ENERGY STAR Multifamily New Construction (MFNC) Program: Q&A

Rebecca Hudson, EPA

Gayathri Vijayakumar, Steven Winter Associates

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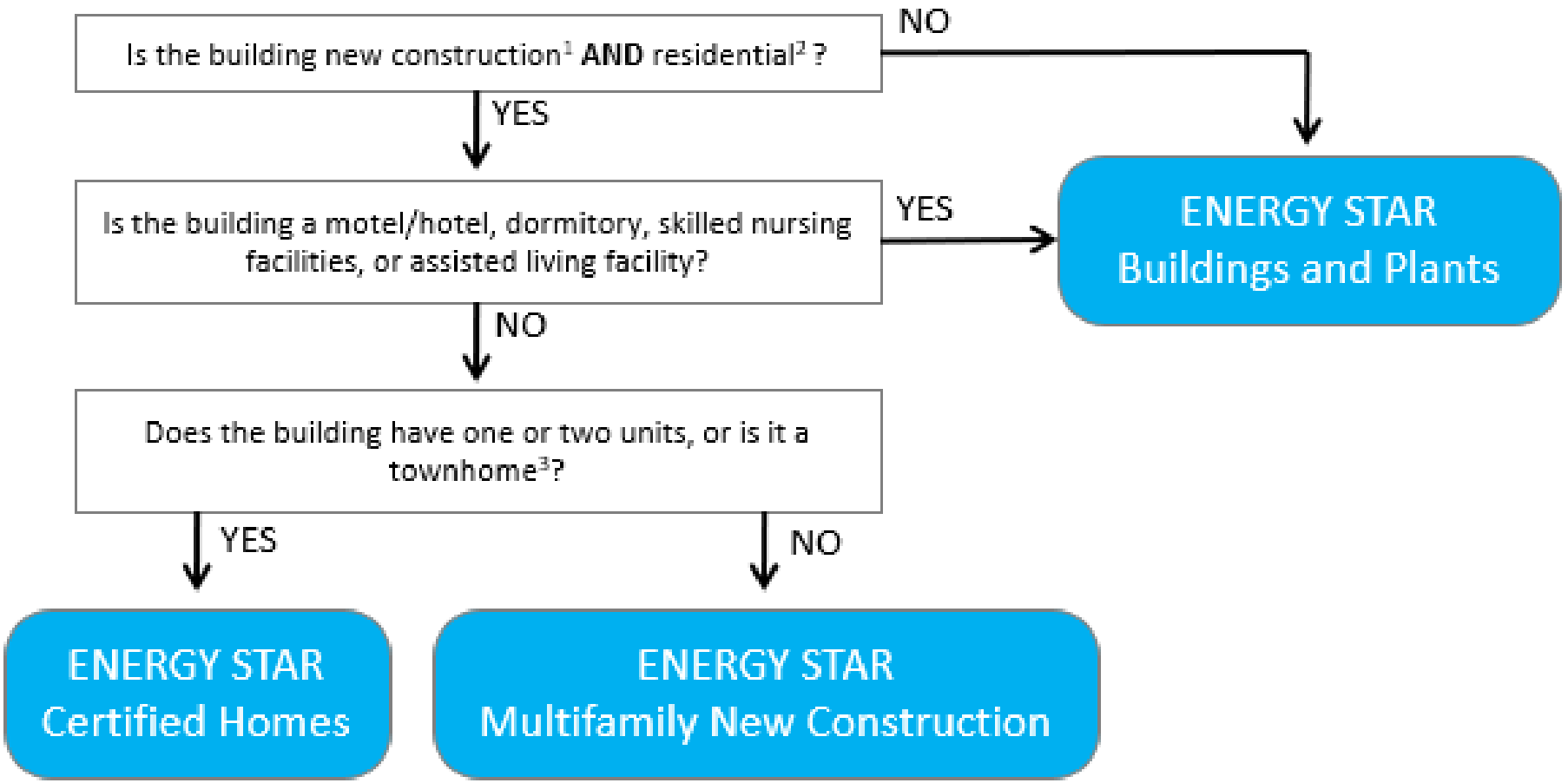
What questions do you have?

- Building Eligibility
- Implementation Timeline
- Certification Process & Procedure
- ENERGY STAR MFNC Program Documents
  - National Program Requirements
  - ~~Rater Design & Field Checklists~~
  - HVAC Design Report
  - HVAC Functional Testing Checklist
  - ERI Target Procedure / Reference Design
  - Rater QA Checklist (for QAD's)
  - Multifamily Workbook
- Frequently Asked Questions

ENERGY STAR Program Decision Tree



Program Decision Tree: Footnote 1

New construction can include significant gut rehabilitations when defined as a change of use, reconstruction of a vacant structure, or when construction work requires that the building be out of service for at least 30 consecutive days and the building is able to meet all the program requirements.

Program Decision Tree: Footnote 2

The primary use of the building must be for residential purpose, i.e. the residential and residential associated common space must occupy more than 50% of the building's occupiable[4] square footage. A garage is not considered 'occupiable'. Common space includes…spaces…such as corridors, stairs, lobbies, laundry rooms, exercise rooms, and residential recreation rooms, …offices used by building management, administration or maintenance…day-care facilities, gyms, dining halls, etc.

Program Decision Tree: Footnote 3

Townhomes may choose to use the Multifamily New Construction Checklists as well, but they must use the ERI Path and Certified Homes Reference Design.

A townhome is defined as a single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.

Townhomes

A single-family dwelling unit constructed in a group of 3 or more attached units in which each unit extends from the foundation to roof and with open space on at least 2 sides

If certifying to MFNC:

- DLTO req'd & room-by-room load calcs
- Must do ERI Path
- Must use Certified Homes Reference Design & Target Procedure
- Version 3 has SAF, not Version 3.1 (09)

Program Decision Tree: Footnote 4

Per ASHRAE 62.2-2010, occupiable space is any enclosed space inside the pressure boundary and intended for human activities or continual human occupancy, including, but not limited to, areas used for living, sleeping, dining, and cooking, toilets, closets, halls, storage and utility areas, and laundry areas.

ENERGY STAR Program Eligibility Quiz

What about a duplex or 1-over-1?

- Certified Homes

What about Townhomes?

- Certified Homes or MFNC

What about a building with 3 or 4 units?

- Certified Homes or MFNC (permits until 1/1/2021)
- Multifamily New Construction (on or after 1/1/2021)

ENERGY STAR Program Eligibility Quiz

What about 3-story garden style?

- Certified Homes if permitted before 2021 or MFNC

What about 5 story with in-unit systems and 21% common area?

- MFHR if permitted before 2021 or MFNC

What about a 10 story, 100,000 ft^2 building, with a 20,000 ft^2 garage, 39,000 ft^2 of retail, 41,000 ft^2 of apartments?

- MFHR if permitted before 2021 or MFNC

ENERGY STAR MFNC Transition Dates

Jan-Dec 2019: MFNC Rater Training is optional for current ENERGY STAR Rater Partners

Jan 2019 – Dec 2020: ESCH, MFHR, & MFNC available for use

- A building that complies with all MFNC requirements, regardless of bldg permit date, can be certified (ie. reported)
- Temporary limits on ERI Path
  - Not yet available in all energy rating software
  - Can't use ERI in buildings above 5 story until RESNET approves

ENERGY STAR MFNC Transition Dates

Jan 2020: To certify to MFNC, MFNC Rater Training certificate uploaded in MESA (My ENERGY STAR Account)

Jan 2021: MFNC required for buildings with permit dates January 1, 2021 and later (cannot do Certified Homes / MFHR)

- No current sunset date established
  - If permitted before 1/1/2021, no time limit to complete under ESCH or MFHR

ENERGY STAR MFNC Transition Dates Quiz

Q: My MFHR project failed a prerequisite (ENERGY STAR refrigerators). Can I switch to MFNC now?

A: Yes, if you can meet all the MFNC requirements.

Q: If my project gets permitted on 12/31/2020, how long does it have to complete under Certified Homes?

A: There is no sunset date at this time.

ENERGY STAR MFNC Transition Dates Quiz

Q: I'm not an ENERGY STAR Rater yet. Can I still certify units in the MFNC program in 2019?

A: No. You can't certify units at all until you complete your ENERGY STAR Rater Training. Only ENERGY STAR Raters are being offered that flexibility in 2019.

Q: When can I use the ERI Path on a 10 story building?

A: RESNET MINHERS Addendum 42 is out for public comment now. If approved, it will be available for use July 1 & required for permits as of January 1, 2020.

MFNC National Program Requirements

Read this document first! Who needs a copy?

Covers certification process, participant roles & requirements, implementation dates, Reference Designs, important footnotes/definitions.

Pay attention to the Exhibits!

