Slide Evacuation Test Method

Standardization of power control for electrical furnace

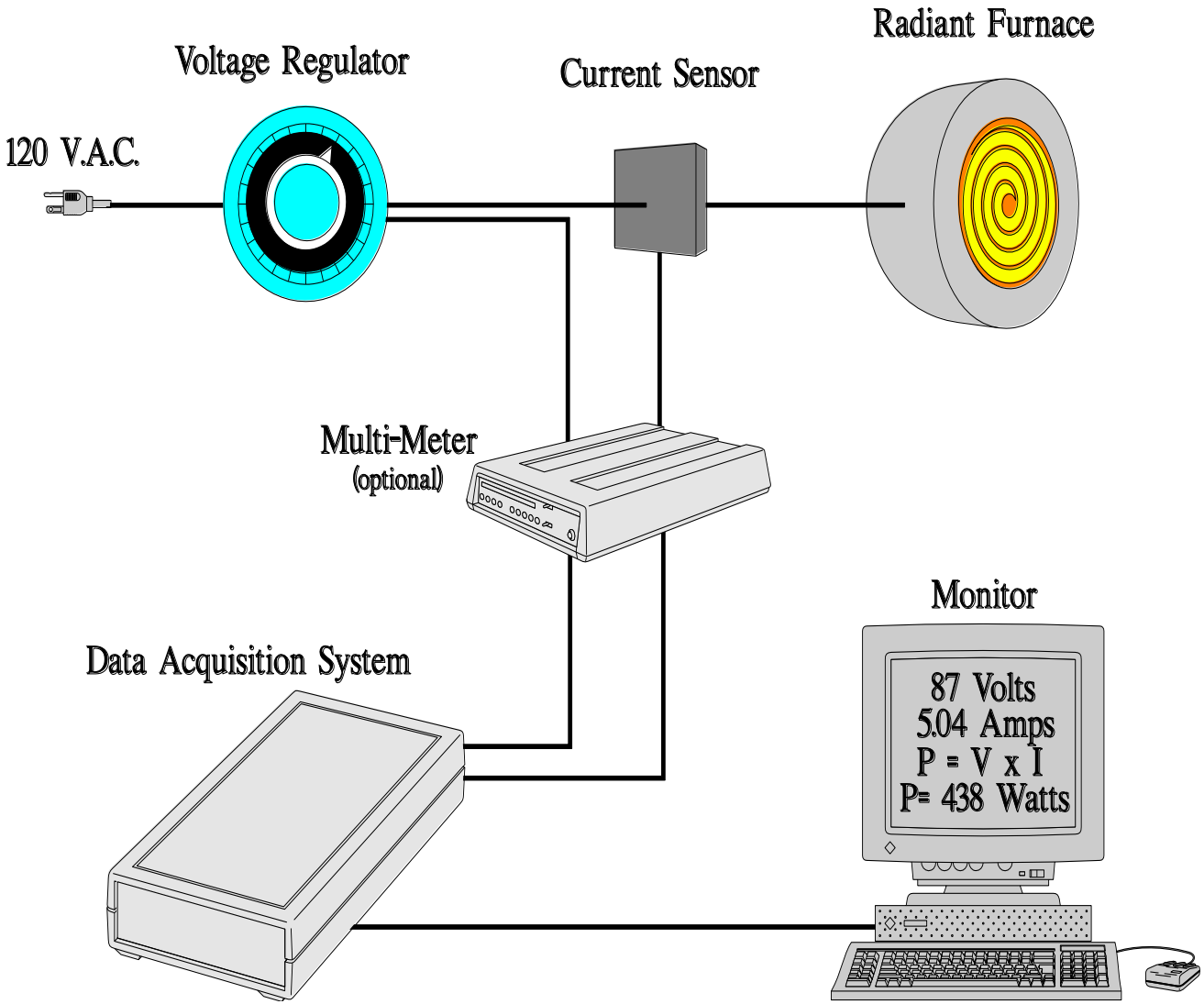
Tim Marker (for Dung Do)
Fire Safety Branch
FAA Wm. J. Hughes Technical Center
Atlantic City International Airport , NJ 08405

Federal Aviation Administration

Activities

- **Tests conducted to assess the power control input of the furnaces for the slide test**
- **Furnaces have different depths of heating coils**
- **Calibrated 3 furnaces (2 solid coil furnaces, 1 wire coil furnace)**
- **Slide Test results of 2 solid coil furnaces.**
- **Two different materials tested. Three tests for each material**

