

APPROVAL REPORT

FIRE-X GLASBORD FM AS CLASS 1 INTERIOR FINISH MATERIALS

Prepared for

KEMLITE COMPANY, INC.
23525 WEST EAMES STREET
CHANNAHON, IL 60410

2B2A2.AM
CLASS 4880
DATE December 20, 1999

FACTORY MUTUAL

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(Factory Mutual Research Class 4880)

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from

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23525 WEST EAMES STREET
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I INTRODUCTION

1.1 Kemlite Company, Inc. submitted their Fire-X Glasbord FM interior finish materials to determine if they meet the Factory Mutual Research Standard 4880 Approval requirements for Class 1 fire classification of interior finish materials to a maximum height of 30 ft (9.1 m).

1.2 Examination included flammability characterization testing using the Factory Mutual Research 50 kW Scale Flammability Apparatus and a Uniform Building Code Standard No. 17-5 (26-3) room fire test of the interior finish materials.

1.3 Tests show that Kemlite Company, Inc. Fire-X Glasbord FM as tested meets the Factory Mutual Research Standard 4880 Approval requirements for Class 1 fire classification to a maximum height of 30 ft (9.1 m) when installed as specified in the CONCLUSIONS of this report.

II MATERIALS TESTED

2.1 Fire-X Glasbord FM interior finish panels are flat, opaque glass fiber reinforced plastic panels with an embossed, pebble-like finish. The panels are nominal 0.090 in. (2.3 mm) thick and are supplied in 4 ft by 8 ft (1.2 m by 2.4 m) sheets.

2.2 A representative of Factory Mutual Research witnessed the sample panel fabrication on April 19, 1999 at the Kemlite Company, Inc. manufacturing facility in Channahon, IL.

2.3 The proprietary formulation is on file at Factory Mutual Research.

III TESTS AND PROCEDURES

3.1 Tests conducted were as required to qualify the Fire-X Glasbord FM interior finish materials for Class 1 fire classification to a maximum height of 30 ft (9.1 m) under Factory Mutual Research Standard 4880.

3.2 Flammability Characterization

3.2.1 A series of measurements were made in the Factory Mutual Research 50 kW Scale Flammability Apparatus to determine the material flammability properties of the interior finish materials.

3.2.2 The critical heat flux for ignition (q''_{cr}) and the thermal response parameter (TRP) were determined by exposing the coated surfaces of several specimens to known radiant heat fluxes and recording the time to piloted ignition. The inverse square root of the time to ignition was plotted against the applied external radiant heat flux. The intercept on the applied heat flux axis is defined as the critical heat flux for ignition (the value of the external heat flux at or below which the sample can no longer achieve piloted ignition during the 15 minute exposure). The inverse of the slope at large external heat fluxes is the thermal response parameter (a measure of the thermal inertia of the material).

3.2.3 The chemical heat of combustion (ΔH_{ch}) and the effective heat of gasification (L_e) were determined by measuring the sample mass loss and heat generation rate history during exposure of a specimen to an external heat flux of 50 kW/m². The chemical heat of combustion was obtained by measuring the chemical heat release rate by CO/CO₂ generation at the applied external heat flux, time integrating to obtain the total energy released, and dividing by the total mass lost. The effective heat of gasification was obtained from the chemical heat release rate, the chemical heat of combustion, and the net heat flux, which was assumed to be the difference between external heat flux and the critical heat flux for ignition.

3.2.4 The convective flame spread parameter (FSP_c) was determined from the chemical heat of combustion, effective heat of gasification, net heat flux, and the thermal response parameter.

3.2.5 The convective flame spread parameter (FSP_c) for the Fire-X Glasbord FM interior finish material was compared to the convective flame spread parameter (FSP_c) of the Fire-X Glasbord interior finish material that was successfully tested in the Factory Mutual Research 25 ft (7.6 m) High Corner Test to determine if further full-scale fire testing is necessary.

3.3 Room Fire Test

3.3.1 A room fire test was conducted in accordance with Uniform Building Code Standard No. 17-5 (26-3) "Room Fire Test Standard for Interior of Foam Plastic Systems".

