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REPORT

on

MINERAL AND FIBERBOARDS

Knight-Celotex LLC
Northfield, IL

GENERAL

The subject of this Report is the fire resistance investigation of 1/2 in. SoundStop mineral and fiber boards manufactured by Knight-Celotex LLC.

The object of this investigation was to develop Fire test data by means of a fire endurance test conducted in accordance with the Standard, Fire Tests of Building Construction and Materials, UL 263 (ASTM E119), 13th Edition dated April 4, 2003. The data will be used to promulgate a new UL Design in the U300 series designs.

TEST RECORD NO. 1

MATERIALS:

The materials used in the construction of the wall assembly are described below:

Wood Studs, Bearing Plates and Blocking - The lumber consisted of nominal 2 by 4 in. lumber (1-1/2 in. by 3-1/2 in. actual). The lumber bore the following marking: "MLB SPF-S No.2 KD-HT 708". The moisture content of the 2 by 4 in. studs ranged from 7.1 to 13.0 percent and averaged 12.0 percent.

Mineral and Fiber Boards – The 1/2 in. SoundStop was supplied in 48 in. by 96 in. panels. The mineral and fiber boards were manufactured by Knight-Celotex LLC. The Type SoundStop production was witnessed by a Field Representative employed by Underwriters Laboratories Inc. in Sunbury, PA.

Gypsum Board - The 5/8 in. thick gypsum board was supplied in nominal 48 in. widths by 12 ft. lengths. The boards were cut to length prior to installation. The gypsum board was Classified by Underwriters Laboratories Inc. for use in Design No. U305 and under the Follow-Up Service Program. The gypsum board bore the appropriate UL Classification Marking.

Batts and Blankets - The glass fiber batt and blanket material was 3-1/2 in. thick by 16 in. wide and supplied in 48 in. long pieces. The batt and blanket material had a nominal density of 0.65 pcf.

Joint Tape - The joint tape was a 2 in. wide paper tape for use with gypsum board.

Joint Compound - The joint compound was a dry compound, which was mixed with water. The dry mixture is intended for use with gypsum board.

Fasteners - The various types of fasteners used in the construction of the wall assembly, are described in their order of the use under the heading "Erection of Test Assembly".

ERECTION OF TEST ASSEMBLY:

The wall assembly was erected in a test frame as to fill the masonry opening (nominal 10 ft. high by 10 ft. wide) in accordance with the methods indicated by the submitter. The test assembly was installed by workmen in the employ of the submitter under the observation of a member of the engineering staff of Underwriters Laboratories Inc.

The nominal 2 in. by 4 in. bridging members were cut to fit between the studs and nailed in place along the horizontal centerline with two No. 16d cement coated (sinker) nails at each end. The bridging members were staggered to permit end nailing.

The lumber frame was then installed in the test frame and secured to the top and bottom of the assembly with 1/4 by 20 steel bolts with lengths sufficient to penetrate the top and bottom plates. The steel bolts were used in conjunction with unistrut channels, which were spaced approximately 24 in. OC.

The nominal 2 in. by 4 in. stud members were cut into nominal 9 ft. 7-1/2 in. lengths, and three bearing plates cut into 10 ft. lengths. Each stud was nailed at the top and bottom to the bearing plates with two No. 16d cement coated (sinker) steel nails. A second bearing plate was nailed to the bottom bearing plate with No. 16d cement coated (sinker) nails spaced 16 in. OC (each stud). The studs were spaced 16 in. OC, with the two end studs spaced 12 in. OC to accommodate the test frame dimension.

On both sides of the assembly, the SoundStop mineral and fiber board was installed vertically. The board was secured with No. 6 by 1-1/4 in. long coarse thread drywall steel screws spaced 12 in. OC at the perimeter and in the field with screws located 1 in. from the panel edges. The joint locations were staggered on each side of the assembly.

On both sides of the assembly, the gypsum board was installed horizontally. The gypsum board was secured with 2 in. long coarse thread drywall steel screws spaced 8 in. OC at the perimeter and in the field with screws located 1 in. from the panel edges. The joint locations were aligned on each side of the assembly.

