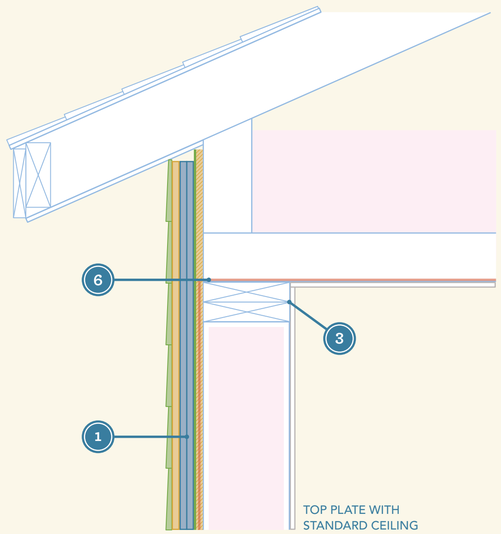
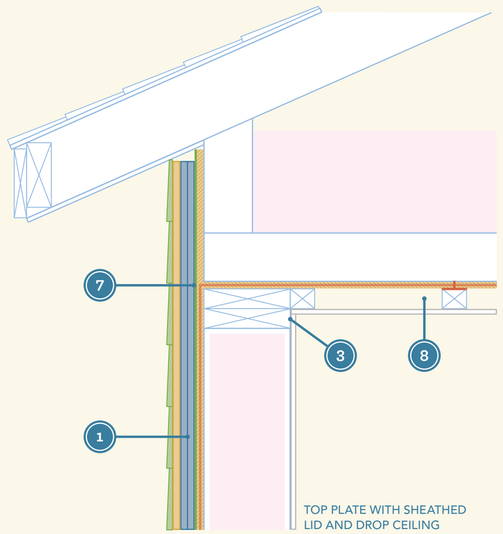
THERMAL ENCLOSURE: EFFICIENT WALLS AND AIRTIGHTNESS

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.

