

(2) **Lavatories.** (See *Plumbing Specialty Code*).

(3) **Piping insulation.** (See Section 1314 of this code).

(4) **Integrated systems.** Service water heating equipment used to provide additional functions (e.g., space heating) as part of a combination (integrated) system shall comply with minimum performance requirements for water heating equipment. (See also Section 1318.4.1.)

**1315.4 Noncirculating systems.** The first 8 feet (2.4 m) of outlet piping from the hot water storage tank, and the piping between the storage tank and a heat trap, shall be insulated as specified in Table 13-~~D~~1314.1.

Storage water heaters for noncirculating systems which are not equipped with integral heat traps and which have vertical pipe risers shall be installed with insulated heat traps as close as possible to both the inlet and outlet connections.

Systems without a heat trap to prevent circulation due to natural convection shall be considered circulating systems. See Section 1314.1 for circulating service water heating system piping insulation requirements.

### 1315.5 Controls.

**1315.5.1 Pump operation.** Circulating service hot water systems shall be equipped with: ~~automatic time switches or other controls that can be set to turn off the system when use of hot water is not required.~~

A control that monitors hot water demand (e.g., flow switch in cold water make-up pipe) and during periods of no hot water demand, either: a) automatically turns off the circulator pump, or b) resets down the hot water storage tank temperature.

A check valve or similar device shall be located between the circulator pump and the water heating equipment to prevent water from flowing backwards through the recirculation loop.

Comment [PRH11]: Penrod: issues around Legionella

#### Exceptions:

1. Where public health standards require 24 hours per day operation of pumps for uses such as swimming pools ~~and~~; spas and hospitals.
2. Pumps required to operate solar or waste-heat-recovery pool heating systems.
3. Service water heating systems used to provide multiple functions (e.g., space heating and DHW) as part of an integrated system.
4. Circulating service hot water systems in hospitals, medical clinics, nursing homes, or retirement lodging facilities where the pump is controlled by an aquastat.

**1315.5.2 Electric heat tapes.** Electric heat tapes installed to maintain water temperatures in pipes shall have automatic time switches or other controls that can be set to turn off the electricity to the heat tapes when use of hot water is not required.

**Exception:** Heat tapes installed for freeze protection provided they are equipped with temperature controls.

...

**1315.6.3 Heat recovery.** Heated indoor swimming pools and Spas, or and Hot tubs with water surface area greater than ~~over~~ 200 square feet in size shall provide for energy conservation by at least one of the following methods:

Comment [AS12]: ASHRAE 189

1. ~~The ventilating system shall provide a~~ **an exhaust air heat recovery of 70 percent at winter design conditions system that heats ventilation air, pool water, or domestic hot water. The heat recovery system shall be capable of decreasing the exhaust air temperature at design heating conditions by 28°F (15.5°C) in Climate Zone 1 and 42°F (23.3°C) in Climate Zone 2.**
2. Heat recovered through dehumidification shall be used to heat pool, spa or hot tub room supply air.

**Exception:** Pools, spas, or Hot tubs that include system(s) that provide equivalent recovered energy on an annual basis through one of the following methods:

- (1) ~~heated by renewable energy,~~
- (2) ~~dehumidification heat recovery, or~~
- (3) ~~waste heat recovery, or~~
- (4) **a combination of these system(s) sources capable of providing at least 70 percent of the heating energy required over an operating season.**

**1315.6.4. Required heat recovery for service water heating. Condenser heat recovery systems shall be installed for heating or preheating of service hot water under one of the following.**

**1315.6.4.1. In facilities that have more than 840,000 Btu/hr (2867 kW) of refrigeration or water-cooled chiller capacity, service water heat recovery shall be employed to recover the lesser of 20% of cooling design day refrigeration or chiller output or 70% of daily service hot water load.**

**Exceptions:**

1. **The design service water heating load is less than 500,000 Btu/h.**
2. **Buildings already employing recovery of at least 20% of available refrigeration or chiller heat rejection for some other purpose.**
3. **Chiller or refrigeration alterations or retrofits where the service water heating system is located more than 100 feet from the chiller or refrigeration system.**
4. **Buildings where the primary service water heater is a condensing boilers or heat pump water heater, or point-of-use water heaters that eliminate hot water supply and recirculation piping.**

Comment [AS13]: Create Additions & Alterations Sections for 1315

**1315.6.4.2. In facilities where the total installed heat rejection capacity of the water-cooled systems exceeds 6,000,000 Btu/h of heat rejection, condenser heat recovery systems shall be installed for heating or preheating of service hot water. The required heat recovery system shall have the capacity to provide the smaller of:**

**60% of the peak heat rejection load at design conditions or**  
**preheat of the peak service hot water draw to 85°F.**

