



PHIUS+ Certification for Multifamily Performance Requirements (v2.1)¹

Program Overview

PHIUS+ Certification is available to multifamily housing developments of any permitting type or size throughout North America. The PHIUS+ Certification standard is a performance-based, low-energy building certification standard that emphasizes robust envelope construction, effective air tightness to promote resilient building assemblies, and high-performance HVAC design and commissioning to ensure occupant comfort and health.

PHIUS+ Certification is applied to projects on a per-building basis², with energy performance metrics based on square foot of Interior Conditioned Floor Area (iCFA)³. Design and primary project energy modeling is performed by the PHIUS Certified Passive House Consultant (CPHC), while on-site verification of the PHIUS+ certification projects and their systems is performed by a PHIUS+ Certified Rater or PHIUS+ Certified Multifamily (MF) Verifier.

In addition to demonstrating compliance with rigorous energy performance metrics, PHIUS+ certified projects must also meet or exceed the certification criteria of the EPA ENERGY STAR Version 3.0 New Homes (ESv3) and DOE Zero Energy Ready Homes (ZERH) programs, along with other PHIUS-specific on-site verification criteria⁴.

Performance Criteria

Multifamily projects shall demonstrate compliance with the following performance metrics using WUFI Passive software⁵

- **Annual Heating/Cooling Demand:** $\leq A$ (heating demand kBTU/iCFA.yr) **and** $< B$ (cooling demand kBTU/iCFA.yr), where A and B are climate-specific criteria by location⁶
- **Peak Heating/Cooling Load:** $\leq C$ (peak heat load BTU/iCFA.hr) **and** $< D$ (peak cooling load BTU/iCFA.hr), where C and D are climate-specific criteria by location⁷
- **Primary Energy Demand:** ≤ 6200 kWh/yr/person. Occupancy is determined by the # of bedrooms + 1, per unit.⁸

In addition to the iCFA-based energy performance metrics listed above, all projects shall meet the following additional on-site verified certification criteria:⁹

- **Whole-building air tightness:** ≤ 0.050 CFM@50 Pa (0.080 CFM@75 Pa) /sqft of building shell¹⁰
- **Dwelling unit compartmentalization:** 0.30 CFM@50 Pa/sqft of dwelling unit shell ¹¹

- Heating and cooling air distribution system tightness testing [12](#)
- Heating, cooling and ventilation air distribution system measurement and balancing [13](#)
- Hydronic heating, cooling and hot water systems appropriately tested and balanced [14](#)
- Installed HVAC, pump, motor, and lighting verification and electrical measurement [15](#)
- Demonstration of compliance with all Esv3 and DOE checklist certification criteria [16](#)
- Verification of renewable energy system installation, or renewable ready. [17](#)

Certification Review Process and Pricing

To begin PHIUS+ certification process, all multifamily projects pursuing PHIUS+ certification must be registered with PHIUS for pre-certification. During pre-certification review, the PHIUS Certification team shall review project design and preliminary energy model. Prior to the start of this review, project teams shall be invoiced for 50% of the quoted project certification fee upon registering and for the remaining 50% of the fee when the project is pre-certified. Quotes are based on the iCFA of the respective project. To request a quote please contact certification@passivehouse.us.

After initial review of energy model and project design, project teams shall confer with the PHIUS Certification team and make any design/modeling alterations deemed necessary until the project reaches pre-certification. All critical design and project efficiency strategies shall be communicated to the project PHIUS+ Rater/MF Verifier to ensure on-site verification of these items is performed. [18](#)

Once all on-site testing and verification has been completed, the PHIUS+ Rater/MF Verifier shall submit final testing and verification reports to the CPHC for incorporation into the final project energy model, which shall be submitted to PHIUS for final certification review. Additionally, the PHIUS+ Rater/MF Verifier shall complete and submit the *PHIUS+ Quality Control Workbook for Multifamily Projects* along with all supporting documentation to the PHIUS+ QA/QC Manager for review and approval. [19](#)

Upon approval of final project energy model and on-site verification documentation, the project shall become a PHIUS+ Certified project. The project shall then be eligible for being listed in the online database of PHIUS+ Certified projects, as well as to purchase a plaque to display certification achievement.

