AtmosAir Dielectric Barrier Discharge (DBD) Bi-Polar Ionization **vs.** Needlepoint (NP) Bi-Polar Ionization

AtmosAir.com

Introduction

Air ionization is a frequently used term, and there are multiple ways to generate the energy needed to create air ions.

AtmosAir Solutions' **patented technology** uses a pulsed AC voltage to a patented composite Bi-Polar ionization (BPI) electrode (tube) to produce a Non-Thermal Plasma discharge which creates measurable quantities of positive and negative air ions. The goal of the technology is to leverage air ionization to continuously disinfect air and surfaces, and reduce indoor contaminant levels.

AtmosAir's BPI tubes are as long as 21 inches. Commercial systems can utilize hundreds of tubes to help clean air and surfaces in buildings.

AtmosAir's Dielectric Barrier Discharge (DBD) Bi-Polar Ionization technology should not be confused with Corona Discharge, Needlepoint Ionization (NPBI), and Electrostatic Precipitation, which all use an ionic process.

Anyone considering the purchase of these two technologies should purchase one of each and note the design, construction, and engineering of both technologies. It is night and day.

Modes of Operation

AtmosAir Bi-Polar Ionization

AtmosAir's technology, DBD Bi-Polar Ionization, relates to the physical construction of the AtmosAir tube (electrode).

- An AtmosAir FC tube uses a 21-inch tube (electrode) to treat approximately 2,000 square feet or 2,000 CFM.
- A most critical difference with AtmosAir's technology is that the **electrode is inside of the AtmosAir ion tube.** The electrode/cathode is not exposed to ambient conditions.
- AtmosAir BPI Systems are designed to be UL2998 Compliant or Verified Zero Ozone Technology.
- **The design of the AtmosAir tube prevents the electrode/cathode from acting as an electrostatic precipitator. An exposed design will attract particles to the 'needlepoints' wearing them out over time.**
- AtmosAir's unexposed design prevents oxidation from occurring as quickly as an exposed design. As electrodes/ion emitters are exposed to ambient conditions, while being subjected to relatively high voltage, they oxidize and eventually wear out. Very similar to how a spark plug operates.
- The composite tube acts as a "barrier" between the inner core (electrode) where input voltage is applied. The voltage tries to "jump" to the outside of the tube but cannot because of the Dielectric Barrier. This process creates a rapidly alternating energy field that converts oxygen molecules into positively or negatively charged oxygen ions.
- **An AtmosAir 508FC has (8) 21" tubes per system. Each tube has 75,000 ion discharge sites. A 45k CFM air handler would require (24) 21" tubes or 1,800,000 ion discharge sites.**

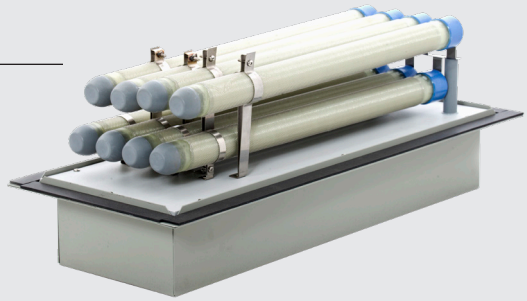
Needlepoint Ionization

Needlepoint or brush ionization uses DC or AC voltage applied to a set of quarter-inch Needlepoints or brushes (electrodes).

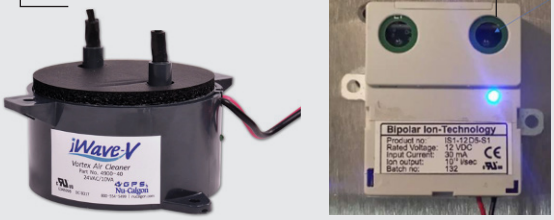
- Most needlepoint designs use a quarter inch (0.25") electrode (needlepoint).
- Needlepoint systems use exposed electrodes to generate air ionization.
- As needlepoint electrodes are exposed to ambient conditions, while being subjected to relatively high voltage, they oxidize and eventually wear out. Very similar to how a spark plug operates.
- Due to the exposed design and process, needlepoint ionization systems **require constant cleaning** (every 12-24 hours per patent). As one needlepoint is always negative and one is always positive, particles moving through the air of the opposite polarity are attracted and stick to the needles.
- If the needlepoints get covered (clogged) by dust (particulate matter), they quickly become useless. When they are clogged, over time, the brush becomes dull and the ionization rates decrease.
- A corona discharge occurs (think of this as a spark) causing one needlepoint to produce positive ions, and the other needlepoint to produce negative ions.

