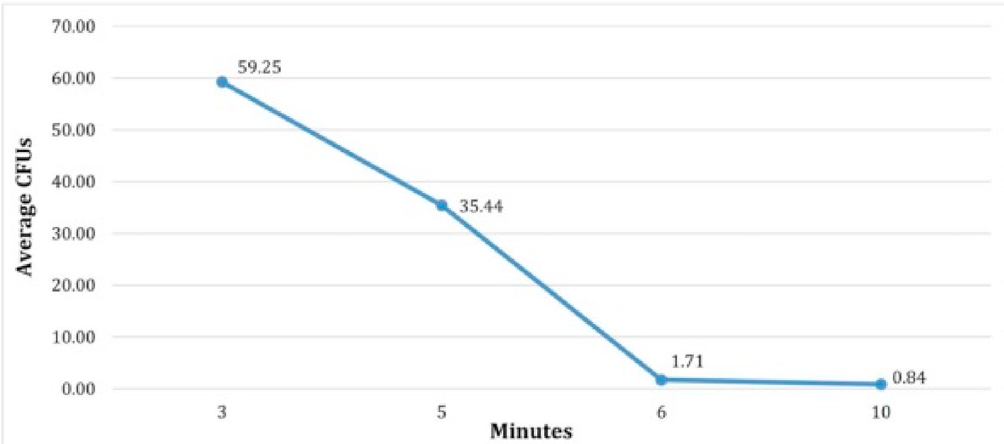
UV Irradiation Time Duration

At a 12 inch distance between the lamp and the surface being cleaned, effective cleaning is achieved between 6 and 10 minutes. There is a 66% increase in cleaning effectiveness between 6 and 10 minute durations. Lowering the distance between the cleaning surface and lamp will shorten the duration time required. At a 1 inch distance, time duration can be lowered to 1-2 minutes.



*Culture data not shown

UV Irradiation Dosage Table

Tests conducted by Light Sources Inc - Orange, CT and verified by American Ultraviolet Company - Lebanon, IN revealed that the American-Lights® lamp produces 800μW/cm² @ 1' with 534FPM air flow at 55º F. UV dose = UV intensity x time in seconds. To compute time needed to inactivate germs in the following chart at 1' distance divide the UV dose by 800. **Example:** for 90% kill factor of Bacillus subtilis spores: 11,600 divided by 800 = 14.5 seconds.

Please note that many variables (air flow, humidity, distance of microorganism to the UV light, irradiation time) take place in a real world environment that make actual calculating of the UV dosage very difficult. However, it is proven that UV light will kill any DNA-based microorganism given enough UV dosage. UV breaks down DNA on a cumulative basis. Microorganisms multiply rapidly if not controlled.

The following are incident energies of germicidal ultraviolet radiation at 253.7 nanometers wavelength necessary to inhibit colony formation in microorganisms (90%) and for 2-log reduction (99%):

Organisms:	Energy Dosage of Ultraviolet radiation (UV dose) in μWs/cm² needed for kill factor	
Bacteria	90% (1 log reduction)	99% (2 log reduction)
Bacillus anthracis - Anthrax	4,520	8,700
Bacillus anthracis spores - Anthrax spores	24,320	46,200
Bacillus magaterium sp. (spores)	2,730	5,200
Bacillus magaterium sp. (veg.)	1,300	2,500
Bacillus paratyphusus	3,200	6,100
Bacillus subtilis spores	11,600	22,000
Bacillus subtilis	5,800	11,000
Clostridium tetani	13,000	22,000
Corynebacterium diphtheriae	3,370	6,510
Ebertelia typhosa	2,140	4,100
Escherichia coli	3,000	6,600
Leptospiracanicola - infectious Jaundice	3,150	6,000
Microccocus candidus	6,050	12,300
Microccocus sphaeroides	1,000	15,400
Mycobacterium tuberculosis	6,200	10,000
Neisseria catarrhalis	4,400	8,500
Phytomonas tumefaciens	4,400	8,000
Proteus vulgaris	3,000	6,600
Pseudomonas aeruginosa	5,500	10,500
Pseudomonas fluorescens	3,500	6,600
Salmonella enteritidis	4,000	7,600
Salmonela paratyphi - Enteric fever	3,200	6,100
Salmonella typhosa - Typhoid fever	2,150	4,100
Salmonella typhimurium	8,000	15,200
Sarcina lutea	19,700	26,400

