AIRFLOW EXPERTS, INC.

P.O. Box 1079
Graham, NC 27253
Phone: 336-229-1470
Fax: 336-578-5378
Email: sales@airflowexperts.com

Airflow Experts, Inc

'Air Balance Solutions for Critical Spaces'

Qualification Submission

January, 2011

NEBB

AIRFLOW EXPERTS, INC.

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Graham, NC 27253
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January 8, 2011

Airflow Experts, Inc (AEI) is a certified woman-in-business enterprise providing air balancing solutions for critical spaces. Founded in 2005, it operates along the east coast of the United States from Connecticut to Georgia. AEI employs NEBB-accredited Test and Balance Supervisors at offices in Graham, North Carolina and Lehigh Valley, Pennsylvania with a combined 40 years of air balancing field expertise; supported by a full complement of NEBB certified field technicians, they are equipped to handle the most demanding of air balancing projects.

Airflow Experts, Inc possesses a full complement of state-of-the-art test instrumentation and equipment with full NIST traceable calibration histories. AEI business approach is focused on providing the most complete and comprehensive level of service to customers in critical spaces. AEI personnel have extensive experience in the balancing of laboratories, cleanrooms and pharmaceutical production facilities. All AEI procedures are standardized to help ensure regulatory compliances, report forms are user-friendly while providing all relevant information necessary for adherence to project specifications and regulatory agencies.

AEI field test reports are collected electronically using handheld computers or PDA's and downloaded via cell phone to a web-based data service. This data is immediately available for review by the NEBB supervisor and can be released for customer access via any web-enabled PC. This cutting-edge process ensures expedient delivery of accurate and intelligible final reports.

AEI Services:

- Air Balancing
- Hydronic Balancing
- Duct Leakage Testing
- Blower Door Testing
- Mechanical Systems
- Commissioning
- Sound & Vibration Testing

Typical Customers:

- Laboratories
- Cleanrooms
- Pharmaceutical Manufacturers
- Biotech Facilities
- Medical Device Manufacturers
- Hospitals
- Universities & Schools
- Food Service Establishments
- Office Buildings
- Shopping Malls
- Convention Centers
- Assisted Care Facilities

'Air Balance Solutions for Critical Spaces'

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Sample Client List

Cogenesys
TEVA Biopharmaceuticals USA
American Industrial Contractors
Chilsholm Services
GlaxoSmithKline
Merck West Point
Cardinal Health Systems
Novartis Pharmaceuticals
Guildford Pharmaceuticals
Global Pharmaceutical Supply Group
Tengion, Inc.
Muskuloskeletal Transplant Foundation
Genesis Engineers
National Institute of Health
LifeCell Technologies
Johnson & Johnson
Ortho-Clinical Diagnostics
MedImmune Incorporated
Siemens Building Technologies
Integrated Project Services
Talecris Plasmaspheres
Elon University
Palram Incorporated
Lafayette College
BioReliance Corporation
Whiting-Turner Contracting
Grandview Hospital
Goddard School
Sanaria Incorporated
Ursinus College
Honda Aero
DJ Wagner Inc
United Mechanical Services
Northampton Area School District
D'Huey Engineers
Osteotech, Inc.
United States Navy
UGI Utilities Corporation
West Pharmaceuticals
Sandoz Pharmaceuticals
MacroGenics
Charles River Laboratories
Imclone Systems, Inc
PPL Company
PTC Therapeutics
Air Energy Systems
University of North Carolina
N. C. State Bureau of Investigations
AeroPharm Technologies
Baxter Laboratories
Lomax Construction
Abbott Laboratories
University of North Carolina
Qiagen, Inc
Worth & Company
Dual Temp, Inc
AERAS Global
American Red Cross
GE Healthcare
Invitrogen
Alamance Community College
Dansko Incorporated
West Chester University
America on Wheels
DPT Laboratories
St. Luke's Hospital
Lehigh University
Immunomedics, Inc
Tetralogics Incorporated
Vertis Logistics
HondaJet
Womack Army Hospital
Great Wolf Lodge
Haemonetics, Inc.
Pfizer, Inc.
Taconic Biotechnology
Wake Forest University
Yonkers Construction

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Air Balancing

- ❑ Testing and Adjusting of Air Distribution Systems
- ❑ Adjusting Total System to Provide Design Quantities
- ❑ NEBB Certified Air Balance
- ❑ Electrical Measurements
- ❑ Establishing Quantitative Performance of All Equipment
- ❑ Verifying Automatic Controls
- ❑ Checking Installations for Conformity to Design
- ❑ Measuring and Establishing Fluid Quantities
- ❑ Recording and Reporting the Results

Hydronic Balancing

- ❑ Balancing of Water Flow Rate
- ❑ NEBB Certified Hydronic Balancing
- ❑ Circulating Pumps
- ❑ Electrical Measurements
- ❑ Calculating Energy Transfer Rates of Fluids Through Heat Exchangers
- ❑ Establishing Pressure Drop Relationships of Hydronic Components
- ❑ Ensuring Efficient Operation of Heating & Cooling Systems

Supplemental Services

- ❑ Sound Source Testing
- ❑ Noise Level Testing
- ❑ A&C Weighted Sound Measurements
- ❑ Octave Band Analysis
- ❑ Vibration Testing
- ❑ Vibration Source Identification
- ❑ Vibration Isolation
- ❑ Dynamic Balancing
- ❑ HVAC Commissioning
- ❑ Duct Leakage Testing

'Air Balance Solutions for Critical Spaces'

NEBB

National Environmental Balancing Bureau

Recertification

THIS IS TO CERTIFY THAT

Airflow Experts, Inc.

in Graham, NC

HAS MET ALL REQUIREMENTS FOR RENEWAL OF NEBB CERTIFICATION IN THE FOLLOWING DISCIPLINE

Air & Hydronics Systems

FOR THE BOARD OF DIRECTORS:

Exp. March 31, 2013

Airflow Experts, Inc./NC

No. 3336

NEBB Cert. No.

President

President-Elect

National Environmental Balancing Bureau

NEBB

Recertification

THIS IS TO CERTIFY THAT

Airflow Experts, Inc.

in Graham, NC

HAS MET ALL REQUIREMENTS FOR RENEWAL OF NEBB CERTIFICATION IN THE FOLLOWING DISCIPLINE

Building Systems Commissioning

FOR THE BOARD OF DIRECTORS:

Exp. March 31, 2013

Airflow Experts, Inc./NC

No. 3336

NEBB Cert. No.

President

President-Elect

National Environmental Balancing Bureau

NEBB

Recertification

THIS IS TO CERTIFY THAT

Airflow Experts, Inc. - Lehigh Valley, PA

in Lehigh Valley, PA

HAS MET ALL REQUIREMENTS FOR RENEWAL OF NEBB CERTIFICATION IN THE FOLLOWING DISCIPLINE

Air & Hydronics Systems

FOR THE BOARD OF DIRECTORS:

Exp. March 31, 2013

Airflow Experts, Inc. - Lehigh Valley, PA/PA

No. 3369

NEBB Cert. No.

Stephen R. Weggins

President

Randy Sikes

President-Elect

Candy Hatfield Clarke

Experience

2006 - Current | Airflow Experts | Graham, NC

Owner, Office Manager, Bookkeeper

- All office aspects while building company.
- Supporting techs in both Pennsylvania and North Carolina.
- Building/Sales North Carolina region.
- Suggested new products that increased earnings by 23%.

1999 - 2005 | SAP America | Newtown Square, PA

Telecommunications Systems Engineer III

- Maintain and support 20 remote sites: both PBX and Phonemail.
- Billing and System auditor for the telecommunications department.

1998 - 1999 | NCIC | Greensboro, NC

Integrations Consultant

- Multiple consultant assignments for: Telecommunications and computer network design and implementation, telecomm MAC support.

1996 - 1998 | Burlington Insurance Co. | Burlington, NC

Help Desk and Telecomm Support

- Maintain the Help Desk for both computer and telephone support.
- Provide software and hardware support for entire employee base of 100+ users.

1995 – 1996 | CCCS | Charleston, SC

Independent Contractor for Bosch Corp – Technology Specialist

1992 – 1995 | Coastal Truck Parts and Driveline | Myrtle Beach, SC

Owner/Bookkeeper

1988 – 1992 | CIBA-Geigy Corp | Greensboro, NC

Programmer Analyst

Education

1986-1989 | Sandhills Community College | Southern Pines, NC

- Associate Degree – Computer Engineering Applications Technology.
- Graduated with honors.

Interests

Working outside, helping with Hospice and spending time with family.

Donald James Clarke

Qualifications & Experience

Work Experience:

May 2005 to Present:
- Operations Manager for Airflow Experts, Inc.
- Responsible for all air balancing activities.
- Training and evaluation of balancing technicians.

November 1999 to May 2006: Employed by Micro-Clean, Inc. of Bethlehem, PA as *Balancing Division Manager*. Duties include:
- Creation and management of balancing services division within Micro-Clean, Inc.
- Establish standardized operating procedures (SOP's) for balancing activities.
- Training and evaluation of balancing technicians.
- Increased department revenue to 1.2 Million with 40% net margin in fiscal 2003.

September 1993 to October 1999: Employed by MCM TAB & Commissioning of Blaine, Washington as, *Project Engineer & Operations Manager*. Duties included;
- Testing, Adjusting & Balancing of HVAC Systems.
- Commissioning of Building Mechanical Systems.
- Supervision and daily work assignment of field technicians.
- Training and evaluation of field personnel.

July, 1992 to August, 1993: Employed By E.H. Price Limited in Surrey, British Columbia, as *Engineering Representative.* Duties included;
- Promoting air distribution products to engineering consultants.
- Technical support and literature distribution.
- Estimation and project cost control.
- Outside sales for Vancouver Island territory.

January 1990 to December, 1991: Employed By the Iron Ore Company of Canada in Labrador City, Newfoundland, as *Co-op Engineer*. Duties included; daily supervision and work assignment of a crew of tradespersons performing routine and preventative maintenance on iron ore processing equipment, updating CAD drawings of piping systems within the pellet plant, and engineering design of improvements to iron ore processing equipment.

April to August 1987: Employed by Newfoundland Hydro, in Bay D'Espoir, Newfoundland, as *Co-op Engineer*. Duties included; assisting the plant engineer Trevor Arbuckle, weekly vibration analysis of hydro-electric generating equipment, and feasibility assessment of replacing non-critical bearings with an engineered polymer.

Education:

1985 to 1992: Attended Memorial University of Newfoundland. Received a Bachelors Degree in Mechanical Engineering (Co-op Program). Cumulative average 77 %, GPA 2.2 out of 3.0.

1981 to 1985: Attended Botwood Senior High School. Graduated at the top of a class of 130. Cumulative average 92 %. Graduation with honors.

Certifications and Achievements:

Test, Adjust and Balance Supervisor, accredited by National Environmental Balancing Bureau, (NEBB) for air & hydronic environmental systems.

Associate Member of American Society of Heating Refrigeration and Air-conditioning Engineers (ASHRAE), Chairman of National Technical Committee TC 1.2 – Instruments and Measurements, and Secretary for Lehigh Valley ASHRAE Chapter.

Primary Researcher for ASHRAE funded Research Project 1212-RP entitled "Airflow Measurement of Biological Safety Cabinets" valued at $95,000

National Environmental Balancing Bureau

NEBB

Recertification

THIS IS TO CERTIFY THAT

Donald James Clarke

with Airflow Experts, Inc. in Graham, NC

HAS MET ALL THE NEBB REQUIREMENTS FOR NEBB CERTIFIED PROFESSIONAL STATUS IN

Air & Hydronics Systems

FOR THE BOARD OF DIRECTORS:

Exp. March 31, 2013

Airflow Experts, Inc./NC

No. 3336

NEBB Cert. No.

President

President-Elect

National Environmental Balancing Bureau

NEBB®

Recertification

THIS IS TO CERTIFY THAT

Donald James Clarke

with Airflow Experts, Inc. in Graham, NC

HAS MET ALL THE NEBB REQUIREMENTS FOR NEBB CERTIFIED PROFESSIONAL STATUS IN

Building Systems Commissioning - Green Buildings

FOR THE BOARD OF DIRECTORS:

Exp. March 31, 2013

Airflow Experts, Inc./NC

No. 3336

NEBB Cert. No.

President

President-Elect

National Environmental Balancing Bureau

NEBB

Recertification

THIS IS TO CERTIFY THAT

Donald James Clarke

with Airflow Experts, Inc. in Graham, NC

HAS MET ALL THE NEBB REQUIREMENTS FOR
NEBB CERTIFIED PROFESSIONAL STATUS IN

Building Systems Commissioning - HVAC

FOR THE BOARD OF DIRECTORS:

Exp. March 31, 2013

Airflow Experts, Inc./NC

No. 3336

NEBB Cert. No.

