

ENERGY STAR Multifamily New Construction

Revision 02



ENERGY STAR. The simple choice for energy efficiency.



Agenda

- Revision 02 Updates to Program Documents
 - National Program Requirements Version 1 / 1.1 / OR-WA 1.2
 - National Rater Design Review Checklist
 - National Rater Field Checklist
 - National HVAC Design Report
 - National HVAC Functional Testing Checklist
 - Water Management System Requirements
 - Simulation Guidelines
 - ASHRAE Path Calculators & Multifamily Workbook
- Summary of Updates

ENERGY STAR Multifamily New Construction: Program Rev. 02 Documents

Website: www.energystar.gov/mfnc

- Updated Revision 02 Documents
- Other resources:
 - [Overall certification process](#)
 - [Recorded introductory-level webinars](#)
 - [Policy Record](#)

ENERGY STAR RESIDENTIAL NEW CONSTRUCTION PROGRAM REQUIREMENTS

SINGLE FAMILY | **MULTIFAMILY** | MANUFACTURED | UNDERGOING GUT REHAB

PROGRAM VERSIONS AT A GLANCE

STEP 1: SELECT A PATH
 ERI and Prescriptive
 ASHRAE / Title 24

STEP 2: Select State or Territory

ELIGIBILITY

These requirements apply to most multifamily buildings. See flow chart (PDF, 85 KB) for the specific multifamily projects that are eligible. Multifamily projects permitted prior to January 1, 2021, may continue to certify through the MFHR or Certified Homes program, based on the eligibility requirements of those programs.

PROGRAM REQUIREMENTS

National Program Requirements
MFNC National Program Requirements Version 1/1, 1/OR-WA 1.2 (PDF, 490 KB)

Regional Program Requirements
MFNC California Program Requirements Version 1.2 (PDF, 387 KB)

Mandatory Measures
MFNC Rater Design Review Checklist (PDF, 523 KB)
MFNC Rater Field Checklist (PDF, 736 KB)
MFNC HVAC Design Report (PDF, 415 KB)
MFNC HVAC Functional Testing Checklist (PDF, 407 KB)
MFNC Water Management System Requirements (PDF, 143 KB)

IMPLEMENTATION TIMELINE

To determine the program Version that a multifamily building is required to be certified under, identify

Multifamily New Construction – Revision 02

- Rev. 02 – flexibility and new options for you!
- Required for projects with permits or permit applications on or after July 1, 2021

Alignment with 'Certified Homes' Revision 11

- All references to Certified Homes updated to Single-Family New Homes
- Additional convention updates (e.g., references from 'Verification Oversight Organization' to 'Home Certification Organization')
- Ventilation clarifications (coming soon)

National Program Requirements Version 1 / 1.1 / OR-WA 1.2



National Program Requirements

ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / OR-WA 1.2 (Rev. 02)

Eligibility Requirements

The following multifamily building types are eligible to participate in the ENERGY STAR Multifamily New Construction program:

- Any multifamily building with dwelling or sleeping units that is NOT a two-family dwelling ¹; OR
- Mixed-use buildings, where dwelling units and common space exceed 50% of the building square footage. Parking garage square footage is excluded from this calculation ²; OR
- Townhouses, if following the requirements listed in Footnote 3. ³

Townhouses are also eligible to earn the ENERGY STAR through the ENERGY STAR Certified Homes program, which is a certification program for single family detached homes and two-family dwellings.¹ For more information, visit: www.energystar.gov/newhomesrequirements. In addition, multifamily buildings with permit dates prior to July 1, 2021, may be eligible to earn the ENERGY STAR through the Certified Homes or Multifamily High Rise programs. ⁴ For more information, visit: www.energystar.gov/mfhr/eligibility.

Note that multifamily buildings in California shall follow the California Program Requirements, not these National Program Requirements. Also note that compliance with these requirements is not intended to imply compliance with all local code requirements that may be applicable to the building to be built. ⁵

Partnership, Training, and Credentialing Requirements

The following requirements must be met prior to certifying multifamily buildings:

- The Builder or Developer for the project is required to sign an ENERGY STAR Partnership Agreement and complete the online "Builder / Developer Orientation", which can be found at www.energystar.gov/homesPA.
- FT Agents must meet one of the following:
 - The HVAC installing contractor AND credentialed by an EPA-recognized HVAC Quality Installation Training and Oversight Organization (H-QUITO). An explanation of this process can be found at www.energystar.gov/eshvac; OR
 - Not the HVAC installing contractor, AND
 - Signed up online in EPA's online database as an FT Agent and watched the online FT Agent orientation, which can be found at www.energystar.gov/ftas; AND
 - Holds one of the credentials listed online here: www.energystar.gov/ftas or is a representative of the Original Equipment Manufacturer (OEM).
- Energy Rating Companies (e.g., rater companies and Providers ⁶) are required to sign an ENERGY STAR Partnership Agreement, which can be found at www.energystar.gov/homesPA, and Raters ⁷ are required to complete EPA-recognized training, which can be found at www.energystar.gov/mftraining.
- Modelers for buildings in the ASHRAE Path must sign up online in EPA's online database as a Modeler and watch the online Modeler orientation, which can be found at www.energystar.gov/ASHRAEdirectory.

ENERGY STAR Certification Process ⁸

1. The certification process offers three paths to meet the performance target. Each has varying levels of flexibility to select a custom combination of measures for each building:
 - a. **Prescriptive Path:** The units and common spaces meet or exceed all the prescriptive items in the National Rater Design Review and Field Checklists which align with the minimum requirements set in the ENERGY STAR Multifamily Reference Design, Exhibit 1. As described in Exhibit 3, buildings in states that have adopted the residential 2012, 2015, or 2018 IECC, or an equivalent code will follow Version 1.1 of the Reference Design, buildings in Oregon (OR) and Washington (WA) will follow the OR and WA Version 1.2 of the Reference Design, otherwise buildings will follow Version 1.

- b. **ERI Path:** Each unit is equivalent in performance to the minimum requirements of the ENERGY STAR Multifamily Reference Design, Exhibit 1, as assessed through energy modeling, and the common spaces meet the prescriptive requirements in the National Rater Design Review and Field Checklists which align with the minimum requirements set in Exhibit 1. As described in Exhibit 3, buildings in states that have adopted the residential 2012, 2015, or 2018 IECC, or an equivalent code will follow Version 1.1 of the Reference Design, buildings in OR and WA will follow the OR and WA Version 1.2 of the Reference Design, otherwise buildings will follow Version 1.

An EPA-recognized Home Certification Organization (HCO)'s Approved Software Rating Tool shall automatically determine the ENERGY STAR ERI Target, which is the highest ERI value that each rated unit may achieve to earn the ENERGY STAR. ^{9, 10}

Note: The ERI path will be available for buildings that exceed five stories on October 1, 2019. After this date, Raters must use an Approved Software Rating Tool that has been updated to ANSI / RESNET / ICC Std. 301-2019 to use the ERI Path for buildings that exceed five stories.

- c. **ASHRAE Path:** The building meets the ASHRAE performance target, which is dependent on the commercial state energy code and baseline chosen, as described in Exhibit 4.

Projects must follow the modeling requirements in the ENERGY STAR Multifamily Simulation Guidelines.

Exception: For buildings that are PHIUS+ certified, achieving a specific source energy use of 6,500 kWh/person per year, without renewables, is accepted in lieu of achieving the ASHRAE performance target.

All ENERGY STAR certifications are subject to the oversight of a Multifamily Oversight Organization which include HCOs or Multifamily Review Organizations (MROs). All ERI Path projects must be overseen by an HCO and all ASHRAE and Prescriptive Path projects must be overseen by an MRO. MRO information can be found at www.energystar.gov/mro.

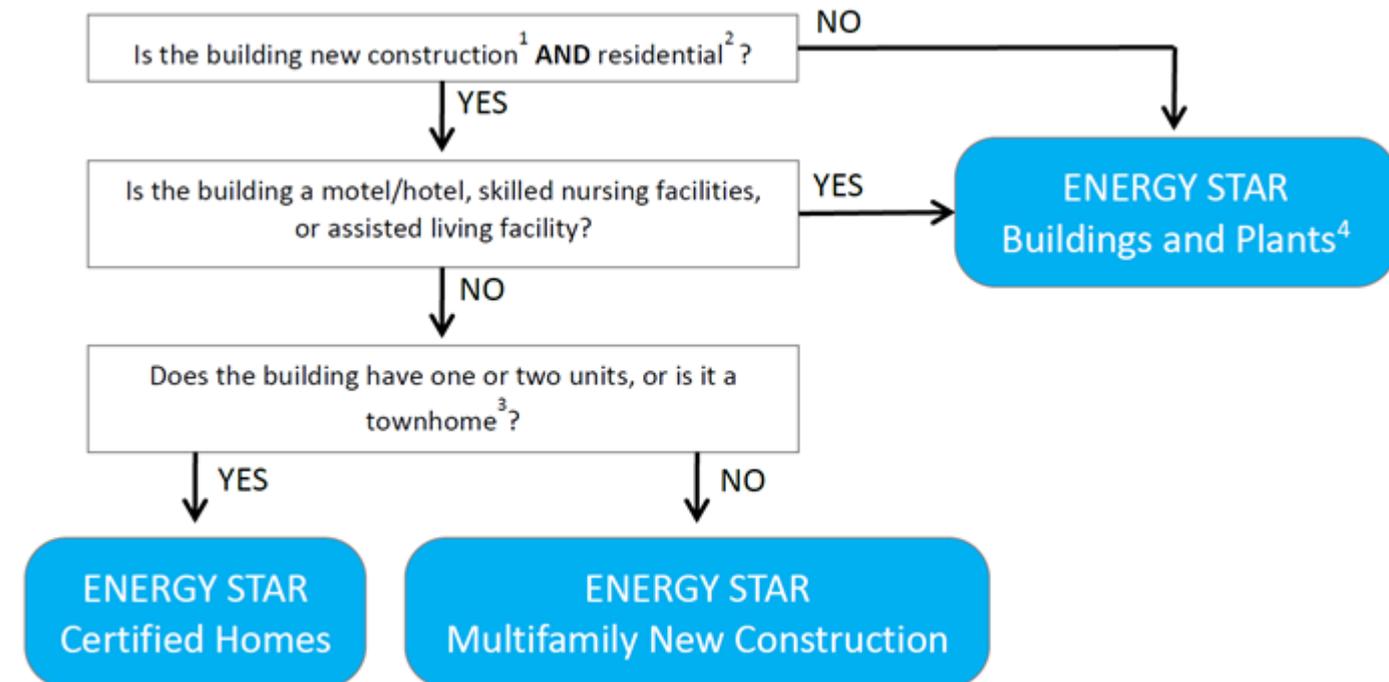
Revised 10/28/2020

Page 1 of 12

National Program Requirements Version 1 / 1.1 / OR-WA 1.2, Rev. 02

Update to program transition date from January 1 to July 1, 2021

- To certify through the Single-Family New Homes program, multifamily buildings must be permitted prior to July 1, 2021
- To certify through MFHR, buildings must have a MFHR project application submitted prior to January 1, 2021 and be permitted (or have permit application) by July 1, 2021.



National Program Requirements Version 1 / 1.1 / OR-WA 1.2, Rev. 02

New performance target alternative for PHIUS Certified projects

- Projects must meet the following requirements:
 - Meet a performance target of **6,500 kWh/person per year** without the use of renewables per PHIUS modeling protocols
 - Earn PHIUS+ certification
 - All other ASHRAE Path requirements
- Documentation requirements:
 - Fill out PHIUS tab in MF Workbook
 - PHIUS documentation of source energy
 - PHIUS pre-certification & PHIUS certificate

PHIUS+ 2018 Source Energy Report					
Project Name	0				
Climate	0				
Type					
Interior conditioned floor area					
Number of units	0				
Occupants					
Source energy use					
Specific source energy use					
Source energy use					
Source energy use per person					
Net source energy use (with 100% renewables)					
Specific net source energy use (with 100% renewables)					
New source energy use (with 100% renewables)					
Specific source energy use per person (with 100% renewables)					
PHIUS+ Source Zero					
Total Use By Type					
Type	Source energy [kWh/yr]				
Space heating					
Space cooling					
Hot water					
Auxiliary energy/fans					
Appliances					
Lighting					
Miscellaneous loads					
Renewable electricity production					
Total (with 100% Renewables)	0				
Total (No Renewable)	0				
Total Source Energy (No Renewable) Per Person					

National Program Requirements Version 1 / 1.1 / OR-WA 1.2, Rev. 02

New option to choose either energy cost savings or source energy savings target for some projects

Projects that:

- Model using ASHRAE 90.1-Appendix G 2016 AND
- Have a performance target based on ASHRAE 90.1-2013 or later

Can choose 15% cost energy savings target OR a 15% source energy savings target.



National Program Requirements

ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / OR-WA 1.2 (Rev. 024)

Exhibit 4: ASHRAE Path Performance Targets

Projects using the ASHRAE Path in states that have adopted as the commercial code the 2012 IECC, 2015 IECC, 2018 IECC, ASHRAE 90.1-2010, ASHRAE 90.1-2013, ASHRAE 90.1-2016, or equivalent, will be required to meet a Performance Target of 15% energy cost savings when compared to the energy code under which the building is permitted (unless otherwise noted below). All other projects must meet the national requirement of 15% over ASHRAE 90.1- 2007. ~~The Performance Target is based on the units of energy cost unless specific EPA guidance approves alternate units for use.~~

Notes and Exceptions:

- Local Code Exception: While local city or town codes may differ from the state code, the determination for the ENERGY STAR program is based on the commercial code adopted by the state, not the local jurisdiction. In an instance where the building is permitted under a local code that is not the same as the state code, the Performance Target is based on the state code in place. The permit application or issue date will be used to determine what state code was in place in the state. To determine the code adopted by the state and its effective date, please visit www.energycodes.gov.
- Modeling options: To reduce the burden of applying two different codes to a given project, projects are allowed to use alternate targets of 20% savings over ASHRAE 90.1-2007 as equivalent to 15% over ASHRAE 90.1-2010; and 25% savings over ASHRAE 90.1-2007 and 20% savings over ASHRAE 90.1-2010, as equivalent alternatives to 15% savings over ASHRAE 90.1-2013.
- Appendix G version: For projects pursuing performance targets based on ASHRAE 90.1-2007 or ASHRAE 90.1-2010, the project must use the Appendix G of the code corresponding to their Performance Target or Appendix G from ASHRAE 90.1-2016. Projects pursuing targets based on ASHRAE 90.1-2013 or later must use Appendix G from ASHRAE 90.1-2016. Projects using Appendix G from ASHRAE 90.1-2016 must use the ASHRAE Path Calculator_AppG2016 and Simulation Guidelines_AppG2016 available on the Guidance Documents page which can be found at www.energystar.gov/mfguidance. Projects may not use Appendix G from ASHRAE 90.1-2016 if they are using the 20% or 25% Performance Target Options. Note: Addendum bm from ASHRAE 90.1-2013 is not referenced since its content and the related excerpts that followed have been incorporated into Appendix G from ASHRAE 90.1-2016.
- **Performance Target for Projects Modeling using Appendix G from ASHRAE 90.1-2016: Projects using this approach to meet a performance target above ASHRAE 90.1-2013 or later, must meet a target of 15% energy cost savings OR 15% source energy savings when compared to the energy code under which the building is permitted.**

State Code (IECC)	Performance Target Options: Savings (%) above varying ASHRAE 90.1 Baselines			
	90.1-2007	90.1-2010	90.1-2013	90.1-2016
2009 IECC	15% ¹⁶	N/A	N/A	N/A
2012 IECC	20% ¹⁷	15% ¹⁶	N/A	N/A
2015 IECC	25% ¹⁷	20% ¹⁷	15% ¹⁸	N/A
2018 IECC	N/A	N/A	N/A	15% ¹⁸

National Program Requirements Version 1 / 1.1 / OR-WA 1.2, Rev. 02

HVAC grading now allowed in common spaces

- Available for residential systems within the scope of ANSI / RESNET / ACCA Std 310 serving a single space
- FT Agents still verify commercial and central systems
- Track names updated
 - HVAC Grading by Rater
 - HVAC Testing by FT Agent



National Program Requirements

ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / OR-WA 1.2 (Rev. 024)

Two paths are provided for satisfying the mandatory requirements for all certified projects, Exhibit 2. **Path Track A – Dwelling Unit HVAC Grading by Rater** allows a Rater to utilize ANSI / RESNET / ACCA Std. 310 ¹³⁴, a standard for grading the installation of residential HVAC systems serving individual spaces Dwelling Units and a Functional Testing Agent to verify common space commercials and central systems. **Track Path B – Dwelling Unit HVAC Testing by FT Agent Commissioning** utilizes a Functional Testing Agent for all systems. Either path may be selected, but all requirements within that path must be satisfied for the building to be certified.

