

Branch Opinion

Clause 9.10.14.12.(2)(a) &
45 minute FRR of exposing building face

Question: What are the Ontario Building Code construction requirements for an exposing building face of a house with a limiting distance less than 1.2 m?

The issue regarding clarification of the construction requirements and fire-resistance ratings (FRR) with respect to an exposing building face and its application to houses has been brought to our attention recently.

In the 1997 Ontario Building Code (OBC), changes were made to the requirements for exterior wall assemblies where the limiting distance is less than 1.2 m and the Supplementary Guidelines to the 1997 OBC was introduced to address the fire-resistance rating of these wall assemblies. These changes were as a result of the elimination of the requirement for the 15 minute FRR for 12.7 mm (½") standard gypsum wallboard specified in Section 2.3.7. of the Supplement to the National Building Code of Canada 1990.

Sentence 9.10.14.12.(2) applies to buildings containing only dwelling units in which there is no dwelling unit above another dwelling unit in areas with adequate fire fighting facilities. This Sentence requires each exposing building face (EBF) to have a FRR of at least 45 minutes where the limiting distance is less than 1.2 m. Furthermore, the EBF must be clad with non-combustible material where the limiting distance is less than 600 mm.

The Supplementary Guidelines, in Chapter 2 (SG-2) and Chapter 8 (SG-8), provide several wall assemblies to meet the OBC requirements, as follows:

1. Wall assemblies according to SG-2

When choosing SG-2 from the Supplementary Guidelines to the OBC 1997 to achieve a 45 minute fire-resistance rating of an exposing building face, the following examples may be applied:

(i) Description of wall assembly to achieve a minimum 45 minute fire-resistance rating

!	2.3.4.(2) - 12.7 mm Type X gypsum wallboard	25 minute protection
!	2.3.4.(3) - wood studs at 400 mm o.c. maximum ⁽¹⁾	20 minute protection
!	2.3.5.(2) - insulation conforming to CAN/ULC-S702, and having a mass of not less than 1.22 kg/m ² of wall surface.	no time assigned
!	2.3.5.(2) - sheathing on outer side of studs	no time assigned
!	2.3.5.(2) - exterior cladding	<u>no time assigned</u>
Total protection =		45 minutes

⁽¹⁾ (Note: confirm wood stud size and spacing according to Table 9.23.10.1., 38 mm x 89 mm studs or 38 mm x 140 mm studs may be used.)

Even though the gypsum wallboard combined with the studs provides the required FRR, an outer membrane is still required consisting of **sheathing** and exterior cladding. The spaces between the studs must be filled with insulation conforming to CAN/ULC-S702, “Thermal Insulation, Mineral Fibre, for Buildings,” and having a mass of not less than 1.22 kg/m² of wall surface. Glass fibre batts conforming to CAN/ULC-S702 and having a mass of not less than 1.22 kg/m² of wall surface would be permitted as the thermal insulation filling the stud spaces.

(ii) Description of wall assembly to achieve a minimum 45 minute fire-resistance rating

!	2.3.4.(2) - 15.9 mm Type X gypsum wallboard	40 minute protection
!	2.3.4.(3) - wood studs at 600 mm o.c. maximum ⁽¹⁾	15 minute protection
!	2.3.5.(2) - insulation conforming to CAN/ULC-S702, and having a mass of not less than 1.22 kg/m ² of wall surface.	no time assigned
!	2.3.5.(2) - sheathing on outer side of studs	no time assigned
!	2.3.5.(2) - exterior cladding	<u>no time assigned</u>
Total protection =		55 minutes

⁽¹⁾ (Note: confirm wood stud size and spacing according to Table 9.23.10.1., 38 mm x 89 mm studs or 38 mm x 140 mm studs may be used.)

Even though the gypsum wallboard combined with the studs provides a 55 minute FRR which exceeds the 45 minute requirement, an outer membrane is still required consisting of sheathing and exterior cladding. The spaces between the studs must be filled with insulation conforming to CAN/ULC-S702, “Thermal Insulation, Mineral Fibre, for Buildings,” and having a mass of not less than 1.22 kg/m² of wall surface. Glass fibre batts conforming to CAN/ULC-S702 and having a mass of not less than 1.22 kg/m² of wall surface would be permitted as the thermal insulation filling the stud spaces.