Effective Date

The effective date of this v2.1 standard for certification of multifamily buildings shall be for any projects contracted with PHIUS on or after March 1, 2017. Any projects registered with under PHIUS prior to this date shall be encouraged but not required to follow this version's protocol, and shall achieve certification based on the certification criteria agreed upon by the project and PHIUS upon original registration of project.

Notes

1. The Version 2.1 of the PHIUS+ certification criteria for multifamily buildings is intended to replace the previous v2.0 standard. This certification criterion and all associated workbook requirements must be completed in full for all PHIUS+ Certified Multifamily projects pre-certified after the Effective Date above.
2. Projects seeking certification that contain multiple detached buildings must have an individual energy model that demonstrates compliance for each building in the development.
3. iCFA shall be measured in the following manner:
 - All floor area of interior space at least 7' in height measured from the interior finished surfaces that comprise the thermal boundary of the building. Spaces that are open to below shall not be counted. (The general concept is "walkable").
 - Other than open-to-below, the projected floor area of all spaces within this shall count towards the iCFA measurement, including interior walls, cabinets, mechanical spaces, storage, etc.
 - Projected floor area of stair treads counts towards iCFA on all floors, that is, once per floor. (By the 7' height rule, some floor area under the stairs on the 1st floor would be excluded. This conflict is resolved by including it).
4. All PHIUS+ Certified projects must meet the certification criteria of the current revision of the ESv3 and ZERH programs at the time that the project is permitted, as well as additional on-site verification criteria as contained in the *PHIUS+ On-Site Quality Control Workbook for Multifamily Projects* and associated checklists. Any building as part of a project that meets the eligibility criteria for ESv3 and ZERH shall additionally be fully certified under both programs, with the exception of projects in California, Alaska, and outside the USA.

The eligibility criteria for these programs include:

- Any multifamily building with 4 units or fewer; OR
- Multifamily buildings with 3 stories or fewer above-grade OR
- Multifamily buildings with 4 or 5 stories above-grade where dwelling units have their own heating, cooling, and hot water systems, separate from other units, and where dwelling units occupy 80% or more of the occupiable square footage of the building. When evaluating mixed-use buildings for eligibility, exclude commercial / retail space when assessing whether the 80% threshold has been met.
- Multifamily buildings with 4 or 5 stories above-grade that meet the above criteria, but that have central water heating system for domestic hot water are eligible for certification if solar energy provides at least 50% of the domestic hot water needs for the residential units.

Additional footnotes regarding eligibility for multifamily buildings is contained in the footnotes of the [ENERGY STAR Version 3 National Program Guidelines](#).

Multifamily buildings that are not eligible for certification based on these criteria cannot be certified under ESv3 and ZERH, and therefore shall not be required to do so for PHIUS+ certification. However, the certification checklist criteria for these programs shall still be achieved and documented through the *PHIUS+ On-site Quality Control Workbook for Multifamily Projects* and associated checklists. Specifically:

- Building envelope construction checklist items for air sealing, thermal bridging reduction, and water management strategies as specified by the ESv3 program shall be met for the entire project.
- HVAC design, installation, testing and commissioning checklist items shall be met for all dwelling units within the project, while HVAC systems for common spaces shall meet the design and commissioning requirements specified by this Standard.
- DOE ZERH requirements that affect dwelling units (the use of ENERGY STAR appliances, efficient lighting, hot water temperature rise testing) shall be implemented for all dwelling units. All other program criteria (heating/cooling ducts within conditioned space, high-efficacy lighting, ENERGY STAR appliances, solar-ready construction, and EPA Indoor airPLUS certification criteria) shall be met for the entire project.

All certified buildings must meet the [ENERGY STAR Multifamily High Rise](#) requirements for lighting and pump motor efficiency shall be met for the entire project. PHIUS encourages, but does not require, that such ineligible projects also meet the criteria of and certify under the EPA ENERGY STAR Multifamily High Rise, LEED Multifamily, and/or National Green Building Standard Multifamily programs.

