FOR PROPOSALS TO THE 2019 DENVER BUILDING CODE AMENDMENTS AND THE 2021 INTERNATIONAL CODES

2021 CODE DEVELOPMENT CYCLE

1) Name: **John Arent** **Date:** **5/9/2022**

Email: **Jarent@noresco.com** **Representing (organization or self): Denver**

2) One proposal per this document is to be provided with clear and concise information.

Is a separate graphic file provided ("X" to answer): ___ Yes or ___ No

3) Highlight the code and acronym that applies to the proposal

Acronym	Code Name	Acronym	Code Name
DBC-AP	Denver Building Code–Administrative Provisions	**IPC**	International Plumbing Code
IBC	International Building Code	**IRC**	International Residential Code
IECC	International Energy Conservation Code	**IFGC**	International Fuel Gas Code
IEBC	International Existing Building Code	**IMC**	International Mechanical Code
IFC	International Fire Code	**DGC**	Denver Green Code

Please provide all the following items in your amendment proposal.

Code Sections/Tables/Figures Proposed for Revision

DGC 701.4.2 (7.4.3)

DGC 701.4.2.1 (7.4.3.2)

Proposal:

x Revision x New Text __ Delete/Substitute __ Deletion

Modify DGC as follows:

701.4.2 (7.4.3) Heating, Ventilating, and Air Conditioning. The heating, ventilating, and air conditioning shall comply with the IECC, Sections C301 and C403, with the following modifications and additions.

701.4.3.1.(7.4.3.1) Minimum Equipment Efficiencies. All *building projects* shall comply with the applicable equipment efficiency requirements in Normative Appendix B and the applicable ENERGY STAR requirements in Section 701.4.7.3.2 (7.4.7.3.2). Where equipment efficiency is not defined/listed in Normative Appendix B or in Section 701.4.7.3.2 (7.4.7.3.2), the equipment shall meet the minimum efficiency requirements defined/listed in ANSI/ASHRAE/IES Standard 90.1. Specifically, this applies to the following products in ANSI/ASHRAE/ IES Standard 90.1:

a. Table 6.8.1.3, "Water-Chilling Packages—Mini- mum Efficiency Requirements
b. Table 6.8.1-11, "Air Conditioners and Condens- ing Units Serving Computer Rooms—Minimum Efficiency Requirements." Products shall meet HVAC equipment efficiency requirements of 701.4.3.2.
c. Table 6.8.1-12, "Commercial Refrigerator and Freezers—Minimum Efficiency Requirements."
d. Table 6.8.1-13, "Commercial Refrigeration— Minimum Efficiency Requirements."
e. Table 6.8.1-14, "Vapor Compression Based Indoor Pool Dehumidifiers—Minimum Effi- ciency Requirements."
f. Table 6.8.1-15, "Electrically Operated DX- DOAS Units, Single-Package and Remote Con- denser, without Energy Recovery—Minimum Efficiency Requirements."
g. Table 6.8.1-16, "Electrically Operated DX- DOAS Units, Single Package and Remote Con- denser, with Energy Recovery—Minimum Efficiency Requirements."-

701.4.2.1 (7.4.3.2) **Minimum HVAC Equipment Performance Ratings.** All building projects with any of the following classes of equipment must meet the following minimum performance ratings at AHRI rated conditions. The following HVAC equipment performance requirements shall supersede the performance requirements in IECC Table 403.3.2(1) and Table 403.3.2(2):

DGC TABLE C403.3.2(1)
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS—MINIMUM EFFICIENCY REQUIREMENTS[c, d]