3.3.2 The room fire test was conducted in a room sheathed on the ceiling and all four walls with glass fiber faced gypsum board secured to wood framing. A 2 ft 6 in. (760 mm) wide by 7 ft 0 in. (2135 mm) high door was located in one 8 by 8 ft (2440 by 2440 mm) wall (front).

3.3.2.1 Sample interior finish panels were installed vertically on the 8 by 8 ft (2440 by 2440 mm) wall opposite the door (back) and the first 8 ft (2440 mm) of the adjacent 12 by 8 ft (3660 by 2440 mm) wall (left). Sample ceiling panels were installed on the first 8 ft (2440 mm) of the 8 ft (2440 mm) high ceiling adjacent to the left and back walls parallel to the 8 ft (2440 mm) dimension. Test panels were mechanically fastened to the gypsum sheathing. Panel joints were covered with molding.

3.3.2.2 The finished interior of the room after sample installation was 12 ft (3660 mm) long by 8 ft (2440 mm) wide by 8 ft (2440 mm) high. Factory Mutual Research personnel installed all test panels and trim.

3.3.3 The exposure fire was a 15 by 15 in. (380 by 380 mm) crib of 1½ in. (38 mm) square Douglas fir sticks placed at the intersection of the sample covered walls 1 in. (25 mm) from the interior of the sample panels and 3 in. (76 mm) above the noncombustible floor. The crib weighed 30.1 lb. (13.7 kg) and it was conditioned to a moisture content of 7.7%. The exposure fire was ignited using 1 lb. (0.45 kg) of shredded wood excelsior and 4 oz. (0.12 L) of ethanol.

3.3.4 The exposure fire was removed from the corner location 15 minutes after ignition and extinguished with water. Flaming on sample panel surfaces or at sample panel joints was extinguished with a fine water spray after the exposure fire was extinguished.

3.3.5 A video tape of the room fire test was taken through the door opposite the exposure fire. Temperature readings were taken at 15 second intervals using thermocouples located 3, 5 and 7 ft (915, 1525 and 2135 mm) above the floor 3 in. (76 mm) from the adjacent interior wall surfaces above the exposure fire and 1 in. below the ceiling at the center of the 8 by 8 ft (2440 by 2440 mm) sample ceiling area.

3.3.6 Performance in the room fire test is satisfactory if there is no evidence of the panels burning at the outer extremities of the test area within 15 minutes of the ignition of the excelsior and smoke levels generated during the test are not excessive.

IV TEST SAMPLES

4.1 Flammability Characterization Test Specimen

A Fire-X Glasbord FM sheet was cut into 4 in. by 4 in. (102 mm by 102 mm) test specimens. Each specimen was coated with a high absorptivity selective black coating prior to placement in the sample holder of the Factory Mutual Research 50 kW Scale Flammability Apparatus.

4.2 Room Fire Test Sample

Sample Fire-X Glasbord FM sheet as described in 2.1 above were supplied.

4.2.1 Two 48 in. by 96 in. (1.2 m by 2.4 m) sheets were secured to the ceiling of the test room. The sheets were installed parallel to the back wall.

4.2.2 Two 48 in. by 96 in. (1.2 m by 2.4 m) sheets were secured to the left wall of the test room. And two 48 in. by 96 in. (1.2 m by 2.4 m) sheets were secured to the back wall of the test room.

4.2.3 The panel joints on the walls and ceiling were covered with PVC molding. When installed the sheets are inserted into the molding. The sheets were mechanically fastened to the gypsum sheathing of the room structure with AMIFasteners nylon, pin-drive rivets spaced 16 in. (406 mm) o.c., horizontally and vertically.

V RESULTS

5.1 Flammability Characterization

The material flammability properties of the test specimens described in 4.1 above are given below along with the values obtained for the currently Approved Fire-X Glasbord.

		<u>Fire-X Glasbord FM</u>	<u>Fire-X Glasbord*</u>
ΔH_{ch}	(kJ/g)	6.5	14.2
L_e	(kJ/g)	0.9	2.8
q''_{cr}	(kW/m ²)	15	15
TRP	(kW/m ² s ^{-1/2})	644	562
FSP _c	(s ^{-1/2})	0.16	0.16

*Testing was completed in the Approval examination (Factory Mutual Research J.I. 1V5A9.AM) sponsored by Kemlite Company, Inc.