President

President-Elect

DAVID GATEWOOD JR.
QUALIFICATION & EXPERIENCE

Highlights:

- Hand-selected by the Mid-Atlantic Environmental Balancing Bureau's Board of Directors to Co-Chair the Technical Committee for NEBB.
- Test, Adjust and Balance supervisor, certified by the National Environmental Balancing Bureau, (NEBB) for air and hydronic systems.

Work Experience:

May 2006 to Present: Employed by Airflow Experts of Graham, N.C. as Project Manager.

- Testing, adjusting and balancing of Air and Hydronic systems
- Responsible for ensuring that heating and air conditioning and ventilation (HVAC) systems are balanced according to specifications.
- Provide troubleshooting for difficult balance situations and offer possible solutions to Engineers and Mechanical Contractors.

May 2003 to Present: Employed by Micro Clean, Inc. of Bethlehem, PA as Project Manager.

- Supervision and daily work assignment of field technicians.
- Training and evaluation of field personnel.
- Responsible for ensuring that heating and air conditioning and ventilation (HVAC) systems are balanced according to specifications.
- Provide troubleshooting for difficult balance situations and offer possible solutions to Engineers and Mechanical Contractors.

June 2002 to May 2003: Employed by TAB Services Co, as Balancing Supervisor.

- Testing, Adjusting & Balancing of HVAC Systems.
- Responsible for training and managing balancing technicians.
- Commissioning of Building Mechanical Systems.
- Ensure that all budget requirements are met.

July 2001 to June 2002: Employed by Double T Balancing Co, as Balancing Supervisor.

- Testing, Adjusting & Balancing of HVAC Systems.
- Responsible for training and managing balancing technicians.

- Responsible for ensuring that HVAC are balanced according to specifications.
- Ensure that all budget requirements are met.

November 1994 to July 2001: Employed by Robinson Mechanical Co, as Balancing Technician/Supervisor & Journeyman Serviceman.

- Managed large balancing contracts.
- Expertise in technical services provided in HVAC systems.
- Control systems installation (DDC).
- Troubleshoot and maintain large commercial boiler systems and chiller plants.

September 1974 to October 1994: Employed by US Air Force

- Retrocommissioning - High-level technician providing critical time response service worldwide for troubleshooting and repair of HVAC systems beyond local technicians' capability level.
- Performed technical systems design compliance inspections throughout the Air Force on new facility HVAC systems prior to Air Force acceptance.
- Provided formal classroom technician training in Testing and Balancing.
- Investigated, identified and corrected numerous problems with buildings having indoor air quality issues.

Education:

1985 to 1989 Attended Community Collage of the Air Force, Gunter AFB, GA
Received an Associate Degree in:
Major: Applied Science
Minor: Heating and Air Conditioning and Electrical

National Environmental Balancing Bureau

NEBB

Recertification

THIS IS TO CERTIFY THAT

David M. Gatewood, Jr.

with Airflow Experts, Inc. - Lehigh Valley, PA in Lehigh Valley, PA

HAS MET ALL THE NEBB REQUIREMENTS FOR NEBB CERTIFIED PROFESSIONAL STATUS IN

Air & Hydronics Systems

FOR THE BOARD OF DIRECTORS:

Exp. March 31, 2013

Airflow Experts, Inc. - Lehigh Valley, PA/PA

No. 3369

NEBB Cert. No.

Stephen R. Wiggins

President

Randy Lee

President-Elect

JAMES J. BATES

Qualifications and Experience

Experience

2006-Present Airflow Experts

AIR BALANCE TECHNICIAN

- Testing, Adjusting and Balancing of Environmental Systems
- Balancing of Cleanrooms and Controlled Environments
- Adjusting and Balancing of Laboratory Ventilation Systems
- NEBB certified Air Balance Technician

2000-2006 Micro-Clean, Inc.

AIR BALANCE TECHNICIAN

- Testing, Adjusting and Balancing of Environmental Systems
- Balancing of Cleanrooms and Controlled Environments
- Adjusting and Balancing of Laboratory Ventilation Systems
- NEBB certified Air Balance Technician

1997–2000 Ron Lenz Heating and Air Conditioning Beach Lake , PA

INSTALLER/SERVICE TECHNICIAN

- Installed residential and light commercial air conditioning
- Installed heating equipment
- Preventive maintenance

1996-1997 Shaunessy Heating & Air Conditioning Honesdale , PA

INSTALLER

- Installed residential air conditioning
- Installed commercial air conditioning
- Installed heating equipment.

1993-1996 Grandstyle Picture Frame Honesdale , PA

BUSINESS PARTNER

- Accounts payable, Accounts receivable.
- Dealing with sales representatives.
- Overseeing everyday business.
- Marketing new products.
- Inventory
-

Education

Dec 2000 – June 2001 Micro-Clean, Inc – Air Balance Training Course

- 250 Hours of Classroom Theory
- 1000 Hours of On the job training

1999 – 2000 HVAC Course (Lackawanna Career Institute)

- Universal EPA Certification

1989-1992 Cleveland Institute of Electronics

- Correspondence course
- Diploma in basic electronic theory

NATIONAL ENVIRONMENTAL BALANCING BUREAU

Certificate of Technician Recertification

James Bates

with

Airflow Experts, Inc. - Lehigh Valley, PA

has recertified as a

NEBB Testing, Adjusting and Balancing (TAB) Technician for Air and Hydronic Environmental Systems

Stephen R. Weggins	January 30, 2011	
NEBB President	Date	
March 31, 2013	Robert McDonell	2/23/11
Expiration Date	Chapter President	Date

Airflow Experts, Inc. - Lehigh Valley, PA
NEBB
DAVID M GATEWOOD JR.
CERTIFICATION
B360
Air and Hydronic Systems
Certified Professional's Stamp

Edward Petruno

Qualifications

Experience

2007-Present Airflow Experts

Air Balance Technician

- Testing, Adjusting and Balancing of Environmental Systems
- NEBB certified Air Balance Technician
- Balancing: Clean Rooms, Schools, Controlled environments

2003-2006 Micro-Clean Inc

Air Balance Technician Trainee/Assistant 7/03 – 5/05

Field Tech Level 1 5/05 – 7/06

- Testing, Adjusting and Balancing Training/Assistance
- Balancing: Clean Rooms, Schools and other controlled environments

Training

- NEBB Procedural Standards and Certification
- OSHA training: Hazard Communication, Ladder Safety, Fall Protection, Lockout/Tagout Standard, Fire Extinguisher, Aerial Work Platform, Bloodborne Pathogen Exposure Control Plan
- Environmental Engineering Consultants Training Course for Testing and Balancing HVAC Systems 451

Education

Two year certificate in Electronic Technology: Lehigh Carbon Community College

NATIONAL ENVIRONMENTAL BALANCING BUREAU

Certificate of Technician Certification

Edward Petruno

with

Airflow Experts, Inc.

has certified as a

NEBB Testing, Adjusting and Balancing (TAB) Technician for Air and Hydronic Environmental Systems

	April 5, 2011	
NEBB President	Date	
March 31, 2013	*April 20, 2011*	
Expiration Date	Chapter President	Date

Airflow Experts, Inc. NEBB DONALD J. CLARKE CERTIFICATION 3336 Exp. 3/31/13 Air and Hydronic Systems

Certified Professional's Stamp

AIRFLOW EXPERTS, INC.

Airflow Experts
STANDARD OPERATING PROCEDURES
BALANCING SERVICES
ALL (AEI) SOP'S ON A FOUR-YEAR REVIEW SCHEDULE

CURRENT SOP #	DESCRIPTION	IMP. DATE	CURRENT DATE	REVIEWER*	CUSTODIAN	REVIEW DATE
MOSA-0506 AEI	MINIMUM OUTSIDE AIR	Jan-00	May 25, 2006	OM/Pres/TC	CLARKE	May-11
EM-0506 AEI	ELECTRICAL MEASUREMENTS	Jan-00	May 25, 2006	OM/Pres/TC	CLARKE	May-11
RM-0506 AEI	ROTATIONAL MEASUREMENTS	Jan-00	May 25, 2006	OM/Pres/TC	CLARKE	May-11
CVSP-0506 AEI	CONSTANT VOLUME STATIC PRESSURES	Jan-00	May 25, 2006	OM/Pres/TC	CLARKE	May-11
VVSP-0506 AEI	VARIABLE VOLUME STATIC PRESSURES	Jan-00	May 25, 2006	OM/Pres/TC	CLARKE	May-11
TAD-0506 AEI	TERMINAL AIR DEVICES	Apr-01	May 25, 2006	OM/Pres/TC	CLARKE	May-11
DT-0506 AEI	DUCT TRAVERSES	Jan-01	May 25, 2006	OM/Pres/TC	CLARKE	May-11
RPD-0506 AEI	ROOM PRESSURE DIFFERENTIALS	Jul-01	May 25, 2006	OM/Pres/TC	CLARKE	May-11

*Pres-President; OM-Oper Mgr; TC-Technical Coordinator;

Instrument calibration

Serial No.	Manufacturer	Model	Calibration Date	Calibration Due
Tachometer				
1835670	Monarch	Pocket Laser Tach 200	29 Jul 10	28 Jul 11
C12B0399	Shimpo	DT-205L	23 Jan 11	22 Jan 12
C29B0070	Shimpo	DT-205L	21 Aug 10	20 Aug 11
C48B0055	Shimpo	DT-205L	05 Feb 10	04 Feb 11
COAB0392	Shimpo	DT-205L	13 Apr 10	12 Apr 11
D52B0102	Shimpo	DT-207L	05 Jun 10	04 Jun 11
G050486	Shimpo	DT-205L	03 Sep 10	02 Sep 11
New Inst		New Instrument		
Hydronic Multimeter				
! 70725158	Alnor	HM670	05 Mar 10	04 Mar 11
! 70750160	Alnor	HM670	10 Feb 10	09 Feb 11
70750161	Alnor	HM670	08 Dec 10	07 Dec 11
70915036	Alnor	HM670	14 Apr 10	13 Apr 11
70931051	Alnor	HM670	20 Aug 10	19 Aug 11
W03013	Shortridge	HDM-300	05 Jun 10	04 Jun 11
W05025	Shortridge	HDM-300	13 Apr 10	12 Apr 11
Clamp-On Ammeter				
75860514	Fluke	89 IV	21 Aug 10	20 Aug 11
78710854	Fluke	335	08 May 10	07 May 11
79801976	Fluke	335	13 Apr 10	12 Apr 11
88105714	Fluke	335	23 Jan 11	22 Jan 12
92857329	Fluke	337	21 Aug 10	20 Aug 11
94860231	Fluke	902	05 Jun 10	04 Jun 11
95060148	Fluke	902	05 Jun 10	04 Jun 11
99820044	Fluke	902	02 Sep 10	01 Sep 11
Thermoanemometer / Manometer				
00080337	TSI	8386	02 Sep 10	01 Sep 11
01040113	TSI	8386	18 Aug 10	17 Aug 11
01040114	TSI	8386	07 Oct 10	06 Oct 11
01040132	TSI	8386	23 Jan 11	22 Jan 12
02040115	TSI	8386	25 Nov 10	24 Nov 11
02120175	TSI	8386	18 Nov 10	17 Nov 11
03120135	TSI	8345	21 Aug 10	20 Aug 11
306100	TSI	8355	02 Sep 10	01 Sep 11
AVM430926003	Alnor	AVM430-A	25 Jun 10	24 Jun 11
Q421223	Extech	407119A	21 Aug 10	20 Aug 11
Rotating Vane Anemometer				
03030219/03030220	TSI	8324 w/ 802149	23 Jan 11	22 Jan 12
03040092/03040093	TSI	8324 w/ 802149	24 Nov 10	23 Nov 11
04027179/04027180	ALNOR	RVD & 100 mm head	18 Nov 10	17 Nov 11
54120083/54120084	TSI	8324 w/ 802149	13 Apr 10	12 Apr 11
Sound Level Meter				
! 3603A 234C16	Ivie Technologies	IE-33	13 Feb 10	12 Feb 11
4104A804C16	Ivie Technologies	IE-33	23 Apr 10	22 Apr 11
Digital Balometer				
70745006	Alnor	6200D	18 Nov 10	17 Nov 11
90826015	Alnor	EBT721	05 Jun 10	04 Jun 11
90835040	Alnor	EBT721	21 Aug 10	20 Aug 11
90932023	Alnor	EBT721	13 Aug 10	12 Aug 11
M01465	Shortridge	ADM-870	29 Oct 10	28 Oct 11
M03714	Shortridge	ADM-870C	14 Jan 11	13 Jan 12
M04800	Shortridge	ADM 870C	18 Nov 10	17 Nov 11
M04816	Shortridge	ADM-870C	23 Jan 11	22 Jan 12
Temperature Meter				
90824074	Alnor	AL72-T1	05 Jun 10	04 Jun 11
CT021406026	Cooper Instruments	SH66AG	21 Aug 10	20 Aug 11
Pressure and Flow Gauge				
1885-4-700	The Energy Conservatory	DG-700	30 Jun 10	29 Jun 11
96700033	Fluke	922	21 Aug 10	20 Aug 11
97600066	Fluke	922	05 Jun 10	04 Jun 11
97600069	Fluke	922	05 Jun 10	04 Jun 11
97600070	Fluke	922	05 Jun 10	04 Jun 11
98040146	Fluke	922	05 Jun 10	04 Jun 11
99560102	Fluke	922	02 Sep 10	01 Sep 11
Temperature/Humidity Meter				
050109014	Cooper Instrument	SRH77A	02 Sep 10	01 Sep 11
483656	Cooper Instrument	SRH77A	21 Aug 10	20 Aug 11
90825020	Alnor	800189	05 Jun 10	04 Jun 11
90832039	Alnor	800189	21 Aug 10	20 Aug 11

AIRFLOW EXPERTS, INC.

