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**Research-Scale Fire Performance Evaluation  
of an Open Wood Floor Joist Assembly Coated  
with Albi Clad FP**

***ASTM E119-98: Standard Test Methods for  
Fire Tests of Building Construction and  
Materials\****

\* Research-scale horizontal test, modified in that the sample size was less than 180 ft<sup>2</sup> (16 ft<sup>2</sup>) and no load was applied

**Conducted For:**

**Albi Manufacturing  
A Division of StanChem Inc.  
401 Berlin Street  
East Berlin, CT 06023**

**WFCi Report #04042(a)**

**Conducted On: June 28, 2004**

**Report Issued On: August 11, 2004**

**Report Revised On: December 17, 2004**

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## **INTRODUCTION**

This report documents the research-scale fire resistance testing of an open wood floor joist assembly performed by Western Fire Center, Inc. (WFCi) for:

**Albi Manufacturing  
A Division of StanChem Inc.  
401 Berlin Street  
East Berlin, CT 06023.**

Mike White of WFCi conducted the test with the assistance WFCi staff Wayne Beres, Logan Byman and Tony Mansur on June 28, 2004.

The 4ft x 4ft floor joist assembly was constructed by the client's representative at the WFCi lab prior to testing. A description of the sample can be found on page seven of this report.

The purpose of this test was to evaluate the fire endurance characteristics (ability to contain a fire) of the client's open floor joist assembly when subjected to a standard fire exposure condition (ASTM E119 standard time-temperature curve).

*This test method is designed to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions.*

## **SUMMARY OF TEST METHOD**

This is a horizontal research-scale fire test of a 16 ft<sup>2</sup> open joist floor construction exposed to the fire (time-temperature) conditions described in ASTM E 119-98, "Fire Tests of Building Construction and Materials". *The principal departure from this referenced standard was a reduction in specimen size, allowing the test results to be used only for research and development purposes.* The test conditions are also closely described by testing standards UBC 7-1, 1997, UL 263, and NFPA 251. A horizontal exposure furnace (described in the following section) was used to subject the samples to a standard time-temperature curve as specified in the referenced test procedures.

-For this fire endurance evaluation, the test was to be performed for a fire resistance period of 1 hour or until failure criteria (transmission of heat or flame) were met.

## **DESCRIPTION OF LABORATORY TEST FACILITY**

The furnace used in the test is a small-scale fire burning apparatus, fueled by natural gas (pictured at right.) The sample was mounted on to the top of the furnace horizontally. The exposed surface is subjected to the E119 time-temperature curve, while temperature measurements are taken from the unexposed surface, using a computerized data acquisition system.



**FIGURE 1: HORIZONTAL FURNACE**

The furnace valves are controlled based upon the average of the interior furnace temperature, which is determined from the internal thermocouples. Additional thermocouples are added to the unexposed surface of the specimen to monitor the specimen's temperature. Windows are provided in the sides of the furnace to allow viewing of the specimen's exposed surface and the taking of photographs during testing. Upon completion, or early termination of a test, the main gas supply valve is closed and the specimen is removed from the furnace, allowing for hose stream testing of specimen, if applicable, and allowing for post-testing observations.

