2024 Baseline Document: Introduction and Overview

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The Baseline Document defines base case (or baseline) parameters for projects pursuing energy savings and incentives under the Program Administrators' (PA) New Construction program(s). This document is intended to inform assumptions for New Construction/Major Renovation applications as well as "end of life" replacements. In this case, "end of life" is defined as either failed or retired equipment, or a specific age of existing equipment that has been established by the PA's in cooperation with state regulators. This document is applicable to commercial buildings and systems in these buildings.

For projects evaluated through Mass Save that are permitted on or after January 1, 2024, this Baseline Document must be used to define the baseline parameters for energy savings.

In general, the baseline for a given system or piece of equipment is defined by one of two primary methods:

1. State Energy Code: For equipment and systems whose performance is explicitly governed by the applicable state's building energy code, the baseline for that equipment is generally based on the minimum allowable performance in the energy code.

2. Industry Standard Practice (ISP): In some cases, the current industry standard practice (ISP) for specific equipment or systems is determined by the PAs to be more efficient than the energy code baseline requirements. For those cases, the baseline requirements within this document reflect the current ISP instead of the energy code. These ISP baselines apply to energy conservation measure (ECM) applications regardless of their inclusion or exclusion from the national model codes and state amendments. Cases where the ISP defines the baseline are identified in this document with a note that the baseline is different from the energy code requirement.

MA Energy Efficiency Advisory Council (EEAC) Baseline Repository:

The Baseline Repository is a separate database developed by the MA EEAC that is designed to provide guidance when selecting baselines for New Construction and lost opportunity measures, according to the latest collection of evaluation research. It serves as a repository for all industry standard practice research.

For equipment and systems that are not governed by energy code, both this Baseline Document and the Baseline Repository might include specific baseline guidelines. In such cases where both documents provide guidance, the most energy efficient baseline definition between the two documents should be used.

Guide for Energy Code Baselines

Energy code requirements vary by state. The Massachusetts energy code as of July 1, 2023 is based on one of two national code standards options, which are used to define the MA program baselines:

i. 2021 IECC (International Energy Conservation Code)
ii. ASHRAE 90.1-2019

This Baseline Document is intended to highlight the key criteria within these codes that set the baseline for code-governed equipment and systems; however, it does not provide every detail of the code criteria or all potential exemptions to code requirements. Where additional information or details are required, the state specific code documents/standards should be referenced for clarification.

a. *IECC vs. ASHRAE code selection*

In MA, state code allows new buildings to use either IECC or ASHRAE 90.1, coupled with the state amendments, as the primary standard for energy code compliance. The selection should be made and documented by the design team. The designed building must comply with the selected standard in its entirety.

The baseline for incentives for a given New Construction project must follow whichever standard is used for that particular project as the basis of code compliance, in its entirety **(i.e. cannot use IECC for some sections and ASHRAE for others)**. It is essential that the code choice followed be clearly documented in any reports submitted along with an application for an incentive.

b. *State Amendments*

Each state energy code can include amendments to either increase or decrease the stringency of the national code standards (IECC and ASHRAE). In general, the baseline for incentives in any given state should reflect any and all amendments included in that state's energy code. For information on state amendments, see the following:

iii. MA: Board of Building Regulations and Standards link at www.mass.gov

c. *IECC C406 - Additional Efficiency Package Options*

IECC includes a section (C406) that outlines Additional Efficiency Package options that go above and beyond the requirements in Sections C402-C405.

State energy codes/amendments may require one or more of the C406 options for energy code compliance; however, for Mass Save, the baseline for new building projects (including additions and gut-renovations of existing buildings) does not require any C406 options. Energy savings can be claimed for C406 options that are implemented into the design (even if required by energy code). Note that this is a divergence from the MA energy code, which requires new buildings to comply with a certain quantity of the C406 Additional Efficiency Package options.

d. *Performance Paths for Energy Code Compliance Not Acceptable for Mass Save Baseline*

The energy code gives the design team the option of following a Prescriptive path (not to be confused with Mass Save prescriptive incentive programs) or a Performance path (energy modeling vs. a "baseline" building as defined by a separate section of the code standard) for complying with the code. While these are viable options for energy code compliance, the Performance path options are not acceptable for defining the baseline for Mass Save.

For Mass Save, the following methods are NOT acceptable baseline modeling methods:

1. ASHRAE 90.1 Appendix G
2. ASHRAE 90.1 Chapter 11 (Energy Cost Budget Method)
3. IECC Section C407

Mass Save custom energy savings must be evaluated through discrete individual ECMs where the proposed high-performance practice is compared to the applicable base case definition as defined in this Baseline Document.

For incentive studies based on designs that have used one of the Performance paths for code compliance, high performance design features that exceed the applicable base case definition in this Baseline Document can be included as ECMs. However, any design tradeoffs used where systems do not meet the applicable base case definition in this Baseline Document must also be accounted for with an energy penalty and included in the project's interactive savings.

e. *Stretch Energy Codes*

States may adopt a stretch energy code ("stretch code") to be more stringent than the "base code" it has adopted with its state amendments. Where a state has adopted the stretch code, municipalities may elect to make the stretch code mandatory for certain building types, sizes, classes of owners, building functions or for public buildings. It varies by the version of the code adopted and by the State or municipal regulations.

Stretch codes do NOT define the baseline for Mass Save incentive programs. For projects in municipalities where stretch code is enforced, the baseline for Mass Save incentive purposes shall still follow the parameters outlined in this Baseline Document. Energy savings can be claimed and incentives may be offered for equipment/systems meeting stretch code that exceed the requirements outlined in this Baseline Document.

f. *Energy Code/Baseline Document Interpretations*

In cases where the baseline definitions in this document or the specific energy codes have gaps or questions on interpretations, one of the following groups should be consulted for assistance in defining baselines. Any rulings by these groups should be communicated to the PAs so that this document can be updated as needed.

i. New Construction Baseline Committee
ii. Statewide C&I Impact Evaluation team' Baseline Advisory Group

g. Prescriptive Program Baselines Relative to Energy Codes

Due to the protocols for reporting savings for Mass Save Prescriptive incentives, it is not possible to take into account all of the possible paths that a design team may take for code compliance. As such, Mass Save has settled on a particular base case for these projects. This in no way is intended to set a common standard for Custom projects. The base case for Custom applications must be determined for each individual project and documented in the application.

h. Federal Exemption from State Energy codes

Federal Buildings are exempt from State Energy codes; however, for incentive purposes the same base case shall be applied to these buildings as any other building.

i. Useful Links

The below links can be used to access useful reference information.

i. IECC 2021 electronic copy link at: https://codes.iccsafe.org/content/IECC2021P2
ii. Massachusetts Amendments to the International Building Code link at: https://www.mass.gov/massachusetts-state-building-code-780-cmr

2024 Program Year			
Line #	***System*** Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
1	***IECC C406 Requirements***	The baseline building for Mass Save shall not include any Section C406 enhanced efficiency options. This does not align with the MA energy code, which requires implementation of select C406 options.	
2	***IECC vs. ASHRAE***	Either IECC 2021 or ASHRAE 90.1 2019 can be used to define the baseline. Whichever standard is used must be followed in its entirety for the given project/study (cannot use IECC for some sections and ASHRAE for others).	
3	***Acceptable Baseline Modeling Methods***	For Mass Save, the only acceptable baseline definition/modeling method is the Prescriptive path for the applicable standard (either IECC or ASHRAE). Although viable paths to demonstrate code compliance, the following methods are not acceptable baseline modeling methods for the MA programs: ASHRAE 90.1-2019 Appendix G, ASHRAE 90-1 2019 Chapter 11 (Energy Cost Budget Method), and IECC 2021 Amended Section C407 (Targeted Performance with Thermal Energy Demand Intensity "TEDI" limits)	

2024 Program Year

Line #	System / Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
4	***Opaque Assemblies***	***IECC ≠ ASHRAE** Opaque thermal envelope insulation requirements meeting table C402.1.3 / ASHRAE Table 5.5-5 (Climate Zone 5). Comply with either R-value or U-value method. The baseline construction type category shall be the same as the design construction type.	Opaque wall insulation with higher thermal resistance. Efficient cladding support system to reduce thermal bridging. *Note: Thermal bridging must be accounted for when estimating effective R-values/U-values for insulated stud cavities (the base case U-values account for thermal bridging). IECC Table C402.1.4.2 and ASHRAE 90.1 Appendix A provides effective U-values with thermal bridging. Additionally 3D thermal bridging associated with linear and/or point transmittances must be accounted for in exterior wall assemblies. The same bridging factor adjustments shall be performed in the base case and design case models. The MA Simulation Guidelines explain the process for estimating these impacts.

		Category	R-value Method*	U-value Method
5				
6	**Roofs**	Insulation entirely above deck	R-30ci	U-0.032
7	**Roofs**	Metal buildings	R-19 + R-11 LS ***ASHRAE - R19+ R-11 LS or R-25 + R-8 LS**	U-0.035 ***ASHRAE U-0.037**
8	**Roofs**	Attic and other	R-49	U-0.021
9	**Walls, above grade**	Mass	R-11.4 ci	U-0.090
10	**Walls, above grade**	Metal building	R-13 + R-14 ci ***ASHRAE R-0 + R-19ci**	U-0.050
11	**Walls, above grade**	Metal framed	R-13 + R-10 ci	U-0.055
12	**Walls, above grade**	Wood framed and other	R-13 + R-7.5 ci or R-20 + R-3.8 ci ***ASHRAE R-13 + R-7.5ci or R-19 + R-5ci**	U-0.051
13		Below-grade wall	R-7.5 ci	C-0.119
14	**Floors**	Mass	R-14.6 ci	U-0.057
15	**Floors**	Joist/framing	R-30	U-0.033 ***ASHRAE** **U-0.038 (steel joist)** **U-0.033 (wood/other)**
16	**Slab-on-grade floors**	Unheated slabs	R-15 for 24" below	F-0.52
17	**Slab-on-grade floors**	Heated slabs	R-15 for 36" below + R-5 full slab ***ASHRAE R-20 for 48"**	F-0.62 ***ASHRAE F-0.688**
18	***Opaque Doors***	Nonswinging	No requirement	U-0.31
19	***Opaque Doors***	Swinging	No requirement	U-0.37
20	***Opaque Doors***	Garage door < 14% glazing	IECC no requirement	U-0.31 ***ASHRAE no requirement**
21		*ci = continuous insulation; when using R-value method, a thermal spacer shall be provided		
22	Greenhouses	Specific baseline envelope requirements for greenhouses are included in IECC Section C402.1.1.		

23	***Window and Skylight Assemblies***	**(ISP) This baseline requirement varies from code.** Performance per IECC Table C402.4 / ASHRAE Table 5.5-5 (Climate Zone 5)			Window and skylight **assembly** U-values exceed code requirements (note that the baseline values for assemblies include frame effects and are not the same as center-of-glass values provided by glass manufacturers).
24			**Vertical Fenestration, U-factor**		**% Glazing Area**
25			Fixed fenestration	U-0.36	Vertical fenestration area shall be ≤ 40% of gross above-grade wall area†
26			Operable fenestration	U-0.45	
27			Entrance doors	U-0.63	

<table>
<tr><th colspan="5">2024 Program Year</th></tr>
<tr><th rowspan="2">Line #</th><td colspan="4">System</td></tr>
<tr><td>Sub-Category</td><td colspan="2">Baseline Minimum Standards & Practice</td><td>Potential High-Performance Practices</td></tr>
<tr><td>28</td><td rowspan="8">Window and Skylight Assemblies</td><td rowspan="8" colspan="2"><table>
<tr><td colspan="4">Vertical Fenestration, Solar Heat Gain Coefficient (SHGC)</td></tr>
<tr><td></td><td>Fixed</td><td>Operable</td><td rowspan="2">*ASHRAE VT/SHGC ≥ 1.1 (all frame types)</td></tr>
<tr><td>PF < 0.2*</td><td>0.38</td><td>0.33</td></tr>
<tr><td colspan="4">Skylights</td></tr>
<tr><td>U-factor</td><td colspan="2">U-0.5†</td><td rowspan="2">Skylight area shall be ≤ 3% of gross roof area†</td></tr>
<tr><td>SHGC</td><td colspan="2">0.4†</td></tr>
</table>
*If PF (projection factor) value greater than 0.2, see IECC 2021 Table C402.4 for SHGC requirements.

†Some exceptions apply. See IECC Sections C402.4.1.1, C402.4.1.2 and C402.4.3; ASHRAE sections 5.5.4.2.2, 5.5.4.3, and 5.5.4.4</td><td rowspan="8">Window and skylight assembly U-values exceed code requirements (note that the baseline values for assemblies include frame effects and are not the same as center-of-glass values provided by glass manufacturers).</td></tr>
<tr><td>29</td></tr>
<tr><td>30</td></tr>
<tr><td>31</td></tr>
<tr><td>32</td></tr>
<tr><td>33</td></tr>
<tr><td>34</td></tr>
<tr><td>35</td></tr>
<tr><td>36</td><td>Window-to-Wall Ratio</td><td colspan="2"><u>(ISP) This baseline requirement varies from code.</u>
Window-to-wall ratio per design and no greater than 40% of gross above-grade wall area. Skylight area per design and no greater than 3% of gross roof area.
No credit allowed for reduced window-to-wall or reduced skylight areas.</td><td>If the design window-to-wall ratio exceeds the maximum value allowed by code, this difference in WWR must be modeled between the baseline and design case.</td></tr>
<tr><td>37</td><td>Code Required Airside Attributes</td><td colspan="3"></td></tr>
<tr><td>38</td><td>Data Centers</td><td colspan="2">*IECC ≠ ASHRAE
Data Center systems shall comply with Sections 6 and 8 of ASHRAE 90.4 with the following baseline Mechanical Load Component (MLC) values:
Maximum Design MLC = 0.22
Maximum Annualized MLC = 0.17 (*ASHRAE = 0.16)

IECC: per Table C403.1.2(1) and per IECC Table C403.1.2(2)
ASHRAE: per Section 6.6.1</td><td></td></tr>
<tr><td>39</td><td>Zone Isolation</td><td colspan="2">HVAC systems serving zones > 25,000 ft² or zones that span more than one floor and are designed to operate or be occupied non-simultaneously are required to be divided into isolation areas with control devices configured to automatically shut off the supply of conditioned air and outside air to and exhaust air from the isolation area.

IECC: per Section C403.2.1
ASHRAE: per Section 6.4.3.3.4</td><td></td></tr>
<tr><td>40</td><td>Demand Controlled Ventilation</td><td colspan="2">*IECC ≠ ASHRAE (difference in exceptions)
Required for spaces > 500ft² with design occupancy ≥ 15 people per 1,000 ft²
IECC - required for all single-zone systems
(*ASHRAE: > 500ft² with design occupancy ≥ 25 people per 1,000 ft²)
Some exemptions: see high performance practices for details

IECC: per Section C403.7.1
ASHRAE: per Section 6.4.3.8</td><td>DCV in systems or spaces where not required by code.
e.g.
· spaces < 500 ft²
· spaces w/ design occupants < 15 (IECC) or 25 (ASHRAE) per 1,000 ft²
· multi-zone systems with total system OA < 750 cfm
· systems with energy recovery that complies with baseline
· spaces where >75% of the design outdoor airflow is required for makeup air that is exhausted from the space (e.g. makeup air for fume hoods or kitchen exhaust hoods).</td></tr>
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<tr><th rowspan="2">Line #</th><th>System</th><th colspan="2"></th></tr>
<tr><th>Sub-Category</th><th>Baseline Minimum Standards & Practice</th><th>Potential High-Performance Practices</th></tr>
<tr><td>41</td><td>Occupied-Standby Controls</td><td>*IECC ≠ ASHRAE
IECC no requirement
*ASHRAE - Zones serving only rooms that are required to have automatic partial OFF or automatic full OFF lighting controls per Section 9.4.1.1 shall meet the following within 5 minutes of all rooms in that zone entering occupied-standby mode:
- active heating/cooling set points shall be setback/setup at least 1°F
- all airflow to the zone shall be shut off when space temperature is between the active heating and cooling setpoints.

