

# Analysis Report

**REPORT NUMBER****754372 Rev. 1***Replaces analysis report 754372***DANISH  
TECHNOLOGICAL  
INSTITUTE**

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**Item:** Test of UV Disinfection Robot acc. NF T72-281

**Sampling:** Danish Technological Institute

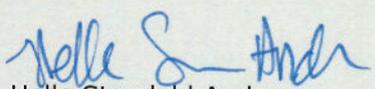
**Period:** Samples received: 7 June 2017  
Test performed: 5 - 26 June 2017

**Storage:** The test material will be destroyed after 3 months, unless otherwise agreed in writing.

**Test results:** The results of the analysis and the method(s) used concern only the sample(s) analysed or the sub-sample(s) selected for analysis.

**Terms:** This analysis was carried out in accordance with Danish Technological Institute's General Terms and Conditions regarding Commissioned Work Accepted by Danish Technological Institute. The test results solely apply to the tested item. This analysis report may be quoted in extract only if the Laboratory for Chemistry and Microbiology has granted its written consent.

**Date/place:** 15 December 2017  
Danish Technological Institute, Aarhus  
Laboratory for Chemistry and Microbiology

**Signature:**   
Helle Stendahl Andersen  
Senior Consultant

## Procedure

The efficacy of ozone on contaminated surfaces was tested according to NF T-72-281, 1<sup>st</sup> ed., 2014-11.

A bacterial, fungal or spore suspension was mixed with a solution of skimmed milk powder to simulate the presence of organic material.

50µl of a test suspension was transferred to a stainless steel surface and dried at 37 °C until visibly dry. The metal discs were then placed in an airtight room and exposed to UV-light for 5 min. at a distance of 1m.

The stainless steel plates were subsequently transferred to a phosphate buffer and the number of surviving microorganisms was quantified and compared with a control sample in which a similarly treated stainless steel surface was placed in a room without being exposed to UV-light for 5 min.

When tested in accordance with the test method under the required test conditions, the product shall demonstrate  $\geq \log 5$  reductions in viable counts for bacteria,  $\geq \log 4$  reductions for fungi and  $\geq \log 3$  reductions for bacteria spores.

## Deviations for test method NF T72-281

Using the robot, it will drive around in a room 1 meter away from all surfaces. Therefore, it is decided to test the effect at 1meter distance.

The size of the room is therefore also irrelevant, as the distance between the surface and the UV Disinfection Robot always will 1meter.

The test suspension for the fungi, *Aspergillus brasiliensis*, was prepared the day before according to DS/EN 1650:2008.

The concentration of the test suspension of the gram negative bacteria, *P. aeruginosa* and *E. coli* and the yeast *C. albicans* were all higher than given in NF T72-281, as they are all very sensitive to drying procedure. The control plates, which are used for calculating the log reduction were all within the given limits.

Product: UV-light  
Device: Blue Ocean Robotics  
Serial No.: Not provided  
Manufacturer: Blue Ocean Robotics ApS

### Experiment conditions

Test organisms:

#### Bacteria

*Staphylococcus aureus* ATCC 6538

*Enterococcus hirae* ATCC 10541

*Pseudomonas aeruginosa* ATCC 15442

*Escherichia coli* ATCC

#### Fungi

*Candida albicans* ATCC 10231

*Aspergillus brasiliensis* ATCC 16404

#### Bacteria spores

*Bacillus subtilis* ATCC 6633, Simicon,  
SPW8601-7. Lot. No. 12SU-W 10415/7.2

*Geobacillus stearothermophilus*  
ATCC 7953, Simicon, SPW8205-7-E,  
lot.no. 2ST-W10417/7.2

Exposure time:	5min. The exposure time was started after 10 min. of warming up the lamp. Exposure time was determined by a pre-test (enclosure 10-13)
Specifications for test room:	52m <sup>3</sup> No ventilation
Distance from device to organisms:	1.0 m ±0.1 m
Test temperature:	(25.5 ± 2) °C (enclosure 9)
Temperature sensor:	EL-USB-1, temperature data logger
Humidity:	35.5-51 %RH (enclosure 9)
Humidity sensor:	EL-USB 2, RH/temp data logger
Test surface:	1.4301 (EN 10088-1) stainless steel discs, 4 cm in diameter with Grade 2 B with finish on both sides (acc. EN 10088-2)
Incubation conditions:	
Bacteria:	(37 ± 1) °C for 48 hours at trypton soya agar (TSA)
<i>C. albicans</i> :	(30 ± 1) °C for 48 hours at malt extract agar (MEA)
<i>A. brasiliensis</i> :	(30 ± 1) °C for 120 hours at malt extract agar (MEA)
<i>B. subtilis</i> :	(30 ± 1) °C for 72 hours at glucose yeast extract agar (GYA)
<i>G. stearothermophilus</i> :	(56 ± 1) °C for 48 hours at trypton soya agar (TSA)

