



Dialog⁺ SW 9.xx

Hydraulics

Technical Support International

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SHARING EXPERTISE

Dialog+ Overview

Welcome to the Dialog+ Component Overview. Here you will have the opportunity to look at different components in the machine. You will find out what their functions are, and how they work together with other components.



Internal Hydraulics

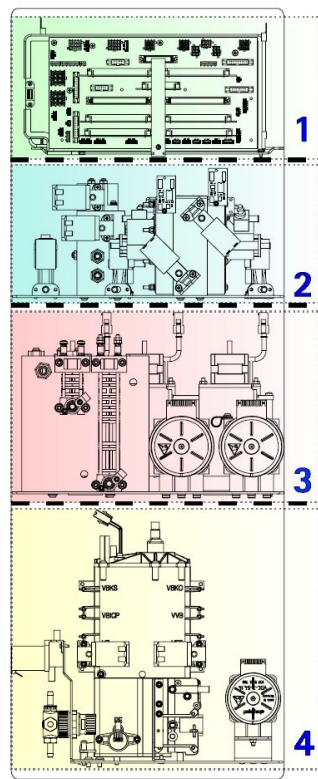
Hydraulics Test

Disinfection

Hydraulics

The hydraulics of the machine is divided into four parts. Please choose a part or look at the flow diagram.

- The Sub-Racks are divided in:
- 1. Electronics
 - 2. UF Sub-Rack
 - 3. DF Sub-Rack
 - 4. Water Sub-Rack

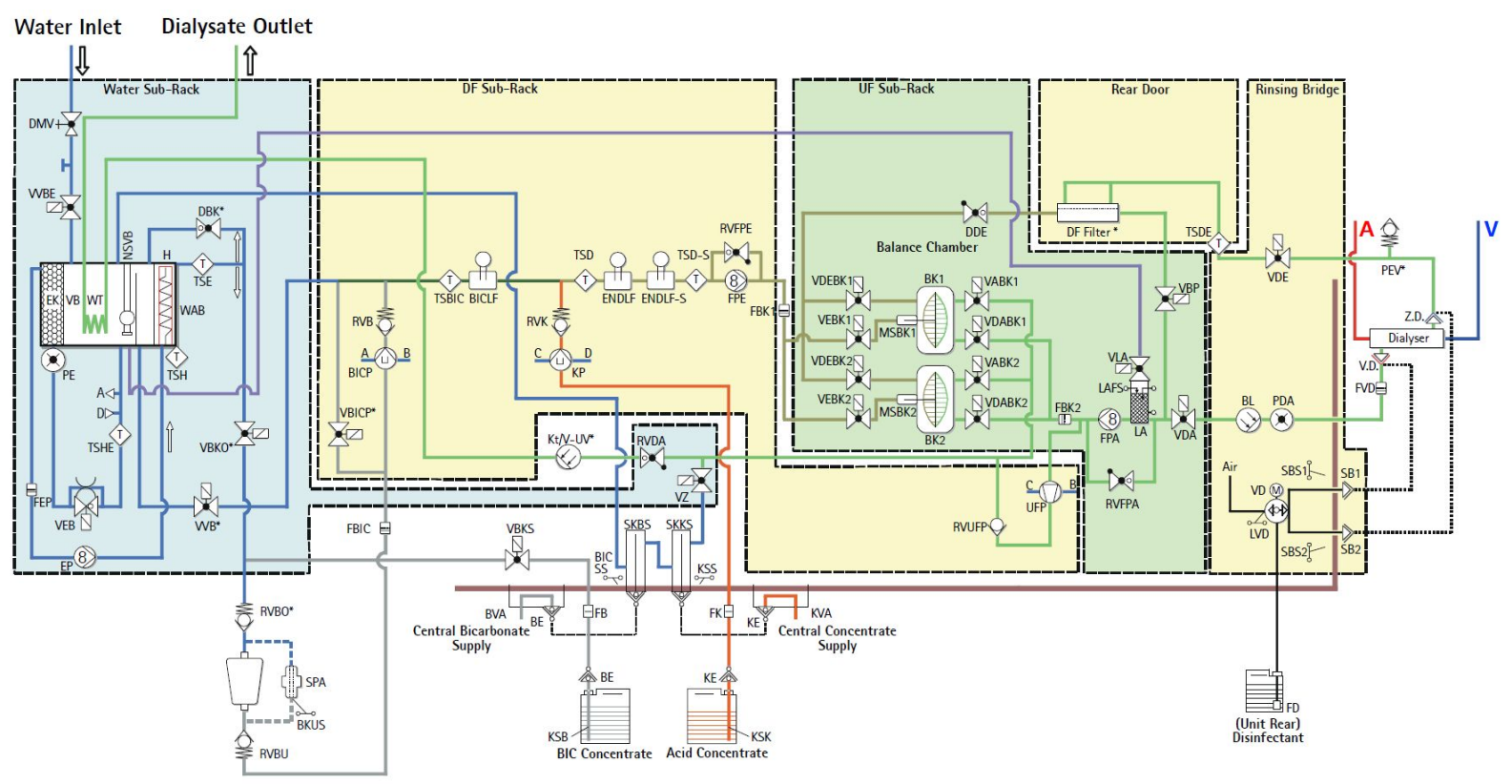


Flow Diagram

Back

Hydraulic Flow Diagram

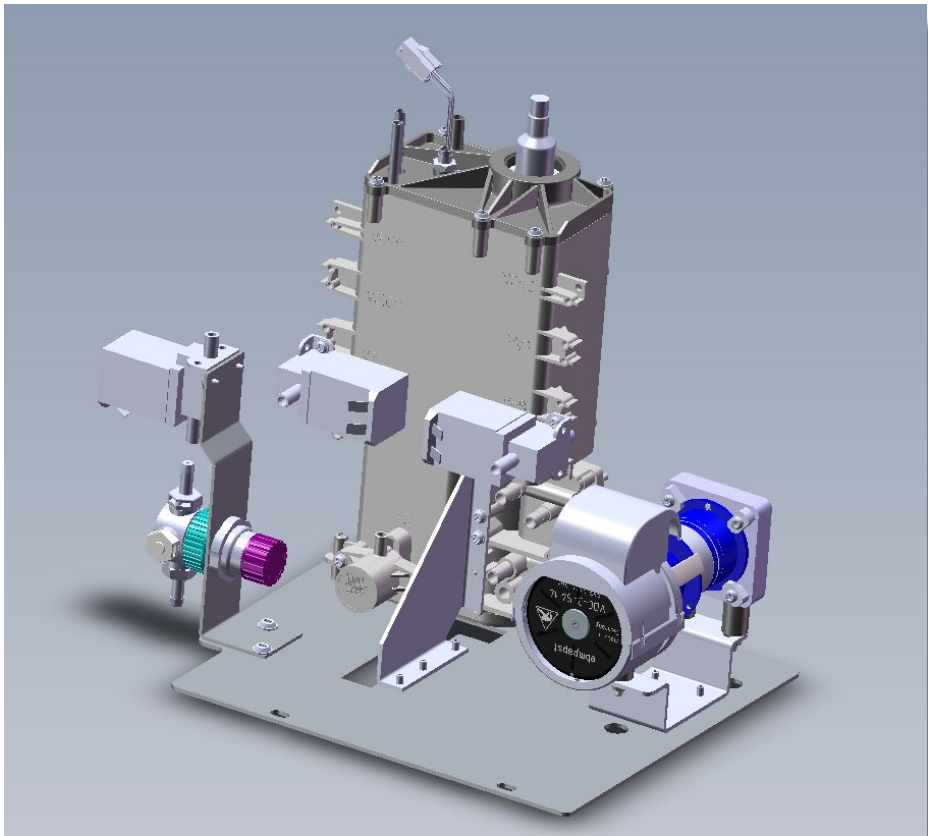
Please choose a part of the flow diagram that you would like to look at.



Water Sub-Rack

Please choose one of the component groups of the water sub-rack.

- Functions of the Water Sub-Rack
- Controls incoming water amount
 - Degasses the water
 - Heats the water
 - Contains bicarbonate valves



Degassing Circuit

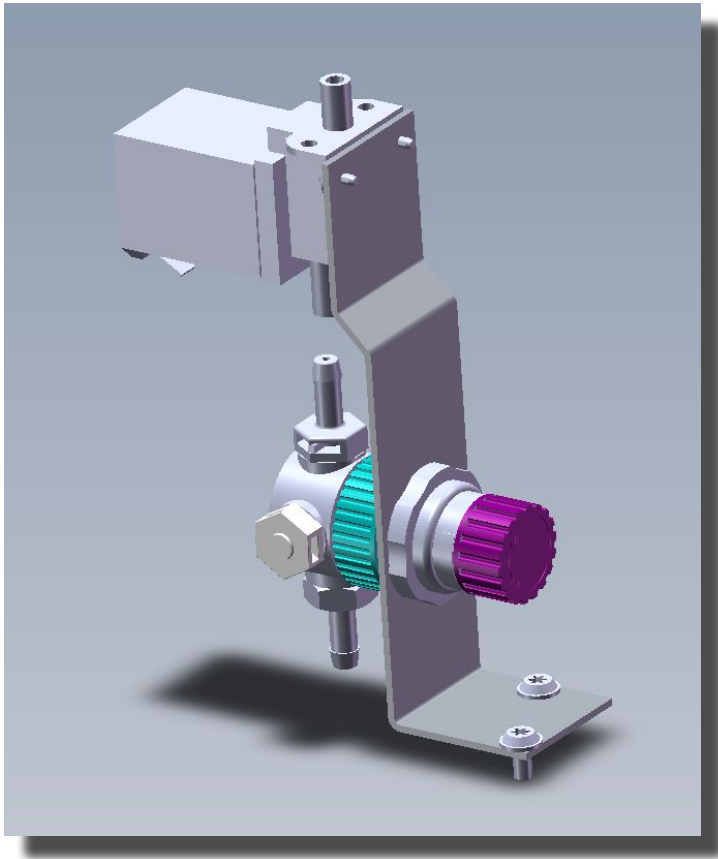
Heating Circuit

Back

Pressure Reduction Valve

Functions of the Pressure Reduction Valve

- Reduces ring-line pressure to



Water Inlet Valve

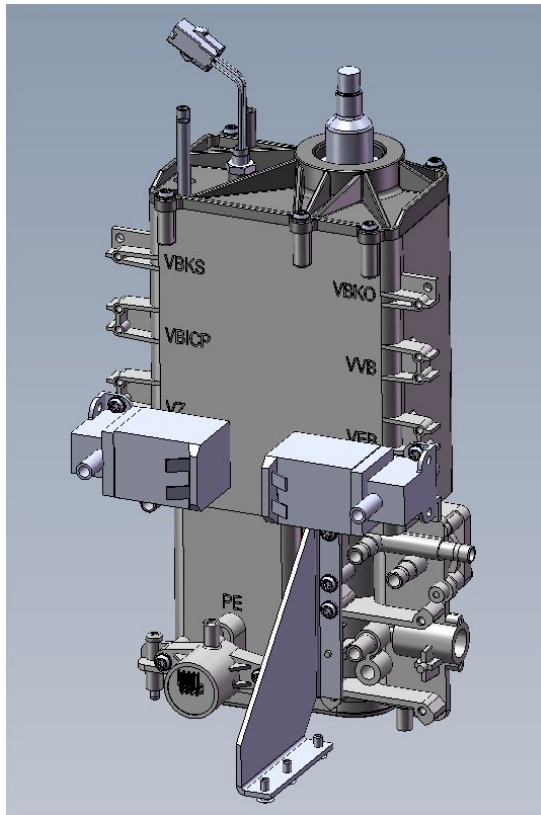
Functions of the Water Inlet Valve

- Controls incoming water amount
- Regulated by the float switch
- Opening time is dependent on flow

Water Block

Please choose one of the components on the water block or the cover to look inside.

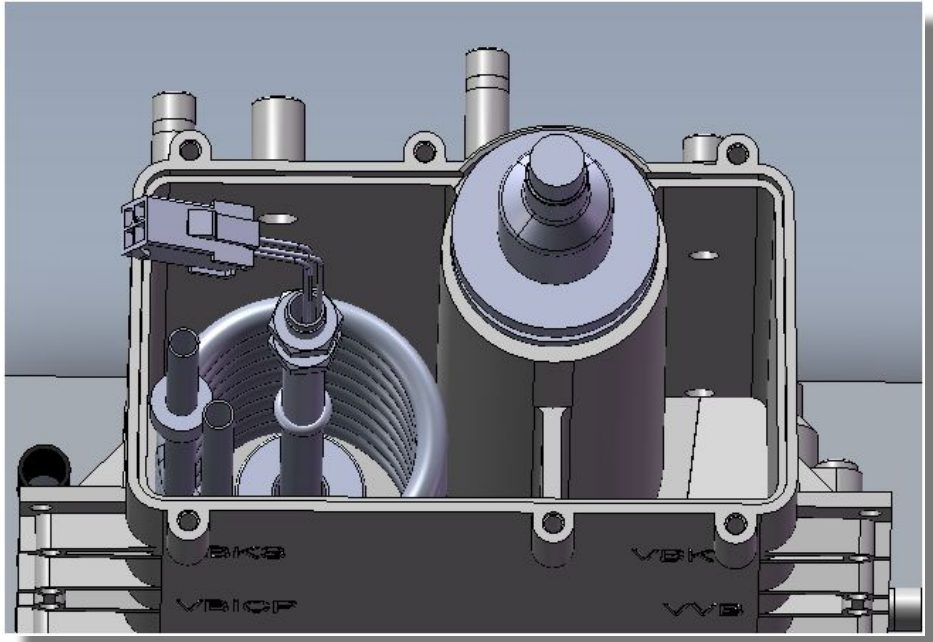
- Functions of the Water Block
- Mounting for all the valves
 - Contains the upline tank
 - Contains the degassing chamber
 - Contains the heating chamber



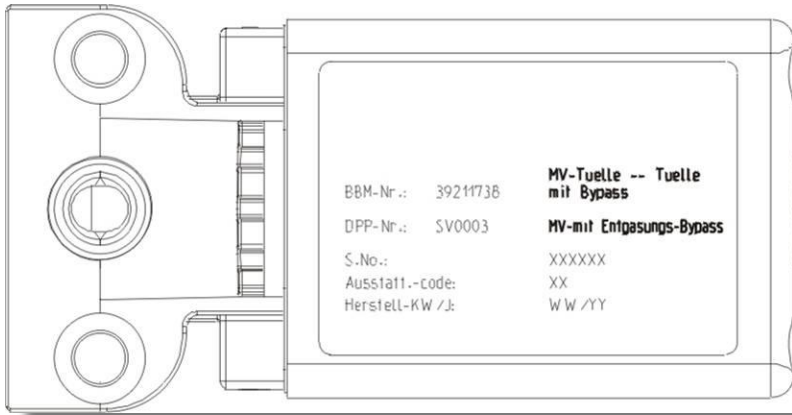
Upline Tank

Please choose one of the components in the upline tank.

- Components in the Upline Tank
- Heat exchanger
 - Level sensor
 - Heater rod

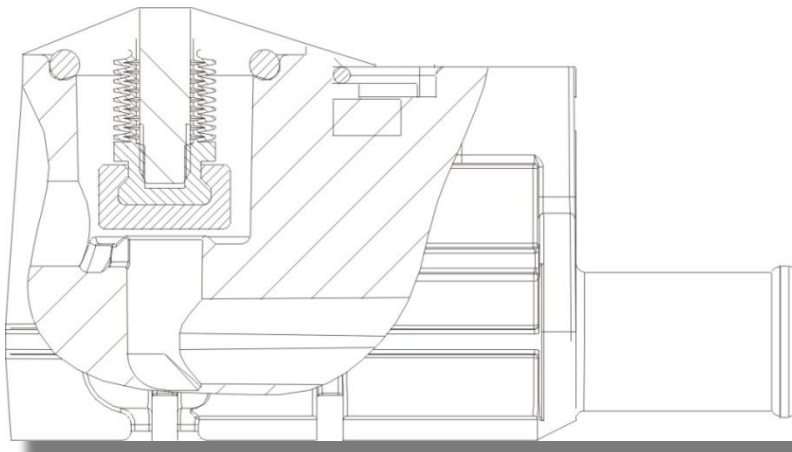


Degassing Valve VEB

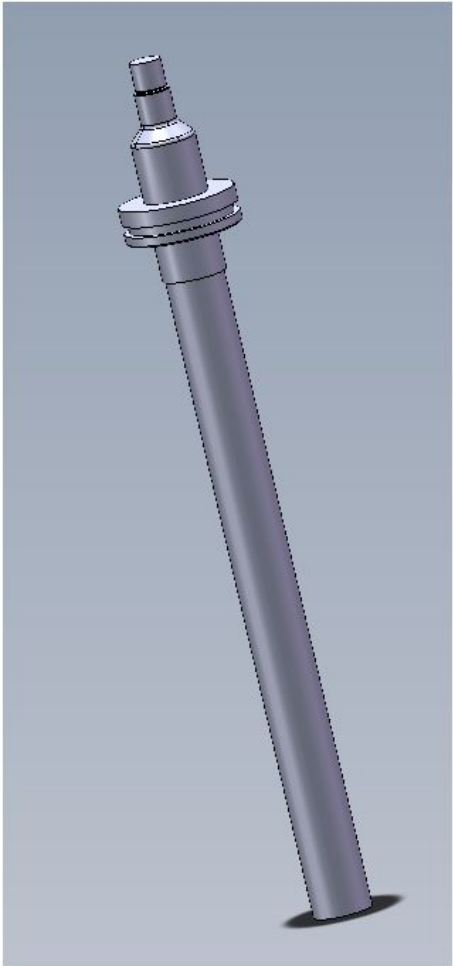


Functions of the Degassing Valve

- Creates a restriction in the water flow
- The restriction creates a negative pressure
- If the valve is open there is no restriction in the flow
- If the valve is closed there is a fixed gap for the water to pass
- The valve will always be open during disinfections



Heater Rod



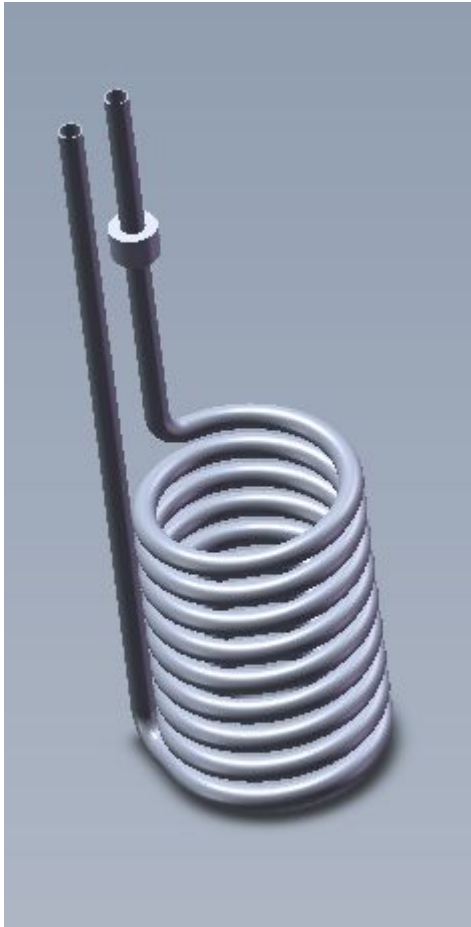
- Functions of the Heater Rod
 - Heats up incoming water
- Properties of the Heater Rod
 - It consists of 2 heating elements with 900 W each
 - The heater rod has a thermal fuse that burns out at 120 °C
 - The fuse is not resettable

Float Switch



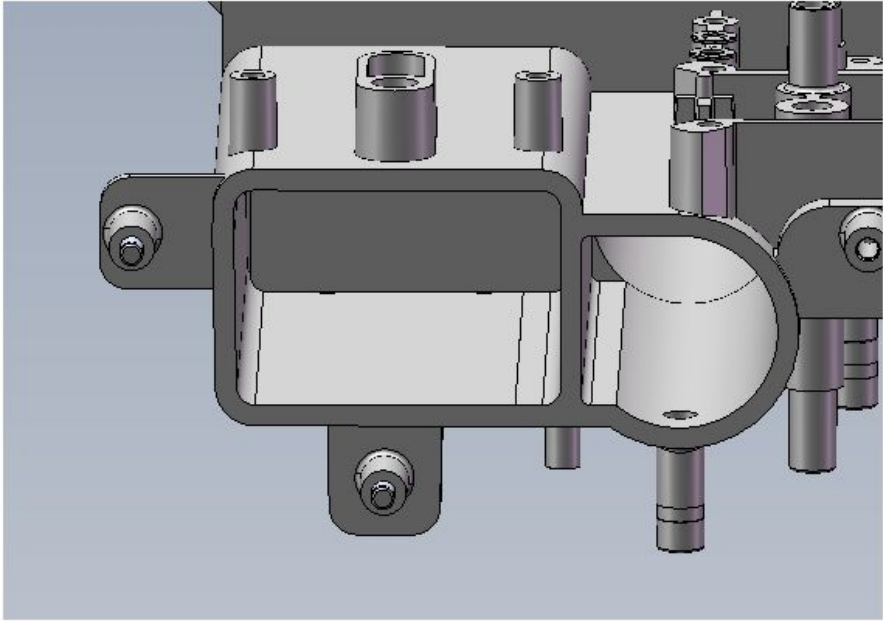
- Functions of the Float Switch
- Regulates the water level in the upline tank
 - Turns off the heater when the tank is empty

Heat Exchanger



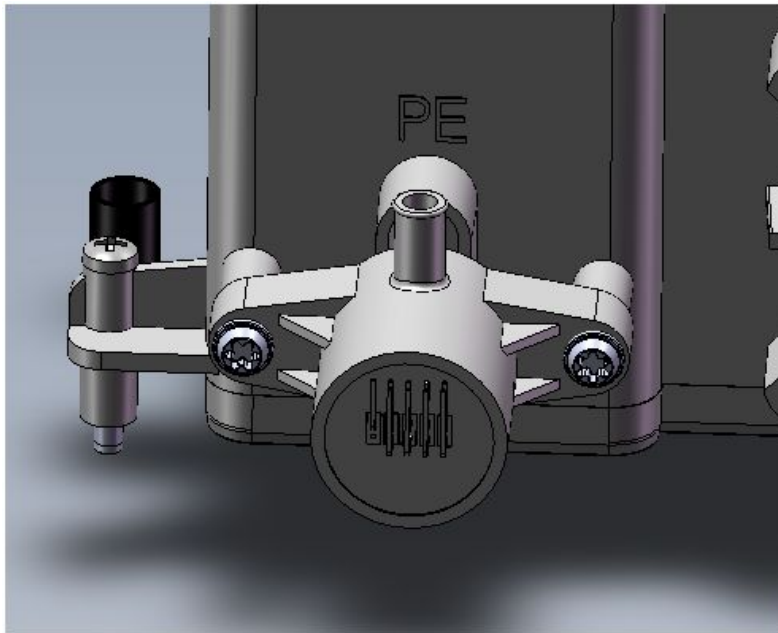
- Function of the Heat Exchanger
- Pre-heats the incoming water to increase energy efficiency
 - The tube is made of stainless steel
 - It is shaped in a spiral form to increase the contact surface area

Degassing Chamber



- Functions of the Degassing Chamber
- Allows water to degas
 - Slow flow of water
 - Contains granulate to allow bubbles to form

