

Micronice Ultrasonic Nozzle Integration

EN 17272-Compliant Automated Decontamination of BSCs and Isolators

Tekceleo on Erlab-Noroit's Return on Experience for implementing Automated Decontamination on the SOLIS BSC range.



Abstract

Automated biodecontamination has become a critical feature for biological safety cabinets (BSCs) and pharmaceutical isolators. Traditionally, users relied on external decontamination services or portable vapor generators, which can be costly, time-consuming, and disruptive.

By integrating Tekceleo's **Micronice® vibrating mesh nozzle technology**, BSC manufacturers now offer an **embedded, compact, and validated dry-fogging solution** compatible with both **hydrogen peroxide (H₂O₂)** and **peracetic acid (PAA)**.

This white paper describes the integration of Tekceleo's Micronice vibrating mesh nozzle (H360 M05 HP) into the Erlab-Noroit Solis Class II Biological Safety Cabinet (BSC) range for automated bio-decontamination using hydrogen peroxide (H₂O₂) or peracetic acid (PAA). It details the technical requirements, compliance with the EN 17-272 norm (including required log reductions of bio-indicators), performance results (cycle times, droplet size, safety), and the scalability of the solution to larger volumes (e.g. isolators).

1. Introduction

Biological Safety Cabinets (BSCs) and isolators are key pieces of equipment in pharmaceutical and biological laboratories. Maintaining sterility and avoiding cross-contamination depends not only on airflow and containment but also on validated decontamination protocols that are safe, economical, and preferably automated.

Biological and pharmaceutical laboratories face increasing regulatory and operational demands for reliable **surface and air bio-decontamination**.

- **Traditional methods:** Portable vaporized hydrogen peroxide (VHP) units or external services. These approaches are effective but often **expensive, time-consuming, and require setup effort**.
- **Customer demand:** Users increasingly seek **integrated, automated, and low-maintenance** systems for **end-of-day or batch-change decontamination cycles**.

The challenge for manufacturers is to **balance efficacy, cost, and compact design** while meeting strict validation requirements such as **EN 17272**. As a result most common challenges are synthetized in the following table :

Common Solutions	Consequences & Challenges
Manual decontamination	High human costs, prolonged downtime, human error risks.
Portable fogging systems	Still requires human time and skill to set it up, condensation risks, uneven distribution.
VHP generators	High investment costs, complex maintenance, highly volatile vapor means risks for human operator, still requires human time and skill to set it up
External Decontamination Services	High recurrent costs, Unplanned maintenance can be time-consuming.

European regulation EN 17272:2020 *“Chemical disinfectants and antiseptics – Methods of airborne room disinfection by automated process”* has defined new standards for airborne-surface disinfection systems. To be compliant, both efficacy and distribution of the disinfectant must be proven, expressed in **log reductions** across various microorganism categories (bacteria, yeasts/fungi, spores, viruses, mycobacteria).

This paper presents how the Solis BSC range, via a one-year engineering project, integrated the Micronice H360 M05 HP nozzle (05 µm droplet size) as a fixed OEM component to meet EN 17272 requirements, with scalability to reduce cycle times or extend to isolators.

2. EN 17-272 Norm: Key Requirements

Before presenting the integration, it's important to understand what EN 17272 requires with respect to log reductions for various microorganism groups, distribution, and test conditions:

- **Log-Reduction Minimums** (for the “medical area” of use, i.e. high-risk / clean lab environments):
 - **Vegetative bacteria:** ≥ 5 -log reduction.
 - **Yeasts & fungi:** ≥ 4 -log reduction.
 - **Viruses** (including phages): ≥ 4 -log reduction.
 - **Mycobacteria:** ≥ 4 -log reduction.
 - **Bacterial spores:** in the medical area, ≥ 4 -log reduction.
- **Distribution Test:** The disinfectant must be tested with supports (“carriers”) placed at multiple positions (corners, walls) within the enclosure. EN 17272 requires the same minimum log reduction (e.g. for bacteria) at all these sampling positions to ensure uniform distribution.
- **Soiling / Interfering Substances:** Tests must be carried out in both clean and “dirty” (interfered) condition to simulate realistic usage.
- **Chamber Sizes:** EN 17272 prescribes tests in small volumes (0.25-4 m³) and large ones (30-150 m³), depending on the intended usage. BSCs fall into the small enclosure category.