5.2 Room Fire Tests

5.2.1 Visual observations during the test period were as follows:

<u>Time(min:sec)</u>	<u>Observation</u>
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0:00	Ignition of exposure fire.
1:50	Sustained burning of left and rear walls at the corner to approximately 2 ft (0.6 m) high.
3:10	Sustained burning of left and rear walls at the corner to approximately 4 ft (1.2 m) high; wall panels at the corner beginning to ripple
5:10	Sustained burning of left and rear walls at the corner to approximately 5 ft (1.5 m) high. Grey smoke exiting door at a height of 2 ft (0.6 m) below top of opening.
5:40	Sustained burning of left and rear walls at the corner to approximately 6 ft (1.8 m) high with flames intermittently extending to ceiling and along eaves to about 3 ft - 4 ft (0.9 m - 1.2 m) from the corner.
6:15	Sustained burning of panels at the wall - ceiling intersection at left and rear walls to approximately 2 ft (0.6 m) from the corner.
7:10	Whitish-grey smoke exiting door.
7:20	Flames at the wall - ceiling intersection at left and rear walls extending to 4 ft - 5 ft (1.2 m - 1.5 m) from the corner.
7:45	Left side of rear ceiling panel falls and hangs from ceiling.
8:10	Flames at the wall - ceiling intersection at left wall continues as previously noted.
9:25	Flames at the wall - ceiling intersection at left wall intermittently extends to 4 ft - 5 ft (1.2 m - 1.5 m) from the corner and approximately 1 ft (0.3 m) from ceiling.
10:50	Ceiling panel near door is beginning to sag along the left wall.
11:35	Sustained burning along left wall limited to the corner.
12:20	Fallen portion of the rear ceiling panel extends to 6 ft (1.8 m) and continues to burn.
13:00	Left wall panel no longer burning; sustained burning along rear wall limited to the corner to approximately 4 ft (1.2 m) high.
13:50	Rear wall panel no longer burning; intermittent burning along left wall limited to the corner to 3 ft - 4 ft (0.9 m - 1.2 m) high.
15:00	Test terminated, fire extinguished.

5.2.2 Upon examination of the test panels after the room fire test, there was no evidence of the panels burning at the extremities of the test panel area.

5.2.3 Smoke levels generated by the test panels during the test period were not considered excessive.

5.2.4 See Appendix A for a record of temperatures recorded at the thermocouple locations outlined in 3.3.5 above.

5.2.5 A videotape (8 mm format) is on file under J.I. 2B2A2.AM in the Technical Information Center at Factory Mutual Research.

VI **CONCLUSIONS**

6.1 Test results from this program indicate that Kemlite Company, Inc. Fire-X Glasbord FM interior finish materials meet the Factory Mutual Research Approval Standard 4880 requirements for Class 1 interior finish materials when installed to the maximum installed height of 30 ft (9.1 m).

6.2 The sheets shall be mechanically fastened to gypsum sheathing with AMIFasteners nylon, pin-drive rivets spaced 16 in. (406 mm) o.c., horizontally and vertically.

6.3 The panel joints on the walls and ceiling shall be covered with PVC molding, supplied by Kemlite.

6.4 Tests show 1) that the panels in and of themselves would not create a need for automatic sprinklers and 2) that the panels would be acceptable in a combustible occupancy protected by automatic sprinklers as defined by Factory Mutual Research Loss Prevention Standards.

6.5 The tested constructions meet the Factory Mutual Research Approval criteria and when Approval is effective will be listed in the Factory Mutual Research Approval Guide.

6.6 Approval is effective when the Approval Agreement is signed and received by Factory Mutual Research.

6.7 Continued Approval is based upon the fabrication of the Approved product in accordance with this Approval Report, satisfactory field experience, and continued use of acceptable quality control procedures as determined by Facilities and Procedures Audits.

