

Evacuation SlideTest Method

Round Robin 4

**Tim Marker (for Dung Do)
Fire Safety Branch
FAA Wm. J. Hughes Technical Center
Atlantic City International Airport , NJ 08405**



**Federal Aviation
Administration**



Activities

Power Control Inputs were used to calibrate the radiant heat of the furnace for Round Robin 4 testing.

A Solid Coil Furnace was used during the tests. The distance from the coil to the opening of the furnace is 1 5/8 inches. This was confirmed previously as the correct distance.

Three labs participated in RR4 (FAA, Goodrich, Uretek).

Two different materials were tested. Three tests were performed on each material.

Results of the Calibration of the Radiant Heat Furnaces.

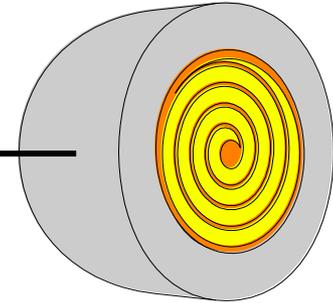
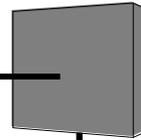
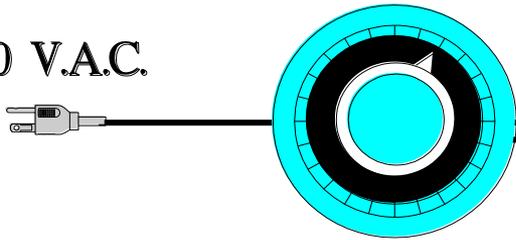
Results of Round Robin 4 Evacuation Slide tests.

Diagram of using the Power Control Input Voltage Regulator

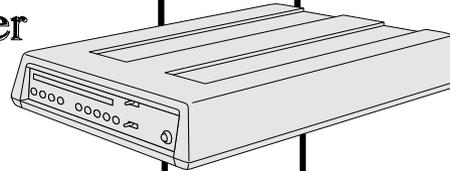
Radiant Furnace

Current Sensor

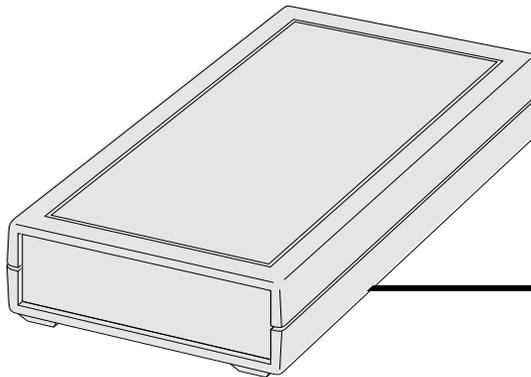
120 V.A.C.



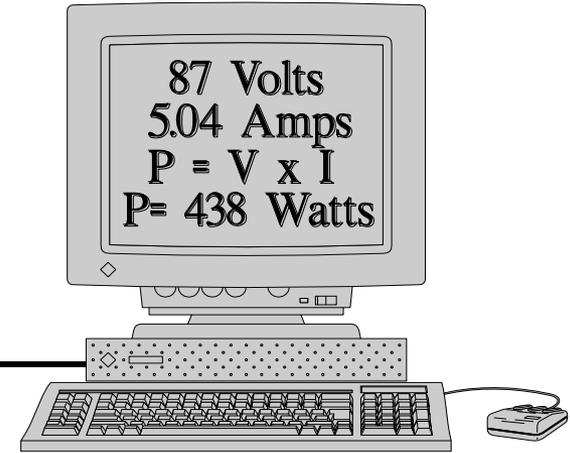
Multi-Meter
(optional)



Data Acquisition System



Monitor



87 Volts
5.04 Amps
 $P = V \times I$
P= 438 Watts

Evacuation Slide Test Method: Power Output to Calibrate the Furnace

Calibration:

Start the radiant heat furnace and other required instrumentation and allow ½ to ¾ hours (30 to 45 minutes) for warm up.

