What is UV-FORCE?

UV-Force® is a combination, through research and expert opinion, of the latest and most advanced UVC technology on the market. This technology includes high-efficiency UVC LEDs and Excimer Far-UVC lamps that offer tailored solutions to infection control problems.

HEPACART vets each of these technologies and develops product solutions for specific applications designed for maximum efficacy and safety.

Solutions

UV-Force® Technology is utilized in the following product solutions:

SmartClean
Disinfection of surfaces in a variety of high-touch environments where viral or pathogen transmission is common.

DuctZone
Disinfection of air in environments where an extra level of protection is needed for risk reduction.

Germbuster +
Added layer of air disinfection in a commercial air purifier.

UVFORCE® Technologies

Air and Surface Disinfection with Far-UVC and Traditional UVC

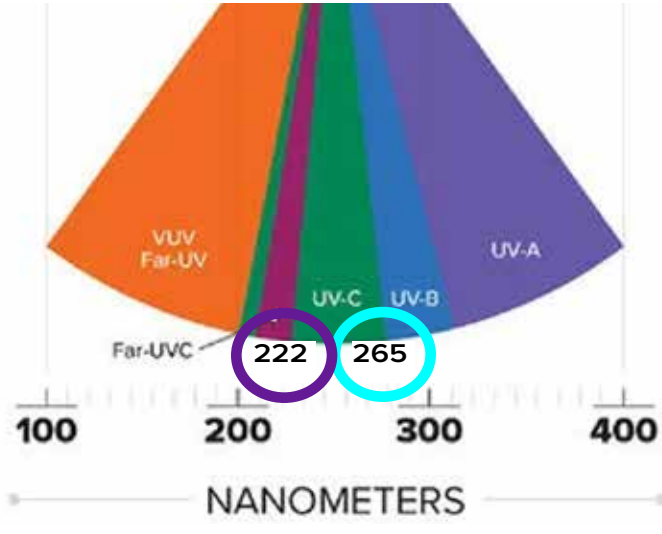
UV 101

UV light is a type of electromagnetic radiation that's transmitted in particles across varying wavelengths and frequencies, which make up the electromagnetic (EM) spectrum (see below).

UVC, is just one range of UV and has the shortest wavelength and the highest energy of all the UV radiation. Once emitted for a certain amoun of time, UVC light will damage or inactivate the DNA and RNA genetic material in virus and bacteria beyond repair. This inactivation keeps them from replicating which in turn, causes normal celluar functions to break down.

UVC needs to be at the correct wavelengths (200-300 is considered germicidal) and delivered in a proper dose / exposure over time. The correct dose is dependent on specific environmental conditions, the items disinfected and the desired level of disinfection.

ULTRAVIOLET LIGHT SPECTRUM



POST-PANDEMIC STATE OF UV

The COVID-19 pandemic highlighted the demand for proven disinfection methods to treat air and surfaces complicit in viral transmission. Traditional UVC is a proven commodity, effectively inactivating most pathogens including drug-resistant bacteria and even the mosthighly contagious viruses.

For several years, conventional UV disinfection with mercury (Hg) lamps were used for this type of disinfection. Recently, however, the safety concerns regarding the use of mercury have lead to new developments of alternate UV sources for air and surface disinfection.

In addition, COVID-19 highlighted the need and opportunity for a UV technology safe for human eyes and skin and subsequently used in human occupied spaces.

At HEPACART®, we see the value in both technologies and maximize effectiveness across applications.

UVFORCE® Technologies From HEPACART®

Air and Surface Disinfection with Far-UVC and Traditional UVC

222nm FAR-UVC

Far-UVC (also referred to as Far-UV) is an advanced technology that pushes UVC down towards its smallest wavelengths. At these smaller wavelengths, the UV light carries more germ-killing energy with significantly lower penetration depth in organic matter.

For these reasons, **Far-UVC is the future for UVC disinfection in occupied public spaces.**

Why? international experts agree that Far-UV cannot pierce the outer layer of already dead cells on the skin and eyes.

Without the ability to penetrate the human body to layers of living tissue, Far-UVC is significantly safer for human contact while maintaining the germicidal power and increased potency against spores and certain pathogens. (See the illustration below)

At this time, HEPACART advises limited human exposure to Far-UVC and adheres to the strict guidance of ACGIH to provide dosing within the approved range. The good news is this approved exposure range for humans is being steadily revised upwards.

