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Lab Water Applications A to Z

Laboratory Water Applications in the Fields of Academia, Biopharma, Pharma, Biomedical Sciences etc.

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Abstract

In the daily work of laboratories, laboratory water is the most used solvent. Used in almost all laboratories, it is an important component of a wide range of applications such as preparation of buffers, samples, media and other solutions, and as feed water for laboratory devices. With a laboratory water purification system, you have access to on-demand, consistent, reliable and high-quality water. Depending on your application, you will need different types of water to have consistent and reliable results. This guide helps you to determine what type of water is needed for different applications.

Within the Sartorius Arium® family, you can find the correct system for your application and laboratory. The system itself is modular, meaning you can select the used purification technologies required for your optimized application. Combine your Arium® system with accessories for even more flexibility and functionality.

Find out more about our solutions: www.sartorius.com/en/products/water-purification

Lab Water Applications

Lab water is the most common solvent used in laboratories and is used in a wide range of applications such as preparing blanks, buffers, samples, media and other solutions, as well as feed water for equipment such as washing machines, autoclaves and ice machines. Sartorius AG manufactures its own water purification systems (Arium®). The Arium® family has several variations and can effectively accommodate your laboratory's requirements and provide you with high quality, on-demand laboratory water.

In this guide, we describe common applications as well as providing recommendations for which Arium® system would be suitable. The recommendations also consider feed water source and daily volume need. Please keep in mind that the applications described in this guide are just a small selection of applications that require laboratory water. If you have several applications which require different quality water, make sure to have a system that produces the needed quality for the more critical application,

which has higher requirements. This is because, generally, the higher quality water will also be suitable for applications with lower requirements, while the same cannot be said the other way around. However, this will always depend on your specific applications in your laboratory. Another option is to choose one of our combined water purification systems (Comfort I & II or Mini Plus) that can produce two water qualities with the same system using tap water as its feed source.

We use a categorization of Non-critical, Critical Life Science and Critical Analytical Applications in this guide. For Non-critical Applications, there are no other specific concerns but the water type (quality) itself – so if RO, pure or ultrapure water is used. Some instances when these applications are used, they can also be critical and therefore may have higher requirements on the water quality, this depends on your specific case. In Critical Life Science, in addition to ultrapure water, endotoxins, nucleic acids, nucleases etc. should also be considered. Similarly in Critical Analytical Applications the TOC level, in addition to being ultrapure water, should be taken into account.





In the overview table you will find the different Arium® series and what applications they are suitable for. Depending on the criticality of your specific application, not all marked systems may be suitable and needs to be determined based on what type and quality of water you need. Remember that to the Pro VF and the different UV-systems (all except the Mini series) an optional TOC-monitor can be integrated into the system. The TOC-monitor is to be used where TOC is very critical and will display the TOC level on the display. There are also different accessories, which in some cases are needed for the system to work (such as the Bagtank which is used as an intermediate storage for pre-treated water) but also for maximum flexibility, such as the Smart Station remote dispenser.

Sartorius is ready to support you when you are considering to purchase a water purification system. Our experts can help to make sure that the chosen system is the right one for your needs and that the necessary accessories and consumables have also been considered. In addition, our experts are also able to discuss installation and qualification options to make sure that the system fits in your laboratory environment and requirements, and works as intended from day one.

You can always ask your Sartorius contact person for more information, or reach out via our webpages and one of our experts will be in touch with you to discuss further. You will also find on the webpage more information regarding our solutions:

www.sartorius.com/en/products/water-purification

Arium® Lab Water System

Lab Water Quality by System	Advanced RO	Advanced EDI	Mini	Mini UV	Mini Essential
Type 1 Water			■	■	■
Type 2 Water		■			
Type 3 Water	■				
Daily Water Consumption by System¹					
Type 1 ultrapure water up to approx. 10 Liter/day			■	■	■
Type 1 ultrapure water approx. 10–40 Liter/day					
Type 1 ultrapure water approx. 40–100 Liter/day					
Type 2 pure water up to approx. 120 Liter/day (5 L/h)		■			
Type 2 pure water up to approx. 150 Liter/day (10 L/h)		■			
Type 3 pure water up to approx. 140 Liter/day (8 L/h)	■				
Type 3 pure water up to approx. 200 Liter/day (16 L/h)	■				
Type 3 pure water up to approx. 270 Liter/day (24 L/h)	■				

