The Perfect Wall
Water Control Layer
Air Control Layer
Vapor Control Layer
Thermal Control Layer
The Perfect Building
Configurations of the Perfect Wall
Brick veneer/stone veneer
Drained cavity
Exterior rigid insulation — extruded polystyrene, expanded polystyrene, isocyanurate, rock wool, fiberglass
Membrane or trowel-on or spray applied drainage plane, air barrier and vapor retarder
Non paper-faced exterior gypsum sheathing, plywood or oriented strand board (OSB)
Uninsulated steel stud cavity
Gypsum board
Latex paint or vapor semi-permeable textured wall finish

Vapor Profile
Brick veneer/stone veneer

Drained cavity

Exterior rigid insulation — extruded polystyrene, expanded polystyrene, isocyanurate, rock wool, fiberglass

Membrane or trowel-on or spray applied drainage plane, air barrier and vapor retarder

Non paper-faced exterior gypsum sheathing, plywood or oriented strand board (OSB)

Insulated wood stud cavity

Gypsum board

Latex paint or vapor semi-permeable textured wall finish

Vapor Profile
Air permeable insulation (fiberglass batts, netted blown cellulose, netted blown fiberglass, spray applied fiberglass)

Cladding

Furring

Rigid Insulation

Air Control Layer (air barrier)

Sheathing

Gypsum board
Air permeable insulation (fiberglass batts, netted blown cellulose, netted blown fiberglass, spray applied fiberglass, stone wool / mineral wool batts)

Air impermeable insulation ("closed cell" spray polyurethane foam)

Gypsum board

Furring

Sheathing

Water Control Layer

Cladding
- Gypsum board
- Air permeable cavity insulation
- Plywood/OSB sheathing
- Air barrier membrane
- Rigid insulation
- Cladding
Shingles
Roofing paper
Roof Sheathing
Air impermeable insulation (aka spray polyurethane foam)
Roof Sheathing
Air permeable insulation (fiberglass batts, netted blown cellulose, netted blown fiberglass, spray applied fiberglass)
Roofting paper
Roof Sheathing
Rigid Insulation
Air control layer (air barrier)
Shingles

Roofing paper

Roof Sheathing

Air impermeable insulation (aka spray polyurethane foam)

Air permeable insulation (fiberglass batts, netted blown cellulose, netted blown fiberglass, spray applied fiberglass)
Shingles
Roofing paper
Roof Sheathing
Air impermeable insulation ("closed cell" spray polyurethane foam)

Air permeable insulation ("open cell" spray polyurethane foam)
Intent of sealant is to limit this lateral flow of water between sheathing and building wrap.
Continuous exterior insulation

Cladding

Rodent protection for continuous rigid insulation

For insect protection provide 3'-0" of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)

Dampproofing

Granular capillary break and drainage pad (no fines)

Rigid insulation as bond break material

Concrete foundation wall

Concrete footing below frost depth

Capillary break
Continuous exterior insulation

Cladding

Rodent protection for continuous rigid insulation

Cavity insulation

Gypsum board

Sealant, adhesive or gasket

Sill gasket

Masticed membrane strip

Concrete slab

For insect protection provide 3'-0" of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)

Dampproofing

Concrete foundation wall

Granular capillary break and drainage pad (no fines)

Polyethylene

Rigid insulation as bond break material

Concrete footing below frost depth

Capillary break
Continuous exterior insulation

Cladding

Rodent protection for continuous rigid insulation

Cavity insulation

Gypsum board

Sealant, adhesive or gasket

Sill gasket

Masticed membrane strip

Polyethylene

Concrete slab

For insect protection provide 3'-0" of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)

Dampproofing

Concrete foundation wall

Geotextile (filter fabric)

Granular capillary break and drainage pad (no fines)

Rigid insulation as bond break material

Concrete footing below frost depth

Capillary break
Continuous exterior insulation

Cladding

Rodent protection for continuous rigid insulation

Cellular PVC protection board

For insect protection provide 3'-0" of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)

