Test Board; **2)** Power Logic Board; **3)** Functional Board (possibly IC20)¹; **4)** Sensor Board¹; **5)** Distribution board; **6)** Motherboard

¹ To prevent "Cond Offset Failure", place the machine into **T and C Mode** for EACH board (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**).

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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 298).

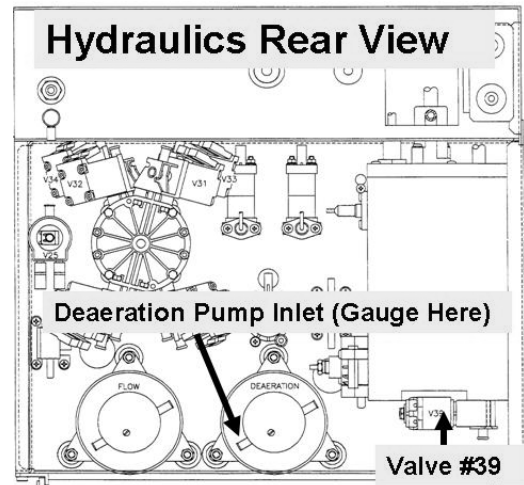


T- 6.1.0 ISOLATE FLOW ERROR

- 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 three (3) minutes or until if it EVER = 1. TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) Flow Error EVER = 1:** Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#).
 - 2) **IF Flow Error = 0:** See procedure number [T- 6.2.0](#) (page 299)

T- 6.2.0 ISOLATE AIR REMOVAL SYSTEM

- Turn the water off.
- The Deaeration gauge is used next. **ENSURE** it reads 0 before installing it!
- After the “No Water” alarm appears allow one (1) minute for the Deaeration motor to stop.
- Figure right, tee the Deaeration gauge into the Input (clear tubing) side of Deaeration Pump #20.
- Turn the water on and allow the “No Water” alarm to go away.
- Is Deaeration Pressure OKAY? Refer to [Appendix A](#) (page 667) 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 299).

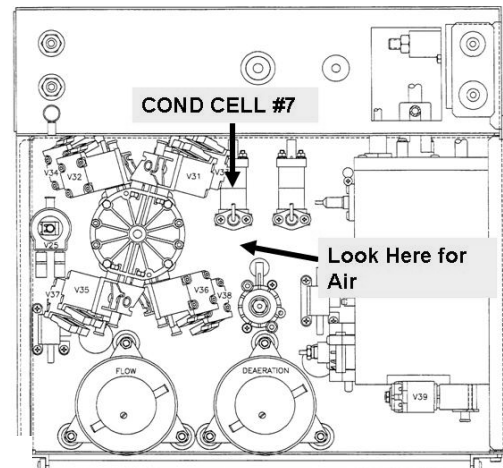
No Deaeration pressure is NOT OKAY! ENSURING the “No Water” alarm is NOT presenting, NOTE this page number, as you will return here, THEN proceed to **page 498**, [SECTION 13 - DEAERATION PROBLEMS](#).

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?

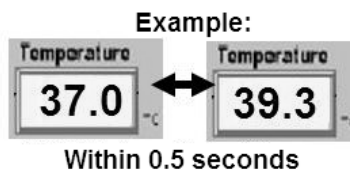
Yes Air seen! Proceed to **page 495**, procedure number [AIR- 1.0.5](#).

No air seen! See procedure number [T- 6.5.0](#) (page 299).



T- 6.5.0 ISOLATE BALANCING CHAMBER DIAPHRAGM

Was [Temperature] EVER observed ‘bouncing wildly’ up for ½ second then returning to normal (Yes or No)?



Yes Another procedure in different Section is performed next. **IMPORTANT! NOTE** this page and procedure number because you may prompted to return to here. Perform parts a and b below

- BEFORE continuing to part b, proceed to **page 535**, to perform [SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM](#).
- If a torn balancing chamber diaphragm was not located in part a see procedure number [T- 6.6.0](#) (page 300).

No See procedure number [T- 6.6.0](#) (page 300).

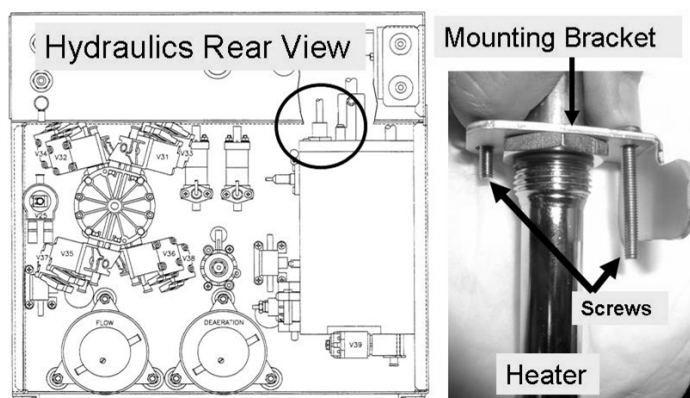
T- 6.6.0 VERIFY INCOMING WATER SOURCE

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 300).
- 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 300).

T- 6.8.0 CHECK / ROTATE HEATER

- a) **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' → 'CONFIRM')
- f) Allow ten (10) minutes before continuing to part g.
- g) If **Temperature** instability continues, changes more than 0.2 °C per minute, see procedure number [T- 6.9.0](#) (page 300).

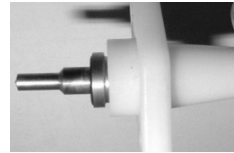
T- 6.9.0 UNSTABLE TEMPERATURE CHECKS

Other procedures, in different Sections of the Guide, are performed next. **IMPORTANT! NOTE** this page and procedure number as you may prompted to return to here. See part a below:

- a) BEFORE continuing to part b, **page 535**, 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!

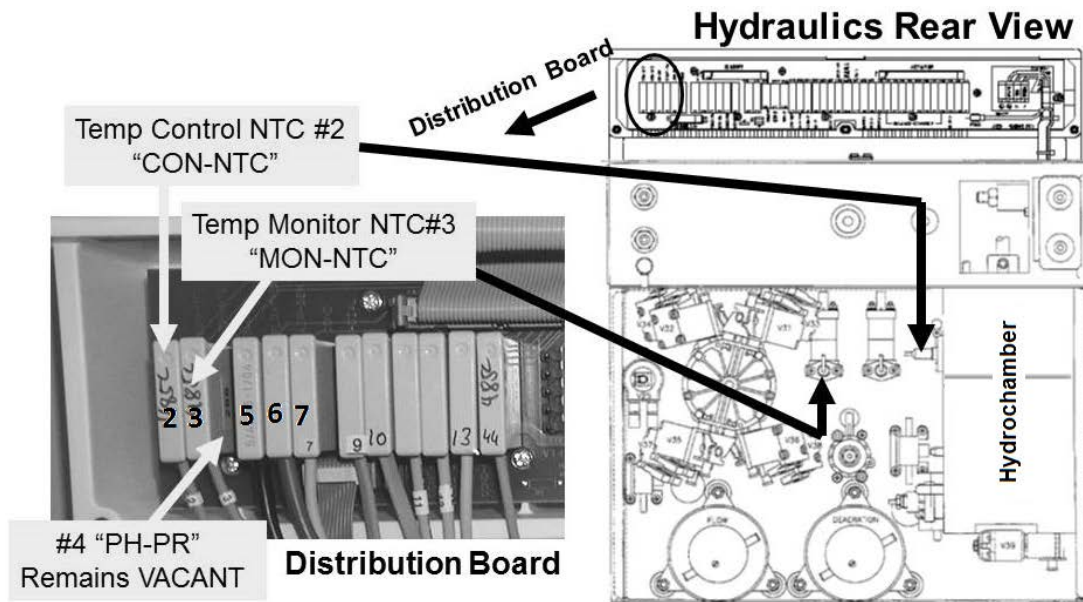
Parts c and d next page

- 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 or burning 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 301).

No Proceed to **page 302**, procedure number [T- 7.0.0](#).



T- 6.9.1 UNSTABLE TEMPERATURE CHECKS

- a) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- b) With [Dialysate Flow] set to where the instability is (or was) occurring 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 and! Watch for thirty (30) 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:** One at a time swap in the listed components (see Component List below) then, in between, repeat procedure number [T- 6.9.1](#) (page 301) to test each new component.

Component List: 1) Power Logic Board^a; 2) NTC #2; 3) Heater; 4) Sensor Board (with a new Sensor board must calibrate Temp Sensor AND Temp Control; 5) Float switch^b ; 6) TWO (2) power supply components: i) Power Control board; ii) Heater Triac^c .

^a To LOCATE refer to [Figure 4A](#) (page 9); ^b To LOCATE refer to [Figure 28](#) (page 129); ^c To LOCATE refer to [Figure 51](#) (page 291)

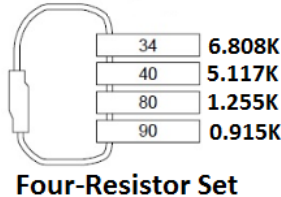
T- 7.0.0 ISOLATE TEMPERATURE SENSOR

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!

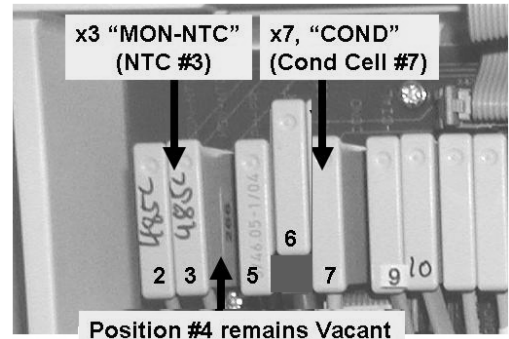
B) ENSURE Cond Cell #7 is plugged into distribution board position "X7, COND"!

C) Figure right, the **FOUR-RESISTOR SET** is required.



D) Enter Service Mode → Calibrate Sensors → Temp Sensor.

E) Proceed to **STEP #1** (page 302).

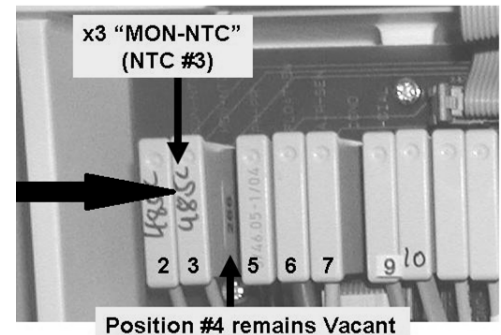


STEP #1

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 'CONFIRM'. If no Error banners¹ appear see **STEP #2** (page 302).

¹ If an "Operator Error" OR "Actuator Board Error" banner appears proceed to **page 303**, 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 303).

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 'CONFIRM' then see **STEP #3** (page 303).

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 303).

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 ‘CONFIRM’ then see **STEP #4** (page 303).

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 303).

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 304**, 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 303).

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 302) HOWEVER, if you return here see part c.
- c) **Read before performing!** With the machine off, one at a time, swap in the listed components (see COMPONENT LIST below), with known good then, in between, return to (ABOVE) procedure number [T- 7.0.0](#) (page 302) to test each new component until the error banner does DOES NOT occur.

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 9)

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!
- e) Enter Service Mode → Options → Hardware Options. Does the "Yes" box at '**Temp Comp**' have an 'X' in it?

Temp Comp. Yes No

Yes Place the 'X' in the "No" box and press 'CONFIRM'. The 'X' turns blue. Post a note that '**Temp Comp**' is off then see procedure number [T- 7.2.1](#) (page 305).

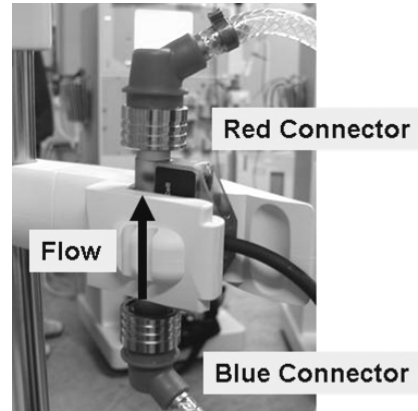
Temp Comp. Yes No

No **Temp Comp** = No! See procedure number [T- 7.2.1](#) (page 305).

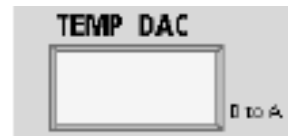
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T- 7.2.1 TEMPERATURE CONTROL

- a) ENSURE the concentrate connectors are attached to acid and **LIQUID** bicarb!
- b) From Service Mode → Calibrate Sensors → Temp Control.
- c) ‘Sharply’ press ‘CONFIRM’. 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 through the meter MUST be bottom to top.**



- e) **IMPORTANT! Close the shunt door!**
- f) ‘Sharply’ press ‘CONFIRM’. The screen says “**5. Adjust the TEMP DAC...**” and the [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 306).
- 2) **IF NOT between 120 and 180:** Perform parts a through d below:
 - a) Select [TEMP DAC], it turns bright yellow.
 - b) Set [TEMP DAC] to “140”.
 - c) ‘Sharply’ press ‘CONFIRM’ ONCE. [TEMP DAC] MUST be pale yellow/white (NOT gray).
 - d) See procedure number [T- 7.2.2](#) (page 306).

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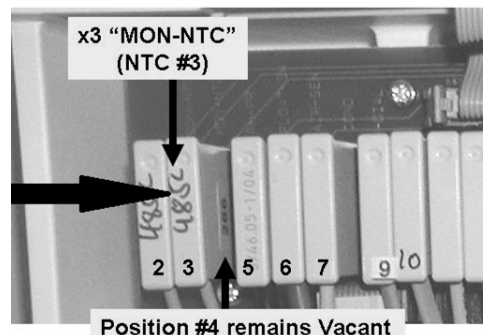
T- 7.2.2 [TEMP DAC] BETWEEN 120 AND 140 / VERIFY FLOW

The external flow indicator's 'bob' is watched to see if it EVER, even once, stays down longer than four (4) seconds AND the external meter is 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 308**, procedure number [T- 7.4.0](#).
- 2) **IF 'bob', even once, stays down longer than four (4) seconds:** See procedure number [T- 7.2.4](#) (page 306).

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 306).

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' → 'CONFIRM') to troubleshoot these problems!

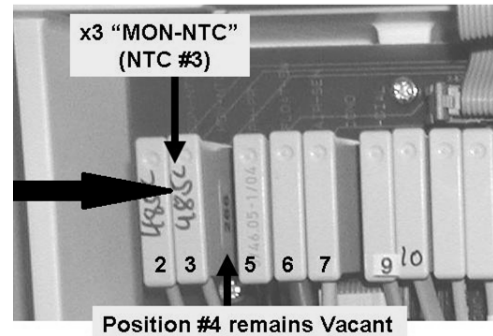
T- 7.2.5 'BOB' WAS NOT RISING BUT IS NOW / ISOLATE POSSIBLE HIGH TEMPERATURE

TO PREVENT DAMAGE, WITHOUT LOOKING AWAY, watch the external meter for six (6) minutes or until 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 307).
- 2) **IF the meter DOES reach 38.9° C at least ONCE:** See parts a THROUGH d 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 37.0° 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' → 'CONFIRM')!
 - e) Proceed to **page 241**, 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) Select the **[TEMP DAC]** data box, it turns bright yellow.
- c) Set **[TEMP DAC]** to "130" then 'sharply' press 'CONFIRM' ONCE.
- d) **IMPORTANT!** Allow five (5) minutes BEFORE continuing to part e!
- e) 'Sharply' press 'CONFIRM' TWICE. The **[Monitor Reference]** data box turns pale yellow / white.
- f) **DO NOT** press 'CONFIRM' until instructed! Select **[Monitor Reference]** it turns bright yellow.
- g) Ignoring the external meter adjust **[Monitor Reference]** to 34.0° C.
- h) 'Sharply' press 'CONFIRM' 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 'CONFIRM' key until the calibration is saved then return to (ABOVE) procedure number **T- 7.2.1 (page 305)**.

No **[Monitor Reference]** does NOT remain less than 35.0°C! **Read before performing!** 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 305)** and test each new component until the **[Monitor Reference]** data box remains less than 35.0° C.

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 218)

** To LOCATE these boards refer to [Figure 4A](#) (page 9)

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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 308).
- 2) **IF (and ONLY if) remaining between 33.1 and 38.9° C:** Proceed to **page 309**, 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' → 'CONFIRM')!
 - b) Using a temperature meter, ENSURE incoming water temperature is less than 35.0° C.
 - c) If (and ONLY if) incoming water temperature is less than 35.0° C proceed to **page 241**, procedure number [T- 1.3.40](#).

T- 7.4.1 TEMPERATURE LESS THAN 33° C

- a) **To avoid damage turn the machine OFF!**
- b) **Read before performing!** Reseat the Power Logic, Sensor and Functional Boards then return to (ABOVE) procedure number [T- 7.2.1 \(page 305\)](#). If you return here continue to part c..
- c) **Read before performing!** Return to (ABOVE) procedure number [T- 7.2.1 \(page 305\)](#) but THIS TIME set [TEMP DAC] to "180". If you return here see (ABOVE) procedure number [T- 1.7.0 \(page 257\)](#).

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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 309).

- 2) **IF temperature does NOT change more than +/- 0.2° C: DO NOT** press '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:** Proceed to **page 311**, procedure number [T- 7.6.0](#).

 - ii) **IF NOT between 36.9 and 37.1° C:** See parts a through c below:
 - a) Select the **[TEMP DAC]** data box, it turns bright yellow.
 - b) Adjust **[TEMP DAC]** (+/- 2 = +/- 0.1° C) then sharply press 'CONFIRM'. **[TEMP DAC] MUST be** pale yellow/white (NOT GRAY) to continue!
 - c) Allow **FIVE (5) FULL** 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 seconds! See (ABOVE) procedure number [T- 7.2.4](#) (**page 306**).
 - No 'Bob' never stays down longer than four seconds! Repeat procedure number [T- 7.5.0](#) (page 309).

T- 7.5.2 TEMPERATURE IS UNSTABLE

- a) Continue to watch the meter for up to six (6) FULL 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 see (ABOVE) procedure number [T- 7.4.1](#) (**page 308**).

- b) Was procedure number [T- 6.0.0](#) (page 298) performed in THIS troubleshooting session?
 - Yes [T- 6.0.0](#) was already performed! See procedure number [T- 7.5.3](#) (page 310).

 - No
 - a) Turn the machine OFF!
 - b) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').
 - b) See (ABOVE) procedure number [T- 6.0.0](#) (**page 298**).

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 315) to check (or replace) NTC #2*.

* To LOCATE NTC #2 refer to [Figure 42](#) (page 218)

- 2) **IF (and ONLY if) NTC #2 was checked in THIS troubleshooting session:** Replace NTC #2* with a known good then return to (ABOVE) procedure number [T- 7.2.1](#) (page 305) to see if this was the problem.

* To LOCATE NTC #2 see [Figure 42](#) (page 218)

- 3) **IF NTC #2 was replaced in THIS troubleshooting session: READ before continuing!** Swap in the listed components (see COMPONENT LIST), one at a time, and in between return to (ABOVE) procedure number [T- 7.2.1](#) (page 305) 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 9)

** To LOCATE the heater refer [Figure 28](#) (page 129)

*** To LOCATE the triac, refer to [Figure 51](#) (page 291).

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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 314**, 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 'CONFIRM' to turn the **[Monitor Reference]** data box pale yellow / white.
 - b) Activate **[Monitor Reference]**, it turns bright yellow. Without pressing 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 311).

No 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 305) to test each new component.

COMPONENT LIST: 1) NTC #3 (to LOCATE NTC #3 refer to [Figure 42](#), page 218);
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 'CONFIRM'! **[Monitor Reference]** MUST return to pale yellow / white!
- b) 'Sharply' press 'CONFIRM' 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 312).
 - 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?

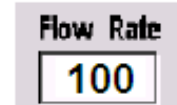
Yes The GRAY data box = between 36.9 and 37.1° C. This completes the calibration HOWEVER, if you started out troubleshooting a "TEMP OVER 95 DEGREES" alarm in Heat Disinfect return to procedure number [T- 1.5.1](#) (page 247). If not, return to Dialysis Program.

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 305) to test each new component.

COMPONENT LIST: 1) NTC #3 (to LOCATE NTC #3 refer [Figure 42](#), page 218);
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 'CONFIRM'. The screen reads "11. Adjust the TEMP DAC..." and **[TEMP DAC]** turns pale yellow / white.
- c) Select **[TEMP DAC]**. It turns bright yellow. Set it to "210" then 'sharply' press 'CONFIRM' 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 305).
- e) WITHOUT LOOKING AWAY, simultaneously watch the external meter AND the screen's **[Monitor Reference]** data box for 13 FULL minutes. TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) one OR both exceed 40.0° C even ONCE:** This time adjusting **[TEMP DAC]** to 10 lower than it already is, repeat parts c through e.
 - 2) **IF neither NEVER exceeds 40.0° C:** See procedure number [T- 7.6.5](#) (page 312).

T- 7.6.5 CALIBRATE SLOW FLOW TEMPERATURE

The external meter fluctuates SLOWLY, approximately +/- 0.4° C, between a maximum (high) and a minimum (low). WITHOUT LOOKING AWAY, watch fifteen (15) consecutive minimum to maximum cycles. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) the maximum is consistently between 36.9 and 37.1° C!** See procedure number [T- 7.6.6](#) (page 313).
- 2) **IF the maximum 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 'CONFIRM' to return **[TEMP DAC]** to pale yellow / white. It must NOT turn gray until the meter consistently fluctuates to a maximum of between 36.9 and 37.1° C.
 - c) Repeat procedure number [T- 7.6.5](#) (page 312).

T- 7.6.6 ADJUST 'SLOW FLOW' MONITOR REFERENCE

- a) 'Sharply' press 'CONFIRM' to turn **[Monitor Reference]** pale yellow / white!
- b) Adjust **[Monitor Reference]** to match the meter's maximum (i.e. between 36.9 and 37.1° C).
- c) CAREFUL HERE! Sharply 'CONFIRM' TWICE to turn **[Monitor Reference]** GRAY!
- d) Does the GRAY **[Monitor Reference]** data box read between 36.4 and 37.6° C?

Yes The GRAY 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" alarm return to procedure number **T- 1.5.1 (page 247)**. If not, return to Dialysis Program.

No The GRAY data box IS NOT between 36.4 and 37.8! 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 305) to test each new component.

COMPONENT LIST: 1) NTC #3¹; 2) Functional Board.

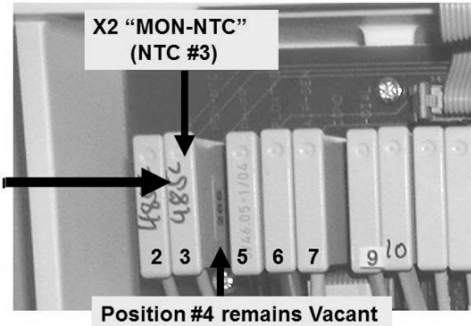
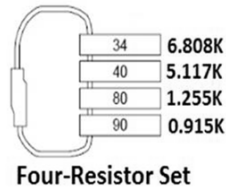
¹ To LOCATE NTC #3 refer to **Figure 42** (page 218)

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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 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 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 218).
 - b) Return to (ABOVE) procedure number [T- 7.2.1](#) (page 305).

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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 315) with a **known good** then return to (ABOVE) procedure number [T- 7.2.1](#) (page 305).

a) **IMPORTANT! Turn the machine OFF!**

b) Per the Figure below, unplug NTC #2's connector from the **1st** position from the left, labeled "CON-NTC".

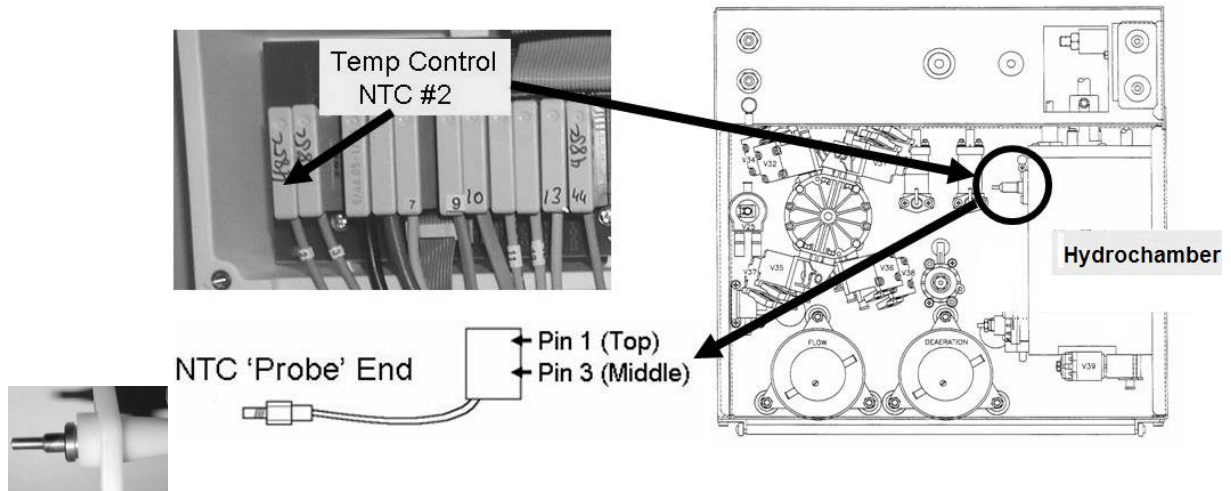


Figure 54 – Hydraulics Rear View – NTC #2

c) **CAREFULLY** (thin wires!) open NTC #2's female distribution board connector.

d) Referring to the Figure above, remove NTC #2 from the hydrochamber to expose its 'probe end'. Do NOT lose 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 305). 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 316), between the minimum and maximum (**K Ω**) range?

Yes Return to (ABOVE) procedure number [T- 7.2.1](#) (page 305).

No Replace NTC #2 with a tested known good then return to (ABOVE) procedure number [T- 7.2.1](#) (page 305).

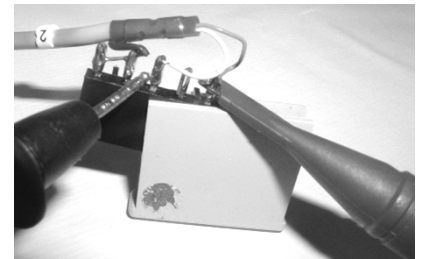


Table 5 – NTC RESISTANCE

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

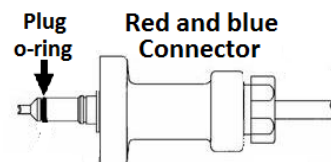
SECTION 5 - CONDUCTIVITY / ON LINE CLEARANCE PROBLEMS

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) ENSURE Dialysate Flow is ON (Flow on/off lamp NOT blinking)!

B) From the Home screen, ENSURE [Dialysate Flow] and has been on and set to 800 ml/min for five (5) minutes!

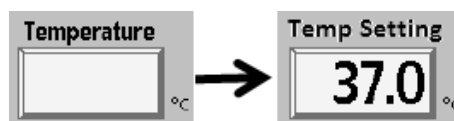
C) If [**Conductivity**] is less than 12.6 mS, Figure right, ENSURE BOTH connector plug O-rings are present! If not this may be the problem!



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

E) **If installed, remove the 'dummy chamber' from the Level Detector.**

F) Select the [**Temperature**] window. Is "Temp Setting" ALREADY = 37.0° C?



Yes See part G.

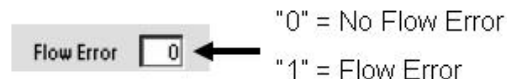
No Adjust "Temp Setting" to 37.0° C THEN continue to part G.

G) Press 'CONFIRM' to return to [**Temperature**].



H) **DO NOT RESET ALARMS!**

I) 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 below:



Scenario #1: IF "Temp Setting" was already 37.0° C (it was NOT necessary to adjust it), **TWO (2) MINUTES OR** until if **Flow Error** EVER = 1.

Scenario #2: IF "Temp Setting" was not already 37.0° C (it was necessary to adjust it), **FOUR (4) MINUTES OR** until if **Flow Error** EVER = 1.

J) Is **Flow Error** is ALWAYS = 0?

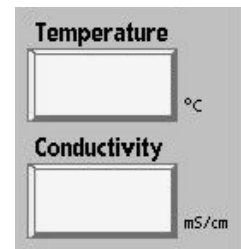
Yes **Flow Error** ALWAYS = 0! See part K.

No **Flow Error** = 1 even if just once! Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#)

K) 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).

Continued on next page

L) Call the Home screen. WITHOUT LOOKING AWAY, watch [Temperature] AND [Conductivity] for one (1) minute. Based first on [Temperature], TWO (2) possible scenarios below



1) **IF between 35.5 and 38.5° C AND STABLE i.e. does NOT changes more than +/- 0.2 °C:** Going forward, if [Temperature] becomes unstable address it FIRST! For now see part M.

2) **ALL OTHERS:** Proceed to **page 214**, [SECTION 4 – TEMPERATURE PROBLEMS](#)

M) Based on [Conductivity], TWO (2) possible scenarios:

1) **IF (and ONLY if) between 13.0 and 14.3 mS AND STABLE i.e. does NOT change more than +/- 0.2:** See procedure number [CO- 1.0.0](#) (page 319).

2) **ALL OTHERS:** See part N.

N) **Firmly connect to JUGS* of known good** bicarb AND acid!**

* To isolate between a Central Concentrate Delivery System (SDS) and the 2008 K/K² connect to JUGS!

** Tested good per clinic procedures!

O) ENSURE [Dialysate Flow] is ON (Dialysate Flow on/off lamp is NOT blinking)!

R) If the acid AND / OR bicarb source was changed above allow five (5) minutes BEFORE continuing to part S.

S) See procedure number [CO- 1.0.0](#) (page 319).

CO- 1.0.0 ISOLATE DIALYSATE SETTINGS

- A) At the bottom of the screen, select the 'Dialysate' tab.
- B) Figure below, ENSURE the 'Selected Acid' matches the acid connected to the machine.
- C) Figure below, ENSURE the Acid 'Type' matches the acid label.

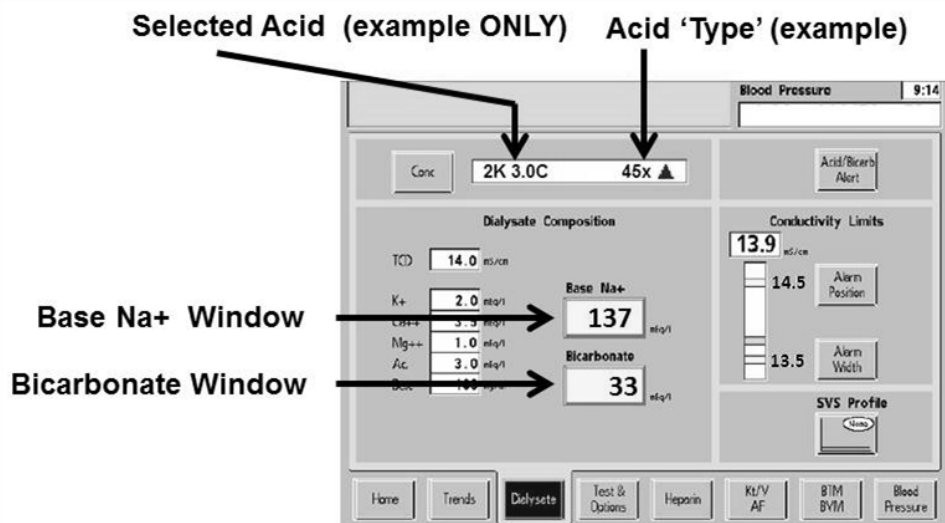
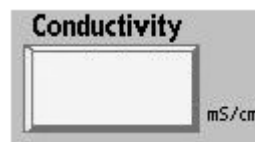


Figure 55 – Dialysate Screen

- D) Set [**Base Na+**] to 137 and press 'CONFIRM'.
- E) Set [**Bicarbonate**] to 33 and press 'CONFIRM'.
- F) If the 'Selected Acid', [**Base Na+**] OR [**Bicarbonate**] was changed, allow five (5) minutes BEFORE continuing to part G.

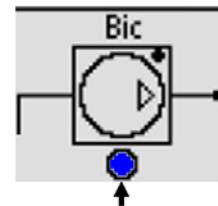
- G) Based on [**Conductivity**] now, THREE (3) possible scenarios:



- 1) **IF (and ONLY if) LESS THAN 13.0 mS:** See procedure number [CO- 1.0.1](#) (page 320).
- 2) **IF (and ONLY if) STABLE between 13.0 and 14.3:** Proceed to **page 335**, procedure number [CO- 1.0.9](#).
- 3) **ALL OTHERS:** Proceed to **page 325**, 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 321**, procedure number [CO- 1.0.3](#).
- 2) **IF WHITE:** a) Select 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 374**, procedure number [CO- 9.0.0](#).

No **[Bicarbonate]** window = zero (0)! Acetate concentrate is selected! See procedure number [CO- 1.0.2](#) (page 320).

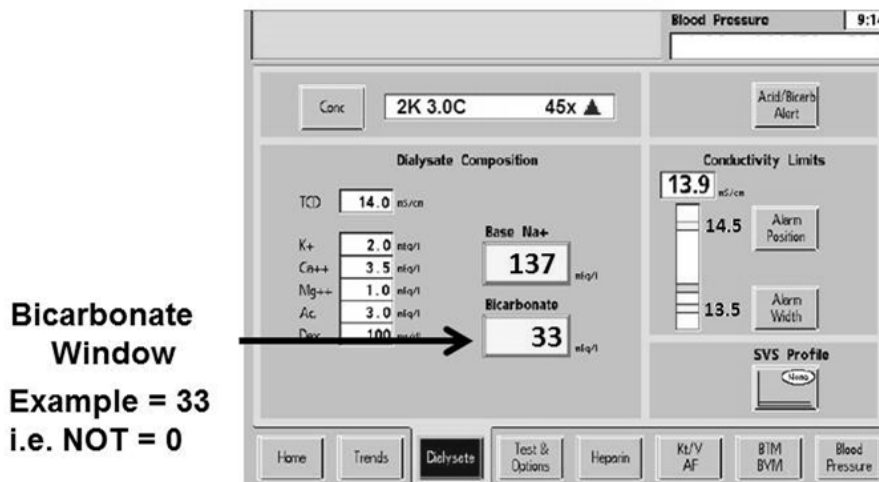


Figure 56 – Dialysate Screen

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 **known good ACID AND bicarbonate!**
- b) Select the screen's 'Conc' button THEN select the **ACID** that is attached to the machine.
- c) Press 'CONFIRM'! 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, allow five (5) minutes. If **[Conductivity]** remains less than 13.0 mS see procedure number [CO- 1.0.3](#) (page 321).
 - 2) **IF WHITE:** Proceed to **page 374**, procedure number [CO- 9.0.0](#).

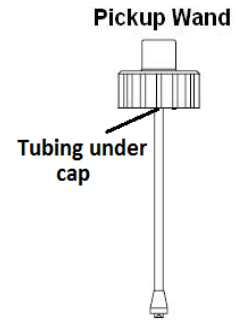
CO- 1.0.3 CONDUCTIVITY IS LOW / ISOLATE PUMP INPUTS

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!

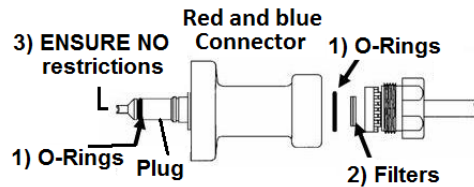


C) Figure right, THREE (3) checks on BOTH concentrate CONNECTORS:

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) **IMPORTANT! 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 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#)

F) Call debug screen 1. If debug does not appear press 'Escape' 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:

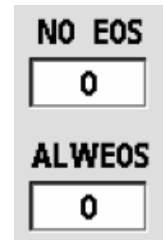


Table 6 - EOS (End Of Stroke) Values

NO EOS	ALWEOS	YOUR RESPONSE
0 (ALWAYS)	0 (ALWAYS)	See part H next page
1 (EVER)	Does not matter	Proceed to page 397 , SECTION 6 – CONCENTRATE PUMP ERRORS.
Does not matter	1 (EVER)	Proceed to page 397 , 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’ → ‘CONFIRM’).
- J) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- K) See procedure number [CO- 1.0.3.7](#) (page 322).

CO- 1.0.3.7 / CONDUCTIVITY LOW

A) Figure right, while watching through the inlet tubing, disconnect the ACID connector from the jug, for seven (7) seconds THEN FIRMLY reconnect!

B) 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!**
Continue to part C.

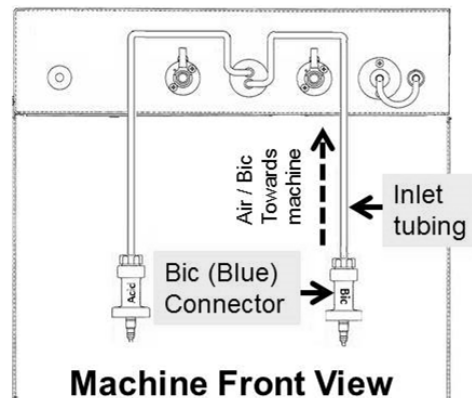
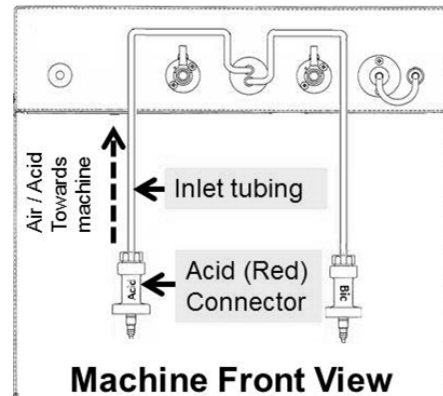
2) **IF air / acid is NOT moving OR moving back and forth!** Proceed to **page 345**, procedure number [CO- 4.1.0](#).

C) Figure right, watching through the inlet tubing, disconnect the BICARB connector from the jug, for seven (7) seconds THEN FIRMLY reconnect!

D) Watching for thirty (30) seconds, TWO (2) possible scenarios:

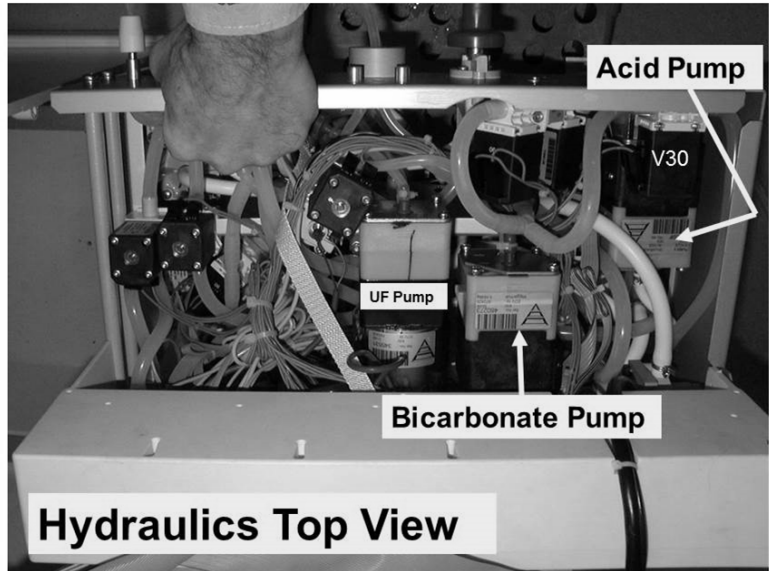
1) **IF (and ONLY if) air / bicarb is moving, in one direction ONLY, towards the machine!** See procedure number [CO- 1.0.3.8](#) (**page 323**).

2) **IF air / bicarb is NOT moving OR moving back and forth!** Proceed to **page 345**, procedure number [CO- 4.1.0](#).



CO- 1.0.3.8 BOTH PUMPS DRAWING CONCENTRATE / ISOLATE LEAKS

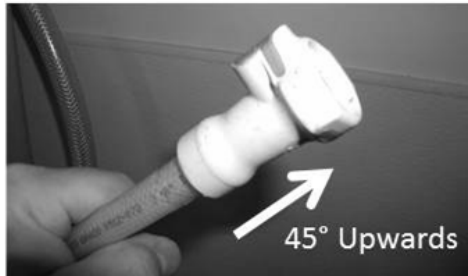
- A) **ENSURE FIRM connections to the acid and bicarb jugs!**
- B) Figure below, ENSURE no leaks from the ACID and BICARB pumps!



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



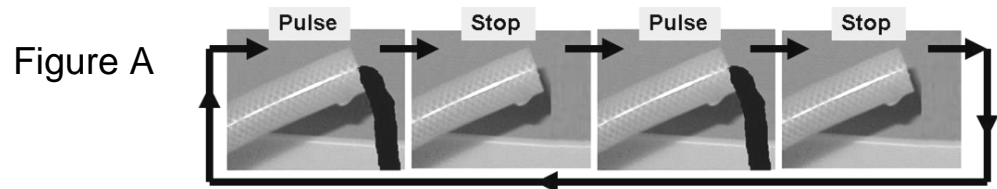
- D) As seen in the Figure right, point the drain tubing OPENING **UP at 45°** and no higher than two (2) feet above the floor! **IF POINTED DOWN GRAVITY FLOW RESULTS IN ERROR!**



- E) Watch for **ONE (1) FULL MINUTE** THEN consider BOTH scenarios next page:

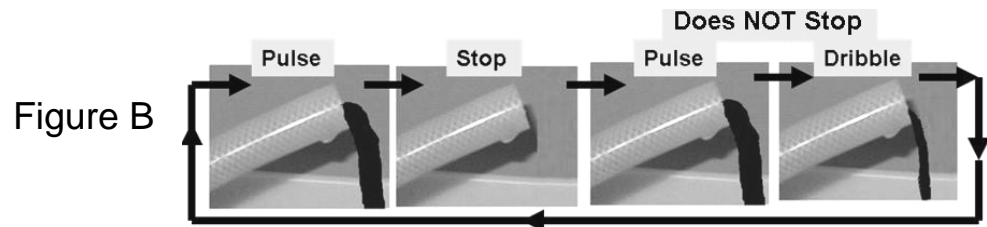
Scenario #1: Referring to *Figure A (below)*, approximately 30 ml pulses that stop completely between each and every cycle i.e. Pulse → Stop → Pulse → Stop: See parts a AND b below:

- a) Reconnect the drain.
- b) ENSURING [Dialysate Flow] is ON and set to 800 ml/min, see procedure number [CO- 1.0.4](#) (page 325).



Scenario #2: Referring 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 **535**, to perform [SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM](#).
- c) If a leaking Balancing Chamber diaphragm was not located in part b, return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!.
- d) Allow four (4) minutes then see procedure number [CO- 1.0.4](#) (page 325).

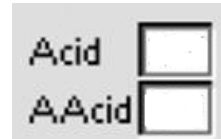


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CO- 1.0.4 ISOLATE ACID PUMP CONTROL

a) **Open the shunt door and LEAVE IT OPEN till instructed!**

b) Call debug screen 0. Figure right, WITHOUT LOOKING AWAY, watch **Acid** versus **AAcid** for one (1) minute. Are they ALWAYS within +/- 3 of each other?



Yes **AAcid = Acid!** See procedure number [CO- 1.0.4.2](#) (page 325).

No **AAcid is NOT remaining within 3 of Acid!** There is a problem with Acid Pump control! Close the shunt door THEN proceed to **page 397**, [SECTION 6 - CONCENTRATE PUMP ERRORS...](#)

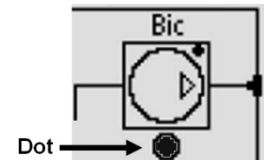
CO- 1.0.4.2 AACID = ACID / ISOLATE BICARB PUMP CONTROL

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- 1.0.5](#) (page 325).

No. **ABic is NOT remaining within +/- 3 of Bic!** Figure right, watch the Bicarb (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:** See procedure number [CO- 9.0.0](#) (page 374).

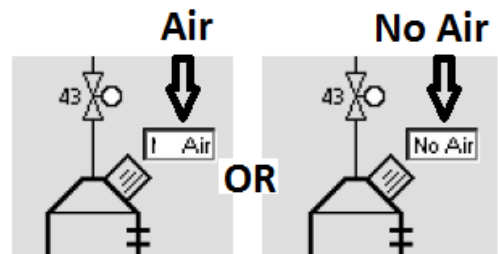
2) **IF the 'dot' REMAINS BLUE:** There is a problem with Bicarb Pump control. Close the shunt door THEN proceed to **page 397**, [SECTION 6 - CONCENTRATE PUMP ERRORS.](#)

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 EVER say "Air", even just once!

b) TWO (2) possible scenarios:



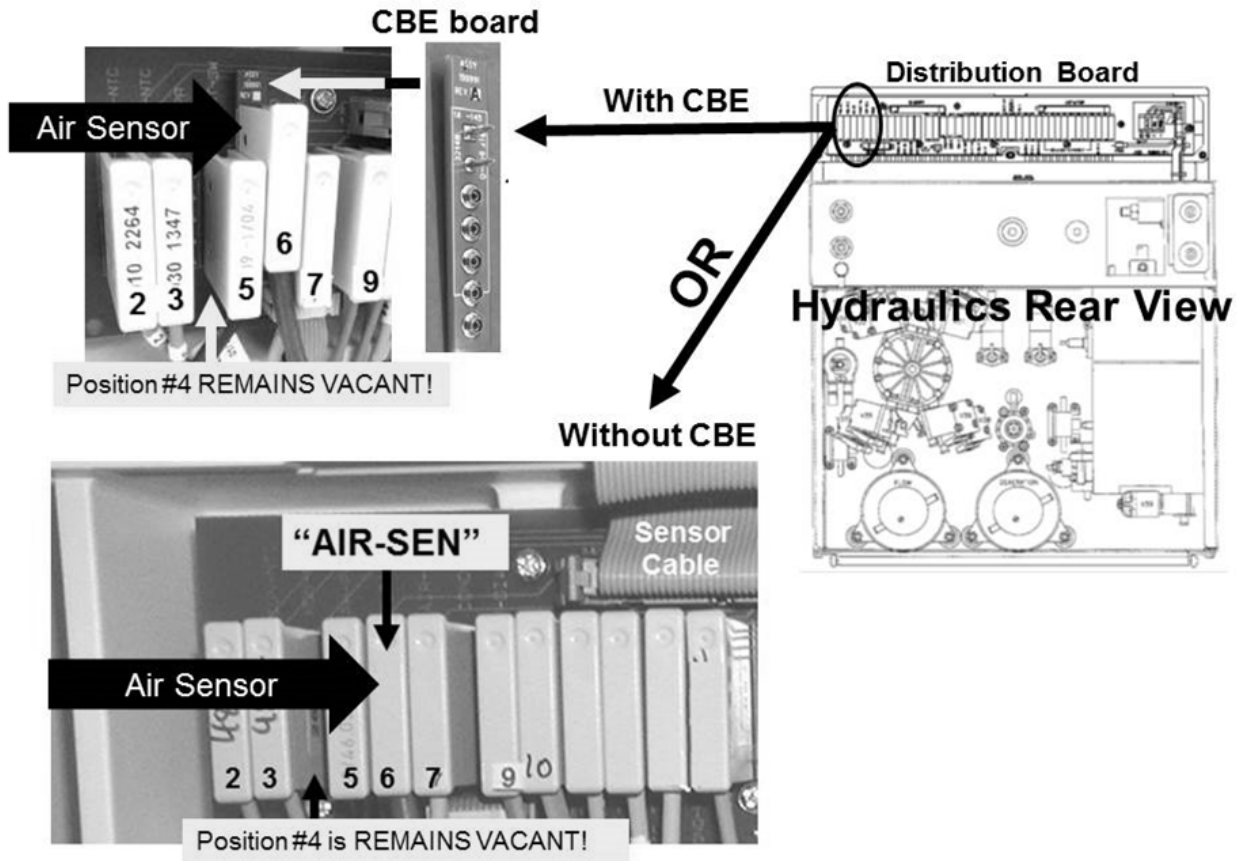
1) **IF it EVER says "Air" even just once:** See procedure number [CO- 1.0.5.2](#) (page 326).

2) **IF (AND ONLY if) it ALWAYS says "No Air"!** Proceed to **page 328**, 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 cap i.e. 5th position FROM THE LEFT**. If CBE modified it plugs into the CBE board higher than the others!

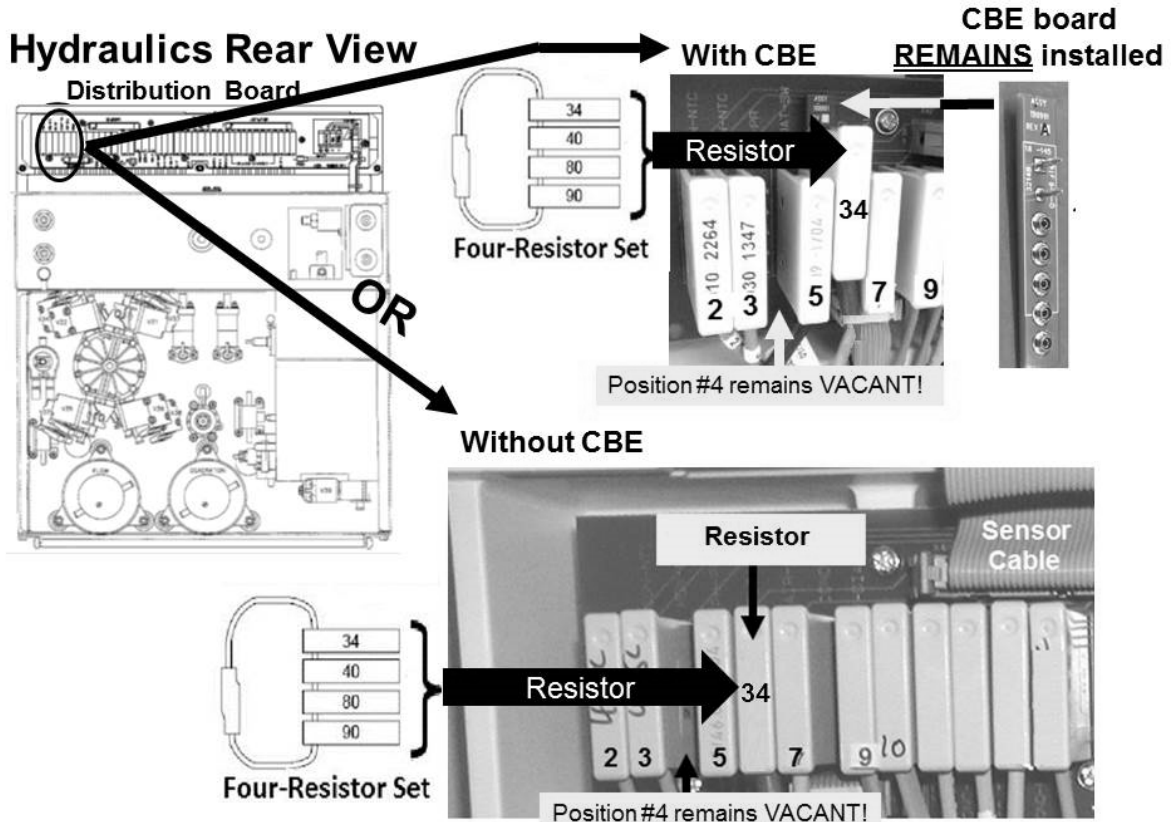
Continue to part B next page



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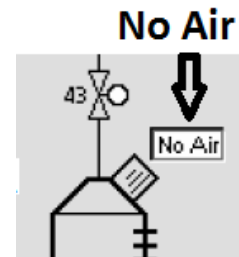
B) **FIGURE BELOW**, place one of the plugs, from the **FOUR-RESISTOR SET** into the Air Sensor's distribution board position i.e. **5th position*** from LEFT

* **NOTE:** If CBE modified the resistor **MUST** 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 **MUST** now say "No Air" always!

D) See procedure number [CO- 1.0.6](#) (page 328).



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CO- 1.0.6 “NO AIR” ALWAYS / ISOLATE LOADING PRESSURE

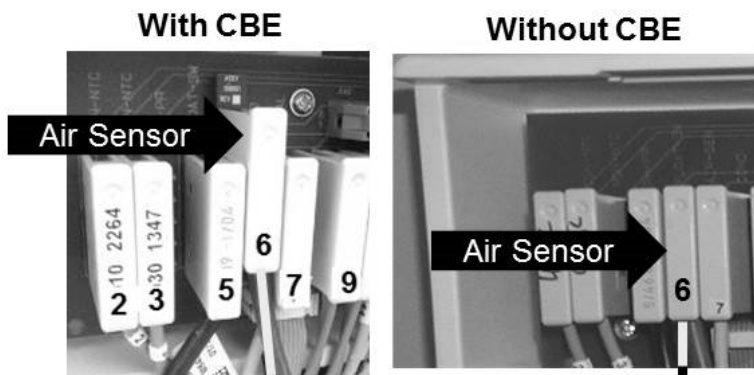
- a) **ENSURING** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it **SLAM*** it into the Acetate/Acid rinse port. * or else pressure always read low
- b) Loading Pressure may not cycle but is ‘OKAY’ if it achieves a peak of between 23 and 26 psi. TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) pressure is ‘OKAY’:** Leaving the gauge installed, see procedure number [CO- 1.0.6.2](#) (page 328).
 - 2) **IF pressure is NOT ‘OKAY’:** Leaving the gauge installed, proceed to **page 27**, procedure number [F- 1.0.8](#)

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 **OR** until it EVER = 1, even just once, indicating a Flow Error:
 - 1) **IF (and ONLY if) Flow Error is NEVER, EVER = 1!** Proceed to **page 329**, 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 = 1 even just once:** Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#).

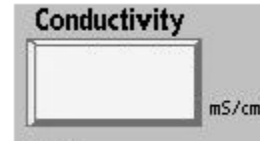
CO- 1.0.6.4 BC SWITCH NEVER = 897 PART 1

- a) If previously removed, return the Air Sensor’s female connector to **5th distribution board position FROM THE LEFT**. Figure below, if CBE modified it MUST plug into the CBE board pin for pin.
- b) See procedure number [CO- 1.0.7](#) (page 329).



CO- 1.0.7 BC SWITCH NEVER = 897 PART 2

- a) BE VERY SURE the blue connector is in KNOWN GOOD bicarb; the red connector in KNOWN GOOD acid!!
- b) Consider using the acid and bicarb jugs from another machine that has good Conductivity!
- c) ENSURE [Dialysate Flow] is ON (Flow on/off lamp NOT blinking)!
- d) From the Home screen, ENSURE [Dialysate Flow] is set to AT LEAST 500 ml/min!
- e) 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!!
- f) Based on [**Conductivity**] now, THREE (3) possible scenarios:



Scenario #1: IF (and ONLY if) **LESS THAN 13.3 mS**: Proceed to **page 337**, procedure number CO- 2.0.0.

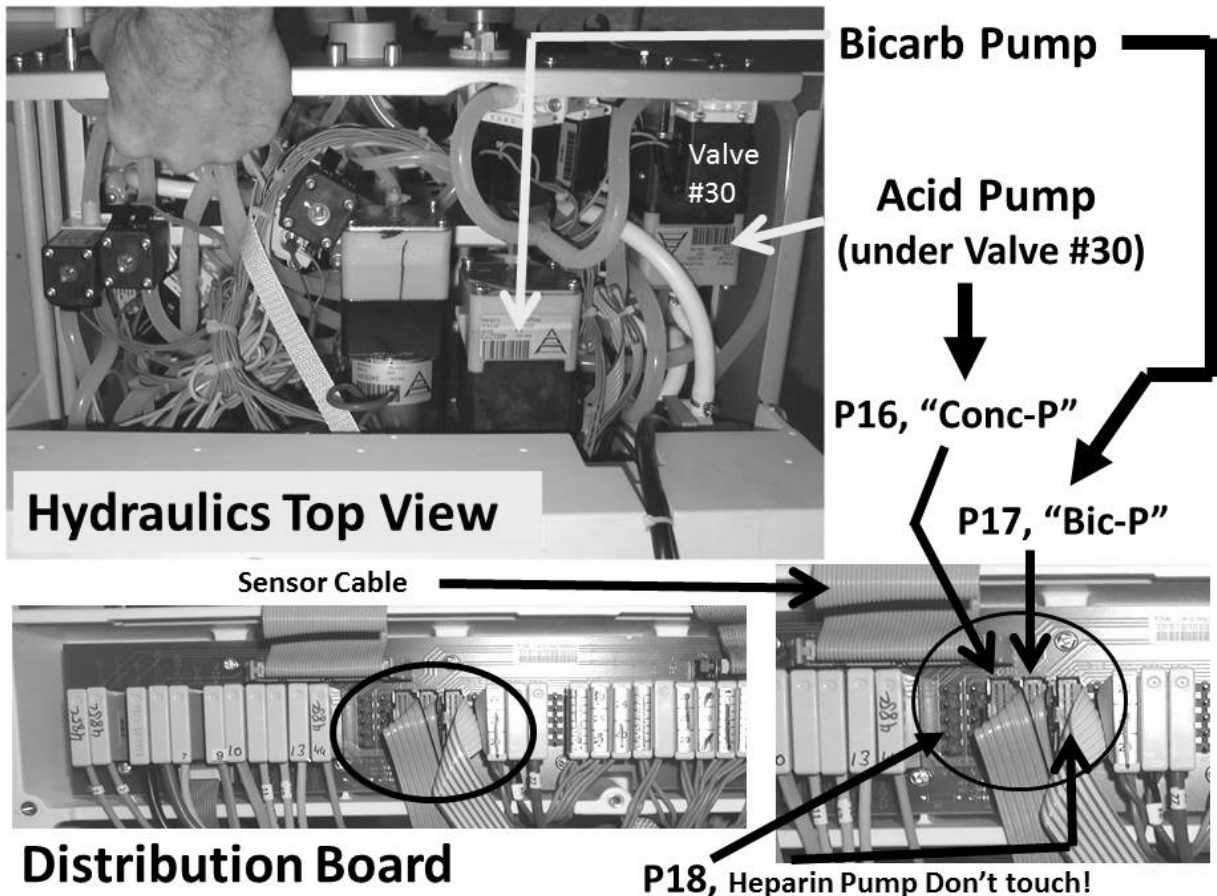
Scenario #2: IF **MORE THAN 14.3 mS**: See procedure number [CO- 1.0.8](#) (page 330)

Scenario #3: IF (and ONLY if) **STABLE between 13.3 and 14.3 mS**: Something may have changed! If the original problem is no longer occurring DO NOT continue. If the problem continues proceed to **page 335**, procedure number [CO- 1.0.9](#).

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CO- 1.0.8 [CONDUCTIVITY] MORE THAN 14.5 mS / ISOLATE PUMP ELECTRICAL CONNECTIONS

- A) These procedures are IMPORTANT to prevent patient harm. **BE CAREFUL!**
- B) **Figure BELOW**, touch the top of the **ACID AND BICARB** pumps to feel them **BOTH** mechanically stroking about every three (3) seconds!



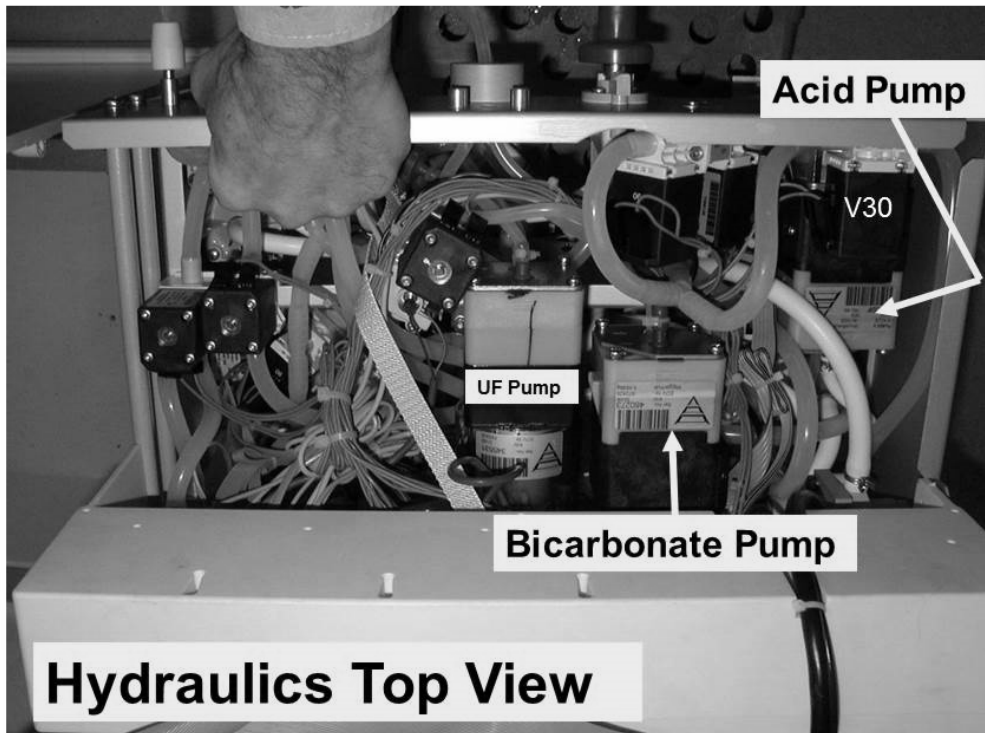
- C) **IMPORTANT!** Return the BICARB (blue) connector to its rinse port!
- D) Call debug screen 2 and **ENSURE BICOUT = 0!**
- E) Touch the **ACID AND BICARB PUMPS** again. TWO (2) possible scenarios:



- 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 331).
- 2) **IF the BICARB PUMP is stroking AND the ACID PUMP stops:** See parts a AND b below:
 - a) **IMPORTANT! To prevent damage turn the machine OFF!**
 - b) Figure above, the acid ("Conc-P") and bicarbonate pump ("Bic-P") distribution board connectors are reversed!

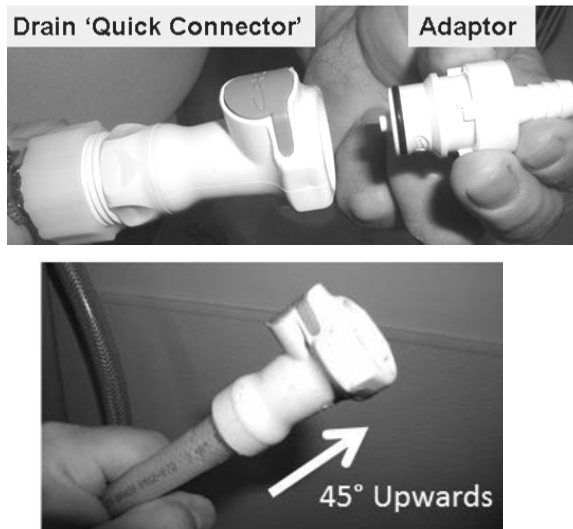
CO- 1.0.8.1 [CONDUCTIVITY] MORE THAN 14.5 mS / ISOLATE PUMP TUBING CONNECTIONS

- a) Per the top Figure below, trace the tubing from the red (ACID) connector to ENSURE it goes to the input of the **ACID PUMP**
- b) If **ABSOLUTELY SURE** the pump is plumbed correctly, see procedure number [CO- 1.0.8.2](#) (page 332).

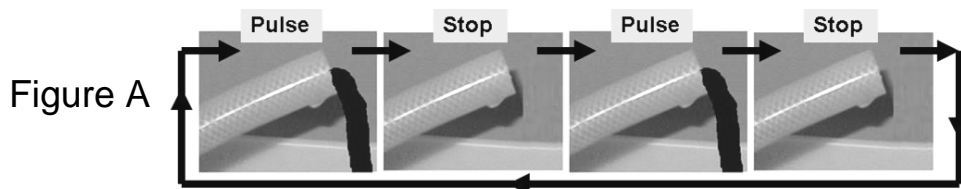


CO- 1.0.8.2 CONDUCTIVITY] MORE THAN 14.5 mS / ISOLATE DRAIN STREAM.

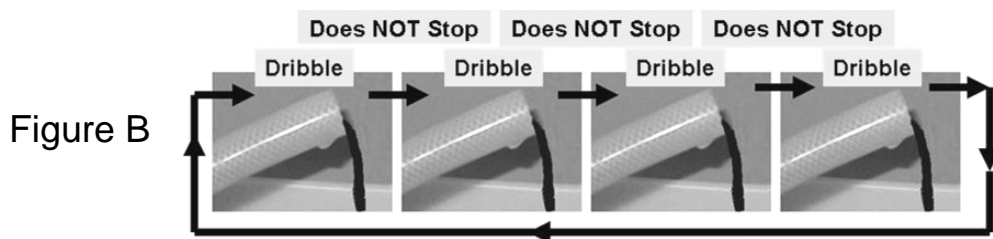
- a) ENSURE Loading Pressure (Acid Rinse Port gauge) continues to reach its high of more than 22 psi!
- b) **IMPORTANT!** If a 'Quick Connector' (Figure right) is present at the end of the drain tubing an ADAPTOR is required!
- c) As seen in the Figure (below right), point the drain tubing opening UP 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 332).



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 58**, procedure number [F- 6.2.0](#).



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) **IMPORTANT! 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 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#)

E) Watch for **ten (10) FULL** minutes ENSURING a "No Water" or a Flow Error NEVER occurs!

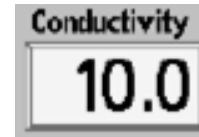
F) See procedure number [CO- 1.0.8.4](#) (page 333).

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' → 'CONFIRM')!

c) **IMMEDIATELY** call the Home screen. Is [Conductivity] = 10 mS?

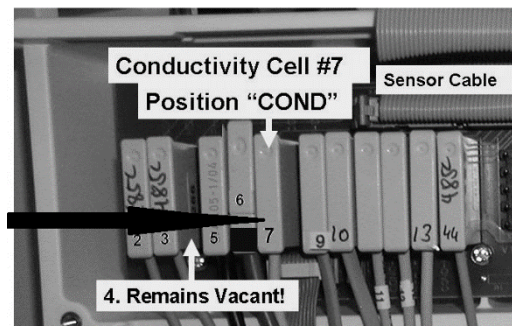


Yes [Conductivity] = 10.0 mS! See procedure number [CO- 1.0.8.5](#) (page 334).

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

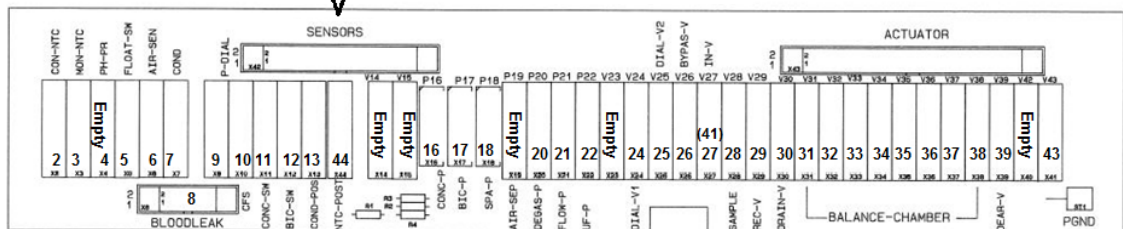
a) **Not likely! BE VERY SURE** you unplugged Conductivity Cell #7's connector from position, "X7, COND"! If [Conductivity] is STILL more than 10.0 mS continue to part b.

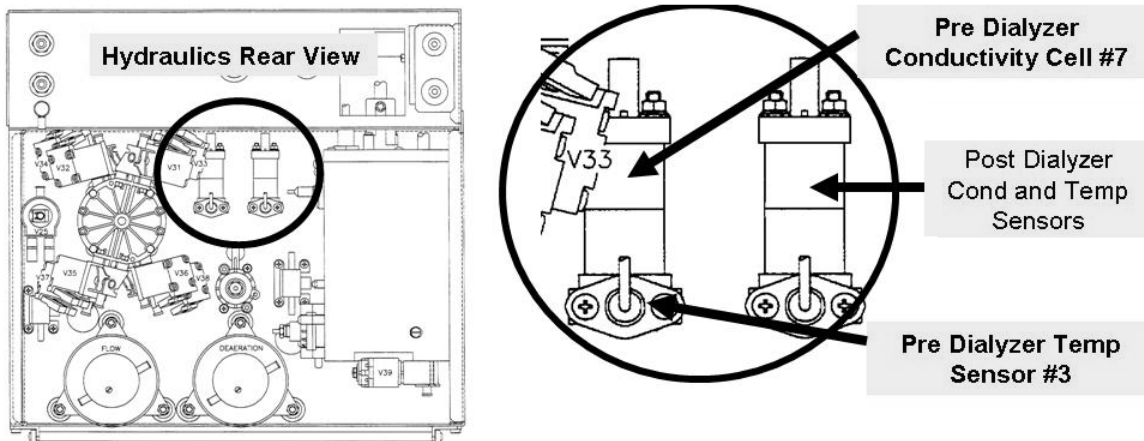
b) Figure below, TWO (2) possible bad components: **1) Bad Sensor Board cable OR 2) Bad** distribution board.

Sensor Cable plugs in here



Distribution Board





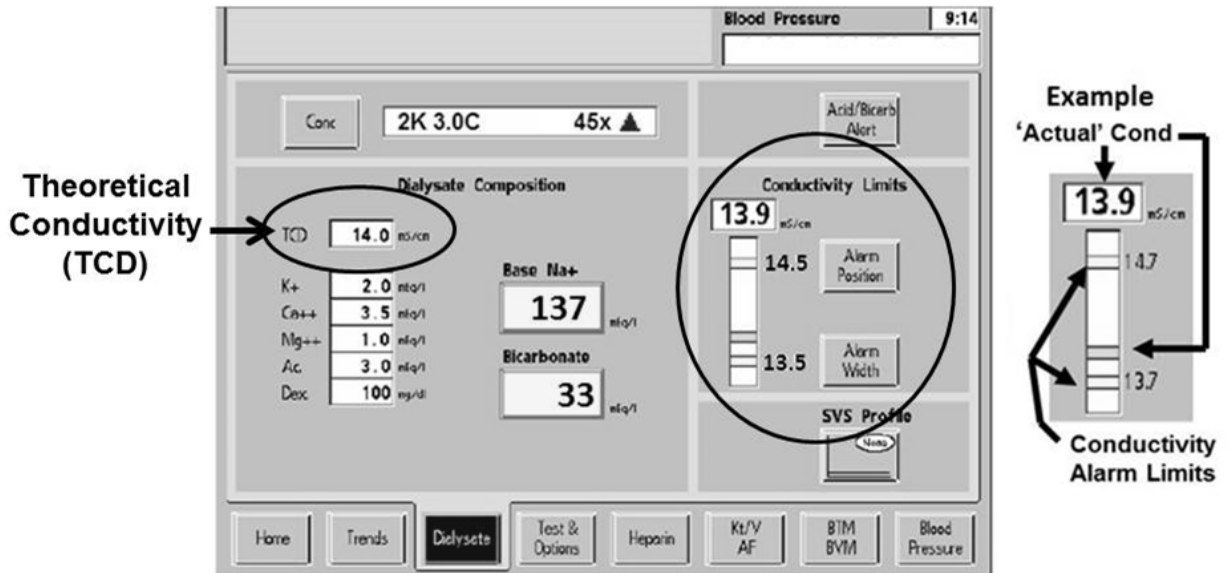
CO- 1.0.8.5 AFTER RINSE CONDUCTIVITY = 10.0 MS

- a) Select the [Dialysate Flow] window.
- b) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- c) Allow six (6) minutes BEFORE continuing to procedure number CO- 2.0.0 (**page 337**).

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CO- 1.0.9 VERIFY DIALYSATE LIMITS

a) Select 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 'CONFIRM'.
- d) Using [Alarm Position], set the upper Limit to 0.5 above **TCD** and press 'CONFIRM'.
- e) Based on the 'Actual' [**Conductivity**] window (Figure right), TWO (2) possible scenarios:

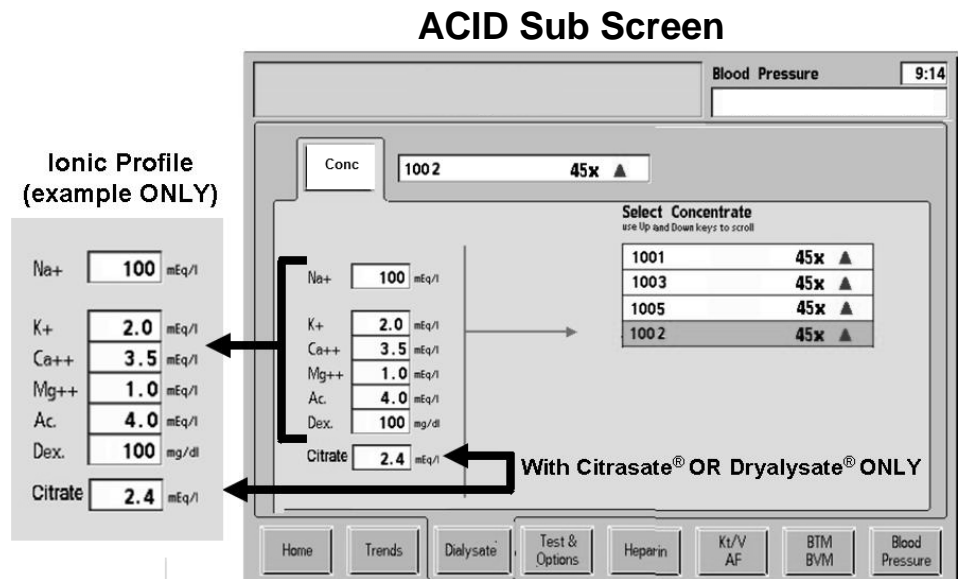
'Actual' Conductivity



- 1) **IF (and ONLY if) [Conductivity] is STABLE between 13.4 and 14.3 mS:** See procedure number [CO- 1.0.10](#) (page 336).
- 2) **ALL OTHERS:** Proceed to **page 337**, procedure number [CO- 2.0.0](#).

CO- 1.0.10 VERIFY ACID SETTINGS

- a) Select the upper left 'Conc' button to call the ACID Sub Screen (Figure below). This screen indicates the 'Selected Acid's' **Ionic Profile**.



- 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 337).

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 may have been 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.

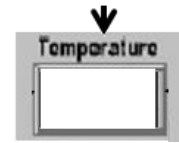
NOTE 4: **K+** = Potassium; **Ca++** = Calcium; **Mg++** = Magnesium; **Ac** = Acetate; **Citrate** is NOT ALWAYS present; **Dex** = Dextrose (mg/dL*).

* 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)?

Red = Temp alarm
White = No Temp alarm



- 1) IF pale yellow/white: Proceed to **page 337**, procedure number [CO- 2.0.6](#).
- 2) IF RED: Proceed to **page 222**, procedure number [T- 1.0.9](#).

CO- 2.0.6 VERIFY PRIMARY CONDUCTIVITY ALARM LIMITS

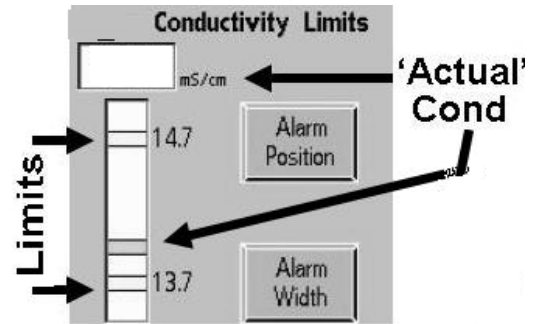
Call the Home screen. What color is the [Conductivity] window (Figure right)? TWO (2) possible scenarios:

Red if Cond Alarm



- 1) IF (and ONLY if) pale yellow / white: See procedure number [CO- 2.0.8](#) (page 340).
- 2) IF RED: See parts a AND b below:

- a) At the bottom of the screen, select the 'Dialysate' tab.
- b) Figure right, using [Alarm Position], can the Limits be adjusted so that 'Actual' Conductivity is CENTERED between them?

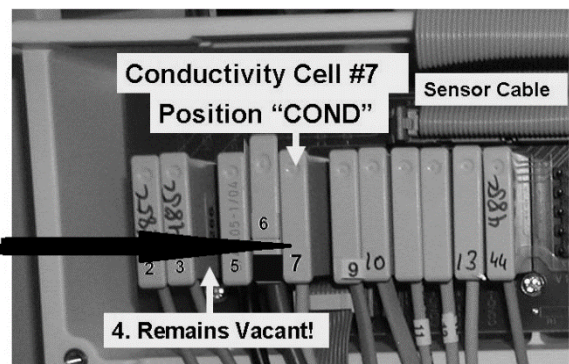
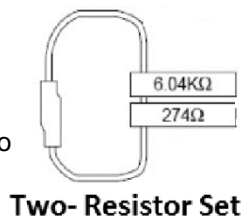


Yes 'Actual' Conductivity between the Limits!
Proceed to **page 339**, procedure number [CO- 2.0.7](#).

No Limits cannot be adjusted properly! See procedure number [CO- 2.0.61](#) (page 337).

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 339).

No The Limits CANNOT be adjusted properly! 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.

Parts c and d next page

c) **IMPORTANT! Place the machine into RINSE!**

d) Is the external flow indicator's 'bob' rising at least $\frac{1}{4}$ way up in the sight tube?

Yes 'Bob' moving! Proceed to **page 353**, procedure number [CO- 6.0.0](#).

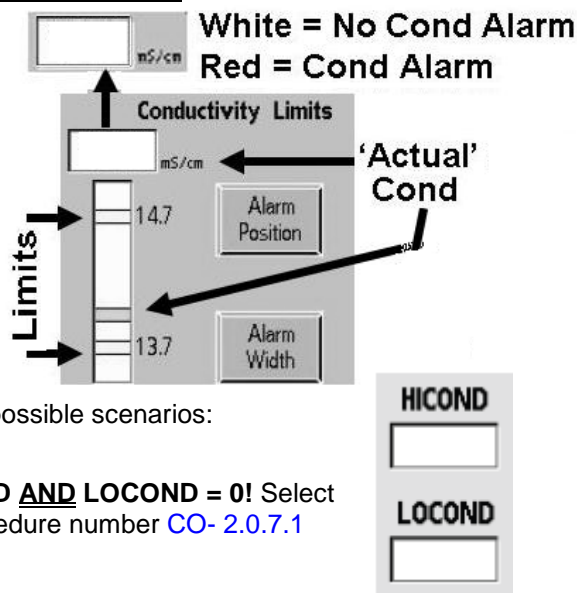
No 'Bob' NOT moving! See parts a AND b below:

a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!

b) Proceed to **page 20**, [SECTION 1 – FLOW ERRORS IN DIALYSIS PROGRAM](#).

CO- 2.0.7 'ACTUAL' CONDUCTIVITY BETWEEN THE ALARM LIMITS

- a) **IMPORTANT!** Press 'CONFIRM'!
- b) Figure right, with 'Actual' Conductivity REMAINING BETWEEN the Limits, what color is the Conductivity window now?
- 1) **IF (and ONLY if) WHITE:** See procedure number [CO- 2.0.8 \(page 340\)](#).
 - 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!** Select the 'Dialysate' tab then see procedure number [CO- 2.0.7.1 \(page 339\)](#).

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 \(page 340\)](#).

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) **IMPORTANT! 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 \(page 353\)](#).

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' → 'CONFIRM')!
- c) Proceed to **page 20, [SECTION 1 – FLOW ERRORS IN DIALYSIS PROGRAM](#)**

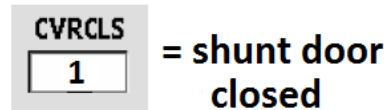
CO- 2.0.8 [CONDUCTIVITY] WINDOW IS WHITE / ISOLATE 'OUT OF BYPASS' FLOW

- A) **IMPORTANT! If not already, 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 342**, procedure number [CO- 2.0.9](#).

No See part E.

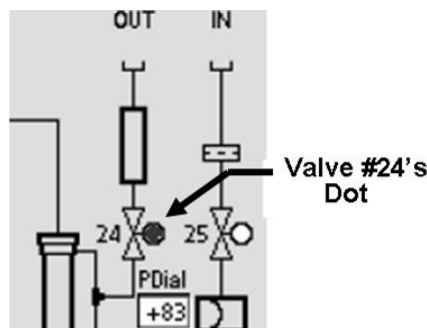
- E) Call debug screen 2. To ENSURE the shunt door is really closed **CVRCLS** (2nd column from left) = 1!



- F) Call debug screen 0. Allowing up to three (3) additional 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 341).

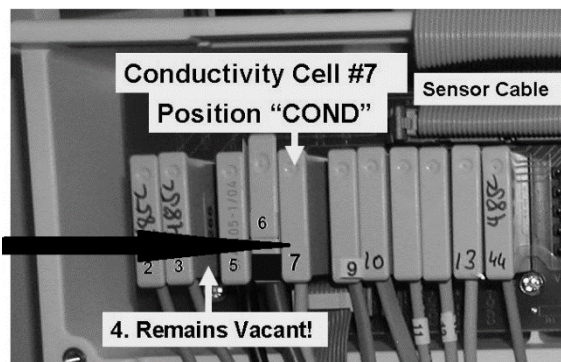
No After 3 minutes Valve #24's 'dot' stays WHITE!
See parts a THROUGH d below:



- 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) **IMPORTANT! 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 353**, procedure number [CO- 6.0.0](#).

No 'Bob' NOT moving! ENSURING the machine is in RINSE AND the bob is NOT moving, see parts a AND b below:

- a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!

- b) Proceed to **page 20**, [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 342).

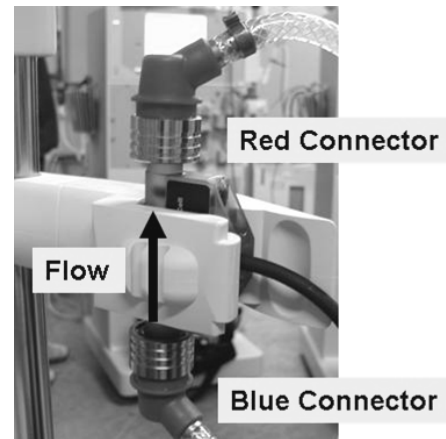
No 'Bob' NOT moving. See parts a THROUGH c below:

- 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 'bob' STILL is not moving AND if (and ONLY if) debug screen 0's, Valve #24's 'dot' is still blue, proceed to **page 20**, [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.
IMPORTANT! Figure right, flow through the meter MUST be from bottom to top!
- b) **IMPORTANT! Close the shunt door!**
- c) Set the meter to measure temperature (° C).
- d) Call debug screen 1.
- e) Press and hold the "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 342).

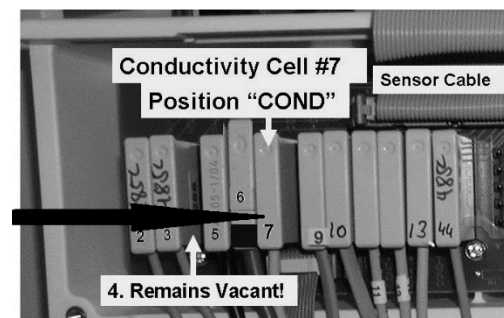
No NOT between 35.5 and 38.5! Proceed to **page 302**, procedure number [T- 7.0.0](#).

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 debug screen 1's, **C TCD** (lower left column). Example: 1360 = 13.60 mS.
- c) ENSURING the flow indicator's '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 343).
 - 2) **IF (and ONLY if) measured conductivity IS NOT within 0.4 of TCD:** Proceed to **page 366**, procedure number [CO- 8.0.0](#).
 - 3) **IF measured conductivity IS MOSTLY within 0.4 of TCD BUT unstable i.e. changes more than 0.15 per minute:** See parts a AND b below:

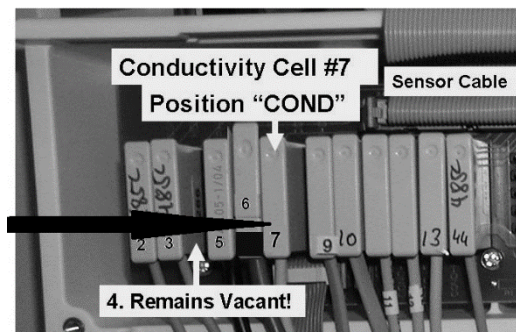


- a) If removed from a previous procedure, return Conductivity Cell #7's connector to distribution board position "X7, COND" (Figure right).
- b) See procedure number [CO- 5.0.0](#) (page 350).



CO- 3.0.0 CONDUCTIVITY IS GOOD / VERIFY DISPLAY

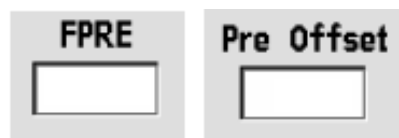
- a) If removed from a previous procedure, return Conductivity Cell #7's connector to distribution board position "X7, COND" (Figure right).
- b) Call the Home screen.
- c) Based on the machine's [Conductivity] window now, THREE (3) possible scenarios 1) or 2) or 3) below:



- 1) **IF (and ONLY if) = 17.0 mS:** See procedure number [CO- 3.1.0.2](#) (page 343).
- 2) **IF (and ONLY if) = 10.0 mS:** See procedure number [CO- 3.2.0.4](#) (page 343).
- 3) **ALL OTHER scenarios:** Is the machine's [Conductivity] window within +/- 0.4 mS of TCD?
Yes [Conductivity] is within 0.4 of TCD! See procedure number [CO- 3.4.0](#) (page 344).
No [Conductivity] is NOT within 0.4 of TCD! See procedure number [CO- 6.0.0](#) (page 353).

CO- 3.1.0.2 [CONDUCTIVITY] WINDOW = 17.0 mS

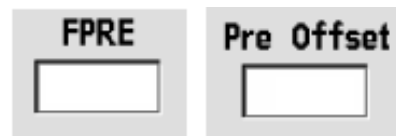
- a) Return the concentrate connectors to their rinse ports!
- b) **IMPORTANT!** Place the machine into RINSE!
- c) ENSURING a Flow Error NEVER occurs allow ten (10) FULL minutes BEFORE continuing to part d!
- d) Call debug screen 5. If debug does not appear press 'Escape' then call debug screen 5.
- e) Is **FPRE** within +/- 400 of **Pre Offset**?



- Yes **FPRE** within +/- 400 of **Pre Offset**! See procedure number [CO- 6.0.0](#) (page 353).
- No **FPRE** is NOT within +/- 400 of **Pre Offset**! Pre Dialyzer Conductivity Cell #7 is bad (see [Figure 57](#), page 344).

CO- 3.2.0.4 [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 OR is bad (to LOCATE Cell #7 refer to [Figure 57](#) (page 344)).
- No **FPRE** is NOT within +/- 10 of **Pre Offset**! Proceed to **page 353**, procedure number [CO- 6.0.0](#).

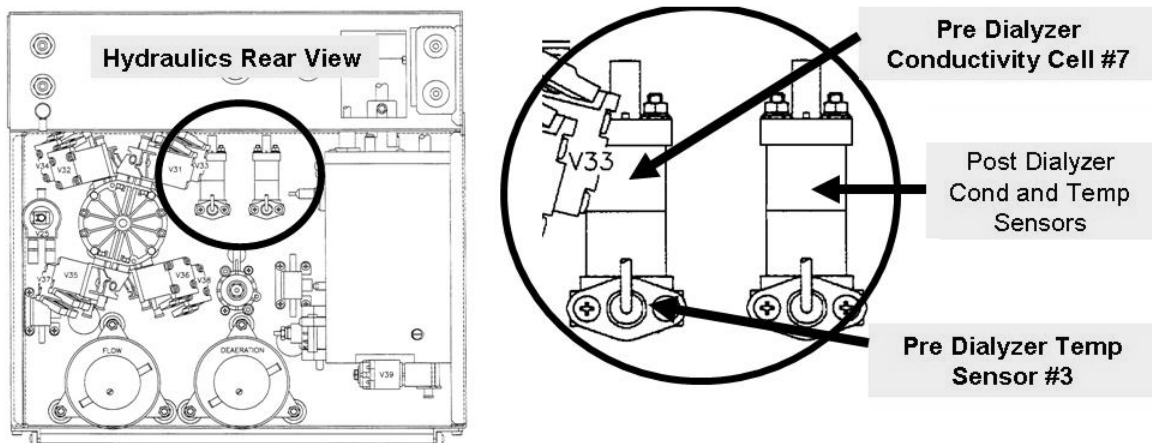


Figure 57 – Hydraulics Rear View

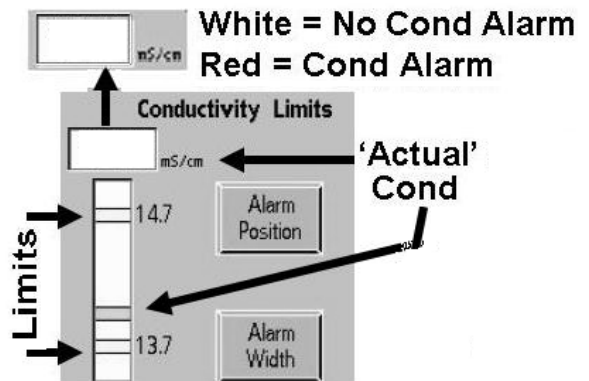
CO- 3.4.0 [CONDUCTIVITY] WITHIN 0.4 OF TCD / VERIFY CONDUCTIVITY ALARM LIMITS

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 344).

2) **IF RED:** See parts a THROUGH e below:

- a) At the bottom of the screen, select the 'Dialysate' tab.
- b) Figure right, using [Alarm Position], adjust the Limits so the 'Actual' Conductivity is CENTERED between them.
- c) Press 'CONFIRM'!
- 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 344).



CO- 3.5.0 VERIFY MEASURED CONDUCTIVITY

- a) Allowing up to two (2) additional minutes OR until the external flow indicator's 'bob' starts to moving 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 375**, 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 353**, 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 346).

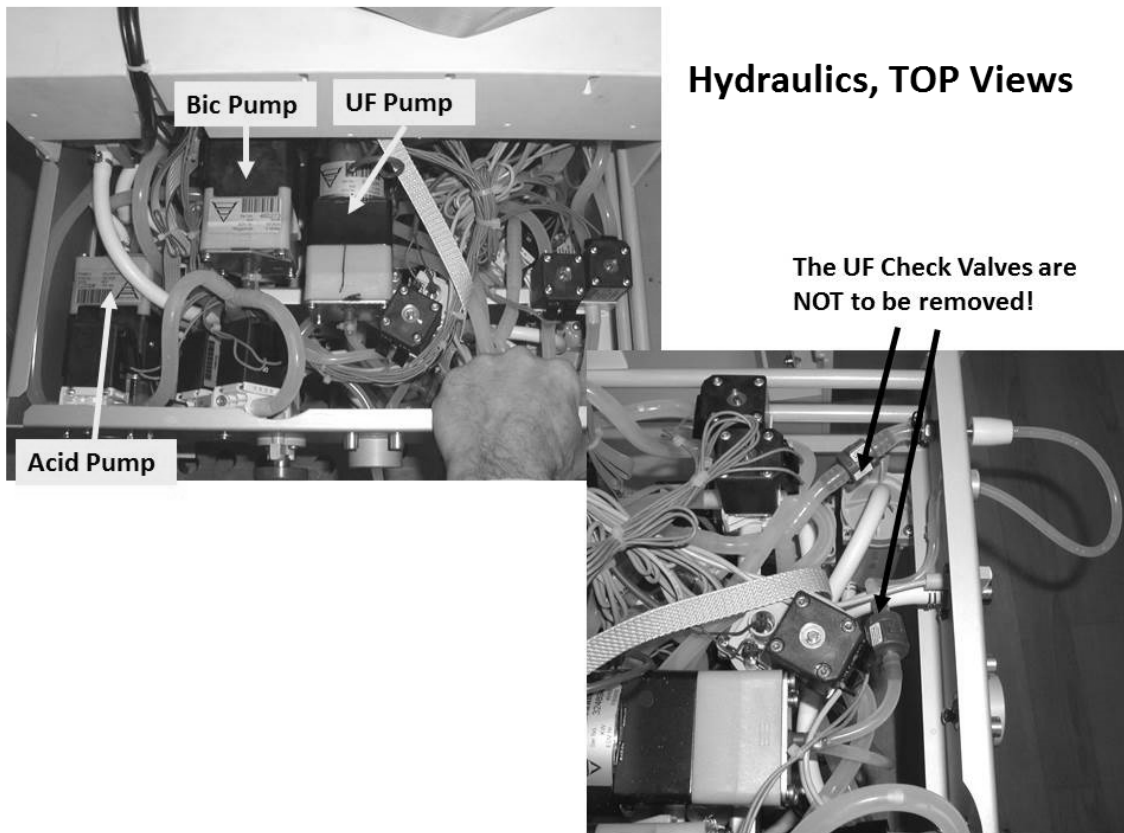


Figure 58 – UF Check Valves

CO- 4.2.0 ISOLATE CONCENTRATE INLET SYSTEMS (2).

- a) Return the acid and bicarb CONNECTORS **HARD** into their rinse ports.
- b) **IMPORTANT!** Place the machine into RINSE!
- c) ENSURE no external leaks!
- d) See procedure number [CO- 4.2.1](#) (page 346).

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:

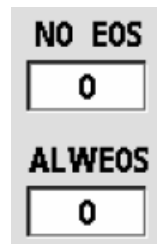
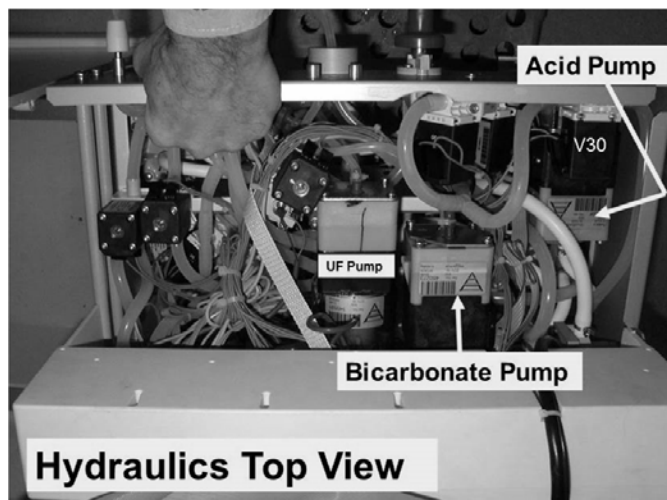


Table 7 – EOS

NO EOS	ALWEOS	YOUR RESPONSE
0 (always)	0 (always)	See procedure number CO- 4.2.2 (page 346).
Does not matter	1 (EVER)	Proceed to page 397 , SECTION 6 - CONCENTRATE PUMP ERRORS .
1 (EVER)	Does not matter	Proceed to page 397 , 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’ → ‘CONFIRM!’)
- 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 347).
- No Air / concentrate NOT seen OR moving back and forth! Proceed to **page 348**, procedure number [CO- 4.4.0](#).

CO- 4.2.3 VERIFY CONDUCTIVITY

- a) From the Home screen, set [Dialysate Flow] to 800 ml/min.
- b) Allow six (6) minutes BEFORE continuing to part c.
- c) Does [**Conductivity**] REMAIN less than 13.0 mS?

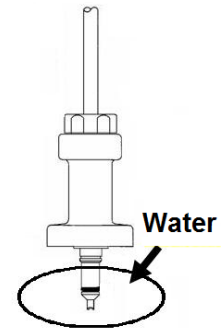
Yes REMAINS LESS than 13.0 mS! Return to **page 325**, procedure number [CO- 1.0.4](#).

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

- Place the concentrate connectors **HARD** into their rinse ports!
- Return to Rinse Program! ALLOW one (1) minute to prime the pumps.
- Per the Figure (right), place the connector's 'adapter plug' **ONLY** into a container of water i.e. **do NOT submerge the whole connector!**
- Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- Is AIR FREE concentrate drawn steadily in one direction now?

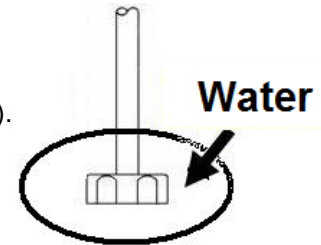


Yes Concentrate drawn! There is a problem with the pickup wand

No See procedure number [CO- 4.4.1](#) (page 348).

CO- 4.4.1 ISOLATE THE CONNECTOR

- Place the concentrate connectors **HARD** into their rinse ports
- Return to Rinse Program!
- ALLOW one (1) minute to prime the pumps
- Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').
- Per the Figure right, remove the connector from the inlet tubing and submerge the tubing, **without the filter**, into a container of water.
- 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 349).

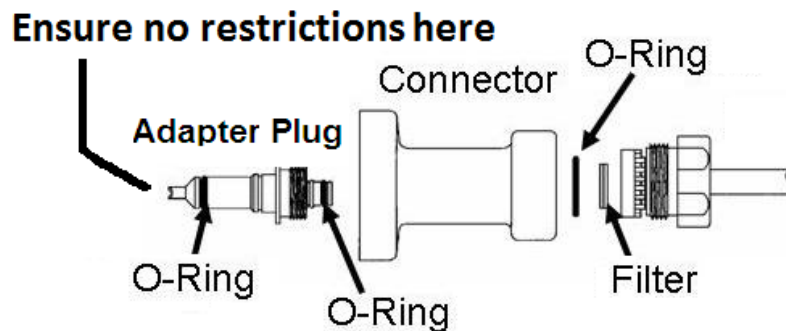


Figure 59 – Concentrate Connectors

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.

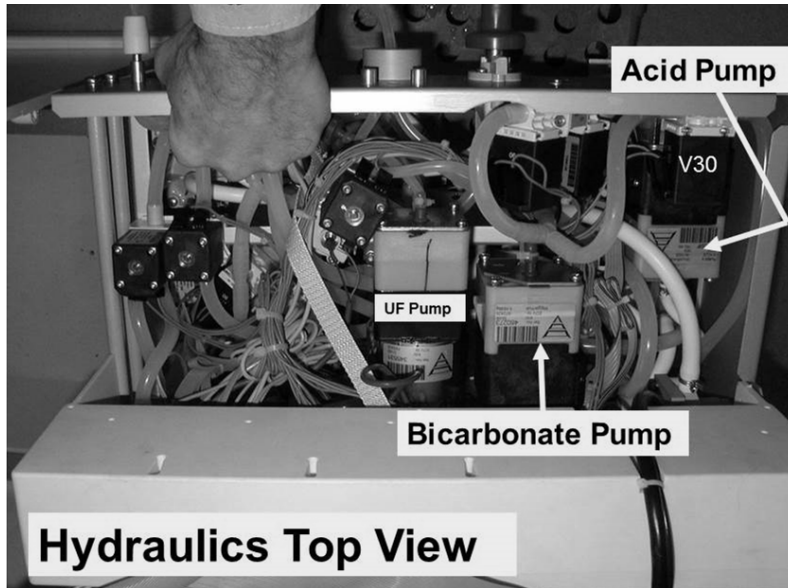
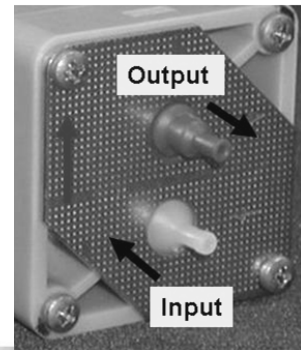


Figure 60 – Acid and Bic Pumps

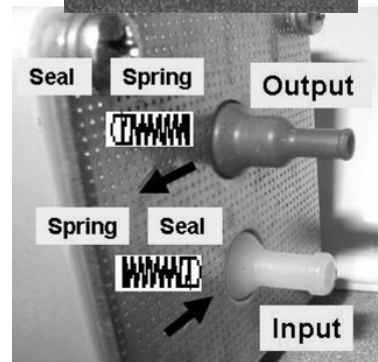
b) At the suspect pump(s), Per the Figure (right), TWO checks:

- 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.

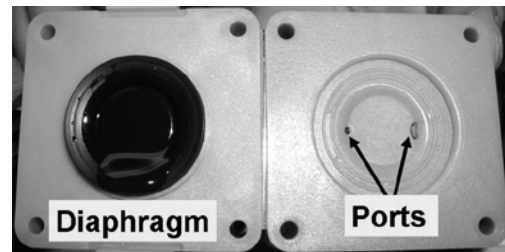


c) Per the Figures right, disassemble the suspect pump(s). SEVEN more checks:

- 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.

