Proposal Summary

Data Centers Efficiency Improvements (HVAC)

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Measure Description

This proposal seeks to address data center/computer room code requirements in sections 100.1, 120.6(j)3 (mandatory), 140.9(a) (prescriptive), and 141.1(b)1 of T24 Part 6 by including the following sub-measures:

- Submeasure 1 – Definition Section 100.1: Add definitions for Liquid-cooled ITE, Computer Room Economizer, Wetbulb Computer Room Economizer, and Drybulb Computer Room Economizer
- Submeasure 2 - Fan Control Section 120.6(j)3: Reduce computer room design cooling load threshold to 30,000 Btu/hr for airflow control
- Submeasure 3 - New Construction Economizer Section 140.9(a)1: Enhance Economizer Requirement based on ITE load density, ITE part load condition, ITE cooling fluid, and type of economizer, modify economizer requirement to air-cooled ITE spaces, add new requirement to liquid-cooled ITE spaces, and modify outdoor air dry bulb and wet bulb temperatures in Exception 2
- Submeasure 4 - Computer Room Heat Recovery Section 140.9(a)5: Add new requirement to transfer recovered heat from the Computer Cooling system to space heating system and or service hot water system
- Submeasure 5 – Existing Building Economizers Section 141.1(b)1: Modify the requirement for additions and alterations so that they shall meet the New Construction requirements as stated in Section 140.9, modify Exception 2 to reduce the ITE load threshold to 20 Tons (~70 kW) for existing computer rooms, and delete Exception 3 for new computer rooms ITE load threshold

Table 1 summarizes the scope of the proposed code change.

Table 1: Scope of Proposed Code Change

An “X” indicates the proposed code change is relevant.

Building Type(s)		single family	**Construction Type(s)**	X	new construction
		multifamily		X	additions

	X	nonresidential		X	alterations
Type of Change	X	mandatory	**Updates to Compliance Software**		no updates
	X	prescriptive		X	update existing feature
	X	performance		X	add new feature
Third Party Verification		no changes to third party verification			
	X	update existing verification requirements			
		add new verification requirements			

Justification for Proposed Change

The state-of-the-art for data center design has advanced significantly since the 2022 requirements were developed in 2020 and will further evolve by 2029, when the 2028 standards take effect. One major change is the rapid growth of liquid-cooled servers, which are often cooled by 80-120°F supply water. It is also now common to cool air-cooled servers with 75-85°F supply air. This measure offers a tremendous opportunity to capture various advancements as described above via sub-measures that will improve the energy efficiency of data centers and computer rooms significantly.

It may also be noted that data center floor area is growing at an alarming rate year over year, and data centers are quite energy intensive.

Data Needs / Information Requests

The Statewide CASE Team is seeking the following information to inform the code change proposal. Data may be provided anonymously. To participate or provide information, please email [bboyce@energy-solution.com] directly and copy info@title24stakeholders.com.

- What are the type of HVAC systems (air-cooled, water-cooled, evaporatively cooled, refrigerant-cooled systems) currently installed in the market?
- What types of servers are prevalent in the California market?
- What is the % of white space (server-occupied floor area) in a typical data center?

- How important is the thermal mass and insulation of the exterior envelope on HVAC selection and performance?
- Is envelope air leakage testing important to the data centers?
- What supply air temperature and resets to the server rack and the space are commonly used in data center buildings?
- What is the frequency of ITE replacements?
- What are the common issues seen in the air distribution system side?
- What is the impact of HVAC systems related to maintenance and downtime?
- Is there a requirement for dedicated HVAC systems in mixed-type buildings (a building with more than 10% of data center space in any commercial/industrial buildings)
- What are the top 3 suggestions to reduce, reuse, and recycle Data Center energy?
- Is there a need for special skills or certification requirements for DC HVAC facility personnel?

Draft Code Language

1.1 Guide to Marked Up Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2025 documents are marked with blue underlining (new language) and ~~strikethroughs~~ (deletions).

1.2 Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

1.3 Title 24, Part 6:

Submeasure 1 Definitions:

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION*:*

LIQUID-COOLED ITE: components of ITE that are cooled by a fluid other than air and that do not use server fans to flow air across the components. Common liquid cooling fluids include water, glycol, and refrigerant. Individual servers can be partially liquid-cooled and partially air-cooled, with server fans serving the air-cooled components and pumps serving the liquid-cooled components.