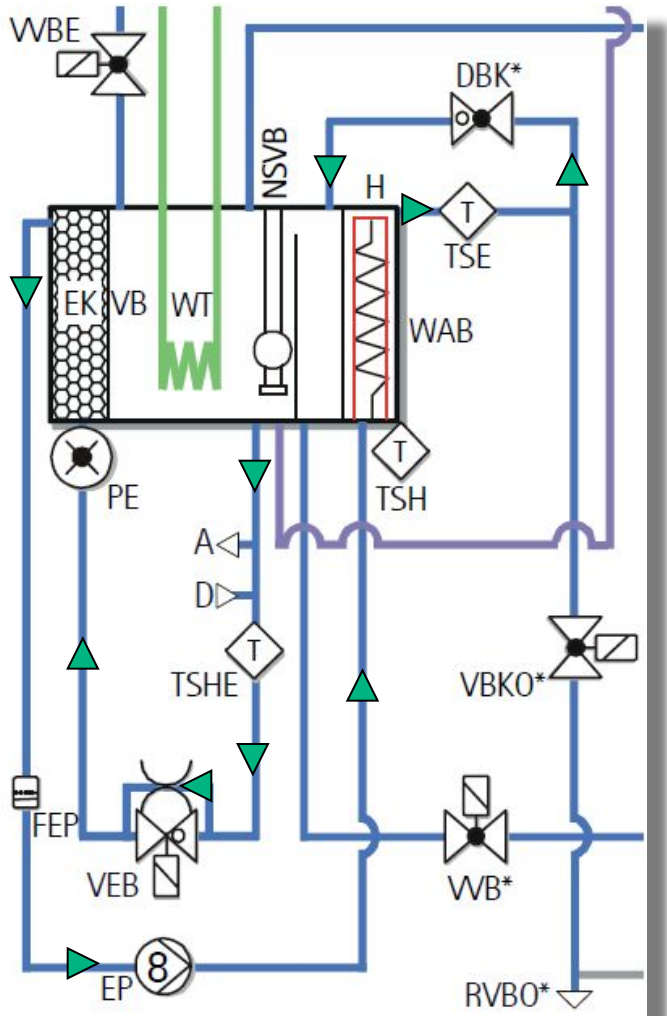
Degassing Pressure Sensor



Functions of the Degassing Pressure Sensor

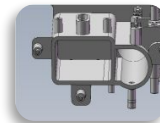
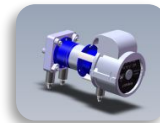
- Measure the degassing pressure
- Feedback for the degassing pump speed
- Protects the heater rod during disinfection by monitoring the pressure. If the pressure is too low, the heater is turned off.
- The same type of sensor is used for PDA

Degassing Circuit



The Flow Path of the Water

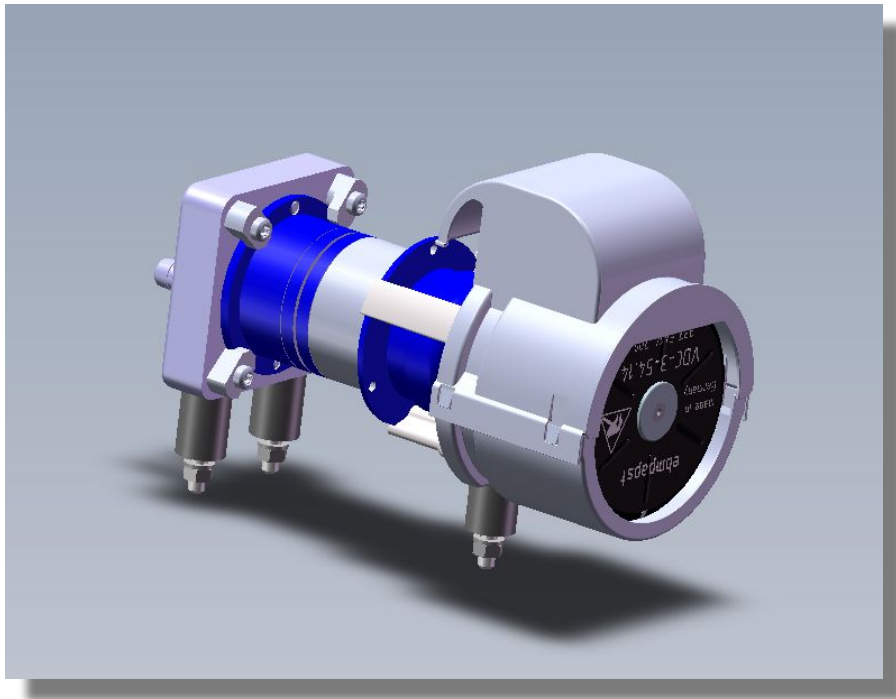
- Water is taken from the upline tank
- If VEB is closed, a restriction in the flow causes a negative pressure
- A negative pressure is measured at PE
- The degassing chamber allows bubbles to form
- The FEP protects the degassing pump from particals that might damage the pump
- The EP generates the negative pressure by pumping water to the heater rod



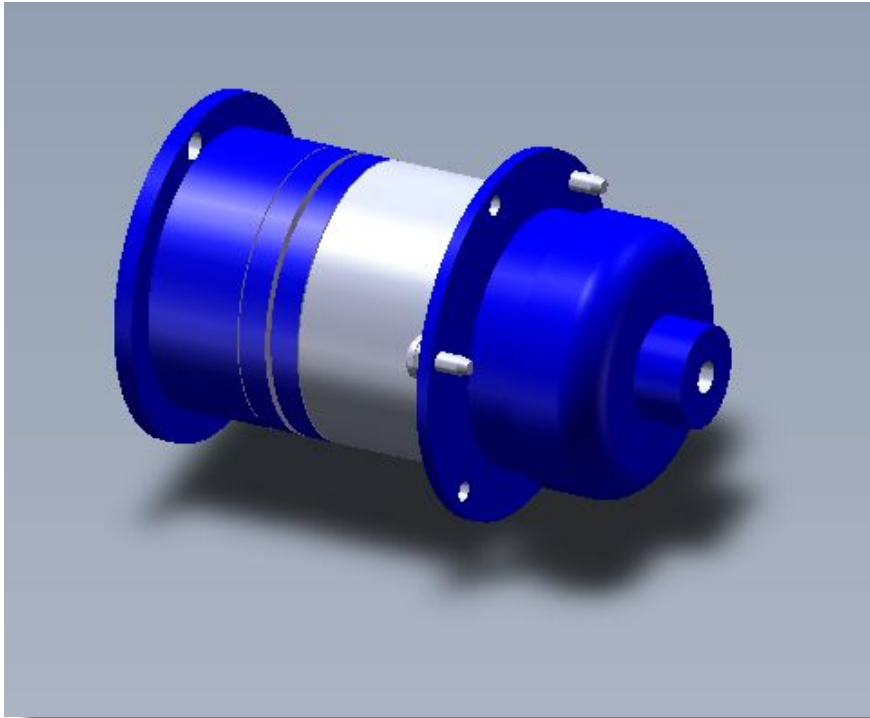
Degassing Pump, Micropump Vers. 2

Please choose a part of the degassing pump that you would like to see.

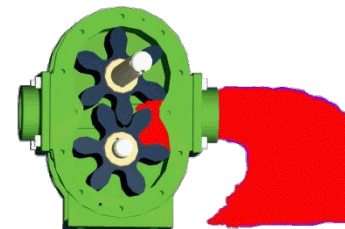
- Functions of the Degassing Pump
- Degasses the water
- Creates a pressure of ± 525 mmHg



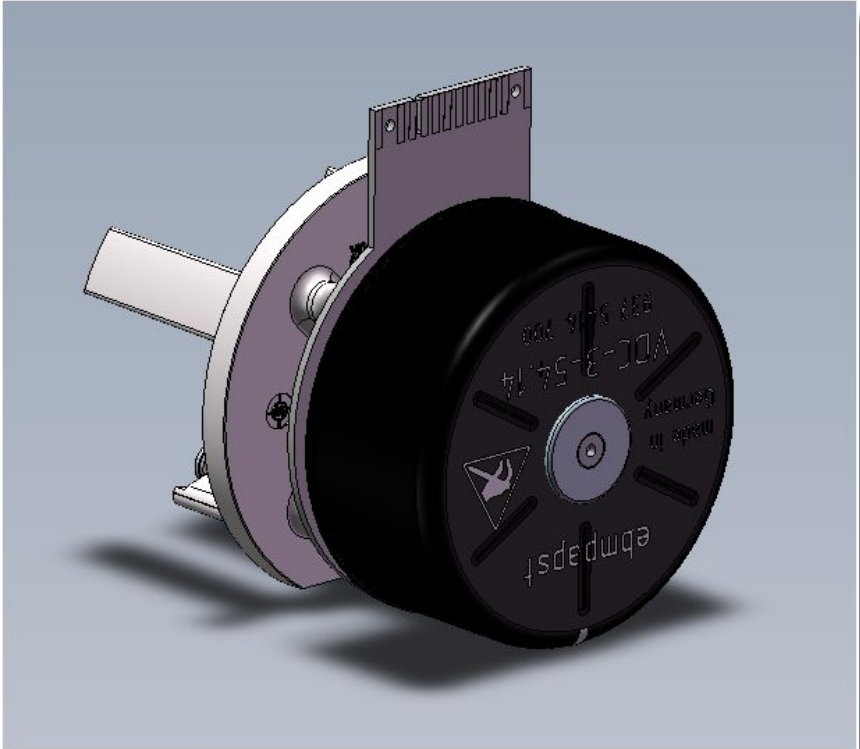
Degassing Pump



- Functions of the Degassing Pump
- Creates a negative degassing pressure
 - Pumps fluid with two interlocked gears
 - The gears are driven by a magnet
 - The pump can only pump water
 - If the pump speed is too low the heater is turned off
 - Degassing pressure should be at least ± 525 mmHg



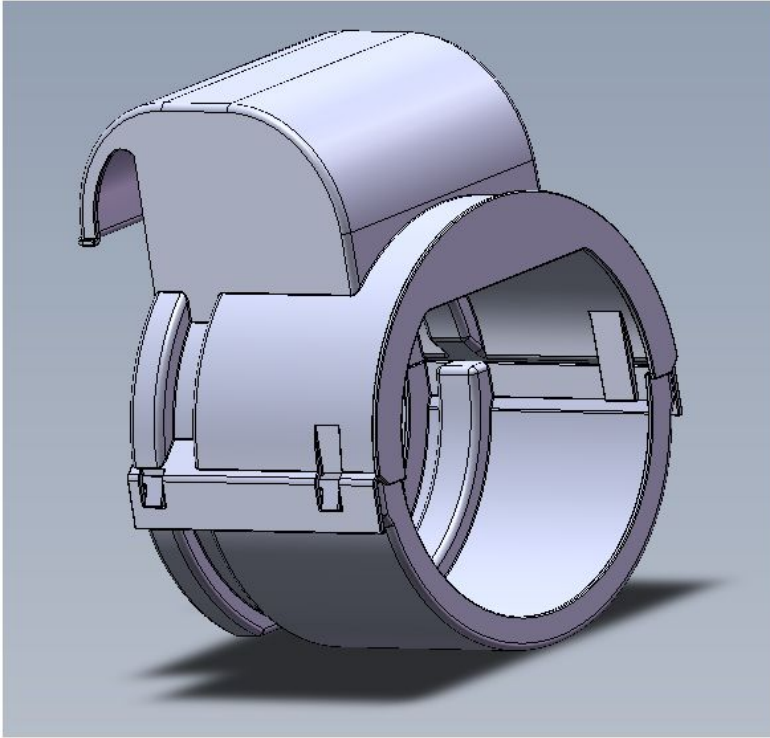
Degassing Motor



Functions of the Degassing Motor

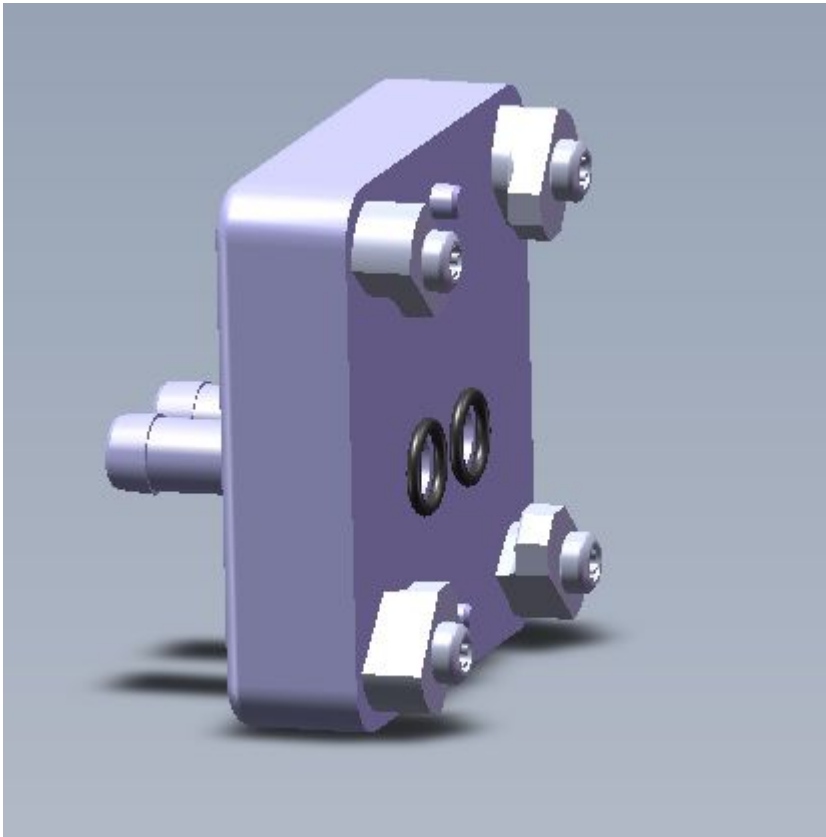
- Drives the degassing pump
- Onboard driving circuits
- Is regulated by the degassing pressure

Degassing Motor Cover



- Functions of the Degassing Motor Cover
- Protects the moving parts of the motor
 - Protects the electronics of the motor

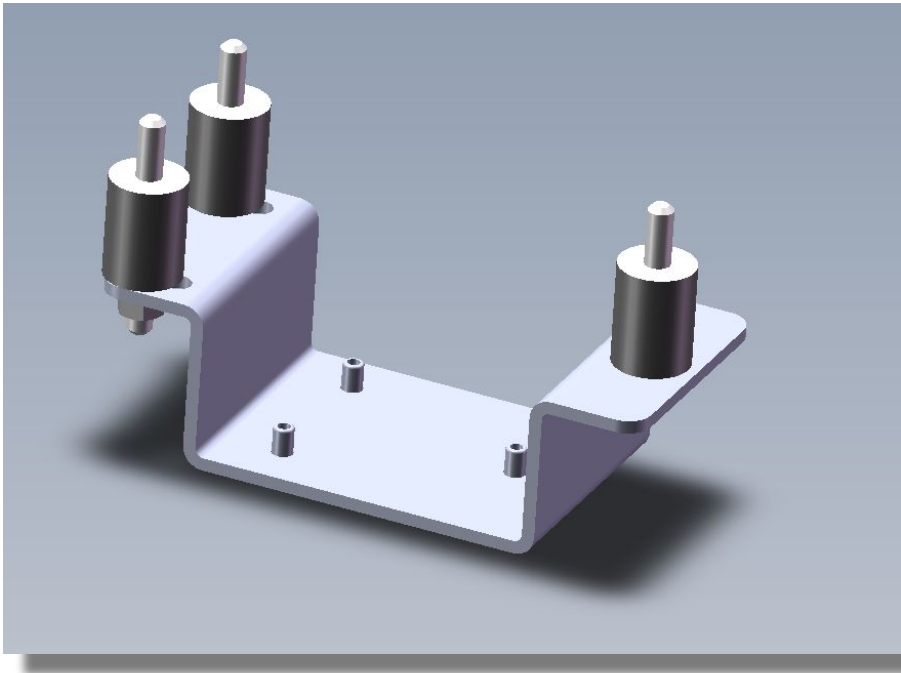
Degassing Adaptor Block



Function of the Adaptor Block

- Mounting of the degassing pump
- O-rings to seal the connection with the motor
- Four clips to hold the motor

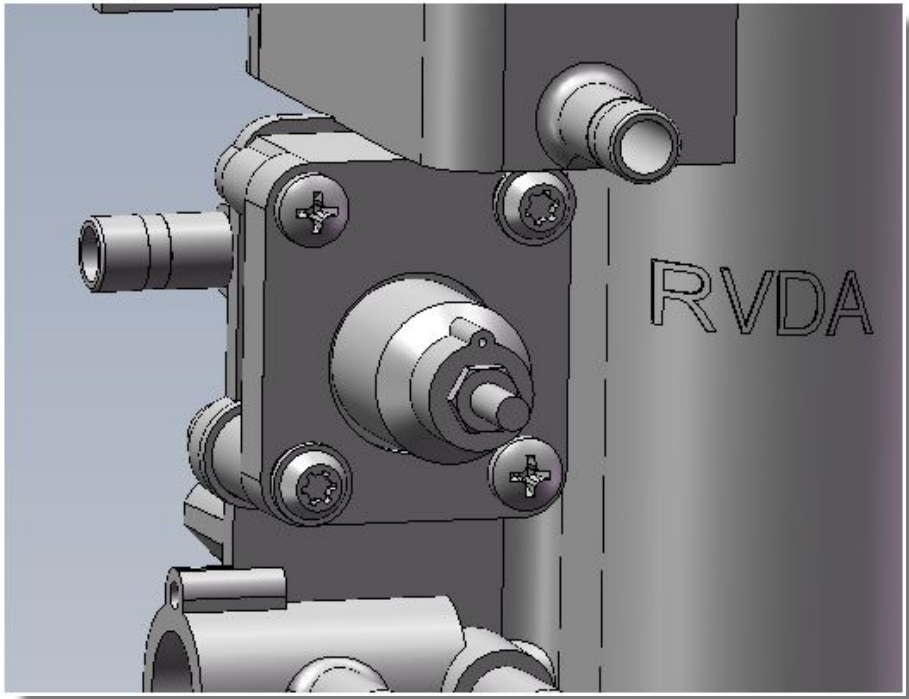
Degassing Pump Foot Piece



Functions of the Foot Piece

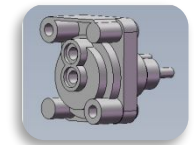
- Holds the degassing pump module
- Absorbs vibrations from the pump
- Reduces the sound volume

RVDA

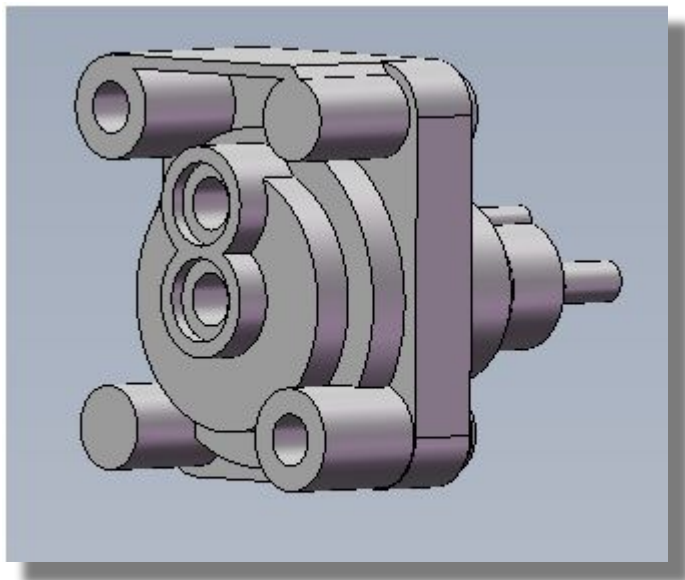


Functions of the RVDA

- Ensures a minimum pressure of 400 mmHg on the balance chamber
- Must be set to 500 mmHg for Online machines



RVDA



Rear view of the RVDA

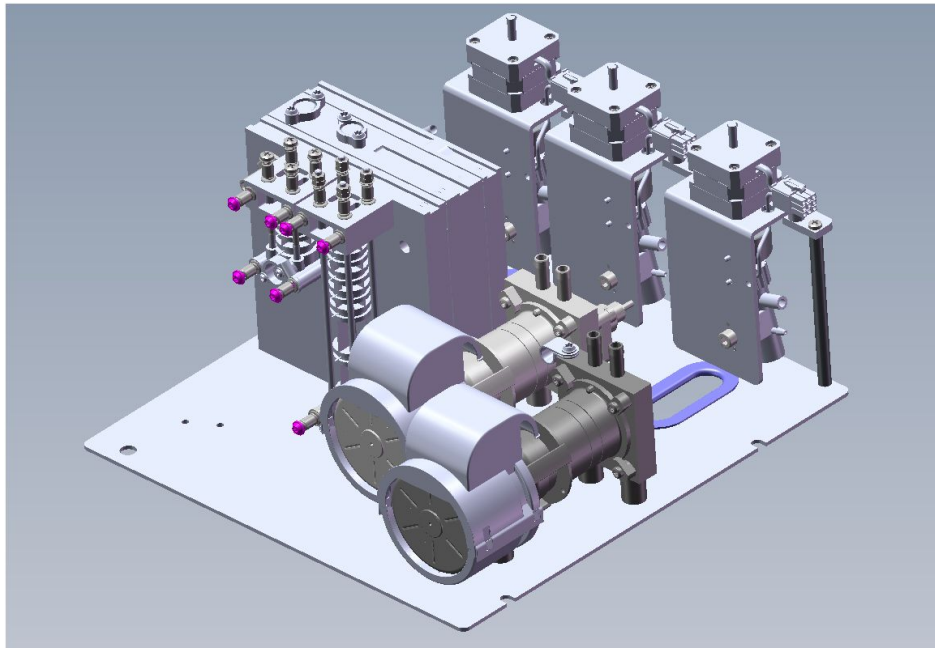
- Pay attention to the assembly direction



Back

DF Sub-Rack

Please choose one of the components on the DF Sub-Rack.

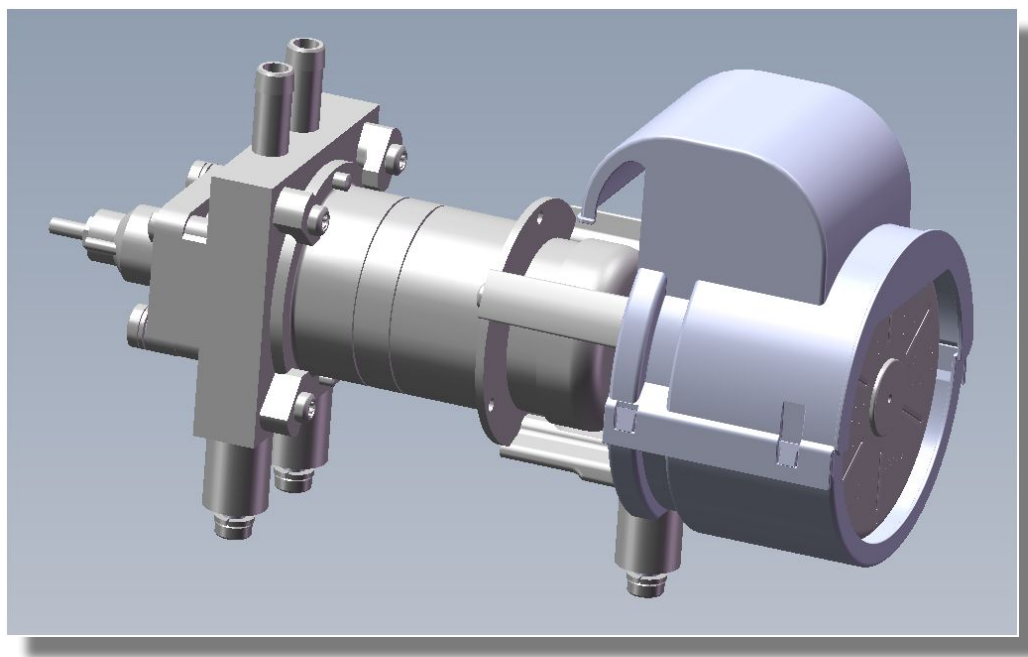


Functions of the DF Sub-Rack

- Contains the pumps that push water in and out of the balance chamber
- Responsible for mixing the dialysate fluid
- Contains the piston pumps
 - Concentrate pump
 - Bicarbonate pump
 - UF pump

Inlet Flow Pump

Please select a part of the FPE that you would like to see.