Lab Water Application Overview | System Requirements by Application

Feed Applications

Feed ultrapure water systems	■	■			
Feed distilled systems	■	■			
Water for Laboratory devices (Autoclaves Washing Machine Ice Machine etc.)	■	■			
Manual Feed for Laboratory Equipment (Water Bath etc.)	■	■			

Non-critical Applications

Buffer, media, and pH solutions	■	■	■	■	■
Rinsing	■	■	■	■	■
AAS (Atomic Absorption Spectroscopy)		■	■	■	■
ELISA (Enzyme-Linked Immunosorbent Assay)		■	■	■	■
Electrophoresis		■	■	■	■
Histology		■	■	■	■
Photometry		■	■	■	■
Preparation of reagents, blank samples, etc.		■	■	■	■
Solutions for chemical analysis and synthesis		■	■	■	■

Critical Life Science Applications

DNA Sequencing			■ ²		■ ²
Endotoxin analysis			■ ²		■ ²
Immunocytochemistry			■ ²		■ ²
Northern Blot			■ ²		■ ²
Nutrient media for cell culture (Mammalia & plant)			■ ²		■ ²
PCR (Polymerase Chain Reaction)			■ ²		■ ²
Production of monoclonal antibodies			■ ²		■ ²
Southern Blot			■ ²		■ ²
Western Blot			■ ²		■ ²

Critical Analytical Applications

GC-MS (Gas Chromatography–Mass Spectrometry)				■	
GF-AAS (Graphite Furnace Atomic Absorption Spectrometry)				■	
HPLC (High-Performance Liquid Chromatography)				■	
IC (Ion chromatography)				■	
ICP-MS (Inductively Coupled Plasma Mass Spectrometry)				■	
SPE (Solid phase extraction)				■	
TOC analysis				■	
Trace metal analysis				■	

All displayed applicable systems starting with the minimal requested water quality criteria: ¹ Average indication depending on incoming feed water, ² Only in combination with an Arium® Cell Plus ultrafilter.

Mini Essential UV	Mini Plus	Mini Plus UV	Comfort I	Comfort I UV	Comfort II	Comfort II UV	Pro	Pro DI	Pro UV	Pro UF	Pro VF
■	■	■	■	■	■	■	■	■	■	■	■
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	■	■	■	■							
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Feed Water Application

There is likely a variety of equipment in your laboratory in need of a reliable source of purified water as feed water. Tap water is a typical source for feed water and is what has been considered in this guide. However, tap water generally needs some sort of pre-treatment before used as feed water to minimize risk for calcification, deposits or other build-ups, corrosion etc.

Sartorius provides solutions within the Arium® family for both tap water purification and intermediate storage (Arium® Bag-tank) of purified water for later use as feed water. It is important to recognize the connections, needed pressure, volume and flow rate to make sure the feed water source is compatible with the equipment. It is also important to remember that some equipment already has internal pumps of their own, so an additional pump in the Arium® Bagtank is not needed and can harm the equipment if the pressure is too high. In such a case, a Bagtank version without the pump can be selected. Some equipment might not have a connection for a direct feed source and require manual filling. The Bagtank accommodates these needs as well by having a Smart Station connected to the Bagtank that allows water to be dispensed directly from the Bagtank to any vessel.

Feed Distilled Systems

Stills produce purified water by evaporating feed water, leaving impurities behind and condensing the steam. Extra stages are required to minimize carry-over and collection of volatiles.

To reduce excessive build-up of deposits which would require frequent cleaning, and minimize carry-over, pretreated water is needed. Reverse osmosis permeate or deionized water are generally used and sufficient.

