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FIRE PERFORMANCE EVALUATION OF *GLASBORD FSAUS* IN ACCORDANCE WITH AUSTRALIAN STANDARD™ (AS) ISO 9705-2003, *FIRE TESTS-FULL-SCALE ROOM TEST FOR SURFACE PRODUCTS*

FINAL REPORT
Consisting of 20 Pages

SwRI Project No. 01.24102.01.310
Test Date: November 7, 2019
Report Date: December 2, 2019

Prepared for:

Crane Composites
23525 W. Eames Street
Channahon, IL 60410

Dynamic Composites Tech PTY Ltd
171-175 Newton Road Unit 8
P.O. Box 7186
Wetherill Park SNW, 2164
Australia

This test was conducted in accordance with the applicable standard; and to the best of our knowledge, it contains no errors, omissions, or false statements.

Submitted by:

KF

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1.0 INTRODUCTION

This report presents the results of a fire performance evaluation of *Glasbord FSAUS* for Crane Composites, located in Channahon, Illinois and Dynamic Composites Tech PTY Ltd, located in Wetherill Park NSW, Australia. Testing was conducted in accordance with Australian Standard™ (AS) ISO 9705-2003 (Reconfirmed 2016), *Fire Tests–Full-Scale Room Test for Surface Products*, which is identical with and reproduced from International Organization for Standardization (ISO) Test Standard 9705:1993, *Fire Tests–Full-Scale Room Test for Surface Products*. The results of the test were then used to calculate the Group number and smoke growth rate index (SMOGR_{RC}) in accordance with AS 5637-2015, Australian Standard®, *Determination of Fire Hazard Properties*. Testing was conducted by Southwest Research Institute’s (SwRI’s) Fire Technology Department, located in San Antonio, Texas.

This test methodology is intended to measure and describe the properties of materials or products in response to heat and flame under controlled laboratory conditions. The results should not be used alone to describe or appraise the fire hazard or the fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a complete fire hazard assessment or a fire risk assessment, which takes into account all the factors that are pertinent to an assessment of the fire hazard or fire risk of a particular end use. The results apply specifically to the specimens tested, in the manner tested, and not to similar materials, nor to the performance when used in combination with other materials.

2.0 TEST METHOD

For the AS ISO 9705 test procedure, specimens are mounted to fully cover both 2.4 × 3.6-m (8 × 12-ft) walls and the 2.4 × 2.4-m (8 × 8-ft) wall that does not have a doorway. In addition, specimens are mounted to fully cover the ceiling area. The walls and ceiling are exposed to a propane gas burner that is placed flush with the intersecting wall surfaces in the right, rear corner of the room, and opposite from the doorway.

One total heat flux gauge is mounted 25 mm above the floor surface facing upward in the geometric center of the room. A Gardon-type gauge with a flat black surface and 180° view angle is used. While in operation, the heat flux gauge is maintained at a constant temperature above the dew point by a heated water supply.

Although not required, bare ½-mm dia. Type K thermocouples (TC) were used in various locations. One TC was located in the interior plane of the door opening, on the door centerline, 25 mm down from the header. In addition, the temperatures at the ceiling surface over the burner and at the following five locations were measured: center of the ceiling, right half, left half, front half, and rear half. Additionally, a thermocouple tree built, in accordance with Figure C.1. of AS ISO 9705, was located 300 mm away from the doorway wall and the wall of the burner.

At the start of the test, the propane gas burner was ignited, and the sample exposed to a 100-kW fire for 10 min, at which point the gas burner was adjusted to an output of 300 kW, by way of a mass flow controller, and run for an additional 10 min.

The products of combustion and entrained air were collected in a hood and extracted through an exhaust duct by a fan. A gas sample was drawn from the exhaust duct and analyzed for oxygen, carbon dioxide, and carbon monoxide concentrations. The gas temperature and differential pressure across a bi-directional probe were measured for calculating the mass flow rate of the exhaust gases. Smoke production rate was determined based on the measured light obscuration in the duct using a white-light extinction photometer located close to the gas sampling point.

3.0 DESCRIPTION OF TEST SPECIMENS

Crane Composites provided the *Glasbord FSAUS* panels for testing, which were received by SwRI on October 2, 2019. Upon arrival, the panels were placed into conditioning (controlled environment of 23 °C ± 3 °C and 50% ± 5% relative humidity) up until installation into the test room on November 7, 2019. Material details provided by the Client are provided in Table 1.

Table 1. Material Details.

Trade Name*	<i>Glasbord FSAUS</i>
Description*	<i>FSAUS fastened to Type X gypsum</i>
Color*	White
Thickness*	0.075 in.
Dimensions*	96 × 48 in.
Density*	0.650 lb/ft ²
Side Tested*	Smooth, Glossy side

* Provided by the Client

4.0 CONSTRUCTION DETAILS

The panels were installed into the test room with the smooth, glossy side exposed by SwRI personnel. Each panel was screwed into the studs using #6 1⁵/₈-in. long self-drilling bugle head screws. Each panel was installed vertically and attached using the Client-provided layout shown in Figure 1. When attaching panels to the ceiling, fastener spacing was reduced to 12 in. on center in the length direction. Care was taken to ensure that the butt joints of adjacent panels were as tight as possible. The three “non-doorway” walls and the ceiling were completely covered using the *Glasbord FSAUS*.