**Exceptions:**

2. New cooling systems that meet one of the following conditions shall be exempt from the economizer requirements of Section 1317.3 providing the mechanical cooling system efficiency meets the Optional Compliance Efficiency column in Tables 1317.5.1(1), 1317.5.1(2), and 1317.5.1(4).
  - 2.1 ~~Economizer cooling is not required for new cooling Systems serving an existing dedicated computer server room, electronic equipment room or telecom switch room in existing buildings up to a total of 600,000 Btu/hr (17 586 W) of new cooling equipment.~~
  - 2.2 ~~Economizer cooling is not required for new cooling Systems serving a new dedicated computer server room, electronic equipment room or telecom switch room in existing buildings up to a total of 240,000 Btu/hr (70 344 W) of new cooling equipment.~~
3. Temperature and pump speed reset control required in sections 1318.2.4 and 1318.2.9 do not apply when all of the following are true:
  - 3.1 The building is not equipped with a direct digital control system,
  - 3.2 The pumps is are not replaced,
  - 3.3 New pumps larger than 1-1/2 horsepower are not added to the hydronic system, and
  - 3.4 Extensions of the existing system do not add more than 100 gpm (380 L/m) of system flow at design.
4. Temperature and fan speed reset control required in sections 1318.2.3 and 1318.2.5 do not apply when all of the following are true:
  - 4.1 The building is not equipped with a direct digital control system,
  - 4.2 The supply fans is are not replaced,
  - 4.3 New fans larger than 1-1/2 horsepower are not added to the fan system, and
  - 4.4 Extensions of the existing system do not add more than 15,000 cfm (7 080 L/s) of system flow at design conditions.

Comment [AS14]: CA Title 24

**1317.3 Mechanical ventilation.** Ventilation shall be provided as specified in the *Oregon Mechanical Specialty Code* and this section.

~~**1317.3.1 Fume hoods Design Ventilation and Exhaust Rates.** Buildings with fume hood systems having a total exhaust rate greater than 15,000 cfm (7 m<sup>3</sup>/s) shall include at least one of the following features: Design outdoor air ventilation and exhaust rates shall not exceed the minimum requirements specified in the *Oregon Mechanical Specialty Code* or other governing code by more than 15 percent.~~

**Exceptions:**

1. ~~Variable air volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values; or Heating and cooling unitary systems or primary sources complying with the Optional Compliance Efficiency column in Tables 1317.6.1(1), 1317.6.1(2), 1317.6.1(4), 1317.6.1(5), and 1317.6.1(6).~~
2. ~~Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (-17°C) below room set point, cooled to no cooler than 3°F (-16°C) above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control; or Systems equipped with a means~~

to automatically reduce outside air intake in proportion to occupancy below design rates when spaces are partially occupied.

- ~~3. Heat recovery systems to precondition makeup air from fume hood exhaust in accordance with Section 1318.3 Exhaust air energy recovery, without using any exception. Systems equipped with an energy recovery device with at least 50 percent recovery effectiveness.~~

**1317.3.2 Ventilation controls for high occupancy areas.** HVAC systems with ventilation air capacities of at least ~~1,500~~ **1000** CFM and serving areas having an average occupant load factor of ~~20~~ **40** or less (as established in Table 1004.1.2) shall include a means to automatically reduce outside air intake below design rates when spaces are partially occupied. Large rooms served by multiple systems with a combined ventilation air capacity of ~~1,500~~ **1000** CFM and an occupant load factor of ~~20~~ **40** or less must also meet this requirement.

Comment [AS15]: Try defining this

**Exception:** Systems equipped with an energy recovery device with at least 50% recovery effectiveness.

~~**1317.3.3 Enclosed parking garage ventilation controls**~~ **Ventilation controls for high occupancy zones.** ~~In Group S-2 parking garages, other than open parking garages, used for storing or handling automobiles operating under their own power having ventilation exhaust rates 30,000 cfm and greater shall employ automatic carbon monoxide sensing devices. These devices shall modulate the ventilation system to maintain a maximum average concentration of carbon monoxide of 50 parts per million during any eight-hour period, with a maximum concentration not greater than 200 parts per million for a period not exceeding one hour. Such system shall be designed to exhaust a minimum of 14,000 cfm (6,608 L/s) for each operating vehicle, but not less than 2.5 percent (or one vehicle) of the garage capacity. Failure of such devices shall cause the exhaust fans to operate in the on position. For HVAC systems serving multiple zones, including variable air volume (VAV) systems, Three-deck multi-zone (MZ) systems, and Variable Volume and Temperature (VVT) systems, zones for which the minimum air flow of at least 150 CFM (71 L/s) and serving areas having an average occupant load factor of 40 or less (as established in Table 1004.1.2) shall include a means to automatically reduce outside air intake below design rates when spaces are partially occupied. Large rooms served by multiple zone controls with a combined minimum air flow of at least 150 CFM (71 L/s) and an occupant load factor of 40 or less must also meet this requirement.~~

*The following blue text, while submitted by PECL, is something that I would recommend as a "fix" to current code*

**1317.3.4 Enclosed parking garage ventilation controls.** Mechanical ventilation systems in Group S-2 parking garages, other than open parking garages, used for storing or handling automobiles operating under their own power, shall meet the requirements of OMSC Section 404. Systems having ventilation exhaust rates 15,000 cfm and greater shall employ automatic carbon monoxide sensing devices. These devices shall modulate the ventilation system to maintain a maximum average concentration of carbon monoxide of 50 parts per million during any eight-hour period, with a maximum concentration not greater than 200 parts per million for a period not exceeding one hour. Failure of such devices shall cause the exhaust fans to operate in the on position.

