ENERGY STAR

ENERGY STAR® Qualified Homes

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST GUIDE

EPA

Revision 02

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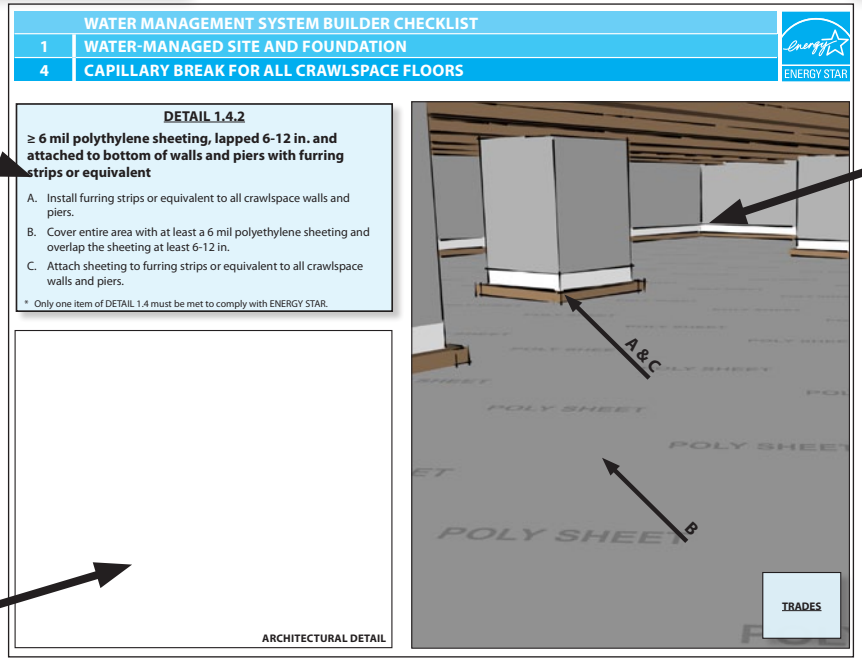
WATER MANAGEMENT BUILDER CHECKLIST

WHAT ARE GUIDE DETAILS?

This Guide for Home Energy Raters presents Guide Details that serve as a visual reference for each of the line items in the Water Management System Builder Checklist. The details are great tools for Rater education and will help Raters answer contractor and subcontractor questions. Together, the Water Management System Builder Checklist and these Guide Details provide a comprehensive process for ensuring that building professionals meet all aspects of the ENERGY STAR V3 requirements. This page illustrates what Raters will see throughout this Guide on every odd page.

Each of the details is listed top left, followed by the actions the Rater should present to the applicable trade to successfully complete the detail.

This image illustrates the detail along with arrows to indicate steps necessary to complete it.



First Page

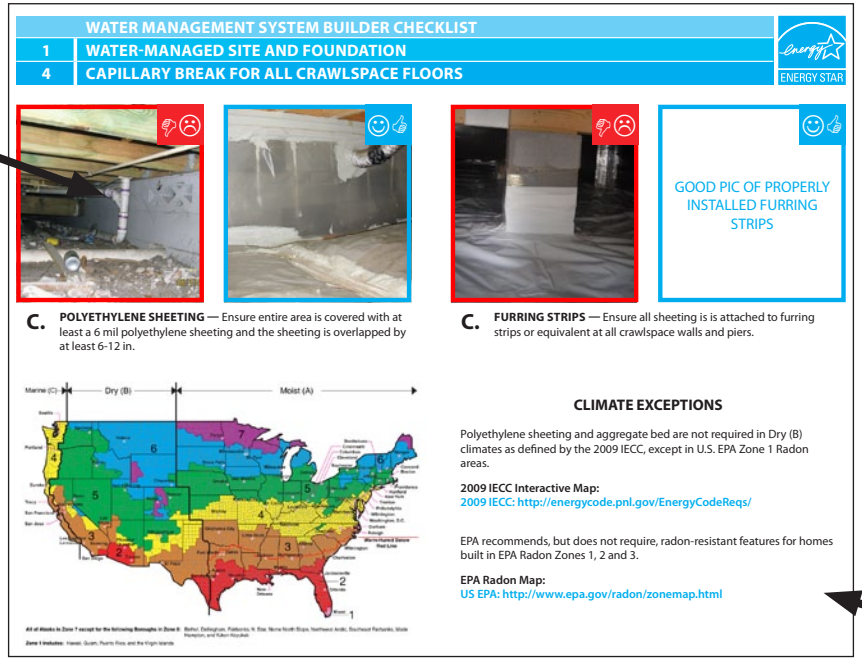
This area presents applicable footnotes for the requirement.

WATER MANAGEMENT BUILDER CHECKLIST

WHAT ARE GUIDE DETAILS? (CONTINUED)

This page illustrates what Raters will see throughout this Guide on every even (left hand) page. The photos show the detailed actions that Raters must verify are completed according to the ENERGY STAR V3 requirements.

Images of both proper and improper installation are included.



WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

1 WATER-MANAGED SITE AND FOUNDATION

4 CAPILLARY BREAK FOR ALL CRAWLSPACE FLOORS

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GOOD PIC OF PROPERLY INSTALLED FURRING STRIPS

C. POLYETHYLENE SHEETING — Ensure entire area is covered with at least a 6 mil polyethylene sheeting and the sheeting is overlapped by at least 6-12 in.

C. FURRING STRIPS — Ensure all sheeting is is attached to furring strips or equivalent at all crawlspace walls and piers.

Marine (C) Dry (B) Moist (A)

CLIMATE EXCEPTIONS

Polyethylene sheeting and aggregate bed are not required in Dry (B) climates as defined by the 2009 IECC, except in U.S. EPA Zone 1 Radon areas.

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If any additional tips, codes, or other information is necessary, it will be located on the lower half of the page.

WATER MANAGEMENT BUILDER CHECKLIST

CONTENTS

WATER MANAGEMENT BUILDER CHECKLIST

NOTES

- The specifications in this checklist are designed to help improve moisture control in new homes compared with homes built to minimum code. However, these features alone cannot prevent all moisture problems. For example, leaky pipes or overflowing sinks or baths can lead to moisture issues and negatively impact the performance of this checklist's specified features.

- This checklist shall be provided by the Rater to the Builder who shall complete the checklist. Upon completion, the Builder shall return the checklist to the Rater for review. If desired by the Builder, the Rater may verify any item on this checklist.

- A completed and signed Indoor airPLUS Verification Checklist may be submitted in lieu of the Water Management System Builder checklist. For more information, see: www.epa.gov/indoorairplus

WATER MANAGEMENT BUILDER CHECKLIST

SECTION 1. WATER-MANAGED SITE AND FOUNDATION

1.1. Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less

1.2. Final grade is, or is scheduled by builder to be, sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. and back-fill tamped to prevent settling

1.3. Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either:

1.3.1. 4 in. bed of ≥ 0.5 in. clean aggregate covered with ≥ 6 mil polyethylene sheeting lapped 6-12 in. OR ≥ 1" extruded polystyrene insulation with taped joints, in direct contact with concrete slab above, **OR**

1.3.2. 4 in. uniform layer of sand overlaid with geotextile drainage matting and covered with sheeting OR ≥ 1" extruded polystyrene insulation with taped joints

1.4. Capillary break for all crawlspace floors using either:

1.4.1. Concrete slab over ≥ 6 mil polyethylene sheeting, lapped 6-12 in., **OR**

WATER MANAGEMENT BUILDER CHECKLIST

1.4.2. ≥ 6 mil polyethylene sheeting, lapped 6-12 in. and either a) lapped up each wall or pier far enough to be fastened with furring strips or equivalent, or b) secured in the ground at the perimeter using stakes

1.5. Exterior surface of below-grade walls finished as follows:

- For poured concrete, concrete masonry, and insulated concrete forms, finish with damp-proofing coating
- For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing

1.6. Class 1 vapor retarders not installed on the interior side of air permeable insulation in exterior below-grade walls

1.7. Sump pump covers mechanically attached with full gasket seal or equivalent

1.8. Drain tile surrounded with clean gravel and fabric filter

DETAIL 1.1 [4]

Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface, or 10 ft., whichever is less

Slope all patio slabs, walks, and driveways away from the house at least 0.25 in. per ft. either:

A. The length of the slab.

B. 10 ft.

If setbacks limit the space to less than 10 ft., install either:

C. Swales.

D. Drains designed to carry water away from the foundation.

DETAIL 1.2 [4]

Final grade is, or is scheduled by builder to be, sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. and back-fill tamped to prevent settlings

E. Slope final grade away from the house at least 0.5 in. per ft. for 10 ft.

F. Back-fill tamp to prevent settling.

If setbacks limit the space to less than 10 ft., install either:

G. Swales.

H. Drains designed to carry water away from the foundation.

FOOTNOTES

4. Where setbacks limit space to less than 10 ft., swales or drains designed to carry water from foundation shall be provided. Backfill tamping is not required if proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer.

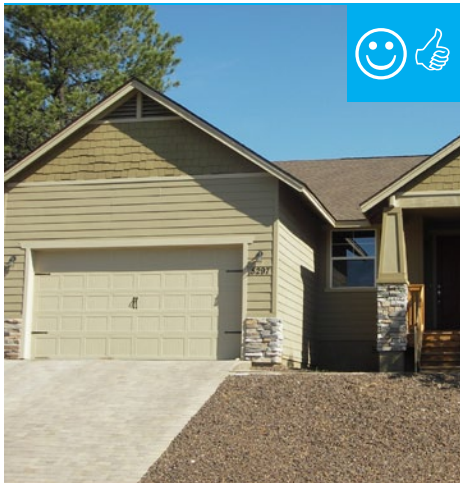
WHAT ARE SWALES?

Swales are typically vegetated, trapezoidal channels, which receive and convey storm water flows. The swale not only aids in storm water flows, but also removes pollutants through vegetation. With the selection of correct planting materials, swales can be an attractive alternative both visually and monetarily.

Back-fill tamping is not required if proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer.

To find out more information and the best plants to use, it is best to contact a local cooperative extension program based at land grant universities. For a list of cooperative extension programs across the nation, please go online and visit: http://www.extension.org/

A/B. Driveway is not sloped away from the house.



Driveway is installed to slope water away from the house.

E. The final grade does not slope away from the house.

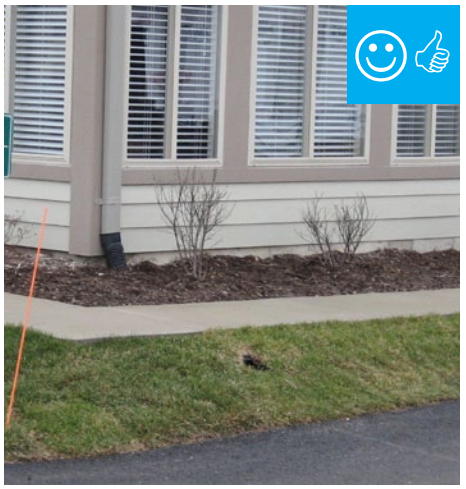
The final grade slopes away from the house.

BAD PIC OF IMPROPERLY INSTALLED OR NO SWALE

C/G.

GOOD PIC OF PROPERLY INSTALLED SWALE

D/H. Drain pipe has been cut and foundation penetration has not been properly sealed.



The drain slopes away from the foundation and terminates at the proper distance.

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DETAIL 1.3.1 [5]

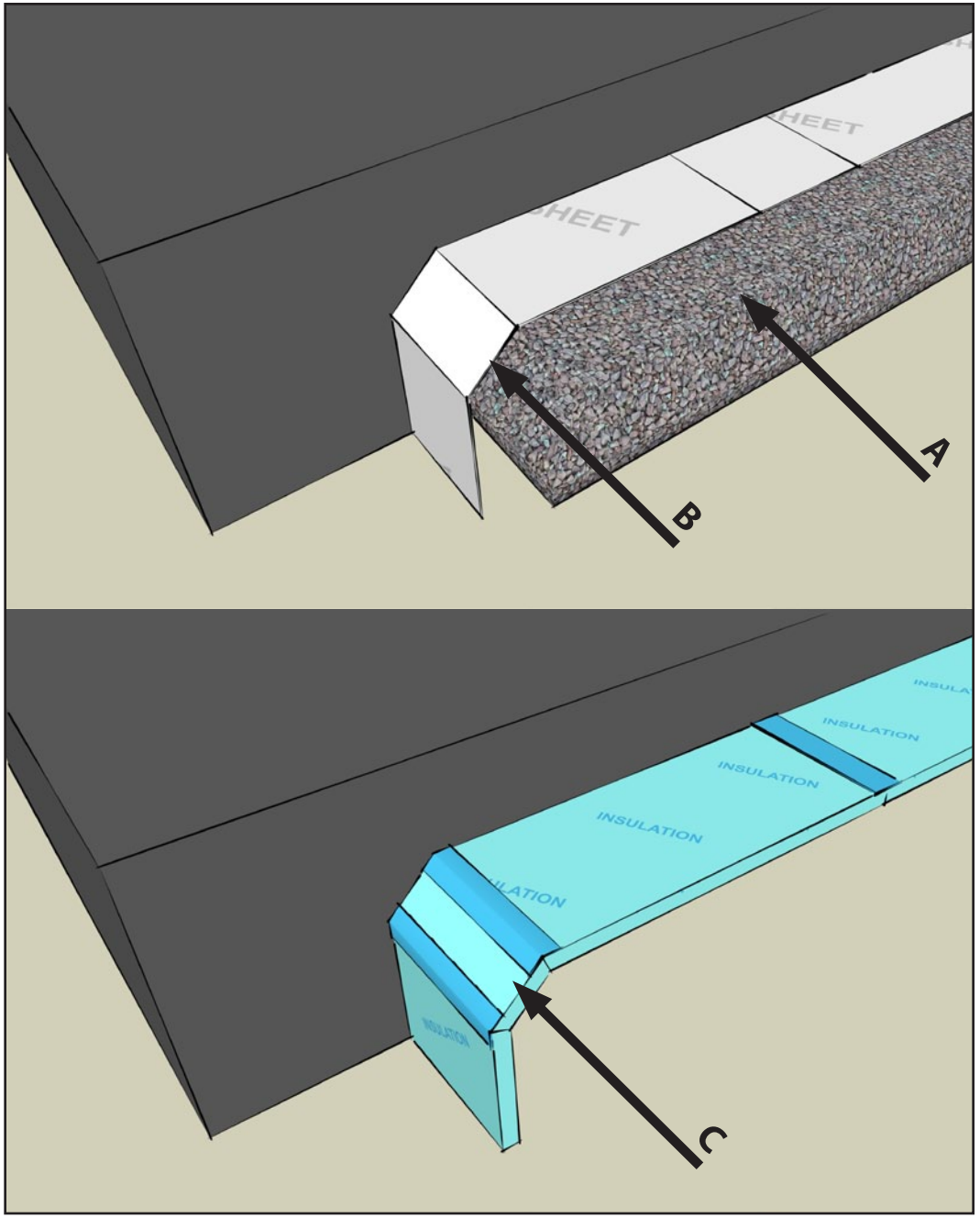
4 in. bed of ≥ 0.5 in. clean aggregate covered with ≥ 6 mil polyethylene sheeting lapped 6-12 in. or ≥ 1" extruded polystyrene insulation with taped joints, in direct contact with concrete slab above *

A. Install a 4 in. bed of at least 0.5 in. clean aggregate.

B. Cover entire area with at least a 6 mil polyethylene sheeting and overlap the sheeting at least 6-12 in.

C. If not using polyethylene sheeting, install at least 1 in. extruded polystyrene insulation to be in contact with the slab and tape all joints.

* Only one item of DETAIL 1.3 must be met to comply with ENERGY STAR.



