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TECHNICAL BULLETIN

# *Minimum Thickness of Mineral Fiber Insulation Board in EIFS Applications*

## Assessment of Minimum Recommended Thickness of Mineral Fiber

**General**

In comparison with EPS-based EIFS, mineral fibre-based EIFS has some definite shortcomings from the insulation's inherent physical and mechanical characteristics that reflect as well on the application and finishing of the system in comparison with EPS-EIFS.

Insulating materials should be used with their mechanical, physical, hygrothermal and fire characteristics in perspective. Mechanical properties such as tensile/compressive strength, hygrothermal properties such as thermal conductivity, physical properties such as surface characteristics and fire-resistance are crucial for establishing the minimum design requirements for the specified insulation material. Consequently, different insulating materials would need to be specified and used differently taking the above-mentioned characteristics into consideration.

Mineral fibre insulation benefits lie in its noncombustibility, thus allowing its use, in conjunction with noncombustible base coats in areas where noncombustible cladding is specified or required by the applicable codes.

**Mineral Fiber vs EPS**

The material characteristics of mineral fibre insulation differ from those of moulded expanded polystyrene (EPS) insulation. The difference in the physical and mechanical characteristics of the two types of insulation boards reflects on the resulting EIFS and on the required finishing techniques of that system.

To reduce these reflections on the resulting mineral fibre-based EIFS, and to make the finished EIFS as close as possible to an EPS-finished one, specific material characteristics of the mineral fibre insulation boards, and application techniques need to be enforced. In particular, the two main physical aspects that need to be enforced are:

- the minimum thickness of the mineral fibre insulation board, and
- the minimum thickness and application techniques of the base coat

The present technical note will address the minimum thickness of mineral fibre insulation boards to be used in conjunction of EIFS applications that is set at 76 mm (3").

*Note: The use of 63 mm (2.5") mineral fiber insulation on projects in which the said thickness is specified is subject to the designer's approval of the said thickness.*

**Particularities**

Mineral wool is a stone-based mineral fiber insulation comprised of Basalt rock and recycled steel slag. It is made from volcanic rock that has been heated in a furnace and spun to create a cotton candy-like texture before being flattened and bonded with organic and/or inorganic binder to form insulation boards.

**Mechanical Characteristics**

From a compositional point of view, and based on the manufacturing process of mineral wool, the product's compressive strength is much lower than the one of EPS and is not as uniform across the surface and thickness of the insulation, as in the case of EPS. As a comparison, the compressive strength of a medium density mineral wool is about 21 kPa, while the compressive strength of a Type II EPS is 70 kPa.

**Hygrothermal Performance**

From an insulation perspectives (RSI/R-value), mineral fibre insulation, with a density of 128 kg/m$^3$ has an average RSI-value of between 0.69 m$^2$.$^o$C/W for 25 mm thickness compared to EPS weighing 15kg/m$^3$ (Type 2 ) with and RSI value of 0.70 m$^2$.$^o$C/W. From an RSI/R-value perspective, the two types of insulation could be considered the same. However, the uniform closed cell structure of EPS renders

it highly resistant to water penetration (hygroscopic). Mineral fibre on the other hand is non-hygroscopic and is carefully treated with water repellent additives to lower its water absorption.

The water content of a material is the most influencing element in determining its thermal conductivity, where the value of the coefficient of thermal conductivity rises as the water content of the material increases. With EPS being more hydrophobic that mineral fibre insulation, it has a very low coefficient of thermal conductivity, while mineral fibre with its potential to absorb 10 times more water than EPS, it has high coefficient of thermal conductivity. Consequently, you would end needing more mineral fibre insulation thickness to increase the thermal efficiency and to maintain the same U-value/R-value.

**Condensation Control**

**Potential Impact of Hygrothermal Properties on Condensation Control**

When insulation is required in the stud space to supplement the thermal resistance provided by the EIFS, there may be potential for condensation within the wall assembly. In designing the wall system, it is necessary to properly account for the risks of vapour condensing within the wall assembly.

