Astell

LEADERS IN STERILIZATION SINCE 1884

GUIDE TO AUTOCLAVING

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MADE IN THE UK SINCE 1884

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The Astell Guide to Autoclaving

Welcome to the Astell Scientific guide to autoclaving, a dedicated resource to help you understand steam sterilization and the available technology you may need to achieve your goal. Whether you are looking for information on how steam generators operate, how to distinguish between the different types of vacuum systems, or just generally how an autoclave works, this guide will help you understand the science so you can specify an autoclave to meet your exact requirements. Please feel free contact us with any questions or to discuss a quotation.

Why choose Astell Scientific

LEADERS IN STERILIZATION SINCE 1884

Custom and standard solutions to meet your specification

Our products are used in over 100 countries, worldwide

Quality maintenance and rapid after-sales support

Over 130 years experience goes into every unit we manufacture

Contents

What is Sterilization?

Sterilization may be defined as the statistically complete destruction of all microorganisms including the most resistant bacteria and spores. This is a condition that is difficult to achieve and hard to prove. Whilst there are many chemicals, inorganic and organic, that kill microorganisms they may not be totally effective and can leave undesirable or toxic residues.

Ultraviolet and Ionising radiations are also effective biocides, disrupting or modifying the DNA to prevent replication, but Ultraviolet will not produce the effective results and easy validation that moist heat (steam) sterilization can provide. If sterility is an absolute requirement then today's scientists turn, as their predecessors did, to steam.

Microorganisms tend to become more active as the temperature of their surroundings rises, - most, but not all, die at above 80°C. In the case of Prions the temperature and time requirements for deactivation are much higher. Steam molecules condense on cooler microorganisms, and transfer 2500 joules per gram of steam, very efficiently heating the microorganisms to the temperature at which they are destroyed. Other methods of heating suffer from the much lower heat transfer of hot dry gases and boundary layer effects, which can insulate and protect the microorganisms.

For maximum effect the steam must be saturated, and this condition, and the temperature and pressure of the steam are easily monitored, facilitating proof that sterilization has occurred. By employing steam sterilization techniques a high level of sterility can be achieved, and the most popular piece of equipment used in laboratories and hospitals is the steam sterilizer or autoclave.

Uses of Autoclaves

Autoclaves can be used for numerous medical and laboratory applications in market sectors such as, Food and Dairy, Universities & Colleges, Agriculture & Horticulture Research, Healthcare (including Pathology), Industrial Research, Water & Environmental, Brewing, Biotechnology Industries and Pharmaceuticals.

Typical applications include:

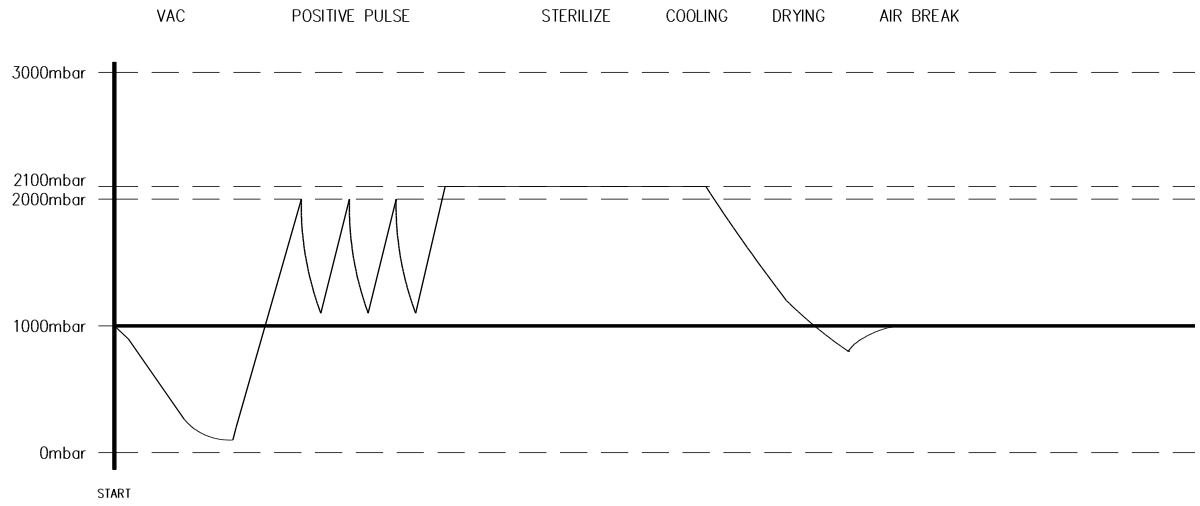
- Sterilization of fluids (e.g. culture media)
- Waste or 'Discard' (either laboratory or clinical)
- Instruments (wrapped and unwrapped)
- Utensils and lab equipment
- Fabrics and textiles

Media preparation: Media is used to grow microorganisms under test conditions and a wide variety of gel and liquid media is used; all media needs to sterile before use, and therefore requires autoclaving. Air removal from fluid/media loads is normally straightforward; however some media cycles can benefit from a short period of 'freesteaming'. Although many types of media require sterilization at 121˚C for 15 minutes, different sterilizing temperatures and times may be necessary for certain types of media, and therefore any autoclave used for the sterilization of media must be capable of sterilizing at a variety of temperatures. Cycle times must be short and the speed of processing is vital. A fast heat up and cool down is beneficial in the maintenance of the quality of the finished product and prevents the 'over cooking' which leads to the deterioration in the quality of the growth medium. Cycle length should be set to as short as possible, and at the temperature specified by the media manufacturer. The main method of controlling the sterilization procedure of any cycle is to use a thermocouple probe in a 'dummy' bottle within the chamber (Load Sensed Process Timing). Only when the probe reaches the correct temperature will the sterilization process begin.

Following sterilization the chamber (and load) is allowed to cool down: For fluid cycles, autoclaves are normally fitted with a safety 'cooling lock' to prevent the chamber from being opened before the load reaches 80˚C. If the autoclave is opened at a higher temperature, the sudden change in pressure can not only cause the media (or other fluids) to boil over; there is also a significant danger that bottles could break or explode causing injury to laboratory personnel.

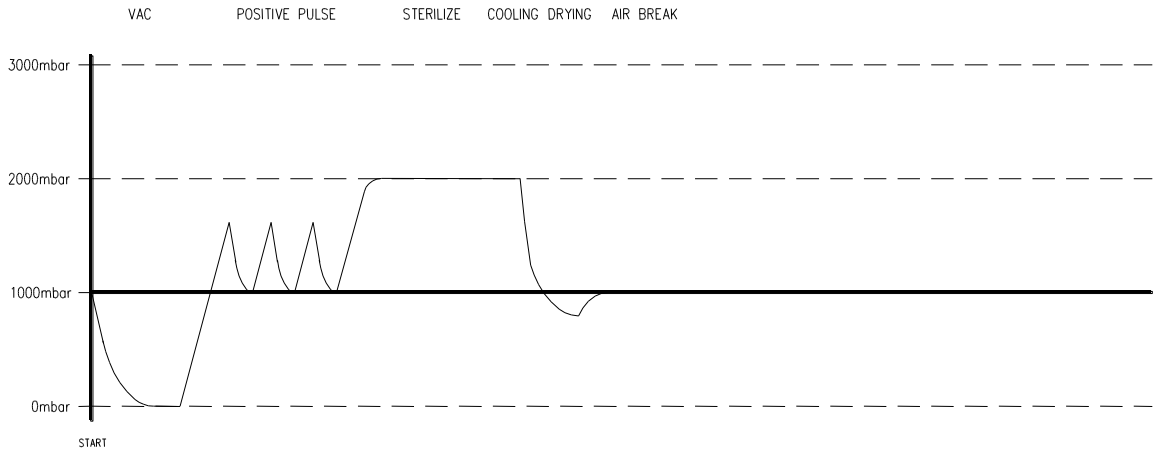
Boil-over can also be an issue if the chamber and load are cooled too quickly. If an autoclave is not fitted with any form of assisted cooling, or 'non aggressive' cooling (e.g. an external fan), the risk of media loss is minimised. However, with more efficient cooling systems such as a water jacket or internal fan cooling, boil-over is extremely likely. The risk of any boil over can be greatly reduced by using Air

Ballast, which maintains chamber pressure during the cooling phase. This involves the controlled introduction of air into the chamber, effectively offsetting the pressure change due to the sudden reduction in temperature.



