Autoclave Water Quality and Management.

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General

Priorclave autoclaves use water in two ways, to produce steam for sterilising with electrical heaters inside the autoclave chamber and for ancillary equipment such as vacuum pumps and cooling condensers.

In general mains / tap water can be used directly for the ancillary equipment as the volume and water pressures required (a minimum of 2Bar) make the use of or need for treated water an unnecessary and impractical expense.

Where the autoclave is heated by external steam then specific feed water requirements will be covered in the manual for the steam boiler.

Water Quality

To avoid unnecessary and costly maintenance and in some cases possible contamination of autoclave loads, close attention should be paid to the quality and condition of the water used to generate steam in electrically heated models.

In these models heaters are fitted to the bottom of the autoclave chamber and sit in a reservoir of water from which the sterilising steam is generated.

The major cause of maintenance issues with Laboratory Research Grade Autoclaves is water hardness and particularly hardness due to calcium carbonate. Over a relatively short period of time lime-scale from hard water will start to coat the heaters, initially reducing their effectiveness and ultimately causing them to fail.

Lime-scale build up will also affect the operation of water level sensors and the efficient operation of valves.

A less common issue is water supplies containing a high level of particulates, which can also affect the operation of valves. This can often be an issue in new buildings for a short period while newly installed pipes flush through.

Particulates in water are measured as turbidity, measured in FTU or NTU. Drinking water supplies will usually have a turbidity significantly lower than 1 FTU (NTU) but river water can be around 25 FTU (NTU) or greater. If your feed water for the autoclave or its ancillary equipment routinely has a turbidity above 1 FTU(NTU) it is strongly recommended that it is at least filtered before use.

Unless the water supply is defined as drinkable (potable), soft water (in the UK soft water is defined as having a total hardness in terms of Calcium Carbonate of up to 50mg/L or 50ppm) then water treatment is strongly recommended.

Although to some extent distilled and ultra-pure water supplies are often abundantly available these are unsuitable for Priorclave Laboratory Research Grade Autoclaves unless they have been specially adapted to run from these types of water supply.

There are two main reasons for this; the first is that extremely pure water prematurely corrodes the copper pipework and brass valves and fittings used in the autoclave and the second is that heater protection and water level controls use the conductivity of the water in the chamber to detect it.

Priorclave recommend the use of a sodium ion exchange water softener, which removes Calcium Carbonate, reducing lime-scale formation, while keeping conductivity levels at a detectable level.

Although electrical and magnetic softeners are available which operate by changing the nature of the calcium carbonate so that it is less able to form lime-scale, these are not recommended as over a short period of time the denatured calcium carbonate becomes concentrated within the autoclave and forms a thick white powder in the bottom of the chamber.

If you already have a water supply that you feel may be suitable the key figures for suitability are as follows:

Total hardness in terms of CaCo3:	**<** 50mg/L (50ppm)
Conductivity:	**>** 100 micro Siemens

Day to Day Water Issues

Unfortunately the avoidance of water related maintenance issues doesn't stop with ensuring the correct water supply.

The water in the chamber gets contaminated in a number of ways:

The first and most apparent of these is spillages out of the autoclave load, especially waste loads. In the case of a spillage then the autoclave should be drained immediately and the dirty water removed. Priorclave can supply a simple syphon pump for this task and in some models a chamber drain is fitted (although with extreme spillages this could clog up as spilled agar cools while passing down it. The simplest method is to use a wet/dry type vacuum cleaner. This will also more easily pick up broken glass if the spill is due to a broken bottle or flask.

After emptying the chamber and heaters should be wiped clean (being careful if there is a likelihood of broken glass) and then rinsed with more water and emptied a couple more times.

Some Priorclave Laboratory Research Grade autoclaves on certain cycles, such as a drying cycle, will automatically empty the water charge under pressure at the end of the sterilising part of the cycle but mostly the water level is simply topped up either manually or automatically between cycles.

Priorclave strongly recommend the use of fully welded stainless steel containers when autoclaving laboratory waste loads to minimise spillages.

On each cycle water is lost from the autoclave during air removal during heat-up, free-steaming and where applicable vacuum pump operation. Over time this has the effect of concentrating whatever is in the water in the chamber, added to which is anything that may be washed from or come out of the autoclave load.

This concentration can also lead to lime-scale formation over longer periods of time. At higher concentrations some salts that may be found in the water and some contaminants can prove corrosive, even to the high quality stainless steel that the Priorclave is made from. They can also in some cases lead to foaming up of the water in the chamber, which can fill sealed containers with water during the cycle, often resulting in a low water failure.

Additionally where softened water from an ion exchange softener is being used, sodium levels in the water will increase and in extreme circumstances this will form its own scale and damage heaters and valves over an extended period. This is seen more often with steam generators that have not been regularly blown down or drained.

Because of these issues Priorclave recommend the autoclave chamber is drained, flushed and cleaned at a minimum of once per month and ideally at weekly intervals.

The operation and salt levels of the water softener if fitted should be checked weekly.

In conclusion - investing in proper water treatment goes a long way towards trouble free operation but this not a substitute for a proper draining and flushing regime.

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