Table 9.25.5 of Division B of the National Building Code (NBC) Canada sets the minimum outboard to inboard ration of insulation that would avoid condensation issues, it must be noted that the established ratios represent minimums and that these ratios have been established on moisture movement calculations over a 3-year period that would have resulted in a drying capacity of the wall without leading to condensation related hazards. It must be noted that in these calculations, there would have been condensation in the cavity of the wall at specific conditions and times within the 3-year cycles, however the resulting drying capacity was deemed to be satisfactory at the end of the cycling period. Table 9.25.5 of the NBC needs to be considered as the starting point for design, however, in order to avoid any potential condensation and any potential increase in the thermal conductivity that would result in a decrease in the thermal resistance value, a 75 mm (3") thick insulation would assist in providing better results.

**Code Requirements**

**Continuous Insulation (CI) SB 10 & SB12 Requirements.**

Higher levels of exterior insulation are required to achieve the minimum effective thermal resistance ($E_{eff}$) of Canada's National Energy Code for Buildings (NECB). Adopting thicker mineral board thermal insulation will provide straight forward compliance to the Energy Efficiency Requirements of the related National, Provincial and Territorial Building Codes.

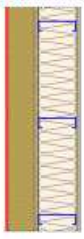
For Durex® Equalite having an R4.0 (0.7RSI) / 25 mm (1"), the following represents the minimum thicknesses of the mineral fibre insulation that would satisfy the continuous insulation (CI) requirements of the identified climatic zones:

**Steel Framed Walls**

## Code Regulations & Standards

*Supplementary Standard - SB10 Compliance*

*Data source : Table 5.5.5, Table 5.5.6 & Table 5.5.7 – 2017 of Supplementary Standard SB-10*

| SB-10 Compliance - Walls Above Grade | | | | | | | Steel Framed |
|---|---|---|---|---|---|---|---|
| Exterior Wall Type | | Climatic Zone | Effective Thermal Requirements | | Insulation RSI (m².K)/W | | Durabond Solution (thickness of insulation required in inched) |
| | | | U-Value W/(m².K) | RSI (m².K)/W | Cavity RSI | C.I. RSI | Durex Equalite Select |
| Steel Framed  | Non Residential | 5 | 0.281 | 3.56 (R20.2) | 2.3 (R13) | 2.1 (R12) | 3 in. |
| | | 6 | 0.250 | 4.00 (R22.7) | 2.3 (R13) | 2.6 (R15) | 4 in. |
| | | 7 | 0.250 | 4.00 (R22.7) | 2.3 (R13) | 2.6 (R15) | 4 in. |
| | Residential | 5 | 0.281 | 3.56 (R20.2) | 2.3 (R13) | 2.1 (R12) | 3 in. |
| | | 6 | 0.250 | 4.00 (R22.7) | 2.3 (R13) | 2.6 (R15) | 4 in. |
| | | 7 | 0.215 | 4.65 (R26.4) | 2.3 (R13) | 3.5 (R20) | 5 in. |

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**Wood Framed Walls**

# Code Regulations & Standards

*Supplementary Standard - SB10 Compliance*

*Data source : Table 5.5.5, Table 5.5.6 & Table 5.5.7 – 2017 of Supplementary Standard SB-10*

