

Evacuation Slide Test Method

Standardization of the Power Required
for Proper Heat Output of the Furnace;
Elimination of the Heat Flux
Transducer for Calibration

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Problems Associated with Calibration of Furnace Using Heat Flux Transducers

- Different manufacturers calibrate the transducers differently, resulting in different calibration data
- Dust on surface of calorimeter may cause improper heat flux readings
- Continuous measurement of furnace output is not possible during the Evacuation Slide test (can only be measured prior to and after test)
- The use of heat flux transducers to calibrate furnaces is time consuming (lengthy time for transducer to reach steady state)
- Heat flux transducer is required to be recalibrated each year due to aging of the black velvet paint on the surface of the device



Activities

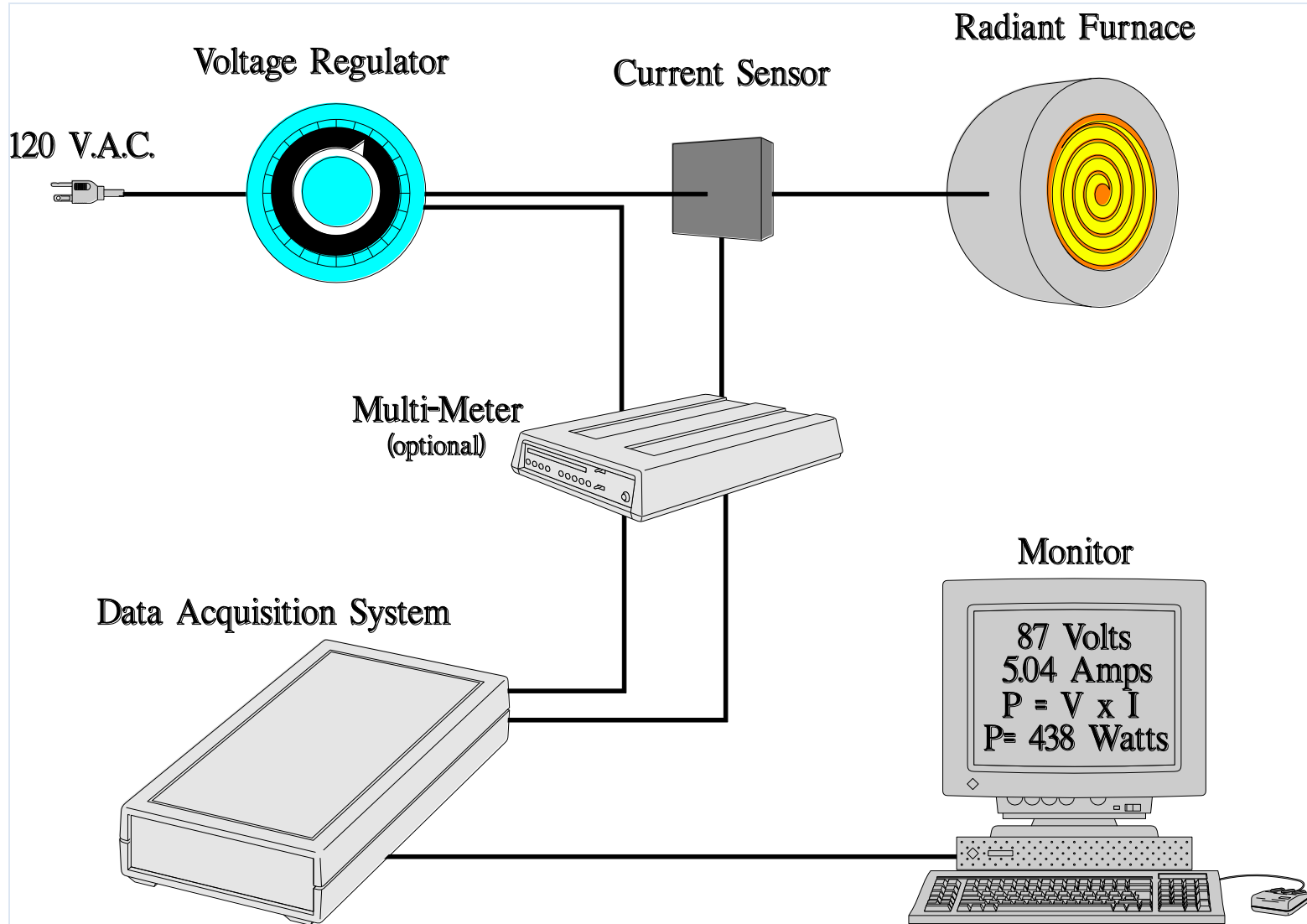
Objective: To maintain the correct heat output of the furnace during tests to compensate for increased coil resistance over time:

Power = V x i, and V = i x r If r ↑ then i ↓, and Power ↓

New methodology allows continuous control of furnace output by monitoring input voltage and current, to ensure consistency of heat output during tests

By continuously controlling the input voltage and maintaining the correct power output during the test, the calibration of the furnace using a heat flux transducer can be eliminated.

Power Output



Recent Activities

Numerous calibration tests were conducted to determine and standardize the power output of the furnace required to produce the correct 1.5 Btu/ft² sec heat flux at the surface of the sample.

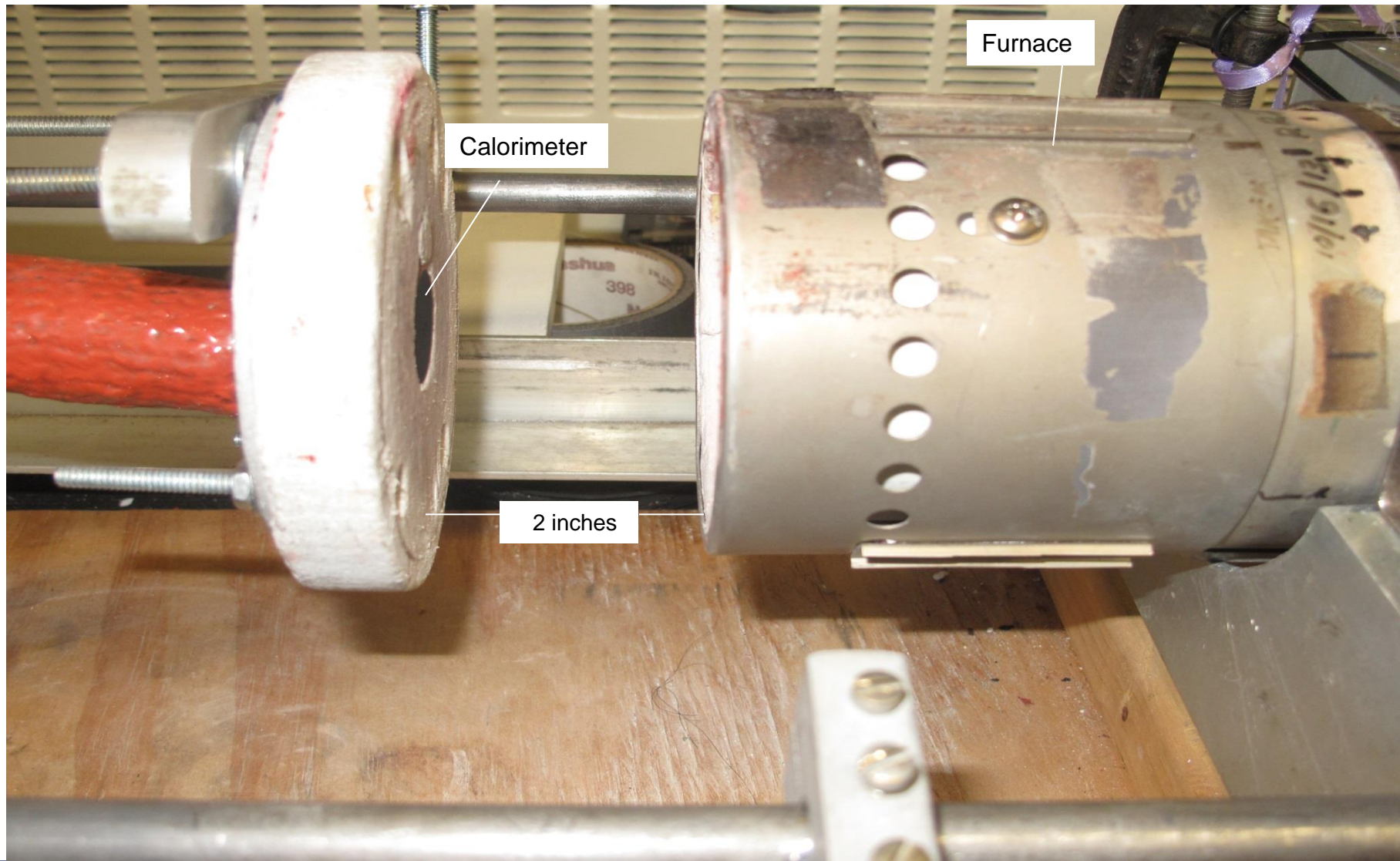
- 3 heat flux transducers (manufactured by Vatell, calibrated by FAATC)
- 2 furnaces (Newport Scientific)
- 3 calibrations conducted on each of the 3 transducers to monitor the heat flux from each furnace (9 tests for each furnace)
- Heat flux transducer located 2 inches in front of the radiant heat furnace
- Furnaces were solid coil type (distance from coil surface to the furnace face was set to 1 ⁵/₈ inches)

