

POROUS MEDIA®

AIR BEARINGS

FOR CLEANROOM APPLICATIONS



| TESTING METHODS AND ANALYSIS

NEWWAY®
air bearings

ABSTRACT

New Way[®] Air Bearings are designed so that the air quality supplied by the bearing satisfies the requirements of ISO Class 3 (Old Class 1) cleanliness, with airborne particulate concentrate limits of less than 1,000 x 0.1µm particles / m³.

The advantage of New Way[®] porous media air bearings is that the porous media itself acts as a sub-micron filter, so the air flowing out of the bearing is inherently clean. The question is just how clean?

The following report provides the testing methods and results to verify New Way products' ability to consistently meet ISO Class 3 cleanroom compliance, as well as provide evidence for their use in cleanrooms as stringent as ISO Class 1.

INTRODUCTION

In order to ensure New Way Air Bearings are viable for use in cleanroom environments, a testing chamber acceptable to ISO 14644-4 standards was constructed to determine the amount of particulation generated from the air bearing.

An air-tight chamber was fabricated, and testing was commenced utilizing multiple test methods in an effort to obtain an accurate sample of the particulate generated from the bearing. Numerous tests were employed in an effort to ensure that the most accurate analysis of the bearing was realized.

This report documents testing performed in 2005 using the largest New Way products at the time, Conveyor Air Bearings, now known as Air Bars. It was assumed that if these air bearings passed a particulation test, smaller air bearings in the New Way product line would particulate less. While New Way has added larger products since the time of testing, the initial testing results indicate the size increase would not affect the end conclusion.

DESIGN OF TESTING CHAMBER

A test chamber was constructed with the following characteristics:

Material	Glass
Dimensions	304.8mm x 152mm x 203.2mm (12" x 6" x 8")
Volume	0.009 cubic meters (0.333 cubic feet)
Air Pressure¹	20 PSI (137.9 kPa)

1: Sub-micron filtered air was used at a flow change rate matching the rate of air being removed by the testing apparatus to collect all the particles within the chamber.

Table 1-1 Chamber Specifications

The sampling equipment used had the following characteristics:

Sampling System	Lasair II 110, by Particle Measuring Systems
Flow Rate	1 CFM (28.3 LPM)
Accuracy	+/- 5%
Testing Range	0.1µm – 5.0µm

