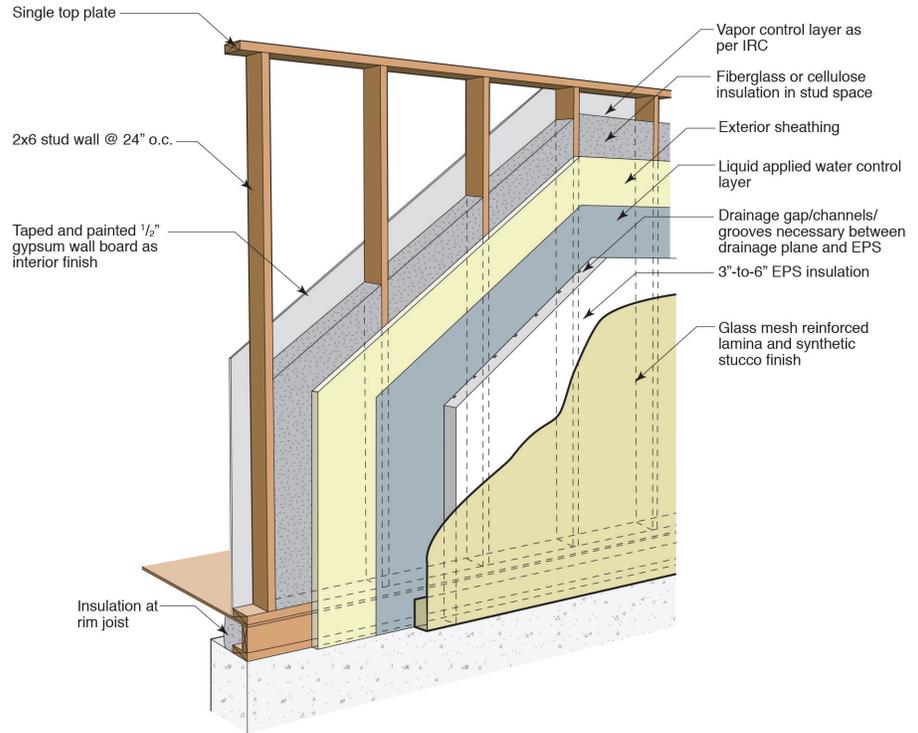


EXTERIOR INSULATION FINISH SYSTEMS (EIFS) WALL CONSTRUCTION

EXTERIOR INSULATION FINISH SYSTEMS (EIFS) WALL CONSTRUCTION DETAILS

- 2x6 wood frame wall at 24" o.c.
- Fiberglass or cellulose cavity insulation
- Glass-faced gypsum sheathing
- Liquid applied water control layer
- Exterior EPS insulation
- Drainage gap/channels/grooves necessary between water control layer and EPS
- Stucco finish



NOTE:

- Thickness of the EPS will need to be increased in very cold climates to control temperature of condensing surface.

REFERENCES

- 1 Lstiburek, J. W. (2006). *Water Management Guide*. Westford: Building Science Press Inc.
- 2 Lstiburek, J. (2008, 08 20). *BSD-104: Understanding Air Barriers*. www.buildingscience.com.
- 3 Straube, J. (2009, 04 22). *BSD-014 Air Flow Control in Buildings*. www.buildingscience.com.
- 4 Lstiburek, J. (2008, 10 17). *BSD-106 Understanding Vapor Barriers*. www.buildingscience.com.

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INTRODUCTION

This overview summarizes EIFS wall construction including the advantages and disadvantages of this construction strategy. Complex two dimensional heat flow analysis and one dimensional hydrothermal modeling were used to determine moisture related durability risks for analysis.

For a more complete analysis of this and other wall constructions, go to www.buildingscience.com.

THERMAL CONTROL

Installed Insulation R-value: The framed portion of this wall assembly typically has an R-value of R-19 to R-20 when insulated with fiberglass batt or cellulose. Exterior insulation for EIFS is typically EPS at R-4/inch.

Whole-wall R-value: Using two dimensional heat flow analysis with thermal bridging effects and average framing factors demonstrates improvements in the efficiency of the fiberglass batt or cellulose in the stud space by decreasing the thermal bridging effects of the framing and the rim joist. Adding 4" of EPS insulation for a total increase of R-16 increases the clear-wall R-value of standard construction by slightly more than R-16 because of thermal bridging of the framing and rim joist. The whole-wall R-value for this system is approximately R-30.

