



# Pure Expertise

*Purified water is an essential resource in all laboratory environments.*

*With over 30 years experience*

*in both the development of advanced water purification technologies and the design of total water purification systems, Millipore possesses an in-depth knowledge of diverse laboratory applications and a clear understanding of how to best meet specific laboratory requirements for purified water.*

Millipore provides a complete range of water purification systems designed to produce the optimum water quality to support application needs. From university research and clinical labs to biopharmaceutical research and pharmaceutical laboratories, systems are available producing from a few liters up to several thousand liters per day of pure and ultrapure water.

Millipore has combined its expertise in laboratory techniques and water purification technologies to create a comprehensive customized package for total water purification systems for a single laboratory, a suite of laboratories or an entire laboratory building.

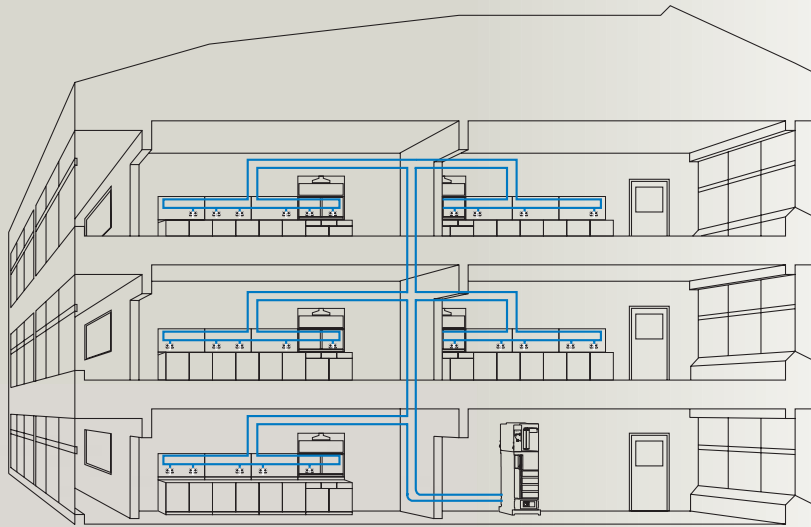


## **Partnership**

■ Millipore works in partnership with end-user scientists, architects, consultants, facilities managers, contractors and equipment suppliers throughout a project to meet each customer's specific requirements for pure water. From the quality and quantities of water required, to practical considerations such as laboratory / building size and requirements of regulatory standards, Millipore provides help and expertise at all stages, offering the advantage of working with just one company, dedicated to delivering results.



# Total Water Purification Systems



## Make-up water purification system

- The starting point and the control center for the total water purification system, the make-up water system must be capable of producing:
  - the required quality of water from tap feedwater to meet the laboratory's specific application requirements
  - the total volume of pure water consumed by the laboratory each day.

Millipore's Elix® and RiOs™ systems are water purification systems that provide purified water from tap water, suitable for laboratories requiring up to several thousand liters/day. These systems offer the advantage of one complete purification and control unit for both the Elix or RiOs make-up system itself as well as the external equipment in the water distribution loop, including storage and monitoring devices.

*The design and installation of a total water purification system depends on a number of factors such as end-user applications, water quality, quantities required including peak-use periods, space requirements and overall cost.*

*Defining these parameters requires real partnerships between all parties involved in the project.*

*Based on these parameters, the key design considerations can be identified. A total water purification system requires the use of the main water purification system integrated into a centralized system. For a modern laboratory using equipment ranging from washing machines to sophisticated analytical instrumentation, a total water purification system can include the following:*

- Make-up water purification system
  - Pure water storage
  - Pure water distribution system
  - Water quality monitoring in the distribution loop
- Final ultrapure water polishing systems (for sensitive applications)

## Final ultrapure water polishing systems

■ For sensitive applications requiring high quality ultrapure water, Millipore's range of Milli-Q® systems further purify water to meet specific ultrapure water requirements for critical applications, from ultra-low levels of organics for HPLC applications to pyrogen-free ultrapure water for DNA sequencing.



And for high-flow ultrapure water needs, Millipore Super-Q™ systems can produce up to 10 Liters/minute on demand.

