

RiOs™ 30/50/100/150/200

Laboratory-Grade Water Systems

<up to 8000 liters per day >



PURE EXPERIENCE

Total Pure Water Solutions

Merck Millipore is the partner of choice for total water purification systems from conception and design through to installation and user support services.

We work in partnership with all parties involved in a project: helping each customer define their own specific needs, then working with equipment suppliers, architects, engineers, and other consultants to design and install the system to meet exact customer requirements. We also help with budget planning, and provide a detailed quotation package.

Merck Millipore can provide project management support and valuable advice on the total water system, including comprehensive maintenance and qualification programs for full peace of mind.

USER & NEEDS REQUIREMENTS

Laboratory-grade water is frequently used in laboratories, mainly for applications such as general rinsing, feedwater to washing machines and autoclaves, or feed to Milli-Q® and Super-Q® ultrapure water systems.

Merck Millipore has developed RiOs™ systems for users requiring a few hundred liters up to several thousand liters per day of laboratory-grade water.

Merck Millipore has over 40 years' experience in the development of products aimed at improving the quality and reliability of results; from research laboratories to QA/QC laboratories in the pharmaceutical industry. Based on this in-depth knowledge of diverse laboratory applications and equipment, pharmaceutical industry requirements and water purification techniques, Merck Millipore provides a comprehensive package for total water purification systems for a single laboratory, a suite of laboratories or an entire laboratory building.

RiOs™ SYSTEM ONE COMPLETE PURIFICATION AND CONTROL UNIT

Total control

RiOs™ systems provide total control of all water purification system functions, operating parameters and standard accessory components:

- Within the RiOs™ system itself, including the purification sequence and water quality monitoring.
- Within the external pure water distribution loop, including the distribution loop pump, distribution loop UV lamp, water detector, automatic loop drain valve, Automatic Sanitization Module (ASM) on the storage reservoir and resistivity monitor in the distribution loop.
- No external control box is normally required.
- Parameters are controlled at each stage of the purification process to ensure consistent water quality - including feedwater conductivity, RO permeate conductivity, % rejection of the RO membranes, water temperature, and operating pressure.