Don't miss the Common Space applicability notes in Exhibit 1 (Reference Designs)! It will be part of Rater Training too! (Note: ASHRAE Path does not use the Reference Design)

National Program Requirements

ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / OR-WA 1.2

ENERGY STAR Multifamily Reference Design, Version 1 (See Exhibit 3 for where this is applicable)

Hot Climates (2009 IECC Zones 1,2,3) [10]	**Mixed and Cold Climates** (2009 IECC Zones 4,5,6,7,8) [10]
Cooling Equipment (Where Provided)	
• Cooling equipment modeled at the applicable efficiency levels below [11].	
• 14.5 SEER / 12 EER AC, • Heat pump (See Heating Equipment)	• 13 SEER AC, • Heat pump (See Heating Equipment)
Heating Equipment	
• Heating equipment modeled at the applicable efficiency levels below, dependent on fuel and system type [11].	

• 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
	• 90 AFUE gas furnace,
	• 85 AFUE ENERGY STAR oil furnace,
	• 85 AFUE boiler,
	• Heat pump, with efficiency as follows:
	  • *CZ 4:* 8.5 HSPF / 14.5 SEER / 12 EER air-source w/ electric or dual-fuel backup,
	  • *CZ 5:* 9.25 HSPF / 14.5 SEER / 12 EER air-source w/ electric or dual-fuel backup,
	  • *CZ 6:* 9.5 HSPF / 14.5 SEER / 12 EER air-source w/ electric or dual-fuel backup,
	  • CZ 7-8: 3.5 COP / 16.1 EER ground-source w/ electric or dual-fuel backup

Envelope, Windows, & Doors	
• A radiant barrier modeled if more than 10 linear feet of ductwork are located in an unconditioned attic.	• No radiant barrier modeled.
• Insulation levels modeled to 2009 IECC levels (Commercial, wood-frame) and Grade I installation per ANSI / RESNET / ICC Standard 301 [11, 12]	

MFNC National Program Requirements

Common Space Applicability Notes:

When using the Reference Design for common space measures as specified in the National Rater Design Review and Rater Field Checklist, the following notes apply*. [*Not to ASHRAE Path]

1) Heating and Cooling efficiencies for additional equipment are available in the Exhibit X of the National Rater Field Checklist.

Q: What is the efficiency requirement for a gas furnace serving a corridor on a multifamily building?

MFNC Rater Field Checklist

5.2 Prescriptive Path: Heating and cooling equipment serving dwelling units and common spaces meet the efficiency levels specified in the Exhibit X. Electric resistance heating is not installed in dwelling units .

5.3 ERI Path: Heating and cooling equipment serving common spaces, but not serving dwelling units, meet the efficiency levels specified in the Exhibit X. See Exhibit X for restrictions on electric resistance heating.

MFNC Rater Field Checklist, Exhibit X

National Rater Field Checklist Footnotes
ENERGY STAR Multifamily New Construction Version 1 / 1.1

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	• 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
Warm-Air Furnace (≥225 KBtu/h)	80% Et (gas) or 81% Et (oil)

MFNC National Program Requirements

Common Space Applicability Notes:

When using the Reference Design for common space measures as specified in the National Rater Design Review and Rater Field Checklist, the following notes apply.

1) Heating and Cooling efficiencies for additional equipment are available in the Exhibit X of the National Rater Field Checklist.

Q: What is the efficiency requirement for a gas furnace serving a corridor on a multifamily building?

A: No requirement if ASHRAE Path; 78% AFUE if < 225, 80% Et if >225

MFNC National Program Requirements

Common Space Applicability Notes:

2) Insulation levels for common spaces in Version 1 and Version 1.1 are not the values shown in the Reference Design. **They must instead meet or exceed the levels in the 2009 and 2012 IECC Commercial chapter, respectively.** The required values should come from the "All Other" column and the row that corresponds to the building assembly (e.g., a building with steel-frame walls would use the value in the 'Metal framed' row).

3) Windows are to meet or exceed the requirements specified for "Class AW" windows in the Reference Design.

MFNC National Program Requirements

Common Space Applicability Notes:

4) All exterior and common space lighting fixtures are still subject to the efficiency requirements, even though they are not in 'ANSI / RESNET / ICC Standard 301-defined Qualifying Light Fixture Locations'. Therefore, 90% of all exterior and common space fixtures must be ENERGY STAR certified or meet the alternatives defined in the National Rater Field Checklist. This requirement applies to exterior lighting fixtures that are attached to the building, but does not apply to landscape or parking lot lighting fixtures.

MFNC Version 1 or 1.1 or OR-WA 1.2?

Exhibit 3: ENERGY STAR Multifamily New Construction Implementation Timeline

State / Territory	Buildings Permitted [4] On or After This Date Must Meet the Adjacent Version	Multifamily New Construction Program Version
AL, AK, AZ, AR, CO, GA, GU, HI, IN, ID, KS, KY, LA, ME, MS, MO, NE, NH, NM, NMI, NC, ND, OH, OK, PA, PR, SC, SD, TN, USVI, UT, VA, WV, WI, WY	01-01-2021	National Version 1
CT, DC, DE, FL, IA, IL, MA, MD, MI, MN, MT, NJ, NV, NY, RI, TX, VT	01-01-2021	National Version 1.1
OR, WA	01-01-2021	Oregon and Washington Version 1.2

MFNC ASHRAE Path Performance Targets

Exhibit 4: ASHRAE Path Performance Targets

Performance Target Options: Savings (%) above varying ASHRAE 90.1 Baselines			
State Code	**90.1-2007**	**90.1-2010**	**90.1-2013**
2009 IECC	15%[13]	N/A	N/A
2012 IECC	20%[14]	15%[13]	N/A
2015 IECC	25%[14]	20%[14]	15%[15]

MFNC ERI Path Overview

Enter	Design	Build	Earn
Builder/Developer and Rater become ES Partners FT Agent takes online orientation (if needed)	Include Mandatory Features in design Complete HVAC Design Report & Rater Design Checklist **Conduct energy modeling to beat the ERI Target**	Build to design Raters inspect & test Complete Rater Field Checklist, HVAC Functional Testing Checklist **& update energy ratings** **Submit to Provider**	

MFNC ASHRAE Path Overview

Enter	Design	Build	Earn
Builder/Developer and Rater become ES Partners FT Agent **& modeler** take online orientation (if needed)	Include Mandatory Features in design Complete HVAC Design Report & Rater Design Checklist **90.1 energy model achieves 15%** **Proposed Design Submittal (to MRO)**	Build to design Raters inspect & test Complete Rater Field Checklist, HVAC Functional Testing Checklist **& update energy model** **As-Built Submittal (to MRO)**	

MFNC Prescriptive Path Overview

Enter	Design	Build	Earn
Builder/Developer and Rater become ES Partners FT Agent **& modeler** take online orientation (if needed)	Include Mandatory Features **& prescriptive req's** in design Complete HVAC Design Report & Rater Design Checklist **Proposed Design Submittal (to MRO)**	Build to design Raters inspect & test Complete Rater Field Checklist, HVAC Functional Testing Checklist **As-Built Submittal (to MRO)**	

Submittals to MRO (ASHRAE & Prescriptive)

Design

- Prescriptive & ASHRAE
  - Rater Design Checklist
  - HVAC Design Report
  - MF Workbook
  - Construction documents
- ASHRAE only
  - Performance Path Calculator
  - Modeling files

As-Built

- Prescriptive & ASHRAE
  - Rater Field Checklist
  - HVAC Functional Testing Checklist
  - MF Workbook
  - Construction documents
  - Photo documentation
- ASHRAE only
  - Performance Path Calculator
  - Modeling files

HVAC Design Report

HVAC Designer to provide one report that documents HVAC design, that includes all HVAC systems in the building:

- Cooling & Heating Equipment Selection
  - Over-sizing limits apply to split AC/HP & furnaces
- Dwelling Unit Duct Design (Manual D not required)
- Items from Rater Field are on HVAC Design Report
  - Equipment Controls & Hydronic Distribution
  - Duct Quality Installation
    - Dwelling Unit (leakage test, insulation, etc)
    - Common Area & Central Exhaust Leakage Test

2a. Dwelling & Common Area OA Ventilation

National HVAC Design Report [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

HVAC Designer Responsibilities:

- Complete one National HVAC Design Report for each building / project, which includes system design for all unique unit plans and common spaces. [1]
- Obtain efficiency features (e.g., window performance, insulation levels, and infiltration rate) from the builder, architect, or Rater.
- Provide the completed National HVAC Design Report to the Rater and the person / company completing the National HVAC Functional Testing Checklist.

