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TEST REPORT # **T1007-1**

DATE: June 8, 2015

CLIENT: **Just BioFiber Structural Solutions**
2916-5th Avenue NE #12
Calgary, Alberta
T2A 6K4
Contact: Terry Radford

SAMPLE DESCRIPTION: SUPER SSR 11 IN. BIOFIBER BLOCK WALL ASSEMBLY. See page 3 for full description.

SAMPLING PROCEDURES: See page 2 for the sampling procedure.

DATE OF RECEIPT: May 11, 2015

DATE(S) OF TESTING: May 22, 2015

TESTING REQUESTED: **Testing to the mandatory requirements of the following criteria: ASTM E119-14, Standard Test Methods for Fire Tests of Building Construction and Materials, and CAN/ULC S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials**

TESTED RATING: 68-minute Fire Resistance

TEST RESULTS: See Page 6 for the test results.

CONTENTS: Test Report Pages 1 through 7, Appendix A1 through A7

TESTING PERFORMED AT: QAI Laboratories Ltd., Coquitlam

Reported By

Scott Leduc, EIT
Project Manager

Reviewed By

Kevin Saito, P.Eng
Division Manager

Introduction:

This report documents the fire testing conducted by QAI Laboratories Ltd. for Just BioFiber Structural Solutions of a Super SSR 11 in. BioFiber block wall assembly. Testing was performed in accordance with ASTM E119-14, Standard Test Methods for Fire Tests of Building Construction and Materials, and CAN/ULC S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials. The wall was evaluated for a 68-minute Fire Resistance rating on May 22, 2015.

The test sample materials sent directly by the client and were not independently selected for test. The wall assembly materials were received on May 11, 2015.

Sample Description:

Table 1: Wall Description

Wall Construction:	Type:	Super SSR 11 in. (Passive Thermal R-27) BioFiber block wall assembly.
	Overall Size:	12 ft. wide by 9 ft. high by 11 in. thick
	Blocks:	Super SSR 11 in. (Passive Thermal R-27) BioFiber blocks measuring 21-1/4 in. wide by 8 in. high by 10-3/4 in. deep with 1 in. holes placed every 5-3/8 in. along the center of the block used for conduit and embedded struts as described below. The blocks consist of lime, hemp herd and water mixed and formed using a mold. After curing the blocks are skinned with a lime, water and fine sand mixture.
	Framing:	Eight 1-1/2 in. by 1-1/2 in. by 8 in. long square wood posts are imbedded every 4 in. in the hemp material so that 2 in. of the posts are protruding out of the top of the block leaving a 2 in. cavity on the bottom. The struts are composed of SPF. A nominal 2x12 wood top and bottom plate were used as well as a starter plate at the bottom consisting of 5/8 in. plywood with 1-1/2 in. by 1-1/2 in. by 2 in. long wood posts screwed to it.
	Adhesive:	The blocks are adhered together with a mix containing flax, Natural Hydraulic Lime (NHL), Graymont Dolime 150 mix Blended Hydraulic Lime and Pressure Hydrated Lime. The adhesive was applied to all mating surfaces of the blocks to a thickness of 1/4 in. Wood adhesive is also used between the posts of the blocks.
	Plaster:	A venetian-type lime plaster mix containing sand, NHL, Kaolin and Graymont Dolime 200 mix Blended Hydraulic Lime was applied to the exposed surface in two coats to a total thickness of approximately 1/4 in.

Test Apparatus:

The furnace used in the test is a full-scale fire burning apparatus with interior dimensions of 13 ft. in height, 13 ft. in width, and 3 ft. in depth.

Temperatures within the furnace were monitored using nine thermocouples. The temperatures are controlled by adjusting fuel to the furnace burners to conform to the time/temperature curve specified by the test standards. Temperature measurements are recorded by a Keithley 2750 data acquisition unit (ID# DMM1) which passes the readings to a computer for graphical display and storage.

Unexposed wall surface temperatures were monitored by thermocouples (TCs) placed at a minimum of nine locations. Five of these were symmetrically disposed, one to be at the center of the assembly, and four at the center of each quarter section. Detailed locations are shown in Figure 4 in Appendix A. The temperatures were recorded continuously for the duration of the test. The temperature rise data are provided graphically in Figure 5 and 6 in Appendix A.