Adjust the transformer voltage to produce a power output of the furnace between 438 watts and 448 watts. This power output produces a heat flux of 1.5 Btu/ft²sec at the distance of 2 inches in front of the radiant heat furnace.

Do not turn off the furnace. Use this radiant heat output for the test

Test Procedure:

After the power output is achieved in the calibration,

Pressurize the cylinder with test specimen to the normal operating pressure and check the distance of the center of the expanded surface of the test specimen, which must be 2 inches in front of the radiant heat furnace. Ensure that the test specimen holds pressure for at least 3 minutes before the test.

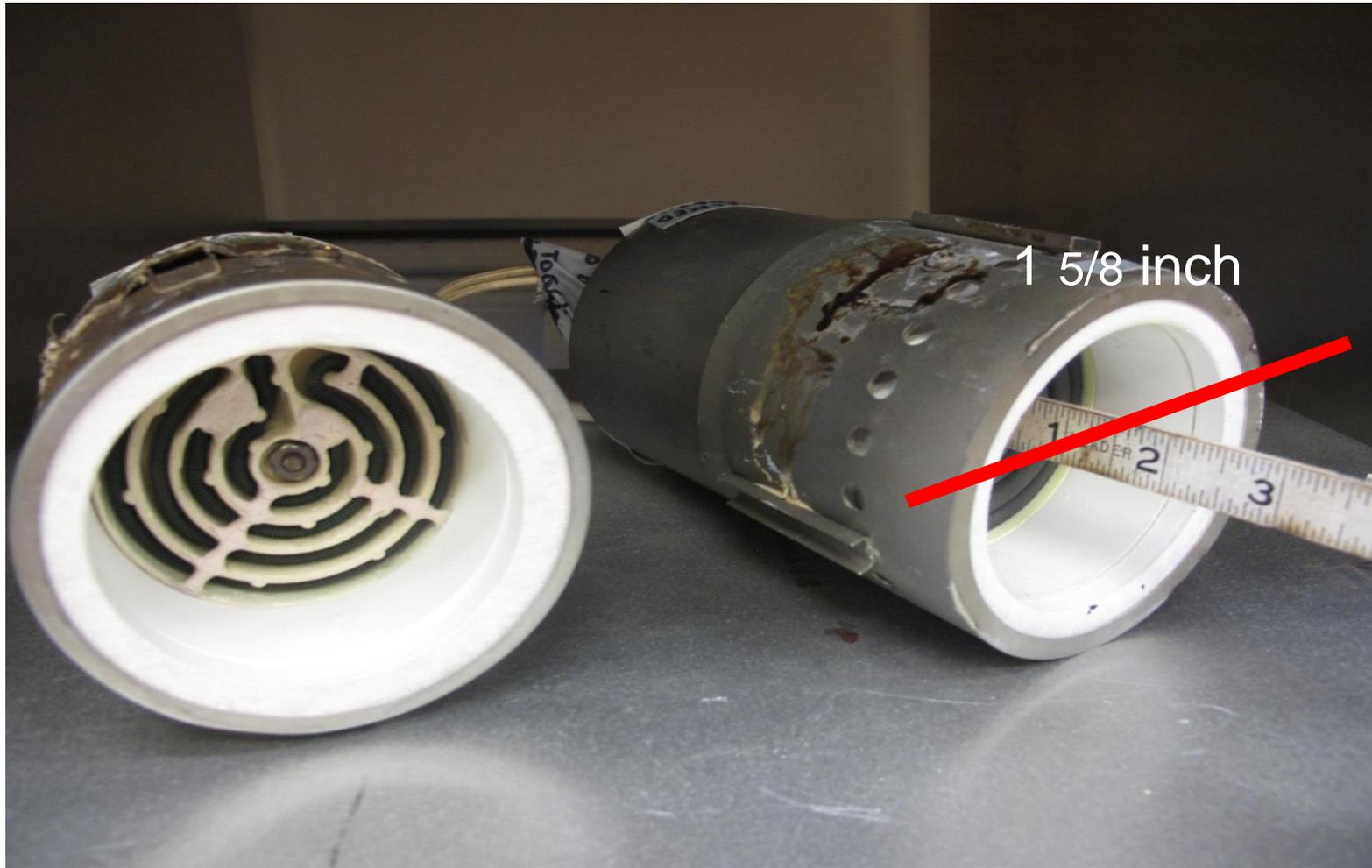
Rotate the pressure cylinder with the test specimen in front of the radiant heat furnace. Simultaneously start the timer

