QUISPAMSIS
There Is No Other

Town of Quispamsis
12 Landing Court | P.O. Box 21085 | Quispamsis, NB | E2E 4Z4
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Evaluation of Alternate Solution

Date of Evaluation: 2015-06-29
Location: n/a

Background:

3.1.5.12 requires either; gyprock, lath and plaster, masonry, concrete or a product meeting classification B of CAN/ULC-S124.

9.10.17.10 requires either; one of the finished described in 9.29.4 to 9.29.9, 0.38mm thick sheet metal with a melting point of 650˚C or a product meeting classification B of CAN/ULC-S124.

Intumescent paints have a natural disadvantage to complying with CAN/ULC-S124 due to the location of thermocouples. The applicant has proposed use of data from both CAN/ULC-S101 and UL 1715, which has no similar standard in Canada, to prove this product complies with the intent of the code. CAN/ULC-S124 requires the location of the thermocouples to be between the foam and the product being tested, where CAN/ULC-S101 permits thermocouples to be located within the assembly at midpoints to better understand the heat stratification. As the thermocouples are much thicker than the applied thickness of the paint, the exposure of the thermocouple is much greater than other barriers tested to this standard.

The limitations of both testing standards are for the foam substrate to not exceed an average temperature of 140˚C and a maximum temperature of 180˚C. This poses a significant problem for incandescent products, which typically react at temperatures exceeding 200˚C. at the relatively low temperatures achieved during the test, the true effect of the incandescent paint would not be assessed.

Application and Intent:

F01,F02,F05-OS1.5: "To limit the probability that foamed plastic insulation will be exposed to a fire or subjected to high temperatures, which could lead to its ignition and contribution to the early growth and spread of fire, which could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons."

Discussion:

Given the other paths of compliance generally do not deal with heat transfer as the products specified are noted to be poor at providing thermal resistance, it is questionable as to why this standard was referenced by the Code. The title of this section of the Code is "Flame Spread Limits", based off this and the other prescriptive protection options, it appears to be the intent of the code to control exposure to fire as a primary issue and heat transfer as a secondary issue. It does seem inconsistent to have an objective to ensure the foam is not "subjected to high temperatures", then allow the use of metal, one of the best commonly available conductors, as a path for compliance.

Potential Problems:

1. For the application to meet the conditions that were present during the test, training should be completed by the applicant in proper application techniques. It is our understanding that this training is currently available from the manufacturer.
2. The report from the engineering firm indicated that the flame spread rating for the foam installed on site must not exceed that of the foam used during the test.
3. Building occupants should be made aware of the product used to protect the foam in the event of damage, in order to effect repairs.

Decision:

Based on the evidence presented by the applicant, it is our decision to approve the use of DC 315 as a combustible insulation protection as per 3.1.5.12.(2) and protection of foamed plastics as per 9.10.17.10 subject to the following conditions;

1. The installation must be completed by individuals either trained by the manufacturer, or completed training approved by the manufacturer and installed in compliance with the manufacturer's installation instructions.
2. The maximum permitted flame spread rating of the foam is 240 when tested to CAN/ULC-S127.
3. Information must be communicated to the owner of the building specifying both the name of the foam used and the name of the intumescent used. This information can be either in the form of an owner's manual in the case of commercial construction that includes all the products used during construction or a label in the case of small scale residential construction affixed permanently to an area adjacent to where the product was installed.

Sincerely;

Trevor Murray

Assistant Building Inspector

Attachments:

Alternate Solution Application

Intertek – Listinf Information of IFT – DC 315

Arencon Inc. – Engineering Review of DC 315 Intumescent Protective Coating

PROJECT LOCATION:		PERMIT APPLICATION #:	

PROJECT INFORMATION AND CONTACTS:

Owner/Designer/Agent:

Owner:

Designer:

SUMMARY OF PROPOSAL:

Use of International Fireproof Technology Inc.'s DC315 Intumescent Coating as thermal barrier over sprayed foam polyurethane insulation having a flame spread of 500 or less. Refer to ARENCON Inc. engineering report, dated May 29, 2015, for further details (copy attached).

ACCEPTABLE DIVISION B SOLUTIONS:

Numeric NBCC Reference		Objectives & Functional Statements (Supplementary Standard SA-1)
3.1.5.1.(1)	Requires noncombustible materials to be used in building required to be of non-combustible construction except as permitted in Articles 3.1.5.2 to 3.1.5.21. Article 3.5.1.12 permits use of foamed plastic insulation which forms parts of walls, floors and ceilings in noncombustible construction to be protected with one of the specified thermal barriers or a thermal barrier that meets the requirements of Class B when tested to CAN/ULC-S124 (see 3.1.5.12.(3), (4) and by reference (2)e))	[F02 - OS1.2] [F02 - OP1.2]
9.10.17.10.(1)	Requires protection of foamed plastic insulation which forms parts of wall or ceiling assemblies to be protected from adjacent spaces in the building by specified thermal barriers or any thermal barrier that meets the requirements of 3.1.5.12.2.(e)	[F01, F02, F05 - OS1.5]

