



March 14, 2017

Mr. Rick Papetti
Aeroseal Product & Application Manager
7989 S Suburban Rd.
Centerville, OH 45458

Our Reference: File SV30831, Project 4787755206

Subject: Verification Testing for Fire and Smoke Dampers After
Exposure to Aeroseal "Duct Seal" Spray

Dear Mr. Papetti:

The following confirms your application for the investigation described herein to develop verification test data on fire and smoke dampers when exposed to your UL Certified Aeroseal "Duct Seal" aerosol duct sealant spray.

This will report the results of the testing.

Aeroseal supplied all of the fire and smoke damper test samples for testing. UL did not select the samples nor determine whether the samples provided were representative of other manufactured products. UL tested the samples in accordance with requirements established by the submitter and in accordance with the noted tests in Standard UL 555. The test results apply only to the samples actually tested.

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GENERAL

The sole purpose of this investigation is the development of fire test data on samples of UL Classified vertically mounted multi-blade dampers equipped with damper operators (electric motors) and curtain type fire dampers. This verification testing contains abbreviated testing strictly for the purpose of providing data relative to exposure of the aerosol spray, and does not constitute a full investigation program of dampers in accordance with UL 555 and UL 555S. The effect of the spray on electrical features, such as motors, actuators, wiring, and the like was outside the scope of this test program. UL tested the samples in accordance with requirements established by the submitter and in accordance with the noted tests in Standard UL 555. The test plan called for the conduct of the following tests on UL Classified fire and smoke damper samples which had been subjected to the Aeroseal spray-applied:

- Fire Endurance Tests

DESCRIPTION

TEST SAMPLES:

Representative samples of UL Classified fire and smoke dampers were submitted by Aeroseal for testing. The samples are summarized below.

Sample	Nom Size, Width by Height, in.	General Description (general description of each damper to be included below)
Damper #1	16 X 16 in.	Multiblade fire smoke damper 3V (single skin) type blades with opposed blade action Galv steel construction Jackshaft design Stainless steel side jamb seals Nonmetallic blade edge seals (sample nos. 1, 2 and 5 only) Closure mechanism - electric motor One 120 V Electric actuator (motor) mounted external to sleeve/duct. <ul style="list-style-type: none"> • Sample #1 and #4: Belimo FSNF120 US actuator • Sample #2 and #3: Honeywell MS4104F 1010 actuator • Sample #5: Belimo FSTF120 actuator Electronic temperature response device (TRD); Aeroseal advised that the TRDs were rated 250F. Sleeved dampers with round duct outlet at each face. The 16 in. dampers had sleeve depths varying from 14 to 20 in. and 13-1/2 to 14 in. diam duct outlets. The 8 in. damper had 6 in. diam duct outlets.
Damper #2	16 X 16 in.	
Damper #3	16 X 16 in.	
Damper #4	16 X 16 in.	
Damper #5	8 X 8 in.	
Damper #6	8 X 8 in.	Curtain type fire damper. Elsie 165F fusible link. Damper equipped with two negator closure springs and lock ramps.

As noted in the individual tests herein, the dampers were subjected to the Aeroseal "Duct Seal" spray prior to the fire testing described herein. The Aeroseal spray was applied at Aeroseal's Centerville, OH facility and witnessed by UL staff.

The Aeroseal "Duct Seal" aerosol duct sealant spray was UL Classified. The spray was applied to each damper using AeroSeal's Gen II System spray equipment. The equipment pumped air, and the Aeroseal spray, through the duct/damper system at the settings noted below. Damper blades were positioned full open during the spray application. A 14 in. diam by 8 ft length of inlet duct was attached to the air entering side of the damper sleeve, and a 6 ft length of nom 24 in. diam plastic layflat duct with a nom 4 x 4 in. relief opening at the downstream end was attached to the downstream side of the damper sleeve. The relief opening at downstream end of duct allowed for a steady flow of Aeroseal "Duct Seal" laden air through the duct system. A nom 20 ft length of nom 24 in. diam plastic lay flat duct was routed from the Aeroseal Gen II System spray equipment to the 8 ft inlet duct of the damper.

For the spray application of the 16 by 16 in. dampers, the AeroSeal Gen II System spray equipment was set for the parameters noted below.

