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Proposed Change 1832

Code Reference(s):	**NECB20 Div.B 5.2.12.1. (first printing)**
Subject:	HVAC Equipment Efficiency Table
Title:	New Performance Metrics for Small Single-Phase Air Conditioners and Heat Pumps
Description:	This proposed change introduces new energy metrics for small single-phase air conditioners and heat pumps.

This change could potentially affect the following topic areas:

- ☐ Division A
- ☐ Division C
- ☐ Building operations
- ☑ Small Buildings
- ☐ Fire Protection
- ☐ Accessibility
- ☐ Building Envelope
- ☑ Heating, Ventilating and Air Conditioning
- ☑ Division B
- ☐ Design and Construction
- ☐ Housing
- ☑ Large Buildings
- ☐ Occupant safety in use
- ☐ Structural Requirements
- ☑ Energy Efficiency
- ☐ Plumbing
- ☐ Construction and Demolition Sites

Problem

Effective January 1, 2023, the US Department of Energy (DOE) introduced a series of new energy performance metrics (EER2, SEER2 and HSPF2) in DOE 10 CFR, Part 430-2022, "Energy, Energy Conservation Program for Consumer Products," that is applicable to small single-phase air-cooled air conditioners and air-source heat pumps. These metrics are similar to the previous ones (EER, SEER and HSPF), but use different test conditions that are considered to be more realistic. Larger units and three-phase models are not affected by this amendment.

With the publication of the Regulations Amending the Energy Efficiency Regulations, 2016 (Amendment 17), SOR/2022-265, on December 7, 2022, the Canadian Energy Efficiency Regulations, 2016 (EER), SOR/2016-311, were aligned with DOE 10 CFR, Part 430-2022 by requiring the minimum performance levels to be expressed with the new metrics. As a result, a discrepancy is caused between the NECB and the EER. If manufacturers provided product labels only using the new metrics, the products available on the market could potentially have issues with their conformance to the NECB.

Moreover, it is anticipated that single-phase variable refrigerant flow systems will also be tested to the new test conditions.

This discrepancy will lead to gaps in the Code, and Code users will be unable to evaluate whether HVAC equipment performance complies with the NECB requirements. This, in turn, will lead to difficulties for enforcement officials when determining compliance.

Justification

This proposed change to the NECB updates the reference to the 2022 amendment to DOE 10 CFR, Part 430 and introduces the new energy performance metrics. To facilitate compliance with the NECB, this proposed change maintains the alignment of the NECB with the Energy Efficiency Regulations, 2016 (EER), as amended by SOR/2022-265 (Amendment 17), and ASHRAE 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings," as well as industry practice by US manufacturers.

Amendment 17 generally presents two sets of performance requirements to the EER: the first came into force on January 1, 2023, and the second comes into force on January 1, 2025.

Considering that the NECB 2025 will be published and adopted after January 1, 2025, these requirements, where applicable, should be included in the 2025 edition of the NECB. Amendment 17 also updates the required minimum performance levels for small variable refrigerant flow systems using the same test conditions.

Furthermore, where the NECB has requirements that were and remain more stringent than the EER, the performance levels of the NECB have been retained and converted to the new metrics using the following references:

- Understanding SEER2: Minimum SEER Rating In 2023 State-By-State (learnmetrics.com)
- Understanding HSPF2 Rating For Heat Pumps (New 2023 Metric) (learnmetrics.com)

PROPOSED CHANGE

NECB20 Div.B 5.2.12.1. (first printing)

[5.2.12.1.] 5.2.12.1. Unitary and Packaged HVAC Equipment

[1] 1) Unitary and packaged HVAC equipment and components with the capacities listed in Tables 5.2.12.1.-A to 5.2.12.1.-P shall comply with the performance requirements stated therein. (See Notes A-5.2.12.1.(1) and A-5.2.12.1.(1) and 6.2.2.1.(1).) (See also Article 6.2.2.4.)

Table [5.2.12.1.-A] 5.2.12.1.-A
Performance Requirements for Air-Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated (1)
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)
Single-phase air conditioners and heat pumps, single-package, space-constrained	< 19	DOE 10 CFR, Part 430-2022, Subpart B, Appendix M1	See standard	SEER2 = 12.4 / HSPF2 V = 5.4 (3) (4)
Single-phase air conditioners and heat pumps, single-package, others				SEER2 = 14.3 / HSPF2 V = 6.3 (3) (4)
Single-phase air conditioners and heat pumps, split-system, others				SEER2 = 12.4 / HSPF2 V = 5.4 (3) (4)
Single-phase air conditioners and heat pumps, split-system, space-constrained				SEER2 = 14.3 / HSPF2 V = 6.6 (4)
Single-phase air conditioners and heat pumps, split-system, small-duct and high-velocity				SEER2 = 12.4 / HSPF2 V = 5.0 (3) (4)
Air conditioners and heat pumps, ~~S~~single-package, space-constrained	< 19	CSA C656	See standard	SEER = 13 / HSPF V = 6.4 (4)
Air conditioners and heat pumps, ~~S~~single-package, others				SEER = 15 / HSPF V = 7.4 (4)
Air conditioners and heat pumps, ~~S~~split-system, space-constrained				SEER = 13 / HSPF V = 6.4 (4)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)
Air conditioners and heat pumps, ~~S~~split-system, others				SEER = 15 / HSPF V = ~~7.4~~7.8 (4)
Air conditioners and heat pumps, split-system, ~~S~~small-duct~~,~~ and high-velocity				SEER = 13 / HSPF V = 5.9 (4)
Large air conditioners and heat pumps, split-system and single-package, all electrical phases, in cooling mode	≥ 19 and < 40	CAN/CSA-C746	Electric resistance heating section or no heating section	EER = 11.2 IEER = 12.9
			Other types of heating sections	EER = 11.0 IEER = 12.7
	≥ 40 and < 70		Electric resistance heating section or no heating section	EER = 11.0 IEER = 12.4
			Other types of heating sections	EER = 10.8 IEER = 12.2
	≥ 70 and < 223		Electric resistance heating section or no heating section	EER = 10.0 IEER = 11.6
			Other types of heating sections	EER = 9.8 IEER = 11.4

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)
	≥ 223	ANSI/AHRI 340/360	Electric resistance heating section or no heating section	EER = 9.7 IEER = 11.2
			Other types of heating sections	EER = 9.5 IEER = 11.0
Large heat pumps, split-system and single-package, all electrical phases, in heating mode	≥ 19 and < 40	CAN/CSA-C746	at 8.3ºC	COP_h = 3.30
			at –8.3ºC	COP_h = 2.25
	≥ 40 and < 70		at 8.3ºC	COP_h = 3.20
			at –8.3ºC	COP_h = 2.05
	≥ 70 and < 223		at 8.3ºC	COP_h = 3.20
			at –8.3ºC	COP_h = 2.05
	≥ 223	ANSI/AHRI 340/360	at 8.3ºC	COP_h = 3.20
			at –8.3ºC	COP_h = 2.05

Notes to Table [5.2.12.1.-A] 5.2.12.1.-A:

(1) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(2) ~~(4)~~The symbols and abbreviations that appear in this column have the following meanings:

COP_h	= *coefficient of performance* in heating mode, in W/W
EER	= *energy-efficiency ratio*, in (Btu/h)/W
HSPF V	= heating seasonal performance factor for region V (see map in CSA C656), in (Btu/h)/W
HSPF2 V	= heating seasonal performance factor 2 for region V (see map in DOE 10 CFR Part 430-2022, Subpart B, Appendix M1), in (Btu/h)/W
IEER	= *integrated energy-efficiency ratio*, in (Btu/h)/W
SEER	= *seasonal energy-efficiency ratio*, in (Btu/h)/W
SEER2	= *seasonal energy-efficiency ratio* 2, in (Btu/h)/W

(3) The SEER2 and HSPF2 V metrics are similar to the SEER and HSPF V metrics, respectively, but use different test conditions, as specified in DOE 10 CFR, Part 430-2022, "Energy, Energy Conservation Program for Consumer Products." For the purpose of compliance with the Code, either pair of performance metrics may be used.

(4) SEER and SEER2 apply~~ies~~ to air conditioners;~~, and both~~ SEER, SEER2,~~and~~ HSPF V and HSPF2 V apply to heat pumps.

Table [5.2.12.1.-B] 5.2.12.1.-B
Performance Requirements for Single-Package Vertical Air Conditioners (SPVAC) and Heat Pumps (SPVHP) (1)
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)
SPVAC and SPVHP in cooling mode	< 70	CAN/CSA-C746	< 19 kW	EER = 11
			≥ 19 kW and < 40 kW	EER = 10
			≥ 40 kW and < 70 kW	EER = 10

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)
SPVHP in heating mode			< 19 kW	COP_h = 3.3
			≥ 19 kW and < 40 kW	COP_h = 3.0
			≥ 40 kW and < 70 kW	COP_h = 3.0

Notes to Table [5.2.12.1.-B] 5.2.12.1.-B:

(1) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(2) The symbols and abbreviations that appear in this column have the following meanings:

COP_h = *coefficient of performance* in heating mode, in W/W
EER = *energy-efficiency ratio*, in (Btu/h)/W

Table [5.2.12.1.-C] 5.2.12.1.-C
Performance Requirements for Water-Cooled and Evaporatively Cooled Unitary Air Conditioners – Electrically Operated
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Water-cooled and evaporatively cooled, split-system and single-package	< 19	ANSI/AHRI 210/240	< 19 kW	EER = 12.1 IEER = 12.3
Water-cooled, split-system and single-package (2)	≥ 19 and < 40	CAN/CSA-C746	Electric resistance heating section or no heating section	EER = 12.1 IEER = 13.9
			Other types of heating sections	EER = 11.9 IEER = 13.7
	≥ 40 and < 70		Electric resistance heating section or no heating section	EER = 12.5 IEER = 13.9
			Other types of heating sections	EER = 12.3 IEER = 13.7
	≥ 70 and < 223		Electric resistance heating section or no heating section	EER = 12.4 IEER = 13.6
			Other types of heating sections	EER = 12.2 IEER = 13.4
Evaporatively cooled, split and single-package (2)	≥ 19 and < 40	CAN/CSA-C746	Electric resistance heating section or no heating section	EER = 12.1 IEER = 12.3

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
			Other types of heating sections	EER = 11.9 IEER = 12.1
	≥ 40 and < 70		Electric resistance heating section or no heating section	EER = 12.0 IEER = 12.2
			Other types of heating sections	EER = 11.8 IEER = 12.0
	≥ 70 and < 223		Electric resistance heating section or no heating section	EER = 11.9 IEER = 12.1
			Other types of heating sections	EER = 11.7 IEER = 11.9
Water-cooled, split and single-package	≥ 223	ANSI/AHRI 340/360	Electric resistance heating section or no heating section	EER = 12.2 IEER = 13.5
			Other types of heating sections	EER = 12.0 IEER = 13.3
Evaporatively cooled, split and single-package			Electric resistance heating section or no heating section	EER = 11.7 IEER = 11.9
			Other types of heating sections	EER = 11.5 IEER = 11.7

Notes to Table [5.2.12.1.-C] 5.2.12.1.-C:

(1) The symbols and abbreviations that appear in this column have the following meanings:

EER = *energy-efficiency ratio*, in (Btu/h)/W
IEER = *integrated energy-efficiency ratio*, in (Btu/h)/W

(2) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A.).

Table [5.2.12.1.-D] 5.2.12.1.-D
Performance Requirements for Condensing Units
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Air-cooled (2)	≥ 40 and < 70	CAN/CSA-C746	See standard	EER = 11.2
Water-cooled and evaporatively cooled (2)				EER = 13.1
Air-cooled	≥ 70	ANSI/AHRI 366 (SI)	≥ 70 kW	EER = 10.5 IEER = 11.8
Water-cooled and evaporatively cooled				EER = 13.5 IEER = 14.0

Notes to Table [5.2.12.1.-D] 5.2.12.1.-D:

(1) The symbols and abbreviations that appear in this column have the following meanings:

EER = *energy-efficiency ratio*, in (Btu/h)/W
IEER = *integrated energy-efficiency ratio*, in (Btu/h)/W

(2) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

Table [5.2.12.1.-E] 5.2.12.1.-E
Performance Requirements for Water-Source Unitary Heat Pumps
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Water-to-air (2)	< 5	CAN/CSA-C13256-1	Water loop	COP_c = 3.58 COP_h = 4.3
	≥ 5 and < 40			COP_c = 3.81 COP_h = 4.3
	< 40		Groundwater	COP_c = 5.28 COP_h = 3.7
			Ground loop	COP_c = 4.13 COP_h = 3.2
Water-to-water	< 40	CAN/CSA-C13256-2	Water loop	COP_c = 3.11 COP_h = 3.7
			Groundwater	COP_c = 5.60 COP_h = 3.4
			Ground loop	COP_c = 4.21 COP_h = 2.8

Notes to Table [5.2.12.1.-E] 5.2.12.1.-E:

(1) The symbols and abbreviations that appear in this column have the following meanings:

COP_c = *coefficient of performance* in cooling mode, in W/W
COP_h = *coefficient of performance* in heating mode, in W/W

(2) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

Table [5.2.12.1.-F] 5.2.12.1.-F
Performance Requirements for Direct-Expansion Ground-Source Heat Pumps – Electrically Operated
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Direct-expansion ground-source heat pumps	≤ 21	CSA C748	See standard	COP_c = 3.81 COP_h = 3.1
	> 21			No requirements

Note to Table [5.2.12.1.-F] 5.2.12.1.-F:

(1) The symbols and abbreviations that appear in this column have the following meanings:

COP_c = *coefficient of performance* in cooling mode, in W/W
COP_h = *coefficient of performance* in heating mode, in W/W

Table [5.2.12.1.-G] 5.2.12.1.-G
Performance Requirements for Packaged Terminal Air Conditioners (PTAC) and Heat Pumps (PTHP), and Room Air Conditioners and Heat Pumps (1)
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)
PTAC and PTHP in cooling mode, standard and non-standard sizes	< 2.1	AHRI 310/380/CSA C744	See standard	EER = 11.9
	≥ 2.1 and < 4.4			EER = 14.1 – (1.0435 × Cap_{kW})

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)
	≥ 4.4			EER = 9.5
PTHP in heating mode, standard and non-standard sizes	< 2.1			COP_h = 3.3
	≥ 2.1 and < 4.4			COP_h = 3.67 – (0.1739 × Cap_{kW})
	≥ 4.4			COP_h = 2.9
Louvered, without reverse cycle	< 5.9	CSA C368.1	See standard	CEER = 10.7
	≥ 5.9 and ≤ 10.6			CEER = 9.0
Louvered, with reverse cycle	< 5.9			CEER = 9.8
	≥ 5.9 and ≤ 10.6			CEER = 9.3
Non-louvered, without reverse cycle	< 4.1			CEER = 9.6
	≥ 4.1 and ≤ 10.6			CEER = 9.4
Non-louvered, with reverse cycle	< 4.1			CEER = 9.3
	≥ 4.1 and ≤ 10.6			CEER = 8.7
Room air conditioners, casement only	All capacities			CEER = 9.5
Room air conditioners, casement slider				CEER = 10.4

Notes to Table [5.2.12.1.-G] 5.2.12.1.-G:

(1) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(2) The symbols and abbreviations that appear in this column have the following meanings:

CEER = combined *energy-efficiency ratio*, in (Btu/h)/W
COP_h = *coefficient of performance* in heating mode, in W/W
EER = *energy-efficiency ratio*, in (Btu/h)/W

Table [5.2.12.1.-H] 5.2.12.1.-H
Performance Requirements for Computer Room Air Conditioners
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Air-cooled, floor-mounted, with or without fluid economizer	< 23	AHRI 1361 (SI)	Downflow or upflow, ducted	SCOP = 2.67
	≥ 23 and < 86			SCOP = 2.55
	≥ 86			SCOP = 2.33
	< 23		Upflow, non-ducted	SCOP = 2.09
			Horizontal	SCOP = 2.65
	≥ 23 and < 70		Upflow, non-ducted	SCOP = 1.99
			Horizontal	SCOP = 2.55
	≥ 70		Upflow, non-ducted	SCOP = 1.81
			Horizontal	SCOP = 2.47
Water-cooled, floor-mounted, with or without fluid economizer	< 23		Downflow or upflow, ducted	SCOP = 2.74
	≥ 23 and < 86			SCOP = 2.65
	≥ 86			SCOP = 2.61
	< 23		Upflow, non-ducted	SCOP = 2.44

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
			Horizontal	SCOP = 2.71
	≥ 23 and < 70		Upflow, non-ducted	SCOP = 2.34
			Horizontal	SCOP = 2.60
	≥ 70		Upflow, non-ducted	SCOP = 2.24
			Horizontal	SCOP = 2.54
Glycol-cooled, floor-mounted, with or without fluid economizer	< 23		Downflow or upflow, ducted	SCOP = 2.48
	≥ 23 and < 86			SCOP = 2.16
	≥ 86			SCOP = 2.12
	< 23		Upflow, non-ducted	SCOP = 2.34
			Horizontal	SCOP = 2.44
	≥ 23 and < 70		Upflow, non-ducted	SCOP = 1.99
			Horizontal	SCOP = 2.10
	≥ 70		Upflow, non-ducted	SCOP = 1.94
			Horizontal	SCOP = 2.10
Air-cooled, ceiling-mounted, free air discharge condenser, with or without fluid economizer	< 8.5		Ducted	SCOP = 2.01
			Non-ducted	SCOP = 2.04
	≥ 8.5 and < 19		Ducted	SCOP = 1.97
			Non-ducted	SCOP = 2.00
	≥ 19		Ducted	SCOP = 1.87
			Non-ducted	SCOP = 1.89
Air-cooled, ceiling-mounted, ducted condenser, with or without fluid economizer	< 8.5		Ducted	SCOP = 1.82
			Non-ducted	SCOP = 1.68

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
	≥ 8.5 and < 19		Ducted	SCOP = 1.78
			Non-ducted	SCOP = 1.81
	≥ 19		Ducted	SCOP = 1.68
			Non-ducted	SCOP = 1.70
Water-cooled, ceiling-mounted, with or without fluid economizer	< 8.5		Ducted	SCOP = 2.33
			Non-ducted	SCOP = 2.36
	≥ 8.5 and < 19		Ducted	SCOP = 2.23
			Non-ducted	SCOP = 2.26
	≥ 19		Ducted	SCOP = 2.13
			Non-ducted	SCOP = 2.16
Glycol-cooled, ceiling-mounted, with or without fluid economizer	< 8.5		Ducted	SCOP = 1.92
			Non-ducted	SCOP = 1.95
	≥ 8.5 and < 19		Ducted	SCOP = 1.88
			Non-ducted	SCOP = 1.93
	≥ 19		Ducted	SCOP = 1.73
			Non-ducted	SCOP = 1.76

Note to Table [5.2.12.1.-H] 5.2.12.1.-H:

(1) The symbols and abbreviations that appear in this column have the following meanings:

SCOP = sensible *coefficient of performance*. The SCOP is a ratio that is calculated by dividing the net sensible cooling capacity, in W, by the total power input, in W (excluding re-heaters and humidifiers).

Table [5.2.12.1.-I] 5.2.12.1.-I
Performance Requirements for Variable Refrigerant Flow Systems
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Single-phase air-cooled air conditioners and heat pumps, with or without heat recovery (2)	< 19	DOE 10 CFR, Part 430-2022, Subpart B, Appendix M1	See standard	SEER2 = 14.3 / HSPF2 V = 6.6 (3) (4)
Air-cooled air conditioners and heat pumps, with or without heat recovery (2)	< 19	CSA C656	See standard	SEER = 15 / HSPF V = 7.8 (3)
Air-cooled air conditioners	≥ 19 and < 40	AHRI 1230	See standard	EER = 11.2 IEER = 15.5
	≥ 40 and < 70			EER = 11.0 IEER = 14.9
	≥ 70			EER = 10.0 IEER = 13.9
Air-source heat pumps, with or without heat recovery	≥ 19 and < 40			EER = 10.8 IEER = 14.4 COP_h = 3.30 evaluated at 8.3ºC db / 6.1ºC wb COP_h = 2.25 evaluated at –8.3ºC db / –9.4ºC wb

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
	≥ 40 and < 70			EER = 10.4 IEER = 13.7 COP_h = 3.20 evaluated at 8.3ºC db / 6.1ºC wb COP_h = 2.05 evaluated at –8.3ºC db / –9.4ºC wb
	≥ 70			EER = 9.3 IEER = 12.5 COP_h = 3.20 evaluated at 8.3ºC db / 6.1ºC wb COP_h = 2.05 evaluated at –8.3ºC db / –9.4ºC wb
Water-source heat pumps, with or without heat recovery	< 40			EER = 11.8 IEER = 15.8 COP_h = 4.3
	≥ 40			EER = 9.8 IEER = 12.0 COP_h = 4.0
Groundwater source heat pumps, with or without heat recovery	< 40			EER = 16.2 COP_h = 3.6
	≥ 40			EER = 13.8 COP_h = 3.3
Ground-source heat pumps, with or without heat recovery	< 40			EER = 13.2 COP_h = 3.1
	≥ 40			EER = 10.8 COP_h = 2.8

Notes to Table [5.2.12.1.-I] 5.2.12.1.-I:

(1) The symbols and abbreviations that appear in this column have the following meanings:

COP_h	= *coefficient of performance* in heating mode, in W/W
db	= dry-bulb outdoor air temperature
EER	= *energy-efficiency ratio*, in (Btu/h)/W
HSPF V	= heating seasonal performance factor for region V (see map in CSA C656), in (Btu/h)/W
HSPF2 V	= heating seasonal performance factor 2 for region V (see map in DOE 10 CFR Part 430-2022, Subpart B, Appendix M1), in (Btu/h)/W
IEER	= *integrated energy-efficiency ratio*, in (Btu/h)/W
SEER	= *seasonal energy-efficiency ratio*, in (Btu/h)/W
SEER2	= *seasonal energy-efficiency ratio* 2, in (Btu/h)/W
wb	= wet-bulb outdoor air temperature

(2) Components or equipment regulated in "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(3) SEER applies to air conditioners, and both SEER and HSPF V apply to heat pumps.

(4) The SEER2 and HSPF2 V metrics are similar to the SEER, EER and HSPF V metrics, respectively, but use different test conditions, as specified in DOE 10 CFR, Part 430-2022, “Energy, Energy Conservation Program for Consumer Products.” For the purpose of compliance with the Code, either group of performance metrics may be used.

Table [5.2.12.1.-J] 5.2.12.1.-J
Performance Requirements for Direct-Expansion Dedicated Outdoor Air Systems
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Air-cooled	All capacities	ANSI/AHRI 921 (SI)	See standard	ISMRE = 1.8
Air-source heat pumps			See standard	ISMRE = 1.8 ISCOP = 1.2
Water-cooled			Cooling tower / condenser water	ISMRE = 2.2
			Chilled water	ISMRE = 2.7
Water-source heat pumps			Water source	ISMRE = 1.8 ISCOP = 3.5
			Groundwater source	ISMRE = 2.3 ISCOP = 3.2
			Ground-source, closed loop	ISMRE = 2.2 ISCOP = 2.0
Air-cooled, with energy recovery			See standard	ISMRE = 2.4
Air-source heat pumps, with energy recovery			See standard	ISMRE = 2.4 ISCOP = 3.3
Water-cooled, with energy recovery			Cooling tower / condenser water	ISMRE = 2.4
			Chilled water	ISMRE = 3.0

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Water-source heat pumps, with energy recovery			Water source	ISMRE = 2.2 ISCOP = 4.8
			Groundwater source	ISMRE = 2.6 ISCOP = 4.0
			Ground-source, closed loop	ISMRE = 2.4 ISCOP = 3.8

Note to Table [5.2.12.1.-J] 5.2.12.1.-J:

(1) The symbols and abbreviations that appear in this column have the following meanings:

ISCOP = integrated seasonal *coefficient of performance*
ISMRE = integrated seasonal moisture removal efficiency, in kg of moisture/kWh

Table [5.2.12.1.-K] 5.2.12.1.-K
Performance Requirements for Packaged Water Chillers (1)
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)	
				Path A (3)	Path B (3)
Air-cooled, with or without remote condensers, all types of compressors	< 528	CAN/CSA-C743	See standard	COP_C = 2.985 IPLV = 4.048	COP_C = 2.866 IPLV = 4.669

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)	
				Path A (3)	Path B (3)
	≥ 528			COP_c = 2.985 IPLV = 4.137	COP_c = 2.866 IPLV = 4.758
Water-cooled, rotary screw, scroll, or reciprocating compressor	< 264			COP_c = 4.694 IPLV = 5.867	COP_c = 4.513 IPLV = 7.041
	≥ 264 and < 528			COP_c = 4.889 IPLV = 6.286	COP_c = 4.694 IPLV = 7.184
	≥ 528 and < 1 055			COP_c = 5.334 IPLV = 6.519	COP_c = 5.177 IPLV = 8.001
	≥ 1 055 and < 2 110			COP_c = 5.771 IPLV = 6.770	COP_c = 5.633 IPLV = 8.586
	≥ 2 110			COP_c = 6.286 IPLV = 7.041	COP_c = 6.018 IPLV = 9.264

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (2)	
				Path A (3)	Path B (3)
Water-cooled, centrifugal compressor	< 528			COP_c = 5.771 IPLV = 6.401	COP_c = 5.065 IPLV = 8.001
	≥ 528 and < 1 055			COP_c = 5.771 IPLV = 6.401	COP_c = 5.544 IPLV = 8.801
	≥ 1 055 and < 1 407			COP_c = 6.286 IPLV = 6.770	COP_c = 5.917 IPLV = 9.027
	≥ 1 407			COP_c = 6.286 IPLV = 7.041	COP_c = 6.018 IPLV = 9.264
Single-effect absorption, air-cooled	All capacities			COP_c = 0.600	
Single-effect absorption, water-cooled				COP_c = 0.700	
Double-effect absorption, indirect fire				COP_c = 1.000 IPLV = 1.050	
Double-effect absorption, direct fire				COP_c = 1.000 IPLV = 1.000	

Notes to Table [5.2.12.1.-K] 5.2.12.1.-K:

(1) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(2) The symbols and abbreviations that appear in this column have the following meanings:

COP_C = *coefficient of performance* in cooling mode, in W/W
IPLV = *integrated part-load value* (no units)

(3) Chillers are permitted to comply with either Path A or Path B of CAN/CSA-C743. Path A is generally better suited to full-load applications (i.e., where chillers operate a significant amount of the time at full load), while Path B is generally better suited to part-load applications.

Table [5.2.12.1.-L] 5.2.12.1.-L
Performance Requirements for Heat Pumps and Heat Recovery Chiller Packages
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)	
				Path A (2)	Path B (2)
Air-source heat pumps, in cooling mode	< 528	ANSI/AHRI 551/591 (SI)	See standard	COP_C = 2.836 IPLV = 3.846	COP_C = 2.723 IPLV = 4.436
	≥ 528			COP_C = 2.836 IPLV = 3.930	COP_C = 2.723 IPLV = 4.520

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)	
				Path A (2)	Path B (2)
Water-source heat pumps and heat recovery chillers, rotary screw, scroll, or reciprocating compressor, in cooling mode	< 264			COP_c = 4.659 IPLV = 5.574	COP_c = 4.287 IPLV = 6.689
	≥ 264 and < 528			COP_c = 4.645 IPLV = 5.972	COP_c = 4.459 IPLV = 6.825
	≥ 528 and < 1 055			COP_c = 5.067 IPLV = 6.193	COP_c = 4.918 IPLV = 7.601
	≥ 1 055 and < 2 110			COP_c = 5.482 IPLV = 6.432	COP_c = 5.351 IPLV = 8.157
	≥ 2 110			COP_c = 5.072 IPLV = 6.689	COP_c = 5.717 IPLV = 8.801
Water-source heat pumps and heat recovery chillers, centrifugal compressor, in cooling mode	< 264			COP_c = 5.482 IPLV = 6.081	COP_c = 4.812 IPLV = 7.601

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)	
				Path A (2)	Path B (2)
	≥ 264 and < 528			COP_C = 5.482 IPLV = 6.081	COP_C = 5.267 IPLV = 6.361
	≥ 528 and < 1 055			COP_C = 5.972 IPLV = 6.432	COP_C = 5.621 IPLV = 8.567
	≥ 1 055			COP_C = 5.972 IPLV = 6.689	COP_C = 5.717 IPLV = 8.801

Notes to Table [5.2.12.1.-L] 5.2.12.1.-L:

(1) The symbols and abbreviations that appear in this column have the following meanings:

COP_C = *coefficient of performance* in cooling mode, in W/W
IPLV = *integrated part-load value* (no units)

(2) Chillers are permitted to comply with either Path A or Path B of CAN/CSA-C743. Path A is generally better suited to full-load applications (i.e., where chillers operate a significant amount of the time at full load), while Path B is generally better suited to part-load applications.

Table [5.2.12.1.-M] 5.2.12.1.-M
Performance Requirements for Heat Pumps and Heat-Recovery Chiller Packages Based on Leaving Water Temperature
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions (1)	Minimum Performance (2)		
				If LWT = 40°C	If LWT = 50°C	If LWT = 60°C
Air-source heat pumps, in heating mode	All capacities	ANSI/AHRI 551/591 (SI)	EAT = 8°C db / 6°C wb	COP_h = 3.350	COP_h = 2.720	COP_h = 2.330
			EAT = –8°C db / –9°C wb	COP_h = 2.250	COP_h = 1.920	COP_h = 1.640
Water-source heat pumps, rotary screw, scroll, reciprocating or centrifugal compressor, in heating mode	< 1 055		EST / LST = 12°C / 7°C	COP_h = 4.760	COP_h = 3.610	COP_h = 2.660
			EST / LST = 24°C / 19°C	—	—	COP_h = 3.530
	≥ 1 055		EST / LST = 12°C / 7°C	COP_h = 5.060	COP_h = 3.880	COP_h = 2.950
			EST / LST = 24°C / 19°C	—	—	COP_h = 3.870
Heat-recovery chillers, rotary screw, scroll, reciprocating or centrifugal compressor, simultaneous heating and cooling modes	< 1 055		EST / LST = 12°C / 7°C	COP_{hr} = 8.550	COP_{hr} = 6.290	COP_{hr} = 4.390

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions (1)	Minimum Performance (2)		
				If LWT = 40°C	If LWT = 50°C	If LWT = 60°C
			EST / LST = 24°C / 19°C	—	—	COP_{hr} = 6.100
	≥ 1 055		EST / LST = 12°C / 7°C	COP_{hr} = 9.140	COP_{hr} = 6.850	COP_{hr} = 4.960
			EST / LST = 24°C / 19°C	—	—	COP_{hr} = 6.800

Notes to Table [5.2.12.1.-M] 5.2.12.1.-M:

(1) The symbols and abbreviations that appear in this column have the following meanings:

db = dry-bulb outdoor air temperature
EAT = entering air temperature
EST = entering source temperature
LST = leaving source temperature
wb = wet-bulb outdoor air temperature

(2) The symbols and abbreviations that appear in this column have the following meanings:

COP_h = *coefficient of performance* in heating mode, in W/W
COP_{hr} = *coefficient of performance* in heat-recovery mode, in W/W
LWT = leaving water temperature

Table [5.2.12.1.-N] 5.2.12.1.-N
Performance Requirements for Boilers
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Electric	< 88	(2)	—	Must be equipped with automatic water temperature control (3)
	≥ 88		—	—
Gas-fired (4)	< 88	CAN/CSA-P.2	See standard	AFUE = 90% (water) (3) AFUE = 82% (steam) (3)
	≥ 88 and < 733	DOE 10 CFR, Part 431, Subpart E, Appendix A	See standard	E_t ≥ 90% (water) E_t ≥ 81% (steam)
	≥ 733 and < 2 930		See standard	E_c ≥ 90% (water) E_t ≥ 82% (steam)
Oil-fired	< 88	CAN/CSA-P.2	See standard	AFUE = 86% (water) AFUE = 85% (steam)
	≥ 88 and < 733	DOE 10 CFR, Part 431, Subpart E, Appendix A	See standard	E_t = 87% (water) E_t = 84% (steam)
	≥ 733 and < 2 930		See standard	E_c = 88% (water) E_t = 85% (steam)

Notes to Table [5.2.12.1.-N] 5.2.12.1.-N:

(1) The symbols and abbreviations that appear in this column have the following meanings:

AFUE = annual fuel utilization efficiency
E_c = *combustion efficiency*
E_t = *thermal efficiency*

(2) No standards address the heating performance efficiency of electric *boilers*; however, their *thermal efficiency* is typically normalized at 97% in the testing standards.

(3) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(4) Includes propane.

Table [5.2.12.1.-O] 5.2.12.1.-O
Performance Requirements for Warm-Air Furnaces, Combination Warm-Air Furnace/Air-conditioning Units, Duct Furnaces and Unit Heaters
Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Electric *furnaces*	< 66	DOE 10 CFR, Part 430, Subpart B, Appendix Aa (2)	—	FER = 0.044 × Q_{max} + 165 (3) (4)
	≥ 66	(2)		—
Gas-fired warm-air *furnaces* (5) (6)	≤ 66	CAN/CSA-P.2 and DOE 10 CFR, Part 430, Subpart B, Appendix Aa	Without integrated cooling	AFUE = 95% (3) FER = 0.044 × Q_{max} + 195
			Outdoor *furnaces* with integrated cooling	AFUE = 78% (3) FER = 0.044 × Q_{max} + 199
			Through-the-wall, with integrated cooling	AFUE = 90% (3) FER = 0.044 × Q_{max} + 195
		ANSI Z21.47/CSA 2.3	Three-phase electric supply	AFUE = 78% or E_t = 80%
	> 66 and ≤ 117		See standard	E_t = 81%
Gas-fired packaged *furnaces* (5)	≤ 2 931	CAN/CSA-P.8, Annex C	See standard	E_t = 80%

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Gas-fired duct *furnaces* (5) (6)	≤ 2 931	ANSI Z83.8/CSA 2.6	See standard	E_t = 81%
Gas-fired *unit heaters* (3) (5)	≤ 2 931	CAN/CSA-P.11	See standard	E_t = 82%
Oil-fired warm-air *furnaces*	≤ 66	CAN/CSA-P.2	See standard	E_t = 84.5% AFUE = 85% (3)
	> 66	CSA B140.4	See standard	E_t = 82%
Oil-fired duct *furnaces* and *unit heaters*	All capacities	CSA B140.4	See standard	E_t = 81%

Notes to Table [5.2.12.1.-O] 5.2.12.1.-O:

(1) The symbols and abbreviations that appear in this column have the following meanings:

AFUE = annual fuel utilization efficiency
E_t = *thermal efficiency*
FER = fan energy rating, in W per 472 L/s
Q_{max} = maximum airflow provided by the *furnace* at test conditions, in cfm

(2) No standards address the heating performance efficiency of electric *furnaces*; however, their *thermal efficiency* is typically normalized at 97% in the testing standard, which addresses fan efficiency rating only.

(3) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(4) Must be equipped with a high-efficiency constant torque or constant airflow fan motor.

(5) Includes propane.

(6) Excludes gas-fired outdoor packaged units.

Table [5.2.12.1.-P] 5.2.12.1.-P
Performance Requirements for Other Fuel-Burning Equipment and Appliances Forming Part of Sentences [5.2.12.1.] 5.2.12.1.([1] 1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance (1)
Gas-fired fireplaces and stoves, non-decorative	All capacities	CAN/CSA-P.4.1	See standard	FE = 50%, with direct vent and without standing pilot light
Solid-fuel-burning stoves	All capacities	EPA 40 CFR, Part 60, Subpart AAA and Subpart QQQQ, and CSA B415.1	See standard	—
Solid-fuel-burning *boilers*	< 2 000	DIN EN 303-5	See standard	—
Gas-fired infrared heaters, high-intensity (2) (3)	≤ 117 per burner	DIN EN 419	See standard	NRE ≥ 55%
Gas-fired infrared heaters, tubular and low-intensity (2) (3)		DIN EN 416	See standard	NRE ≥ 45%

Notes to Table [5.2.12.1.-P] 5.2.12.1.-P:

(1) The symbols and abbreviations that appear in this column have the following meanings:

E_o	= overall efficiency
FE	= fireplace efficiency
NRE	= net radiant efficiency. NRE corresponds to the ratio of useful (dry) radiant output to the heat input. CAN/ANSI/AHRI 1330, "Performance Rating for Radiant Output of Gas Fired Infrared Heaters", uses the same test methods as DIN EN 416 and DIN EN 419. However, CAN/ANSI/AHRI 1330 reports test results as gross radiant efficiency (GRE), which is the ratio between the corrected radiant output to the heat input and is about 6%–9% lower than NRE, or as infrared factor (IF), which relates to GRE.

(2) Excludes gas-fired outdoor packaged units.

(3) Includes gas-fired patio heaters, high- or low-intensity, as applicable.

Impact analysis

This proposed change would help Code users and authorities having jurisdiction to assess whether equipment conforms to the Code.

This proposed change is expected to be cost neutral because it simply aligns the NECB requirements with the Canadian Energy Efficiency Regulations, 2016.

Enforcement implications

This proposed change would facilitate enforcement since the metrics used in the NECB would align with those of the Canadian Energy Efficiency Regulations, 2016 and the US Department of Energy, Energy Conservation Program for Consumer Products.

Who is affected

Designers, engineers, architects, manufacturers, builders, specification writers and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NECB20 Div.B 5.2.12.1. (first printing)

[5.2.12.1.] 5.2.12.1. ([1] 1) [F95,F98,F99-OE1.1]