



TECHNICAL REPORT

# Microbial Bioburden on Mop Pad Frames/Backer Plates After Repeated Use

*Clean counts most*



## Summary

Mop frames (also called backer plates) are used to secure microfiber mop pads when cleaning and disinfecting. While the mop pads may be single-use/disposable or re-laundered after each use, the mop frames often are re-used for several months. During these repeated uses, the frames are rarely cleaned and can accumulate debris, including dirt, fibers, and hair. While the hygiene of a simple mop frame might seem a trivial issue, the accumulated dirt and debris can interfere with disinfectants, spread pathogens throughout a facility, and make the tool heavier and more difficult to use.

To better understand the risk from this issue and if the design of the mop frame could help reduce that risk, Contec conducted a series of studies in 2021. Several samples of two types of mop frames designed for microfiber flat mop pads were retrieved from healthcare facilities. The frames were washed in sterile buffer to remove attached microorganisms. The number of extracted microbes were then quantified using standard microbiological techniques.

Results indicated that Contec’s ZeroGravity® mop frames contained substantially less bioburden than typical aluminum-based mop frames after repeated use. This was evident from visual inspection of the used mop frames, as well as the number of viable microbes extracted from the items.

Number of microorganisms (CFU/mop frame).

ZeroGravity® Mop Frame with Microhooks (State)	Typical Aluminum Mop Frame with Strips of Hooks (State)
<2,500 (SC)	13,000 (AZ)
2,500 (SC)	225,000,000 (OK)
42,500 (SC)	5,944,806 (NY)
15,811 (IL)	160,000,000 (SC)
End-of-life	7,262,663 (Geometric Mean)
<b>900x Less Contamination!</b>	

## Background

Re-using cleaning “hardware” (buckets, dispensers, mop frames and other tools) for too long or without proper cleaning/disinfection can:

### Degrade disinfectants/sanitizers

- Dirt, debris and residues will build up on hardware if the items are not cleaned or replaced frequently enough.
- Disinfectants and sanitizers react with dirt and dead microbes in the same way as with living germs.
- To avoid reducing the germicidal effect of the product, many disinfectant and sanitizer labels instruct users to clean any visible dirt or debris from a surface before applying the chemical.
- The label instructions are focused on the surfaces being treated, but the items used to store and dispense the disinfectants/sanitizers also should be considered.
- The CDC also warns that disinfectants can become contaminated from items such as containers.<sup>1</sup>

### Lead to the spread of pathogens

- A common bucket or mop frame used to clean and apply disinfectant to several areas of a facility can become a source of spreading germs if they are not cleaned or replaced appropriately.
- One recent published study described how a disinfectant wipe dispenser became contaminated from improper re-use and caused an outbreak of bloodstream infections in over 20 patients.<sup>2</sup>

**Make the tool difficult to use**

- After several uses, the mop frames often become clogged with hair, sutures, fibers and other debris.
- This adds unnecessary weight, makes it challenging to secure the mop pads and creates frustration when trying to pick up and move the mop or mopping walls or ceilings (like in an operating procedure room).
- Our Environmental Services or Custodial associates know this issue well when it comes to mopping.

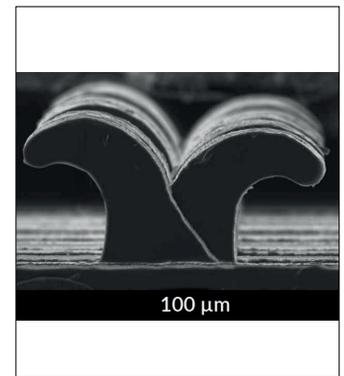
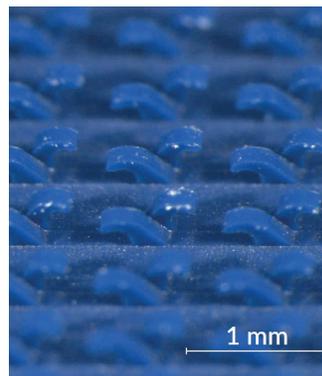
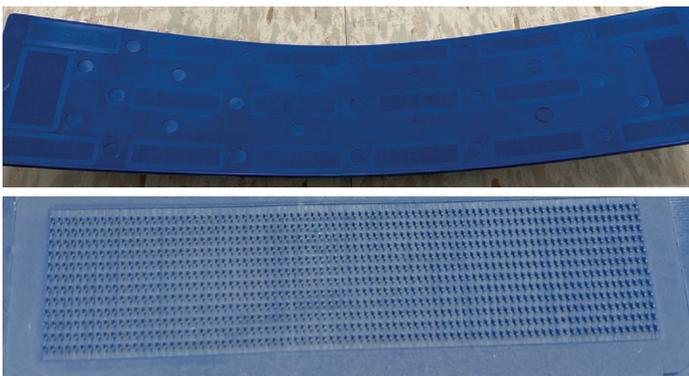
Contec® Professional has conducted a recent study to better understand the potential risk from mop frames after repeated use. The study includes examining the contamination risk from different types of mop frames commonly used with microfiber flat mops and to guide recommendations for cleaning and frequency of replacement.