Record time (in seconds) to the first observed pressure loss

Each specimen must maintain correct pressure for a minimum of 180 seconds to pass the test

Repeat the complete Calibration and Test Procedure for each test specimen.

Depth of the heating Coil is the distance from the opening of the furnace to the face of the coil



Standardize the Power Output of the furnaces correspondent to a heat flux of 1.5 Btu/ft²sec at distance 2 inches in front of the radiant heat furnace

Test #	Lab #	Furnace type	Voltage (ACV)	Current (Ampere)	Power (Watts)	Heat Flux (Btu/ft ² sec)	Distance of Calorimeter placed in front of the opening surface of the furnace	Distance from the opening of the furnace to the coil
1	A	Solid p/n: 68086038000	87	5.1	444 to 445	1.49-1.50	2 inches	1 5/8 inches
2	A	Solid p/n: 68086038000	87	5.1	445	1.50- 1.51	2 inches	1 5/8 inches
3	A	Solid p/n: 68086038000	87	5.1	444 to 445	1.49 - 1.51	2 inches	1 5/8 inches
4	B	Solid p/n: 68086040400	86.5	5.14	445	1.51	2 inches	1 5/8 inches
5	B	Solid p/n: 68086040400	86.3	5.18	447	1.51	2 inches	1 5/8 inches
6	B	Solid p/n: 68086040400	86.2	5.16	445	1.51	2 inches	1 5/8 inches
7	C	Solid p/n: 68086038000	79.5	4.626	368	1.5	2 inches Used the Uretak Calorimeter calibrated at Vatell	1 9/16 inches
8	C	Solid p/n: 68086038000	86.8	5.046	438	1.61	2 inches Used the FAA Calorimeter	1 5/8 inches
9	C	Solid p/n: 68086038000	86.8	5.046	438	1.5	2.25 inches Used the FAA Calorimeter	1 5/8 inches