The joints of the gypsum board were treated with two coats of joint compound and the 2 in. wide paper tape. The screw heads were treated with two coats of joint compound.

FIRE ENDURANCE TEST:

The fire endurance test was conducted on October 19, 2007 in accordance the Standard, Fire Tests of Building Construction and Materials, ANSI/UL 263 (ASTM E119, NFPA 251) Thirteenth Edition dated April 2003.

SAMPLE

The fire endurance test was conducted on the assembly described previously in this Report under "Erection Of Test Assembly". Test results relate only to items tested.

METHOD

The temperatures of the furnace chamber were measured with 12 thermocouples symmetrically spaced and placed 6 in. from the exposed surface of the test assembly. A graph of the furnace curve can be seen on ILL 1.

The temperatures of the unexposed surface were measured by 9 thermocouples located as shown on ILL. 2. Each thermocouple was covered with a 6 by 6 in. dry ceramic fiber pad. The measured temperatures can be seen on ILL 3.

The lateral deflection of the wall was determined by measurements taken near the quarter and center points along the horizontal centerline of the unexposed surface. The reference line was a fine taut steel wire with both ends fastened to the test frame.

Throughout the test, observations were made of the character of the fire, of the conditions of the exposed and unexposed surfaces, and of other events relative to the fire resistance performance of the assembly.

RESULTS

Character and Distribution of the Furnace Fire - The furnace fire was luminous and well distributed throughout the test. The temperatures that developed conformed with the standard time-temperature curve as described in the Standard for Fire Tests of Building and Construction Materials, ANSI/UL 263 and shown on ILL. 1.

The assembly was loaded with 81 psi approximately 30 minutes prior to the exposure to heat. The load was maintained throughout the duration of the test.

Observations of the Exposed and Unexposed Surfaces - The following observations were made during the fire test. All references to dimensions are approximate.

Test Time, min	Exposed (E) or Unexposed (U) Surface	Observations
3	E	The paper began to burn. Flames from joints could be seen.
5	E	Gypsum board turned gray and flaked.
15	E	Gypsum board turned white in color. About 40% of joint compound had fallen off.
24	E	A gap of 1/4 in. could be seen between gypsum board joints. Flames were apparent.
26	E	South top corner of center panel of gypsum board began cracking.
31	E	Large flames could be seen from joints of gypsum board.
36	U	Popping and cracking could be heard.
43	E	Gypsum board joints opened to about 5/8 in. wide.
50	E	Vertical and horizontal cracks could be seen throughout the gypsum board.
57	E	Large cracks and flames could be seen on bottom panel of gypsum board.
60	E	No apparent changes.
62	E	Center panel of gypsum board stated to peal off.
65	E	80% of center panel of gypsum board fell off.
69	E	80% of all gypsum board fell off.
73:30	E/U	Gas off due to load.

Temperatures of the Unexposed Surface - The average temperature of the unexposed surface before the test was 70.9°F; therefore, based on a maximum average temperature rise of 250°F, and a maximum individual temperature rise of 325°F, the average limiting temperature was 320.9°F and the individual limiting temperature was 395.9°F. A plot of unexposed temperatures during the test can be seen on ILL 3.

Neither the average limiting temperature nor the individual limiting temperature were reached during the 61 minutes fire exposure. At 73 minutes and 30 seconds the average temperature was 161.5°F and the maximum individual temperature as recorded by thermocouple No. 8 was 178°F. During the classification period no location developed unexposed surface conditions which would ignite cotton waste.

Deflection of the Assembly - The deflection of the wall assembly during the fire test is shown below.