(iii) Description of wall assembly to achieve a minimum 45 minute fire-resistance rating

!	2.3.4.(2) - 12.7 mm Type X gypsum wallboard	25 minute protection
!	2.3.4.(3) - wood studs at 600 mm o.c. maximum ⁽¹⁾	15 minute protection
	2.3.4.(4) - preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, and having a mass of not less than 1.22 kg/m ² of wall surface filling the spaces between the studs.	15 minute protection
!	2.3.5.(2) - sheathing on outer side of studs	no time assigned
!	2.3.5.(2) - exterior cladding	<u>no time assigned</u>
Total protection =		55 minutes

⁽¹⁾ (Note: confirm wood stud size and spacing according to Table 9.23.10.1., 38 mm x 89 mm studs or 38 mm x 140 mm studs may be used.)

The gypsum wallboard combined with the studs **does not** provide a 45 minute FRR. The insulation filling the stud spaces **must** be preformed insulation of **rock or slag** fibres conforming to CAN/ULC-S702, “Thermal Insulation, Mineral Fibre, for Buildings,” and with a mass of not less than 1.22 kg/m² to provide the additional required FRR.

The interior wallboard membrane specified in SG-2 Table 2.3.4.D required to achieve the FRR with the insulation must be either gypsum wallboard or lath and plaster. **Glass fibre batts** would **not** be permitted in this assembly. Even though the gypsum wallboard combined with the studs and specified insulation provide a 55 minute FRR which exceeds the 45 minute requirement, an outer membrane is still required consisting of sheathing and exterior cladding.

2. Wall assemblies according to SG-8

When choosing SG-8 from the Supplementary Guidelines to the 1997 OBC to achieve a 45 minute fire-resistance rating of an exposing building face, the following may be applied:

Wall numbers W1 or EW1 from SG-8 may be chosen if the wall assembly is required to provide a minimum 45 minute FRR. *Note:* EW1 has been tested as an **exterior** wall assembly and is the generic version of wall numbers EW1a, EW1b and EW1c.

Wall numbers W1 and EW1 provide the general information to choose from depending on which wall is specified. The Notes found at the end of Table 8.1 in SG-8 are applicable as noted for each wall. Note (1) shown in the heading of Fire-Resistance Rating is required for **all** types of walls including W1 and EW1 wall numbers to determine the FRR. Notes (4) and (5) noted in the Descriptions column are required where specified. Note (6) is only applicable for walls tested to achieve a higher FRR of 1 hour. Note (9) is referenced in EW1 and may be used for a W1 wall assembly where gypsum board is specified on the exterior side.

(i) **Description of wall number W1e to achieve a minimum 45 minute fire-resistance rating**

- ! 38 mm x 89 mm or 38 mm x 140 mm studs spaced @ 400 mm or 600 mm o.c.
(If 38 mm x 140 mm studs are used, Note (1) in the Notes to Table 8.1 in SG-8 is applicable)
- ! **no** absorptive material (W1e does not require insulation to achieve the FRR)
- ! 1 layer of 12.7 mm Type X gypsum board on the inside of the studs (Note (5) in the Notes to Table 8.1 in SG-8 is applicable)
- ! 1 layer of 12.7 mm **Type X** gypsum sheathing on the outside of the studs. The gypsum **board** on the exterior side should be replaced with gypsum **sheathing** (appropriate for exterior use) of the same thickness and **type (Type X)**. Note (9) from the Notes to Table 8.1 in SG-8 is applicable.

Note: This wall assembly has been tested to confirm that it does provide a 45 minute FRR as listed. Generally this wall assembly would be used for unheated garage spaces where the limiting distance is less than 1.2 m. The exterior cladding must be installed according to the applicable code requirements.

