

Halton UVGI

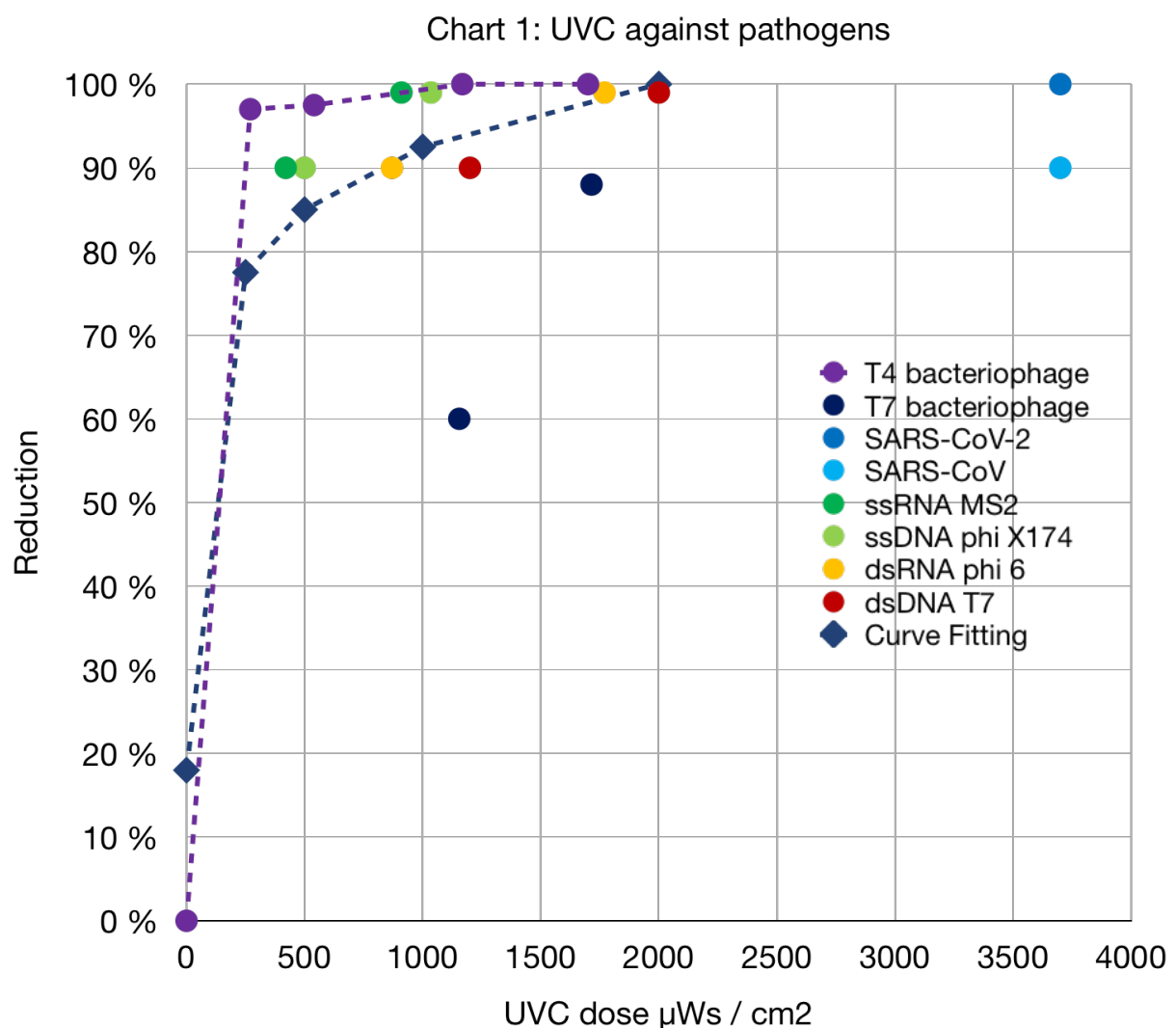
Halton Marine Solutions for Virus Mitigation on Board



UVGI operating principle

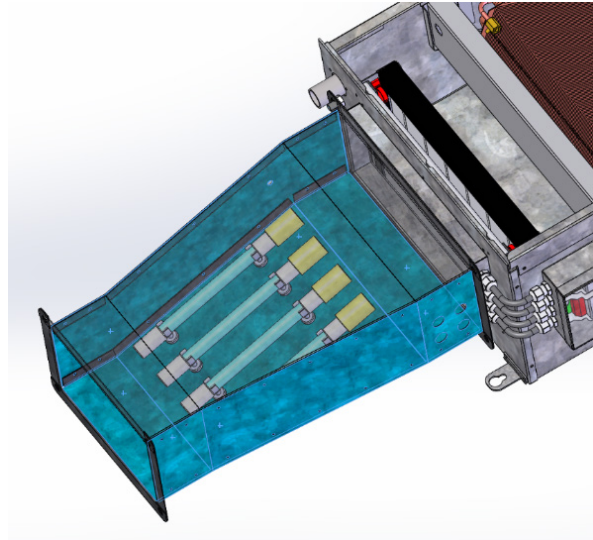
Ultraviolet-C (UVC) radiation (253 nm wavelength) can be used to destroy harmful pathogens and microorganisms, such as bacteria and viruses, from air and surfaces. This technology is also referred to as Ultraviolet Germicidal Irradiation (UVGI). Pathogens are highly susceptible to UVC radiation, and even small doses of radiation can reduce bacteria and viruses. Radiation dose is a factor of radiation power, distance to radiation (surface area) and residence time. In Halton Marine UVGI solutions, the UVC tubes are installed inside the air duct. The UVC tubes have been tested against test pathogens at the University of Helsinki. [1]