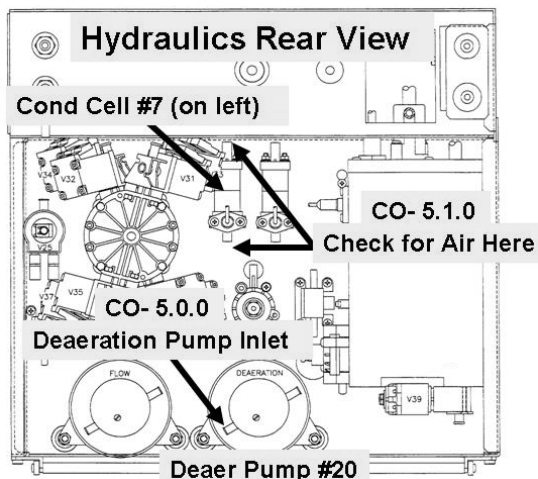


CO- 5.0.0 UNSTABLE CONDUCTIVITY / CHECK PRESSURES

- ENSURE Loading Pressure (Rinse port gauge) is cycling between its PEAK of somewhere between 23 and 25 psi **AND** to NEVER LOWER than 11 psi.
- Temperature influences Conductivity. If it changes more than +/- 0.2° C per minute address the temperature problem first!
- Turn the machine OFF to avoid air locking the deaeration pump!
- The deaeration gauge is used next. ENSURE it reads 0 inHg before installing it!
- Figure right, tee a gauge into the INLET tubing of the Deaeration Pump.
- IMPORTANT!** Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- Is Deaeration Pressure OKAY? Refer to [Appendix A](#) (page 667) for what pressure should be.

Yes Deaeration OKAY! Position the gauge so that tubing is NOT pinched then see procedure number [CO- 5.1.0](#) (page 350).

No NOTE this page number, as you will return here, THEN proceed to **page 498**, [SECTION 13 - DEAERATION PROBLEMS](#).



CO- 5.1.0 CHECK FOR AIR LEAK

Per the Figure (above, right), using a flashlight, for ONE (1) MINUTE, WITHOUT LOOKING AWAY, check for air bubbles flowing MOVING through the clear tubing at Conductivity Cell #7. Is air seen?

Yes Air seen! Proceed to **page 495**, procedure number [AIR- 1.0.5](#).

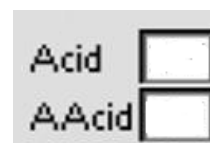
No No air seen! See procedure number [CO- 5.3.0](#) (page 350).

CO- 5.3.0 NO AIR SEEN / ISOLATE PUMP ACCURACY

Call debug screen 0. Watch **Acid** versus **AAcid** (Figure right) for one (1) minute. The values don't matter but should remain within +/- 3 of each other?

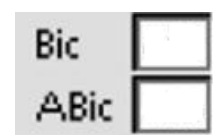
Yes **AAcid = Acid!** See procedure number [CO- 5.3.1](#) (page 350).

No **AAcid** is NOT remaining within +/- 3 of **Acid!** Proceed to **page 397**, [SECTION 6 - CONCENTRATE PUMP ERRORS](#).



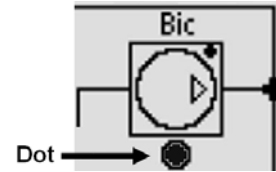
CO- 5.3.1 CHECK BICARBONATE STEPS

Watch **Bic** versus **ABic** (Figure right) for one minute. Remaining within +/- 3 of each other?



Yes **ABic = Bic!** See procedure number [CO- 5.4.0](#) (page 351).

No Watch the Bicarbonate (BIC) pump's 'dot' (Figure right) for TWO (2) minutes. TWO (2) possible scenarios:



1) **IF (and ONLY if) the 'dot' EVER turns white:** Proceed to **page 374**, procedure number [CO- 9.0.0](#).

2) **IF the 'dot' REMAINS CONSTANTLY BLUE:** Proceed to **page 397**, [SECTION 6 - CONCENTRATE PUMP ERRORS](#).

CO- 5.4.0 ISOLATE ACID PUMP

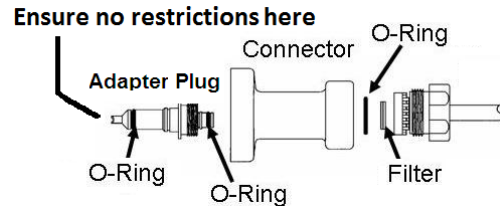
a) Figure right, ENSURE the Acid (red) AND Bicarbonate (blue) Connector's O-rings are present

b) ENSURE the filters is clean AND 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 CALIBRATION PROCEDURES booklet.

e) Are you able to accurately enter the burette volumes and 'CONFIRM' them without an "Operator Error" banner (Figure right) occurring?



Yes "Operator Error" did NOT occur! See procedure number [CO- 5.5.0](#) (page 351).

No "Operator Error" occurred! Proceed to **page 349**, procedure number [CO- 4.9.0](#).

CO- 5.5.0 ISOLATE BICARB PUMP

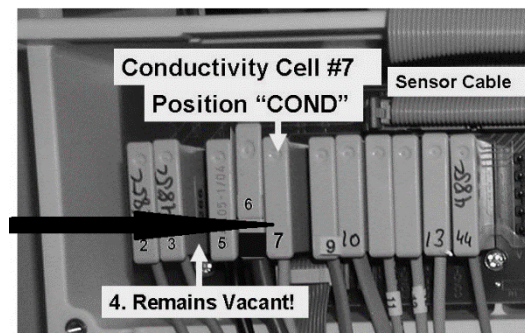
a) Read parts b AND c before performing them.

b) Perform the BICARBONATE PUMP VOLUME CALIBRATION.

c) Are you able to accurately enter the burette volumes and 'CONFIRM' them without an "Operator Error" banner occurring (Yes or No)?

Yes "Operator Error" did NOT 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 352).

No "Operator Error" occurred. See procedure number [CO- 4.9.0](#) (**page 349**).



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 accidentally 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 prompted to return here.
4. If not already performed in THIS Troubleshooting session, BEFORE continuing to step #5, proceed to **page 535**, 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 139**, to perform [PRESSURE TEST HYDROCHAMBER](#).
6. If the Hydrochamber is okay, 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.

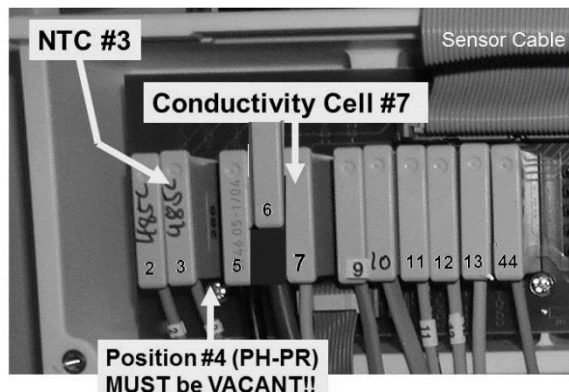
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CO- 6.0.0 DISTRIBUTION BOARD CHECKS / ON LINE CLEARANCE (OLC) ENABLED?

- 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.



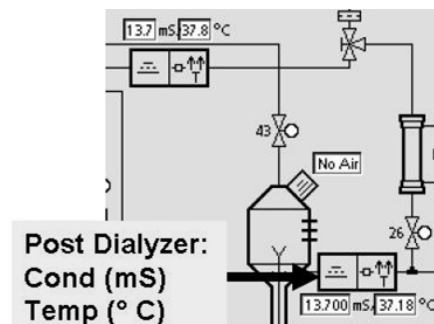
- b) If troubleshooting an Online Clearance (OLC) problem see part c. If NOT, proceed to **page 354**, procedure number [CO- 6.2.0](#).

- 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 353).
 ↑
 ↓

No The OLC option is off! **A)** Enter Service mode → Options → Hardware Options; **B)** Set OLC to "Yes" and press 'CONFIRM'; **C)** Return to debug screen 0 to ENSURE the **Post Dialyzer Cond** and **Temp** symbols now appear; **D)** Proceed to **page 354**, procedure number [CO- 6.2.0](#).



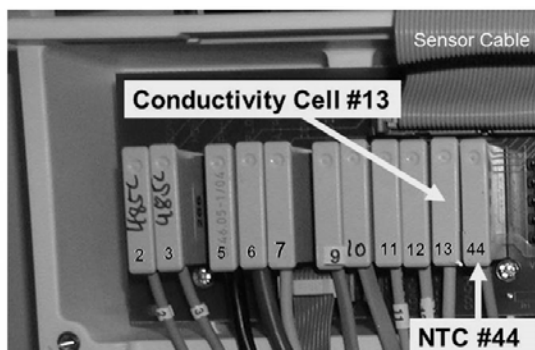
CO- 6.1.0 OLC OPTION ENABLED

- 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.

- d) 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 354).

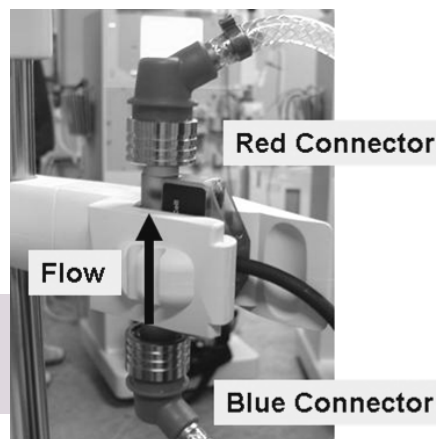
No **Post Dialyzer Temp** LESS THAN 34.00° C! Proceed to **page 380**, procedure number [CO- 10.0.20](#).

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!

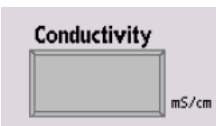
- a) **IMPORTANT!** Install the hydraulics however, there is no need to screw in the rear panels yet!
- b) **IMPORTANT!** ENSURING plenty of known good acid and LIQUID Bicarb plug **FIRMLY** into each!
- c) Place the machine into Service Mode → Calibrate Sensors → Cond Cells

- d) Install a Temperature / Conductivity meter into the dialysate lines. **Figure right, flow through the meter MUST directed from bottom to top!**



- e) **IMPORTANT! Close the shunt door!**

- 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) **IMPORTANT!** 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’ → ‘CONFIRM!’)

b) Proceed to **page 214**, [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 seconds, to about 25 psi. If not cycling return to Dialysis Program!

b) Proceed to **page 361**, procedure number [CO- 6.8.0](#).

NOTE: If an “Operator Error” banner appears but the external flow indicator's 'bob' continues to move up and down ignore the banner. If the 'bob' not moving it is necessary to ‘Escape’ the calibration then reenter the Cond Cells calibration!

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’ → ‘CONFIRM’)

b) See (ABOVE) procedure number [CO- 5.0.0](#) (page 350).

STEP #4: Is the screen’s **Frequency** window between ten-thousand (10000) and twelve-thousand (12000) Hz (Hertz)?

Yes **Frequency** between 10000 and 120000 Hz! Continue to STEP #5.

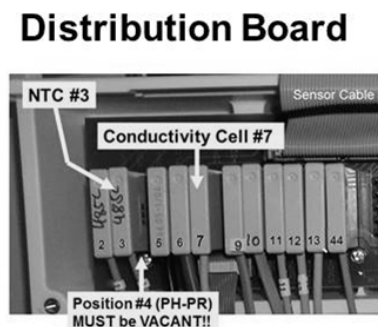
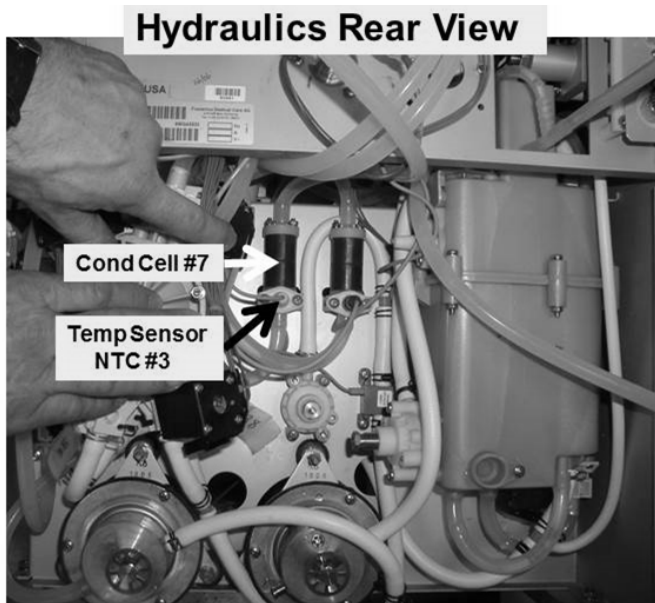
No **Frequency** is NOT between 10000 and 12000 Hz! See parts a AND b below:

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) FIVE (5) possible bad components (see [Component List](#) below). Swap in, one at a time with known good and in between repeat (ABOVE) procedure number [CO- 6.2.0](#) (page 354) to test each.

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 356).

No **[Conductivity]** box remains gray! Possible problem with the Cond Cell #7 circuit. Proceed to **page 363**, procedure number [CO- 7.0.0](#).

CO- 6.3.0 COND CELL #7 STABILIZES

- a) Select the **[Conductivity]** data box, it turns bright yellow.
- b) Enter the external meter's conductivity.
- c) 'Sharply' press 'CONFIRM' to turn **[Conductivity]** pale yellow / white. Does it 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 356).

No **Read this step BEFORE performing it!** Acid Clean the machine THEN return to (ABOVE) procedure number [CO- 6.2.0](#) (page 354) HOWEVER, if you return here, swap the listed components (see COMPONENT LIST below) one at a time in between returning to (ABOVE) procedure number [CO- 6.2.0](#) to test each new component.

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 'CONFIRM'. Does the screen say "**7. Connect the Lines to a Large Dialyzer...**"?

Yes "**Connect the Lines to a Large Dialyzer**" appears! See procedure number [CO- 6.4.0](#) (page 357).

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 357).

b) 'Sharply' press 'CONFIRM' 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 354) 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](#) to test each new component.

COMPONENT LIST: **1)** Conductivity Cell #7 (see [Figure 57](#), page 344); **2)** Sensor Board; **3)** Functional Board (IC 20?).

No a) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!

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

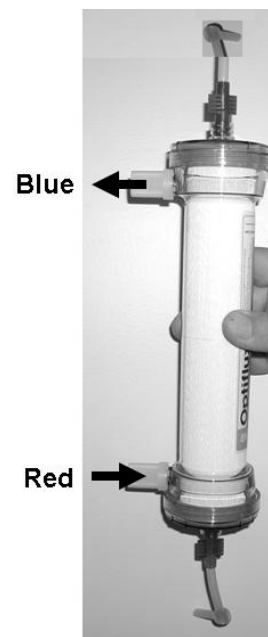
c) Allow six (6) minutes before continuing to part d!

d) If you started out troubleshooting an OLC problem proceed to **page 386**, procedure number [CO- 10.0.41](#).

CO- 6.4.0 OLC (COND CELL #13) CALIBRATION

This four-point calibration sets slope for Post Dialyzer Cond Cell #13. See parts a THROUGH e below:

- a) Figure right, connect the dialyzer lines to a PRIMED dialyzer^{1,2}.
IMPORTANT! The dialyzer MUST 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) **IMPORTANT! CLOSE the shunt door!**
- c) Allow one (1) FULL minute!
- d) Press 'CONFIRM'. 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 358).
- 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:** See procedure number [CO- 6.5.0](#) (page 359).
 - 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 reenter it.
 - b) If the external flow indicator's bob is moving up and down proceed to **page 360**, 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 358).

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 359**, procedure number [CO- 6.5.0](#).
- 2) **ALL OTHER scenarios:** Proceed to **page 360**, procedure number [CO- 6.6.0](#).

CO- 6.4.4 ALL FOUR OLC POINTS ADVANCED SUCESSFULLY

Press ‘CONFIRM’ 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 354) but if you return here the Functional Board may be bad (IC20)?

No a) Turn the machine OFF.

b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!

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

d) Allow six (6) minutes before continuing to part e!

e) If you were troubleshooting an OLC problem proceed to see **page 386**, 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 between NEVER less than 11 psi and 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?

Yes See procedure number [CO- 6.5.6](#) (page 359).

No See procedure number [CO- 6.5.4](#) (page 359).

CO- 6.5.4 [CONDUCTIVITY] BOX NOT GOOD (2)

- a) **IMPORTANT!** Swap acid and bicarbonate 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 359).

No Return to (ABOVE) procedure number [CO- 6.2.0](#) (page 354).

CO- 6.5.6 [CONDUCTIVITY] BOX STABILIZES

Does the “COND LESS THAN 10 or 15...” alarm go away?

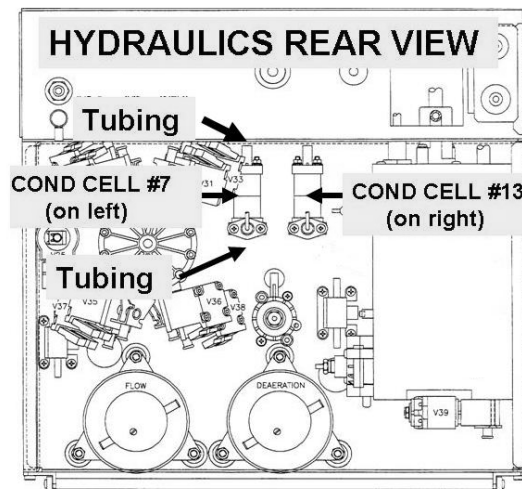
Yes Alarm goes away! Return to (ABOVE) procedure number [CO- 6.4.2](#) (page 358).

No a) ‘Escape’ the calibration

b) Return to (ABOVE) procedure number [CO- 6.2.0](#) (page 354).

CO- 6.6.0 POST DIALYZER COND / TROUBLESHOOTING POST DIALYZER COND

- 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!
- 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!
- Check for air bubbles flowing through the dialyzer AND the dialyzer lines. Air does NOT allow conductivity to stabilize!
- Figure right, using a flashlight, and WITHOUT LOOKING AWAY for ONE (1) MINUTE watch for air bubbles through the tubing at Cond Cell #7.
- DO NOT continue UNLESS ABSOLUTELY SURE there are NO AIR leaks!
- See procedure number CO- 6.6.2 (page 360).



CO- 6.6.2 ISOLATE THE DIALYZER

- Remove the dialyzer and reinstall the external meter to measure conductivity.
- Close the shunt door then return to Service Mode → Calibrate Sensors → Cond Cells.
- Follow the screen’s instructions through: “4. **Waiting until the Conductivity value is stable.**”
- 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.
- Enter the measured conductivity into the [**Conductivity**] box and press ‘CONFIRM’ twice.
- This time DO NOT install a dialyzer!
- Press ‘CONFIRM’. 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 354**, procedure number **CO- 6.2.0**.

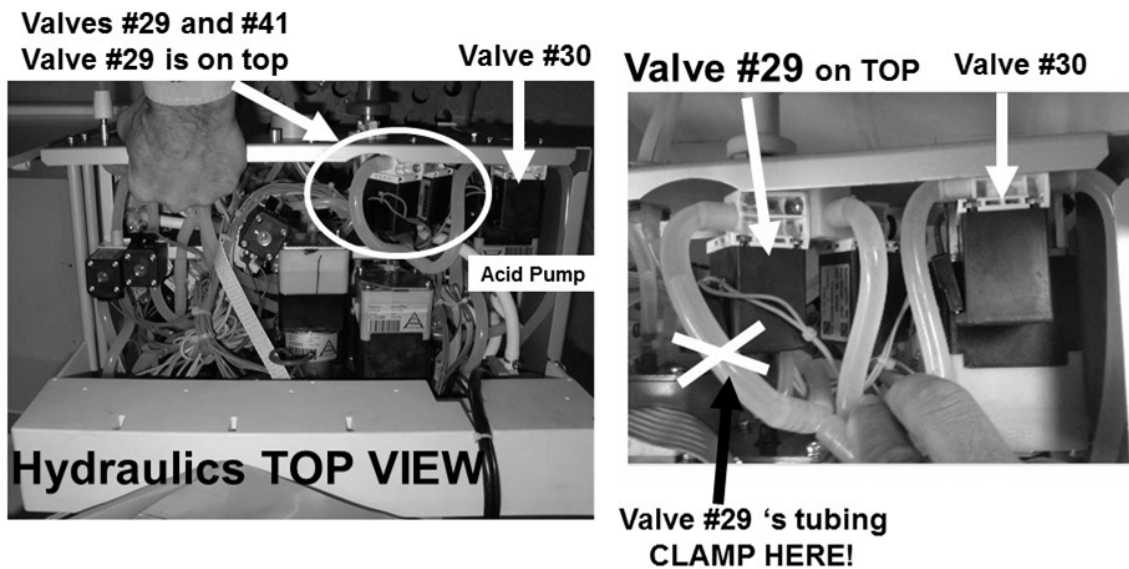
No “**Press ‘Confirm...**” DOES NOT appear! TWO (2) possible scenarios:

- 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 359).
- All OTHER scenarios:** A possible problem with the Cond Cell #7 Circuit. Proceed to **page 363**, 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 362** 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 accidentally plugged into acid; the red (acid) connector **MUST** be in acid!
 - b) Figure below, clamp the tubing at Valve #29.



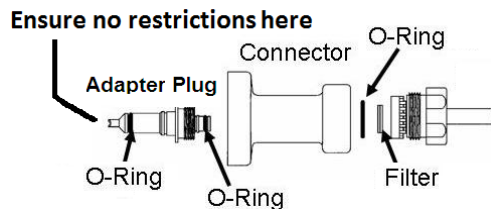
- c) ENSURE the external flow indicator's 'bob' continues to move up and down
- d) Allowing up to fifteen (15) minutes, does the external meter's reading stabilize between 13.0 and 14.4 (Yes or No)?

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 IS NOT between 13.0 and 14.4! See procedure number [CO- 6.8.6](#) (page 362).

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 and 'CONFIRM' them without an "Operator Error" banner occurring (Figure right)?

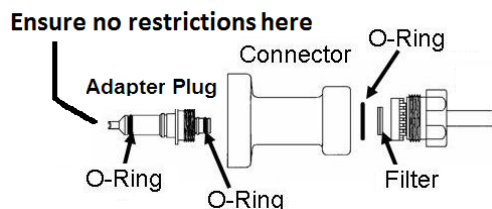


Yes "Operator Error" did NOT occur! See procedure number [CO- 6.8.8](#) (page 362).

No "Operator Error" occurred! Problem with the acid pump! See (ABOVE) procedure number [CO- 4.9.0](#) (page 349).

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 and "CONFIRM" them without an "Operator Error" banner occurring (Yes of No)?



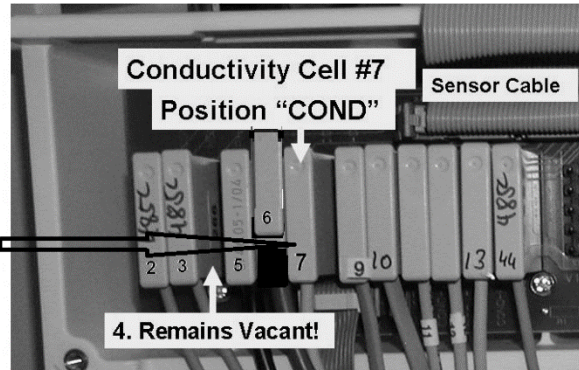
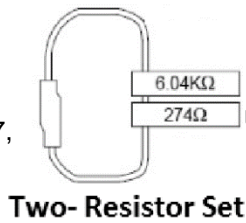
Yes "Operator Error" did NOT occur! Repeat the Cond Cells calibration. If the external meter' conductivity is NOW between 13.0 and 14.4 return to ABOVE procedure number [CO- 6.3.0](#) (page 356). If NOT, assuming you performed all procedures correctly, the Troubleshooting Guide cannot locate the problem.

No "Operator Error" occurred! Problem with the bicarb pump! See (ABOVE) procedure number [CO- 4.9.0](#) (page 349).

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 344).

No See procedure number [CO- 7.3.0](#) (page 364).

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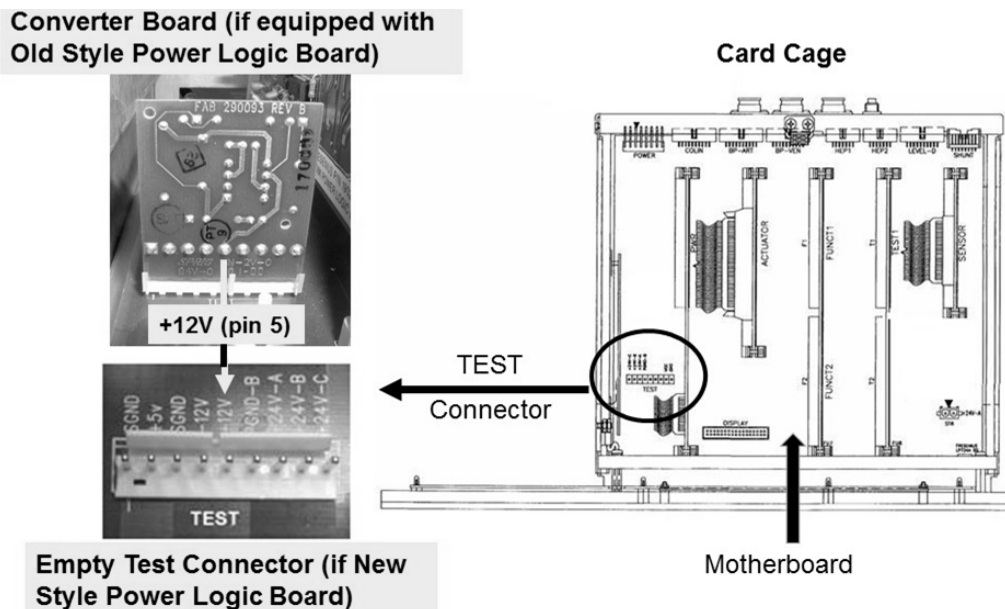
CO- 7.3.0 ISOLATE POSITIVE (+)12 VOLT DC SUPPLY

- 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) See procedure number [CO- 7.3.1](#) (page 364).

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) Spread the card cage side panels open then gently drop the front panel down to access the motherboard's nine (9) pin TEST Connector (Figure below).
- d) **IMPORTANT! Set your CALIBRATED volt meter to DC volts (V_{DC}).**
- e) **Connect the meter's black lead to chassis ground (see Figure 2 (page 4)).**
- f) Per the Figure below, measure at the TEST Connector's **+12V** pin (pin 5, five pins from the left). 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 365).
 - 2) **IF NOT between 11.7 and 12.3 volts DC:** Replace the Power Logic Board*.

* To LOCATE the board refer to Figure 4A (page 9).

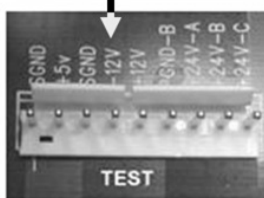
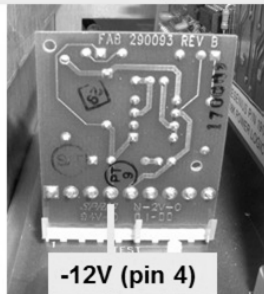


CO- 7.3.4 ISOLATE NEGATIVE (-)12 VOLT DC SUPPLY

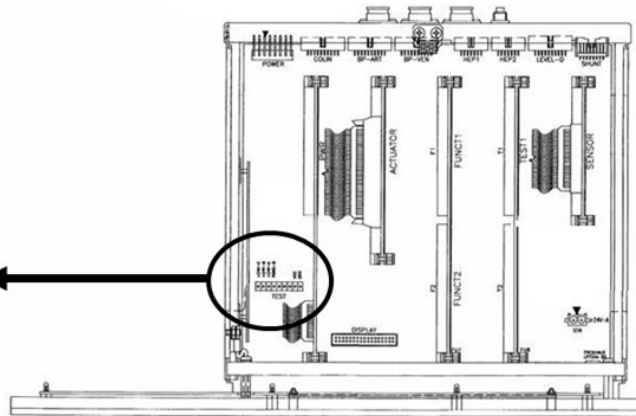
Per the Figure below, measure at the TEST Connector's **-12V** (negative 12V) pin (pin 4, four pins from left). TWO (2) possible scenarios:

- 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 354) to test each component
↕
COMPONENT LIST: 1) Sensor Board; 2) Actuator-Test Board; 3) Functional Board (IC20?); 4) Sensor Board cable; 5) Distribution board.
- 2) **IF NOT between -11.7 and -12.3 volts DC:** Proceed to **page 407**, procedure number [CR- 1.0.9](#).

Converter Board (if equipped with Old Style Power Logic Board)



Empty Test Connector (if New Style Power Logic Board)



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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:

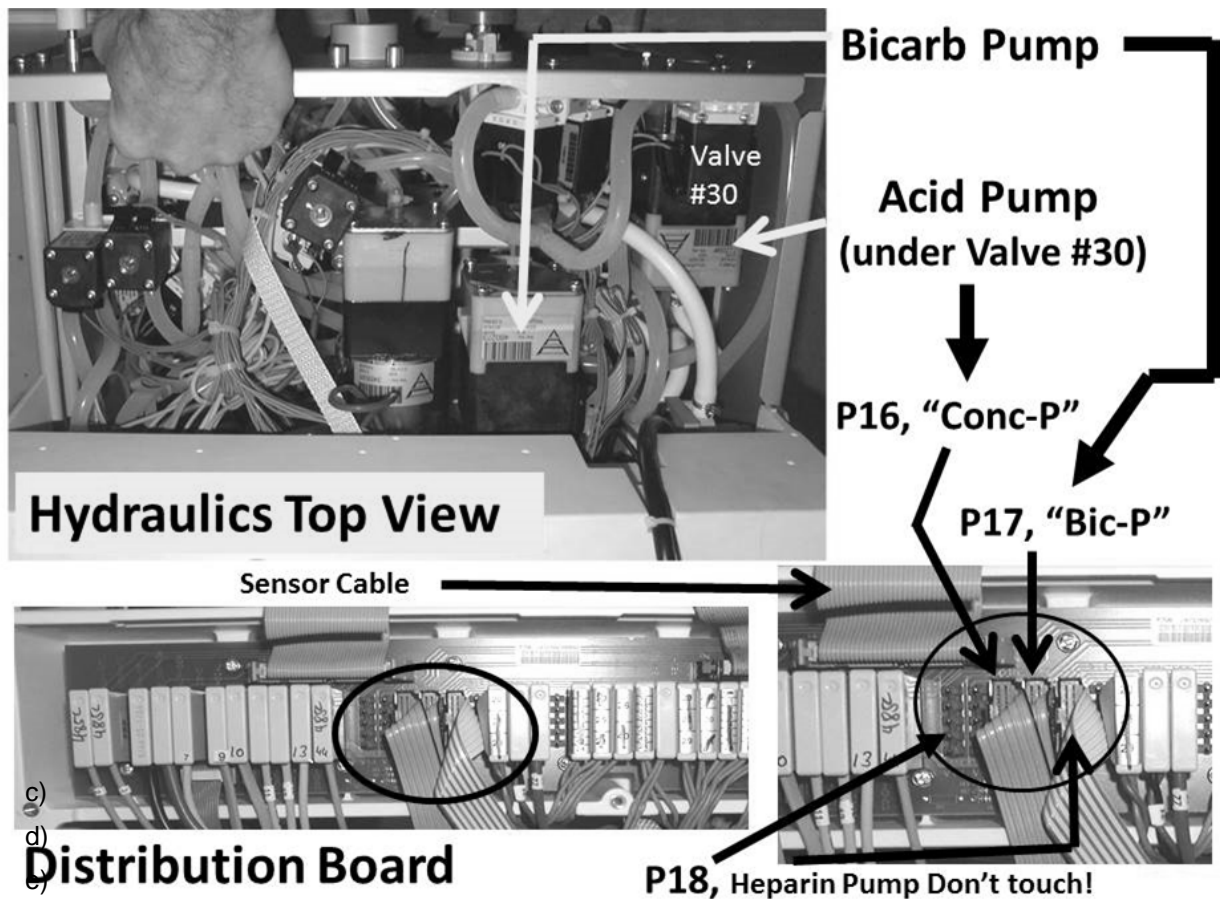
- 1) IF (and ONLY if) **LESS THAN** TCD - (minus) 0.4 i.e. Conductivity is **LOW**: Proceed to **page 368**, procedure number **CO- 8.2.0**.
- 2) IF **MORE THAN** TCD + 0.4 i.e. Conductivity is **HIGH**: See procedure number **CO- 8.1.0** (page 366).

CO- 8.1.0 CONDUCTIVITY IS HIGH (MORE THAN TCD + 0.4 mS)

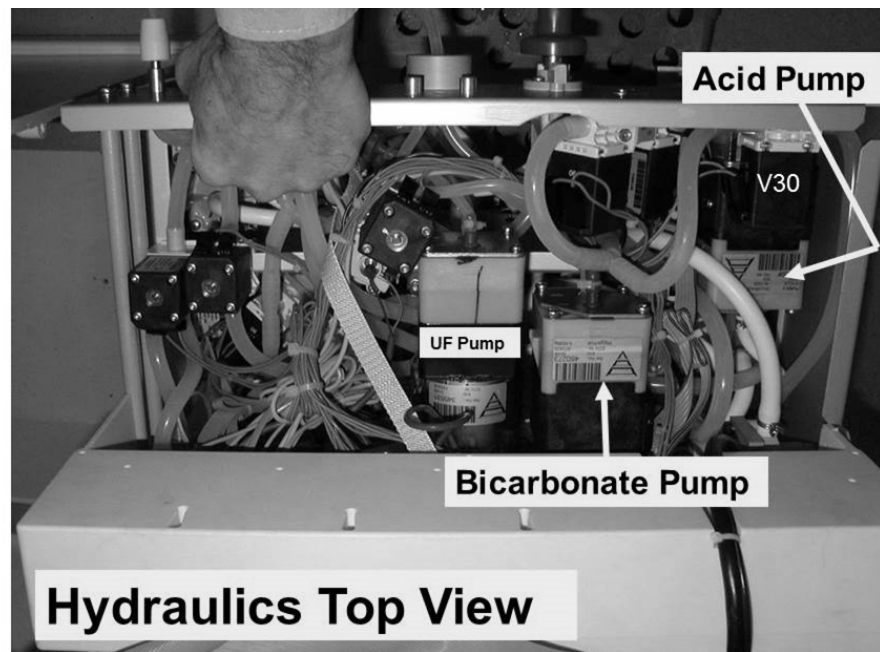
TWO (2) possible scenarios based on the external meter's reading:

- 1) IF (and ONLY if) **LESS THAN** 15.0 mS: See procedure number **CO- 8.1.1** (page 367).
- 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



- f) Per the Figure below, trace the tubing from the red (ACID) connector to ENSURE it goes to the ACID pump



- g) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’).
h) Set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
i) See procedure number [CO- 8.1.1](#) (page 367).

CO- 8.1.1 ISOLATE POSSIBLE VERY INTERMITTENT FLOW ERROR

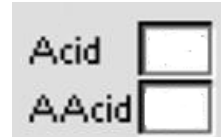
- a) Call debug screen 6.
b) WITHOUT LOOKING AWAY, watch **BC Switch** (middle column) for THREE (3) MINUTES If it EVER = 897 or more, even just once, indicates a masked Flow Error! Is it EVER = 897 or more?

Yes **BC Switch** = 897 even if just once! Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#).

No **BC Switch** is NEVER, EVER = 897 or more! See procedure number [CO- 8.2.0](#) (page 368)

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 368).

No **AAcid is NOT** remaining within 3 of **Acid!** Proceed to **page 397**, [SECTION 6 - CONCENTRATE PUMP ERRORS...](#)

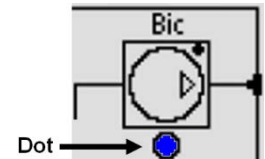
CO- 8.2.1 AACID = ACID / ISOLATE BICARB PUMP CYCLES

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 368).

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 374**, procedure number [CO- 9.0.0](#).

2) **IF the 'dot' REMAINS BLUE:** Proceed to **page 397**, [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:

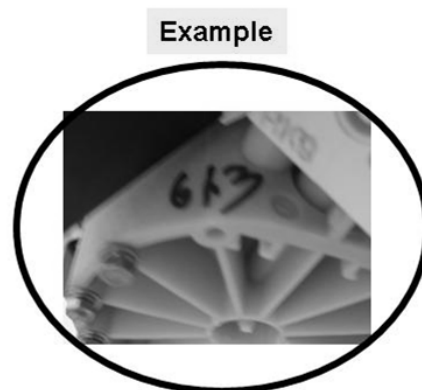
1) **IF (and ONLY if) LESS THAN TCD - (minus) 0.4:** See procedure number [CO- 8.3.0](#) (page 369).

2) **IF MORE THAN TCD + 0.4 i.e.:** See procedure number [CO- 8.3.0](#) (**page 369**).

CO- 8.3.0 BALANCING CHAMBER VOLUME (BCV)

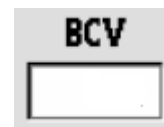
Figure below, the **Balancing Chamber(s) Volume (BCV)** MAY HAVE BEEN factory recorded, a three-digit number (example **61.3**), written on the top or side of the balancing chambers (Yes or No)?

Yes BCV is recorded! See
 ↑ procedure number
 ↕ CO- 8.3.1 (page 369).
No BCV is NOT recorded!
 Proceed to **page 370**,
 procedure number
 CO- 8.4.0.



CO- 8.3.1 BCV IS RECORDED

Call debug screen 3. **BCV** (upper right) is the stored **Balancing Chamber Volume**, 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 370).

No Read parts a THROUGH f below BEFORE performing them!

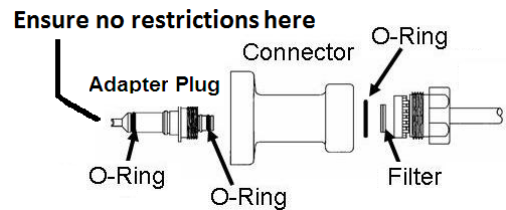
- a) Perform **BALANCING CHAMBER VOLUME CALIBRATION**, per the CALIBRATION PROCEDURES booklet, **BUT enter the factory recorded volume!**
- b) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- c) Call debug screen 3. If the calibration was performed correctly **BCV** = the factory value.
- d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- 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 370).

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 AND 'CONFIRM' them without an "Operator Error" (Figure right) occurring?



Yes "Operator Error" did NOT occur! See procedure number [CO- 8.5.2](#) (page 370).

No "Operator Error" occurred! Acid pump problem! See (ABOVE) procedure number [CO- 4.9.0](#) (page 349).

CO- 8.5.2 ISOLATE BICARBONATE PUMP

- a) Perform the BICARBONATE PUMP VOLUME CALIBRATION.
- b) Are you able to enter measured burette volumes AND 'CONFIRM' them without an "Operator Error" occurring?

Yes "Operator Error" DID NOT occur! See procedure number [CO- 8.5.4](#) (page 370).

No "Operator Error" occurred! Bicarb Pump problem! See (ABOVE) procedure number [CO- 4.9.0](#) (page 349).

CO- 8.5.4 VERIFY CONDUCTIVITY

- a) Return to Dialysis Program ("Select Program" → 'Dialysis' → "CONFIRM")!
- b) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'!
- 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 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 372**, 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 371).

CO- 8.6.0 COND MORE THAN TCD + 0.4 / ISOLATE VALVE #29

a) Per the Figure below, clamp the tubing at Valve #29.

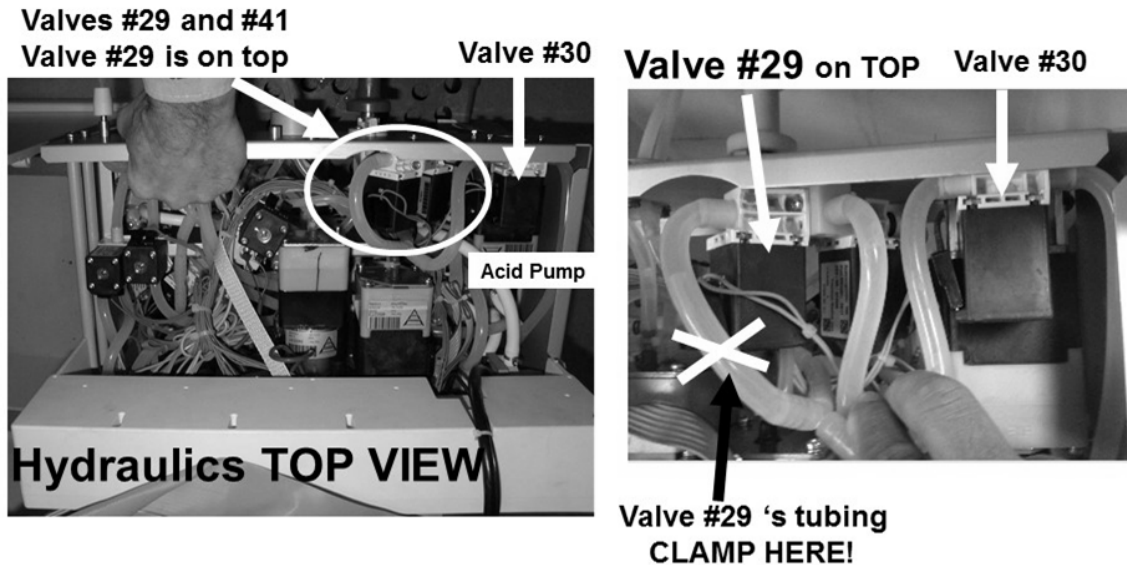


Figure 61 – Valve #29

b) Allow fifteen (15) minutes OR until if the external meter returns to within +/- 0.4 of TCD?

Yes 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 Actuator-Test Board OR; 2) Bad valve #29.

No External meter is NOT within 0.4 of TCD! See procedure number [CO- 8.7.0](#) (page 372).

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CO- 8.7.0 ISOLATE BALANCING CHAMBER DIAPHRAGMS

- BEFORE continuing to part b, **NOTE** this page and procedure number in case you need to return here then proceed to **page 535**, [SECTION 19 - TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM](#).
- If a leaking balancing chamber diaphragm was NOT located in part a return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- See procedure number [CO- 8.8.0](#) (page 372).

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)!

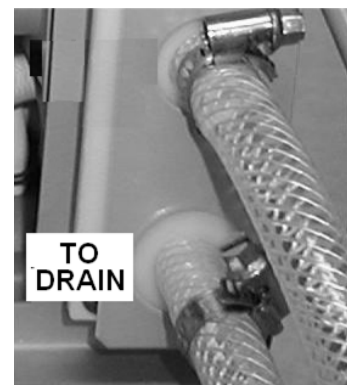
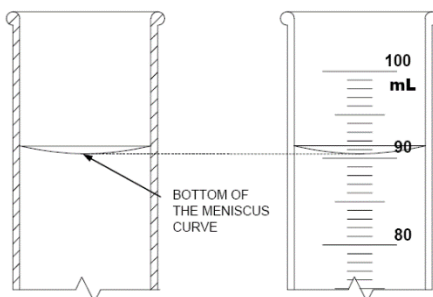
- WITHOUT turning flow off**, remove the tubing from the 'To Drain' (**BOTTOM***) nozzle at the REAR OF THE MACHINE.

* **Do NOT measure from the drain tubing to prevent gross error!!**

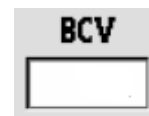
- Allow **ten (10) drain 'pulses'** to **ENSURE stability!**

- ACCURATELY**, collect two consecutive drain 'pulses' into the 100 ml cylinder.

- Per the Figure right, read the bottom of the meniscus curve.



- Call debug screen 3.
- 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).
- Does **BCV** AND the measured volume times (x) 10 match?



Yes **BCV** = measured volume! See procedure number [CO- 8.9.0](#) (page 373).

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' → 'CONFIRM')!

c) Allow ten (10) minutes BEFORE continuing to part d.

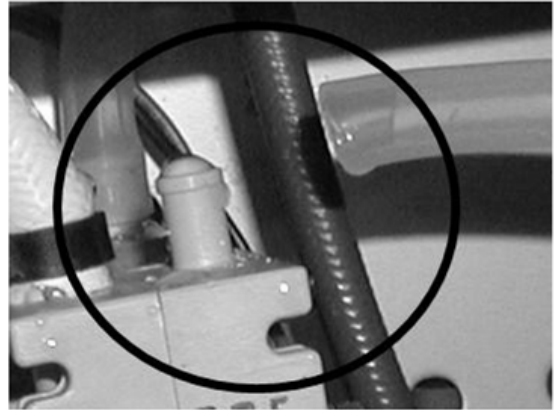
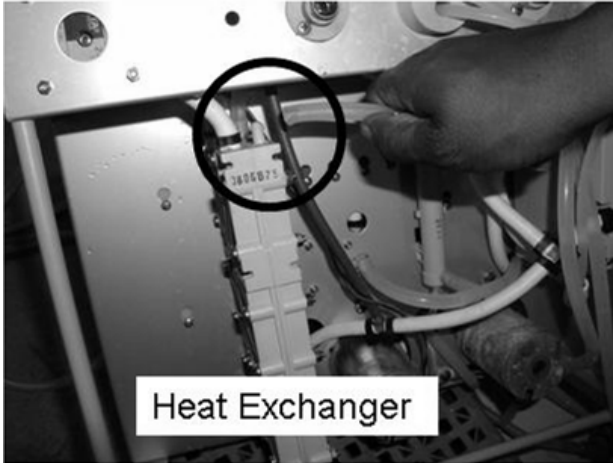
d) Is the external meter's conductivity within +/- 0.4 mS of TCD?

Yes Conductivity within +/- 0.4 mS of TCD! The balancing chamber was out of calibration. Do NOT continue!

No Conductivity IS NOT within +/- 0.4 mS of TCD! See procedure number [CO- 8.9.0](#) (page 373).

CO- 8.9.0 ISOLATE POSSIBLE LEAKING HEAT EXCHANGER

- a) **IMPORTANT! Leaving the water on 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 Dripping from Heat Exchanger! TWO (2) procedures MUST be performed! **Procedure #1:**
↑ With the water turned OFF, REPLACE the Heat Exchanger; **Procedure #2:** See procedure
↓ number [OVER- 8.0.0](#) (page 551) to check incoming water pressure.

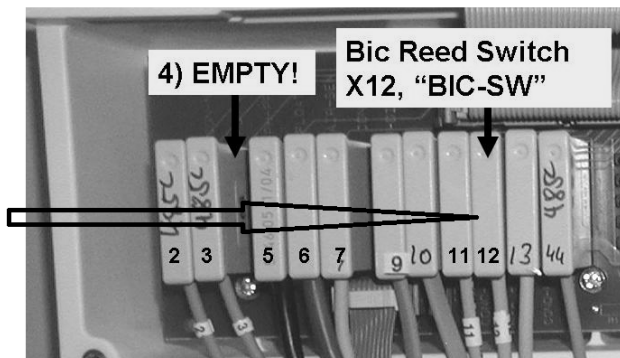
No dripping seen a) Return the tubing to the Heat Exchanger.

b) From the Home screen, set the [Dialysate Flow] window to 500 ml/min and press 'CONFIRM'.

c) See (ABOVE) procedure number [CO- 5.6.0](#) (page 352).

CO- 9.0.0 BIC DOT IS WHITE / ISOLATE BICARB DEBUG SIGNAL

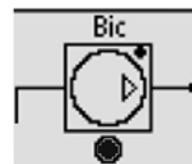
- A) Per the Figure below, inside the distribution board, unplug the **9th** CONNECTOR CAP from the left! This is the Bicarb Reed Switches Connector, “X12, BIC-SW”.



- B) Using a flashlight, check **inside** the “BIC-SW” position for corrosion or damaged male pins as this may be the problem!

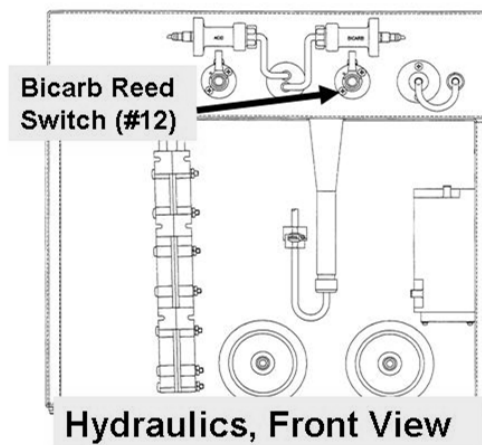
- C) Call debug screen 0.

- D) **WITHOUT LOOKING AWAY**, watch the bicarbonate (BIC) pump's ‘dot’ (Figure right) for two (2) minutes. Does it **REMAIN ALWAYS** 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 **Error! Bookmark not defined.**)

- H) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’).

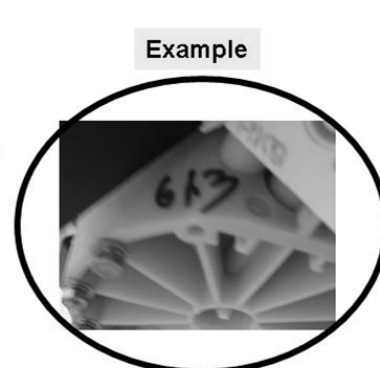
- I) Call debug screen 0. If the Bic ‘dot’ **REMAINS** blue the last component swapped in was the problem. If still white or cycling between white and blue return the to part F to swap in the next component

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)?

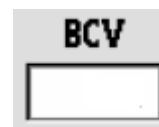
Yes BCV is factory recorded!
See procedure number
[CO- 9.8.11](#) (page 375).

No **BCV** not recorded! If (and ONLY if) troubleshooting bad lab values proceed to **page 376**, procedure number [CO- 9.8.3](#). All other problems see procedure number [CO- 9.8.2](#) (page 375).



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 (and ONLY if) troubleshooting bad lab values proceed to **page 377**, procedure number [CO- 9.8.4](#). All other problems see procedure number [CO- 9.8.2](#) (page 375).

No **BCV** does NOT = the factory value! See parts a THROUGH e below:

- Perform the **BALANCING CHAMBER VOLUME CALIBRATION**, **BUT instead of measuring from the drain enter the factory volume!**
- Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- Call debug screen 3. If the calibration took **BCV** now = the factory value.
- From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'
- Allow six (6) minutes. Does the machine's [**Conductivity**] window stabilize to within +/- 0.4 mS of TCD?

Yes If (and ONLY if) troubleshooting bad lab values proceed to **page 377**, procedure number [CO- 9.8.4](#). All other problems see procedure number [CO- 9.8.2](#) (page 375).

No See (ABOVE) procedure number [CO- 8.4.0](#) (**page 370**).

CO- 9.8.2 VERIFY ORIGINAL PROBLEM

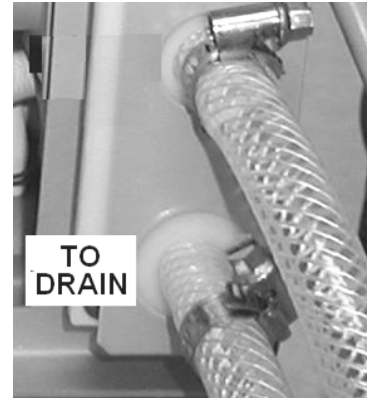
Did you originally start troubleshooting On Line Clearance (OLC) problems?

Yes Troubleshooting OLC problems! Proceed to **page 378**, procedure number [CO- 10.0.00](#)

No A Conductivity problem is not indicated at this time. DO NOT continue!

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!!

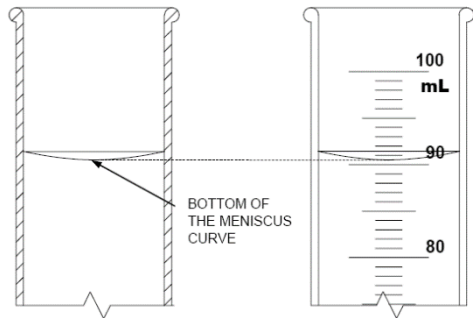


a) **WITHOUT turning flow off**, figure right, remove the tubing from the 'To Drain' (***BOTTOM!**) nozzle at the REAR OF THE MACHINE. ***CAUTION!** Measuring from the end of the 'to drain' tubing causes gross error!

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).

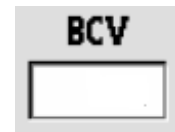
d) Reattach the drain tubing! TWO (2) possible scenarios:



1) **IF (and ONLY if) measured volume is NOT consistent between 58 and 62 ml:** Proceed to **page 535**, 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, Balancing Chamber Volume) 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 377).

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' → 'CONFIRM')!

c) Call debug screen 3. If the calibration took **BCV** = your RECORDED volume.

d) See procedure number [CO- 9.8.4](#) (page 377).

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 per the Preventative Maintenance Procedures. This **IS NOT** the CALIBRATIONS! It is a CHECK!
- b) NEVER use a 50 ml burette. The additional pressure from the column may influence pump volume.
- c) When pump strokes reach twenty (20) 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- 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 'CONFIRM'.
- d) See procedure number [CO- 10.0.10](#) (page 379).

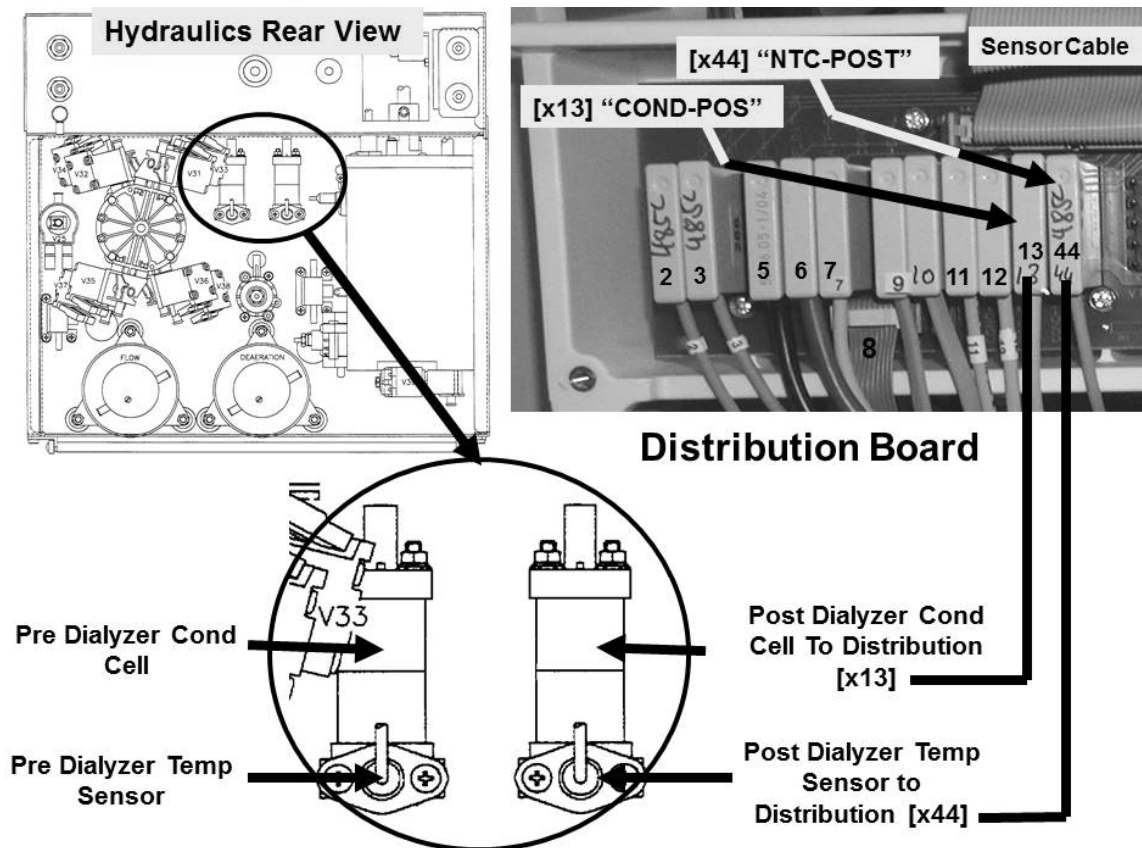
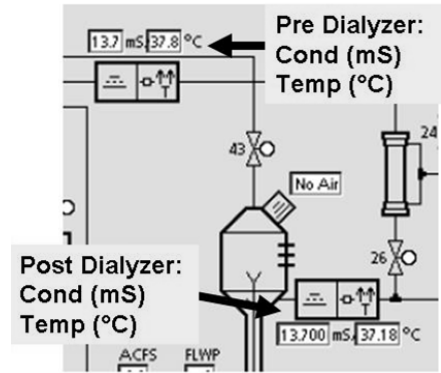


Figure 62 – Conductivity / OLC Components

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 379).
 - No Post Temp IS NOT within 1.2 of Pre Temp! Proceed to **page 380**, procedure number [CO- 10.0.20](#).



CO- 10.0.11 POST TEMP WITHIN 1.2 OF PRE TEMP / ISOLATE POST DIALYZER COND

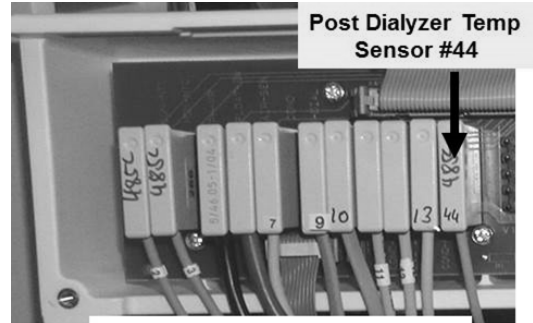
Post Dialyzer Cond changes but overall is it remaining within +/- 0.4 mS of **Pre Dialyzer Cond**?

- Yes Post Cond within 0.4 of Pre Cond! See procedure number [CO- 10.0.405](#) (page 385).
- No Post Cond IS NOT within 0.4 of Pre Cond! Proceed to **page 383**, procedure number [CO- 10.0.30](#).

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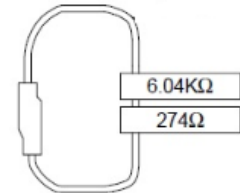
CO- 10.0.20 PROBLEM WITH POST DIALYZER TEMP / ISOLATE TEMP SENSOR #44

- Figure right, from the distribution board, unplug the **11th** Connector cap from the left. This is Temperature Sensor NTC #44, "x44, NTC-POST"!
- 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!
- Using a flashlight, check the vacant "x44" position. If **corrosion or damage is located this may be the problem!**



Distribution Board

- 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".
- Is screen 0's **Post Dialyzer Temp** between 35.5 and 38.5° C?



Two- Resistor Set

Yes Post Temp between 35.5 and 38.5! Proceed to **page 382**, procedure number [CO- 10.0.26](#).

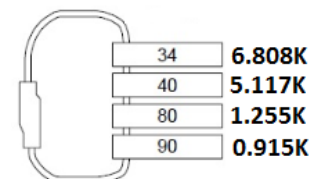
No Post Temp is NOT between 35.5 and 38.5! See parts a and b below:

- 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 380) AND / OR CONSIDER using the **6.04 KΩ** plug from another TWO-RESISTOR SET.
- If SURE the plug is placed correctly see procedure number [CO- 10.0.22](#) (page 380).

CO- 10.0.22 POST DIALYZER TEMP IS NOT BETWEEN 35 AND 38°C

- ENSURE connector labeled #7 (Pre Cond Cell #7) is in position "X7, COND".
- Enter Service Mode → Calibrate Sensors → **Post Temp Sensor**. **NOTE:** This is a non-routine troubleshooting procedure! Follow the instructions carefully to avoid error!
- Press 'CONFIRM'. The screen says "**1. Connect a 6.808 K ohm resistor...**".

- Per the Figure right, place the **34° C** (6.808 KΩ) plug, from the FOUR-RESISTOR SET into distribution board position, "x44, NTC-POST".



Four-Resistor Set

- Is the screen's [**Post-Temperature Reference**] more than 20?


Yes **[Post-Temperature Reference]** more than 20! Without pressing 'CONFIRM' yet, see procedure number [CO- 10.0.24](#) (page 381).

No **[Post-Temperature Reference]** is less than 20! See parts a and b below:

- a) ENSURE the **34° C** (6.808 K Ω) plug is placed properly at position "x44, NTC-POST". If NOT, repeat (ABOVE) procedure number [CO- 10.0.22](#) (page 380) AND/ OR consider using the **34° C** plug from another **FOUR-RESISTOR SET!**
- b) If SURE the plug is placed correctly proceed to **page 394**, procedure number [CO- 11.0.00](#).

CO- 10.0.24 POST TEMPERATURE REFERENCE MORE THAN 20

'Sharply' press 'CONFIRM' 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 380). CONSIDER using the **34° C** plug from another **FOUR-RESISTOR SET**. If the "Error" banner reoccurs proceed to **page 394**, procedure number [CO- 11.0.00](#).

No "Error banner does NOT appear. See parts a through g below:

- a) The screen says "**2. Connect a 5.117 K ohm resistor...**".
- b) Place the 41° C (5.117 K Ω) 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 'CONFIRM'. The screen says "**3. Calibration saved**" and the screen's **[Post-Temperature]** data box should = 41° +/- 0.1 °C.
- e) Press 'CONFIRM' again to save the calibration.
- f) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- g) See procedure number [CO- 10.0.26](#) (page 382).

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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 'CONFIRM'.
- 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 382).

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 378).

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' → 'CONFIRM')!
- d) From the Home screen, allow [Temperature] 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 378).

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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 383),

No Post Cond less than 10.000! See procedure number [CO- 10.0.34](#) (page 383),

CO- 10.0.32 POST DIALYZER COND MORE THAN 10.000

Is screen 0's **Post Dialyzer Cond** more than 20.000 mS?

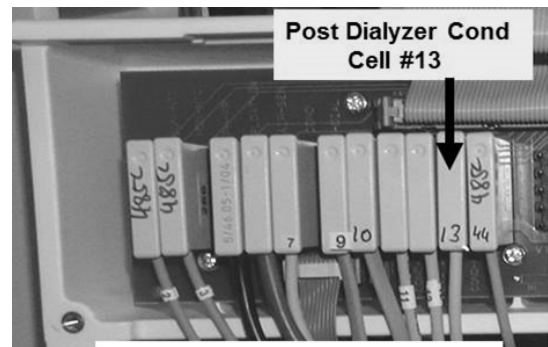
Yes Post Cond more than 20.000! See procedure number [CO- 10.0.34](#) (page 383).

No Post Cond less than 20.000! Proceed to **page 354**, procedure number [CO- 6.2.0](#).

CO- 10.0.34 ISOLATE POST COND CIRCUIT

- Figure right, from the distribution board, unplug the **10th** connector cap from the LEFT. This is Post Dialyzer Cond Cell #13, "x13, COND-POS"!
- Using a flashlight, check inside the "x13" position. **If damage or corrosion is located this may be the problem!**
- Call debug screen 5, Is **FPOS** more than 4000 (four thousand) [Yes or No]?

FPOS



Distribution Board

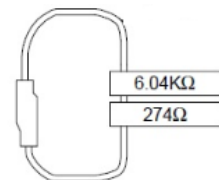
Yes **FPOS** more than 4000! Either Post Dialyzer Cond Cell #13 was not unplugged from position "x13" or there is a problem with its circuit. THREE (3) possible bad components: **1)** Sensor Board¹; **2)** Sensor Board cable; **3)** distribution board.



¹ To prevent "Cond Offset Failure" place the machine into T and C mode. Refer to [OPERATING MODES](#), (page **Error! Bookmark not defined.**).

No **FPOS** less than 4000! See parts a AND b below:

- 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

- Is **FPOS** between 13500 and 14500?

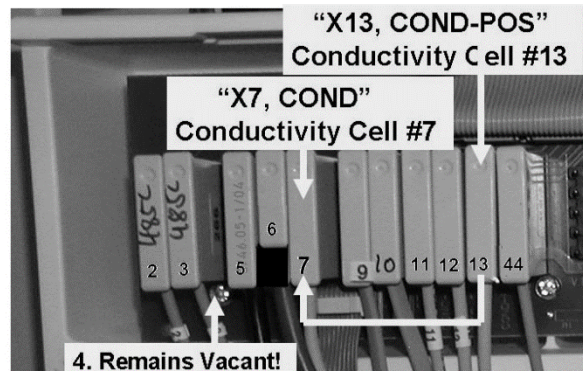
Yes **FPOS** between 13500 and 14500! See procedure number [CO- 10.0.36](#) (page 384).

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; **2)** Sensor Board cable; **3)** Distribution board.

^a To prevent "Cond Offset Failure" place the machine into T and C mode. Refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**).

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 384).

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 378).

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 \(page 354\)](#). 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 \(page 354\)](#).

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CO- 10.0.405 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?

CPRE <input type="text"/>	ACOND <input type="text"/>
-------------------------------------	--------------------------------------

Check #2 **CPRE versus CPOS (middle column):** Change continually but MUST REMAIN within +/- 500 of each other?

CPRE <input type="text"/>	CPOS <input type="text"/>
-------------------------------------	-------------------------------------

Yes (to both): CLOSE THE SHUNT DOOR then see procedure number [CO- 10.0.41](#) (page 386).

No (to either OR both): Proceed to **page 354**, procedure number [CO- 6.2.0](#) to calibrate COND CELLS but if (and ONLY if) you return here see procedure number [CO- 10.0.41](#) (page 386).

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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 occurs, allow thirty (30) seconds before continuing!

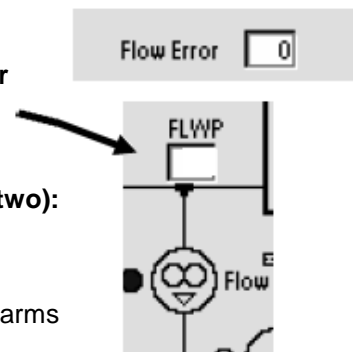
NOTE: Multiple "Filling Programs" occurrences indicate an air leak that **MUST** be located and repaired or else OLC tests cancel!!

- 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 386).

CO- 10.0.42 ISOLATE FLOW PUMP DIGITAL CONTROL (FLWP)

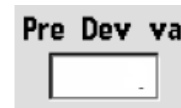
- a) Call debug screen 1.
- b) Press the "1" key for five (5) seconds.
- c) Allow forty five (45) seconds BEFORE continuing to part d.
- d) Call debug screen 0. Without resetting alarms, ENSURING Flow Error REMAINS = 0 ALSO watch **FLWP** for two (2) minutes. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) FLWP continually changes more than +/- 2 (two):** Proceed to **page 44**, 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 386).

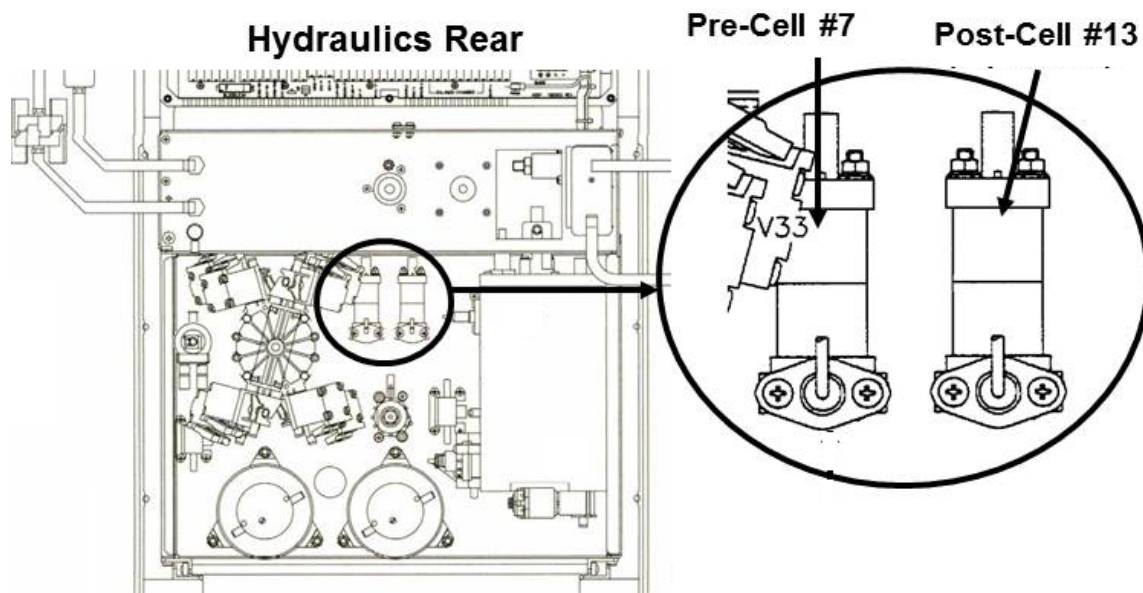


CO- 10.0.43 PRE CONDUCTIVITY STABILITY

- a) Call debug screen 5. **Pre Dev val** (right column) is the conductivity difference between now and one (1) minute ago from Pre-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 387).
- 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 391**, procedure number [CO- 10.0.60](#).



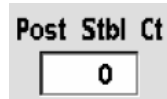
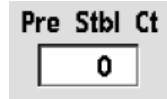
CO- 10.0.44 PRE DEV VALUE LESS THAN 135 / CONDUCTIVITY STABILITY

- 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 OR falls to less than 70:** See procedure number [CO- 10.0.46](#) (page 388).
 - 2) **IF Post Dev val NEVER 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 Post Dialyzer Cond Cell #13's locate and repair the air leak!
 - b) If (and ONLY if) absolutely sure of no air proceed to **page 391**, 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 select the **[Kt/V AF]** button at the bottom of the screen.



- d) Select the **[OLC Self-Test]** button then press 'CONFIRM'. Does the "**Online Clearance Self-Test**" banner appear?



Yes The "**Online Clearance Self-Test**" banner appeared! IMMEDIATELY proceed to **page 390**, procedure number [CO- 10.0.50](#).

No The OLC Test did 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 388).
- 2) **IF "OLC steps not calculated" appeared:** Allow two (2) FULL 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 See procedure number [CO- 10.0.50](#) (**page 390**).
 - ii) **IF "OLC steps not calculated" banner reoccurs:** Read before performing! Proceed to **page 354**, procedure number [CO- 6.2.0](#) to calibrate COND CELLS. If you return here ("**OLC steps not calculated**"), TWO (2) possible bad components: **1)** Bad Actuator-Test Board; **2)** Bad 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 three (3) minutes proceed through the following three (3) steps until if the OLC Test starts. If (and ONLY if) either one does NOT go to 0 within three (3) minutes proceed to **page 391**, 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 see procedure number [CO- 10.0.50](#) (page 390). 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 [Conductivity] stabilizes to between 13.0 and 14.3 mS.
- d) Reset all alarms!
- e) Return to (ABOVE) **page 385**, procedure number **CO- 10.0.405** HOWEVER, 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 [Conductivity] stabilizes to between 13.0 and 14.3 mS.
- d) Reset all alarms!
- e) Return to (ABOVE) **page 385**, procedure number **CO- 10.0.405** HOWEVER, if you return here (because “**Can’t Run OLC Test**” reoccurs) proceed to **page 354**, 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 below:

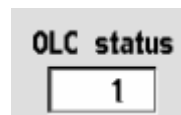
Component List:

- 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.

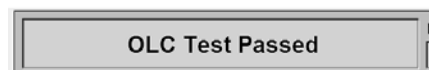
* If a BLOOD ALARM OR a red banner Conductivity alarm occurs the counters stop! In this event, see NOTES 1 and 2 below!

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 386). If (and ONLY if) you return to here, because a Conductivity alarm reoccurs, see (ABOVE) procedure number [CO- 6.2.0](#) (page 354).

- d) When (and if) BOTH **Pre Stbl Ct** AND **Post Stbl Ct** = 0 (Conductivity is stable), **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": Proceed to page 395**, procedure number [CO- 12.0.00](#).

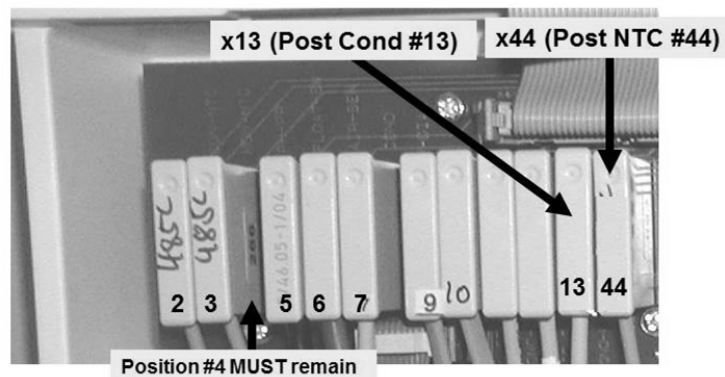


- 2) **IF (and ONLY if) "OLC Test Failed" AND a Conductivity alarm did NOT occur during the test:** See procedure number [CO- 10.0.60](#) (page 391).

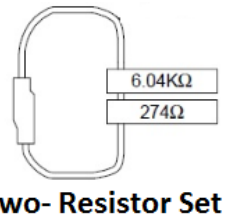
- 3) **IF "OLC Test Cancelled":** Call debug screen 6 to see the **OLC Cancels 1 – 6** data boxes. If code "1" and / or "2" appear in any of the boxes see procedure number [CO- 10.0.60](#) (page 391). Codes "3" through "7" refer to [Table A](#) (page 395) for their meaning.

CO- 10.0.60 ISOLATE POST SENSORS STABILITY

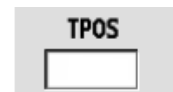
- a) Per the Figure below, remove Post Dialyzer Temp Sensor NTC #44's connector from distribution board position "x44, NTC-POST".



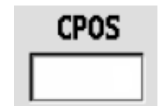
- b) Using a flashlight, check the vacant "x44" position for 'white' corrosion and/or damaged **male** pins. **If damage is located this may be the problem!**
- c) Per the Figure right, place the **6.04 K Ω** plug, from the **TWO-RESISTOR SET** into the Post Dialyzer Temp Sensor's vacant distribution board position "x44, NTC-POST".
- d) Per the Figure above, remove Post Dialyzer Cond Cell #13's connector from distribution board position "x13, COND-POS".
- e) Check the vacant "x13" position for 'white' corrosion and/or damaged **male** pins.
- f) Place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into the Post Dialyzer Cond Cell's #13 distribution board position "x13, COND-POS".
- g) Call debug screen 5. TWO (2) checks then proceed according to the TWO (2) possible scenarios after check #2:



CHECK #1 (TPOS): WITHOUT LOOKING AWAY, watch **TPOS** (4th column from right, at top) for exactly one (1) minute noting its highest and lowest values. Subtract the lowest value seen from the highest. 2 (two) or less = GOOD! MORE THAN 2 = BAD!



CHECK #2 (CPOS): Now watch **CPOS** (4th column from right, third box down) for exactly one (1) minute noting its highest and lowest values. Subtract the lowest value seen from the highest. 8 (eight) or less = GOOD! MORE THAN 8 is BAD!



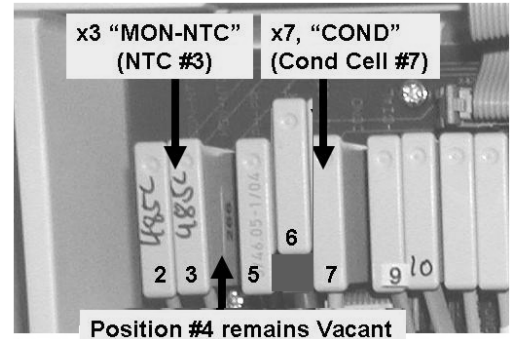
- 1) **IF (and ONLY if) TPOS AND / OR CPOS ARE BAD:** Proceed to **page 394**, procedure number [CO- 11.0.00](#).
- 2) **IF TPOS AND CPOS are both GOOD:** See parts a through d below:
 - a) Return Post Dialyzer Temp Sensor NTC #44's connector to distribution board position labeled "x44, NTC-POST".

Parts b through d next page

- b) Return Post Dialyzer Cond Cell #13 connector to distribution board position labeled “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 392).

CO- 10.0.66 ISOLATE PRE SENSORS STABILITY

- a) Figure right, remove Pre the Dialyzer Temp Sensor (NTC #3's) connector from the **2nd** distribution board position from the left, “MON-NTC”.
- b) Using a flashlight, CAREFULLY check the vacant “x3” distribution board 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) Using a flashlight, CAREFULLY check the vacant “x7” position for corrosion and/or damaged pins. **If damage is located this may be the problem!**
- f) Leaving the 6.04 KΩ plug installed, place the **274 Ω** resistor plug, from the **TWO-RESISTOR SET**, into the 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** (3rd column from left, at top) for exactly one minute noting its highest and lowest values. Subtract the lowest value seen from the highest. Two (2) or less = GOOD! MORE THAN 2 = BAD.

TPRE

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 8 = BAD.

CPRE

- 1) **IF (AND ONLY IF) TPRE AND / OR CPRE are BAD:** Proceed to **page 394**, procedure number [CO- 11.0.00](#).
- 2) **IF (and ONLY if) TPRE AND CPRE are GOOD:** See parts a through c below.
 - a) Return Pre Dialyzer Temp Sensor NTC #3s connector to distribution board 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 distribution board 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 393).

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 fresh 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- 10.0.405** (page 385) HOWEVER, if (and ONLY if) you return here see procedure number **CO- 10.0.706** (page 393).

CO- 10.0.706 ISOLATE OLC PROBLEM

- a) **Read before performing!** Proceed to (ABOVE) procedure number **CO- 6.2.0** (page 354) to calibrate COND CELLS HOWEVER, 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- 10.0.405** (page 385) to test the new component. If (and ONLY if) you return here continue through the list until the OLC problem is solved.

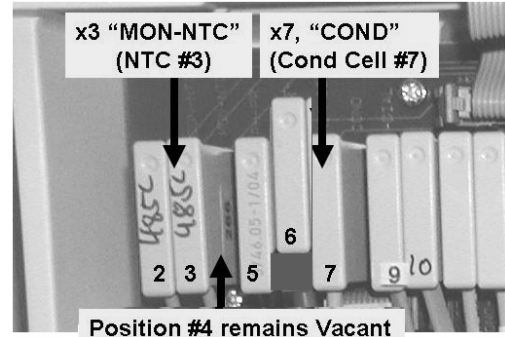
COMPONENT LIST: 1) Power Logic Board OR; 2) Actuator-Test Board OR; 3) Functional Board¹

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 Board¹; **3)** Sensor Board cable; **4)** Functional Board²; **5)** Distribution board.

¹ To prevent "Cond Offset Failure" place the machine into T and C mode. Refer to [OPERATING MODES](#), (page **Error! Bookmark not defined.**).

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' → 'CONFIRM')!
- g) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'CONFIRM'!
- h) Allow six (6) FULL minutes, for Temperature and Conductivity to stabilize to normal, before continuing to part i!
- i) **Read before performing!** Repeat (ABOVE) procedure number [CO- 10.0.00 \(page 378\)](#) to see if the new component fixed the problem but if you return here, continue through the [Component List](#) until the OLC problem is fixed.

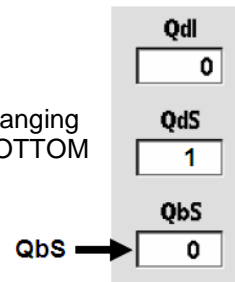
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CO- 12.0.00 OLC SELF TEST PASSED / CHECK BLOOD PUMP / ADDITIONAL TROUBLESHOOTING

OLC Self-Test PASSED! A conductivity-related OLC problem is not indicated HOWEVER, unstable Blood Pump rate may also cause OLC Tests to cancel. See parts a THROUGH c below:

- 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! If (and ONLY if) the Pump is stable¹, from debug screen 5, **QbS** (BOTTOM window, Figure right) will settle to and remain between 0 and 3.

¹ Resetting multiple blood alarms cause Blood Pump rate instability (**OLC cancel code** = "3"). In this event the problem may be related to the patient's access.



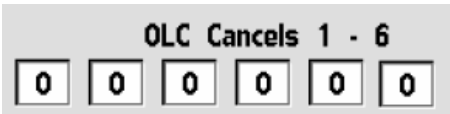
- c) ENSURE ALL treatment parameters (see below) were entered PRIOR to treatment initiation. Changes made just prior to OR while an OLC Test is running cause instability AND OLC Test cancellation.

- 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

- d) For additional OLC diagnostics call debug screen 6 and refer to [Table A](#) (below)

- e) For even more OLC diagnostics call debug screen 5 and refer to [Table B](#) (page 396).

Table A - Debug Screen 6 OLC Values

Parameter	Description	Value
Max QBS	Maximum QbS (screen 5) <u>during</u> 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 8 = 800 ml/min; 5 = 500 ml/min, etc
QD Cancel	Dialysate Flow if OLC test canceled	Valid ONLY if patient is on machine 5 = 500 ml/min, 3 = 300 ml/min, etc
OLC Cancels 1- 6^a 		0 = OLC test not yet performed 1 = Unable to reach or stabilize @15.5 mS 2 = Unable to reach or stabilize @13.5 mS 3 = Blood pump rate changed or was turned off or multiple blood alarms occurred 4 = Dialysate Flow was unstable or turned off or multiple TMP alarm resets or Filling Programs or Conductivity or Temperature alarms occurred 5 = OLC was turned OFF 6 = Dialysate Flow was turned off 7 = OLC test started
^a NOTE: If the machine is turned off OLC Cancels 1 – 6 codes default to 0!		

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 1 = Dialysate Flow is stable. NOTE: QdS may = 0 if a Temp or Cond alarm occurs <u>OR</u> if Dialysate Flow rate was changed <u>OR</u> if a Filling Program occurs <u>OR</u> 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 <u>OR</u> 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 1 = At or going to approx. 15.5 mS 2 = At or going to the approx. 13.5 mS
OLC Enable	OLC Enabled	0 = OLC is turned off (OLC will NOT run). 1 = If OLC is turned on.
CPRE Stable	Pre Dialyzer Conductivity when stable during OLC test Example: 15318 = 15.318 mS	Not valid UNLESS an OLC test was performed.
CPOS Stble	Post Dialyzer Conductivity when stable during OLC test Example: 15318 = 15.318 mS.	Not valid UNLESS an OLC was performed.







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 398), ENSURE the pumps are installed with their output (red or blue) nozzles towards the top and the cable extending from the side. **If not, this may be the problem!**
- B) Note this page number then perform [INITIAL CHECKS](#) (page 6) and return here if a problem is NOT located.
- 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’ → ‘CONFIRM’); **2)** From the Home screen, set [Dialysate Flow] to 800 ml/min!
- D) Call debug screen 0. If debug does not appear press ‘Escape’ 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)**  **symbol is EVER pink (solid or blinking) AND the BIC**  **symbol is ALWAYS white:** ACID pump system problem! See procedure number [EOS- 2.0.0](#) (page 398).
- 2) **IF the CONC (acid)**  **symbol is ALWAYS white AND the BIC symbol**  **is EVER pink (solid or blinking):** BIC pump system problem!. See procedure number [EOS- 3.0.0](#) (**page 399**).
- 3) **IF BOTH the CONC (acid)**  **AND the BIC**  **symbols are EVER pink (solid or blinking):** See procedure number [EOS- 5.0.0](#) (**page 402**).
- 4) **IF BOTH pump symbols REMAIN ALWAYS white (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 +/- 3 of **Acid** the acid pump system is okay (for now anyway). In this event continue to part b. If **AAcid** does NOT remain within +/- 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. If **ABic** REMAINS within +/- 3 of **Bic** the bicarb pump system is okay (for now anyway)! If **ABic** does NOT remaining within +/- 3 of **Bic** then TWO (2) possible bad components: **1)** Bad BICARB pump OR; **2)** Bad Actuator-Test Board.

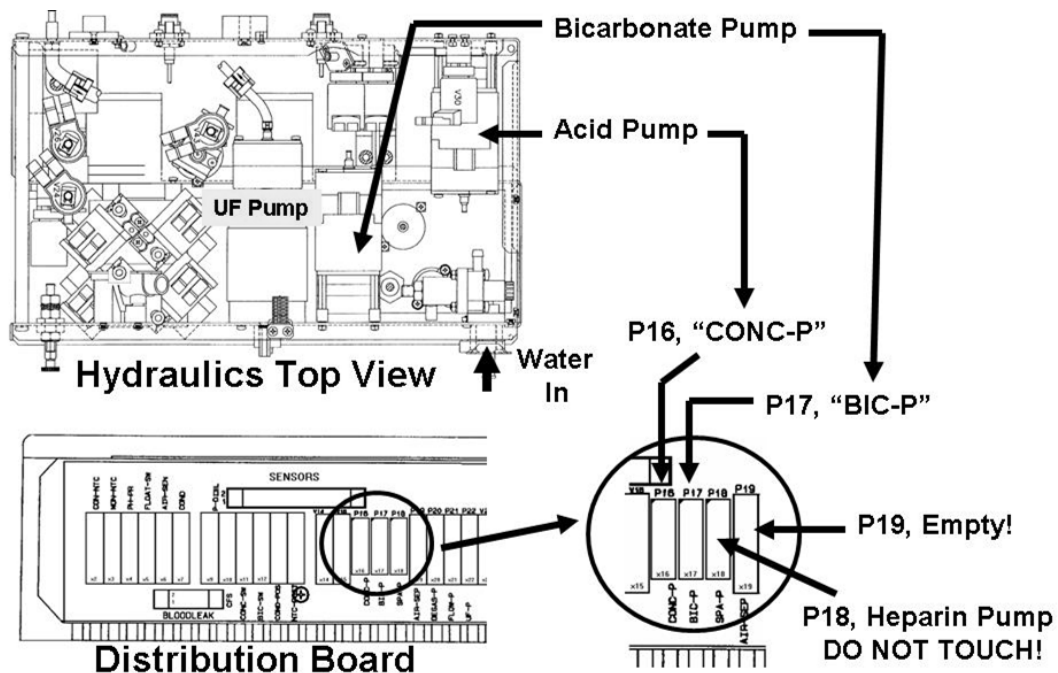


Figure 63 – Distribution Board / Hydraulics Top View (Pumps)

EOS- 2.0.0 ACID SYSTEM PROBLEM / ISOLATE THE ACID PUMP

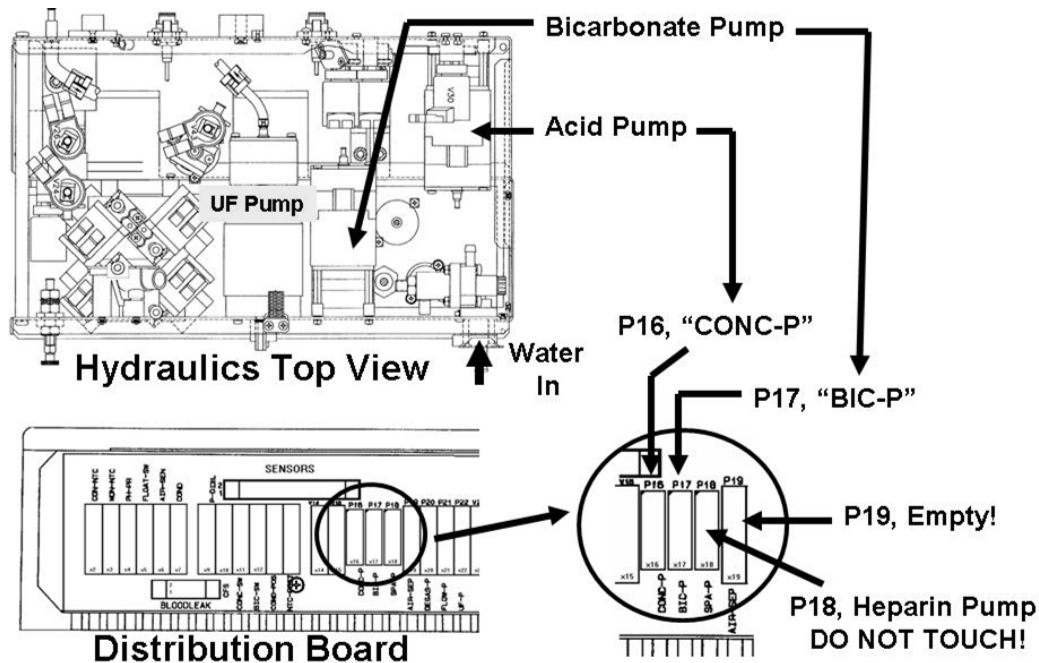
This procedure uses the known good bicarbonate pump to check the acid pump.

- A) **IMPORTANT! Turn the machine off to prevent damage!**
- 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 bicarbonate pump’s cable into the acid pump’s position “P16, CONC-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 press ‘Escape’ then call debug 0.
- F) 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) Remaining ALWAYS white?**
 - 1) **IF ever pink:** The acid pump is probably okay. See procedure number [EOS- 4.0.0](#) (page 400).
 - 2) **IF remaining white:** See parts a THROUGH c below:
 - a) **IMPORTANT! Turn the machine OFF to prevent damage!**
 - 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) **IMPORTANT! Turn the machine off to prevent damage!**
- 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 acid pump's 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 'Escape' then call screen 0.
- F) Allow thirty (30) seconds THEN, ignoring the **CONC** symbol, watch the **BIC** symbol for up to two minutes: **1) EVER pink (solid or blinking)?** OR **2) Remaining ALWAYS white?**
- 1) **IF Pink:** The bicarbonate pump is probably okay. See procedure number [EOS- 4.0.0](#) (page 400).
 - 2) **IF remaining White:** See parts a THROUGH c below:
 - a) **IMPORTANT! Turn the machine OFF to prevent damage!**
 - 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) **IMPORTANT! Turn the machine OFF to prevent damage!**
- b) Per [Figure 63](#) (page 398), 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) **IMPORTANT! Turn the machine OFF to prevent damage!**
- b) Swap in a known good Actuator-Test Board. To LOCATE the board refer to [Figure 4A](#) (page 9).
- 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 'Escape' 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) **IMPORTANT! Turn the machine OFF to prevent damage**
- b) Swap in (or check¹) a known good Sensor Board cable. To LOCATE the cable refer to [Figure 4A](#) (page 9).

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 524, [SECTION 17- CHECKING THE SENSOR BOARD CABLE](#)**. If the cable checks good continue to procedure number EOS- 4.0.0, step #3.

IF BICARB: **NOTE** that one (1) BICARB EOS connection (ONLY) will be checked and proceed to **page 524, [SECTION 17 - CHECKING THE SENSOR BOARD CABLE](#)**. If the cable checks good continue to procedure number EOS- 4.0.0, step #3.

- 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 'Escape' 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) **IMPORTANT! Turn the machine OFF to prevent damage!**
- b) Swap in (or check²) a known good actuator cable*. *To LOCATE the cable refer to [Figure 4A](#) (page 9).

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 521**, [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 521**, [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 'Escape' 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 have been 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 Board¹; 2) Distribution board; 3) Bad motherboard

¹ To prevent a "Cond Offset Failure" place the machine into **T and C Mode**. Refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**)

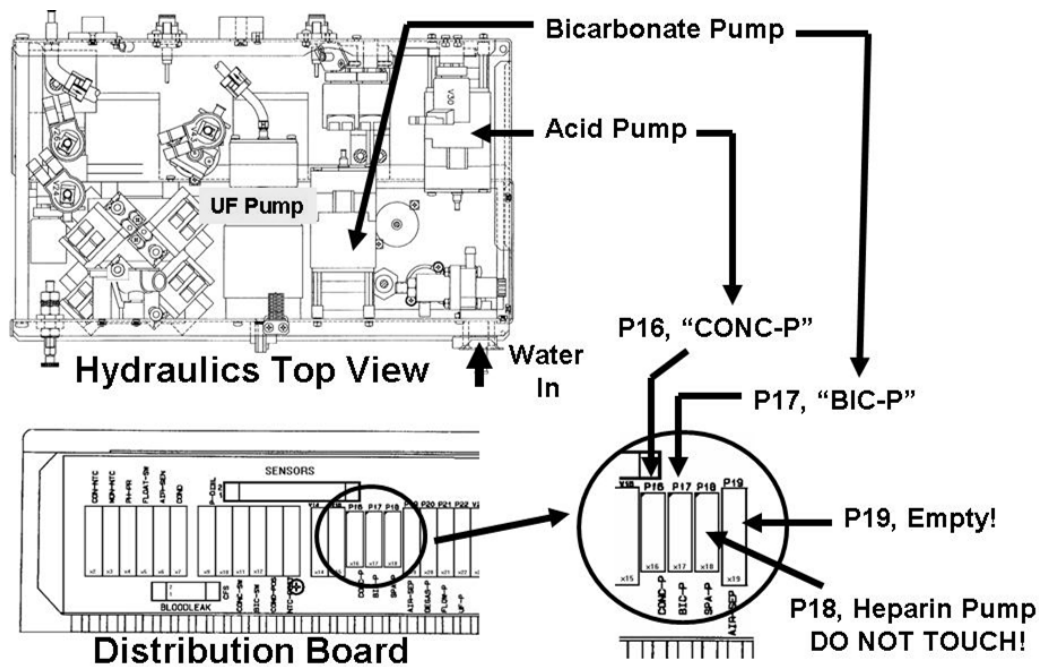
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EOS- 5.0.0 BOTH PUMP SYMBOLS ARE PINK

- IMPORTANT! Turn the machine OFF to prevent damage!**
- 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!**
- Swap in a known good Actuator-Test Board* *To LOCATE the board refer to [Figure 4A](#), page 9).
- If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.
- Call debug screen 0. If debug does not appear press 'Escape' then call screen 0.
- 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 402).

No Neither pump pink! The previous Actuator-Test Board is bad.



EOS- 5.0.1 ISOLATE THE PUMPS

- IMPORTANT! Turn the machine off to prevent damage!**
- 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.
- If the problem was occurring in a Cleaning Program return to it. If not return to Dialysis Program.
- Call debug screen 0. If debug does not appear press 'Escape' 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:** See (ABOVE) procedure [EOS- 1.0.0](#) (page 397).

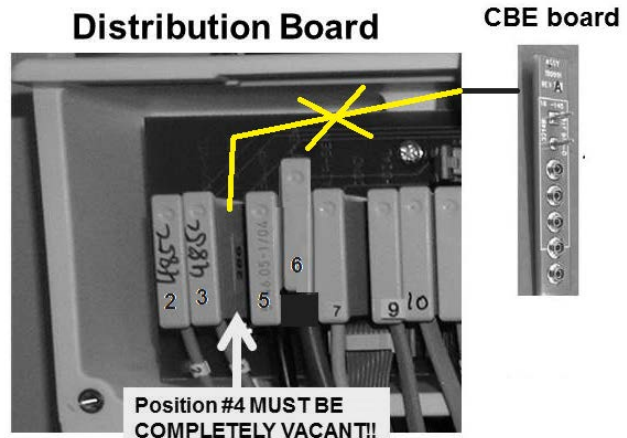
No Pump symbol pink! FIVE (5) possible bad components (referring to [Figure 4A](#), page 9):
1) Bad actuator cable OR; **2)** Bad Sensor Board cable OR; **3)** Bad Sensor Board OR; **4)** Bad distribution board OR; **5)** Bad mother board

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 accidentally 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 404).



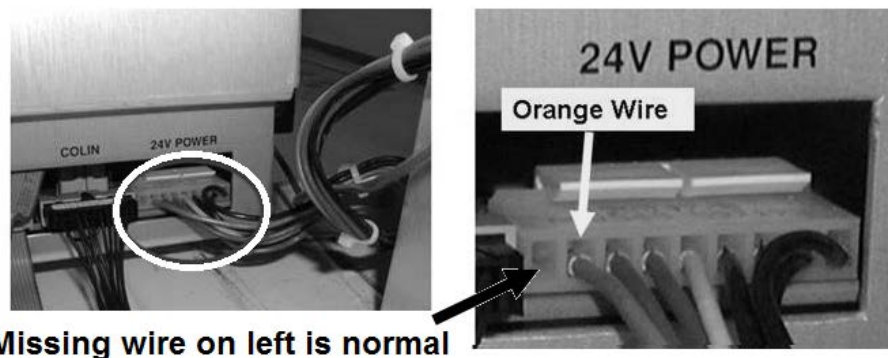
CR- 1.0.1 VERIFY COND FAILURE

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 **Error! Bookmark not defined.**) to place the machine into **T and C Mode**.

No See parts a THROUGH e below:

- a) **IMPORTANT!** Before continuing to part b, perform [INITIAL CHECKS](#) (page 6) and return here if a problem is NOT located.
- b) To avoid pulling cables loose GENTLY open the card cage.
- c) Figure below, at the rear of the machine, ENSURE the 24V POWER harness has remained plugged in!



- d) Spread the card cage side panels open then gently drop the front panel down.

Parts e and f next page

- e) Referring to the Figure below, locate the motherboard's nine (9) pin TEST Connector. Voltage signals will be measured from here next.
- f) See procedure number [CR- 1.0.2](#) (page 405).

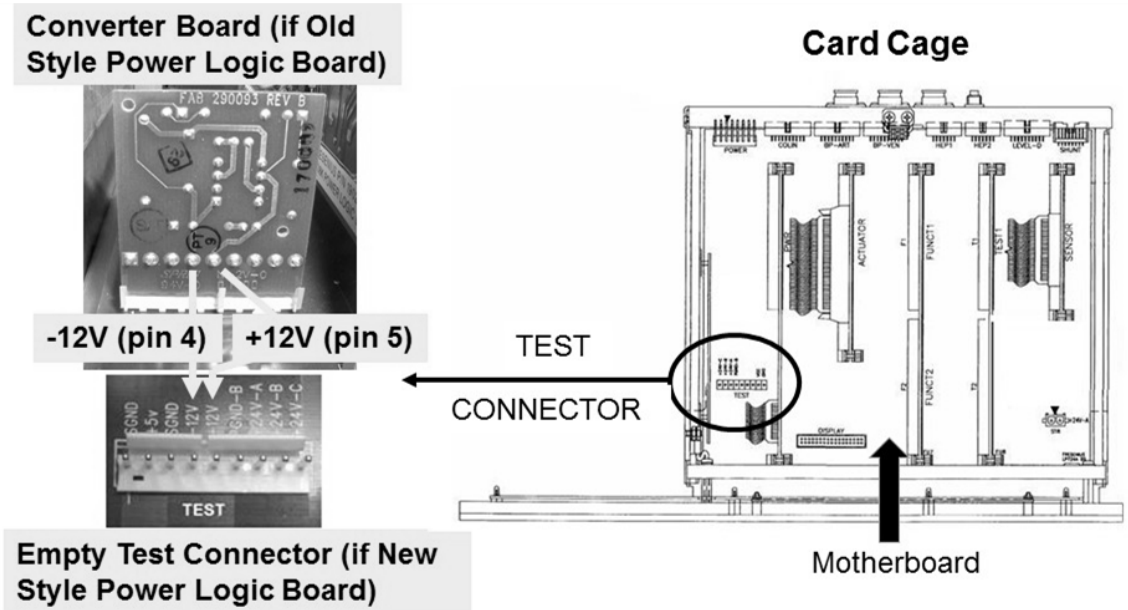


Figure 64 – TEST Connector

CR- 1.0.2 ISOLATE POSITIVE (+)12 VOLT DC SUPPLY

- A) **IMPORTANT!** Set your CALIBRATED volt meter to DC Voltage (V_{DC}).
- B) **Connect the meter's black lead to chassis ground (see [Figure 2](#) (page 4)).**
- C) **IMPORTANT!** Turn the machine on (Fan running)!
- D) Measure at the TEST Connector's **negative -12V** pin (pin 4, four pins from left). Between -11.00 and -13.00 volts DC?

Yes Between -11.00 and -13.00 volts DC! See procedure number [CR- 1.0.4](#) (page 406).

No Is NOT between -11.00 and -13.00. Measure at the TEST Connector's **positive +12V** pin (pin 5, five pins from left). Between 11.75 and 12.25 volts?

Yes Between 11.75 and 12.25 volts! See procedure number [CR- 1.0.9](#) (page 407).