## **SAMPLE DESCRIPTION**

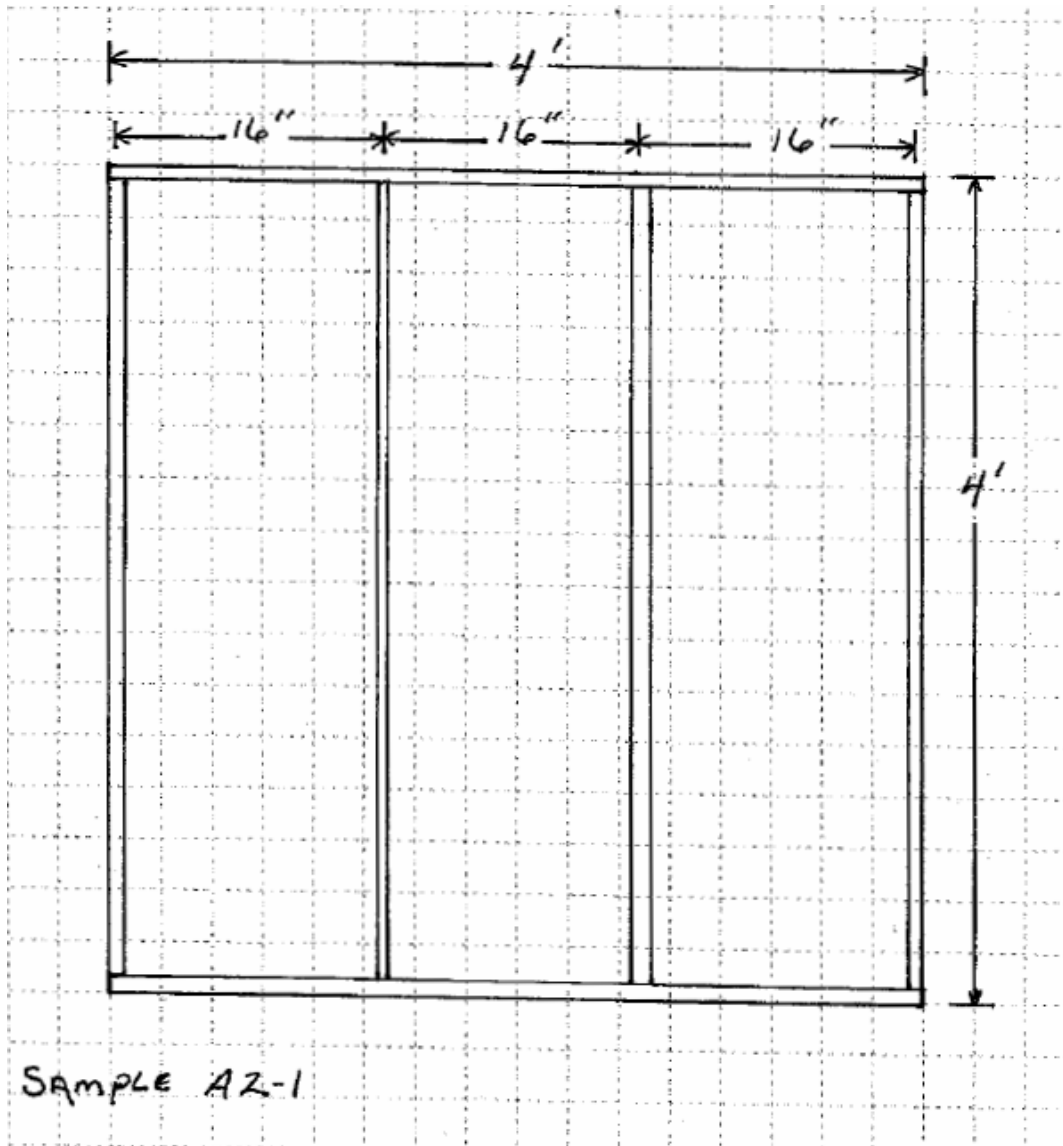
The 4' X 4' wood floor joist assembly was constructed of rough cut (full dimensional) Douglas fire 2"X10"s to simulate a flooring section of an older building. The joists were spaced at 16" on center and the UL-labeled intumescent material, identified by the client as Albi Clad FP, was spray-applied to a wet film thickness of 40 mils (applied and measured by the client's representative) to the open joist area and bottom of floor decking on the exposed side. The floor decking consisted of 1"x4" fir tongue and groove subfloor covered by 5/8" CDX plywood decking.

The overall sample was identified by the client as **A2-1**.