## Test Results

Test organism	Log reduction 5 min. 1 m distance	Log reduction which should be achieved acc. NF T72-281
<i>S. aureus</i>	6.38 ± 0.68	>5
<i>E. hirae</i>	≥ 6.96	>5
<i>P. aeruginosa</i>	5.73 ± 0.50	>5
<i>E. coli</i>	6.10 ± 0.01	>5
<i>C. albicans</i>	5.12 ± 1.38	>4
<i>A. brasiliensis</i>	1.60 ± 0.13	>4
<i>B. subtilis</i>	3.66 ± 0.40	>3
<i>G. stearothermophilus</i>	3.96 ± 0.50	No requirements Fx. >3 as the other bacteria spore

Table 1: The product has to achieve ≥ 5 log reduction for bacteria, ≥ 4 log reduction for fungi and ≥ 3 log reduction for bacteria spores. The results are given as the log reduction ± the standard deviation.

For all results, see Enclosure 1 – 9.

## Conclusion

It was possible to achieve ≥ 5 log reduction for all the bacteria and ≥ 4 log reduction for the yeast, *C. albicans*, during the given test conditions with an exposure time of 5 min. and a distance of 1m.

For the two bacteria spores, >3 log reduction was achieved.

For the fungi, *Aspergillus brasiliensis* it was not possible to achieve a >log 4 reduction with 5min. of exposure.

During the given test conditions with an exposure time of 5 min. and a distance of 1m, the UV Disinfection Robot is suitable against both bacteria, yeast and bacteria spores.

## Analysis method

The samples were analysed according to Danish Technological Institute's method: MA 700-03

Reference method: NF T72-281:2014.

## Revision 1

The conclusion for the two bacteria spores was corrected that there is consistent with the achieved results.

**Enclosure 1**

Exposure time / distance	5 min. at 1m of distance.
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Test suspension N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	5·10 <sup>7</sup> ≤ N ≤ 2·10 <sup>9</sup> 7.7 ≤ N ≤ 9.3 7.7 ≤ 8.17 ≤ 9.3 Accepted	N [cells/metal disc] Log(N)
<i>Staphylococcus aureus</i> ATCC 6538	10 <sup>-6</sup>	150	1.47·10 <sup>8</sup>		7.34·10 <sup>6</sup>
	10 <sup>-7</sup>	18	8.17		6.87
	10 <sup>-8</sup>	1	<1		

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T2)	T
<i>Staphylococcus aureus</i> ATCC 6538	10 <sup>-3</sup>	62	6.05·10 <sup>6</sup>	58	5.75·10 <sup>6</sup>	5.90·10 <sup>6</sup>
	10 <sup>-4</sup>	5	Accepted	5	Accepted	
	10 <sup>-5</sup>	<1	6.78	<1	6.76	
	10 <sup>-6</sup>	<1		<1		6.77

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 6.77
<i>Staphylococcus aureus</i> ATCC 6538	10 <sup>0</sup>	<1	<1	<1	Test 1	<1	0	≥ 6.77
	10 <sup>-1</sup>	<1	<1	<1	Test 2	15	1.18	5.59
	10 <sup>-2</sup>	<1	<1	<1	Test 3	<1	0	≥ 6.77
	10 <sup>-3</sup>	<1	<1	<1				
n'2 CFU/metal disc	10ml	<1	3	<1	Average	≤ 6	0.39	6.38 ± 0.68
	87ml	<1	12	<1				
		<1	<1	<1				

Calculated according to NF T72-281:2014, 5.6.6.