No Less than 11.75 OR more than 12.25 volts! Proceed to **page 599** and refer to [Table 17](#).

CR- 1.0.4 BETWEEN -11.0 AND -13.0 VOLTS / ISOLATE CELLS CALIBRATION

- A) Turn the machine OFF.
- B) **DO NOT allow the acid and LIQUID bicarb to run empty subsequently!**
- C) Place the machine into Service Mode → Calibrate Sensors → Cond Cells.
- D) ENSURING the external flow indicator's 'bob' is moving up at least ¼ way up in the sight tube ALLOW six (6) minutes BEFORE continuing to part E.
- E) Set the external meter to measure Temperature (°C). If temperature is stable between 35.1 and 39.9° C continue to part F. If (and ONLY if) temperature IS NOT between 35.1 and 39.9° C proceed to **page 302**, procedure number T- 7.0.0
- F) Set the meter to measure Conductivity (mS).
- G) Proceed per the screen's instructions. Is the Cond Cells calibration successful?

Yes Calibration successful! See procedure number [CR- 1.0.5](#) (page 406).

No Calibration IS NOT successful ("Operator Error")! 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 406) to test each new component.

Component List: **1)** Sensor Board; **2)** Test Board; **3)** Actuator-Test Board; **4)** 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 or No)?

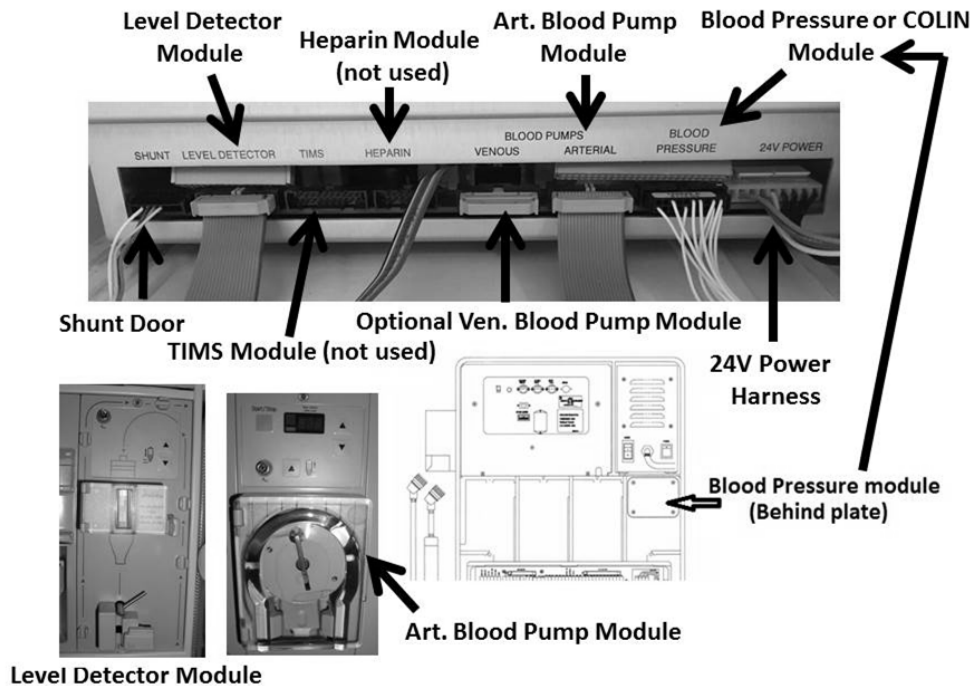
Yes ↑ Problem reoccurs! Swap in the listed component (see the **Component List** below) one at a time, with known good then, in between, repeat procedure number [CR- 1.0.4](#) (page 406) to test the new component. When the Failure DOES NOT reoccur the last component swapped in is the problem.

Component List: **1)** Sensor Board; **2)** Test Board; **3)** Actuator-Test Board; **4)** Functional Board's EEPROM (IC20); **5)** Functional Board

↓ No 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) **IMPORTANT! 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 then re-measure -12 volts as this may be the problem!



- c) **IMPORTANT!** Unplug the **Blood Pressure** module.
- d) **IMPORTANT!** Turn the machine on (fan running)!
- e) **ENSURE** the meter's black lead **REMAINS** connected to ground!
- f) Repeat the measurement at TEST Connector's -12V pin (pin 4, four pins from left). 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.

No NOT between -11.0 and -13.0 DC! See procedure number [CR- 1.0.10](#) (page 407).

CR- 1.0.10 NEGATIVE 12 VOLTS NOT WITHIN RANGE

- a) **IMPORTANT!** To avoid damage turn the machine off THEN allow two (2) full minutes!
- b) **IMPORTANT!** Set your volt meter to measure resistance (Ω)!
- c) **ENSURE** the meter's black lead **REMAINS** connected to ground!

Parts d and e next page

- d) **CAUTION!** Due to the time consuming work that may be performed if the following resistance reading is misinterpreted proceed VERY carefully. Do NOT read just the meter's numeric display, read ALSO its UNITS (“Ω”, “KΩ”, “MΩ”) AND the location of its decimal point!



- e) Measure resistance at TEST connector *pin 4* (4 pins from left). More than 75.0 Ω (0.075 KΩ)?

Yes More than 75.0 Ω! See procedure number [CR- 1.0.20](#) (page 408).

No Way less than 75.0 Ω. Possible -12 volt short. One of the card cage boards (which can be isolated by removing them one at a time and measuring resistance until pin 4 is more than 75 Ω. After all boards have been removed and the measurement is still less than 75 Ω the motherboard may be bad.

CR- 1.0.20 ISOLATE NEGATIVE TWELVE VOLT PROBLEM

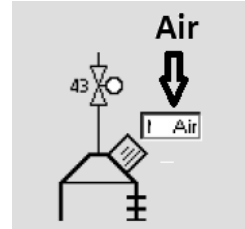
Per Figure 4A and NOTE A (page 9), proceed according to how the machine is equipped (1) **Old** OR 2) **New Style Power Logic Board:**

- 1) **IF Old Style Power Logic Board:** Replace the Convertor board* with a known good or with a known good New Style Power Logic Board and remove the Convertor board*
- 2) **IF New Style Power Logic Board:** Replace it with a known good New Style Power Logic Board¹ OR with a known good Old Style Power Logic Board AND Convertor board*

* **CAUTION!** To avoid damage, the ‘Convertor board’ MUST be installed with the ‘solder side’ towards the front of the machine AND matched pin for pin to the TEST connector.

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!

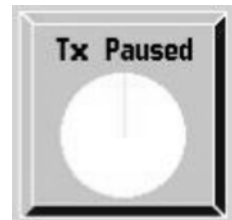
B) Close the shunt door!

C) ENSURE the external flow indicator's (sight tube) fittings are tight!

D) From the Home screen, ENSURE [Dialysate Flow] has been on and set to 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!

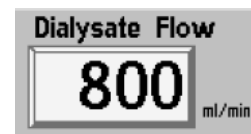


G) [**Conductivity**] MUST BE more than 13.0 mS BEFORE continuing to part H!

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!**

J) Select the [Dialysate Flow] window (it turns bright yellow).



K) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.

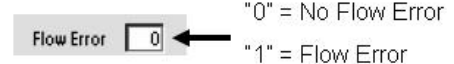
L) **DO NOT reset alarms!**

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 410).

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 REMAINS 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 410).

2) **IF Flow Error EVER = 1!** Proceed to **page 20**, [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 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!

* **IMPORTANT!** If CBE modified the **CBE board** plugs directly into the distribution board and positions the female Air Sensor 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 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

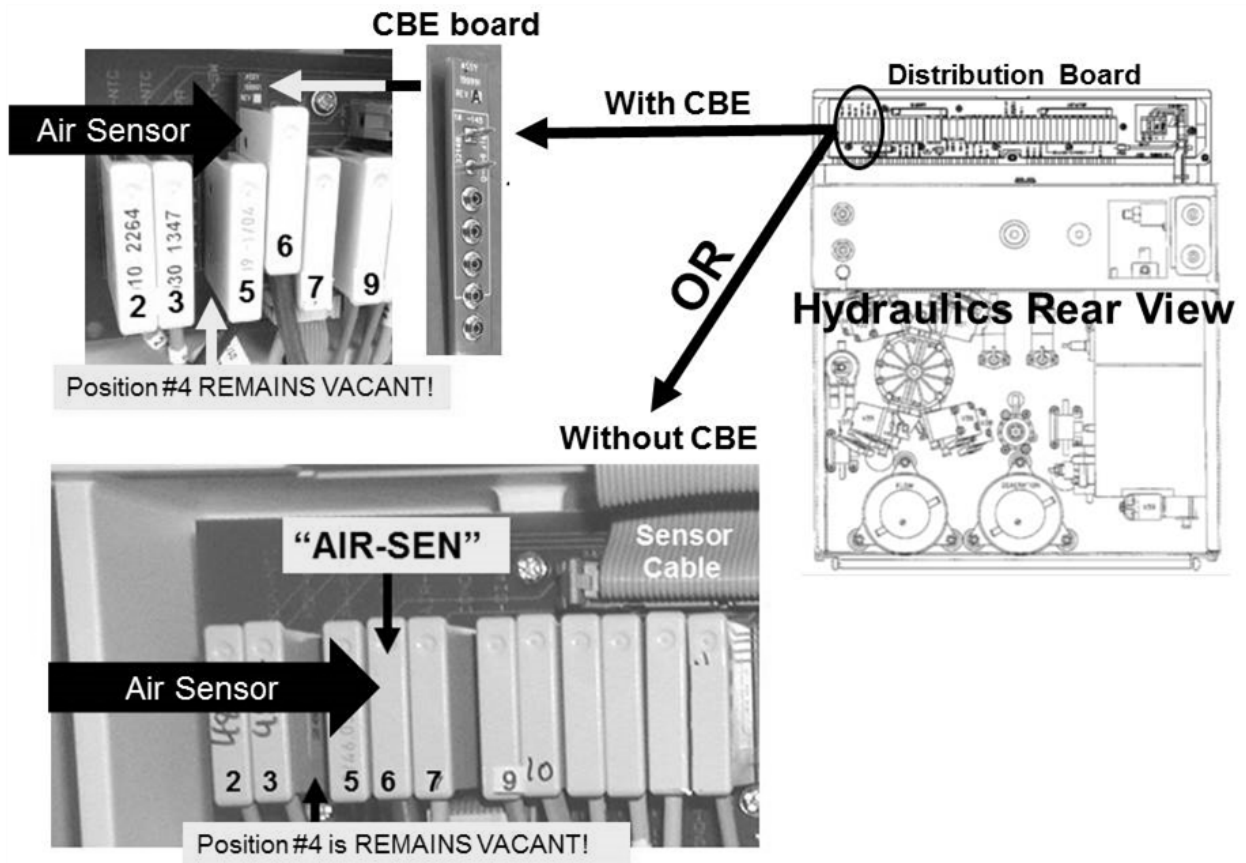
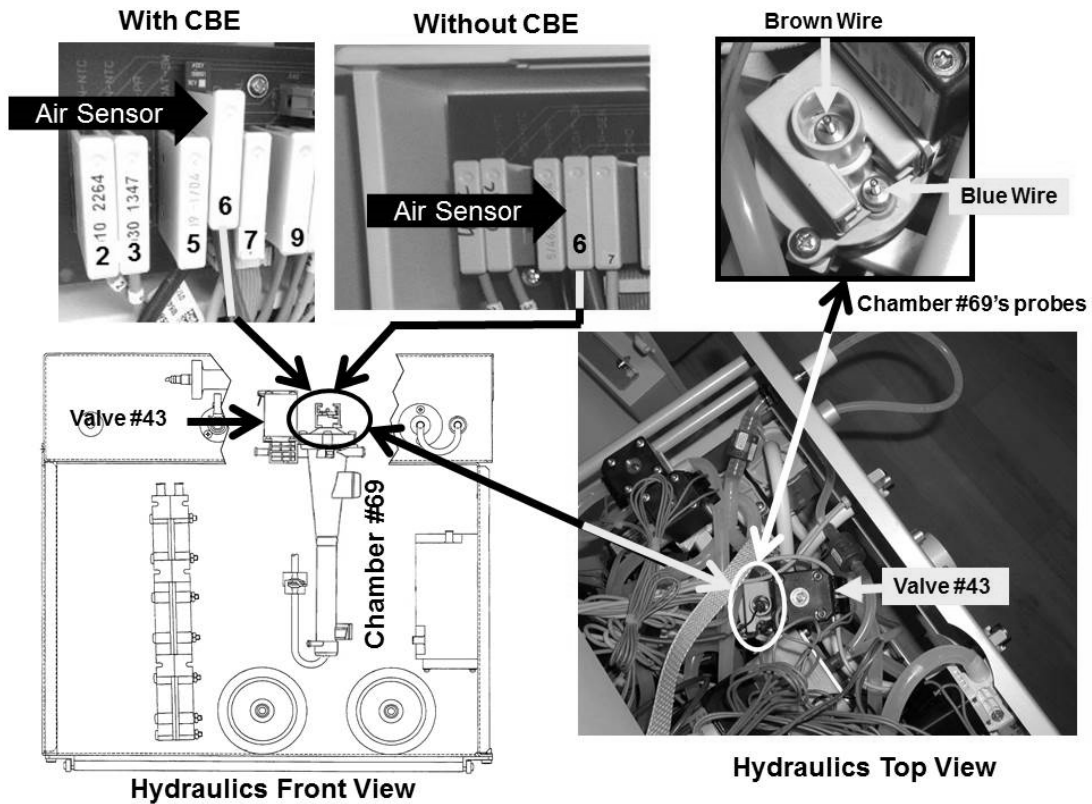


Figure 65 – Chamber #69 / Air Sensor

- c) **Figure below**, ENSURE the Air Sensor Connector's brown and blue wires terminate tightly into the probes at the top Chamber #69, brown wire to the top probe; blue to the bottom!

NOTE: If the wires are loose OR not connected properly this may be the problem!

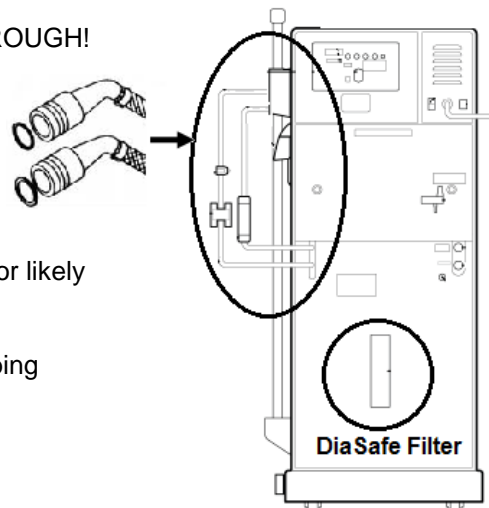


- d) Very small external leaks cause BIG problems! Be THOROUGH!
THREE (3) leak checks:

CHECK #1 Figure right, the ENTIRE length of the dialyzer lines including 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!

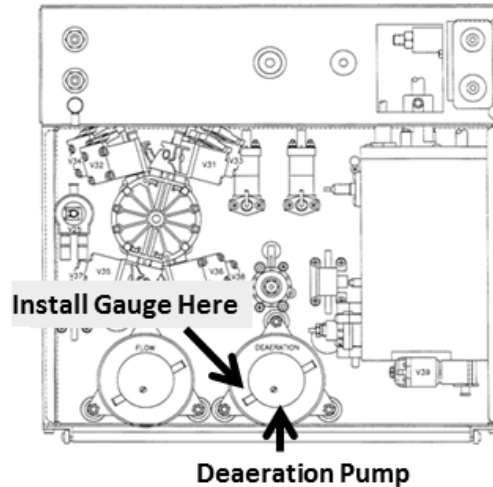


- e) See procedure number [FIL- 1.0.1](#) (page 412).

FIL- 1.0.1 ISOLATE AIR REMOVAL SYSTEM

- a) Turn the machine OFF!
- b) The Deaeration gauge is used next. **ENSURE** it reads 0 inHg before installing it!
- c) Figure below, tee the gauge into the Inlet (clear tubing) side of the Deaeration Pump!

Hydraulics Rear View



- d) Turn the machine on and return to Dialysis Program ("Select Program → "Dialysis" → 'CONFIRM').
- e) Is Deaeration Pressure OKAY? Refer to [Appendix A](#) (page 667) for what pressure should be.

Yes Deaeration Pressure OKAY! See procedure number [FIL- 1.0.2](#) (page 412).

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 498**, [SECTION 13 - DEAERATION PROBLEMS](#).

FIL- 1.0.2 DEAERATION PRESSURE OKAY

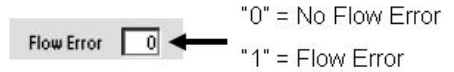
- a) Turn the machine OFF.
- b) Remove the gauge and reattach the tubing.
- c) Turn the machine on and return to Dialysis Program ("Select Program → "Dialysis" → 'CONFIRM').
- d) See procedure number [FIL- 1.0.3](#) (page 413).

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 413).

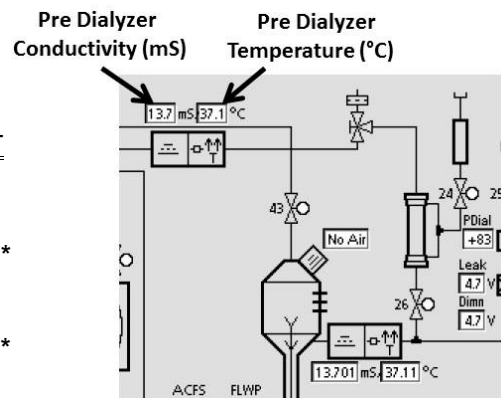
2) **IF Flow Error EVER = 1:** Proceed to **page 20, SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM.**

FIL- 1.0.4 ISOLATE 'OUT OF BYPASS' CIRCUIT

a) From debug screen 0, Figure right, TWO (2) IMPORTANT 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 air leak that must be located and repaired!

b) See procedure number [FIL- 1.0.5](#) (page 413).

FIL- 1.0.5 STABLE CONDUCTIVITY / ISOLATE OLC

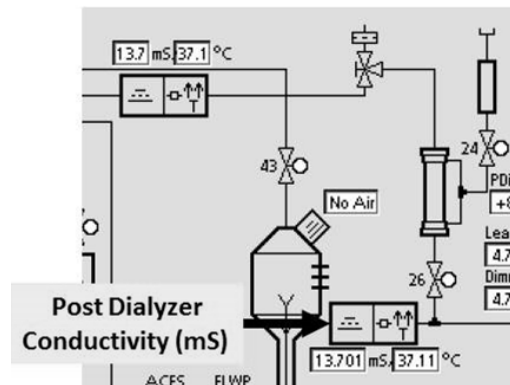
A bad On Line Clearance (OLC) component may cause Filling Programs EVEN if OLC is not activated or used! From debug screen 0:

a) **Figure right**, if the **POST Dialyzer Cond** symbol appears see part b. If NOT skip to procedure number [FIL- 1.0.6](#) (page 414).

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 416**, 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 414).



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 414).

No Cond Cell #13 NOT present! Proceed to **page 416**, procedure number [FIL- 2.0.0](#).

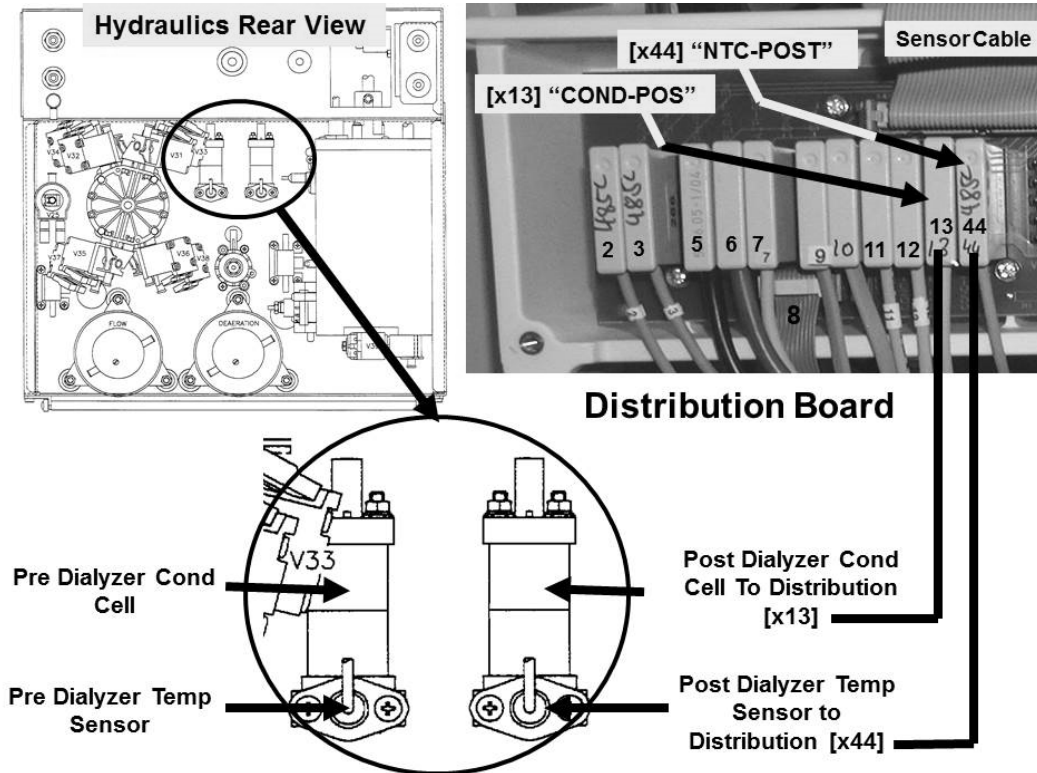


Figure 66 – OLC Pre AND Post Components

FIL- 1.0.7 ISOLATE OLC SENSORS CONNECTIONS AND CABLES

a) Per the Figure above, **FOUR (4) IMPORTANT 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 415).

No Problem with a cable! After the repair, perform parts a THROUGH d below:

- a) Turn the machine OFF then allow even (7) minutes BEFORE continuing to part b.
- b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- c) Allow Conductivity to increase to more than 13.0 mS.
- d) Call debug screen 1. Watch **FILACT** for two (2) minutes. If REMAINING = 0 the problem is solved. If still going ever = 1 return to (ABOVE) procedure number [FIL- 1.0.3](#) (page 413).

FIL- 1.0.8 OLC ACTIVATED?

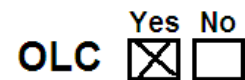
From debug screen 0, once again, does the OLC **POST Dialyzer Cond** symbol appear?

Yes **POST Dialyzer Cond** symbol appears! A problem with Post Dialyzer Cond. Close the shunt door THEN proceed to **page 379**, procedure number [CO- 10.0.10](#).

No The OLC option will have to be activated as a bad OLC reading may cause Filling Programs EVEN IF 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 ‘CONFIRM’. The ‘X’ turns blue.



c) Turn the machine off then back on.

d) Return to Dialysis Program (“Select Program”→ ‘Dialysis’ → ‘CONFIRM’)!

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) **IMPORTANT!** Allow two (2) additional minutes for Post Conductivity to stabilize!

i) Call debug screen 0. Are PRE AND POST Cond within 0.4 of each other now?

Yes PRE AND POST Conductivity within 0.4 mS of each other! See procedure number [FIL- 2.0.0](#) (page 416).

No PRE AND POST Conductivity ARE NOT within 0.4 mS of each other! A problem with Post Dialyzer Cond. Close the shunt door and proceed to **page 379**, procedure number [CO- 10.0.10](#) (page 379).

FIL- 2.0.0 VERIFY DIALYSATE SETTINGS

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

b) Is the external flow indicator's 'bob' moving up and down in the sight tube?

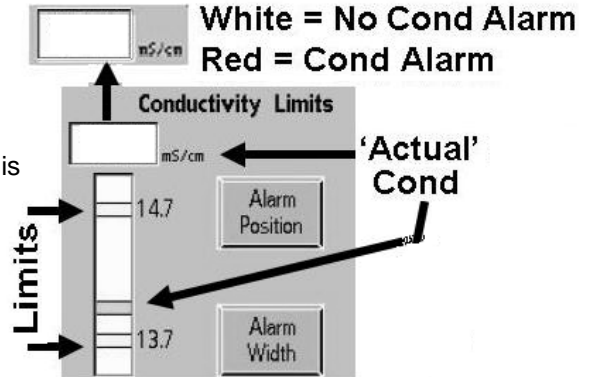
Yes 'Bob' moving! See procedure number [FIL- 2.0.1](#) (page 416).

No a) At the bottom of the screen, select the 'Dialysate' tab.

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

c) **IMPORTANT!** Press 'CONFIRM'.

d) Allow up to three (3) minutes for the Conductivity window to turn white (i.e. No Cond alarm).

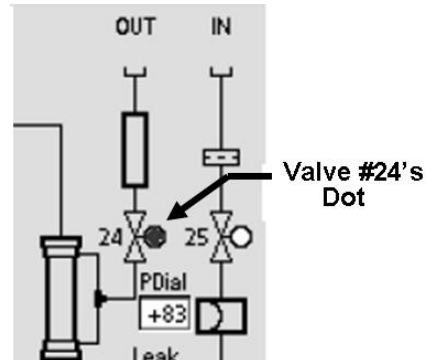


e) Call debug screen 0. Figure right, allow Valve #24's 'dot' to turn BLUE BEFORE continuing to part f!

f) Is the flow indicator's 'bob' moving up and down now?

Yes 'Bob' moving!' See procedure number [FIL- 2.0.1](#) (page 416).

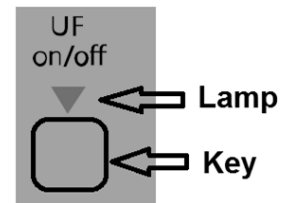
No 'Bob' NOT moving! **ENSURING:** 1) From the Home screen, [Dialysate Flow] is set to 800 ml/min! AND; 2) Screen 0's Valve #24's 'dot' is blue! If (and ONLY if) 'bob' is still not moving proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM!](#)



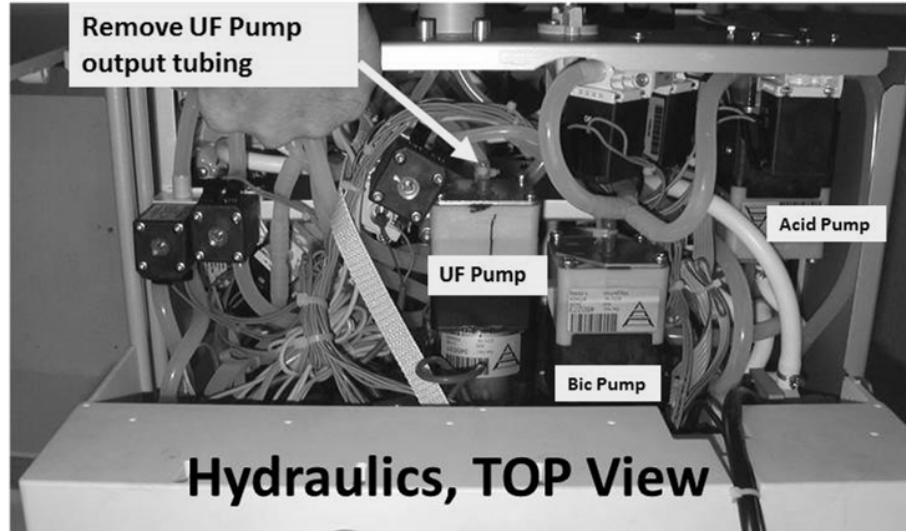
FIL- 2.0.1 'BOB' MOVING / ISOLATE POSSIBLE UF PUMP LEAK

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 418).

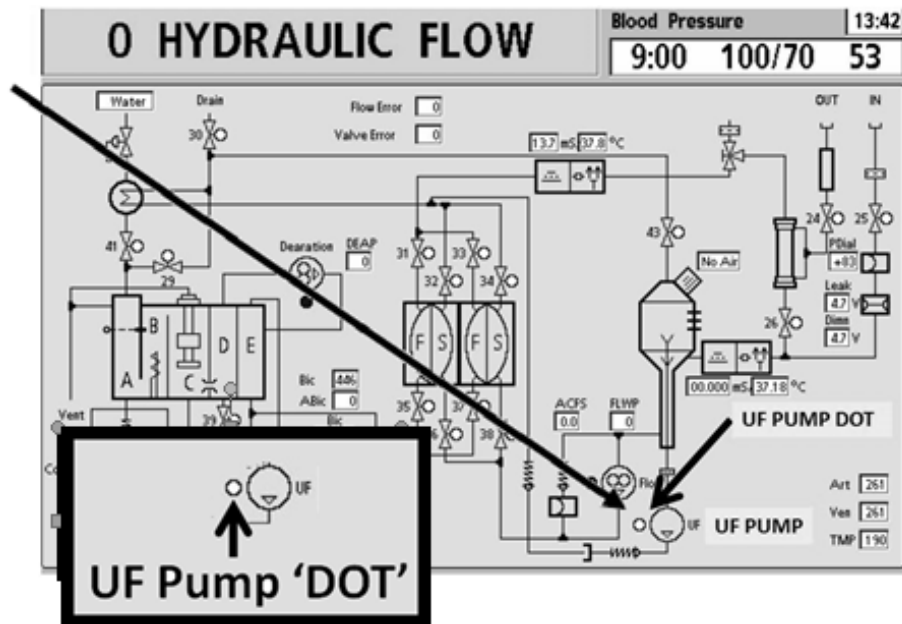
2) **IF you see fluid output:** See parts a AND b below:

a) Call debug screen 0.

b) Per the Figure below, WITHOUT LOOKING AWAY, watch the UF Pump's 'dot' for ONE (1) FULL 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!

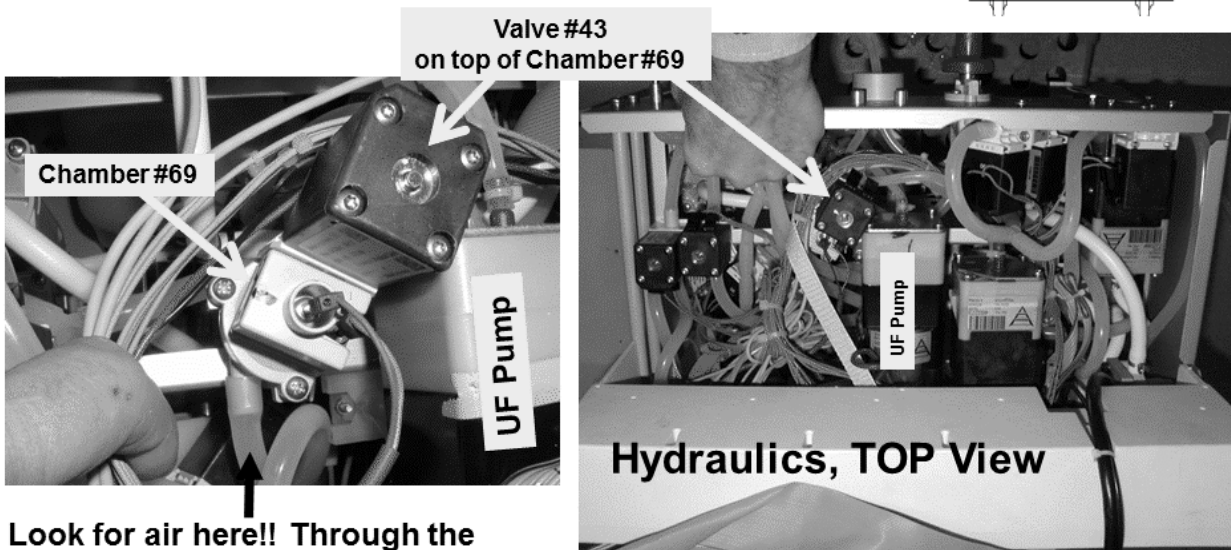
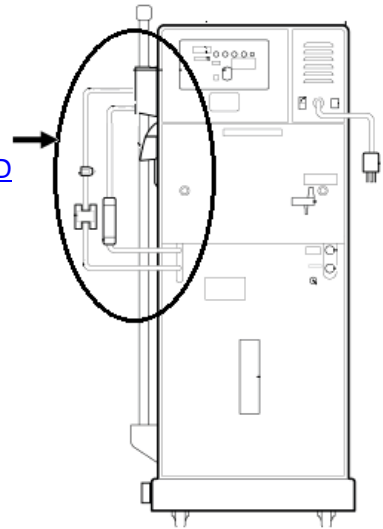


FIL- 2.0.2 'BOB' MOVING / ISOLATE POSSIBLE AIR LEAK (1)

Figure right, USING A FLASHLIGHT, look for air bubbles MOVING through the dialyzer lines. Air seen?

Yes Air seen! Proceed to **page 490**, [SECTION 11 - INDUCED AIR LEAK TESTS](#).

No air! See procedure number [FIL- 2.0.3](#) (page 418).



Look for air here!! Through the tubing at the REAR side of Chamber #69!!

Figure 67 – Chamber #69 Air Check

FIL- 2.0.3 NO AIR IN DIALYZER LINES

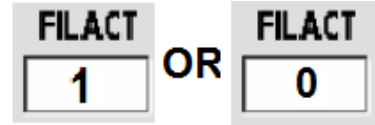
Figure above, USING A FLASHLIGHT, FOR TWO (2) MINUTES, watch for air bubbles MOVING into Chamber #69! Air seen?

Yes Air seen! Proceed to **page 490**, [SECTION 11 - INDUCED AIR LEAK TESTS](#).

No air seen! See procedure number [FIL- 2.0.4](#) (page 419).

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 **421**, procedure number [FIL- 2.1.0](#).
- 2) **IF FILACT ALWAYS = 0:** See parts a THROUGH d below:
 - a) **Open the shunt door and LEAVE IT OPEN till instructed otherwise!**
 - 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 419).

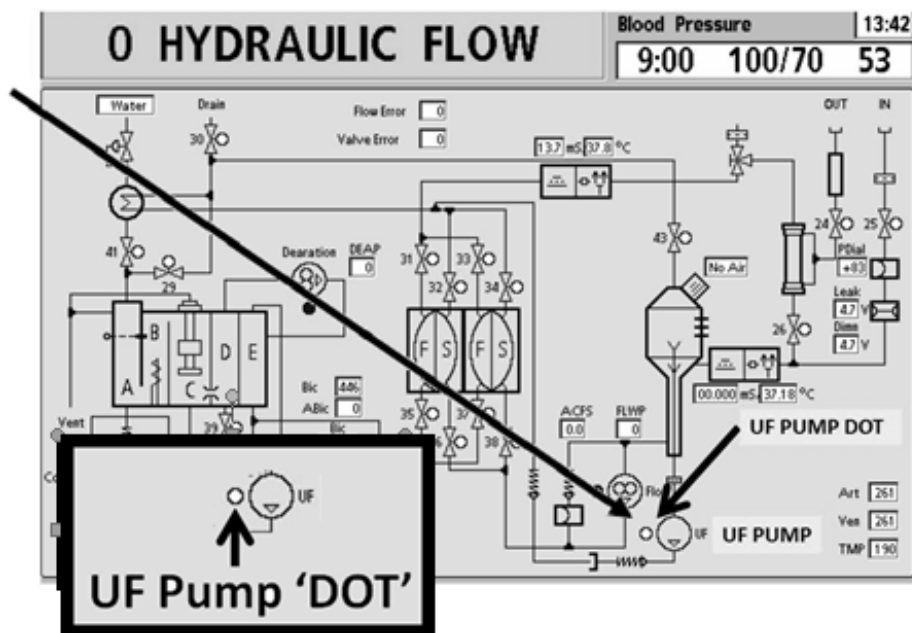
No Address the alarm that cannot be reset!

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 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! See procedure number [FIL- 2.0.6](#) (page 420).



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) Select the [**Test & Options**] tab at the bottom of the screen. TWO (2) possible scenarios:

1) **IF the [Pressure Test] button is BLUE:** **A)** Select [Pressure Test]; **B)** Press 'CONFIRM'; **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)** Select [Both Tests]; **B)** Press 'CONFIRM'; **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 432**, 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 'CONFIRM'.

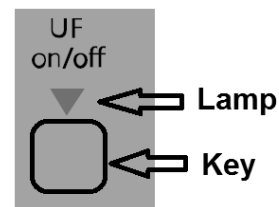
C) **RESET ALL alarms!**

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)!



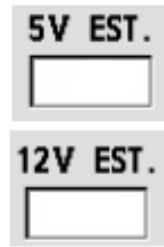
* If a "Filling Program" banner appears: 1) Repeat parts C) through G); 3) If "Filling Program" reoccurs more than twice proceed to **page 432**, procedure number [FIL- 5.0.0](#)

H) At Chamber #69's INPUT tubing, IMMEDIATELY watch for air again. Air seen?

Yes Air seen! Proceed to **page 432**, 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 and 5.3?

Check #2: 12V Est. (right column): Between 11.7 and 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 421).

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.

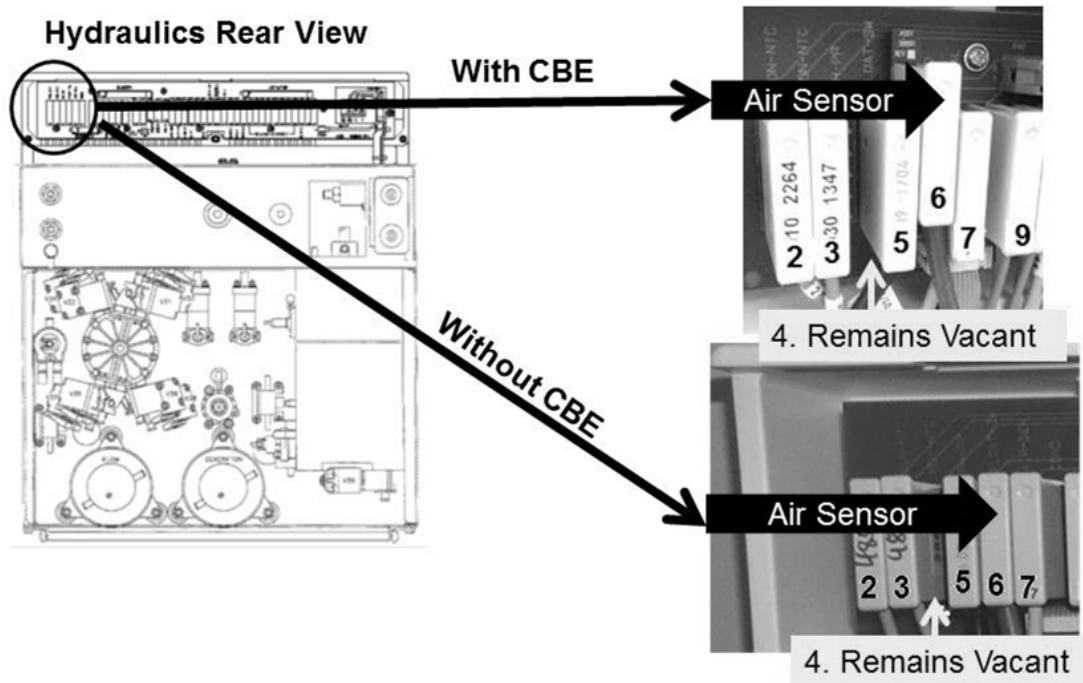
B) Behind the card cage, ENSURE the 24V POWER harness has remained plugged in.

C) Proceed to **page 599**, procedure number [P- E.0.0](#).

FIL- 2.3.0 VOLTAGES IN RANGE / ISOLATE AIR SENSOR CIRCUIT

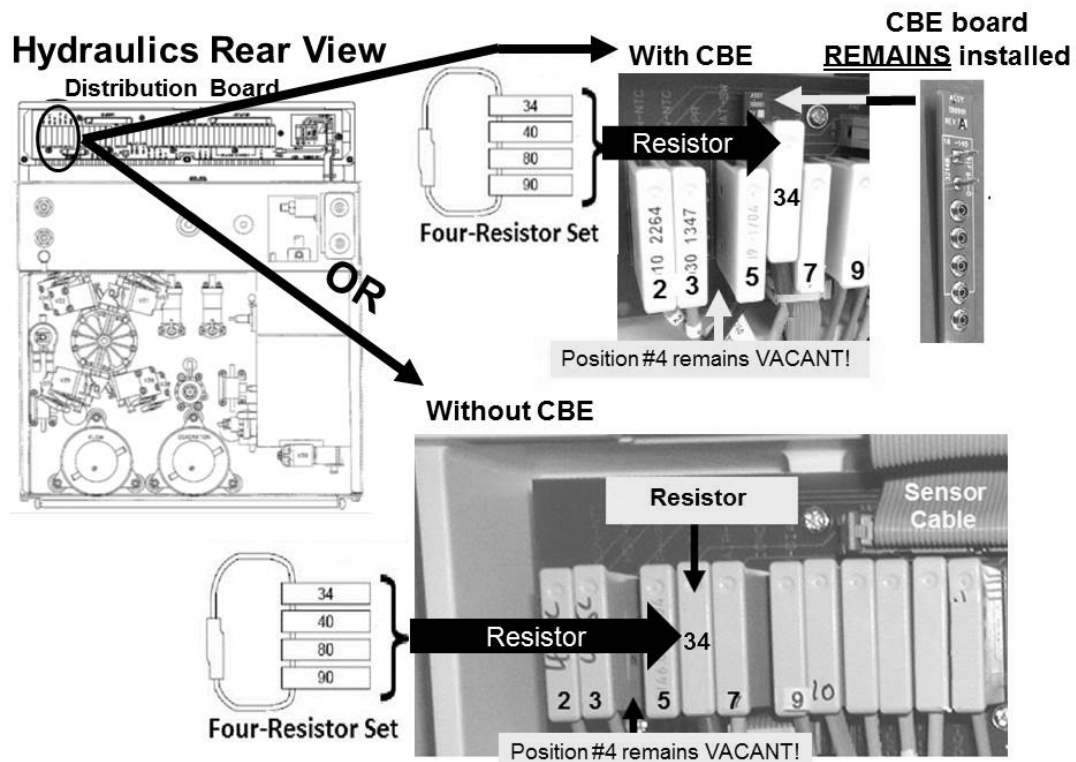
a) FIGURE BELOW, inside the distribution board, unplug the female Air Sensor's connector i.e. **4th CONNECTOR CAP, 5th** position from the left. If present, DO NOT unplug the CBE board!

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) **IMPORTANT!** Allow thirty (30) seconds BEFORE continuing to part e

e) Based on debug screen's **FILACT** now, TWO (2) possible scenarios:

1) **IF (and ONLY if) FILACT ALWAYS = 0:** See procedure number [FIL- 2.4.0](#) (page 423).

2) **IF FILACT = 1 or cycles between 0 and 1:** Perform parts a THROUGH c below:

a) **ENSURE** the plug is placed **PROPERLY** 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 423).

b) Use a different plug! If **FILACT** remains = 1 see part c. If **FILACT** = 0 always see procedure number [FIL- 2.4.0](#) (page 423).

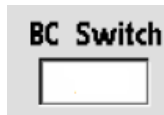
c) SIX (6) possible bad components: **1)** CBE board^a; **2)** Sensor Board^b; **3)** Sensor Board cable^c; **4)** Functional Board^b; **5)** Distribution board; **6)** Motherboard.

^a **A)** Swap in a known good CBE board; **B)** Return the resistor plug **PROPERLY** to the Air Sensor's position!; **C)** Return to Dialysis Program ('Dialysis' → 'CONFIRM'); **C)** From debug screen 1, if **FILACT** now = 0 the previous CBE board may be bad.

^b **A)** Swap in a known good board; **B)** For each board, to prevent "Cond Offset" Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**); **C)** Return to Dialysis Program; **D)** From debug screen 1, if **FILACT** now = 0 the previous board is bad.

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 masked Flow Error! In any event see part b.



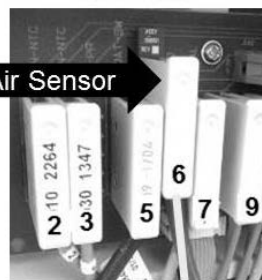
b) WITHOUT LOOKING AWAY, watch **BC Switch** for two (2) minutes. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) BC Switch NEVER, EVER = 897 or more!** See procedure number [FIL- 2.4.2](#) (page 423).
- 2) **IF BC Switch = 897 or more, even just once!** Proceed to **page 20**, [SECTION 1- FLOW ERRORS IN DIALYSIS PROGRAM](#).

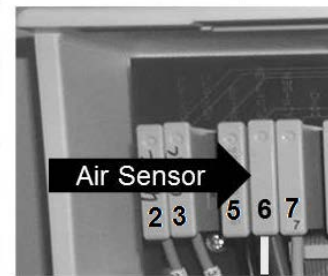
FIL- 2.4.2 BC SWITCH NEVER = 897 / ISOLATE X6

a) **Figure right**, return the Air Sensor's connector to the distribution board. If CBE equipped, using a flashlight, **ENSURE** the connector covers ALL CBE board pins, especially the top pin!

With CBE



Without CBE



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 (and ONLY if) FILACT = 0 ALWAYS:** Proceed to **page 425**, procedure number [FIL- 3.0.0](#).
- 2) **IF FILACT EVER = 1:** See parts a THROUGH e below:

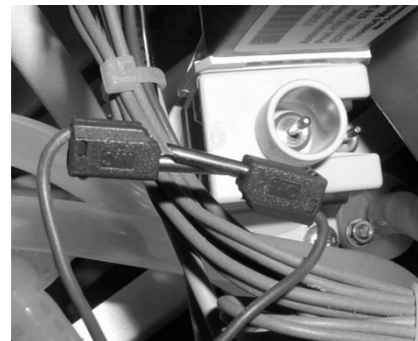
a) **ENSURE** the female Air Sensor's Connector is plugged in PROPERLY! If CBE equipped using a flashlight, **ENSURE** the connector covers ALL CBE board pins, especially the top pin!

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! ALWAYS = 0?

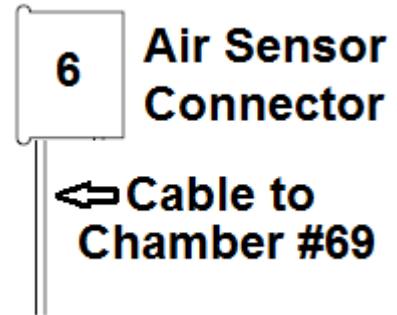
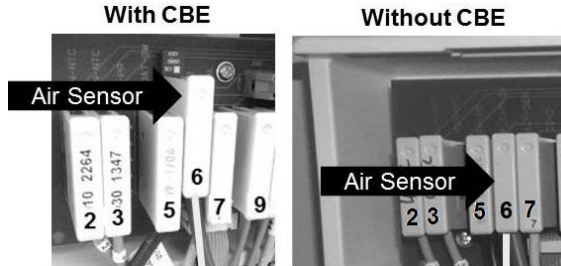


Yes **FILACT ALWAYS** = 0! Leaving the wires connected together proceed to **page 425**, procedure number [FIL- 3.0.0](#).

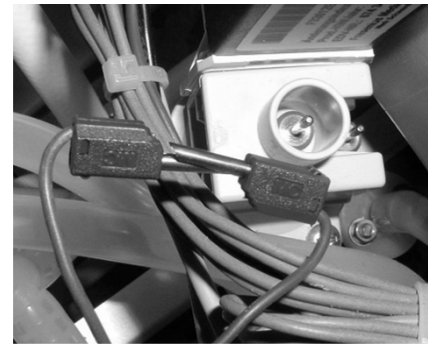
No **FILACT** = 1 at least once! See procedure number [FIL- 2.4.4](#) (page 424)

FIL- 2.4.4 FILACT = 1

- a) Figure right, swap in a known good Air Sensor Connector.
- 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' → 'CONFIRM'").
- 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 (and ONLY if) FILACT = 0 ALWAYS:** Problem solved! The previous Air Sensor Connector is bad!
- 2) **IF FILACT EVER = 1:** Leaving the wires connected together until **FILACT = 0 ALWAYS**, perform parts A through F 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 part C through F to test each new component.

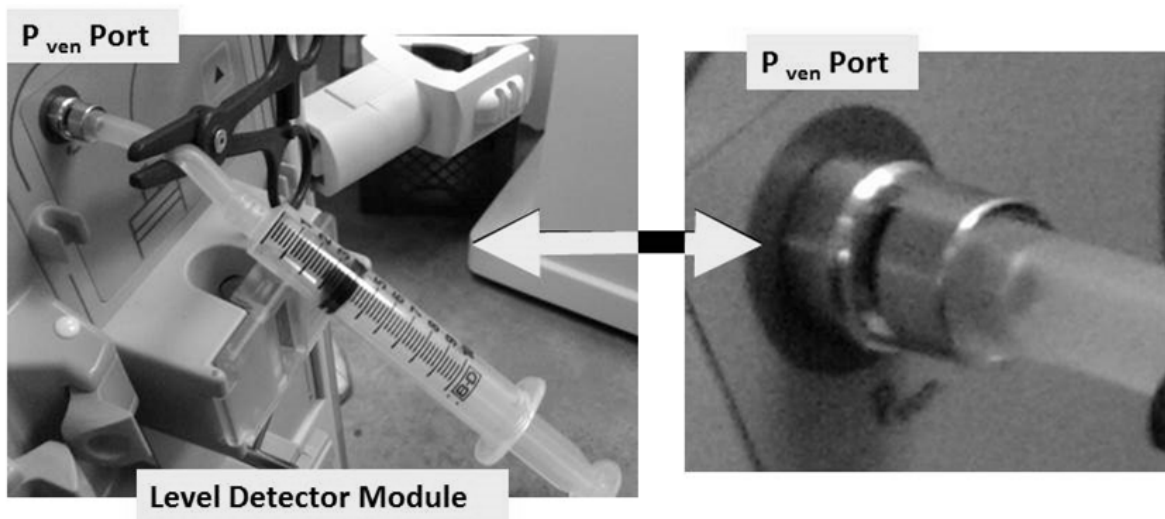
Component List: 1) CBE board; 2) Sensor Board ; 3) Sensor Board cable; 4) Functional Board ; 5) Distribution board; 6) Motherboard

- C) If the time comes to swap in the Sensor or Functional board, to prevent "Cond Offset" Failure", place the machine into **T and C Mode** (refer to OPERATING MODES (page **Error! Bookmark not defined.**));
- D) Turn the machine on and return to Dialysis Program ("Select Program → 'Dialysis' → 'CONFIRM'").
- E) Allow thirty (30) seconds BEFORE continuing to part F!
- F) Call debug screen 1. Watch **FILACT** for two (2) 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.

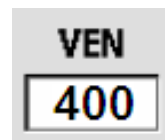
FIL- 3.0.0 FILACT = 0 / CREATE VENOUS PRESSURE

This procedure creates Venous Pressure to ensure Valve #25 remains open for the subsequent test:

- a) **Turn Dialysate Flow OFF (Dialysate Flow on/off lamp blinks)!**
- b) Call debug screen 0. ENSURE all eight balancing chamber valves (#31 through #38) 'dots' are REMAINING white (Flow is Off)!
- c) **IMPORTANT! Dialysate Flow MUST REMAIN OFF till instructed otherwise!**
- 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.

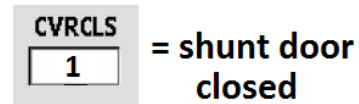
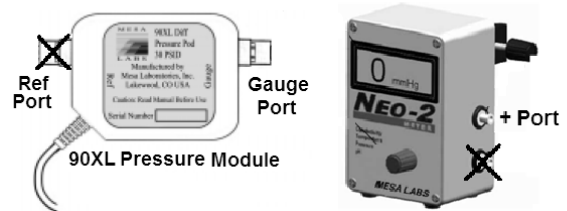
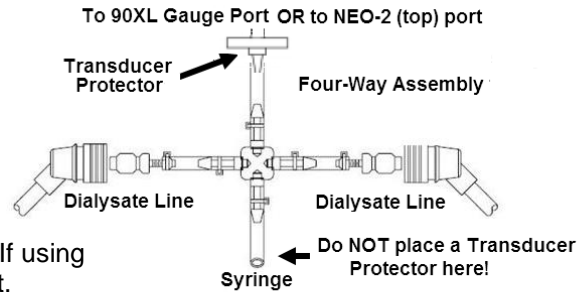


- e) Call debug screen 1.
- f) Push on the syringe plunger until **VEN** (middle column) is between 400 and 450.
- g) Clamp the syringe tubing to keep the pressure!
- h) If **VEN** falls more than three (3) mmHg in thirty (30) seconds there is a leak at the P_{ven} port OR inside the module.
- i) Leaving the clamp in place, to keep **VEN** more than 400, see procedure number [FIL- 3.1.0](#) (page 426).



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 at dialyzer level! 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 in the Four-Way tubing segments!
- e) **IMPORTANT! 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 approximately negative (-)250 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- 3.2.0](#) (page 426).

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 426).

FIL- 3.2.0 -250 ACHIEVED / PRESSURE TEST HYDRAULICS (2)

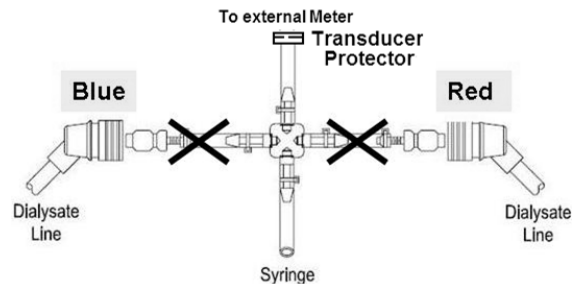
Watch the meter for one (1) minute. Does pressure HOLD +/- 15 mmHg for one (1) minute?

Yes Pressure holds! Proceed to **page 427**, procedure number [FIL- 3.5.0](#).

No Pressure does NOT hold! See procedure number [FIL- 3.3.0X](#) (page 426).

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?

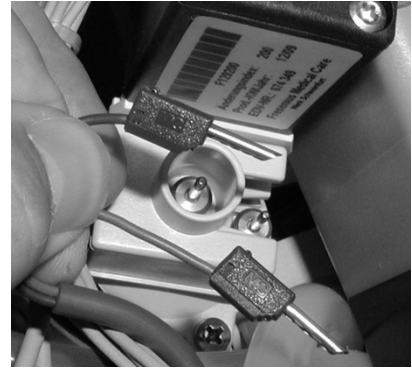


Yes -250 achieved and HOLDS! **IMPORTANT!** Remove BOTH clamps from both Four-Way Dialysate Line segments and proceed to **page 466**, procedure number [TMP- 4.0.0](#)

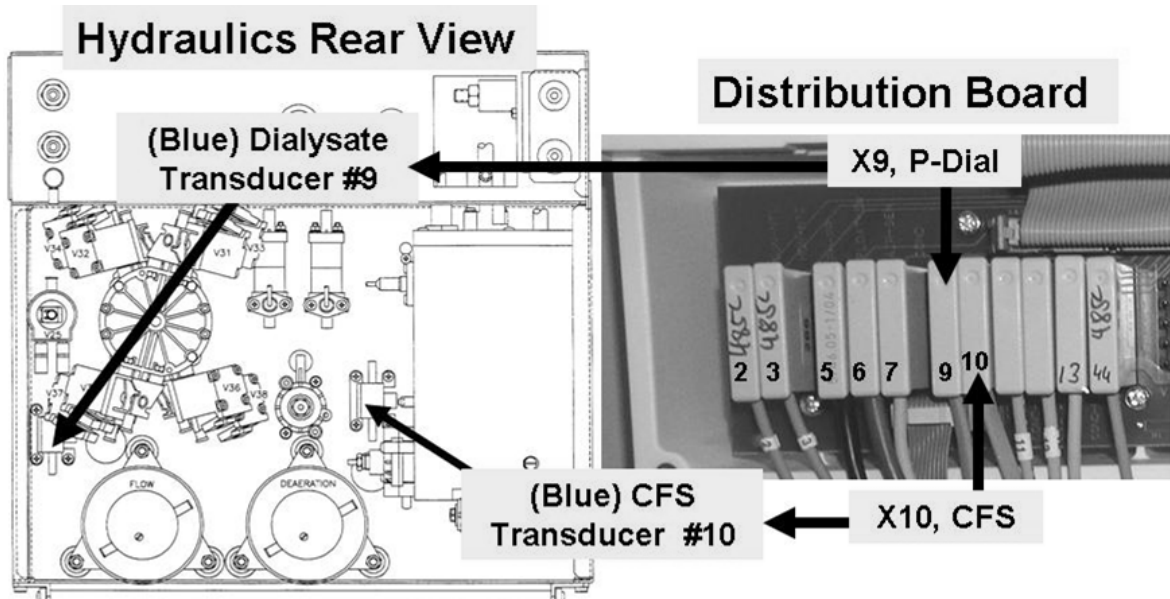
No Either the transducer protector at the meter is wet OR a Four-Way tubing connection is leaking. Locate and repair the problem then return to (ABOVE) procedure number [FIL- 3.0.0](#) (**page 425**).

FIL- 3.5.0 -250 MMHG HELD / ISOLATE VALVE #43 FLOW

- a) **IMPORTANT! Return the dialyzer lines to the shunt and close the door!**
- b) **IMPORTANT! Turn Dialysate Flow on (Flow on/off lamp STOPS blinking)!**
- c) Figure right, separate the Air Sensor Connector's brown and blue wires.
- 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 428).
- 2) **IF less than 600 ml collected:** ENSURING Dialysate Flow was on, perform parts a AND b below:
 - a) Figure below, CAREFULLY trace the wire harness from distribution board positions "X9, P-Dial" AND "X10, CFS" to ENSURE they terminate at the correct Pressure Transducer. **If NOT, this may be the problem!**
 - b) Reconnect the drain then proceed to **page 41**, procedure number [F- 3.1.1](#)



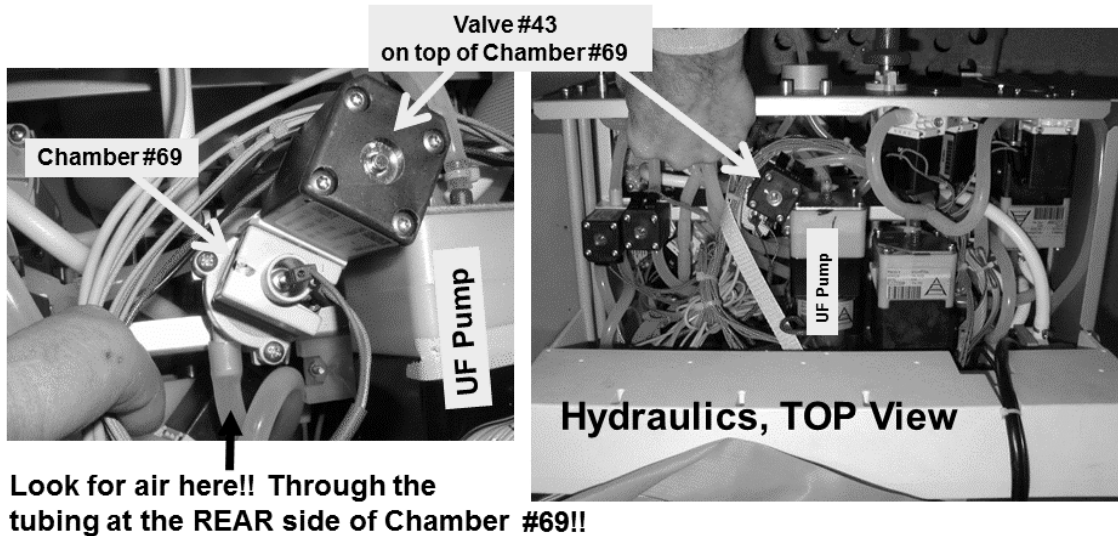
FIL- 3.6.0 600 ML/MIN COLLECTED / VERIFY FILLING PROGRAM

- a) Reconnect the machine's drain tubing to the station drain!
- b) ENSURING Dialysate Flow is on, ENSURE a good drain connection by either 'listening' for drain flow or visually verifying it!
- c) **IMPORTANT! Return the Air Sensor Connector's wires to their probes on top of Chamber #69 i.e. brown on top; blue on bottom!**
- d) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'!
- 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 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 429).
 - 2) **IF FILACT = 0 always:** Proceed to **page 431**, 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 490**, [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 430).
- 2) **IF (and ONLY if) FILACT now REMAINS = 0:** Proceed to **page 431**, 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 527** 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 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 (and ONLY if) FILACT EVER = 1:** See procedure number [FIL- 3.7.0](#) (page 430).
 - 2) **IF FILACT now REMAINS = 0:** Proceed to **page 431**, procedure number [FIL- 4.0.0](#)

FIL- 3.7.0 FILACT = 1 CONSTANT OR INTERMITTENT

READ THIS PROCEDURE before performing it:

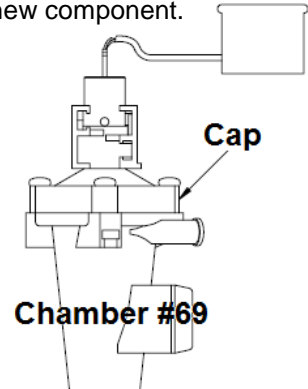
A) **To avoid damage turn the machine OFF!**

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.

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) When it is time 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 **Error! Bookmark not defined.**)).

D) When it is time to swap in Chamber #69's cap BE SURE to attach the Air Sensor's Connector wires to Chamber #69's probes to the new cap.



E) Turn the machine on and return to Dialysis Program ("Select Program → 'Dialysis' → 'CONFIRM').

F) From the Home screen, allow [**Conductivity**] to increase to at least 13.0 mS.

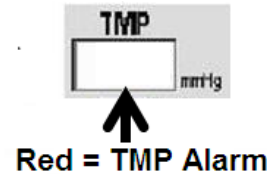
G) Allow thirty (30) seconds BEFORE continuing to part H!

H) Call debug screen 1. Watch **FILACT** for two (2) 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

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 [FIL- 4.0.2](#) (page 431).
- 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) **IMPORTANT!** Allow thirty (30) seconds!
 - 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 431).

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:

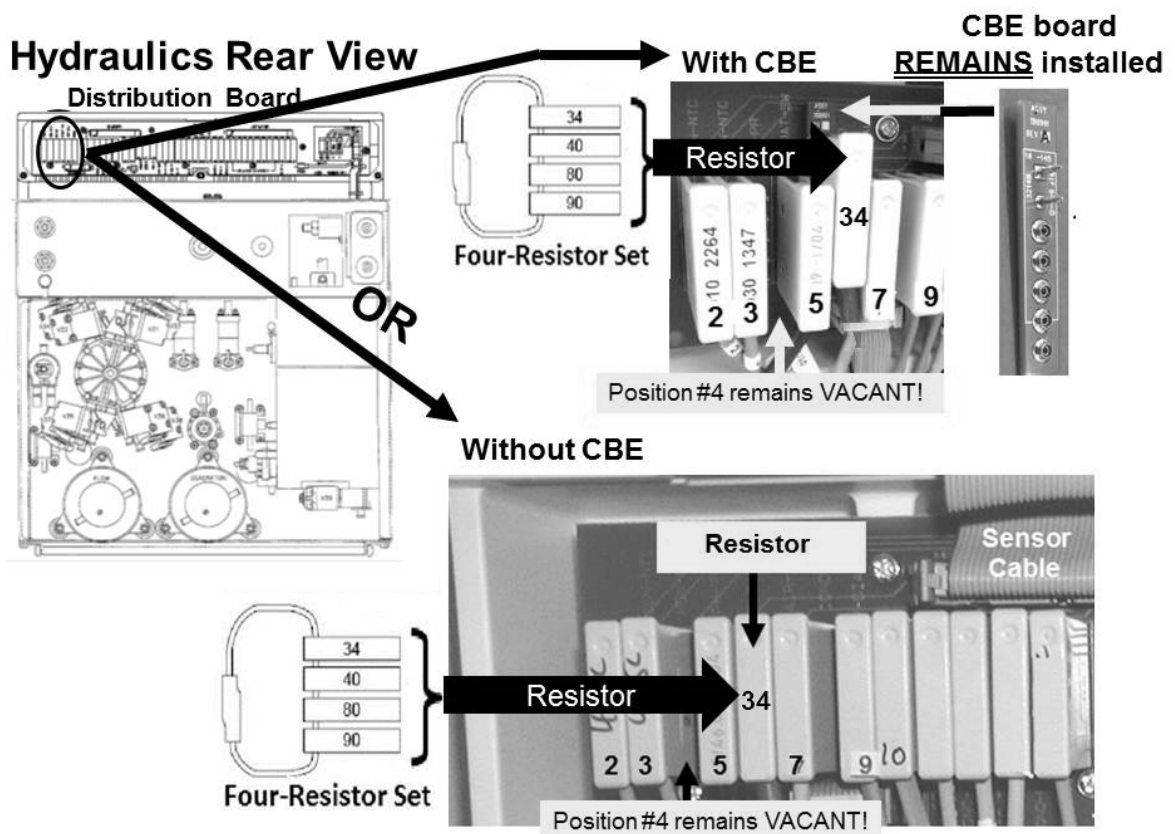
- 1) **IF (and ONLY if) TMP is STABLE**: ASSUMING all procedures were performed correctly (i.e. no air seen at Chamber #69) AND if (and ONLY if) **FILACT** continues to = 1 intermittently, see (ABOVE) procedure number [FIL- 3.7.0](#) (page 430).
- 2) **IF TMP is UNSTABLE**: See parts a THROUGH c below:
 - 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. Perform parts a and b below
 - b) Before continuing to part b, proceed to **page 527**, to perform [SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS](#).
 - c) If balancing chamber valve leak was NOT located in part a, proceed to **page 440**, [SECTION 9- TMP \(PRESSURE\) PROBLEMS](#)

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FIL- 5.0.0 AIR SEEN AT CHAMBER #69

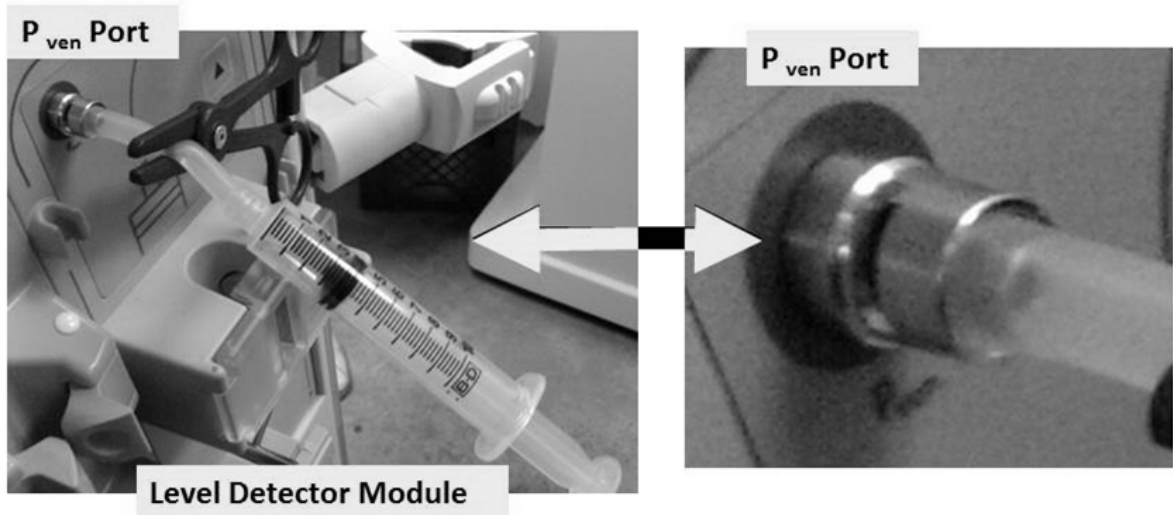
Call debug screen 1. Look at **FILACT** (middle column). TWO (2) possible scenarios:

- 1) **IF (and ONLY if) FILACT = 0:** See procedure number [FIL- 5.1.0](#) (page 433).
- 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 the plug is placed correctly **FILACT** eventually = 0 ALWAYS!
 - c) See procedure number [FIL- 5.1.0](#) (page 433).

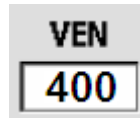


FIL- 5.1.0 FILACT = 0 / ISOLATE VENOUS PRESSURE (VEN)

- a) **Turn Dialysate Flow OFF i.e. Flow on/off lamp blinks!**
- b) Call debug screen 0. ENSURE all eight balancing chamber valves (#31 through #38) 'dots' are REMAINING white (Flow is Off)!
- c) **IMPORTANT! Dialysate Flow REMAINS OFF till instructed!**
- 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.



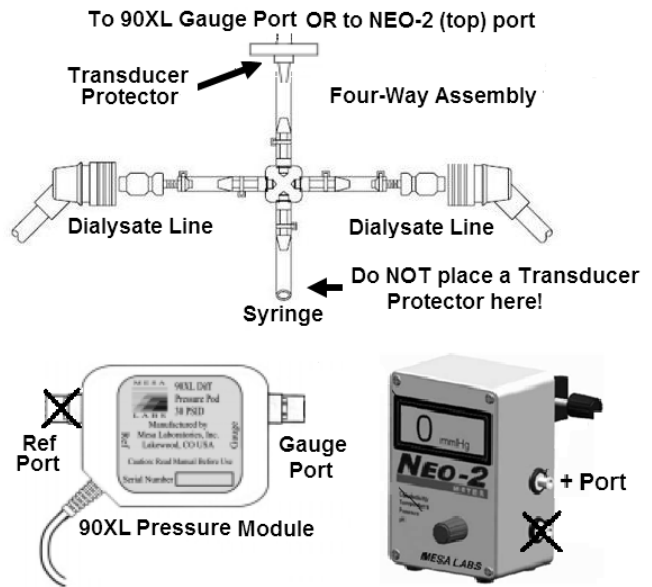
- e) Call debug screen 1. Push on the syringe plunger until **VEN** (middle column) is between 400 and 450.
- f) Clamp the syringe tubing to HOLD the pressure!
- g) If **VEN** falls more than 3 mmHg in 30 seconds there is a leak at the P_{ven} port OR inside the module.
- h) Leaving the clamp in place to keep **VEN** at more than 400, see procedure number [FIL- 5.2.0](#) (page 434).



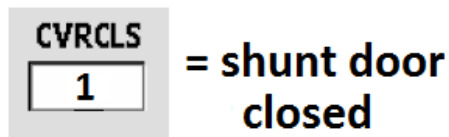
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FIL- 5.2.0 VEN MORE THAN 400

- a) Figure right, connect the Four-Way Assembly (P/N 150034) to the dialyzer connectors.
- b) Place the Four-Way at dialyzer level!
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 in the Four-Way tubing segments!
- e) **IMPORTANT! 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 approximately negative (-)250 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 434).
 - No ENSURE the transducer protector, at the meter, is not wet OR consider replacing it. If OKAY, proceed to **page 435**, procedure number [FIL- 5.4.0](#).

FIL- 5.3.0 -250 ACHIEVED / PRESSURE TEST HYDRAULICS (2)

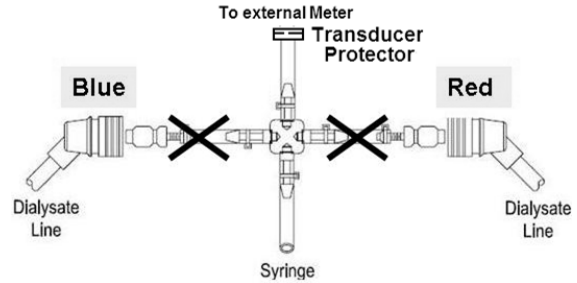
Watch for one (1) FULL minute. Does pressure HOLD +/- 15 mmHg?

- Yes Pressure holds! Proceed to **page 436**, procedure number [FIL- 5.5.0](#).
- No Pressure DOES NOT hold! See procedure number [FIL- 5.4.0](#) (page 435).

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 the Four-Way Dialyzer Line segments and, leaving Dialysate Flow OFF, proceed to **page 466**, 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!

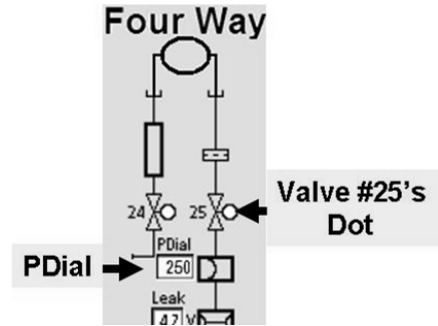
A) Locate and repair the leak.

B) Return to (ABOVE) procedure number [FIL- 5.2.0](#) (**page 434**).

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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 433).
- 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 439**, 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 437).

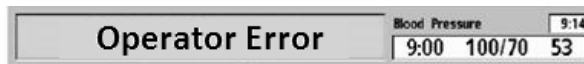
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FIL- 6.0.0 PDIAL DOES NOT AGREE WITH THE METER

- a) To prevent wetting the meter's transducer protector clamp the 'to meter' tubing segment!
- b) Turn Dialysate Flow ON (Dialysate Flow on/off lamp STOPS blinking).
- c) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'CONFIRM'.
- d) Enter Service Mode → Calibrate Sensors → Dialysate Pressure. The screen says "**1. Connect a pressure gauge in line...**". The "gauge" (meter) is ALREADY connected!
- e) ENSURE the external flow indicator's 'bob' is moving up and down.
- f) Press 'CONFIRM'. The screen says "**3. Press the [Dialysate Flow on/off] key...**".
- g) Press the Dialysate Flow on/off key (the Flow on/off lamp blinks).
- h) ENSURE the external flow indicator's 'bob' is NOT moving (i.e. Flow is off).
- i) **IMPORTANT!** Remove the clamp from the external meter's tubing segment!
- j) Using the syringe, adjust pressure until the external meter reads 0 +/- 2 mmHg.
- k) See procedure number [FIL- 6.1.0](#) (page 437).

FIL- 6.1.0 CREATE NEGATIVE PRESSURE

- a) Press 'CONFIRM'. The screen now says "**6. Pressurize until dialysate pressure reads -250 mmHg...**".
- b) PULL on the syringe plunger to achieve negative (-)250 +/- 5 mmHg on the external meter.
- c) Clamp the Four-Way's syringe tubing to keep this pressure!
- d) ENSURING the external meter = -250 +/- 5 mmHg, press 'CONFIRM'.
- e) 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 [FIL 6.2.0](#) (page 438).
- 2) **IF "Operator Error" DID NOT occur!** See parts a AND b below:
 - a) Press 'CONFIRM' twice to save the calibration.
 - b) Proceed to **page 439**, 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 Dialyzer 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’ → ‘CONFIRM’)!
- e) **IMPORTANT!** From the Home screen, select the [Dialysate Flow] window.
- f) Set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- g) **Read before performing!** Return to (ABOVE) procedure number [FIL- 6.0.0 \(page 437\)](#) but, if (and ONLY if) “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 \(page 437\)](#) 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 19).

^b To prevent “Cond Offset Failure” place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

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FIL- 7.0.0 ISOLATE AIR LEAK

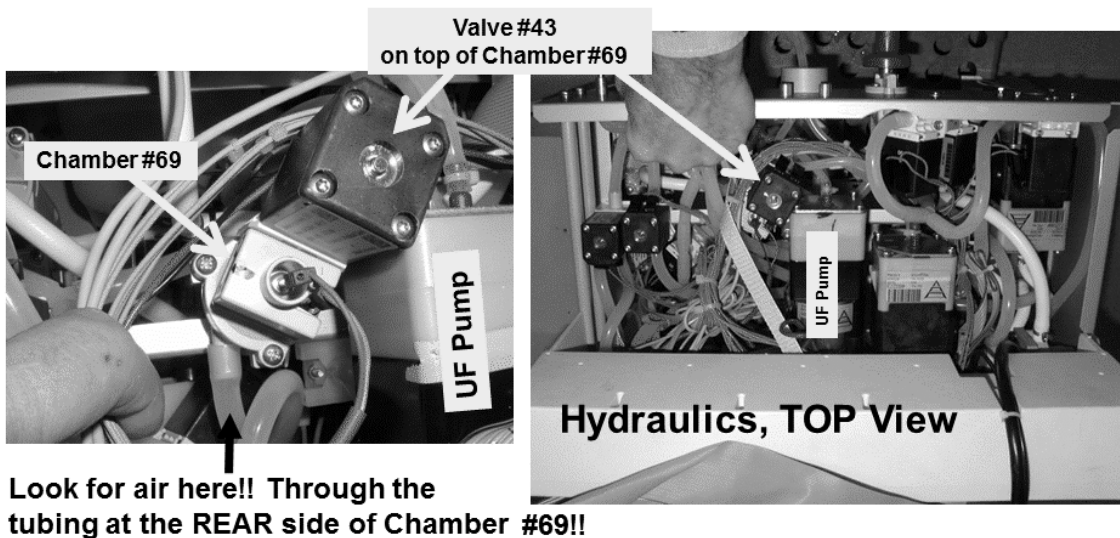
- a) Remove the Four-Way.
- b) **IMPORTANT! Return the Dialyzer lines to the shunt door!**
- c) Turn the machine OFF!
- d) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- e) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'.
- 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 490**, [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:

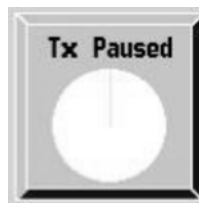
1) **IF (and ONLY if) FILACT EVER = 1:** Return to ABOVE procedure number [FIL- 2.1.0 \(page 421\)](#).

2) IF **FILACT ALWAYS = 0:** Problem solved!



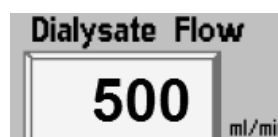
SECTION 9 - TMP (PRESSURE) PROBLEMS

- A) If the drain tubing is transparent, look through its ENTIRE length for possible 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 (Flow on/off lamp NOT blinking) 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) Select the [Dialysate Flow] window!



H) Set [Dialysate Flow] to 500 ml/min and press 'CONFIRM'.

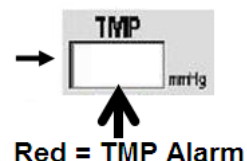
I) **DO NOT reset alarms!**

J) Is the external flow indicator's 'bob' moving at least ¼ up the sight tube?

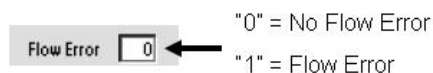
Yes 'Bob' moving! See procedure number [TMP- 1.0.0](#) (page 442).

No a) **OPEN THE SHUNT DOOR AND LEAVE IT OPEN UNTIL 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) possible scenarios:



1) **IF (and ONLY if) Flow Error ALWAYS = 0!** See part L!

2) **IF Flow Error EVER = 1 even if only once:** Proceed to **page 20, [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 every minute!

M) At the bottom of the screen, select the 'Dialysate' tab!

Parts N through U next page

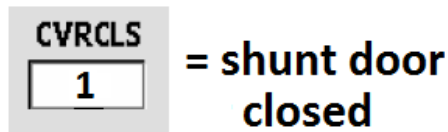
N) Figure right, if necessary adjust the Conductivity Limits until the 'Actual' Conductivity is CENTERED between them.

O) **IMPORTANT!** Press 'CONFIRM'.

P) Allow up to three (3) minutes for the Conductivity window to turn white indicating no Conductivity alarms!

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

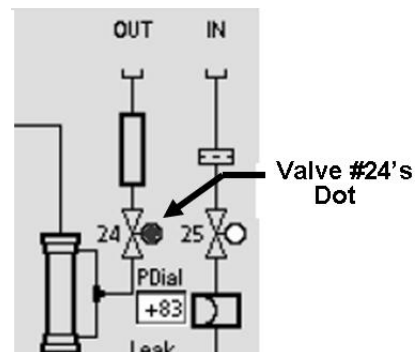
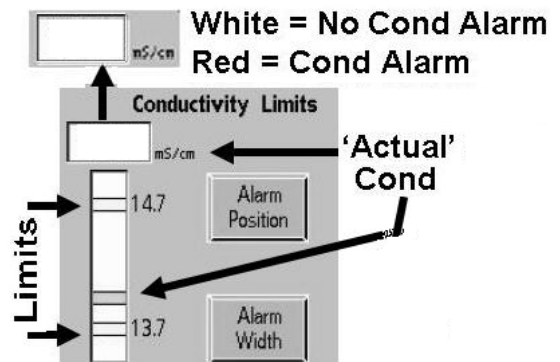
R) Call debug screen 2. To ENSURE the shunt door is indicated closed **CVRCLS** (2nd column from left) = 1!



S) Call debug screen 0.

T) Allow Valve #24's 'dot' (Figure right) to turn blue BEFORE CONTINUING to part U indicating no Temp or Cond alarms!

U) Is the flow indicator's 'bob' move at least ¼ way up in the sight tube?



Yes 'Bob' moving! See procedure number [TMP- 1.0.0](#) (page 442).

No 'Bob' NOT moving! See parts a THROUGH c below:

- a) From the Home screen, ENSURE [Dialysate Flow] remains at 500 ml/min!
- b) From debug screen 0. ENSURE Valve #24's 'dot' is **REMAINING** BLUE!
- c) Is the external flow indicator's 'bob' rising and falling now?

Yes 'Bob' moving! See procedure number [TMP- 1.0.0](#) (page 442).

No 'Bob' NOT moving! ENSURE Valve #24's 'dot' is REMAINING BLUE! If (and ONLY if) 'bob' is still not moving, proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#).

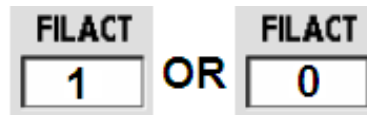
TMP- 1.0.0 'BOB MOVING' / ISOLATE POSSIBLE AIR LEAK

- 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!

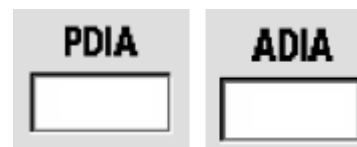
CHECK #2: ENSURE the external flow indicator's (sight tube) fittings are tight!

- b) Call debug screen 1. WITHOUT LOOKING AWAY, watch **FILACT** (middle column) for two (2) minutes OR until 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 410**, 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 should be REMAINING between 2.0 and 7.5. TWO (2) possible scenarios:



- 1) IF (and ONLY if) **PDIA AND ADIA are REMAINING between 2.0 and 7.5**: Proceed to **page 444**, procedure number [TMP- 1.0.4](#).
- 2) IF **PDIA AND/OR ADIA is IS NOT remaining between 2.0 and 7.5**: See parts a THROUGH e below:
- Momentarily plug the acid concentrate into its rinse port to call "Select Program"!
 - Return the connector to acid concentrate!
 - Select the screen's 'Dialysis' button but **DO NOT press 'CONFIRM' till instructed!**
 - Call debug screen 0. If parts a through c were performed correctly the TOP balancing chamber valves, #31 through #34, 'dots' REMAIN BLUE!
 - Call debug screen 4 to watch **PDIA** (left column) AND **ADIA** (right column) for one (1) minute. TWO (2) possible scenarios:
 - IF (and ONLY if) **PDIA AND ADIA remaining between 3.0 and 6.0 AND DOES NOT change more than 0.1 i.e. stable**: See procedure number [TMP- 1.0.2](#) (page 443).
 - IF **PDIA AND/OR ADIA is IS NOT between 3.0 and 6.0 OR one or both IS NOT stable**: See parts a AND b below:
 - Remove the RED DIALYZER connector from the shunt door and **HOLD** it as seen in the Figure right!



Part b next page

PDIA OR ADIA is **IS NOT** between 3.0 and 6.0 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;

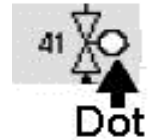
↑ **B)** Turn the machine OFF; **C)** Proceed to **page 527**, [SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS](#).
↓

No continuous 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) Watch Valve #41's 'dot' (Figure right) for one (1) minute. It should stay white! TWO (2) possible scenarios:



1) **IF (and ONLY if) Valve #41's 'dot' REMAINS white!**
Proceed to **page 462**, procedure number [TMP- 3.0.0](#).

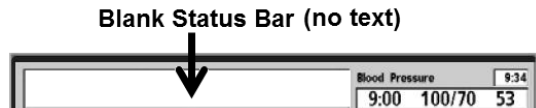
2) **IF Valve #41's 'dot' cycles between white and blue: A)** Turn the machine OFF! **B)** Proceed to **page 527**, [SECTION 18A – DIAGNOSTIC VALVE LEAK TESTS](#).

TMP- 1.0.2 PDIA AND ADIA STABLE BETWEEN 3.0 AND 6.0

a) **IMPORTANT!** At the bottom of the screen, select the 'Dialysate' tab.

b) Press 'CONFIRM'.

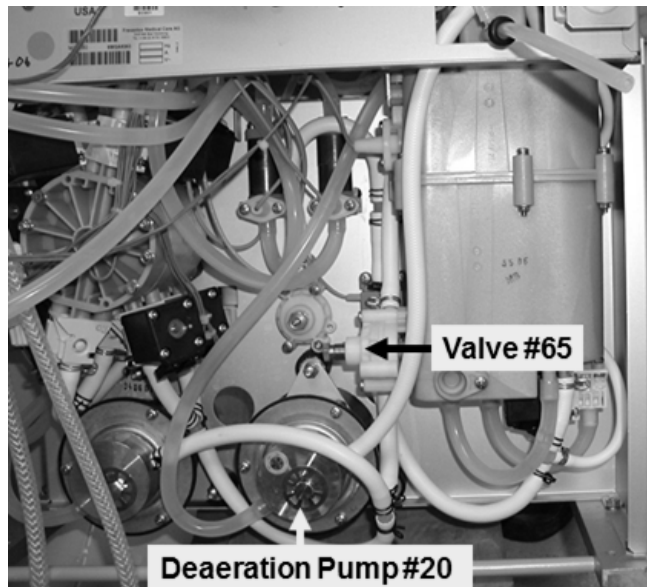
c) Figure right, if (and ONLY if) the screen's 'status' bar is NOT BLANK see procedure number [TMP- 1.0.4](#) (page 444). If BLANK repeat parts a and b!



LEFT BLANK INTENTIONALLY

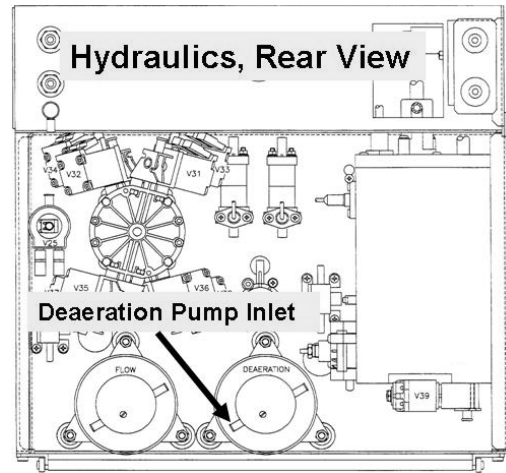
TMP- 1.0.4 ISOLATE LOADING PRESSURE

- 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. *OR 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):
 - 1) **IF (and ONLY if) pressure REMAINS 'OKAY'**: See procedure number [TMP- 1.0.5](#) (page 445).
 - 2) **IF (and ONLY if) peaking to MORE THAN 26 psi**: Turn Valve #65's nut (Figure below) counterclockwise (outward). If pressure CAN be adjusted to between 23 and 26 psi, see procedure number [TMP- 1.0.5](#) (page 445). If (and ONLY if) it CANNOT Valve #65 may be bad.
 - 3) **IF (and ONLY if) pressure is NEVER less than 11 psi AND peaks to between 18 and 22**: Adjust Valve #65's nut (Figure below). Clockwise increases pressure! If PEAK pressure CAN be adjusted to between 23 and 25 psi proceed to **page 446**, procedure number [TMP- 2.0.0](#). If (and ONLY if) it CANNOT proceed to **page 27**, procedure number [F- 1.0.8](#).
 - 4) **ALL other scenarios**: ENSURING the gauge was SLAMMED into the Rinse Port proceed to **page 27**, procedure number [F- 1.0.8](#).



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) **IMPORTANT! Turn the water on and allow the “No Water” alarm to go away!**
- f) Is Deaeration Pressure OKAY? Refer to [Appendix A](#) (page 667) for what pressure should be.



Yes Deaeration pressure OKAY! See procedure number [TMP- 2.0.0](#) (page 446).

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 498**, [SECTION 13 - DEAERATION PROBLEMS](#).

LEFT BLANK INTENTIONALLY

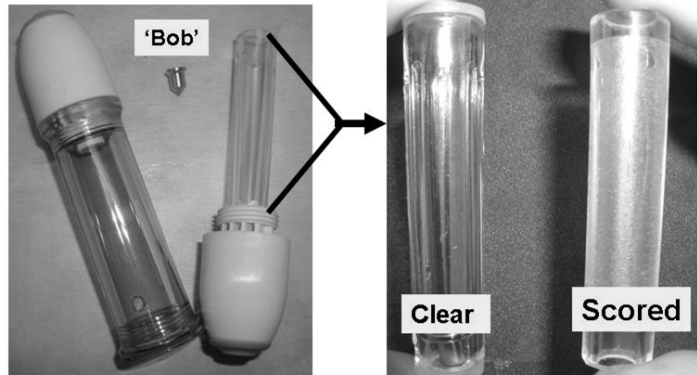
TMP- 2.0.0 DEAERATION PRESSURE OKAY

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) **IMPORTANT! 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! From here forward, ENSURE a "No Water" alarm does not occur!**

i) Unless as external leak is immediate allow ninety (90) seconds minute BEFORE continuing to procedure number [TMP- 2.0.1](#) (page 447).

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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!

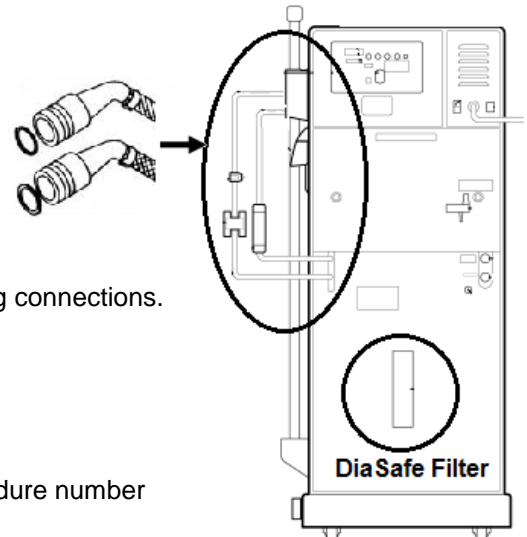
NOTE: Not being THROUGH may cost unnecessary troubleshooting time!

a) THREE (3) leak checks:

CHECK #1: Figure right, the ENTIRE length of the dialyzer lines ESPECIALLY the quick connectors!

CHECK #2: The ENTIRE hydraulic compartment!

CHECK #3: Figure right, DiaSafe® filter housing and tubing connections.



b) Figure below, any leak seen through Diasafe® Filter #92*?

* Water staying inside the filter is NORMAL!

Yes Valve #28 is leaking! Proceed to **page 473**, procedure number [TMP- 9.0.0](#).

No leaks seen! See procedure number [TMP- 2.0.2](#) (page 448)!

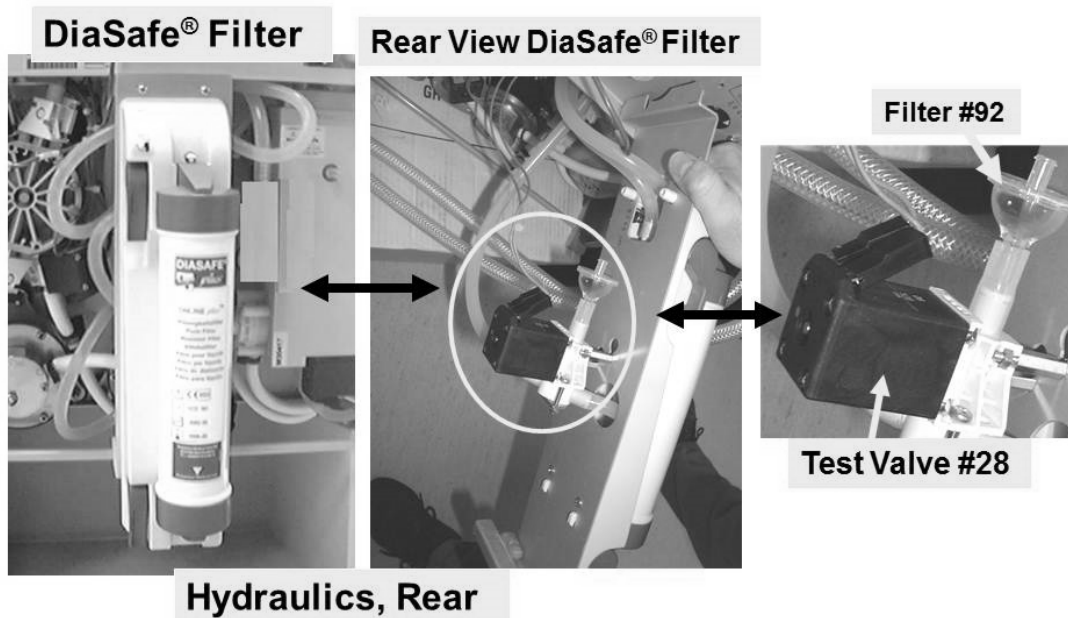


Figure 68 – DiaSafe® Filter / Test Valve #28 / Filter #92

TMP- 2.0.2 POSITIVE PRESSURE LEAK TEST CONTINUED

- a) Figure below, **THOROUGHLY ENSURE** no leaks at the UF, Acid and Bicarbonate (Bic) Pumps including their input and output tubing!
- b) See procedure number [TMP- 2.0.3](#) (page 449).

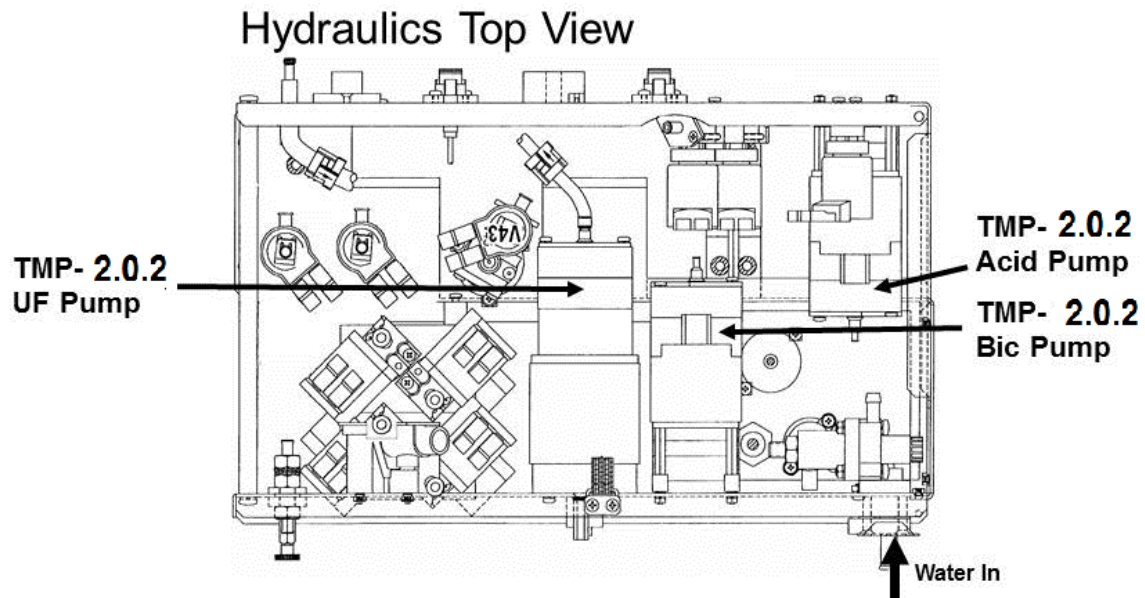
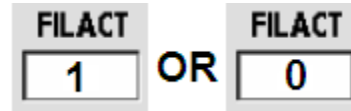


Figure 69 – Hydraulics Top View, Pumps

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TMP- 2.0.3 NO EXTERNAL PUMP LEAKS / ISOLATE FILLING PROGRAM (FILACT)

- a) Return the concentrate connectors to acid and bicarb.
- b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- c) Call debug screen 1. Is **FILACT** (middle column) = 1?

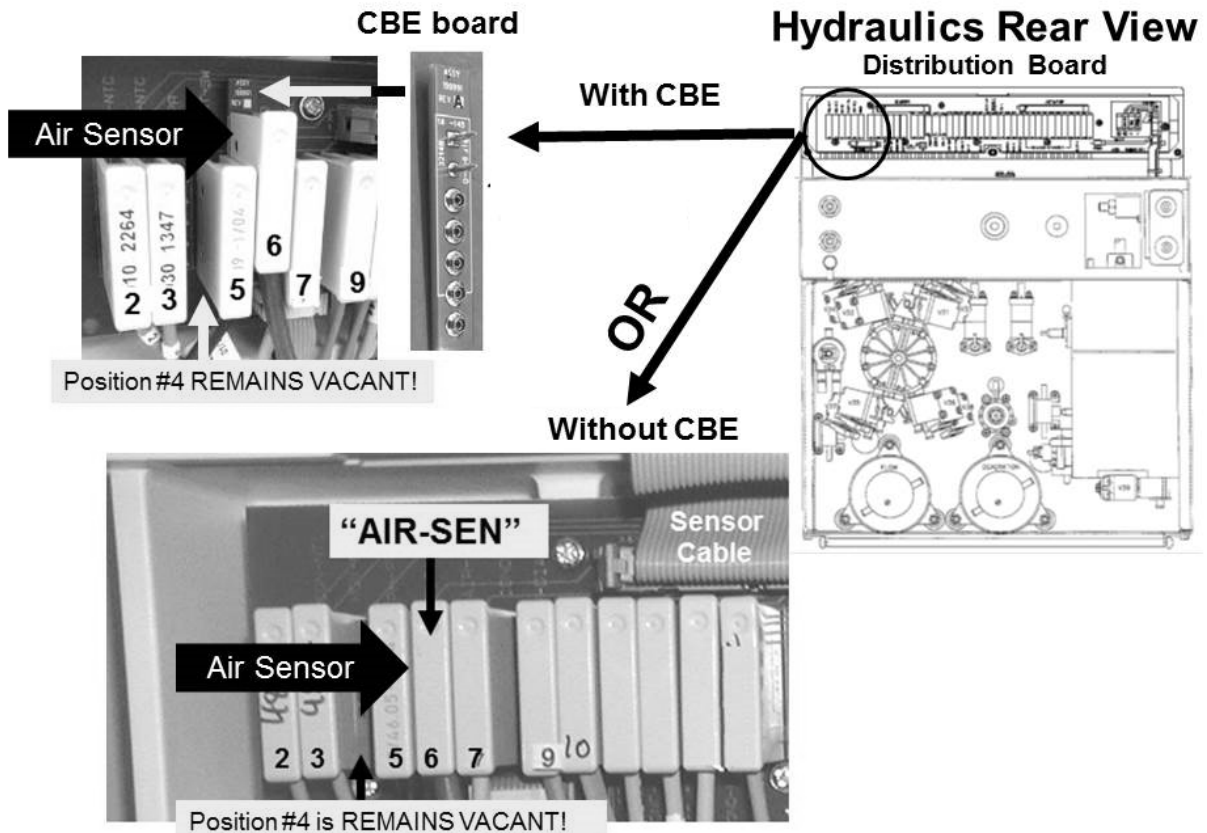


Yes **FILACT** = 1! Proceed to **page 452**, procedure number [TMP- 2.0.5](#).

