ENERGY STAR Multifamily High Rise National Prescriptive Path Requirements, Version 1.0

THE ENERGY STAR MFHR Prescriptive Path is only available in states where buildings are permitted to meet energy codes that are equal to or less stringent than the 2009 IECC or ASHRAE 90.1-2007 ~~(or an earlier version)~~. EPA has not created a Prescriptive Path for states where energy code exceeds ASHRAE 90.1-2007. Therefore, all buildings permitted under codes that are equal to or more stringent than 2012 IECC or ASHRAE 90.1-2010, ~~or Title 24~~ must follow the ENERGY STAR Performance Path to achieve certification.

ENERGY STAR MFHR Prescriptive Path Requirements:

To earn the ENERGY STAR using this prescriptive approach, a building must meet the requirements specified below and be verified and field-tested in accordance with the *ENERGY STAR MFHR Testing and Verification Protocols*. Note that compliance with these guidelines is not intended to imply compliance with all local code requirements that may be applicable to the building to be built[1].

To ~~ensure that a MFHR building meets ENERGY STAR~~meet the certification guidelines, the developer of a project participating in the program must provide EPA or its designated agent with program specific submittals. These submittals, which must be validated by a licensed professional (registered architect or professional engineer), are used to demonstrate that all prescriptive measures are included and installed to specification.

ENERGY STAR MFHR Testing and Verification Protocols (T&V Protocols):

The *T&V Protocols* are mandatory requirements for the inspection, testing, and verification of components related to the building's energy performance. All inspections and diagnostic tests described within these protocols are required for each of the energy-related components and systems that exist in the participating building. Results of inspections must be documented and kept on record with the building file by a licensed professional and submitted to EPA, or its designated agent, at the completion of construction. These inspections shall be conducted throughout the project construction phase at a time that is best suited to determine whether the energy efficiency element is installed to specification.

ENERGY STAR MFHR Submittal Requirements:

To meet the certification guidelines,~~certify a MFHR building as ENERGY STAR,~~ EPA or its designated agent must approve a complete Proposed Design Submittal and a complete As-Built Submittal. EPA or its designated agent will not approve incomplete submittals, but will communicate with Developer Partners and licensed professionals on which requirements must be met to bring the submittal into compliance with program requirements.

Proposed Design Submittal (Submitted prior to construction)

The Proposed Design Submittal is used to ensure that the project design meets the prerequisite and prescriptive requirements of the program and that they have been included in the construction documents. The licensed professional is responsible for submitting a Proposed Design Submittal, with an *ENERGY STAR MFHR Submittal Validation Form* to EPA, or its designated agent for approval, prior to beginning construction. The Proposed Design Submittal includes the following:

- Testing and Verification Worksheets
  A full review of all construction documents must be conducted prior to construction and documented using the *T&V Worksheets.* The *Prescriptive Path Checklist* is used at this stage to demonstrate that prerequisites and prescriptive requirements have been properly specified within the construction documents. The checklist is included as part of the *T&V Worksheets* and is automatically completed if the other *T&V Worksheets* are used to document the review process.

Developer partners may not promote the units within their project as ENERGY STAR until all program requirements are met and confirmed by EPA or their designated agent. Eligible projects may use the Designed to Earn the ENERGY STAR mark after the design phase of the project if they have an approved Proposed Design Submittal and the design receives a score of 75 or higher, using EPA's Portfolio Manager. More information is available in the *Designed to Earn the ENERGY STAR for MFHR* document available on the Guidance Documents page.

As-Built Submittal (Submitted post construction)

ENERGY STAR Multifamily High Rise National Prescriptive Path Requirements, Version 1.0

The As-Built Submittal is used to ensure that the prerequisites and prescriptive measures are installed to specification. After the final inspection, the licensed professional is responsible for submitting an As-Built Submittal, with an *ENERGY STAR MFHR Submittal Validation Form* to EPA, or its designated agent for approval. Once EPA has determined that the project has fulfilled all of the program requirements, the Developer Partner will be notified that the building has earned the ENERGY STAR and that it can be marketed and promoted per the *ENERGY STAR Logo Identity Guidelines*. The As-Built Submittal includes the following:

- Testing and Verification Worksheets and Photo Template
  The *T&V Worksheets* and *Photo Template* are used to demonstrate that prerequisites and prescriptive requirements are included in the completed building and meet all requirements of the *ENERGY STAR MFHR Testing and Verification Protocols*. (Note, once a licensed professional or Developer Partner has successfully certified 3 buildings, submission of a Photo Template as a component of the Testing and Verification Protocols is no longer required.)