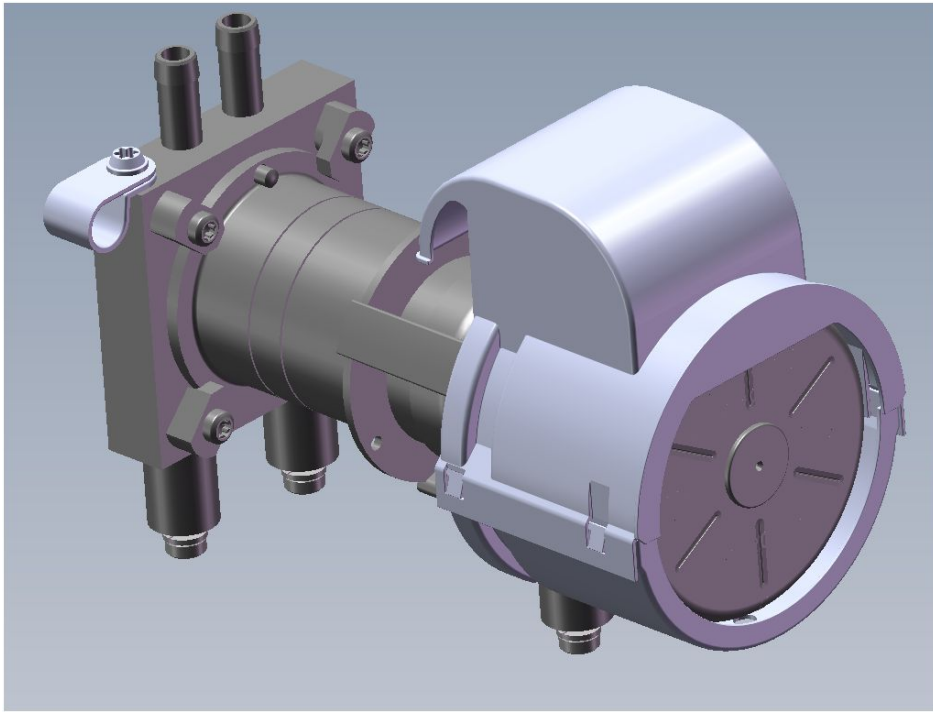


Functions of the FPE

- Pumps fresh dialysate into the balance chamber
- Pumps used dialysate to the drain
- Creates a high positive pressure for the DFS pressure test

Outlet Flow Pump

Please select a part of the FPA that you would like to see.



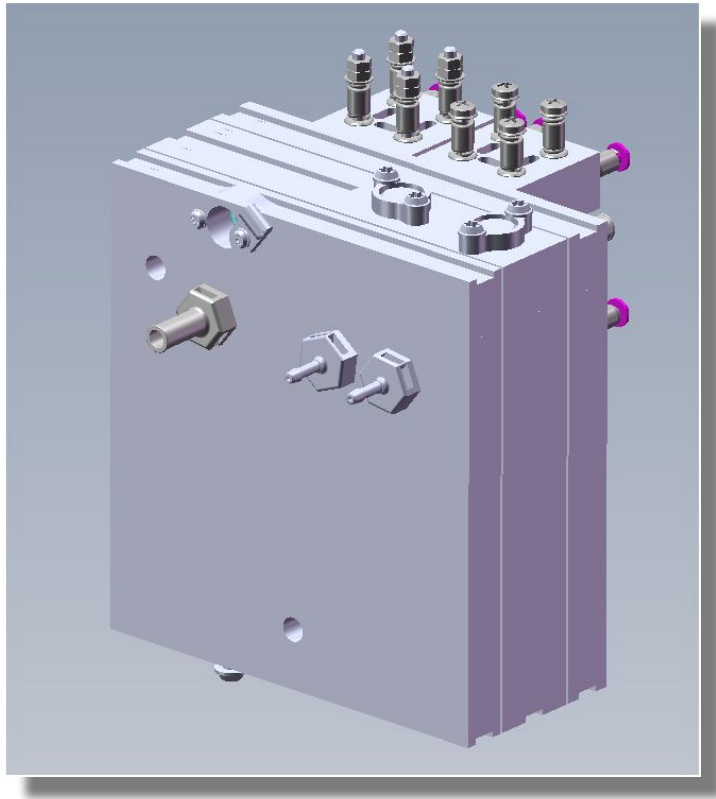
Functions of the FPA

- Pumps used dialysate from the dialyser to the balancing chamber
- Creates a negative pressure for the tests of the HDF Online system
- Creates a negative pressure for the VBICP test at the end of disinfection

DF Block

Please select one of the components on the DF block.

- Functions of the DF Block
- Measures conductivity
 - Measures temperature
 - Mixes the dialysate fluid



Inner View

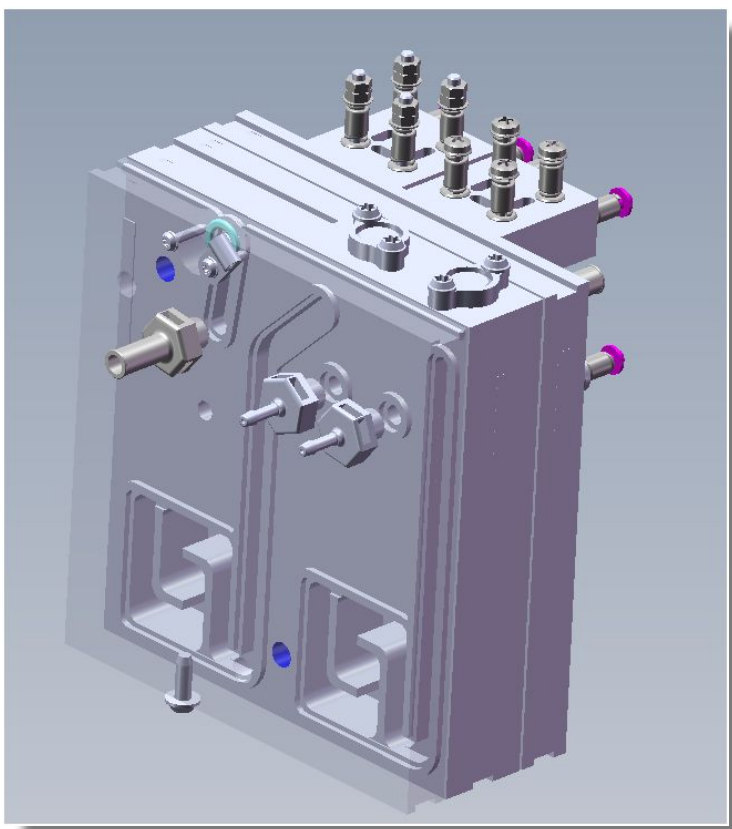
Rear View

Back

DF Block

Please select one of the components on the DF block.

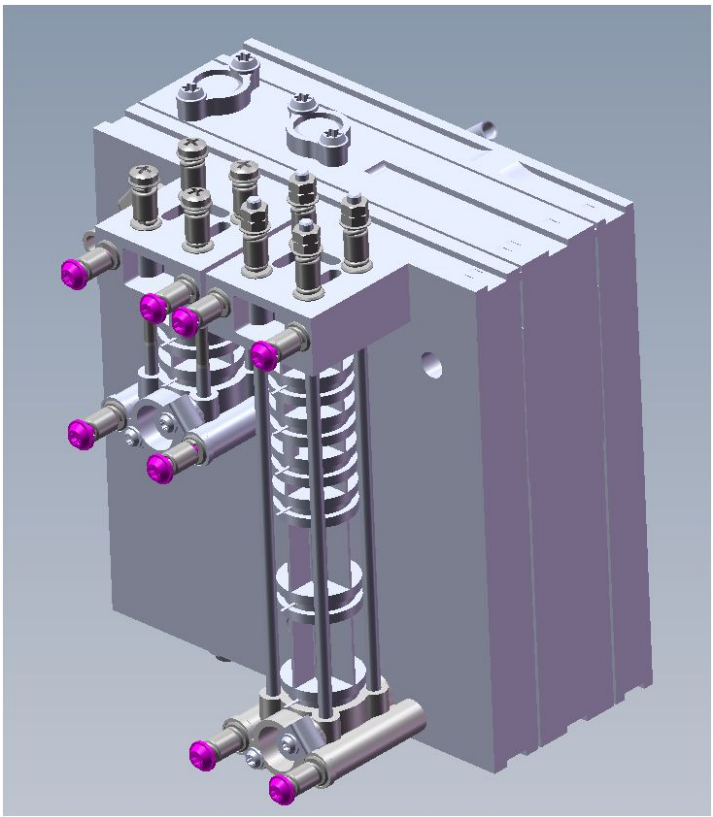
- Functions of the DF Block
- Measures conductivity
 - Measures temperature
 - Mixes the dialysate fluid

[Front View](#)[Rear View](#)[Back](#)

DF Block

Please select one of the components on the DF block.

- Functions of the DF Block
- Measures conductivity
 - Measures temperature
 - Mixes the dialysate fluid

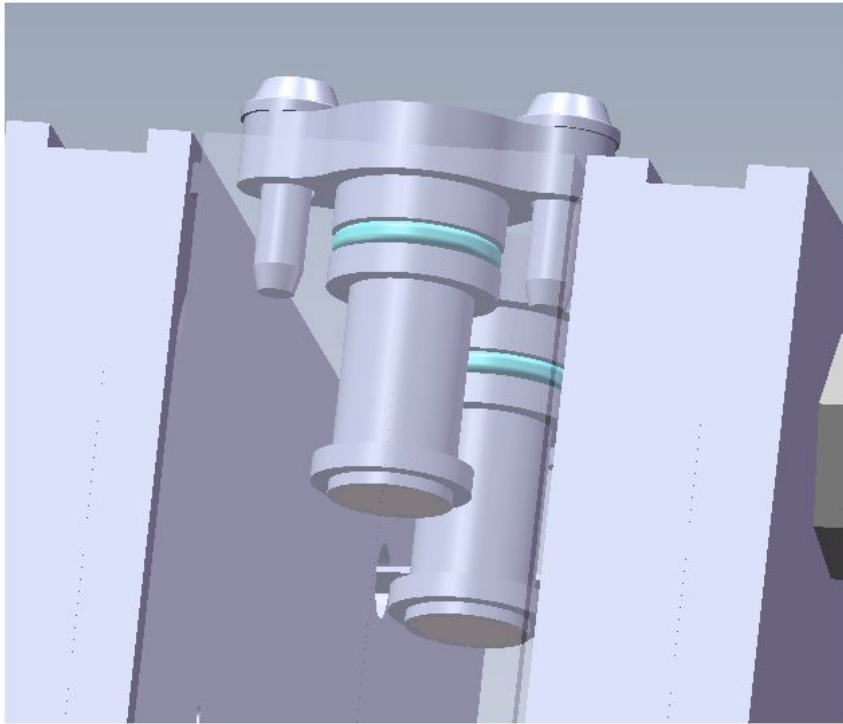


Inner View

Front View

Back

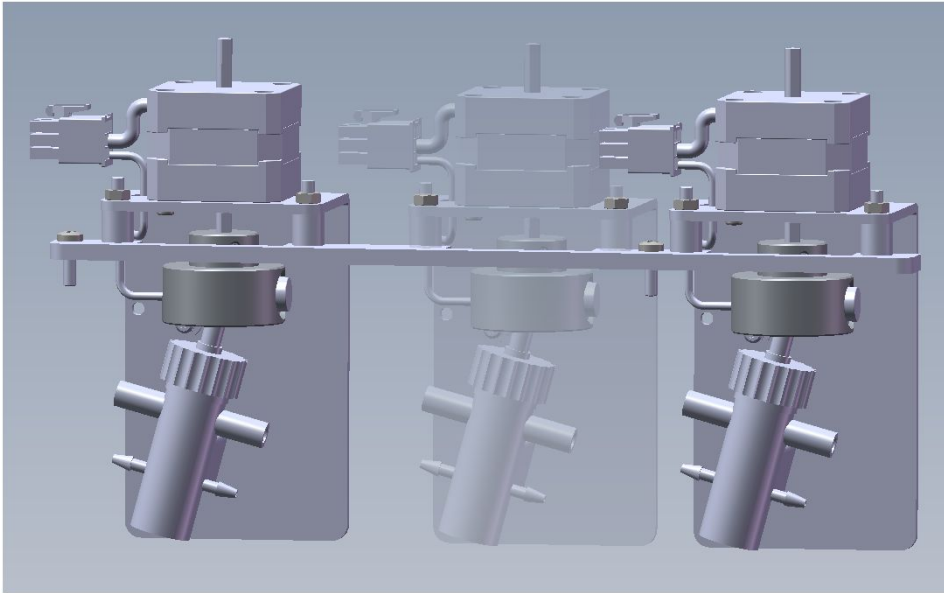
RVB & RVK



Functions of RVB and RVK

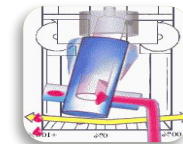
- Absorbs the shock from the piston pumps
- This causes a steady inflow of concentrate and bicarbonate
- Stabilizes conductivity
- Contains a 500 mmHg spring

Concentrate and Bicarbonate Pumps

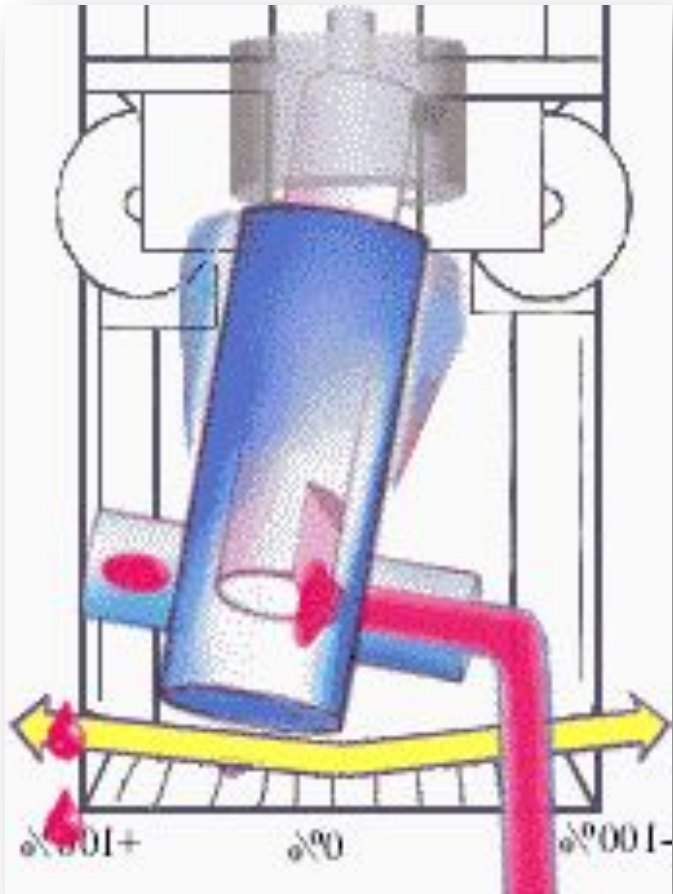


Pump Functions

- Pumps concentrate and bicarbonate into the DF block
- Normal speed is ± 60 rpm
- Consists of
 - Pump body
 - Bell
 - Hall sensor
 - Motor
- The speed is regulated by the conductivity cells

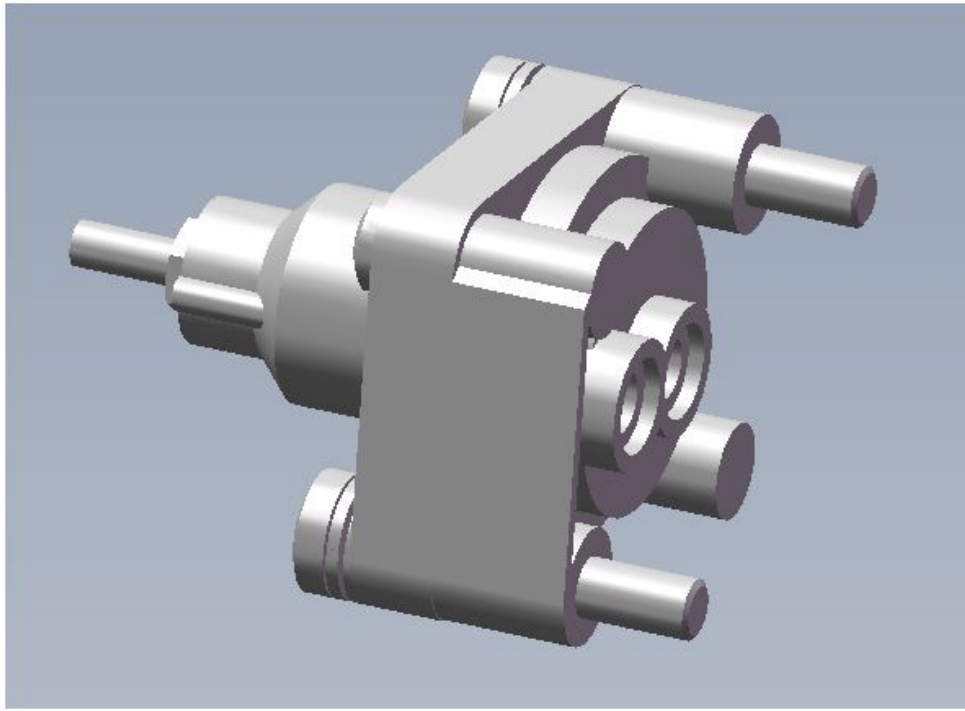


Working concept of the Piston Pump



- Fluid is sucked in on the one side of the pump.
- By rotating the shaft fluid is pushed out the other side of the pump.
- The volume for each stroke is the same.

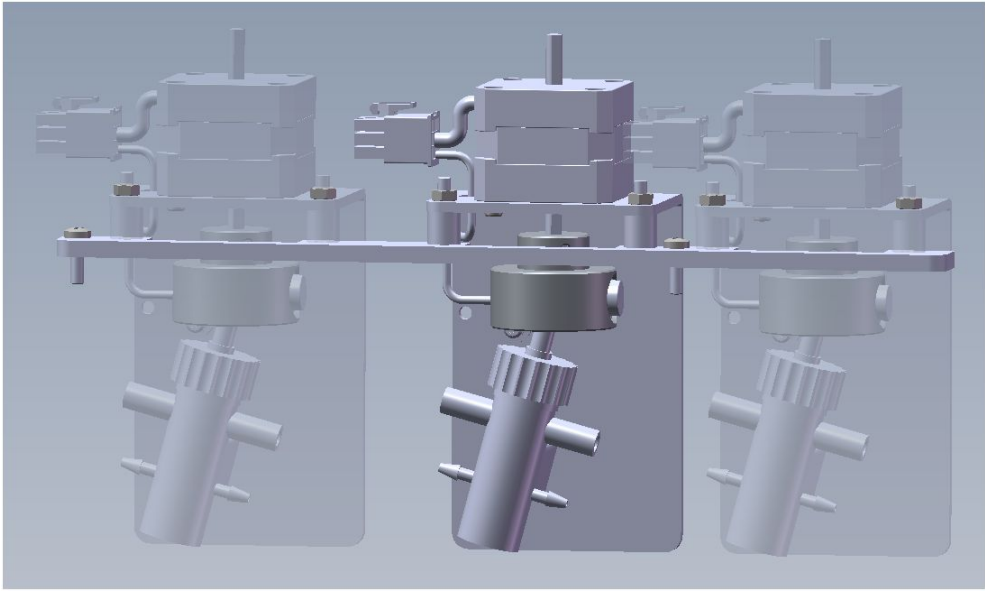
RVFPE



Functions of the RVFPE

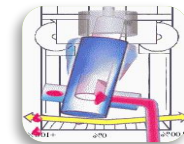
- Prevents an over pressure
- Set to 1.3 bar
- Prevents tubes from popping off

Concentrate and Bicarbonate Pumps

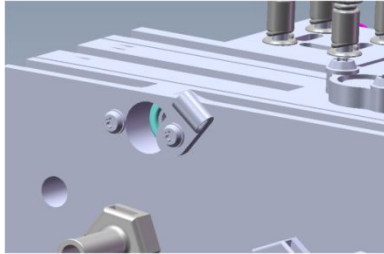


UF Pump Functions

- Pumps the UF volume to drain
- Remove fluid from the patient
- Calibrated accurately
- Tolerance of 1 %
- Consists of
 - Pump body
 - Bell
 - Hall sensor
 - Motor

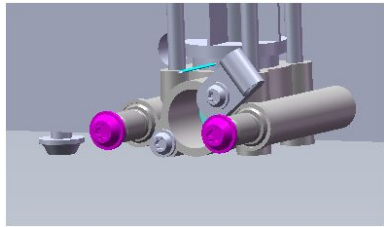


Temperature Sensors



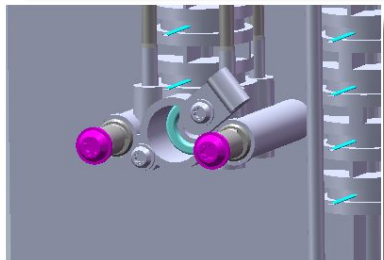
Functions of TSD_S

- Measures the temperature for ENDLF_S
- Is used to compensate the conductivity measurement
- Should be equal to TSD



Functions of TSD

- Measures the temperature for ENDLF
- Is used to compensate the conductivity measurement
- Should be equal to TSD_S

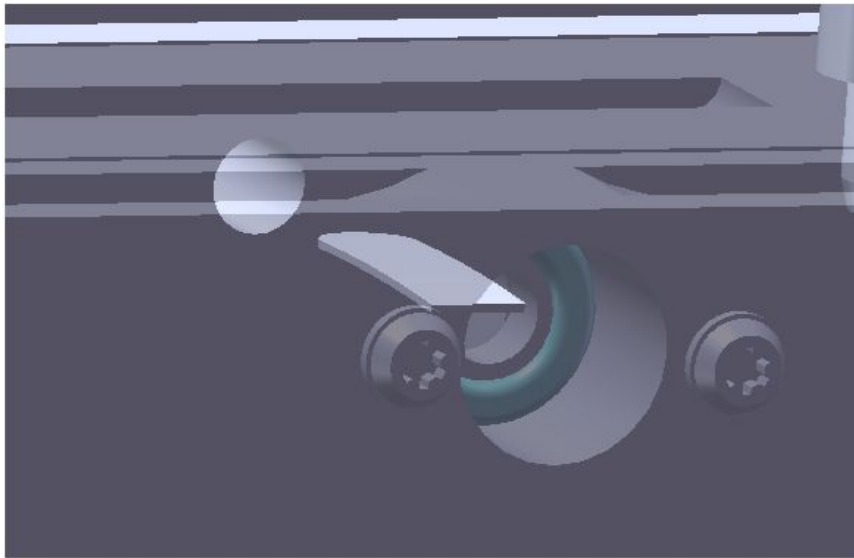


Functions of TSBIC

- Measures the temperature for TSBIC
- Is used to compensate the conductivity measurement
- Should be slightly colder than TSD

[Terbulance Spacer](#)[Back](#)

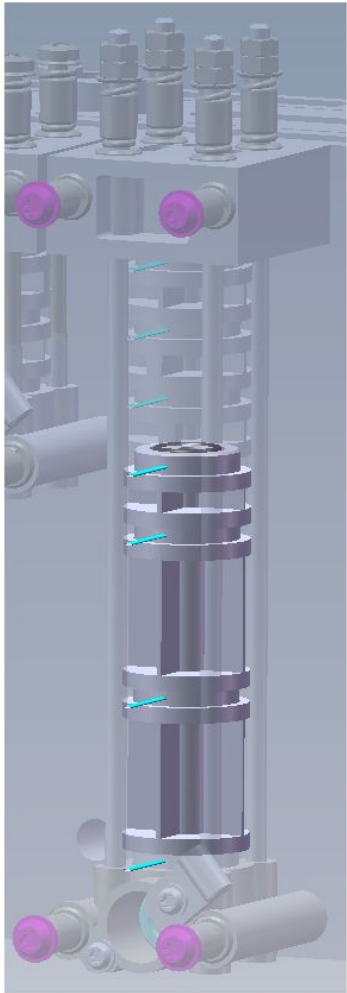
Terbulance Spacer



Functions of the Terbulance Spacer

- Creates terbulance on the temperature sensor
- Removes dead spaces from the sensor

