HealthWay

ARIIX/ PURITII AIR PURIFICATION SYSTEM

TEST REPORT

Version 1.0

10/27/2014

DISCLAIMER: This is a pilot in-house study, not a peer–reviewed or published scientific study. In-House testing data generated in this study represent a fundamental phase of the research and development process. The purpose of conducting post beta phase testing is to examine the feasibility of an approach that is intended to be used in a third party testing, other regulatory compliance used assessment procedures, industry best practices, new methods, and implementation. This pilot in house study is not a hypothesis testing study and, due to the small sample size, the results are not generalizable beyond the samples in the study.

VERSION HISTORY

This report represents the Post-Beta Phase testing data of the Ariix/Puritii eleven stage air purification system conducted by both HealthWay R&D USA and HealthWay manufacturing plant China. This version of the report provides information on the initial production unit's performance, efficiency, engineering criteria check and QA/QC of first production units. This Test Report is developed by HealthWay Production & R&D, controlled and tracked by HealthWay R&D department, revised by HealthWay R&D/ Quality Control department, and approved by Ariix/Puritii project manager Mr. Vincent Lobdell.

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason
1.0	Yahya Al Rayyes	10/27/2014	Vince Lobdell	11/02014	

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1.0 INTRODUCTION

1.1 PURPOSE

This Ariix/Puritii 11 Stage Air Purification System Test Report provides a summary of engineering test results performed and outlined within this document.

2.0 TEST SUMMARY

All tests were conducted following HealthWay quality QA/QC policies, air purifier performance testing and industry general guidelines. Listed below are the specific tests and test results.

Project Name: Ariix/Puritii
System Name: Puritii portable 11 stage air purification system
Version Number: 1.0
Additional Comments: (This list of testing represents in-house post-beta phase testing and not a third party testing evaluation)

2.1 FUNCTION, POWER AND UNIT CONTROLS

Test Owner: Tim Cusak
Test Date: (10/25/2014) – (10/28/2014)
Test Results: All of unit functions were operative including motor, blower, speed variations, power efficiency range, control board and unit remote control. (Results are tabulated in section 4.1)
Additional Comments: Initial functionality test were conducted on intervals of 1 hour, 2 hours, 5 hours, 24 hours, 48 hours and 72 hours.

2.2 FINE PARTICULATE MATTER @ PM 2.5 FILTER EFFECIENCY

Test Owner: Yahya Al-Rayyes
Test Date: (10/25/2014) – (10/28/2014)
Test Results: Unit filter efficiency was assessed in removal of fine particulate matter of a size PM 2.5 and larger at all unit 4 speeds. Unit efficiency was observed to be above 99%. (Results are tabulated in section 4.2)
Additional Comments: PM 2.5 filter performance efficiency was assessed on the system exhaust side in comparison to background levels using the handheld particulate counter model MET-ONE GT321

2.3 AIR FLOW/AIR DELIVERY PER FAN SPEED WITH ALL FILTERS INSTALLED

Test Owner: Chet chase
Test Date: (10/25/2014) – (10/28/2014)
Test Results: Air flow/Air delivery per fan speed assessment of air at exhaust side of the filter utilizing fast response capture hood air flow meter. (Results are tabulated in section 4.4)
Additional Comments: Filtration unit air flow was assessed on the system exhaust side using Alnor Balometer Capture Hood 6200D is the ideal way to measure very low volumetric flow. Confidently and accurately measure supply or return flows from 10 to 500 cfm (17 to 850 m3/h).

2.4 NOISE LEVELS DB BY THE OPERATING SYSTEM AT ALL SPEEDS.

Test Owner: Yahya Al Rayyes
Test Date: (10/25/2014) – (10/28/2014)
Test Results: Noise levels of the unit were assessed at all 4 speeds. (Results are tabulated in section 4.5) All test results are found to be meeting China's national standards as per unit engineering design.
Additional Comments: Noise level was measured inside testing room and at a distance of 1 meter from unit using SL-5868P Sound Level Meter.

2.5 POWER, RPM AND ENERGY WATTAGE EFFICIENCY

Test Owner: Tim Cusak /Chet Chase
Test Date: (10/25/2014) – (10/28/2014)
Test Results: All 4 speeds power consumption, motor blower RPM and energy Watt efficiency were assessed. (Results are tabulated in section 4.6)
Additional Comments: Energy/wattage consumption assessment were conducted for each individual speed correlating with blower motor RPM using Fluke 789 Process Meter and 400A AC True-RMS Clamp Meter at 220V 50Hz. All test results are found to be meeting China's national standards as per unit engineering design.