ENERGY STAR MFHR Prescriptive Requirements[2]:

Appliances	When provided in common areas and/or apartments, refrigerators, dishwashers, clothes washers, ceiling fans and vending machines must be ENERGY STAR certified.
Heating and Cooling Equipment[3]	▪ The heating and cooling systems must comply with ASHRAE 90.1-2007, Sections 6.4 and 6.5. ▪ Load sizing calculations must reflect the design[4]. The installed capacity cannot exceed design by more than 20%, except when smaller sizes are not available. ▪ See Table 1 for list of equipment and minimum efficiencies per ASHRAE 90.1 – 2007 Climate Zones[5]. Part-load minimum efficiencies listed are only applicable to equipment with capacity modulation. See ASHRAE 189.1-2009, Appendix C, for equipment not listed in Table 1.
Heating and Cooling Distribution[6,7,8,9,10,11,12,13]	▪ Total duct leakage for in-unit systems shall be ≤8 CFM25 per 100 ft^2 of conditioned floor area[7]. Sampling procedures and tolerances are described in the *T&V Protocols*. ▪ Heating and cooling supply and return ductwork shall be insulated to a minimum R-8 in unconditioned space.
Envelope[14,15,16]	▪ The envelope components must comply with ASHRAE 90.1-2007, Section 5.4. Assembly U-value determinations must follow ASHRAE 90.1-2007, Appendix A[17]. ▪ The building plans shall demonstrate a continuous, unbroken air barrier separating the conditioned space of the building from the following spaces: - the exterior, - unconditioned spaces within the building, - commercial spaces, - mechanical rooms vented with unconditioned air, - mechanical chases opening to unconditioned spaces, - elevator shafts, and - garages or other vehicle/equipment storage facilities. ▪ All roof, wall, floor and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces that contain a layer of continuous, air impermeable insulation (≥R-3 in CZ1-4 and ≥R-5 in CZ 5-8). ▪ For steel-framed and metal building walls, continuous exterior insulation (≥R-3) is required on above grade walls. For mass or masonry walls with metal framing, continuous interior or exterior insulation (≥R-3) is required on above grade walls[18]. ▪ Maximum allowable glazing area: 30% Window-to-Wall Ratio.[19] ▪ See Tables 2 and 3 for climate specific envelope requirements for the following components: roof insulation; above grade and below grade wall insulation; floor and slab insulation; exterior doors; and vertical glazing.[20]

<table>
<tr><td>Garages and Sidewalks[21,22]</td><td>▪ Attached garages shall be fully compartmentalized from the rest of the building through air sealing. All pipe and conduit penetrations shall be sealed with material compatible with the surface and resilient to temperature fluctuations.
▪ When garage exhaust is required by code, CO and NO_2 sensors must be installed that control exhaust fan operation.</td></tr>
<tr><td rowspan="5">Ventilation and Infiltration[23]</td><td>Apartments shall be sealed to reduce air exchange between the apartment and outside as well as the apartment and other adjacent spaces. A maximum air leakage rate of 0.30 CFM50 per square feet of enclosure is allowed. Sampling procedures and tolerances are described in the T&V Protocols. Specific apartment air leakage paths to be sealed are listed in the T&V Worksheets.</td></tr>
<tr><td>▪ Apartment in-line and ceiling exhaust fans must be ENERGY STAR certified.
▪ Central exhaust and in-line exhaust systems serving apartments must have self-balancing dampers at each register.</td></tr>
<tr><td>▪ Central exhaust fans 1/16 HP and less must be direct-drive and have variable speed controllers.
▪ Central exhaust fans greater than 1/16 HP and less than 1 HP must be direct-drive with ECM motors and variable speed controllers.
▪ Central exhaust fans 1 HP and larger must have NEMA Premium efficient motors.
▪ In addition to requirements above, powered common laundry ventilation must be installed with automatic demand control to turn off ventilation fans when no dryers are operating.</td></tr>
<tr><td>Central exhaust duct leakage not to exceed the sum of 2.5 CFM50 per register per shaft and 2.5 CFM50 per floor per shaft during testing.</td></tr>
<tr><td><table>
<tr><td>Design/Measured Ventilation Rates for Common Area[24]</td><td><u>Minimum</u>
ASHRAE 62.1-2007</td><td><u>Maximum</u>
not to exceed ASHRAE 62.1 by more than 50%</td></tr>
<tr><td>Design/Measured Ventilation Rates for Apartments and Local Exhaust [25]</td><td><u>Minimum</u>
ASHRAE 62.2-2007</td><td><u>Maximum</u>
not to exceed ASHRAE 62.2 by more than 50%</td></tr>
</table></td></tr>
<tr><td>Domestic Water Heating[26,27]</td><td>▪ Domestic water heating systems must comply with ASHRAE 90.1-2007, Sections 7.4 and 7.5.
▪ Water Heater minimum efficiencies[28]
- In-Unit Electric OR Gas Water Heaters (storage or instantaneous)
Gas (EF): 0.69-(0.002 x Tank Gallon Capacity)
Electric (EF): 0.97-(0.001 x Tank Gallon Capacity)
- Hot Water Supply Boiler: Oil or Gas: 85% Et
▪ Domestic water heating equipment shall be ENERGY STAR certified, where applicable. Atmospherically vented gas water heaters, tankless coils and side-arm water heaters shall not be specified. Indirect water heaters, with or without storage, are acceptable. If storage is provided, the maximum storage tank capacity shall be specified based on occupancy.
▪ The average flow rate for all showers must be ≤ 1.75 gallons per minute per stall (as rated at 80 psi) and all showerheads must be WaterSense® labeled.
▪ All lavatory faucets or aerators must be WaterSense® labeled.
▪ The average flow rate for all other faucets must be ≤ 2.0 gallons per minute (as rated at 80 psi) [29].
▪ All tank-type toilets must be WaterSense® labeled.</td></tr>
<tr><td>Lighting[30,31]</td><td><u>Occupancy Controls</u>
All non-apartment spaces, except those where automatic shutoff would endanger the safety of occupants, must have occupancy sensors or automatic bi-level lighting controls. Automatic controls must be specified for spaces intended for 24-hour operation such as corridors and stairwells.</td></tr>
</table>

