

Small-Scale Autoclaves to Manage Medical Waste

A buyer's guide to
selecting autoclaves
manufactured in India

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About this guide

There is a growing interest, globally, in more sustainable non-incineration approaches to treatment of medical waste. However, currently there is very little information on practical alternatives for treating medical waste in low resource settings. In this guide PATH has gathered information from manufacturers of small-scale Indian autoclaves as one option for treatment of medical waste. India was chosen as the focus country for the guide because of its large number of manufacturers of lower-cost, small-scale autoclaves.

Autoclaves can offer a safe, affordable means for disinfecting some medical waste, including highly infectious sharps waste. This booklet is intended to provide a starting point for managers interested in learning more about autoclaves and to aid in decision-making for purchase of medical waste autoclaves. It includes issues to consider when purchasing an autoclave, technical specifications of some devices, and a list of Indian manufacturers of autoclaves with current contact information. The information is based on desk research and has not been verified through bench testing or field evaluation. For further guidance on deciding whether an autoclave is appropriate for waste treatment in your setting, refer to the references listed at the end of this guide.

About PATH

PATH is an international, nonprofit organization that creates sustainable, culturally relevant solutions, enabling communities worldwide to break cycles of poor health. By collaborating with diverse public- and private-sector partners, PATH helps provide appropriate health technologies and vital strategies that improve global health and well-being.

In the field of safe injection and medical waste management, PATH has served for over 20 years in a global leadership role, championing improved approaches to injection safety for the developing world. PATH actively participated in establishing the Safe Injection Global Network (SIGN). As a founding member and chair of the Injection Safety Alliance in India, whose objectives and activities included reducing unnecessary injections, PATH carried out nationwide studies of injection safety in

association with the government of India. PATH has also published relevant training materials and tools and trained health care workers—primarily in Africa, India, and Indonesia—on appropriate safe injection and medical waste management techniques.

The importance of safe treatment and disposal of medical waste

Between 10% and 25% of all medical waste is hazardous, and the majority of hazardous medical waste is infectious, meaning that it can transmit infections and may be harmful to health workers, the community, and the environment.¹ Injection equipment (e.g., needles and syringes) and other sharps waste are often exposed to bloodborne pathogens and therefore carry the greatest risk of disease transmission if they are reused or handled in an unsafe manner. This risk creates a significant public health burden. The World Health Organization (WHO) estimates that 21 million hepatitis B infections, 2 million hepatitis C infections, and 260,000 HIV infections are inadvertently caused by injections administered with contaminated needles and syringes each year.²

Proper segregation of medical waste into general waste, infectious waste, and sharps waste is the first step in preventing accidental injury and disease transmission. Once waste is properly segregated, it must be treated and disposed of in a safe manner according to facility and country policies for medical waste disposal.³ For an overview of medical waste treatment and disposal options, refer to *Safe Management of Wastes from Health-Care Activities* (WHO 1999).⁴ For further information on safe handling and disposal of medical waste, visit PATH's Health Care Waste Management Resource Page (http://www.path.org/projects/health_care_waste_resources.php), which offers a convenient compilation of key guidance documents, training materials, and case studies.

Using autoclaves to treat infectious waste

Autoclaves are the most common non-incineration treatment method for medical waste.¹ By using pressurized steam to heat the waste to a temperature of at least 121°C, autoclaves can disinfect infectious waste without causing airborne emissions that are created when waste is burned. Steam disinfection is an efficient method of treating medical waste because the moisture increases heat transfer and more effectively penetrates the waste load, reducing the time needed to achieve disinfection.

It is recommended that operators of autoclaves confirm that autoclaved waste is disinfected by using a chemical or biological indicator. These indicators are commercially available and should be included with every batch of waste.

Segregation of waste is an important part of medical waste treatment when using an autoclave. Waste-containing mercury (e.g., broken thermometers) and high-mass waste such as body parts should not be disinfected by autoclave.