OBJECTIVES/FUNCTIONAL STATEMENTS: (Linked Pairs)			
Objectives Sec. Div. A-2.2		Functional Statement Div. A-3.2	
1.	[OP1.2] To limit the probability that as a result of its design and construction, a building will be exposed to an unacceptable risk of damage due to fire or explosion impacting areas beyond its point of origin	1.	F02: To retard the effects of fire beyond its point of origin
2.	[OS1.2] To limit the probability that, as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by fire or explosion impacting areas beyond its point of origin.	2.	F02: To retard the effects of fire beyond its point of origin
3.	[OS1.5.] To limit the probability that, as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused persons being delayed in or impeded from moving to a safe place during a fire emergency	3.	F01: To minimize the risk of accidental ignition
4.	[OS1.5.] To limit the probability that, as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused persons being delayed in or impeded from moving to a safe place during a fire emergency		F02: To limit the severity and effects of fire
5.	[OS1.5.] To limit the probability that, as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused persons being delayed in or impeded from moving to a safe place during a fire emergency	4.	F05: To retard the effect of fire on emergency egress facilities

Confirmation of Level of Performance of:	
Division B Provisions What is the level of performance of Division B in the "areas of performance" defined by the *applicable objectives* and *functional statements*?	**Proposed Alternative Solution Justification** (include supporting documentation for past performance, test described in Article 2.1.1.2 or other evaluation that the proposed *alternative solution* will achieve the level of performance required under Article 1.2.1.1 of Div. A)
Level of performance per Division B: - Provide one of the barriers, as described in Sentences 3.1.5.12.(2), (3) and (4), over the foamed insulation. Provision of a thermal barrier over the insulation in intended to minimize the risk of accidental ignition, minimize risk of damage to the building, minimize risk of injury to persons due to fire impacting areas beyond the point of origin, and retard effects of fire on emergency egress facilities.	Refer to ARENCON Inc. assessment report, dated May 29, 2015.
Identify any Assumptions, Limiting or Restrictive Factors	
Refer to ARENCON Inc. assessment report, dated May 29, 2015.	
List all Test Procedures, Engineering Studies, Building Performance Parameters, etc... supporting the Assessment for Compliance	
Refer to ARENCON Inc. assessment report, dated May 29, 2015.	
Information concerning any Special Maintenance or Operation Requirements including Commissioning, necessary for the Integrity	
Refer to ARENCON Inc. assessment report, dated May 29, 2015.	

LISTING INFORMATION OF IFT - DC 315 Water-based Fireproof Paint

SPEC ID: 32890

International Fireproof Technology Inc.
17528 Von Karman Avenue

Irvine, CA 92614

DC 315 Water-based Fireproof Paint is manufactured utilizing a proprietary formulation. For interior applications, use DC 315 Water-based Fireproof Paint on the surface of polyurethane (PU) foam structures such as partition walls, ceilings, and so on.

RATINGS

The following ratings were achieved:

Standard	Rating	Limitations/Design
ASTM E84	Flame Spread Index - 0 Smoke Developed Index - 10	DC 315 applied at a rate of 120 square feet per gallon to mineral cement fiber board
CAN/ULC S101	25 minutes	Design No. IFT/WA 25-01 Design No. IFT/WA 25-02 Design No. IFT/WA 25-03
UL 1715	Passed	See NOTE 1 below.
NFPA 286	N/A - See NOTE 2 below	See NOTE 2 below.

NOTE 1: DC 315 met the applicable requirements of UL 1715 when applied to the following room construction:

- DC 315 applied at a minimum 18 mils wet film thickness
- Nominal 2 pound per cubic foot polyurethane spray foam nominal 6 inches thick on walls and ceiling
- Polyurethane Spray Foam with Flame Spread Index of 25 or less
- Polyurethane Spray Foam with Smoke Developed Index of 450 or less

NOTE 2: DC 315 met the applicable requirements set forth in the 2006 IBC Section 803.2.1 / 2009 IBC Section 803.1.2 when applied to the following room construction:

- DC 315 applied at a minimum 20 mils wet film thickness
- Nominal 0.5 pound per cubic foot LaPolla Foam-LOK FL 500 polyurethane spray foam nominal 5-1/4 inches thick on walls and nominal 11-1/4 inches thick on the ceiling
- 2x6 wall studs spaced 16 inches on center
- 2x12 celing joists spaced 16 inches on center running perpendicular to the side walls

Attribute Value

Classification - Flame Spread Index	0
Classification - Smoke Developed Index	10
Criteria	UL 1715 (1997)
Criteria	NFPA 286 (2006)
Criteria	ASTM E84 (2009)
Criteria	ASTM E84 (2010)
Criteria	ASTM E84 (2010b)
Criteria	ASTM E84 (2011a)
Criteria	ASTM E84 (2012)
Criteria	ASTM E84 (2011c)
Criteria	ASTM E84 (2011b)
Criteria	ASTM E84 (2013a)
Criteria	CAN / ULC S101 (2014)
CSI Code	07 81 00 Applied Fireproofing
Intertek Services	Certification
Listed or Inspected	LISTED
Listing Section	OTHER PRODUCTS
Report Number	315976; 3172697; 10140462; 1014231785; 100220191; 101863734
Spec ID	32890

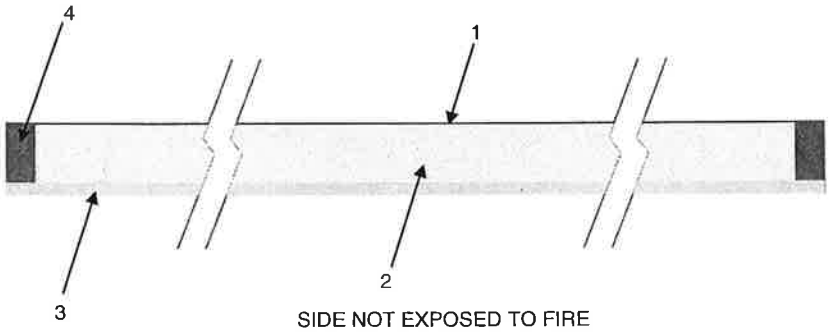
DRAWING INDEX

IFT/WA 25-01

Division 09 – Finishes
09 96 43 – Fire Retardant Coatings

DESIGN NO. IFT/WA 25-01
ASYMMETRIC ASSEMBLY RATING – 25 MINUTES
NON-LOAD-BEARING WALL ASSEMBLY
DC 315 Fire Retardant Paint, by International Fireproof Technology Inc.
CAN/ULC S101-14

SIDE EXPOSED TO FIRE



SIDE NOT EXPOSED TO FIRE

1. **CERTIFIED MANUFACTURER:** International Fireproof Technology Inc.