(ii) **Description of wall number EW1b to achieve a minimum 45 minute fire-resistance rating**

- ! 38 mm x 89 mm or 38 mm x 140 mm studs spaced @ 400 mm or 600 mm o.c. (Note ⁽¹⁾ SG-8 applies)
- ! 89 mm thick absorptive material (glass fibre batt insulation is permitted as an absorptive material for a 45 minute FRR and where 38 mm x 140 mm framing is used, the absorptive material must be 140 mm thick.. Note ⁽¹⁾ SG-8 applies)
- ! 1 layer of 12.7 mm Type X gypsum wallboard on the inside of the studs (Notes (5) and (9) in the Notes to Table 8.1 in SG-8 is applicable)
- ! exterior rigid sheathing with siding (*except rigid insulation*). This assembly was tested with siding only. For an exposing building face with brick veneer, stucco or any other type of cladding, W1 or Section SG-2 may be used to determine the FRR.

Note: This wall assembly was tested as specified and must be constructed according to these specific requirements only. **Variations to this assembly are not permitted.**

3. Header location in an EBF to achieve the required 45 minute FRR.

The header space is required to be constructed to achieve a minimum 45 minute FRR. SG-8 does not provide a detail that specifically addresses the header location at the exposing building face.

Section 2.4 of SG-2 provides for the fire-resistance ratings of solid wood walls, floors and roofs. Table 2.4.1. provides for solid wood walls of loadbearing vertical plank. The assembly must consist of 38 mm thick members on edge fastened together with 101 mm common wire nails spaced not more than 400 mm o.c. and staggered in the direction of the grain. Section 2.4.1. permits solid wooden members based on their combined thicknesses to achieve a FRR. When using this type of wall construction to achieve a FRR, 3 pieces of 38 mm wood, totalling 114 mm in combined thickness would achieve a 45 minute FRR. This could also consist of the rim joist, and two pieces of blocking between the joists running perpendicular to the the rim joist for a combined thickness of 114 mm.

The header construction could be considered equivalent to the loadbearing vertical plank since it is installed on edge. According to Section 2.4.1. of SG-2, solid wood walls of loadbearing vertical plank at least 89 mm thick would achieve a 30 minute FRR. Two 38 mm members totalling 76 mm fastened together would achieve less than 30 minutes. 12.7 mm Type X gypsum wallboard provides a 25 minute FRR and 15.9 mm Type X gypsum wallboard provides a 40 minute FRR based on the wallboard membrane on the fire-exposed side .

Therefore, it is the opinion of the Housing Development Buildings Branch that the minimum construction requirements to achieve a 45 minute FRR for the header location at the EBF is to provide either a single 38 mm thick continuous header with a single layer of 15.9 mm Type X gypsum wallboard or to provide a 38 mm continuous header with solid 38 mm blocking and 12.7 mm Type X gypsum wallboard filling the spaces between the joists to achieve the required FRR.

A ceiling membrane chosen from SG-2, Table 2.3.12. may be used to contribute to the FRR of the header based on the membrane only, provided that there are no openings located within the ceiling membrane.

Note: *Where a garage wall is located with a limiting distance less than 1.2 m, its exposing building face must also comply with the construction requirements in Sentence 9.10.14.12.(2) to achieve a 45 minute FRR. For some wall assemblies, insulation would be required as specified for the chosen wall assembly in order to achieve the FRR as noted in the requirements in both SG-2 and SG-8.*

4. Intersections of interior partitions and exterior wall assemblies

Where an interior partition abuts a wall assembly of an EBF required to provide a FRR, the wallboard membrane on the interior side of the EBF must provide continuous protection from the fire-exposed side and must run continuously behind the interior partition wall.

5. Rigid Insulation (insulated sheathing) installed on the outboard side of the exterior sheathing

Rigid insulation is permitted on the outboard side of the exterior wallboard sheathing for wall assemblies chosen from SG-2 of the Supplementary Guidelines to the OBC. However, it is not permitted for the tested wall assembly EW1 chosen from SG-8. The rigid insulation does not contribute to the FRR.

Consideration must be given to wall assemblies where insulated sheathing has low air leakage characteristics and low water vapour permeance. Where rigid insulation or sheathing material also has the characteristics of a vapour barrier, then its location must be chosen carefully to avoid condensation and moisture accumulation due to vapour entrapment.

Attached are analyses of dew point calculations based on different wall assemblies in different degree day zones.