- NP ionizers produce single polarity ions at separate needlepoints. Alternating Current systems produce both polarities of air ions at each needlepoint.
- When a carbon brush is subjected to a 'cold plasma discharge' it eventually burns, as it is carbon after all. This turns to ash and 'clogs' the emitter reducing ion emission effectiveness severely. This is another reason why you may see products with 'wiper arms' which clean off the dead brush debris. The wiper arms rely on a stepper motor which can go bad over time. Any product that is not self-cleaning is sure to go bad over time.
- Most HVAC professionals has experienced a picture of a dirty coil or dirty return filter. Most can envision the fact that a 0.25" needlepoint upstream of a coil stands little to no chance of not getting covered by particles just as a media filter would. They require constant cleaning for effectiveness.

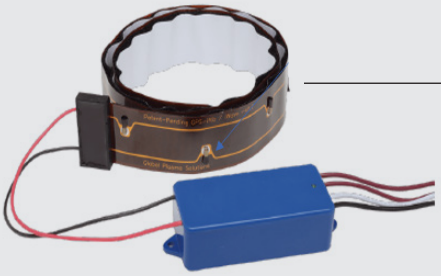
AtmosAir 508FC
Each AtmosAir 508FC system has (8) 21" AtmosAir tubes. 21" Electrode/cathode is in core of tube not exposed to ambient conditions.



0.25" Exposed Electrode ("needlepoint")



0.25" Exposed Electrode ("needlepoint")



0.25" Exposed Electrode ("needlepoint")

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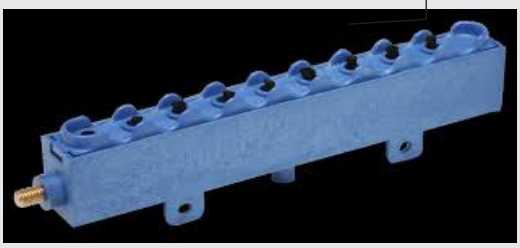

AtmosAir Solutions DBD BPI vs. Needlepoint Ionization BPI		
	AtmosAir DBD BPI	**Needlepoint Ionization**
Length of electrode per 2,000 CFM	21"	0.25"
Ion Discharge Sites per 2,000 CFM	75,000	2
Product Weight (Pounds)	6	0.07
Exposed Electrode Product Design	×	✓
Reduces Contaminants In the Space	✓	Limited
UL2998 Verified Zero Ozone	✓	Limited Models
Produces Superoxide Anion	✓	×
Reduces Odors	✓	×
Reduces VOCs	✓	Limited
Reduces Particles	✓	Limited
Maintenance Frequency	Every 2 Years	Every 12-24 Hours
Effective on Bacteria and Virus	✓	×
Smart IoT Capable System	✓	Limited
Tested Contaminant Reductions in Occupied Space	✓	×
Tested Clean Air Delivery Rate (CADR) Performance	✓	×
Tested Against COVID to ASTM Test Method	✓	×