Media preparation cycle graph

Sealed Fluids: Some fluid loads may require to be sterilized in special sealed containers. Air purging (or 'freesteaming') is normally sufficient to remove air, and extended freesteaming should be unnecessary. As with media preparation the speed of processing is vital to the quality of the end product and often temperatures in excess of 121˚C will be used to speed up the sterilization process. Again the cooling time should be as short as possible.

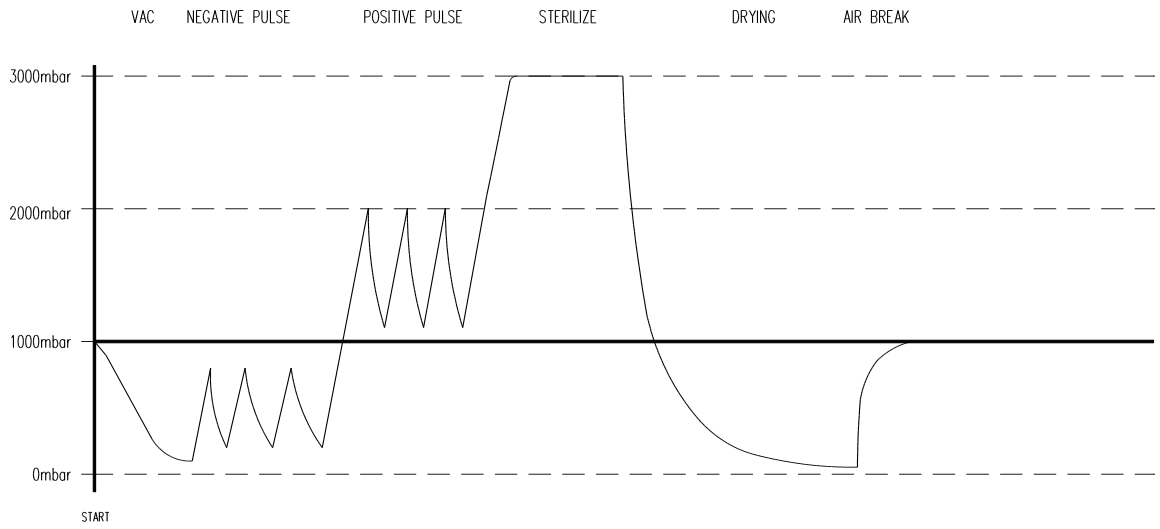


Sealed fluids cycle graph

Instruments: The sterilization of instruments falls into two main categories:

a.) Unwrapped instruments
b.) Wrapped instruments

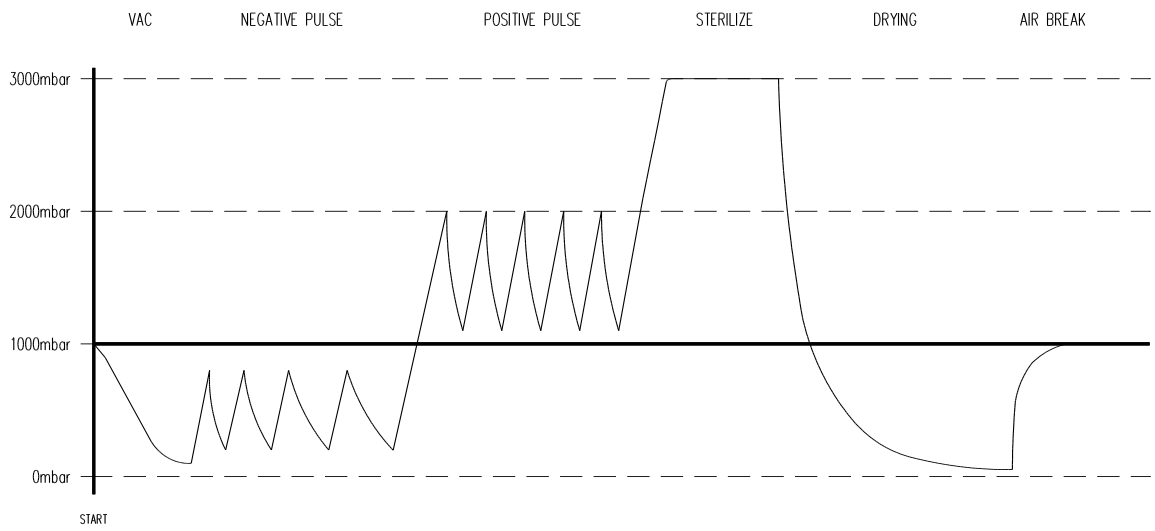
Both types of instrument loads benefit from drying at the end of the cycle. Unwrapped instruments can be dried by the heating of the surrounding air at the end of the cycle, whilst wrapped instruments require a more sophisticated drying system. Post vacuum systems on small bench-top units will improve drying, whilst a jacketed pressure vessel is strongly recommended on larger units (see Fabrics and Textiles).



Typical glassware / utensils (134°C) cycle graph

Fabrics and Textiles: A variety of fabrics and textiles can be sterilized in an autoclave/sterilizer, e.g. many hospitals will use an autoclave to sterilise gowns, instrument packs etc. As these are true ‘porous loads’ they will require both pre and post vacuum systems, negative and positive steam pulsing and a fully heated jacket. Steam quality is important when operating Porous Load Autoclaves.

Vacuum steam pulsing provides effective air-removal (essential for porous loads), ensuring good steam penetration, whilst post vacuum drying in conjunction with a steam-heated jacket results in touch-dry loads at the end of the cycle.

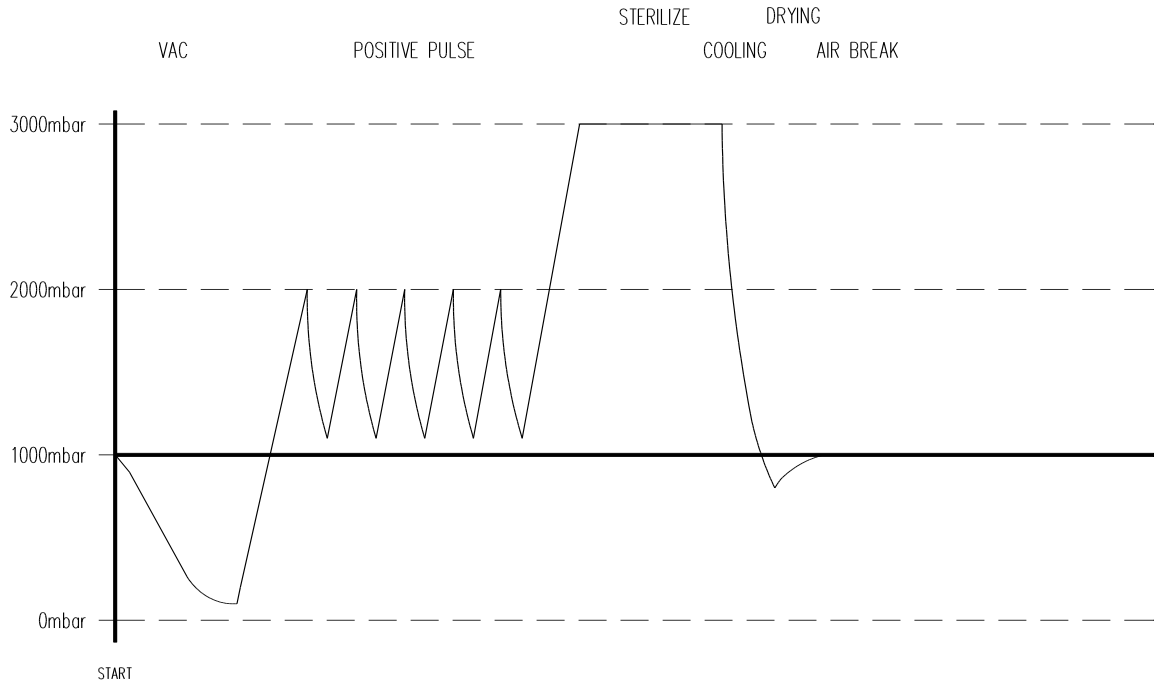


Typical fabrics cycle graph

Discard Loads: There is an ever-increasing need for the safe sterilization of contaminated material before disposal to ensure that it is microbiologically safe. The contaminated material can be of many types and in many forms. For example, all microbiological laboratory waste should be processed prior to disposal, as must all clinical samples e.g. blood, tissue etc.