1. The total sealing (spray application) duration of 30 min.
2. Aeroseal system inlet gate setting: 2.
3. Aeroseal system pump speed setting: 2.

For the spray application of the 8 by 8 in. dampers, the AeroSeal Gen II System spray equipment was set for the parameters noted below.

1. The total sealing (spray application) duration of 15 min.
2. AeroSeal system inlet gate setting: 4.
3. AeroSeal system pump speed setting: 4.

SUMMARY OF TESTS CONDUCTED ON THE DAMPER SAMPLES

I. FIRE ENDURANCE TESTS (UL 555):

SAMPLES

Two wall assemblies, each with three damper samples, were tested. The wall assemblies were constructed in accordance with a 2 hr rated gypsum steel stud wall design. The wall openings for each damper sample allowed for a minimum expansion clearance of 1/8 in. per ft.

The motorized multiblade damper samples were installed within the wall openings using 1-1/2 by 1-1/2 by 16 ga steel perimeter retaining angles at both sides of wall. The angles were secured to the damper sleeves with #10 sheet metal screws. Due to the short sleeve depth (6 in.) provided with the 8 by 8 in. curtain damper, the perimeter retaining angles were located at only the fire side of that damper assembly and each retaining angle was secured to the face of the wall with one screw, in addition to being secured to damper sleeve with two screws on each angle.

The damper samples installed in each wall assembly as described in this section were subjected to a fire endurance test exposure to evaluate the closure and performance of the dampers which had been subjected to the AeroSeal spray. Each fire exposure was continued for a duration of 90 min at the submitter request, well beyond the time at which the AeroSeal spray was no longer impacting damper performance.

The upstream face of each damper sample when exposed to the spray application was located toward the fire side of the test assembly for the fire testing.

Wall Assembly No. 1:

Test Sample	Size, W x H in.	Remarks
Damper #1	16 x 16 in.	Actuator on nonfire side.
Damper #2	16 x 16 in.	Actuator on nonfire side.
Damper #5	8 x 8 in.	Actuator on nonfire side.

Wall Assembly No. 2:

Test Sample	Size, W x H in. (mm)	Remarks
Damper #3	16 x 16 in.	Actuator on fire side.
Damper #4	16 x 16 in.	Actuator on fire side.
Damper #6	8 x 8 in.	Curtain damper. Retaining angles on fire side only.

Each fire endurance test was started with the damper blades in the open position.

METHOD

The fire endurance tests were conducted in accordance with the Standard UL 555. Furnace temperatures were measured with three thermocouples symmetrically located in the furnace chamber. The junction of the thermocouples was located 12 in. from the exposed face of the test assembly.

Throughout the fire test, observations were made of the character of the fire and its control, the conditions of the exposed and unexposed faces and all developments pertaining to the performance of the dampers as a fire barrier with special reference to stability and flame passage when installed in ducts passing through walls or floors.

RESULTS

Character And Distribution Of Fire - The fire was luminous and well distributed during the fire test. The temperatures developed within the furnace chamber were controlled in accordance with the standard ASTM E119 time-temperature curve specified in the Standard. See Appendix A for a graph of the furnace temperatures and pressures, and pictures for Test Assembly Nos. 1 and 2. The neutral plane for furnace pressure was the top of the highest damper in the test assembly.

Fire Test Observations - The following observations were noted during the Fire Endurance tests conducted on the test samples described above.

Wall Assembly No. 1, Fire Test Observations:

Time	Observation
0	Gas on. Unexposed end of each sample was covered (to prevent cooling air currents) until TRD activated and covers then removed.
49 sec	Damper #1 TRD tripped and damper closed completely with linkage engaged.
1 min	Damper #2 TRD tripped and damper closed completely with linkage engaged.
6 min 53 sec	Damper #5 TRD tripped and damper closed completely with linkage engaged. Power supply to actuators disconnected. Covers on unexposed ends of dampers removed.
8 min	Smoke from unexposed face of all 3 dampers. Flames were evident on fire side of damper #5. No flames on any dampers on unexposed side of openings.
9.5 min	Galv coating of blades in damper #1 is melting.
12 min	Sealant/substance on surface of one blade in damper #1 is melting and flowing down on blade surface (sealant from label which had fallen off the blade?). No flaming on unexposed side of dampers.
23 min	Damper #5 is still emitting smoke from unexposed face but there is no flaming on unexposed surfaces of the 3 dampers. The Aero seal spray in the heavier application areas is drying and discoloring white and on the inside of sleeve, has a snowflake appearance. No flaming on unexposed sides.
45 min	Blades in damper #2 are discoloring and becoming a greenish/orange.
60 min	Blades in damper #2 are red hot. Blades in damper #s 1 and 5 are dark gray in color.
75 min	Gypsum board above dampers 2 and 5 is discoloring black. No flaming on unexposed side of damper assemblies/wall assembly.
90 min	Gas off. The influence of the Aero seal on the dampers had ceased by approx 45 min but at client request we continued the test for 90 min.

Observations After Fire Exposure Test (Wall Assembly No. 1) - The dampers closed and latched as intended and in accordance with the applicable requirements of the Standard during the fire exposure and no flaming was observed on the nonfire side of the dampers.

Wall Assembly No. 2, Fire Test Observations:

Time	Observation
0	Gas on (Unexposed end of curtain sample was covered (to prevent cooling air currents) until fusible link activated and cover then removed.)
12 sec	TRD triggered and damper #3 closed completely.
39 sec	Fusible link in damper #6 melted and damper closed approx ½ way and it was then manually pushed to full close position. It was noted that the damper was racked by approx ¼ in. off center and this may have caused the closure since the blade to frame clearance at one side was tight.
43 sec	TRD triggered and damper #4 closed completely. Power to actuators was disconnected.
2 min	Heavy smoke from fire side of assembly emitting through damper blades. No flames unexposed side.
3 min	Flames on fire side of curtain damper #6 are evident and it appears to be the Aeroseal spray which is flaming. No flames on unexposed side of test assembly.
6 min	Flames are evident on fire side of dampers 3 and 4 - appears to be from the Aeroseal sealant on inside of dampers and the motor/TRD/wiring on outside of damper sleeves. No flames on unexposed side of dampers.
7 min	Damper #3 blades are discolored black.
10 min	Flames of wires and motors on fire side of assembly still evident. No flaming on unexposed side of assembly.
12 min	Fire side flames nearly ceased. On nonfire side, bottom blade in damper #4 is discolored black.
23 min	Black discoloring of blades on nonfire side has now disappeared and blades are dull gray. No flaming unexposed side.
40 min	No flaming on unexposed side of test assembly. Damper blades in #3 are slight green tint in color. Gypsum bd above dampers 3 and 6 is discoloring brown a small amount.
60 min	Damper blades in sample 3 are all discolored green. No flaming unexposed side of test assembly.
75 min	Damper blades in samples 3 and 4 glowing red. Discoloring of gypsum board above openings 3 and 6 continues. Blades in curtain damper are discoloring gray.
90 min	Gas off

Observations After Fire Exposure Test (Wall Assembly No. 2) - The multiblade dampers closed and latched as intended and in accordance with the applicable requirements of the Standard during the fire exposure and no flaming was observed on the nonfire side of the dampers. Although the curtain damper did not fully close when the fusible link melted, this was not attributed to the Aeroseal spray. It was observed that the damper was skewed within the wall opening resulting in a reduced blade to frame operating clearance at one side which inhibited full closure. Once the blades were manually pushed to full close, the curtain damper performed in accordance with the applicable requirements of the Standard during the fire exposure and no flaming was observed on the nonfire side of the damper.

This will complete the work anticipated under Project 4787755206

Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc, (UL) or any authorized licensee.