	Common Space Lighting[32] ▪ 80% of installed light fixtures in common spaces must be ENERGY STAR certified or have ENERGY STAR certified lamps installed. Alternatively, 100% of installed light fixtures in common spaces must have high-efficacy lamps installed, as defined in Appendix B. ▪ Total specified lighting power for the combined common spaces must not exceed ASHRAE 90.1-2010 allowances for those combined spaces.
	In-Unit Lighting ▪ 80% of installed light fixtures within apartments must be ENERGY STAR certified or have ENERGY STAR certified lamps installed. Alternatively, 100% of installed light fixtures within apartments must have high-efficacy lamps installed, as defined in Appendix B. ▪ Overall in-unit lighting power density may not exceed 0.75 W/ft^2. When calculating overall lighting power density, use 1.1 W/ft^2 for spaces where lighting is not installed. ▪ For spaces where installed light fixtures do not meet illumination requirements and occupants are expected to provide supplemental lighting (i.e. bedrooms, living rooms), assume the installed light fixture can illuminate at most 3 ft^2 per Watt installed.
	Exterior Lighting ▪ 80% of outdoor lighting fixtures shall be ENERGY STAR certified or have ENERGY STAR certified lamps installed. Alternatively, 100% of outdoor lighting fixtures must have high-efficacy lamps installed, as defined in Appendix B. ▪ Fixtures must include automatic switching on timers or photocell controls except fixtures intended for 24-hour operation, required for security, or located on apartment balconies. ▪ Total specified exterior lighting power cannot exceed ASHRAE 90.1-2010 allowances.
	Exit Signs All exit signs shall be specified as LED (not to exceed 5W per face) or photo-luminescent and shall conform to local building code; fixtures located above stairwell doors and other forms of egress shall contain a battery back-up feature.
Pump Motor Efficiency[33]	All three-phase pump motors 1 horse-power or larger shall meet or exceed efficiency standards for NEMA Premium™ motors, where available. Motors 5 horse-power or larger for circulating pumps serving hydronic heating or cooling systems must be specified with variable frequency drives.

ENERGY STAR MFHR Benchmarking:

Although ~~an~~ eligible units in a multifamily high rise building may earn the ENERGY STAR based on the mandatory requirements listed above at completion of construction, building performance is as much a function of proper building management as the energy conservation measure incorporated into the structure. Therefore, after earning the ENERGY STAR ~~for the project~~, the developer/owner must commit to benchmarking their building in Portfolio Manager for a period of at least two years.

Portfolio Manager is a free, online, interactive energy management tool that allows developers/owners to measure and track their building's energy and water consumption, identify investment priorities, and verify improvements over time. Developers/owners can use Portfolio Manager to track weather-normalized energy use intensity (EUI), energy costs, greenhouse gas emissions, and water consumption. For more information on how to use Portfolio Manager, see the Portfolio Manager - Multifamily Housing Quick Reference Guide document.

To accomplish this goal the developer/owner or an entity working on their behalf, must be capable of evaluating the utility consumption of the residential-associated spaces independent of any commercial/retail space. These nonresidential associated parts of the building shall be separately metered (or sub-metered) for electricity, gas, fuel oil, water, steam, and hot water for domestic and/or space heating purposes. Also, they should work with tenants to secure consumption information. If the building is direct-metered for utilities to the apartments, the building owner may need signed releases from individual

apartment occupants to allow for benchmarking or find alternative methods to assessing whole building energy consumption such as a whole-building meter or asking the utility for aggregated data.

All data uploaded to Portfolio Manager is strictly confidential and only used to estimate the energy performance of the building as a whole, not of individual apartments.

ENERGY STAR MFHR Website:
More information on program requirements, submittals, processes, and benchmarking can be found at www.energystar.gov/mfhr, including our Current Policy Record, which contains policy issues that were received and have been resolved since the last revision of the program documents. Questions? Please email us at mfhr@energystar.gov.