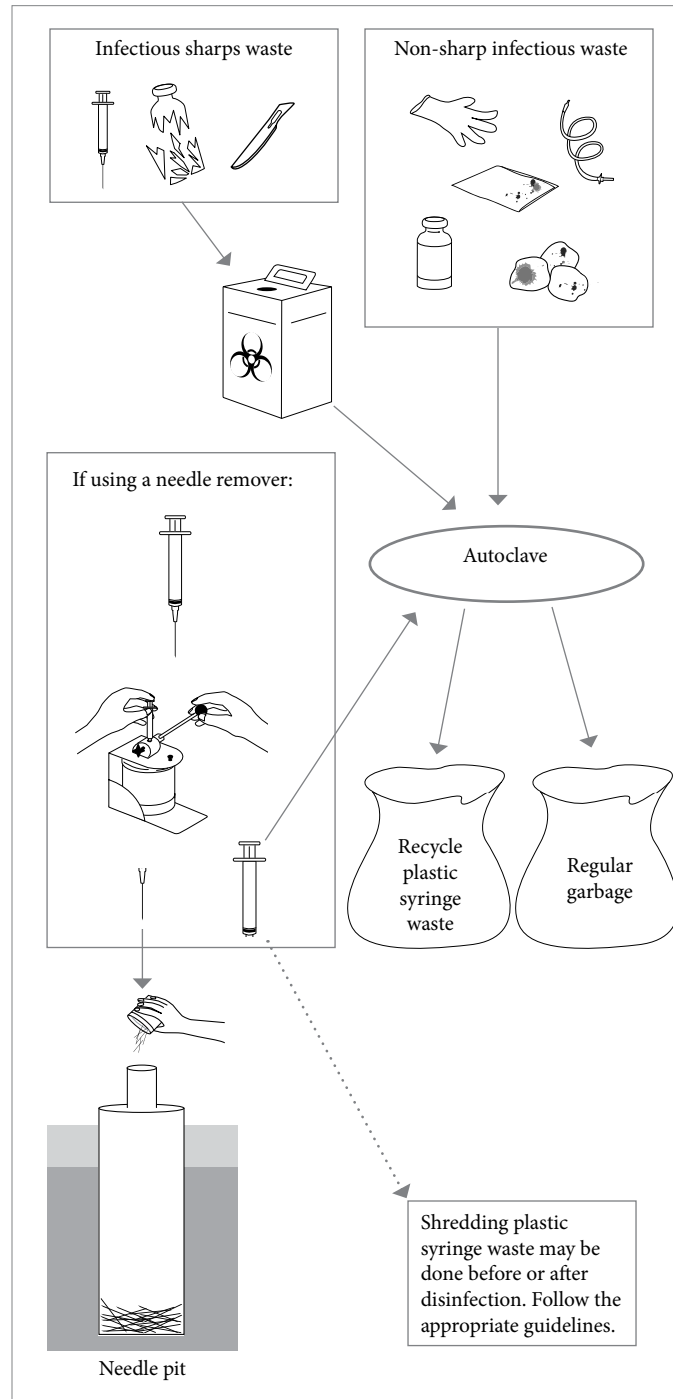
Using an autoclave may open up opportunities to consider recycling the disinfected plastic waste. If plastic waste is intended to be recycled, consider integrating needle remover devices for immediate removal of needles at all injection locations in the facility. Dispose of needles in a needle pit or a specially designed barrel.[†] Alternatively, the needles and syringes can be shredded in safety boxes after they have been autoclaved. It is recommended that cardboard safety boxes be placed in an autoclave bag before disinfection. Although some boxes may withstand the high heat and steam of autoclaving, the quality of boxes varies by manufacturer and some types may come apart in the autoclave.

Shredding of plastic syringe waste reduces the volume of the waste, prevents reuse, and may facilitate the plastic recycling process. Shredding may be done either before or after autoclaving; there is no consensus on a preferred strategy and there are

[†] For more information on constructing a needle pit or barrel for use with needle removers, visit PATH's Needle Remover Resource Page at http://www.path.org/projects/health_care_waste_needle_remover_resources.php.

advantages and disadvantages to each. Shredding plastic syringe waste after disinfection prevents aerosolization of contaminated blood and makes the task of clearing potential jams in the shredder less hazardous. Shredding infectious waste before it has been autoclaved increases the surface area exposed to the heat and steam and can result in more complete disinfection.

Infectious waste stream



As with the handling of all medical waste, health workers and waste handlers operating a shredder should be supplied with personal protective equipment such as gloves, goggles, masks, and aprons. In addition, the shredder must be properly cleaned and disinfected following use.

Prior to purchasing an autoclave, each facility should have a plan for regular collection and disposal of disinfected waste. Depending on local policy, waste disinfected in an autoclave may be disposed of in a municipal landfill or buried in a protected pit. In addition, every facility should have a comprehensive plan for the segregation, treatment, collection, and final disposal of all other medical waste disinfected at the facility.

Choosing the right autoclave for your needs

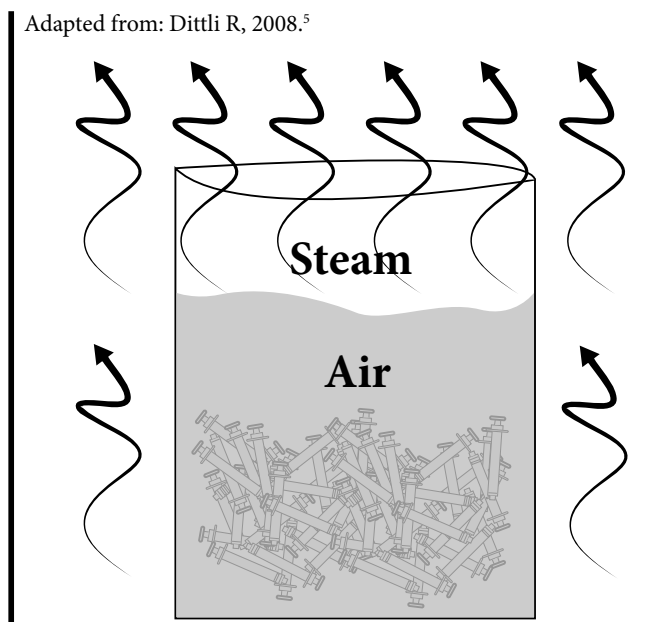
There is a wide selection of autoclaves that are commercially available, and their features vary greatly. This buyer's guide focuses on small-scale autoclaves that can be used for disinfecting medical waste. Autoclaves intended for disinfecting waste are generally larger than those intended for disinfecting reusable equipment, and they come with bin-shaped containers or carts for holding the waste rather than trays. Medical waste must be autoclaved in specially designed autoclave bags that will withstand the steam and extreme heat.