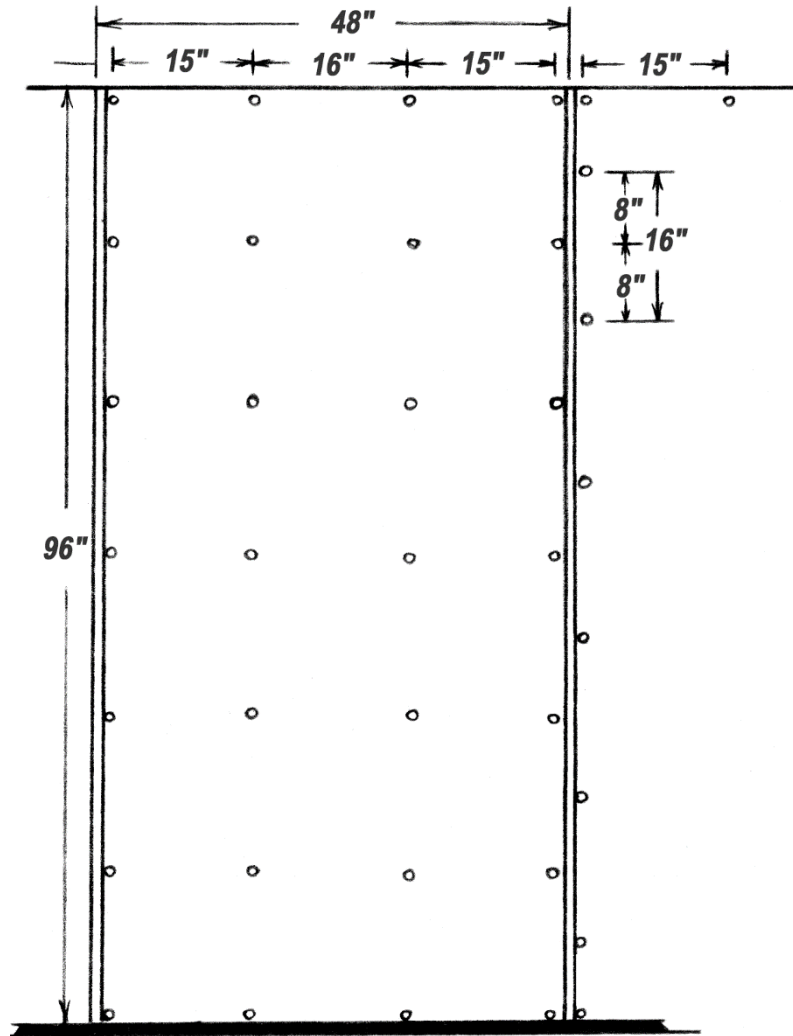


Figure 1. Client-Provided Attachment Layout.

5.0 ACCEPTANCE CRITERIA

No acceptance criteria is included in the AS ISO 9705 test method however the test results were used in order to calculate the Group number and smoke growth rate index (SMOGR_{RC}) in accordance with procedures and calculations described in AS 5637. AS 5637 is designed to assess internal wall and ceiling linings for their ability to ignite, release heat once ignition has occurred, cause flashover, release smoke, and contribute to fire growth.

5.1. Group Number

The Group number is a measure of the ignitability and heat release rate of a material, expressed as a number from 1 to 4. The Group number was determined using AS ISO 9705. The Group number is assigned using the criteria below:

- a) Group 1—material that does not reach flashover when exposed to 100 kW for 600 s followed by exposure to 300 kW for 600s.
- b) Group 2—material that reaches flashover following an exposure to 300 kW within 600 s after not reaching flashover when exposed to 100 kW for 600 s.
- c) Group 3—material that reaches flashover in more than 120 s but within 600 s when exposed to 100 kW.
- d) Group 4—material that reaches flashover within 120 s when exposed to 100 kW.

Flashover is defined by AS 5637 and AS ISO 9705 as a heat release rate of 1000 kW (1 MW) or greater inclusive of the burner output. During testing of the *Glasbord FSAUS*, flashover, as defined by AS 5637 and ISO 9705, occurred at 11 min 22 s and, therefore, is assigned a Group number of 2.

5.2. SMOGRA_{RC}

The smoke growth rate index or SMOGRA_{RC} is a measure of smoke obscuration determined in accordance with AS ISO 9705, expressed in square meters per second squared (m²/s²). SMOGRA_{RC} is determined by using the calculations in Section 6 of AS 5637. In order to determine the SMOGRA_{RC}, a 60 s running average (R₆₀) rate of light obscuring smoke (R_{inst}) is calculated. The maximum R₆₀ was 6.14 m²/s and occurred at 686 s (t₆₀), therefore, the SMOGRA_{RC} for the *Glasbord FSAUS* as tested is 8.95 m²/s² based on the following formula:

$$\text{SMOGRA}_{\text{RC}} = \frac{1000 \times R_{60}}{t_{60}}$$

6.0 TEST RESULTS

Testing was conducted at SwRI's Fire Technology Department located in San Antonio, Texas on November 7, 2019. The test room and building were approximately 20 °C (68 °F) and 74% relative humidity prior to the test. Section 12.2.5 of AS ISO 9705 states that the test should be ended if flashover occurs, which is defined as a combined heat release rate in excess of 1,000 kW at any point during the test. Due to flashover conditions, the test was stopped at 11 min 50 s, and the room extinguished. Selected photographic documentation is provided in Appendix A. The test results are summarized in Appendix B, and visual observations can be found in Appendix C. Video of the test will be provided electronically.

APPENDIX A
INSTALLATION, TEST, AND POST-TEST PHOTOGRAPHS
(CONSISTING OF 5 PAGES)



Figure A-1. Pretest View of Room.



Figure A-2. Pretest View of Ceiling.



Figure A-3. Test at 2 min 11 s, Burner Output of 100 kW.



Figure A-4. Test at 5 min 58 s, Burner Output of 100 kW.



Figure A-5. Test at 9 min 39 s, Burner Output of 100 kW.



Figure A-6. Test at 10 min 55 s, Burner Output of 300 kW.



Figure A-7. Test at 11 min 35 s, Burner Output of 300 kW.



Figure A-8. Test at 11min 51 s, Burner Output of 300 kW. Flashover Conditions.



Figure A-9. Posttest View of Room.