Conclusion

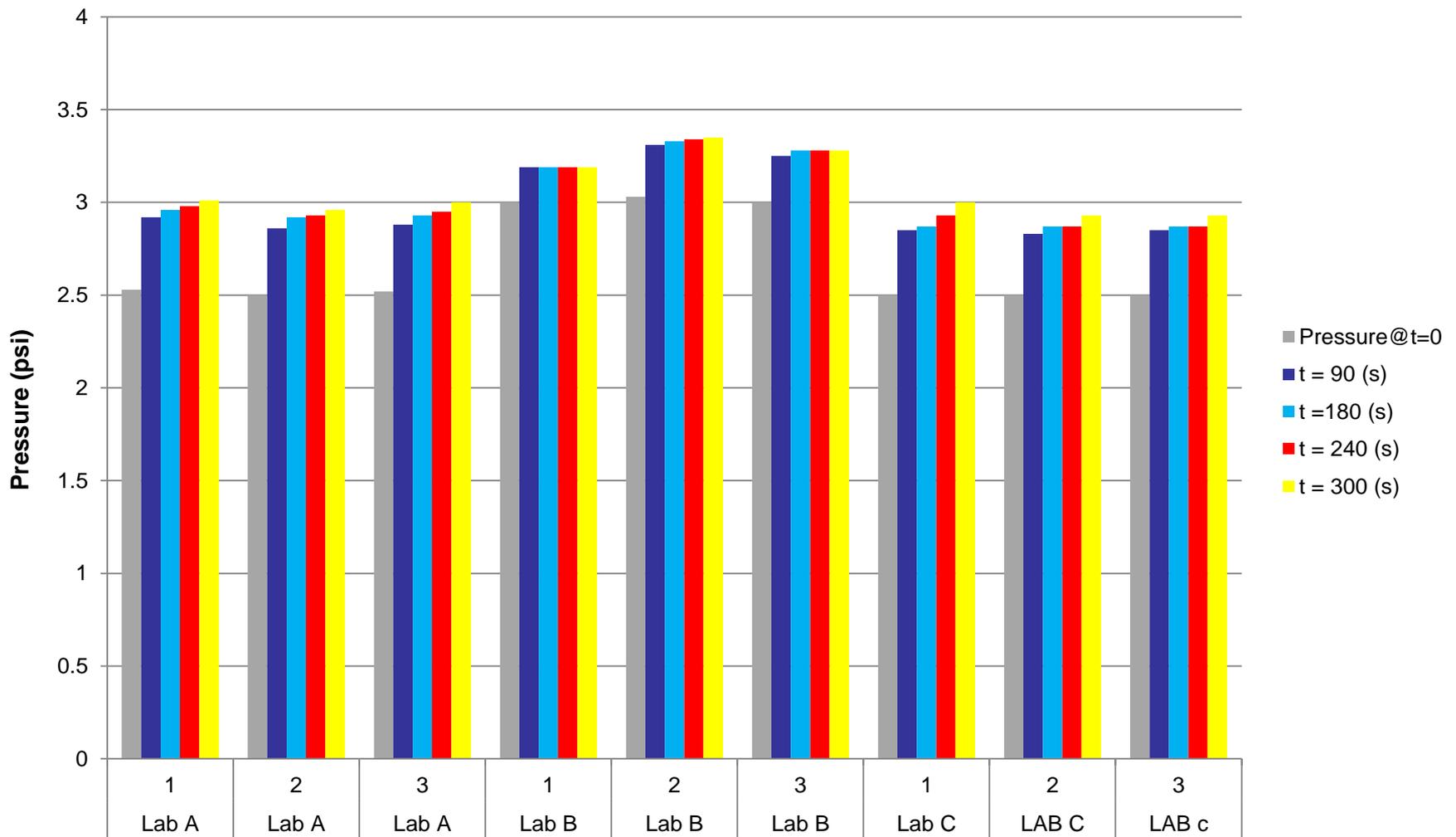
Lab A used power control inputs of about 87 Volts and 5.1 amps (445 Watts) to produce a heat flux of 1.5 Btu/ft²sec at the location of 2 inches in front of the furnace.

Lab B used a voltage of about 86 VAC to produce a heat flux of 1.5 Btu/ft²sec at the location of 2 inches in front of the furnace. These inputs produce an output in the range of 445 to 447 watts.