   CERTIFIED PRODUCT: DC 315 Fire Retardant Paint

   DC 315 Fire Retardant paint is spray-applied over the polyurethane foam (Item 2) at a wet thickness of 18 mils.

2. **CERTIFIED MANUFACTURER:** LaPolla Industries, Inc.

   CERTIFIED PRODUCT: FL2000 Foam-Lok Spray Foam Wall Insulation

   LaPolla Industries FL2000 Foam-Lok Spray foam insulation is an Intertek certified product. It was spray-applied in accordance with the manufacturer's instructions at an average thickness of 3-1/2 in. over the back face of the gypsum described in Item 3.

3. **GYPSUM SHEATHING:** One layer of 5/8 in. thick Type X Gypsum wallboard was fastened to the perimeter wood studs using 1-1/4 in. long coarse-thread drywall screws spaced 8 in. on centre. Gypsum wallboards were 4 ft. wide by 10 ft. high. Vertical butted joints (with no joint treatment applied) were located at 4 ft. and 8 ft. from the left side of wall when viewing the non-fire exposed face of the wall.

4. **PERIMETER FRAMING:** Nominal 2x4 SPF wood studs are used to secure the gypsum boards in place before the spray foam and coating are installed.

Please refer to https://whdirectory.intertek.com for current information on all Intertek certified products.

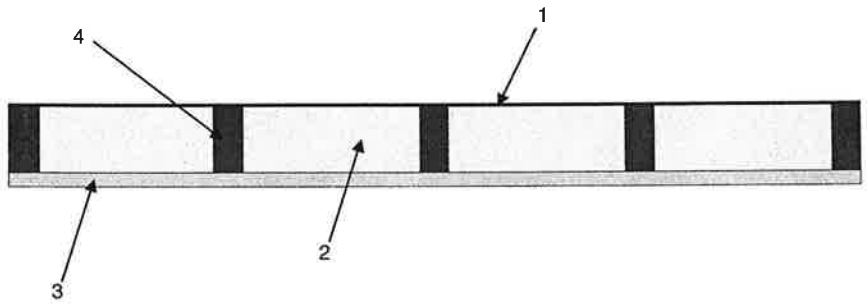
Date revised: February 19, 2015
Project No: G101426185

IFT/WA 25-02

Division 09 – Finishes
09 96 43 – Fire Retardant Coatings

DESIGN NO. IFT/WA 25-02
ASYMMETRIC ASSEMBLY RATING – 25 MINUTES
NON-LOAD-BEARING WALL ASSEMBLY
DC 315 Fire Retardant Paint, by International Fireproof Technology Inc.
CAN/ULC S101-14

SIDE EXPOSED TO FIRE



SIDE NOT EXPOSED TO FIRE

1. **CERTIFIED MANUFACTURER**: International Fireproof Technology Inc.

   CERTIFIED PRODUCT: DC 315 Fire Retardant Paint

   DC 315 Fire Retardant paint is spray-applied over the polyurethane foam (Item 2) in one layer with a wet thickness of 18 mils.

2. **CERTIFIED MANUFACTURER**: LaPolla Industries, Inc.

   CERTIFIED PRODUCT: FL2000 Foam-Lok Spray Foam Wall Insulation

   LaPolla Industries FL2000 Foam-Lok Spray foam insulation is an Intertek certified product. It was spray-applied in accordance with the manufacturer's instructions at an average thickness of 3-1/2 in. over the back face of the gypsum described in Item 3.

3. **GYPSUM SHEATHING**: One layer of 1/2 in. thick Type C Gypsum wallboard was fastened to the wood studs using 1-1/4 in. long coarse-thread drywall screws spaced 8 in. on centre (oc). Gypsum wallboards were 4 ft. wide by 10 ft. high, oriented vertically. No joint treatment was applied to the drywall joints.

4. **FRAMING**: Nominal 2x4 SPF wood studs, spaced 16 in. oc, are used to secure the gypsum boards in place before the spray foam and coating are installed.

Please refer to https://whdirectory.intertek.com for current information on all Intertek certified products.

