



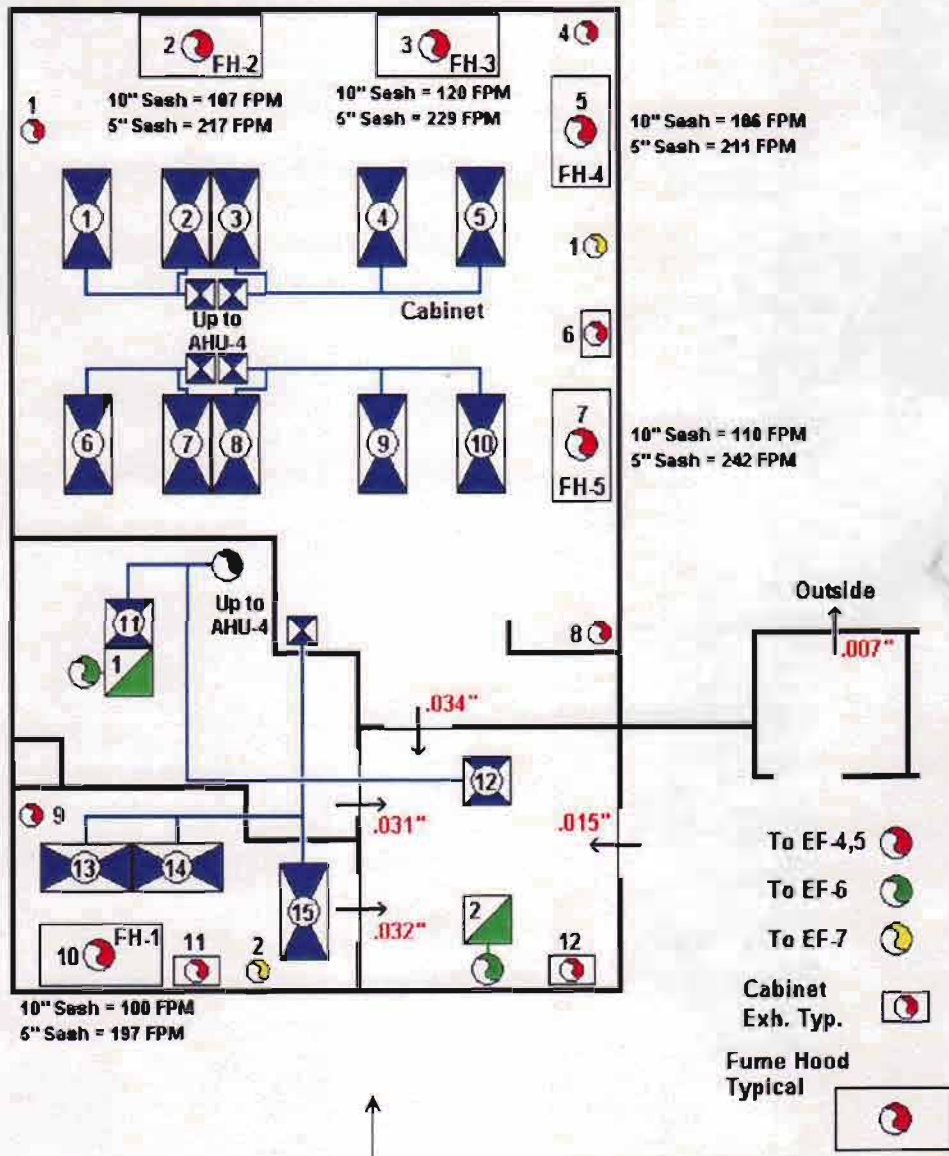
**Cosmogenic Nuclide
Laboratory
Delehanty Hall
University of Vermont
Burlington, Vermont
NEAS # RC646-S
Precision Balancing # 1987
June / October, 2008**

PRECISION BALANCING LLC

SAVE ENERGY • BE COMFORTABLE • GET BALANCED!

Cosmogenic Nuclide Laboratory
 Delehanty Hall
 University Of Vermont
 Burlington, Vermont
 NEAS # RC646-S
 Precision Balancing # 1987

October, 2008



N
 Not to Scale

Note: Pressure drop across Hepa diffuser # 9 is .34"

File Name: 1987S

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: DC & TC	
Project: 1987AHU4	Location: Burlington, Vermont	Date: 6-27-08	

Air Apparatus Test Report

System/Unit: AHU-4

UNIT DATA

Make	Clean PAK	Class/Discharge	/
Model No.	Size 22 Fanwall	Tag No.	AHU-1
Serial No.	A09 AH-01	Location	Rooftop

MOTOR DATA

Make	Toshiba (Two Motors)	Model / Part No.	B0154FLF2USH02	RPM	1775
Frame	254T	Volts / Phase /Hz	230-460, 3, 60	S.F.	1.15
H.P.	15	Full Load Amps	37 - 18.5	Flac	N/A
Measured Volts	66.5% (Freq)	Measured Amps	16.0 (Freq)	BHP	N/A

DRIVE DATA

Fan Data		Motor Data	
Sheave Size / Make	Direct Drive	Sheave Size / Make	Direct Drive
Bushing / Bore Size	Direct Drive	Bushing / Bore Size	Direct Drive
No. Belts / Make / Size	Direct Drive	Sheave C to C	Direct Drive
Fan Design RPM	2222 (74 Hz)	Fan Actual RPM	1752
		Motor Actual RPM	1752

AIR DATA

	Design	Actual		Design	Actual
Total CFM	7,500 Rated	7,053	Total S.P.	6.0"	N/A
O.A. CFM	6,850	7,053	Disch. S. P.	/	.80" Control
Ret. Air CFM	/	/	Suc. S. P.	/	N/A
Pre-Heat S.P. Drop	N/A	Cooling Coil S.P. Drop	N/A	Re-Heat S.P. Drop	N/A
Pre-Filter S.P. Drop	N/A	Hi Eff. Filter S.P. Drop	N/A		
Vortex Damp. Pos.	57.8 Hz	O.A. Damper Pos.	100% OP	Ret. Air Damp Pos.	/

NOTES

<p>1.) Unable to drill unit for pressure readings.</p> <p>2.) Control point readout equals .80".</p> <p>3.) System balance with 'B' fan running.</p>
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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: DC & PM	
Project: 1987ah4d	Location: Burlington, Vermont	Date: 6-27-08	

Diffuser, Register, & Grille Test Report

System/Unit:	AHU-4
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Area Served	Outlet Number	Type	Size	"K" Factor	Design		Pre CFM	Final		%Diff CFM	Refer to Note
					FPM	CFM		FPM	CFM		
	1	HEPA	12"	1	500	500		518	518	3.6%	
	2	HEPA	12"	1	500	500		510	510	2.0%	
	3	HEPA	12"	1	500	500		541	541	8.2%	
	4	HEPA	12"	1	500	500		508	508	1.6%	
	5	HEPA	12"	1	500	500		537	537	7.4%	
	6	HEPA	12"	1	500	500		528	528	5.6%	
	7	HEPA	12"	1	500	500		514	514	2.8%	
	8	HEPA	12"	1	500	500		474	474	-5.2%	
	9	HEPA	12"	1	500	500		532	532	6.4%	
	10	HEPA	12"	1	500	500		501	501	0.2%	
	11	CD	10"	1	300	300		275	275	-8.3%	
	12	CD	6"	1	50	50		51	51	2.0%	
	13	HEPA	12"	1	500	500		497	497	-0.6%	
	14	HEPA	12"	1	500	500		521	521	4.2%	
	15	HEPA	12"	1	500	500		546	546	9.2%	
Total from Previous Page(s)								Previous Total			
Total							6850	Total		7053	

NOTES

- 1.) Refer to drawing for diffuser location.
- 2.) Flowhood used 'K' factor equals (1) one.