COMPARE AND CONTRAST UV-FORCE TECHNOLOGIES

222nm FAR-UVC

- Much safer for human skin and eyes
- Applications for human occupied areas
- Better against spores and preventing re-growth
- Generally requires my time for an effective dose

BOTH

- Strong and effective germicidal properties
- Eco-friendly lamps with no mercruy
- No warm up time with instant on/off

265nm UVC-LEDs

- Not safe for human skin and eyes
- Applications for unoccupied areas and spaces
- Less expensive and longer lasting lamps
- Generally faster and more efficient

265nm UVC-LEDs

UVC-LEDs, radiate light in a small band providing a non-ionizing form of radiation that like Far-UVC inactivates and often destroys harmful pathogens.

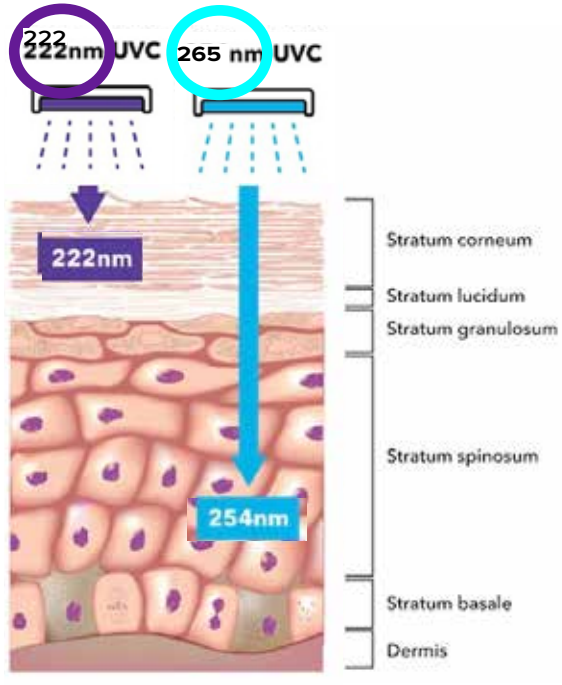
Inactivated pathogens have their DNA and cell structure destroyed at a level that they can no longer reproduce, keeping them from causing re-infection.

UVC LEDs offers a variety of advantages including mercury-free lamps, instantaneous on/offf, lower costs, low maintenance, high performance and reliability.

UVC-LEDS are a potent disinfectant and exposure to the light is dangerous for skin or eyes. The bandwidthsof 265 nm and more commonly used 254 nm both penetrate human eyes and skin and makes utilization of UVC-LEDs impossible to use around people.

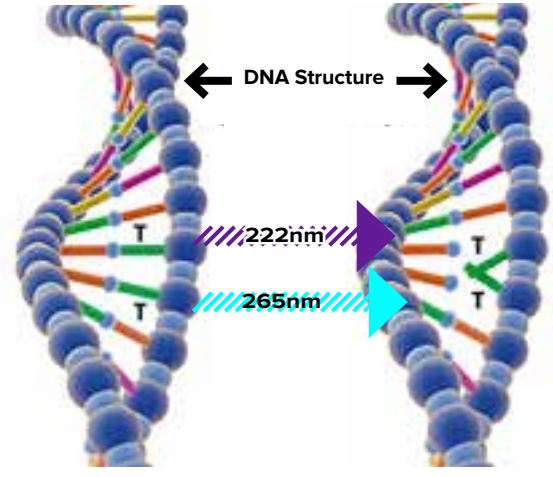
For these reasons, **UVC-LEDS are the future of UVC and the natural replacement for traditional Mercury lamps in non-occupied spaces.**

UVC PENETRATION HUMAN SKIN



UVC RADIATION EFFECT ON DNA

When exposing pathogenic microorganisms to UVC light (Far-UVC 222nms or UVC-LED 265nm), the light penetrates through their cell wall and disrupts the structure of their DNA molecules, prohibiting reproduction. With a long enough dose, the UVC light can cause irreparable harm to the DNA structure.



SMARTCLEAN BY HEPACART®

Automatic Surface Disinfection

For Safety and Efficiency Using Far-UVC 222 nm

UV FORCE® Technology

HOW IT WORKS

- The SmartClean works on an automatic cycle, providing hands off intelligent cleaning and factory programmed to provide the level of disinfection needed for the application
- SmartClean initiates the lamp at your desired dosage (per your requirements/ safety guidance) at the desired time
- The unit can be programmed to reduce dose or turn off completely upon being triggered by the motion sensor
- The result is continous, safe and autonomous disinfection of the work areas

Three Lamp Modes

- The SmartClean has three primary Lamp Modes that determine the duty-cycle of lamp activation, based on cleaning needs. These modes include:

1. OFF/Dormant – Lamp is turned off and waiting
2. ON/Occupied Mode – 2% Duty Cycle
3. ON/Un-Occupied Mode – 83.3% Duty Cycle

Lamp Activation Sequence

1. SmartClean is turned on

2. Lamp begins Occupied Mode on a 2% Duty Cycle and initiates a 15-minute timer

3. If no motion is detected for 15-minutes, the SmartClean will initiate Un-Occupied Mode on an 83.3% Duty Cycle for deep cleaning

4. After 8 hours of Un-Occupied cleaning, the SmartClean will complete its cleaning routine and enter Dormant Mode

5. No cleaning is performed during Dormant Mode. Any motion detection will re-initiate the above cycle

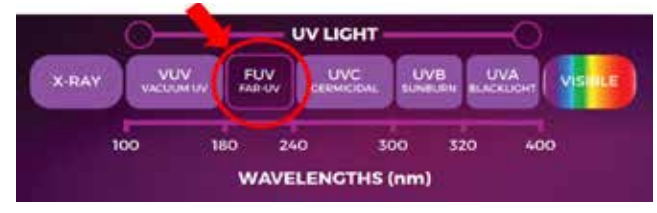
If the SmartClean detects motion during its cleaning cycle, it will immediately revert to the beginning of Stage 2 and reset the 15-minute timer

Safe and Effective:

- **Uses filtered Far-UVC CARE222 technology; safe to human skin and eyes in limited doses**
- Delivers 100mJ of disinfecting power in one cycle
- **Delivers 2-20x the necessary exposure to inactivate many of the most common pathogens**
- Provides proper dosing for pathogens while limiting exposure to people
- Light dose is nano-filterd and delivers the strictly safe 222nm Far-UVC
- Highly effective against C. diff, coronavirus, MRSA and others

State-of-the-Art Far-UVC Technology

- **Far-UVC has a photon energy powerful enough to destroy the chemical bones of pathogens**
- Far-UVC is absorbed at higher levels for DNA and other proteins
- **Mercury-free lamp with instant-on effectives**
- Highly effective at a wide variance of temperatures
- ACGIH (American Conference of Governmental Indusrial Hygienists has confirmed Far-UVC, filtered to 222 nm is safe to exposure up to 160 mJ
- Performs significantly better in some microbials than traditional UV at 254 nm



AUTONOMOUS CYCLING PROVIDES HANDS-OFF INTELLIGENT CLEANING OF SURFACES AND AIR

Intuitive Design:

- **Motion-sensing** technology can be programmed based on dose needs and safety protocols
- The unit operates autonomously once powered on
- Motion-sensing and adjustable doses provide extented lamp-life
- One lamp retains maximum effectiveness for 1 year with daily use
- Timed disinfection lowers operational cost

Other Features:

- Mountable to any ceiling or wall suface (mounting brackets sold separately)
- Includes 3 ft. power cord for any standard 120v outlet or can be hardwired into current power source
- Made of powder-coated steel, SmartClean is easy to clean and holds up to harsh cleaning chemicals

Made in USA

HEPACART®

SMARTCLEAN BY HEPACART® UV FORCE®

Automatic Surface Disinfection

For Safety and Efficiency Using Far-UVC 222 nm.

SMART CLEAN

MODEL#:
UVFSC

One Far-UVC CARE222 lamp module

Secure key operation to power up unit

Working Dimensions
6” L x 9” W x 3” H
Working Weight:
4 lbs

Lamp replacement Model #:
UVFSC.12W.RLMP

SMARTCLEAN DELIVERS 100 mJ OR 2-20x DOSE NEEDED TO DESTROY MOST PATHOGENS

CORONAVIRUS, C-DIFF, MEASLES, MRSA, TUBERCULOSIS, SALMONELA AND MANY MORE

Species		mJ dose for 3 log reduction
MRSA (Methicillin - Resistant *Staphylococcus aureus*)		15
Pseudomonas aeruginosa		8
Escherichia. coli O157		9
Salmonella Typhimurium		10
Campylobacter jejuni		4
Bacillus subtilis	Vegetative cell	7
Bacillus Cereus	Spore	44
Bacillus subtilis	Spore	30
Clostridum difficile	Spore	30
Candida albicans		24
Penichillium expansum		50
Aspergillus niger	Hypha	>1000
	Spore	>500
MS2		23
Feline Calicivirus		24

