GHL CONSULTANTS LTD

409 GRANVILLE STREET, SUITE 950
VANCOUVER, BC V6C 1T2 CANADA

P 604 689 4449
F 604 689 4419
www.ghl.ca
Holder of AIBC Certificate of Practice

December 18, 2014
Revised April 13, 2015

Via Email dieter.hardock@schoeck.de
Phone 49 7223 967 229

Mr. Dieter Hardock
Product Management Thermal Insulation
Schöck Bauteile GmbH
Vimbucher Straße 2, 76534
Baden-Baden
Germany

SCHÖCK ISOKORB STRUCTURAL THERMAL BREAK **GHL File SIB-4270.02**

Dear Mr. Hardock:

Further to our recent discussions, this letter is to provide a summary of our review findings with respect to the structural thermal break product referenced, relative to compliance with key provisions of Division B, Part 3 of the BC Building Code 2012.

This review focusses only on key fire and life safety aspects of Division B, Part 3 of the BC Building Code 2012. Other relevant aspects relating to compliance with Division B, Parts 4, 5, 8 and 10 of the Building Code should be reviewed and coordinated by other respective consultants with respect to those Parts of the Building Code. This includes for aspects related to structural, building envelope, construction safety, energy efficiency, etc.

The discussion is in reference to buildings classified as being required to be noncombustible. It is acknowledged that the Schöck Isokorb system may be used for many other building types and conditions; however, those other situations are not necessarily all addressed in this review.

Schöck Isokorb is a special system of thermal break products installed to address the challenges of thermal bridging at various parts of a building, such as at cantilevered balconies or canopies, roof parapets, etc, where highly conductive structural components penetrate the insulating envelope enclosure of the building. Components of the Schöck Isokorb systems incorporate combustible materials including plastics and expandable polystyrene beads such as BASF Neopor F2300. The following Building Code compliance related questions arise from this product application:

1. Are the combustible components of the Schöck Isokorb system permitted in a building classified as required to be noncombustible?
2. For the construction assembly containing the Schöck Isokorb system, is the required fire resistance rating affected?
3. What flame spread rating restrictions apply to the Schöck Isokorb system?

4. How is fire blocking maintained at concealed spaces?

5. What fire performance related test standards apply to the Schöck Isokorb system?

Each of these questions are discussed further on in this report.

1. Use of Combustible Components in a Building required to be Noncombustible

Subsection 3.1.5 sets out various combustible materials permitted to be used in a noncombustible building.

Clause 3.1.5.2.(1)(b) permits the use of foamed plastic air sealants applied to provide a seal between the major components of exterior wall construction. There is no specific mention in this Sentence, of combustible thermal breaks; however, Clause 3.1.5.2.(1)(h) permits minor combustible components to be used similar to those in the Clauses provided.

Sentence 3.1.5.12.(3) permits combustible insulation to be used in exterior walls provided the flame spread rating of the insulation is limited to a maximum 500 throughout the insulation material, and protected from adjacent space in the building by any of the following thermal barriers:

- Not less than 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation.
- Lath and plaster, mechanically fastened to a supporting assembly independent of the insulation.
- Masonry.
- Concrete.
- Any thermal barrier that meets the requirements of classification B when tested in conformance with CAN/ULC-S124, "*Test for the Evaluation of Protective Coverings for Foamed Plastic*". The standard fire exposure temperature in CAN/ULC-S101, "*Fire Endurance Tests of Building Construction and Materials*," is the same as in CAN/ULC-S124, "*Test for the Evaluation of Protective Coverings for Foamed Plastic*". A thermal barrier that, when tested in conformance with CAN/ULC-S101, does not exceed an average temperature rise of 140°C on its unexposed face after a period of 10 minutes satisfies this requirement.

From review of available information and typical details provided, we expect that the Schöck Isokorb system would be able to comply readily with Subsection 3.1.5.