Report by:

Margaret Figueroa
Staff Engineer

Reviewed by:

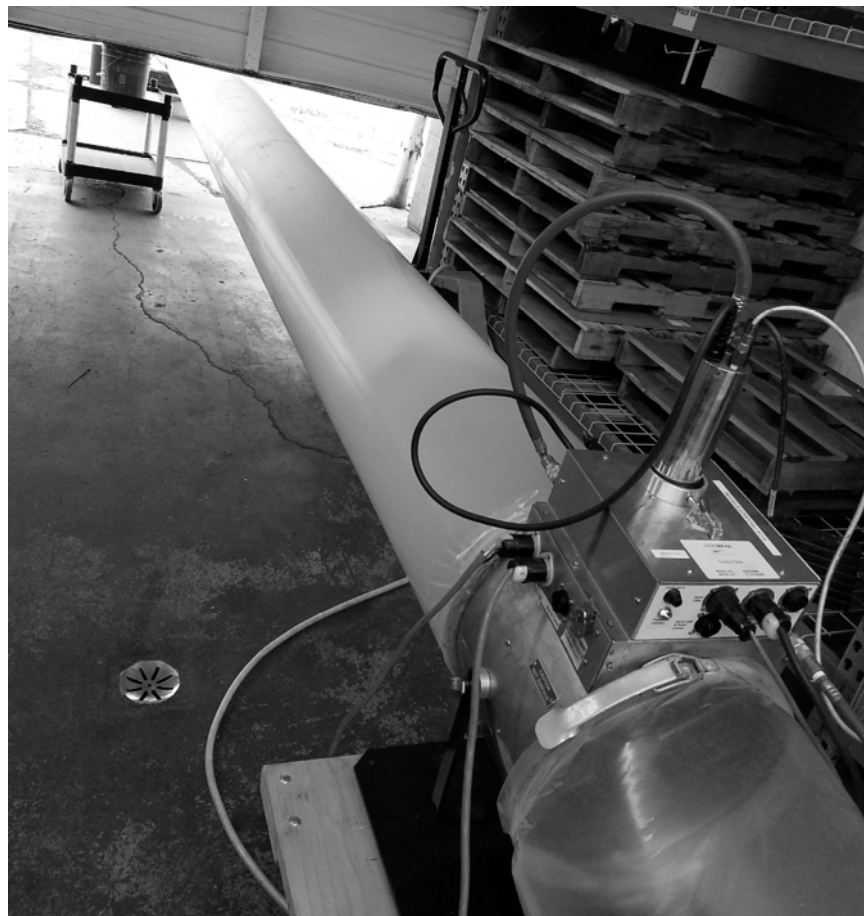
Steven J. Hoffman
Staff Engineer

APPENDIX A

PICTURES OF AEROSEAL SET-UP FOR GEN II SYSTEM SPRAY EQUIPMENT AND APPLICATION TO THE DAMPER SAMPLES



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APPENDIX A (CONT'D)

PICTURES OF AEROSEAL SET-UP FOR GEN II SYSTEM SPRAY EQUIPMENT AND APPLICATION TO THE DAMPER SAMPLES



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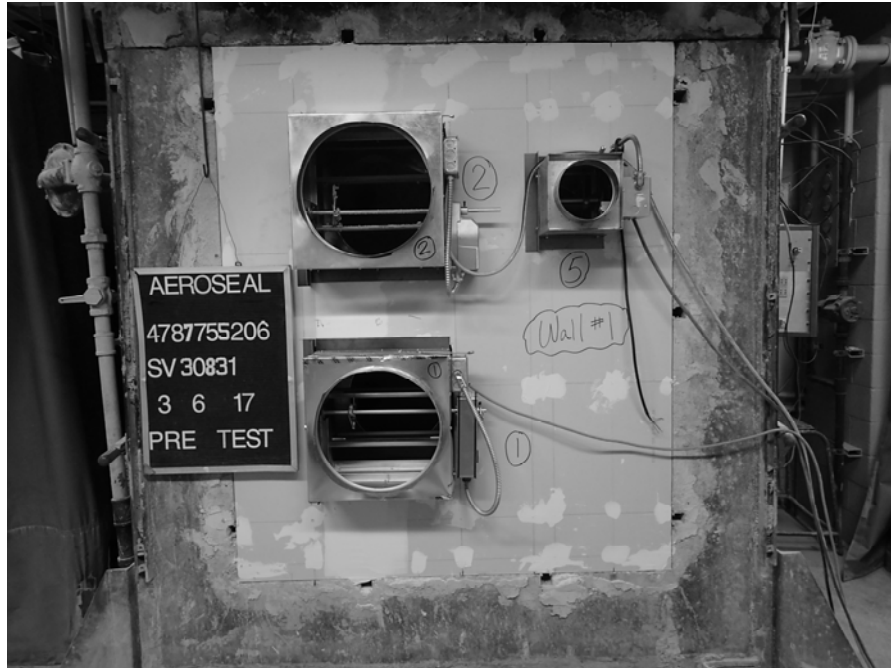