6.8 The interior finish materials have not been evaluated for the toxicity of the products of combustion.

VII MARKING

7.1 The manufacturer shall mark each panel or packing container with the manufacturer's name and the product trade name. In addition, the panel or packing container must be marked with the Factory Mutual Research Approval Mark and the words "Subject to the conditions of Approval as a Class 1 interior finish material when installed as described in the current edition of the Factory Mutual Research Approval Guide".

7.2 Markings denoting Factory Mutual Research Approval shall be applied by the manufacturer only within and on the premises of manufacturing locations that are under Factory Mutual Research's Facilities and Procedures Audit Program.

7.3 The manufacturer agrees that use of the Factory Mutual Research name or Approval Mark is subject to the conditions and limitations of the Factory Mutual Research Approval. Such conditions and limitations must be included in all references to Factory Mutual Research Approval.

VIII MANUFACTURER'S RESPONSIBILITIES

8.1 To assure compliance with the CONCLUSIONS of this report, the manufacturer shall supply to the installer or building owner such necessary instructions or assistance required to produce the desired performance achieved in the tests.

8.2 The manufacturer shall notify Factory Mutual Research of any planned change in the Approved product prior to general sale or distribution. All requests for changes shall be made and agreed to in writing, utilizing Factory Mutual Research Form 797, Approval Product-Revision Report.

IX QUALITY AUDIT INSPECTION AND RE-EXAMINATION

9.1 Re-examination and manufacturing inspections will be conducted periodically on the Approved interior finish materials at the Kemlite Company, Inc. manufacturing facility in Channahon, IL to determine that the quality and uniformity of the Approved insulated panels and foam system have been maintained and will provide the same level of performance as originally Approved.

9.2 Re-examination of the Approved insulated wall and ceiling panels may be required to assess formulation changes to the foam insulation system, panel configuration changes or changes in field installation procedures or end-use.