What type?

Autoclaves achieve rapid disinfection at relatively low temperatures (121°C) by removing air from the chamber. This is done either through gravity displacement, in which the hot steam injected into the chamber forces air out through a vent in the bottom, or with a vacuum that removes the air from the chamber prior to beginning the steam disinfection cycle.

Gravity displacement autoclaves must be carefully loaded to avoid air pockets within the waste that would prevent the steam from fully penetrating the

Adapted from: Dittli R, 2008.⁵



load and resulting in sub-optimal temperatures for disinfection. Autoclave models that have a “pulsing” feature may achieve better disinfection by releasing bursts of steam into the chamber, which improves air circulation and minimizes air pockets.

Vacuum autoclaves are a newer design, and achieve disinfecting temperatures more quickly by removing all air from the autoclave chamber prior to filling the chamber with steam.

There are many models of autoclaves to choose from. Generally, autoclaves may be defined by whether they are horizontal or vertical, rectangular or cylindrical, and frontloading or toploading. Some features may suit your needs better than others, depending on how waste is collected at your facility.

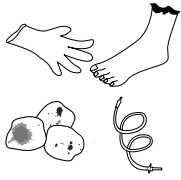

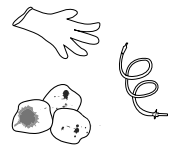
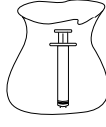

? How large?

The autoclaves listed in this guide range between 35 liters and 200 liters in capacity and in some cases can be custom made to suit the needs of the user.

Each autoclave should be purchased according to the amount of waste generated at the facility in which the device will be placed. In order to calculate the capacity needed you should consider the waste management policies in place that may influence what types of waste are treated, how often waste is treated, and what final disposal methods will be used. This will

inform the calculations for frequency of operation of the autoclave, the size of each batch of waste to be treated, and subsequently the size of autoclave that will be needed. For example, if a facility has a recycling program in place, the plastic waste will be segregated and treated separately from other infectious waste. This may, in turn, affect the batch size and frequency of treatments needed to process the different types of waste at this facility.

Sample calculation for autoclave size

15 liters	Non-sharp infectious waste	
- 8 liters	Waste not appropriate for autoclaving	
= 7 liters	Infectious waste appropriate for autoclaving	
+ 3 liters	Recyclable plastic syringe waste	
+ 1 liter	Infectious sharps waste	
= 11 liters		
/ 5 autoclave cycles per day		
= 2.2 liters*		

* Capacity needed will vary depending on the number of cycles run each day.

Sample calculation for autoclave size

A hospital produces 3 liters per day of plastic syringe waste (after needles are removed), 1 safety box (1L) of infectious sharps waste such as broken vials and scalpels, and 15 liters per day of other infectious waste. Of the non-sharp infectious waste, 8 liters are infectious waste that may not be placed in an autoclave, such as body parts or placentas. This amount is subtracted from the total infectious waste, so the health center is left with 7 liters of non-sharp infectious waste appropriate for disinfection in an autoclave, 3 liters of plastic syringe waste, and 1L of other sharps waste. The autoclave the hospital is considering purchasing can run up to 5 cycles per day, so they determine the capacity needed will be $(7L + 3L + 1L)/5$ cycles per day = 2L capacity needed. To reduce the number of cycles that the autoclave is run each day, a slightly larger capacity device may be preferred.

What temperature?

WHO recommends that for treatment of medical waste in an autoclave, the disinfection cycle should reach 121°C with 1 bar pressure for 60 minutes.⁵ While this is a good general rule to follow, actual disinfection time will vary depending on the autoclave and size and composition of the load (metals and plastics achieve disinfection more quickly than saturated gauze and other wet materials). Refer to the manufacturer's operation manual for specific instructions on time requirements for disinfection.

What features?

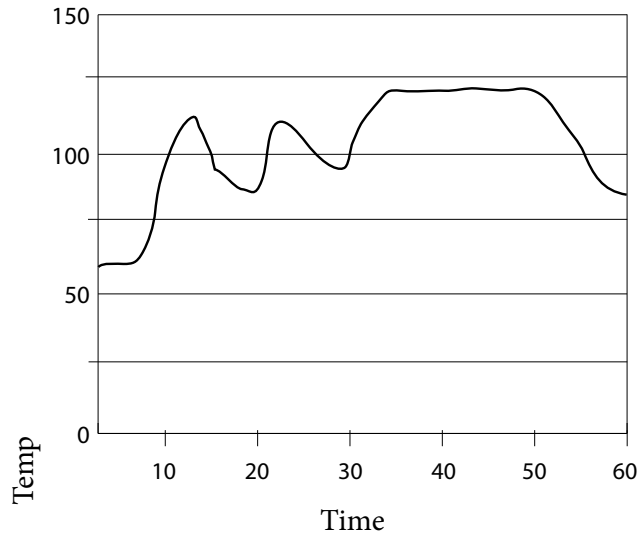
Autoclaves come with many different features depending on the size, type, and intended use. In general, standard features include:

Pressure gauge

The pressure gauge enables operators to confirm that the chamber is reaching the proper pressure to achieve disinfected conditions.

