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Underwriters Laboratories Inc.®

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September 25, 1998

International Cellulose Corp.
Mr. Harold Boyer
P. O. Box 450006
Houston, TX 77245-0006

Our Reference: File R5499

Dear Mr. Boyer:

Confirming our September 16, 1998 telephone conversation, this letter certifies that your "K-13 Spray-On" product has been tested in accordance with UL 723 (ASTM E84) "Test for Surface Burning Characteristics Of Building Materials" and is eligible to bear the following Classification Marking of Underwriters Laboratories for Spray Fiber:

	Applied to Inorganic Reinforced Cement Board in a Maximum Thickness of 6 in.+
Flame Spread	5
Smoke Developed	5

+ - Must be applied with International Cellulose Corp. "SK-2000" adhesive in accordance with application instructions.

The Classification Marking of Underwriters Laboratories Inc. on the product is the only method provided by Underwriters Laboratories Inc. to identify Spray Fiber which has been produced under its Classification and Follow-Up Service Program.

We trust the above provides requested information. However, should you have additional questions, please feel free to contact the undersigned.

Very truly yours,

ROBERT S. KIEFER (Ext. 42014)
Engineering Associate
Engineering Services, Dept 411

Reviewed by:

R. K. LAYMON (Ext. 42687)
Engineering Group Leader
Engineering Services, Dept 411

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INTRODUCTION

On March 25, 1968, the Building Research Laboratory of The Ohio State University conducted an ASTM Fire Endurance and Hose Stream Test on a non-load bearing unsymmetrical exterior wall assembly. The specimen was constructed of 26 ga galvanized pre-formed steel siding panels insulated on the exposed face with a 3-9/16 in. thick layer of K-13 Spray-On Insulation. The test was conducted for the National Cellulose Corporation of Houston, Texas.

MATERIALS

ANCHORS:

The anchors used to secure the vertical and top channel framing units were 3/8-16 by 1-1/2 and 2-1/2 in. long round head machine screws with companion spring loaded clamp nuts. The machine screws and clamp nuts were required for the test frame anchor channel system.

The anchors used to attach the base channel framing unit were 1-3/16 in. long powder actuated drive pins. The shank diameter of the drive pins was 0.146 in., the head diameter was 0.221 in. and the washer diameter was 0.466 in.

CHANNEL FRAMING MEMBERS:

The periphery framing members were 5 in. deep cold rolled 16 ga channel sections formed and connected as shown in Figure 1.

STEEL SIDING:

The steel panels used were formed from 26 ga galvanized steel. A cross section of the panel is shown in Figure 1. The measured weight for a steel panel unit 10 ft long was 20 lbs. As certified by the manufacturer, the minimum yield stress of the steel was 50,000 psi.

FASTENERS:

The screws used to attach the steel siding were No. 14 by 3/4 in. and 1-1/2 in. long cadmium plated 3/8 in. hexagonal head, self-threading, tapping screws with pre-assembled watertight washers.

INSULATION:

The insulation used was K-13 Spray-On Insulation as manufactured by the National Cellulose Corporation of Houston, Texas. As certified by the manufacturer, the insulation conformed to Federal Specification HH-I-571a and

Commercial Standard CS-160-49. The insulation bore the Underwriters' Laboratories, Inc. label for sprayed fiber, issue No. AC-168. The label indicated a fire retardant hazard classification for flame spread of 20, for fuel contributed of 10 and for smoke developed of 0.

The densities determined from three 24 in. long by 17-1/2 in. wide by 2-7/8, 3-1/4 and 3-1/4 in. thick weighing samples were as follows:

Condition	Range	Average
Wet density	11.8-21.7	16.9 lbs/cu ft
Air dry density (time of test)	6.6-9.2	8.3 lbs/cu ft
Oven dry density (150°F)	5.7-8.4	7.3 lbs/cu ft

CONSTRUCTION

The construction was performed by skilled workmen regularly employed by the sponsor for this type of work under the direct supervision of the sponsor.

The bolster was aligned in the concrete test frame to form the proper height for the assembly. For the protection of the test frame, layers of gypsum wallboard were placed along the vertical and ceiling edges of the frame. The steel channel framing members were attached to the test frame 24 in. on center and bolted at the four corners as shown in Figure 1. A steel siding panel was erected vertically starting at a vertical edge. The panels were fastened to the vertical framing channels with the 1-1/2 in. long screws spaced 12 in. on center and to the top and bottom framing channels with 3/4 in. long screws spaced 8 in. on center. The successive sheets were lapped 1 rib and the joint was secured with the 3/4 in. long screws spaced 12 in. on center. The subsequent sheets were erected in a similar manner across the opening. The end siding panel was trimmed to fit and fastened to the channel framing with the 3/4 in. long screws spaced 12 in. on center.

The K-13 insulation was spray applied to the exposed face of the panels to an average thickness of 3-9/16 in. measured over the flat portion of the siding. The thickness ranged from 3 to 4-1/4 in. The insulation was dry blown through a hose to a water emulsion atomizer at the nozzle head. The K-13 was applied, patted, rolled and formed over the channel framing. The exposed surface was sprayed so as to be a plane surface rather than following the contour of the siding. The K-13 was applied in approximately three layers. Each layer was patted and roll packed in such a way as to eliminate any voids. Details and dimensions of the construction are shown in Figure 1.

