BOABC 60th Annual Conference & AGM
Richmond, BC

Plasti·Fab®
EPS PRODUCT SOLUTIONS
Better building ideas from PFB™

INSULSPAN®

STRUCTURAL INSULATING PANEL SYSTEM

Better building ideas from PFB™

What are Structural Insulating Panels?

SIPs use three main components:

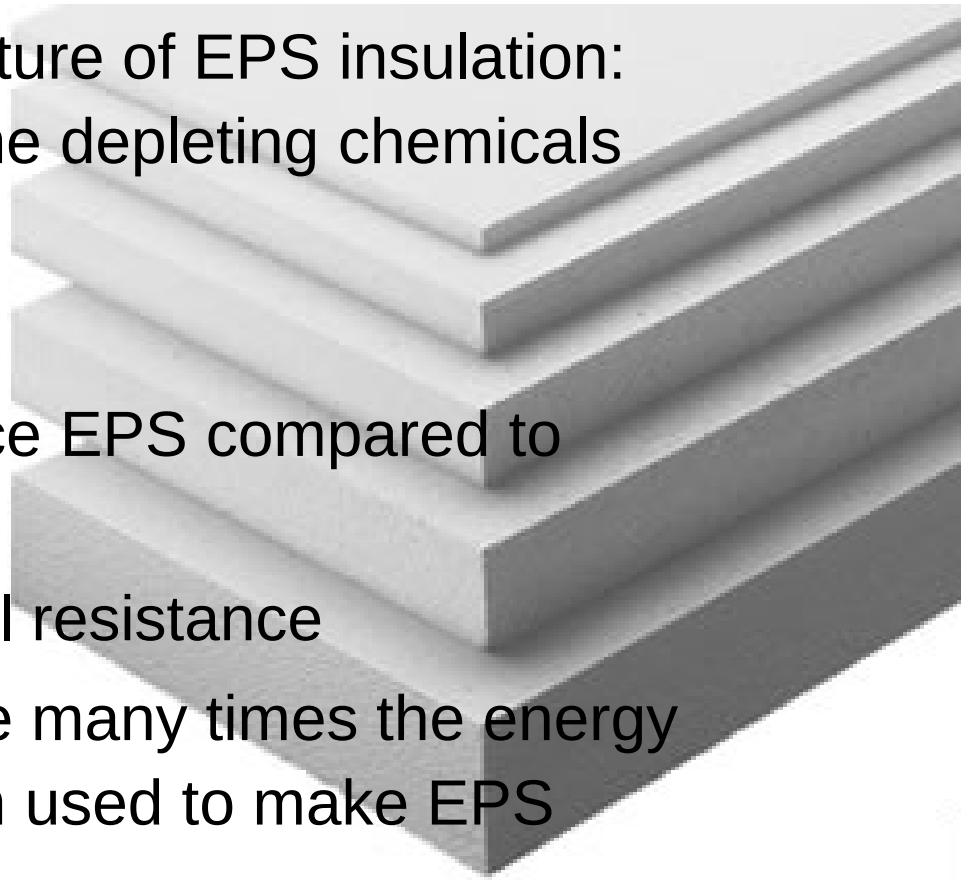
- Oriented Strand Board
- Expanded Polystyrene
- Structural Adhesive

- The result is a strong, energy efficient building component that can be used for walls, floors, and roofs of single family homes, timber frame homes, log homes, multiunit complexes, and light commercial buildings.

Oriented Strand Board (OSB)

- Harvested forests
  - fast growth, renewable
- Engineered – consistent characteristics
- Larger dimensions

• Expanded Polystyrene (EPS)



- The rigid closed cellular structure of EPS insulation:
  - Does not contain any ozone depleting chemicals
  - 90 to 98% air
  - Recyclable
  - 24% less energy to produce EPS compared to fiberglass insulation
  - Provides long term thermal resistance
  - EPS used in SIPs will save many times the energy embodied in the petroleum used to make EPS

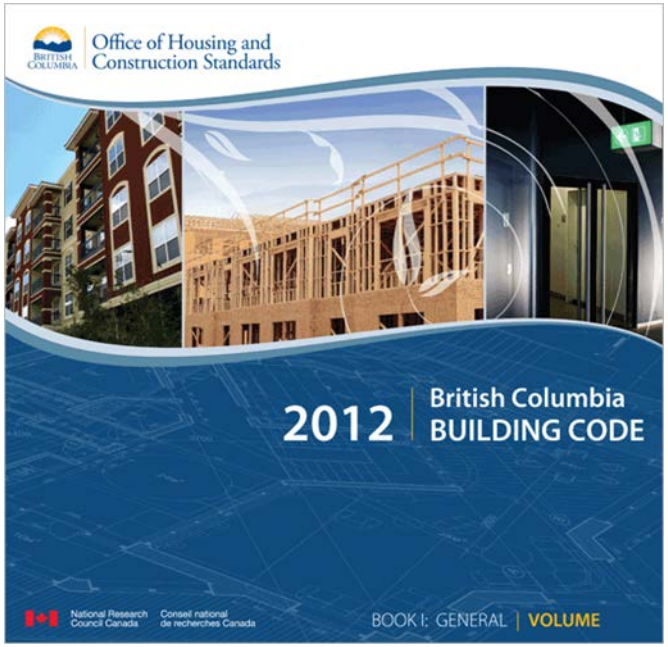
2012 BC Building Code

Jim Whalen, P. Eng.

Technical Services Engineer

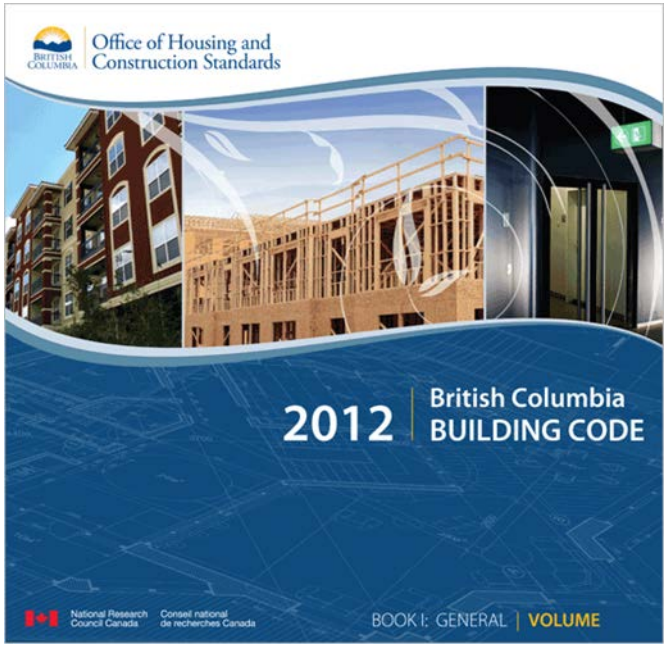
Plasti-Fab Ltd.

- Responsible for developing and maintaining all technical information for Insulspan SIP System.



2012 BC Building Code

- Areas of discussion
  - How structural insulated panel (SIP) manufacturers demonstrate compliance
  - Structural design requirements
  - Section 9.36 energy efficiency requirements
- Questions

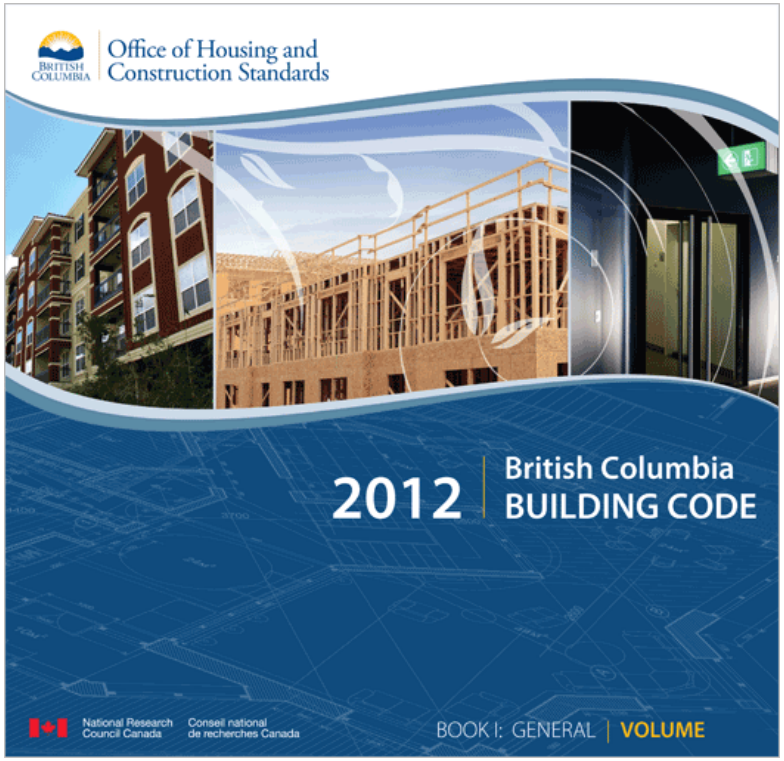


SIP Building Components

- Scope of Insulspan SIP System components:
  - Walls
  - Roofs

SIP Compliance with 2012 BCBC

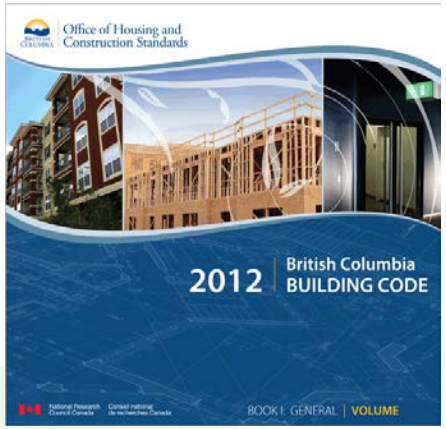
- Code Compliance Options:
  - **Acceptable Solution**
    - Solution that can be shown to meet all provisions of Division B – e.g., complies with applicable provisions of a standard referenced in Code.
  - **Alternative Solution**
    - Solution differs from acceptable solutions in Division B but is offered as an **Alternate Solution** that addresses the same issues as the applicable **Acceptable Solution** and can demonstrate **equivalent performance**.



Alternative Solutions Process

2012 BCBC, Article 2.3.1.1. Application

1) States that, on written request by the owner of a building or an authorized agent of that owner, the AHJ shall accept a measure as an alternate solution to an acceptable solution for the building if satisfied
   a) Alternate Solution will achieve at least the level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions, and
   b) the Acceptable Solution does not expressly require conformance to a provincial enactment other than the British Columbia Building Code.

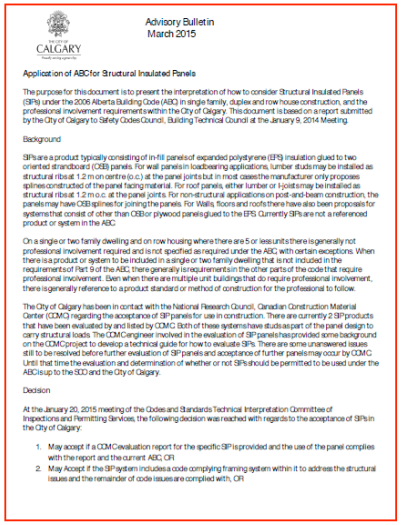


Alternative Solutions Process

2012 BCBC, Article 2.3.1.2. Documentation

1) The AHJ **may require a person requesting the use of an Alternative Solution to provide documentation** to demonstrate that it will achieve at least the level of performance required by applicable acceptable solutions in Division B.

2) The documentation must include a **Code analysis** outlining the analytical methods and rationales used to determine that the proposed alternative solution will achieve at least the level of performance required.



Advisory Bulletin
March 2015

Application of ABCfor Structural Insulated Panels

The purpose for this document is to present the interpretation of how to consider Structural Insulated Panels (SIPs) under the 2006 Alberta Building Code (ABC) in single family, duplex and row house construction, and the professional involvement requirements within the City of Calgary. This document is based on a report submitted by the City of Calgary to Safety Codes Council, Building Technical Council at the January 9, 2014 Meeting.

Background

SIPs are a product typically consisting of in-fill panels of expanded polystyrene (EPS) insulation glued to two oriented strandboard (OSB) panels. For wall panels in loadbearing applications, lumber studs may be installed as structural ribs at 1.2 m on centre (o.c.) at the panel joints but in most cases the manufacturer only proposes splines constructed of the panel facing material. For roof panels, either lumber or I-joists may be installed as structural ribs at 1.2 m o.c. at the panel joints. For non-structural applications on post-and-beam construction, the panels may have OSB splines for joining the panels. For Walls, floors and roofs there have also been proposals for systems that consist of other than OSB or plywood panels glued to the EPS. Currently SIPs are not a referenced product or system in the ABC

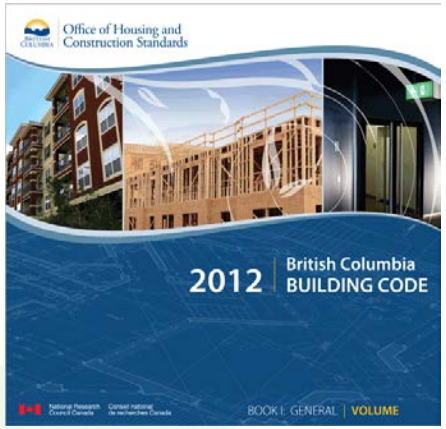
On a single or two family dwelling and on row housing where there are 5 or less units there is generally not professional involvement required and is not specified as required under the ABC with certain exceptions. When there is a product or system to be included in a single or two family dwelling that is not included in the requirements of Part 9 of the ABC, there generally is requirements in the other parts of the code that require professional involvement. Even when there are multiple unit buildings that do require professional involvement, there is generally reference to a product standard or method of construction for the professional to follow.

The City of Calgary has been in contact with the National Research Council, Canadian Construction Material Center (CCMC) regarding the acceptance of SIP panels for use in construction. There are currently 2 SIP products that have been evaluated by and listed by CCMC. Both of these systems have studs as part of the panel design to carry structural loads. The CCMC engineer involved in the evaluation of SIP panels has provided some background on the CCMC project to develop a technical guide for how to evaluate SIPs. There are some unanswered issues still to be resolved before further evaluation of SIP panels and acceptance of further panels may occur by CCMC. Until that time the evaluation and determination of whether or not SIPs should be permitted to be used under the ABC is up to the SDO and the City of Calgary.

