MILLIPORE


# Milli-Q®

## Water Purification Systems Range

**The standard for ultrapure water**

# The Milli-Q system range matches specific applications

**Ultrapure (Type I) water** that is ideal for critical laboratory applications needs to meet the minimum standards for resistivity levels of 18.2 MΩ·cm at 25 °C and Total Organic Carbon (TOC) levels below 10 ppb. However, different applications might require the additional removal of specific contaminants.

Water is the most commonly used laboratory reagent. Using the appropriate water quality is key to reduce the risk of artifacts or errors in experimental outcomes.

Each of the following Milli-Q systems is designed to produce water adapted to specific applications:

- Delivery of Type 1 ultrapure water on demand at a high flow rate for immediate use upon dispensing to limit the risks of recontamination
- Sequence of purification steps designed to remove the contaminants that are specifically critical for the considered application
- Optimum performance reproducibility warranted by consumables certification
- On-line measurement of the water quality by calibrated meters close to the point of dispense
- Qualification procedures available for users concerned with validation

Millipore water purification specialists can recommend the purification technologies best suited for your source water and application requirements.

# A complete purification path

All systems in the Milli-Q range include a comprehensive purification process that ensures analytical water quality. Trained experts propose the most efficient purification technologies.

1 **Plug-in Q-Gard® purification packs**

Tailored to a specific feedwater source that optimizes the performance of downstream purification media

- Q-Gard 1 cartridge is recommended for water pre-treated by Elix® and RiOs™ systems or distillation. It contains high quality Jetpore® mixed-bed ion-exchange resin and Organex®.
- Q-Gard 2 cartridge is recommended for deionized water. It contains a microfilter for particulate removal, activated carbon for organics adsorption and mixed-bed ion-exchange resin for ion removal.

2 **Quantum™ application specific cartridges**

Removes ionic and organic contaminants down to trace levels

- Quantum IX cartridge (ionic contaminants)
- Quantum EX cartridge (ionic and organic contaminants)
- Quantum VX cartridge for ultra-low levels of volatile organic contaminants

3 **Double wavelength UV lamp**

Ensures organic molecules oxidation and bacteria destruction

4 **Pyrogard™ 5000 cartridge**

Removes pyrogens efficiently

5 **Resistivity meter**

Detects traces (< ppb level) of ionic contaminants

6 **Final filters**

Eliminates the last specific contaminants at the outlet

The systems include a high-precision resistivity meter to verify that the ionic contamination of purified water remains at sub-ppb levels.

# Pyrogen and nuclease-free water

**To ensure efficient pyrogen removal, an ultrafiltration (UF) cartridge resistant to sodium hydroxide was selected and validated by Millipore.**

The Pyrogard 5000 UF cartridge is used in the Milli-Q Biocel® and Synthesis systems to remove pyrogens and nucleases. It produces RNase-free water without the need for DEPC treatment.

Extremely fine UF membrane microfibers construct this capillary fiber cartridge. Purified water is processed at a high internal cross-flow velocity within the fibers, which results in a rapid rinse to quality on start-up and after routine maintenance procedures. To prevent contaminants from building up on the membrane or flow reduction from air-lock, a built-in program enables automatic sanitization by using sodium hydroxide and air purging of the UF cartridge on start-up.

Validation tests were performed: several UF cartridges were challenged with endotoxin solutions and the pyrogen concentration was measured upstream and downstream of the UF cartridge using a kinetic turbidimetric Limulus Amebocyte Lysate (LAL Associates of Cape Cod, MA, USA). During tests, the Pyrogard 5000 ultrafiltration cartridges demonstrate log reduction values (LRV) between 5.6 and 7.65 at contamination levels of 442 and 44,200 EU/ml.

# Low TOC water

**The UV oxidation water treatment removes organic impurities to improve consistency and sensitivity in applications such as high-performance liquid chromatography (HPLC), ion-exchange chromatography, solid-phase extraction and UV spectroscopy.**

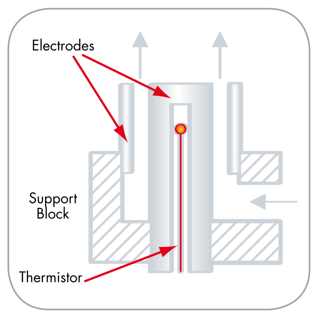
The photo-oxidation process used in the Milli-Q Gradient, Synthesis and Element systems effectively can destruct organic molecules. When irradiated by UV at 185 and 254 nm, oxygen dissolved in water will form ozone, which will generate hydroxyl radicals. These radicals will oxidize organic compounds dissolved in water and convert them to carbon dioxide. This is in equilibrium with carbonic acid, bicarbonate ions and carbonate ions that will bind to the ion exchange resins in the Quantum cartridge.

