



EMISSIONS TEST REPORT – REVISION 1.0

EAGLE FOUNDRY COMPANY

PERMANENT TOTAL ENCLOSURE VERIFICATION ON AIR ARC AND GRIND AREAS

**Oregon Department of Environmental Quality
Air Contaminant Discharge Permit No. 03-2631-ST-01**

Prepared for:

Eagle Foundry Co.
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Eagle Creek, OR 97022

Prepared by:

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Project Number: EFC223174
Test Date: April 18, 2023 and June 1, 2023
Revised Report Issued: June 15, 2023



EXECUTIVE SUMMARY

Eagle Foundry Company contracted Bison Engineering, Inc. to conduct permanent total enclosure (PTE) verifications at the Eagle Foundry Company facility in Eagle Creek, Oregon. PTE verification was performed on the Air Arc and Grind enclosures to demonstrate that all suspended particulate in each work area is captured by the associated baghouses. Bison completed verifications on both enclosures on April 18, 2023, and after modifications were made to the Air Arc enclosure, performed another verification on the Air Arc enclosure on June 1, 2023. This report presents test data, describes the methods employed and details the quality assurance measures taken to ensure accurate data. Tables 1 through 4 summarize the test results.

Table 1 Air Arc Area PTE Verification Results Summary

Parameter	Units	Test Result	Criteria	Criteria Status
NEAR	N/A	0.001	≤ 0.05	Pass
FV (via differential pressure measurement approach)	Inches water	All readings were less than -0.007	≤ -0.007	Pass
Distance to any NDO from each emission point	Equivalent opening diameters	≥ 4 from each emission point to any NDO	≥ 4	Pass
Inward direction of air flow	N/A	Visually confirmed inward direction of flow at each NDO*	Continuous inward direction at each NDO	Pass

NEAR – natural draft opening to enclosure area ratio

NDO – natural draft opening

N/A – not applicable

inH₂O – inches of water

ED – equivalent opening diameter

* Documented photographically

Table 2 presents the average differential pressure readings taken for the Air Arc enclosure. All readings were < -0.007 inH₂O, demonstrating that the enclosure captures 100% of emissions. Inward flow was documented visually at all NDOs on April 18, 2023, and no visible particulate emissions were observed leaving the test enclosure on either April 18 or June 1.

Table 2 Air Arc Area Differential Pressures

NDO #	NDO Description	Units	Round 1 Average	Round 2 Average	Round 3 Average
A-1	South Loading Door	inH ₂ O	-0.0362	-0.0329	-0.0372
A-2	North Loading Door	inH ₂ O	-0.0372	-0.0367	-0.0396

Table 3 Grind Area PTE Verification Results Summary

Parameter	Units	Test Result	Criteria	Criteria Status
NEAR	N/A	0.002	≤ 0.05	Pass
Distance to any NDO from each emission point	Equivalent opening diameters	≥ 4 from each emission point to any NDO	≥ 4	Pass
Inward direction of air flow	N/A	Visually confirmed inward direction of flow at each NDO*	Continuous inward direction at each NDO	Pass

* Documented photographically

Table 4 presents the average differential pressure readings taken for the Grind enclosure. While not all readings were <-0.007 inH₂O, these readings may still demonstrate that the enclosure does capture 100% of emissions. All readings demonstrate a negative pressure differential, the average of all readings is <-0.007 inH₂O, inward flow was documented visually at all NDOs, and no visible particulate emissions were observed leaving the test enclosures.

Table 4 Grind Area Differential Pressures

NDO #	NDO Description	Units	Round 1 Average	Round 2 Average	Round 3 Average
F-1	NE Loading Door	inH ₂ O	-0.0076	-0.0067	-0.0138
F-2	North Man Door	inH ₂ O	-0.0062	-0.0116	-0.0090
F-3	NW Loading Door	inH ₂ O	-0.0051	-0.0075	-0.0102
F-4	West Loading Door	inH ₂ O	-0.0188	-0.0286	-0.0399
F-5	South Man Door	inH ₂ O	-0.0062	-0.0046	-0.0114
F-6	Casting Loading Opening	inH ₂ O	-0.0115	-0.0074	-0.0085
F-7	SE Loading Door	inH ₂ O	-0.0106	-0.0078	-0.0091

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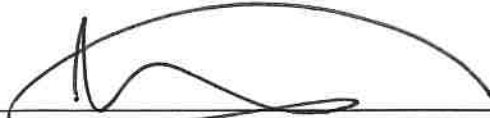
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CERTIFICATION FROM RESPONSIBLE OFFICIAL

I have reviewed the information being submitted in its entirety. Based on information and belief formed after reasonable inquiry, I certify that the statements and information contained in this submittal are true, accurate, and complete.



Signature

6-15-23
Date

Jack Scott

Name (printed)

General Manager

Title

Eagle Foundry Company

Company

REVIEW AND CERTIFICATION

All work, calculations, other activities, and tasks performed and documented in this report were carried out under my direction and supervision. This test project conforms to the requirements of Bison Engineering, Inc.'s quality manual and American Society for Testing and Materials (ASTM) D7036-04.

Project Manager: Jacob Rankin, QSTI
Title: Helena Source Team Lead
Signature: *Jacob Rankin*
Date: 6/15/2023

I have reviewed all testing details, calculations, results, conclusions and other appropriate written material contained herein, and hereby certify that the presented material is authentic and accurate.

Reviewer: Lynn Dunnington
Title: Environmental Scientist/Reporting Lead
Signature: *Lynn Dunnington*
Date: 6/15/23

I have reviewed all revised testing details, calculations, results, conclusions and other appropriate written material contained herein, and hereby certify that the presented material is authentic and accurate.

Reviewer: Jennifer Kessler
Title: Environmental Scientist/Quality Manager
Signature: *Jennifer Kessler*
Date: 6/15/23

1.0 INTRODUCTION

1.1 Project Summary and Objectives

Eagle Foundry Company (Eagle Foundry) contracted Bison Engineering, Inc. (Bison) to perform permanent total enclosure (PTE) verification on the Air Arc (cutting) and Grind (grinding) enclosures at the Eagle Foundry facility in Eagle Creek, Oregon. Bison performed the PTE verification in accordance with the pre-test protocol dated February 16, 2023, that was submitted to the Oregon Department of Environmental Quality (ODEQ). Testing was conducted to demonstrate increased capture efficiency. Bison employed U.S. Environmental Protection Agency (EPA) test methods as described in Title 40 Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A. Bison followed EPA Method 204 to determine whether the Air Arc and Grind work area enclosures inside their respective buildings meet the criteria to be considered PTEs, in which case particulate capture efficiency can be assumed to be 100 percent.

1.2 Project Contacts

Facility: **Eagle Foundry Company**
Address: 23123 SE Eagle Creek Road
Eagle Creek, OR 97022
Contact: Greg Lasslett
Phone: (503) 637-3048
Email: gregl@eaglefoundryco.com

Consultant: **Bison Engineering, Inc.**
Address: 3143 E Lyndale Avenue
Helena, MT 59601
Contact: Jacob Rankin
Phone: (406) 442-5768
Email: jrankin@bison-eng.com

State Authority: **Oregon Department of Environmental Quality
Northwest Region**
Address: 700 NE Multnomah Street, Suite 600
Portland, OR 97232
Contact: Julia DeGagne
Phone: (503) 866-9643
Email: julia.degagne@deq.oregon.gov

1.3 Testing Personnel

The Bison on-site testing team was led by Jacob Rankin, Qualified Source Test Individual (QSTI), Helena Source Team Lead. Mr. Rankin was assisted during field testing by Adam Bender, Qualified Individual (QI), Environmental Scientist. Mr. Rankin served as project manager. Jennifer Kessler, QI, Environmental Scientist/Quality Manager, audited the test data and authored this report. Lynn Dunnington, Environmental Scientist/Reporting Lead, performed a final quality assurance review of the data and test report. Report updates completed for Report Revision 1.0 were completed by Mr. Rankin, and an additional quality assurance review was completed by Ms. Kessler.

Greg Lasslett, Project Manager, was the primary contact for Eagle Foundry. Jack Scott, General Manager, and Mr. Lasslett were on-site during testing.

ODEQ representative Thomas Rhodes was on-site during PTE verification on April 18, 2023, but was not on-site during the PTE verification of the Air Arc enclosure on June 1, 2023.

2.0 SOURCE DESCRIPTION

2.1 Facility Description

Eagle Foundry owns and operates a white iron and steel alloy casting facility in Eagle Creek, Oregon. The facility specializes in custom castings for the aggregate industry and others.

2.2 Emission Source Description

After casting in the main foundry, steel alloy parts require Air Arc cutting to remove solidified metal risers from the cast part. Both steel and white iron parts are sent to the finishing building grinding enclosure. Within the enclosure parts are ground with grinding wheels to remove surface imperfections before they are considered finished and ready for sale. Cutting and grinding occur in two separate enclosures within buildings, each enclosure being equipped with a dedicated baghouse collection system.

The cutting, or Air Arc, enclosure is approximately 738 square feet (ft²) with two NDOs. The associated collection system is powered by a 10,000 cubic feet per minute (cfm) baghouse. The particulate emitting point in the Air Arc enclosure is the cutting table located on the west side of the room, from which particulate matter becomes airborne when excess material from castings is cut off using electric Air Arc cutting process. The cutting table has a hood system above it to collect the particulate matter and direct it to the baghouse.

The grinding, or Grind, enclosure is approximately 5,225 ft² with seven NDOs. The associated collection system is powered by a 30,000 cfm baghouse. Within each building, an enclosure has been constructed around the respective process (cutting or grinding), creating a smaller volume and more tightly sealed space in which the process occurs, thereby maximizing capture of emissions. The particulate emitting point in the Grind enclosure are the eight grinding booths (3 - swing grinder workstations and 5 - portable grinding workstations) located centrally in the enclosure, from which particulate matter becomes airborne when excess material from castings is ground off using various grinding tools. The swing grinder tools (3) are connected directly to the baghouse and all 8 grinding workstations (booths) have a dust pickup hood that is easily positioned close to the grinding operation on the work bench at any given time to collect particulate matter as it is generated. All the suction hoses lead to the same baghouse.

3.0 PTE VERIFICATION RESULTS

Bison followed EPA Method 204 to assess whether the Air Arc and Grind enclosures meet the criteria for a PTE. Area measurements were taken for each NDO in an “as-found” condition. Supporting data and photographic evidence of inward flow are included in the appendices to this report.

A Shortridge Instruments electronic micromanometer (serial number M22572) was used to measure differential pressure in lieu of calculating facial velocity. Some of the differential pressure measurements were greater than -0.007 inches of water and therefore did not meet acceptance criteria. Field personnel believe that the layout of the buildings and weather conditions at the time of the verification influenced these measurements.

3.1 Air Arc Enclosure Results

3.1.1 Natural Draft Opening to Enclosure Area Ratio

Bison field personnel calculated the total interior area of the Air Arc enclosure to be 3,573 ft². Using Method 204, Eq. 204-2 the NEAR was calculated as follows:

$$\begin{aligned} \text{Eq. 204-2} \quad \text{NEAR} &= \text{total area of all NDOs} / \text{total enclosure area} \\ \text{NEAR} &= 1.9 \text{ ft}^2 / 3,573 \text{ ft}^2 = 0.001 \end{aligned}$$

The NEAR for the Air Arc enclosure was calculated to be 0.001, which is less than the limit of 0.05 for permanent total enclosures as stipulated by Method 204, Section 8.2. Table 5 presents the NDO dimensions. The south loading door (A-1) is a hinged door with a 1-inch gap at the bottom, a ½-inch gap on the left side and a ¼-inch gap on the right side to allow air to flow into the enclosure. The top of the door seals against the door frame and does not contribute any area to the total NDO dimensions. The south loading door is closed during normal operations; area measurements were taken with the door closed. The door frame is 10 feet wide by 10 feet tall. The north loading door (A-2) is a hinged door and remains closed during normal operations; the area of A-2 was measured with the door fully closed. A-2 has a ½-inch gap along the bottom of the door; the door frame is 10 feet by 10 feet. The sides and top of the door are insulated and sealed by foam padding so they do not contribute to the total NDO dimensions.