FOOTNOTES

5. Polyethylene sheeting is not required in Dry (B) climates as shown in 2009 IECC Figure 301.1 and Table 301.1, except in U.S. EPA Zone 1 Radon areas. Polyethylene sheeting is also not required for raised pier foundations with no walls. In areas with free-draining soils, identified as Group 1 in the IRC by a certified hydrologist, soil scientist, or engineer through a site visit, a gravel layer or geotextile matting is not required. EPA recommends, but does not require, radon-resistant features for homes built in EPA Radon Zones 1, 2 and 3. For more information, see www.epa.gov/indoorairpluss

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

1 WATER-MANAGED SITE AND FOUNDATION

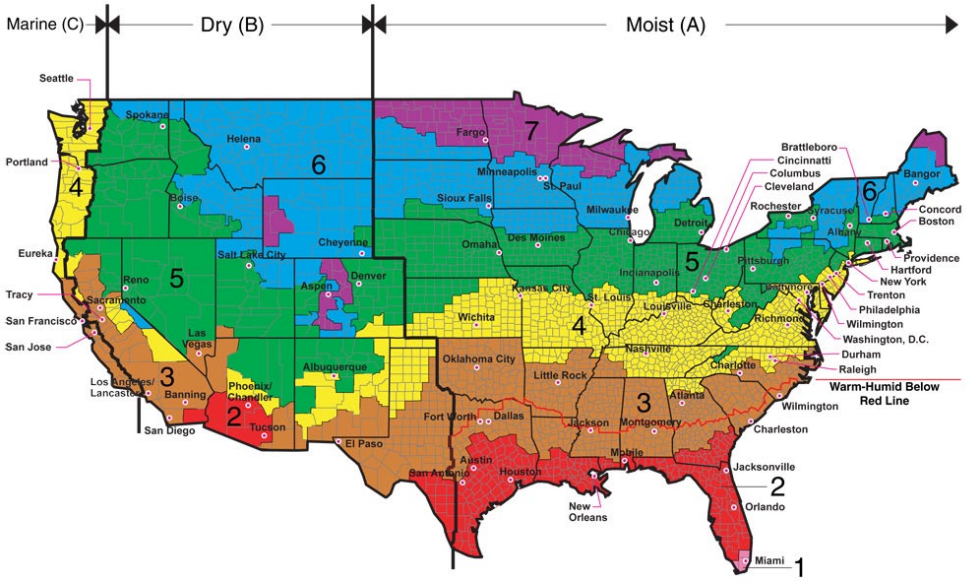
3 CAPILLARY BREAK BENEATH ALL SLABS EXCEPT CRAWLSPACE SLABS

B. There is no polyethylene sheeting installed between the ground and the slab.

There is polyethylene sheeting installed to provide a capillary break between the ground and slab.

C. The seams of the rigid insulation are not taped and it will not provide a complete capillary break.

GOOD PIC OF PROPERLY INSTALLED RIGID INSULATION



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

CLIMATE EXCEPTIONS

Polyethylene sheeting and aggregate bed are not required in Dry (B) climates as defined by the 2009 IECC, except in U.S. EPA Zone 1 Radon areas.

2009 IECC Interactive Map:
http://energycode.pnl.gov/EnergyCodeReqs/

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EPA Radon Map:
http://www.epa.gov/radon/zonemap.html

In areas with free-draining soils, identified as Group 1 in the IRC by a certified hydrologist, soil scientist or engineer through a site visit, a gravel layer or geotextile matting is not required.

DETAIL 1.3.2 [5]

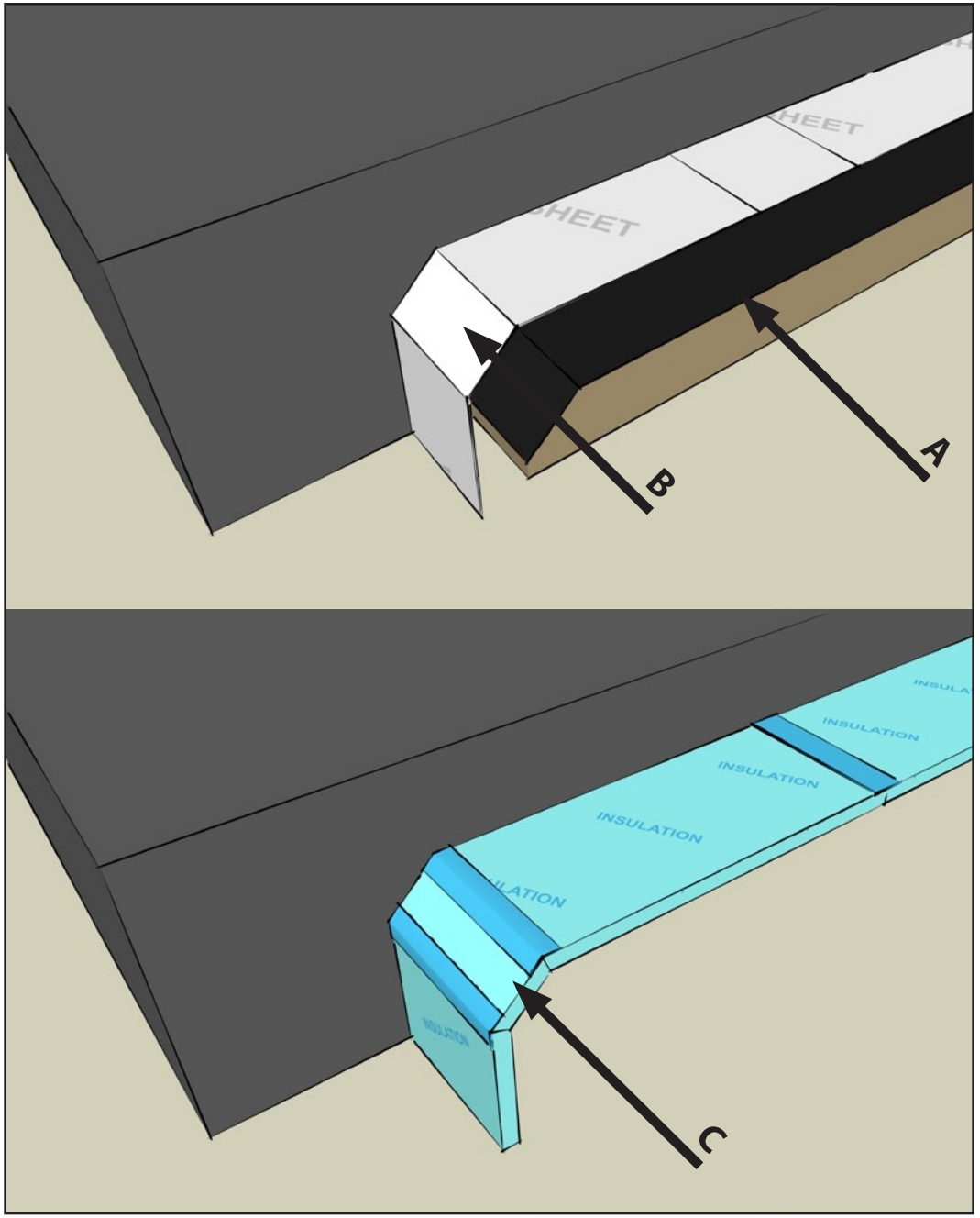
4 in. uniform layer of sand overlaid with geotextile drainage matting and covered with sheeting or ≥ 1" extruded polystyrene insulation with taped joints*

A. Install geotextile drainage matting over a 4 in. uniform layer of sand.

B. Cover entire area with polyethylene sheeting and overlap the sheeting at least 6-12 in.

C. If not using polyethylene sheeting, install at least 1 in. extruded polystyrene insulation to be in contact with the slab and tape all joints.

* Only one item of DETAIL 1.3 must be met to comply with ENERGY STAR.



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WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

1 WATER-MANAGED SITE AND FOUNDATION

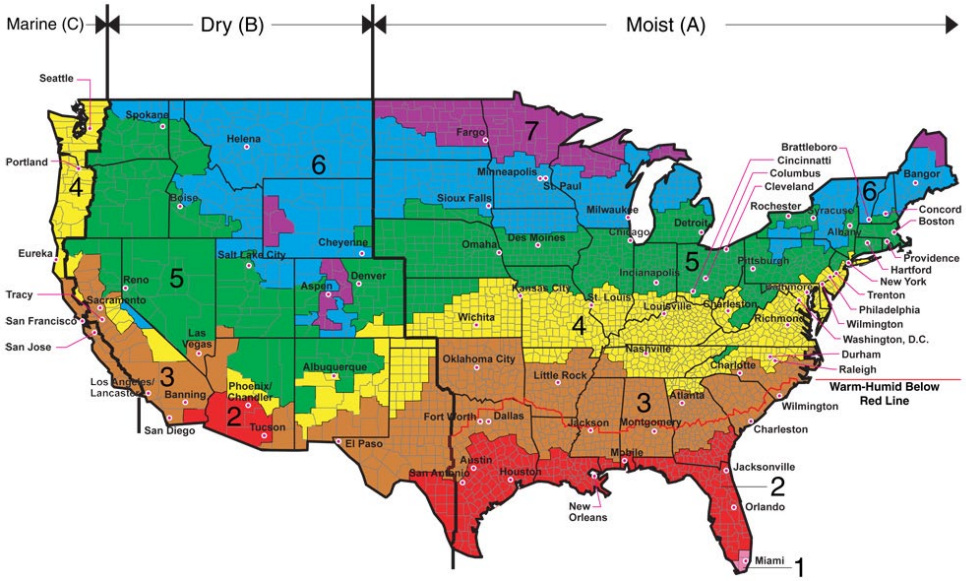
3 CAPILLARY BREAK BENEATH ALL SLABS EXCEPT CRAWLSPACE SLABS

B. There is no polyethylene sheeting installed.

There is polyethylene sheeting installed to provide a capillary break between the ground and slab.

C. The seams of the rigid insulation are not taped and it will not provide a full capillary break.

GOOD PIC OF PROPERLY INSTALLED RIGID INSULATION



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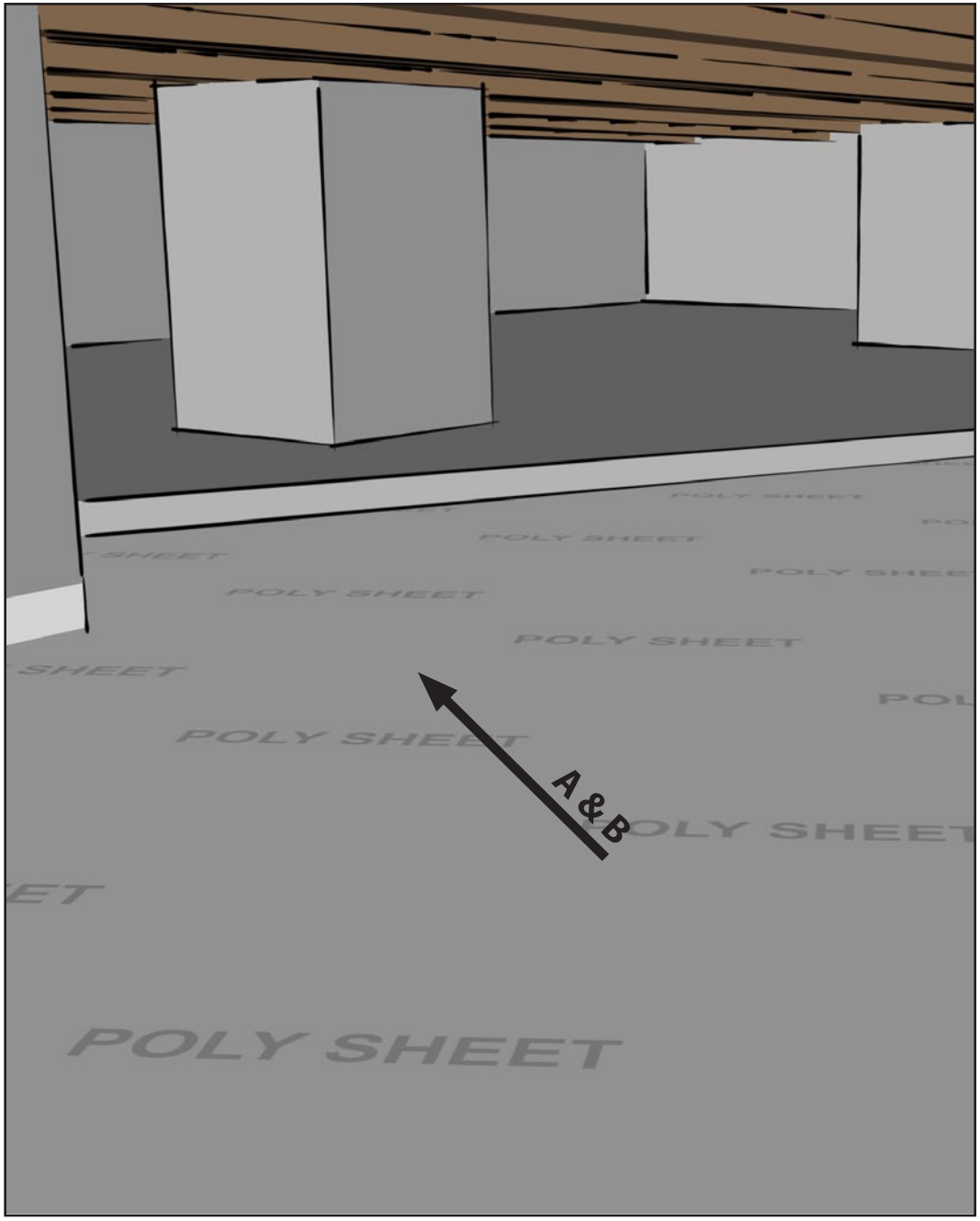
DETAIL 1.4.1 [5]

Concrete slab over ≥ 6 mil polyethylene sheeting, lapped 6-12 in.*

A. Cover entire area with at least a 6 mil polyethylene sheeting.

B. Overlap the polyethylene sheeting at least 6-12 in.

* Only one item of DETAIL 1.4 must be met to comply with ENERGY STAR.



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WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

1 WATER-MANAGED SITE AND FOUNDATION

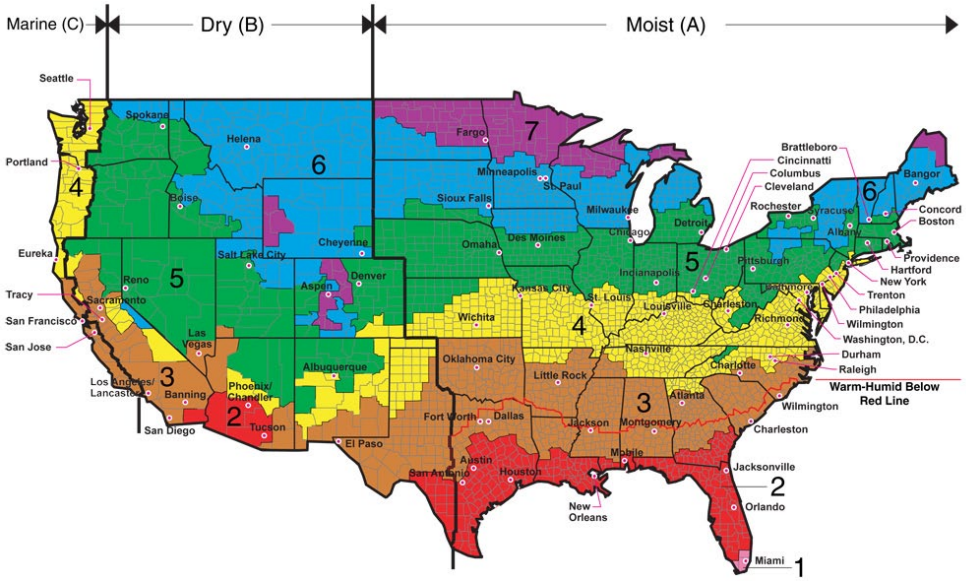
4 CAPILLARY BREAK FOR ALL CRAWLSPACE FLOORS

A. There is no polyethylene sheeting installed in the crawlspace.

There is 6 mil polyethylene sheeting installed and sealed in the crawlspace.