COMPUTER ROOM ECONOMIZER: A system by which heat from ITE is rejected to the environment without the use of a refrigerant compressor. If a computer room economizer is part of a cooling system that also includes a refrigerant compressor, then the system shall be fully integrated, meaning it shall be capable of providing partial economizer cooling without limiting the capacity of compressor cooling and without limiting the capacity of compressor-less cooling. The following systems DO NOT meet the fully integrated criteria of a computer room economizer:

1. Waterside economizer heat exchangers that are piped in parallel with chillers on the chilled water side (parallel on the condenser water side is ok).
2. Air-cooled chillers with integrated economizer coils that are piped into the primary circuit of a primary/secondary system.
3. Air-cooled chillers with integrated economizer coils that are served by the same condenser fans that serve refrigerant condenser coils whose speed is limited by the need to maintain a minimum refrigerant head pressure.
4. Refrigerant economizer systems with one or more refrigerant circuits that can switch from refrigerant compressor operation to refrigerant pump operation.

The following systems DO meet the fully integrated criteria of a computer room economizer:

1. Waterside economizer heat exchangers that are piped in series with chillers on the chilled water side.
2. Air-cooled chillers with integrated economizer coils that are piped into the secondary circuit of a primary/secondary system.
3. Air-cooled chillers with integrated economizer coils that are served by dedicated economizer fans and not by condenser fans that serve refrigerant condenser coils.
4. Refrigerant economizer systems where 10-90% of the load on a refrigerant circuit can be met by a passive condenser or refrigerant pump, while the other 90% to 10% of the load is met by an active condenser or refrigerant compressor.

WETBULB COMPUTER ROOM ECONOMIZER: A computer room economizer that provides cooling by evaporating water (e.g. cooling tower, dry cooler with adiabatic assist).

DRYBULB COMPUTER ROOM ECONOMIZER: A computer room economizer that either (1) provides cooling by directly supplying outside air or (2) provides cooling by transferring heat to the outside air with a sensible-only heat exchanger (e.g. dry cooler).

Submeasure 2: Fan Control

SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

(j) Mandatory requirements for computer rooms. Space-conditioning systems serving a computer room shall meet the following requirements:

1. **Reheat.** Each computer room zone shall have controls that prevent reheating, recooling and simultaneous provisions of heating and cooling to the same zone,

such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems.

2. **Humidification.** Humidification shall be adiabatic. Nonadiabatic humidification, including but not limited to steam and infrared, is prohibited.

3. **Fan control.** Each unitary air conditioner with mechanical cooling capacity exceeding ~~60,000~~ 30,000 Btu/hr and each chilled water fan system shall be designed to vary the airflow rate as a function of actual load. Fan motor demand shall not exceed ~~50~~ 40 percent of design wattage at 66 percent of design fan speed.

Submeasure 3 New Construction Economizers:

SECTION 140.9 – PRESCRIPTIVE REQUIREMENTS FOR COVERED PROCESSES

a. **Prescriptive Requirements for Computer Rooms.** Computer rooms with a power density greater than 20 W/ft^2 shall comply with this section.

1. **Economizers.**

A Each individual cooling system primarily serving computer rooms shall include a computer room economizer capable of meeting the "Percent of current ITE Load met by Economizer" at all of the conditions listed in this table.

	If Drybulb Economizer is used				If Wetbulb Economizer is used			
outside drybulb	< = 70F	< = 70F	80F	90F	Note 1	Note 1	Note 1	Note 1
outside wetbulb	Note 1	Note 1	Note 1	Note 1	< = 60F	< = 60F	65F	70F
outside dewpoint	<= 60F	<= 60F	<= 60F	<= 60F	Note 1	Note 1	Note 1	Note 1
Current ITE Load Range	100%	10%-99%	10-100%	10-100%	100%	10%-99%	10-100%	10-100%
supply air/fluid temperature to the ITE	design temp	design temp	design temp	design temp	design temp	design temp	design temp	design temp
return air/fluid temperature from the ITE	design temp	expected temp	expected temp	expected temp	design temp	expected temp	expected temp	expected temp
Percent of current ITE Load met by Economizer	100%	100%	>=50%	>=10%	100%	100%	>=50%	>=10%
Note1: Any outside temperature that is possible at the other outside conditions								

B All liquid-cooled ITE in buildings with a design liquid-cooled ITE load greater than 2 MW shall be served by a cooling system with a computer room economizer capable of meeting the "Percent of current ITE Load met by Economizer" at all of the conditions listed in this table.