Table 5 NDO Dimensions

NDO #	NDO Description	Length (in)	Width (in)	Area (in²)
A-1	South Loading Door – Bottom	120	1	120
	South Loading Door – Left	120	0.5	60
	South Loading Door - Right	120	0.25	30
A-2	North Loading Door - Bottom	120	0.5	60
Total area of all NDOs				270 (1.9 ft²)

in – inches

in² – square inches

3.1.2 Equivalent Opening Diameters

Method 204, Section 5.1 requires each NDO to be at least four equivalent opening diameters (ED) from each emitting point. Using the dimensions from Table 5, Bison calculated the number of EDs from each NDO to the emitting point in the Air Arc enclosure. Table 6 presents the calculated distances as ED. ED calculations are included in the appendices to this report. To determine ED for A-1, the sum of the side gap measurements (1.75 in.) was used as the length measurement, and a width of 120 in. was used.

Table 6 Equivalent Opening Diameters

NDO #	NDO Description	ED (in)	Distance to Emitting Point (in)	# of Diameters
A-1	South Loading Door	3.45	277	80
A-2	North Loading Door	1.00	199	200

3.1.3 Differential Pressure Measurements and Inward Flow

Bison conducted three rounds of five differential pressure measurements at each NDO. The five measurements were taken approximately one minute apart. After recording the five pressure measurements, field personnel moved to the next location and performed five measurements on that NDO. This procedure was repeated until three rounds of five measurements were complete. Table 7 presents averages of the differential pressure measurements.

Table 7 Differential Pressures

NDO #	NDO Description	Units	Round 1 Average	Round 2 Average	Round 3 Average
A-1	South Loading Door	inH ₂ O	-0.0362	-0.0329	-0.0372
A-2	North Loading Door	inH ₂ O	-0.0372	-0.0367	-0.0396

On April 18, 2023, continuous inward direction of airflow at each NDO was confirmed by visual observation and documented photographically. Photographs are presented in an appendix to this report. Bison did not verify inward flow again on June 1, 2023 because all differential pressure readings indicated more facial velocity and inward flow was previously observed at lower differential pressure measurements.

3.2 Grind Enclosure Results

3.2.1 Natural Draft Opening to Enclosure Area Ratio

Bison field personnel calculated the total interior area of the Grind enclosure to be 19,594 ft². Using Method 204, Eq. 204-2 the NEAR was calculated as follows:

$$\text{Eq. 204-2} \quad \text{NEAR} = \text{total area of all NDOs} / \text{total enclosure area}$$

$$\text{NEAR} = 30.6 \text{ ft}^2 / 19,594 \text{ ft}^2 = 0.002$$

The NEAR for the Grind enclosure was calculated to be 0.002, which is less than the limit of 0.05 for permanent total enclosures as stipulated by Method 204, Section 8.2. Table 8 presents the NDO dimensions. All dimensions were measured with the NDOs in a normal operation orientation. The west loading door remains closed during normal operation, the NW and NE loading doors open episodically, and all other openings and doorways are covered with freezer strips. The openings and doorways with freezer strips are high traffic openings. The west loading door (F-4) is a roll-up door that is always closed and has a two-inch gap at the bottom. The NW (F-3) and NE (F-1) doors are sliding doors that have bristles around all edges of the door. A width of 0.25 inches was assumed for the draft opening of the bristles to be conservative and is applied on all four sides of both doors. The north man door (F-2), south man door (F-5), and SE loading door (F-7) all have a one-inch gap between the bottom of the freezer strips and the ground. Castings are fed into the grinding enclosure through the Casting Loading opening (F-6) on rollers underneath freezer strips; a maximum height of 14 inches was measured from the bottom of the freezer strips to the ground. Some sections of the freezer strips between the rollers were lower in height, but 14 inches was assumed across the length of the opening to be conservative.

Table 8 NDO Dimensions

NDO #	NDO Description	Length (in)	Width (in)	Area (in ²)
F-1	NE Loading Door	480	0.25	120
F-2	North Man Door	1	38	38
F-3	NW Loading Door	480	0.25	120
F-4	West Loading Door	2	144	288
F-5	South Man Door	1	43	43
F-6	Casting Loading Opening	14	264	3,696
F-7	SE Loading Door	1	108	108
Total area of all NDOs				4,413 (30.6 ft²)

3.2.2 Equivalent Opening Diameters

Method 204, Section 5.1 requires each NDO to be at least four equivalent opening diameters from each emitting point. Using the dimensions from Table 8, Bison calculated the number of ED from each NDO to the nearest emitting point (grinding booth) in the Grind enclosure. Table 9 presents the calculated distances as ED.

Table 9 Equivalent Opening Diameters

NDO #	NDO Description	ED (in)	Distance to Emitting Point (in)	# of Diameters
F-1	NE Loading Door	0.50	353	706.4
F-2	North Man Door	1.95	282	144.7
F-3	NW Loading Door	0.50	295	590.3
F-4	West Loading Door	3.95	212	53.7
F-5	South Man Door	1.95	189	96.7
F-6	Casting Loading Opening	26.59	174	6.5
F-7	SE Loading Door	1.98	262	132.2

3.2.3 Differential Pressure Measurements and Inward Flow

Bison conducted three rounds of five differential pressure measurements at each NDO. The five measurements were taken approximately one minute apart. After recording the five pressure measurements, field personnel moved to the next location and performed five measurements on that NDO. This procedure was repeated until three rounds of five measurements were complete. Table 10 presents averages of the differential pressure measurements. While several readings were greater than -0.007, the overall average of the readings were within the method requirement of less than -0.007.

Table 10 Differential Pressures

NDO #	NDO Description	Units	Round 1 Average	Round 2 Average	Round 3 Average
F-1	NE Loading Door	inH ₂ O	-0.0076	-0.0067	-0.0138
F-2	North Man Door	inH ₂ O	-0.0062	-0.0116	-0.0090
F-3	NW Loading Door	inH ₂ O	-0.0051	-0.0075	-0.0102
F-4	West Loading Door	inH ₂ O	-0.0188	-0.0286	-0.0399
F-5	South Man Door	inH ₂ O	-0.0062	-0.0046	-0.0114
F-6	Casting Loading Opening	inH ₂ O	-0.0115	-0.0074	-0.0085
F-7	SE Loading Door	inH ₂ O	-0.0106	-0.0078	-0.0091

The grinding enclosure exhaust flow rate is rated at approximately 30,000 cfm. Dividing by the total area of all the NDOs, the resulting average facial velocity through the NDOs would be 980 fpm. Further measurements may prove that the grinding enclosure can pass the facial velocity criteria. Continuous inward direction of airflow at each NDO was confirmed by visual observation and documented photographically. Photographs are presented in an appendix to this report.

3.3 Operating Conditions

Eagle Foundry personnel ensured that the main foundry, Air Arc, and Grind areas were operating under normal conditions during the PTE verification.

3.4 Field Observations

Testing was performed as outlined in the test protocol. No adverse or unusual environmental conditions other than those noted in Section 3.0 are known to have influenced the outcome of these tests. No visible emissions were observed outside of the enclosures.

3.5 Conclusions

All Method 204 criteria were met to demonstrate that the Air Arc enclosure meets the definition of a PTE. Three of the four Method 204 criteria were met to demonstrate that the Grind enclosure meets the definition of a PTE. Though differential pressure measurements at the Grind enclosure were not all <-0.007 inH₂O, all measurements were negative, indicating inward flow. Additionally, inward flow was visually confirmed over a one-hour period. Fume generated in the Grind enclosure was suspended and was not directed at any of the NDOs, meaning it did not appear to have any momentum that would allow it to overcome the inward flow. As a result, it is our professional opinion that the Air Arc enclosure is capturing 100% of the emissions generated inside and the Grind enclosure is capturing approximately 100% of the emissions generated inside.

4.0 EMISSION TEST METHODS AND PROCEDURES

4.1 Testing Methods and Procedures

Bison testing personnel performed the following EPA methods as described in 40 CFR 60, Appendix A.

EPA Reference Method 204, “Criteria for and Verification of a Permanent or Temporary Total Enclosure.” The objective of Method 204 is to determine whether a permanent or temporary enclosure meets the criteria for being considered a total enclosure. If all criteria are met, then the capture efficiency is assumed to be 100 percent.

4.2 Sample Handling and Analytical Procedures

Sampling procedures are cited in the appropriate methods and there was no deviation from those methods. No physical samples requiring off-site processing were generated during this test campaign.

4.3 Audit Samples

The stationary source audit program (SSAP) is effectively suspended as of March 2022 because there are currently no independent accredited audit sample providers (AASP).

APPENDIX A: AREA DRAWINGS AND TEST DATA



COMPANY	Eagle Foundry
FACILITY	Eagle Foundry
LOCATION	Eagle Creek, OR
SOURCE	Air Arc (Cutting) Enclosure
DATE	06/01/23
METHOD	204
PARAMETER	PTE Verification

Bison Engineering, Inc.
Method 204 Area Calculations

Enclosure Interior Dimensions

	Location Description	Length (ft)	Width (ft)	Area (ft ²)
N	Wall	25.0	21.5	537.5
S	Wall	25.0	17.0	425.0
W	Wall	29.5	19.3	567.9
E	Wall	29.5	19.3	567.9
	Floor	25.0	29.5	737.5
	Ceiling	25.0	29.5	737.5
Total enclosure area:				3,573 ft ²

NEAR Calculation

Total area of NDOs (A _N):	1.9 ft ²	
Total enclosure area (A _T):	3,573 ft ²	
	0.001 ≤ 0.05	PASS
NEAR - NDO to enclosure area ratio		

Note: The ceiling is assumed to have the same surface area as the floor.

NDO Dimensions

NDO #	NDO Location Description	Length (in)	Width (in)	Area (in ²)
A-1	South Loading Door - Bottom	120	1	120
	South Loading Door - Left	120	0.5	60
	South Loading Door - Right	120	0.25	30
A-2	North Loading Door - Bottom	120	0.5	60
Total area of all NDOs:				1.9 ft ²

Total area of Normal Operation Draft Openings

Equivalent Diameter (ED)

NDO #	NDO Location Description	ED (in)	Distance to emitting* point (in)	# of ED	
A-1	South Loading Door	3.45	277	80	PASS
A-2	North Loading Door	1.00	199	200	PASS

* The emitting point is a cutting table located on the southern side of the building. The cutting table has a hood system above it to collect particulate matter and route it to the baghouse.

Note ED for the South Loading Door was calculated using the sum of the side gaps (1.75") for use as the width and using 120" as the length.

