CREATE THE CONDITIONS

HOW TO CHOOSE NEW WATER CIRCULATORS AND COLD TRAPS THAT HELP OPERATORS IN YOUR LAB SUCCEED.

LEARN HOW TO CHOOSE THE RIGHT WATER CIRCULATORS AND COLD TRAPS TO MAKE OPERATORS' JOBS EASIER, AND THE LAB MORE SUCCESSFUL.

Most experiments in the lab call for highly controlled conditions to ensure the results can be analyzed and interpreted correctly. Temperature is one of those conditions.
You can't study ice with your feet up on the beach, and you'll never be an expert on Birds of Paradise if you live in the arctic. That is, unless you build a lab, create the conditions, and bring the samples to you.

You also have to control contamination.

You can't bring those Birds of Paradise to your arctic lab and let loose a bunch of snakes and owls. You have to check that contamination at the door.

Mastering temperature and contamination helps you construct the optimal environment for whatever you're exploring - birds, ice, bacteria, viruses, tissue, or anything else.
And two of the most valuable instruments to support your mastery are water circulators/chillers and cold traps. They're used across many applications and give labs:

- Substantial cost savings.
- Greater testing accuracy.
- Improved sustainability.
- Enhanced safety.
- Confidence in testing quality.

Water circulators are powerful closed cooling systems. The cooling capacity you get is far beyond anything you could achieve with a steady stream of fresh water. With only tap water and antifreeze solution, these supply cold environments for a huge range of applications in the lab.

Cold traps efficiently trap toxic substances and water vapor where needed. It can function as a substance extractor or a protector for other pieces of equipment.

Before you spend money on either for your lab, you have to do your due diligence. Make sure you get the right features for your lab's applications.

We wrote this guide to make your job easier. Not to tell you exactly what to buy (although we'll make suggestions), but to show you the features that are out there and how they relate to common applications. So you don't have to spend hours figuring out how the technology has changed since your lab's last purchase.

Read on if you prefer an easier job today.

TABLE OF CONTENTS

WATER CIRCULATORS

WHAT EXACTLY IS A WATER CIRCULATOR?

Water circulators are typically recirculating chillers that supply an environment with a desired temperature through liquid cooling. Typically water, with the aid of an anti-freeze solution, removes heat from a process by circulating through the system/process repeatedly. It's a lot like opening the window in your house to cool the place down. Cool air doesn't come in, technically. The warm air from inside moves outside and disperses in the larger space.

It might be a strange distinction to make, but it makes a lot of sense in the context of your lab application. Heat is carried away and dispersed in a constant cycle.

WHAT ARE THE MOST IMPORTANT FEATURES?

Your water circulator will have unique specifications as you narrow down exactly what's needed. But to make sure you start in the right place before narrowing it down, the specifications should closely mirror those outlined below.

Broadly, look at:

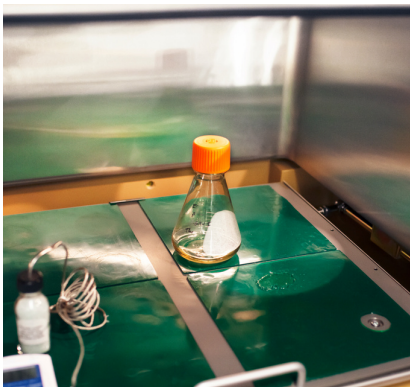
- Circulation type
- Temperature setting range
- Cooling capacity
- Flow rate

Aligning these fundamental features with your application means you don't spend any more than you need and you ensure operators are happy when they show up to work.

WATER CIRCULATORS

CIRCULATION TYPE

You can choose open or closed circulation. Closed circulation (or closed-loop circulation) has fewer moving parts. So the pump is less likely to break down and needs fewer maintenance visits over the lifetime of the circulator.
Closed circulation is generally more affordable and is suitable for 8 out of 10 applications.



TEMPERATURE SETTING RANGE

The temperature setting range can be substantial. Some circulators operate at ambient to +85°C or more, and can drop down to -20°C with its cooling capacity.
A wider temperature range usually means a larger price tag.

Temperature control accuracy is important to look at in conjunction with your range. If accuracy is ±0.1°C, figure out the maximum and minimum temperatures you will need for the circulator and don't buy outside that range. You can save budget by not spending money on capacity you don't need.