2.6 CLEAN AIR DELIVERY RATE CADR OF THE SYSTEM AT HI/TURBO SPEED.

Test Owner: Mr. Chen /HealthWay
Test Date: (09/17/2014) – (09/19/2014)
Test Results: Clean Air Delivery Rate (CADR) was measured by cubic feet per minute (CFM) of air that has had all the particles of a given size distribution removed. (Results are tabulated in section 4.7)
Additional Comments: The CADR indicates the volume of filtered air delivered by an air cleaner. The higher the tobacco smoke, pollen and dust numbers, the faster the unit filters the air. All test results are found to be meeting or exceeding China's national standards as per unit engineering design.

2.7 IONIZING NEEDLE AND ION PCS/CC LEVELS GENERATED

Test Owner: Yahya Al Rayyes/Tim Cusak/John Pugh
Test Date: (10/25/2014) – (10/31/2014)
Test Results: carbon fiber brush, needlepoint, bi-polar ionization generator rated > 600,000 pcs/cc (Results are tabulated in section 4.8)
Additional Comments: When high voltage is applied to a conductive surface that is not grounded, electrons will build up until they find a place to "jump off." A sharply pointed surface, such as a needlepoint, allows the negative ions to easily escape and ionize the air surrounding the point. Negative ions travel through the air until they attract airborne particulates that agglomerate until they are too heavy and settle to the floor.

2.8 BYPRODUCTS/OZONE EMISSION

Test Owner: Yahya Al Rayyes /John Pugh
Test Date: (10/25/2014) – (10/31/2014)
Test Results: Testing of ozone levels in comparison to background levels shows zero emission from unit. (Results are tabulated in section 4.9)
Additional Comments: Ozone levels measurements were conducted at exhaust side of air purification system in comparison to background natural levels of ozone. Ozone levels were measured in part per million ppm using GreyWolf sense ozone monitor. All test results are found to be meeting China's national standards as per unit engineering design.

3.0 Test Assessment

As shown in the test results section, Ariix/Puritii air filtration device has the potential to reduce fine particulate matter of a size PM 2.5 by approximately 99% and above of the background levels.

Personal air filtration devices can protect individuals from the adverse health effects of fine particulate matters PM with high filtration efficiencies. The rapid mitigation provided by the Puritii unit reducing and controls fine particulate matter of a size PM 2.5 and larger are needed to control the effects of harmful emissions.

The ability of any portable air purification system to effectively impact the indoor air quality is dependent on the filter efficiency in removing fine particulate matters, capacity to adsorb or oxidize VOCs, larger air flow (CFM) and the number of air exchanges per hour while keeping the operating noise within acceptable limits. Additionally, it is highly desirable that a continuously operating air filtration system can have a good performing blower with lower power consumption. The efficiency of arresting fine particulate matter pollutants by the Puritii air purification system was assessed in the following categories:

1. Function, POWER and unit controls
2. Removing fine particulate matter of a size PM 2.5 and larger at four different speeds.
3. Removing fine particulate matter of a size PM 0.5 and larger at four different speeds.
4. Air flow passing through the system in low, medium, high and Turbo speed.
5. Noise levels dB by the operating system at all speeds.
6. Power, RPM and energy Wattage efficiency
7. Clean Air Delivery Rate CADR of the system at Turbo speed.
8. Ionizing needle and ion pcs/cc levels generated
9. Assessment of byproducts that are possibly generated by the operating air filtration system such as ozone.

4.0 TEST RESULTS

4.1 UNIT STAGES, FUNCTIONS, POWER AND UNIT CONTROLS

UNIT FUNCTION	SETTING	REMARKS
Power Cable	Unit Power	Functioning/ OK
POWER ON/OFF	Display/Control board	All functions are OK
POWER OFF	Remote Control	OFF function/OK
Fan Speeds	Display/Control board	Functioning/ OK
Remote control	Power off/speeds/ionizer	Functioning/ OK
Fan Speeds control	Remote Control	Functioning/ OK
Pre-Filter 3 Stages	Pre-Filter enclosure panel	Assembly in place/frame is sealed
Main filter assembly	Main filter stages 4-10	Assembly in place/frame is sealed
Ionizing needle	Ionizing needle assembly	Functioning/ OK