Example of applying formula specified in 1317.5.2:

Table 1317.5.1 (3) Efficiencies:

Full Load = 0.570 kw/ton

IPLV = 0.539 kW/ton

CEWT = 80°F

Flow = 2.5 GPM/Ton

CLWT = 42°F

LIFT = 80 - 42 = 38°F

DT = (24 + 0.570 x 6.83)/2.5 = 11.1°F

X = 38 + 11.16 = 49.16°F

$K_{adj} = 6.174772 - 0.303668(49.16) + 0.00629466(49.16)^2 - 0.00004578(49.16)^3 = 1.020$

Adjusted Full Load = 0.570/1.020 = 0.559 kW/ton

NPLV = 0.539/1.020 = 0.528 kW/ton

**1317.6.3 Packaged terminal air conditioners and heat pumps.** Non-standard size packaged terminal air conditioners and heat pumps with existing sleeves having an external wall opening of less than 16 inches high or less than 42 inches wide, and having a cross-sectional area less than 670 in<sup>2</sup> shall be factory labeled as follows: Manufactured for non-standard size applications only: not to be installed in new construction projects.

<sup>6</sup> Minimum efficiency required as of January 1, 2010 shall be 10.0 EER.

**Comment [AS36]:** With amendments per ASHRAE 90.1-2007, Addendum s

**TABLE 13-M1317.6.1(2)  
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS**

EQUIPMENT TYPE	SIZE CATEGORY AT COOLING CAPACITY	HEATING SECTION TYPE	SUB CATEGORY OR RATINGS CONDITIONS	MINIMUM EFFICIENCY REQUIRED <sup>1</sup>	OPTIONAL EFFICIENCY	TEST PROCEDURE
Air Cooled (Cooling Mode)	Cooling Capacity less than $\leq 65,000$ Btu/h	All	Split Systems	13.0 SEER <sup>2</sup>	15.0 SEER 12.5 EER	ARI 210/240-9406
		All	Single Package	13.0 SEER <sup>2</sup>	15.0 SEER 12.0 EER	
Through-the-wall, air-cooled, cooling mode	$\leq 35,000$ Btu/h	All	Split Systems	12.0 SEER	14.0 SEER	
			Single Package	12.0 SEER	14.0 SEER	
Small-duct high velocity, air cooled	$\leq 65,000$ Btu/h	All	Split System	10.0 SEER	12.0 SEER	
Air Cooled (Cooling Mode)	Cooling Capacity equal to or greater than $\geq 65,000$ and less than $\leq 135,000$ Btu/h	Electric Resistance or None	Split System and Single Package	10-11.0 EER <sup>3,4</sup> 11.2 IEER	12.2 EER 12.6 IEER	
		All Other	Split System and Single Package	10.8 EER 11.0 IEER	12.0 EER 12.4 IEER	
	Cooling Capacity equal to or greater than $\geq 135,000$ and less than $\leq 240,000$ Btu/h	Electric Resistance or None	Split System and Single Package	9-10.6 EER <sup>3,5</sup> 10.7 IEER	12.2 EER 12.6 IEER	
		All Other	Split System and Single Package	10.4 EER 10.5 IEER	12.0 EER 12.4 IEER	
	Cooling Capacity equal to or greater than $\geq 240,000$ Btu/h	Electric Resistance or None	Split System and Single Package	9-09.5 EER <sup>3</sup> 9-2 IPLV <sup>3</sup> 9.6 IEER	11.0 EER 12.2 IEER	
		All Other	Split System and Single Package	9.3 EER 9.4 IEER	10.8 EER 12.0 IEER	
Water Source (Cooling Mode)	Cooling Capacity less than $\leq 17,000$ Btu/h	All	Entering Water: 86°F	11.2 EER	14.0 EER	ARI/ISO-13256-1-98
	Cooling Capacity equal to or greater than $\geq 17,000$ less than $\leq 65,000$ Btu/h	All	Entering Water: 86°F	12.0 EER	14.0 EER	
	Cooling Capacity equal to or greater than $\geq 65,000$ and less than $\leq 135,000$ Btu/h	All	Entering Water: 86°F	12.0 EER	14.0 EER	
Groundwater Source (Cooling Mode)	Cooling Capacity less than $\leq 135,000$ Btu/h	All	Entering Water: 59°F	16.2 EER	19.4 EER	ARI/ISO-13256-1-98
Ground Source (Cooling Mode)	Cooling Capacity less than $\leq 135,000$ Btu/h	All	Entering Water: 77°F	13.4 EER	16.1 EER	ARI/ISO-13256-1-98
Air Cooled (Heating Mode)	Cooling Capacity less than $\leq 65,000$ Btu/h	All	Split System	7.7 HSPF <sup>6</sup>	9.0 HSPF	ARI 210/240-9406
			Single Package	7.7 HSPF <sup>6</sup>	8.5 HSPF	
Through-the-wall, air-cooled, heating mode	$\leq 35,000$ Btu/h	All	Split System	7.4 HSPF	8.8 HSPF	
			Single Package	7.4 HSPF	8.8 HSPF	
Small-duct high velocity, air cooled	$\leq 65,000$ Btu/h	All	Split System	6.8 HSPF	8.1 HSPF	
Air Cooled (Heating Mode)	Cooling Capacity equal to or greater than $\geq 65,000$ and less than $\leq 135,000$ Btu/h	All	47°F db/43°F wb Outdoor Air	3-23.3 COP <sup>7</sup>	3.4 COP	
			17°F db/15°F wb Outdoor Air	2.2 COP	2.4 COP	
	Cooling Capacity equal to or greater than $\geq 135,000$ Btu/h	All	47°F db/43°F wb Outdoor Air	3-13.3 COP <sup>8</sup>	3.9 COP	
			17°F db/15°F wb Outdoor Air	2.0 COP	2.4 COP	