NEBB ® Cert. No. 3336

P.O. Box 1079
Graham, NC 27253
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Fax: 336.229.1422
Email: sales@airflowexperts.com

Air and Hydronic Balance Report

Sample Balancing Report
100 Main Street
Hometown
USA

January 2011

Prepared for:

Joe's Plumbing & Heating
100 King Street
Smithfield
USA

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
Fax: 888.229.0422

TABLE OF CONTENTS

Project: Sample Balancing Report

Report	System/Unit	Page #
Cover Page		1
Table of Contents		2
Certification		3
Project Summary	SAMPLE	4
Air Handling Unit	AHU-1	5
Static Pressures	AHU-4	7
Duct Traverse Square Duct	AHU-1 / Supply	9
Air Outlet	AHU-1 / Supply Air	8
Air Apparatus	FC-3	10
Terminal Air Device	FC-4 / SUPPLY	11
Duct Traverse Round Duct	EF-1 / Exhaust	12
Terminal Air Valves	EF-1	13
Fan	EF-2	14
Terminal Air Device	VAV-1 / Supply	15
Exhaust Fan	EF-1	16
Fume Hood Face Velocity	EF-2	18
Room Pressure Differentials	ROOM TO AMBIENT	19
Room Pressure Differentials	ROOM TO ROOM	20
Other	ROOM AIR CHANGES PER HOUR	21
Chilled Water Cooling Coil	CC-1	22
Coil Apparatus	COOLING COIL CC-1	23
Hydronic Pump	New Report 31	
Valve	New Report 30	
Hydronic Circulating Pump	CHP-1	24
Room Pressure	Copy of New Report 438 / Sub-System 438	
Balancing Valve/Flow Meter	Hot Water Coils / Sub-System	25
Balancing Valve/Flow Meter	Hot Water Heating / 2nd Floor	26
Certificates		27

AIRFLOW EXPERTS, INC.

P.O. Box 1079
Graham, NC 27253
Phone: 336.229.1470
Fax: 336.229.1422
Email: sales@airflowexperts.com

CERTIFICATION

PROJECT: **Sample Balancing Report**

ADDRESS: **100 Main Street**
Hometown
USA

The data presented in this report is an exact record of system performance and was obtained in accordance with NEBB standard procedures. Any variances from design quantities, which exceed NEBB tolerances, are noted throughout this report.

The air distribution systems have been tested & balanced and final adjustments have been made in accordance with NEBB "PROCEDURAL STANDARDS FOR TESTING, ADJUSTING, BALANCING OF ENVIRONMENTAL SYSTEMS" and the project specifications.

NEBB TAB FIRM: Airflow Experts Inc. **REG. NO.:** 3336

CERTIFIED BY: Jim Clarke **DATE:** January 8, 2011

The hydronic distribution systems have been tested & balanced and final adjustments have been made in accordance with NEBB "PROCEDURAL STANDARDS FOR TESTING, ADJUSTING, BALANCING OF ENVIRONMENTAL SYSTEMS" and the project specifications.

NEBB TAB FIRM: Airflow Experts Inc. **REG. NO.:** 3336

CERTIFIED BY: Jim Clarke **DATE:** January 8, 2011

SUBMITTED AND CERTIFIED BY:

NEBB TAB FIRM: Airflow Experts Inc.

TAB SUPERVISOR: Jim Clarke

SIGNATURE: _____

Airflow Experts, Inc. NEBB DONALD J. CLARKE CERTIFICATION 3336 Exp. 3/31/13 Air and Hydronic Systems

DATE: January 8, 2011

AIRFLOW EXPERTS, INC.
Phone: 888.229.1477
Fax: 888.229.0422

Project Summary

This form is used to summarize the results of the balancing activites, highlight any difficulties encountered, define system operating parameters during testing activities and identify any items which deviate from specified values. This area also indentifies the primary contact for the project and whom to contact with any questions.

AIRFLOW EXPERTS, INC.

UNIT #
AHU-1

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Constant Volume Air Handling Unit

Unit Number:	AHU-1		
Location:	Mechanical Room	**Service:**	Cleanroom
Manufacturer:	Great Fan Co.		
Model:	123456		
Serial:	98765		
Heating Device:	Hot Water Coil		
Cooling Device:	Chilled Water Coil		

Supply Fan Data

Fan Type:	FCBI-DW	**Fan Size:**	25
Manufacturers; Fan:	Fan & Fan, Inc	**Motor:**	Electric Company
Specified Motor HP:	25	**Nameplate:**	30
Specified Motor RPM:	1800	**Nameplate:**	1725
Specified Motor Volts:	480	**Nameplate:**	460
Motor Sheave Size:	2B50	**Bushing:**	H1
Fan Sheave Size:	2B90	**Bushing:**	H 7/8
Belt Size & No.:	BX50 X 2	**Centerline:**	15

I. Fan Capacity Measurements

Test Apparatus:	Digital Balometer		
Manufacturer:	Shortridge	**Model:**	ADM-870
Serial Number:	M01465	**Cal. Date:**	03 Nov 2010
		Cal. Due:	02 Nov 2011

SUPPLY FAN TEST DATA	Specified	As Found	Final
Outlet Airflow Total:	4000	5200	4250
Fan Airflow Total:	4000	5360	4300
Fan T.S.P.:	2.2	1.8	1.4

Notes & Observations:

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
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UNIT #
AHU-1

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

II. Measuring Outside Air Volume (SOP: MOSA-0100 TAB)

Test Apparatus:	Digital Balometer	**Accuracy +/-**	
Manufacturer:	Shortridge	**Model:**	ADM-870
Serial Number:	M01465	**Cal. Date:**	03 Nov 2010

Direct Measurement: Total CFM: 4300 **Return CFM:** 300 **Outside Air CFM:** 1300

Temperature Method: Mixed Air Temp: 71 **Return Air Temp:** 82 **Outside Temp:** 45

Calculated Outside Air % = $\frac{\text{RAT-MAT}}{\text{RAT-OAT}}$ **X 100% =** $\frac{82 - 71}{82 - 45}$ **=** 30%

Calculated Outside Air = **1278.38** **CFM +/-** 123 **CFM** **Accuracy = +/-** 5

Provision for Maintaining Minimum Ventilation Rate: **Computer Setting**

Normal Setpoint to Maintain Minimum Ventilation Rate: **15%**

III. Rotational Speed Measurements (SOP: RM-0100 TAB)

Test Apparatus:	Tachometer		
Manufacturer:	Shimpo	**Model:**	DT-205L
Serial Number:	COAB0392	**Cal. Date:**	02 Aug 2010
		Cal. Due:	01 Aug 2011

TEST DATA	Specified	Initial	Final
Supply Fan Motor RPM:	1800	1778	1767
Supply Fan RPM:	1000	1200	1089

IV. Electrical Measurements (SOP: EM-0100 TAB)

Test Apparatus:	Clamp-On Ammeter		
Manufacturer:	Fluke	**Model:**	335
Serial Number:	78710854	**Cal. Date:**	28 Jun 2010
		Cal. Due:	27 Jun 2011

TEST DATA	Rating	As Found	Final
Supply Fan Motor Volts:	480	460/457/484	462/577/480
Supply Fan Motor Amp:	33	26/28/22	27/25/23
Supply Fan BHP:	19.2	26.3	25.5
Motor Service Factor:	1.15	**Current Overload Rating:**	33

AIRFLOW EXPERTS, INC.

UNIT #
AHU-4

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

V. Static Pressure Measurements (SOP CVSP-0100 TAB)

Test Apparatus: Thermoanemometer / Manometer

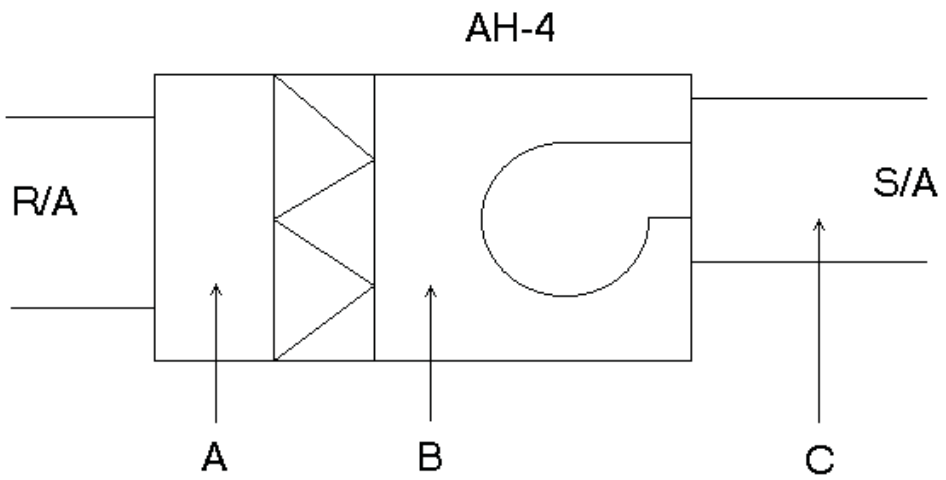
Manufacturer: TSI **Model:** 8386

Serial Number: 01040114 **Cal. Date:** 03 Nov 2010

Cal. Due: 02 Nov 2011

TEST DATA	Specified	Initial	Final
Unit E.S.P.:	3.00	2.95	3.25
Supply Fan T.S.P.:	3.50	3.38	3.58

System Diagram



LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
As Found	-1.80	-2.23	+1.15										
Final	-1.91	-2.24	+1.34										
100% O/A	-1.99	-2.35	+1.15										
Filter Load	-1.61	-2.45	+1.08										

Notes & Observations:

AIRFLOW EXPERTS, INC.