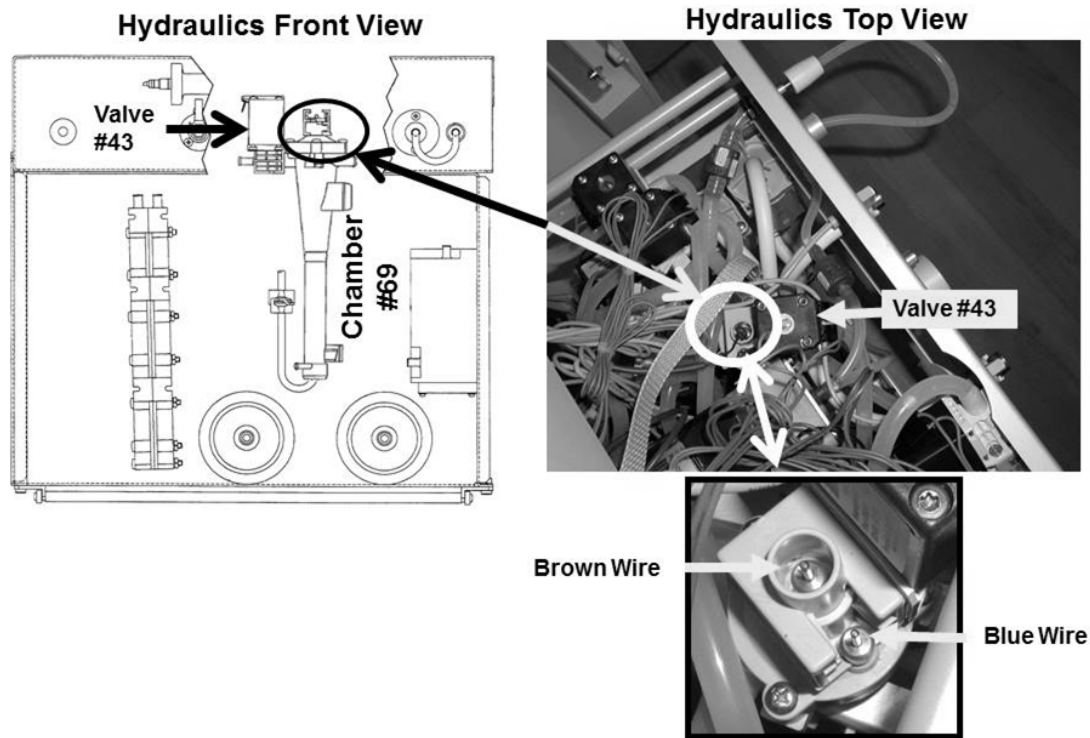
No **FILACT** = 0! See parts a THROUGH d below:

- a) **FIGURE BELOW**, inside the distribution, unplug the Air Sensor’s female Connector i.e. **4th CONNECTOR, 5th position from the left.** **NOTE:** If the machine is CBE equipped the CBE board plugs into the distribution board and Connector plugs into the CBE board which positions it higher than the other connectors.
- b) **Leave the Air Sensor’s Connector unplugged till instructed!**

Parts c and d next page



- c) Figure below, ENSURE the Air Sensor Connectors wires terminates with the brown wire to the TOP male probe on top of Chamber #69 AND the blue wire to the bottom probe!



- d) **IMPORTANT!** Allow up to three (3) FULL minutes for **FILACT** to = 1. Does **FILACT** go to 1?

Yes **FILACT** = 1! Perform part A and B below:

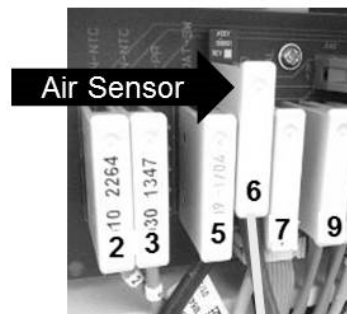


A) IMPORTANT! Return the Air Sensor's female connector PROPERLY to its distribution board position! If CBE equipped, using a flashlight, ENSURE the top CBE board pin is covered by the connector.

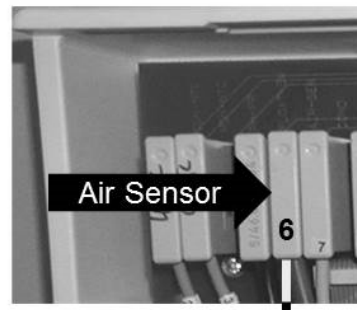
B) Proceed to **page 452**, procedure number [TMP- 2.0.5](#)

No **FILACT** remains = 0! **NOT LIKELY!** ENSURE the Air Sensor's distribution board position is COMPLETELY VACANT! After three (3) minutes, if (and ONLY if) **FILACT** remains = 0 see procedure number [TMP- 2.0.4](#) (page 451).

With CBE

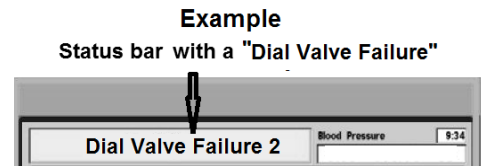


Without CBE



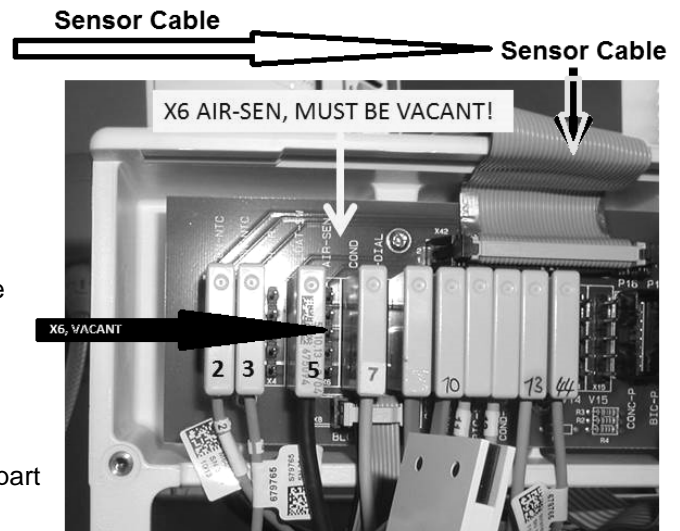
TMP- 2.0.4 FILACT REMAINING = 0

- 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 652, Section 26**



- b) **IMPORTANT! Turn the machine OFF to prevent damage!**

- c) **Figure right**, at the TOP of the distribution board, ENSURE the Sensor ribbon cable is plugged in SECURELY.



- d) **Figure right**, the Air Sensors's position (5th position from the left) MUST BE VACANT!
- e) Leaving the position VACANT, turn the machine on.
- f) Return to Dialysis Program (“Select Program → ‘Dialysis’ → ‘Enter’”)
- g) Allow three (3) minutes BEFORE continuing to part h!

- h) Call debug screen 1 to see **FILACT**. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) FILACT now = 1: A) IMPORTANT!** Return the female Air Sensor PROPERLY to its distribution board position; **B)** See procedure number [TMP- 2.0.5](#) (page 452).

- 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 6)!
- b) Leaving the Air Sensor's female connector unplugged until **FILACT = 1**, FIVE (5) possible bad components: **1)** CBE board; **2)** Sensor Board^a; **3)** Functional Board^b; **4)** Distribution board; **5)** Motherboard.

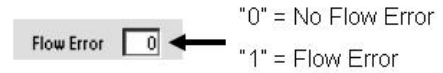
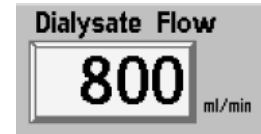
- ^a **A)** Swap in a known good Sensor Board (see [Figure 4A](#), page 9): **B)** Place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**); **C) IMPORTANT!** Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’); **D)** From debug screen 1. if **FILACT = 1** now the previous Sensor Board is bad.

- ^b **A)** Swap in a known good Functional Board (see [Figure 4A](#), page 9) then: **B)** Place the new Functional Board into **T and C Mode**; **C)** 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:

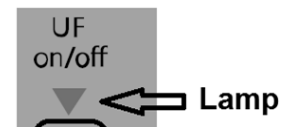
- a) **IMPORTANT!** From the Home screen, select the [Dialysate Flow] window!
- b) Set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'!
- c) Call debug screen 0. **WITHOUT LOOKING AWAY**, watch **Flow Error** for four (4) minutes. It should NEVER = 1! TWO (2) possible scenarios:



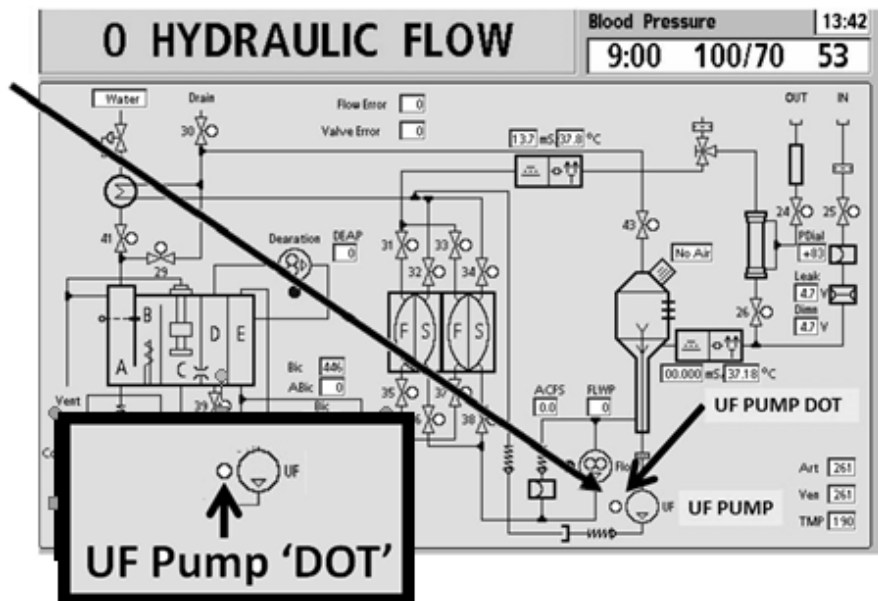
- 1) **IF (and ONLY if) Flow Error EVER = 1 , even if only once:** Proceed to **page 20, SECTION 1, FLOW ERRORS IN DIALYSIS PROGRAM.**
- 2) **IF Flow Error ALWAYS = 0!** See parts a THROUGH e below
 - a) From the Home screen, allow [**Conductivity**] to stabilize between 13.0 and 14.5 mS!
 - b) **IMPORTANT! Open the shunt door and LEAVE IT OPEN till instructed!**
 - c) **Install a 'dummy venous chamber' in the Level Detector module!**
 - d) Call debug screen 1. Allow **FILACT** = 0 ALWAYS. If **FILACT DOES NOT** = 0, after two (2) minutes, most likely, the female Air Sensor connector is NOT plugged in PROPERLY!
 - e) **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. If ANY alarm reoccurs attempt RESET up to twice more BEFORE continuing to procedure number **TMP- 2.0.6** (page 452).

TMP- 2.0.6 ISOLATE UF PUMP CONTROL / UF PUMP LEAK

- a) 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 MUST REMAIN white! Does it EVER 'blink' to blue (Yes or No)?



Yes The UF 'dot' blinks blue! If SURE the green UF lamp was OFF, the Actuator-Test Board may be bad!

No The 'dot' REMAINS white! **Per Figure 70 below**, remove the UF Pump's output (TOP) tubing! 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 453).
- 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.

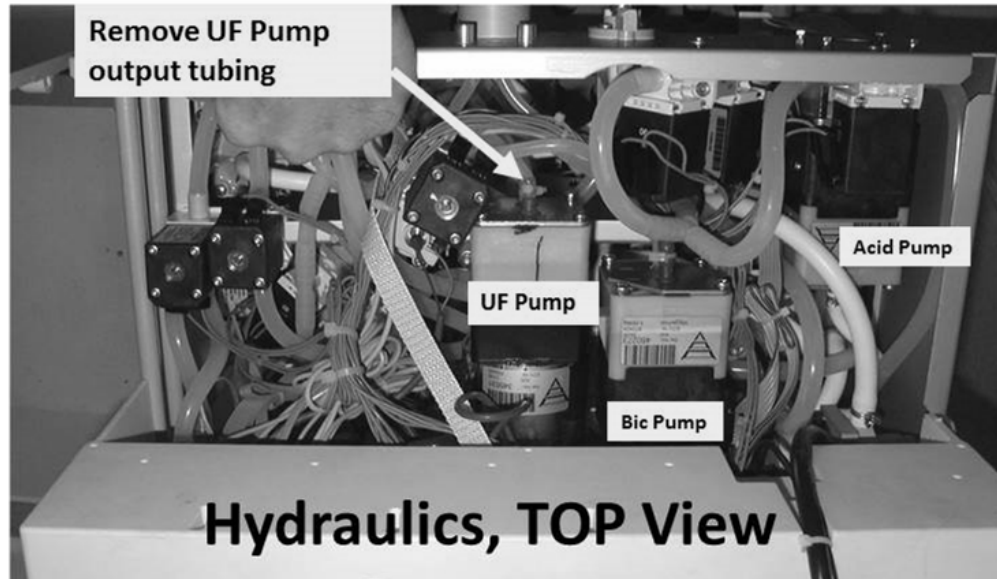
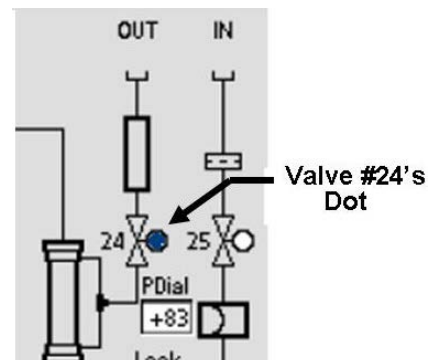


Figure 70 – UF Pump OUTPUT

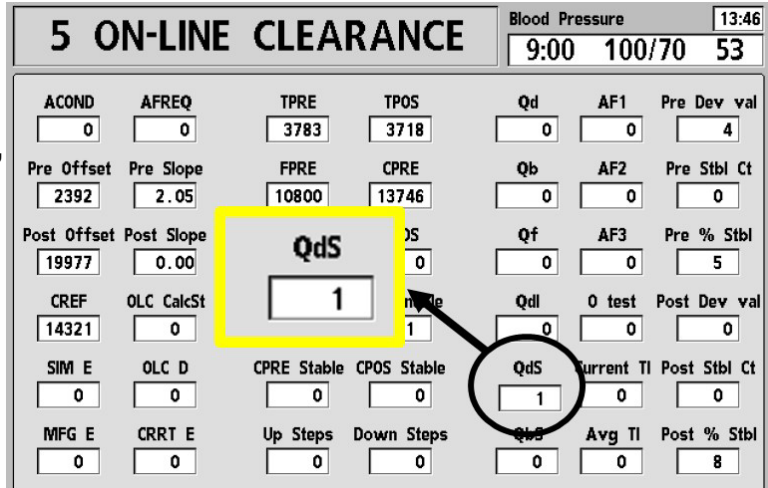
TMP- 2.0.7 NO UF PUMP LEAKS

- a) **IMPORTANT!** Remove the 'dummy chamber' from the Level Detector module!
- b) **IMPORTANT!** CLOSE the shunt door!
- c) From debug screen 0, Figure right, allow Valve #24's 'dot' to REMAIN BLUE i.e. normal AND stable Temp, Cond AND shunt door closed!
- d) The external flow indicator's 'bob' MUST be moving up and down!
- 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 454).



TMP- 2.0.8 ISOLATE ACCURATE DIALYSATE FLOW

- a) **IMPORTANT!** Press the “1” key for five (5) seconds.
- b) **Allow forty five (45) seconds, BEFORE continuing to part c!**
- c) Call debug screen 5. **QdS** (Figure right) REMAINS = 1 if dialysate flow is stable.
- d) Watch **QdS** for two (2) minutes OR until if it EVER = 0. TWO (2) possible scenarios?



- 1) **IF (and ONLY if) QdS REMAINS = 1:** See procedure number [TMP- 2.0.9](#) (page 454).
- 2) **IF QdS EVER = 0!** See parts a AND b below:

- a) Press the “1” key for five (5) seconds THEN allow forty five (45) FULL seconds before continuing to part b!
- b) Return to debug screen 5. Does **QdS** NOW REMAIN = 1?

Yes **QdS** REMAINNS = 1! See procedure number [TMP- 2.0.9](#) (page 454).

No **QdS** goes to 0 at least once! Call debug screen 0 to watch **Flow Error** for three (3) FULL minutes. If it EVER = 1 proceed to **page 20, SECTION 1- FLOW ERRORS IN DIALYSIS PROGRAM**. If NEVER = 1 a restriction is indicated. Try replacing the DiaSafe® filter, rinse the machine for five minutes, then return to (ABOVE) procedure number [TMP- 2.0.5](#) (page 452). 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 TMP window white! Proceed to **page 456**, procedure number [TMP- 2.0.16](#).

No TMP window RED! See parts a AND b below:

- a) Attempt the 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 (and ONLY if) WHITE:** Proceed to **page 456**, procedure number [TMP- 2.0.16](#).
- 2) **IF RED:** See procedure number [TMP- 2.0.10](#) (page 455).

TMP- 2.0.10 TMP WINDOW RED

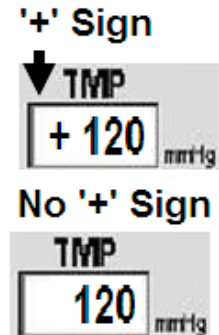
a) TMP is UNSTABLE if ANY one or more of the three (3) conditions below occur:

Condition #1: Figure right, if a positive ('+') sign* appears in the TMP window.

* 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 456**, procedure number [TMP- 2.0.16](#).

No **TMP** is STABLE! i.e. no '+' sign AND TMP is between 0 and 450 AND is NOT changing more than 40. See procedure number [TMP- 2.0.11](#) (page 455).

TMP- 2.0.11 TMP WINDOW IS RED BUT TMP IS STABLE

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

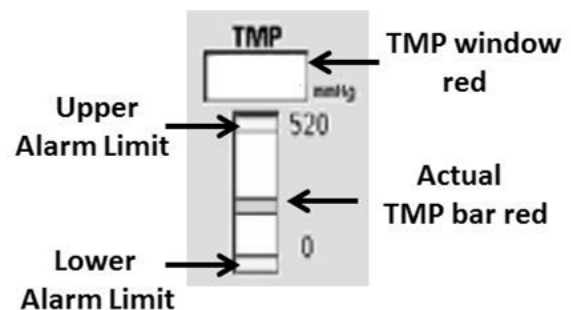
b) Allow thirty (30) seconds. What color is the TMP window now? TWO (2) possible scenarios:

- 1) **IF (and ONLY if) WHITE:** See procedure number [TMP- 2.0.16](#) (page 456).
- 2) **IF remaining 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 Board¹ OR; 3) Functional Board¹ OR; 4) Motherboard.**

¹ To prevent "Cond Offset Failure" place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**)).

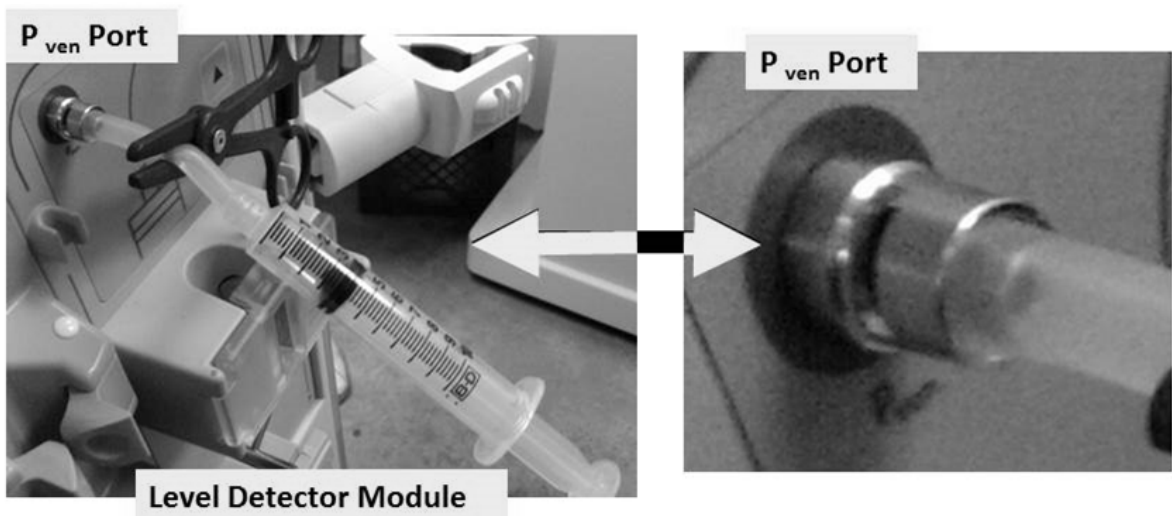
TMP- 2.0.16 ISOLATE TMP

- a) **Turn Dialysate Flow OFF i.e. Flow on/off lamp blinks!**
- b) Call debug screen 0. If (and ONLY if) ALL EIGHT (8) Balancing Chamber Valve 'dots' (#31 - #38) are REMAINING WHITE i.e. Dialysate Flow is OFF see part d! NOTE: If the Balancing Chamber Valves are NOT remaining white allow debug screen 1's **FILACT** = 0 then they will!
- c) **Leaving Flow OFF till instructed** see procedure number [TMP- 2.0.17](#) (page 456).

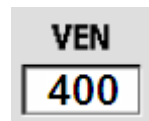
TMP- 2.0.17 ISOLATE VENOUS PRESSURE

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.

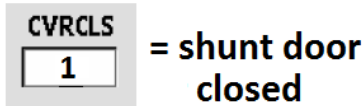
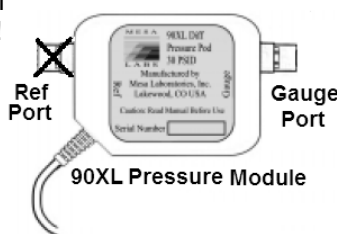
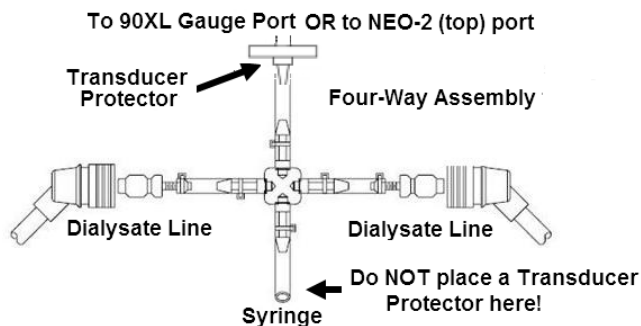


- b) Call debug screen 1. Push on the syringe plunger until **VEN** (middle column) is between 400 and 450.
- c) Clamp the syringe tubing to HOLD the pressure!
- d) If **VEN** falls more than 3 mmHg in thirty (30) seconds there is a leak at the P_{ven} port OR inside the module.
- e) Leaving the clamp in place to keep **VEN** more than 450 see procedure number [TMP- 2.2.5](#) (page 457).



TMP- 2.2.5 ACHIEVE NEGATIVE PRESSURE

- a) Figure right, connect the Four-Way Assembly (P/N 150034) to the dialyzer connectors.
- b) Place the Four-Way at dialyzer level!
- c) ENSURE a transducer protector IS NOT in the 'to syringe' tubing segment!
- 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 in the Four-Way tubing segments!
- f) **IMPORTANT! 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 negative (-) 250 +/- 5 mmHg on the meter?



Yes -250 achieved! Clamp the 'to syringe' tubing segment to keep the pressure then see procedure number [TMP- 2.2.6](#) (page 457).

No CANNOT achieve -250 on the meter! ENSURE the transducer protector, at the meter, is not wet OR consider replacing it! If OKAY, see procedure number [TMP- 2.2.7X](#) (page 457).

TMP- 2.2.6 NEGATIVE (-)250 ACHIEVED / NEGATIVE PRESSURE HOLDING TEST

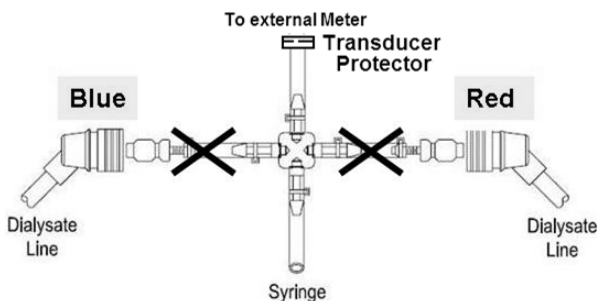
Does -250 HOLD, +/- 15 mmHg, for one (1) minute?

Yes -250 HOLDS! Proceed to **page 459**, procedure number [TMP- 2.2.8](#).

No -250 does NOT hold! See procedure number [TMP- 2.2.7X](#) (page 457).

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 negative (-)250 mmHg AND does it HOLD (+/- 15 mmHg) for one (1) minute now?

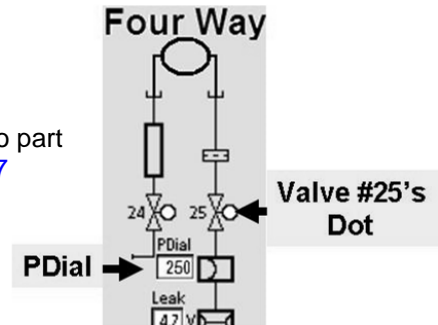


- Yes -250 mmHg holds! **A) IMPORTANT!** Remove the clamps from both Four-Way tubing segments then; **B)** Leaving [Dialysate Flow] off, proceed to **page 466**, procedure number [TMP- 4.0.0](#).
- No -250 could not be achieved or did NOT hold! Either the transducer protector is wet OR a Four-Way assembly 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 456).

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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 \(page 456\)](#).
- 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:** See procedure number [TMP- 2.3.0](#) (page 459).
- 2) **IF PDial DOES NOT agree with the external meter within +/- 35:** Proceed to **page 470**, 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 459).
 - No Cannot achieve -520! Proceed to **page 470**, 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 460).
 - No **PDial** is NOT between 0 and 40! Proceed to **page 470**, 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** = 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 per minute (Yes or No)?

Yes **PDial** HOLDS +/- 25 mmHg per minute! See parts a AND b below:



a) **IMPORTANT!** Return the dialyzer lines to the shunt and CLOSE THE DOOR!

b) Proceed to **page 461**, procedure number [TMP- 2.3.4](#).

No **PDial** does NOT hold! See procedure number [TMP- 2.3.3](#) (page 460).

TMP- 2.3.3 PDIAL DOES NOT HOLD / ISOLATE POSITIVE PRESSURE LEAK

- a) **IMPORTANT!** 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) because you may be prompted to return here.
- c) BEFORE continuing to part d, proceed to **page 496**, 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 as you may prompted to return to here.
- b) BEFORE continuing to part c, proceed to **page 527**, 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 already replaced! See procedure number [TMP- 2.3.5](#) (page 461).

No The DiaSafe® filter was NOT replaced in THIS session! 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 461).

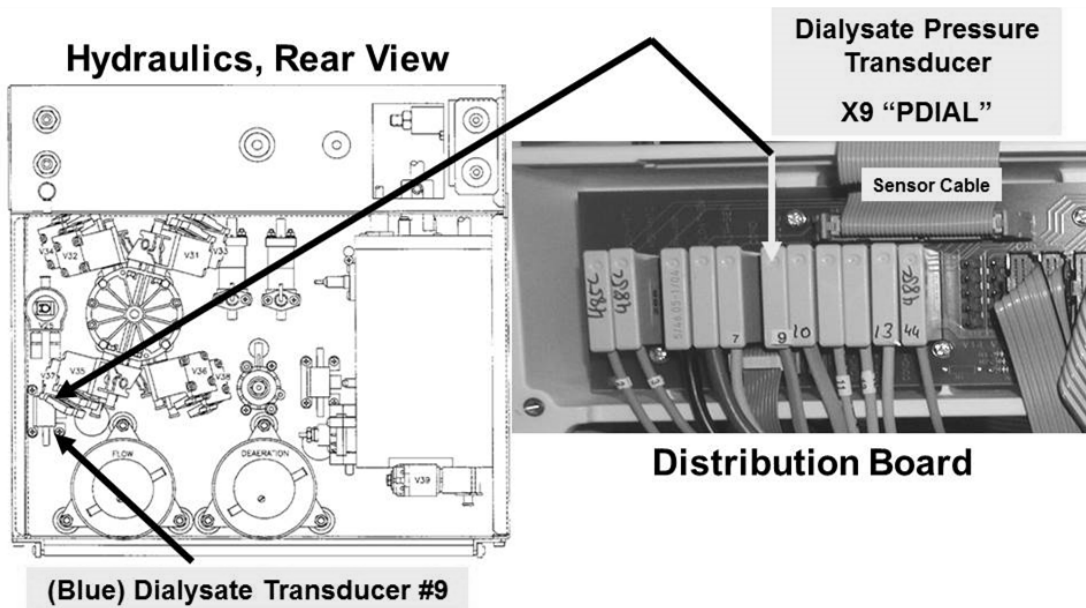
TMP- 2.3.5 DIASAFE FILTER WAS REPLACED PREVIOUSLY

- a) Return to Dialysis Program (“Select Program” → ‘Dialysis → ‘CONFIRM’).
- b) **IMPORTANT!** From the Home screen, set [Dialysate Flow] to 500 ml/min and press ‘CONFIRM’!
- c) Allow [**Conductivity**] to stabilize to more than 13.0 THEN, ENSURING [Dialysate Flow] has remained at 500 ml/min, the external flow indicator’s ‘bob’ is rising and falling in the sight tube.
- d) Call debug screen 1 to see **FILACT**. It must REMAIN = 0 before continuing to part e!
- e) If necessary, reset a TMP alarm up to twice, allowing thirty (30) seconds between each reset, BEFORE continuing to part f
- f) **TMP** is STABLE if (and ONLY if) the TMP window REMAINS white AND TMP does NOT change more than 20 mmHg in one (1) minute. TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) TMP is STABLE:** The Troubleshooting Guide cannot locate an immediate problem!
 - 2) **IF TMP is UNSTABLE:** Assuming ALL procedures were performed correctly AND assuming a debug screen’s **Flow Error** is NEVER, EVER = 1, Dialysate Pressure Transducer #9* may be bad intermittent.

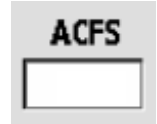
* To LOCATE Transducer #9 refer to [Figure 6](#) (page 19).

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 to ENSURE it has not been reversed connected with another hydraulic component.



- b) Call debug screen 1. ENSURE **FLWP** (upper right column) = 255 constant i.e. Dialysate Flow is “OFF”.
- c) Remove the red dialyzer connector from the shunt door and place it at dialyzer level.
- d) Call debug screen 10. Is **ACFS** (right corner) between 3.5 and 6.0?



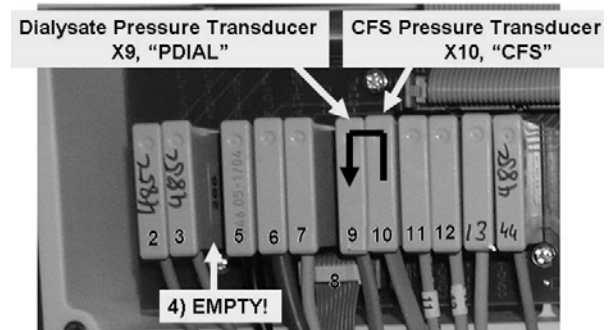
Yes **ACFS** between 3.5 and 6.0! See procedure number [TMP- 3.1.0](#) (page 463).

No **ACFS** is NOT between 3.5 and 6.0! Proceed to **page 464**, 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.

- a) Per the Figure right, unplug the Dialysate Pressure Transducer #9 from distribution board position "x9, PDIAL".
- b) Check inside the vacant x9 position for corrosion and/or damaged male pins. **Damage indicates the distribution board may need to be replaced!**
- c) Per the Figure right, CAREFULLY place the CFS Transducer's distribution board connector (#10) into the Dialysate Pressure Transducer's position "x9, PDIAL".
- d) 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! See 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!

COMPONENT LIST: 1) Sensor Board^{1,2}; 2) Actuator-Test Board¹; 3) Sensor Board cable; 4) Functional Board^{1,2}; 5) Distribution board; 6) Motherboard.

¹ To LOCATE the boards, refer to [Figure 4A](#) (page 9)

² To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

- D) Return to Dialysis Program.
- 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

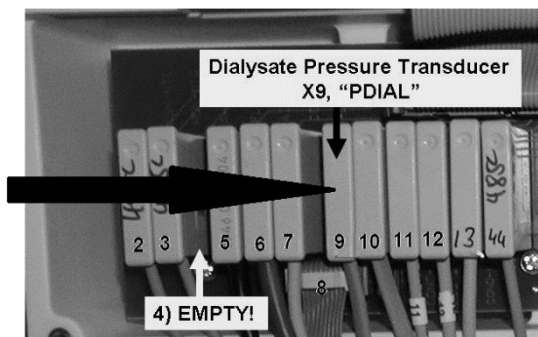
TMP- 3.4.0 ACFS NOT BETWEEN 3.5 AND 6.0 / ISOLATE PDIA

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 464).
- 2) **IF PDIA = more than 6.0:** Proceed to **page 465**, 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) **IMPORTANT!** To avoid unnecessary work, using the screen's clock (upper right), allow up to five (5) minutes (**PDIA** response is **NOT** instantaneous). **PDIA** should increase to 9.0 or more?



Yes **PDIA** increased to 9.0 or more! See procedure number [TMP- 3.6.0](#) (page 465).

No **PDIA** DOES NOT increase to 9.0 or more! See parts A through D below:

- A) Turn the machine OFF.
- B) Swap in the following components (**COMPONENT LIST** below), one at a time, with known good, and in between perform parts C and D to see if the new component fixed this problem.

COMPONENT LIST: **1)** Actuator-Test Board²; **2)** Sensor Board¹; **3)** Sensor Board cable; **4)** Functional Board^{1, 2}; **5)** Distribution board; **6)** Motherboard¹

¹ To locate the boards refer to [Figure 4A](#) (page 9)

² To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

- C) Leaving distribution board position "x9, "P-DIAL" VACANT return to Dialysis Program.
- D) If screen 10's **PDIA** is still NOT more than 9.0 return to part A!

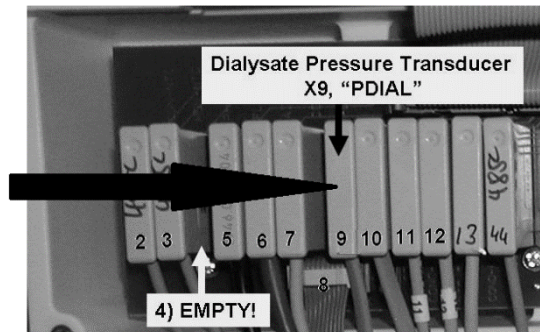
TMP- 3.6.0 PDIA MORE THAN 6.0 / ISOLATE TRANSDUCER #9 / POSSIBLE OPEN

a) A **known good**¹ pressure sensor, from your spare parts, is required to isolate the dialysate pressure circuit from the sensor circuit.

³ To ENSURE the sensor is **known good**, when it is plugged into distribution board position X9, "PDIAL", on ANOTHER machine that is not exhibiting TMP problems, it will drive the machine's debug screen 10 **PDIA** to between 3.5 and 6.0.

b) Figure right, plug the **known good** pressure sensor into the malfunctioning machine's distribution board position X9, "PDIAL". There is NO NEED to install the pressure sensor into the hydraulic yet.

c) From the malfunctioning machine's 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! See parts A through D below:

A) Turn the machine OFF.

B) Swap in the following components (see **COMPONENT LIST** below), one at a time, with **known good**, and in between continue to parts C and D to see if the new component fixed the problem.

COMPONENT LIST: **1)** Actuator-Test Board²; **2)** Sensor Board¹; **3)** Sensor Board cable; **4)** Functional Board^{1, 2}; **5)** Distribution board; **6)** Motherboard¹

¹ To locate the boards refer to [Figure 4A](#) (page 9)

² To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**))

C) With the known good pressure sensor remaining plugged in, return to Dialysis Program.

D) If screen 10's **PDIA** is 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 -250 mmHg and HOLD it (+/- 15 mmHg per minute) now?
 - Yes -250 mmHg achieved and HOLDS! TWO (2) possible bad components: **1) Bad Actuator-Test Board OR; 2) Bad valve #43.**
 - No -250 cannot be achieved and / or held! See procedure number [TMP- 4.2.0](#) (page 467).

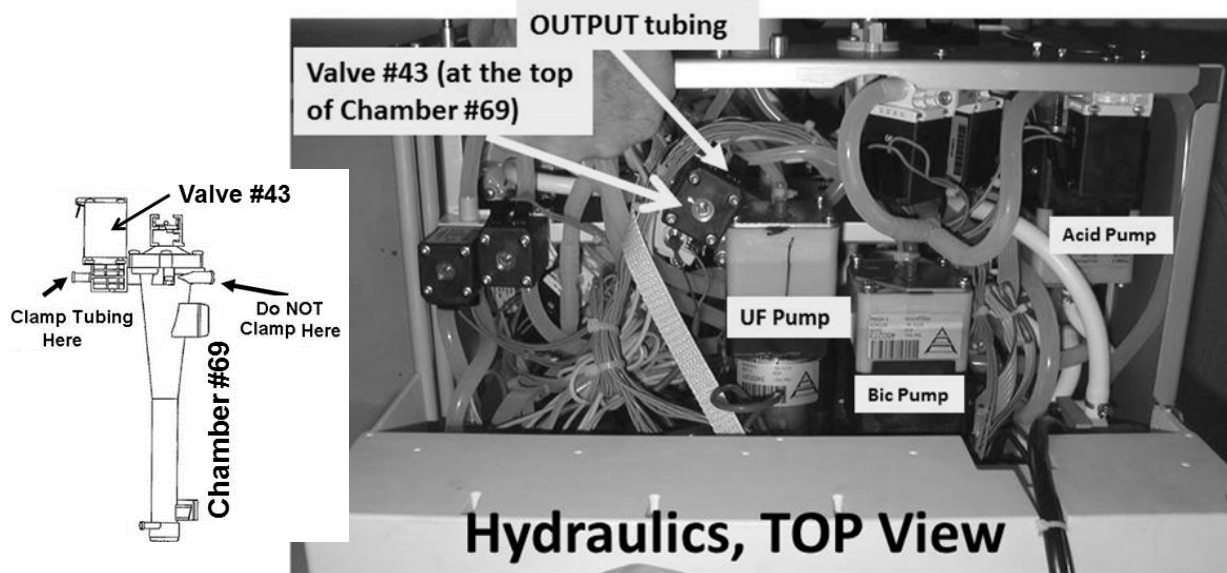


Figure 71 A – Valve #43

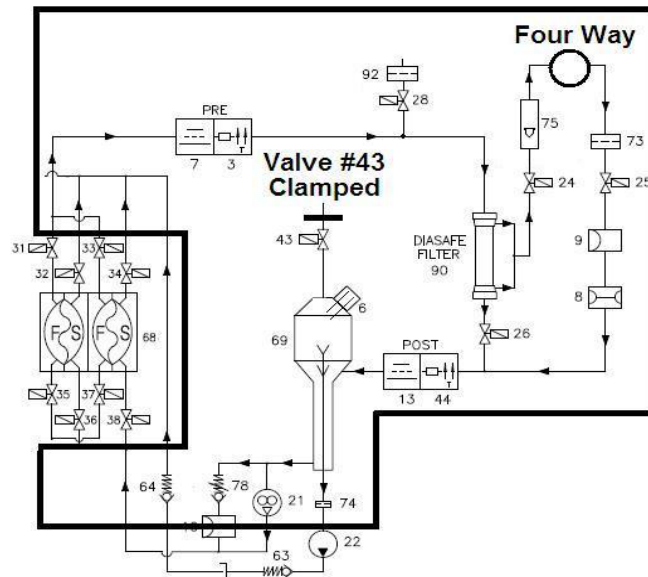


Figure 71 B – Isolation Area (includes dialysate lines)

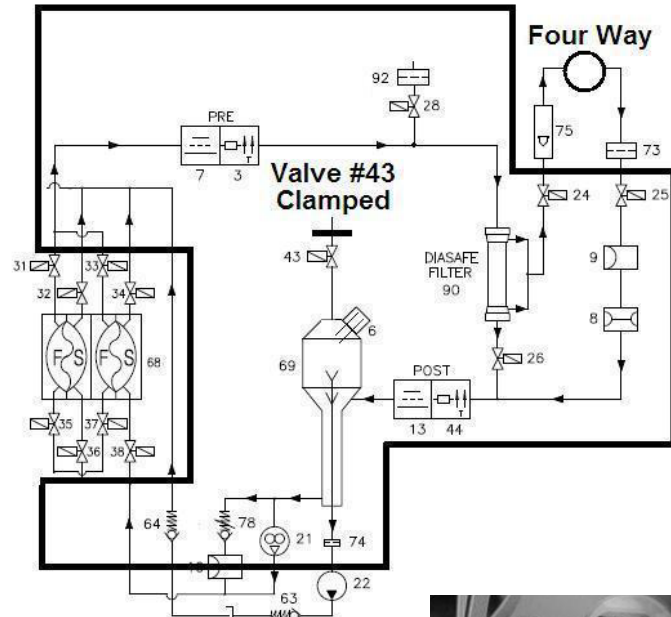
TMP- 4.2.0 ISOLATE SECONDARY CIRCUIT

- Open the shunt door to close valve #24 and #25. This isolates the external dialysate lines (see [Figure 71 C](#) (below)).
- 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 468**, procedure number [TMP- 4.4.0](#).

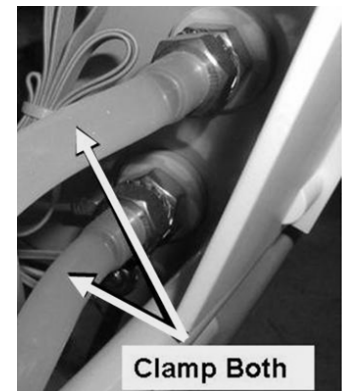
No -250 cannot be achieved and / or held! See procedure number [TMP- 4.3.0](#) (page 467).

**Figure 71 C - Isolation Area
(excludes dialysate lines)**



TMP- 4.3.0 -250 LEAKING / ISOLATE DIALYSATE LINES

- Trace the to and from dialyzer lines to where they attach to the rear of the machine.
- INSIDE the machine, clamp the clear (non-braided) tubing, at BOTH dialysate line connectors.
- 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 468).

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 check CAREFULLY!

↑
↓

No --250 cannot be achieved and / or held! See procedure number [TMP- 4.5.0](#) (page 469).

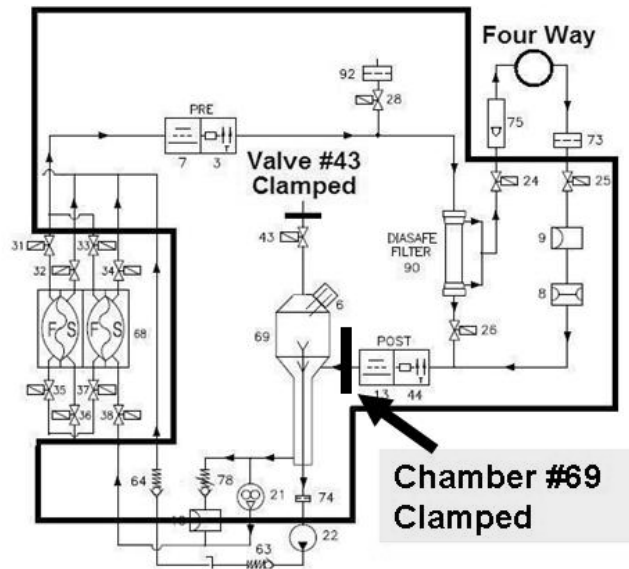
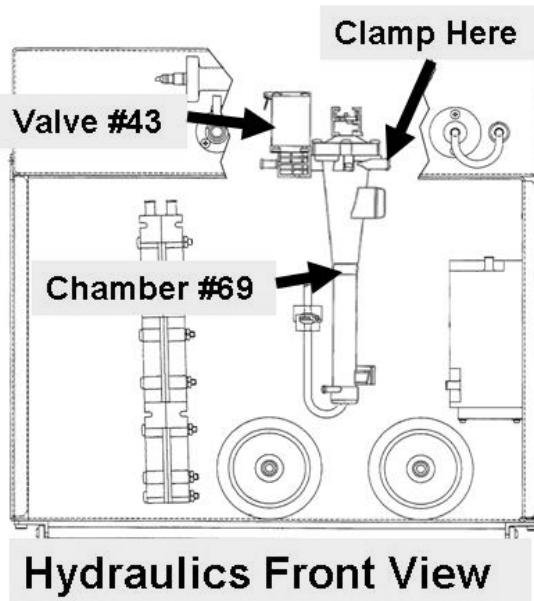
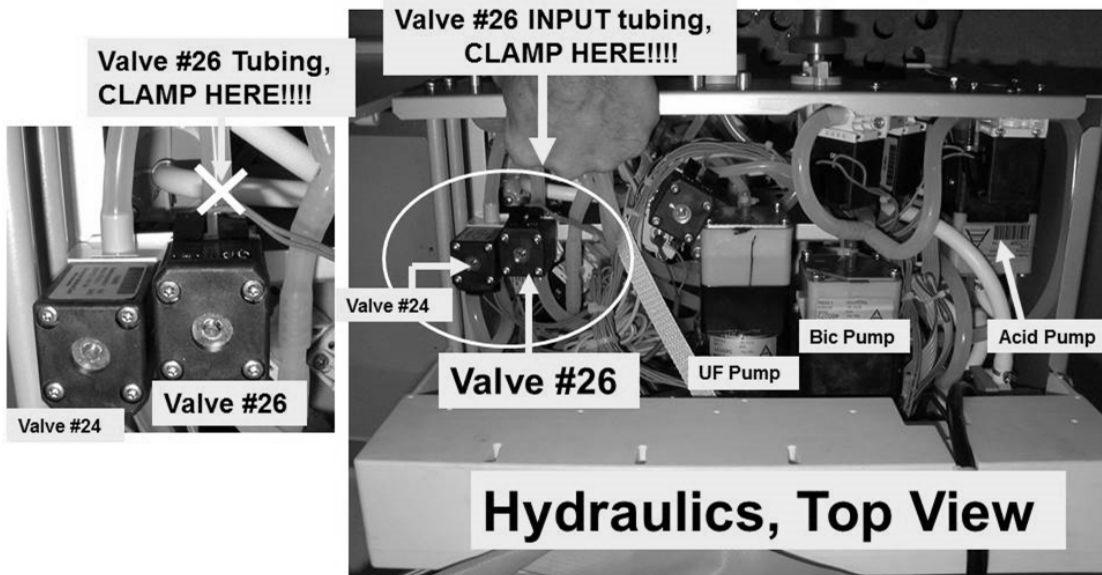


Figure 72 A – Isolate Chamber #69

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 \updownarrow -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 490**, [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 490) may help locate the leak.

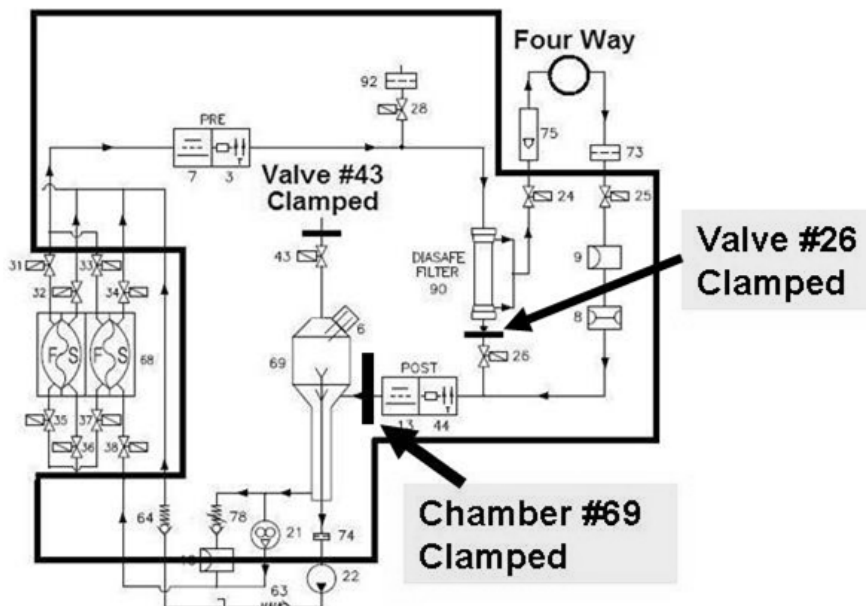


Figure 72 C – Isolation Area

TMP- 6.0.0 CALIBRATE DIALYSATE PRESSURE

NOTE: 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 'CONFIRM'.
- 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 'CONFIRM'. The screen says "**3. Press the [Dialysate Flow on/off] key...**".
- f) Press the Dialysate Flow on/off key to turn Flow off (Flow on/off lamp blinks)!
- g) ENSURE the external flow indicator is NOT moving i.e. flow is off.
- h) **IMPORTANT!** 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) Is the screen's **[Dial Pressure Reference]** window is between 90 and 110?

- Yes **[Dial Pressure Reference]** is between 90 and 110! Press 'CONFIRM' then see procedure number [TMP- 6.1.0](#) (page 471).
- No **[Dial Pressure Reference]** is NOT between 90 and 110! Proceed to **page 472**, procedure number [TMP- 6.5.0](#)

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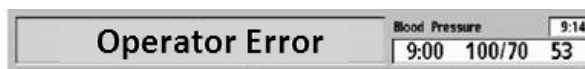
TMP- 6.1.0 CREATE NEGATIVE PRESSURE

- A) The screen says “**6. Pressurize until dialysate pressure reads -250 mmHg....**”.
- B) PULL on the syringe plunger to achieve negative (-)250 +/- 5 mmHg on the external meter.
- C) Clamp the Four-Way's syringe tubing segment to keep this pressure.
- D) ENSURING the external meter = -250 +/- 5 mmHg, is the screen's [**Dial Pressure Reference**] window between 130 and 150?

Yes **[Dial Pressure Reference]** is between 130 and 150! See part E.

No **[Dial Pressure Reference]** is NOT between 130 and 150! Proceed to **page 472**, procedure number [TMP- 6.5.0](#)

- E) Press 'CONFIRM'. 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 472).

2) **IF an “Operator Error” did NOT occur:** See parts a THROUGH f below:

- a) Press 'CONFIRM' twice to save the calibration then turn the machine off.
- b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- c) Call debug screen 1. If not already, allow **FILACT** = 0.
- d) Press the Dialysate Flow on/off key. The Flow on/off lamp blinks indicating Flow is off!.
- 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 460**, procedure number [TMP- 2.3.2](#).

TMP- 6.5.0 “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 and back on.
- d) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- e) From the Home screen, select the [Dialysate Flow] window.
- f) Set [Dialysate Flow] to 500 ml/min and press ‘CONFIRM’!
- g) **Read before performing!** Repeat (ABOVE) procedure number [TMP- 6.0.0 \(page 470\)](#) but if the problem reoccurs swap in the listed components (see Component List below), one at a time, in between returning to procedure number [TMP- 6.0.0 \(page 470\)](#) until the problem does not occur indicating the last component swapped in is the problem!

Component List

1) Dialysate Pressure Transducer #9*; **2)** Sensor Board; **3)** Actuator-Test Board; **4)** Functional Board; **5)** Sensor Board cable; **6)** Distribution board.

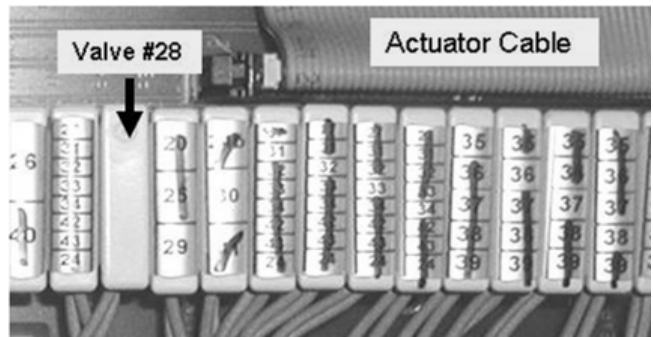
* To LOCATE Transducer #9 refer to [Figure 6](#) (page 19).

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TMP- 9.0.0 VALVE #28 LEAKING / ISOLATE ACTUATOR-TEST BOARD

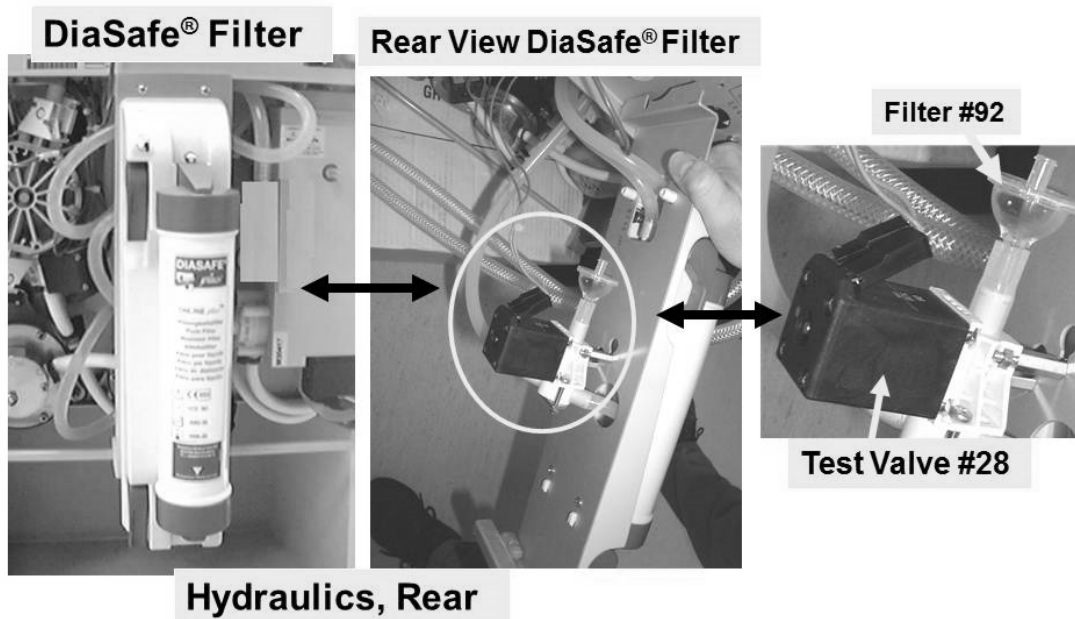
DiaSafe® filter 'Test Valve' #28 is leaking:

- a) Figures right and below, trace the wires from Valve #28's distribution board position ("V28, SAMPLE") to ensure it connects to the correct valve.
- 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 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”.

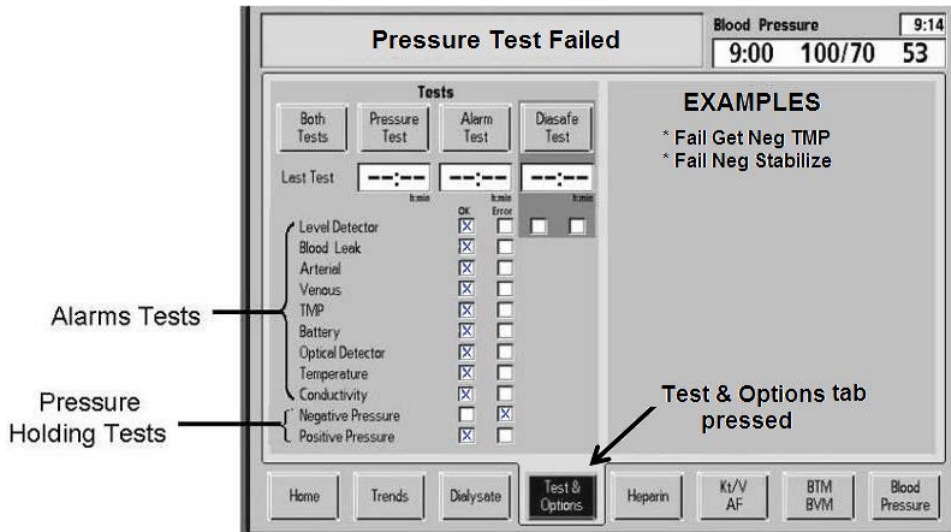


Figure 73 – Test & Options Screen

- 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 476**, 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” lasting longer than 90 seconds! See procedure number [PHT- 1.0.0](#) (page 475).

No Allow the Tests to finish then **even if they pass**, proceed to **page 476**, procedure number [PHT- 1.5.0](#).

PHT- 1.0.0 “GET NEG TMP” LASTING FOREVER / ISOLATE UF PUMP

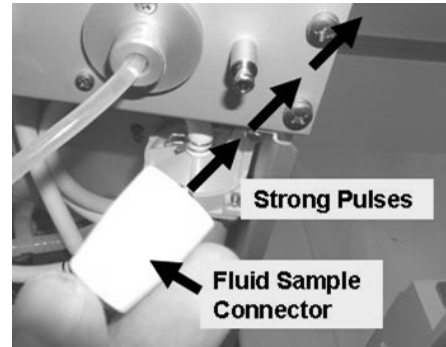
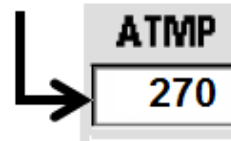
- A) Call debug screen 1 to see **ATMP** (Figure right). It should increase to about -250 during “Get Neg TMP” and if it does “Neg Flow On” appears.
- B) If the “Get Neg TMP” banner is still up see part C. If NOT allow the Tests to finish THEN, **even if they pass**, proceed to **page 476**, procedure number [PHT- 1.5.0](#).
- C) Figure right, remove the Fluid Sample Connector from its port and hold it UP as shown!
- D) ENSURING the “Get Neg TMP” banner REMAINS up, watch for up to TWO (2) minutes or until you see a strong pulse that squirts out more than six (6) feet?

Yes Strong pulse(s)! See procedure number [PHT- 1.0.2](#) (page 475).

No No strong pulse! TWO (2) possible scenarios 1) or 2) below:

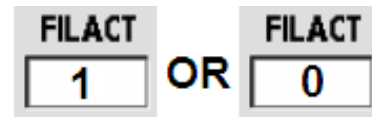
- 1) **IF (and ONLY if) “Get Neg TMP” is still up:** Proceed to **page 503**, [SECTION 14 – UF PUMP PROBLEMS](#)
- 2) **ALL OTHER banners:** Allow the Tests to finish then, **even if they pass**, proceed to **page 476**, procedure number [PHT- 1.5.0](#).

No positive (+) sign
indicates negative pressure



PHT- 1.0.2 STRONG PULSE(S) SEEN

ENSURING “Get Neg TMP” remains up, watch **FILACT** (middle column) for one (1) minute. TWO (2) possible scenarios:



- 1) **IF FILACT EVER = 1!** A hydraulic air leak is indicated! See procedure number [PHT- 1.0.3](#) (page 475).
- 2) **IF FILACT ALWAYS = 0:** Is the “Get Neg TMP” banner still up?

Yes “Get Neg TMP” still up! See procedure number [PHT- 1.0.3](#) (page 475).

No “Get Neg TMP” IS NOT up! Allow the Tests to finish then, **even if they pass**, proceed to **page 476**, procedure number [PHT- 1.5.0](#).

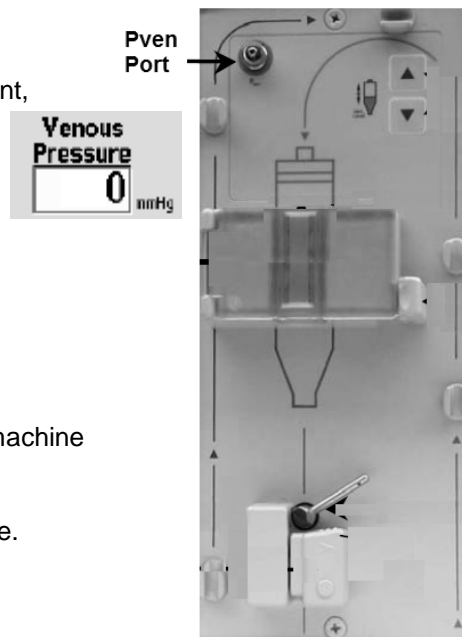
PHT- 1.0.3 “GET NEG TMP” STILL UP

- 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 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)

PHT- 1.5.0 INITIAL PHT CHECKS

- Call the Home screen. With the Level Detector's P_{ven} port vacant, (Figure right) **Venous Pressure** MUST = 0 mmHg!
- 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!

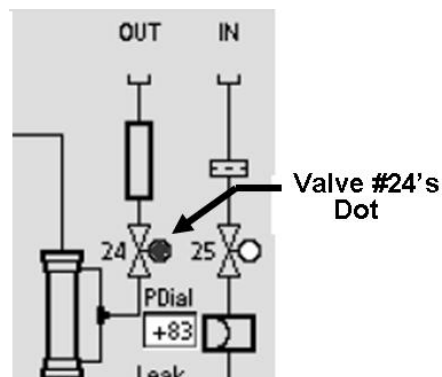
* Stable = NOT changing more than 0.2 per minute
- Using a flashlight, ENSURE no air bubbles MOVING into the machine through the acid and bicarb inlet tubing!
- Install a 'dummy venous chamber' in the Level Detector module.
- RESET ALL alarms!
- If screen says "Standby For Test" OR the tests are running (screen says "Test:...") allow them to finish BEFORE continuing to procedure number [PHT- 1.5.1](#) (page 476)



PHT- 1.5.1 INITIAL PHT CHECKS CONTINUED

IMPORTANT! If a "No Water" or Flow Error alarm EVER occur address them first!

- Call debug screen 0. Valve #24's 'dot' (Figure right) MUST be BLUE BEFORE continuing to part b!
- From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'CONFIRM'.
- Small external leaks cause BIG problems! Using a flashlight, FOUR (4) checks. BE THOROUGH!



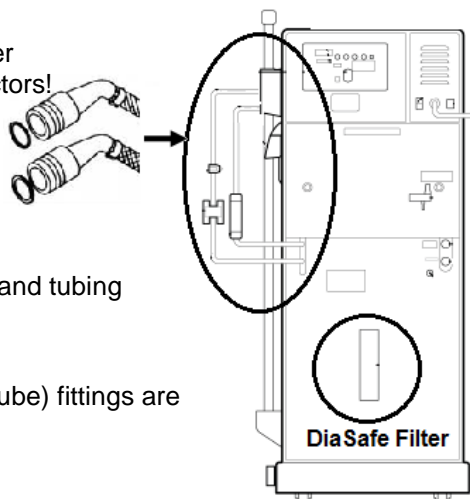
Check #1: Figure right, the ENTIRE length of the dialyzer lines ESPECIALLY the dialyzer quick connectors!

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!

- See procedure number [PHT- 1.5.2](#) (page 477).

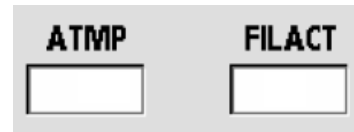


PHT- 1.5.2 PRESSURE HOLDING TEST (PHT) THEORY

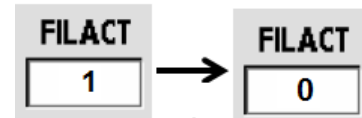
A) **DO NOT START THE TESTS TILL INSTRUCTED!**

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 478)

C) Call debug screen 1 to locate **ATMP** AND **FILACT**.



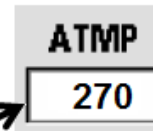
- 1) The Pressure Tests begin with “Remove Air”. This is a sixteen (16) second Filling Program to purge air from the hydraulics. During this time **FILACT** = 1 then should go to and remain = 0.



Test: Remove Air

Test: Get Neg TMP

- 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

No positive sign here indicates negative pressure

Test: Neg Flow On

- 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 return to step #1

Test: Get Pos TMP

- 4) During the very brief “Get Pos TMP” the fresh side balancing chamber valves momentarily open to achieve **POSITIVE PRESSURE** then all eight (8) balancing chamber valves close (i.e. Flow Off)! **ATMP** should go to about positive (+)350.



The positive sign here indicates positive pressure

Test: Pos Flow Off

- 5) When “Pos Flow Off” appears a twenty (20) second **STABILIZATION** period begins followed by a thirty (30) second **HOLD** period. During **STABILIZATION** **ATMP** is initially unstable but 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 478).

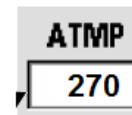
PHT- 2.0.0 START PRESSURE TESTS

- a) RESET ALL alarms!
 - b) At the bottom of the screen, select the **[Test & Options]** tab. TWO (2) possible scenarios:
 - 1) **IF the [Pressure Test] button is BLUE:** Select **[Pressure Test]** THEN press 'CONFIRM' then IMMEDIATELY continue to procedure number [PHT- 2.0.1](#) (page 478).
 - 2) **IF the [Pressure Test] button is GRAY:** Select **[Both Tests]** THEN press 'CONFIRM' 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 seconds see ABOVE procedure number [PHT- 1.0.0](#) (page 475). 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 continue to procedure number [PHT- 2.0.1](#) (page 478).
- * 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 every eight (8) seconds until **ATMP** (Figure right) reaches about -250 mmHg then "Neg Flow On" appears (for one minute) followed by "Pos Flow Off" (for one minute).
- c) Is "**Get Neg TMP**" lasting longer than ninety (90) seconds?

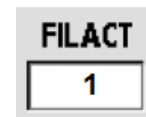
No positive (+) sign indicates negative pressure



- Yes "Get Neg TMP" longer than 90 seconds! See procedure number [PHT- 2.0.2](#) (page 478).
- No "Neg Flow On" appeared! Proceed to **page 480**, procedure number [PHT- 3.0.0](#).

PHT- 2.0.2 "GET NEG TMP" LASTING LONGER THAN 90 SECONDS

Watch **FILACT** for one (1) minute while ALSO ENSURING "Get Neg TMP" REMAINS up. Does **FILACT** EVER = 1, even if just once?



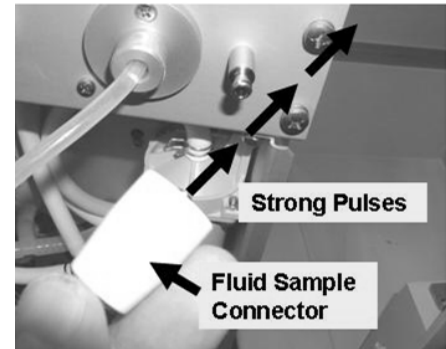
- Yes **FILACT** = 1 even if only once WHILE "Get Neg TMP" is up! Possible air leak. Proceed to **page 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)
- No **FILACT** ALWAYS = 0! See procedure number [PHT- 2.0.3](#) (page 479).

PHT- 2.0.3 FILACT ALWAYS = 0

TWO (2) possible scenarios:

- 1) **IF (and ONLY if) “Get Neg TMP” is NOT up!** See procedure number [PHT- 3.0.0](#) (page 480).
- 2) **IF “Get Neg TMP” is still up!** See parts a AND b below:

- a) Figure right, remove the Fluid Sample Connector from its port and hold it UP as shown!
- b) ENSURING “Get Neg TMP” REMAINS up, allow up to TWO (2) minutes or until you see a strong pulse that squirts out 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 up:** Proceed to **page 440**, [SECTION 9 – TMP \(PRESSURE\) PROBLEMS](#).
- 2) **ALL OTHER banners:** See procedure number [PHT- 3.0.0](#) (page 480).

No Strong pulse(s) NEVER seen! Is the “Get Neg TMP” banner still up?

Yes “Get Neg TMP” is still up! Proceed to **page 503**, [SECTION 14 – UF PUMP PROBLEMS](#)

No “Get Neg TMP” is NOT up! See procedure number [PHT- 3.0.0](#) (page 480).

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PHT- 3.0.0 “NEG FLOW ON” APPEARED

Allow the tests to finish! Do BOTH Pressure Tests (Positive and Negative) pass?

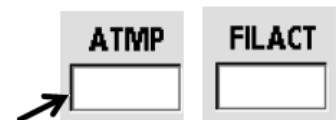
Yes BOTH pass! **IMPORTANT!** Proceed to **page 484**, procedure number [PHT- 4.0.0](#).

No “Pressure Test Failed”! At the bottom of the screen, select the [Test & Options] tab. TWO (2) possible scenarios:

- 1) **IF “Fail: Remove Air” is listed:** NOTE it THEN see continue to procedure number [PHT- 3.1.0](#) (page 480).
- 2) **ALL OTHER failure listings:** See procedure number [PHT- 3.1.0](#) (page 480).

PHT- 3.1.0 PRESSURE TEST(S) FAILED

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) Select the [Test & Options] tab THEN the [Pressure Test] button.

d) Press ‘CONFIRM’ 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** should settle between -250 and -440!

NOTE: If “Remove Air” reappears the tests are REPEATING 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 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** increases to more than -440 NOTE this!

NOTE: If “Remove Air” reappears the tests are REPEATING 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 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** should drop to between +300 and +500.
- i) When “Pos Flow Off” first appears a twenty (20) second stabilization period begins. **ATMP** should settle between +180 and +350.

NOTE: If **FILACT EVER** = 1 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 a large external leak OR **FILACT** went to ‘1’.

- j) Assuming **ATMP** remained between +180 and +350 during the stabilization period a 30 second HOLD period begins. “Pos Flow Off” remains up AND **ATMP** 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 Pressure Tests pass?

Yes BOTH pass! Proceed to **page 484**, procedure number [PHT- 4.0.0](#).

No “Pressure Test(s) Failed”! See procedure number [PHT- 3.1.2](#) (page 481).

PHT- 3.1.2 PRESSURE TEST(S) FAILED AGAIN

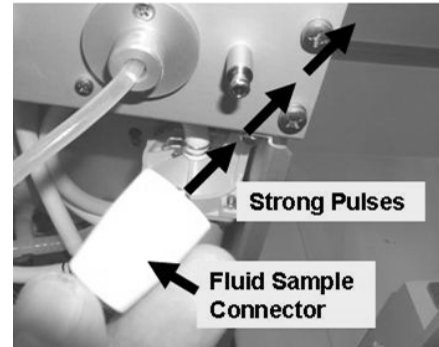
Select the Test & Options tab. FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:

- 1) **IF (and ONLY if) “Fail Remove Air” is listed:** Proceed to **page 409**, [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’ (even if only once) during the repeat 30 second STABILIZATION “Neg Flow On” period:** Proceed to **page 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)
 - ii) **IF FILACT ALWAYS ‘0’ during the repeat 30 second “Neg Flow On” STABILIZATION period:** Proceed to **page 440**, [SECTION 9 – TMP \(PRESSURE\) 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 482).
 - ii) **IF FILACT EVER ‘1’ (even if only once) during the repeat 30 second HOLD “Neg Flow On” period:** Proceed to **page 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)
 - iii) **IF FILACT ALWAYS ‘0’ during the repeat 30 second HOLD “Neg Flow On” period:** Proceed to **page 409**, [SECTION 8 – FILLING PROGRAM 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 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)
- ii) **IF FILACT ALWAYS '0'!** Proceed to **page 440**, [SECTION 9 – TMP \(PRESSURE\) PROBLEMS](#).

PHT- 3.1.3 PRESSURE TEST FAILS AND ATMP INCREASED TO MORE THAN -400

- a) Remove the UF Sample Connector (Figure right) AND hold it so that you can observe UF PUMP output!
- b) Below you will **simultaneously** watch the screen banners, debug screen 1's **ATMP** AND the UF Sample Connector!
- c) Reset all alarms. From the Test & Options screen select the [Pressure Tests] button then press 'CONFIRM'.



- 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 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)** A 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 482). If a Positive Pressure Test listing appears return to Scenario #4 of ABOVE procedure number **PHT- 3.1.2** (page 481). If (and **ONLY** if) the Pressure Tests pass proceed to **page 484**, 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 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)
 - ii) **IF FILACT ALWAYS = 0 during the repeat 30 second "Neg Flow On" STABILIZATION period:** Proceed to **page 440**, [SECTION 9 – TMP \(PRESSURE\) 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 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)
 - ii) **IF FILACT ALWAYS = 0 during the repeat 30 second HOLD "Neg Flow On" period:** Proceed to **page 440**, [SECTION 9 – TMP \(PRESSURE\) PROBLEMS](#)

PHT- 3.1.5 ALL OTHER SCENARIOS / PRESSURE TEST FAILED

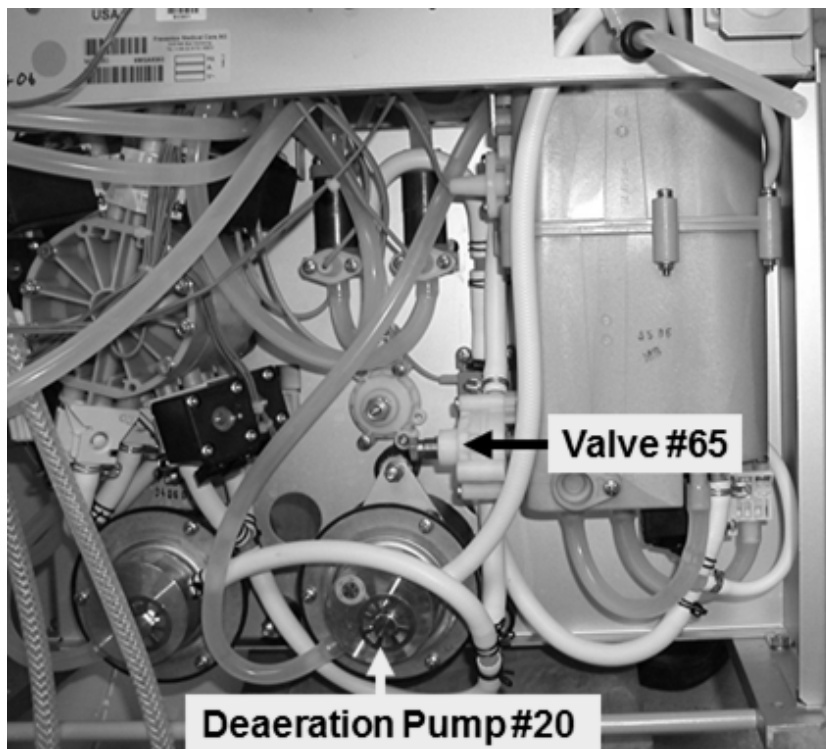
Has the DiaSafe® filter been replaced in THIS Troubleshooting session?

- Yes The DiaSafe® filter has been replaced! Proceed to **page 440**, [SECTION 9 – TMP \(PRESSURE\) 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) FULL minutes!
- c) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’).
- d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’!
- 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 one (1) minute 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, IMPORTANT!** See procedure number [PHT- 4.0.0](#) (page 484).
- No Pressure test(s) Fail! Proceed to **page 440**, [SECTION 9 – TMP \(PRESSURE\) PROBLEMS](#)

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PHT- 4.0.0 BOTH PRESSURE TESTS PASS

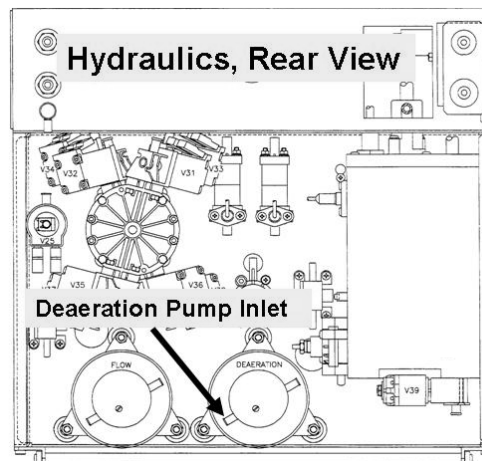
- a) **ENSURE** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it!
- b) **SLAM** the gauge into the red Acetate/Acid rinse port. *ELSE pressure will not be read correctly
- c) Loading Pressure is 'OKAY' if it cycles between a peak of somewhere between 23 and 25 psi AND **NEVER** lower than 11 psi at its lowest.
- 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) Loading Pressure REMAINS 'OKAY'**: See procedure number [PHT- 4.2.0](#) (page 485).
 - 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 485). If (and ONLY if) NOT Valve #65 may be bad.
 - 3) **IF (and ONLY if) NEVER less than 11 and peaking to between 15 and 22 psi**: Adjust Valve #65's nut (Figure below), clockwise until a peak of between 23 and 25 can be achieved! If good pressure CAN be adjusted see procedure number [PHT- 4.2.0](#) (page 485). If (and ONLY if) it CANNOT proceed to **page 27**, procedure number [F- 1.0.8](#).
 - 4) **ALL other scenarios**: ENSURING the gauge was SLAMMED into the Rinse Port proceed to **page 27**, procedure number [F- 1.0.8](#).



PHT- 4.2.0 LOADING PRESSURE OKAY

- 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.
- d) Figure right, tee the gauge to the Inlet (clear tubing) of the Deaeration Pump.
- e) **IMPORTANT! Turn the water on and allow the “No Water” alarm to go away!**
- f) Deaeration Pressure OKAY? Refer to [Appendix A](#) (page 667) for what pressure should be.

Yes Deaeration pressure is OKAY. See procedure number [PHT- 4.3.0](#) (page 485).



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 498**, [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) **IMPORTANT!** 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 one (1) more minute BEFORE continuing to part g.
- g) Reset all alarms then select the **[Test & Options]** tab. TWO (2) possible scenarios.
 - 1) **IF the [Pressure Test] button is BLUE:** Select the **[Pressure Test]** button THEN press ‘CONFIRM’ THEN IMMEDIATELY see procedure number [PHT- 4.4.0](#) (page 486).
 - 2) **IF the [Pressure Test] button is GRAY:** Select **[Both Tests]** THEN press ‘CONFIRM’ THEN IMMEDIATELY see procedure number [PHT- 4.4.0](#) (page 486).

PHT- 4.4.0 REPEAT PRESSURE TESTS

Call debug screen 1. While watching the screen banners¹, **ATMP**¹ **AND** **FILACT**² allow the tests to finish. Do **BOTH** (Negative and Positive) pass?

Yes **BOTH** pass! **IMPORTANT!** See procedure number [PHT- 4.5.0](#) (page 486).

No Pressure Test Failed! Return to (ABOVE) procedure number [PHT- 3.1.2](#) (page 481) to analyze the failure(s).

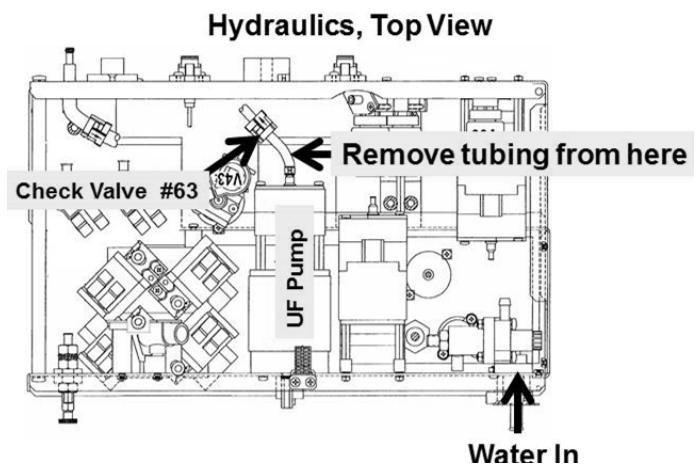
¹ If **ATMP** changes more than 20 during Neg Flow On's HOLD period indicates a leak

² After "Remove Air", if **FILACT** goes to 1 the indicates an air leak.

PHT 4.5.0 BOTH TESTS PASS / PERFORM UF INTEGRITY TEST

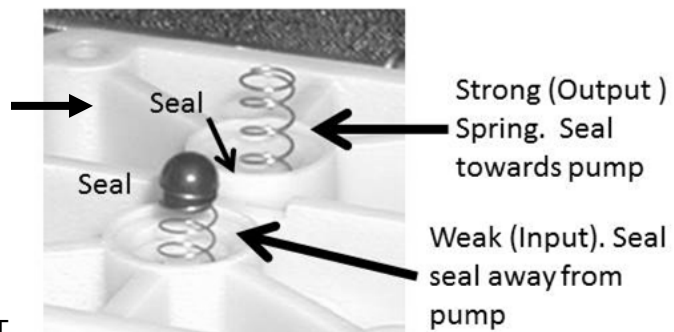
The Important UF INTEGRITY TEST, performed here, isolates the UF Pump for leaks:

- Figure right**, remove the TOP tubing from between the UF Pump and Check Valve #63.
- Attach a tubing segment to the vacant Pump nozzle that is long enough to route it away from the hydraulics.
- RESET all alarms!
- From the **[Test & Options]** screen repeat the Pressure Tests.
- Do **BOTH** Pressure Tests pass?



Yes **BOTH** Tests pass! See procedure number [PHT- 4.6.0](#) (page 487).

- No
- Rebuild the UF Pump per the [Preventative Maintenance Procedures](#) booklet ENSURING the springs and seals are properly installed!
 - Return to Dialysis Program.
 - 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) Return the UF Pump's tubing.
- b) Was the machine originally pulled for service because of reported "On Line PHT Failed"?
 - Yes On Line PHT Failed! See procedure number [PHT- 4.7.0](#) (page 487).
 - No See procedure number [PHT- 5.0.0](#) (**page 488**).

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.
- b) Allow the [**Test Status**] data box = "Ready".
- c) Select the screen's [**Valve Number**] data box.
- d) K machine use the up/down arrow keys until [**Valve Number**] = "Valve #24"; K² machine use the +/- keys until [**Valve Number**] = "Valve #24".
- e) Press 'CONFIRM'.
- f) Allow "Prep" and "Testing" to complete then read the [**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 193).
 - 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 488).
 - 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 193).

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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) At the time of Troubleshooting Guide's release an alternate Flow Pump calibration was being considered that may solve some problems. Please call Technical Services (800-227-2572) for further 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 overshoot 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.

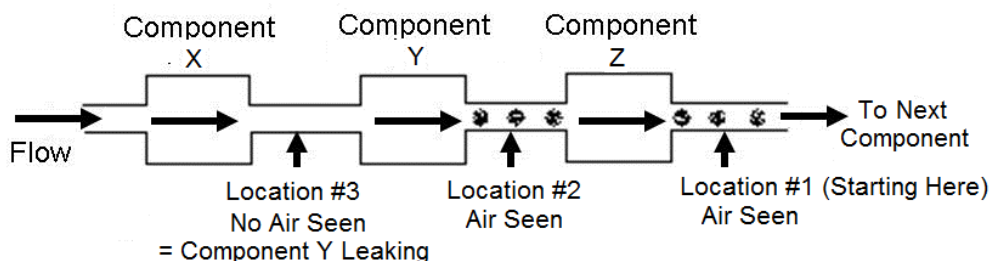
PHT0	PHT1	Meaning
Less than 25	Less than 25	All BC valves are okay
More than 25	Less than 25	BC valve leak (first valve cycle)
Less than 25	More than 25	BC valve leak (second valve cycle)
More than 25	More than 25	Leak (probably) external to the BC valves

Probable Causes of Pressure Test Failures:

- 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

These procedures use negative pressure to locate an 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.



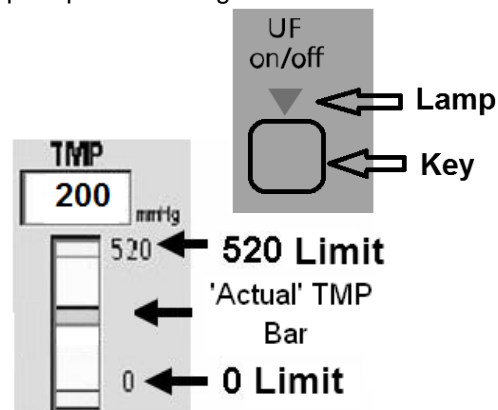
NOTE: Air is NORMAL in some locations, for example through the input tubing of Deaeration Pump #20 AND in the 'To Drain' tubing.

- A) Referring to [Figure 75](#) (page 491), 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 it 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 'CONFIRM'.
- H) See procedure number [AIR- 1.0.0](#) (page 490).

AIR- 1.0.0 ACHIEVE NEGATIVE DIALYSATE PRESSURE

This procedure describes how to achieve negative pressure (TMP). TMP MUST be maintained between 300 and 360 mmHg for all subsequent tests. If it EVER falls below 220 repeat parts a through c below:

- a) RESET ALL alarms!
- b) To turn UF on, Figure right, press the front panel's UF on/off key. The UF lamp turns on solid.
- c) Figure right, allow the 'actual' TMP to increase to 250 then IMMEDIATELY turn UF off (UF Lamp off)!
- d) See procedure number [AIR- 1.0.1](#) (page 491).



AIR- 1.0.1 CHECK FOR AN AIR LEAK AT FILTER #73

Figure below, for two (2) minutes, 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 492).

No air seen at L1! Proceed to **page 493**, procedure number [AIR- 1.0.3](#).

Figure 74 – Leak Checks (1) / Abbreviated Flow Diagram

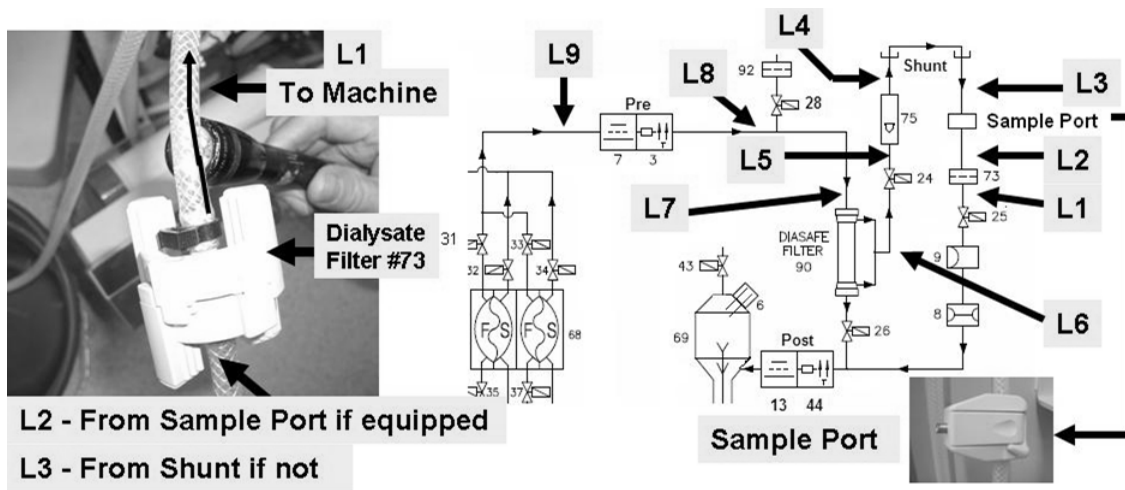
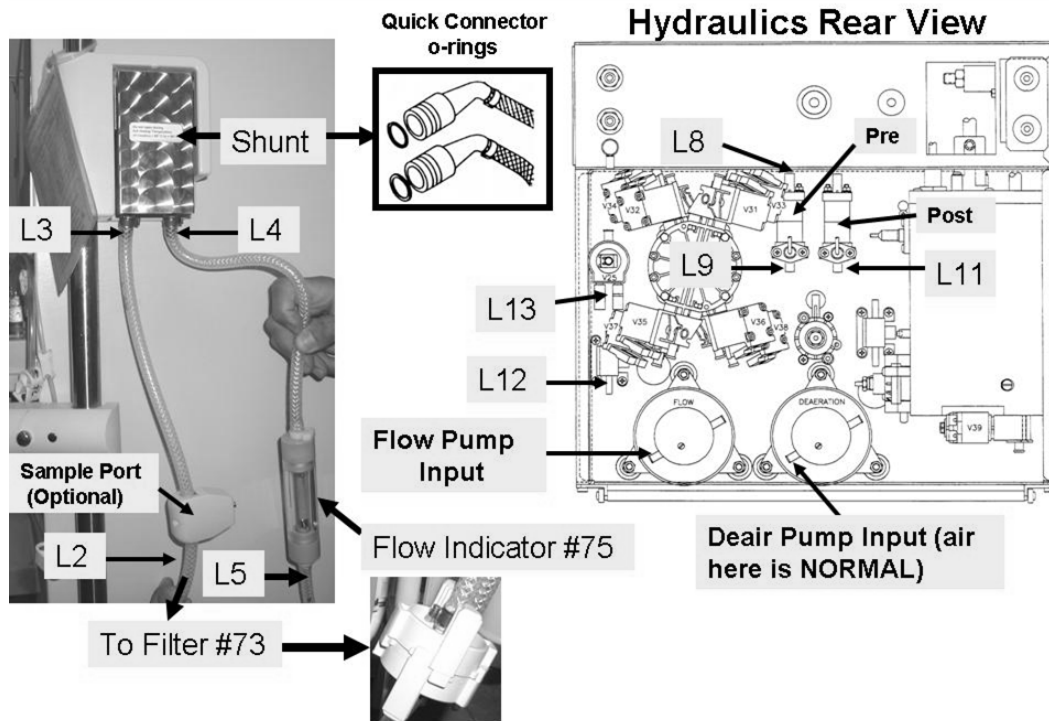


Figure 75 – Hydraulics (External & Rear Views)



AIR- 1.0.2 AIR SEEN AT L1 (OUTPUT FILTER #73)

Referring to [Table 9](#) below, ensuring **TMP is between 300 and 340 mmHg**:

Table 8 – Air Checks (1)

Location	Location Description	If air is seen go to:	If air is <u>NOT</u> seen the leak is from:
L2	Post Sample Port (Figure 75, page 491)	L3	Dialysate Filter #73
L3	From Shunt (Figure 75)	L4	<ul style="list-style-type: none"> • Equipped with Sample Port: The Sample Port is leaking • NOT Equipped with Sample Port: Dialysate Filter #73 is leaking
L4	To Shunt (Figure 75)	L5	Dialyzer connector(s) or o-ring(s)
L5	Bottom of Flow Indicator #75 (Figure 75)	L6	Flow Indicator #75
L6	Input Valve #24 / Valve #26 (Figure 76, page 492).	L7 if DiaSafe® filter equipped, L9 if not	Valve #24 / Valve #26 mounting (L6) OR Valves #24 / #26
L7	Input DiaSafe® Filter #90	L8	DiaSafe® Filter #90 OR Valve #24 / Valve #26 mounting (L6) OR Valves #24 / #26
L8	Output Pre-Dialyzer Cond. Cell #7 (Figure 75)	L9	DiaSafe® Filter Test Valve (see Figure 82, page 497)
L9	Input Pre-Dialyzer Cond Cell #7 (Figure 75)	Procedure number AIR- 1.0.5 (page 495)	Pre-Dialyzer Cond. Cell #7

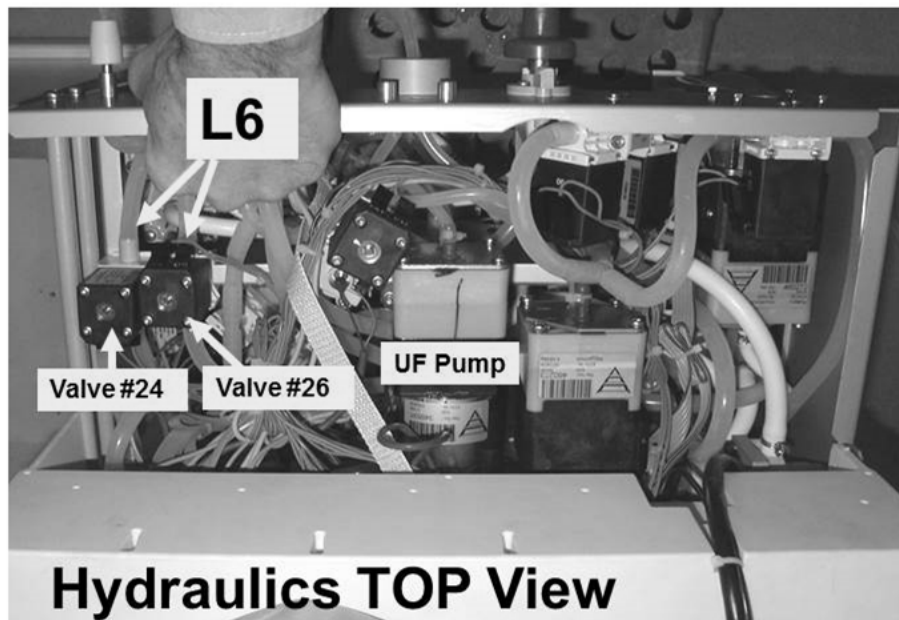


Figure 76 – Hydraulics Top View

AIR- 1.0.3 AIR AT L1 / CHECK FOR AIR INPUT CHAMBER #69

Figure below, ensuring **TMP is between 300 and 360 mmHg**, for two (2) minutes, 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 494).

No air seen at L10! Return to the procedure that brought you here.

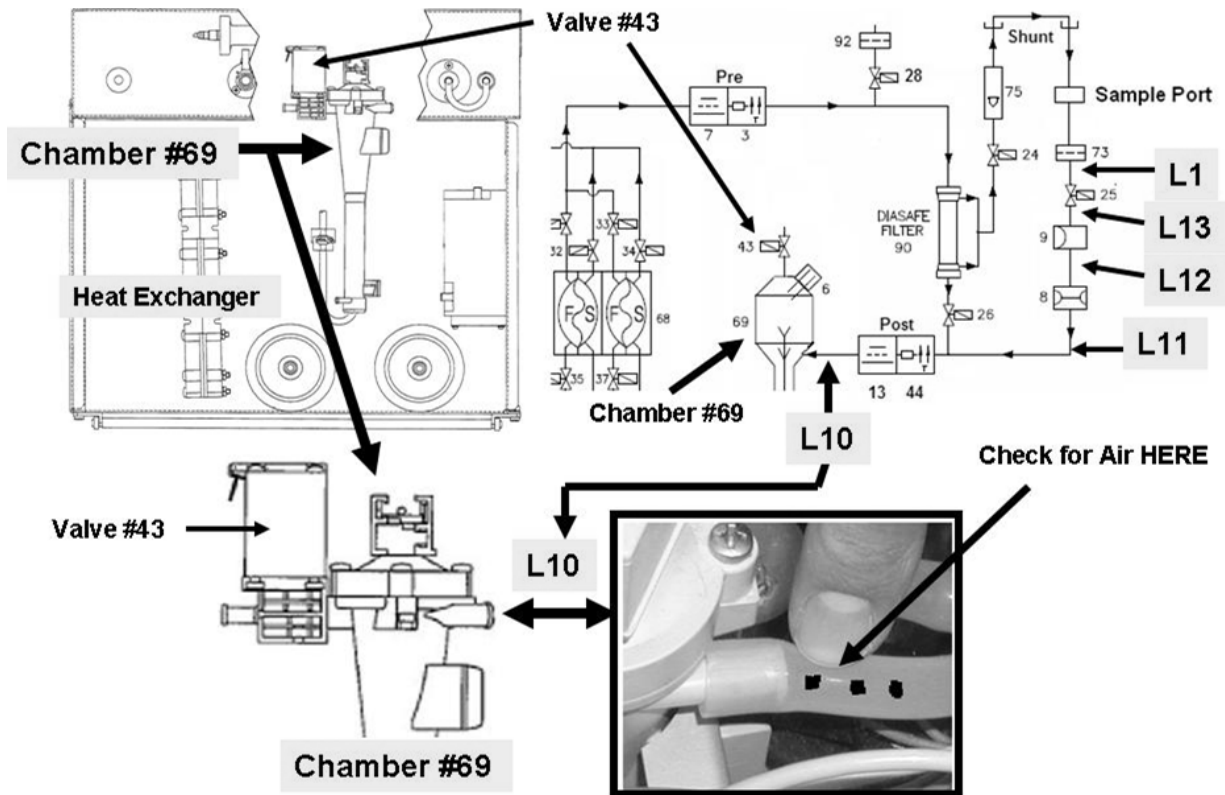


Figure 77 – Leak Checks (2) / Abbreviated Flow Diagram

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 two (2) minutes, watch for air starting at Location #11 (L11).

Table 9 – 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 494)	L12 (next row)	Valve #24 / Valve #26 mounting O-Ring(s) (to LOCATE refer to Figure 76 , page 492) <u>OR</u> 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 491)	L1 (next row)	Dialysate Pressure Transducer #9
L1	OUTPUT (to machine) side of Dialysate Filter #73 (see Figure 74 , page 491)	See (ABOVE) procedure number AIR- 1.0.2 (page 492).	Valve #25

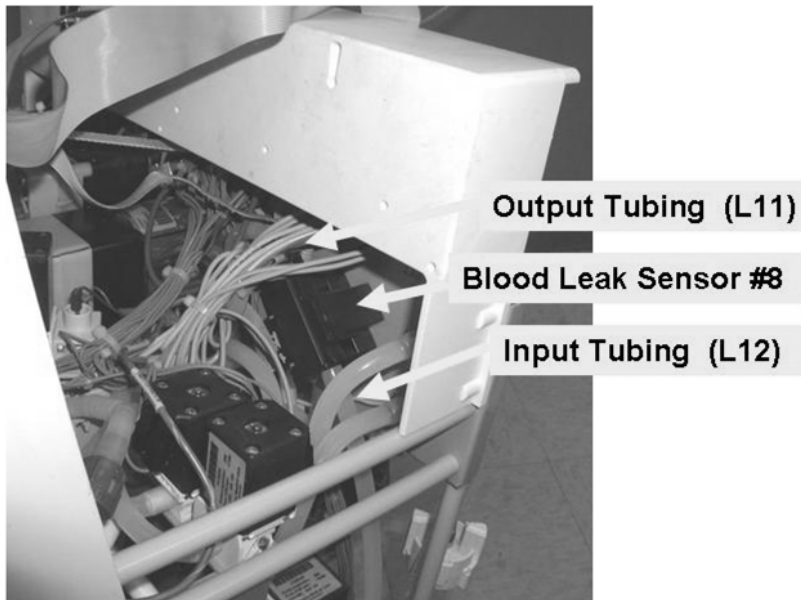


Figure 78 – Blood Leak Tubing

AIR- 1.0.5 AIR SEEN FROM PRE-DIALYZER COND CELL #7

Figure below, ensuring **TMP is between 300 and 360 mmHg**, 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 495).

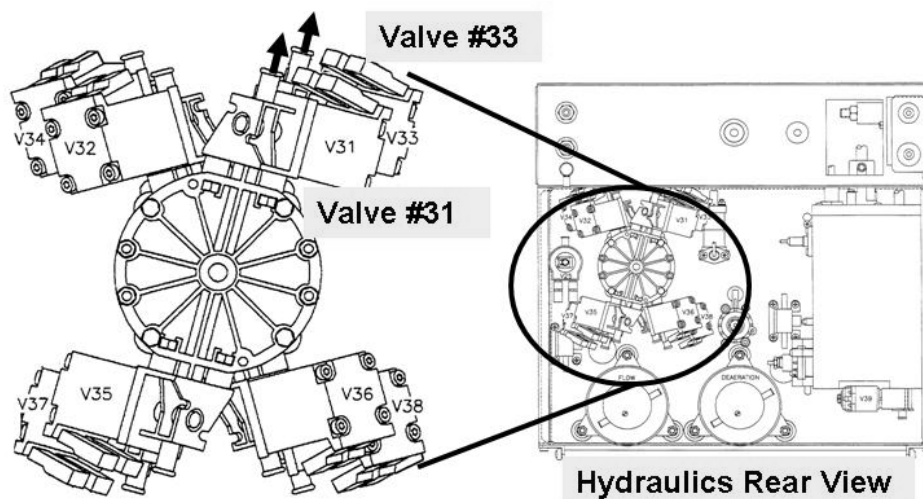


Figure 79 – Balancing Chamber Valves #31 and #33

AIR- 1.0.6 CHECK FOR COMMON AIR LEAK

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- 1.0.8](#) (page 495).

AIR- 1.0.8 LEAK TEST HYDROCHAMBER

- a) A procedure, in a different Section, is performed next. **NOTE** this page and procedure number (AIR-1.0.8) as you may prompted to return to here!
- b) BEFORE continuing to part c, proceed to **page 139** to perform [PRESSURE TEST HYDROCHAMBER](#).
- c) If a leak in the Hydrochamber was not located in part b return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’).
- d) Return to (ABOVE) procedure number [AIR- 1.0.0](#) (**page 490**) 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 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.