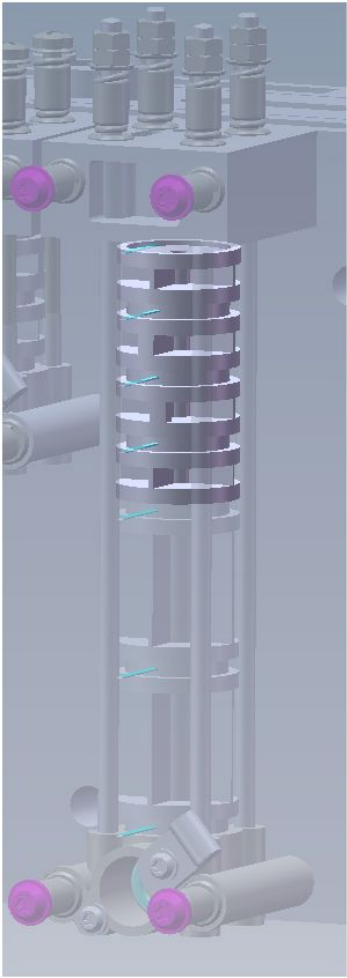
ENDLF



Functions of the Final Conductivity Sensor

- Measures the final conductivity
- The conductivity controls the speed of the concentrate pump
- Is dependent on TSD

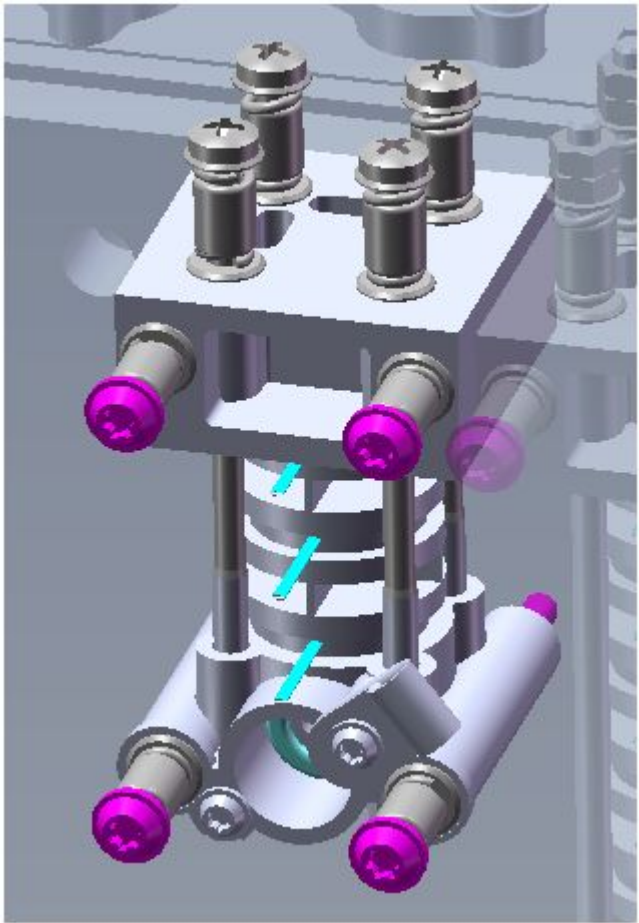
ENDLF_S



Functions of the Final Conductivity Sensor for the Supervisor

- Measures the final conductivity
- Is dependent on TSD_S

BICLF

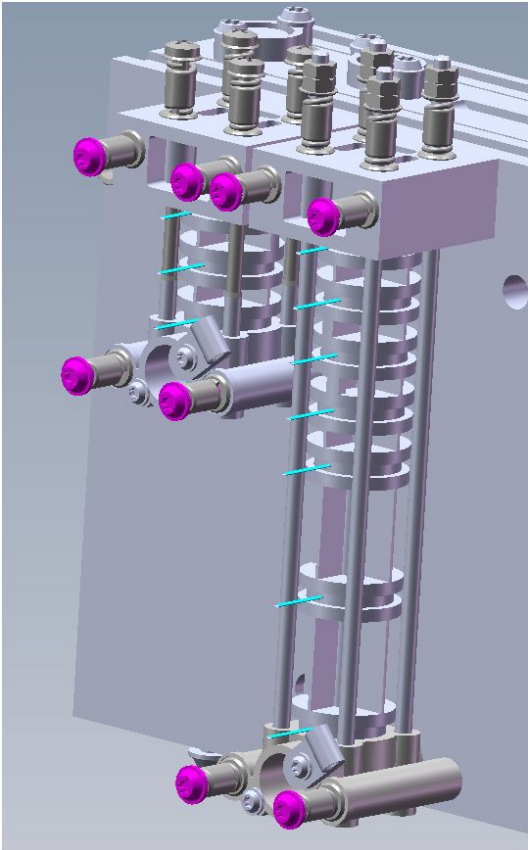


Functions of the Bicarbonate Conductivity Sensor

- Measures bicarbonate conductivity
- The conductivity controls the speed of the Bicarbonate pump
- Is dependent on TSBIC

Conductivity Sensors

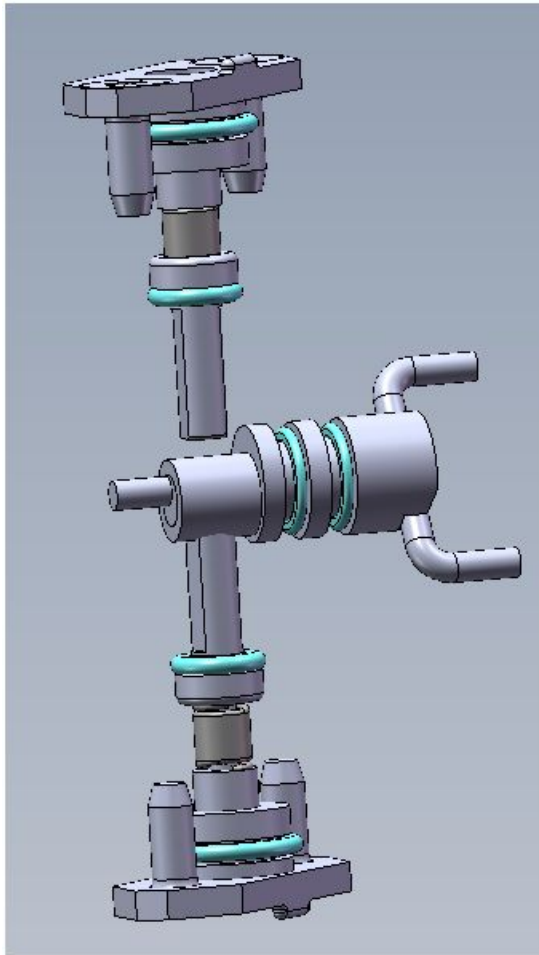
Please select a part of the conductivity cell that you would like to see.



Functions of the conductivity cells

- ENDLF measures the final conductivity
- ENDLF_S supervises the ENDLF
- BICLF measures the bicarbonate conductivity
- Conductivity is dependent on temperature

O-Rings of the Disinfection Valve

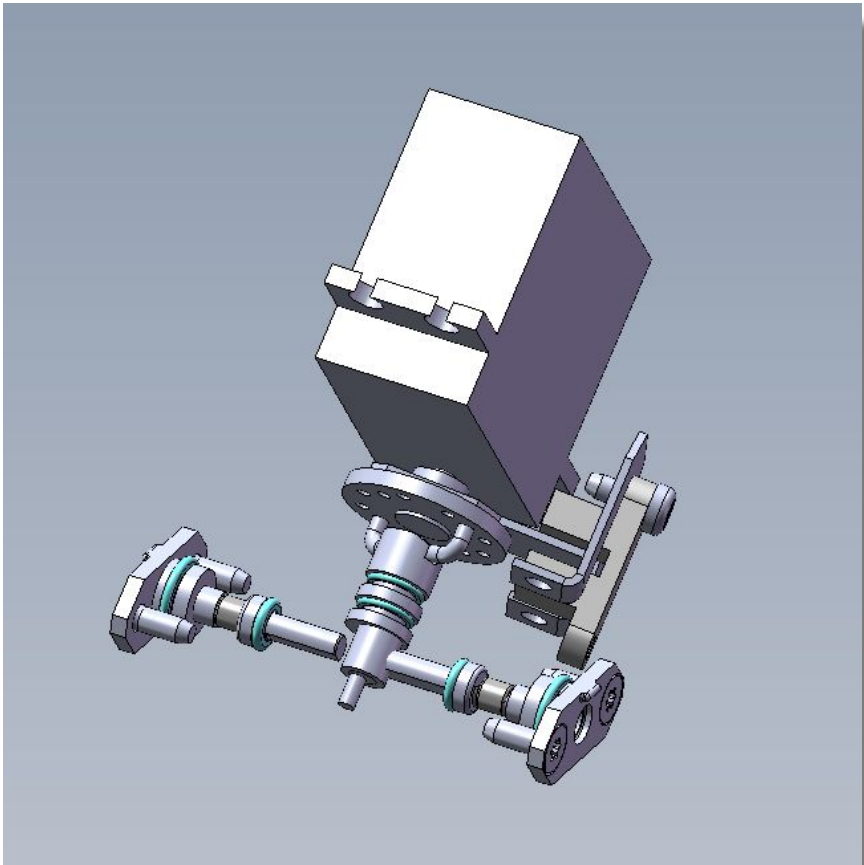


Function of the O-Rings

- Lower O-ring: seals of the disinfection port from the dialysate lines
- Upper O-ring: prevents the machine from sucking air when disinfection is taken into the machine

Disinfection Valve

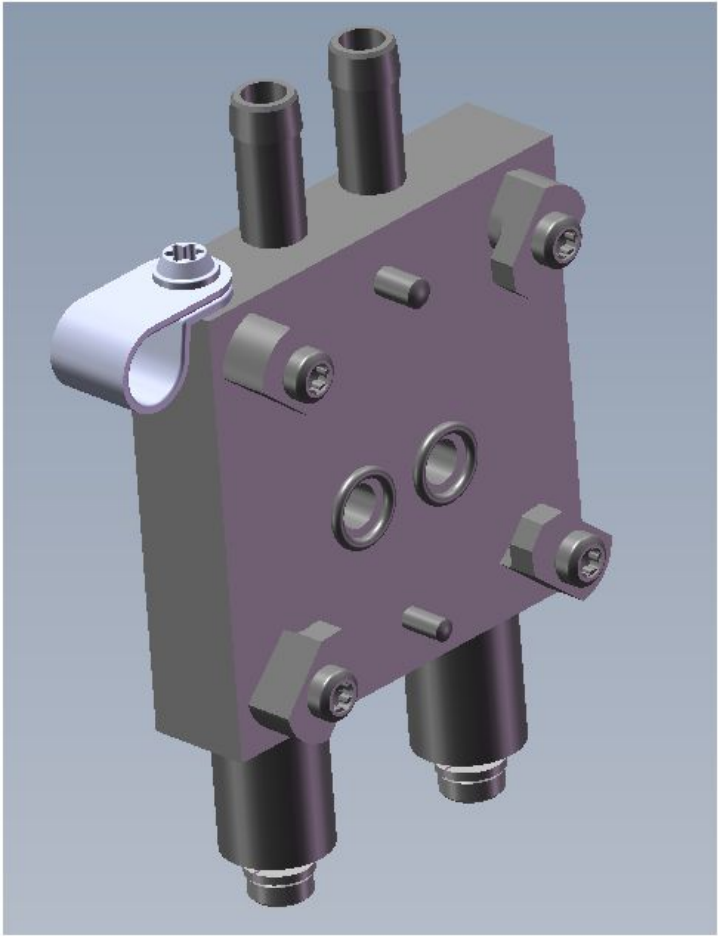
Please select a part of the disinfection valve.



Functions of the Disinfection Valve

- Opens when the machine needs to suck in disinfectant
- Closes to allow air back into the disinfection tube
- Is controlled by a servo motor

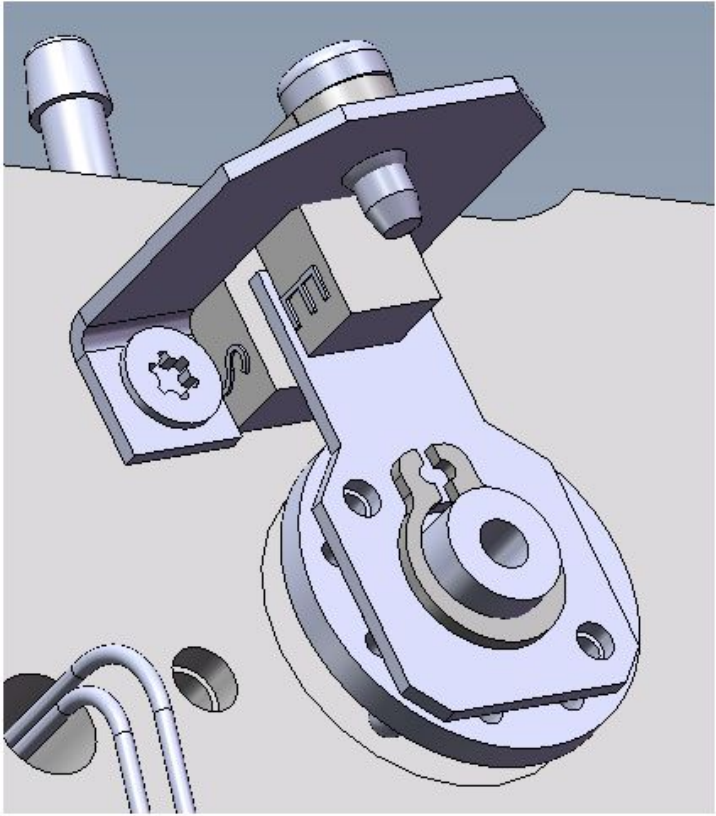
FPA Adaptor Block



Functions of the FPA Adaptor Block

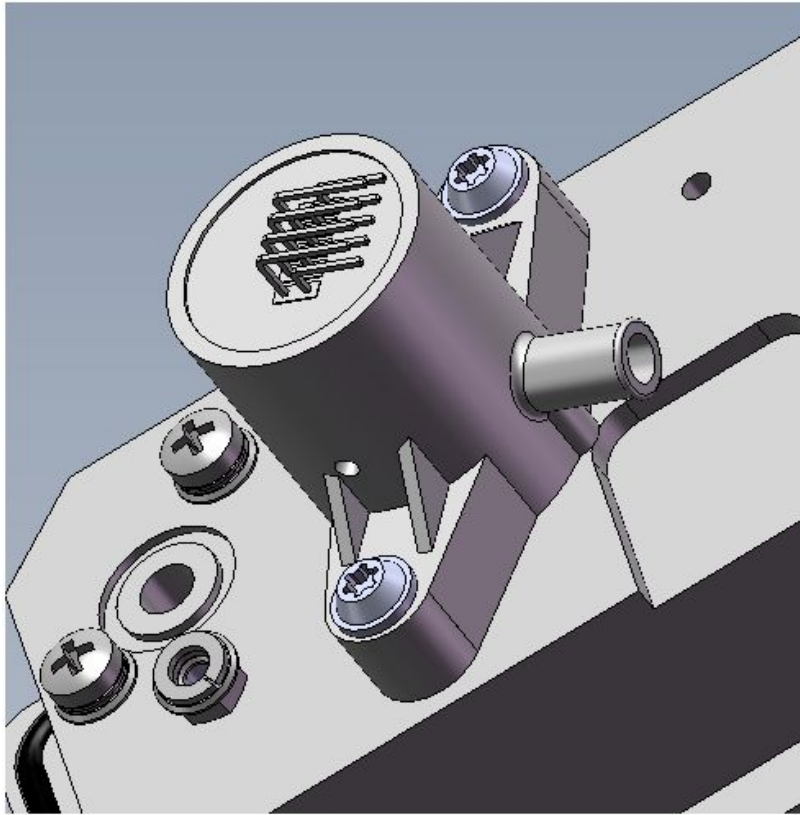
- Mounts the FPA
- Absorbs vibrations for noise reduction

Light Barrier



- Function of the Light Barrier
- Senses the position of the disinfection valve

Pressure Sensor Dialysate



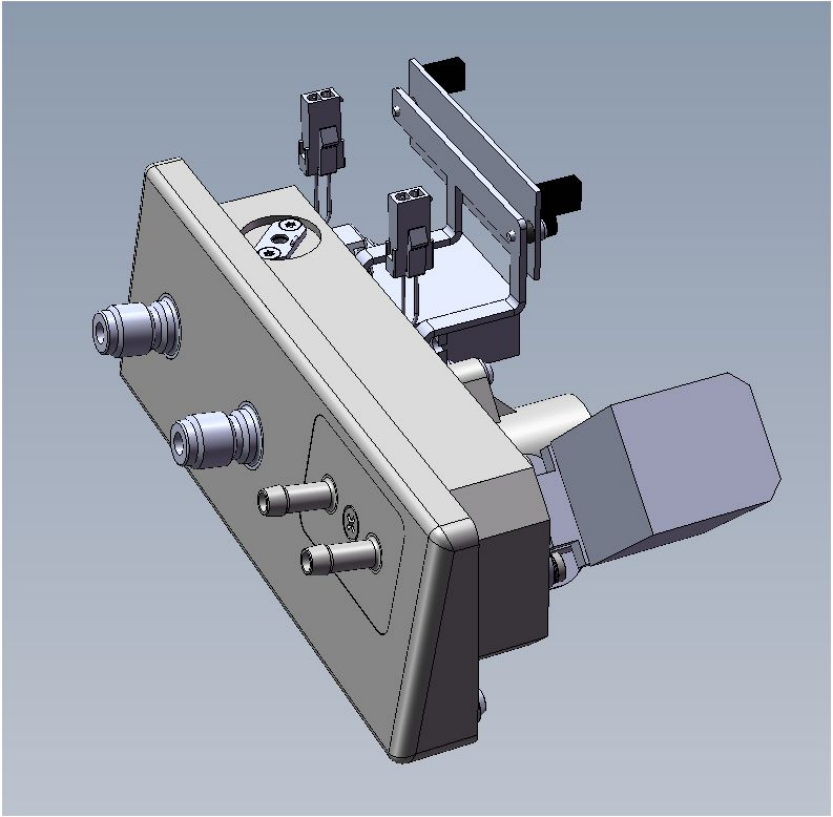
Functions of PDA

- Measure the dialysate pressure
- This is used to calculate TMP
- Used as testing device during the DFS Pressure Test
- Large working range
- The same type of sensor as PE

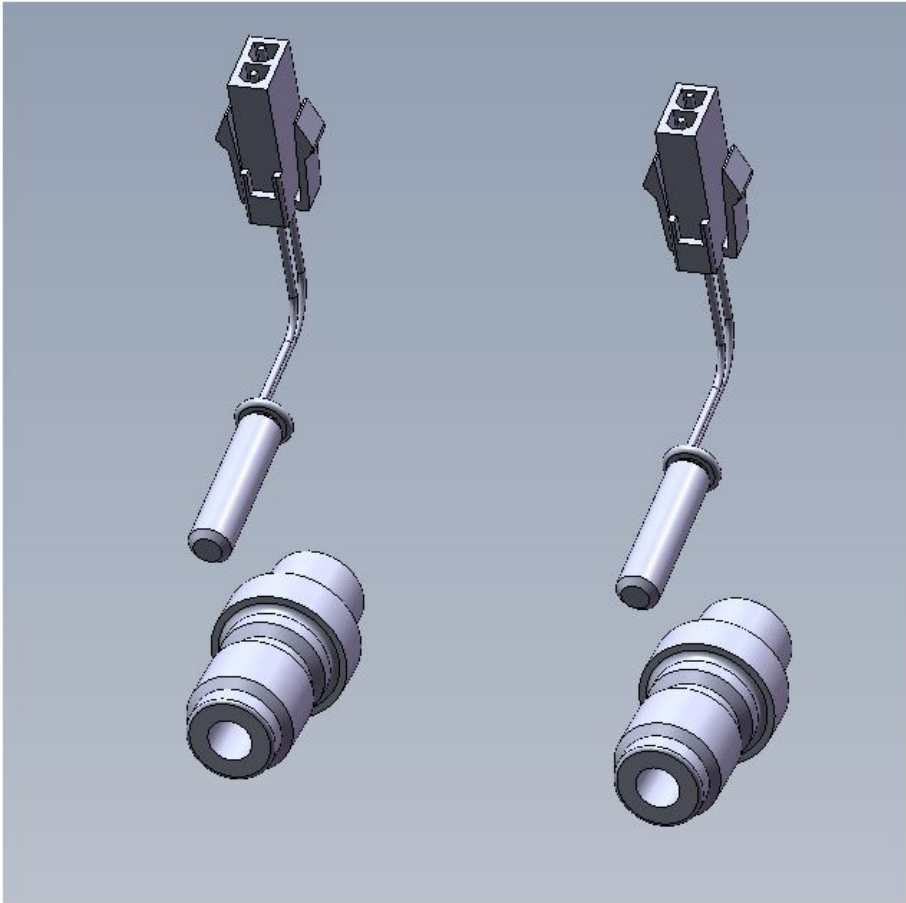
Rinsing Bridge

Please choose one of the components on the rinsing bridge.