Example Calculations:

$$NEAR = A_N / A_T = 0.001$$

Where A_N = 1.9 ft²

Where A_T = 3,573 ft²

$$ED = (2 * Length * Width) / (Length + Width) = 1.00 \text{ in}$$

Where Length = 120 in

Where Width = 0.5 in

A-2, North Loading Door - Bottom

Bison Engineering, Inc.
Method 204 Field Data

Client: Eagle Foundry
Source: Air Arc (Cutting) Enclosure
Location: Eagle Creek, OR
Date: 6/1/2023

NDO Description		South Loading Door (A-1)			North Loading Door (A-2)		
Time (mm:ss)		9:35	9:38	9:40	9:34	9:36	9:39
Units		Inches of H ₂ O			Inches of H ₂ O		
Readings	#1	-0.0357	-0.0316	-0.0354	-0.0365	-0.0379	-0.0400
	#2	-0.0370	-0.0346	-0.0365	-0.0367	-0.0376	-0.0400
	#3	-0.0361	-0.0332	-0.0372	-0.0382	-0.0367	-0.0382
	#4	-0.0358	-0.0330	-0.0384	-0.0374	-0.0360	-0.0399
	#5	-0.0362	-0.0323	-0.0384	-0.0370	-0.0354	-0.0398
Average		-0.0362	-0.0329	-0.0372	-0.0372	-0.0367	-0.0396
Overall			-0.0354			-0.0378	

Note: Yellow shading indicates values between -0.01 and -0.007 to alert testing personnel of values approaching (but not exceeding) the limit of -0.007. Red shading indicates readings greater than -0.007.



BISON

ENGINEERING, INC.

An Employee Owned Company

Prj. No.:

Location:

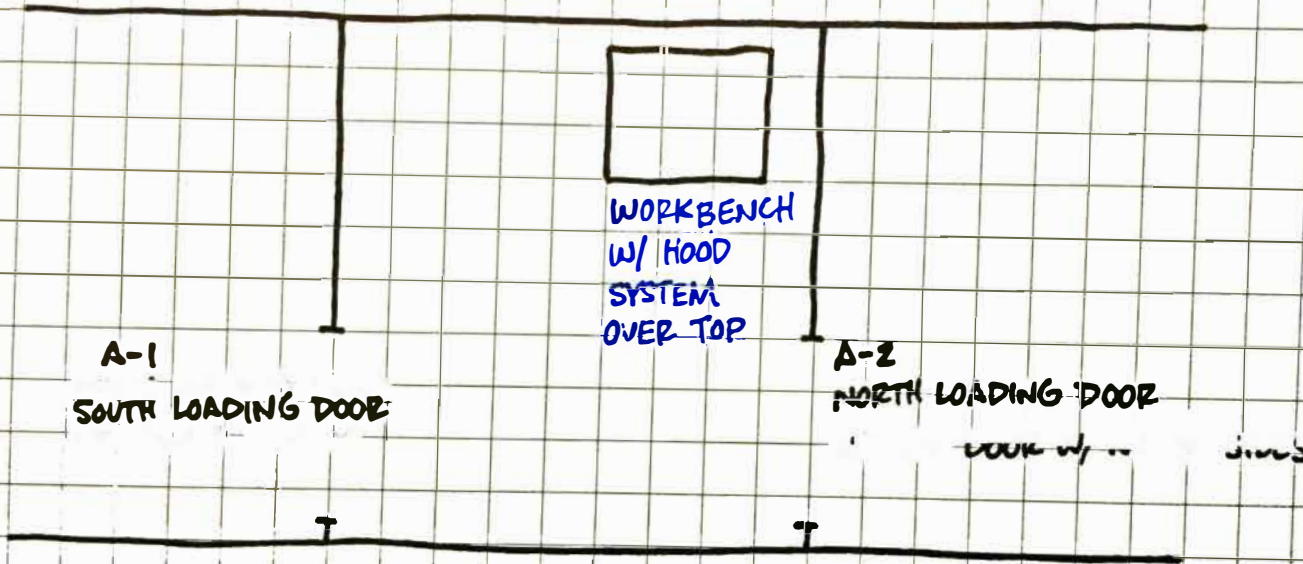
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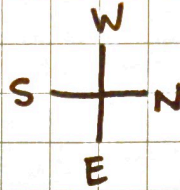
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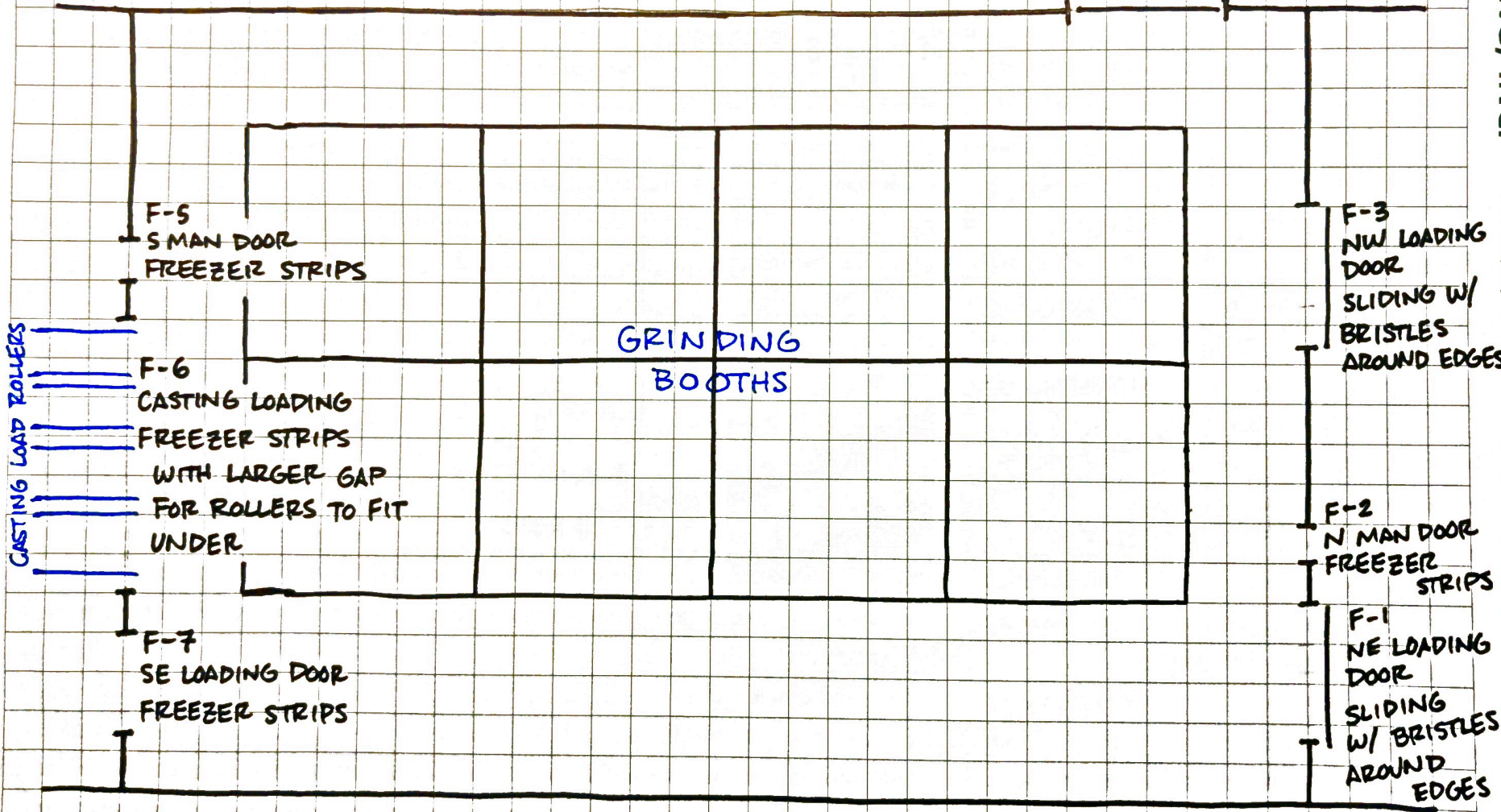
**EAGLE FOUNDRY
AIR ARC ENCLOSURE**



EAGLE FOUNDRY
FINISH END ENCLOSURE



F-4 W LOADING DOOR
OPENING
ROLL-UP DOOR WITH GAP
AT THE BOTTOM



BISON

ENGINEERING, INC.

An Employee Owned Company

Proj. No.: _____
 Location: _____
 By: _____
 Date: _____
 Sheet: _____ of _____

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COMPANY	Eagle Foundry
FACILITY	Eagle Foundry
LOCATION	Eagle Creek, OR
SOURCE	Grind Enclosure
DATE	04/18/23
METHOD	204
PARAMETER	PTE Verification

Bison Engineering, Inc.
Method 204 Area Calculations

Enclosure Interior Dimensions

	Location Description	Length (ft)	Width (ft)	Area (ft ²)
N	Wall	59.8	32.3	1,929.6
S	Wall	59.8	32.3	1,929.6
E	Wall	87.3	30.3	2,641.8
W	Wall	87.3	30.3	2,641.8
	Floor	87.3	59.8	5,225.4
	Ceiling	87.3	59.8	5,225.4
		Total enclosure area:		19,594 ft ²

Note: The ceiling is assumed to have the same surface area as the floor.

NEAR Calculation

Total area of NDOs (A _N):	30.6 ft ²	
Total enclosure area (A _T):	19,594 ft ²	
	0.002 ≤ 0.05	PASS
NEAR - NDO to enclosure area ratio		

NDO Dimensions

NDO #	NDO Location Description	Height (in)	Width (in)	Area (in ²)
F-1	NE Loading Door	480	0.25	120
F-2	North Man Door	1	38	38
F-3	NW Loading Door	480	0.25	120
F-4	West Loading Door	2	144	288
F-5	South Man Door	1	43	43
F-6	Casting Loading Opening	14	264	3,696
F-7	SE Loading Door	1	108	108
		Total area of all NDOs:		30.6 ft ²

Normal Operation Door Opening
 Normal Operation Door Opening
 Normal Operation Door Opening
 Normal Operation Door Opening
 Normal Operation Door Opening
 Normal Operation Door Opening
 Normal Operation Door Opening

Equivalent Diameter (ED)

NDO #	NDO Location Description	ED (in)	Distance to emitting* point (in)	# of ED	
F-1	NE Loading Door	0.50	353	706.4	PASS
F-2	North Man Door	1.95	282	144.7	PASS
F-3	NW Loading Door	0.50	295	590.3	PASS
F-4	West Loading Door	3.95	212	53.7	PASS
F-5	South Man Door	1.95	189	96.7	PASS
F-6	Casting Loading Opening	26.59	174	6.5	PASS
F-7	SE Loading Door	1.98	262	132.2	PASS

*The emitting point is the grinding booths located in the center of the building. Each grinding booth has two suction hoses to collect particulate matter and route it to the baghouse.