OBC Requirements: ⁽²⁾

Sentence 9.10.3.3.(2) Exterior walls shall be rated for exposure to fire from inside the *building*,

Sentence 9.10.14.12.(2) Except as required in Article 9.10.14.3. and as provided in Sentence (4), in *buildings* containing only *dwelling units* in which there is no *dwelling unit* above another *dwelling unit*, the requirements of Article 9.10.14.11. do not apply provided that the exposing building face

- (a) has a *fire-resistance rating* of not less than 45 min where the *limiting distance* is less than 1.2 m, and
- (b) is clad with *non-combustible* material where the *limiting distance* is less than 600 mm.

Supplementary Guidelines to the OBC 1997:

Section 2.3.5. Considerations for various types of Assemblies

2.3.5.(2) When an exterior wall assembly is required to be rated from the interior side only, such wall assemblies shall have an outer membrane consisting of sheathing and exterior cladding with spaces between the studs filled with insulation conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fiber, for Buildings," and having a mass of not less than 1.22 kg/m² of wall surface.

⁽²⁾ *This information is provided for convenience only. For accurate reference, recourse should be had to the official volumes(Regulations).*

Under the Ontario Building Code Act, the local Municipality is the authority having jurisdiction and they are responsible for enforcing the Ontario Building Code Act and its regulations.

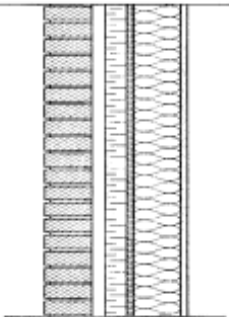


Ali Arlani
Code Development & Training Section
Housing Development & Buildings Branch
Issued: July 18, 2001

DEW POINT ANALYSIS According to OBC – Article 9.25.1.2.

Wall assemblies according to SG-2 (c/w vapour barrier on interior side of insulation)

1. (Less than 5000 degree days - Zone 1 (R-17 minimum) gypsum sheathing for exterior bracing)

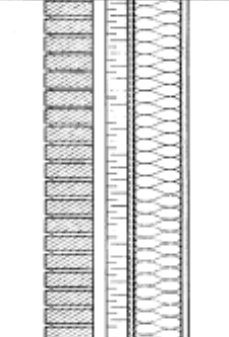
2"x 4" Wall Assembly		R-Values	
	Inside air	0.68	*
	12.7 mm (1/2") Type X gypsum wallboard	0.45	* Inboard
	2"x4" wood studs @ 400 mm o.c.	na	*
	insulation batt type	12.0	*
	12.7 mm (1/2") gypsum sheathing	0.45	(vapour permeance > 60 ng/Pa.s.m ²) *
	rigid insulation	5.0	
	1" air space	0.97	
	brick veneer	0.42	Outboard
	outside air	0.17	
	total R-Value	20.14	

Minimum R-Value for Zone 1	17
Minimum Ratio total thermal resistance Table 9.25.1.2.	0.20
Inboard R-Value *	13.58
Outboard R-Value	6.56
Ratio of Outboard to Inboard Thermal resistance 9.25.1.2.)	0.48 > 0.20 (Table

(ACCEPTABLE)

Note: gypsum sheathing has a water vapour permeance greater than 60 ng and will not create a double vapour barrier and will not increase condensation within the wall assembly.

2. (Less than 5000 degree days - Zone 1 (R-17 minimum) 1/4" plywood sheathing for exterior bracing)

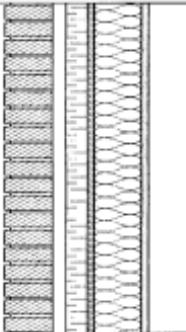
2"x 4" Wall Assembly		R-Values	
	Inside air	0.68	*
	12.7 mm (1/2") Type X gypsum wallboard	0.45	* Inboard
	2"x4" wood studs @ 400 mm o.c.	na	*
	insulation batt type	12.0	*
	1/4" exterior plywood sheathing	0.31	(vapour permeance is 23-74 ng/Pa.s.m ²)
	rigid insulation	5.0	
	1" air space	0.97	
	brick veneer	0.42	Outboard
	outside air	0.17	
	total R-Value	20.0	