- Functions of the Rinsing Bridge
- Contains the disinfection valve
 - Contains the dialysate pressure sensor
 - The Dialyser couplings are connected to the rinsing bridge



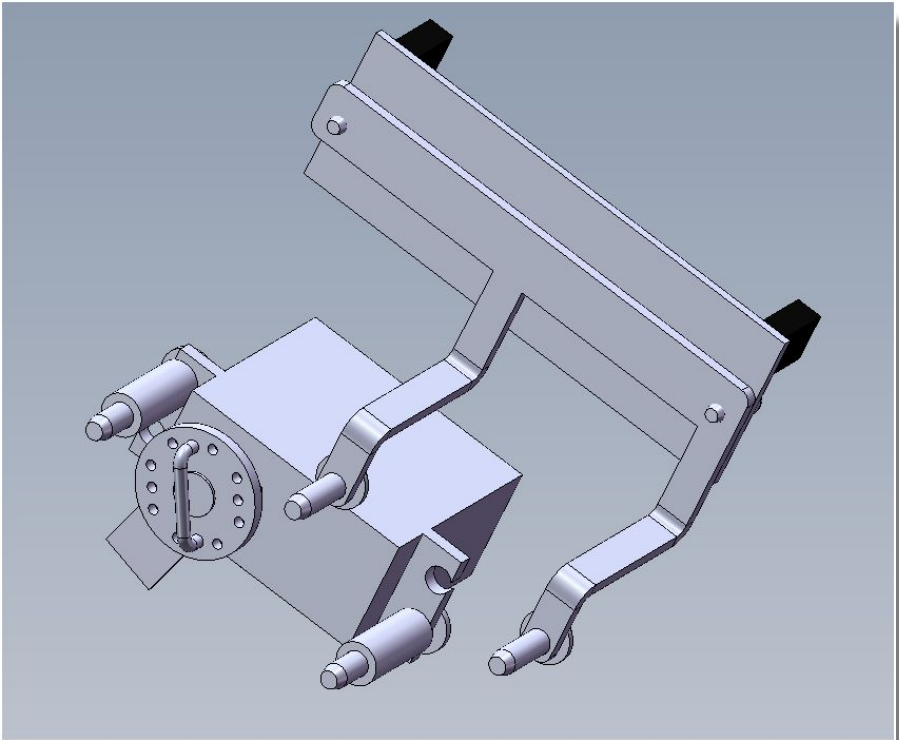
Rinsing Bridge Sensors



Function of the Sensors

- Detects whether the dialyser couplings are connected to the rinsing bridge

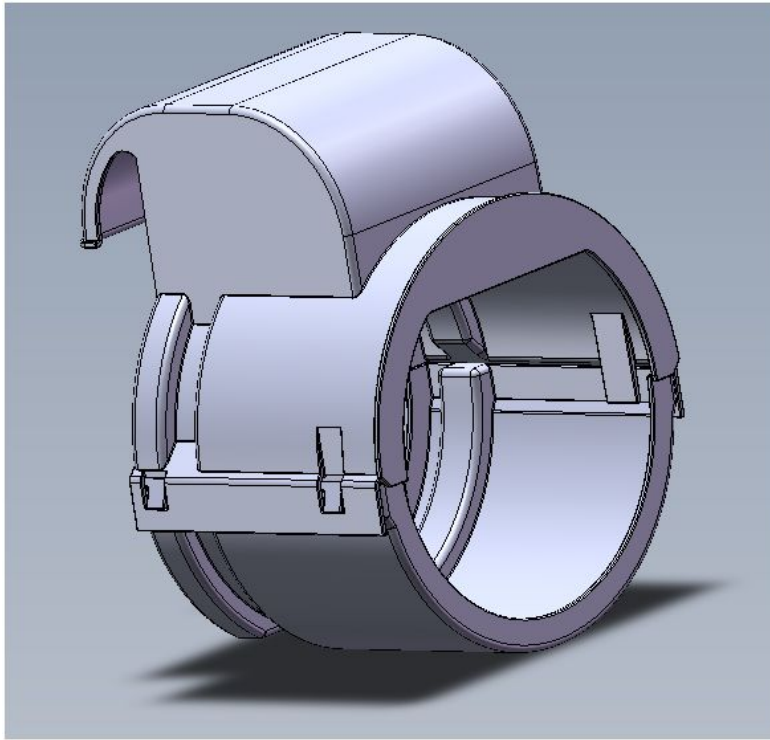
Servo Motor and Controller Board



Function of the Servo Motor

- The motor opens and closes the disinfection valve
- A disc moves into the light barrier when the valve is closed
- The electronics of the motor is also mounted on the rinsing bridge

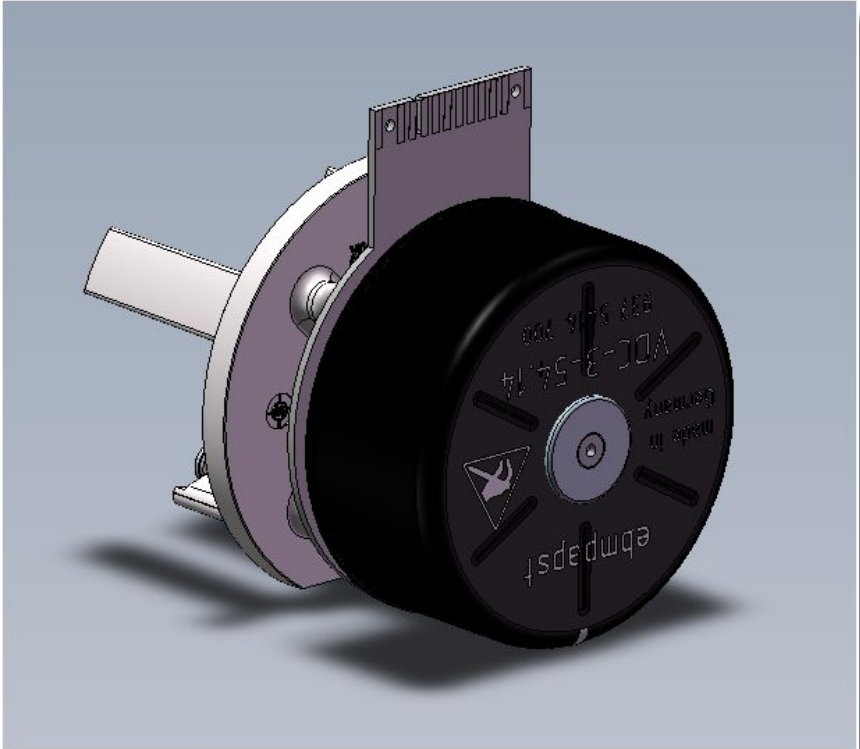
FPE Motor Cover



Functions of the FPE Motor Cover

- Protects the moving parts of the motor
- Protects the electronics of the motor

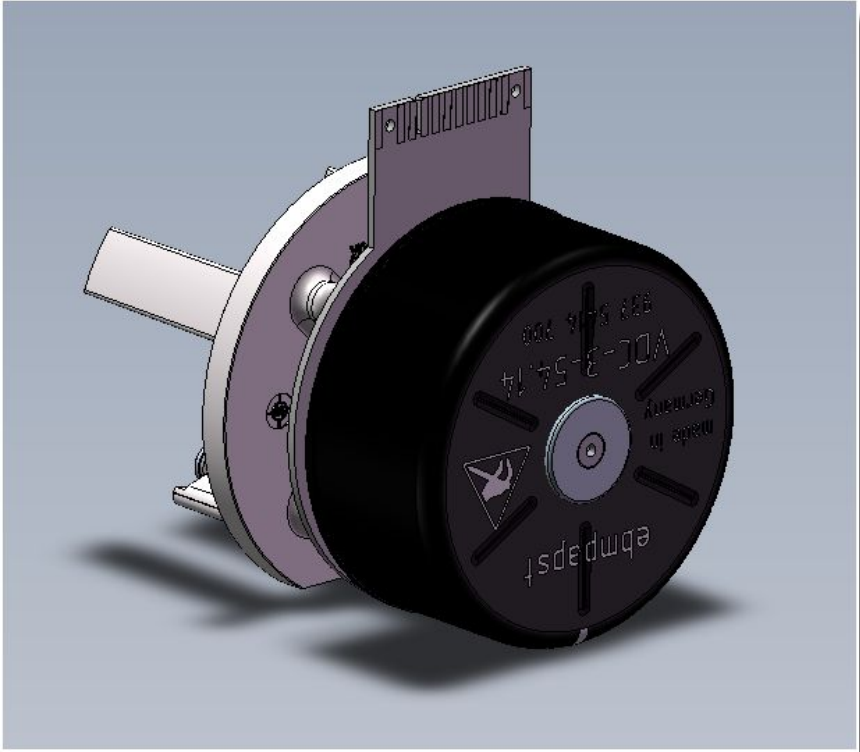
FPE Motor



Functions of the FPE Motor

- Drives the degassing pump
- Onboard driving circuits
- Is regulated by the degassing pressure

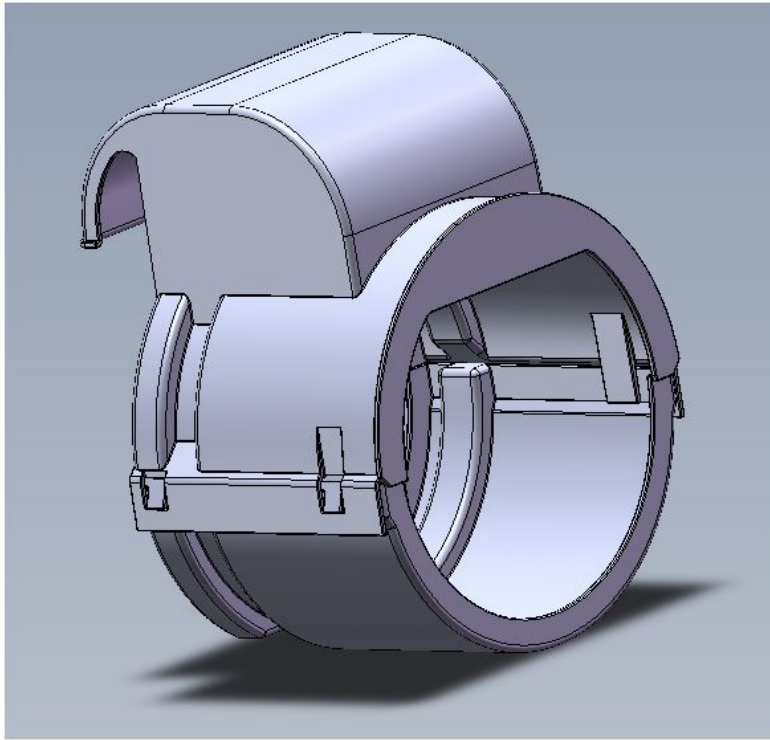
FPA Motor



Functions of the FPA Motor

- Drives the degassing pump
- Onboard driving circuits
- Is regulated by the degassing pressure

FPA Motor Cover

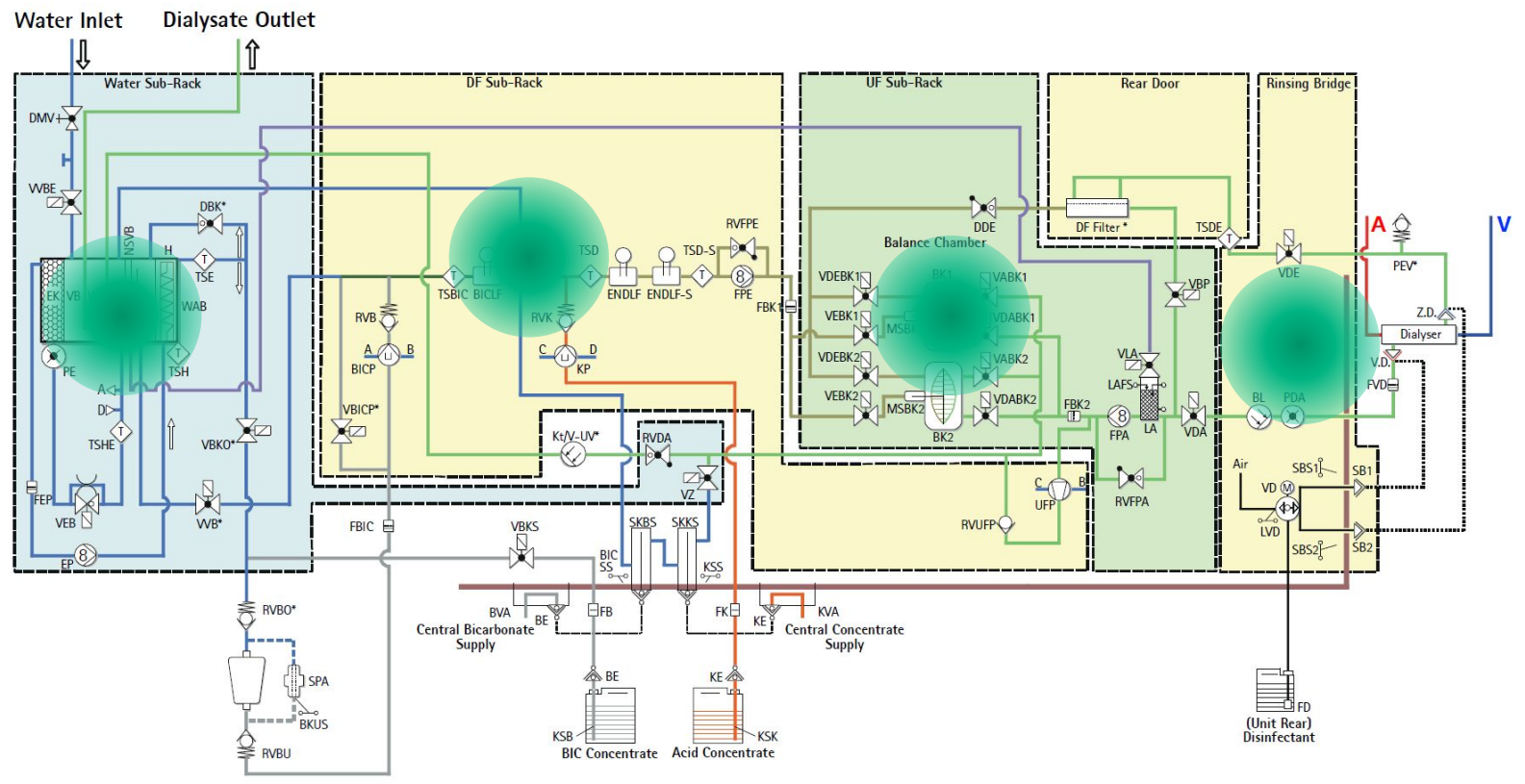


Functions of the FPA Motor Cover

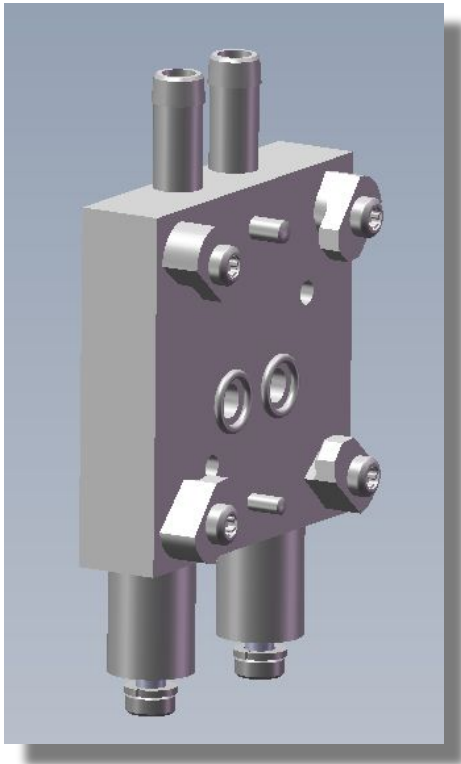
- Protects the moving parts of the motor
- Protects the electronics of the motor

Hydraulic Flow Diagram

Please choose a part of the flow diagram that you would like to look at.
Touch one of the green areas.



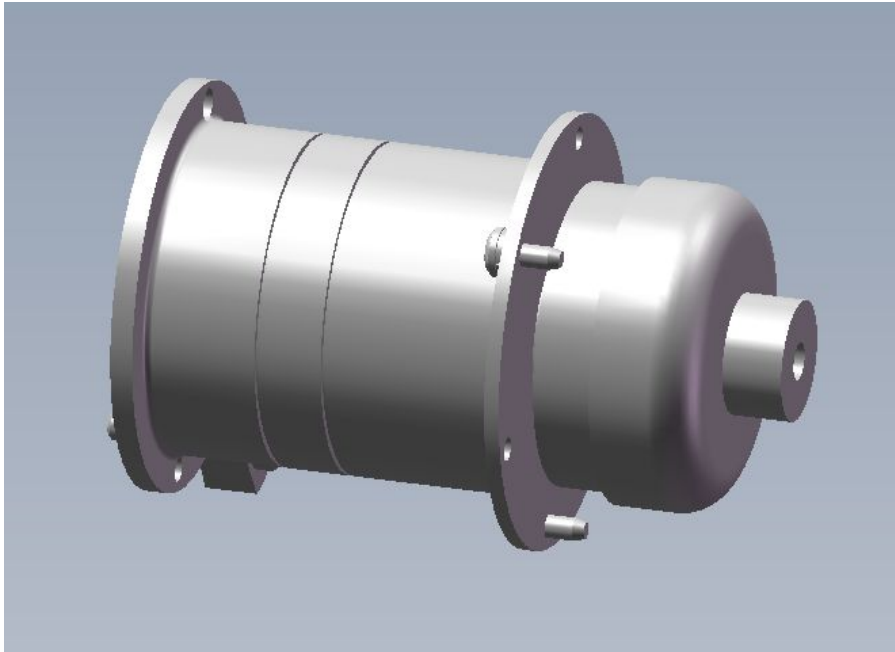
FPE Adapter Block



Functions of the FPE Adaptor Block

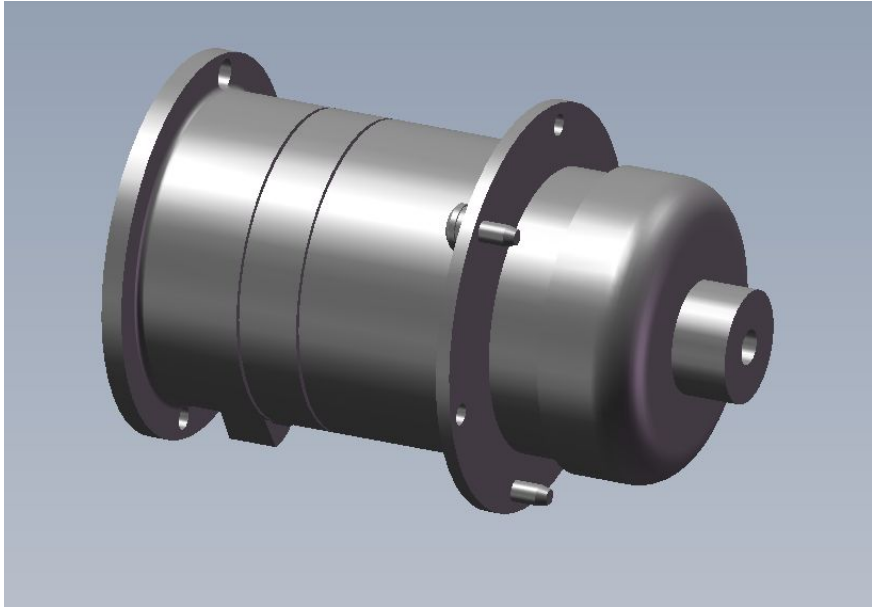
- Mounts the FPE
- Absorbs vibrations for noise reduction

FPE, Micropump Vers. 2



- Functions of the FPE Pump
- Creates a positive pressure to refill the balancing chamber
 - Pumps fluid with two interlocked gears
 - The gears are driven by a magnet
 - The pump can only pump water
 - A normal speed during treatment is ± 1000 rpm

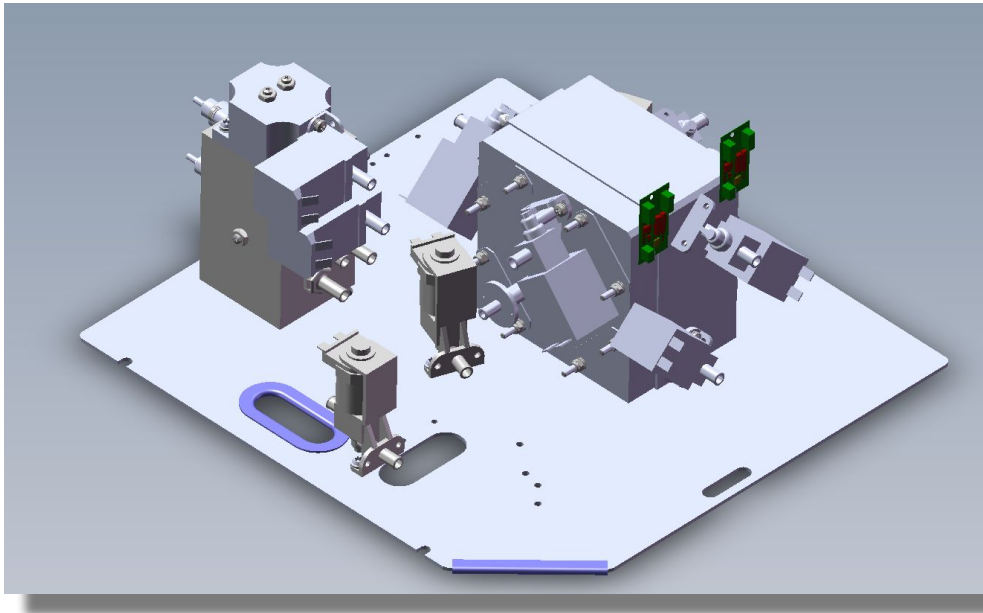
FPA, Micropump Vers. 1



- Functions of the FPA Pump
- Creates a positive pressure to fill the balancing chamber used dialysate
 - Pumps fluid with two interlocked gears
 - The gears are driven by a magnet
 - The pump can only pump fluid
 - A normal speed during treatment is ± 1000 rpm

UF Sub-Rack

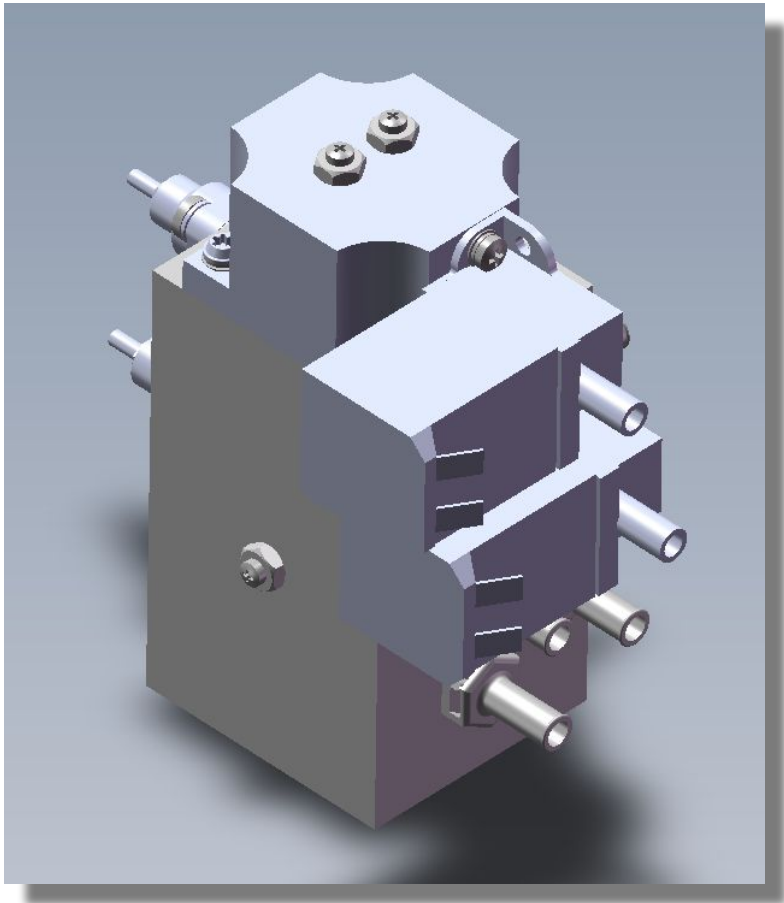
Please choose one of the components on the UF Sub-Rack.



