



STATE OF WASHINGTON  
**STATE BUILDING CODE COUNCIL**

169-2018  
 Proponent Revision 3  
 09/05/18

Washington State Energy Code Development  
**Standard Energy Code Proposal Form**

Code being amended:  Commercial Provisions  Residential Provisions

**Code Section # Table C503.4**

**Brief Description:** *This proposal corrects errors and outdated references in this economizer exception table. It revises efficiency requirements for various equipment types so they are the same for a replacement unit of the same equipment type with the same or smaller output capacity, and for a replacement of the same equipment type with a larger output capacity.*

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

**TABLE C503.4  
 ECONOMIZER COMPLIANCE OPTIONS FOR MECHANICAL ALTERATIONS**

Unit Type	Option A	Option B (alternate to A)	Option C (alternate to A)	Option D (alternate to A)
	Any alteration with new or replacement equipment	Replacement unit of the same type with the same or smaller output capacity	Replacement unit of the same type with a larger output capacity	New equipment added to existing system or replacement unit of a different type
1. Packaged Units	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,3</sup>	Efficiency: min. <sup>1</sup> Economizer: <u>C403.5<sup>2,3</sup></u>	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,4</sup>
2. Split Systems	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	<u>For units &lt; 60,000 Btuh:</u> Efficiency: + <u>10/5%</u> <u>10%</u> <sup>5</sup> Economizer: shall not decrease existing economizer capability  <u>Otherwise:</u> <u>Efficiency: min.<sup>1</sup></u> <u>Economizer: C403.5<sup>2</sup></u>	<u>Only for new</u> <u>For units &lt; 54,000 &lt; 60,000 Btuh</u> replacing unit installed prior to 1991 (one of two): Efficiency: + <u>10/5%</u> <u>10%</u> <sup>5</sup> Economizer: 50% <sup>6</sup>  <u>For units &gt; 54,000 Btuh or any units installed after 1991:</u> <u>Otherwise: Option A</u> <u>Efficiency: min.<sup>1</sup></u> <u>Economizer: C403.5<sup>2</sup></u>	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,4</sup>
3. Water Source Heat Pump	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	(two of three): Efficiency: + <u>10/5%</u> <u>10%</u> <sup>5</sup> <u>for units &lt; 72,000 Btuh</u> Flow control valve <sup>7</sup> Economizer: 50% <sup>6</sup>  <u>Otherwise:</u> <u>Efficiency: min.<sup>1</sup></u>	(three of three): Efficiency: + <u>10/5%</u> <u>10%</u> <sup>5</sup> <u>for units &lt; 72,000 Btuh</u> Flow control valve <sup>7</sup> Economizer: 50% <sup>6</sup> (except for certain pre-1991 systems <sup>8,17</sup> )  <u>Otherwise:</u>	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,4</sup> (except for certain pre-1991 systems <sup>8,17</sup> )

Unit Type	Option A	Option B (alternate to A)	Option C (alternate to A)	Option D (alternate to A)
	Any alteration with new or replacement equipment	Replacement unit of the same type with the same or smaller output capacity	Replacement unit of the same type with a larger output capacity	New equipment added to existing system or replacement unit of a different type
		<b>Economizer: C403.5<sup>2</sup></b>	<b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b>	
4. <b>Hydronic Water</b> Economizer using Air-Cooled Heat Rejection Equipment (Dry Cooler)	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	Efficiency: + <b>10/5%<sup>5</sup></b> <b>5%<sup>4</sup></b> Economizer: shall not decrease existing economizer capacity	<b>Option A</b> <b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b>	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,4</sup>
5. Air-Handling Unit (including fan coil units) where the system has an air-cooled chiller	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	Economizer: shall not decrease existing economizer capacity	<b>Option A</b> <b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b> (except for certain pre-1991 systems <sup>8,17</sup> )	<b>Option A</b> <b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b> (except for certain pre-1991 systems <sup>8,17</sup> )
6. Air- Handling Unit (including fan coil units) and Water-cooled Process Equipment, where the system has a water-cooled chiller <sup>10</sup>	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	Economizer: shall not decrease existing economizer capacity	<b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b> (except for certain pre-1991 systems <sup>8,17</sup> and certain 1991-2004 2016 systems <sup>9</sup> )	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,4</sup> (except for certain pre-1991 systems <sup>8,17</sup> and certain 1991-2004 2016 systems <sup>9</sup> )
7. Cooling Tower	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	No requirements	<b>Option A</b> <b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b>	<b>Option A</b> <b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b>
8. Air-Cooled Chiller	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	Efficiency: + <b>5% 10%<sup>11</sup></b> Economizer: shall not decrease existing economizer capacity	Efficiency (two of two): (1) + 10% <sup>11,12</sup> and (2) multistage Economizer: shall not decrease existing economizer capacity	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,4</sup>
9. Water-Cooled Chiller	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2</sup>	Efficiency: (one of <del>two</del> <b>three</b> ): (1) <b>Part load IPLV + 10% 15%<sup>13,14</sup></b> or (2) <b>Full load and part load IPLV + 5%<sup>13</sup></b> or (3) plate frame heat exchanger <sup>15</sup> Economizer: shall not decrease existing economizer capacity	Efficiency: (two of <del>two</del> <b>three</b> ): (one of <del>two</del> <b>three</b> ): (1) <b>Part load IPLV + 10% 15%<sup>13,14</sup></b> or (2) <b>Full load and part load IPLV + 5%<sup>13</sup></b> or (3) plate frame heat exchanger <sup>15</sup> Economizer: shall not decrease existing economizer capacity	Efficiency: min. <sup>1</sup> Economizer: C403.5 <sup>2,4</sup>
10. <b>Boiler</b>	<b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2</sup></b>	<b>Efficiency: + 8%<sup>16</sup></b> <b>Economizer: shall not decrease existing</b>	<b>Efficiency: + 8%<sup>16</sup></b> <b>Economizer: shall not decrease existing</b>	<b>Efficiency: min.<sup>1</sup></b> <b>Economizer: C403.5<sup>2,4</sup></b>

Unit Type	Option A	Option B (alternate to A)	Option C (alternate to A)	Option D (alternate to A)
		Any alteration with new or replacement equipment	Replacement unit of the same type with the same or smaller output capacity	Replacement unit of the same type with a larger output capacity
		economizer capacity	economizer capacity	

1. Minimum equipment efficiency shall comply with Section C403.3.2 and Tables C403.3.2(1) through C403.3.2(9).
2. ~~All separate new equipment and replacement equipment System and building shall have air economizer complying~~ ~~comply~~ with Section C403.5 (including both the individual unit size limits and the total building capacity limits on units without economizer). It is acceptable to comply using one of the exceptions to Section C403.5.
3. ~~All equipment replaced in an existing building shall have air economizer complying with Section 403.5 unless both the individual unit size and the total capacity of units without air economizer in the building is are less than that allowed in Exception 2 to Section C503.4. Reserved.~~
4. ~~All separate new equipment added to an existing building shall have air economizer complying with Section C403.5 unless both the individual unit size and the total capacity of units without air economizer in the building is less than that allowed in Exception 2 to Section C503.4~~ Equipment shall have a capacity-weighted average cooling system efficiency that is 5 percent better than the requirements in Tables C403.3.2(1) and C403.3.2(2) (1.10 x values in Tables C403.3.2(1) and C403.3.2(2)).

*Commentary for Footnotes 3 and 4 – The original economizer exception that these footnotes pointed to has not existed since the 2006 WSEC. It required high efficiency cooling units with 20% better than Code efficiency and limited total capacity of all systems in the building without economizer to no greater than 480,000 btu/h. In subsequent code editions, the economizer exception this footnote referenced did not align with the original intent. In addition, several new economizer exceptions have been added since the 2006 WSEC. This proposal recommends consolidating Footnotes 2-4 so it allows application of any of the available economizer exceptions in C403.5.*

5. Equipment shall have a capacity-weighted average cooling system efficiency ~~a. for units with a cooling capacity below 54,000 Btuh, a minimum of 10% greater that is 10 percent better~~ than the requirements in Tables C403.3.2(1) ~~A~~ and C403.3.2(2) (1.10 x values in Tables C403.3.2(1) ~~A~~ and C403.3.2(2)).

*Commentary for Footnote 5 – The original equipment efficiency tables that this footnote pointed to in the 2006 WSEC were just the packaged AC equipment table and the unitary and applied heat pump table. In subsequent code editions, equipment efficiency tables have been inserted and moved around such that the table references in this footnote no longer reflect the original intent. This proposal limits the scope back to the originally intended tables per the 2006 WSEC.*

6. Minimum of ~~50% 50 percent~~ air economizer that is ducted in a fully enclosed path directly to every heat pump unit in each zone, except that ducts may terminate within 12 inches of the intake to an HVAC unit provided that they are physically fastened so that the outside air duct is directed into the unit intake. If this is an increase in the amount of outside air supplied to this unit, the outside air supply system shall be capable of providing this additional outside air and equipped with economizer control.
7. ~~Water-source heat pump systems shall have a~~ flow control valve to eliminate flow through the heat pumps that are not in operation ~~with and~~ variable speed pumping control complying with Section ~~C403.9 C403.4.3~~ for that heat pump.
  - When the total capacity of all units with flow control valves exceeds ~~15% 15 percent~~ of the total system capacity, a variable frequency drive shall be installed on the main loop pump.
  - As an alternate to this requirement, ~~have a the~~ capacity-weighted average cooling system efficiency ~~that is 5% shall be 5 percent greater better~~ than the requirements in ~~Footnote 5 for water-source heat pumps~~ (i.e. a minimum of ~~15%/10% greater 15 percent better~~ than the requirements in ~~Tables C403.3.2(1) and Table C403.3.2(2)~~ (1.15 /1.10 x values in ~~Tables C403.3.2(1) and Table C403.3.2(2)~~).
8. ~~Systems installed prior to 1991 without fully utilized capacity are allowed to comply with Option B, provided that the individual unit cooling capacity does not exceed 90,000 Btuh. Water economizer equipment shall have a capacity-weighted average cooling system efficiency that is 10 percent better than the requirements in Tables C403.3.2(8) and C403.3.2(9) (1.10 x values in Tables C403.3.2(8) and C403.3.2(9)).~~
9. ~~Air economizer is~~ not required for systems installed with water economizer plate and frame heat exchanger complying with previous codes between 1991 and ~~June 2013 July 2016~~, provided that the total fan coil load does not exceed the existing or added capacity of the heat exchangers.

*Commentary for Footnote 9 – This allowance applies to any system previously installed with a water economizer per the Code requirements of this system at the time the project was permitted. This exception was originally incorporated into the 2006 WSEC.*



Your amendment must meet one of the following criteria. Select at least one:

- |                                                                                                                                        |                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <input type="checkbox"/> Addresses a critical life/safety need.                                                                        | <input type="checkbox"/> Consistency with state or federal regulations. |
| <input checked="" type="checkbox"/> The amendment clarifies the intent or application of the code.                                     | <input type="checkbox"/> Addresses a unique character of the state.     |
| <input checked="" type="checkbox"/> Addresses a specific state policy or statute.<br>(Note that energy conservation is a state policy) | <input checked="" type="checkbox"/> Corrects errors and omissions.      |

Check the building types that would be impacted by your code change:

- |                                                        |                                                              |                                                   |
|--------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------|
| <input type="checkbox"/> Single family/duplex/townhome | <input checked="" type="checkbox"/> Multi-family 4 + stories | <input checked="" type="checkbox"/> Institutional |
| <input type="checkbox"/> Multi-family 1 – 3 stories    | <input checked="" type="checkbox"/> Commercial / Retail      | <input checked="" type="checkbox"/> Industrial    |

## **Economic Impact Data Sheet**

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

*This table provides flexible alternatives in lieu of economizer for mechanical system retrofits projects that offers long term energy savings for the owner. Proposed changes in requirements and capacities align better with products identified as readily available in the marketplace.*

*The following summarizes construction cost impacts for various updates in this proposal:*

- For the split systems, a 5 ton cooling-only unit that meets 13.0 SEER is approximately \$1500. To exceed this by 5% (~14 SEER), the cost would be \$1625. To exceed it by 10% (~16 SEER), the cost would be \$1,890. Over 65,000 Btuh, there are no options to exceed code by 5% or more, as nearly everything is 11 – 11.2 SEER. The 5 tons and down market is consumer driven residential and the volume is quite high so manufacturers offer a larger selection of unit models but 6 tons and up is a commercial contractor market with lower volume and fewer choices.*
- A split system heat pump at 5 tons and 14 SEER has a cost of \$2,010. The 16 SEER 5 ton heat pump is \$2,920. An 18 SEER unit is \$3,430. Again, nothing will exceed code for larger heat pumps.*
- For water source heat pumps, a 5 ton standard efficiency (13.7 SEER) unit is \$3,750 and a 16 SEER unit is \$4,600. Add \$1000 to each price for the 6 ton size. There isn't anything at 7.5 tons and higher. The table below is for the high efficiency WSHP.*

Unit Size	Capacity Modulation	Pressure Drop		GPM	Cooling			Heating		
		PSI	Ft		CFM	Total Cap.	EER	CFM	Tot Cap.	COP
026	Full load	2.5	5.7	6.5	800	26400	18.0	800	29300	5.7
	Part load	2.5	5.7	6.5	700	19800	20.3	700	21800	6.4
032	Full load	3.3	7.4	7.5	1000	32500	16.5	1000	36400	5.3
	Part load	3.3	7.4	7.5	875	24700	18.5	875	27800	6.0
038	Full load	2.0	4.7	9.0	1250	39000	17.6	1250	44400	5.6
	Part load	2.0	4.7	9.0	1090	28300	20.2	1090	32600	6.4
044	Full load	2.0	4.7	10.5	1400	44400	17.3	1400	50100	5.4
	Part load	2.0	4.7	10.5	1225	32900	19.7	1225	36600	6.0
049	Full load	2.7	6.2	12.2	1600	48900	16.7	1600	55300	5.3
	Part load	2.7	6.2	12.2	1400	36900	19.6	1400	40800	6.0
064	Full load	4.8	10.9	16.0	2000	64800	17.4	2000	76100	5.2
	Part load	4.8	10.9	16.0	1750	48200	19.7	1750	53800	5.8
072	Full load	5.7	12.9	17.5	2160	72700	15.9	2160	88400	5.0
	Part load	5.7	12.9	17.5	1920	56400	18.5	1920	64600	5.5

- *Since a dry cooler is just a coil and fan(s), the only way to get more efficiency is by adding surface area to the coil. However, this adds more fans. The market here for dry coolers is very small, and most will have glycol. A unit that could exceed code by 5% might be 10% more expensive than a base line unit, and one that could exceed code by 10% would be 30% more expensive. But they're available in an infinite number of sizes. Heat rejection equipment isn't available in specific sizes as their capacity is based on ambient conditions which vary by location.*

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). [Webinars on the tool can be found Here and Here](#))

**Construction cost estimates outlined in summary above are provided by Washington Air Reps.**

(For residential projects, also provide [Click here to enter text./](#) dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

**Construction cost estimates outlined in summary above are provided by Washington Air Reps.**

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

[Click here to enter text.](#)KWH/ square foot (or) NA

(For residential projects, also provide [Click here to enter text.](#)KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

**Efficiency requirements have been aligned so that for projects that involve a replacement unit of the same type with a larger output capacity is required to comply with the same requirements as that for replacement unit of the same type with the same or smaller output capacity. Energy savings are the same as the 2015 WSEC.**

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

**No change to plan review or inspection compared to the 2015 WSEC.**

**All questions must be answered to be considered complete. Incomplete proposals will not be accepted.**