

# Good Building Design - water appliances

**Water safety in hospitals**

**Sted: Oslo universitetssykehus, Ullevål**

**Tid: 28. november 2023**

**11:05 – 11:35**



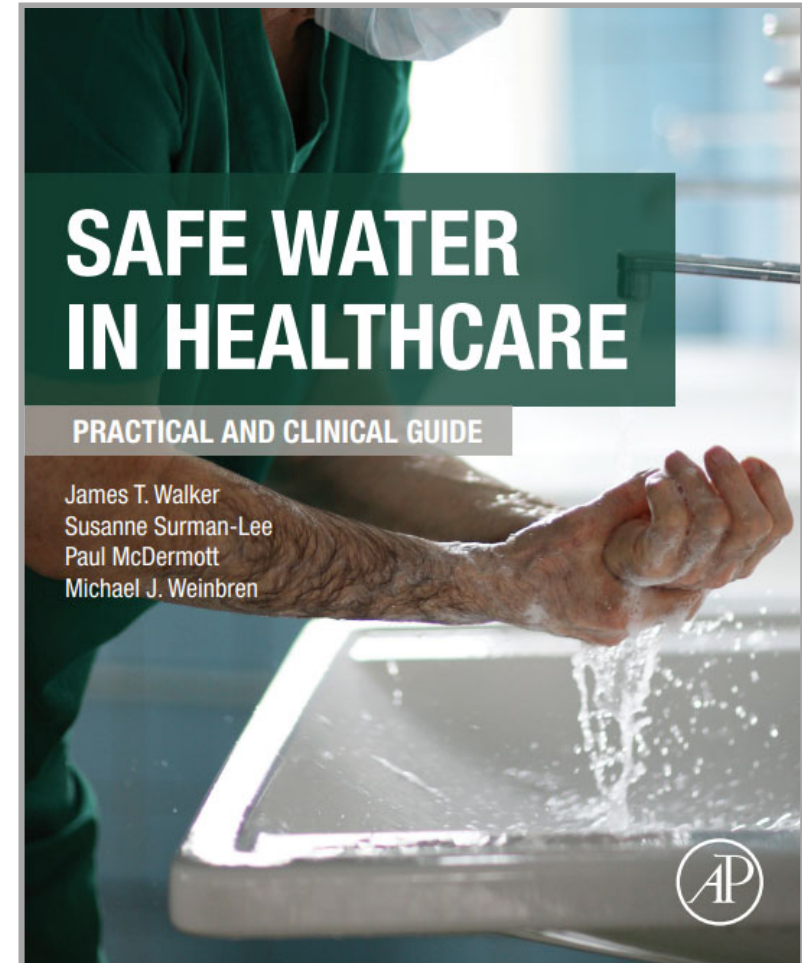
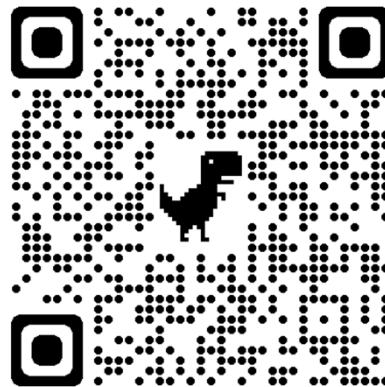
# Declarations

Working with the Scottish Health Inquiry to provide expert advice on water microbiology

Provide expert consultancy advice to IDEXX

Chairman of the Central Sterilising Club

Work with other experts to write technical manuscripts and books on safe water issues



# Content

- **What appliances should we use?**
  - **Effect of synthetic materials**
  - **Thermostatic mixing devices**
  - **Electronic Faucets**
  - **Showering/bathing**
- **Is quality important (role of WRAS in the UK)**

# Donald Rumsfeld, 2002

‘There are known knowns. There are things we know that we know. There are known unknowns. That is to say, there are things that we now know we don't know. But there are also unknown unknowns. There are things we do not know we don't know.’

And so explains what we know about water.....







# Putting patients at the centre of care

- Why do we need a good design?
- What does a good design look like?
- How do you protect patients?
- What outlets are important?
- What are the residual risks?
- So where are we?
- What are the consequences?



Definitions of water tap.....

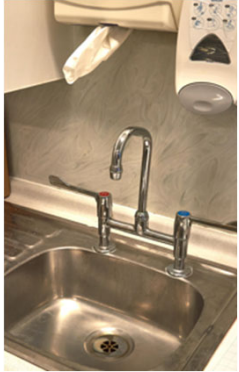
**a faucet for drawing water from a pipe or cask.**

**synonyms: hydrant, tap, water faucet.**

**type of: faucet, spigot.**

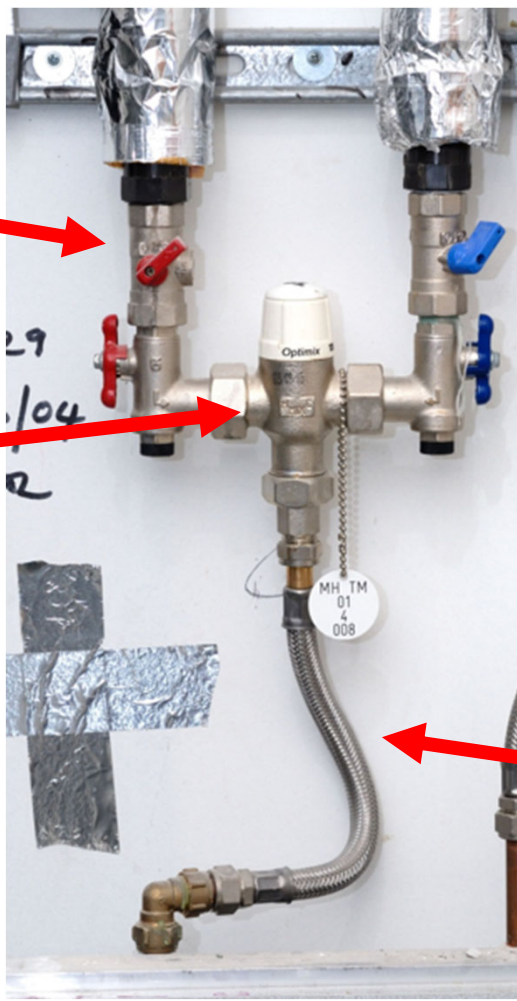
**a regulator for controlling the flow of a liquid from a reservoir**