3. Technology Overview: The Micronice® Vibrating Mesh Nozzle

Tekceleo’s **Micronice® technology** relies on a **vibrating mesh nozzle** to generate a **very fine dry fog** of biocidal agents. In this use case the Micronice H360 M05 HP nozzle is integrated in Solis Class II BSCs :

- **Nozzle used:** H360 M05 HP
- **Droplet size:** 5 µm (dry fog, no condensation)
- **Compatibility:** Validated with both H₂O₂ (5% to 35%) and PAA
- **Form factor:** 20 mm diameter, highly compact
- **Components required:** Nozzle + ECU (Electronic Control Unit)

Key advantages:

1. **Ease of integration:** Minimal components, direct interface with BSC or isolator HMI.
2. **Scalability:** From a single nozzle (BSC) to multiple nozzles (2–5) for larger isolators.
3. **Robustness:** No maintenance required; resistant to long-term exposure to oxidizing agents.
4. **Low noise:** Ideal for laboratory working environments.

4. Implementation on Solis Class II BSC Case Study

4.1. Integration Process

A leading French BSC manufacturer integrated the **P&S360 kit** (comprising the H360 M05 HP nozzle and ECU) into its **Solis product range**.

- **Integration process:** Completed over one year, involving design adaptation and validation.
- **Deployment:** Over 3 years of commercial use with **no reported after-sales issues**.
- **Customer benefit:** A fully integrated, automated system offering **cost savings** and **reliability** compared to portable solutions.

By embedding Tekceleo’s nozzle directly into the BSC, the manufacturer gained:

- **Competitive differentiation:** High-end BSC range with built-in bio-decontamination.
- **Scalability:** Easy adaptation of the same system to isolators (2–5 nozzles).
- **Long-term return on investment:** Initial engineering effort has since enabled rapid adaptation across multiple product lines.

The BSC manufacturer decision to choose Tekceleo was based on a benefit matrix, such as below (simplified) :

Criteria	Portable VHP Generator	Micronice® Nozzle Integration
Validation (EN 17272)	Yes	Yes
Installation	External device, manual	Built-in, automated
Maintenance	Regular servicing	None
Cost	High (equipment & service)	Low (integrated components)
Cycle time	≥30 minutes + significant installation and preparation time (> 2h overall)	7 minutes spray + 2 h contact (scalable)
Noise / Footprint	Significant	Minimal

4.2. Constraints and Design Decisions

- **Space constraints:** BSCs inherently have limited internal volume and fixed fixtures. The nozzle's compact size (nominal ~20 mm diameter) and minimal accessory bulk were critical.
- **Noise:** Vibrating mesh and fluid delivery designed to minimize mechanical noise.
- **Regulatory Compliance:** Since EN 17272 demands both efficacy and distribution in small enclosures, the design had to ensure the fog reaches all internal surfaces, without condensation (dry fog < ~5 µm) which could cause dripping or damage.

The constraints vs. design solution can be summarized in the following table :

Constraint	Tekceleo's Solution
Limited space in BSCs	Compact nozzle (~20 mm diameter) with minimal bulk.
Time & Comfort	Integrated design : no set up required. "Set and Forget" process. Vibrating mesh technology for quiet operation.
Uniform distribution	Dry fog (5 µm) for complete coverage without condensation.
Regulatory compliance	Pre-validated for EN 17272 (log reductions and distribution).

4.3. Scalability

Though only **one** H360 M05 HP nozzle was required to satisfy EN 17272 in a Solis BSC (small enclosure) for the performance targets, scalability was built in:

- **Two-nozzle option:** for customers who want faster cycle times, adding a second nozzle reduces spray time and/or contact time.
- **Multiple nozzle arrays (2 to 5 nozzles):** for larger volumes (isolators, airlocks), the same design can be multiplied. Because each nozzle is compact (≈ 20 mm diameter), these can be arranged without excessive space, plumbing or control complexity.

