CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Proposals Based on ASHARE 90.1-2016- Part 2 of 2

Draft Code Language

Last Updated: 03-15-2017

1. INTRODUCTION

The California Statewide Utility Codes and Standards Team actively supports the California Energy Commission in developing revisions to the 2019 California Building Energy Efficiency Standards (Title 24, Part 6). Our joint intent is to achieve significant energy savings through the development of reasonable, responsible, and cost-effective code change proposals for the 2019 Title 24 code change cycle.

Current United States (U.S.) federal law does not require states to adopt building energy efficiency codes for nonresidential buildings. However, if states decide to adopt building efficiency codes for nonresidential buildings, those codes must result in energy performance that is equal to or better than the energy performance achieved through the current version of ASHRAE 90.1. In addition, energy performance is evaluated on the code as a whole – not on a measure-by-measure basis. This means that Energy Commission does not have to adopt any one measure in ASHRAE 90.1 as long as the aggregate of all measures in Title 24 result in the same or better energy performance as the aggregate of all measures in ASHRAE 90.1. (42 U.S.C. §6832-6836).

Although California is not required to adopt every measure in ASHRAE 90.1, some of the measures adopted into ASHRAE 90.1 are well-suited for California's building code. California typically reviews revisions to ASHRAE 90.1 on a measure-by-measure basis to identify potential revisions to Title 24. It should be noted that ASHRAE 90.1 Standards are designed for all states. Therefore, some of the measures in ASHRAE 90.1 are not ideally suited for California, and oftentimes the ASHRAE 90.1 Standards that are well-suited for California can be further tailored so they are more appropriate for California.

The Statewide Utility Team is proposing code change to:

1. **Fan System Power**- change the prescriptive fan power calculation methodology
2. **Exhaust Air Heat Recovery**- incorporate a prescriptive requirement for exhaust air heat recovery
3. **Equipment Efficiency**- update mandatory efficiency requirements for space conditioning equipment
4. **Transfer Air for Exhaust Air Makeup**- expand the existing requirement for kitchen exhaust transfer air to other types of exhaust systems, such as toilet and lab exhaust
5. **Demand Controlled Ventilation for Classrooms**- modify the existing mandatory requirement for demand controlled ventilation for high-density spaces, including spaces that were not previously covered- most notably, classrooms.
6. **Occupant Sensor Ventilation Requirements**- modify the existing mandatory occupant sensor ventilation requirements to allow the minimum ventilation rate to turn to zero when unoccupied and to expand the space types required to use occupant sensor ventilation.

The Statewide Utility Team is requesting feedback on the draft code language presented in this document. Input we receive will inform the code change proposal that the Statewide Utility Team will be proposing to the California Energy Commission in April 2017.

To provide feedback, please email us at info@title24stakeholders.com or contact the measure lead at:

Stefan Gracik (sgracik@integralgroup.com)

Ken Takahashi (ktakahashi@integralgroup.com)

Matt Dehghani (mdehghani@integralgroup.com)

For more information about the California Statewide Utility Codes and Standards Team's 2019 Title 24, Part 6 advocacy efforts, and the latest information on this code change proposal please visit: www.title24stakeholders.com.

2. DRAFT CODE LANGUAGE

The proposed changes to the Standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2016 documents are marked with underlining (new language) and ~~strikethroughs~~ (deletions).

2.1 Standards

2.1.1 Fan System Power

SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

Subsection 140.4(C) – Power Consumption of Fans. Each fan system with total fan system power exceeding 5 hpsed for space conditioning shall meet the requirements of Items 1, 2, 3 and 4 below. Total fan system power demand equals the sum of the power demand of all fans in the system that are required to operate at design conditions in order to supply air from the heating or cooling source to the conditioned space, and to return it back to the source or to exhaust it to the outdoors~~; however, total fan system power demand need not include (i) the additional power demand caused solely by air treatment or filtering systems with final pressure drops more than 245 pascals or one-inch water column (only the energy accounted for by the amount of pressure drop that is over 1 inch may be excluded), or (ii) fan system power caused solely by exempt process loads.~~

1. Fan Power Limitations. Each HVAC system at fan system design conditions shall not exceed the allowable fan system as listed in Table 140.4-A-1 by either the
    a. motor nameplate hp (Option 1) or
    b. fan system bhp (Option 2)

Table 140.4-A-1 Fan Power Limitation[1]

	Limit	Constant Volume	Variable Volume
Option 1: Fan *system* motor nameplate hp	Allowable *motor nameplate hp*	$hp = cfm_S \times 0.00095$	$hp = cfm_S \times 0.0013$
Option 2: Fan *system* bhp	Allowable fan *system* bhp	$bhp = cfm_S \times 0.00082 + A$	$bhp = cfm_S \times 0.0011 + A$