The wall section is mounted in a vertical orientation, into a steel frame specimen holder. The specimen holder is then rolled up to the furnace and secured by chain and straps to the furnace opening. At the end of the test the specimen holder is rolled away from the furnace so that the exposed face can be subjected to the impact, erosion and cooling effects of the hose stream test.

Two pressure taps are installed through the vertical centerline of the furnace back wall, one near the top of the test assembly and one near the center of the wall. The pressure taps are each attached and monitored by Setra model 264 pressure transducers (ID# Pressure T1 and Pressure T2). The furnace pressure is controlled by adjusting a damper in the furnace exhaust stack and air flow into the furnace to maintain the neutral pressure plane.

Figure 1: Burners Fired in the Furnace

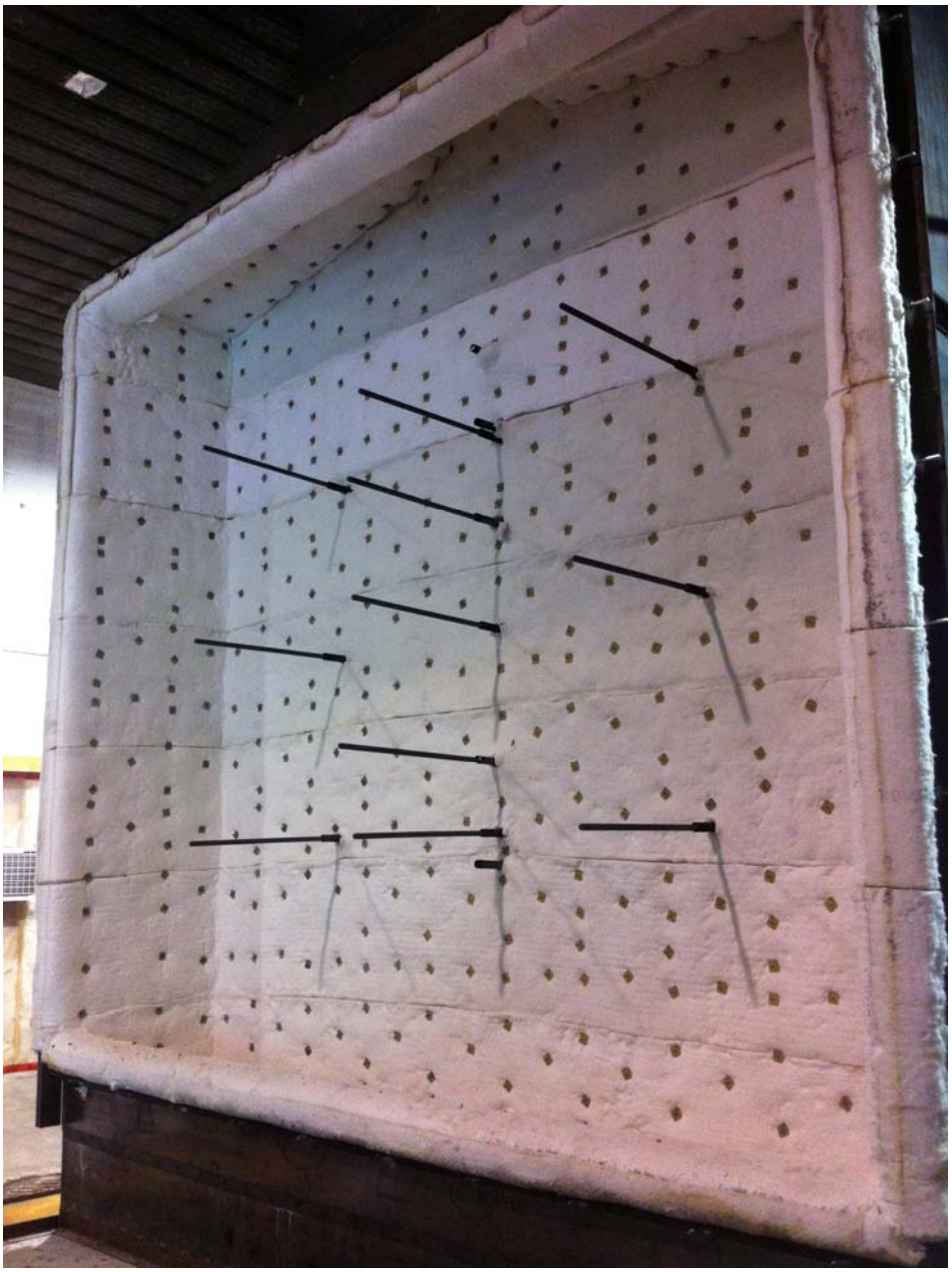

Figure 2: Full-Scale Furnace

Test Conditions:

The Just BioFiber Structural Solutions Wall assembly was constructed in a full-scale moveable steel test frame. Side walls were constructed using wood studs and 3 layers of 5/8 type X gypsum board. The wall was held in place with two screw jacks which clamped the wall into place between the lower and upper steel beams. The space between the test frame and the wall assembly was filled with ceramic fiber batt to prevent air movement between the frame and wall.

The vertical pressure distribution within the furnace was measured by two probes separated by a vertical distance of 2 m. The pressures were continuously monitored using calibrated pressure transducers.

Prior to the fire endurance test the test assembly was moved into position in front of the furnace opening and the pilot burners were ignited. The fire endurance test was initiated after igniting the burners. The temperature inside the furnace was controlled to follow the standard time/temperature curve within the limits described in the test standards.

The following observations were taken over the duration of the fire test:

Table 2: Test Observations

Test Time (min)	Unexposed	Exposed
8:48		Cracks have formed in the plaster. Intermittent flaming at the cracks.
9:33		The plaster is beginning to peel away at the cracks.
13:23		Aggressive flaming at 3 locations approx. 2 ft. from the bottom.
16:42		Cracks in the plaster are forming at mid-height.
18:00		Crack at the top right corner is flaming.
28:25	Venting through a block joint near the top center.	
33:20	Venting from the joint at the top right corner.	
40:00		Small cracks forming across the surface.
52:42		1 ft. by 1 ft. section of plaster has fallen from the wall approx. 3 ft. from the bottom.
68:00	Test discontinued.	No change.

This report includes tests performed on a specimen of specific dimensions. Actual product performance may be affected by variations in the dimensions, assembly details and installation method. Details of the assembly can be found in table 1.

Test Results:

Flaming and Penetration

No flaming occurred on the unexposed face of the test assemblies, and no through penetrations or openings were observed during the fire test.

Unexposed Temperature Rise

During the fire endurance test the average temperature measured by the unexposed thermocouples reached a maximum of 27°C above initial, and the maximum temperature reached by an individual point was 63°C above initial. The maximum allowable average temperature rise is 140°C above the initial average temperature, and the maximum allowable temperature at an individual point is 180°C above its initial temperature. The wall assembly met the unexposed temperature rise requirements of the test standard.

Hose Stream Test

Immediately after the fire test, a hose stream test was conducted for 67 seconds. The wall assembly successfully met the conditions of acceptance for the hose stream test: no through openings were developed that would allow a projection of water from the stream beyond the unexposed face during the time of the hose stream test.

Conclusion:

QAI Laboratories Ltd., with lab facilities located in Coquitlam, British Columbia, performed testing in accordance with ASTM E119-14, Standard Test Methods for Fire Tests of Building Construction and Materials, and CAN/ULC S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials, on a representative sample of a Just BioFiber Structural Solutions Super SSR 11 in. BioFiber block wall assembly.

Test results in this report may not be reproducible in the field. Test results relate only to those products tested. See Table 1 for a summary of the product description. The test specimen successfully met the conditions of acceptance for a 68-minute Fire Resistance rating.

