LIGHTHOUSE WORLDWIDE SOLUTIONS

TECHPAPER

Autoclaving Sterility Covers

Ensuring Compliance with EU GMP Annex 1:2022 Requirements

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Overview

In the ever-evolving landscape of pharmaceutical manufacturing, maintaining sterility in critical environments is paramount. The revised EU GMP Annex 1:2022 has heightened the need for rigorous microbial monitoring, particularly in aseptic environments where products cannot undergo terminal sterilization. To meet these stringent requirements, innovative solutions like the ActiveCount and Remote ActiveCount microbial air samplers with sample head isolator kit from LWS have emerged. These advanced systems, coupled with Pharmaclean® autoclavable mini covers made from DuPont™ Tyvek® 1421B material, offers a comprehensive approach to ensuring data integrity and minimizing contamination risks. By addressing the challenges of particle generation and potential recontamination during the sterilization process, these tools provide pharmaceutical manufacturers with the confidence and capability to maintain the highest standards of sterility, ultimately safeguarding the quality and safety of critical healthcare products.

Active Microbial Air samplers are used to monitor inside cleanrooms and controlled environments for microbial contamination. They have been complimenting settle plate monitoring for over 50 years in gathering air samples from the environment providing a second data set of microbial information. It is important that the air samplers maintain data integrity. What is meant by maintaining data integrity?

Since microbial air samplers collect air samples from the air in critical environments and the data used to make critical process and product release decisions in a regulatory environment it is extremely important that we have assurance that the sample as well as the sample equipment is not compromised from operator handling and the sterility process itself.

EU GMP Annex1:2022

Revised Guidelines

With the revision of EUGMP Annex1 in 2022 the need for continuous microbial monitoring will increase the need for more microbial sampling in aseptic environments. The objective of this microbial monitoring is to ensure that aseptic environments where pharmaceutical products that cannot be terminally sterilized are free from microorganisms that can be harmful and potentially dangerous to patients who depend on these products especially in injectable delivery systems. (Known as Parentals)

ActiveCount 25H Microbial Air Sampler with sample head isolator kit

In **Section 8 Production and Specific Technologies** and specifically in section 8.2 states,

"Primary packaging containers and components should be cleaned using validated processes to ensure that particle, endotoxin/pyrogen and bioburden contamination is appropriately controlled". this also applies for sampling equipment that comes into contact with the sterile process".

Section 8.7 states that:

"The aseptic process should be clearly defined. The risks associated with the aseptic process, and any associated requirements, should be identified, assessed and appropriately controlled. The site's CCS (Contamination Control Strategy) should clearly define the acceptance criteria for these controls, requirements for monitoring and the review of their effectiveness. Methods and procedures to control these risks should be described and implemented. Accepted residual risks should be formally documented".

Moreover Section 8.8 states that

"Precautions to minimize microbial, endotoxin/ pyrogenic and particle contamination should be taken, as per the site's CCS, during the preparation of the aseptic environment, during all processing stages (including the stages before and after bulk product sterilization), and until the product is sealed in its final container. The presence of materials liable to generate particles and fibers should be minimized in cleanrooms".

Particle Generation in Autoclaves

- Autoclaves themselves do not typically generate particles, but improper loading/ unloading practices or wear on components (e.g., seals, gaskets) may lead to particulate contamination.
- Cleanroom environments require careful handling post-autoclaving to avoid particle contamination, especially from operators.

Sterilization of Critical Components

Autoclaves

Autoclaves are used to sterilize equipment, containers, and materials by exposing them to pressurized steam at high temperatures. This process ensures the elimination of microorganisms, including bacterial spores, which are among the most resistant forms of life.

Autoclaves operate using moist heat sterilization under specific temperature and pressure conditions, commonly 121°C at 15 psi for 15–20 minutes or 134°C at higher pressures for shorter cycles.

Steam transfers heat to the load, coagulating and denaturing microbial proteins, effectively killing the microorganisms.

ActiveCount

How the Microbial Sampler meet EU GMP Annex 1 Requirements

At LWS we understand the importance of data integrity and ensuring that the monitoring components that come into contact with aseptic processes in Grade A and B environments need assurance of sterility.

Sterility Covers offer our customers a system to add more confidence in the sterility process of an autoclave where critical components of the active air samplers are sterilized prior to their use in critical zones in Grade A/B and also in grade C and D cleanrooms. The Remote ActiveCount and ActiveCount microbial air sampler sampling heads, media dish holder base plate are easily removable especially the media dish base plate that holds the media dish in place.

This part is magnetic and does not require any tools to remove it like other competitor models on the market. This makes it versatile and efficient in cleanroom working environments. These components are frequently sterilized, so it makes sense to enable operators an easy way to remove them from the air sampling devices.

Removal of Sampling head and media holder base plate for autoclaving

Introducing

Pharmaclean® Autoclavable Mini Covers

Pharmaclean mini cover made in DuPont™ Tyvek® 1421B material, sewn with elastic on the base, to cover these components are gaining popularity. They are autoclavable and can therefore be used during sterilization operations. Breathable and with low particle release, they are moisture-proof and puncture-resistant. They guarantee a higher antibacterial barrier than medical grade paper and reduce the issue of false positive CFU counts on the media where recontamination can be introduced post autoclave sterilization.

As we understand from the standard operating procedures for sterilization of critical process components such as the air sampler head and base plate (media dish holder) these parts are removed from the air sampler and transported into the sterilization process whether it is

Example of sample head with sterility cover and double bagged ready for use after sterility process

an oven or autoclave. Therefore, proper handling and minimization of pre and post handling is critical especially in post handling where microbiological contaminants can be reintroduced by operators failing to aseptically handle these parts prior to reinstallation back into the air sampler.

The use of sterility covers such as the Pharmaclean mini covers protect the parts during their journey to and from the autoclaves. The Active Count and RAC sample heads and media dish holders have been designed

to be easily removed and reinstalled to minimise the generation of particles from the removal and reinstallation process by the operators. These air sampler products are the first in Industry to use a magnetic base holder where no tools are required for removal, preventing the process from particle generation by hand tools. This is another first by Lighthouse Worldwide Solutions in providing better technologies to solve process issues. Pharmaclean® mini covers are now being supplied with our ActiveCount air samplers and can be directly supplied to customers who already have microbial air samplers and want to meet EU GMP Annex1:2022 guidelines for minimizing contamination in their processes to achieve higher levels of data integrity. It is all about the data and the safety of injectable products to patients in need during health issues.

Conclusion

The implementation of Pharmaclean® mini covers and advanced microbial air sampling technologies represents a critical advancement in pharmaceutical manufacturing sterility protocols. By addressing the complex requirements of EU GMP Annex 1:2022, these innovative solutions provide manufacturers with robust mechanisms to minimize contamination risks, enhance data integrity, and ultimately protect patient safety. As the pharmaceutical industry continues to evolve, such meticulous approaches to sterile processing will remain essential in delivering high-quality, uncompromised injectable medical products.

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