4.2 REMOVING FINE PARTICULATE MATTERS OF A SIZE PM 2.5 AND LARGER AT FOUR DIFFERENT SPEEDS

Performance of current filter media at PM2.5

Speed	Background PM 2.5	PM 2.5 @ Exhaust	Efficiency
Turbo	418.233	500	99.88%
High	674,200	962	99.86%
Medium	689,400	300	99.95%
Low	539,945	230	99.95%

4.3 AIR FLOW/ AIR DELIVERY PER FAN SPEED (ALL FILTERS INSTALLED)

Speed	CFM	m^3/hr
Turbo	280	475.7
High	220	374
Medium	163	277
Low	104	177

4.4 NOISE LEVELS dB BY THE OPERATING SYSTEM AT ALL SPEEDS

Speed	Noise dB (1 m)	Noise dB (30 cm)
Turbo	66.5	74.5
High	56.8	65
Medium	50	57
Low	42	48

4.5 POWER, RPM AND ENERGY WATTAGE EFFICIENCY

Speed	Motor speed RPM	CFM	Power usage Watt
Turbo	1682	280	99
High	1305	220	49
Medium	1045	163	19
Low	780	104	7

4.6 CLEAN AIR DELIVERY RATE CADR OF THE SYSTEM AT Hi/TURBO SPEED

4.6.1 Test Purpose:

Test and compare the CFM on Turbo, CADR value on Turbo and Hi, purification efficiency of Turbo and Hi of the current filter and Apollo filter.

4.6.2 Test Time: Sep. 17th, 2014

4.6.3 Test Location: The technology test room

4.6.4 Tester： Mr. Chen

4.6.5 Test environment Temperature：28℃， Humidity： 70%

4.6.6Test Instrument: Ariix/Puritii unit, Regulated Power Supply, Particle counter, Air volume tester

4.6.7 Testing Content: CFM of turbo

Place and tes main filter assembly into the Ariix/Puritii unit (220V/50Hz), operate the unit on Turbo speed, test the CFM by used an air volume tester, record the results in the below form.

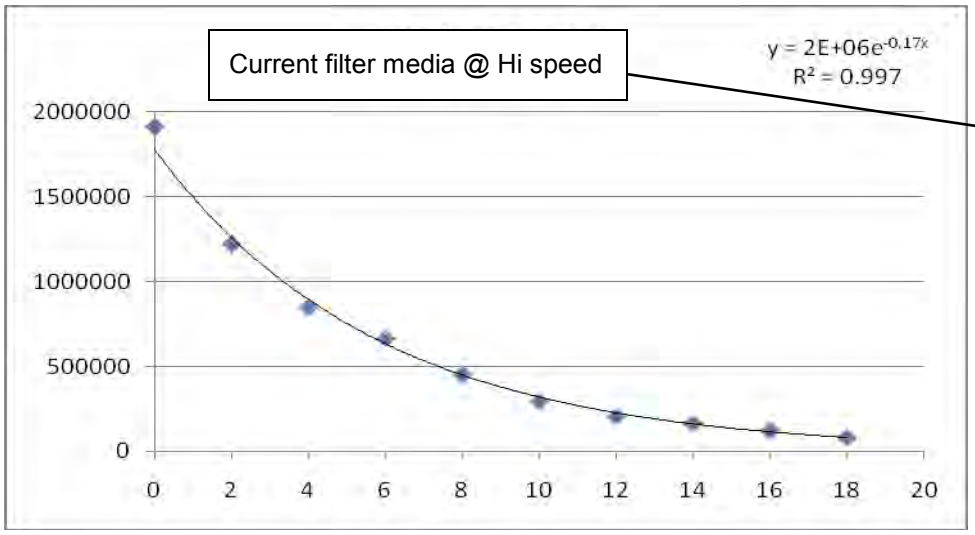
Turbo		Hi	
m3/h	**CFM**	**m3/h**	**CFM**
410	240	310	180

1) Purification efficiency of Turbo and Hi

Place the tested main filter into the sample Ariix unit, and place the unit in a 30m^3 standard test room, operate the unit on Hi and Turbo speed, test the particle count of the test room per 2 minute by used a particle counter, record the results in the below form.