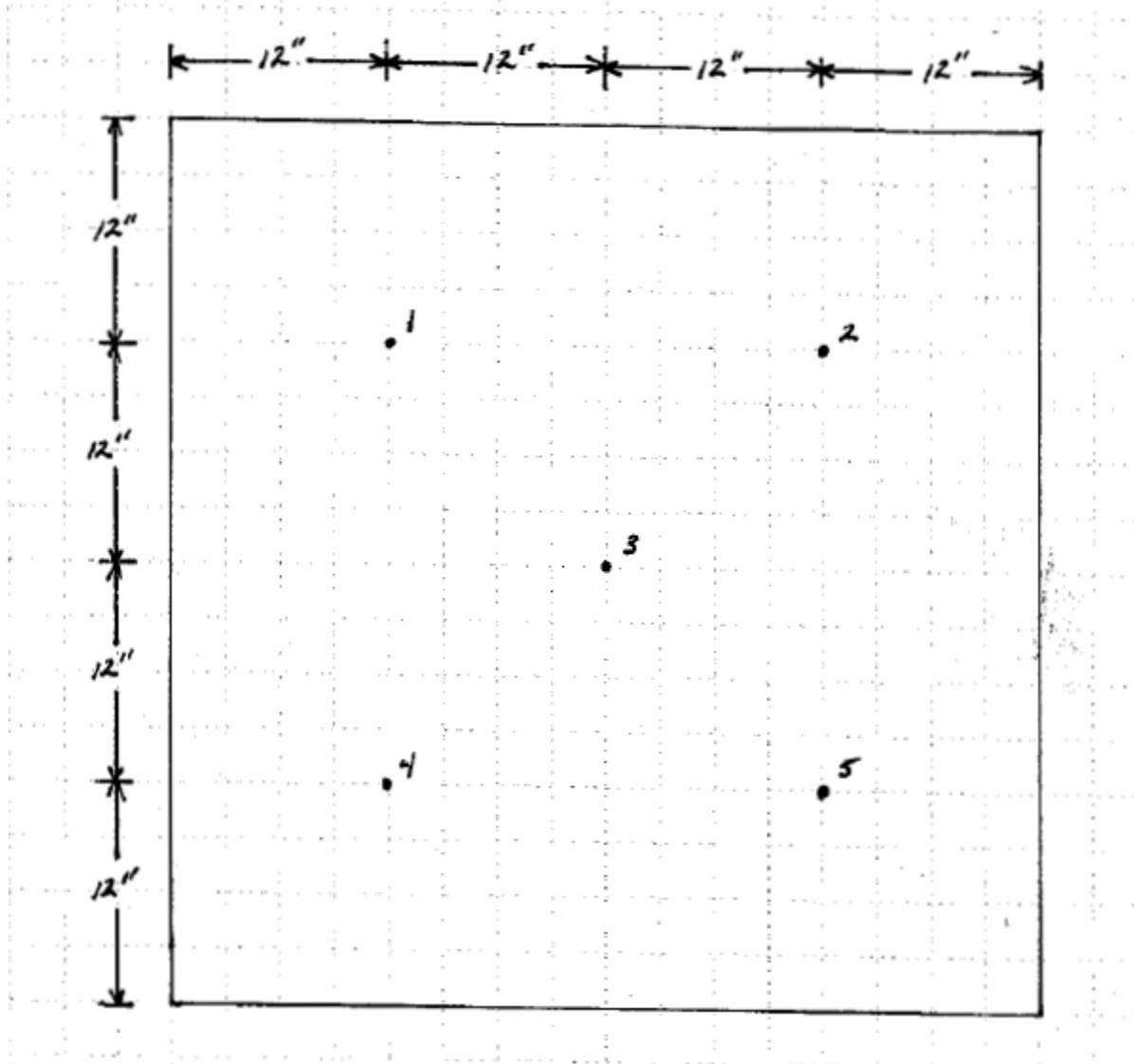
The unexposed face of the floor construction was instrumented with 5 thermocouples to take temperature measurements throughout the test. These measurements appear in tabular form in the Test Data section of this report and in graphical form in Appendix A of this report.

Thermocouples 1-5 were located on the unexposed face of the wall construction. TC 3 was centered on the sample and TCs 1, 2, 4 and 5 were placed at quarter points on the upper left, upper right, lower left and lower right corners of the sample, respectively.

