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FIRE PERFORMANCE EVALUATION OF BONDED LOGIC, INC.'S ULTRATOUCH® NATURAL COTTON FIBER INSULATION TESTED IN ACCORDANCE WITH ASTM E 119-00, "STANDARD TEST METHODS FOR FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS"

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ABSTRACT

A non-load bearing wall assembly was tested by Southwest Research Institute's® (SwRI®) Department of Fire Technology, located in San Antonio Texas, on April 3 and April 25, 2003. The wall assembly was exposed to the temperature conditions specified in ASTM E 119-00, *Standard Test Methods for Fire Tests of Building Construction and Materials* for 1 hr.

The non-load bearing wall assembly was comprised of 2 x 4-in. southern yellow pine wood studs spaced 16 in. on center with a double 2 x 4-in. top plate and single 2 x 4-in. bottom plate. Fire blocking was installed at mid-height of frame. The interior and exterior side of the wall assembly was finished with one layer of 5/8-in. thick, Type X gypsum wallboard. The wallboard was fastened with 1-5/8-in., No. 6 drywall screws spaced 8 in. on center at perimeter joints and 12 in. in the field of the wallboard. All joints were taped and treated with joint compound and all fastener heads were covered with joint compound. Stud cavities were filled with 3-1/2-in. thick UltraTouch® Natural Cotton Fiber Insulation.

Since the non-load bearing wall assembly is considered to be symmetric in construction, the assembly was fire and hose stream tested from one side of the wall assembly and successfully obtained the 1-hr rating from both sides.



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1.0 INTRODUCTION

The ASTM E 119-00, *Standard Test Methods for Fire Tests of Building Construction and Materials*, is intended to evaluate the duration for which the described assembly will contain a fire, or retain its structural integrity, or display both properties dependent upon the type of assembly involved, during a predetermined fire test exposure.

This test measures the response of the assembly to exposure in terms of the transmission of heat and hot gases through the assembly. This standard should be used 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. However, results of this test may be used as elements of a fire risk assessment, which takes into account all the factors that are pertinent to an assessment of the fire hazard of a particular end use.

This report describes the testing and analysis of a distinct wall assembly, and includes descriptions of the test procedure followed, assembly tested, and the results obtained. The results presented in this report apply only to the material tested, in the manner tested, and not to any similar materials or material combinations.

2.0 TEST PROCEDURE

The test exposes a wall assembly to standard fire conditions controlled to achieve specified temperatures throughout a specified time period. The fire exposure is typically followed by a standard hose stream test, which subjects the specimen to impact, erosion, and cooling effects of the water stream.

2.1. ASTM E 119-00 FIRE EXPOSURE

The furnace exposure is described in Section 5 of the standard, and is used to regulate the furnace environment throughout the duration of the exposure period. Points on the standard time/temperature curve are shown in Table 1.



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Table 1. Points on the Time/Temperature Curve.

TIME	TEMPERATURE
0 min	Ambient
5 min	1000°F (538°C)
10 min	1300°F (704°C)
30 min	1550°F (843°C)
45 min	1638°F (892°C)
60 min	1700°F (927°C)
2 hrs	1850°F (1010°C)
3 hrs	1925°F (1052°C)
4 hrs	2000°F (1093°C)

2.2. ASTM E 119-00 HOSE STREAM TEST

Where required by conditions of acceptance, the specimen is subjected to the impact, erosion, and cooling effects of a water stream directed first at the middle and then at all parts of the exposed face. The hose stream test is usually conducted immediately following the fire exposure. In some cases, the hose stream test is conducted on a separate wall assembly that has been subjected to a fire exposure equal to one-half of the rated fire exposure. The water stream is applied from a distance of 20 ft and delivered through a 2-1/2-in. hose discharging through a National Standard Playpipe of corresponding size equipped with a 1-1/8-in. discharge tip of the standard-taper, smooth-bore pattern. The water pressure and duration are outlined in Table 2.

Table 2. Conditions for Hose Stream Test.

RESISTANCE PERIOD (hr)	WATER PRESSURE AT BASE OF NOZZLE Psi (kPa)	DURATION OF APPLICATION Min/100 ft ² (Min/9.3 m ²)
4 and over, if less than 8	45 (310)	5
2 and over, if less than 4	30 (207)	2½
1½ and over, if less than 2	30 (207)	1½
1 and over, if less than 1½	30 (207)	1
Less than 1, if desired	30 (207)	1



2.3. TEST SETUP

Southwest Research Institute's[®] (SwRI's[®]) vertical furnace is capable of exposing a maximum test specimen of 12-1/2 ft high and 12-1/2 ft wide. The 30-in. deep furnace is equipped with nine flat-flame burners symmetrically placed across the back wall, which are controlled by a variable air-gas ratio regulator. View ports are located on both sides of the furnace to allow observation of the surface exposed to flame.