ASHRAE: per Section 6.5.3.8</td><td>The controls described in the baseline can be considered a measure only when using the IECC baseline path.</td></tr>
<tr><td>42</td><td>Energy Recovery</td><td><u>(ISP) This baseline requirement varies from code.</u>
Energy recovery is required in the baseline for all air handling systems with the following design parameters (both %OA and fan system total supply CFM), including for non-transient dwelling units.

<table>
<tr><th>% OA</th><th>Systems Operating < 8,000 hours/year, CFM</th><th>Systems Operating ≥ 8,000 hours/year, CFM</th></tr>
<tr><td>≥ 80% OA</td><td>> 120 CFM</td><td>≥ 40 CFM</td></tr>
<tr><td>≥ 70% and < 80%</td><td>≥ 1,000 CFM</td><td>≥ 50 CFM</td></tr>
<tr><td>≥ 60% and < 70%</td><td>≥ 2,000 CFM</td><td>≥ 60 CFM</td></tr>
<tr><td>≥ 50% and < 60%</td><td>≥ 3,500 CFM</td><td>≥ 70 CFM</td></tr>
<tr><td>≥ 40% and < 50%</td><td>≥ 4,500 CFM</td><td>≥ 80 CFM</td></tr>
<tr><td>≥ 30% and < 40%</td><td>≥ 5,500 CFM</td><td>≥ 100 CFM</td></tr>
<tr><td>≥ 20% and < 30%</td><td>≥ 16,000 CFM</td><td>≥ 130 CFM</td></tr>
<tr><td>≥ 10% and < 20%</td><td>≥ 26,000 CFM</td><td>≥ 200 CFM</td></tr>
</table>
</td><td>1. Energy recovery where not code required
2. Energy recovery effectiveness exceeding baseline value
3. Use of low face velocity in recovery section or other strategies to reduce interior static pressure losses associated with energy recovery below the code allowable static pressure allowance for energy recovery</td></tr>
<tr><td>53</td><td>Energy Recovery (Performance)</td><td><u>(ISP) This baseline requirement varies from code.</u>
Where energy recovery is required, baseline effectiveness shall be as follows:
- For rated supply airflow < 5,000 cfm: 55% effectiveness
- For rated supply airflow ≥ 5,000 cfm: 65% effectiveness

Where an economizer is required, the energy recovery system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

IECC: per Section C403.7.4/Tables C403.7.4(1)&(2) - some exceptions apply
ASHRAE: per Section 6.5.6/Tables 6.5.6.1.2(1)&(2) - some exceptions apply</td><td>1. Energy recovery where not code required
2. Energy recovery effectiveness exceeding baseline value
3. Use of low face velocity in recovery section or other strategies to reduce interior static pressure losses associated with energy recovery below the code allowable static pressure allowance for energy recovery</td></tr>
<tr><td>54</td><td>Energy Recovery (Dual Wheel)</td><td>Dual Recovery Wheel/Dehumidification Reheat - Where a central air handler reheat section is required to temper supply air during dehumidification, the baseline reheat shall be defined as follows:

For DX air handlers with central dehumidification reheat, the Baseline shall have a hot gas reheat coil.

For Chilled Water air handlers with central dehumidification reheat, the Baseline shall have a mechanical central system reheat coil. The reheat coil heating source shall match the typical heat source for the building (e.g. hot water, fossil fuel furnace, electric heat pump). If the building uses only electric heat, the baseline reheat coil shall be a heat pump.</td><td>For Chilled Water air handlers: Dual recovery wheel (or coil) system with a second heat recovery element to provide necessary reheat.

Note: No high performance alternative for DX systems, because hot gas reheat provides similar benefit as a second recovery element.</td></tr>
</table>

2024 Program Year			
Line #	***System***		
	Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
55	Acute Inpatient Hospital: Condenser Heat Recovery for Space Conditioning	***IECC ≠ ASHRAE** IECC - no requirement ***ASHRAE - condenser heat recovery where heating water is used for space heating in a 24/7 acute inpatient hospital facility where the total design chilled-water capacity exceeds 3,600 MBH and simultaneous heating and cooling occurs above 60°F. The required heat recovery system shall have a cooling capacity that is at least 7% of the total design chilled water capacity of the acute inpatient hospital at peak design conditions.**	Condenser heat recovery where not code required
56 57	Economizer	**(ISP) This baseline requirement varies from code.** Air or water economizer interlocked with mechanical cooling required for: - each individual fan system with a cooling capacity ≥ 54,000 Btu/h - ALL chilled water systems, regardless of capacity. The total supply cooling capacity of all fan cooling units not provided with economizers shall be ≤ 20% of the total supply cooling capacity of all fan cooling units in the building or 300,000 Btu/h, whichever is greater. ***The above baseline economizer requirements also apply to data center cooling systems.** Note: Each individual zone terminal unit (i.e. VRF, fan coil unit, water-loop heat pump) qualifies as an individual fan system. **VRF systems installed with a dedicated outdoor air system are not required to have economizer capability.**	Economizers in systems with: 1. DX cooling capacity < 54,000 Btu/h 2. Service water heat recovery in accordance with IECC Section C403.10.5/ ASHRAE Section 6.5.6.2.2 (see "Service Water Heat Recovery" section below) 4. If it can be documented that one type of economizer (water or air) is both more expensive and more efficient than the other, acceptable to compare economizer types.
58	Water-side Economizer	Water-side economizer piped in parallel with chiller(s)	Water-side economizer piped in series with chiller(s) (e.g. partial economizer capability)
59	Multizone System Airflow Control	Each supply air system serving multiple zones must be variable volume with zone controls to reduce the volume of air that is reheated, recooled, or mixed to 20% of zone peak design supply for systems with DDC controls or 30% for other systems unless a higher minimum limit is required is deliver adequate outside air or is otherwise approved by code official. IECC: per Section C403.6.1 ASHRAE: per Section 6.5.2.1	VAV control for systems where ≥ 75% of the energy for reheating or for providing warm air in mixing systems is provided by a site-recovered or site-solar energy source, provided this site energy requirement is documented in the MRD.
60	Fan Airflow/Speed Control	**(ISP) This baseline requirement varies from code.** Each DX cooled AHU ≥ 65,000 Btu/h, each chilled water AHU with a fan motor ≥ 1/4 HP, and each evaporatively cooled AHU with a fan motor ≥ 1/4 HP must have one of the following: - VFDs with modulating fan speed controls, or - EC motors with multi-speed control Not required for chilled water and evaporatively cooled units with fan motors of < 1 hp where the units are not used to provide ventilation air and indoor fan cycles with load.	Modulating fan speed controls using VFDs or EC motors for: DX cooled AHUs < 65,000 Btu/hr, or CHW cooled AHUs with a fan motor < 1/4 hp, or evaporatively cooled AHUs with a fan motor < 1/4 hp using VFDs or EC motors
61	Static Pressure Reset	Static pressure reset required for systems where zone VAV boxes are controlled by a central energy management system (EMS). IECC: per Section C403.6.8 ASHRAE: per Section 6.5.3.2.3	

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Line #	*System* Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
62	Supply Air Temperature Reset	Multiple-zone HVAC systems (including DOAS) shall have supply air temperature reset capable of and configured to reset air temperature by at least 25% of the difference between design supply air temp and room air temp. Controls that adjust the reset based on zone humidity are allowed. IECC: per Section C403.6.5 ASHRAE: per Section 6.5.3.5	1. Supply air temperature reset greater than 25% of dT 2. Supply air temperature reset in system where at least 75% of the energy for reheating is from site-recovered or site-solar energy sources, provided this site energy requirement is documented in the MRD.
63	Fractional HP Fan Motors (EC Motors)	Motors for fans ≥ 1/12 hp and < 1 hp shall be electronically commutated (EC) motors, or if non-EC motor must have a motor efficiency of ≥ 70%. IECC: per Section C403.8.4 ASHRAE: per Section 6.5.3.6	Higher efficiency fractional hp motors (> 70%) if not an EC motor. (not applicable for EC motors) Non-excitable commutated motors Permanent magnet motors
64	Low Capacity Ventilation Fans	***IECC ≠ ASHRAE** Motors < 1/12 hp for mechanical ventilation systems shall meet the minimum efficacy requirements below:	

65	*Fan Location*	*Airflow Rate (CFM)*	*Minimum Efficacy (CFM/Watt)*
66	HRV or ERV	Any	1.2
67	In-line fan	Any	3.8
68	Bathroom, utility room	≥ 10 and < 90	2.8
69	Bathroom, utility room	≥ 90	3.5

70		IECC: per Section C403.8.5 ***ASHRAE no baseline requirement**	
71	Fan Efficiency	Each fan and fan array shall have a fan energy index (FEI) ≥ 1.00 for constant volume systems and ≥ 0.95 for variable volume systems, at the design point of operation. The FEI is determined in accordance with AMCA 208 (AMCA 208 Annex C for fan arrays). FEI is the ratio of actual fan system efficiency to baseline fan system efficiency (as defined by AMCA 208); system fan efficiency includes motor, belt and bearing, and fan aerodynamic losses at application duty point. IECC: per Section C403.8.3 ASHRAE: per Section 6.5.3.1.3	Fan energy index greater than minimum requirement. Calculation of baseline and design fan system efficiency in accordance with AMCA 208 must be documented to validate any proposed savings.
72	Fan Power	Each fan system with > 5 hp motor power, shall not exceed the allowable fan system nameplate hp or bhp at design conditions (includes supply, return, exhaust, and zonal fan units combined). Include the supply air from the ventilation unit and the zone recirculated air from any terminal units in calculating total CFM. Constant Volume: hp ≤ CFM · 0.0011 OR bhp ≤ CFM · 0.00094 + Allowances VAV: hp ≤ CFM · 0.0015 OR bhp ≤ CFM · 0.0013 + Allowances Allowances = Sum of (PD Adjustment × CFM/4131)	Lower fan motor horsepower requirements at design through reduced pressure (e.g. increased duct size) and/or increased fan efficiency, high efficiency filters with reduced pressure drop. This is not intended to account for a change of use with pre-existing ductwork. **If credit is taken for systems with fan HP/BHP below the code maximum allowable, a penalty must also be taken for any systems in the design that exceed the code maximum allowable fan HP/BHP.**
73		**Fan systems <5 hp not governed by code.** All fan systems < 5hp shall be modeled with baseline fan power equal to the design fan power. IECC: per Section C403.8.1/Table C403.8.1(1 & 2) ASHRAE: per Section 6.5.3.1/Table 6.5.3.1-1&2	Note: fanwalls are not considered any more efficient than a single larger fan with VFD control

2024 Program Year				
Line #	***System***			
	Sub-Category	Baseline Minimum Standards & Practice		Potential High-Performance Practices
74	Fan Power (PD Allowances)	Device	Adjustment	
75		**Allowance - Pressure Drop (PD) Adjustments (in w.c.)**		
76		Fully ducted return and/or exhaust air systems	0.5 in w.c.	
77		Return and/or exhaust airflow control devices	0.5 in w.c.	
78		Exhaust filters, scrubbers or other treatment	design PD	
79		Filters: MERV 9 thru 12	0.5 in w.c.	
80		Filters: MERV 13 thru 15	0.9 in w.c.	
81		Filters: MERV 16+	design PD calculated at 2x clean filter PD	
82		Carbon and other gas-phase air cleaners	clean filter PD at design	
83		Biosafety cabinet	PD of device at design	
84		Energy recovery device, other than coil runaround loop	for each airstream, (2.2 x energy recovery effectiveness) - 0.5 in w.c.	
85		Coil runaround loop	0.6 in w.c. for each airstream	
86		Evaporative humidifier/cooler in series with another cooling coil	PD at design	
87		Sound attenuation section	0.15 in w.c.	
88		Exhaust system serving fume hoods	0.35 in w.c.	
89		Laboratory and vivarium exhaust systems in high-rise buildings	0.25 in w.c. / 100 feet of vertical duct exceeding 75 feet	
90		**Deductions - PD**		
91		Systems without central cooling device	-0.6 in w.c.	
92		Systems without central heating device	-0.3 in w.c.	
93		Systems with central electric resistance heat	-0.2 in w.c.	
94	***EMS Basic Functionality***	EMS functionality meeting the following requirements: - Individual zone heating and cooling controls - Temperature dead bands of at least 5˚F - Automatic shutdown/setback controls - Optimal start capabilities - Shutoff damper controls for outdoor air intake and exhaust dampers to automatically close dampers when spaces unoccupied or in setback - Shut off vestibule heating when outdoor air temperature > 45°F; maintain vestibule temperature ≤ 60°F (heating) and ≥ 85°F (cooling) - IECC Only - Hot water reset control based on outside air temperature - IECC Only - Optimal stop capabilities IECC: per Sections C403.4.1-2 ASHRAE: per Section 6.4.3		See "Code Required Airside Attributes" section (line 35) for additional baseline controls and potential high-performance controls measures.
95	***Base Case HVAC System Design and Equipment for Non-Electrification Projects***	For instances where the designed building is all-electric, see line 96. This line applies to non-electrification projects. In general, the baseline should reflect the same type of HVAC systems that are designed, unless the design team has seriously considered other, less efficient HVAC system types. If the design team considered multiple HVAC system types and ultimately chose a more energy efficient option, then the designed system strategy can be compared to a different baseline system type, provided that the baseline system type meets the following guidelines: 1. The baseline was actually considered for potential implementation by the design team and owner, 2. The baseline is physically, architecturally, and economically feasible for the given project, 3. The baseline type is at least as efficient as the system types outlined in Appendix A for the respective building type, 4. The PA must approve the baseline system type to be used The system types outlined in Appendix A are suggested as a minimum Industry Standard Practice for the respective building types. ASHRAE 90.1 Appendix G cannot be used to model a baseline building for Mass Save savings. Refer to the specific prescriptive code sections for all equipment performance and controls requirements.		

