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The Bactericidal Irradiators

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Abstract

This article describes the irradiators are designed for disinfection of air and surfaces areas with a high risk of spreading germs. Disinfection of surfaces and air in the room is due to the effect on microorganisms bactericidal UV radiation with a wavelength of 253.7 nm. Inactivation of microorganisms is due to the messages they are a sufficient dose of UV radiation. The exposure dose or the amount of energy supplied to microorganisms is the main characteristic of the installation of UV disinfection. This equipment ensures the implementation of sanitary-epidemiological norms in the air, significantly reducing the concentration of microorganisms in the air. This allows, first, to significantly reduce the incidence of persons in the premises, and to improve the quality of finished products and raw materials in production, to reduce the number of chemicals used in traditional methods of disinfection of the premises.

Keywords: Irradiation, UV light, Time, Air, Surface, Bactericidal radiation, The radiation dose, Wavelength.

1. Introduction

Irradiators are designed for disinfection of air and surfaces areas with a high risk of transmission of pathogens in health-care, preschool, school, industrial and public organisations and other the premises with the aim of reducing the number of airborne and on the surfaces of microorganisms and prevention of infectious diseases in the absence of people. Climatic design of the irradiator - UHL category 4.2 according to GOST 15150 when the ambient temperature is in the range from +10 ° C to +35 ° C, relative humidity up to 80% at a temperature of +25ºC.

When exposed to ultraviolet (UV) radiation on living organisms, there is an optimum for their inactivation the wavelength range from 250 to 266 nm [1].

Disinfection of surfaces and air in the room is due to the effect on microorganisms bactericidal UV radiation with a wavelength of 253.7 nm. Inactivation of microorganisms is due to the messages they are a sufficient dose of UV radiation [2, 3]. Dose D or the amount of energy supplied to microorganisms is the main characteristic of the installation of UV disinfection. It is equal to the product of the average intensity of UV irradiation, the I is on the average time under irradiation of the t is:

$$D = \langle I \rangle \cdot \langle t \rangle$$

where, D - is the dose of UV radiation, I - is the average intensity of UV radiation, t - is average time spent under irradiation.

Main parameters and technical characteristics of the equipment are presented in table # 1.

The irradiator is made of stainless steel and consists of a housing that has a UV lamp and fence elements, lamp, which protects them from mechanical damage. The rails are designed to move the installation. The set time operation using the remote control. Inside posted by electronic ballasts (ballasts). To move the irradiator housing has wheels. To connect the feed to the network is a cable with RCD. In an unusable state for protection against dusts tissue protective case. Before turning on the UV lamp protective cover must be removed.

The control panel consists of 6-digit digital display and 4 buttons:

- The inclusion of UV lamp
- Time between
- Increase time of exposure
- Reducing the time of exposure

The display is intended to display the modes of operation of the irradiator: time, trouble code, the exposure time, the time countdown to turn on the UV lamp and the session is complete disinfection.

Table-1. Specifications

№ p/p	The name of the parameter	SVETOLIT-200	SVETOLIT-400	SVETOLIT-300	SVETOLIT-600
	Overall dimensions, mm, not more Height Width Length	 1325 460 460			
	Weight, kg, not more	23,5	26,0	24,3	28,0
	The supply voltage	220±10%			
	The frequency of the supply voltage, Hz	50-60			
	Type of current	single-phase			
	Power consumption, W, not more	600	1200	1000	2000
	Capacity, m^3/h, not less	1400	2800	2400	4800
	Bactericidal flow, W	200	400	300	600
	The irradiance at a distance of 1 m from the irradiator, W/m^2, not less than	12,0	21,3	18,0	35,5
	The service life of the UV lamp, hour , not less	12 000			
	Number of on/off UV lamps for life, time, not more than	5 000			
	The number of lamps	2	4	2	4

The operation of the irradiator should be subject to security measures, and taking into account requirements for irradiators open type according to P 3.5.1904-04 Ministry of health of the Russian Federation "The Use of ultraviolet germicidal radiation for disinfection of air and surfaces in the premises". Before you begin you must ensure that there are no people, animals, living plants in the room in which it is necessary to conduct decontamination. During the session over the entrance to the premises to enable light displays: "Do Not enter. Is ultraviolet irradiation or post a sign warning about the course of the process of UV irradiation in this area. The irradiator is subject to all the safety requirements when operating electrical power which is supplied with voltage of 220 V and a frequency of 50-60 Hz. The walls and ceiling in the premises, which are processed irradiators must be made of materials that are resistant to ultraviolet radiation. During operation, the bulb UV lamp is heated to a high temperature (100-110°C). Be careful when working with feed in order to avoid burns.

To achieve the most effective disinfection of air and surfaces in the room, the irradiator should be placed in the room so that the spread of UV radiation was as few obstacles as possible.

The irradiation is performed depending on the type of premises and the level of bactericidal efficiency:

• areas categories I - operating, preoperative, maternity, premises centralized sterilization departments, children's wards of hospitals, and wards for premature and injured children of 99.9%;

• space category II - dressing rooms, rooms for sterilization and pasteurization breast milk, chambers and offices for immunolabeling patients, wards intensive care units, bacteriological and virological laboratory of the blood transfusion station, a pharmaceutical plant - 99%;

• space category III - Commerce, offices and other premises of medical institutions, not related to categories I and II - 95%;

• space category IV - children's playrooms, classrooms, home, industrial premises and public buildings with a high concentration of people with long - term stay of 90%;

• space category V - Smoking rooms, public toilets, staircases - 85%.

Choose the duration of the session disinfection to achieve a desired germicidal effectiveness and recommended time irradiator depending on area and level of bactericidal efficiency are shown in tables #2 and #3.

Table-2. The time of irradiation for disinfection of premises I and II categories depending on the volume of the room.

The room volume, m^3	SVETOLIT -200		SVETOLIT -300		SVETOLIT -400		SVETOLIT -600	
	99%	99,9%	99%	99,9%	99%	99,9%	99%	99,9%
100	3	4	-	-	-	-	-	-
150	4	6	3	4	-	-	-	-
200	6	8	4	5	3	4	-	-
250	7	10	4	7	4	5	-	-
300	8	12	5	8	4	6	3	4

Table-3. The time of irradiation for disinfection of premises III, IV and V categories depending on the volume of the room.

The room volume, m^3	SVETOLIT -200			SVETOLIT -300			SVETOLIT -400			SVETOLIT -600		
	85%	90%	95%	85%	90%	95%	85%	90%	95%	85%	90%	95%
300	3	4	5	2	3	4	-	1	2	-	-	-
500	4	5	7	3	4	5	2	3	4	-	2	3
1000	9	11	14	6	7	9	4	5	7	3	4	5

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