	If Drybulb Economizer				If Wetbulb Economizer
outside drybulb	< = 80F	< = 80F	85F	95F	Note 1
outside wetbulb	Note 1	Note 1	Note 1	Note 1	< = 85F
outside dewpoint	Note 1	Note 1	Note 1	Note 1	Note 1
Current ITE Load Range	100%	10%-99%	10-100%	10-100%	0-100%
supply air/fluid temperature to the ITE	design temp	design temp	design temp	design temp	design temp
return air/fluid temperature from the ITE	design temp	expected temp	expected temp	expected temp	expected temp
Percent of current ITE Load met by Economizer	100%	100%	>=50%	>=10%	100%
Note1: Any outside temperature that is possible at the other outside conditions					

EXCEPTION 1 to Section 140.9(a)1: Individual computer rooms with an ITE design load under 5 tons (18 kW) in a building that does not have any economizers.

EXCEPTION 2 to Section 140.9(a)1: A computer room with an ITE design load less than 20 tons (70 kW) may be served by a second fan system without an economizer if it is also served by a fan system with an economizer that also serves other spaces within the building, provided that all of the following are met:

i. The economizer system is sized to meet the design cooling load of the computer room when the other spaces within the building are at 50 percent of their design load at outside air temperatures of ~~65°F~~ 70°F dry-bulb and below and ~~50°F~~ 60°F wet-bulb and below; and

ii. An economizer system that can stop service to other spaces in the building when those spaces are unoccupied and serve only the computer rooms.

EXCEPTION 3 to Section 140.9(a)1: Computer rooms that reject heat to a heat recovery system that is sized to accept at least 50% of the design computer room heat and is predicted to recover at least 25% of the annual computer room heat.

2. **Power Consumption of Fans.** The total fan power at design conditions of each fan system shall not exceed 27 W/kBtu·h of net sensible cooling capacity.
3. **Air Containment.** Computer rooms with air-cooled computers in racks and with a ITE design load exceeding 10 kW (2.8 tons) per room shall include air barriers such that there is no significant air path for computer discharge air to recirculate back to computer inlets without passing through a cooling system.

EXCEPTION 1 to Section 140.9(a)3: Expansions of existing computer rooms.

EXCEPTION 2 to Section 140.9(a)3: Computer racks with a design load less than 1 kW (0.28 tons) per rack.

EXCEPTION 3 to Section 140.9(a)3: Equivalent energy performance based on computational fluid dynamics or other analysis.

Submeasure 4 Computer Room Heat Recovery:

5. **Computer Room Heat Recovery.** Building with a design computer room ITE load greater than 100 KW and a non-computer room area greater than 35,000 ft2 shall include a dual fan dual duct system, or a heat recovery chiller, or other means, capable of transferring the lesser of the following from the computer room cooling system to the space heating system and/or to the service water heating (SWH) system:

A. 0.25 times the peak heat rejection of the computer room system

B. 0.25 x (capacity of space heating system + capacity of SWH system)

Submeasure 5 Existing Building Economizers:

SECTION 141.1 – REQUIREMENTS FOR COVERED PROCESSES IN ADDITIONS, ALTERATIONS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS

Covered processes in additions or alterations to existing buildings that will be nonresidential, and hotel/motel occupancies shall comply with the applicable subsections of section 120.6 and 140.9.

a. **Lab and Process Facility Exhaust Systems.** All newly installed fan systems for a laboratory or process facility exhaust system greater than 10,000 cfm shall meet the requirements of Section 140.9(c).

b. **Computer Rooms.** All newly installed computer room cooling systems and uninterruptible power supply systems in additions/alterations shall meet the requirements of Sections 120.6(j), 140.9(a)2, and 140.9(a)4 and comply with item 1 below.

1. **Economizers.** Each individual cooling system primarily serving computer rooms in an existing building shall ~~include either:~~ meet the requirements of Section 140.9(a)1

~~A. An integrated air economizer capable of partial cooling when additional mechanical cooling is required and capable of providing 100 percent of the expected system cooling load up to 80°F room supply air temperature at outside air temperatures of 55°F dry-bulb and below or 50°F wet-bulb and below, and be equipped with a fault detection and diagnostic system as specified by section 120.2(i); or~~

~~B. An integrated water economizer capable of partial cooling when additional mechanical cooling is required and capable of providing 100 percent of the expected system cooling load up to 80°F room supply air temperature at outside air temperatures of 40°F dry-bulb and below or 35°F wet-bulb and below.~~

EXCEPTION 1 to Section 141.1(b)1: Individual computer rooms with an ITE design load under 5 tons (18 kW) in a building that does not have any economizers.

EXCEPTION 2 to Section 141.1.(b)1: New cooling systems serving an existing computer room in an existing building with an ITE design load up to a total of 20 tons (70 kW) ~~50 tons (176 kW).~~

~~**EXCEPTION 3 to Section 141.1(b)1:** New cooling systems serving a new computer room in an existing building with an ITE design load up to a total of 20 tons (70 kW).~~

1.4 Reference Appendices

TBD