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: DC & TC	
Project: 1987ef4	Location: Burlington, Vermont	Date: 6-13-08	

Air Apparatus Test Report

System/Unit: EF-4

UNIT DATA

Make	Hartzell Fan	Class/Discharge	/
Model No.	A41-9-222FA100FGFEN3	Tag No.	PO # RC622
Serial No.	Order # 0821763-01	Location	Rooftop

MOTOR DATA

Make	Westinghouse	Model / Part No.	S # GSP407607	RPM	1755
Frame	215T	Volts / Phase /Hz	230-460, 3, 60	S.F.	1.15
H.P.	10	Full Load Amps	23.2 - 11.6	Flac	25.7
Measured Volts	206.6, 207.3, 207.9	Measured Amps	18.0, 17.6, 18.0	BHP	7.70

DRIVE DATA

Fan Data		Motor Data			
Sheave Size / Make	5 3/8" OD	Sheave Size / Make	2BK57H / Power Drive		
Bushing / Bore Size	B 1 11/16	Bushing / Bore Size	H X 1 3/8"		
No. Belts / Make / Size	2 / Browning / BX66	Sheave C to C	26"		
Fan Design RPM	1808	Fan Actual RPM	1821	Motor Actual RPM	1767

AIR DATA

	Design	Actual		Design	Actual
Total CFM	5,665	5,947	Total S.P.	5.0"	N/A
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	N/A
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	4.65" Control
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

- 1.) Unable to drill coated exhaust duct for pressures.
- 2.) Control point readout equals 4.65".
- 3.) Fan is rated for 6,500 CFM at 5.0".

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-3	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM & TC	
Project: 1987ef5	Location: Burlington, Vermont	Date: 6-17-08	

Air Apparatus Test Report

System/Unit: EF-5

UNIT DATA

Make	Hartzell Fan	Class/Discharge	/
Model No.	A41-9-222FA100FGFEN3	Tag No.	PO # RC622
Serial No.	Order # 0821763-02	Location	Rooftop

MOTOR DATA

Make	Westinghouse	Model / Part No.	S # GSP407607	RPM	1755
Frame	215T	Volts / Phase /Hz	230-460, 3, 60	S.F.	1.15
H.P.	10	Full Load Amps	23.2 - 11.6	Flac	25.7
Measured Volts	206.5, 207.1, 208	Measured Amps	16.8, 16.9, 17.4	BHP	7.34

DRIVE DATA

Fan Data		Motor Data	
Sheave Size / Make	5 3/8" OD	Sheave Size / Make	2BK57H / Power Drive
Bushing / Bore Size	B 1 11/16	Bushing / Bore Size	H X 1 3/8"
No. Belts / Make / Size	2 / Browning / BX66	Sheave C to C	26"
Fan Design RPM	1808	Fan Actual RPM	1827
		Motor Actual RPM	1770

AIR DATA

	Design	Actual		Design	Actual
Total CFM	5,665	5,590	Total S.P.	5.0"	N/A
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	N/A
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	4.30" Control
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

- 1.) Unable to drill coated exhaust duct for pressures.
- 2.) Control point readout equals 4.30".
- 3.) Fan is rated for 6,500 CFM at 5.0".

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Precision Balancing No.	1987	Contractor No.	NEAS # RC646-S		
Contract No.	Job Name:	Delehanty Hall, UVM	Technician:	PM & TC	
Project:	1987ef45	Location:	Burlington, Vermont	Date:	8-29-08

Diffuser, Register, & Grille Test Report

System/Unit: E.F. 4 & 5

Area Served	Outlet Number	Type	Size	"K" Factor	Design		Pre CFM	Final		%Diff CFM	Refer to Note
					FPM	CFM		FPM	CFM		
	1	SS	4"	.087	575	50		574	50	0.0%	
	2	SS	14"	1.07	1005	1075		/	/	-100.0%	3, 4
	3	SS	14"	1.07	1005	1075		/	/	-100.0%	3, 4
	4	SS	4"	.087	575	50		572	50	0.0%	
	5	SS	14"	1.07	1005	1075		/	/	-100.0%	3, 4
	6	SS	3"	.049	612	30		593	29	-3.3%	
	7	SS	14"	1.07	1005	1075		/	/	-100.0%	3, 4
	8	SS	4"	.087	575	50		583	51	2.0%	
	9	SS	4"	.087	575	50		589	51	2.0%	
	10	SS	14"	1.07	1005	1075		/	/	-100.0%	3, 4
	11	SS	3"	.049	612	30		573	28	-6.7%	
	12	SS	3"	.049	612	30		568	28	-6.7%	

Total from Previous Page(s)

Previous Total

Total 5665

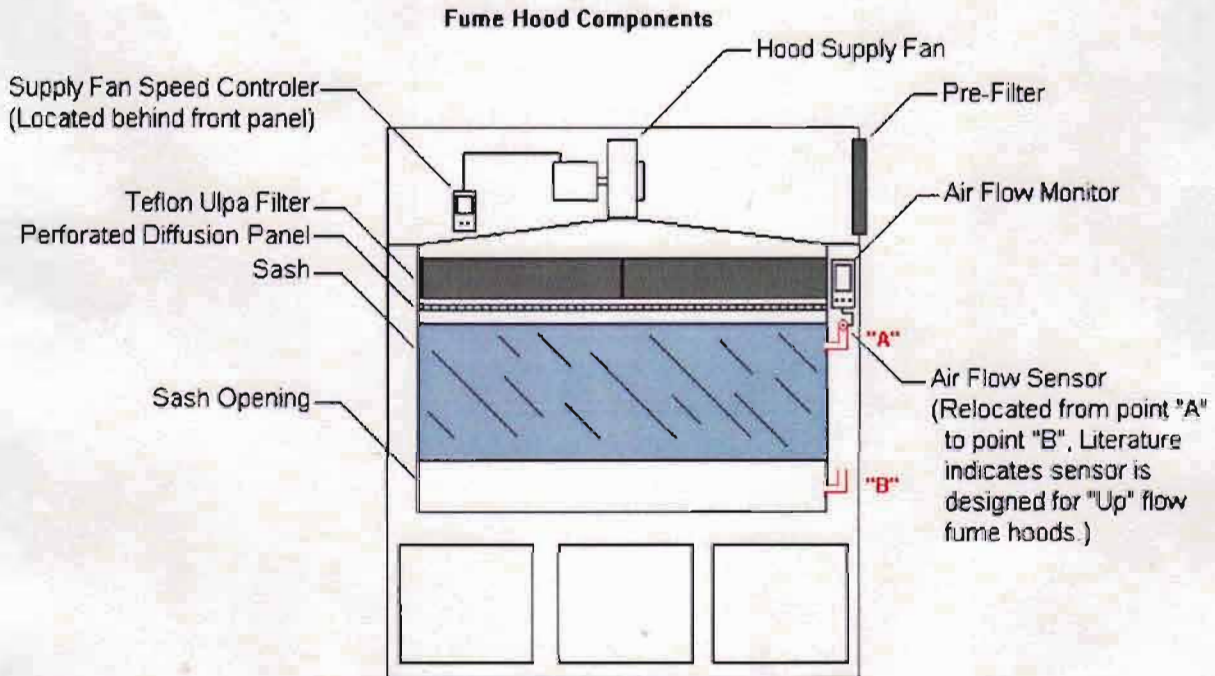
Total

NOTES

- 1.) Refer to drawing for exhaust location.
- 2.) Drops balanced with EF-5 running.
- 3.) 1,075 CFM listed in design column is minimum CFM required (per manufacturer).
- 4.) Hoods balanced with the sash 10" open, the supply fan set at 60 FPM, face velocity set and calibrated at 100 FPM. Velocity readings were taken at the locations shown on the "Face Velocity Profile" report. Velocities were taken with a Shortridge Velprobe. A laser line was used to ensure the velprobe position listed on the report.

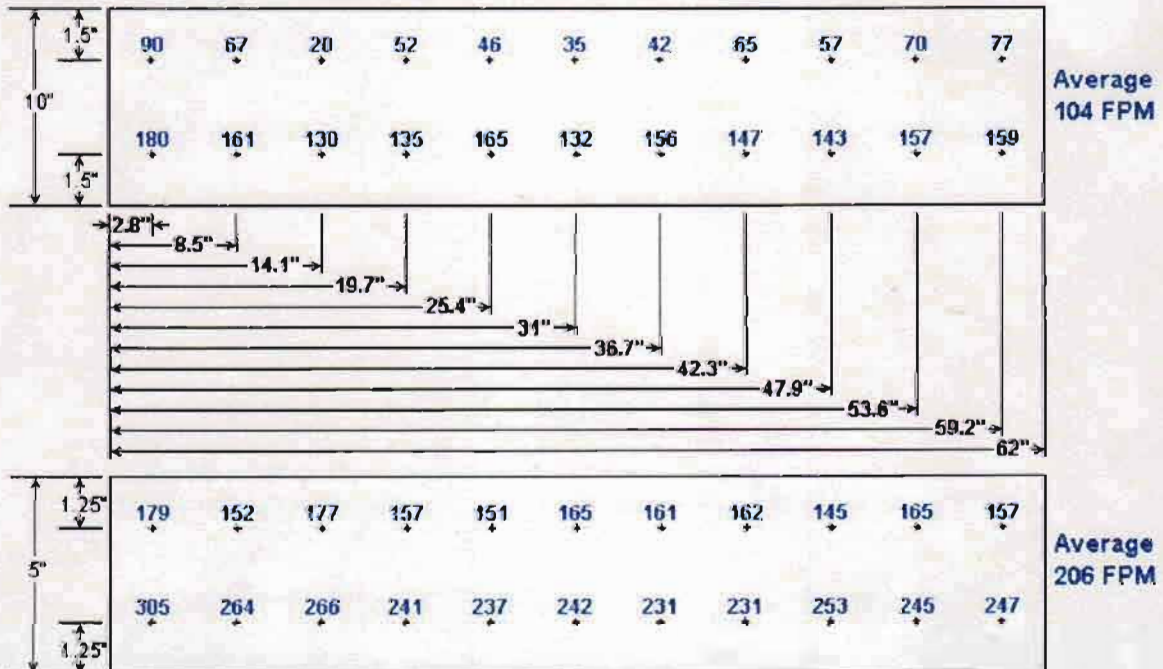
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Note: Supply fan set for 60 FPM "Downflow Velocity".
 Readings were taken and recorded 2" and 6" below the perforated diffusion panel, using a Shortridge meter with the "Velgrid" adapter.

