WHITE PAPER

Water Bath, Circulator, or Chiller?

A Buyer's Guide to Choosing the Right Temperature Control Platform

Prepared by PolyScience
August 2026

Executive Summary

General purpose water baths, constant temperature circulators, and recirculating chillers all move heat, and all three show up in the same lab, production floor, or process environment — which is exactly why they get confused for one another. Each is built to do a different job, and choosing the wrong one usually shows up later as a temperature control problem, a missing pump, or a chiller that was never meant to hold a sample bottle in the first place.

This guide lays out how the three product categories differ, the questions that reliably point to the right one, and the specifications and features that separate models within each category. PolyScience manufactures across all three categories — spanning a combined temperature range of -100°C to 200°C — so the goal here is to help you land on the right platform first, rather than the one that happened to be closest at hand.

Whichever category ends up being the right fit, it is built to the same standard. PolyScience applies one quality philosophy across its entire temperature control line: precision-engineered components, rigorous testing, and construction designed for years of dependable, continuous-duty service — so the decision this guide helps you make is purely about capability, not about which product line is built to last.

	General Purpose Water Bath	Constant Temperature Circulator	Recirculating Chiller
Typical temperature range	Ambient +5°C to 100°C	As low as -40°C up to 200°C, depending on model	Roughly -20°C to 70°C, depending on model
Has a pump?	No	Yes — internal and/or external circulation	Yes — sized to remove heat from external equipment
Primary job	Hold directly immersed samples at a set temperature	Hold a fluid at a precise temperature and deliver it elsewhere	Continuously remove heat that another device is generating
Best fit when…	Samples sit in the bath itself; no below-ambient or external circulation needed	You need broader range, tighter stability, or fluid delivered to an external vessel or instrument	A piece of equipment runs hot on its own and needs continual, sized heat removal to function or

Table 1. Quick-reference comparison. Exact ranges and capabilities vary by specific model — see each section for detail.

The Core Question: Is Heat Being Added, or Removed?

Before comparing specifications, one question does most of the sorting: does the application need heat added to a sample sitting in the unit, or does it need heat removed from something else entirely?

A water bath and a circulator both hold a fluid at a controlled temperature — the difference between them is whether that fluid needs to go anywhere. A chiller is a different job altogether: it doesn't hold samples at all. It removes heat that some other piece of equipment is generating, so that equipment can keep working. Once you know which of those two situations you're in, the choice usually narrows to one category quickly.

From there, PolyScience's role is to make sure the category you land on has a quality-engineered model to match — each product line below is designed, built, and tested to the same PolyScience standard, so the comparison that matters is capability against your application, not one product line's reliability against another's.

General Purpose Water Baths

A general purpose water bath is an unstirred tank that holds samples at a controlled temperature above ambient — the simplest and most direct way to warm, incubate, or thaw something that can sit directly in the tank. Simple as the job is, PolyScience builds its water baths to the same quality standard as its most advanced circulators and chillers — precision temperature control in a durable, purpose-built platform.

Specifications

- Temperature range: ambient +5°C to 100°C (not for boiling)
- Stability: ±0.1°C to ±0.2°C depending on model
- Capacities from 2 to 28 liters
- 300-series stainless steel tank

Key Features

A gabled, hinged, clear cover is standard: tilting it back drains condensation into the bath instead of onto the bench, and the extra height accommodates taller media bottles and samples. A silicone-pad heating element applies even heat across the entire tank bottom for temperature uniformity, and a full-color, multi-language display shows status at a glance — readable from across the room on larger units. An eco-mode can shut the bath off automatically after a preset run time, and PolyScience's water baths are compatible with waterless bath beads as a water-free alternative. Details like these — a heavy-gauge stainless tank, a heating element engineered for even heat distribution across the whole tank bottom, a display built for at-a-glance readability — reflect the same quality-first construction standard PolyScience applies across every product in this guide.

Choose a Water Bath When

- Samples (bottles, vials, tubes) can sit directly immersed in the tank — no external circulation is needed
- The set temperature is above ambient and at or below 100°C
- No pumping to another vessel or instrument is required
- Samples don't need to be shaken or stirred while in the bath

Typical markets: academia, microbiology, clinical, biotechnology, chemical, food & beverage, medical, petrochemical, and pharmaceutical. Typical applications: tempering, thawing, and incubation.