UNIT #
AHU-1

Phone: 888.229.1477
Fax: 888.229.0422

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Balancing of Terminal Air Valves (SOP: TAD-0100 TAB)

Air Outlet Terminal				OUTLET						
				Design CFM		Preliminary		Final CFM		
NO.	Area Served	Type	Size	MAX	MIN	Test 1	Test 2	MAX	MIN	%
	Supply Air									
01	Room 101	HEPA	24 x 48	800	400	897	841	810	442	101%
02	Room 102	HEPA	24 x 48	800	300	775	792	808	376	101%
03	Room 103	HEPA	24 x 24	400	200	372	389	398	210	100%
	TOTAL			2000	900	2044		2016	1028	101%

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UNIT #
AHU-1

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Duct Traverse Test Report

System/Unit:	AHU-1 / Supply	**Service:**	Cleanroom
Location/Zone:	Mechanical Room	**Altitude:**	0
Density:	0.075	**Corr. Factor:**	1.00
Test Apparatus:	Thermoanemometer / Manometer	**Manufacturer:**	TSI

Model: 8386 **Serial:** 01040114 **Cal. Date/Due:** 03 Nov 2010 / 02 Nov 2011

Duct			Design		As Found		Final	
Width	24	**in.**	**SCFM**	6200	**SCFM**	6400	**SCFM**	6323
Depth	48	**in.**	**CFM**	6200	**CFM**	6400	**CFM**	6323
Area	8.00	**ft²**	**FPM**	775	**FPM**	800	**FPM**	790
Air Temp	70	**°F**	**S.P.**	**"W.C.**	**S.P.**	2.1 **"W.C.**	**S.P.**	2.05 **"W.C.**

Reading		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
	Distance from Duct Edge	**3**	**9**	**15**	**21**							
1	**6**	700	800	900	800							
2	**18**	750	850	950	850							
3	**30**	700	800	900	800							
4	**42**	650	750	850	750							
5												
6												
7												
8												
9												
10												
11												
Velocity Subtotals		2800	3200	3600	3200							

Average Velocity = $\frac{12800}{16}$ (Velocity Total) / (# of Readings) = 800 FPM

Air Volume = 8.00 X 800 = 6400 CFM

Notes & Observations:

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Air Apparatus Report

Project:	Sample Balancing Report	**Report No:**	None
Test Performed By:	Joe Technician	**Report Date:**	07 Jan 2011

Unit Data

System/Unit:	FC-3	**Model Number:**	FC0134
Unit Designation:	FAN COIL UNIT	**Serial Number:**	123456
Manufacturer:	CARRIER		

Motor Data

Service Factor:	1.0			Nameplate		
Motor Manufacturer:	GE		**Rated Amps:**	4.2		
	Design	**Actual**	**Rated Volts:**	208		
HP/Frame:	2	2/218T		**L1**	**L2**	**L3**
RPM:	1600	1550	**Operating Amps:**	2.7	2.8	2.8
Phase/Hz:	3/60	3/60	**Operating Volts:**	212	212	212

Fan Data

	Design	**Actual**		**Design**	**Actual**
Supply Air CFM:	1600	1611	**Fan Total S.P.(in.):**	1.5	1.4
Outside Air CFM:	300	299	**External S.P.(in.):**	0.75	0.88
Return Air CFM:	1300	1312	**Fan RPM:**	866	884
Total Outlet Air CFM:	1600	1611	**BHP:**	1.3	1.6

Provisioning for Maintaining Minimum Ventilation Rate:	DDC CONTROL
Normal Setpoint to Maintain Minimum Ventilation Rate:	15%

Other Data

	Actual		**Actual**
Motor Sheave OD/Bore:	2VP40/H	**Fan Sheave OD/Bore:**	2B5V50/P1
Motor Sheave Bushing:	H X 7/8	**Fan Sheave Bushing:**	P1 X 1 5/16
Number of Belts:	2	**Sheave Center Dist.:**	15"
Belt Size (in.):	BX40	**Fan Type:**	DWDI-FC

Test Apparatus

Electric Test Apparatus:	Shortridge ADM-870C	**Serial Number:**	M04816
Rotational Test Apparatus:	Fluke 335	**Serial Number:**	88105714
Outside Air Test Apparatus:	Shortridge ADM-870C	**Serial Number:**	M04816

Remarks

AIRFLOW EXPERTS, INC.

UNIT #
FC-4

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

Project: Sample Balancing Report
Test Performed By: Joe Technician
System/Unit: FC-4

Report No: None
Report Date: 07 Jan 2011

Balancing of Terminal Air Valves

Air Outlet Terminal				Outlet		
				Design	Final	
NO.	Area Served	Type	Size	CFM	CFM	%
SUPPLY						
01	Office 100	SD-1	10"	200	215	108%
02	Office 101	SD-1	10"	200	210	105%
03	Office 102	SD-1	10"	200	190	95%
04	Office 103	SD-1	10"	200	180	90%
			Totals:	800	795	99%

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
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UNIT #
EF-1

NEBB

Project: Sample Balancing Report **Report No:** None

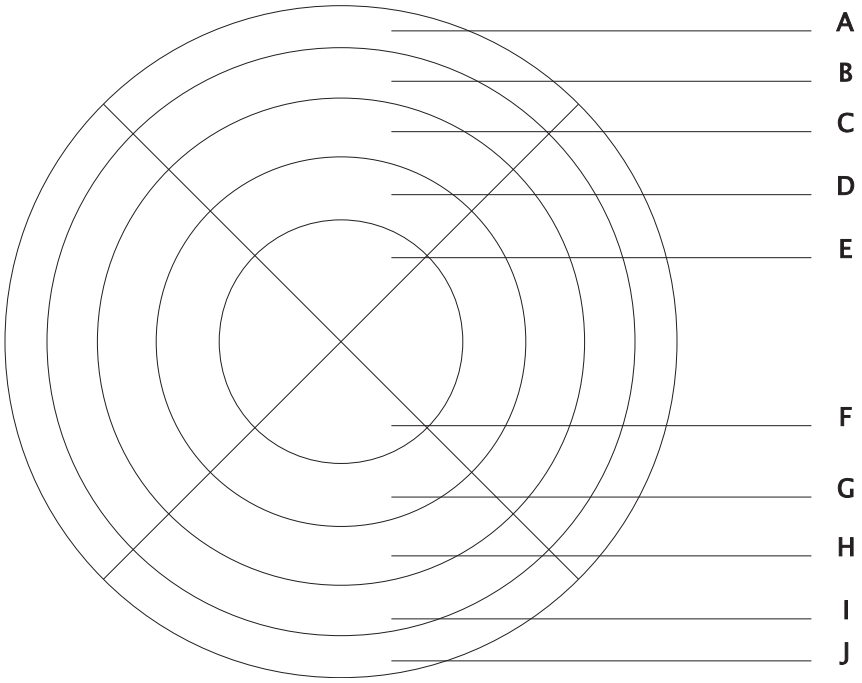
Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Duct Traverse Test Report

System/Unit:	EF-1 / Exhaust	**Service:**	Process Exhaust
Location/Zone:	Roof	**Altitude:**	0
Density:	0.075	**Corr. Factor:**	1.0
Test Apparatus:	Thermoanemometer / Manometer	**Manufacturer:**	TSI

Model: 8386 **Serial:** 01040114 **Cal. Date/Due:** 03 Nov 2010 / 02 Nov 2011

Duct		Design		As Found		Final	
Diameter	14 **in.**	**SCFM**	1200	**SCFM**	0	**SCFM**	0
		CFM	1200	**CFM**	0	**CFM**	0
Area	1.07 **ft²**	**FPM**	1121	**FPM**	0	**FPM**	0
Air Temp	**°F**	**S.P.**	**"W.C.**	**S.P.**	**"W.C.**	**S.P.**	**"W.C.**



Sample Locations	A	B	C	D	E	F	G	H	I	J

Velocity Subtotal 0 **Average Velocity** 0 **Measured Airflow** 0

Notes & Observations:

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
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UNIT #
EF-1

NEBB

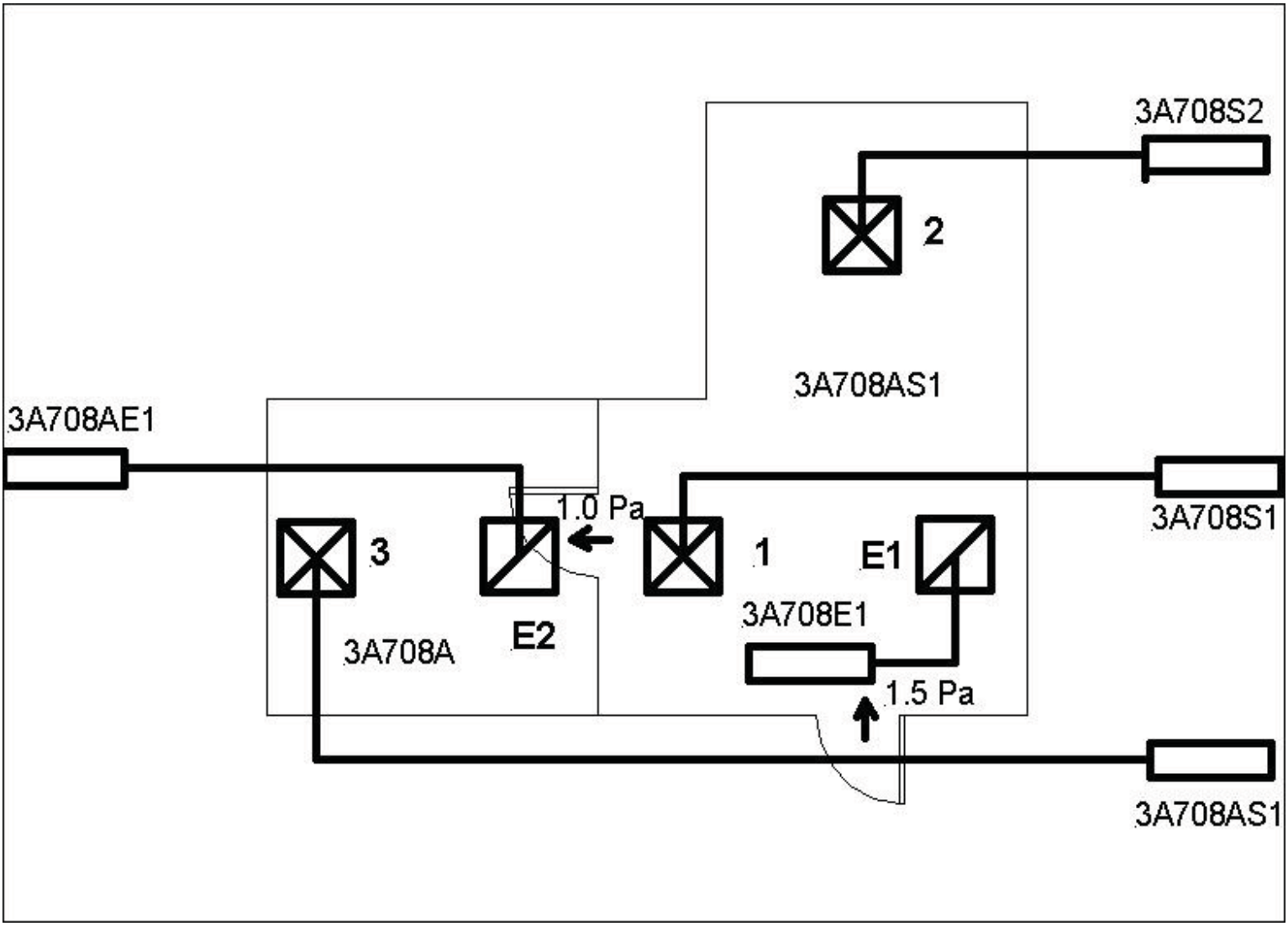
Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Balancing of Terminal Air Valves (SOP: TAD-0506 AEI)

Test Apparatus:	Digital Balometer		
Manufacturer:	Shortridge	**Model:**	ADM-870
Serial Number:	M01465	**Cal. Date:**	03 Nov 2010
		Cal. Due:	02 Nov 2011

System Diagram



Notes & Observations:

AIRFLOW EXPERTS, INC.
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Fan Report

Project:	Sample Balancing Report	**Report No:**	None
Test Performed By:	Joe Technician	**Report Date:**	07 Jan 2011

Unit Data

System/Unit:	EF-2	**Model Number:**	GB-100
Unit Designation:	Toilet Exhaust	**Serial Number:**	123456
Manufacturer:	Greenheck		

Motor Data

Service Factor:	1.15				**Nameplate**	
Motor Manufacturer:	Marathon		**Rated Amps:**		5.0	
	Design	**Actual**	**Rated Volts:**		208	
HP/Frame:	1	0.75/48Y		**L1**	**L2**	**L3**
RPM:	1725	1770	**Operating Amps:**	4.1	4.2	4.3
Phase/Hz:	3/60	3/60	**Operating Volts:**	212	213	214

Fan Data

	Design	**Actual**		**Design**	**Actual**
Fan Air CFM:	2000	1975	**Fan Total S.P.(in.):**	0.5	0.45
Total Outlet CFM:	2100	1888	**External S.P.(in.):**	0.3	0.32
Fan Rpm:	1000	1050			

Other Data

	Actual		**Actual**
Motor Sheave OD/Bore:	1VL34/1/2	**Fan Sheave OD/Bore:**	AK60/1"
Motor Sheave Bushing:	NA	**Fan Sheave Bushing:**	NA
Number of Belts:	1	**Sheave Center Dist.:**	8"
Belt Size (in.):	AX22	**Type of Service:**	GENERAL EXHAUST

Unit Type/Size/Arrangement/Class: DWDI-BI / 10" / UPBLAST / II

Test Apparatus

Electric Test Apparatus:	Fluke 335	**Serial Number:**	78710854
Rotational Test Apparatus:	Shimpo DT-205L	**Serial Number:**	COAB0392
Airflow Test Apparatus:	Shortridge ADM-870	**Serial Number:**	M01465

Remarks

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
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UNIT #
VAV-1

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Balancing of Terminal Air Devices (SOP: TAD-0100 TAB)

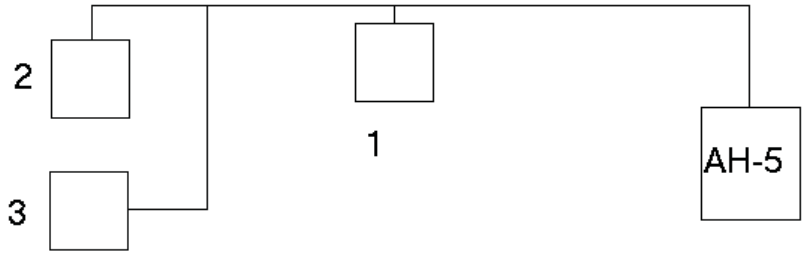
Test Apparatus: Digital Balometer

Manufacturer: Shortridge **Model:** ADM-870

Serial Number: M01465 **Cal. Date:** 03 Nov 2010

Cal. Due: 02 Nov 2011

System Diagram



Air Outlet Terminal				OUTLET		
				Design	Final	
NO.	Area Served	Type	Size	CFM	CFM	%
Supply						
01	Room A	CD	24 x 24	300	305	102%
02	Room B	CD	24 x 24	280	288	103%
03	Room C	CD	24 x 24	320	319	100%
	TOTAL			900	912	101%

AIRFLOW EXPERTS, INC.