Exhibit 2: Mandatory Requirements for All Certified Multifamily Projects

Party Responsible	Mandatory Requirements
Requirements Applicable to Track Path A & B	
Rater	<ul style="list-style-type: none"> • Completion of National Rater Design Review Checklist • Completion of National Rater Field Checklist
Builder or Developer	<ul style="list-style-type: none"> • Completion of National Water Management System Requirements
Requirements Only Applicable to Track Path A – Dwelling Unit HVAC Grading by Rater ¹³⁴	
HVAC System Designer	<ul style="list-style-type: none"> • Completion of an HVAC design report compliant with ANSI / ACCA / RESNET Std. 310, plus the ENERGY STAR MFNC Supplement
Functional Testing Agent	<ul style="list-style-type: none"> • Completion of applicable sections of the National HVAC Functional Testing Checklist. Exempt from Sections 2 and 3 for Dwelling Unit HVAC as the Rater is the party responsible for assessing these systems installation quality in accordance with ANSI / RESNET / ACCA Std. 310
Requirements Only Applicable to Track Path B – Dwelling Unit HVAC Testing by FT Agent Commissioning	
HVAC System Designer	<ul style="list-style-type: none"> • Completion of National HVAC Design Report
Functional Testing Agent	<ul style="list-style-type: none"> • Completion of National HVAC Functional Testing Checklist

National Program Requirements Version 1 / 1.1 / OR-WA 1.2, Rev. 02

- Reference Design format updated to better delineate between Version 1, Version 1.1, and Version 1.2 Reference Designs.
- Added references to common spaces to clarify requirements

Version 1: ENERGY STAR Multifamily Reference Design (See Exhibit 3 for where this is applicable)																																																																
Hot Climates (2009 IECC Zones 1,2,3) ¹²	Mixed and Cold Climates (2009 IECC Zones 4,5,6,7,8) ¹²																																																															
Residential Cooling Equipment (Where Provided) in Dwelling Units or Common Spaces. If not listed here, see Rater Field Checklist Exhibit X.																																																																
<ul style="list-style-type: none"> Cooling equipment modeled at the applicable efficiency levels below: <ul style="list-style-type: none"> 14.5 SEER / 12 EER AC, Heat pump (See Residential Heating Equipment) 																																																																
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<ul style="list-style-type: none"> Heating equipment modeled at the applicable efficiency levels below, dependent on fuel and system type: <ul style="list-style-type: none"> 80 AFUE gas furnace, 80 AFUE oil furnace, 80 AFUE boiler, 8.2 HSPF / 14.5 SEER / 12 EER air-source heat pump with electric or dual-fuel backup. 																																																																
Envelope, Windows, & Doors																																																																
<ul style="list-style-type: none"> A radiant barrier modeled if more than 10 linear feet of ductwork are located in an unconditioned attic. No radiant barrier modeled. Dwelling unit insulation levels modeled to 2009 IECC levels (Commercial, wood-frame) and Grade I installation per ANSI / RESNET / ICC Standard 301. For all other spaces, refer to the Common Space Applicability Notes on page 4 for insulation levels.¹³ 																																																																
<table border="1"> <thead> <tr> <th>Climate Zone:</th> <th>CZ 1</th> <th>CZ 2</th> <th>CZ 3</th> <th>CZ 4</th> <th>CZ 4 C & 5</th> <th>CZ 6</th> <th>CZ 7</th> <th>CZ 8</th> </tr> </thead> <tbody> <tr> <td>Slab Insulation R-Value:</td> <td>0</td> <td>0</td> <td>0</td> <td>10</td> <td>10</td> <td>15</td> <td>15</td> <td>20</td> </tr> <tr> <td>Slab Insulation Depth (ft):</td> <td>0</td> <td>0</td> <td>0</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> </tr> <tr> <td>Basement Wall Continuous Insulation R-Value:</td> <td>0</td> <td>0</td> <td>0</td> <td>7.5</td> <td>7.5</td> <td>7.5</td> <td>10</td> <td>12.5</td> </tr> <tr> <td>Floor Assembly U-Factor:</td> <td>0.282</td> <td>0.052</td> <td>0.033</td> <td>0.033</td> <td>0.033</td> <td>0.033</td> <td>0.033</td> <td>0.033</td> </tr> <tr> <td>Wall Assembly U-Factor:</td> <td>0.089</td> <td>0.089</td> <td>0.089</td> <td>0.089</td> <td>0.064</td> <td>0.051</td> <td>0.051</td> <td>0.036</td> </tr> <tr> <td>Ceiling Assembly U-Factor:</td> <td>0.027</td> <td>0.027</td> <td>0.027</td> <td>0.027</td> <td>0.027</td> <td>0.027</td> <td>0.027</td> <td>0.027</td> </tr> </tbody> </table>		Climate Zone:	CZ 1	CZ 2	CZ 3	CZ 4	CZ 4 C & 5	CZ 6	CZ 7	CZ 8	Slab Insulation R-Value:	0	0	0	10	10	15	15	20	Slab Insulation Depth (ft):	0	0	0	2	2	2	2	2	Basement Wall Continuous Insulation R-Value:	0	0	0	7.5	7.5	7.5	10	12.5	Floor Assembly U-Factor:	0.282	0.052	0.033	0.033	0.033	0.033	0.033	0.033	Wall Assembly U-Factor:	0.089	0.089	0.089	0.089	0.064	0.051	0.051	0.036	Ceiling Assembly U-Factor:	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027
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<ul style="list-style-type: none"> Infiltration rates modeled as follows: <math>\leq 0.30</math> CFM50/ft² of enclosure. Non-Class AW dwelling unit windows and doors modeled, as illustrated below: <table border="1"> <thead> <tr> <th></th> <th>0.60 in CZs 1,2</th> <th>0.35 in CZ 3</th> <th>0.32 in CZ 4</th> <th>0.30 in CZs 4 C,5,6,7,8</th> </tr> </thead> <tbody> <tr> <td>Window U-Factor:</td> <td>0.60 in CZs 1,2</td> <td>0.30 in CZ 3</td> <td>0.40 in CZ 4</td> <td>Any in CZs 4 C,5,6,7,8</td> </tr> <tr> <td>Window SHGC:</td> <td>0.27 in CZs 1,2</td> <td>0.30 in CZ 3</td> <td>0.40 in CZ 4</td> <td>Any in CZs 4 C,5,6,7,8</td> </tr> <tr> <td>Door U-Factor:</td> <td>Opaque: 0.21</td> <td>$\leq 1/2$ lite: 0.27</td> <td>$\leq 1/2$ lite: 0.27</td> <td>$> 1/2$ lite: 0.32</td> </tr> <tr> <td>Door SHGC:</td> <td>Opaque: Any</td> <td>$\leq 1/2$ lite: 0.30</td> <td>$\leq 1/2$ lite: 0.30</td> <td>$> 1/2$ lite: 0.30</td> </tr> </tbody> </table> 			0.60 in CZs 1,2	0.35 in CZ 3	0.32 in CZ 4	0.30 in CZs 4 C,5,6,7,8	Window U-Factor:	0.60 in CZs 1,2	0.30 in CZ 3	0.40 in CZ 4	Any in CZs 4 C,5,6,7,8	Window SHGC:	0.27 in CZs 1,2	0.30 in CZ 3	0.40 in CZ 4	Any in CZs 4 C,5,6,7,8	Door U-Factor:	Opaque: 0.21	$\leq 1/2$ lite: 0.27	$\leq 1/2$ lite: 0.27	$> 1/2$ lite: 0.32	Door SHGC:	Opaque: Any	$\leq 1/2$ lite: 0.30	$\leq 1/2$ lite: 0.30	$> 1/2$ lite: 0.30																																						
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Class AW and all common space fenestration modeled to 2012 IECC levels (Commercial fenestration U-Factor requirements).¹³ <table border="1"> <thead> <tr> <th>Climate Zone:</th> <th>CZ 1</th> <th>CZ 2</th> <th>CZ 3</th> <th>CZ 4</th> <th>CZ 4 C & 5</th> <th>CZ 6</th> <th>CZ 7</th> <th>CZ 8</th> </tr> </thead> <tbody> <tr> <td>Fixed Window U-Factor:</td> <td>0.50</td> <td>0.50</td> <td>0.46</td> <td>0.38</td> <td>0.38</td> <td>0.36</td> <td>0.29</td> <td>0.29</td> </tr> <tr> <td>Operable Window U-Factor:</td> <td>0.65</td> <td>0.65</td> <td>0.60</td> <td>0.45</td> <td>0.45</td> <td>0.43</td> <td>0.37</td> <td>0.37</td> </tr> <tr> <td>Glazed Entrance Door U-Factor:</td> <td>1.10</td> <td>0.83</td> <td>0.77</td> <td>0.77</td> <td>0.77</td> <td>0.77</td> <td>0.77</td> <td>0.77</td> </tr> <tr> <td>SHGC:</td> <td>0.27</td> <td>0.27</td> <td>0.30</td> <td>0.40</td> <td>0.40</td> <td>0.40</td> <td>any</td> <td>any</td> </tr> </tbody> </table>		Climate Zone:	CZ 1	CZ 2	CZ 3	CZ 4	CZ 4 C & 5	CZ 6	CZ 7	CZ 8	Fixed Window U-Factor:	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29	Operable Window U-Factor:	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37	Glazed Entrance Door U-Factor:	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77	SHGC:	0.27	0.27	0.30	0.40	0.40	0.40	any	any																		
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<ul style="list-style-type: none"> DHW equipment modeled with the following efficiency levels as applicable: <table border="1"> <thead> <tr> <th></th> <th>≤ 55 Gal = 0.67 EF (0.64 UEF, medium; 0.68 UEF, high-draw)</th> <th>> 55 Gal = 0.77 EF (0.78 UEF, medium; 0.80 UEF, high-draw)</th> </tr> </thead> <tbody> <tr> <td>Gas:</td> <td></td> <td></td> </tr> <tr> <td>Electric:</td> <td colspan="2">0.95 EF (0.93 UEF)</td> </tr> <tr> <td>Oil:</td> <td>30 Gal = 0.64 EF 40 Gal = 0.62 EF 50 Gal = 0.60 EF 60 Gal = 0.58 EF 70 Gal = 0.56 EF 80 Gal = 0.54 EF</td> <td></td> </tr> </tbody> </table> 			≤ 55 Gal = 0.67 EF (0.64 UEF, medium; 0.68 UEF, high-draw)	> 55 Gal = 0.77 EF (0.78 UEF, medium; 0.80 UEF, high-draw)	Gas:			Electric:	0.95 EF (0.93 UEF)		Oil:	30 Gal = 0.64 EF 40 Gal = 0.62 EF 50 Gal = 0.60 EF 60 Gal = 0.58 EF 70 Gal = 0.56 EF 80 Gal = 0.54 EF																																																				
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Thermostat & Ductwork																																																																
<ul style="list-style-type: none"> Programmable thermostat modeled. Supply ducts in unconditioned attics modeled with R-8 insulation; all other ducts in unconditioned space modeled with R-6 insulation. Duct leakage to outdoors modeled at the greater of ≤ 4 CFM25 per 100 ft² of conditioned floor area or ≤ 40 CFM25. 																																																																
Lighting, Appliances & Fixtures																																																																
<ul style="list-style-type: none"> ENERGY STAR refrigerators and dishwashers modeled. ENERGY STAR light bulbs or fixtures modeled in 90% of ANSI / RESNET / ICC Standard 301-defined Qualifying Light Fixture Locations. For all other spaces, refer to the Common Space Applicability Notes on page 4.¹³ WaterSense bathroom faucets, bathroom aerators, and showerheads.¹³ 																																																																



National Program Requirements Version 1 / 1.1 / OR-WA 1.2, Rev. 02

Other Updates

- Clarifies that hotels, motels, and senior care facilities are not considered multifamily buildings for the purpose of eligibility
- Announces new Excel-based ASHRAE 90.1 Compliance Form coming soon (alternate option to ASHRAE Path Calculator AppG 2016)
- Clarifies that the Proposed Design Submittal is strongly recommended, but not required
- Updates wood-framed wall U-factor requirements in CZ 4, 4C & 5
- Sets the electric water heater efficiency to 0.95 EF in the Reference Design, regardless of storage capacity
- Removes ENERGY STAR clothes washers and dryers from the Reference Design
- Describes the transition timeline to Version 1.1 for PA and NE

National Rater Design Review Checklist



National Rater Design Review Checklist ¹ ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev. 02)

If pursuing Track A – HVAC Grading by Rater, complete this page. ³

Project Name: _____ Number of Units: _____ Permit Date: _____
 Project Address: _____ City: _____ State: _____

	Must Correct	Rater ⁴ Verified
1. Partnership Status		
1.1 Rater has verified and documented that builder or developer has an ENERGY STAR partnership agreement using www.energystar.gov/partnerlocator . Builder name: _____ Developer name: _____	<input type="checkbox"/>	<input type="checkbox"/>
1.2 ASHRAE Only: Rater has verified that modeler is listed in the online directory using www.energystar.gov/ASHRAEdirectory . Modeler name: _____ (Not required for projects in California)	<input type="checkbox"/>	<input type="checkbox"/>
2. High-Performance Fenestration		
2.1 Dwelling units:		
2.1.1 Prescriptive: Specified fenestration meets or exceeds ENERGY STAR MF Reference Design requirements. ⁵	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2 ERI and ASHRAE only: Specified fenestration meets or exceeds 2009 IECC residential requirements. ⁵	<input type="checkbox"/>	<input type="checkbox"/>
2.2 Common space: ²		
2.2.1 ERI and Prescriptive: Specified fenestration meets or exceeds ENERGY STAR MF Reference Design requirements. ⁵	<input type="checkbox"/>	<input type="checkbox"/>
2.2.2 ASHRAE only: Specified fenestration meets or exceeds 2009 IECC commercial requirements. ⁵	<input type="checkbox"/>	<input type="checkbox"/>
3. High-Performance Insulation		
3.1 Dwelling unit:		
3.1.1: Prescriptive: Specified ceiling ⁶ , wall ⁷ , floor, and slab-on-grade insulation levels meet or exceed ENERGY STAR MF Reference Design requirements. ^{8, 9, 10}	<input type="checkbox"/>	<input type="checkbox"/>
3.1.2: ERI and ASHRAE only: Specified ceiling ⁶ , wall ⁷ , floor, and slab-on-grade insulation levels meet or exceed values from the "Group R" column in the 2009 IECC Commercial chapter. ^{8, 9, 10}	<input type="checkbox"/>	<input type="checkbox"/>
3.2 Common space: ²		
3.2.1 ERI and Prescriptive: Specified ceiling ⁶ , wall ⁷ , floor, and slab-on-grade insulation levels meet or exceed ENERGY STAR MF Reference Design requirements. ^{8, 9, 10}	<input type="checkbox"/>	<input type="checkbox"/>
3.2.2 ASHRAE only: Specified ceiling ⁶ , wall ⁷ , floor, and slab-on-grade insulation levels meet or exceed the values from the "All Other" column in the 2009 IECC Commercial chapter. ^{8, 9, 10}	<input type="checkbox"/>	<input type="checkbox"/>
4a. Review of ANSI / RESNET / ACCA Std. 310 HVAC Design Report with ENERGY STAR MFNC Supplement		
4a.1 HVAC design report(s) compliant with ANSI / RESNET / ACCA Std. 310 representing all applicable systems, with the ENERGY STAR MFNC supplement, collected for records, with no items left blank.	<input type="checkbox"/>	<input type="checkbox"/>
4a.2 ANSI / RESNET / ACCA Std. 310 Rater Design Review Checklist completed for applicable housing type, with all items marked, "Rater Verified".	<input type="checkbox"/>	<input type="checkbox"/>
4a.3 Prescriptive Path: Dwelling Unit Mechanical Ventilation is <150% of ASHRAE 62.2-2013 requirements. ¹¹	<input type="checkbox"/>	<input type="checkbox"/>
4a.4 Total occupant gains do not exceed 645 Btuh per occupant. ¹²	<input type="checkbox"/>	<input type="checkbox"/>
4a.5 Non-occupant internal gains are less than 3,600 Btuh.	<input type="checkbox"/>	<input type="checkbox"/>
4a.6 Cooling sizing % is within the cooling sizing limit selected by the HVAC designer.	<input type="checkbox"/>	<input type="checkbox"/>
Rater Name: _____ Date of Review: _____		
Rater Signature: _____ Rater Company Name: _____		

National Rater Design Review Checklist, Rev. 02

Updates

- Adjusts wood-framed wall U-factor requirements in CZ 4, 4C & 5
- Clarifies requirements for skylights and applicability of requirements to specific types of ceilings and walls.

