



SeriesLock Xgen Ingress Study

Brevundimonas diminuta (B.diminuta) Ingress – Aerosol

Background

Quick disconnect connectors that can interrupt flow and provide a low leak / leak free seal have been available for some time. As designs have matured and a better understanding of customer needs has materialized, specialized configurations have been produced to meet the needs of medical, pharmaceutical, automotive, food and beverage, and general-purpose applications to name a few.

With respect to medical and pharmaceutical applications, the incorporation of quick disconnect fittings has become more prevalent with the adoption of single use systems in lieu of the traditional sterilizable, reusable systems. Autoclavable stainless steel and glass have been replaced with sterilizable plastics and rubbers. The new single use systems are typically preassembled in a cleanroom environment and packaged in materials which will provide a sustained sterile barrier. Sterilization of these systems is typically accomplished with radiation (gamma or E-beam) and ethylene oxide gas (EtO) conditioning while packaged and steam when fully assembled prior to being put into service.

After these systems are sterilized and put into service, fluid fills the system through filter ports designed to minimize bacterial/sporal transfer to the sterile inner volume of the system. These systems will then undergo a series of fluid transfers which are defined by the system use protocol and used in cleanroom environments, under sterile hoods, or in simple grey space. There are an infinite number of variables that need to be considered for the component manufacturer to provide sterile barrier verification and validation. One approach would be to state that the sterile boundary validation is the responsibility of the end user. Another more **conservative approach** is to utilize a model that provides an elevated challenge such that once validated, no real-world scenario will be worst in application. This approach consisted of a bacterial aerosol application directly applied to the outer surfaces of the diaphragm valve and inner surfaces of the Xgen connector.

Additionally, systems traditionally use quick connection fittings that permit system assembly and use. The fittings allow for multiple systems, each individually sterilized, to be connected together prior to system use, ease of assembly during production of the system, and/or the ability to provide a disconnection for collection container storage and manipulation once the system is no longer needed and the fluid needs to be stored. The later becomes the next goal as the **disconnection/re-connection of the fitting** while maintaining the sterile boundary at the connector is desired. SeriesLock Xgen was designed and built to meet this challenge.

SeriesLock Xgen is a genderless fluid connector enabling up to ten (10) connect/disconnect/re-connect cycles. Sterility of the fluid path is maintained through the use of an innovative barrier separating the sterile fluid path from the non-sterile environment.

Test Setup

SeriesLock Xgen connectors were tested to ensure that the fluid line connectors remained sterile during simulated usage. The test setup consisted of two E-beam sterilized Xgen genderless connectors with a section of Eldon James FLXC-12-8 tubing attached, two 1/2" barbed open/valved flow SeriesLock Connectors for sample collection, additional 1/2" FLXC12-8 tubing, and a peristaltic pump.

