

[PRODUCTS \(/products\)](/products)
[RESOURCES](/resources)
[SUPPORT \(/support\)](/support)
[NEWS](/news)
[BLOG \(/blog\)](/blog)

You're in » [Home \(/\)](#) :: [Blog \(/blog/\)](/blog/) :: [The Ultraviolet Germicidal Irradiation \(UV-C\) Wavelength](#)

(<https://mailchi.mp/uvresources/subscribe>) « [Back to Blog \(/blog\)](#)

Blog

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Why UV-C Cannot Produce Ozone



The Ultraviolet Germicidal Irradiation (UV-C) wavelength is an invaluable tool for an HVACR system. By leveraging germicidal energy to keep refrigeration coils free of microbial growth, facility managers also enjoy the benefit of reducing the spread of airborne infectious agents.

However, some facility managers may hesitate to leverage these benefits for their application due to a concern about ozone. While the Ultraviolet spectrum contains four separate wavelengths—UV-A, B, C and Vacuum UV—each operates at different energy levels and only one is capable of producing ozone (Vacuum UV).

As you'll note in the graphic below, Vacuum UV operates in the 100-200nm range, where it is capable of producing ozone. UV-C, conversely, reaches its optimal germicidal strength near 253.7nm. Because ozone may only be produced below 200nm, at 253.7nm (rounded to 254nm), the germicidal wavelength does not generate ozone.

In addition to the stronger 254nm wavelength that does not produce ozone, UV-C lamps offer another layer of ozone protection.

Most germicidal lamps, including those from UV Resources, are produced with doped quartz glass, which blocks the transmission of the 185nm ozone-producing wavelength. The doped quartz glass allows the 253.7nm radiation to pass through, but it blocks the 185nm wavelength from escaping. Therefore, germicidal lamps with doped glass CANNOT produce ozone.

WHAT IS OZONE?

Ozone is present in low concentrations throughout the earth's atmosphere. Some researchers say that this chemical is "good up high, but bad down low." Without the ozone layer protecting our Earth's stratosphere, for example, the Sun's ultraviolet radiation would make life on Earth uninhabitable. At street level, however, a high concentration of ozone is toxic to plants and animals. In humans, ozone can irritate nasal passages, cause nausea and extended exposure can lead to lung inflammation.

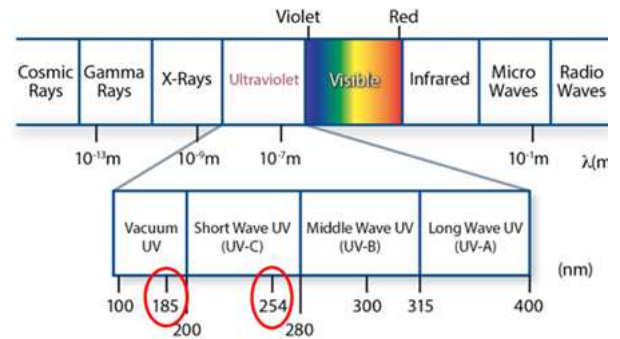
Ozone, also called Vacuum Ultraviolet (UV-V), is a gas molecule that contains three (3) oxygen atoms – and as such, it has a destabilizing effect on oxygen in the air (leading to its irritation and danger to humans). A UV lamp "tuned" to 185nm can create ozone from oxygen (O₂) by disrupting the O₂ molecule and splitting it into two oxygen atoms. These two oxygen atoms attempt to attach to other oxygen molecule (O₂). It is the attachment of this third oxygen atom that creates ozone (O₃).

Ironically, UV light in the 240-315nm wavelength will break this third oxygen atom attachment above and convert it back to oxygen. The peak ozone destruction occurs at the 254nm wavelength. So, a UV-C lamp at the 253.7nm wavelength will actually destroy ozone!

ASHRAE has said that certain air cleaners produce ozone and thus, its position is to recommend discontinuing utilizing "devices that use the reactivity of ozone for the purpose of cleaning the air." [1]

KEEPING PERFORMANCE SUSTAINABLE

Keeping buildings operating at their most efficient level and sustaining that performance over the life of a building is one of today's key challenges for specifying engineers, HVACR contractors and facility managers. Today, with germicidal technology, virtually all HVACR systems are potential candidates because of the many operational benefits it offers, including: (a) destruction of surface and airborne microorganisms; (b) the restoration and preservation of heat transfer and airflow capacities to "as-built" conditions; (c) greatly improved indoor air quality; and (d) reduced maintenance.



253.7nm UV-C LAMPS = GERMICIDAL EFFICIENCY WITHOUT OZONE PRODUCTION

Again, while UV-C technology has been proven to restore HVACR performance to its original capacity, specifying engineers, HVACR contractors and facility managers can rest assured that the germicidal wavelength is incapable of producing ozone. Moreover, the 253.7nm germicidal wavelength will destroy ozone.

So stay ozone free in the 254nm zone.

[1] <https://www.ashrae.org/File%20Library/About/Position%20Documents/Filtration-and-Air-Cleaning-PD.PDF>

in (<https://www.linkedin.com/company/2539221>)

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