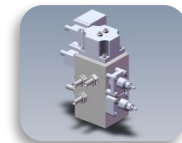
Functions of the UF Sub-Rack

- Contains the balancing chamber
- Is responsible for controlling the UF during dialysis
- Contains the air separator

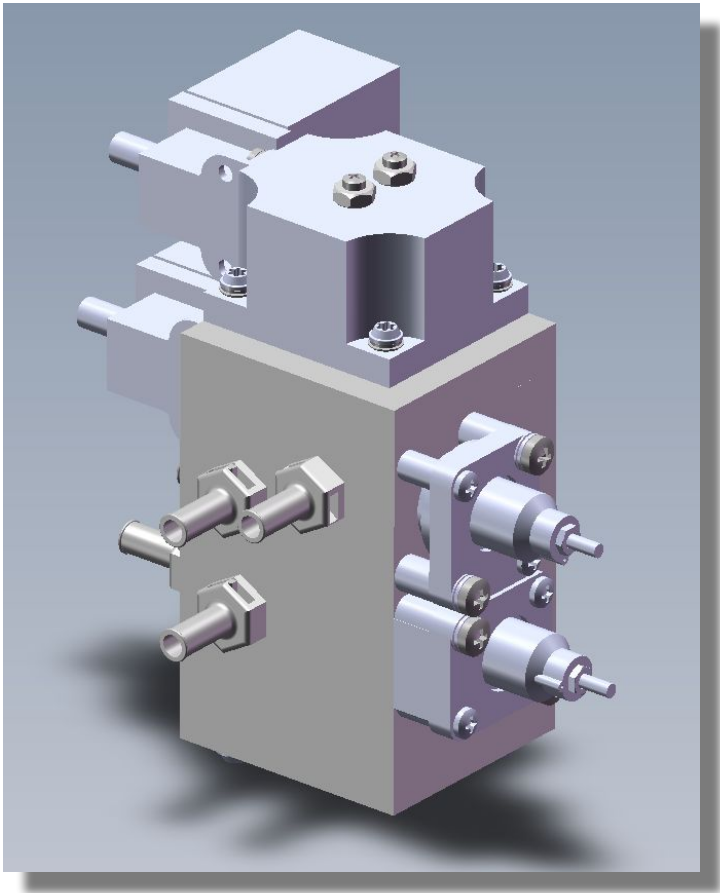
Air Separator



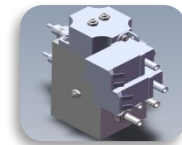
- Functions of the Air Separator
- Prevents air from entering the balancing chamber
 - Contains VLA and VBP
 - Contains DDE and RVFPA



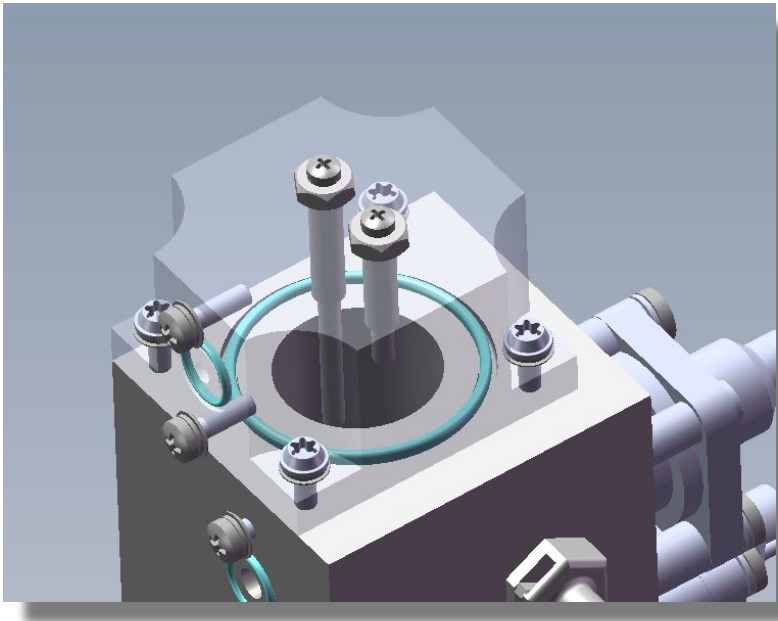
Air Separator



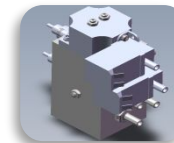
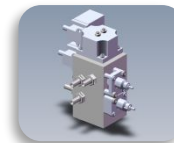
- Functions of the Air Separator
- Prevents air from entering the balancing chamber
 - Contains VLA and VBP
 - Contains DDE and RVFPA



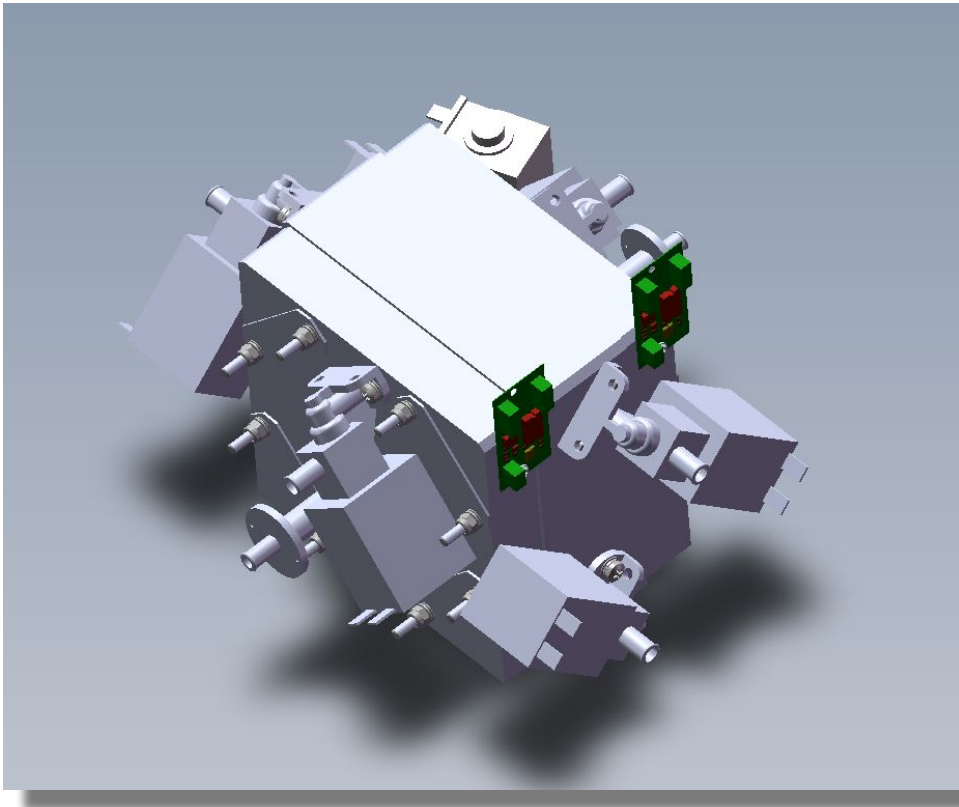
Air Separator



- Functions of the Air Separator
- There are 2 pins that sense the level of fluid in the air separator
 - VLA is opened when air is sensed on both sensors
 - VLA is closed when the top sensor senses fluid
 - The sensors do not work on pure RO Water

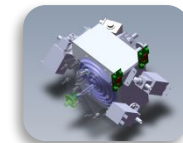


Balance Chamber



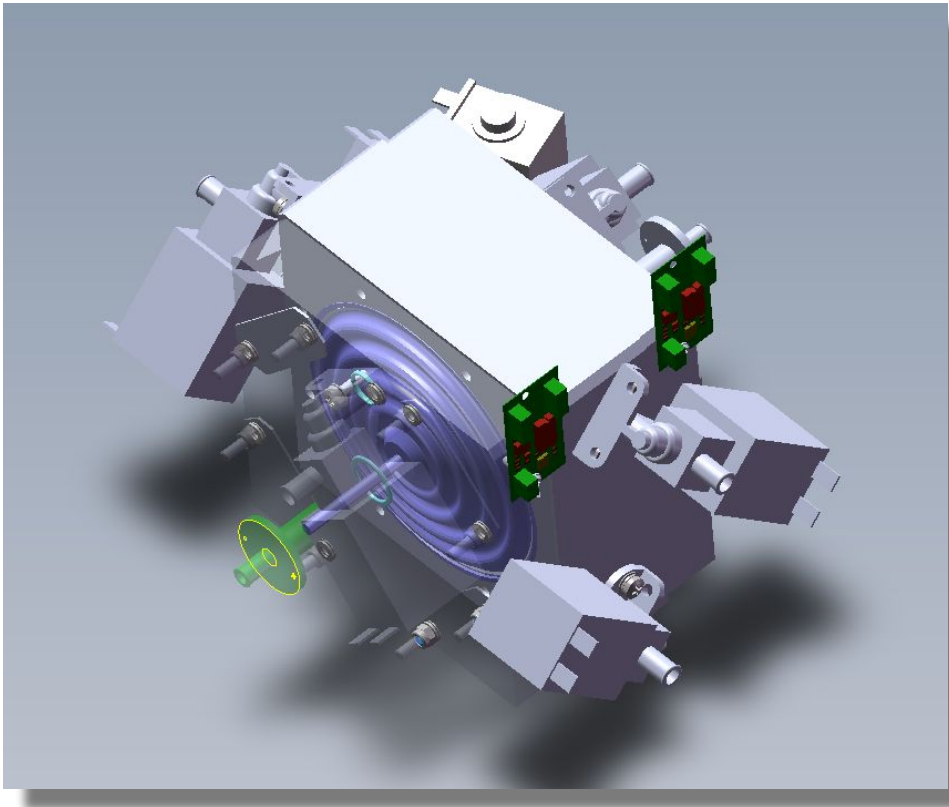
Functions of the Balance Chamber

- Consists of 2 chambers, with 8 valves
- Induction coils measure the membrane positions



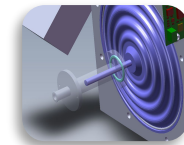
Back

Balance Chamber Membrane

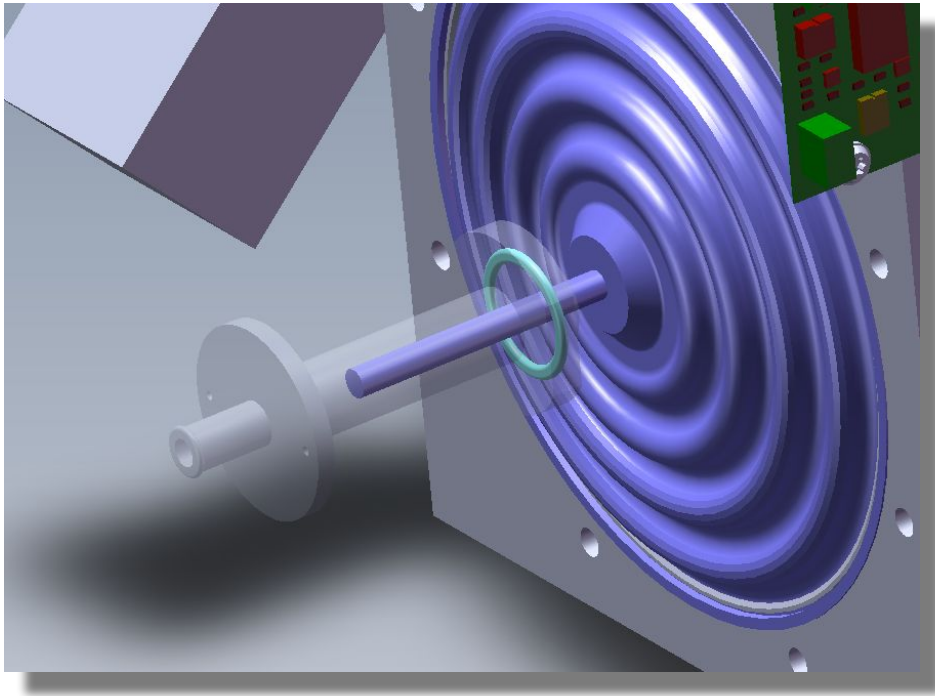


Functions of the Balance Chamber Membrane

- Separates fresh and used dialysate
- Controls incoming and outgoing fluid volume
- The position of the membrane is measured with MSBK



Membrane Position Sensor

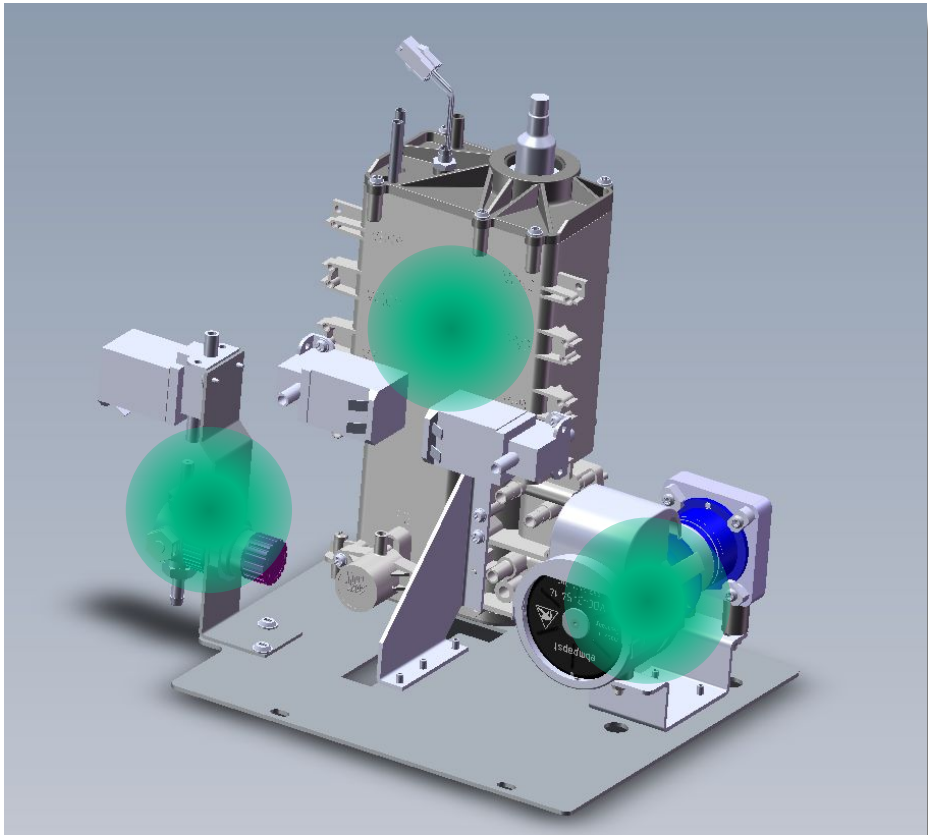


- Functions of the membrane position sensor
- Measures the position of the membrane
 - Uses induction to sense the position of a metal pin inside of the membrane
 - The pin moves in and out of the coil in the sensor
 - The result is shown in μS

Water Sub-Rack

Please choose one of the component groups of the water sub-rack.

- Functions of the Water Sub-Rack
- Controls incoming water amount
 - Degasses the water
 - Heats the water
 - Contains bicarbonate valves



Degassing Circuit

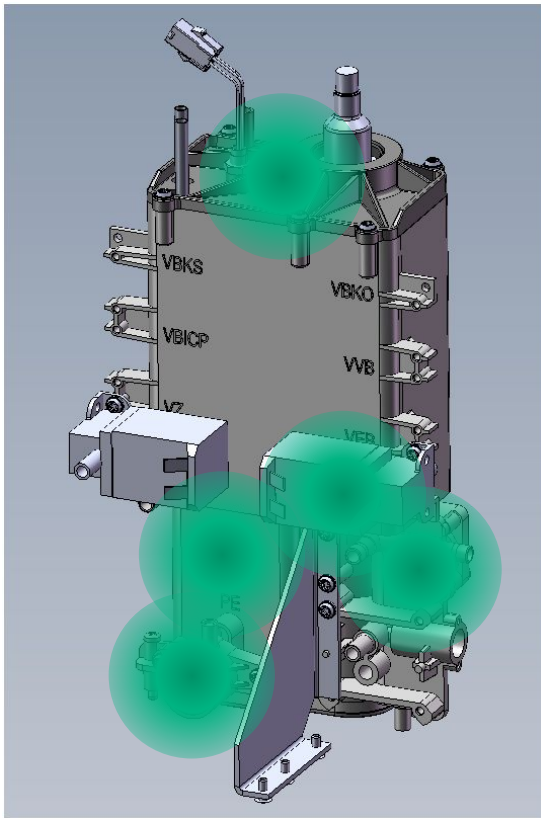
Heating Circuit

Back

Water Block

Please choose one of the components on the water block or the cover to look inside.

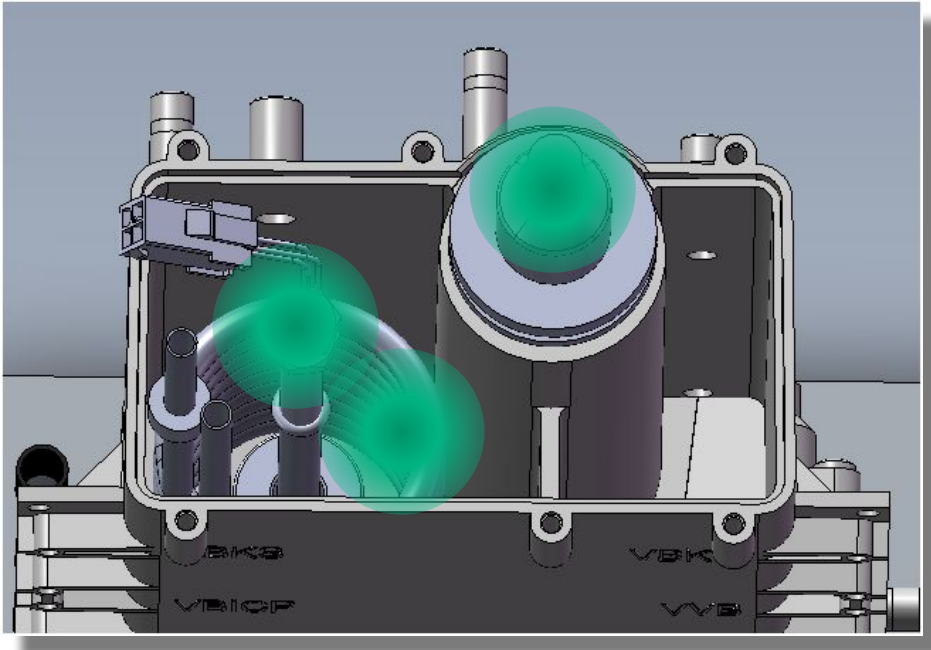
- Functions of the Water Block
- Mounting for all the valves
 - Contains the upline tank
 - Contains the degassing chamber
 - Contains the heating chamber



Upline Tank

Please choose one of the components in the upline tank.

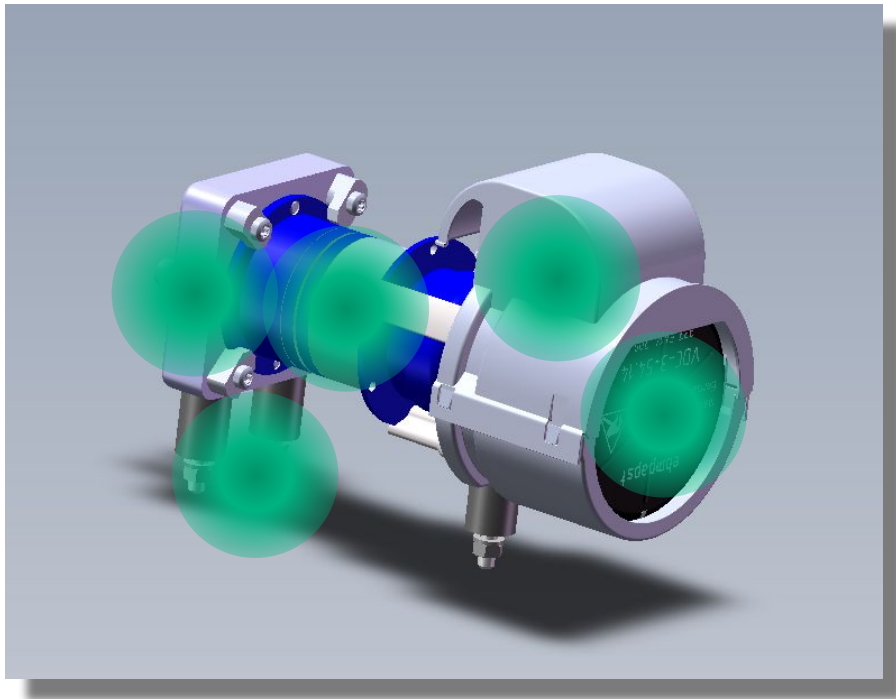
- Components in the Upline Tank
- Heat exchanger
 - Level sensor
 - Heater rod



Degassing Pump, Micropump Vers. 2

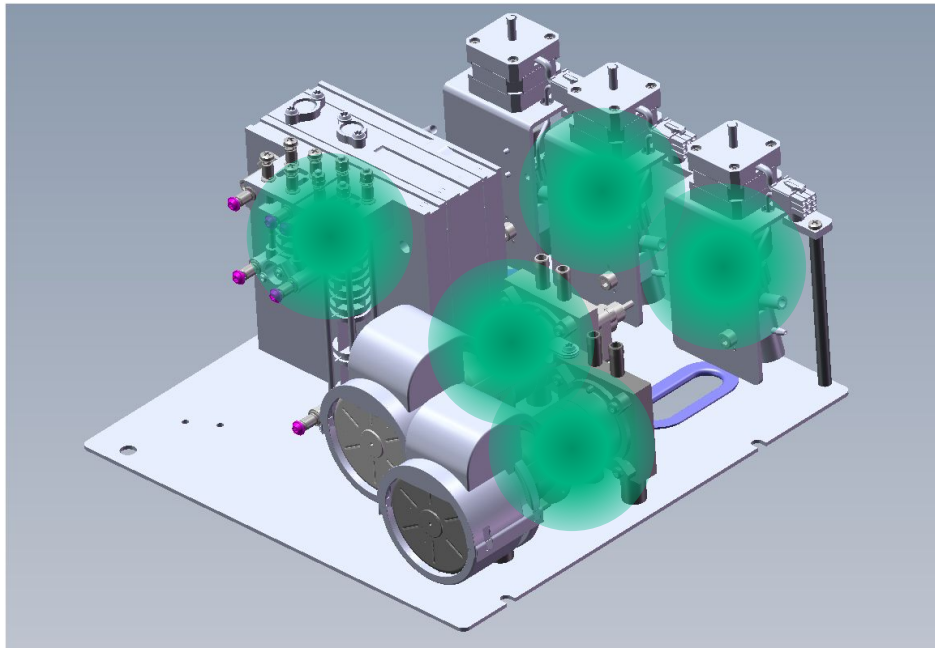
Please choose a part of the degassing pump that you would like to see.

- Functions of the Degassing Pump
- Degasses the water
- Creates a pressure of ± 525 mmHg



DF Sub-Rack

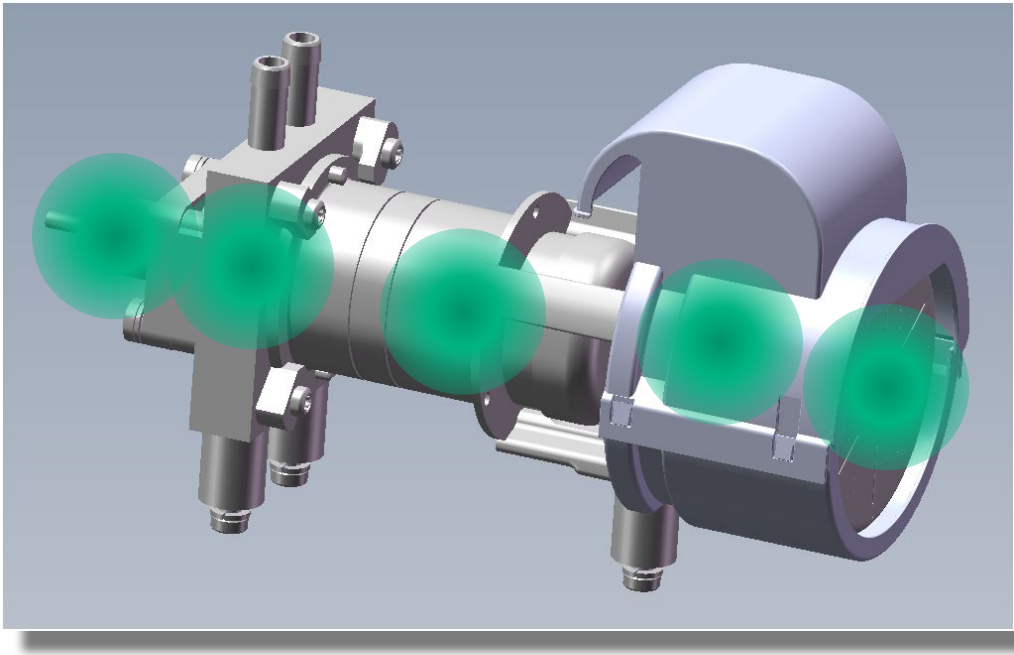
Please choose one of the components on the DF Sub-Rack.



- Functions of the DF Sub-Rack
- Contains the pumps that push water in and out of the balance chamber
 - Responsible for mixing the dialysate fluid
 - Contains the piston pumps
 - Concentrate pump
 - Bicarbonate pump
 - UF pump

Inlet Flow Pump

Please select a part of the FPE that you would like to see.