UV radiation at 254 nm also generates the adequate energy required to break down DNA and is highly effective in killing bacteria that might have survived the osmotic pressure of ultrapure water.

# Accurate water quality measurement

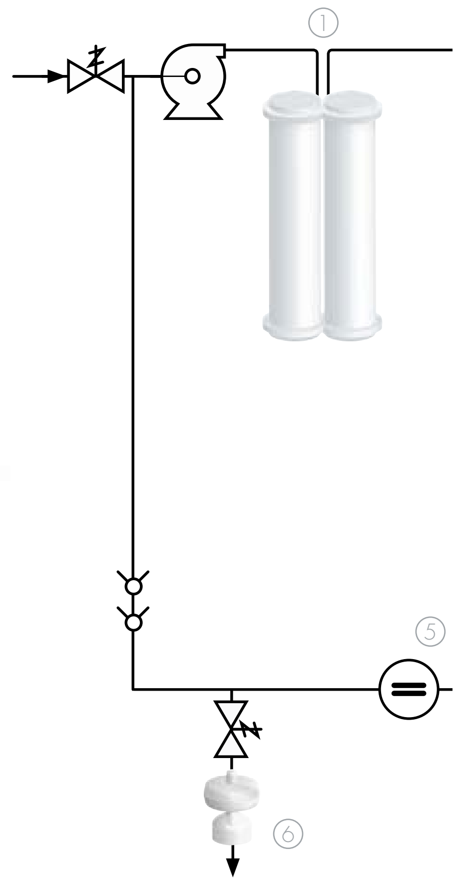
The high precision resistivity meter in the Milli-Q system has specific features to display clearly the ionic content. This includes:

- Coaxial electrode design that guarantees cell constant stability
- Flow-through design ensuring that the measurement is representative of the ionic concentration in water
- Low cell constant (0.01 $cm^{-1}$) for optimum accuracy
- Temperature measurement with 0.1 °C variation detection precisely displays temperature compensated resistivity
- Automatic alert if there is a fault in the resistivity measurement
- Designed to take into account the USP suitability requirements



# A choice of configuratic

## Milli-Q **Academic** System


### General laboratory applications

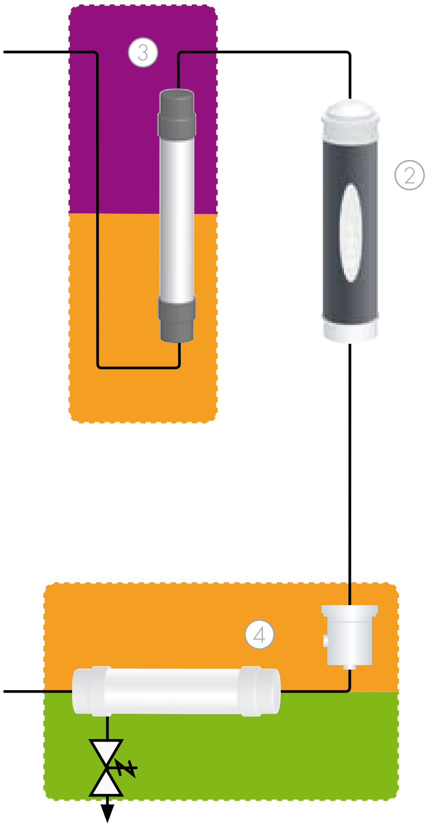
The Milli-Q system utilizes **the standard three-step purification** process - pretreatment, application specific polishing and final filtration - to produce Type 1, reagent-grade water suitable for all general laboratory applications.

## Milli-Q **Biocel** System


### Life science research

**The Pyrogard 5000 ultrafilter** removes endotoxins and nucleases in water for use in applications such as serum-based cell and tissue culture media preparation, PCR, electrophoresis gel make-up and monoclonal antibody production.