## Enclosure 2

Exposure time / distance	5 min. at 1m of distance.
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Test suspension_N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	5·10 <sup>7</sup> ≤ N ≤ 2·10 <sup>9</sup> 7.7 ≤ N ≤ 9.3	N [cells/metal disc] Log(N)
<i>Enterococcus hirae</i> ATCC 10541	10 <sup>-6</sup>	254	2.57·10 <sup>8</sup>	7.7 ≤ 8.41 ≤ 9.3	1.29·10 <sup>7</sup>
	10 <sup>-7</sup>	21	8.41	Accepted	7.11
	10 <sup>-8</sup>	4			

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T2)	T [cells/metal disc] Log(T)
<i>Enterococcus hirae</i> ATCC 10541	10 <sup>-3</sup>	71	8.25·10 <sup>6</sup>	99	1.01·10 <sup>7</sup>	9.11·10 <sup>6</sup>
	10 <sup>-4</sup>	7	Accepted	6	Accepted	
	10 <sup>-5</sup>	<1	6.92	2	7.00	6.96
	10 <sup>-6</sup>	<1	<1	<1	1	

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 6.96
<i>Enterococcus hirae</i> ATCC 10541	10 <sup>0</sup>	<1	<1	<1	Test 1	<1	0	≥ 6.96
	10 <sup>-1</sup>	<1	<1	<1	Test 2	<1	0	≥ 6.96
	10 <sup>-2</sup>	<1	<1	<1	Test 3	<1	0	≥ 6.96
	10 <sup>-3</sup>	<1	<1	<1				
n'2 CFU/metal disc	10ml	<1	<1	<1	Average	<1	0	≥ 6.96
	87ml	<1	<1	<1				

Calculated according to NF T72-281:2014, 5.6.6.

### Enclosure 3

Exposure time / distance	5 min. at 1m of distance.
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Test suspension N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	5·10 <sup>7</sup> ≤ N ≤ 2·10 <sup>9</sup> 7.7 ≤ N ≤ 9.3	N [cells/metal disc] Log(N)
<i>Pseudomonas aeruginosa</i> ATCC 15442	10 <sup>-6</sup>	>330	1.18·10 <sup>10</sup>	7.7 ≤ 10.1 ≤ 9.3*	5.90·10 <sup>8</sup>
	10 <sup>-7</sup>	>330	10.1	Accepted as the control discs are within the given limits	8.77
	10 <sup>-8</sup>	122	114		

\*See note on "deviation for test method", page 2

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T2)	T [cells/metal disc] Log(T)
<i>Pseudomonas aeruginosa</i> ATCC 15442	10 <sup>-3</sup>	>330	6.30·10 <sup>7</sup>	>330	>330	5.95·10 <sup>7</sup>
	10 <sup>-4</sup>	67	Accepted	62	51	Accepted
	10 <sup>-5</sup>	6	7.80	10	3	7.75
	10 <sup>-6</sup>	1	<1	1	1	7.78

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 7.78
<i>Pseudomonas aeruginosa</i> ATCC 15442	10 <sup>0</sup>	1	<1	13	>330*	>330*	4.90·10 <sup>1</sup>	1.69
	10 <sup>-1</sup>	1	<1	<1	>330*	>330*	2.53·10 <sup>2</sup>	2.40
	10 <sup>-2</sup>	<1	<1	<1	>330*	>330*	-	-
	10 <sup>-3</sup>	<1	<1	<1	<1	<1	-	-
n'2 CFU/metal disc	10ml	9	88	>165*	Average	1.51·10 <sup>2</sup>	2.05	5.73 ± 0.50
	87ml	40	165	>165*				
		<1	<1	20				

Calculated according to NF T72-281:2014, 5.6.6. \*Contamination of samples. Test 3 is not included in the calculation

**Enclosure 4**

Exposure time / distance	5 min. at 1m of distance.
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Test suspension N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	5·10 <sup>7</sup> ≤ N ≤ 2·10 <sup>9</sup> 7.7 ≤ N ≤ 9.3	N [cells/metal disc] Log(N)
<b>Escherichia coli ATCC 10536</b>	10 <sup>-6</sup>	>330	8.70·10 <sup>9</sup>	7.7 ≤ N ≤ 9.3*	4.35·10 <sup>8</sup>
	10 <sup>-7</sup>	>330	9.94	Accepted as control discs are within the given limits	8.64
	10 <sup>-8</sup>	89			

