



# **Phius Certified Building System / Panel System Program**

Requirements, Methods, and Application Agreement

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# 1. Program Overview

Passive House Institute US (Phius) developed the voluntary [Verified Building System / Panel System Program](#) to make verified performance data for opaque building components (which may include windows and doors) readily available to passive building practitioners. The scope may comprise a full construction system, or a partial system such as a wall, roof, or foundation. Manufacturers who have their building / panel system performance data verified by Phius are able to better position their products in the marketplace by providing practitioners with the information they need to specify high-performance products in their projects.

Verified products receive a program-specific Phius product performance data verification mark upon completion of the verification process. The verified product performance values will be published to the Phius Verified Building System / Panel System Database on the Phius website. These verified performance values are also periodically released in database files suitable for import to the WUFI® Passive building simulation modeling tool.

The program verifies that the system design addresses the four critical control functions of a building enclosure: water control, air control, water vapor control, and thermal control, as well as a minimum level of “critter control” (for insects and rodents). The program also verifies that the system is low risk for moisture problems.

For most of these functions, the required performance varies with climate. Verification may be sought for one or more climate zones. The climate zone system used follows the ENERGY STAR / Building America map: Subarctic, Very Cold, Cold, Mixed-Humid, Marine, Mixed-Dry, Hot-Dry, and Hot-Humid. For more information, view the [U.S. Department of Energy \(DOE\) Building Science-Based Climate Maps](#).

The building / panel system program produces certified energy performance data for passive building modeling and planning purposes. The program also verifies that the building / panel system does not use materials threatening to indoor air quality and analyzes the environmental impact of the system’s manufacturing process. There are multiple options and an extended grace period for fulfilling the environmental impact requirement.

In the text below, **yellow** is used to highlight requirements pertaining to the **builder’s manual**, application instructions or warranty of the system. **Aqua** color highlights information to be shown on the **drawings submitted for evaluation**.

## 2. Verification Requirements

### 2.1 Water Control

The building / panel system's water control layer must be clearly illustrated in the drawings submitted with the application, and the water control system must be conceptually sound. If the scope of the building / panel system's application includes residential construction, the system must also meet all applicable provisions of the [ENERGY STAR Certified Homes Version 3 Water Management System Builder Requirements](#).

Cladding and roofing materials may be 1) Included in the scope of prefabrication, 2) Included as a kit of separate materials to be attached on-site, or 3) Specified in generic terms in the application instructions for the system, to be specified in detail and acquired separately by building project teams. In any case, the design drawings must indicate at least one definite water management, cladding, and cladding attachment concept/approach.

The application instructions must include guidance on the kinds of cladding and roofing with which the system is intended to be compatible or incompatible.

### 2.2 Air Control

The building / panel system's air control layers and their connecting elements must be clearly illustrated in the drawings submitted with the application, and the air control concept must be conceptually sound, i.e., there must be a continuous primary air barrier. See [Section 6](#) for documentation examples.

The system must meet the following requirements from the *U.S. Army Corps of Engineers Air Leakage Test Protocol for Building Envelopes, Version 3, Section 2.1*:

1. Clearly identify all air barrier components of each envelope assembly on construction documents and detail the joints, interconnections, and penetrations of the air barrier components.
2. Join and seal the air barrier materials of each assembly to the air barrier materials of adjacent assemblies, allowing for the relative movement of these assemblies and components. Clearly identify air barrier system continuity on the plan and section construction drawings.
3. Provide details to seal all penetrations of the air barrier assembly, including but not limited to electrical, plumbing and HVAC components, windows and doors, and compatibility of materials with one another.
4. Support the air barrier so that it shall withstand the maximum positive and negative air pressures that will be placed on the building without displacement or damage. Forces due to pressure differences are transferred to the structure. The air barrier assembly must be durable to last the anticipated service life of the envelope.