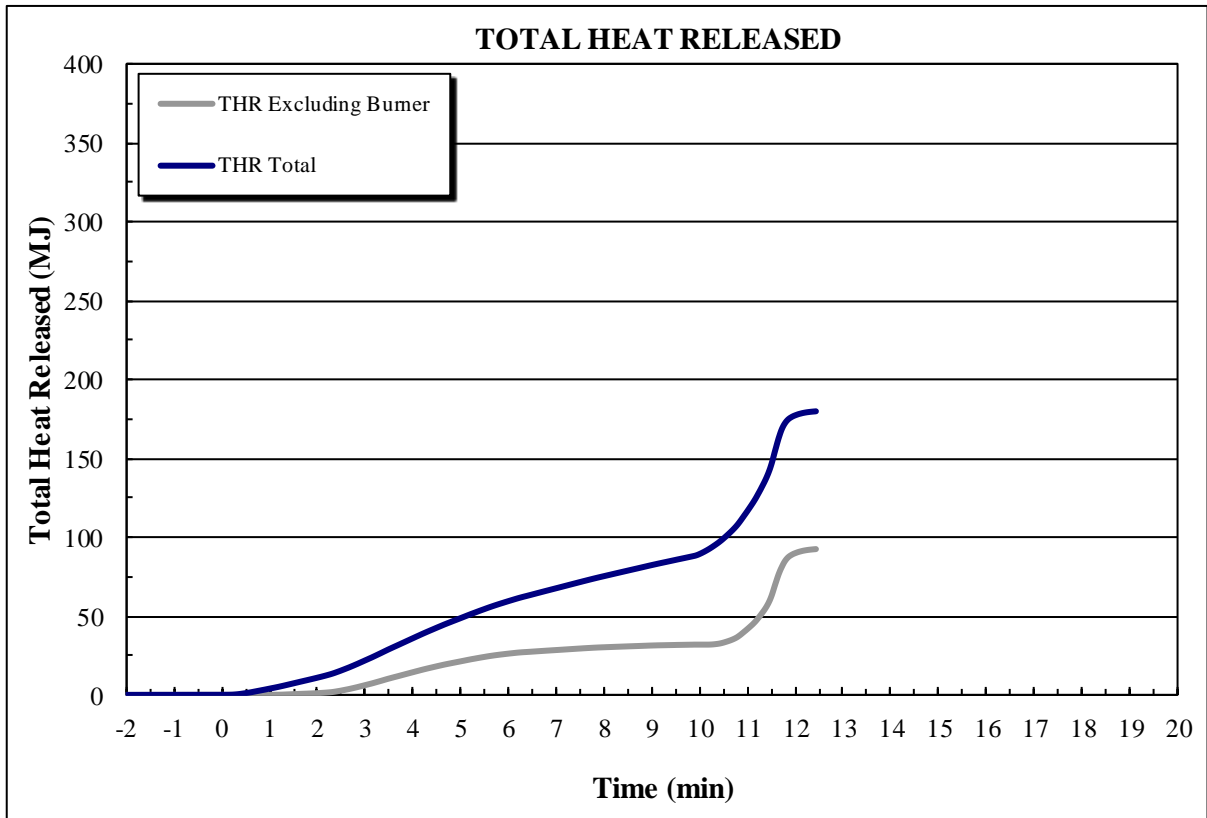
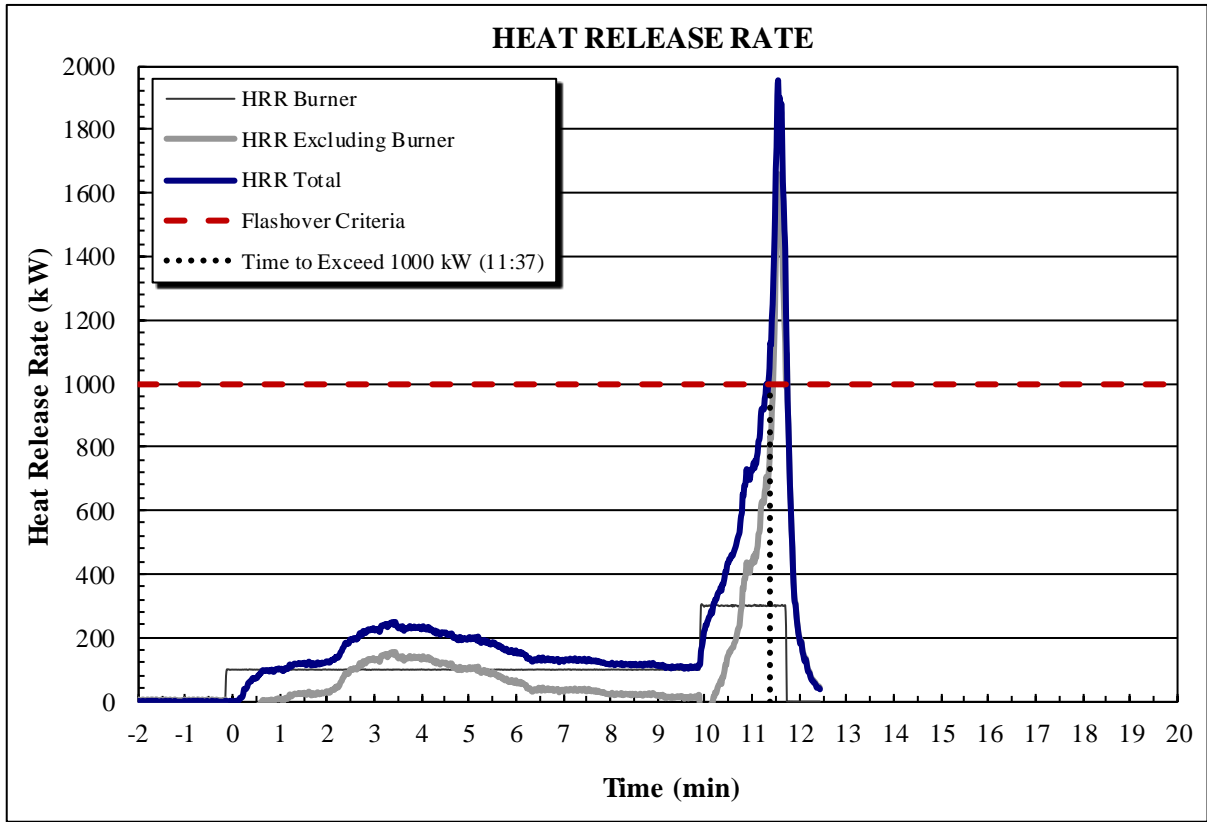
Figure A-10. Posttest View of Room Ceiling.