\*See note on "deviation for test method", page 2

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T2)	T
<b>Escherichia coli ATCC 10536</b>	10 <sup>-3</sup>	>330	3.50·10 <sup>8</sup>	>330	1.34·10 <sup>8</sup>	2.17·10 <sup>8</sup>
	10 <sup>-4</sup>	>330	Accepted	110	Accepted	
	10 <sup>-5</sup>	33	8.54	28	8.13	8.34
	10 <sup>-6</sup>	2	7	6	3	

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 8.34
<b>Escherichia coli ATCC 10536</b>	10 <sup>0</sup>	6	<1	3	Test 1	170	2.23	6.11
	10 <sup>-1</sup>	<1	<1	<1	Test 2	172	2.24	
	10 <sup>-2</sup>	<1	<1	<1	Test 3	176	2.25	
	10 <sup>-3</sup>	<1	<1	<1	<b>Average</b>	<b>173</b>	<b>2.24</b>	
n'2 CFU/metal disc	10ml 87ml	5 >165	7 >165	11 >165				<b>6.10 ± 0.01</b>

Calculated according to NF T72-281:2014, 5.6.6.

**Enclosure 5**

Exposure time / distance	5 min. at 1m of distance.
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Test suspension_N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	2·10 <sup>7</sup> ≤ N ≤ 1·10 <sup>8</sup> 7.3 ≤ N ≤ 8.0	N [cells/metal disc] Log(N)
<i>Candida albicans</i> ATCC 10231	10 <sup>-6</sup>	>330	4.00·10 <sup>8</sup>	7.3 ≤ N ≤ 8.0*	2.93·10 <sup>7</sup>
	10 <sup>-7</sup>	49	8.60	Accepted as control discs are within the given limits	7.47
	10 <sup>-8</sup>	2			

\*See note on "deviation for test method", page 2

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥ 1·10 <sup>5</sup> CFU/disc Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] ≥ 1·10 <sup>5</sup> CFU/disc Log(T2)	T [cells/metal disc] Log(T)
<i>Candida albicans</i> ATCC 10231	10 <sup>-1</sup>	>330	1.43·10 <sup>7</sup>	>330	8.65·10 <sup>6</sup>	1.11·10 <sup>7</sup>
	10 <sup>-2</sup>	>330	Accepted	>330	Accepted	
	10 <sup>-3</sup>	148	7.16	85	6.94	7.05

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 7.05
<i>Candida albicans</i> ATCC 10231	10 <sup>0</sup>	<1	<1	26	Test 1	6	0.78	6.27
	10 <sup>-1</sup>	<1	<1	3	Test 2	34	1.53	5.51
	10 <sup>-2</sup>	<1	<1	<1	Test 3	2.87·10 <sup>3</sup>	3.46	3.59
	10ml	1	4	100	<b>Average</b>	<b>1.73·10<sup>2</sup></b>	<b>2.24</b>	<b>5.12 ± 1.38</b>
	87ml	5	30	>165				
n'2 CFU/metal disc		<1	>1	>1				

Calculated according to NF T72-281:2014, 5.6.6.

**Enclosure 6**

Exposure time / distance	5 min. at 1.m of distance.
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Test suspension N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	$5 \cdot 10^6 \leq N \leq 1 \cdot 10^7$ $6.7 \leq N \leq 7.0$	N [cells/metal disc] Log(N)
<i>Aspergillus brasiliensis</i> ATCC 16404	10 <sup>-5</sup>	-*	9.89·10 <sup>6**</sup>	6.7 ≤ N ≤ 7.0	4.95·10 <sup>5**</sup>
	10 <sup>-6</sup>	3	7.00	Accepted as control discs are within the given limits	5.69
	10 <sup>-7</sup>	1			

\*The dilution was not made by mistake. \*\*Concentration of the test suspension is based on counting in microscope

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥ 1·10 <sup>5</sup> CFU/disc Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] ≥ 1·10 <sup>5</sup> CFU/disc Log(T2)	T [cells/metal disc] Log(T)
<i>Aspergillus brasiliensis</i> ATCC 16404	10 <sup>-1</sup>	>165	2.00·10 <sup>5</sup> Accepted	>165	2.30·10 <sup>5</sup> Accepted	2.14·10 <sup>5</sup>
	10 <sup>-2</sup>	21	19	21		
	10 <sup>-3</sup>	1	2	3	5.36	5.33

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 5.33
<i>Aspergillus brasiliensis</i> ATCC 16404	10 <sup>0</sup>	62	47	72	68	38	40	Test 1 3.75
	10 <sup>-1</sup>	10	10	10	9	7	5	Test 2 3.85
	10 <sup>-2</sup>	2	1	<1	2	<1	<1	Test 3 3.60
	10ml	>55	>55	>55	>55	>55	>55	
n'2 CFU/metal disc	87ml	>55	>55	>55	>55	>55	>55	
		3	7	1	Average	5.56·10 <sup>3</sup>	3.73	1.60 ± 0.12

Calculated according to NF T72-281:2014, 5.6.6.