B. There is no polyethylene sheeting installed in the crawlspace.

GOOD PIC OF POLY INSTALLED IN THE CRAWLSPACE OVERLAPPED 6-12”



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DETAIL 1.4.2 [5]

≥ 6 mil polyethylene sheeting, lapped 6-12 in. and either a) lapped up each wall or pier far enough to be fastened with furring strips or equivalent, or b) secured in the ground at the perimeter using stakes*

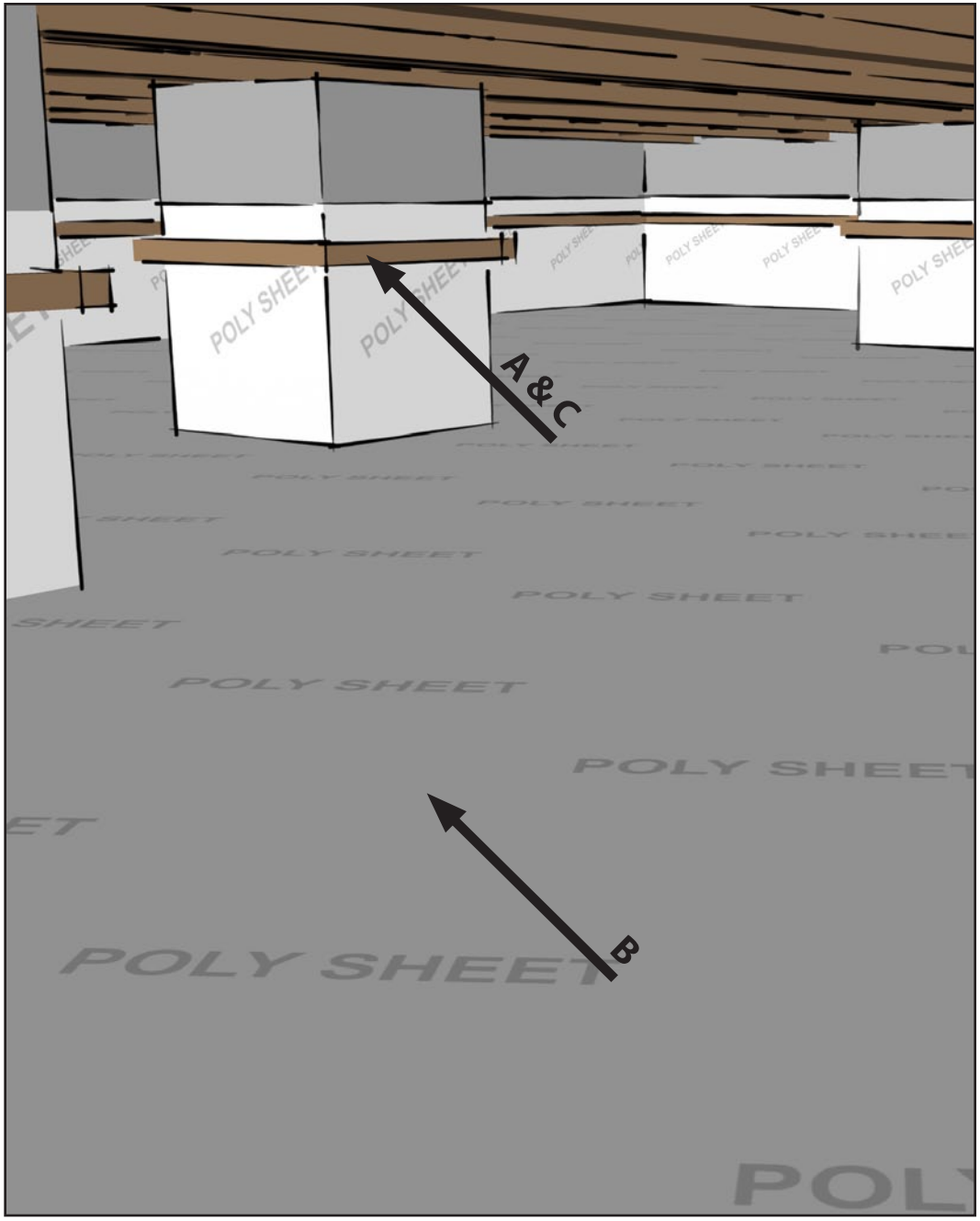
A. Install furring strips or equivalent to all crawlspace walls and piers.

B. Cover entire area with at least a 6 mil polyethylene sheeting and overlap the sheeting at least 6-12 in.

C. Attach sheeting to furring strips, or equivalent, installed on all crawlspace walls and piers **OR**

D. Secure the sheeting in place by staking at the perimeter.

* Only one item of DETAIL 1.4 must be met to comply with ENERGY STAR.



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1 WATER-MANAGED SITE AND FOUNDATION

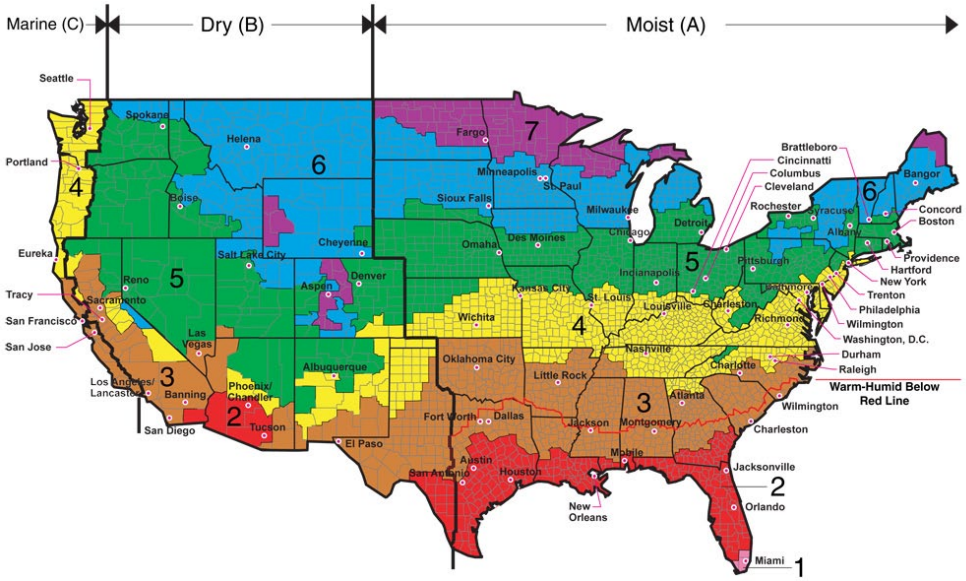
4 CAPILLARY BREAK FOR ALL CRAWLSPACE FLOORS

B. There is no polyethylene sheeting installed in the crawlspace.

There is polyethylene sheeting installed and sealed in the crawlspace.

C. The polyethylene sheeting is not staked or attached to furring strips for mechanical support.

GOOD PIC OF PROPERLY INSTALLED FURRING STRIPS



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DETAIL 1.5 †

Exterior surface of below-grade walls finished as follows: For poured concrete, concrete masonry, and insulated concrete forms, finish with damp-proof coating

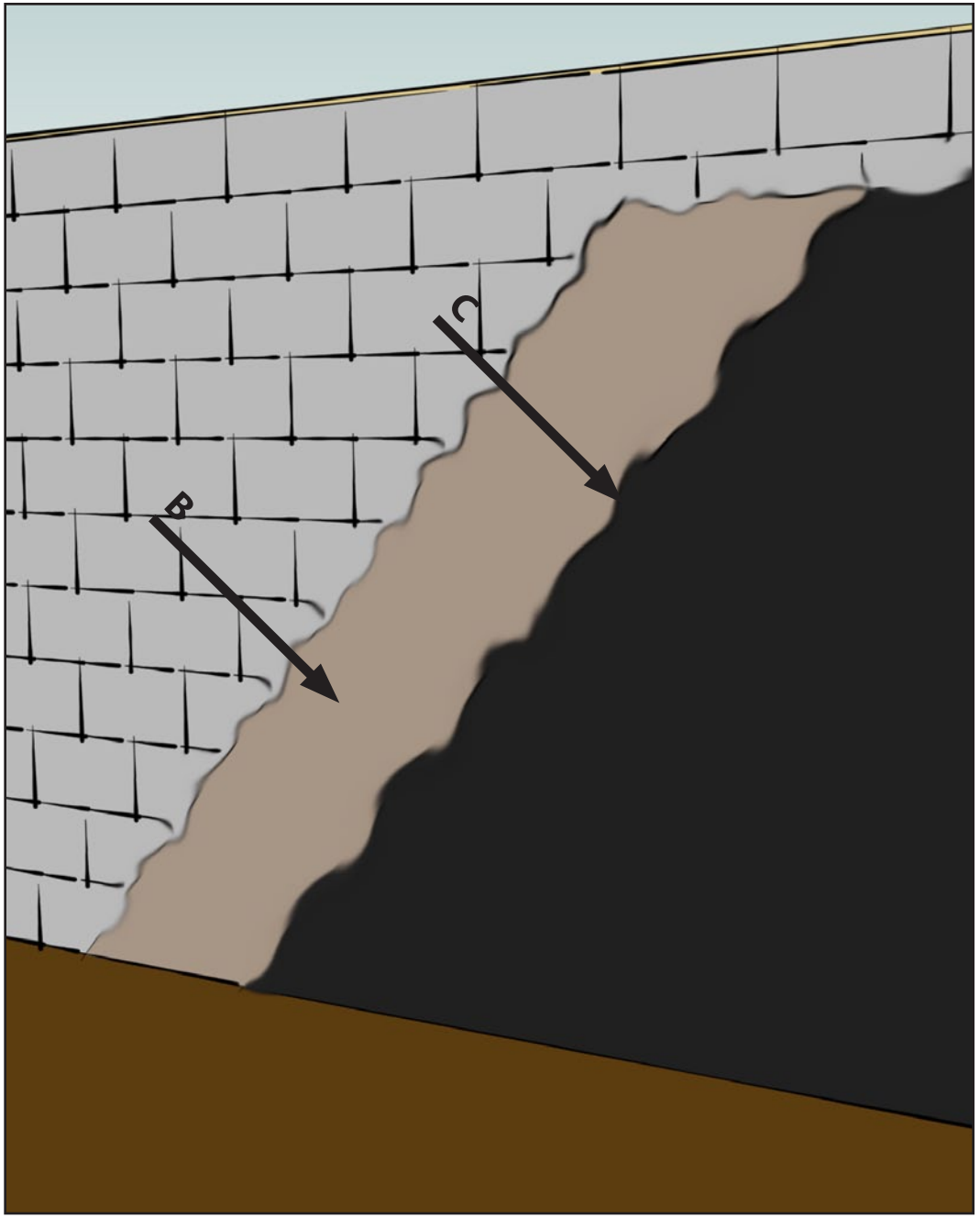
A. If installing below-grade poured concrete, the mixture can be customized to yield concrete impermeable to water migration.

B. If applying a damp-proof coating to a rough surface such as concrete masonry block walls, coat all walls with a layer of parging prior to applying the damp-proof coating.

C. Cover the surface of all below-grade walls with damp-proof coating.

D. If installing below-grade insulated concrete forms, use manufacturer-approved materials for damp-proof coating.

† Detail is continued across several pages



WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

1 WATER-MANAGED SITE AND FOUNDATION

5 EXTERIOR SURFACE OF BELOW-GRADE WALLS FINISHED

A. The below-grade concrete does not have the correct mixture to be impermeable to moisture.

Below-grade concrete has been properly sealed against moisture and is now having insulation installed.

BAD PIC OF CMU WALL WITHOUT PARGING

B.

GOOD PIC OF CMU WALL WITH PARGING

C. The below-grade concrete walls do not have any damp-proof coating.

The below-grade concrete walls have damp-proof coating.

D. The insulated concrete forms at the foundation do not have a damp-proof coating.

The insulated concrete forms that are below grade have a damp-proof coating to prevent moisture seeping into the foundation.

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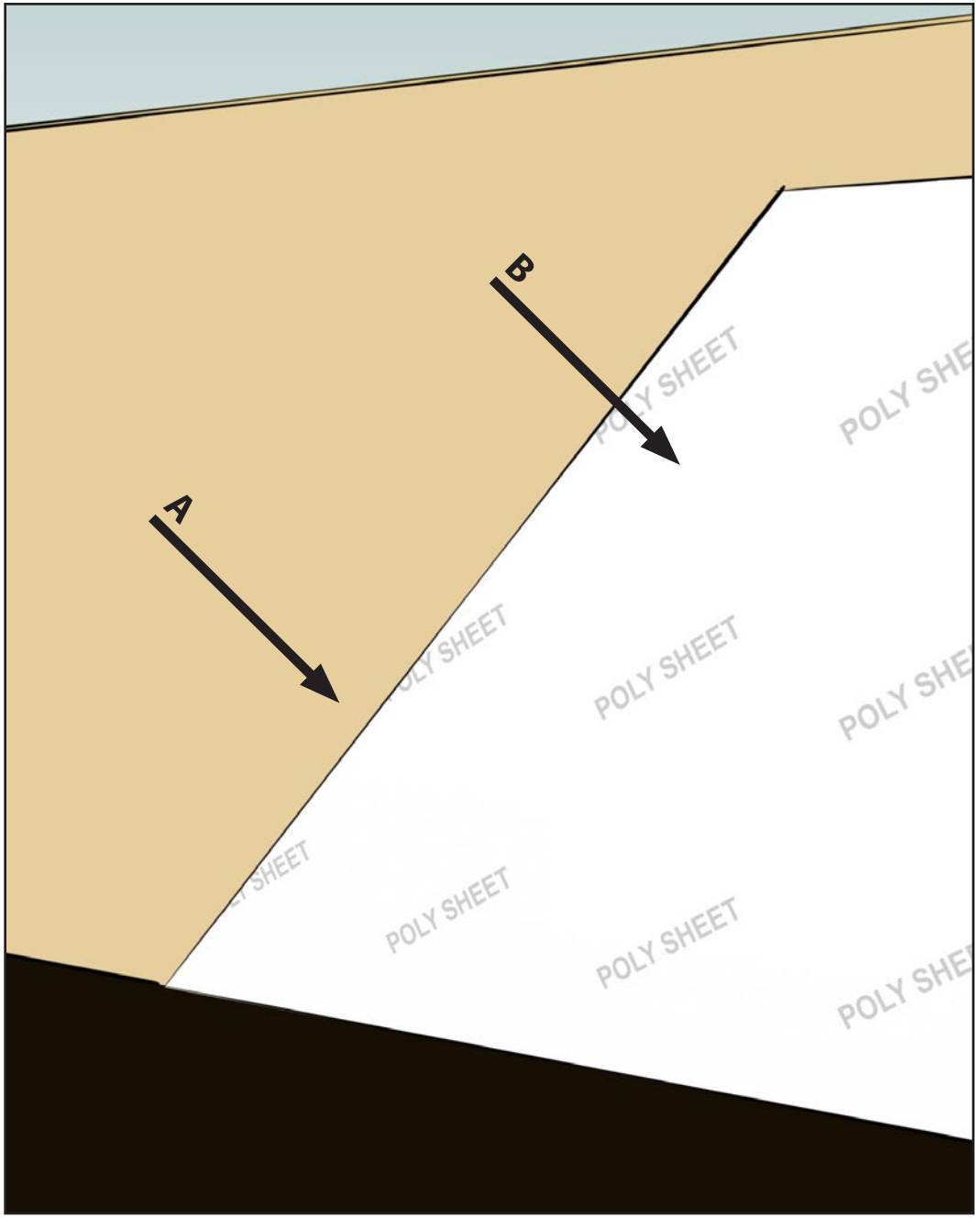
DETAIL 1.5 (Continued)

Exterior surface of below-grade walls finished as follows: for wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing

A. Install preservative-treated lumber and sheathing for all below-grade walls.

B. Cover entire area with at least a 6 mil polyethylene sheeting and attach the exterior side of the wall, with the appropriate adhesive.



1 WATER-MANAGED SITE AND FOUNDATION

5 EXTERIOR SURFACE OF BELOW-GRADE WALLS FINISHED

A. Untreated lumber has been used on a below-grade wall against masonry.

GOOD PIC OF TREATED WOOD / MATERIALS ON BELOW GRADE WALL

BAD PIC OF FOUNDATION WITHOUT POLY

B.

GOOD PIC OF FOUNDATION WITH POLY

DETAIL 1.6 [6]

Class 1 vapor retarders not installed on the interior side of air permeable insulation in exterior below-grade walls

A. Install materials with a permeability rating of less than or equal to 0.1 perm on the interior of all below-grade walls.

B. Impermeable materials such as ceramic tile may be used at shower and tub walls.

FOOTNOTES

6. The 2009 IRC defines Class I vapor retarders as a material or assembly with a rating of ≤ 0.1 perm, as defined using the desiccant method with Procedure A of ASTM E 96. The following materials are typically rated at ≤ 0.1 perm and therefore shall not be used on the interior side of air permeable insulation in above-grade exterior walls in warm-humid climates or below-grade exterior walls in any climate: rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, foil-faced insulating sheathings, and foil-faced non-insulating sheathings. These materials can be used on the interior side of walls if air permeable insulation is not present (e.g., foil-faced extruded polystyrene rigid insulation board adjacent to a below-grade concrete foundation wall is permitted).