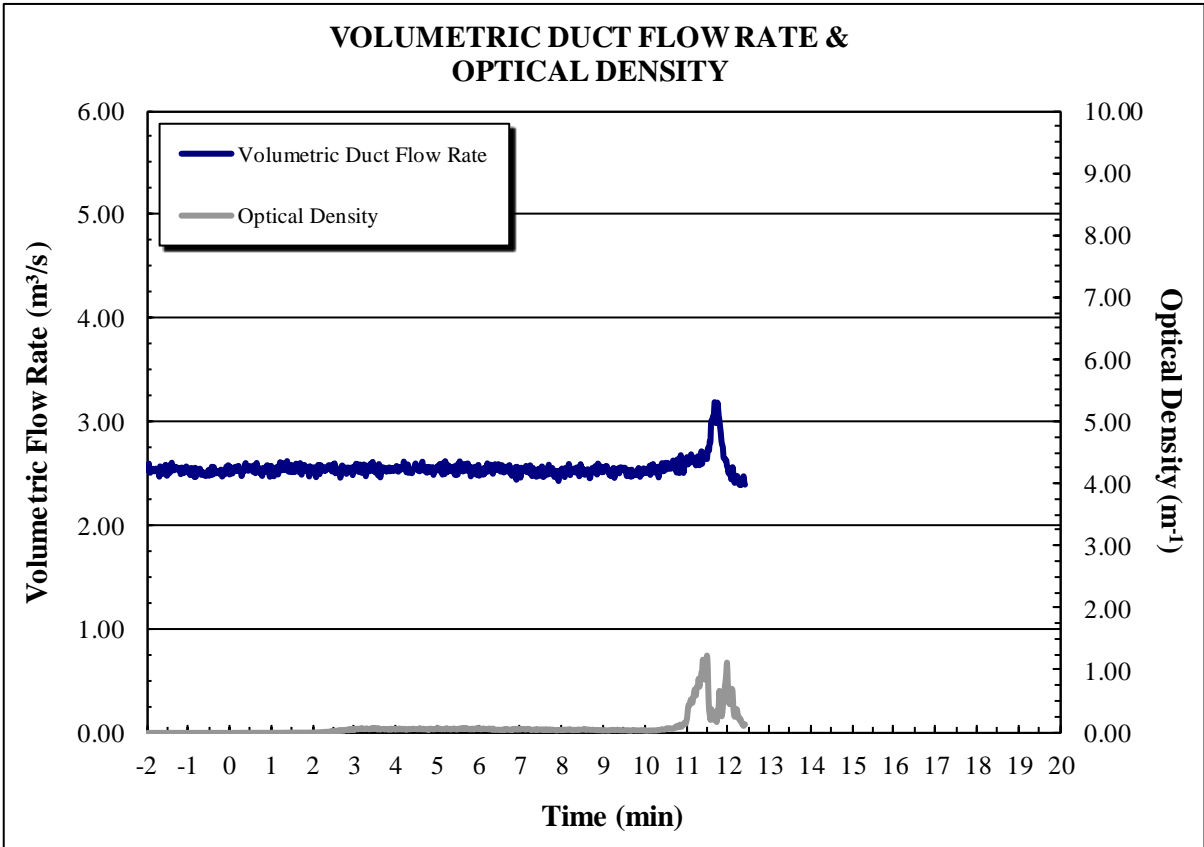
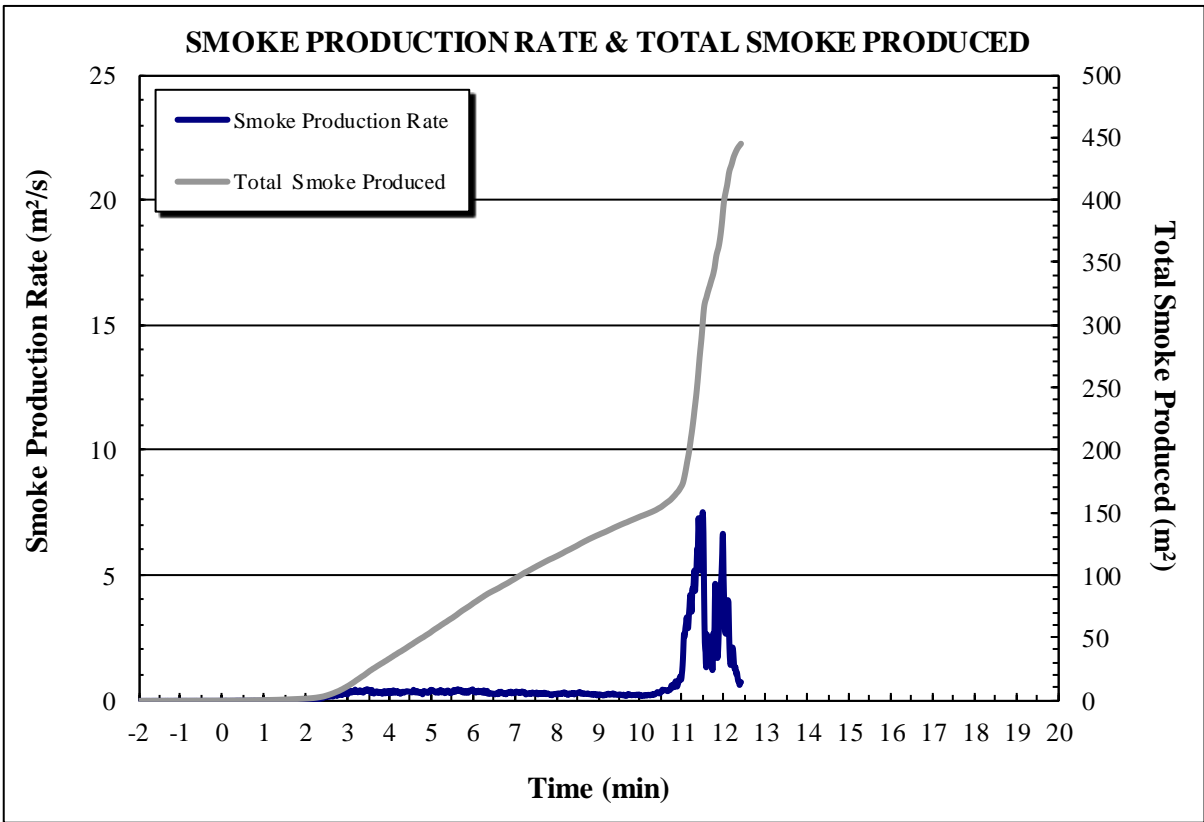
APPENDIX B
TEST DATA
(CONSISTING OF 6 PAGES)