Example Calculations:

$$NEAR = A_N / A_T = 0.002$$

Where A_N = 30.6 ft²

Where A_T = 19593.81 ft²

$$ED = (2 * Length * Width) / (Length + Width) = 0.50 \text{ in}$$

Where Length = 480 in

Where Width = 0.25 in

(NE Loading Door)

Bison Engineering, Inc.
Method 204 Field Data

Client: Eagle Foundry
Source: Grind Enclosure
Location: Eagle Creek, Oregon
Date: 4/18/2023

NDO Description		NE Loading Door (F-1)			North Man Door (F-2)			NW Loading Door (F-3)			West Loading Door (F-4)		
Time (mm:ss)		12:14	13:48	14:07	12:17	13:49	14:08	12:21	13:51	14:09	12:24	13:54	14:10
Units		Inches of H ₂ O			Inches of H ₂ O			Inches of H ₂ O			Inches of H ₂ O		
Readings	#1	-0.0075	-0.0042	-0.0088	-0.0044	-0.0078	-0.0062	-0.0033	-0.0060	-0.0092	-0.0167	-0.0255	-0.0424
	#2	-0.0074	-0.0075	-0.0070	-0.0138	-0.0261	-0.0064	-0.0049	-0.0052	-0.0128	-0.0149	-0.0336	-0.0509
	#3	-0.0078	-0.0066	-0.0149	-0.0055	-0.0120	-0.0142	-0.0038	-0.0103	-0.0105	-0.0206	-0.0355	-0.0352
	#4	-0.0070	-0.0100	-0.0166	-0.0024	-0.0064	-0.0079	-0.0082	-0.0101	-0.0079	-0.0234	-0.0224	-0.0426
	#5	-0.0084	-0.0054	-0.0219	-0.0048	-0.0055	-0.0101	-0.0053	-0.0061	-0.0106	-0.0186	-0.0262	-0.0286
Average		-0.0076	-0.0067	-0.0138	-0.0062	-0.0116	-0.0090	-0.0051	-0.0075	-0.0102	-0.0188	-0.0286	-0.0399
Overall			-0.0094			-0.0089			-0.0076			-0.0291	

NDO Description		South Man Door (F-5)			Casting Loading Opening (F-6)			SE Loading Door (F-7)		
Time (mm:ss)		12:26	13:58	14:12	12:28	14:00	14:13	12:29	14:02	14:14
Units		Inches of H ₂ O			Inches of H ₂ O			Inches of H ₂ O		
Readings	#1	-0.0072	-0.0050	-0.0148	-0.0072	-0.0111	-0.0076	-0.0094	-0.0087	-0.0092
	#2	-0.0057	-0.0045	-0.0095	-0.0092	-0.0059	-0.0099	-0.0098	-0.0082	-0.0104
	#3	-0.0071	-0.0054	-0.0167	-0.0137	-0.0055	-0.0096	-0.0077	-0.0057	-0.0065
	#4	-0.0034	-0.0040	-0.0074	-0.0143	-0.0066	-0.0064	-0.0109	-0.0067	-0.0073
	#5	-0.0075	-0.0039	-0.0086	-0.0132	-0.0079	-0.0089	-0.0150	-0.0096	-0.0120
Average		-0.0062	-0.0046	-0.0114	-0.0115	-0.0074	-0.0085	-0.0106	-0.0078	-0.0091
Overall			-0.0074			-0.0091			-0.0091	

Note: Yellow shading indicates values between -0.01 and -0.007 to alert testing personnel of values approaching (but not exceeding) the limit of -0.007. Red shading indicates readings greater than -0.007.

APPENDIX B: INWARD FLOW DIRECTION PHOTOS

Bison Engineering, Inc.
EPA Method 204
Documentation of Inward Flow Direction

Client: Eagle Foundry Co.
Location: Eagle Creek, Oregon
Enclosure: Air Arc Building (Cutoff)
Date: April 18, 2023

The following photographs document inward flow direction at NDOs A-1, South Loading door and A-2, North Loading door.

A-2 - North Loading Door

4-18-2023 15:51

4-18-2023 16:20

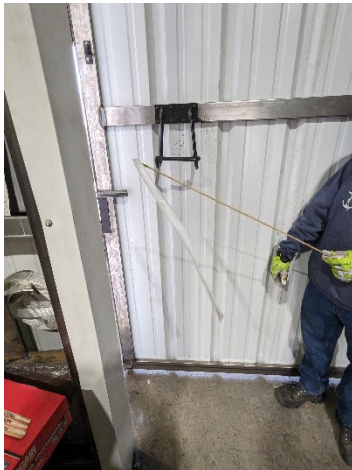
Outside Doorway



4-18-2023 15:30

4-18-2023 16:00

4-18-2023 16:31



4-18-2023 15:40

4-18-2023 16:10

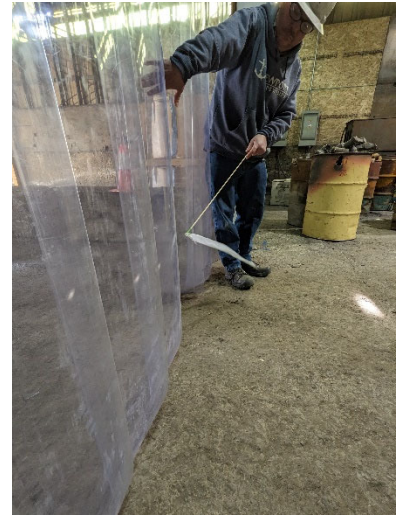
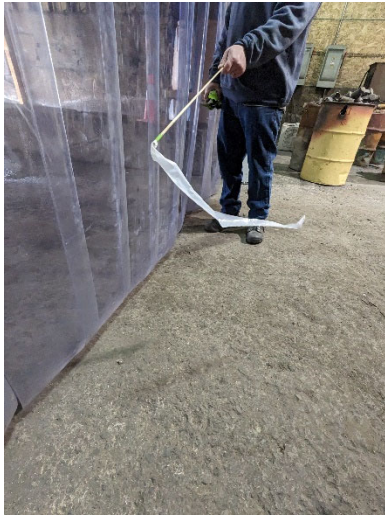


A-1 - South Loading Door

4-18-2023 15:52

4-18-2023 16:20

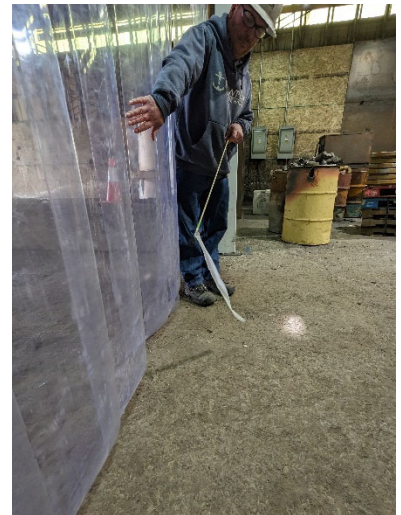
Inside Doorway



4-18-2023 15:31

4-18-2023 16:00

4-18-2023 16:31



4-18-2023 15:41

4-18-2023 16:10



Bison Engineering, Inc.
EPA Method 204
Documentation of Inward Flow Direction

Client: Eagle Foundry Co.
Location: Eagle Creek, Oregon
Enclosure: Grind (Grinding Booths)
Date: April 18, 2023

The following photographs document inward flow direction at seven NDOs:

- F-1, NE Loading Door
- F-2, North Man Door
- F-3, NW Loading Door
- F-4, West Loading Door
- F-5, South Man Door
- F-6, Casting Loading Opening
- F-7, SE Loading Door