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APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 1 / TEST NO. 1

UNEXPOSED SIDE OF TEST ASSEMBLY BEFORE TEST



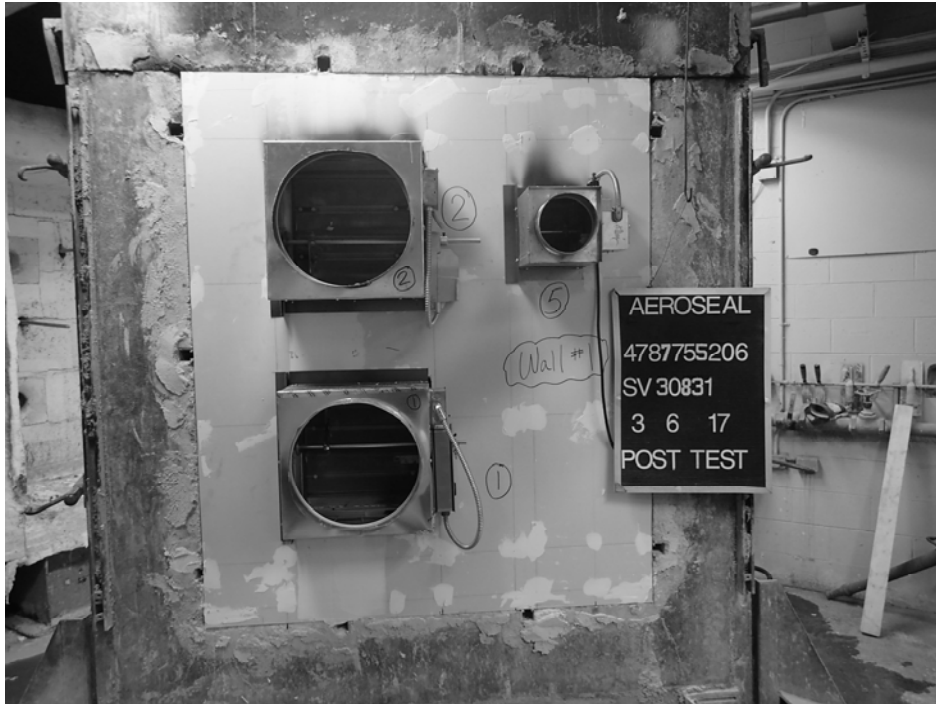
EXPOSED SIDE OF TEST ASSEMBLY BEFORE TEST



APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 1 / TEST NO. 1

UNEXPOSED SIDE OF TEST ASSEMBLY AFTER TEST



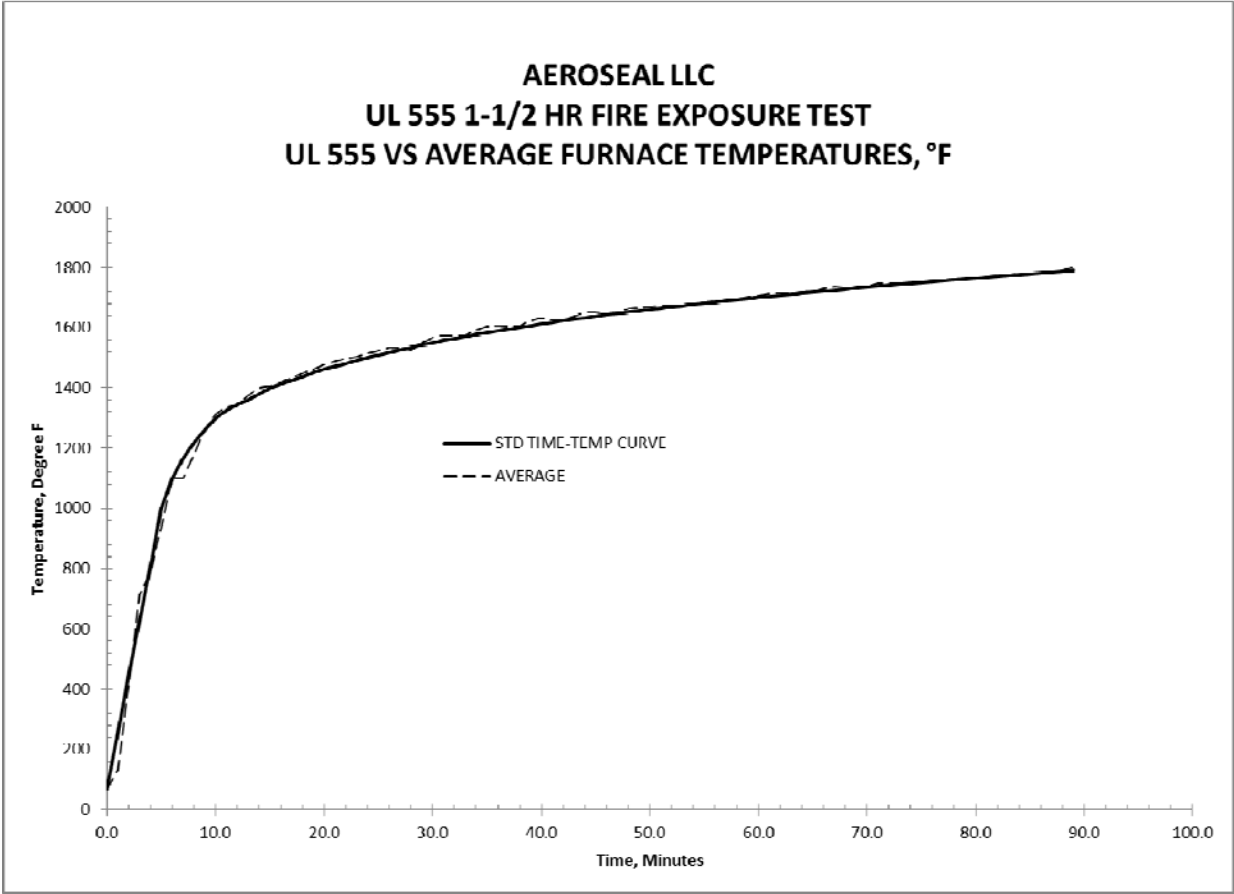
EXPOSED SIDE OF TEST ASSEMBLY AFTER TEST



APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 1 / TEST NO. 1