LARSON ELECTRONICS LLC • 9419 E US HWY 175 • KEMP, TX 75143
p: 1-800-369-6671 • intl: 903-498-3363 • f: 903-498-3364 • sales@larsonelectronics.com

Serratia marcescens	2,420	6,160
Shigella dyseteriae - Dysentery	2,200	4,200
Shigella flexneri - Dysentery	1,700	3,400
Shigella paradysenteriae	1,680	3,400
Spirillum rubrum	4,400	6,160
Staphylococcus albus	1,840	5,720
Staphylococcus aureus	2,600	6,600
Staphylococcus hemolyticus	2,160	5,500
Staphylococcus lactis	6,150	8,800
Streptococcus viridans	2,000	3,800
Vibrio comma - Cholera	3,375	6,500
Molds	90%	99%
Aspergillius flavus	60,000	99,000
Aspergillius glaucus	44,000	88,000
Aspergillius niger	132,000	330,000
Mucor racemosus A	17,000	35,200
Mucor racemosus B	17,000	35,200
Oospora lactis	5,000	11,000
Penicillium expansum	13,000	22,000
Penicillium roqueforti	13,000	26,400
Penicillium digitatum	44,000	88,000
Rhisopus nigricans	111,000	220,000
Protozoa	90%	99%
Chlorella Vulgaris	13,000	22,000
Nematode Eggs	45,000	92,000
Paramecium	11,000	20,000
Virus	90%	99%
Bacteriopfage - E. Coli	2,600	6,600
Infectious Hepatitis	5,800	8,000
Influenza	3,400	6,600
Poliovirus - Poliomyelitis	3,150	6,600
Tobacco mosaic	240,000	440,000
Yeast	90%	99%
Brewers yeast	3,300	6,600
Common yeast cake	6,000	13,200
Saccharomyces carevisiae	6,000	13,200
Saccharomyces ellipsoideus	6,000	13,200
Saccharomyces spores	8,000	17,600

UV Effectiveness Resources:

1) Virus Sensitivity Index of UV disinfection.
   https://www.ncbi.nlm.nih.gov/pubmed/25495554
2) Stability of SARS coronavirus in human specimens and environment and its sensitivity to heating and UV irradiation.
   https://www.ncbi.nlm.nih.gov/pubmed/14631830
3) Can UV Light Fight the Spread of Influenza?
   https://www.cuimc.columbia.edu/news/can-uv-light-fight-spread-influenza
4) Molecular Mechanisms of Ultraviolet Radiation-Induced DNA Damage and Repair
   https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3010660/
5) Predicted Inactivation of Viruses of Relevance to Biodefense by Solar Radiation
   https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1280232/
6) Efficacy of an Automated Multiple Emitter Whole-Room Ultraviolet-C Disinfection System Against Coronaviruses MHV and MERS-CoV.
   https://www.ncbi.nlm.nih.gov/pubmed/26818469
7) Virus inactivation and protein recovery in a novel ultraviolet-C reactor.
   https://www.ncbi.nlm.nih.gov/pubmed/15144527
8) Inactivation of three emerging viruses - severe acute respiratory syndrome coronavirus, Crimean-Congo haemorrhagic fever virus and Nipah virus
   https://www.ncbi.nlm.nih.gov/pubmed/31930543

LARSON ELECTRONICS LLC • 9419 E US HWY 175 • KEMP, TX 75143
p: 1-800-369-6671 • intl: 903-498-3363 • f: 903-498-3364 • sales@larsonelectronics.com