Aquaboss®

Dialysis water purification
During hemodialysis treatment patients are exposed to large quantities of dialysis fluid, which is comprised of more than 99.3% of water, only separated from the patient's blood by a non-selective dialyzer membrane. Clinical data show that contaminants in dialysis water are contributory factors for acute and chronic problems as well as severe injuries to hemodialysis patients. It is estimated that many more incidences go unreported because chronic symptoms and side-effects are often related to problems secondary to ESRD patients. Due to this, water quality is an essential key factor in modern dialysis.

In addition to striving to achieve the best possible treatment outcome, healthcare systems face financial strain all over the world. Depending on the system configuration, pure investment costs for water treatment systems only comprise approximately one quarter of the total life cycle costs. Due to this, it is an important aim to strive for innovative and flexible solutions to reduce the total life cycle costs and to ensure a cost effective dialysis.

Lauer has been a company completely focused on dialysis water purification for almost 20 years. The Aquaboss® portfolio differentiates itself from its competition through superior technology and many patented features.

Today, Lauer is a B. Braun company. Both companies have enjoyed a strong partnership in the dialysis market for a number of years. The acquisition marks B. Braun’s response to increasing demands for dialysis products and services from a single source. Together with the Aquaboss® portfolio, B. Braun Avitum strives to offer the best possible system solution, by always focusing on the customers’ key drivers: Increase patients’ quality of life and reduce the total cost of ownership.
Innovation and highest water quality

- **Aquaboss® Reverse Osmosis Systems**
  - Stainless steel quality
  - Dead space free design
  - Leakage monitoring
  - Modular system
  - Compact device
  - Water saving technology

Reverse Osmosis Systems

<table>
<thead>
<tr>
<th></th>
<th>I Single Stage</th>
<th>Stations (with 500 ml/min)</th>
<th>II Double Stage</th>
<th>Stations (with 500 ml/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RO Dia LCC</td>
<td>210-900 l/h at 6 °C</td>
<td>6-25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO Dia C</td>
<td>500-3000 l/h at 6 °C</td>
<td>14-90</td>
<td>500-1600 l/h at 6 °C</td>
<td>14-45</td>
</tr>
<tr>
<td>RO Dia</td>
<td>1800-3600 l/h at 6 °C</td>
<td></td>
<td>500-1600 l/h at 6 °C</td>
<td></td>
</tr>
</tbody>
</table>

Generally Aquaboss® reverse osmosis systems are characterized by an efficient water consumption. Innovative water saving technology enable best use of freshwater resource. In addition to this, the RO Dia / RO Dia C series are available as complete heat disinfectable reverse osmosis systems. This allows a chemical free disinfection for high patient safety and environmental compatibility.
**Impulse Backwashing (Lauer Patent*)**

Raw water contains dissolved and undisolved substances. Over time, those substances will manifest on the RO membrane, bearing the risk that bacteria will grow through the membrane to release endotoxins. Furthermore, the membrane will become blocked and therefore reduce the permeate capacity. The impulse backwashing (Lauer Patent) is an option for all Aquaboss® RO devices. An innovative flow technology significantly reduces deposits on the RO membrane. This actually leads to two advantages: a high permeate quality as well as a stable permeate production capacity.

All Aquaboss® RO devices equipped with the impulse back-washing function are labelled as Eco versions, e.g. Eco RO Dia C.

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**Double Stage RO for all Center Sizes**

Single Stage RO Systems are a reliable solution for all standard treatment applications. However, Single Stage RO Systems are often not able to reduce specific ions such as nitrate or aluminum under the limited value. A second RO Stage further reduces those substances and thus results in higher permeate quality and an excellent solution to perform HDF or High-Flux therapies. In addition to this, the concentrate of the second RO Stage is recirculated to the first stage resulting in no water loss and thereby lower running costs. The Aquaboss® double stage systems provides a 100% redundancy the same as that delivered by two independent single stage systems. Due to this Aquaboss® double stage systems reduce a breakdown and interruption of dialysis treatment to a minimum.
Innovation and highest water quality

**Hot Total (HT)**

Today, hot disinfection is often seen as an integral part of modern dialysis systems. However, hot disinfection should cover the whole water treatment system, including the distribution system to the dialysis machine and the RO device. Single Stage and Double Stage Aquaboss® RO devices go in line with the technology to also perform hot disinfection on the RO device, including all elements and parts of the system, from the break tank up to the point of use.

**Dead Space Free Secondary Ring Piping (Lauer Patent*)**

To ensure a high permeate quality it is crucial to have a complete and continuous flow in the whole water treatment system. In this case, stub hose connections from the primary ring piping to the dialysis machine are a weak point of the system, as these are dead spaces. Stagnant permeate triggers the proliferation of a biofilm, resulting in a retrograde contamination of the primary ring. The dead space free Aquaboss® secondary ring piping (Lauer Patent) always ensures a constant permeate flow up to the dialysis machine.

* P 43 41 456.7-09 and other patents or patent applications
Dialysis time / dialysis free time

Hot disinfection 90°C

An increasing demand of hot disinfection goes in line with different system solutions. One approach was the Aquaboss® Hot Rinse Smart 300/500, which is a hot tank disinfection system. All tank systems have stagnant permeate and dead spaces. Consequently, the Aquaboss® Hot Rinse flow through heater was successfully launched to ensure a dead space free system.