5. Projects attempting certification under these Version 2.1 standards shall be required to demonstrate compliance with the per iCFA energy metrics using WUFI Passive software. PHIUS shall reserve the right on a case-by-case basis to accept energy models created using Passive House Planning Package (PHPP) software.
6. The heating and cooling criteria are determined from formulas based mainly on local climate factors including degree-days, outdoor design temperatures and design humidity, and annual solar radiation. A map of such values can be found [here](#). The formulas were developed from life-cycle cost optimization studies. As a result the heating criteria also depend secondarily on energy prices (on a state-by-state average basis), because higher electricity prices justified more investment in heat-saving upgrades. The energy price effect was not statistically significant for cooling, thus the cooling criteria depend only on climate factors.
7. PHIUS will accept peak loads generated by either WUFI software, or ACCA Manual J 8th Edition residential load calculation software. For buildings in which Manual J load calculation procedures are inappropriate, PHIUS will consider the use of ACCA Manual N or ASHRAE load calculations on a case-by-case basis.

8. For buildings where occupancy is predetermined by space use or permitting constraints, such as dorms or senior housing, primary energy calculations shall be based on true occupancy density instead of bedrooms plus one.
9. PHIUS accepts Sampling as a method for streamlining on-site verification by PHIUS+ Rater/MF Verifier. If the project is being verified by a PHIUS+ Rater/MF Verifier who is in good standing with a RESNET Sampling Provider, they shall have their plan for implementing Sampling approved by their Provider prior to Sampling being implemented. Where the Rater/Verifier is not a RESNET Rater working with a Sampling Provider, project Sampling plan must be submitted to PHIUS+ QA/QC Manager for approval prior to implementation of Sampling.

Approved Sampling plan shall be no less stringent than the Sampling policies and procedures specified by the RESNET Chapter 6 Standards. Documentation of execution of Sampling plan shall be submitted to PHIUS+ QA/QC Manager as part of the final submission package of on-site project documentation.

The following dwelling unit-level on-site verification measures are likely candidates for implementation of Sampling controls:

- Compartmentalization testing.
- Duct system tightness testing.
- Ducted heating, cooling and ventilation air volume measurement and balancing.
 - If project has hired third-party air volume measurement and balancing professional other than the Rater/MF Verifier to conduct air volume measurement and balancing, Rater/MF Verifier shall be responsible for repeating the air volume measurement testing on 10% of dwelling units (maximum of 10, minimum of 3), whichever is greater. Any failures identified by the Rater/MF Verifier shall be corrected, and an additional unit shall be added to Rater/MF Verifier verified tally to ensure project failures are either isolated occurrences or are appropriately fixed.
 - If project has hired third-party professional as described above, Rater/MF Verifier shall not be responsible for repeating common space ducted HVAC system air volume measurements. However, testing professional shall submit documentation of this test to Rater/MF Verifier as described below.
- ZERH hot water distribution efficiency test.
- Bedroom pressure balancing for units with ducted HVAC systems
 - Per ESv3 standards, bedrooms shall be pressure balanced to +/- 3 Pa for dwelling units with ducted heating and cooling systems.
 - Per PHIUS+ standards, bedrooms shall also be pressure balanced to +/- 1 Pa for dwelling units with ducted ventilation systems.
- External static pressure testing of forced air heating and cooling systems.
- Spot ventilation air volume measurements to comply with ESv3 standards.
- Verification of insulated assemblies, mechanical systems, lighting and appliances.

- All other ESv3 and ZERH Rater-verifiable checklist requirements.

In addition to dwelling-unit-level measures, the Rater/MF Verifier may also implement a customized sampling plan for common space building envelope and mechanical system verification. A written plan of for sampling of these additional measures must be submitted to PHIUS+ QA/QC Manager for review prior to execution.

10. Whole-building infiltration testing shall be performed by the PHIUS+ Rater/MF Verifier for each detached building in certification project. Testing shall be conducted using multi-point infiltration procedures as specified in RESET Standards Chapter 8, as well as additional guidance specific to multifamily building testing included in the [RESNET Guidelines for Multifamily Energy Ratings](#) document.