Application	Recommended daily volume	Recommended system
Feed Water Applications	>10 L/day	Advance EDI, Advance RO, Comfort I, Comfort II

Feed Ultrapure Water Systems

Type 1 ultrapure water is widely used in laboratories. It is often prepared in two stages: a source of pre-purified water followed by a “polisher” to achieve ultrapure water quality.

Pre-purified water is produced by reverse osmosis (possibly with ion-exchange or electrodeionization) and stored in an intermediate water storage unit before polishing. The quality of the pre-treated water affects the performance of the system and cartridge life. Type 3 RO or Type 2 pure water is sufficient.

Application	Recommended daily volume	Recommended system
Feed Water Applications	>10 L/day	Advance EDI, Advance RO, Comfort I, Comfort II

Feed Water for Laboratory Equipment (Autoclaves | Washing Machine | Ice Machine etc.)

Plenty of laboratory equipment needs reliable and constant feed of pretreated water to reduce build-up, calcification, residues and other problems that could arise if using water with too low quality.

Therefore, a reliable and constant source of pre-treated feed water is needed in various volumes, depending on the equipment. High purity is not needed, and general Type 2 pure water or Type 3 RO water would be satisfactory.

Application	Recommended daily volume	Recommended system
Feed Water Applications	>10 L/day	Advance EDI, Advance RO, Comfort I, Comfort II

Manual Feed for Laboratory Equipment (Water Bath etc.)

Some equipment in the laboratory needs purified water but does not have an inlet for automatic feed water. One example is water baths, which can keep water at a constant temperature over a long period of time. They are used for practices like incubating samples in water and provide a reliable surrounding temperature. This equipment needs manual filling either directly from a water tank or via another vessel. Either way, easy and flexible filling of water to any vessel or basin is required.

Water baths usually use purified water to avoid corrosion and build-ups in the basin.

Application	Recommended daily volume	Recommended system
Feed Water Applications	>10 L/day	Advance EDI, Advance RO, Comfort I, Comfort II



Non-critical Application

During an average day of laboratory work, there are numerous routines and tasks that require purified water. Depending on the application – and its criticality and sensitivity – different quality water may be needed, sometimes with specific parameters in mind. Generally, Type 2 (pure) water is sufficient when it comes to general laboratory tasks. Both classical methods and instrumental methods are included in this segment, which will determine some degree of sensitivity by itself.

AAS (Atomic Absorption Spectroscopy)

AAS is a technique for determination of the total concentrations of specific elements in a sample. It is used for trace analysis at ppm (mg/L) or ppb ($\mu\text{g/L}$) levels. Analysis by AAS requires the use of high-purity reagents and solvents during sample preparation and calibration to ensure the accuracy and precision of measurements. Type 1 ultrapure water is required for high-sensitivity, while Type 2 pure water can be used for general AAS.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Analytical Applications				
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV



Buffer, Media and pH Solutions

Buffers are used in several fields to create an environment that is more stable and resistant to pH level changes. Media on the other hand creates an environment to allow cells to grow by introducing important nutrients. Finally, pH solutions are needed for pH measurements, which is a quick and easy way to determine the acidity or basicity of a solution, which is important in many applications.

The water used to prepare buffer, media and pH solutions should be devoid of significant concentrations of acids or bases and free of other substances that can modify pH. Generally, Type 2 pure water is sufficient, but depending on criticality and application, higher quality water might be needed. It is also important to understand how TOC or endotoxins may play a role as well!

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Advance RO, Comfort I, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Life Science Applications				
	>10 L/day	Comfort I*, Comfort II*	Pro, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*
Critical Analytical Applications				
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

*in combination with an Arium® Cell Plus ultrafilter

ELISA (Enzyme-Linked Immunosorbent Assay)

ELISA is a technique to detect the presence of antigens, antibodies or other analytes in a sample. It can be used as qualitative or quantitative method. It is a highly sensitive technique for determining infections and diseases as well as food allergens. It can also be used in toxicology.