Why Exposed Electodes (Needlepoints) Wear and Foul Quickly In HVAC Systems	
Reason for Failure	**Detail**
Erosion, Corrosion, and Oxidation	The material of the electrode(s) has oxidized, and when the oxidation is heavy, it will be green on the surface. The surface of the electrodes is also fretted and rough. Leads to imbalanced positive and negative ionization rates.
Dry and Wet Fouling	The electrode (needlepoint) is fouled by either wet or dry carbon.
Abnormal Erosion	Abnormal electrode erosion is caused by the effects of corrosion, oxidation and reaction with ambient air—all resulting in imbalanced electrode length and positve/negative ion generation rates.
Deposits	The accumulation of deposits on the needlepoint end is influenced by input voltage, and the needlepoints operating duration. This is why you see some models with self cleaning apparatus.
Overheating	When a needlepoint overheats, deposits that have accumulated on the electrode tip melt and give the electode tip (needlepoint) a glazed or glossy appearance.
Breakage	Breakage is usually caused by thermal expansion and thermal shock due to sudden heating or cooling.
Normal Life	A worn electrode due to erosion requires higher voltages, which can lead to failure.

Performance and Efficacy

In large commercial air distribution systems, AtmosAir Solutions has thoroughly tested and vetted many different needlepoint ionization systems.

Needlepoint ionization manufacturers have not produced standardized testing to show the systems are effective on particulate matter (PM) removal (See AtmosAir ETL ANSI/ AHAM Dust Clean Air Delivery Rate Test).

Needlepoint ionization is not effective on odor (VOC) removal in large AHU or RTU systems.

In a commercial application with an air distribution system greater than 2,000 CFM, there is no noticeable, perceptual, difference in the space when NP systems are installed. **This is because the half-life of ions generated by a Needlepoint ion generator is extremely short.**

Needlepoint ionization has not produced **third party standardized testing** against mold spores (See ETL Clean Air Delivery Rate test), bacteria and viruses in an occupied space. All tests are from chamber environments. Ultimately, needlepoint technology has not tested to reduce contaminants in occupied spaces, unlike needlepoint ionization manufacturer's claims. In addition, little to zero published research exists around the Needlepoint ionization technology.

"**Be wary of the needlepoint efficacy claims against the SARS-CoV-2 (COVID-19) virus**. I've reviewed their lab reports, and the conditions do not compare to those in typical occupied spaces. They applied 27,000 ions/cc to the virus target while a typical occupied space (school, office, etc) is on the order of 2,000 ions/cc. Their air velocity was about 4x the typical velocity in an office space. That means they hit the virus with 40x – 60x more total ions than what would be a normal setting. The ions react with everything and so it is not typically possible to approach a value of 27,000 ions/cc in an occupied space. AtmosAir tested in a standard chamber to ASTM E1053, which is a standard testing protocol. The ion concentration was set to normal occupied room levels of approximately 1,500 ions/cc."

– Jim Bogart, Senior Product Manager, Airside Advanced Engineering, Johnson Controls

AtmosAir designs and engineers air purification systems that will generate between 500-1,500 ions/cubic centimeter which is achievable in an office setting. AtmosAir testing to a structured ASTM E1053 Method by an ISO 17025 accredited testing laboratory, Microchem Laboratory showed measurable virus mitigation results at an average level of 1,500 of ions/ cc. Microchem Laboratory offers testing in compliance with current Good Laboratory Practices (GLP) regulations as stipulated by the EPA and FDA.

Needlepoint manufacturers have produced test results displaying reductions at 27,000 ions per cubic centimeter in a 1' cubic chamber. This ion power cannot be replicated in an occupied space.

Please ask a needlepoint manufacturer to provide references of smoking casinos they have installed teir systems in. Ask to talk to those casinos. Needlepoint manufacturers state they have a solution that mitigates particulate matter and VOCs. You would think every casino in the world would use this solution for that reason, to break down VOCs and particles as smoke is complex particulate. When you apply a needlepoint solution in a casino it does not impact the air. No large casinos have adopted the technology for good reason.

Clean Air Delivery Rate - Third Party Testing Performance vs. Key Contaminants of Concern.