Table 1 ENERGY STAR MFHR Prescriptive Path – Minimum Heating and Cooling Equipment Efficiencies

Equipment Type	Minimum Efficiency per ASHRAE 90.1-2007 Climate Zones							
	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8
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)	16 SEER		ENERGY STAR certified			13 SEER		
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 space using the Prescriptive Path[34]							
Warm-Air Furnace (<225 KBtu/h, common areas)	78% AFUE or 80% Et							
Warm-Air Furnace (<225 KBtu/h, apartments)[35]	80% AFUE			ENERGY STAR certified		95% AFUE (gas) 90% AFUE (oil)		
Warm-Air Furnace (≥225 KBtu/h)	80% Et (gas) or 81% Et (oil)							
Packaged Terminal Air Conditioner (PTAC)	13.8 – (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)[34]	15.0 SEER/ 12.5 EER/ 8.2 HSPF		ENERGY STAR certified					
			8.2HSPF	8.5HSPF	9.25HSPF	9.5HSPF	Dual-fuel backup[36]	
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)	85% AFUE					90% AFUE		
Boilers, hot water (≥300,000 Btu/h)	87% E_t (86% E_t, with additional requirements[35], or 89% E_t if using heat pumps)							
VRF Air Conditioners and Heat Pumps	See Tables 6.8.1I 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[37]	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)							
Closed-loop propeller or axial fan cooling towers[37]	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)							
Open-loop centrifugal fan cooling towers[37]	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)							
Closed-loop centrifugal fan cooling towers[37]	>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.

Table 2 Climate Specific Envelope Requirements for Climate Zones 1, 2, 3, and 4

	Nominal R Value (Minimum)	Assembly U-Value (Maximum)	Nominal R Value (Minimum)	Assembly U-Value (Maximum)	Nominal R Value (Minimum)	Assembly U-Value (Maximum)	Nominal R Value (Minimum)	Assembly U-Value (Maximum)
	Climate Zone 1		Climate Zone 2		Climate Zone 3		Climate Zone 4	
Roof Insulation								
Insulation entirely above deck	R-25.0 ci	U-0.039	R-25.0 ci	U-0.039	R-25.0 ci	U-0.039	R-25.0 ci	U-0.039
Metal Building	R-19.0 + R-11.0 Ls	U-0.035	R-19.0 + R-11.0 Ls	U-0.035	R-19.0 + R-11.0 Ls	U-0.035	R-19.0 + R-11.0 Ls	U-0.035
Attic and Other	R-49.0	U-0.021	R-49.0	U-0.021	R-49.0	U-0.021	R-49.0	U-0.021
Above Grade Wall Insulation								
Mass	R-7.6 ci	U-0.123	R-9.5 ci	U-0.104	R-11.4 ci	U-0.090	R-13.3 ci	U-0.080
Metal Building	R-13.0 + R-6.5 ci	U-0.079	R-13.0 + R-13.0 ci	U-0.052	R-13.0 + R-13.0 ci	U-0.052	R-13.0 + R-13.0 ci	U-0.052
Steel-Framed	R-13.0 + R-5.0 ci	U-0.077	R-13.0 + R-10.0 ci	U-0.055	R-13.0 + R-10.0 ci	U-0.055	R-13.0 + R-10.0 ci	U-0.055
Wood-framed and other	R-13.0 + R-3.8 ci	U-0.064	R-13.0 + R-3.8 ci	U-0.064	R-13.0 + R-3.8 ci	U-0.064	R-13.0 + R-7.5 ci	U-0.051
Below Grade Wall Insulation								
Conditioned and Indirectly Conditioned space	NR		NR		NR		R-10.0 ci	C-0.092
Unconditioned space	NR		NR		NR		NR	
Floor Insulation								
Mass	R-4.2 ci	U-0.137	R-8.3 ci	U-0.087	R-8.3 ci	U-0.087	R-12.5 ci	U-0.064
Steel-Joist	R-19.0	U-0.052	R-30.0	U-0.038	R-30.0	U-0.038	R-38.0	U-0.032
Wood-framed and other	R-19.0	U-0.051	R-30.0 + R-7.5 ci	U-0.026	R-30.0 + R-7.5 ci	U-0.026	R-30.0 + R-7.5 ci	U-0.026
Slab Insulation								
Unheated (non-radiant) and on-grade	NR		NR		NR		R-15.0 for 24 in.	
Heated (radiant)	R-7.5 for 12 in. + R-5 ci below		R-7.5 for 12 in. + R-5 ci below		R-7.5 for 12 in. + R-5 ci below		R-10.0 for 24 in. + R-5 ci below	
Exterior Doors								
Opaque - All	--	U-0.6	--	U-0.6	--	U-0.6	--	U-0.6
Vertical Glazing								
Nonmetal framing	ENERGY STAR		ENERGY STAR		ENERGY STAR		ENERGY STAR	
	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC
Metal framing (curtain wall/ storefront)	U-1.20	SHGC-0.25	U-0.70	SHGC-0.25	U-0.50	SHGC-0.25	U-0.40	SHGC-0.40
Metal framing (entrance door)	U-1.20		U-1.10		U-0.80		U-0.75	
Metal framing (all other)	U-1.20		U-0.75		U-0.55		U-0.45	

The following definitions apply: ci=continuous insulation, Ls= liner system, NR=no insulation requirement.