Terry Brooks died from Legionnaire's disease while he was a patient at the RUH



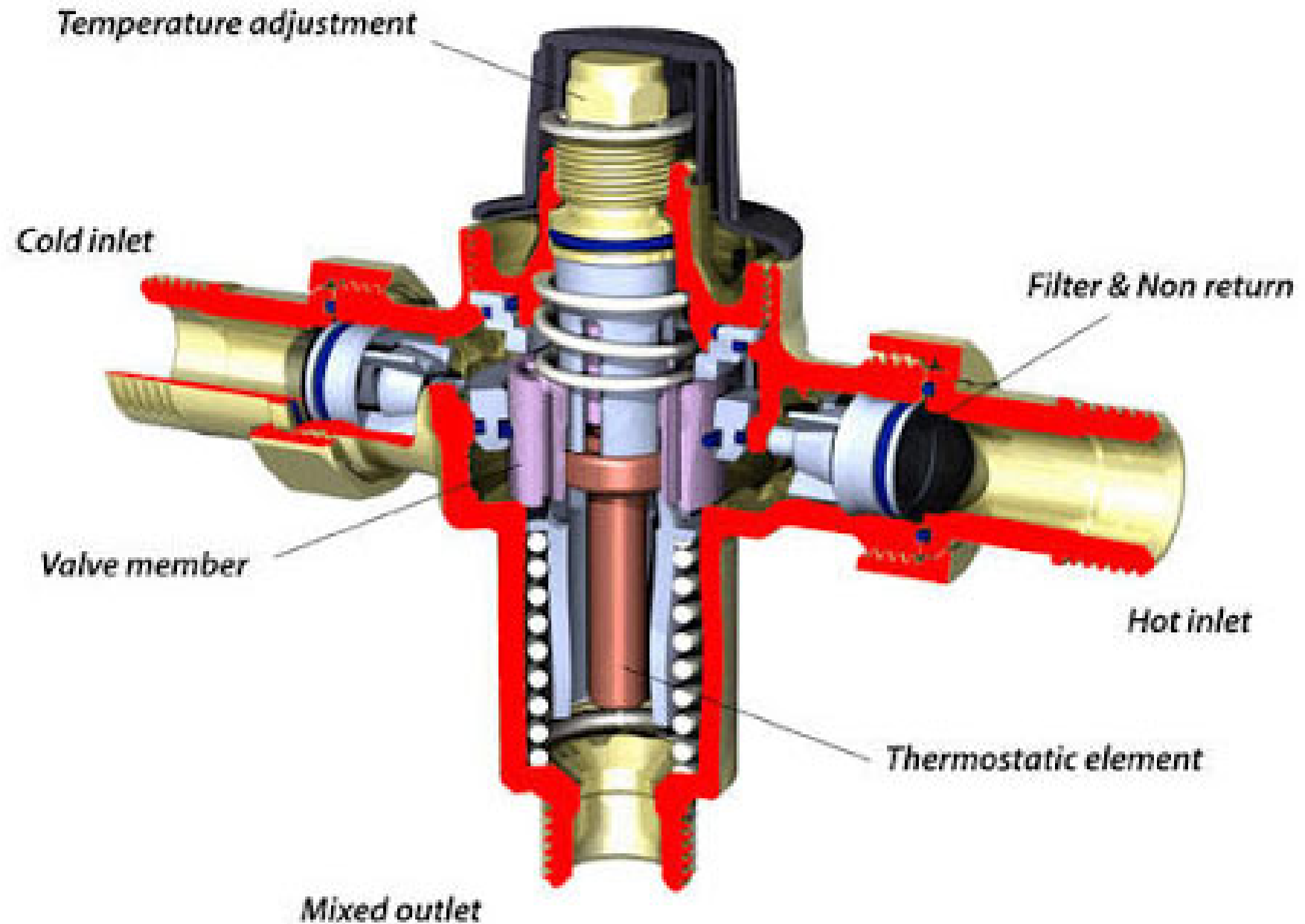


**HOT**

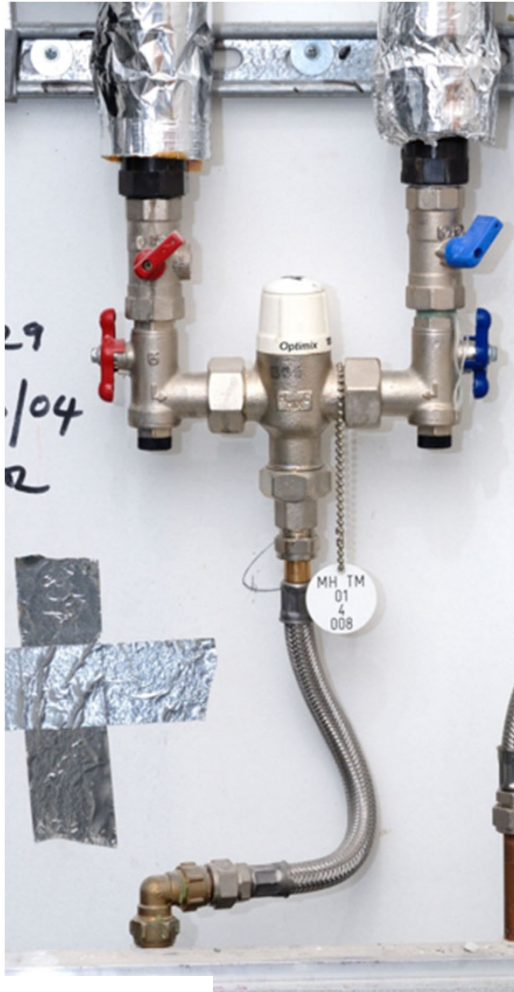
**COLD**

**THERMOSTATIC  
MIXER VALVE  
(TMV)**

**FLEXIBLE HOSE  
- SYNTHETIC  
MATERIAL  
EPDM**



## Sensor Operated Outlet



**SOLENOID**



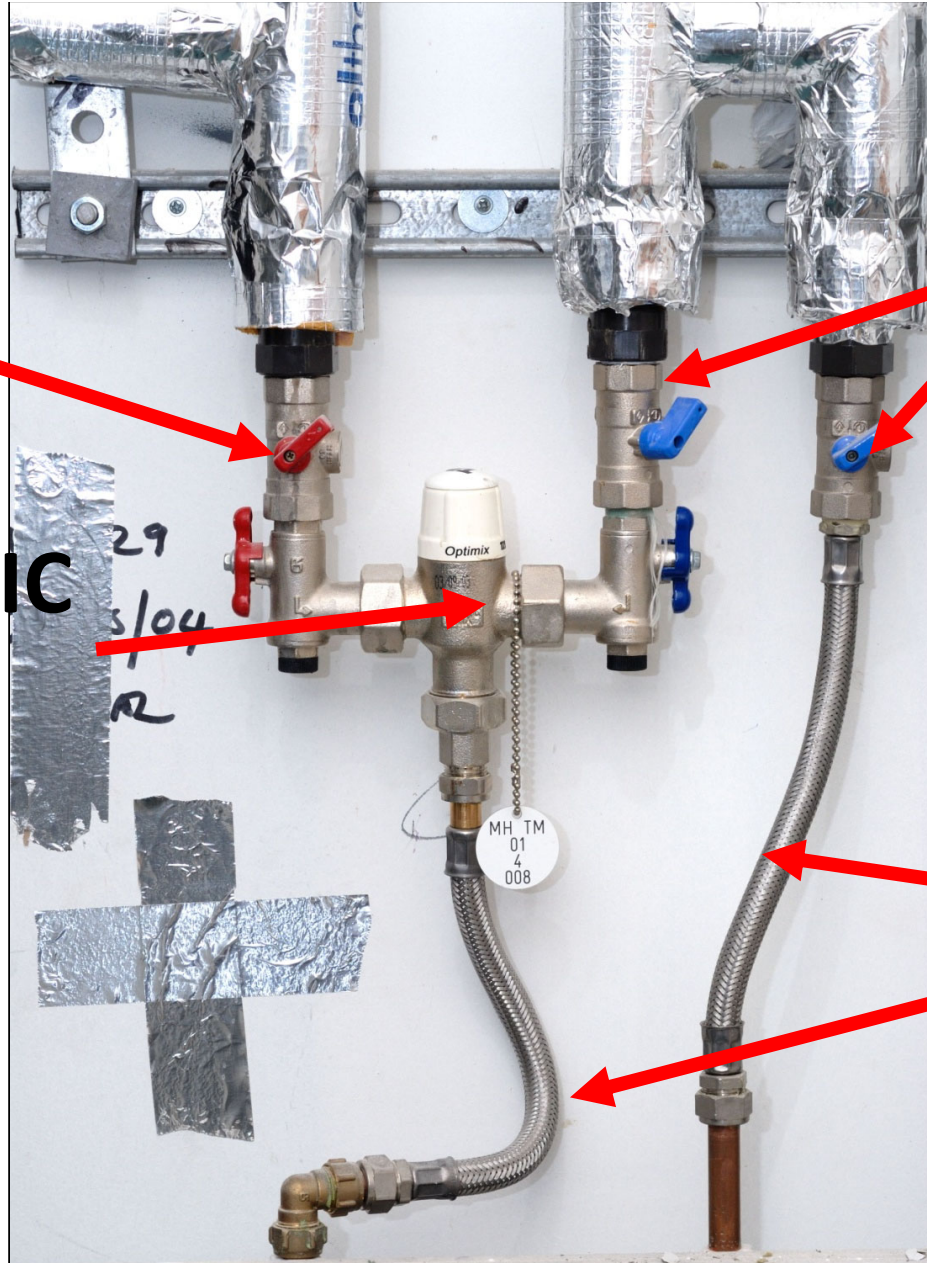
**SENSOR**

**HOT**

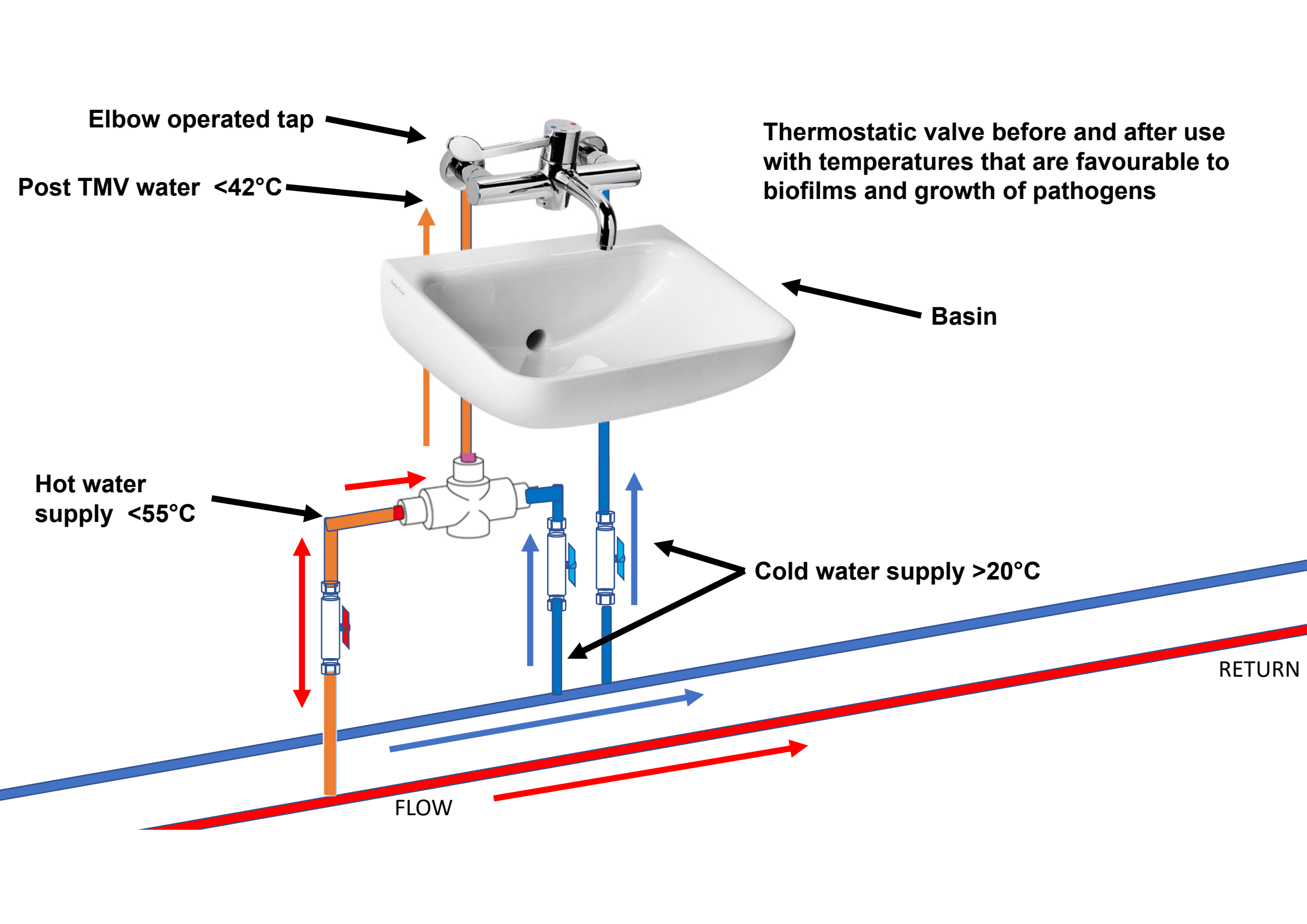
**COLD**

**THERMOSTATIC  
MIXER VALVE  
(TMV)**

**FLEXIBLE  
HOSES  