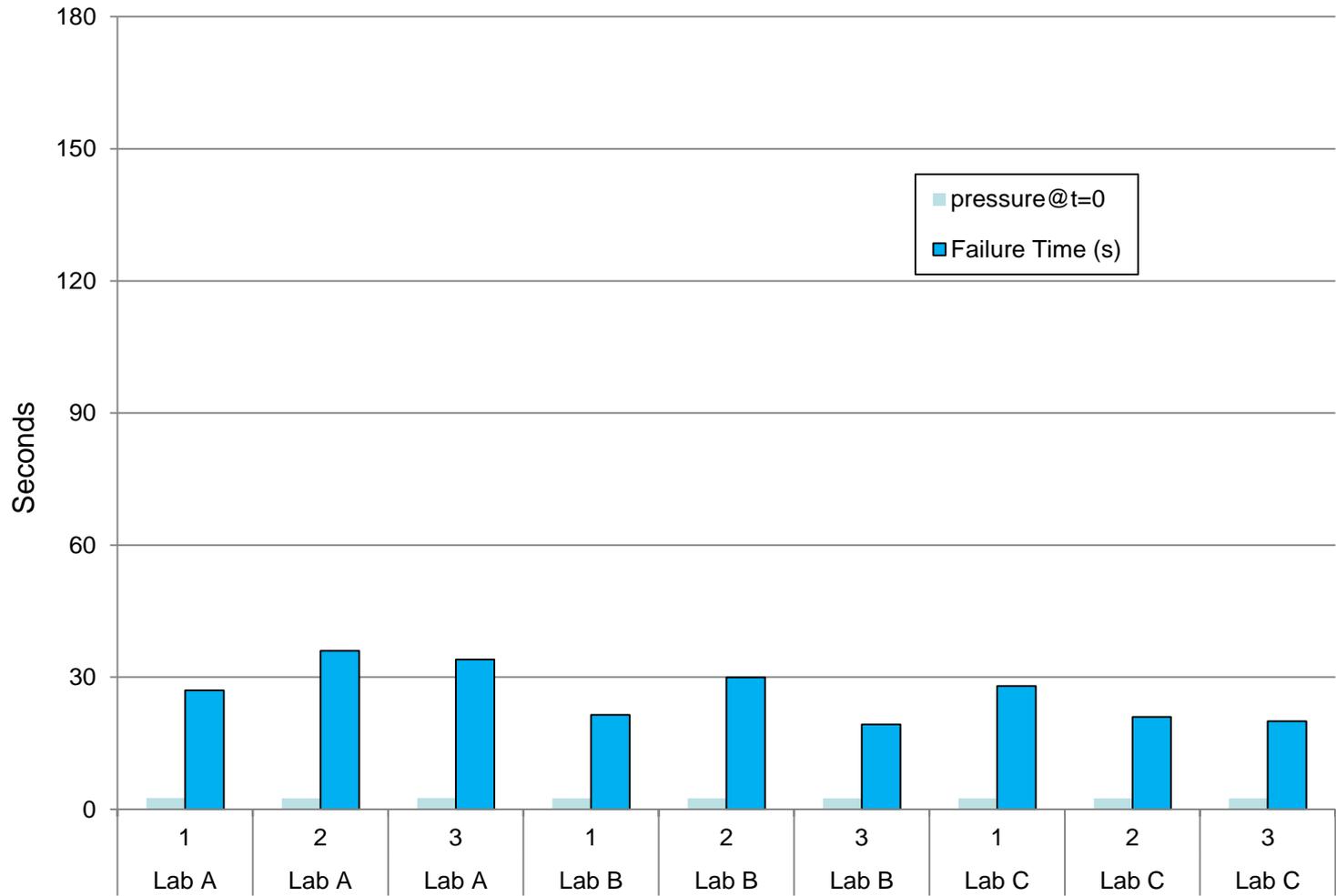
Lab C used the power control inputs of about 86.8 VAC and 5.05 amps (438 Watts) to produce a heat flux of 1.61 Btu/ft²sec (not 1.5 Btu/ft²sec) at the location of 2 inches in front of the furnace. Lab C used the FAA calorimeter to conduct the calibration tests. This calorimeter was used by the FAA for the calibration tests.

The part number of the furnace used by Lab B was different from those of Lab A and the Lab C. The furnace of Lab B had the thermocouple inserted in it.