Sentence 3.2.3.8.(1) permits the use of foamed plastic insulation in an exterior wall in a building of more than 3 storeys, provided:

a) the building is permitted to have more than 10% of unprotected openings on exterior walls per Subsection 3.2.3; and,

b) the insulation is protected by concrete or masonry not less than 25mm thick or the wall assembly has been tested in accordance with CAN/ULC-S134 and meets the criteria in Article 3.1.5.5.

For projects of concrete construction the Schöck Isokorb system's foam insulation will likely be protected by more than 25mm of concrete based on the concrete of the balcony on the exterior side, and the concrete of the floor assembly on the interior side, and it is considered that the system complies with Sentence 3.2.3.8.(1) in this respect. For other detail conditions where concrete or masonry protection is

not used, fire testing to CAN/ULC-S134 would be required.

2. Fire Resistance Rating of Assemblies

The Schöck Isokorb system forms a structural component of the building; however, it is typically used at the interface between an interior floor assembly and an exterior balcony assembly, and provides structural support only for the cantilevered balcony assembly. The thermal break is typically positioned at the termination of the fire rated interior floor assembly at the exterior wall, or where the balcony floor assembly attaches to the building façade.

We understand from review of typical details available that the Schöck Isokorb system is not used at the axis junction where a structural support column or exterior wall forms the structural support for the interior fire rated floor assembly; therefore, the Schöck Isokorb system is typically outside of and independent of the fire rated floor system and will not affect its fire resistance rating.

Sentence 3.2.2.11.(1) requires balconies to be constructed in accordance with the type of construction (but not the fire resistance ratings) required under Articles 3.2.2.20 to 3.2.2.88; in other words, balconies are not required to be constructed to the required fire resistance ratings. Therefore, balconies are not expected to remain structurally supported under a fire condition. Failure of the Schöck Isokorb system and subsequent collapse of the cantilevered balconies under a fire condition is considered an acceptable risk.

Similarly, where used as a thermal break for an exterior roof parapet, there would not be a concern for failure of a Schöck Isokorb system and subsequent collapse of a roof parapet in a fire scenario.
Note however that this would be different for a fire rated parapet used specifically as part of a *firewall* under Subsection 3.1.10, used to create separate buildings or to limit *building area*.

Based on the above we are of the opinion that fire rated floor assemblies in typical non-combustible projects will not be affected by use of the Schöck Isokorb system.

3. Flame Spread Rating Restrictions

The Schöck Isokorb system will not typically be exposed as an interior finish and will not be subject to the flame spread rating limits of Subsection 3.1.13; however, as previously indicated in the response to Question 1, as the Schöck Isokorb system incorporates foamed plastic insulation, it is subject to a flame spread rating limit of 500 when incorporated into an exterior wall assembly. Since the material is considered thermoplastic, the flame spread rating is required to be determined on the basis of not less than 3 tests conducted in conformance with CAN/ULC-S102.2, "*Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies*".

The Schöck Isokorb system has had an evaluation report number ESR-2784 done by ES ICC Evaluation Service dated April 2014. The report indicates the polystyrene used in the Schöck Isokorb system has been found to have a flame-spread index of 25 and smoke-developed index of 450 when subjected to the ASTM E84 test; however this test standard is not referenced or acknowledged under the BC Building Code 2012. While the ASTM E84 test is similar to the CAN/ULC-S102.2 test standard, the Canadian test requires the testing of thermoplastics to be carried out in a different orientation than that described in the ASTM E84. As such, the Schöck Isokorb system requires a separate testing using CAN/ULC-S102.2 to demonstrate compliance with the Canadian flame spread rating requirements.

However, we understand there has also been a fire test done by QAI Laboratories, on the expanded molded polystyrene (EPS) BASF NEOPOR F2300 typically used in the structural thermal break. See summary report copy attached. The test findings indicate a maximum flame spread rating of 35 and smoke developed classification of 240 when tested to CAN/ULC S102.2-10 "Method of Test for Surface Burning Characteristics of Flooring, Floor coverings and Miscellaneous Materials and Assemblies".