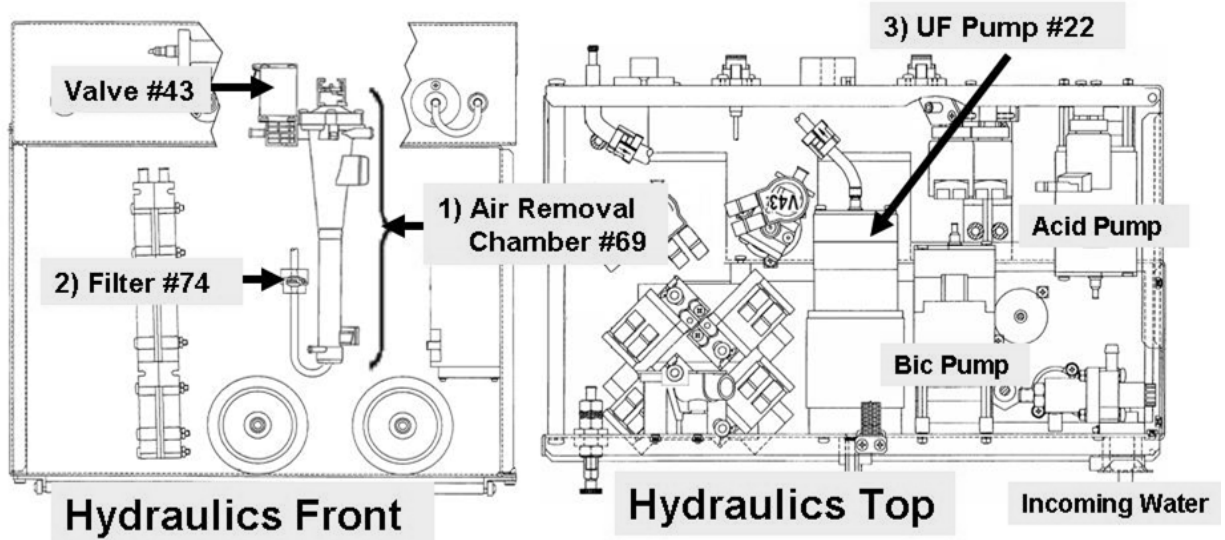


Figure 80 – Internal Dialysate Circuit Leak Checks

3. Figure below, check for leaks at: **4) Valve #78; 5) Dialyzer Quick Connectors and O-rings; 6) External Flow Indicator #75; 7) Dialysate Line Filter #73; 8) (Optional) Fluid Sample Port; 9) Dialysate line connections at the rear of the machine.** If no leaks continue to step #4 (next page).

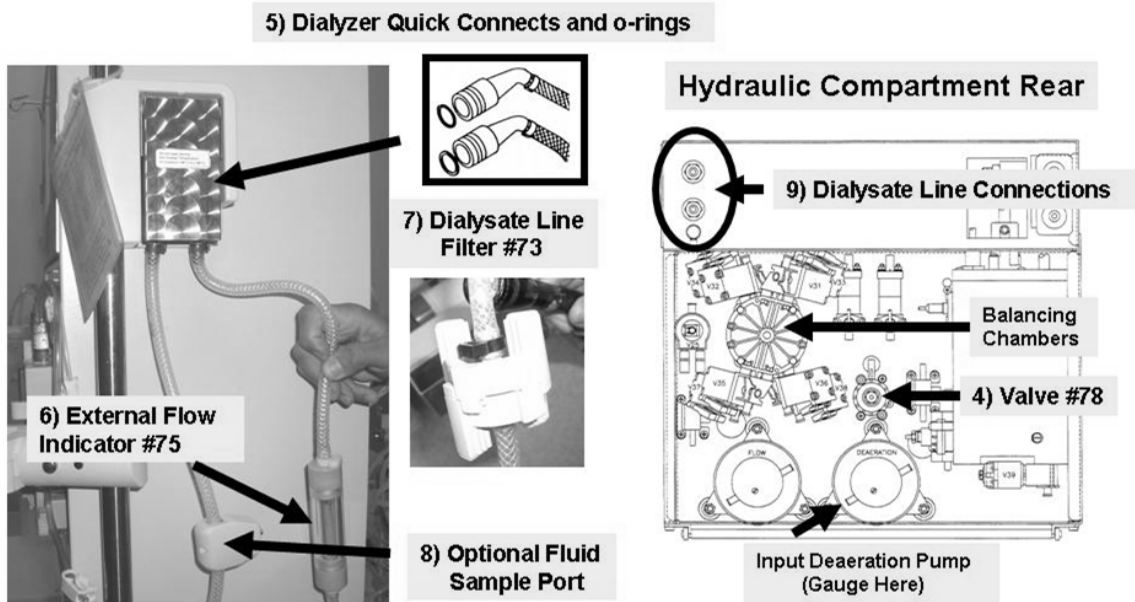


Figure 81 – External Dialysate Circuit Leak Tests

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.

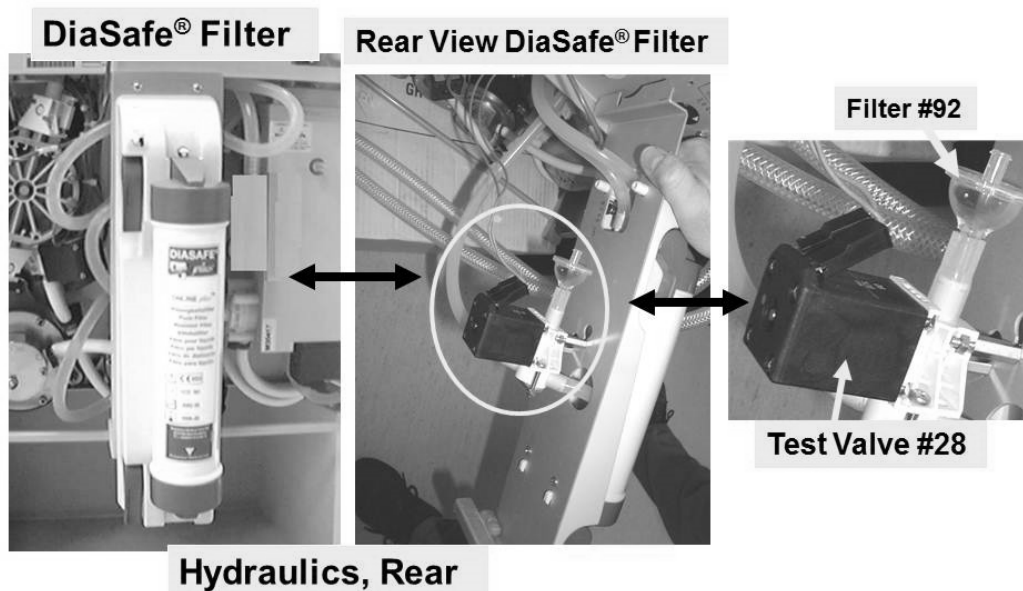


Figure 82 – DiaSafe® Filter / Housing Leak Tests

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 473**, 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

- Enter Service Mode → Calibrate Hydraulics → Deaeration Pressure but **DO NOT** press 'CONFIRM' yet!
- Per the Figure below, ENSURE the [PUMP RATE] box = 0!

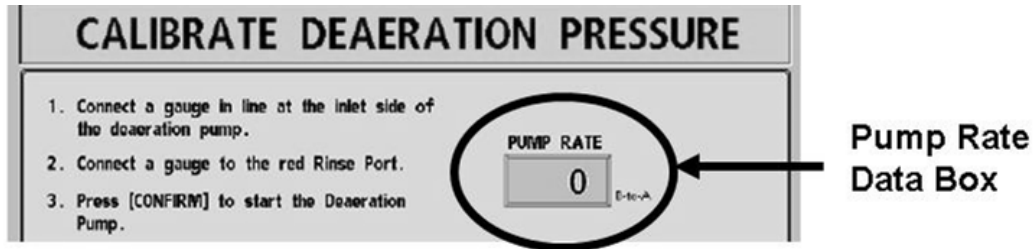


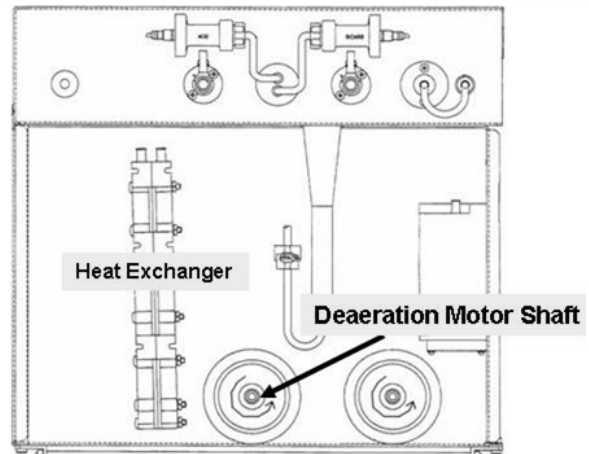
Figure 83 – Calibrate Deaeration Pressure Screen

- 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 498).



DAIR- 1.1.0 CHECK DEAERATION MOTOR

- ENSURE** the Loading Pressure gauge (yellow connector) reads 0 psi before inserting it,
- SLAM*** the gauge into the Acetate/Acid rinse port. *ELSE pressure will not be read correctly!
- Press 'CONFIRM'. The screen says "4. Adjust PUMP RATE..." AND the [Pump Rate] box is yellow!
- 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 499).

No Less than 16 psi! Perform parts a THROUGH d below:

- If the [Pump Rate] window box is LESS THAN 210 set it to 210 and press 'CONFIRM'. If Loading Pressure remains less than 16 psi see part b. If at least 16 psi see procedure number [DAIR- 2.0.0](#) (page 499).
- Press 'CONFIRM' to save the calibration then turn the machine off.

Parts c and d next page

Loading Pressure less than 16 psi continued:

- c) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- d) Proceed to **page 116**, 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 667).

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 500)), 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 500))!

5) ‘Sharply’ press ‘CONFIRM’ 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) Select the **[PUMP RATE]** data box, it turns bright yellow.

- c) Adjust its value, then sharply press ‘CONFIRM’ 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 ‘CONFIRM’ to save the calibration! **B)** Turn the machine off then on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’); **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 500)

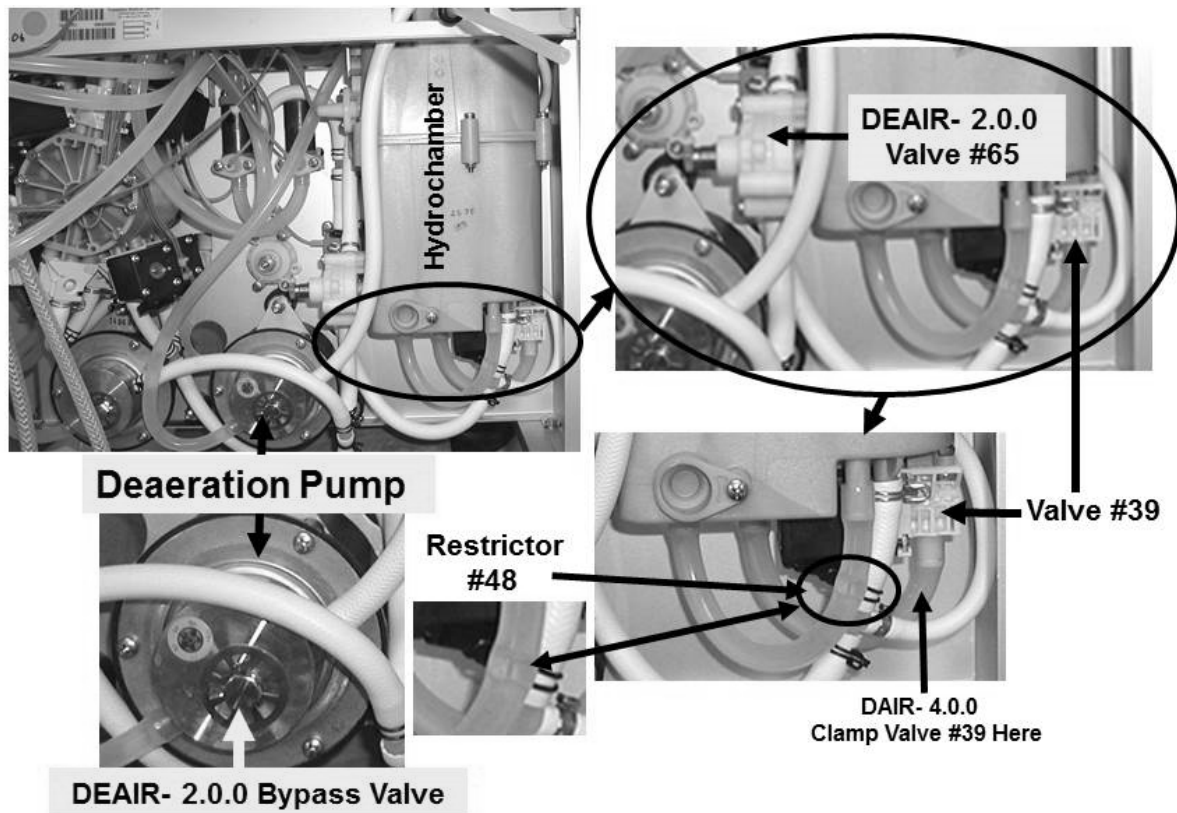
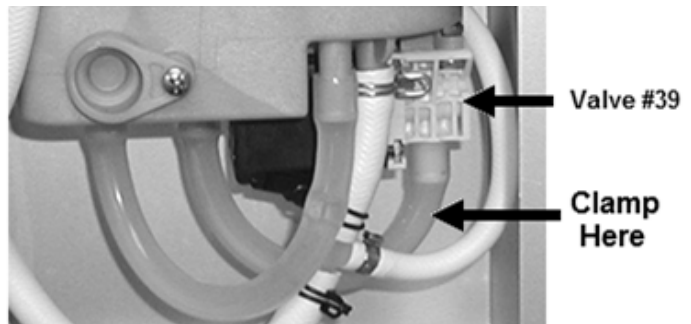


Figure 84 – Hydraulics Rear View

DAIR- 4.0.0 ISOLATE VALVE #39

If Valve #39 is sticking open target Deaeration Pressure CANNOT be achieved:

- a) Per the Figures above AND right locate Valve #39 on the BOTTOM of the hydrochamber.
- b) Figure right, clamp Valve #39's clear tubing at the location seen.
- c) Can [**PUMP RATE**] now be adjusted to achieve target pressures?



Yes Target pressures achieved! See procedure number [DAIR- 4.0.1](#) (page 501).

No Pressures CANNOT be achieved! See procedure number [DAIR- 5.0.0](#) (page 502).

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 CONFIRM to save the calibration! **B)** Turn the machine off. **C)** Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → CONFIRM). **D)** 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 501).

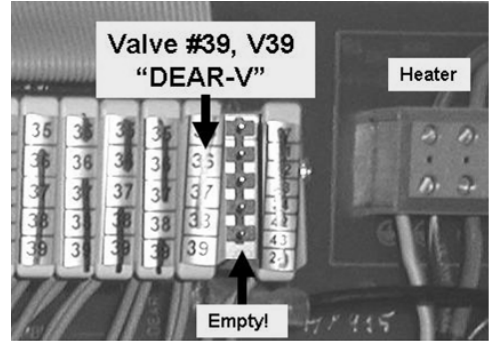
DAIR- 4.0.2 ISOLATE ACTUATOR BOARD / VALVE #39

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.

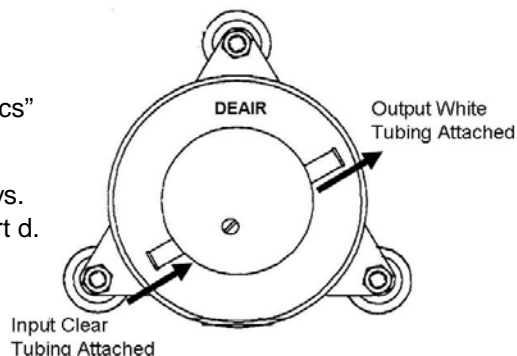
No Pressures DO NOT go to target! Valve #39 is bad.



LEFT BLANK INTENTIONALLY

DAIR- 5.0.0 ISOLATE THE DEAERATION PUMP HEAD

- a) **IMPORTANT!** Remove the clamp from Valve #39.
- b) Press 'CONFIRM' 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 [Figure 84](#) (page 500) AND 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 remain! **A)** Press CONFIRM to save the calibration; **B)** Turn the machine off; **C)** Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → CONFIRM); **D)** 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 502).
NOTE: The previous pump head may be good!

DAIR- 6.0.0 ISOLATE THE DEAERATION MOTOR

- a) Press 'CONFIRM' twice to return to the "Calibrate Hydraulics" menu.
- b) Select "Deaeration Pressure" but **DO NOT** 'CONFIRM! The [PUMP RATE] data box MUST = 0 before continuing to part c
- c) Swap in a KNOWN good deaeration motor.
- d) 'Sharply' press 'CONFIRM'. Can [PUMP RATE] be adjusted to achieve target pressures?

Yes Target pressures achieved! Target pressures achieved! **A)** Press 'CONFIRM' to save the calibration! **B)** Turn the machine off then on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM'). **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' → 'CONFIRM')!
- b) BEFORE continuing to part c, a procedure, in a different Section, is performed.
IMPORTANT! NOTE this page and procedure number (DAIR- 6.0.0) because you may prompted to return to here.
- c) Before continuing to part d, proceed to **page 139** to perform [PRESSURE TEST HYDROCHAMBER](#).
- d) If a Hydrochamber leak WAS NOT located in part c, THREE (3) possible bad components: **1)** Bad deaeration motor OR; **2)** Bad deaeration restrictor* (*to LOCATE refer to [Figure 84](#), page 500) OR; **3)** Bad Hydrochamber.

SECTION 14 - UF (ULTRAFILTRATION) PUMP PROBLEMS

UF- 1.0.0 ISOLATE UF CIRCUIT

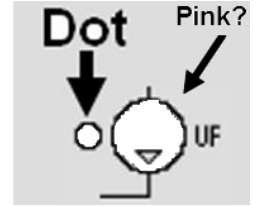
THREE (3) checks! Answer for all three below Check #3:

The UF Pump 'dot' toggles between white and blue when the UF Pump strokes. It should NOT be constantly blue!

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?



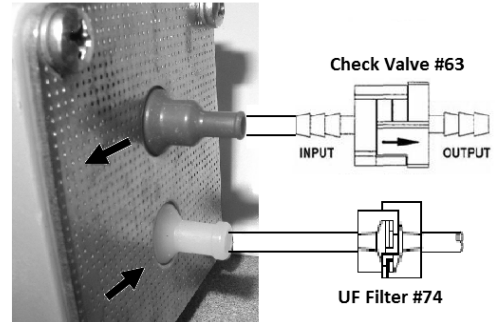
Yes (to any of the three): See procedure number UF- 5.0.0 (**page 508**).

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 504).

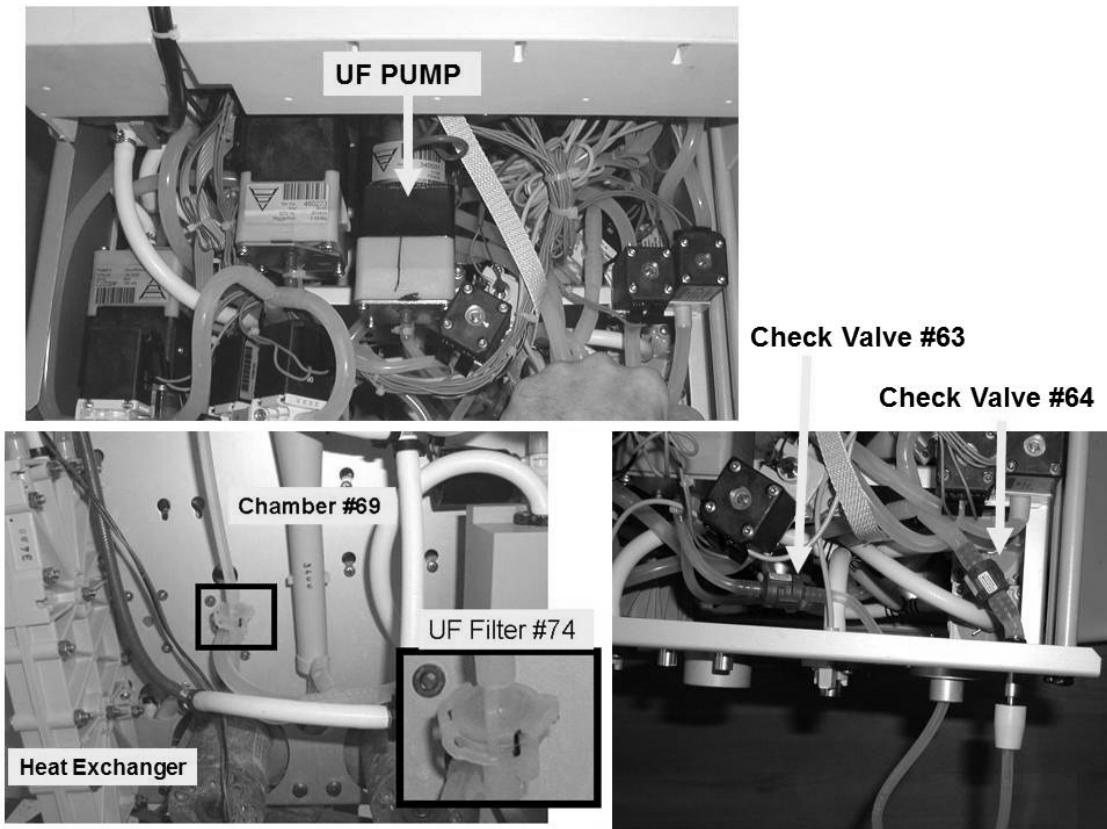


Figure 85 – Hydraulics Top / Front Views

UF- 1.4.0 ALL FIVE CHECKS OKAY / ISOLATE UF HYDRAULICS

- If the Automated Tests are running (screen reads "Test:...") turn the machine OFF!
- Return the concentrate connectors to their rinse ports and place the machine into **RINSE!** **ENSURE** the external flow indicator's 'bob' is moving up and down!
- If (and ONLY if) the UF pump is 'clicking' loudly **ENSURE** the wear button and shim washers are installed properly! NOTE: To **LOCATE** the button and washers refer to [Figure 88](#) (page 507).
- Staying in **RINSE** and referring to [Figure 85](#) (page 503), TWO (2) checks:

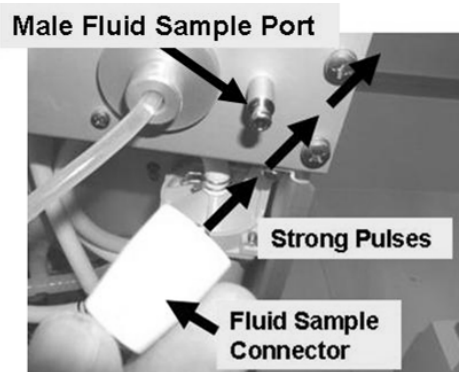
Check #1: ENSURE no external leaks from UF Check Valves #63 and #64.

Check #2: ENSURE no leaks from the UF Pump **AND** UF Filter #74.

- 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 504).

No Weak or no pulses! Proceed to **page 506**, procedure number [UF- 3.0.0](#).



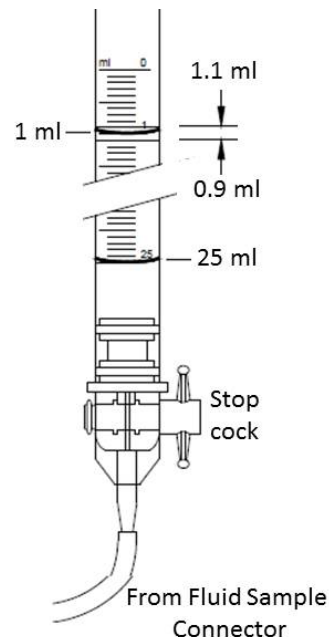
UF- 2.0.0 STRONG PULSES / ISOLATE UF PUMP CONSISTENCY

- Enter Service Mode → Calibrate Hydraulics → UF Pump Volume.
- Follow the screen's instructions through step #4. The screen's **[Target]** box defaults to 24 strokes. **DON'T CHANGE IT!**
- Per the Figure right, attach the Fluid Sample Connector to a 25 ml burette. **ENSURE** the burette's stopcock is OPEN!
- Press 'Prime' and allow the **[Target]** box to reach 0!
- Drain the burette to EXACTLY the 25 ml scale mark.
- REPEAT parts c through f. 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 505).

No TWO (2) possible scenarios:

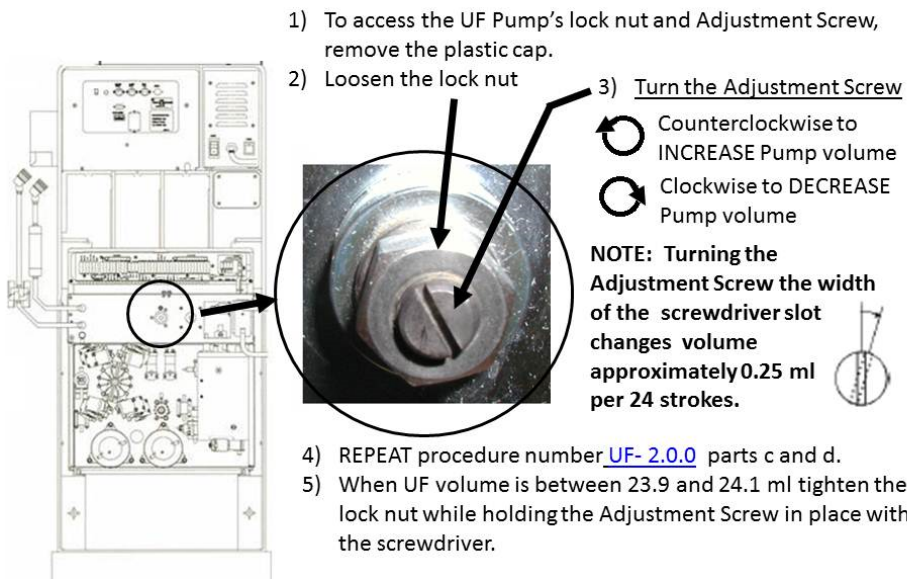
- IF (and ONLY if) BELOW the burette's 4 ml scale mark i.e. less than 21 ml delivered:** See procedure number [UF- 3.0.0](#) (**page 506**).
- IF ABOVE the burette's 4 ml scale mark i.e. more than 21 ml delivered:** Referring to [Figure 86](#) (page 505), attempt to calibrate UF Pump Volume. Does UF 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 505).

No Pump does NOT calibrate! See procedure number [UF- 4.0.0](#) (page 507).

**Figure 86 –
UF Pump
Adjustment**

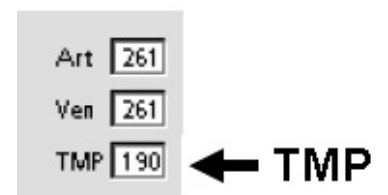


UF- 2.1.0 UF PUMP CALIBRATES OKAY / ISOLATE UF CIRCUIT IN DIALYSIS

- Plug into concentrate and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')
- From the Home screen, allow [Temperature] and [Conductivity] to become normal!
- ENSURING the external flow indicator's 'bob' is rising and falling, reset ALL alarms and select the screen's **[Test & Options]** button.
- Select **[Both Tests]** then press 'CONFIRM'. Allow the 'Conductivity' test to pass.



- Remove the Fluid Sample Connector to observe UF output below.
- Call debug screen 0 to see the UF Pump's 'dot' and TMP (Figure right).
- 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 at least six (6) feet into the room.



Yes Strong pulses! The UF Pump is okay! See procedure number [UF- 2.2.0](#) (page 505).

No Weak or no pulses! Proceed to **page 507**, procedure number [UF- 4.0.0](#).

UF- 2.2.0 STRONG PULSES / VERIFY PRESSURE TESTS

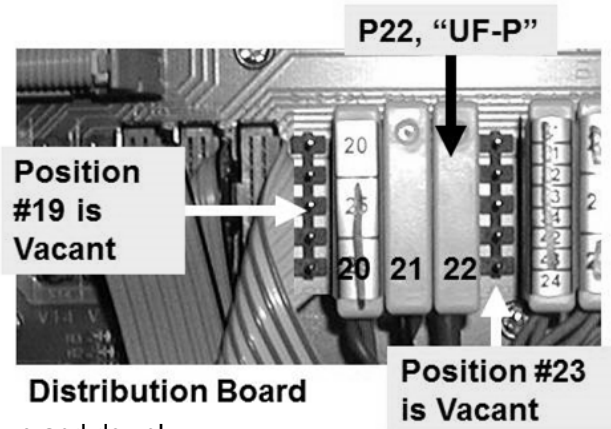
- TMP should increase to more than 240 mmHg causing the "Test: Neg Flow On" banner to appear. Allow both (Negative and Positive) pressure test to complete.
- Do BOTH tests pass?

Yes BOTH Pressure Tests pass! Proceed to **page 510**, procedure number [UF- 7.0.0](#).

No Both tests DO NOT pass! Proceed to **page 440**, [SECTION 9- TMP \(PRESSURE\) PROBLEMS](#) to perform related pressure/leak checks.

UF- 3.0.0 INADEQUATE UF PUMP OUTPUT

- Per the Figure right, trace the UF Pump's cable to distribution board position "P22, UF-P".
- ENSURE the connector is placed properly AND the cable is not damaged.
- IMPORTANT**, if **NOT** already, place the machine into **RINSE!**
- Ensure the external flow indicator's 'bob' is moving up and down!
- 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 507).

No No flow! This may be the problem! Replace UF Filter #74.

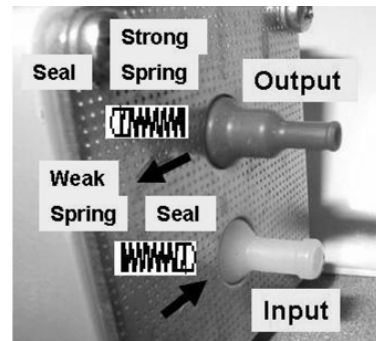
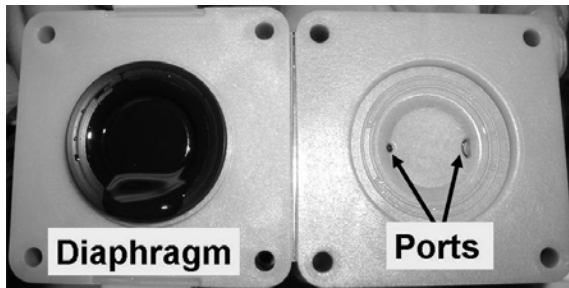
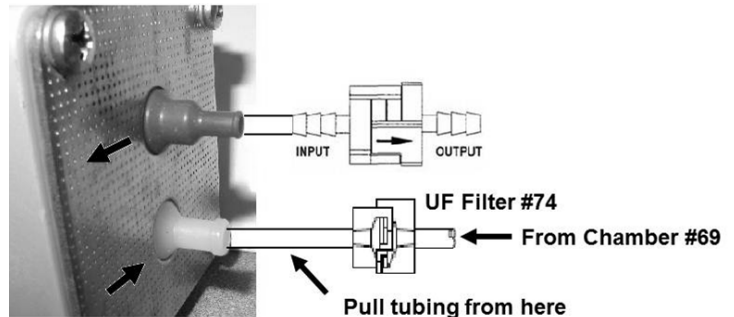
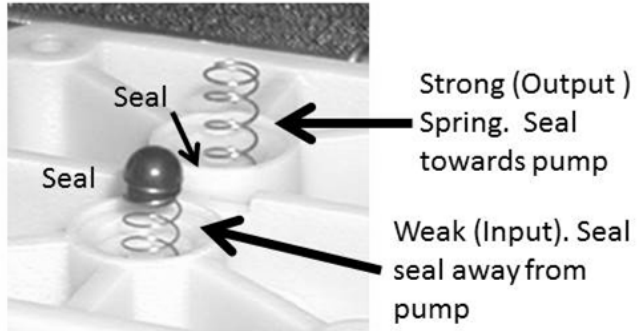


Figure 87 – UF Pump Springs / Seals/ Diaphragm

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 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 ALL tubing HOWEVER, DO NOT mount the pump to the cabinet yet!
- e) See procedure number [UF- 6.0.0 \(page 509\)](#).

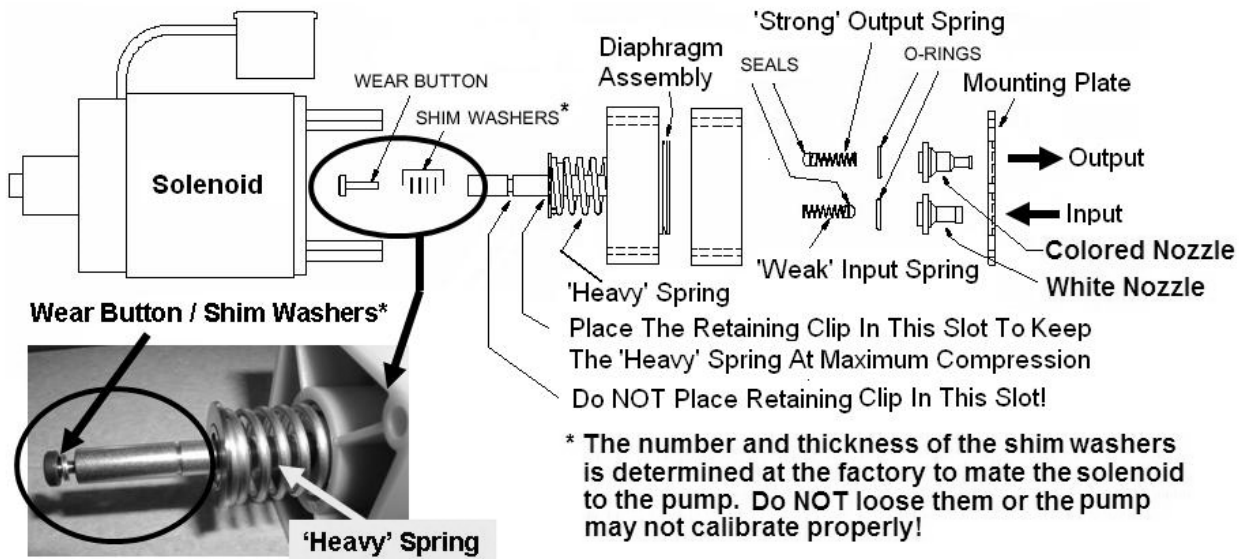
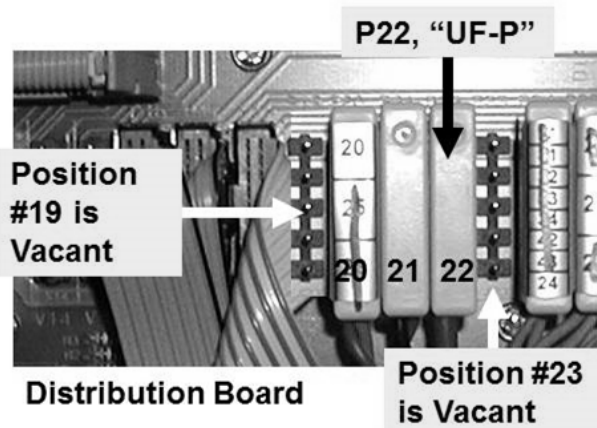


Figure 88 – UF Pump Exploded

UF- 5.0.0 CHECK UF PUMP FOR 'OPEN CIRCUIT'

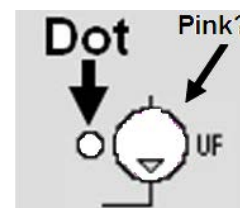
- a) Turn the machine OFF!
- b) Per the Figure right, ENSURE the UF Pump is plugged PROPERLY into distribution board position "P22, UF-P"!
- c) Trace the UF Pump's wiring to distribution board position "P22, UF-P" looking for insulation damage.
- d) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')
- e) Allow two (2) minutes BEFORE continuing.
- f) THREE (3) checks. Answer for all three below 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 508).

No (to ALL three): The problem is no longer present **HOWEVER:** 1) Check the UF Pump per the Calibration Procedures AND 2) Perform the Alarms and Pressure Holding Tests AND the UF Pump Integrity Test as described in the PM booklet!

NOTE: If a "UF Pump Alarm" banner reappears intermittently see procedure number **UF- 5.1.0** (page 508)

UF- 5.1.0 ISOLATE UF PUMP CIRCUIT

"UF Pump Alarm" OR pink UF Pump symbol OR UF pump 'dot' is ALWAYS blue:

One at a time swap in the listed components (see COMPONENT LIST below) but in between, to check if the new component fixes the problem, return to (ABOVE) procedure number **UF- 5.0.0** (page 508).

COMPONENT LIST: 1) UF Pump¹; 2) Actuator-Test Board; 3) Actuator cable²; 4) Distribution board; 5) Motherboard.

- ¹ With a known good 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. **NOTE** that four (4) **UF PUMP** connections will be checked and proceed to **page 521**, [SECTION 16 - CHECKING THE ACTUATOR BOARD CABLE](#)

UF- 6.0.0 CHECK UF PUMP FUNCTION

- Place the machine into RINSE and ENSURE the external flow indicator's 'bob' is moving up and down.
- Ensuring NO LEAKS, per the Figure right, remove the Ultrafiltrate Output Sample Connector from its port to observe UF Pump output.
- Are there 'strong individual pulses' through the Fluid Sample Connector that 'squirts' out at least six (6) feet?

Yes Strong pulses! See procedure number [UF- 6.1.0](#) (page 509).

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, repeat procedure number [UF- 6.0.0](#) (page 509).

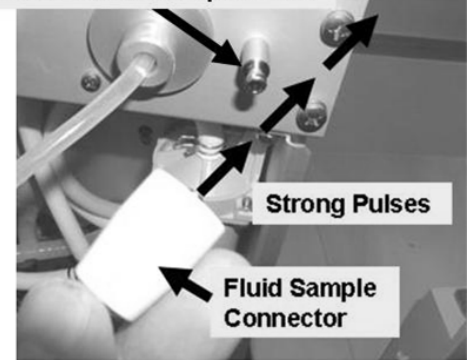
Component List: **1)** UF Pump¹; **2)** Actuator-Test Board²; **3)** Actuator cable³; **4)** Distribution board; **5)** Motherboard.

¹ Without mounting the pump into the hydraulic 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 cable can be checked. **NOTE** that four (4) **UF PUMP** connections will be checked and proceed to **page 521, SECTION 16 - CHECKING THE ACTUATOR BOARD CABLE**

Male Fluid Sample Port

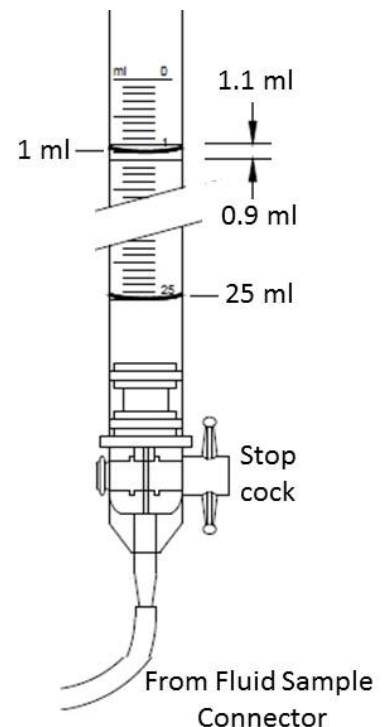


UF- 6.1.0 STRONG PULSES / ISOLATE UF PUMP CONSISTENCY

- Place the machine into Service Mode → Calibrate Hydraulics → UF Pump Volume.
- Follow the screen's instructions through step #4. The screen's **[Target]** box defaults to 24 strokes. DON'T CHANGE IT!
- Per the Figure right, attach the Fluid Sample Connector to a 25 ml burette. Ensure the burette's stopcock is OPEN!
- Press 'Prime' and allow the **[Target]** box to reach 0.
- Drain the burette EXACTLY the 25 ml scale mark.
- REPEAT c through f. 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! Proceed to **page 505**, procedure number [UF- 2.1.0](#).

No Referring to [Figure 86](#) (page 505), 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?):

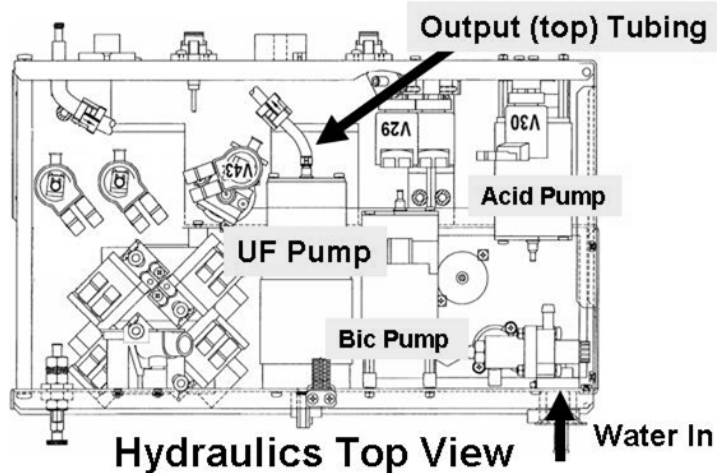
Yes Pump calibrates! Proceed to **page 505**, procedure number [UF- 2.1.0](#).

No Replace the UF Pump with a known good and repeat (ABOVE) procedure [UF- 6.0.0 \(page 509\)](#)

UF- 7.0.0 BOTH PRESSURE TESTS PASS / UF PUMP INTEGRITY TEST

This IMPORTANT procedure checks the UF Pump's 'strong' output spring:

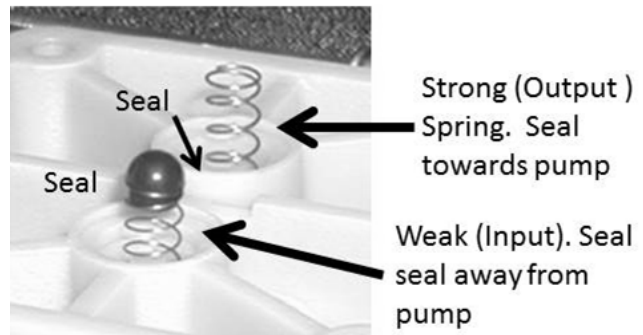
- a) **Figure right**, remove the UF Pump's solid (TOP) OUTPUT tubing.
- b) Attach a tubing segment to the vacant nozzle and route it away from the machine.
- c) RESET all alarms!
- d) From the **[Test & Options]** screen repeat the Pressure Tests.
- e) Do BOTH Pressure Tests (Neg Flow On, Positive Flow Off) pass?



Yes BOTH Tests pass! **A)** Return the UF Pump's tubing; **B)** If not already done, perform the UF Pump (UF Volume) Check per the Preventative Maintenance 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 door!
- B) CLOSE THE SHUNT DOOR!
- C) **DO NOT** reset alarms until instructed!
- D) [**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 per minute!
- E) If automated tests EVER start (screen reads "Test:...") allow them to finish BEFORE continuing!
- F) From the Home screen, set [Dialysate Flow] to 500 ml/min and press 'CONFIRM'.
- G) 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, even if only once:** Proceed to **page 20**, [SECTION 1 - FLOW ERRORS IN DIALYSIS PROGRAM](#).

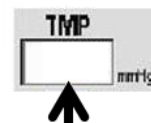
No **Flow Error ALWAYS = 0:** See parts a AND b below:

a) Valve #24's 'dot' MUST be BLUE i.e. machine is not in bypass BEFORE continuing to part b!

b) Call the Home screen. Figure right, what color is the TMP Window?

1) **IF (and ONLY if) pale yellow/white:** See procedure number [BL- 1.0.4](#) (page 511).

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 511).



Red = TMP Alarm

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 440**, [SECTION 9- TMP PROBLEMS](#).
- 2) **IF TMP is STABLE:** See procedure number [BL- 1.0.5](#) (page 512).

Do NOT troubleshoot Blood Leak if a "No Water", Flow Error, Temperature, or Conductivity alarm **EVER** occur! The machine **MUST NOT** be 'in bypass'!

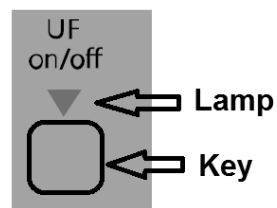
BL- 1.0.5 BLOOD LEAK ALARM?

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 clears:** See procedure number [BL- 1.0.6](#) (page 512).
 - 2) **IF the Blood Leak alarm does NOT clear:** See procedure number [BL- 2.0.0](#) (**page 513**).
- No ↓ The alarm clears! See procedure number [BL- 1.0.6](#) (page 512).

BL- 1.0.6 BLOOD LEAK ALARM NOT PRESENT (CHECK FOR AIR)

- 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 tests.
- From the Home screen, set [**UF GOAL**] to 1000 ml; set [**UF Time**] to 1:00 hr.
- Press 'CONFIRM'.
- To turn UF on, press the front panel's UF on/off key. The green on/off lamp turns on solid.

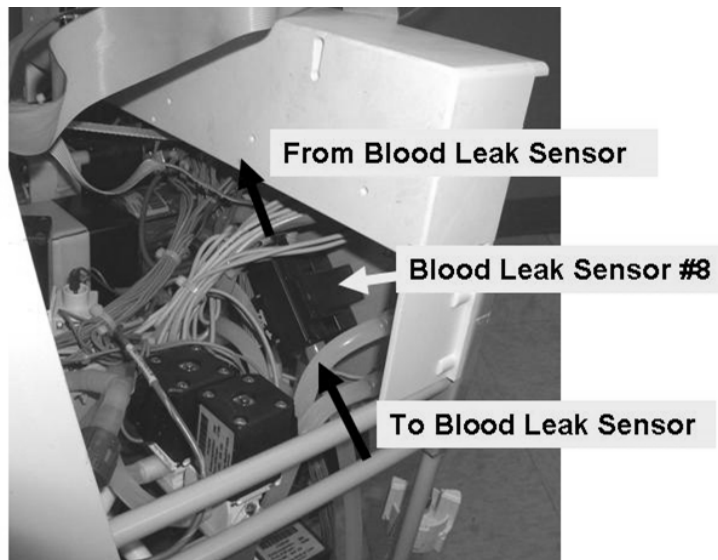


- Allow **TMP** to increase to 160 mmHg THEN IMMEDIATELY turn UF off (UF lamp off). **TMP** should increase to no more than 300 mmHg¹.

¹ If a "Filling Program" banner appears allow it to clear. If "Filling Program" occurs more than twice an air leak may be indicated. In this event (ONLY) proceed to **page 514**, procedure number [BL- 3.0.0](#)

- 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.

- TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) air is seen!** See procedure number [BL- 3.0.0](#) (**page 514**).
 - 2) **IF no air is seen:** Proceed to **page 520**, procedure number [BL- 6.0.0](#)



BL- 2.0.0 BLOOD LEAK ALARM PRESENT (CHECK FOR AIR)

IMPORTANT! 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 514).

No air seen! See procedure number [BL- 4.0.0](#) (**page 516**).

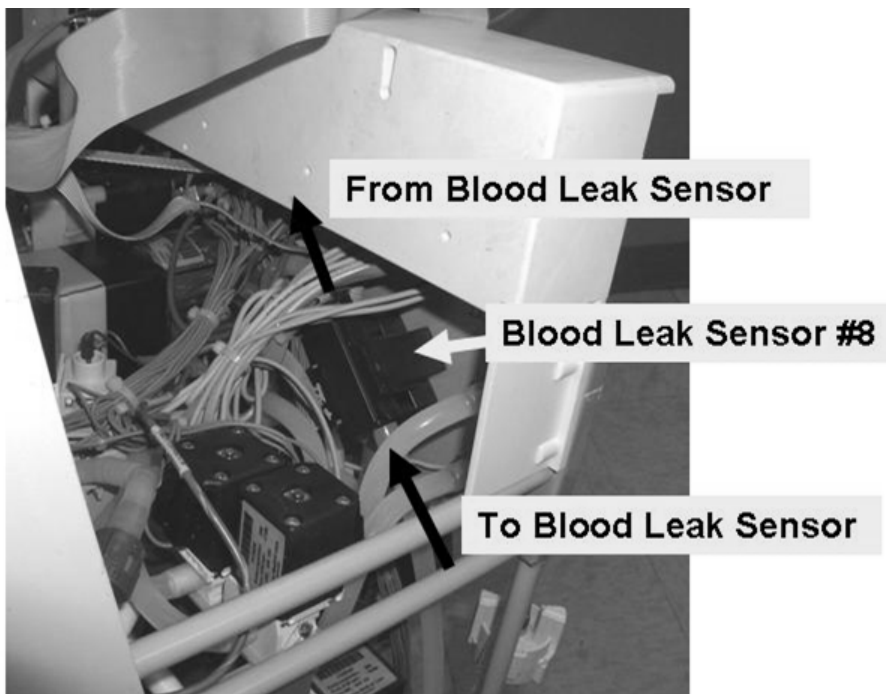


Figure 89 – Hydraulics Side View

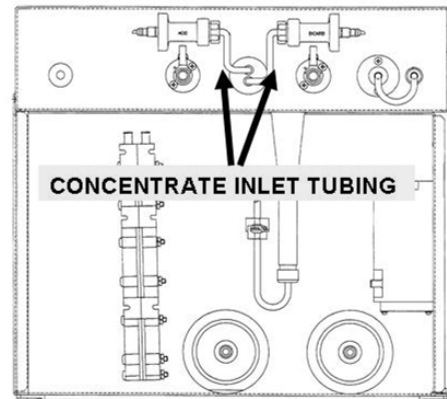
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BL- 3.0.0 AIR SEEN

Per the Figure right, 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 514).

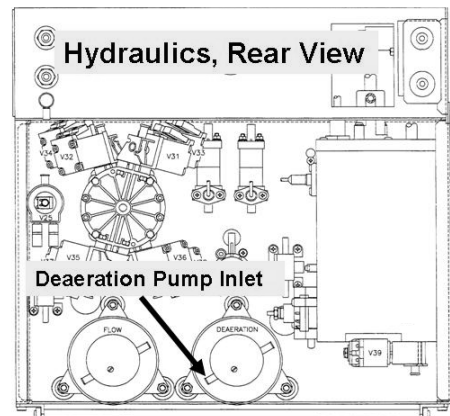


BL- 3.0.1 ISOLATE AIR REMOVAL SYSTEM

- Turn the water off and allow a “No Water” alarm to occur!
- The Deaeration gauge is used next. **ENSURE** it reads 0 inHg before installing it!
- Allow one (1) minute for the deaeration motor to stop running!
- Figure right, tee the gauge to the INPUT (clear tubing) of the Deaeration Pump.
- IMPORTANT!** Turn the water on and allow the “No Water” alarm to go away!
- Is Deaeration Pressure OKAY? Refer to [Appendix A](#) (page 667) for what pressure should be.

Yes Deaeration Pressure is OKAY! See procedure number [BL- 3.0.4](#) (page 514).

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 498, SECTION 13 - DEAERATION PROBLEMS.**



BL- 3.0.4 DEAERATION PRESSURE OKAY

- Turn the water off and allow a “No Water” alarm to occur!
- Allow one (1) minute for the deaeration motor to stop running!
- Remove the gauge and reattach the tubing.
- IMPORTANT!** Turn the water on and allow the “No Water alarm to go away!
- See procedure number [BL- 3.0.5](#) (page 515).

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) because you may be prompted to return to here
- b) Before continuing to part c, proceed to **page 496**, to perform [SECTION 12 - INDUCED POSITIVE PRESSURE TESTS](#)
- c) If no leaks were located in part b return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- d) ALLOW six (6) minutes for [Temperature] AND [Conductivity] to STABILIZE to normal.
- e) ENSURING the external flow indicator 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, 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 will RESET AND air is still seen:** Proceed to **page 490**, [SECTION 11 - INDUCED AIR LEAK TESTS](#).
 - 2) **IF (and ONLY if) the Blood Leak alarm will NOT RESET AND air is still seen:** Locate and repair the air leak!
 - 3) **IF no air is seen:** See procedure number [BL- 4.0.0](#) (page 516).

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BL- 4.0.0 NO AIR SEEN / ISOLATE BLOOD LEAK DETECTOR #8

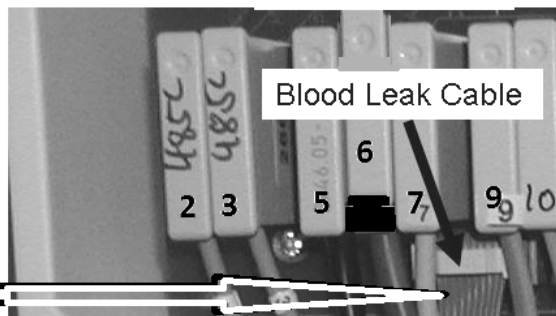
- a) If automated tests are running (screen reads "Test: ...") allow them to finish before continuing!
- b) Call debug screen 4 to see **LEAK** and **DIMN**. FIVE (5) possible scenarios, 1) or 2) or 3) or 4) or 5) below:



- 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 \(page 520\)](#).
- 2) **IF LEAK AND/OR DIMN are less than 0.2:** See procedure number [BL- 4.1.0 \(page 516\)](#).
- 3) **IF LEAK is more than 5.2; DIMN does not matter:** See procedure number [BL- 4.4.4 \(page 517\)](#).
- 4) **IF DIMN is more than 6.0; LEAK does not matter:** See procedure number [BL- 4.4.4 \(page 517\)](#).
- 5) **All OTHER scenarios:** See procedure number [BL- 6.0.0 \(page 520\)](#).

BL- 4.1.0 ISOLATE 'OPEN CIRCUIT' BLOOD LEAK DETECTOR

- a) **IMPORTANT! To prevent damage turn the machine off!**
- b) Figure right, at the distribution board, ENSURE the Blood Leak Cable is plugged in properly. **If not, this may be the problem!**



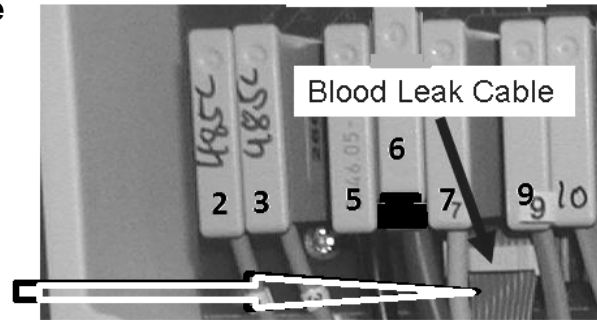
- c) A procedure, in different Section, is performed next. **IMPORTANT! NOTE** this page and procedure number ([BL- 4.1.0](#)) because you may be prompted to return to here.
- d) BEFORE continuing to part e the Sensor Board cable MAY be bad. **NOTE** that five (5) BLOOD LEAK connections will be checked and proceed to **page 524**, to perform [SECTION 17 - CHECKING THE SENSOR BOARD CABLE](#).
- e) If the Sensor Board cable checks okay return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM')!
- f) Allow six (6) minutes for stabilization!
- g) ENSURING the external flow indicator's 'bob' is rising and falling see procedure number [BL- 5.0.0 \(page 518\)](#).

BL- 4.4.4 ISOLATE BLOOD LEAK DETECTOR

a) **IMPORTANT! To prevent damage 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' → 'CONFIRM')!

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 517).

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 517), parts d and e, to test each new component until **LEAK** and **DIMN** are BOTH 0.0!

Component List: **1)** Sensor Board cable; **2)** Sensor Board¹ (see [Figure 4A](#), page 9); **3)** Distribution board.

¹ To prevent a "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**)).

BL- 4.5.0 RETURN BLOOD LEAK SYSTEMS

a) **IMPORTANT! To prevent damage turn the machine off!**

b) Return the Blood Leak ribbon cable to the distribution board.

c) Return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').

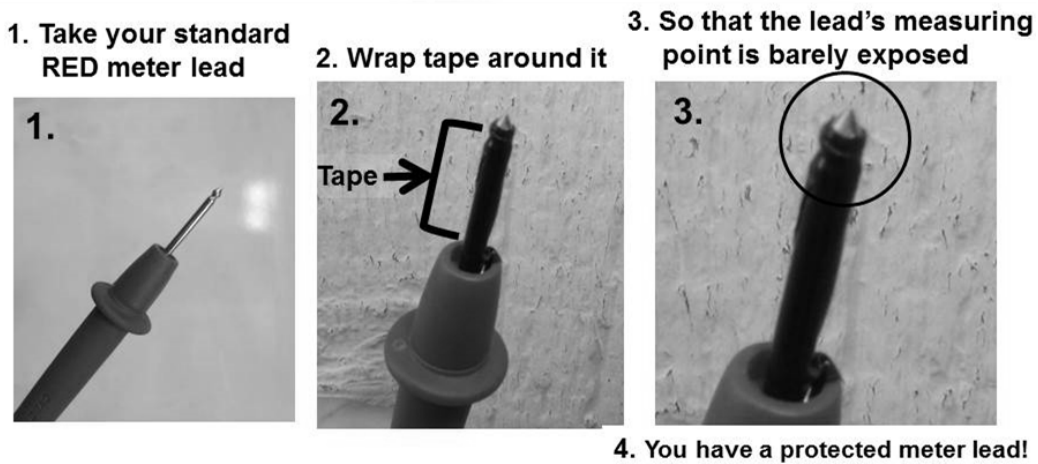
d) Allow six (6) minutes for stabilization!

e) ENSURING the external flow indicator's 'bob' is rising and falling see procedure number [BL- 5.0.0](#) (page 518).

BL- 5.0.0 CHECK BLOOD LEAK

- A) **CAUTION!** DC voltages are about to be measured* at pins that are VERY close to others and touching them together with a standard meter lead WILL DAMAGE the Sensor board. As instructed below make your RED meter lead a PROTECTED lead!

* **NOTE:** If you do NOT wish to check voltages see procedure number **BL- 6.0.0** (page 520) otherwise **DO NOT CONTINUE UNTIL YOU HAVE A PROTECTED LEAD!**



- B) To avoid pulling cables loose GENTLY open the card cage.
- C) **IMPORTANT!** Set your **CALIBRATED** volt meter to DC voltage (V_{DC})!
- D) **IMPORTANT!** 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:

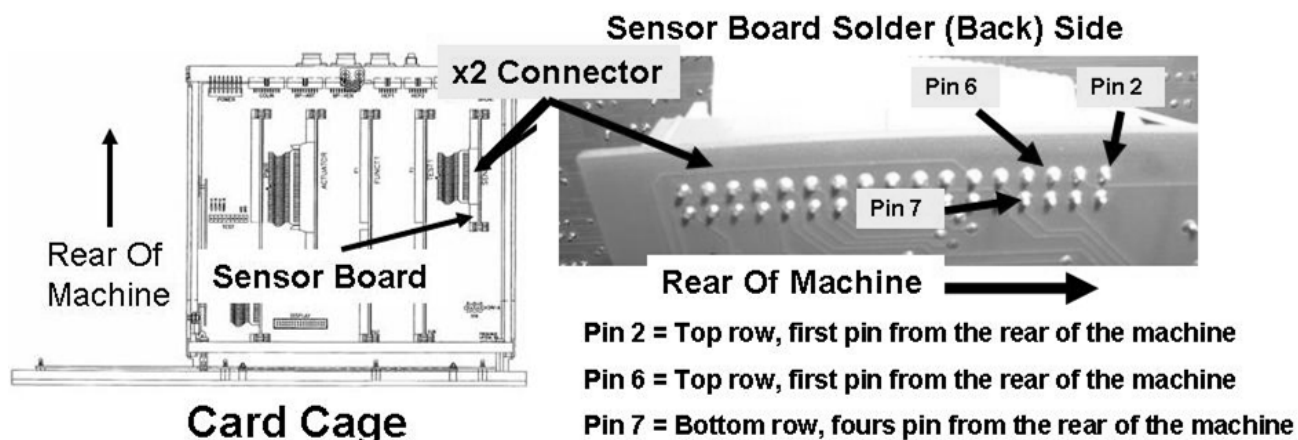


Figure 90 – Electronic Card Cage (Sensor Board)

Table 10 – 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	<ul style="list-style-type: none"> • IF less than 0.5 volts DC: Measure at pin 6 (next row in table) • IF more than 0.5 volts DC: Bad Actuator-Test Board (see page 9).
6	Top row, third pin from the REAR of the machine	<ul style="list-style-type: none"> • IF less than 4.5 volts DC: See procedure number BL- 6.0.0 (page 520). • IF more than 5.2 volts DC: See procedure number BL- 6.0.0 (page 520). • IF between 4.5 and 5.2 volts DC: From debug screen 4, does LEAK = the pin 6 measurement within +/- 0.3 volts DC? Yes LEAK = pin 6 (+/- 0.3). Measure at pin 7 (next row in table). No LEAK NOT within +/- 0.3 of pin 6 = Bad Sensor Board (see page 9).
7	Bottom row, fourth pin from the REAR of the machine	<ul style="list-style-type: none"> • IF less than 4.0 volts DC: See procedure number BL- 6.0.0 (page 520). • IF more than 6.0 volts DC: See procedure number BL- 6.0.0 (page 520). • IF between 4.0 and 6.0 volts DC: From debug screen 4, does DIMN = the pin 7 measurement within +/- 0.3 volts DC? Yes DIMN = pin 7 (+/- 0.3). See procedure number BL- 6.0.0 (page 520). No DIMN does NOT within +/- 0.3 of pin 7= Bad Sensor Board (see page 9).

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 cleared:** 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 520).
↑
↓
- 2) **IF the Blood Leak alarm cannot be cleared:** See procedure number [BL- 6.1.0](#) (page 520).

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 in the card cage. After reseating ENSURE they 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 520).

BL- 6.2.0 CALIBRATE BLOOD LEAK SENSOR #8

- a) Place the machine into Service mode → Calibrate Sensors → Blood Leak Detector.
- b) Press 'CONFIRM' 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 no more than 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 'CONFIRM' <u>twice</u> to save the calibration. Problem solved for now HOWEVER , if a false Blood Leak alarm reoccurs in the <u>near future</u> swap the listed components (see Component List below) one at a time with <u>known good</u> and repeat procedure number BL- 6.2.0 (page 520) until a Blood Leak does <u>NOT</u> reoccur. |
| ↑
↓ | |
| No | Turn the machine off and swap the following components (see Component List below), one at a time, with <u>known good</u> , and in between attempting the Blood Leak calibration until it calibrates normally. |

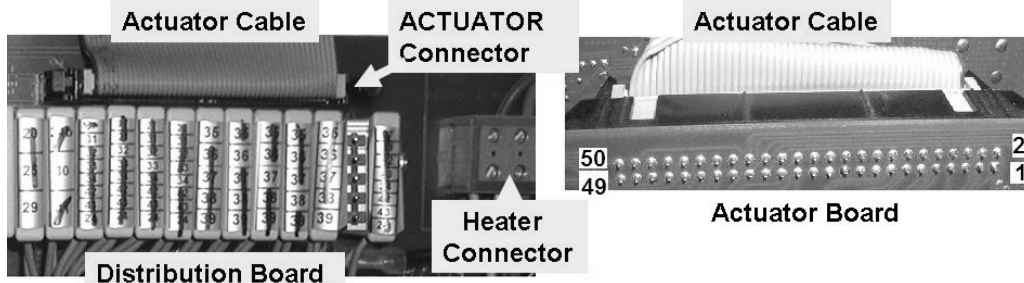
Component List: **1)** Blood Leak Sensor #8¹; **2)** Actuator-Test Board²; **3)** Sensor Board²; **4)** Sensor Board cable; **5)** Functional Board²; **6)** Distribution board.

¹ **NOTE:** To LOCATE the Blood Leak Sensor see [Figure 89](#) (page 513)

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 to prevent damage! 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!**

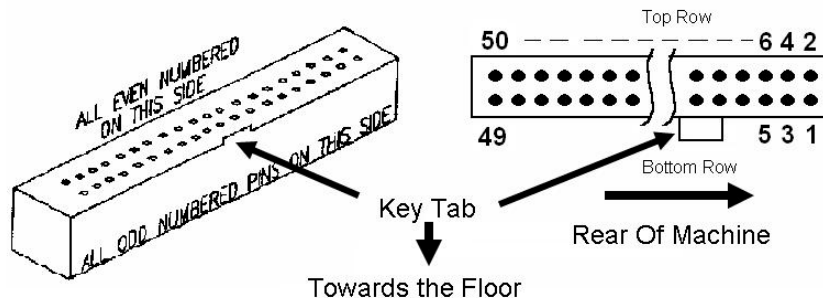
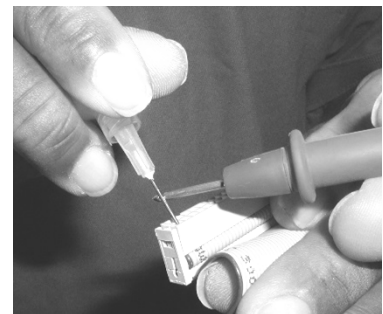


Figure 91 – Female Distribution Board Connector

- 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 522), to LOCATE the appropriate numbered **PLUG(S)** for the NOTED PUMP or the NOTED VALVE [Table 13](#) (page 523).
- 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 522), 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](#).



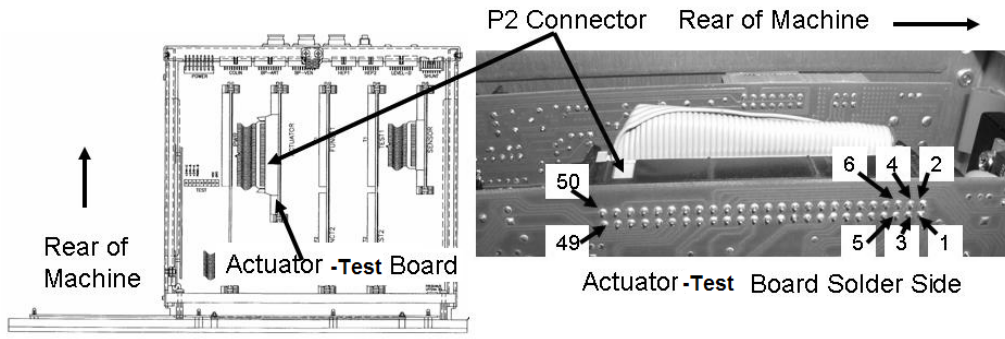


Figure 92 – Electronic Card Cage (Actuator-Test Board)

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 11 – 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

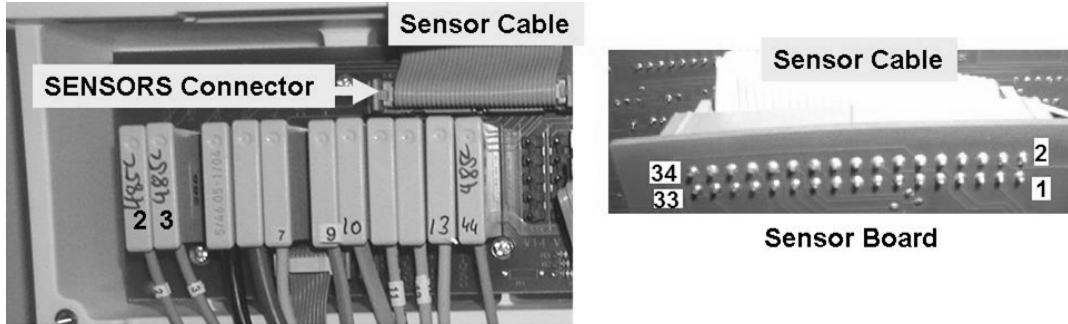
Table 12 – VALVES Cable Plug / Actuator-Test Board P2 Pin Locations

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 to prevent damage! 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.

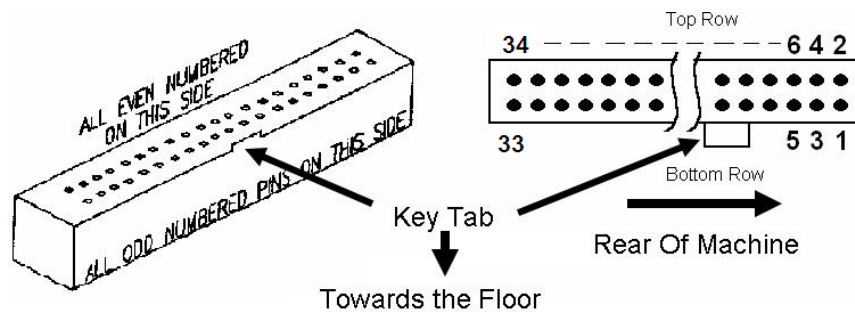


Figure 93 – Female Distribution Board Connector

- g) Referring to [Table 14](#) (page 525), LOCATE the appropriate **PLUGS** for the NOTED component.
- h) A 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 525).
- 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.

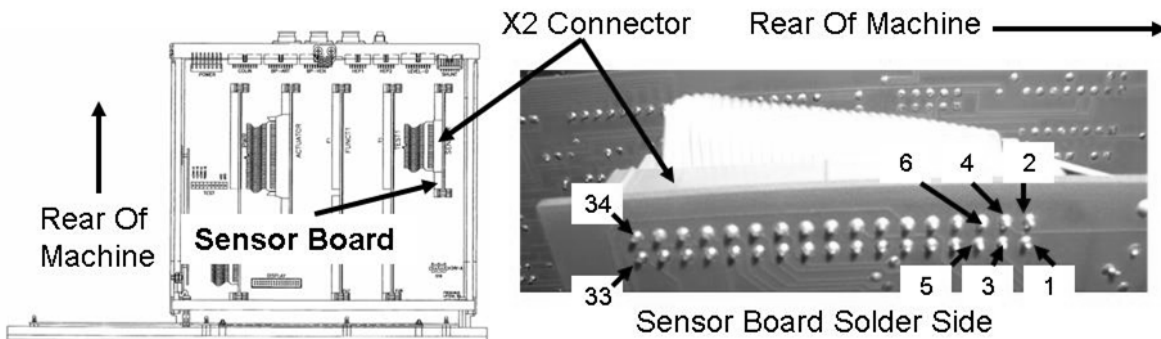


Figure 94 – Electronic Card Cage (Sensor Board)

Table 13 – 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) **IMPORTANT!** Return the concentrate connectors to the rinse ports and go to RINSE PROGRAM!!
- c) Using a flashlight, THOROUGHLY check for and repair ANY leak located!
- d) Enter Service Mode → Diagnostics → Valve Leak Test. When the [Test Status] data box says “Ready” proceed to B. PERFORM IOS TEST (page 527).

B. PERFORM IOS TEST

The **IOS** (Integrity Of System) isolates Chamber #69 and its tubing for leaks AND an **IOS** failure may cause valves to fail falsely! **IOS must pass BEFORE testing the valves!**

- a) Select the screen's [Valve Number] data box.
- b) K machine use the up/down arrow keys until [Valve Number] = “IOS”; K² machine use the +/- keys until [Valve Number] = “IOS”.
- c) Press ‘CONFIRM’ and allow “Prep” and “Testing” to complete then read the [TEST STATUS] box. TWO (2) possible scenarios:

- 1) **IF “Failed”:** 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 528).
- 2) **IF “Passed”:** Perform parts a THROUGH d below until ALL EIGHT Balancing Chamber Valves, #31 through #38, have been tested:

- a) Select the [Valve Number] box THEN: K machine use the up/down arrow keys until [Valve Number] = a Balancing Chamber Valve*; K² machine use the +/- keys select until [Valve Number] = 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 ‘CONFIRM’ and 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 balancing chamber valves have been tested then refer to Table 15 (next page):

Table 14 – 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 532)
If ONLY Valves #31 and #35 fail	See procedure number AUTOTEST- 7.0.0 (page 532)
If ONLY Valves #32 and #36 fail	See procedure number AUTOTEST- 7.0.0 (page 532)
If ONLY Valves #33 and #37 fail	See procedure number AUTOTEST- 7.0.0 (page 532)
If ONLY Valves #34 and #38 fail	See procedure number AUTOTEST- 7.0.0 (page 532)
ALL OTHER scenarios	Turn the machine OFF then see procedure number AUTOTEST- 1.0.0 (page 528)

AUTOTEST- 1.0.0 IOS FAILED / POSITIVE PRESSURE LEAK TESTS

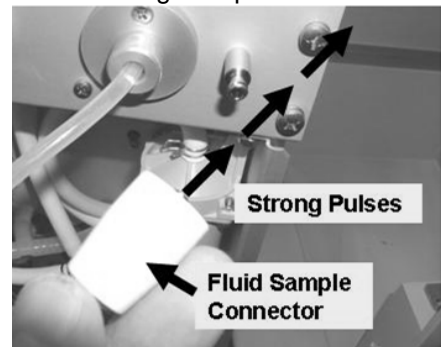
ANY external leak, however small, MAY be causing IOS failures and MUST be repaired!

- a) Place the machine into RINSE PROGRAM.
- b) Using a flashlight, THOROUGHLY check for external leaks.
- c) Check the **ENTIRE** length of the external 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 its housing for external leaks!
- e) If an immediate 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 528).

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 'CONFIRM'. 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, that squirt out at least six (6) feet?

Yes Strong pulses! See procedure number [AUTOTEST- 3.0.0](#) (page 529).

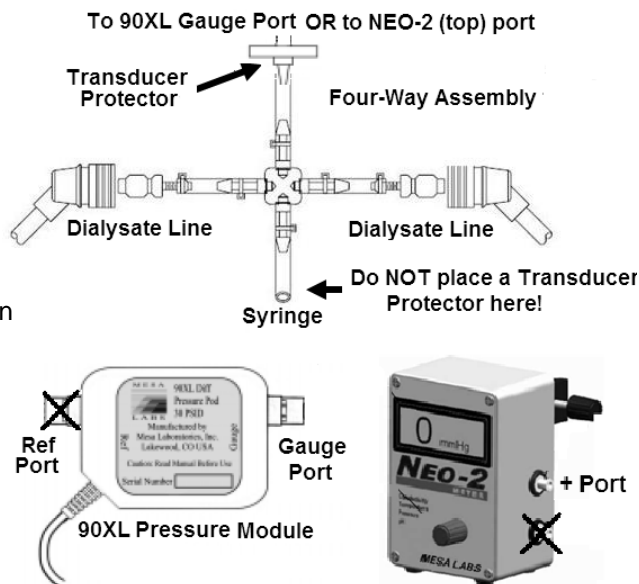
No Very weak or no pulses! See parts a THROUGH c below:

- a) Turn the machine OFF.
- b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- c) Proceed to **page 503**, [UF PUMP PROBLEMS](#).

AUTOTEST- 3.0.0 DIALYSATE PRESSURE TEST

This is NOT a routine calibration. Follow the instructions exactly to avoid error!

- a) Select 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 dialyzer 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 at dialyzer level.
- e) **IMPORTANT!** Clamp the ‘to meter’ tubing segment!
- 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 in the Four-Way’s tubing segments!
- h) **IMPORTANT!** CLOSE the shunt door **AND** ENSURE the external flow indicator’s ‘bob’ is moving at least ¼ way up in the sight tube.
- i) Press ‘CONFIRM’. The screen says “3. **Press the [Dialysate Flow on/off] key**”.
- j) Press the Dialysate Flow on/off key to turn flow off (Flow on/off lamp blinks).
- k) ENSURE the external flow indicator ‘bob’ is **NOT** moving (i.e. Flow is off).
- l) **IMPORTANT!** Remove ALL clamps!
- m) Using the syringe, adjust pressure until the external meter reads 0 +/- 4 mmHg.
- n) Press ‘CONFIRM’ then see procedure number [AUTOTEST- 3.1.0](#) (page 530).



AUTOTEST- 3.1.0 CREATE NEGATIVE PRESSURE

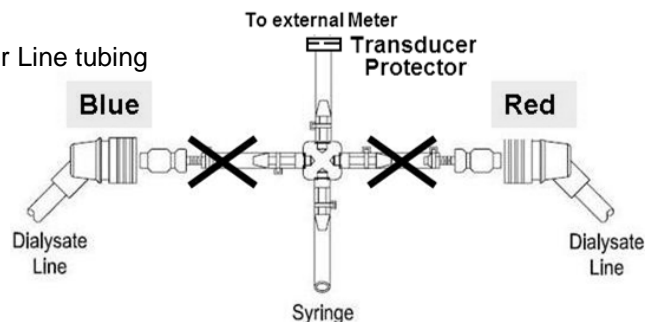
- a) The screen says “**6. Pressurize until dialysate pressure reads -250 mmHg...**”.
- b) PULL on the syringe plunger. Can you achieve between -248 and -252 mmHg on the external meter?
- Yes Between -248 and -252 on the meter. See procedure number [AUTOTEST- 3.2.0](#) (page 530).
- No Between -248 and -252 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 530).

AUTOTEST- 3.2.0 BETWEEN -248 AND -250 ON THE METER/ 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 531**, procedure number [AUTOTEST- 5.0.0](#).
- No Pressure does DOES NOT hold! See procedure number [AUTOTEST- 4.0.0X](#) (page 530).

AUTOTEST- 4.0.0X PRESSURE CANNOT 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 -248 and -252 AND does it HOLD it, +/- 15 mmHg, for one (1) minute now. TWO (2) possible scenarios below:

- 1) **IF still CANNOT achieve between -248 and -252 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 530).
- 2) **IF you CAN achieve -248 and -252 AND it HOLDS:** See parts a THROUGH e below:
 - a) Turn the machine OFF!
 - b) **IMPORTANT!** Remove BOTH clamps from the Four -Way dialyzer line segments.
 - c) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’).
 - d) **IMPORTANT!** Turn Dialysate Flow OFF (Flow on/off lamp blinks)!
 - e) Proceed to **page 466**, procedure number [TMP- 4.0.0](#).

AUTOTEST- 5.0.0 EXTERNAL METER PRESSURE IS GOOD / CONTINUE CALIBRATION

a) ENSURING the meter is still between -248 and -252 mmHg, press 'CONFIRM'.

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 531).
- 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) **IMPORTANT!** Press the Dialysate on/off button to turn flow ON (Flow on/off lamp turns off)!
 - c) Press 'CONFIRM' to save the calibration.
 - d) Turn the machine OFF!
 - e) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').
 - f) From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'!
 - 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 components: **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' → 'CONFIRM')!
- c) **IMPORTANT!** From the Home screen, set [Dialysate Flow] to 800 ml/min and press 'CONFIRM'!
- d) **Read before performing!** Repeat (ABOVE) procedure number [AUTOTEST- 3.0.0 \(page 529\)](#) but if you return here, 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 \(page 529\)](#) 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; **3)** Actuator-Test Board; **4)** Functional Board; **5)** Sensor Board cable; **6)** Distribution board.

^a To LOCATE Transducer #9 refer to [Figure 6](#) (page 19)

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 9).
- 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 534). **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 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 30 seconds and the valve passes.
- d) 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!

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 533), 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.

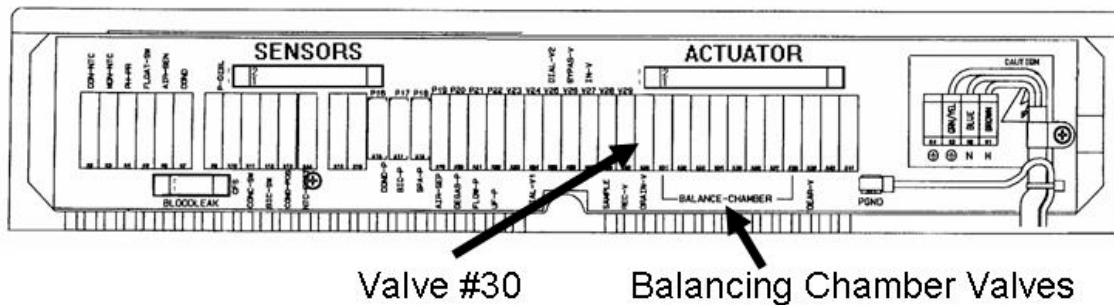


Figure 95 – Distribution Board

TOP SIDE LEAK PROCEDURE (Valves #31 through #34)

- a) Referring to [Figure 96](#) (page 534), 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’ → ‘CONFIRM’).
- 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 534).

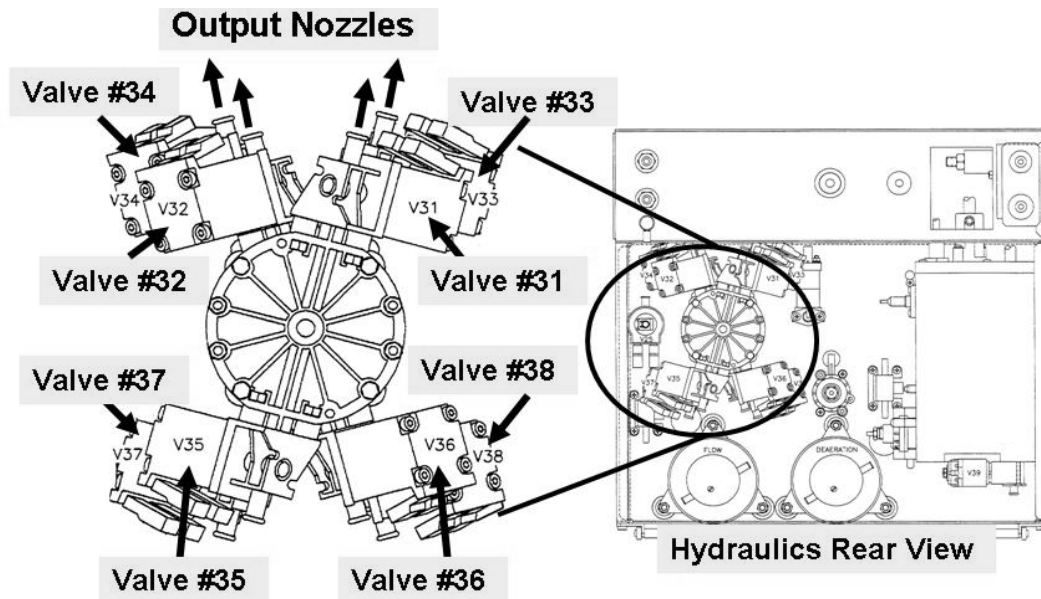


Figure 96 – Balancing Chamber Valves

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 (**WARNING!** 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 534), locate these valves at this time (left side, bottom).

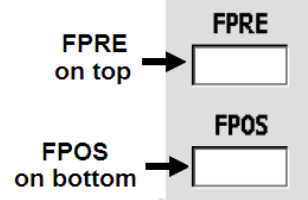
- a) Plug valve #31 into valve #30's distribution board position (V30, "DRAIN-V") and watch valve #31's nozzle. Is a leak seen?
 - Yes QUICKLY clamp valve #35's white tubing. If the leak stops replace valve #35. If not, replace valve #36.
 - No Unplug valve #31 and leave it unplugged. See part b.
- b) 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 'Escape' key then call screen 5.
- b) IGNORING **FPRE** for now, is **FPOS** (Figure right, middle column, BELOW **FPRE**) more than nine thousand (9000)?



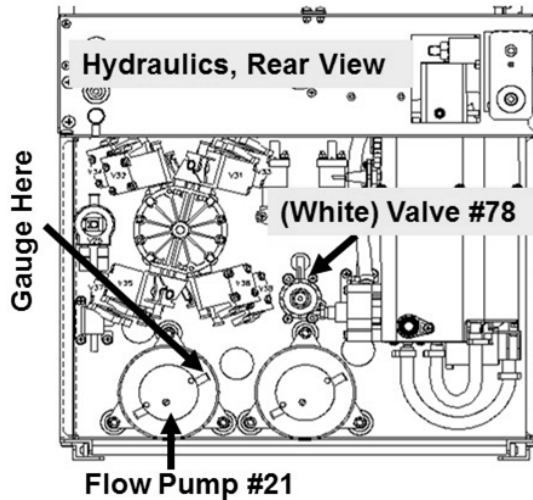
Yes **FPOS** more than 9000! See procedure number [BC LEAK- 3.0.0](#) (page 538).

No **FPOS** is NOT more than 9000. See procedure number [BC LEAK- 1.1.0](#) (page 535).

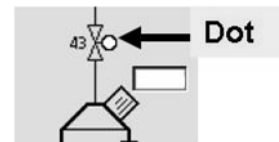
BC LEAK- 1.1.0 ISOLATE FLOW PUMP (#21)

- 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) **IMPORTANT!** Tie wrap both sides of the gauge tubing to prevent leaks and false readings!
- e) Place the machine into **RINSE!** **IMPORTANT!** 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 'Escape' 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 536).

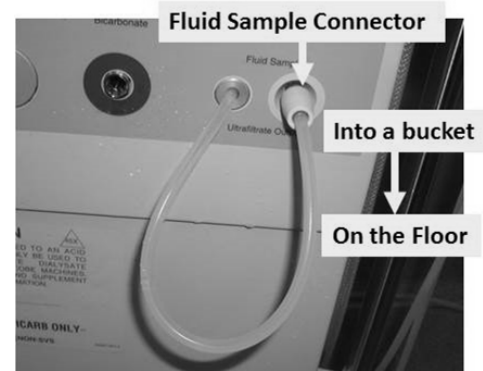
No Is NOT between 35 and 36 psi! ENSURING the machine was in RINSE AND no leaks, TWO (2) possible scenarios:

- 1) **IF (and ONLY if) pressure is too low:** DO NOT calibrate instead proceed to **page 93**, procedure number see [F- 9.0.23](#).
- 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 535).
 - b) Leaving the machine in RINSE, see procedure number [BC LEAK- 2.0.0](#) (page 536).

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, ABOVE **FPOS**) 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) **IMPORTANT!** Per the Figure below, TIGHTLY clamp the tubing at Valve #29. Ignore Flow Errors for now!



Parts e through g next page

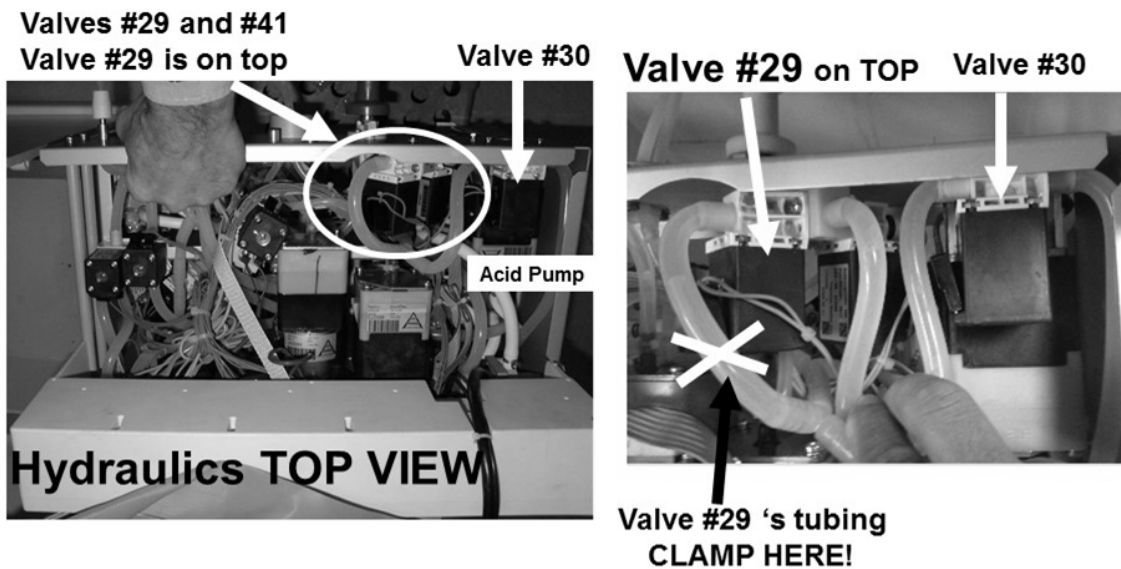


Figure 98 – Valve #29 Location

- 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:

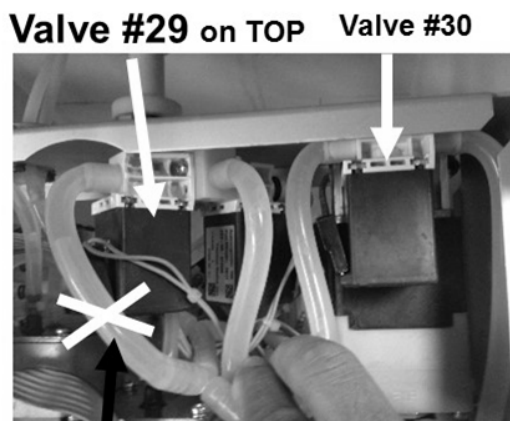
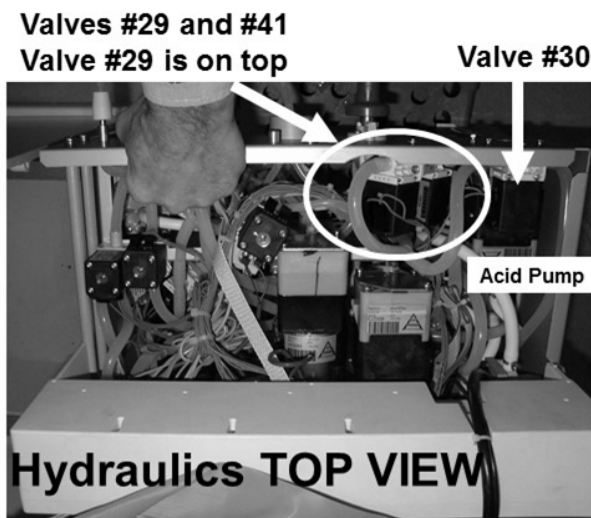
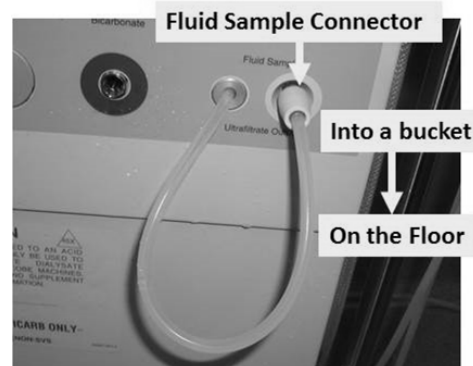
- a) A torn diaphragm is NOT indicated! Remove the clamp from valve #29 and return the dialyzer lines to the shunt!
- b) If referred to TESTING FOR A LEAKING BALANCING CHAMBER DIAPHRAGM, return to the procedure that brought you here as NOTED!

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BC LEAK- 3.0.0 DIAPHRAM 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 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 NOT = 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) **IMPORTANT!** Per the Figure below, TIGHTLY clamp the tubing at Valve #29's. Ignore Flow Errors for now!



**Valve #29 's tubing
CLAMP HERE!**

- 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 flow into its bucket!
- i) WITHOUT LOOKING AWAY, 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 539).

No **FPOS** less than 7000. See (ABOVE) procedure number [BC LEAK- 1.1.0](#) (page 535) to check the Flow Pump.

BC LEAK- 3.2.0 PERFORM DIAPHRAGM LEAK TEST

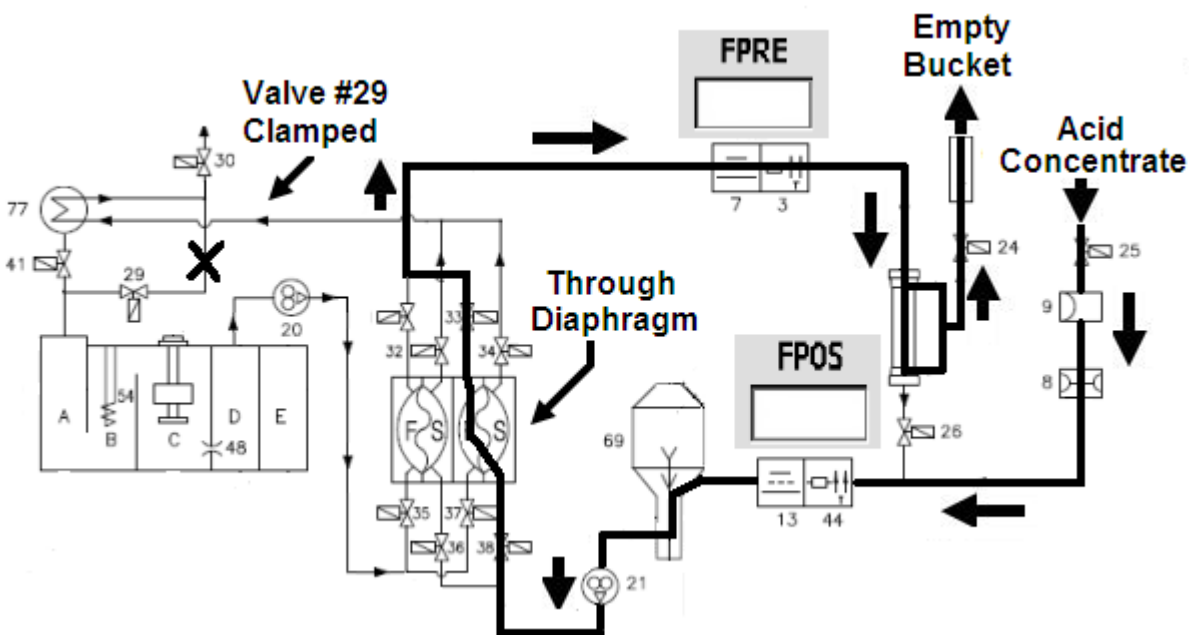
WITHOUT LOOKING AWAY, NOW watch **FPRE** for up to three (3) minutes. Does it EVER, even if only once, increase or fluctuate to MORE THAN four thousand (4000)?

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!

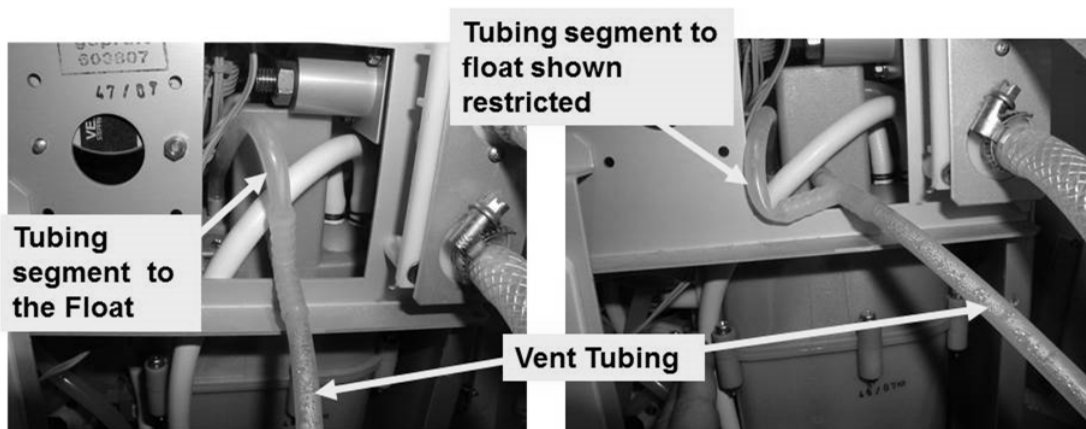
Balancing Chamber Diaphragm Leak Test Theory: Referring to the Figure below, the Flow Pump #21 delivers a highly conductive acid solution into the 'spent' (S) side of the balancing chambers at high pressure. Both balancing chamber 'fresh' (F) sides are open to low pressure because the blue (to dialyzer 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) **IMPORTANT!** 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 548**, 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 'Escape' then call screen 0.

Part I next page

- l) 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:



"0" = No Flow Error

"1" = Flow Error

- 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 542**, 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** ALWAYS = 1 (Yes or No)?



Yes **FILACT** = 1! Proceed to **page 409**, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)

No **FILACT** = 0! See procedure number [OVER- 1.0.0](#) (page 541).

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 541). 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 542). If overflow is NOT occurring maybe it was occurring ONLY when attached to a SDS where the pressure is too high.

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 542).

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 542):

No NOT in Heat Disinfect! See procedure number [OVER- 2.0.2](#) (page 542).

OVER- 2.0.1 IN HEAT DISINFECT

a) Press 'Escape' to return to the Main Heat Disinfect screen.

b) Allow Remaining **Prerinse Time** to = 0:00.

Remaining Prerinse Time 0:00 min:sec

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- 2.0.1](#) (page 542).

OVER- 2.0.2 ISOLATE HEAT EXCHANGER #77 (Slow Overflow)

a) **IMPORTANT! 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.

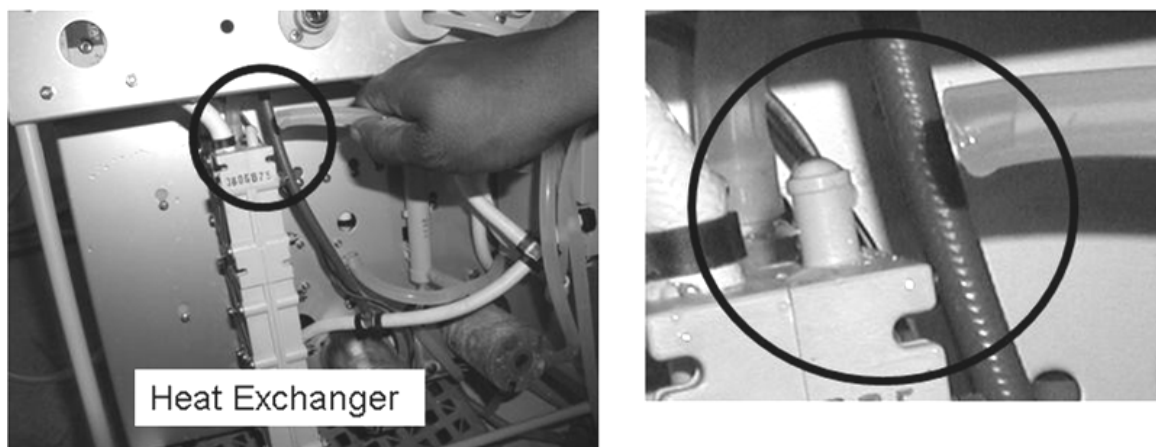


Figure 99 – Hydraulics Front View / Heat Exchanger Check

c) Watch the vacant Heat Exchanger nozzle for up to THREE (3) FULL minutes, or until you see dripping, possibly VERY slowly (Yes or No)?

Yes Dripping seen! **IMPORTANT! YOU MUST** perform the following TWO procedures:
Procedure #1: Turn the water OFF and replace the Heat Exchanger; **Procedure #2:** To prevent damage to the new Heat Exchanger, see procedure number [OVER- 8.0.0](#) (page 551) IMMEDIATELY.

No dripping! Reattach the tubing then see procedure number [OVER- 3.0.0](#) (page 543).

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.

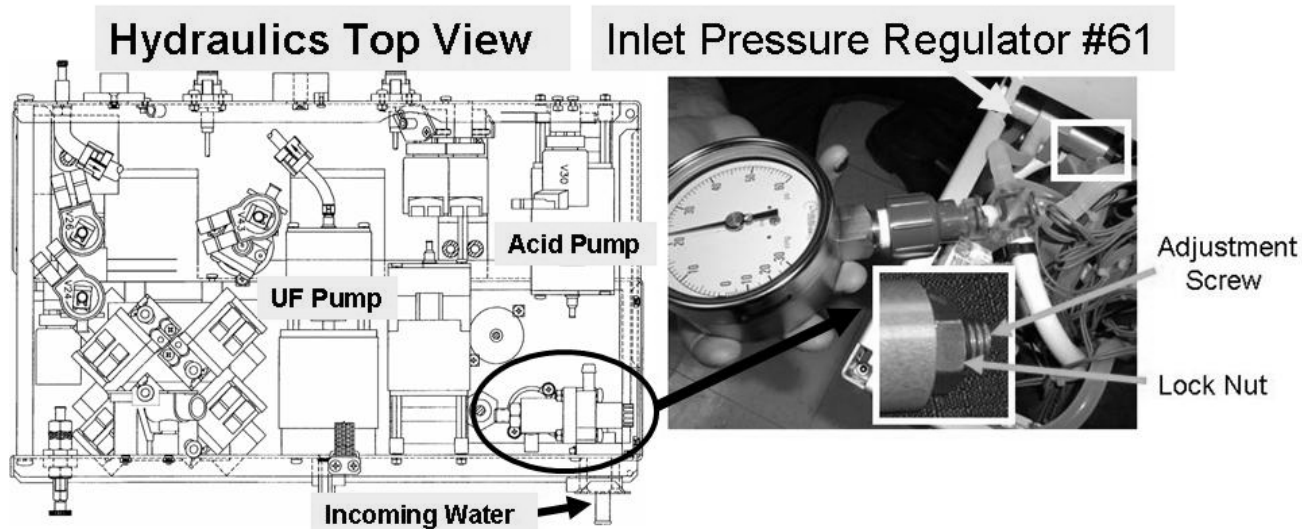
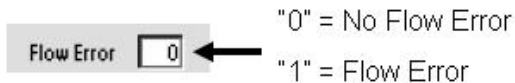


Figure 100 – Inlet Pressure Regulator #61

- 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 'Escape' then call screen 0.
- g) **ENSURE Flow Error = '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 544).