### Diagram 1: Sample Layout



**Diagram 2: Thermocouple Layout**





**TEST DATA**

**Test Observations**

**Test Date:** 6/28/2004, 9:52 AM

**Specimen Tested:** wood floor joist assembly coated with Albi Clad FP

**Furnace:** Research-Scale Horizontal Exposure Furnace

**Cameras:** 1 digital still camera and 1 video camera

**Ambient Conditions:** Lab room Temp: 65F

Relative Humidity: 41%

**Observations:**

Test Time (h:mm:ss)	Event
0:00:00	Ignite Furnace, Start Test
0:00:47	Coating discoloring on joist edges
0:01:50	Joist edges black, joist face brown
0:02:30	Joist face black and intumescent
0:04:00	All surfaces are black and intumescent
0:11:55	Minor amount of smoke escaping from tongue and groove on left side
0:23:07	Cracks forming in the intumescent and flames attempting to attach at joist
0:25:00	Intumescent coating turning white or ash color at flaming locations
0:27:43	Smoke escaping from all perimeters of unexposed side
0:31:23	Joists have attached flames
0:34:38	All cavities of sample are filled with flames and the top of the furnace appears to be a fuel-rich environment
0:44:06	No change, sample filled with dark red flames with attached bright yellow flames at joists
0:55:25	No change
0:57:55	Flames to exterior of sample at top between sample and furnace seal, flames smothered with Kao-wool
1:00:00	Stop Test
Post Test	Cavity intumescent thickness is approximately 2-15/16". Thickness on joist face is approximately 1-1/8", thickness on joist edge is unknown, all burned off

**Average Furnace Temperatures (every 5 min.)**

Time	Total % of Standard Curve	Temperature (Celsius)	Standard Temperature
0:00:00	0	0	0
0:05:00	94.9	637.4	556.6
0:10:00	97.6	620.2	658.5
0:15:00	95.9	670.9	718.6
0:20:00	94.4	713.5	761.4
0:25:00	94.6	765.1	794.6
0:30:00	95.5	791.7	821.8
0:35:00	96.0	834.1	844.8
0:40:00	96.3	829.9	864.8
0:45:00	96.1	838.4	882.4
0:50:00	96.3	884.5	898.1
0:55:00	96.6	891.3	912.3
0:60:00	96.7	892.2	925.0

**Unexposed Thermocouple Temperatures (every 5 min.)**

(See diagram on page 8 for locations)

Time	Temperature (Celsius)				
	TC1	TC2	TC3	TC4	TC5
0:00:00	20.8	21.2	21.2	20.9	21.3
0:05:00	21.0	21.4	21.5	21.0	21.4
0:10:00	23.0	23.0	21.8	23.3	24.8
0:15:00	28.7	28.0	Malf.	30.0	36.1
0:20:00	36.0	35.5	Malf.	38.7	47.1
0:25:00	43.5	44.3	Malf.	48.6	54.8
0:30:00	51.1	52.2	Malf.	57.5	60.2
0:35:00	58.6	58.5	Malf.	63.3	64.1
0:40:00	64.3	63.1	Malf.	67.6	66.9
0:45:00	70.0	66.5	Malf.	72.2	69.4
0:50:00	78.1	70.0	82.8	78.4	72.8
0:55:00	90.4	73.5	89.9	86.5	78.0
0:60:00	74.4	56.5	100.8	95.6	38.4

## **TEST RESULTS AND CONCLUSION**

Charts illustrating data collected from the test are included in Appendix A. Photographs from the test are included in Appendix B.

From ASTM E 119:

***32. Conditions of Acceptance—Unrestrained Assembly***

*32.1 In obtaining an unrestrained assembly classification, the following conditions shall be met:*

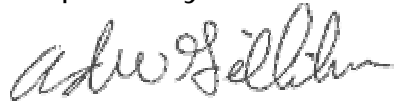
*32.1.1 The specimen shall have sustained the applied load during the classification period without developing unexposed surface conditions which will ignite cotton waste.*

*32.1.2 The transmission of heat through the specimen during the classification period shall not have been such as to raise the average temperature on its unexposed surface more than 250°F (139°C) above its initial temperature.*

The 4' X 4' wood floor joist assembly described in this report successfully met the temperature rise criteria for a 1 hour fire endurance period under conditions of this research-scale test. Temperatures on the unexposed side of the assembly remained below failure limits described above (with thermocouples 1, 3 and 4 peaking at around 100°C) and no flaming occurred on the unexposed side during the test. The load-bearing capability of this assembly was not assessed in this test.