Decision

At the January 20, 2015 meeting of the Codes and Standards Technical Interpretation Committee of Inspections and Permitting Services, the following decision was reached with regards to the acceptance of SIPs in the City of Calgary:

1. May accept if a CCMC evaluation report for the specific SIP is provided and the use of the panel complies with the report and the current ABC; OR
2. May Accept if the SIP system includes a code complying framing system within it to address the structural issues and the remainder of code issues are complied with; OR



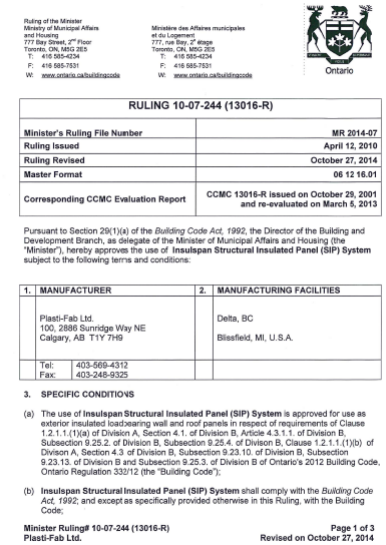
Alternative Solutions Process

2.3.1.2. Documentation

3) The **Code analysis** must identify the **applicable objectives, functional statements and acceptable solutions, and any assumptions, limiting or restricting factors, testing procedures, engineering studies or performance parameters that will support a Code compliance assessment.**

4) The Code analysis must also include information about the **qualifications, experience and background of the person or persons taking responsibility for the design**.

5) **The information provided must** be in sufficient detail to **convey the design intent and to support the validity, accuracy, relevance and precision of the Code analysis**.



Ruling of the Minister
Ministry of Municipal Affairs and Housing
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Ontario

RULING 10-07-244 (13016-R)

Minister's Ruling File Number	**MR 2014-07**
Ruling Issued	**April 12, 2010**
Ruling Revised	**October 27, 2014**
Master Format	**06 12 16.01**
Corresponding CCMC Evaluation Report	**CCMC 13016-R issued on October 29, 2001 and re-evaluated on March 5, 2013**

Pursuant to Section 29(1)(a) of the *Building Code Act, 1992*, the Director of the Building and Development Branch, as delegate of the Minister of Municipal Affairs and Housing (the "Minister"), hereby approves the use of **Insulspan Structural Insulated Panel (SIP) System** subject to the following terms and conditions:

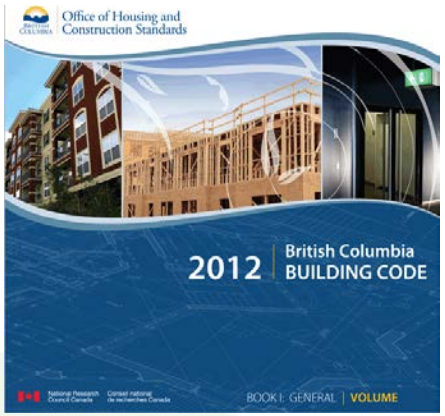
1.	MANUFACTURER	2.	MANUFACTURING FACILITIES
	Plasti-Fab Ltd. 100, 2886 Sunridge Way NE Calgary, AB T1Y 7H9		Delta, BC Blissfield, MI, U.S.A.
	Tel: 403-569-4312 Fax: 403-248-9325		

3. SPECIFIC CONDITIONS

(a) The use of **Insulspan Structural Insulated Panel (SIP) System** is approved for use as exterior insulated loadbearing wall and roof panels in respect of requirements of Clause 1.2.1.1.(1)(a) of Division A, Section 4.1. of Division B, Article 4.3.1.1. of Division B, Subsection 9.25.2. of Division B, Subsection 9.25.4. of Divison B, Clause 1.2.1.1.(1)(b) of Divison A, Section 4.3 of Division B, Subsection 9.23.10. of Division B, Subsection 9.23.13. of Division B and Subsection 9.25.3. of Division B of Ontario's 2012 Building Code, Ontario Regulation 332/12 (the "Building Code");

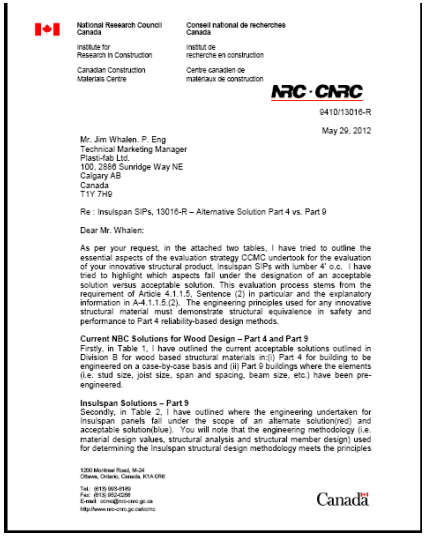
(b) **Insulspan Structural Insulated Panel (SIP) System** shall comply with the *Building Code Act, 1992*, and except as specifically provided otherwise in this Ruling, with the Building Code;

Minister Ruling# 10-07-244 (13016-R) **Page 1 of 3**
Plasti-Fab Ltd. **Revised on October 27, 2014**



CCMC Evaluation Report 13016-R

- ***CCMC Evaluation Report*** 13016-R for the Insulspan SIP System is an example of documentation that confirms compliance with code for SIPs used as exterior insulated loadbearing wall and roof panels as follows
  - **Purpose of Evaluation:** Establish equivalent performance within Code intent.
  - **Opinion:** How the product provides equivalent performance.
  - **Description:** Detailed description of product evaluated.
  - **Usage and Limitations:** Intended applications and limitations of evaluation.
  - **Technical Evidence:** Applicable performance requirements together with design assumptions for building systems.



National Research Council Canada
Institute for Research in Construction
Canadian Construction Materials Centre

Conseil national de recherches Canada
Institut de recherche en construction
Centre canadien de matériaux de construction

NRC·CNRC

9410/13016-R

May 29, 2012

Mr. Jim Whalen, P. Eng
Technical Marketing Manager
Plasti-fab Ltd.
100, 2888 Sunridge Way NE
Calgary AB
Canada
T1Y 7H9

Re : Insulspan SIPs, 13016-R – Alternative Solution Part 4 vs. Part 9

Dear Mr. Whalen:

As per your request, in the attached two tables, I have tried to outline the essential aspects of the evaluation strategy CCMC undertook for the evaluation of your innovative structural product, Insulspan SIPs with lumber 4' o.c. I have tried to highlight which aspects fall under the designation of an acceptable solution versus acceptable solution. This evaluation process stems from the requirement of Article 4.1.1.5. Sentence (2) in particular and the explanatory information in A-4.1.1.5.(2). The engineering principles used for any innovative structural material must demonstrate structural equivalence in safety and performance to Part 4 reliability-based design methods.

Current NBC Solutions for Wood Design – Part 4 and Part 9

Firstly, in Table 1, I have outlined the current acceptable solutions outlined in Division B for wood based structural materials in:(i) Part 4 for building to be engineered on a case-by-case basis and (ii) Part 9 buildings where the elements (i.e. stud size, joist size, span and spacing, beam size, etc.) have been pre-engineered.

Insulspan Solutions – Part 9

Secondly, in Table 2, I have outlined where the engineering undertaken for Insulspan panels fall under the scope of an alternate solution(red) and acceptable solution(blue). You will note that the engineering methodology (i.e. material design values, structural analysis and structural member design) used for determining the Insulspan structural design methodology meets the principles

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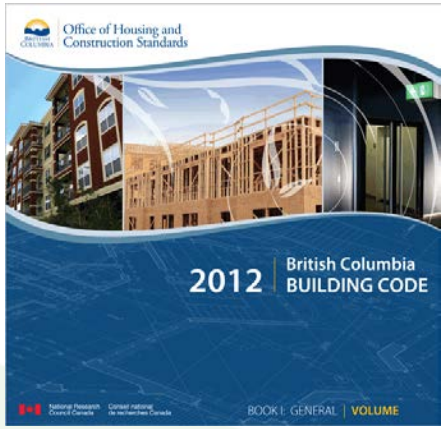
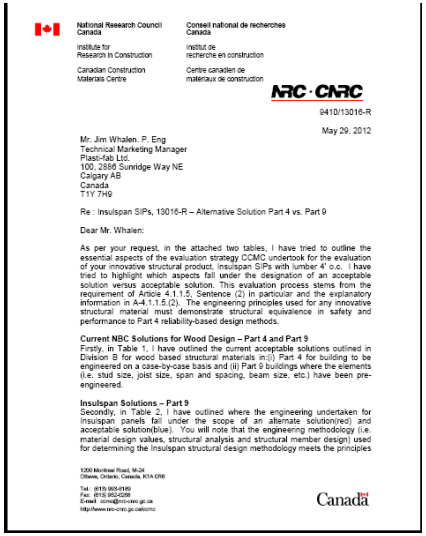
Canada



CCMC Evaluation Report 13016-R

- ***CCMC Evaluation Report*** 13016-R for the **Insulspan SIP System** confirms equivalent performance as an alternative solution for wood-based structural materials:
  - Used for Part 9 buildings where the elements – i.e., stud size, joist size, span and spacing, beam size, etc. – are pre-engineered as an Acceptable Solutions.
  - Use in other non-Part 9 buildings – e.g., commercial, industrial, institution buildings – where the structural elements require engineering design on a case-by-case basis using 2012 BCBC, Part 4, Structural Design.
- Design basis for both types of building applications in Part 4 is CSA O86 for structural member design.



National Research Council Canada
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NRC·CNRC

9410/13016-R

May 29, 2012

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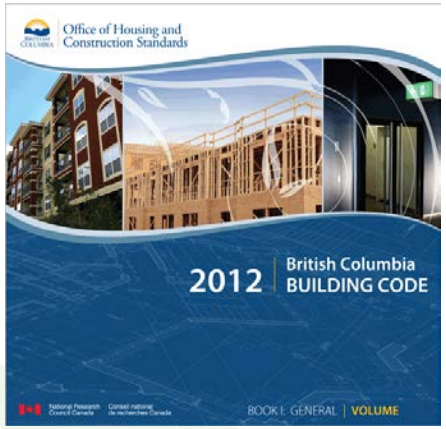


CCMC Evaluation Report 13016-R

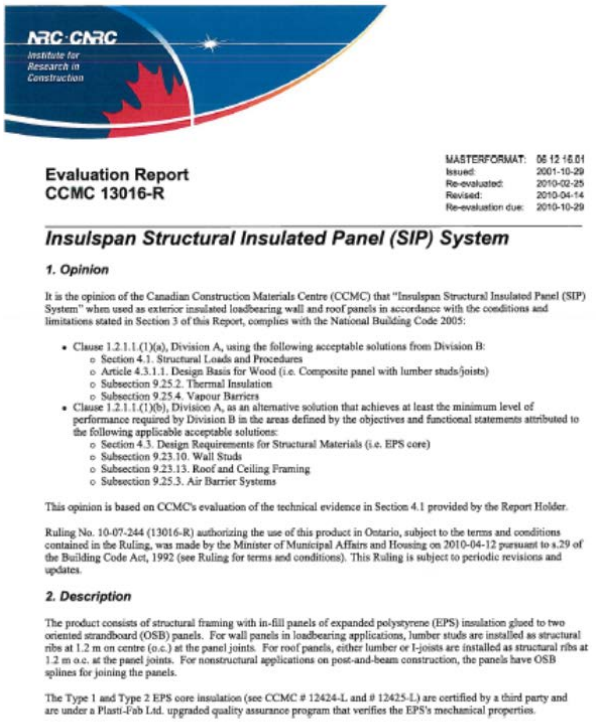
CCMC Evaluation Report 13016-R

- Evaluated against Code requirements detailed in CCMC Technical Evaluation Guide.

•Structural Insulated Panel System:

Insulspan® SIP System

<u>NOTE:</u> A copy of CCMC 13016-R is provided with this presentation.



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Evaluation Report
CCMC 13016-R

MASTERFORMAT: 06 12 16.01
Issued: 2001-10-29
Re-evaluated: 2010-02-25
Revised: 2010-04-14
Re-evaluation due: 2010-10-29

Insulspan Structural Insulated Panel (SIP) System

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "Insulspan Structural Insulated Panel (SIP) System" when used as exterior insulated loadbearing wall and roof panels in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2005:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Section 4.1. Structural Loads and Procedures
  - Article 4.3.1.1. Design Basis for Wood (i.e. Composite panel with lumber studs/joists)
  - Subsection 9.25.2. Thermal Insulation
  - Subsection 9.25.4. Vapour Barriers
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Section 4.3. Design Requirements for Structural Materials (i.e. EPS core)
  - Subsection 9.23.10. Wall Studs
  - Subsection 9.23.13. Roof and Ceiling Framing
  - Subsection 9.25.3. Air Barrier Systems

This opinion is based on CCMC's evaluation of the technical evidence in Section 4.1 provided by the Report Holder.

Ruling No. 10-07-244 (13016-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2010-04-12 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

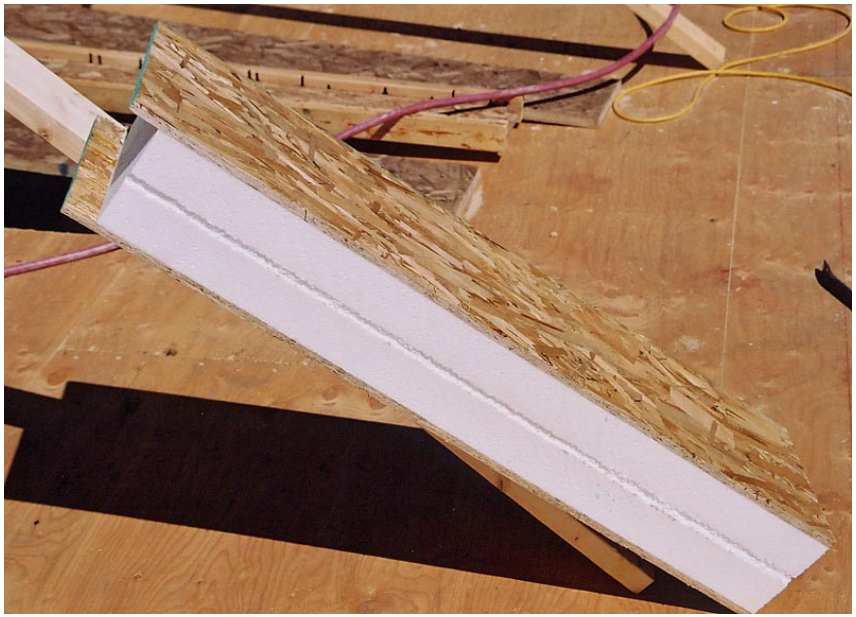
The product consists of structural framing with in-fill panels of expanded polystyrene (EPS) insulation glued to two oriented strandboard (OSB) panels. For wall panels in loadbearing applications, lumber studs are installed as structural ribs at 1.2 m on centre (o.c.) at the panel joints. For roof panels, either lumber or I-joists are installed as structural ribs at 1.2 m o.c. at the panel joints. For nonstructural applications on post-and-beam construction, the panels have OSB splines for joining the panels.