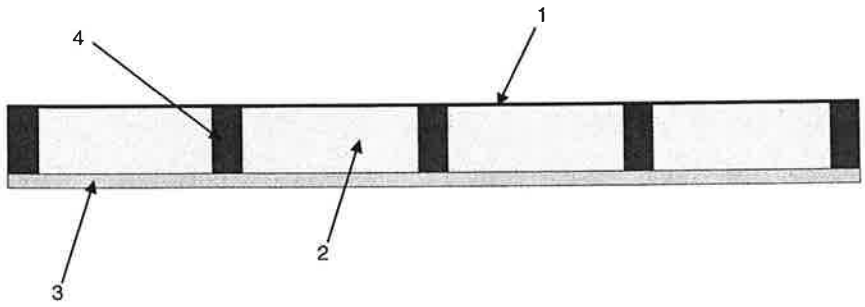
Date revised: February 19, 2015
Project No: G101426185

IFT/WA 25-03

Division 09 – Finishes
09 96 43 – Fire Retardant Coatings

DESIGN NO. IFT/WA 25-03
ASYMMETRIC ASSEMBLY RATING – 25 MINUTES
NON-LOAD-BEARING WALL ASSEMBLY
DC 315 Fire Retardant Paint, by International Fireproof Technology Inc.
CAN/ULC S101-14

SIDE EXPOSED TO FIRE



SIDE NOT EXPOSED TO FIRE

1. **CERTIFIED MANUFACTURER:** International Fireproof Technology Inc.

   CERTIFIED PRODUCT: DC 315 Fire Retardant Paint

   DC 315 Fire Retardant paint is spray-applied over the polyurethane foam (Item 2) at a wet thickness of 18 mils.

2. **Insulation Foam:** Spray-apply Proline Plus™ 200, EcoBay® CC, Insulthane® 200 or EcoloFoam 200 polyurethane foam insulation in accordance with the manufacturer's instructions at an average thickness of 3-1/2 in. over the back face of the gypsum described in Item 3.

3. **GYPSUM SHEATHING:** One layer of 1/2 in. thick Type C Gypsum wallboard was fastened to the wood studs using 1-1/4 in. long coarse-thread drywall screws spaced 16 in. on centre (oc) horizontally and max. 17 in. oc vertically. Gypsum wallboards were 4 ft. wide by 10 ft. high, oriented vertically. No joint treatment was applied to the drywall joints.

4. **FRAMING:** Nominal 2x4 SPF wood studs, spaced 16 in. oc, are used to secure the gypsum boards in place before the spray foam and coating are installed.

Please refer to https://whdirectory.intertek.com for current information on all Intertek certified products.

Date created: February 19, 2015
Project No: G101863734

ARENCON INC.

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ENGINEERING REVIEW

OF

DC 315 INTUMESCENT PROTECTIVE COATING

Prepared for:
International Fireproof Technology Inc.
17528 Von Karman Ave.
Irvine, CA 92614

Project No. 6390.00 B05
May 29, 2015

Prepared By:

Amal Tamim, M.Sc. FPE
ARENCON INC.

Reviewed By:

Leslie Morgan, P.Eng.
ARENCON INC.

SAFFIRE
SAFETY CONSULTANTS INC.

Engineering Review of DC 315 Intumescent Protective Coating
Project No. 6390.00 B05
Signature Page

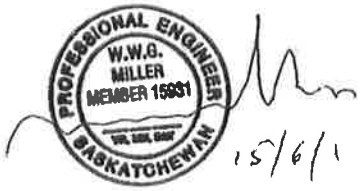
BRITISH COLUMBIA

ONTARIO

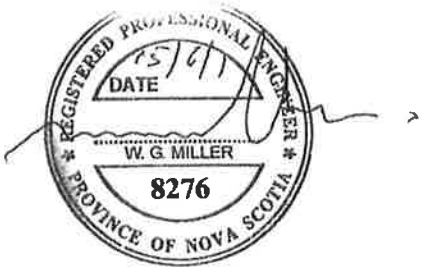
ALBERTA

NEW BRUNSWICK

SASKATCHEWAN



NOVA SCOTIA



MANITOBA

Executive Summary

This report documents our engineering review of International Fireproof Technology Inc.'s DC 315 Intumescent Coating for use as a thermal barrier over polyurethane foam insulation in buildings of combustible and noncombustible construction. The assessment is based on the requirements of the 2010 National Building Code of Canada (NBC) Part 3 and Part 9.

The engineering assessment is based on review of documentation provided by International Fireproof Technology Inc., as identified in this report.

DC 315, is a thin film intumescent coating applied directly to the foam insulation at a thickness of 18 mil (dry) (0.02in) or more. The product, under fire conditions, will provide a protective thermal barrier to the foam insulation.

The prescriptive requirements for thermal barriers are established through CAN/ULC-S124, which classifies the barriers based on the thermal performance of the fire barrier. DC315, being an intumescent product, cannot be assessed to CAN/ULC-S124 as the product must react to high temperatures in order form a protective barrier over the insulation.

This engineering assessment uses provisions in the Appendix of the NBC and other internationally recognized, and codified, test methods and evaluation criteria to address product performance and evaluate satisfying the intended performance for thermal barriers and foam insulation.

DC 315 acts as a protective barrier to protect SPF insulation. The product testing demonstrates that the intumescent barrier protects the SPF without significant temperature increase of the SPF insulation and will limit the SPF contribution to fire growth. The fire testing of a DC 315 protected wall assembly to CAN/ULC-S101 fire conditions demonstrated average temperatures of approximately 36°C within 1" of the fire exposed foam surface at 10 min. Fire testing of a DC 315 protected wall assembly to UL 1715 passed the acceptance criteria for protective coatings

Based on the product's tested performance, it is our opinion that DC 315 can be used as an alternative to prescriptive thermal barriers over spray polyurethane foam insulation products, such as FL2000 Foam-Lok and other tested spray foam polyurethane insulation products of similar density and thickness and with a flame spread rating not exceeding that of FL2000 Foam-Lok.