**TECHNICAL SUPERVISION OF
CONSTRUCTION, FIRE TESTS
AND REPORT BY:**

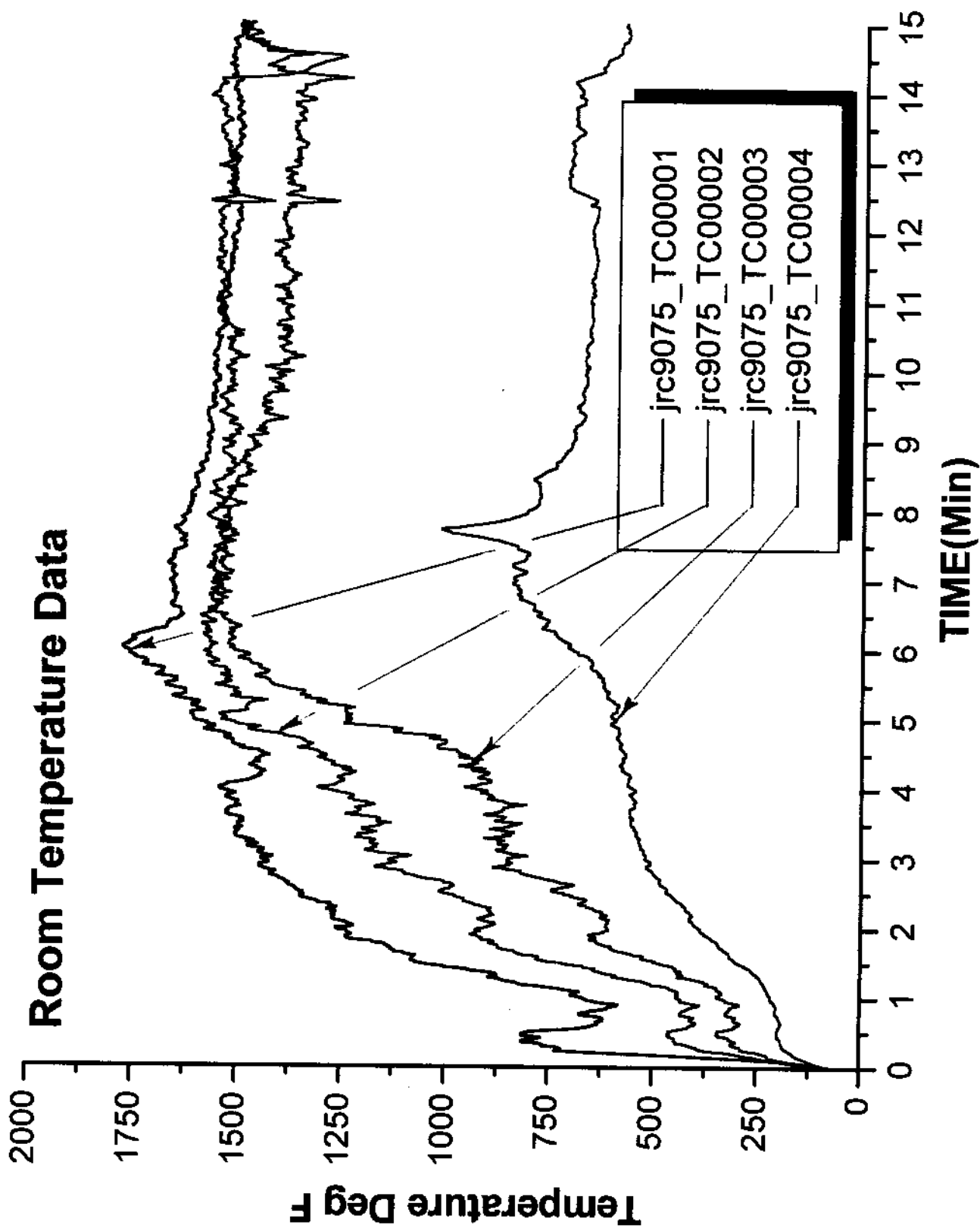
D. K. Tanaka
Project Engineer

REPORT APPROVED BY:

P. J. Smith
Senior Engineer
Materials Section - Approvals

Appendices: Appendix A - Thermocouple Graph
Appendix B - Thermocouple Information

Test #02 Kemlite Room 832-6232-66 09-01-1999
Job Index # 2b2a2.am
1107 Scans



Thermocouple Information

<u>Designation (corresponding to Appendix A)</u>	<u>Location</u>
jrc9075_TC00001	3 ft (915 mm) above floor in corner
jrc9075_TC00002	5 ft (1525 mm) above floor in corner
jrc9075_TC00003	7 ft (2135 mm) above floor in corner
jrc9075_TC00004	center of ceiling

Factory Mutual Research

March 28, 2002

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Mr. Bob Barney
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P.O. Box 2429
Joliet, IL 60434

Subject: Factory Mutual Research Approval of Fire-X Glasbord FM as Class 1 Interior Finish Materials in accordance with Factory Mutual Research Approval Standard 4880

Dear Bob:

I am writing to confirm the changes that will take place in an upcoming edition of the Factory Mutual Research Approval Guide. As requested in your Revision Report (form 797) we are extending Approval to include suspended ceiling grid installations. Additionally, we are revising the original Approval to include noncombustible substrates (originally gypsum core boards) and to redefine the fasteners for mechanically fastening the panels at the ceiling. I discussed the above issues with your Mr. Mike Burr and Mr. Chris Patterson on March 22, 2002.

The Kemlite listing in the Factory Mutual Research Approval Guide will be revised to read as follows:

Fire-X Glasbord FM. Flat panels, 4 ft (1.2 m) wide, nominal 0.09 in. (2.3 mm) thick. Installed over noncombustible substrate and mechanically fastened with stainless steel or aluminum screws. Alternatively, AMIFasteners nylon, pin-drive rivets may be used on walls only. All fasteners are spaced at 16 in. (0.4 m) o.c., vertically and horizontally. PVC batten strip joint treatment. Alternatively, the panels, 2 ft by 4 ft (610 mm by 1220 mm) or 2 ft by 2 ft (610 mm by 610 mm) in size, are installed in metal suspended ceiling grid system, with optional plastic or metal hold-down clips.

Please advise if you have any questions or require further information. I can be reached by phone at 781-255-4642, by fax at 781-762-9375, and by e-mail at David.Tanaka@FMGlobal.com.

Very truly yours,



David K. Tanaka, P.E.
Senior Engineer
Materials Section

DKT/

cc: TIC - Class File 4880
DKT