

COMMERCIAL ENERGY EFFICIENCY

- 7.2.2. Chilled water plant includes a heat recovery chiller or water-to-water heat pump capable of rejecting heat from the chilled water system to the hydronic heating equipment capacity.
- 7.2.3. Heat recovery chillers shall have a minimum COP of 7.0 when providing heating and cooling water simultaneously.
- 8. Water-cooled equipment served by systems meeting the requirements of Section C403.9.2.4 Condenser heat recovery.
- 9. Dedicated outdoor air systems that include energy recovery as required by Section C403.7.6 but that do not include mechanical cooling.
- 10. Dedicated outdoor air systems not required by Section C403.7.6 to include energy recovery that modulate the supply airflow to provide only the minimum outdoor air required by Section C403.2.2.1 for ventilation, exhaust air make-up, or other process air delivery.
- ~~(9) 11. Equipment used to cool any dedicated server room, electronic equipment room, elevator machine room or telecom switch room provided the system complies with Option a, b, ~~(or)~~ c, d or e in ~~(the table)~~ Table C403.5(9) below. The total cooling capacity of all fan systems qualifying under this exception without economizers shall not exceed 240,000 Btu/h per building or 10 percent of its *air economizer* capacity, whichever is greater. This exception shall not be used for Total Building Performance or Target Performance Path compliance.~~
- ~~(10. Dedicated outdoor air systems that include energy recovery as required by Section C403.7.6 but do not include mechanical cooling.~~
- ~~11. Dedicated outdoor air systems not required by Section C403.7.6 to include energy recovery that modulate the supply airflow to provide only the minimum outdoor air required by Section C403.2.2.1 for ventilation, exhaust air make up, or other process air delivery.)~~
- 12. Medical and laboratory equipment that is directly water-cooled and is not dependent upon space air temperature.

**Table C403.5(9)
Server room, electronic equipment room or telecom room cooling equipment**

	Equipment Type	Higher Equipment Efficiency	Part-Load Control	Economizer
Option a	Tables C403.3.2(1), C403.3.2(2) and C403.3.2(14) ^a	+15% ^b	Required over 85,000 Btu/h ^c	None Required
Option b	Tables C403.3.2(1), C403.3.2(2) and C403.3.2(14) ^a	+5% ^d	Required over 85,000 Btu/h ^c	Waterside Economizer ^e
Option c	AHRI 1360 ^f	+10% ^g	Required over 85,000 Btu/h ^c	Waterside Economizer ^e
_____	_____ ¹	_____	_____	_____
_____	_____	_____	_____	_____

Footnotes for Table C403.5(9):

- a For a system where all of the cooling equipment is subject to the AHRI standards listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14), the system shall comply with ~~(all of the following)~~ the higher equipment efficiency, part-load control and economizer requirements of the row in which this footnote is located, including the associated footnotes (note that if the system contains any cooling equipment that exceeds the capacity limits in Table C403.3.2(1), C403.3.2(2), or C403.3.2 (14), or if the system contains any cooling equipment that is not included in Table C403.3.2(1), C403.3.2(2), or C403.3.2 (14), then the system is not allowed to use this option).
- b The cooling equipment shall have a SEER/EER value and an IEER/IPLV value that each is a minimum of 15 percent greater than the value listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14).
- c For units with a total cooling capacity over 85,000 Btu/h, the system shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50 percent of the load or less that results in the compressor operating at the same or higher EER at part loads than at full load (e.g., minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, dual tandem scrolls, but hot gas bypass is not credited as a compressor unloading system).
- d The cooling equipment shall have a SEER/EER value and an IEER/IPLV value that each is a minimum of 5 percent greater than the value listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14).
- e The system shall include a water economizer in lieu of air economizer. Water economizers shall meet the requirements of C403.5.1 and C403.5.2 and be capable of providing the total concurrent cooling load served by the connected terminal equipment lacking airside economizer, at outside air temperatures of 50°F dry-bulb/45°F wet-bulb and below. For this calculation, all factors including solar and internal load shall be the same as those used for peak load calculations, except for the outside temperatures. The equipment shall be served by a dedicated condenser water system unless a nondedicated condenser water system exists that can provide appropriate water temperatures during hours when waterside economizer cooling is available.
- f For a system where all cooling equipment is subject to ~~((ASHRAE Standard 127))~~ AHRI 1360, the system shall comply with the higher equipment efficiency, part-load control, and economizer requirements of the row in which this footnote is located, including the associated footnotes.
- g The cooling equipment subject to the ~~((ASHRAE Standard 127))~~ AHRI 1360 shall have a ~~(n EER value and an IPLV)~~ SCOP value that is ~~((equal or))~~ a minimum

a minimum of 10 percent greater than the value listed in Table C403.3.2(1), C403.3.2(2), and C403.3.2(14)) C403.3.2(10) (1.10 × values in these tables) when determined in accordance with the rating conditions (ASHRAE Standard 127)) AHRI 1360 (i.e., not the rating conditions in AHRI Standard 210/240 or 340/360). This information shall be provided by an independent third party.

- h For a system with chillers subject to the AHRI standards listed in Table C403.3.2(3) (as an example, a chilled water system with fan coil units), the system shall comply with the higher equipment efficiency, part-load control and economizer requirements of the row in which this footnote is located, including the associated footnotes.
- i The cooling equipment shall have a full-load EER value and an IPLV value that is a minimum of 25 percent greater than the value listed in Table C403.3.2(3) C403.3.2(3) (1.25 × value in Table C403.3.2(3)) or a full-load and IPLV kW/ton that is at least 25 percent lower than the value listed in C403.3.2(3) (0.75 × value in Table C403.3.2(3)).
- j For all chillers, the system shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50 percent of the load or less and that result in the compressor operating at the same or higher EER at part loads than at full load (e.g., minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, or dual tandem scrolls, but hot gas bypass is not a qualifying compressor unloading system).
- k For air-cooled chillers, the cooling equipment shall have an IPLV EER value that is a minimum of 10 percent greater than the IPLV EER value listed in Table C403.3.2(3) (1.10 × values in Table C403.3.2(3)). For water-cooled chillers, the cooling equipment shall have an IPLV kW/ton that is at least 15 percent lower than the IPLV kW/ton value listed in Table C403.3.2(3) (0.85 × values in Table C403.3.2(3)).

**Table C403.5(3)
Equipment Efficiency Performance**

Climate Zones	Efficiency Improvement ^a
4C	64%
5B	59%

^a If a unit is rated with an IPLV, IEER or SEER then to eliminate the required air or water economizer, the minimum cooling efficiency of the HVAC unit must be increased by the percentage shown. If the HVAC unit is only rated with a full load metric like EER or COP cooling, then these must be increased by the percentage shown.

C403.5.1 Integrated economizer control. Economizer systems shall be integrated with the mechanical cooling system and be configured to provide partial cooling even where additional mechanical cooling is required to provide the remainder of the cooling load. Controls shall not be capable of creating a false load in the mechanical cooling system by limiting or disabling the economizer or any other means, such as hot gas bypass, except at the lowest stage of mechanical cooling.

Units that include an *air economizer* shall comply with the following:

1. Unit controls shall have the mechanical cooling capacity control interlocked with the *air economizer* controls such that the outdoor air damper is at the 100 percent open position when mechanical cooling is on and the outdoor air damper does not begin to close to prevent coil freezing due to minimum compressor run time until the leaving air temperature is less than 45°F (7°C).
2. Direct expansion (DX) units with cooling capacity 65,000 Btu/H (19 kW) or greater of rated capacity shall comply with the following:
 - 2.1. DX units that control the capacity of the mechanical cooling directly based on occupied space temperature shall have not fewer than two stages of mechanical cooling capacity.
 - 2.2. Other DX units, including those that control space temperature by modulating the airflow to the space, shall be in accordance with Table C403.5.1.

**TABLE C403.5.1
DX COOLING STAGE REQUIREMENTS FOR MODULATING AIRFLOW UNITS**

Rating Capacity	Minimum Number of Mechanical Cooling Stages	Minimum Compressor Displacement ^a
≥ 65,000 Btu/h and < 240,000 Btu/h	3 stages	≤ 35% of full load
≥ 240,000 Btu/h	4 stages	≤ 25% of full load

For SI: 1 Btu/h = 0.2931 W

a. For *mechanical cooling* stage control that does not use variable compressor displacement, the percent displacement shall be equivalent to the mechanical cooling capacity reduction evaluated at the full load rating conditions for the compressor.

C403.5.2 Economizer heating system impact. HVAC system design and economizer controls shall be such that economizer operation does not increase building heating energy use during normal operation.

EXCEPTION: Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.

C403.5.3. Air economizers. *Air economizers* shall comply with Sections C403.5.3.1 through C403.5.3.5.

C403.5.3.1 Design capacity. *Air economizer* systems shall be configured to modulate *outdoor air* and return air dampers to provide up to 100 percent of the design supply air quantity as *outdoor air* for cooling.

C403.5.3.2 Control signal. Economizer controls and dampers shall be configured to sequence the dampers with mechanical cooling equipment and shall not be controlled by only mixed air temperature. *Air economizers* on systems with cooling capacity greater than 65,000 Btu/h shall be configured to provide partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.