

# UVC germicidal products reference guide



UVC radiation has sanitizing properties, and has many uses in commercial, healthcare and consumer settings. UVC has germicidal benefits, killing bacteria and deactivating viruses depending on the exposure dose (based on source strength, proximity, and time). However, there are serious risks to UVC exposure, so proper safety precautions are essential.

## What qualifies as UVC?

Electromagnetic wavelengths shorter than the visible spectrum of light are known as ultraviolet (UV) (180-400 nm). This reference guide is focused on UVC. Please note that UVA and UVB regions have certain benefits and pose some hazards of their own.

UVC (Short-wave)	UVB (Middle-wave)	UVA (Long-wave)
180-280 nm	280-315 nm	315-400 nm

## What are the key risks of UVC?

There are serious risks to UVC exposure. UVC can be dangerous if improperly used. In only moments, UVC exposure can cause serious damage:

- **EYE:** pain, light sensitivity, and gritty sensation on eye can occur, since UVC does not trigger aversion response (blinking, squinting, looking away)
- **SKIN (erythema):** similar to a sunburn



## What are the dangers of breathing emitted ozone from a UVC device?

Some UVC lamps emit ozone, which enhance germicidal effects but can be hazardous in enclosed spaces:

- **LUNG DAMAGE:** ozone may also worsen underlying respiratory conditions



## What if the UVC is contained?

Containment is a set of design criteria that ensures that people are not exposed to excessive UVC. Consumer products that contain the UVC radiation inside the equipment may be safe and eligible for safety certification based on evaluation per the applicable safety Standards.



## What if you are a trained professional in a controlled setting taking safety precautions?

Commercial and healthcare related UVC products may have uncontained UVC sources. They are intended for use by trained professionals based on product and site safeguards. Such equipment may be safe and eligible for safety certification based on evaluation per the applicable safety Standards.



## Warning labels are not enough!

Some consumer products without UVC source containment have warning labels or timers - this is not enough! Children and pets cannot be expected to follow written warnings, and home environments have too many variables that could result in misuse. Remember that UVC disrupts DNA; in a home environment, devices without containment pose a hazard to the residents, pets, and plants.

## What will UL Certify?

UL will certify eligible UVC devices for safety using UL Standards for the product type (see following page for examples). Where the Standard does not already include personal injury requirements for UVC, ANSI/IES RP-27 or IEC 62471 for photobiological assessments will apply. Safety certifications address risks of electric shock, fire and personal injury; safety certifications do not address efficacy claims.

## Safety Testing

1. Consumer products with contained UVC sources
2. Commercial and healthcare related products with UVC sources
3. Components integrated inside UVC equipment (Ballasts, LED drivers, UVC sources, Controls & Sensors)
4. Commercial lighting products (Upper Room UVGI, Hybrid lighting systems, UVA & 405 nm systems)

## Performance Assessments

Photobiologic, photometric testing to determine risk category, exposure dose, and UVC source characteristics. Performance can be assessed as an independent service with or without a safety certification. Performance evaluation will not result in a UL safety Mark.

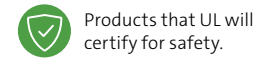
## Risk Categories for UVC

UVC lamps and lamp systems are classified into risk groups based on UVC exposure limits and the relative photobiological risk of the radiation source. The criteria for each risk group designation is based on the type of UVC source characteristics, the length of exposure under normal conditions, and other factors.

UL can help you understand what risk group your product/design falls into and the corresponding safety implications.

Learn more at [UL.com/uvlighting](https://www.ul.com/uvlighting).

## Examples of current germicidal UVC devices



Products that UL will certify for safety.



Products that UL is unwilling to certify for safety due to high risk.