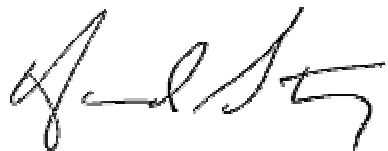
## **SIGNATURES**

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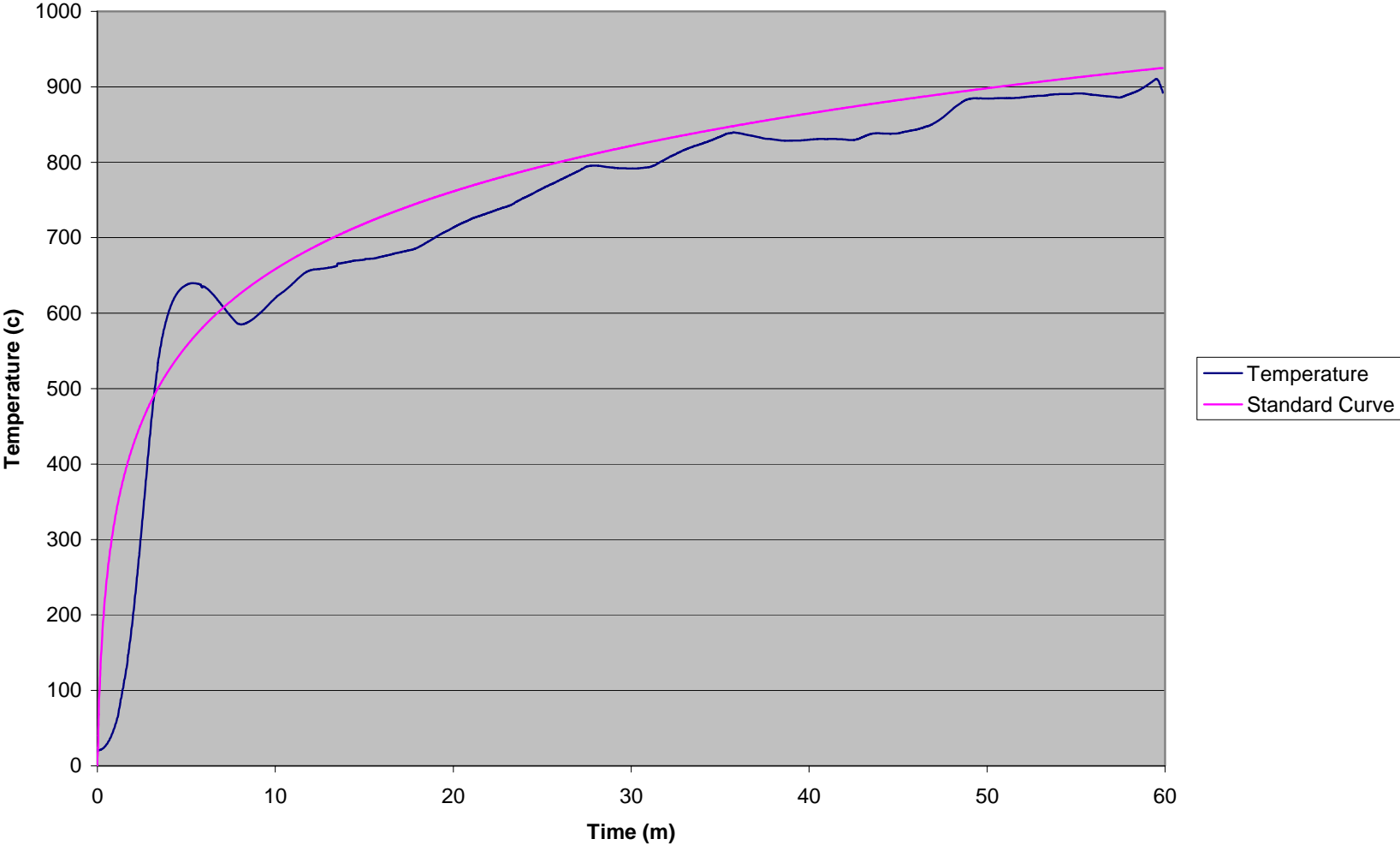
**WESTERN FIRE CENTER INC. AUTHORIZES THE CLIENT NAMED  
HEREIN TO REPRODUCE THIS REPORT ONLY IF REPRODUCED IN ITS  
ENTIRETY.**

**The test specimen identification is as provided by the client and WFCi accepts no  
responsibilities for any inaccuracies therein. WFCi did not select the specimen and has not  
verified the composition, manufacturing techniques or quality assurance procedures.**