Yellow/Gray material Test Results (Aluminum coated facing towards radiant heat)



Mustard/Mustard Material Test Results



Yellow/Gray Material Test Data

Test #	Lab #	Furnace #	Material	Pressure at 0 sec	Pressure at 90 secs	Pressure at 180 secs	Pressure at 240 secs	Pressure at 300 secs	Pass/Fail
1	A	Solid p/n: 68086038000	Yellow/Gray	2.53	2.92	2.96	2.98	3.01	Pass
2	A	Solid p/n: 68086038000	Yellow/Gray	2.50	2.86	2.92	2.93	2.96	Pass
3	A	Solid p/n: 68086038000	Yellow/Gray	2.52	2.88	2.93	2.95	3.00	Pass
1	B	Solid p/n: 68086040400	Yellow/Gray	3	3.19	3.19	3.19	3.19	Pass
2	B	Solid p/n: 68086040400	Yellow/Gray	3	3.31	3.33	3.34	3.35	Pass
3	B	Solid p/n: 68086040400	Yellow/Gray	3	3.25	3.28	3.28	3.28	Pass
1	C	Solid p/n: 68086038000	Yellow/Gray	2.5	2.85	2.87	2.93	3	Pass
2	C	Solid p/n: 68086038000	Yellow/Gray	2.5	2.83	2.87	2.87	2.93	Pass
3	C	Solid p/n: 68086038000	Yellow/Gray	2.5	2.85	2.87	2.87	2.93	Pass