	Dwelling unit doors and windows that are <u>not</u> classified "Class AW"*	Dwelling unit windows and doors that are classified as "Class AW"* <u>and all skylights</u>	Common Space [†]
ERI	2009 IECC Table 402.1.1	2009 IECC Table 502.3	ENERGY STAR MF Reference Design – for Class AW
ASHRAE	2009 IECC Table 402.1.1	2009 IECC Table 502.3	2009 IECC Table 502.3
Prescriptive	ENERGY STAR MF Reference Design	<u>Windows and Doors:</u> ENERGY STAR MF Reference Design – for Class AW <u>Skylights: 2012 IECC Table 402.3</u>	ENERGY STAR MF Reference Design – for Class AW

* Classified as "Class AW" under the North American Fenestration Standard (AAMA / WDMA / CSA 101 / I.S.2 / A440).

† Opaque doors in common spaces in CZ1-6 shall not exceed U-0.70, and in CZ 7-8, shall not exceed U-0.5.

National Rater Field Checklist



National Rater Field Checklist ¹ ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev. 02)

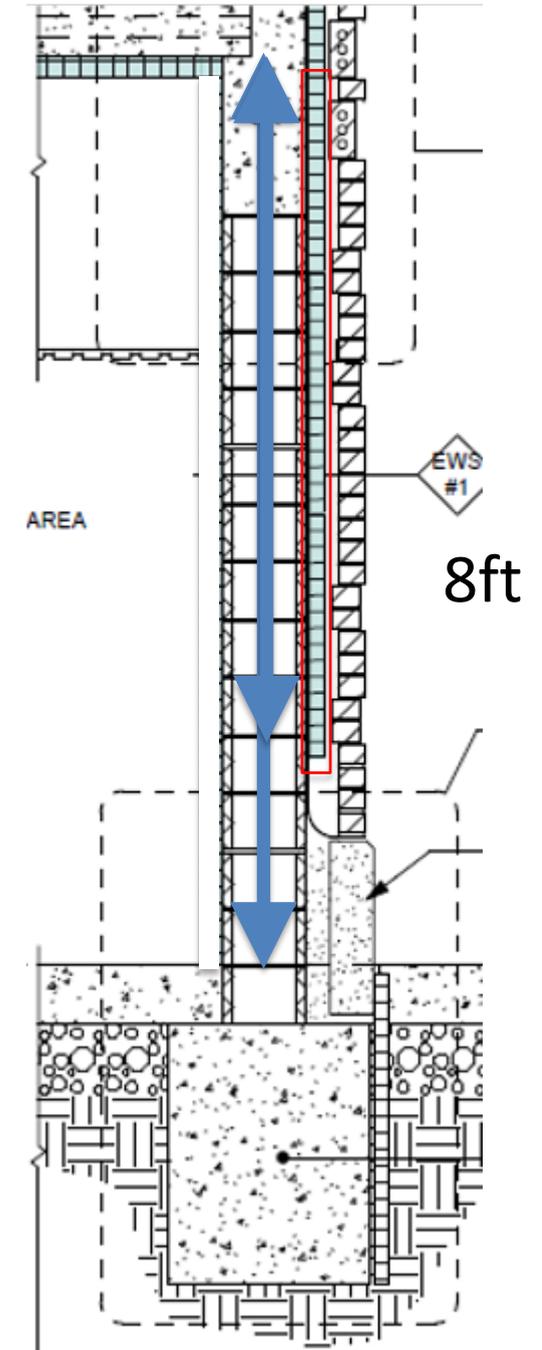
Project Name: _____ Number of Units: _____ Permit Date: _____
 Project Address: _____ City: _____ State: _____

Thermal Enclosure System	Must Correct	Builder Verified ³	Rater Verified ⁴	N/A ⁵
1. High-Performance Fenestration & Insulation				
1.1 Fenestration meets or exceeds specification in Items 2.1 & 2.2 of the Nat'l Rater Design Review Checklist.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
1.2 Insulation meets or exceeds specification in Items 3.1 & 3.2 of the Nat'l Rater Design Review Checklist.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
1.3 All insulation achieves Grade I install. per ANSI / RESNET / ICC Std. 301. Alternatives in Footnote 6. ^{6,7}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
1.4 Prescriptive Path: Window-to-wall ratio \leq 30%. ⁸	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.5 Heated plenums in unconditioned space or ambient conditions must meet the following requirements: ⁹				
1.5.1 Sides of heated plenum are an air barrier and insulated to \geq R-3ci in CZ 1-4; \geq R-5ci in CZ 5-6; \geq R-7.5ci in CZ 7; \geq R-9.5ci in CZ 8, AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.5.2 Insulation at top of heated plenum meets or exceeds the R-value for mass floors from the "All Other" column of Table 502.2(1) of 2009 IECC, AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.5.3 Bottom of heated plenum must have at least R-13 insulation. ¹⁰	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.6 Garages with space heating must meet the following requirements: ⁹				
1.6.1 Insulation on above grade walls and walls on the first story below grade \geq R-5ci in CZ 5-6; \geq R-7.5ci in CZ 7; \geq R-9.5ci in CZ 8, AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.6.2 Ceiling insulation meets or exceeds the R-value for mass floors from the "All Other" column of Table 502.2(1) of 2009 IECC.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Fully-Aligned Air Barriers ¹¹ At each insulated location below, a complete air barrier is provided that is fully aligned as follows: Ceilings: At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8. Also, at exterior vertical surface of ceiling insulation in all climate zones (e.g., using a wind baffle that extends to the full height of the insulation in every bay or a tabbed baffle in each bay with a soffit vent that prevents wind washing in adjacent bays). ¹²				
2.1 Dropped ceilings / soffits below unconditioned attics, chase / dead space, and all other ceilings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Walls: At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8. ¹³				
2.2 Walls behind showers, tubs, staircases, and fireplaces.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.3 Architectural bump-outs, dead space, and all other exterior walls.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
Floors: At exterior vertical surface of floor insulation in all climate zones and, if over unconditioned space, also at interior horizontal surface including supports to ensure alignment. Alternatives in Footnotes 15 & 16. ^{14, 15, 16}				
2.4 Floors above garages, floors above unconditioned spaces, and cantilevered floors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.5 All other floors adjoining unconditioned space (e.g., rim / band joists at exterior wall or at porch roof).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Reduced Thermal Bridging				
3.1 For insulated ceilings with attic space above (i.e., non-cathedralized), Grade I insulation extends to the inside face of the exterior wall below and is \geq R-21 in CZ 1-5; \geq R-30 in CZ 6-8. ¹⁷	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2 For insulated ceilings with attic space above, attic access panels and drop-down stairs insulated \geq R-10 or equipped with durable \geq R-10 cover. ¹⁸	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) \geq R-21 in CZ 1-5; \geq R-30 in CZ 6-8.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.4 For slabs on grade in CZ 4-8, 100% of slab edge insulated to \geq R-5 at the depth specified by Table 502.2(1) of the 2009 IECC and aligned with the thermal boundary of the walls. ^{19, 20}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.5 For elevated concrete slabs in CZ 4-8 (i.e., podiums and projected balconies, but not intermediate slab floor edges) 100% of the slab edge insulated to \geq R-5. For podiums, this insulation must extend for a minimum of 8ft below the bottom of the slab edge. For columns, the insulation must surround the column, at a depth of 4ft. Alternatives in Footnote 21. ²¹	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.6 For elevated concrete slabs in CZ 4-8 (i.e., podiums, but not intermediate floor slabs), floor insulation meets the U-factor specified in Table 502.1.2 of the 2009 IECC for Group R when dwelling units are above the slab, and for "All Other" when common space is above the slab. ²²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7 At above-grade walls and rim / band joists separating conditioned space from the exterior, one of the following options used: ^{23,26}				
3.7.1 Continuous rigid insulation, insulated siding, or combination of the two is: \geq R-3 in CZ 1-4; \geq R-5 in CZ 5-8 ^{24, 25, 26, 27} , OR;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7.2 Structural Insulated Panels OR; Insulated Concrete Forms OR; Double-wall framing OR; ^{24, 26, 28}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7.3 Option only for wood-framed walls either in CZ 1-3 OR \leq 3 stories: "advanced framing" details including all of the items below: ^{26,29}				
3.7.3a Corners insulated \geq R-6 to edge ³⁰ , AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7.3b Headers above windows & doors insulated \geq R-3 for 2x4 framing or equivalent cavity width, and \geq R-5 for all other assemblies (e.g., with 2x6 framing) ³¹ , AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7.3c Interior / exterior wall intersections insulated to same R-value as rest of exterior wall. ³²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

National Rater Field Checklist, Rev. 02

Clarifies podium insulation requirements and provides other alternatives

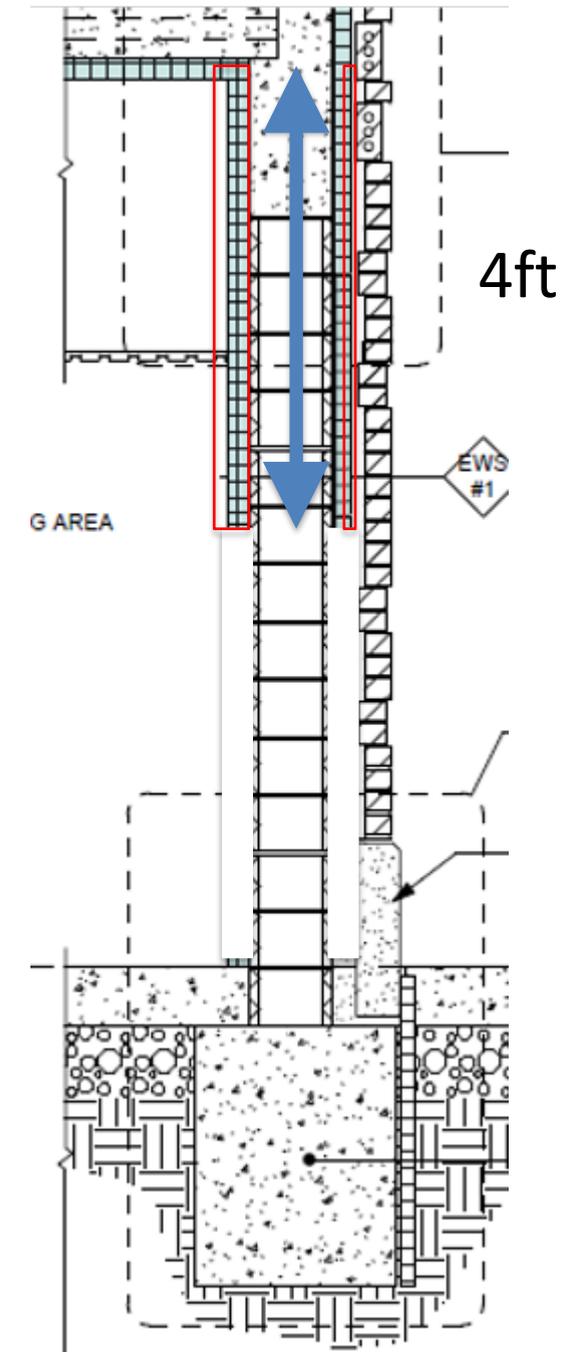
- Item 3.5 required that in CZ 4-8, 100% of the slab edge must be insulated to at least R-5 for the “full height of the podium wall”
- Since there are diminishing returns to insulating the whole wall, the requirement will be updated to require the wall be insulated to a height of 8 feet, or the whole wall, if the wall height is less than 8 feet
- “For podiums, this insulation must extend for a minimum of 8 ft below the bottom of the slab edge”



National Rater Field Checklist, Rev. 02

Clarifies podium insulation requirements and provides other alternatives

- An Alternative is shown in Footnote 21
- “For podiums, where insulation is installed on both interior and exterior surfaces of the wall, insulation depth may be reduced to 4ft”



National Rater Field Checklist, Rev. 02

HVAC grading by Rater allowed for residential systems serving common spaces

- System must serve a single space and type must be eligible for HVAC grading
- Requires compliance with HVAC Grading and all Path A requirements
 - Includes Standard 310 Design Report and Grade I or II Duct Leakage

38. Two tracks are provided for satisfying the mandatory requirements for all certified buildings, Exhibit 2. Track A – HVAC Grading by Rater allows a Rater to utilize ANSI / RESNET / ACCA Std. 310³⁹, a standard for grading the installation of residential HVAC systems, **for all applicable systems serving individual dwelling units or common spaces,** and a Functional Testing Agent to verify **commercial** and central systems. Track B – HVAC Testing by FT Agent utilizes a Functional Testing Agent for all systems. Either path may be selected, but all requirements within that path must be satisfied for the building to be certified.

National Rater Field Checklist, Rev. 02

Appliances and plumbing fixture requirements in the ERI and Prescriptive Paths are described in the checklist directly

13. Appliances and Plumbing Fixtures	Must Correct	Rater Verified ⁴	N/A ⁵
13.1 Prescriptive Path: Installed appliances are ENERGY STAR certified. Installed bathroom faucets, bathroom aerators, and showerheads are WaterSense labeled. 78	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.2 ERI Path: Where installed in common spaces, refrigerators and dishwashers are ENERGY STAR certified and showerheads are WaterSense labeled.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Footnote 78. Appliances include refrigerators, dishwashers, clothes washers, and clothes dryers. Where an appliance type is not eligible for ENERGY STAR certification, (e.g., commercial dryers) the appliance is exempt from this requirement. Where a bathroom faucet or aerator is not eligible for WaterSense certification, (e.g., public use lavatory faucets) the fixture is exempt from this requirement.

National Rater Field Checklist, Rev. 02

New alternative whole-building airtightness test threshold (1 ACH50) that qualifies for the reduced continuous kitchen exhaust rates when balanced ventilation is installed.