Loads consisting of such a wide variety of materials in a broad range of containers will present specific sterilization problems. One of the main problems with such mixed discard loads is that they invariably contain small pockets of trapped air, which present particular air removal problems before steam penetration. Such loads are often contained in special plastic bags and comprise a variety of plastic containers; these are liable to melt and collapse before sterilization, thus increasing the likelihood of trapped air. A pre-vacuum and steam pulsing feature is now a commonly requested option for autoclaves running frequent discard cycles. However an alternative to vacuum is a long period of freesteaming or pulsed freesteaming. There are special discard (Morrison) containers available for this application. In certain circumstances a double-door (or ‘pass-through) autoclave may be required. The loading (“dirty” or non-sterile) end is often separated from the unloading (“clean” or sterile) end by a wall, which often contains an SPF seal (Bio seal) to prevent bacteriological migration.

In Category 3 (Cat III, BSL 3) laboratories an effluent retention system would also be a requirement, which would include a bacteriological hepa filter on the exhaust, preventing dangerous pathogens from entering the atmosphere. In addition, for hazardous loads of this type a heated jacket would often be fitted to ensure the best possible temperature distribution within the vessel/chamber.



Typical fluid discard cycle graph

	Load Sensed Process Timing	Vacuum Pulsing	Vacuum & Heated Jacket	Assisted Cooling	Assisted Cooling & Air Ballast
Media	■	x	x	■(3)	■
Mixed Discard	■	■	x(4)	X	x
Fluid Discard	■	x	x(4)	■	■
Glassware	x	■	x	x	x
Unwrapped Instruments	x	■	■(1)	x	x
Wrapped Instruments	x	✓	■(1)	x	x
Fabrics	x	✓	✓(2)	x	x

✓ Essential ■ Recommended x Not Needed

(1) If dry load is required
(2) Vacuum & Heated Jacket required to ensure drying of fabric loads
(3) To prevent excessive cycle time
(4) Recommended for Cat III (BSL 3) loads

How does an Autoclave work?

The terms Autoclave and Sterilizer are interchangeable and mean the same thing. ‘Autoclave’ is a term used mainly in laboratories whilst ‘Sterilizer’ is used more commonly for medical and pharmaceutical applications.

An effective autoclave or sterilizer must contain dry saturated steam. In order to achieve this, air must be removed from both the load and the chamber which can be accomplished in a number of ways. Air removal from high mass low surface area items (i.e. comprising mainly solid areas that contain little or no air pockets such as bottled media) will need little air removal and this can be facilitated by automatic air purging. Here the air is allowed to leave the chamber through a vent as steam enters the chamber from an integral source (i.e. heaters within the chamber) resulting in 'upward' displacement, or an external supply (i.e. steam generator on in-house steam) resulting in 'downward displacement'. This purging process (also known as 'freesteaming') can be programmed to continue for a set length of time. The turbulent steam passes through the vent, forcing trapped air out of the autoclave. Once the air has been expelled, the vent closes and the cycle continues.

For more stubborn loads that contain a number of air pockets such as wrapped instruments or fabrics, a more effective method of air removal is essential. By far the most effective way of air removal is a vacuum system, whereby a vacuum is achieved in the chamber before any introduction of steam, removing most of the air before freesteaming and/or vacuum pulsing. Once all of the air is removed from the load and chamber, the temperature within the vessel will rise along with the pressure until the pre-selected temperature is reached. To achieve a typical sterilization temperature of 121°C or more, requires the steam to be pressurized to at least 1.1 Bar G. Since pressures used are greater than 0.5 Bar G the autoclave assembly is classified as a pressure system and must be designed to a strict engineering standard, such as PED97/23EC/PD5500/ASME etc.

Creating the required temperature within the chamber is reached in a number of ways:

1) Steam can be injected into the chamber via an internal steam source such as an integral stainless steel steam generator, which can be built within the autoclave cabinet or can be supplied as a separate external unit on larger autoclaves.

2) Some laboratories or hospitals have their own direct steam source on site, which would similarly be injected into the chamber.

3) In some autoclaves heaters are built into the base of the chamber and the water is heated until it boils and produces steam.

The main advantage of using a steam generator (or the direct steam method) is that cycle times can be considerably faster as the steam can be made immediately available. In basic autoclaves the water is topped up manually by pouring water into the vessel, whilst some autoclaves are connected to a direct water supply and the water level is maintained automatically. Some of Astell's smaller units are available with 'Autofill' – an integral water tank, which once filled, can run for up to 15 cycles repeatedly before being replenished. In CSSD applications it is often a requirement that the steam is dry saturated steam with a known dryness and non-condensable gas content e.g. in the UK, steam with values within the specification set out in HTM2010.

Once the sterilization temperature is reached, it is thermostatically held for the time that has been programmed. When the desired temperature is achieved for the required time then the steam supply will cease either by shutting off the power to the heaters or by cutting off the steam supply. Thus the temperature and the pressure will gradually drop. In units with a vacuum system fitted the vacuum pump can be used to remove the steam (i.e. where drying is required).

Typical Autoclave Cycles

Typical temperature/time sterilization parameters are 115°C for 30 minutes, 121°C for 15 minutes and 134°C for 3 minutes. However, overall cycle times will vary depending on load characteristics. Firstly it is important to realise that the time and the amount of steam that is needed for the load to reach sterilization will vary greatly depending on the thermal capacity of the load in question. Two or three 1 litre bottles of culture media will often need more steam than a dozen small containers, and the heating time will take longer. Likewise the time taken to achieve sterilization once the temperature has been attained will depend on the type of microbiological organisms present. Bacteria and fungi are rapidly killed by moist heat but viruses and particular bacterial spores are very persistent, and may need long sterilization times. The development and wide availability of reliable microprocessors means that most modern autoclaves are fully user programmable, allowing the sterilization temperature to be set to suit the requirements of the load.

The most accurate way of ensuring that sterilization occurs when the correct temperature is reached is by Load Sensed Process Timing. Here the cycle is controlled via the temperature achieved in the centre of the load. A ‘wandering’ thermocouple probe situated within the chamber is inserted into the load, or a load simulator and initiates the sterilization period once the probe reaches the programmed threshold temperature. This ensures that sterilization starts at the correct stage of the cycle.

Following sterilization and depressurization of the chamber it may be possible to open the autoclave immediately. However, when autoclaving bottled fluids, a ‘cooling lock’ is normally fitted to comply with various safety regulations (e.g. in the UK: HSE PM73). This prevents the autoclave from being opened until the load temperature has fallen to typically 80°C, thus reducing the risk of both the boiling over of fluids (e.g. media) and the breaking or explosion of glass bottles.

Validation

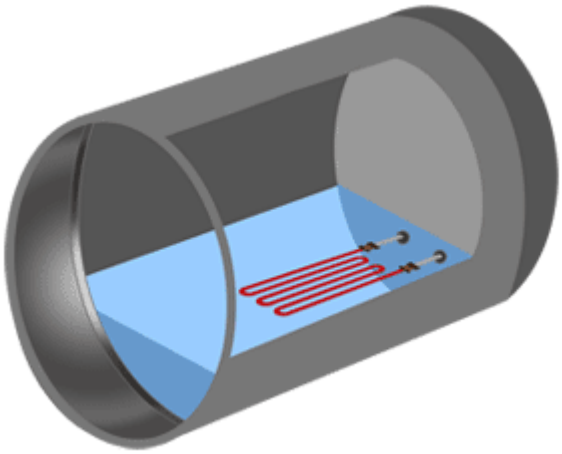
It has become increasingly important to comply with Quality Assurance procedures, which require validation that sterilization has been achieved. Validation is best defined as the documented procedure of obtaining, recording and interpreting results to ensure that the machine will consistently carry out a defined process. This will involve carrying out multi-point temperature mapping to establish suitable loading configurations and cycle parameters to ensure that the process is controlled within predetermined limits. Astell Scientific is a UKAS accredited company. For further details please contact our Service Department.

What steam source options are available?

There are several different steam source options available depending on the size of autoclave you require from Astell. As a general rule, all autoclaves over 95 litres are available as 'Direct Steam' models at no extra cost. Most autoclaves over 875 litres require an external stand-alone steam generator due to the power required to produce the levels of steam necessary for sterilization. If you require a specific configuration, then please contact us to discuss your requirements.