Temperature indicator

Along with the pressure gauge, a thermostat helps the operator track optimal conditions within the autoclave during a cycle.



Sample readout from temperature recorder displaying temperatures during a disinfection cycle

Temperature recorder

A temperature recorder provides a retrospective analysis of the temperature inside the chamber throughout the duration of the autoclave cycle. This is useful for tracking the length of proper disinfection temperatures inside the autoclave.

Steam release valve

A steam release valve maintains the appropriate level of pressure within the chamber.

Door lock

A door lock prevents the chamber door from being opened while it is pressurized, which is very dangerous and can cause serious injury.

Safety valve

This valve is an extra safety precaution that prevents the operator from inadvertently opening the autoclave chamber before it is completely depressurized.

User controls

User controls allow the operator to adjust temperature settings, pressure settings, and duration of the cycle. They are useful for modifying the disinfection cycle depending on the type and quantity of waste.

Automatic shut-off

This feature allows the operator to be away from the autoclave during the cycle without concern of running the device longer than the recommended duration. This is a particular concern when there is no continuous water supply.

Timer alarm

When the automatic shut-off feature is not available, an alarm can be used to alert the operator that the autoclave cycle is complete.

Continuous water supply

When available, continuous water supply (water faucet connected to the autoclave) relieves the burden of refilling the autoclave before each cycle. By ensuring the autoclave never runs out of water, it also prevents damage to the equipment caused by overheating.

Water level detection

This feature sounds an alarm when the water level is too low to provide sufficient steam to run the disinfection cycle to completion, and alerts operators of action needed to prevent damage to heating elements.

? How much will it cost?

Prices vary based on size, durability, type of device, and extra features. In general, capital cost for an autoclave used for medical waste and manufactured in a middle income country is between US\$1,300 and US\$11,000 excluding the price of consumables needed to operate the equipment.

? Other considerations

Operator training

A skilled operator is required for running an autoclave. This person must be trained in proper loading, routine monitoring, and safe operation of the device, and must have solid knowledge of safe medical waste practices.

Spare parts

Verify that the manufacturer or supplier will service and repair the unit they are selling, and can provide spare parts. This is critical for proper function of the device as autoclaves are pressurized and can be dangerous if not maintained and repaired properly. Typically, the spare part that wears out first is the gasket seal to the pressure chamber, but each manufacturer's device is different, and, in general, spare parts are not interchangeable. When obtaining price quotes from manufacturers you may wish to ask if any spare parts are included.

Consumables

Special bags that are resistant to high temperatures but penetrable to steam must be used to line bins used to collect waste for autoclaving. Biological or chemical indicators should be used to confirm disinfection of treated waste. Buyers must consider the logistics of supplying bags and other consumables when they purchase the autoclave, and ensure that the associated cost is incorporated into the facility's waste management budget.

Waste water disposal

Autoclaves generate steam which condenses and runs off as water. When considering where to install an autoclave, note the availability of drainage for disposal of water runoff from the disinfection cycle. Depending on the type of waste in the autoclave, this water may or may not be suitable for open drainage.

Maintenance

As with all complex instruments, some maintenance will be required to keep the autoclave operating well. When developing a medical waste management plan for a facility, be sure to allocate budget and human resources for maintenance. This should include regular purchasing of consumables, monitoring of the accuracy of thermocouples and pressure gauges, replacing filters and gaskets, and inspecting for cracks, leaks, or other damage.

Energy availability

Autoclaves require a reliable source of electricity in order to maintain the pressurization and temperatures necessary to properly disinfect infectious waste. If a facility does not have sufficient electricity, they should consider alternative treatment methods.

Import and export regulations

Regulations for importing and exporting autoclaves will vary by country. When considering the purchase of an autoclave, be sure to research import and export regulations that may affect the procurement process.

The autoclaves listed in this guide are manufactured in India and fall under Chapter 81, Heading 8402 of the Indian Trade Clarification based on Harmonized System of Coding (ITC-HS) codes, which define types of steam-generating products/sterilizers/boilers. Products covered under this category of equipment are among the freely exportable goods and there are no restrictions imposed on their export from India.

Listing of autoclaves for the treatment of medical waste

Alphabetically by manufacturer

The following section contains a listing of autoclave products and details about specific products, where that information is available. At the end is a list of the contact information for all manufacturers, which can be used to obtain additional information on the products and prices.

This information was compiled from the manufacturer's websites, promotional materials, and interviews with manufacturer representatives, and is subject to change.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by PATH or the US Agency for International Development in preference to others of a similar nature that are not mentioned.