Washing is needed in several steps of the analysis. For this, Type 2 pure water is generally sufficient for preparing the washing solution. For more critical applications, Type 1 ultrapure water might be needed.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Life Science Applications				
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

Electrophoresis

Electrophoresis is used to separate molecules based on charge, size and affinity with the help of an applied electrical field and an adequate buffer solution. The molecules typically migrate through a gel medium (such as SDS-Polyamid or Agarose) with a specific velocity and distance and creates a pattern that can be analyzed. The technique is widely used, especially to separate and analyze biomolecules such as DNA, RNA and proteins. There are different sub-techniques that use electrophoresis depending on application and sensitivity.

For general applications, Type 2 pure water is sufficient. For more critical analysis, Type 1 ultrapure water with low levels of pyrogens, nucleases or nucleic acids might be needed.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Life Science Applications				
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

Histology

Histology is the study of the microscopic anatomy of cells and tissues of plants and animals, performed by examining a thin slice (section) of tissue under an electron or light microscope. Water is used for rinsing, preparation of buffered solutions, etc. Histopathology, the microscopic study of diseased tissue, is an important tool in the diagnosis of cancer and other diseases.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Life Science Applications				
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter



Photometry

Photometry studies measurement of visible light (around 360 nm to 830 nm). In chemistry, it is used for example to determine substances and their concentrations (ppm level) by color reaction and light absorbance. Every substance has a specific chemical property at a specific wavelength. The measurements are done by a photometer, of which there are different kinds depending on application.

Water is used in photometry to prepare samples. Impurities in the water may affect the results, but in general Type 2 pure water is sufficient. For more critical applications, Type 1 ultrapure water with low level of TOC might be needed.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Analytical Applications				
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

Preparation of Reagents, Blank Samples, etc.

The water required for diluting samples, blanks, reagents and standards must be of sufficient purity that subsequent analyses are not affected. These can range from ppb to ppt levels. Minimum Type 2 pure water is recommended, but for more critical applications higher quality might be needed with specific focus on either TOC or endotoxins, pyrogens or nucleic acids.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Life Science Applications				
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*
Critical Analytical Applications				
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

*in combination with an Arium® Cell Plus ultrafilter

Rinsing

Rinsing is a common laboratory practice. Washing glass or plastic ware between experiments or washing equipment are two examples of when it might be necessary to rinse off chemical or particle residues.

Purified water is usually used to avoid deposits and impurities from tap water. RO or pure water is usually sufficient for rinsing, but for some applications higher quality water might be needed.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance RO, Advance EDI, Comfort I, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Life Science Applications				
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*
Critical Analytical Applications				
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

*in combination with an Arium® Cell Plus ultrafilter

Solutions for Chemical Analysis and Synthesis

Chemical analysis includes classical and instrumental methods. Both methods can be used for identification, separation and quantity measurements with various sensitivity. Chemical synthesis is used to produce new products with the help of reagents. Water is often used to produce the solution in which the reagents can react, after which a purification process might be needed to isolate the final product.

The water used in producing the solutions should be free of impurities that could inhibit reactions or falsify results. Generally, Type 2 pure water is sufficient but, depending on criticality and method, ultrapure water with low TOC might be needed.

Application	Recommended daily volume	Recommended system based on feed water		
Non-critical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Advance EDI, Comfort II	Pro DI	
	<10 L/day	Mini Plus	Mini Essential	Mini
Critical Analytical Applications				
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV



Critical Life Science Applications

When it comes to Life Science Applications, water is commonly used to prepare buffers or other solutions and samples, or for washing the samples. Therefore, it is important to have water with a low level of endotoxins and other pyrogens, nucleic acids, nucleases or microorganisms to ensure reliable and reproducible results. This generally means ultrapure water is needed with special attention to these impurities.

DNA Sequencing

DNA sequencing refers to sequencing methods for determining the order of nucleotide bases in a molecule of DNA. The generation of DNA fragments – generally by a PCR-based technique – is followed by separation of the fragments by capillary or regular agarose gel electrophoresis.