4. Fire Blocking at Concealed Spaces

Sentence 3.1.11.2.(1) requires fire blocks to be provided at exterior walls to block off concealed spaces within a wall assembly:

- At every floor level;
- At every ceiling level where the ceiling forms part of an assembly required to have a *fire-resistance rating;* and
- So that the maximum horizontal dimension is not more than 20m and the maximum vertical dimension is not more than 3m.

Sentence 3.1.11.2.(2) indicates these fire blocks are not required if:

- The wall space is filled with insulation;
- The exposed construction materials and any insulation within the wall space are *noncombustible*;
- the exposed materials within the space, including insulation but not including wiring, piping or similar services, have a *flame-spread rating* not more than 25 on any exposed surface, or on any surface that would be exposed by cutting through the material in any direction, and *fire blocks* are installed so that the vertical distance between them is not more than 10m; or,
- The insulated wall assembly contains not more than one concealed air space, and the horizontal thickness of that air space is not more than 25mm.

Therefore, if the exterior walls are filled with insulation and any drainage cavity provided does not exceed 25mm, then fire blocks can be omitted. Specific details in a project may need to be further reviewed with respect to fire blocking requirements and/or exceptions. If fire blocks are required as part of the interface between building and balcony, the detailing adjacent the Schöck Isokorb system may be affected.

5. Fire Performance Test Standards

Based on our review we find it necessary to establish the flame spread rating characteristics with suitable documentation. The BC Building Code references CAN/ULC-S102.2, "*Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies*" for thermoplastics. Testing performed by QAI Laboratories has confirmed a maximum flame spread rating of 35 and smoke developed classification of 240, when the polystyrene component is tested according to this standard.

Concluding Comments

This review has focussed on application of key provisions of Division B, Part 3 of the BC Building Code 2012 to the proposed Schöck Isokorb system for a typical non-combustible project. In general, we are of the opinion that the system will meet the acceptable solutions of the Building Code. Our comments are subject to agreement from the local Authority having Jurisdiction.

It should be noted that GHL's comments in this letter are based only on our general review of a number of typical generic details and product information and with respect to the BC Building Code 2012. Once the exact construction details to be used for a specific project have been developed, GHL can review the details further to comment on consistency with fire safety provisions in the applicable Building Code.

It should be noted that this letter provides a general opinion only and is not a document to be used for bidding or construction purposes. The use of the Schöck Isokorb system specifically for each project must be reviewed by a qualified registered professional and is subject to acceptance by the local Authority having Jurisdiction.

Prepared by,
GHL CONSULTANTS LTD

REGISTERED ARCHITECT TEDDY Y. LAI BRITISH COLUMBIA

Teddy Lai, ARCHITECT AIBC, MRAIC, CP

Reviewed by,

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA K. M. CHEN # 33494 Apr 13, 2015

K. M. Gary Chen, MASc, P.Eng.

cc Adam Kimble Schöck Innovative Building Solutions P 855 572 4625 E adam.kimble@schock-us.com

* Limitation of Liability *

This technical report addresses only specific Building Code issues under the GHL/Client agreement for this project and shall in no way be construed as exhaustive or complete. This technical report is issued only to the Authority Having Jurisdiction, the Client, Prime Consultants and Fire Suppression Designer to this project and shall not be relied upon (without prior written authorization from GHL) by any other party.

TL/GC P:\PRJ\42\4270.02 - 13483 103rd Avenue, Surrey\Report\Code Compliance 15-04-13 (4270.02).doc

QAI LABORATORIES
CERTIFICATION TESTING INSPECTION

8385 White Oak Avenue
Rancho Cucamonga, CA 91730
909.483.0250 ph. | 909.483.0336 fx.

CLIENT: BASF-EPS DIVISION
1609 Biddle Avenue
Wyandotte, MI 48192

Test Report No: RJ3477-1	Date: October 21, 2014

SAMPLE ID: The material was Type IX molded Expanded Polystyrene (EPS). The material was selected by a QAI representative at the molding facility OPCO, located in Latrobe, PA on September 30, 2014. OAI documented the materials and manufacturing procedures in accordance with ICC-ES AC85, Section 3.1.
The received test material BASF NEOPOR F2300 board, 4" thick was molded from BASF F2300 expandable polystyrene beads BASF Batch Code: 98-9812.93QO.