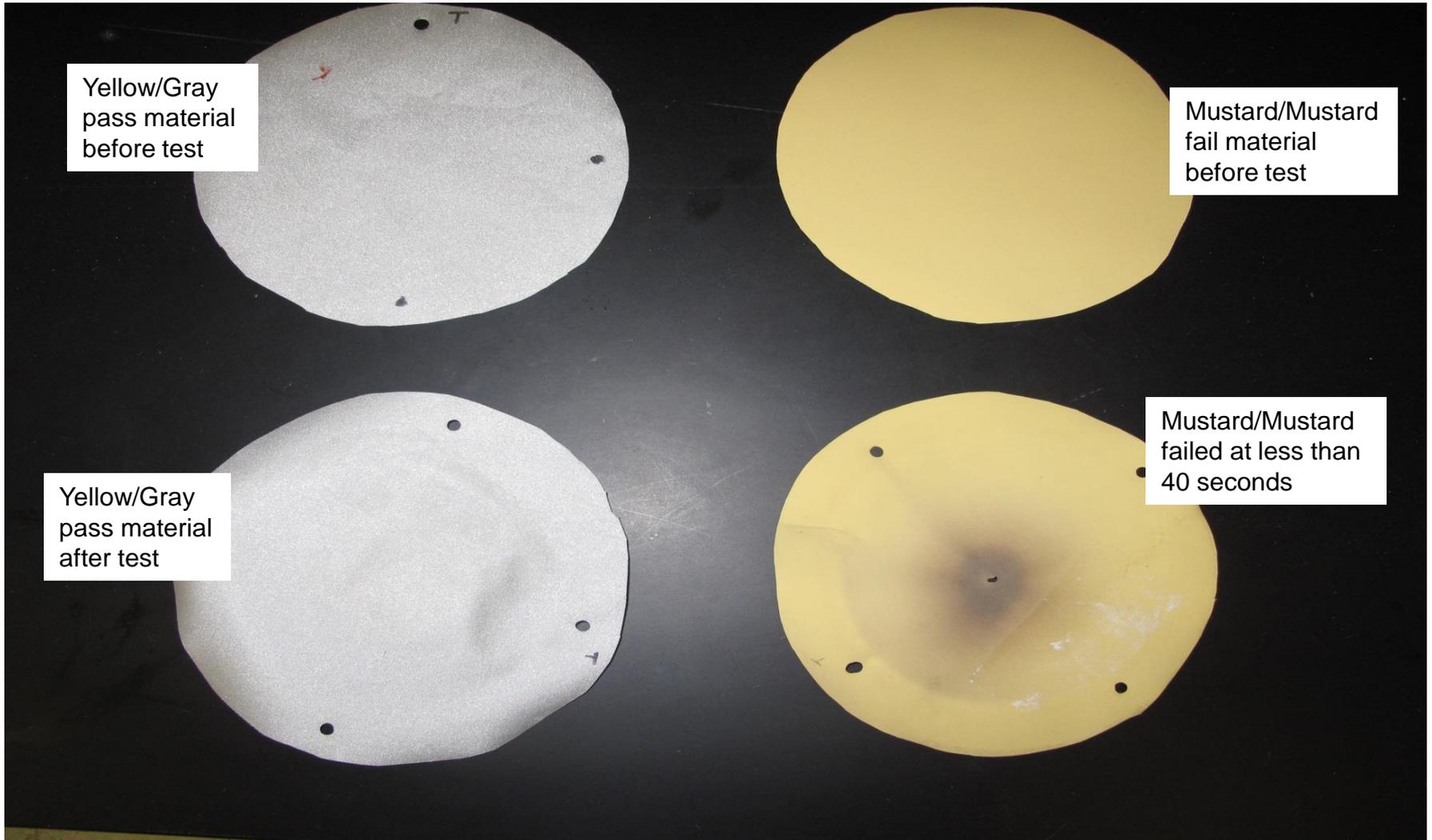


Mustard/Mustard Material Test Data

Test #	Lab #	Furnace type	Material	Pressure (PSI) at t = 0 sec	Pass/Fail
1	A	Solid p/n: 68086038000	Mustard/Mustard	2.53	Failed at 27 secs
2	A	Solid p/n: 68086038000	Mustard/Mustard	2.52	Failed at 36 secs
3	A	Solid p/n: 68086038000	Mustard/Mustard	2.53	Failed at 34 secs
1	B	Solid p/n: 68086040400	Mustard/Mustard	2.50	Failed at 21.46 secs
2	B	Solid p/n: 68086040400	Mustard/Mustard	2.50	Failed at 29.95 secs
3	B	Solid p/n: 68086040400	Mustard/Mustard	2.50	Failed at 19.3 secs
1	C	Solid p/n: 68086038000	Mustard/Mustard	2.50	Failed at 28 secs
2	C	Solid p/n: 68086038000	Mustard/Mustard	2.50	Failed at 21 secs
3	C	Solid p/n: 68086038000	Mustard/Mustard	2.50	Failed at 20 secs