Accumax India

Vertical autoclave

Model Number	AI-175
Standard features	<ul style="list-style-type: none">• Low water cut-off device• Pressure control
Working pressure	15–18 psi
Power mode	220 VAC
Power usage rate	3 KW
Working temperature	121°C
Cycle duration	30 minutes
Certification	Yes
Price (internal dimension)	US\$1,326 (550 x 750 mm)
Other comments	<ul style="list-style-type: none">• No continuous water supply necessary; water added manually at start of cycle• OK to release waste water in open sewer• Runs up to 12 cycles per day• Stainless steel, radial locking lid• Manufacturer provides training and operation guides• User reviews available on request• Available in the following sizes (diameter x depth): 250 x 450mm; 300 x 500mm; 350 x 550mm; 450 x 600mm; 550 x 750mm

ACMAS Technocracy PVT, Ltd.

Vertical autoclave	
Model Number	NI/GMP/STR
Standard features	<ul style="list-style-type: none">• Radial locking mechanism• Steam release valve• Spring-loaded safety valve• Water level gauge• Pressure gauge
Working pressure	15–30 psi
Power mode	220 VAC
Power usage rate	Depends on size
Working temperature	121°C/134°C
Cycle duration	1 to 1.5 hours
Certification	ISO 9001:2000
Price (internal dimension)	US\$10,204 (400 x 450 x 900 mm)
Other comments	<ul style="list-style-type: none">• Constructed of stainless steel• Fully automatic• Runs 5 to 6 cycles per day• Lid-opening mechanism• Foot operated (pedal) lift• Air insulated

Cylindrical autoclave

Standard features	<ul style="list-style-type: none">• Double safety radial locking arrangement• Stainless steel steam release valve• Spring-loaded safety valve• Low water level gauge• Pressure gauge• Multiple operating valves for controlling disinfection cycle• Accidental vacuum break device• Water level cut-off device• Specially designed ISI-marked stainless steel heaters• Plug screen to prevent line choking due to sediment discharge• Insulated with mineral glass wool
Working pressure	15–30 psi
Power mode	440 VAC
Power usage rate	Depends on size
Working temperature	121°C/134°C
Certification	ISO 9001:2000
Price (internal dimension)	US\$5,004 (400 x 600 mm)

Horizontal rectangular autoclave

Standard features	<ul style="list-style-type: none">• Radial locking mechanism• Stainless steel steam release valve• Spring-loaded safety valve• Low water level gauge• Pressure gauge• Multiple operating valves for controlling disinfection cycle• Accidental vacuum break device• Water level cut-off device• Specially designed ISI-marked stainless steel heaters• Plug screen to prevent line choking due to sediment discharge
Working pressure	15–30 psi
Power mode	440 VAC
Power usage rate	Depends on size
Working temperature	121°C/134°C
Certification	ISO 9001:2000
Price (internal dimension)	US\$5,004 (400 x 600 mm)

Agrawal Brothers

Vertical autoclave

Standard features	<ul style="list-style-type: none">• Automatic pressure control switch• Automatic low water cut-off device• Mechanical timer with alarm system• Temperature indicator and temperature chart recorder• Pressure release valve• Pressure gauge• Double safety radial locking arrangement• Brass steam release valve• Brass spring loaded safety valve• Water outlet valve• Water level indicating gauge (glass with metal guard)• Electrical control box fitted with toggle switch, indicating neon lamps, and steam release valve• Foot operated pedal lifting device• MS chrome plated radial locking arrangement and ring for the lid
Working pressure	5–20 psi

ASCO (Apothecaries Sundries Mfg. Co.)

Aluminum knob type autoclave

Model Number	AU 4100
Standard features	<ul style="list-style-type: none">• Two safety valves• Steam release• Control valve• Pressure gauge• Safety pressure release weight valve
Working pressure	15 psi
Other comments	Economy series autoclave made of 10 gauge aluminum. The drum is deep drawn and the ring on top is riveted. The lid is made by casting. Lid is locked by 6 nuts with rubber gasket seal in between (no metal to metal seal). Includes outer stand, inner aluminum container, and inner tripod stand.

Bioasset Technologies PVT, Ltd

Semiautomatic laboratory autoclave

Standard features	<ul style="list-style-type: none">• Pedal-free design• Fully stainless steel 304-grade construction• Micro controller based proportional integral derivative controller (PID) controller with dual display for temperature and time• Reduced loading height
Working pressure	15–30 psi
Power usage rate	4–6 Kw
Working temperature	121°C
Other comments	<ul style="list-style-type: none">• Capacities available: 35 liters, 52 liters, 111 liters and 178 liters

Fully automatic GMP compliant autoclave

Standard features	<ul style="list-style-type: none">• Lower working height• Microprocessor-based precise controlling• User adjustable multi-program cycle• Flexible load sensor• Data logging of 2 sensors• Automatic purging and venting• Low water level protection• Self-diagnostic error display• IO/OQ/PQ documentation
Working pressure	15 psi
Power usage rate	2–6 Kw
Working temperature	121°C
Other comments	<ul style="list-style-type: none">• Pedal-free system in vertical model• Capacity: 35 to 178 Liters