SYNTHETIC  
MATERIAL  
EPDM**





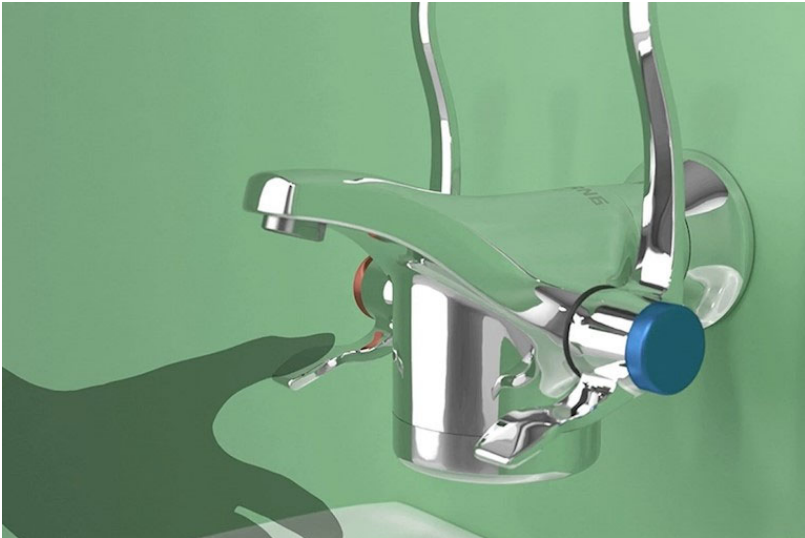


# THERMOSTATIC MIXER TAP



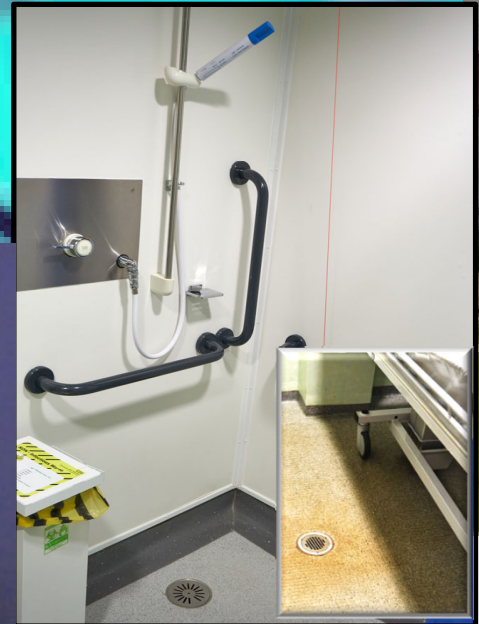
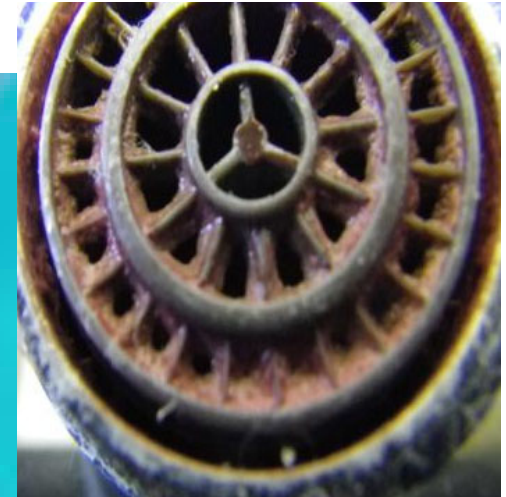
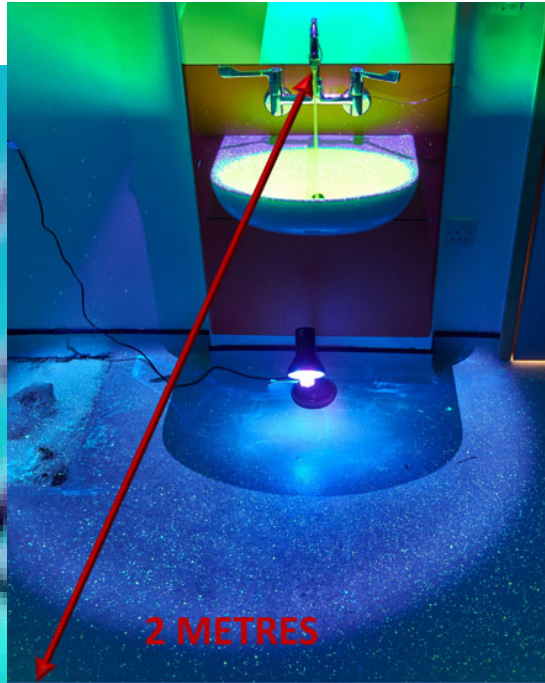


**Thumb operation to  
switch on**



**Elbow operation to  
switch off**





# Just when you thought it was safe to use your water?

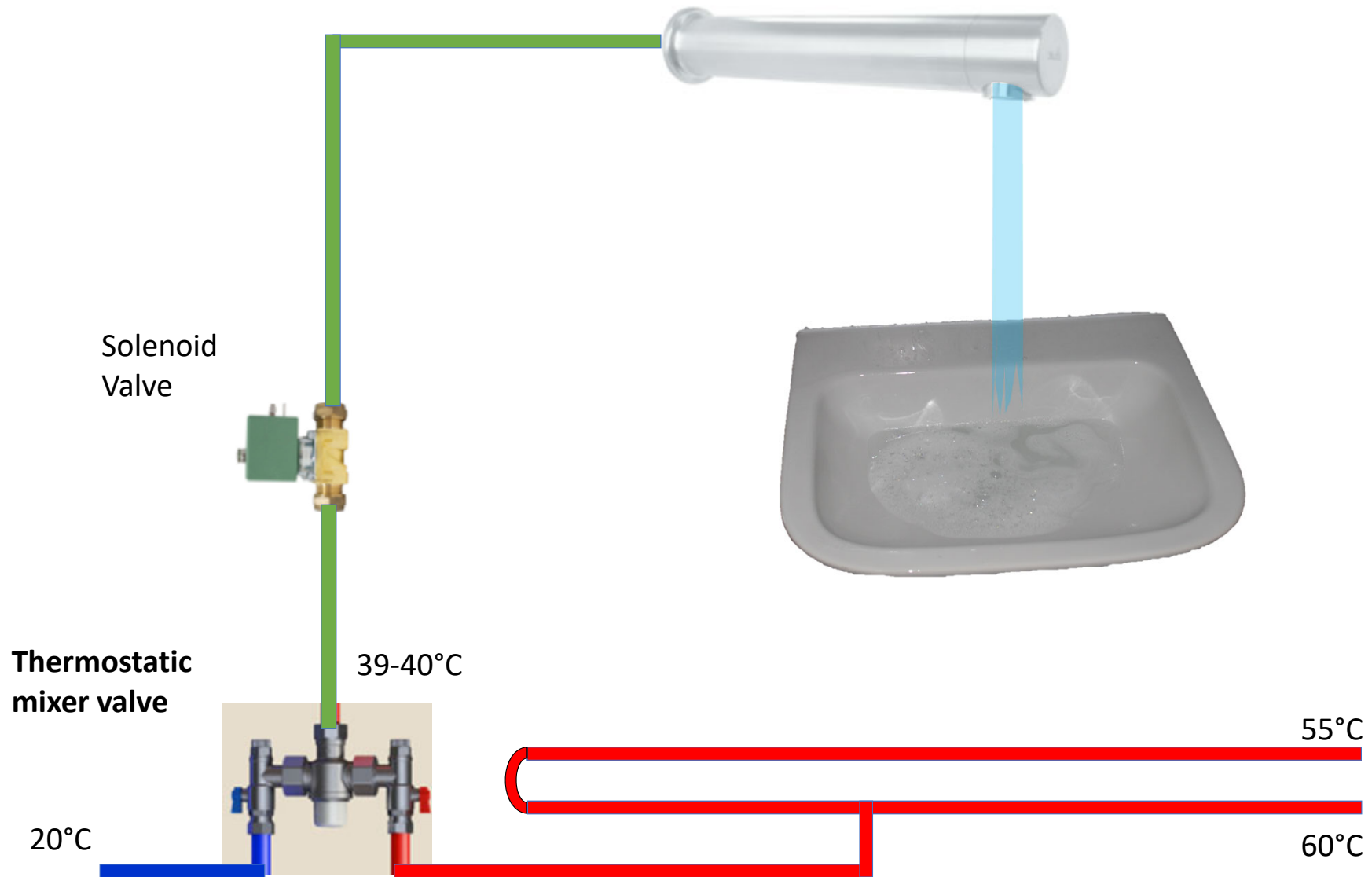
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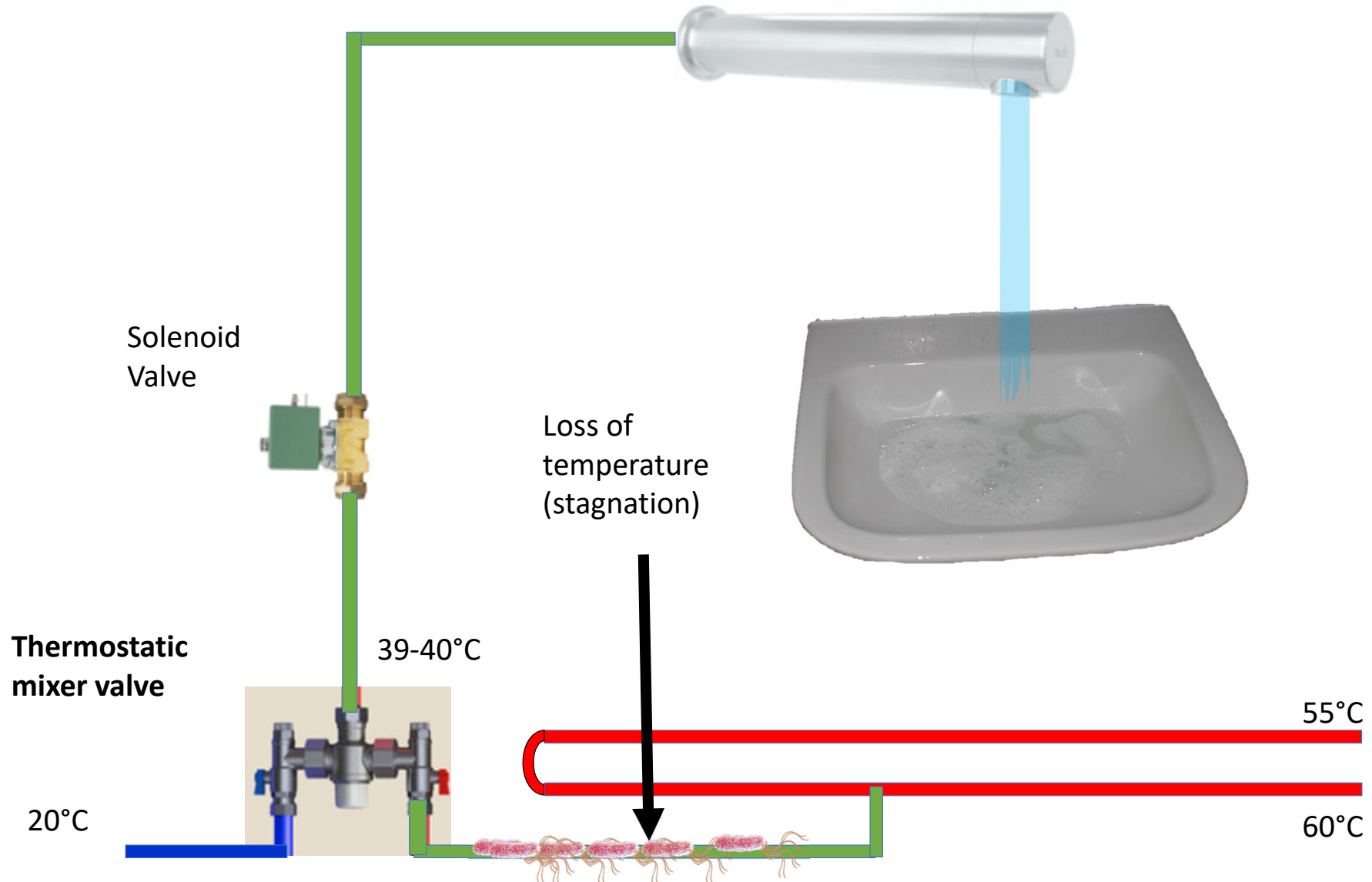