5. Performance Results

5.1. Cycle Parameters & Validation

The tests proved EN 17272 Compliance with the following parameters :

- **Disinfectant:** ~ **7.8% hydrogen peroxide** solution (H₂O₂), or peracetic acid (PAA) in compatible form.
- **Spray / Fogging Phase:** ~ **7 minutes** for one nozzle in standard Solis BSC configuration.
- **Contact (Dwell) Time:** ~ **2 hours** in standard validated cycle.
- **Efficacy :** validated log reduction for all microorganism groups with all log reduction required by the EN 17277, for bacteria, log reduction was superior than log 6.

- Using **two nozzles**, spray/fogging time can be reduced (e.g. to ~3 minutes), thereby shortening the overall cycle while maintaining required contact time or slightly reducing it if validated by the customer.
 - Other test carried also proved **that 2 nozzles configuration allows for a dwell time of 30-45 min** instead of 2 hours in the case of Solis Class II use.

5.2. Compliance with EN 17-272

- **Efficacy:** Bio-indicator tests per EN 17272 (using the required bacterial, yeast/fungal, virus, spore and mycobacteria groups) achieved at or above required **log reductions**:
 - ≥ 5-log reduction for bacteria
 - ≥ 4-log for yeasts/fungi
 - ≥ 4-log for viruses
 - ≥ 4-log for mycobacteria
 - ≥ 4-log for spores (medical area)
- **Distribution:** Sampling carried out across supports (carriers) in standard positions inside the BSC; all locations met required log reduction thresholds for the bacterial tests (e.g. *Staphylococcus aureus*) per EN 17272 distribution test requirement.
- **Droplet Size:** 5 µm ensures dry fog, preventing condensation on surfaces or internal glazing or instruments.

5.3. Reliability and Long-Term Usage

The integration of Micronice nozzle by Erlab-Noroit in its Solis BSC range date back from 2021. After four years of implementation and marketing, Tekceleo now has the necessary perspective to establish the following facts:

- **Integration period:** approximately **6 months** :
 - 1 month of engineering and integration
 - 3 months of qualification
 - 2 months to launch the new Solis BSC with automated decontamination
- **Very good field reliability in BSCs:** more than **three years** in regular product lifecycle; no after-sales issues noted (no failures, clogging or material degradation) with respect to nozzle, ECU, or fluidic components under standard usage.
- **Maintenance:** minimal; routine checks only. Materials chosen are resistant to H₂O₂ / PAA abrasion / corrosion, mesh maintained performance over time.
 - **In 3 years of commercialization, there was no occurrence of after-sales service or support regarding the automated decontamination feature.**

6. Benefits and Trade-offs

Benefit	Explanation
Regulatory Compliance	Allows Solis BSCs to ship with validated EN 17272 compliance for airborne / fogged disinfection. This is a strong selling point in regulated labs and pharmas.
Competitive Differentiation	Offers an automated, integrated decontamination option rather than relying on portable systems or external services.
Cost Savings Over Time	Reduced labor, no need for external contractors, and lower operating expense compared to frequent VHP decontamination or manual wipe/fogging.
Scalability & Flexibility	One engineering investment scales across BSCs and isolators; users can choose between 1-nozzle or multi-nozzle configurations based on volume and cycle time needs.
Safety and Convenience	Dry fog avoids condensation; controlled contact times; integrated into existing HMI; safer than handling portable units or vapor generators.

Trade-offs / Considerations:

- Contact time of ~2 hours is long for some labs; customers desiring shorter overall downtime will want multi-nozzle configurations and must validate reduced contact times.
 - For a BSC a **2 nozzles configuration proved to work with a total dwell time of 30 to 40 min** instead of 2 hours in the case of Solis use case.
- Chemical handling and safety still require appropriate protocols (operator safety, sealing, aeration).
 - The use of low concentration H₂O₂, or even better PAA, allows this problem to be addressed. In particular, PAA, which is generally harmless to humans and therefore avoids the risks of mishandling or poisoning of operators.
- Integration cost and certification time are nontrivial; but see ROI due to recurring usage and differentiation.
 - Overall, 6 month for an integration project of a new technology in the Pharma industry remains a great achievement.
 - However, A change in process or technology can be a barrier for equipment manufacturers or customers. The pharmaceutical industry is very risk-averse and therefore slow to adopt change. That's why Tekceleo's value proposition is easy to integrate and comes with comprehensive support to facilitate integration and limit risk.