Note that this list is not comprehensive and other materials with a perm rating ≤ 0.1 also shall not be used. Also, if manufacturer specifications for a specific product indicate a perm rating above 0.1, then the material may be used, even if it is in this list. Also note that open-cell and closed-cell foam generally have perm ratings above this limit and may be used unless manufacturer specifications indicate a perm rating ≤ 0.1.

Several exemptions to these requirements apply:

a. Class I vapor retarders, such as ceramic tile, may be used at shower and tub walls;

b. Class I vapor retarders, such as mirrors, may be used if they are mounted with clips or other spacers that allow air to circulate behind them.

SELECTING MATERIALS

The current code has the following definitions:

Class I Vapor Retarder: 0.1 perm or less

Class II Vapor Retarder: 1.0 perm or less and greater than 0.1 perm

Class III Vapor Retarder: 10 perm or less and greater than 1.0 perm

The current proposals are to define them this way:

Vapor impermeable: 0.1 perm or less

Vapor semi-impermeable: 1.0 perm or less and greater than 0.1 perm

Vapor semi-permeable: 10 perms or less and greater than 1.0 perm

Vapor permeable: greater than 10 perms

WHAT IS VAPOR PERMEABILITY?

Vapor permeability (commonly referred to as breathability) is a material's ability to allow water vapor to pass through it.

Moisture vapor transmission rate (MVTR) is the measurement referenced in building codes. This is measured in a lab using ASTM E96. The test method measures how much moisture vapor is allowed to pass through a material in a 24-hour period.

This measurement can be impacted by vapor pressure, so when manufacturers compare and test materials, they adjust the measurement for vapor pressure across the sample to get the moisture vapor permeance (MVP). The unit of measurement for MVP is perms.

The higher the number, the more moisture vapor the material will allow to pass, and the better drying the material allows.

The water vapor permeability of a material is roughly inversely proportional to its thickness—doubling the thickness halves the permeability.

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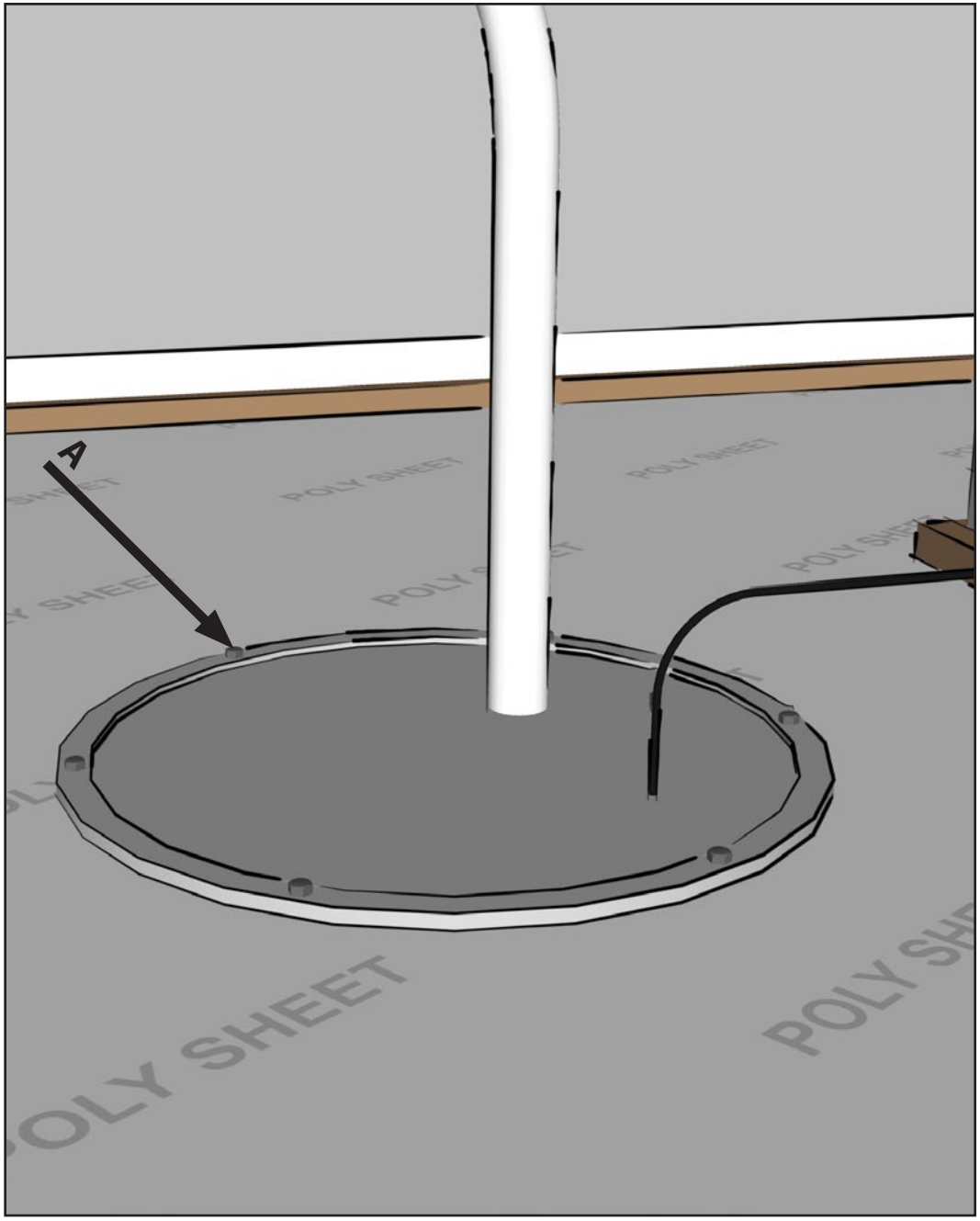
DETAIL 1.7

Sump pump covers mechanically attached with full gasket seal or equivalent

A. Install sump pumps which have covers that can be mechanically sealed and have full gasket seals or equivalent.



WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

1 WATER-MANAGED SITE AND FOUNDATION

7 SUMP PUMP COVERS MECHANICALLY ATTACHED WITH FULL GASKET SEAL

A. The sump pump does not have a cover.

The sump pump has a sealed cover that is mechanically attached.

A. The sump pump does not have a cover.

The sump pump has a sealed cover that is mechanically attached.

ENERGY STAR

DETAIL 1.8 [7]

Drain tile surrounded with clean gravel and fabric filter

A. Lay fabric cloth where drain tile and gravel will be located. Ensure enough is laid down to wrap both pipe and gravel.

B. Install drain tile near the footings of basement and crawlspace walls below the bottom of the slab or floor.

C. Install drain tile to transport water to the exterior or a sump pump.

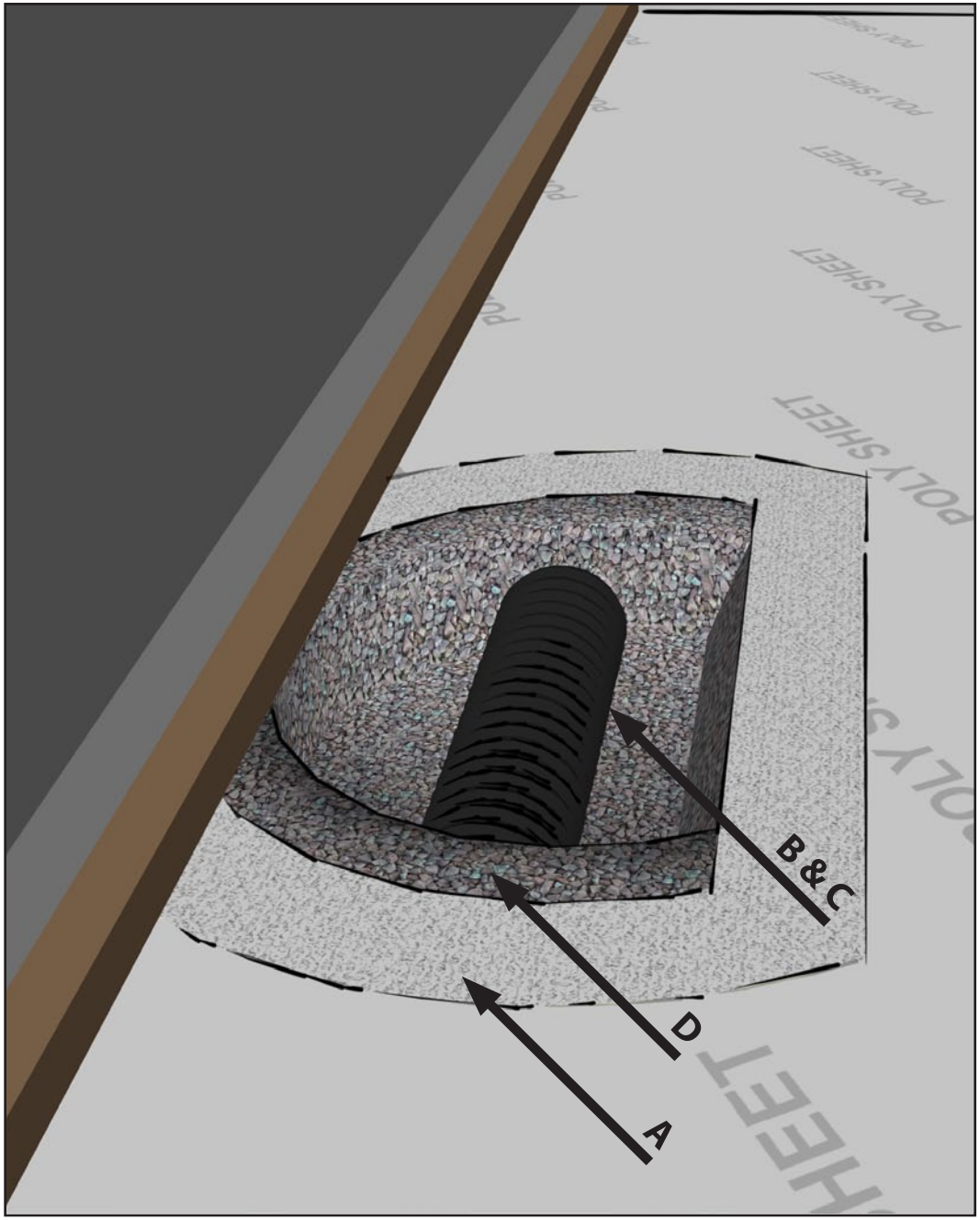
D. Surround all pipes with at least 6 in. of ½ to ¾ in. washed or clean gravel.

WHAT IS DRAIN TILE?

Typically, the drain tile is a pipe approximately 4 in. diameter and is perforated or has pre-drilled holes along the length. Depending upon the type, it can be purchased in rolls up to 250 ft. or in 10 ft. sections. Fittings are available to allow for turning corners or interconnecting the pipe.

WHY ARE GRAVEL AND FABRIC FILTERS NEEDED?

Gravel is used to cover the drain tile because it allows water to easily flow to the pipe. The fabric filter prevents silt and mud from clogging the gravel and the drain tile pipe. Without a barrier, the silt particles would immediately clog the gravel and drain tile and prevent it from removing water from the basement or crawlspace.



FOOTNOTES

7. Protected drain tile shall be installed at the footings of basement and crawlspace walls, level or sloped to discharge to outside grade (daylight) or to a sump pump. The top of each drain tile pipe shall always be below the bottom of the concrete slab or crawlspace floor. Each pipe shall be surrounded with at least 6 inches of ½ to ¾ inch washed or clean gravel. The gravel layer shall be fully wrapped with fabric cloth or drain tile pre-wrapped with a fabric filter to prevent clogging of the drain tile with sediment.

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

1 WATER-MANAGED SITE AND FOUNDATION

8 DRAIN TILE SURROUNDED WITH CLEAN GRAVEL AND FABRIC FILTER

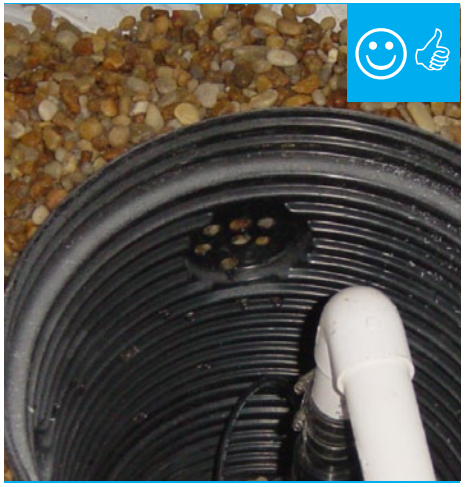
A. The drain tile is not wrapped in fabric and could become clogged with debris.

The drain tile is wrapped in fabric which will prevent it clogging with debris.

B. The drain tile is cut and now does not extend around the entire foundation footing.

The drain tile is installed along the bottom of the entire foundation footing.

C. The drain tile is not installed to terminate properly and will not transport water to the exterior.



The drain tile connects to a sump pump which will pump water away from the foundation.

D. The gravel surrounding the drain tile is too large and will let too much debris through.

GOOD PIC OF DRAIN TILE SURROUNDED WITH GRAVEL

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

SECTION 2. WATER-MANAGED WALL ASSEMBLY

2.1. Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system

2.2. Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Detail 2.1. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies.

2.3. Window and door openings fully flashed

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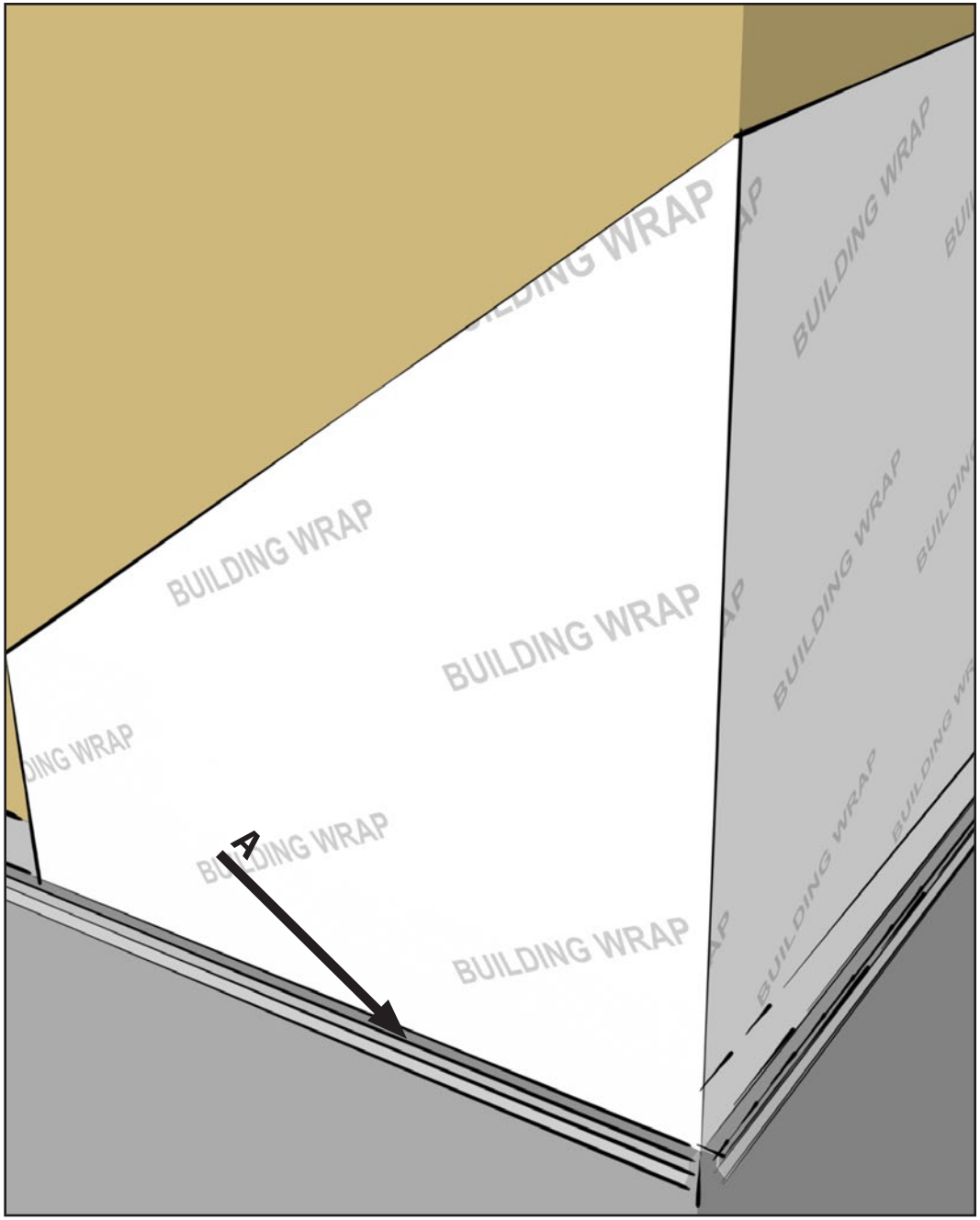
ENERGY STAR

DETAIL 2.1†

Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system

A. Install flashing at the bottom of all exterior walls or an equivalent drainage system.

† Detail is continued across several pages



2 WATER-MANAGED WALL ASSEMBLY

1 FLASHING AT BOTTOM OF EXTERIOR WALLS

A. There is no flashing installed at the bottom of the exterior walls to create a drainage system.

There is flashing installed at the bottom of the wall to create a satisfactory drainage system.