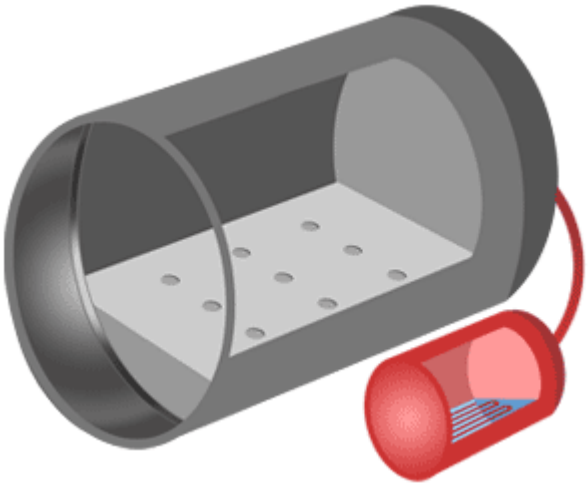
Heaters in Chamber

‘Heaters in chamber’ is the standard configuration fitted to all circular chambered Astell autoclaves and Economy range square chambered models. With these machines water is manually poured by the user directly into the chamber before each cycle begins. As the heater element(s) reach temperature, the water in the chamber boils to produce steam. An ‘Autofill’ option is available to allow automatic water filling to take place so that the autoclave does not need to be manually filled between cycles. The ‘Heaters in chamber’ configuration is not suitable for sterilization cycles where drying is required for porous loads/fabrics.



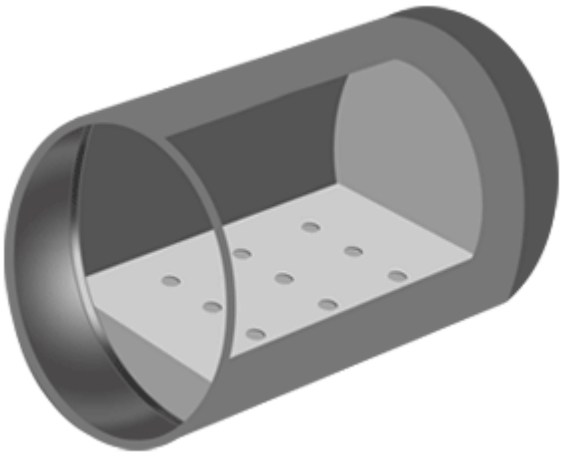
Integral Steam Generator

The integral steam generator option removes the heating elements from the chamber and replaces them with an integral generator for improved control over steam production. ‘Autofill’ is also fitted as standard to the steam generator, eliminating the need to manually refill the chamber between cycles. A mains water supply enters the steam generator, where it is heated and converted to steam. This then enters the chamber directly from the steam generator as and when it is required. This option is available throughout the range on autoclaves 95 litres and above in size (excluding the E-Range).

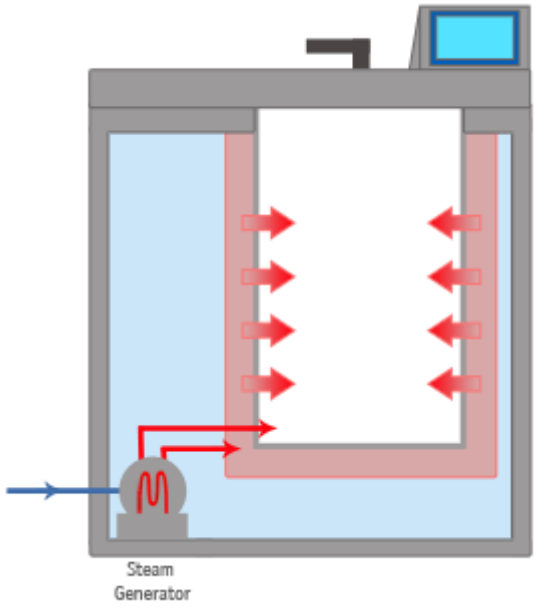


Direct Steam/External Steam Generators

The direct steam option is intended for sites which already have a steam supply, or for larger autoclaves that require a powerful stand-alone steam generator. An external steam feed is plumbed directly in to the unit. This option is available on all Astell autoclaves from 95 litres and above. Astell external steam generators are available for large square section units, with 48kw and 72kw versions available. For more information on external steam generators, please refer to our website or catalogue.



Heated Jackets - What they do and why you might need one



Q: In what circumstances will a heated jacket be required?

A: A heated jacketed is necessary if a dry load is required following sterilization (when used in conjunction with a pulsed vacuum system).

Typical loads where a jacket would be required for drying include wrapped instruments or porous fabrics. Heated jackets are available on all Astell autoclaves over 95 litres with integral steam generators or with a direct steam supply. They add a secondary external layer to the autoclave allowing steam to circulate outside the sterilization chamber whilst insulating the main vessel.

When a jacket is fitted, its effect is two-fold. Firstly, when sterilizing fabrics and porous loads, the jacket is kept constantly heated which means that the chamber maintains a residual temperature between cycles, avoiding excessive condensate forming inside the chamber and wetting the load when steam enters the vessel. Secondly, after preventing condensation forming at the beginning of a cycle, at the end of a cycle the jacket stays running during a final vacuum, which then evaporates any remaining liquid, allowing porous loads to be touch dry when they are removed at the end of the cycle.

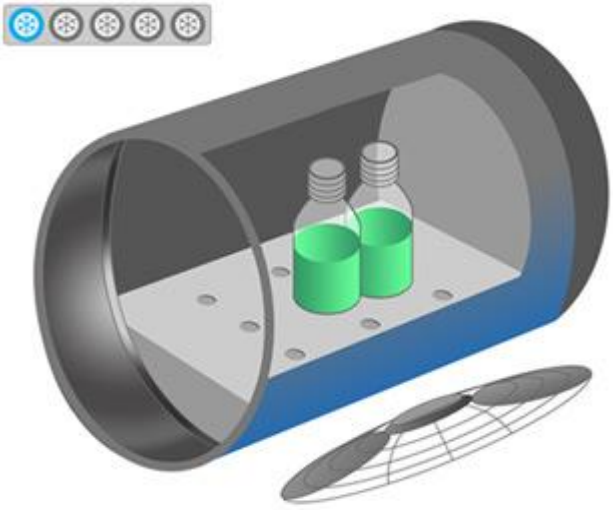
The cooling options available for your Autoclave

The table below shows you what cooling options are compatible with the size and type of autoclave you may require. For more information on the specific option itself, please see the required paragraph following this table.

				
	Benchtops	**Compacts**	**Top Loaders**	**Front Loaders**
Fan Cooling (External)	■	■	■	■
Autodrain	■	■	■	■
Water Cooling (Coils)			■	■
Water Cooling (Jacket)			■	■
Cyclon Cooling			■	■
Fan Cooling (Internal)				■

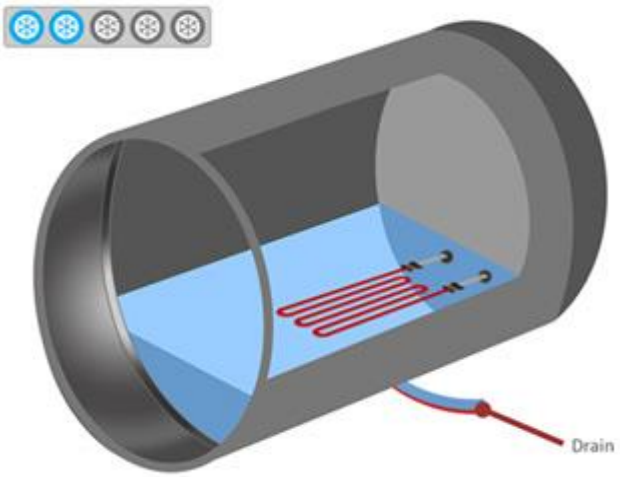
Fan Cooling (External)

A powerful, externally mounted fan helps to reduce the cooling down stage of a cycle. Like all Astell's cooling options, the operation of external fan systems is controlled via the colour touchscreen controller. This cooling option is available on all models (except for those fitted with a cooled or heated jacket).