Diagram of using the Power Control Input



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:

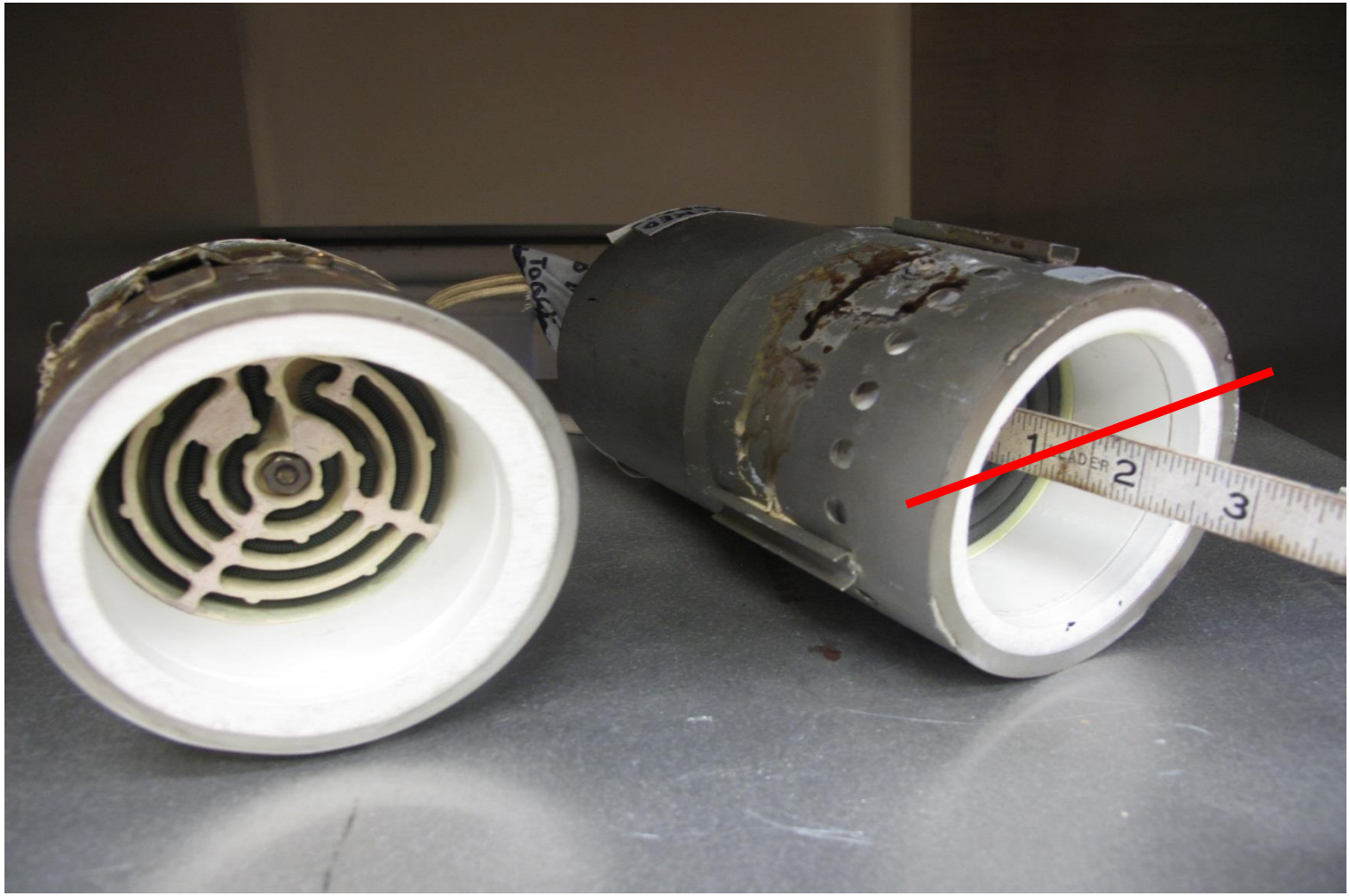
Pressurize the cylinder with test specimen to the normal operating pressure and check the distance of the center of the expanded surface of the test specimen, which is 2 inches in front of the radiant heat furnace. Ensure that the test specimen holds pressure for at least 3 minutes before the test

