



KILLING THE BUGS

Astell Scientific is one of the UK's leading manufacturers of sterilizing equipment. With over seventy years experience their products are used by the world's leading companies in the medical and pharmaceutical fields. The term Autoclave and Sterilizer are interchangeable and mean the same thing. "Autoclave" is used in laboratories whilst "Sterilizer" is used more commonly in medical and pharmaceutical applications.

All scientists and technicians who work in microbiology or related areas, including health care and sterile services, understand the need for sterilization. Laboratory equipment needs to be sterile to prevent contamination, surgical instruments and dressings need to be sterile to prevent infection, growth media must be sterile to prevent ambiguous results and discards must be sterile to ensure that there is no danger of pathogens.

What is more difficult to understand is exactly what is meant by sterilization. The best definition of sterilization is the statistically complete destruction of all micro-organisms including the most resistant bacteria and spores. This is a condition that is difficult to achieve and even harder to prove.

Whilst there are many chemicals, both inorganic and organic, that will kill micro-organisms, they may not be 100% effective and frequently leave undesirable or even toxic residues. Ultra-violet and ionizing irradiations are also effective biocides but do not guarantee complete removal.

The steamy side of microbiology

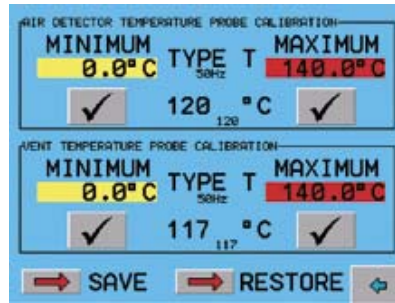
If sterility is an absolute requirement, today's laboratory scientists turn to steam heat.

Micro-organisms tend to become more active as the temperature of their surroundings rises. But at around 80°C most, but not all, of them die. At above 120°C (the temperature of dry saturated steam at 1 bar g) you can guarantee that in time there will be no living micro-organisms left. The most widely used piece of heat sterilizing equipment is the steam sterilizer or autoclave, in which the load to be sterilized is exposed directly to high temperature steam. When steam condenses on cooler surfaces, its latent heat is transferred rapidly and efficiently, so the surface temperature rises quickly to that at which any micro-organisms on it are destroyed. The time and the amount of steam needed for the load to reach sterilization temperature will vary with the nature and thermal capacity of the load. Most autoclaves are user-programmable, allowing the sterilization temperature and time and the rate of cooling to be set to suit the

requirements of the load. Although the temperature of steam is a function of its pressure, simply achieving pressure in an autoclave does not necessarily mean that the corresponding temperature has been reached, so temperature is the critical parameter.

How Does an Autoclave Work?

An effective autoclave must contain dry saturated steam. In order to achieve this, air must be removed from both the load to be sterilized and the chamber. This can be achieved in a number of ways; however the most effective method of air removal is using a vacuum system. Once all the air is removed, the temperature within the chamber will rise along with the pressure in a controlled way 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. Typical temperature/time sterilization cycles are 115°C for 30 minutes, 121°C for 15 minutes and 134°C for 3 minutes, however this will depend on the thermal capacity of the load. Sev-



The Power Panel visualization allows easy setting of temperature vacuum, pressure pulses, drying and cooling.

eral control options can be selected for the various stages in the cycle, namely: vacuum, pressure pulsing (both negative and positive), drying and finally cooling. Whilst the system control is based on the step sequencer principle all these options add significantly to the complexity of the control. A comprehensive alarming and continuous print recording also adds to the scope of the project. Therefore the control on a modern system needs a powerful processor. Many applications require strict control to ensure that clean areas are not contaminated by un-sterilized loads. For this purpose the sterilizer is equipped with two doors - one in the clean area and one in the un-sterilized area. In these applications a fully interlocked door system is provided with operator control on both sides.

Achieving sterilization of the load is only part of the story. Compliance with GMP, UKAS and similar Quality Assurance procedures is equally critical, requiring proof that sterilization has been achieved. For complete sterilization, the temperature has to be reached in all parts of the autoclave and its load. This is validated by automatic monitoring and recording of the temperature inside the autoclave and the time for which it is held during the sterilization procedure.

The B&R Solution

When Astell decided to increase their market share in the larger square and rectangular section sterilizers market, they realized a new control system was needed which was ahead of the current control technology. A B&R Panel

based automation system provided an ideal solution, thus bringing together two companies with years of experience to produce a user friendly, fully automatic control system.

The heart of the control system is a Power Panel 220 with a 5.7" color touch screen and digital and analog I/Os. The screen provides a full operator panel showing temperatures, pressures and fault status. The system features password protected security with multiple access levels. An innovative and unique graphical selection tool allows for the simple and effective creation of sterilizer cycles, which can then be stored within a recipe handling data base for immediate recall. Alarm monitoring is a key element of the system and a printer output is provided for hard copy data logging, a standard requirement in this industry.

In the words of Graham Scarr, Astell's Technical Director: "The new control system provides greater accuracy, reliability and flexibility than previous systems. We are now in a position to offer to the customer numerous features

(e.g. Data archiving, Fo control, specific cycle design) previously unavailable on our products. This not only provides us with the opportunity to increase our market share, but also enables us to address new areas, such as the medical and pharmaceutical sectors, where precision and ease of validation are of prime importance".

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Astell autoclaves with rectangular section. In the non-sterile outside area the load is placed into the opening and the sterilization process is started.