Application instructions for the system must include advice to meet these additional provisions of the aforementioned USACE document:

- Provide a motorized damper in the closed position and connect it to the fire alarm system to open on call and fail in the open position for any fixed open louvers such as at elevator shafts. Dampers and controls shall close all ventilation or make-up air intakes and exhausts, atrium smoke exhausts and intakes, etc., where leakage can occur during inactive periods. Garages under buildings shall be compartmentalized by providing airtight vestibules at building access points. Provide airtight vestibules at building entrances with high traffic.
- Compartmentalize spaces under negative pressure such as boiler rooms and provide make-up air for combustion.

In multi-unit construction, the air barrier system may also be required by building codes to have fire or sound resistance ratings for the inter-unit separations. Such requirements are outside the scope of the Phius Verified Building System / Panel System Program.

## 2.3 Water Vapor Control

The building / panel system's main assemblies must be low risk for moisture problems. As in the Phius+ 2015 whole-building certification program, there are three compliance paths: 1) Meet the prescriptive guidelines in Section 3.4.1 of *High-Performance Enclosures* (Straube 2012)\*, 2) Pass a WUFI hygrothermal assessment performed by Phius for two representative cities per climate zone, or 3) Be stamped by a professional engineer.

\*Exception: Exterior load-bearing double-stud wall systems require WUFI hygrothermal assessment for climate zones other than Hot-Dry and Hot-Humid.

## 2.4 Thermal Control

The building / panel system's thermal performance must be assessed by calculations, all of which must be performed by Phius. The R-values of opaque components, including the effect of a pattern of fasteners penetrating an insulation layer, must meet the minimum values given in Table 1: Thermal Performance Criteria below.

Window condensation resistance must be assessed according to current protocol in the [Phius+ 2015 Certification Guidebook](#), and must also meet the minimum values given in Table 1.

Surface temperature factors must be calculated for the following linear connections, and must meet the minimum values for the climate given in Table 1.

- Foundation perimeter
- Roof eave
- Roof rake
- Roof parapet
- Roof ridge/hip
- Exterior wall corner
- Reentrant wall corner

- Roof to wall above (wall to roof below)
- Overhanging floor at outside corner
- Floor to floor rim joist (wall to interior floor)
- Window sill
- Window jamb
- Window head
- Skylight curb
- Door sill

A “system” cannot consist only of assemblies but must include some of the above connection details. A full building system should include almost all of them.

Linear and/or point thermal bridge coefficients must be calculated for any connections which appear significantly bridged.

At the manufacturer’s option and for additional cost, Phius will calculate and report all of the linear thermal bridge coefficients in the system.

**Table 1.** Thermal Performance Criteria

| Zone                | Minimum Surface Temperature Factor | Minimum Wall / Roof R-value (IP) | Minimum Foundation Insulation (against ground) | Minimum Window Condensation Resistance |
|---------------------|------------------------------------|----------------------------------|------------------------------------------------|----------------------------------------|
| Subarctic           | 0.73                               | 60 / 80                          | Whole slab R-40                                | 0.74                                   |
| Very Cold           | 0.70                               | 55 / 75                          | Whole slab R-30                                | 0.67                                   |
| Cold                | 0.69                               | 40 / 65                          | Whole slab R-20                                | 0.63                                   |
| Mixed-Humid         | 0.67                               | 25 / 50                          | 2 ft. R-20 vertical perimeter                  | 0.56                                   |
| Marine              | 0.72                               | 24 / 45                          | 4 ft. R-20 vertical perimeter                  | 0.54                                   |
| Mixed-Dry / Hot-Dry | 0.57                               | 18 / 40                          | No minimum                                     | 0.63                                   |
| Hot-Humid           | N/A                                | 12 / 30                          | No minimum                                     | 0.57                                   |

It is recommended to follow the guidelines in the [Phius Verified Window Performance Data Program](#) with regard to window U-values and solar heat gain coefficients.