Constant Temperature Circulators (Circulating Baths)

In simplest terms, a circulating bath is a water bath with a pump. That pump is what unlocks everything a water bath can't do: broader temperature range, tighter stability, and the ability to deliver temperature-controlled fluid to something outside the bath itself — a jacketed vessel, a viscometer, a rotary evaporator, or any other external load — in addition to direct immersion. PolyScience engineers that pump, and every component around it, to the same rigorous quality standard applied across its instrument lines, so the added capability doesn't come at the cost of reliability.

Specifications

- Temperature range: as low as -40°C to as high as 200°C, depending on refrigeration and controller
- Stability: from ±0.07°C down to ±0.005°C, depending on controller tier
- Reservoir sizes from 6 to 45 liters
- Available as heat-only, refrigeration & heat, or immersion heat-only (a controller that clamps onto any existing tank)

Four Controller Tiers

The controller is what determines maximum temperature, stability, pump behavior, display and language options, computer connectivity, and programmability. MX is the entry tier (heats to 135°C, ±0.07°C, single-speed pump). Standard Digital steps up to 170°C and ±0.04°C with a two-speed pump and RS232 connectivity. Advanced Digital reaches 200°C at ±0.01°C with a variable-speed pump and full connectivity (USB-A, USB-B, Ethernet, RS232, external probe). Advanced Programmable matches Advanced Digital's range and connectivity but tightens stability to ±0.005°C and adds open-mode, multi-step time/temperature ramping for unlimited ramp-and-soak programs. PolyScience applies the same quality-engineering discipline across all four tiers, so moving up the range is a matter of capability, not a trade-off against build quality.

Pump Options

A pressure-only pump (used on MX and Standard Digital controllers) is a low-pressure design with an unrestricted output of 15 L/min, intended for closed-loop circulation with no breaks in the path. A pressure-suction pump (Advanced Digital and Advanced Programmable) adds higher pressure and unrestricted flow of 20 L/min pressure / 15 L/min suction — a better fit for larger baths, closed-loop systems with higher-viscosity fluid or small-diameter tubing, and the rare case where the circulator needs to control a separate open tank.

Choose a Circulator Over a Water Bath When

- The application needs a temperature below ambient, or above 100°C
- Temperature-controlled fluid needs to be pumped to an external vessel or instrument
- Tighter stability than a water bath provides is required
- Multi-step, programmable ramp/soak profiles or computer connectivity/data logging are needed

Typical applications: rotary evaporators, media warming, electrophoresis, extractions, viscosity and ASTM D-445 testing, solvent traps, cell freezing, DNA/PCR work, tissue freezing, histological studies, calibration, chromatography, isoelectric focusing, forced-age testing, and coliform testing.

Recirculating Chillers

A chiller circulates fluid through a customer's process or equipment to remove heat and provide precise temperature control — it is not generally used to directly immerse samples. In many applications the process or equipment runs hot on its own and needs continual cooling simply to maintain performance and protect the equipment itself. That continual heat removal is the job a chiller is built for.

Sizing a Chiller: The Three Questions That Matter

Desired cooling temperature is the fluid temperature going into the customer's process or equipment. Because that temperature needs to be accurate at the point of use, insulating the supply tubing is often worthwhile, and a remote temperature probe option exists for applications that need remote monitoring or control.

Heat load (cooling capacity) is the amount of heat that must be removed at the desired control temperature — usually specified by the equipment manufacturer. Cooling capacities are rated at a 20°C ambient and de-rate by roughly 1.3% for every 1°C the room runs above that, so it's standard practice to specify a chiller with about 20% more capacity than the calculated requirement, as a margin against a warmer-than-expected room.

Coolant flow and pressure often matter as much as temperature: many devices being cooled include a flow or pressure switch that the chiller's output must satisfy. PolyScience chillers are available with different pump options to meet a range of flow and pressure requirements — turbine pumps, the most popular option, offer strong flow and pressure characteristics with quiet, durable operation, while positive-displacement pumps are the better choice where higher pressure is required. Matching the pump to the application, rather than defaulting to a single standard part, is consistent with PolyScience's broader quality-first approach to chiller design.