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 [2, 3]						**Designer Verified**
Airflow:						
2.1 Dwelling unit ventilation airflow design rate & run-time meet the requirements of Section 4 of ASHRAE 62.2 [4] - ☐ 2010 ☐ 2013						☐
2.2 Common space outdoor airflow design rate meet the requirements of Section 6 of ASHRAE 62.1 [5] - ☐ 2010 ☐ 2013, without exceeding 2013 rates by more than 50%						☐
2.3 Access points to measure airflow rate are provided and accessible by the Rater						☐
List unique unit plan for which 62.2 ventilation rates were calculated in the spaces to the right: [6]						
2.4 # of bedrooms:						
2.5 Square footage:						
2.6 Ventilation airflow rate required by ASHRAE 62.2:						
2.7 Ventilation airflow rate designed:						

2b. Dwelling Unit Local Exhaust

2b. Dwelling-Unit Local Mechanical Exhaust Design – System(s) are installed that mechanically exhaust air from each dwelling unit kitchen and bathroom directly to the outdoors or to ventilation risers and meet one of the following[11]. ☐

Location		Continuous Rate	Intermittent Rate[12]	Exhaust Fan Type
Kitchen	Airflow	≥ 5 ACH, based on kitchen volume[13, 14,15]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [13, 14, 15, 16]	☐ In-unit fan ☐ Central/shared fan
	Sound	Recommended if in-unit: ≤ 1 sone	Recommended if in-unit: ≤ 3 sones	
Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM	☐ In-unit fan ☐ Central/shared fan
	Sound	Required if in-unit: ≤ 2 sone	Recommended if in-unit: ≤ 3 sones	

2c. Common Area Minimum Exhaust Rates – System(s) are installed that mechanically exhaust air from each common space, as required by ASHRAE 62.1-2010 or 2013. ☐

Location	ASHRAE 62.1 Rate	Design Rate	Location	ASHRAE 62.1 Rate	Design Rate
Janitor Room	1 cfm/ft^2		Common area kitchen[17]	50 cfm / 100 cfm	
Trash/Recycling Room	1 cfm/ft^2		Common area bathroom[18]	50 cfm per toilet/urinal	
Parking Garage	0.75 cfm/ft^2		☐ Garage exhaust fan controls include CO and NO2 sensors		

2c. Common Area Local Exhaust

2b. Dwelling-Unit Local Mechanical Exhaust Design – System(s) are installed that mechanically exhaust air from each dwelling unit kitchen and bathroom directly to the outdoors or to ventilation risers and meet one of the following[11].				☐
Location		**Continuous Rate**	**Intermittent Rate**[12]	**Exhaust Fan Type**
Kitchen	Airflow	≥ 5 ACH, based on kitchen volume[13, 14,15]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [13, 14, 15, 16]	☐ In-unit fan ☐ Central/shared fan
	Sound	Recommended if in-unit: ≤ 1 sone	Recommended if in-unit: ≤ 3 sones	
Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM	☐ In-unit fan ☐ Central/shared fan
	Sound	Required if in-unit: ≤ 2 sone	Recommended if in-unit: ≤ 3 sones	

2c. Common Area Minimum Exhaust Rates – System(s) are installed that mechanically exhaust air from each common space, as required by ASHRAE 62.1-2010 or 2013.					☐
Location	**ASHRAE 62.1 Rate**	**Design Rate**	**Location**	**ASHRAE 62.1 Rate**	**Design Rate**
Janitor Room	1 cfm/ft^2		Common area kitchen[17]	50 cfm / 100 cfm	
Trash/Recycling Room	1 cfm/ft^2		Common area bathroom[18]	50 cfm per toilet/urinal	
Parking Garage	0.75 cfm/ft^2		☐ Garage exhaust fan controls include CO and NO2 sensors		

3. Dwelling & Common Area Design Loads

3. Heating & Cooling Loads

Dwelling Unit Heating & Cooling Loads (only required for ducted split AC, unitary AC, ASHP, WSHP, GSHP, and furnaces) [19]

3.1 Loads calculated using: ☐ Unabridged ACCA Manual J v8 ☐ 2013/2017 ASHRAE Fundamentals ☐ Other per AHJ [20]

3.2 Check one box only to indicate whether the Dwelling Unit Loads is unit-specific or represents the design of more than one unit: [2]

☐ Unit/space-specific design ☐ Group design[21] _____ total groups for this project, representing _____ units

☐ Worst-case design. (If the top floor unit with the greatest CFA and window area results in total heat gain <18 kBtuh, it may represent all other units, if cooling system selected for all is single-speed & <20 kBtuh or two-speed/variable-speed & <25 kBtuh.

3.3 Indoor design temperatures used in loads are 70°F for heating and 75°F for cooling ☐

3.4 Outdoor design temperatures used in loads: (See Footnote 12 and energystar.gov/hvacdesigntemps) [22]

County & State selected: _____ Cooling season: _____°F Heating season: _____°F

Unit plan for which Loads were calculated:	Unit A	Unit B	Unit C	Unit D	Unit E	Unit F	Unit G	Unit H
Location of Unit: top, mid, bottom, corner, interior								
3.5 Number of occupants used in loads: [23]								
3.6 Total occupant gains (Btuh)[2]:								
3.7 Conditioned floor area used in loads:								
3.8 Window area used in loads:								
3.9 Predominant window SHGC used in loads:[24]								
3.10 Infiltration (ACH/ACH50) used in loads:[25]								
3.11 Mechanical ventilation (CFM) used in loads:								
3.12 Non-occupant Internal gains (appliance, equipment and lighting) used in loads (Btuh):								
3.13 Sensible Heat Gain At Design Conditions (kBtuh)								
3.14 Latent Heat Gain At Design Conditions (kBtuh)								
3.15 Total Heat Gain at Design Conditions (kBtuh)								
3.16 Total Heat Loss at Design Conditions (kBtuh)								

Common Area Heating & Cooling Loads

Common Space Name: _____ Design Conditions: Cooling Load: _____(kBtuh) Heating Load: _____(kBtuh)

Common Space Name: _____ Design Conditions: Cooling Load: _____(kBtuh) Heating Load: _____(kBtuh)

Building Heating & Cooling Loads (only required when shared systems such as central boilers or chillers are specified)

Design Conditions: Cooling Load: _____(kBtuh) Heating Load: _____(kBtuh)

3. Dwelling Unit Load Calcs: Inputs/Outputs

3. Heating & Cooling Loads

Dwelling Unit Heating & Cooling Loads (only required for ducted split AC, unitary AC, ASHP, WSHP, GSHP, and furnaces) [19]

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☐ Unit/space specific design. ☐ Group design[21]. ____ total groups for this project, representing ____ units.
☐ Worst-case design. (If the top floor unit with the greatest CFA and window area results in total heat gain <18 kBtuh, it may represent all other units, if cooling system selected for all is single-speed & <20 kBtuh or two-speed/variable-speed & <25 kBtuh.

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3. Common Area & Building Design Loads

3. Heating & Cooling Loads

Dwelling Unit Heating & Cooling Loads (only required for ducted split AC, unitary AC, ASHP, WSHP, GSHP, and furnaces) [19]

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Common Area Heating & Cooling Loads

Common Space Name: _____ Design Conditions: Cooling Load: _____(kBtuh) Heating Load: _____(kBtuh)

Common Space Name: _____ Design Conditions: Cooling Load: _____(kBtuh) Heating Load: _____(kBtuh)

Building Heating & Cooling Loads (only required when shared systems such as central boilers or chillers are specified)

Design Conditions: Cooling Load: _____(kBtuh) Heating Load: _____(kBtuh)

4. Cooling Equipment & Sizing Limit

Cooling Equipment [6] (Complete all applicable items; otherwise check "N/A")							☐ 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 #: [28]							
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): [29]							
4.16 Sensible capacity at design conditions (kBtuh): [29]							
4.17 Total capacity at design conditions (kBtuh): [29]							
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) [19]							
4.20 If "B", list Load sensible heat ratio = Max. sensible heat gain (Item 3.14) / Max. total heat gain (Item 3.16): [30]							
4.21 If "B", calculate HDD / CDD ratio: [30]							

4. Heating Equipment & Furnace Sizing Limit

Heating Equipment (Complete all applicable items; otherwise check "N/A")							
Heating Equipment ID	FC-1	FC-2	FC-3	Boiler-1	Boiler-2	WLHP-1	WLHP-2
4.20 Electric equipment type: PTHP, WLHP, GSHP, ASHP, VRF, Boiler, Furnace, Electric Baseboard							
4.21 Gas Equipment type: HW PTAC/fan coil, Gas-Fired PTAC, Boiler, Furnace							
4.22 Area/Space that system serves:							
4.23 Manufacturer & model:							
4.24 Listed efficiency:							
4.25 Equipment output capacity:							
4.26 Air-source heat pump output capacity (17°F):							
4.27 Type of Venting: Natural Draft, Mechanically Drafted, Direct Vent[32]							
4.28 Furnace heating sizing % = Total capacity (Item 4.25) divided by total heat loss (Item 3.16)							
4.29 Meets furnace sizing limit (A, B, C, or NA)							
"A": For low-load spaces (≤ 10 kBtuh), furnace output capacity is ≤ 40 kBtuh.							
"B": When Used for Heating Only	"C": When Paired With Cooling						
100 – 400%	Recommended: 100 – 140% Allowed: 100 – 400%						