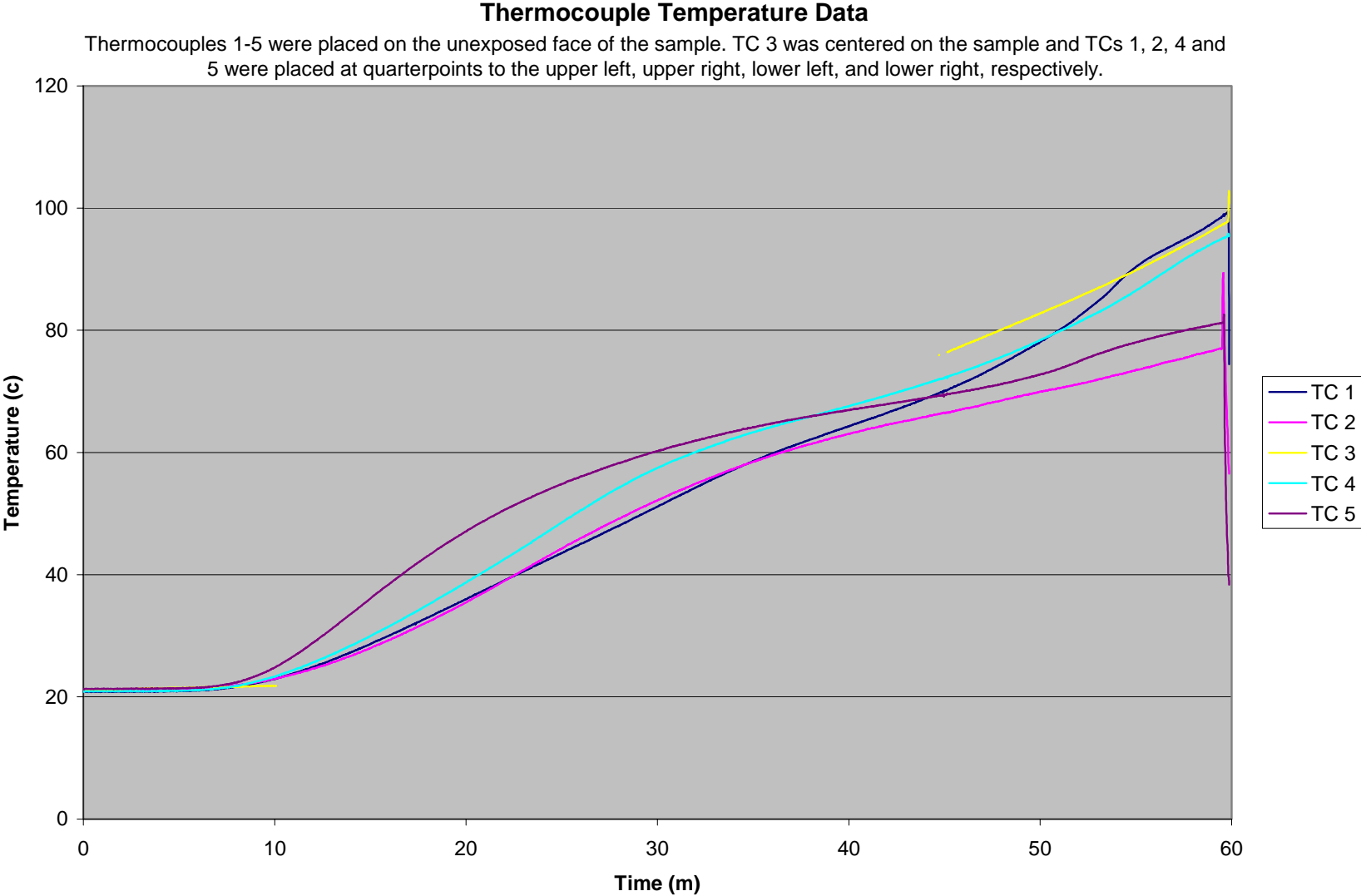
**APPENDIX A:**  
**CHARTS**

Chart 1: Furnace Temperature Vs. Standard Curve

Furnace Temperature Vs. Standard Curve



### Chart 2: Unexposed Face Thermocouple Temperatures



**APPENDIX B:**  
**PHOTOGRAPHS**





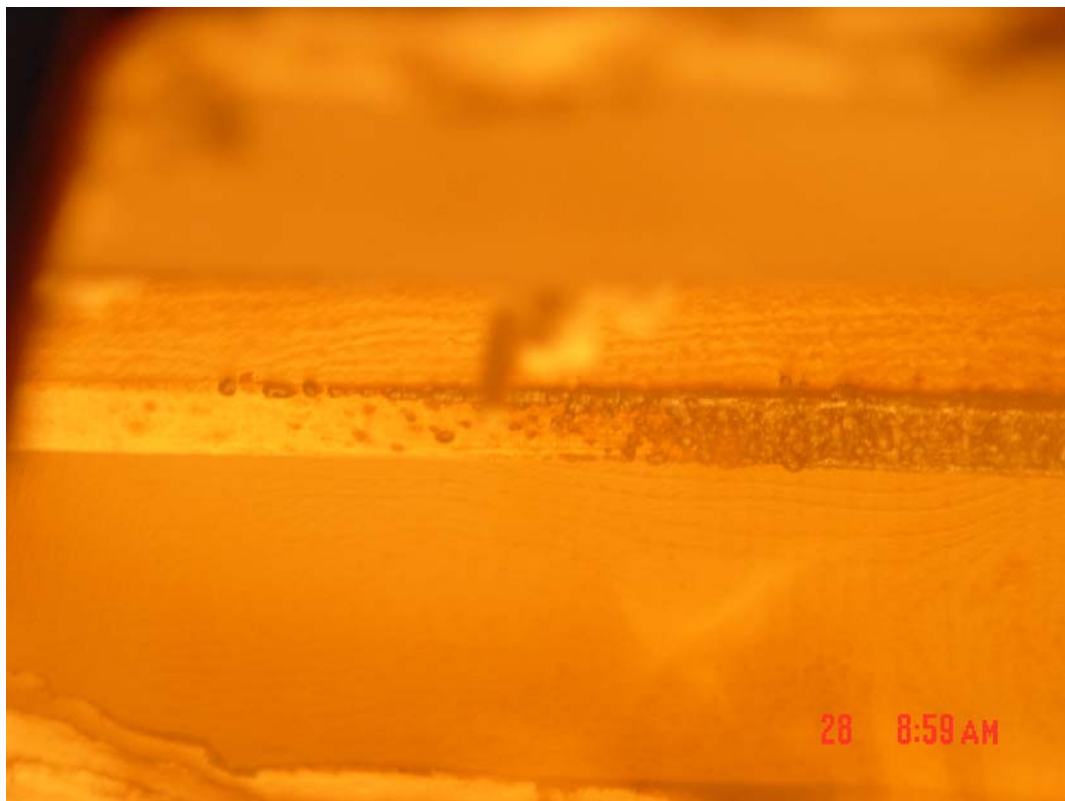