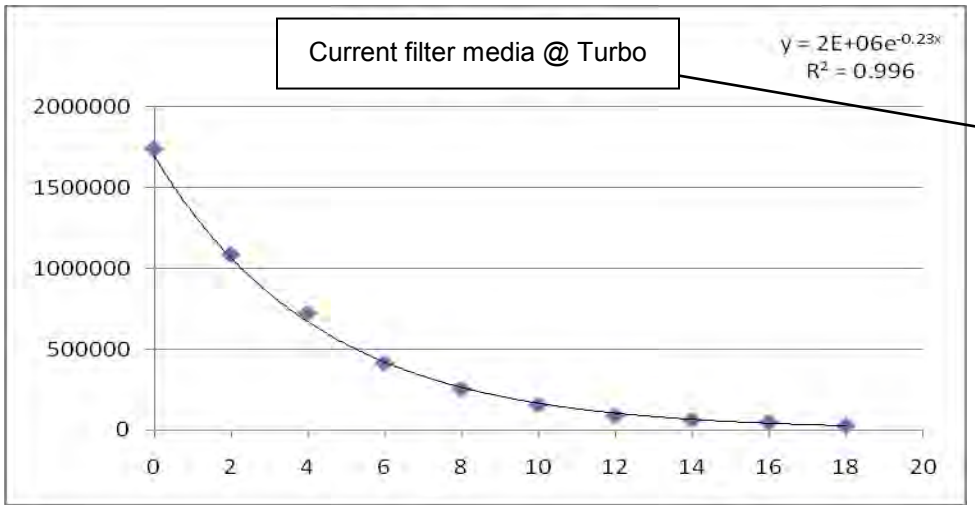
Duration (minute）	Current Filter		Remark
	Hi	Turbo	
0	1909733	1736033	
2	129533	1083450	
4	850300	721966	
6	665200	413483	
8	449766	252783	
10	294716	153416	
12	206783	87433	
14	165200	61716	
16	119550	47016	
18	82150	27200	

1）



CADR=0.17×60×30=306 m^3 /h=178 CFM

2）



CADR=0.23×60×30=414 m^3 /h=241 CFM

4) **Power**

Place the tested main filter into the sample Ariix unit(220V/50Hz), operate the unit on Hi and Turbo speed, observe the power from the regulated power supply directly, record the results in the below form.

Serial #	Hi (w)	Turbo (w)	Remark
40143309	45	106	

2) Energy efficiency

Refer to the above test data, use CADR value to divided by power, calculate the energy efficiency value, and record the results in the below form.

Serial #	Hi (m^3 /h.w)	Turbo (m^3 /h.w)	Remark
40143309	6.8	3.91	

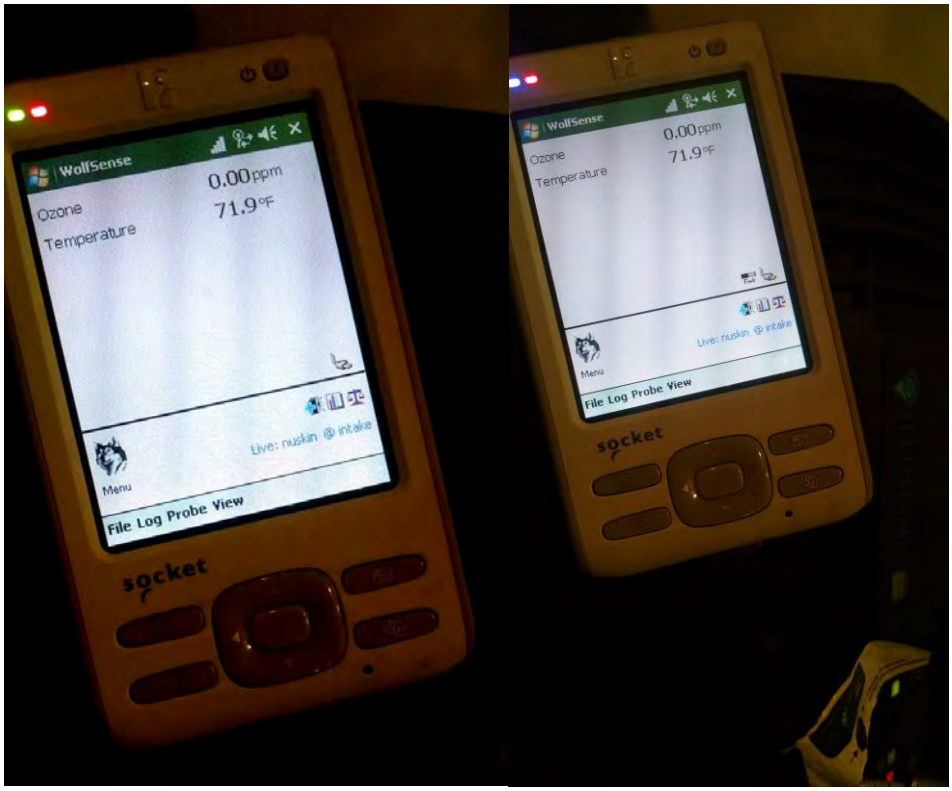
4.8 IONIZING NEEDLE AND ION PCS/CC LEVELS GENERATED

Negative ion count (blow off direction)

Ion counts were conducted by using Ultra Wide Range Ion Counter IC-1000-W. Ionizing needle generated negative ion performance can't be evaluation without negative ion counter and count information. Ion generator cannot be classified as good if ion counts are less than 2000-3000 at distance 1 m from device.