APPENDIX A

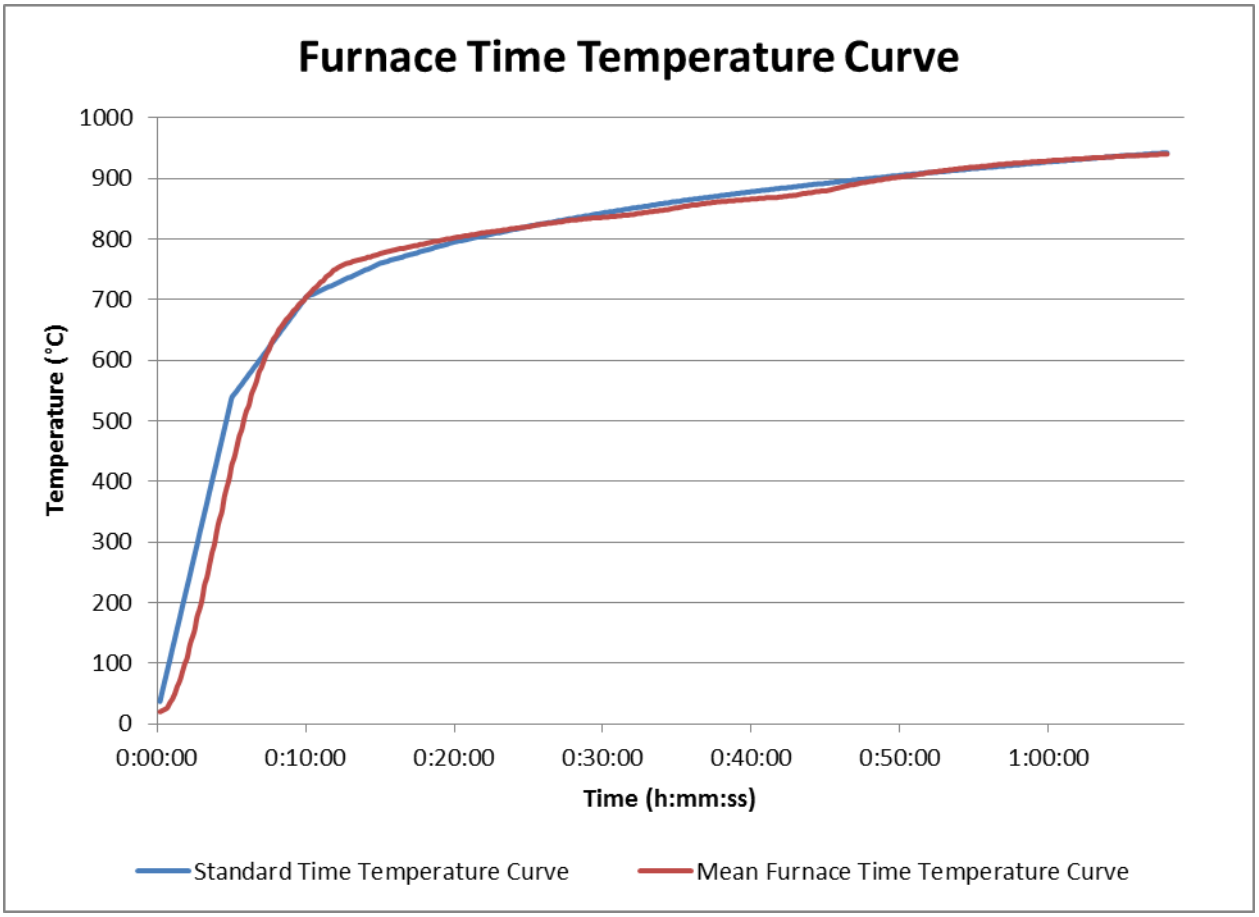

Figure 3: Time Temperature Curve

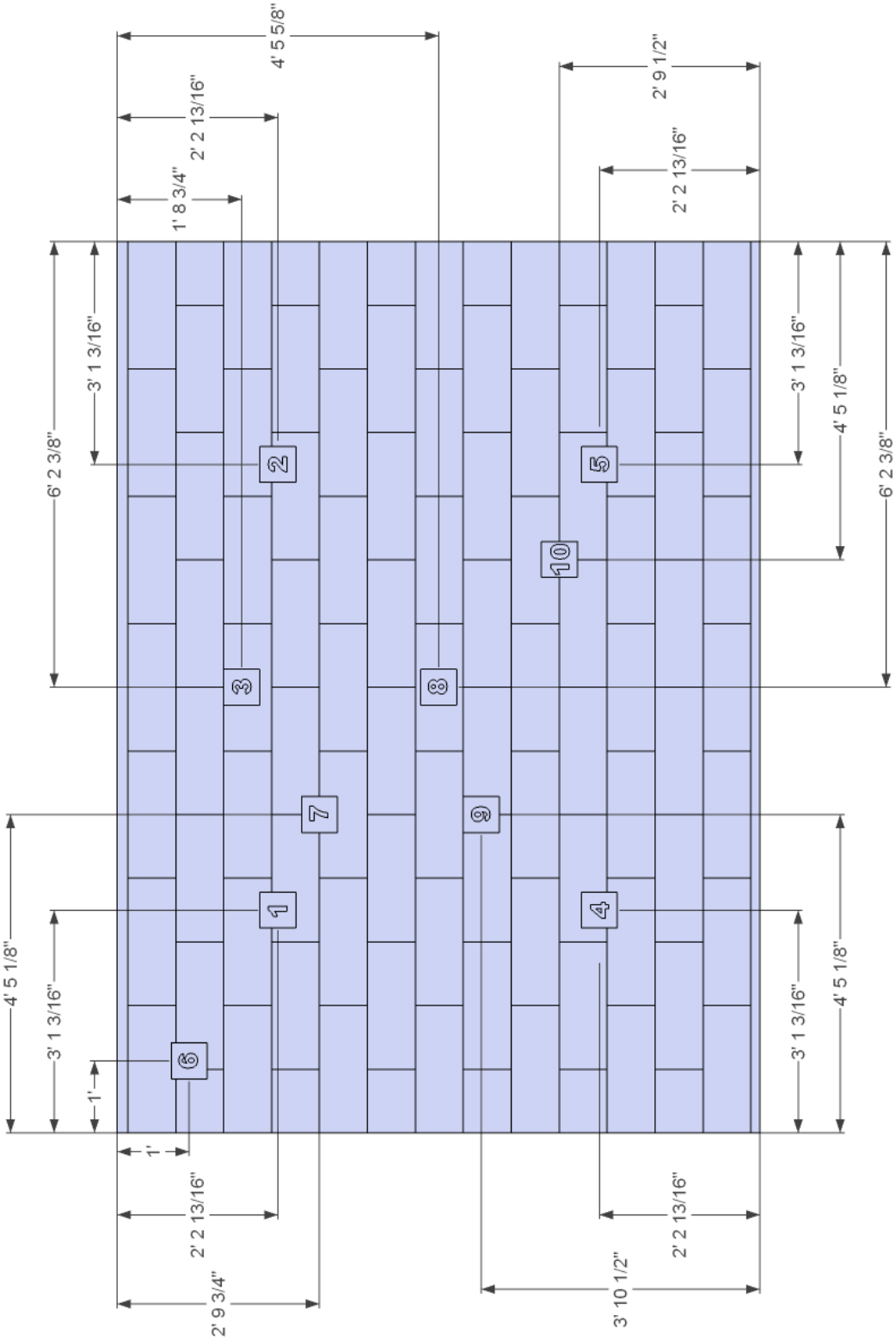

Figure 4: Unexposed Face Thermocouple Locations