Table 3 Climate Specific Envelope Requirements for Climate Zones 5, 6, 7, and 8

	Nominal R Value (Minimum)	Assembly U-Value (Maximum)	Nominal R Value (Minimum)	Assembly U-Value (Maximum)	Nominal R Value (Minimum)	Assembly U-Value (Maximum)	Nominal R Value (Minimum)	Assembly U-Value (Maximum)
	Climate Zone 5		Climate Zone 6		Climate Zone 7		Climate Zone 8	
Roof Insulation								
Insulation entirely above deck	R-25.0 ci	U-0.039	R-30.0 ci	U-0.032	R-35.0 ci	U-0.028	R-35.0 ci	U-0.028
Metal Building	R-19.0 + R-11.0 Ls	U-0.035	R-25.0 + R-11.0 Ls	U-0.031	R-30.0 + R-11.0 Ls	U-0.029	R-30.0 + R-11.0 Ls	U-0.029
Attic and Other	R-49.0	U-0.021	R-49.0	U-0.021	R-60.0	U-0.017	R-60.0	U-0.017
Above Grade Wall Insulation								
Mass	R-15.2 ci	U-0.071	R-20.0 ci	U-0.060	R-20.0 ci	U-0.060	R-31.3 ci	U-0.043
Metal Building	R-13.0 + R-13.0 ci	U-0.052	R-13.0 + R-13.0 ci	U-0.052	R-13.0 + R-19.5 ci	U-0.039	R-13.0 + R-26.0 ci	U-0.031
Steel-Framed	R-13.0 + R-10.0 ci	U-0.055	R-13.0 + R-10.0 ci	U-0.055	R-13.0 + R-18.8 ci	U-0.037	R-13.0 + R-21.9 ci	U-0.033
Wood-framed and other	R-13.0 + R-10.0 ci	U-0.045	R-13.0 + R-10.0 ci	U-0.045	R-13.0 + R-10.0 ci	U-0.045	R-13.0 + R-18.8 ci	U-0.032
Below Grade Wall Insulation								
Conditioned and Indirectly Conditioned space	R-10.0 ci	C-0.092	R-10.0 ci	C-0.092	R-12.5 ci	C-0.075	R-15.0 ci	C-0.063
Unconditioned space	NR		NR		NR		NR	
Floor Insulation								
Mass	R-14.6 ci	U-0.057	R-16.7 ci	U-0.051	R-20.0 ci	U-0.043	R-20.0 ci	U-0.043
Steel-Joist	R-38.0	U-0.032	R-38.0 + R-12.5 ci	U-0.023	R-38.0 + R-12.5 ci	U-0.023	R-38.0 + R-12.5 ci	U-0.023
Wood-framed and other	R-30.0 + R-7.5 ci	U-0.026	R-30.0 + R-7.5 ci	U-0.026	R-30.0 + R-7.5 ci	U-0.026	R-30.0 + R-7.5 ci	U-0.026
Slab Insulation								
Unheated (non-radiant) and on-grade	R-15.0 for 24 in.		R-20.0 for 24 in.		R-15.0 for 24 in. + R-5 ci below		R-15.0 for 24 in. + R-5 ci below	
Heated (radiant)	R-15.0 for 36 in. + R-5 ci below		R-15.0 for 36 in. + R-5 ci below		R-20.0 for 36 in. + R-5 ci below		R-20.0 for 36 in. + R-5 ci below	
Exterior Doors								
Opaque - All	--	U-0.4	--	U-0.4	--	U-0.4	--	U-0.4
Vertical Glazing								
Nonmetal framing	ENERGY STAR		ENERGY STAR		ENERGY STAR		ENERGY STAR	
	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC
Metal framing (curtain wall/ storefront)	U-0.35	SHGC-0.40	U-0.35	SHGC-0.40	U-0.30	SHGC-NR	U-0.30	SHGC- NR
Metal framing (entrance door)	U-0.70		U-0.70		U-0.70		U-0.70	
Metal framing (all other)	U-0.45		U-0.45		U-0.35		U-0.35	

The following definitions apply: ci=continuous insulation, Ls= liner system, NR=no insulation requirement.

ENERGY STAR Multifamily High Rise National Prescriptive Path Notes

1. Where requirements of the local codes, manufacturers' installation instructions, engineering documents, or regional ENERGY STAR programs overlap with the requirements of these guidelines, EPA offers the following guidance:

   a. In cases where the overlapping requirements exceed the ENERGY STAR guidelines, these overlapping requirements shall be met;

   b. In cases where overlapping requirements conflict with a requirement of these ENERGY STAR guidelines (e.g., slab insulation is prohibited to allow visual access for termite inspections), then the conflicting requirement within these guidelines shall not be met. Qualification shall only be allowed if the licensed professional has determined that no equivalent option is available that could meet the intent of the conflicting requirement of these ENERGY STAR guidelines (e.g., switching from exterior to interior slab edge insulation).

