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# So, You Want To Buy An Autoclave

**Expert-Approved Tips for Choosing The Right Steam Sterilizer for Your Lab**





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Autoclaving has earned its place as the gold-standard of sterilization methods because of its ability to rapidly kill microorganisms without needing toxic chemicals to get the job done. Often, you can see autoclaves in industries ranging from scientific to commercial. A few example industries include Microbiology, Mycology, Podiatry, Dentistry, Pharmaceuticals, Prosthetic Fabrication, Veterinary Medicine, Tattooing, and Body Piercing.

Despite the autoclave's popularity, however, many would-be users still find themselves scratching their heads, trying to make sense of all the models, sizes, options, and components that are out there.

These tips should arm you with the knowledge to make an informed decision and clear out all that marketing clutter. Let this expert-approved guide serve as a cheat sheet to getting everything you need in an autoclave and maximizing your investment today!

## THINKING AHEAD

Before you start browsing through autoclave units online, think about your current throughput capacity and look around your facility for potential areas where you can install your new autoclave. Knowing what size autoclave to buy depends on the size and quantity of your loads. Meanwhile, an ideal location will have enough floor space and have easy access to essential utilities.

### A. Autoclave Size

Autoclaves can come in the form of tabletop, small, medium, and large models. The size you need to get depends heavily on the size of your average load.

For small laboratories or facilities with limited space such as dental clinics or tattoo shops, benchtop steam sterilizers will be the best choice. Tabletop autoclaves are standalone machines that can operate independently of any external resources. They only need to be connected to a power source to begin operation. Units like the [Yamato SK Series Standard Benchtop Steam Sterilizers & Autoclaves](#) are perfect for small sterilization items and infrequent throughputs. They are also the most affordable type of steam sterilizer units on the market.



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On the other hand, anything more than that will require bigger sized models. Clinical, medical research, pharmaceutical, life science, biotechnology, animal, commercial, and industrial applications all use autoclaves that have chambers with an internal volume capacity of 2 - 200 cubic feet.

Once you determine your average throughput capacity, compare that to the chamber size and volume capacity of the autoclaves you are looking at to see if they are compatible with your load.

You may also need to consider how many autoclaves your laboratory will need to keep up with your daily load.

## **B. Floor Space**

Once you have surveyed your facility, take measurements of the floor space where you plan to install the autoclave. Make sure you leave an additional 12 to 24 inches of extra space around the sides and back to account for heat dissipation and service clearance. For laboratories with limited space, you may be able to request the manufacturer to customize your unit so that all the plumbing is mounted on one side.

## **C. Utility Checklist**

Your potential autoclave floorspace must have access to the following utilities within 5 feet of the unit:

- Water
- Steam
- Electricity
- Drainage



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## **D. Lab Layout**

Survey the lab space you've chosen to house your autoclave and take note of any neighboring equipment or furniture. Their placement may obstruct access to your autoclave and interrupt your workflow. We talk more about doors later on in the guide, but as early as now, you should determine whether or not you have space for a door to swing open. If you do, which way do you want the door to swing open? Keep that area clear. The last thing you need is your autoclave competing for space in your already busy lab. Alternatively, you may want to consider top-loading autoclaves such as the [SN and SQ Series Standard Lab Autoclaves](#) and the [SM Series Steam Sterilizers with dryer](#) from Yamato. These units are particularly advantageous because they allow for maximum loading space, require little floor space, and do not require any building steam connections.

Yamato's unique top loading autoclaves are space-saving, requiring minimum clearance on all sides. Its rolling casters allow easy mobility from lab to lab. Moreover, water is simply poured inside the chamber. There is no plumbing required – no mechanical connections such as water supply, waste line, or steam exhaust line – simply plug in!

## **LET'S TALK SPECIFICS**

Now that you have sorted out your autoclave placement and you know what size autoclave you need to get, it's time to dive into the configurations and features you need to optimize your productivity.

### **A. Top-Load vs. Front-Load Autoclaves**

Top-loading steam sterilizers are the practical choice for most laboratories because they are smaller and have a tinier footprint while still delivering high-quality sterilizing performance. Top-loading autoclaves such as the [SN Series Laboratory Autoclaves from Yamato](#) only expand in height, making them ideal when handling longer items like fermentation vessels, which would otherwise require a much larger and more expensive front-loading autoclave. All of Yamato's autoclave units are top-loading.





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## **B. Manual vs. Powered Sliding Doors**

Working with a pressured autoclave can be dangerous, which is why users need to be particular about the door style of their desired unit. Autoclave doors need to have safety interlocks that prevent a door from opening during elevated pressures and high temperatures. Furthermore, they should not impede the workflow of your lab layout at any time. Some examples of autoclaves with safety interlock features include the [Yamato SK Series Autoclaves](#), [Yamato SN Series Autoclaves](#), and the [SQ Series Autoclaves](#).