Two Form Factors

Benchtop chillers trade maximum heat-removal capacity for a smaller footprint that fits directly on the bench rather than the floor — a good fit for rotary evaporators, vacuum systems, spectrometers, CCD cameras, small lasers, and similar bench-scale loads. Portable and DuraChill® chillers scale up to substantially higher heat-removal capacity for equipment with a larger cooling demand — lasers, EDM, battery testing, bioreactors, CT/MRI/PET systems, and semiconductor processes among them. Both form factors are engineered and tested to the same PolyScience quality standard for continuous, industrial-duty operation.

DuraChill® Feature Highlights

The DuraChill platform is where PolyScience's quality engineering shows up most concentrated — features purpose-built to eliminate common chiller failure points and reduce the maintenance burden on the customer:

- Dynamic Self-Changing Filter — DuraChill is preprogrammed to change its own air filter on a schedule (once a month by default, over a two-year filter life, with an adjustable interval), removing the need for manual preventative maintenance on the air filter and the downtime or service calls a missed change can cause
- Continuous Liquid Level Monitoring — a capacitance sensor protects the pump from running dry, which can damage pump seals in as little as 30 seconds; low fluid triggers a visual and audible alarm, and the chiller shuts itself down before air can be pulled into the pump
- WhisperCool® Noise Reduction — a patent-pending system that evaluates real-time cooling demand and slows the fan to the minimum speed needed to hold setpoint, for quieter operation without sacrificing temperature control
- Hot Gas Bypass — reduces compressor cycling, which lowers overall energy consumption
- UV Light Biological Growth Inhibitor — a patent-pending system that controls biological growth in the fluid path with passive UV light instead of chemical algicides
- Front Fill Reservoir — a front-mounted fill port avoids reaching over or behind the unit to refill
- Full-color touchscreen — displays setpoint, actual temperature, reservoir level, output pressure, and air filter status at a glance, with plain-language system messages instead of error codes

Fluid Selection for Chillers

The most common and broadly compatible circulating fluid is a 50/50 mix of ethylene glycol and distilled water, which gives the best results across roughly -25°C to 80°C setpoints. Antifreeze isn't required for setpoints above 20°C, but it's still recommended even there: glycol helps lubricate pump seals, and the fluid temperature inside a chiller can run as much as 20°C colder than the setpoint at various points in the circuit.

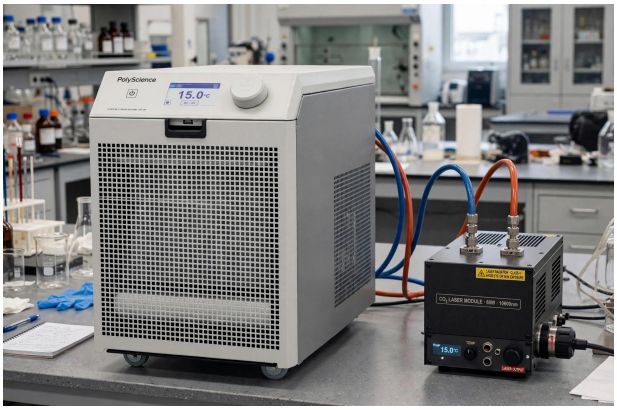
Choose a Chiller When

- A separate piece of equipment generates heat on its own and needs continual, sized cooling to function or to protect itself
- The application requires circulating fluid through external tubing or a jacket, not holding a directly immersed sample
- The device being cooled has a specific flow or pressure requirement that must be satisfied

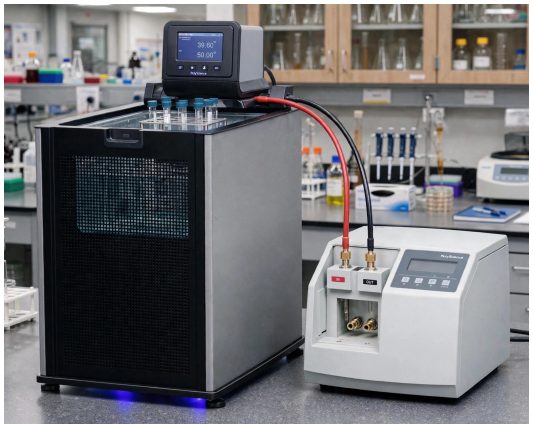
Typical applications: rotary evaporators, condenser cooling, distillation, lasers, EDM, battery testing, bioreactors, CT/MRI/PET scanning, diffusion pumps, vacuum systems and traps, and semiconductor plasma etching and wafer trimming.