Endotoxin and pyrogen free Type 1 ultrapure water is needed.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini UV*

*in combination with an Arium® Cell Plus ultrafilter

Endotoxin Analysis

Bacterial endotoxins are generally lipopolysaccharides (LPS) which have pyrogenic effects and are therefore very undesired in some applications. Endotoxin analysis is performed by three technologies with the help of a microplate reader: Gel-Clot, Endpoint Analysis and Kinetic Assays. All techniques are based on the LAL-test (limulus amoebocyte lysate), which is a sensitive reagent for detecting bacterial endotoxins.

Water is used to prepare buffers and sample dilutions. Endotoxin and pyrogen-free water is essential.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

Immunocytochemistry

Immunocytochemistry (ICC) – also known as immunofluorescence (IF) – is used to visualize/label proteins or antigens, typically with the help of an antibody (primary or secondary) with an attached fluorophore. However, magnetic or radioactive labeling is possible. This determines if a specific protein or antigen is present in a sample and in that case where it is present.

Immunocytochemistry is a sensitive technique that requires ultrapure water to avoid interferences.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

Northern and Southern Blot

The Southern blot is a method routinely used in molecular biology for detection of a specific DNA sequence in DNA samples. The Northern blot is a technique used to study gene expression by detection of RNA in a sample.

Pyrogen and nuclease-free Type 1 ultrapure water is used for many steps of blotting: sample, buffer, gels and preparation of rinsing solutions. Prior to blotting itself – for Southern or Northern blotting – sample preparation requires the highest purity of water to protect the raw material DNA or RNA.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

Nutrient Media for Cell Culture (Mammalian and Plant)

To support the growth of cells in cell culture, a nutrient or growth media is needed. Depending on the cells cultivated, different components or ratios of nutrients might be needed in the media.

Nutrient/growth media can be produced by mixing water with the necessary nutrients. It is recommended to use ultrapure water that is low in nucleic acids, nucleases and pyrogens | endotoxins.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

PCR (Polymerase Chain Reaction)

PCR is a technique used in molecular biology to amplify a single piece of DNA (or a few copies) by several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.

PCR and related PCR-based techniques, including quantitative PCR and reverse transcriptase PCR, require nuclease-free and endotoxin-free water to avoid degradation of the nucleic acid. Water should also be free of specific ions, organics and bacteria. Pyrogen and nuclease-free Type 1 ultrapure water is essential.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter



Production of Monoclonal Antibodies

Monoclonal antibodies are antibodies that can bind to a single epitope of an antigen. They are widely used in biochemistry, molecular biology and medicine where they can help determine the presence of a specific antigen in a sample. Monoclonal antibodies are also used to diagnose and treat several diseases.

To produce monoclonal antibodies, you will need ultrapure water with low level of pyrogens, endotoxins, nucleases or nucleic acids.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

Western Blot

The western blot is an analytical technique used to detect specific proteins in a sample of tissue homogenate or extract. It uses gel electrophoresis to separate native or denatured proteins by the length of the polypeptide (denaturing conditions) or by the 3-D structure of the protein (native | non-denaturing conditions).

In Western blotting, water is used to prepare the transfer buffer, buffers used to prepare the blocking solution, primary and secondary antibodies and the wash solutions. It is critical to use water free of impurities that are biologically active and could interfere. Pyrogen free Type 1 ultrapure water is essential.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Life Science Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I*, Comfort II*	Pro UF, Pro VF	
	<10 L/day	Mini Plus*	Mini Essential*	Mini*

*in combination with an Arium® Cell Plus ultrafilter

Critical Analytical Applications

When sensitivity or accuracy is needed, it also brings higher requirements on the quality and purity of the water used. Critical Analytical Applications refer to applications where analyses are performed with highly sensitive instruments in a wide range of areas. At this stage, TOC (total organic carbon) is usually a concern. Therefore, water for preparing blanks and samples needs to be low in particles and other impurities that can interfere with the analysis or create blockage in the instrument itself.