Table 1-2 Sampling System Specifications

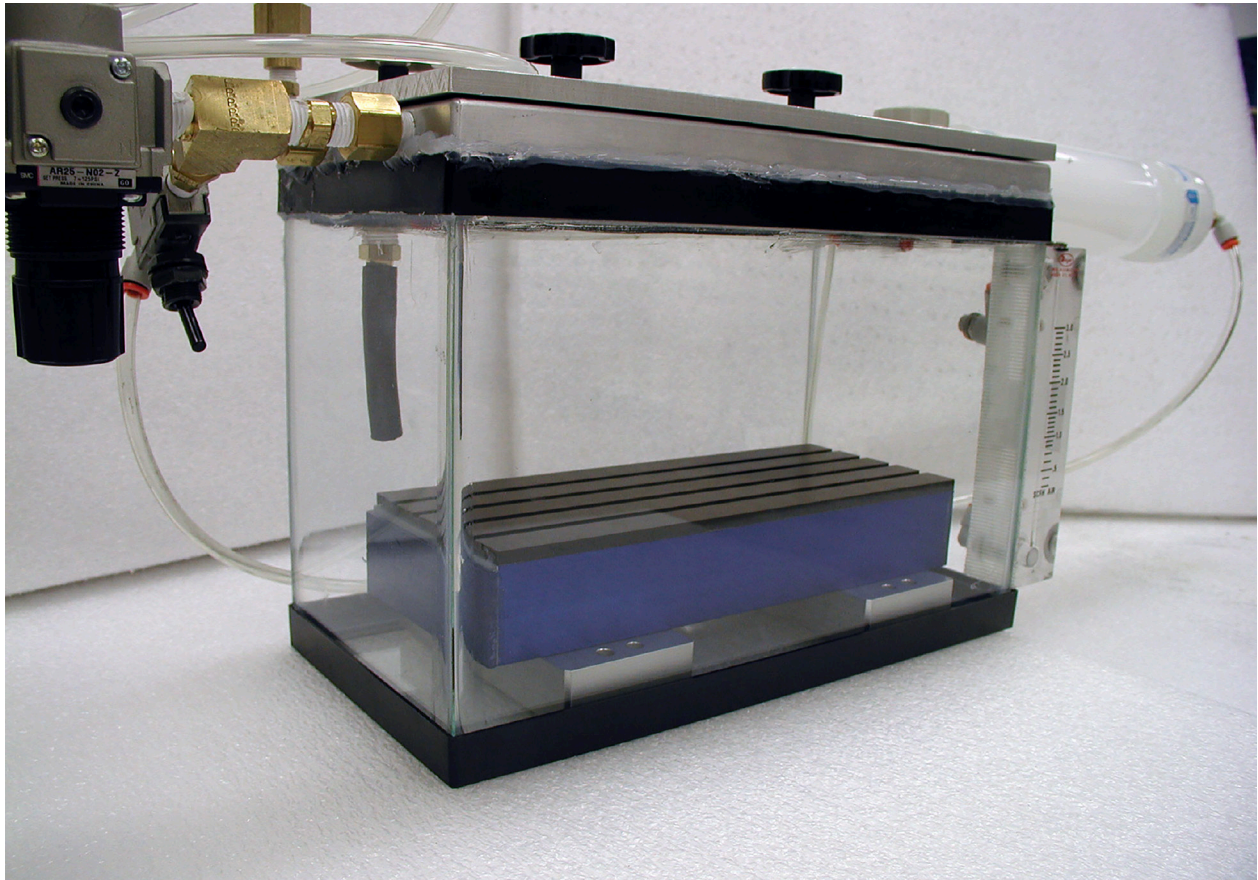
The system utilizes a "normalization" feature, which allows a calculation based on the particles sampled to extrapolate the readings to cubic meter readings; in order to compare results directly with ISO 14644-1 designated standards. The testing apparatus and chamber were calibrated using a known value of particulate generation by a different bearing.

The orifice for collecting an air sample was moved based on test results in order to collect the most accurate analysis of particulate coming off of the bearing. Initially, the sample was taken from a position level with the surface of the bearing, 25.4mm (1") away, in the middle of the length of the bearing. The sample inlet port was moved to a position directly over the bearing so that the inlet port was less than 25.4mm (1") above the surface of the bearing. This position was replicated in five (5) different places over the bearing surface.

An ION gun* was used to ensure that there was no particulation present on the chamber walls, prior to sealing the container. The testing chamber was fully purged and tested to sub ISO Class 1 levels of particulation (less than ten 0.1µm particles present ft 3) in order to ensure that an accurate test was being performed, and particulates being produced was from the air bearing only.

The New Way 250mm Conveyor Air Bearing was mounted in a chamber 25.4mm (1") off of the surface of the container, in order to ensure adequate circulation of air. The air supplied to the bearing was filtered to below 0.1µm particle levels. Figure 1-1 shows the 250mm bearing being tested. A similar method was utilized for testing the 750 mm bearings (not shown). Two different 750mm bearings were tested using the same methods.





*An ION gun delivers a steady stream of +/- ions in order to neutralize a charge on a surface. "Static" charges are often the principal contributors to particulation generation on surfaces.

Figure 1-1 Air Bearing Test Setup

RESULTS

New Way Conveyor Air Bearings were tested with the following conditions:

- Air Pressure: 137.9 kPa (20Psi)
- Sample inlet port less than 25.4 mm (1") above the bearing surface.

Tables 1-3, 1-4 and 1-5 contain the results represented as particles per 1/3 cubic foot or .009m³. This data was then normalized to the volume specified in the ISO 14644-1 classification document (see References) for airborne particulate cleanliness.

