Nu-Calgon Application Bulletin 4-100

Air Purification Through Bi-Polar Ionization

Nu-Calgon has partnered with Global Plasma Solutions (GPS) to bring a new, advanced air purification technology to the HVACR market. This patented technology called needle-point bi-polar ionization uses carbon fiber brushes to produce a refined electrical charge to proactively and safely clean the air in residential and commercial buildings. The iWave approach produces equal amounts of positive and negative ions (combined charge neutral) that react and break down pathogens, allergens, particles, smoke, odors and VOCs in the air, creating a healthy environment without producing any harmful byproducts like ozone or unstable ROS (Reactive Oxidation Species) molecules that result in the use of PCO technologies.

How Bi-Polar Ionization Works

iWave devices are bi-polar, meaning they use two emitters to create equal amounts of positive and negative ions. When these ions are injected into the air stream, creating a plasma region, they break down passing pollutants and gases into harmless compounds like oxygen, carbon dioxide, nitrogen and water vapor. When the ions come in contact with viruses, bacteria or mold, they remove the hydrogen molecules from the pathogens. Without hydrogen, the pathogens have no source of energy and will die. The ions also attach to allergens, such as pollen, smoke and other particles, causing them to band together until they are large enough to be caught by filters.

iWave's technology generates the same ions that nature creates with lightning, waterfalls, ocean waves, etc. Nature uses ion energy to break apart molecules, naturally cleaning the air and producing a healthy environment. The only difference between iWave's technology and nature is that iWave does it without developing detectable ozone. In fact, third party testing of iWave technology by Intertek/ETL to the UL867 ozone chamber test confirmed ozone levels less than 0.00PPM!

How iWave Ionization Differs from PCO Technology

Unlike iWave's bi-polar ionization method, Photo Catalytic Oxidation (PCO) technology uses UV light, commonly with titanium dioxide (TiO2) and often with other alloys, to create ionization. The Centers for Disease Control (CDC) has warned of cancerous risks involved with TiO2* – not something you want in a building's air quality!

ASHRAE issued a position document in January 2015 on Filtration and Air Cleaning where they cautioned UV lamps used in many PCO devices can emit significant ozone – known to be harmful for human health. They also observed and reported on page 9 of the document "…potential of an incomplete oxidizing process, which produces by-products of reaction that can be more toxic or harmful than the original constituents (i.e. formaldehyde). The catalysts can be contaminated (poisoned) by airborne reagents and/or products of oxidation, which results in reduced or total efficiency failure of the process." Lastly, the PCO approach requires the replacement of the UV cell every year or two. Bi-polar ionization requires no replacement parts, and on the self-cleaning models, they are maintenance free. The chart on the next page shows several advantages of iWave technology over two common market approaches.

*CDC Current Intelligence Bulletin 63

Advantages of iWave Technology Over Two Common Market Approaches:

Feature	iWave	UVPCO Ionizers	UV Lights
Kills pathogens downstream?	Yes	Yes	Only line-of-sight pathogens
Controls odors?	Yes	Yes	No
Reduces airborne particles?	Yes	Poor	No
Replacement parts?	No	UV cell replaced every 1-2 years	Bulb replaced every 1-2 years
Self-cleaning options?	Yes	No	No
Performance	Self-cleaning provides continual peak performance	Fades with UV output	Fades with UV output
Harmful byproducts?	No	Creates ozone & other byproducts	Some bulbs emit ozone
Cleans entire depth of coil?	Yes	Yes	Cleans only one side
Mercury in airstream?	No	Yes	Yes
Energy required	< 10 watts	> 60 watts	> 60 watts
Universal voltage?	Most models	Most models don't	No
Robust construction?	Solid state design	UV bulbs can break	UV bulbs can break
UV material breakdown?	No	UV lights hard on materials	UV lights hard on materials
Contains Titanium Dioxide?	No	Some Models	No
Three Year Warranty	Yes	Replace parts in 1-2 years	Replace parts in 1-2 years