**Materials**

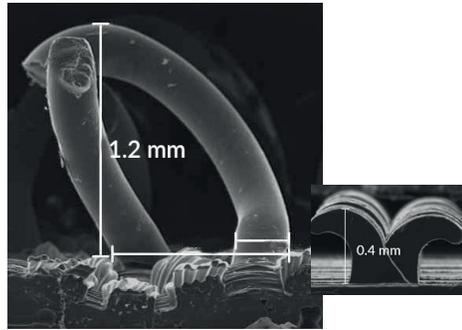
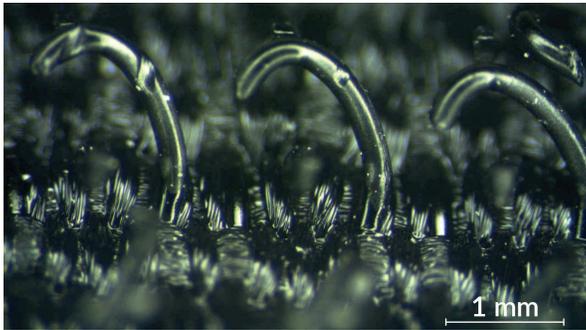
Contec’s ZeroGravity® Mop Frame (Part # PRMH8005) is a one-piece mop frame constructed of 100% recyclable polypropylene. The frames are engineered with a curve to maximize contact with the floor or other surface when the user applies the appropriate pressure during mopping. The curvature also prevents most of the mop frame from contacting the floor during storage when a pad is not attached, even with the pole attached.



The ZeroGravity® Mop Frame (17.5" x 4") weighs only 4.4 ounces and has over 41,000 low-profile “microhooks” arranged in 18 panels on the side facing the mops. The hooks maximize attachment to microfiber mop pads such as the PREMIRA disposable mop pads but reduce entrapment of dirt and debris, making the frames easier to clean and maintain.



Typical “hook-n-loop” mop frames are often made of different materials including aluminum and plastic. Although similar in size, these types of frames are over 2 times heavier than Contec’s ZeroGravity® mop frame. The “Velcro®”-type hooks often are arranged in two strips to secure to the loops in the backing of typical microfiber mop pads. The 3x longer hooks and flat profile of these mop frames increases the risk of trapping dirt and debris when not attached to a mop pad.



The microhooks on ZeroGravity™ mop frames are >3x lower profile than the hooks on conventional mop frames

## Methods

During 2021, 8 used mop frames (4 Contec ZeroGravity® backer plates and 4 conventional hook-type aluminum frames) were retrieved from healthcare facilities across the country.

The items are placed into clean bags using gloved hands and shipped quickly to Contec’s R&D labs in Spartanburg, SC.

Within days of receipt, the mop frames are examined, photographed, and analyzed for the number of viable germs on the surface of the items.

- This was accomplished by a process called stomaching (Sewell Model 500 Stomacher) in a solution of sterile Fluid D, followed by serial dilution and spread plating onto general-purpose nutrient agar.
- After incubation, the agar plates were analyzed for the number of colony-forming-units (CFU) of microbes.
- More simply, each frame was “washed” in a sterile solution and the solution was then assessed for the number of living bacteria and fungi.

## Results and Conclusions

High levels of visible debris were observed with the hook-and-loop mop frames. The debris entrapped in the hooks consisted of fibers from microfiber mops, other cleaning textiles or sutures, but also human hair and unidentified debris that was collected and retained from the areas being cleaned.