## Pure water distribution

■ The pure water distribution system ensures that the purified water is delivered to the appropriate points throughout the laboratory / building through a system of pipes. Several key design factors ensure water quality in the distribution loop:

- a distribution pump is selected to meet requirements for water pressure and flow rate
- appropriate construction materials are used to avoid contamination
- maintaining minimum pipe flow velocity and use of recirculating pipe configurations to avoid "dead legs" further reduce the risk of contamination
- additional water purification components can be included to maintain the water quality in the loop (UV lamp, bacteria filter).

## Pure water storage

■ The pure water produced by the make-up water purification system must then be stored for use when needed. The storage reservoir must

- be of the appropriate volume to provide sufficient quantities of pure water during the day and at peak volume demands
- maintain purified water quality and minimize the risk of contamination.

Millipore provides different sizes of polyethylene reservoirs, depending on requirements, which incorporate vent filtration and sanitary overflow protection. Additionally, the Automatic Sanitization Module (ASM) prevents the build-up of biofilm (bacterial contamination) with 254 nm UV radiation.



## In-line water quality monitoring

Conductivity, or its inverse, resistivity, is generally the most common criterion used to determine the purity of pure or ultrapure water, and determines the total ionic concentration of a solution. Measurement of Total Organic Carbon (TOC) provides a means for determining organic contamination. Water quality monitors are incorporated into RiOs or Elix make-up water purification systems and are also available for installation within the external distribution loop of the Millipore Total Water System.

# Purified Water Quality

Product water specifications for Millipore water purification systems have been designed to meet or exceed the needs for all industry sectors.

## ■ Type III water

**Recommended for:** general, non-critical laboratory applications

- > feed to glassware washing machines for the final rinsing procedure, heating baths, autoclaves, etc.

## ■ Type II water

**Recommended for:** regular laboratory applications

- > buffers
- > pH solutions
- > microbiological media preparation
- > feed to clinical analyzers and weatherometers
- > preparation of reagents for chemical analysis or synthesis
- > feed to Type I ultrapure water systems (such as Milli-Q systems), etc.

## ■ Type I water

**Recommended for:** critical laboratory applications

- > HPLC mobile phase preparation
- > blanks and sample dilution in GC, HPLC, AA, ICP-MS and other advanced analysis techniques
- > preparation of buffers and culture media for mammalian cell culture
- > reagents for molecular biology, etc.

Several organizations (such as ASTM®, CAP, ISO®, CLSI, USP and the European Pharmacopoeia) have developed water quality standards or guidelines to facilitate processes within various industry sectors. Depending on the standard that must be followed, Millipore will design the system accordingly.



## Pretreatment

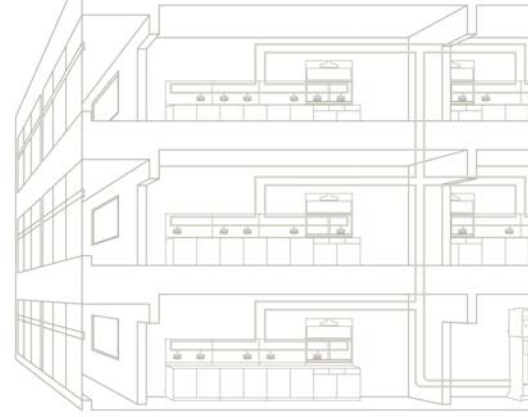
■ Pretreatment includes activated carbon to remove free chlorine and colloids, prefiltration to remove particles (0.5 µm filter) and an anti-scaling agent to protect the reverse osmosis membrane in hard water areas.

## Reverse Osmosis

■ Reverse osmosis (RO) removes 95-99 % of ions and up to 99 % of all dissolved organic substances (MW > 200 Dalton), micro organisms and particles. The advanced reverse osmosis loop employed in RiOs and Elix systems provides high water recovery and a constant product flow rate, independent of temperature.

# Total Quality

# Pure Technology



## Elix Technology

■ Millipore's patented Elix Technology, incorporated in Elix systems, is an advanced electrodeionization module that efficiently removes ionic contaminants. Ion-exchange resins are continuously regenerated by the electric field applied within the module. Therefore, there is no need for costly resin replacement or chemical regeneration. No softeners are required for most feedwater conditions when Elix Technology is used.