UNIT #
EF-1

Phone: 888.229.1477
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NEBB

Project:	Sample Balancing Report	**Report No:**	None
Test Performed By:	Jim Clarke	**Date:**	07 Jan 2011

Constant Volume Exhaust System

Unit Number:	EF-1		
Location:	Roof	**Service:**	Process Room
Manufacturer:	Exhaust Fan Company		
Model:	Exhaust-matic		
Serial:	5551212		
Filtration:	Bag-in Bag-out HEPA & Charcoal		
Heat Recovery:	None		

Exhaust Fan Data

Fan Type:	DWDI-FC	**Fan Size:**	16
Manufacturers; Fan:	Exhausto	**Motor:**	Electro
Specified Motor HP:	10	**Nameplate:**	10
Specified Motor RPM:	1800	**Nameplate:**	1750
Specified Motor Volts:	200	**Nameplate:**	208
Motor Sheave Size:	1VP60	**Bushing:**	None Required
Fan Sheave Size:	BK160	**Bushing:**	P1 x 1 1/16
Belt Size & No.:		**Centerline:**	

I. Fan Capacity Measurements

Test Apparatus:	Digital Balometer		
Manufacturer:	Shortridge	**Model:**	ADM-870
Serial Number:	M01465	**Cal. Date:**	03 Nov 2010
		Cal. Due:	02 Nov 2011

FAN TEST DATA	Specified	As Found	Final
Outlet Airflow Total:	2000	1600	1975
Fan Airflow Total:	2000	1875	1950
Fan T.S.P.:	2.2	2.8	2.4

Notes & Observations:

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UNIT #
EF-1

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

II. Rotational Speed Measurements (SOP: RM-0100 TAB)

Test Apparatus:	Tachometer		
Manufacturer:	Shimpo	**Model:**	DT-205L
Serial Number:	COAB0392	**Cal. Date:**	02 Aug 2010
		Cal. Due:	01 Aug 2011

TEST DATA	Specified	As Found	Final
Exhaust Fan Motor RPM:	1800	1778	1766
Exhaust Fan RPM:	654	621	708

III. Electrical Measurements (SOP: EM-0100 TAB)

Test Apparatus:	Clamp-On Ammeter		
Manufacturer:	Fluke	**Model:**	335
Serial Number:	78710854	**Cal. Date:**	28 Jun 2010
		Cal. Due:	27 Jun 2011

TEST DATA	Rating	As Found	Final
Exhaust Fan Motor Volts:	200	229/218/220	212/214/215
Exhaust Fan Motor Amp:	7.8	5.4	6.7
Exhaust Fan BHP:	7.7	6.9	8.1

Motor Service Factor:	1.16	**Current Overload Rating:**	7.8

Notes & Observations:

AIRFLOW EXPERTS, INC.

UNIT #
EF-2

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Joe Technician **Date:** 07 Jan 2011

Fume Hood Face Velocity Report

System/Unit: EF-2 Fume Hood #: FH-15

Room #: C1015 Serial Number:

Sash Opening	Horizontal	Vert Max	Vert Min
Height (inches)	14		
Width (inches)	48		
Area (square feet)	4.67	NA	NA
Average Face Velocity (FPM)	100.00	100.00	100.00
Exhaust Airflow (CFM)	466.67	NA	NA

Horizontal Sash Opening

Face Velocity FPM								
No.	1	2	3	4	5	6	7	8
1	101.0	110.0	99.0	95.0	100.0	NA	NA	NA
2	110.0	105.0	102.0	110.0	90.0	NA	NA	NA
3	102.0	99.0	95.0	92.0	90.0	NA	NA	NA

Vertical Sash Maximum Opening

Face Velocity FPM								
No.	1	2	3	4	5	6	7	8
1	105.0	95.0	100.0	105.0	95.0	NA	NA	NA
2	95.0	105.0	105.0	100.0	95.0	NA	NA	NA
3	105.0	100.0	95.0	95.0	105.0	NA	NA	NA

Vertical Sash Minimum Opening

Face Velocity FPM								
No.	1	2	3	4	5	6	7	8
1	105.0	100.0	95.0	101.0	99.0	NA	NA	NA

Notes & Observations:

AIRFLOW EXPERTS, INC.
Phone: 888.229.1477
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UNIT
ROOM TO AMBIENT

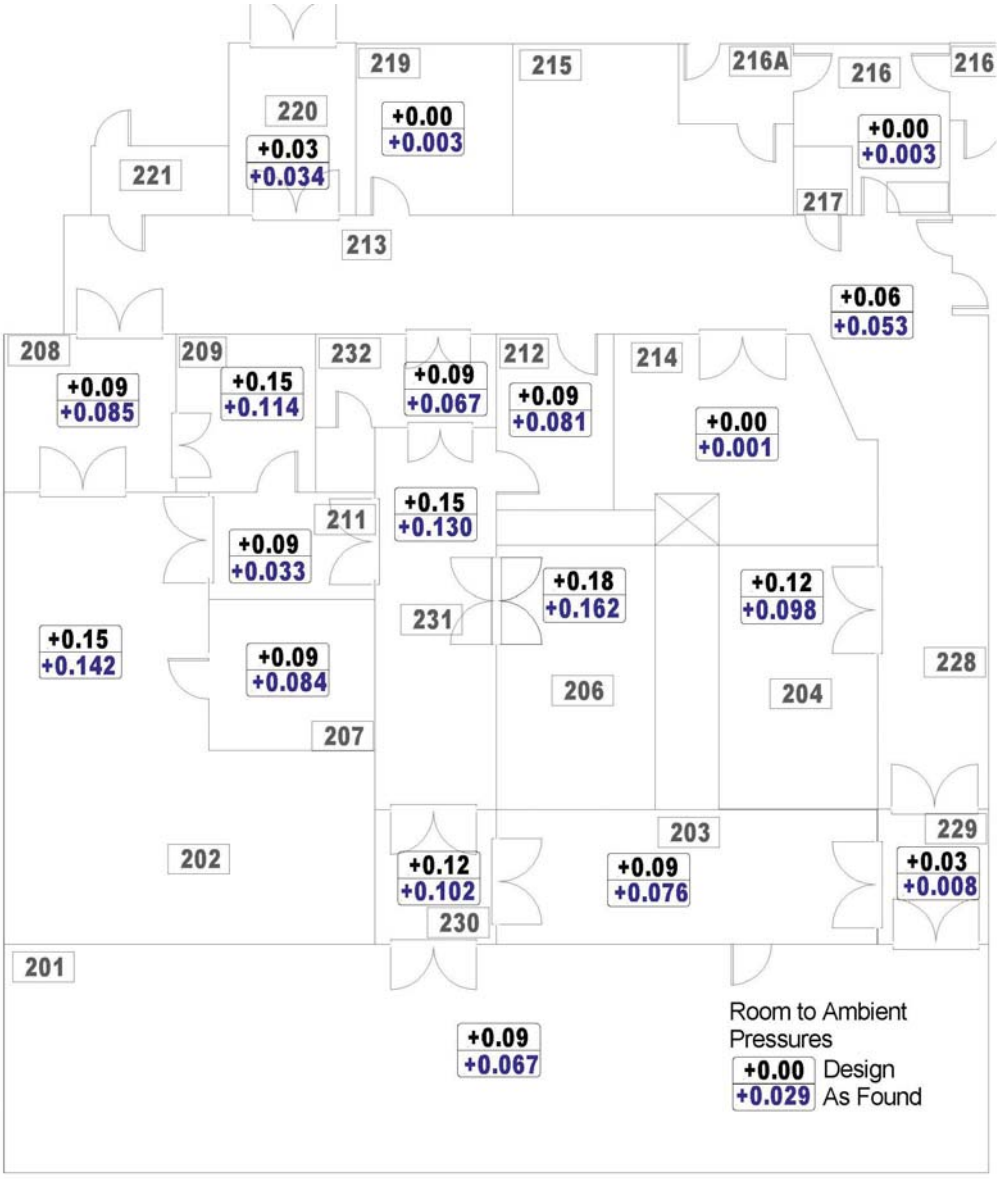
Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Room Pressure Differentials (SOP: TAD-0100 TAB)

Test Apparatus:	Digital Balometer		
Manufacturer:	Alnor	**Model:**	EBT721
Serial Number:	90826015	**Cal. Date:**	02 Jun 2010
		Cal. Due:	01 Jun 2011

System Diagram



Notes & Observations:

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Phone: 888.229.1477
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UNIT
ROOM TO ROOM

NEBB

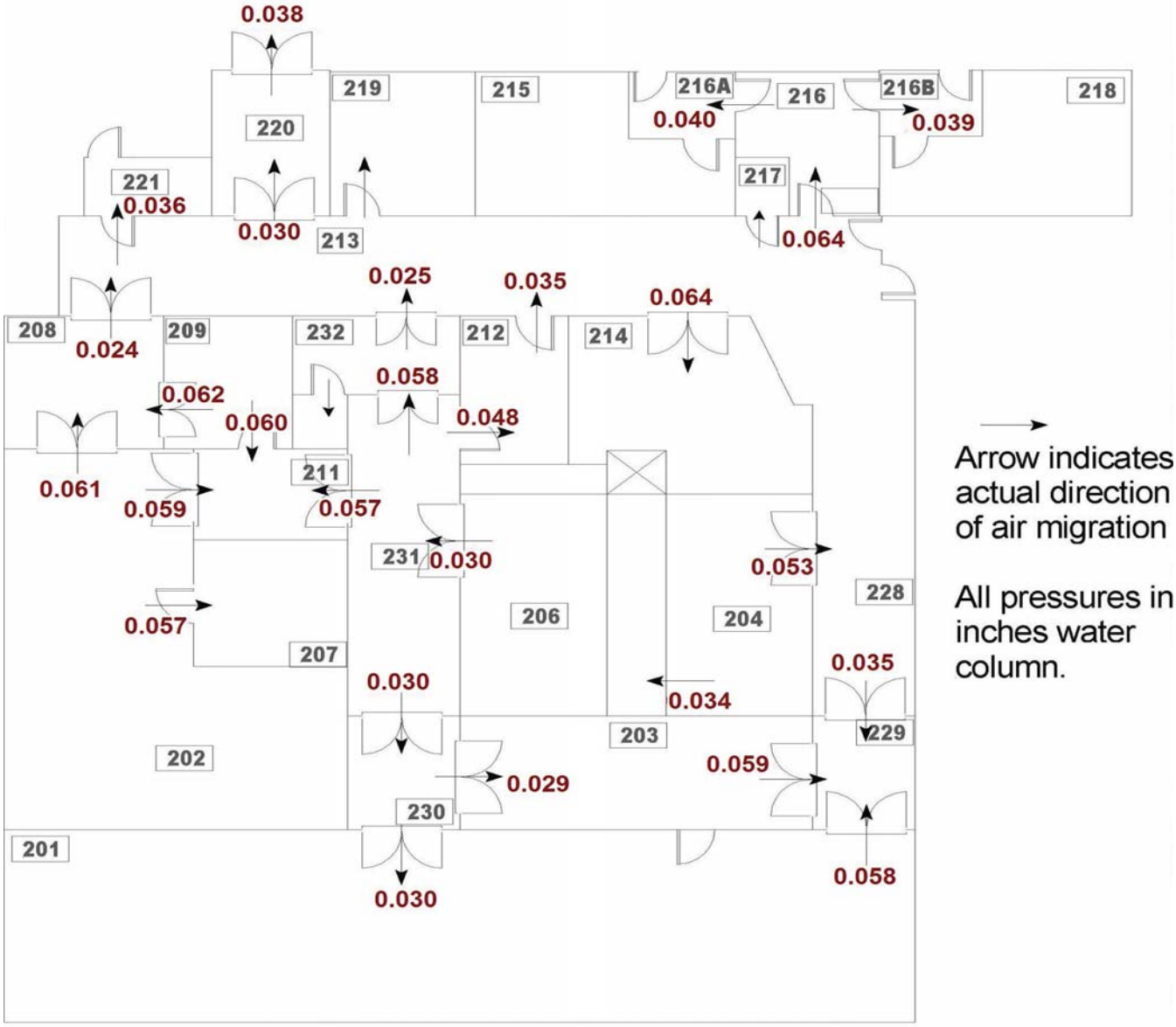
Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Room Pressure Differentials (SOP: TAD-0100 TAB)

Test Apparatus:	Digital Balometer		
Manufacturer:	Alnor	**Model:**	EBT721
Serial Number:	90826015	**Cal. Date:**	02 Jun 2010
		Cal. Due:	01 Jun 2011

System Diagram



Notes & Observations:

AIRFLOW EXPERTS, INC.

