

Proposal Summary



HVAC Fault Detection and Diagnostics

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Measure Description

This measure proposes the following revisions to the required controls for space-conditioning systems (Section 120.2). The proposed changes include updates to the requirements and adding definitions for clarity.

- 1) Define terms for fault detection and diagnostics (FDD)
- 2) Require the installation of an FDD system for new nonresidential buildings and alterations over 100,000 square feet, with heating or cooling capacities over 300,000 Btu/hr
- 3) Require baseline functionality, communication, and accessibility

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

Justification for Proposed Change

HVAC fault detection and diagnostics (FDD) provides building operators with a proactive way to maintain and optimize their systems by bringing operational data together and providing actionable insights for inefficient operation. FDD can sustain other HVAC efficiency measures by monitoring their performance and identifying repairs. FDD enables a resilient energy efficiency strategy for buildings.

HVAC systems are designed, built, and operated to meet conditioning and ventilation needs of the building, ideally using as little energy as possible to do it. Modern HVAC direct digital control (DDC) systems provide the access to understanding HVAC system operation and automatically controlling the system, while also providing ability to monitor, trend, and analyze the system. However, over time HVAC systems lose their efficiency due to installation error, wear-and-tear on system components, lack of maintenance, and changes in control strategies.

Already-established processes such as start-up commissioning and existing building commissioning attempts to verify proper operation and/or optimize these systems. FDD is an automated version commissioning, using rule- or model-based approaches to identify faults that raise energy usage and limit the functionality of the system. The FDD system will also identify possible repairs to bring the system back to its original efficient operations or optimize it to save more energy than before.

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 Chris Battisti, cbattisti@trccompanies.com, directly and copy info@title24stakeholders.com.

Data needs include:

- Market penetration of FDD for buildings
- Building types that are implementing FDD
- System types that should be implementing FDD
- Range of HVAC energy savings that can be obtained with this measure
- Reasons buildings may not see energy savings or sustained energy efficiency
- Technical and market barriers to the measure
- First costs for FDD, and what building characteristics impact the costs
- Ongoing costs for FDD

- Software must be updated, and the associated costs for additional services

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

Section 120.2(i)

HVAC Fault Detection and Diagnostics (FDD).

All new HVAC systems with a design cooling or heating capacity over 300,000 Btu/hr, installed in new construction or alterations of buildings 100,000 square feet or larger, shall include a stand-alone or integrated Fault Detection and Diagnostics (FDD) system in accordance with Subsections 120.2(i)1 through 120.2(i)5.

1. The FDD controller shall:
 - i. Use permanently installed sensors to monitor HVAC equipment and system, and
 - ii. Have the capability of displaying the value of each sensor; and
 - iii. Provide system status by indicating the following conditions:
 - i. Simultaneous heating and cooling
 - ii. Leaking valves
 - iii. Stuck dampers
 - iv. Sensor calibration
 - v. Low change in temperature across a chiller
 - vi. Low or high airflow, and
- D. Trend system performance data at least once every 15 minutes or as event-based and storing data for a minimum of six months, and
- E. Automatically identify faults using a rule-based or model-based process, and automatically identify recommended actions to remove the fault and return the

system to original or improved operations.

Exception to Section 120.2(i)5: FDD algorithms based in direct digital control systems are not required to be certified to the Energy Commission

Below is the proposed draft language for new definitions to be added to clarify the additional language to section 120.2:

Fault – a deviation from normal operation that prevents the system from performing its intended function efficiently.

Fault Detection and Diagnostics – an automated process to identify faults in building systems using sensors and data analytics to monitor system performance, determine potential solutions, and communicate findings.

1.4 Reference Appendices

Updates are needed to NA7.5 Mechanical Systems Acceptance Tests.