2024 Program Year			
Line #	***System*** Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
96	***Heat Pump Electrification of Heating and/or DHW Systems: Base Case HVAC and/or Water Heating System Design***	Where electric heat pumps are designed for HVAC heating or domestic water heating systems, the baseline for the applicable equipment should reflect fossil fuel-fired equipment. All baseline equipment performance shall be as-defined in this baseline document. The baseline system should be as similar to the proposed system as possible, with HVAC heating and/or domestic hot water loads served by fossil fuel-fired equipment. The specific baseline system type/components shall be based on the design system type, using the below table as a guide. Consult the PAs for specific projects that do not fit into the below table. **Baseline Fossil Fuel Type:** If natural gas is available within 100 feet of the property line or in use at an adjacent property, the baseline fuel source shall be natural gas. Otherwise, the baseline fuel source shall be propane.	
97		Designed System	Baseline System
98		Zone air source heat pumps (VRF, PTHP, ASHP)	Zone 4-pipe (HW/CHW) FCUs, served by central HW boiler & chiller plant
99		Water loop heat pumps sourced by boilers and cooling towers (boilers and towers temper the WLHP condenser water)	Same as designed. This equipment is not eligible as an electrification measure.
100		Ground Source water loop heat pumps (WLHPs using ground loop or groundwater as the heat source/sink)	Water loop heat pumps sourced by boilers and cooling towers (boilers and towers temper the WLHP condenser water)
101		Ground Source central water-to-water heat pumps	Gas-fired boiler plant, separate chiller plant (no ground loop system)
102		Central AHUs with heat pump coil (< 760 MBH)	Central AHUs with gas-fired furnaces; cooling source same as design
103		Central AHUs with heat pump coil (≥ 760 MBH)	Central AHUs with hot water coils; cooling source same as design
104		Electric resistance heating coil (in any application)	Same as designed. This equipment is not eligible as an electrification measure.
105		Heat recovery chillers or air-to-water heat pumps for hot water	Gas-fired boiler plant, separate chiller plant
106		Domestic Hot Water: heat pump water heaters	Domestic Hot Water: fossil fuel-fired water heater
107		Domestic Hot Water: electric resistance water heaters	Same as designed. This equipment is not eligible as an electrification measure.
108	***Core & Shell Buildings***	Equipment/Systems Fully Designed within Core building scope (Central building HVAC equipment, envelope, and core spaces, typically): Systems shall meet all baseline requirements as defined within the applicable sections of this Baseline Document.	Exceed minimum baseline requirements for equipment that is fully designed within the Core building scope.
109		Equipment/Systems Not Fully Designed (e.g. shell/future tenant spaces, typically): Systems shall meet all baseline requirements as defined within the applicable sections of this Baseline Document. *Consult the MA Simulation Guidelines for guidance on shell/future tenant area load assumptions.	Proposed/Design Case equipment and systems must be identical to Baseline in the shell/future tenant areas.
110		Core & Shell Buildings Designed for Laboratory Use: For Core & Shell designs that include ventilation/exhaust systems to meet laboratory air change requirements, the baseline shall include time of day scheduled airflow controls to reduce lab ventilation rates by at least 50% of design rates during unoccupied hours. (see MA Simulation Guidelines for guidance on occupied/unoccupied lab air change rates.) Lab exhaust air energy recovery is not required in the baseline; however, ventilation/exhaust systems designed to serve both lab and non-lab space must have baseline-compliant energy recovery for the non-lab exhaust air.	Exhaust air energy recovery from lab exhaust

<table>
<tr><th colspan="5">2024 Program Year</th></tr>
<tr><th rowspan="2">Line #</th><td colspan="4">System</td></tr>
<tr><td>Sub-Category</td><td colspan="2">Baseline Minimum Standards & Practice</td><td>Potential High-Performance Practices</td></tr>
<tr><td>111</td><td colspan="4">Special Ventilation System Types</td></tr>
<tr><td>112</td><td>Parking Garages</td><td colspan="2"><u>(ISP) This baseline requirement varies from code.</u>
Enclosed parking garage ventilation controls that automatically detect contamination levels and modulate fan airflow rates to 50% or less of design capacity for systems with either:
1. ≥ 8,000 cfm exhaust (IECC)
2. a total area of ≥ 30,000 ft² (ASHRAE)

Savings cannot be claimed for variable speed fan controls with minimum speed below 50%
No credit allowed for ventilation controls in systems designed to exceed the ratio of garage area to ventilation horsepower (ft²/hp) limits listed in ASHRAE and IECC.</td><td>Garage ventilation controls for systems without heating or cooling and with either:
1. < 8,000 cfm exhaust (IECC)
2. a total area < 30,000 ft² (ASHRAE)</td></tr>
<tr><td>113</td><td rowspan="2">Kitchen Hood Exhaust Controls</td><td colspan="2">Replacement air directly to hood shall be ≤ 10% of total hood exhaust airflow.</td><td rowspan="2"></td></tr>
<tr><td>114</td><td colspan="2">Systems where total combined kitchen hood exhaust > 5,000 cfm are required to have one of the following:
• ≥ 50% of all replacement air is transfer air from an adjacent zone
• DCV on ≥ 75% of exhaust air capable of 50% airflow reductions, or
• energy recovery with ≥ 40% sensible effectiveness on ≥ 50% of total exhaust airflow.

IECC: per Section C403.7.5
ASHRAE: per Section 6.5.7.2</td><td>1. Systems ≤ 5,000 cfm: VFD on exhaust fan with sensor-based velocity controls, dedicated makeup air
2. Systems ≤ 5,000 cfm: systems with one or more of the baseline options
3. Systems > 5,000 cfm: hood exhaust system complying with more than one baseline option
4. Dishwasher hood interlocked with dishwasher operation</td></tr>
<tr><td>115</td><td rowspan="8">Kitchen Hood Exhaust Flow</td><td colspan="2">Each hood has a maximum exhaust rate complying with below table:</td><td rowspan="8">Low flow kitchen hood exhaust system. For savings to be claimed, the kitchen hood designer must provide a calculation indicating the allowable maximum flow rate and the design case flow rate.</td></tr>
<tr><td>116</td><td><u>Type of Hood</u></td><td><u>Light / Medium / Heavy / Extra-Heavy (-Duty)
(CFM per Linear Foot of Hood Length)</u></td></tr>
<tr><td>117</td><td>Wall-mounted canopy</td><td>140 / 210 / 280 / 385</td></tr>
<tr><td>118</td><td>Single Island</td><td>280 / 350 / 420 / 490</td></tr>
<tr><td>119</td><td>Double island (per side)</td><td>175 / 210 / 280 / 385</td></tr>
<tr><td>120</td><td>Eyebrow</td><td>175 / 175 / NA / NA</td></tr>
<tr><td>121</td><td>Back shelf/Pass-over</td><td>210 / 210 / 280 / NA</td></tr>
<tr><td>122</td><td colspan="2">IECC: per Table C403.7.5
ASHRAE: per Table 6.5.7.2.2</td></tr>
</table>

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	System		
Line #	Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
123 124 125 126 127	Laboratory Exhaust Systems	**(ISP) This baseline requirement varies from code:** • All laboratory spaces (**for ASHRAE only systems with > 5,000 CFM of exhaust)** shall have time of day, scheduled airflow controls to reduce unoccupied airflow rates by at least 50%. Note: Industry standard fume hoods specified at 100 fpm ***IECC ≠ ASHRAE** **IECC requirement:** If used to bypass the energy recovery requirements of IECC 2021 Section C403.7.4, fume hoods shall have either: • VAV hood exhaust and supply systems capable of 50% airflow reductions • Direct makeup air ≥ 75% of the exhaust rate, heated no warmer than 2°F above room setpoint and cooled no cooler than 3°F below room setpoint ***ASHRAE - Systems > 5,000 cfm must:** **• Implement one of above IECC options, OR** **• Install a combination of turndown and/or heat recovery to comply with below formula:** **A+B x (E/M) ≥ 50%** **A = % airflow reduction over design (supply & exhaust)** **B = % sensible recovery effectiveness** **E = exhaust airflow rate through heat recovery** **M = system makeup airflow rate** IECC: per Section C403.7.4.2, exception 2 ASHRAE: per Section 6.5.7.3 ***For air-side systems that serve both laboratory and non-laboratory spaces, exhaust air energy recovery is required in the baseline for the non-lab space exhaust air regardless of how the lab spaces are designed/controlled.**	1. Systems ≤ 5,000 cfm: variable flow controls (ASHRAE) 2. Systems > 5,000 cfm: exceed requirements for turndown and heat recovery 3. Systems complying with more than one baseline option 4.. VAV fume hood systems with minimum 50% airflow reduction and with energy recovery (IECC) 5. Occupancy based airflow setback 6. Hazard sensing system to modulate airflow based on contaminant levels 7. Ventless fume hoods (this may not have an incremental cost) 8. Low-flow fume hoods (< 100 fpm) 9. Cascaded air
128	Laboratory Exhaust Fan Control	Staged constant speed fans with plenum bypass damper, the number of baseline exhaust fans shall be equal to the number of fans in the design case. The plenum bypass damper is controlled to maintain exhaust riser static pressure. Staging control minimizes the number of active fans.	Variable speed exhaust fans capable of modulating speed below the balanced speed setting in response to reduced building exhaust flow, while maintaining adequate air velocity / plume height at reduced flow.
129	Operable Openings	***IECC ≠ ASHRAE** Where operable openings per the proposed design are larger than 40 ft² **(*ASHRAE - applies only to doors, no size limit)**, interlock controls with HVAC system to raise cooling setpoint to 90°F and lower heating setpoint to 55°F when opening is open. Controls shall shut HVAC systems off when outdoor air temperature below 90°F or above 55°F. IECC: per C402.5.11 and C403.14 ASHRAE: per Section 6.5.10	Interlock controls with HVAC system where not code required Note: For natural ventilation design; check with Program Administrator to see if high-performance plan qualifies.
130	Guest Room HVAC System Temperature Controls	For R-1† buildings with > 50 guestrooms: - Automatically raise cooling setpoint and lower heating setpoint by 4°F within 30 minutes **(*ASHRAE - 20 minutes)** of the occupant leaving when the guestroom is rented - Automatically raise the cooling setpoint to ≥ 80°F and lower the heating setpoint to < 60°F when guestroom unrented or unoccupied for > 16 hours IECC: per Section C403.7.6.1 ASHRAE: per Section 6.4.3.3.5.1 †Type R-1 buildings are residential occupancies containing sleeping units where the occupants are primarily transient in nature, including boarding houses, hotels and motels.	Guestroom HVAC system automatic temperature controls for R-1 buildings with ≤ 50 guestrooms.

	2024 Program Year		
Line #	***System*** Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
131	Guest Room HVAC System Ventilation Controls	For R-1† buildings with > 50 guestrooms: - Automatically turn off ventilation and exhaust fans within 20 minutes of the occupant leaving or provide isolation devices that automatically shut off the supply of outdoor air to and exhaust air from the guestrooms. IECC: per Section C403.7.6.2 ASHRAE: per Section 6.4.3.3.5.2 †Type R-1 buildings are residential occupancies containing sleeping units where the occupants are primarily transient in nature, including boarding houses, hotels and motels.	Guestroom HVAC system automatic ventilation controls for R-1 buildings with ≤ 50 guestrooms.
132	***Hydronic Systems Equipment & Controls***		
133	HW / CHW Temperature Reset	For all HW/CHW systems, automatically reset supply temperature by at least 25% of system dT (dT = supply temperature - return temperature at design condition) IECC: per Section C403.4.4 ASHRAE: per Section 6.5.4.4 *for IECC, per Section C403.4.1.5, HW temperature reset should be based on OA temperature.	HW/CHW reset greater than 25% of system dT Note: condensing boilers should be combined with aggressive HW reset down to at least 120°F to achieve higher operating efficiency
134	HW / CHW Variable Flow Control	***IECC ≠ ASHRAE** Required for systems ≥ 300 MBH with ≥ 2 hp total pump capacity; must automatically reduce flow by at least 50%. VFDs are required for pumps ≥ 7.5 hp where DDC controls installed and for pumps ≥ 2 hp that operate continuously or based on time of day schedule. (DP sensors controlling VFD speed should be located at a remote coil.) IECC: per Section C403.4.4 ***ASHRAE - required for systems with three or more control valves; individual hot water or chilled-water pumps serving variable-flow systems having motors ≥ 7.5 hp; must automatically reduce flow by at least 75% via installation of variable frequency drives (VFDs) (per Section 6.5.4.2)**	1. HW/CHW pump VFDs for pumps < 7.5 hp with DDC controls (IECC) 2. HW/CHW variable flow controls for systems < 300 MBH (IECC), N/A for ASHRAE 3. HW/CHW variable flow controls for systems with < 2 hp total pump power (IECC) 4. HW/CHW flow reduction of greater than 50% of design flow (IECC) or greater than 75% of design flow (ASHRAE) 5. Fractional horsepower pumps with EC motors and variable flow control. 6. HW VFDs where > 50% of annual heat generated by electric boiler
135	Heat Rejection Loop Variable Flow Controls	***IECC ≠ ASHRAE** Required for systems ≥ 300 MBH with either ≥ 2 hp total pump power (pumps scheduled or continuously operating) or ≥ 7.5 hp total pump power (DDC controls) serving water-cooled unitary air conditioners; must automatically reduce flow by at least 50%. VFDs are required for pumps ≥ 7.5 hp where DDC controls installed and for pumps ≥ 2 hp that operate continuously or based on time of day schedule. IECC: per Section C403.4.4 ***ASHRAE - required for hydronic heat pumps and water-cooled unitary air conditioners with total pump system power > 5hp; must automatically reduce flow by at least 50% via installation of variable frequency drives (VFDs) (per Section 6.5.4.5.2)**	1. Heat Rejection Loop pump VFDs for pumps < 7.5 hp with DDC controls (IECC) 2. Heat Rejection Loop variable flow controls for systems < 300 MBH (IECC), N/A for ASHRAE 3. Heat Rejection Loop variable flow controls for system with < 7.5 hp total pump power (IECC) or < 5 hp (ASHRAE) 4. Heat Rejection Loop flow reduction of greater than 50% of design flow 5. Fractional horsepower pumps with EC motors
136	Piping Insulation	Hydronic pipe insulation meeting minimum thickness IECC: per Table C403.12.3 ***ASHRAE: per Table 6.8.3-1 and 6.8.3-2**	
137	Heat Pumps: Standard Water Loop	Minimum heat pump water supply temperature dead band of 20°F IECC: per Section C403.4.3.3.1 ASHRAE: per Section 6.5.2.2.3	Controls that optimize loop temperature based upon real-time conditions and loads

2024 Program Year			
Line #	***System***		
	Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
138	Heat Pump: Valves	***IECC ≠ ASHRAE** Two way automatic valves for each hydronic heat pump where the total pump system power is >10 hp. Valves interlocked to shut off the water flow when the compressor is off. IECC: per Section C403.4.3.3.3 ***ASHRAE - required for all hydronic heat pumps (no size limit), unless units utilize a fluid economizer (per Section 6.5.4.5.1)**	Two way valves and variable flow controls for systems where total pump power ≤ 10 hp (IECC)
139	***Furnaces***	**This baseline only applies to heat pump electrification projects. Where gas heating equipment is included in the design, the baseline gas equipment and controls shall be identical to the design.** **(ISP) This baseline requirement exceeds code for furnaces ≤ 225 MBH.** **(See Appendix C for replace on failure baseline requirements.)** Warm-air furnaces with performance meeting IECC Table 403.3.2(5) / ASHRAE 90.1 Table 6.8.1-5	Heat pump electrification No savings can be considered for high performance gas-fired equipment.

	Type	*<225 MBH*	*≥225 MBH*
140			
141	Warm Air, Gas fired	**82% AFUE**	
142	Warm Air, Oil Fired	82% Et	n/a
143	Warm Air Duct, Gas Fired	**82% AFUE**	
144	Warm Air Unit Heater, Gas Fired	**82% Ec**	
145	Warm Air Unit Heater, Oil Fired	80% Ec	

146	***Boilers***				
147	Selection	**This baseline only applies to heat pump electrification projects. Where gas heating equipment is included in the design, the baseline gas equipment shall be identical to the design.** **(ISP) This baseline requirement exceeds code for all hot-water boilers.** **(See Appendix C for replace on failure baseline requirements.)** Hot Water Boilers: baseline is Condensing boilers with typical condensing efficiency.			Heat pump electrification No savings can be considered for rated boiler performance.
148		Steam Boilers: baseline performance meeting IECC 2021 Table C403.3.2(6) / ASHRAE 90.1 2019 Table 6.8.1-6:			
149			*Capacity (Input, MBH)*	*gas-fired*	*oil-fired*
150		Steam Boilers	< 300	80% AFUE	82% AFUE
151			≥ 300 and ≤ 2,500	79% Et	81% Et
152			> 2,500	79% Et	81% Et
153	Design HW Return Temp/ Coil Selection (Gas-Fired Systems)	***IECC ≠ ASHRAE** No IECC Requirement *ASHRAE - For Gas-fired HW boiler systems with total system input ≥ 1,000 MBH and ≤ 10,000 MBH, hot water coils shall be selected so that at design conditions the hot water return temperature entering the boilers is 120°F or lower per ASHRAE 90.1-2019 Section 6.5.4.8.2			