A. There is no flashing installed at the bottom of the exterior walls to create a drainage system.

GOOD PIC OF FLASHING INSTALLED FINISHED

DETAIL 2.1 (Continued) †

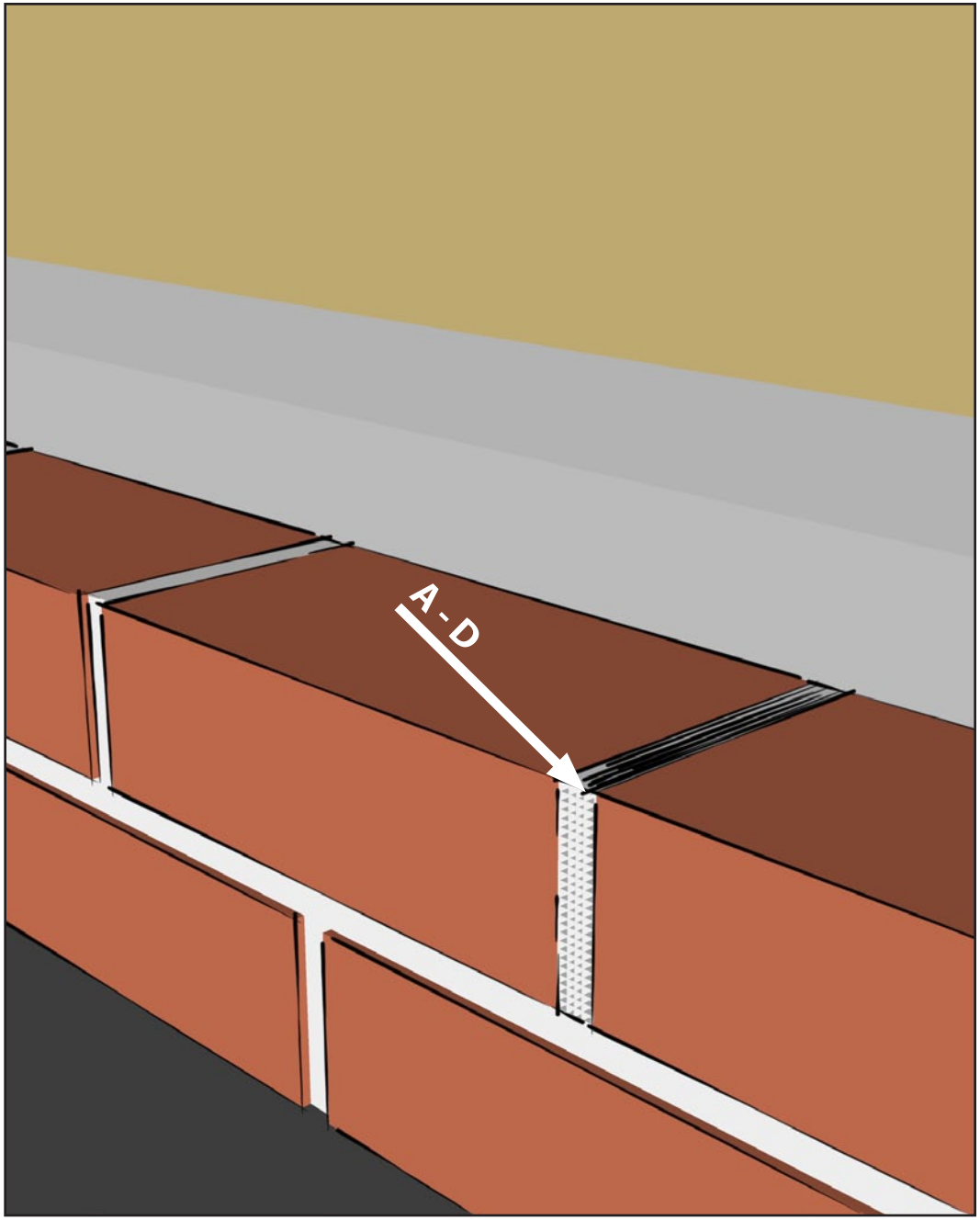
Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system

A. If installing masonry veneer, clean cavities of weep hole locations prior to installation.

B. If installing masonry veneer, install weep holes at all flashing locations such as the base of walls, above all window and door lintels, and above shelf angles.

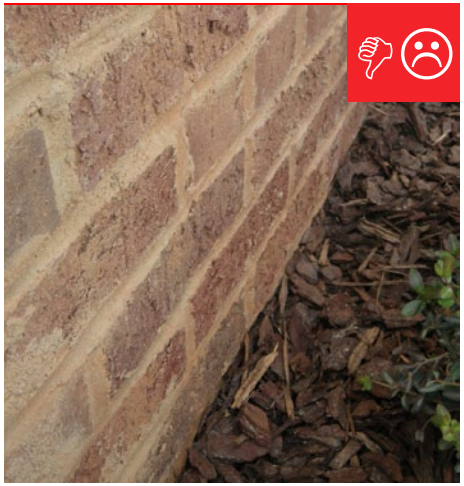
C. If installing masonry veneer, EPA recommends following manufacturer's specs when installing weep hole materials.

† Detail is continued across several pages

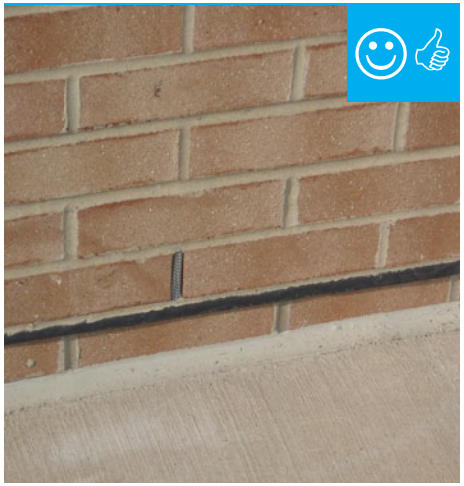


A. The weep holes were not properly cleaned before the weeps were installed.

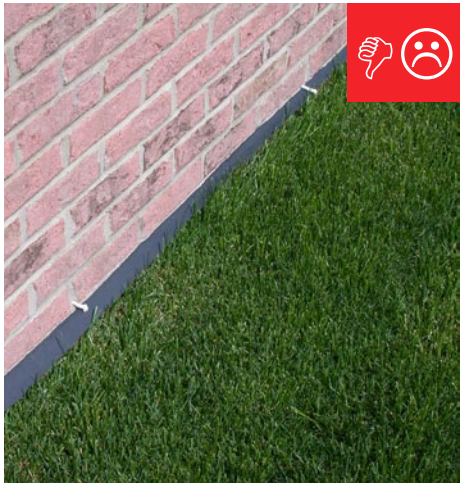
The weep holes are properly cleaned out and the weeps properly installed.



B. There are no weep holes installed at the bottom of the exterior wall.



There is both flashing and weep holes installed at the bottom of the exterior wall.



B. The weep holes are spaced too far apart.

The weep holes are spaced at the correct distance to provide a complete drainage system.

C. **WEEP HOLE MATERIAL** — If materials are installed to carry water through the weep hole, check to see if installation follows manufacturer's specifications, as recommended by EPA. Key recommendations include:

- If no material is installed in the weep hole, it is important to notify the homeowner about the purpose of the gap in the masonry veneer.
- If installing hollow plastic tubes, EPA recommends to install them at an angle in the mortar.
- If installing rope wicks, EPA recommends using only cotton wicks.
- If using oiled rods, verify the holes are clear after the rods are removed.

ENERGY STAR

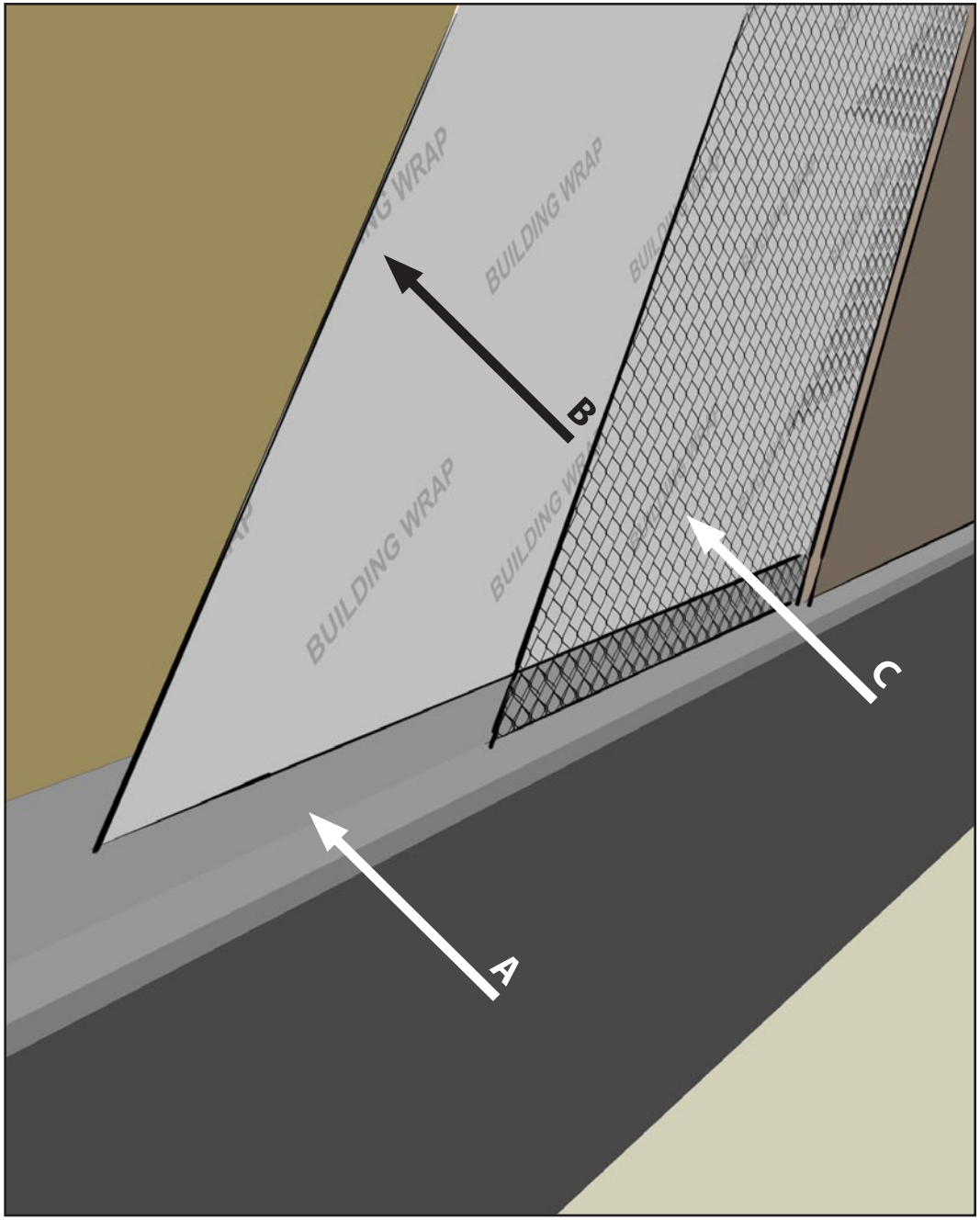
DETAIL 2.1 (Continued)

Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system

A. If installing stucco, install a weep screed at the base of all exterior walls at the height above grade specified by the local building code.

B. If installing stucco, install the water-resistant barrier over the weep screed.

C. If installing stucco, install the lathe and stucco to the first bend in the weep screed.



WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

2 WATER-MANAGED WALL ASSEMBLY

1 FLASHING AT BOTTOM OF EXTERIOR WALLS: STUCCO

A. There is not a weep screed installed at the bottom of the stucco wall.

There is a weep screed installed at the bottom of the wall.

BAD PIC OF FLASHING OVER WATER BARRIER

B.

There is a water-resistant barrier installed underneath the stucco and lathe.

C. The water-resistant barrier, weep screed, and stucco lathe are not properly layered.

The water-resistant barrier, weep screed, and stucco lathe are properly layered and will create a complete drainage system.

DETAIL 2.2 [8]

Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Detail 2.1. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies.

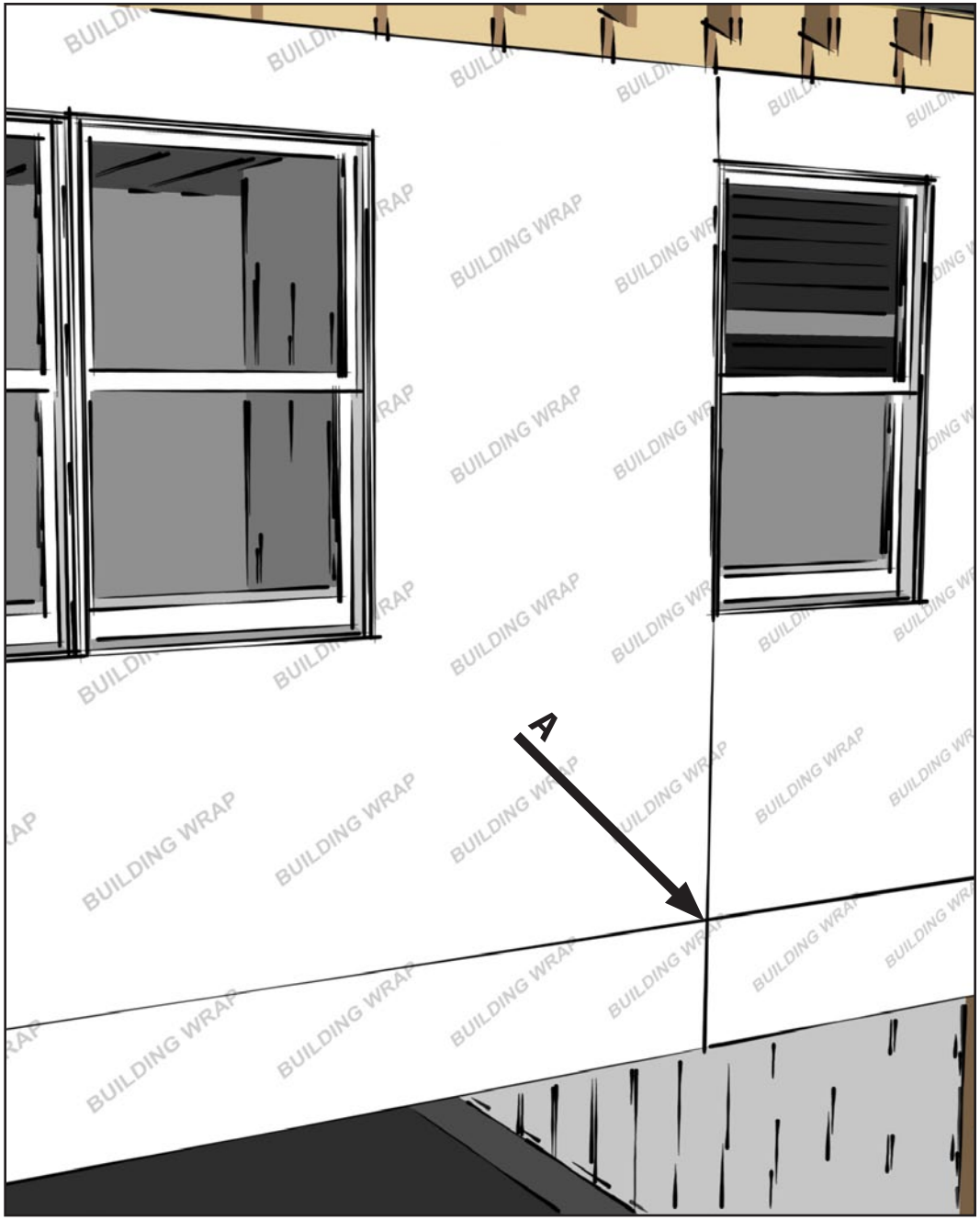
Any of the following systems may be used:

A. A monolithic weather-resistant barrier (i.e., house wrap) sealed or taped at all joints.

B. Weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints.

C. Lapped shingle-style building paper or felts.

D. Other water-resistant barrier recognized by ICC-ES or other accredited agency.



FOOTNOTES

8. Any of the following systems may be used: a monolithic weather-resistant barrier (i.e., house wrap) sealed or taped at all joints; weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints; lapped shingle-style building paper or felts; or other water-resistive barrier recognized by ICC-ES or other accredited agency.