DATE OF RECEIPT: Samples were received at QAI on October 9, 2014. Samples were found in good condition.

TESTING PERIOD: October 17 20, 2014.

AUTHORIZATION: Testing authorized by Luis Espada.

TEST REQUESTED: Perform standard flame spread and smoke density developed classification tests on the sample supplied by the Client in accordance with CAN/ULC S102.2-10, "Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and assemblies

TEST RESULTS:

Flame Spread Rating	Smoke Developed Classification
35	240*

*See notes on pages 2, 4 and 6.
Detailed test results are presented in the subsequent pages of this report.

Prepared By

Brian Ortega
Test Technician

Signed for and on behalf of QAI Laboratories, Inc.

Greg Banasky
Senior Test Technician

PREPARATION: For each test, three 18" wide by 96" long pieces of foam were placed on the chamber floor.

SAMPLE CONDITIONING: Prior to testing the test specimens were conditioned to a constant weight at a temperature of 73.4 ± 5° F (23 ± 2.8° C) and a relative humidity of 50 ± 5 %.

CEMENT BOARD PLACEMENT: The 1/4" cement boards were placed between the test specimen and the chamber lid.

TEST RESULTS:	**Flame Spread Values**	**Smoke Developed Values**
Test No. 1	28.27	215.20
Test No. 2	36.99	261.91
Test No. 3	33.90	247.83
Average	**33.05**	**241.64**

Rounded Average Flame Spread Rating (FSR): 35

Rounded Average Smoke Developed Classification (SDC): 240

CAN/ULC S102.2-10 TEST DATA SHEET:

CLIENT: BASF-EPS DIVISION **DATE:** 10/17/14

SAMPLE: BASF NEOPOR F2300 board, 4" thick. Test No. 1. Density measured 1.93 lbs/ft^3.

FLAME SPREAD:

IGNITION: 6 minutes, 44 seconds

FLAME FRONT: 19.5 feet maximum

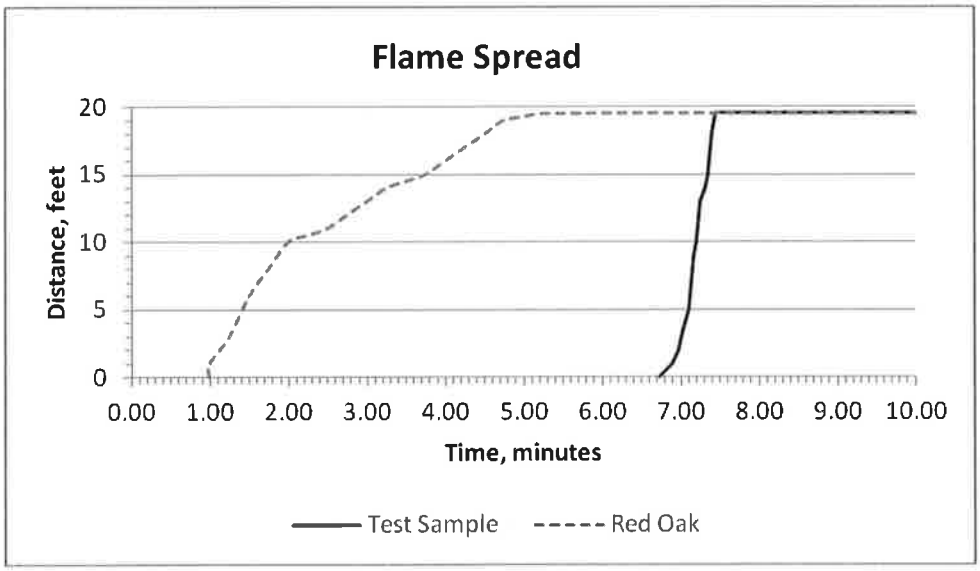
TIME TO MAXIMUM SPREAD: 7 minutes, 27 seconds