Recent Activities

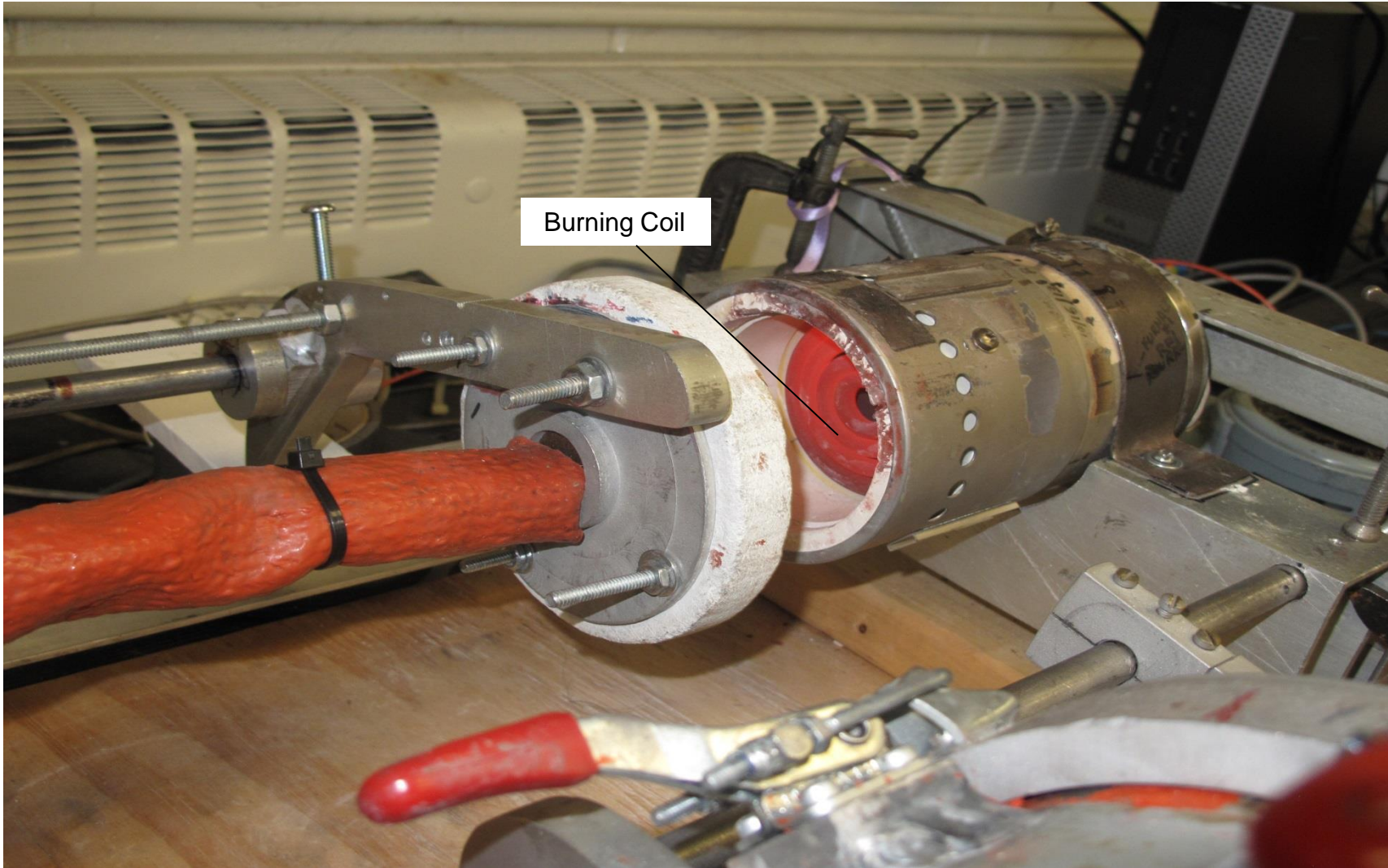
Calibration Procedure:

- 1) **Start the radiant heat furnace and other required instrumentation and allow 30 to 45 minutes for warm up.**
 - 2) **Adjust and find the power output of the furnace to provide a heat flux of 1.5 Btu/ft²sec at the distance of 2 inches in front of the radiant heat furnace.**
- *The testing indicated a power output of 440 +/- 5 Watts was required to produce the correct heat output of the furnace (previously estimated at 438 Watts)**

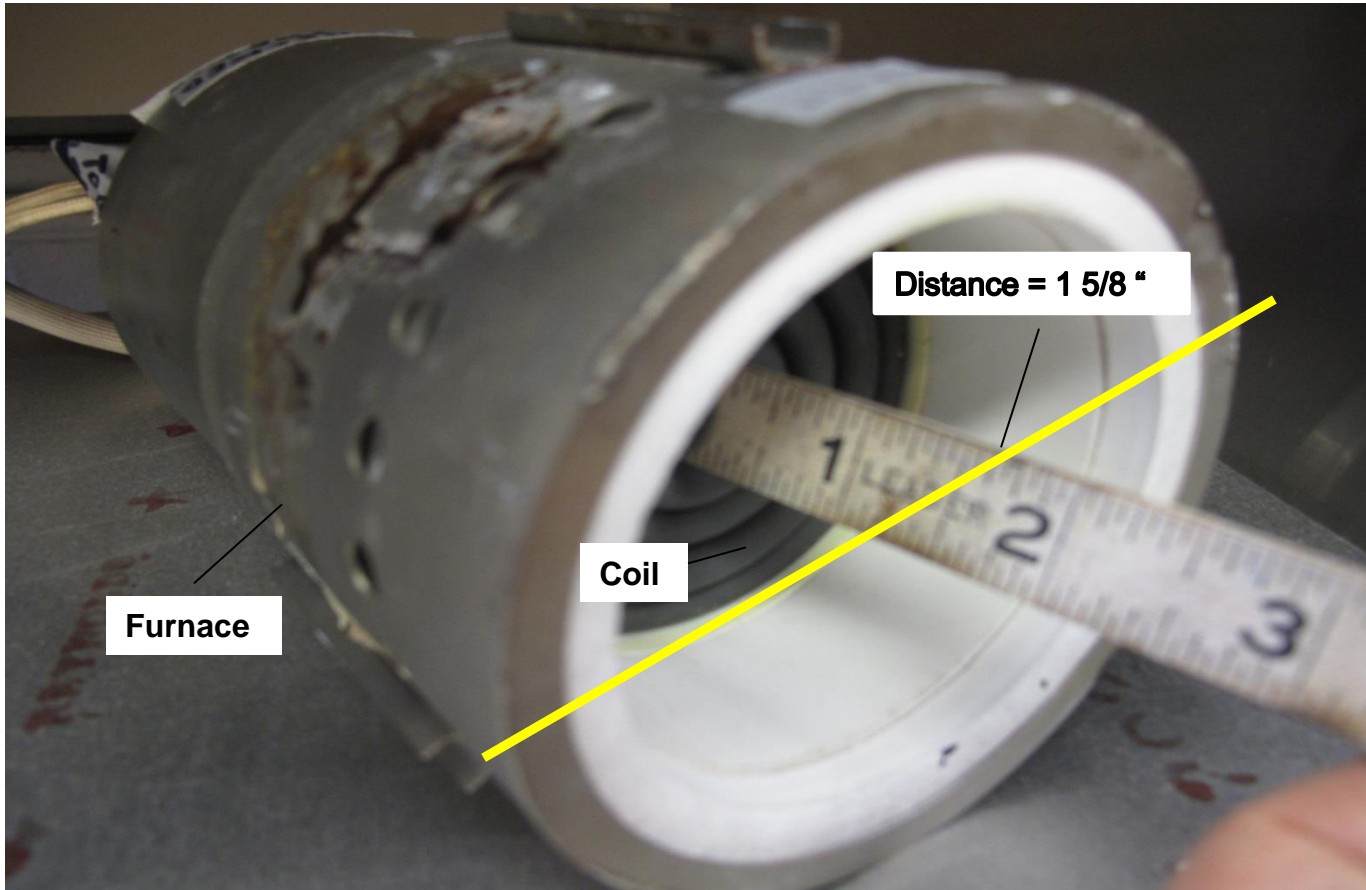
Calorimeter placed 2 inches in front of the radiant heat furnace in the Calibration Test