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 coil



Standardize the Power Output of the furnaces correspondent to a heat flux of 1.5 Btu/ft^{2}sec at distance 2 inches in front of the radiant heat furnace

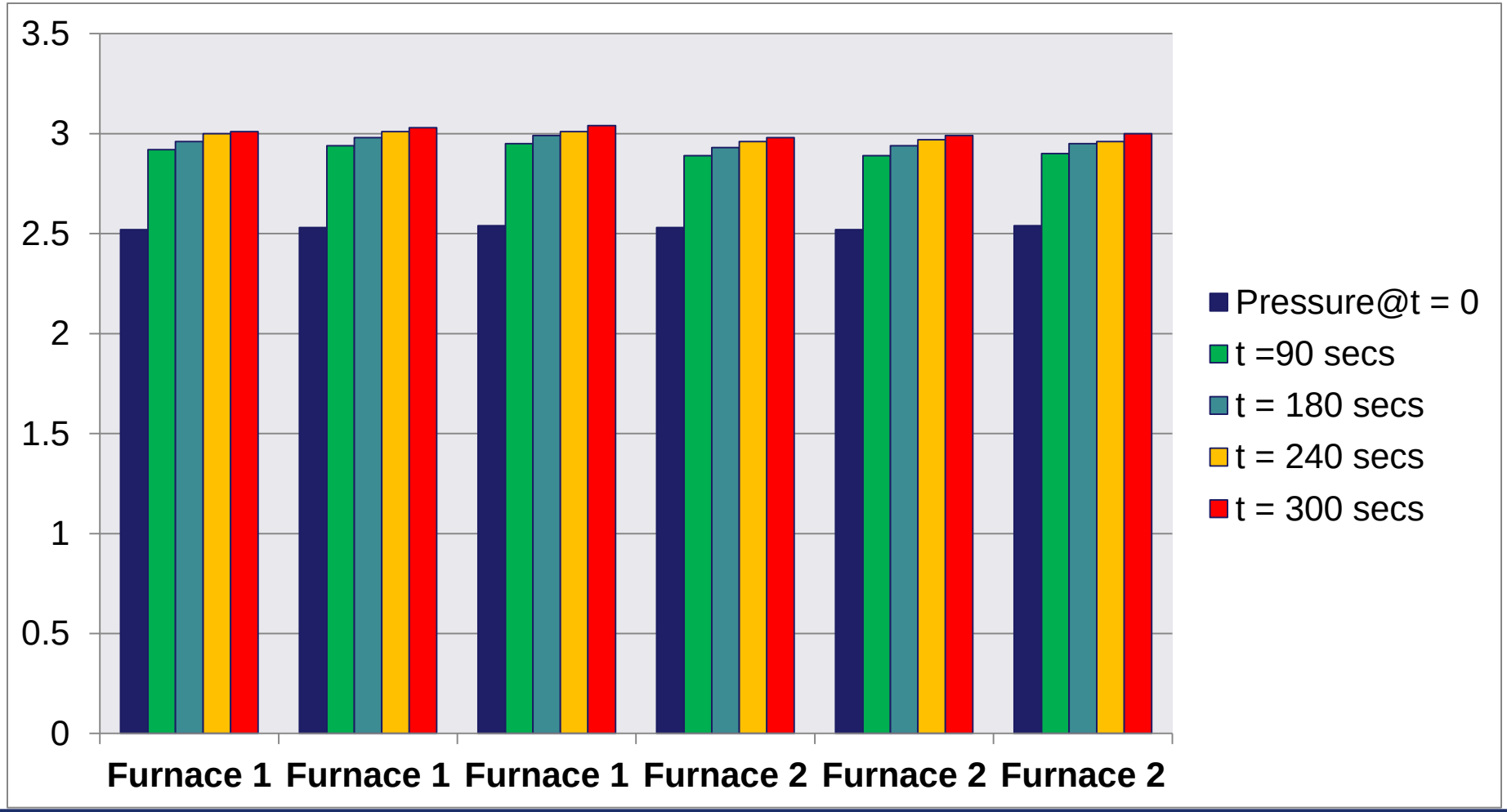
Test #	Furnace #	Furnace Type	Voltage AC	Current (ampere)	Power Output (watts)	Heat Flux (Btu / ft^{2}se)	Distance of Calorimeter placed in front of the radiant heat Furnace	Distance from the opening surface of the furnace to the coil
1	1	Solid Coil	86 - 87	5.04	438 - 440	1.49 – 1.51	2 inches	1 5/8 inches
2	1	Solid Coil	87	5.04 - 5.10	438 – 448	1.50 – 1.53	2 inches	1 5/8 inches
3	1	Solid Coil	86 - 87	5.04 – 5.10	438 - 448	1.51 – 1.52	2 inches	1 5/8 inches
4	2	Solid Coil	89	4.92	438 - 439	1.54	2 inches	1 ½ inches
5	2	Solid Coil	89	4.92	438	1.53 – 1.54	2 inches	1 ½ inches
6	2	Solid Coil	89	4.92	438	1.53 – 1.54	2 inches	1 ½ inches
7	2	Solid Coil	89	4.86	435 - 437	1.51 – 1.52	2 inches	1 ½ inched increased to 1 5/8 inches
8	2	Solid Coil	90	4.86	437 - 438	1.51 – 1.52	2 inches	1 ½ inches increased to 1 5/8 inches
9	2	Solid Coil	90	4.86	437 - 438	1.52	2 inches	1 ½ inches increased to1 5/8 inches
11	3	Wire Coil	108	3.6	389 - 390	1.51 – 1.52	2 inches	1 5/8 inches
12	3	Wire Coil	108	3.6	387 - 388	1.48 - 150	2 inches	1 5/8 inches
13	3	Wire Coil	110	3.72	411	1.58 – 1.60	2 inches	1 5/8 inches