F-1 - NE Loading Door

Outside Doorway



4-18-2023 14:35



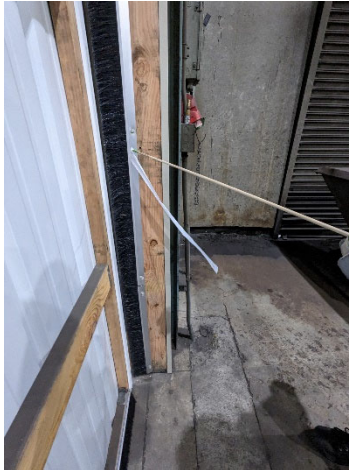
4-18-2023 15:05



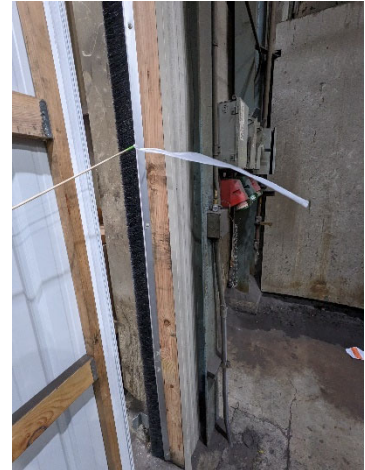
Inside Doorway



4-18-2023 14:45



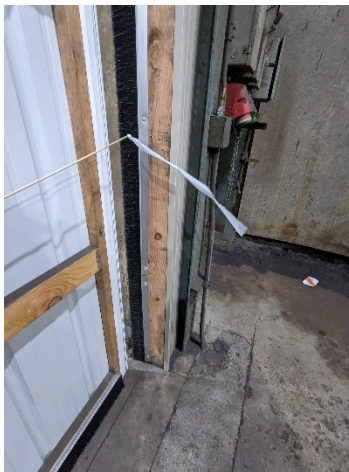
4-18-2023 15:15



4-18-2023 14:25



4-18-2023 14:55

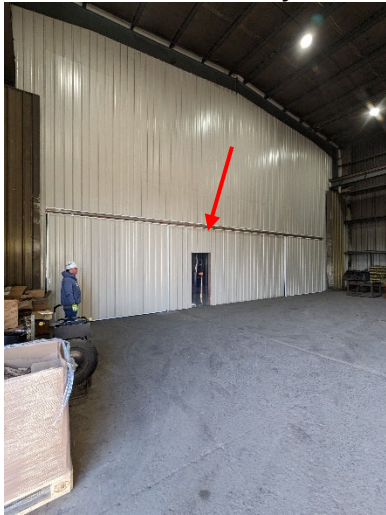


4-18-2023 15:25



F-2 - North Man Door

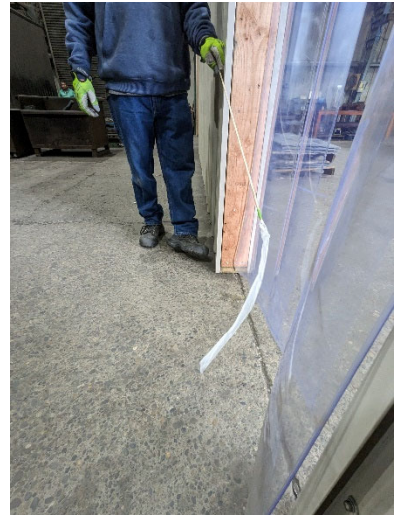
Outside Doorway



4-18-2023 14:36



4-18-2023 15:06



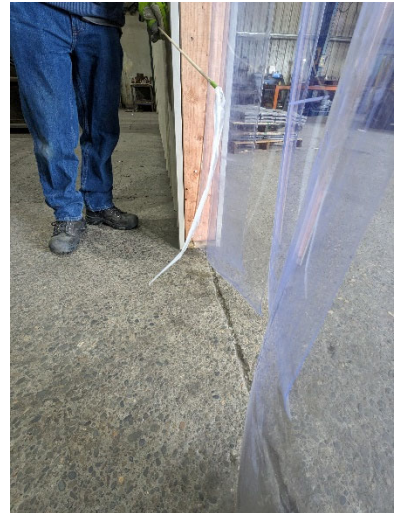
Inside Doorway



4-18-2023 14:46



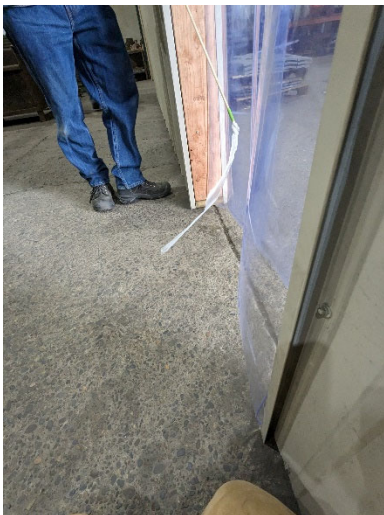
4-18-2023 15:15



4-18-2023 14:25



4-18-2023 14:57



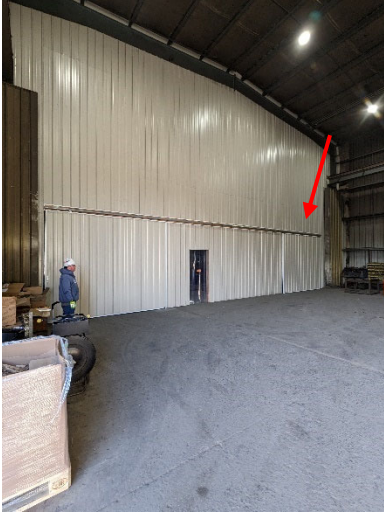
4-18-2023 15:25



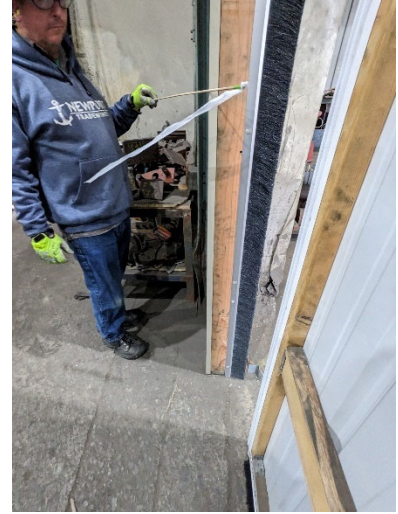
F-3 - NW Loading Door

4-18-2023 14:37

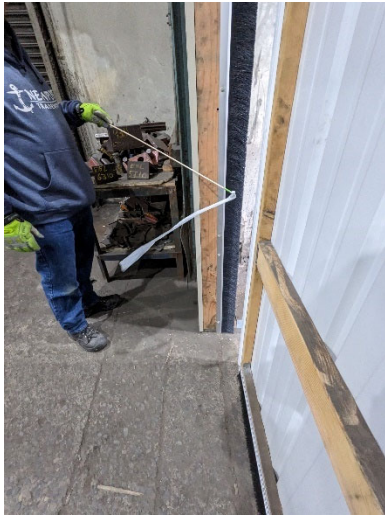
Outside Doorway



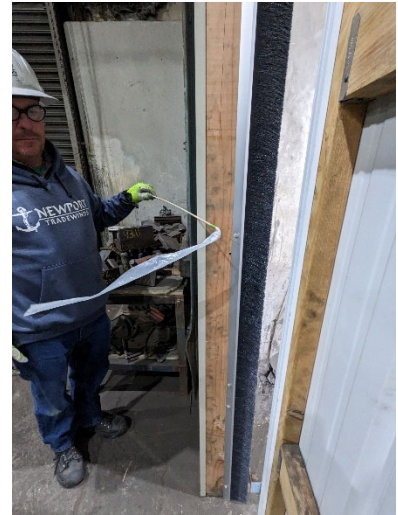
4-18-2023 15:06



4-18-2023 14:46



4-18-2023 15:16



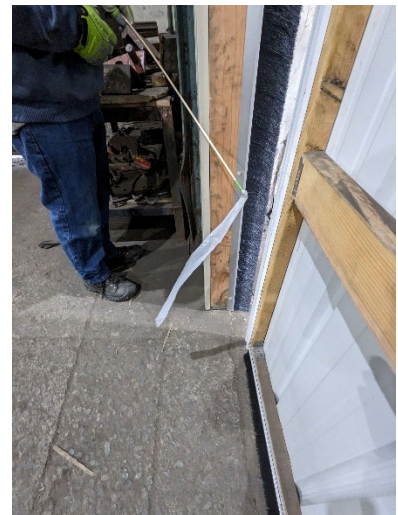
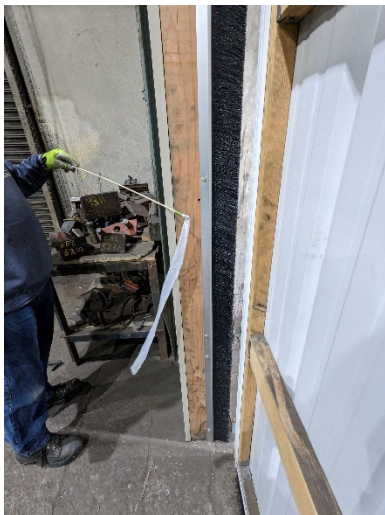
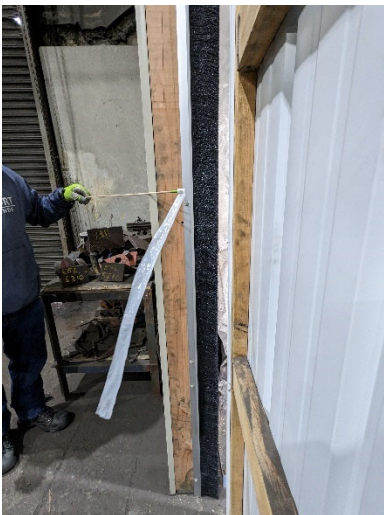
Inside Doorway