In accord with the NBC DC 315 may not be used as a thermal barrier in interior walls, ceilings or roofs in a building required to be of noncombustible construction that is unsprinklered and is more than 18 m high or is considered a high building per NBC 3.2.6, unless additional testing confirms that it will remain in place for 40 minutes when tested to CAN/ULC-S101.

Table of Contents

1 Introduction

This report discusses our review of International Fireproof Technology Inc.'s (IFTI) DC 315 Intumescent Coating for use as a thermal barrier over LAPOLLA Foam-Lok FL 2000 polyurethane foam insulation which has a flame spread rating of 500 or less..

The engineering review identifies the prescriptive Code requirements relevant to protection of foam insulation in combustible and noncombustible construction contained in the 2010 National Building Code of Canada (NBC) Part 3 and Part 9. The engineering review also identifies testing standards and performance requirements for thermal barriers and provides assessment of DC 315.

The performance of the coating evaluated in this report is the application of DC 315 as an alternative to listed thermal barriers tested to CAN/ULC-S124.

The product testing, as discussed in this report, demonstrates that DC 315 will protect and reduce the flame spread over the insulation while providing minimum 10 min fire endurance when exposed to CAN/ULC-S101 fire conditions.

2 Limitations

This report was prepared by ARENCON INC. for the account of International Fireproof Technology Inc. (IFTI).

The material in this report reflects ARENCON INC.'s best judgement in light of the information available to it at the time of preparation. Any use which a third party other than IFTI, makes of this report, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. ARENCON INC. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The following comments are based on review of the information provided including data sheets, test reports and International Code Council Evaluation Service evaluation reports of DC 315, all of which were provided by the Client and as referenced in this report.

3 DC 315 Intumescent Protective Coating

DC 315 is a proprietary, water-based, intumescent coating. The product is developed and manufactured by International Carbide Technology, Ltd. in Taiwan and 'toll' manufactured/distributed in North America by International Fireproof Technology, Inc.

DC 315 is a thermal and ignition barrier to be applied over spray polyurethane foam (SPF) insulation. The product is water-based single component and does not require site mixing. It is marketed as an alternative barrier system for protection of SPF insulation. It is tested and listed by Intertek Warnock Hersey. The product manufacturing process and facility are reviewed and third party inspected under Warnock Hersey Intertek Manufacturing Certification # 20947.

The product's use, as evaluated in this report, is as a thermal barrier to protect spray polyurethane foam insulation in walls, ceilings and floors. The product is typically spray-applied at 18 - 24 wet mills (0.46 - 0.61 mm) with average dry thickness of 14 - 18 dry mils (0.36 - 0.46 mm).

The coating is applied over SPF insulation. SPF is a thermoset foam. The intumescent coating is applied directly to the cured SPF, without air space or mechanical fasteners. The intumescent coating adheres directly to the surface of the SPF.

4 Code Requirements / Application

NBC Part 3 and Part 9 address the installation of foam plastic insulation in buildings of combustible and noncombustible construction.

Various performance requirements apply to foam insulation depending on:
- The type of construction (i.e combustible or noncombustible),
- The flame spread rating of the insulation, and
- The location where the insulation will be used in the building.

The following summarizes relevant NBC provisions to this evaluation.

4.1 Determination of Flame Spread Rating and Smoke Developed Classifications

- NBC 3.1.12.1 requires that the flame spread rating and smoke developed classification of a material, assembly or structural member be determined on the basis of not less than three tests conducted in accordance with CAN/ULC-S102 "Test for Surface Burning Characteristics of Building Materials and Assemblies."

4.2 Combustible Construction

- NBC 3.1.4.1. permits foamed plastic insulation to be used in combustible construction if the flame spread rating of the insulation on any surface is not more than 500.

- NBC 3.1.4.2. requires foamed plastic insulation used in walls and ceilings to be protected by specified interior finishes or by a thermal barrier that meets the requirements of Sentence 3.1.5.12.(2). The barrier specified in 3.1.5.12.(2)(e) is 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 Appendix note to this Article indicates that any thermal barrier accepted under 3.1.5.2.(2) for noncombustible construction is also acceptable for combustible construction.

- NBC Appendix A, A-.3.1.5.12.(2)(e) clarifies that the standard fire exposure in CAN/ULC-S101 "Fire Endurance Tests of 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 surface after a period of 10 min satisfies this requirement.

4.3 Noncombustible Construction

- NBC 3.1.5.12.(2) requires combustible insulation with flame spread rating not more than 25 to be protected by specified thermal barriers or 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".

  A thermal barrier, tested to CAN/ULC-S101, that does not exceed an average temperature rise of 140°C on its unexposed face after a period of 10 min satisfies this requirement, as per Appendix A, A-3.1.5.12.(2)(e).

- NBC 3.1.5.12.(3) requires combustible insulation with flame spread rating more than 25 and not more than 500 when used in exterior walls of a building to be protected from adjacent spaces in the buildings, other than adjacent concealed spaces within the wall assembly, by specified thermal barriers or any thermal barrier that when tested to CAN/ULC-S101 "Fire Endurance Tests of Building Construction and Materials" will not develop an average temperature rise more than 140°C or a maximum temperature rise not more than 180°C at any point on its unexposed surface within a 10 min period.

- NBC 3.1.5.12.(4) requires combustible insulation with flame spread rating more than 25 but not more than 500 when used in interior walls and within ceilings and roof assemblies to be protected from adjacent spaces in the building, other than adjacent concealed spaces within wall assemblies, by a 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".