# ns for your applications





## Milli-Q **Gradient** System

### Chromatography

Built-in **UV photo-oxidation technology** reduces organic contaminants to ultra-low levels for optimum chromatographic separations and increased column lifetime. Milli-Q Gradient water is recommended for HPLC, LC, ILC and GC-MS.


## Milli-Q **Synthesis** System

### Molecular biology

**The Pyrogard 5000 ultrafilter and UV photo-oxidation technologies are combined** in one system for applications that require low ionic, organic, pyrogen and nuclease levels, such as 2D electrophoresis, DNA sequencing, mammalian cell culture and proteomics research.

# Elemental analysis

## Ultra-trace element analysis (ICP-MS, FAAS, ILC)

This Milli-Q Element system uses ultra-clean materials and an optimized succession of water purification technologies to provide the highest quality water without contaminants that are detrimental to trace elemental analysis.

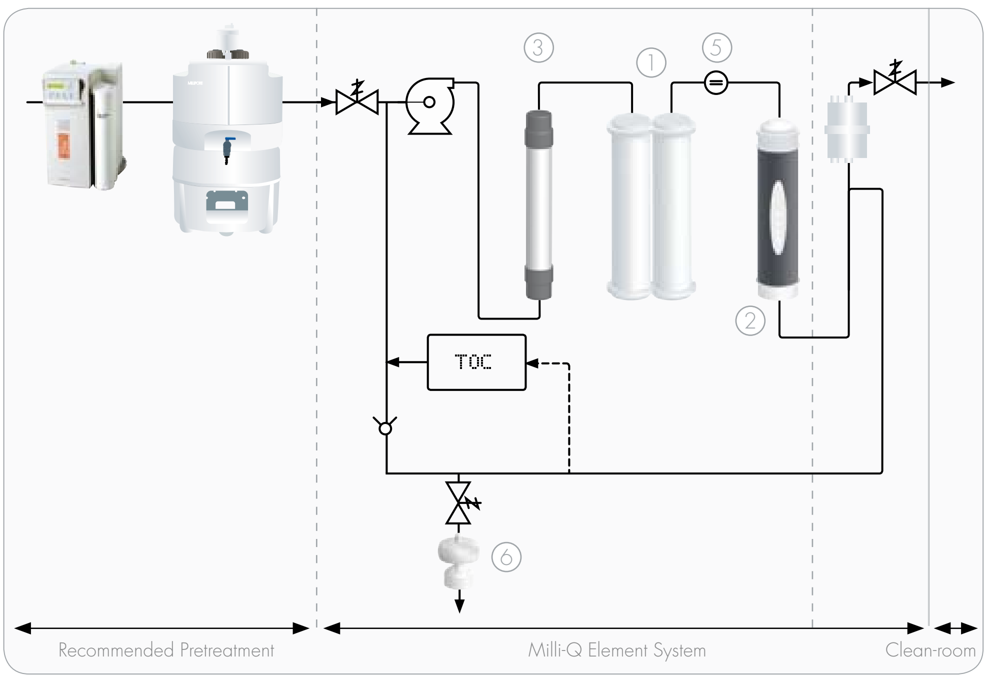
Specific purification cartridges and filters produce ultrapure water with elemental contamination down to ppt and sub ppt levels depending on the element considered.*

- Q-Gard 1 cartridge for all ions removal
- Q-Gard B1 preteatment cartridge for low Boron levels
- Quantum ICP polishing cartridge
- Optimizer™ LW 0.1 nm final filter

An optional TOC meter is recommended to ensure that the organic removal process operates within specifications. It is designed to take into account the USP suitability requirements.

Foot-pedal activation allows hands-free, contaminant-free operation that is ideal for clean-room use.