8. Local Mechanical Exhaust (National HVAC Design Report Item # indicated in parenthesis)						
Dwelling Unit Mechanical exhaust - In each dwelling unit kitchen and bathroom, a system is installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow and manufacturer-rated sound level standards: ^{54, 61}						
Location		Continuous Rate	Intermittent Rate ⁶²	Must Correct	Rater Verified ⁴	N/A ⁵
8.1 Kitchen	Airflow	≥ 5 ACH, based on kitchen volume ^{63, 64}	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume ^{61, 64, 65}	<input type="checkbox"/>	<input type="checkbox"/>	-
	Sound	Recommended: ≤ 1 sone	Recommended: ≤ 3 sones			
8.2 Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM	<input type="checkbox"/>	<input type="checkbox"/>	-
	Sound	Required: ≤ 2 sones	Recommended: ≤ 3 sones			

Footnote 64. Alternatively, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 are permitted to be used for kitchen exhaust fans based upon the rated airflow of the fan at 0.25 IWC. If the rated airflow is unknown, ≥ 6 in. smooth duct shall be used, with a rectangular to round duct transition as needed. Guidance to assist partners with these alternatives is available at www.energystar.gov/newhomesguidance. As an alternative to Item 8.1, dwelling units are permitted to use a continuous kitchen exhaust rate of 25 CFM per 2009 IRC Table M1507.3, if they are either a) PHIUS+ or PHI certified, or b) provide both dwelling-unit ventilation and local mechanical kitchen exhaust using a balanced system, and have a Rater-verified whole-building infiltration rate **≤ 1.0 ACH50** or ≤ 0.05 CFM50 per sq. ft. of Enclosure Area. 'Enclosure Area' is defined as the area of the surfaces that bound the volume being pressurized / depressurized during the test.



National Rater Field Checklist, Rev. 02

Other Updates

- Clarifies that insulation at the bottom of a heated plenum can be either Grade I or Grade II.
- Clarifies that projected balconies with a thermal break of at least R-2 are *not* subject to the modification of area in the total UA calculation.



20sf x4= 80 sf
in UA calculation

National Rater Field Checklist, Rev. 02

Other Updates

- Clarifies that the reduced thermal bridging requirements for above-grade walls apply to walls adjacent to the exterior, rather than walls to unconditioned spaces.
- [Slab edge details](#) document clarifies that slab edge insulation is not needed between conditioned and unconditioned space within the thermal envelope
- Clarifies the requirement for ventilation override control to is for all dwelling units, while still only requiring them to be 'readily-accessible' in townhouses
- Clarifies that ducted systems not subject to a duct leakage test are still subject to visual inspection.

National Rater Field Checklist, Rev. 02

Other Updates

- Clarifies that multi-splits, ductless systems, and systems with a supply ductwork 10 ft or less are not subject to the Rater-measured static pressure test requirement.
- Expands the options for attic “access” with respect to the requirement for HVAC filters to be accessible
- Requires pest screens on air inlets
- Updates Exhibit X to better describe minimum efficiencies for PTAC’s and to reference ASHRAE 90.1-2010 for minimum efficiencies for equipment not listed in the Exhibit.



Exhibit X – Prescriptive Minimum Heating and Cooling Equipment Efficiencies †

Equipment Type	Minimum Efficiency
Room AC (-window, through-wall, ductless mini-splits)	ENERGY STAR certified
Air conditioners, air cooled (<13 KBtu/h)	13 SEER
Air conditioners, air cooled (≥13 and <65 KBtu/h)	See Reference Design
Air conditioners, air cooled (≥65 and <240 KBtu/h)	11.5 EER/12.0 IEER
Air conditioners, air cooled (≥240 and < 760 KBtu/h)	10.0 EER/10.5 IEER
Electric resistance space heating	<ul style="list-style-type: none"> • Not permitted in any dwelling unit using the Prescriptive Path • Electric resistance heating specified in common spaces has a total heating capacity ≤ 12 kBtu/h (3.5 kW) per enclosed space and has automatic thermostatic controls
Warm-Air Furnace (<225 KBtu/h, common spaces)	78% AFUE or 80% Et
Warm-Air Furnace (<225 KBtu/h, dwelling units)	See Reference Design, For PTAC, use 80% Et
Warm-Air Furnace (≥225 KBtu/h)	80% Et (gas) or 81% Et (oil)
Packaged Terminal Air Conditioner (PTAC < 7 kBtu/h)	11.9 EER
Packaged Terminal Air Conditioner (PTAC > 15 kBtu/h)	9.5 EER
Packaged Terminal Air Conditioner (≥7 and ≤15 kBtu/h)	14.043.8 – (0.300 X Cap/1000) EER
Packaged Terminal Heat Pump (PTHP)	Cooling: 14.0 – (0.3 X Cap/1000) EER Heating: 3.7 – (0.052 X Cap/1000) COP
Air cooled heat pump (≥13 and <65 KBtu/h)	See Reference Design
Air cooled heat pump (≥65 and <240 KBtu/h)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)
Air cooled heat pump (≥240 KBtu/h)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)
Water-source heat pump (<135 KBtu/h)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)
Boilers, hot water (<300,000 Btu/h)	See Reference Design
Boilers, hot water (≥300,000 Btu/h)	86% E _t (89% E _t if using heat pumps)
VRF Air Conditioners and Heat Pumps	See Tables 6.8.11 and 6.8.1J of ASHRAE 90.1-2010
Air-cooled chillers with or without condenser	10.0 EER / 12.5 IPLV
Water-cooled chiller, positive displacement (<75 tons)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)
Water-cooled chiller, positive displacement (75-150 tons)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)
Water-cooled chiller, positive displacement (150-300tons)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)
Water-cooled chiller, positive displacement (>300 tons)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)
Water-cooled, centrifugal (<300 tons)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)
Water-cooled, centrifugal (≥300 and <600 tons)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)
Water-cooled, centrifugal (≥600 tons)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)
Air-cooled absorption single effect chiller	0.6 COP
Water-cooled absorption single effect chiller	0.7 COP
Absorption double effect indirect-fired chiller	1.0 COP (Full load) / 1.05 COP (IPLV)
Absorption double effect direct-fired chiller	1.0 COP (Full load) / 1.00 COP (IPLV)
Open-loop propeller or axial fan cooling towers*	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
Closed-loop propeller or axial fan cooling towers*	>15 gpm/hp @102°F entering water, 90°F leaving water, 75°F wb entering air)
Open-loop centrifugal fan cooling towers*	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
Closed-loop centrifugal fan cooling towers*	>8 gpm/hp @102°F entering water, 90°F leaving water, 75°F wb entering air)

Cap means the rated capacity of the product in Btu/h. If < 7,000 Btu/h, use 7,000; if > 15,000, use 15,000 in calculation.

*Cooling tower fan motors must be equipped with VFD controlled by a temperature sensor on the condenser water supply pipe.

† For Equipment Types not listed here, minimum efficiencies shall be based on those listed in ASHRAE 90.1-2010.

Revised 10/24/2020



National HVAC Design Report



National HVAC Design Report ¹

ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev. 02)

- HVAC Designer Responsibilities:**
- Complete one National HVAC Design Report for each building which includes system design for all unique unit plans and common spaces. For projects with multiple buildings, one National HVAC Design Report per building or per project is permitted. ¹
 - Obtain efficiency features (e.g., window performance, insulation levels, and infiltration rate) from the builder, architect, or Rater. ²
 - Provide the completed National HVAC Design Report to the Rater and the person / company completing the National HVAC Functional Testing Checklist. ²

1. Design Overview

1.1 Designer name: _____ Designer company: _____ Date: _____

1.2 Select which party you are providing these design services to: Builder / Developer FT Agent MEP / Credentialed HVAC contractor

1.3 Name of company you are providing these design services to (if different than Item 1.1): _____

1.4 Project address: _____ City: _____ State: _____ Zip code: _____

2a. Dwelling Unit & Common Space Mechanical Ventilation Design ^{3,4}						Designer Verified
Airflow:						
2.1 Dwelling unit ventilation airflow design rate & run-time meet the requirements of Section 4 of ASHRAE 62.2 ⁵ <input type="checkbox"/> 2010 <input type="checkbox"/> 2013.						<input type="checkbox"/>
2.2 Common space outdoor airflow design rate meet the requirements of Section 6 of ASHRAE 62.1 ⁶ <input type="checkbox"/> 2010 <input type="checkbox"/> 2013, without exceeding 2013 rates by more than 50%.						<input type="checkbox"/>
2.3 Access points to measure airflow rate and inspect outdoor air dampers are provided and accessible by the Rater. ²						<input type="checkbox"/>
List unique unit plan for which 62.2 ventilation rates were calculated in the spaces to the right: ⁷						
2.4 # of bedrooms:						
2.5 Square footage:						
2.6 Ventilation airflow rate required by ASHRAE 62.2:						
2.7 Ventilation airflow rate designed:						
2.7.1 If applicable, run-time per cycle (minutes):						
2.7.2 If applicable, cycle time (minutes):						
List common space for which 62.1 ventilation rates were calculated in the spaces to the right: ⁷						
2.8 Ventilation airflow rate required by ASHRAE 62.1:						
2.9 Ventilation airflow rate designed:						
System Type & Controls:						
List Ventilation System ID in the spaces to the right: ⁷						
2.10 Specified system type: (e.g., supply, exhaust, balanced, ERV, HRV)						
2.11 Specified system type: (e.g., in-unit, central)						
2.12 Manufacturer:						
2.13 Model Number:						
2.14 Area / space(s) that system serves: (e.g., Unit A kitchens, corridor, community room)						
2.15 Specified control location: (e.g., Master bath, utility):						
2.16 Specified controls allow the systems to operate automatically, without occupant intervention. A ventilation override control is specified and also labeled if its function is not obvious (e.g., a label is required for a standalone wall switch, but not for a switch that's on the ventilation equipment). In townhouses only, this control must be readily accessible to the occupant. In all other multifamily dwelling units, the override control is not required to be readily accessible to the occupant. However, in such cases, EPA recommends but does not require that the control be readily accessible to others (e.g., building maintenance staff) in lieu of the occupant.						<input type="checkbox"/>
2.17 No outdoor air intakes designed to connect to the return side of the dwelling unit HVAC system, unless specified controls operate intermittently and automatically based on a timer and restrict intake when not in use (e.g., motorized damper). ⁸						<input type="checkbox"/>
Sound:						
2.18 If located in the dwelling unit, the fan of the specified system is rated ≤ 3 sones if intermittent and ≤ 2 sones if continuous, or exempted. ⁹						<input type="checkbox"/>
Efficiency:						
2.19 If system utilizes the dwelling unit HVAC fan, then the specified fan type in Item 4.12 is ECM / ICM, or the specified controls will reduce the standalone ventilation run-time by accounting for hours when the HVAC system is heating or cooling.						<input type="checkbox"/>
2.20 If in-unit bathroom fans or in-line fans are specified as part of the dwelling unit mechanical ventilation system, then they are ENERGY STAR certified. ¹⁰						<input type="checkbox"/>
2.21 If central exhaust fans, ≤ 1 HP, are specified as part of the dwelling unit mechanical ventilation system, then they are direct-drive, ECM, with variable speed controllers. If > 1 HP, they are specified with NEMA Premium™ Motors.						<input type="checkbox"/>

Revised 10/28/2020

Page 1 of 13



ENERGY STAR. The simple choice for energy efficiency.



National HVAC Design Report, Rev. 02

What happens when you have 7 unique load calcs for 7 unique units from Section 3, but specifying **the same 2 ton HP** for each?

Cooling Equipment ⁷ (Complete all applicable items; otherwise check "N/A".) <input type="checkbox"/> N/A						
List Cooling Equipment ID in the spaces to the right:						
4.4 Equipment type: (e.g., PTAC / AC, Chiller / CT, PTHP / WLHP / GSHP / ASHP / VRF)						
4.5 Area / Space(s) that system serves:						
4.6 Chiller / condenser / outdoor unit manufacturer:						
4.7 Chiller / condenser / outdoor unit model #:						
4.8 Evaporator / indoor unit manufacturer:						
4.9 Evaporator / indoor unit model #:						
4.10 AHRI reference #: ³¹						
4.11 AHRI listed efficiency:						
4.12 Evaporator fan type: PSC, ECM / ICM Other:						
4.13 Compressor speed: Single, Two, Variable						
4.14 Turn down ratio (for variable speed equipment):						
4.15 Latent capacity at design conditions (kBtuh): ³²						
4.16 Sensible capacity at design conditions (kBtuh): ³²						
4.17 Total capacity at design conditions (kBtuh): ³²						
4.18 Cooling sizing % = Total capacity (Item 4.17) divided by Total Heat Gain of space(s) in Item 4.5:						
4.19 Meets cooling sizing limit: (see below for A, B, C, D or N/A) ²⁰						
4.20 If "B", list Load sensible heat ratio = Max. sensible heat gain (Item 3.15) / Max. total heat gain (Item 3.17): ³³						
4.21 If "B", calculate HDD / CDD ratio: ³³						

National HVAC Design Report, Rev. 02

Rev.02 provides guidance on documenting equipment that is used in multiple spaces to avoid duplicate data entry

“...where the same equipment ID is used in multiple spaces, identical data is not required to be repeated...”

Cooling Equipment ⁷ (Complete all applicable items, <u>noting "N/A" as needed</u> ; where the same Equipment ID is used in multiple spaces (columns), identical data is not required to be repeated and can be left blank; where cooling is not provided, otherwise check "N/A".)							
List Cooling Equipment ID in the spaces to the right: <u>duplicating as needed for each unique space served:</u>	HP1						
4.4 Equipment type: (e.g., PTAC / AC, Chiller / CT, PTHP / WLHP / GSHP / ASHP / VRF)							
4.5 Area / Space(s) that system serves:							
4.6 Chiller / condenser / outdoor unit manufacturer:							
4.7 Chiller / condenser / outdoor unit model #:							
4.8 Evaporator / indoor unit manufacturer:							
4.9 Evaporator / indoor unit model #:							
4.10 AHRI reference #: ³¹							
4.11 AHRI listed efficiency:							
4.12 Evaporator fan type: PSC, ECM / ICM, Other:							
4.13 Compressor speed: Single, Two, Variable							
4.14 Turn down ratio (for variable speed equipment):							
4.15 Latent capacity at design conditions (kBtuh): ³²							
4.16 Sensible capacity at design conditions (kBtuh): ³²							
4.17 Total capacity at design conditions (kBtuh): ³²							
4.18 Cooling sizing % = Total capacity (Item 4.17) divided by Total Heat Gain (Item 3.17) of space(s) in Item 4.5: ²²							
4.19 Meets cooling sizing limit: (see below for A, B, C, D or N/A) ²⁰							
4.20 If "B", list Load sensible heat ratio = Max. sensible heat gain (Item 3.15) / Max. total heat gain (Item 3.17): ³³							
4.21 If "B", calculate HDD / CDD ratio: ³³							

Leave these gray areas blank



National HVAC Design Report, Rev. 02

Other Updates

- Provides clearer guidance on documenting load calculations for a group design.
- Adds alternative options for documenting equipment sizing when equipment is outside the scope of Manual S.
- Allows heating equipment to be over-sized as needed if equipment is also providing domestic hot water or where standby equipment is installed for safety/redundancy.

4. Heating & Cooling Equipment Selection	
4.1 Equipment selected per <input type="checkbox"/> ACCA Manual S, <u>or where not applicable, <input type="checkbox"/> Other: _____</u> . (See Footnote 30) ³⁰	<input type="checkbox"/>

30. Equipment shall be selected using the maximum total heat gain and the total heat loss in Section 3 per ACCA Manual S, Second Edition, except that cooling ranges above ACCA Manual S limits are temporarily allowed, per Item 4.19, and heating ranges above ACCA Manual S limits are allowed where heating and hot water are provided by the same equipment or where standby equipment is needed for redundancy, but only operate when the primary equipment is not operating. For equipment outside the scope of ACCA Manual S, "Other" may be indicated and the equipment sizing approach listed in the space provided.