The conduct of the fire test is controlled according to the standard time/temperature curve, as indicated by the average temperature obtained from the readings of nine thermocouples symmetrically located across the face of the specimen, 6 in. away. The thermocouples are enclosed in protection tubes of such material and dimensions that the time constant of the thermocouple assembly lies between 5.0 and 7.2 min, as required by the standard. The furnace temperature during a test is controlled such that the area under the time/temperature curve is within 10% of the corresponding area under the standard time/temperature curve for tests of 1 hr or less, 7-1/2% for those less than 2 hr, and 5% for those tests of 2 hr or more duration.

2.4. INSTRUMENTATION AND DOCUMENTATION

2.4.1. Unexposed Surface Temperature

The unexposed surface temperature is monitored using nine, symmetrically placed thermocouples. Temperatures of unexposed surfaces are measured with No. 20 B & S gage, Type K (Chromel-Alumel) welded thermocouples, placed under flexible, dry, felted mineral fiber pads. The wire leads of the thermocouple terminate under the pad and are in contact with the unexposed surface. The pads are attached firmly to the surface to minimize any heat loss from the sides. Temperature levels are monitored continuously throughout the test and recorded with computer data acquisition equipment for subsequent data reduction.

Thermocouples were placed in a symmetric pattern on the unexposed surface. The location of unexposed surface thermocouples is provided in Appendix A, Test Assembly Drawings.

2.4.2. Photographic and Video Documentation

Photographic and video documentation of the fire exposure was conducted. Photographic documentation is provided in Appendix B and video documentation of the fire and hose stream tests accompany this report.



3.0 TEST ASSEMBLY

A 12 x 9-ft non-load bearing test wall assembly was constructed. The wall assembly was comprised of 2 x 4-in. southern yellow pine wood studs spaced 16 in. on center with a double 2 x 4-in. top plate and single 2 x 4-in. bottom plate. Fire blocking was installed at mid-height of frame. The interior and exterior side of the wall assembly was finished with one layer of 5/8-in. thick, Type X gypsum wallboard. The wallboard was fastened with 1-5/8-in., No. 6 drywall screws spaced 8 in. on center at perimeter joints and 12 in. in the field of the wallboard. All joints were taped and treated with joint compound, and all fastener heads were covered with joint compound. Stud cavities were filled with 3-1/2-in. thick UltraTouch® Natural Cotton Fiber Insulation.

4.0 TEST RESULTS

The non-load bearing wall assembly was mounted to the large vertical furnace. Instrumentation connections were verified and the wall was tested on April 3, 2003, at an ambient temperature of 79°F.

The fire exposure was terminated at 60 min 15 sec, at which time the average unexposed surface temperature was 204°F, representing a 125°F rise above ambient conditions. The maximum unexposed surface temperature was 225°F, representing a 146°F rise above ambient conditions.

There was no change in the appearance of the unexposed side of the wall during the 1-hr fire exposure. Visual observations of the test are summarized in Table 3.

Table 3. Visual Observations of Test No. 1.

TIME (min:sec)	OBSERVATION
0:00	Test begun at ambient temperature of 79°F.
5:00	No smoke or flames observed on the unexposed side.
10:00	No smoke or flames observed on the unexposed side.
15:00	No smoke or flames observed on the unexposed side.
20:00	No smoke or flames observed on the unexposed side.
30:00	Flaming observed on exposed side gypsum board along the joints.
40:00	Light smoke observed along top right corner of wall.
50:00	Continued smoking along top right corner of wall.
55:00	Flaming continued on exposed gypsum wallboard. Gypsum wallboard still intact.
60:15	Test concluded with no flaming on unexposed side and an average temperature of 204°F and a maximum single point temperature of 225°F.



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An identical sample was exposed to furnace conditions on April 25, 2003, for the purposes of conducting a hose stream test. The duplicate sample was exposed for 30 min (1/2 of the 1-hr desired fire resistance rating) and was immediately subjected to a 30-psi hose stream for 65 sec. The assembly did not allow the passage of water during the hose stream test.

5.0 CONCLUSION

A non-load bearing wall assembly was tested by Southwest Research Institute's® (SwRI®) Department of Fire Technology, located in San Antonio Texas, on April 3 and April 25, 2003. The wall assembly was exposed to the temperature conditions specified in ASTM E 119-00, *Standard Test Methods for Fire Tests of Building Construction and Materials* for 1 hr.

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