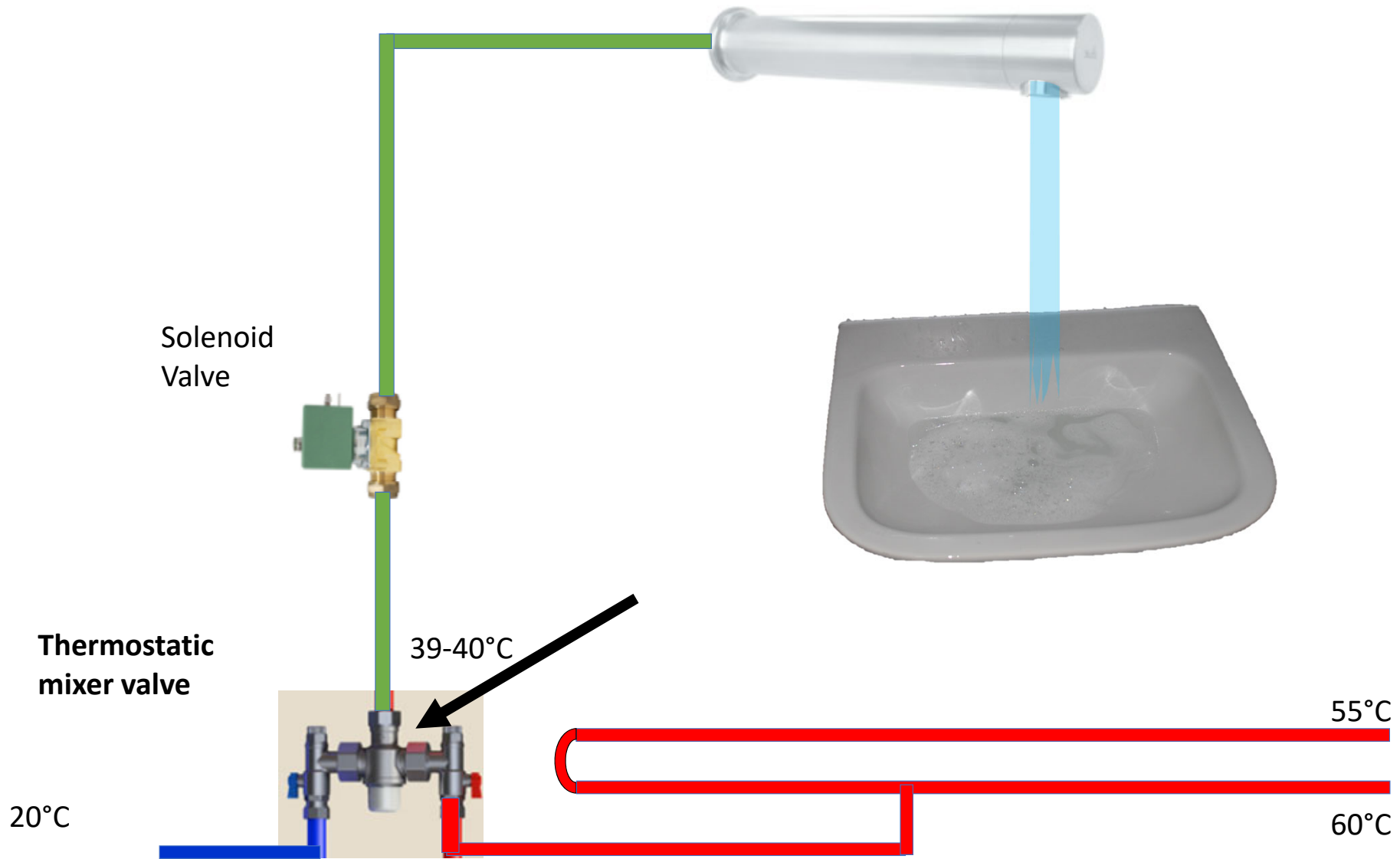
search ID: hsc0824

"THAT WOULD BE A WHOLE LOT FUNNIER IF IT WEREN'T HOOKED UP TO YOUR COLOSTOMY BAG."