Minimum R-Value for Zone 1	17
Minimum Ratio total thermal resistance Table 9.25.1.2.	0.20
Inboard R-Value *	13.13
Outboard R-Value	6.87
Ratio of Outboard to Inboard Thermal resistance 9.25.1.2.)	0.52 > 0.20 (Table

(ACCEPTABLE)

Note: plywood has a water vapour permeance between 23-74 which may be less than 60 ng and could create a double vapour barrier. Spaces in sheathing material would be required to permit the vapour within the assembly to escape. (i.e horizontal installation with a minimum 2 mm air gap)

3. (5000 degree days or more - Zone 2 (R-22 minimum) gypsum sheathing for exterior bracing)

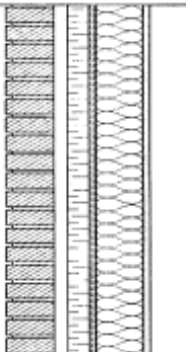
	2" x 4" Wall Assembly		R-Values	
	inside air		0.68	*
	12.7 mm (1/2") Type X gypsum wallboard		0.45	*
	2"x4" wood studs @ 400 mm o.c.		na	*
	insulation batt type		12	*
	12.7 mm (1/2") gypsum sheathing		0.45	(vapour permeance > 60 ng/Pa.s.m ²)*
	rigid insulation		10	
	1" air space		0.97	
	brick veneer		0.42	
	outside air		0.17	
	total R-Value		25.14	

Minimum R-Value for Zone 2	22	
Minimum Ratio total thermal resistance Table 9.25.1.2.	0.30	
Inboard R-Value *	13.58	
Outboard R-Value	11.56	
Ratio of Outboard to Inboard Thermal resistance 9.25.1.2.)	0.85	> 0.30 (Table

(ACCEPTABLE)

Note: gypsum sheathing has a water vapour permeance greater than 60 ng and will not create a double vapour barrier and will not increase condensation potential within the wall assembly.

4. (5000 degree days or more - Zone 2 (R-22 minimum) 1/4 inch exterior plywood for exterior bracing)

	2" x 4" Wall Assembly		R-Values	
	Inside air		0.68	*
	12.7 mm (1/2") Type X gypsum wallboard		0.45	*
	2"x4" wood studs @ 400 mm o.c.		na	*
	insulation batt type		12.0	*
	1/4" exterior plywood sheathing		0.31	(vapour permeance is 23-74 ng/Pa.s.m ²)
	rigid insulation		10.0	
	1" air space		0.97	
	brick veneer		0.42	
	outside air		0.17	
	total R-Value		25.0	

Minimum R-Value for Zone 2	22	
Minimum Ratio total thermal resistance Table 9.25.1.2.	0.30	
Inboard R-Value *	13.26	
Outboard R-Value	11.56	
Ratio of Outboard to Inboard Thermal resistance 9.25.1.2.)	0.87	> 0.30 (Table

(ACCEPTABLE)

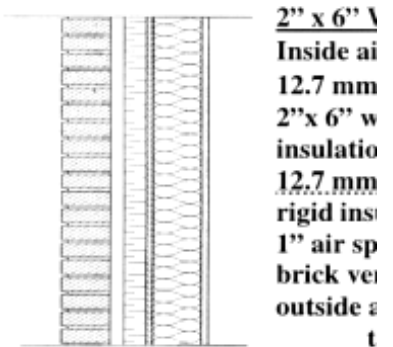
vapour permeance of the 2" x 6" wallboard should be less than 60 ng/Pa.s.m² and a cavity that could contribute to increased condensation damage potential spaces between the sheathing would be required to permit the vapour within

Note: If the wallboard has a water create a double vapour barrier within the wall assembly. So the wall assembly to escape.

ore - Zone 2 (R-22 minimum) gypsum sheathing for exterior bracing)

5. (5000 degree days or more)

Wall Assembly	R-Values	
Interior	0.68 *	
(1/2") Type X gypsum wallboard	0.45 *	Inboard
Wood studs @ 400 mm o.c.	na *	
Insulation batt type	19 *	
(1/2") gypsum sheathing	0.45 (vapour permeance > 60 ng/Pa.s.m ²)*	
Insulation	3	
Interior	0.97	
Exterior	0.42	Outboard
Air	0.17	
Total R-Value	25.14	