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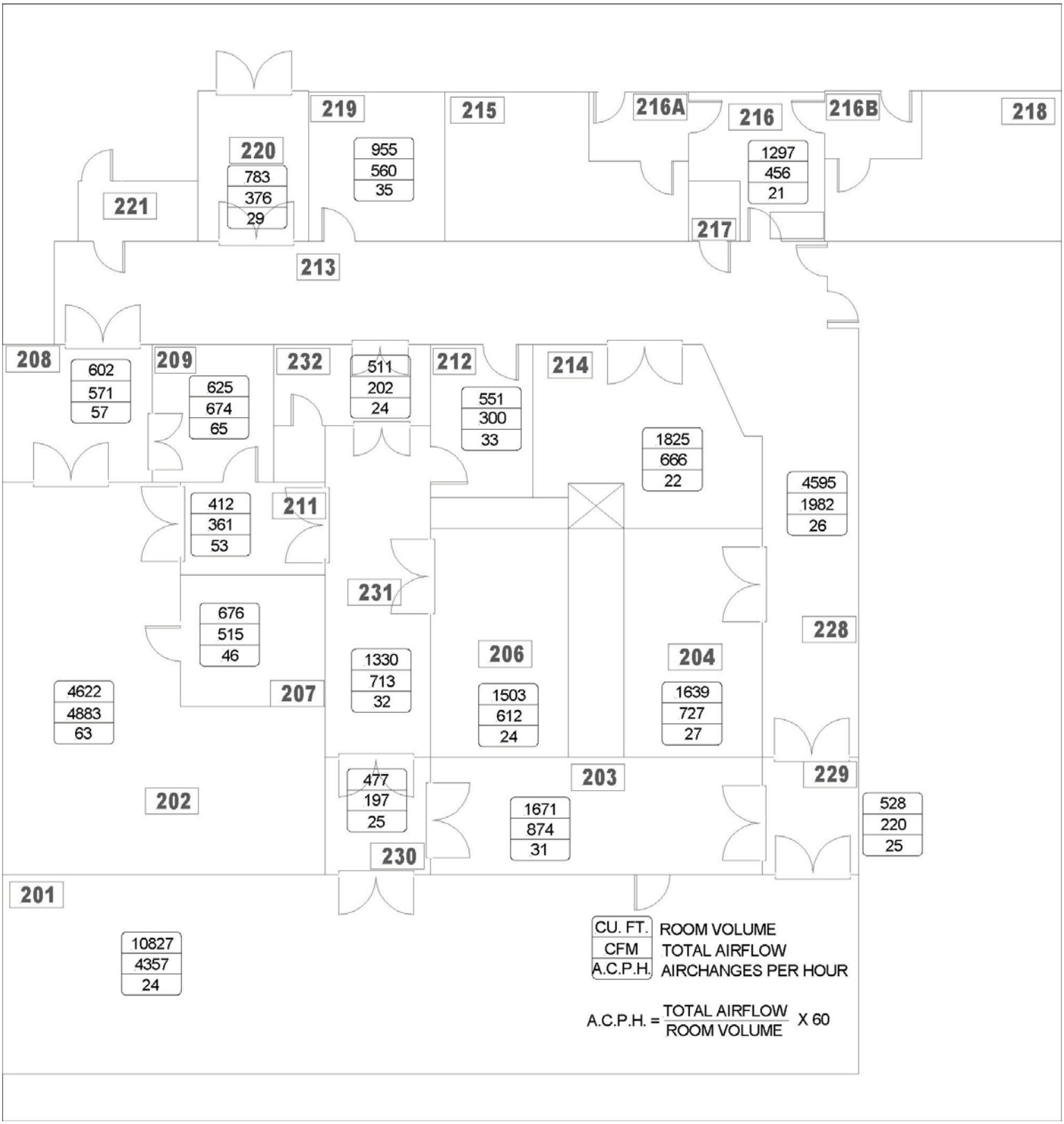
NEBB



AIRFLOW EXPERTS, INC.

UNIT #
CC-1

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Chilled Water Cooling Coil

Test Apparatus: Hydronic Multimeter

Manufacturer: Shortridge **Model:** HDM-300

Serial Number: W05025 **Cal. Date:** 02 Aug 2010

Test Apparatus: Thermoanemometer / Manometer

Manufacturer: TSI **Model:** 8386

Serial Number: 01040114 **Cal. Date:** 03 Nov 2010

	Design	Actual
Coil Location	Air Handing Unit 1	Duct mounted
Area Served	Cleanroom	Cleanroom
Coil Manufacturer	Quick Coil	Cold Coil
Capacity	3600 MBH	3800 MBH
Coil Face Size	42" x 50"	48" x 48"
Coil Face Velocity	550	565
Airflow Rate, CFM	2000	2200
Air Pressure Drop "W.C.	0.5" W.C.	0.65 " W.C.
Water Flow, GPM	35	33
Balancing Valve Size	2"	2"
Valve Type & Position	CBV	CBV
Valve Pressure Drop	15 Feet	15 Feet
Coil Pressure Drop, ft.	2.3 ft	3.1 Ft
Entering Air Temp D.B.	93	98
Entering Air Temp W.B.	86	78
Leaving Air Temp D.B.	55	58
Leaving Air Temp W.B.	53	57
Entering Water Temp	42	44
Leaving Water Temp	56	57

Relative Humidity of Entering Air 45%

Relative Humidity of Leaving Air 98%

Calculated Latent Heat Transferred From Air 1900 BTUH

Calculated Sensible Heat Transferred From Air 1500 BTUH

Calculated Total Heat Transferred From Air 3400 BTUH

Calculated Heat Quantity Transferred to Water 3650 BTUH

Heat Loss 250 BTUH **Calculated Water Flow** 37 GPM

Notes & Observations:

AIRFLOW EXPERTS, INC.
Phone: 888.229.1477
Fax: 888.229.0422

Coil Apparatus Report

Project: Sample Balancing Report | **Report No:** None
Test Performed By: Jim Clarke | **Date:** 07 Jan 2011
System/Unit: COOLING COIL CC-1

1. Unit Data

Unit Identification:	AHU-1	Location:	PENTHOUSE			Model #:	CC-205
Manufacturer:	TRANE	Type:	TSW	Size:	440	Serial #:	12345
Unit Arrangement:	DRAW THROUGH	Disch. Arr:	VERTICAL	Class:	II	Filters:	95%

2. Motor Data

Manufacturer:	BALDOR	Frame:	215T	HP:	5	V/Ph/Hz:	208 / 3 / 60	FLA:	7.2	S.F.:	1.15

3. Coil Data

System ID:	COOLING COIL #1	Location:	AHU-1	Type:	CHILLED WATER
Manufacturer:	TRANE	Model #:	TSW140DEF0004	Face Area:	20" X 80"
Fins Spacing:	10/IN	Fin Material:	ALUMINUM	Circuit Arr.:	SERPENTINE
Tube Size:	1/2"	Tube Material:	COPPER	# of Rows:	4

4. Test Data

	Design	Actual		Design	Actual	Notes
Total Airflow (cfm):	4000	4100	System S.P. ("wc):	2"	2.15"	
Filter Press. ("wc):	0.3"	0.33"	Discharge S.P. ("wc):	1"	1.15"	
Cool Airflow (cfm):	4000	4100	Coil P.D. ("wc):	0.5"	0.62"	
Fan RPM:	750	737	Coil Face Velocity(fpm):	440	451	
Outside Airflow:	1000	1010	O.A. Temp DB (°F):	55	61	
OAD Position (%):	10%	15%	O.A. Temp WB (°F):	51	57	
Return Airflow:	3000	3090	R.A. Temp DB (°F):	77	74	
RAD Position (%):	90%	85%	R.A. Temp WB (°F):	60	64	
Water Flow (gpm):	75	77	E.A. Temp DB (°F):	71	70	
Water DP (ft. hd.):	10 FT (max)	9.2	E.A. Temp WB (°F):	53	62	
E.W. Temp (°F):	44	42.5	L.A. Temp DB (°F):	55	53	
L.W. Temp (°F):	55	53.3	L.A. Temp WB (°F):	54	52	

5. Test Apparatus

Rotational Test Apparatus:	Shimpo DT-205L	Serial #:	COAB0392
Airflow Test Apparatus:	Alnor EBT721	Serial #:	90835040
Pressure Test Apparatus:	Fluke 922	Serial #:	96700033
Water Flow Test Apparatus:	Alnor HM670	Serial #:	70931051
Temperature Test Apparatus:	Cooper Instrument SRH77A	Serial #:	483656

6. Remarks

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
Fax: 888.229.0422

UNIT #
CHP-1

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Hydronic Circulating Pump

Test Apparatus: Hydronic Multimeter

Manufacturer: Shortridge **Model:** HDM-300

Serial Number: W05025 **Cal. Date:** 02 Aug 2010

Unit Number:	CHP-1
Location	Pump Room
Service	Chilled Water
Manufacturer / Model	Pump-It Company / 555-ghp
Serial	246897531

Pump Data

	Design	Actual
Pump Type	End Suction	Inline
Mounting Arrangement	Base Mounted	Pipe-Hung
Inlet Size	3"	3"
Discharge Size	2 1/2"	2"
Coupling Type	Flexible	Direct
Seal Type	Graphite	Metallic
Body Material	Brass	Cast IUron
Impeller Material	Stainless	Bronze
Net Positive Suction Head	14	12
Motor Manufacturer	Electric & Electric	Electric Co
Motor HP/Frame	15/254T	10/182T
Motor RPM	1800	1140
Motor Voltage	200	208

Nameplate Amperage 12.5 **Measured Currents** 10.8 / 11.0 / 11.2

Service Factor 1.15 **Current Overload Protection** 12.5 A

Test Data

	No Flow or Dead Head	Normal Operation - Full Flow
Measured Head Pressures		
Discharge Pressure, PSI	50	38
Suction Pressure, PSI	10	19
Differential Pressure, PSI	40.00	19.00
Head Pressure, Ft. Hd.	92.40	43.89

Pump Performance	Design	Pump Body	Submittal	Calculated	Measured
Impeller Size	7.75	7.5	7.5	8.0	Not Measured
Flow Rate	300	325	325	315	335
Head Pressure	45 ft	50 ft	50 ft	48	48.5

Notes & Observations:

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Balancing Valve/Flow Meter Report

Project: Sample Balancing Report
Test Performed By:
System/Unit: Hot Water Coils
Report No: None
Report Date: 07 Jan 2011

Balancing Valve/Flow Meter Report

Test Apparatus: Hydronic Multimeter **Serial Number:** W03013

No.	Service Designation	Manufacturer	Model	Size	Design Flow	Actual Flow	Dial Set	Delta P	Op. Pres. Range
Sub-System									
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
19									
20									
				TOTAL					

AIRFLOW EXPERTS, INC.