### 2.4.1 Window substitutions

The scope of verification may include window installation thermal bridge coefficients. This may be done using specific windows modeled in THERM or using Phius generic windows (derived from EWC/RESFEN parameters.) In case of a window substitution, verification remains valid, and the psi-install numbers need not be recalculated, for these changes:

For specific THERM-modeled windows:

The glazing, the IGU, is swapped out for something else with the same overall thickness or number of panes.

The frame width changes by less than 15%, while the materials and frame depth remain the same.

For the generic windows, psi-install verification is considered valid for any window with the same frame material class and with the same overall glazing thickness or number of panes.

See Section 3.1 for the cost impact of window substitutions.

### 2.5 Critter Control

The building / panel system must include a critter control function at the following kinds of connections (refer to [Section 6](#) for examples).

- Overhanging floor at outside corner
- Wall to foundation
- Deck connection to base of wall

Additional measures may be identified during the Evaluation phase, which would be required for verification under this program.

Also, following Section 3 of the [EPA Indoor airPLUS Version 1 Construction Specifications](#), corrosion-proof rodent/bird screens must be installed at all openings that cannot be fully sealed, with the exception of dryer vents.

As with cladding and roofing materials, critter control materials may be 1) Included in the scope of prefabrication, 2) Included as a kit of separate materials to be attached on-site, or 3) Specified in generic terms in the application instructions for the system, to be specified in detail and acquired separately by building project teams. In any case, **the design drawings must indicate at least one definite concept/approach.**

## 2.6 Health / Indoor Air Quality

A Phius+ Rater / Verifier must verify, by on-site inspection at the factory, that the building / panel system meets the materials provisions in Section 6 of the [EPA Indoor airPLUS Version 1 Construction Specifications](#), as summarized below:

- Wood materials must be certified low-formaldehyde composite, structural plywood and OSB must be PS1 or PS2 compliant.
- Interior paints and finishes must be certified low-VOC or no-VOC.
- Carpet and carpet adhesives must be certified CRI Green Label Plus, carpet cushion must be certified CRI Green Label.

In addition, the builder's manual for the system must call for finishing the building in compliance with said checklist and the system warranty must contain provisions voiding the warranty if the building is not finished in compliance with said checklist.

## 2.7 Sustainability Assessments or Certifications

The blowing agents for any extruded polystyrene or spray polyurethane foam products used over broad areas in assemblies must be disclosed, and necessary calculations performed using the [Phius Insulation Global Warming Potential Calculator](#). Products used only in spot or linear patterns such as door installation and rim joists are exempt from this requirement.

The building / panel system must obtain one of the following sustainability assessments or certifications. There is a grace period of 30 months (from July 2017) on the selection of the compliance path, and a grace period of 60 months on obtaining the credential.

1. Environmental Product Declaration (EPD) according to the ISO 14025 family of standards, such as ISO 14044 - Compliant Life Cycle Assessment and ISO 21930 - Compliant Product Category Rule. Underwriters Laboratories (UL) is the leading program operator for EPDs in North America. Other organizations performing these functions include ASTM International, NSF International, ICC Evaluation Service, and the Institute for Environmental Research and Education (IERE). Refer to the [UL Product Category Rules for Preparing an EPD for Product Groups](#) for more information.
2. DECLARE listing or [Living Product Challenge](#) certification from the International Living Future Institute.
3. UL Environment [ECOLOGO Product Certification](#) for any and all of the following component materials used in the building / panel system: Gypsum Boards and Panels (UL 100), Plastic Film Products (UL 126), Sealants and Caulking Compounds (UL 2761), Adhesives (UL 2762), Paint, Stain, Varnish (UL 2768), Construction Steel (UL 2840), Thermal Insulation (UL 2985).
4. Overall, Bronze level or higher certification from the [Cradle-to-Cradle Products Innovation Institute](#).
5. Benchmark level 3 or higher from [GreenScreen® for Safer Chemicals](#).