Time (min)	Lateral Deflection (in)		
	North	Center	South
No Load	5-1/4	5-1/4	5-1/2
100% Load	5-1/4	5-5/16	5-1/2
5	5-1/4	5-5/16	5-7/16
10	5-3/16	5-1/4	5-7/16
15	5	5-3/16	5-5/16
20	4-7/8	5	5-3/16
25	4-13/16	5	5-3/16
30	4-13/16	5	5-3/16
35	4-3/4	4-15/16	5-1/8
40	4-5/8	4-3/4	5-1/16
45	4-7/16	4-9/16	4-13/16
50	4-3/16	4-1/4	4-5/8
55	3-15/16	4	4-3/8
60	3-9/16	3-5/8	4-1/8
65	2-15/16	3	3-5/8
70	0	0	0

TEST RECORD NO. 2

ERECTION OF TEST ASSEMBLY:

Duplicate Hose Stream – The duplicate hose stream assembly was constructed in the identical manner as the assembly in Test Record 1.

DUPLICATE HOSE STREAM TEST:

The duplicate hose stream test was conducted on October 22, 2007 in accordance the Standard, Fire Tests of Building Construction and Materials, ANSI/UL 263 (ASTM E119, NFPA 251) Thirteenth Edition dated April 2003.

SAMPLE

The fire endurance test was conducted on the assembly described previously in this Report under "Erection Of Test Assembly" in Test Record 1. Test results relate only to items tested.

METHOD

The temperatures of the furnace chamber were measured with 12 thermocouples symmetrically spaced and placed 6 in. from the exposed surface of the test assembly. A graph of the furnace curve can be seen on ILL 4.

The lateral deflection of the wall was determined by measurements taken near the quarter and center points along the horizontal centerline of the unexposed surface. The reference line was a fine taut steel wire with both ends fastened to the test frame.

Throughout the test, observations were made of the character of the fire, of the conditions of the exposed and unexposed surfaces, and of other events relative to the fire resistance performance of the assembly.

RESULTS

Character and Distribution of the Furnace Fire - The furnace fire was luminous and well distributed throughout the test. The temperatures that developed conformed with the standard time-temperature curve as described in the Standard for Fire Tests of Building and Construction Materials, ANSI/UL 263 and shown on ILL. 4.

The assembly was loaded with 85 psi approximately 30 minutes prior to the exposure to heat. The load was maintained throughout the duration of the test.

Observations of the Exposed and Unexposed Surfaces - The following observations were made during the fire test. All references to dimensions are approximate.

Test Time Min	Exposed (E) or Unexposed (U) Surface	Observations
3	E	Paper on gypsum board turned dark in color.
7	E	Paper on gypsum board turned lighter and began to flake.
12	E	Paper on gypsum board continued to burn and flake off.
14	E	Joint compound began to fall off.
20	E	Joint compound continued to fall off. No horizontal compound left on assembly.
24	E	Flames were present along horizontal joints.
29	E	Larger flames could be seen.
30	E/U	Gas off.

Deflection of the Assembly - The deflection of the wall assembly during the fire test is shown below.

Time (min)	Lateral Deflection (in)		
	North	Center	South
No Load	4-1/8	4-1/8	4-1/8
100% Load	4-1/8	4-1/8	4-1/8
5	4-1/8	4-1/8	4-1/8
10	4-1/16	4-1/8	4-3/16
15	4-1/16	4-1/8	4-3/16
20	4-1/16	4-1/8	4-3/16
25	4-1/16	4-1/16	4-1/8
30	4-1/16	4-1/8	4-1/8

Hose Stream Test – A hose stream of 30 psi for 1 minute was applied to the exposed surface of the assembly directly after the exposure to flame. No through penetrations were seen and the assembly maintained the calculated load of 85 psi for the duration of the hose stream test.

SUMMARY

TEST RECORDS 1 AND 2

During the Classification period the average and maximum unexposed temperatures at 60 minutes were 145°F and 162.1°F, respectively. The average and maximum limiting temperatures were 320.9°F and 395.9°F, respectively. The failure mode of the assembly was due to the loading of the assembly.

The above data demonstrates the ability of the Mineral and Fiber Boards coupled with 5/8 in. thick gypsum board as well as unclassified 3-1/2 in. thick fiberglass insulation to affectively slow the heat transmission through the fire resistant assembly and not allow the passage of flame or gasses hot enough to ignite cotton waste during a classification period (Section 7.3.1 item a of UL 263). The wall or partition will sustain the hose stream without development of an opening that would permit a projection of water form the hose stream beyond the unexposed surface (Section 7.3.1 item b of UL 263). Also the transmission of heat through the wall or partition during the classification period will not raise the temperature on its unexposed surface for than 250°F above its initial temperature (Section 7.3.1 item c of UL 263). Allowing the uses of any 5/8 in. gypsum board listed in Design U305 as the face layer and the 1/2 in. Type SoundStop mineral and fiberboard as the base layer will not detrimentally affect the fire resistive assembly and is deemed an acceptable additional construction.