DRYING AND AGING

A pipe enclosed relative humidity sensing element was located in the bot-

tom channel. After 34 days, all three weighing samples had reached equilibrium, but the relative humidity in the bottom channel was not showing a drying trend. After a period of time and still the bottom channel location was not showing a drying trend, a second element was installed in the insulation on the siding. After sufficient time for assurance of an accurate reading at this new location, it was found that the drying requirements in the field of the assembly had been met. At the time of the test the equilibrium relative humidity of the insulation on the siding was 28 per cent. The high reading inside the bottom channel was ignored in establishing the time of test because it was not representative of the major portion of the specimen and would not have affected the fire endurance results significantly. The insulation had set and air dried for 129 days. During this time, the specimen stood in the normal atmosphere of the testing laboratory where air could circulate freely about the assembly.

DESCRIPTION OF TEST EQUIPMENT AND TEST PROCEDURE

The test furnace consists of massive masonry walls lined with fire brick. One wall of the furnace is a hinged steel restraining frame in which the test specimen is placed. The restraining frame can be opened to install the test assembly and to conduct the standard hose stream test without any interference from the furnace itself. Ports are located in the north and south walls to permit visual observations of the exposed surface of the test assembly and the furnace chamber. The furnace is fired with 10 luminous flame natural gas burners, one at the top and bottom on the north and south walls and 6 burners mounted along the base.

The assembly was non-load bearing and was restrained along all four edges. The test frame containing the test assembly was placed in the steel restraining frame and securely fastened. During the test, the assembly remained in the restrained condition imposed by the restraining frame and bolster.

The deflection of the specimen was measured 5 in. north of center at mid-height on the unexposed face.

The unexposed surface temperature was measured with 10 thermocouples of Chromel-Alumel wire located as shown in Figure 2. Each thermocouple was tightly covered with an oven dried, flexible, felted asbestos pad 6 in. square by approximately 0.4 in. thick. One thermocouple was located near the center of the partition and one was located near the center of each quarter section. The other five thermocouples were located to provide representative readings with respect to the construction. The room temperature at the start of the test was read from an etched stem, mercury filled minus 30 to plus 120°F thermometer placed under a thermocouple pad on the unexposed surface of the wall.

All furnace thermocouples and unexposed surface thermocouples were

connected to a direct reading temperature indicating instrument and were read at the start of the test and at intervals of not more than 5 minutes throughout the test.

Figure 3 is a view of the exposed surface before test and Figure 4 is a view of the unexposed surface before the test with the thermocouples mounted on the surface.

The furnace temperature was controlled from the average of ten individual Chromel-Alumel thermocouples enclosed in stainless steel protection tubes within the furnace chamber.

OBSERVATIONS DURING FIRE ENDURANCE AND HOSE STREAM TEST

EXPOSED SURFACE:

0-1/4 minutes:	The surface darkened immediately.
1 minute:	The north half ignited and burned.
2 minutes:	The flaming stopped.
4 minutes:	The surface reignited.
5 minutes:	Intermittent flaming flitted across the surface.
5-3/4 minutes:	The entire surface of the assembly was engulfed in flames.
7 minutes:	The flaming stopped.
8 minutes:	The surface reignited.
10 minutes:	Cracks similar to those found in dried mud flats appeared in the surface. The flaming continued intermittently.
33 minutes:	The flaming continued from the entire surface accompanied by an overall red glow. The cracks in the surface had a maximum width of approximately 3/4 in.
52 minutes:	The surface crack width increased to approximately 2 in. maximum. The lazy flaming of the entire surface continued.
60 minutes:	The flaming continued. The surface of the assembly remained intact although badly cracked.

71 minutes: The fire in the furnace was extinguished. There was no fall-off of insulation.

UNEXPOSED SURFACE:

0-71 minutes: No apparent changes appeared in the unexposed surface of the assembly during this period.

71 minutes: The test was discontinued at the request of the sponsor although no end point criteria as stipulated by ASTM had been reached.

Figure 5 is a view of the unexposed surface at the end of the Fire Endurance Test. The restraining frame which contained the test specimen was swung to the open position. Figure 6 shows the exposed surface after 71 minutes of fire endurance.

FIRE ENDURANCE TEST RESULTS

The furnace temperature was adjusted in such a manner that it conformed as closely as possible to the Standard ASTM Time-Temperature Curve. The time-temperature data for the furnace and unexposed surface thermocouples is given in Table 1. The area error for this test as calculated from recorded data was plus 0.27 per cent at the end of the test. The deflection of the assembly during the progress of the test is shown in Table 2.

The assembly demonstrated an ASTM Fire Endurance Time of 1 hour and 11 minutes. The test was discontinued at the request of the sponsor although no ASTM end point criterion had been reached.

HOSE STREAM TEST

Having endured the fire for 1 hour and 11 minutes, the test specimen was subjected to the hose stream test, as permitted by Paragraph 8 (c) of the Specification. The hose stream was applied at a pressure of 30 psi for a period of one minute.

As a result of the hose stream test most of the insulation was eroded away.

The same panel used in the fire endurance test met the hose stream requirements consistent with the endurance time.

Figure 7 shows the exposed surface after the impact and erosion of the hose stream test. The restraining frame was swung to the closed position and Figure 8 shows the unexposed surface after the hose stream test showing that no breakthrough occurred.

VISITOR PRESENT DURING CONDUCT OF TEST

Mr. John L. Webb, National Cellulose Corporation, Houston, Texas

ENGINEERING EXPERIMENT STATION
THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO 43212

Report of a

STANDARD ASTM FIRE ENDURANCE AND HOSE STREAM TEST ON A NON-LOAD BEARING EXTERIOR WALL ASSEMBLY

for

National Cellulose Corporation
Houston, Texas
Project T-4354

Conducted by

BUILDING RESEARCH LABORATORY
Richard W. Bletzacker, Director
John G. Birle, Associate Supervisor
William W. Lane, Project Engineer

April, 1968

The test reported herein was conducted in accordance with the Standard Method of Fire Tests of Building Construction and Materials, ASTM Designation E 119-67.