Agentis Air

PERFORMANCE REPORT

Performance Degradation Testing Due to Dust Loading for Brio™, HEPA-style, and PCO-style Air Purifiers

October 21, 2021

SUMMARY

Clean air delivery rate (CADR) is a standard measure of air purifier effectiveness that is based on the performance of a new air filter. However, as an air purifier traps pollutants the airflow may be reduced, and the CADR can drop below the original performance. Effectiveness declines if the airflow is reduced.

In laboratory testing, the Brio™ Air Purifier with APART™ Advanced Particle Removal Technology maintains peak air-cleaning effectiveness, as measured by a clean air delivery rate (CADR) at or above 90% of the unit's original CADR, and this performance is largely unaffected by the amount of pollutant collected. APART technology maintains this peak-air cleaning effectiveness at high and low fan settings.

By contrast, tested air purifiers which use either HEPA-style or Photocatalytic Oxidation (PCO)-style filtration technology experience a rapid decay in air-cleaning effectiveness that is directly proportional to the level of particle pollutants collected. This performance degradation occurs at high and low fan speeds.

TEST OBJECTIVE

To determine the comparative rates of CADR decay for APART, HEPA-style, and PCO-style technology, the test incrementally introduces controlled amounts of dust to a Brio 550 portable air cleaner and to three portable air cleaners that use either HEPA-style or PCO-style filtration.

The test simulates real-world conditions by circulating the dust through the filtration media, and measuring each unit's CADR at regular intervals to measure any reduction in performance as the filtration media becomes loaded with dust. For each unit, the CADR is measured at regular intervals, and at both high and low fan speeds, to determine the effect of dust loading on CADR.

METHODOLOGY

For each unit, the new-filter CADR is measured first, followed by a dust loading. This procedure ends if the unit's CADR drops to 50% of its original value. This process approximates the procedure found in the internationally recognized Chinese national standard for measuring Cumulative Clean Mass (CCM) published in GB/T 18801-2015. This standard is more stringent and advanced than current United States standards for evaluating consumer air purifiers.

Initial CADR Determination The testing equipment, procedures, and calculations for CADR measurement approximate the ANSI/AHAM AC-1 standard. Each device is placed into a 30 m^3 sealed chamber and "ISO 12103-1 A2 Fine Test Dust" is introduced in a controlled amount via compressed air and recirculation fans. The reduction in particulate count is measured by a MetOne BT-610 6-Channel Particle Counter over the course of 20 minutes while the air purifier is running.

CADR Test Under Dust Loading Each device is placed into a small room (3 m^3) and "ISO 12103-1 A2 Fine Test Dust" is introduced in a controlled amount via compressed air. The dust is circulated into the device by its own fan. Before and after each loading, the filtration media is removed from the device and weighed using a high-precision, lab scale to determine the mass of dust that has accumulated on the filter. Pre-Filters are not included during the dust-loading phase, to ensure they do not negatively affect test results on the main device filtration media.

RESULTS

Brio's performance never drops below 90% during the course of this test. On high speed, Brio's CADR only drops by 10% after 60 grams of dust loading. On low speed, Brio's performance drops even less, by about 8% after 66.2 grams of dust loading. Brio doesn't clog, so the airflow and performance remain constant, and Brio stays effective, even after collecting a large amount of dust.

For the three competitor units tested, performance drops rapidly and less dust is collected. HEPA-style Unit A collects 33.3 grams of dust before dropping to 50% CADR on high speed. It collects only 23.5 grams of dust before dropping to 50% on low speed. HEPA-style Unit B collects 22.3 grams of dust before dropping to 50% CADR on high speed. On low speed, it collects 17.5 grams of dust before dropping to 50% of original CADR. The PCO-style Unit C collects 14.3 grams of dust before dropping to 50% CADR on high speed. It collects only 2 grams of dust before dropping to 50% on low speed.

Under identical conditions, Brio collects more dust and maintains peak performance (90% of original CADR) while competitor units clog significantly and performance is dramatically reduced (to 50% of original CADR).

INITIAL CADR DETERMINATION AT HIGH AND LOW SPEEDS

Unit Tested	Dimensions (inches)	Initial CADR High Speed	Initial CADR Low Speed	Low CADR /High CADR
Brio 550	23.5 X 12 X 12	240	140	58%
Unit A - HEPA Style	25 X 15 X 8.5	200	49	24%
Unit B - HEPA Style	27 X 11.8 X 11.8	275	76	28%
Unit C - PCO Style	23 X 8.25 X 8.25	68	10	15%

CADR AFTER DUST LOADING AT HIGH FAN SPEED

Unit Tested	Initial CADR	CADR After Dust Loading	End Dust Load (g)	CADR Capacity After Dust Loading
Brio 550	240	216	59.9	90%
Unit A - HEPA Style	200	100	33.3	50%
Unit B - HEPA Style	275	138	22.3	50%
Unit C - PCO Style	68	34	14.3	50%