National HVAC Design Report, Rev. 02

Other Updates

- Provides an alternative to use the Single-Family New Homes HVAC Design report for dwelling units.
- Clarifies that townhouses are still required to use Manual D for duct design, while other dwelling units have other options.
- Clarifies the requirement for ventilation override control is for all dwelling units, while still only requiring them to be 'readily-accessible' in townhouses.
- Adds relevant items from the Functional Testing Checklist for improved visibility.

4.42 For circulating pumps serving hydronic heating or cooling systems with three-phase motors, 1 horse-power or larger, motors shall meet or exceed efficiency standards for NEMA Premium™ motors. If 5 horse-power or larger, must also be specified with variable frequency drives.

4.43 If a variable speed pumping system is installed, system designed to prevent "dead-heading" and a method of water flow bypass is provided, such as a minimum flow bypass valve or 3-way valves on specific terminal units.

4.44 For shared boilers, chillers, and cooling towers, temperature and pressure gauges, air eliminator, expansion tank, and check valves are clearly shown on the drawings. A complete sequence of operations for all systems indicating recommendations for all setpoints is provided.

National HVAC Functional Testing Checklist



National HVAC Functional Testing Checklist ¹ ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev.02)

HVAC Functional Testing Agent Responsibilities:

- The entity verifying Functional Testing, the Functional Testing Agent ("FT Agent"), must be a contractor credentialed by an HVAC Quality Installation Training and Oversight organization (H-QUITO), or must hold an approved credential, as listed at www.energystar.gov/ftas, or must be a representative of the Original Equipment Manufacturer (OEM) to complete this checklist. A contractor credentialed by an H-QUITO is only permitted to complete Sections 1-5 of this checklist. ²
- Functional Testing checklists must be completed and signed by an FT Agent. ¹ An FT Agent is permitted to complete just the specific sections of this checklist that pertain to their area of expertise. However, all applicable sections must be completed by an FT Agent, which may result in multiple checklists signed by multiple FT Agents. FT Agents shall only sign checklists that contain items that they have verified. An FT Agent may mark an item as 'verified' by conducting the test or inspection themselves, or witness the test or inspection being conducted by the installing contractor or other HVAC professional. Where a checkbox for "FT Agent Verified" is not provided, FT Agents should fill in all applicable data fields.
- Functional Testing checklists must include all HVAC systems in the building / project that serve the dwelling units, common spaces, and where applicable, parking garages, but may exclude systems solely serving commercial / retail spaces. Multiple checklists will be needed to document all HVAC systems in the building / project. Except where items are verified by the installing contractor, items on the Functional Testing Checklist are permitted to be verified using [MFNC HVAC Functional Testing Checklist Sampling Protocols](#).
- The completed checklists, along with the corresponding National HVAC Design Report, shall be retained by the FT Agent for quality assurance purposes. Furthermore, if the FT Agent is not a credentialed contractor, they shall provide the completed and signed checklists to the builder / developer and the Rater ³ responsible for certifying the units / building, prior to the project's certification. Credentialed contractors shall provide the checklist upon request.

1. Functional Testing Overview

1.1 Company performing Functional Testing: _____ FT Agent name: _____ Date: _____

1.2 Functional Testing Agent Credential: _____
If a credentialed contractor, fill out applicable H-QUITO and ID Number: ACCA Advanced Energy ID Number: _____

1.3 Builder / developer client name: _____

1.4 Project address: _____ City: _____ State: _____ Zip code: _____

1.5 National HVAC Design Report corresponding to this project has been collected from designer or builder.

1.6 Checklist applies to the following equipment (include unit # as applicable): _____

2. Refrigerant Charge - Run system for 15 minutes before testing. If outdoor ambient temperature at the condenser is $\leq 55^{\circ}\text{F}$ or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, the outdoor temperature shall be recorded in Item 2.1, and the contractor shall check "N/A" in this Section. ⁴ This section must be completed for refrigerant-based systems with field-installed refrigerant piping or components (i.e., split air conditioners, air-source heat pumps, and water-source heat pumps), up to 65 kBtu/h, whether serving dwelling units or common spaces in the building. Ducted or non-ducted single-packaged systems (i.e., PTAC), mini-splits, or multi-splits are exempt from this section. When using the alternative OEM test procedure in Item 2.16, check "NA" for Items 2.1-2.15. ⁵

	FT Agent Verified	N/A
2.1 Outdoor ambient temperature at condenser: _____ $^{\circ}\text{F}$ DB	-	-
2.2 Return-side air temperature inside duct near evaporator, during cooling mode: _____ $^{\circ}\text{F}$ WB	-	<input type="checkbox"/>
2.3 Liquid line pressure: _____ psig	-	<input type="checkbox"/>
2.4 Liquid line temperature: _____ $^{\circ}\text{F}$ DB	-	<input type="checkbox"/>
2.5 Suction line pressure: _____ psig	-	<input type="checkbox"/>
2.6 Suction line temperature: _____ $^{\circ}\text{F}$ DB	-	<input type="checkbox"/>
For System with Thermal Expansion Valve (TXV):		
2.7 Condenser saturation temperature: _____ $^{\circ}\text{F}$ DB (Using Item 2.3)	-	<input type="checkbox"/>
2.8 Subcooling value: _____ $^{\circ}\text{F}$ DB (Item 2.7 – Item 2.4)	-	<input type="checkbox"/>
2.9 OEM subcooling goal: _____ $^{\circ}\text{F}$ DB	-	<input type="checkbox"/>
2.10 Subcooling deviation: _____ $^{\circ}\text{F}$ DB (Item 2.8 – Item 2.9)	-	<input type="checkbox"/>
For System with Fixed Orifice:		
2.11 Evaporator saturation temperature: _____ $^{\circ}\text{F}$ DB (Using Item 2.5)	-	<input type="checkbox"/>
2.12 Superheat value: _____ $^{\circ}\text{F}$ DB (Item 2.6 – Item 2.11)	-	<input type="checkbox"/>
2.13 OEM superheat goal: _____ $^{\circ}\text{F}$ DB (Using superheat tables and Items 2.1 & 2.2)	-	<input type="checkbox"/>
2.14 Superheat deviation: _____ $^{\circ}\text{F}$ DB (Item 2.12 – Item 2.13)	-	<input type="checkbox"/>
2.15 Item 2.10 is $\pm 3^{\circ}\text{F}$ or Item 2.14 is $\pm 5^{\circ}\text{F}$.	<input type="checkbox"/>	<input type="checkbox"/>
2.16 An OEM test procedure (e.g., as defined for a ground-source heat pump) has been used in place of the sub-cooling or super-heat process and documentation has been attached that defines this procedure.	<input type="checkbox"/>	<input type="checkbox"/>



National HVAC Functional Testing Checklist, Rev. 02

In Rev.01, HVAC Functional Testing Checklists must include all HVAC systems in the building/project that serve the dwelling units, common spaces, and where applicable, parking garages

Rev.02 provides sampling protocols for FT Agents

 National HVAC Functional Testing Checklist ¹
ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev.02)

HVAC Functional Testing Agent Responsibilities:

- The entity verifying Functional Testing, the Functional Testing Agent ("FT Agent"), must be a contractor credentialed by an HVAC Quality Installation Training and Oversight organization (H-QUITO), or must hold an approved credential, as listed at www.energystar.gov/ftas, or must be a representative of the Original Equipment Manufacturer (OEM) to complete this checklist. A contractor credentialed by an H-QUITO is only permitted to complete Sections 1-5 of this checklist. ²
- Functional Testing checklists must be completed and signed by an FT Agent. ¹ An FT Agent is permitted to complete just the specific sections of this checklist that pertain to their area of expertise. However, all applicable sections must be completed by an FT Agent, which may result in multiple checklists signed by multiple FT Agents. FT Agents shall only sign checklists that contain items that they have verified. An FT Agent may mark an item as 'verified' by conducting the test or inspection themselves, or witness the test or inspection being conducted by the installing contractor or other HVAC professional. Where a checkbox for "FT Agent Verified" is not provided, FT Agents should fill in all applicable data fields.
- Functional Testing checklists must include all HVAC systems in the building / project that serve the dwelling units, common spaces, and where applicable, parking garages, but may exclude systems solely serving commercial / retail spaces. Multiple checklists will be needed to document all HVAC systems in the building / project. **Except where items are verified by the installing contractor, items on the Functional Testing Checklist are permitted to be verified using [MFNC HVAC Functional Testing Checklist Sampling Protocols](#).**
- The completed checklists, along with the corresponding National HVAC Design Report, shall be retained by the FT Agent for quality assurance purposes. Furthermore, if the FT Agent is not a credentialed contractor, they shall provide the completed and signed checklists to the builder / developer and the Rater ³ responsible for certifying the units / building, prior to the project's certification. Credentialed contractors shall provide the checklist upon request.

1. Functional Testing Overview

1.1 Company performing Functional Testing: _____ FT Agent name: _____ Date: _____

1.2 Functional Testing Agent Credential: _____
If a credentialed contractor, fill out applicable H-QUITO and ID Number: ACCA Advanced E

1.3 Builder / developer client name: _____

1.4 Project address: _____ City: _____

_____ National HVAC Design Report corresponding to this project

National HVAC Functional Testing Checklist, Rev. 02

Sampling Protocols

- Provide rules and rates for FT Agent to sample Sections 2-6
- FT Agent may only sample if not the installing contractor, and installing contractor must complete tests on all systems
- FT Agent may sample by re-testing or witnessing
- Examples & guidance on 'similar' systems

Additional Notes:

- When Rater samples Section 5 for indoor units served by shared outdoor units (VRF systems), the Rater must select indoor units such that they are connected to a representative sample of outdoor units



HVAC Functional Testing Checklist Sampling Protocols ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / OR-WA 1.2

This document describes the protocols that must be followed when sampling is used to verify items contained within the ENERGY STAR Multifamily New Construction HVAC Functional Testing Checklist.

When a Rater is sampling Section 4 or 5 of the Functional Testing Checklist, the following rules apply:

1. The Rater must follow an HCO-approved Sampling Protocol.
2. When the Rater is using sampling to complete Section 5 for a shared VRF system, Raters must select units from a representative sample of the associated outdoor units.

Sampling of Functional Testing Checklist items by the Functional Testing Agent is permitted only if the following requirements are met for a given project:

1. The Functional Testing Agent is *not* the installation contractor.
2. The installation contractor completes all required tests on all systems.

Where eligible to use sampling, Functional Testing (FT) Agents may apply sampling on all qualifying HVAC systems, or on a subset of their HVAC systems and/or on a subset of the required functional tests.

When an FT Agent is sampling Functional Testing Checklist items, the following rules apply:

1. Sampling may be used to complete Sections 2, 3, 4, 5 and 6, but not Sections 7, 8, or 9.
 - a. Exception: 100% of systems that serve common spaces must meet Functional Testing Sections 5.2 and 6.2.
2. In this document, the 'similar systems' refers to all systems of the same system type, meaning they are the same fuel type, manufacturer, class and series. They may be different nominal sizes.
3. Similar systems may be grouped together regardless of whether they are serving common spaces or dwelling units, however at least one system must be tested in a common space and in a dwelling unit.
4. Each sampled item shall qualify for sampling independently of the other sampled items.
5. When pursuing sampling, a representative sampling of similar systems must be tested. At a minimum there must be one test of each similar system, per floor, per building.
6. Sampling may be applied to multiple multifamily buildings, but only if they are within the same project, and installed by the same installation contractor company.
7. The Rater is responsible to ensure the minimum number of systems have been verified by the Functional Testing Agent. The Rater is responsible for collecting all sampling documentation, including any reports of failures.

Two options for sampling are available to the Functional Testing (FT) Agent, based on whether they choose to verify Functional Testing Checklist items directly, by re-testing and re-inspecting items that have already been tested or inspected by the installation contractor OR they choose to witness the tests or inspections as they are being conducted by the installation contractor.

Sampling Option 1: Re-testing

Before beginning the sampling process, the FT Agent must test five (5) similar systems.

Next, in order to start sampling, the FT Agent must test at least five (5) similar systems in a row without failure.

- o This brings the minimum number of systems tested before sampling is started to ten (10).

After a minimum of 5 systems have passed in a row, the FT Agent may test a minimum of 20% of the remaining similar systems.

Any system that fails the test or inspection shall be corrected and re-inspected and/or re-tested on that system until it passes.

The failed item(s) shall then be tested on five (5) similar systems in a row without a failure, before the FT Agent may again start sampling on a minimum of 20% of the remaining similar systems.

National HVAC Functional Testing Checklist, Rev. 02

Sampling Protocol Rates

- Test 5 initial units, then 5 in a row without failure to start sampling.
 - Option 1: Re-test 20% of remaining units. If a failure, fix failure and test 5 in a row without failure to sample again
 - Option 2: Witness 30% of remaining units. If a failure, fix failure and witness 5 in a row without failure to sample again

National HVAC Functional Testing Checklist, Rev. 02

Rev.02 clarifies text in Section 2 to better describe systems that are subject to the refrigerant charge tests. Basically, if there's field-installed refrigerant piping or components, testing is required. Single-packaged and mini/multi-splits are exempt.

<p>2. Refrigerant Charge - Run system for 15 minutes before testing. If outdoor ambient temperature at the condenser is $\leq 55^{\circ}\text{F}$ or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, the outdoor temperature shall be recorded in Item 2.1, and the contractor shall check "N/A" in this Section. ⁴ This section must be completed for refrigerant-based systems with field-installed refrigerant piping or components (i.e., split air conditioners, air-source heat pumps, and water-source heat pumps), up to 65 kBtu/h, whether serving dwelling units or common spaces in the building. Ducted or non-ducted single-packaged systems (i.e., PTAC), mini-splits, or multi-splits are exempt from this section. When using the alternative OEM test procedure in Item 2.16, check "NA" for Items 2.1-2.15. ⁵</p>		FT Agent Verified	N/A <input type="checkbox"/>
2.1 Outdoor ambient temperature at condenser:	<input type="text"/>	°F DB	-
2.2 Return-side air temperature inside duct near evaporator, during cooling mode:	<input type="text"/>	°F WB	<input type="checkbox"/>
2.3 Liquid line pressure:	<input type="text"/>	psig	<input type="checkbox"/>
2.4 Liquid line temperature:	<input type="text"/>	°F DB	<input type="checkbox"/>
2.5 Suction line pressure:	<input type="text"/>	psig	<input type="checkbox"/>
2.6 Suction line temperature:	<input type="text"/>	°F DB	<input type="checkbox"/>

National HVAC Functional Testing Checklist, Rev. 02

Rev.02 provides an alternative to Section 3 (Indoor HVAC Fan Airflow) for supply systems with 10 ft. or less of ductwork.