Hot disinfection 150°C

Steam Sterilization / AutoClav

By definition, disinfection is the elimination of pathogenic bacteria. Even though hot disinfection is a good solution for inactivating bacteria, it is a matter of fact that 90°C hot water cannot inactivate all dangerous pathogens. The Aquaboss® AutoClav Solution provides 150°C steam sterilization and currently is the world’s only safe solution for eliminating all microorganisms (bacteria, viruses, fungi) and prions in the field of dialysis. Aquaboss® AutoClav offers a sterile system from the time of installation. An autoclaving is performed once a year as a safety measure as part of an extended maintenance agreement, which results in lower follow-up costs compared to a conventional system.

<table>
<thead>
<tr>
<th>Resistance level</th>
<th>Organism/pathogen</th>
<th>Temperature in °C (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Pathogenic streptococci, listeria, polio viruses</td>
<td>61.5</td>
</tr>
<tr>
<td>II</td>
<td>Most vegetative bacteria, yeasts, mold, all viruses except for Hepatitis B</td>
<td>80</td>
</tr>
<tr>
<td>III</td>
<td>Hepatitis B viruses, most fungal spores</td>
<td>90°C hot disinfection</td>
</tr>
<tr>
<td>IV</td>
<td>Bacillus anthracis spores</td>
<td>100</td>
</tr>
<tr>
<td>V</td>
<td>Bacillus stearothermophilus spores</td>
<td>105</td>
</tr>
<tr>
<td>VI</td>
<td>Prions</td>
<td>121</td>
</tr>
<tr>
<td></td>
<td></td>
<td>137</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150°C steam sterilization</td>
</tr>
</tbody>
</table>
Cost effectiveness

- Complete Stainless Steel Construction
  Highest durability/longest lifetime!
- Double Stage
- Impulse Backwashing

Aquaboss® RO devices are high quality products and are all manufactured from stainless steel. They are extremely reliable and have an outstanding long life cycle. As water costs comprise approximately one quarter of the total life cycle costs, the water consumption of the device needs to be seen as a crucial factor. Due to its innovative technology, Aquaboss® RO devices reduce the water consumption by approximately 40%, compared to competitor systems. In addition to this, life cycle costs will be reduced by a longer membrane usage (impulse backwashing) and a minimum need of chemical disinfections.

- Flow Through Heater

Tank systems for hot disinfection have stagnant permeate. Therefore, it is necessary to always maintain the permeate temperature at 90°C to reduce the risk of bacterial growth. In contrast to this, a flow through heater ensures continuous recirculation and only heats up the permeate during hot disinfection. Consequently, the Aquaboss® Hot Rinse Smart reduces the energy costs against a tank system by up to 80%.

- Process Visualization & Optimization

Aquaboss® Vision is an online monitoring system for all Aquaboss® medical devices. The software provides for the visualization of operating parameters and displays the status and digital readings of all the sensors. The possibility to exchange log files and to track the operation status online leads to quick fault finding and error prevention. Thus Aquaboss® Vision helps to provide cost-effective maintenance as well as an optimized and paperless process for the user.
## Flexibility

<table>
<thead>
<tr>
<th>I Single Stage</th>
<th>Eco (including impulse back washing)</th>
<th>II Double Stage</th>
<th>Hot Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Patient Unit</td>
<td>70 l/h at 10°C</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>RO Dia LCC</td>
<td>210–700 l/h at 6°C</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>RO Dia C</td>
<td>700–3600 l/h at 6°C</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>RO Dia</td>
<td>700–3600 l/h at 6°C</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

### Modular System

The Aquaboss® RO portfolio not only enables the user to easily expand the system but also ensures the upgradability of the RO device. For this reason, it is feasible to start with a state-of-the-art Single Stage RO and upgrade the system – e.g. in case of raising standards – to the next quality level later. As a result, the Aquaboss® portfolio shows a high grade of flexibility and already meets tomorrow’s demands today.

### Choice of Different Ring Loop Solutions

Depending on customer needs and requirements, the Aquaboss® portfolio includes all types of materials – from the conventional PVCU and PEX up to the stainless steel gold standard. In addition, the user has a choice of two different ring loop solutions. The first option is a conventional stub connection, whereas the second choice ensures a dead space free and complete permeate recirculation up to the dialysis machine.

### Media Providing Centers

The Aquaboss® portfolio offers a wide range of different media providing panels. The Aquaboss® Flex represents Lauer’s latest innovation, providing a permeate supply to the dialysis machines without hoses and tubes on the ground. This results in an increased hygiene of the dialysis center. An additional advantage will be a clear separation between permeate and drain. Furthermore, the user can easily choose between different concentrates by using a selection switch.
Lauer – B. Braun’s partner for complete water treatment solutions

- Aquaboss Dead Space Free Secondary Ring Piping
- Media Providing Centers
- Different Disinfection and Sterilization Solutions

Lauer

- Professional consultation and planning of the overall concept
- Pre-treatment
- Modular Reverse Osmosis Systems
- Disinfection and sterilization options
- Dialysis water ring piping solutions
- Central concentrate supply facilities
- Media providing centers
- Process visualisation
- Water accessories (e.g. online hardness monitoring)
- Technical service
- Training

Central Concentrate Supply
Lauer – B. Braun’s partner for complete water treatment solutions

- Pre-treatment
- Modular Reverse Osmosis
- Process Visualisation
- Dialysis unit
- Dialysis machines
- Data Management System
- Dialyzers
- Blood tubing systems
- Dialysis concentrates
- Rinsing solutions
- Complete range of disposables
- Technical service
- Training