Report No. 3069544-002

Test Equipment List:

Equipment Used	Model Number	Intertek Control #	Cal. Due Date
Laser Aerosol Spectrometer	HSLAS 0.065	N829	12/05
Aerodynamic Particle Sizer	3321	A-261	01/05
Fluidized Bed Aerosol Generator	340000	--	--
Sola Voltage regulator (120 Vac)	MCR	V245	06/05
Temperature/Humidity Sensor	HMW30YB	T680	11/05
Power Transducer	AGH-002B	E399	04/05

Results of Performance Tests:

Model/Configuration	Test Particulate	Natural Decay Rate	CADR	MERV EQUIVELENT
AtmosAir 100C In-Duct unit	**Dust**	**0.00424**	**125.0**	**13**
	Mold	**0.11245**	**158.4**	**13**

Summary

Testing of the AtmosAir unit was designed to simulate real world use. A test chamber duplicating typical household conditions was modified to introduce outside air processed by the AtmosAir unit as might be seen in a standard installation.

The above results were achieved under the following conditions:

1. There was no requirement for any of the client's equipment to be in the room during the testing; and
2. The client's equipment does not utilize any type of filtering system.

Report Reviewed By:

Terence J. O'Beirne
Senior Project Engineer
Appliance Group

Tested By:

Michael Podoliak
Technician
Appliance Group

pac

GPS RN

Results of Performance Tests:

Model/Configuration	Test Particulate	Natural Decay Rate	CADR	CADR STDEV.	Power (Watts)
ActivTek 2000, Speed tested as received, UV Light on	**Smoke**	**0.00266**	**-0.40**	**0.1**	**23.4**
	Dust	**0.00923**	**-3.90**	**0.6**	**23.6**
	Pollen	**0.10044**	**17.7**	**6.2**	**23.8**
GPS RN, Speed tested as received, Ionizer on	**Smoke**	**0.00273**	**0.11**	**0.1**	**16.8**
	Dust	**0.00755**	**1.36**	**0.4**	**16.8**
	Pollen	**0.09548**	**7.02**	**4.1**	**16.9**

Conclusion:

The results reported above for model ActivTek 2000 and GPS RN fall below the minimum limits of measurability of the ANSI/AHAM AC-1-2006 "Association of Home Appliance Manufacturers Method for Measuring Performance of Portable Household Electric Room Air Cleaners" Test Method.

Report Reviewed By:

Eric Dunay
Engineer
Energy Efficiency Group

Tested By:

Mike Podoliak
Technician I
Energy Efficiency Group

A big claim of Bi-Polar Ionization is the technology's ability to "agglomerate" particulate matter (PM). The theory is that ions will interact with oppositely charged particles, agglomerate them, essentially making them bigger, heavier and easier to filter.

Essentially, AtmosAir BPI will 'move' and agglomerate bigger volumes and weights of particles whereas ions generated from Needlepoints will not reduce or impact particulate matter.

AtmosAir and Needlepoint Ionization were independently tested by ETL to ANSI/AHAM test protocols to determine rated Clean Air Delivery Rate (CADR) performance. AtmosAir has tested to have a CADR of of 125 versus dust, and a 190 CADR vs. mold. Needlepoint ionization tested to have a 1.36 CADR vs. Dust, 0.11 CADR vs. smoke, and 7.02 CADR vs. pollen.

Ionization Half-Life

- AtmosAir ions have been tested to have longer persistence or half-life due to interaction with the AtmosAir DBD field and the proprietary discharge process of positive and negative air ions.
- Needlepoint ionization technology produces single polarity ions at separate needlepoints placed right next to each other. Needlepoint ions tend to re-combine very close to the unit leaving little ions to enter the space.
- A respected third-party Air Handling Unit manufacturer studied AtmosAir DBD BPI vs. needlepoint ionization. The findings are below. Ultimately, 48" from the Needlepoints there was no measurable air ionization.
- When applied in a commercial air distribution system there is no way for the ions to get to the space and decrease odors/contaminants.
- AtmosAir DBD BPI uses a patented approach that leverages pulsed ionization. Systems are engineered and designed so that optimal ion levels get to the occupied space to interact with contaminants.
- Third party tested 'DBD' ions have a stronger "electron volt potential" than needlepoint ions, which makes them survive into the occupied spaces, where they can interact with contaminants and clean air.
- Ions, in their nature, have a lifespan between five and three hundred seconds.
- Needlepoint ions are much more affected by humidity than AtmosAir DBD BPI ions.
- HPS Environmental - Engineered Air Ionization Testing Report (third party comparison test)