Easy maintenance and low running costs

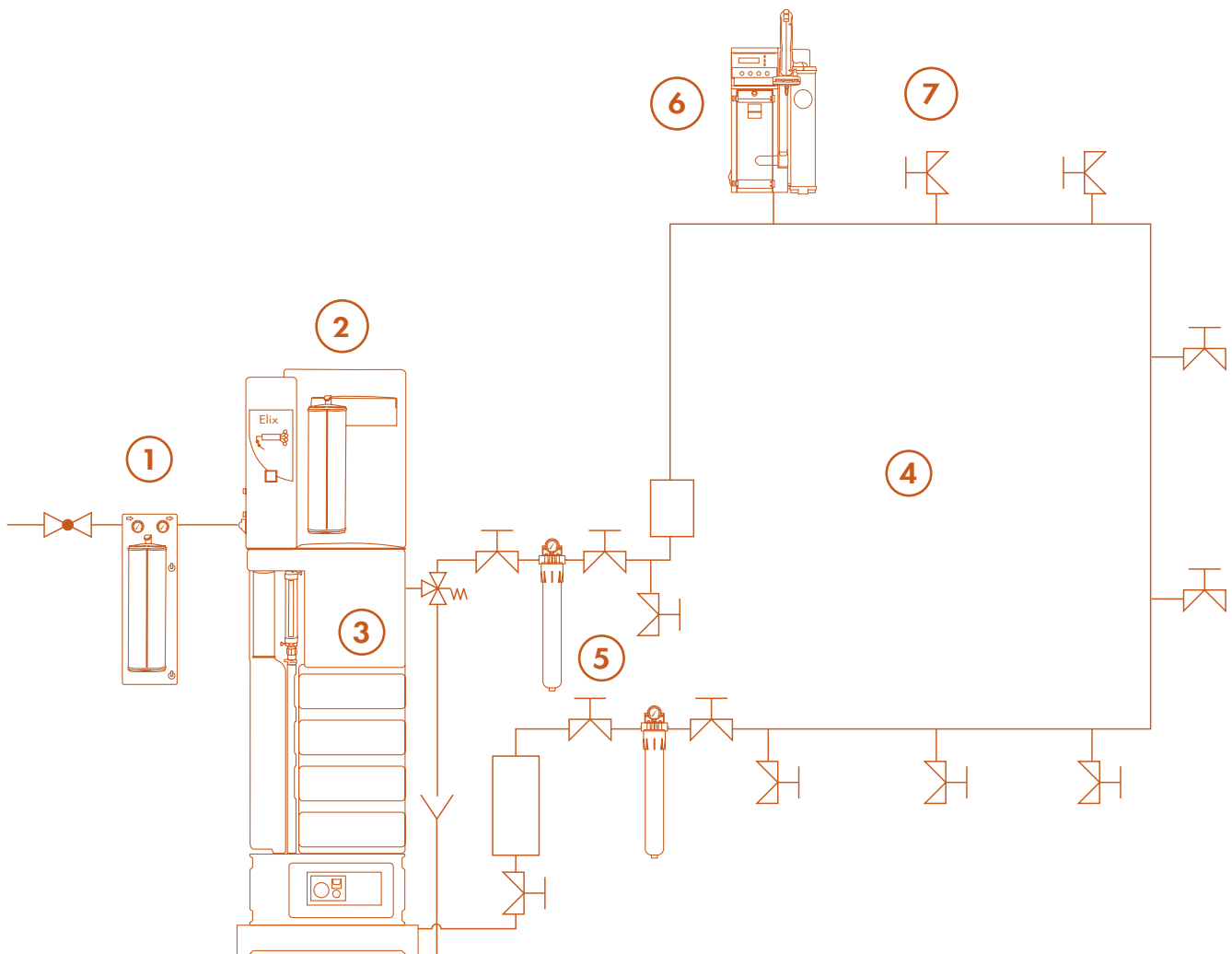
- Easy-to-replace pretreatment packs, tailored to the feedwater source.
- Water savings based on the RO-reject water recirculation loop.
- Adjustable RO percent recovery to optimize running conditions.

The RiOs™ system incorporates both the complete water purification sequence for the production of laboratory-grade water, as well as the entire control and monitoring functions for the total water purification system. Flow rate and water quality can be upgraded in RiOs™ systems.