Specification item	Sample result	Importance
Negative ion count (blow off direction)	1,655,000(pcs/cc at 5cm) 1,622,000(pcs/cc at 10cm) 1,622,000(pcs/cc at 10cm) 260,000 (pcs/cc at 1m)	High

4.9 Byproducts/ozone emission



Time/duration	O3 concentration ppm	ANSI/UL Standard 867 or ANSI/UL Standard 507
1 hour	0.00 ppm	Meets standards requirements
8 hours	0.00 -0.01	Meets standards requirements
12 hours	0.00 – 0.01	Meets standards requirements

4.10 SYSTEM TESTING

The table below summarizes the results of system testing:

Test Case ID	Date Tested	Tester	Pass/Fail	Severity of Defect	Summary of Defect	Closed prior to Production Release?	Comments
ARIIX2014	10/24/2014	Yahya Al Rayyes	PASS	NON	NON	NON	RFP

4.11 USER ACCEPTANCE TESTING

The table below summarizes the test cases employed for user acceptance testing and the test results obtained for each test case:

Test Case ID	Date Tested	Tester	Pass/Fail	Severity of Defect	Summary of Defect	Closed prior to Production Release?	Comments
1. Function, POWER and unit controls	Oct 25-28/14	TC/JP	PASS	NON	NON	NO	
2. Efficiency @ PM 2.5	Oct 25-28/14	YR	PASS				
3. Efficiency @ PM 2.5 PM 0.5	Oct 25-28/14	YR	PASS				
4. Air delivery rate CFM	Oct 25-28/14	CC	PASS				
5. Noise levels dB	Oct 25-28/14	YR	PASS				
6. Power, RPM and y Wattage	Oct 25-28/14	CC	PASS				
7. CADR.	Sept 17-20/14	C.	PASS				
8. Ion generating Ionizing needle pcs/cc levels	Oct 30-31/14	YR/TC	PASS				
9. Byproducts/ozone	Oct 30-31/14	YR/JP	PASS				

4.12 PERFORMANCE TESTING

The table below summarizes the test cases employed for performance testing and the test results obtained for each test case:

Test Case ID	Date Tested	Tester	Pass/Fail	Severity of Defect	Summary of Defect	Closed prior to Production Release?	Comments
1. Function, POWER and unit controls	Oct 25-28/14	TC/JP	Pass/Fail	NON	NON	NO	
2. Efficiency @ PM 2.5	Oct 25-28/14	YR	PASS				
3. Efficiency @ PM 2.5 PM 0.5	Oct 25-28/14	YR	PASS				
4. Air delivery rate CFM	Oct 25-28/14	CC	PASS				
5. Noise levels dB	Oct 25-28/14	YR	PASS				
6. Power, RPM and y Wattage	Oct 25-28/14	CC	PASS				
7. CADR.	Sept 17-20/14	C.	PASS				
8. Ion generating Ionizing needle pcs/cc levels	Oct 30-31/14	YR/TC	PASS				
9. Byproducts/ozone	Oct 30-31/14	YR/JP	PASS				

5.0 VARIANCES

CFM readings at Turbo for current media are higher than Beta-Testing filter media. RPM readings on hi and Turbo are lower while CFM is higher at post Beat testing phase.

6.0 TEST INSTANCES

Fluctuation of ion counts when ion counter not grounded, positive ions are recorded however at lower levels

6.1 RESOLVED TEST INCIDENTS

Ion readings were retested after grounding ion counter device.

6.2 UNRESOLVED TEST INCIDENTS

Ion counts were recorded at desired levels for ionizing needle functionality

7.0 RECOMMENDATIONS

Unit is ready for third party testing and safety standards as per requirements of industry guidelines ad international standards.

APPENDIX A: Test Report Approval

The undersigned acknowledge they have reviewed the Ariix/Puritii **Test Report** and agree with the approach it presents. Changes to this **Test Report** will be coordinated with and approved by the undersigned or their designated representatives.

Signature:		Date:	10/31/2014
Print Name:			
Title:			
Role:	Project Manager		