Testing Information			Measured at Unit Discharge		Measured at 24" from Discharge		Measured at 48" from Discharge	
Technology	**FPM**	**CFM**	**Positive Ions**	**Negative Ions**	**Positive Ions**	**Negative Ions**	**Positive Ions**	**Negative Ions**
AtmosAir Matterhorn (DBD BPI)	575	23.575	4.5	3.7	3.2	3.5	2.2	2.4
	1192	48.872.	7.2	6.3	5.8	6	4.5	4.2
	1710	70.11	14.3	7	12.8	6.8	10.8	5.7
Needlepoint Ionization (NP BPI)	570	23.37	3	3.1	1.2	0.2	0.2	0.2
	1102	45.182	2.2	4.3	1.8	3	0.5	0
	1685	69.085	6.3	5.2	4.5	3	0	0

Third party test by Engineered Air

Construction, Design, Size and Dimensions of AtmosAir Tubes and Systems

- Needlepoint ion systems are in some cases 1/100th the size of AtmosAir systems.
- There is significant difference in the quantity of ion discharge points. One AtmosAir FC tube has 75,000 discharge points or 'Needlepoints' per tube.
- Needlepoint systems typically have 2-16 Needlepoint pairs per system.
- AtmosAir tube surface area (each tube is 21" in length) is much larger than (2) Needlepoint brushes (< 1").
- "AtmosAir 21" tube presents more ability for airflow to flow over the tube. This is very important as airflow (oxygen) needs to flow over the discharge points to be ionized.
- Needlepoint discharge points are < 0.25", and they are cheap.
- Touch and feel the difference in quality of the products.

One AtmosAir F tube = 75,000 ion discharge points.
(1) 508FC = 600,000 ion discharge points

(2) 0.25" ion discharge points

Needlepoint ion systems need to be cleaned frequently.

"Self Cleaning Functionality"

Needlepoint ion manufacturers have contradicted themselves and needlepoint ionization technology products in the marketplace with the development of the "self-cleaning ionizer." For many years manufacturers stated, 'Needlepoint systems do not require maintenance.'

Plastic Wiper Blade powered by Stepper Motor

Per published patents, needlepoint ion systems need to be cleaned every 12-24 hours.

Some needlepoint systems are provided with a plaste wiper blade that is set up from the factory to activate and clean the carbon fibers every day.

It is important to think, 'Why do some Needlepoint products have plastic self-cleaning apparatus yet other products (ion bars, modular ion bars, etc.) do not have self-cleaning apparatus?'

This is a major fundamental contradiction that any engineer of record should be able to comprehend.

Why the needlepoint ion systems require constant maintenance is because as voltage is applied to the individual Needlepoints, a debris or discharge builds up on the tip of the needlepoint. This causes deposits and ultimately clogging of the ion pins. Needlepoint ion systems can be clogged and covered with particles, dirt, carbon deposits, etc. Once they are dirty, they start to erode and fail.

A typical office environment can contain Nitrogen, Oxygen, Salt vapours, salt crystals, dust and traces of nitrides and chloride salts (HCL). Ammonium nitrates salt cystals are commonly created, and these can grow on the tip of the pin (needlepoint) electrodes. At high humidities, the aforementioned salts become conductive, thus degrading and compromising bipolar ion production.

Needlepoint ionization requires **constant** maintenance. It is a disposable product and burns out after a period. When the needlepoints or brushes begin to foul up, they disintegrate, and the entire system needs to be thrown away. It is fact that needlepoints wear out at the tip and ion formation decreases. (See picture below).

In contrast, AtmosAir tubes last for over two years. In environments that are not dirty they do not need to be cleaned frequently.