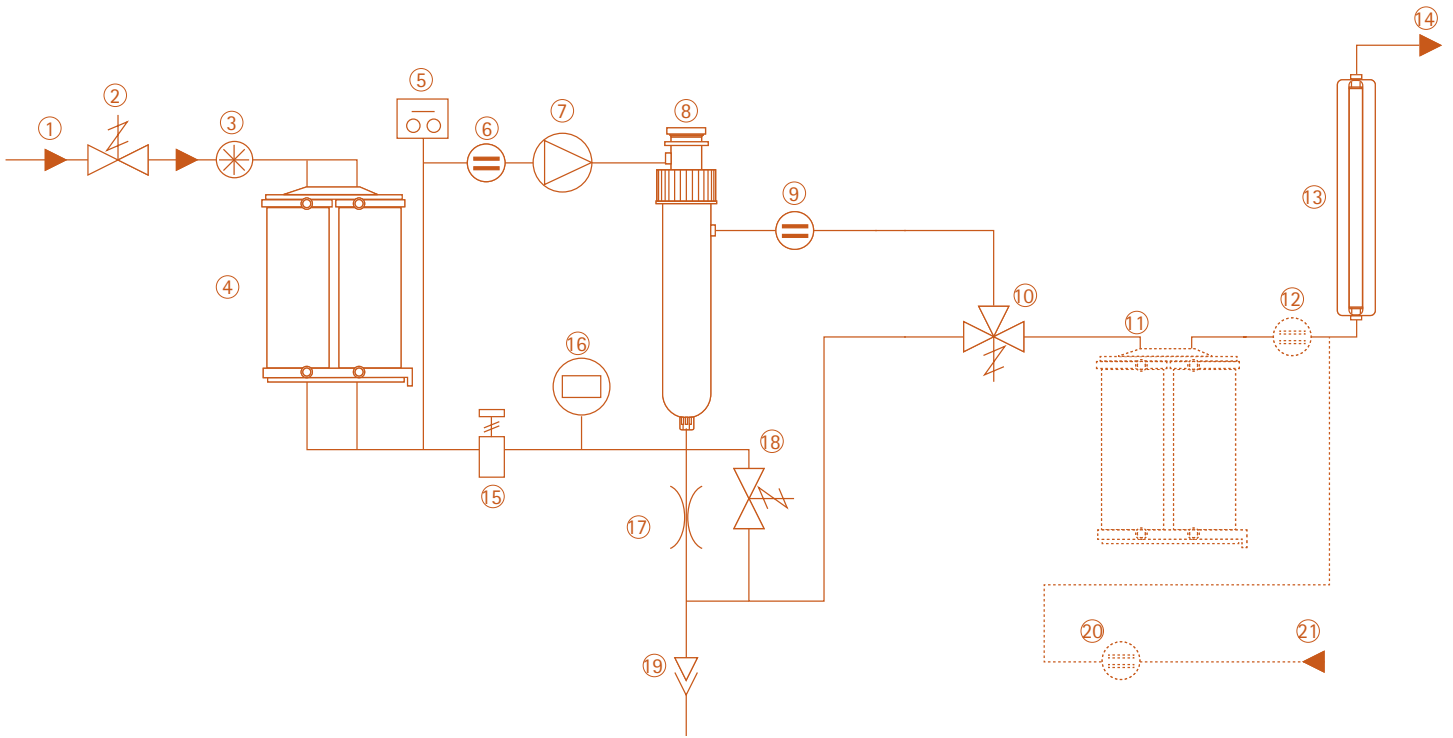
Example of a Total Water Purification System

A total water purification system requires the main water purification system to be integrated into a centralized system. For example:

- ① Pretreatment
- ② Make-up water purification system (RiOs™ system)
- ③ Storage reservoir
- ④ Distribution loop
- ⑤ Accessories (UV Lamp, Resistivity Monitor, Bacteria Filter, etc.)
- ⑥ Milli-Q® system (point-of-use polisher)
- ⑦ Pure water point of use



INSIDE THE RiOs™ SYSTEM



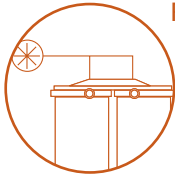
- | | |
|-------------------------------|------------------------------------|
| ① Feedwater | ⑫ Resistivity Cell (optional) |
| ② Inlet Solenoid Valve | ⑬ UV Lamp |
| ③ Flow Meter | ⑭ Product Water to Reservoir |
| ④ Progard® Pack | ⑮ Pressure Control |
| ⑤ Pressure Switch | ⑯ Pressure Sensor |
| ⑥ Feedwater Conductivity Cell | ⑰ Adjustable Flow Control |
| ⑦ Pump | ⑱ Flush Valve |
| ⑧ RO Cartridge(s) | ⑲ Reject |
| ⑨ Permeate Conductivity Cell | ⑳ Loop Resistivity Cell (optional) |
| ⑩ Permeate Divert Valve | ㉑ Loop Return |
| ⑪ Polishing Pack (optional) | |



Optimum control of water quality

After each purification step, relevant parameters are checked by the system:

- Feed pressure, feedwater quality
- Pressure, RO water quality, RO membrane efficiency (% ion rejection)
- RiOs™ product water quality: conductivity and temperature



Pretreatment

The Progard® TL pretreatment pack is the first step and removes:

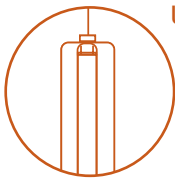
- Particles (0.5 µm filter)
- Free chlorine and colloids (activated carbon filter) from tap water to protect the system.

Additionally:

- An anti-scaling agent protects the reverse osmosis membrane in hard water areas
- Bactericidal carbon prevents unwanted bacterial growth.