7. Case Study: Solis BSC Integration (Erlab-Noroit)



The integration of Tekceleo's Micronice® technology into the **Solis range of biological safety cabinets** illustrates the value of a compact, validated OEM module.

- **Project timeline:** Approximately **6 months** from specification to market launch, including validation under EN 17272.
- **Configuration:** A single **H360 M05 HP nozzle** integrated per cabinet, with the full electronic and fluidic interface.
- **Operation:** Designed for **end-of-day automated decontamination**, ensuring compliance without user intervention. A dual-nozzle configuration is available as an option, reducing spray time from 7 minutes to ~3 minutes.
- **Reliability:** The system has been in **continuous commercial use for over 3 years with no after-sales failures reported**, confirming the robustness of both the nozzle and electronics.

This case demonstrates how an initial engineering investment directly translates into a reliable and differentiating feature for end users.

8. Scalability to Isolators and Larger Enclosures

One of the strongest advantages of the Micronice® platform is its **inherent scalability**. The same validated architecture—nozzle, ECU, and fluidic components—can be seamlessly deployed in larger containment systems.

- **Flexible arrays:** **2 to 5 nozzles** can be configured in isolators, airlocks, or larger BSCs, ensuring **homogeneous fog distribution** across complex geometries.
- **Integration efficiency:** The system uses the **same HMI interface, control logic, and safety interlocks** as in the BSC application, significantly simplifying both engineering replication and regulatory re-validation.
- **Design advantage:** With a footprint of only **20 mm diameter per nozzle**, the solution remains compact and unobtrusive even in space-constrained enclosures.

This modular approach allows OEMs to extend the same proven solution across multiple product families, accelerating time-to-market while maintaining validated performance.

9. Key Takeaways

The integration of the Micronice technology as an automated decontamination feature using dry fog H₂O₂ inside the Solis Class II BSC of Erlab-Noroit has enabled us to learn the following topics:

- **Only one Micronice M05 nozzle is enough to reach EN 17-272**, meaning **log reduction** requirements: ≥5 log for bacteria, ≥4 logs for viruses, yeasts/fungi, mycobacteria, and in medical areas also ≥4 log for spores.
- Micronice’s vibrating mesh nozzle (H360 M05 HP) with dry-fog 5 µm droplet size satisfies these for Solis BSCs, using a single nozzle.
- **Scalability (more nozzles) allows reduction of spray/ fog time and adaptation to larger volumes.**
- **Long-term reliability, low maintenance, and OEM embedding are strong advantages over external or portable decontamination** methods or VHP generators in many scenarios.

This return on experience allows us to get the following table comparing different solution for this recurrent problem of decontamination of BSC in pharma industry :

Criteria	Tekceleo Micronice	Manual Decontamination	Portable Foggers	VHP Generators
EN 17272 compliance	✓ Pre-validated	✗ Labor-intensive	⚠ External validation required	✓ Validated
Integration	✓ OEM, HMI-controlled	✗ None	✗ External unit	⚠ Often external, complex if fixed
Cycle time	🕒 7 min + 2h with one nozzle 3 min + 1h with two nozzles	🕒 1–2h (labor)	🕒 Similar to Micronice	🕒 ~30 min cycle time + Long preparation time + Long aeration times
Maintenance	✓ Minimal, no occurrence of after-sales services or support in 3 years	✗ High	⚠ Moderate	✗ High
Scalability	✓ 1–5 nozzles	✗ None	✗ Limited	✗ Limited

10. Conclusion

For BSCs and isolators in biological / pharmaceutical labs, integrating an EN 17272 validated airborne disinfection system **is becoming a requirement rather than a luxury**. The case of Erlab-Noroit’s Solis range demonstrates that Tekceleo’s Micronice ultrasonic vibrating mesh solution provides a path to achieve this: **validated log reductions, reliable operation, compact and integrable design, and scalability**.

Organizations that choose this path **benefit not only from compliance, but also competitive differentiation, cost savings, safety, and improved lab workflows**.



Contact us at : www.tekceleo.com