The Type 1 and Type 2 EPS core insulation (see CCMC # 12424-L and # 12425-L) are certified by a third party and are under a Plasti-Fab Ltd. upgraded quality assurance program that verifies the EPS's mechanical properties.

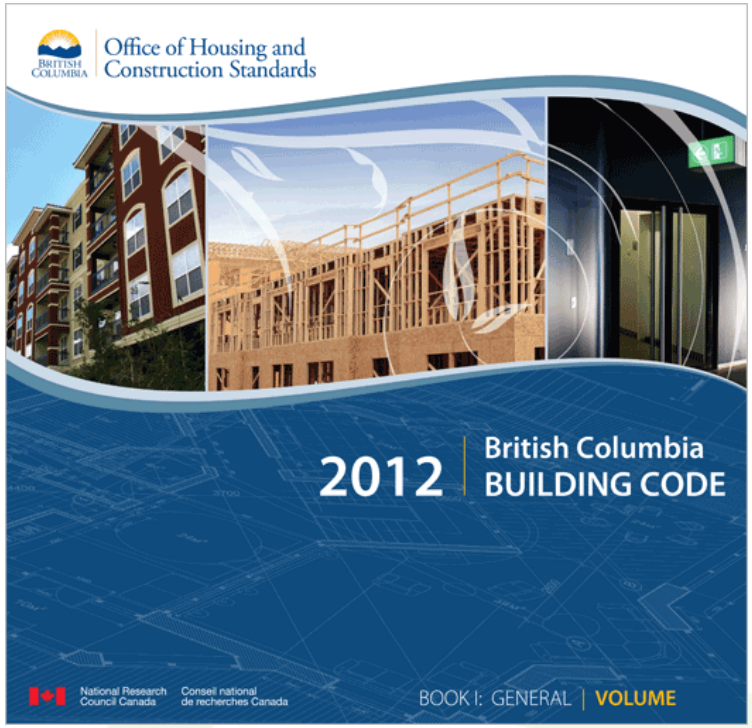
CCMC Evaluation Report 13016-R

Description:

- Insulspan SIP consists of:
  - Certified EPS insulation core meeting CAN/ULC-S701, type 1 (or 2).
  - SIP-Grade certified Oriented Strand Board (OSB) facers structurally laminated to each side of EPS.
  - SIP manufacture under a factory controlled quality control system with third party certification.



CCMC Evaluation Report 13016-R



Building Structural Requirements

- Section Section 4.3. Design Requirements for Structural Materials
- Subsection 9.23.10. Wall Studs
- Subsection 9.23.14. Roof and Ceiling Framing

CCMC Evaluation Report 13016-R

- Structural design:
  - Carried out using reliability-based proprietary specified load design values with the structural member designed in accordance with Part 4 **Limit States Design** (LSD) design standards
  - the structural member design may be conducted to factored resistance loads specified in Part 4, or for small buildings, loads specified in Part 9.
- SIP design values provide equivalent performance to LSD requirements for Part 9 specified gravity loads and building envelope requirements using Part 4 design requirements.

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CCMC 13016-R

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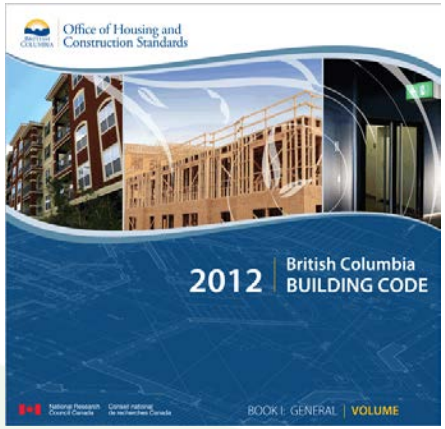
The Type 1 and Type 2 EPS core insulation (see CCMC # 12424-L and # 12425-L) are certified by a third party and are under a Plasti-Fab Ltd. upgraded quality assurance program that verifies the EPS's mechanical properties.



CCMC Evaluation Report 13016-R


INSULSPAN
STRUCTURAL INSULATING PANEL SYSTEM

CCMC Evaluation Report 13016-R / Rapport d'Évaluation CCMC 13016-R

CERTIFIED BY
HOMOLOGUÉ PAR

SEE ITS DIRECTORY OF LISTED PRODUCTS
VOIR LE RÉPERTOIRE DES PRODUITS HOMOLOGUÉS ITS

MANUFACTURED BY / FABRIQUÉ PAR

INSULSPAN CORPORATION
#1, 600 CHESTER ROAD
ANNACIS BUSINESS PARK
DELTA, B.C.
V3M 5Y3

DATE FABRICATED / DATE DE FABRICATION

ORDER NUMBER / NUMÉRO DE COMMANDE

For more information call 1-800-PANEL-10
Pour plus de renseignements, veuillez communiquer avec le 1-800-PANEL-10
www.insulspan.com

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MADE IN CANADA / FABRIQUÉ AU CANADA

- Wall and roof LSD design values
  - Insulspan SIP load tables prepared using a proprietary reliability-based computer model to produce design values meeting the reliability targets of CAN/CSA-O86-09, "Engineering Design in Wood."
  - Benchmark testing was conducted to confirm compliance with Part 4 structural design requirements.
- Manufacture under a third party certification program subject to audit on a quarterly basis.

CCMC Evaluation Report 13016-R

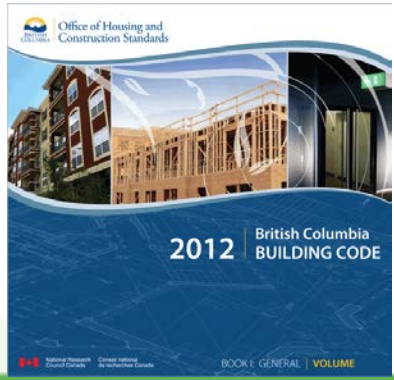
SIP Load Design Tables

- SIP design tables for use Canada and USA are different based upon:
  - Tables for USA are intended for use with **Allowable Stress Design** (ASD) and provide allowable loads typically developed based ICC-ES acceptance criteria.
  - Tables for Canada must be developed based upon **Limit States Design** (LSD), the only option permitted by Canadian codes, and provide specified loads that can be compared to LSD factored loads for Ultimate (Strength) Limit State and Serviceability Limit State.


Differences between Design Tables in Canada and USA

Differences between ASD and LSD

Differences between ICC-ES and CCMC Evaluations



CCMC Evaluation Report 13016-R

- SIP System Design Manual
  - Load span tables for typical roof and wall applications.
    - Insulspan Technical Bulletin nos. 118, 119, 120, 121 and 122.
  - Design assumptions provided for engineering analysis.
  - Design review for individual applications reviewed by P. Eng.

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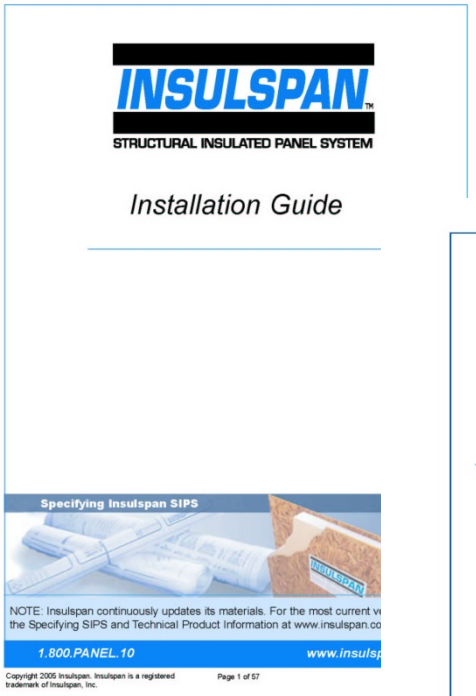

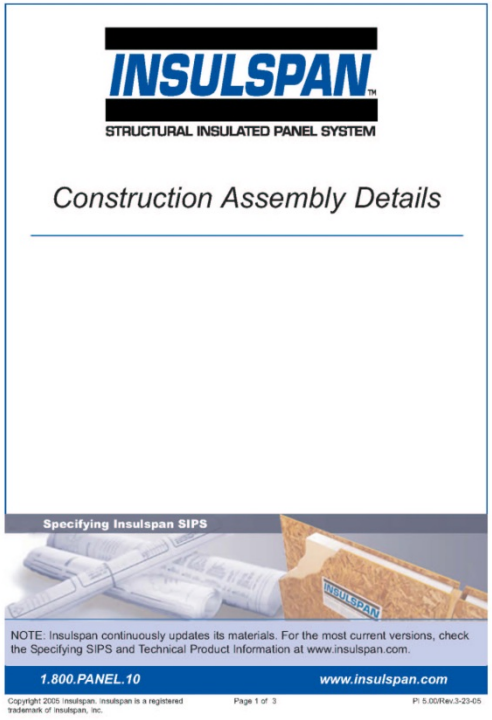

- SIP System Installation:
  - Installation guide
  - On-site training
  - Detailed panel layouts

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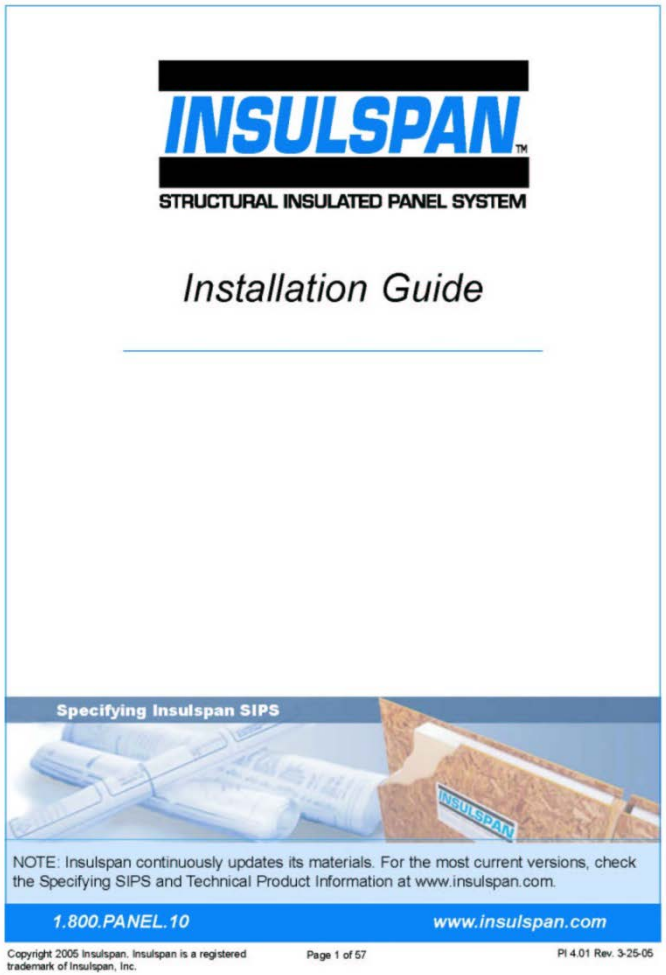

SIP Installation Guide

- Provides step by step instructions from initial review of on-site conditions to sealing of joints.
- Detail drawings for typical SIP installation requirements provided.

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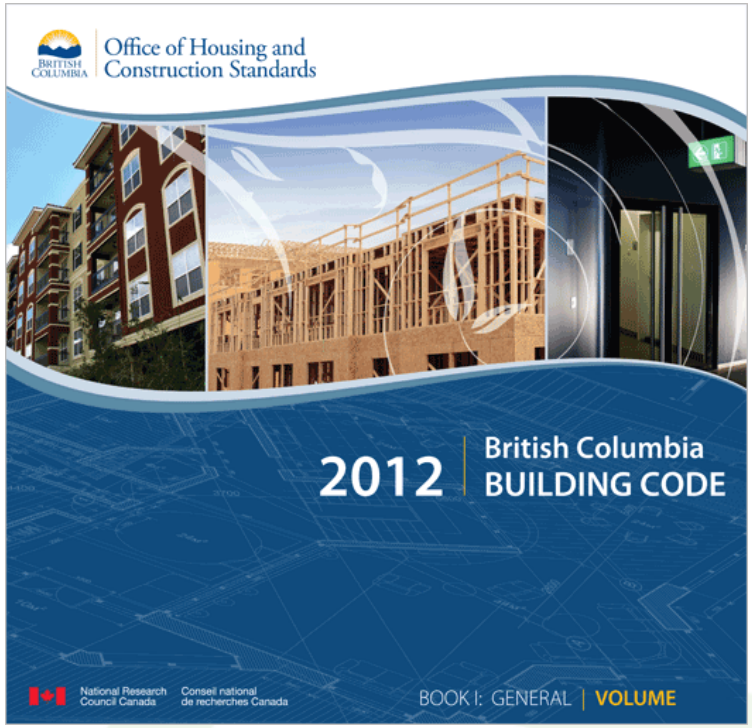

Building Envelope Requirements

- Subsection 9.25.2. Thermal Insulation
- Subsection 9.25.3. Air Barrier Systems
- Subsection 9.25.4. Vapour Barriers

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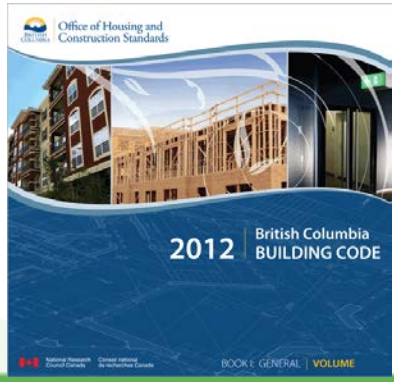
- Code identifies properties to resist heat transfer or dissipate heat in Articles 5.3.1.1. and 9.25.2.1.
  - All walls and ceilings separating heated space from unheated space, the exterior air or the exterior soil shall be provided with sufficient thermal insulation to prevent moisture condensation on their room side during the winter and to ensure comfortable conditions for the occupants.
- CCMC 13016-R confirms that the Insulspan SIP System with an EPS insulation core meets requirement.