2024 Program Year					
Line #	***System***				
	Sub-Category	Baseline Minimum Standards & Practice			Potential High-Performance Practices
154	Burner controls	**This baseline only applies to heat pump electrification projects. Where gas heating equipment is included in the design, the baseline gas equipment shall be identical to the design.** Boilers ≥ 1,000 MBH shall meet the minimum turndown ratios of IECC 2021 Table C403.3.4 / ASHRAE 90.1 2019 Table 6.5.4.1			
155			*Capacity (Input, MBH)*	*Minimum Turndown*	
156			≥ 1,000 and ≤ 5,000	3 to 1	
157			> 5,000 and ≤ 10,000	4 to 1	
158			> 10,000	5 to 1	
159		IECC Only - Heating systems comprised of a single boiler > 500 MBH shall have a multistage or modulating burner IECC: Section C403.4.3			
160	Burner controls	< 25 hp: Constant-speed forced-draft burner fans having inlet guide vane or outlet damper volume control ≥ 25 hp: VFD on draft fan			VFD on forced-draft burner fans < 25 hp
161		Mechanical linkage control			
162	Boiler pumps	***IECC ≠ ASHRAE** No IECC Requirement ***ASHRAE = For systems with multiple boilers, automatically shut off flow through each boiler when that specific boiler is shut off. For systems with multiple boilers and constant speed pumps, number of pumps equal to the number of boilers and stage on/off with boilers (per Section 6.5.4.3.2)**			
163	***Cooling Systems***				
164	Heat Pumps: Air Source (excludes VRF, see VRF section)	**The baseline for this section is based on the more stringent value between the 2022 ISP and the new code requirements. For heat pumps < 65 MBH, the new code uses SEER2 and HSPF2 ratings.** Air-source heat pumps with performance meeting the values in the below table. IECC: per Table C403.3.2(2) ASHRAE: per Table 6.8.1-2			Heat pumps with performance exceeding baseline requirements
165			*Equipment Type*	*Size (MBH)*	*Minimum Efficiency*
166			Air cooled	< 65	Split: 14.3 SEER2, 7.5 HSPF2 Pkgd: 13.4 SEER2, 6.7 HSPF2
167			Through-the-wall	≤30	Split: 11.7 SEER2, 6.3 HSPF2 Pkgd: 11.7 SEER2, 6.3 HSPF2
168			Single-duct high-velocity	<65	Split: 12.0 SEER2, 6.1 HSPF2
169			Air cooled	≥ 65 and < 135	11.3 EER & 14.1 IEER (electric heat or no heat) 11.1 EER & 13.9 IEER (other heat) 3.5 COP (47°F db/43°F wb) 2.4 COP (17°F db/ 15°F wb)
170				≥ 135 and < 240	10.9 EER & 13.5 IEER (electric heat or no heat) 10.7 EER & 13.3 IEER (other heat) 3.4 COP (47°F db/43°F wb) 2.2 COP (17°F db/ 15°F wb)
171				≥ 240	9.8 EER & 12.5 IEER (electric heat or no heat) 9.6 EER & 12.3 IEER (other heat) 3.4 COP (47°F db/43°F wb) 2.2 COP (17°F db/ 15°F wb)

2024 Program Year						
	System					
Line #	Sub-Category	Baseline Minimum Standards & Practice				Potential High-Performance Practices
172	Heat Pumps: Water-Source (includes geothermal)	**(ISP) This baseline requirement varies from code.** Water-source heat pumps with performance meeting the values in the below table. For equipment outside of the capacity ranges shown below, the baseline should match the design selection unless documentation is provided for an alternative selection of the same equipment that is less efficient and available to purchase.				Heat pumps with performance exceeding baseline requirements
173			*Equipment Type*	*Size (MBH)*	*Minimum Efficiency*	
174			Water to Air: Water Loop	<17	12.5 EER (86°F EWT) 4.5 COP (68°F EWT)	
175				≥ 17 and < 65	13.4 EER (86°F EWT) 4.5 COP (68°F EWT)	
176				≥ 65 and < 135	13.4 EER (86°F EWT) 4.5 COP (68°F EWT)	
177			Water to Air: Ground Water (Open Loop)	<135	18.5 EER (59°F EWT) 3.9 COP (50°F EWT)	
178			Brine to Air: Ground Loop (Closed Loop)	<135	14.5 EER (77°F EWT) 3.4 COP (32°F EWT)	
179			Water to Water: Water Loop	<135	10.9 EER (86°F EWT) 3.9 COP (68°F EWT)	
180			Water to Water: Ground Water (Open Loop)	<135	16.7 EER (59°F EWT) 3.3 COP (50°F EWT)	
181			Brine to Water: Ground Loop (Closed Loop)	<135	12.4 EER (77°F EWT) 2.6 COP (32°F EWT)	
182	Unitary Air Conditioners (RTUs, etc.) and Split Systems	Standard efficiency packaged/split unit with DX cooling with performance meeting IECC 2021 Table C403.3.2(1) / ASHRAE 2019 Table 6.8.1-1				Cooling systems with performance exceeding baseline requirements
183			*Equipment*	*Size (MBH)*	*Minimum Efficiency*	
184			Air cooled	< 65	Split: 13.4 SEER2; Pkgd: 13.4 SEER2	
185			Through-wall	≤30	Split: 11.7 SEER2; Pkgd: 11.7 SEER2	
186			Small-duct high-velocity	<65	Split: 12.1 SEER2 ***ASHRAE - 12.0 SEER2**	
187			Air cooled	≥ 65 and < 135	11.2 EER & 14.8 IEER (electric heat or no heat) 11.0 EER & 14.6 IEER (other heat)	
188				≥ 135 and < 240	11.0 EER & 14.2 IEER (electric heat or no heat) 10.8 EER & 14.0 IEER (other heat)	
189				≥ 240 and <760	10.0 EER & 13.2 IEER (electric heat or no heat) 9.8 EER & 13.0 IEER (other heat)	
190				≥ 760	9.7 EER & 12.5 IEER (electric heat or no heat) 9.5 EER & 12.3 IEER (other heat)	
191			Water cooled	<65	12.1 EER & 12.3 IEER (all)	
192				≥ 65 and < 135	12.1 EER & 13.9 IEER (electric heat or no heat) 11.9 EER & 13.7 IEER (other heat)	
193				≥ 135 and < 240	12.5 EER & 13.9 IEER (electric heat or no heat) 12.3 EER & 13.7 IEER (other heat)	
194				≥ 240 and <760	12.4 EER & 13.6 IEER (electric heat or no heat) 12.2 EER & 13.4 IEER (other heat)	
195				≥ 760	12.2 EER & 13.5 IEER (electric heat or no heat) 12.0 EER & 13.3 IEER (other heat)	

2024 Program Year							
Line #	***System***						
	Sub-Category	Baseline Minimum Standards & Practice					Potential High-Performance Practices
196	Unitary Air Conditioners (RTUs, etc.) and Split Systems		Evap. cooled	<65	12.1 EER & 12.3 IEER (all)		Cooling systems with performance exceeding baseline requirements
197				≥ 65 and < 135	12.1 EER & 12.3 IEER (electric heat or no heat) 11.9 EER & 12.1 IEER (other heat)		
198				≥ 135 and < 240	12.0 EER & 12.2 IEER (electric heat or no heat) 11.8 EER & 12.0 IEER (other heat)		
199				≥ 240 and <760	11.9 EER & 12.1 IEER (electric heat or no heat) 11.7 EER & 11.9 IEER (other heat)		
200				≥ 760	11.7 EER & 11.9 IEER (electric heat or no heat) 11.5 EER & 11.7 IEER (other heat)		
201			Cond. Unit, air cool	≥ 135	10.5 EER & 11.8 IEER		
202			Cond. Unit, water cool	≥ 135	13.5 EER & 14.0 IEER		
203			Cond. Unit, evap. cool	≥ 135	13.5 EER & 14.0 IEER		
204	PTAC and PTHP	Standard efficiency units with performance meeting IECC Table C403.3.2(4)/ ASHRAE Table 6.8.1-4.					PTHP and PTAC with performance exceeding baseline requirements
205	Chilled Water Plants	*(design CHWT > 35°F)*					Chillers with performance exceeding baseline requirements.
206	Equipment Selection	**(ISP) This baseline requirement varies from code.** **(See Appendix C for replace on failure baseline requirements.)** Chiller performance meeting the values in the below table. Baseline chiller should have the same heat rejection method (air-cooled or water-cooled) as the designed system.					
207			*Equipment Type*	*Size (tons)*	*Minimum Efficiency (choose either Path A or Path B)*		
208					*Path A*	*Path B*	
209			Air cooled	<150	≥ 10.403 EER (FL) ≥ 14.111 EER (IPLV)	≥ 9.991 EER (FL) ≥ 16.274 EER (IPLV)	
210				≥ 150	≥ 10.403 EER (FL) ≥ 14.420 EER (IPLV)	≥ 9.991 EER (FL) ≥ 16.583 EER (IPLV)	
211			Air cooled w/o condenser, electrically operated	ALL	Units shall be rated with matching condensers and comply with air-cooled chiller requirements		
212			Water cooled, electrically operated, positive displacement	< 75	≤ 0.728 kW/ton (FL) ≤ 0.582 kW/ton (IPLV)	≤ 0.757 kW/ton (FL) ≤ 0.485 kW/ton (IPLV)	
213				≥ 75 and < 150	≤ 0.698 kW/ton (FL) ≤ 0.543 kW/ton (IPLV)	≤ 0.728 kW/ton (FL) ≤ 0.475 kW/ton (IPLV)	
214				≥ 150 and < 300	≤ 0.640 kW/ton (FL) ≤ 0.524 kW/ton (IPLV)	≤ 0.660 kW/ton (FL) ≤ 0.427 kW/ton (IPLV)	
215				≥ 300 and < 600	≤ 0.592 kW/ton (FL) ≤ 0.504 kW/ton (IPLV)	≤ 0.606 kW/ton (FL) ≤ 0.398 kW/ton (IPLV)	
216				≥ 600	≤ 0.543 kW/ton (FL) ≤ 0.485 kW/ton (IPLV)	≤ 0.567 kW/ton (FL) ≤ 0.369 kW/ton (IPLV)	
217			Water cooled, electrically operated centrifugal	<150	≤ 0.592 kW/ton (FL) ≤ 0.534 kW/ton (IPLV)	≤ 0.674 kW/ton (FL) ≤ 0.427 kW/ton (IPLV)	
218				≥ 150 and < 300	≤ 0.592 kW/ton (FL) ≤ 0.534 kW/ton (IPLV)	≤ 0.616 kW/ton (FL) ≤ 0.388 kW/ton (IPLV)	
219				≥ 300 and < 400	≤ 0.543 kW/ton (FL) ≤ 0.504 kW/ton (IPLV)	≤ 0.577 kW/ton (FL) ≤ 0.378 kW/ton (IPLV)	
220				≥ 400 and < 600	≤ 0.543 kW/ton (FL) ≤ 0.485 kW/ton (IPLV)	≤ 0.567 kW/ton (FL) ≤ 0.369 kW/ton (IPLV)	
221				≥ 600	≤ 0.543 kW/ton (FL) ≤ 0.485 kW/ton (IPLV)	≤ 0.567 kW/ton (FL) ≤ 0.369 kW/ton (IPLV)	
222			Absorption, single effect	ALL (air cooled)	≥ 0.6 COP (FL)	N/A	
223			Absorption, single effect	ALL (water cooled)	≥ 0.7 COP (FL)	N/A	
224			Absorption, double effect	ALL (indirect fired)	≥ 1.0 COP (FL) ≥ 1.05 COP (IPLV)	N/A	
225			Absorption, double effect	ALL (direct fired)	≥ 1.0 COP (FL) ≥ 1.0 COP (IPLV)	N/A	

2024 Program Year			
Line #	***System***		
	Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
226	Chiller Sequencing	Automatic lead/lag chiller staging (run one chiller to full capacity before staging on second chiller)	Optimal automatic chiller sequencing based on total plant efficiency Different-sized chillers with optimized sequencing for prolonged high-load vs low-load operation
227	Pumping	Chilled water pumping approach (primary/secondary vs. variable primary) shall be the same as what is designed	
228	Piping	***IECC ≠ ASHRAE** No IECC Requirement ***ASHRAE - Chilled water piping sized according to ASHRAE 90.1-2019 Table 6.5.4.6**	
229	Coil Selection	***IECC ≠ ASHRAE** No IECC Requirement ***ASHRAE - Chilled water coils shall be selected to provide a 15°F or higher difference between the leaving and entering water temperatures and a minimum 57°F leaving water temperature per ASHRAE 90.1-2019 Section 6.5.4.7 (some exceptions apply)**	Design coil dT greater than 15°F
230	Cooling Towers	Cooling tower performance meeting IECC 2021 Table C403.3.2(7) / ASHRAE 90.1-2019 Table 6.8.1-7	Oversize cooling tower evaporative surface area in order to reduce the required cooling tower fan motor size
231		*Equipment Type* / *Rating Condition* / *Fan Performance*	
232		Propeller or axial fan, open-circuit: 95°F EWT; 85°F LWT, 75°F OAT (wb): ≥ 40.2 gpm/hp	
233		Centrifugal fan, open-circuit: 95°F EWT; 85°F LWT, 75°F OAT (wb): ≥ 20.0 gpm/hp	
234		Propeller or axial fan, closed-circuit: 102°F EWT; 90°F LWT, 75°F OAT (wb): ≥ 16.1 gpm/hp	
235		Centrifugal fan, closed-circuit: 102°F EWT; 90°F LWT, 75°F OAT (wb): ≥ 7.0 gpm/hp	
236		Propeller or axial fan dry cooler (air-cooled fluid coolers): 115°F EWT; 105°F LWT, 95°F OAT (wb): ≥ 4.5 gpm/hp	
237	Condensers	Condenser performance meeting IECC 2021 Table C403.3.2(7) / ASHRAE 90.1-2019 Table 6.8.1-7	Oversize condenser heat exchanger surface area in order to reduce the required condenser fan motor size
238		*Equipment Type* / *Rating Condition* / *Performance*	
239		Propeller or axial fan, evaporative: Ammonia: 140°F entering gas temp, 96.3°F condensing temp; 75°F OAT (wb): ≥ 134 MBH/hp	
240		Centrifugal fan, evaporative: Ammonia: 140°F entering gas temp, 96.3°F condensing temp; 75°F OAT (wb): ≥ 110 MBH/hp	
241		Propeller or axial fan, evaporative: R-448A: 165°F entering gas temp, 105°F condensing temp; 75°F OAT (wb): ≥ 160 MBH/hp	
242		Centrifugal fan, evaporative: R-448A: 165°F entering gas temp, 105°F condensing temp; 75°F OAT (wb): ≥ 137 MBH/hp	
243		Air-cooled: 125°F condensing temp; 190°F entering gas temp; 15°F subcooling; 95°F OA(db): ≥ 176 MBH/hp	
244	Heat Rejection Fan Controls	Each fan system with connected motor power ≥ 5 hp shall have capability to operate at 50% speed or less with controls to automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure. IECC: per Section C403.10.1 ASHRAE: per Section 6.5.5.2	Variable speed fan controls w/ VFD. When considering savings for these controls, provide documentation showing two-speed fans are an option from the manufacturer.
245	Condenser Water Temperature	Condenser water (CW) supply temperature reset from design value down to minimum setpoint of 70°F.	Reset CW temperature setpoint below 70°F