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 544).
- 2) **IF between 18 and 20 psi CANNOT be achieved:** TWO (2) possibilities: **1)** Incoming water pressure more than 105 psi OR; **2)** Rebuild Regulator #61 (Rebuild kit, 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.

- IMPORTANT!** Leaving the water on, turn the machine **OFF!**
- NOTE** gauge pressure for use later. It **MUST NOT** be more than 22 psi!
- 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 for Regulator #61 (P/N 190934).

↕

No Pressure did **NOT** increase! See procedure number **OVER- 4.0.0** (page 544).

OVER- 4.0.0 ISOLATE INLET WATER VALVE #41 (Slow Overflow)

- ENSURE the machine is off AND the water is on!
- 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.

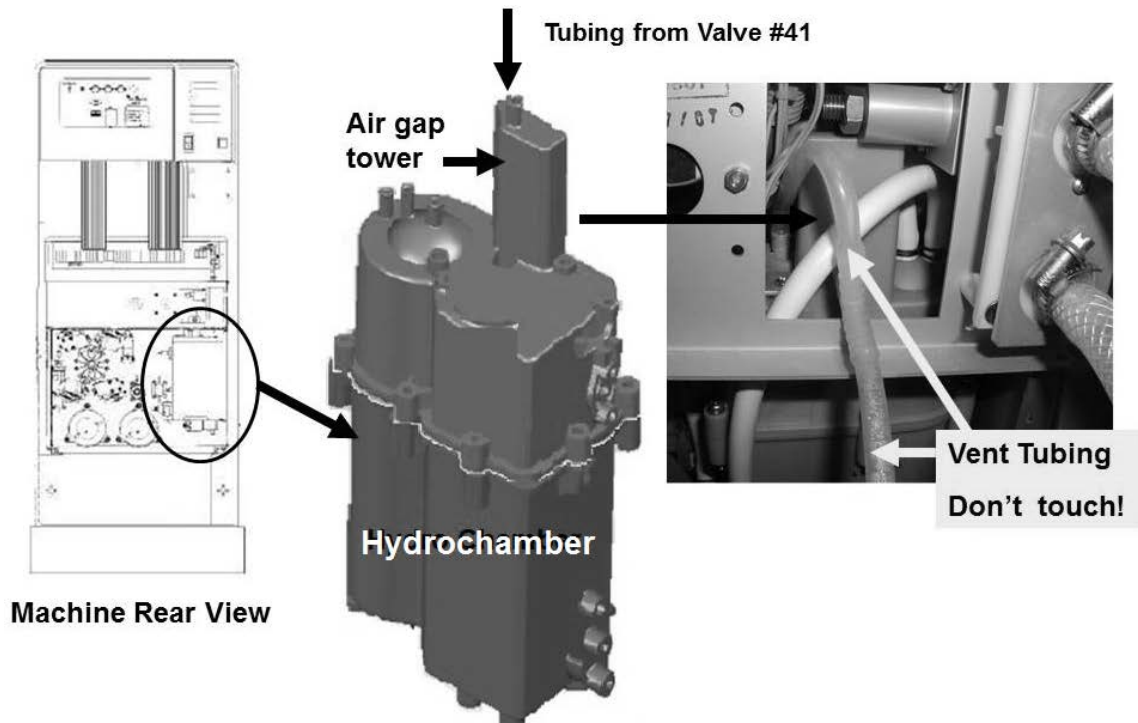


Figure 101 – Valve #41 Check

- DO NOT touch the Vent Tubing** but pull the tubing off the Air Gap Tower.

Part d next page

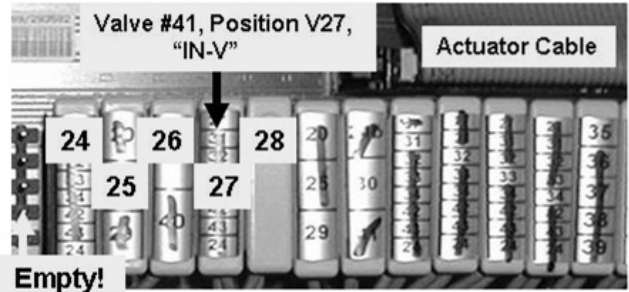
- d) **IMPORTANT!** Allow fifteen (15) seconds then watch the tubing opening for up to five (5) minutes. Is there flow or dripping (possibly slowly) from it?

Yes Flow or dripping seen! See procedure number [OVER- 4.0.1](#) (page 545).

No No flow OR dripping seen! See procedure number [OVER- 5.0.0](#) (page 546).

OVER- 4.0.1 FLOW OR DRIPPING

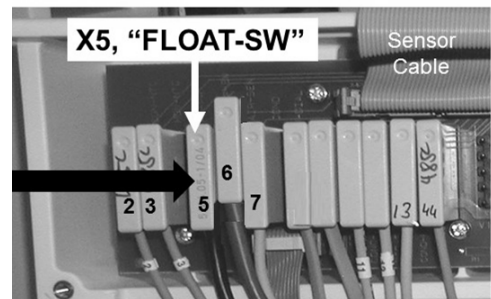
- a) Figure right, unplug Valve #41 from distribution board position labeled "V27, IN-V".
- b) Does flow or dripping continue from the Air Gap tubing?



Yes Flow or dripping continues! Valve #41* is leaking and must be replaced! *To LOCATE Valve #41 refer to [Figure 35](#) (page 193).

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 9).

No Flow or dripping stops! Float Switch #5 is bad! To LOCATE Float Switch #5 refer to [Figure 28](#) (page 129).

LEFT BLANK INTENTIONALLY

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) **IMPORTANT!** 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) and the deaeration pump's input nozzle.

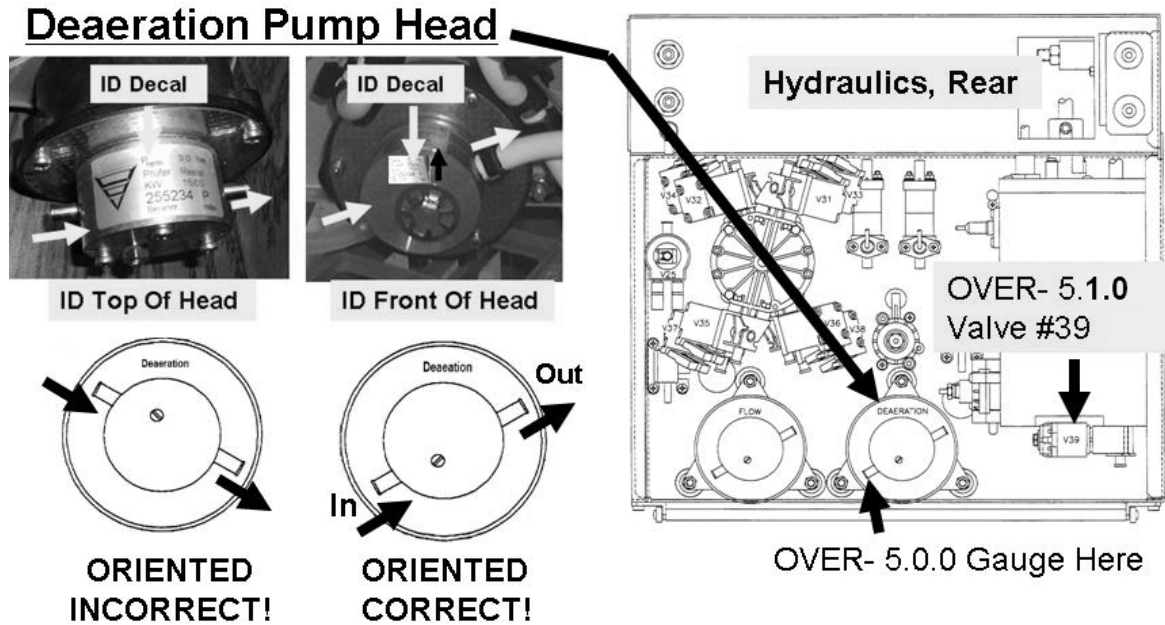
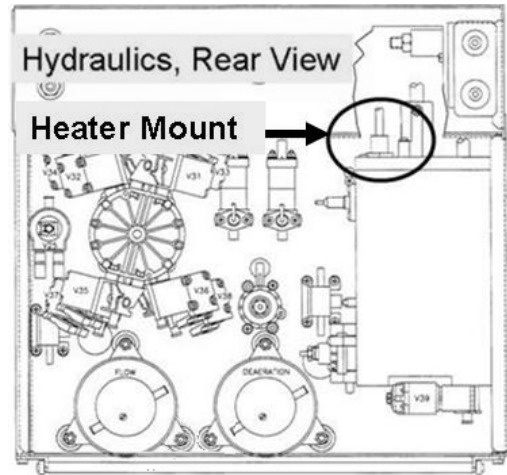


Figure 102 – Deaeration Pump Head

- d) Return the concentrate connectors to their rinse ports
- e) **IMPORTANT! 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 547).
 - 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 (REFER to [Figure 102](#), page 546) OR; 3) Bad ACTUATOR cable OR; 4) Bad distribution board!**

OVER- 5.2.0 HEAT DAMAGE CHECKS

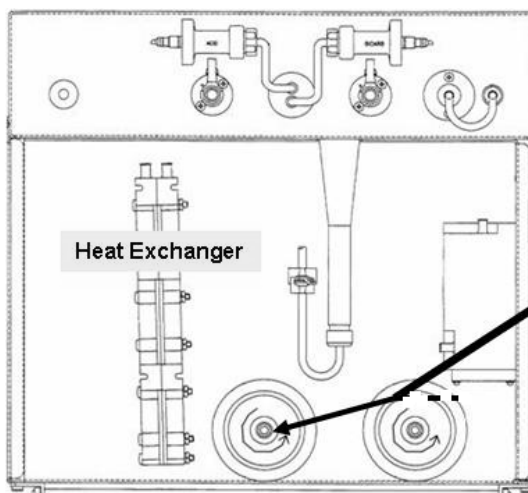
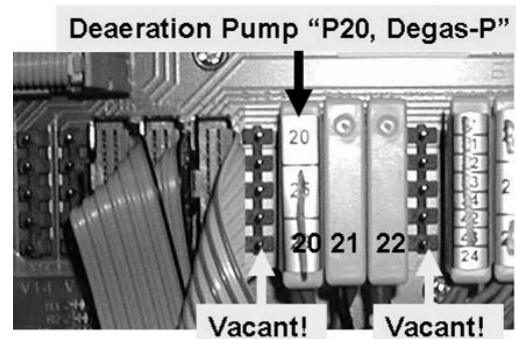
- a) **IMPORTANT!** Turn the machine OFF to prevent electrocution!
- b) Per the Figure right, remove the heater and check its opening into the top of the hydrochamber for damage i.e. melting. If (and ONLY if) damage is LOCATED replace the hydrochamber. If (and ONLY if) damage is NOT located continue 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!



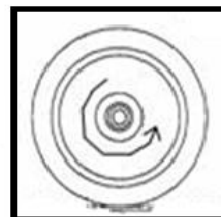
LEFT BLANK INTENTIONALLY

OVER- 6.0.0 MASSIVE OVERFLOW (More than 600 ml per minute)

- a) With the machine OFF, perform [INITIAL CHECKS](#) (page 6) and return here if a problem is NOT located.
- 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) **IMPORTANT! Turn the machine on!**
- e) Per [Figure 103](#) (below), ENSURE the Deaeration Motor is NOT rotating i.e. is unplugged!



OVER- 6.0.0 (part e). Motor should NOT be rotating at all!

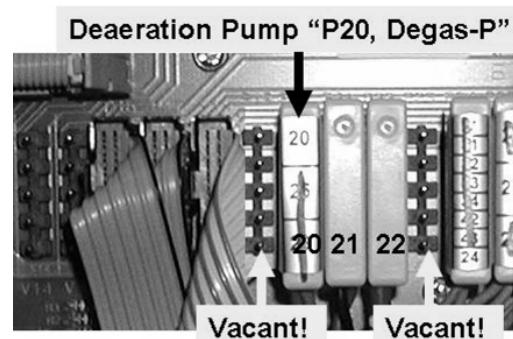


Deaeration Motor

OVER- 6.0.0 Scenario #2. MOTOR MUST be rotating counterclockwise (CCW)

Figure 103 – Hydraulics FRONT View / Deaeration Motor

- f) **IMPORTANT!** 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 550).
 - 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)?

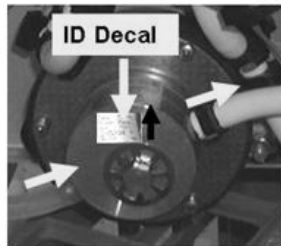


- Yes Figure below, if the deaeration pump head is oriented properly its 'ID Decal' is either on top or front. If on the front it MUST be right side up. If the head is oriented correctly see (ABOVE) procedure number [OVER- 5.2.0](#) (page 547):
- No Deaeration motor is rotating clockwise! **NOTE ONLY** the DEAERATION MOTOR will be checked then proceed to **page 130**, [TROUBLESHOOTING MOTORS](#).

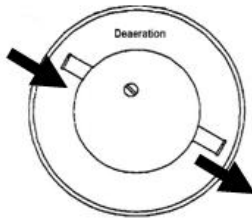
Deaeration Pump Head



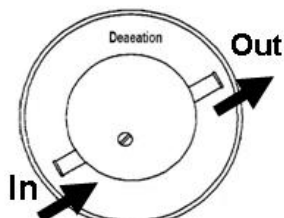
ID Top Of Head



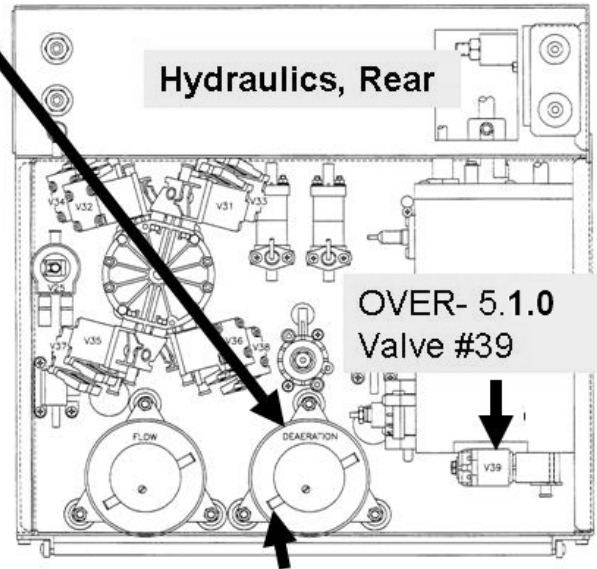
ID Front Of Head



ORIENTED INCORRECT!



ORIENTED CORRECT!



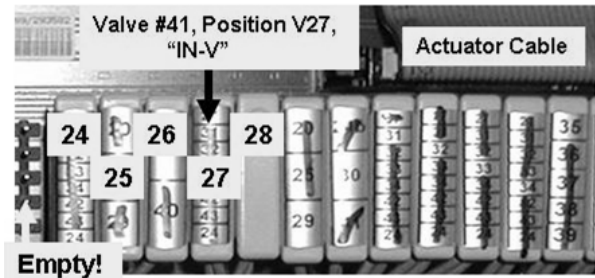
OVER- 5.0.0 Gauge Here

LEFT BLANK INTENTIONALLY

OVER- 7.0.0 ISOLATE VALVE #41

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 550).
- 2) **IF massive overflow does NOT stop:** ENSURING Valve #41 was unplugged, perform parts AND b below:
 - a) Turn the water OFF! Referring [Figure 35A](#) (page 193), trace valve #41's wiring harness from the distribution board to ENSURE it terminates at valve #41's solenoid terminals.
 - b) If the harness terminates at valve #41, valve #41 is bad (to LOCATE refer to [Figure 35](#) (page 193)).

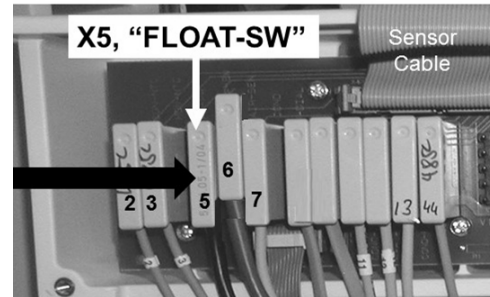


OVER- 7.0.1 ISOLATE FLOAT SWITCH

- 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 9).



- 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 129).

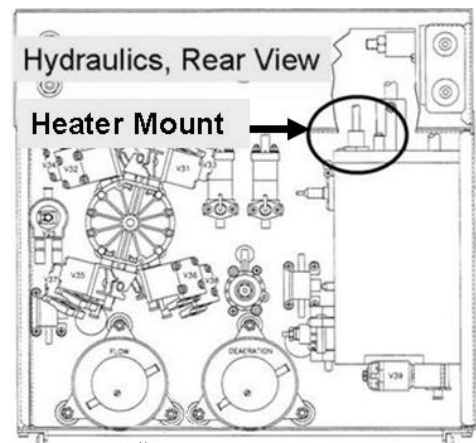
- b) If the harness terminates correctly replace the float.
- c) With the machine AND water ON, if (and ONLY if) massive overflow continues see part d.
- d) **IMPORTANT!** Turn the machine OFF to prevent electrocution then see part e.

- 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 necessary to replace the Hydrochamber. If (and ONLY if) heat 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 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 Exchange!

- 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.

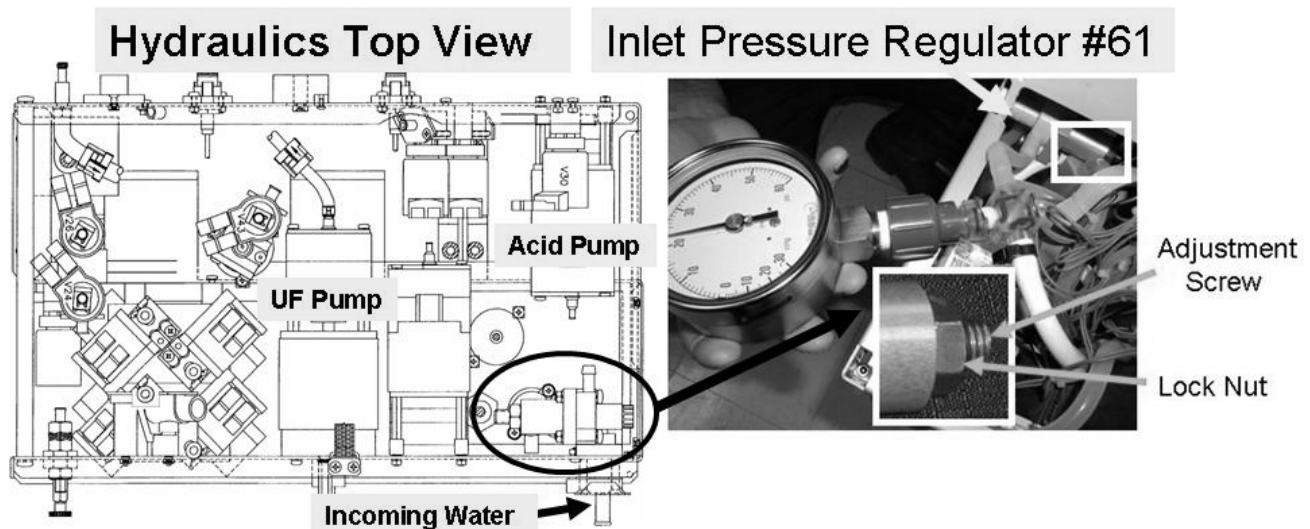
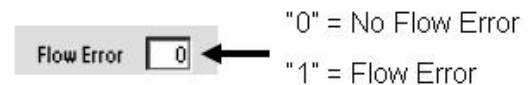


Figure 104 – Hydraulics TOP View

- 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** (Figure right) = 0 constant.
- g) Pressure should be cycling to a maximum of between 18 and 20 psi?



Yes Maximum is between 18 and 20 psi! See procedure number [OVER- 8.2.0](#) (page 552).

No Per the Figure above, **A)** Loosen Regulator's #61's lock nut. **B)** Can the center screw be adjusted until a maximum 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 552).
- 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. 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?

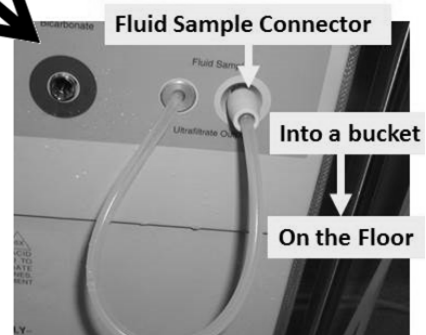
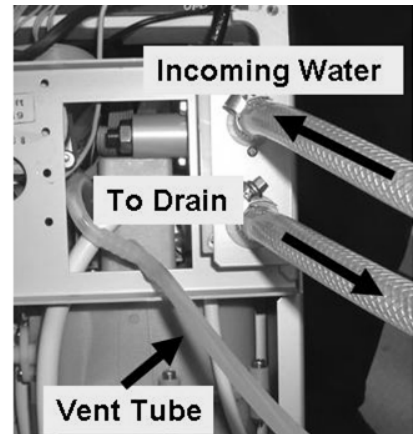
Yes Pressure increased more than 2 psi! TWO (2) possibilities: **1)** Incoming water pressure is more than 105 psi OR; **2)** Bad Regulator #61 NOTE: Regulator #61 can be rebuilt (Rebuild kit, P/N 190934).

No Pressure did NOT increase over time. Pressure regulator #61 is okay. The overflow problem should be solved!

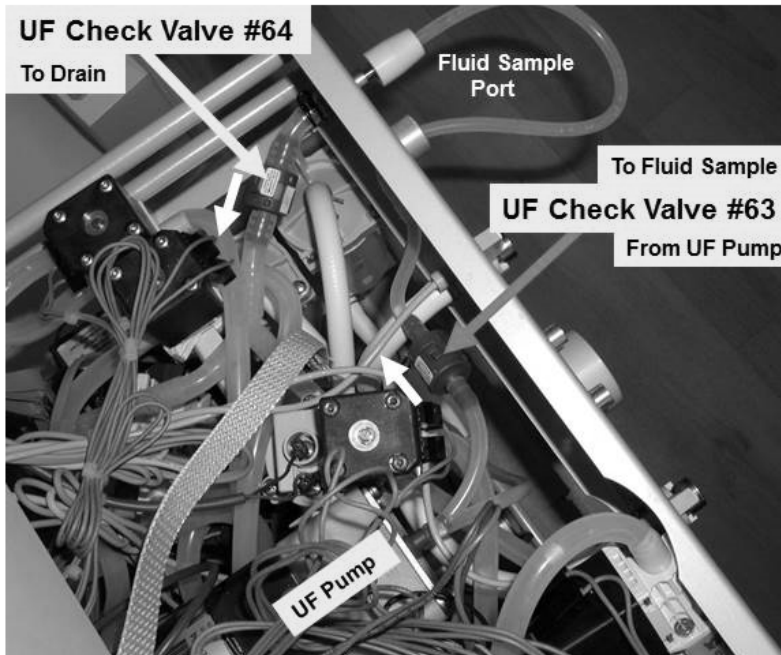
SECTION 21 – HYDRAULIC LEAKS

NOTE: These procedures do NOT troubleshoot Vent Tubing overflow!

- A) **IMPORTANT! 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) **FIGURE104** into a bucket!
- F) Per the Figure below, was tubing 'blowing off' a UF Check Valve?
 - Yes UF Check Valve tubing 'blowing off! See procedure number [LEAKING- 1.0.0](#) (page 554).
 - No UF Check Valves okay! See procedure number [LEAKING- 1.1.0](#) (page 555).



HYDRAULICS TOP VIEW



NOTE! Arrows on the valve bodies indicate flow direction!



LEAKING- 1.0.0 UF TUBING BLOWING OFF

- ENSURE the tubing to and from UF Check Valve #63 is NOT restricted!
- 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 'Escape' key then 'CONFIRM' twice!
- See procedure number [LEAKING- 1.0.2](#) (page 554).

LEAKING- 1.0.2 ISOLATE RESTRICTION

- 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!
- Place the acid and bicarbonate connectors into their rinse ports.
- Turn the machine on **THEN go** to RINSE PROGRAM!
- Allow up to four (4) minutes OR until if a leak occurs. TWO (2) possible scenarios:
 - IF (and ONLY if) NO leaks!** Unless UF Check Valve #63's tubing 'blew off' whatever was causing the leak is no longer present!



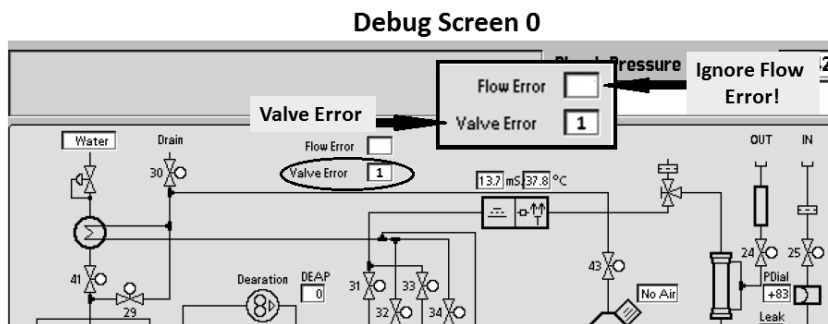
- IF a leak occurs!** With the "Interrupted" banner up perform parts AND b below:



- If (and ONLY if) UF Check Valve's tubing 'blew off' it is oriented incorrectly.
- See procedure number [LEAKING- 1.0.4](#) (page 554).

LEAKING- 1.0.4 LEAK OCCURS

- Call debug screen 0 (Figure right). If debug does not appear press 'Escape' then call screen 0.
- Ignoring **Flow Error** (the TOP window) look at **Valve Error** the **2nd window down!**

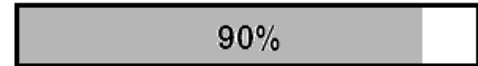


- IF (and ONLY if) Valve Error = 1 LONGER THAN two (2) seconds:** Proceed to **page 189**, procedure number [CLEAN- 7.0.0](#).
- IF Valve Error = 0 OR 'blinks to 1' for less than one (1) second:** Turn the machine OFF then proceed to **page 562**, procedure number [LEAKING- 4.0.0](#)

LEAKING- 1.1.0 ISOLATE FOR HIGH LOADING PRESSURE

ENSURING the water is on, this procedure checks if VERY 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) **IMPORTANT! To avoid error read parts c AND d BEFORE performing them!**
- c) Turn the machine on. When "Press CONFIRM For Service Mode" appears press 'CONFIRM'.
- 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?



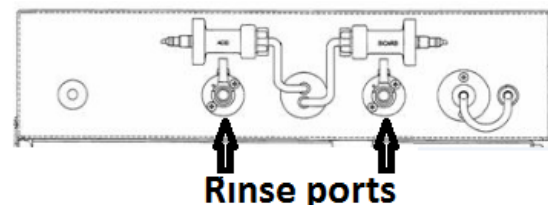
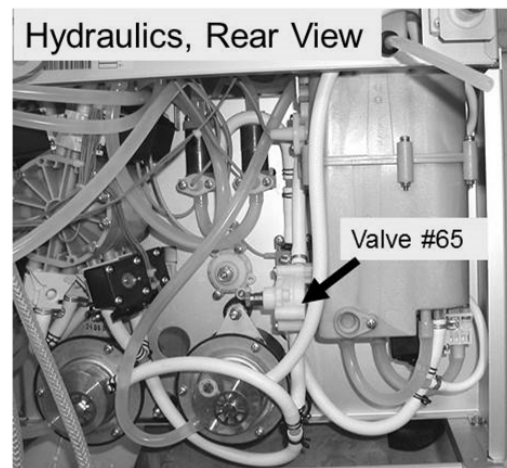
System Initializing ...

- Yes Pressure more than 30 psi! Turn the machine OFF then see procedure number [LEAKING- 6.0.0](#) (page 568).
- 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 558).
 - 2) **IF leak reoccurs:** Listed under **PRIMARY SIDE LEAK** (below) are TWELVE (12) possible scenarios (not inclusive):

PRIMARY SIDE LEAK:

Proceed according to where the leak is seen:

- 1) **Figure right, IF from Loading Pressure Valve #65:** Tighten the Valve's Phillips screws. If the leak continues replace Valve #65.
- 2) Per [Figure 105 A](#) (page 556), **IF from the Heat Exchanger BODY:** Proceed to page **665**, [HEAT EXCHANGER LEAKING EXTERNALLY](#)
- 3) Per [Figure 105 A](#) (page 556), **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 105 B](#) (page 557).
- 4) **Figure right, IF from a RINSE PORT:** 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) Per [Figure 105 B](#) (page 557), **IF from Regulator #61 OR 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 [CALIBRATION PROCEDURES](#) 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) Per [Figure 105 A](#) (page 556), **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) Per [Figure 105 A](#) (page 556), **IF between Deaeration Pump #20 and the Hydrochamber including Mixing Chambers #82:** Secure tubing connections with tie wraps.
- 10) Per [Figure 105 C](#) (page 557), **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) Per [Figure 105 C](#) (page 557), **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.

Figure 105 A – Various Hydraulic Views

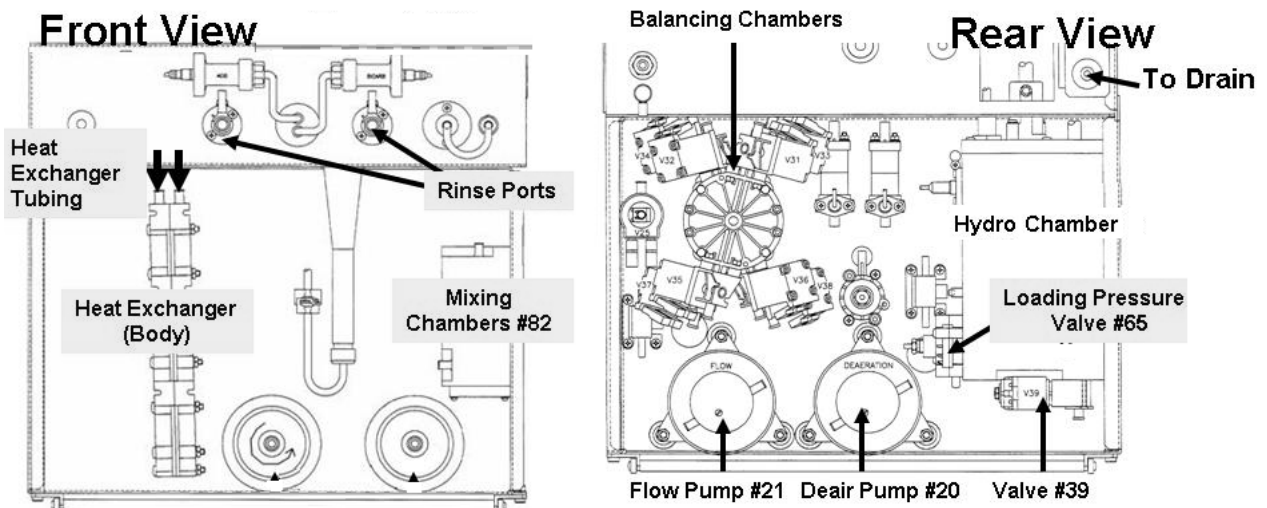


Figure 105 B – Hydraulics Top View

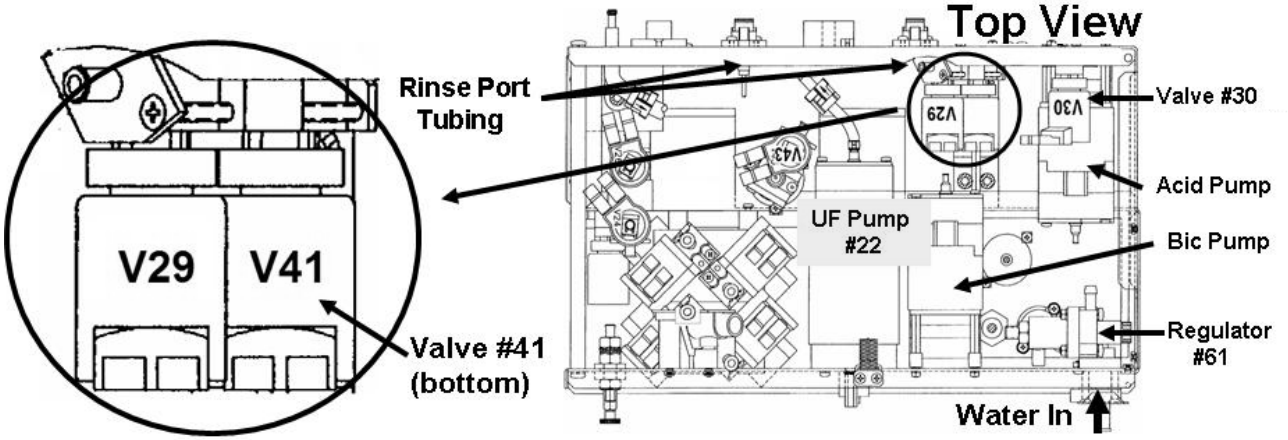
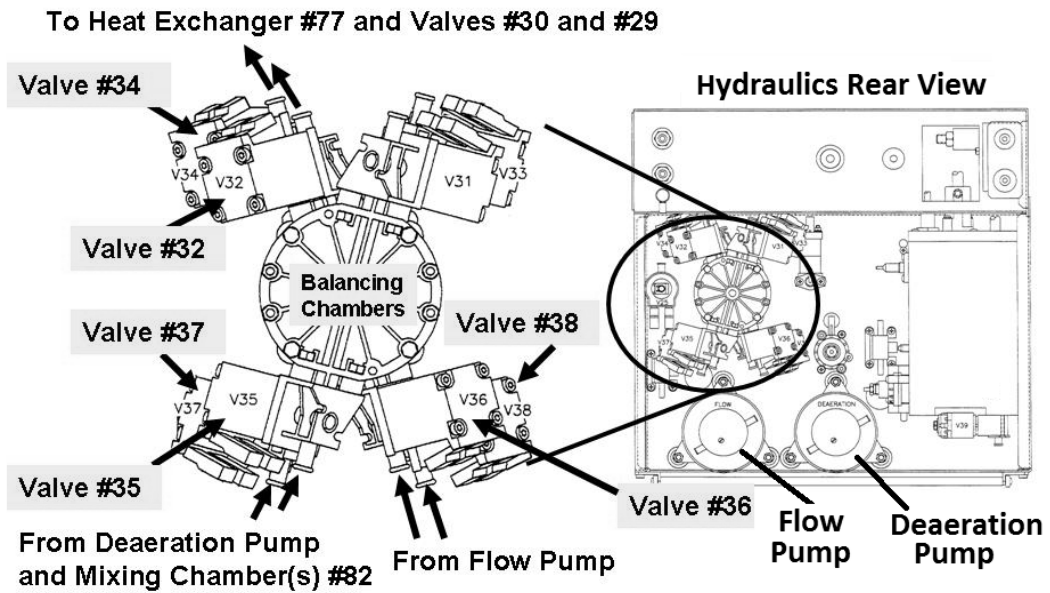
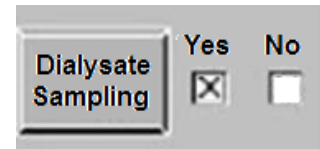


Figure 105 C – Balancing Chamber Valves



LEAKING- 2.0.0 SECONDARY SIDE LEAK / DIALYSATE SAMPLING OPTION?

- a) From the Service Mode menu, select the 'Options' button.
- b) Select 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 558).
- 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 proceed to **page 560**, procedure number [LEAKING- 3.2.0](#).
- 2) **IF in a Cleaning Program:** Proceed to **page 559**, procedure number [LEAKING- 3.0.0](#).

LEAKING- 2.1.0 DIALYSATE SAMPLING = "YES"

- a) Place the 'X' in the "No" box and press 'CONFIRM'.
- 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 ORIGINALLY seen! In a Cleaning Program squirting into the bucket occurs if (and ONLY if) 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) FULL 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 560).
- 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 158**, procedure number [CLEAN- 1.2.0](#).
 - ii) **IF in Dialysis Program AND a Flow Error occurs:** Proceed to **page 20**, [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 'CONFIRM' to return to the Main Service Mode menu.
- b) Select 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 189**, 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 559).

No UF Check Valves were okay! Turn the machine OFF then proceed to **page 560**, 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 **189**, 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 560).

- ii) **IF (and ONLY if) an active leak does NOT reoccur HOWEVER, a Flow Error occurs:** Proceed to **page 158**, procedure number **CLEAN- 1.2.0** (page 158).

- 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 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 561)
- 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 562).
- 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 561).
- 5) **All OTHER scenarios:** See procedure number [LEAKING- 4.0.0](#) (page 562).

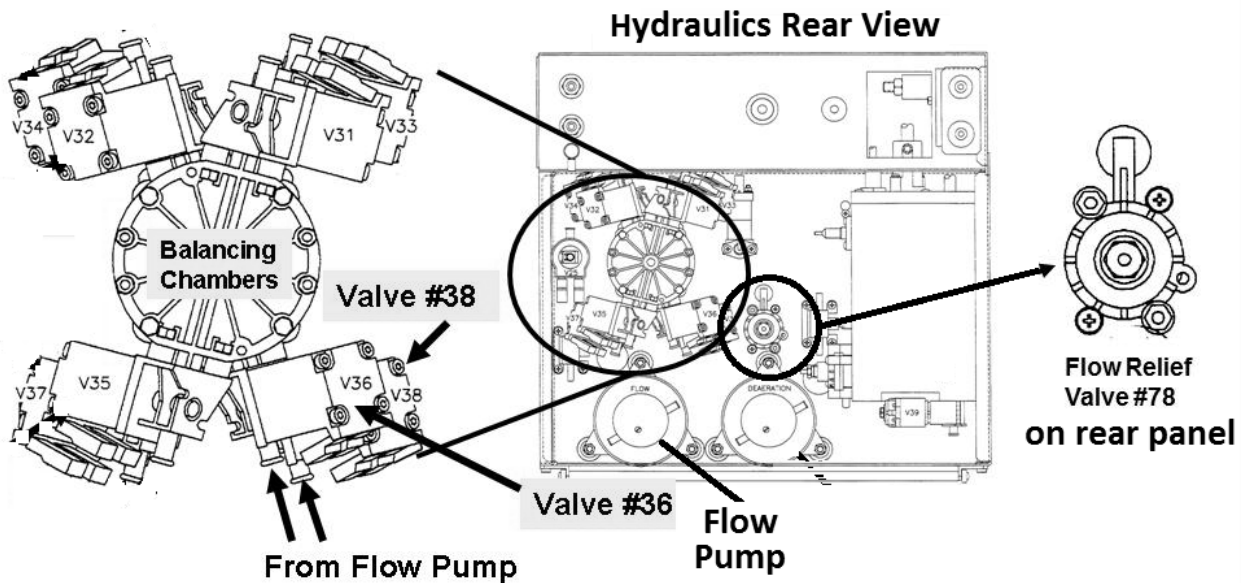
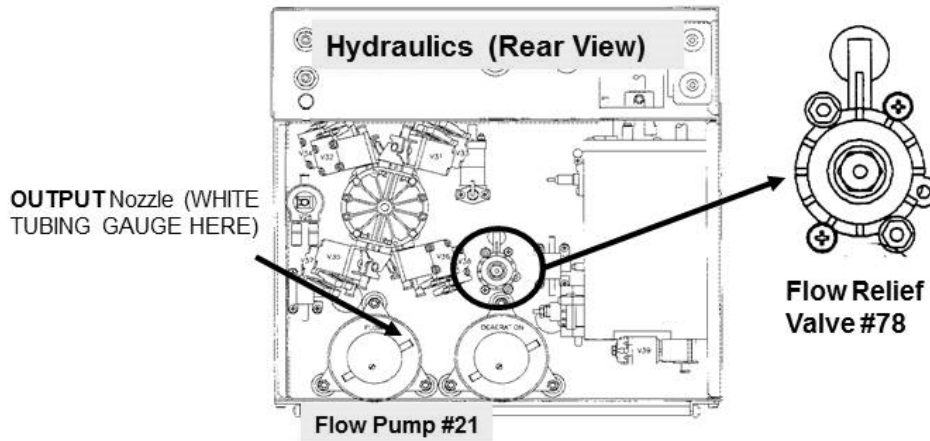


Figure 106 – Hydraulics Rear View

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) **IMPORTANT!** 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 'CONFIRM' ONCE.
- g) ENSURE the Flow Motor is rotating!
- h) 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)

IMPORTANT! A 60 ml luer lock syringe, FILLED with water is REQUIRED here!

- Without causing tension on cables and tubing, move the hydraulics as far away from the cabinet as possible!
- ENSURE the distribution board cover is on!
- Per Figure 107 below, check through Valve #30's INPUT and OUTPUT tubing for restrictions.
- Turn the machine but when "Select Program" appears DO NOT press 'Dialysis' or start a Cleaning program!**
- Figure right, screw the 60 syringe onto the Fluid Sample Port.
- 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!
- 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 within 6 seconds! The Drain path is okay! Proceed to **page 564**, procedure number [LEAKING- 5.0.0](#).

No Cannot push all water out! See procedure number [LEAKING- 4.0.1](#) (page 563).

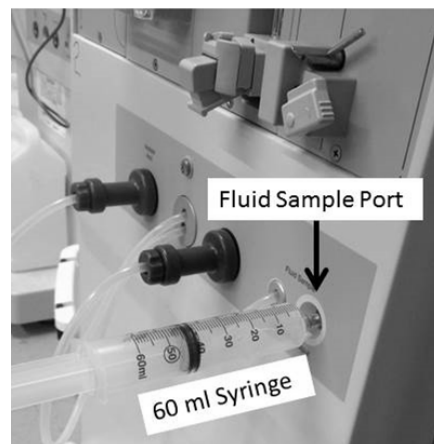
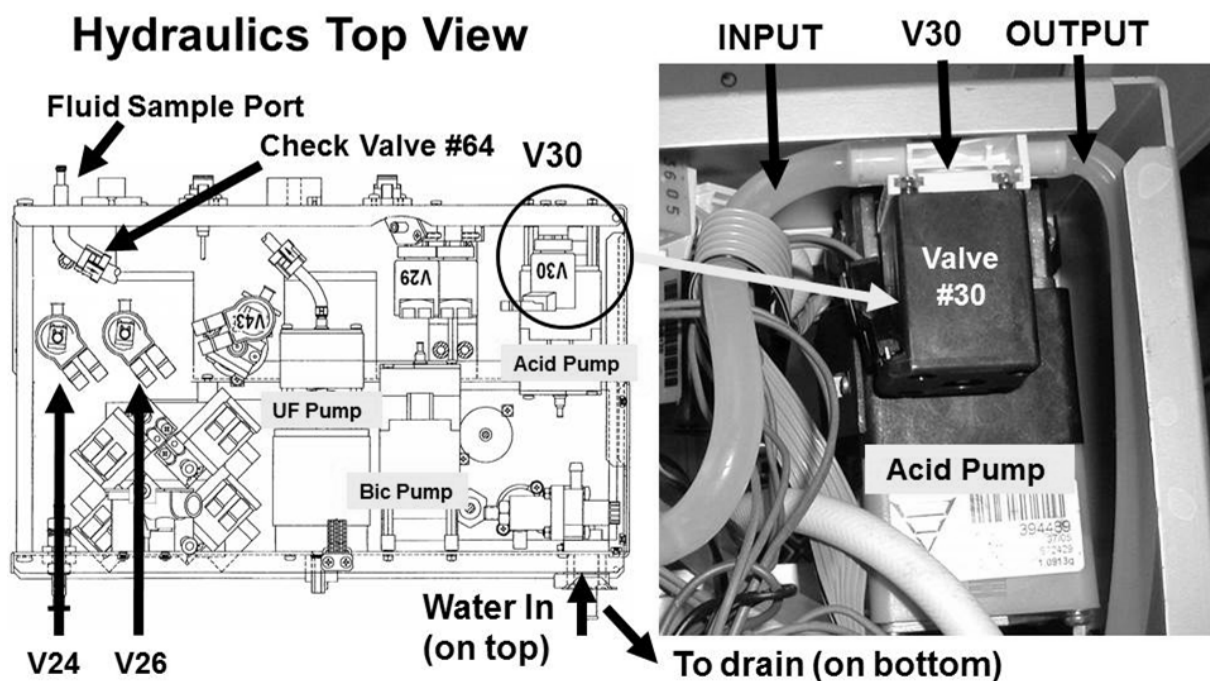


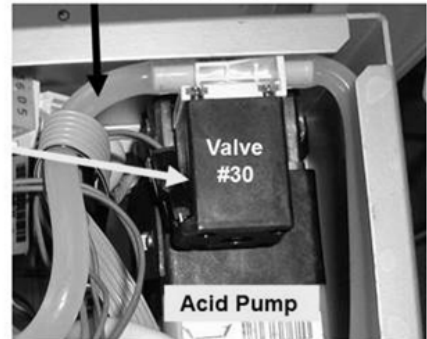
Figure 107 – Hydraulics Top View



LEAKING- 4.0.1 CANNOT PUSH ALL 60 ML THROUGH THE SAMPLE PORT

- Remove the syringe from the Sample Port and fill it with water.
- Per the Figure right, remove Valve #30's INPUT tubing!
- Attach a tubing segment to the syringe that will fit snug onto the syringe AND Valve #30's INPUT nozzle.
- 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?

Valve #30 Input Tubing



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 562).

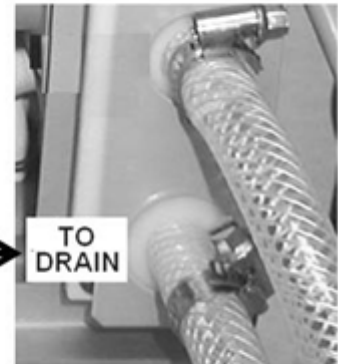
No Cannot push all water out! See procedure number [LEAKING- 4.0.2](#) (page 563).

LEAKING- 4.0.2 CANNOT PUSH THROUGH VALVE #30 / ISOLATE VALVE #30

- Per the Figure right, remove the **BOTTOM** 'To DRAIN' tubing from the rear of the machine!
- Fill the syringe with 60 ml of water and reattach it to Valve #30's INPUT nozzle.
- 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!



'To DRAIN'
Bottom Tubing!



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 192, [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 564).



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 564). If still not more than 300 ml per thirty (30) seconds! **NOTE ONLY VALVE #24** will be checked and proceed to **page 192, [TROUBLESHOOTING A VALVE.](#)**

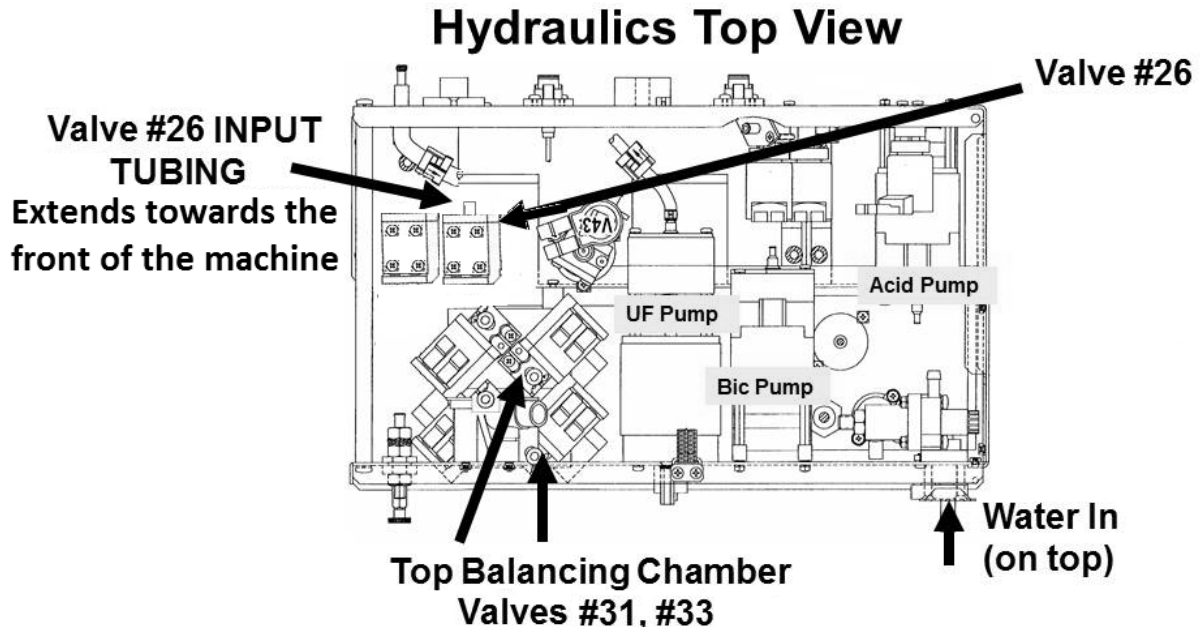
LEAKING 5.1.0 VALVE #24 OKAY / ISOLATE VALVE #25

- a) Press the 'Escape' key then 'CONFIRM' twice to call the "Select Program" screen.
- b) **IMPORTANT!** 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) **IMPORTANT!** 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 565).

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 564).
- 2) **IF tubing DID NOT ‘blow off’:** **A)** Reconnect the drain tubing; **B) NOTE ONLY VALVE #25** will be checked and proceed to **page 192, [TROUBLESHOOTING A VALVE](#)**.



LEAKING 5.2.0 VALVE #25 OKAY / ISOLATE VALVE #26

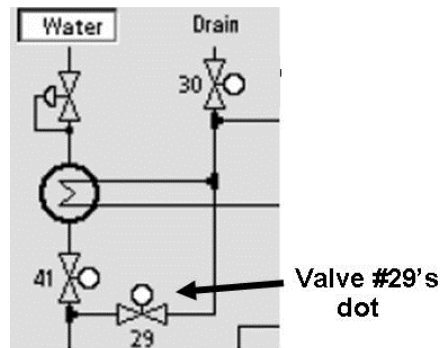
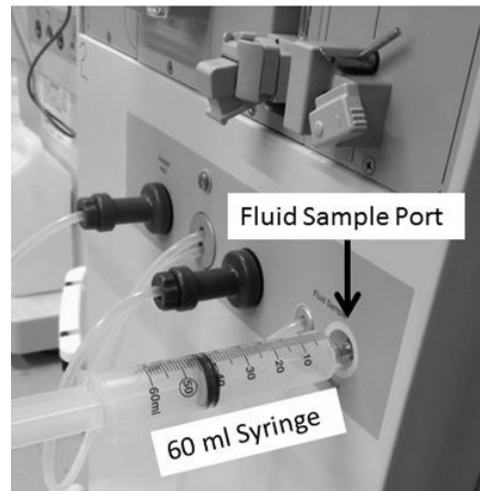
- a) Press ‘Escape’ then ‘CONFIRM’ twice to call the “Select Program” screen!
- b) Remove the red dialyzer connector from the shunt door and place it on the floor!
- c) Close the door!
- d) Per the Figure above, clamp and remove Valve #26’s **INPUT tubing!**
- e) Fill the 60 ml syringe with water then 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 566).

No Significant resistance felt! **NOTE ONLY VALVE #26** will be checked and proceed to **page 192, [TROUBLESHOOTING A VALVE](#)**.

LEAKING- 5.3.0 VALVE #26 OKAY / ISOLATE VALVE #29

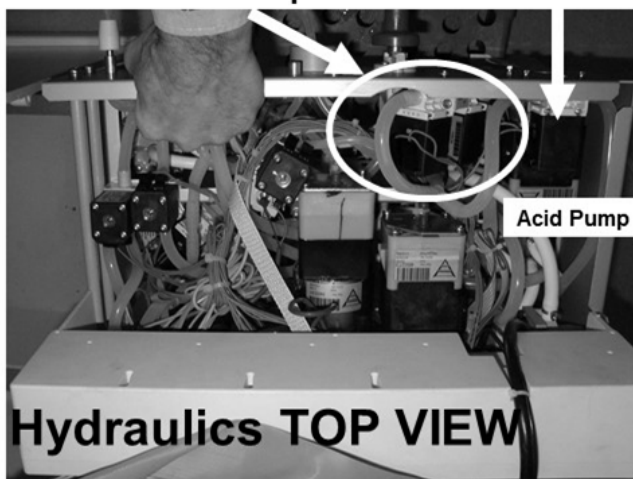
- a) **IMPORTANT!** Reattach Valve #26' its tubing!
- b) Figure right, screw the 60 ml syringe, filled with water, onto the Fluid Sample Port.
- c) This procedure is time sensitive! Read parts d through g **BEFORE** performing them!!
- d) **IMPORTANT!** Return to **RINSE Program!**
- e) Call debug screen 0. If the debug screens do not appear press 'Escape' 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 567).

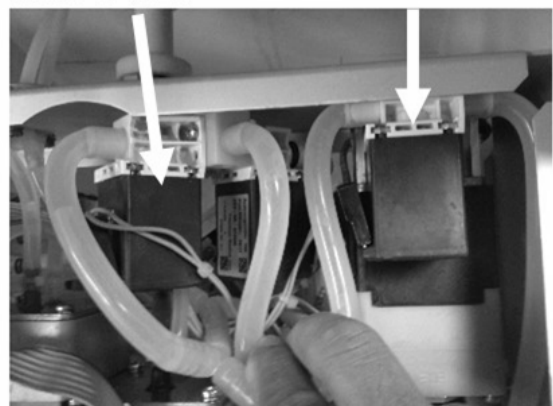
No Significant resistance felt! **NOTE ONLY VALVE #29** (Figure below) will be checked and proceed to **page 192**, [TROUBLESHOOTING A VALVE](#)

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

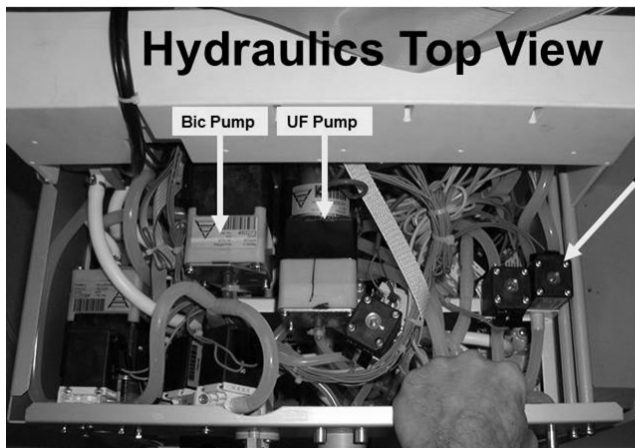
- a) **IMPORTANT! Turn the machine OFF then back on.**
- b) If the screen's Heat Disinfect button is BLUE go to Heat Disinfect. If gray go to RINSE!
- c) Allow ONE (1) FULL minute for debug screens to update!

d) Call debug screen 10 (Figure right) to locate **PDIA**

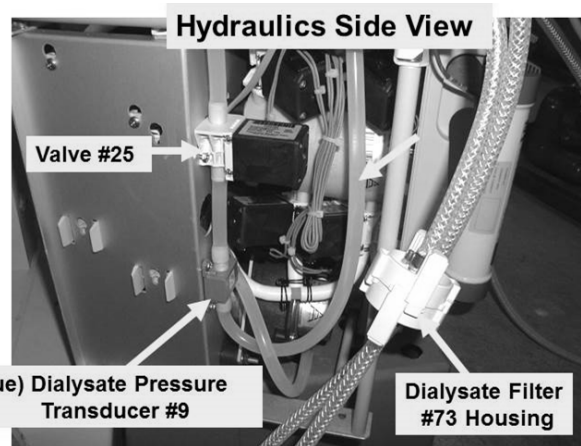
									Blood Pressure		13:48
									9:00	100/70	53
BLD LK	HI	LO	BLD DIM	HI	LO	PART	HI	LO			
4.7	4.7	4.7	4.7	4.7	4.7	6.0	6.0	6.0			
PVEN	HI	LO	PDIA	HI	LO	TEMP37	HI	LO			
6.0	6.0	6.0				5.0	5.0	5.0			
ABPR	HI	LO	VBPR	HI	LO	5V	HI	LO			
5.7	5.7	5.7	5.7	5.7	5.7	5.0	5.0	5.0			
24V	HI	LO	ASET	HI	LO	VSET	HI	LO			
24.4	24.4	24.4	6.0	6.0	6.0	6.0	6.0	6.0			

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 6.0!** 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!



Valve #24



(Blue) Dialysate Pressure Transducer #9

Dialysate Filter #73 Housing

LEAKING- 6.0.0 LOADING PRESSURE IS HIGH / ISOLATE VALVE#65 FOR DEBRIS

- a) **With the machine OFF**, referring to [Figure 105 A](#) (page 556), turn Loading Pressure Valve's #65's adjustment 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 'CONFIRM'. 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 568).

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. *To LOCATE Valve #65 refer to [Figure 105 A](#) (page 556)). **NOTE: There will be leakage but leave the water on!**
- c) Debris that may be restricting Valve #65's Hydrochamber return port. **NOTE:** Referring to the 2008K/K² 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 568).

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.

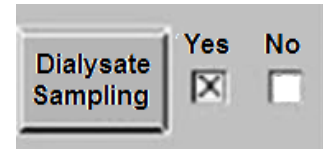
LEAKING- 6.2.0 DEBRIS LOCATED (IMPORTANT CHECKS)

- 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 ‘CONFIRM’. The screen says “Machine In Service Mode”.
- b) Select the screen’s ‘Options’ button.
- c) Select 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 569).

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 555).

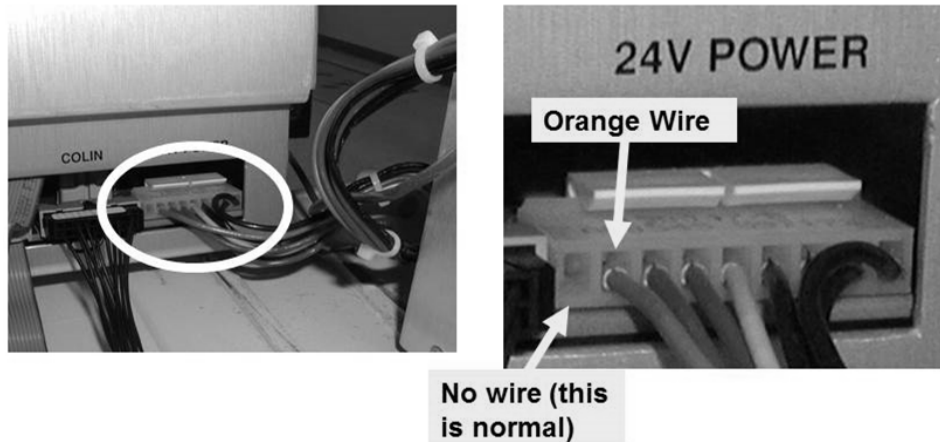
LEAKING- 7.1.0 DIALYSATE SAMPLING = “YES”

- a) Select **Dialysate Sampling**.
- b) Place the ‘X’ in the “No” box and press ‘CONFIRM’.
- c) ENSURE the “No” box at **Dialysate Sampling** now has a blue ‘X’ in it!
- d) Reattach and all ‘blown off’ tubing but **LEAVE** the Fluid Sample Connector in the bucket!
- e) Turn the machine OFF then back on!
- f) From the ‘Select Program’ screen select RINSE then press ‘CONFIRM’. The “Sample Bag Connected” banner should NOT appear!
- g) With the machine in RINSE Program **NOTE:** Squirting from the Fluid Sample Connector is NORMAL = UF Check Valve #63 is oriented correctly!
- h) If (and ONLY if) an active leak reoccurs turn the machine OFF then return to (ABOVE) procedure number [LEAKING- 1.1.0](#) (page 555).

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!

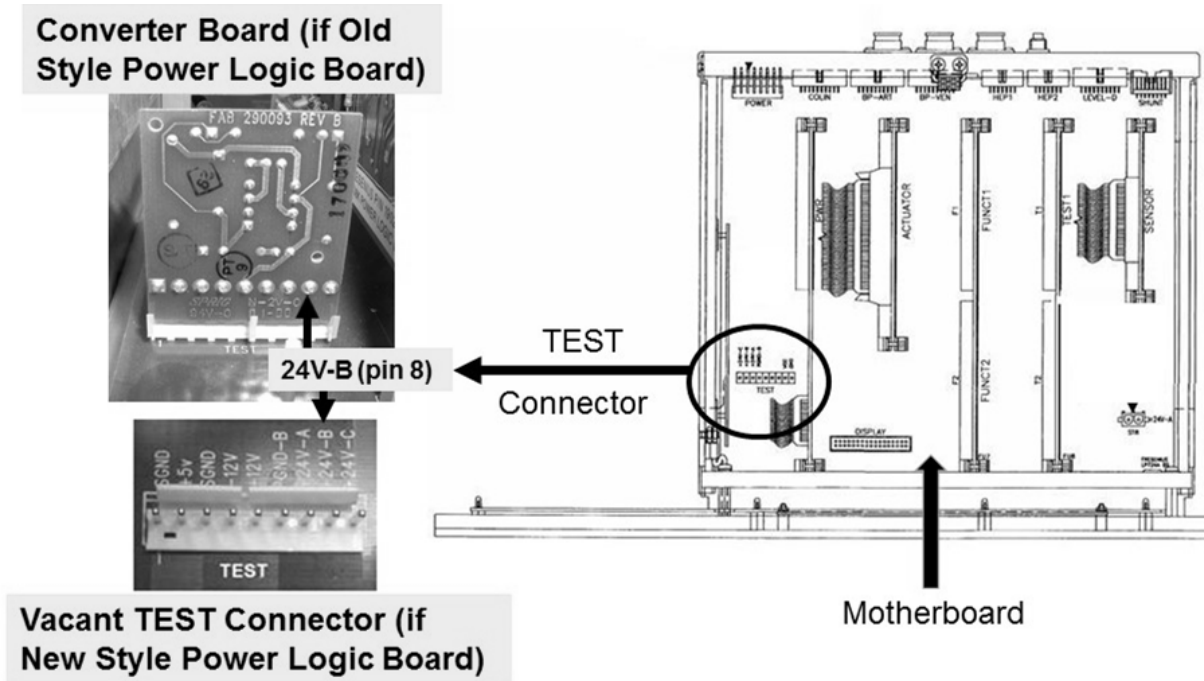


- b) **IMPORTANT!** Set your **CALIBRATED** volt meter DC voltage (V_{DC})
- c) **Connect the meter’s ground (black) lead to chassis ground (see [Figure 2](#), page 4)).**
- d) **ENSURING** the “WD: Fail Long Pulse” OR “WD: Fail Short Pulse” banner is on the screen, see procedure number [WD- 1.0.0](#) (page 571).

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WD- 1.0.0 ISOLATE 24V- B POWER SUPPLY

- Per the Figure below, locate the motherboard's nine (9) pin TEST Connector.
- Spread the card cage side panels open then gently drop the front panel down to access the motherboard's nine (9) pin TEST Connector.



- Measure at **pin 8** (second pin from right) as seen in the Figure above. TWO (2) possible scenarios:
 - 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 572).
 - 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, then test the machine in between each. **Turn the machine off and on several times, allowing twenty (20) seconds in between, to test each component!**

Component List: 1) Sensor Board¹; 2) Actuator-Test Board; 3) Functional Board²

^{1,2} To prevent "Cond Offset Failure", place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**) 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.

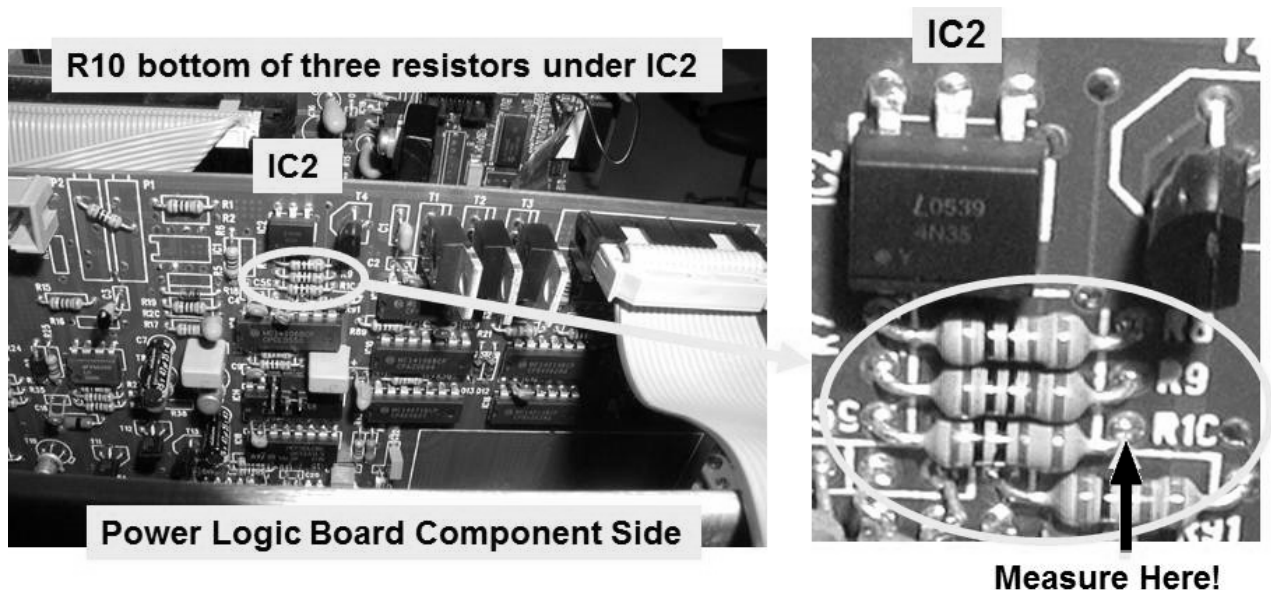


Figure 108 – Power Logic Board / R10

- 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 the board refer to [Figure 4A](#), page 9)).
 - 2) **IF less than 3.6 volts DC:** See procedure number [WD- 1.0.3](#) (page 572).

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](#), page 9).
- 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!**

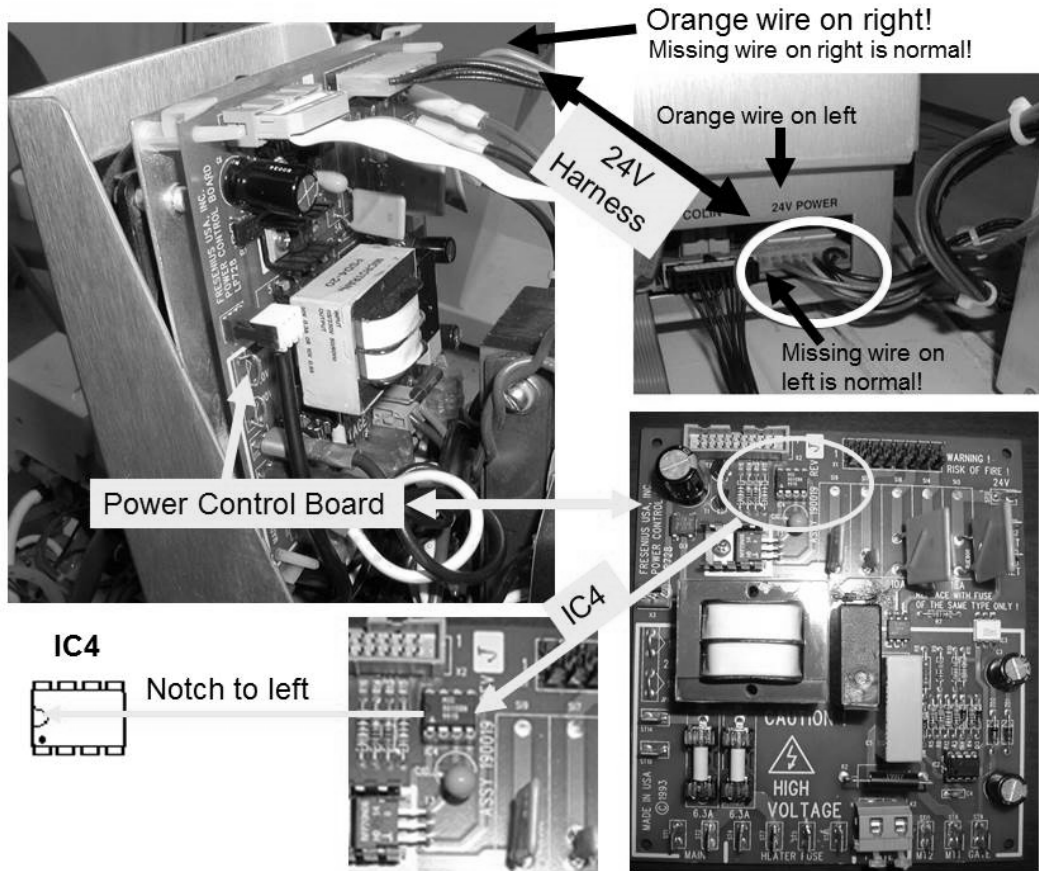


Figure 109 – Power Control Board / 24V Power Harness / IC4

c) Locate IC4 on the Power Control board..

d) IC4 (see Figure 109 above) is socketed and can be removed without desoldering! **CAUTION!** Being careful NOT to install it upside down swap in a known good IC4 chip BEFORE continuing to procedure number [WD- 1.0.4](#) (page 574).

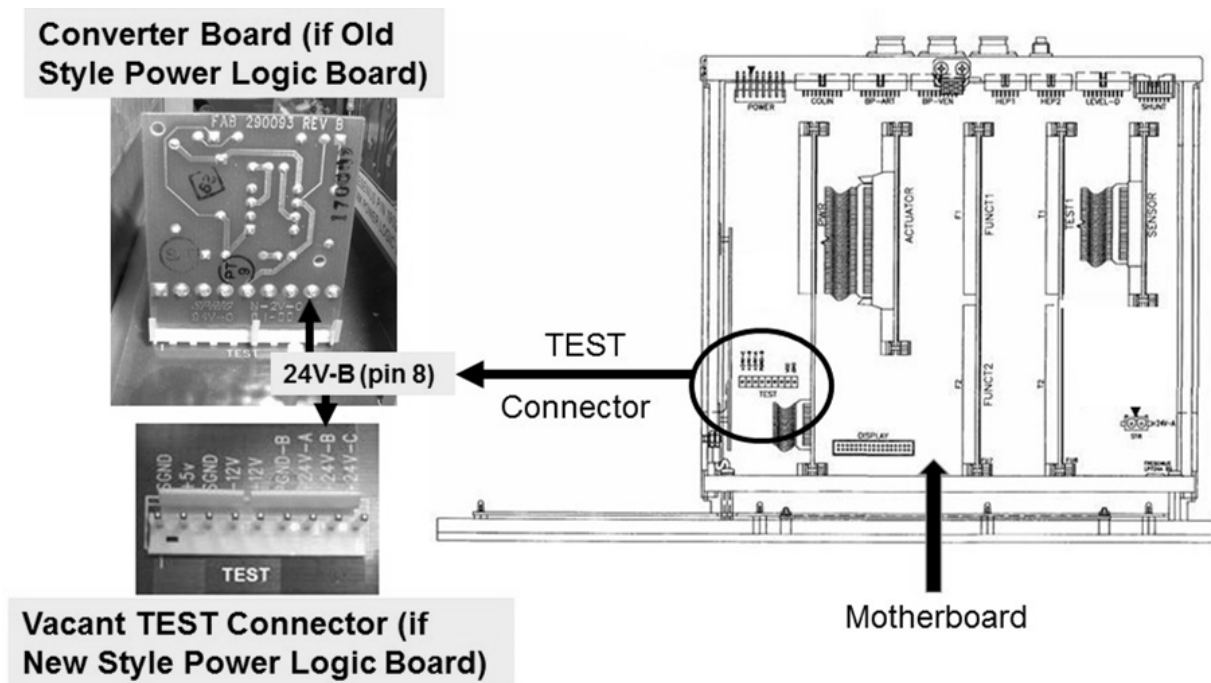
WD- 1.0.4 CHECK FOR POWER CONTROL BOARD 'SHORT'

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 574).

WD- 1.0.5 ISOLATE POWER SUPPLY / CARD CAGE

- a) **IMPORTANT!** ENSURE the “WD: Fail Long Pulse” OR “WD: Fail Short Pulse” banner is up BEFORE continuing to part b.
- b) Per the Figure below, measure again at the TEST Connector's, **pin 8**. 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 575).
 - 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 571) 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.

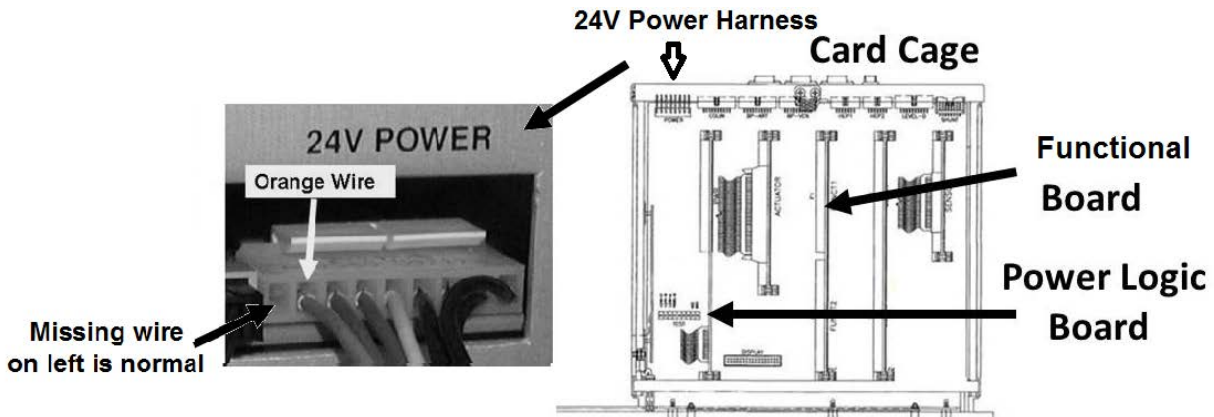
* To LOCATE the 24V Harness refer to [Figure 109](#) (page 573)

SECTION 23 – HEATER RELAY TEST FAIL

This is NOT a Heater or Triac problem! From “Select Program”, for eight (8) seconds after selecting ‘Dialysis’ then ‘CONFIRM’, 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) **IMPORTANT! Turn the machine OFF!**

B) Figure below, being careful NOT to pull the 24V Power Harness loose, GENTLY open the card cage.

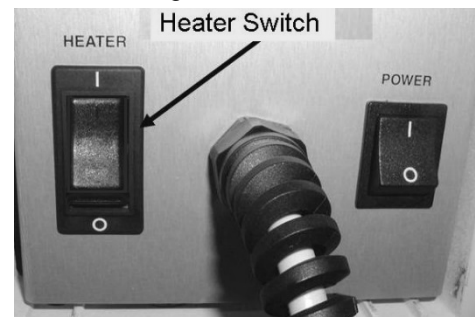


C) Push down **HARD** on the Power Logic and Functional Boards to ENSURE good connections to the motherboard.

D) Close the card cage.

E) Figure right, ENSURE the Heater Switch is on!

F) See procedure number [HEATER RELAY- 1.0.0](#) (page 576).



HEATER RELAY- 1.0.0 ISOLATE INTERMITTENT ALARM

a) Turn the machine on and return to Dialysis Program (“Select Program”→ ‘Dialysis’ → ‘CONFIRM’)!

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 577).

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 583**).

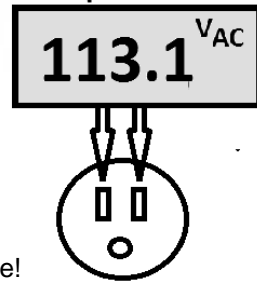
HEATER RELAY- 1.0.1 TEST YOUR VOLT METER

a) **IMPORTANT!** 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 577).

Example:



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** select 'Dialysis' yet!

c) **Read this step BEFORE going to part d!** For eight (8) seconds, after selecting 'Dialysis' then 'CONFIRM' 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!

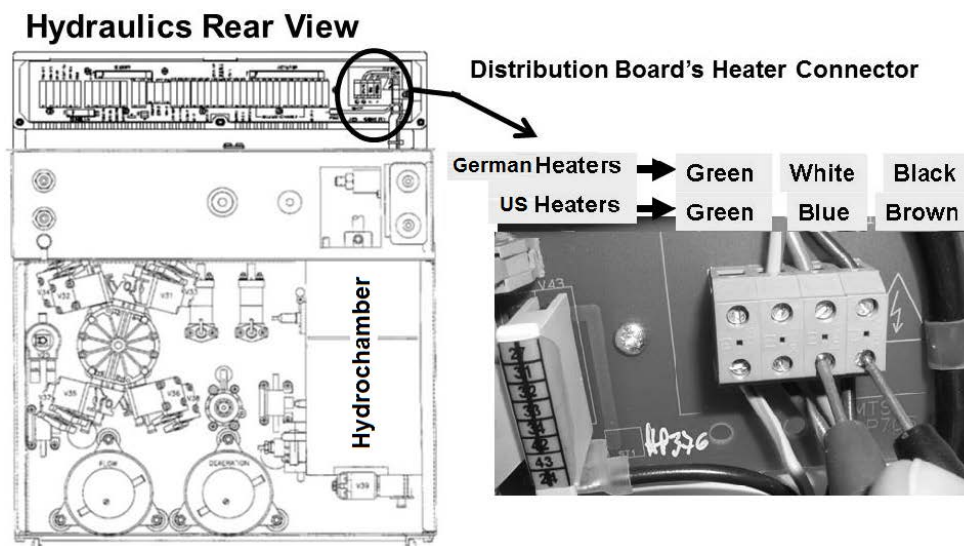


Figure 110 – Heater Connector

e) Person #2: **Step #1** Select 'Dialysis'; **Step #2** Saying "Now" press 'CONFIRM' 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 579).

No Less than 10.0 volts! Consider repeating procedure number [HEATER RELAY- 1.0.2](#) (page 577) 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 578).

No “HEATER RELAY TEST FAIL” did NOT reoccur! See procedure number [HEATER RELAY- 3.0.0](#) (**page 583**).

HEATER RELAY- 1.0.3 ISOLATE HEATER OFF LOGIC

- a) Turn the machine OFF!
- b) **IMPORTANT!** Turn the HEATER Switch off!
- c) Turn the machine on AND return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’).
- 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 578).

No “HEATER RELAY TEST FAIL” did NOT reoccur! See parts a AND b below:

- a) **IMPORTANT!** Turn the Heater Switch on!
- b) CAREFULLY repeat (ABOVE) procedure number [HEATER RELAY- 1.0.2](#) (page 577) HOWEVER, if you return here see procedure number [HEATER RELAY- 3.0.0](#) (**page 583**).

HEATER RELAY- 1.0.4 HEATER SWITCH OFF BUT “HEATER RELAY TEST FAIL” REOCCURS

- a) **IMPORTANT!** 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](#) (page 9).
- c) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’). If (and ONLY if) “HEATER RELAY TEST FAIL” reoccurs see procedure number [HEATER RELAY- 1.0.5](#) (page 578). 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 **Error! Bookmark not defined.**));
3) Motherboard.

- b) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’). 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:

- Turn the power off and unplug the machine! **Caution! Electrocutation hazard if not unplugged!**
- Per [Figure 111](#) below, open the power supply to see the component side of the Power Control board.
- IMPORTANT!** 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)!

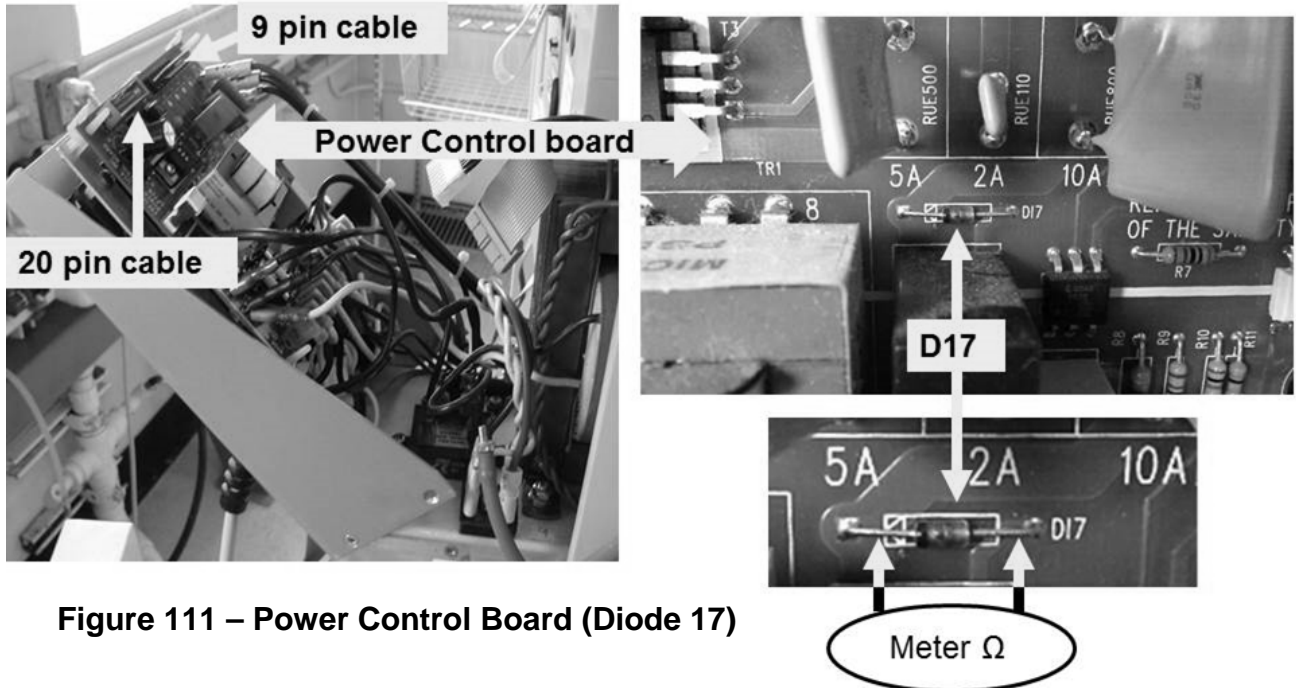


Figure 111 – Power Control Board (Diode 17)

- IMPORTANT! Set your volt meter to RESISTANCE (Ω)!**
- 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.
- Figure right, reading the meter's numeric AND units display, TWO (2) possible scenarios:

Examples: Units

1000	Ω	= 1000 ohms
	M Ω	= million ohms
1.001	K Ω	= 1.001 K (thousand) ohms

- IF (and ONLY if) between 900 and 1500 Ω ! (0.900 and 1.5 K Ω):** Diode 17 is good!
Proceed to **page 581**, procedure number **HEATER RELAY- 2.0.1**.
- IF less than 900 Ω (0.900 K Ω) OR more than 1500 Ω (1.5 K Ω):** Diode 17 is bad!
Perform parts a THROUGH e below:
 - IMPORTANT!** Replace **BOTH** the Power Control AND Power Logic boards with known good! To LOCATE the Power Logic board refer to [Figure 4A](#) (page 9).

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’ → ‘CONFIRM’).
- 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 582).
 - 2) IF “Heater Relay Test Fail” does NOT reoccur:** Problem solved! The previous diode 17 AND the 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](#) (page 9).
- d) Turn the machine on and return to Dialysis Program ("Select Program" → 'Dialysis' → 'CONFIRM').
- 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 582).
 - 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) **IMPORTANT! 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** Select ‘Dialysis’; **Step #2** Saying “Now” press ‘CONFIRM’ 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 \(page 578\)](#).
- 2) **IF “HEATER RELAY TEST FAIL” did NOT reoccur:** See procedure number [HEATER RELAY- 3.0.0 \(page 583\)](#).

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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’ → ‘CONFIRM’). If (and ONLY if) “HEATER RELAY TEST FAIL” reoccurs see procedure number [HEATER RELAY- 3.1.0](#) (page 583). 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 board refer to [Figure 4A](#) (page 9).
- E) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’). If (and ONLY if) “HEATER RELAY TEST FAIL” reoccurs see procedure number [HEATER RELAY- 3.2.0](#) (page 583) 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 **Error! Bookmark not defined.**)); **3)** Motherboard.

- H) Turn the machine on and return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’). 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 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, select the [Dialysate Flow] window.
- D) Set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- 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:



"0" = No Flow Error
"1" = Flow Error

- 1) **IF (and ONLY if) Flow Error REMAINS = 0!** Continue to part G.
 - 2) **IF Flow Error EVER = 1!** Proceed to **page 20**, [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 584).

DIASAFE- 2.0.0 FLOW ERROR ALWAYS = 0 / ISOLATE PRESSURE TESTS

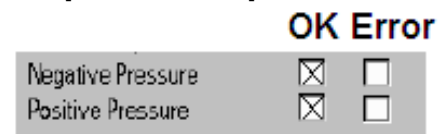
- a) Using a flashlight, ENSURE no air bubbles through the external flow indicator's sight tube*!
- * Air is normal after a Diasafe® test but should clear within four (4) minutes! Prolonged air cause Filling Programs (i.e. **FILACT** = 1) and TMP will NOT stabilize!

b) **Reset ALL alarms!**

- c) At the bottom of the screen, select the [**Test & Options**] tab.
- d) If the [**Pressure Test**] key is gray select [**Both Tests**]. If blue select [**Pressure Test**]!

e) Press ‘CONFIRM’ and allow the tests to finish!

f) Do BOTH Negative AND Positive Pressure Tests pass?



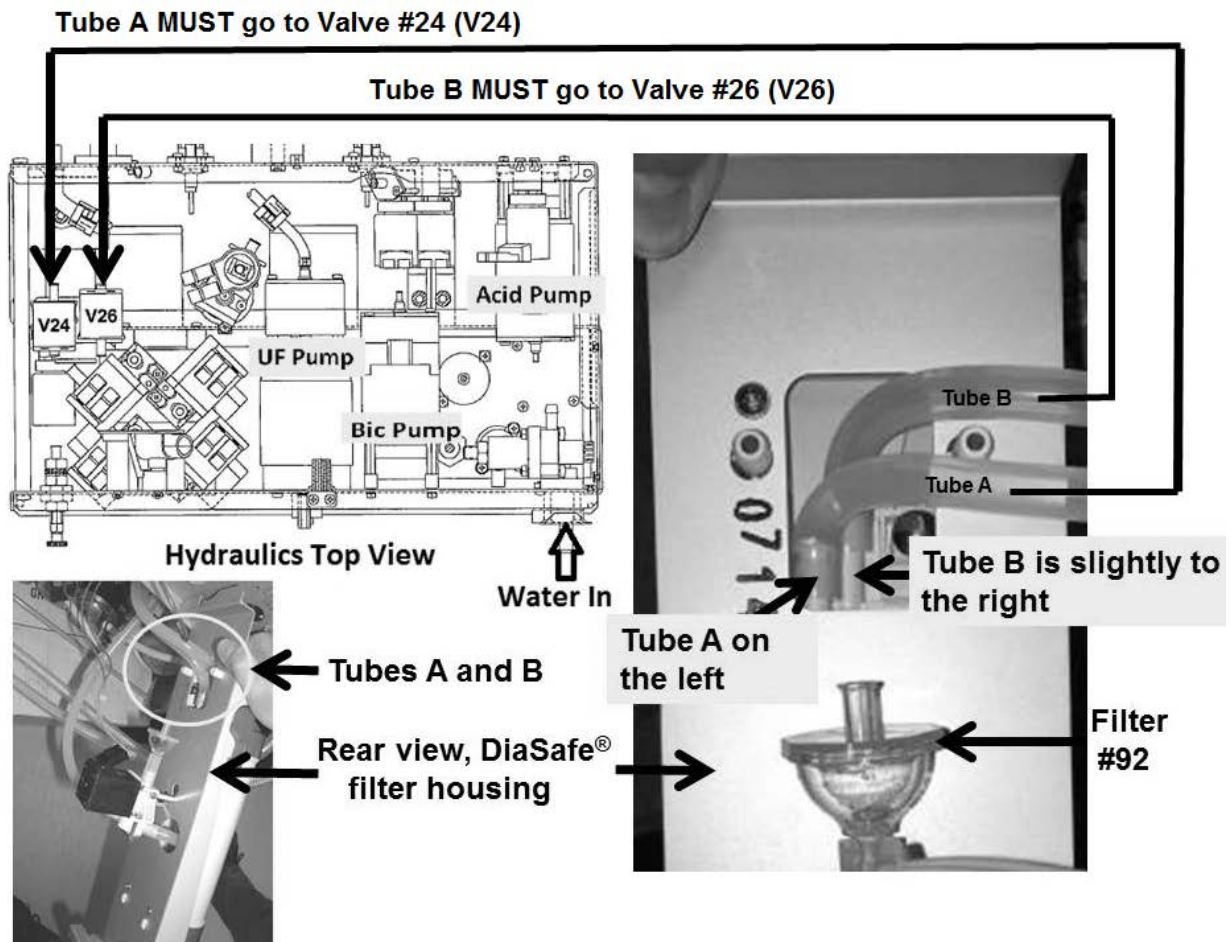
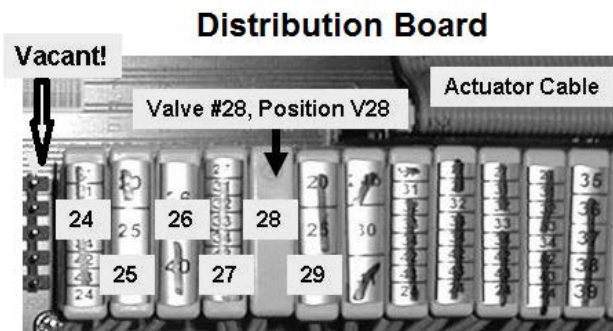
Yes BOTH Pressure Tests pass! See procedure number [DIASAFE- 3.0.0](#) (page 585).

No A pressure test fails*! Proceed to **page 474**, [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

- A) Figure right, ENSURE Valve #28 is plugged PROPERLY into distribution board position, "V28"!
- B) **Figure below**, inside the hydraulics and the rear side of the Diasafe® housing, ENSURE 'TUBE A' goes to VALVE #24 AND 'TUBE B' goes to VALVE #26!



- C) Are you ABSOLUTELY SURE the DiaSafe® tubing is plumbed correctly?

Yes Tubing is plumbed properly! Continue to part D.

No Tubing is backwards! This most likely is the problem! Per the Figure above turn the machine off and attach the tubing properly.

- D) From the Home screen, allow [**Conductivity**] to stabilize between 13.2 and 14.4 mS.

Parts F through I next page

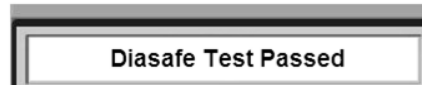
E) **Reset ALL alarms!**

F) Select the screen's lower **[Test & Options]** tab.

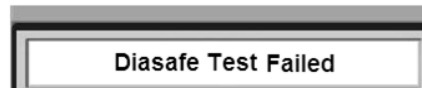
G) Select the 'Diasafe Test' button.

H) Press 'CONFIRM' 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 'CONFIRM'.

d) Allow two (2) minutes BEFORE continuing.

e) Using a flashlight, ENSURE no air flowing through the external flow indicator sight tube.

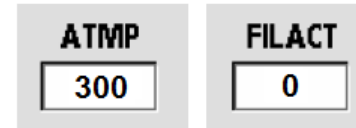
f) See procedure number [DIASAFE- 4.0.0](#) (page 587).

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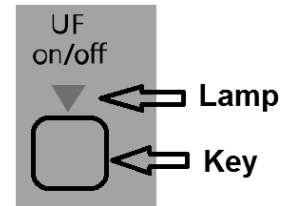
DIASAFE- 4.0.0 DIASAFE TEST FAILED / ISOLATE ATMP AND FILLING PROGRAM

- A) **RESET ALL alarms!**
- B) Turn the Blood Pump on so that it is rotating at more than 100 ml/min.
- C) Call debug screen 1. **ATMP AND FILACT** will be watched below. If **FILACT EVER = 1** may indicate a hydraulic air leak causing **ATMP** to be unstable or not reach its specified goal of 300!
- 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) **MUST STAY ON SOLID!**
- F) Without looking away, watch **FILACT AND ATMP**. If **ATMP** reaches 300, within forty (40) seconds, turn UF off **IMMEDIATELY** i.e. UF lamp OFF!
TWO (2) possible scenarios:

No positive (+) sign in the ATMP window = negative pressure



If FILACT = 1 = hydraulic air leak



- 1) **IF ATMP reached 300 within 40 seconds:** See procedure number [DIASAFE- 4.0.2](#) (page 587).
- 2) **IF ATMP DOES NOT reach 300 within 40 seconds:** Based on **FILACT**, TWO (2) possible scenarios below:

Scenario #1: IF FILACT WAS EVER = 1: A) Turn UF OFF then! **B)** Allow two (2) 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 409, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)**.

Scenario #2: IF FILACT was ALWAYS = 0: A) To check the UF Pump, perform the UF Pump Calibration per the [2008 Calibration Procedures](#) booklet then; **B)** If (and ONLY if) UF volume is okay perform the Dialysate Pressure Calibration per the [2008 Calibration Procedures](#) booklet.

DIASAFE- 4.0.2 ATMP REACHED 300

Watching **FILACT AND ATMP**, allowing ten (10) seconds for stabilization, **ATMP** should stay more than 300 for twenty (20) seconds. TWO (2) possible scenarios below.

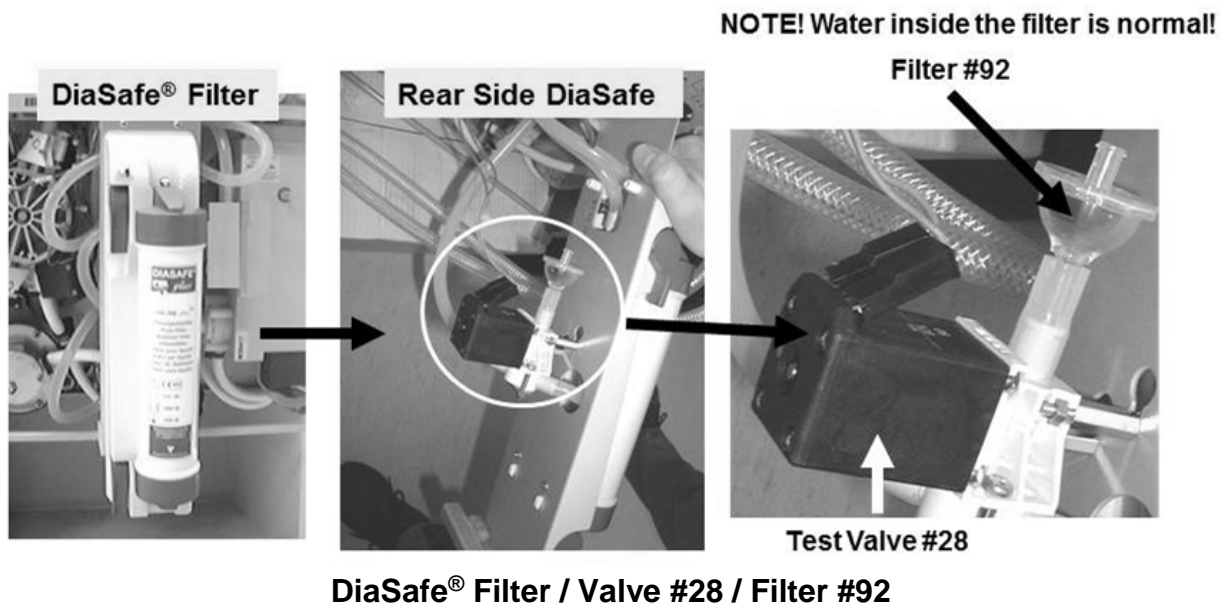
- 1) **IF ATMP stays 300 OR more:** See procedure number [DIASAFE- 5.0.0](#) (page 588).
- 2) **IF ATMP DOES NOT stay more than 300:** Based on **FILACT**, TWO (2) possible scenarios:

Scenario #1: IF FILACT was EVER = 1: A) Allow two (2) minutes then; **B)** Repeat procedure number DIASAFE- 4.0.0 (page 587); **C)** If (and ONLY if) **FILACT** = 1 reoccurs proceed to **page 409, [SECTION 8 – FILLING PROGRAM PROBLEMS](#)**.

Scenario #2: IF FILACT was ALWAYS = 0: ENSURING UF is off proceed to **page 440, [SECTION 9 - TMP PROBLEMS](#)**.

DIASAFE- 5.0.0 ATMP STAYS 300 OR MORE / ISOLATE DIASAFE FILTER #92

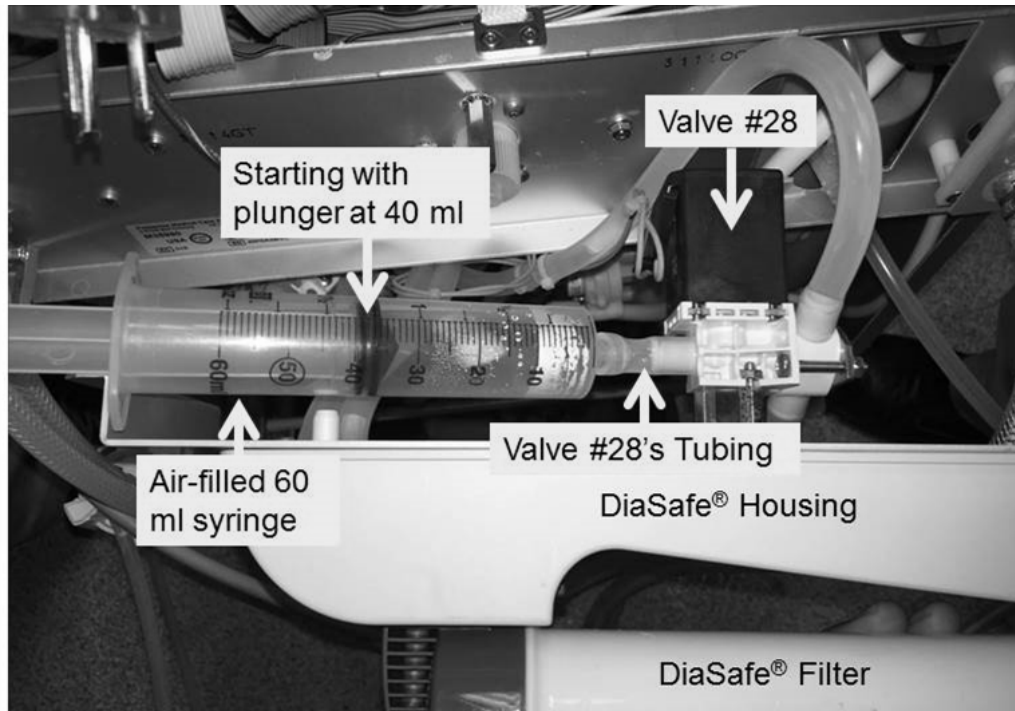
- a) Figure below, remove FILTER #92 from Valve #28's tubing.



- b) Press 'Esc' to return to the Home screen.
- c) ENSURE no air flowing through the external flow indicator.
- d) **Reset ALL alarms.**
- e) Select the [Test & Options] tab.
- f) Select the 'Diasafe Test' button then 'CONFIRM' to start the test.
- g) Allow the test to finish! TWO (2) possible scenarios:
- 1) **IF (and ONLY if) "Diasafe Test Passed":** FILTER #92 MAY be restricted! Repeat the Diasafe® test once more as the failure may be intermittent!
 - 2) **IF "Diasafe Test Failed":** See procedure number [DIASAFE- 6.0.0](#) (page 589).