4. Equipment Controls & Hydronic Req'ts

Equipment Controls	
4.30 All equipment controls below have been reviewed and included where applicable, in the HVAC Design	☐
4.31 All heating and cooling systems serving a dwelling unit shall have thermostatic controls within the dwelling uni	
4.32 Stair and elevator shaft vents shall be equipped with motorized dampers that are capable of being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems	
4.33 Freeze protection systems, such as heat tracing of piping and heat exchangers, including self-regulating heat tracing, and garage/plenum heaters shall include automatic controls capable of shutting off the systems when pipe wall or garage temperatures are above 40°F	
4.34 Snow- and ice-melting systems shall include automatic controls capable of shutting off the systems when the pavement temperature is above 50°F and no precipitation is falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F so that the potential for snow or ice accumulation is negligible	
Hydronic Distribution	
4.35 All hydronic distribution requirements below have been reviewed and included where applicable, in the HVAC Design	☐
4.36 All terminal heating and cooling distribution equipment must be separated from the riser or distribution loop by a control valve or terminal distribution pump, so that heated or cooled fluid is not delivered to the apartment distribution equipment when there is no call from the apartment thermostats	
4.37 Terminal units must be equipped with pressure independent balancing valves or pressure independent control valves	

5. Dwelling Unit Duct Design

5. Dwelling Unit Duct Design (Complete if heating or cooling equipment will be installed with ducts; otherwise check "N/A")	☐ N/A
5.1 Duct system designed for the equipment selected in Section 4, per ☐ ACCA Manual D ☐ Other:	☐
5.2 Room-by-room design airflows documented below (which should sum to the mode with the higher Design HVAC fan airflow) [6, 33, 34]	

Name of the unit plan:	Name of the unit plan:
Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM	Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM
Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____	Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____
Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC	Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC

	Room Name	Design Airflow (CFM)		Room Name	Design Airflow (CFM)
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
	Total for all rooms			Total for all rooms	

6. Duct Quality Installation

6. Duct Quality Installation - *Applies to Heating, Cooling, Ventilation, Exhaust, & Pressure Balancing Ducts, Unless Noted in Footnote*	
6.1 All duct quality installation requirements below have been included where applicable in the HVAC Design	☐
6.2 Ductwork specified without kinks, sharp bends, compressions, or excessive coiled flexible ductwork [38]	
6.3 All supply and return ducts not in conditioned space, including connections to trunk ducts, are insulated to ≥ R-6 [39]	
6.3.1 Prescriptive Path: Dwelling unit ductwork meets the location and insulation requirements specified in the ENERGY STAR MF Reference Design	
Dwelling Unit	
6.4 At least one MERV 6 or higher filter specified for each ducted mechanical system serving an individual dwelling unit and is in a location that facilitates access and regular service by the occupant or building owner. Filter access panel specified with a gasket or comparable sealing mechanism. All return air and mechanically supplied outdoor air designed to pass through filter prior to conditioning	
6.5 Ductwork air-sealing specified such that Rater-measured total duct leakage is ≤ 4 CFM25 per 100 ft^2 of CFA at rough-in or ≤ 8 CFM25 per 100 ft^2 at final, or if there are no ducted returns, ≤ 3 CFM25 per 100 ft^2 of CFA at rough-in or ≤ 6 CFM25 per 100 ft^2 at final. [40] Additionally, for Townhouses only, Rater-measured duct leakage to outdoors is ≤ 4 CFM25 per 100 ft^2 of CFA or ≤ 40 CFM25 [41]	
6.6 Bedrooms with a design supply airflow ≥ 150 CFM (as reported in Item 5.2) are specified with any combination of transfer grilles, jump ducts, dedicated return ducts, and/or undercut doors to achieve a Rater-measured pressure differential ≥ - 5 Pa and ≤ 5 Pa with respect to the main body of the dwelling unit when all air handlers are operating	
Common Space	
6.7 Duct design specifies that all supply, return, and exhaust ductwork and all plenums shall be sealed at all transverse joints, longitudinal seams, and duct wall penetrations	
6.8 Central exhaust systems (that serve four or more dwelling units): Ductwork air-sealing specified such that measured duct leakage does not exceed 25% of exhaust fan flow at rough-in (e.g., including trunks, branches, and take-offs) or 30% of exhaust fan flow at final (e.g., inclusive of all ductwork between the fan and the grilles) [42]	

HVAC Design Report Quiz

Q: Do the cooling equipment system sizing limits apply to common area equipment?

A: No, footnote 19 states that it is dwelling unit only.

Q: If the top floor apartment with the most CFA & window area has a heat gain <18 kBtuh, can I just document the load calcs for that ONE floorplan?

A: Yes, but the system selected for all units has to be single-speed (<20 kBtuh) or 2-speed/variable (<25 kBtuh)

Q: What if the tables aren't enough for my building?

A: Extras in the Appendix

HVAC Functional Testing Checklist

- Verified by HVAC Credentialed Contractor, individual with commissioning credentials from AEE, BCCP, ASHRAE or NEBB, OEM representative
  - Checklist must be collected if not an HVAC credentialed contractor
  - If installing contractor wants to be FT Agent, they have to be a credentialed contractor
  - Credentialed contractors can only complete Sections 1-5 (cannot complete Sections 6-9)

HVAC Functional Testing Checklist

All systems (boilers, chillers, cooling towers, PTAC/PTHPs, furnaces, mini-split heat pumps, etc) will require some level of functional testing whether in-unit, common, or central, such as:

- Functional testing of systems, controls, sensors, thermostats
- Testing for proper refrigerant charge, fan flow & power, static pressure, like in ESCH
- Verifying temperatures on central hydronic systems

MFNC Functional Testing Checklist

Section 1: Functional Testing Overview

Section 2: Refrigerant Charge

Section 3: Indoor HVAC Fan Airflow

Section 4: Air Balancing of Supply/Return
[Recommended, not required]

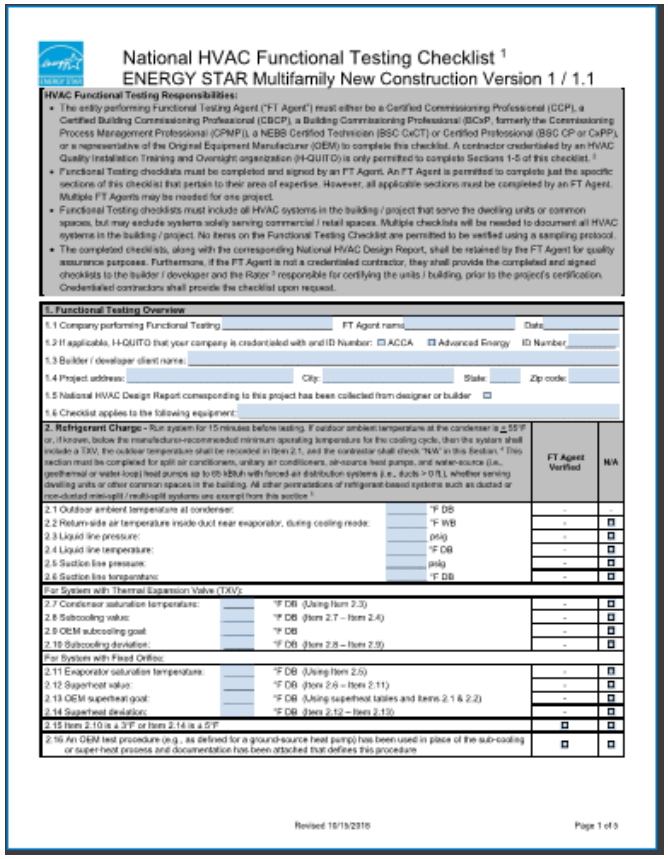
Section 5: Indoor/Terminal Units
[Rater can complete]

Section 6: VRF Outdoor Unit

Section 7: Central Boilers

Section 8: Cooling Towers

Section 9: Chillers



National HVAC Functional Testing Checklist [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

HVAC Functional Testing Responsibilities:

- The entity performing Functional Testing Agent ("FT Agent") must either be a Certified Commissioning Professional (CCP), a Certified Building Commissioning Professional (CBCP), a Building Commissioning Professional (BCxP, formerly the Commissioning Process Management Professional (CPMP)), a NEBB Certified Technician (BSC CxCT) or Certified Professional (BSC CP or CxPP), or a representative of the Original Equipment Manufacturer (OEM) to complete this checklist. A contractor credentialed by an HVAC Quality Installation Training and Oversight organization (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. 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. Multiple FT Agents may be needed for one project.
- Functional Testing checklists must include all HVAC systems in the building / project that serve the dwelling units or common spaces, but may exclude systems solely serving commercial / retail spaces. Multiple checklists will be needed to document all HVAC systems in the building / project. No items on the Functional Testing Checklist are permitted to be verified using a sampling protocol.
- 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 If applicable, H-QUITO that your company is credentialed with 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: _____

