

ENGINEERING CHECKLIST

Lab Water System Specification Checklist for Engineers

A practical planning checklist for engineers, contractors, facility teams, and lab planners specifying a laboratory water purification system.

Specifying a lab water system is not just about choosing a purification unit.

A good specification connects the water quality target, daily usage, peak demand, feedwater conditions, storage, distribution, monitoring, service access, and future growth plan. Miss one of those inputs and the system may still get installed, but it may not perform the way the lab needs it to.

For engineers, contractors, facility teams, and lab planners, the goal is simple: define the water system clearly before purchasing, installation, or construction moves too far ahead.

Why Lab Water System Specs Go Wrong

Lab water systems often get underspecified when the project team starts with equipment instead of requirements.

A system may look correct on paper, but still create problems later if the specification does not account for:

✓ The required water type

✓ Daily water usage

✓ Peak demand

✓ Number of users

✓ Points of use

✓ Feedwater quality

✓ Pretreatment needs

✓ Storage and distribution

✓ Service access

✓ Monitoring and alarms

✓ Redundancy

✓ Future lab growth

The best water system specification starts with how the lab will actually use the water.

Quick Checklist: What to Confirm Before Specifying a Lab Water System

Core specification inputs		
SPEC ITEM	WHAT TO CONFIRM	WHY IT MATTERS
Water quality target	Type I, Type II, Type III, ASTM, CLSI, USP, instrument-specific, or application-specific requirements	Prevents overspending on unnecessary purity or underspecifying critical applications
Daily demand	Average gallons or liters used per day	Helps size production capacity
Peak demand	Highest short-term demand period	Prevents slow recovery, shortages, or undersized storage
Points of use	Number and location of taps, instruments, benches, washers, or equipment connections	Affects layout, piping, pressure, and distribution
Feedwater quality	Incoming TDS, hardness, chlorine/chloramine, silica, CO ₂ , pressure, temperature	Drives pretreatment and RO design
Pretreatment	Sediment, carbon, softening, antiscalant, filtration, or other upstream treatment	Protects membranes, cartridges, and final water quality
Storage	Tank size, material, venting, sanitization, recirculation	Supports demand and protects water quality
Distribution	Loop design, dead legs, materials, flow, pressure, return path	Impacts water quality at each point of use
Monitoring	Resistivity, conductivity, TOC, flow, pressure, tank level, alarms	Gives the lab visibility into system performance
Service access	Filter clearance, cartridge replacement, valve access, drain access, controls access	Reduces maintenance headaches
Redundancy	Backup production, bypasses, spare capacity, critical-use planning	Helps reduce downtime risk
Future growth	New instruments, more users, expansion, higher demand	Avoids early redesign or replacement

1. Define the Water Quality Target

The first question is not "Which system should we buy?" The first question is: What water quality does the lab actually need?

- Type I water
- Type II water
- Type III water
- ASTM reagent water requirements
- CLSI clinical lab requirements
- USP purified water requirements
- Instrument manufacturer requirements
- Process-specific or application-specific requirements

A vague spec like "provide purified water" leaves too much room for interpretation. A better spec identifies the required quality at the point of use, not just at the outlet of the purification unit.

For a plain-English breakdown of water grades, reference the internal guide on [lab water quality requirements](#).

2. Identify Each Application the System Will Support

A single lab may use purified water for several different purposes. List every application before choosing the system.

✓ HPLC	✓ LC-MS
✓ ICP-MS	✓ General reagent preparation
✓ Buffer preparation	✓ Media preparation
✓ Glassware washing	✓ Autoclave feedwater
✓ Analyzer feedwater	✓ Humidification
✓ Environmental chambers	✓ Rinsing
✓ Final rinse stations	✓ Lab sinks or taps
✓ Central distribution loops	✓ Point-of-use polishing

Different applications may need different water quality levels. Some may need Type I water. Others may only need Type II or Type III. Some may require a central system, and some may require final polishing close to the point of use.

3. Calculate Daily Water Demand

Daily demand tells you how much purified water the lab uses over a typical day. This should include all connected applications, not just the main instrument or main lab sink.

- Average daily use
- High-use days
- Number of users
- Number of shifts
- Number of instruments
- Glassware washer cycles
- Autoclave cycles
- Batch prep needs
- Rinse needs
- Future planned equipment

Daily demand affects the production rate, storage size, recovery expectations, cartridge life, and service frequency.

4. Confirm Peak Demand

Peak demand is often more important than average demand. A lab may only use a moderate amount of purified water per day, but still need a large amount during a short window.

- Highest expected draw rate
- When peak demand occurs
- How long peak demand lasts
- Which users or equipment draw water at the same time
- Whether storage is needed to cover peak use
- Whether pressure must remain stable during peak use

Peak demand helps determine tank size, pump selection, distribution layout, and system recovery rate.

5. Map Every Point of Use

A water system spec should identify where water is needed, not just how much water is needed.

- Number of outlets
- Location of each outlet
- Required water quality at each outlet
- Required flow rate at each outlet
- Pressure requirements
- Tubing or piping distance
- Floor, room, or suite served
- Instruments served
- Future connection points

This helps determine whether the project needs a point-of-use system, central system, or hybrid design.

For smaller or localized applications, [point-of-use lab water systems](#) may be the better fit. For larger systems, multiple users, storage, and distribution, [custom engineered lab water systems](#) may make more sense.

6. Test and Document Feedwater Quality

The incoming water drives the rest of the system design. Before specifying the purification sequence, document the feedwater conditions.

Feedwater factors to review	
FEEDWATER FACTOR	WHY IT MATTERS
TDS or conductivity	Affects RO loading, DI cartridge life, and polishing requirements
Hardness	Can cause scaling and membrane problems
Chlorine or chloramine	Can damage some membranes and affect pretreatment needs
Silica	Can be difficult for some systems and applications
CO2	Can reduce DI resin life
Iron or manganese	Can foul membranes and filters
Particulates	Can clog filters and affect downstream performance
Temperature	Affects membrane production rate
Pressure	Affects RO performance and system output
Seasonal changes	Feedwater quality may shift through the year

7. Specify Pretreatment

Pretreatment protects the rest of the system. The right pretreatment depends on the incoming water and the target water quality.

✓ Sediment filtration	✓ Carbon filtration
✓ Water softening	✓ Antiscalant
✓ Particulate filtration	✓ Iron removal
✓ Chlorine or chloramine reduction	✓ pH adjustment

Pretreatment should not be treated as an afterthought. Poor pretreatment can shorten membrane life, burn through consumables, reduce flow, create alarms, and raise operating cost.

8. Decide Whether Storage Is Needed

Storage can help support peak demand and reduce pressure on the purification system. But storage also creates design decisions.

✓ Required storage volume	✓ Tank material
✓ Tank location	✓ Vent filtration
✓ Level controls	✓ Overflow protection
✓ Drain location	✓ Sanitization method
✓ Recirculation needs	✓ Space and access requirements

A storage tank can solve demand problems, but a poorly designed storage setup can create water quality problems.

9. Plan the Distribution Layout

Distribution design matters as much as purification. A central system may produce high-quality water, but poor distribution can degrade it before it reaches the user.

✓ Piping or tubing material	✓ Loop design
✓ Dead legs	✓ Distance to users
✓ Recirculation	✓ Flow velocity
✓ Pump sizing	✓ Pressure stability
✓ Drain access	✓ Sanitization method
✓ Sample points	✓ Isolation valves
✓ Future branches	

10. Confirm Monitoring and Controls

A lab water system should give users clear visibility into performance. Depending on the system, monitoring may include:

✓ Conductivity	✓ Resistivity
✓ TOC	✓ Flow
✓ Pressure	✓ Tank level
✓ Temperature	✓ Cartridge status
✓ RO performance	✓ Alarm history
✓ Leak detection	✓ Remote monitoring

At minimum, the spec should define what needs to be measured, where it should be measured, and who needs to see the data.

11. Plan for Maintenance Access

A water system can meet the spec and still be painful to service. Before finalizing the layout, confirm access for:

✓ Filter changes	✓ Cartridge replacement
✓ RO membrane service	✓ UV lamp replacement
✓ Tank inspection	✓ Sanitization
✓ Pump service	✓ Valve access
✓ Controls access	✓ Drain access
✓ Sample collection	✓ Clearance around equipment

Poor service access leads to skipped maintenance, longer service visits, and higher frustration for facility teams.

12. Define Redundancy Needs

Not every lab needs redundancy. But critical labs should discuss it before the system is installed.

- What happens if the system goes down?
- Can the lab operate for a day without purified water?
- Is backup water available?
- Are there critical instruments that cannot stop?
- Does the system need spare capacity?
- Should there be bypass capability?
- Should consumables be stocked on site?
- Is a service agreement needed?

13. Account for Future Growth

Many lab water systems are designed for today's needs, then outgrown within a few years.

✓ Will the lab add instruments?

✓ Will more users need access?

✓ Will another room or suite need service later?

✓ Will demand increase after startup?

✓ Will the lab add washers, sterilizers, or analyzers?

✓ Can the system be expanded?

✓ Is there space for a larger tank or additional polishing?

✓ Are future taps or branches planned?

14. Clarify Ownership and Maintenance Responsibilities

A water system often touches several teams. Before handoff, clarify who owns:

✓ Daily checks

✓ Filter replacement

✓ Cartridge replacement

✓ Sanitization

✓ Alarm response

✓ Quality logs

✓ Vendor service coordination

✓ Consumable ordering

✓ Spare parts

✓ Calibration

✓ Documentation

15. Review the Spec Before Purchasing

Before purchasing or releasing the final spec, review the complete system against the actual lab workflow.

✓ Required water quality is clearly defined

✓ Applications are listed

✓ Daily demand is estimated

✓ Peak demand is estimated

✓ Points of use are mapped

✓ Feedwater quality is documented

✓ Pretreatment is specified

✓ Storage needs are defined

✓ Distribution layout is reviewed

✓ Monitoring requirements are clear

✓ Maintenance access is confirmed

✓ Redundancy needs are discussed

✓ Future growth is included

✓ Ownership after installation is assigned

✓ The system is matched to the lab's real use

This is where a [water system spec review](#) can help. A second technical review can catch missing requirements before they become expensive field issues.

Common Spec Mistakes to Avoid

Common issues that can show up after installation	
MISTAKE	POTENTIAL RESULT
Spec says "purified water" without defining quality	Wrong system or unclear vendor interpretation
Daily use is estimated but peak demand is ignored	Slow recovery, low pressure, or user frustration
Feedwater quality is skipped	Poor pretreatment, short consumable life, unstable performance
Storage is added without quality planning	Water quality loss in the tank or distribution
Distribution layout has dead legs	Stagnation and quality issues
Service clearance is ignored	Harder maintenance and longer downtime
Future expansion is not discussed	Early system replacement or costly redesign
No one owns maintenance after startup	Reactive service and avoidable downtime

Need Another Set of Eyes on Your Lab Water System Spec?

Pure Process Technology helps engineers, facility teams, lab planners, and procurement teams review lab water system requirements before installation or purchasing decisions are finalized.

If you are planning a new system, replacing an existing unit, or preparing a specification for a lab project, request help reviewing your specification.

[Request Help Reviewing Your Specification](#)

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Suggested excerpt

Specifying a lab water system takes more than choosing equipment. This checklist helps engineers, facility teams, and lab planners define water quality, usage, pretreatment, storage, distribution, maintenance access, and future growth before installation.