



Test Report No. 1.6/ČP/22/19

Measurement of the number of particles of determinate aerosol in air

<u>Expertise No.:</u>	EX 221361, SZÚ/15078/2022
<u>Customer:</u>	VYRTYCH a. s., Židněves 116, 294 06 Březno
<u>Date of measurement:</u>	3. – 4.11.2022
<u>Reason of measurement:</u>	Verification of luminaires for clean rooms – Manufacturer VYRTYCH a.s.
<u>Place of measurement:</u>	Operating room Klinika Dr. Pírka, Mladá Boleslav
<u>Measurement performed by:</u>	Ing. Z. Mathauserová, J. Kořízková - NIPH

Test method and evaluation

The test method of measuring dustiness in clean rooms was used, i. e. determining of the number of solid aerosol particles with dimensions $\geq 0,5 \mu\text{m}$ and $\geq 5,0 \mu\text{m}$ accordance to Annex B of ČSN EN ISO 14644-1:2019 Cleanrooms and associated controlled environments - Part 1: Classification of air cleanliness by particle concentration and accordance to the document of the Laboratory for Physical Factors – SOP No.2/1.6 Determination of cleanliness classes defined cleanroom.

One measurement (one data reading on the measuring device) is a two-minute sampling of air at an air flow through a particle counter of $1 \text{ft}^3 / \text{min}$ - the results are converted to a volume of 1m^3 of air according to the requirements of the standard

A clean room without installed item-by-item luminaires was monitored, after verifying the cleanliness class of the operating room, luminaires *FILA-N-LED-2,21-OP-10000-236-4K*, *NORD-N-LED-CG-5100-236-G2-4K*, *NORD-N-LED-OPG-10000-236-G2-4K*, *BORDER-N-LED-SQ-OP-7000-4K*, *ODIS-LED-SQ-OP-7600-4K*, *HOOVER/3-LED-SQ-MP-7100-4K*, *HOOVER/3-LED-SQ-GLM-7100-4K*, *HOOVER4-LED-SQ-OP-6100-4K*, *HOOVER4-LED-SQ-MP-6100-4K*, *HOOVER4-LED-SQ-GLM-6100-4K*, *HOUND/3-MAG-LED-SQ-GLM-5100-4K*, *HOUND4-MAG-LED-SQ-GLM-5300-4K* were placed and turned on. After an hour of operation of the luminaires, repeated measurement of the number of particles of determinate aerosol in air was performed - the conclusion follows from the comparison of the obtained data.

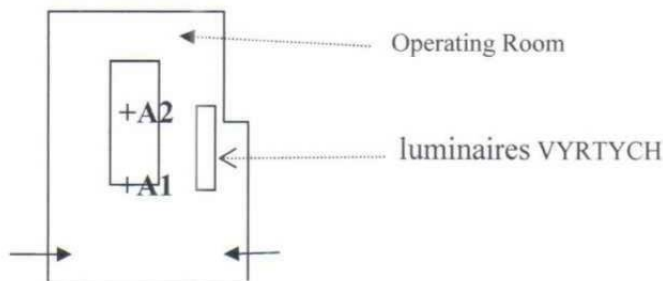
Used equipment:

Particle counter - CI-200 model, serial No. 034316, CC No. 6014-KL-C0067-21 from 23. 11. 2021, which determines and registers numbers of dust particles in 6 dimension intervals from $0,2$ to $10 \mu\text{m}$.

Place of measurement was a clean room of the operating room with a verified cleanliness class 5 under the laminar air supply (except for the laminar cleanliness class 4/5) according to ČSN EN ISO 14644-1. The measurement took place "at rest", i.e. without no personnel present in the room.

Measurement results:

In Tab. 1 are the requirements for a clean room of cleanliness class 4 and 5 according to ČSN EN ISO 14644-1, Tab. 2 - 5 shows the measured values of the number of particles of determinate aerosol.



Scheme measurement

Tab. 1: Requirements for cleanliness air according to ČSN EN ISO 14644-1 and Decree No. 84/2008 Coll.

Cleanliness classes of air (at rest)	Number of particles in 1m ³ of air	
	≥ 0,5 μm	≥ 5,0 μm
4	352	-
5	3 520	29

Tab. 2: Measured values of the number of solid aerosol particles in the operating field where the luminaires *FILA-N-LED-2,21-OP-10000-236-4K*, *NORD-N-LED-CG-5100-236-G2-4K*, *NORD-N-LED-OPG-10000-236-G2-4K* were placed (3.11.2022).

Before installing the luminaire				After installing the luminaire			
A1		A2		A1		A2	
Number of particles in 1ft ³ of size and larger 0,5 μm		Number of particles in 1ft ³ of size and larger 5,0 μm		Number of particles in 1ft ³ of size and larger 0,5 μm		Number of particles in 1ft ³ of size and larger 5,0 μm	
4	0	6	1	3	0	4	1
5	1	8	1	3	0	4	1
4	0	2	0	6	0	6	1
3	0	2	0	4	0	2	0
4	1	4	1	3	1	3	0
4	0	4	1	4	0	4	1
Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³	
141	14	145	21	125	10	125	21

Note. Due to the very low measured values and the nature of test, uncertainty of measurement was not determined.