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

2 WATER-MANAGED WALL ASSEMBLY

2 FULLY SEALED CONTINUOUS DRAINAGE PLANE BEHIND EXTERIOR CLADDING

A. The water-resistant barrier is not complete and the holes and gaps could cause moisture problems.

The water-resistant barrier covers the entire house and the seams are taped to provide a complete drainage system.

B. The rigid sheathing seams are not taped and the gaps could cause moisture problems.

The rigid insulation covers all of the exterior walls and all of the seams are taped to provide a complete drainage system.

C. The building felt is not installed on the entire house.

The building felt is installed on all exterior walls and provides a complete drainage system.

D. There is not a water-resistant barrier installed underneath the exterior finish of the walls.

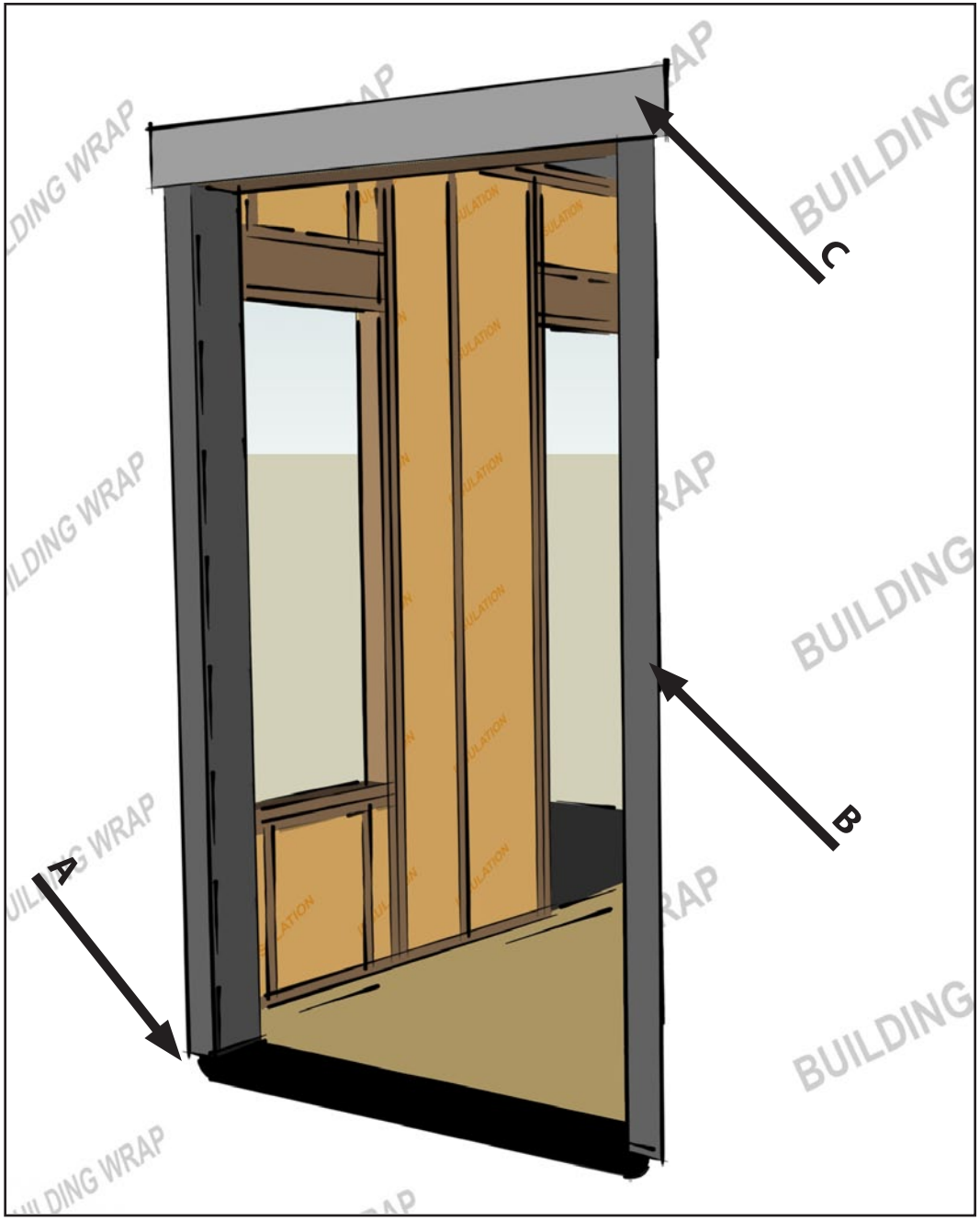
GOOD PIC OF A DIFFERENT TYPE OF WATER RESISTANT BARRIER

ENERGY STAR

DETAIL 2.3 [9]

Window and door openings fully flashed

A. Install pan flashing at sills.
B. Install side flashing that extends over the pan flashing.
C. Install top flashing that extends over the side flashing.



FOOTNOTES

9. Include pan flashing at sills, side flashing that extends over pan flashing, and top flashing that extends over side flashing.

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

2 WATER-MANAGED WALL ASSEMBLY

3 WINDOW AND DOOR OPENINGS FULLY FLASHED

A. The corners are not properly flashed, leaving a vulnerable area in the drainage system.

The flashing is properly installed to create a complete drainage system.

B. There is no flashing installed along the sides of the window.

Side flashing extends over the pan flashing.

C. There is no flashing installed at the top of the window.

There is flashing installed along the top of the window and the water-resistant barrier is layered over to create a complete drainage system.

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

SECTION 3. WATER-MANAGED ROOF ASSEMBLY

3.1. Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated with drainage plane above

3.2. For homes that don't have slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that deposits water on sloping final grade ≥ 5 ft. from foundation or to underground catchment system ≥ 10 ft. from foundation

3.3. Self-sealing bituminous membrane or equivalent at all valleys and roof deck penetrations

3.4. In 2009 IECC Climate Zones 5 and higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall.

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DETAIL 3.1 [10]

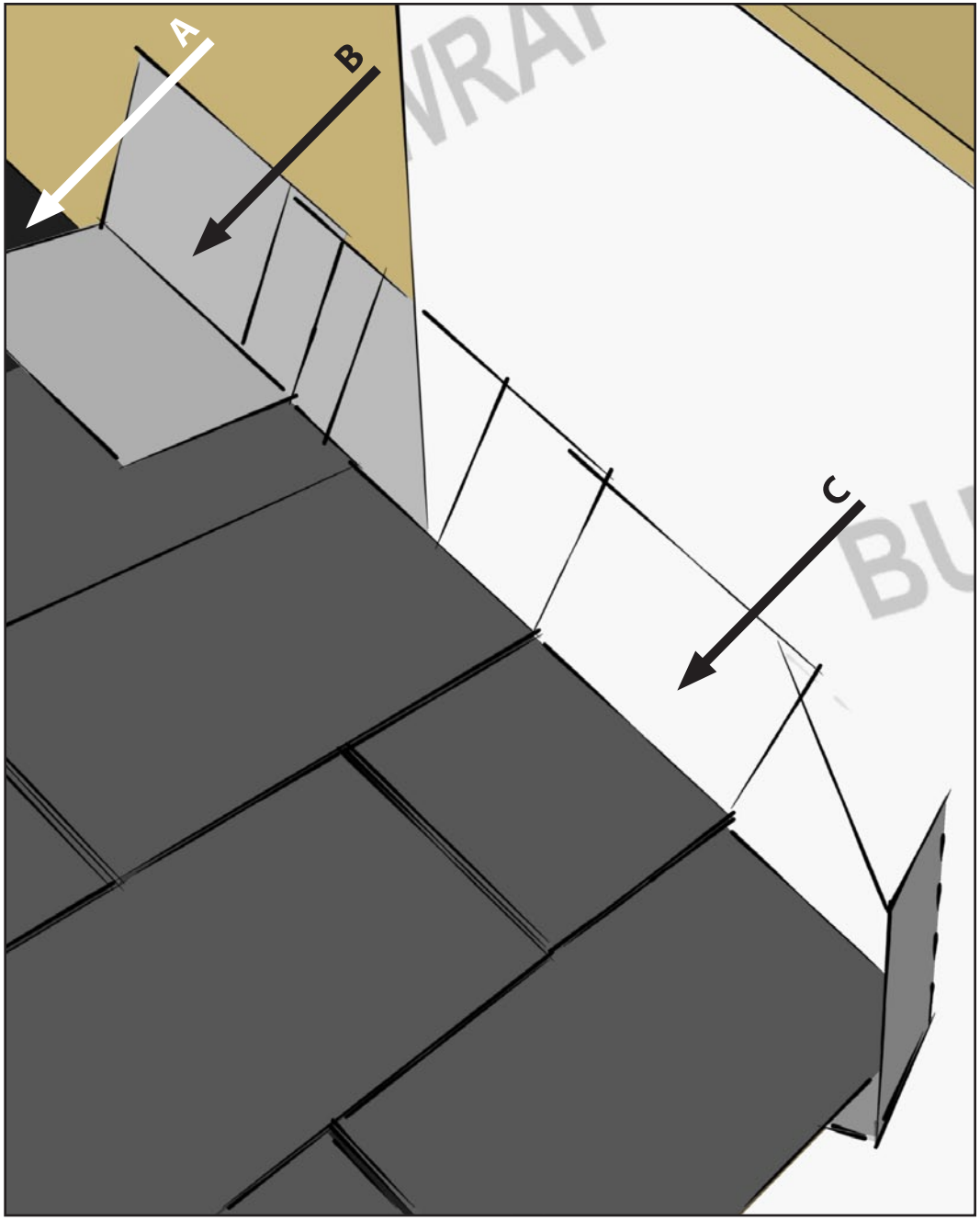
Step and kick-out flashing at all roof-wall intersections extending ≥ 4" on wall surface above roof deck and integrated with drainage plane above

A. Install roof felt prior to step and kick-out flashing.

B. Install step and kick-out flashing to extend at least 4 in. above the roof deck along the wall.

C. Install roofing shingles and building wrap over flashing.

D. If installing a metal and rubber membrane roof, install continuous flashing instead of step flashing.



FOOTNOTES

10. Intersecting wall siding shall terminate 1 in. above the roof or higher, per manufacturer's recommendations. Continuous flashing shall be installed in place of step flashing for metal and rubber membrane roofs.

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

3 WATER-MANAGED ROOF ASSEMBLY

1 STEP AND KICK-OUT FLASHING AT ALL ROOF-WALL INTERSECTIONS

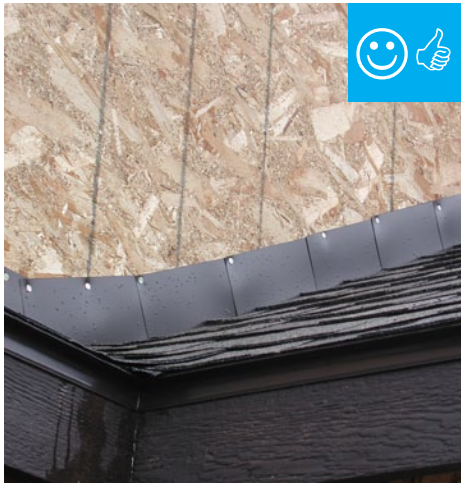
ENERGY STAR

BAD PIC OF ROOF FELT INSTALLATION

GOOD PIC OF PROPERLY LAYERED ROOFING

A.

B. The step flashing is not the required height above the roof deck.



The step flashing is the correct height above the roof deck.

C. The water-resistant barrier is layered underneath the step flashing and could create a water damage.

The water-resistant barrier is layered over the step flashing to provide a complete drainage system.

ENERGY STAR

DETAIL 3.2 [11]

For homes that don't have slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that deposits water on sloping final grade ≥ 5 ft. from foundation or to underground catchment system ≥ 10 ft. from foundation

A. Install gutters and downspouts that terminate at least 5 ft. away from foundations. **OR**

B. Install gutters and downspouts that terminate to an underground catchment system at least 10 ft. away from foundations. **OR**

C. An alternative option to gutters is to deposit rainwater to a grade-level rock bed with a waterproof liner and a drain pipe where water terminates on a sloping finish grade at least 5 ft. from foundation. **OR**

D. If a rainwater harvesting system is installed, properly design the drain to adequately manage the overflow, and meet the discharge-distance requirements above.

FOOTNOTES

11. The assessment of whether the soil is expansive or collapsible shall be completed by a certified hydrologist, soil scientist, or engineer. Gutters shall be not required in dry climates as shown in 2009 IECC Figure 301.1 and Table 301.1. A roof design without gutters is also acceptable if it deposits rainwater to a grade-level rock bed with a waterproof liner and a drain pipe that deposits water on a sloping finish grade ≥ 5 ft. from foundation. Rainwater harvesting systems may also be used to meet this requirement when designed to properly drain overflow, meeting the discharge-distance requirements above.

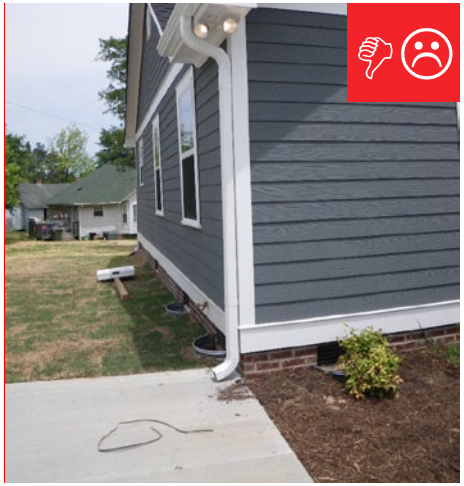
WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

3 WATER-MANAGED ROOF ASSEMBLY

2 GUTTERS AND DOWNSPOUTS EMPTY TO LATERAL PIPING THAT DEPOSITS WATER

A. The downspout terminates too close to the foundation of the house.

The downspout pipes far enough away from the foundation to prevent moisture problems.



B. The downspout terminates too close to the foundation of the house.

The downspout terminates into a catchment system that moves water away from the foundation of the house.

C. There are no gutters installed and there is not a proper gravel bed located at the foundation.

House without gutters has waterproof liner, drain tile and gravel bed extending more than 5 feet from foundation.