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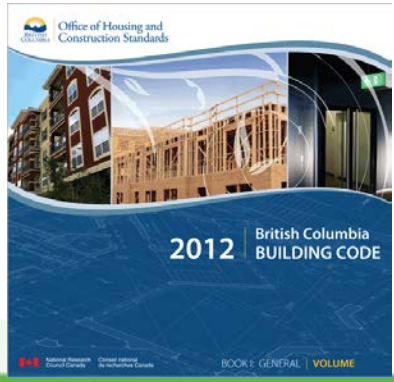
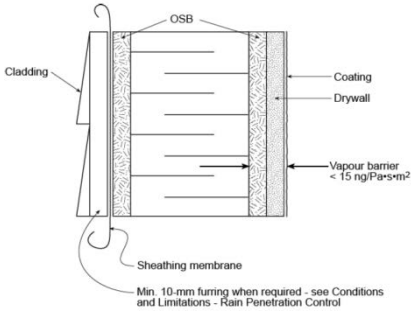
- Code identifies air barrier system properties requirements in Articles 5.4.1.2. and 9.25.3.2.
  - Materials providing air barrier function must have an air leakage characteristic not greater than 0.02 L/(s•m^2) measured at an air pressure difference of 75 Pa.
  - Systems must possess the characteristics necessary to provide an effective barrier to air exfiltration under differential air pressure due to stack effect, mechanical systems or wind.
- CCMC 13016-R states Insulspan SIP System with two layers of OSB and an EPS foam core meet requirement when panels have joints sealed to maintain airtightness and continuity.

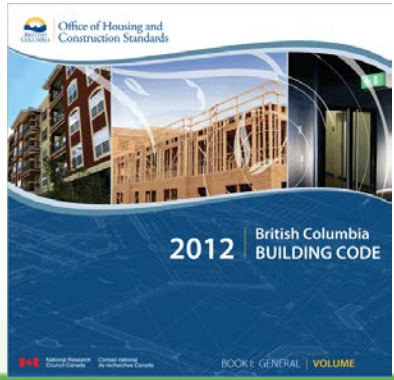


CCMC Evaluation Report 13016-R

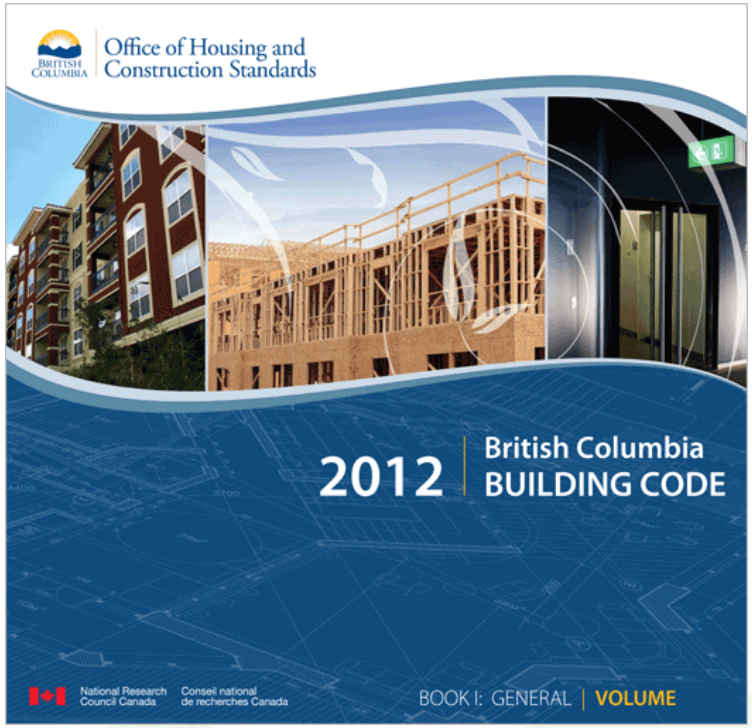
- Code identifies vapour barrier system requirements in Articles 5.5.1.2. and 9.25.4.2.
  - Materials providing vapour barrier function must minimize moisture transfer by diffusion to surfaces within an assembly that cause condensation at the design temperature and humidity conditions
  - Vapour barrier materials must have a permeance not greater than 60 ng/(Pa•s•m^2) measured in accordance with ASTM E 96.



- CCMC 13016-R states Insulspan SIP System with interior painted drywall on the warm side of the wall assembly can provide required vapour diffusion control with a 10-mm air space beneath cladding installed on the cold side.



BC Energy Efficiency Requirements



- **2012 BCBC,** Section 9.36.

  Energy Efficiency

  - Subsection 9.36.2.6. Thermal Characteristics of Above-ground Opaque Building Assemblies
  - Tables 9.36.2.6.A. and 9.36.2.6.B. provide effective thermal resistance for above-ground opaque assemblies in buildings

BC Energy Efficiency Requirements

- Homeowner Protection Office (HPO) publishes illustrated guides that highlight 2012 BCBC Section 9.36 requirements.
- Plasti-Fab Product Information Bulletin 217 demonstrates how Insulspan SIP System complies with 2012 BCBC, Subsection 9.36.2.6.

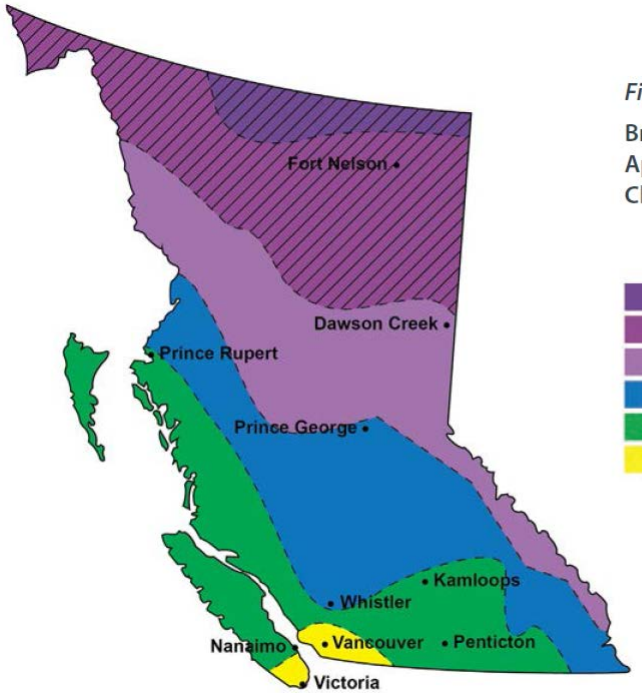


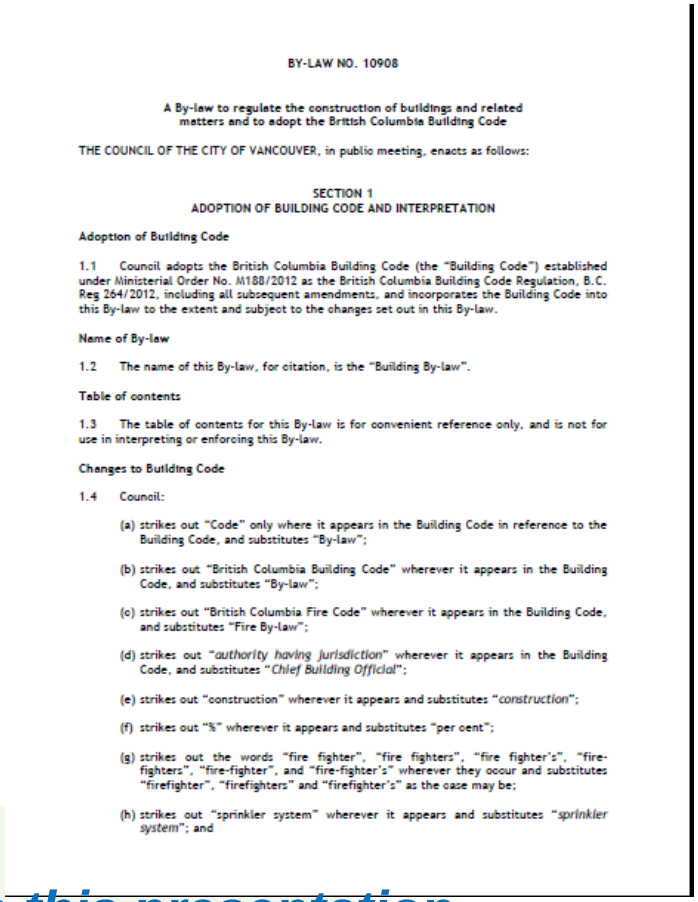
Figure 1:
British Columbia Approximate Climate Zones

8	≥ 7000 HDD
7B	6000 to 6999 HDD
7A	5000 to 5999 HDD
6	4000 to 4999 HDD
5	3000 to 3999 HDD
4	< 3000 HDD

NOTE: Copy of PIB 217 is appended to this presentation.

BC Energy Efficiency Requirements

- City of Vancouver By-Law no. 10908 regulates the construction of buildings and adopts BCBC with revisions.
- Vancouver Building Code Table 10.2.1.1.A. provides minimum RSI for frame walls and ceilings for one and two family dwellings.
- Plasti-Fab Product Information Bulletin 222 demonstrates how Insulspan SIP System complies.



BY-LAW NO. 10908

A By-law to regulate the construction of buildings and related matters and to adopt the British Columbia Building Code

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts as follows:

SECTION 1
ADOPTION OF BUILDING CODE AND INTERPRETATION

Adoption of Building Code

1.1 Council adopts the British Columbia Building Code (the "Building Code") established under Ministerial Order No. M188/2012 as the British Columbia Building Code Regulation, B.C. Reg 264/2012, including all subsequent amendments, and incorporates the Building Code into this By-law to the extent and subject to the changes set out in this By-law.

Name of By-law

1.2 The name of this By-law, for citation, is the "Building By-law".

Table of contents

1.3 The table of contents for this By-law is for convenient reference only, and is not for use in interpreting or enforcing this By-law.

Changes to Building Code

1.4 Council:

(a) strikes out "Code" only where it appears in the Building Code in reference to the Building Code, and substitutes "By-law";

(b) strikes out "British Columbia Building Code" wherever it appears in the Building Code, and substitutes "By-law";

(c) strikes out "British Columbia Fire Code" wherever it appears in the Building Code, and substitutes "Fire By-law";

(d) strikes out "*authority having jurisdiction*" wherever it appears in the Building Code, and substitutes "*Chief Building Official*";

(e) strikes out "construction" wherever it appears and substitutes "*construction*";

(f) strikes out "%" wherever it appears and substitutes "per cent";

(g) strikes out the words "fire fighter", "fire fighters", "fire fighter's", "fire-fighters", "fire-fighter", and "fire-fighter's" wherever they occur and substitutes "firefighter", "firefighters" and "firefighter's" as the case may be;

(h) strikes out "sprinkler system" wherever it appears and substitutes "*sprinkler system*"; and

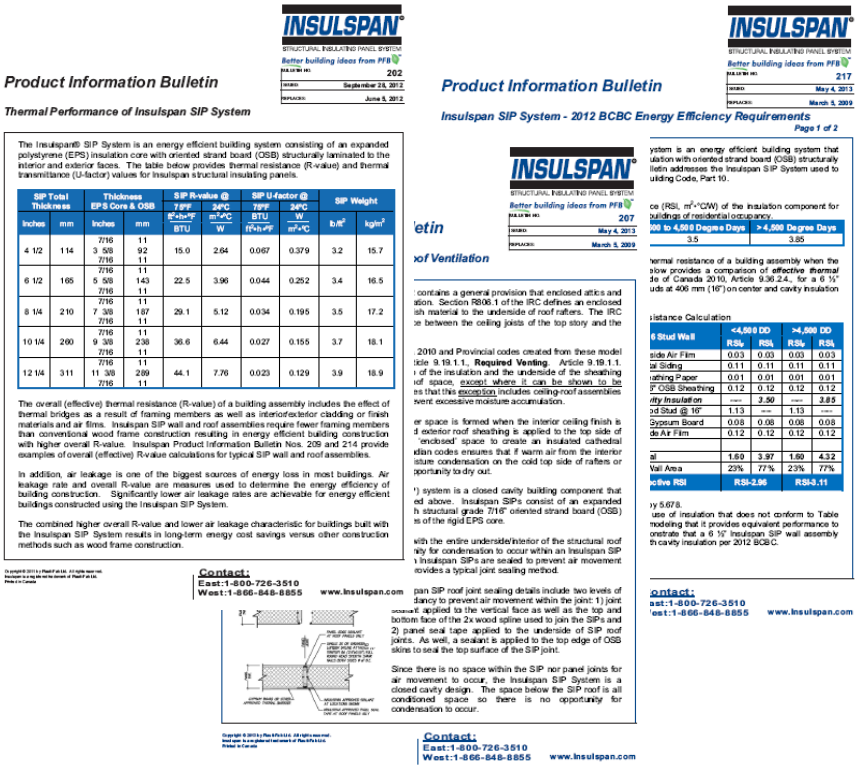
NOTE: A copy of PIB 222 is appended to this presentation.

CCMC Evaluation Report 13016-R

Other code compliance issues

- Article 9.19.1.1. **Required Ventilation – PIB 207.**

  NOTE: A copy of PIB 207 is appended to this presentation.



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Product Information Bulletin
Thermal Performance of Insulspan SIP System

The Insulspan® SIP System is an energy efficient building system consisting of an expanded polystyrene (EPS) insulation core with oriented strand board (OSB) structurally laminated to the interior and exterior faces. The table below provides thermal resistance (R-value) and thermal transmittance (U-factor) values for Insulspan structural insulating panels.

SIP Total Thickness		Thickness EPS Core & OSB		SIP R-value @ 72°F / 24°C		SIP U-factor @ 70°F / 24°C		SIP Weight	
Inches	mm	Inches	mm	ft²•h•°F/BTU	m²•°C/W	BTU/ft²•h•°F	W/m²•°C	lb/ft²	kg/m²
4 1/2	114	7/16 3 5/8 7/16	11 92 11	15.0	2.64	0.067	0.379	3.2	15.7
6 1/2	165	7/16 5 5/8 7/16	11 143 11	22.5	3.96	0.044	0.252	3.4	16.5
8 1/4	210	7/16 7 3/8 7/16	11 187 11	29.1	5.12	0.034	0.195	3.5	17.2
10 1/4	260	7/16 9 3/8 7/16	11 238 11	36.6	6.44	0.027	0.155	3.7	18.1
12 1/4	311	7/16 11 3/8 7/16	11 289 11	44.1	7.76	0.023	0.129	3.9	18.9

The overall (effective) thermal resistance (R-value) of a building assembly includes the effect of thermal bridges as a result of framing members as well as interior/exterior cladding or finish materials and air films. Insulspan SIP wall and roof assemblies require fewer framing members than conventional wood frame construction resulting in energy efficient building construction with higher overall R-value. Insulspan Product Information Bulletin Nos. 209 and 214 provide examples of overall (effective) R-value calculations for typical SIP wall and roof assemblies.