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 591**, procedure number [DIASAFE- 7.0.0](#).

No Plunger is NOT drawn! See procedure number [DIASAFE- 6.1.0](#) (page 589).

DIASAFE- 6.1.0 PLUNGER IS NOT DRAWN IN / ISOLATE FOR VALVE #28 SOLENOID ACTIVATION

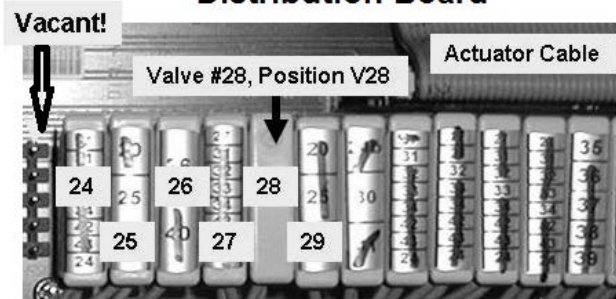
Per the Figure above, touch Valve #28's (black) solenoid. Is it warm?

Yes Solenoid is warm! TWO (2) possible bad components: **1) Bad Actuator-Test Board** OR **2) Bad Valve #28**.

No Solenoid IS NOT warm! Perform parts a THROUGH d next page:

Distribution Board

- a) Trace Valve #28's wires from the distribution board to the valve's (black) solenoid. THREE (3) checks:

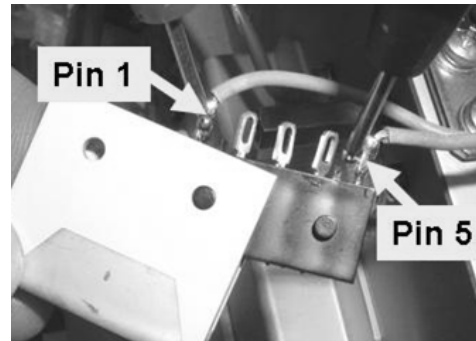


Check #1: If a wire is pinched or insulation is damaged this may be the problem!

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 this may be the problem!

- b) Figure right, open Valve #28's female distribution board connector cap.
- c) If the 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 \updownarrow Between 40 and 100 Ω ! THREE (3) possible bad components (see COMPONENT LIST below). One at a time, swap in each component 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.

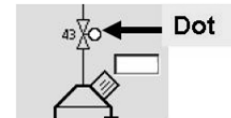
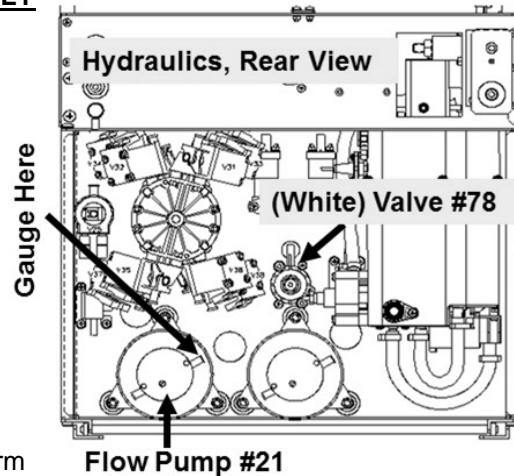
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DIASAFE- 7.0.0 VALVE #28 OKAY

- a) Return FILTER #92 to Valve #28!
- b) See procedure number [DIASAFE- 8.0.0](#) (page 591).

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) **IMPORTANT! Place the machine into 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 592).

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 93**, procedure number [F- 9.0.2](#)

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

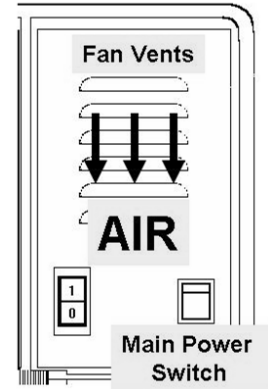
- a) Per the Figure (above, right) adjust Valve #78 until pressure cycles to between 35 and 36 psi!
- b) See procedure number [DIASAFE- 9.0.0](#) (page 592).

DIASAFE- 9.0.0 GOOD FLOW PUMP PRESSURE / PRESSURE TEST VALVE #26

- a) Place the machine into Service Mode → Diagnostics → Valve Leak Test.
- b) Allow the screen's **[Test Status]** data box = "Ready".
- c) Select the **[Valve Number]** data box.
- d) K machine use the up/down arrow keys until **[Valve Number]** = Valve #26; K² machine use the +/- keys until **[Valve Number]** = Valve #26
- e) Press 'CONFIRM' to start the test!
- f) 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 71)).
 - 2) **IF Valve #26 "Passed":** Perform parts a THROUGH c below:
 - a) Perform the UF Pump Calibration per the 2008 Calibration Procedures booklet.
 - b) Perform the TRANSMEMBRANE PRESSURE check per the 2008 Preventative Maintenance Procedures 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

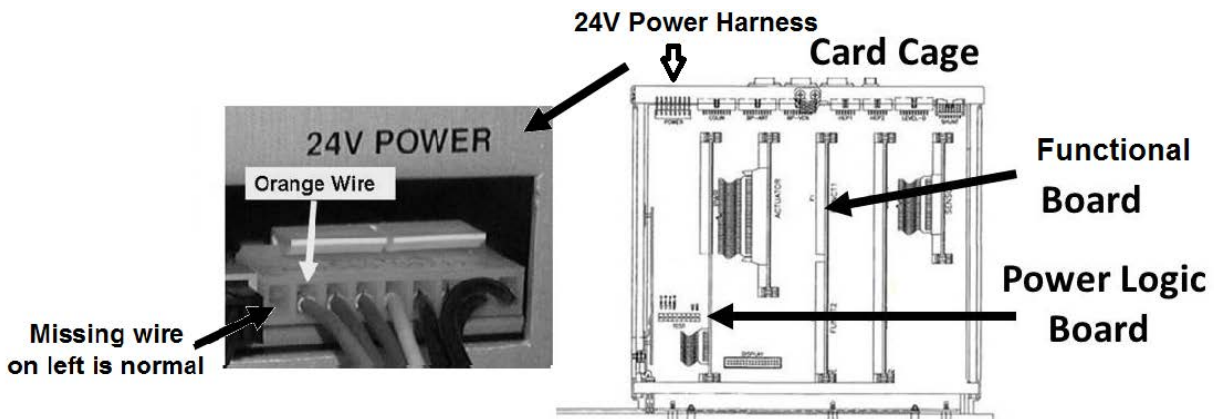
- A) **BEFORE** continuing to part B, perform [INITIAL CHECKS](#) (page 6!
- B) If troubleshooting the screen 'remaining black', if air is felt from the Power Supply vents (Figure right) = fan running = MACHINE IS ON!
- C) Figure right, the Main Power Switch does not turn the machine on but must be on to turn the machine on! It MUST REMAIN ON for all procedures!
- D) Proceed according to the OBSERVED symptom ONLY! Listed below are eleven (11) possible symptoms:



- 1) **IF 'blows' the GFI i.e. wall breaker:** **A)** Turn off ALL OTHER machines that are connected to GFI circuit; **B)** Reset the GFI; **C)** Plug a known good machine into it; **D)** If possible, place it into Heat Disinfect THEN allow up to thirty (30) minutes for the GFI to possibly 'blow' again. TWO (2) possible scenarios **i)** or **ii)** below:
- i) IF (and ONLY if) the GFI 'blows' again:** Either the GFI is not rated for the current drawn when a machine is in Heat Disinfect OR it may be bad.
- ii) IF the GFI DOES NOT 'blow' again:** There may have been too many machines plugged into the circuit. Plug in the suspected malfunctioning machine and (if possible) place it into Heat Disinfect. If (and ONLY if) the GFI 'blows' again see procedure number [P- A.0.0](#) (page 595).
- 2) **IF "24V Low" OR "24V High" OR "WD: 24V Rcvr Err Short" OR "WD: 24V Rcvr Err Long":** Proceed to **page 597**, procedure number [P- B.0.0](#).
- 3) **IF "5V Low" OR "5V High":** Proceed to **page 597**, procedure number [P- B.0.0](#).
- 4) **IF "12V POWER FAIL":** Proceed to **page 597**, procedure number [P- B.0.0](#).
- 5) **IF the fan is running BUT, after fifty (50) seconds, the screen REMAINS BLACK:** Proceed to **page 598**, procedure number [P- C.0.0](#).
- 6) **IF the machine turns on (fan runs) BUT THEN turns itself off:** Proceed to **page 647**, procedure number [P- 3.0.0](#).

Scenarios 7 through 11 next page

- 7) **IF the machine NEVER turns on i.e. fan NEVER runs:** Perform parts a THROUGH d below:
- If the fan IS NOT running continue to part b. If the fan IS RUNNING but, after fifty (50) seconds, the screen REMAINS BLACK proceed to **page 598**, procedure number [P- C.0.0](#).
 - Press the Power button for two (2) seconds! If the fan IS NOT running perform parts c and d. If the fan is running but, after fifty (50) seconds, the screen REMAINS BLACK proceed to **page 598**, procedure number [P- C.0.0](#).
 - Plug into a **KNOWN GOOD** GFI power outlet.
 - Press the Power button for two (2) seconds! If the machine still DOES NOT turn on (fan NEVER runs), ENSURING the GFI did not 'blow', proceed to **page 595**, procedure number [P- A.0.0](#).
- 8) **IF after being on for fifty (50) seconds the screen REMAINS fully OR partially white and possibly displays nothing:** Proceed to **page 598**, procedure number [P- C.0.0](#).
- 9) **IF “Failed Sending Data To Actuator Board”:** Proceed to **page 597**, procedure number [P- B.0.0](#).
- 10) **IF after being on (fan running) for fifty (50) seconds the screen displays ‘weird’ data i.e. scrambled, weird colors, abnormal lines etc.:** Proceed to **page 598**, procedure number [P- C.0.0](#).
- 11) **IF after being on (fan running) for fifty (50) seconds the screen still says “Loading Software....Please Wait”:** See parts a through c below:
- To avoid pulling cables loose, GENTLY open the card cage.
 - Behind the card cage (Figure below), ENSURE the 24V POWER harness is plugged in properly.
 - Proceed to **page 599**, procedure number [P- E.0.0](#).



P- A.0.0 ISOLATE POWER CORD / PLUG / STRAIN RELIEF

- a) Unplug the machine!
- b) Inspect the power plug and cord for burning or other damage.
- c) Per the Figure below, inspect the strain relief for damage.
- d) Plug into the known good GFI outlet.
- e) See procedure number [P- A.2.0](#) (page 595).

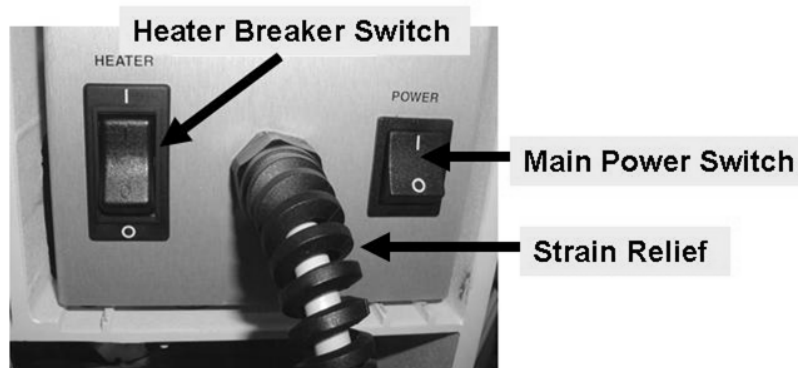


Figure 112 – Heater Breaker Switch / Main Power Switch / Strain Relief

P- A.2.0 ISOLATE HEATER CIRCUIT

- A) **IMPORTANT!** Per the Figure above, turn the Heater Breaker Switch OFF!
- B) ENSURE the Main Power Switch REMAINS ON!
- C) Press the Power button. If the machine STAYS ON perform parts D and E. If the machine DOES NOT TURN ON (no fan) OR it TURNS ON but immediately 'blows' the GFI skip to part F.
- D) Return to Dialysis OR preferably Heat Disinfect.
- E) Allow up to thirty (30) minutes, for the problem to possibly reoccur, BEFORE continuing to part F.
- F) 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 596).
 - 2) **IF** continues to 'blow' the GFI: Proceed to **page 649**, procedure number [P- 4.0.0](#).
 - 3) **IF** was NEVER turning on (fan NEVER runs) AND still NEVER turns on: Proceed to **page 628**, procedure number [P- 1.0.0](#).
 - 4) **IF** was NEVER turning on but is on now (fan running): The heater¹ 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. ¹ To LOCATE the Heater refer to [Figure 28](#) (page 129).

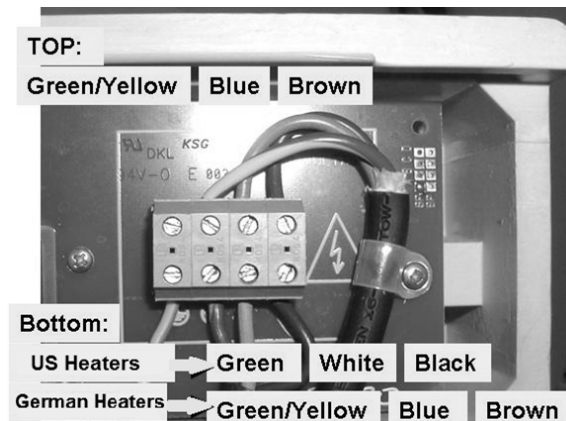
P- A.4.0 ISOLATE 'HEATER CIRCUIT'

a) **CAUTION!** Turn the machine OFF! Electrocutation hazard if NOT turned off!

b) Figure right, at the Distribution board's 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 DISCONNECT: If a **US Heater** the brown wire OR if a **German Heater** the black wire.

d) **IMPORTANT! Turn the Heater Breaker Switch on!**

e) If possible turn the machine on (fan running).

f) If possible place the machine in Heat Disinfect then allow up to thirty (30) minutes.

g) 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) Replace the heater. To LOCATE the heater refer to [Figure 28](#) (page 129).

b) After replacing the heater turn the Heater Switch on.

c) From Dialysis Program OR Heat Disinfect if the GFI 'blows' again the fan or the power supply may be bad.

P- B.0.0 ISOLATE POWER SYSTEMS

- a) Figure right, ENSURE the 3rd distribution board position from the left, "x4, PH-P", **IS VACANT!** If NOT, this may be the problem!
- b) To avoid pulling cables loose, GENTLY open the card cage.
- c) 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. **If not, this may be the problem!**
- d) Per Figure 113B below, check the power plug, cord and strain relief for signs of burning or other damage. **Replace a damaged plug, cord or strain relief!**
- e) With the machine on i.e. message displayed on the screen ENSURE the fan is running i.e. air from the power supply rear vents. If not air from the vents the fans is bad and this allows excessive heat which causes electronic failures!
- f) Proceed to **page 599**, procedure number **P- E.0.0**

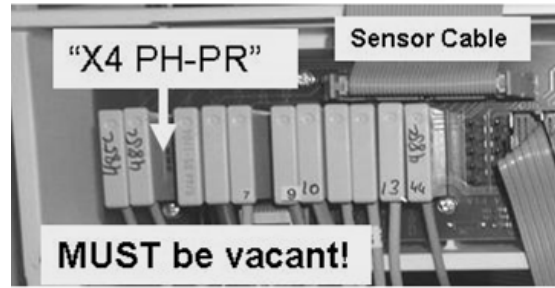


Figure 113A – 24V POWER Harness

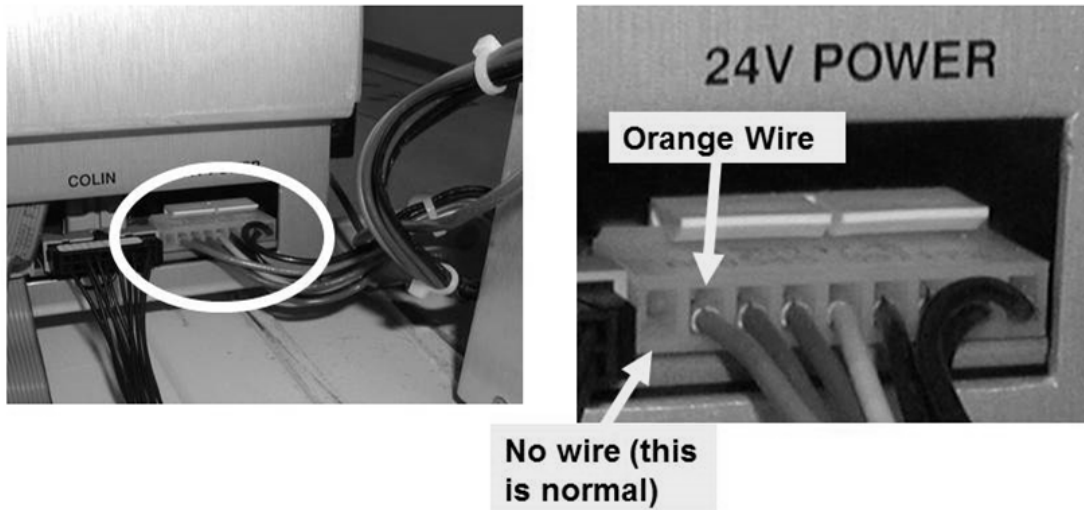
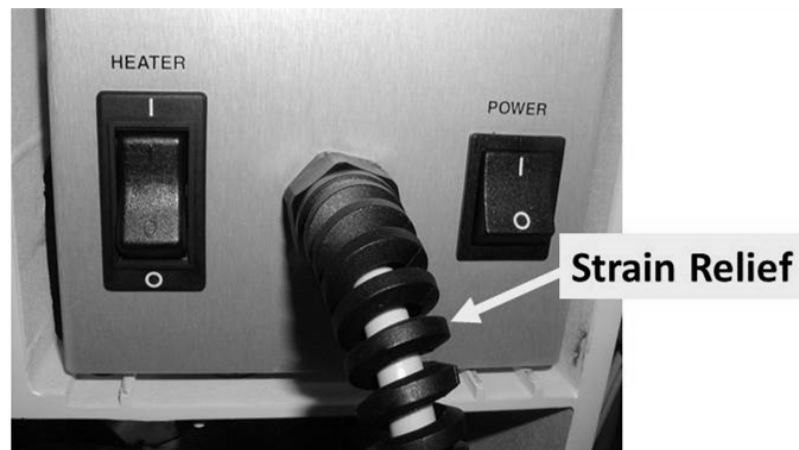
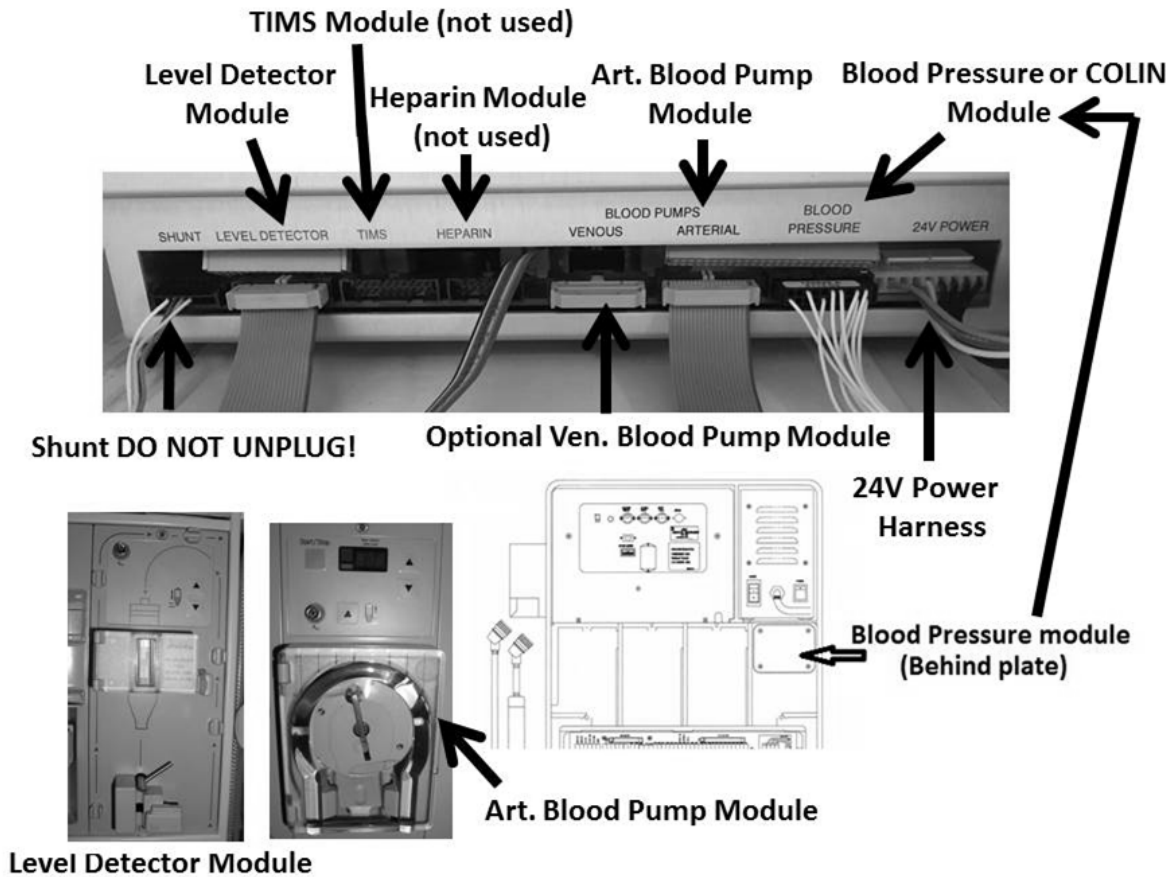


Figure 113B – Power Supply Rear View



P- C.0.0 ISOLATE SCREEN PROBLEMS (1)

- a) **IMPORTANT! 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 this may be the problem!
- c) Proceed to **page 599**, procedure number P- E.0.0.



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e) Per the Figure right AND Table 16 below, TWO (2) measurements at the TEST Connector's +5V AND +12V pins. TWO (2) possible scenarios:

- 1) **IF (and ONLY if) BOTH are IN RANGE:**
RECORD the +12V measurement then see procedure number [P- F.0.0](#) (page 601).
- 2) **ANY BAD measurement:** See [Table 17](#) below and respond accordingly.

Table 15 – Measurement Locations / Expected Good

Measurement	Pin # and location	Expected (GOOD) range
+5V	2 (second pin from right)	4.8 – 5.2 V _{DC}
+12V	5 (five pins from right)	11.7 – 12.3 V _{DC}

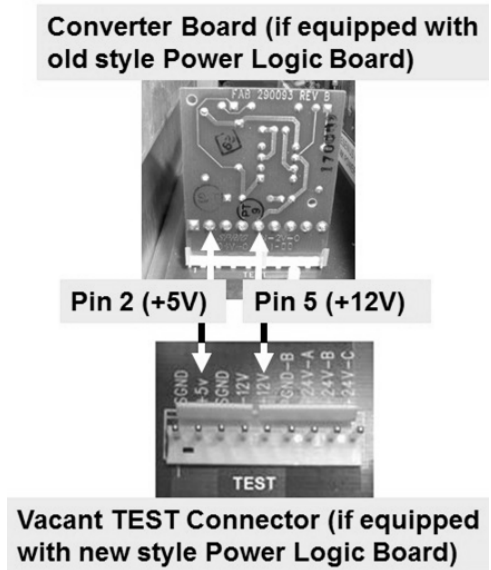


Table 16 – Any BAD Measurement(s)

Measured +5 Volts (V _{DC})	Measured +12 Volts (V _{DC})	Response based on <u>BOTH</u> measurements
4.8 – 5.2 (i.e. good)	0 – 11.6 (i.e. low)	+5 volts GOOD; +12 volts LOW. Proceed to page 609 , procedure number P- G.0.0
0 – 4.7 (i.e. low)	11.7 – 12.3 (i.e. good)	+5 volts LOW; +12 volts GOOD. Proceed to page 609 , procedure number P- G.0.0
5.3 or more (i.e. high)	11.7 – 12.3 (i.e. good)	+5 volts HIGH; +12 volts GOOD. Proceed to page 609 , procedure number P- G.0.0
4.8 – 5.2 (i.e. good)	12.4 or more (i.e. high)	+5 volts GOOD; +12 volts HIGH. Proceed to page 609 , procedure number P- G.0.0.
5.3 or more (i.e. high)	12.4 or more (i.e. high)	<u>BOTH</u> +5 <u>AND</u> +12 volts HIGH! Proceed to page 609 , procedure number P- G.0.0.
0 – 4.7 (i.e. low)	0 – 11.6 (i.e. low)	<u>BOTH</u> +5 <u>AND</u> +12 volts LOW. Proceed to page 604 , procedure number P- F.4.0

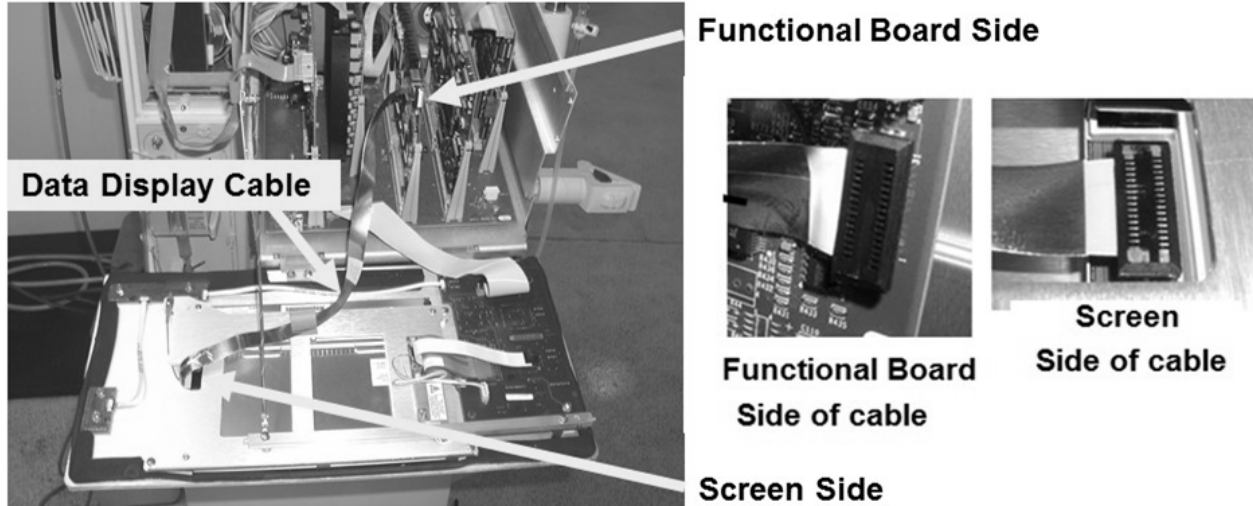
P- F.0.0 MEASURED +12 AND +5 VOLTS ARE GOOD / VERIFY SYMPTOM

Proceed according to the OBSERVED symptom ONLY! Ten (10) 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 617**, procedure number [P- H.0.0](#).
- 2) **IF “5V Low” OR “5V High”**: Proceed to **page 617**, procedure number [P- H.0.0](#).
- 3) **IF “12V POWER FAIL”**: Proceed to **page 617**, procedure number [P- H.0.0](#).
- 4) **IF the screen REMAINS totally BLACK**: Proceed to **page 603**, 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 in, proceed to **page 603**, procedure number [P- F.2.0](#).
- 6) **IF the screen REMAINS FULLY OR PARTIALLY white and possibly displays nothing**: See procedure number [P- F.1.0](#) (**page 602**).
- 7) **IF the screen displays ‘weird’ i.e. scrambled, weird colors, abnormal lines, etc.**: See procedure number [P- F.1.0](#) (**page 602**).
- 8) **IF “Loading Software.... Please Wait” lasts longer than one (1) minute**: Proceed to **page 617**, procedure number [P- H.0.0](#).
- 9) **IF “TEMP OVER 95 Degrees” in Heat Disinfect**: Proceed to **page 617**, procedure number [P- H.0.0](#).
- 10) **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, reseal 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 “24V” alarm occurs OR “Failed Sending Data...” reoccurs proceed to **page 617**, procedure number [P- H.0.0](#).

P- F.1.0 TROUBLESHOOT SCREEN PROBLEM

- a) Turn the machine OFF!
- b) Per the Figure below, ENSURE the aluminum-looking Data Display Cable (P/N 190194), between the functional board and the screen, is plugged in CORRECTLY at BOTH sides.



- c) Turn the machine on and allow fifty (50) seconds. If the screen continues to display 'weird' or NOTHING continue to part d.
- d) Turn the machine OFF!
- e) Swap in a known good Data Display Cable (P/N 190194).
- f) Turn the machine on and allow fifty (50) seconds.
- g) If the screen continues to display 'weird' or NOTHING continue to part h.
- h) Turn the machine OFF!
- i) Swap in a known good Functional Board.
- j) Turn the machine on and allow fifty (50) seconds. **NOTE:** A "Cond Offset" banner may appear due to the different Functional board. Ignore it for now. If the screen continues to display 'weird' or NOTHING the screen may be bad.

P- F.2.0 SCREEN REMAINS 'BLACK' / ISOLATE +12 AND +5 VOLTS AT BACKLIGHT CONVERTER

- a) Per the Figure below, measure for +5 AND +12 volts DC (V_{DC}) inside the backlight converter connector. **BE CERTAIN the meter lead contacts the metal portion of the connector!** TWO (2) measurements:

Measurement #1: Where the **red wire** is connected. Good = between 11.7 and 12.3 volts DC

Measurement #2: Where the **white wire** is connected. Good = between 4.7 and 5.3 volts DC

- b) BOTH +12 and +5 volts DC good?

Yes BOTH +12 and +5 good! See procedure number P- F.3.0 (page 603).

No Referring to the Figure below, THREE (3) possibilities: **1)** Bad Data Cable* (between the Motherboard and the Display Board) OR; **2)** Bad Backlight Converter Cable (between the High Voltage Power Supply and the Display Board) OR; **3)** Bad High Voltage Power Supply.

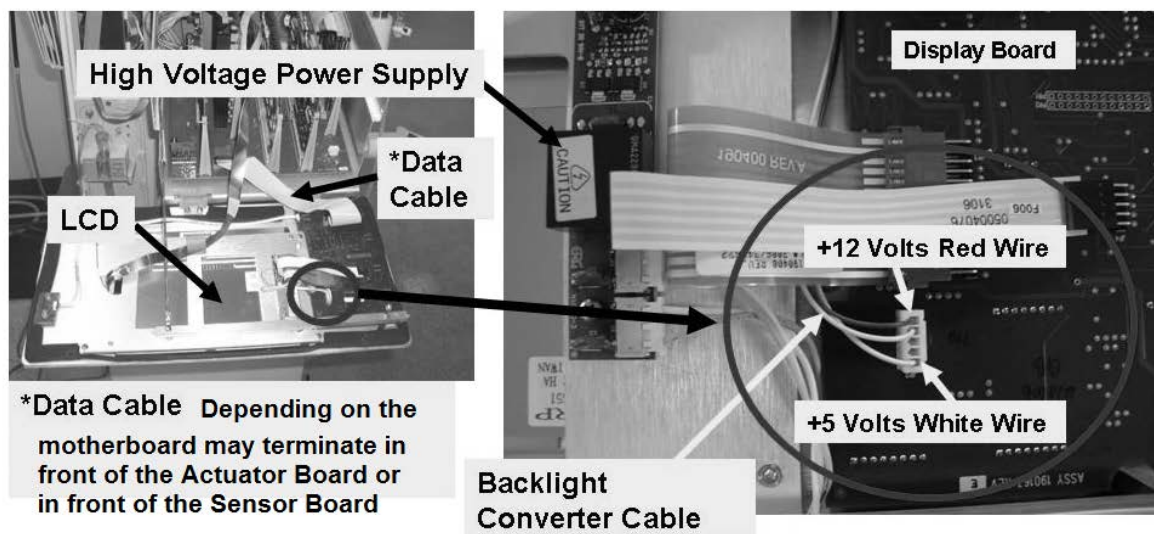


Figure 114 – Back Light Supply Voltages

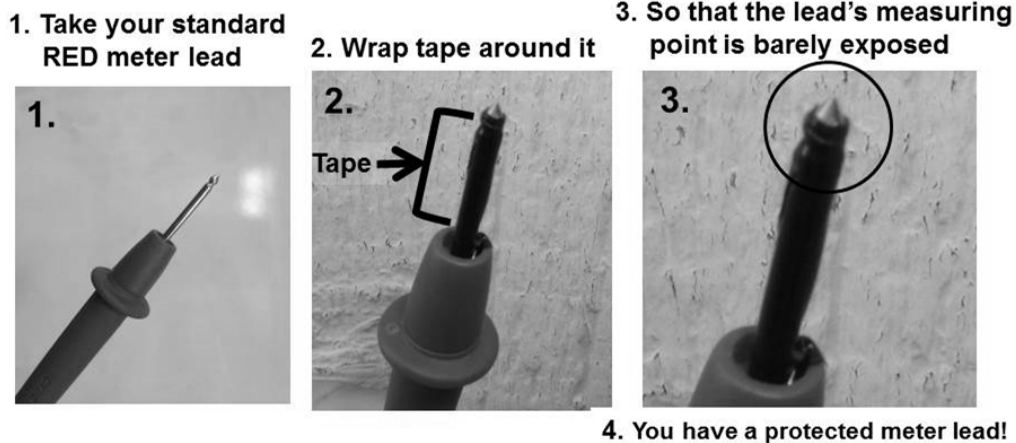
P- F.3.0 TROUBLESHOOT A BLACK SCREEN

Referring to the Figure above:

- Turn the machine OFF!* then ENSURE ALL screen and High Voltage Power Supply cables are plugged in correctly. * **WARNING! VERY HIGH VOLTAGE if the machine is not off!**
- Turn the machine on. If (and ONLY if) the white backlight STILL does not turn on continue to part c.
- Turn the machine OFF then swap in a known good Backlight Converter Cable (between the High Voltage Power Supply and the Display Board).
- Turn the machine ON. If (and ONLY if) the white backlight STILL does not turn on continue to part e.
- Turn the machine OFF then swap in a known good High Voltage Power Supply.
- Turn the machine ON. If (and ONLY if) the white backlight STILL does turn on swap in a known good screen.

P- F.4.0 BOTH +12 AND +5 VDC LOW / ISOLATE 24 VOLTS DC AT POWER LOGIC BOARD

- a) **IMPORTANT!** 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 **WILL CAUSE DAMAGE!** As directed in the Figure below, make your **RED** meter lead a **PROTECTED** lead! **DO NOT CONTINUE UNTIL YOU HAVE DONE THIS!**



- c) **IMPORTANT!** 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.

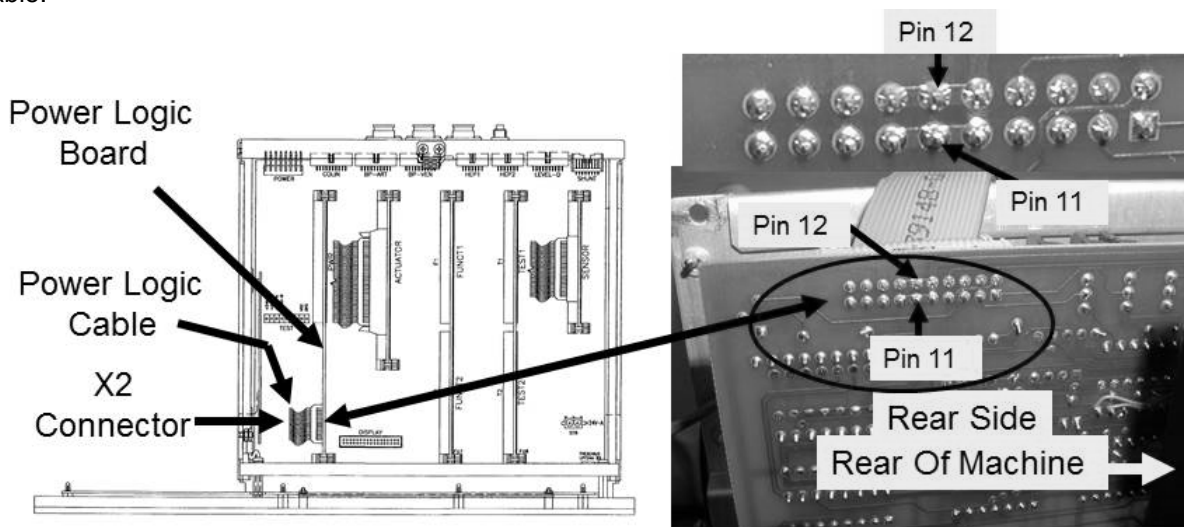


Figure 115 – Power Logic Board Pins 11/ 12 / 13

- 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** measurements more than 23.0 volts DC?

Yes BOTH more than 23.0 volts! Proceed to page **609**, 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 605).

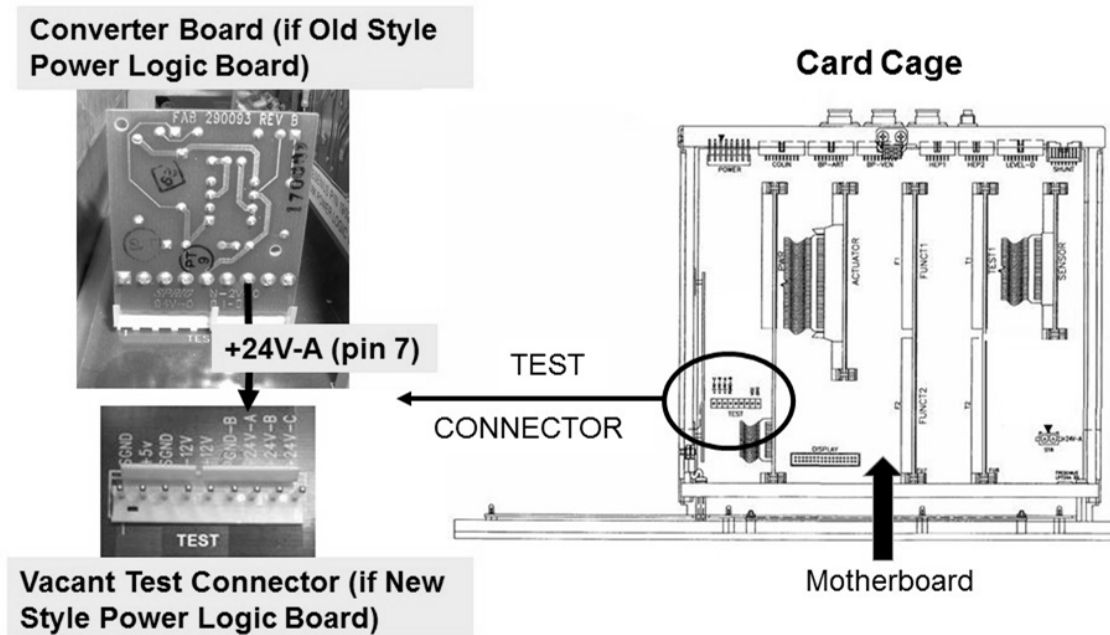
2) **IF AT LEAST one is more than 23.0 volts:** The Power Logic X2 ribbon cable may be bad.

P- F.5.0 ISOLATE +24V-A

- Spread the card cage side panels open then gently drop the front panel down to access the motherboard's nine (9) pin TEST Connector.
- ENSURE the machine is on (fan running)!
- ENSURE the meter's black lead REMAINS connected to chassis ground!
- Per the Figure below**, measure from the TEST Connector's **pin 7** (three (3) pins from the right). More than 23.0 volts DC (Yes or No)?

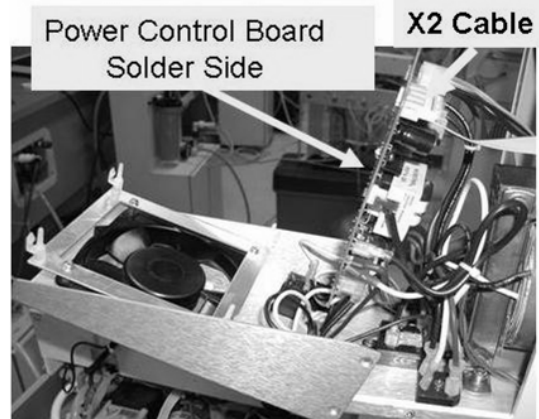
Yes
 ↑
 More than 23.0 volts DC! TWO (2) possible bad components: **1)** Power logic cable OR; **2)** Bad thermal (BROWN) fuse S19* (5 Amp).
 ↓
 * To LOCATE fuse S19 refer to [Figure 132](#) (page 651)! With the machine off, it can be checked by measuring RESISTANCE (Ω) BETWEEN its two terminals. A good fuse measures less than 0.5 Ω !

No Less than 23.0 volts DC! See procedure number [P- F.6.0](#) (page 606).



P- F.6.0 CHECK TRANSFORMER OUTPUT

- a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocutation 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) **IMPORTANT! 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)?



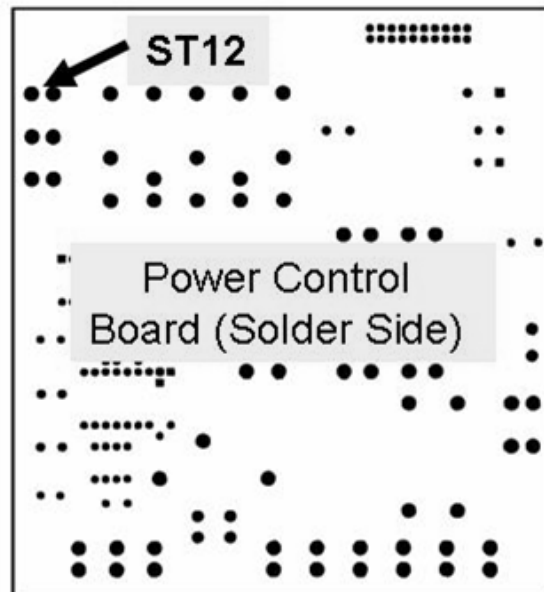
Yes More than 23.0 volts! See parts a AND b below:



- a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocutation hazard if not unplugged!**
- b) Bad thermal (BROWN) fuse S13 (16 Amp). To LOCATE S13 refer to [Figure 132](#) (page 651).

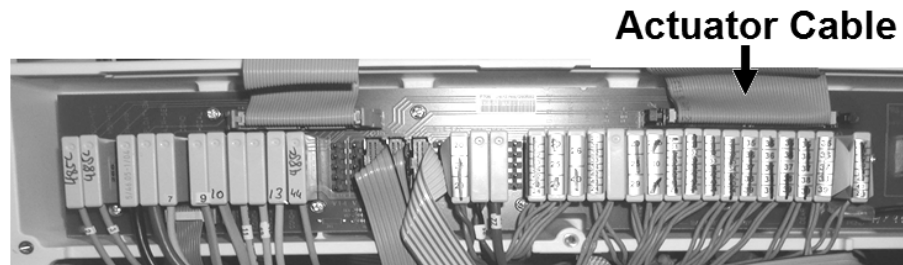
No Less than 23.0 volts! See procedure number [P- F.7.0](#) (page 607).

Figure 116 – Power Control Board (ST12)



P- F.7.0 ST 12 LESS THAN 23.0 VOLTS/ ISOLATE MODULES / PUMPS

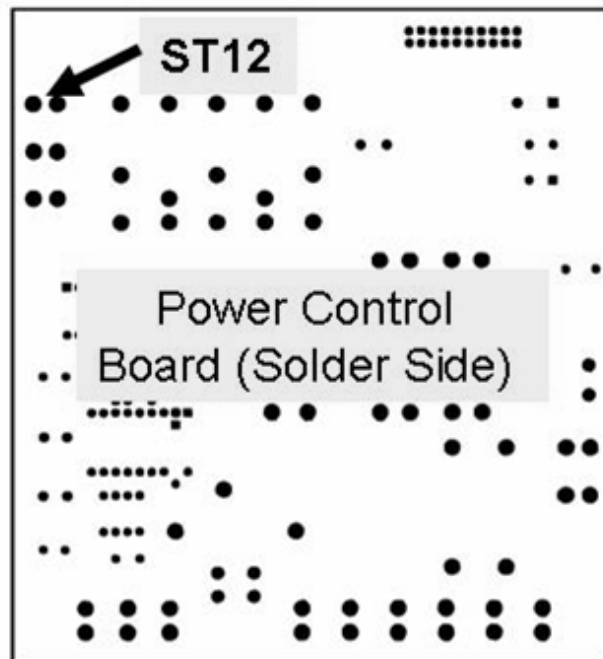
- a) **IMPORTANT! To prevent damage, turn the machine OFF!**
- b) Figure below, unplug the ACTUATOR Cable from the distribution board.



- c) **ENSURE the meter's black lead remains connected to chassis ground!**
- d) **IMPORTANT! 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?

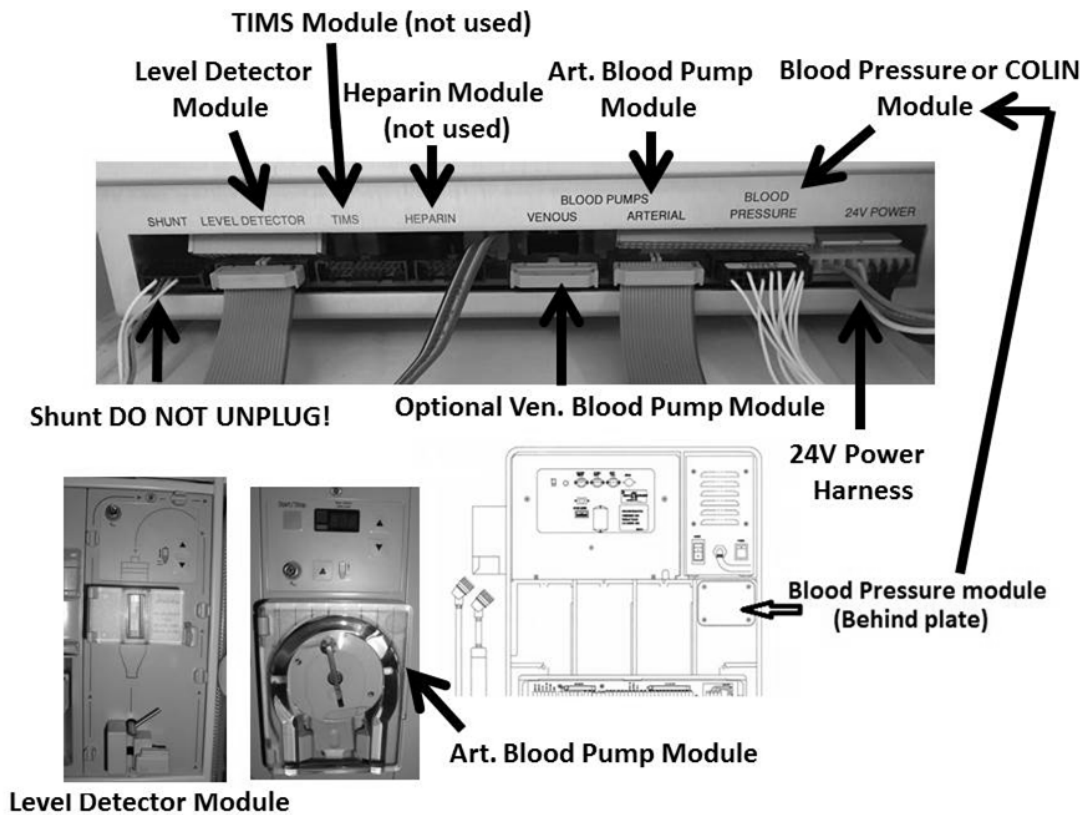
Yes More than 23.0 volts! Possible bad Acid, Bicarbonate, Flow or Deaeration Pump. Check their distribution board connectors and wire harnesses for damage.

No Less than 23.0 volts! See procedure number [P- F.8.0](#) (page 608).



P- F.8.0 ST 12 STILL LESS THAN 23.0 VOLTS

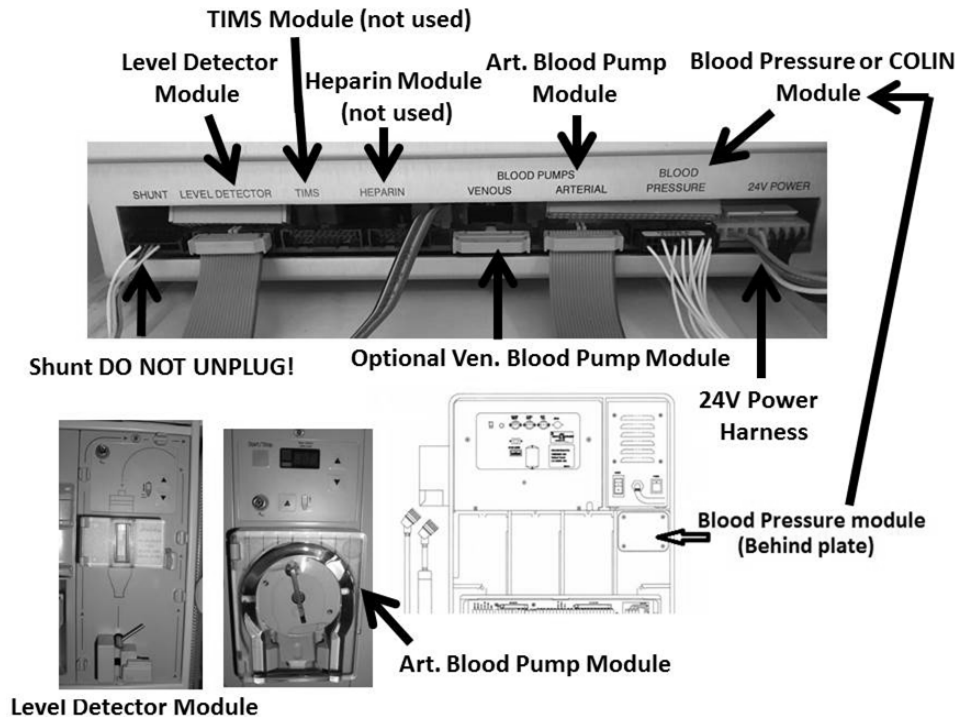
- a) **IMPORTANT! To avoid damage, turn the machine OFF!**
- b) Figure below, unplug the modules **ONLY**, including the **Blood Pressure** module!



- c) **IMPORTANT!** Reconnect the Actuator Cable!
- d) **IMPORTANT! Turn the machine on (fan running)!**
- e) Measure again from the rear side of the Power Control Board's ST12 connector. More than 23.0 volts DC now? TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) 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 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) **IMPORTANT! To prevent damage turn the machine off!**
 - B) Your choice, plug in one 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 C until you locate the bad module.

P- G.0.0 ISOLATE POWER LOGIC BOARD

- IMPORTANT! To prevent damage turn the machine OFF!**
- Figure below, trace the cable from the Blood Pressure Module to ENSURE it is NOT reverse connected with another module! If it first correct this problem THEN re-measure +5 and +12 volts as this may be the problem!
- See procedure number P- G.2.0 (page 609).



P- G.2.0 MODULES OKAY / ISOLATE POWER LOGIC BOARD

- Swap in a known good* Power Logic Board.** The board is known good if +5 and +12 volts are present in another machine.

* To LOCATE the board see [Figure 4A](#) (page 9))!.

- IMPORTANT! Turn the machine on (fan running)!**
- ENSURE the meter's black lead remains connected to chassis ground!**
- 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 610).

No Screen on and / or good voltage(s) now! The previous Power Logic Board may be bad.

P- G.5.0 ORIGINAL SYMPTOM STILL PRESENT / ISOLATE MODULES

NOTE: The previous Power Logic Board is probably good!

- a) **IMPORTANT!** To prevent damage turn the machine OFF!
- b) **Per the Figure previous page**, unplug the **MODULES ONLY**, including the Blood Pressure module!
- c) **IMPORTANT!** Turn the machine ON (fan running)! If possible, return to Dialysis OR Heat Disinfect.
- d) 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! **A) IMPORTANT!** Turn the machine OFF! **B) BEING CERTAIN** the Blood Pressure module cable **ONLY** is returned to the Blood Pressure or Colin connector, reconnect **ALL** module cables; **C)** Proceed to **page 611**, procedure number **P- G.5.2**.

No Screen on and / or good voltage(s) now! To locate the bad module see procedure number **P- G.5.1** (page 610).

P- G.5.1 SYMPTOM NOT PRESENT / ISOLATE POTENTIAL BAD MODULE

- a) **IMPORTANT!** To prevent damage turn the machine OFF!
- b) Your choice, plug **ONE** of the modules back in. **CAUTION!** Be 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)! If possible, return to Dialysis OR Heat Disinfect.
- d) 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! The last module plugged in (or its cable) is causing the problem!

No Screen on and/or good voltage(s)! Repeat parts a through d until **ALL** modules and have been plugged in. If the symptom does not reoccur, reseating the cables **MAY** have eliminated the problem.

P- G.5.2 SYMPTOM STILL PRESENT / ISOLATE FUNCTIONAL / POWER LOGIC BOARD DEVICES

- a) **IMPORTANT! The machine MUST be OFF to prevent damage!**
- b) **Per the Figure below**, device cables along the TOP EDGE of the Functional 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 (cable closest to the screen)!
- d) **ENSURE the meter's black lead remains connected to chassis ground!**
- e) **IMPORTANT!** Turn the machine on (fan running)! If possible, return to Dialysis Program OR Heat Disinfect.
- f) 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! Proceed to **page 613**, procedure number [P- G.5.4](#).

No Screen on and /or good voltages! To locate the bad device, perform parts A THROUGH E next page:

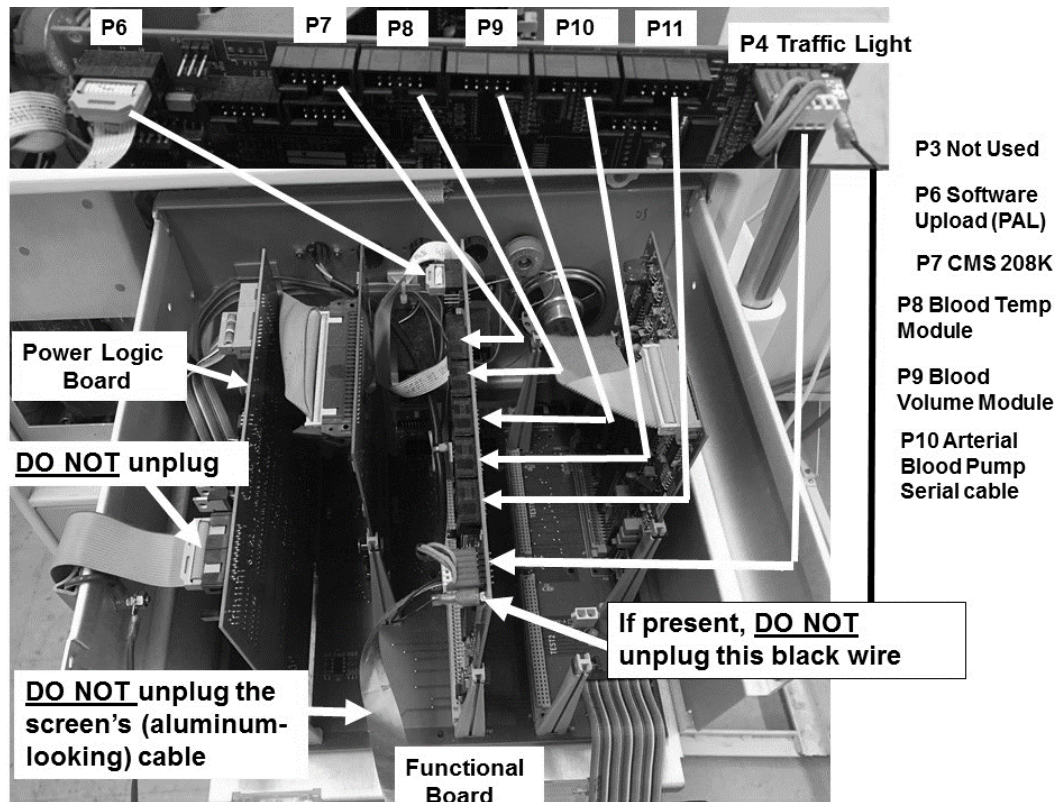


Figure 117 – Card Cage / Functional and Power Logic Board Devices

Screen on and / or good voltages continued:

- A) **IMPORTANT! To prevent damage turn the machine OFF!**
- B) Your choice, referring to Figure 117 (page 611), plug ONE of the cables back in to where it belongs as recorded above.
- C) Turn the machine on (fan running)!
- D) If possible, return to Dialysis Program 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?

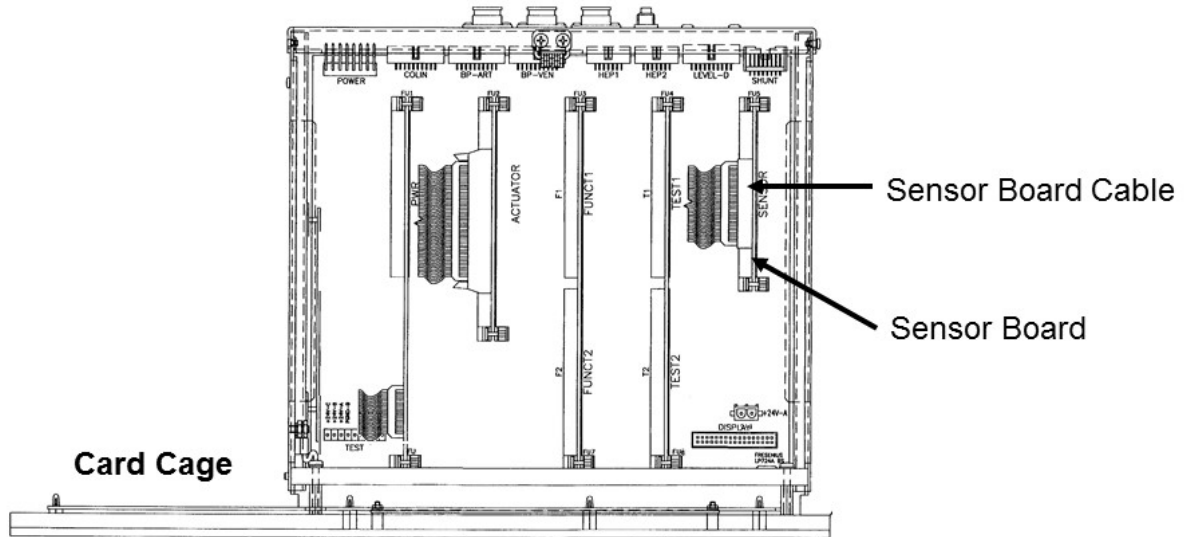
Yes Symptom reoccurs! The last device plugged in (or its cable) may be causing the problem!

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.5.4 SYMPTOM REOCCURS / ISOLATE HYDRAULIC SENSORS

- a) **IMPORTANT! To prevent damage turn the machine OFF!**
- b) To isolate ALL hydraulic sensors at the same time, Figure below, unplug the Sensor board's ribbon cable!



- c) **IMPORTANT! Turn the machine on (fan running)!**
- d) If possible go to **Dialysis Program** or RINSE (**DO NOT** go to Heat Disinfect)!
- e) **IGNORE acid and / or bicarb pump EOS alarms or possible grinding!**
- f) **ENSURE the black lead remains connected to chassis ground!**
- g) 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! Proceed to **page 615**, procedure number [P- G.5.6](#).

No Screen on and / or good voltage(s)! See procedure number [P- G.5.5](#) (page 614).

P- G.5.5 SYMPTOM NOT PRESENT / ISOLATE SENSORS AND PUMPS

- a) **IMPORTANT! To prevent damage turn the machine OFF!**
- b) **IMPORTANT!** 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 the bad component.

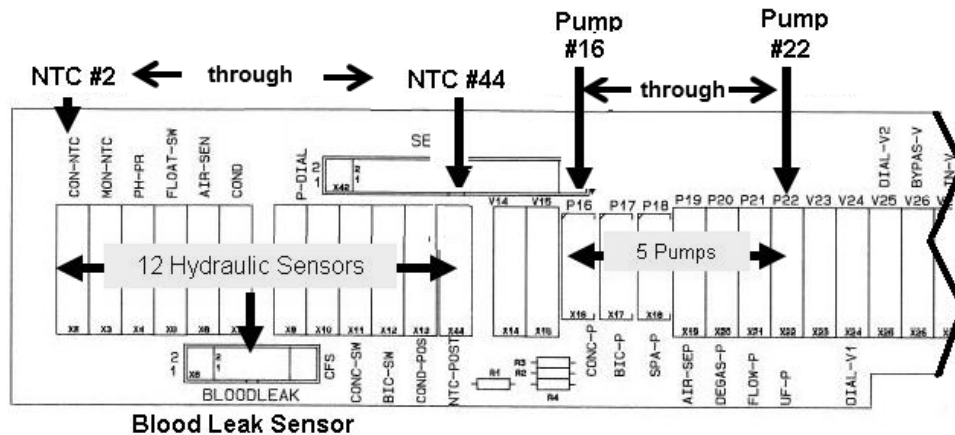


Figure 118 – Distribution Board

- 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 chassis ground!**
- f) **IMPORTANT! Turn the machine ON (fan running)!**
- g) IGNORE grinding and / or UF and / or acid and / or bicarb pump alarms and / or Flow Errors.
- h) Re-measure +12 and / or +5 volts (within range now?). If the screen is on select the ‘Dialysis’ button but **DO NOT** press ‘CONFIRM’ THEN call debug screen 1. If the symptom was intermittent allowing sufficient time, does the symptom you were troubleshooting reoccur?

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 or its cable is the problem.

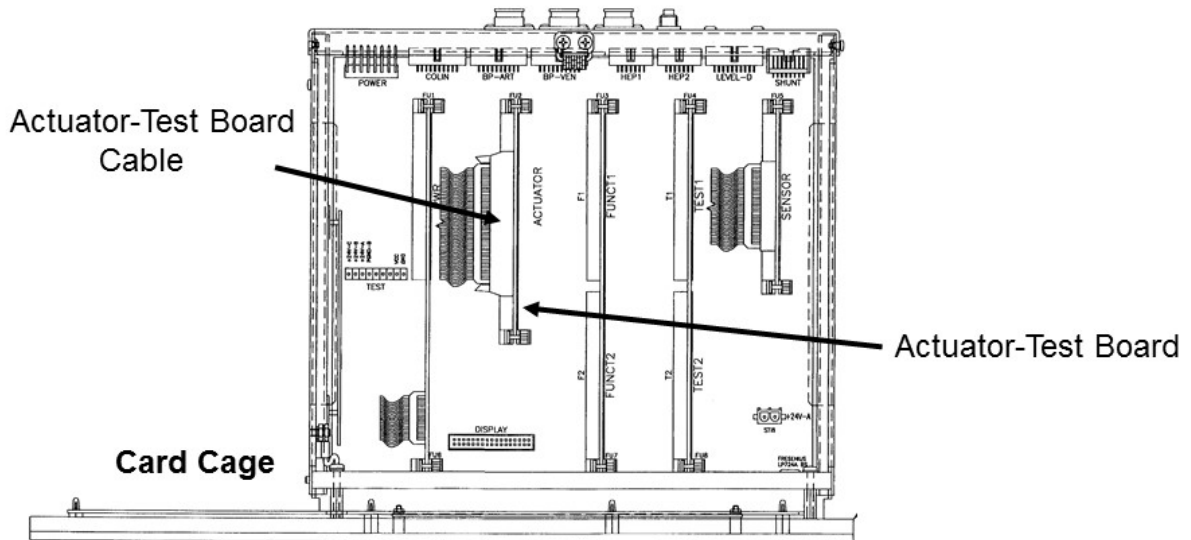


NOTE: If after ALL components have been unplugged AND the symptom reoccurs, turn the machine off and replace the Sensor Board cable with a known good then repeat parts e through h. If the symptom reoccurs see procedure number [P- G.5.6](#) (page 615).

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) **IMPORTANT! To prevent damage turn the machine OFF!**
- b) **IMPORTANT!** Return the ribbon cable to the Sensor Board.
- c) Figure below, unplug the Actuator-Test board's ribbon cable.



- d) **IMPORTANT! Turn the machine on (fan running)!**
- e) If possible, place the machine in Dialysis Program.
- f) **Ignore all hydraulic alarms and possible grinding!**
- g) **ENSURE the black lead remains connected to chassis ground!**
- h) 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.5.9](#) (page 616).

No Screen on and/or good voltages! The actuator cable may be causing the problem.

P- G.5.9 SYMPTOM STILL PRESENT

- A) **To prevent damage turn the machine OFF!**
- B) Reconnect the Actuator ribbon cable to to the Actuator-Test board
- 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 see part D to test the board.

BOARD LIST: 1) Actuator-Test Board; 2) Sensor Board; 3) Functional Board¹.

¹ To prevent "Cond Offset Failure", place the machine in **T and C Mode** Refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**).

- D) Turn the machine on (fan running)!
- E) If possible, place it into Dialysis OR Heat Disinfect.
- F) **ENSURE the black lead remains connected to chassis ground!**
- G) Per the ORIGINAL symptom, THREE (3) possible scenarios below:
 - 1) **IF (and ONLY if) the screen was not turning on but is now:** The last board swapped in is the problem!
 - 2) **IF (and ONLY if) the screen was remaining black and still is black:** Return to part a HOWEVER, if after ALL boards have been replaced AND the screen remains black possible bad: 1) Distribution board OR; 2) Bad motherboard.
 - 3) **IF the screen has ALWAYS been on:** Allow sufficient time for the symptom to reoccur then see part H.
- H) 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! Repeat parts C through H until each circuit board in the BOARD LIST have been replaced. 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 replaced 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 ‘CONFIRM’. 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 617).
 - No The Service menu DOES NOT appear! Proceed to **page 638**, 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!** See part B instead!

B) Select the [12 Volt Set] data box. It turns bright yellow!



C) Enter the MEASURED +12 volt value into the [12 volt set] window.

D) Sharply press ‘CONFIRM’.

E) ENSURE the [12 Volt Set] box is pale yellow/white. If the box is gray start over!

Status bar with "Operator Error" banner

F) Sharply press ‘CONFIRM’ again.



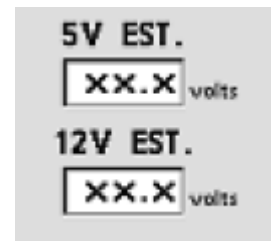
G) Figure right, does an “Operator Error” appear?

Yes “Operator Error” occurs! Proceed to **page 618**, procedure number [P- H.1.2](#).

No “Operator Error” DID NOT occur! Perform parts a AND b below:

a) If done correctly, the screen says “4. Verify that 5V EST is between 4.8 to 5.2....”. If not start over!

b) Figure right, look at the **screen’s [5V EST] AND [12V EST] windows!** TWO (2) IMPORTANT CHECKS:



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?

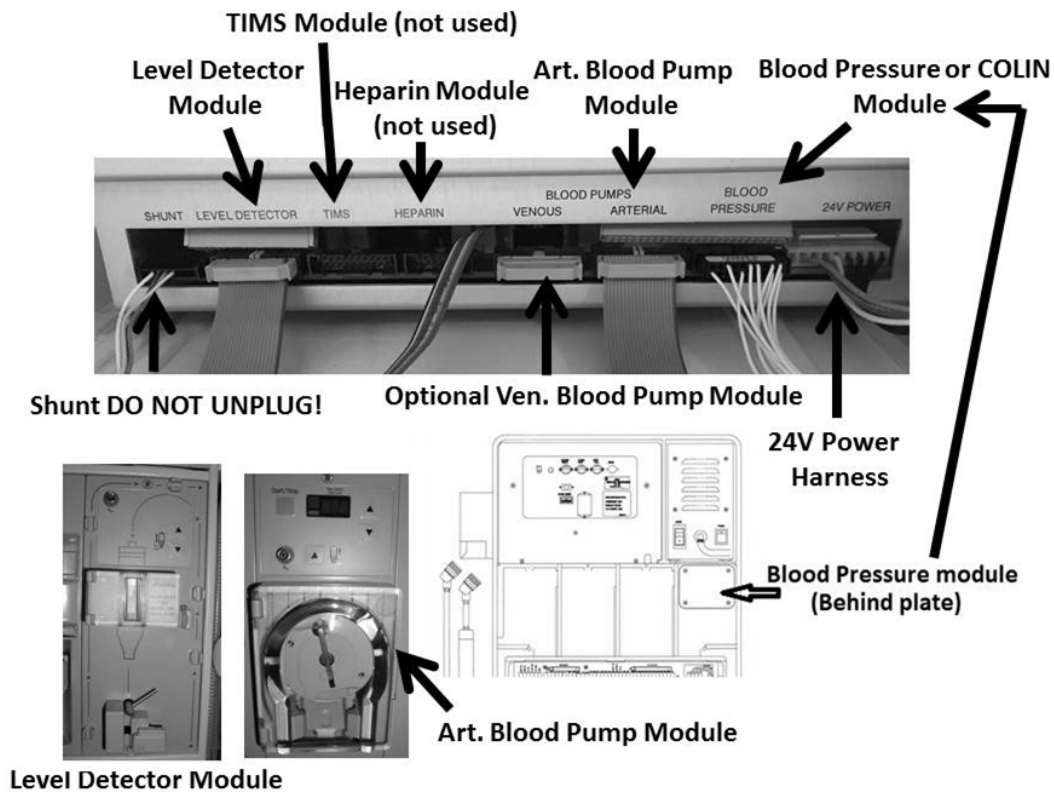
Yes (to BOTH): Proceed to **page 623**, procedure number [P- H.3.0](#).

No (to one OR both): See procedure number [P- H.1.2](#) (page 618).

P- H.1.2 TROUBLESHOOT VOLTAGE DETECTION PROBLEM

Either "Operator Error" occurred OR **5V EST AND** / OR **12V EST** were not in range. These procedures determines if a component may be 'dragging' +12 and / or +5 high or low:

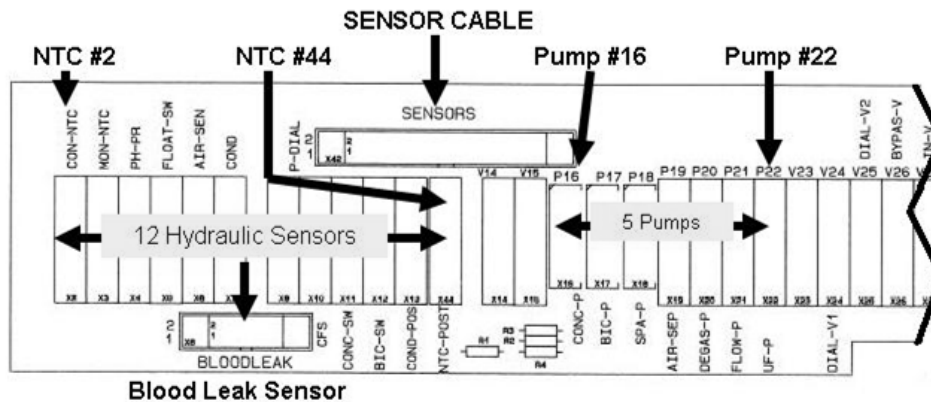
- a) **IMPORTANT! To prevent damage turn the machine OFF!**
- b) Figure below, unplug ALL **MODULES ONLY**, including the Blood Pressure module!



- c) From here forward, 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 619).
 - 2) **IF (and ONLY if) 5V EST AND / OR 12V EST are not in range:** See procedure number [P- H.1.3](#) (page 619).
 - 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 in between until the problem reoccurs indicating the last module plugged may be the problem.
- * **CAUTION! DO NOT plug a module, other than the Blood Pressure module, into the Blood Pressure or Colin position!**
- * **CAUTION! DO NOT plug the Blood Pressure module, into another module's position!**

P- H.1.3 ISOLATE HYDRAULIC SENSORS

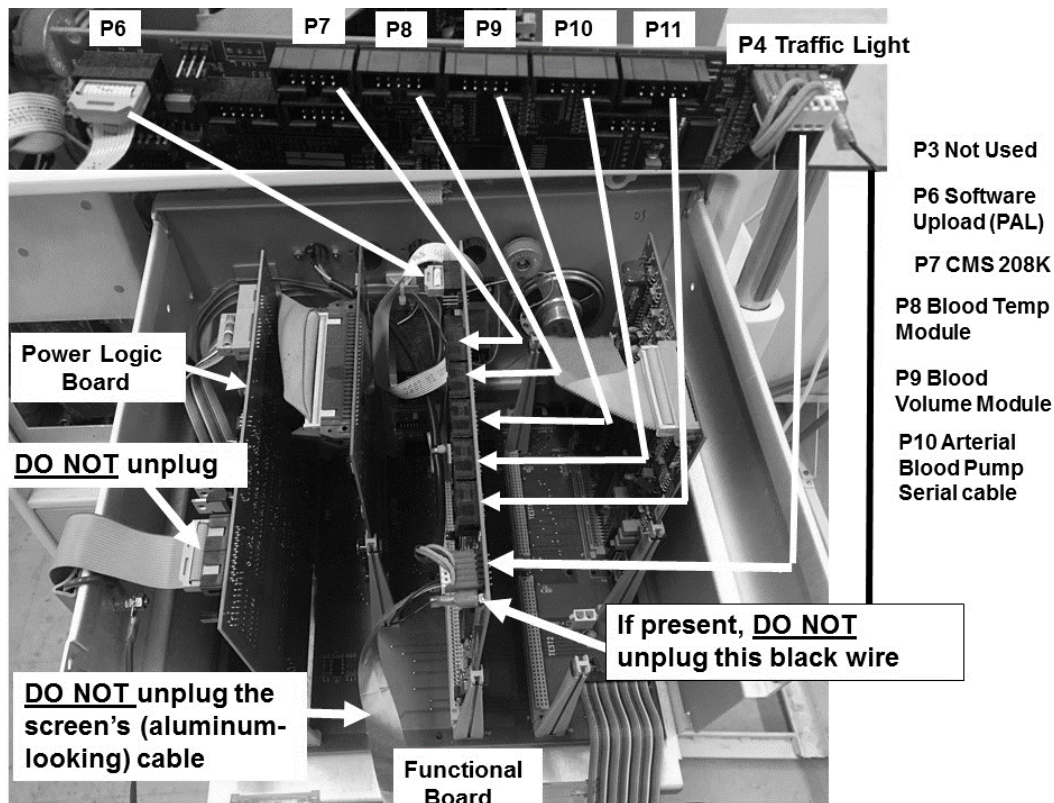
- a) **IMPORTANT!** To prevent damage turn the machine OFF!
- b) CAREFULLY* return the module cables to their positions.
 - * **CAUTION! DO NOT** a plug a module, other than the Blood Pressure Module, into the Blood Pressure or Colin position! **DO NOT** plug the Blood Pressure Module into another module's position!
- 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 620).
 - 2) **IF (and ONLY if) 5V EST AND / OR 12V EST are not in range:** See procedure number [P- H.1.4](#) (page 620).
 - 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 determine which one:
 - a) **IMPORTANT!** Turn the machine OFF and reconnect the Sensor Board cable.
 - b) Per the Figure above, your choice, unplug ONE of 12 hydraulic Sensors or ONE of 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 or its cable may be causing the problem.
 - 2) **IF problem reoccurs:** Repeat parts b through c until ALL (12) twelve sensors (NTC #2 through NTC #44 AND the Blood Leak Sensor) AND ALL five pumps (#16 through #22), have been unplugged. **NOTE:** AFTER all components have been unplugged AND, the problem reoccurs replace the Sensor Board cable with a known good. If (and ONLY if) the problem reoccurs see procedure number [P- H.1.4](#) (page 620).

P- H.1.4 ISOLATE FUNCTIONAL BOARD DEVICES

- a) **IMPORTANT! To prevent damage turn the machine OFF!**
- b) Device cables along the TOP EDGE 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 cable (closest to the screen)!

NOTE: Ignore "Blood Pump No Communication" if one occurs!

- 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.1.5](#) (page 623).
 - 2) **IF 5V EST AND/OR 12V EST are not in range:** See procedure number [P- H.1.5](#) (page 623).
 - 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) Attempt the Voltage Detection Calibration. When the problem reoccurs the last device plugged in or its cable is causing the problem!

P- H.1.5 SYMPTOM STILL PRESENT

- a) **To avoid damage, turn the machine off!**
- b) Return the Functional and Power Logic board device cables to EXACTLY as recorded above!
- c) Referring to see Figure 4A and NOTE A (page 9), if (and ONLY if) the machine is equipped with the New Style Power Logic Board (i.e. NO 'Converter Board') skip to procedure number [P- H.1.7](#) (page 622). If the 'Converter Board' is present see procedure number [P- H.1.6](#) (page 621).

P- H.1.6 ISOLATE CONVERTER BOARD (IF PRESENT)

- a) CAREFULLY remove the Converter Board from the motherboard's nine (9) pin TEST connector.
- b) If the screen is NOT turning ON skip to part d. If the screen IS turning on enter Service Mode → Options → Hardware Options. Next to **T and C Mode** place the 'X' in the "Yes" box and press the 'CONFIRM' key (the 'X' turns blue).

T and C Mode	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- c) Turn the machine ON (fan runs).
- d) If possible, place it into Dialysis or RINSE. **IGNORE the 'grinding sound' and all hydraulic alarms!**
- e) ALLOWING sufficient time for the symptom to develop, either measure for +12 and/or +5 volts DC (**V_{DC}**), OR call debug screen 1 to monitor **5V Est** and/or **12V Est**. Within range and stable now?

Yes Good voltages and stable! The Converter Board may be causing the problem! **CAUTION!**
The new Converter Board MUST be installed with the 'solder side' towards the front of the machine AND matched pin for pin to the TEST connector!

No See procedure number [P- H.1.7](#) (page 622).

P- H.1.7 ISOLATE CARD CAGE

- A) **IMPORTANT!** 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 continue to part C to test it.

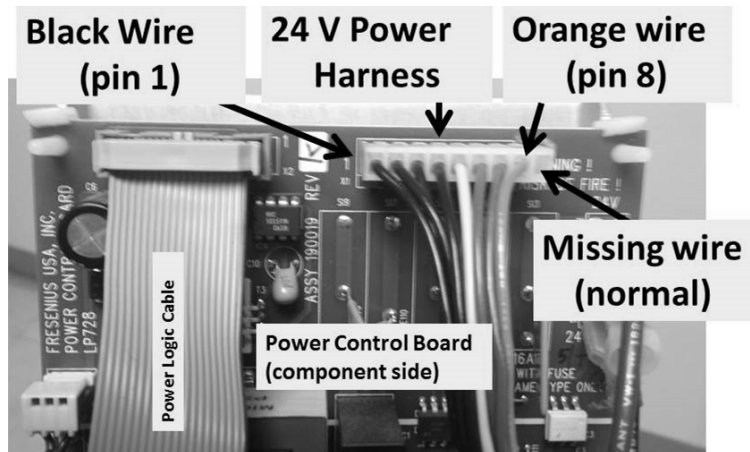
BOARD LIST: 1) Actuator-Test Board; 2) Sensor Board*; 3) Functional Board*.

* To prevent “Cond Offset Failure”, place the machine in **T and C Mode**. Refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**)

- 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 replaced was the problem. If after all boards have been swapped in AND if “Operator Error” still occurs 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 replaced was the problem. If after all boards have been swapped in AND the problem reoccurs 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) Open the power supply enough to see the top edge of the Power Control Board (Figure right).
- c) ENSURE the 24V Power Harness is connected SECURELY, pin for pin, to its connector!
- d) See procedure number [P- H.3.1](#) (page 623).



P- H.3.1 SYSTEM INITIALIZATION?

- a) Turn the machine on (fan running).
- b) Allowing forty (40) seconds does System Initialization reach 100%?



System Initializing

Yes System Initialization reaches 100%! See procedure number [P- H.3.2](#) (page 623).

No System Initialization does NOT reach 100%! Proceed to **page 638**, procedure number [P- 2.0.0](#).

P- H.3.2 SYSTEM INITIALIZATION REACHES 100%

NOTE: The previous Voltage Detection calibration may have solved the problem!

NOTE: If the 24V Power Harness was not securely connected this may have been the problem!

- a) Place the machine into Dialysis OR Heat Disinfect OR Rinse.
- b) Does a voltage OR "Failed Sending Data" OR "Temp Over 95 Degrees" alarm occur?

Yes Alarm occurs! See procedure number [P- H.3.3](#) (page 623)

No An alarm does not occur! Allow thirty (30) minutes or longer. If a voltage OR "Failed Sending Data" OR "Temp Over 95 Degrees" alarm reoccurs see procedure [P- H.3.3](#) (page 623). If these alarms DO NOT reoccur the troubleshooting Guide cannot locate an immediate problem.

P- H.3.3 ALARM REOCCURS

- a) Turn the machine off then back on HOWEVER, when "System Initialization" reaches 100% **DO NOT** press any keys yet!
- b) Per the OBSERVED symptom, FOUR (4) possible scenarios 1) or 2) or 3) below:

1) IF "5V High" OR "5V Low" OR "12V Power Fail": See procedure number [P- H.4.1](#) (page 624).

Scenarios 2 through 4 next page

2) IF any “24V” alarm OR “Loading Software....Please Wait” lasts longer than one (1) minute: Proceed to **page 625**, procedure number [P- H.4.5](#).

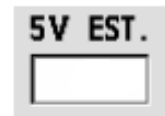
3) IF a “24V” alarm has never occurred but “Failed Sending Data To Actuator Board” has: If the “Actuator Board” alarm reoccurs one of the card cage boards may be interfering with communication between the Actuator-Test Board and the Functional Board. The most likely culprit is the Actuator-Test Board itself.

4) ALL other scenarios: See procedure number [P- H.4.1](#) (page 624).

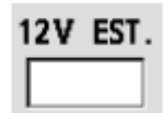
P- H.4.1 ISOLATE “5V High” OR “5V Low OR “12V Power Fail”

The following procedure describes how to use the debug screens to monitor +5 and +12 volts:

a) Select the screen’s ‘Dialysis’ button but **DO NOT** press CONFIRM yet!



b) Call debug screen 1 and locate **5V Est AND 12V Est** (Figure right):



- **5V Est:** If EVER less than 4.8 (“5V Low”) OR more than 5.3 (“5V High”) OR unstable (changes more than +/- 0.1) see procedure number [P- H.4.2](#) (page 624).

- **12V Est:** If EVER less than 11.7 OR more than 12.3 (“12V Power Fail”) OR unstable (changes more than +/- 0.1) see procedure number [P- H.4.2](#) (page 624).

c) At the bottom of the screen, select the ‘Dialysate’ tab, THEN press ‘CONFIRM’ to return to Dialysis Program!

d) Call debug screen 1.

e) 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 624).

No a) To generate cabinet temperature place the machine into Heat Disinfect then call debug screen 1. If debug does not appear press ‘Escape’ then call screen 1.

b) If **5V Est OR 12V Est** BECOME unstable see procedure number [P- H.4.2](#) (page 624). If Heat Disinfect completes without a voltage-related alarm occurring the Troubleshooting Guide cannot locate an immediate problem!

P- H.4.2 HEAT-RELATED FAILURE?

a) The most likely cause of this failure is the Power Logic Board (see Figure 4A and NOTE A (page 9)). Replace it with a known good then see part b

b) Repeat procedure number [P- H.4.1](#) (page 624) to watch **5V Est AND/OR 12V Est.. ALLOW SUFFICIENT TIME!** If the problem reoccurs next try a known good Sensor Board then see part c.

c) Repeat procedure number [P- H.4.1](#) (page 624) to watch **5V Est AND/OR 12V Est.. ALLOW SUFFICIENT TIME.** If the problem reoccurs see procedure number [P- G.5.0](#) (**page 610**).

P- H.4.5 +24 VOLT- A TROUBLESHOOTING

- a) Spread the card cage panels open then gently drop the front panel down.
- b) **ENSURE the volt meter's black lead remains attached to chassis ground!**
- c) ENSURE the machine in on (fan running)!
- d) **Figure below**, place the red meter lead into the RIGHT SIDE socket of the motherboard's white, two (2) pin, +24V-A connector. **BE CERTAIN to make good contact with the metal pin inside the socket!**
- e) TWO (2) possible scenarios:
 - 1) **IF between 23.0 and 28.0 volts DC (V_{DC}):** See procedure number [P- H.4.6](#) (page 626).
 - 2) **IF NOT between 23.0 and 28.0 volts DC (V_{DC}):** Proceed to **page 649**, procedure number [P- 4.0.0](#).

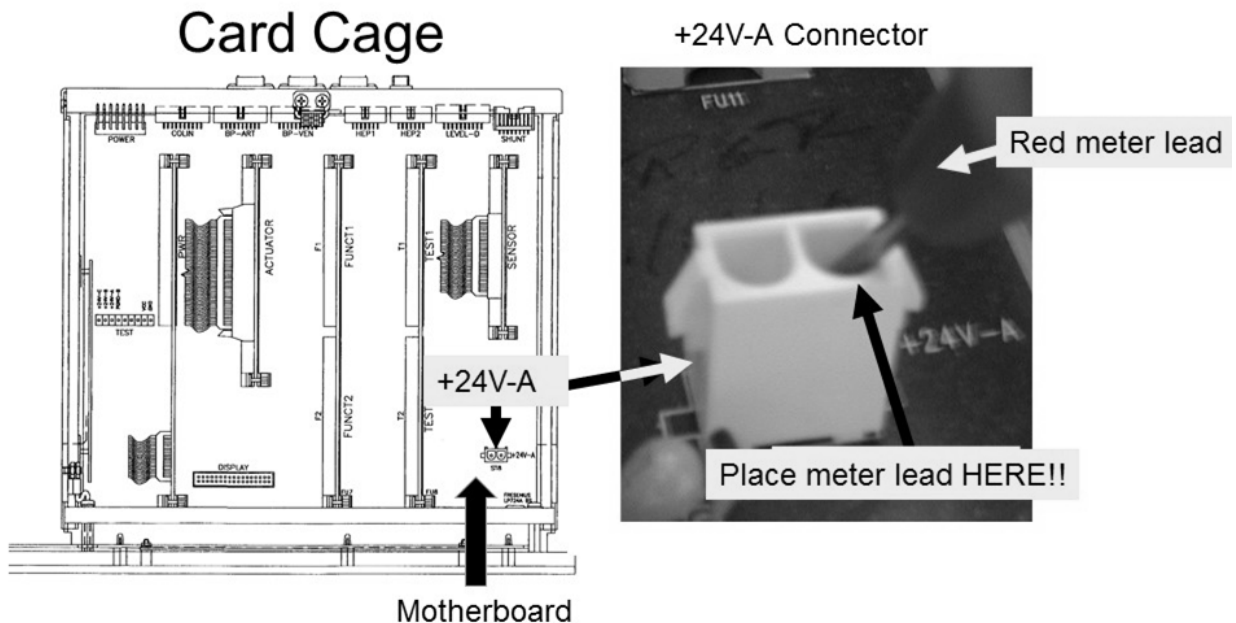


Figure 119 – Motherboard +24V-A Connector

P- H.4.6 BETWEEN 23.0 AND 28.0 VOLTS / MONITOR 24 VOLTS

a) With the “Select Program” banner up select the screen’s ‘Dialysis’ button but **DO NOT** press CONFIRM yet!

b) Call debug screen 10. Figure right, **24V** is the ‘real time’ reading from the +24 volt supply. **HI** and **LO** ‘records’ the highest and lowest starting one (1) minute after the machine is turned on.

24V	HI	LO
24.4	24.4	24.4

c) At the bottom of the screen, select the ‘Dialysate’ tab THEN press ‘CONFIRM’ to return to Dialysis Program!

d) Call debug screen 10 and allow one (1) minute for the **24V** window to update. The **24V** window IS NORMALLY UNSTABLE however, an alarm does not occur unless if it falls below 22.8 volts (“24V Low”) or rises above 28.0 volts (“24V High”) for several seconds.

e) WITHOUT LOOKING AWAY, watch the volt meter for ten (10) minutes. Does the measurement become unstable (i.e. changes more than +/- 0.5) OR does a “24V” OR “Failed Sending Data To Actuator Board” alarm occur?

Yes Measurement became unstable AND / OR “24V” OR “Failed Sending Data...” reoccurs!
See procedure number [P- H.4.7.1](#) (page 626).

No Measurement remains stable AND a “24V” OR “Failed Sending Data To Actuator Board” alarm reoccurs! Proceed to **page 627**, procedure number [P- H.4.8.2](#).

P- H.4.7.1 UNSTABLE OR 24V OR FAILED SENDING REOCCURS

Based on the MEASURED voltage, TWO (2) possible scenarios:

1) **IF MEASURED voltage became UNSTABLE:** Proceed to **page 649**, procedure number [P- 4.0.0](#).

2) **IF MEASURED voltage remained STABLE:** Perform parts a through c 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 ‘CONFIRM’ key. The ‘X’ MUST turn blue!

T and C Mode	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>

c) One at a time, starting with the Actuator-Test Board, swap in the card cage circuit boards, with known good then, in between, return to (ABOVE) procedure number [P- H.4.6](#) (**page 626**) to test each new board.

P- H.4.8.2 REMAINS STABLE AND NO ALARMS OCCUR / HEAT-RELATED PROBLEM?

- a) Place the machine into Heat Disinfect then call debug screen 10 to watch the **24V** window.
- b) WITHOUT LOOKING AWAY, watch the volt meter until if the program completes.
- c) Does the measurement become unstable AND/OR does a “24V” OR “Failed Sending Data To The Actuator Board” alarm occur before Heat Disinfect completes?

Yes Unstable measurement OR “24V” OR “Failed Sending Data...” alarm! See procedure number [P- H.4.9](#) (page 627).

No Return to Dialysis Program. Does a “24V” OR “Failed Sending Data To The Actuator Board” alarm occur (Yes or No)?

Yes One at a time, starting with the Actuator-Test Board, swap in the card cage circuit boards, with known good then, in between, repeat procedure number [P- H.4.8.2](#) (page 627) to test each new board.

No The Troubleshooting Guide cannot locate an immediate problem!

P- H.4.9 UNSTABLE OR ALARM REOCCURS / ANALYZE PROBLEM

TWO (2) possible scenarios, based on MEASURED voltage:

- 1) **IF (and ONLY if) MEASURED voltage became UNSTABLE:** Proceed to **page 649**, procedure number [P- 4.0.0](#).
- 2) **IF MEASURED voltage remained STABLE:** Perform parts a THROUGH c 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 ‘CONFIRM.’ The ‘X’ turns blue.

T and C Mode	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>

c) With the machine off, swap in the card cage circuit boards, with known good, one at a time, starting with the Actuator-Test Board and, in between, return to Heat Disinfect to test each new board. If “24V” OR “Failed Sending Data...” alarm reoccurs swap in the next board until these alarms DO NOT occur.

P- 1.0.0 MACHINE NEVER TURNS ON (FAN NEVER RUNS)

- IMPORTANT!** Set your **CALIBRATED** volt meter to DC voltage (V_{DC})!
- Connect the meter's black lead to chassis ground (see [Figure 2](#) (page 4)).
- Per the [Figure](#) below, locate regulator **T1** at the TOP EDGE of the Power Logic Board. TWO (2) measurements may be made at T1 depending on the first!
- MEASUREMENT 1:** From the REAR side of T1's **TOP** pin (pin 1). More than 10.0 volts DC?

Yes More than 10.0 volts! The main line fuses are okay. See procedure number [P- 1.0.1](#) (page 628).

No Less than 10.0 volts! Proceed to [page 634](#), procedure number [P- 1.1.0](#).

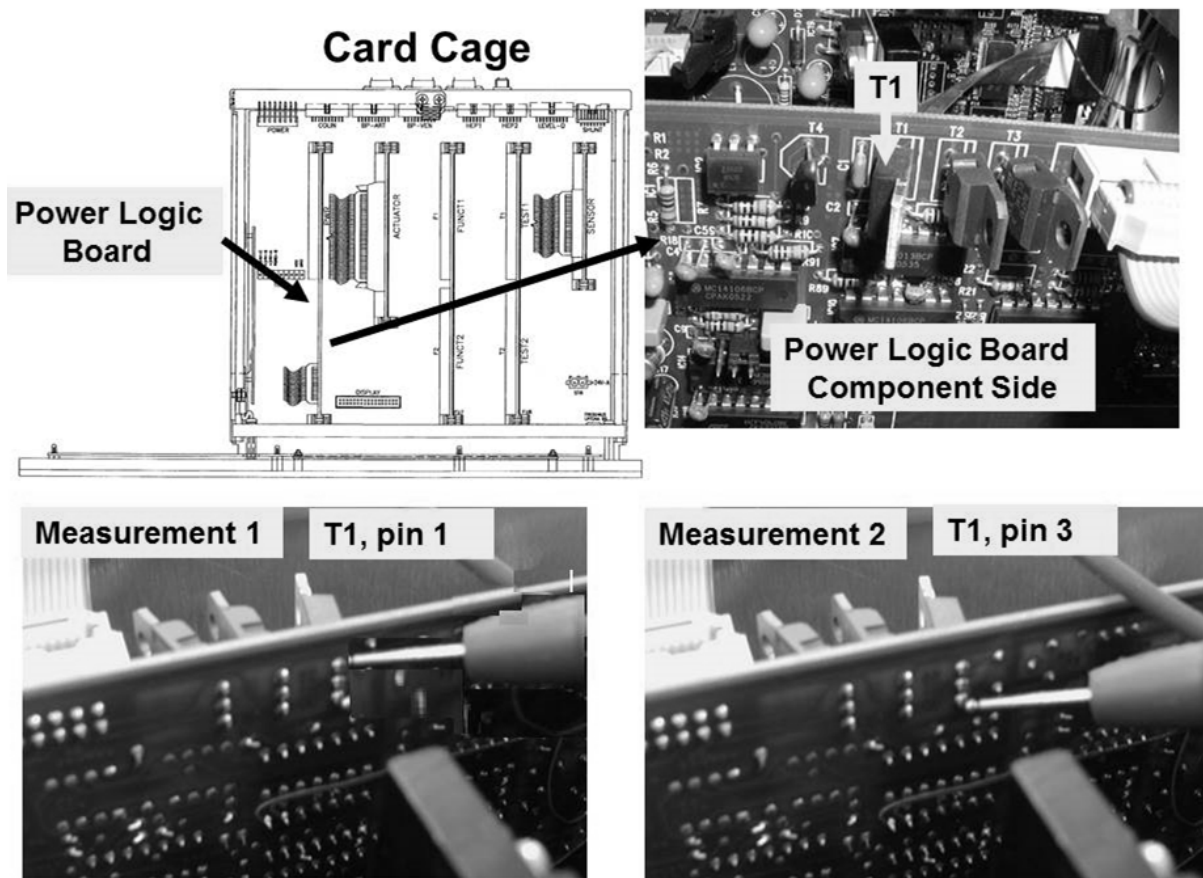


Figure 120 – Power Logic Board (T1)

P- 1.0.1 PIN 1 MORE THAN 10.0 VOLTS / MEASUREMENT 2

MEASUREMENT 2: Per the Figure above, from the rear side of T1's **BOTTOM** pin (pin 3). Between 4.0 and 6.0 volts DC?

Yes Between 4.0 and 6.0 volts! See procedure number [P- 1.0.2](#) (page 629).

No IS NOT between 4.0 and 6.0 volts! The Power Logic Board is bad (card cage, first circuit board from the left).

P- 1.0.2 PIN 3 BETWEEN 4.0 AND 6.0 VOLTS / ISOLATE POWER ON/OFF CIRCUIT

a) Spread the card cage side panels open then gently drop the front panel down.

b) **Per the Figure below**, TWO (2) checks:

CHECK #1: ENSURE the twenty-four (24) pin Front Panel Data Cable is plugged in properly between the motherboard and the Front Panel Interface board. If not this may be the problem!

CHECK #2: ENSURE the sixteen (16) pin, Switch Matrix Cable is plugged in securely, pin for pin, at the Front Panel Interface board. If not this may be the problem!

c) Measure at the 16 pin Switch Matrix Cable's, from **pin 4** (4th pin from the REAR of the machine). Between 4.0 and 6.0 volts DC?

Yes Between 4.0 and 6.0 volts! Proceed to **page 631**, procedure number [P- 1.0.4](#).

No IS NOT between 4.0 and 6.0 volts! See procedure number [P- 1.0.3](#) (page 630).

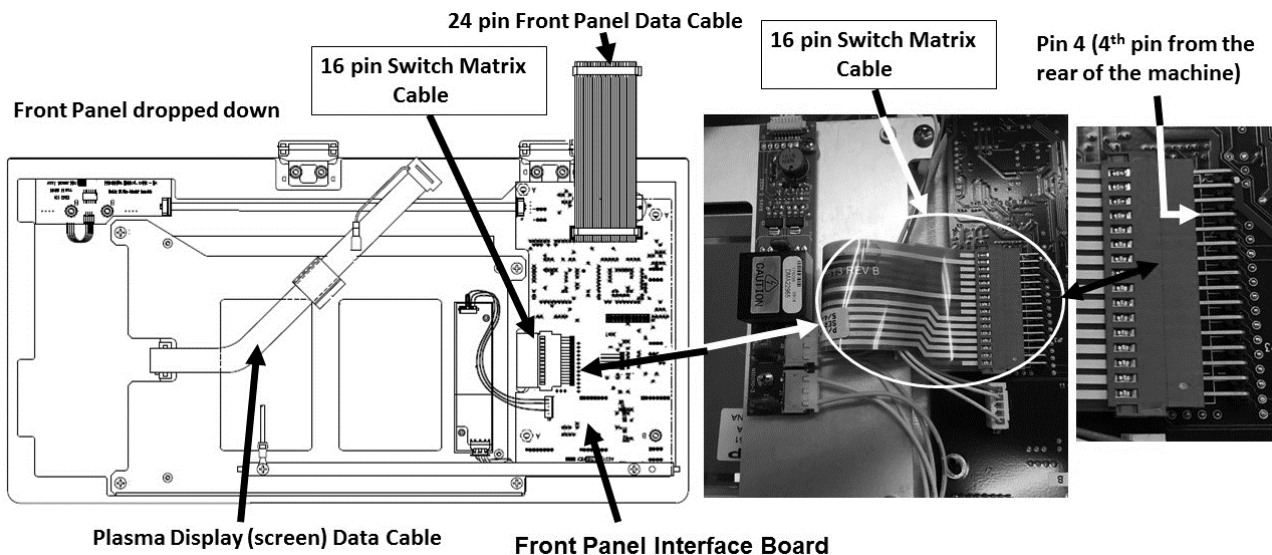
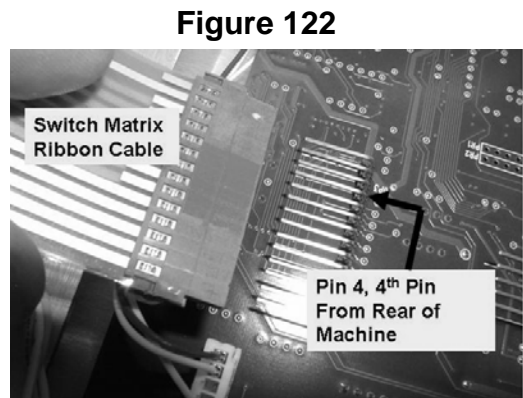


Figure 121 – Front Panel

P- 1.0.3 PIN 4 IS NOT BETWEEN 4.0 AND 6.0 VOLTS

- a) Figure right, unplug the sixteen (16) pin Switch Matrix Cable.
- b) Figure right, measure again at **pin 4**. Between 4.0 and 6.0 volts DC now (Yes or No)?

Yes Between 4.0 and 6.0 volts! Replace the front panel. The Power button is shorted.