Air Sample Position	0.1 Microns	0.2 Microns	0.3 Microns	0.4 Microns	1.0 Microns	5.0 Microns
On edge, at midpoint	0	0	0	0	0	0
On edge at end of brng	0	0	0	0	0	0
Middle of brng, on top	1	0	0	0	0	0
On top, end of bearing	0	0	0	0	0	0
Bot. chamber, end brng	2	0	0	0	0	0

Figure 1-3 750MM Bearing (106654)

Air Sample Position	0.1 Microns	0.2 Microns	0.3 Microns	0.4 Microns	1.0 Microns	5.0 Microns
On edge, at midpoint	1	0	0	0	0	0
On edge at end of brng	0	0	0	0	0	0
Middle of brng, on top	1	0	0	0	0	0
On top, end of bearing	0	0	0	0	0	0
Bot. chamber, end brng	0	0	0	0	0	0

Figure 1-4 750MM Bearing (104852)

Air Sample Position	0.1 Microns	0.2 Microns	0.3 Microns	0.4 Microns	1.0 Microns	5.0 Microns
On edge, at midpoint	0	0	0	0	0	0
On edge at end of brng	0	0	0	0	0	0
Middle of brng, on top	1	0	0	0	0	0
On top, end of bearing	0	0	0	0	0	0
Bot. chamber, end brng	0	0	0	0	0	0

Figure 1-5 250MM Bearing (110227)

CONCLUSION

The test results validate New Way's design requirement, clearly meeting ISO 14644-1 Class 3 levels (old Class 1) of particulate generation, producing fewer than one thousand 0.1µm particles per m³.

While limited testing was performed, the test data also makes a plausible case for the use of New Way products in cleanrooms more stringent than ISO Class 3. The unique property all air bearings introduce to cleanroom environments is the constant source of air they provide when in operation. Some level of particulation may be present in the air that flows into the bearing.

Each cleanroom environment is different with many variables including:

- Size of cleanroom
- Number of air changes per minute
- Location of equipment
- Type of operation
- Position of the bearings relative to the workpiece
- Number of operators

The airflow rate through New Way[®] air bearings is very low, and hence the supply of particles, is relatively slow (0.15 m³ per hour for a 50mmx100mm air bearing), meaning it will take over 6 hours of operation for a New Way[®] Air Bearings air bearing to supply 1 m³ of air. There is also considerable dilution effect provided by the air changes within the cleanroom, as much as 10 room changes per minute.

Therefore, it is quite easy to understand how New Way[®] Air Bearings can be used in not only ISO Class 3 cleanrooms, but even in those as clean as ISO Class 1.

REFERENCES

CLEAN ROOM STANDARDS

New Standards

ISO/TC209 14644-1 Airborne Particulate Cleanliness Classes

As comparison, the new classification table from ISO 14644-1:2015 is shown below:

ISO CLASSES OF AIR CLEANLINESS BY PARTICLE CONCENTRATION

ISO Class Number (N)	Maximum allowable concentrations (particles/m ³) for particles equal and greater than the considered sizes, shown below ^a					
	0.1 Microns	0.2 Microns	0.3 Microns	0.5 Microns	1.0 Microns	5.0 Microns
1	10 ^b	d	d	d	d	e
2	100	24 ^b	10 ^b	d	d	e
3	1,000	237	102	35 ^b	d	e
4	10,000	2,370	1,020	352	83 ^b	e
5	100,000	23,700	10,200	3,520	832	d, e, f
6	1,000,000	237,000	237,000	35,200	8,320	293
7	c	c	c	352,000	83,200	2,930
8	c	c	c	3,520,000	832,000	29,300
9g	c	c	c	35,200,000	8,320,000	