[1]where
cfm_S = maximum design supply airflow rate to *conditioned spaces* served by the *system* in cubic feet per minute
hp = maximum combined motor *nameplate horsepower*
bhp = maximum combined fan-brake horsepower
A = sum of $(PD \times cfm_D/4131)$
where
PD = each applicable pressure drop adjustment from Table 140.4-A-2 in in. of water

cfm_D = the design airflow through each applicable device from Table 140.4-A-2 in cubic feet per minute

Table 140.4-A-2 Fan Power Limitation Pressure Drop Adjustment

Device	**Adjustment**
Credits	
Exhaust filters, scrubbers, or other exhaust treatment	The pressure drop of device calculated at *fan system design condition*
Particulate Filtration Credit: MERV 9 through 12	0.5 in. of water
Particulate Filtration Credit: MERV 13 through 15	0.9 in. of water
Particulate Filtration Credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2× clean filter pressure drop at *fan system design condition*
Carbon and other gas-phase air cleaners	Clean filter pressure drop at *fan system design condition*
Biosafety cabinet	Pressure drop of device at *fan system design condition*
Energy recovery device, other than coil runaround loop[2]	For each airstream [(2.2 × *Enthalpy Recovery Ratio*) – 0.5] in. of water
Coil runaround loop[2]	0.6 in. of water for each airstream
Exhaust *system* serving fume hoods	0.35 in. of water

[2]Credit to be taken only when required by code

~~1. Constant volume fan systems. The total fan power index at design conditions of each fan system with total horsepower over 25 hp shall not exceed 0.8 watts per cfm of supply air.~~

2. Variable air volume (VAV) systems.

~~B.A. The total fan power index at design conditions of each fan system with total horsepower over 25 hp shall not exceed 1.25 watts per cfm of supply air;~~

EXCEPTION 1 to Section 140.4(c)1: Individual exhaust fans with motor nameplate horsepower of 1 hp or less.

EXCEPTION 2 to Section 140.4(c)1: Fan system power caused solely by exempt process loads.

2.1.2 Exhaust Air Heat Recovery

SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

(o) – Exhaust Air Heat Recovery.

1. Each fan system shall have a heat recovery system when the system's supply airflow rate exceeds the value listed in Tables 140.4-E-1 and 140.4-E-2, based on the climate zone and percentage of outdoor airflow rate at design conditions. Table ___-1 shall be used for all ventilation systems that operate less than 8000 hours per year, and Table ___-2 shall be used for all ventilation systems that operate 8000 or more hours per year.

2. Heat recovery systems required by this section shall result in a sensible energy recovery ratio of at least 70%. A 70% sensible energy recovery ratio shall mean a change in the dry bulb of the outdoor air supply equal to 70% of the difference between the outdoor air and exhaust air dry bulb at design conditions. Provision shall be made to bypass or control the energy recovery system to permit air economizer operation as required by Section 140.4(e): Economizers.

EXCEPTION 1 to Section 140.4(o): Systems serving spaces that are not cooled and that are heated to less than 60°F.

EXCEPTION 2 to Section 140.4(o): Where more than 60% of the outdoor air heating energy is provided from site-recovered energy or site-solar energy.

EXCEPTION 3 to Section 140.4(o): Heating energy recovery in Climate Zones ____

EXCEPTION 4 to Section 140.4(o): Cooling energy recovery in Climate Zones ____

EXCEPTION 5 to Section 140.4(o): Where the sum of the airflow rates exhausted and relieved within 20 ft. of each other is less than 75% of the design outdoor airflow rate, excluding exhaust air that is

1. used for another energy recovery system,
2. not allowed by ASHRAE Standard 170 for use in energy recovery systems with leakage potential, or
3. of Class 4 as defined in ASHRAE Standard 62.1.

EXCEPTION 6 to Section 140.4(o): Systems expected to operate less than 20 hours per week

Table 140.4-E-1 Exhaust Air *Energy* Recovery Requirements for *Ventilation Systems* Operating Less than 8000 Hours per Year

	% *Outdoor Air* at Full Design Airflow Rate							
	≥10% and <20%	**≥20% and <30%**	**≥30% and <40%**	**≥40% and <50%**	**≥50% and <60%**	**≥60% and <70%**	**≥70% and <80%**	**≥80%**
Climate Zone	**Design Supply Fan Airflow Rate, cfm**							
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16	NR	NR	NR	NR	NR	NR	NR	NR
15	NR	NR	NR	NR	≥26000	≥12000	≥5000	≥4000

NR-Not Required

Commented [AB1]: The values in this table are still being analyzed. Further analysis is required to outline exact requirements. Requirements will not be identical to ASHRAE 90.1-2016, but ASHRE 90.1-2016 values are shown as a placeholder.