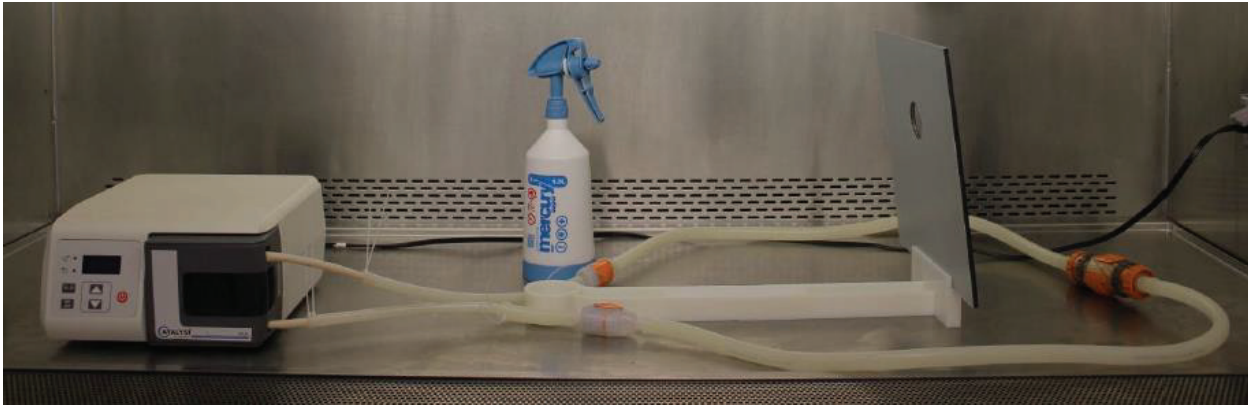


FIGURE 1: Overall Test System

Test Procedure

Once connected to complete the circuit, the complete circuit was steam sterilized to ensure all circuit components initial sterility. Sterile TSB was introduced to fill the circuit prior to Xgen fitting connection. Both diaphragm valves were then challenged with an aerosolized application of *B. diminuta* (2×10^8 CFU/ml concentration). For consistency from application to application, a fixture (Figure 2) was used to precisely deliver the challenge media to the inner diaphragm valve surfaces before each reconnection (Figure 3 – Green Circle).

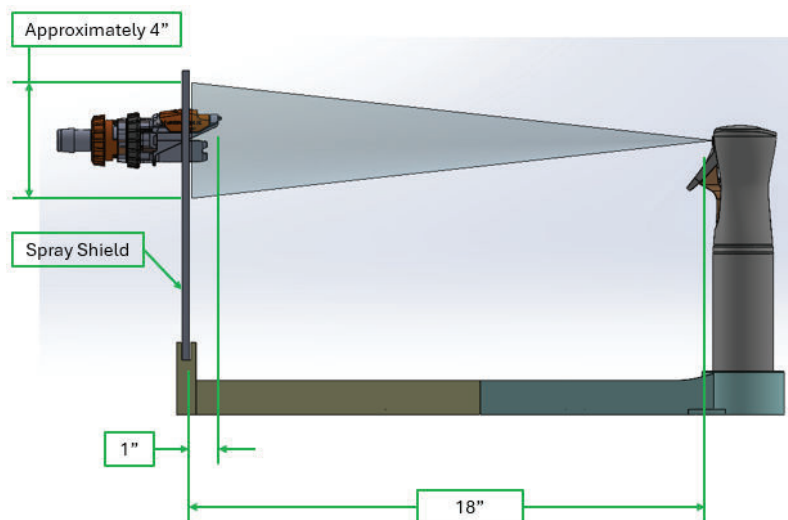


FIGURE 2: Challenge Media Application Fixture

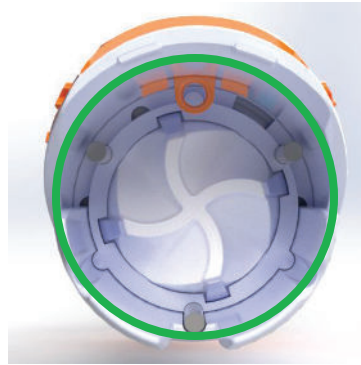


FIGURE 3: Inner Diaphragm Challenge Media Application Fixture

Prior to actual aerosol application to the test devices, the sprayer was cycled once in a safe direction to ensure proper aerosolized volume delivery to the test device surfaces.

The Xgen connectors were then connected/reconnected to complete the circuit and the peristaltic pump flowed the sterile TSB through the system to maximize possible bacterial transfer. At connection cycles 1, 2, 3, 4, 5, 10, 15, 20, and 30, 100µl of the tryptic soy broth was collected from the flow path for microbial analysis. The samples were then evenly spread on tryptic soy agar plates and incubated at 30°C for 72 hours. Post incubation, the presence of microbial growth was analyzed.

RESULTS:

Positive and Negative Controls

A positive control was used to verify that the bacterial challenge was grown correctly in an intentionally contaminated TSB plated sample. The negative control was used to verify no background bacterial growth was present prior to the start of the test.

The positive control presented with bacterial growth that was Too Numerous To Count (TNTC) (Figure 4). The negative control presented with no bacterial growth confirming initial TSB sterility (Figure 5).