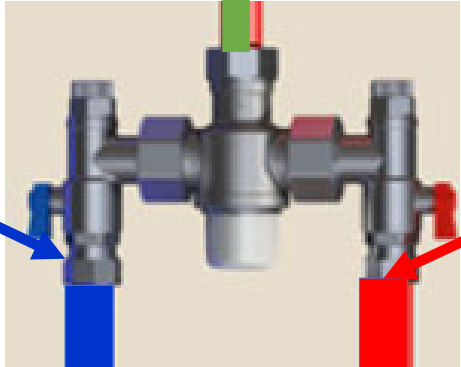
**STRAINER**



**STRAINER**



Mixed Outlet

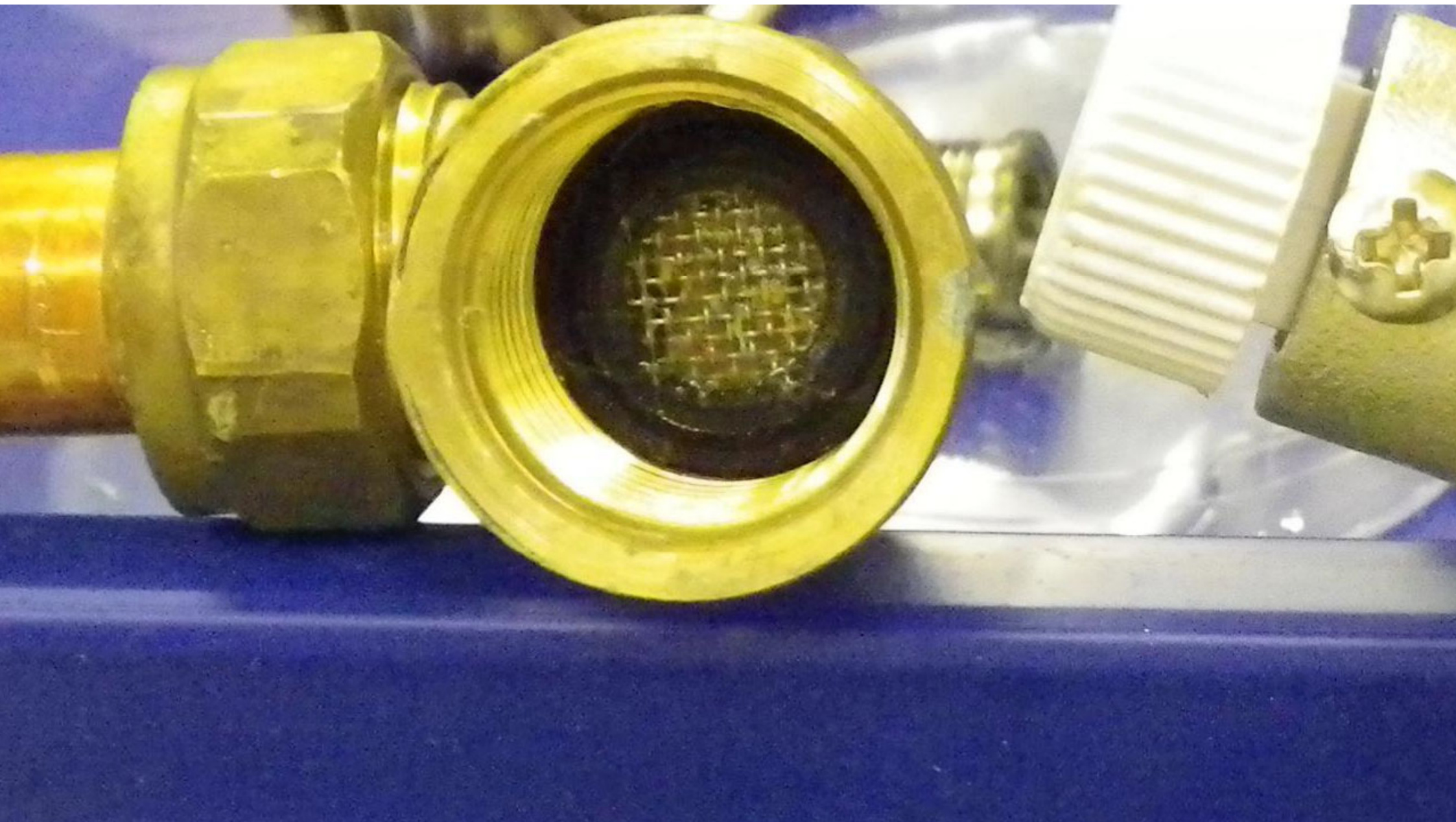


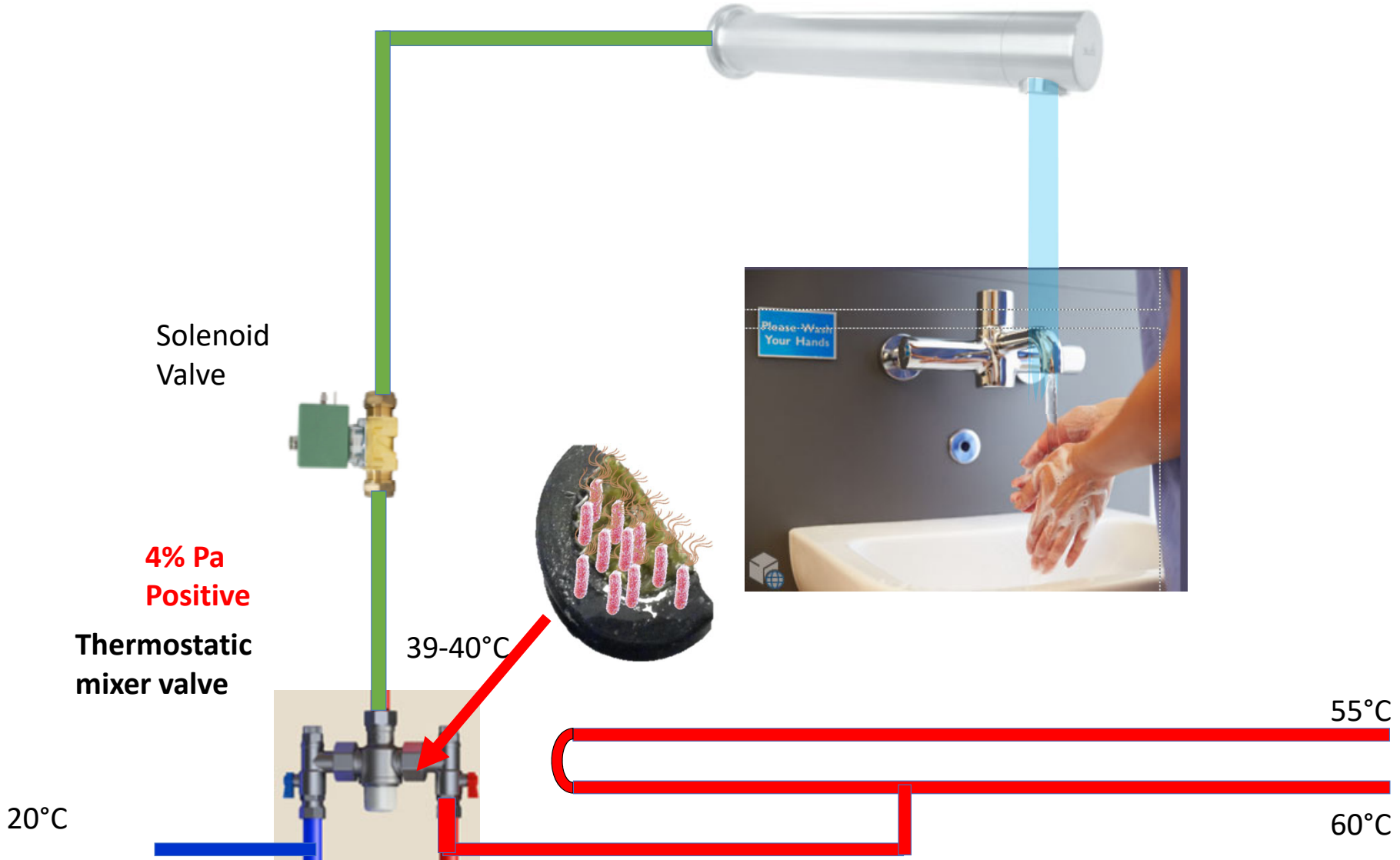
**COLD  
INLET**

**HOT  
INLET**

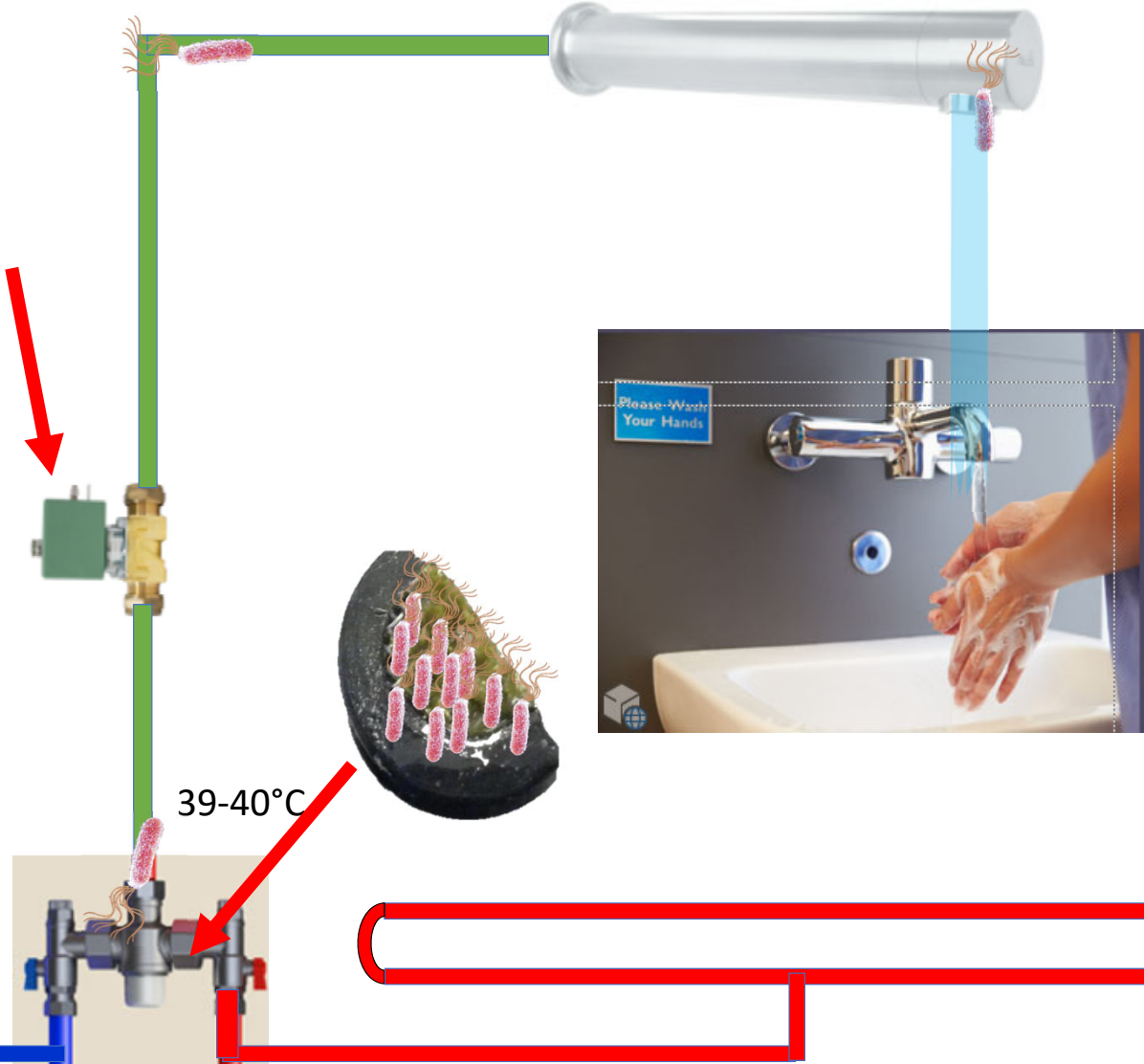
**Thermostatic mixer valve**







**Solenoid**



**4% Pa  
Positive**

**Thermostatic  
mixer valve**

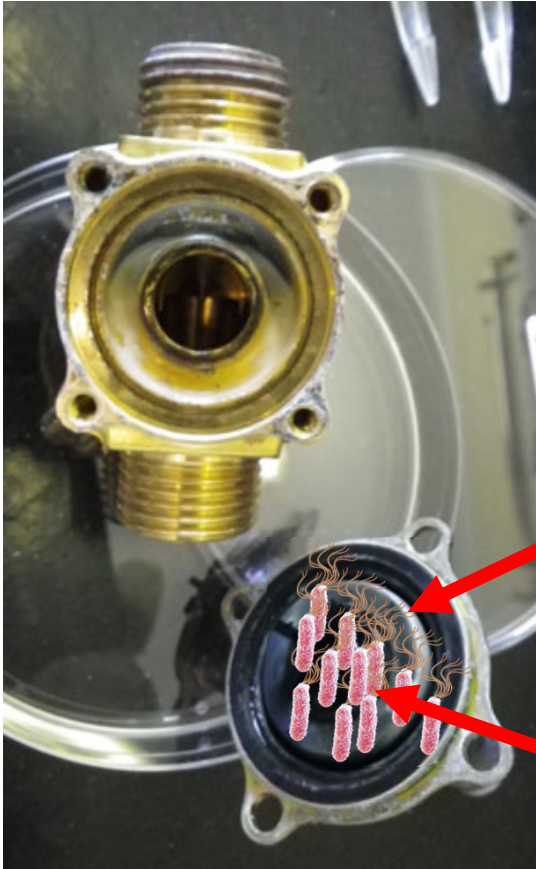
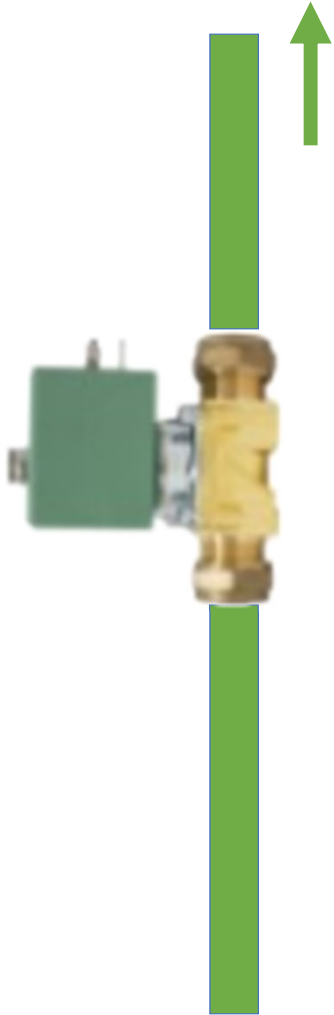
39-40°C