UNIT #
Hot Water Heating

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

Project: Sample Balancing Report **Report No:** None

Test Performed By: Jim Clarke **Date:** 07 Jan 2011

Balancing Valve/Flow Meter Report

Test Apparatus: Hydronic Multimeter

Manufacturer: Shortridge **Model:** HDM-300

Serial Number: W05025 **Cal. Date:** 02 Aug 2010

Cal. Due: 01 Aug 2011

Service or Designation	Manufacturer	Model	Size	Design GPM	Valve Position	Valve P.D.	Actual GPM	Notes
2nd Floor								
HC-1	Coilco	BFG10	1"	10	50%	15 ft	11	
HC-2	Coilco	BFG15	1.5"	15	40%	25 ft	14	
HC-3	Coilco	BFG20	2.0"	25	100%	1 ft	23	
	TOTAL			50.0			48.0	

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MICRO-CLEAN
microcln.com

Micro-Clean, Inc.
P.O. Box 21806
Lehigh Valley, PA 18002-1806

610-867-5302
1-800-523-9852
Fax: 610-954-7803

CERTIFICATE OF CALIBRATION

MODEL *8386* **SERIAL NO.** *01040114*

DESCRIPTION *TSI VelociCalc Plus Thermoanemometer*

Micro-Clean Calibration Services does hereby certify that all performance and acceptance tests required were successfully conducted according to required specifications. All calibration data and test instrumentation used have been obtained using standards whose accuracies are traceable to the National Institute of Standards and Technology (NIST), have been derived from accepted values of natural physical constants, or by the use of ratio type of self calibration. The calibration system complies with ANSI/NCSL Z540-1-1994.

November 3, 2010
Date of Calibration

November 2, 2011
Next Calibration is Due

Ed Pitosky Ed Pitosky 03NOV2010
Authorized Name/Signature/Date

MCI# 105087

AEI AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

MICRO-CLEAN CALIBRATION SERVICES
177 North Commerce Way
Bethlehem, PA 18017-8933
(800) 523-9852

CALIBRATION CERTIFICATE

Manufacturer: TSI
Model : 8386
Serial Number: 01040114
Description: VelociCalc Plus
Noun: Thermoanemometer
MCI #: 105087

Customer: AEI AIRFLOW EXPERTS INC.
Address: PO BOX 418
GRAM, NC 27253

Last Calibration Date : October 7, 2009
Calibration Date : November 3, 2010
Calibration Due : November 2, 2011

Ambient Temperature : 69 °F
Relative Humidity : 25 % RH
Barometric Pressure : 29.90 in.Hg

Calibrated by : Ed Pitosky Ed Pitosky 03NOV2010

MCI Quality Assurance approval: Thomas A Zilio 03NOV2010
Name / Signature / Date of signature

All results contained within this certification relate only to item(s) calibrated.
This certificate shall not be reproduced except in full, without the written consent of Micro-Clean Calibration Services.
Micro-Clean Calibration Services quality system complies with applicable requirements of ANSI/NCSL Z540-1-1994.

NOMINAL	AS FOUND	AS LEFT	Test accuracy ratio	TOLERANCE (ft / min)	
50 ft / min	50 ft / min	50 ft / min	1.0 : 1	47	53
100 ft / min	100 ft / min	100 ft / min	<1.0 : 1	97	103
200 ft / min	202 ft / min	202 ft / min	1.0 : 1	194	206
500 ft / min	510 ft / min	510 ft / min	1.0 : 1	485	515
1000 ft / min	1005 ft / min	1005 ft / min	1.2 : 1	970	1030
2000 ft / min	1980 ft / min	1980 ft / min	1.7 : 1	1940	2060
3500 ft / min	3470 ft / min	3470 ft / min	2.1 : 1	3395	3605
6000 ft / min	5890 ft / min	5890 ft / min	2.8 : 1	5820	6180
9000 ft / min	9250 ft / min	9250 ft / min	2.6 : 1	8730	9270

FUNCTION: Velocity
TOLERANCE: ± 3.0% of reading or ± 3 ft / min, whichever is greater
SOP NUMBER: TA-1108 CAL

NOMINAL	AS FOUND	AS LEFT	Test accuracy ratio	TOLERANCE (in. W.C.)	
-4.00 in. W.C.	-4.010 in. W.C.	-4.010 in. W.C	3.0 : 1	-4.045	-3.955
-2.50 in. W.C.	-2.500 in. W.C.	-2.500 in. W.C	1.7 : 1	-2.530	-2.470
0.000 in. W.C.	0.000 in. W.C.	0.000 in. W.C	NA	-0.005	0.005
0.050 in. W.C.	0.050 in. W.C.	0.050 in. W.C	< 1.0:1	0.045	0.056
0.100 in. W.C.	0.100 in. W.C.	0.100 in. W.C	< 1.0:1	0.094	0.106
0.500 in. W.C.	0.501 in. W.C.	0.501 in. W.C	< 1.0:1	0.490	0.510
1.000 in. W.C.	1.002 in. W.C.	1.002 in. W.C	1.0:1	0.985	1.015
2.000 in. W.C.	2.005 in. W.C.	2.005 in. W.C	1.7 : 1	1.975	2.025
4.000 in. W.C.	4.010 in. W.C.	4.010 in. W.C	3.0 : 1	3.955	4.045
9.000 in. W.C.	9.025 in. W.C.	9.025 in. W.C	> 4.0 : 1	8.905	9.095
12.00 in. W.C.	12.040 in. W.C.	12.040 in. W.C	> 4.0 : 1	11.875	12.125

FUNCTION: Pressure
TOLERANCE: ± 1.0% of reading, ± 0.005 in. W.C.
SOP NUMBER: PRSS-0709 CAL

NOMINAL	AS FOUND	AS LEFT	Test accuracy ratio	TOLERANCE (°F)	
69.318 °F	69.4 °F	69.4 °F	10:1	68.8	69.8

FUNCTION: Temperature
TOLERANCE: ± 0.5° Fahrenheit
SOP NUMBER: TEMP-1208 CAL

NOMINAL	AS FOUND	AS LEFT	Test accuracy ratio	TOLERANCE (%RH)	
LiCl (12.4 %)	0.0 % RH	0.0 % RH	NA	9.4	15.4
K_2CO_3 (44.0 %)	0.0 % RH	0.0 % RH	NA	41.0	47.0
NaCl (75.5 %)	0.0 % RH	0.0 % RH	NA	72.5	78.5

FUNCTION: Humidity
TOLERANCE: ± 3.0% Relative Humidity
SOP NUMBER: TEMP-1208 CAL

Comments: Unit received in tolerance, unit returned in tolerance,(limited calibration not to be used for humidity).

NOTE 1: Velocity Corrected for Std. Conditions

NOTE 2: * Asterisk indicates out-of-tolerance condition

CALIBRATION STANDARDS

Description	Part Number	Serial Number	Calibration Date	Date Due
Wind Tunnel Transducer	MKS 225AD	14935015/00334	May 17, 2010	May 16, 2011
Temperature IRTD	Kaye M2801	90414	October 1, 2010	September 30, 2011
Pressure Standard	Heise ST-2H	50560	September 9, 2010	September 8, 2011
Pressure Standard	Heise HQS-1	19205	January 28, 2010	January 27, 2011
RH Reference	LiCl (12.4%) RH	NA	NA	NA
RH Reference	K_2CO_3 (44.0%) RH	NA	NA	NA
RH Reference	NaCl (75.5%) RH	NA	NA	NA

AIRFLOW EXPERTS, INC.

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PRECISION MEASUREMENTS CORPORATION

553-E Pylon Drive • Raleigh, NC 27607
(919) 755-0382
FAX 755-0383

ISO/IEC 17025
Accredited

CALIBRATION CERTIFICATE

INSTRUMENT: Alnor - HM 670

SERIAL NO.: 70931051

DESCRIPTION: Hydronic Manometer

PROPERTY OF: Airflow Experts Inc.

TEST PERFORMED BY: R.Hammerle

TEST DATE: 08/27/10

TEMPERATURE: 23°C **HUMIDITY:** 45%

NEXT CALIBRATION DUE: 08/27/2011

CERTIFICATE NO.: 100827-7

The above instrument was checked and calibrated against working standards which are traceable to the National Institute of Standards Technology. The metrology procedures utilized conform to and satisfy the requirements of ISO/IEC 17025: 2005, ISO 10012-1, and ANSI/NCSL Z540.3-2006. The above instrument performance was determined using the specifications available from the manufacturer or some equivalent acceptable reference or PMC procedures specified in the QA manual. Expanded uncertainties represent uncertainties expressed at the 95% confidence level using a coverage factor of K=2. Although the item calibrated meets the specifications and performance at the time of calibration, due to any number of factors, the recommended due date of the item calibrated does not imply continuing conformance to specifications during the recommended interval. This certificate shall not be reproduced, except in full, without prior written approval of the laboratory.

Instrument Received: Within Tolerance

Instrument Returned: Within Tolerance

Authorized Signature

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
Fax: 888.229.0422

PRECISION MEASUREMENTS CORPORATION
553-E Pylon Drive • Raleigh, NC 27607
(919) 755-0382
FAX 755-0383

ISO/IEC 17025 Accredited

TEST REPORT

Company:	Airflow Experts Inc.
Certificate No.:	1008277
Manufacturer:	Alnor
Model:	HM 670
Serial No:	70931051
Test Date:	08/27/10
Temperature:	23 °C
Relative Humidity:	45%
Description:	Hydronic Manometer
Accuracy:	+/-1% of reading or .036psi whichever is greater
Repair Status:	N/A
Calibration Specs:	Manufacturer

Calibration Data

	Standard	Before	After		Standard	Before	After
1	High PSI 5.000	5.002	Same As Received	7	Low PSI 5.000	5.002	SAR
2	50.00	50.03	SAR	8	50.00	50.01	SAR
3	100.00	100.1	SAR	9	100.00	99.9	SAR
4	150.00	150.1	SAR	10	150.00	149.8	SAR
5	200.00	200.2	SAR	11	200.00	199.7	SAR
6	300.00	300.3	SAR	12	300.00	299.6	SAR

Standards Used

Manufacturer	Model	Serial No.	Date Cal.	Due Cal.	Description	Best Uncertainty
Beta	320	12139	02/12/10	2/2011	Precision Pressure Calibrator	0-30psi +/-.001psi 0-300psi +/-.01psi 0-3000psi +/-.5psi 0-30"Hg +/-.01"Hg

Applicable NIST Tests

Pressure- 821/248681; 821/229629; 821/316451;737/236653;52/-236653;QSP-A012;MMAP822/LA

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FAX 755-0383

ISO/IEC 17025
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CALIBRATION CERTIFICATE

INSTRUMENT: Alnor - EBT-721 / 800188 / 800189

SERIAL NO.: 90826015 / 90824074 / 90825020

DESCRIPTION: Balometer / Temp Probe / Humidity Probe

PROPERTY OF: Airflow Experts Inc.

TEST PERFORMED BY: B.Cullen

TEST DATE: 06/02/10

TEMPERATURE: 23°C **HUMIDITY:** 45%

NEXT CALIBRATION DUE: 06/02/2011

CERTIFICATE NO.: 100602-3

The above instrument was checked and calibrated against working standards which are traceable to the National Institute of Standards Technology. The metrology procedures utilized conform to and satisfy the requirements of ISO/IEC 17025, ISO 10012-1, and ANSI/NCSL Z540-3-1994. The above instrument performance was determined using the specifications available from the manufacturer or some equivalent acceptable reference or PMC procedures specified in the QA manual. Expanded uncertainties represent uncertainties expressed at the 95% confidence level using a coverage factor of K=2. Although the item calibrated meets the specifications and performance at the time of calibration, due to any number of factors, the recommended due date of the item calibrated does not imply continuing conformance to specifications during the recommended interval. This certificate shall not be reproduced, except in full, without prior written approval of the laboratory.