TABLE 1 - ISO 14644-1:2015

OLD STANDARDS

Federal Standard 209E Airborne Particulate Cleanliness Classes

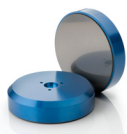
CLASS LIMITS

		0.1 Microns		0.2 Microns		0.3 Microns		0.5 Microns		5.0 Microns	
Class Name		Volume Units		Volume Units		Volume Units		Volume Units		Volume Units	
SI	ENGLISH	m ³	ft ³	m ³	ft ³	m ³	ft ³	m ³	ft ³	m ³	ft ³
M1		350	9.91	75.7	2.14	30.9	0.875	10.0	0.283	---	---
M1.5	1	1,240	35.0	265	7.50	106	3.00	35.3	1.00	---	---
M2		3,500	99.1	757	21.4	309	8.75	100	2.83	---	---
M2.5	10	12,400	350	2,650	75.0	1,060	30.0	353	10.0	---	---
M3		35,000	991	7,570	214	3,090	87.5	1,000	28.3	---	---
M3.5	100	---	---	26,500	750	10,600	300	3,530	100	---	---
M4		---	---	75,500	2,140	30,900	875	10,000	283	---	---
M4.5	1,000	---	---	---	---	---	---	35,300	1,000	247	7.00
M5		---	---	---	---	---	---	100,000	2,830	618	17.5
M5.5	10,000	---	---	---	---	---	---	353,000	10,000	2,470	70.0
M6		---	---	---	---	---	---	1,000,000	28,300	6,180	175
M6.5	100,000	---	---	---	---	---	---	3,530,000	24,700	24,700	700
M7		---	---	---	---	---	---	10,530,000	61,800	61,800	1,750

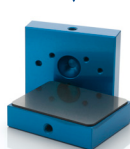
FEDERAL STANDARD - 209E



COMPLETE NEW WAY POROUS MEDIA® AIR BEARING PRODUCT LINE



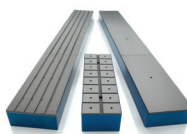
Flat Round
Air Bearings



Flat Rectangular
Air Bearings



Vacuum Preloaded
Air Bearings



Conveyor
Air Bearings



Radial
Air Bearings



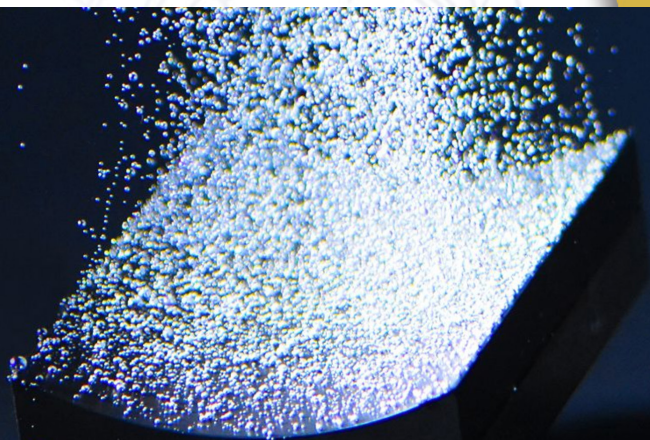
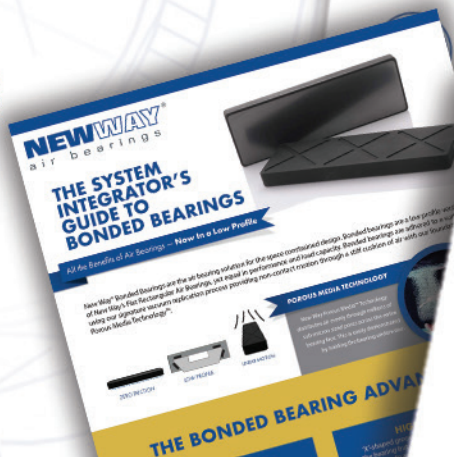
Air Bushings



Air Sliders

NEWWAY®
air bearings

**VISIT OUR WEBSITE
TO SEE MORE
PRODUCT GUIDES**



NEWWAY

50 MCDONALD BLVD.
ASTON, PA, 19014 USA

610.494.6700
NEWWAYAIRBEARINGS.COM

ISO
9001:2008
CERTIFIED

New Way Air Bearings
products are manufactured
using ISO 9001:2008
certified processes