20°C

55°C

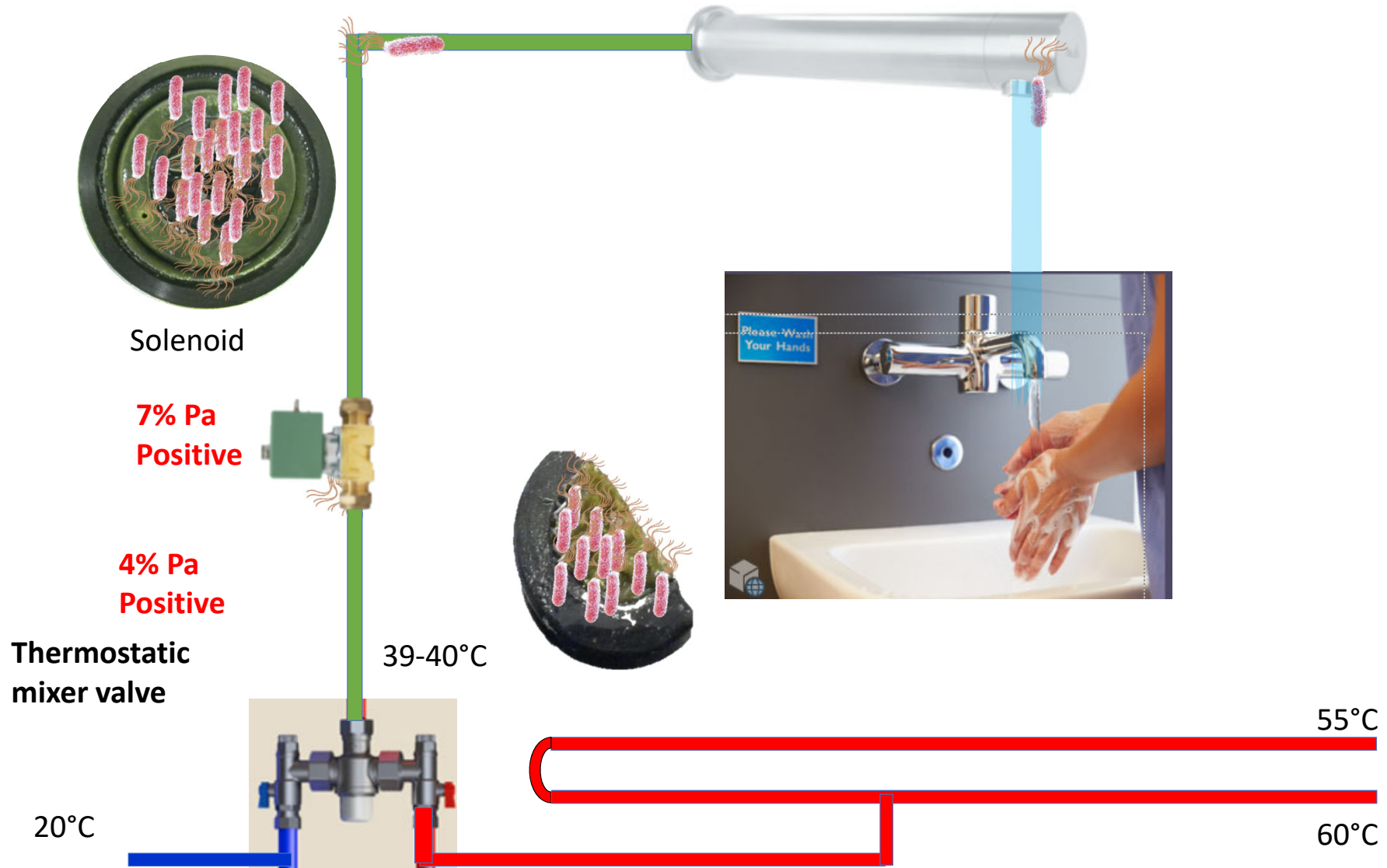
60°C

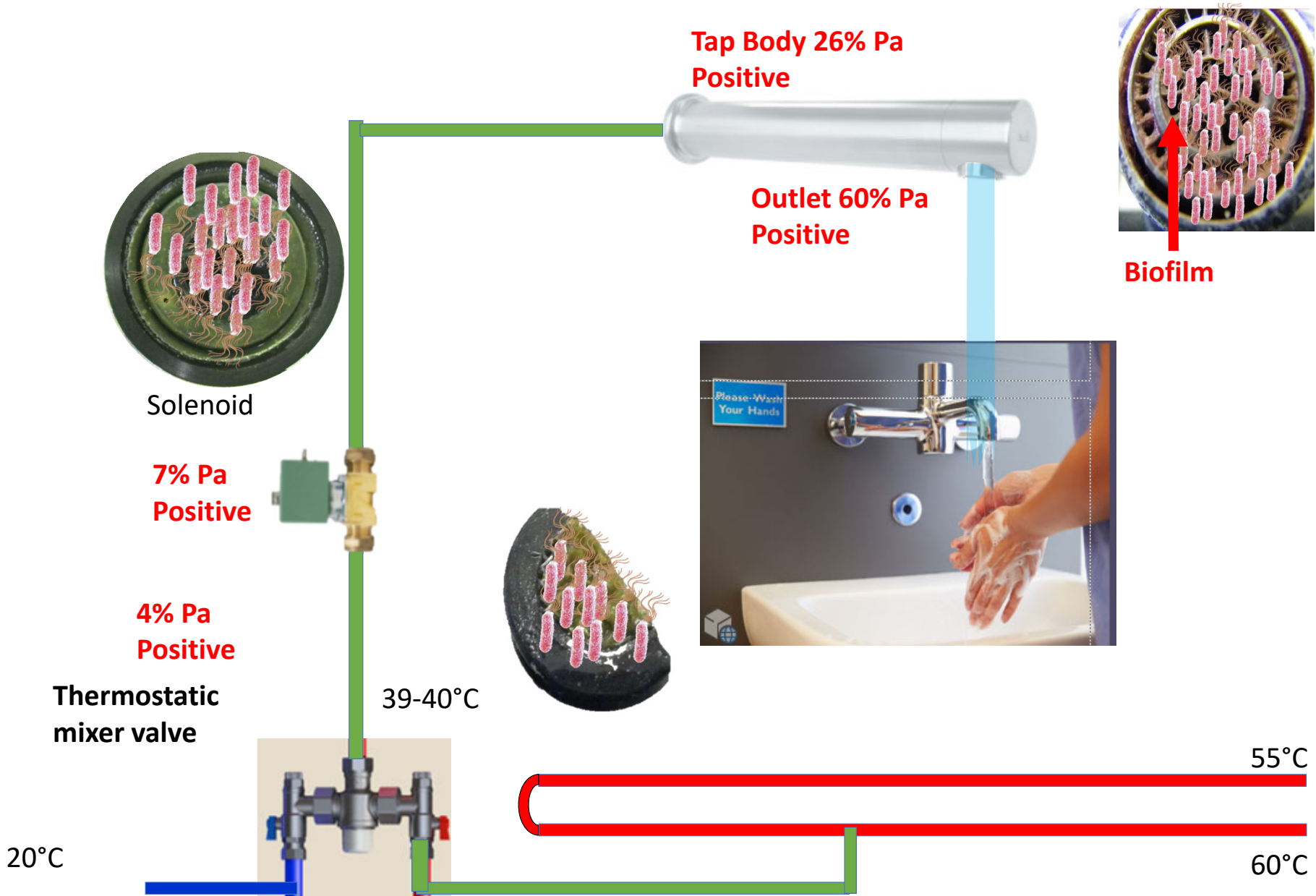
# Solenoid Valve

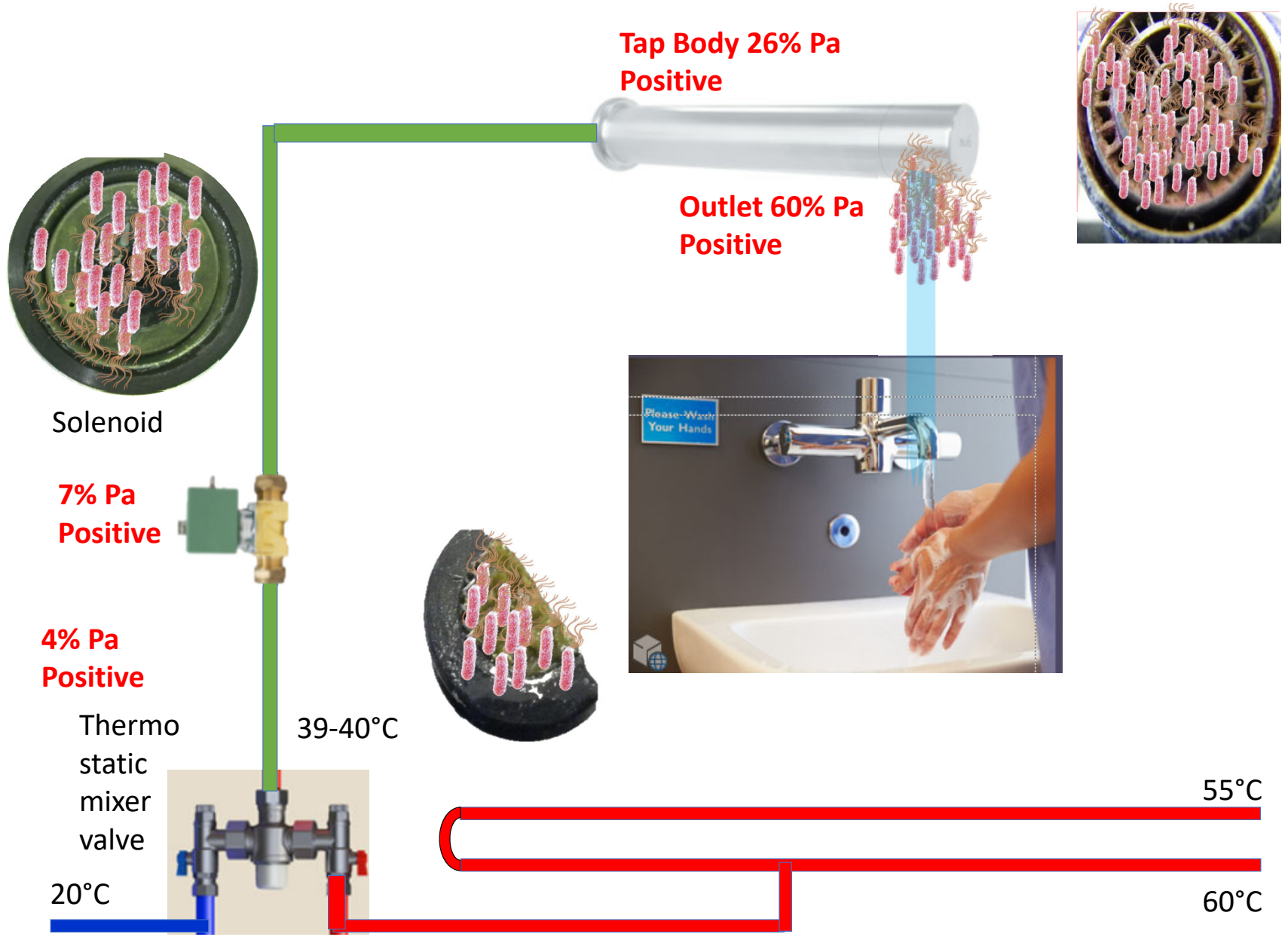


EPDM  
SYNTHETIC  
DIAPHRAGM

Biofilm







**Tap Body 26% Pa Positive**

**Outlet 60% Pa Positive**

Solenoid

**7% Pa Positive**

**4% Pa Positive**

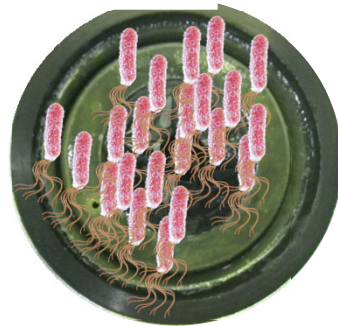
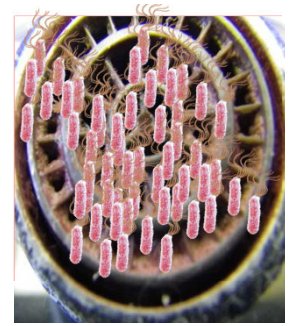
Thermostatic mixer valve