**Comment [mt37]:** Values from CEE as published Jan 2009 <http://www.cce1.org/com/hecac/hecac-main.php3>

**Comment [mt38]:** WaterFurnace Envision series can meet this

**Comment [mt39]:** WaterFurnace Envision series can meet this

Water Source (Heating Mode)	Cooling Capacity less than $\leq 135,000$ Btu/h	All	68°F Entering Water	4.2 COP	4.6 COP	ARI/ISO-13256-1-98
Ground Water Source (Heating Mode)	Cooling Capacity less than $\leq 135,000$ Btu/h	All	50°F Entering Water	3.6 COP	4.1 COP	ARI/ISO-13256-1-98
Ground Source (Heating Mode)	Cooling Capacity less than $\leq 135,000$ Btu/h	All	32°F Entering Water	3.1 COP	3.4 COP	ARI/ISO-13256-1-98

**Comment [mt40]:** WaterFurnace Envision series can meet this

**Comment [mt41]:** WaterFurnace Envision series can meet this

For SI: 1 Btu/hr = 0.2931 W, °F = 1.8 °C + 32, 1 ton = 3517 W.

- <sup>1</sup> IPLVs and part load rating conditions are only applicable to equipment with capacity modulation.
- <sup>2</sup> Replacement equipment may use a minimum efficiency of 10.0 SEER for Split Systems and 9.7 EER for Single Package.
- <sup>3</sup> Units with a heating section other than electric resistance heat may deduct 0.2 from the required EERs and IPLVs.
- <sup>4</sup> Minimum efficiency required as of January 1, 2010 shall be 11.0 EER.
- <sup>5</sup> Minimum efficiency required as of January 1, 2010 shall be 10.6 EER.
- <sup>6</sup> Replacement equipment may use a minimum efficiency of 6.6 HSPF for both Split Systems and Single Package.
- <sup>7</sup> Minimum efficiency required as of January 1, 2010 shall be 3.3 COP.
- <sup>8</sup> Minimum efficiency required as of January 1, 2010 shall be 3.3 COP.

**TABLE 13-0  
WATER CHILLING PACKAGES**

EQUIPMENT TYPE	SIZE CATEGORY	MINIMUM EFFICIENCY REQUIRED <sup>1</sup>	TEST PROCEDURE
Air Cooled, With Condenser, Electrically Operated	Less than 150 tons	2.8 COP	ARI 550-92 or ARI 590-92 as appropriate
	Equal to or greater than 150 tons	2.8 IPLV	
Air Cooled, Without Condenser, Electrically Operated	All Capacities	3.10 COP 3.10 IPLV	
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities	4.20 COP 4.65 IPLV	ARI 550-92
Water Cooled, Electrically Operated, Positive Displacement (Rotary, Screw and Scroll)	Less than 150 tons	4.45 COP 4.50 IPLV	ARI 550-92 or ARI 590-92 as appropriate
	Equal to or greater than 150 tons and less than 300 tons	4.90 COP 4.95 IPLV	
	Equal to or greater than 300 tons	5.50 COP 5.60 IPLV	
Water Cooled, Electrically Operated, Centrifugal	Less than 150 tons	5.0 COP 5.0 IPLV	ARI 550-92
	Equal to or greater than 150 tons and less than 300 tons	5.5 COP 5.5 IPLV	
	Equal to or greater than 300 tons	6.1 COP 6.1 IPLV	
Air Cooled Absorption, Single Effect	All Capacities	0.60 COP	ARI 560-92
Water Cooled Absorption, Single Effect	All Capacities	0.70 COP	
Absorption Double Effect, Indirect Fired	All Capacities	1.0 COP 1.05 IPLV	
Absorption Double Effect, Direct Fired	All Capacities	1.0 COP 1.0 IPLV	

For SI: °C = [(°F) - 32] / 1.8

<sup>1</sup> The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is less than or equal to 40°F.