Table 140.4-E-1 Exhaust Air *Energy* Recovery Requirements for *Ventilation Systems* Operating Greater than or Equal to 8000 Hours per Year

	% *Outdoor Air* at Full Design Airflow Rate							
	≥10% and <20%	**≥20% and <30%**	**≥30% and <40%**	**≥40% and <50%**	**≥50% and <60%**	**≥60% and <70%**	**≥70% and <80%**	**≥80%**
Climate Zone	**Design Supply Fan Airflow Rate, cfm**							
2, 3, 4, 5, 6	NR	NR	NR	NR	NR	NR	NR	NR
1, 7, 8, 9, 10, 11, 12, 13, 14, 15	NR	≥19,500	≥9000	≥5000	≥4000	≥3000	≥1500	≥120
16	≥2500	≥2000	≥1000	≥500	≥140	≥120	≥100	≥80

NR-Not Required

Commented [AB2]: The values in this table are still being analyzed. Further analysis is required to outline exact requirements. Requirements will not be identical to ASHRAE 90.1-2016, but ASHRE 90.1-2016 values are shown as a placeholder.

2.1.3 Equipment Efficiency

SECTION 110.2- MANDATORY REQUIREMENTS FOR SPACE CONDITIONING EQUIPMENT

TABLE 110.2-A ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Efficiency [a, b]		Test Procedure
		~~Before 1/1/2016~~	~~After 1/1/2016~~	
Air conditioners, air cooled both split system and single package	≥ 65,000 Btu/h and < 135,000 Btu/h	~~11.2 EER~~ ~~11.4 IEER~~	11.2 EER 12.9 IEER	ANSI/AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 12.4 IEER	ANSI/AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	~~10.1 EER~~ ~~10.2 IEER~~	10.0 EER 11.6 IEER	
	≥ 760,000 Btu/h	~~9.7 EER~~ ~~9.8 IEER~~	9.7 EER 11.2 IEER	
Air conditioners, water cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	~~12.1 EER~~ ~~12.3 IEER~~	12.1 EER 13.9 IEER	ANSI/AHRI 340/360
	≥135,000 Btu/h and < 240,000 Btu/h	~~12.5 EER~~ ~~12.5 IEER~~	12.5 EER 13.9 IEER	ANSI/AHRI 340/360
	≥240,000 Btu/h and < 760,000 Btu/h	~~12.4 EER~~ ~~12.6 IEER~~	12.4 EER 13.6 IEER	ANSI/AHRI 340/360
	≥ 760,000 Btu/h	~~12.2 EER~~ ~~12.4 IEER~~	12.2EER 13.5 IEER	ANSI/AHRI 340/360
Air conditioners, evaporatively cooled	≥65,000 Btu/h and < 135,000 Btu/h	12.1 EER[b] 12.3 IEER[b]		ANSI/AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h	12.0 EER[b] 12.2 IEER[b]		ANSI/AHRI 340/360
	≥240,000 Btu/h and < 760,000 Btu/h	11.9 EER[b] 12.1 IEER[b]		ANSI/AHRI 340/360
	≥ 760,000 Btu/h	11.7 EER[b] 11.9 IEER[b]		ANSI/AHRI 340/360
Condensing units, air cooled	≥ 135,000 Btu/h	10.5 EER 11.8 IEER		ANSI/AHRI 365
Condensing units, water cooled	≥ 135,000 Btu/h	13.5 EER 14.0 IEER		
Condensing units, evaporatively cooled	≥ 135,000 Btu/h	13.5 EER 14.0 IEER		

[a] IEERs are only applicable to equipment with capacity control as specified by ANSI/AHRI 340/360 test procedures

[b] Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

[c] Applicable test procedure and reference year are provided under the definitions.

TABLE 110.2-B UNITARY AND APPLIED HEAT PUMPS, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Efficiency [a, b]	Test Procedure[c]
		~~Before 1/1/2016~~	~~After 1/1/2016~~	
Air Cooled (Cooling Mode), both split system and single package	≥ 65,000 Btu/h and < 135,000 Btu/h	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 12.2 IEER	ANSI/AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h	~~10.6 EER~~ ~~10.7 IEER~~	10.6 EER 11.6 IEER	
	≥ 240,000 Btu/h	~~9.5 EER~~ ~~9.6 IEER~~	9.5 EER 10.6 IEER	
Water source (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	86°F entering water	13.0 EER	ISO-13256-1
Groundwater source (cooling mode)	< 135,000 Btu/h	59°F entering water	18.0 EER	ISO-13256-1
Ground source (cooling mode)	< 135,000 Btu/h	77°F entering water	14.1 EER	ISO-13256-1
Water source water-to-water (cooling mode)	< 135,000 Btu/h	86°F entering water	10.6 EER	ISO-13256-2
Groundwater source water-to-water (cooling mode)	< 135,000 Btu/h	59°F entering water	16.3 EER	ISO-13256-1
Ground source brine-to-water (cooling mode)	< 135,000 Btu/h	77°F entering water	12.1 EER	ISO-13256-2
Air Cooled (Heating Mode) Split system and single package	≥ 65,000 Btu/h and < 135,000 Btu/h	47° F db/43° F wb outdoor	3.3 COP	ANSI/AHRI 340/360
		17° F db/15° F wb outdoor	2.25 COP	
	≥ 135,000 Btu/h (cooling capacity)	47° F db/43° F wb outdoor	3.2 COP	
		17° F db/15° F wb outdoor	2.05 COP	

CONTINUED: TABLE 110.2-B UNITARY AND APPLIED HEAT PUMPS, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Efficiency [a]	Test Procedure[c]
Water source (heating mode)	< 135,000 Btu/h (cooling capacity)	68°F entering water	4.3 COP	ISO-13256-1
	≥ 135,000 Btu/h and < 240,000 Btu/h	68°F entering water	2.90 COP	
Groundwater source (heating mode)	< 135,000 Btu/h	50°F entering water	3.7 COP	ISO-13256-1
Ground source (heating mode)	< 135,000 Btu/h	32°F entering water	3.2 COP	ISO-13256-1
Water source water-to-water (heating mode)	< 135,000 Btu/h	68°F entering water	3.7 COP	ISO-13256-2
Groundwater source water-to-water (heating mode)	< 135,000 Btu/h	50°F entering water	3.1 COP	ISO-13256-2
Ground source brine-to-water (heating mode)	< 135,000 Btu/h	32°F entering water	2.5 COP	ISO-13256-2

[a] IEERs are only applicable to equipment with capacity control as specified by ANSI/AHRI 340/360 test procedures.

[b] Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

[c] Applicable test procedure and reference year are provided under the definitions.

… {Section of code omitted; no proposed changed to Table 110.2-C, or Table 110.2-D} …

TABLE 110.2-E PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Efficiency		Test Procedure [c]
PTAC (Cooling mode) Newly constructed or newly	All Capacities	95°F db Outdoor Air		14.0 - (0.300 x Cap/1000) [a] EER	
PTAC (Cooling mode)	All Capacities	95°F db Outdoor Air		10.9 - (0.213 x Cap/1000) [a] EER	
PTHP (Cooling mode) Newly constructed or newly	All Capacities	95°F db Outdoor Air		14.0 - (0.300 x Cap/1000) [a] EER	

PTHP (Cooling mode)	All Capacities	95°F db Outdoor Air		10.8 - (0.213 x Cap/1000) [a] EER	ANSI/AHRI/CSA 310/380
PTHP (Heating Mode) Newly constructed or newly	All Capacities	-		3.7 - (0.052 x Cap/1000) [a] COP	
PTHP (Heating mode)	All Capacities	-		2.9 - (0.026 x Cap/1000) [a] COP	

TABLE 110.2-E PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS (CONTINUED)

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Efficiency		Test Procedure [c]
			Before 9/23/2019	After 9/23/2019	
SPVAC (Cooling Mode)	<65,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER	11.0 EER	ANSI/AHRI 390
	≥65,000 Btu/h and <135,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
	≥135,000 Btu/h and <240,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
SPVAC (Cooling Mode) non-weatherized space constrained	≤ 30,000 Btu/h	"95^{0}F db / 75^{0}F wb outdoor air"	9.20 EER		
	> 30,000 Btu/h and ≤ 36,000 Btu/h	"95^{0}F db / 75^{0}F wb outdoor air"	9.00 EER		
SPVHP (Cooling Mode)	<65,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER	11.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
	≥135,000 Btu/h and <240,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
SPVHP (Cooling Mode) non-weatherized space constrained	≤ 30,000 Btu/h	95°F db / 75°F wb Outdoor Air	9.20 EER		
	> 30,000 Btu/h and ≤ 36,000 Btu/h	95°F db / 75°F wb Outdoor Air	9.00 EER		
SPVHP (Heating Mode)	<65,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP	3.3 COP	
	≥65,000 Btu/h and <135,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP		
	≥135,000 Btu/h and <240,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP		
SPVHP (Heating Mode) non-weatherized space constrained	≤ 30,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.00 COP		
	> 30,000 Btu/h and ≤ 36,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.00 COP		

[a] Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

[b] Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEWLY CONSTRUCTED BUILDINGS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches high or less than 42-inch-wide and having a cross-sectional area less than 670 square inches.

[c] Applicable test procedure and reference year are provided under the definitions

TABLE 110.2-E PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Efficiency		Test Procedure [c]
PTAC (Cooling mode) Newly constructed or newly	All Capacities	95°F db Outdoor Air		14.0 - (0.300 x	ANSI/AHRI/CSA 310/380
PTAC (Cooling mode)	All Capacities	95°F db Outdoor Air		10.9 - (0.213 x	
PTHP (Cooling mode) Newly constructed or newly	All Capacities	95°F db Outdoor Air		14.0 - (0.300 x Cap/1000) [a] EER	
PTHP (Cooling mode)	All Capacities	95°F db Outdoor Air		10.8 - (0.213 x	
PTHP (Heating Mode) Newly constructed or newly	All Capacities	-		3.7 - (0.052 x Cap/1000) [a] COP	
PTHP (Heating mode)	All Capacities	-		2.9 - (0.026 x Cap/1000) [a] COP	

... {Section of code omitted; no proposed changed to Table 110.2-F} ...

TABLE 110.2-E PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS (CONTINUED)

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Efficiency		Test Procedure [c]
			Before 9/23/2019	After 9/23/2019	
SPVAC (Cooling Mode)	<65,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER	11.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
	≥135,000 Btu/h and <240,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
SPVAC (Cooling Mode) non-weatherized space constrained	≤ 30,000 Btu/h	"95^{0}F db / 75^{0}F wb outdoor air"	9.20 EER		
	> 30,000 Btu/h and ≤ 36,000 Btu/h	"95^{0}F db / 75^{0}F wb outdoor air"	9.00 EER		
SPVHP (Cooling Mode)	<65,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER	11.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
	≥135,000 Btu/h and <240,000 Btu/h	95°F db / 75°F wb Outdoor Air	10.0 EER		
SPVHP (Cooling Mode) non-weatherized space constrained	≤ 30,000 Btu/h	95°F db / 75°F wb Outdoor Air	9.20 EER		
	> 30,000 Btu/h and ≤ 36,000 Btu/h	95°F db / 75°F wb Outdoor Air	9.00 EER		
	<65,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP	3.3 COP	

SPVHP (Heating Mode)	≥65,000 Btu/h and <135,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP	ANSI/AHRI 390
	≥135,000 Btu/h and <240,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP	
SPVHP (Heating Mode) non-weatherized space constrained	≤ 30,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.00 COP	
	> 30,000 Btu/h and ≤ 36,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.00 COP	

[a] Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

[b] Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEWLY CONSTRUCTED BUILDINGS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches high or less than 42-inch-wide and having a cross-sectional area less than 670 square inches.

[c] Applicable test procedure and reference year are provided under the definitions

... {Section of code omitted; no proposed changed to Table 110.2-F} ...

TABLE 110.2-G PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition	Performance Required [a, b, c, d]	Test Procedure [e]
Propeller or axial fan Open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering air wb	≥ 42.1 gpm/hp	CTI ATC-105 and CTI STD-201 RS
Centrifugal fan Open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering air wb	≥ 20.0 gpm/hp	
Propeller or axial fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering air wb	≥ 16.1 gpm/hp	
Centrifugal fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering air wb	≥ 7.0 gpm/hp	
Propeller or axial fan evaporative condensers	All	R-507A test fluid 165^{0}F entering gas temp 105^{0}F condensing temp 75^{0}F entering air wb"	≥ 157,000 Btu/h • hp	CTI ATC-106
	All	Ammonia test fluid 140^{0}F entering gas temp 96.3^{0}F condensing temp 75^{0}F entering air wb"	≥ 134,000 Btu/h • hp	
Centrifugal fan evaporative condensers	All	R-507A test fluid 165^{0}F entering gas temp 105^{0}F condensing temp 75^{0}F entering air wb"	≥ 135,000 Btu/h • hp	
	All	Ammonia test fluid 140^{0}F entering gas temp 96.3^{0}F condensing temp 75^{0}F entering air wb"	≥ 110,000 Btu/h • hp	

Air cooled condensers	All	125°F condensing temperature R22 test fluid 190°F entering gas temperature 15°F subcooling 95°F entering dry bulb	≥ 176,000 Btu/h • hp	ANSI/AHRI 460

[a] For purposes of this table, open-circuit cooling tower performance is defined as the water flow rating of the tower at the given rated conditions divided by the fan motor nameplate power.

[b] For purposes of this table, closed-circuit cooling tower performance is defined as the process water flow rating of the tower at the given rated conditions divided by the sum of the fan motor nameplate rated power and the integral spray pump motor nameplate power.

[c] For purposes of this table air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan motor nameplate power.

[d] Open cooling towers shall be tested using the test procedures in CTI ATC-105. Performance of factory assembled open cooling towers shall be either certified as base models as specified in CTI STD-201 or verified by testing in the field by a CTI approved testing agency. Open factory assembled cooling towers with custom options added to a CTI certified base model for the purpose of safe maintenance or to reduce environmental or noise impact shall be rated at 90 percent of the CTI certified performance of the associated base model or at the manufacturer's stated performance, whichever is less. Base models of open factory assembled cooling towers are open cooling towers configured in exact accordance with the Data of Record submitted to CTI as specified by CTI STD-201. There are no certification requirements for field erected cooling towers.

[e] Applicable test procedure and reference year are provided under the definitions.

For refrigerated warehouses or commercial refrigeration applications, condensers shall comply with requirements specified by Section 120.6(a) or Section 120.6(b).

TABLE 110.2-H ELECTRICALLY OPERATED VARIABLE REFRIGERANT FLOW (VRF) AIR CONDITIONERS MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure[a]
VRF Air Conditioners, Air Cooled	<65,000 Btu/h	All	VRF Multi-split System	13.0 SEER	ANSI/AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	11.2 EER ~~13.1 IEER~~ [b] ~~15.5 IEER~~ [b]	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	11.0 EER ~~12.9 IEER~~ [b] ~~14.9 IEER~~ [b]	
	≥240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	10.0 EER ~~11.6 IEER~~ [b] ~~13.9 IEER~~ [b]	

[a] Applicable test procedure and reference year are provided under the definitions.

[b] IEERs are only applicable to equipment with capacity control as specified by ANSI/AHRI 1230 test procedures.

TABLE 110.2-I ELECTRICALLY OPERATED VARIABLE REFRIGERANT FLOW AIR-TO-AIR AND APPLIED HEAT PUMPS - MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure [b]

VRF Air Cooled, (cooling mode)	<65,000 Btu/h	All	VRF Multi-split System	13.0 SEER	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System [a]	11.0 EER ~~12.9 IEER [e]~~ 14.6 IEER [c]	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System [a]	10.6 EER ~~12.3 IEER [e]~~ 13.9 IEER [c]	
	≥240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System [a]	9.5 EER ~~11.0 IEER [e]~~ 12.7 IEER [c]	
VRF Water source (cooling mode)	<65,000 Btu/h	All	VRF Multi-split systems [a] 86ºF entering water	12.0 EER 15.8 IEER [c]	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	All	VRF Multi-split System [a] 86ºF entering water	12.0 EER 15.8 IEER [c]	
	≥135,000 Btu/h	All	VRF Multi-split System [a] 86ºF entering water	10.0 EER 13.8 IEER [c]	
	≥240,000 Btu/h	All	VRF Multi-split System [a] 86ºF entering water	10.0 EER 12.0 IEER	
VRF Groundwater source (cooling mode)	<135,000 Btu/h	All	VRF Multi-split System [a] 59ºF entering water	16.2 EER	AHRI 1230
	≥135,000 Btu/h	All	VRF Multi-split System [a] 59ºF entering water	13.8 EER	
VRF Ground source (cooling mode)	<135,000 Btu/h	All	VRF Multi-split System [a] 77ºF entering water	13.4 EER	AHRI 1230
	≥135,000 Btu/h	All	VRF Multi-split System [a] 77ºF entering water	11.0 EER	

CONTINUED: TABLE 110.2-I ELECTRICALLY OPERATED VARIABLE REFRIGERANT FLOW AIR-TO-AIR AND APPLIED HEAT PUMPS - MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure [b]
	<65,000 Btu/h (cooling capacity)	- - -	VRF Multi-split System	7.7 HSPF	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	- - -	VRF Multi-split system 47ºF db/ 43ºF wb outdoor air	3.3 COP	

	(cooling capacity)		VRF Multi-split system 17ºF db/15ºF wb outdoor air	2.25 COP	
VRF Air Cooled (heating mode)	≥135,000 Btu/h (cooling capacity)	- - -	VRF Multi-split system 47ºF db/ 43ºF wb outdoor air	3.2 COP	
	≥135,000 Btu/h and <240,000 Btu/h		VRF Multi-split system 17ºF db/15ºF wb outdoor air	2.05 COP	
VRF Water source (heating mode)	<65,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68ºF entering water	4.3 COP	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68ºF entering water	~~4.2 COP~~ 4.3 COP	
	≥135,000 Btu/h and <240,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68ºF entering water	~~3.9 COP~~ 4.0 COP	
	≥240,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68ºF entering water	3.9 COP	
VRF Groundwater source (heating mode)	<135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 50ºF entering water	3.6 COP	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 50ºF entering water	3.3 COP	
VRF Ground source (heating mode)	<135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 32ºF entering water	3.1 COP	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 32ºF entering water	2.8 COP	

[a] Deduct 0.2 from the required EERs and IEERs for Variable Refrigerant Flow (VRF) Multi-split system units with a heating recovery section.

[b] Applicable test procedure and reference year are provided under the definitions.

TABLE 110.2-J WARM-AIR FURNACES AND COMBINATION WARM-AIR FURNACES/AIR-CONDITIONING UNITS, WARM-AIR DUCT FURNACES, AND UNIT HEATERS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition[b]	Minimum Efficiency[d, e]	Test Procedure[a]
		Maximum Capacity[b]	78% AFUE or	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47

Warm-Air Furnace, [illegible]	[illegible]	Maximum Capacity[b]	80% E_t	Section 2.39, Thermal Efficiency, ANSI Z21.47
[illegible]	[illegible]	Maximum Capacity[b]	78% AFUE or [illegible]	DOE 10 CFR Part 430 or Section 42, [illegible]
Warm-Air Furnace, oil-Fired	[illegible]	Maximum Capacity[b]	81% E_t	Section 42, Combustion, UL 727
Warm-Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity[b]	80% E_c	Section 2.10, Efficiency, ANSI Z83.8
Warm-Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity[b]	80% E_c	Section 2.10, Efficiency, ANSI Z83.8
Warm-Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity[b]	81% E_c	Section 40, Combustion, UL 731

[a] Applicable test procedure and reference year are provided under the definitions.

[b] Compliance of multiple firing rate units shall be at maximum firing rate.

[c] Combustion units not covered by ~~NAECA~~ the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (3-phase power or cooling capacity greater than or equal to 19 kW) may comply with either rating.

[d] E_t= thermal efficiency. Units must also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

[e] E_c= combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

[f] As of August 8, 2008, according to the Energy Policy Act of 2005, units must also include interrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper.

2.1.4 Transfer Air for Exhaust Air Makeup

Add the following to SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS:

(e) **Exhaust System Transfer Air.** Conditioned supply air delivered to any space with mechanical exhaust shall not exceed the greater of

a. the supply flow required to meet the space heating or cooling load

b. the ventilation rate required by the authority having jurisdiction, the facility Environmental Health and Safety department, or by Section 120.1

c. the mechanical exhaust flow minus the available transfer air from conditioned spaces or return air plenums on the same floor, not in different smoke or fire compartments, and that at their closest point are within 15 feet of each other. Available transfer air is that portion of outdoor ventilation air that

i. is not required to satisfy other exhaust needs,

ii. is not required to maintain pressurization of other spaces, and

iii. is transferable according to applicable codes and standards and to the class of air recirculation limitations in the California Mechanical Code

EXCEPTION 1 to Section 140.4(o): Biosafety level classified laboratories 3 or higher.

EXCEPTION 2 to Section 140.4(o): Vivarium spaces.

EXCEPTION 3 to Section 140.4(o): Spaces that are required by applicable codes and standards to be maintained at positive pressure relative to adjacent spaces. For spaces taking this exception, any transferable air that is not directly transferred shall be made available to the associated air-handling unit and shall be used whenever economizer or other options do not save more energy**.**

EXCEPTION 4 to Section 140.4(o): Spaces where the highest amount of transfer air that could be used for exhaust makeup may exceed the available transfer airflow rate and where the spaces have a required negative pressure relationship. For spaces taking this exception, any transferable air that is not directly transferred shall be made available to the associated air-handling unit and shall be used whenever economizer or other options do not save more energy.

Add the following to SECTION 140.9 – PRESCRIPTIVE REQUIREMENTS FOR COVERED PROCESSES:

(d) **Exhaust System Transfer Air**. The exhaust system transfer air requirements in section 140.4(o) also apply to covered processes.

Section 141.0 (ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL…) should be revised if necessary to clarify that the new transfer air requirement does not apply to alterations and repairs but would apply where new exhaust systems are added to existing buildings.

2.1.5 Demand Control Ventilation for Classrooms

Modify SECTION 120.1- REQUIREMENTS FOR VENTILATION 120.1(c)3 as follows:

~~3. **Required Demand Control Ventilation.** HVAC systems with the following characteristics shall have demand ventilation controls complying with 120.1(c)4:~~

~~A. They have an air economizer; and~~

~~B. They serve a space with a design occupant density, or a maximum occupant load factor for egress purposes in the CBC, greater than or equal to 25 people per 1000 square feet (40 square feet or less per person); and~~

~~C. They are either:~~

~~i. Single zone systems with any controls; or~~

~~ii. Multiple zone systems with Direct Digital Controls (DDC) to the zone level.~~

3. **Required Demand Control Ventilation.** Demand ventilation controls complying with 120.1(c)4 is required for a spaces with a design occupant density, or a maximum occupant load factor for egress purposes in the CBC, greater than or equal to 25 people per 1000 square feet (40 square feet or less per person) if the system serving the space has one or more of the following:

   A. an air economizer

   B. modulating outside air control

   C. design outdoor airflow rate > 3000 cfm

   EXCEPTION 1 to Section 120.1(c)3: ~~Classrooms, call centers, office spaces served by multiple zone systems that are continuously occupied during normal business hours with~~

~~occupant density greater than 25 people per 1000 ft² as specified by Section 120.1(b)2B, healthcare facilities and medical buildings, and public areas of social services buildings are not required to have demand control ventilation.~~ Spaces with one of the following occupancy categories as defined in the California Mechanical Code: correctional cells, daycare sickrooms, science labs, barber shops, beauty and nail salons, and bowling alley seating.

EXCEPTION 2 to Section 120.1(c)3: Where space exhaust is greater than the design ventilation rate specified in Section 120.1(b)2B minus 0.2 cfm per ft² of conditioned area.