During the Classification period the average and maximum unexposed temperatures at 60 minutes were 145°F and 162.1°F, respectively. The average and maximum limiting temperatures were 320.9°F and 395.9°F, respectively. The failure mode of the assembly was due to the loading of the assembly.

The above data demonstrates the ability of the Mineral and Fiber Boards coupled with 5/8 in. thick Type X gypsum board as well as unclassified 3-1/2 in. thick fiberglass insulation to affectively slow the heat transmission through the fire resistant assembly and not allow the passage of flame or gasses hot enough to ignite cotton waste during a classification period (Section 7.3.1 item a of UL 263). The wall or partition will sustain the hose stream without development of an opening that would permit a projection of water form the hose stream beyond the unexposed surface (Section 7.3.1 item b of UL 263). Also the transmission of heat through the wall or partition during the classification period will not raise the temperature on its unexposed surface for than 250°F above its initial temperature (Section 7.3.1 item c of UL 263). Allowing the uses of any Classified Batt and Blanket insulation along with the 5/8 in. Type X gypsum board as the face layer and the 1/2 in. Type SoundStop mineral and fiberboard as the base layer will not detrimentally affect the fire resistive assembly and is deemed an acceptable additional construction.

The materials and construction methods of the test assembly described in this Report will be covered in the Fire Resistance Directory under Design No. U387.

CONCLUSION

The following conclusions represent the judgment of Underwriters Laboratories Inc. based upon the results of the examination and tests presented in this Report as they relate to established principles and previously recorded data.

FIRE RESISTANCE PROPERTIES:

It is judged that the wall assemblies constructed of materials and in the manner described in this Report will afford a 1 hour restrained assembly rating.

Passage of flames through the unexposed surface of the test assemblies did not occur during the 1 hr. rating period time. Transmission of heat through the test assemblies did not raise the temperature on the unexposed surface at any one point more than 325° F above the initial temperature and the average temperature did not exceed 250° F above the initial temperature during the 1 hr rating period time. The test assemblies performed during the 1 hr rating period without developing unexposed surface conditions which would ignite cotton waste.

The results from this test will be incorporated into Volume 1 of Underwriters Laboratories Fire Resistance Directory.

The above conclusion is based on the Conditions of Acceptance as stated in the Standard, Fire Tests of Building Construction and Materials, ANSI/UL 263 (ASTM E119, NFPA 251), Thirteenth Edition, dated April 4, 2003 and the Standard, Standard Methods of Fire Endurance Tests of Building Construction and Materials CAN/ULC-S101-04, Third Edition, dated April 2004.

PRACTICABILITY:

The materials used in the test assembly were readily installed by qualified workers with tools and methods commonly used for construction work of this nature.

Materials and installation procedures in accordance with those described in this Report are significant factors in the fire resistance of the construction.

CONFORMITY:

The assembly was tested in accordance with the Standard, Fire Tests of Building Construction and Materials, ANSI/UL 263 (ASTM E119, NFPA 251).

The wall assemblies were tested in accordance with the Standard, Fire Tests of Building Construction and Materials, ANSI/UL 263 (ASTM E119, NFPA 251), Thirteenth Edition, dated April 4, 2003.

Samples of the product covered by this Report are judged to be eligible for Classification and Follow-Up Service. The manufacturer is authorized to use the UL Mark on such products which comply with the Follow-Up Procedure and any other applicable requirements of Underwriters Laboratories Inc. Only those products which properly bear the UL Mark are considered as Classified by Underwriters Laboratories Inc. Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

Report by:

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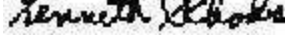
Engineer

Reviewed by:



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