- When insulation is used in unsprinklered buildings over 18 m in height, the insulation shall be protected with specific thermal barriers or protected with any thermal barrier that when tested to CAN/ULC-S101 "Fire Endurance Tests of Building Construction and Materials" will not develop an average temperature rise more than 140°C or a maximum temperature rise not more than 180°C at any point on its unexposed face within 20 min period and will remain in place for 40 min.

- NBC 3.1.5.10. permits combustible interior finish paint not more than 1 mm thick in noncombustible construction.

- NBC Section 5.10 provides a listing of standards applicable to environmental separators and assemblies exposed to the exterior in Table 5.10.1.1. Medium density spray-applied polyurethane foam insulation is required to meet CAN/ULC-S705.1 and CAN/ULC-S705.2 for materials and installation. The flame spread requirements applicable to the insulation are as per Part 3 requirements of the NBC.

4.4 Part 9 - Housing and Small Buildings

- NBC 9.10.6.1. addresses combustible elements in noncombustible construction and requires combustible elements to be in conformance with the requirements of Subsection 3.1.5. The provisions related to foam insulation when used in noncombustible construction as described above is also applicable to small buildings of noncombustible construction.

- NBC 9.10.17.10.(1) requires protection of foam plastic which form parts of ceilings and walls in combustible construction to be protected from adjacent spaces in the buildings by specified thermal barriers or by any thermal barrier that meets the requirements of Clause 3.1.5.12.2.(e).

5 Prescriptive and Alternative Test Methods

5.1 Prescriptive Tests

NBC Sentence 3.1.5.12.(2) prescribes acceptable thermal barriers for foamed plastic insulation as 12.7 mm gypsum board, lath and plaster, masonry, concrete or any thermal barrier that meets the requirements of Class B when tested in conformance with CAN/ULC-S124, "Test for the Evaluation of Protective Coverings for Foamed Plastic".

Under CAN/ULC-S124, the protective covering/thermal barrier evaluation involves testing a 700 mm x700 mm horizontal assembly. This assembly consists of the thermal barrier, the foam insulation and backing material (gypsum board). The assembly is exposed to fire conditions the follow the standard time-temperature curve specified in CAN/ULC-S101. Five thermocouples measure the temperature increase on the interface of the thermal barrier and insulation. A Class B rating requires that the average temperature rise at the end of 10 minutes not exceed 140°C, with not single thermocouple exceeding 180°C.

Per NBC Appendix A, A-3.1.5.12.(2)(e), a thermal barrier, tested to CAN/ULC-S101, that does not exceed an average temperature rise of 140°C on its unexposed face after a period of 10 min is deemed to satisfy the requirements of a Class B rating per CAN/ULC-S124. The size of CAN/ULC S101 full scale tested assembly is approximately 3000 mm x 3000 mm. The wording of the Appendix lacks clarity with respect to orientation of the tested assembly and to where the temperature is to be measured on the unexposed side of the test assembly. The measurement of the temperature on the unexposed side of the coating is discussed in the following section of the evaluation.

The NBC does not have any specific requirements/restrictions for testing the product in a vertical or horizontal orientation. nor does it specify the unexposed face of thin-film intumescent type products .

5.2 Alternative Code Compliance Approach

The overall goal of the NBC is to establish a minimum, accepted level of fire and life safety and property protection within buildings. While the Code provides prescriptive measures for achieving these expectations, it has long been held that alternative designs, materials and methods of construction can be used. This is now recognized under the Alternative Solution provisions contained within the Code.

NBC Div A., Clause 1.2.1.1.(1)(b) permits compliance using alternative solutions that will achieve at least the minimum level of performance required by Division B in the areas defined by the Objectives and Functional Statements attributed to the applicable acceptable solutions.

The attributed objective and functional statements for Subsection 3.1.5 are to minimize the risk of damage to buildings and to minimize the risk of injury to persons due to fire/explosions impacting areas beyond point of origin. This is achieved by limiting the severity and effects of fire. (NBC Table 3.9.1.1.; [F02-OS1.2] & [F02-OP1.2]are attributed to Sentence 3.1.5.1.(1)).

The attributed objective and functional statements for Article 9.10.17.10 are to minimize the risk of accidental ignition, to limit the severity and effects of fire or explosions and to retard the effects of fire on emergency egress facilities in order to limit the probability that a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to persons being delayed in, or impeded from, moving to a safe place in a fire emergency (NBC Table 9.36.1.1.; [F1,F02, F05-OS.1.5] are attributed to Sentence 9.10.17.10.(1)).

This engineering review evaluates DC315 in achieving the above attributed objectives, when DC315 is used as a thermal barrier protecting SPF building insulation. It is intended that this report may be used in support of alternative solutions for consideration of DC315 intumescent coatings as an alternative to thermal barriers.

5.3 Alternative Tests / Evaluations

Unlike typical thermal barrier products, such as boards, blankets and renders (spray-applied cementitious or fibrous products), intumescent coatings require exposure to high temperatures in order to expand, typically at a temperature in excess of 200 °C , before they can intumesce and form the protective barrier over the foam or other substrates.

DC 315, and any other intumescent coating product applied at thicknesses of 18 mils cannot be assessed to the CAN/ULC-S124 test methodology as they cannot meet the temperature requirements at the interface with the insulation. Due to their nature and thin film depth, the CAN/ULC-S124 is not an appropriate test methodology to evaluate these products, or the level of protection that they provided to the foamed insulation.

In order to assess performance of the intumescent thin-film thermal barrier products to the standards referenced in the OBC, some alterations/variation to the depth of the thermocouple need to made, such as locating the thermocouple at an intermediate interface close to the exposed surface of the assembly, as well as evaluating if the SPF located within this interface contributes to fire growth.