Tab. 3: Measured values of the number of solid aerosol particles in the operating field where the luminaires *BORDER-N-LED-SQ-OP-7000-4K*, *ODIS-LED-SQ-OP-7600-4K*, *HOOVER/3-LED-SQ-MP-7100-4K* were placed (3.11.2022).

Before installing the luminaire				After installing the luminaire			
A1		A2		A1		A2	
Number of particles in 1ft ³ of size and larger 0,5 µm		Number of particles in 1ft ³ of size and larger 5,0 µm		Number of particles in 1ft ³ of size and larger 0,5 µm		Number of particles in 1ft ³ of size and larger 5,0 µm	
5	0	8	1	3	0	4	0
6	1	6	0	3	0	7	2
4	0	2	0	1	0	7	1
3	0	4	2	4	0	3	0
5	1	3	0	8	1	2	0
5	0	5	1	5	0	5	1
Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³	
171	14	153	21	171	10	153	21

Note: Due to the very low measured values and the nature of test, uncertainty of measurement was not determined.

Tab. 4: Measured values of the number of solid aerosol particles in the operating field where the luminaires *HOOVER/3-LED-SQ-GLM-7100-4K*, *HOOVER4-LED-SQ-OP-6100-4K*, *HOOVER4-LED-SQ-MP-6100-4K* were placed (4.11.2022).

Before installing the luminaire				After installing the luminaire			
A1		A2		A1		A2	
Number of particles in 1ft ³ of size and larger 0,5 µm		Number of particles in 1ft ³ of size and larger 5,0 µm		Number of particles in 1ft ³ of size and larger 0,5 µm		Number of particles in 1ft ³ of size and larger 5,0 µm	
6	0	2	0	3	0	4	0
4	1	3	0	3	0	2	1
2	0	2	0	2	0	2	1
3	0	3	0	4	0	3	0
5	0	2	1	6	1	3	0
4	0	2	0	4	0	3	0
Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³	
141	7	85	7	128	10	99	14



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Tab. 5: Measured values of the number of solid aerosol particles in the operating field where the luminaires *HOOVER4-LED-SQ-GLM-6100-4K*, *HOUND/3-MAG-LED-SQ-GLM-5100-4K*, *HOUND4-MAG-LED-SQ-GLM-5300-4K* were placed (4.11.2022).

Before installing the luminaire				After installing the luminaire			
A1		A2		A1		A2	
Number of particles in 1ft ³ of size and larger 0,5 µm		Number of particles in 1ft ³ of size and larger 5,0 µm		Number of particles in 1ft ³ of size and larger 0,5 µm		Number of particles in 1ft ³ of size and larger 5,0 µm	
4	0	7	1	3	1	4	0
6	1	2	1	3	0	6	0
2	0	5	0	1	0	6	2
3	0	1	0	4	0	2	0
5	1	4	1	6	1	3	1
5	0	4	1	3	0	4	1
Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³		Number of particles in 1 m ³	
171	14	138	21	113	14	148	21

Measurement of the number of particles of determinate aerosol in air



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Date: 8. 12. 2022

Prepared by and approved: Ing. Z. Mathauserová
Technical head of Laboratory

END OF TEST REPORT





Statement on the Test Report No. 1.6/MKL/22/19

Measurement of the number of particles of determinate aerosol in air for the purpose of verification of luminaires manufactured by VYRTYCH a.s. for clean rooms

Expertise No.: EX 221361, SZÚ/15078/2022

Date of measurement: 3. – 4. 12. 2022

CONCLUSION

Installed luminaires FILA-N-LED-2,21-OP-10000-236-4K, NORD-N-LED-CG-5100-236-G2-4K, NORD-N-LED-OPG-10000-236-G2-4K, BORDER-N-LED-SQ-OP-7000-4K, ODIS-LED-SQ-OP-7600-4K, HOOVER/3-LED-SQ-MP-7100-4K, HOOVER/3-LED-SQ-GLM-7100-4K, HOOVER4-LED-SQ-OP-6100-4K, HOOVER4-LED-SQ-MP-6100-4K, HOOVER4-LED-SQ-GLM-6100-4K, HOUND/3-MAG-LED-SQ-GLM-5100-4K, HOUND4-MAG-LED-SQ-GLM-5300-4K were not a source of pollution of clean room, during their operation did not release any solid aerosol particles into the clean room air. Due to its identical construction, used materials and the installation procedure into the ceiling of the clean room are recessed luminaires of the entire product type FILA-N-LED, NORD-N-LED, BORDER-N-LED, HOOVER/3-LED, HOOVER4-LED, HOUND/3-MAG-LED, HOUND4-MAG-LED, ODIS-LED suitable for use in all types of clean rooms.

8. 12. 2022

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