### 3. Verification Process and Required Documentation Checklists

#### 3.1 Scope and Pricing Phase

The manufacturer must provide the following information in order to initiate the Scope and Pricing phase:

- Types of construction. Check all that apply:
  - Residential
  - Non-residential
- The climate zones for which verification will be sought. Check all that apply:
  - Subarctic
  - Very Cold
  - Cold
  - Mixed-Humid
  - Marine
  - Mixed-Dry
  - Hot-Dry
  - Hot-Humid
- The number of assemblies:  **$N_a$**  = \_\_\_\_
  - This is the number of functionally or conceptually different assemblies; e.g., walls are different from roofs, interior load-bearing walls are different from exterior load-bearing walls, vented attics are different from flat roofs.
  - Assemblies that vary only by thickness of insulation count as one.
- The number of low thermal inertia elements (window frame types):  **$N_{fen}$**  = \_\_\_\_
- The total number of linear connection details:  **$N_{2d}$**  = \_\_\_\_
- The number of linear connection details and penetrations requiring thermal bridge calculation:  **$N_{psi}$**  = \_\_\_\_
- The number of hygrothermal assessments to be run in WUFI:  **$N_{hyg}$**  = \_\_\_\_
- Are all linear thermal bridge coefficients to be calculated, by manufacturer's request?  
Check one:
  - Yes
  - No
- Approach for windows – check one:
  - Use specific Phius-verified windows
  - Submit institutional 3<sup>rd</sup>-party THERM models of the windows (e.g., from NFRC-qualified simulation labs, IFT Rosenheim).
  - Use Phius generic window models and specify the overall thickness of the glazing or the number of panes. (These are based on the EWC/LBL/RESFEN generic frames, namely Metal, Thermally-broken Metal, Nonmetal, and Nonmetal Improved.

Submit 2<sup>nd</sup>-party THERM models for the windows, i.e., from the panel system submitter, the window manufacturer, or consultants hired by them, whose work is not backed by an institution. These must be submitted along with drawings and a bill of materials and will require additional verification. The number of such frame cross sections is denoted *Nfenframe* in the pricing formula. Unlike for *Nfen*, sill, jamb, head, meeting rails etc. count separately if the profiles for those members are different.

Panel/system manufacturer and window manufacturer will share the cost of full-service window verification under the Phius window program, either Blue Path or Orange Path.

- Any necessary improvements to the documentation.

Once the manufacturer has provided all of the above information, the pricing for the Evaluation phase of verification is calculated according to the following formula:

- $\$ = 150 \cdot (2 + 0.5 \cdot N_a + 0.6 \cdot N_{2d} + 0.4 \cdot N_{psi} + 1.5 \cdot N_{hyg} + 0.2 \cdot N_{fen} + N_{fenframe}) + \$R_{ater}$ 
  - where  $\$R_{ater} = \$750$
  - Note that there is no charge for the Scope and Pricing phase itself.

In the drawings for the Evaluation phase, identify components of the assemblies that perform necessary building enclosure functions using the following key (see [Section 6](#) for examples):

WCS – component of water control system

ACS – component of air control system

VCS – component of vapor control system

TCS – component of thermal control system

CCS – component of critter control system

Documentation submittal checklist for the Scope and Pricing phase:

Pre-existing shop drawings

Pre-existing narrative or sell sheet

Builders' manual

Warranty for the building / panel system updated with IAQ provisions

### 3.2 Evaluation Phase

Upon the manufacturer's:

- Acceptance of the price quote
- Payment of the Evaluation fee
- Updates to the documentation

Phius will calculate the R-values of assemblies, surface temperature factors of all linear connections, thermal bridge coefficients of any problematic linear connections and penetrations, and condensation resistance of low thermal inertia elements.

Checklist for the Evaluation phase:

- Perform any necessary hygrothermal analyses
- Coordinate a Phius+ Rater / Verifier factory inspection
- Identify any deficiencies and suggest improvements

### 3.3 Verification and Maintenance Phase

It is not expected that the results of the Evaluation phase will be satisfactory in all respects, but rather that it will reveal opportunities for improvement, with varying degrees of benefit relative to the effort required to make the change. The Verification and Maintenance phase consists of back-and-forth rounds of exchange between Phius and the manufacturer. In response to the Evaluation report, the manufacturer may submit modifications to the provided information for re-evaluation by Phius. The price for each round of review is quoted by Phius accordingly. The process continues until all the requirements for Verification are met, or until the manufacturer declines to pursue Verification any further.