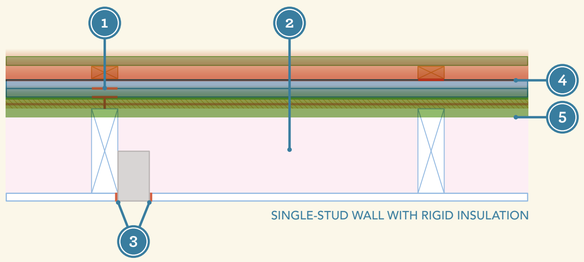


TOP PLATE WITH STANDARD CEILING

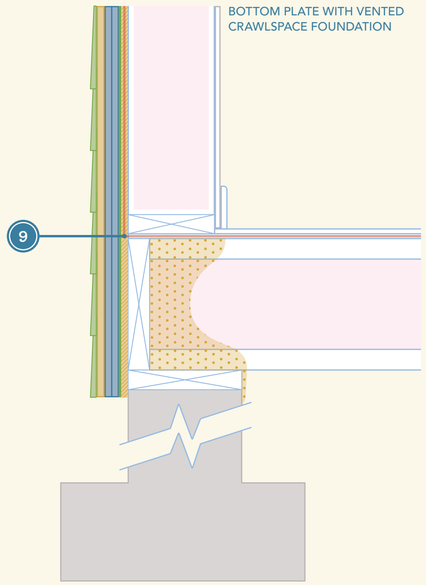


TOP PLATE WITH SHEATHED LID AND DROP CEILING

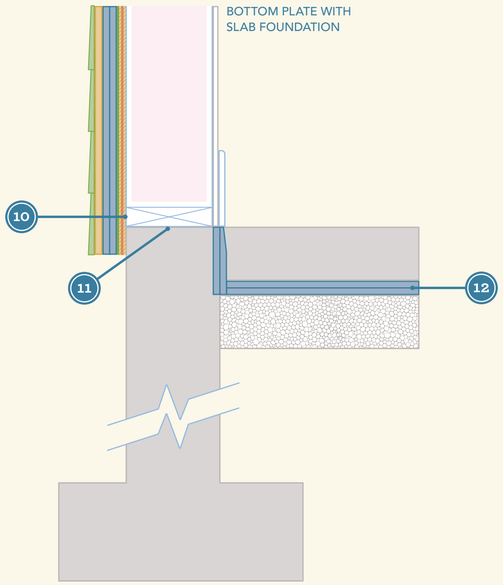
Cladding/siding =
Rain screen batten =
Rigid insulation =
Wall exterior sheathing with weather-resistive barrier =
Interior finish/wallboard =
Tape, gasket or sealant =
Insulation =
High-density spray foam =
Concrete =
Gravel =
Drainage fabric =
Continuous air barrier =
Dew points =



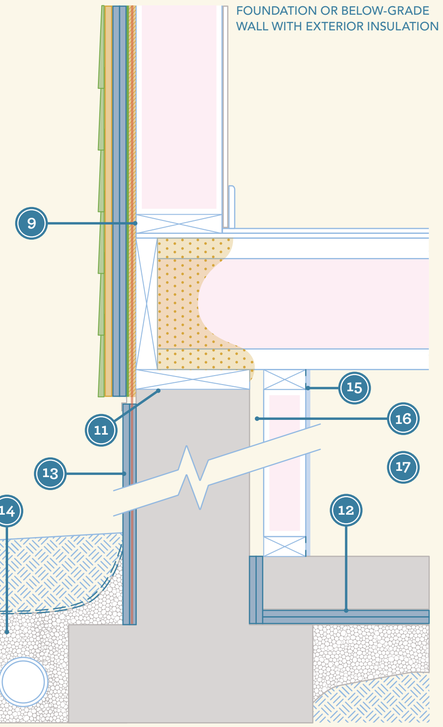
SINGLE-STUD WALL WITH RIGID INSULATION



BOTTOM PLATE WITH VENTED CRAWLSPACE FOUNDATION



BOTTOM PLATE WITH SLAB FOUNDATION



FOUNDATION OR BELOW-GRADE WALL WITH EXTERIOR INSULATION

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 fastened 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 rim/band joist connections with durable tapes, gaskets and sealants. For best results, use high-density spray foam at rim/band joists.

10 Seal wall exterior sheathing at connection to bottom and/or sill plate with durable tapes, gaskets and sealants.

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.

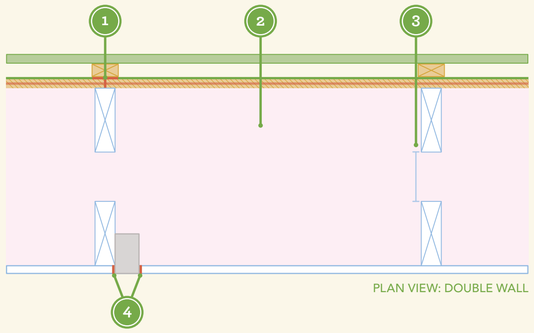
13 *Rigid insulation rated for use below grade or insulating drainage board*
Protect with rigid, opaque and weather-resistant covering to at least 6" below grade.

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

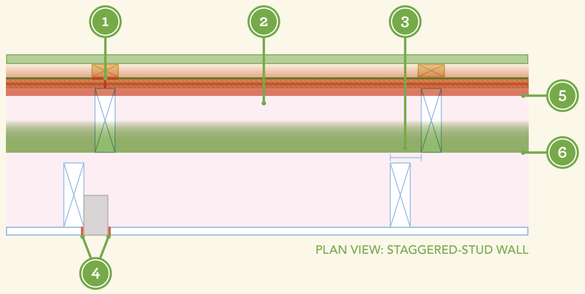
15 Allow wall to dry to the interior with vapor-permeable interior coverings, or install vented channel under wallboard at top and bottom plates.