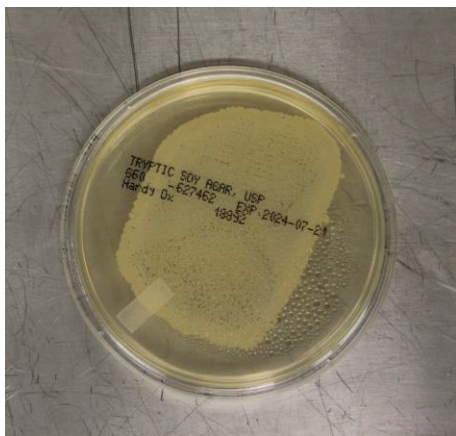


FIGURE 4: Positive Control Post Incubation Growth

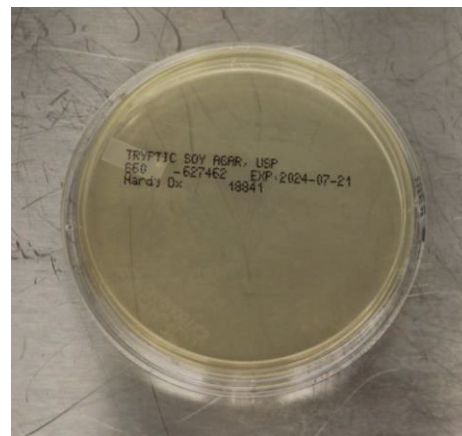


FIGURE 5: Negative Control Post Incubation (No Growth)

Cycles 1, 2, 3, 4, 5, 10, 15, 20, and 30

All ten (10) cycle samples presented with NO GROWTH after the 30°C 72 hour incubation period.

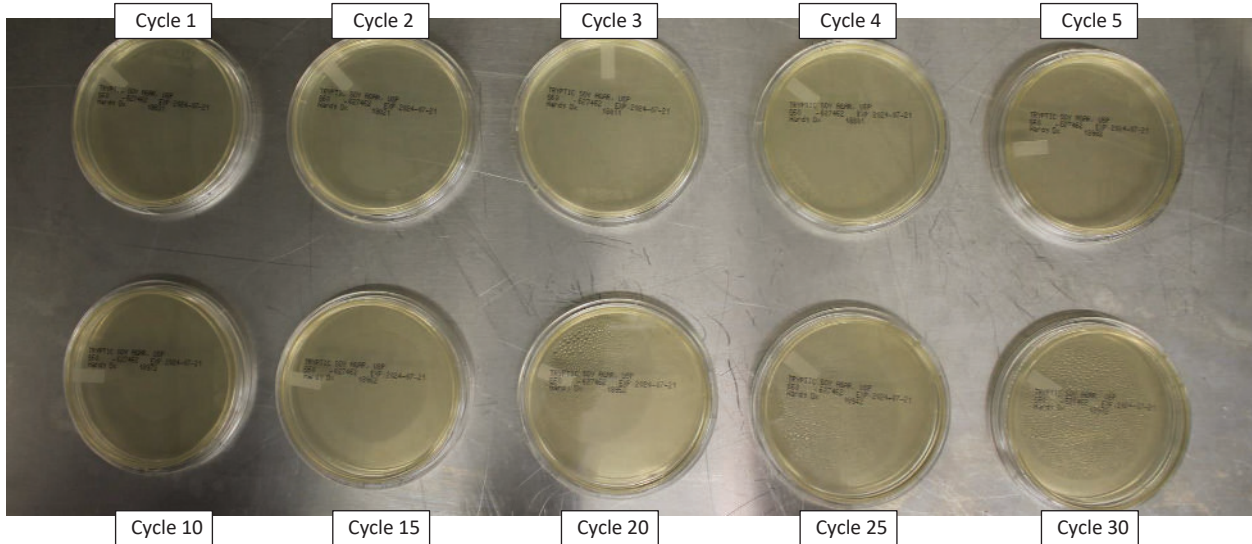


FIGURE 6: Positive Control Post Incubation Growth

Cycle	# Colony Forming Units (CFU)	Concentration (cells/ml)
1	0.00	<1.00 CFU/ml
2	0.00	<1.00 CFU/ml
3	0.00	<1.00 CFU/ml
4	0.00	<1.00 CFU/ml
5	0.00	<1.00 CFU/ml
10	0.00	<1.00 CFU/ml
15	0.00	<1.00 CFU/ml
20	0.00	<1.00 CFU/ml
25	0.00	<1.00 CFU/ml
30	0.00	<1.00 CFU/ml

TNTC = Too Numerous To Count

FIGURE 7: Testing Cycle Results

CONCLUSIONS

Positive and negative controls confirmed the testing integrity. The SeriesLock Xgen Connector successfully completed and ***PASSED*** all thirty (30) test cycles without compromising the sterility of the fluid in the circuit. Assuming a 3:1 Factor of Safety, the SeriesLock Xgen Connector will enable **ten (10) connect/disconnect/reconnect cycles** while maintaining system sterility.