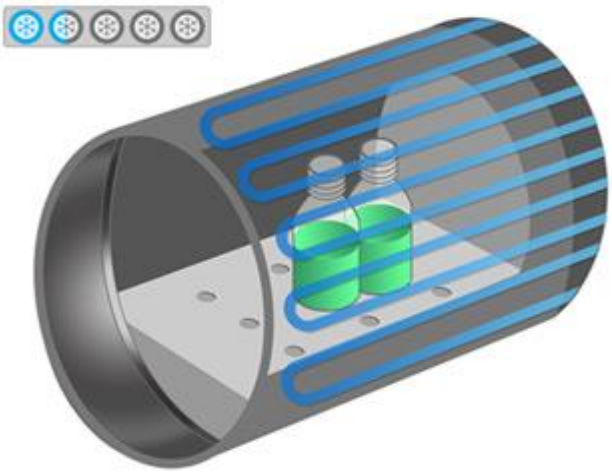
Autodrain

For use in 'Heaters in Chamber' autoclaves only. This feature can be selected on any cycle and will substantially decrease the time required to cool the chamber to a temperature where the door can be safely opened, especially when used in conjunction with the Water Cooling (Coils) or External Fan Cooling. At a pre-selected pressure during the cooling phase of the cycle, any remaining water in the chamber is evacuated to the drain.



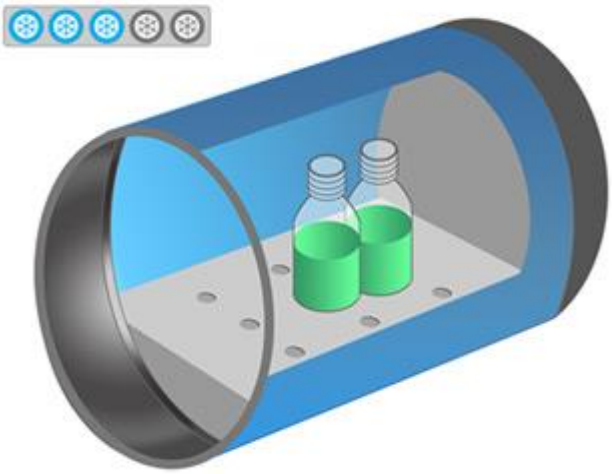
Water Cooling (Coils)

Water is circulated through cooling coils in direct contact with the outside of the autoclave chamber, resulting in a substantial reduction in cooling time.



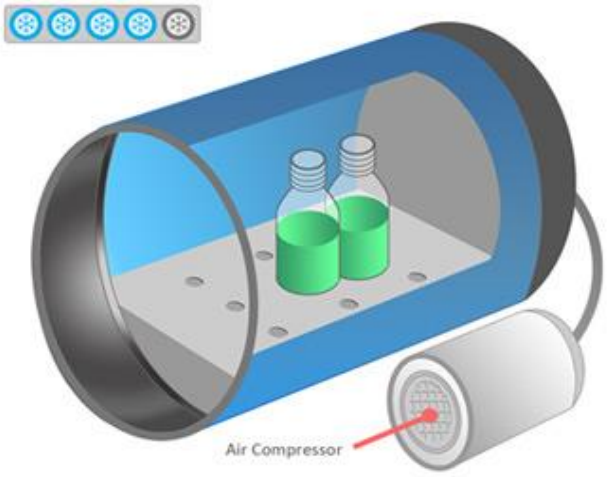
Water Cooling (Jacket)

This option quickly and effectively cools bottled media and other fluid loads. After sterilization water is circulated in direct contact with the outside of the autoclave chamber, resulting in the rapid decrease of the internal chamber temperature. The effectiveness of Jacket Water Cooling can be further enhanced if the autoclave is fitted with Internal Fan Cooling (see overleaf).



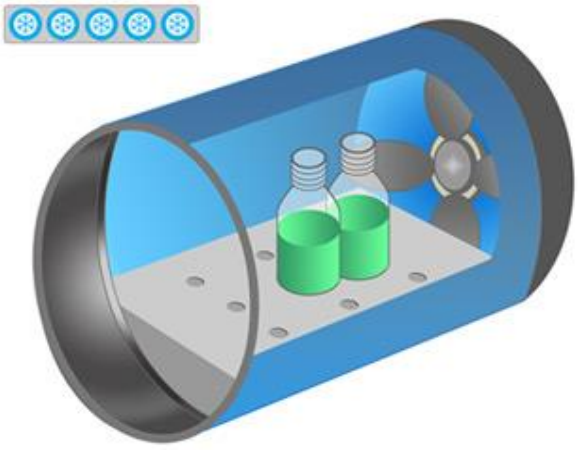
Cyclon Cooling

Cyclon Cooling provides major benefits in laboratories where large quantities of culture media need to be processed quickly as it provides a significant reduction in cycle time. The option in itself is available free of charge, however as a prerequisite, Water Cooling (Jacket) and Air Ballast options are both required. This method of cooling is ideal for use in situations where large loads of bottled fluids (e.g. culture media) need to be sterilized quickly.



Fan Cooling (Internal)

A magnetically driven internal fan is situated in the chamber itself, which creates turbulence. The fan needs to be fitted in conjunction with Water Cooling (Jacket) in order to be effective, and these combined options provide one of the most efficient ways of cooling the chamber and load. The dual system is therefore ideal in situations where large fluid loads need to be processed as quickly as possible. Internal Fan Cooling, when used in conjunction with Water Cooling (Jacket), Air Ballast and Load Sensed Timing makes cooling times up to 70% faster than a standard autoclave fitted with no cooling system.



Air Ballast and Load Sensed Process Timing – cooling liquids quickly and safely

How can I quickly and efficiently sterilize fluid loads?

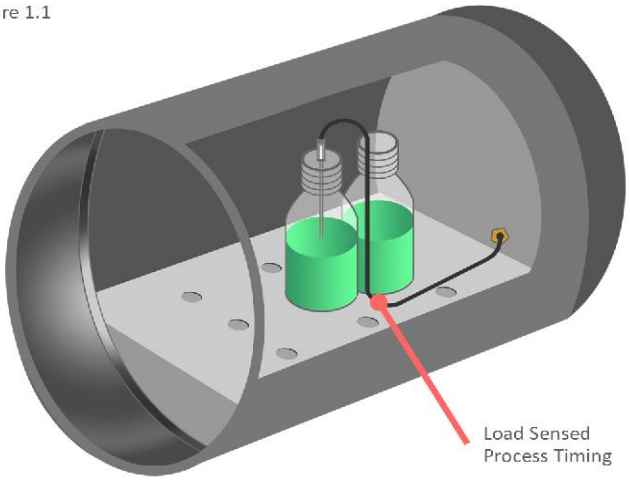
Sterilizing fluid loads in a quick an effective manor is something that can be easily achieved by using the right options. All Astell autoclaves can be used to sterilize fluids, but to sterilize fluid loads quickly the addition of a cooling system and ‘Air Ballast’ must be used.

What is Load Sensed Timing?

Load Sensed Process Timing allows the sterilization cycle to be controlled directly by the actual temperature of the load rather than just the chamber temperature. A flexible sensor probe (pictured below) is fitted inside the autoclave chamber and the user should submerge the probe directly into the media (or a reference bottle). It is recommended this is placed in the centre of the autoclave, or the coldest spot (usually determined during validation).

By selecting one of the pre-set sterilization cycles via the touchscreen controller, the user can then ensure that sterilization does not begin until the very centre of the load has reached the correct temperature.

Figure 1.1

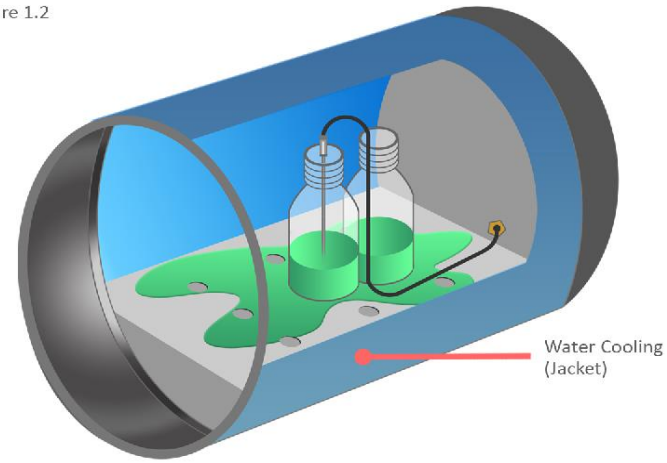


Why is Air Ballast required?

Figure 1.1 shows how most autoclaves would operate when no assisted cooling is used. This can be a long process, as after sterilization the chamber must cool down naturally to a safe temperature.

However, in circumstances where a rapid cooling system is used, the sudden change in pressure will most likely cause media/fluids to “boil over” rendering the samples useless and creating spillage in the autoclave chamber (as illustrated in Figure 1.2 below).

Figure 1.2



The best solutions to avoid this problem are as follows:

Solution One

ADVANTAGE: Cost effective cooling for standard loads.