16 Provide minimum ½" break between concrete or masonry and interior wall framing or air-permeable insulation.

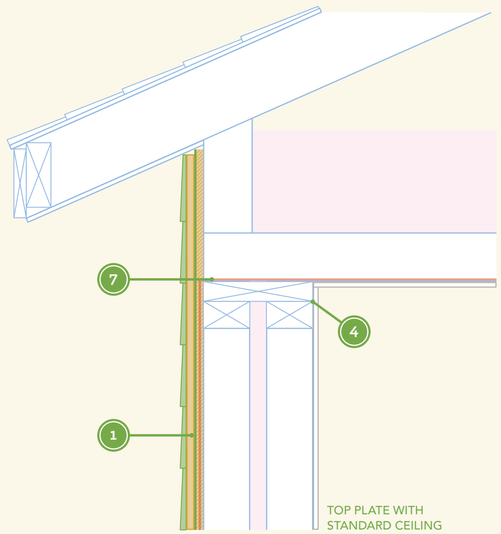
17 Provide active, balanced supply and exhaust ventilation to all crawlspaces located inside the thermal envelope at rates specified by 2012 IRC and to all basements located inside the thermal envelope at rates specified by ASHRAE 62.2-2010.



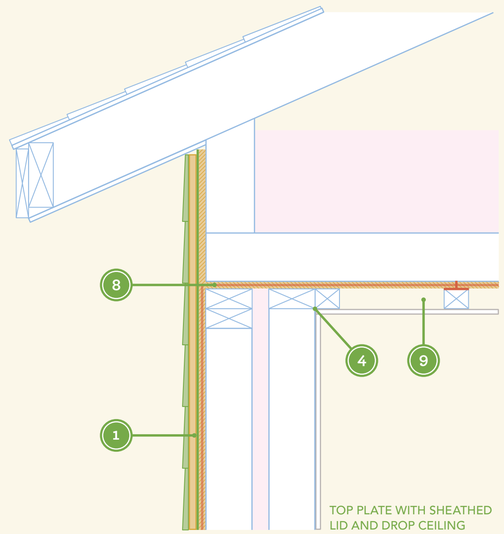
PLAN VIEW: DOUBLE WALL



PLAN VIEW: STAGGERED-STUD WALL



TOP PLATE WITH
STANDARD CEILING



TOP PLATE WITH SHEATHED
LID AND DROP CEILING

Cladding/siding =

Rain screen batten =

Rigid insulation =

Wall exterior sheathing
with weather-resistive barrier =

Interior finish/wallboard =

Tape, gasket or sealant =

Insulation =

High-density spray foam =

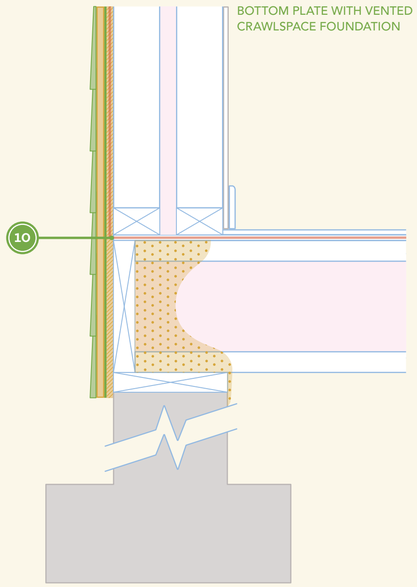
Concrete =

Gravel =

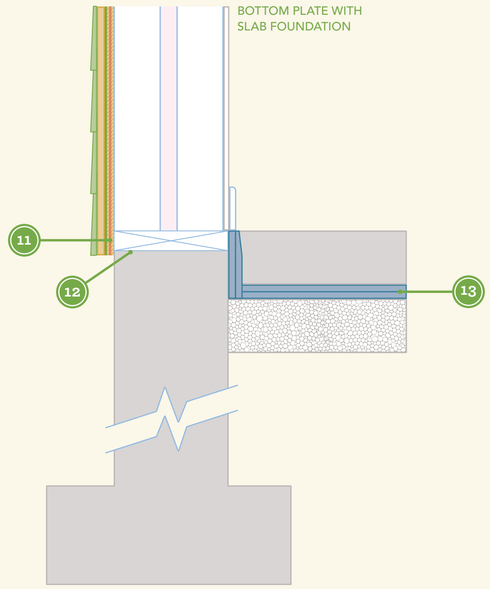
Drainage fabric =

Continuous air barrier =

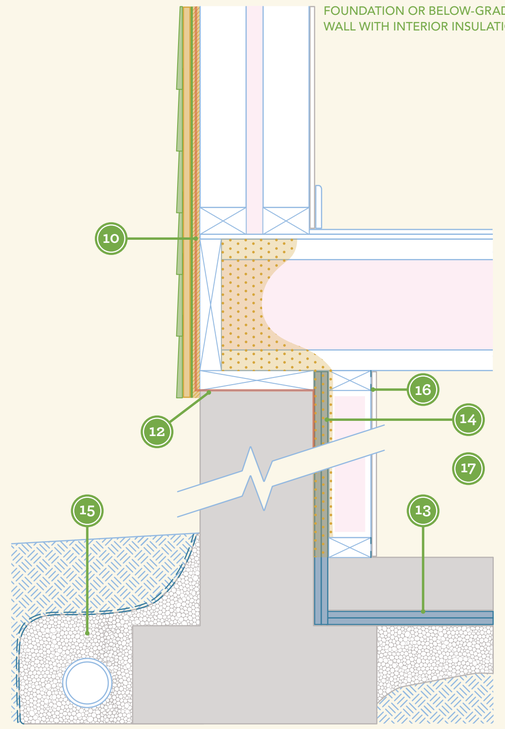
Dew points =



BOTTOM PLATE WITH VENTED
CRAWLSPACE FOUNDATION



BOTTOM PLATE WITH
SLAB FOUNDATION



FOUNDATION OR BELOW-GRADE
WALL WITH INTERIOR INSULATION

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 are likely to produce condensation.

With 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 assemblies can include selection of appropriate assemblies and materials, limiting leakage of indoor air into building cavities 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.buildingscience.com/documents/published-articles/pa-moisture-control-for-buildings
- www.hammerandhand.com/best-practices/manual
- www.epa.gov/iaq/pdfs/moisture-control.pdf

STAGGERED-STUD OR DOUBLE WALL

