ELGA VEOLIA

BUYER'S GUIDE

Quality Control

Choosing the right water purification system for pharmaceutical quality control

WATER TECHNOLOGIES

Driving Discovery

Quality control (QC) testing is essential in the pharmaceutical industry to ensure that medicines are safe for use and have optimal therapeutic performance. Water plays a vital role in the analytical techniques at the heart of a QC laboratory, but its ability to dissolve a range of compounds and gases makes it susceptible to contamination. The risks that insufficiently pure water poses for a QC laboratory are extensive; impurities in water can damage lab equipment, distort data and disrupt analyses.

The importance of water purity

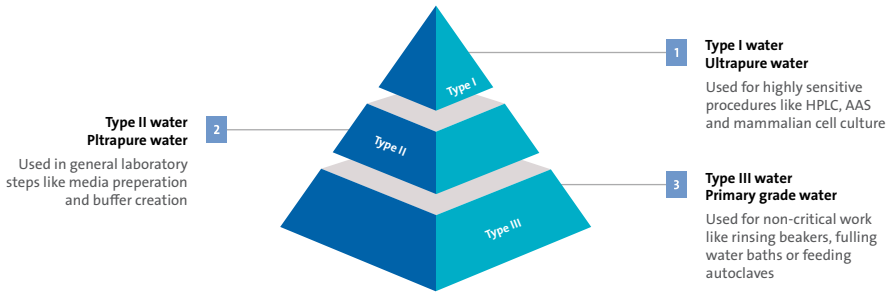
QC analysis is a crucial step in the pharmaceutical production process and its failure can be catastrophic. If poor quality data allows medicines slip through the QC net, adverse consequences may include:

- reduced laboratory productivity
- a waste of limited financial resources
- a lack of therapeutic effect that could lead to prolonged illness or death
- toxic or adverse drug reactions
- a loss of patients' confidence in the healthcare system

What's in my water?

QC labs use the same range of analytical techniques as many other laboratories and are susceptible to the same kinds of impurities present in unpurified water. A range of hidden 'extras' can be present in mains water, including particulates, inorganic ions, dissolved gases, microorganisms and organic compounds.

However, the degree of contamination can range from being perfectly adequate for purpose to adversely critical for certain applications. For this reason, laboratory water is categorized in grades, using several properties to define purity.

	Type III	Type II	Type II*	Type I	Type I*
					
Inorganics (resistivity at 25°C)	>0.05 MΩ.cm	>1 MΩ.cm	>10 MΩ.cm	>18 MΩ.cm	18.2 MΩ.cm
Total organic carbon (TOC)	<200 ppb	<50 ppb	<50 ppb	<10 ppb	<5 ppb
Bacteria	<1000 CFU/ml	<100 CFU/ml	<10 CFU/ml	<10 CFU/ml	<1 CFU/ml
Endotoxin	-	-	-	0.03 µm filter	0.03 µm filter

The analytical risks of impurities

Water is essential in a QC laboratory for everything from the preparation of blanks, dilutions, samples and solutions to washing and rinsing containers, pipework and valves. For example, high performance liquid chromatography (HPLC) and inductively coupled plasma mass spectrometry (ICP-MS) are two core analytical techniques that are strongly impacted by poor quality water.

Using insufficiently pure water for HPLC purposes may undermine data quality, contributing to a range of problems including variable retention times, a loss of resolution, tailing peaks, baseline drift, noisy baselines, negative peaks, ghost peaks, adduct peaks and back pressure issues. Poor quality water can also lead to increased running costs, as damage to equipment may result in excess downtime and/or the frequent need to replace consumables.