Autoclave door styles can differ amongst models and brands. Generally, steam sterilizer doors fall into two groups: manual and powered sliding doors.

Manual doors come in two styles: hand bolted or single-action closures. These types of doors are less complicated versus powered sliding doors. They require little to no servicing and are less expensive. All of Yamato's autoclave units have manual doors. Be advised that front-loading autoclaves with manual doors will need more space in the lab to accommodate the opening.

Powered doors also come in two styles based on the direction they open: vertically or horizontally. Powered doors do not require any swing space. They also allow users to unlock their autoclave with a push of a button, quickly. However, keep in mind that powered doors rely on moving door seals, which over time, will require constant and expensive replacement. Regular maintenance is also vital since these types of doors are more complex.

## **C. Cylindrical vs. Rectangular Chambers**

Most autoclaves are constructed with stainless steel and come in two shapes: cylindrical or rectangular. During operation, the pressure inside an autoclave's chamber naturally attempts to make it round, so an already round body can be beneficial as it provides less resistance when the unit is pressurized. Most autoclave chambers are manufactured in this shape.



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Cylindrical chambers have thinner walls and require less metal to manufacture, so it becomes easier to heat the inside. Autoclaves that feature this chamber style weigh less are less expensive to produce and therefore cost less than their rectangular counterparts. For sterilization to be effective, the steam must come into full contact with the items inside, and all the air must escape the chamber. Therefore, the space surrounding the circular chamber offers a significant advantage because it allows for better steam circulation. [All of Yamato's autoclave units come with cylindrical chambers.](#)

Rectangular chambers, on the other hand, offer a larger chamber capacity within its given dimensions, which wastes less potential capacity. However, users need to be more careful so as not to overfill the chamber and possibly restrict steam circulation despite the larger space. Manufacturers usually build these chambers with much thicker walls to prevent the inside from becoming round under pressure. They also add a significant amount of bracing on the outside. The heftier build not only makes the rectangular chamber autoclaves more expensive to produce but heavier and costlier for the end-user too. It can also affect the heating and cool downtimes, which may make them more costly to operate in the long term.

## **D. Heating and Steam Generation**

There are three principal ways to heat an autoclave and generate steam. Keep in mind that the method you use will largely depend on the available facilities in your laboratory:

### **1. Electrical Heating Through In-Chamber Heaters**

This method makes use of simple and easy to maintain heaters that are visible and accessible within the chamber. While in-chamber electrical heaters are inexpensive, autoclaves with these types of heaters tend to have more extended cooling periods because of the reservoir of water found at the bottom of the chamber that also needs to cool along with the load.

Some autoclave models will allow you to empty the bottom to improve your cooling time. Heating through this method will also have slower heat up times versus their steam-heated counterparts.



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All of Yamato's autoclave units are designed with electrical heating through in-chamber heaters. Yamato autoclaves have drain valves to connect a hose or position a drain pan when draining the sterilization chamber.

## **2. Steam Heating Through An External Source**

Steam heated autoclaves will always offer faster heat-up times when compared to electrically heated units. Steam injected into the chamber at pressure provides better circulation and steam penetration. They also cool down much faster than the previous method since there is no reservoir to factor in.

With external steam heat sources, however, users will need a reliable supply of dry steam to get the job done. You will also need a reducing valve to reduce the steam line pressure down to a level that best fits your new autoclave. On top of that, you may also need condensate-return equipment to dry the steam before delivery. Larger autoclaves will tend to have external steam sources fitted to the machine, but many models will require you to spend an additional amount for installation.

If you decide to work with an externally heated steam source, consider the condition and possible chemical contamination of the steam if you plan to reuse the items you autoclave, especially when you have other things connected to this supply.

## **3. Dedicated Steam Generators**

Like the previous method, autoclaves with dedicated steam generators also offer quick heat up and cool downtimes. Because other machines do not share this steam source, their main advantage is that there is no risk of contamination.

There are three types of dedicated steam generator:

### **a. Electrical or Gas-Heated Standalone Steam Generator**

This type of steam generator has the same advantages as in-house steam supplies, but they lean more on the pricier side of the spectrum. In most cases, standalone steam generators can cost just as much if not more than autoclaves, so this may not be the most economical option if you plan to get a small autoclave.



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Standalone steam generators will also require water treatment systems, suitable drains, and other ancillary equipment, which can drive up the cost of operation.

### **b. Built-In Electrically Heated Steam Generator**

Autoclaves, which have electrically heated steam generators built into the unit, provide faster heat-up times and steam penetration than their in-chamber counterparts. These steam generators are in separate chambers directly connected to the main vessel, and the autoclave's temperature controls manage the amount of steam generated. This type of steam generator also provides faster cooling times than the in-chamber electrically heated models because there is no reservoir of hot water at the bottom of the autoclave. The heaters and other parts may be a little more challenging to access than in-chamber models, but this shouldn't be a problem when you get your equipment serviced by a professional.