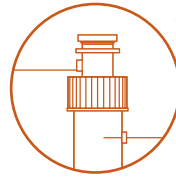
Pretreatment packs are tailored to the feedwater source:

- Primary system packs for standard feedwaters.
- Secondary system packs (external holder) for high fouling index and/or high chlorine levels.



Ultraviolet Lamp

During the last step, the water is sanitized by a 254 nm UV lamp. This powerful UV lamp leads to a log reduction value (LRV) of 4 in the bacterial count of the water (a bacterial count of 10,000 cfu/ml will be reduced to 1 cfu/ml), irrespective of the system's nominal flow rate. This allows the RiOs™ system to produce optimum water quality for bacteriasensitive applications.



Advanced Reverse Osmosis

Reverse Osmosis (RO), the second step, removes 95- 99 % of ions and 99 % of all dissolved organic substances (MW > 200 Dalton), micro-organisms and particles.

Built-in advanced features provide 2 major benefits:

- **High water recovery:** Part of the RO reject water is recycled back to the RO membrane feedwater stream. To optimize water consumption, water recovery can be adjusted up to 70 %, depending on the feedwater quality and the pretreatment sequence used.
- **Constant product flow rate independent of temperature:** A unique feature allows RiOs™ systems to maintain a constant flow rate from 7- 30 °C. Typically, standard RO-based systems suffer a decline of as much as 50 % in product flow rate as water temperature decreases.

Merck Millipore also offers a range of lower-volume water purification systems based on the same purification sequence and containing similar features. They can be an economical solution to supply a remote laboratory with the same laboratory-grade water quality for needs of 10 to 200 liters per day.



Maximum control of distribution loop components

Integrated control functions for:

- The distribution pump
- UV lamp
- ASM on the storage reservoir
- Resistivity monitoring in the distribution loop*.

*If Q-Gard® is installed

SPECIFICATIONS

Feedwater Requirements

Quality	Potable (Tap) Water
Conductivity	< 2000 $\mu\text{S}/\text{cm}$ (@ 25 °C)
pH	4 - 10
Maximum LSI	< 0,3
Calcium (as CaCO_3)	< 300 ppm (when system water recovery > 50 %)
Total Chlorine level	Merck Millipore Application Specialist will determine pretreatment required
Fouling index	Merck Millipore Application Specialist will determine pretreatment required
Feedwater pressure	2 bar minimum, 6 bar maximum (29 psi min, 86 psi max)
Flow rate	> 5 l/min at 2 bar (1.3 gal/min at 29 psi)

General Specifications

Water connections

Solenoid valve feed: $\frac{1}{2}$ - in NPTM or $\frac{1}{2}$ -in M-GAZ

System feed: $\frac{1}{2}$ - in tubing

Product: 8 mm tubing

RO reject: $\frac{1}{2}$ - in tubing

Electrical requirements

- 117 V/60 Hz, 10 A, (10 A Slo-Blo® fuse)
- 230 V/50 Hz, 5 A, (10 A Slo-Blo fuse)
- 110 V/50/60 Hz, 10 A, (10 A Slo-Blo fuse)

Data port connection: RS232

Drain requirements: > 5 l/min (> 1.3 gal/min)

Dimensions (H x W x D)

733 mm x 662 mm x 441 mm (28.9 x 26.1 x 17.4 in)
additional 47 mm (1.8 in) width required for plumbing connections