2. Each building that participates in the program, regardless if it chooses the Performance Path or the Prescriptive Path, must meet certain mandatory program requirements. These requirements are outlined in the *Prerequisites Checklist*, a worksheet within the *ENERGY STAR MFHR Testing and Verification Worksheets*. These prerequisites establish the minimum program requirements within which the design team may make performance trade-offs in the design of an ENERGY STAR certified building. Since Prescriptive requirements comply with or exceed the prerequisites, the *Prescriptive Path Checklist,* a worksheet within the *ENERGY STAR MFHR Testing and Verification Worksheets,* is used to demonstrate whether these criteria have been met. As used in this document, the word 'shall' means that the action specified is mandatory and must be accomplished.

Heating and Cooling Equipment

3. Atmospherically vented gas furnaces and boilers shall not be specified.

4. Heating and cooling loads shall be calculated, equipment capacity shall be selected, and duct systems shall be sized according to the latest editions of ACCA Manual J, S, & D, respectively, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure. Indoor temperatures shall be 70°F for heating and 75°F for cooling. Outdoor temperatures shall be the 1.0% and 99.0% design temperatures, respectively, as published by the ASHRAE Handbook of Fundamentals.

5. The appropriate climate zone for each building site shall be determined by ASHRAE 90.1–2007, Table B-1. Exception: The appropriate climate zone for each building site in California will be determined by Title 24.

Heating and Cooling Distribution

6. Terminal heating and cooling distribution equipment serving an apartment shall be controlled by a thermostat(s) within the same apartment.

7. Heating and cooling ductwork shall be sealed at all transverse joints and connections, including ductwork connections through drywall or other finish materials, using UL-181 compliant methods and materials. Construction documents shall specify that ductwork must be inspected before access is covered up. As an alternative to meeting total duct leakage requirements post-construction, total duct leakage measured at rough-in, ≤4 CFM25 per 100ft^2, with air handler and all ductwork installed, is accepted.

8. Heating and cooling ductwork that is specified as flex duct shall follow the Sheet Metal and Air Conditioning Contractors' (SMACNA) installation standards for flex ducts (see Appendix A).

9. For hydronic distribution systems, 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.

10. Piping carrying fluid or steam with temperatures greater than 105°F must have a minimum of 1" of insulation; pipes 1.5" in diameter and greater must have a minimum of 1.5" of insulation. Piping carrying fluid (chilled water or refrigerant) with temperatures less than 60°F must have a minimum of 0.5" of insulation; pipes 1.5" in diameter and greater must have a minimum of 1.0" of insulation. Construction documents must account for piping total thickness including required insulation when passing through planks or any other penetrations. For PTACs or any other heating/cooling systems that require branch pipe insulation, the insulation thickness must be considered when designing room dimensions and access chases. Construction documents shall specify that the piping must be inspected before access is covered up. Extent and location to be determined by ASHRAE 90.1-2007 Section 6.4.4.1.3 or local code.

11. For systems designed with outdoor-air supplied to the heating, cooling, or ventilation distribution system, provide motorized dampers that will automatically shut when systems or spaces are not in use.

12. For hydronic distribution systems without automatic balancing valves, all supply/return headers must be designed in a "reverse return" configuration (i.e. first riser supplied is the last returned, etc.) and/or sized based on a water velocity of less than 4 ft/s. Total pressure drop of terminal unit branch piping and fittings between a supply and return riser must be significantly greater than the total pressure drop from the top to the bottom of these risers. Calculations and assumptions for sizing circulating pumps must meet Chapter 43 of the ASHRAE Handbook, HVAC Systems and Equipment or equivalent industry accepted standard.

13. For in-unit forced air distribution systems, perform design calculations (using ACCA Manuals J and D, the ASHRAE Handbook of Fundamentals, or an equivalent procedure) and install ducts accordingly. Bedrooms must be pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors.

Envelope

14. When required by local building code, entranceways shall be designed with vestibules with weather-stripping hard-fastened to the door or frame.

15. If installing sleeves for through-wall AC units, insulated covers must be provided by the building for use during heating season and when AC units are not installed.

16. Ductwork penetrating the building envelope shall be sealed to prevent air leakage through the duct system and/or the building envelope. This includes, but it not limited to, roof curbs and exterior wall exhaust/intake vents.

17. An area weighted average of the U-factors of the wall and floor perimeter assemblies is acceptable for compliance with the above-grade wall U-factor. When calculating the wall U-factor, the full R-value for any exterior wall insulation can only be used for portions of the assembly where shelf angles or other continuous metal fastened to the wall are not used. For portions of this assembly where shelf angles or other continuous metal fastened to the wall are used, the exterior insulation cannot contribute to the assembly R-value and an overall U-value shall be calculated based on an area weighted ratio.

18. Where specific details cannot meet this continuous insulation requirement, the Licensed Professional shall provide the detail to EPA to request an exemption prior to the building's certification. Projected balconies are currently exempt, however EPA recommends that they be thermally broken.