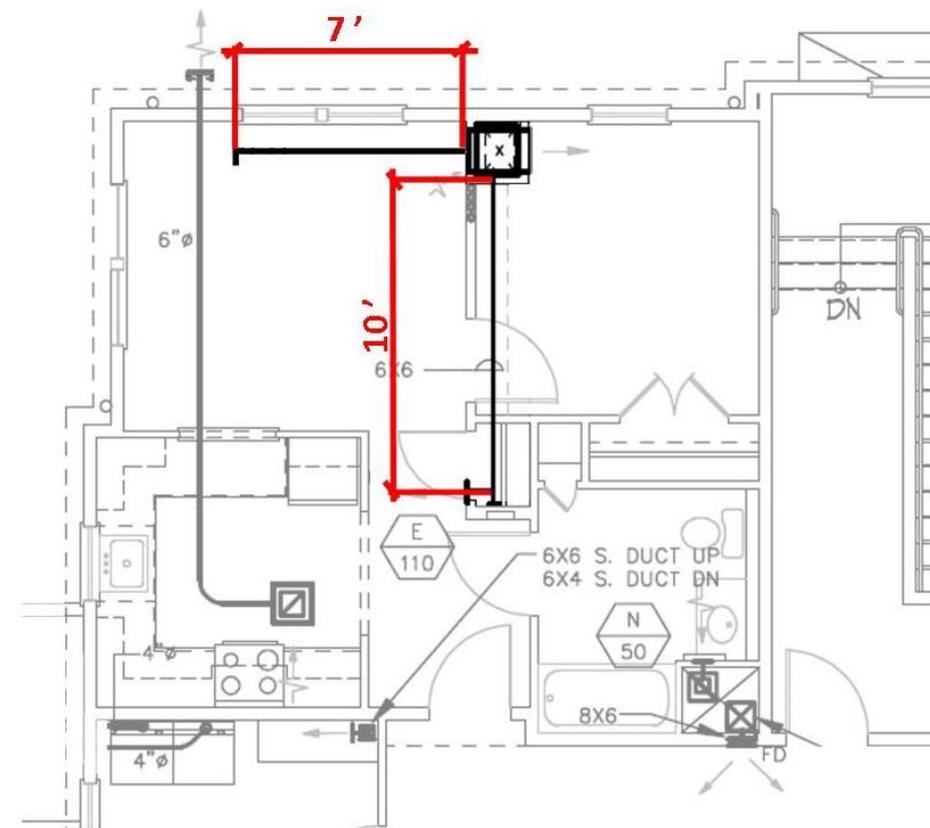
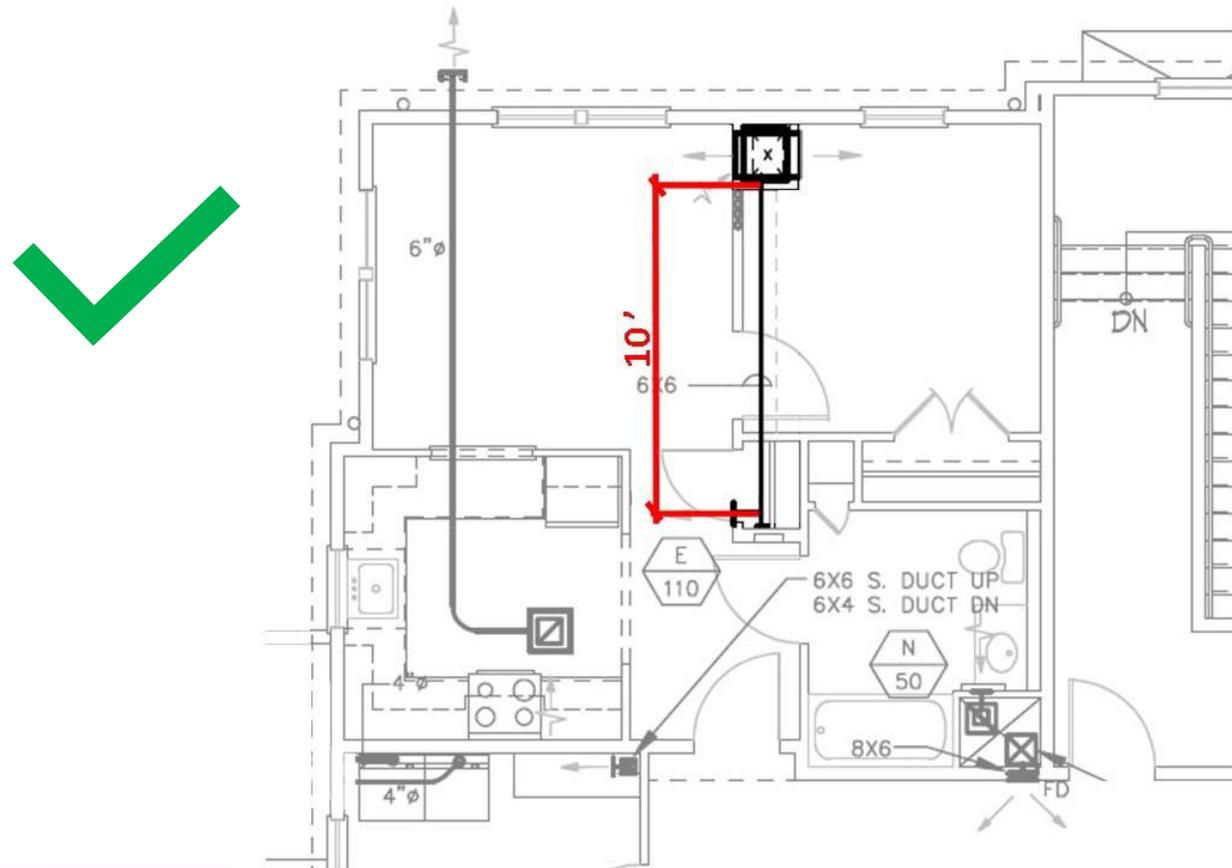
 National HVAC Functional Testing Checklist ¹ ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev.02)		FT Agent Verified	N/A <input type="checkbox"/>
3. Indoor HVAC Fan Airflow - This section must be completed for split air conditioners, unitary air conditioners, air-source heat pumps (including multi-splits), and water-source (i.e., geothermal or water-loop) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air distribution systems (i.e., ducts), whether serving dwelling units or other common spaces in the building. Mini-splits, ducted or non-ducted, are exempt; however, multi-split systems such as shared VRF systems, where indoor HVAC fans with forced-air distribution are connected to a shared outdoor unit that exceeds 65 kBtuh, are not exempt. 5			
3.1 The mode with the higher design HVAC fan airflow used, per Item 5.2 of National HVAC Design Report: <input type="checkbox"/> Heating <input type="checkbox"/> Cooling		<input type="checkbox"/>	-
3.2 Static pressure test holes have been created, and test hole locations are well-marked and accessible.		<input type="checkbox"/>	-
Test hole location for return external static pressure: <input type="checkbox"/> Plenum <input type="checkbox"/> Cabinet <input type="checkbox"/> Transition <input type="checkbox"/> Other: _____		-	-
Test hole location for supply external static pressure: <input type="checkbox"/> Plenum <input type="checkbox"/> Cabinet <input type="checkbox"/> Transition <input type="checkbox"/> Other: _____		-	-
3.3 Measured return external static pressure (Enter value only, without negative sign): _____ IWC		-	-
3.4 Measured supply external static pressure (Enter value only, without positive sign): _____ IWC		-	-
3.5 Measured total external static pressure = Value-only from Item 3.3 + Value-only from Item 3.4 = _____ IWC		-	-
3.6 Measured (Item 3.5) - Design (Item 5.2 on National HVAC Design Report) total external static pressure = _____ IWC		-	-
3.7 Measured HVAC fan airflow, using Item 3.5 and fan speed setting: _____ CFM		-	-
3.8 Measured HVAC fan airflow (Item 3.7) is ± 15% of design HVAC fan airflow (Item 5.2 on National HVAC Design Report).		<input type="checkbox"/>	-

National HVAC Functional Testing Checklist, Rev. 02

Footnote 5. The term “mini-split” ... Systems where total supply duct length of the entire system, including the sum of all supply trunks and branches, is 10 ft or less,

National HVAC Functional Testing Checklist, Rev. 02

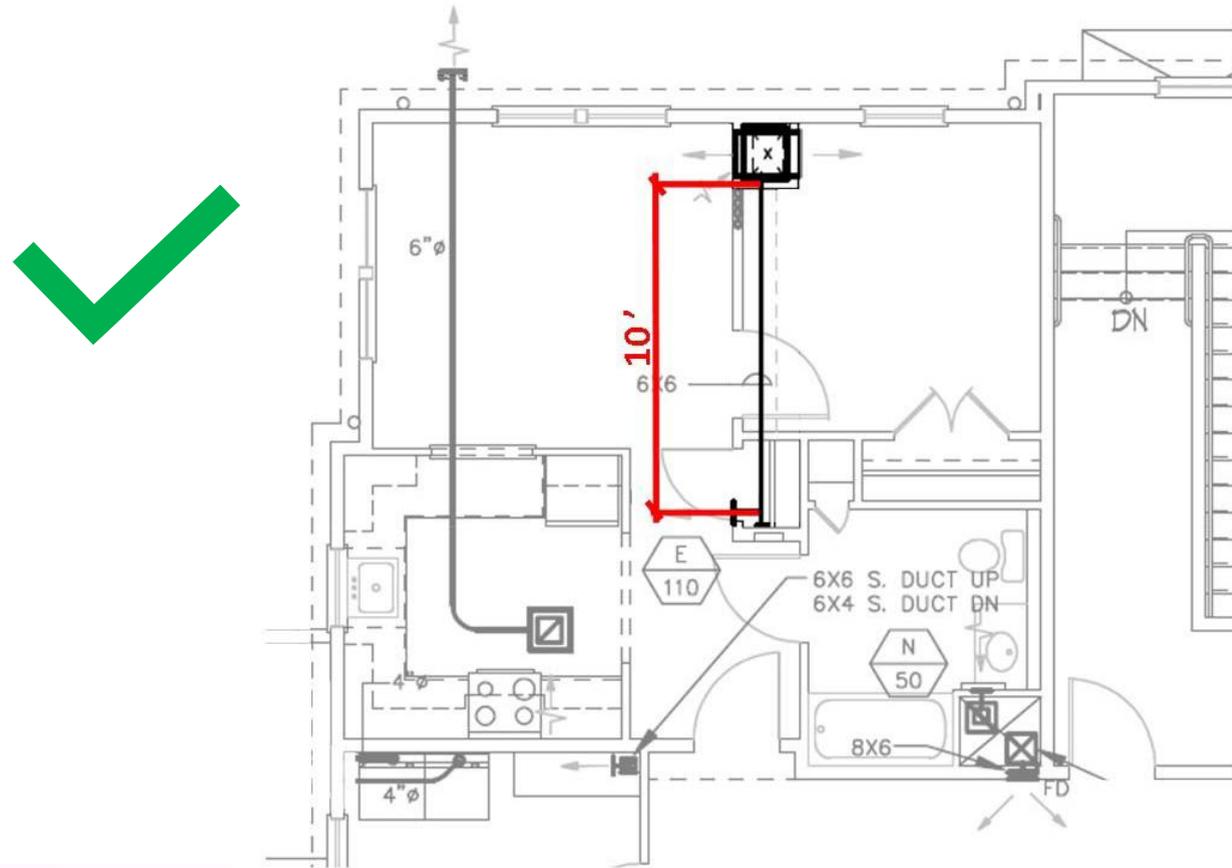
Footnote 5. The term “mini-split” ... Systems where total supply duct length of the entire system, including the sum of all supply trunks and branches, is 10 ft or less,



National HVAC Functional Testing Checklist, Rev. 02

Footnote 5. The term “mini-split” ... Systems where total supply duct length of the entire system, including the sum of all supply trunks and branches, is 10 ft or less, may complete Item 4.2 in lieu of all items in Section 3.

4.2 Room-by-room airflows verified to be within the greater of $\pm 20\%$ or 25 CFM of design airflow.



National HVAC Functional Testing Checklist, Rev. 02

Rev.02 provides an exemption to certain tests based on equipment lock-outs due to ambient temperature.

5.2 Functional Testing			
5.2.1 Measured zone temperature is within 5°F of zone temperature displayed on thermostat or sensor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.2 System turns on when there is a call for heat and heating is provided. System turns off when the heating setpoint has been met. For forced air systems: Measured discharge air temperature ____ °F	N/A due to ambient temperature ____ °F or equipment lock-out <input type="checkbox"/>		
5.2.3 System turns on when there is a call for cooling and cooling is provided. System turns off when the cooling setpoint has been met. For forced air systems: Measured discharge air temperature ____ °F	N/A due to ambient temperature ____ °F or equipment lock-out <input type="checkbox"/>		
5.2.4 Where OA dampers are installed, the damper closes when there is no call for ventilation or when fan is off.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.5 If more than one system provides heating or cooling to the same space, controls prevent simultaneous heating and cooling.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.2 Functional Testing: Boilers ⁷			
7.2.1 Measure the combustion gas efficiency at high fire and low fire for one of the boilers. Note which one and record information. ⁷ ____ % <input type="checkbox"/> high fire ____ % <input type="checkbox"/> low fire	N/A due to ambient temperature ____ °F or equipment lock-out <input type="checkbox"/>		<input type="checkbox"/>
7.2.2 Where not direct-vented, boiler combustion air intake dampers open / close with boiler operation. ⁷	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.2.3 If each boiler has its own dedicated boiler circulator pump, it operates only when the respective boiler is firing. ⁷ (Circulator pump may run for a short period of time before or after the boiler fires, as recommended by the equipment manufacturer.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Footnote 7. For seasonally dependent testing: Where temperature lock-outs or equipment safety lock-outs prevent systems from operating in the specified mode during functional testing, "N/A" may be checked. The builder or developer must then provide signed documentation acknowledging that components of the Functional Testing were not completed due to temperature lock-outs or equipment safety lock-outs.

National HVAC Functional Testing Checklist, Rev. 02

Other Updates

- Allows HVAC grading of residential systems serving common spaces by the Rater rather than an FT Agent completing Sections 2 or 3.
- Allows Mechanical Engineers that are Licensed Professional Engineers (PE) to serve as the FT Agent.
- Confirms that FT Agents may not be employed by the same company as the installing contractor.
- Clarifies that Section 6 applies to shared VRFs that are commercial-grade and serve multiple dwelling units; MFNC continues to exempt variable refrigerant flow (VRF) systems that serve one dwelling unit from refrigerant charge testing.
- Clarifies that Section 7 applies to commercial-grade boilers that provide space heating to multiple dwelling units and not to boilers that provide DHW or serve just one dwelling unit or just the common spaces.

National HVAC Functional Testing Checklist, Rev. 02

Other Updates

Reduces the number of times certain systems must be cycled on/off during functional testing.

National HVAC Functional Testing Checklist, Rev. 02

Other Updates

Reduces the number of times certain systems must be cycled on/off during functional testing.

Removes the Section 5 requirement to inspect the condensate drain pan and to measure inlet and outlet temperatures at the terminal units.

5. Functional Testing: Indoor / Terminal Units - This section must be completed for all heating and cooling equipment located within dwelling units or common spaces, including systems identified in Sections 2 and 3, except where specifically noted. Indoor / terminal units include, but are not limited to, mini-splits, multi-splits, PTAC's, PTHP's, WLHP's, fan coils, and hydronic distribution systems. ⁵	Rater Verified	FT Agent Verified	N/A
5.1 Installation Checks			
5.1.1 Zone thermostat (or remote zone temperature sensor) in dwelling units installed in design location, within the zone being served, and not on an exterior wall.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.1.2 Where external condensate pump is installed, condensate drain pan drains to a conspicuous point of disposal in case of blockage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2 Functional Testing			
5.2.1 Measured Z zone temperature displayed on thermostat or sensor is within 5°F of measured zone temperature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.2 System turns on when there is a call for heat and heating is provided. System turns off when the heating setpoint has been met. ⁷ N/A due to ambient temperature _____ °F or equipment lock-out <input type="checkbox"/> For forced air systems: Measured discharge air temperature _____ °F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.3 System turns on when there is a call for cooling and cooling is provided. System turns off when the cooling setpoint has been met. ⁷ N/A due to ambient temperature _____ °F or equipment lock-out <input type="checkbox"/> For forced air systems: Measured discharge air temperature _____ °F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.4 Measure and record the inlet and outlet condenser, chilled, or hot water temperatures at the terminal unit. _____ Cooling mode: Inlet _____ °F Outlet _____ °F _____ Heating mode: Inlet _____ °F Outlet _____ °F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2. 54 Where OA dampers are installed, the damper closes when there is no call for ventilation or when fan is off.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2. 65 If more than one system provides heating or cooling to the same space, controls prevent simultaneous heating and cooling.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Water Management System Requirements



National Water Management System Requirements ¹ ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev. 02)

Builder / Developer Partner Responsibilities:

- It is the exclusive responsibility of the Partner to ensure that each multifamily building is constructed to meet these requirements.
- While Partners are not required to maintain documentation demonstrating compliance for each multifamily building, Partners are required to develop a process to ensure compliance for each building (e.g., incorporate these requirements into the Scope of Work for relevant sub-contractors, require the site supervisor to inspect each building for these requirements, and/or sub-contract the verification of these requirements to a Rater ²).
- In the event that the EPA determines that a certified multifamily building was constructed without meeting these requirements, the building may be decertified.