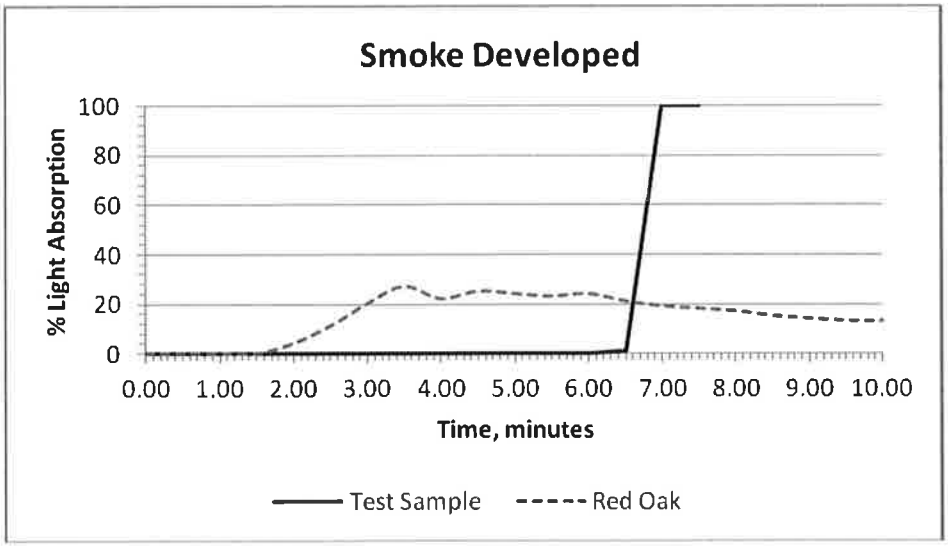
TEST DURATION: 7 minutes, 30 seconds

CALCULATION: 54.90 x 0.515 = 28.27

SUMMARY: FLAME SPREAD: 28.27 **SMOKE DEVELOPED:** 215.20

* Note: Due to heat production and loss of air flow through the chamber, the test was terminated at 7 minutes, 30 seconds Had the test continued for the normal 10 minute period, the flame spread value would have remained unchanged. The laboratory plotted the smoke developed value for the remaining 2 minutes, 30 seconds at 0% transmittance and derived a final Smoke Developed value of 215.20.





CAN/ULC S102.2-10 TEST DATA SHEET:

CLIENT: BASF-EPS DIVISION **DATE:** 10/20/14

SAMPLE: BASF NEOPOR F2300 board, 4" thick. Test No. 2. Density measured 1.93 lbs/ft^3.

FLAME SPREAD:

IGNITION: 5 minutes, 58 seconds

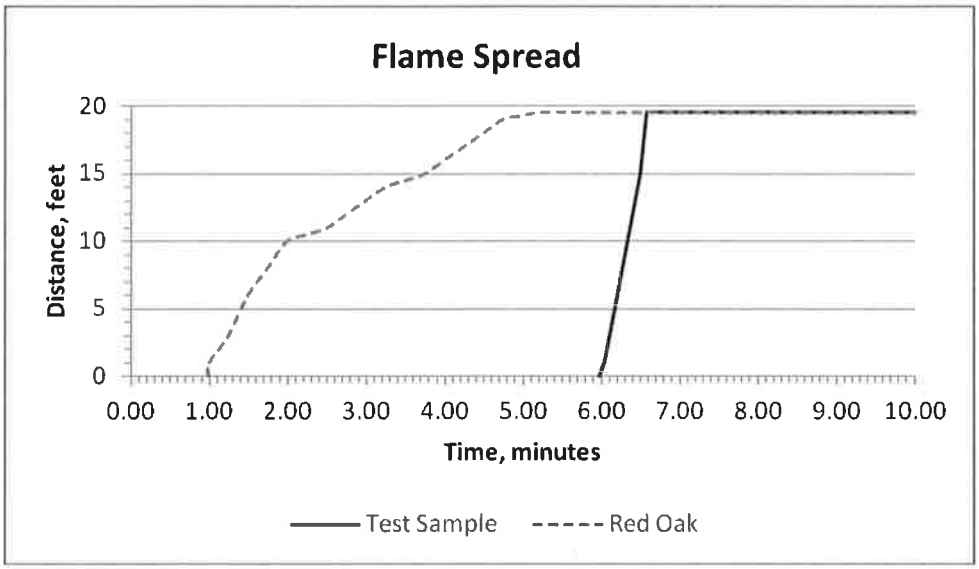
FLAME FRONT: 19. 5 feet maximum

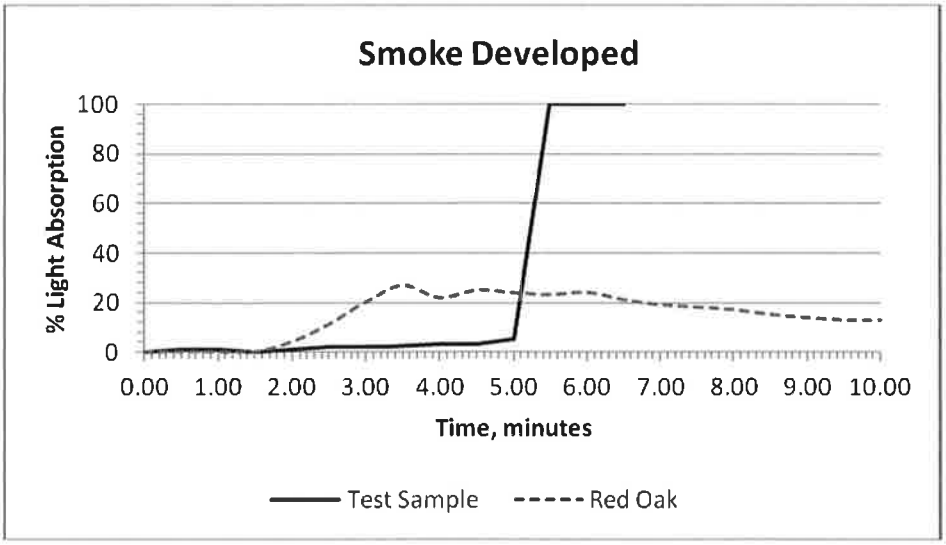
TIME TO MAXIMUM SPREAD: 6 minutes, 35 seconds

TEST DURATION: 6 minutes, 40 seconds

CALCULATION: 71.83 x 0.515 = 36.99

SUMMARY: FLAME SPREAD: 36.99 **SMOKE DEVELOPED:** 261.91
* Note: Due to heat production and loss of air flow through the chamber, the test was terminated at 6 minutes, 40 seconds Had the test continued for the normal 10 minute period, the flame spread value would have remained unchanged. The laboratory plotted the smoke developed value for the remaining 3 minutes, 20 seconds at 0% transmittance and derived a final Smoke Developed value of 261.91





CAN/ULC S102.2-10 TEST DATA SHEET:

CLIENT: BASF-EPS DIVISION **DATE:** 10/20/14

SAMPLE: BASF NEOPOR F2300 board, 4" thick. Test No. 3. Density measured 1.93 lbs/ft^3.