Type of UVC Device	Sample Image	Environment	Assessing the risks	Safety Certification(s)
<b>Home use portable sterilizer</b> Marketed to clean a room in the home		Consumer	UVC is NOT contained - not safe for a home setting  There is too great a risk that people and pets could accidentally be exposed to UVC and be injured, and ozone may be emitted. The exposure dose to people can be far above accepted levels and can cause injury. Integral timers or proximity and orientation sensors pose concerns with accuracy and reliability of these safeguards, as well as opportunities for misuse or bypass	NOT eligible for certification for consumer use
<b>Personal portable sterilizer/wand</b> Marketed to be hand held and moved over surfaces to sterilize		Consumer	UVC is NOT contained - not safe for a home setting  There is too great a risk that people and pets could accidentally be exposed to UVC and be injured, and ozone may be emitted. The exposure dose to people can be far above accepted levels and can cause injury. Integral timers or proximity and orientation sensors pose concerns with accuracy and reliability of these safeguards, as well as opportunities for misuse or bypass	NOT eligible for certification for consumer use; for commercial and healthcare applications contact UL to discuss
<b>Home use air cleaners with internal (contained) UVC</b> Marketed to homes and offices		Consumer	UVC is contained  The UVC source is inside the product enclosure and a safeguard disables the UVC when an access door is opened	UL 507 for electrical investigation; standard includes personal injury requirements for UVC based on ANSI/IES RP-27 for photobiological assessment
<b>Portable and stationary UVC sterilization boxes</b>		Consumer and Commercial	UVC is contained  The UVC source is inside the enclosure; opening the door will disable the UV source. Testing would ensure that any 'UV leakage' will be within safe exposure dose limits	UL 73 for electrical investigation; includes personal injury requirements for UVC based on ANSI/IES RP-27 for photobiological assessment. UL 62368-1 (or 60950-1) may also apply.
<b>Upper room (UVGI)</b> Mounted out of easy reach, typically 2.1m (7 feet) from floor		Commercial	Permanently mounted (i.e. fixed) equipment intended to be installed and operated in non-residential locations. UVC containment is achieved based on product design features, please site safeguards	UL 1598 for electrical investigation  IEC 62471 for photobiological assessment
<b>Commercial/industrial heating &amp; ventilation</b> May also be found in home settings		Commercial	UVC is contained inside the air duct and not visible  Access is restricted to qualified personnel during installation and service. The design also includes other product safeguards such as ON/ OFF switch and interlock switch	UL 1598 (or UL 153) and UL 1995 for electrical investigation; UL 1995 includes personal injury requirements for UVC based on ANSI/IES RP-27 for photobiological assessment
<b>Water treatment</b> UVC disinfects the water as an alternative to chlorination		Commercial	UVC is contained inside a water vessel and not visible  Access is restricted to qualified personnel during installation and service	UL 979 for water treatment equipment  ANSI/IES RP-27 for photobiological assessment
<b>Mobile UVC sterilizer/ equipment sterilization</b>		Healthcare and Commercial	UVC containment is achieved by product safeguards, trained operator and limiting access to the space so people are not present during operation  In addition, the equipment includes reliable safeguards and is operated by staff with training for its proper use	In healthcare facility and laboratory settings - UL 61010 for electrical investigation; the standard references IEC 62471 for photobiological assessment to address personal injury concerns for UVC  In commercial settings - UL 73 for electrical investigation; standard includes personal injury requirements for UVC based on ANSI/IES RP-27 for photobiological assessment
<b>Germicidal Systems</b> (may have regular lights in addition to UV emitters)		Healthcare and Commercial	Permanently mounted (i.e. fixed) equipment intended to be installed and operated in non-residential locations. UVC containment is achieved based on product safeguards, trained staff and site safeguards	UL 8802 Outline of Investigation  IEC 62471 for photobiological assessment
<b>UVC lamps, ballasts, LED drivers, UVC emitters, controls, sensors, etc.</b>		Components	Components for use in UVC equipment and germicidal systems; contact UL to discuss the specific use and design, and intended operation (within luminaires or only within equipment designed specifically for germicidal applications)	Various, as applicable

Always follow device labeling and manufacturer recommendations for appropriate settings, use restrictions, recommended PPE (if applicable), and required training. Don't see your product type here? We can help. Contact us today.