1. Water-Managed Site and Foundation

- 1.1 Impermeable surfaces, such as patio, porch, or plaza slabs, sidewalks, ramps and driveways, sloped ≥ 0.25 in. per ft. away from building to edge of surface or 10 ft., whichever is less. ³
- 1.2 Back-fill has been tamped, and permeable surfaces sloped ≥ 0.5 in. per ft. away from building for ≥ 10 ft. Alternatives in Footnote. ³
- 1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1 in. extruded polystyrene insulation with taped joints. See additional exemptions for garage slabs in Footnote 4. ^{4, 5, 6, 7}
- 1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., & installed using one of the following: ^{5, 6, 7}
- 1.4.1 Placed beneath a concrete slab; OR,
- 1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,
- 1.4.3 Secured in the ground at the perimeter using stakes.
- 1.5 Exterior surface of below-grade walls of basements & unvented crawlspaces finished as follows:
- a) For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating. ⁸
- b) For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.
- 1.6 Class 1 vapor retarder not installed on interior side of air permeable insulation in exterior below-grade walls. ⁹
- 1.7 Sump pit cover mechanically attached with full gasket seal or equivalent.
- 1.8 Drain tile installed at basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of $\frac{1}{2}$ to $\frac{3}{4}$ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pit with a pump. If drain tile is on interior side of footing, then channel provided through footing to exterior side. ¹⁰

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. ¹¹
- 2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1 and fully sealed at all penetrations. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. ^{11, 12}
- 2.3 Window and door openings fully flashed. ¹³

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 shingle-style with drainage plane above; boot / collar flashing at all roof penetrations. ¹⁴
- 3.2 For buildings that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that discharges water on sloping final grade ≥ 5 ft. from foundation, or to underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation. Alternatives & exemptions in Footnote. ^{5, 15, 16}
- 3.3 Self-adhering polymer-modified bituminous membrane at all valleys & roof deck penetrations. ^{5, 17}
- 3.4 In 2009 IECC Climate Zones 5 & higher, self-adhering polymer-modified bituminous membrane 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. ^{5, 17}

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. ¹⁸
- 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. ⁹
- 4.4 Building materials with visible signs of water damage or mold *not* installed or allowed to remain. ¹⁹
- 4.5 Framing members & insulation products having high moisture content *not* enclosed (e.g., with drywall). ²⁰
- 4.6 For each condensate-producing HVAC component, corrosion-resistant drain pan (e.g., galvanized steel, plastic) included that drains to a conspicuous point of disposal in case of blockage. Backflow prevention valve included if connected to a shared drainage system.

Water Management System Requirements

Rev.02 updates language to use the terms 'permeable' and 'impermeable'

Clarifies language for requirements related to sump pits (rather than sump pumps)

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1.1 <u>Impermeable surfaces, such as pPatio, -slabs, porch, or plaza</u> slabs, <u>sidewalks, ramps</u> and driveways, sloped ≥ 0.25 in. per ft. away from building to edge of surface or 10 ft., whichever is less. ³
1.2 Back-fill has been tamped, and <u>final grade permeable surfaces</u> sloped ≥ 0.5 in. per ft. away from building for ≥ 10 ft. Alternatives in Footnote. ³
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1 in. extruded polystyrene insulation with taped joints. See additional exemptions for garage slabs in Footnote 4. ^{4, 5, 6, 7}
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1.7 Sump <u>pump-pit</u> covers mechanically attached with full gasket seal or equivalent.
1.8 Drain tile installed at basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of $\frac{1}{2}$ to $\frac{3}{4}$ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump <u>pit with a pump</u> . If drain tile is on interior side of footing, then channel provided through footing to exterior side. ¹⁰



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3. Water-Managed Roof Assembly
3.1 Step and kick-out flashing at all roof-wall intersections, extending $\geq 4"$ on wall surface above roof deck and integrated shingle-style with drainage plane above; boot / collar flashing at all roof penetrations. ¹⁴
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Simulation Guidelines

ENERGY STAR®
MULTIFAMILY NEW CONSTRUCTION PROGRAM

Simulation Guidelines
Version 1, Revision 02
October 2020

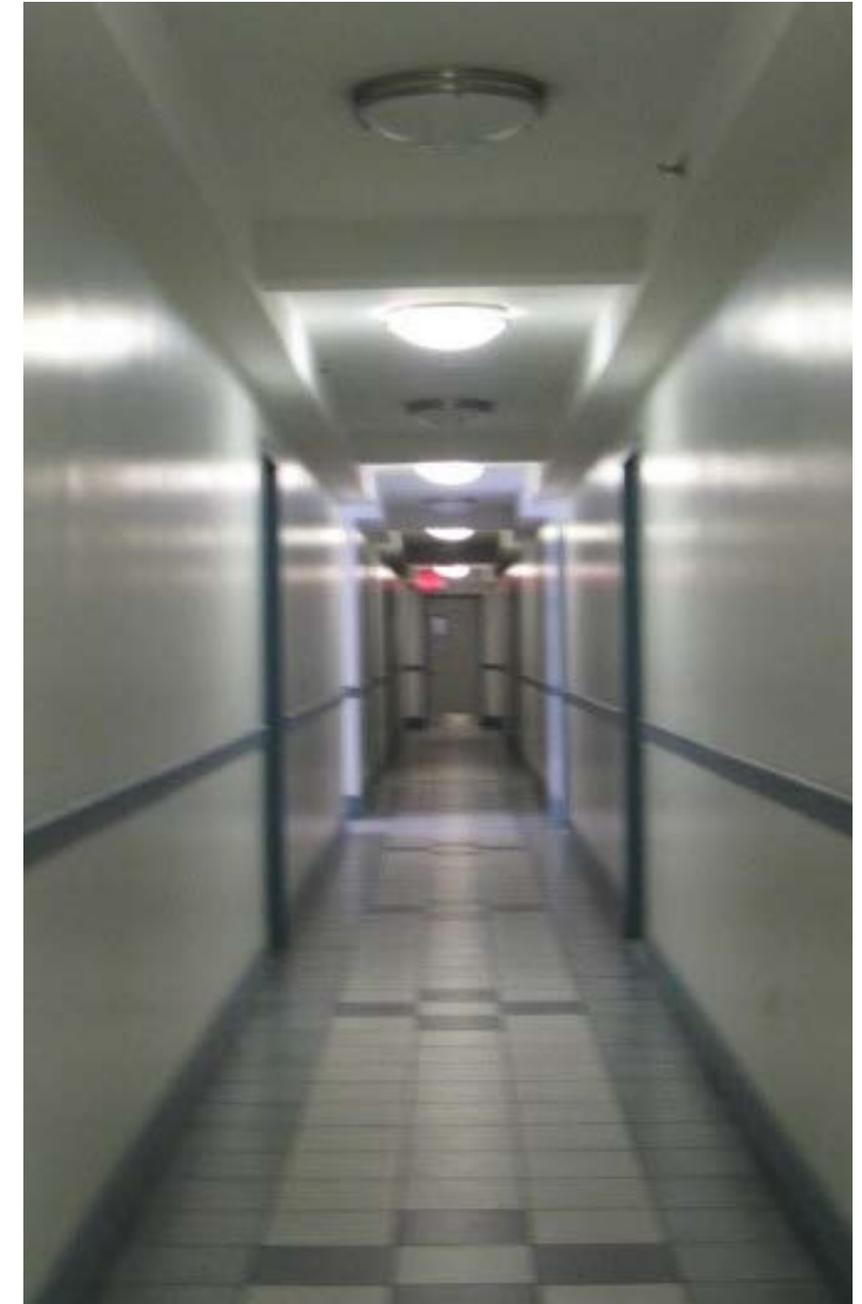
ENERGY STAR®
MULTIFAMILY NEW CONSTRUCTION PROGRAM

Simulation Guidelines-Appendix G 90.1-2016
Version 1, Revision 02
October 2020

Simulation Guidelines

Rev.02 Updates

- Updates definitions for sleeping units, parking garages, common spaces to be consistent with other program documents.
- Clarifies that townhome projects must use the ERI Path and not the ASHRAE Path.
- Clarifies how variations of 'bi-level' lighting can take the occupancy sensors performance credit (PR: 00099).
- Corrects the minimum illumination levels (footcandles) for corridors to properly align with the 10th edition of IESNA and adds values for common laundry rooms (20 fc).



Simulation Guidelines

Other Rev.02 Updates

- For ASHRAE 90.1-2010 projects using the original Simulation Guidelines, adds text to clarify when 2010 requirements apply when modeling the Baseline.
- For ASHRAE 90.1-2016 Appendix G projects, reduces Proposed Design (LPD) for unspecified lighting in units from 1.07 to 0.6 W/ft² if ASHRAE 90.1-2016 is the reference edition.
- Adds the Building Performance Factors (BPF) for ASHRAE 90.1-2019 (2021 IECC).

Reference Edition of 90.1	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
2007	0.96	0.96	0.93	0.91	0.93	0.92	0.85	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.93	0.95
2010	0.92	0.91	0.88	0.86	0.87	0.87	0.8	0.9	0.93	0.92	0.88	0.92	0.92	0.88	0.91	0.83	0.89
2013	0.78	0.78	0.76	0.74	0.79	0.78	0.73	0.83	0.86	0.86	0.81	0.85	0.86	0.81	0.84	0.79	0.85
2016	0.73	0.73	0.71	0.69	0.74	0.73	0.68	0.78	0.81	0.81	0.76	0.8	0.81	0.76	0.79	0.74	0.8
<u>2019</u>	<u>0.68</u>	<u>0.70</u>	<u>0.66</u>	<u>0.66</u>	<u>0.69</u>	<u>0.68</u>	<u>0.59</u>	<u>0.74</u>	<u>0.76</u>	<u>0.74</u>	<u>0.70</u>	<u>0.73</u>	<u>0.75</u>	<u>0.68</u>	<u>0.71</u>	<u>0.68</u>	<u>0.72</u>

ASHRAE Path Calculators & Multifamily Workbook

ENERGY STAR Multifamily New Construction, Version 1, Revision 02: Multifamily Workbook Edition 01

Introduction:

This entire spreadsheet is optional for ERI path projects, but it may be useful for project teams looking for alternate tracking options. It is submitted to the MPO initially to document compliance with requirements at Design, and then again after construction is complete. All information provided at Proposed Design enables the MPO to comment on whether the item is designed for compliance. Where information is not provided or is not adequately described, MPO may at their discretion approve the submittal or request a re-submission. Items required to be completed at Design, are indicated below in the Tab Instructions and/or on each tab.

While the ERI states that each requirement is met by checking a box and providing photo documentation, these tabs allow the MPO to verify that the checklist requirements are met.

As needed, Have s

Tab Number
1a
1b
2
3a
3b
4
5
5a
5b
5c
6
7
8
9
10
11

Cell
Enter Proj
Yellow Propo
Yellow Propo
Orange As-Bu
Orange As-Bu
Blue Option
Blue Option
Gray Enter S
AddP

Automated Cell
Equati
Requir
Requir
PASS
FAIL

MFNC ASHRAE Path Calculator
Version 1, Revision 02, Edition 01

The following worksheets assist in documenting the achievement of the Performance Target. Some cells are protected to prevent accidental over-writing of formulas. There is no password required to unprotect the worksheets.

Note that throughout these worksheets, common information from cells are linked and should automatically update. Only cells shaded in blue need to be entered manually. Entering values into white or orange cells will override pre-determined formulas.

Basic Info (REQUIRED)

In blue cells only, enter the basic information about the building (number of units, square footage of the apartments and commercial spaces, type of garage (if applicable) and indicate the level of space conditioning in each zone). All other square footages will auto-fill after completion of the Interior Lighting worksheet.

Reporting Summary (REQUIRED)

In blue cells only, enter general information about the project, the model and specifics about the ASHRAE compliant components of the Baseline Building and the energy efficient components in the Proposed Design.

SIR by Measure (OPTIONAL)

Although not required by the EPA to earn the ENERGY STAR, if incremental costs are entered, this worksheet can be used to determine the cost effectiveness for each recommended measure and for the project as a whole.

Windows eQUEST (REQUIRED FOR eQUEST only)

For eQUEST users only, this calculates the Shading Coefficient for entry into eQUEST and modifies the NFRC U-factor to exclude the air-film.

Water Savings (OPTIONAL)

By entering data in blue cells only, this worksheet will calculate the water savings in gallons based on the proposed flow rates entered. This information does not affect the Performance Rating but can be used when calculating SIR to justify measures that reduce consumption of water.

DHW Demand (OPTIONAL)

Enter in occupancy usage characteristic (low/medium/high) and information about the appliances that consume water in the building. You must enter data in the Basic Info and Water Savings tab, prior to this tab.

Appliances (OPTIONAL)

Introduction | Basic Info | Reporting Summary | SIR by Measure | Windows eQUEST | Water Savings

Multifamily Workbook

Created a Must Correct Report. Available from the Rater Design Review Checklist & Rater Field Checklist.