19. Window-to-Wall ratio is taken as the sum of all window area divided by the total exterior above-grade wall area. All decorative glass and skylight window area contribute to the total window area to above-grade wall ratio (WWR). Spandrel sections of curtain wall systems contribute to the above-grade wall area.

20. Specified windows must be double or triple-pane, with low-emissivity glass or coatings. See Table 2 and 3 for additional climate specific performance requirements. If an NFRC label is not available, manufacturer must provide assembly U-values, not center-of-glass. Alternatively, LBNL's WINDOW 6.3 software or NFRC's CMAST may be used. Envelope

requirements are based on ASHRAE 189.1-2009, Appendix A. A total building UA calculation, that excludes fenestration, is acceptable for compliance with the insulation requirements in these Tables.

Garages and Sidewalks

21. Garages, including plenums and dropped ceilings within the garage, shall not be heated for comfort or to prevent pipes from freezing. Piping design and layout shall locate piping within conditioned spaces or grouped and properly insulated to prevent freezing. Heat tracing for freeze protection may not be used.

22. Radiant heating (i.e. infrared), either wall or ceiling-mounted, or heating within the garage floor (or sidewalks) may be used to prevent ice formation on the ground as a safety feature only and temperature-based controls must comply with ASHRAE 90.1-2007 Section 6.4.3.8.

Ventilation and Infiltration

23. Ventilation system ductwork shall be sealed at all transverse joints and connections including boot to wall/ceiling connections through drywall using UL-181 compliant materials and methods. Central exhaust systems that serve one or more apartments must be tested for duct leakage, where the maximum leakage allowance is calculated as 2.5 CFM per register per shaft plus 2.5 CFM per floor per shaft. See *T&V Protocols* for details.

24. Common area ventilation systems shall be designed and tested to satisfy minimum requirements of ASHRAE 62.1-2007, without exceeding recommended rates by more than 50%.

25. Apartment ventilation systems shall be designed and tested to satisfy minimum requirements of Section 4.1 of ASHRAE 62.2-2007, without reliance on natural ventilation and without exceeding ASHRAE 62.2-2007 by more than 50%. Compliance with ASHRAE 62.2-2007 Sections 4.3 and 5.3.1 is recommended, but not required. Providing outdoor air to each apartment directly from the outdoors is recommended, but not required. Design and tested local exhaust rates shall not exceed the minimum local exhaust rates specified in Table 5.1 and 5.2 of ASHRAE 62.2-2007 by more than 50%. Therefore, the maximum continuous exhaust rate in kitchens is 7.5 ACH and in bathrooms is 30 CFM. The maximum intermittent exhaust rate in kitchens is 150 CFM and in bathrooms is 75 CFM. For kitchen exhaust fans, prescriptive duct sizing requirements described at www.energystar.gov/newhomesresources may be used in lieu of measuring the actual air flow rate. For systems providing both continuous local exhaust and apartment ventilation, rates may exceed 50% of the local exhaust rates of Section 5 if needed to comply with ventilation rates of Section 4.1, and vice versa.

Domestic Water Heating

26. The temperature setting of in-unit storage water heaters must not exceed 140°F. For both in-unit and central DHW systems, temperatures measured at faucets and showerheads must not exceed 125°F. Domestic hot water piping carrying liquid with temperatures greater than 105°F must have a minimum of 1" insulation. Pipes over 1.5" in diameter must have a minimum of 1.5" of insulation. Extent and location to be determined by ASHRAE 90.1-2007 Section 7.4.3 or local code.

27. Self-contained or electronic mixing valves shall be used to control hot water temperature for central domestic water heating systems serving apartments.

28. The minimum efficiency for instantaneous water heaters shall be determined assuming 1 gallon tank capacity.

29. If flow ratings at 80 psi are not available, WaterSense® labeled faucets or aerators may be used to meet this requirement.

ENERGY STAR Multifamily High Rise National Prescriptive Path Notes

Lighting

30. ASHRAE 90.1-2007, Section 9.1.4a, requires that fixture wattage be calculated using the maximum labeled wattage of the fixture. EPA will allow light fixtures to be calculated based on the installed wattage of the lamps. Ex: A fixture with a 13 W screw-in CFL can be calculated as 13 W, plus any associated ballast power. See Appendix B to determine input power.

31. Lighting must comply with ASHRAE 90.1-2007, Section 9.4. At a minimum, interior lighting must be designed or measured to meet light levels (footcandles) by space type as recommended by the Illumination Engineering Society (IESNA) Lighting Handbook, 9th edition. Values for commonly used spaces are listed below. For senior housing, minimum illumination requirements may follow recommendations in IESNA's 2007 Lighting and the Visual Environment for Senior Living. See Appendix B to determine lamp lumens.