Horizontal autoclave: rectangular/cylindrical/STD/high- pressure high-volume (HPHV)

Standard features	<ul style="list-style-type: none">• GMP compliant• Semi-automatic operation• Pressure switch control• Low water level cutoff
Working pressure	1.26 Kg
Power mode	440 V
Power usage rate	9–18 Kw
Working temperature	121°C
Optional features	<ul style="list-style-type: none">• Double door• High pressure high vacuum• Online validation
Other comments	<ul style="list-style-type: none">• Pedal free system in vertical model• All models are made of stainless steel

Biological Enterprises

Vertical autoclave	
Standard features	<ul style="list-style-type: none">• Pressure stat• Low water cut-off device• Safety valve• Pressure gauge steam release
Working pressure	Up to 20 psi
Other comments	<ul style="list-style-type: none">• Stainless steel autoclave with pedal lifting device and stainless steel basket

Conica Enterprises

Horizontal steam sterilizer

Standard features	<ul style="list-style-type: none">• Triple walled with steam jacket and separate boiler• Inner chamber and steam jacket made of heavy gauge stainless steel sheet• Door and back plates made of stainless steel
Working pressure	1.2–1.5kg/cm ² ; 15–22 psi
Power mode	440V, 3-phase, 50Hz/AC
Working temperature	122°C

High pressure radial automatic steam sterilizer

Standard features	<ul style="list-style-type: none">• Pressure control device• Low water level cut-off system• Front panel is provided with working pilot lamps• Timer for sterilizing
Working pressure	1.2-1.5kg/cm ² ; 15–22 psi
Working temperature	122°C
Other comments	<ul style="list-style-type: none">• Medical grade 16-gauge stainless steel

Vertical radial locking autoclave

Standard features	<ul style="list-style-type: none">• Steam release• Double safety valves and drain• Specially designed heat resistance gasket• Low water level cut-off device system
Working temperature	122°C
Other comments	<ul style="list-style-type: none">• Portable vertical cylindrical single chamber autoclave with central locking system lid• Cylindrical drum and outer cover made out of stainless steel• Top lid of solid die-pressed stainless steel

Everflow Scientific Instruments

Horizontal and vertical autoclaves

Standard features	<ul style="list-style-type: none">• Automatic low water level cut-off device• Temperature control indicator• Radial locking system• Pressure gauge• Air/steam release cock
Working pressure	1.2–1.5kg/cm ² ; 15–22 psi
Power mode	440V, 3-phase, 50Hz/AC
Working temperature	122°C
Optional features	Pressure control switch
Other comments	<ul style="list-style-type: none">• Double walled chambers• Lid is made of stainless steel plate with locking wing nuts

Global Corporation

Vertical autoclave

Standard features	<ul style="list-style-type: none">• Stainless steel basket• Safety valve• Pressure release valve• Water level indicator• Cord and plug• Fully automatic microprocessor-based temperature controller• Process timer• Low level water alarm• Over-temperature protection• High-pressure cutoff• Two mechanical safety valves
Working pressure	Up to 20 psi
Other comments	<ul style="list-style-type: none">• Double walled• Chamber and jacket of 18 SWG• Radial locking system, chrome plated, with pedal lifting device• Lid is made of stainless steel with seal on silicon rubber gasket

GPC Medical Ltd.

Horizontal and cylindrical high pressure autoclaves

Model Number	AU620 and AU630
Standard features	<ul style="list-style-type: none">• Three-way valve for disinfection cycle• Automatic pressure control switch• Water level indicator• Temperature gauge• Pressure release valve• Safety valve
Working pressure	5–20 psi
Certification	ISO 9001:2000, ISO 13485:2003, WHO-GMP compliance
Optional features	<ul style="list-style-type: none">• Automatic low water cut-off device• Musical bell timer• Vacuum breaker valve• Pressure control switch
Other comments	<ul style="list-style-type: none">• Double/triple wall• Inner chamber made of stainless steel• Outer chamber made of mild steel/stainless steel

Vertical high pressure autoclaves

Model Number	AU600 and AU615
Standard features	<ul style="list-style-type: none">• Safety valve• Pressure gauge• Pressure release valve• Water level indicator• Stainless steel basket• Radial locking system with pedal lifting device
Working pressure	5–20 psi
Certification	ISO 9001:2000, ISO 13485:2003, WHO-GMP compliance
Optional features	<ul style="list-style-type: none">• Automatic low water cut-off device• Digital temperature indicator• Dial type analog temperature gauge• Mechanical timer 60 minutes with alarm system
Other comments	<ul style="list-style-type: none">• Triple wall with steam jacket; inner and outer chamber made of stainless steel