In addition, air leakage is one of the biggest sources of energy loss in most buildings. Air leakage rate and overall R-value are measures used to determine the energy efficiency of building construction. Significantly lower air leakage rates are achievable for energy efficient buildings constructed using the Insulspan SIP System.

The combined higher overall R-value and lower air leakage characteristic for buildings built with the Insulspan SIP System results in long-term energy cost savings versus other construction methods such as wood frame construction.

Contact:
East:1-800-726-3510
West:1-866-848-8855
www.insulspan.com

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Product Information Bulletin
Insulspan SIP System - 2012 BCBC Energy Efficiency Requirements
Page 1 of 2

Contact:
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West:1-866-848-8855
www.insulspan.com

- Copies of Insulspan SIP System PIBs available at: www.insulspan.com/product_specs/product_bulletins.aspx

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Plasti-Fab EPS PRODUCT SOLUTIONS

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Questions and Discussion

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BULLETIN NO.	107
ISSUED:	May 5, 2013
REPLACES:	July 12, 2010

Technical Bulletin

CCMC Evaluation Report 13016-R - Insulspan SIP System *(12 pages attached)*

The Canadian Construction Materials Centre (CCMC) is a part of the National Research Council's Institute for Research in Construction. CCMC provides a national evaluation service for new and innovative materials, products, systems and services that is recognized by provincial and territorial building regulatory bodies.

CCMC Evaluation Report 13016-R confirms the Insulspan Structural Insulating Panel (SIP) System complies with the National Building Code (NBC) of Canada 2010 when used as exterior insulated loadbearing wall and roof panels in accordance with the conditions and limitations stated in Section 3 of the report as follows:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Section 4.1. Structural Loads and Procedures
  - Article 4.3.1.1. Design Basis for Wood (i.e. Composite panel with lumber studs/joists)
  - Subsection 9.25.2. Thermal Insulation
  - Subsection 9.25.4. Vapour Barriers
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Section 4.3. Design Requirements for Structural Materials (i.e. EPS core)
  - Subsection 9.23.10. Wall Studs
  - Subsection 9.23.14. Roof and Ceiling Framing
  - Subsection 9.25.3. Air Barrier Systems

NOTE: CCMC 13016-R presents alternative solutions to using lumber stud tables in article 9.23.10.1 and lumber rafters in sentence 9.23.4.2.(1), i.e. pre-engineered Insulspan wall and roof panel LSD design values provide equivalent performance for Part 9 specified gravity loads and building envelope requirements using Part 4 design requirements. Hence the structural capacity of the Insulspan SIP System developed in accordance with Part 4 may be used for any building permitted to be of combustible construction that falls under Part 9 or Part 4 for the specified loads.

Refer to the attached copy of CCMC 13016-R for additional detail. For copies of the signed and sealed load span tables referenced under Section 3, ***Conditions and Limitations***, refer to Insulspan Technical Bulletin nos. 118, 119, 120, 121 and 122.

Note: Canada Mortgage and Housing Corporation recognizes a CCMC evaluation report for products as demonstrating Code compliance when used in construction financed or insured under the National Housing Act.

Contact:
East:1-800-726-3510
West:1-866-848-8855
www.Insulspan.com

Evaluation Report CCMC 13016-R
Insulspan Structural Insulated Panel (SIP) System

MASTERFORMAT:	06 12 16.01
Issued:	2001-10-29
Re-evaluated:	2013-03-05
Re-evaluation due:	2016-10-29

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "Insulspan Structural Insulated Panel (SIP) System", when used as exterior insulated loadbearing wall and roof panels in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2010:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Section 4.1. Structural Loads and Procedures
  - Article 4.3.1.1. Design Basis for Wood (i.e. Composite panel with lumber studs/joists)
  - Subsection 9.25.2. Thermal Insulation
  - Subsection 9.25.4. Vapour Barriers

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Section 4.3. Design Requirements for Structural Materials (i.e. EPS core)
  - Subsection 9.23.10. Wall Studs
  - Subsection 9.23.14. Roof and Ceiling Framing
  - Subsection 9.25.3. Air Barrier Systems

This opinion is based on CCMC's evaluation of the technical evidence in Section 4 provided by the Report Holder.

Ruling No. 10-07-244 (13016-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2010-04-12 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

The product consists of structural framing with in-fill panels of expanded polystyrene (EPS) insulation glued to two oriented strandboard (OSB) panels. For wall panels in loadbearing applications, lumber studs are installed as structural ribs at 1.2 m on centre (o.c.) at the panel joints. For roof panels, either lumber or I-joists are installed as structural ribs at 1.2 m o.c. at the panel joints. For nonstructural applications on post-and-beam construction, the panels have OSB splines for joining the panels.

The Type 1 and Type 2 EPS core insulation (see CCMC # 12424-L and # 12425-L) are certified by a third party and are under a Plasti-Fab Ltd. upgraded quality assurance program that verifies the EPS's mechanical properties.

The OSB panels conform to CSA O325.0-07, "Construction Sheathing," and are certified by a third party. In addition, the Plasti-Fab Ltd. requires that the OSB manufacturer provide assurance that its OSB panels possess the properties specified in Insulspan's proprietary specifications entitled "Insulspan SIP Grade OSB."

The adhesive used to bond the EPS core to the OSB facers is a moisture-cured, one-part urethane adhesive designed for application by bead applicator.

All aspects of the product's manufacturing are verified by an in-plant quality control program. The in-plant quality control and the product are third-party certified by Intertek Testing Services (ITS) with the Warnock Hersey certification mark, providing assurance that the product's panels meet the product proprietary specification.

The panels are available in thicknesses of 115 mm, 165 mm, 210 mm and 260 mm for walls, and of 115 mm, 165 mm, 210 mm, 260 mm and 310 mm for roofs. The spans vary based on the anticipated loading and are outlined in the manufacturer's published span charts as specified in Section 3 of this Report.

Lintels for doors and windows are framed as in conventional framing. The "Insulspan SIP System" panel wall and roof construction is proprietary, with specific construction details for the top and bottom plates, a nailing schedule (size, spacing and angle of nail entry) and a field adhesive/sealant. The field construction sequencing must be in strict accordance with the "Insulspan SIP Installation Guide" (also Check List).

The figures below show the salient features of the product. Please refer to the manufacturer's specifications for detailed requirements.

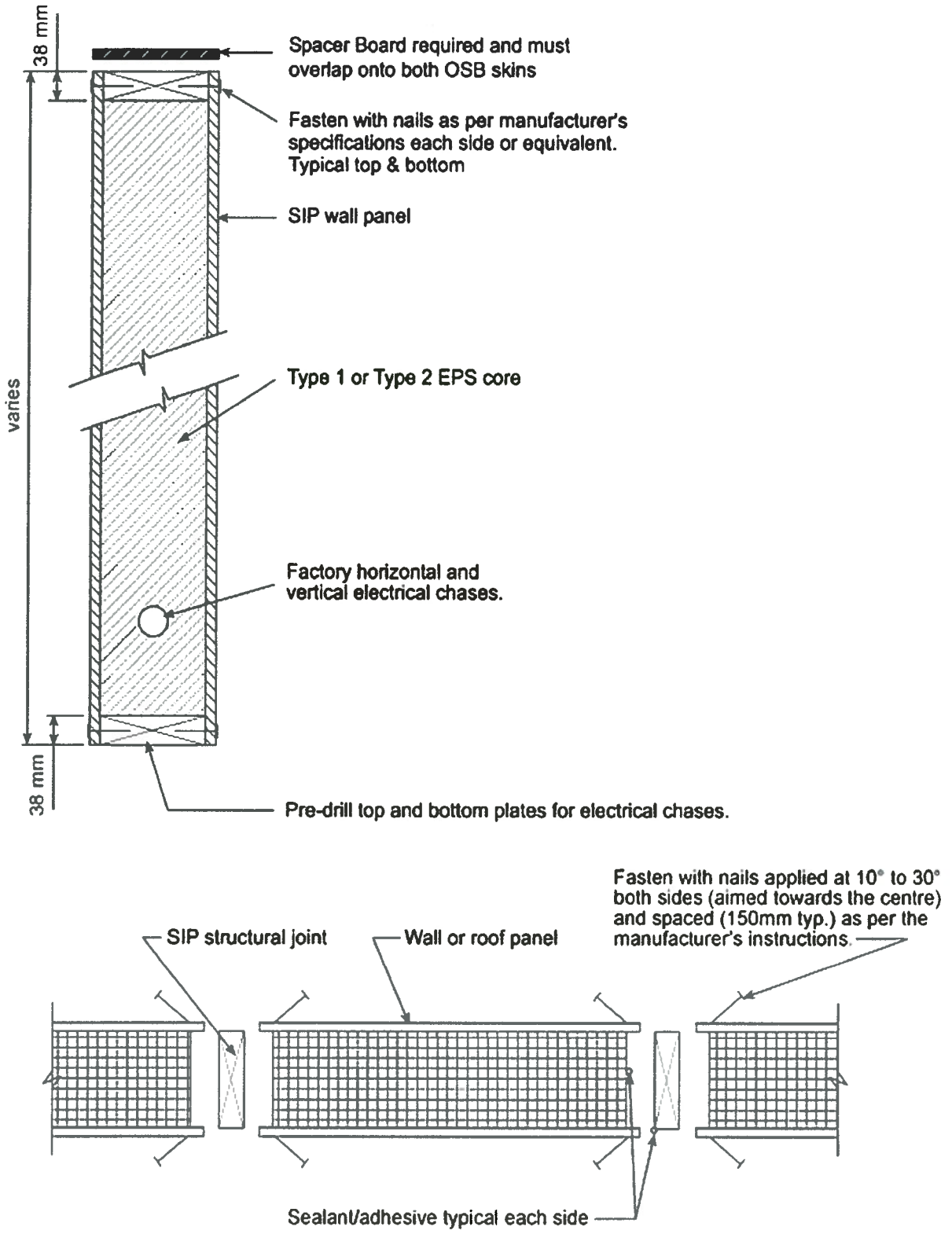

Figure 1. "Insulspan SIP System" wall panels with lumber studs at 1.2 m o.c. See manufacturer's details for sealant and tape requirements.

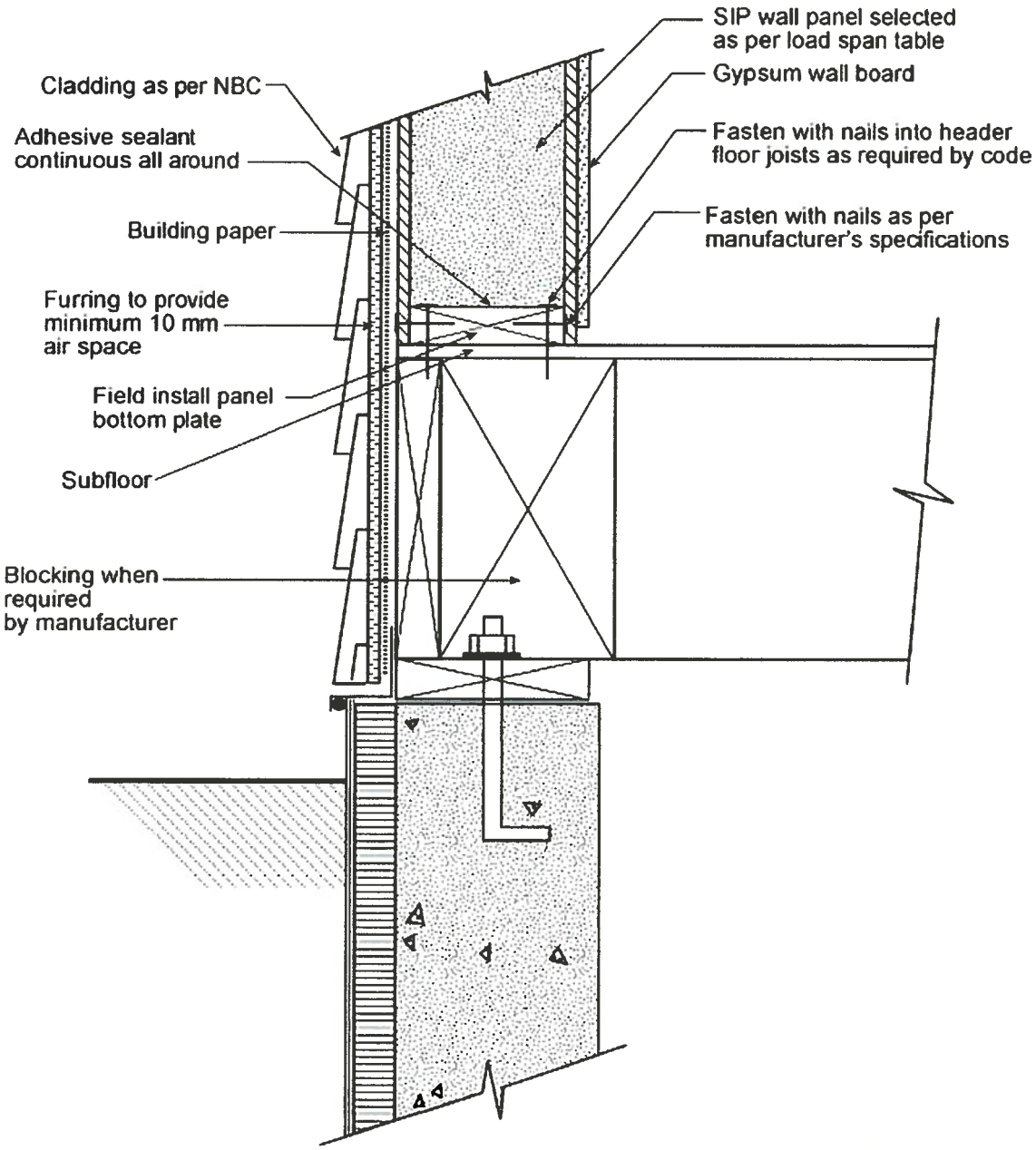

Figure 2. "Insulspan SIP System" – details of a wall panel connection to floors and rainscreen cladding. See manufacturer's details for sealant and tape requirements.