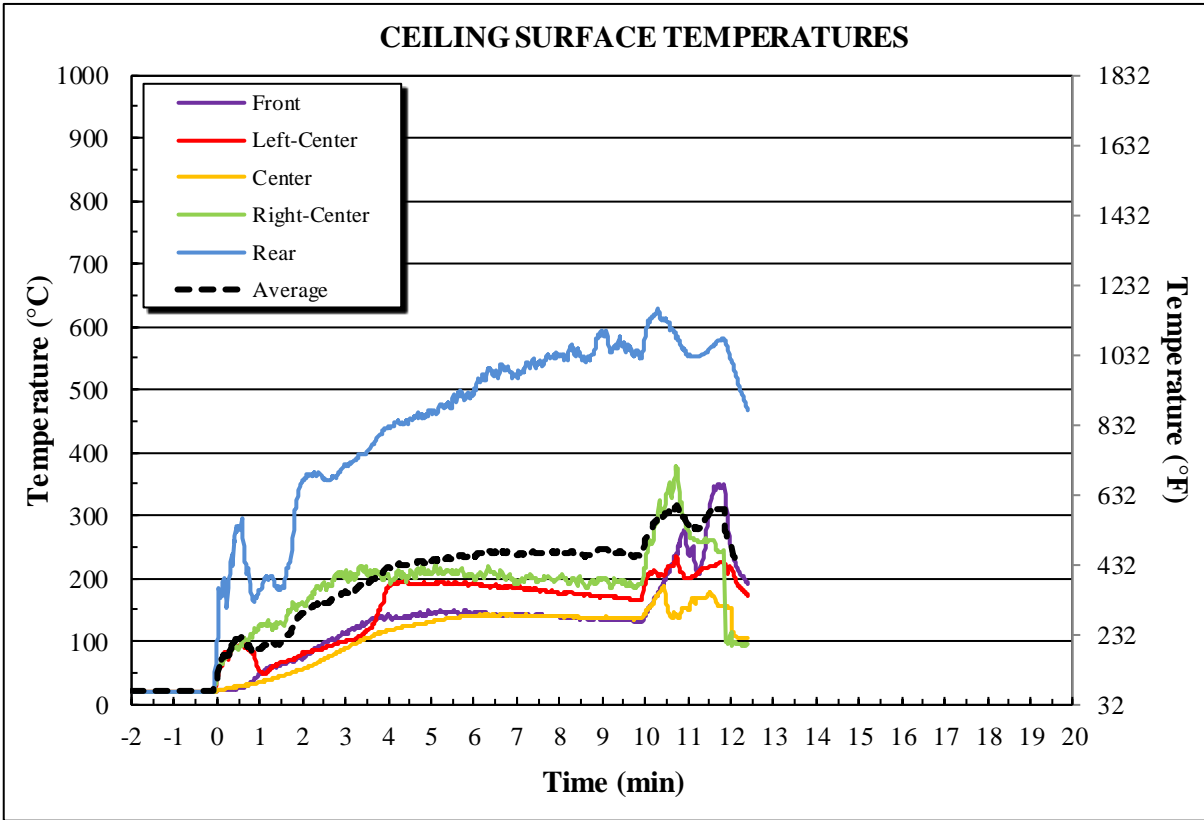
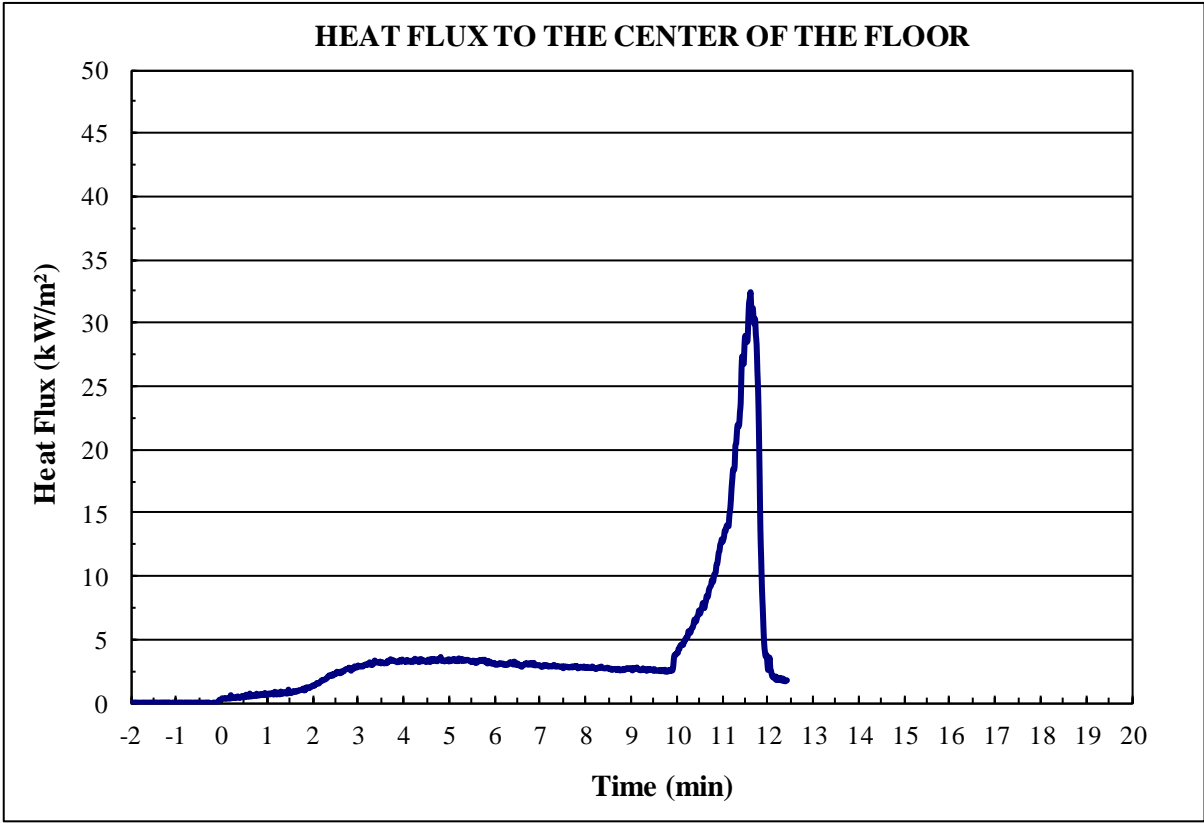
**SUMMARY OF
AS 9705 TEST RESULTS**