WATER CIRCULATORS

COOLING CAPACITY

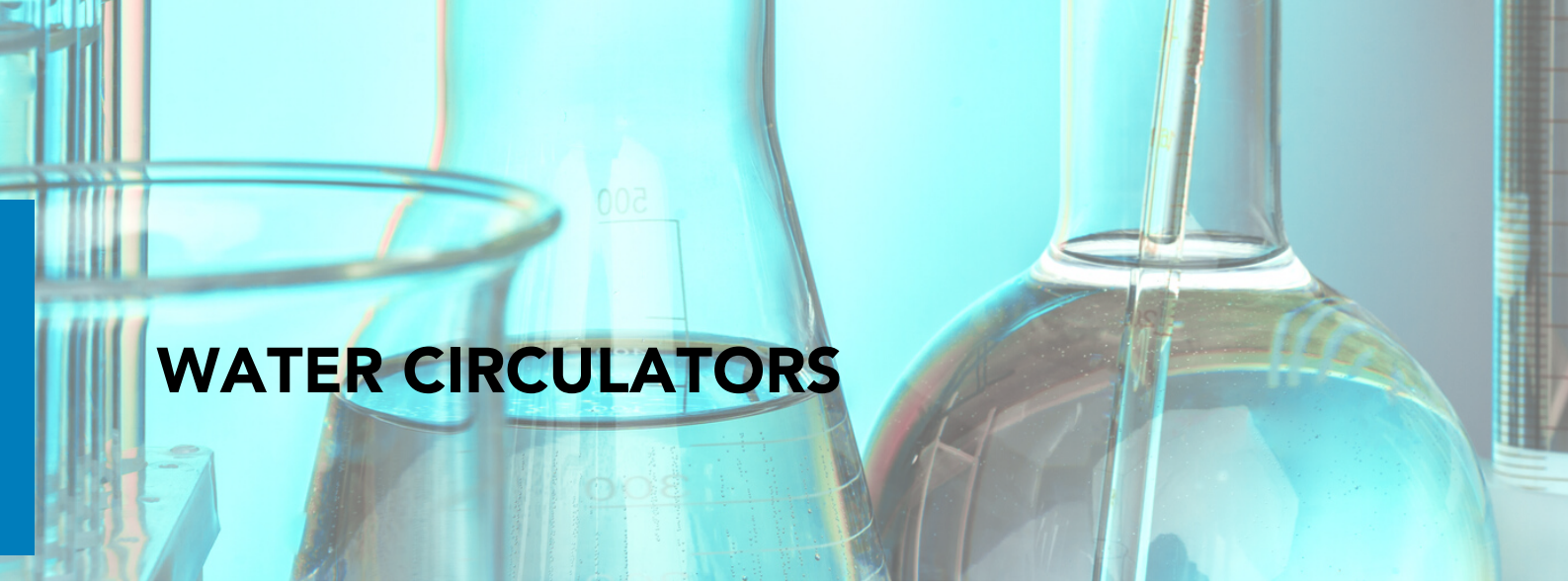
Not all water circulators have built-in cooling capacity. Choosing a circulator with built-in cooling capacity of at least 200W will ensure you don't have to stand over your sample all day monitoring the temperature and making sure your test isn't spoiled by low temperature fluctuations.

FLOW RATE

Flow rate is a delicate balance.

Too slow and your process loses efficiency and you probably won't recondense all the solvent vapor. Too fast and...the same thing.

A circulator must be designed to maintain adequate flow rate despite the resistances of the pipe, fittings and valves connected to a circulator (e.g. rotary evaporator). Failure to find that balance may result to both units' decreased performance.



WATER CIRCULATORS

WHAT ARE COMMON FEATURES, UNIQUE FEATURES, AND HOW DO THEY RELATE TO YOUR APPLICATION?