2024 Program Year							
Line #	***System***						
	Sub-Category	Baseline Minimum Standards & Practice					Potential High-Performance Practices
246	Water-side Economizer	See "Economizer" section starting on line 49.					
247	Thermal Storage	No thermal storage					Thermal storage to reduce plant peak kW demand (consider energy penalty on overall plant energy use)
248	Central Hydronic Heat Pump and Heat Recovery Chiller Packages (Simultaneous Cooling/Heating Chiller)	Performance meeting IECC 2021 Table C403.3.2(15) / ASHRAE 90.1-2019 Table 6.8.1-16					Where Heat Recovery Chillers are installed to offset fossil fuel heating energy, it is acceptable to evaluate the proposed Heat Recovery Chiller compared to the fossil fuel baseline equipment (i.e. no baseline HRC performance used).
249		*Equip. Type*	*Size Category (tons cooling)*	*Heating Source Conditions (entering/ leaving water) OR OAT (db/wb), °F*	*Cooling-Only Operation Cooling Efficiency*	*Heat Pump: Heating Full Load Efficiency (COP)* *Heat Recovery Chiller: Simultaneous Cooling and Heating Full Load Efficiency (COP $_{HR}$ *)* *Leaving Hot Water Temperature of (low - 105°F / medium - 120°F / high - 140°F / boost - 140°F)*	
250		Air source	All sizes	47 db 43 wb	Path A (EER): ≥ 9.595 FL & ≥ 13.02 IPLV Path B (EER): ≥ 9.215 FL & ≥ 15.01 IPLV	Heat Pump: 3.29 / 2.77 / 2.31 / NA Heat Recovery Chiller: NA	
251				17 db 15 wb	Path A (EER): ≥ 9.595 FL & ≥ 13.30 IPLV Path B (EER): ≥ 9.215 FL & ≥ 15.30 IPLV	Heat Pump: 2.23 / 1.95 / 1.63 / NA Heat Recovery Chiller: NA	
252		Water-source electrically operated positive displacement	<75	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.7885 FL & ≤ 0.6316 IPLV Path B (kW/ton): ≤ 0.7875 FL & ≤ 0.5145 IPLV	Heat Pump: 4.64 / 3.68 / 2.68 / NA Heat Recovery Chiller: 8.33 / 6.41 / 4.42 / NA	
253				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.55 Heat Recovery Chiller: NA / NA / NA / 6.15	
254			≥ 75 and < 150	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.7579 FL & ≤ 0.5895 IPLV Path B (kW/ton): ≤ 0.7140 FL & ≤ 0.4620 IPLV	Heat Pump: 4.64 / 3.68 / 2.68 / NA Heat Recovery Chiller: 8.33 / 6.41 / 4.42 / NA	
255				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.55 Heat Recovery Chiller: NA / NA / NA / 6.15	
256			≥ 150 and < 300	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.6947 FL & ≤ 0.5684 IPLV Path B (kW/ton): ≤ 0.7140 FL & ≤ 0.4620 IPLV	Heat Pump: 4.64 / 3.68 / 2.68 / NA Heat Recovery Chiller: 8.33 / 6.41 / 4.42 / NA	
257				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.55 Heat Recovery Chiller: NA / NA / NA / 6.15	
258			≥ 300 and < 600	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.6421 FL & ≤ 0.5474 IPLV Path B (kW/ton): ≤ 0.6563 FL & ≤ 0.4305 IPLV	Heat Pump: 4.93 / 3.96 / 2.97 / NA Heat Recovery Chiller: 8.90 / 6.98 / 5.00 / NA	
259				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.90 Heat Recovery Chiller: NA / NA / NA / 6.85	

2024 Program Year							
Line #	***System*** Sub-Category	Baseline Minimum Standards & Practice					Potential High-Performance Practices
260	Central Hydronic Heat Pump and Heat Recovery Chiller Packages (Simultaneous Cooling/Heating Chiller)	Water-source, positive displacement	≥ 600	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.5895 FL & ≤ 0.5263 IPLV Path B (kW/ton): ≤ 0.6143 FL & ≤ 0.3990 IPLV	Heat Pump: 4.93 / 3.96 / 2.97 / NA Heat Recovery Chiller: 8.90 / 6.98 / 5.00 / NA	Where Heat Recovery Chillers are installed to offset fossil fuel heating energy, it is acceptable to evaluate the proposed Heat Recovery Chiller compared to the fossil fuel baseline equipment (i.e. no baseline HRC performance used).
261				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.90 Heat Recovery Chiller: NA / NA / NA / 6.85	
262		Water-source electrically operated centrifugal	<75	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.6421 FL & ≤ 0.5789 IPLV Path B (kW/ton): ≤ 0.7316 FL & ≤ 0.4632 IPLV	Heat Pump: 4.64 / 3.68 / 2.68 / NA Heat Recovery Chiller: 8.33 / 6.41 / 4.42 / NA	
263				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.55 Heat Recovery Chiller: NA / NA / NA / 6.15	
264			≥ 75 and < 150	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.5895 FL & ≤ 0.5474 IPLV Path B (kW/ton): ≤ 0.6684 FL & ≤ 0.4211 IPLV	Heat Pump: 4.64 / 3.68 / 2.68 / NA Heat Recovery Chiller: 8.33 / 6.41 / 4.42 / NA	
265				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.55 Heat Recovery Chiller: NA / NA / NA / 6.15	
266			≥ 150 and < 300	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.5895 FL & ≤ 0.5263 IPLV Path B (kW/ton): ≤ 0.6263 FL & ≤ 0.4105 IPLV	Heat Pump: 4.64 / 3.68 / 2.68 / NA Heat Recovery Chiller: 8.33 / 6.41 / 4.42 / NA	
267				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.55 Heat Recovery Chiller: NA / NA / NA / 6.15	
268			≥ 300 and < 600	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.5895 FL & ≤ 0.5263 IPLV Path B (kW/ton): ≤ 0.6158 FL & ≤ 0.4000 IPLV	Heat Pump: 4.93 / 3.96 / 2.97 / NA Heat Recovery Chiller: 8.90 / 6.98 / 5.00 / NA	
269				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.90 Heat Recovery Chiller: NA / NA / NA / 6.85	
270			≥ 600	54 EWT 44 LWT	Path A (kW/ton): ≤ 0.5895 FL & ≤ 0.5263 IPLV Path B (kW/ton): ≤ 0.6158 FL & ≤ 0.4000 IPLV	Heat Pump: 4.93 / 3.96 / 2.97 / NA Heat Recovery Chiller: 8.90 / 6.98 / 5.00 / NA	
271				75 EWT 65 LWT	n/a	Heat Pump: NA / NA / NA / 3.90 Heat Recovery Chiller: NA / NA / NA / 6.85	
272		*COP_{HR} applies to operation at full load with 100% heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery should meet the chiller minimum performance requirements (see section above).					

2024 Program Year						
Line #	***System*** Sub-Category	Baseline Minimum Standards & Practice				Potential High-Performance Practices
273	Variable Refrigerant Flow (VRF) Air Conditioners (Cooling Only systems that are not used for heating)	VRF performance meeting IECC 2021 Table C403.3.2(8) / ASHRAE 90.1-2019 Table 6.8.1-8				VRF air conditioners with performance exceeding baseline requirements.
274			*Equipment Type*	*Size (MBH)*	*Minimum Efficiency*	
275			VRF air conditioner, air cooled	< 65	13 SEER (VRF multisplit, all heat types)	
276				≥ 65 and < 135	11.2 EER & 15.5 IEER (VRF multisplit, electric heat or no heat)	
277				≥ 135 and < 240	11.0 EER & 14.9 IEER (VRF multisplit, electric heat or no heat)	
278				≥ 240	10.0 EER & 13.9 IEER (VRF multisplit, electric heat or no heat)	
279	Variable Refrigerant Flow (VRF) Heat Pumps (for Heating and Cooling)	**(ISP) This baseline requirement varies from code.** **(See Appendix C for replace on failure baseline requirements.)** VRF heat pumps with performance meeting the values in the below table.				VRF heat pumps with performance exceeding baseline requirements.
280			*Equipment Type*	*Size (MBH)*	*Minimum Efficiency (VRF multisplit)*	
281			VRF air cooled (cool mode)	< 65	13.4 SEER (all heat types)	
282				≥ 65 and < 135	11.3 EER & 15.0 IEER (electric heat/no heat) 11.1 EER & 14.8 IEER (heat recovery, electric heat/no heat)	
283				≥ 135 and < 240	10.9 EER & 14.3 IEER (electric heat/no heat) 10.7 EER & 14.1 IEER (heat recovery, electric heat/no heat)	
284				≥ 240	9.8 EER & 13.1 IEER (electric heat/no heat) 9.6 EER & 12.9 IEER (heat recovery, electric heat/no heat)	
285			VRF water source (cool mode)	< 65	12.4 EER & 16.5 IEER; 86°F EWT 12.2 EER & 16.3 IEER; 86°F EWT (heat recovery)	
286				≥ 65 & < 135	12.4 EER & 16.5 IEER; 86°F EWT 12.2 EER & 16.3 IEER; 86°F EWT (heat recovery)	
287				≥ 135 & < 240	10.3 EER & 14.4 IEER; 86°F EWT 10.1 EER & 14.2 IEER; 86°F EWT (heat recovery)	
288				≥ 240	10.3 EER & 12.4 IEER; 86°F EWT 10.1 EER & 12.2 IEER; 86°F EWT (heat recovery)	
289			VRF ground-water source (cool mode)	<135	16.7 EER; 59°F EWT 16.5 EER; 59°F EWT (heat recovery)	
290				≥ 135	14.2 EER; 59°F EWT 14.0 EER; 59°F EWT (heat recovery)	
291			VRF ground source (cool mode)	<135	13.8 EER; 77°F EWT 13.6 EER; 77°F EWT (heat recovery)	
292				≥ 135	11.3 EER; 77°F EWT 11.1 EER; 77°F EWT (heat recovery)	
293			VRF air cooled (heat mode)	< 65	8.2 HSPF	
294				≥ 65 & < 135	3.5 COP (47°Fdb/43°Fwb); 2.4 COP (17°Fdb/15°Fwb)	
295				≥ 135	3.4 COP (47°Fdb/43°Fwb); 2.2 COP (17°Fdb/15°Fwb)	
296			VRF water source (heat mode)	<135	4.6 COP; 68°F EWT	
297				≥ 135 & < 240	4.2 COP; 68°F EWT	
298				≥ 240	4.1 COP; 68°F EWT	
299			VRF ground-water source (heat mode)	<135	3.8 COP; 50°F EWT	
300				≥ 135	3.5 COP; 50°F EWT	
301			VRF ground source (heat mode)	<135	3.3 COP; 32°F EWT	
302				≥ 135	3.0 COP; 32°F EWT	

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Line #	*System* Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
303	DX-DOAS Units	DX DOAS unit performance meeting IECC 2021 Tables C403.3.2(12)&(13) / ASHRAE 90.1-2019 Tables 6.8.1-13 and 6.8.1-14	DX-DOAS units with performance exceeding the baseline requirements.

Line #	***Equipment Type***	***Minimum Efficiency (without energy recovery)***	***Minimum Efficiency (with energy recovery)***
304			
305	Air cooled (dehumidification mode)	4.0 ISMRE	5.2 ISMRE
306	Air Source Heat Pumps (dehumidification mode)	4.0 ISMRE	5.2 ISMRE
307	Water cooled (dehumidification mode)	4.9 ISMRE (cooling tower condenser water) 6.0 ISMRE (chilled water)	5.3 ISMRE (cooling tower condenser water) 6.6 ISMRE (chilled water)
308	Air source heat pump (heating mode)	2.7 ISCOP	3.3 ISCOP
309	Water source heat pump (dehumidification mode)	4.8 ISMRE (ground source, closed loop) 5.0 ISMRE (ground-water source) 4.0 ISMRE (water source)	5.2 ISMRE (ground source, closed loop) 5.8 ISMRE (ground-water source) 4.8 ISMRE (water source)
310	Water source heat pump (heating mode)	2.0 ISCOP (ground source, closed loop) 3.2 ISCOP (ground-water source) 3.5 ISCOP (water source)	3.8 ISCOP (ground source, closed loop) 4.0 ISCOP (ground-water source) 4.8 ISCOP (water source)
311	*ISMRE = integrated seasonal moisture removal efficiency		
312	*ISCOP = integrated seasonal coefficient of Performance		

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Line #	*System* Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
313	Floor-Mounted DX Computer Room Air Conditioners and Condensing Units (Excludes Chilled Water Computer Room Air Handlers)	Air conditioner and condenser performance meeting IECC 2021 Table C403.3.2(10) / ASHRAE 90.1-2019 Table 6.8.1-10 Computer rooms shall have dedicated air-side HVAC systems. ***The Baseline Repository has specific additional requirements for data center equipment. These must also be applied to the baseline. The Baseline Repository is available on the MA Energy Efficiency Advisory Council website (ma-eeac.org).**	Computer room air conditioners with performance exceeding baseline requirements. For new data centers designed with central chiller plants, consult the PA regarding savings potential.

Equipment Type	Net Sensible Cooling Capacity (MBH)*	Min Net SCOP Efficiency
Downflow / Upflow-ducted		
Air cooled	< 80	2.70/2.67
	≥ 80 and < 295	2.58/2.55
	≥ 295	2.36/2.33
Air cooled with fluid economizer	< 80	2.70/2.67
	≥ 80 and < 295	2.58/2.55
	≥ 295	2.36/2.33
Water cooled	< 80	2.82/2.79
	≥ 80 and < 295	2.73/2.70
	≥ 295	2.67/2.64
Water cooled with fluid economizer	< 80	2.77/2.74
	≥ 80 and < 295	2.68/2.65
	≥ 295	2.61/2.58
Glycol cooled	< 80	2.56/2.53
	≥ 80 and < 295	2.24/2.21
	≥ 295	2.21/2.18
Glycol cooled with fluid economizer	< 80	2.51/2.48
	≥ 80 and < 295	2.19/2.16
	≥ 295	2.15/2.12
Upflow-nonducted / Horizontal		
Air cooled	<65	2.16/2.65
	≥ 65 and < 240	2.04/2.55
	≥ 240	1.89/2.47
Air cooled with fluid economizer	<65	2.09/2.65
	≥ 65 and < 240	1.99/2.55
	≥ 240	1.81/2.47
Water cooled	<65	2.43/2.79
	≥ 65 and < 240	2.32/2.68
	≥ 240	2.20/2.60
Water cooled with fluid economizer	<65	2.35/2.71
	≥ 65 and < 240	2.24/2.60
	≥ 240	2.12/2.54
Glycol cooled	<65	2.08/2.48
	≥ 65 and < 240	1.90/2.18
	≥ 240	1.81/2.18
Glycol cooled with fluid economizer	<65	2.00/2.44
	≥ 65 and < 240	1.82/2.10
	≥ 240	1.73/2.10

*Net sensible cooling capacity = Total Gross - Latent - Fan Power

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Line #	*System* Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
355	Ceiling Mounted DX Computer Room Air Conditioners and Condensing Units (Excludes Chilled Water Computer Room Air Handlers)	Air conditioner and condenser performance meeting IECC 2021 Table C403.3.2(16) / ASHRAE 90.1-2019 Table 6.8.9-17 Computer rooms shall have dedicated air-side HVAC systems. **The Baseline Repository has specific additional requirements for data center equipment. These must also be applied to the baseline. The Baseline Repository is available on the MA Energy Efficiency Advisory Council website (ma-eeac.org).**	Computer room air conditioners with performance exceeding baseline requirements. For new data centers designed with central chiller plants, consult the PA regarding savings potential.