Pass and Fail Materials



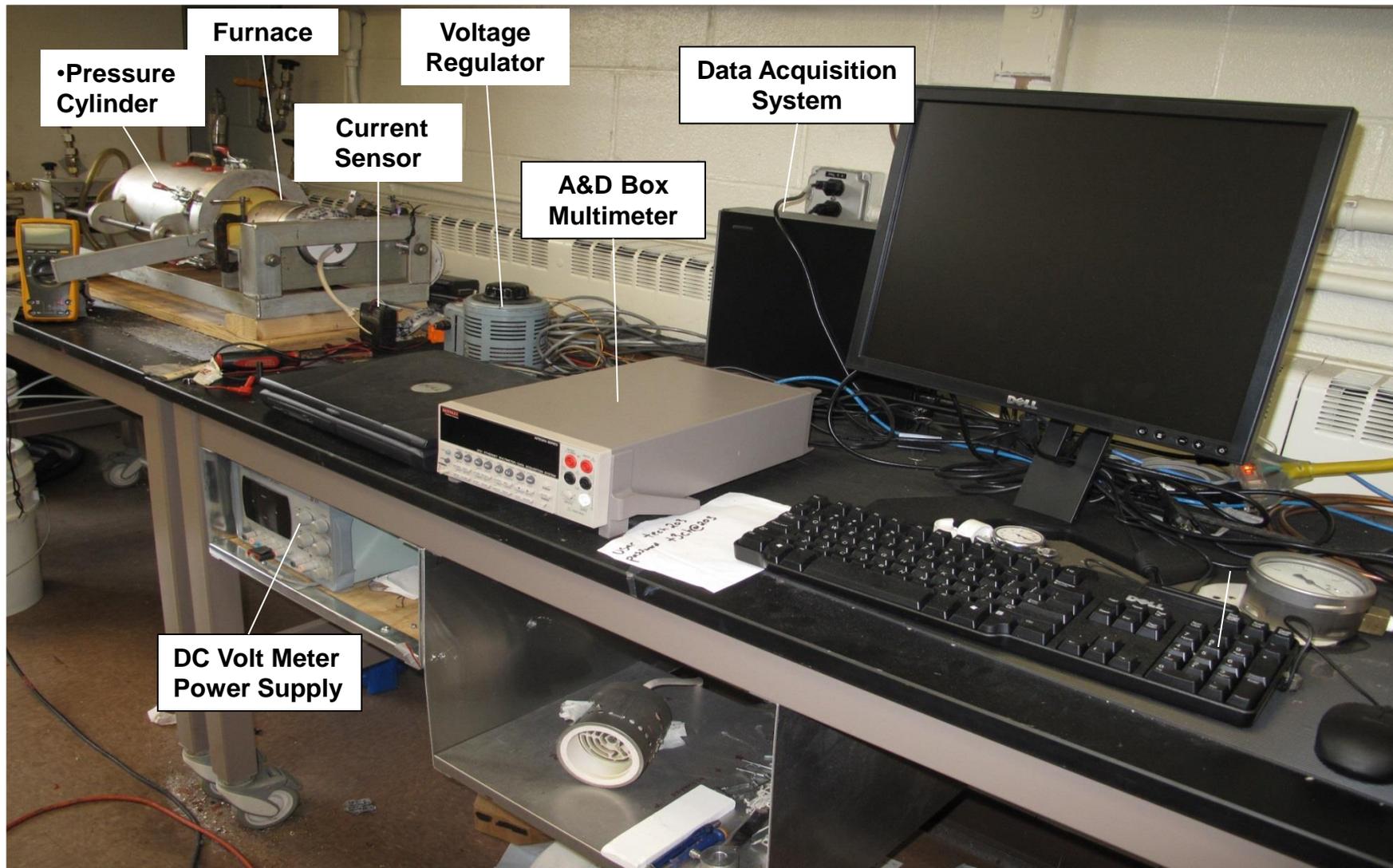
Conclusions

- ***(Yellow/Gray) slide materials with the aluminum coating on the gray side facing the radiant heat furnace that passed the all tests with all labs.***
- ***Lab B conducted the tests on the Yellow/Gray materials with the starting pressure of 3 psi, instead of the required 2.5 psi. These materials still passed all tests.***
- ***(Mustard/Mustard) slide materials all failed the tests with all labs.***
- ***Lab C exposed the expanded surface of the test specimen to a heat flux of 1.61 Btu/ft² sec from the radiant heat furnace, instead of 1.5 Btu/ft² sec as test required.***
- ***Part number of the Furnace of Lab B was different from Lab A and Lab C. Furnace of the Lab B had the thermocouple inserted in it.***

Future Work

- **Evacuation Slide Working Group Meeting** will be held on October, 2015 at the FAA Technical Center to discuss the Current and New Recommended Evacuation Slide Test Method. The use of the power control inputs will be demonstrated at this meeting.
- For the test results , using the power control unit, should be similar between the labs. All participants must use the solid coil furnace (Part # = 68086038000) and the distance of the coil must be 1 ^{5/8} inches from the opening of the furnace.
- Calorimeters of participants must be recalibrated at FAA Technical
- For those labs that did not participate in Round Robin 4, Test Samples will be sent to you. Please contact Dung Do, if you wish to perform the Round Robin 4 Testing.
- FAA will conduct the calibration tests of several furnaces by using several calorimeters to compare their heat fluxes and power inputs.

Equipment set up used to measure the power control input of the furnace



Evacuation Slide Test