2. Refrigerant Charge - Run system for 15 minutes before testing. If outdoor ambient temperature at the condenser is ≥ 55°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 split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal or water-loop) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts > 0 ft.), whether serving dwelling units or other common spaces in the building. All other permutations of refrigerant-based systems such as ducted or non-ducted mini-split / multi-split systems are exempt from this section [5]			FT Agent Verified	N/A
2.1 Outdoor ambient temperature at condenser:		°F DB	-	-
2.2 Return-side air temperature inside duct near evaporator, during cooling mode:		°F WB	-	☐
2.3 Liquid line pressure:		psig	-	☐
2.4 Liquid line temperature:		°F DB	-	☐
2.5 Suction line pressure:		psig	-	☐
2.6 Suction line temperature:		°F DB	-	☐
For Systems with Thermal Expansion Valve (TXV):				
2.7 Condenser saturation temperature:		°F DB (Using Item 2.3)	-	☐
2.8 Subcooling value:		°F DB (Item 2.7 – Item 2.4)	-	☐
2.9 OEM subcooling goal:		°F DB	-	☐
2.10 Subcooling deviation:		°F DB (Item 2.8 – Item 2.9)	-	☐
For System with Fixed Orifice:				
2.11 Evaporator saturation temperature:		°F DB (Using Item 2.5)	-	☐
2.12 Superheat value:		°F DB (Item 2.6 – Item 2.11)	-	☐
2.13 OEM superheat goal:		°F DB (Using superheat tables and Items 2.1 & 2.2)	-	☐
2.14 Superheat deviation:		°F DB (Item 2.12 – Item 2.13)	-	☐
2.15 Item 2.10 is ≥ 3°F or Item 2.14 is ≥ 5°F			☐	☐
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 superheat process and documentation has been attached that defines this procedure			☐	☐

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MFNC Functional Testing Checklist

Section 1: Functional Testing Overview

1. Functional Testing Overview
1.1 Company performing Functional Testing _____ FT Agent name _____ Date _____
1.2 If applicable, H-QUITO that your company is credentialed with 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: _____

MFNC Functional Testing Checklist

Section 2: Refrigerant Charge

2. Refrigerant Charge - Run system for 15 minutes before testing. If outdoor ambient temperature at the condenser is ≤ 55°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 split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal or water-loop) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts > 0 ft.), whether serving dwelling units or other common spaces in the building. All other permutations of refrigerant-based systems such as ducted or non-ducted mini-split / multi-split systems are exempt from this section [q]

Footnote 4: Either factory-installed or field-installed TXV's may be used. For field-installed TXV's, ensure that sensing bulbs are insulated and tightly clamped to the vapor line with good linear thermal contact at the recommended orientation, usually 4 or 8 o'clock.

MFNC Functional Testing Checklist

Footnote 5: The term “mini-split” refers to air conditioners and heat pumps that have variable refrigerant flow and distributed refrigerant technology with a single outdoor section serving a single indoor section. The indoor section is typically, but not exclusively, mounted on room walls and/or ceilings and designed to heat or cool air within the conditioned space either directly or through limited duct runs.

The term “multi-split” refers to air conditioners and heat pumps that have variable refrigerant flow and distributed refrigerant technology with the capability of serving multiple indoor sections with a single outdoor section. The indoor sections are typically, but not exclusively, mounted on room walls and/or ceilings and designed to heat or cool air within the conditioned space either directly or through a ducted system. A single outdoor section can serve one or more dwelling units.

The length of the duct system is not a determinant for meeting either of these definitions.

MFNC Functional Testing Checklist

Section 2: Refrigerant Charge

			FT Agent Verified	N/A
2.1 Outdoor ambient temperature at condenser:	_____	°F DB	-	-
2.2 Return-side air temperature inside duct near evaporator, during cooling mode:	_____	°F WB	-	☐
2.3 Liquid line pressure:	_____	psig	-	☐
2.4 Liquid line temperature:	_____	°F DB	-	☐
2.5 Suction line pressure:	_____	psig	-	☐
2.6 Suction line temperature:	_____	°F DB	-	☐
For System with Thermal Expansion Valve (TXV):				
2.7 Condenser saturation temperature:	_____	°F DB (Using Item 2.3)	-	☐
2.8 Subcooling value:	_____	°F DB (Item 2.7 – Item 2.4)	-	☐
2.9 OEM subcooling goal:	_____	°F DB	-	☐
2.10 Subcooling deviation:	_____	°F DB (Item 2.8 – Item 2.9)	-	☐
For System with Fixed Orifice:				
2.11 Evaporator saturation temperature:	_____	°F DB (Using Item 2.5)	-	☐
2.12 Superheat value:	_____	°F DB (Item 2.6 – Item 2.11)	-	☐
2.13 OEM superheat goal:	_____	°F DB (Using superheat tables and Items 2.1 & 2.2)	-	☐
2.14 Superheat deviation:	_____	°F DB (Item 2.12 – Item 2.13)	-	☐
2.15 Item 2.10 is ± 3°F or Item 2.14 is ± 5°F			☐	☐
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			☐	☐

MFNC Functional Testing Checklist

Section 3: Indoor HVAC Fan Airflow

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 > 0 ft.), 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 central 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]

MFNC Functional Testing Checklist

Section 3: Indoor HVAC Fan Airflow

	FT Agent Verified	N/A
3.1 The mode with the higher design HVAC fan airflow used, per Item 5.2 of National HVAC Design Report: ☐ Heating ☐ Cooling	☐	-
3.2 Static pressure test holes have been created, and test hole locations are well-marked and accessible	☐	-
Test hole location for **return** external static pressure: ☐ Plenum ☐ Cabinet ☐ Transition ☐ Other: _____	-	-
Test hole location for **supply** external static pressure: ☐ Plenum ☐ Cabinet ☐ Transition ☐ 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)	☐	-

MFNC Functional Testing Checklist

Section 4: Air Balancing of Supply Registers & Return Grilles

4. Air Balancing of Supply Registers & Return Grilles (Recommended, but not Required) [6]	FT Agent Verified	N/A
4.1 Balancing report attached with room-by-room design airflows from Item 5.2 on National HVAC Design Report, and contractor-measured airflow using ANSI / ACCA 5 QI-2015 protocol	☐	☐
4.2 Room-by-room airflows verified by contractor to be within the greater of ± 20% or 25 CFM of design airflow	☐	☐

MFNC Functional Testing Checklist

Section 5: Indoor/Terminal Units (Rater can complete)

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	☐	☐	☐
5.1.2 Where specified by design, external condensate pump installed and condensate drain pan drains to a conspicuous point of disposal in case of blockage	☐	☐	☐

MFNC Functional Testing Checklist

Section 5: Indoor/Terminal Units (Rater can complete)

	Rater Verified	FT Agent Verified	N/A
5.2 Functional Testing			
5.2.1 Zone temperature displayed on thermostat or sensor is within 5°F of measured zone temperature	☐	☐	☐
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	☐	☐	☐
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	☐	☐	☐
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	☐	☐	☐
5.2.5 Where OA dampers are installed, the damper closes when there is no call for ventilation or when fan is off	☐	☐	☐
5.2.6 If more than one system provides heating or cooling to the same space, controls prevent simultaneous heating and cooling	☐	☐	☐

HVAC Functional Testing Checklist Quiz

Q: I have a 4 ton ducted forced air heat pump serving the 1st floor community room. What sections of the checklist apply?

A: Section 2 (Refrigerant Charge), Section 3 (HVAC Fan Airflow), and Section 5 (Indoor/Terminal units)

Q: Are ducted mini-splits exempt from any sections?

A: Just exempt from Section 2 and 3.

Q: Is Sampling allowed or does each system get tested?