Line #	*Equipment Type*	*Net Sensible Cooling Capacity (MBH)**	*Min SCOP Efficiency (ducted / nonducted)*
356			
357	Air cooled with free air discharge condenser	< 29	2.05/2.08
358		≥ 29 and < 65	2.02/2.05
359		≥ 65	1.92/1.94
360	Air cooled with free air discharge condenser with fluid economizer	< 29	2.01/2.04
361		≥ 29 and < 65	1.97/2.00
362		≥ 65	1.87/1.89
363	Air cooled with ducted condenser	< 29	1.86/1.89
364		≥ 29 and < 65	1.83/1.86
365		≥ 65	1.73/1.75
366	Air cooled with fluid economizer and ducted condenser	< 29	1.82/1.85
367		≥ 29 and < 65	1.78/1.81
368		≥ 65	1.68/1.70
369	Water cooled	< 29	2.38/2.41
370		≥ 29 and < 65	2.28/2.31
371		≥ 65	2.18/2.20
372	Water cooled with fluid economizer	< 29	2.33/2.36
373		≥ 29 and < 65	2.23/2.26
374		≥ 65	2.13/2.16
375	Glycol cooled (40% PG)	< 29	1.97/2.00
376		≥ 29 and < 65	1.93/1.98
377		≥ 65	1.78/1.81
378	Glycol cooled (40% PG) with fluid economizer	< 29	1.92/1.95
379		≥ 29 and < 65	1.88/1.93
380		≥ 65	1.73/1.76
381	*Net sensible cooling capacity = Total Gross - Latent - Fan Power		

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Line #	***System*** Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
382 383	Walk-in coolers/ freezers, Refrigerated warehouse coolers/ freezers	**(ISP) This baseline requirement varies from code in some cases:** The following system features are considered baseline: · Automatic door closer controls · EC motors on all evaporator and condenser fans < 1 hp · Doorways shall have strip doors, curtains, spring-hinged doors, or other method of minimizing infiltration when doors are open. · Timer to turn lights off within 15 minutes of occupants leaving · LED lighting · Temperature based defrost termination control · On/Off type antisweat door heater controls (baseline shall assume that heater controls reduce heater run time by 46% for freezers and by 74% for coolers.) · Wall, ceiling, and door minimum insulation R-25 (coolers) or R-32 (freezers) · Floor minimum insulation R-28 (freezers) For transparent reach-in doors connected to walk-in freezers or coolers: · For walk-in *Freezers* : Triple pane glass with inert gas or with heat-reflective treated glass or vacuum insulated glazing for transparent reach-in doors for walk-in freezer and windows in walk-in freezer doors · For walk-in *Coolers* : Double pane glass with heat reflective treated glass and gas filled, or triple pane glass for transparent reach-in doors for walk-in coolers and windows in walk-in cooler doors IECC per Section C403.11 ASHRAE: per Section 6.4.5	1. Coolers with insulation > R-25 (wall, ceiling, or door) 2. Freezers with insulation > R-32 (wall, ceiling, or door) 3. Walk-in freezers with floor insulation > R-28 4. Hot gas defrost 5. Heat recovery off of condensers 6. Micro-pulse antisweat door heater controls that reduce heater run time by more than baseline threshold
384	Refrigerated Display Cases (Separate from walk-in cases)	**(ISP) This baseline requirement varies from code in some cases:** The following system features are considered baseline: · Automatic lighting controls (time switch or motion sensor) · LED lighting · Temperature based defrost controls · Where antisweat heaters are installed, antisweat heater controls for low temperature (freezer) doors (baseline shall assume that heater controls reduce heater run time by 46% for freezers) IECC per Section C403.11 ASHRAE: per Section 6.4.6	1. Hot gas defrost 2. Antisweat heater controls for medium temperature doors 3. Micro-pulse antisweat door heater controls that reduce heater run time by more than baseline threshold 4. Low/no heat low temperature doors
385	Commercial Refrigerators and Freezers (Stand-Alone)	(Stand-Alone, Cabinet Type with Packaged Compressors) Performance meeting IECC Tables C403.11.1(1)&(2)/ ASHRAE Tables 6.8.1-11.	Commercial refrigeration, refrigerators, and freezers with performance exceeding baseline requirements.
386	Remote Condensers & Remote Compressors Serving Refrigeration Systems	EC motors for condenser fans < 1 hp Variable speed condenser fan control Condensing temperature reset (Min. condensing temp = 70°F) Compressors with suction pressure reset (some exceptions apply) Subcooling for compressors ≥ 100 MBH with maximum suction temperature of -10°F Cycling crankcase heaters IECC: per Section C403.11.3 ASHRAE: per Section 6.5.11	1. Minimum condensing temperature < 70°F (check manufacturer's specifications to determine if viable) 2. Subcooling where not code required 3. Floating suction pressure controls if not code required per exceptions
387	Indoor Pool Dehumidifiers (Vapor Compression Based)	All equipment types shall have a minimum MRE of 3.5 per IECC 2021 Table C403.3.2(11) and ASHRAE 90.1-2019 Table 6.8.1-12 MRE = moisture removal efficiency, a ratio of the moisture removal capacity (lbs of moisture/hr) to the input power kW of the equipment	Indoor pool dehumidifiers with performance exceeding the baseline requirements.

<table>
<tr><th colspan="5">2024 Program Year</th></tr>
<tr><th rowspan="2">Line #</th><td colspan="4">System</td></tr>
<tr><td>Sub-Category</td><td colspan="2">Baseline Minimum Standards & Practice</td><td>Potential High-Performance Practices</td></tr>
<tr><td>388</td><td>Indoor Pool Dehumidifier Energy Recovery</td><td colspan="2">*IECC ≠ ASHRAE
IECC - no requirement
*ASHRAE - for heated indoor pool over 500 ft^2, provide either an exhaust air sensible energy recovery system with sensible effectiveness ≥ 50%, a condenser heat recovery system capable of and configured to use 100% of the heat generated through dehumidification to heat the pool water, or an exhaust air energy recovery system with enthalpy effectiveness ≥ 50% per ASHRAE Section 6.5.6.4.</td><td>IECC Only -
1) Waste heat used for pool heating
2) Energy recovery (sensible or enthalpy) from exhaust air</td></tr>
<tr><td>389</td><td>Equipment Performance</td><td colspan="2">This baseline only applies to heat pump electrification projects. Where gas heating equipment is included in the design, the baseline gas equipment shall be identical to the design.
Water heating equipment and storage tanks must meet minimum performance requirements of IECC Table C404.2 / ASHRAE Table 7.8</td><td rowspan="11">Heat pump electric HW heaters</td></tr>
<tr><td>390</td><td>Gas-fired water heaters</td><td colspan="2" rowspan="10"><table>
<tr><th>Equipment Type</th><th>Size (MBH)</th><th>Minimum Efficiency</th></tr>
<tr><td rowspan="4">Storage water heaters (gas)</td><td>≤ 75</td><td>0.675-0.0015×V*, EF (≥ 20 gal & ≤ 55 gal)
0.8012 - 0.00078×V*, EF (> 55 gal & ≤100 gallons)
*ASHRAE - not specified</td></tr>
<tr><td>>75 and ≤ 105</td><td>80% Et
*ASHRAE -
Very Small DP**: UEF = 0.2674 - (0.0009 x Vr)
Low DP**: UEF = 0.5326 - (0.0012 x Vr)
Medium DP**: UEF= 0.6002 - (0.0011 x Vr)
High DP**: UEF= 0.6597 - (0.0009 x Vr)</td></tr>
<tr><td>>105 and ≤ 155</td><td>80% Et</td></tr>
<tr><td>>155</td><td>80% Et</td></tr>
<tr><td rowspan="2">Instan-taneous water heaters (gas)</td><td>> 50 and ≤ 200</td><td>0.82-0.0019×V*, EF
*ASHRAE - not specified</td></tr>
<tr><td>≥ 200</td><td>80% Et</td></tr>
<tr><td>ALL</td><td>≥ 1,000</td><td>92% Et for singular piece of equipment; 90% Et for multiple pieces of equipment (See below section for "High Input Service Water Heating Systems")
*ASHRAE - 90% Et for all systems</td></tr>
</table></td></tr>
<tr><td>391</td></tr>
<tr><td>392</td></tr>
<tr><td>393</td></tr>
<tr><td>394</td></tr>
<tr><td>395</td></tr>
<tr><td>396</td></tr>
<tr><td>397</td></tr>
<tr><td>398</td><td colspan="2">*V and Vr are both the rated volume in gallons. See code tables for additional water heater types.
** DP = draw pattern profile in the Uniform Energy Factor (UEF) test.</td></tr>
<tr><td>399</td><td>Electric Water Heaters</td><td colspan="2">For building using a heat pump water heater, an electric resistance water heater is an acceptable base case.</td><td>Heat pump water heater (air temperature and sensible heating loads within zones must be accounted for if heat is sourced from air within a conditioned space)</td></tr>
<tr><td>400</td><td>High Input Service Water Heating Systems</td><td colspan="2">For gas-fired water-heating equipment systems with total combined input capacity ≥ 1,000,000 Btu/h:
1. If one singular piece of equipment, the equipment shall have a minimum thermal efficiency of 92% Et (*ASHRAE - 90% Et).
2. If multiple pieces of equipment, the combined input-capacity-weighted-average efficiency shall be a minimum of 90% Et. (Note there are exceptions for water heaters installed in individual dwelling units and water heaters with an input capacity ≤ 100,000 Btu/hr)

IECC: per Section C404.2.1
ASHRAE: per Section 7.5.3</td><td>Heat pump electric HW heaters</td></tr>
</table>

2024 Program Year				
	System			
Line #	Sub-Category	Baseline Minimum Standards & Practice		Potential High-Performance Practices
401	Domestic Water Fixture Flowrates	**(ISP) This baseline requirement varies from code.** Rated maximum fixture flowrates per below table		Rated fixture flowrates below the baseline requirements.
402		*Equipment Type*	*Flow Rate*	
403		Showerheads	2.0 gpm	
404		Kitchen Faucets	1.5 gpm	
405		Private Lavatory Faucets	1.5 gpm	
406		Public Lavatory Faucets	0.5 gpm	
407	***Heat Recovery***	Condenser heat recovery for heating or reheating of service hot water provided the facility operates 24 hr/day, total heat capacity exceeds 6,000 MBH of heat rejection, and design service water load exceeds 1,000 MBH Heat recovery system must provide the smaller of: 1. 60% of peak heat rejection load at design conditions 2. Preheating required to raise peak hot water draw to 85˚F IECC: per Section C403.10.5 ASHRAE: per Section 6.5.6.2		Condenser heat recovery where not code required
408	***Motors***			
409	Selection	Minimum motor efficiencies per: - 60 Hz NEMA Design A, NEMA Design B, and IEC Design N Motors - Table C405.8(1) - 60 Hz NEMA Design C and IEC Design H Motors - Table C405.8(2) - Polyphase small electric motors - Table C405.8(3) - Capacitor-start capacitor-run and capacitor-start induction-run small electric motors - Table C405.8(4) *ASHRAE Section 10.4.1		Motors exceeding baseline efficiency
410	***Elevators & Escalators***			
411	Elevators	Lighting efficacy > 35 lumens/watt Ventilation fans shall be sized for no more than 0.33 watts/cfm Controls to de-energize ventilation fans and lighting systems when the elevator is stopped and unoccupied with doors closed for at least 15 minutes IECC: per Section C405.9.1 ASHRAE: per Section 10.4.3		Regenerative drives
412	Escalators	***IECC ≠ ASHRAE** Automatic controls to reduce speed Shall be designed with energy recovery when resisting overspeed in the down direction (IECC only). IECC: per Section C405.9.2 ASHRAE: per SEction10.4.4		Energy recovery (ASHRAE only)
413	***Plug-Loads***			
414	Automatic Receptacle Control	Automatic receptacle controls in at least 50% of the 125V, 15- and 20-amp receptacles in offices, conference rooms, printing/copying rooms, break rooms, classrooms, and individual workstations. Automatic receptacle controls in at least 25% of the branch circuit feeders installed for modular furniture not shown on the construction documents. Receptacles shall be controlled via time-of-day schedule, occupancy sensor, or other automated signal. IECC: per Section C405.11 ASHRAE Section 8.4.2		Automatic receptacle controls controlling >50% of all receptacles in required spaces, controlling >25% of all branch circuit feeders installed for modular furniture, or implemented in non-required space types.

2024 Program Year			
Line #	***System***		
	Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
415	***Lighting***		
416	Lighting Power (Interior)	(ISP) This baseline requirement varies from code. Baseline lighting power density (LPD) in W/ft² is the lesser of the values in 2021 IECC or 60% of the values in IECC 2015 (ISP). See Appendix B for specific baseline LPD values based on building type or space type. Per IECC and ASHRAE 90.1, there are two methods for determining LPD: the Building Area Method or the Space-by-Space Method. The same LPD modeling approach (either Building Area Method or Space-by-Space Method) must be utilized in modeling both the baseline and design.	High efficiency design including LEDs with LPD less than the maximum allowable (Field "tuning" of LED fixtures for reduced watts should be supported with clear design documentation and any tuning requirements should be outlined in MRD)
417 418 419 420	Lighting Occupancy Sensor Control	***IECC ≠ ASHRAE** Automatic occupant sensor lighting controls installed in the following space types: ▪ Classrooms/lecture/training rooms ▪ Conference/meeting/multipurpose rooms ▪ Copy/print rooms ▪ Lounges/breakrooms ▪ Enclosed offices ▪ Open plan office areas - for this space type, sensor controls must be configured to reduce general lighting in control zones independently from entire open plan office space. Each control zone must be ≤ 600 SF. ▪ Restrooms ▪ Storage Rooms ▪ Locker rooms ▪ Corridors - for this space type, controls shall uniformly reduce lighting power to not more than 50% of full power ▪ Spaces ≤ 300 SF enclosed by floor to ceiling partitions ▪ Warehouse storage areas - for this space type, sensor controls must be configured such that each aisleway lighting is controlled independently from other aisleways and open areas. IECC: per Section C405.2.1 *ASHRAE - differences in required sensor locations per Table 9.6.1 (explained in Section 9.4.1.1). Section 9.4.1.1(g) requires that stairwell lights be automatically controlled to reduce power by at least 50% within 20 minutes of all occupants leaving the space.	
421 422	Lighting Time Switch Control	Time-switch controls installed in building areas not provided with occupancy sensors. Light-reduction controls allowing occupants to manually reduce the connected lighting load in a reasonably uniform illumination pattern by at least 50% . IECC: per Section C405.2.2 & C405.2.3 ASHRAE: per Table 9.6.1 (explained in Section 9.4.1.1)	
423 424	Lighting Daylight Dimming Control	***IECC ≠ ASHRAE (some differences in exceptions)** Daylight-responsive (on/off) controls in "sidelight" and "toplight" daylight zones where there are greater than 150 watts of general lighting within primary sidelit daylight zones, 300 watts of general lighting within secondary sidelit daylight zones, and 150 watts of general lighting within toplit daylight zones; Continuous dimming down to 15% **(*20% ASHRAE)** of full light output for all daylight zone fixtures IECC: per Section C405.2.4, see Section C405.2.4.2/3 for definitions of primary/secondary sidelight and toplight zones. ASHRAE: per Table 9.6.1 (explained in Section 9.4.1.1)	1. Daylight responsive controls in spaces in health care facilities where patient care is directly provided 2. Controls for new buildings where the total connected lighting power ≤ LPAnorm × (1.0 - 0.4 × UDZFA / TBFA) (IECC Only) LPAnorm = lighting power allowanced calculated per Section C405.3.2 and reduced in accordance with Section C406.3 UDZFA = uncontrolled daylight zone floor area is the sum of all sidelit and toplit zones without daylight responsive controls TBFA = total building floor area

2024 Program Year			
Line #	***System***		
	Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
425	Lighting Dwelling Unit Controls	***IECC ≠ ASHRAE** Dwelling units shall be provided with controls to automatically turn off lights within 20 minutes after all occupants have left the space. Dwelling units shall be equipped with daylight responsive controls. IECC: per Sections C405.1 and C405.2.5 ***ASHRAE: per Section 9.4.1.3b = for all guestrooms and dwelling units, automatically turn off power to the lighting and switched receptacles in each enclosed space within 20 minutes after all occupants have left the space; bathrooms shall be controlled separately and have controls to automatically turn off bathroom lighting within 30 minutes after all occupants have left the bathroom.**	
426	Lighting Controls for Non-Visual Applications	***IECC ≠ ASHRAE** Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a time switch control that is independent of the controls for other lighting within the room or space. IECC: per Section C405.2.5 ***ASHRAE no requirement**	
427	Lighting for Plant Growth and Maintenance	***IECC ≠ ASHRAE** At least 95% of permanently installed luminaires shall have a photon efficiency of ≥ 1.6 µmol/J IECC: per Section C405.4 ***ASHRAE no requirement**	
428	Parking Garage Lighting Control	***IECC ≠ ASHRAE** · Automatic lighting shutoff required when spaces scheduled to be unoccupied (or via occupancy sensor). · Lighting power of each luminaire shall be automatically reduced by a minimum of 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones shall be no larger than 3,600 ft^2. · Transition lighting power for covered vehicle entrances and exits from building and parking structures must be automatically controlled to reduce lighting 50% from sunset to sunrise **(*ASHRAE - reduce lighting to no more than the general light level)**. · Daylight controls to reduce lighting power by at least 50% for lighting fixtures within 20 feet of any perimeter wall structure that has a minimum 40% "opening-to-wall" ratio and no exterior obstructions within 20 feet. IECC: per Section C405.2.8 / ASHRAE: per Section 9.4.1.2	Automatic parking garage lighting controls that allow for luminaires to reduce lighting power by > 30% when no activity detected for 20 minutes; > 50% lighting power reduction for covered vehicle entrances and exits from sunset to sunrise (IECC); lighting power reduction for covered vehicle entrances and exits below general light levels (ASHRAE); >50% lighting power reduction for fixtures within 20 feet of any perimeter wall structure and a minimum 40% "opening-to-wall-ratio"; daylight controls where not required
429	Exterior Lighting	**(ISP) This baseline requirement varies from code.** Baseline exterior lighting power is the lesser of the values in 2021 IECC or 67% of the values in 2015 IECC (ISP). See Appendix B for specific baseline LPD values. The baseline exterior lighting power allowance shall be based on the same illuminated area as the design case (i.e. areas with no light cannot be counted toward the baseline allowance).	High efficiency design including LEDs