Rigid insulation

Polyethylene vapor barrier extended under grade beam where it also acts as a capillary break

Concrete grade beam

4" granular capillary break and drainage pad (no fines)

4" concrete slab

For mastic sealed to slab

Sealant, adhesive or gasket

Sill gasket

Gypsum board

Cavity insulation

Building Science Corporation

Joseph Lstiburek  80
Continuous exterior insulation
Cladding
Rodent protection for continuous rigid insulation
Cellular PVC protection board

For insect protection provide 3'-0" of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)
Damproofing
Rigid insulation

Cavity insulation
Gypsum board
Flashing set in mastic sealed to slab
Sealant, adhesive or gasket
Sill gasket

4" concrete slab
4" granular capillary break and drainage pad (no fines)
Concrete grade beam
Polyethylene vapor barrier extended under grade beam where it also acts as a capillary break
Building wrap

Sealant, adhesive or gasket (typ.)

2x4

Capillary break

Rodent protection for continuous rigid insulation

For insect protection provide 3'-0" of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)

T&G subfloor

1½" rigid insulation

Plate under load bearing walls only

Polyethylene
Building wrap

Sealant, adhesive or gasket (typ.)

2x4

Capillary break

T&G subfloor

1 1/2” rigid insulation
Plate under load bearing walls only

For insect protection provide 3’-0” of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)

Polyethylene
Building wrap

Sealant, adhesive or gasket (typ.)

2x4

Capillary break

T&G subfloor

1 1/2" rigid insulation

Plate under load bearing walls only

For insect protection provide 3'-0" of mulch and then drought-resistant plants

Ground slopes away from wall at 5% (6 in. per 10 ft.)

Polyethylene
Perforated drain pipe added to “T” in order to couple sub-slab pressure field to vent stack
Crawl Spaces
Leaky air handling unit and supply ducts

Supply

Return

Supply

Depressurized conditioned space inducing infiltration
Crawl Spaces Need to be Completely “Inside” or Completely “Outside”
Capillary break

Masonry support pier

Continuous polyethylene vapor diffusion retarder/air flow retarder

Membrane sheet waterproofing under steel column or masonry pier

All joints/seams taped

Interior crawl-space concrete support pad

Steel support column
Conditioned Crawlspaces Not Unvented Crawlspaces
Need Supply Air
50 cfm/1000 ft² of Crawlspace Area

Or
Dehumidification
4x10 transfer grille to first floor conditioned space

Interior wall

Subfloor

Floor joist

Duct open to crawlspace
Any type of flooring/floor finish

Floor sheathing (OSB or plywood)

Foil-faced isocyanurate
Any type of flooring/floor finish

Floor sheathing (OSB or plywood)

Airspace

Foil-faced isocyanurate

Cavity insulation
Perimeter of slab protected above grade

Perimeter edge of slab protected below grade

Ground saturated with water

Sub-slab vapor barrier
Capillary break under framing (polyethylene strip)

Latex paint (vapor permeable, but water repellent)

Polyethylene "skirt" attached to form; remains in place after form is removed

Capillary break (plastic/polyethylene ground cover) extending under grade beam and upwards to grade
Diagram showing a wood floor on a concrete slab with a polyethylene vapor barrier and a granular base.
Plain
Hollow Back
Scratch Back
Hollow or Scratch Back
Mechanical Systems
Mechanical Systems
Cooling System To Make It Cold
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Energy Recovery System To Keep It Cold and Dry and Warm and Comfortable
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Energy Recovery System To Keep It Cold and Dry and Warm and Comfortable
Distribution System To Make It Uniform
Mechanical Systems

Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Energy Recovery System To Keep It Cold
and Dry and Warm and Comfortable
Distribution System To Make It Uniform
Range Hoods Are A Special Kind of Hell
Don’t Try to Combine Them......
Cooling System makes it cold
Dehumidification System makes it dry
Heating System makes it warm
ERV keeps it cold and dry and warm and comfortable
Distribution System makes it uniform