If assisted cooling is used (i.e. an External Fan, Water Cooling (Coils) or Jacket Cooling) the cooling would normally be set to activate at just above 100°C to stop a rapid drop in the chamber pressure. Whilst this means there is a delay between sterilization completion and the start of the cooling process, it ensures there is a reduced risk of media/fluids boiling over and emptying into the chamber.

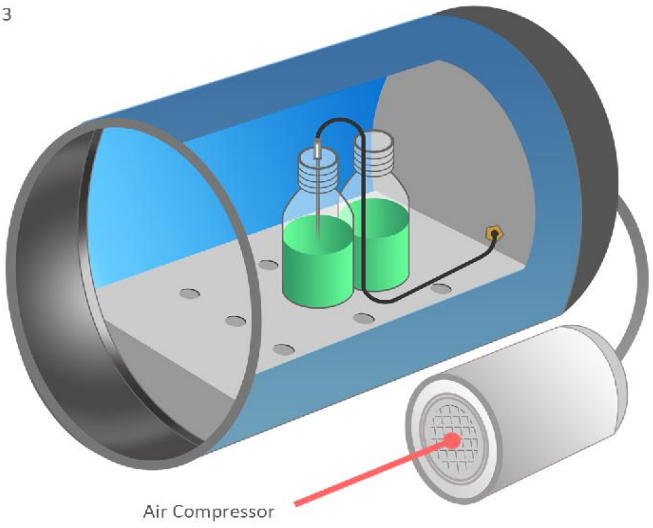
Solution Two

ADVANTAGE: Fast efficient cooling (when required).

The second way is to use ‘Air Ballast’. Compressed air is quickly injected into the chamber to replace the steam used during sterilization and maintain the chamber pressure during the cooling phase (see Figure 1.3).
By using a compressed air source, or an air compressor (available separately), the cooling process can begin immediately following sterilization. The Air Ballast function controls the internal chamber pressure whilst at the same time allowing the selected cooling method to cool the load.

This combination of these two processes ensures a controlled and quick cooling process. If this is then coupled with Fan Cooling (Internal to the chamber) it provides one of the fastest cooling methods available for non-sealed fluid loads.

Figure 1.3

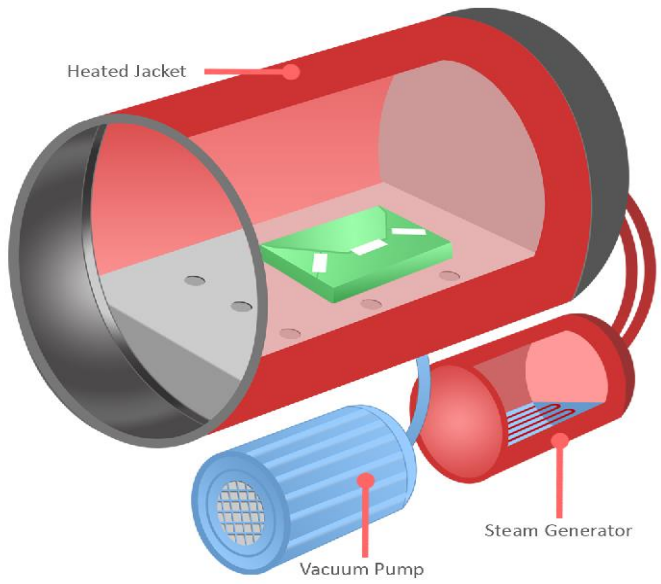


Advanced and Simple Vacuum options

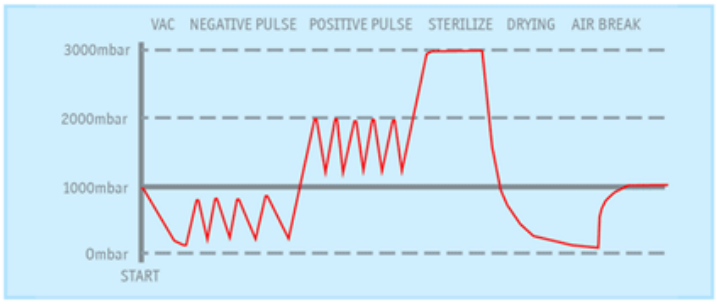
A vacuum option is essential for porous loads (e.g. wrapped instruments and fabrics) or other cycles where air pockets could easily become trapped within the load. Available in two derivatives, the AVC001 option is Astell's advanced pulsar vacuum, which when used in conjunction with the integral steam generator and a heated jacket enables the dry output of all loads. Alternatively, the AVC002 vacuum utilizes the standard heaters in the base of the chamber with simple pre-vacuum air removal and post vacuum cooling to efficiently sterilize porous loads, but *without* any drying capability.

AVC001 - Advanced 'Pulsar' Vacuum

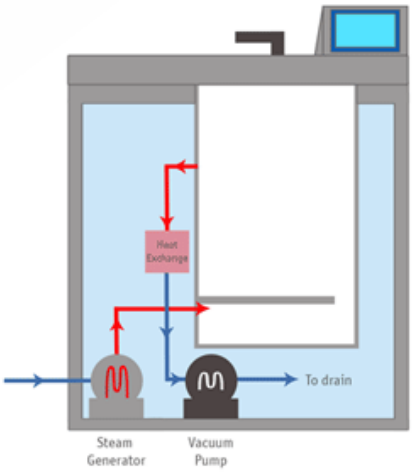
Suitable for all units with an integral steam generator (or external steam supply), the AVC001 vacuum option is Astell's most advanced method of air removal. It's ideal for sterilizing porous loads and other materials typically found in dental and medical applications where air pockets could easily form.



An AVC001 vacuum cycle starts with a pre-vacuum which is followed by negative and positive pulsing. By introducing steam between vacuum pulses, air is forced out of the autoclave chamber under pressure; the best method for removing air from porous loads and discard waste. Following the sterilization stage, a post vacuum removes the steam from the chamber. In combination with the jacket option, a drying stage then begins to ensure loads are touch-dry upon removal.



Above: A typical fabrics graph



Why is a Steam Generator and Heated Jacket required?

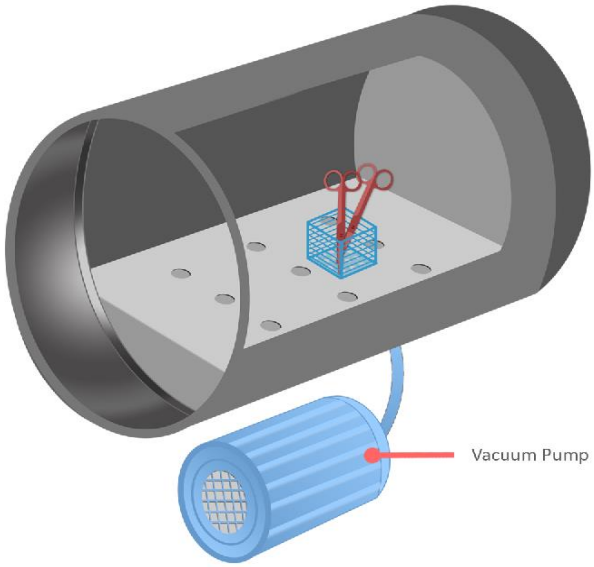
In order to achieve a touch-dry load, conditions inside the autoclave need to be just right. With the Advanced Vacuum, negative and positive steam pulses from a dry saturated steam source (i.e. a steam generator) provide the perfect air removal, sterilization and drying conditions.

A touch-dry load is not only accomplished with the Advanced Vacuum, but also by using a steam source external to the chamber and a Heated Jacket to avoid cold spots within the autoclave chamber.

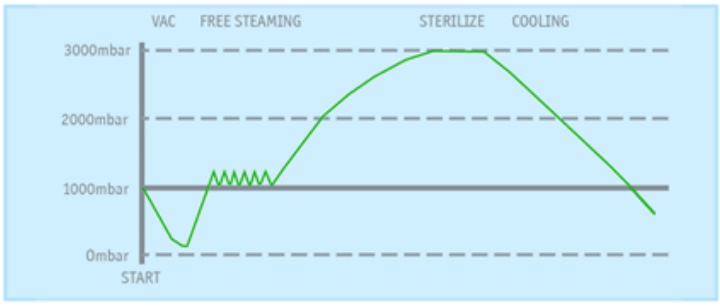
This then means that as steam enters the autoclave and comes into contact with the chamber wall, the steam does not condense and produce a wet environment.
At the end of the cycle a vacuum is pulled on the chamber, removing the remainder of the steam within the chamber to leave the sterilized load touch-dry.