Milli-Q **Element** System




*Millipore R&D brochures are available upon request for detailed analysis and experimental conditions.*

# Point-of-use configuration

## Optimal pretreatment

Use an Elix system to pretreat your ultrapure water systems. You'll benefit from a guaranteed reduction in contaminant levels.

| Parameter | | Value |
|---|---|---|
| **Milli-Q System Feedwater requirements** | | |
| Pressure | | Min 0 bar (0 psi) / Max 0.3 bar (4.5 psi) |
| Flow rate | | Min 100 l / h |
| Temperature | | Min 5 °C / Max 35 °C |
| Connection | | ½" NPTM |
| **Milli-Q System Specifications** | | |
| Production unit dimensions (H x W x D) | | 455 x 255 x 315 mm (18"x 10"x 12.4") |
| Production unit weight | Academic | 16.6 kg (36.6 lb) |
| | Gradient | 17.4 kg (38.4 lb) |
| | Biocel | 16.9 kg (37.3 lb) |
| | Synthesis | 17.7 kg (38.9 lb) |
| | Element | 19.9 kg (39.8 lb) |
| Electric power cable length | | 2.5 m (98.42") |

# Milli-Q systems at a glance

| | Academic | Gradient | Biocel | Synthesis | Element |
|---|---|---|---|---|---|
| **Standard Features** | | | | | |
| Q-Gard Cartridge | ● | ● | ● | ● | ● |
| Quantum Cartridge | ● | ● | ● | ● | ● |
| Millipak® Final Filter | ● | ● | ● | ● | ● |
| Optimizer Filter | | | | | ● |
| Resistivity Meter | ● | ● | ● | ● | ● |
| UV Lamp | | ● | | ● | ● |
| Pyrogard 5000 UF Cartridge | | | ● | ● | |
| Remote Water Dispenser | | | | | ● |
| Foot-pedal | | | | | ● |
| **Optional Features** | | | | | |
| Remote Water Dispenser | ● | ● | ● | ● | |
| Remote Display | ● | ● | ● | ● | |
| Foot-pedal | ● | ● | ● | ● | |
| TOC meter | ● | ● | ● | ● | ● |
| **Product Water Specifications*** | | | | | |
| Resistivity (MΩ.cm @ 25 °C) | 18.2 | 18.2 | 18.2 | 18.2 | 18.2 |
| TOC Level (typical values) (ppb) | 5-10 | 1-5 | 5-10 | 1-5 | <5 |
| Pyrogen Level (EU/ml) | NA | NA | <0.001 | <0.001 | NA |
| Bacteria* (cfu/ml) | <1 | <1 | <1 | <1 | <1 |
| Particulates* >0.22 µm (P/ml) | <1 | <1 | <1 | <1 | <1 |
| RNases* (ng/ml) | – | – | < 0.01 | < 0.01 | – |
| DNases* (pg/µl) | – | – | < 4 | < 4 | – |
| Flow Rate (l/min) | 1.5 | 1.5 | 1.0 | 1.0 | 1.5 |

*Test conditions with the appropriate final filter.
These values are typical and may vary depending on the nature and concentration of contaminants in the feedwater.

# Peace of Mind, Support to meet your needs

Millipore application specialists provide information about system use and application insights as well as how to select the best services related to your particular situation.

## Professional installation support for ease-of-use

Millipore's Certified Field Service Support Engineers provide expert, professional support for the installation of your water purification systems. Working together with end-users and appropriate Facilities personnel, they follow a comprehensive pre-installation checklist to ensure that Millipore water purification systems are installed in your laboratory in compliance with all applicable codes (i.e. electrical, plumbing).

## Comprehensive service program

### Preventive maintenance plans for optimal water quality

Regular preventive maintenance of your water purification system is the most efficient way of ensuring optimal water quality and system reliability. This program covers all your requirements every step of the way:

- Preventive maintenance visits
- Troubleshooting visits
- Customized user training
- Verification and/or calibration of monitoring devices
- Pharmacopeia suitability tests
- Validation support
- Maintenance plans
- Scheduled delivery and replacement of consumables
- Extended warranty

## Qualification Expertise

### Millipore's qualification program facilitates laboratory validation procedures

Validation support is provided by trained Millipore field Service Support Engineers using calibrated equipments and Qualification Workbooks. With more than 10 years experience in water system qualification services, Millipore can assist you in complying with regulatory standards applicable to your industry.

*Millipore's Bioscience Division provides innovative tools, services and biological reagents that drive advancements in biomedical and academic research as well as support the discovery and development of new pharmaceuticals. Our customers work in leading research laboratories across a variety of industries throughout the world. Millipore improves their laboratory productivity and efficiency through optimized workflows. Please visit **www.millipore.com/bioscience** for more details.*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