EQUIPMENT TYPE	SIZE CATEGORY	HEADING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air Conditioner, air-cooled	<65,000 Btu/h	All	Split system, three phase and applications outside US single phase	~~13.0~~ 16.0 SEER before 1/1/2023 ~~13.4~~ 16.5 SEER2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-package, three-phase and applications outside US single phase	~~13.0~~ 16.0 SEER before 1/1/2023 ~~13.4~~ 16.5 SEER2 after 1/1/2023	
Space constrained, air-cooled	≤ 30,000 Btu/h	All	Split system, three phase and applications outside US single phase	12.0 SEER before 1/1/2023 11.7 SEER2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-package, three phase and applications outside US single phase	12.0 SEER before 1/1/2023 11.7 SEER2 after 1/1/2023	
Small duct, high velocity, air-cooled	<65,000 Btu/h	All	Split system, three phase and applications outside US single phase	12.0 SEER before 1/1/2023 12.1 SEER2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	Split system and single package	11.2 EER, 12.9 IEER before 1/1/2023 12.6 EER, ~~14.8~~ 16.2 IEER after 1/1/2023	AHRI 340/360
		All Other		11.0 EER, 12.7 IEER before 1/1/2023 12.6 EER, ~~14.6~~ 16.0 IEER after 1/1/2023	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)		11.0 EER, 12.4 IEER before 1/1/2023 12.4 EER, ~~14.2~~ 16.0 IEER after 1/1/2023	AHRI 340/360
		All Other		10.8 EER, 12.2 IEER before 1/1/2023 12.2 EER, ~~14.0~~ 15.8 IEER after 1/1/2023	

TABLE C403.3.2(2)
ELECTRICALLY OPERATED AIR-COOLED UNITARY HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	HEADING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air cooled (cooling mode)	<65,000 Btu/h	All	Split system, three phase and applications outside US single phase	14.0 SEER before 1/1/2023 14.3 SEER2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023

			Single-package, three-phase and applications outside US single phase	14.0 SEER before 1/1/2023 13.4 SEER2 after 1/1/2023	
Space constrained, air-cooled (cooling mode)	≤ 30,000 Btu/h	All	Split system, three phase and applications outside US single phase	12.0 SEER before 1/1/2023 11.7 SEER2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-package, three phase and applications outside US single phase	12.0 SEER before 1/1/2023 11.7 SEER2 after 1/1/2023	
Single duct, high velocity, air-cooled (cooling mode)	<65,000 Btu/h	All	Split system, three phase and applications outside US single phase	12.0 SEER before 1/1/2023 12.0 SEER2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER, 12.2 IEER before 1/1/2023 12.2 EER, ~~14.1~~ 16.0 IEER after 1/1/2023	AHRI 340/360
		All Other		10.8 EER, 12.7 IEER before 1/1/2023 12.2 EER, ~~13.9~~ 15.8 IEER after 1/1/2023	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)		10.6 EER, 11.6 IEER before 1/1/2023 ~~10.6~~ 11.8 EER, ~~13.5~~ 16.0 IEER after 1/1/2023	AHRI 340/360
		All Other		10.4 EER, 11.4 IEER before 1/1/2023 ~~10.6~~ 11.8 EER, ~~13.5~~ 15.8 IEER after 1/1/2023	
	≥ 240,000 Btu/h	Electric resistance (or none)		9.5 EER, 10.6 IEER before 1/1/2023 ~~9.5~~ 11.0 EER, ~~12.5~~ 15.0 IEER after 1/1/2023	
		All Other		9.3 EER, 10.4 IEER before 1/1/2023 ~~9.3~~ 10.8 EER, ~~12.3~~ 14.8 IEER after 1/1/2023	
Air cooled (heating mode)	≤ 65,000 Btu/h	All	Split system, three phase and applications outside US single phase	8.2 HSPF before 1/1/2023 ~~7.5~~ 8.5 HSPF2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single package, three phase and applications outside US single-phase	8.0 HSPF before 1/1/2023 ~~6.7~~ 7.6 HSPF2 after 1/1/2023	
Air cooled (heating mode)	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	All	47F db/43F wb outdoor air	3.30 COP_H before 1/1/2023 ~~3.4~~ 3.6 COP_H after 1/1/2023	AHRI 340/360
			17F db/15F wb outdoor air	~~2.25~~ 2.4 COPH	
	≥ 135,000 Btu/h and < 240,000 Btu/h	All	47F db/43F wb outdoor air	3.20 COP_H before 1/1/2023 ~~3.3~~ 3.45 COPH after 1/1/2023	AHRI 340/360

			17F db/15F wb outdoor air	~~2.05~~ 2.3 COP_H	
	≥ 240,000 Btu/h	All Other	47F db/43F wb outdoor air	3.20 COP_H	
			17F db/15F wb outdoor air	~~2.05~~ 2.2 COP_H	

Supporting Information:

Purpose: this proposal establishes higher minimum efficiency requirements for packaged HVAC equipment for the voluntary Denver Green Code. The Denver building base efficiency code uses federal minimum efficiency requirements, and due to federal preemption, these cannot be set more stringent in the base code. Moreover, essentially all system control features and efficiency options are already required by code. However, the Denver Green Code presents a significant savings opportunity.