Calibration Test

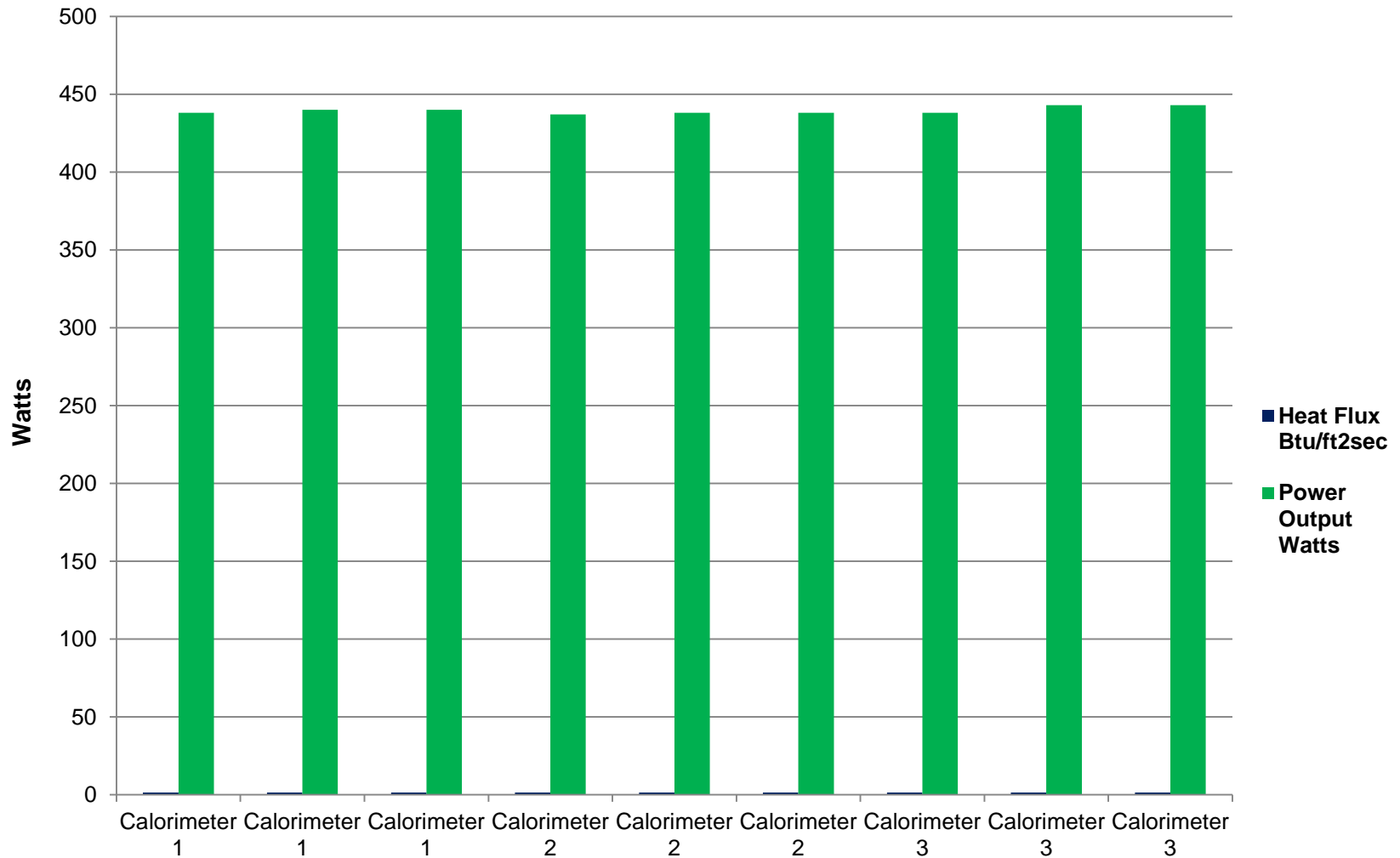


Measurement of Coil Depth



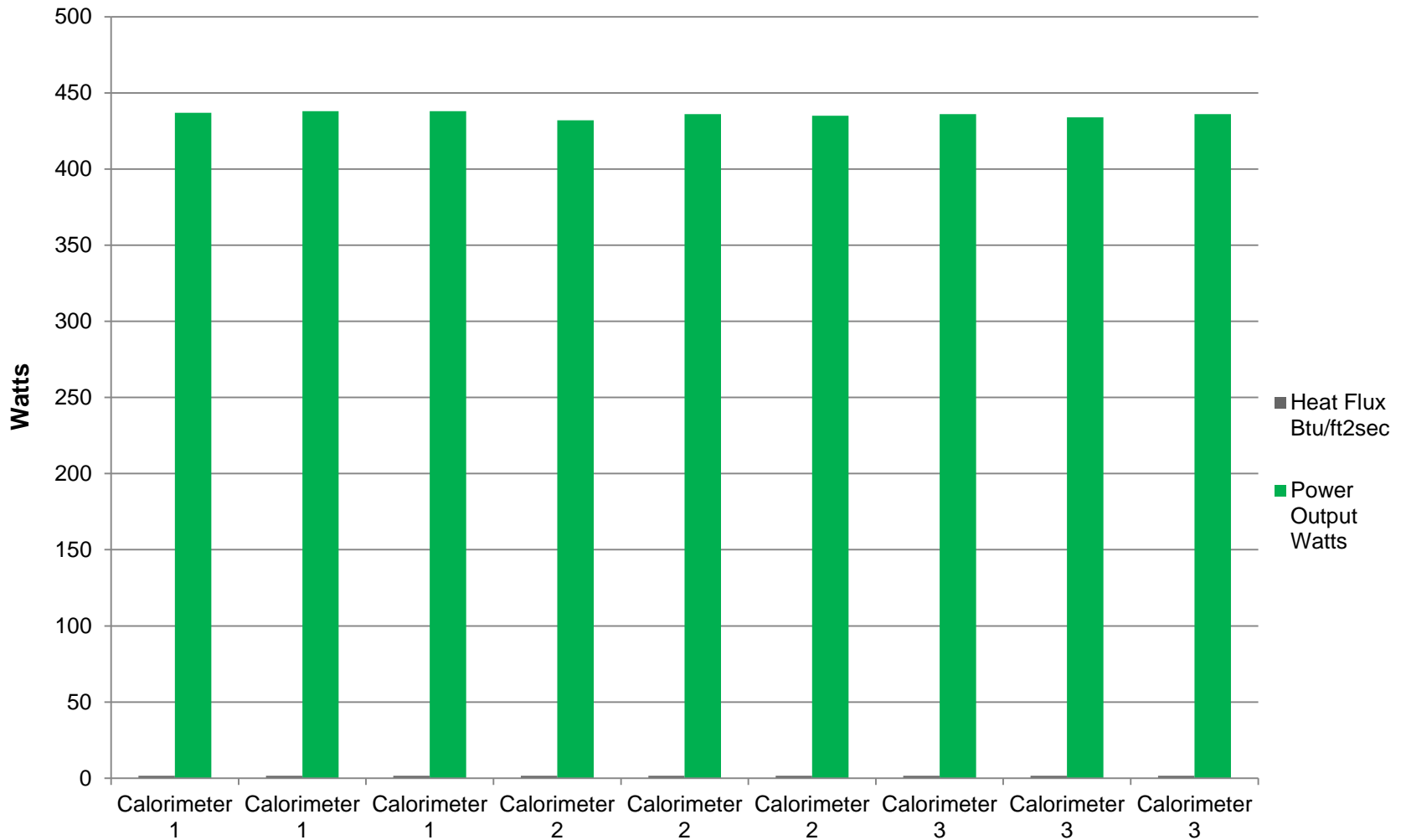
Calibrations of the Furnace # 1

3 Calibration Tests conducted each of the 3 Calorimeter to assess the Power Output of the furnace



Calibrations of the Furnace # 2

3 Calibration Tests conducted each of the 3 Calorimeter to assess the Power Output of the furnace



Test Data Results: Calibrations of 2 different Furnaces using thee calorimeters as a comparison between heat flux and power output

Calorimeter #	Furnace #1		Furnace # 2	
	Heat Flux Btu/ft ² sec	Power Output Watts	Heat Flux Btu/ft ² sec	Power Output Watts
1	1.50	438	1.51	437
	1.52	440	1.51	438
	1.51	440	1.52	438
2	1.53	437	1.52	432
	1.53	438	1.50	436
	1.52	438	1.52	435