4-18-2023 14:26

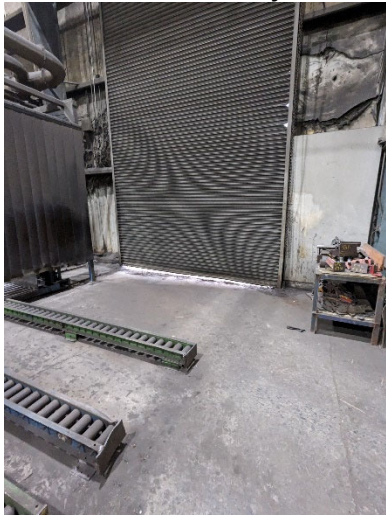
4-18-2023 14:58

4-18-2023 15:25



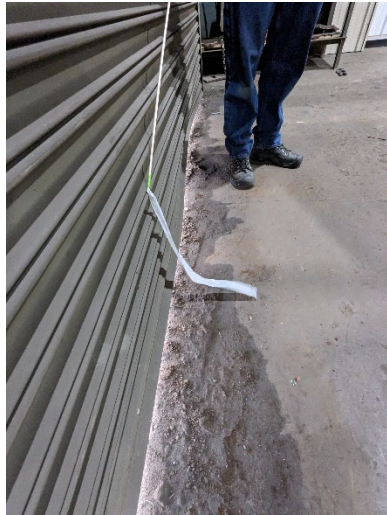
F-4 - West Loading Door Opening

Inside Doorway



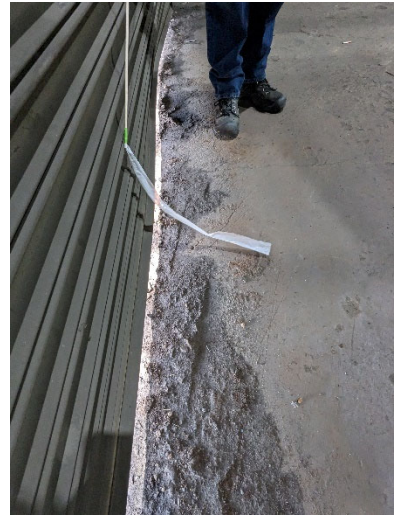
4-18-2023 14:26

4-18-2023 14:46



4-18-2023 14:58

4-18-2023 15:16



4-18-2023 15:26



4-18-2023 14:38

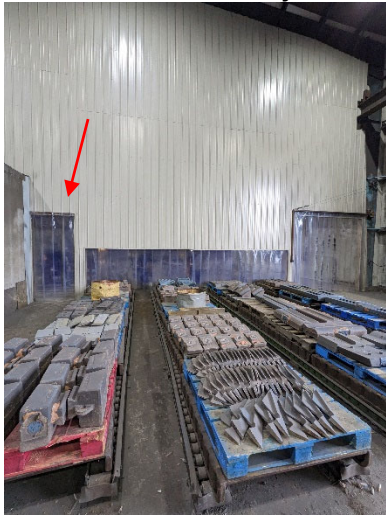


4-18-2023 15:07

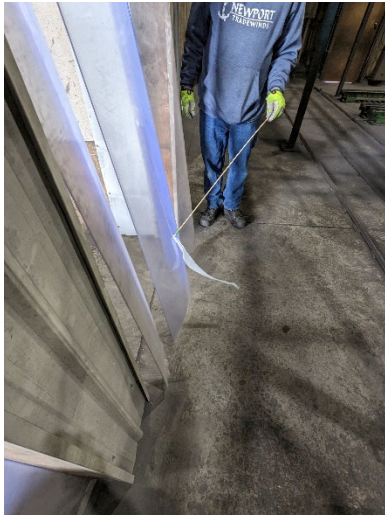


F-5 - South Man Door

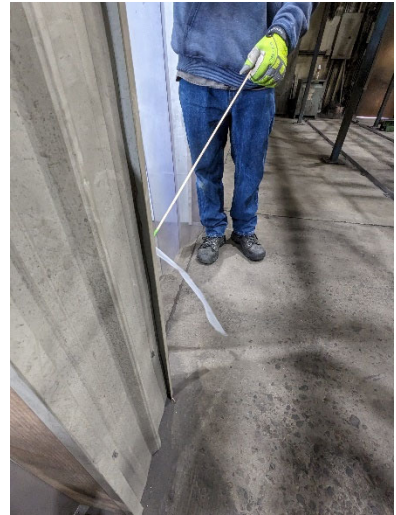
Outside Doorway



4-18-2023 14:38



4-18-2023 15:08



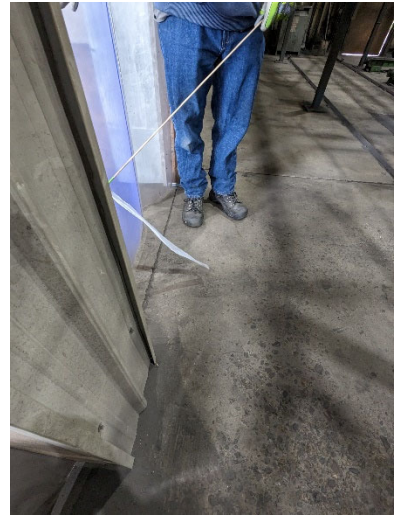
Inside Doorway



4-18-2023 14:47



4-18-2023 15:17



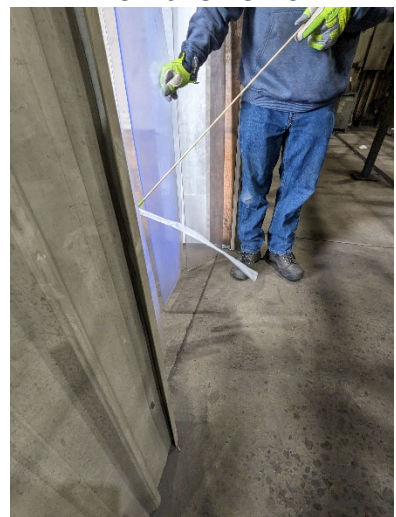
4-18-2023 14:27



4-18-2023 14:59

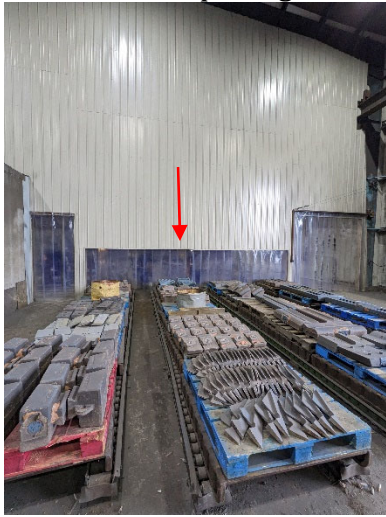


4-18-2023 15:26

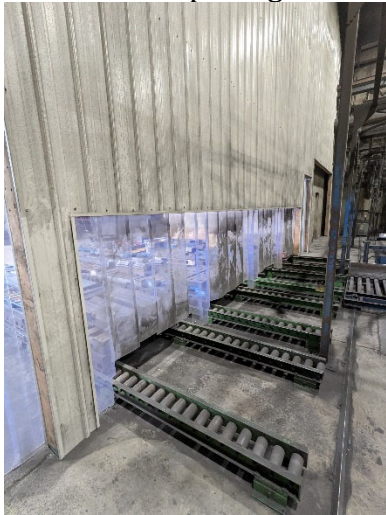


F-6 - Casting Loading

Outside Opening

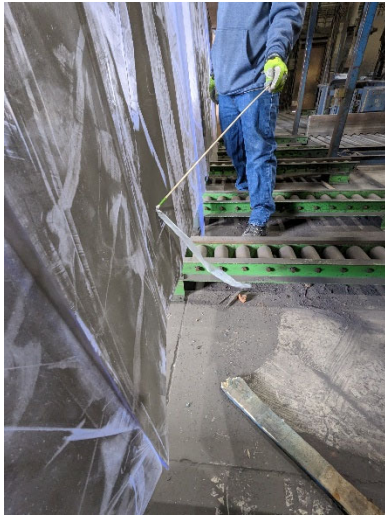


Inside Opening



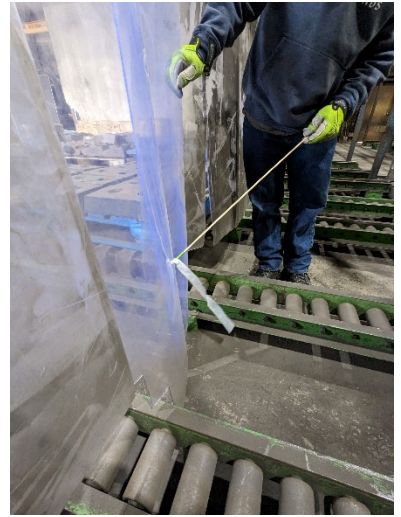
4-18-2023 14:27

4-18-2023 14:39

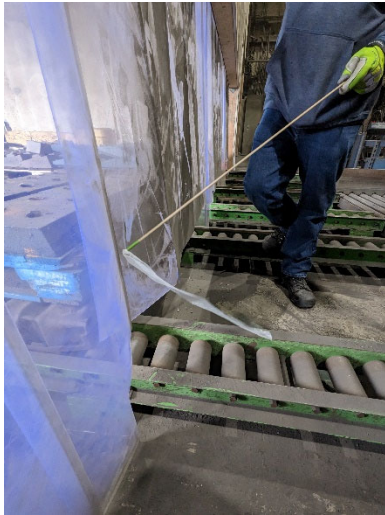


4-18-2023 14:48

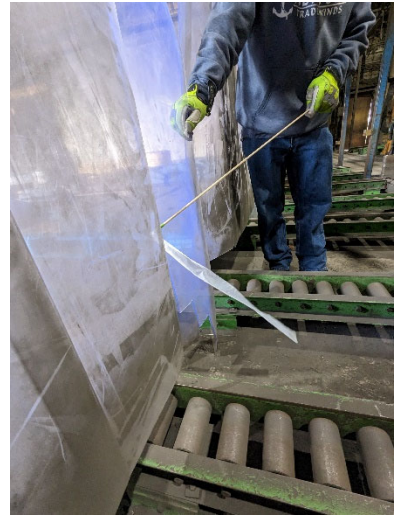
4-18-2023 15:08



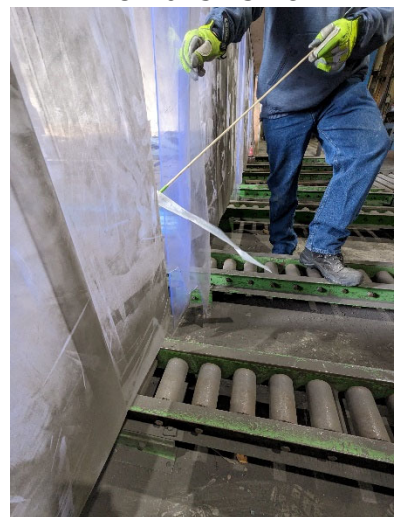
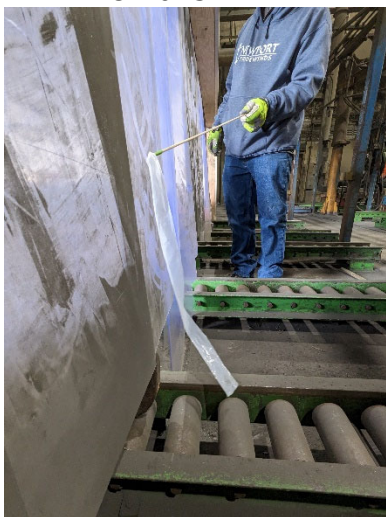
4-18-2023 15:17



4-18-2023 14:59



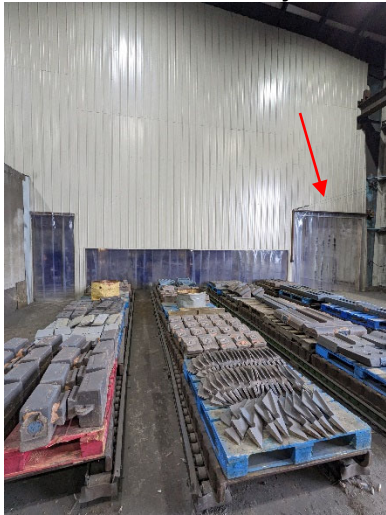
4-18-2023 15:26



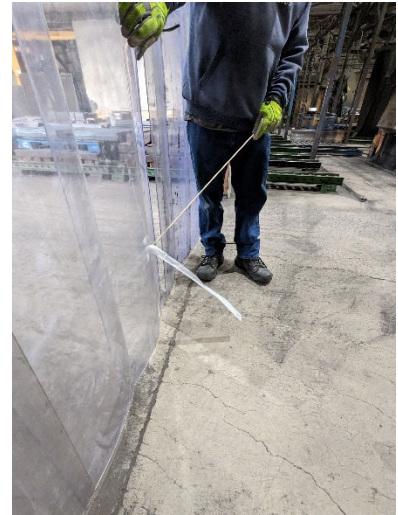
F-7 - SE Loading Door

4-18-2023 14:39

Outside Doorway



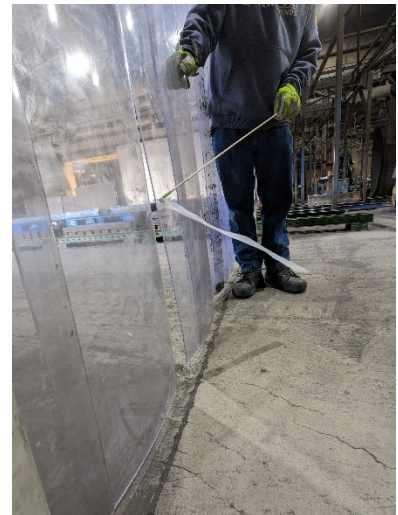
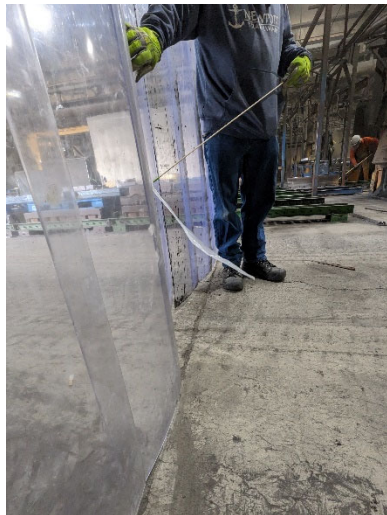
4-18-2023 15:08



Inside Doorway

4-18-2023 14:48

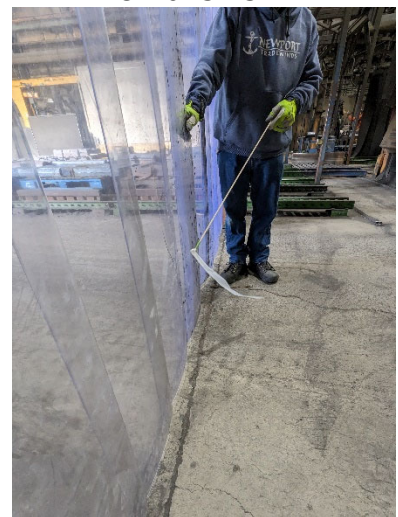
4-18-2023 15:17



4-18-2023 14:28

4-18-2023 15:00

4-18-2023 15:27



APPENDIX C: CALIBRATIONS AND CERTIFICATIONS

Accredited Air Emission Testing Body

A2LA has accredited

BISON ENGINEERING, INC.

In recognition of the successful completion of the joint A2LA and Stack Testing Accreditation Council (STAC) evaluation process, this laboratory is accredited to perform testing activities in compliance with ASTM D7036:2004 - Standard Practice for Competence of Air Emission Testing Bodies.

Presented this 27th day of January 2022 .



Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4675.01
Valid to November 30, 2023

This accreditation program is not included under the A2LA ILAC Mutual Recognition Arrangement.

AIRDATA MULTIMETER CERTIFICATE OF CALIBRATION

Customer ID: 022037 S/N: M22572
 Customer: BISON ENGINEERING, INC. City: HELENA State: MT
 Model #: ADM-850L PO #: _____ Calibration Due Date: 02/2025 Order #: 230186

Rh 35 % Ambient Temperature 71 °F Barometric Pressure 28.56 in Hg

ABSOLUTE PRESSURE TEST (in Hg) TEST METER TOLERANCE = ± 2.0 % ± .1 in Hg

Pressure Standard: Heise #02-R S/N: 41741/42451 _____	Pressure Standard: Heise #12A-R S/N: 45605/48491 _____
Pressure Standard: Heise #04-R S/N: 41743/42453 _____	Pressure Standard: Heise #14-R S/N: 43412/45043-2 _____
Pressure Standard: Heise #06-R S/N: 41742/42452-1 <input checked="" type="checkbox"/>	Pressure Standard: Heise #16-R S/N: 43413/45044 _____
Pressure Standard: Heise #08-R S/N: 42186/43328 _____	Pressure Standard: Heise #18-R S/N: 44581/46845 _____
Pressure Standard: Heise #10-R S/N: 42203/43352 _____	Pressure Standard: Heise #20-R S/N: 44582/46847 _____

Approx Set Point	Standard	Test Meter	% Diff
14.0	14.00	13.9	-.71
28.4	28.56	28.7	.49
40.0	40.00	40.2	.50

DIFFERENTIAL PRESSURE TEST (in wc) TEST METER TOLERANCE = ± 2.0 % ± 0.001 in wc

Pressure Standard: Heise #01-L S/N: 41739/42449 _____	Pressure Standard: Heise #11-L S/N: 43165/44551-1 _____
Pressure Standard: Heise #01-R S/N: 41739/42446 _____	Pressure Standard: Heise #11-R S/N: 43165/44730 _____
Pressure Standard: Heise #02-L S/N: 41741/42454 _____	Pressure Standard: Heise #12A-L S/N: 45605/48490-1 _____
Pressure Standard: Heise #03A-L S/N: 45570/48461 _____	Pressure Standard: Heise #13-L S/N: 43415/45041 _____
Pressure Standard: Heise #03A-R S/N: 45570/48460 _____	Pressure Standard: Heise #13-R S/N: 43415/45039 _____
Pressure Standard: Heise #04-L S/N: 41743/42456 _____	Pressure Standard: Heise #14-L S/N: 43412/45045 _____
Pressure Standard: Heise #05-L S/N: 41740/42450 <input checked="" type="checkbox"/>	Pressure Standard: Heise #15-L S/N: 43416/45042 _____
Pressure Standard: Heise #05-R S/N: 41740/42447 <input checked="" type="checkbox"/>	Pressure Standard: Heise #15-R S/N: 43416/45040-1 _____
Pressure Standard: Heise #06-L S/N: 41742/42455 <input checked="" type="checkbox"/>	Pressure Standard: Heise #16-L S/N: 43413/45046 _____
Pressure Standard: Heise #07-L S/N: 42185/42186 _____	Pressure Standard: Heise #17-L S/N: 44579/46842 _____
Pressure Standard: Heise #07-R S/N: 42185/43326 _____	Pressure Standard: Heise #17-R S/N: 44579/46841 _____
Pressure Standard: Heise #08-L S/N: 42186/43329 _____	Pressure Standard: Heise #18-L S/N: 44581/46846 _____
Pressure Standard: Heise #09-L S/N: 42202/43351 _____	Pressure Standard: Heise #19-L S/N: 44580/46844 _____
Pressure Standard: Heise #09-R S/N: 42202/43350 _____	Pressure Standard: Heise #19-R S/N: 44580/46843 _____
Pressure Standard: Heise #10-L S/N: 42203/43353 _____	Pressure Standard: Heise #20-L S/N: 44582/46848 _____

Approx Set Point	Standard	Test Meter	% Diff
.0100	.0100	.0100	.00
.0500	.0515	.0514	-.19
.1250	.1254	.1254	.00
.2250	.2254	.2253	-.04
1.000	1.008	1.006	-.20
2.000	2.008	2.004	-.20
3.600	3.604	3.590	-.39
4.400	4.401	4.399	-.05
27.00	27.01	27.02	.04
50.00	50.05	49.85	-.40
Over Pressure	NA	<input checked="" type="checkbox"/>	NA

Shortridge Instruments, Inc.