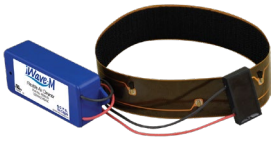
Products:

iWave®-R

4900-20

With technology installed in over 200,000 applications worldwide, iWave-R is the world's first self-cleaning, bi-polar ionization air cleaner specially designed for residential duct air conditioning systems up to 6 tons (2400 CFM) in size. Needle-point ionization actively treats air in the living space with no replacement parts, no maintenance and patented universal voltage (24-240VAC). It can mount easily inside or outside of duct, or it can attach magnetically near indoor fan. iWave-R always works at peak performance, producing over 160 million ions/cc per polarity (320 million total ions/cc), more than any interior air quality product on the market. Patented self-cleaning design includes programmable cleaning cycle with alarm contact option. UL and cUL approved. Three-year limited warranty.

iWave®-M



4900-35

iWave-M is a flexible ion-generating bar that can treat IAQ in nearly any HVAC application. Its revolutionary circuit bar with special ion-generating needles suitable for any HVAC cooling coil up to 1,600 CFM. Plus, it can be shortened in the field to any size! Perfect for ducted package or ductless HVAC systems in living centers, hotels, commercial buildings, residential (including mini-splits), transport cooling coils or even in ice machines – applications where mold is an issue. Provides the highest level of ionization energy in the most compact size available on the market. UL and cUL approved with patented universal voltage (110-240VAC). Virtually maintenance free with no replacement parts. Produces over 35 million ions/cc per foot per foot of flexible ribbon. Three-year limited warranty.

iWave®-V

4900-40

With technology currently installed in over 200,000 applications worldwide, iWave-V is a versatile, low-maintenance bi-polar ionization generator for treating air in residential duct air conditioning systems up to 6 tons (2400 CFM) in size. Needle-point ionization actively treats air in the living space with low maintenance and no replacement parts. Produces over 160 million ions/cc per polarity (320 million total ions/cc), more than any other interior air quality product on the market. Installs inside or outside of duct, or attaches magnetically near indoor fan. UL and cUL approved. Three-year limited warranty.

4900-10

iWave®-C

Although it can be used for residential applications, the original iWave-C is especially suitable for light commercial systems up to 12 tons (4800 CFM). iWave-C is a self-cleaning, bi-polar ionization generator for treating a building's air quality that does not require replacement parts in a year or two like competing technologies. iWave-C always works at peak performance, producing over 200 million ions/cc per polarity (400 million total ions/cc), making it superior to other market approaches. Special features include a programmable cleaning cycle, waterproof housing, digital display and integral alarm contact. Duct mount to air handler inside or outside of building. For systems larger than 12 tons, multiple iWave-C units can be applied. UL and cUL approved with patented universal voltage (24-240VAC). Three-year limited warranty.

Application	iWave-R	iWave-V	iWave-C	iWave-M
Residential - Mini-Split A/C Systems				X
Commercial - VRF A/C Systems				X
PTAC Systems				X
Residential Duct HVAC Systems	X	X	X	X
Light Commercial Duct HVAC Systems			X	X
Transport HVAC Systems				X
Industrial HVAC Systems				X
Ice Machines to Reduce Mold in Cabinet				X

Features	iWave-R	iWave-V	iWave-C	iWave-M
Patented Self-Cleaning Technology	X		X	
No Replacement Parts	X	X	X	X
No Maintenance	X	*	X	*
Kills Mold, Bacteria, and Viruses	X	X	X	X
Controls Odor (Cooking, Pet, VOCs)	X	X	X	X
Reduces Allergens	X	X	X	X
Prevents/Eliminates Dirty Sock Syndrome	X	X	X	X
Controls Particles in Air	X	X	X	X
Reduces Smoke	X	X	X	X
Reduces Static Electricity	X	X	X	X
Actively Treats Pathogens in Space (entire coil/living space)	X	X	X	X
Universal Voltage (24-240VAC)	X	24VAC	X	110-240VAC
Universal Mounting	X	X	Duct Mounted	X
Customizable Length				X
Digital Display/Weatherproof Housing			X	
Alarm Contact Option for Notification	X		X	
Replaceable Emitters	X		X	
Service Temperature Range	-40ºF to 160ºF	-40ºF to 160ºF	-40ºF to 160ºF	-40ºF to 140ºF
Limited Three Year Warranty	X	X	X	X

** The iWave-M, and iWave-V require low maintenance. The emitters may require a wipe with damp cloth from time to time to ensure ionizer tips are clear of particles. After power is turned off, the carbon bristles on the iWave-V should be looked at periodically (every time the air filter is replaced) to ensure they are clean for optimum performance.*

Frequently Asked Questions:

What makes iWave products unique?