FLAME SPREAD:

IGNITION: 6 minutes, 20 seconds

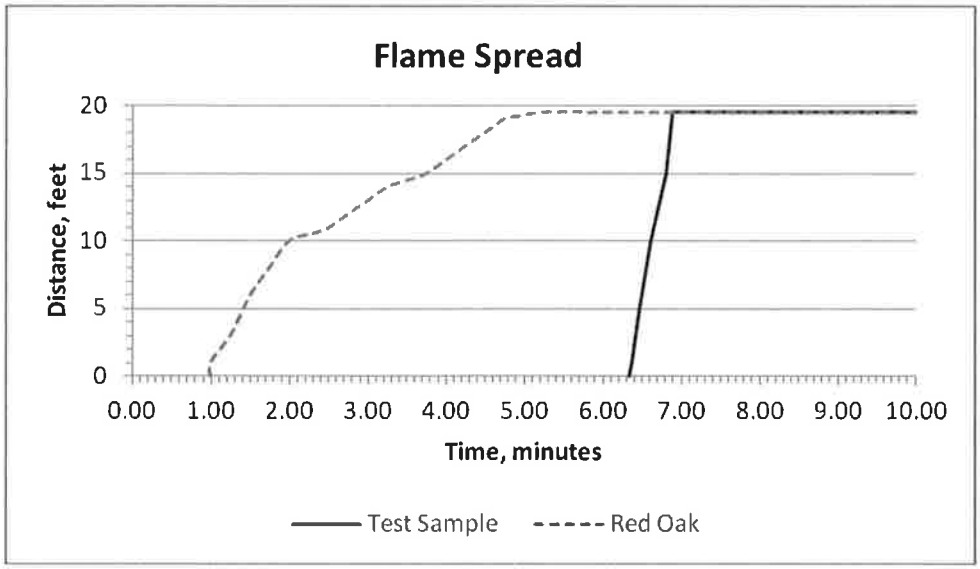
FLAME FRONT: 19.5 feet maximum

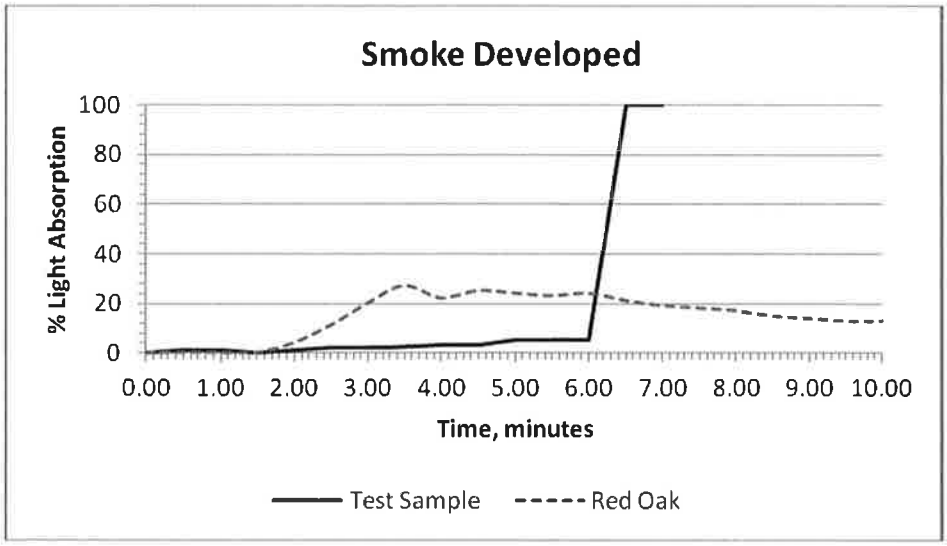
TIME TO MAXIMUM SPREAD: 6 minutes, 54 seconds

TEST DURATION: 7 minutes

CALCULATION: 65.83 x 0.515 = 33.90

SUMMARY: FLAME SPREAD: 33.90 **SMOKE DEVELOPED:** 247.82
* Note: Due to heat production and loss of air flow through the chamber, the test was terminated at 7 minutes, Had the test continued for the normal 10 minute period, the flame spread value would have remained unchanged. The laboratory plotted the smoke developed value for the remaining 3 minutes seconds at 0% transmittance and derived a final Smoke Developed value of 247.82.





End of Report