AVC002 - Pre and Post 'Simple' Vacuum

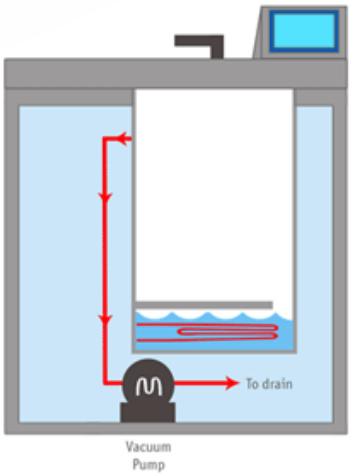
The AVC002 option is Astell's basic vacuum system and is only suitable for standard autoclaves with the heaters in the chamber, or direct steam models. It is ideal for situations where improved air removal is required, such as for dense discard loads or vacuum cooling of unwrapped items (i.e. beakers, plastic containers, metal instruments or glassware).



A typical cycle begins with a pre vacuum, reducing the chamber pressure and removing most of the air. A freesteaming / air purge stage then begins. After the sterilizing stage is complete, water in the bottom of the chamber is expelled and then a post vacuum takes place, removing any remaining steam from the chamber and cooling the load.



Above: A typical Pre/Post Vacuum cycle graph

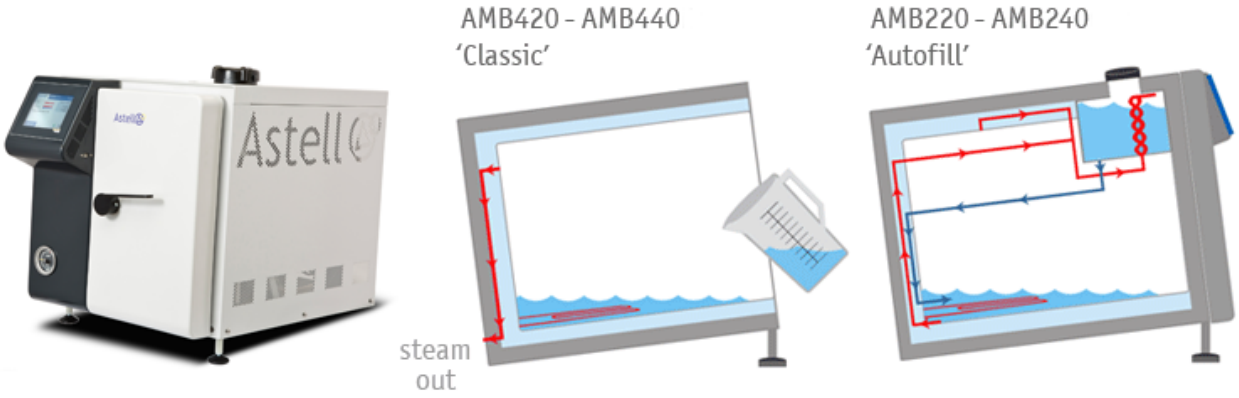


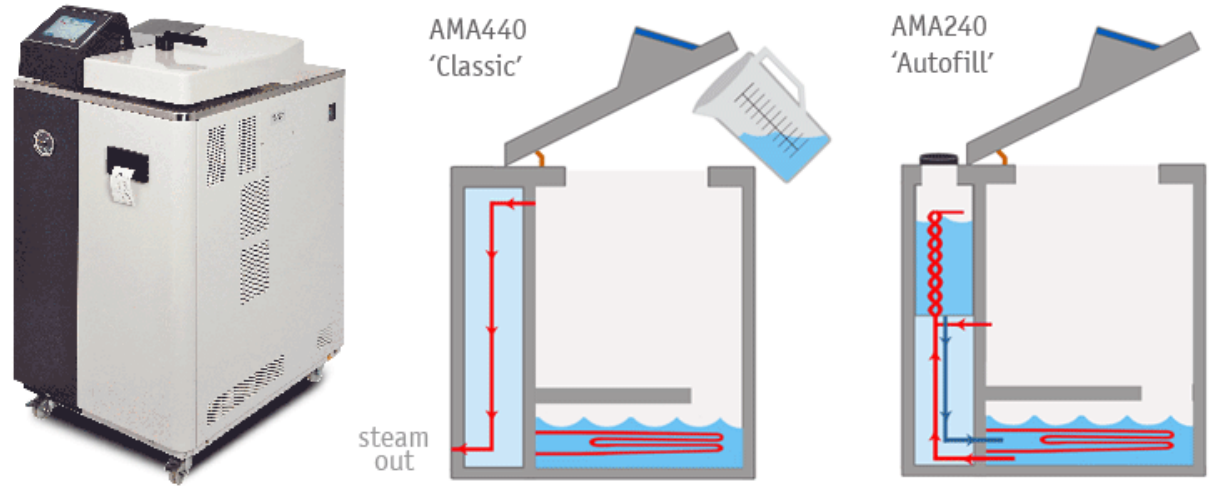
Please note: Whilst the AVC002 is more effective than a standard autoclave without vacuum, it is still a simple vacuum and as such does not have the drying capability of the AVC001 and Jacket option. Items which retain water (such as fabrics and porous items) should be sterilized using the ‘Advanced Vacuum’ method AVC001.

Autofill vs Classic Benchtop & Compact models

The Astell Benchtop and Compact range (33 - 63 litres) is available in two different versions which have two totally different systems for filling the autoclave with water.

These are as follows:





The 'Classic' version (e.g. the AMB420 or AMA440 above)

The 'Classic' version is the simplest type of autoclave in Astell's range. Water is poured directly into the chamber of the autoclave by the operator and the colour touchscreen advises when the water is at the correct level.

During the cycle at the freesteaming stage, a small amount of condensate is generated which leaves the autoclave by a flexible hose located at the back of the unit. This flexible hose should be placed into a drain or a heat resistant condensate collection bottle (available separately as an additional option).

At the end of each cycle the operator is prompted by the touchscreen controller display to top up the water level to the correct point before starting another cycle.

The 'Autofill' version (e.g. the AMB220 or AMA240 above)

The 'Autofill' versions of the Benchtop and Compact autoclave ranges use Astell's unique recirculation system - meaning that there is no need for the autoclave to be connected to any services other than a standard electric power supply. The 'Autofill' versions differ from the 'Classic' versions as they have an integral reservoir built into the inside of the unit. The user simply has to top up this internal tank via a removable screw lid, and a single fill will last for approximately 15 - 20 cycles. At the start of each cycle the chamber is automatically filled from the reservoir, and following sterilization the autoclave then automatically drains any excess water from the chamber and returns it to the internal tank. This saves the user having to top up the autoclave after every cycle, and also ensures that no provision for condensate collection is necessary.

Following automatic drainage of the chamber, this clever system then also allows users to activate the 'Pulsed Heat Drying' system. Available exclusively on the 33 - 63 litre Autofill range, this feature allows quick and easy drying of pipette tips, empty glassware and other plastics at the end of the cycle.

Colour touchscreen controller

All Astell Scientific Autoclaves, Steam Generators and Effluent Decontamination Systems incorporate the latest innovations in control system technology, providing colour touchscreen controllers as standard throughout the range. The Astell control systems are an advance in sterilization control technology, bringing together years of unrivalled experience, to produce a user friendly, fully automatic control system, to meet and exceed the expectations of the most demanding laboratories and centres of sterilization.

The controller consists of a wipe clean touchscreen measuring 122mm x 94mm and is based on an industrial PLC system, combined with a number of analogue and digital input/output modules. The controller software has been developed by Astell for the precision control of all our autoclaves and sterilizers.

Standard Features

Colour Touchscreen	Icon Driven Menu System	Simple Cycle Selection	Continual Cycle Monitoring
Data Archive for up to 5,000 cycles	USB Connection for USB back up (requires additional lead)	Multiple user access levels	Multi-level password protection
User log	Multi programmable controller	Programme new cycles	Modify existing cycles
Duplicate, modify & rename cycles	Cycle jump facility	Multiple languages	Delayed start facility
Hold warm facility (if applicable)	Default to factory settings	Input / output override	Machine service timer
Digital pressure display	Digital Temperature display	Cycle counter	Stage timer
Cycle timer	Cycle header	Stage display	Pressure display
Up to four temperatures displayed	View input / output display	Logs batch number	Logs load number
Safety valve test cycle	Diagnose faults		

Frequently Asked Questions

Are Astell autoclaves medical devices?