CADR AFTER DUST LOADING AT LOW FAN SPEED

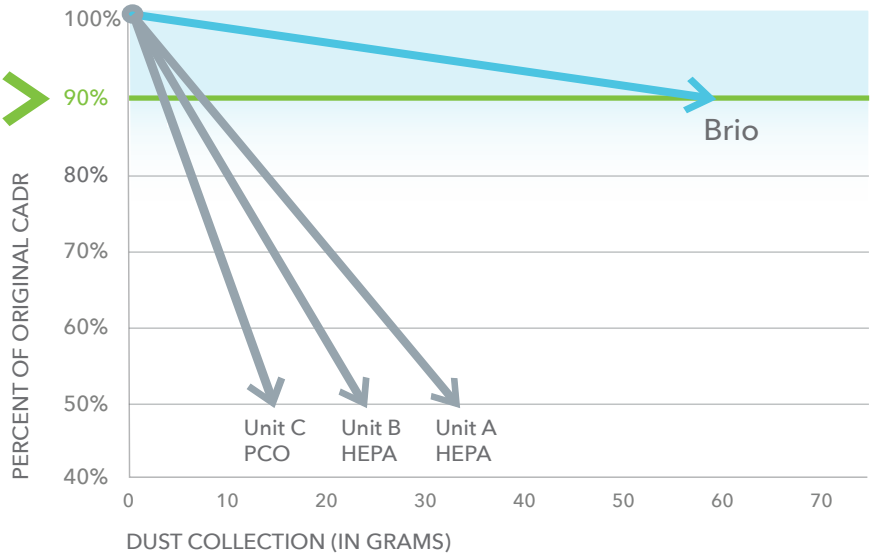
Unit Tested	Initial CADR	CADR After Dust Loading	End Dust Load (g)	CADR Capacity After Dust Loading
Brio 550	140	126	66.2	92%
Unit A - HEPA Style	49	25	23.5	50%
Unit B - HEPA Style	76	38	17.5	50%
Unit C - PCO Style	10	5	2.0	50%

Note: CADR is measured in cubic feet per minute (CFM).

RESULTS

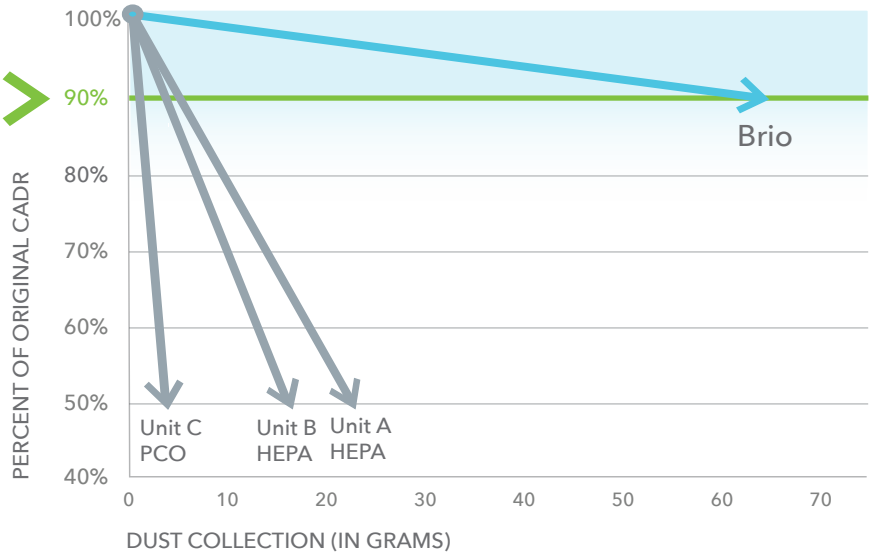
COMPARATIVE DECLINE IN CADR: DUST COLLECTION AT HIGH FAN SPEED

Change HEPA or PCO filters here to match Brio's constant peak performance



COMPARATIVE DECLINE IN CADR: DUST COLLECTION AT LOW FAN SPEED

Change HEPA or PCO filters here to match Brio's constant peak performance



KEY TAKEAWAYS

Brio maintains peak effectiveness over time

- Brio can capture more than 60 grams of dust without significant performance decline
- HEPA-style and PCO-style air purifiers require 5-10 filter changes to stay at the same performance level

Brio maintains peak effectiveness under extreme conditions

- Brio's performance stays at or above 90% of its original, new-filtration-media CADR
- HEPA-style air purifiers clog rapidly, resulting in dramatic CADR drop off
- PCO-style air purifiers have the lowest amount of dust collected and biggest drop off in CADR, for the weakest performance among tested air purifier types

Brio maintains peak effectiveness at low fan speeds

- Brio air purifier performance stays above 90% of its original CADR at low fan speed
- HEPA-style and PCO-style air purifier performance drop off becomes even more pronounced at low fan speeds

HOW BRIO DOES IT

Deep air cleaning begins at the **360-degree air intake zone** at Brio's elevated base.

Next, the **Pre-Filter** traps larger visible particles, pet hair, and debris.

The powerful fan draws invisible pollutants upward past the **Particle Charger** where they gain an electrostatic charge.

Charged particles are drawn out of the airflow and trapped in the **APART Collection Cartridge** for later disposal.

As the final stage, Brio's **Refresh Plus™ Filter** removes ambient ozone before returning better air to the room. Brio is certified as ozone-safe by the California Air Resources Board.

Brio's Advanced Particle Removal Technology

Agentis Air

A collaboration of research scientists, engineers, and air quality experts, Agentis Air is on a mission to improve human health and longevity through better indoor air purification technology. With decades of university research and development experience, our company is focused on transformational air purification technologies with broad applications for institutional, commercial, and consumer markets.

Our patented Advanced Particle Removal Technology™ elevates effectiveness, reduces energy use, and eliminates maintenance. Developed over five years at the University of Washington's Sensors, Energy, and Automation Laboratory, the technology is designed for the next generation of indoor air quality solutions.

Find out more about our advanced air purification technology

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