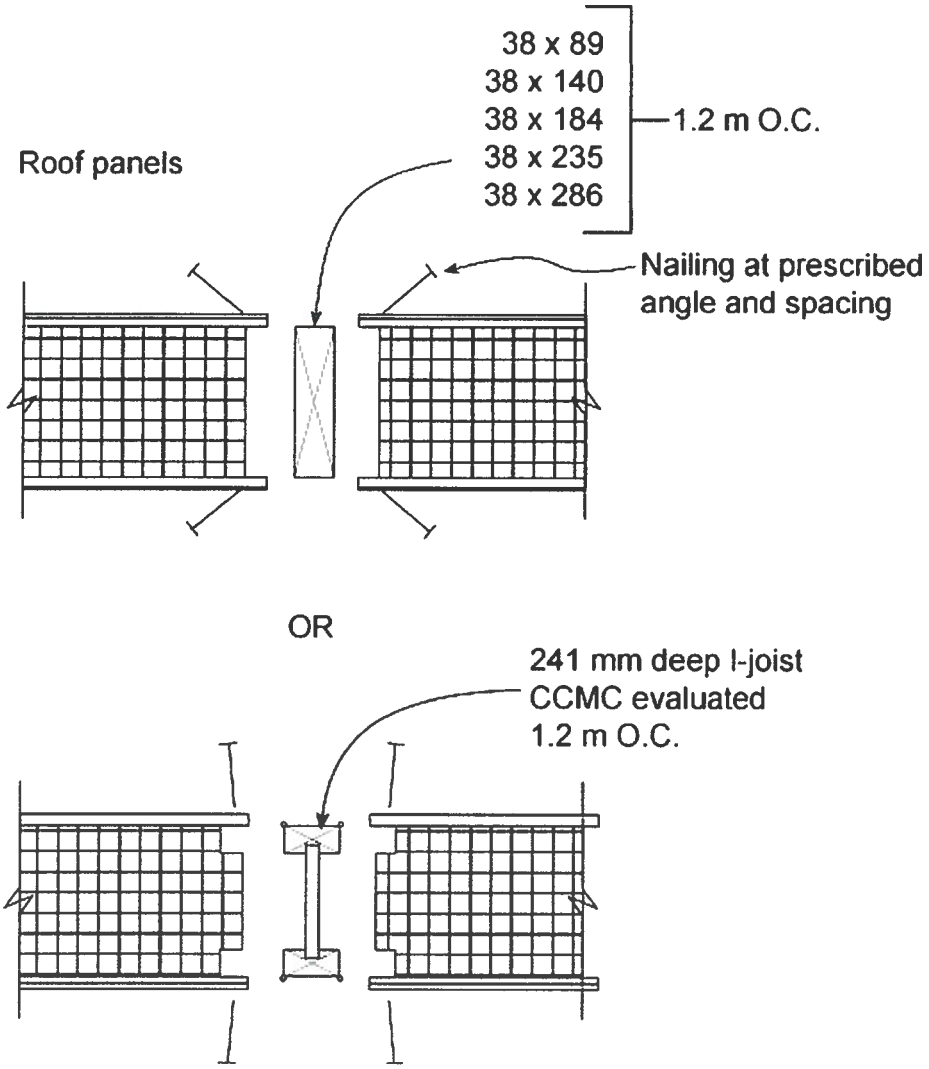

Figure 3. "Insulspan SIP System" – structural roof panels with lumber or prefabricated I-joists at 1.2 m o.c. See manufacturer's details for sealant and tape requirements

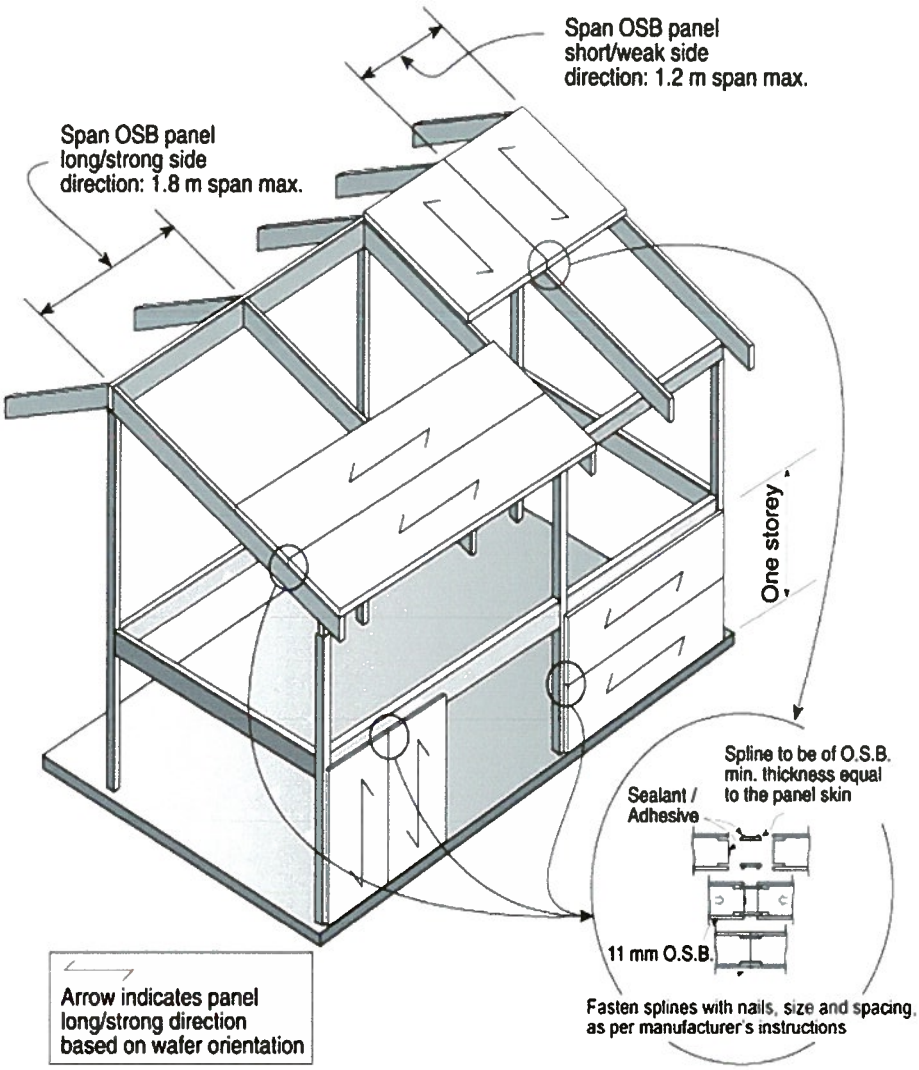

Figure 4. "Insulspan SIP System" – non-axially loaded structural panels with OSB splines on post-and-beam frame with limited roof spans of 1.2 m in OSB weak direction and 1.8 m in OSB strong direction. See manufacturer's panel-to-structure fastening details.

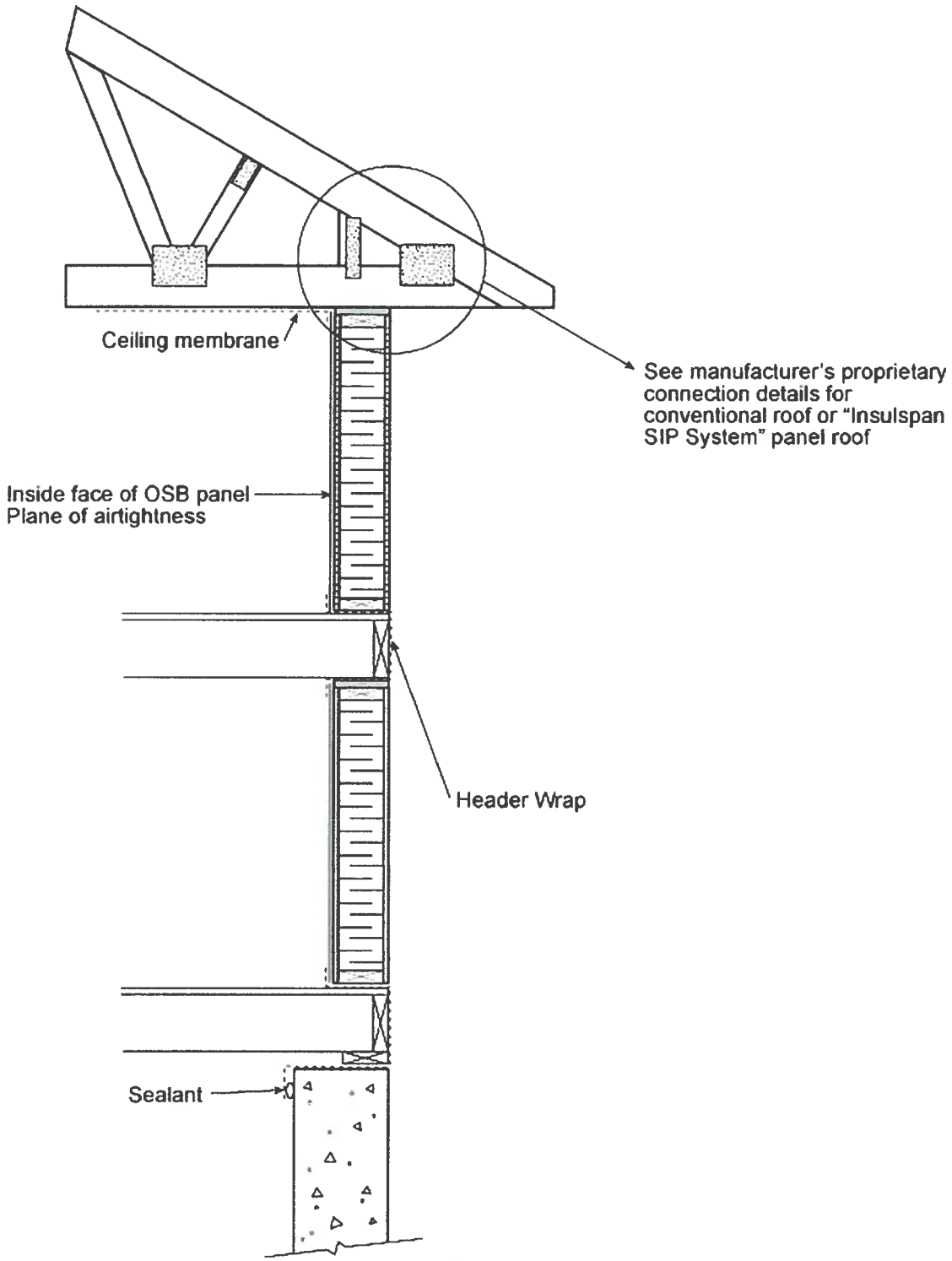

Figure 5. "Insulspan SIP System" – proprietary air barrier system – continuity of seal of the inside barrier face must be maintained.

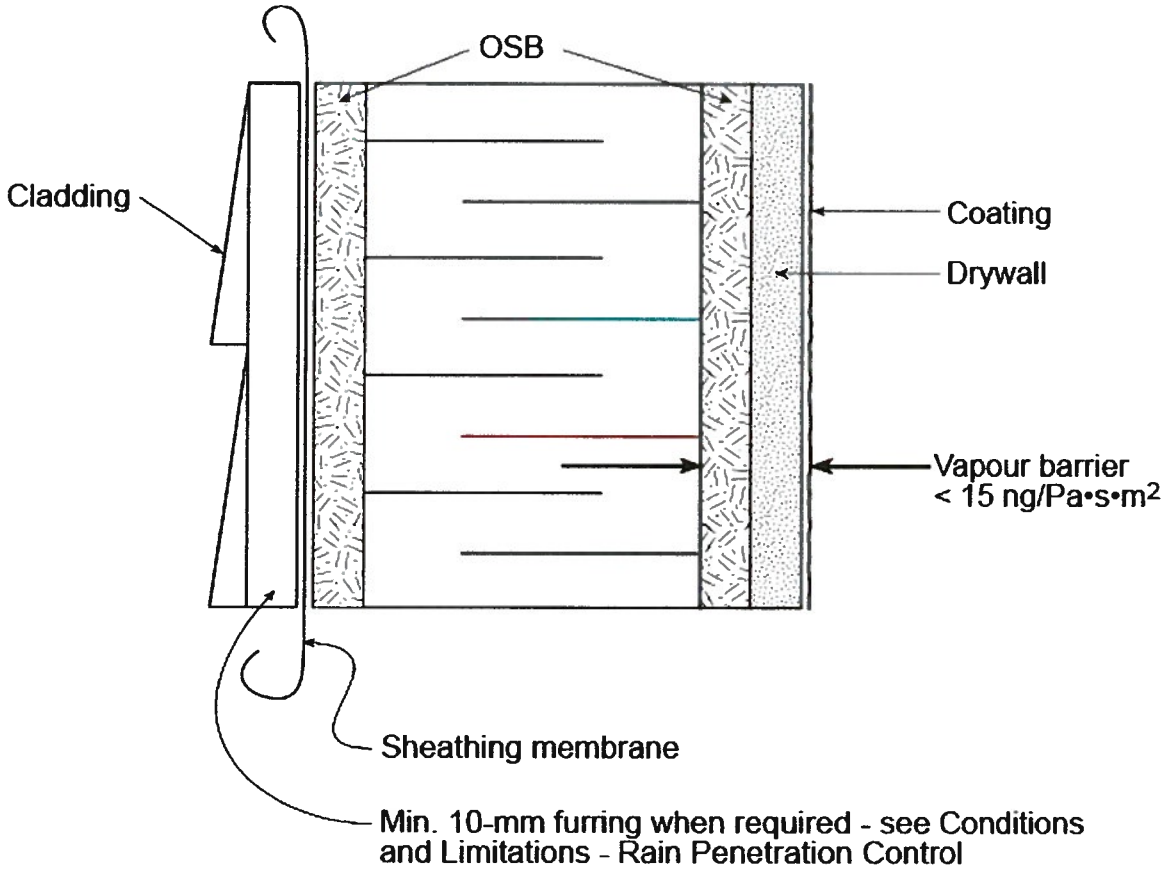

Figure 6. "Insulspan SIP System" – vapour diffusion control.

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "Insulspan Structural Insulated Panel (SIP) System" being used in accordance with the conditions and limitations set out below.

Application Scope

As the acceptable solutions in Section 9.23. of Division B of the NBC 2010 are limited to conventional wood-frame construction, alternative solutions must conform to Subsection 9.4.1., which states that the structural design: (i) must be carried out in accordance with Part 4 (i.e. **reliability-based proprietary design values be established** and that the subsequent member **design methodology/equations** be in accordance with Part 4 limit states design (LSD) design standards) and (ii) the member design may be conducted to **resist loads specified** in Part 4, or for small buildings, loads specified in Part 9.

This CCMC Evaluation Report presents Plasti-Fab Ltd.'s alternative solutions to: (i) using the lumber stud tables in article 9.23.10.1 and lumber rafters in sentence 9.23.4.2.(1) , i.e. pre-engineered wall and roof Insulspan panel resistance values for LSD design, for the specified gravity loads, and (ii) the building envelope requirements for a Part 9 building. Hence the structural capacity of the Insulspan panels mentioned in (i), developed in accordance with Part 4, may be used for any building permitted to be of combustible construction that falls under Part 9 or Part 4, for the specified loads. The scope presented below is limited to single-family houses since fire-resistance ratings, sound ratings, etc. are not provided herein for occupancies beyond single family houses.

Single-Family Houses

The use of the Insulspan panel product as a structural insulating framing system is limited to single-family housing falling within the scope of Part 9 buildings of Division B of the NBC 2010. The product provides: (i) an alternative solution to Clause 9.4.1.1.(1)(c), General (structural design requirements and application limitations), and Section 9.23., Wood-Frame Construction, of Division B of the NBC 2010, for framing of walls and roof, and (ii) an NBC-specified acceptable solution meeting Section 9.25, Heat Transfer, Air Leakage and Condensation Control, of Division B of the NBC 2010, for insulation, air leakage control and vapour diffusion control, when the following conditions and limitations are met:

For Structural Use

- When used as wall and roof panels, the installation must conform to the signed and sealed load tables for "Insulspan Structural Insulated Panels (SIP)," dated January 20, 2010 for walls and for roofs.

These load tables have been prepared using a proprietary reliability-based SIP computer model with benchmark testing conducted to produce design values meeting the reliability targets of CAN/CSA-O86-09, "Engineering Design in Wood." As stated below, design details can be obtained from the manufacturer for custom designs not covered by the pre-engineered span tables.

It should be noted that the load tables outline the total specified live and dead loads permitted, with a ratio of 2:1. As a result, the load tables are presented based on the anticipated local wind load and resulting maximum permitted axial load. Maximum total specified loads (live load plus dead load) of: 14.6 kN/m, 21.8 kN/m, 29.2 kN/m (1 000 lbs/ft, 1 500 lbs/ft or 2 000 lbs/ft) are permitted as long as the dead load portion does not exceed 4.8 kN/m, 7.3 kN/m, 9.5 kN/m (333 lbs/ft, 500 lbs/ft and 667 lbs/ft) respectively. When the latter dead load levels are exceeded, the design must be modified to address duration of load effects.

For structural applications outside the scope of the above-referenced manufacturer's publication, the drawings or related documents must bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.

- Window and door lintel framing shall be conventional framing. Lintels at door and window openings must be in conformance with Article 9.23.12.3., Lintel Spans and Sizes, of Division B of the NBC 2010. Point loads within the wall assembly must also be addressed in a conventional manner with adequate columns as per NBC.
- Except for conventional treatment of lintels and point loads, the remainder of the SIP panel wall construction is proprietary with specific construction details for top and bottom plates, the nailing schedule (number, spacing and angle of nail entry), and field adhesive/sealant. The field construction sequencing must be in strict accordance with the Insulspan SIP Installation Guide (also Check List). The Plasti-Fab Ltd. provides field plans and field advisory service (when specified) for the proper installation of the panels.
- All details of design, handling, and installation must comply with the manufacturer's current specification and instruction manual titled "Insulspan Structural Insulated Panel System - Installation Guide," dated 05-29-2008. It is important that the construction sequence of the panel erection (i.e. bottom plate attachment to floor, panel erection, stud installation, top plate and second cover plate, nail spacing and angle of nail entry, adhesive, etc.) be followed to ensure panel performance.
- For areas of high wind and high seismicity, designers should consult the manufacturer for proprietary shear wall test data for comparison with current table of shear wall design values in CAN/CSA-O86. With no hold-downs, the "Insulspan SIP System" is limited for use in geographical locations where the $q_{1/50}$ wind load is less than 0.6 kPa and the 5% damped spectral response acceleration, $Sa(0.2) < 0.7$.

Air Leakage Control

- The product panel can be used as an air barrier material within the manufacturer's proprietary air barrier system. Two layers of OSB and an EPS foam core meet the 0.02 l/sm^2 at 75 Pa air leakage rate requirement and is equivalent to materials specified in Appendix Note A-9.25.5.1(1) of the NBC 2010. To be installed as the designated air barrier system, the panels must have joints sealed to maintain airtightness and continuity (i.e. CCMC-evaluated header wrap around floors, sealed at penetrations, etc.) in accordance with Article 9.25.3.3., Continuity of the Air Barrier System, of Division B of the NBC 2010. See the manufacturer's proprietary air barrier system details and Figure 5.

Alternatively, if a separate proprietary air barrier system is to be installed, Plasti-Fab Ltd.recommends a sheathing membrane-type air barrier material and system as outlined in CCMC 13280-R or 13290-R.

Vapour Diffusion Control

- When used to provide vapour diffusion control, the "Insulspan SIP System" wall panels, consisting of two layers of OSB and EPS foam core, meet the requirements of Subsection 9.25.4. of Division B of the NBC 2010, when interior painted drywall with a composite water vapour permeance of 15 $ng/Pa{\cdot}s{\cdot}m^2$ is installed on the warm side of the wall assembly and a 10-mm air space is installed on the cold side (see Figure 6).

Rain Penetration Control

- The product's performance depends on continuous protection from water penetration of the SIP panels for the projected lifetime of the structure. In conventional wood-frame structures, when a failure of the roof or wall cladding occurs, water will normally leak into the occupant's space. Such leakage alerts the occupants to failure and repairs can be undertaken.

In the case of closed panels, such as SIPs, the occupants may not be alerted of any water penetration until the exterior OSB skins have absorbed excessive moisture increasing the risk of failure. The use of OSB in wet conditions is not permitted as per CAN/CSA-O86 and the NBC 2010, hence the cladding design must prevent the OSB from being subjected to wet conditions.

As a result, the cladding solutions in Section 9.27., Cladding, of Division B of the NBC 2010, which apply to conventional woodframe must be enhanced for both wall and roof installations by installing an appropriate "second line of defence" against water penetration in line with the occupant's expectations of performance, maintenance and inspection.

Wall Cladding - Rainscreen System

- The wall cladding must be installed as a rainscreen system with a minimum 10-mm air space to allow for drainage of any water that may breach the cladding. The 10-mm air space for drainage must be outboard of a sheathing membrane protecting the SIP panel. The membrane must be properly installed in conjunction with top and bottom window flashing to shed water to the exterior.

Roof Cladding - Design Installation

- The strength of conventional roof structures, whether they consist of roof trusses or roof rafters, is largely unaffected by the initial stages of any water penetration. In the case of SIPs, failure of the roof covering could lead to the rapid accumulation of moisture in the top skin accompanied by changes in the performance of the panels and likely, permanent sagging of the roof panels.

Hence the design of the roof cladding for use with SIPs must perform to provide a reduced risk of water penetration when compared with conventional roof structures. The roof cladding installed must have a second line of defence based on the anticipated wind-driven rain, snow and ice conditions for the geographical location.

Examples of a second line of defence include single or multiple layers of 15-lb or 30-lb asphalt-impregnated membranes or modified bituminous membranes. The selection should be based on the climatic loads at the building location, anticipated roof slope, quality of the roof cladding selected and occupant performance expectations and maintenance envisioned.

Construction Moisture During Installation of Roof Panels

- Care must be taken in the case where the "Insulspan SIP System" roof panels have been exposed to moisture/rain and where a water and vapour impermeable roof cladding is being installed (i.e. asphalt shingles). As the OSB panel, which has been wetted, cannot dry towards the attic (like in conventional construction), the exposed OSB panel should be allowed to dry before the asphalt shingles are installed. OSB, like other wood products, must be protected from excessive moisture and covered with cladding as soon as possible.
- These panels must be identified with the phrase "CCMC # 13016-R" along with the Intertek Testing Services (ITS), Warnock Hersey certification mark.

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

4.1 Material Requirements

The material properties which must be maintained include, but are not limited to the following:

- The proprietary-grade OSB facers must meet CSA O325 and the enhanced mechanical properties specified by the manufacturer.
- The EPS core must meet the CAN/ULC-S701-05, "Thermal Insulation, Polystyrene, Boards and Pipe Covering," standard.
- The adhesive shall be the Mor-Ad M-657 by Dow Chemical (formerly Rohm & Haas).
- The fastener specification and installation schedule on the interior and exterior of panels, as well as the angle of entry into the framing.
- For walls, the specified lumber grade for the wood studs.
- For roof panels, the specified lumber or I-joist grade.
- The headerwrap material shall be CCMC-evaluated as an air barrier material.

4.2 Prescriptive Requirements

The thermal resistance requirements are met by having demonstrated that the EPS used in the panels comply with CAN/ULC-S701-05, "Thermal Insulation, Polystyrene, Boards and Pipe Covering," via third-party certification of the EPS boards used.

The air leakage control requirements are met through the Insulspan proprietary air barrier system details where the inner OSB facer is forming the principal plane of airtightness. The continuity details are met via a CCMC-evaluated headerwrap with an air leakage rate of ≤ 0.02 l/s·m^2. The vertical joints of the panels are to be sealed and rendered airtight as per the manufacturer's details.

The vapour diffusion control requirements are met by combining the inner OSB with a gypsum interior finish and coating (i.e. primer and 2 coats of paint), that together result in a water vapour permeance value of ≤ 15 ng/Pa·s·m^2.

4.3 Performance Requirements

Structural testing of the "Insulspan SIP System" was witnessed by an independent testing agency recognized by CCMC. The scope of the test program, quality control and certification programs are summarized below.

Stiffness

Forty-nine (49) specimens of OSB panels, lumber ribs and wood I-joist ribs were tested for their modulus of elasticity. In addition, testing of EPS to determine the shear modulus and density was conducted. Ninety (90) connection shear tests were also conducted to determine the shear stiffness of the rib-skin interface.

Full-scale Panel Strength Tests

Thirty (30) full-size panels were tested and the results were compared with the predictions of the computer model. The model proved to be reliable in predicting the SIP panel performance for roof and wall panels.

SIP Panel Tests - Weak (short) OSB Direction

Concentrated static and impact tests (wet and dry) were conducted on panels in accordance with CSA O325.1. All specimens met the criteria for 1.2-m span rating contained in CSA O325.0.

SIP Panel Tests - Strong (long) OSB Direction

Panel bending tests were conducted, before and after wetting, to determine the effect of moisture on the strength of the exposed panels. The loss of strength was in the order of 10%, but remained well above the permitted specified ultimate transverse load.

Creep and Recovery

Three (3) pairs of full-scale panel bending tests were conducted with a sustained 24-hour specified load imposed. The CCMC criteria of a maximum 25% creep and recovery of L/1440 were met. The permitted specified loads were then doubled and no failures occurred after 24 hours.

OSB/EPS Adhesive Qualification

Adhesive shear testing conducted to date, before and after aging, has demonstrated shear strength in excess of the EPS foam core.

On-going QC and Certification

All manufacturing plants listed in this report participate in third-party certification currently provided by Intertek Testing Services (ITS) as a third-party agency, a certification organization accredited by the Standards Council of Canada for this type of product. ITS has extended certification for the listed plant locations based upon:

- review of Insulspan's "Panel and SIP Engineering Model Program;"
- review of Panel qualification tests conducted by an independent testing agency recognized by CCMC; and
- implemented quality control procedures for staff, components, equipment and panel tolerances with panel testing at each of the listed plant locations. On-going audits of Insulspan manufacturing plants is conducted to verify continued compliance with all requirements.

4.4 Design Requirements

4.3.1 Loads as per NBC and Wood Design

Design Model

Many of the structural panel tests and connection tests were used to calibrate and validate a reliability-based design computer model. The design model was then used for the engineering design of the panel for the various load configurations.

Structural test data for plant qualification to manufacture the product is consistent with test data used to validate the reliability-based design model. Insulspan plants are listed based on the accredited third-party plant qualification and the on-going quality control (QC) as part of the product certification.

Report Holder

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Disclaimer

Date modified:
2013-04-09

INSULSPAN®
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BULLETIN NO.	207
ISSUED:	May 4, 2013
REPLACES:	March 5, 2009

Product Information Bulletin

Building Code Requirements for Roof Ventilation

The International Residential Code (IRC) 2012 contains a general provision that enclosed attics and enclosed rafter spaces must have cross ventilation. Section R806.1 of the IRC defines an enclosed attic as the space formed by application of finish material to the underside of roof rafters. The IRC further defines an attic as the unfinished space between the ceiling joists of the top story and the roof rafters.

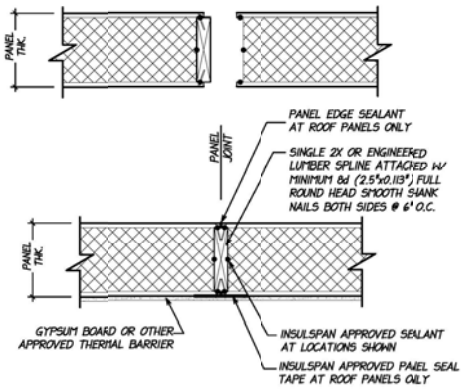
The National Building Code of Canada 2005 & 2010 and Provincial codes created from these model codes address venting of roof spaces in Article 9.19.1.1., **Required Venting**. Article 9.19.1.1. requires vents to be provided between the top of the insulation and the underside of the sheathing where insulation is installed in a ceiling-roof space, except where it can be shown to be unnecessary. Appendix note A-9.19.1.1 clarifies that this exception includes ceiling-roof assemblies that have been shown to be tight enough to prevent excessive moisture accumulation.

In wood frame construction, an enclosed rafter space is formed when the interior ceiling finish is applied directly to the underside of rafters and exterior roof sheathing is applied to the top side of rafters. Insulation material is placed in the 'enclosed' space to create an insulated cathedral ceiling. Ventilation called for in US and Canadian codes ensures that if warm air from the interior enters this enclosed space and results in moisture condensation on the cold top side of rafters or underside of the roof sheathing it is given an opportunity to dry out.