If a single blower door fan is utilized for testing, the Rater/MF Verifier shall use an automated multi-point testing software such as The Energy Conservatory *TECTITE* or Retrotec *Fantestic* software. If multiple fans are used, it is recommended that the test be performed using a multi-fan control testing software such as The Energy Conservatory *TECLOG* software. Alternative testing methodologies proposed by the Rater/MF Verifier must be presented in writing to the PHIUS+ QA/QC Manager and will be considered on a case-by-case basis.

The whole-building infiltration tests shall be performed in both pressurization and depressurization modes, with the results averaged. Test results of up to 0.050 CFM@50 Pa/building shell area or 0.080 CFM@75 Pa/building shell area shall be accepted as a passing result. For buildings whose building shell is constructed of noncombustible building materials per the definitions of the International Building Code (IBC), the building will be considered to pass program whole-building air tightness performance thresholds if the measured leakage is less than 0.08 CFM@50 Pa/building shell area or 0.11 CFM@75 Pa/building shell area. If air tightness criterion is missed, and the extra leakage can be proven to be due to a non-assembly-threatening leakage element such as a vent damper, Certification staff may allow that element to be taped off for purpose of passing the airtightness criterion. If such a strategy is approved, the whole-building infiltration test must also be run untaped with this result used for energy model.

For attached multifamily housing developments without common access point to perform testing of all building common spaces and dwelling units, achieving uniform test pressure from a single testing location will likely be impossible. This will often be the case for attached townhouse developments, or apartment buildings without common enclosed hallways with doorways connecting the dwelling units to the common space. In such cases, multi-zone whole building testing shall be required, which will necessitate the use of multiple fans set up in multiple testing locations to achieve uniform testing pressure throughout all building zones, and either a multi-fan control testing software must be utilized, or sufficient fan operators must be employed to achieve accurate testing results.

If the nature of the development is such that the number of fans and/or fan operators needed to achieve uniform multi-zone testing conditions to assess whole-building infiltration result is beyond the ability of the project to reasonably coordinate (example: a 20-unit attached townhouse development, which would require 20 simultaneously running blower door tests to create a uniform result), the project shall use the following testing protocol:

- Individual zone, “unguarded” testing
 - Each unique building zone shall be tested individually, without adjusting the pressure of adjacent zones.
 - The test results shall be adjusted using the coefficients provided in the *Guidance for modeling infiltration results for dwelling units in multifamily residential buildings* section of the [RESNET Guidelines for Multifamily Energy Ratings](#) document.
 - All coefficient-adjusted test results for each individual zone shall be added together. The total sum of all project zone test results shall comply with the whole-building infiltration threshold.
- Individual zone, “guarded” testing
 - In general, “guarded” blower door testing of individual dwelling units is undesirable due to a lack of confidence in the isolation of individual dwelling unit infiltration to outdoor results. However, certain cases may require implementation of such a strategy to isolate the infiltration to outdoors of an individual dwelling unit.
 - The strategy below shall only be allowed if an appropriate whole-building test is unable to be performed, and where dwelling units achieve the following prescriptive measures:
 - All penetrations in dwelling unit enclosure shell shall be sealed, including pipes, wires, light fixtures, vent fans, duct/ventilation boots, light switches, electrical outlets, etc. so as to prevent leakage between the dwelling unit and other adjacent spaces.
 - If electrical conduit is used to connect electrical fixtures or junction boxes, the conduit shall be sealed at each fixture or junction box to prevent air leakage within the conduit. Additionally, if each dwelling-unit contains an electrical service panel, the conduit leading from the service panel to outside of the dwelling unit shall be sealed.
 - Dwelling unit bottom and top plates shall be sealed using appropriate sealing product, such as high-quality caulk, air sealing tape, foam gasket product, etc.
 - Partition walls between dwelling units shall be capped at the top of the wall so as to prevent air leakage into the interstitial ceiling cavity space. In addition, solid blocking material shall be installed above partition walls for the entire perimeter of the dwelling unit so as to create a sealed ceiling cavity space directly above the dwelling unit. Any wires, pipes, ducts or other penetrations running through this blocking shall be sealed so as to prevent leakage into adjacent building chase spaces.

the conduit size must be increased in size, or additional fans may be required for testing to achieve consistent pressure.