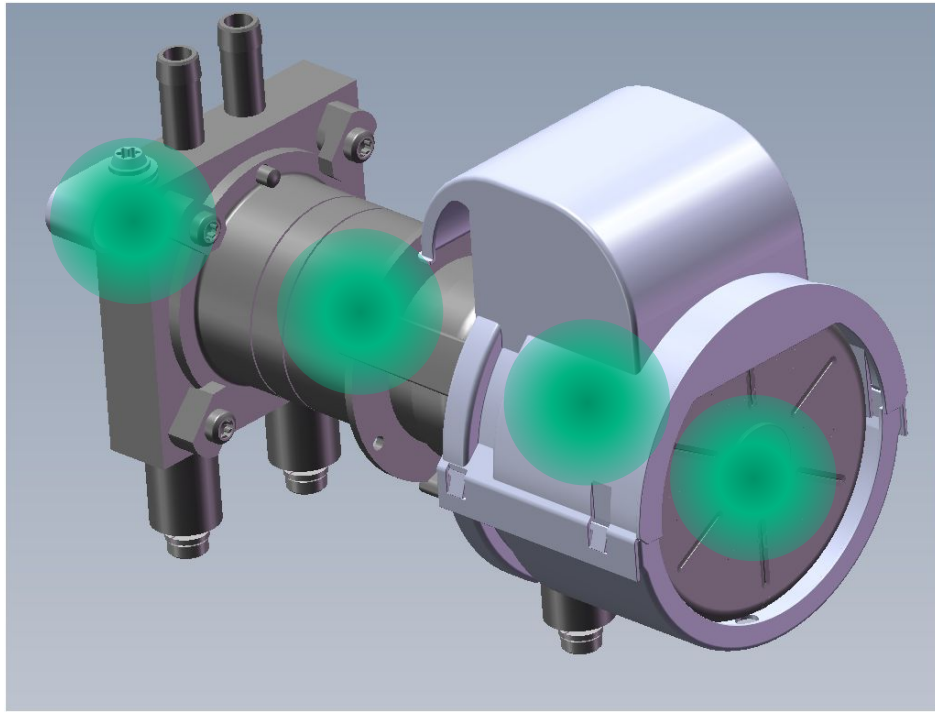


Functions of the FPE

- Pumps fresh dialysate into the balance chamber
- Pumps used dialysate to the drain
- Creates a high positive pressure for the DFS pressure test

Outlet Flow Pump

Please select a part of the FPA that you would like to see.



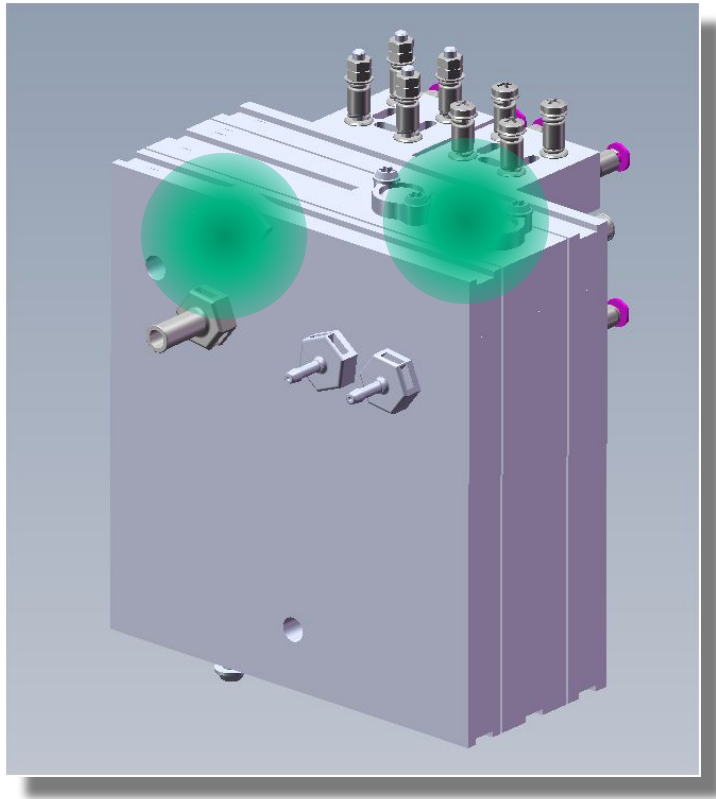
Functions of the FPA

- Pumps used dialysate from the dialyser to the balancing chamber
- Creates a negative pressure for the tests of the HDF Online system
- Creates a negative pressure for the VBICP test at the end of disinfection

DF Block

Please select one of the components on the DF block.

- Functions of the DF Block
- Measures conductivity
 - Measures temperature
 - Mixes the dialysate fluid



Inner View

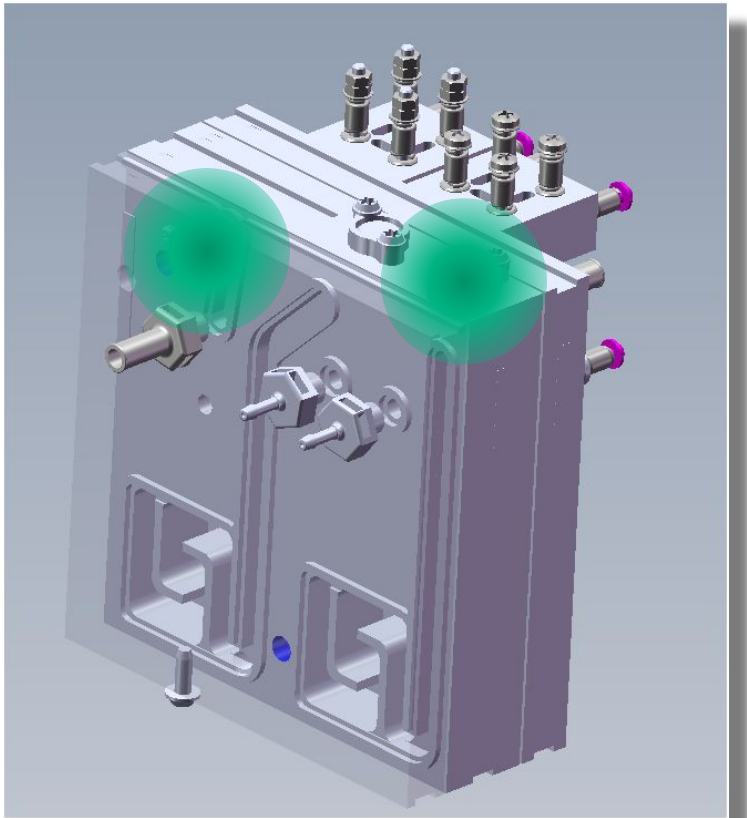
Rear View

Back

DF Block

Please select one of the components on the DF block.

- Functions of the DF Block
- Measures conductivity
 - Measures temperature
 - Mixes the dialysate fluid



Front View

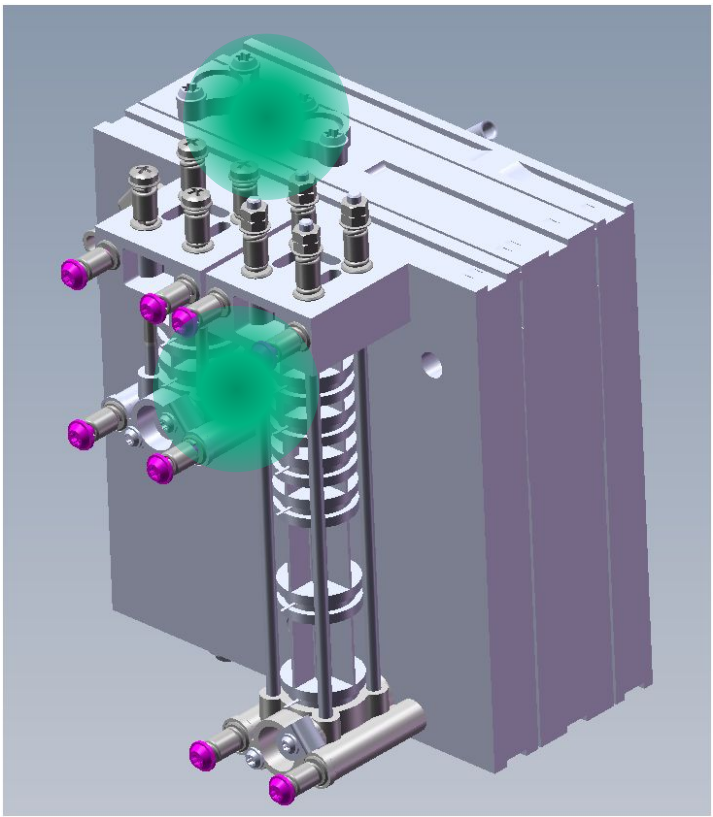
Rear View

Back

DF Block

Please select one of the components on the DF block.

- Functions of the DF Block
- Measures conductivity
 - Measures temperature
 - Mixes the dialysate fluid



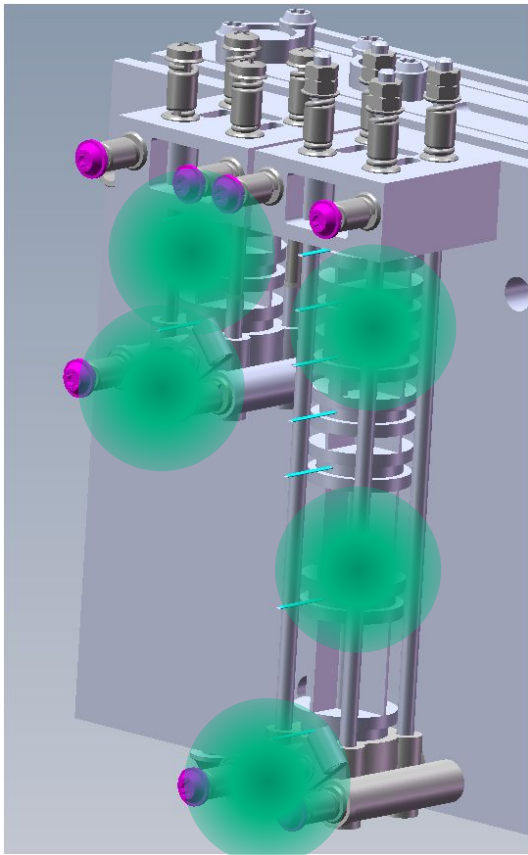
Inner View

Front View

Back

Conductivity Sensors

Please select a part of the conductivity cell that you would like to see.

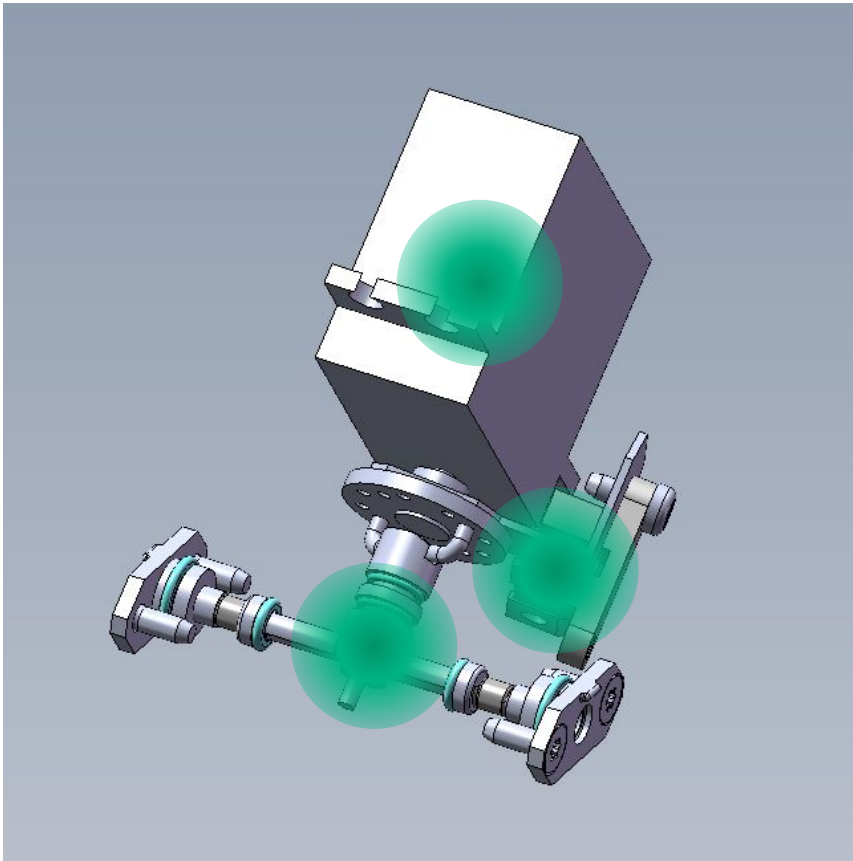


Functions of the conductivity cells

- ENDLF measures the final conductivity
- ENDLF_S supervises the ENDLF
- BICLF measures the bicarbonate conductivity
- Conductivity is dependent on temperature

Disinfection Valve

Please select a part of the disinfection valve.



Functions of the Disinfection Valve

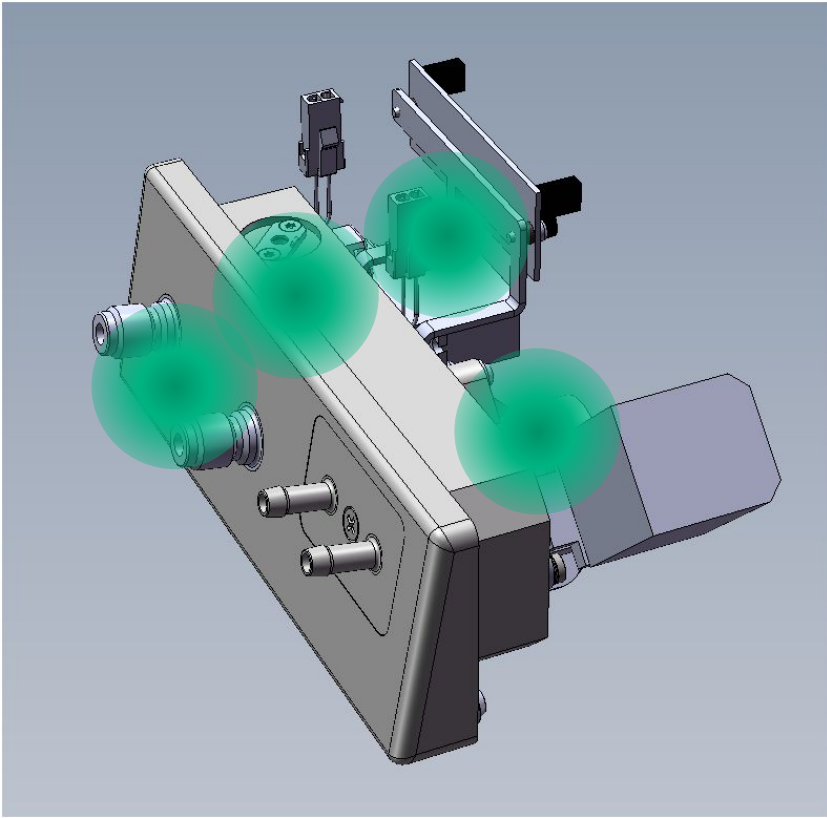
- Opens when the machine needs to suck in disinfectant
- Closes to allow air back into the disinfection tube
- Is controlled by a servo motor

Back

Rinsing Bridge

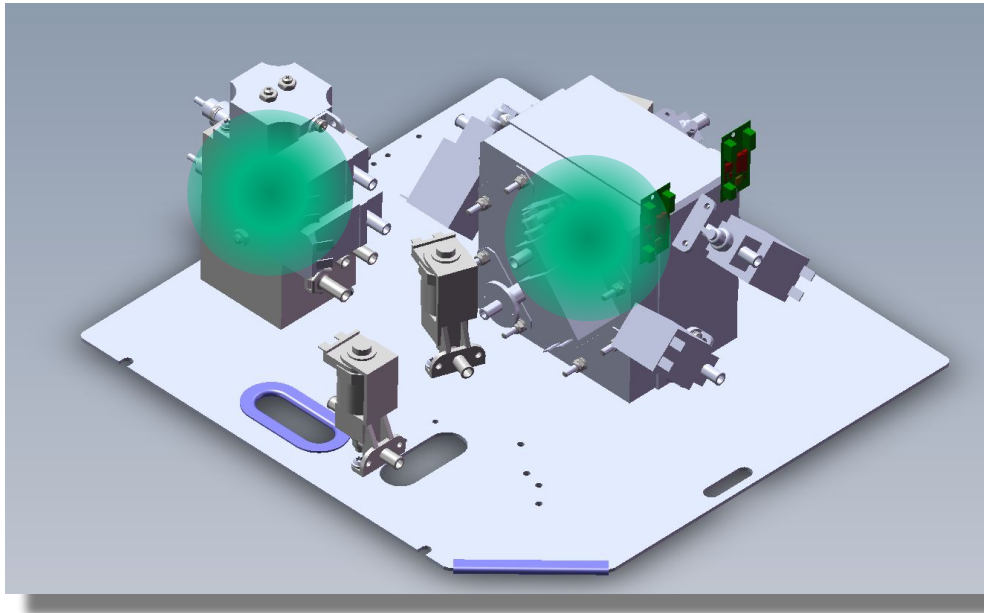
Please choose one of the components on the rinsing bridge.

- Functions of the Rinsing Bridge
- Contains the disinfection valve
 - Contains the dialysate pressure sensor
 - The Dialyser couplings are connected to the rinsing bridge



UF Sub-Rack

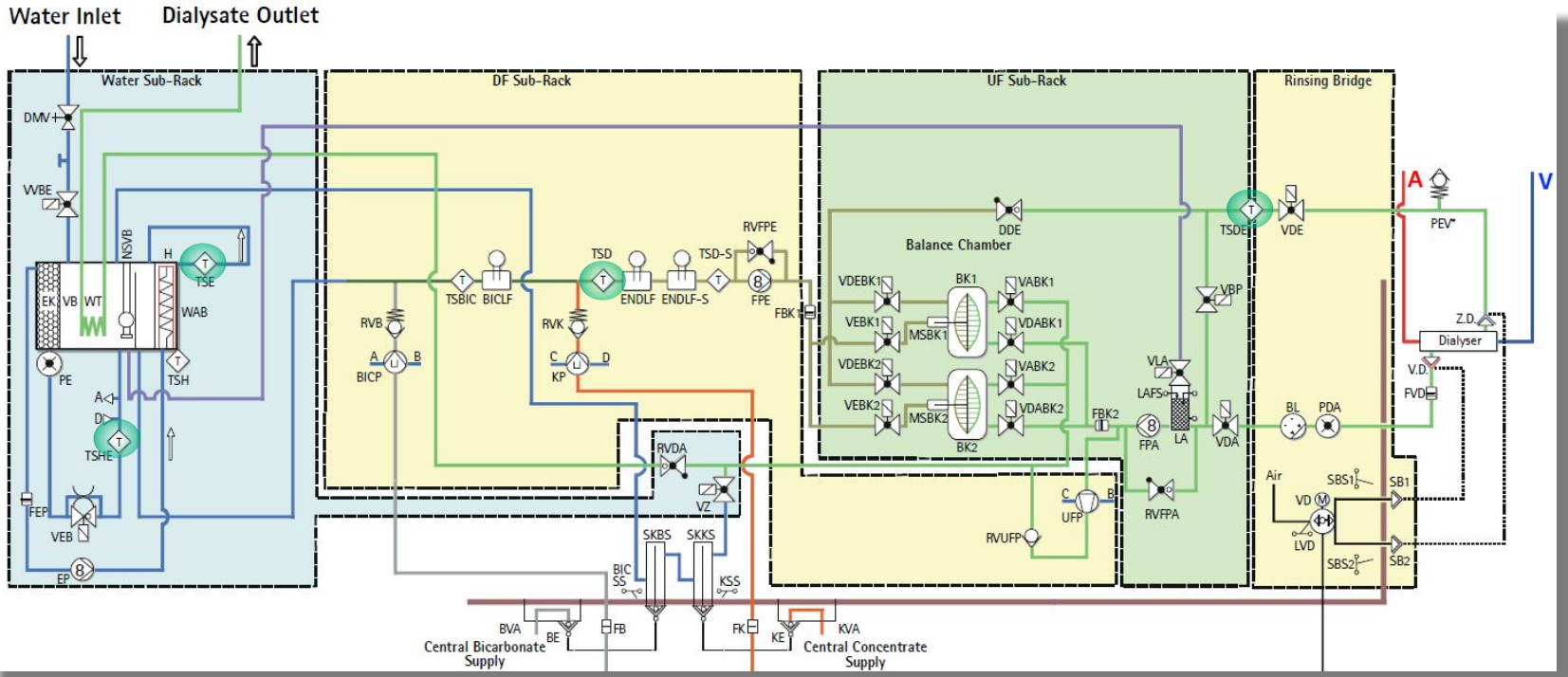
Please choose one of the components on the UF Sub-Rack.



Functions of the UF Sub-Rack

- Contains the balancing chamber
- Is responsible for controlling the UF during dialysis
- Contains the air separator