Yes, Astell autoclaves are registered Medical Devices. The relevant certificates (Medical Device Directive 93/42/EEC & ISO13485 can be found on our website – Astell.com

What is the maximum achievable temperature and pressure for our autoclaves?

138°C (280°F); 2.4 Bar (34.8 PSI).

Does the total cycle time vary between Classic and Autofill versions of Benchtop/Compact autoclaves?

Cycle times are very much dependent on the size and nature of the load being sterilized. However, for identical loads, an Autofill unit will have a slightly (up to 15%) faster cycle time than a Classic unit. This is because with the Autofill version the hot water is ejected from the chamber after sterilization, whilst with the Classic unit, the water remains.

Which options are required for pipette tips and textiles?

Pipettes and textiles can be sterilized in any autoclave. However, in most cases these products will need to be dry at the end of the cycle, and for this an Advanced Vacuum and Heated Jacket will be necessary.

What is meant by a dry discard cycle?

A dry discard cycle is intended for the sterilization of waste loads that contain little or no liquid. Often these will consist of petri dishes, and other plastic containers etc. that require decontamination prior to disposal.

Can the air ballast system be used to speed up cooling?

Air Ballast reduces the risk of bottled fluids boiling over when an efficient cooling system (e.g. Water Cooling Jacket) causes a sudden change in pressure within the autoclave chamber. Therefore when an autoclave is fitted with air ballast the cooling stage can be implemented earlier; this will mean that improved cooling times can be achieved.

Does a top loading, non-Autofill autoclave need to be filled before each use?

An autoclave without an Autofill system will need to be manually filled before each cycle. However, please note that in normal circumstances some water will remain in the chamber at the end of each cycle, so the water required to reach the minimum

level will be relatively small. Note: The latter applies only to autoclaves with heaters in the chamber; an autoclave fitted with a steam generator will fill automatically (and therefore will require a water supply).

Most manufacturers request a deionised water supply. Ours only need a potable water supply. Isn't there a potential problem with limescale?

If the water supply is relatively hard (<50ppm) a Water Softener would be advisable. This is particularly critical for units with a steam generator, where any build-up of scale will not be visible, and the first sign of unsuitable water may be heater failure.

Is it possible to keep media warm using 'Holdwarm' whilst removing bottles from time to time?

No, once the autoclave is opened the Holdwarm system ceases to operate.

Is the 'Holdwarm' facility available for models with a steam generator?

No, the Holdwarm system is dependent on the remaining water in the chamber being held at a constant temperature. If an autoclave has a steam generator little or no water remains at the end of the cycle.

Is a media melting/warming cycle available?

Yes, a media melting/warming cycle is available.

What's the difference between freesteaming and pre-vacuum?

Freesteaming involves 'air purging', where air is effectively 'driven' from the chamber and load using turbulent steam. Pre-vacuum withdraws air from the chamber using a vacuum pump.

How many programs can be set on the controller?

The Astell controller unit allows the programming of at least 50 different cycles.

How many cycles can be stored in the data archiving function of the controller?

Up to 5,000 cycles can be stored, although this may vary depending on cycle parameters.

Is it possible to limit various cycles to a given operator?

Operator specific cycles can be provided on request. Please contact Astell Service for further details.

Are Classic or Autofill Compact and Benchtop autoclaves best for discard?

The Classic and Autofill Compact and Benchtop autoclaves can be used for small quantities of non-hazardous discard. For larger, difficult loads a vacuum system is beneficial. If BSL3 (Cat III) waste is being sterilized, a heated jacket in addition to vacuum, would be recommended, since this ensures improved temperature distribution within the chamber. Twelve point validation to a recognised standard is also recommended to ensure that all parts of the load are being sterilized.

What sort of waste can be sterilised using an autoclave with BSL3 option?

BSL3 is generally hazardous waste containing pathogens that are potentially harmful. Further details can be provided on request.

Can Petri dishes with media be sterilised in an open discard bag in autoclaves 63 litres and under?

Yes, although care should be taken to ensure that the autoclave is not overfilled, since this may prevent efficient air removal.

What's the advantage of using Simple Vacuum for discard loads?

Simple Vacuum will improve air removal from discard loads (in comparison with freesteaming), although the most efficient form of air removal is Advanced (pulsed) Vacuum.

Is it possible to have two water sources for an autoclave, one for the steam generator and a separate untreated source for the jacket?

Yes, this is possible with most models. Please contact Astell for further information.

Do our autoclaves need to be connected to a vent system?

Models that need to be installed (i.e. this excludes Compact and Benchtop units) should be connected to a vented drain, which will eliminate the possibility of back-flow.

Quick reference overview of the Astell autoclave range

Astell Scientific manufacture many types and sizes of autoclave. Our main product range can be categorised as follows, however for more information please refer to the main product catalogue or our website Astell.com, where individual range brochures are available to download.

Benchtop and Compact Autoclaves

This range of circular section autoclaves from Astell offer guaranteed precision and versatility for a wide range of applications. Featuring many of the benefits associated with Astell's larger units these stylish yet economical models meet the demanding requirements of current sterilization procedures.

Benchtop Autoclaves
33, 43 & 63 litres

These are available in *Classic* and *Autofill* versions.

- A choice of 33, 43 and 63 litre models
- Fully programmable colour touchscreen controller
- Electro polished stainless steel chamber
- Base shelf within the chamber
- Ultra-quick Swiftlock door mechanism
- Full range of options & accessories
- Self-contained design with no installation required - just fill with water and plug it in and the machine is ready to be used
- A pulsed-heat drying system, which is adjustable in 5 minute steps (available when running a non-fluid cycle. Not suitable for drying fabrics or porous loads). Available on Autofill models only.

Compact Autoclaves
63 litres

These are available in *Classic* and *Autofill* versions.

- Temperature range of 100°C to 138°C (0.2 - 2.4 Bar)
- Self-contained design with caster wheels – no installation required, just fill with water and plug it in and the machine is ready to be used
- Fully programmable 5.7" colour touchscreen controller
- Electro polished stainless steel chamber
- Base shelf within the chamber
- Ultra quick Swiftlock door mechanism
- Five password levels to stop lower level users making changes
- Validation Port
- Cooling Lock
- Over Temperature Protection
- Pressure Gauge
- Internal Memory for storing up to 5,000 cycles
- Five Pre Programmed Cycles and up to 50 available
- Timed Free Steaming

Top Loading and Front Loading Autoclaves

A range of top loading and front loading microprocessor controlled autoclaves in volumes from 95 to 344 litres. The easy open/close Swiftlock closure combines with a user-friendly control system to ensure simple operation for all applications, whilst a comprehensive range of safety features ensures peace of mind for the user.

Swiftlock Front Loading Autoclaves 120, 153, 247, 290 & 344 litres

Astell's Front Loading range is provided with heaters in the base of the chamber as standard. Other options are available upon request.

- A choice of 120, 153, 247, 290 and 344 litres models
- A fully programmable touchscreen colour controller
- Timed/Pulsed Free Steaming
- An electro polished stainless steel chamber
- Holdwarm / Delayed Start feature
- Full range of options & accessories
- Ultra quick Swiftlock door mechanism
- An external pressure gauge, cooling lock, safety valve test and emergency stop button

Top Loading Autoclaves 95, 120 & 135 litres

Astell's Top Loading range is provided with heaters in the base of the chamber as standard. Other options are available upon request.

- A choice of 95, 120 and 135 litres models
- A fully programmable touchscreen colour controller
- Timed/Pulsed Free Steaming
- An electro polished stainless steel chamber
- Holdwarm / Delayed Start feature
- Full range of options & accessories
- Ultra quick Swiftlock door mechanism
- Caster mounted for easily moving the unit
- An external pressure gauge, cooling lock, safety valve test and emergency stop button

Square Section Autoclaves (including models with Vacuum & Air Ballast)

A comprehensive range of square and rectangular section front-loading autoclaves, in standard volumes from 125 to 2000 litres.

Square Section Autoclaves 125 – 2000 litres

The modular internal chamber dimensions of these units ensure maximum space utilisation for all sterilization purposes. The models with vacuum facility are especially suitable for 'difficult' discard loads, ensuring efficient air removal prior to sterilization.

- Fully customisable design – maximum space utilisation
- Fully interlocked sliding door
- Stainless steel pressure vessels
- Standard sectional jacket with water cooling
- Optional Vacuum & Air Ballast systems
- Double door units available

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www.astell.com