11. Individual dwelling unit compartmentalization testing shall be performed to test the air barrier integrity of each dwelling unit. Testing shall be performed as an “unguarded” test as described under the section *Procedures for Multifamily Dwelling unit/Building Air Tightness Testing*, Test 1 from the [RESNET Guidelines for Multifamily Energy Ratings](#) document, and shall not be adjusted by any multifamily infiltration correction coefficient.

Dwelling unit compartmentalization testing shall be performed in single-point depressurization mode following RESNET Chapter 8 protocol unless the testing condition at the time of the test qualifies as a *Reduced Level of Accuracy* testing condition per RESNET Chapter 8. Any adjustments for temperature, altitude or reduced accuracy as specified by Chapter 8 shall be applied to the measured CFM@50 Pa leakage rate.

This adjusted compartmentalization value shall be divided by the square footage of the dwelling unit enclosure shell area to demonstrate compliance with this requirement. For apartment-style dwelling units, “band joist” surface area accounted for as the perimeter of the ceiling cavity space of the dwelling unit shall be applied to the lower dwelling unit, and shall only be added if the entire perimeter of the ceiling cavity space is blocked and sealed (i.e., an open floor truss that is not blocked for the ceiling cavity spaces between building zones cannot have the “band joist” surface area included in this calculation.)

12. All heating, cooling and ventilation air distribution systems shall comply with the following:
 - Located inside conditioned space (heating and cooling ducts only)
 - Dwelling units
 - Comply with all HVAC design, installation and testing requirements of ESv3 Checklists
 - Common spaces
 - Be designed, sized and installed according to all local and municipal code requirements by the project engineer or HVAC contractor,
 - Be constructed, installed and sealed per SMACNA Duct Construction Standards based on Class rating of duct system or the municipal mechanical code requirement where the project is permitted, whichever is more stringent.
 - Common space load calculations and duct designs submitted to the PHIUS+ Rater/MF Verifier for documentation.
 - Duct tightness testing performed by either the Rater/MF Verifier, HVAC contractor or third-party air balancing firm to demonstrate compliance with SMACNA HVAC Air Duct Leakage Test Manual thresholds or the municipal mechanical code requirement where the project is permitted, whichever is more stringent.

- Tests completed by a party other than the Rater/MF Verifier shall be documented and sent to Rater/MF Verifier for documentation.

13. HVAC air volume measurement and balancing shall be performed for all ducted heating, cooling and ventilation systems. All measurements shall be performed by the PHIUS+ Rater/MF Verifier unless a certified third-party air balancing contractor has been hired by the project team to perform air volume measurements and balancing. If no third-party air balancing contractor has been hired and Rater/MF Verifier is not experienced or qualified to perform system balancing, the project HVAC installing contractor shall be responsible for system air volume balancing, and the Rater/MF Verifier shall perform air volume measurements to confirm that air volume balancing has been performed and measurements are within design specifications.

Systems shall comply with the following:

- Air balancing reports produced listing the design airflows, tested airflows, locations of registers and grilles for all systems. Submitted to the PHIUS+ Rater/MF Verifier for review and documentation.
- Dwelling units
 - Comply with all air volume measurement and balancing requirements of ESv3 program and *PHIUS+ On-site Quality Control Workbook for Multifamily Projects*.
- Common spaces
 - Comply with all air volume measurement and balancing requirements of local and municipal codes.
 - Exhaust ventilation systems that exert greater than -5 Pa of depressurization shall have make-up air systems with mechanical dampers that open while the exhaust system is operating installed that are sized to relieve depressurization effect.
 - The Rater/MF Verifier shall document through zonal pressure testing that each zone containing an exhaust system does not depressurize the zone by more than -5 Pa.

14. Hydronic heating and cooling systems fall outside of the scope of ESv3 and ZERH standards. Nevertheless, their design, installation and performance are critical to building performance.