CONTINUOUS CLEANING SURFACE AND AIR CLEANING OF HIGH-USE ANTEROOMS

Test and Lab Results Confirm Reduction of CFU’s by 99.97%

- Control swabs were taken from six different points inside
- SmartClean delivers 100 mJ in 8 hours in automous cycle
- Dose rates and overall dose validated by radiometer
- Collected samples were counted at 48 and 72 hours
- Reduction of CFUs from 67 to 2 over the 72 hour time period

Before Dose Cycle

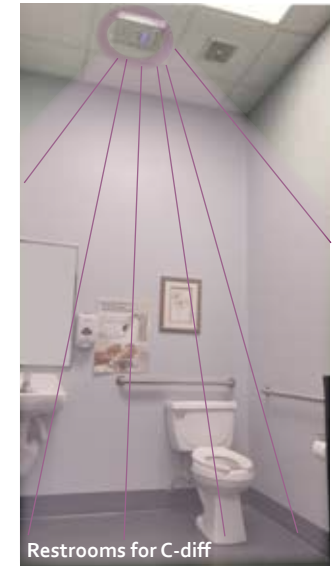
67 CFUs

After Dose Cycle

2 CFUs

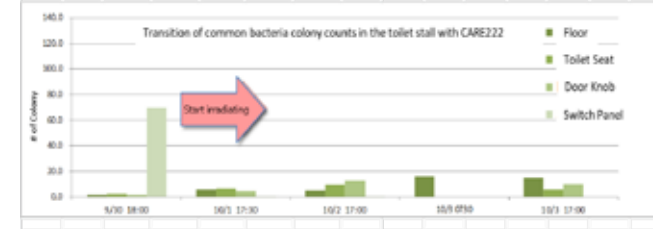
USED IN A WIDE VARIETY OF HIGH TRAFFIC AREAS OUTSIDE OF HEALTHCARE INCLUDING OFFICES, LABS, SCHOOLS AND RESTAURANTS

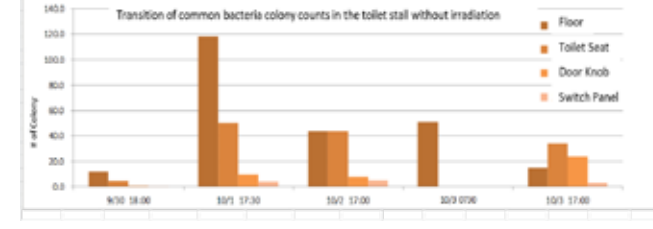
CONTINUOUS CLEANING SURFACE AND AIR CLEANING OF RESTROOMS



Autonomous Cycle Continuously Reduces C.diff and Other Bacteria

- The following graphs represent a predictive model of reduced bacteria colony counts on surfaces with a ceiling mounted SmartClean.
- Study shows day & night bacteria inactivation
- SmartClean delivers 3x the dose needed to inactivate C. diff





HEPACART®

DUCTZONE

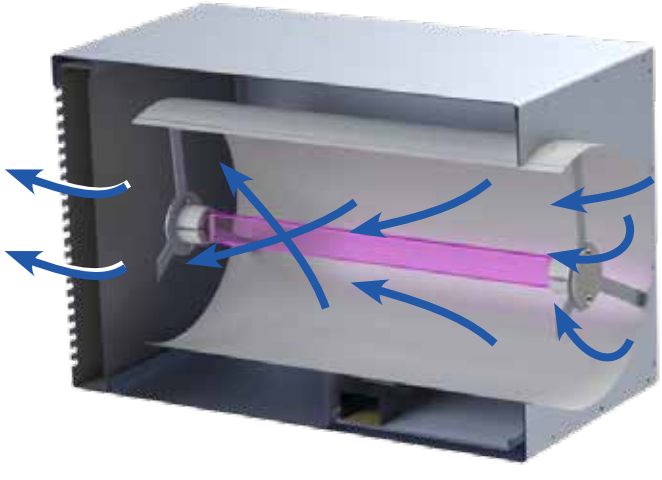
Air Disinfection and Diffusing

A Safe Alternative to Venting/Ducting Using Far-UVC 222 nm

UV FORCE®

MODEL#:
FUV-ADM.USH

HOW IT WORKS



- Filtered air from the negative air machine is pushed through the unit
- Air is funneled into a tube near the Far-UVC lamp
- Treated air is then diffused back into the working space.

Safe and Effective UV Technology

- Delivers the necessary exposure to inactivate many of the most common pathogens (see reverse side for data)
- Instant-on Far-UVC CARE222 technology begins disinfecting the air with no warm up time
- Delivers the effective dose up to 500 cfm
- Includes final exhaust carbon filter for additional dust filtration and diffusion

Build Quality: Best in Class!