## Enclosure 7

Exposure time / distance	5 min. at 1m of distance.
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Test suspension N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	2·10 <sup>5</sup> ≤ N ≤ 5·10 <sup>5</sup> 5.3 ≤ N ≤ 5.7 5.3 ≤ 5.30 ≤ 5.7 Accepted	N [cells/metal disc] Log(N)
<i>Bacillus subtilis</i> ATCC 6633	10 <sup>-3</sup>	215	1.97·10 <sup>5</sup>		9.86·10 <sup>3</sup>
	10 <sup>-4</sup>	22	5.30		3.99

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] Log(T2)	T [cells/metal disc] Log(T)
<i>Bacillus subtilis</i> ATCC 6633	10 <sup>0</sup>	82	6.75·10 <sup>3</sup>	105	8.90·10 <sup>3</sup>	7.75·10 <sup>3</sup>
	10 <sup>-1</sup>	12	Accepted	13	Accepted*	
	10 <sup>-2</sup>	3	3.83	1	3.95	3.89

\*Still possible to achieve >log3 reduction with a start concentration of log<sub>10</sub> = 3.89

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 3.89
<i>Bacillus subtilis</i> ATCC 6633	10 <sup>0</sup>	<1	<1	<1	Test 1	1	0.00	3.89
	10 <sup>-1</sup>	<1	<1	<1	Test 2	1	0.00	3.89
	10 <sup>-2</sup>	<1	<1	<1	Test 3	5	0.70	3.19
	10ml	<1	<1	<1	Average	5.56·10 <sup>3</sup>	3.73	3.66 ± 0.40
n'2 CFU/metal disc	87ml	1	1	5				
		<1	<1	<1				

Calculated according to NF T72-281:2014, 5.6.6.

**Enclosure 8**

Exposure time / distance	5 min. at 1m of distance.
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Test suspension N	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	2·10 <sup>6</sup> ≤ N ≤ 5·10 <sup>6</sup> 5.3 ≤ N ≤ 5.7 6.3 ≤ 6.47 ≤ 6.7 Accepted	N [cells/metal disc] Log(N)
<i>Geobacillus stearothermophilus</i> ATCC 7953	10 <sup>-4</sup>	>330	2.95·10 <sup>6</sup>		1.34·10 <sup>5</sup>
	10 <sup>-5</sup>	29	6.47	Accepted	5.13

Control plates	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥1·10 <sup>5</sup> CFU/disc Log(T1)	Microbial count of plates T2	T2: [cells/metal disc] ≥1·10 <sup>5</sup> CFU/disc Log(T2)	T [cells/metal disc] Log(T)
<i>Geobacillus stearothermophilus</i> ATCC 7953	10 <sup>0</sup>	>330	1.55·10 <sup>5</sup>	105	1.69·10 <sup>5</sup>	1.62·10 <sup>5</sup>
	10 <sup>-1</sup>	157	Accepted	13	Accepted	
	10 <sup>-2</sup>	12	5.19	1	5.23	5.21

Test	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Microbial count of plates Test 3	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 5.21
<i>Geobacillus stearothermophilus</i> ATCC 7953	10 <sup>0</sup>	<1	<1	1	Test 1	4	0.60	4.61
	10 <sup>-1</sup>	<1	<1	<1	Test 2	17	1.23	3.98
	10 <sup>-2</sup>	<1	<1	<1	Test 3	39	1.59	3.62
	10ml 87ml	1 3	<1	2 17	Average	5.56·10 <sup>3</sup>	3.73	3.96 ± 0.50
n'2 CFU/metal disc		<1	<1	<1				

Calculated according to NF T72-281:2014, 5.6.6.