2024 Program Year			
	System		
Line #	Sub-Category	Baseline Minimum Standards & Practice	Potential High-Performance Practices
430	Exterior Lighting Controls	***IECC ≠ ASHRAE** Timeclock and/or photocell controls that automatically turn off lighting fixtures as a function of available daylight. Façade and landscape lighting controls to shut off lighting no later than 1 hour after business closing and to turn on lights no earlier than 1 hour before business opening **(*ASHRAE = shut off between midnight or business closing, whichever is later, and 6AM or business opening, whichever is earlier)**. All other fixture types shall have controls to reduce connected lighting power by ≥ 50% from 12AM to 6AM, from one hour after business closing to one hour before business opening, or during any period when activity not detected for 15 minutes Outdoor parking area luminaires ≥ 78 W and mounted ≤ 24 feet above the ground shall be controlled to automatically reduce the power of each luminaire by a minimum of 50% when no activity has been detected for 15 minutes IECC: per Section C405.2.7 ASHRAE: per Section 9.4.1.4	Automatic high/low controls (for loading docks or areas with variable occupancy; no manual override ON option)

Line #	Div.	APPENDIX A - BASE CASE HVAC SYSTEM DESIGN			
		System			
		Sub-Category	Baseline Minimum Standards & Practice	Mandatory for Code Compliance regardless of path	Potential High-Performance Practices
A1	Mechanical	***Base Case HVAC System Design Based on Building Type***	In general, the baseline should reflect the same type of HVAC systems that are designed, unless the design team has seriously considered other, less efficient HVAC system types. If the design team considered multiple HVAC system types and ultimately chose a more energy efficient option, then the designed system strategy can be compared to a different baseline system type, provided that the baseline system type meets the following guidelines: 1. The baseline was actually considered for potential implementation by the design team and owner, 2. The baseline is physically, architecturally, and economically feasible for the given project, 3. The baseline type is at least as efficient as the system types outlined in Appendix A for the respective building type, 4. The PA must approve the baseline system type to be used The system types outlined in Appendix A are suggested as a minimum Industry Standard Practice for the respective building types. ASHRAE 90.1 Appendix G cannot be used to model a baseline building for Mass Save savings. Refer to the specific prescriptive code sections for all equipment performance and controls requirements.		
A2		*Equipment Sizing*	Equipment sizing shall match the design. For Integrated Design studies, sizing in the baseline model (if necessary) can only be increased to reduce unmet hours such that the total unmet hours in the baseline are similar to the design model.	N/A	In comprehensive projects, if equipment downsizing is possible via implementation of high-performance measures (e.g. improved envelope performance, reduced LPD, etc.), saving can be claimed for downsized equipment.
A3		*Use of Cooling*	The baseline shall only have cooling where it is actually designed	N/A	
A4		Hotels (Guest Rooms) (≤ 6 floors)	PTAC units with hot water fossil fuel boiler and DX cooling	N/A	
A5		Hotels (Guest Rooms) (> 6 floors) and all Multifamily	Water-source heat pumps, or 4-pipe fan coil units with HW, CHW *For multi-family buildings, consult PA to determine whether building should be considered under the Commercial program.	N/A	
A6		Nonresidential ≤ 3 floors and < 25,000 ft² OR Warehouses/ Manufacturing Space	Packaged Constant Volume AHUs with DX Cooling, and central heating section Each AHU serves no more than 5,000 ft² of conditioned space with zoning identical to the design	N/A	
A7		Nonresidential AND -4 or 5 floors and < 25,000 ft², OR - 5 floors or fewer and 25,000 ft² to 150,000 ft²	Packaged rooftop VAV with reheat, hot-water boiler and DX cooling	N/A	

Line #	Div.	APPENDIX A - BASE CASE HVAC SYSTEM DESIGN			
		System			
		Sub-Category	Baseline Minimum Standards & Practice	Mandatory for Code Compliance regardless of path	Potential High-Performance Practices
A8	**Mechanical**	Nonresidential and more than 5 floors or > 150,000 ft²	VAV with reheat, hot-water fossil fuel boiler and chilled water	N/A	
A9		Retail with ≤ 2 Floors	Packaged Constant Volume AHUs with DX Cooling, and central heating section Each AHU serves no more than 5,000 ft² of conditioned space with zoning identical to the	N/A	
A10		Schools (all sizes)	Packaged VAV air handling units with DX cooling and HW reheat for multi-zone service (e.g. classrooms, offices, etc.) Packaged Constant Volume AHUs with DX cooling for specialty spaces (e.g. auditorium, gym, cafeteria, etc.) Central HW boiler plant serving AHUs, VAV reheats, and perimeter radiant heating elements	N/A	

APPENDIX B: LIGHTING BASELINE LPD VALUES

The Mass Save Baseline Interior Lighting LPD (W/ft²) values are generally defined by Industry Standard Practice (ISP), which differs from 2021 IECC. The Baseline LPD values are equal to 60% of the 2015 IECC allowable values, unless the 2021 IECC base LPD is lower. The 2015 IECC and 2021 IECC LPD values are provided below for reference only.

Building Area Method - Interior Lighting			
Building Type	**Mass Save Baseline W/ft²**	IECC 2015 W/ft²	IECC 2021 W/ft²
Automotive facility	**0.48**	0.80	0.75
Convention center	**0.61**	1.01	0.64
Courthouse	**0.61**	1.01	0.79
Dining: bar lounge/leisure	**0.61**	1.01	0.80
Dining: cafeteria/fast food	**0.54**	0.90	0.76
Dining: family	**0.57**	0.95	0.71
Dormitory	**0.34**	0.57	0.53
Exercise center	**0.50**	0.84	0.72
Fire station	**0.40**	0.67	0.56
Gymnasium	**0.56**	0.94	0.76
Health care clinic	**0.54**	0.90	0.81
Hospital	**0.63**	1.05	0.96
Hotel/Motel	**0.52**	0.87	0.56
Library	**0.71**	1.19	0.83
Manufacturing facility	**0.70**	1.17	0.82
Motion picture theater	**0.44**	0.76	0.44
Multifamily	**0.31**	0.51	0.45
Museum	**0.55**	1.02	0.55
Office	**0.49**	0.82	0.64
Parking garage	**0.13**	0.21	0.18
Penitentiary	**0.49**	0.81	0.69
Performance arts theater	**0.83**	1.39	0.84
Police Station	**0.52**	0.87	0.66
Post office	**0.52**	0.87	0.65
Religious building	**0.60**	1.00	0.67
Retail	**0.76**	1.26	0.84
School/university	**0.52**	0.87	0.72
Sports arena	**0.55**	0.91	0.76
Town hall	**0.53**	0.89	0.69
Transportation	**0.42**	0.70	0.50
Warehouse	**0.40**	0.66	0.45
Workshop	**0.71**	1.19	0.91

*Mass Save follows Industry Standard Practice to define baseline LPD

Space-by-Space Method - Interior Lighting				
Common/Building Specific	**Space Type**	**Mass Save Baseline W/ft²**	IECC 2015 W/ft²	IECC 2021 W/ft²
Common Space types	Audience seating area - In a convention center	**0.49**	0.82	0.49
Common Space types	Audience seating area - In a gymnasium	**0.23**	0.65	0.23
Common Space types	Audience seating area - In a motion picture theater	**0.27**	1.14	0.27
Common Space types	Audience seating area - In a penetentiary	**0.17**	0.28	0.67
Common Space types	Audience seating area - In a performing arts theater	**1.16**	2.43	1.16
Common Space types	Audience seating area - In a religious building	**0.72**	1.53	0.72
Common Space types	Audience seating area - In a sports arena	**0.26**	0.43	0.33
Common Space types	Audience seating area - In an auditorium	**0.38**	0.63	0.61
Common Space types	Audience seating area - OTHERWISE	**0.26**	0.43	0.33
Common Space types	Banking activity area	**0.61**	1.01	0.61
Common Space types	Classroom/lecture hall/ training room - In a penetentiary	**0.80**	1.34	0.89
Common Space types	Classroom/lecture hall/ training room - OTHERWISE	**0.71**	1.24	0.71
Common Space types	Computer Room	**0.94**	1.71	0.94
Common Space types	Conference/meeting/multipurpose room	**0.74**	1.23	0.97
Common Space types	Copy/Print Room	**0.31**	0.72	0.31
Common Space types	Corridor - facillity for viusually impaired (not primarily used by staff)	**0.55**	0.92	0.71
Common Space types	Corridor - In a hospital	**0.47**	0.79	0.71
Common Space types	Corridor - In a manufacturing facility	**0.25**	0.41	0.25
Common Space types	Corridor - OTHERWISE	**0.40**	0.66	0.41
Common Space types	Courtroom	**1.03**	1.72	1.20
Common Space types	Dining area - facillity for viusually impaired (not primarily used by staff)	**1.14**	1.90	1.27
Common Space types	Dining area - In a penetentiary	**0.42**	0.96	0.42
Common Space types	Dining area - In bar/lounge or leisure dining	**0.64**	1.07	0.86
Common Space types	Dining area - In cafeteria or fast food dining	**0.39**	0.65	0.40
Common Space types	Dining area - In family dining	**0.53**	0.89	0.60
Common Space types	Dining area - OTHERWISE	**0.39**	0.65	0.43
Common Space types	Electrical/mechanical	**0.43**	0.95	0.43
Common Space types	Emergency vehicle parking	**0.34**	0.56	0.52
Common Space types	Food preparation	**0.73**	1.21	1.09
Common Space types	Guest room	**0.28**	0.47	0.41
Common Space types	Laboratory - In or as classrooms	**0.86**	1.43	1.11
Common Space types	Laboratory - OTHERWISE	**1.09**	1.81	1.33
Common Space types	Laundry/washing area	**0.36**	0.60	0.53
Common Space types	Loading dock, interior	**0.28**	0.47	0.88
Common Space types	Lobby - facillity for viusually impaired (not primarily used by staff)	**1.08**	1.80	1.69
Common Space types	Lobby - for an elevator	**0.38**	0.64	0.65
Common Space types	Lobby - In a hotel	**0.51**	1.06	0.51
Common Space types	Lobby - In a motion picture theater	**0.23**	0.59	0.23
Common Space types	Lobby - In a performing arts theater	**1.20**	2.00	1.25
Common Space types	Lobby - OTHERWISE	**0.54**	0.90	0.84
Common Space types	Locker room	**0.45**	0.75	0.52
Common Space types	Lounge/breakroom - In a **healthcare facility**	**0.42**	0.92	0.42
Common Space types	Lounge/breakroom - OTHERWISE	**0.44**	0.73	0.59
Common Space types	Office - enclosed (<=250 sqft)	**0.67**	1.11	0.74
Common Space types	Office - enclosed (>250 sqft)	**0.67**	1.11	0.74
Common Space types	Office - open plan	**0.59**	0.98	0.61
Common Space types	Parking area, interior	**0.11**	0.19	0.15
Common Space types	Pharmacy area	**1.01**	1.68	1.66
Common Space types	Restroom - facillity for viusually impaired (not primarily used by staff)	**0.73**	1.21	1.26
Common Space types	Restroom - OTHERWISE	**0.59**	0.98	0.63
Common Space types	Sales area	**0.95**	1.59	1.05
Common Space types	Seating area, general	**0.23**	0.54	0.23
Common Space types	Stairwell	**0.41**	0.69	0.49
Common Space types	Storage room	**0.38**	0.63	0.38
Common Space types	Vehicular Maintenance area	**0.40**	0.67	0.60
Common Space types	Workshop	**0.95**	1.59	1.26

Space-by-Space Method				
Common/Building Specific	**Space Type**	**Mass Save Baseline W/ft²**	IECC 2015 W/ft²	IECC 2021 W/ft²
Bldg. Specific Space Types	Convention center - exhibit space	**0.61**	1.45	0.61
Bldg. Specific Space Types	Dormitory - living quarters	**0.23**	0.38	0.50
Bldg. Specific Space Types	Facility for visually imparired - In a Chapel (not primarily used by staff)	**0.70**	2.21	0.70
Bldg. Specific Space Types	Facility for visually imparired - In a rec room (not primarily used by staff)	**1.45**	2.41	1.77
Bldg. Specific Space Types	Fire Station - sleeping quarters	**0.13**	0.22	0.23
Bldg. Specific Space Types	Gymnasium/fitness center - In a playing area	**0.72**	1.20	0.85
Bldg. Specific Space Types	Gymnasium/fitness center - In an exercise area	**0.43**	0.72	0.90
Bldg. Specific Space Types	Healthcare Facility - In a medical supply room	**0.44**	0.74	0.62
Bldg. Specific Space Types	Healthcare Facility - In a nursery	**0.53**	0.88	0.92
Bldg. Specific Space Types	Healthcare Facility - In a patient room	**0.37**	0.62	0.68
Bldg. Specific Space Types	Healthcare Facility - In a physical therepay room	**0.55**	0.91	0.91
Bldg. Specific Space Types	Healthcare Facility - In an exam/treatment room	**1.00**	1.66	1.40
Bldg. Specific Space Types	Healthcare Facility - In an imaging room	**0.91**	1.51	0.94
Bldg. Specific Space Types	Healthcare Facility - In an nurse's station	**0.43**	0.71	1.17
Bldg. Specific Space Types	Healthcare Facility - In an operating room	**1.49**	2.48	2.26
Bldg. Specific Space Types	Healthcare Facility - In a recovery room	**0.69**	1.15	1.25
Bldg. Specific Space Types	Library - In a reading area	**0.64**	1.06	0.96
Bldg. Specific Space Types	Library - In the stacks	**1.03**	1.71	1.18
Bldg. Specific Space Types	Manufacturing - In a detailed manufacturing area	**0.77**	1.29	0.80
Bldg. Specific Space Types	Manufacturing - In a high bay area (25- – 50-foot floor-ceiling height)	**0.74**	1.23	1.24
Bldg. Specific Space Types	Manufacturing - In a low bay area (<25-foot floor-ceiling height)	**0.71**	1.19	0.86
Bldg. Specific Space Types	Manufacturing - In an equipment room	**0.44**	0.74	0.76
Bldg. Specific Space Types	Manufacturing - In an extra high bay area (>50-foot floor-ceiling height)	**0.63**	1.05	1.42
Bldg. Specific Space Types	Museum - In a general exhibition area	**0.31**	1.05	0.31
Bldg. Specific Space Types	Museum - In a restoration room	**0.61**	1.02	1.10
Bldg. Specific Space Types	Performing arts theater - dressing room	**0.37**	0.61	0.41
Bldg. Specific Space Types	Post office - sorting area	**0.56**	0.94	0.76
Bldg. Specific Space Types	Religious building - In a fellowship hall	**0.38**	0.64	0.54
Bldg. Specific Space Types	Religious building - In a worship/pulpit/choir area	**0.85**	1.53	0.85
Bldg. Specific Space Types	Retail - In a dressing/fitting area	**0.43**	0.71	0.51
Bldg. Specific Space Types	Retail - In a mall concourse	**0.66**	1.10	0.82
Bldg. Specific Space Types	Sports arena - playing area - For a Class I facility	**2.21**	3.68	2.94
Bldg. Specific Space Types	Sports arena - playing area - For a Class II facility	**1.44**	2.40	2.01
Bldg. Specific Space Types	Sports arena - playing area - For a Class III facility	**1.08**	1.80	1.30
Bldg. Specific Space Types	Sports arena - playing area - For a Class IV facility	**0.72**	1.20	0.86
Bldg. Specific Space Types	Transportation facility - At a terminal ticket counter	**0.48**	0.80	0.51
Bldg. Specific Space Types	Transportation facility - In a baggage/carousel area	**0.32**	0.53	0.39
Bldg. Specific Space Types	Transportation facility - In an airport concourse	**0.22**	0.36	0.25
Bldg. Specific Space Types	Warehouse - storage area - For medium to bulky, palletized items	**0.33**	0.58	0.33
Bldg. Specific Space Types	Warehouse - storage area - For smaller, hand-carried items	**0.57**	0.95	0.69

*Mass Save follows Industry Standard Practice to define baseline LPD

The Mass Save Baseline for Exterior Lighting power is generally defined by Industry Standard Practice (ISP), which differs from 2021 IECC. The Baseline LPD values are the lesser of the 2021 IECC values or 67% of the 2015 IECC allowable values.