- iWave products are patented ion-generating devices that produce the highest available ion outputs and do not create ozone or harmful byproducts, which are different than current ionizers on the market. Not only that, there are self-cleaning options that require no maintenance, no replacement parts, universal voltage and universal mounting, making these highly versatile devices game-changers in the IAQ market for proactive whole home/office purification. The devices offer a superior three-year warranty – other products require light/cell replacement in a year or two.

What does it mean when you are saying 'killing pathogens in space'?

- The ions are circulated downstream of the iWave-M, iWave-V, iWave-C and iWave-R to where they thoroughly address pathogens through the coil, duct and living space, making it an active whole purification system. This is different than UV lights with a passive approach that only address pathogens that circulate past the UV light in the duct and only affect part of the coil.

How long will iWave products last?

- iWave products are designed to last for a very long time, up to the design life of the air conditioning equipment.

What should be covered when installing an iWave-V or iWave-R in a residential A/C system?

- Install between the air filter and the indoor coil.
- The air current must flow through the "goal posts" (two emitters) so total ionization output is achieved.
- Attach IN or ON duct or indoor fan with air current flowing through "goal posts." If installing on fan housing (shaft side), make sure self-tapping screws are used to secure device to housing, since the magnets alone may not be adequate if there is excessive vibration.
- Keep emitter brushes at least two inches from any metal surface. Electrical wires from the ionizer (or any wire in the equipment) must be kept away from emitter brushes.
- The products are only performing if there is air flow across the device.
- The devices pull low power (10VA), which allows maximum flexibility for installation.

Any electrical hook-up guidelines for residential A/C systems?

- The iWave-C and iWave-R have universal voltage capability between 24-240VAC for maximum versatility on electrical service options that are available for duct A/C systems. The iWave-M will handle between 110-240VAC voltage outputs typical for its intended application. The iWave-V requires 24 volts VAC.
- For residential duct A/C systems where 24/7 operation is desired, connect the device wires with "R" and "C" terminals/auxiliary board hook-ups, commonly available for 24VAC or 120VAC, but 240VAC is also an option.
- For the iWave-V running 24/7, the brushes may need to be cleaned a little more often, which is not an issue with the iWave-C/iWave-R because of the self-cleaning feature. Without air flow, the air is not being cleaned. With the device continuously on, the ions are quickly neutralized and there is no ion build-up in the home, smell at start-up or health concerns.

  NOTE: If the device is wired to be cycled with fan, for best results to quickly address IAQ in home, turn indoor fan to "On" position (continuously run) for 24-48 hours, then cycle with thermostat.
- For residential duct A/C systems where it is desirable to cycle the ionizer with the internal fan, connect the device wires with "R" and "G" terminals/auxiliary board hook-ups. Another easy option is to add a 24VAC or 120VAC current relay to the wire of the blower so it energies the ionizer every time the blower is energized.
- NOTE: Depending on circumstances and what is being powered by a commonly used 40VA transformer, another 40VA foot-mounted transformer may be needed to power the ionizer.

iWave® AIR PURIFIERS

PATHOGEN TEST RESULTS

All tests were run using proprietary NPBI™ technology.

SARS-CoV-2 (Covid-19)

TIME IN CHAMBER	30 MINUTES
RATE OF REDUCTION	99.4%

INNOVATIVE BIOANALYSIS

This test was run using the iWave-C (GPS-DM48-AC) in a test designed to mimic ionization conditions like that of a commercial aircraft's fuselage.

Based on viral titrations, it was determined that at 10 minutes, 84.2% of the virus was inactivated. At 15 minutes, 92.6% of the virus was inactivated, and at 30 minutes, 99.4% of the virus was inactivated.

Human Coronavirus 229E

TIME IN CHAMBER	60 MINUTES
RATE OF REDUCTION	90%

ALG ANALYTICAL LAB GROUP

This test was run in a test chamber in a lab setting with the Nu-Calgon iWave-R Air Purifier P/N 4900-20.

A petri dish containing a pathogen is placed underneath a laboratory hood, then monitored to assess the pathogen's reactivity to Needle Point Bi-polar Ionization (NPBI) over time. This controlled environment allows for comparison across different types of pathogens.

iWave's Needle Point Bi-polar Ionization (NPBI) technology is used in a wide range of applications across diverse environmental conditions. Since locations will vary, clients should evaluate their individual application and environmental conditions when making an assessment regarding the technology's potential benefits.

Nu-Calgon

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