A: Sampling is not allowed, not even in Section 5

MFNC Functional Testing Checklist

Section 6: VRF Outdoor Unit

6. VRF Outdoor Unit - This section must be completed for all VRF outdoor units serving dwelling units or common spaces	FT Agent Verified	N/A
6.1 Installation Checks		
6.1.1 Pressure testing on refrigerant piping has been completed for this system (indicate exact test in / test out pressure (psig) / time (hours)): _____/_____/_____	☐	☐
6.1.2 Vacuum testing has been completed (indicate exact test in / test out pressure (psig) / time (hours)): _____/_____/_____	☐	☐
6.1.3 Refrigerant line lengths and height differences have been recorded from as-built shop drawings or field measured, and documentation of the measurement is available, if requested	☐	☐
6.1.4 Indicate required additional charge amount (lbs): _____	☐	☐
6.2 Functional Testing		
6.2.1 In cooling mode, the outdoor unit fan is ON and heat is being rejected. Measure and verify that outdoor unit fan discharge air temperature is warmer than the ambient air temperature	☐	☐
6.2.2 In heating mode, the outdoor unit fan is ON and heat is being absorbed. Measure and verify that outdoor unit fan discharge air temperature is colder than the ambient air temperature	☐	☐
6.2.3 Using the central maintenance tool or controller, none of the outdoor units or connected indoor units are showing an alarm	☐	☐
6.2.4 Using the central maintenance tool, the manufacturer's representative confirmed refrigerant charge test per manufacturer's guidelines	☐	☐

MFNC Functional Testing Checklist

Section 7: Central Boilers

7. Central Boilers - This section must be completed for all central boilers serving dwelling units or common spaces	FT Agent Verified	N/A
7.1 Installation Checks		
7.1.1 Piping pressure testing is completed and all accessible boiler piping, fittings, and accessories are free from leaks. FT agent may conduct the test or witness the test being conducted by the installing contractor	☐	☐
7.1.2 Boiler relief valves and discharge piping do not show signs of weeping or leakage	☐	☐
7.1.3 No signs of blockage, leakage, or deterioration in the fresh air intake or flue gas vent piping	☐	☐
7.1.4 Temperature, pressure gauges, air eliminator, expansion tank, check valves and all other piping components installed as specified by HVAC Designer	☐	☐
7.1.5 Boiler supply / header temperature sensor and, where applicable, outdoor air temperature sensor, are located as specified by HVAC Designer	☐	☐
7.1.6 Indicate boiler header / supply setpoint type: ☐ Fixed ☐ Seasonal ☐ Outdoor temperature reset ☐ Indoor temperature reset ☐ Other: _____	☐	☐
7.1.7 Where outdoor air temperature reset schedule is applicable, indicate reset schedule (e.g., 180°F Supply @ 10°F outdoor, 120°F supply @ 55°F outdoor) _____ @ _____ , _____ @ _____	☐	☐
7.1.8 Where Warm Weather Shut Down (WWSD) is applicable, list temperature (NA if boilers and system pumps also serve DHW)	_____ °F	☐

MFNC Functional Testing Checklist

Section 7: Central Boilers

7.2 Functional Testing: Boilers	FT Agent Verified	N/A
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 _____% ☐ high fire _____% ☐ low fire	☐	☐
7.2.2 Boiler combustion air intake dampers open / close with boiler operation	☐	☐
7.2.3 If each boiler has its own dedicated boiler circulator pump, it operates only when the respective boiler is firing. (Circulator pump may run for a short period of time before or after the boiler fires, as recommended by the equipment manufacturer)	☐	☐
7.2.4 When there is a call for heating, the boiler(s) are enabled according to their design sequence of operation	☐	☐
7.2.5 When multiple boilers are supposed to operate at the same time, they operate according to the Engineer of Record's sequence of operation and the on / off sequencing is observed	☐	☐
7.2.6 Cycle the boilers on and off 3 times. Boiler(s) modulate / step down to the minimum firing rate before shutting off	☐	☐
7.2.7 Boiler(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the boiler manufacturer to prevent short cycling)	☐	☐
7.2.8 Condensing Boiler: Return temperature enables condensing Design / OEM temp: _____°F Measured temp: _____°F	☐	☐
7.2.9 Boiler supply / header temperature sensor is reading within 3°F of measured boiler supply / header temperature	☐	☐
7.2.10 Boiler minimum flow rate and change in flow rate are maintained within the manufacturer's stated limits throughout the sequence of operation	☐	☐

MFNC Functional Testing Checklist

Section 7: Central Boilers

7.3 Functional Testing: Heating System Pumps	FT Agent Verified	N/A
7.3.1 Where heating system pumps (i.e., the pumps which are responsible for moving the water through the terminal units) are equipped with a VFD which is responding to a pressure sensor within the system or a sensorless pumping system, indicate which one: ☐ VFD+Sensor ☐ Sensorless	☐	☐
7.3.2 If a variable speed pumping system is installed, the VFD increases and decreases pump speed in response to changes in the system	☐	☐
7.3.3 If a variable speed pumping system is installed, system prevents "dead-heading". (May be tested under real or simulated low flow conditions.) Select the method of water flow bypass: ☐Minimum Flow Bypass Valve ☐ 3 way valves on specific terminal units ☐Other: _____	☐	☐
7.3.4 Pumps are off when outside air temperature is above WWSD (N/A if pumps serve DHW as well as heating)	☐	☐

MFNC Functional Testing Checklist

Section 8: Cooling Towers

8. Cooling Towers - This section must be completed for all cooling towers serving dwelling units or common spaces	FT Agent Verified	N/A
8.1 Installation Checks		
8.1.1 Cooling Tower piping and all components are free from leaks	☐	☐
8.1.2 Temperature gauges, check valves, tower bypass valve and all other piping components installed as specified by HVAC Designer	☐	☐
8.1.3 Condenser Water Supply setpoint type: ☐ Fixed ☐ Outdoor temperature reset ☐ Seasonal / based on free cooling	-	☐
8.1.4 All control sensors (condenser water supply temperature, outdoor air humidity, etc.) are located as specified by HVAC Designer	☐	☐

MFNC Functional Testing Checklist

Section 8: Cooling Towers

	FT Agent Verified	N/A
8.2 Functional Testing: Tower Fans		
8.2.1 Tower fan(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the manufacturer to prevent short cycling)	☐	☐
8.2.2 Cooling Tower fan(s) do not run unless associated cooling tower pump(s) are running	☐	☐
8.2.3 If installed, basin heater is not enabled when the basin water temperature is above the setpoint	☐	☐
8.2.4 Condenser Water Supply Sensor is reading within 3°F of measured temperature	☐	☐
8.3 Functional Testing: Cooling Tower Pumps		
8.3.1 Cycle the cooling tower pumps on and off 3 times. Cooling tower pumps only operate when controls call for operation (N/A if tower pumps are set to run year round)	☐	☐

MFNC Functional Testing Checklist

Section 9: Chillers

9. Chillers - This section must be completed for all chillers serving dwelling units or common spaces	FT Agent Verified	N/A
9.1 Installation Checks		
9.1.1 Chiller piping and all components are free from leaks	☐	☐
9.1.2 If multiple chillers, water flow is balanced across chillers using (indicate which one): ☐ Balancing valves ☐ Reverse return piping ☐ Individual chiller pumps ☐ Other:	☐	☐
9.1.3 Temperature, pressure gauges, air eliminator, expansion tank, check valves and all other piping components installed as specified by HVAC Designer	☐	☐
9.1.4 Chilled Water Supply temperature sensor (and outdoor air temperature sensor where applicable) are located as specified by HVAC Designer	☐	☐

MFNC Functional Testing Checklist

Section 9: Chillers

9.2 Functional Testing: Chillers	FT Agent Verified	N/A
9.2.1 When there is a call for cooling, chillers are operating and maintaining chilled water setpoint	☐	☐
9.2.2 When multiple chillers are supposed to operate at the same time, they operate according to the Engineer of Record's sequence of operations and the on / off sequencing is observed	☐	☐
9.2.3 Chiller(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the chiller manufacturer to prevent short cycling)	☐	☐
9.2.4 Chilled Water Supply Sensor is reading within 3°F of measured chiller temperature	☐	☐
9.2.5 Chiller minimum flow rate and change in flow rate are maintained within the manufacturer's stated limits throughout the sequence of operation	☐	☐

MFNC Functional Testing Checklist

Section 9: Chillers

	FT Agent Verified	N/A
9.3 Functional Testing: Chilled Water System Pumps		
9.3.1 Where Chilled Water System pumps (i.e., the pumps which are responsible for moving the chilled water through the terminal units) are equipped with a VFD, which is responding to a pressure sensor within the system or a sensorless VFD system, indicate which one: ☐ VFD+Sensor ☐ Sensorless	☐	☐
9.3.2 If a variable speed pumping system is installed, confirm that the VFD increases and decreases pump speed in response to changes in the system	☐	☐
9.3.3 If a variable speed pumping system is installed, system prevents "dead-heading". (May be tested under real or simulated low flow conditions.) Select the method of water flow bypass: ☐Minimum Flow Bypass Valve ☐ 3 way valves on specific terminal units ☐Other: _____	☐	☐
9.3.4 Pumps are off when cooling is not required (N/A if chilled water is required year round)	☐	☐

HVAC Functional Testing Checklist Quiz

Q: I have commissioning credentials from my University. Can I be a Functional Testing Agent?

A: No.

Q: I'm a Rater but also am a NEBB Building System Commissioning Certified Technician (BSC CxCT). Can I be a Functional Testing Agent?

A: Yes. You still can't do Sampling.

Q: I'm installing the central boiler and also have the BSC CxCT. Can I complete the section on boilers?

A: No.

The following slides related to Duct Leakage testing were updated and expanded based on questions received during the session at RESNET. These are not the same slides that were presented.

They are presented first for Townhomes, and then for other attached units eligible for MFNC.