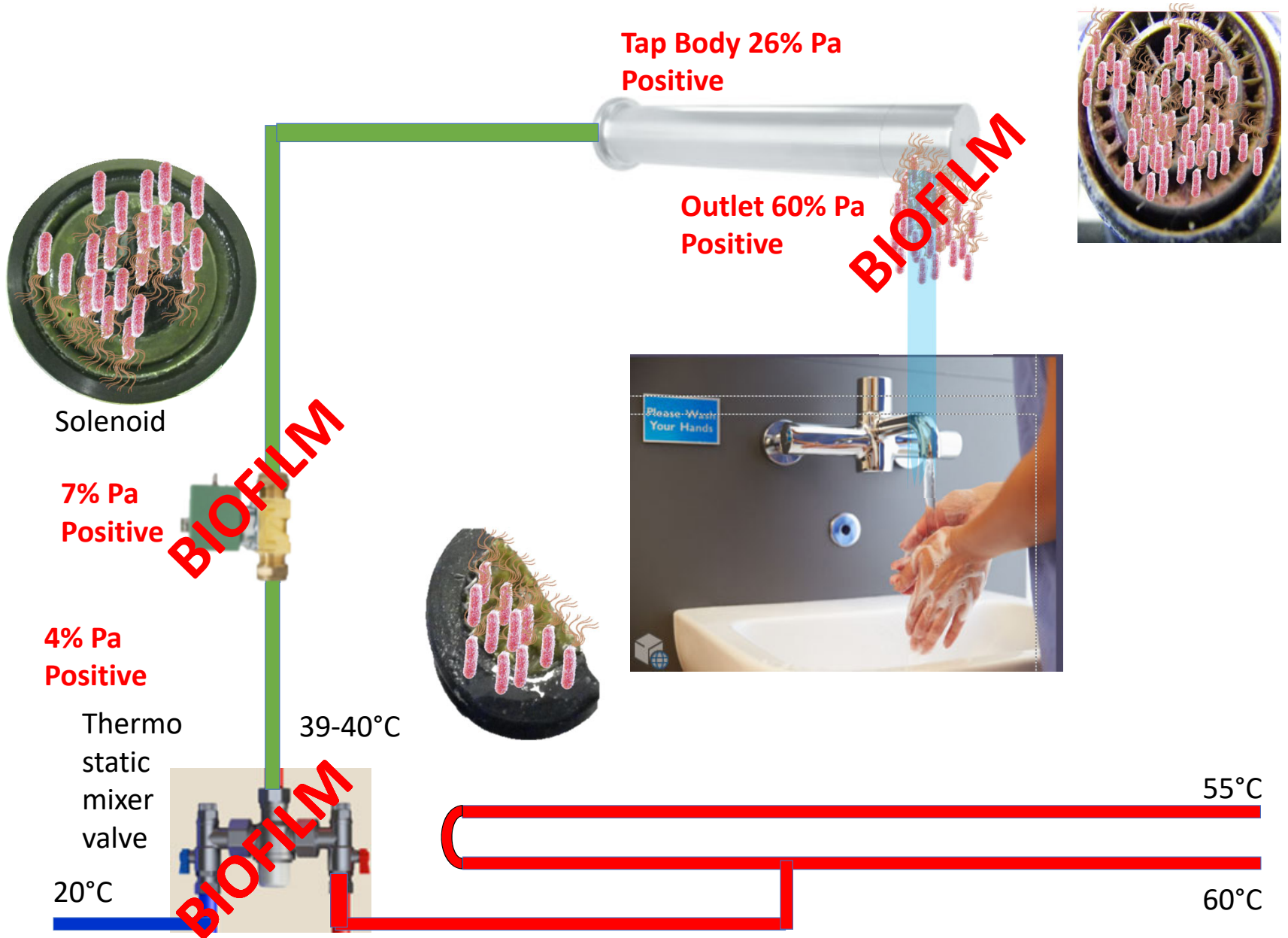
20°C

39-40°C

55°C

60°C



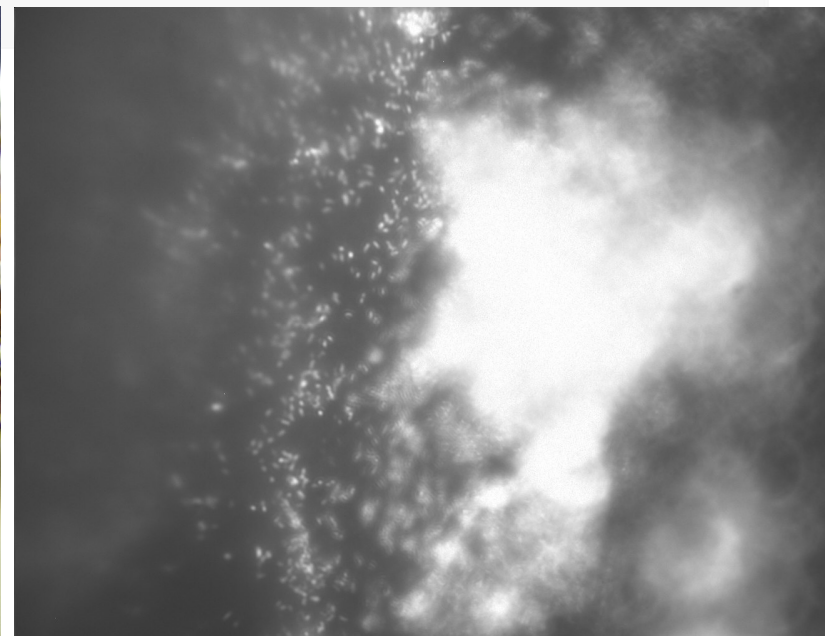
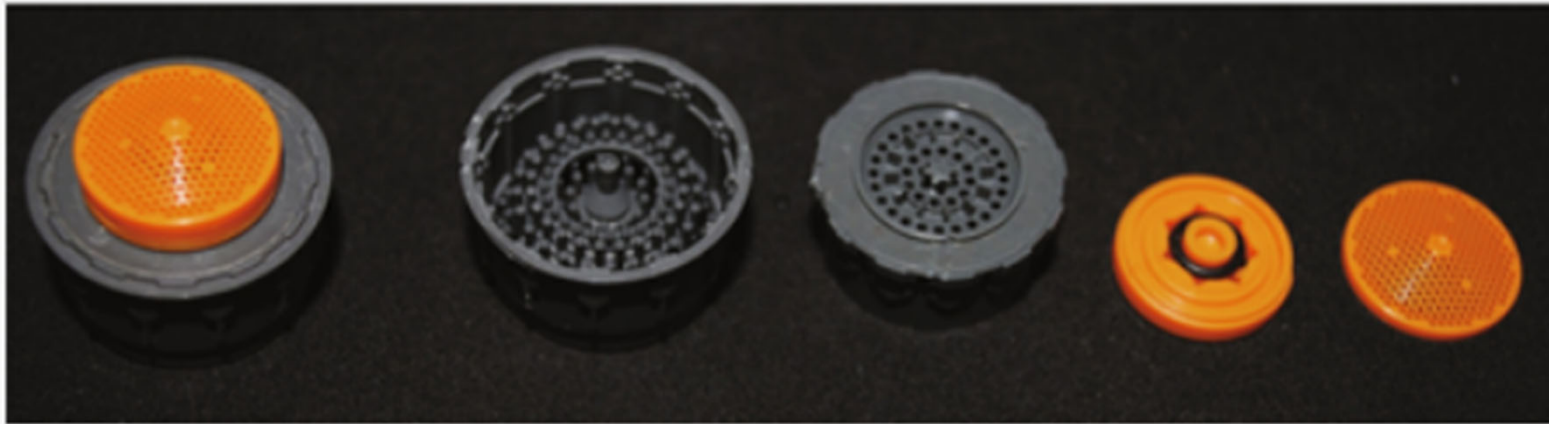




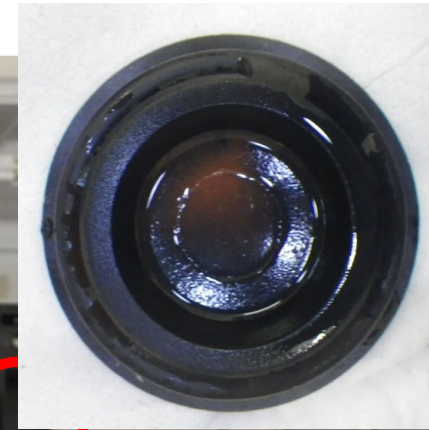
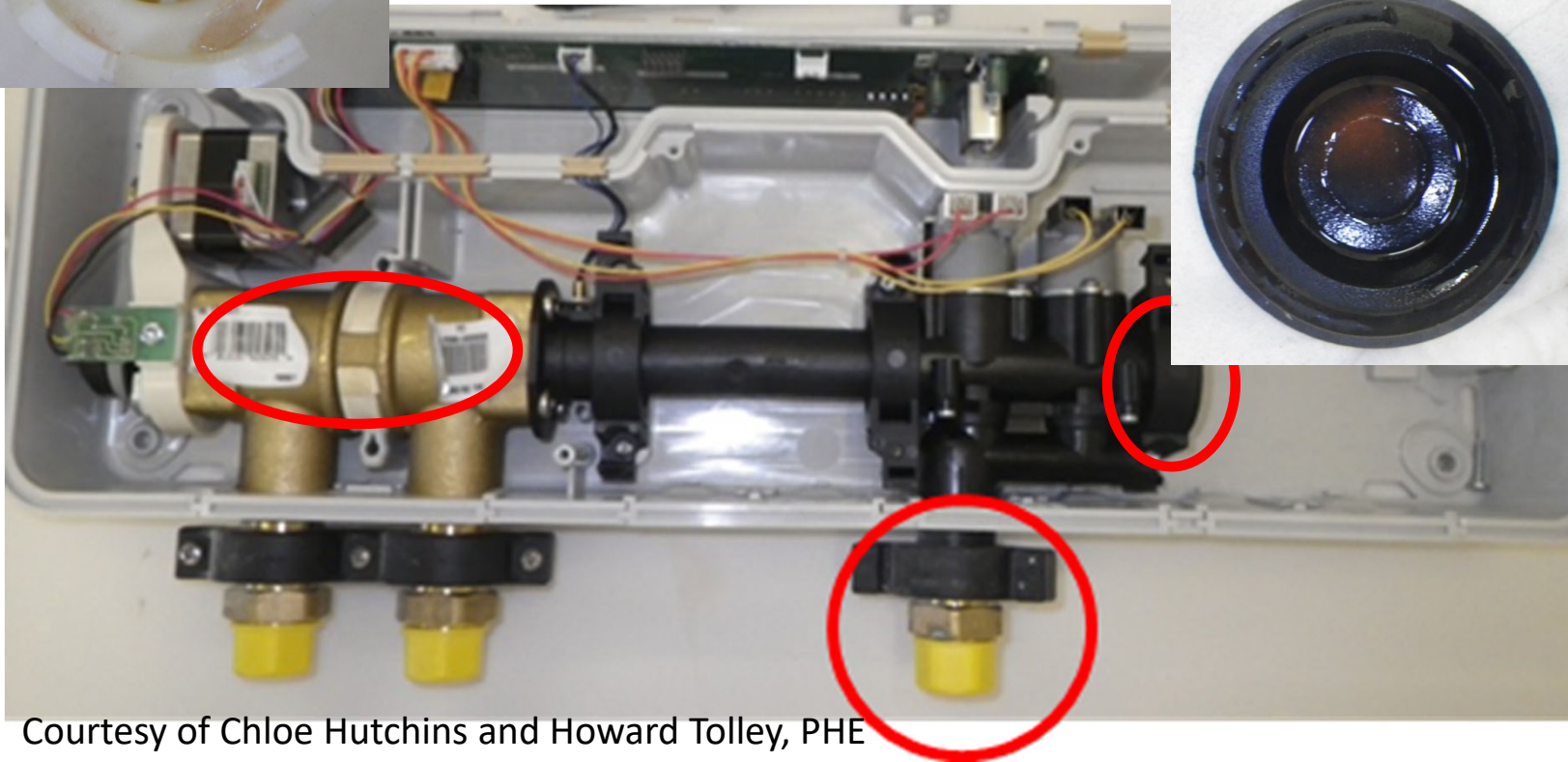
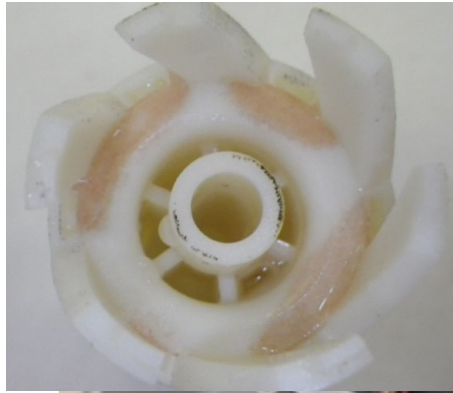


	All components		<i>P. aeruginosa</i> positive Components		
	N	%	N	%	Median Pseudomonas CFU (IQR)
<b>Tap component location</b>					
<b>Tap body</b>	<b>126</b>	<b>26</b>	<b>18</b>	<b>26</b>	<b>6,340 (22,580)</b>
<b>Connectors</b>	<b>31</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>-</b>
<b>Isolation valve</b>	<b>30</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>-</b>
<b>Integrated Mixer and solenoid</b>	<b>38</b>	<b>8</b>	<b>1</b>	<b>1</b>	<b>60 (0)</b>
<b>Mixer</b>	<b>98</b>	<b>20</b>	<b>2</b>	<b>3</b>	<b>20 (0)</b>
<b>Flow straightener</b>	<b>97</b>	<b>20</b>	<b>41</b>	<b>60</b>	<b>52,033 (816,820)</b>
<b>Solenoid</b>	<b>54</b>	<b>11</b>	<b>5</b>	<b>7</b>	<b>520 (23,380)</b>

Aerators or flow regulators are used to reduce the volume of water used by mixing air with the water. However, they are inherently complex and present a high surface area to volume ratio that enable bacteria to colonize the surfaces. This image presents the large number of complex components that form an aerator.