## 4. Manufacturer's Privileges and Obligations

- The product manufacturer, the specific product, and the verified building / panel system's performance values will be published to the Phius Verified Building System / Panel System Database on the Phius website.
- Verification and listing in the databases continue for a period of five (5) years or until the manufacturer makes any changes to the design/composition of the product. The manufacturer must inform Phius when any pertinent changes to the building / panel system are made that would impact the performance values. In case of no change after five years, the verification can be renewed for an additional five-year period for a nominal fee of \$1000. In case of a product change, the manufacturer's verification automatically expires; the modified product would need to be re-verified to be renewed for a new five-year period.
- The verification of performance data is product specific. The certification mark logo *is not transferable* to other products of the same manufacturer.
- Subject to the terms of a separate written license, the manufacturer may use the graphic passive house certification mark logo in conjunction with the product and verified performance data only. The manufacturer will be granted access to the certification mark logo according to use guidelines issued by Phius to designate the Phius Verified Product status.
- Phius reserves the right to terminate and revoke the Phius Verified Product Certificate and all rights of use of the graphic passive house certification mark logo if the manufacturer:
  - Falsely represents the product data in the marketplace, documents submitted with the application, or any material misrepresentation made by the manufacturer; or
  - Submits falsified information to obtain the verification for a product, or
  - Promotes products as having obtained Phius Verified Product evaluation while they have not.
- Manufacturers who are sponsors of the Passive House Alliance US (PHAUS) may receive, depending on sponsorship level, discounts on the verification fee as listed under the membership benefits.
- Phius will deliver the following calculated values to the manufacturer:
  - R-values of the main assemblies
  - Surface temperature factors of all linear connection details
  - Any thermal bridge coefficients calculated for linear connection or penetration details
  - Condensation resistance of low thermal inertia elements

By signing this application form, the program registrant agrees that he/she has read and agrees to the terms of the "Phius Verified Building System / Panel System Program." The registrant agrees to acknowledge, accept, and abide by Phius verification determination procedures. Phius reserves the right to update or change the requirements of this program at any time.