### **c. Built-In, Electrically Heated, High Pressure, On-Demand Generator**

These on-demand generators share the same performance with external steam supplies or standalone steam generators. However, this type of generator has a much lower steam pressure, which eliminates the need for reducing valves and condensate-return equipment. Just like built-in electrically heated steam generators, they also provide faster cooling than the in-chamber models.

But while on-demand generators don't need reduction valves or condensate-return equipment, they do require a control system, water pump, and separate safety valve to operate, making them more expensive.

The heaters for on-demand generators will need to operate all day to maintain the supply of readily available steam. To put this into perspective: a 10-hour workday will need this generator to run for 2 to 3 times longer than heaters in a comparable electrically heated model.





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## OTHER THINGS TO CONSIDER

### **A. Water Quality and Source**

Water is said to be the lifeblood of autoclaving applications. The quality of water, along with its source, can not only drastically impact a steam sterilizer's lifespan but also dictate the types of loads that can be sterilized.

For example, when working with biohazardous waste, clothing, cages, glassware, media, or general lab equipment, using water between 0.1 MΩ/cm to 1.0 MΩ/cm is recommended. However, items that are susceptible to mineral contamination, such as tissue samples or items used in cGMP processes must use water that is >1 MΩ/cm.

When discussing water quality, factors such as hardness, minerals, and chloride levels are what define its quality. There are two types of water sources:

**Tap Water** – This is the most common water supply used by labs to feed their autoclave. However, using tap water can potentially lead to costly downtime and expensive repairs if the quality is subpar. Tap water has a variety of dissolved minerals and salts. The more minerals the water contains, the “harder” it becomes. The harder water becomes, the more problems it can bring to your autoclave.

When hard water is boiled into pressurized steam or used to cool autoclave waste, the water leaves behind mineral deposits within the unit. Over time, these deposits can build up within the generator, pipes, and valves, which decreases the efficiency and functionality of the autoclave. Always refer to your local municipal sewage report to check the hardness of your water before using it as the primary source for your autoclave.

**Purified Water** – When water is harder than 5 grains (85 mg/L), users must first remove impurities. There are three methods to do this:

- a. Water Softening - removes most hardness from water
- b. Reverse Osmosis (RO) - removes most solid contaminants, dissolved minerals, and hardness
- c. Reverse Osmosis/Deionization (RO/DI) - removes most solid pollutants, metals, and ions



When working with high purity water or water that is  $> 1 \text{ M}\Omega/\text{cm}$ , make sure to use an autoclave constructed from stainless steel. Because high purity water lacks ions or minerals, it will try to absorb impurities from everything it comes into contact with, including glass, steel, and copper. This reaction can cause continuous corrosion and premature failure of non-stainless steel components.

Yamato does not recommend well water or tap water in their autoclave chambers. To prevent mineral deposits from forming and to protect chamber components from corrosion, Yamato recommends using distilled water.

## B. Matching Load Types to Autoclave Cycles

There are three main types of steam sterilization cycles: gravity, vacuum, and liquid. All of the cycle types use high heat and pressure in the sterilization process. The difference lies in the process each cycle uses to maximize the sterilization conditions for particular items.

Use our table below to determine the ideal cycle types for your loads.

Load Type	Autoclave Cycle
Biohazardous Waste, Glass-ware, Un-wrapped Goods	<b>Gravity Cycle</b> It is the simplest and most common autoclave cycle. Relies on gravity to replace air with steam. Steam pumped into the chamber rises to the top because of its low density. The steam forces the air to the bottom and displaces it from the chamber through a drain port. The steam escapes through a drain vent, and cooling begins after the cycle is complete.
Bagged or Wrapped Loads, Porous Materials and Packets (ex. Pipettes or Surgical Instruments)	<b>Vacuum Cycle</b> <ul style="list-style-type: none"><li>• It is configured with a vacuum system.</li><li>• Each cycle begins by alternating steam injections and vacuum pulls to remove air from the chamber altogether.</li><li>• The absence of air allows the steam to rapidly penetrate the entire load, leading to faster overall sterilization cycles.</li></ul>
Water, Saline, Agar	<b>Liquid Cycle</b> <ul style="list-style-type: none"><li>• It does not involve sterilizing with liquid. Instead, it sterilizes the liquid itself.</li><li>• Combats the risk of boil-over by slowly releasing the chamber pressure, which also slowly cools off the liquid's temperature.</li></ul>



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Buying a new autoclave requires planning, forethought, and research. We hope that our guide has made it a little easier for you to choose the most appropriate steam sterilizer for your applications.

With over 130 years of experience in the industry, **Yamato Scientific America** continues to provide superior services and state-of-the-art products for the scientific market. We manufacture all our equipment in compliance with stringent industry quality standards and international regulatory requirements. If you have any additional questions or require assistance, feel free to contact us at **1-800-292-6286**.