ASHRAE Space Type	Lighting Power Densities (W/ft^2)	Recommended Light Levels (Weighted Avg. Footcandles)	ASHRAE Space Type	Lighting Power Densities (W/ft^2)	Recommended Light Levels (Weighted Avg. Footcandles)
Apartments	0.75	16	Stairway	0.69	15
Storage	0.63	20	Restrooms	0.98	12
Elevator	0.64	16	Office enclosed/open	1.11/0.98	35
Food Preparation	0.99	40	Conference/meeting/ multipurpose	1.23	30
Dining Area - For Family Dining	0.89	23	Electrical/Mechanical	0.95	30
Lobby	0.90	16	Workshop	1.59	50
Corridor/Transition	0.66	10	Parking garage	0.19	7

32. Lighting power densities and allowances must be determined using ASHRAE 90.1-2010, Table 9.5.1, Table 9.6.1, or the table above. Lighting controls may not be used to reduce the specified lighting power for compliance with this requirement. For senior living, an increase in lighting power densities and allowances corresponding to the increase in footcandles, is permitted.

Motors

33. Many motors are NEMA labeled and this label alone, does not ensure that a motor is energy-efficient. This requirement refers specifically to the **NEMA Premium** energy efficient motors program. Participating companies may be found at http://www.nema.org/Policy/Energy/Efficiency/Documents/NEMA_Premium_Partners.pdf. Motors for fire pumps and booster pumps are exempt from this requirement.

Minimum Equipment Efficiencies

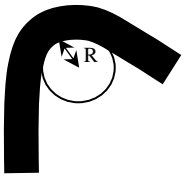
34. In Climates Zones 1 through 6, if the prescriptive Heating Season Performance Factors are met for air-source heat pumps, electric resistance back-up heating is allowed, if programmable thermostats with adaptive recovery technology are installed.

35. For all Climate Zones, minimum efficiencies for gas-fired PTAC's are 80% AFUE or 82% E_t. In Climates Zones 4-8, buildings with gas-fired PTAC's or 86% E_t boilers must meet higher standards for compartmentalization (≤0.27 $CFM50/ft^2$), in-unit lighting (≤0.6 W/ft^2), and plumbing fixtures (≤1.5 gpm showerheads and ≤1.0 gpm lavatory faucets).

36. In Climate Zone 7 and 8, dual-fuel backup is not required for ENERGY STAR certified heat pumps that have no backup heating because the heat pump is capable of meeting 100% of the design heating load.

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

Appendix A: Specifications for Flexible Duct Installation

Component/Location	Standard
Duct length	Limit duct length to no more than 25' per run for flex duct, not to exceed the manufacturer's recommended limit
Excess ductwork	Runs should be as direct as possible. Excess ductwork should be no more than 5% for any given section of flexible duct.
Supports	Suspended horizontal ducts should be supported at least every 5'.
Hangers	Hanger material should be at least 1-1/2" in width and hangers should not crimp the ductwork, causing the interior dimension of the duct to be less than specified
Sag	Suspended ductwork should be allowed to sag no more than ½" for every 1' of run
Trunk and boot connections	Flexible duct should be allowed to run straight out of any connection at least 12" before taking a turn
Bends	The radius at the centerline of a bend must be a minimum of one duct diameter as shown in the diagram (R = 1 duct diameter): 
Connections	Connections to boots, collars, and trunks must be substantially airtight
Sealants	Sealants and tapes used to make ductwork airtight must be compliant with UL=181 standards and installed according to the manufacturer's specifications

Reference: Sheet Metal and Air Conditioning Contractor's National Association

Appendix B: Typical lamp lumens and input power for installed lighting

Efficacy: Lumens per Watt = Measured Lamp Lumens [Lumens]/Measured Input Power [Watts]

High Efficacy Lamps: Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps or lamps with a minimum efficacy of 60 lumens/W for lamps over 40W; 50 lumens/W for lamps over 15W to 40W; and 40 lumens/W for lamps 15W or less

Footcandle: one lumen per square foot.

Lamp Lumens: Lamp lumens must be measured using the lamp and ballast that are shipped with the fixture, using the tables on the ENERGY STAR website, or by using the charts below.

Input Power: Input power must be measured with the lamp and ballast that are shipped with the fixture, by using Tables 9-E through 9-H in the User's Manual for ASHRAE 90.1-2007, or the charts below.

Standard Metal Halide			
Lamp Watts	Lumens	Input Power	Efficacy
150	13,500	186	73
175	15,000	205	73
250	23,000	295	78
360	36,000	388	93
400	40,000	461	87

Typical T-8 (Electronic Ballast)			
Lamp Watts	Lumens	Input Power	Efficacy
17	1400	22	64
25	2225	27	82
32	3100	32	97
40	3725	46	81
86	8200	88	93

Compact Fluorescent					
Lamp Watts	Lumens	Input Power	Ballast	Efficacy	Minimum Lumens Needed
9	280-680	13	Electro-magnetic	22*-52	650
9	280-680	10	Electronic	28*-68	500
13	600-950	17	Electro-magnetic	35*-56	850
13	600-950	14	Electronic	43*-68	700
26	1200-1900	37	Electro-magnetic	32*-51	1850
26	1200-1900	28	Electronic	43*-68	1400

*may not meet current ENERGY STAR specifications, check lamp lumens on ENERGY STAR website.