3	1.49	438	1.49	436
	1.50	443	1.51	434
	1.51	443	1.51	436

Conclusion

- **The results of the calibration tests showed that the power output of 2 furnaces provided the heat flux monitored by 3 Calorimeters were similar**
- **The power outputs of the 2 furnaces were required to be 440 +/- 5 Watts to produce a heat flux of 1.5 Btu/ft²sec at a location of 2 inches in front of furnace**
- **The steady state heat output of the furnaces was reached quickly (< 10 seconds). By eliminating the need to calibrate the furnace using a heat flux transducer, significant time will be saved during the conduct of the evacuation slide test**
- **Continuous monitoring of the furnace power during testing will ensure consistent application of heat to the test samples, resulting in better test results**



Future Work

- **Task Group participants are scheduled to meet at the FAA on October 21, 2015 to discuss the new recommended test method. The test calibration and evacuation slide tests will be demonstrated at the meeting**
- **Participants will run test calibrations of their furnaces to ensure the power input of 440 +/- 5 watts provides a heat flux of 1.5 Btu/ft²sec at location of 2 inches in front of the radiant heat furnace**
- **Round Robin 6 will be conducted and presented at the next International Aircraft Materials Fire test Working Group meeting, using the updated method of calibration**
- **For Round Robin 6 testing, 2 different materials will be sent to labs, and 3 tests will be conducted on each material**