Several contaminants in impure water can also cause issues during ICP-MS:

- Inorganic ions found in low quality water can result in matrix effects
- Organic compounds can stick to nebulizer, tubing and spray chamber surfaces, resulting in poor reproducibility and the need for cleaning
- Metals associated with organic moieties can cause elemental contamination
- Bacteria can lead to several problems, by releasing ions which may interfere with the analysis, producing organic by-products that may stick to the nebulizer surface, and behaving as particulates that can block the nebulizer and prevent efficient sample introduction. In turn, this may lead to increased signal noise and reduced analytical sensitivity

Organizational risks resulting from poor quality lab water

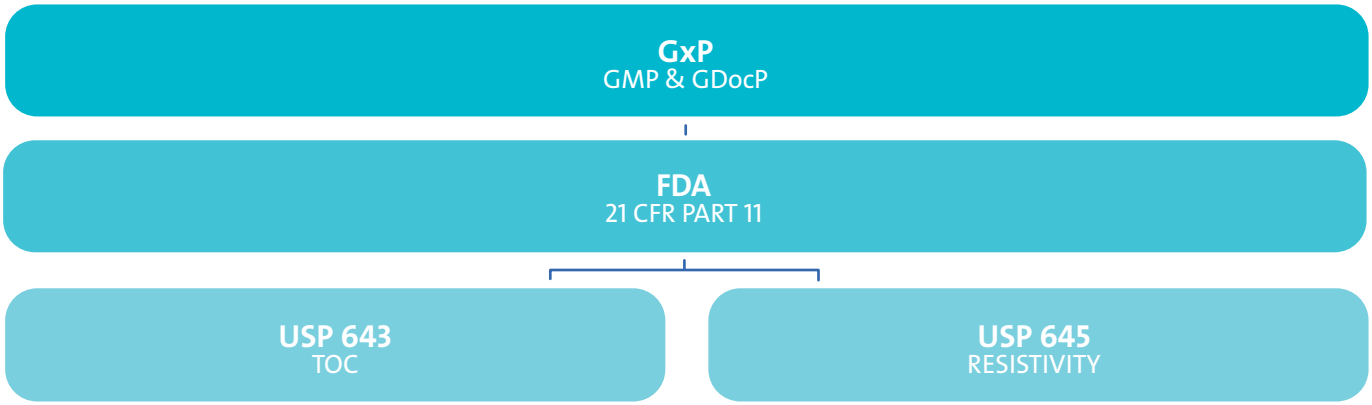
All laboratories are human systems, so water quality impacts much more than just analytical techniques. An increase in analytical risk can also have detrimental effects on operational efficiency, team morale, professional reputations, career progression, equipment longevity, servicing costs and – of course – confidence in compliance processes. An effective water purification system therefore needs to integrate smoothly into the workflow of a QC laboratory.

Ideally, purification equipment should produce water that is suitable for every lab technique. Aside from this requirement, the simplicity, reliability and adaptability of a water purification system are integral to the user experience it delivers. Several features of the product – including its durability, ease of use, simplicity of maintenance and environmental impact – will also affect the team working with the system. The best water purification systems should therefore offer quality that is beyond question, and be supported by a global service network.

Regulation of QC labs

The work that QC laboratories complete is crucial for the performance of the pharmaceutical industry, and so labs are subject to extensive requirements set out by national, regional and global regulating bodies. The suite of Good 'x' Practice (GxP) guidelines are accepted as international best practice and must be met by all laboratories. Due to the need for digital record keeping, and the specifics of using ultrapure water for QC protocols, QC labs must meet three key regulatory requirements:

- FDA 21 CFR Part 11: QC labs must follow guidelines which define criteria under which electronic records and signatures are considered to be accurate, authentic, trustworthy, reliable, confidential and equivalent to paper records and handwritten signatures
- USP 643: This standard specifies the required TOC content of water for laboratory purposes. Labs using ultrapure water must meet specified TOC suitability tests to ensure that recorded TOC data is sufficiently accurate to meet 'Part 11' requirements
- USP 645: This standard applies to electrical conductivity of purified water. Resistivity measurement systems must have a cell constant of +/-2 % to meet 'Part 11' accuracy requirements



All laboratories are required to meet GxP regulations, including 'Part 11' requirements. Additionally, water purification systems – as with any equipment used in a GxP environment – must support validation activities. However, QC laboratories have complete control with regards to how they operate and choose to meet the requirements of regulating bodies. Selecting the right water purification system is an essential step in ensuring seamless regulatory compliance. The best water purification systems will fulfil the necessary technical requirements for meeting regulatory and validation standards, making it easy for QC laboratories to provide sufficient proof of internal processes and how they meet GxP requirements.