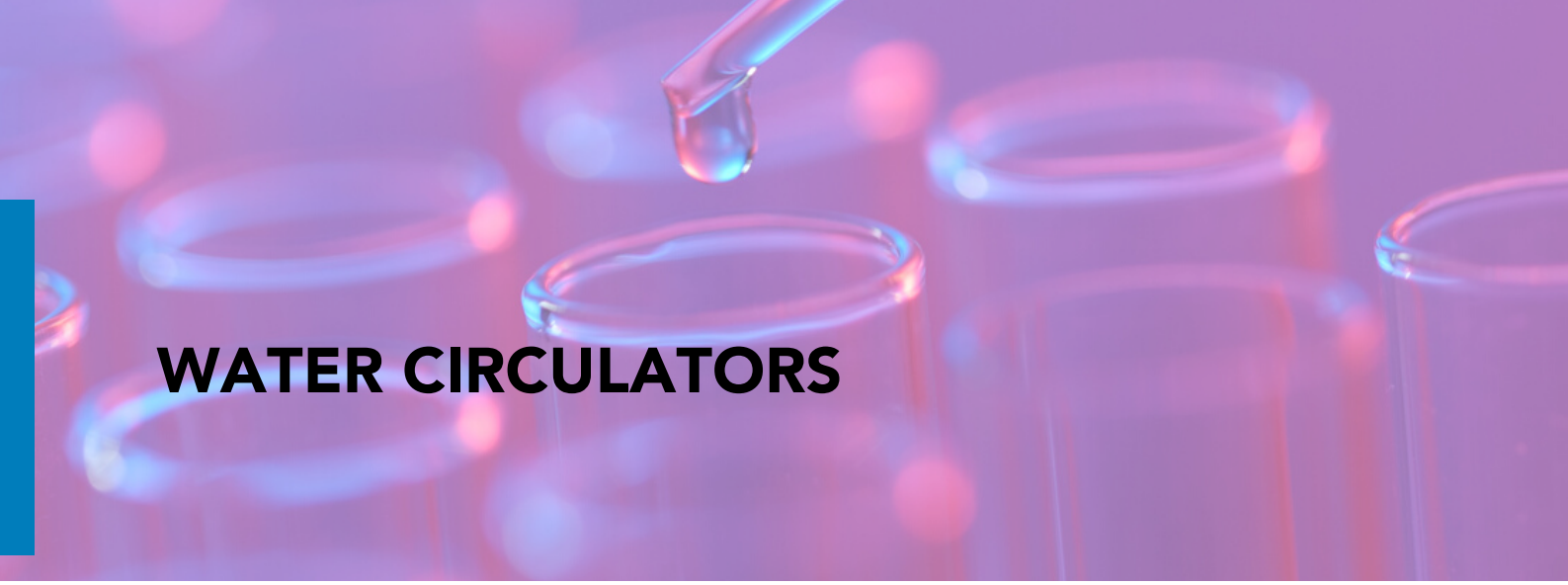
Most water circulators have similar set of components configured in different ways to give whatever the manufacturer thinks is the best and most comfortable user experience. Every unit will have:

- A control panel
- Filter mounting plates
- Discharge and return ports
- Drain plugs

Chillers typically range from -20°C to 30°C. So as long as you know the solvent, choosing the right temperature should be simple. The optimal temperature for the coolant stream should be around 25°C less than the vapor temp of the solvent. You might want to set the temperature well below that to increase the speed of condensation - you're busy and have a lot to get done after all. But this can be counterproductive. Cooling capacity actually decreases at lower temperatures.

KEEP YOUR EYES ON THE PRIZE!

A slower flow rate means the coolant hangs out in the condenser longer. And that means it stays in the condenser warming up for a longer amount of time.
As it warms, the evaporated solvent transfers heat to the coolant less efficiently. This results in an increased risk that not all of your solvent vapor will be recondensed.
Paying attention to the temperature needed for each application will provide the optimal conditions for the system and for the longevity and efficiency of the chiller.



WATER CIRCULATORS

Chillers can be set up in slightly different configurations depending on the application. Generally, however, most chillers can be tweaked on-site to work with:

- Analytical instrumentation.
- Large capital equipment.
- MRI machines & CT scanners
- Clinical blood cooling systems.
- Radiation therapy instrumentation
- Linear accelerators.
- Solvent recovery in cannabis applications, paired with a rotary evaporator.

Yamato Scientific America offers 3 different models of water circulators. One of the many applications suitable for a CB100 compact water circulator is maintaining temperature of sample cells in a spectrofluorometer and a viscometer.

CF302 is recommended for rotary evaporators and spray nozzle cooling systems.
The more powerful model CF802 is ideal for the Kjeldahl distillation method, aside from rotary evaporators.

You'll be collecting quotes from more than one manufacturer before you make your purchase. If the information in this guide is useful to you, get your first quote from Yamato Scientific America.

Yamato's water circulators meet every standard set out in the information above, and give you the best baseline to measure any other quotes against. In most cases, any other quotes that follow won't be able to match the value your first quote gives.

COLD TRAPS

IS A COLD TRAP TODAY THE SAME AS IT WAS 10 YEARS AGO?

During evaporation in the lab, the main job of the cold trap is to collect dangerous vapors before they work their way into the vacuum pump.

- For a vacuum pump using oil, collecting thoes solvent vapors is important to stop them from collecting and compounding in the vacuum pump's oil. If corrosive or water vapors collect in pump oil, it will start to wear down the pump very quickly. And as the damage piles on, the pump will need replacing.
- For non-oil based vacuum pumps, collecting the vapors prior to the vacuum pump results in a closed system. This stops vapors from passing through the vacuum pump, into the environment, and into your lungs.

The primary differences between older cold traps and new models revolve around ease. Designs have evolved over the years to make a few things easier.
So what's easier now?

- Newer models are easier to clean than legacy models.
- Newer models are easier to disassemble for repairs, maintenance, or fun (whoever finds this fun, we'd love to meet you).
- Newer models are easier to run for longer periods of time (by not requiring as many coolant refills as older models.
- Newer models have refined designs that make condensate draining much easier - most without any disassembling whatsoever.