Typical "Face Velocity Profile" (FPM) with Sash at 10" and 5" opening.



Hood Supply Fan Set Points

(Set Point Read-out is located on "Fan Speed Controller")

- Note:**
- 1) Hoods 1,2,3, and 5 came factory set at 58.0
 - 2) Hood 4 came factory set at 56.0
 - 3) Velocity readings taken with a Shortridge Velgrid Meter.
Readings taken 2" and 6" below the "Perforated Diffusion Panel"

Hood # 1

Fan Set Point: 53.5
Velocity at 2" 67 FPM
Velocity at 6" 63 FPM

Hood # 2

Fan Set Point: 54.5
Velocity at 2" 66 FPM
Velocity at 6" 62 FPM

Hood # 3

Fan Set Point: 54.0
Velocity at 2" 59 FPM
Velocity at 6" 62 FPM

Hood # 4

Fan Set Point: 54.0
Velocity at 2" 67 FPM
Velocity at 6" 61 FPM

Hood # 5

Fan Set Point: 54.0
Velocity at 2" 68 FPM
Velocity at 6" 62 FPM

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: TC & PM	
Project: 1987ef6	Location: Burlington, Vermont	Date: 10-17-08	

Air Apparatus Test Report

System/Unit: EF-6

UNIT DATA

Make	Greenheck	Class/Discharge	/
Model No.	8-BISW-41-X-10-1	Tag No.	EF
Serial No.	11221500 0802	Location	Rooftop

MOTOR DATA

Make	WEG	Model / Part No.	1UTOICGNXX1/204E	RPM	1750
Frame	B56	Volts / Phase /Hz	208-230-460, 3, 60	S.F.	1.25
H.P.	1/2	Full Load Amps	2.21 - 2.0 - 1.0	Flac	2.22
Measured Volts	207, 207.1, 207.3	Measured Amps	1.5, 1.53, 1.55	BHP	.35

DRIVE DATA

Fan Data			Motor Data		
Sheave Size / Make	AK34 x QT		Sheave Size / Make	AK44	
Bushing / Bore Size	QT x 1"		Bushing / Bore Size	5/8"	
No. Belts / Make / Size	1 / Carlisle / 4L300R		Sheave C to C	8 3/4"	
Fan Design RPM	1808	Fan Actual RPM	2219	Motor Actual RPM	1773

AIR DATA

	Design	Actual		Design	Actual
Total CFM	575	575	Total S.P.	1.5"	.59"
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	.01" pos
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	.58" neg
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

1.) Exhaust set to room pressure.

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM & TC	
Project: 1987ef6d	Location: Burlington, Vermont	Date: 10-17-08	

Diffuser, Register, & Grille Test Report

System/Unit: E.F. 6

Area Served	Outlet Number	Type	Size	"K" Factor	Design		Pre CFM	Final		%Diff	Refer to Note
					FPM	CFM		FPM	CFM		
	1	CE	12x12	1	200	200		210	210	5.0%	
	2	CE	12x12	1	375	375		365	365	-2.7%	2,3
Total from Previous Page(s)								Previous Total			
							Total		Total		575

NOTES

- 1.) Refer to drawing for exhaust location.
- 2.) Take-off damper is full open.
- 3.) Exhaust set to room pressure.

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: DC & TC	
Project: 1987ef7	Location: Burlington, Vermont	Date: 6-12-08	

Air Apparatus Test Report

System/Unit: EF-7

UNIT DATA

Make	M.K. Plastics	Class/Discharge	/
Model No.	CNW250	Tag No.	EF-6
Serial No.	/	Location	Rooftop

MOTOR DATA

Make	WEG	Model / Part No.	Part # HT003404P	RPM	1765
Frame	182T	Volts / Phase /Hz	208-230-460, 3, 60	S.F.	1.25
H.P.	3	Full Load Amps	7.8 - 3.9	Flac	7.83
Measured Volts	206.9, 207.1, 207.3	Measured Amps	4.6, 4.9, 4.8	BHP	1.88

DRIVE DATA

Fan Data			Motor Data		
Sheave Size / Make	2B40SH		Sheave Size / Make	2VP45 x 1 1/8	
Bushing / Bore Size	SH 15/16		Bushing / Bore Size	1 1/8"	
No. Belts / Make / Size	2 / Carlisle / BP30		Sheave C to C	10 1/2"	
Fan Design RPM	Not Given	Fan Actual RPM	1600	Motor Actual RPM	1777

AIR DATA

	Design	Actual		Design	Actual
Total CFM	1,105 (Rated)	Note 3	Total S.P.	5.5"	N/A
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	.01" pos
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	1.45" Control
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

- 1.) Adjustable sheave on motor set two turns from maximum.
- 2.) Control setpoint readout equals 1.45".
- 3.) Unable to drill fan for total airflow and pressure.
- 4.) Fan has an inlet bleed on the roof (set near full open).

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Precision Balancing No. 1987	Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM & TC
Project: 1987ef7d	Location: Burlington, Vermont	Date: 6-12-08

Diffuser, Register, & Grille Test Report

System/Unit: E.F. 7

Area Served	Outlet Number	Type	Size	"K" Factor	Design		Pre CFM	Final		%Diff CFM	Refer to Note
					FPM	CFM		FPM	CFM		
	1	SS	4"	.087	2299	200		2318	202	1.0%	
	2	SS	4"	.087	2299	200		2223	193	-3.5%	
Total from Previous Page(s)								Previous Total			
Total							400	Total		395	

NOTES

1.) Refer to drawing for exhaust location.

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Precision Balancing No. 1987	Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM & TC
Project: 1987Pump	Location: Burlington, Vermont	Date: 6-13-08

Pump Test Report

System/Unit: Pump-1 (AHU-4 Hot Water Coil)

PUMP DATA

Pump Number	Pump 1
Service / Location	H.W. Coil AHU-4 / Penthouse
Pump Manuf.	Bell & Gossett
Model Number	60
Impeller Size	1x5.25
RPM	Not Given
Design GPM	Not Given
Design Head (FT)	Not Given

MOTOR DATA

Motor Manuf.	Bell & Gossett
Motor Part# /Frm	48T175BP / 48Y
Horsepower	1/2
RPM	1725
Volts / Ph	208-230-460 / 3
F.L. Amps / S.F.	2.1-2.2-1.1 / 1.25
NEMA Eff. / P.F.	/

TEST DATA

Pump Off Pres.	N/A	
Valve Shut Diff	N/A	
Actual Impell. Dia	N/A	
Valve Open Diff.	35.6-33=2.6 psig (6.01 ft/hd)	
Valve Open GPM	47	
Final Suction Pr.	33.2 psig	
Final Disch. Pr.	36.4 psig	
Final Differential	3.2 psig (7.39 ft/hd)	
Final GPM	35	
Voltage	T1-T2	204
	T2-T3	206.5
	T3-T1	206.7
Amps	T1	2.0
	T2	1.9
	T3	1.8

NOTES

1.) Pump trips on overloads.

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM DC	
Project: 1987CS	Location: Burlington, Vermont	Date: 6-13-08	

Circuit Setter Flow Test Report

System/Unit: Chilled Water & Hot Water Coils

Area Served or Device #	Model	Size	C.S. Set Point	C.S. Pressure Drop (FT.)	Design GPM	Actual GPM	Notes
AHU-4							
C.W. Coil	T/A	3"	5.0	1.0	61	41	1
H.W. Coil	T/A	2 1/2"	4.0	1.75	34	35	
Re-Heats							
RH-26	T/A	1 1/4"	1.25	46.1	12.4	13.1	
RH-27	T/A	1"	.7	36	3.3	3.4	
RH-28	T/A	3/4"	.5	32.4	1.3	2.3	2
End of Line							
By-Pass	T/A	1/2"	.6	80	1.0	1.0	
Unit Heater							
U.H. By-Pass	T/A	3/4"	.5	63	3.0	3.2	3

NOTES

- 1.) Circuit setter on its highest graphable setting (1.0 ft).
- 2.) Circuit setter on its lowest graphable setting (0.5).
- 3.) Broken control valve.

AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

Customer ID: 011144 S/N: M951030
 Customer: PRECISION BALANCING LLC City: ESSEX JUNCTION State: VT
 As-Received Model #: ADM-870 Converted to Model #: _____ Order #: R072913
 PO #: _____ Customer Eqpt ID#: _____ Calibration Due Date: _____

This instrument has been calibrated using Calibration Standards which are traceable to NIST (National Institute of Standards and Technology). Quality Assurance Program and calibration procedures meet the requirements for ANSI/NCSL Z540-1-1994; MIL-STD 45662A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. All Uncertainties are expressed in expanded terms (twice the calculated uncertainty). This report shall not be reproduced, except in full, without the written approval of Shortridge Instruments, Inc. Results relate only to the item calibrated. For limitations on use, see Shortridge Instruments, Inc. Instruction Manual for the use of AirData Multimeters. Procedure used: Procedure for Differential Pressure, Absolute Pressure and Temperature Recalibration of AirData Multimeters SIP-CP02 Revision: 26 Dated: 03/31/06

Calibration Technician(s): A. Jauruff Y. Laubner Calibration Date: 09/19/2007
 Calibration Approved by: Jay Baseler Title: Cal Mgr Date: 09/20/2007

AS-Received By <u>aq</u>	Final Test By <u>ZL</u>	Test By _____
Date <u>09/19/07</u> Rh <u>54</u> %	Date <u>09/19/07</u> Rh <u>41</u> %	Date _____ Rh _____ %
Ambient Temperature <u>74</u> °F	Ambient Temperature <u>75</u> °F	Ambient Temperature <u>74</u> °F
Barometric Pressure <u>28.36</u> in Hg	Barometric Pressure <u>28.41</u> in Hg	Barometric Pressure _____ in Hg
Within spec <u>YES</u> NO NA	Within spec <u>YES</u> NO	Within spec <u>YES</u> NO

ABSOLUTE PRESSURE TEST (in Hg)

TEST METER TOLERANCE = ± 2.0 % ± .1 in Hg AS-RECEIVED TEST WITHIN SPEC YES NO N/A

Pressure Standard: Heise #02-R	S/N: 41741/42451	Calibration Date: 02/28/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #04-R	S/N: 41743/42453	Calibration Date: 10/25/06	Calibration Due Date: 11/2007	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #06-R	S/N: 41742/42452	Calibration Date: 02/08/07	Calibration Due Date: 02/2008	<u>As-Rcvd</u>	<u>Test 2</u>	Test 3
Pressure Standard: Heise #08-R	S/N: 42186/43328	Calibration Date: 11/15/06	Calibration Due Date: 11/2007	As-Rcvd	<u>Test 2</u>	Test 3
Pressure Standard: Heise #10-R	S/N: 42203/43352	Calibration Date: 01/15/07	Calibration Due Date: 01/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #12-R	S/N: 43166/44731	Calibration Date: 03/26/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #14-R	S/N: 43412/45043	Calibration Date: 06/08/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3

Heise Model PPM-2 Mfgd by Dresser Industries Rated Accuracy: 0.05% fs (0.0305 in Hg) Range: 0-61 in Hg Resolution: 0.01 Uncertainty: < 0.0358

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
14.0	14.35	14.3	-0.35	13.95	13.9	-0.36			
28.4	28.36	28.3	-0.21	28.41	28.2	-0.74			
40.0	40.38	40.2	-0.45	42.53	42.2	-0.78			

DIFFERENTIAL PRESSURE TEST (in wc)

TEST METER TOLERANCE = ± 2.0 % ± 0.001 in wc AS-RECEIVED TEST WITHIN SPEC YES NO N/A

Pressure Standard: Heise #01-L	S/N: 41739/42449	Calibration Date: 03/06/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #01-R	S/N: 41739/42446	Calibration Date: 03/06/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #02-L	S/N: 41741/42454	Calibration Date: 03/06/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #03-L	S/N: 41738/42448	Calibration Date: 11/03/06	Calibration Due Date: 11/2007	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #03-R	S/N: 41738/42445	Calibration Date: 11/02/06	Calibration Due Date: 11/2007	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #04-L	S/N: 41743/42456	Calibration Date: 11/02/06	Calibration Due Date: 11/2007	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #05-L	S/N: 41740/42450	Calibration Date: 02/15/07	Calibration Due Date: 02/2008	<u>As-Rcvd</u>	Test 2	Test 3
Pressure Standard: Heise #05-R	S/N: 41740/42447	Calibration Date: 02/15/07	Calibration Due Date: 02/2008	<u>As-Rcvd</u>	Test 2	Test 3
Pressure Standard: Heise #06-L	S/N: 41742/42455	Calibration Date: 02/13/07	Calibration Due Date: 02/2008	<u>As-Rcvd</u>	Test 2	Test 3
Pressure Standard: Heise #07-L	S/N: 42185/42186	Calibration Date: 11/29/06	Calibration Due Date: 11/2007	As-Rcvd	<u>Test 2</u>	Test 3
Pressure Standard: Heise #07-R	S/N: 42185/43326	Calibration Date: 11/29/06	Calibration Due Date: 11/2007	As-Rcvd	<u>Test 2</u>	Test 3
Pressure Standard: Heise #08-L	S/N: 42186/43329	Calibration Date: 11/22/06	Calibration Due Date: 11/2007	As-Rcvd	<u>Test 2</u>	Test 3
Pressure Standard: Heise #09-L	S/N: 42202/43351	Calibration Date: 01/13/07	Calibration Due Date: 01/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #09-R	S/N: 42202/43350	Calibration Date: 01/13/07	Calibration Due Date: 01/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #10-L	S/N: 42203/43353	Calibration Date: 01/23/07	Calibration Due Date: 01/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #11-L	S/N: 43165/44551	Calibration Date: 03/27/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #11-R	S/N: 43165/44730	Calibration Date: 03/27/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #12-L	S/N: 43166/44732	Calibration Date: 03/27/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #13-L	S/N: 43415/45041	Calibration Date: 06/12/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #13-R	S/N: 43415/45039	Calibration Date: 06/11/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #14-L	S/N: 43412/45045	Calibration Date: 06/12/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3

Differential Pressure Standards: Heise Model PPM1 Manufactured by Dresser Industries
 #01-L, 03-L, 05-L, 07-L, 09-L, 11-L, 13-L Rated Accuracy: > 0.07% fs (0.000175 in wc) Range: 0.0-0.25 in wc Res.: 0.00001 Uncertainty: < 0.00035
 #01-R, 03-R, 05-R, 07-R, 09-R, 11-R, 13-R Rated Accuracy: > 0.06% fs (0.003 in wc) Range: 0.0-5.0 in wc Res.: 0.0001 Uncertainty: < 0.00348
 #02-L, 04-L, 06-L, 08-L, 10-L, 12-L, 14-L Rated Accuracy: > 0.06% fs (0.03 in wc) Range: 0.0-50.0 in wc Res.: 0.001 Uncertainty: < 0.0346

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
0500	0505	0504	-0.20	0521	0520	-0.19			
1250	1264	1262	-0.16	1282	1284	0.16			
2250	2214	2211	-0.14	2239	2232	-0.31			
2700	2723	2734	0.40	2733	2739	0.22			
2.000	2.007	2.009	0.10	2.013	2.012	-0.05			
3.600	3.644	3.644	0	3.677	3.673	-0.11			
4.400	4.433	4.466	0.74	4.475	4.479	0.09			
27.00	27.06	27.20	0.52	27.10	27.11	0.04			
50.00	50.56	50.57	0.02	49.60	49.42	-0.36			
Overrange	NA	✓	NA	NA	✓	NA	NA	NA	NA

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AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

S/N: M931
Order #: R07291

LOW VELOCITY CONFIRMATION (FPM)
TEST METER TOLERANCE = $\pm 3.0\% \pm 7$ FPM AS-RECEIVED TEST WITHIN SPEC **(YES)** NO N/A

Vel Equiv Trans Std: AirData Multimeter	S/N: M96452	Calibration Date: 06/15/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M99420	Calibration Date: 06/15/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M02903	Calibration Date: 06/15/07	Calibration Due Date: 06/2008	(As-Rcvd)	Test 2	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M02009	Calibration Date: 12/05/06	Calibration Due Date: 12/2007	As-Rcvd	(Test 2)	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M96099	Calibration Date: 06/15/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3

Rated Accuracy: Velocity $\pm 1.5\% \pm 3.5$ fpm Manufactured by Shortridge Instruments, Inc. Range: 100-5000 fpm Resolution: 0.1
Uncertainty: <5.00 fpm at 100 fpm; <7.50 fpm at 500 fpm

Approx Set Point	Standard	Test Meter	Diff	Standard	Test Meter	Diff	Standard	Test Meter	Diff
100	140.6	142	1.4	101.9	102	.1	N/A		
500	514.5	514	-.5	517.0	516	-1.0			

ADM-880C, ADM-870/870C and ADM-860/860C AirData Multimeters are read in AirFoil Mode. ADM-850 Multimeters are read in Pitot Tube Mode.

TEMPERATURE TEST - AIRDATA MULTIMETER (° F)
TEST METER TOLERANCE = ± 0.2 ° F AS-RECEIVED TEST WITHIN SPEC **(YES)** NO N/A

RTD Simulator: S/N 249	Calibration Date: 03/10/06	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 250	Calibration Date: 03/10/06	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 253	Calibration Date: 03/10/06	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 254	Calibration Date: 06/06/06	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 256	Calibration Date: 06/06/06	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 257	Calibration Date: 06/06/06	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 292	Calibration Date: 12/20/05	Calibration Due Date: 12/2007	(As-Rcvd)	(Test 2)	Test 3	Set Point: (35.6° F)	95° F	154.4° F
RTD Simulator: S/N 293	Calibration Date: 12/20/05	Calibration Due Date: 12/2007	(As-Rcvd)	(Test 2)	Test 3	Set Point: 35.6° F	(95° F)	154.4° F
RTD Simulator: S/N 294	Calibration Date: 12/20/05	Calibration Due Date: 12/2007	(As-Rcvd)	(Test 2)	Test 3	Set Point: 35.6° F	95° F	(154.4° F)

RTD Simulators Model RTD-1000/500 Manufactured by General Resistance Rated Accuracy: 0.025% of setting Range: 100 Ω to 11111.10 Ω
Resolution: 0.01 Ω Uncertainty: < 32 ppm

RTD Simulator Temperature Equivalent Set Point	Test Meter	Difference	Test Meter	Difference	Test Meter	Difference
35.60	35.6	0	35.7	.1	N/A	
95.00	95.0	0	95.0	0		
154.40	154.5	.1	154.5	.1		

TEMPERATURE TEST OF CUSTOMER'S TEMPROBE (° F)
TEMProbe TOLERANCE FOR ADT442, ADT443, ADT444, ADT445, ADT446 = ± 0.3 ° F TEMProbe TOLERANCE FOR ADT447 = ± 0.8 ° F
AS-RECEIVED TEST WITHIN SPEC **(YES)** NO N/A (TemProbes are ADT442 unless otherwise stated)

Thermometer #1 S/N 8A089/Thermistor	S/N A410660	Calibration Date: 03/30/06	Cal Due Date: 03/2008	Set Point: 35° F	(95° F)	(155° F)
Thermometer #2 S/N 8B104/Thermistor	S/N 871507	Calibration Date: 10/19/06	Cal Due Date: 10/2008	Set Point: 35° F	95° F	(155° F)
Thermometer #3 S/N 92142/Thermistor	S/N A560303	Calibration Date: 05/11/07	Cal Due Date: 05/2009	Set Point: 35° F	95° F	155° F
Thermometer #4 S/N 92143/Thermistor	S/N A310867	Calibration Date: 08/29/06	Cal Due Date: 08/2008	Set Point: (35° F)	95° F	155° F

Rated Accuracy(Combined): 0.023° F/0.018° F Mfgd by Hart Scientific Range: 32° F-176° F Resolution: 0.001° F Combined Uncertainty: < 0.025° F

Temperature Standard AirData Multimeter S/N M00136 Calibration Date: 02/27/07 Cal Due Date: 02/2008 Set Point: **(35° F)** **(95° F)** **(155° F)**
Temperature Standard AirData Multimeter S/N M96100 Calibration Date: 03/06/07 Cal Due Date: 03/2008 Set Point: 35° F 95° F 155° F
Rated Accuracy: 0.03° F Manufactured by Shortridge Instruments, Inc. Range: 33° F-158° F Resolution: 0.01° F Uncertainty: < 0.023° F
Total combined Uncertainty for TemProbe testing : < 0.039° F

Approx Set Point	Standard	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff
35.0	35.0	34.9	-.1	N/A									
95.0	95.0	94.9	-.1										
155.0	155.0	154.9	-.1										

NOTES: _____

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AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

Customer ID: 011144 S/N: m96891
 Customer: PRECISION BALANCING LLC City: ESSEX JUNCTION State: VT
 As-Received Model #: ADM-870 Converted to Model #: _____ Order #: R081389
 PO #: _____ Customer Eqpt ID#: _____ Calibration Due Date: _____

This instrument has been calibrated using Calibration Standards which are traceable to NIST (National Institute of Standards and Technology). Quality Assurance Program and calibration procedures meet the requirements for ANSI/NCSL Z540-1-1994, MIL-STD 45662A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. All Uncertainties are expressed in expanded terms (twice the calculated uncertainty). This report shall not be reproduced, except in full, without the written approval of Shortridge Instruments, Inc. Results relate only to the item calibrated. For limitations on use, see Shortridge Instruments, Inc. Instruction Manual for the use of AirData Multimeters. Procedure used: Procedure for Differential Pressure, Absolute Pressure and Temperature Recalibration of AirData Multimeters SIP-CP02 Revision: 26 Dated: 03/31/06

Calibration Technician(s): A. Normand Calibration Date: 05-05-2008
 Calibration Approved by: A. Normand Title: QA Mgr Date: 05-07-2008

AS-Received By <u>ag</u>	Final Test By <u>JW</u>	Test By <u>VIA</u>
Date <u>04/25/08</u> Rh <u>28%</u>	Date <u>05/05/08</u> Rh <u>43%</u>	Date _____ Rh _____ %
Ambient Temperature <u>75</u> °F	Ambient Temperature <u>76</u> °F	Ambient Temperature _____ °F
Barometric Pressure <u>28.54</u> in Hg	Barometric Pressure <u>28.22</u> in Hg	Barometric Pressure _____ in Hg
Within spec (YES) NO NA	Within spec (YES) NO	Within spec YES NO

ABSOLUTE PRESSURE TEST (in Hg)

TEST METER TOLERANCE = ± 2.0 % ± 1 in Hg AS-RECEIVED TEST WITHIN SPEC (YES) NO N/A

Pressure Standard: Heise #02-R	S/N: 41741/42451	Calibration Date: 03/11/08	Calibration Due Date: 03/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #04-R	S/N: 41743/42453	Calibration Date: 10/07/07	Calibration Due Date: 10/2008	(As-Rcvd)	(Test 2)	Test 3
Pressure Standard: Heise #06-R	S/N: 41742/42452	Calibration Date: 02/19/08	Calibration Due Date: 02/2009	As-Rcvd	(Test 2)	Test 3
Pressure Standard: Heise #08-R	S/N: 42186/43328	Calibration Date: 03/05/08	Calibration Due Date: 03/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #10-R	S/N: 42203/43352	Calibration Date: 01/14/08	Calibration Due Date: 01/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #12-R	S/N: 43166/44731	Calibration Date: 03/26/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #14-R	S/N: 43412/45043	Calibration Date: 06/08/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3

Heise Model PPM-2 Mfgd by Dresser Industries Rated Accuracy: 0.05% fs (0.0305 in Hg) Range: 0-61 in Hg Resolution: 0.01 Uncertainty: < 0.0358

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
14.0	14.18	14.2	.14	13.51	13.5	-.07	VIA		
28.4	28.54	28.6	.21	28.22	28.2	-.07			
40.0	40.60	40.6	0	40.48	40.4	-.20			

DIFFERENTIAL PRESSURE TEST (in wc)

TEST METER TOLERANCE = ± 2.0 % ± 0.001 in wc AS-RECEIVED TEST WITHIN SPEC (YES) NO N/A

Pressure Standard: Heise #01-L	S/N: 41739/42449	Calibration Date: 03/15/08	Calibration Due Date: 03/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #01-R	S/N: 41739/42446	Calibration Date: 03/15/08	Calibration Due Date: 03/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #02-L	S/N: 41741/42454	Calibration Date: 03/15/08	Calibration Due Date: 03/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #03-L	S/N: 41738/42448	Calibration Date: 10/10/07	Calibration Due Date: 10/2008	(As-Rcvd)	Test 2	Test 3
Pressure Standard: Heise #03-R	S/N: 41738/42445	Calibration Date: 10/10/07	Calibration Due Date: 10/2008	(As-Rcvd)	Test 2	Test 3
Pressure Standard: Heise #04-L	S/N: 41743/42456	Calibration Date: 10/09/07	Calibration Due Date: 10/2008	(As-Rcvd)	Test 2	Test 3
Pressure Standard: Heise #05-L	S/N: 41740/42450	Calibration Date: 02/22/08	Calibration Due Date: 02/2009	As-Rcvd	(Test 2)	Test 3
Pressure Standard: Heise #05-R	S/N: 41740/42447	Calibration Date: 02/22/08	Calibration Due Date: 02/2009	As-Rcvd	(Test 2)	Test 3
Pressure Standard: Heise #06-L	S/N: 41742/42455	Calibration Date: 02/22/08	Calibration Due Date: 02/2009	As-Rcvd	(Test 2)	Test 3
Pressure Standard: Heise #07-L	S/N: 42185/42186	Calibration Date: 11/26/07	Calibration Due Date: 11/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #07-R	S/N: 42185/43326	Calibration Date: 11/21/07	Calibration Due Date: 11/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #08-L	S/N: 42186/43329	Calibration Date: 03/10/08	Calibration Due Date: 03/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #09-L	S/N: 42202/43351	Calibration Date: 01/29/08	Calibration Due Date: 01/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #09-R	S/N: 42202/43350	Calibration Date: 01/29/08	Calibration Due Date: 01/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #10-L	S/N: 42203/43353	Calibration Date: 01/30/08	Calibration Due Date: 01/2009	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #11-L	S/N: 43165/44551	Calibration Date: 03/27/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #11-R	S/N: 43165/44730	Calibration Date: 03/27/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #12-L	S/N: 43166/44732	Calibration Date: 03/27/07	Calibration Due Date: 03/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #13-L	S/N: 43415/45041	Calibration Date: 06/12/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #13-R	S/N: 43415/45039	Calibration Date: 06/11/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Pressure Standard: Heise #14-L	S/N: 43412/45045	Calibration Date: 06/12/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3

Differential Pressure Standards: Heise Model PPM1 Manufactured by Dresser Industries

#01-L, 03-L, 05-L, 07-L, 09-L, 11-L, 13-L	Rated Accuracy: > 0.07% fs (0.000175 in wc)	Range: 0.0-0.25 in wc	Res.: 0.00001	Uncertainty: < 0.00035
#01-R, 03-R, 05-R, 07-R, 09-R, 11-R, 13-R	Rated Accuracy: > 0.06% fs (0.003 in wc)	Range: 0.0-5.0 in wc	Res.: 0.0001	Uncertainty: < 0.00348
#02-L, 04-L, 06-L, 08-L, 10-L, 12-L, 14-L	Rated Accuracy: > 0.06% fs (0.03 in wc)	Range: 0.0-50.0 in wc	Res.: 0.001	Uncertainty: < 0.0346

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
0500	.0510	.0511	.20	.0512	.0512	0	VIA		
1250	.1279	.1281	.16	.1257	.1255	-.16			
2250	.2253	.2257	.18	.2250	.2245	-.22			
2700	.2735	.2748	.48	.2724	.2735	.40			
2.000	2.009	2.019	.50	2.049	2.055	.29			
3.600	3.626	3.642	.44	3.610	3.613	.08			
4.400	4.403	4.433	.68	4.438	4.445	.16			
27.00	27.04	27.07	.11	27.41	27.50	.33			
50.00	50.18	50.22	.08	50.42	50.51	.18			
Overrange	NA	✓	NA	NA	✓	NA		NA	NA

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AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

S/N: m96991
Order #: RO81389

LOW VELOCITY CONFIRMATION (FPM)
TEST METER TOLERANCE = $\pm 3.0\% \pm 7$ FPM AS-RECEIVED TEST WITHIN SPEC **(YES)** NO N/A

Vel Equiv Trans Std: AirData Multimeter	S/N: M96452	Calibration Date: 06/15/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M99420	Calibration Date: 06/15/07	Calibration Due Date: 06/2008	As-Rcvd	(Test 2)	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M02903	Calibration Date: 06/15/07	Calibration Due Date: 06/2008	As-Rcvd	Test 2	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M02009	Calibration Date: 12/04/07	Calibration Due Date: 12/2008	(As-Rcvd)	Test 2	Test 3
Vel Equiv Trans Std: AirData Multimeter	S/N: M96099	Calibration Date: 03/27/08	Calibration Due Date: 03/2009	As-Rcvd	Test 2	Test 3

Rated Accuracy: Velocity $\pm 1.5\% \pm 3.5$ fpm Manufactured by Shortridge Instruments, Inc. Range: 100-5000 fpm Resolution: 0.1
Uncertainty: <5.00 fpm at 100 fpm; <7.50 fpm at 500 fpm

Approx Set Point	Standard	Test Meter	Diff	Standard	Test Meter	Diff	Standard	Test Meter	Diff
100	105.9	107	1.1	128.8	129	.2	N/A		
500	520.8	522	1.2	517.5	517	-.5			

ADM-880C, ADM-870/870C and ADM-860/860C AirData Multimeters are read in AirFoil Mode. ADM-850 Multimeters are read in Pitot Tube Mode.

TEMPERATURE TEST - AIRDATA MULTIMETER (° F)
TEST METER TOLERANCE = $\pm 0.2^\circ$ F AS-RECEIVED TEST WITHIN SPEC **(YES)** NO N/A

RTD Simulator: S/N 249	Calibration Date: 01/24/08	Calibration Due Date: 01/2012	As-Rcvd (Test 2)	Test 3	Set Point: (35.6°) F	95° F	154.4° F
RTD Simulator: S/N 250	Calibration Date: 01/24/08	Calibration Due Date: 01/2012	As-Rcvd (Test 2)	Test 3	Set Point: 35.6° F	(95°) F	154.4° F
RTD Simulator: S/N 253	Calibration Date: 01/24/08	Calibration Due Date: 01/2012	As-Rcvd (Test 2)	Test 3	Set Point: 35.6° F	95° F	(154.4°) F
RTD Simulator: S/N 254	Calibration Date: 03/07/08	Calibration Due Date: 03/2012	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 256	Calibration Date: 03/07/08	Calibration Due Date: 03/2012	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 257	Calibration Date: 03/07/08	Calibration Due Date: 03/2012	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 292	Calibration Date: 12/03/07	Calibration Due Date: 12/2011	(As-Rcvd)	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 293	Calibration Date: 12/03/07	Calibration Due Date: 12/2011	(As-Rcvd)	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 294	Calibration Date: 12/03/07	Calibration Due Date: 12/2011	(As-Rcvd)	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F

RTD Simulators Model RTD-1000/500 Manufactured by General Resistance Rated Accuracy: 0.025% of setting Range: 100 Ω to 11111.10 Ω
Resolution: 0.01 Ω Uncertainty: < 32 ppm

RTD Simulator Temperature Equivalent Set Point	Test Meter	Difference	Test Meter	Difference	Test Meter	Difference
35.60	35.6	0	35.7	.1	N/A	
95.00	95.1	.1	95.0	0		
154.40	154.4	0	154.4	0		

TEMPERATURE TEST OF CUSTOMER'S TEMPROBE (° F)
TEMPROBE TOLERANCE FOR ADT442, ADT443, ADT444, ADT445, ADT446 = $\pm 0.3^\circ$ F
AS-RECEIVED TEST WITHIN SPEC **(YES)** NO N/A (TempProbes are ADT442 unless otherwise stated)

Thermometer #1 S/N 8A089/Thermistor	S/N A410660	Calibration Date: 02/21/08	Cal Due Date: 02/2010	Set Point: 35° F	95° F	155° F
Thermometer #2 S/N 8B104/Thermistor	S/N 871507	Calibration Date: 10/19/06	Cal Due Date: 10/2008	Set Point: 35° F	95° F	(155°) F
Thermometer #3 S/N 92142/Thermistor	S/N A560303	Calibration Date: 05/11/07	Cal Due Date: 05/2009	Set Point: 35° F	(95°) F	155° F
Thermometer #4 S/N 92143/Thermistor	S/N A310867	Calibration Date: 08/29/06	Cal Due Date: 08/2008	Set Point: (35°) F	95° F	155° F

Rated Accuracy(combined): 0.023° F/0.018° F Mfgd by Hart Scientific Range: 32° F-176° F Resolution: 0.001° F Combined Uncertainty: < 0.025° F

Temperature Standard AirData Multimeter S/N M00136	Calibration Date: 02/07/08	Cal Due Date: 02/2009	Set Point: (35°) F	95° F	155° F
Temperature Standard AirData Multimeter S/N M96100	Calibration Date: 03/07/08	Cal Due Date: 03/2009	Set Point: 35° F	95° F	155° F

Rated Accuracy: 0.03° F Manufactured by Shortridge Instruments, Inc. Range: 33° F-158° F Resolution: 0.01° F Uncertainty: < 0.023° F
Total combined Uncertainty for TempProbe testing: < 0.039° F

Approx Set Point	Standard	TempProbe	Diff	TempProbe	Diff	TempProbe	Diff	TempProbe	Diff	TempProbe	Diff	TempProbe	Diff
35.0	35.0	35.0	0										
95.0	95.0	95.0	0										
155.0	155.0	154.9	-.1										

NOTES:

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HDM-250 HYDRODATA MULTIMETER CERTIFICATE OF RECALIBRATION

CO ID: 011144 S/N: W07120
 Customer: PRECISION BALANCING LLC City: ESSEX JUNCTION State: VT
 PO #: _____ Customer Eqpt ID#: _____ Calibration Due Date: _____ Order #: R082563

AS-Received By <u>TW</u> Date <u>08-07-08</u> Rh <u>53</u> % Ambient Temperature <u>75</u> °F Barometric Pressure <u>28.35</u> in Hg Within spec <u>YES</u> NO NA	Final Test By <u>TW</u> Date <u>08-14-08</u> Rh <u>53</u> % Ambient Temperature <u>76</u> °F Barometric Pressure <u>28.31</u> in Hg Within spec <u>YES</u> NO	Test By <u>PA</u> Date _____ Rh _____ % Ambient Temperature _____ °F Barometric Pressure _____ in Hg Within spec YES NO
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HDM Pressure Standard Heise #1-L: S/N: 41744/42459 Calibration Date: 08/14/07 Calibration Due Date: 08/2008 As-Rcvd Test 2 Test 3
 HDM Pressure Standard Heise #3-L: S/N: 41745/42460 Calibration Date: 02/22/08 Calibration Due Date: 02/2009 As-Rcvd Test 2 Test 3
 Model PPM-1 Manufactured by Dresser Industries Rated Accuracy: 0.06% fs Range: 0.0 to 15.0 in wc Res: 0.001 in wc Uncertainty: < 0.00651 in wc
 Used at Set Points: 3.0; 14.0

HDM Pressure Standard Heise #1-R: S/N: 41744/42457 Calibration Date: 08/14/07 Calibration Due Date: 08/2008 As-Rcvd Test 2 Test 3
 HDM Pressure Standard Heise #3-R: S/N: 41745/42458 Calibration Date: 02/22/08 Calibration Due Date: 02/2009 As-Rcvd Test 2 Test 3
 Model PPM-1 Manufactured by Dresser Industries Rated Accuracy: 0.06% fs Range: 0.0 to 150.0 in wc Res: 0.01 in wc Uncertainty: < 0.07540 in wc
 Used at Set Points: 25.0; 31.0; 140.0

HDM Pressure Standard Heise #2-L: S/N: 41747/42464 Calibration Date: 08/10/07 Calibration Due Date: 08/2008 As-Rcvd Test 2 Test 3
 HDM Pressure Standard Heise #4-L: S/N: 41746/42463 Calibration Date: 02/14/08 Calibration Due Date: 02/2009 As-Rcvd Test 2 Test 3
 Model PPM-1 Manufactured by Dresser Industries Rated Accuracy: 0.05% fs Range: 0.0 to 50.0 psi Res: 0.1 in wc Uncertainty: < 0.479 in wc
 Used at Set Points: 225.0; 275.0; 1025

HDM Pressure Standard Heise #2-R: S/N: 41747/42462 Calibration Date: 08/10/07 Calibration Due Date: 08/2008 As-Rcvd Test 2 Test 3
 HDM Pressure Standard Heise #4-R: S/N: 41746/42461 Calibration Date: 02/14/08 Calibration Due Date: 02/2009 As-Rcvd Test 2 Test 3
 Model PPM-2 Manufactured by Dresser Industries Rated Accuracy: 0.05% fs Range: 0.0 to 300 psi Res: 1 in wc Uncertainty: < 2.77 in wc
 Used at Set Points: 1620; 2000; 4500; 6930

DIFFERENTIAL PRESSURE TEST (in wc)

TEST METER TOLERANCE = ± 2.0 % ± .28 in wc AS-RCVD TEST WITHIN SPEC YES NO N/A

Approx Set Pt	Standard			Test Meter			Standard	Test Meter	% Diff
	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff			
3.0	3.16	3.1	-1.90	3.16	3.1	-1.90	N/A		
14.0	14.75	14.8	.34	14.72	14.8	.54			
25.0	25.55	25.5	-.20	25.53	25.7	.67			
31.0	31.64	31.6	-.13	31.60	31.6	0			
140.0	140.27	140.2	-.05	140.34	140.5	.11			
225.0	225.6	225.2	-.18	226.5	226.5	0			
275.0	275.8	275.6	-.07	279.4	280.2	.29			
1025	1027.3	1028	.07	1025.9	1026	.01			
1620	1653	1649	-.24	1655	1651	-.24			
2000	2023	2021	-.10	2025	2025	0			
4500	4519	4521	.04	4531	4536	-.11			
6930	6957	6950	-.10	6936	6927	-.13			

GAGE PRESSURE (P₂) TEST (in wc)

TEST METER TOLERANCE = ± 2.0 % ± .28 in wc AS-RCVD TEST WITHIN SPEC YES NO N/A

Approx Set Pt	Standard			Test Meter			Standard	Test Meter	% Diff
	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff			
3.0	3.15	3.2	1.59	3.14	3.1	-1.27	N/A		
14.0	14.75	14.9	1.02	14.72	14.8	.54			
25.0	25.56	25.8	.94	25.53	25.7	.67			
31.0	31.64	31.7	.19	31.62	31.5	-.38			
140.0	140.36	140.5	.10	140.35	140.4	.04			
225.0	225.5	226.4	.40	231.9	231.9	0			
275.0	274.8	274.5	-.11	280.1	280.3	.07			
1025	1023.6	1023	-.06	1021.4	1022	.06			
1620	1658	1651	-.42	1654	1649	-.30			
2000	2081	2080	-.05	2051	2051	0			
4500	4517	4515	-.04	4510	4513	.07			
6930	6966	6943	-.33	6934	6921	-.19			

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HDM-250 HYDRODATA MULTIMETER CERTIFICATE OF RECALIBRATION

S/N: W07120
Order #: R082563

TEMPERATURE TEST - HYDRODATA MULTIMETER (° F)

TEST METER TOLERANCE = ± 0.2° F AS-RCVD TEST WITHIN SPEC **YES** NO N/A

RTD Simulator: S/N 249	Calibration Date: 01/24/08	Calibration Due Date: 01/2012	As-Rcvd Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 250	Calibration Date: 01/24/08	Calibration Due Date: 01/2012	As-Rcvd Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 253	Calibration Date: 01/24/08	Calibration Due Date: 01/2012	As-Rcvd Test 2	Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 254	Calibration Date: 03/07/08	Calibration Due Date: 03/2012	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 256	Calibration Date: 03/07/08	Calibration Due Date: 03/2012	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 257	Calibration Date: 03/07/08	Calibration Due Date: 03/2012	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 292	Calibration Date: 12/03/07	Calibration Due Date: 12/2011	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 293	Calibration Date: 12/03/07	Calibration Due Date: 12/2011	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulator: S/N 294	Calibration Date: 12/03/07	Calibration Due Date: 12/2011	As-Rcvd	Test 2 Test 3	Set Point: 35.6° F	95° F	154.4° F
RTD Simulators Model RTD-1000/500 Manufactured by General Resistance Rated Accuracy: 0.025% of setting					Range: 100 Ω to 11111.10 Ω		
Resolution: 0.01 Ω		Uncertainty: < 32 ppm					

RTD Simulator Temperature

Equivalent Set Point	Test Meter	Diff	Test Meter	Diff	Test Meter	Diff
35.60	35.7	-1	35.7	-1	N/A	
95.00	95.1	-1	95.1	-1	N/A	
154.40	154.4	0	154.4	0	N/A	

TEMPERATURE TEST OF CUSTOMER'S TEMPROBE (° F)

TEMPROBE TOLERANCE FOR ADT442, ADT443, ADT444, ADT445, ADT446 = ± 0.3° F
AS-RECEIVED TEST WITHIN SPEC YES NO **N/A** (TemProbes are ADT442 unless otherwise stated)

Thermometer #1 S/N 8A089/Thermistor S/N A410660	Calibration Date: 02/21/08	Cal Due Date: 02/2010	Set Point: 35° F	95° F	155° F
Thermometer #2 S/N 8B104/Thermistor S/N 871507	Calibration Date: 10/19/06	Cal Due Date: 10/2008	Set Point: 35° F	95° F	155° F
Thermometer #3 S/N 92142/Thermistor S/N A560303	Calibration Date: 05/11/07	Cal Due Date: 05/2009	Set Point: 35° F	95° F	155° F
Thermometer #4 S/N 92143/Thermistor S/N A310867	Calibration Date: 08/29/06	Cal Due Date: 08/2008	Set Point: 35° F	95° F	155° F
Rated Accuracy(combined): 0.023° F/0.018° F Mfgd by Hart Scientific Range: 32° F-176° F Resolution: 0.001° F Combined Uncertainty: < 0.025° F					
Temperature Standard AirData Multimeter S/N M00136	Calibration Date: 02/07/08	Cal Due Date: 02/2009	Set Point: 35° F	95° F	155° F
Temperature Standard AirData Multimeter S/N M96100	Calibration Date: 03/07/08	Cal Due Date: 03/2009	Set Point: 35° F	95° F	155° F
Rated Accuracy: 0.03° F Manufactured by Shortridge Instruments, Inc. Range: 33° F-158° F Resolution: 0.01° F Uncertainty: < 0.023° F					
Total combined Uncertainty for TemProbe testing: < 0.039° F					

Approx Set Point	Standard	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff	TemProbe	Diff
35.0													
95.0													
155.0													

All meters are set to zero prior to taking pressure readings.

NOTES:

Procedure used: Procedure for Differential Pressure, Gage Pressure, and Temperature Recalibration of HydroData Multimeters SIP-CP11 Revision: 03
Dated: 03/31/06

This instrument has been calibrated using Calibration Standards which are traceable to NIST (National Institute of Standards and Technology). Quality Assurance Program and calibration procedures meet the requirements for ANSI/NCSS Z540-1-1994; MIL-STD 45662A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. Uncertainties are expressed in expanded terms (twice the calculated uncertainty). This report shall not be reproduced, except in full, without the written approval of Shortridge Instruments, Inc. Results relate only to the item calibrated.

Limitations on use: See Shortridge Instruments, Inc. Instruction Manual for the use of HydroData Multimeters

Calibration Technician(s): J. P. Normand Calibration Date: 08-14-2008

Calibration Approved by: J. P. Normand Title: QA Mgr Date: 08-15-2008

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FLUKE® Everett Service Center

1420 75th St. SW
Everett, Washington 98203
USA



Calibration Certificate

NQA ISO 9000: 2000 Certified

Description:	MULTIMETER	Certificate Number:	885905-66480245:1199875789
Manufacturer:	FLUKE	Date of Calibration:	09 January 2008
Model:	21 II	Date of Certificate:	09 January 2008
Serial Number:	66480245	Date Due:	09 January 2009
Customer Name:	PRECISION BALANCING LLC	Procedure Name:	FLUKE 21-2: (1 YEAR) CAL VER/ALT 5520A
City, State:	ESSEX JUNCTION, VT	Procedure Revision:	1.0
Customer Item ID:	66480245	Temperature:	23.00 °Celsius
PO Number:	MITCHELL CCS	Relative Humidity:	40 %
RMA Number:	3872716	Data Type:	FOUND-LEFT
		Test Result:	PASS

In the attached measurement results, deviation may be expressed with units, *Measured Value (MV) - Nominal Value (NV)* or as a proportion of the nominal value $((MV-NV)/NV)$, expressed without units with a scalar multiplier such as % (0.01), or as a ratio of the units (mW/W, mA/A, mV/V, etc.) Descriptions such as mW/W, mV/V, and others, where used to annotate results or measurement uncertainties, are the preferred replacements for what was historically labeled as "ppm" or parts-per-million and describe the results in that column, unless otherwise noted by units symbols.

- The Data type that could be found in this certificate must be interpreted as:
- As Found - Calibration data collected before the unit is adjusted and/or repaired.
 - As Left - Calibration data collected after the unit is adjusted and/or repaired.
 - As Found/ As Left - Calibration data collected without any adjustment and/or repair performed.

Unless otherwise stated the TUR (Test Uncertainty Ratio) of this calibration is 4:1 or greater.

This Calibration conforms to ANSI/NCSL Z540.1-1994(R2002)

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications. Measured values greater than the Manufacturer's specification are indicated by "I".

This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. The user is obliged to have the object recalibrated at appropriate intervals. Calibration certificates without signature are not valid.

Comments:

Long Le
Metrology Technician

David Deaver
Technical Manager

Calibration Results

Function/Range	Nominal Value	Measured Value	TUR	Manufacturer's Specifications	
				Lower Limit	Upper Limit
10.00 MOhm	10.000	10.02		9.79	10.21
DIODE TEST					
BEEPER AUDIBLE		PASS			
BEEPER OFF		PASS			
DC VOLTAGE TEST					
320mV Range					
300.0 mV	300.00	299.9		298.7	301.3
DC VOLTAGE TEST					
3.2V Range					
2.700 V	2.7000	2.700		2.688	2.712
32V Range					
27.00 V	27.000	27.00		26.88	27.12
320V Range					
270.0 V	270.00	270.0		268.8	271.2
1000V Range					
1000 V	1000.0	1000		995	1005
AC VOLTAGE TEST					
3.2V Range					
2.700 V @ 100 Hz	2.7000	2.704		2.644	2.756
2.700 V @ 500 Hz	2.7000	2.693		2.644	2.756
750V Range					
750 V @ 100 Hz	750.0	751		733	767
750 V @ 1000 Hz	750.0	755		733	767
DC mA TEST					
32mA Range					
27.00 mA	27.000	26.89		26.57	27.43
320mA Range					
200.0 mA	200.00	199.8		196.8	203.2
DC AMPS TEST					
10A Range					
2.00 A	2.000	1.98		1.95	2.05

End of Report

— N I S T —

Calibration Certificate

Certificate No: S22082	Date Calibrated: 06/17/2008
Manufacturer: Nidec-Shimpo America Corp.	Next Date Due: 06/17/2009
Model: DT-315EB	Calibrated by: S.BLYAKHMAN
Description: Digital Stroboscope	<i>S. Blyakhman</i>
Serial No: 22707004	Conditions
Range: 54.0 to 33,000 FPM	Degrees Fahrenheit: 71.3°F
Tolerance: ±0.01% of reading	Relative Humidity: 44%

This certificate attests that this instrument has been calibrated under the standard conditions with standards traceable to the National Institute of Standards and Technology (NIST). Evidence of traceability is included and also maintained on file at our laboratory. An acceptable accuracy ratio between the standard and the item calibrated has been maintained.

Accuracy of standard used for certification is equal to or greater than the accuracy of the certified instrument. Calibration is in conformance with manufacture's specification.

Standard Used: Shimpo Non-contact Tachometer
Model: DT-209X
Serial No: E058A0007
Accuracy: Certificate No. 342861

Check Point (STD)	+ Limit (FPM)	- Limit (FPM)	Unit Reads (FPM)
1,000.0	1,000.1	999.9	1,000.0
5,000	5,000.5	4,999.5	5,000
10,000	10,001	9,999	10,000
15,000	15,002	14,998	15,000
20,000	20,002	19,998	20,000
25,000	25,003	24,997	25,000
33,000	33,003	32,997	33,000

SHIMPO INSTRUMENTS
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