Summary

Choosing the right water purification system is crucial, not only to meet quality requirements, but also for best laboratory practice. The right water purification system will improve the productivity, efficiency and accuracy of your lab's QC workflows, but the wrong system can result in lengthy and costly downtime from extensive cleaning and replacing of parts, as well as reagent wastage and unforeseen expenditure in the long run.

Whether your lab needs pure or ultrapure water, or if you need low or high level compliance with GxP guidelines, ELGA has the system for you, offering:

- quality beyond question
- a user experience that supports your team
- equipment that makes regulatory compliance easy

Choosing the ideal water purification system for QC procedures

Some applications are more sensitive to impurities than others, and laboratories must make sure that they use the appropriate grade of water for their QC tests to minimize contamination during analysis. For example, ultrapure water (Type I+ water) must be used for highly sensitive endotoxin analysis, liquid chromatography and cell cultures, while apyrogenic water (Type II or Type II+ water) can be used for general chemistry and microbiological analysis.

Method	Sensitivity	Resistivity (MΩ.cm)	TOC (ppb)	Filter (µm)	Bacteria (CFU/ml)	Endotoxin	Nuclease	Water grade
HPLC	General	>5.0	<20	<0.2	<10	NA	NA	Type II+
	High	>18.0	<2	<0.2	<1	<0.03	NA	Type I+
IC	General	>5.0	<50	<0.2	<10	NA	NA	Type II+
	High	18.2	<10	<0.2	<1	<0.03	NA	Type I+
LC-MS	High	>18.0	<2	<0.2	<1	<0.03	NA	Type I+
ICP-MS		18.2	<10	<0.2	<1	NA	NA	Type 1+
ICP-OES		>18.0	<10	<0.2	<1	NA	NA	Type 1

What factors should you consider before choosing a water system for your lab?

There are several things to keep in mind when selecting the ideal water purification system for your QC laboratory. We have developed a step-by-step guide to help you choose the water purification system that is best suited to your QC laboratory's needs.

Step one: consider what level of water purification you need.

What grades of water quality do your laboratory applications require?
What technologies are needed to meet your requirements?
What is the source and quality of your feed water?

Challenge	Solution
You are looking to perform highly sensitive QC applications – such as endotoxin analysis, mammalian cell culture, molecular biology, bacterial cell culture, plant tissue culture, ion chromatography, graphite furnace AAS, ICP-MS, HPLC or TOC analysis – and this requires ultrapure water.	You need a water purification system capable of producing ASTM Type 1 water: • Resistivity at 25 °C: 18.2 MΩ.cm • Conductivity at 25 °C: 0.056 mS/cm • TOC: <1 mg/l • Sodium: <1 mg/l • Silica: <3 mg/l • Chloride: <1 mg/l Your water purification system should be constructed from the highest quality components to guarantee optimal purity. It should provide recirculation through reverse osmosis (RO), deionization (DI) and ultraviolet (UV) technologies, as well as microfiltration (MF) and ultrafiltration (UMF) steps. TOC monitoring is an additional feature to look for, to reassure you that every drop of water generated is within the required quality standards.
Your laboratory receives poor quality feed water that needs pretreatment to achieve efficient purification.	It is essential to use the right kind of feed water when using a Type I or Type I+ purification system to obtain ultrapure water. Choose a supplier that offers a complete purification package including all pre- and post- treatment steps. Prefiltration reduces the number of incoming particulates found in municipal water, protecting mechanical parts of the water purifier from damage.