D. Rain barrel installed without an overflow spout that terminates away from foundation.

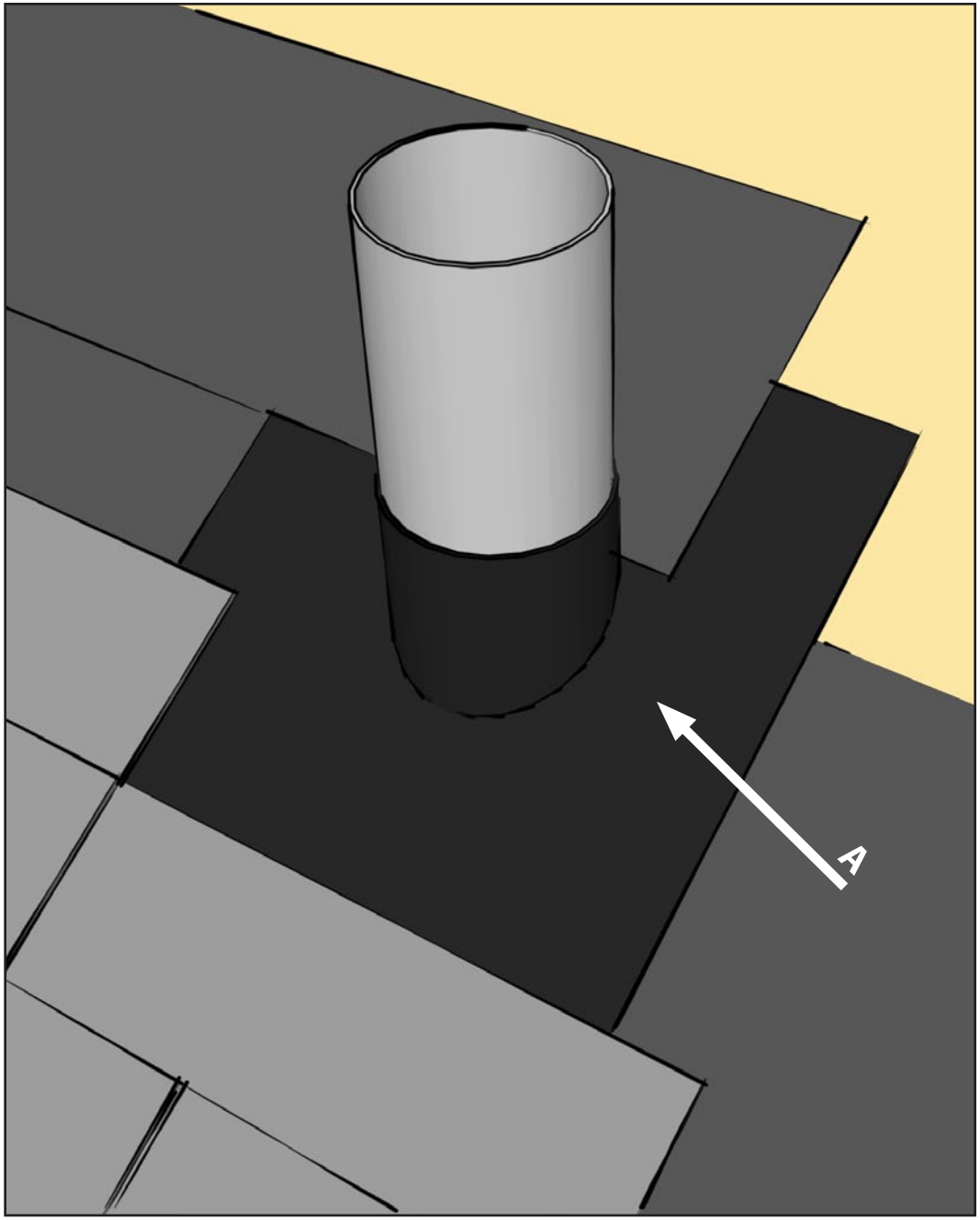
Rain barrel installed with an overflow spout terminating at least 5 feet from foundation.

ENERGY STAR

DETAIL 3.3 [12]

Self-sealing bituminous membrane or equivalent at all valleys and roof deck penetrations

A. Install a self-sealing bituminous membrane or equivalent at all valleys and roof deck penetrations prior to roofing felt.



FOOTNOTES

12. Not required in dry climates as shown in 2009 IECC Figure 301.1 and Table 301.1.

WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

3 WATER-MANAGED ROOF ASSEMBLY

3 SELF-SEALING BITUMINOUS MEMBRANE: VALLEYS AND ROOF DECK PENETRATIONS

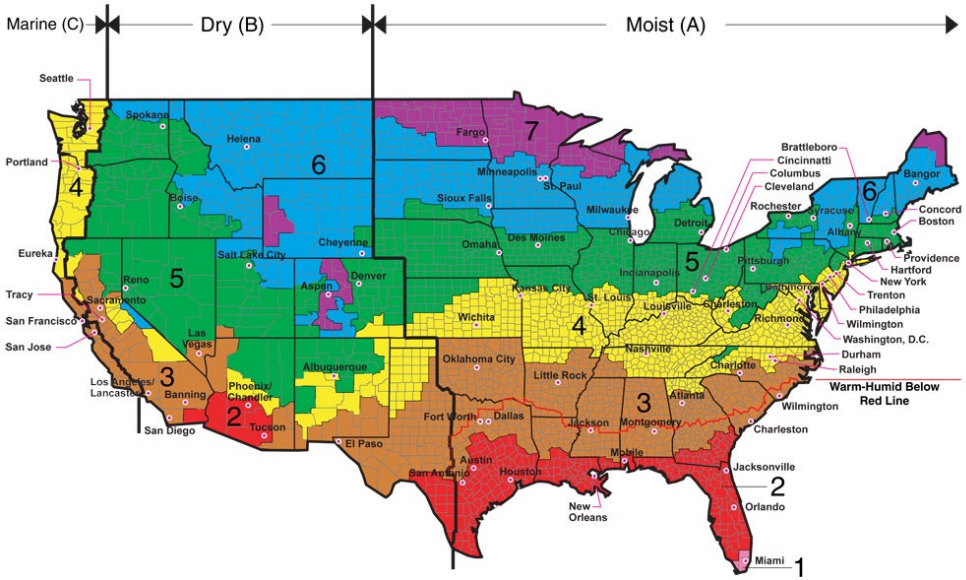
A. There is not a self-sealing bituminous membrane installed at the valley of the roof.

There is a self-sealing bituminous membrane installed at the valley of the roof prior to the roof felt.

BAD PIC OF ROOF WITHOUT MEMBRANE INSTALLED

A.

There is a properly installed and layered self-sealing bituminous membrane installed at the roof penetration.



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

CLIMATE EXCEPTIONS

Polyethylene sheeting and aggregate bed are not required in Dry (B) climates as defined by the 2009 IECC, except in U.S. EPA Zone 1 Radon areas.

2009 IECC Interactive Map:
http://energycode.pnl.gov/EnergyCodeReqs/

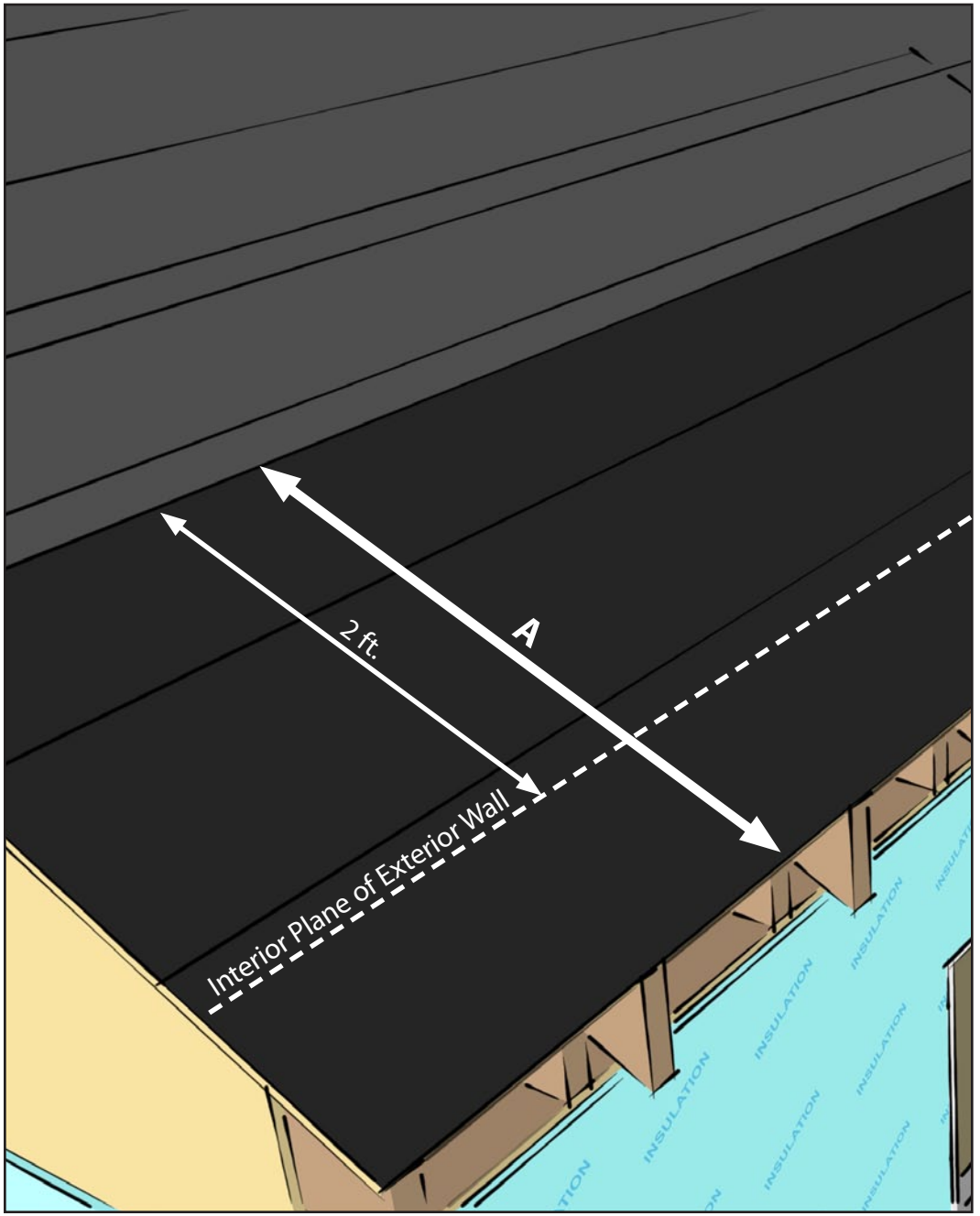
EPA recommends, but does not require, radon-resistant features for homes built in EPA Radon Zones 1, 2 and 3.

US EPA Radon Map:
http://www.epa.gov/radon/zonemap.html

DETAIL 3.4 [12]

In 2009 IECC Climate Zones 5 and higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall

A. Install a self-sealing bituminous membrane to sheathing from the edge of the roof line to at least 2 ft. beyond the interior plane of the exterior wall.



FOOTNOTES

12. Not required in dry climates as shown in 2009 IECC Figure 301.1 and Table 301.1.

BAD PIC OF NO MEMBRANE AT EAVES

GOOD PIC OF PROPERLY INSTALLED MEMBRANE AT EAVES

A.

BAD PIC OF NO MEMBRANE AT EAVES

GOOD PIC OF PROPERLY INSTALLED MEMBRANE AT EAVES

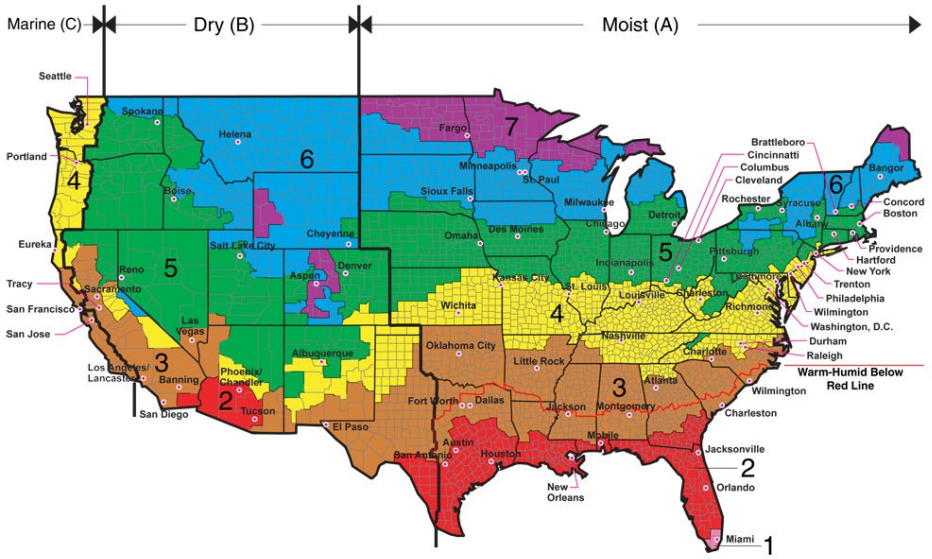
A.

CLIMATE EXCEPTIONS

A self-sealing bituminous membrane not required in Climate Zones 1-4 as defined by the 2009 IECC.

The membrane used for protection from ice dams should first be applied at the eave and extended up the roof to a point at least 24 in. inside a line projected vertically from the inside surface of the exterior wall. This is the area that needs protection from the repeated thawing and freezing of ice at the eaves. The membrane is a back-up measure of protection; to avoid warming the attic space enough to cause ice dams, air sealing must be done to keep warm house air out of the attic.

2009 IECC Interactive Map:
http://energycode.pnl.gov/EnergyCodeReqs/



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

WATER MANAGEMENT BUILDER CHECKLIST

SECTION 4. WATER-MANAGED BUILDING MATERIALS

4.1. Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers

4.2. Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used

4.3. In warm-humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls

4.4. Building materials with visible signs of water damage or mold *not* installed

4.5. Interior walls *not* enclosed (e.g., with drywall) if either the framing members or insulation products have high moisture content

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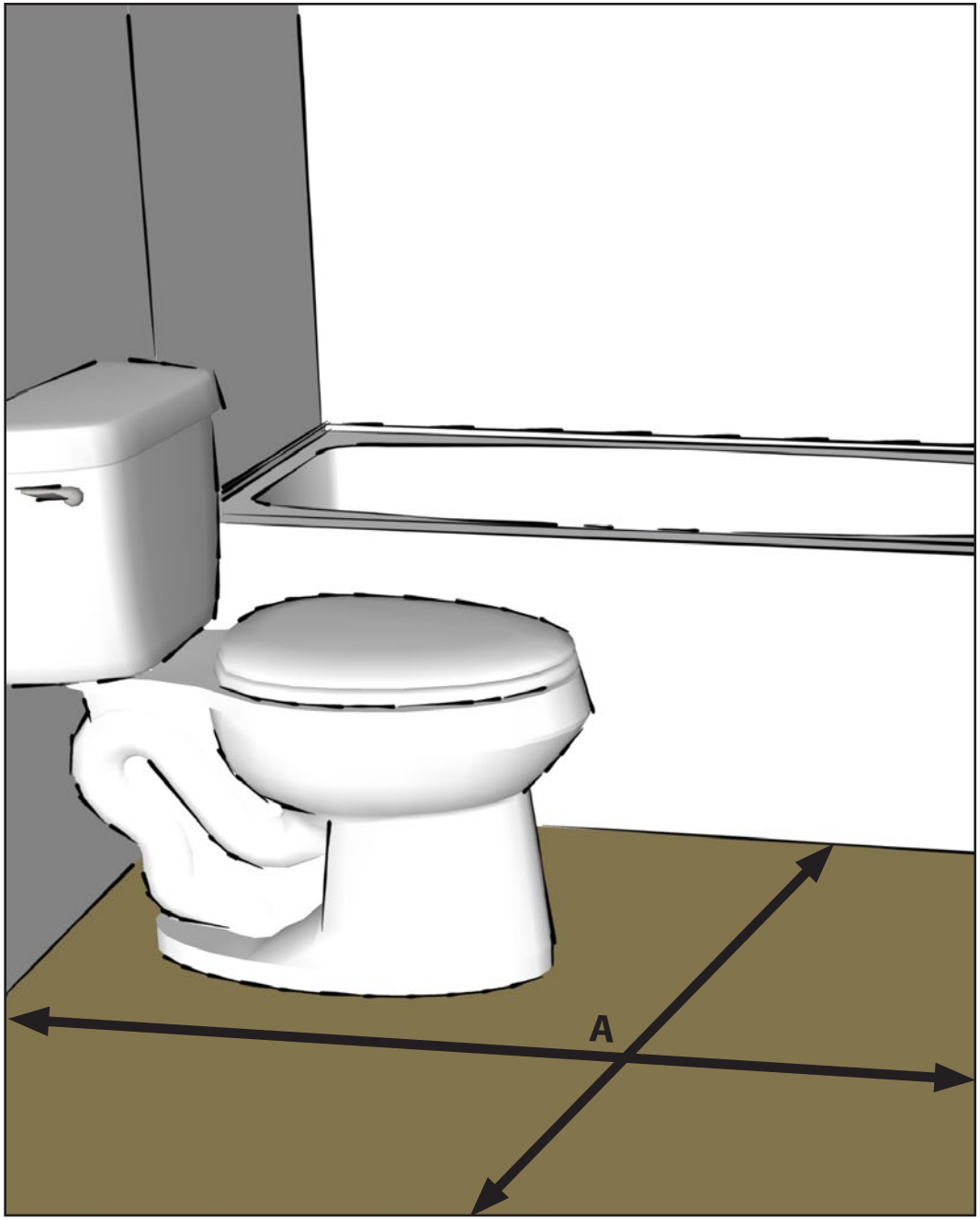
4 WATER-MANAGED BUILDING MATERIALS

1 WALL-TO-WALL CARPET *NOT* INSTALLED WITHIN 2.5 FT. OF TOILETS, TUBS, AND SHOWERS

DETAIL 4.1

Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers

A. Do not install wall-to-wall carpet within 2.5 ft. of toilets, tubs, and showers.

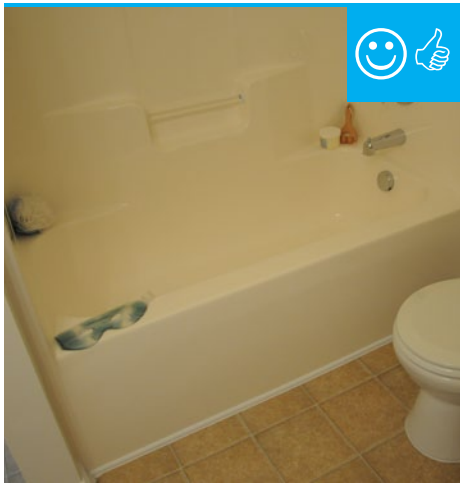


WATER MANAGEMENT SYSTEM BUILDER CHECKLIST

4 WATER-MANAGED BUILDING MATERIALS

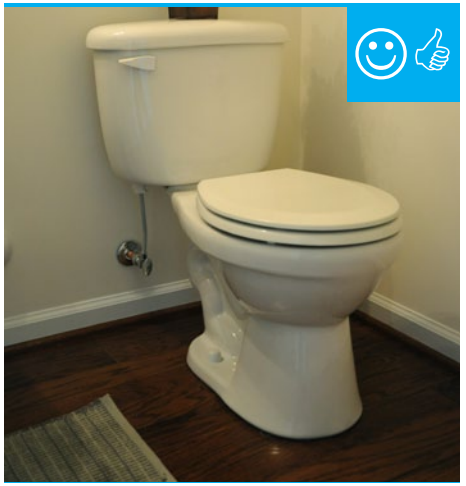
1 WALL-TO-WALL CARPET *NOT* INSTALLED WITHIN 2.5 FT. OF TOILETS, TUBS, AND SHOWERS

A. There is carpet installed too close to the plumbing fixtures in the bathroom.



There is no carpet installed in the bathroom.