## 5. Signature Page

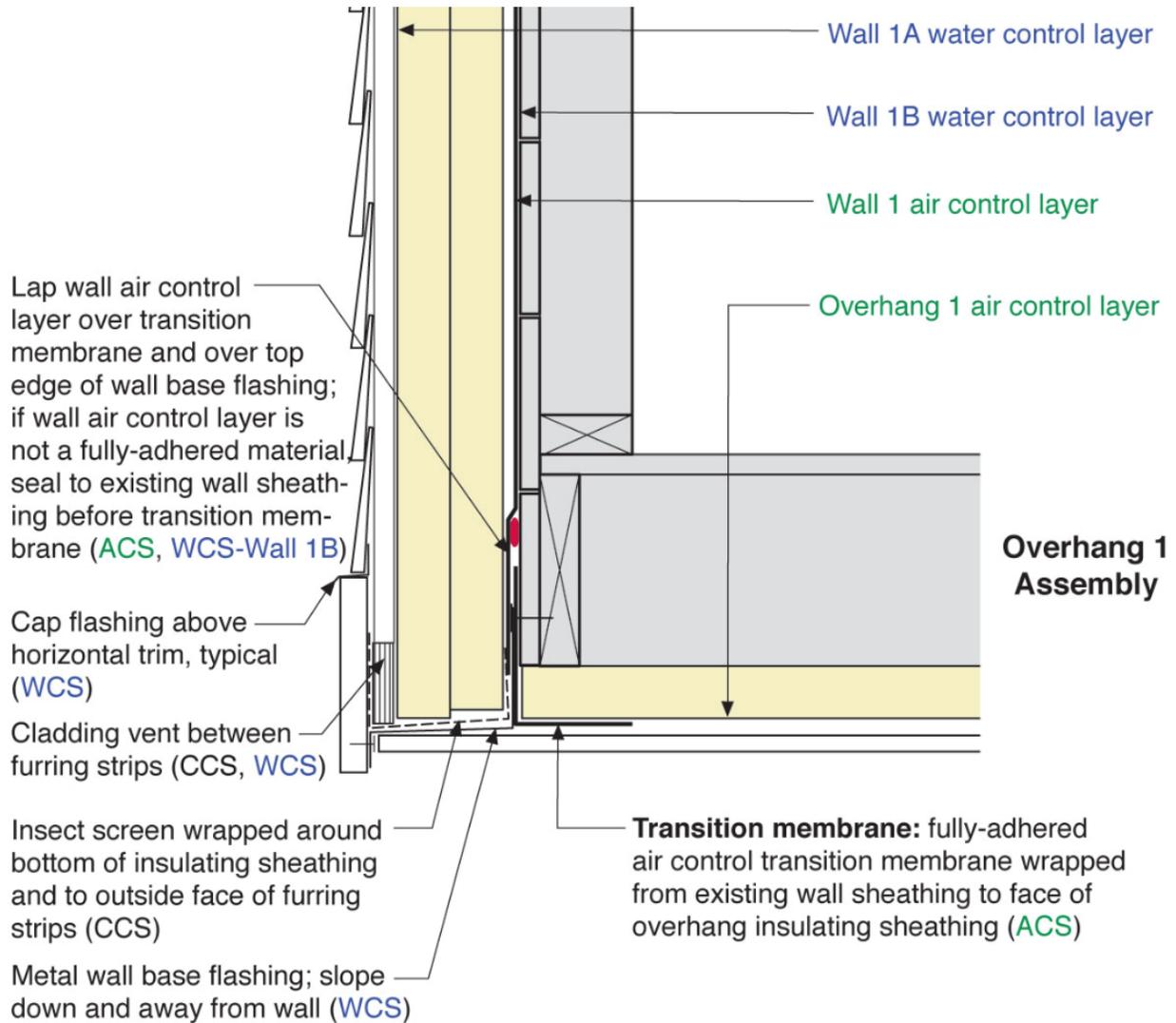
### Application to Verify Performance Data for a Building System / Panel System

| <i>General Information for the Application Process</i>                                                          |                                                            |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Manufacturer *                                                                                                  | ←                                                          |
| Product Name*                                                                                                   | ←                                                          |
| Representative Contact Person *                                                                                 | ←                                                          |
| Street Address *                                                                                                | ←                                                          |
| City, State ZIP *                                                                                               | ←                                                          |
| Phone *                                                                                                         | ←                                                          |
| E-mail *                                                                                                        | ←                                                          |
| Please attach Required Documentation (see <a href="#">Section 2</a> )                                           |                                                            |
| Attached Yes <input type="checkbox"/> No <input type="checkbox"/>                                               |                                                            |
| E-Mail *                                                                                                        |                                                            |
| <i>(Business email address for Representative of Manufacturer required)</i>                                     |                                                            |
| Website URL                                                                                                     | http://                                                    |
| PHAUS Sponsor                                                                                                   | Yes <input type="checkbox"/> No <input type="checkbox"/> ← |
| I have read and agree to the terms of the "Phius Verified Building System / Panel System Program" Instructions. |                                                            |
| Signature * _____<br>Type "X" to indicate electronic signature<br><br>Date * _____                              |                                                            |