**Photograph 1: Exposed face of sample, pre-test**



**Photograph 2: Sample mounted on horizontal furnace at start of test**



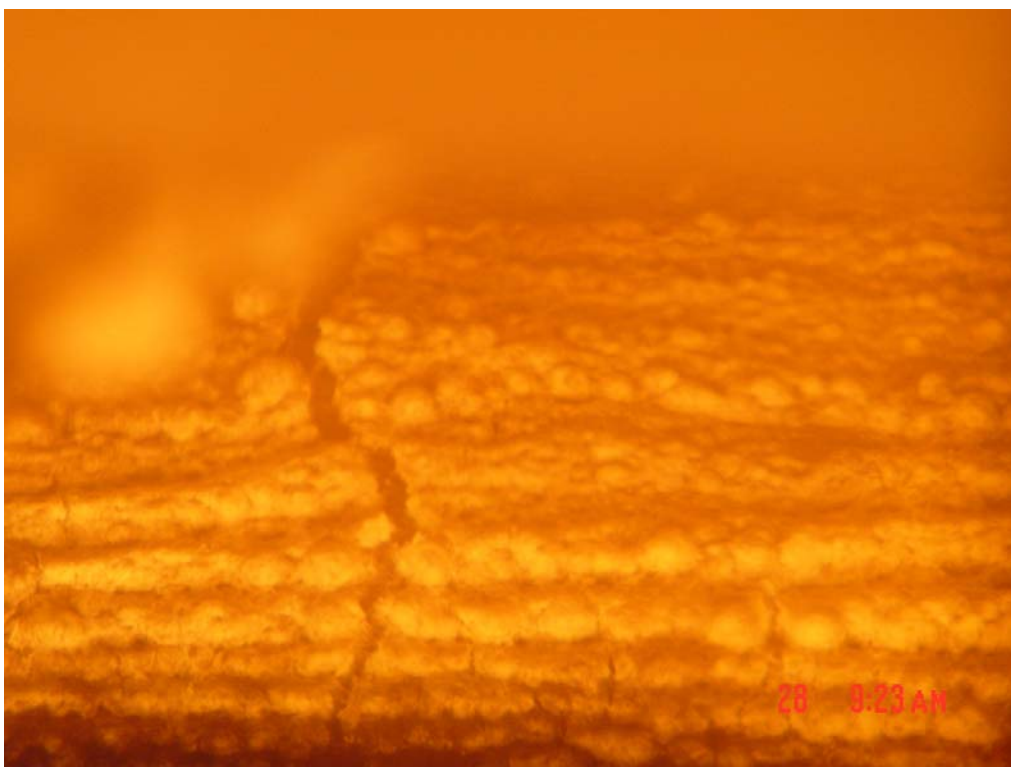
**Photograph 3: Unexposed sample face pre-test showing thermocouple placement**