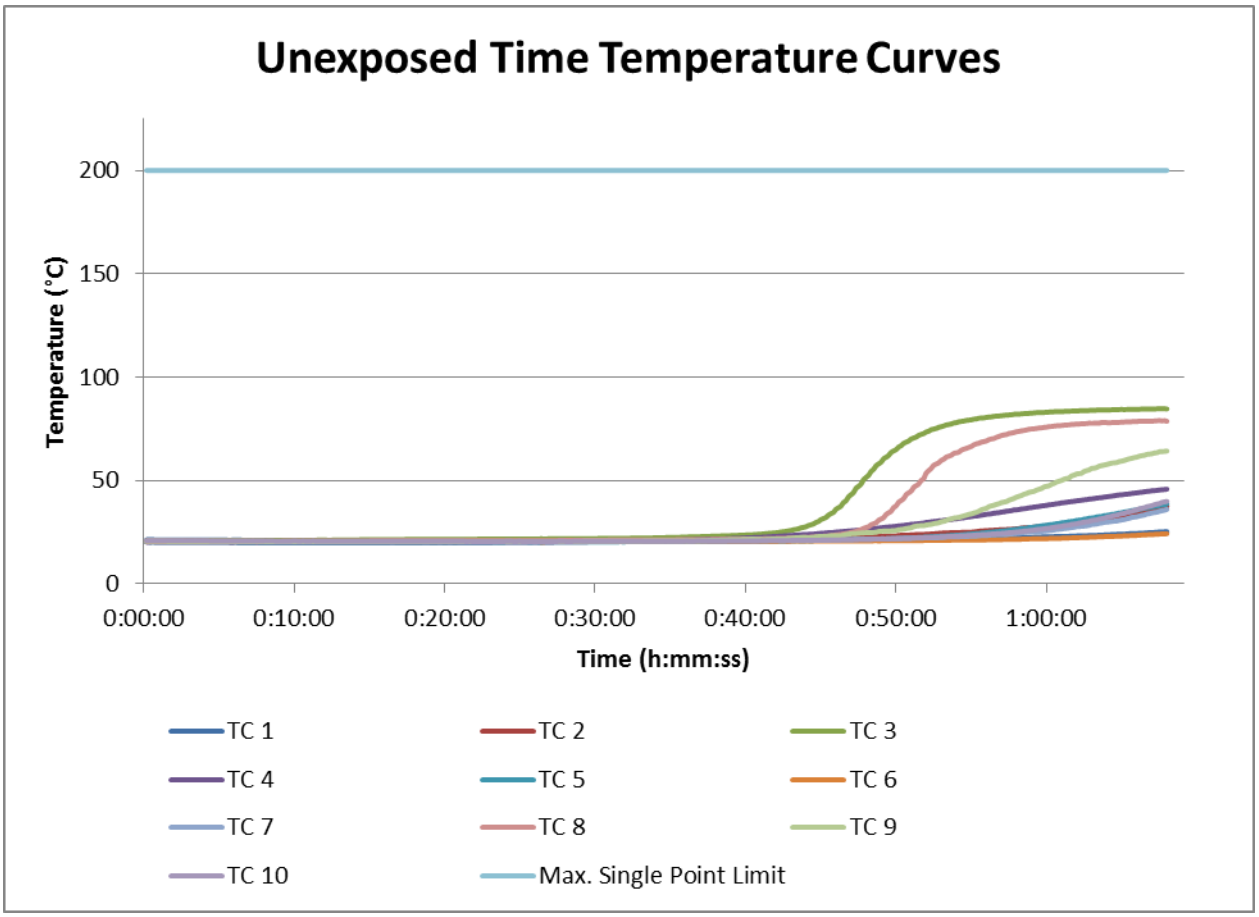

Figure 5: Unexposed Time Temperature Curves

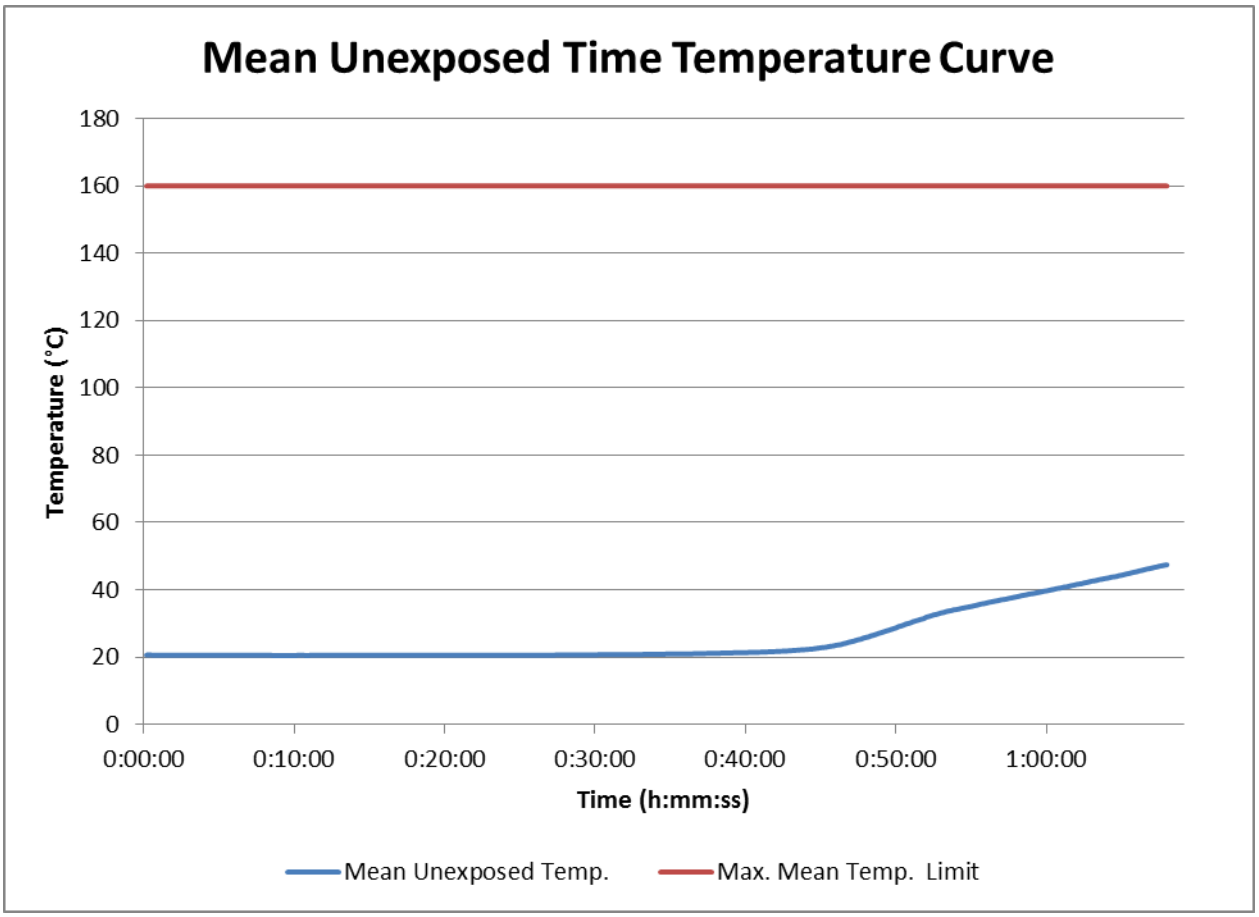

Figure 6: Mean Unexposed Time Temperature Curve

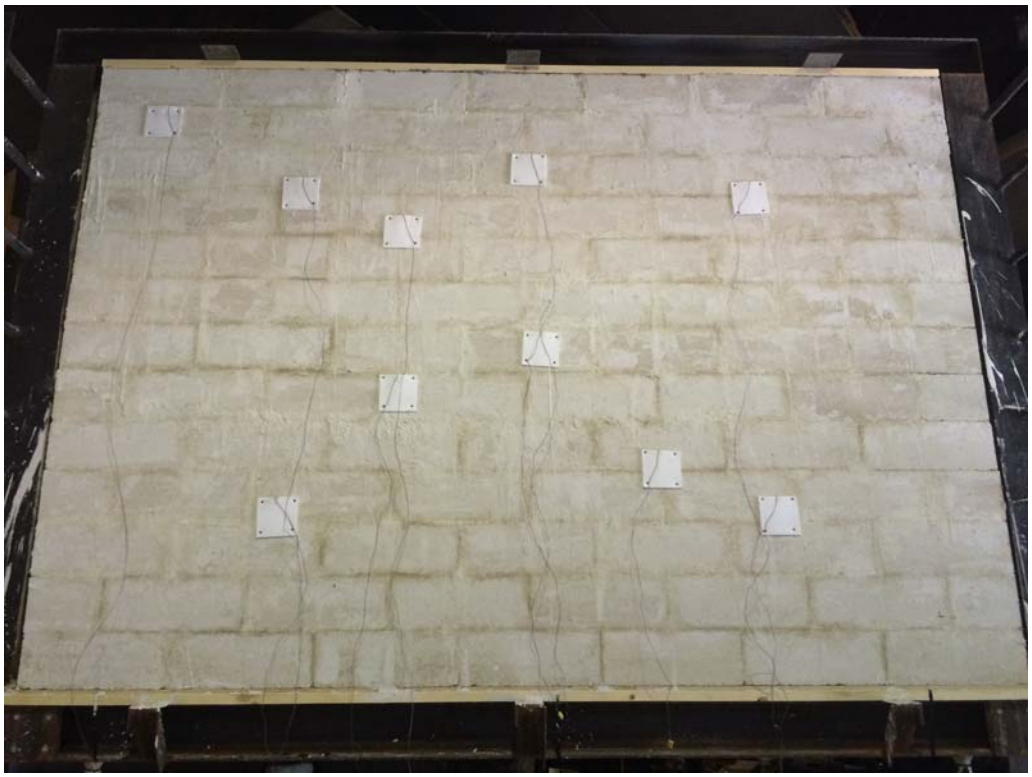

Figure 7: Unexposed side prior to the fire test.

Figure 8: Exposed side prior to the fire test.

Figure 9: Exposed side at termination of fire exposure.

Figure 10: Exposed side after the hose stream test.

Figure 11: Unexposed side after the hose stream test.

Figure 12: Exposed side after hose stream test at the center lower portion of wall near the area where the plaster had fallen off.