Furthermore, dust collects on and around the pin electrode, mitigating efficient ion propagation, hence requiring periodic cleaning. Over a period of time, pin electrodes get corroded by either sulfur salts, corona discharge frequency, and both can adversely dull the keenness of the electrode. As the needlepoint erodes, it moves away from the nominal position and reduces ion production, and thus produces non uniform ion generation.

The phenomena is keen to spark erosion of metals and alloys, impacting the service life of the device. Furthermore, electrode steel erosion significantly increases with ambient temperature, frequency of bi-polar ion mobility, acid concentrations of the operating environment as well as NOx vapors and HCL vapors,

“Carbon Fiber Brushes”

Needlepoint manufacturers will try to market the needlepoint technology design as durable and long lasting. “Carbon fiber brushess are so strong that they are used to create airplane fuselages and automotive shells.”

Long lasting carbon fiber brushes is marketing. Typically, the bristles of the needlepoint brush may contain between 20 to about 80 wt % polypropylene copolymers, about 5-40 wt % talc, and 5 to 40 wt % carbon black.

A needlepoint carbon brush system has a brass electrode with carbon brushes crimped or heat shrinked to the electrode.

AtmosAir systems use stainless steel cathodes which have a melting point of up to 2500°F, which is superior. Cold plasma isn’t “cold,” as the discharges at the tip are up to 1500° which can easily burn away “carbon.”

Needlepoint Electrode (0.25”) core is brass.

Real-Time Indoor Air Quality Measurement and Verification

- AtmosAir BPI has been awarded for being a smart system with demand-controlled capabilities (AtmosSmart).
- Since needlepoint ionization does not impact indoor air quality, needlepoint ionization manufacturers typically do very little when it comes to commissioning, measurement, and verification of actual air cleaning performance.
- AtmosSmart is an integrated in duct air monitoring system, that connects to the AtmosAir bi-polar ion unit and will adjust Bi-Polar Ion levels based on feedback from the IAQ readings it is measuring. This is to provide optimal ion levels in changing IAQ conditions. The AtmosAir sensor probe typically resides in the main return duct or plenum so it can sample air coming back from the space being treated by the AtmosAir bi-polar unit.
- AtmosSmart also has the option to be connected to BMS using BACnet IP with an RJ 45 Ethernet connection so the BMS can trend and display Indoor Air Quality data.
- AtmosSmart measures and controls around 8 parameters of IAQ: TVOC, particulate matter (PM2.5), formaldehyde, ozone, carbon dioxide, carbon monoxide, relative humidity and temperature.

AtmosAir	Needlepoint
Multiple test from certified labs	Primarily references / focuses on lab tests
Dozens of 3rd party tests done by customers in real world spaces used in normal conditions	Sparse measurement and verification
Numerous case studies / references supported by clients	The few case studies focus primarily on reduction of outside air and the subsequent energy savings. NOT evidence that the NBPI improved the air quality or addresses viruses in real world setting..

Ion Bars

Needlepoint manufacturers have started to focus on ionization bars for “treatment of cooling coils.” Per their installation language it is supposed to be mounted on the “inlet side of the coil.”

It is important to note this technology does not offer continual self cleaning to the needlepoints.

Most importantly, if an ion bar is installed on the inlet side of the coil it will have little to no impact on air or surfaces in the occupied space.

Testing and experience shows that a dramatic percentage of ions are lost while being transferred through the coil. The majority of ions are eaten up by that infrastructure.

Many HVAC professionals have experienced a picture of a dirty coil or dirty return filter. Most can envision the fact that a 0.25” needlepoint array upstream of a coil stands little to no chance of not getting covered by particles just as a media filter would. **It requires constant cleaning for effectiveness.**

The design and placement of an ion bar will only impact a portion of the HVAC conditioning coils as aerodynamics will push the ions through a small section where the ion bar is typically placed. An AtmosAir system designed and engineered for coil cleaning benefit would more evenly saturate the coil with ions affecting a much larger surface area.

Ion Science

The below comments are from **Dr. Stacy Daniels, Adjunct Professor, University of Michigan**.