The chart (Chart 1) is showing the reduction rate of the different pathogens [2, 3, 4] depending on the UVC radiation dose. A reduction rate of 100 % means that all viruses are inactivated. The purple dashed line represents the measurements of the Halton Marine UVGI air purification test device [1]. The blue dashed line represents simulated performance.



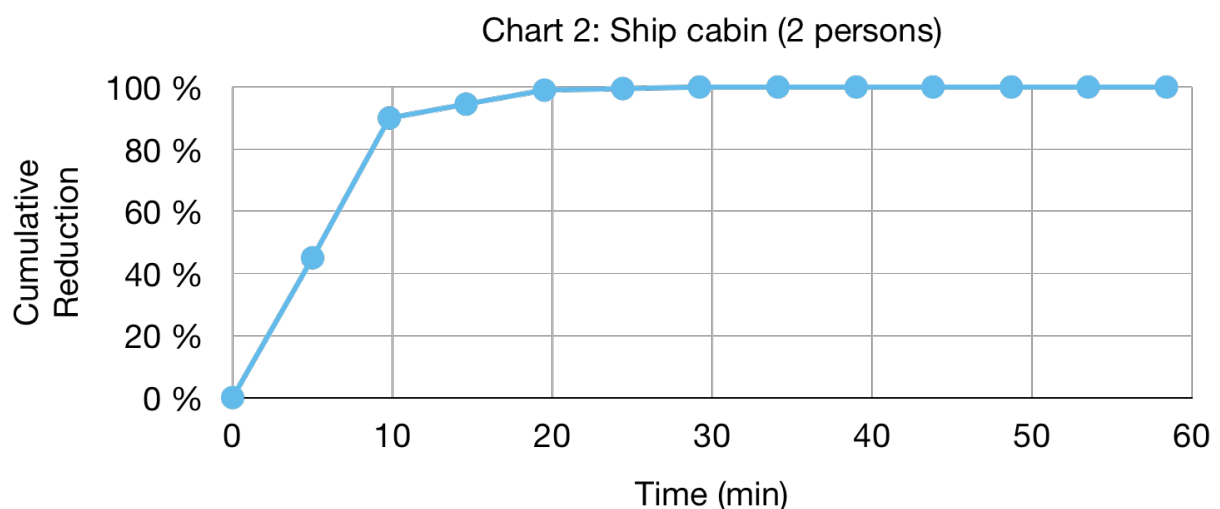
UVGI Device for Cabin FCU

The UVGI device is installed in the recirculation air duct in connection with the fancoil unit (FCU). Once the UVGI device is installed, the air in the cabin circulates through the UVC radiation zone. The dimensions of the device can be, for example, 420 mm (length) x 240 mm (width) x 115 mm (height). The dimensions can be customized according to the size of the duct and FCU. For retrofits, it is also possible to deliver standalone UVC lamps with magnetic attachment clips. Service (UV-Tube replacement) takes place through the opening of the FCU filter. The ballast and controls are located on the side of the FCU. The UVC tubes produce a wavelength of 253 nm and, according to measurements made by VTT Technical Research Centre of Finland, no ozone is generated.



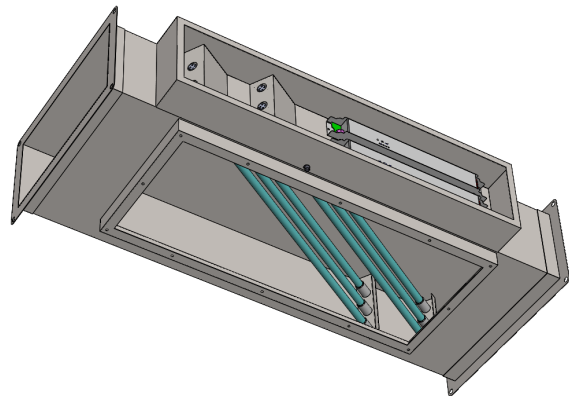
A simulated example of performance

The chart (Chart 2) depicts a 2-person ship cabin with a volume of 33.8 m³. The airflow is recirculated through the FCU at a rate of 0.058 m³/s. The time required to circulate full air volume through the FCU and UVGI device is 10 minutes (6 changes per hour). The UVC radiation power is 10.8 W (4 x 2.7 W). An airflow velocity of 2.1 m/s gives a residence time of 0.2 seconds in the UVC radiation zone. The UVC dose is 762 μ Ws / cm². The single-pass virus reduction rate is about 90 %. After 24 minutes, a reduction rate of 99 % is achieved (Log2).