System operating weight

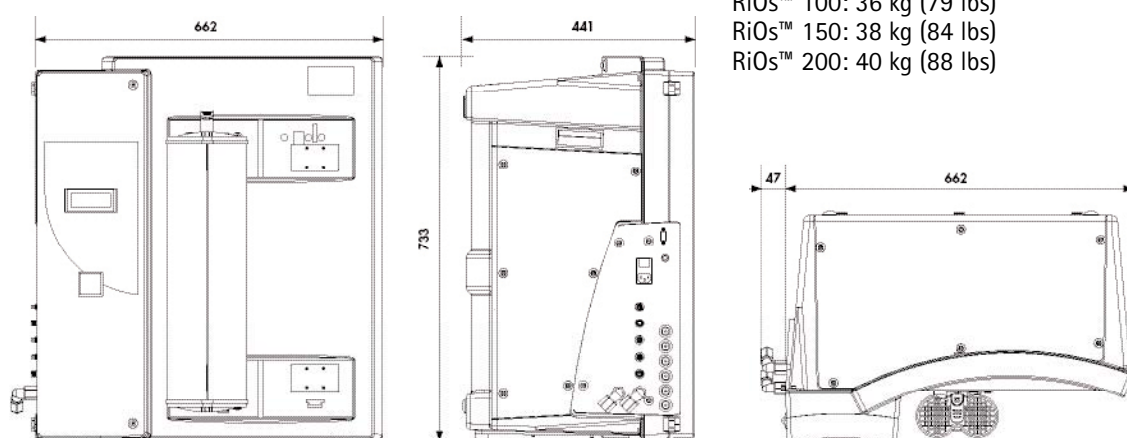
RiOs™ 30: 33 kg (73 lbs)

RiOs™ 50: 34 kg (75 lbs)

RiOs™ 100: 36 kg (79 lbs)

RiOs™ 150: 38 kg (84 lbs)

RiOs™ 200: 40 kg (88 lbs)



System Performance

	RiOs™ 30	RiOs™ 50	RiOs™ 100	RiOs™ 150	RiOs™ 200
Product flow rate (nominal flow rates, 7- 30 °C)	30 l/h 7.9 gal/h	50 l/h 13.2 gal/h	100 l/h 26.4 gal/h	150 l/h 39.6 gal/h	200 l/h 52.8 gal/h
Water recovery (Merck Millipore Application Specialist will optimize recovery based on feedwater and pretreatment)	up to 45 %	up to 55 %	up to 70 %	up to 70 %	up to 70 %
Ion rejection	95-99 %	95-99 %	95-99 %	95-99 %	95-99 %
Organic rejection (MW > 200 Dalton)	> 99 %	> 99 %	> 99 %	> 99 %	> 99 %
Particles	> 99 %	> 99 %	> 99 %	> 99 %	> 99 %
Bacteria	< 10 cfu/ml	< 10 cfu/ml	< 10 cfu/ml	< 10 cfu/ml	< 10 cfu/ml

MAXIMUM CONVENIENCE AND ADAPTATION TO GLP/GMP REQUIREMENTS

- The system indicates when the Progard pretreatment pack is exhausted.
- Automatic sanitization of the RO modules is carried out when the pretreatment pack is changed.
- Automatic flush and rinsing cycles avoid stagnation of the water inside the system during periods when not in use.
- All operating modes, performance parameters and indicators for routine maintenance are shown on the built-in backlit display.
- When service and/or maintenance is required, this is clearly indicated by a message on the system display and a flashing red or yellow LED indicator, depending on the intervention required.

TOTAL SERVICE & SUPPORT

From each stage of the project (conception, design and installation) to everyday use, Merck Millipore offers comprehensive, high quality support services.

From the make-up water purification system to the components in the total water purification system (pure water storage, distribution loop, UV lamp, warning systems and control and measuring functions), Merck Millipore gives customers the advantage of dealing with only one company for guaranteed results.

After installation, Merck Millipore Field Service Support Engineers can train you on system use and provide technical and maintenance support that responds to specific needs. This includes preventive maintenance and customized services, such as conductivity/temperature meter verification.

Additionally, our certified Field Service Support Engineers offer assistance to help you successfully perform the Installation Qualification (IQ), Operational Qualification (OQ) and maintenance program within a GMP and/or GLP environment.

RiOs™ systems have been designed for minimum maintenance and to help users working in GLP / GMP environments. Each purification step contains specific features that make the systems easy to use.

R&D

All Merck Millipore water purification systems are designed and developed in our integrated Research and Development centers in Europe, Japan and the United States.

QUALITY

Our manufacturing and distribution site is ISO® 9001 and ISO 14001 certified.



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