Rater Design Checklist (Reset All)
Show all Footnotes
Hide all Footnotes
SELECT PATHWAY (Reset to All Paths)
Prescriptive
ASHRAE
ERI
Title 24: Dwelling Unit Models
Title 24: Whole Building Models
(Reset to All Available)
Required Only
Optional Only
Prescriptive

Project Name: Smith Crossing Number of Units: 50 Permit Date: 6/25/2020
 Project Address: 3248 Huger Street City: Columbia State: SC

Rater Design Review Checklist ¹				Show Footnote(s)
	Must Correct	Rate ⁴	Verified	Comments
1. Partnership Status				
1.1 Rater has verified and documented that builder or developer has an ENERGY STAR partnership agreement using www.energystar.gov/partners .	Generate MC Report		X	
2. High-Performance Fenestration				
2.1 Dwelling units:				
2.1.1 Prescriptive: Specified fenestration meets or exceeds ENERGY STAR MF Reference requirements. ⁵			X	
Show Footnote(s)				
2.2 Common space: ²				
Show Footnote(s)				
2.2.1 ERI and Prescriptive: Specified fenestration meets or exceeds ENERGY STAR MF Reference Design requirements. ⁵			X	
Show Footnote(s)				

Instructions

To refresh report:

1a. Rater Design Checklist
Right-click in cell A7 >Filter > Reapply

1b. Rater Field Checklist
Right-click in cell A72 >Filter > Reapply

Quick Analysis

Sort >

Filter > Clear Filter From

Table > Reapply

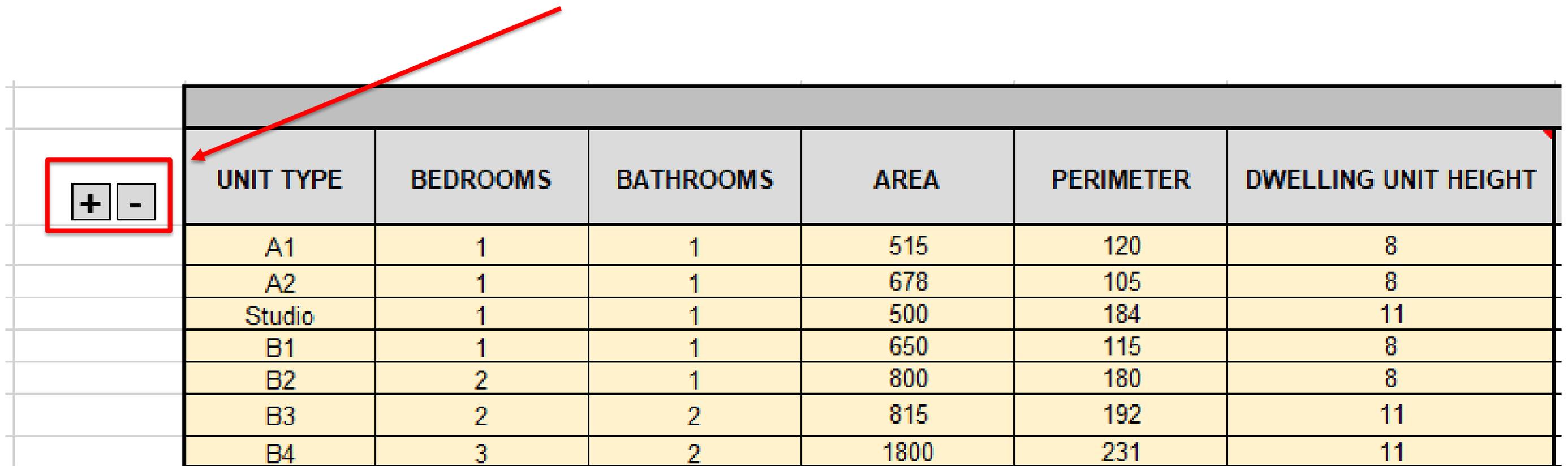
ENERGY STAR Multifamily Workbook

Must Correct Report

Checklist Items to Correct	Checklist Comments
1a. Rater Design Checklist - Must Correct	
4a.4 Total occupant gains do not exceed 645 Btuh per occupant. ¹²	0
4b.1 National HVAC Design Report(s) collected for records, with no items left blank.	Missing documentation
1b. Rater Field Checklist - Must Correct	
2.4 Floors above garages, floors above unconditioned spaces, and cantilevered floors.	0
3.7.2 Structural Insulated Panels OR; Insulated Concrete Forms OR; Double-wall framing OR; 24, 26, 28	0

Multifamily Workbook

Created button to add Rows/Columns to tables.



	UNIT TYPE	BEDROOMS	BATHROOMS	AREA	PERIMETER	DWELLING UNIT HEIGHT
	A1	1	1	515	120	8
	A2	1	1	678	105	8
	Studio	1	1	500	184	11
	B1	1	1	650	115	8
	B2	2	1	800	180	8
	B3	2	2	815	192	11
	B4	3	2	1800	231	11

Multifamily Workbook

For PHIUS projects choosing the alternate performance target, we added a PHIUS tab to demonstrate compliance with this new WUFI-based performance target - $\leq 6,500$ kWh/yr per person (without renewables)

For these PHIUS projects, while they are following the “ASHRAE Path”, are not required to complete the APC

	A	B	C	D	E	F
1						
2		ENERGY STAR Multifamily New Construction, Version 1, Revision 02: Multifamily Workbook Edition 03				
3						
4		PHIUS+ 2018 Source Energy Report				
5						
6		Project Name	Smith Crossing			
7		Climate	CZ 4			
8		Type				
9		Interior conditioned floor area				
10		Number of units	50			
11		Occupants				
12						
13		Source energy use				
14		Specific source energy use				
15						
16		Source energy use				
17		Source energy use per person				
18						
19		Net source energy use (with 100% renewables)				
20		Specific net source energy use (with 100% renewables)				
21						
22		New source energy use (with 100% renewables)				
23		Specific source energy use per person (with 100% renewables)				
24						
25		PHIUS+ Source Zero				
26						
27		Total Use By Type				
28		Type	Source energy [kWh/yr]			
29		Space heating				
30		Space cooling				
31		Hot water				
32		Auxiliary energy/fans				
33		Appliances				
34		Lighting				
35		Miscellaneous loads				
36		Renewable electricity production				
37		Total (with 100% Renewables)	0			
38		Total (No Renewable)	0			
39		Total Source Energy (No Renewable) Per Person				



Multifamily Workbook

Introduction:	Insert general project information in this tab. This information will autopopulate tabs throughout the workbook. MROs can copy the summary table at the bottom of this page to into their reporting spreadsheet to submit projects to EPA.		
Project Details			
Project Name: _____	Permit Date: _____		
Project Address: _____	City: _____	State: _____	
Pathway: <u>ASHRAE</u>	Version: _____ (Prescriptive and ERI Only)	PHIUS? <u>Yes</u>	
Heating & Cooling Equipment Pathway: _____			
Stories: _____	Climate Zone: _____	Number of Buildings: _____	
Project Square Feet: _____	Number of Units: _____	Townhomes? _____	
Market Sector: _____	Number of IAP Units: _____	Project Type: _____	

Multifamily Workbook

Added a 'Failed Tests' table to the Unit Testing Results tab for project teams to enter failed tests.

Failed Tests: Copy entire row from the Units Testing table above for any failed tests. Overwrite the values in the table above with re-test values.

UNIT DETAILS				TESTING TARGETS								SAMPLING		TOTAL DUCT LEAKAGE (6.4.1 / 6.4.2)		TESTING FAILURE	TESTING DATE	TESTING FAILURE	TOTAL DUCT LEAKAGE (6.4.1 / 6.4.2)	TESTING FAILURE		
UNIT	UNIT TYPE	SQUARE FOOTAGE	ENCLOSURE AREA	TOTAL DUCT LEAKAGE (6.4.1/6.4.2)	Duct Leakage to Outdoors (Townhouses Only) (6.5)	UNIT INFILTRATION (4.10)	DWELLING UNIT VENTILATION (7.2)	KITCHEN VENTILATION (8.1)	BATH 1 VENTILATION (8.2)	BATH 2 VENTILATION (8.2)	BATH 3 VENTILATION (8.2)	SAMPLE SET ID	TESTING DATE	Testing Failure	Value	Pass/Fail	TESTING FAILURE	TESTING DATE	Testing Failure	TOTAL DUCT LEAKAGE (6.4.1 / 6.4.2)	TESTING FAILURE	
101	A1	515	1990	40	40	597	25	100	50			1	6/10/2020	Yes	25	PASS	Yes	6/10/2020	Yes	25	PASS	
102	B3	815	3742	40	40	1122.6	47	100	50	50		1	6/10/2020	Yes	21	PASS	Yes	6/10/2020	Yes	21	PASS	
103	Studio	1800	6141	72	72	1842.3	86	175	50	50		1	6/10/2020	Yes	29	PASS	Yes	6/10/2020	Yes	29	PASS	
104	B4	1800	6141	144	72	1842.3	86	175	50	50		1	6/10/2020	Yes	4	PASS	Yes	6/10/2020	Yes	4	PASS	
105	Studio	1800	6141	144	72	1842.3	86	175	50	50		1	6/10/2020	Yes	36	PASS	Yes	6/10/2020	Yes	36	PASS	
106	B1	650	2220	80	40	666	35	150	50			1	6/14/2020	Yes	45	PASS	Yes	6/14/2020	Yes	45	PASS	
107	B3	815	3742	40	40	1122.6	47	100	50	50		1	6/15/2020	Yes	19	PASS	Yes	6/15/2020	Yes	19	PASS	
108	B2	800	3040	40	40	912	31	100	50			2	6/20/2020	Yes	51	FAIL	Yes	6/20/2020	Yes	51	FAIL	



Multifamily Workbook & ASHRAE Path Calculators

Other Updates

- Rater Design and Field Checklists are updated in the Multifamily Workbook, in accordance with the changes noted above.
- Updated the Rater Field Checklist tab to add a count of Builder Verified Items. This information is also listed in the Certificate & Label Data Review tab. Builders may verify up to 8 items of the Rater Field Checklist.
- Added details about the building number, project type, and PHIUS participation to the Project Information tab.
- Added an 'MRO Certificate Review' dropdown to the DHW SHW Schedule and Heating and Cooling Schedule tabs to allow project teams to notify MROs if they prefer to have their certificates reviewed in the Workbook or to submit the files separately.
- Updated the ASHRAE Path Calculator to carry over changes from the Lighting tab of the MFNC Workbook to the Interior Lighting tab.

Multifamily New Construction – Revision 02 Summary

Additional Flexibility, Alignment with Single-Family, Clarifications, and Streamlining

Required for projects with permits or permit applications on or after July 1, 2021

Next few slides will re-organize the key updates by these stakeholders:

- Rater
- Architect
- HVAC Designer
- HVAC FT Agent
- Energy Modelers

Multifamily New Construction – Revision 02 Summary

Key Updates for the Rater

- Improved formatting in NPR to easily find the Reference Design for Version 1, 1.1, & OR-WA 1.2.
- Adds requirement to verify pest screens on air inlets.
- Clarifies that ducted systems not subject to a duct leakage test are still subject to visual inspection.
- Ventilation override control is required for all dwelling units but must be 'readily-accessible' just in townhouses.
- Clarifies that multi-splits, ductless systems, and systems with a supply ductwork 10 ft or less are not subject to the Rater-measured static pressure test requirement.
- Provides an alternative whole-building airtightness test threshold (1 ACH50) that qualifies for the reduced continuous kitchen exhaust rates (25 cfm) when balanced ventilation is installed.
- Rater can perform HVAC grading of residential systems serving common spaces rather than the FT Agent completing Sections 2 and 3 of the HVAC FT Checklist.
- If the Rater is completing Section 5 of the HVAC FT Checklist, removes the requirement to inspect the condensate drain pan and to measure inlet and outlet temperatures at the terminal units.

Multifamily New Construction – Revision 02 Summary

Key Updates for the Architect

Envelope Requirements

- Updates maximum wall U-factor requirements in CZ 4, 4C & 5.
- Clarifies requirements for skylights.
- Clarifies when requirements apply to specific types of ceilings and walls.
- Clarifies podium insulation requirements and provides other alternatives (PR: 00106)
- Clarifies that insulation at the bottom of a heated plenum can be either Grade I or Grade II.
- Clarifies that projected balconies with a thermal break of at least R-2 are not subject to the modification of area in the total UA calculation.
- Clarifies that the reduced thermal bridging requirements for above-grade walls apply to walls adjacent to the exterior, rather than walls to unconditioned spaces.
- If balanced ventilation is installed and designing for the reduced continuous kitchen exhaust rates, whole-building airtightness test threshold can be less than either 1 ACH50 or the current requirement of 0.05 cfm50/ft².

Multifamily New Construction – Revision 02 Summary

Key Updates for the Architect

Other Requirements

- Expands the options for attic “access” with respect to the requirement for HVAC filters to be accessible.
- Clarifies the ENERGY STAR and WaterSense requirements for appliances and plumbing fixtures in the ERI and Prescriptive Paths.
- For water management, updates language regarding permeable and impermeable surfaces, as well as clarifies language for requirements related to sump pits.

Multifamily New Construction – Revision 02 Summary

Key Updates for the HVAC Designer

- Allowance to use Single-Family New Homes HVAC Design Report for dwelling units.
- Provides clearer guidance on documenting load calculations for a group design.
- Adds alternative options for documenting equipment sizing when equipment is outside the scope of Manual S.
- Allows heating equipment to be over-sized as needed if equipment is also providing domestic hot water or where standby equipment is installed for safety/redundancy.
- Provides guidance on documenting equipment that is used in multiple spaces to avoid duplicate data entry.
- New options for attic “access” with respect to the accessing HVAC filters.
- Requirement for ventilation override control doesn’t change, but was revised for better clarity and alignment with Rater-F.
- Updates in Rater-F Exhibit X to better describe minimum efficiencies for PTAC’s & to reference ASHRAE 90.1-2010 for minimum efficiencies for equipment not listed.
- Clarifies that Townhouses are still required to use Manual D for duct design, while other dwelling units have other options.
- Adds relevant items from the Functional Testing Checklist for improved visibility.

Multifamily New Construction – Revision 02 Summary

Key Updates for the HVAC Functional Testing Agent

- Clarifications and streamlining functional tests and inspections
 - Section 2: better describes systems that are subject to the refrigerant charge tests
 - Section 3: provides alternative to measuring HVAC fan airflow for some ducted systems (<10')
 - Section 5: removes inspection of condensate drain pan & temperature measurement at some terminal units
 - Section 6: clarifies that “shared” VRFs subject to refrigerant charge tests are commercial-grade and serve multiple dwelling units; VRF systems serving just one dwelling unit are still exempt.
 - Section 7: clarifies that it applies to commercial-grade boilers that provide space heating to multiple dwelling units; does not apply to DHW boilers or boilers that serve just one dwelling unit or just common spaces
 - Multiple Sections: provides an exemption to certain tests based on temperature lock-outs due to ambient temperature & reduces the number of times certain systems must be cycled on/off during functional testing
- Allows Rater to do HVAC Grading for residential systems in common spaces
- New Sampling Protocols
- FT Agent may be a Professional Engineer (Mechanical), but not employed by the installing contractor

Multifamily New Construction – Revision 02 Summary

Key Updates for the ASHRAE Path Energy Modeler

- Creates an alternative performance target for PHIUS Certified projects
- Allows energy cost savings or source energy savings with ASHRAE 90.1-2013 baselines or later
- Announces the development of the new Excel-based ASHRAE 90.1 Compliance Form and plans for its use in the MFNC program
- Clarifies that the Proposed Design Submittal is strongly recommended, but not required
- Updates definitions for sleeping units, parking garages, & common spaces
- Clarifies that townhome projects must use the ERI Path and not the ASHRAE Path
- Clarifies how variations of 'bi-level' lighting can take the occupancy sensors performance credit
- For ASHRAE 90.1-2010 projects using the original Simulation Guidelines, adds text to clarify when 2010 requirements apply when modeling the Baseline
- For ASHRAE 90.1-2016 Appendix G projects, reduces the Proposed Design LPD for unspecified lighting in dwelling units from 1.07 to 0.6 W/ft² when modeling ASHRAE 90.1-2016 as the reference edition

Multifamily New Construction – Revision 02 Summary

Key Updates for the ERI Path Energy Modeler (Rater)

- Sets 0.95 EF as the electric water heater efficiency in the Reference Design, for all storage capacities
- Updates wall U-factor requirements in CZ 4, 4C & 5 for Version 1 projects
- Removes ENERGY STAR clothes washers and dryers from the Reference Design
- For most interior walls, not exposed to the exterior, clarifies that those are uninsulated in the Reference Design, rather than matching the insulation levels used in the Rated Home at those walls

Caribbean MFNC Program Requirements

- Built off Single-Family New Homes Caribbean Req'ts
- Expands to common spaces
- Includes some additional requirements (e.g., ENERGY STAR appliances)
- Adds flexibility



Upcoming Partner Meeting Webinar Series Sessions

- [HVAC Grading and Standard 310](#) | Dean Gamble, EPA | Thursday, November 5, 2020 at 1:00pm
- [Indoor airPLUS Version 2](#) | Nick Hurst, EPA | Tuesday, November 10, 2020 at 1:00pm ET
- [ES Certified Homes Revision 11](#) | Dean Gamble and Elliot Seibert, EPA | Thursday, November 12, 2020 at 1:00pm ET
- [ES Marketing Materials & Communications](#) | Marta Montoro, EPA | Tuesday, November 17, 2020 at 1:00pm ET
- [WaterSense Labeled Homes Version 2.0](#) | Jonah Schein, EPA | Thursday, November 19, 2020 at 1:00pm ET



Q&A