| SB-10 Compliance - Walls Above Grade | | | | | | | Wood Framed |
|---|---|---|---|---|---|---|---|
| Exterior Wall Type | | Climatic Zone | Effective Thermal Requirements | | Insulation RSI (m².K)/W | | Durabond Solution (thickness of insulation required in inched) |
| | | | U-Value W/(m².K) | RSI (m².K)/W | Cavity RSI | C.I. RSI | Durex Equitite Select |
| Wood Framed & Others  | Non Residential | 5 | 0.261 | 3.83 (R21.8) | 2.3 (R13) | 1.8 (R10) | 2.5 in. |
| | | 6 | 0.261 | 3.83 (R21.8) | 2.3 (R13) | 1.8 (R10) | 2.5 in. |
| | | 7 | 0.261 | 3.83 (R21.8) | 2.3 (R13) | 1.8 (R10) | 2.5 in. |
| | Residential | 5 | 0.261 | 3.83 (R21.8) | 2.3 (R13) | 1.8 (R10) | 2.5 in. |
| | | 6 | 0.261 | 3.83 (R21.8) | 2.3 (R13) | 1.8 (R10) | 2.5 in. |
| | | 7 | 0.261 | 3.83 (R21.8) | 2.3 (R13) | 1.8 (R10) | 2.5 in. |

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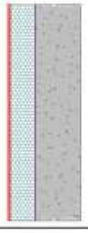
**Mass Wall Construction**

# Code Regulations & Standards

*Supplementary Standard - SB10 Compliance*

*Data source : Table 5.5.5, Table 5.5.6 & Table 5.5.7 – 2017 of Supplementary Standard SB-10*

| SB-10 Compliance - Walls Above Grade | | | | | | | Mass Wall |
|---|---|---|---|---|---|---|---|
| Exterior Wall Type | | Climatic Zone | Effective Thermal Requirements | | Insulation RSI (m².K)/W | | Durabond Solution (thickness of insulation required in inched) |
| | | | U-Value W/(m².K) | RSI (m².K)/W | Cavity RSI | C.I. RSI | Durex Equitite Select |
| Mass Wall Construction  | Non Residential | 5 | 0.307 | 3.26 (R18.5) | na | 3.0 (R17) | 4.5 in. |
| | | 6 | 0.273 | 3.66 (R20.9) | na | 3.3 (R19) | 5 in. |
| | | 7 | 0.261 | 3.83 (R21.8) | na | 3.5 (R20) | 5 in. |
| | Residential | 5 | 0.273 | 3.66 (R20.9) | na | 3.3 (R19) | 5 in. |
| | | 6 | 0.261 | 3.83 (R21.8) | na | 3.5 (R20) | 5 in. |
| | | 7 | 0.261 | 3.83 (R21.8) | na | 3.5 (R20) | 5 in. |

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## Code Regulations & Standards

*Supplementary Standard - SB10 Compliance*

*Data source : Table 5.5.5, Table 5.5.6 & Table 5.5.7 – 2017 of Supplementary Standard SB-10*

**Steel Structure Construction**

| SB-10 Compliance - Walls Above Grade | | | | | | | Mass Wall |
|---|---|---|---|---|---|---|---|
| Exterior Wall Type | | Climatic Zone | Effective Thermal Requirements | | Insulation RSI (m².K)/W | | Durabond Solution (thickness of insulation required in inched) |
| | | | U-Value W/(m².K) | RSI (m².K)/W | Cavity RSI | C.I. RSI | Durex Equinite Select |
| Metal Building  | Non Residential | 5 | 0.256 | 3.91 (R22.2) | 2.3 (R13) | 3.3 (R19) | 5 in. |
| | | 6 | 0.256 | 3.91 (R22.2) | 2.3 (R13) | 3.3 (R19) | 5 in. |
| | | 7 | 0.225 | 4.44 (R25.2) | 2.3 (R13) | 3.3 (R19) | 5 in. |
| | Residential | 5 | 0.256 | 3.91 (R22.2) | 2.3 (R13) | 3.3 (R19) | 5 in. |
| | | 6 | 0.256 | 3.91 (R22.2) | 2.3 (R13) | 3.3 (R19) | 5 in. |
| | | 7 | 0.225 | 4.44 (R25.2) | 2.3 (R13) | 3.3 (R19) | 5 in. |

**Conclusion**

Conclusion

Based on the technical issues explained above, and based on the fact that the low cost to thickness ratio of mineral fibre insulation, a minimum 75 mm (3.0”) board thickness would address the physical, mechanical and hygrothermal characteristics more effectively and efficiently.


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