Chiller vs. Circulator: What Closed-Loop Cooling Looks Like

The photographs below show the fluid-path difference described above in two representative PolyScience setups. A chiller circulates fluid through a sealed, closed loop directly to the load — in this example, a CO2 laser module — continuously removing the heat that load generates. A circulator, by contrast, works from an open bath; pairing it with an external pump lets it deliver temperature-controlled fluid to a remote vessel or flow cell while the reservoir itself stays open to the room.



Chiller — closed-loop cooling to an external application. Strong pumping and high heat removal in a limited temperature range.



Circulating Bath + external pump — open-bath control of direct immersion samples and external circulation to an external application. High precision and broad temperatu range.

Figure 1. Representative PolyScience setups: chiller closed-loop cooling to an external load (left) vs. circulator with external pump feeding a remote flow cell (right).

Fluid Selection Across All Three Categories

Since every product in this guide is intended to control the temperature of a fluid, fluid selection follows a consistent, simple rule of thumb across water baths, circulators, and chillers: for setpoints between 20°C and 99.9°C, use distilled or tap water (or another fluid suited to the specific application); below 20°C, use a 50/50 glycol/water antifreeze mix or another fluid with a suitably lower freeze point; above 99.9°C, use silicone oil or another fluid with a higher boiling point. Deionized water should not be used in any of these products. If a specific fluid is required for an application, the instruction manual for each product lists compatible wetted parts so compatibility can be confirmed before use — a level of documentation that reflects PolyScience's quality-assurance approach to every fluid path component, not just the ones a customer sees.

Questions to Ask Before You Buy

Regardless of which of the three categories fits, the same core questions determine which specific model is the right one:

- What is the application?
- What pump flow and/or pressure is required?
- What fluid temperature range or set temperature is needed?
- What reservoir size is needed, or what is the sample size and quantity?
- What cooling capacity (heat removal) is required?
- Is remote temperature control or monitoring needed?
- What temperature stability does the application require?
- Is programmability (multi-step ramp/soak) needed?

- Is data logging needed?

It's also worth confirming accessories up front — fluid, tubing, and a temperature probe are easy to overlook until setup. PolyScience's applications engineers work through this exact list with customers directly, matching the specific model and configuration to the application — the same consultative, quality-first approach that shapes how every PolyScience product in this guide is designed and built.

Still Not Sure Which One You Need?

A quick way to narrow it down: if samples sit directly in the unit, start with a water bath or a circulator depending on the range and stability needed. If the unit needs to deliver fluid somewhere else, it's a circulator or a chiller — and if that "somewhere else" is a piece of equipment generating its own heat that needs to be removed, it's a chiller.

Contact PolyScience to talk through your application and get a model recommendation.

Conclusion

Water baths, circulators, and chillers all belong to the same family of temperature control equipment, but they answer different questions: how do I hold a sample at temperature, how do I deliver precisely controlled fluid somewhere else, and how do I remove heat that something else is generating. Matching the application to the right category first — before comparing individual models — is what keeps the resulting purchase from being a compromise. PolyScience manufactures across all three categories specifically so that match can be made on the merits of the application, not the limits of a single product line.

That match is only worth making if the equipment behind it holds up. It's why PolyScience builds every water bath, circulator, and chiller in this guide to one quality standard — precision-engineered components, rigorous testing, and construction designed for years of dependable service — regardless of which product line ends up being the right fit for your application.

Specifications in this guide reflect general product-line ranges and vary by specific model, controller, and configuration. Confirm exact specifications for a given model against current PolyScience documentation before finalizing a purchase.