Zone 2	22
Thermal resistance Table 9.25.1.2.	0.30
	20.58
	4.56
and Thermal resistance	0.22 < 0.30 N/A (Table

Minimum R-Value for Zone 2
Minimum Ratio total thermal resistance
Inboard R-Value *

a water vapour permeance less than 60 ng/Pa.s.m² which acts as a vapour barrier (ACCEPTABLE)

(If the rigid insulation has a vapour barrier, it is NOT a vapour barrier)

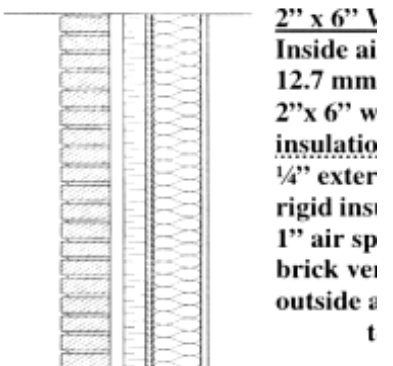
inboard is less than the minimum ratio of 0.30.

Note: Ratio of outboard to inboard

ore - Zone 2 (R-22 minimum) 1/4" plywood sheathing for exterior bracing)

6. (5000 degree days or more for exterior bracing)

Wall Assembly	R-Values	
Interior	0.68 *	
(1/2") Type X gypsum wallboard	0.45 *	Inboard
Wood studs @ 400 mm o.c.	na *	
Insulation batt type	19 *	
Exterior plywood sheathing	0.31 (vapour permeance is 23-74 ng/Pa.s.m ²)	
Insulation	3.0	
Interior	0.97	
Exterior	0.42	Outboard
Air	0.17	
Total R-Value	25.0	



Zone 2	22
Thermal resistance Table 9.25.1.2.	0.30
	20.13
	4.87

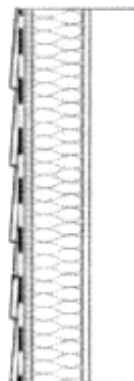
Minimum R-Value for Zone 2
Minimum Ratio total thermal resistance
Inboard R-Value *

Ratio of Outboard to Inboard Thermal resistance 0.24 < 0.30 N/A (Table 9.25.1.2.)

(If the rigid insulation has a water vapour permeance less than 60 ng/Pa.s.m² which acts as a vapour barrier, it is NOT ACCEPTABLE).

Note: Ratio of outboard to inboard is less than the minimum ratio of 0.30.

7. (LD less than 600 mm (2'- 0"), VINYL SIDING conforming to CAN/CGSB-41. 24)

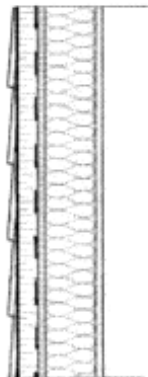
	<u>2" x 6" Wall Assembly</u>	<u>FRR (min)</u>
	12.7 mm (1/2") Type X gypsum wallboard	25
	vapour/air barrier	na
	2"x 6" wood studs @ 400 mm o.c.	20
	insulation batt type (SG-2, 2.3.5.(2))	na
	12.7mm (1/2") gypsum sheathing	na
	sheathing paper	na
	<u>vinyl siding conforming to CAN/CGSB-41. 24</u>	<u>na</u>
	total	45

Refer to Sentence 9.10.14.12.(3) for additional requirements

Fire resistance rating 45 minutes

(rigid insulation is not permitted for wall assemblies with a LD less than 600 mm using vinyl siding as per Sentence 9.10.14.12.(3), outboard/inboard calculations are not needed)

8. (LD less than 600 mm (2'-0") METAL SIDING with rigid insulation)

	<u>2" x 6" Wall Assembly</u>	<u>FRR (min)</u>
	12.7 mm (1/2") Type X gypsum wallboard	25
	vapour/air barrier	na
	2"x 6" wood studs @ 400 mm o.c.	20
	insulation batt type (SG-2, 2.3.5.(2))	na
	exterior plywood sheathing	na
	sheathing paper (membrane)	na
	1" x 2" furring	na
	rigid insulation between furring	na
	<u>metal siding</u>	<u>na</u>
	total	45

Fire resistance rating – 45 minutes