Exterior Lighting Power - Mass Save Baseline					
		Lighting Zone			
	Units	1	2	3	4
Base Allowance	Watts	335	400	500	871
Uncovered Parking Areas					
Parking Areas and Drives	W/ft²	0.0268	0.04	0.06	0.08
Building Grounds					
Walkways and ramps less than 10 ft wide	W/linear ft	0.47	0.47	0.54	0.67
Walkways and ramps 10 ft wide or greater, plaza areas, special feature areas	W/ft²	0.09	0.09	0.11	0.13
Dining Areas	W/ft²	0.44	0.44	0.50	0.64
Stairways	W/ft²	0.50	0.67	0.67	0.67
Pedestrian Tunnels	W/ft²	0.10	0.10	0.13	0.20
Landscaping	W/ft²	0.02	0.03	0.03	0.03
Building Entrances and Exits					
Pedestrian and vehicular entrances and exits	W/linear ft	13.40	13.40	20.10	20.10
Entry canopies	W/ft²	0.17	0.17	0.27	0.27
Loading docks	W/ft²	0.23	0.23	0.23	0.23
Sales Canopies					
Free-standing and attached	W/ft²	0.40	0.40	0.54	0.67
Outdoor Sales					
Open areas (including vehicle sales lots)	W/ft²	0.17	0.17	0.34	0.47
Street frontage for vehicle sales lots in addition to "open area" allowance	W/linear ft	0.00	6.70	6.70	20.10
Building Exteriors					
Building facades	W/ft²	0.00	0.05	0.08	0.10
Automated teller machines (ATM) and night depositories	Watts	135 W per location Plus 45 W per additional ATM			
Uncovered entrances and gatehouse inpection stations at guarded facilities	W/ft²	0.50	0.50	0.50	0.50
Uncovered loading areas for law enforcement, fire, ambulance and other emergency service vehicles	W/ft²	0.34	0.34	0.34	0.34
Drive-up windows and doors	Drive-thru	200 W per drive through			
Parking near 24-hour retail entrances	Entry	400 W per main entry			

Lighting Zone	Description
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed-use areas
3	All other areas not classified as lighting zone 1, 2, or 4
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

Line #	Div.	APPENDIX C - BASELINE REQUIREMENTS FOR REPLACE ON FAILURE EQUIPMENT				
		System				
		Sub-Category	Baseline Minimum Standards & Practice			Potential High-Performance Practices
C1	Mechanical	***Replace On Failure***	In general, if a specific piece of existing equipment has failed and requires replacement, the baseline performance for the replacement equipment is defined by this appendix. This appendix is only intended to be used for applications where a piece of existing failed equipment is being replaced in-kind, and the replacement unit has the same capacity as the existing system. Refer to the main body of the Baseline Document to define the baseline performance for "New Construction" equipment (e.g. ground-up new construction, gut/rehab, added capacity, etc.).			
C2		***Energy Recovery***	**This baseline requirement varies from code.** System type and effectiveness selected to match the existing unit connections, available space, and market availability without considering code.			Energy recovery effectiveness exceeding the baseline requirement.
C3		***Furnaces***	**This baseline requirement exceeds code for furnaces ≤ 225 MBH.** Warm-air furnaces with performance meeting IECC Table 403.3.2(5) / ASHRAE 90.1 2019 Table 6.8.1-5			
C4			*Type*	*<225 MBH*	*≥225 MBH*	
C5			Warm Air, Gas fired	**85% AFUE**	n/a ***ASHRAE - 81% Et**	Furnace with performance exceeding baseline requirement (e.g. condensing furnaces)
C6			Warm Air, Oil Fired	**83% AFUE**	n/a ***ASHRAE - 82% Et**	
C7			Warm Air Duct, Gas Fired	**85% AFUE**	80% Ec	
C8			Warm Air Unit Heater, Gas Fired	80% Ec		
C9			Warm Air Unit Heater, Oil Fired			
C10		***Boilers***				
C11		Selection	**This baseline requirement exceeds code for gas-fired hot-water boilers ≤ 2,500 MBH.** ***IECC ≠ ASHRAE** Hot water - non-condensing boilers with performance meeting IECC 2021 Table C403.3.2(6) / ASHRAE 90.1 2019 Table 6.8.1-6:			Boilers with performance exceeding baseline requirement Note: condensing boilers should be combined with aggressive HW reset down to at least 120°F to achieve higher operating efficiency
C12			*Capacity (Input, MBH)*	*gas-fired*	*oil-fired*	
C13			< 300	**85%**	84% AFUE	
C14			≥ 300 and ≤ 2,500	**85%**	82% Et	
C15			> 2,500	82% Ec	84% Ec	

Line #	Div.	APPENDIX C - BASELINE REQUIREMENTS FOR REPLACE ON FAILURE EQUIPMENT					
		System					
		Sub-Category	Baseline Minimum Standards & Practice				Potential High-Performance Practices
C16	Mechanical	***Cooling Systems***					
C17		Heat Pumps: Air Source (excludes VRF, see VRF section)	***IECC ≠ ASHRAE** Air-source heat pumps with performance meeting IECC 2021 Table C403.3.2(2) / ASHRAE 90.1-2019 Table 6.8.1-2				
C18				*Equipment Type*	*Size (MBH)*	*Minimum Efficiency*	
C19				Air cooled	< 65	Split: 14.3 SEER2, 7.5 HSPF2 Pkgd: 13.4 SEER2, 6.7 HSPF2	
C20				Through-the-wall	≤30	Split: 11.7 SEER2, 6.3 HSPF2 Pkgd: 11.7 SEER2, 6.3 HSPF2	
C21				Single-duct high-velocity	<65	Split: 12.0 SEER2, 6.1 HSPF2	Heat pumps with performance exceeding baseline requirements
C22				Air cooled	≥ 65 and < 135	11.0 EER & 14.1 IEER (electric heat or no heat) 10.8 EER & 13.9 IEER (other heat) 3.4 COP (47°F db/43°F wb) 2.25 COP (17°F db/ 15°F wb)	
C23					≥ 135 and < 240	10.6 EER & 13.5 IEER (electric heat or no heat) 10.4 EER & 13.3 IEER (other heat) 3.3 COP (47°F db/43°F wb) 2.05 COP (17°F db/ 15°F wb)	
C24					≥ 240	9.5 EER & 12.5 IEER (electric heat or no heat) 9.3 EER & 12.3 IEER (other heat) 3.2 COP (47°F db/43°F wb) 2.05 COP (17°F db/ 15°F wb)	
C25		Ground-source Heat Pumps	Ground-source heat pumps with performance meeting IECC 2021 Table C403.3.2(14) / ASHRAE 90.1-2019 Table 6.8.1-15				
C26				*Equipment Type*	*Size (MBH)*	*Minimum Efficiency*	
C27				Water to Air: Water Loop	<17	12.2 EER (86°F EWT) 4.3 COP (68°F EWT)	
C28					≥ 17 and < 65	13.0 EER (86°F EWT) 4.3 COP (68°F EWT)	
C29					≥ 65 and < 135	13.0 EER (86°F EWT) 4.3 COP (68°F EWT)	Heat pumps with performance exceeding baseline requirements
C30				Water to Air: Ground Water	<135	18.0 EER (59°F EWT) 3.7 COP (50°F EWT)	
C31				Brine to Air: Ground Loop	<135	14.1 EER (77°F EWT) 3.2 COP (32°F EWT)	
C32				Water to Water: Water Loop	<135	10.6 EER (86°F EWT) 3.7 COP (68°F EWT)	
C33				Water to Water: Ground Water	<135	16.3 EER (59°F EWT) 3.1 COP (50°F EWT)	
C34				Brine to Water: Ground Loop	<135	12.1 EER (77°F EWT) 2.5 COP (32°F EWT)	

Line #	Div.	APPENDIX C - BASELINE REQUIREMENTS FOR REPLACE ON FAILURE EQUIPMENT						
		System						
		Sub-Category	Baseline Minimum Standards & Practice					Potential High-Performance Practices
C35	Mechanical	Chilled Water Plants	*(design CHWT > 35°F)*					Chillers with performance exceeding baseline requirements.
C36		Equipment Selection	Chiller performance meeting IECC 2021 Table C403.3.2(3) / ASHRAE 90.1-2019 Table 6.8.1-3.					
C37				*Equipment Type*	*Size (tons)*	*Minimum Efficiency (choose either Path A or Path B)*		
C38						*Path A*	*Path B*	
C39				Air cooled	<150	≥ 10.1 EER (FL) ≥ 13.7 EER (IPLV)	≥ 9.7 EER (FL) ≥ 15.8 EER (IPLV)	
C40					≥ 150	≥ 10.1 EER (FL) ≥ 14.0 EER (IPLV)	≥ 9.7 EER (FL) ≥ 16.1 EER (IPLV)	
C41				Air cooled w/o condenser, electrically operated	ALL	Units shall be rated with matching condensers and comply with air-cooled chiller requirements		
C42				Water cooled, electrically operated, positive displacement	< 75	≤ 0.75 kW/ton (FL) ≤ 0.6 kW/ton (IPLV)	≤ 0.78 kW/ton (FL) ≤ 0.5 kW/ton (IPLV)	
C43					≥ 75 and < 150	≤ 0.72 kW/ton (FL) ≤ 0.56 kW/ton (IPLV)	≤ 0.75 kW/ton (FL) ≤ 0.49 kW/ton (IPLV)	
C44					≥ 150 and < 300	≤ 0.66 kW/ton (FL) ≤ 0.54 kW/ton (IPLV)	≤ 0.68 kW/ton (FL) ≤ 0.44 kW/ton (IPLV)	
C45					≥ 300 and < 600	≤ 0.61 kW/ton (FL) ≤ 0.52 kW/ton (IPLV)	≤ 0.625 kW/ton (FL) ≤ 0.41 kW/ton (IPLV)	
C46					≥ 600	≤ 0.56 kW/ton (FL) ≤ 0.5 kW/ton (IPLV)	≤ 0.585 kW/ton (FL) ≤ 0.38 kW/ton (IPLV)	
C47				Water cooled, electrically operated centrifugal	<150	≤ 0.610 kW/ton (FL) ≤ 0.550 kW/ton (IPLV)	≤ 0.695 kW/ton (FL) ≤ 0.440 kW/ton (IPLV)	
C48					≥ 150 and < 300	≤ 0.610 kW/ton (FL) ≤ 0.550 kW/ton (IPLV)	≤ 0.635 kW/ton (FL) ≤ 0.4 kW/ton (IPLV)	
C49					≥ 300 and < 400	≤ 0.56 kW/ton (FL) ≤ 0.52 kW/ton (IPLV)	≤ 0.595 kW/ton (FL) ≤ 0.39 kW/ton (IPLV)	
C50					≥ 400 and < 600	≤ 0.56 kW/ton (FL) ≤ 0.5 kW/ton (IPLV)	≤ 0.585 kW/ton (FL) ≤ 0.38 kW/ton (IPLV)	
C51					≥ 600	≤ 0.56 kW/ton (FL) ≤ 0.5 kW/ton (IPLV)	≤ 0.585 kW/ton (FL) ≤ 0.38 kW/ton (IPLV)	
C52				Absorption, single effect	ALL (air cooled)	≥ 0.6 COP (FL)	N/A	
C53				Absorption, single effect	ALL (water cooled)	≥ 0.7 COP (FL)	N/A	
C54				Absorption, double effect	ALL (indirect fired)	≥ 1.0 COP (FL) ≥ 1.05 COP (IPLV)	N/A	
C55				Absorption, double effect	ALL (direct fired)	≥ 1.0 COP (FL) ≥ 1.0 COP (IPLV) ***ASHRAE - no requirement**	N/A	

Line #	Div.	APPENDIX C - BASELINE REQUIREMENTS FOR REPLACE ON FAILURE EQUIPMENT					
		System					
		Sub-Category	Baseline Minimum Standards & Practice				Potential High-Performance Practices
C56	Mechanical	Variable Refrigerant Flow (VRF) Heat Pumps	VRF heat pump performance meeting IECC 2021 Table C403.3.2(9) / ASHRAE 90.1-2019 Table 6.8.1-9				VRF heat pumps with performance exceeding baseline requirements.
C57				*Equipment Type*	*Size (MBH)*	*Minimum Efficiency (VRF multisplit)*	
C58				VRF air cooled (cool mode)	< 65	13 SEER (all heat types)	
C59					≥ 65 and < 135	11.0 EER & 14.6 IEER (electric heat/no heat) 10.8 EER & 14.4 IEER (heat recovery, electric heat/no heat)	
C60					≥ 135 and < 240	10.6 EER & 13.9 IEER (electric heat/no heat) 10.4 EER & 13.7 IEER (heat recovery, electric heat/no heat)	
C61					≥ 240	9.5 EER & 12.7 IEER (electric heat/no heat) 9.3 EER & 12.5 IEER (heat recovery, electric heat/no heat)	
C62				VRF water source (cool mode)	< 65	12.0 EER & 16 IEER; 86°F EWT 11.8 EER & 15.8 IEER; 86°F EWT (heat recovery)	
C63					≥ 65 and < 135	12.0 EER & 16 IEER; 86°F EWT 11.8 EER & 15.8 IEER; 86°F EWT (heat recovery)	
C64					≥ 135 and < 240	10.0 EER & 14.0 IEER; 86°F EWT 9.8 EER & 13.8 IEER; 86°F EWT (heat recovery)	
C65					≥ 240	10.0 EER & 12.0 IEER; 86°F EWT 9.8 EER & 11.8 IEER; 86°F EWT (heat recovery)	
C66				VRF groundwater source (cool mode)	<135	16.2 EER; 59°F EWT 16.0 EER; 59°F EWT (heat recovery)	
C67					≥ 135	13.8 EER; 59°F EWT 13.6 EER; 59°F EWT (heat recovery)	
C68				VRF ground source (cool mode)	<135	13.4 EER; 77°F EWT 13.2 EER; 77°F EWT (heat recovery)	
C69					≥ 135	11.0 EER; 77°F EWT 10.8 EER; 77°F EWT (heat recovery)	
C70				VRF air cooled (heat mode)	< 65	7.7 HSPF	
C71					≥ 65 and < 135	3.3 COP (47°F db/ 43°F wb); 2.25 COP (17°F db / 15°F wb)	
C72					≥ 135	3.2 COP (47°F db/ 43°F wb); 2.05 COP (17°F db / 15°F wb)	
C73				VRF water source (heat mode)	<135	4.3 COP; 68°F EWT	
C74					≥ 135 and < 240	4.0 COP; 68°F EWT	
C75					≥ 240	3.9 COP; 68°F EWT	
C76				VRF groundwater source (heat mode)	<135	3.6 COP; 50°F EWT	
C77					≥ 135	3.3 COP; 50°F EWT	
C78				VRF ground source (heat mode)	<135	3.1 COP; 32°F EWT	
C79					≥ 135	2.8 COP; 32°F EWT	