A related proposal adjusts the energy efficiency credits in the Denver Building Code (IECC), to (1) require additional efficiency to get credit points and (2) establish a higher efficiency tier for additional credit points. The credit points for packaged equipment should be based on both full-load and part-load efficiency metrics, where present.

Reason: Equipment with this performance is widely available for the identified equipment types but projects do not often specify high-performance equipment, in part due to poor performance characterization, and in part due to cost. ASHRAE's SPC 205 Committee is in the process of revising performance specifications for HVAC equipment to be used with energy simulation software, but these specifications are not yet available. Identifying this savings opportunity will motivate designers to specify high-performance equipment, which should lead to an increase in market adoption and a potential decrease in unit cost. The performance of many classes of HVAC equipment is constrained by federal preemption. An increase in specification of high-efficiency equipment would send specifiers and policymakers a signal that the availability of and demand for high-efficiency equipment can help accelerate the timeline for raising federal minimum efficiency standards.

Focusing on part-load performance metrics for high-performance equipment aligns with high performance and best-in-class product capabilities. Through the use of variable speed drives and sophisticated controls, equipment have achieved high part-load performance ratings, with comparably small gains in full-load performance. In commercial buildings, equipment runs most often at part-load, and equipment with high part-load performance will save additional energy. The current IECC credit points are limited to equipment that is only slightly more efficient than federal minimums.

Substantiation: The summary tables below compare recommended performance requirements with minimum federal efficiency standards. Multiple manufacturers have equipment that can meet these requirements. While this is a voluntary Standard, in some cases equipment with these performance levels can provide a life-cycle cost that is competitive with standard-efficiency equipment.

The proposed minimum performance requirements for packaged units greater than 65,000 Btu/h cooling capacity was developed with a review of all equipment rated in the AHRI directory that meet minimum federal efficiency standards. The proposed values for EER and IEER for large packaged equipment correspond to the 80th percentile of efficiency. Large numbers of equipment can meet this proposed efficiency requirement for the Denver Green Code.

SZAC (65-135 kBtu/h)	EER	IEER
Code Min (1/23)	11	14.6
Median	12.2	14.2
75%ile	12.2	15.5
80%ile	**12.6**	**16**

SZHP (65-135 kBtu/h)	EER	IEER
Code Min (1/23)	10.8	13.9
Median	11.5	14
75%ile	12	16
80%ile	**12.1**	**16**

SZAC (135-240 kBtu/h)	EER	IEER
Code min (1/23)	10.8	14

Median	12	17.1
75%ile	12.2	18.6
80%ile	**12.34**	**19**

Bibliography and Access to Materials (as needed when substantiating material is associated with the amendment proposal):

2013 Title 24 Building Efficiency Standards, California Energy Commission. https://ww2.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF-REV2.pdfhttps://ww2.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF-REV2.pdf

2021 AHRI. AHRI Directory for Large Unitary Equipment. https://www.ahrinet.org/certification/ahri-certification-programs/unitary-large-equipment

Other Regulations Proposed to be Affected

***For proposals to delete content from the 2019 Denver Green Code in conjunction with adding it to other mandatory Denver codes and/or regulations, only.**

Please identify which other mandatory codes or regulations are suggested to be updated (if any) to accept relocated content.

Referenced Standards :

N/A

Impact:

How will this proposal impact cost and restrictiveness of code? (”X” answer for each item below)

Cost of construction:	____ Increase	___ Decrease	_x_ No Impact
Cost of design:	___ Increase	___ Decrease	_x_ No Impact
Restrictiveness:	_x_ Increase	___ Decrease	___ No Impact