**Photograph 4: Coating intumescenting early in the test**

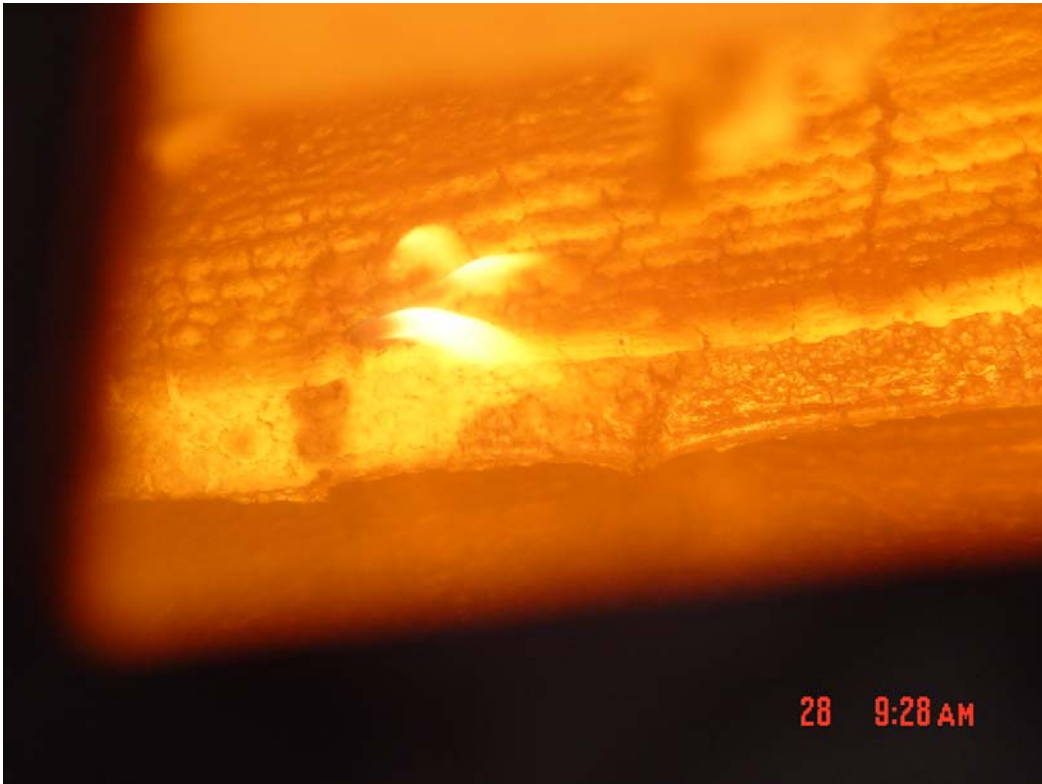


**Photograph 5: Light smoke leaking through the tongue and groove layer**



**Photograph 6: A crack forming in the intumescent coating during the test**





**Photograph 7: Flame attaching to the sample during the test**



**Photograph 8: Flame attaching to the sample during the test**



**Photograph 9: Smoke rising from the sample during the test**



**Photograph 10: Sample post-test**





**Photograph 11: Intumescent being scraped away to show char depth**



**Photograph 12: Exposed sample with coating scraped away**





**Photograph 13: Close-up of an exposed joist with the intumescent scraped off**



**Photograph 14: Measuring the intumescent depth on the side of a joist**