HMG India

Horizontal and cylindrical high pressure autoclaves

Standard features	<ul style="list-style-type: none">• 304-gauge stainless steel• Multiport valve• SS radial locking arms• Automatic pressure locking device to prevent opening under pressure• Quick-dry apparatus• Accidental vacuum breaker valve• Safety valve• Plug screen• Dial thermometer• Pressure gauge• Low water level cut-off device• Water level indicator gauge water inlet/drain valve.• Pressure control switc
Working pressure	15–20 psi
Power mode	3-phase, 440 Volts AC
Power usage rate	Depends on size
Working temperature	121°C
Cycle duration	25 minutes
Price (internal dimension)	US\$10,204 (400 x 450 x 900 mm)

Khera Exim

Rectangular high pressure horizontal sterilizer KI 174(c)

Standard features	<ul style="list-style-type: none">• Automatic pressure switch• Steam release valve• Spring loaded safety valve• Pressure gauge• Low water level cut-off device• Automatic vacuum breaker• Dial/digital thermometer• Multiport valve
Working pressure	10–20 psi ± 1 psi
Power mode	Single phase 440 Volts AC
Certification	ISO 9001:2004
Other comments	<ul style="list-style-type: none">• Triple walled• Outer body, inner chamber and jacket made of stainless steel 304/316 sheet• Mounted on a tubular stand. Lid is made of stainless steel plate with radial locking system, neoprene rubber gaskets• Fitted with self-locking safety lock

Medical Surgicals Delhi

Horizontal high pressure autoclave

Standard features	<ul style="list-style-type: none">• Automatic pressure control switch• Three-way valve for disinfection cycle• Water level indicator• Temperature gauge• Pressure release valve• Safety valve
Working pressure	5–20 psi
Power mode	Single phase 440 Volts AC
Certification	ISO 9001:2000, CE, GMP certified
Optional features	<ul style="list-style-type: none">• Automatic low water cut-off device• Timer with alarm• Vacuum breaker valve• Pressure control switch
Other comments	<ul style="list-style-type: none">• Triple walled with steam jacket• Inner and outer chamber made of stainless steel• Outer chamber works as steam stock jacket• Radial locking system with pedal lifting device

Narang Scientific Works

Horizontal autoclave	
Model Number	NSW-233
Standard features	<ul style="list-style-type: none">• Dial thermometer• Automatic vacuum breaker
Working pressure	15–22 psi
Power mode	Single phase 440 Volts AC
Certification	ISO 9001
Optional features	<ul style="list-style-type: none">• Digital temperature indicator• Thermograph to record sterilizing temperature and time• Door at back• Fully automatic PLC base
Other comments	<ul style="list-style-type: none">• Complete construction made of stainless steel 304• Triple walled with steam jacket and separate boiler• Mounted on tubular stainless steel frame with ground leveling screwed flanges

Horizontal autoclave

Model Number	NSW-235
Standard features	<ul style="list-style-type: none">• Water level indicator• Pressure gauge• Safety valve• Steam release cock• Indicating lamp• Pressure control switch
Working pressure	10–20 psi
Power mode	440 volts; 3-phase 4 wire 50 cycles supply
Certification	ISO 9002
Optional features	<ul style="list-style-type: none">• Digital temperature indicator• Thermograph to record sterilizing temperature and time• Door at back• Fully automatic PLC base
Other comments	<ul style="list-style-type: none">• Double walled• Inner and outer chamber made of 304-grade stainless steel• Hinged door made of stainless steel plate• Radial locking system ensures complete risk-free and leak-proof sterilizing cycle• Vertical model is also available

Neelam Industries

Autoclave/steam sterilizer

Model Number	NI/GMP/STR
Standard features	<ul style="list-style-type: none">• Standard cycle operating• Pressure -1 bar to + 4 bar• High-pressure high-volume cycle• Leak test cycle
Working pressure	15 psi
Power mode	220 Volts AC
Cycle duration	1–1.5 hrs
Certification	ISO 9001, I.S. 3829 or ASTM specifications
Price (internal dimension)	US\$10,144 (400 x 450 x 900 mm)
Optional features	Another high-pressure high-volume cycle with post vacuum pulses can be provided
Other comments	<ul style="list-style-type: none">• Fully automatic by means of PLC base controls, which operate pneumatically, actuated solenoid valves• Four cycles and programs• No water hookup required (water is added manually)

Obromax

Vertical autoclave (deluxe model)	
Standard features	<ul style="list-style-type: none">• Double safety radial locking arrangement• Stainless steel steam release valve• Spring loaded safety valve of stainless steel (grade SS-304)• Water inlet and water valves• Water level indicating gauge glass with stainless steel guard• Pressure gauge• Electrical control box fitted with toggle switch, light-up indicators, and steam release valve• Foot pedal lifting device
Working pressure	5–20 psi; recommended 15–17 psi
Power mode	220 volts: single-phase, 50 cycles
Working temperature	121°C
Optional features	<ul style="list-style-type: none">• Automatic pressure control switch• Automatic water cut-off device• Temperature gauge (dial-type)• Mechanical timer with alarm system
Other comments	<ul style="list-style-type: none">• Supplied with stainless steel basket

Vertical autoclave (economy model)