## Enclosure 9

Test organism	Temperature	Humidity
<i>S. aureus</i>	27.5 °C	36.0 %RH
<i>E. hirae</i>	23.5 °C	48.0 % RH
<i>P. aeruginosa</i>	23.5 °C	48.0 % RH
<i>E. coli</i>	25.0 °C	51.0 %RH
<i>C.albicans</i>	25.0 °C	51.0 %RH
<i>A. brasiliensis</i>	27.0 °C	42.5 %RH
<i>B. subtilis</i>	27.5 °C	35.5 %RH
<i>G. stearothermophilus</i>	27.5 °C	35.5 %RH

Temperature and humidity were measured with EL-USB-1temp data logger. The measurements were started after 10 min. of warming up the lamp.

## Enclosure 10

Pre-test to determine the optimal exposure time

Exposure time / distance	10 sec., 20 sec. 40 sec., 75 sec., 150 sec. and 300 sec. at 3m of distance.
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Test suspension N <i>Enterococcus hirae</i> ATCC 10541	Dilutions	Microbial count of plates	N [cells/ml] Log(N)	5·10 <sup>7</sup> ≤ N ≤ 2·10 <sup>9</sup> 7.7 ≤ N ≤ 9.3 7.7 ≤ 8.29 ≤ 9.3 Accepted	N [cells/metal disc] Log(N)
	10 <sup>-6</sup>	196	189	1.95·10 <sup>8</sup>	
10 <sup>-7</sup>	26	17	8.29		6.99
10 <sup>-8</sup>	2	<1			

Control plates <i>Enterococcus hirae</i> ATCC 10541	Dilutions	Microbial count of plates T1	T1: [cells/metal disc] ≥ 1·10 <sup>6</sup> CFU/disc Log(T1)	T [cells/metal disc] Log(T)
	10 <sup>-3</sup>	96	75	8.55·10 <sup>6</sup>
10 <sup>-4</sup>	13	5	Accepted	
10 <sup>-5</sup>	<1	2	6.93	6.93
10 <sup>-6</sup>	<1	<1		

Pre-test 1 <i>Enterococcus hirae</i> ATCC 10541	Dilutions/ Filtration volume	Microbial count of plates Test 1	Microbial count of plates Test 2	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 6.93
10 sec. of exposure	10 <sup>0</sup>	>330	>330	>330	>330	6.42	0.51
	10 <sup>-1</sup>	>330	>330	>330	>330	6.73	0.20
	10 <sup>-2</sup>	262	256	>330	>330		
	10 <sup>-3</sup>	25	37	46	61		
n'2: CFU/metal disc	10ml	>165	>165	>165	3.99·10 <sup>6</sup>	6.57	0.36 ± 0.22
	87ml	>165	>165	>165	100		
Calculated according to NF T72-281:2014, 5.6.6.		100	100				

## Enclosure 11

Pre-test to determine the optimal exposure time

Exposure time / distance	10 sec., 20 sec. 40 sec., 75 sec., 150 sec. and 300 sec. at 3m of distance.
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Pre-test 2 <i>Enterococcus hirae</i> ATCC 10541	Dilutions/ Filtration volume	Microbial count of plates Test 1		Microbial count of plates Test 2		Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 6.93
		>330	>330	>330	>330				
20 sec. of exposure	10 <sup>0</sup>	>330	>330	>330	>330	Test 1	6.10·10 <sup>5</sup>	5.78	1.15
	10 <sup>-1</sup>	>330	>330	>330	>330	Test 2	3.85·10 <sup>5</sup>	5.59	1.35
	10 <sup>-2</sup>	60	60	>330	>330				
	10 <sup>-3</sup>	6	6	46	61				
n'2: CFU/metal disc Calculated according to NF T72-281:2014, 5.6.6.	10ml	1		4		Average	4.93·10 <sup>5</sup>	5.68	1.25 ± 0.14
	87ml	>165	>165	>165	>165				
		100	100	100	100				