Conclusion

- **Power output for the slide test is changed when the location of the depth of the heating coil in the furnace is changed.**
- **The heating coil is closer to the opening of the furnace producing more radiant heat to the test specimen.**
- **The depth of coil of furnace # 2 is 1 ½ inches and the depth of the coil of furnace # 1 is 1 5/8 inches**
- **The distance of the coil to the opening of furnace # 2 was changed from 1 ½ inches to 1 5/8 inches in order to be the same that of furnace # 1. Their power outputs are the same.**
- **Power outputs of Wire Coil and Solid Coil furnaces are significant different even when they have the same location of the coil in the furnace**
- **For solid coil furnaces, the distance of the coil will be adjusted by pushing back and fort the cover of the furnace. This is due to have the same power output when they have the same distance of the coil from the opening of the furnace**

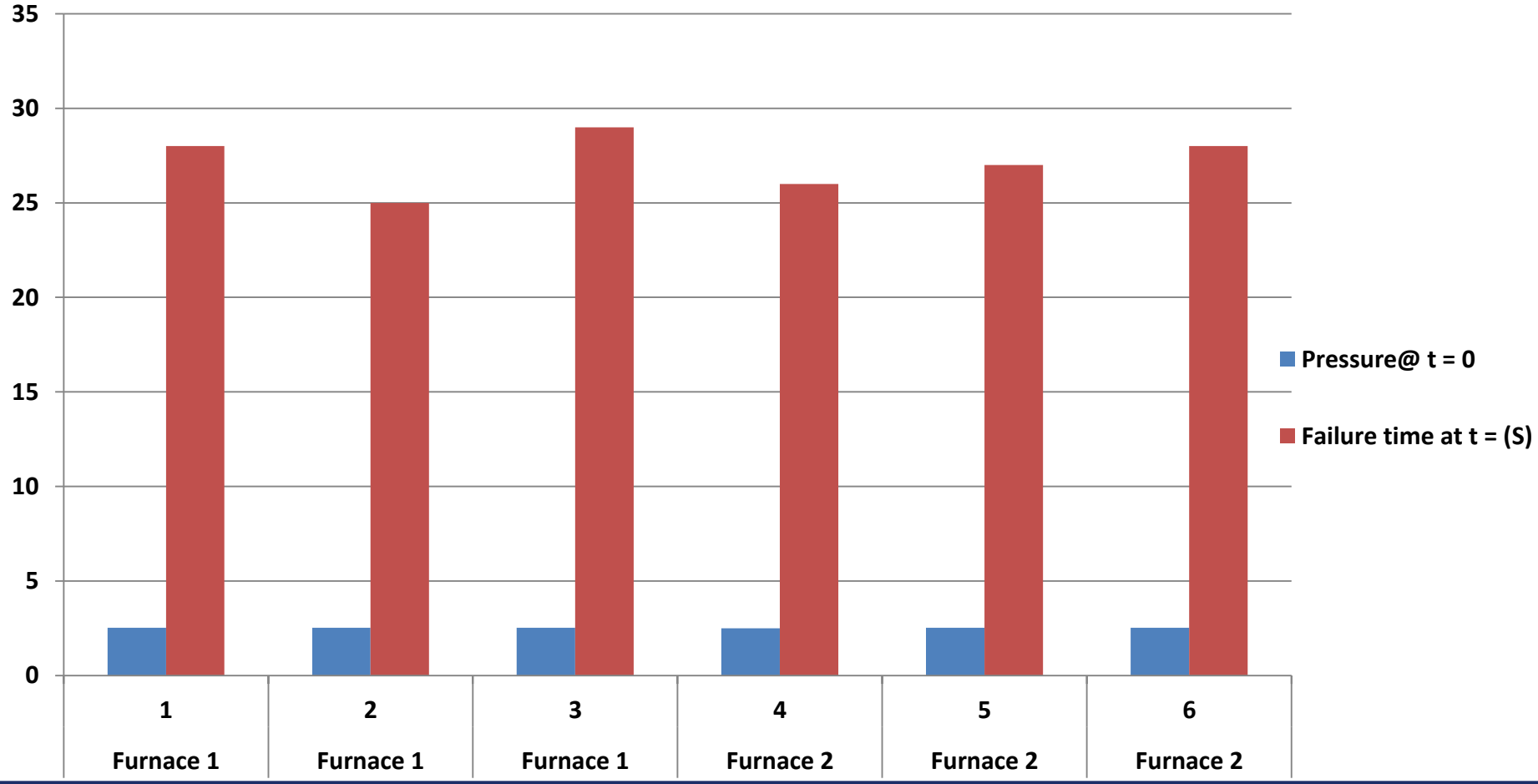
Yellow/Gray Material

Solid Furnace # 1 and Solid Furnace # 2 have same power outputs for the Slide Test and same location of coil in the furnace



Mustard/Mustard Material

Solid furnace # 1 and solid furnace # 2 have the same power control input for the slide test and the same depth of coil for the test



Furnace # 1 and Furnace # 2 have the same locations of the coils of 1 5/8 inches from the opening of the furnace and have same power control input

Test #	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	1	Yellow/Gray	2.52	2.92	2.96	3	3.01	Pass
2	1	Yellow/Gray	2.53	2.94	2.98	3.01	3.03	Pass
3	1	Yellow/Gray	2.54	2.95	2.99	3.01	3.04	Pass