Instrument Received: Within Tolerance

Instrument Returned: Within Tolerance

Authorized Signature

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
Fax: 888.229.0422

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PRECISION MEASUREMENTS CORPORATION

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(919) 755-0382
FAX 755-0383

ISO/IEC 17025
Accredited

TEST REPORT

Company:	Airflow Experts Inc.
Certificate No.:	1006023
Manufacturer:	Alnor
Model:	EBT-721 / 800188 / 800189
Serial No:	90826015 / 90824074 / 90825020
Test Date:	06/02/10
Temperature:	23 °C
Relative Humidity:	45%
Description:	Balometer / Temp Probe / Humidity Probe
Accuracy:	Airflow+/-3% Full Scale +/-.5 Deg F RH+/-3%
Repair Status:	N/A
Calibration Specs:	Manufacturer

Standards Used

Manufacturer	Model	Serial No.	Date Cal.	Due Cal.	Description	Best Uncertainty
Alphagaz	Calgaz	90-1086	10/08/07	10/2010	Nitrogen	99.995 to 99.999
Beta	320	12139	02/12/10	2/2011	Precision Pressure Calibrator	0-30psi +/-.001psi 0-300psi +/-.01psi 0-3000psi +/-.5psi 0-30"Hg +/-.01"Hg
Fisher Scientific	14-649-6	20234990	06/02/09	6/2012	Precision Stop Watch	+/-.0003%
Omega	CL-505A	91064671	10/30/09	10/2010	Precision Temperature Calibrator	+/-.1 Deg C +/-.2 Deg F mV+/-.05% mA+/-.05%
Reagents Inc.	11.3% to 97.3%	PMC-16	05/04/09	5/2011	Saturated Aqueous Salt Solutions	+/-1%
Oakton	35612-00	9009291	01/04/10	1/2011	Thermohygrometer	+/-2% RH +/-.6 Deg C

Applicable NIST Tests

DC Voltage- 811/249920-92; 243290; 2300010062;2300010061, Frequency- WWVB;2300009707, Humidity- Saturated Salt Solutions, Pressure- 821/248681; 821/229629; 821/316451,737/236653;52/-236653;QSP-A012;MMAP822/LA, Temperature- 238455;130734;37488-40832

AIRFLOW EXPERTS, INC.

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Airflow Experts Inc.

TEST REPORT

Certificate No: 1006023

Calibration Data

	Standard	Before	After		Standard	Before	After
1	FPM 24	25	Same As Received	26			
2	197	200	SAR	27			
3	296	300	SAR	28			
4	395	400	SAR	29			
5	494	500	SAR	30			
6	795	800	SAR	31			
7	1206	1200	SAR	32			
8	1607	1600	SAR	33			
9	2011	2000	SAR	34			
10	2532	2500	SAR	35			
11	Deg F 32.0	32.2	SAR	36			
12	50.0	50.2	SAR	37			
13	75.0	75.3	SAR	38			
14	100.0	100.3	SAR	39			
15	150.0	150.3	SAR	40			
16	200.0	200.3	SAR	41			
17	250.0	249.7	SAR	42			
18	%RH 22.0	22.3	SAR	43			
19	43.0	43.4	SAR	44			
20	75.0	75.5	SAR	45			
21	90.0	90.6	SAR	46			
22				47			
23				48			
24				49			
25				50			

AIRFLOW EXPERTS, INC.

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CERTIFICATE OF CALIBRATION

TSI Incorporated, Alnor Products, 500 Cardigan Road, Shoreview, MN 55126 USA
TEL:1-800-874-2811 1-651-490-2811 FAX: 1-651-490-3824 www.alnor.com

ENVIRONMENT CONDITION		
TEMPERATURE	71.1	° F
RELATIVE HUMIDITY	30.0	% RH
BAROMETRIC PRESSURE	29.24	inHg

MODEL	EBT™ Micromanometer EBT721
SERIAL NO.	90835040

CALIBRATION STANDARDS USED
Manometer Calibration Bench 1

☒ AS LEFT ☒ IN TOLERANCE
☐ AS FOUND ☐ OUT OF TOLERANCE

CALIBRATION DATA

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN in.Hg			DIFFERENTIAL PRESSURE MEASURED IN in.H2O		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	20.06	**20.04**	19.66 ~ 20.46	0.097	**0.097**	0.095 ~ 0.099
2	29.20	**29.20**	28.62 ~ 29.78	0.483	**0.483**	0.473 ~ 0.493
3	34.47	**34.46**	33.79 ~ 35.15	2.85	**2.85**	2.80 ~ 2.90
4	-	-	-	12.0	**12.0**	11.8 ~ 12.2
5	-	-	-	15.1	**15.1**	14.8 ~ 15.4

TESTING POINTS	TEMPERATURE MEASURED IN °F			HUMIDITY MEASURED IN %RH		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	-38.0	**-38.0**	-37.0 ~ -39.0	71.4	**71.5**	71.3 ~ 71.5
2	5.0	**5.0**	4.7 ~ 5.3	5.6	**5.6**	5.5 ~ 5.7
3	77.0	**77.0**	76.8 ~ 77.2	-	-	-
4	158.0	**158.0**	157.8 ~ 158.2	-	-	-
5	230.0	**230.0**	229.7 ~ 230.3	-	-	-

** Indicates out of tolerance condition*

TSI Incorporated does hereby certify that the above described instrument conforms to the original manufacturer's specifications (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology within the limitations of NIST's calibration services or have been derived from accepted values of natural physical constants or have been derived by the ratio type of self calibration techniques. The calibration ratio for this instrument is at least 6.7:1 for barometric pressure and 3:1 for differential pressure. TSI's calibration system meets ISO-9001:2008 and complies with ISO 10012:2003, Quality Assurance Requirements for Measuring Equipment. This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the calibration organization issuing this report.

Measurement Variable	System ID Number	Date Last Calibrated	Calibration Due Date
DC Voltage	E002798	06-24-10	12-24-11
DC Voltage	E002797	06-24-10	12-24-11
Pressure	E002173	06-16-10	12-16-10
Pressure	E002447	06-30-10	06-30-11

Calibration procedure used: 10000000787B

Thay Xiong
Calibrated By

Nov. 2, 2010
Calibration Date

1083501A

AIRFLOW EXPERTS, INC.
Phone: 888.229.1477
Fax: 888.229.0422

CERTIFICATE OF CALIBRATION

TSI Incorporated, Alnor Products, 500 Cardigan Road, Shoreview, MN 55126 USA
TEL:1-800-874-2811 1-651-490-2811 FAX: 1-651-490-3824 www.alnor.com

ENVIRONMENT CONDITION		
TEMPERATURE	21.7	° C
RELATIVE HUMIDITY	30.0	% RH
BAROMETRIC PRESSURE	990	hPa

MODEL	EBT™ Micromanometer EBT721
SERIAL NO.	90835040

CALIBRATION STANDARDS USED
Manometer Calibration Bench 1

☒ AS LEFT ☒ IN TOLERANCE
☐ AS FOUND ☐ OUT OF TOLERANCE

CALIBRATION DATA

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN hPa			DIFFERENTIAL PRESSURE MEASURED IN Pa		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	679	**679**	665 ~ 693	24.2	**24.2**	23.5 ~ 24.9
2	989	**989**	969 ~ 1009	120	**120**	117 ~ 123
3	1167	**1167**	1144 ~ 1190	710	**710**	696 ~ 724
4	-	-	-	2989	**2989**	2929 ~ 3049
5	-	-	-	3761	**3761**	3686 ~ 3836

TESTING POINTS	TEMPERATURE MEASURED IN °C			HUMIDITY MEASURED IN %RH		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	-38.9	**-38.9**	-38.3 ~ -39.4	71.4	**71.5**	71.3 ~ 71.5
2	-15.0	**-15.0**	-14.8 ~ -15.2	5.6	**5.6**	5.5 ~ 5.7
3	25.0	**25.0**	24.9 ~ 25.1	-	-	-
4	70.0	**70.0**	69.9 ~ 70.1	-	-	-
5	110.0	**110.0**	109.8 ~ 110.2	-	-	-

** Indicates out of tolerance condition*

TSI Incorporated does hereby certify that the above described instrument conforms to the original manufacturer's specifications (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology within the limitations of NIST's calibration services or have been derived from accepted values of natural physical constants or have been derived by the ratio type of self calibration techniques. The calibration ratio for this instrument is at least 6.7:1 for barometric pressure and 3:1 for differential pressure. TSI's calibration system meets ISO-9001:2008 and complies with ISO 10012:2003, Quality Assurance Requirements for Measuring Equipment. This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the calibration organization issuing this report.

Measurement Variable	System ID Number	Date Last Calibrated	Calibration Due Date
DC Voltage	E002798	06-24-10	12-24-11
DC Voltage	E002797	06-24-10	12-24-11
Pressure	E002173	06-16-10	12-16-10
Pressure	E002447	06-30-10	06-30-11

Calibration procedure used: 10000000787B

Thay Xiong
Calibrated By

Nov. 2, 2010
Calibration Date

1083501A

Litho. in U.S.A.

© GOES 346

AIRFLOW EXPERTS, INC.

Phone: 888.229.1477
Fax: 888.229.0422

NEBB

CERTIFICATE OF CALIBRATION

TSI Incorporated, Alnor Products, 500 Cardigan Road, Shoreview, MN 55126 USA
TEL:1-800-874-2811 1-651-490-2811 FAX: 1-651-490-3824 www.alnor.com

ENVIRONMENT CONDITION		
TEMPERATURE	71.1	° F
RELATIVE HUMIDITY	30.0	% RH
BAROMETRIC PRESSURE	29.24	inHg

MODEL	EBT™ Micromanometer EBT721
SERIAL NO.	90835040

CALIBRATION STANDARDS USED
Manometer Calibration Bench 1

☐ AS LEFT ☒ IN TOLERANCE
☒ AS FOUND ☐ OUT OF TOLERANCE

CALIBRATION DATA

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN in.Hg			DIFFERENTIAL PRESSURE MEASURED IN in.H2O		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	20.06	**19.87**	19.66 ~ 20.46	0.093	**0.094**	0.091 ~ 0.095
2	29.21	**29.02**	28.63 ~ 29.79	0.480	**0.484**	0.470 ~ 0.490
3	34.47	**34.25**	33.79 ~ 35.15	2.83	**2.85**	2.78 ~ 2.88
4	-	-	-	11.9	**12.0**	11.7 ~ 12.1
5	-	-	-	15.1	**15.3**	14.8 ~ 15.4

TESTING POINTS	TEMPERATURE MEASURED IN °F			HUMIDITY MEASURED IN %RH		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	-38.0	**-38.0**	-37.0 ~ -39.0	71.4	**71.5**	71.3 ~ 71.5
2	5.0	**5.0**	4.7 ~ 5.3	5.6	**5.6**	5.5 ~ 5.7
3	77.0	**77.0**	76.8 ~ 77.2	-	-	-
4	158.0	**158.0**	157.8 ~ 158.2	-	-	-
5	230.0	**230.0**	229.7 ~ 230.3	-	-	-

** Indicates out of tolerance condition*

TSI Incorporated does hereby certify that the above described instrument conforms to the original manufacturer's specifications (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology within the limitations of NIST's calibration services or have been derived from accepted values of natural physical constants or have been derived by the ratio type of self calibration techniques. The calibration ratio for this instrument is at least 6.7:1 for barometric pressure and 3:1 for differential pressure. TSI's calibration system meets ISO-9001:2008 and complies with ISO 10012:2003, Quality Assurance Requirements for Measuring Equipment. This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the calibration organization issuing this report.

Measurement Variable	System ID Number	Date Last Calibrated	Calibration Due Date
DC Voltage	E002798	06-24-10	12-24-11
DC Voltage	E002797	06-24-10	12-24-11
Pressure	E002173	06-16-10	12-16-10
Pressure	E002447	06-30-10	06-30-11

Calibration procedure used: 10000000787B

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ENVIRONMENT CONDITION		
TEMPERATURE	21.7	° C
RELATIVE HUMIDITY	30.0	% RH
BAROMETRIC PRESSURE	990	hPa

MODEL	EBT™ Micromanometer EBT721
SERIAL NO.	90835040

CALIBRATION STANDARDS USED
Manometer Calibration Bench 1

☐ AS LEFT ☒ IN TOLERANCE
☒ AS FOUND ☐ OUT OF TOLERANCE

CALIBRATION DATA

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN hPa			DIFFERENTIAL PRESSURE MEASURED IN Pa		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	679	**673**	665 ~ 693	23.2	**23.4**	22.5 ~ 23.9
2	989	**983**	969 ~ 1009	120	**121**	117 ~ 123
3	1167	**1160**	1144 ~ 1190	705	**710**	691 ~ 719
4	-	-	-	2964	**2989**	2905 ~ 3024
5	-	-	-	3761	**3811**	3686 ~ 3836

TESTING POINTS	TEMPERATURE MEASURED IN °C			HUMIDITY MEASURED IN %RH		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	-38.9	**-38.9**	-38.3 ~ -39.4	71.4	**71.5**	71.3 ~ 71.5
2	-15.0	**-15.0**	-14.8 ~ -15.2	5.6	**5.6**	5.5 ~ 5.7
3	25.0	**25.0**	24.9 ~ 25.1	-	-	-
4	70.0	**70.0**	69.9 ~ 70.1	-	-	-
5	110.0	**110.0**	109.8 ~ 110.2	-	-	-

** Indicates out of tolerance condition*

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DC Voltage	E002798	06-24-10	12-24-11
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