Air Leakage Control: Fiberglass batt, blown and sprayed cellulose are all air permeable materials allowing possible air paths between the interior and exterior as well as convective looping through the material. The air tightness of an EIFS system is typically at the surface of the exterior sheathing (usually glass-faced exterior gypsum) because it is the water control layer.

Typical Insulation Products: EPS exterior insulation, fiberglass batt, blown cellulose, sprayed cellulose.

DURABILITY

Rain Control: In the EIFS system, it is critical to correctly detail the water control layer to adequately handle rain. Historically, EIFS were constructed using a face-sealed approach, but this led to many moisture-related durability issues. EIFS can be used as part of a very durable and reliable enclosure system, provided it is drained and ventilated. Intersections, windows, doors and other penetrations must be detailed to prevent the penetration of rain water.¹

Air Leakage Control: By adding exterior insulation as part of the EIFS construction, the temperature of the sheathing (condensation plane) increases, and the risk of air leakage condensation is reduced. It is always good practice to build airtight enclosure systems, often with both an interior and exterior air barrier to avoid air leakage condensation and windwashing. Air leakage condensation is one of the greatest causes of premature building enclosure failure. An air barrier should be stiff, continuous, durable, strong, and impermeable.²

Air need not leak straight through an assembly to cause moisture problems; it can also leak from the inside, through the wall, and back to the inside. Condensation within the stud space is possible if this type of airflow occurs, depending on the weather conditions. Hence, wall designs should control airflow into the stud space.³

Vapor Control: By adding exterior insulation as part of the EIFS construction, the temperature of the sheathing (condensation plane) increases, and the risk of moisture vapor condensation is reduced. It may be possible to avoid the use of an interior vapor control layer, or use a higher permeance vapor control layer (Class II or III) depending on the amount of insulation on the exterior and regional building codes. Installing the incorrect vapor control layer or installation in the incorrect location can lead to building enclosure failure.⁴

Drying: Insulating sheathing limits the drying to the exterior, and the wall must be able to dry to the interior. Poly vapor barriers are typically avoided so that this drying can occur. The minimum level of vapor control on the interior surface is determined by the IRC. Installing vapor control on both sides of the enclosure will seal any moisture into the stud space, resulting in low drying potential, and possibly resulting in moisture-related durability risks. Ventilation behind vapor impermeable claddings and interior components (e.g. kitchen cabinets) can encourage drying.

Built-in Moisture: Care should always be taken to build with dry materials where possible, and allow drying of wet materials before close in. Cellulose is often sprayed in damp, and manufacturers recommend drying before close in and moisture content limits.

Durability Summary: The primary durability risks associated with these wall assemblies involve moisture damage related to rain water penetration. Insulating sheathings keep the condensation plane temperature elevated so there is less risk of condensation due to air leakage or vapor diffusion. Framing members are also kept warmer so they are exposed to lower relative humidity levels and generally have lower equilibrium moisture contents. Board foam products are typically less moisture sensitive than wood-based structural sheathing products.

Cellulose insulated walls are somewhat more durable because cellulose insulation is capable of storing and redistributing small amounts of moisture. Cellulose insulation is typically treated with borates that have been argued to protect adjacent wood members from mold and decay.

BUILDABILITY

Exterior insulation up to 1½” requires minimal changes to standard construction practices. Exterior insulation in excess of 1½” requires minor changes to window and wall construction and detailing which requires training and monitoring during the initial implementation. The EIFS finish system is directly applied to the exterior foam, and requires skilled trades to install. Some EIFS companies produce detail drawings for their products to reduce the risk of construction issues resulting in premature enclosure failure. www.stocorp.com and www.dryvit.ca are two examples that provide detailed drawings on their websites.

COST

There is an increased cost to EIFS wall construction because of the specialized stucco like finish. It is possible to add exterior insulation with a rain screen cladding as an alternative to the stucco appearance finish that may be more cost effective.

MATERIAL USE

Typically, in EIFS construction, structural wood sheathing is exchanged for a more moisture tolerant sheathing such as glass mesh reinforced exterior gypsum board. The addition of EPS foam can usually be sourced locally, and has relatively low embodied energy relative to other board foam insulations.

SUMMARY

This wall system is a durable and reliable choice regardless of the historical failures of this construction strategy. A better understanding of enclosure design and building science with drained and ventilated claddings and better design details have nearly eliminated the historical moisture related issues. This wall system has the appearance of a stucco finish, but with significant energy improvements, which is often the reason for using this construction strategy. It is possible to use exterior insulation with many different cladding options if a stucco appearance is not the desired architectural result.