1. Air seal at each break in wall exterior sheathing. Tapes provide added security when installed under mechanically fastened wall components.
2. *7¼"–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 1¾".
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 35% 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, span flexible, vapor-permeable air barrier material from wall exterior sheathing onto ceiling plane.
8. To form a continuous air barrier, span rigid air barrier material from wall exterior sheathing onto ceiling plane.
9. Use a furred-down ceiling assembly as an electrical chase to minimize penetrations and preserve the integrity of the ceiling air barrier.
10. Seal wall exterior sheathing at bottom plate, sill plate and rim/band joist connections with durable tapes, gaskets and sealants. For best results, use high-density spray foam at rim/band joists.
11. Seal wall exterior sheathing at connections to bottom and/or sill plate with durable tapes, gaskets and sealants.
12. Seal sill plate to stem wall connection with gasket material.
13. Where slab is 2' or less below grade, insulate to at least R-10. Insulate radiant (heated) slabs 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 air-permeable insulation.
15. *Perforated drainpipe in coarse gravel fill, surrounded by drainage fabric*
    Situate top of pipe below top of footing and apply water-proofing or damp-proofing material to foundation wall as specified in 2012 IRC. This applies to all foundation types.
16. Allow wall to dry to the interior with vapor-permeable interior coverings, or install vented channel under wallboard at top and bottom plate.
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.