"Reactive Oxygen Species (ROS) are widely acknowledged to be the sanitizing agent with regards to both pathogens and gases. A system or technology needs to ionize oxygen to create any of the various Reactive Oxygen Species (ROS). An Ionization Energy (IE) of 12.07 eV is the level at which oxygen begins to ionize. Needlepoint manufacturers have been explicitly stating that they DO NOT reach 12.07 eV. Therefore if there are no ROS then what is the mysterious active agent? Eradication without oxidation? Ions without air? It is the superoxide anion that creates the hydroxyl radicals on surfaces of pathogens. Hydroxyls are an extremely powerful sanitizing agent. The only way to generate superoxide anions is to ionize oxygen at over 12.07 eV. Needlepoint bi-polar ionization does not reach this level and therefore would NOT create superoxide anions."

Conclusion: Needlepoint ionization does not ionize oxygen and does not create superoxide anions to act as a sanitizing agent with regards to both viruses, pathogens, and VOCs.

AtmosAir operates at 12.6 eV.

Dynamic Ion Adjustment

Ionization is not "install and forget."

Giving Owners the ability to adjust their ionization system is very important.

All AtmosAir systems have various control settings they can be run at. All AtmosAir systems have various BMS integration controls including continuous Indoor Air Quality monitoring.

Needlepoint systems are not adjustable. They run on (1) ionization setting out of the box.

Published Third Party Case Studies and Findings.

- Needlepoint ionization has yet to have any institutions or journals publish third-party findings or case studies.
- There is little to no published or peer reviewed research on needlepoint ionization.
- Data on Needlepoint ionization is typically coming from a manufacturer claiming product effectiveness.

From the CDC

"Relative to many other air cleaning or disinfection technologies, **needlepoint bi-polar ionization has a less-documented track record** in regards to cleaning/ disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems."

– CDC, 2020

Feedback from Engineering Community

A highly respected MEP Consulting Engineering firm was asked to inspect a needlepoint ionization installation, Comments from the inspection include:

- "Needlepoints began to arc when they became dirty with dust or corrosion from the airstream. Once needlepoints arced, they were not effective any longer."
- "We used an ion meter to try determine the effectiveness of the needlepoints. You literally had to get within about 2 to 3 inches of each needlepoint to read any ions at all. We were all surprised."
- "Ionization tubes (DBD), similar to AtmosAir, are the better investment in comparison to needlepoint ionization."

Documented bullets from the site visit at project installation detailed:

- Needles became corroded.
- The protective cover over the needles is split due to arcing and breakdown of the plastic insulator.
- The light circular pattern around one needle is indicative of arcing.
- The dark stains on the stainless-steel enclosure are the electroplating of contamination. The circular discoloration of the galvanized steel support shows the extent of the ion field which is obviously very small and ineffective.
- Downstream coils will likely be fouled.

Perceptual indoor air quality difference

- In our testing, we have only recognized perceptual differences in indoor air quality when NP is installed in standalone systems serving a very small area (+/- 400 sq ft).
- This is because of the ionization half-life issue.

Ease of Maintenance

Every manufacturer can claim a product lifespan. AtmosAir suggests that Owners change out the electrode (tube) every two years. It is a great option for an owner to have. They can run the systems longer than 2 years, but the ease of tube replacement makes the design truly superior. Over a period of time the cathode/ion generator will wear, and that would be a fact for any ionization system.

Conclusion

AtmosAir's Dielectric Barrier Discharge (DBD) Bi-Polar Ionization technology should not be confused with Corona Discharge, Needlepoint Ionization (NPBI), and Electrostatic Precipitation, which all use an ionic process.

AtmosAir DBD BPI has been installed in over 100M square feet of commercial space. AtmosAir's proven indoor air quality technologies are engineered to as a continuous disinfectant, actively reducing a wide range of airborne and surface contaminants such as viruses, VOCs (volatile organic compounds), bacteria, and germs. AtmosAir presents the ability to measure, treat, and monitor indoor air quality continuously while purifying contaminants in the air and on surfaces.