Alternatively, different test standards or evaluation methodology needs to be examined and evaluated. One such test is Underwriters Laboratories test standard UL 1715 "Fire Test of Interior Finish Material". This test is a room corner test where the foam and coating are applied to the wall and ceiling of the room and exposed to wood crib fire. The test evaluates the flammability contribution of the wall finish material/assemblies under these fire conditions. The primary purpose of the test is to evaluate the effectiveness of the fire barrier materials /surface finishes as protection to the combustible materials in the wall/ceiling assembly. Observations are made to assess its performance and adherence of the coating to the foam insulation and potential of flash-over.

There is no comparable test standard in Canada that is referenced through the building regulations, however, there are comparable 'room corner' test standards to UL 1715 internationally.

DC 315 has been tested to S101, with thermocouples placed within 13mm to 25.4 mm from the exposed surface. Additional measurements were taken at the interface with the backing material and at the unexposed side of the assembly.

In addition, the performance of the DC 315 over polyurethane foam insulation has also assessed in conformance the test method UL 1715 "Fire Test of Interior Finish Material".

The results of those tests are discussed in the following Section of this evaluation.

6 DC 315 Test Reports and Listing Review

6.1 Intertek Report # 101426185COQ-003a 'Report of Testing DC 315 Intumescent Coating for Compliance with CAN/ULC-S101-07', issue date April 29, 2014

The test is a product evaluation of the above product for compliance with the applicable requirements of CAN/ULC-S101-07, "Fire Endurance Tests of Building Construction and Materials". The report was issued to International Carbide Technology Co., Ltd., Taiwan.

DC 315 was applied at 18 mils wet thickness over 3.5" thick LAPOLLA Industries Foam-Lok FL 2000 insulation installed in a 10' x 10' wall assembly with 2" x 4" wood studs at 16" o.c. with a 0.5" thick Type C gypsum wallboard as the substrate.

The test assembly had thermocouples located on the unexposed side of the assembly, at the interface between the insulation and the drywall substrate, and at approximately 1" below the exposed surface of the DC 315 coating. The test ran for a duration of 25 min.

The approximate temperature readings at the interfaces are as follows:

Location	# thermocouples	Avg. Temp at 10 min	Max. Temp at 10 min
Furnace Temp	9	760°C	n/a
1" below DC315	5	36°C	160°C
Foam/substrate interface	9	16°C	21°C
Unexposed Surface	9	16 °C	16.6°C

Test observations include:

- There was no burn through on the unexposed side of the wall. The average unexposed temperature did not rise above the max allowable of 140°C over the 25 minute period.

- No single thermocouple on the unexposed side showed a temperature rise exceeding the maximum allowable of 180°C above the initial temperature over the 25 minute period.

- An additional set of thermocouples (five) were placed within the insulation within 1" from the DC315 paint and foam interface and another set (nine) at the foam and gypsum board interface. No single thermocouple exceeded the max allowable of 140°C above the initial temperature over the 15 minute period.

The wall assembly with the intumescent coating achieved 25 min rating based on CAN/ULC-S101 test requirements.

6.2 *Intertek SPEC ID 32890: 'Listing Information of DC 315 - Water based Fireproof Coating', issued to International Fireproof Technology Inc.*

Listing is based on testing conducted with DC 315 applied directly to the surface of polyurethane foam structures.

- The report confirms that DC 315 intumescent coating met the applicable requirements of UL 1715 "Fire Test of Interior Finish Material" when applied at 18 mils wet film thickness to nominal 6" thick LAPOLLA Industries FL2000 Foam-Lok Spray Foam Insulation. UL 1715 is the acceptable standard of practice/test criteria used internationally for assessing protective coverings for combustible sprayed foam insulation products for use as interior finish in noncombustible construction without the use of a thermal barrier (International Building Code (IBC) IBC 2603.9 - Special Approval.) In this room corner test, the foam insulation is sprayed on the walls and ceilings of the test room and the thermal barrier is applied over the foam.
- DC 315 achieves a Flame Spread Index: 0 and Smoke Development Classification: 10, when tested over 6 inches thick FL2000 Foam-Lok Spray Foam Insulation in accordance with ASTM E84.

- Design IFT/WA 25-01 - Asymmetric Assembly Rating - 25 minutes, non-load bearing wall assembly with certified DC 315 Fire Retardant Coating manufactured by IFTI over 3.5 inches thick certified LAPOLLA Industries FL2000 Foam-Lok Spray Foam Insulation over gypsum sheathing. Tested to CAN/ULC-S101-07.

- Design IFT/WA 25-2- Asymmetric Assembly Rating - 25 minutes, non- load bearing wall assembly with certified DC 315 Fire Retardant Coating manufactured by IFTI over 3.5 inches thick certified LAPOLLA Industries FL2000 Foam-Lok Spray Foam Insulation over gypsum sheathing and wood studs. Tested to CAN/ULC-S101-07.

6.3 Additional Information

The following information was also provided by the Client as part of the evaluation:

- IFTI literature titled 'Application Guide for DC 315. DC 315: Alternate Thermal Barrier on Spray Polyurethane Foam (SPF)'

  The guide provide installation instruction and directions for correct application of DC 315, included required wet film thicknesses and required cure times for both SPF and DC 315.

- ICC ES Evaluation Report ESR-2629 for FOAM-LOK FL 2000 Spray Foam Insulation.