Step two: consider your laboratory's regulatory requirements, and whether the system will be used in processes covered by GxP and national regulatory standards.

What level of compliance must your lab adhere to?

Challenge	Solution
Your QC laboratory is a low-level compliance lab.	Your laboratory needs a reliable supply of high quality water, without the additional regulatory requirements of some QC labs.
Your QC laboratory is a mid-level compliance lab.	Look for water purification systems that come with a validation support manual (VSM), as your instrument will need to be validated with some level of documentation. Choose a system that allows basic data tracking to be compliant with regulations.
Your laboratory receives poor quality feed water that needs pretreatment to achieve efficient purification.	It is essential to use the right kind of feed water when using a Type I or Type I+ purification system to obtain ultrapure water. Choose a supplier that offers a complete purification package including all pre- and post-treatment steps. Prefiltration reduces the number of incoming particulates found in municipal water, protecting mechanical parts of the water purifier from damage.

Step three: consider your laboratory's throughput and water demands.

Is the purification system delivering water for a single use or multiple uses?
How much pure water is required per hour?
How quickly must the water be delivered to your instruments?

Challenge

An efficient water purification system must meet lab volume requirements, while keeping stored water free from microbial contamination.

You are looking to install a water purification system that serves a large group of users or provides different grades of water across multiple laboratories from a single mains supply.

You need efficient water dispensing to enhance productivity.

Solution

Your water purification system should include a storage reservoir with a composite vent filter (CVF) to protect stored water from airborne CO2 and bacteria, guaranteeing a supply of quality water in sufficient volumes to ensure laboratory productivity.

Make sure that your chosen water purification system allows you to connect several dispensing points to deliver water for multiple uses. In addition, check whether additional point of use (POU) filters are available to further 'polish' Type I water by removing endotoxins, RNases, DNases and bacteria at these dispense points.

Choose a system with user-friendly, ergonomic dispensing heads for simple, straightforward access to high quality water.

Step four: consider your laboratory's budget, focusing on value rather than cost.

Where will the system be located in your lab?
What is the overall footprint of the purification system(s) and its components?

Challenge

You operate with and adhere to a tight annual budget, so you want the lowest possible cost of ownership and predictable running costs.

Solution

To avoid any surprises, choose a supplier that offers a pre-installation site survey and provides realistic information on the cost of ownership. In addition, select an instrument that incorporates built-in technologies like electrodeionization (EDI) to significantly reduce running costs and consumable requirements. This will minimize the cost of purified water over the lifetime of the unit.

Step five: consider the available space in your laboratory.

Where will the system be located in your lab?
What is the overall footprint of the purification system(s) and its components?

Challenge

Lab space is at a premium and only a small area is available for a water purification unit.

Solution

Compact water purification systems have a built-in wrap-around reservoir and flexible design, so they can be installed under benches or mounted on the wall to minimize their footprints. An optimal system will offer a wide range of dispensing configurations to make the most of the available lab space.

Step six: consider your laboratory's uptime requirements.

What quality guarantee does the water purification provider offer?
What kind of warranty and maintenance service is available?
How will your laboratory manage in the event of instrument downtime?

Challenge

Your laboratory operates 24/7 and therefore you need a high performing water purification system that lasts.

You need reliability and ease of use, while demanding schedules limit the time you can spend on water unit maintenance.

It is essential that your lab instrumentation does not experience downtime.

Solution

To prolong the longevity of your equipment, choose a water purification system that incorporates preventive steps – such as EDI or additional enhanced DI technologies – to reduce the ionic load on downstream technologies.

The most efficient water purification systems monitor water purity right up to the point of use, and alert you when components are nearing the end of their life cycle to minimize disruption to laboratory processes. Look for an instrument with an easy-to-read display screen, so that you can easily check the quality of your water.

It is important to choose reliable equipment with long warranties as standard, and good service and support to back it up. Look for a supplier that offers a remote monitoring service, to ensure a preemptive response if any downtime is anticipated.

Step seven: consider your laboratory's operations, now and in the future.

Can the system be expanded if demand increases?
Do the systems meet your sustainability targets?

Challenge

You want the ability to increase your pure water output as demand on your laboratory grows.

You need a sustainable water purification system to save energy and future-proof your laboratory.

Solution

Look for water purification systems with a modular design, so that you can add additional capacity without expanding the footprint if your demands for pure water increase.

Water purification is a resource-intensive process, so choose products designed to have the lowest possible impact on the environment. Your equipment should save you water and energy, reduce plastic use and chemical waste, and eliminate mercury.

What can you expect from ELGA?

Absolute focus on water purification:
The quality of ELGA water is guaranteed to the very last drop, so you can be confident that your clinical analyzers are receiving consistent (and guaranteed) water purity.

Proven efficacy:
ELGA is a trusted name and supplier with proven efficacy in helping to progress a wide range of scientific disciplines worldwide.

Smart and simple design:
ELGA water purification systems fit seamlessly into the lab without taking up valuable bench space.

Ease of use and simplicity:
Minimal training is required to quickly get your teams using ELGA products efficiently. Ease of use also minimizes the risk of user error.

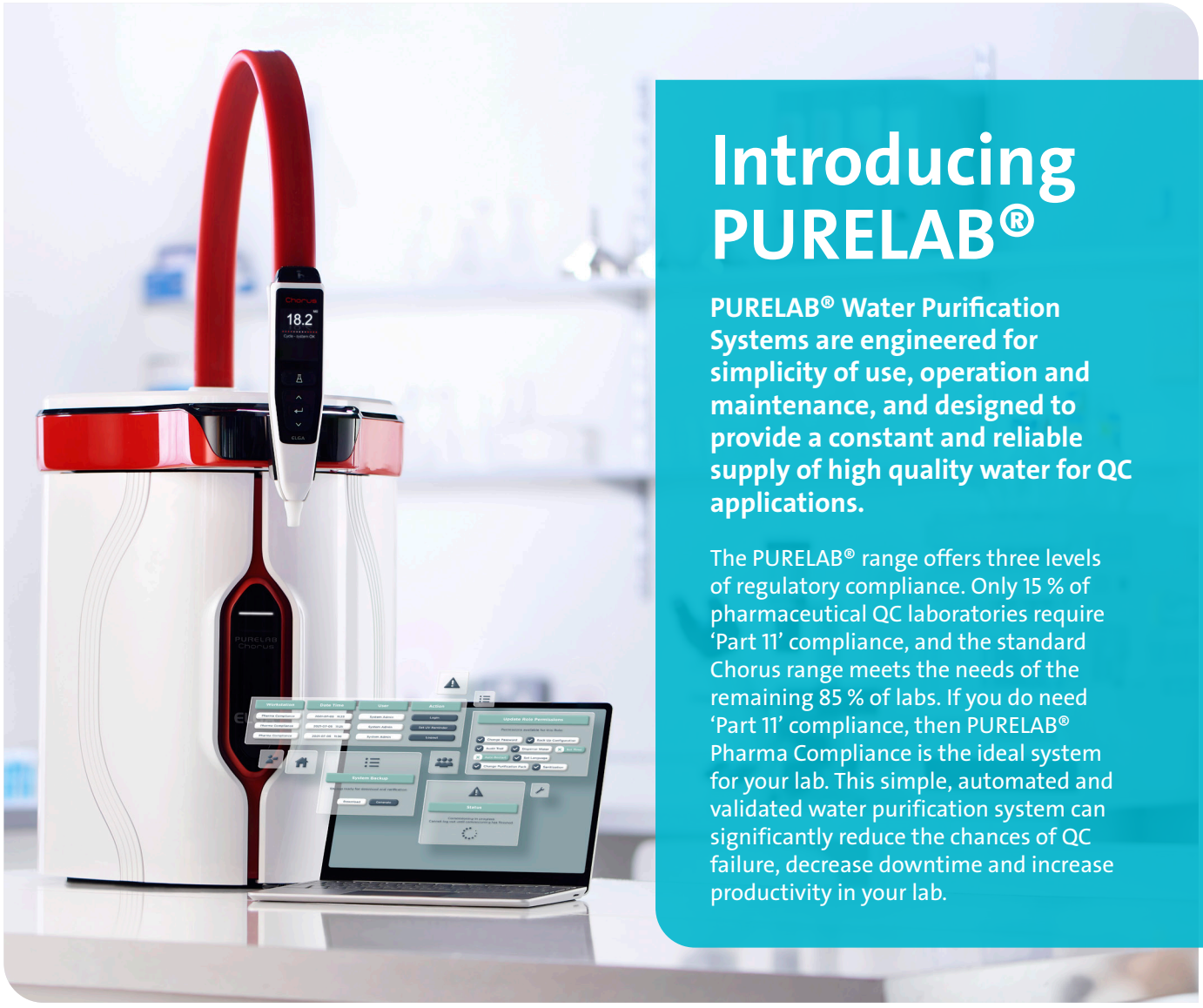
Equipment that is easy to self-maintain:
Any minor issues can be resolved quickly, without interruptions to your workflow.

Maximal uptime:
Ordering consumables and ensuring uptime is easy through ELGA's smart technology.

Access to a global network of water technologists:
ELGA is part of Veolia, the largest environmental management agency in the world.

ELGA LabWater: dedicated to discovery

ELGA has been working with scientists since 1937 to guarantee pure and ultrapure water for their experiments and laboratory work. We designed the PURELAB® product range with a wide variety of water purification technologies to meet any one of your requirements for water quality.



Introducing PURELAB®

PURELAB® Water Purification Systems are engineered for simplicity of use, operation and maintenance, and designed to provide a constant and reliable supply of high quality water for QC applications.

The PURELAB® range offers three levels of regulatory compliance. Only 15 % of pharmaceutical QC laboratories require 'Part 11' compliance, and the standard Chorus range meets the needs of the remaining 85 % of labs. If you do need 'Part 11' compliance, then PURELAB® Pharma Compliance is the ideal system for your lab. This simple, automated and validated water purification system can significantly reduce the chances of QC failure, decrease downtime and increase productivity in your lab.

Low-level compliance: PURELAB® Chorus 1 Life Science or Analytical Research	Mid-level compliance: PURELAB® Chorus 1 Life Science or Analytical Research + VSM	High-level compliance: PURELAB® Pharma Compliance
• Low or non-regulation control • Only require quality water	• Require some level of documentation • Validated system • Basic data tracking	• Require detailed documentation • Validated to USP 643 and 645 • Data tracking to comply with 'Part 11'

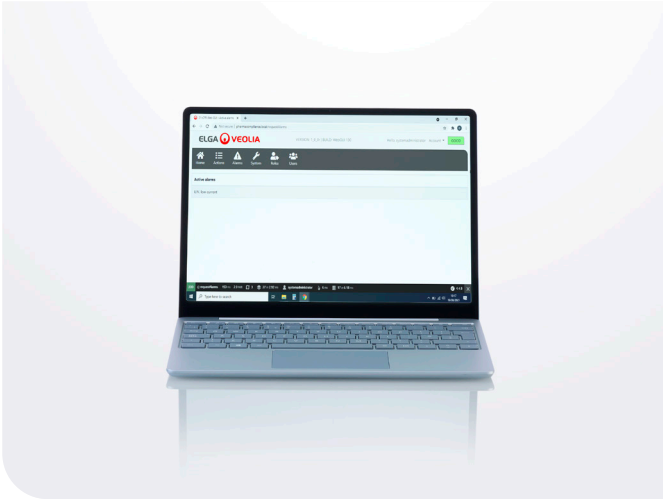
The PURELAB Range

PURELAB® Chorus 1

- Consistently delivers Type I+ or Type I water
- Life Science or Analytical Research models are appropriate for QC labs
- Up to 2.0 l/min dispense flow rate
- PureSure® technology for optimal water purity
- Modular design to optimize value lab space
- Range of dispensing solutions, reservoir sizes and purification packs
- In-built auto-recirculation to manage biofilm, ensuring reliable water quality and optimal readings
- Real-time TOC monitoring
- Intuitive menu navigation to minimize the risk of error

PURELAB® flex 2

- Consistently delivers Type I+ or Type I water
- Point-of-Use filters, appropriate for QC labs
- Up to 2.0 l/min dispense flow rate
- Small and slender design to optimize value lab space
- Perfect for low usage laboratories
- Auto-recirculation before use for optimal readings and water quality
- Real-time TOC monitoring
- Intuitive menu navigation to minimize the risk of error



PURELAB® Pharma Compliance

- Consistently delivers Type I+ or Type I water
- Up to 2.0 l/min dispense flow rate
- Provides up to 120 l/day of ultrapure water
- Smart, intuitive software
- Digital record keeping
- Quality management system
- Meets GxP requirements
- Complies with the TOC verification and water conductivity measurements required under USP 643 and 645

The PURELAB® range offers a complete purification solution:

PURELAB® Chorus 1 Life Science, PURELAB® flex 2 and PURELAB® Pharma Compliance need pretreated laboratory feed water.

- preferably RO, service deionization (SDI) or distilled water
- PURELAB® Chorus 2/2+ provides Type II water directly from a potable water supply
- PURELAB® Chorus 3 provides Type III RO water

Key features of the PURELAB® range

Auto-recirculation	Water left for any period of time will drop in quality, so the auto-recirculation feature in PURELAB® purification systems pushes fresh cleaned water to the point of use, and provides a reading of the water purity. This reassures QC laboratories that the water used for their tests is of the highest quality – without any need to manually recirculate the water – and that the data will be sufficiently accurate to meet 'Part 11' requirements.
Real-time TOC monitoring	PURELAB® systems calculate the TOC value of water produced before it is dispensed, and display the value in real time. This method of TOC monitoring enables the unit to read all the water that is running through the system, rather than just a sample.
PureSure® technology	PureSure® technology consists of a double purification pack and monitoring system, using an enhanced DI process that relies on ion exchange (IX) resins to guarantee water quality. The technology will provide advance warning when the first DI pack has been fully exhausted. When this occurs, the system switches over to the secondary DI pack, ensuring that water continues to meet the required specification and allowing the laboratory to replace the DI pack at a convenient time, without interrupting its workflow or causing downtime.
Integrated filtration	POU filters have a limited lifespan, and typically need to be replaced every 1 to 3 months, depending on the usage. Instead, PURELAB® systems feature integrated filtration, ensuring that the quality of water meets specification with just annual replacements. With the addition of a service contract, the laboratory will never need to remember filter replacement dates.

ELGA VEOLIA

Dedicated to Discovery

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ELGA Labwater are specialists in the engineering, service & support of water purification systems.

Unrivalled product design has achieved international recognition and awards.

Worldwide technical service teams support science & healthcare globally with specialist expertise.

Global digital performance monitoring from Hubgrade ensures laboratory work is uninterrupted.

A global supply chain supports clients from regional centres on every continent.

To discover how ELGA can benefit your QC applications, please contact our team of experts. ELGA offices and distributors are located in more than 60 countries and are fully trained in all ELGA systems.

To find your nearest ELGA representative, go to *www.elgalabwater.com* and select your country for contact details.

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GIT INNOVATIONS AWARD 2010 — 2nd PLACE

reddot design award winner 2011

GOOD DESIGN AWARD 2021

Design Award Gold 2015 TBO

Hubgrade

OVER 80 INTERNATIONAL PATENTS