UVGI Device for Public Area FCU

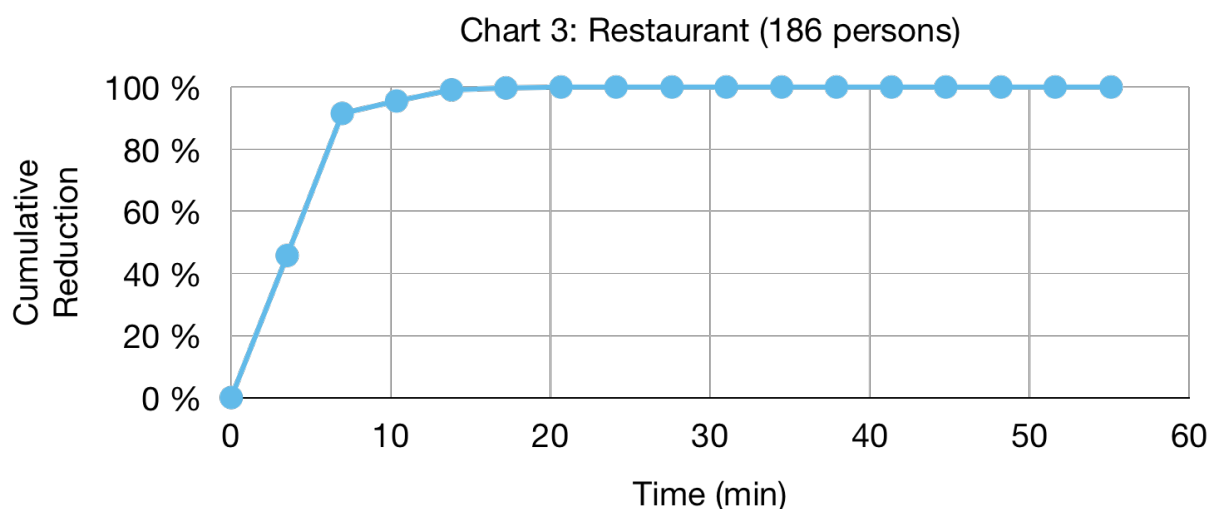
The UVGI device is installed in the recirculation air duct in connection with the fancoil unit (FCU). Once the UVGI device is installed, the air in the room circulates through the UVC radiation zone. Open doors or corridors may affect the reduction performance. The dimensions of the device can be, for example, 1000 mm (length) x 350 mm (width) x 170 mm (height). The dimensions can be customized according to the size of the



duct and FCU. Service (UV-Tube replacement) takes place through the service hatch. The ballast and controls are located on the side of the UVGI device. The UVC tubes produce a wavelength of 253 nm and, according to measurements made by VTT Technical Research Centre of Finland, no ozone is generated.

A simulated example of performance

The chart (Chart 3) depicts a restaurant with a capacity of 186 people. The restaurant has a volume of 1,203 m³. The airflow is recirculated through the FCU at a rate of 0.833 m³/s. The UVGI devices are installed in parallel (2 devices per FCU). The time required to circulate full air volume through the FCU and UVGI device is 5.5 minutes (11 changes per hour). The UVC radiation power is 66 W (6 x 11 W). An airflow velocity of 7.0 m/s gives a residence time of 0.14 seconds in the UVC radiation zone. The UVC dose is 906 μ Ws / cm². The single-pass virus reduction rate is about 91 %. After 14 minutes, a reduction rate of 99 % is achieved (Log2).



Sources

1. Asplund, A., et al., Virus inactivation in Halton Marine UVGI air purification test device
2. Biasin, M., et al., UVC irradiation is highly effective in inactivating SARS-CoV-2 replication
3. Chun-Chieh Tseng, Chih-Shan Li, Inactivation of virus-containing Aerosols by Ultraviolet Germicidal Irradiation
4. Hessling, M., et al., Ultraviolet irradiation doses for coronavirus inactivation - review and analysis of coronavirus photoinactivation studies

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About us

Halton Marine

Halton Marine, one of the world's leading suppliers of marine HVAC, develops, manufactures and markets reliable, high-quality ventilation solutions specifically designed for different types of ships, offshore oil & gas, heavy industry and offshore wind. Our track record includes deliveries to over 150 major cruise ships, 200 oil & gas projects and 100 naval vessels.

Halton Group

Halton Group specializes in indoor environment solutions, ranging from public and commercial buildings to foodservice facilities. Founded in Finland in 1969, Halton operates today in over 35 countries around the world, with annual sales of €220 million and over 1600 employees. The company has production facilities in Brazil, Canada, China, France, Finland, Germany, Malaysia, the United Kingdom, and the USA.