Technical Update

TROUBLESHOOTING

Equipment Type: Phoenix® Dialysis System

Subject: P2 Pump Calibration Tool Fills or Empties

From: Don O’Connell

During the P2 pump autocalibration the P1 pump, controlled by the D1 flowmeter, pumps water into the P2 calibration tool. P2, controlled by D2, pulls fluid from the tool and runs at the speed necessary to make the D2 reading match the D1 reading. The speed will depend on the pressure across the P2 pump head. P2 inlet pressure is measured by the PO pressure transducer and PDR measures the outlet pressure. At a given flow rate the outlet pressure (PDR) will be the same. Depending on the inlet pressure, P2 will have to run faster or slower to deliver the commanded flow rate. The more positive the inlet pressure (PO) the easier it is for P2 to deliver the requested flow and the slower the pump runs. The pump also has to run faster to deliver a flow of 750 ml/min than 500 ml/min.

During the calibration PS applies the required positive or negative pressure to the air space in the top of the P2 calibration tool to control the pressure at PO until the desired PDR-PO pressure is reached. The P2 pump speed (as measured by the pump’s encoder) used to deliver the requested flow (as measured by D2) is recorded. By taking samples at two flow rates and two delta pressures at each flow rate the Phoenix software is able to calculate the P2 pump speed required to deliver a given flow at a given pressure.

The P2 Pump Test is similar except that the pressure across the pump is manually controlled and the P2 flow rate displayed is observed as being in specification or not. (Notice that the P2 Flow displayed on the Status screen is a calculated, rather than a measured value.)
Throughout these procedures the water level in the P2 Calibration Tool should be constant. (P2 is pulling water from the tool at the same rate as P1 is filling it). If the tool fills or empties during the procedure this indicates a problem in the system.

- The most common cause of the tool filling or emptying is that either PO or PDR have failed or are out of calibration.

- An EVUFO that does not seal. EVUFO is closed during the Autocal and Test.

- Less common causes are a failed or out of calibration D1/D2, or a mismatch between P1 and P2. For example, P1 is a worn old style pump and P2 has been replaced by a new style gear pump with the larger pump head. The machine behaves as if P1 can’t fill the chamber of the tool as fast as P2 pulls fluid out and the water level drops.

- One more possibility is a leaking P2 Calibration Tool. This would most likely result in a Calibration Tool Error when attempting calibration.