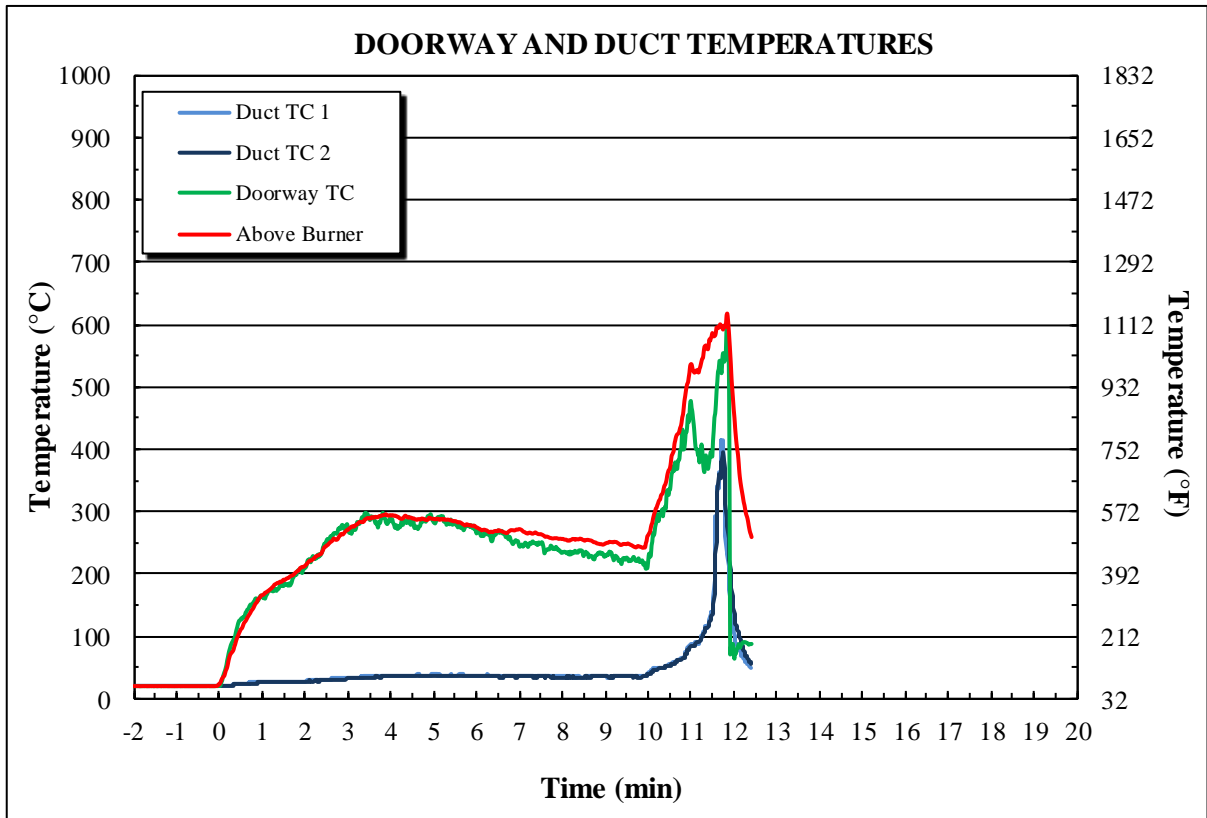
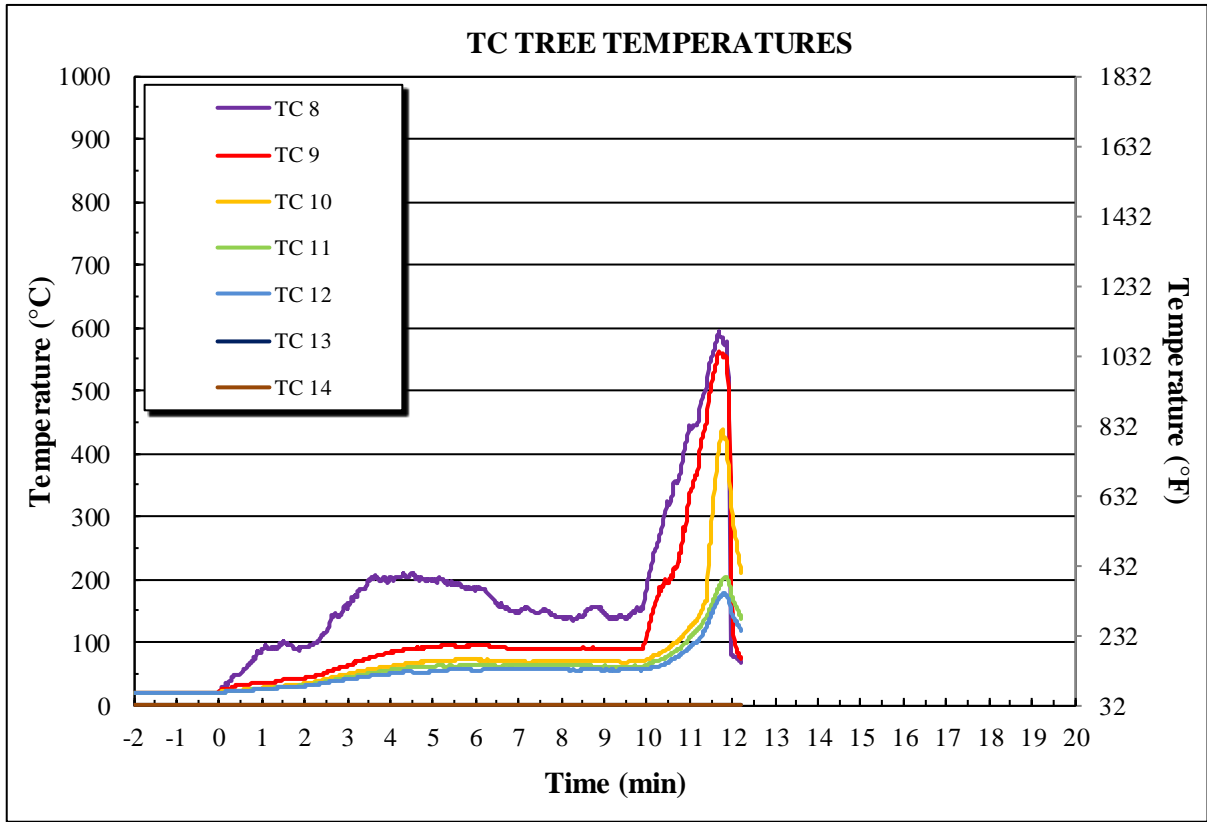
Material: *Glasbord FSAUS*