## Polishing packs

■ High quality deionization resins can be included as an extra polishing step to further remove ionic contaminants.

## Ultraviolet radiation

■ In the last treatment step in Elix and RiOs systems, the water is sanitized by a 254 nm UV lamp to dramatically reduce the bacterial count (by a Log Reduction Value of 4) for sensitive applications. UV treatment is also available in the storage reservoir (ASM) as well as within the external distribution loop.

## Water quality monitoring

■ High precision resistivity and Total Organic Carbon (TOC) monitoring is incorporated into the make-up water purification system to ensure product water quality. As an additional assurance, resistivity/conductivity, temperature and TOC monitoring are possible within the external purification loop.

## Final polishing

■ For sensitive applications requiring high quality ultrapure water, water polishing systems are required to remove the remaining ionic and organic contaminants. Millipore's range of Milli-Q systems employs application-specific cartridges as well as a point-of-use purifier. Milli-Q systems are available with ultraviolet photo-oxidation to reduce organics and/or with ultrafiltration for the removal of nucleases, endotoxins and pyrogens. Additionally, Super-Q systems are available for higher volume polishing requirements.



*The successful design, installation and commissioning of a total water purification system to feed an entire laboratory building, clean room or other specialized facility requires the real formation of partnerships between all parties involved in the project as well as the required skills and expertise to provide effective project management, back-up support and training. Millipore has a wealth of experience in water purification technologies and laboratory applications and the combined skills of our engineers enable them to effectively design total water systems, selecting the optimum systems, materials and components, to produce the required quality and quantity of water to meet customers' exact specifications.*

## Project Management

■ From design and installation services, to system qualification and user training, Millipore provides comprehensive project management throughout to ensure that all bases are covered. This includes hands-on assistance with the total water purification system design and installation, selection of the necessary materials and components, as well as assistance with budget planning and providing a detailed quotation package.



## Design

■ Millipore designs the water purification installation to meet a customer's exact specifications. This includes the make-up water purification system as well as the storage, distribution and control systems. Millipore's engineering group has a broad selection of systems and accessories available (such as storage reservoirs, distribution pumps, UV lamps, warning systems, and control and measuring systems) and the required expertise to design the system to meet your specific needs.



## User Support

■ Millipore's Customer Support Team is available to answer any questions you may have on your water purification system. Our specialized team is always ready to help. Because preventive maintenance is the most efficient and reliable way to ensure optimum water quality over the long term, our specialists offer service plans designed to match your requirements: regular maintenance, rapid intervention and customized services such as verification of water quality monitoring devices.



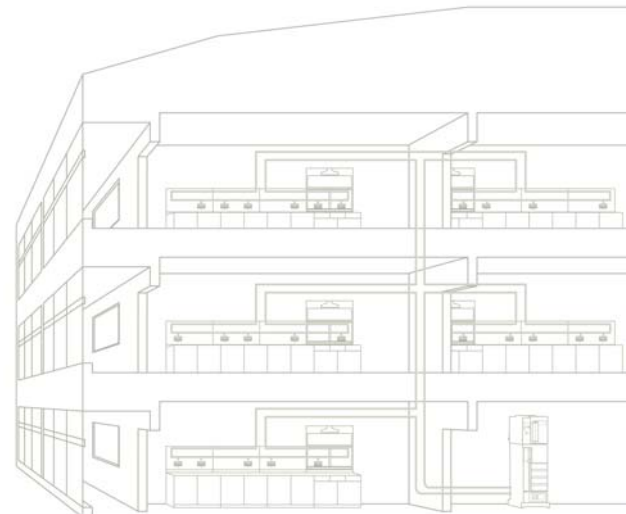
# Total PureWater Solutions

## Installation & Training

■ Millipore Field Service Support Engineers provide an efficient system installation service and supply all the systems and components required. Additionally they provide training and advice on how to optimize the use of your system.

## Qualification Support – Compliance with Standards

■ Millipore has over 9 years qualification experience, having performed thousands of qualification protocols, using calibrated devices and specific test equipment developed for our systems. Our certified Field Service Support Engineers will help you to successfully carry out your Installation Qualification (IQ), Operational Qualification (OQ) and Maintenance Program within a GMP and/or GLP environment.



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