THERMAL ENCLOSURE: EFFICIENT WALLS AND AIRTIGHTNESS

The thermal enclosure must effectively separate the indoor environment from the outdoor environment. Thorough separation requires high-performance assemblies that control the movement of heat, air, moisture and vapor, including insulating layers that maintain or improve the assembly’s structural, air-, moisture-, and vapor-control properties.

SINGLE-STUD WALL WITH RIGID INSULATION

1. Air seal at each break in wall exterior sheathing and rigid insulation. If seams are taped, rigid insulation serves as a redundant air barrier that contributes to overall tightness. Tape provides added security when installed underneath mechanically attached wall components.

2. Insulated wall cavity

3. Air seal all penetrations in wallboard or interior finish. Air seal wallboard to top plate at all attic-to-wall intersections with durable tapes, gaskets and sealants.

4. Calculated dew point at 32°F outdoor temperature (indoor conditions: 70°F and 35% relative humidity; 5½” wall with blown fiberglass insulation and R-10 sheathing)

5. Calculated dew point at 0°F outdoor temperature (indoor conditions: 70°F and 25% relative humidity; 5½” wall with blown fiberglass insulation and R-10 sheathing)

6. To form a continuous air barrier, span flexible, vapor-permeable air barrier material from wall exterior sheathing onto ceiling plane.

7. To form a continuous air barrier, span rigid air barrier material from wall exterior sheathing onto ceiling plane.

8. Use a furred-down ceiling assembly as an electrical chase to minimize penetrations and preserve the integrity of the ceiling air barrier.

9. Seal wall exterior sheathing at bottom plate, sill plate and support post connections with durable tapes, gaskets and sealants. For best results, use high-density spray foam at post locations.

10. Seal wall exterior sheathing at connection to bottom plate with gasket material.

11. Seal sill plate to stem wall connection with gasket material.

12. Where slab is 2’ or less below grade, insulate to at least R-10. Insulate radiant (heated) slabs to at least R-20.

13. Rigid insulation rated for use below grade or insulating drainboard. Protect with rigid, opaque and weather-resistant covering to at least 6” below grade.

14. Perforated drainpipe in coarse gravel fill, surrounded by drainage fabric. Situate top of pipe below top of footing and apply waterproofing or damp-proofing material to foundation as specified in 2012 IRC. This applies to all foundation types.

15. Allow wall to dry to the interior with vapor-permeable interior coverings, or install vented channel under wallboard at top and bottom plates.

16. Provide minimum 1” break between concrete or masonry and interior wall framing or air-permeable insulation.

17. Provide active, balanced supply and exhaust ventilation to all crawlspaces located inside the thermal envelope at rates specified by 2012 IRC and to all basements located inside the thermal envelope at rates specified by ASHRAE 62.2-2010.
Dew Point in Walls

When the dew point of a home’s indoor air is known, one can estimate whether the exterior sheathing or other surfaces in a wall or building assembly will likely produce condensation. Using a mobile application, web tool or psychrometric chart, calculate dew point using assumed interior temperature and relative humidity values. The dew point calculation can be used in combination with known characteristics of the building assembly and local weather to determine if the wall or building assembly is an appropriate choice.

While condensation in wall cavities is a concern, a simple dew point calculation may not effectively illustrate all the necessary considerations. Effective means of controlling condensation in building envelopes include:
- Limiting leakage of indoor air into building cavities through proper air sealing, and controlling depressurization and indoor relative humidity with effective ventilation strategies.
- Calculating condensation in building envelopes with high-performance assemblies, refer to the following resources:
  - www.epa.gov/iaq/pdfs/moisture-control.pdf
  - www.hammerandhand.com/best-practices/manual
  - www.greenbuildingadvisor.com/blogs/dept/musings/are-dew-point-calculations-really-necessary

High-performance assemblies can include selection of appropriate assemblies and materials, limiting leakage of indoor air through proper air sealing, and controlling depressurization and indoor relative humidity with effective ventilation strategies.

For more information on dew point, hygrothermal analysis and moisture management in high-performance assemblies, refer to the following resources:
- www.greenbuildingadvisor.com/blogs/dept/musings/are-dew-point-calculations-really-necessary
- www.hammerandhand.com/best-practices/manual
- www.epa.gov/iaq/pdfs/moisture-control.pdf

Dew points = 1

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1. Air seal at each break in wall exterior sheathing. Tape provides added security when installed under mechanically fastened wall components.
2. 7/8”-12” wall cavity with blown insulation
3. Spacing as needed for optimal cavity depth. In walls with less than 2” gap between stud faces, offset studs by at least 1½”.
4. Air seal all penetrations in wallboard or interior finish. Air seal wallboard to top plate at all attic-to-wall intersections with durable tapes, gaskets and sealants.
5. Calculated dew point at 32°F outdoor temperature (indoor conditions: 70°F and 25% relative humidity; 9” wall with blown fiberglass insulation)
6. Calculated dew point at 0°F outdoor temperature (indoor conditions: 70°F and 25% relative humidity; 9” wall with blown fiberglass insulation)
7. To form a continuous air barrier, use flexible vapor-permeable air barrier material from wall exterior sheathing onto ceiling plane.
8. Use a turned-down ceiling assembly as an electrical chase to minimize penetrations and preserve the integrity of the ceiling air barrier.
9. Seal wall exterior sheathing at bottom plate, sill plate and rim/band joist connections with durable tapes, gasket and sealants. For best results, use high-density spray foam or high-density spray foam on interior face of foundation wall, or provide minimum ⅝” break between concrete or masonry and interior wall framing or an air-permeable insulation.
10. Seal wall exterior sheathing at connections to bottom and/or sill plate with durable tapes, gaskets and sealants.
11. Seal sill plate to inter-wall connection with gasket material.
12. Allow wall to dry to the interior with vapor-permeable interior coverings, or install vented channel under wallboard at top and bottom plate.
13. Where slab is 2’ or less below grade, insulate to at least R-10. Insulate radiant heated slab to at least R-20.
14. Install rigid insulation or at least 2” of high-density spray foam on interior face of foundation wall, or provide minimum ½” break between concrete or masonry and interior wall framing or an air-permeable insulation.
15. Ventilated drainage in coarse gravel/DE surrounded by drainage fabric. Elevate top of pipe below top of footing and apply waterproofing or water-proofing material to foundation wall as specified in 2012 IRC. This applies to all foundation types.