COLD TRAPS

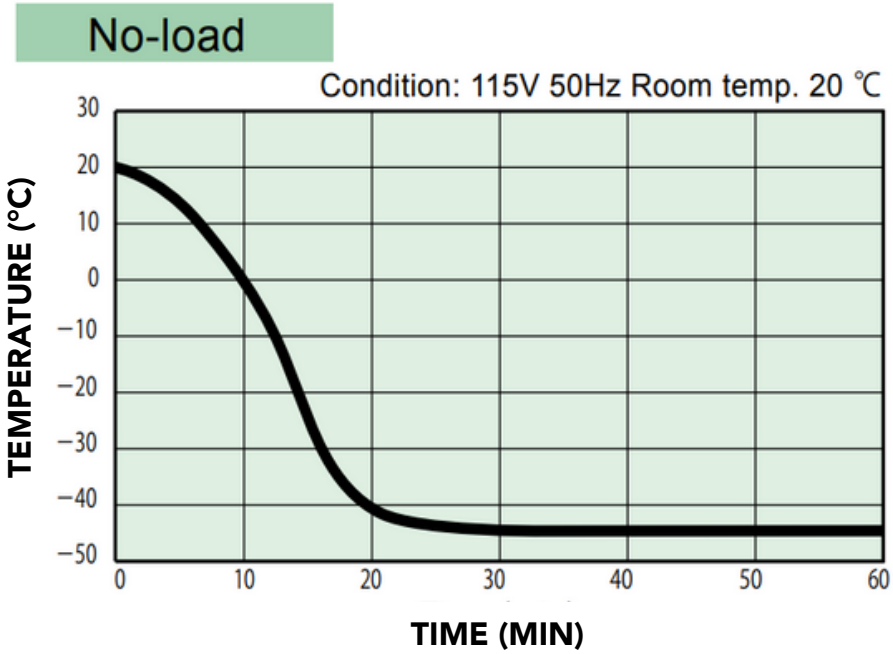
WHAT IMPORTANT NUMBERS SHOULD YOU KNOW BEFORE BUYING?

With a cold trap, there are three main features to weigh (there are other selling points manufacturers will talk about, but the things that really matter are somewhat basic sounding).

DEHUMIDIFYING CAPACITY

MAX. LOW TEMPERATURE

REFRIGERATOR



CA301

Choosing the correct cold trap temperature will optimize the moisture trapping efficiency. It is important to select a cold trap capable of reaching a temperature that is colder than your sample's freezing point.

COLD TRAPS

FOR WATER SAMPLES, THE -50°C COLD TRAP WILL COLLECT THE SAME AMOUNT AS THE -105°C COLD TRAP.

If the sample contains a mixture of solutions, the cold trap temperature should be matched to the component with the lowest freezing point.

PRESSURE CONTROL!

Pressure control is an important factor in a vacuum evaporation system. Without reliable pressure control:

- Evolved vapors won't be trapped optimally - leaving a risk to operators.
- Complex mixtures will evaporate slowly, causing inefficiencies and delays in your work.
- You could lose trace amounts of sample to sublimation.

Benefits of cold traps include:

- It is a compact and leak-tight structure that doesn't pass even an ounce of oil vapor. With direct mounting installed at the inlet, you can expect the cold trap to keep the gases intact inside the chamber.
- It offers direct visibility of the condensate. Cold traps have transparent catch-pots that allow you to see the condensate from a distance.
- Sometimes the condensate can be a pollutant. The cold trap has outlets that can drain the condensate easily.

Cold traps can be used in several applications, typically with anything that uses a vacuum pump: with optimal conditions at -20°C for certain uses.

Start with a quote from Yamato Scientific America to be sure your cold trap has all the qualities you learned about in this guide.

WHAT DO YOU USE, AND WHEN?

Both water circulators and cold traps have several functions, some of which are common. To determine the optimal equipment for each application, factors like temperature, pressure, condensation, and cooling rates, as discussed previously, should be studied.

Water circulators work better at temperatures around 0°C, providing a constant flow of liquid coolant that works best with a rotary evaporator.

Cold traps, on the other hand, function as condensers, dehumidifiers, and toxic substance absorbers. With its several advantages in many applications, cold traps work best when paired with a vacuum pump. Vacuum oven applications and large freeze dryer systems can also use cold traps to increase efficiency.

CONCLUSION

From cool environments to toxic-free experiments, water circulators and cold traps are essential in any laboratory.

Water circulators offer a liquid cooling system while being both efficient and cost-friendly.

Cold traps provide protection and adequate conditions for different types of systems. Cold traps' versatility allows for increased productivity in several aspects of your laboratory.

All the information in this guide is based on years of immersion in laboratory best practices. If you want to make your job as a lab manager or project manager easy, get a quick quote from Yamato on equipment you know for certain will live up to everything you read about here.