A. There is carpet installed too close to the plumbing fixtures in the bathroom.



There is no carpet installed in the bathroom.

DETAIL 4.2 [13]

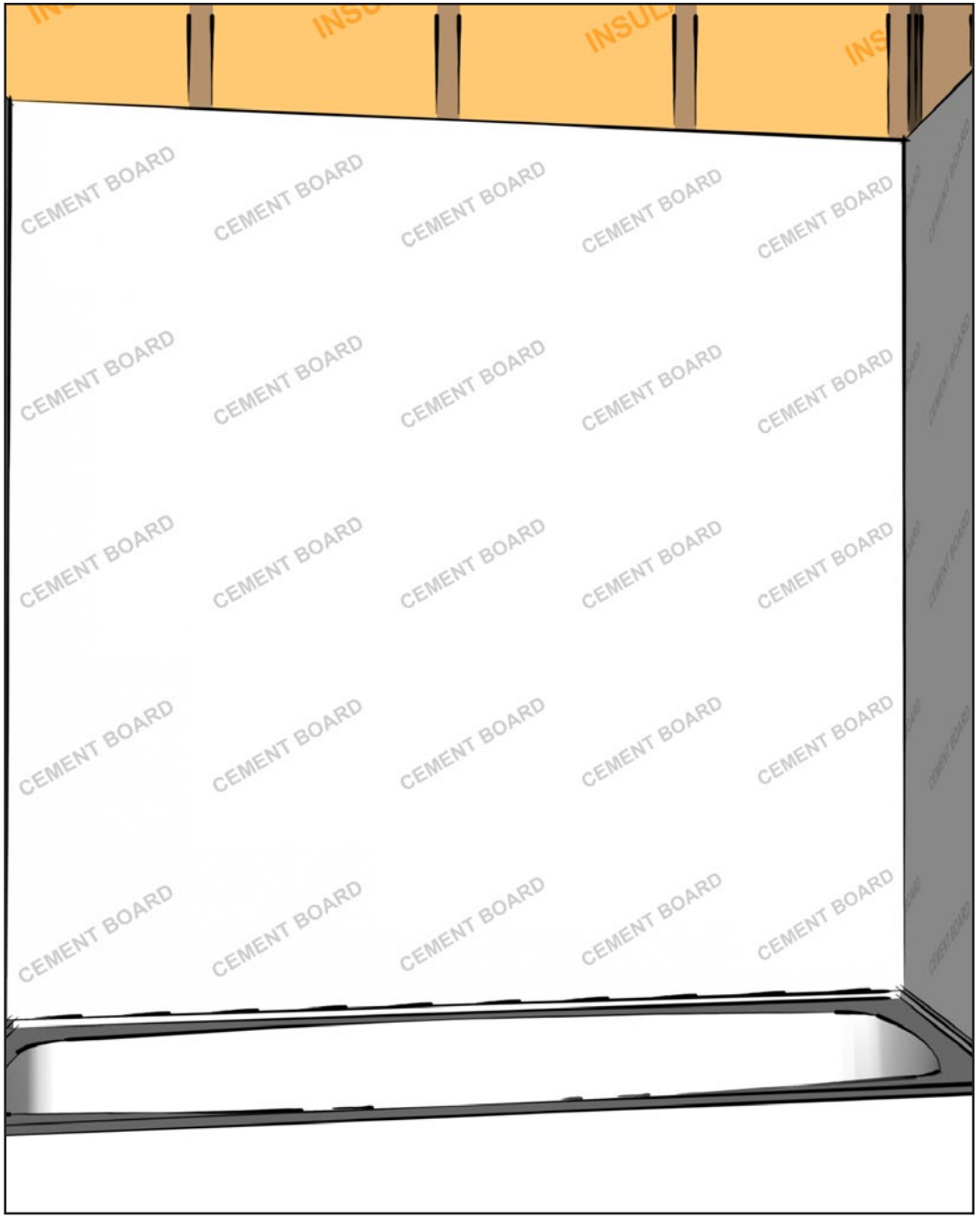
Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used

A. Install cement board or an equivalent material behind tub and shower enclosures.

B. If a monolithic tub and shower enclosure (e.g., fiberglass with no seams) is used, cement board or an equivalent material is not required, but all paper-faced backerboard must meet ASTM mold-resistant standards.

FOOTNOTES

13. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from this backing material requirement unless required by the manufacturer. Paper-faced backerboard may only be used behind monolithic enclosures and only if it meets ASTM mold-resistant standards ASTM D3273 or ASTM D6329.



4 WATER-MANAGED BUILDING MATERIALS

2 MOISTURE-RESISTANT MATERIAL INSTALLED ON WALLS BEHIND TUB/SHOWER ENCLOSURES

A. No backing installed behind shower enclosure.

Foam board taped at seams installed behind shower enclosure.

BAD PIC OF NON MOISTURE RESISTANT MATERIAL BEHIND TUB/SHOWER

B.

Moisture resistant backing material has been used above the tub enclosure.

ASTM MOLD-RESISTANT STANDARD

The current standard for mold-resistant characteristics of paper-faced backerboard is ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. This standard measures the ability of the paper-faced backerboard product to resist mold and mildew growth under certain prescribed moisture conditions.

DETAIL 4.3 [6]

In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls

A. Install materials with a permeability rating of greater than 0.1 perm on the interior of all exterior walls.

B. Impermeable materials such as ceramic tile may be used at shower and tub walls.

FOOTNOTES

6. The 2009 IRC defines Class I vapor retarders as a material or assembly with a rating of ≤ 0.1 perm, as defined using the desiccant method with Procedure A of ASTM E 96. The following materials are typically rated at ≤ 0.1 perm and therefore shall not be used on the interior side of air permeable insulation in above-grade exterior walls in warm-humid climates or below-grade exterior walls in any climate: rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, foil-faced insulating sheathings, and foil-faced non-insulating sheathings. These materials can be used on the interior side of walls if air permeable insulation is not present (e.g., foil-faced extruded polystyrene rigid insulation board adjacent to a below-grade concrete foundation wall is permitted).

Note that this list is not comprehensive and other materials with a perm rating ≤ 0.1 also shall not be used. Also, if manufacturer specifications for a specific product indicate a perm rating above 0.1, then the material may be used, even if it is in this list. Also note that open-cell and closed-cell foam generally have perm ratings above this limit and may be used unless manufacturer specifications indicate a perm rating ≤ 0.1.

Several exemptions to these requirements apply:

a. Class I vapor retarders, such as ceramic tile, may be used at shower and tub walls;

b. Class I vapor retarders, such as mirrors, may be used if they are mounted with clips or other spacers that allow air to circulate behind them.

SELECTING MATERIALS

The current code has the following definitions:

Class I Vapor Retarder: 0.1 perm or less

Class II Vapor Retarder: 1.0 perm or less and greater than 0.1 perm

Class III Vapor Retarder: 10 perm or less and greater than 1.0 perm

The current proposals are to define them this way:

Vapor impermeable: 0.1 perm or less

Vapor semi-impermeable: 1.0 perm or less and greater than 0.1 perm

Vapor semi-permeable: 10 perms or less and greater than 1.0 perm

Vapor permeable: greater than 10 perms

WHAT IS VAPOR PERMEABILITY?

Vapor permeability (commonly referred to as breathability) is a material's ability to allow water vapor to pass through it.

Moisture vapor transmission rate (MVTR) is the measurement referenced in building codes. This is measured in a lab using ASTM E96. The test method measures how much moisture vapor is allowed to pass through a material in a 24-hour period.

This measurement can be impacted by vapor pressure, so when manufacturers compare and test materials, they adjust the measurement for vapor pressure across the sample to get the moisture vapor permeance (MVP). The unit of measurement for MVP is perms.

The higher the number, the more moisture vapor the material will allow to pass, and the better drying the material allows.

The water vapor permeability of a material is roughly inversely proportional to its thickness—doubling the thickness halves the permeability.

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DETAIL 4.4 [14, 15]

Building materials with visible signs of water damage or mold *not* installed

A. Store all building materials in a dry location.

B. Visually inspect all building materials prior to installation.

DETAIL 4.5 [15]

Interior walls *not* enclosed (e.g., with drywall) if either the framing members or insulation products have high moisture content

C. Enclose interior walls if moisture content of framing and insulation is low. It is recommended that lumber does not exceed 18% moisture content.

D. If installing wet applied insulation products, follow the manufacturer's specifications.

FOOTNOTES

14. If mold is present, effort should be made to remove all visible signs of mold using detergent or other method. If removal methods are not effective, then the material shall be replaced.

15. For wet-applied insulation products, follow manufacturer's drying recommendations. As guidance, EPA recommends that lumber not exceed 18% moisture content.

A. Building materials are being stored outdoors with no protection from weather.

Shingles kept wrapped and on pallets to prevent from getting wet.

B. Building materials with visible signs of mold have been used.

Building materials were kept dry and free of mold.

C. Building materials have signs of water damage and high moisture content.

A moisture meter verifies that the moisture content of the framing is below the recommended 18%.

BAD PIC OF WET BLOWN INSULATION PRODUCT

D.

GOOD PIC OF WET BLOWN INSULATION PRODUCT

WATER MANAGEMENT BUILDER CHECKLIST

ALL FOOTNOTES

1. The specifications in this checklist are designed to help improve moisture control in new homes compared with homes built to minimum code. However, these features alone cannot prevent all moisture problems. For example, leaky pipes or overflowing sinks or baths can lead to moisture issues and negatively impact the performance of this checklist's specified features.

2. This checklist shall be provided by the Rater to the Builder who shall complete the checklist. Upon completion, the Builder shall return the checklist to the Rater for review. If desired by the Builder, the Rater may verify any item on this checklist. When this occurs, the Rater shall check the box of the verified items in the Rater Verified column. The Rater is only responsible for ensuring that the Builder has completed the Builder checklist in its entirety and for the items that are checked in the Rater Verified column (if any). The Rater is not responsible for assessing the accuracy of the field verifications for items in this checklist that are not checked in the Rater Verified column. Instead, it is the builder's exclusive responsibility to ensure the design and installation comply with the Builder checklist.

3. A completed and signed Indoor airPLUS Verification Checklist may be submitted in lieu of the Water Management System Builder checklist. For more information, see www.epa.gov/indoorairplus

4. Where setbacks limit space to less than 10 ft., swales or drains designed to carry water from foundation shall be provided. Backfill tamping is not required if proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer.

5. Polyethylene sheeting is not required in Dry (B) climates as shown in 2009 IECC Figure 301.1 and Table 301.1, except in U.S. EPA Zone 1 Radon areas. Polyethylene sheeting is also not required for raised pier foundations with no walls. In areas with free-draining soils, identified as Group 1 in the IRC by a certified hydrologist, soil scientist, or engineer through a site visit, a gravel layer or geotextile matting is not required. EPA recommends, but does not require, radon-resistant features for homes built in EPA Radon Zones 1, 2 and 3. For more information, see www.epa.gov/indoorairplus

6. The 2009 IRC defines Class I vapor retarders as a material or assembly with a rating of ≤ 0.1 perm, as defined using the desiccant method with Procedure A of ASTM E 96. The following materials are typically rated at ≤ 0.1 perm and therefore shall not be used on the interior side of air permeable insulation in above-grade exterior walls in warm-humid climates or below-grade exterior walls in any climate: rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, foil-faced insulating sheathings, and foil-faced non-insulating sheathings. These materials can be used on the interior side of walls if air permeable insulation is not present (e.g., foil-faced extruded polystyrene rigid insulation board adjacent to a below-grade concrete foundation wall is permitted).

   Note that this list is not comprehensive and other materials with a perm rating ≤ 0.1 also shall not be used. Also, if manufacturer specifications for a specific product indicate a perm rating above 0.1, then the material may be used, even if it is in this list. Also note that open-cell and closed-cell foam generally have perm ratings above this limit and may be used unless manufacturer specifications indicate a perm rating ≤ 0.1.

   Several exemptions to these requirements apply:

   a. Class I vapor retarders, such as ceramic tile, may be used at shower and tub walls;

   b. Class I vapor retarders, such as mirrors, may be used if they are mounted with clips or other spacers that allow air to circulate behind them.

7. Protected drain tile shall be installed at the footings of basement and crawlspace walls, level or sloped to discharge to outside grade (daylight) or to a sump pump. The top of each drain tile pipe shall always be below the bottom of the concrete slab or crawlspace floor. Each pipe shall be surrounded with at least 6 inches of ½ to ¾ inch washed or clean gravel. The gravel layer shall be fully wrapped with fabric cloth or drain tile pre-wrapped with a fabric filter to prevent clogging of the drain tile with sediment.

8. Any of the following systems may be used: a monolithic weather-resistant barrier (i.e., house wrap) sealed or taped at all joints; weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints; lapped shingle-style building paper or felts; or other water-resistive barrier recognized by ICC-ES or other accredited agency.

9. Include pan flashing at sills, side flashing that extends over pan flashing, and top flashing that extends over side flashing.

WATER MANAGEMENT BUILDER CHECKLIST

10. Intersecting wall siding shall terminate 1 in. above the roof or higher, per manufacturer's recommendations. Continuous flashing shall be installed in place of step flashing for metal and rubber membrane roofs.

11. The assessment of whether the soil is expansive or collapsible shall be completed by a certified hydrologist, soil scientist, or engineer. Gutters shall be not required in dry climates as shown in 2009 IECC Figure 301.1 and Table 301.1. A roof design without gutters is also acceptable if it deposits rainwater to a grade-level rock bed with a waterproof liner and a drain pipe that deposits water on a sloping finish grade ≥ 5 ft. from foundation. Rainwater harvesting systems may also be used to meet this requirement when designed to properly drain overflow, meeting the discharge-distance requirements above.

12. Not required in dry climates as shown in 2009 IECC Figure 301.1 and Table 301.1.

13. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from this backing material requirement unless required by the manufacturer. Paper-faced backerboard may only be used behind monolithic enclosures and only if it meets ASTM mold-resistant standards ASTM D3273 or ASTM D6329.

14. . 14. If mold is present, effort should be made to remove all visible signs of mold using detergent or other method. If removal methods are not effective, then the material shall be replaced.

15. For wet-applied insulation products, follow manufacturer's drying recommendations. As guidance, EPA recommends that lumber not exceed 18% moisture content.