7855 East Redfield Road Scottsdale, Arizona 85260
 (480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com

AIRDATA MULTIMETER CERTIFICATE OF CALIBRATION

S/N: M22572

Order #: 230186

LOW VELOCITY CONFIRMATION (FPM) TEST METER TOLERANCE = ± 3.0% ± 7 FPM

Vel Eqv Trans Std: S/N: M02009	Vel Eqv Trans Std: S/N: M10897
Vel Eqv Trans Std: S/N: M02903	Vel Eqv Trans Std: S/N: M10901
Vel Eqv Trans Std: S/N: M10839	Vel Eqv Trans Std: S/N: M13492
Vel Eqv Trans Std: S/N: M10840	Vel Eqv Trans Std: S/N: M19325

Approx Set Point	Standard	Test Meter	Diff
100	101	100	-1
500	514	514	0

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

TEMPERATURE TEST - AIRDATA MULTIMETER (° F) TEST METER TOLERANCE = ± 0.2° F

RTD Simulator: S/N 249	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 250	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 253	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 254	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 256	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 257	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 292	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 293	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 294	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 313	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 314	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 315	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 316	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 317	Set Point:	35.6° F	95° F	154.4° F
RTD Simulator: S/N 318	Set Point:	35.6° F	95° F	154.4° F

Equivalent Set Point	RTD Simulator Temperature Test Meter	Diff
35.60	35.7	.1
95.00	95.0	.0
154.40	154.4	.0

NOTES: _____

Procedure used: Procedure for Differential Pressure, Absolute Pressure and Temperature Calibration of AirData Multimeters SIP-CP01 Revision: 17
Dated: 12/10/15. There were no additions to or deviations from the calibration procedure during this calibration process.

This instrument has been calibrated using Calibration Standards which are traceable to NIST (National Institute of Standards and Technology). Test accuracy ratio is 4:1 for pressures and temperature. Quality Assurance Program and calibration procedures meet the requirements for ANSI/NCSL Z540-1, ISO 17025, 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.

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

Any calibration due date shown is specified by the customer. The enclosed ADM Calibration Standards for Pressure and Temperature form is an integral part of this calibration and must remain with this Certificate of Calibration.

Calibration Technician(s): B. Lu Calibration Date: 02/24/2023

Calibration Approved by: m. Ramirez Title: Cal Mgr Date: 02/24/2023

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Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Order Number: 230186 Serial Number: M22572 Test Type: Initial As-Received Final

ABSOLUTE PRESSURE STANDARDS

ADM #02-R	S/N: 41741/42451	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/28/22	Due Date: 06/2023
ADM #04-R	S/N: 41743/42453	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/19/21	Due Date: 02/2023
ADM #06-R	S/N: 41742/42452-1	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #08-R	S/N: 42186/43328	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/26/22	Due Date: 05/2023
ADM #10-R	S/N: 42203/43352	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #12A-R	S/N: 45605/48491	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/01/22	Due Date: 08/2023
ADM #14-R	S/N: 43412/45043-2	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/28/22	Due Date: 09/2023
ADM #16-R	S/N: 43413/45044	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/27/22	Due Date: 03/2023
ADM #18-R	S/N: 44581/46845	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/26/21	Due Date: 11/2022
ADM #20-R	S/N: 44582/46847	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/07/22	Due Date: 07/2023
#02-R, 04-R, 06-R, 08-R, 10-R, 12A-R, 14-R, 16-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)		Range: 0-30 psia		Resolution: 0.01	Uncertainty: < 0.0358
#18-R, 20-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)		Range: 0-60 in Hg		Resolution: 0.001	Uncertainty: < 0.0358

DIFFERENTIAL PRESSURE STANDARDS

ADM #01-L	S/N: 41739/42449	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/28/22	Due Date: 06/2023
ADM #01-R	S/N: 41739/42446	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/29/22	Due Date: 06/2023
ADM #02-L	S/N: 41741/42454	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/28/22	Due Date: 06/2023
ADM #03A-L	S/N: 45570/48461	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 02/2023
ADM #03A-R	S/N: 45570/48460	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 02/2023
ADM #04-L	S/N: 41743/42456	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/23/21	Due Date: 02/2023
ADM #05-L	S/N: 41740/42450	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #05-R	S/N: 41740/42447	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #06-L	S/N: 41742/42455	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #07-L	S/N: 42185/42186	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/29/22	Due Date: 05/2023
ADM #07-R	S/N: 42185/43326	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/29/22	Due Date: 05/2023
ADM #08-L	S/N: 42186/43329	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/28/22	Due Date: 05/2023
ADM #09-L	S/N: 42202/43351	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #09-R	S/N: 42202/43350	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #10-L	S/N: 42203/43353	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #11-L	S/N: 43165/44551-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/04/22	Due Date: 08/2023
ADM #11-R	S/N: 43165/44730	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/04/22	Due Date: 08/2023
ADM #12A-L	S/N: 45605/48490-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/03/22	Due Date: 08/2023
ADM #13-L	S/N: 43415/45041	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/11/22	Due Date: 09/2023
ADM #13-R	S/N: 43415/45039	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/11/22	Due Date: 09/2023
ADM #14-L	S/N: 43412/45045	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/11/22	Due Date: 09/2023
ADM #15-L	S/N: 43416/45042	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 02/07/22	Due Date: 03/2023
ADM #15-R	S/N: 43416/45040-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 02/07/22	Due Date: 03/2023
ADM #16-L	S/N: 43413/45046	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 02/07/22	Due Date: 03/2023
ADM #17-L	S/N: 44579/46842	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 11/2022
ADM #17-R	S/N: 44579/46841	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 11/2022
ADM #18-L	S/N: 44581/46846	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 11/2022
ADM #19-L	S/N: 44580/46844	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/14/22	Due Date: 07/2023
ADM #19-R	S/N: 44580/46843	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/14/22	Due Date: 07/2023
ADM #20-L	S/N: 44582/46848	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/14/22	Due Date: 07/2023
#01-L, 03A-L, 05-L, 07-L, 09-L, 11-L, 13-L, 15-L, 17-L, 19-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, 03A-R, 05-R, 07-R, 09-R, 11-R, 13-R, 15-R, 17-R, 19-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, 12A-L, 14-L, 16-L, 18-L, 20-L	Rated Accuracy: > 0.06% fs (0.03 in wc)		Range: 0.0-50.0 in wc		Res.: 0.001	Uncertainty: < 0.0346

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EFC223174

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Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Customer Order Number, Meter Serial Number, and Test Type are referenced on page 1

LOW VELOCITY EQUIVALENT CONFIRMATION STANDARDS

Vel Eqv Transfer Standard S/N: M02009	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 08/16/22	Due Date: 08/2023
Vel Eqv Transfer Standard S/N: M02903	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/28/22	Due Date: 12/2023
Vel Eqv Transfer Standard S/N: M10839	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/22	Due Date: 10/2023
Vel Eqv Transfer Standard S/N: M10840	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/22	Due Date: 10/2023
Vel Eqv Transfer Standard S/N: M10897	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 01/25/23	Due Date: 01/2024
Vel Eqv Transfer Standard S/N: M10901	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, inc.	Calibration Date: 12/29/22	Due Date: 12/2023
Vel Eqv Transfer Standard S/N: M13492	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, inc.	Calibration Date: 08/16/22	Due Date: 08/2023
Vel Eqv Transfer Standard S/N: M19325	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 06/30/22	Due Date: 06/2023
Rated Accuracy: Velocity $\pm 1.5\% \pm 3.5$ fpm		Range: 100-5000 fpm Resolution: 0.1	Uncertainty: <5.00 fpm at 100 fpm; <7.50 fpm at 500 fpm	

TEMPERATURE STANDARDS

RTD Simulator S/N: 249	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 250	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 253	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 254	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 256	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 257	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 292	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 293	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 294	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 313	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/25/22	Due Date: 03/2026
RTD Simulator S/N: 314	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/25/22	Due Date: 03/2026
RTD Simulator S/N: 315	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/25/22	Due Date: 03/2026
RTD Simulator S/N: 316	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 06/06/22	Due Date: 05/2026
RTD Simulator S/N: 317	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/23/22	Due Date: 05/2026
RTD Simulator S/N: 318	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/23/22	Due Date: 05/2026
Rated Accuracy: 0.025% of setting		Range: 100.00 Ω to 11111.10 Ω	Resolution: 0.01 Ω	Uncertainty: ≤ 32 ppm	

Thermometer #1 S/N 8A089/Thermistor S/N A410660	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 02/24/22	Due Date: 02/2024
Thermometer #2 S/N 8B104/Thermistor S/N 871507	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 12/07/22	Due Date: 11/2024
Thermometer #5 S/N B11780/Thermistor S/N B10505	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 05/16/22	Due Date: 05/2024
Thermometer #6 S/N B11782/Thermistor S/N B10509	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 06/09/22	Due Date: 06/2024
Thermometer #7 S/N B49938/Thermistor S/N B482202	Model 1504/5610	Mfgd and Calibrated by Fluke		Calibration Date: 10/13/21	Due Date: 10/2023
Rated Accuracy(combined): 0.0324° F		Range: 32° F to 176° F	Resolution: 0.001° F	Combined Uncertainty with Baths: ≤ 0.040 ° F	

Temp Transfer Standard S/N M00136	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/22	Due Date: 10/2023
Temp Transfer Standard S/N M96100	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 03/15/22	Due Date: 03/2023
Rated Accuracy: 0.03° F		Range: 33° F to 158° F	Resolution: 0.01° F	Uncertainty: < 0.023° F
Total combined Uncertainty for MultiTemp and TemProbe testing : ≤ 0.046 ° F				

This form must remain with the Certificate of Calibration corresponding to the Customer Order Number and Meter Serial Number referenced on page 1.