4	2	Yellow/Gray	2.53	2.89	2.93	2.96	2.98	Pass
5	2	Yellow/Gray	2.53	2.89	2.93	2.96	2.98	Pass
6	2	Yellow/Gray	2.52	2.89	2.94	2.97	2.99	Pass
7	2	Yellow/Gray	2.54	2.90	2.95	2.96	3	Pass

Mustard/Mustard

Furnace # 1and Furnace # 2 have the same location of the coil of 1 5/8 inches from the surface of the opening and have the same power control input

Test #	Furnace #	Material	Pressure (PSI) at t = 0 sec	Pressure (PSI)at 90 secs	Pressure (PSI) at 180 secs	Pressure at 240 secs	Pressure at 300 secs	Pass/Fail
1	1	Mustard/Mustard	2.53					Failed at 28 secs
2	1	Mustard/Mustard	2.52					Failed at 25 secs
3	1	Mustard/Mustard	2.52					Failed at 29 secs
4	2	Mustard/Mustard	2.50					Failed at 26 secs
5	2	Mustard/Mustard	2.52					Failed at 27 secs
6	2	Mustard/Mustard	2.53					Failed at 28 secs

Conclusions

- **Furnace 1 and Furnace 2 had the same Power Control Input and the depth of the Coil in the Furnaces**
- **(Yellow/Gray) slide materials with the aluminum coating on the gray side facing the radiant heat furnace passed the tests with both furnaces**
- **(Mustard/Mustard) slide materials failed the tests with both furnaces**
- **Wire Coil Furnace was not used for Slide Test, because it has different the Power output and the same depth of coil of solid coil furnace**

Future Work

- **Participants will use the power output of 437 to 447 watts and the location of the solid coil of 1 5/8 inches from the opening of the solid coil furnace for the slide tests**

- **Tool will be made to measure the distance of the heating coil in the furnace**

- **Round Robin 4 will be conducted in the next meeting**