**TABLE 1317.6.1(3)**  
**WATER CHILLING PACKAGES – EFFICIENCY REQUIREMENTS<sup>1</sup>**

EQUIPMENT TYPE	SIZE CATEGORY	UNITS	PATH A <sup>2</sup>		PATH B <sup>2</sup>		OPTIONAL COMPLIANCE EFFICIENCY <sup>3</sup>	TEST PROCEDURE	
			FULL LOAD	IPLV	FULL LOAD	IPLV	IPLV		
Air-Cooled Chillers	<150 tons	EER	>9.562	>12.500	NA <sup>3</sup>	NA <sup>3</sup>	>15.0	ARI 550/590-03	
	>150 tons	EER	>9.562	>12.750	NA <sup>3</sup>	NA <sup>3</sup>	>15.3		
Air-Cooled without Condenser, Electrically Operated	All Capacities	Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller efficiency requirements							
Water-Cooled, Electrically Operated, Reciprocating	All Capacities	Reciprocating units must comply with water cooled positive displacement efficiency requirements							
Water-Cooled, Electrically Operated, Positive Displacement	<75 tons	kW/ton	<0.780	<0.630	<0.800	<0.600	<0.55		
	>75 tons and <150 tons	kW/ton	<0.775	<0.615	<0.790	<0.586	<0.55		
	>150 tons and <300 tons	kW/ton	<0.680	<0.580	<0.718	<0.540	<0.38		
	>300 tons	kW/ton	<0.620	<0.540	<0.639	<0.490	<0.35		
Water-Cooled, Electrically Operated, Centrifugal	<150 tons	kW/ton	<0.634	<0.596	<0.639	<0.450	<0.40		
	>150 tons and <300 tons	kW/ton							
	>300 tons and <600 tons	kW/ton	<0.576	<0.549	<0.600	<0.400	<0.40		
	>600 tons	kW/ton	<0.570	<0.539	<0.590	<0.400			
Air-Cooled Absorption Single Effect	All Capacities	COP	>0.600	NR <sup>4</sup>	NA <sup>3</sup>	NA <sup>3</sup>	NA <sup>3</sup>	ARI 560-92	
Water-Cooled Absorption Single Effect	All Capacities	COP	>0.700	NR <sup>4</sup>	NA <sup>3</sup>	NA <sup>3</sup>	NA <sup>3</sup>		
Absorption Double Effect	All Capacities	COP	>1.000	>1.050	NA <sup>3</sup>	NA <sup>3</sup>	NA <sup>3</sup>		
Absorption Double Effect Direct Fired	All Capacities	COP	>1.000	>1.000	NA <sup>3</sup>	NA <sup>3</sup>	NA <sup>3</sup>		

**Comment [AS42]:** From ASHRAE Standard 90.1-07, Addendum m

**Comment [mt43]:** NBI Core Performance

**Comment [mt44]:** From Carrier (better than NBI)

**Comment [mt45]:** From Carrier (better than NBI)

For SI: 1 Btu/hr. = 0.2931 W

<sup>1</sup> The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is <38°F.

<sup>2</sup> Compliance with this standard can be obtained by meeting the minimum requirements of Path A or Path B. However, both the full and IPLV must be met to fulfill the requirements of Path A or Path B.

<sup>3</sup> NA means that this requirement is not applicable and cannot be used for compliance.

<sup>4</sup> NR means that there are no minimum requirements for this category.

**TABLE 13-P1317.6.1(5)**  
**WARM AIR FURNACES, AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING**  
**UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY REQUIRED	OPTIONAL EFFICIENCY	TEST PROCEDURE
Warm Air Furnace, Gas-Fired	<225,000 Btu/h		78% AFUE or 80% $E_t^1$	81% AFUE, 82% $E_t$	DOE 10 CFR, Part 430, App N or ANSI Z21.47-1993/2006 inc Addenda 1 & 2
	≥225,000 Btu/h	Maximum Capacity <sup>1</sup>	80% $E_c^2$	87% $E_c$	ANSI Z21.47-1993/2006 inc Addenda 1 & 2
Warm Air Furnace, Oil-Fired	<225,000 Btu/h		78% AFUE or 80% $E_t^1$	84% AFUE	DOE 10 CFR, Part 430, App N or UL 727-94
	≥225,000 Btu/h	Maximum Capacity <sup>3</sup>	81% $E_t^{3d}$	92% $E_t$	UL 727-94
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity <sup>3</sup>	80% $E_c^{45}$	85% $E_c$	ANSI Z83.9-1999/83.8-2002
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity <sup>3</sup>	80% $E_c^{45,6}$	87% $E_c$	ANSI Z83.9-1999/83.8-2002
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity <sup>3</sup>	80% $E_c^{45,6}$	90% $E_c$	UL 731-95

**Comment [mt46]:** Values from California Energy Commission appliance efficiency database. <http://www.energy.ca.gov/appliances/database/>  
 All categories have at least 3 mfgs supplying units at these levels. See supporting spreadsheets for details.

For SI: 1 Btu/hr. = 0.2931 W

- <sup>1</sup> Combination units not covered by NAECA with 3-phase power or cooling capacity greater than or equal to 65,000 Btu/h (19 kW) may comply with either rating.
- <sup>2</sup>  $E_c$  = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion. These units must also include an 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.
- <sup>3</sup> Minimum and maximum ratings are provided for and allowed by the unit's controls.
- <sup>3d</sup>  $E_t$  = Thermal efficiency. Units must also include an 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.
- <sup>45</sup>  $E_c$  = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.
- <sup>6</sup> Units must also include an uninterrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper. A vent damper is an acceptable alternative to a flue damper for those units where combustion air is drawn from the conditioned space.