All hydronic heating and cooling systems shall be designed, sized and installed per local or municipal code requirements. Additionally, systems shall be balanced by installing contractor or third-party balancing professional. It is recommended that balancing be performed following either National Environmental Balancing Bureau (NEBB) *PROCEDURAL STANDARDS FOR TESTING ADJUSTING AND BALANCING OF ENVIRONMENTAL SYSTEMS - SEVENTH EDITION*, ACCA Manual B, or another professional industry-accepted testing and balancing standard. Documentation of balancing shall be provided to Rater/MF Verifier with design flows, tested flows, and locations of all terminal devices.

Rater/MF Verifier shall test hot water distribution effectiveness for each dwelling unit by measuring the temperature-rise of highest volume fixture per ZERH standards. PHIUS encourages, but does not require, project teams to install demand-based controls for central hot water distribution systems to

meet this requirement. Additionally, PHIUS strongly discourages, but shall not prevent, the use of continuous or time-based hot water circulation systems.

15. The Rater/MF Verifier shall perform visual verification that all installed HVAC, pump, motor and lighting equipment meet the specifications of the building design. Where deviations occur, the Rater/MF Verifier shall report findings to the project energy modeler to revise the PHIUS+ energy model. Additionally, the Rater/MF Verifier shall perform electrical wattage measurement on installed ventilation systems, or alternatively shall shadow an electrical/mechanical contractor in their measurement of such systems.
16. For projects where Esv3 and ZERH certification are required, as described in Footnote 4, the project team shall choose to comply with either the Performance or Prescriptive Path of each program. Choosing the Performance Path of these programs will require that the PHIUS+ Rater complete additional HERS-based energy modeling in addition to the PHIUS energy model. Choosing the Prescriptive Path will eliminate the need for modeling, but may only be chosen for projects where all dwelling units meet all Prescriptive Path eligibility criteria. Additionally, many utility and state energy efficiency programs offer incentives for HERS-based performance verification, and thus projects may benefit overall from using the Performance Path.

The appropriate version of the Esv3 and ZERH standards shall be based on the permit date of the project. ZERH also requires certification under the EPA Indoor airPLUS program as part of its certification criteria. PHIUS also encourages, but does not require, certification under the EPA WaterSense New Homes program. For more information on these programs, please see the following links:

Esv3: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_guidelines

ZERH: <http://energy.gov/eere/buildings/zero-energy-ready-home>

IAP: <http://www.epa.gov/indoorairplus/index.html>

WaterSense: http://www.epa.gov/watersense/new_homes/index.html

17. All projects shall either have renewable energy systems installed or shall comply with the DOE Zero Energy Ready Home PV-Ready Checklist, regardless of how much average daily solar radiation the site receives. Sites with significant adjacent shading or insufficient roof area facing true south per the program checklist shall not be required to comply with this requirement.
18. PHIUS encourages project teams to get PHIUS+ Raters/MF Verifiers involved in the project as early as possible, including potentially during the initial design phase. Raters/MF Verifiers may have significant multifamily program on-site verification experience that can help project teams ensure that their designs will not only work out from a modeling perspective, but in the field as well.

Additionally PHIUS encourages project CPHCs to clearly communicate the following to the Rater/MF Verifier as early as possible so that on-site verification can be performed as efficiently and effectively as possible:

- Foundation condition and insulation strategy.
- Primary whole-building air barrier/infiltration control strategy.
- Intended insulation materials, installed thicknesses and R-values for all building enclosure assemblies.
- HVAC and hot water system strategies, equipment and design drawings.
- Intended labeled window performance values.
- Known project thermal bridges and associated mitigation strategies/products.
- Window install and sealing strategies.
- Window shading strategies, including adjacent site shading, overhangs and/or external movable shading.
- Intended tested whole-building infiltration values, including intended mid-construction infiltration testing values.

It is the responsibility of the PHIUS+ Rater/MF Verifier to communicate all on-site verification data to the CPHC so that such information can be included in the PHIUS energy model. A comparison of the data in the PHIUS energy model to the on-site data collected by the PHIUS+ Rater/MF Verifier shall be performed by the PHIUS certification team prior to final project certification.

19. PHIUS+ Rater/MF Verifier shall be responsible for completing and submitting in full all required on-site verification documentation, including *PHIUS+ On-site Quality Control Workbook for Multifamily Project*, supporting ESv3 program checklists and documentation, HERS energy models (if performed), and any other relevant documentation.