# Areas of biofilm detected in Electronic sensor operated taps



Courtesy of Chloe Hutchins and Howard Tolley, PHE

**Acrylic manual tap handle on a patient sink (not recommended) was difficult to clean Q1 and has implicated in an extended outbreak of CPE**

Inappropriate acrylic handle

Inaccessible dirt, debris and microbial contamination

Chain for pug – difficult to clean



Lime scale that would harbour bacteria

Difficult to clean outlet

Crevices and niches in which bacteria would be protected

Turner, C., Mosby, D., Partridge, D., Mason, C., Parsons, H., 2020. A patient sink tap facilitating carbapenemase-producing enterobacteriales transmission. *J. Hosp. Infect.* 104, 511– 512. <https://doi.org/10.1016/j.jhin.2019.12.020>.



ELSEVIER

Practice Point

The sink

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<sup>b</sup> Hospital Infection

Birmingham, Edg

<sup>c</sup> Institute of Micro

<sup>d</sup> University of W

<sup>e</sup> Walker on Water



**POOR DESIGN**  
**LACK OF RISK ASSESSMENT**  
**LACK OF KNOWLEDGE OF**  
**RISK**



C. Wilkinson <sup>a,b</sup>,

Edgaston, Birmingham, UK  
Queen Elizabeth Hospital



OXFORD

 **FEMS**

FEMS Microbes, 2023, 4, 1–13

DOI: 10.1093/femsmc/xtad016

Advance access publication date: 16 August 2023

Research Article – Microbes & Environment

## Legionella relative abundance in shower hose biofilms is associated with specific microbiome members

Alessio Cavallaro<sup>1,2</sup>, William J. Rhoads<sup>1</sup>, Émile Sylvestre<sup>1</sup>, Thierry Marti<sup>1,2</sup>, Jean-Claude Walser<sup>2,3</sup>, Frederik Hammes<sup>1,\*</sup>

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Editor: [ana jani]

# Water Regulations Advisory Scheme (WRAS)

- Require that a water fitting should not cause waste, misuse, undue consumption or contamination of the water supply and must be ‘of an appropriate quality and standard’.
- assess non-metallic materials are described in BS 6920: 2000/2014 “Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water.”

## Estates & Facilities Alert



Ref. DH (2010) 03  
Gateway Ref. 14265

	IMMEDIATE ACTION	
For:	<b>ACTION</b>	✓
	INFORMATION	
	UPDATE	

Issued: 05/05/2010

Action underway by: 24/05/2010

Action completed by: 30/11/2010

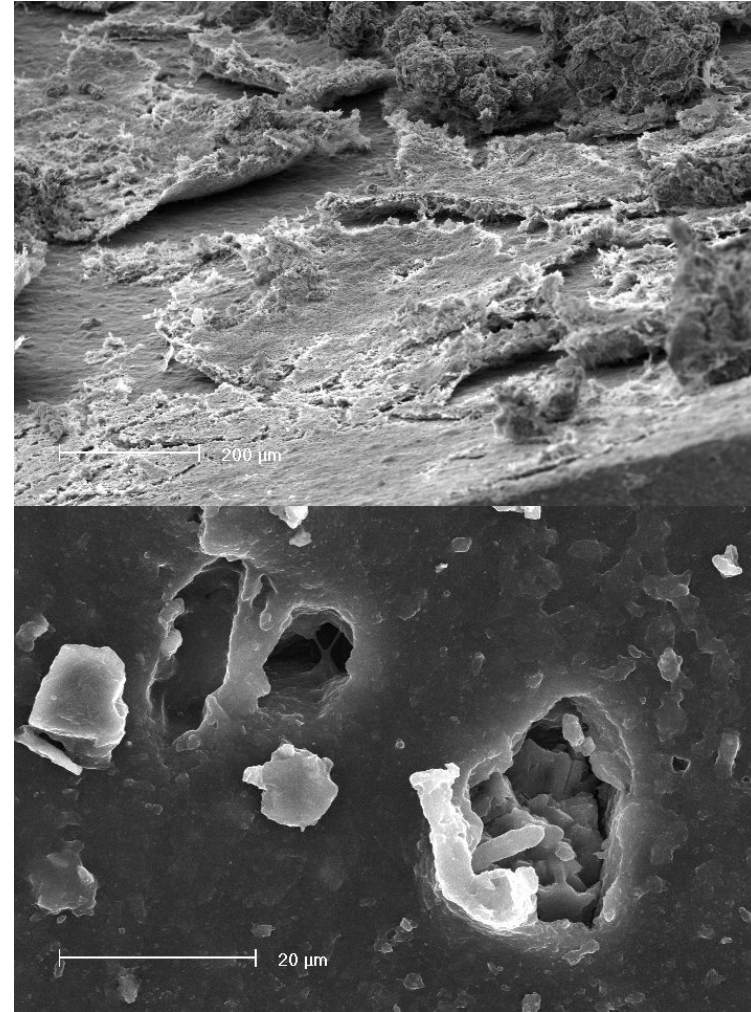
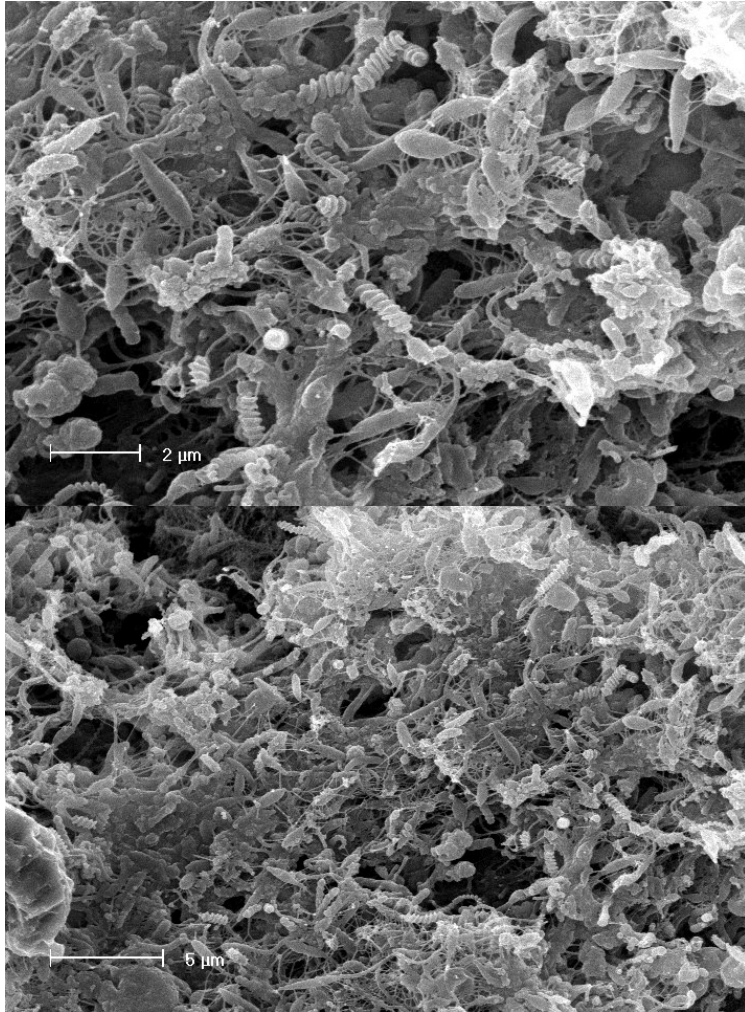


## **BS 6920 shows that a non-metallic material or component does not:**

- Impart odour or flavour on the water (Section 2.2);  
Cause change in the appearance of the water (colour, turbidity) (Section 2.3);
- Enhance microbial growth (MDOD test) (Section 2.4);
- Leach substances harmful to human health into the water (cytotoxicity) (Section 2.5);
- or Leach metals into the water (Section 2.6).

# Biofilms in lumen of flexible hoses

(SEM with kind permission of Dr T Makin Sen)



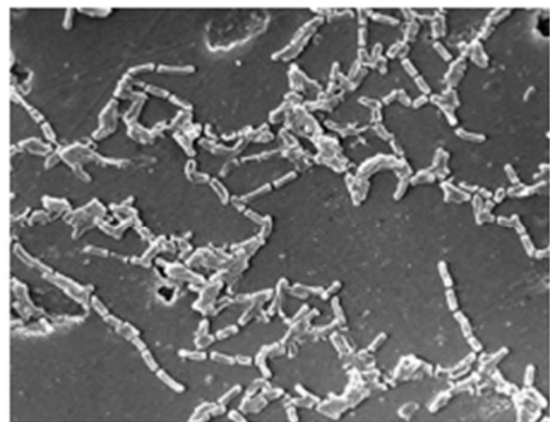


# Practicalities

- Water systems are complex
- Taps/outlets/showers are often not used frequently enough
- Stagnation creates favourable environment for biofilm growth
- Patients are at risk from contaminated water

# Nosocomial *Mycobacterioides chelonae* Outbreak in England

📅 14 March, 2022    💬 Add comment    ⌚ 3 min read



A 3rd death has been linked to a *Mycobacterium chelonae* outbreak at Cambridge's Royal Papworth Hospital, England. A 26-year-old patient underwent a double lung and heart transplant in June 2019. The patient tested culture positive for *M. chelonae* following the surgery and continued to suffer devastating complications. He died in July 2021, still testing positive for *M.*