**Comment [AS47]:** From ASHRAE Standard 90.1-07, addendum ao

**TABLE 13-Q1317.6.1(6)**  
**BOILERS, GAS-AND OIL-FIRED**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATINGS CONDITIONS	MINIMUM EFFICIENCY REQUIRED <sup>1,2</sup>	TEST PROCEDURE <sup>3</sup>
Boilers, Gas-Fired	Less than 300,000 Btu/h	Hot Water	80% AFUE	DOE Test Procedure 10 CFR, Part 430 App N
		Steam	75% AFUE	
	Equal to or greater than 300,000 Btu/h and less than or equal to 2,500,000 Btu/h	Maximum Capacity <sup>4</sup>	75% $E_t$	Hydronics Institute Heating Boiler Std. 86
		Greater than 2,500,000 Btu/h <sup>5</sup>	Hot Water	
Boilers, Oil-Fired	Less than 300,000 Btu/h		80% AFUE	DOE Test Procedure 10 CFR, Part 430 App N
		Equal to or greater than 300,000 Btu/h and less than or equal to 2,500,000 Btu/h	Maximum Capacity <sup>4</sup>	
	Greater than 2,500,000 Btu/h <sup>5</sup>	Hot Water	83% $E_c$	Hydronics Institute Heating Boiler Std. 86
		Steam	83% $E_c$	
Oil-Fired (Residual)	Equal to or greater than 300,000 Btu/h and less than or equal to 2,500,000 Btu/h	Maximum Capacity <sup>4</sup>	78% $E_t$	Hydronics Institute Heating Boiler Std. 86

	Greater than 2,500,000 Btu/h <sup>5</sup>	Hot Water	83% $E_c$
	Greater than 2,500,000 Btu/h <sup>5</sup>	Steam	83% $E_c$

For SI: 1 Btu/hr. = 0.2931 W

<sup>1</sup>  $E_c$  = Combustion efficiency (100% less flue losses). See reference document for detailed information.

<sup>2</sup>  $E_t$  = Thermal efficiency. See reference document for detailed information.

<sup>3</sup> These requirements apply to all packaged boilers and to all other boilers with rated input of 8,000,000 Btu/h or less. The minimum efficiency requirements for boilers cover all capacities of packaged boilers.

<sup>4</sup> Minimum and maximum ratings as provided for and allowed by the unit's controls.

<sup>5</sup> These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

Per ASHRAE Standard 90.1-07 and Addendum "an" format.

Underlined "Subcategory or Ratings Conditions" and "Size Category" are new compared to current Oregon Table

EQUIPMENT TYPE <sup>1</sup>	SUBCATEGORY OR RATINGS CONDITIONS	SIZE CATEGORY (INPUT)	MINIMUM EFFICIENCY <sup>2,3</sup>	OPTIONAL EFFICIENCY <sup>2,3</sup>	TEST PROCEDURE
Boilers, Hot Water	Gas-Fired	<300,000 Btu/h	80% AFUE	<u>90% AFUE</u>	10 CFR Part 430
		>300,000 and <2,500,000 Btu/h <sup>4</sup>	80% $E_t$	83% $E_t$	10 CFR Part 431
		>2,500,000 Btu/h <sup>1</sup>	82% $E_c$	85% $E_c$	
	Oil-Fired <sup>5</sup>	<300,000 Btu/h	80% AFUE	84% AFUE	10 CFR Part 430
		>300,000 and <2,500,000 Btu/h <sup>4</sup>	82% $E_t$	82% $E_t$	10 CFR Part 431
		>2,500,000 Btu/h <sup>1</sup>	84% $E_c$	85% $E_c$	
Boilers, Steam	Gas-Fired	<300,000 Btu/h	75% AFUE	80% AFUE	10 CFR Part 430
	<u>Gas-Fired-All, except Natural Draft</u>	>300,000 and <2,500,000 Btu/h <sup>4</sup>	79% $E_t$	82% $E_t$	10 CFR Part 431
		>2,500,000 Btu/h <sup>1</sup>	79% $E_t$	80% $E_t$	
	<u>Gas-Fired-Natural Draft</u>	>300,000 and <2,500,000 Btu/h <sup>4</sup>	79% $E_t$	82% $E_t$	
	Oil-Fired <sup>5</sup>	<300,000 Btu/h	80% AFUE	82% AFUE	10 CFR Part 430
		>300,000 and <2,500,000 Btu/h <sup>4</sup>	81% $E_t$	84% $E_t$	10 CFR Part 431
>2,500,000 Btu/h <sup>1</sup>		81% $E_t$	85% $E_t$		

**Comment [mt48]:** Values from California Energy Commission appliance efficiency database. <http://www.energy.ca.gov/appliances/database/>  
All categories have at least 3 mfgs supplying units at these levels. See supporting spreadsheets for details.

For SI: 1 Btu/hr. = 0.2931 W

<sup>1</sup> These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

<sup>2</sup>  $E_c$  = Combustion efficiency (100% less flue losses). See reference document for detailed information.

<sup>3</sup>  $E_t$  = Thermal efficiency. See reference document for detailed information.

<sup>4</sup> Maximum capacity – minimum and maximum ratings as provided for and allowed by the unit's controls.

<sup>5</sup> Includes oil-fired (residual)

**TABLE 43-R1317.6.1(7)**  
**PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT**

Equipment Type <sup>1</sup>	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition	Performance Required <sup>1,2,3</sup>	Optional Efficiency	Test Procedure
Propeller or Axial Fan Open-Circuit Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb Outdoor Air	>38.2 gpm/hp	>40 gpm/hp	CTI ATC-105(9700) and CTI STD-201(9604)
Propeller or Axial Fan Closed-Circuit Cooling Towers	All	102°F Entering Water 90°F Leaving Water 75°F wb Outdoor Air	≥14.0 gpm/hp	≥15.0 gpm/hp	CTI ATC-105S(96) and CTI STD-201(04)
Centrifugal Fan Open-Circuit Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb Outdoor Air	>20.0 gpm/hp	>22.0 gpm/hp	CTI ATC-105(9700) and CTI STD-201(9604)
Centrifugal Fan Closed-Circuit Cooling Towers	All	102°F Entering Water 90°F Leaving Water 75°F wb Outdoor Air	≥7.0 gpm/hp	≥8 gpm/hp	CTI ATC-105S(96) and CTI STD-201(04)
Air Cooled Condensers	All	125°F Condensing Temperature R-22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	>176,000 Btu/h-hp	Not applicable, air cooled condenser shall be matched to the HVAC system and rated per table 1317.5.1 (3)	ARI 460(0005)

**Comment [AS49]:** From ASHRAE Standard 90.1-07, Addendum I

**Comment [mt50]:** Values from ASHRAE 189 draft

For SI: °C = [(°F) - 32]/1.8

- <sup>1</sup> For purposes of this table, open-circuit cooling tower performance is defined as the process water maximum flow rating of tower at thermal rating conditions listed in this table divided by the sum of fan motor nameplate rated motor power.
- <sup>2</sup> For purposes of this table, closed-circuit cooling tower performance is defined as the process water flow rating of tower at thermal rating conditions listed in this table divided by the sum of fan motor nameplate power.
- <sup>3</sup> For purposes of this table, air-cooled condenser performance is defined as heat rejected from refrigerant divided by the fan motor nameplate rated motor power.

fan systems, constant volume fans, heating and cooling hydronic pumping systems, pool and service water pumping systems, domestic water pressure boosting systems, with modulating control valves, and cooling tower fans, and other pumps or fans where variable flows are required. Units designed for constant volume fan operation during heating or cooling shall operate at 60% flow or less while not heating or cooling. Variable inlet vanes, throttling valves (dampers), scroll dampers or bypass circuits shall not be allowed.

Comment [AS58]: From Mike Kennedy: This requires DCV??

**Exceptions:**

1. Axial vane fans with variable pitch control.
2. ~~Dedicated equipment circulation pumps designed to meet minimum flow requirements established by manufacturer, such as boiler or chiller auxiliary circulation pumps.~~ 3. Cooling towers designed with two fan motors (main and small auxiliary motor) or multi-speed fan motors.
3. Backup pumps or fans intended only for use in case of failure of a variable speed drive equipped pump or fan.
4. Pumps or fans intended only for use in case of emergency such as a fire pump or smoke evacuation fan.
5. Fans that operate in constant flow during heating and cooling that are equipped with a multiple-speed motor and operate at 60 percent or less while not heating or cooling.

Note: Variable speed on constant volume fan systems may require advanced ventilation controls to meet ventilation requirements.

*The following section was moved and amended from 1318.4.2.4. New text is double-underlined*

1317.11.3.2 Large volume fan systems. Single or multiple fan systems serving a zone or adjacent zones without separating walls with total air flow over 7,500 cfm (3,540 l/s) are required to reduce airflow based on space thermostat heating and cooling demand. A two-speed motor or variable speed drive shall reduce airflow to a maximum 60 percent of peak airflow or minimum ventilation air requirement as required by Chapter 12, whichever is greater.

Comment [AS59]: ???

**Exceptions:**

1. Systems where the function of the supply air is for purposes other than temperature control, such as maintaining specific humidity levels or supplying an exhaust system.
2. Dedicated outdoor air supply unit(s) with heat recovery where airflow is equal to the minimum ventilation requirements and other fans cycle off unless heating or cooling is required.
3. An area served by multiple units where designated ventilation units have 50 percent or less of total area airflow and non-ventilation unit fans cycle off when heating or cooling is not required.

**1317.12 Kitchen hoods.** Kitchen makeup air shall be provided as required by the *Oregon Mechanical Specialty Code*. For each kitchen exhaust system area with a total exhaust capacity greater than 5,000 ~~2,000~~ cfm (2360 ~~944~~ L/s), 50 percent of the required makeup air shall be (a)

Comment [AS60]: From WA code

**1318.2.2 Humidity control.** If a system is equipped with a means to add moisture to maintain specific humidity levels in a zone or zones, a humidistat humidity control device shall be provided.

**1318.2.2.1 The humidity control** ~~This device shall be capable of being set to prevent the use of fossil fuel or electricity to produce relative humidities~~ humidity in excess of 30 percent ~~for comfort purposes.~~ Where a humidistat humidity control device is used for ~~comfort~~ dehumidification, it shall be ~~capable of being set to prevent the use of fossil fuel or electricity to reduce relative humidities~~ humidity below 60 percent. ~~Humidifiers with preheating devices mounted in the air stream shall be provided with an automatic valve to shut off preheat when humidification is not required.~~

Exception: Hospitals, process needs, archives, museums, critical equipment, and other non-comfort situations with specific humidity requirements outside this range.

**1318.2.2.2 Humidity controls shall maintain a deadband of at least 10% relative humidity where no active humidification or dehumidification takes place.**

Exception: Heating for dehumidification is provided with heat recovery or heat pumping and the mechanical cooling system efficiency shall be from the Optional Compliance Efficiency column in Tables 1317.5.1 (1), 1317.5.1 (2), and 1317.5.1 (4).

**1318.2.3 Variable air volume system static pressure reset controls.** The system static pressure set point shall be reset to the lowest point possible while still providing the required air flow to the zones with the greatest demand. Maximum setpoint shall be no more than one-third total fan design static pressure.

Exceptions: Systems where fan speed is reset directly based on zone airflows or other zone load indicators.

- ~~1. Systems that are not controlled by a static pressure sensor.~~
- ~~2. Systems without direct digital control of individual zone boxes.~~

Comment [AS62]: From CA title 24 & common practice

**1318.2.4 Chilled and hot water temperature reset controls.** Chilled and hot water systems with a design capacity exceeding 300,000 Btu/hr. (88 kW) supplying chilled or heated water (or both) to ~~comfort conditioning systems~~ shall include controls that automatically reset supply water temperatures by representative building loads ~~(including return water temperature)~~ or by outside air temperature.

- Exceptions:
- ~~1. Where the supply temperature reset controls cannot be implemented without causing improper operation of dehumidifying systems.~~
  - ~~2. Hydronic systems that use variable flow to reduce pumping energy.~~

Comment [r63]: strike

**1318.2.5 Supply-air temperature reset controls.** Multiple zone HVAC systems must include controls that automatically reset the supply-air temperature in response to representative building zone loads, ~~or to outdoor air temperature.~~ The controls must be ~~capable of resetting~~ the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature. Interior zones without an exterior wall load impact and high occupancy areas (per section 1317.2.2) shall have maximum airflow sized to meet typical cooling loads with the higher reset air temperature.

- (1) Controls shall be installed that ~~are capable of providing~~ **provide** a heat pump water supply temperature dead band of at least 20°F (-7°C) between initiation of heat rejection and heat addition by the central devices (e.g., tower and boiler).
- (2) Closed-circuit tower (fluid cooler) shall have either an automatic valve installed to bypass all but a minimal flow of water around the tower (for freeze protection) or low-leakage positive closure dampers.
- (3) Open-circuit tower installed directly in the heat pump loop shall have an automatic valve installed to bypass all heat pump water flow around the tower. Open-circuit towers used in conjunction with a separate heat exchanger to isolate the tower from the heat pump loop shall be controlled by shutting down the circulation pump on the cooling tower loop.
- (4) A two-position valve at each hydronic heat pump for hydronic systems having a total pump system power exceeding 10 hp.

**1318.2.9 8.4 Variable flow controls.** ~~Controls capable of varying pump flow shall be installed on hydronic pumping systems with motors of 10 hp and greater.~~ **Hydronic variable flow systems. HVAC chilled water, condenser water, and hot water pumping shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of 50 percent or less of the design flow rate; or the minimum flow required by the equipment manufacturer for proper operation of equipment served by the system.**

Comment [AS64]: From CA Title 24.

**Exceptions:**

1. ~~Heating, chilled, and heat pump water systems that include three or fewer control valves and have a total pump system power less than or equal to 3 hp (2.2 kW).~~
2. ~~Systems having a total pump system power less than or equal to 1-1/2 hp (1.1 kW).~~
3. ~~Condenser water systems for chillers with capacities less than 780,000 Btu/hr (2,662 kW).~~

Comment [r65]: Nameplate horsepower.

Comment [r66]: Nameplate horsepower.

**1318.2.9.1. Chiller isolation.** ~~When a chilled water plant includes more than one chiller, provisions shall be made so that flow through any chiller is automatically shut off when that chiller is shut off while still maintaining flow through other operating chiller(s). Chillers that are piped in series for the purpose of increased temperature differential shall be considered as one chiller.~~

Comment [AS67]: From CA Title 24.

~~Exception: Chillers that are piped in series for the purpose of increased temperature differential.~~

Comment [mt68]: Redundant – strike this exception.

**1318.2.9.2. Boiler isolation.** ~~When a hot water plant includes more than one boiler, provisions shall be made so that flow through any boiler is automatically shut off when that boiler is shut off while still maintaining flow through other operating boiler(s).~~

Comment [AS69]: From CA Title 24.

**1318.2.9.3. Variable flow controls.** ~~Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp (3.7 kW) shall have control devices (such as variable speed control) that will result in pump motor demand of no more~~

Comment [AS70]: From CA Title 24.