Duct Leakage Testing for Townhomes

Duct Leakage Testing for Townhomes

MFNC Rater Field Checklist Items 6.4 and 6.5

6.4 Rater-measured total duct leakage in dwelling units meets one of the following two options: [43]
6.4.1 Rough-in: Tested per allowances below, with air handler & all ducts, building cavities used as ducts, & duct boots installed. In addition, all duct boots sealed to finished surface, Rater-verified at final [44] No ducted returns [34]: The greater of ≤ 3 CFM25 per 100 sq. ft. of CFA or ≤ 30 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton One or two ducted returns [34]: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM Three or more ducted returns [34]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM
6.4.2 Final: Tested per allowances below, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles atop the finished surface (e.g., drywall, floor) installed [45] No ducted returns [34]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton One or two ducted returns [34]: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM Three or more ducted returns [34]: The greater of ≤ 12 CFM25 per 100 sq. ft. of CFA or ≤ 120 CFM
6.5 Townhouses only: Rater-measured duct leakage to outdoors the greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25 [43, 46]

Duct Leakage Testing for Townhomes

MFNC Rater Field Checklist Footnote 43 & 46

43. …Duct leakage testing is not required if the ducts and air handler are in conditioned space and the total supply duct length of the system, including all supply trunks and branches, is ≤ 10 ft….

46: Testing of duct leakage to the outside can be waived if all ducts & air handling equipment are located within the townhouse's air and thermal barriers AND infiltration does not exceed the following: CZ 1-2: 3 ACH50; CZ 3-4: 2.5 ACH50; CZ 5-7: 2 ACH50; CZ 8: 1.5 ACH50.

Alternatively, testing of duct leakage to outside can be waived if total duct leakage (at rough-in OR final) is ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25, whichever is larger.

Text in blue is added for clarity but is not explicitly stated in the footnote currently. This added text will be considered in MFNC Rev01.

Duct Leakage Testing for Townhomes

ANSI/RESNET/ICC 301-2014 Addendum L, Table 4.2.2 (1)

Table 4.2.2(1) Specifications for the Energy Rating Reference and Rated Homes

Building Component	Energy Rating Reference Home	Rated Home
Thermal distribution systems	Thermal Distribution System Efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies.	Forced air distribution systems duct leakage to outside tests (w) shall be conducted and documented by an Approved Tester in accordance with requirements of Standard ANSI/RESNET/ICC 380 with the air handler installed, and the energy

Duct Leakage Testing for Townhomes

ANSI/RESNET/ICC 301-2014 Addendum L, Table 4.2.2 (1)

(w) When both of the following conditions are met and documented, duct leakage testing is not required.

1. At a pre-drywall stage of construction, 100% of the ductwork and air handler shall be visible and visually verified to be contained inside the Conditioned Space Volume. At a final stage of construction, ductwork that is visible and the air handler shall again be verified to be contained in the Conditioned Space Volume.
2. 2. At a pre-drywall stage of construction, the ductwork shall be visually verified to be 100% fully ducted, with no building cavities used as supply or return ducts.

To calculate the energy impacts on the Rated Home, a DSE of 0.88 shall be applied to both the heating and cooling system efficiencies.

Duct Leakage Testing for Townhomes

ANSI/RESNET/ICC 301-2014 Addendum L, Table 4.2.2 (1)

(w) ….continued.

Alternatively, for Dwellings and Townhouses only, when all of the following conditions are met and documented, total duct leakage testing is permitted to be conducted in lieu of duct leakage to outside testing and half of the measured total leakage shall be assigned duct leakage to outside. At a final stage of construction, if visible ductwork or the air handler is observed outside the Infiltration Volume or ductwork is no longer 100% fully ducted, duct leakage to outside testing is required:

1. At a pre-drywall stage of construction, 100% of the ductwork and air handler shall be visible and visually verified to be contained inside the Infiltration Volume. At a final stage of construction, ductwork that is visible and the air handler shall again be verified to be contained in the Infiltration Volume

2. At a pre-drywall stage of construction, the ductwork shall be visually verified to be 100% fully ducted, with no building cavities used as supply or return ducts.

3. The total leakage shall be less than or equal to the greater of: 4 cfm per 100 ft^2 of Conditioned Floor Area served by the duct system being tested, or 40 cfm. For duct systems with 3 or more returns, the total leakage shall be less than or equal to the greater of: 6 cfm per 100 ft^2 of Conditioned Floor Area served by the duct system being tested, or 60 cfm

4. Airtightness less than or equal to 3 ACH50

Duct Leakage Testing for Townhomes

	ANSI/RESNET/ICC 301 Addendum L	ENERGY STAR MFNC
When is Duct Leakage to Outside (DLTO) required?	Required if you don't qualify or choose to use options in (w)	Required, unless you meet Rater Field footnote 43 or 46
When is Total Duct Leakage required?	Not required, but can use half of Total for DLTO if you meet 1-4 in (w)	Required, unless you meet Rater Field footnote 43
When is duct leakage testing NOT required?	If ducts & AHU inside Conditioned Space Volume & fully ducted: DSE=0.88, not DLtO=0	Footnote 43. Ducts & AHU inside conditioned space & ≤10 ft total supply

Duct Leakage Testing for Townhomes

Q: I don't want to test ductwork. What do I need to do to meet 2012/15 IECC, ENERGY STAR, & ANSI 301 Addendum L?

A: Merging the test exemptions of all 3: total supply ducts have to be less than or equal to 10 ft AND the ducts and AHU have to be inside Conditioned Space Volume (as defined in 301 or 380) AND no building cavities used as supply or return ducts.

Q: If I meet all those 3 criteria, does the ERI get a DLTO of 0?

A: No, the ERI will be based on a DSE=0.88. The ENERGY STAR Certified Homes Reference Design Version 1.1 ERI will be based on a tested value of 0 cfm25/100ft^2, so not testing may make it harder to meet the ENERGY STAR ERI Target.

Duct Leakage Testing for Townhomes

Q: Townhouses are unlikely to have less than 10 ft of total supply. Can I just test total at rough-in and meet 2012/15 IECC, ENERGY STAR, & ANSI 301 Addendum L?

A: If you still meet the other 2 criteria, (ducts/AHU in CSV) AND no building cavities used as supply or return ducts, no testing is required for IECC.

If you test total at rough-in (≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25), no DLTO is required for MFNC. To also be exempt from DLTO for ANSI 301, you need air tightness ≤ 3 ACH50 at final.

Q: Is more leakage allowed if the system has ≥ 3 ducted returns?

A: Yes. If you test total at rough-in (≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM25), you do not need DLTO for ANSI 301 and you meet the MFNC total duct leakage requirement. If you ALSO meet the ACH50 in your CZ: CZ 1-2: 3 ACH50; CZ 3-4: 2.5 ACH50; CZ 5-7: 2 ACH50; CZ 8: 1.5 ACH50, then DLTO is not required for MFNC either.

Duct Leakage Testing for Townhomes

Q: If I meet all those criteria, does the ERI get a DLTO of 0?

A: No, the ERI will assume HALF of your TOTAL duct leakage as DLTO (so, 0-2 CFM25 per 100 sq. ft. of CFA).

The ENERGY STAR Certified Homes Reference Design Version 1.1 ERI will be based on a tested value of 0 cfm25/100ft^2, so not testing DLTO may make it harder to meet the ENERGY STAR ERI Target.

Duct Leakage Testing for Other MF

Duct Leakage Testing for Other MF

MFNC Rater Field Checklist Item 6.4

6.4 Rater-measured total duct leakage in dwelling units meets one of the following two options: [43]
6.4.1 Rough-in: Tested per allowances below, with air handler & all ducts, building cavities used as ducts, & duct boots installed. In addition, all duct boots sealed to finished surface, Rater-verified at final [44] No ducted returns [34]: The greater of ≤ 3 CFM25 per 100 sq. ft. of CFA or ≤ 30 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton One or two ducted returns [34]: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM Three or more ducted returns [34]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM
6.4.2 Final: Tested per allowances below, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles atop the finished surface (e.g., drywall, floor) installed [45] No ducted returns [34]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton One or two ducted returns [34]: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM Three or more ducted returns [34]: The greater of ≤ 12 CFM25 per 100 sq. ft. of CFA or ≤ 120 CFM

Duct Leakage Testing for Other MF

MFNC Rater Field Checklist Footnote 43

43. …Duct leakage testing is not required if the ducts and air handler are in conditioned space and the total supply duct length of the system, including all supply trunks and branches, is ≤ 10 ft….

Duct Leakage Testing for Other MF

ANSI/RESNET/ICC 301-2014 Addendum L, Table 4.2.2 (1)

Table 4.2.2(1) Specifications for the Energy Rating Reference and Rated Homes

Building Component	Energy Rating Reference Home	Rated Home
Thermal distribution systems	Thermal Distribution System Efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies.	Forced air distribution systems duct leakage to outside tests (w) shall be conducted and documented by an Approved Tester in accordance with requirements of Standard ANSI/RESNET/ICC 380 with the air handler installed, and the energy

Duct Leakage Testing for Other MF

ANSI/RESNET/ICC 301-2014 Addendum L, Table 4.2.2 (1)

(w) When both of the following conditions are met and documented, duct leakage testing is not required.