Standard features	<ul style="list-style-type: none"> • Double safety radial locking arrangement • Stainless steel steam release valve • Spring loaded safety valve of stainless steel (grade SS-304) • Water inlet and water valves • Water level indicating gauge glass with stainless steel guard • Pressure gauge • Electrical control box fitted with toggle switch, indicating neon lamps, and steam release valve • Foot pedal lifting device
Working pressure	5–20 psi; recommended 15–17 psi
Power mode	220 volts: single-phase, 50 cycles
Working temperature	121°C
Optional features	<ul style="list-style-type: none"> • Automatic pressure control switch • Automatic water cut-off device • Temperature gauge (dial-type) • Mechanical timer with alarm system
Other comments	<ul style="list-style-type: none"> • Outer chamber is made of thick-gauge mild steel • Inner is made of 304-grade stainless steel • Lid and inside made of mild steel

Vertical autoclave (deluxe model)

Standard features	<ul style="list-style-type: none">• Double safety radial locking arrangement• Stainless steel steam release valve• Spring loaded safety valve of stainless steel (grade SS-304)• Water inlet and water valves• Water level indicating gauge glass with stainless steel guard• Pressure gauge• Electrical control box fitted with toggle switch, indicating neon lamps, and steam release valve• Foot pedal lifting device
Working pressure	5–20 psi; recommended 15–17 psi
Power mode	220 volts: single-phase, 50 cycles
Working temperature	121°C
Other comments	<ul style="list-style-type: none">• Triple walled construction, made of 304-grade stainless steel• Lid is made of stainless steel sheet• Fitted with radial locking system with pedal lifting device• Supplied with stainless steel basket

Horizontal autoclave

Standard features	<ul style="list-style-type: none"> • Multiple operating valve door • Quick vacuum drying apparatus • Accidental vacuum breaker • Safety valve • Dial type thermometer • Plug screen • Chamber condensate line • Pressure and compound gauge • Steam generator (boiler) • Electrical control box
Working pressure	5–20 psi; recommended 15–17 psi
Power mode	440 volts, three-phase 50 Hz.
Working temperature	121°C
Optional features	<ul style="list-style-type: none"> • Automatic pressure control switch • Automatic water cut-off device • Temperature gauge (dial-type) • Mechanical timer with alarm system
Other comments	<ul style="list-style-type: none"> • Available in rectangular and cylindrical models • Unit has outer chamber, inner chamber, boiler, lid and jacket, all made of 304-grade stainless steel • Includes a three-way valve or a multiport valve made of stainless steel for controlling disinfection cycle • Unit is mounted on a tubular stand

Rajas Enterprise

Horizontal cylindrical sterilizer

Model Number	S.T.R-02
Standard features	<ul style="list-style-type: none">• Radiant locking system• Cold water drainage system• Steam exhaust• Timer from 1 to 60 minute with double safety valve• Steam releasing valve• 2 pressure gauges• Water level indicator• Heavy duty power plug with socket provided with the unit
Working pressure	1.26 kgf/cm ³
Power mode	240 VAC, 50 Hz
Working temperature	121°C
Certification	ISO 9001 and 14002
Other comments	<ul style="list-style-type: none">• Triple-walled• Inner and outer walls made of heavy-gauge stainless steel and middle jacket made of brass and gun metal

Horizontal rectangular high pressure steam sterilizer STR

Model Number	S.T.R-02
Standard features	<ul style="list-style-type: none"> • Radiant locking system • Cold water drainage system • Steam exhaust • Timer from 1 to 60 minute with double safety valve • Steam releasing valve • 2 pressure gauges • Water level indicator • Heavy duty power plug with socket provided with the unit
Working pressure	1.26 kgf/cm ⁴
Power mode	Operating voltage 240, single phase, AC supply, 50 Hz
Working temperature	121°C
Certification	ISO 9001 and 14003
Other comments	<ul style="list-style-type: none"> • Triple walled • Suitable for drums up to 12x15 inches in size • Made of 304-gauge stainless steel with middle jacket made of brass or stainless steel and gun metal



Other Autoclave Manufacturers

(Product information available by request
to the manufacturer)

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Notes

References

- ¹ Health Care Without Harm (HCWH). For Proper Disposal: A Global Inventory of Alternative Medical Waste Treatment Technologies. Arlington, VA: HCWH; 2008. Available at: <http://www.noharm.org/details.cfm?ID=1514&type=document>.
- ² Simonsen L, Kane A, Lloyd J, Zaffran M, Kane M. Unsafe injections in the developing world and transmission of bloodborne pathogens: a review. *Bulletin of the World Health Organization*. 1999;77(10):789–800.
- ³ PATH. Treatment Alternatives for Medical Waste Disposal. Seattle, WA: PATH; 2005. Available at: http://www.path.org/files/TS_trt_alt_med_wst_disp.pdf.
- ⁴ Treatment and Disposal Technologies for Health-Care Waste. In: Prüss A, Giroult E, Rushbrook P, eds. *Safe Management of Waste From Health-Care Activities*. Geneva, Switzerland; 1999: 77–112.
- ⁵ SYSTEC. Steam Sterilization: Market Overview Autoclaves, Basics, and Waste Disinfection in Destruction Bags. Available at: <http://www.sidi.uzh.ch/activities/bio/Dittli.pdf>.



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