GC-MS (Gas Chromatography–Mass Spectrometry)

GC and GC-MS are the most sensitive and widely used techniques for separation and determination of the components of mixtures of volatile or semi-volatile compounds. Samples are volatilized and separated on a column. The technique is especially powerful when a mass spectrometer is used as a detector, as individual components can then be characterized and identified directly.

Type I ultrapure water is typically used in sample preparation. Low TOC is essential.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV



GF-AAS (Graphite Furnace Atomic Absorption Spectrometry)

GF-AAS is a variant of AAS which uses a small carbon tube rather than a flame to atomize the sample. It is a more sensitive method than AAS, and suitable for measurements of ultra-trace levels of elements. The detection limits for many elements are well below 1 ppb.

Water is used to prepare blanks, standards and sample preparation and needs to be extremely low in relevant impurities. Type 1 ultrapure water is required.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

HPLC (High-Performance Liquid Chromatography)

HPLC can separate a mixture of compounds and is used in biochemistry and analytical chemistry to identify, quantify and purify the individual components of the mixture. It is one of the most powerful tools in analytical chemistry. With suitable choice of methodology, HPLC can separate, identify and quantify most compounds present in any sample that can be dissolved in a liquid. Today, compounds in trace concentrations as low as parts per trillion may be identified with the appropriate detector.

Type 1 ultrapure water with typical TOC less than ≤ 2 ppb is needed for the more demanding applications.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

IC (Ion Chromatography)

IC is a chromatographic technique that allows the separation of ions and polar molecules based on their interaction with a column of ion-exchange media. It can be used for almost any charged molecule including large proteins, small nucleotides and amino acids. It is widely used for determining inorganic and organic cations and especially anions. With pre-concentration, low-ppt concentrations may be measured.

Type 1 ultrapure water is needed for blanks, standards, sample preparation and eluents.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

ICP-MS (Inductively Coupled Plasma Mass Spectrometry)

ICP-MS uses a high temperature source and a mass spectrometer to provide the most sensitive method for general analysis of elements in solution with detection limits below 1 ppt for many elements. Clean room conditions are preferred.

Water is extensively used for sample preparation, standards and blanks. Type 1 ultrapure water, free from elemental impurities, is essential. Low levels of organics are also desirable.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

SPE (Solid Phase Extraction)

SPE is a semi-automated separation and concentration process by which compounds that are dissolved or suspended in a liquid mixture are taken up on a solid substrate and subsequently eluted before analysis.

For trace analysis, water of the highest organic purity is needed to prepare blanks and standards and to rinse the solid phase. Type 1 ultrapure water with a TOC of less than ≤ 2 ppb is needed.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

TOC Analysis

TOC is the amount of carbon bound in organic compounds, (i.e., in an aqueous solution). It is often used as a non-specific indicator of the level of organic impurities in water or cleanliness of pharmaceutical manufacturing equipment.

Water is used to prepare the standards necessary for instrument calibration, run the blanks and to clean or rinse the instrument. To optimize the performances of TOC analysis – in particular the concentration range below 1 ppm – it is important to have water with very low TOC.

Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

Trace Metal Analysis

Trace metal detection is carried out by a variety of methods. Due to its extremely high sensitivity and specificity, ICP-MS has become very popular. ICP- AES is still widely used for multi-element analysis, and AAS provides a cheaper alternative when fewer elements are being determined.

Spectrophotometric and electrochemical detection have advantages in specific cases. Water purity requirements depend on the sensitivity needed. Type 1 ultrapure water is generally recommended.


Application	Recommended daily volume	Recommended system based on feed water		
Critical Analytical Applications		Tap Water	RO DI EDI Water	Manual Top-Up with Pretreated Water
	>10 L/day	Comfort I UV, Comfort II UV	Pro UV, Pro VF	
	<10 L/day	Mini Plus UV	Mini Essential UV	Mini UV

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