- Crafted with the same premium quality as the flagship HEPACART®
- Made of commercial grade aluminum
- Assembled with blind self-sealing rivets
- Looks professional in any environment
- Easy to clean and maintains appearance (no discoloration) through daily cleanings

State-of-the-Art Far-UVC Technology

- Includes 18” Far-UVC mercury free lamp with instant-on effectiveness
- Includes one 300-watt power supply
- Lamp effectiveness is affected by heat/cold nor humidity
- Far-UVC has a photon energy powerful enough to destroy the chemical bonds of pathogens
- Far-UVC is absorbed at higher levels for DNA and other proteins
- Highly effective at a wide variance of temperatures

Convenience: Best in Class!

- Includes 8 ft. self-storing extension cord
- Easy pre-filter changes
- Easy to move from location to location
- Simple operation with integrated controls

Simple Effective Design:

- Air is directed through a horizontal tube and forced within 4 inches of the UV disinfection lamp
- Simply power on the unit and flip the switch to activate the lamp
- One lamp retains maximum effectiveness for 1 year of daily use

Other Features:

- Stacks on top of or in -line with HEPAFORCE and other negative air machines

HEPACART®

DUCTZONE

Air Disinfection and Diffusing

A Safe Alternative to Venting/Ducting Using Far-UVC 222 nm

UV FORCE®

DUCT ZONE

UV FORCE®

MODEL#:
FUV-ADM.USH

Working Dimensions
26.35 ” L x 20.12” W x 16.6”
Weight: 40 lbs

ONE PASS AIR DISINFECTION MODULE

- One 18” Far-UVC (222nm) lamp delivers the disinfecting power to inactivate viruses and bacteria in a single pass
- One 300-watt power supply and one mercury free Far-UVC lamp with 3,000-hour lifetime

Replacement Lamp for DUCTZONE:
PART#: FUV-ADMRLMP.USH
Exhaust Filter:
PART#: ADM.201602-C (3 pack)

EXPECTED DOSING AND EFFICACY FOR FAR-UVC AIR DISINFECTION WITH DUCTZONE

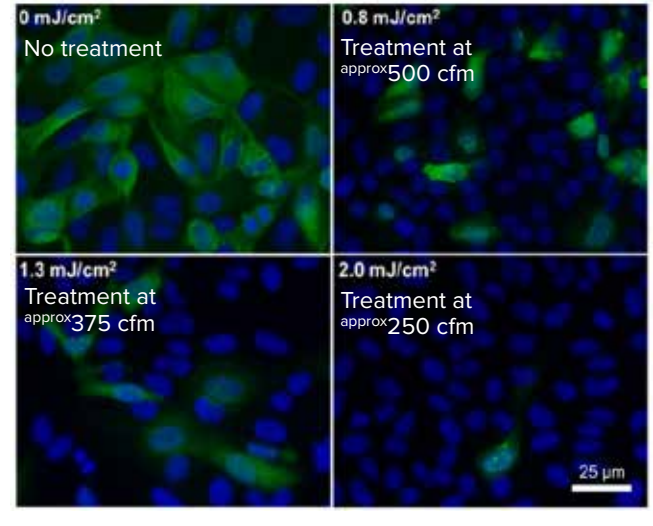
FIGURE 1. ANTIVIRAL EFFICACY OF DIFERENT LOW DOSES OF 222-NM FAR-UVC LIGHT.

Typical fluorescent images of MDCK epithelial cells infected with influenza A virus (H1N1).

The viruses were exposed in aerosolized form in the irradiation chamber to doses of 0, 0.8, 1.3 or 2.0 mJ/cm2 of 222-nm far-UVC light.

Infected cells fluorescent green (blue=nuclear stain DAPI; green=Alexa Fluor-488 conjugated to anti-influenza A antibody).

Images were acquired with a 40× objective



AIR SPEED AND EFFICACY AT DIFERENT DOSES OF 222-NM FAR-UVC LIGHT.

To estimate effective Far-UVC dosing with the DuctZone Air Disinfection Module, we have measured the lamp intensity as installed and calculated the average dose achieved on the airstream.

This data is then compared with the published data for air disinfection using Far-UV to provide a relative estimate for Far-UV cleaning of the air.

For the DuctZone ADM per exchange at:

- 500 cfm the unit achieves 0.87 mJ/cm2
- 375 cfm the unit achieves 1.26 mJ/cm2
- 250 fm the unit achieves 1.89 mJ/cm2