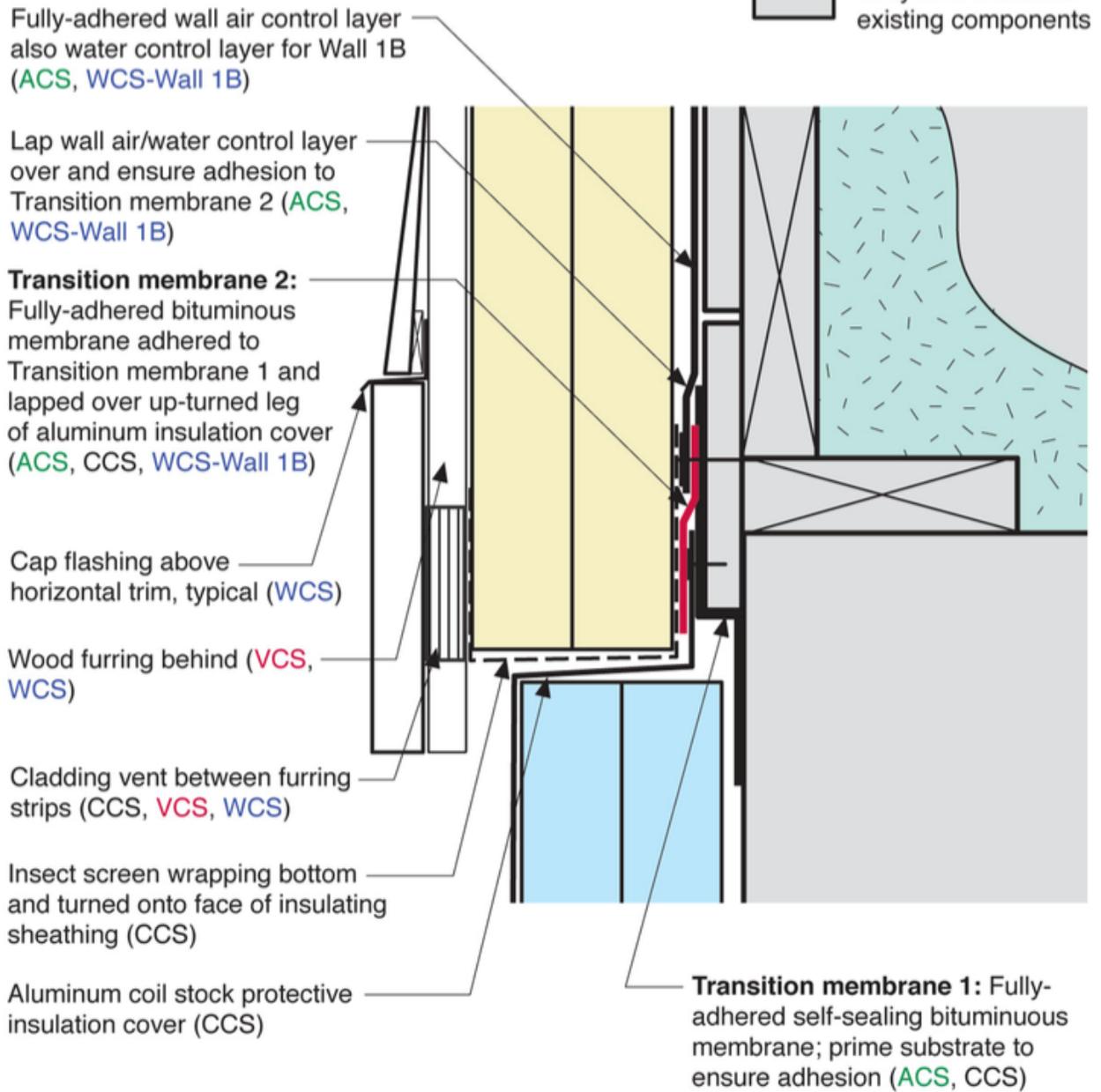
\* Required Information

## 6. Supplemental Information

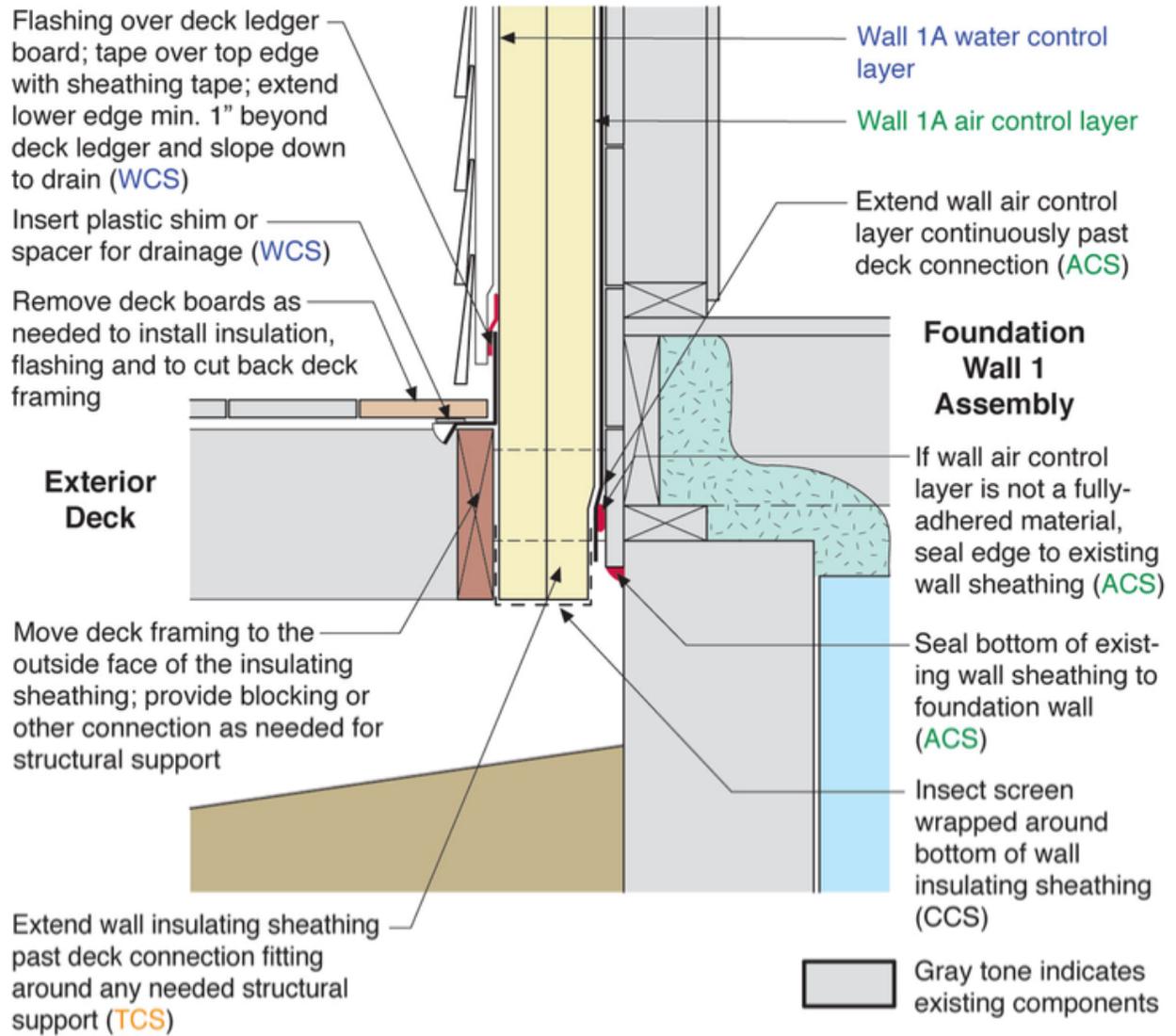
The following figures illustrate the documentation of assemblies and details as found in the Mass Save Deep Energy Retrofit Builder Guide, Building Science Corporation (2013).



**Figure 1.** Example drawing of wall to overhanging floor at outside corner (MSDERBG, p. 112).



**Figure 2.** Example drawing of wall to foundation (MSDERBG, p. 134).



**Figure 3.** Example drawing of deck to base of wall (*MSDERBG*, p. 162).