EXCEPTION 3 to Section 120.1(c)3: Spaces that have processes or operations that generate dusts, fumes, mists, vapors, or gases and are not provided with local exhaust ventilation, such as indoor operation of internal combustion engines or areas designated for unvented food service preparation, or beauty salons shall not install demand control ventilation.

EXCEPTION 4 to Section 120.1(c)3: Spaces with an area of less than 150 square feet, or a design occupancy of less than 10 people as specified by Section 120.1(b)2B.

~~**EXCEPTION 5 to Section 120.1(c)3:** Spaces with an area of less than 1,500 square feet complying with Section 120.1(c)5.~~

2.1.6 Occupant Sensor Ventilation Requirements

Add the following definition to the definitions section:

occupied-standby mode: when a zone is scheduled to be occupied and an occupant sensor indicates zero population within the zone.

Modify SECTION 120.1- REQUIREMENTS FOR VENTILATION 120.1(c)5 as follows:

5. **Occupant Sensor Ventilation Control Devices.** When occupancy sensor ventilation devices are required by Section 120.2(e)3 ~~or when meeting EXCEPTION 5 to Section 120.1(c)3,~~ occupant sensors shall be used to reduce the rate of outdoor air flow when occupants are not present in accordance with the following:

   A. Occupant sensors shall meet the requirements in Section 110.9(b)4 and shall have suitable coverage and placement to detect occupants in the entire space ventilated. Occupant sensors controlling lighting may be used for ventilation as long as the ventilation signal is independent of daylighting, manual lighting overrides or manual control of lighting. When a single zone damper or a single zone system serves multiple rooms, there shall be an occupancy sensor in each room and the zone is not considered vacant until all rooms in the zone are vacant.

   ~~B. One hour prior to normal scheduled occupancy, the occupancy sensor ventilation control shall allow pre-occupancy purge as described in Section 120.1(c)2.~~

   ~~C. Within 30 minutes after being vacant for all rooms served by a zone damper on a multiple zone system, and the space temperature is between the heating and cooling setpoints, then no outside air is required and supply air shall be zero.~~

   ~~D. Within 30 minutes after being vacant for all rooms served by a single zone system, the single zone system shall cycle off the supply fan when the space temperature is between the heating and cooling setpoints.~~

   ~~E. In spaces equipped with an occupant sensor, when vacant during hours of expected occupancy and the occupied ventilation rate required by Section 120.1(b)2 is not provided, then the system or zone controls shall cycle or operate to maintain the average outdoor air~~

~~rate over an averaging period of 120 minutes equal to 25percent of the rate listed in TABLE 120.1-A.~~

~~**Exception to 120.1(c)5:** If Demand Control Ventilation is implemented as required by Section 120.1(4).~~

Modify SECTION 120.2- REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS 120.2(e)3 as follows:

~~3. Multipurpose room less than 1000 square feet, classrooms greater than 750 square feet and conference, convention, auditorium and meeting center rooms greater than 750 square feet that do not have processes or operations that generate dusts, fumes, vapors or gasses shall be equipped with occupant sensor(s) to accomplish the following during unoccupied periods:~~

~~A. Automatically setup the operating cooling temperature setpoint by 2°F or more and setback the operating heating temperature setpoint by 2°F or more; and~~

~~B. Automatically reset the minimum required ventilation rate with an occupant sensor ventilation control device according to Section 120.1(c)5.~~

3. **Occupied Standby Controls.** Zones serving only room(s) that are required to have occupant sensing lighting controls per sections 130.1(c)5 to 130.1(c)8, and where the ASHRAE Standard 62.1 occupancy category permits ventilation air to be reduced to zero when the space is in occupied-standby mode, shall meet the following within 5 minutes of all room(s) in that zone entering occupied-standby mode.

   C. Active heating setpoint shall be setback at least 0.5ºF, and

   D. Active cooling setpoint shall be setup at least 0.5ºF, and

   E. All airflow supplied to the zone shall be shut-off whenever the space temperature is between the active heating and cooling setpoints

   EXCEPTION 1 to Sections 120.2(e)1, 2~~, and 3~~: Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

   EXCEPTION 2 to Sections 120.2(e)1, 2~~, and 3~~: Where it can be demonstrated to the satisfaction of the enforcing agency that shutdown, setback, and setup will not result in a decrease in overall building source energy use.

   EXCEPTION 3 to Sections 120.2(e)1, 2~~, and 3~~: Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.

   EXCEPTION 4 to Sections 120.2(e)1 and 2: Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

   ~~**EXCEPTION 5 to Sections 120.2(e)3:** If Demand Control Ventilation is implemented as required by Section 120.1(c)3 and 120.1(c)(4).~~

Section 141.0 (ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL…) should be revised if necessary to clarify that the new transfer air requirement does not apply to alterations and repairs but would apply where new exhaust systems are added to existing buildings.

2.2 Reference Appendices

There are no proposed changes to the Reference Appendices.