1. At a pre-drywall stage of construction, 100% of the ductwork and air handler shall be visible and visually verified to be contained inside the Conditioned Space Volume. At a final stage of construction, ductwork that is visible and the air handler shall again be verified to be contained in the Conditioned Space Volume.
2. 2. At a pre-drywall stage of construction, the ductwork shall be visually verified to be 100% fully ducted, with no building cavities used as supply or return ducts.

To calculate the energy impacts on the Rated Home, a DSE of 0.88 shall be applied to both the heating and cooling system efficiencies.

Duct Leakage Testing for Other MF

ANSI/RESNET/ICC 301-2014 Addendum L, Table 4.2.2 (1)

(w) ….continued.

Alternatively, for Attached Dwelling Units, excluding Dwellings and Townhouses, total duct leakage testing, at either pre-drywall or final stage of construction, is permitted to be conducted in lieu of duct leakage to outside testing. Software shall calculate the energy impact using the total duct leakage results and prorating based on the percent of duct surface area that is not in Rated Home Conditioned Space Volume, plus a contribution from the associated air handler if located outside the Rated Home Conditioned Space Volume. The air handler contribution shall be a minimum of 2.5% of the supply airflow, where supply airflow is calculated as 400 cfm per 12,000 Btu/h of output capacity of the heating or cooling equipment. The sum of the duct leakage associated with duct surface area outside the Conditioned Space Volume and the air handler leakage shall not exceed the measured duct leakage from the entire duct system.

Duct Leakage Testing for Other MF

	ANSI/RESNET/ICC 301 Addendum L	ENERGY STAR MFNC
When is Duct Leakage to Outside (DLTO) required?	Only if not testing Total or using Total results or not exempt per (w)	Never required
When is Total Duct Leakage required?	Only if not exempt or not testing DLTO; if used, ERI software will pro-rate Total to estimate DLTO	Required unless you meet Rater Field footnote 43
When is duct leakage testing NOT required?	If ducts & AHU inside Conditioned Space Volume & fully ducted: DSE=0.88, not DLtO=0	Footnote 43. Ducts & AHU inside conditioned space & ≤10 ft total supply

Duct Leakage Testing for Other MF

Q: I don't want to test ductwork. What do I need to do to meet 2012/15 IECC, ENERGY STAR, & ANSI 301 Addendum L?

A: Merging the test exemptions of all 3: total supply ducts have to be less than or equal to 10 ft AND the ducts and AHU have to be inside Conditioned Space Volume (as defined in 301 or 380) AND no building cavities used as supply or return ducts.

Q: If I meet all those 3 criteria, does the ERI get a DLTO of 0?

A: No, the ERI will be based on a DSE=0.88. The ENERGY STAR Multifamily Reference Design Version 1.1 ERI will be based on a tested value of 0 cfm25/100ft^2, so not testing may make it harder to meet the ENERGY STAR ERI Target.

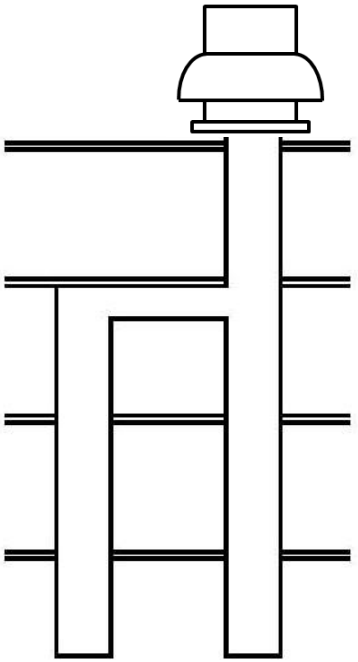
Duct Leakage Testing for Other MF

Q: I don't want to get stuck with that DSE=0.88. What if I meet all those criteria, but test Total at rough-in anyway?

A: If you meet all those criteria (fully ducted, inside CSV, and have 10ft or less supply ducts), and test Total at rough-in, the ERI software will pro-rate those results and it will yield DLTO=0, same as the ENERGY STAR MF Reference Design.

Central Exhaust Leakage Test

- Prior to drywall, 25% of exhaust fan CFM
- At final, 30% of exhaust fan CFM
- Footnote limits over-sizing of fan



Central Exhaust Rough-in Test Example 1

A 20 story building has a central exhaust fan that serves 20 apartments, each sized for 50 cfm.

The fan is specified for 1,000 cfm [20 x 50]

This is 100% of what is needed.

The leakage allowance at rough-in is 25% of 1,000 cfm or 250 cfm at 50 Pa. At final, it would be 300 cfm.

MFHR allowed 5 cfm/register and 5 cfm/floor: 200 cfm

Central Exhaust Rough-in Test Example 2

A 20 story building has a central exhaust fan that serves 20 apartments, each sized for 50 cfm.

The fan is over-sized at 2,000 cfm, 200% of what is needed.

The leakage allowance is instead based on 133% of 1,000 cfm, resulting in 332.5 cfm, rather than 25% of 2,000 cfm, which would result in 500 cfm.

Design = 1,000 cfm. Can over-size 133% without penalty (1,333 cfm). 25% of that value is 332.5 cfm.

MFNC Reference Design, Version 1

- Dwelling Unit Insulation is 2009 IECC Commercial, wood-frame
- Infiltration 0.3 cfm50/ft2, not 3-6 ACH50
- Class AW windows = 2012 IECC Commercial
- 90% Tier I lighting
- DHW is more efficient
- ENERGY STAR fridge, dishwasher, ceiling fans, clothes washer, clothes dryer
- WaterSense bathroom faucets & showerheads

MFNC Reference Design, Version 1.1

- Dwelling Unit Insulation is 2012 IECC Commercial, wood-frame
- Infiltration 0.3 cfm50/ft2, not 3-4 ACH50
- Class AW windows = 2015 IgCC Commercial
- 90% Tier I lighting
- DHW is more efficient
- ENERGY STAR fridge, dishwasher, ceiling fans, clothes washer, clothes dryer
- WaterSense bathroom faucets & showerheads

MFNC ERI Target Procedures

- No Size Adjustment Factor (SAF)
- MF RD has an ENERGY STAR DW even when not present in the Rated dwelling unit (0.66 EF vs RESNET Reference Home default)
- MF RD has an ENERGY STAR washer/dryer, even when not present in the Rated dwelling unit or building
  - Except if laundry equipment not available as ES Certified, then same in MF RD as installed
- Most units will get to reduce compartmentalization results by 15% to obtain infiltration results (but also happens to the MF RD)
- MF RD windows have same orientation as Rated dwelling unit (rather than across all walls)

MFNC Rater QA Checklist

- New Documentation Collection Section & some items that are being added to 2019 Certified Homes Rater QA checklist
- Values re-tested by QAD given more leeway (duct blaster, blower door, etc).
- New sections added to match the new sections added to Rater Field (DHW, lighting, etc).
- Expand QA verification to common spaces, but not at 100%

Multifamily Workbook

Multifamily Workbook (Excel-based) offers:

- Spreadsheet versions of the two Rater Checklists
- Dwelling unit testing results spreadsheet
- Common area testing results spreadsheet
- Spreadsheets to help demonstrate compliance with envelope, DHW, lighting, and HVAC requirements
- BETA version online shows example

Used by MRO's in ASHRAE & Prescriptive Paths; Optional for ERI Path

Frequently Asked Questions

Q: Can rehabs participate?

A: Yes, if they meet all requirements

Q: Can ERI be done on building or unit?

A: Unit, and it requires ALL units in building to be uploaded.

Q: When will software have the ANSI 301-2019 ERI ready? ES MF Reference Design?

A: Ask your software provider

Q: Is Prescriptive Path ok in 2018 IECC state?

A: Yes!

Frequently Asked Questions

Q: If there is a local stretch code, which code is used for ASHRAE?

A: The commercial code adopted by the State.

Q: Is a Rater required in ASHRAE Path?

A: Yes. They are required to complete the Rater Design Review and Field Checklist and submit documents to the MRO, but equivalent designations may be allowed by the MRO, subject to EPA approval.

Q: How is QA done on a Prescriptive Path project?

A: The MRO reviews ASHRAE and Prescriptive path projects. Additional details on the required QA can be found in the National Program Requirements, MRO Application online, or by contacting your MRO.

Wrap-up

MFNC website: www.energystar.gov/mfnc

MFNC program available now! ERI limited to 5 stories and less until RESNET confirms

MFNC required if permitted on or after 1/1/2021

MFNC Rater Training available in 2019 but not required until January 2020

Contact energystarhomes@energystar.gov with any questions, for webinar recordings, or to be added to the stakeholder list for MF updates