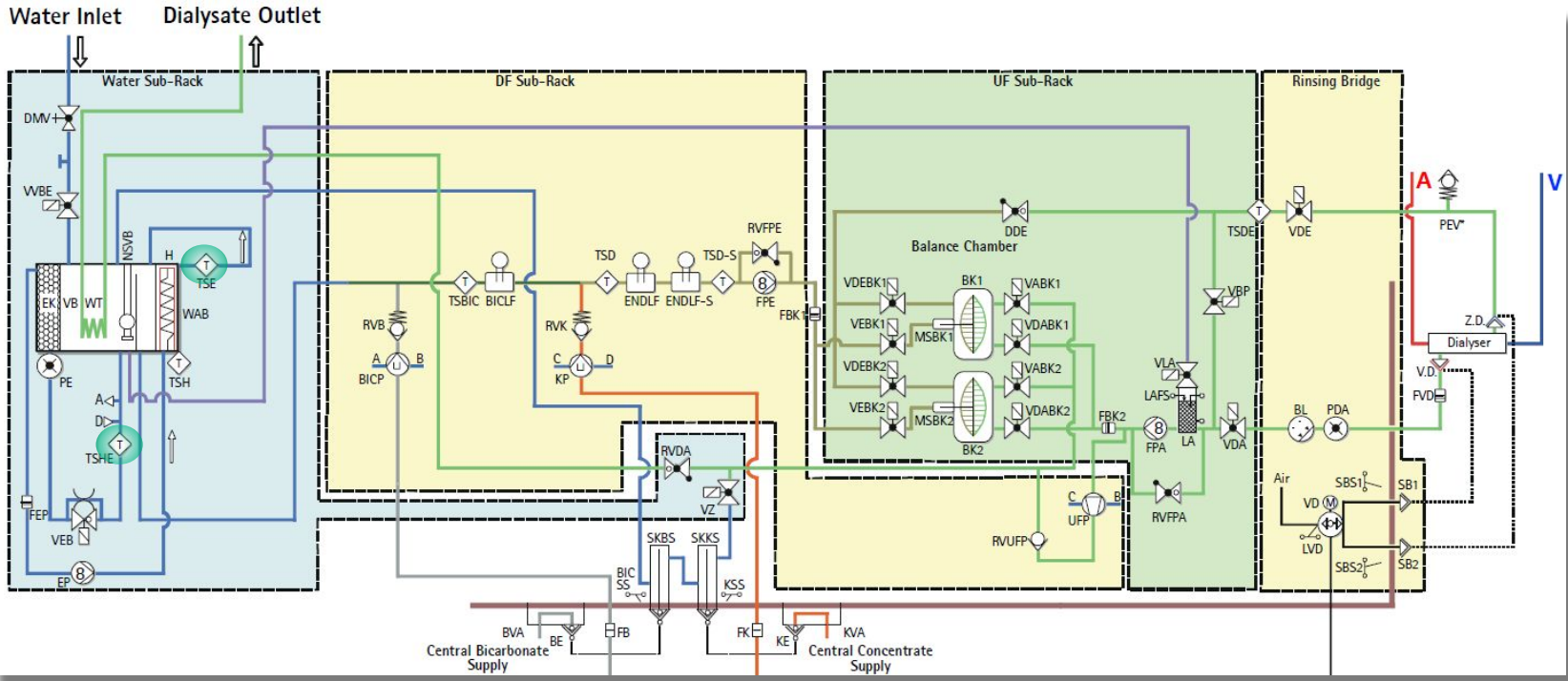
Temperature Regulation



The temperature regulation is done by the following components

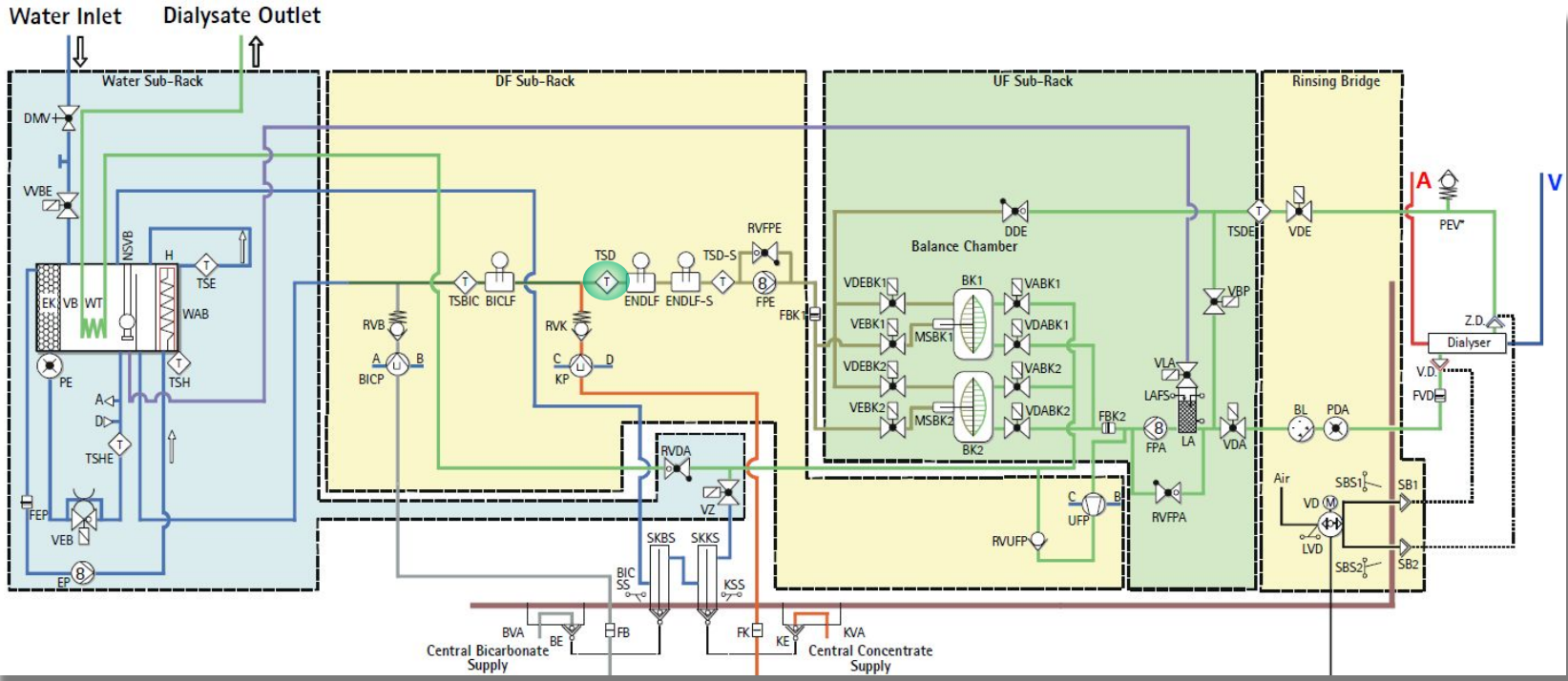
- TSE
- TSHE
- TSD
- TSDE

Temperature Regulation



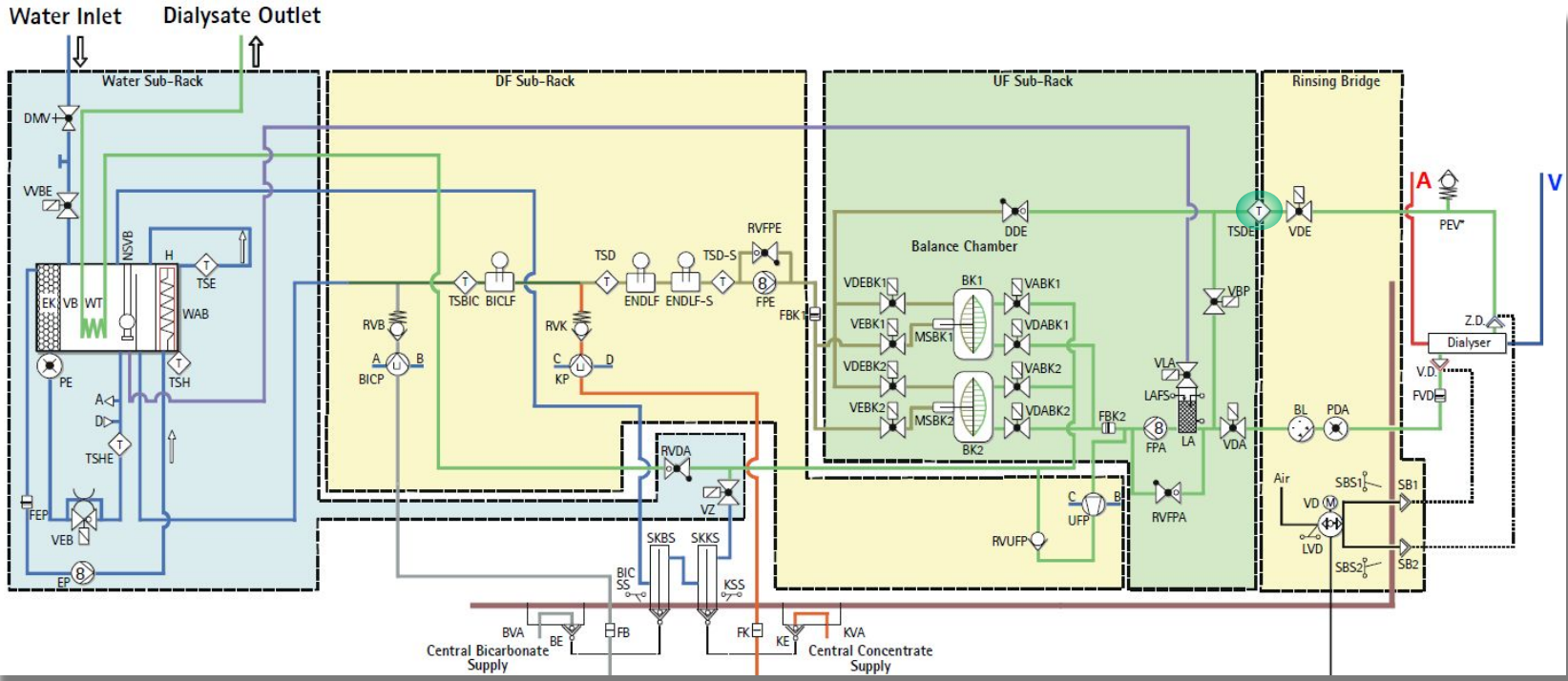
The first temperature regulation is done with TSE. This sensor is used until the temperature is stable. If a sudden flush of cold water reaches TSHE, the heater will be given an extra boost to compensate.

Temperature Regulation



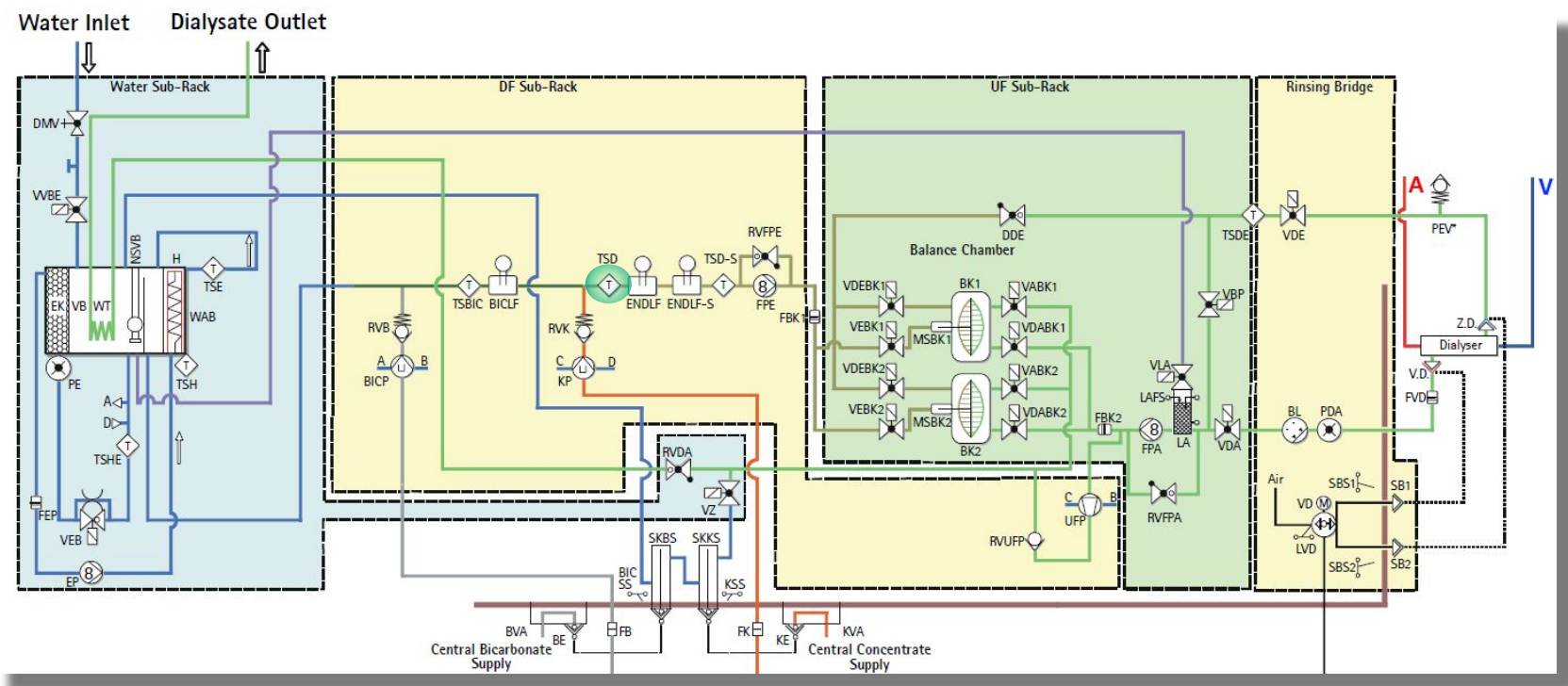
Once the temperature is stable at TSE, the controller starts to regulate the temperature with TSD.

Temperature Regulation



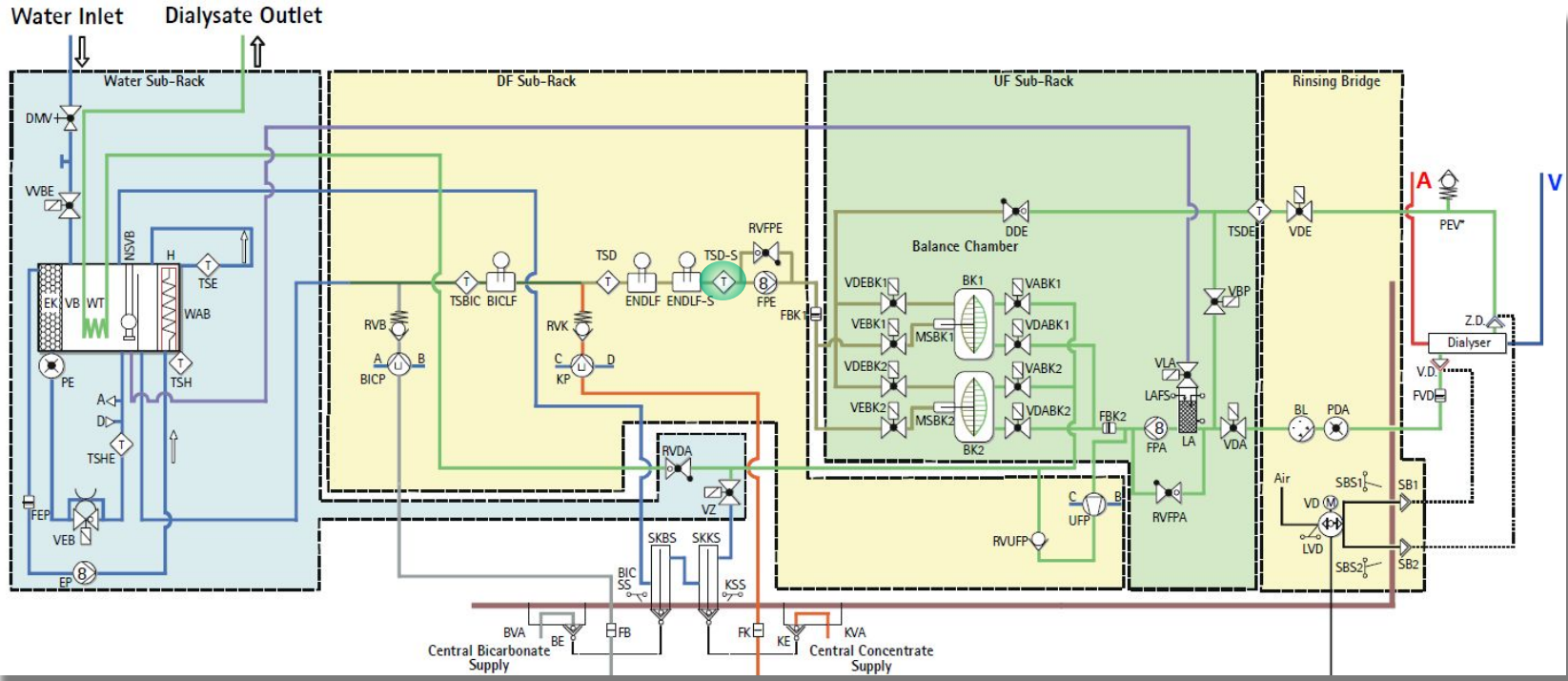
After approx. 10 minutes the machine will use TSDE to regulate the final temperature. This ensures a stable temperature at the dialyser throughout the therapy.

Temperature Regulation



If the machine is switched to bypass, TSD will take over regulation of the temperature, because there is no flow through TSDE. Regulation by TSDE is restored once the temperature is stable again at TSD.

Temperature Regulation



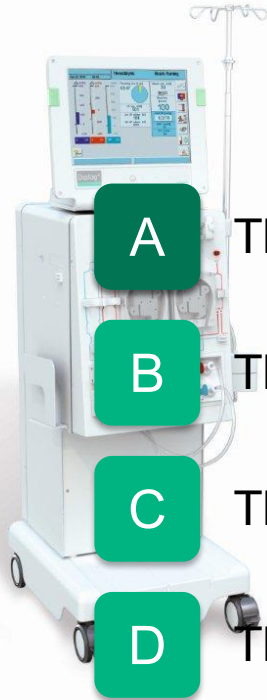
At all times during the therapy TSD-S is active to ensure patient safety. The machine will switch to bypass if the temperature exceeds 41°C at any time.

Dialog+ Hydraulic Test

Welcome to the Dialog+ Component Overview. Here you will have the opportunity to look at different components and find out what their functions are, and how they work together.

Question 1

What component is not part of the water sub-rack?



- A** The Disinfection Valve
- B** The Degassing Valve
- C** The Degassing Temperature Sensor
- D** The Water Inlet Valve

Next

Dialog+ Hydraulic Test

Question 2

How many temperature sensors are in the machine?

- A 4
- B 5
- C 6
- D 7

Next

Dialog+ Hydraulic Test

Question 3

What is the status of the degassing valve during disinfection?

- A Closed
- B Open
- C Switches between open and closed
- D Only open for short times

[Next](#)

Dialog+ Hydraulic Test

Question 4

Which pump is responsible for pumping fresh dialysate fluid into the balance chamber?

- A Flow Pump Inlet
- B Flow Pump Outlet
- C Flow Pump Inlet and Flow Pump Outlet
- D Degassing Pump

[Next](#)

Dialog⁺ Hydraulic Test

Question 5

What is the pressure of RVDA set to on a standard and Online machine?

- A Standard: 400mmHg, Online: 400mmHg
- B Standard: 500mmHg, Online: 400mmHg
- C Standard: 400mmHg, Online: 500mmHg
- D Standard: 500mmHg, Online: 500mmHg

Next

Dialog⁺ Hydraulic Test

Question 6

What is the approx. speed for EP, FPE, FPA during therapy?

- A** EP: 1500 rpm, FPE: 1800 rpm, FPA: 1800 rpm
- B** EP: 2000 rpm, FPE: 1000 rpm, FPA: 2000 rpm
- C** EP: 2000 rpm, FPE: 1000 rpm, FPA: 1200 rpm
- D** EP: 2000 rpm, FPE: 1000 rpm, FPA: 1000 rpm

[Next](#)

Dialog+ Hydraulic Test

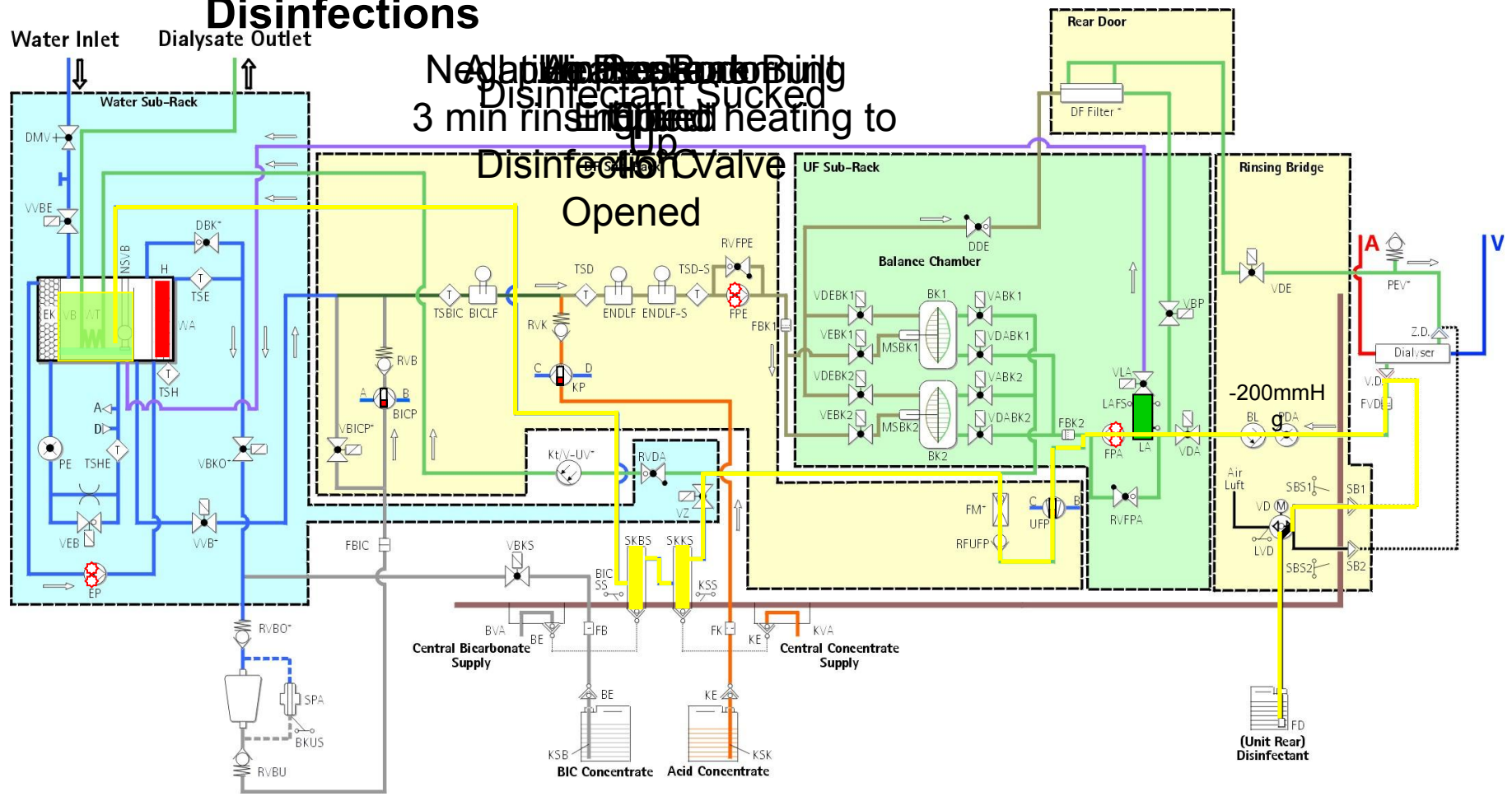
Test Completed

Press the Show Results button to find out how many questions were answered correctly.

Restart Test

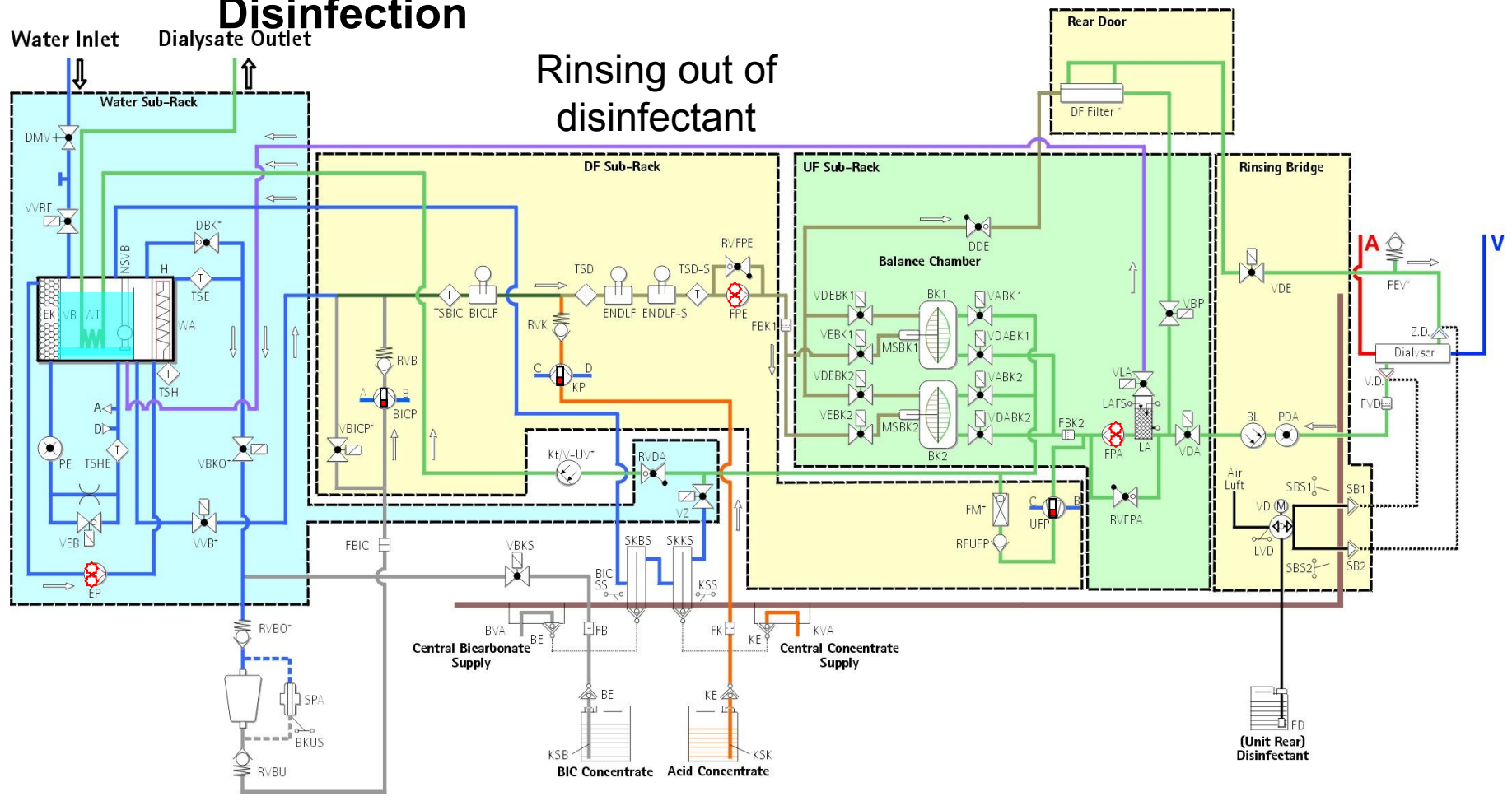
Back

Chemical Thermal Disinfections



Chemical Thermal Disinfection

Rinsing out of disinfectant



Balance Chamber Concept

After approx. 10 minutes the machine will use TSDE to regulate the final temperature. This ensures a stable temperature at the dialyser throughout the therapy.

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