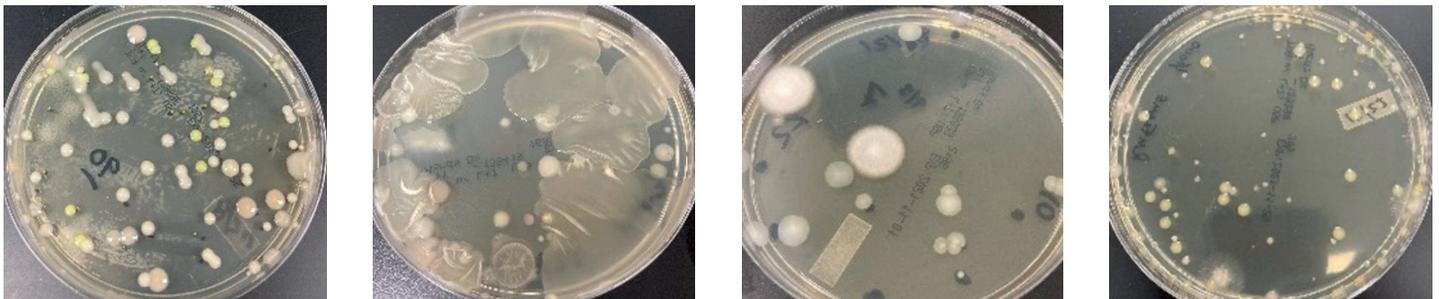


The number of microbes recovered from the two types of mop frames after repeated use revealed substantially (<900x) lower contamination on Contec's ZeroGravity® mop frames compared to the typical aluminum frames (Table 1).

**Table 1.** Bioburden (CFU) recovered from used mop frames after extraction, serial dilution and spread plating onto nutrient agar.

ZeroGravity® Mop Frame with Microhooks (State)	Typical Aluminum Mop Frame with Strips of Hooks (State)
<2,500 (SC)	13,000 (AZ)
2,500 (SC)	225,000,000 (OK)
42,500 (SC)	5,944,806 (NY)
15,811 (IL)	160,000,000 (SC)
8,050 (Geometric Mean)	7,262,663 (Geometric Mean)

### Typical Colony Morphologies



## Discussion notes

- While both types of mop frames entrap debris after repeated use, the debris found in the ZeroGravity® mop frame contained substantially less bioburden than the aluminum mop frames. This may be a function of both the amount and composition of the debris. The debris associated with the long hooks on the aluminum frames contained massive amounts of human hair and other unidentified objects and particles that may have been contaminated with bodily fluids.
  - Much of the larger pieces of debris remained attached to the hooks after the extraction process, so the bioburden values may underestimate the total amount of microbial contamination associated with the objects.
  - It was not known how long the frames had been in use or if they were used with disinfectants or neutral floor cleaners. As discussed in the background section, chemical solutions used to disinfect hard surfaces should not be relied upon to disinfect debris entrapped in cleaning tools.
  - As mentioned above, the entire ZeroGravity® mop frame can be recycled when disposed. This is not true for the mop frames with integrated plastic and metal.
  - We did not attempt to identify the species of microbes recovered, but selected colonies were examined with a phase-contrast microscope. The colonies consisted of mostly bacteria with some fungi (yeast and mold). The bacterial colonies exhibited a range of morphologies – some were indicative of spore-forming bacteria such as *Bacillus* spp. However, given the use in healthcare facilities, it is possible that many of the microbes were bacteria that could cause human disease.
  - The next steps on this project are to understand the optimal procedure for cleaning the ZeroGravity® Mop Frames and when cleaning is a feasible option vs. discarding as recycled waste.
- Testing and report by Mark Wiencek, PhD, Lead Microbiologist, Contec, Inc.

## References

1. Rutala, W. A., & Weber, D. J. (2008). Guideline for disinfection and sterilization in healthcare facilities (See Section 12: Microbial Contamination of Disinfectants).
2. Günther, Frank, et al. (2016) Pseudobacteremia outbreak of biofilm-forming *Achromobacter xylosoxidans* –environmental transmission. *BMC Infectious Diseases*. 16.1: 1-5.

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