The Insulspan structural insulating panel (SIP) system is a closed cavity building component that does not include "enclosed rafters" as defined above. Insulspan SIPs consist of an expanded polystyrene (EPS) insulation core material with structural grade 7/16" oriented strand board (OSB) factory laminated to the top and bottom surfaces of the rigid EPS core.

Since the EPS insulation is in direct contact with the entire underside/interior of the structural roof deck (top skin of the SIP), there is no opportunity for condensation to occur within an Insulspan SIP roof assembly. In addition, the joints between Insulspan SIPs are sealed to prevent air movement into joints between panels. The detail below provides a typical joint sealing method.

Roof Panel Connection Detail



Insulspan SIP roof joint sealing details include two levels of redundancy to prevent air movement within the joint: 1) joint sealant applied to the vertical face as well as the top and bottom face of the 2x wood spline used to join the SIPs and 2) panel seal tape applied to the underside of SIP roof joints. As well, a sealant is applied to the top edge of OSB skins to seal the top surface of the SIP joint.

Since there is no space within the SIP nor panel joints for air movement to occur, the Insulspan SIP System is a closed cavity design. The space below the SIP roof is all conditioned space so there is no opportunity for condensation to occur.

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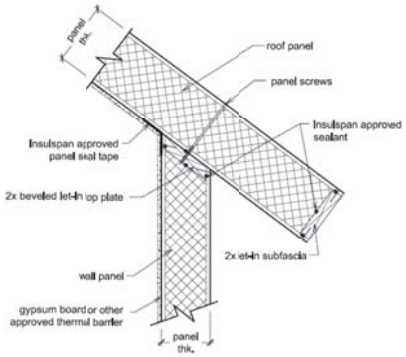
BULLETIN NO.	217
ISSUED:	May 25, 2015
REPLACES:	April 15, 2015

Product Information Bulletin

Insulspan® SIP System - 2012 BCBC Energy Efficiency Requirements

The Insulspan® SIP (Structural Insulating Panel) System is an energy efficient building system that consists of a core of expanded polystyrene (EPS) insulation with oriented strand board (OSB) structurally laminated to the interior and exterior faces.

This bulletin provides typical Insulspan SIP System assemblies used to meet the requirements of the 2012 British Columbia Building Code (2012 BCBC).



Insulspan SIP System wall and roof assemblies are constructed with wood framing at 1,220 mm (48") on center versus typical wood frame assemblies which are constructed with wood framing at 406 mm (16") to 610 mm (24") on center. Energy efficiency requirements in 2012 BCBC, Subsection 9.36.2. are based upon minimum ***effective thermal resistance (RSI_{eff}/R_{eff})*** of building assemblies which includes the effect of thermal bridging due to repetitive structural members such as wood framing members in wall or roof assemblies calculated using the formula below.

$$RSI_{eff}\,(R_{eff}) = \frac{100\%}{\frac{\%\text{ with Framing}}{RSI_F\ (R_F)} + \frac{\%\text{ Area Cavity}}{RSI_C\ (R_C)} + \text{RSI(R) Continuous Material Layers}}$$

Insulspan SIP System Wall Assemblies:

Table 1 provides ***minimum RSI_{eff}/R_{eff}*** requirements per 2012 BCBC, Tables 9.36.2.6.A. and 9.36.2.6.B. for above grade wall assemblies.

Table 1 - Minimum RSI_{eff}/R_{eff} for Wall Opaque Assemblies per 2012 BCBC

2012 BCBC Climate Zones	Zone 4	Zone 5	Zone 6	Zone 7a	Zone 7b	Zone 8
Heating Degree-Days (HDD) Celsius Degree-Days	< 3,000	3,000 to 3,999	4,000 to 4,999	5,000 to 5,999	6,000 to 6,999	≥ 7,000
Table 9.36.2.6.A. - Buildings Where a Heat Recovery Ventilator (HRV) is not Installed						
RSI_{eff} – m^2•°C/W	2.78	3.08	3.08	3.08	3.85	3.85
R_{eff} – ft^2•hr•°F/BTU	15.8	17.5	17.5	17.5	21.9	21.9
Table 9.36.2.6.B. - Buildings Where a Heat Recovery Ventilator (HRV) is Installed						
RSI_{eff} – m^2•°C/W	2.78	2.97	2.97	2.97	3.08	3.08
R_{eff} – ft^2•hr•°F/BTU	15.8	16.9	16.9	16.9	17.5	17.5

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Table 2 provides the ***effective thermal resistance*** calculated as per as per 2012 BCBC, Appendix Note A-9.36.2.4.(1) for a 6 ½" Insulspan SIP wall assembly meeting ***minimum RSI_{eff}/R_{eff}*** requirements per 2012 BCBC, Table 9.36.2.6.A. for climate zones 4 to 7a and Tables 9.36.2.6.B. for all climate zones.

Table 2 – Insulspan SIP System RSI_{eff}/R_{eff} Calculation for Wall Assembly

6 ½" Insulspan SIP Wall Components		RSI_F Framing	RSI_C Cavity Insulation	Continuous Materials
Outside Air Film		----	----	0.03
Cladding		----	----	0.11
7/16" Oriented Strand Board		----	----	0.11
PlastiSpan Type 1 Insulation		----	3.71	----
Wood Stud @ 1220 mm (48") o.c.		1.19	----	----
7/16" Oriented Strand Board		----	----	0.11
Gypsum Wall Board, 13 mm (1/2")		----	----	0.08
Inside Air Film		----	----	0.12
RSI Sub-totals		**1.19**	**3.71**	**0.56**
% Area of Each Component		**14%**	**86%**	**100%**
Effective Thermal Resistance	**RSI_{eff}**	**RSI-3.42**		
	R_{eff}	**R-19.4**		

Table 3 provides the ***effective thermal resistance*** for an 8 ¼" Insulspan SIP wall assembly meeting ***minimum RSI_{eff}/R_{eff}*** requirements per 2012 BCBC Table 9.36.2.6.A. for climate zones 7b & 8.

Table 3 – Insulspan SIP System RSI_{eff}/R_{eff} Calculation for Wall Assembly

8 ¼" Insulspan SIP Wall Components		RSI_F Framing	RSI_C Cavity Insulation	Continuous Materials
Outside Air Film		----	----	0.03
Cladding		----	----	0.11
7/16" Oriented Strand Board		----	----	0.11
PlastiSpan Type 1 Insulation		----	4.87	----
Wood Stud @ 1220 mm (48") o.c.		1.57	----	----
7/16" Oriented Strand Board		----	----	0.11
Gypsum Wall Board, 13 mm (1/2")		----	----	0.08
Inside Air Film		----	----	0.12
RSI Sub-totals		**1.57**	**4.87**	**0.56**
% Area of Each Component		**14%**	**86%**	**100%**
Effective Thermal Resistance	**RSI_{eff}**	**RSI-4.32**		
	R_{eff}	**R-24.5**		

Insulspan SIP System Roof Assemblies:

Insulspan SIP System roof assemblies are typically constructed with wood framing at 1,220 mm (48") on center versus a typical wood frame roof assembly which is constructed with wood rafters at 406 mm (16") to 610 mm (24") on center.

Table 4 provides ***minimum RSI$_{eff}$/R$_{eff}$*** requirements per 2012 BCBC, Tables 9.36.2.6.A. and 9.36.2.6.B. for cathedral ceilings and flat roofs. Note that 2012 BCBC ***minimum RSI$_{eff}$/R$_{eff}$*** requirements are the same for this type of assembly for buildings with or without an HRV installed.

Table 4 - Minimum RSI$_{eff}$/R$_{eff}$ for Cathedral Ceilings and Flat Roofs

2012 BCBC Climate Zones	Zone 4	Zone 5	Zone 6	Zone 7a	Zone 7b	Zone 8
Heating Degree-Days (HDD) Celsius Degree-Days	< 3,000	3,000 to 3,999	4,000 to 4,999	5,000 to 5,999	6,000 to 6,999	≥ 7,000
RSI$_{eff}$ – m^2•^{o}C/W	4.67	4.67	4.67	5.02	5.02	5.02
R$_{eff}$ – ft^2•hr•^{o}F/BTU	26.5	26.5	26.5	28.5	28.5	28.5

Table 4 provides ***effective thermal resistance*** calculated as per as per 2012 BCBC, Appendix Note A-9.36.2.4.(1), for a 10 ¼" Insulspan SIP roof assembly meeting ***minimum RSI$_{eff}$/R$_{eff}$*** requirements per 2012 BCBC, Table 9.36.2.6.A. and Tables 9.36.2.6.B. for all climate zones.

Table 5 – Insulspan SIP System RSI$_{eff}$/R$_{eff}$ Calculation for Cathedral Ceilings and Flat Roofs

10 ¼" Insulspan SIP Wall Components		RSI$_F$ Framing	RSI$_C$ Cavity Insulation	Continuous Materials
Outside Air Film		----	----	0.03
Asphalt Shingles		----	----	0.08
Roof Sheathing Membrane		----	----	0.03
7/16" Oriented Strand Board		----	----	0.11
PlastiSpan Type 1 Insulation		----	6.19	----
Wood Stud @ 1220 mm (48") o.c.		2.00	----	----
7/16" Oriented Strand Board		----	----	0.11
Gypsum Wall Board, 13 mm (1/2")		----	----	0.08
Inside Air Film		----	----	0.12
RSI Sub-totals		**2.00**	**6.19**	**0.56**
% Area of Each Component		**9%**	**91%**	**100%**
Effective Thermal Resistance	**RSI$_{eff}$**	**RSI-5.76**		
	R$_{eff}$	**R-32.7**		

Energy Efficiency Note:
Another key consideration in the design of energy efficiency structures is air leakage characteristics of the structure. Air leakage rates vary widely for different types of house construction. Typical energy efficient structures provide an air leakage rate of 1.5 acph (air changes per hour). Homes built with the Insulspan SIP System can provide a significant reduction in air leakage with values less than 1.0 acph achievable when constructed according to the Insulspan Installation Guide in combination with other energy-efficient building co

BULLETIN NO. 222
ISSUED: June 2, 2015
REPLACES: April 21, 2015

Product Information Bulletin

Insulspan SIP System - City of Vancouver Bylaw No. 10908

The Insulspan® SIP (Structural Insulating Panel) System is an energy efficient building system that consists of a core of expanded polystyrene (EPS) insulation with oriented strand board (OSB) structurally laminated to the interior and exterior faces.

This bulletin provides examples of Insulspan SIP System assemblies meeting City of Vancouver By-Law No. 10908 adopting the British Columbia Building Code (BCBC) with modifications. ***Effective thermal resistance (RSI_{eff}/R_{eff})*** of building assemblies which includes the effect of thermal bridging due to repetitive structural members such as wood framing members in wall or roof assemblies is calculated using the formula below as per 2012 BCBC Subsection 9.36.2.

$$RSI_{eff}\,(R_{eff}) = \frac{100\%}{\frac{\%\text{ with Framing}}{RSI_F\ (R_F)} + \frac{\%\text{ Area Cavity}}{RSI_C\ (R_C)}} + \text{RSI(R) Continuous Material Layers}$$

Figure 1 - City of Vancouver - Minimum Thermal Resistance

Table 10.2.1.1.A
Minimum Thermal Resistance of Insulation RSI, $m^2°C/W$ for Buildings of Residential Occupancy less than 4 Storeys in Building Height
Forming part of Sentence 10.2.1.1.(2)

Building Assembly	Value Required
Attic Space other than one and two family dwellings(1)	7.0
Attic Space for one and two family dwellings(1)	8.8
Roof Joist Assemblies (Cathedral Ceilings/Flat Roofs)	4.9
Frame Walls other than one and two family dwellings (including frame crawl space walls)	3.5
Frame Walls for one and two family dwellings (including frame crawl space walls) – Effective rating	3.85
Concrete or Masonry Walls (other than foundation walls)	2.1
Suspended Floors (framed)	4.9
Suspended Floors (concrete slab)	2.1
Foundation Walls other than one and two family dwellings	2.1
Foundation Walls for one and two family dwellings - Effective rating	3.85
Concrete Slabs on Ground at, above, or below grade (insulation under all slab area and around edge of slab)	2.1
Radiant Heating Suspended Floor Assembly Over Heated Area (insulation between heated floor and heated area below)(4)	2.1

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Table 1 provides the ***effective thermal resistance*** calculated as per as per 2012 BCBC, Appendix Note A-9.36.2.4.(1) for a 8 ¼" Insulspan SIP wall assembly meeting ***minimum effective rating*** requirements per City of Vancouver building code bylaw.

Table 1 – Insulspan SIP System RSI_{eff}/R_{eff} Calculation for Wall Assembly

6 ½" Insulspan SIP Wall Components		RSI_F Framing	RSI_C Cavity Insulation	Continuous Materials
Outside Air Film		----	----	0.03
Cladding		----	----	0.11
7/16" Oriented Strand Board		----	----	0.11
PlastiSpan Type 1 Insulation		----	4.79	----
Wood Stud @ 1220 mm (48") o.c.		1.61	----	----
7/16" Oriented Strand Board		----	----	0.11
Gypsum Wall Board, 13 mm (1/2")		----	----	0.08
Inside Air Film		----	----	0.12
RSI Sub-totals		**1.61**	**4.79**	**0.56**
% Area of Each Component		**14%**	**86%**	**100%**
Effective Thermal Resistance	**RSI_{eff}**	**RSI-4.32**		
	R_{eff}	**R-24.5**		

Table 2 provides ***effective thermal resistance*** for a 10 ¼" Insulspan SIP roof assembly meeting ***minimum RSI_{eff}/R_{eff}*** requirements per City of Vancouver building code bylaw.

Table 2 – Insulspan SIP System RSI_{eff}/R_{eff} Calculation for Cathedral Ceilings and Flat Roofs

10 ¼" Insulspan SIP Wall Components		RSI_F Framing	RSI_C Cavity Insulation	Continuous Materials
Outside Air Film		----	----	0.03
Asphalt Shingles		----	----	0.08
Roof Sheathing Membrane		----	----	0.03
7/16" Oriented Strand Board		----	----	0.11
PlastiSpan Type 1 Insulation		----	6.19	----
Wood Stud @ 1220 mm (48") o.c.		2.00	----	----
7/16" Oriented Strand Board		----	----	0.11
Gypsum Wall Board, 13 mm (1/2")		----	----	0.08
Inside Air Film		----	----	0.12
RSI Sub-totals		**2.00**	**6.19**	**0.56**
% Area of Each Component		**9%**	**91%**	**100%**
Effective Thermal Resistance	**RSI_{eff}**	**RSI-5.76**		
	R_{eff}	**R-32.7**		