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TEMPROBES CALIBRATION TEST REPORT

Customer ID: 022037

Multimeter Serial Number: M 22572

Customer: BISON ENGINEERING, INC. City: HELENA

State: MT Order #: 230186

Test By: B. Lu Date: 02/15/2023

Calibration Due Date: 02/2025

Rh: 26 % Ambient Temperature: 71 ° F Barometric Pressure 28.44 in Hg

TEMPERATURE TEST (° F) TEMPROBE TOLERANCE = ± 0.3° F
 TEMPROBE MODEL NUMBER: ADT442 TEMPROBE ID#: TP-M22572

Test(s) with Customer's Meter Test(s) with In-house Temperature Calibration Standard All Within Specification Yes No

Temperature Standard Thermometer #1 S/N 8A089 / Thermistor S/N A410660	Set Point: <u>35° F</u> 95° F 155° F
Temperature Standard Thermometer #2 S/N 8B104 / Thermistor S/N 871507	Set Point: 35° F 95° F 155° F
Temperature Standard Thermometer #5 S/N B11780 / Thermistor S/N B10505	Set Point: 35° F 95° F <u>155° F</u>
Temperature Standard Thermometer #6 S/N B11782 / Thermistor S/N B10509	Set Point: 35° F 95° F 155° F
Temperature Standard Thermometer #7 S/N B49938 / Thermistor S/N B482202	Set Point: 35° F <u>95° F</u> 155° F
Temperature Standard AirData Multimeter S/N M00136	Set Point: 35° F 95° F 155° F
Temperature Standard AirData Multimeter S/N M96100	Set Point: <u>35° F</u> <u>95° F</u> <u>155° F</u>

Approx Set Point	Uncertainty ° F	Thermometer/Thermistor ° F	TempProbe ° F	Offset ° F
35 ° F	0.00324	<u>35.0</u>	<u>35.0</u>	<u>.0</u>
95 ° F	0.00324	<u>95.0</u>	<u>94.9</u>	<u>-.1</u>
155 ° F	0.00324	<u>155.0</u>	<u>155.1</u>	<u>.1</u>

TEMPERATURE TEST (° F) TEMPROBE TOLERANCE = ± 0.3° F
 TEMPROBE MODEL NUMBER: ADT446 TEMPROBE ID#: TP-M22572

Test(s) with Customer's Meter Test(s) with In-house Temperature Calibration Standard All Within Specification Yes No

Temperature Standard Thermometer #1 S/N 8A089 / Thermistor S/N A410660	Set Point: <u>35° F</u> 95° F 155° F
Temperature Standard Thermometer #2 S/N 8B104 / Thermistor S/N 871507	Set Point: 35° F 95° F 155° F
Temperature Standard Thermometer #5 S/N B11780 / Thermistor S/N B10505	Set Point: 35° F 95° F <u>155° F</u>
Temperature Standard Thermometer #6 S/N B11782 / Thermistor S/N B10509	Set Point: 35° F 95° F 155° F
Temperature Standard Thermometer #7 S/N B49938 / Thermistor S/N B482202	Set Point: 35° F <u>95° F</u> 155° F
Temperature Standard AirData Multimeter S/N M00136	Set Point: 35° F 95° F 155° F
Temperature Standard AirData Multimeter S/N M96100	Set Point: <u>35° F</u> <u>95° F</u> <u>155° F</u>

Approx Set Point	Uncertainty ° F	Thermometer/Thermistor ° F	TempProbe ° F	Offset ° F
35 ° F	0.00324	<u>35.0</u>	<u>35.0</u>	<u>.0</u>
95 ° F	0.00324	<u>95.0</u>	<u>95.0</u>	<u>.0</u>
155 ° F	0.00324	<u>155.0</u>	<u>155.1</u>	<u>.1</u>

Procedure used: Procedure for Calibration/Recalibration of MultiTemps and/or TempProbes SIP-CP14 Rev: 03 Dated: 07/31/14. There were no additions to or deviations from the calibration procedure during this calibration process.

Calibration standards used by Shortridge Instruments, Inc. are traceable to NIST (National Institute of Standards and Technology). Calibration is performed in accordance with ANSI/NCSL Z540-1, ISO 17025, MIL-STD 45662A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. 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 AirData Multimeters.

The enclosed ADM or HDM Calibration Standards form(s) is/are an integral part of this calibration and must remain with this Certificate of Calibration. Any calibration due date shown is specified by the customer.

Calibration Approved by: m. Ramirez Title: Cal Mgr. Date: 02/24/2023

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Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Order Number: 230186 Serial Number: TP-M22572 Test Type: Initial As-Received Final

ABSOLUTE PRESSURE STANDARDS

ADM #02-R	S/N: 41741/42451	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/28/22	Due Date: 06/2023
ADM #04-R	S/N: 41743/42453	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/19/21	Due Date: 02/2023
ADM #06-R	S/N: 41742/42452-1	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #08-R	S/N: 42186/43328	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/26/22	Due Date: 05/2023
ADM #10-R	S/N: 42203/43352	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #12A-R	S/N: 45605/48491	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/01/22	Due Date: 08/2023
ADM #14-R	S/N: 43412/45043-2	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/28/22	Due Date: 09/2023
ADM #16-R	S/N: 43413/45044	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/27/22	Due Date: 03/2023
ADM #18-R	S/N: 44581/46845	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 11/2022
ADM #20-R	S/N: 44582/46847	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/07/22	Due Date: 07/2023
#02-R, 04-R, 06-R, 08-R, 10-R, 12A-R, 14-R, 16-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)		Range: 0-30 psia		Resolution: 0.01	Uncertainty: < 0.0358
#18-R, 20-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)		Range: 0-60 in Hg		Resolution: 0.001	Uncertainty: < 0.0358

DIFFERENTIAL PRESSURE STANDARDS

ADM #01-L	S/N: 41739/42449	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/28/22	Due Date: 06/2023
ADM #01-R	S/N: 41739/42446	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/29/22	Due Date: 06/2023
ADM #02-L	S/N: 41741/42454	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/28/22	Due Date: 06/2023
ADM #03A-L	S/N: 45570/48461	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 02/2023
ADM #03A-R	S/N: 45570/48460	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 02/2023
ADM #04-L	S/N: 41743/42456	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/23/21	Due Date: 02/2023
ADM #05-L	S/N: 41740/42450	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #05-R	S/N: 41740/42447	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #06-L	S/N: 41742/42455	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/01/22	Due Date: 09/2023
ADM #07-L	S/N: 42185/42186	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/29/22	Due Date: 05/2023
ADM #07-R	S/N: 42185/43326	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/29/22	Due Date: 05/2023
ADM #08-L	S/N: 42186/43329	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/28/22	Due Date: 05/2023
ADM #09-L	S/N: 42202/43351	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #09-R	S/N: 42202/43350	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #10-L	S/N: 42203/43353	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/07/22	Due Date: 04/2023
ADM #11-L	S/N: 43165/44551-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/04/22	Due Date: 08/2023
ADM #11-R	S/N: 43165/44730	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/04/22	Due Date: 08/2023
ADM #12A-L	S/N: 45605/48490-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/03/22	Due Date: 08/2023
ADM #13-L	S/N: 43415/45041	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/11/22	Due Date: 09/2023
ADM #13-R	S/N: 43415/45039	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/11/22	Due Date: 09/2023
ADM #14-L	S/N: 43412/45045	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/11/22	Due Date: 09/2023
ADM #15-L	S/N: 43416/45042	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 02/07/22	Due Date: 03/2023
ADM #15-R	S/N: 43416/45040-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 02/07/22	Due Date: 03/2023
ADM #16-L	S/N: 43413/45046	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 02/07/22	Due Date: 03/2023
ADM #17-L	S/N: 44579/46842	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 11/2022
ADM #17-R	S/N: 44579/46841	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 11/2022
ADM #18-L	S/N: 44581/46846	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 11/2022
ADM #19-L	S/N: 44580/46844	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/14/22	Due Date: 07/2023
ADM #19-R	S/N: 44580/46843	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/14/22	Due Date: 07/2023
ADM #20-L	S/N: 44582/46848	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/14/22	Due Date: 07/2023
#01-L, 03A-L, 05-L, 07-L, 09-L, 11-L, 13-L, 15-L, 17-L, 19-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, 03A-R, 05-R, 07-R, 09-R, 11-R, 13-R, 15-R, 17-R, 19-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, 12A-L, 14-L, 16-L, 18-L, 20-L	Rated Accuracy: > 0.06% fs (0.03 in wc)		Range: 0.0-50.0 in wc		Res.: 0.001	Uncertainty: < 0.0346

Shortridge Instruments, Inc.

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Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Customer Order Number, Meter Serial Number, and Test Type are referenced on page 1

LOW VELOCITY EQUIVALENT CONFIRMATION STANDARDS

Vel Eqv Transfer Standard S/N: M02009	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 08/16/22	Due Date: 08/2023
Vel Eqv Transfer Standard S/N: M02903	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/28/22	Due Date: 12/2023
Vel Eqv Transfer Standard S/N: M10839	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/22	Due Date: 10/2023
Vel Eqv Transfer Standard S/N: M10840	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/22	Due Date: 10/2023
Vel Eqv Transfer Standard S/N: M10897	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 01/25/23	Due Date: 01/2024
Vel Eqv Transfer Standard S/N: M10901	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/29/22	Due Date: 12/2023
Vel Eqv Transfer Standard S/N: M13492	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 08/16/22	Due Date: 08/2023
Vel Eqv Transfer Standard S/N: M19325	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 06/30/22	Due Date: 06/2023
Rated Accuracy: Velocity $\pm 1.5\% \pm 3.5$ fpm		Range: 100-5000 fpm Resolution: 0.1	Uncertainty: <5.00 fpm at 100 fpm; <7.50 fpm at 500 fpm	

TEMPERATURE STANDARDS

RTD Simulator S/N: 249	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 250	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 253	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 254	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 256	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 257	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 292	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 293	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 294	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 313	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/25/22	Due Date: 03/2026
RTD Simulator S/N: 314	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/25/22	Due Date: 03/2026
RTD Simulator S/N: 315	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/25/22	Due Date: 03/2026
RTD Simulator S/N: 316	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 06/06/22	Due Date: 05/2026
RTD Simulator S/N: 317	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/23/22	Due Date: 05/2026
RTD Simulator S/N: 318	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/23/22	Due Date: 05/2026
Rated Accuracy: 0.025% of setting		Range: 100.00 Ω to 11111.10 Ω	Resolution: 0.01 Ω	Uncertainty: ≤ 32 ppm	

Thermometer #1 S/N 8A089/Thermistor S/N A410660	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 02/24/22	Due Date: 02/2024
Thermometer #2 S/N 8B104/Thermistor S/N 871507	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 12/07/22	Due Date: 11/2024
Thermometer #5 S/N B11780/Thermistor S/N B10505	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 05/16/22	Due Date: 05/2024
Thermometer #6 S/N B11782/Thermistor S/N B10509	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 06/09/22	Due Date: 06/2024
Thermometer #7 S/N B49938/Thermistor S/N B482202	Model 1504/5610	Mfgd and Calibrated by Fluke		Calibration Date: 10/13/21	Due Date: 10/2023
Rated Accuracy(combined): 0.0324° F		Range: 32° F to 176° F	Resolution: 0.001° F	Combined Uncertainty with Baths: $\leq 0.040^\circ$ F	

Temp Transfer Standard S/N M00136	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/22	Due Date: 10/2023
Temp Transfer Standard S/N M96100	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 03/15/22	Due Date: 03/2023
Rated Accuracy: 0.03° F		Range: 33° F to 158° F	Resolution: 0.01° F	Uncertainty: < 0.023° F
Total combined Uncertainty for MultiTemp and TemProbe testing : $\leq 0.046^\circ$ F				

This form must remain with the Certificate of Calibration corresponding to the Customer Order Number and Meter Serial Number referenced on page 1.

Shortridge Instruments, Inc.

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This is the last page of the report.