Pre-test 3 <i>Enterococcus hirae</i> ATCC 10541	Dilutions/ Filtration volume	Microbial count of plates Test 1		Microbial count of plates Test 2		Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 6.93
		>330	>330	>330	>330				
40 sec. of exposure	10 <sup>0</sup>	>330	>330	>330	>330	Test 1	1.96·10 <sup>6</sup>	6.29	0.64
	10 <sup>-1</sup>	>330	>330	>330	>330	Test 2	1.43·10 <sup>6</sup>	6.16	0.78
	10 <sup>-2</sup>	205	186	135	145				
	10 <sup>-3</sup>	20	21	17	18				
n'2: CFU/metal disc Calculated according to NF T72-281:2014, 5.6.6.	10ml	>165	>165	>165	>165	Average	1.70·10 <sup>6</sup>	6.22	0.71 ± 0.01
	87ml	>165	>165	>165	>165				
		100	100	100	110				

## Enclosure 12

Pre-test to determine the optimal exposure time

<b>Exposure time / distance</b>	10 sec., 20 sec. 40 sec., 75 sec., 150 sec. and 300 sec. at 3m of distance.
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Pre-test 4 <i>Enterococcus hirae</i> ATCC 10541	Dilutions/ Filtration volume	Microbial count of plates Test 1		Microbial count of plates Test 2	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 6.93
		>330	>330					
75 sec. of exposure	10 <sup>0</sup>	>330	>330	>330	Test 1	7.75·10 <sup>5</sup>	5.89	1.04
	10 <sup>-1</sup>	>330	>330	>330	Test 2	3.95·10 <sup>5</sup>	5.60	1.33
	10 <sup>-2</sup>	75	80	39				
	10 <sup>-3</sup>	7	8	1				
	10ml 87ml	>165 >165	>165 >165	>165 >165	<b>Average</b>	<b>5.85·10<sup>5</sup></b>	<b>5.74</b>	<b>1.19 ±0.21</b>
n'2: CFU/metal disc		20	26					

Calculated according to NF T72-281:2014, 5.6.6.

Pre-test 5 <i>Enterococcus hirae</i> ATCC 10541	Dilutions/ Filtration volume	Microbial count of plates Test 1		Microbial count of plates Test 2	Result	n'1+n'2	Log(n'1+n'2)	Log reduction T = 6.93
		16	21					
150 sec. of exposure	10 <sup>0</sup>	16	21	5	Test 1	2.12·10 <sup>3</sup>	3.33	3.61
	10 <sup>-1</sup>	2	1	<1	Test 2	2.18·10 <sup>2</sup>	2.34	4.59
	10 <sup>-2</sup>	<1	<1	<1				
	10 <sup>-3</sup>	<1	<1	<1				
	10ml 87ml	100 >165	100 >165	53 >165	<b>Average</b>	<b>1.17·10<sup>3</sup></b>	<b>2.83</b>	<b>4.10 ±0.70</b>
n'2: CFU/metal disc		1	<1					

Calculated according to NF T72-281:2014, 5.6.6.

## Enclosure 13

Pre-test to determine the optimal exposure time

<b>Exposure time / distance</b>	10 sec., 20 sec. 40 sec., 75 sec., 150 sec. and 300 sec. at 3m of distance.
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<b>Pre-test 6</b> <i>Enterococcus hirae</i> ATCC 10541	<b>Dilutions/ Filtration volume</b>	<b>Microbial count of plates Test 1</b>	<b>Microbial count of plates Test 2</b>	<b>Result</b>	<b>n'1+n'2</b>	<b>Log(n'1+n'2)</b>	<b>Log reduction T = 6.93</b>
<b>300 sec. of exposure</b>	10 <sup>0</sup>	2	1	2	1.94·10 <sup>2</sup>	2.29	4.64
	10 <sup>-1</sup>	<1	<1	<1	1.90·10 <sup>2</sup>	2.28	4.65
	10 <sup>-2</sup>	<1	<1	<1			
	10 <sup>-3</sup>	<1	<1	<1			
	10ml 87ml	21 >165	24 >165	24 >165	<b>Average</b>	<b>1.92·10<sup>2</sup></b>	<b>2.28</b>
n'2: CFU/metal disc Calculated according to NF T72-281:2014, 5.6.6.	8	1	1				

### Conclusion on pre-test

The pre-test was performed with a distance of 3m, according to NF T72-281, annex B.

However, using the robot, it will drive around in a room 1 meter away from all surfaces. The size of the room is therefore also irrelevant, as the distance between the surface and the UV Disinfection Robot always will 1meter.

It was therefore decided to test the effect at 1meter distance and an exposure time of 5min., as the pre-test showed that there was a significantly better effect a 5min (300 sec.) compared to 150 sec.