No IS NOT between 4.0 and 6.0 volts! See parts A AND B below:

- A) Plug the 16 pin Switch Matrix Cable into the male pins on the Front Panel Interface board.
- B) Four (4) possible bad components. One at a time, referring to the **Component List** below, swap in each then, in between, measure at the Switch Matrix Cable's pin 4. When between 4.0 and 6.0 volts is measured the last component swapped in is the problem.

Component List: **1)** 24 pin Front Panel Data Cable*; **2)** Power Logic Board (card cage, first board from the left); **3)** Front Panel Interface Board*; **4)** Motherboard*.

* To LOCATE these components refer to Figure 121 (page 629)

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P- 1.0.4 PIN 4 BETWEEN 4.0 AND 6.0 VOLTS / ISOLATE THE POWER BUTTON

- a) Continuing to measure at the Switch Matrix Cable's, **pin 4**, press and release the Power button three (3) times.
- b) Does voltage drop to LESS THAN 0.5 volts 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 631).

No DOES NOT drop to less than 0.5 volts! Five (5) possible bad components. One at a time, referring to the **Component List** below, swap in each then, in between, press the Power button to see if the machine turns on indicating the last component swapped in is the problem.

Component List: **1)** 24 pin Front Panel Data cable*; **2)** Front Panel (Power button)*; **3)** Front Panel Interface Board*; **4)** Power Logic board (card cage, first board from the left); **5)** Motherboard*.

* To LOCATE these components refer to Figure 121 (page 629).

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) Per the 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 632).
 - 2) **IF LESS THAN 6.0 volts:** Proceed to **page 633**, procedure number [P- 1.0.9](#).

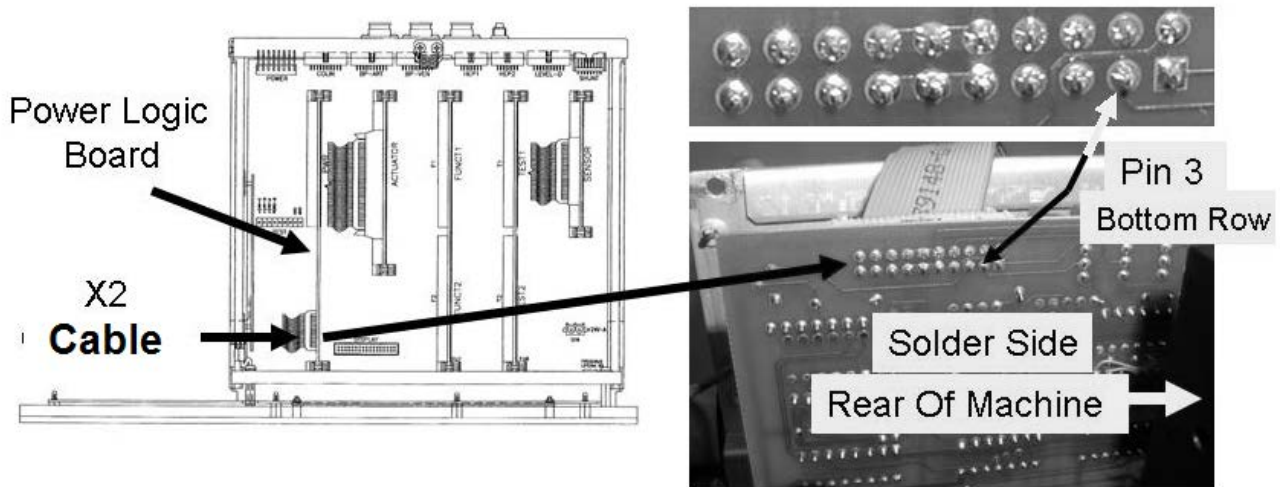


Figure 123 – Power Logic Board / X2 pin 3

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 632).
- 2) **IF REMAINS more than 1.4 volts DC:** The Power Logic Board is bad.

P- 1.0.7 PIN 3 LESS THAN 1.4 VOLTS / ISOLATE FAN AIR OUTPUT i.e. IS THE MACHINE ON?

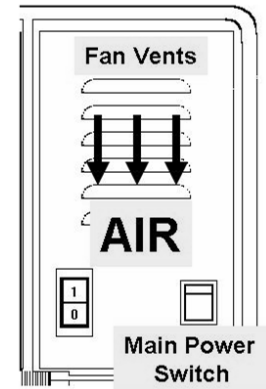
Figure right, is air felt from the power supply fan vents?

Yes Fan running! The machine is on! See procedure number [P- 1.0.8](#) (page 632).

No Fan IS NOT running! TWO (2) possible scenarios. Is the screen:
1) On? OR 2) Remaining black?

- 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 651).



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 597).
- b) ENSURING the fan continues to run, allow adequate time to see if the machine turns itself off. If (and ONLY if) it DOES turn off proceed to **page 647**, procedure number [P- 3.0.0](#).
- 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! Electrocutation hazard if not unplugged!**

b) Slide the power supply away from the cabinet to see the Power Control board inside.

c) ENSURE the cables, along the top edge of the board, are plugged in securely. **If not this may be the problem!**

d) Un-mount the board from its four plastic clips.

e) Figure right, remove the two (2) **front** screws and lay power supply rear panel down to access to the rear (solder) side of the board.

f) **IMPORTANT!** Plug the machine in. **CAUTION! High voltage now present!**

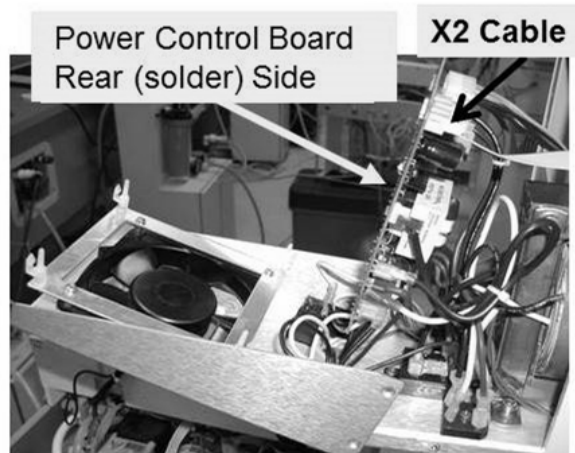


Figure 124

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 OR possibly its four-pin cable¹.

No Less than 6.0 volts! Unplug the machine then TWO (2) possible bad components: 1) Most likely, bad main Relay K1 (possibly its four-pin cable)¹ OR 2) Bad Power Control board.

¹ To LOCATE K1 and its cable refer to [Figure 132](#) (page 651).

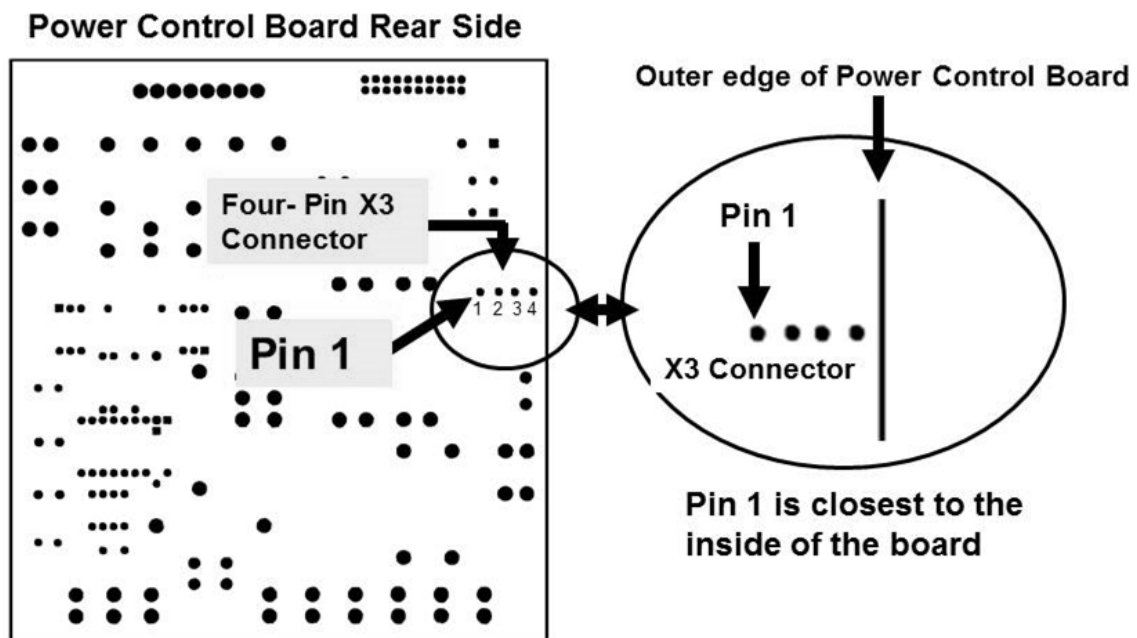
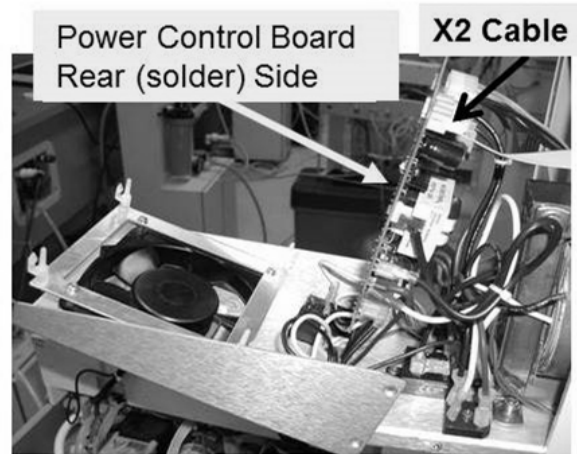


Figure 125 – Power Control Board / X3 Connector, Pin 1

P- 1.1.0 ISOLATE POWER LOGIC BOARD CABLE (PIN 4)

- a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocutation hazard if not unplugged!**
- b) Slide the power supply away from the cabinet to see the Power Control Board inside.
- 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) **IMPORTANT!** Plug the machine in! **CAUTION! High voltage now present!**
- g) **Per the Figures below**, measure at the rear (solder) side of the Power Control board's X2 connector, at **pin 4** (BOTTOM row, SECOND pin from the left). More than 10.0 volts DC?

Yes More than 10.0 volts! TWO (2) possible bad components: **1)** 20 pin Power Logic ribbon cable (X2) OR; **2)** Power Control board.

No Less than 10 volts! See procedure number [P- 1.2.0](#) (page 635).

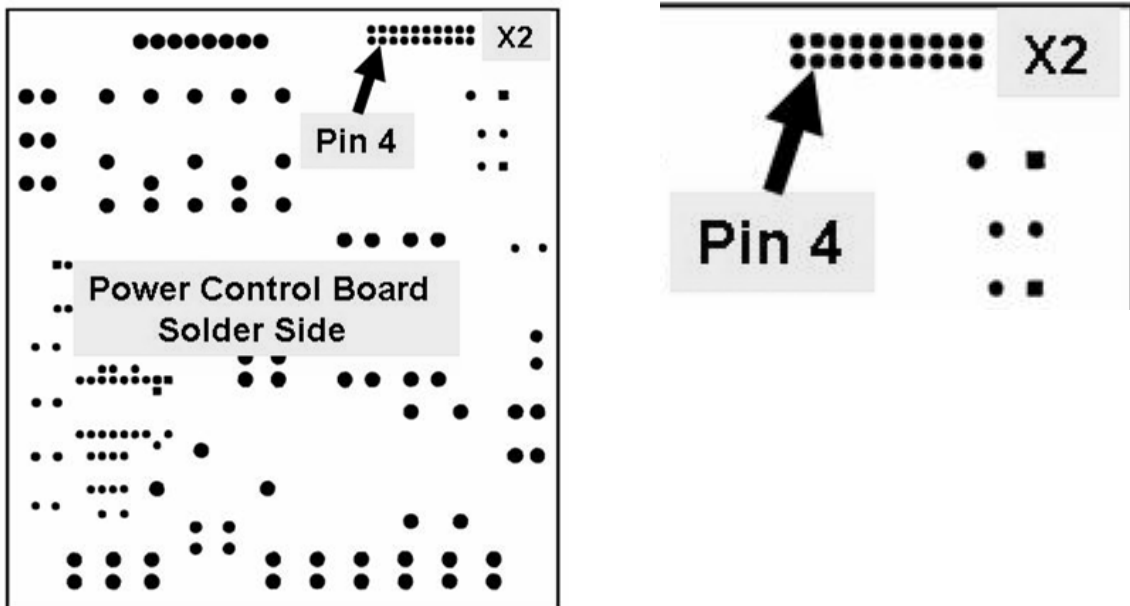


Figure 126 – Power Control Board Solder Side

P- 1.2.0 PIN 4 LESS THAN 10 VOLTS / ISOLATE MAIN LINE FUSES 6.3 AMP FUSES

- a) **Unplug the machine! CAUTION!** Electrocutation hazard if not unplugged!
- b) **IMPORTANT! 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 1.0 Ω ! Subtract this reading from all subsequent measurements!
- d) On the Power Control board, per the **Figure below**, measure **ACROSS BOTH** 6.3 Amp fuses.
NOTE: "OL" = bad fuse!

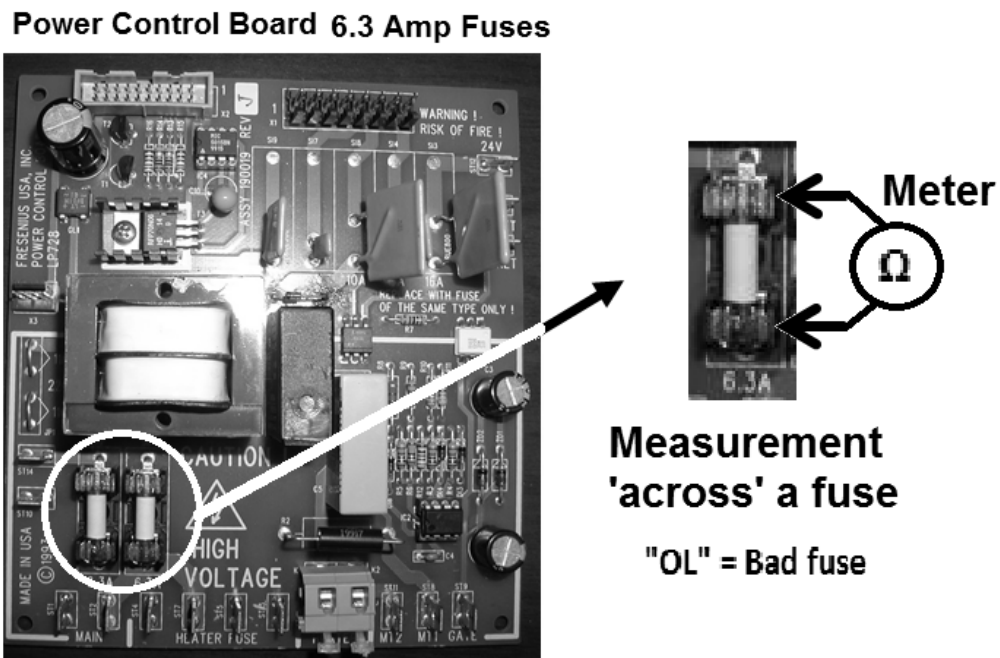


Figure 127 – Power Control Board / Fuses S12 and S16 / ST2 and ST1

- e) Are BOTH fuses less than 1.0 Ω ?

Yes BOTH less than 1.0 Ω ! See procedure number [P- 1.2.1](#) (page 635).

No One or both fuses MORE THAN 1.0 Ω or "OL"! Proceed to **page 637**, 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) **IMPORTANT!** 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

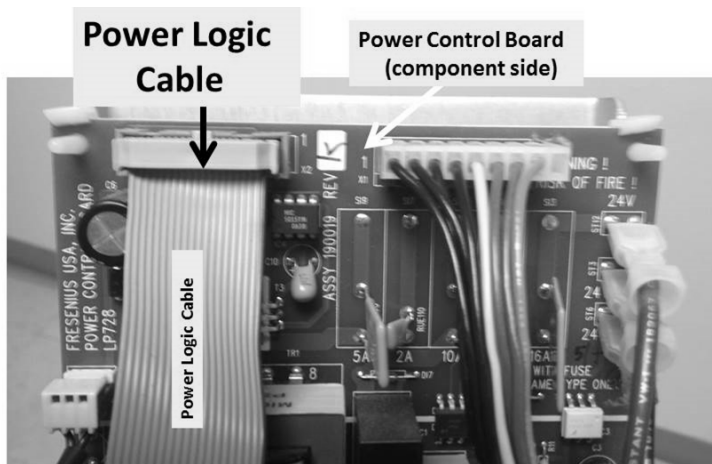
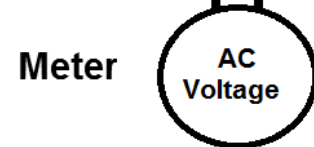
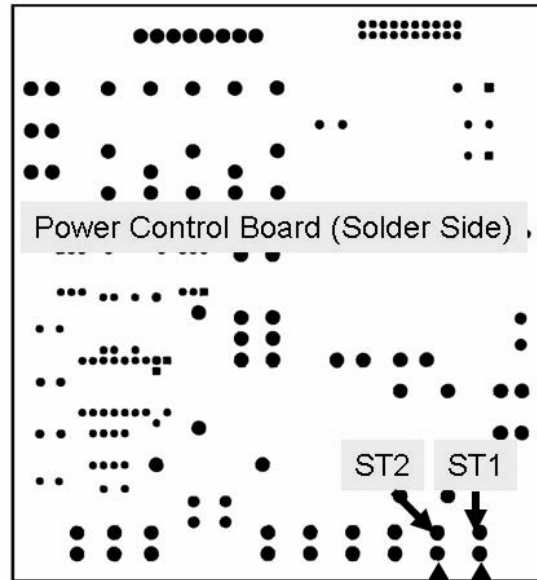
c) **IMPORTANT! Set your CALIBRATED volt meter to measure AC (~) voltage**

d) 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.



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P- 1.2.2 FUSES MORE THAN 1.0 Ω OR “OL” / TROUBLESHOOT BAD FUSES

- a) Replace the bad 6.3 Amp fuse(s). Call Fresenius Technical Services to ENSURE you are using the updated fuses!
- b) **IMPORTANT!** Plug the machine in!
- c) Push and hold the Power button for two (2) seconds. Does the machine turn on now (fan running)?

Yes One or both of the fuses were bad.

No Machine DOES NOT turn on! Perform parts A through D below:

A) **IMPORTANT! 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 651).

C) Diode check² or replace the Main Bridge Rectifier (BR1).

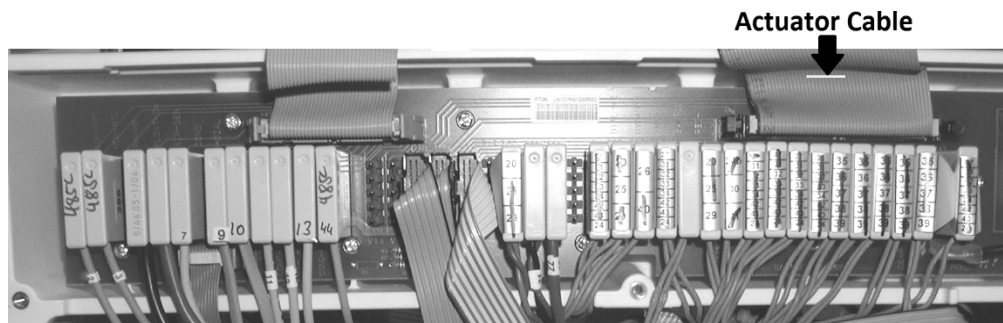
² NOTE: All Bridge Rectifier wires must be unplugged before performing a diode check. The wires are position sensitive! To prevent damage, NOTE where they plug into BEFORE unplugging them!

D) If the Bridge Rectifier checks good, or was previously replaced and the fuse(s) continue to 'blow' immediately proceed to **page 649**, procedure number [P- 4.0.0](#).

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P- 2.0.0 INITIALIZATION DOES NOT COMPLETE / ISOLATE PUMPS

- a) **IMPORTANT! 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%?

100%
System Initializing

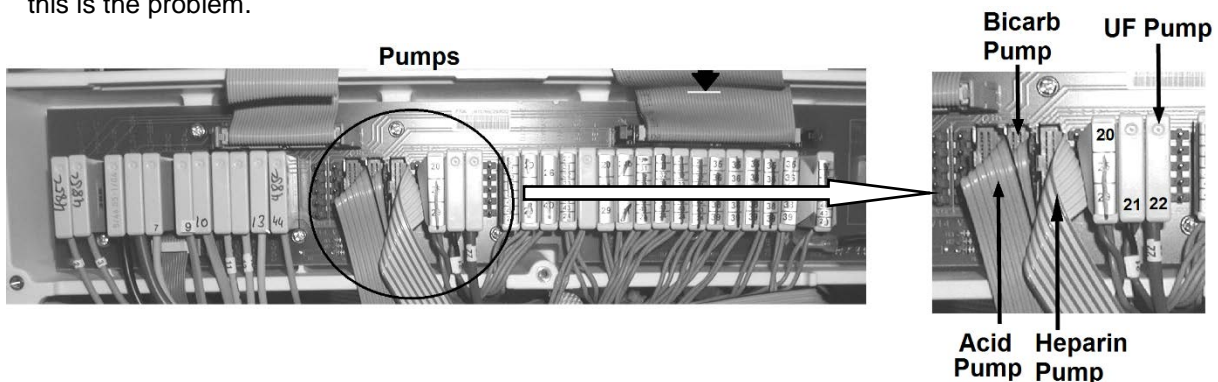
Yes System Initialization reaches 100%! See ISOLATING THE PUMPS this page.

No System Initialization does NOT reach 100%! See procedure number [P- 2.0.1](#) (page 639)

ISOLATING THE PUMPS

Possible 24 volt 'short circuit' at the Acid, Bicarb, Heparin OR UF Pump.

- A) **IMPORTANT! Turn the machine OFF and reconnect the ACTUATOR cable.**
- B) Figures below, from the distribution board, unplug a pump (your choice) then continue to part C to see if this is the problem.



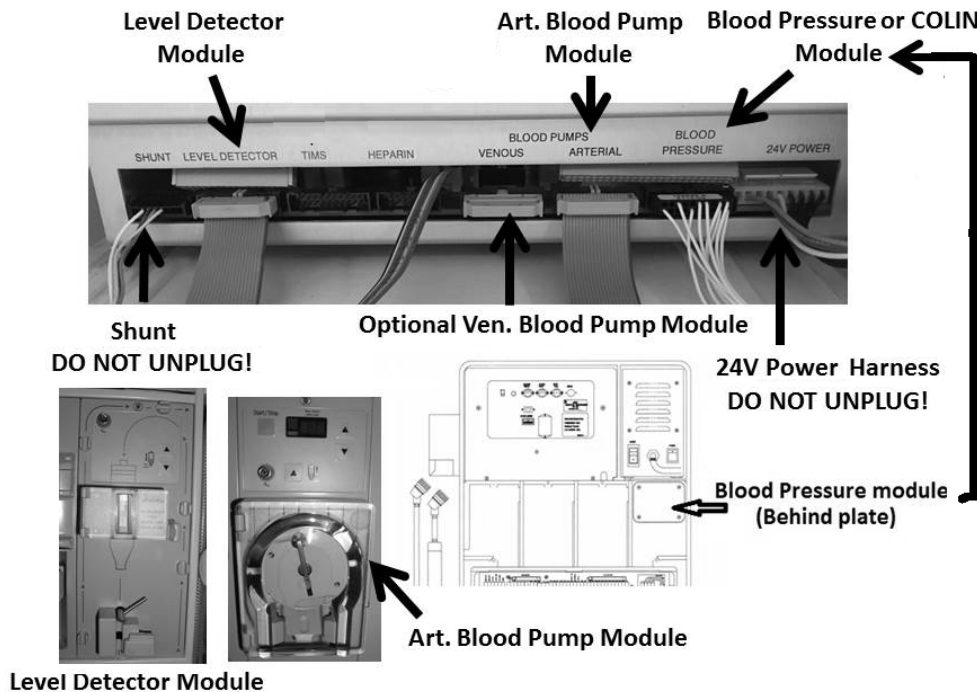
- C) Turn the machine on (fan running). Does System Initialization reaches 100%?

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% either the Actuator Cable OR the distribution board may be bad.

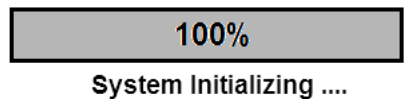
P- 2.0.1 SYSTEM INITIALIZATION DOES NOT REACH 100%

- a) **IMPORTANT!** Turn the machine OFF!
- b) **IMPORTANT!** Reconnect the ACTUATOR cable.
- c) **Figure below**, behind the card cage, unplug the **ALL MODULES ONLY** including the Blood Pressure module!



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%! ENSURING the ACTUATOR cable has been reconnected, see procedure number **P- 2.0.2** (page 640).

ISOLATING THE MODULES

- A) **Turn the machine OFF!**
- B) Your choice, CAREFULLY* plug one of the modules back in. ***NEVER reverse connect the modules! 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% the problem may be heat related and requires running the machine in Heat disinfect to locate it.

P- 2.0.2 SYSTEM INITIALIZATION DOES NOT REACH 100% / ISOLATE +24 V-A

- a) Spread the card cage side panels open then gently drop the front panel down to access the motherboard's white two (2) pin, +24V-A connector (Figure below).

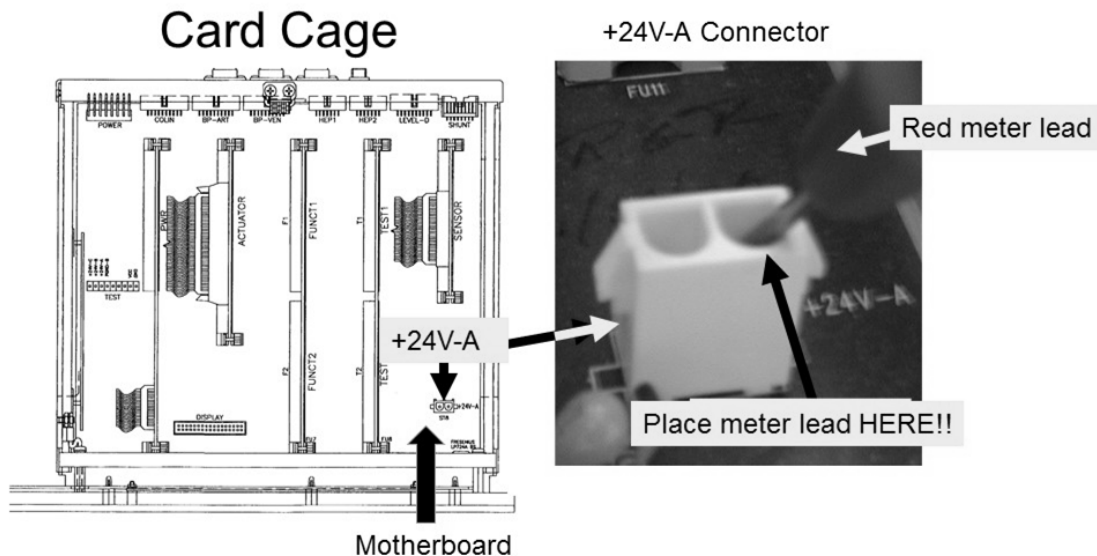


Figure 128 – Card Cage TEST Connector (24V-A)

- b) **Per the Figure above**, place the red meter lead into the right hand socket of the +24V-A connector. **ENSURE GOOD contact with the metal pin inside the socket!**
- c) **ENSURE the meter's black lead REMAINS attached to chassis ground!**
- d) **If not already, turn the machine is ON (fan running)!**
- e) 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 641).
- No IS NOT between 23.0 and 28.0 volts OR unstable! Proceed to **page 649**, procedure number [P- 4.0.0](#).

P- 2.0.3 ISOLATE 'SWITCHED' 24 V-B

- a) **IMPORTANT! TURN THE MACHINE OFF!**
- b) Figure below, locate the motherboard's nine (9) pin TEST connector.

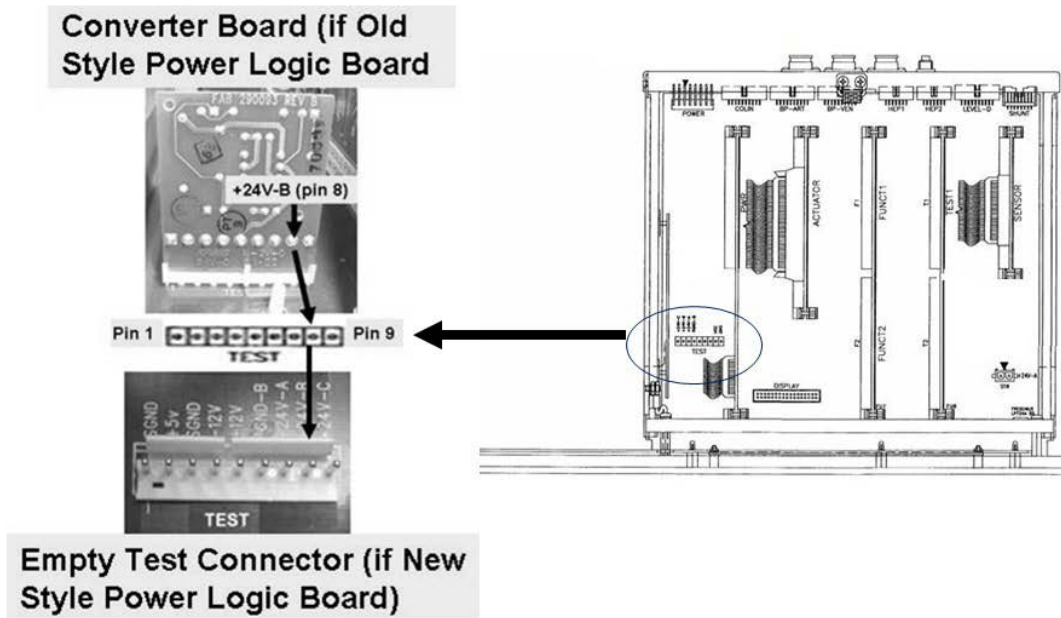


Figure 129 – Card Cage / TEST Connector / 24V-B

- c) TIGHTLY HOLD the red meter lead on the TEST connector's pin 8 (2nd pin from the right).
- d) Looking for approximately 24.0 volts to momentarily pulse on and off more than once, **WITHOUT LOOKING AWAY FROM THE METER**, turn the machine ON (fan running) and watch for thirty (30) seconds!
- e) FOUR (4) possible scenarios 1) or 2) or 3) or 4) below:
 - 1) **IF (and ONLY if) momentarily went to between 23.0 and 28.0 volts but after about thirty (30) seconds dropped to AND remained less than 3.0 volts:** See procedure number [P- 2.0.4](#) (page 642).
 - 2) **IF (and ONLY if) ALWAYS less than 3.0 volts i.e. NEVER more than 23.0 volts!** Perform procedure number P- 2.0.3 once again just to be sure. If still always less than 3.0 volts, proceed to **page 643**, procedure number [P- 2.0.5](#).

Scenario #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 651). 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 seconds REMAINS between 23.0 and 28.0 volts:** See (ABOVE) procedure number [P- H.4.6](#) (page 626).

P- 2.0.4 MOMENTARILY BETWEEN 23.0 AND 28.0 VOLTS DC

a) **Turn the machine OFF!**

b) Swap in a known good Sensor board*. *To LOCATE the board refer to [Figure 4A](#) (page 9)

c) Turn the machine on (fan running). When "Press CONFIRM for Service Mode" appears press 'CONFIRM'. The screen says "Machine in Service Mode".

d) Allow forty (40) seconds! Does the Main Service Program menu appear?

Yes Service menu appears! The previous Sensor board is bad. Perform all calibrations with the new Sensor board!

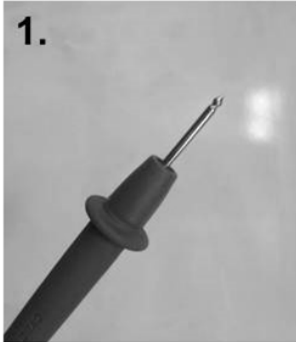
No Service mode menu DOES NOT appear! One by one, with the power off, swap in the remaining card cage circuit boards with known good, starting with the Actuator-Test Board, and repeating parts c through d in between to test each new board. After replacing all boards if a Main Service menu still does NOT appear proceed to **page 649**, procedure number [P- 4.0.0](#)

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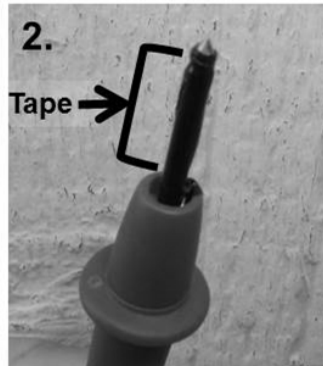
P- 2.0.5 ISOLATE POWER LOGIC CABLE

- a) **ENSURE** the machine is on (fan running)!
- b) **CAUTION!** Signals will be measured at pins that are VERY close to others and touching them together, with a standard meter lead, **WILL CAUSE DAMAGE!** As directed below, make your RED meter lead PROTECTED! **DO NOT CONTINUE UNTIL YOU HAVE DONE THIS!**

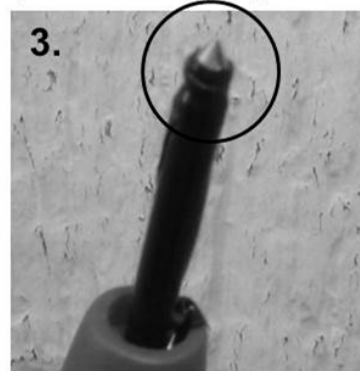
1. Take your standard RED meter lead



2. Wrap tape around it



3. So that the lead's measuring point is barely exposed



4. You have a protected meter lead!

- c) **Per the Figure below**, at the top of the Power Logic Board, closest to the screen, locate its 20-pin X2 ribbon cable.
- d) Measure at the rear 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 10.0 volts! See procedure number [P- 2.0.6](#) (page 644).
- No Less than 10.0 volts! Replace the 20-pin Power Logic X2 ribbon cable.

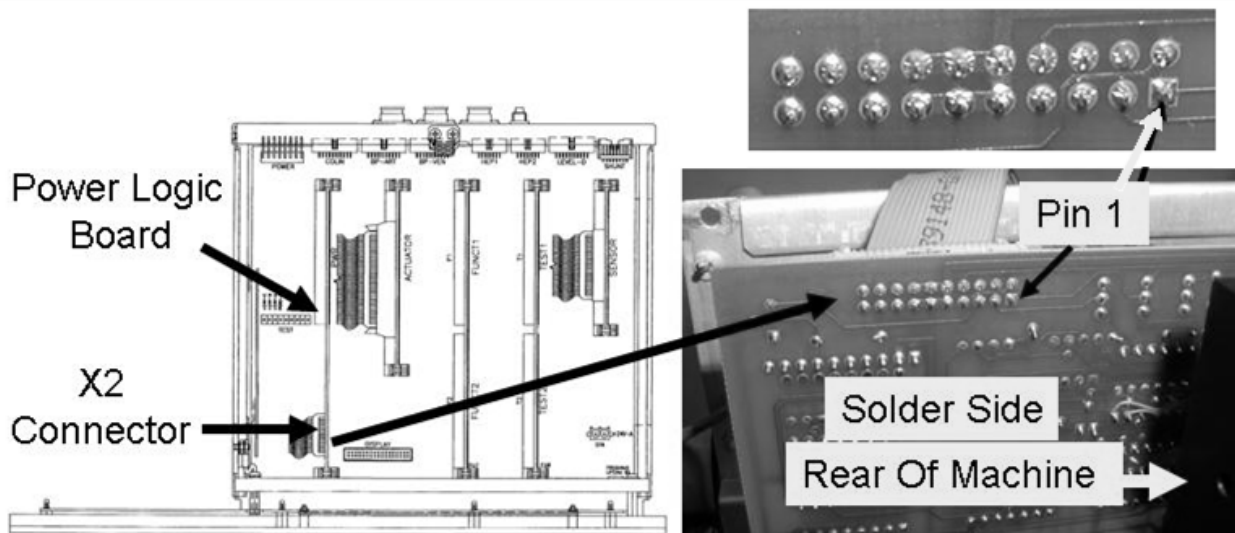


Figure 130 – Electronic Card Cage / Power Logic Board / Pin1

P- 2.0.6 ISOLATE 24 VOLT SWITCH

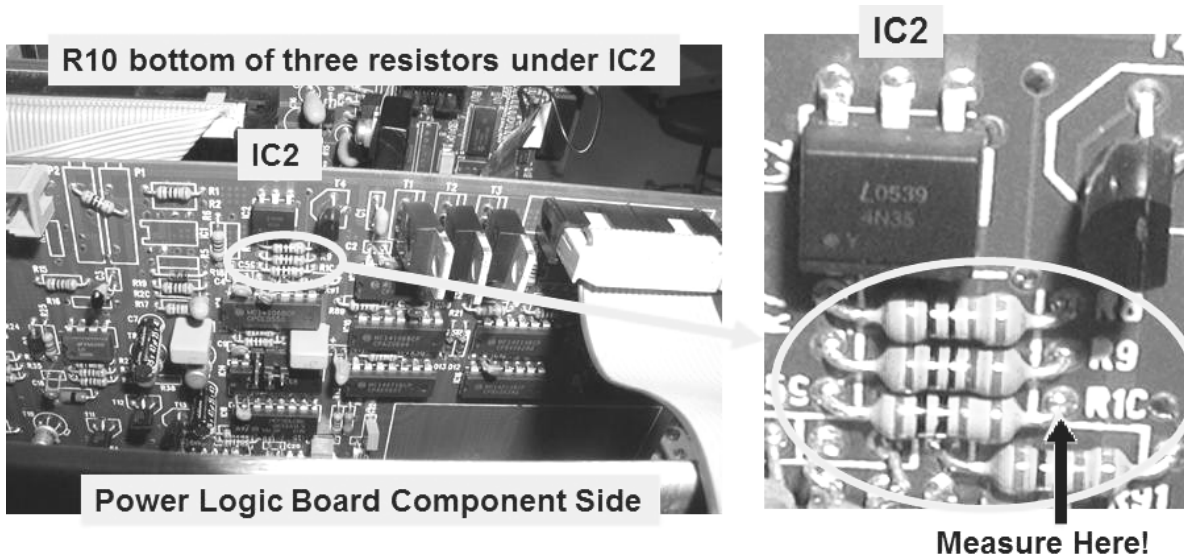
- a) **IMPORTANT! Turn the machine OFF!**
- b) Per the Figure previous page, **TIGHTLY HOLD** the meter lead at the solder (rear) side of Power Logic Board's X2 connector, **pin 1** (bottom row, first pin from the REAR of the machine).
- c) Looking for pin 1 to fall below 1.0 volts AT LEAST ONE (1) TIME, **WITHOUT LOOKING AWAY FROM THE METER**, turn the machine ON (fan running) and watch for thirty (30) seconds!
- d) TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) pin 1 NEVER, EVER drops to less than 1.0 volt i.e. REMAINS ALWAYS more than 10.0 volts!** Repeat procedure P- 2.0.6 just to be sure. If pin 1 still never drops to less than 1.0 volts see procedure number [P- 2.0.7](#) (page 645).
 - 2) **IF pin 1, at least once, drops to less than 1.0 volt:** If System Initialization does 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 651)

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P- 2.0.7 ISOLATE 'WATCH DOG OUTPUT'

- a) **IMPORTANT! 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 resistors, top to bottom R8, R9 and R10.

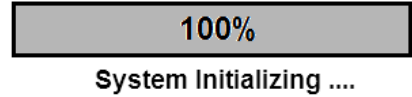


- d) TIGHTLY HOLD the meter lead at resistor #10 (R10) at the location shown in the Figure above.
- e) Looking for more than 4.0 volts at least once, **WITHOUT LOOKING AWAY FROM THE METER**, turn the machine ON (fan running) and watch for thirty (30) seconds,!
- f) TWO (2) possible scenarios:
 - 1) **IF (and ONLY if) NEVER, EVER more than 4.0 volts:** Repeat procedure P- 2.0.7. If R10 still NEVER goes to more than 4.0 volts see procedure number [P- 2.0.8](#) (page 646).
 - 2) **IF more than 4.0 volts at least once!** See parts A through C below:
 - A) Turn the machine off and swap in known good Power Logic Board.
 - B) Turn the machine on.
 - C) If System Initialization does reach 100% see procedure number [P- 2.0.8](#) (page 646). If System Initialization does reach 100% the previous Power Logic board is bad!

P- 2.0.8 ISOLATE ACTUATOR-TEST BOARD 'SET' SIGNAL

- a) **To avoid damage, turn the machine OFF!**
- b) Swap in a known good Actuator-Test Board*. * To LOCATE the Actuator-Test board refer to [Figure 6](#) (page 19).

- c) Turn the machine on 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 DOES NOT reach 100%! The previous Actuator-Test Board is good. TWO (2) possible bad components: **1) Functional Board¹**; **2) Motherboard**

¹ To avoid "Cond Offset Failure", place the machine into T and C mode! Refer to [OPERATING MODES](#) (page **Error! Bookmark not defined.**)

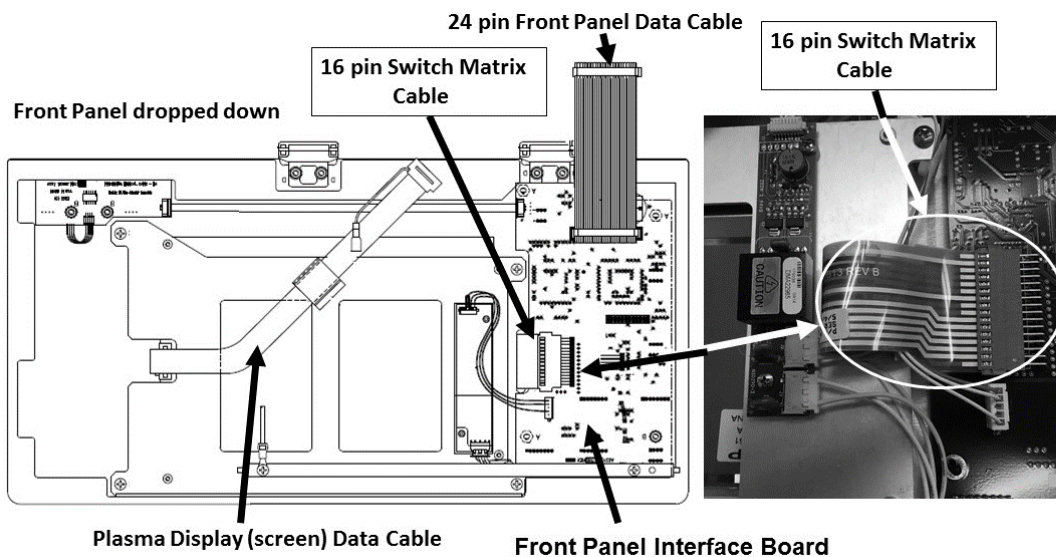
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P- 3.0.0 MACHINE TURNS ITSELF OFF

- a) ENSURE the machine is OFF!
- b) To avoid pulling cables loose GENTLY open the card cage.
- c) Spread the card cage side panels open then gently drop the front panel down.
- d) **Per the Figure below**, TWO (2) checks:

CHECK #1: ENSURE the twenty-four (24) pin Front Panel Data Cable is plugged in properly between the motherboard and the Front Panel Interface board. If not this may be the problem!

CHECK #2: ENSURE the sixteen (16) pin, Switch Matrix Cable is plugged in securely, pin for pin, at the Front Panel Interface board. If not this may be the problem!



- e) Press the Power button for two (2) seconds. In an attempt to isolate the Power button, TWO (2) possible scenarios:
 - 1) **IF the machine REMAINS on (fan running) for at least thirty (30) seconds:** See procedure number [P- 3.0.1](#) (page 648).
 - 2) **IF the machine turns on (fan running) but then turns itself off almost immediately:** The most likely cause of this is the front panel (Power button). Replace the front panel, 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 is 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 651).

P- 3.0.1 REMAINS ON FOR AT LEAST 30 SECONDS

With the machine on, QUICKLY unplug the sixteen (16) pin, Switch Matrix Cable from the Front Panel Interface board. 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 648). 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 is 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 651).

- 2) **IF the machine turns off before unplugging the cable:** The most likely cause is the front panel (Power button). Replace the front panel 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:

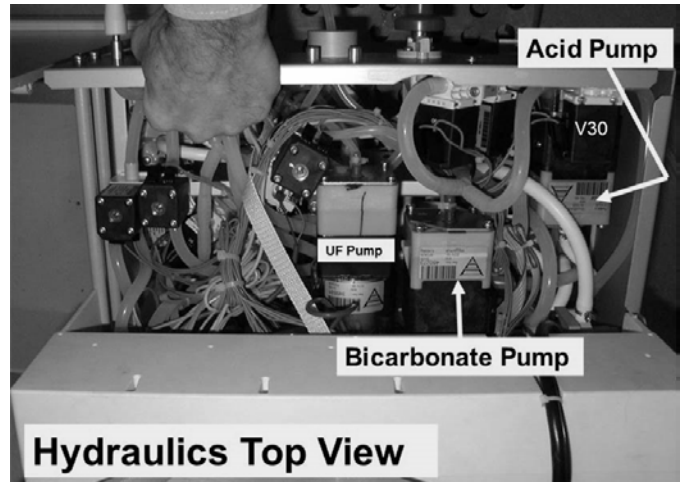
- 1) Power Logic Board; 2) Power Logic Board cable; 3) Main Relay (K1)*. *To LOCATE K1 refer to Figure 132 (page 651).

P- 3.0.2 MACHINE REMAINS ON

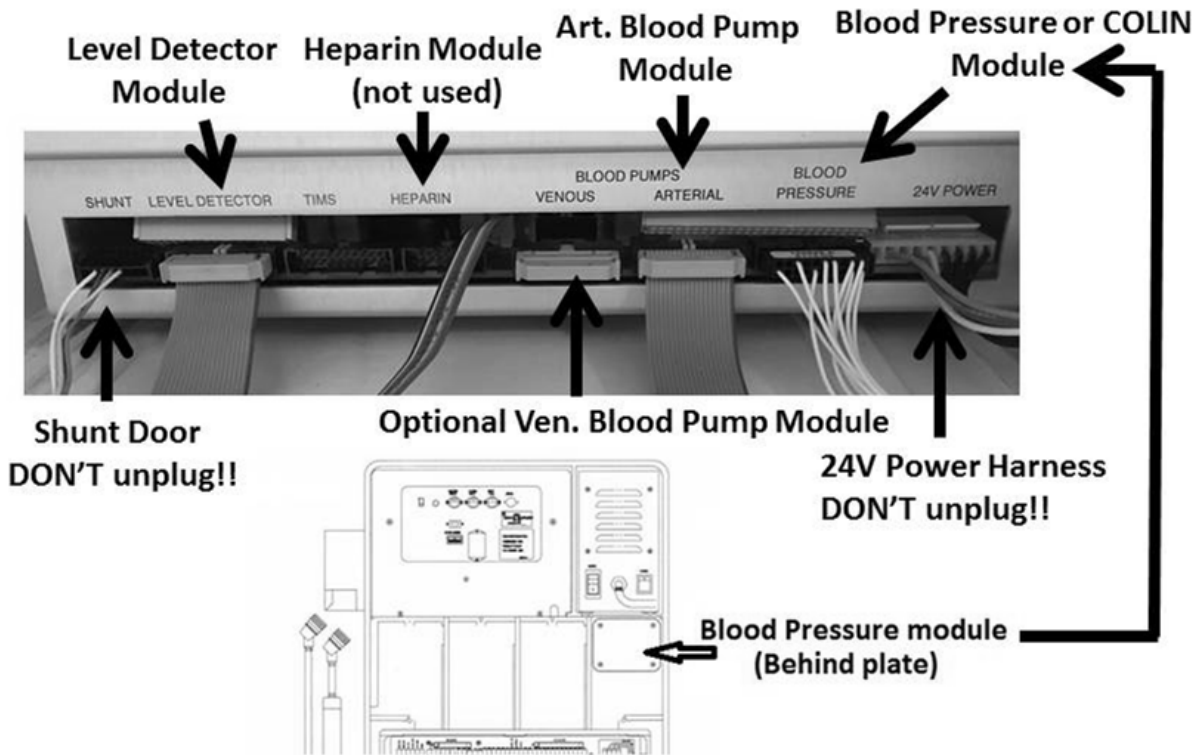
The most likely culprit is the front panel (Power button) HOWEVER, this can be confirmed by, while leaving the machine on unplug the sixteen (16) pin, Switch Matrix Cable from the Front Panel Interface board. Allowing up to one (1) hour, if the machine turns itself off again the front panel is bad!

P- 4.0.0 ISOLATE THE POWER SUPPLY

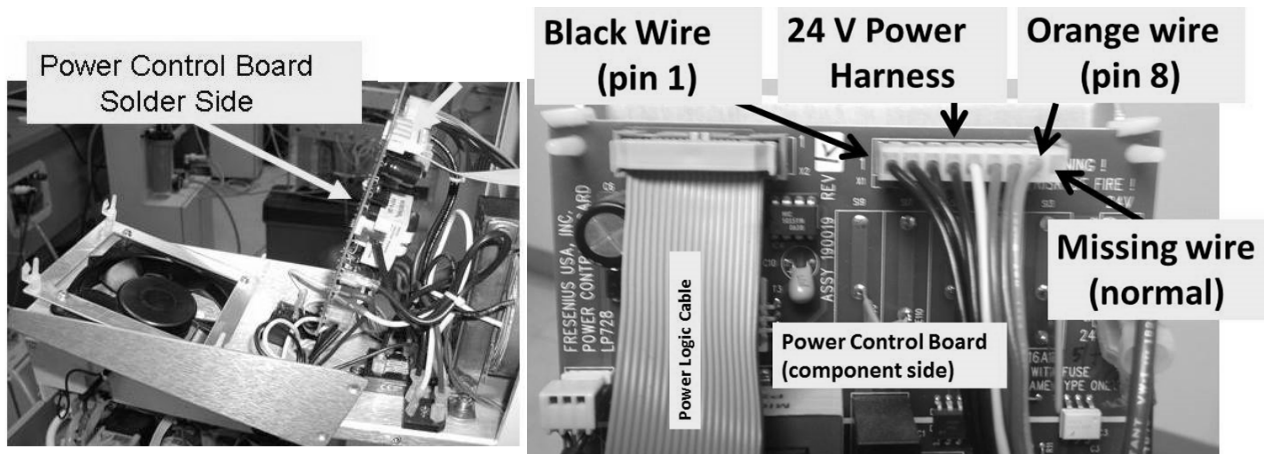
- a) **CAUTION!** To prevent an electrocution hazard unplug the machine!
- b) Figure right, trace the cables between the Acid, Bicarb AND UF Pumps and the distribution board to ENSURE they are NOT pinched or damaged!
- c) Figure below, trace the cables between the modules and the rear of the card cage to ENSURE they are not pinched or damaged!



Parts 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 at the Power Control Board. **If not, this is may be the problem!**



- f) Check the Power Control board cables and wires for signs of burning or damage! **This may be the problem!**
- g) Check the board's component (front) and solder (rear) surfaces for signs of burning or damage. **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 651), using a Phillips screw driver ensure that Capacitor C1's terminal screws are tight. **If not tight this may be the problem!**
- j) If possible, turn the machine on (fan running) then, if possible, place it into Dialysis Program or Heat Disinfect. 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 μ F, P/N 361216-01); **2)** Bad main bridge rectifier* (BR1, P/N 362009-04); **3)** Bad boot capacitor* (C2, 10 μ F, P/N 361216-03); **4)** Bad Power Control board* (P/N 190019); **5)** Bad main transformer* (P/N 290030); **6)** Bad motherboard**.

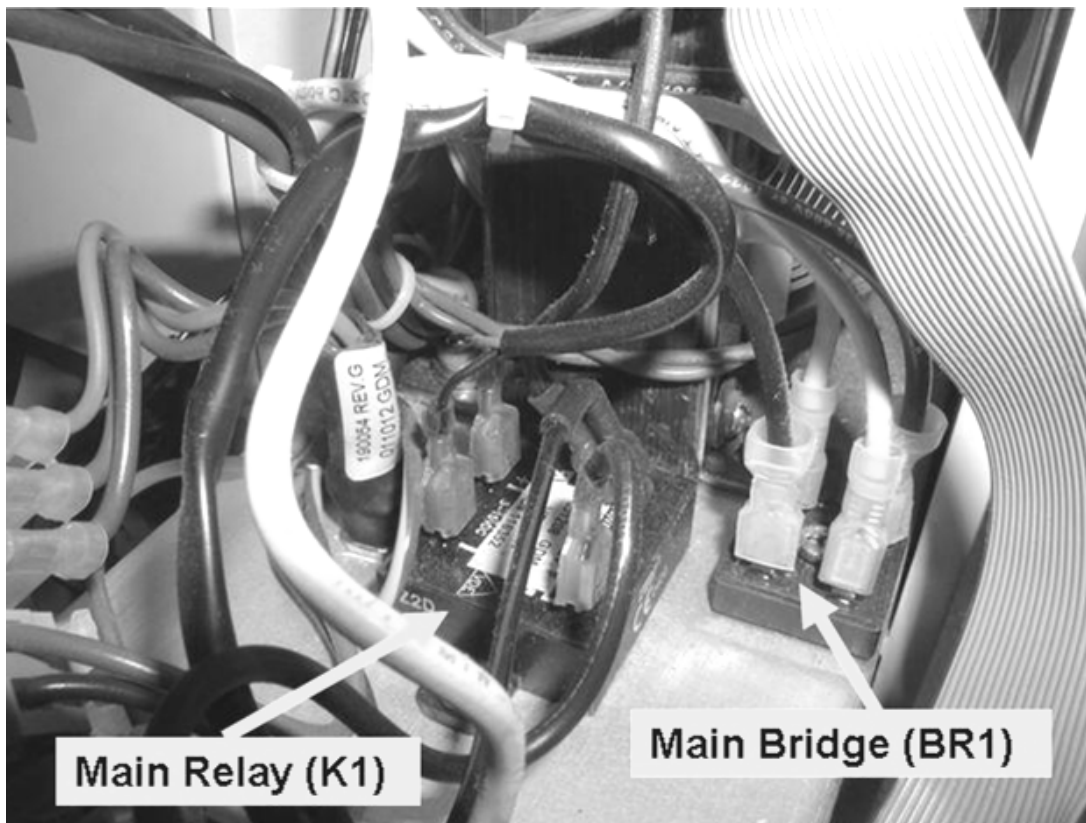
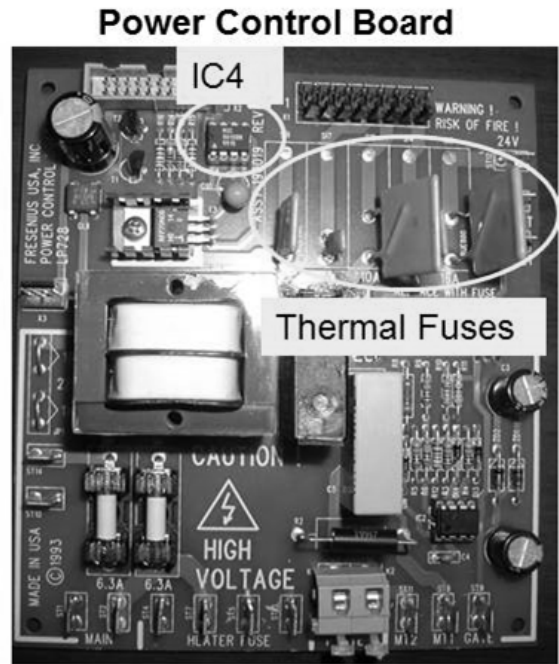
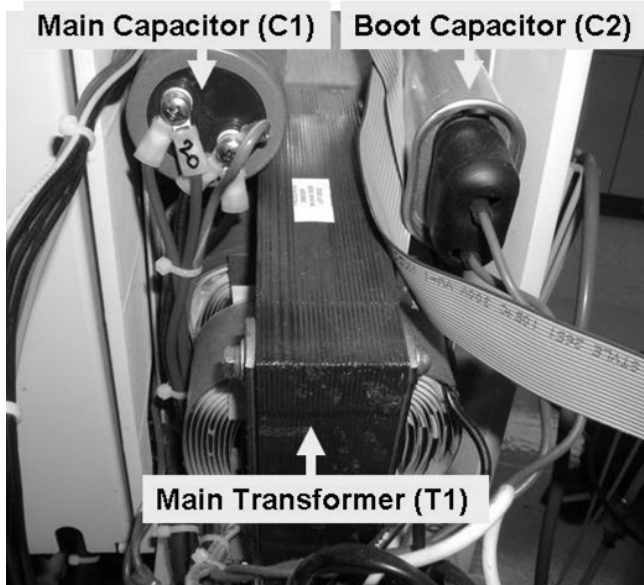
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No Problem does NOT reoccur! Allow up to thirty (30) minutes as the problem may be intermittent. An intermittent problem more than likely is a (FIVE (5) possible bad component): **1)** Main capacitor * (C1, 24,000 μ F, P/N 361216-01) OR; **2)** Main bridge rectifier* (BR1, P/N 362009-04) OR; **3)** Boot capacitor* (C2, 10 μ F, P/N 361216-03) OR; **4)** Bad motherboard**.

* To LOCATE these components refer to [Figure 132](#) (page 651)

** To LOCATE the motherboard refer to [Figure 6](#) (page 19)

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”.

IMPORTANT! The problem may be heat related. Observe all stated times to avoid error!

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

B) Figure below, remove the distribution board cover.

C) FOUR (4) IMPORTANT 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 653).

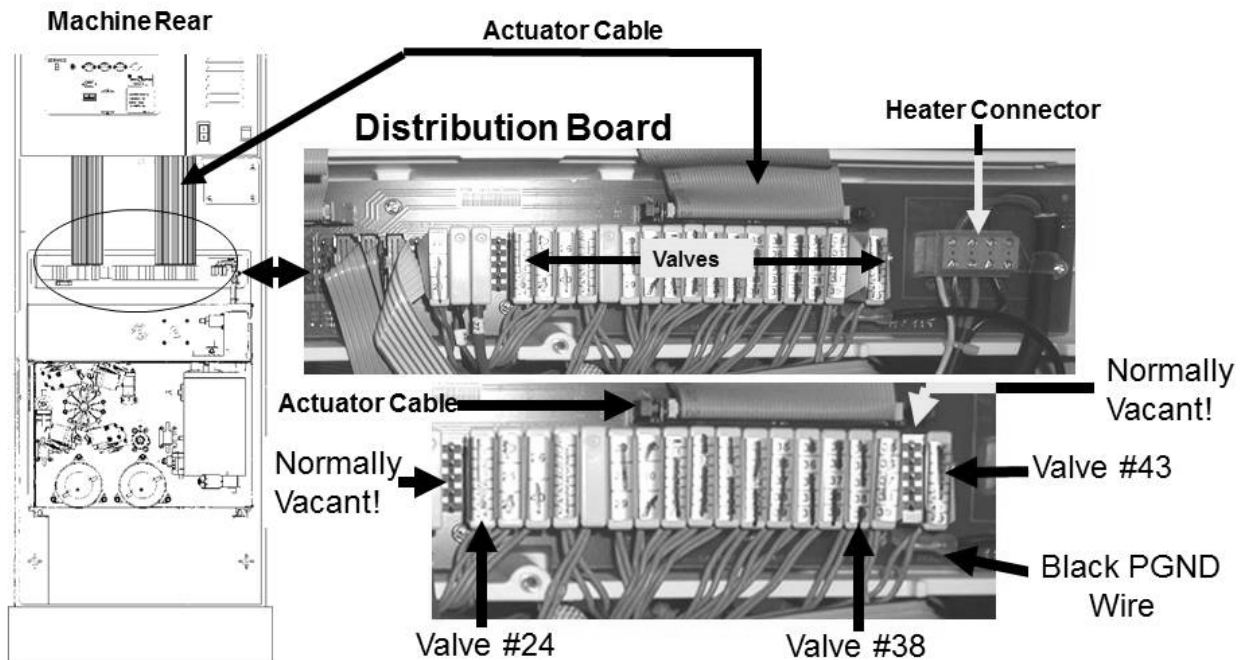
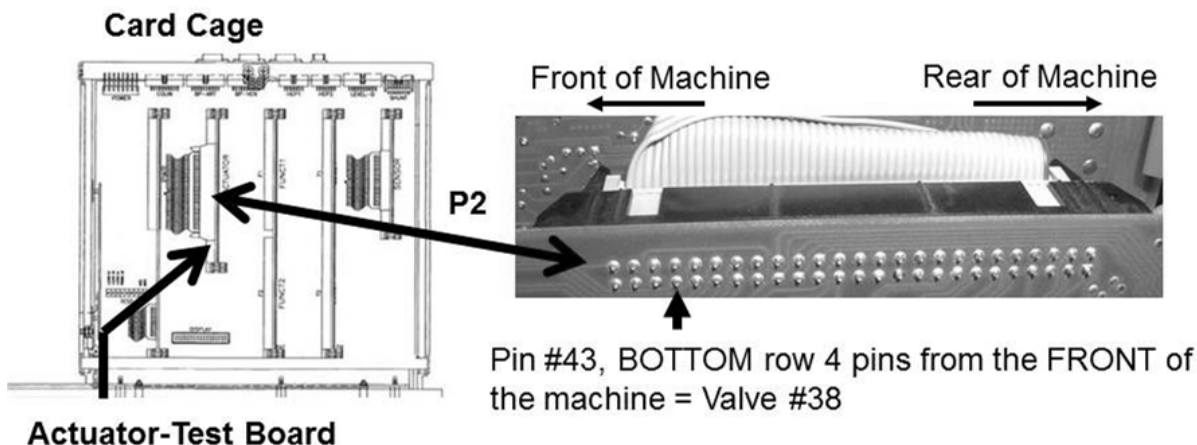


Figure 133 – Distribution Board / Valves #24, #43, #38 / PGND

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) **IMPORTANT! 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 ?

Example: Units

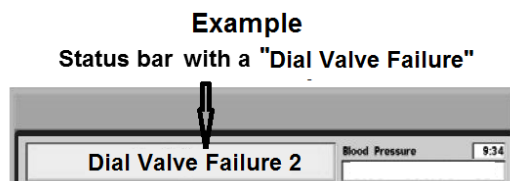
72.1	Ω	= 72.1 ohms
		K Ω = thousand ohms
		M Ω = million ohms

Yes MORE THAN 40 Ω ! See procedure number [DVF- 1.1.0](#) (page 653).

No LESS THAN 40 Ω ! Proceed to **page 660**, procedure number [DVF- 5.0.0](#)

DVF- 1.1.0 PIN 43 MORE THAN 40 OHMS

- a) Close the card cage for now.
- b) **IMPORTANT! Open the shunt door and LEAVE IT OPEN till instructed otherwise!**
- c) Turn the machine on AND return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!
- d) From the Home screen, set [Dialysate Flow] to 800 ml/min and press ‘CONFIRM’.
- e) Allowing up to five (5) minutes, Figure right, does a “Dial Valve Failure” OR “Act Byp Valve Fail” alarm banner OCCUR?



Yes “Dial Valve Failure” OR “Act Byp Valve Fail” OCCURS! Proceed to **page 657**, 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 654).

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 (5) minutes?



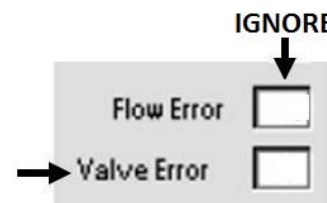
Yes **VERR** REMAINS = 0! Proceed to **page 655**, procedure number [DVF- 2.0.0](#).

No **VERR** = 1 OR more! See procedure number [DVF- 1.3.0](#) (page 654).

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:

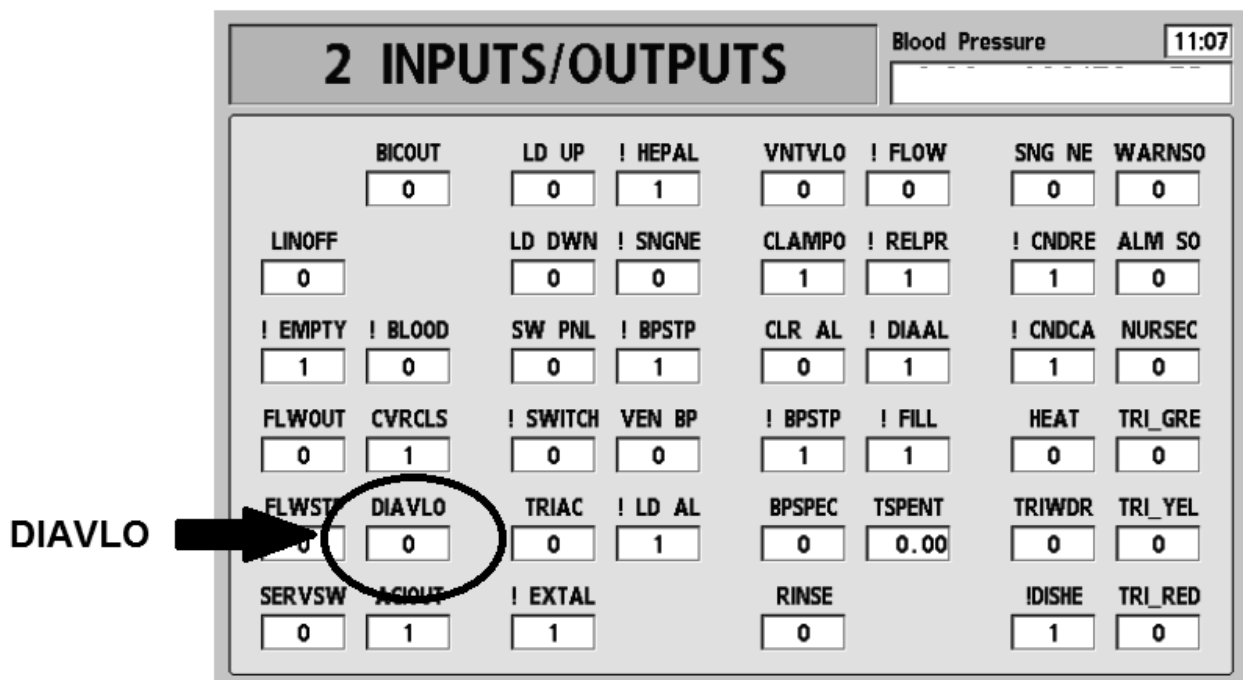
- 1) **IF Valve Error = 0 OR ‘blinks to 1’ for less than one (1) second!** Proceed to **page 195**, [TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM](#)
- 2) **IF (and ONLY if) Valve Error = 1 for LONGER THAN two (2) seconds!** With the shunt door remaining open, proceed to **page 657**, procedure number [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 REMAINS ALWAYS = 1:** Electrical problem with Valve #24. Proceed to **page 657**, procedure number [DVF- 4.0.0](#).
- 2) **IF DIAVLO REMAINS ALWAYS = 0:** With the shunt door REMAINING open, see procedure number [DVF- 2.1.0](#) (page 656).
- 3) **IF (and ONLY if) DIAVLO blinks rapidly between 0 and 1:** Electrical problem with Valve #24. Proceed to **page 657**, procedure number [DVF- 4.0.0](#).



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**, 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 27**, procedure number [F- 1.0.6](#).

2) **IF Flow Error ALWAYS = 0:** Perform parts A THROUGH I 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) At the bottom of the screen, select the ‘Dialysate’ tab.

D) If necessary, adjust the Conductivity Limits until ‘Actual’ Conductivity is **CENTERED** between the Limits.

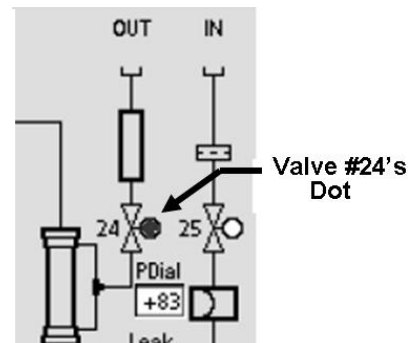
E) Press ‘CONFIRM’

F) Call debug screen 0 to locate Valve #24’s ‘dot’ (Figure right).

G) **CLOSE THE SHUNT DOOR!**

H) Allow up to two (2) minutes OR until Valve #24’s ‘dot’ turns blue.

I) 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 657**, 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 proceed to **page 27**, procedure number [F- 1.0.6](#).

LEFT BLANK INTENTIONALLY

DVF- 4.0.0 ISOLATE VALVES #24 AND #43 SOLENOID CIRCUITS (1)

- a) **IMPORTANT! 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.

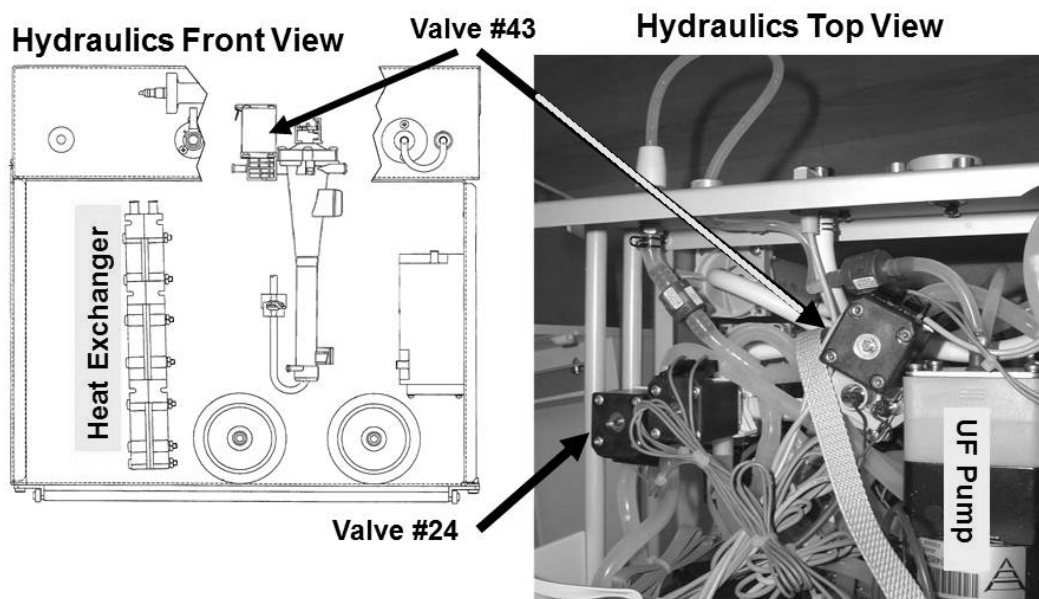
CHECK #1: ENSURE no 'pinched' or damaged wires!

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!

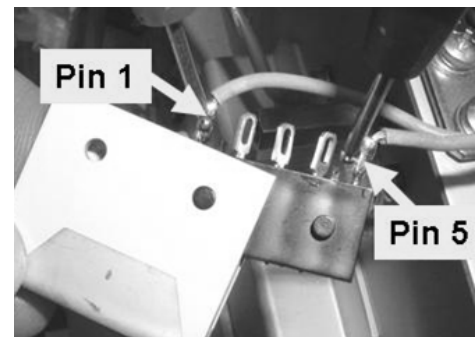


- c) See procedure number [DVF- 4.1.0](#) (page 657).



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) **IMPORTANT! 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)



Example: Units
72.1 Ω = 72.1 ohms
K Ω = thousand ohms
M Ω = million ohms

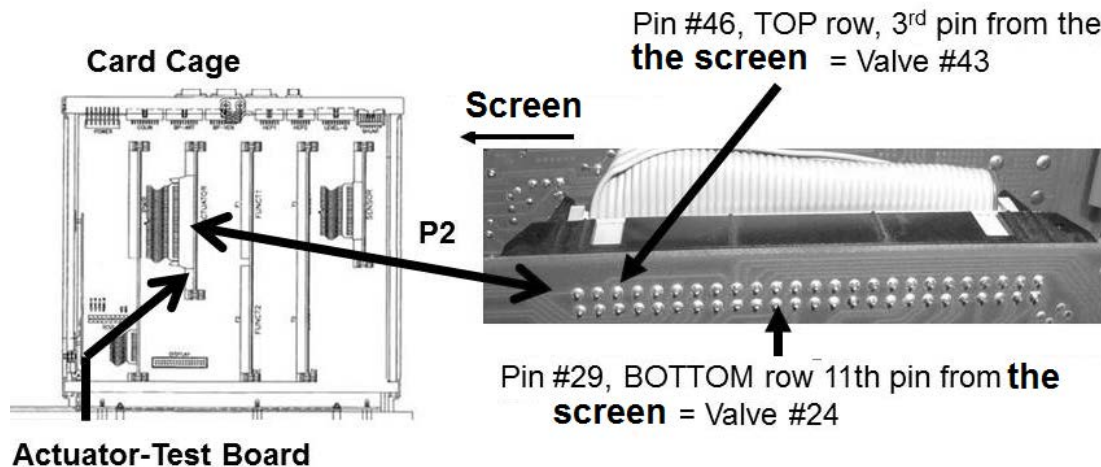
- 2) **IF (and ONLY if) BOTH valves between 40 and 100 Ω :** See procedure number [DVF- 4.2.0](#) (page 658).
- 3) **IF ONE OR BOTH is less than 40 Ω OR more than 100 Ω :** Replace the valve AND its blue wiring harness.

DVF- 4.2.0 BOTH VALVES BETWEEN 40 AND 100 Ω / ISOLATE TOTAL CIRCUIT RESISTANCE (Ω)

- a) **IMPORTANT!** Return BOTH valves connectors to their PROPER distribution board positions!
- b) To avoid pulling cables loose, GENTLY open the card cage!
- c) **IMPORTANT! 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 659).
- 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 658).
 - 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.

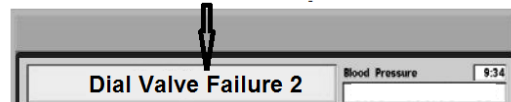
DVF- 4.2.2 BOTH MEASUREMENTS BETWEEN 40 AND 100 Ω

- a) Turn the machine ON.
- b) Return to Dialysis Program (“Select Program” → ‘Dialysis’ → ‘CONFIRM’)!

- 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 659). If neither occurs allow five (5) minutes BEFORE continuing to part d!

Example

Status bar with a "Dial Valve Failure"



- d) Call debug screen 1. Is **VERR** (right column, bottom) = 0?

Yes **VERR** = 0! See (ABOVE) procedure number [DVF- 2.1.0](#) (page 656).

No **VERR** = 1 OR more! Call debug screen 0. Ignoring **Flow Error**, 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 659).

No **Valve Error** = 0 OR 'blinks to 1' for less than one second! Proceed to **page 195**, [TROUBLESHOOTING VALVE ERRORS IN DIALYSIS PROGRAM](#)

DVF- 4.3.0 VALVE ERROR = 1 LONGER THAN TWO SECONDS

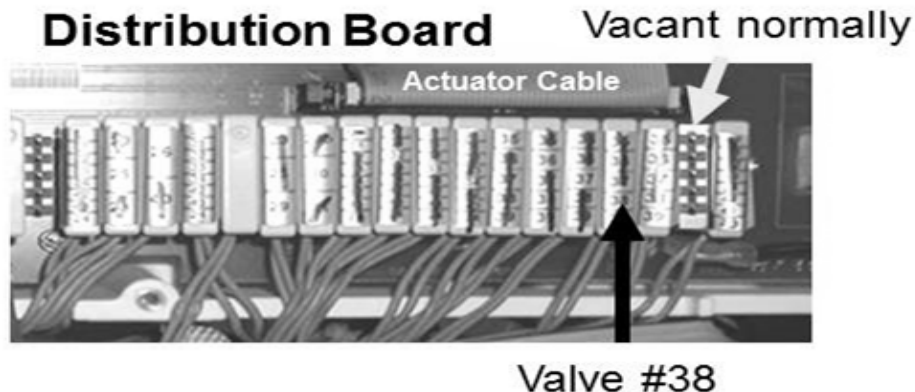
Assuming all procedures were performed correctly, THREE (3) possible bad components (see COMPONENT LIST below). Swap in each, one at a time, and in between return to Dialysis Program to test the new component until debug screen 1's **VERR** remains = 0.

COMPONENT LIST: 1) Actuator-Test Board; 2) Functional Board¹; 3) Distribution board.

¹ To prevent “Cond Offset Failure”, place the machine into **T and C Mode** (refer to [OPERATING MODES](#), page **Error! Bookmark not defined.**)).

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’ → ‘CONFIRM’)!
- e) From the Home screen, set [Dialysate Flow] to 500 ml/min and press ‘CONFIRM’.
- 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 193).

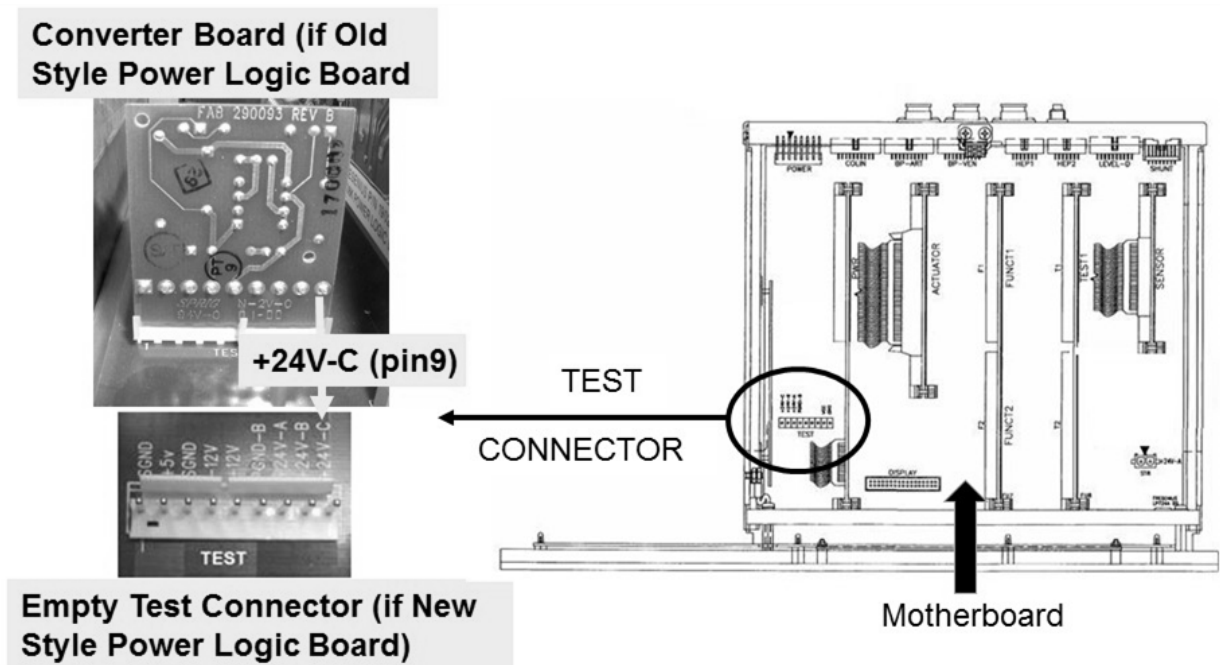
- No a) Return Valve #38 to its distribution board position
- b) See (ABOVE) procedure number [DVF- 1.2.0](#) (page 654).

SECTION 27 - "ACT BLOOD PUMP FAILED"

- A) Turn the machine off and back on. If (and ONLY if) "Act Blood Pump Failed" alarm reoccurs proceed to part B.
- B) **IMPORTANT!** Perform [INITIAL CHECKS](#) (page 6)!
- C) See procedure number [ABPF- 1.0.0](#) (page 661).

ABPF- 1.0.0 TROUBLESHOOT ACT BLOOD PUMP FAILED

- a) Turn the machine OFF and, to prevent pulling cables loose, GENTLY open the card cage!
- b) **IMPORTANT!** Set your CALIBRATED volt meter to Volts DC (V_{DC}).
- c) **Connect the meter's ground (black) lead to chassis ground (see Figure 2, page 4).**
- d) Spread the card cage side panels open then gently drop the front panel down to access the motherboard's nine (9) pin TEST Connector (Figure below).
- e) TIGHTLY HOLD the red meter lead at the TEST Connector's **+24V-C** pin (pin 9).

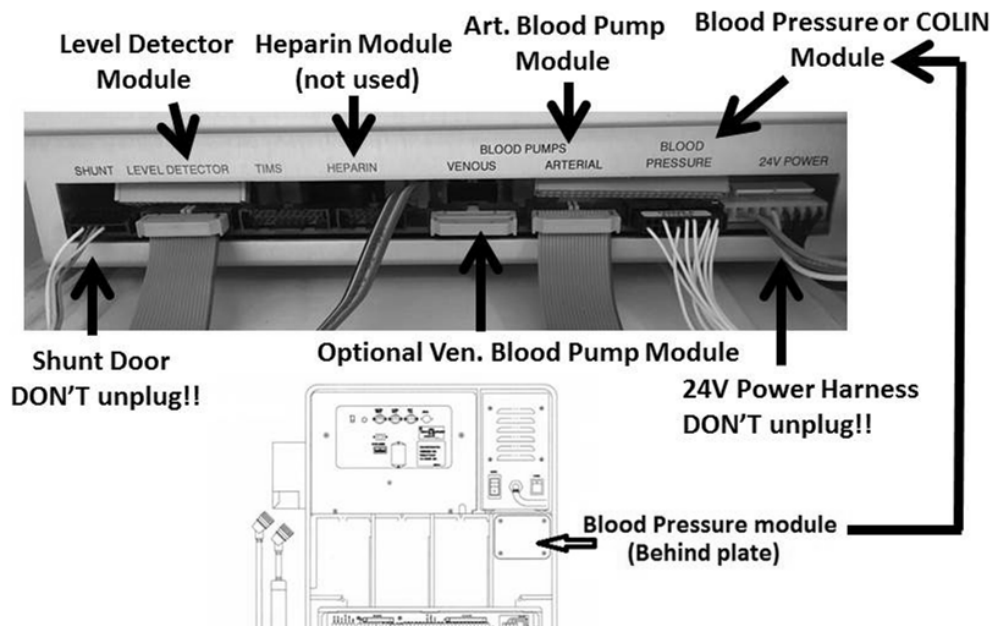


- f) Looking for approximately 24.0 volts at least once, WITHOUT LOOKING AWAY from the meter, for thirty (30) seconds, **turn the machine on (fan running)!** More than 23.0 volts DC (V_{DC}) seen at ANY TIME (Yes or No)?

- 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! See procedure [ABPF- 1.0.3](#) (page 662).

ABPF- 1.0.3 APPROXIMATELY 24 VDC NOT PRESENT

- a) **To avoid damage turn the machine OFF!**
- b) At the rear of the card cage, **per the Figure below**, unplug the MODULES ONLY including the Blood Pressure module.



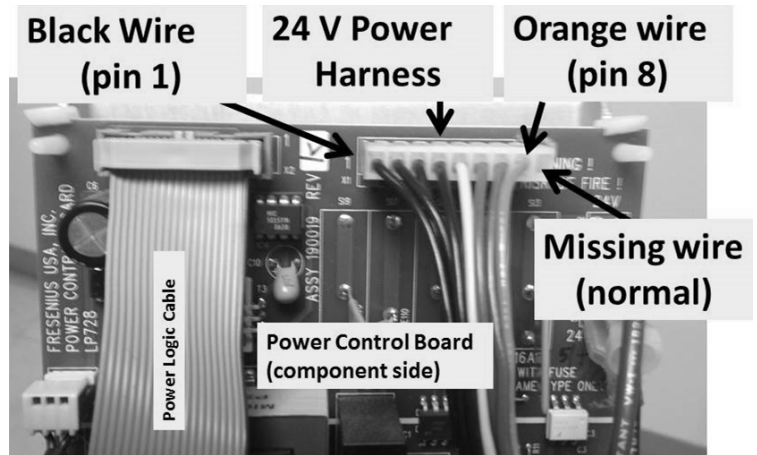
- c) Again TIGHTLY HOLD the red meter lead at the TEST Connector's **+24V-C** pin.
- d) **WITHOUT LOOKING AWAY** from the meter, for thirty (30) seconds, **turn the machine on (fan running)!** More than 23.0 volts DC (V_{dc}) seen at ANY TIME (Yes or No)?

- 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 TEST Connector's **+24V-C** pin; **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 663).

ABPF- 1.0.4 ISOLATE POWER CONTROL BOARD OUTPUT

a) Turn the machine off and **UNPLUG** it. **CAUTION! Electrocutation 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.



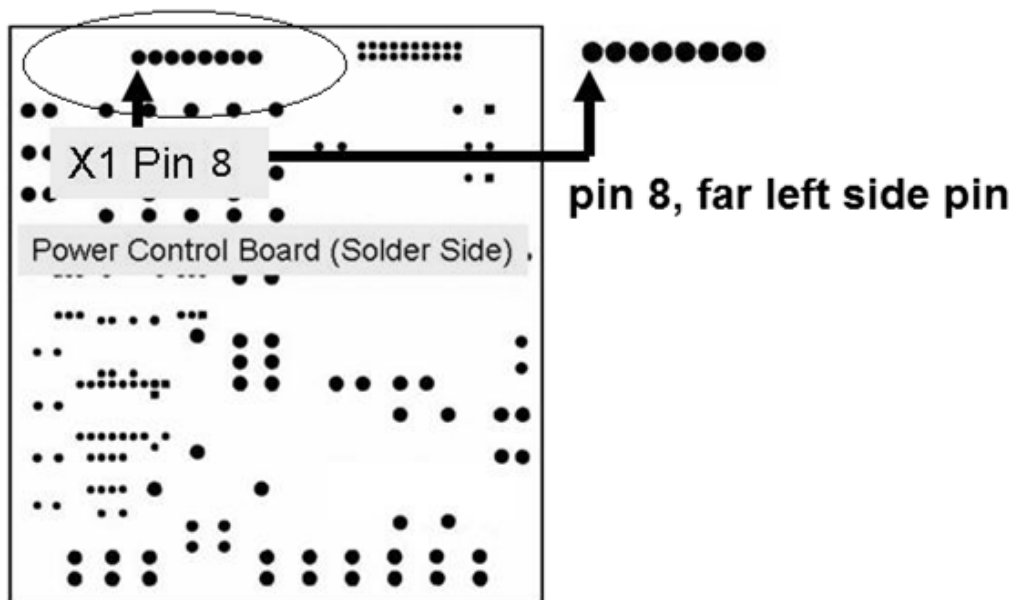
c) ENSURE harness is plugged in securely. **If NOT, this may be the problem!**

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) 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 664), the 24 V Power Harness is bad.

No Never more than 23.0 volts! The Power Control Board may be bad.

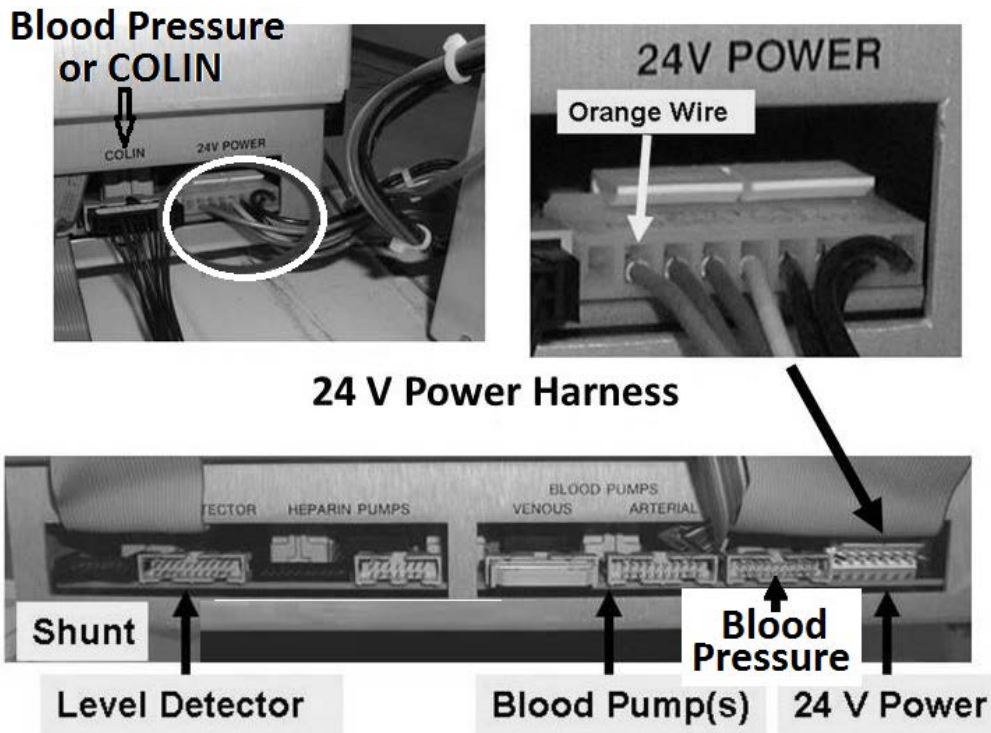
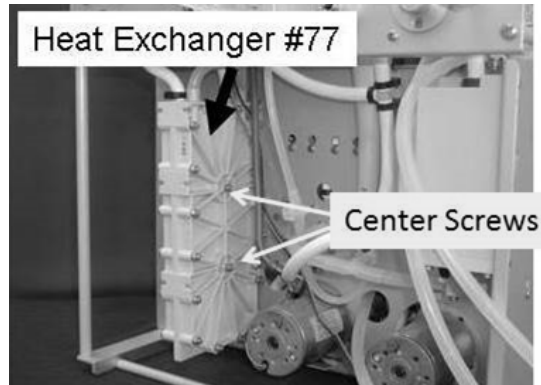


Figure 134 – 24 V Power Harness

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!



- 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.

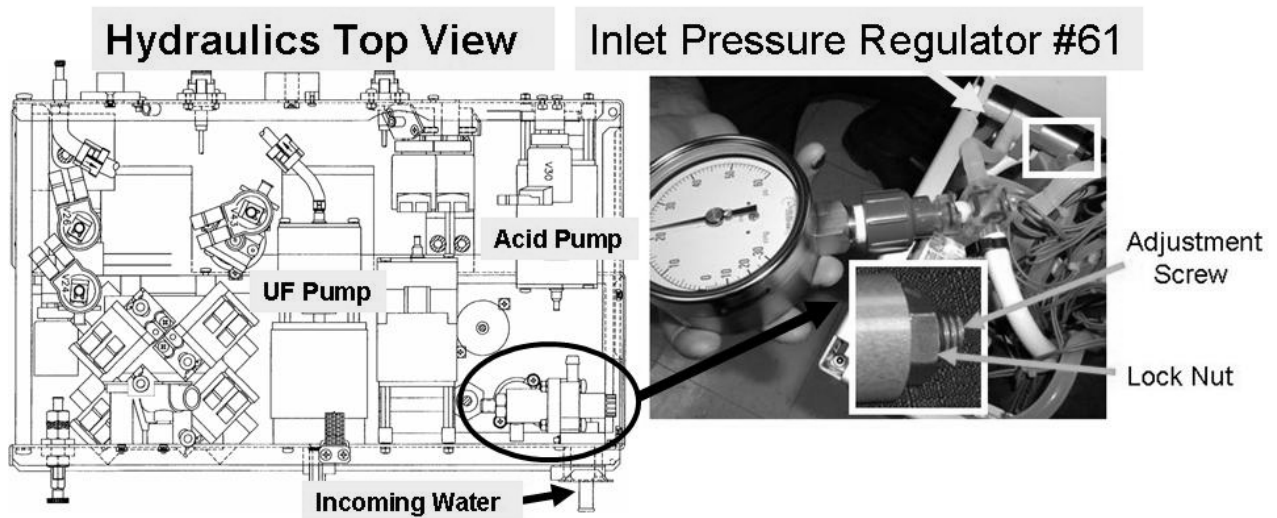


Figure 135 – Inlet Water Regulator #61

- E) **IMPORTANT!** Turn the water on!
- F) **ENSURE NO LEAKS** at the gauge!
- G) Plug the concentrate connectors into their rinse ports.
- H) Place the machine in **RINSE!**

Part I next page

- l) 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 666).

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 666).
- 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 (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). **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.

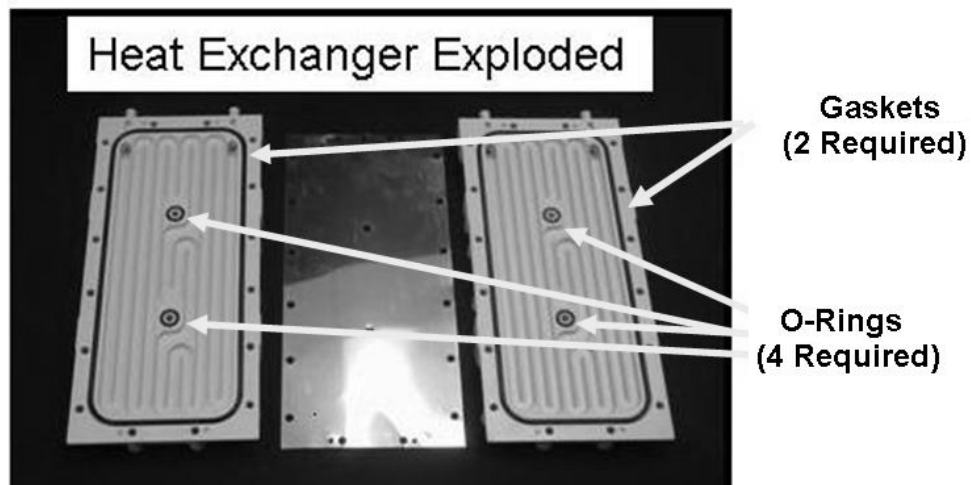


Figure 136 – Heat Exchanger (Exploded)

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

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	K Calibration Procedures Section #
- Display Assembly (i.e. screen)	- Touch Screen Calibration	2.1
- Deaeration Pump Head (#20)	- Deaeration and Loading Pressure	2.2.1
- Deaeration Motor (or if brushes are replaced)		
- Loading Pressure Relief Valve (#78)		
- Flow Pump Head (#21)	- Flow Pressure	2.2.2
- Flow Motor (or if brushes are replaced)		
- Flow Pressure Relief Valve (#78)		
- 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)	- Temperature Control	2.3.6
- Post Dialyzer Temperature Sensor (NTC #44)		
- 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 - BLOOD PUMP ERROR CODES

Alarm Code	Cause	Solution
A.11	Pump is not reaching speed.	Check or replace in the following order: <ul style="list-style-type: none"> • Rotor Hall Sensor • LP955 • LP956
A.13	Pump rotor is turning in the wrong direction.	Check or replace in the following order: <ul style="list-style-type: none"> • Rotor Hall Sensor • LP955 • LP956
A.16	Key stuck or held in too long.	Check or replace in the following order: <ul style="list-style-type: none"> • User holding key too long • BP Keypad • LP955 • 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: <ul style="list-style-type: none"> • Motor/Tachometer Assy. • LP955 • LP956
A.25	Pressure increases too quickly when the Level Up key is pressed.	Check or replace in the following order: <ul style="list-style-type: none"> • Vent Valve • LP955 • LP956
A.26	Pressure was adjusted too much in calibration mode.	Check or replace in the following order: <ul style="list-style-type: none"> • Pre/Post Pump set wrong • 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: <ul style="list-style-type: none"> • Rotor Hall Sensor • LP955 • 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: <ul style="list-style-type: none"> • Machine voltage (+12V) • Ribbon cable from machine • LP955
E.08	+ 24 volts is outside the allowable range of 22.8 to 28.0 volts.	Check or replace in the following order: <ul style="list-style-type: none"> • Machine voltage (+24V) • Ribbon cable from machine • 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: <ul style="list-style-type: none"> • Rotor Hall Sensor • LP955 • 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: <ul style="list-style-type: none"> • Door Hall Sensor • LP955 • LP956

NOTE! Additional Blood Pump Dip-Switch settings can be found in the Arterial Pressure Calibration of the 2008 Calibration booklet.

COMMON CONVERSIONS

PRESSURE

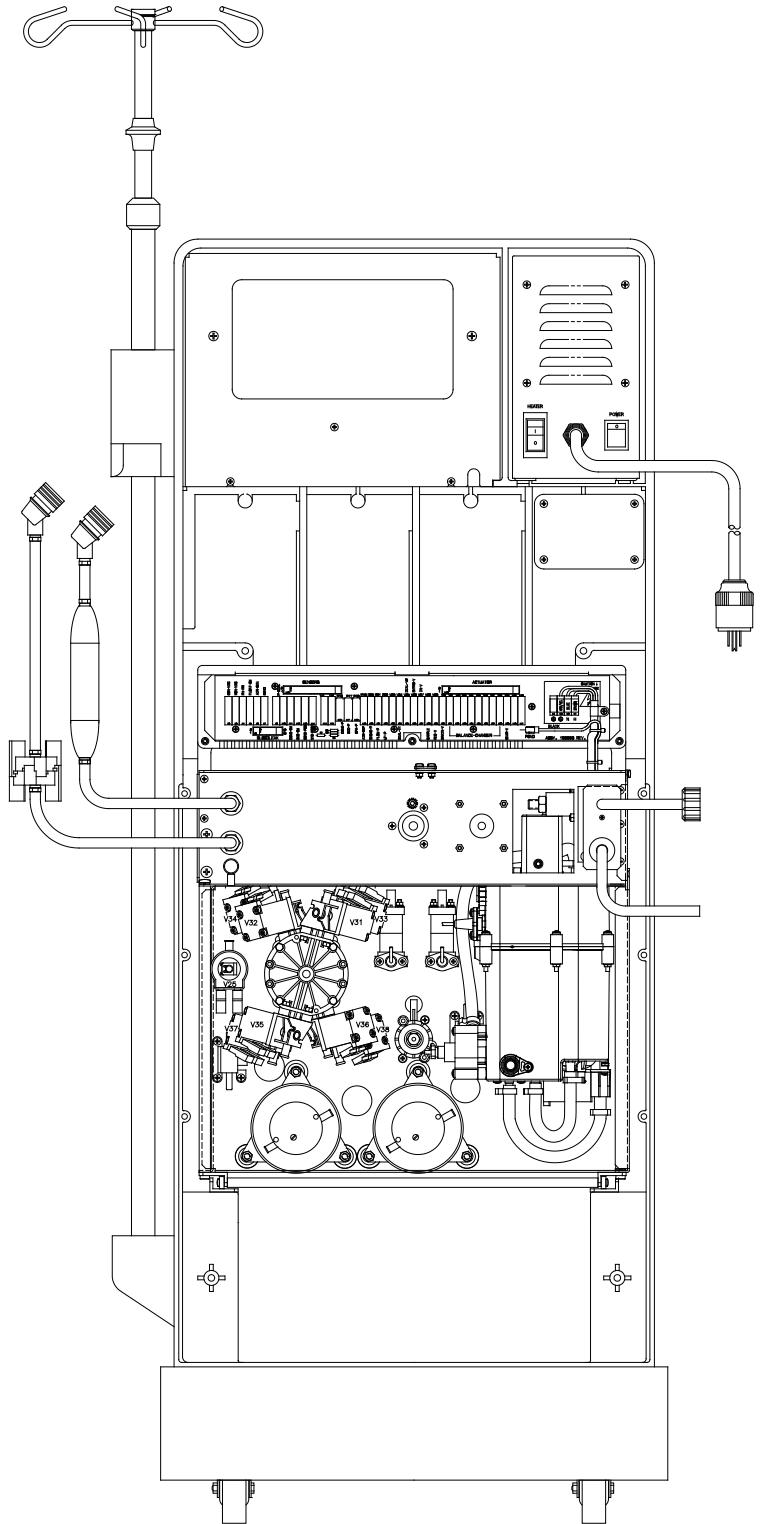
1 Bar	29.53 inHg
1 inHg	25.4 mmHg
1 Psi	51.72 mmHg

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



Fresenius Medical Care North America

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