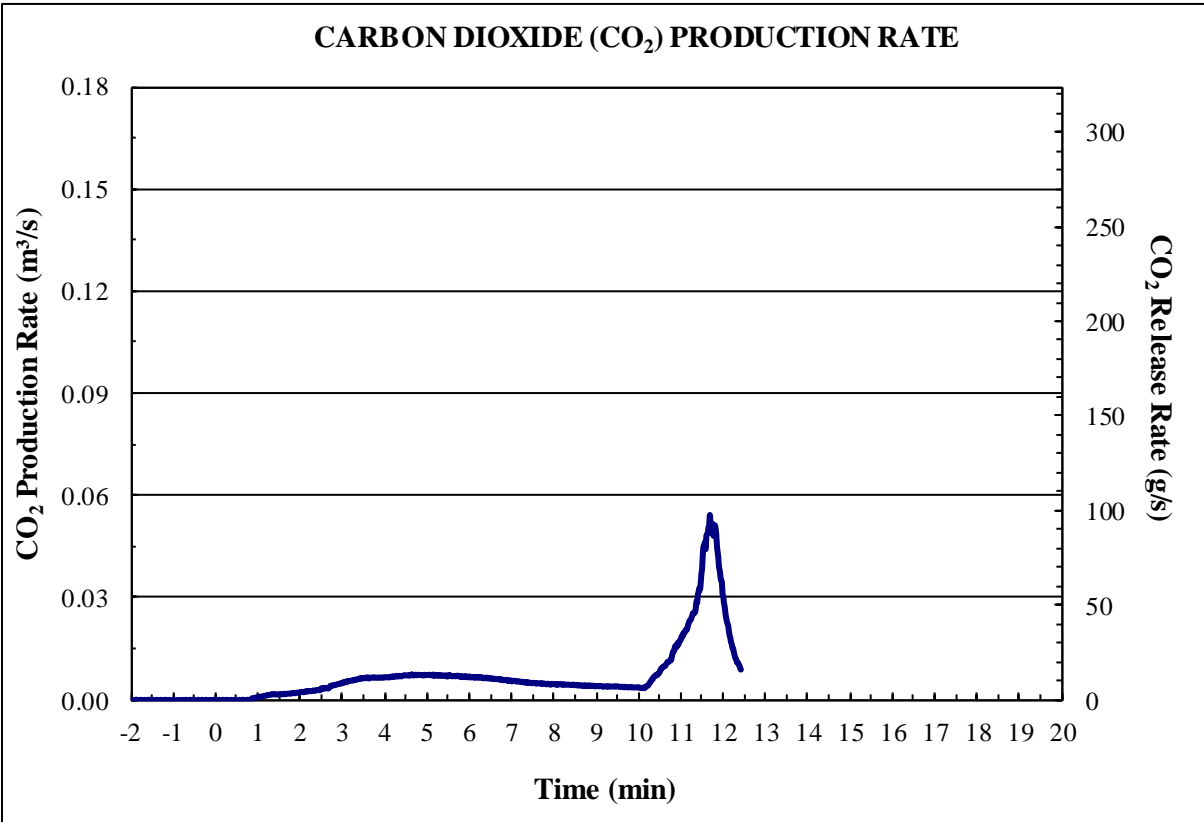
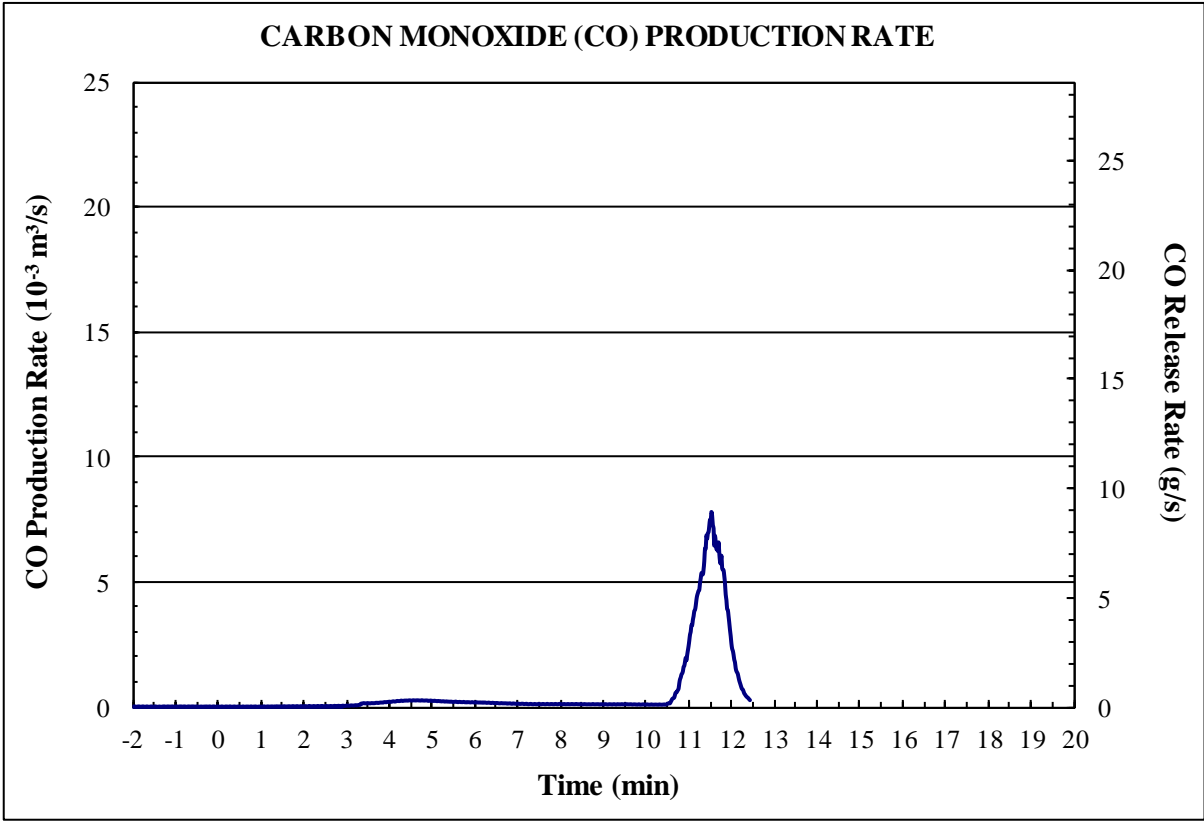
Maximum HRR _{total}	1957 kW	at 11 min 32 s
Average HRR _{total}	251 kW	
Total Heat Released	180 MJ	
Maximum HRR _{excl. burner}	1659 kW	at 11 min 32 s
Maximum HRR _{excl. burner, 30 sec}	1167 kW	
Average HRR _{excl. burner}	128 kW	
Total Heat Released (Excluding Burner)	92 MJ	
Maximum Smoke Production Rate	7.51 m ² /s	at 11 min 30 s
Maximum Smoke Production Rate _{60 sec}	3.86 m ² /s	at 11 min 37 s
Average Smoke Production Rate	0.62 m ² /s	
Total Smoke Released	445 m ²	
Maximum Optical Density	1.24 1/m	at 11 min 30 s
Exhaust Duct Flow at Maximum O.D.	2.64 m ³ /s	
Average Optical Density	0.086 1/m	
Average Volumetric Duct Flow Rate	2.55 m ³ /s	
Maximum Heat Flux to the Floor	32.5 kW/m ²	at 11 min 37 s
Max Average Ceiling Temperature	314 °C 598 °F	at 10 min 45 s
Maximum Doorway Temperature	618 °C 1144 °F	at 11 min 51 s
Maximum CO Production Rate	7.78 × 10 ⁻³ m ³ /s	at 11 min 31 s
Maximum CO Release Rate	8.91 g/s	
Maximum CO ₂ Production Rate	0.054 m ³ /s	at 11 min 41 s
Maximum CO ₂ Release Rate	98 g/s	











APPENDIX C
VISUAL OBSERVATIONS
(CONSISTING OF 1 PAGE)

Table C-1. Visual Observations.

Time (min:s)	Observation
-02:00	Pre-test baseline.
00:00	Start of test. Burner located in the right, rear corner. Burner set at 100 kW.
00:15	Flames from the burner reach the ceiling and spread 1–2 ft.
01:52	Charring and discoloration in the burner corner.
02:15	Ignition of the wall covering in the area of the burner impingement.
03:05	Flames from the burner reach the ceiling and spread 4 ft.
03:30	Flames from the burner reach the ceiling and spread 6–8 ft.
04:15	Light smoke layer is present at 5½ ft.
08:20	Small areas of active burning near the flame impingement area.
10:00	Burner increased to 300 kW.
10:30	Flames hit the ceiling and spread across the ceiling.
11:18	The smoke layer has darkened and descended to 5 ft.
11:32	Flames exiting the doorway.
11:45	Flames present in the top 2 ft of the doorway.
11:50	Flashover conditions are present. Burner turned off.
12:00	Test Ended. Room extinguished.