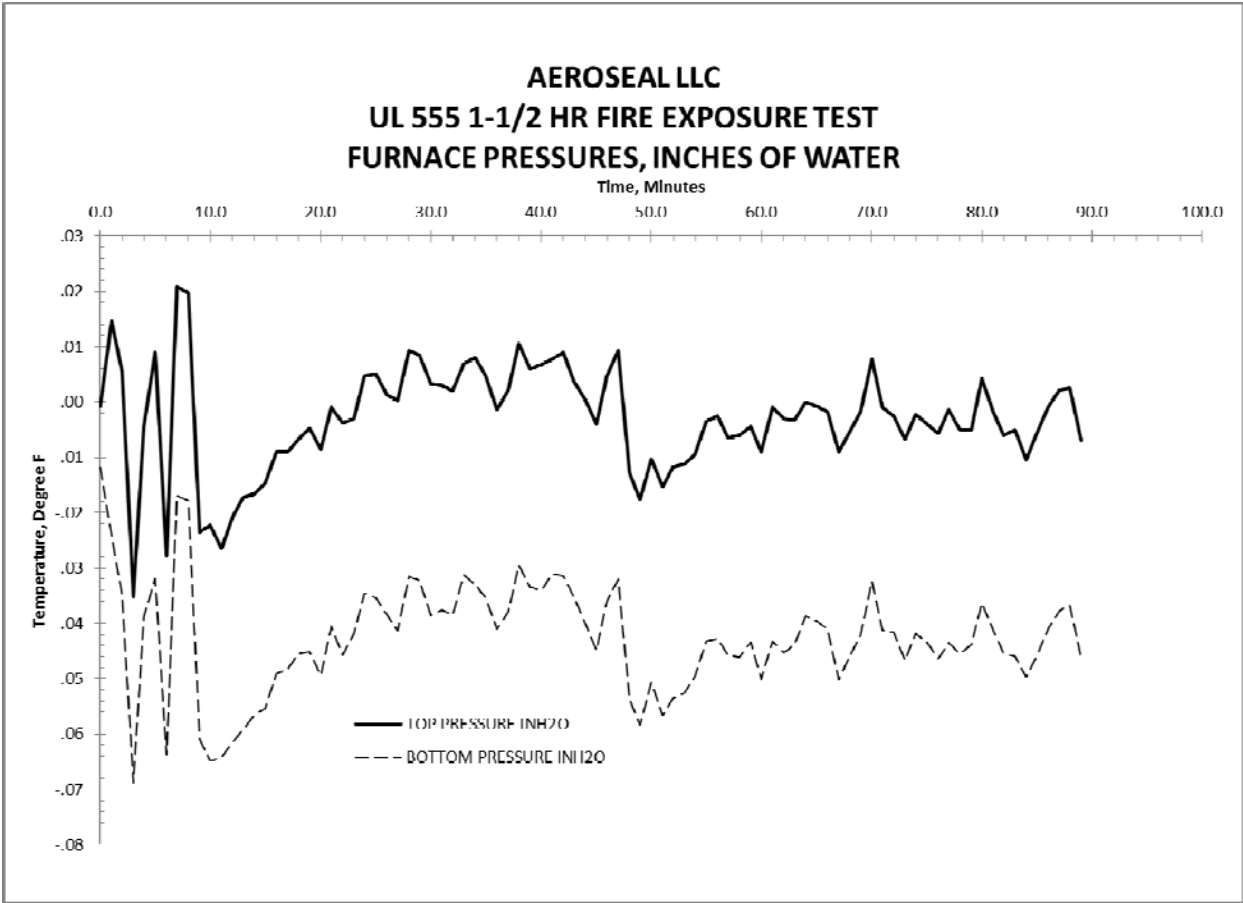
FURNACE TEMPERATURES



APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 1 / TEST NO. 1

FURNACE PRESSURE



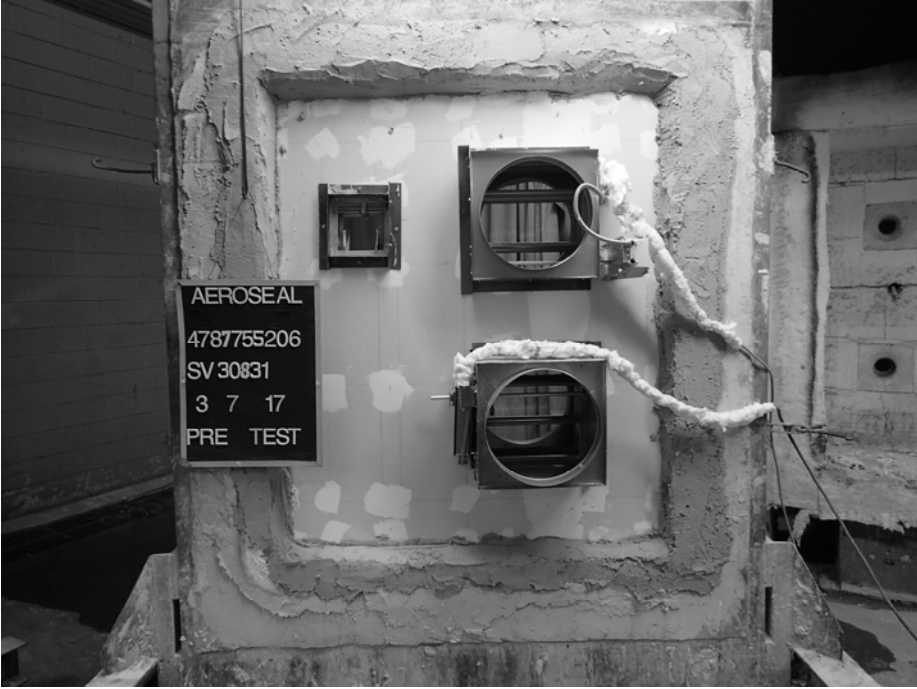
APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 2 / TEST NO. 2

UNEXPOSED SIDE OF TEST ASSEMBLY BEFORE TEST



EXPOSED SIDE OF TEST ASSEMBLY BEFORE TEST



APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 2 / TEST NO. 2

UNEXPOSED SIDE OF TEST ASSEMBLY AFTER TEST



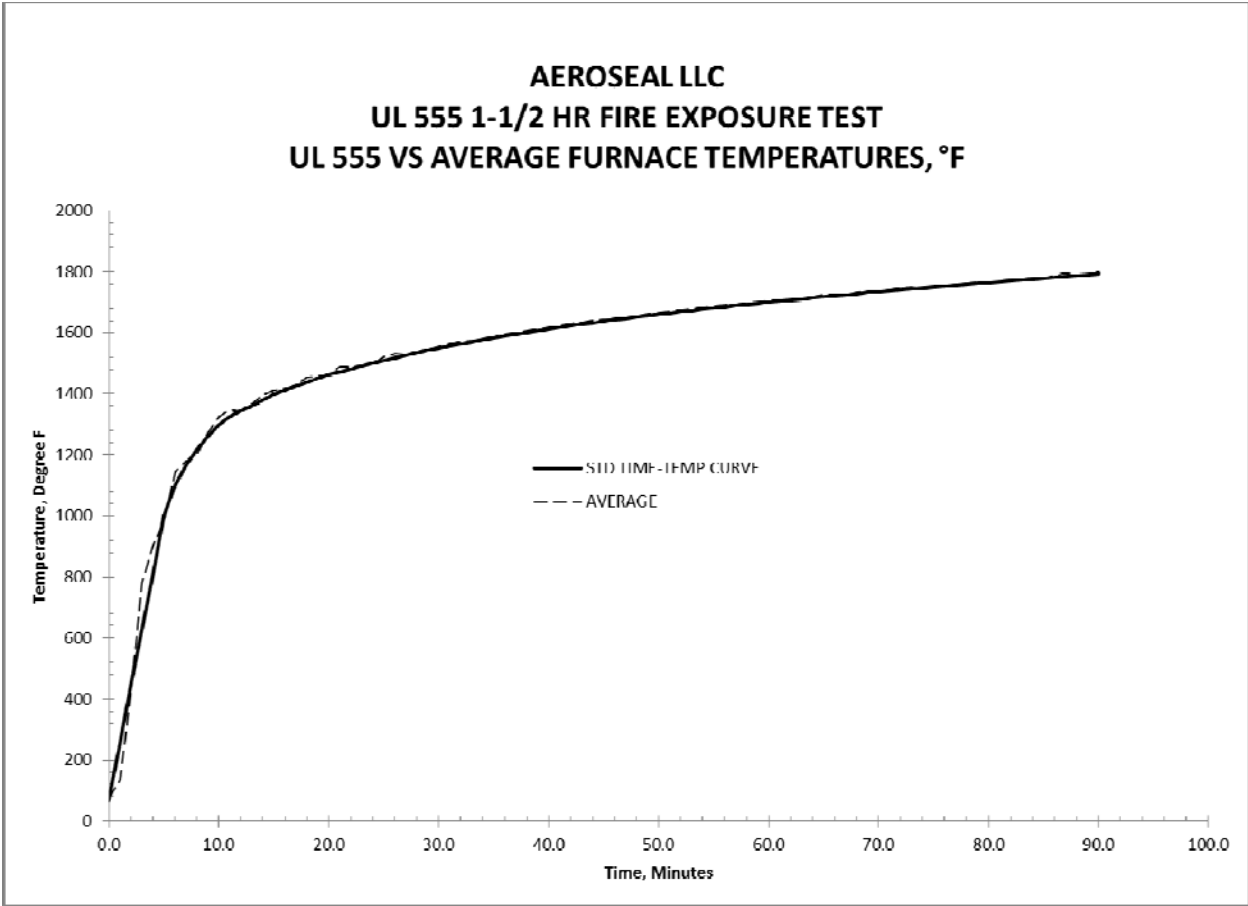
EXPOSED SIDE OF TEST ASSEMBLY AFTER TEST



APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 2 / TEST NO. 2

FURNACE TEMPERATURES



APPENDIX A (CONT'D)

WALL ASSEMBLY NO. 2 / TEST NO. 2

FURNACE PRESSURE