  This report addresses using the SPF foam insulation as nonstructural thermal insulating material in Type I, II, III, IV and V construction categories (as per the IBC). The ICC-ES Evaluation Report Section 4.3. addresses required thermal barriers, either with or without prescriptive thermal barriers, i.e. drywall. Section 4.3.2. pertains to installation of FL2000 Application without a Prescriptive Thermal Barrier, and requires when DC-315 to be applied to all exposed foam surfaces at a minimum rate of 22 mils (14 dry mils) at a rate of 1 gallon per 73 square feet and the maximum installed thickness of FL2000 is 6.25 inches (159mm) on vertical walls and 8.25 inches (210 mm) on ceilings.

7 Assessment

7.1 Noncombustible Construction

The foam insulation products to be used with DC 315 must be tested to CAN/ULC-S102 to assess the flame spread rating and establish that it does not exceed 500. This assessment is based on LAPOLLA Industries FL2000 Foam-Lok, which has flame spread rating of not more than 500.

LAPOLLA Industries FL2000 Foam-Lok and other spray polyethylene foam (SPF) insulation products that are permitted to be used with DC 315 (as per manufacturer's criteria) shall be tested to establish their flame spread rating to be not more than 500 in accordance with CAN/ULC-S102 and to meet CAN/ULC-S705.1 Specification and CAN/ULC-S705.2 Application.

The test criteria of CAN/ULC-S124 is not an appropriate standard by which to evaluate DC 315 or any thin film intumescent coating. The CAN/ULC-S124 test measures the temperature rise at the interface between the thermal barrier and the insulation. Due to intumescent coatings' applied thickness and the need to be exposed to high temperatures to intumesce, these products cannot satisfy the test criteria.

UL 1715"Fire Test of Interior Finish Material" uses a room corner test, with the protective coating applied to walls and ceiling of the room . The test evaluates the effectiveness of the fire barrier materials /surface finishes as protection to the combustible materials in the wall/ceiling assembly. DC 315 was tested to this standard and demonstrates that it meets the test requirements of NFPA 286.

DC 315's performance meets the conditions set for thermal barriers in 3.1.5.12.(3) and 3.15.12.(4), with the exception of subclause 3.1.5.12.(4)(d)(ii).

The DC 315's performance in the tests demonstrates that it may be used as an alternative to prescriptive thermal barrier over LAPOLLA Industries FL2000 Foam-Lok Spray Foam Insulation in the following building areas:

- Within exterior walls of all buildings,
- Within interior walls, ceilings and roof assemblies of sprinklered buildings of any height, and
- Within interior walls, ceilings and within roof assemblies of unsprinklered buildings not more than 18 m in height measured between grade and floor level of the top storey.

It is expected that the above installations will apply to DC 315 when applied over polyurethane sprayed-foam insulation products that are applied at the same density and thickness as LAPOLLA Industries FL2000 Foam-Lok Spray Foam Insulation and having a flame spread rating not exceeding that of FL2000 Foam-Lok

Assessment for using DC 315 over other foam insulation products manufactured by other manufacturers is not addressed in this evaluation. Additional test evidence shall be provided for other SPF insulation products based on CAN/ULC-S101, CAN/ULC S102 and UL 1715.

However, it is expected that similar results will be achieved for any polyurethane sprayed foam insulation product that is applied at the same density and thickness as LAPOLLA Industries FL2000 Foam-Lok Spray Foam Insulation and having a flame spread rating not exceeding that of FL2000 Foam-Lok.

7.2 Combustible Construction

The use of DC 315 as thermal barrier over LAPOLLA Industries FL2000 Foam-Lok Spray Foam Insulation is permitted in buildings of combustible construction for the same reasons as stated above.

8 Summary

DC 315 acts as a protective barrier to SPF insulation. The product testing demonstrates that the intumescent barrier protects the SPF under fire conditions and limits the risk of accidental ignition of the SPF as the intumescent coating limits any significant temperature increase of the SPF insulation. The intumescent coating limits the SPF contribution to fire growth and retards the effects of fire on building facilities, thereby limiting the probability that a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to persons being delayed in or impeded from moving to a safe place in a fire emergency.

The fire testing of a DC 315 protected wall assembly to CAN/ULC-S101 fire conditions demonstrated average temperatures well under 140°C within 1" of the foam surface at 10 min fire endurance. Fire testing of a DC 315 protected wall assembly to UL 1715 passed the acceptance criteria for protective coatings

Based on the product's tested performance, it is our opinion that DC 315 can be used as an alternative to prescriptive thermal barriers over SPF insulation products, such as FL2000 Foam-Lok and others of similar density and thickness and with a flame spread rating not exceeding that of FL2000 Foam-Lok. Except as noted below, DC315 is, in our opinion, acceptable for use as a protective barrier to SPF, in buildings of noncombustible construction or of combustible construction and in small buildings.

DC 315 may not be used as an alternative to prescriptive thermal barrier in interior walls, ceilings or roofs in a building required to be of noncombustible construction that is unsprinklered and is more than 18 m high or is considered a high building per NBC 3.2.6, unless additional testing confirms that it will remain in place for 40 minutes when tested to CAN/ULC-S101.

Should other polyurethane spray-foam insulation products, other than LaPolla FL2000 Foam-Lok, be used with DC 315, additional test evidence must be available to ensure the SPF meets the criteria established in NBC, in accordance with CAN/ULC-S101 as described above, to CAN/ULC-S102 and as required in CAN/ULC-S705.1 Specification.

AST/LAM: