

Proposal Summary



ASHRAE Guideline 36

Updated: February 27, 2023

Prepared by: Rupam Singla, TRC and Hwakong Cheng, Taylor Engineers

This code change proposal will be included in the CASE Report titled ASHRAE Guideline 36

Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on February 27, 2023. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments on this proposal, please email Rupam Singla, rsingla@trccompanies.com directly and copy info@title24stakeholders.com by March 10, 2023.

Measure Description

Title 24 includes aggressive HVAC controls requirements, but they have not been realized often enough in practice. Rather than placing the burden on designers and installers, standardization around ASHRAE Guideline 36 provides the opportunity to move the process “upstream” to the manufacturer level where the controls are programmed centrally and savings are automatically realized. The Title 24 Nonresidential Compliance Manual describes ASHRAE Guideline 36 as follows:

ASHRAE Guideline 36, High-Performance Sequences of Operation for HVAC Systems, provides peer-reviewed sequences of operation for HVAC systems, written in a format that can be readily implemented by building controls manufacturers and control system contractors. It is continuously updated by a large committee of engineers, manufacturers, scientists, and contractors following the rigorous ASHRAE public review process. These sequences are intended to maximize energy efficiency while maintaining good indoor air quality and comfort. The sequences have been configured and tested to provide control stability and real-time fault detection and diagnostics. Specifying Guideline 36 control sequences reduces risk of Energy Management Control System programming errors and provides a common set of terms and sequences to facilitate communication between specifiers, contractors, and operators.

Were this measure to be implemented into Title 24, control equipment would be designed to use Guideline 36 application libraries. Controls designers would specify



Guideline 36 sequences of operation and BAS installers would leverage Guideline 36 application libraries that are certified by the Energy Commission. Over time, the expectation is that BAS installers would spend less time programming sequences and debugging control logic. This measure will streamline the design and installation process, and also achieve more efficient outcomes for buildings due to the use of high performance Guideline 36 sequences in BAS equipment.

Data Needs/Stakeholder Information Requests

- **For Building Automation System manufacturers:**
 1. How much of Guideline 36 sequences are incorporated into your application library?
 2. Can you share a list of compliant sequences, those in development, and future planned sequences for inclusion?
 3. How quickly are you adding additional sequences?
 4. What do you expect your library to include by January 2026?
- **For controls contractors:**
 1. With comprehensive and robust application libraries developed around Guideline 36 sequences of operation, do you expect installation costs to increase or decrease, and why?

Data may be provided anonymously. To participate or provide information, please email Rupam Singla, rsingla@trccompanies.com directly and copy info@title24stakeholders.com.

Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2022 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions). When the specific requirements are still unknown, the language that will change is highlighted **blue**.

Standards

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

Section 100.1(b) – Definitions

ASHRAE Guideline 36 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “High-Performance Sequences of Operation for HVAC Systems”. 2021 (ANSI/ASHRAE Guideline 36-2021).

Programming Library is a collection of programming logic used for controlling HVAC equipment with direct digital control systems.

SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

A building complies with this section by being designed with and having constructed and installed a space- conditioning system that meets the applicable prescriptive requirements of Subsections (a) through (r).

(c) Fan systems

2. Variable air volume (VAV) systems

B. Setpoint reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure setpoints shall be reset based on the zone requiring the most pressure using control sequences of operation in accordance with ASHRAE Guideline 36; i.e., the setpoint is reset lower until one zone damper is nearly wide open.

(d) Space-conditioning zone controls. Each space-conditioning zone shall have controls designed in accordance with 1 or 2:

2. Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, recooled, or mixed air are allowed only if the controls meet all of the following requirements:

A. For each zone with direct digital controls (DDC):

i. The volume of primary air that is reheated, recooled or mixed air supply shall not exceed the larger of:

a. 50 percent of the peak primary airflow; or

b. The design zone outdoor airflow rate as specified by Section 120.1(c)3.

ii. The volume of primary air in the deadband shall not exceed the design zone outdoor airflow rate as specified by Section 120.1(c)3.

iii. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95°F while the airflow is maintained at the dead band flow rate.

iv. The second stage of heating consists of modulating the airflow rate from the dead band flow rate up to the heating maximum flow rate.

v. Control sequences of operation for reheat zones shall be in accordance with ASHRAE Guideline 36.

(e) Economizers.

2. If an economizer is required by Section 140.4(e)1, and an air economizer is used to meet the requirement, then it shall be:

A. Designed and equipped with controls so that economizer operation does not increase the building heating energy use during normal operation; and

Exception to Section 140.4(e)2A: Systems that provide 75 percent of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source.

B. Capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

C. Designed and equipped with a device type and high limit shut off complying with Table 140.4-G.

D. If controlled by a DDC system, configured with control sequences of operation in accordance with ASHRAE Guideline 36

(f) Supply air temperature reset controls. Space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply air temperatures. Air distribution systems serving zones that are likely to have constant loads shall be designed for the air flows resulting from the fully reset supply air temperature. Supply air temperature reset controls shall be:

1. In response to representative building loads or to outdoor air temperature; and

2. At least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

3. Configured with control sequences of operation in accordance with ASHRAE Guideline 36.

(r) DDC Controller Logic Using ASHRAE Guideline 36. HVAC systems with DDC shall use controller logic originating from a programming library based on sequences of operation from ASHRAE Guideline 36 in accordance with Subsections 140.4(r)1 through 140.4(r)2.

1. Requirement applies to the entirety or portions of equipment control for configurations included in the programming library.

2. The programming library shall be certified by the Energy Commission as meeting the requirements of JAX.X.

Exception 1 to Section 140.4(r): Logic from the certified programming library may be modified to suit application-specific needs that are not supported by Guideline 36 sequences.

Exception 2 to Section 140.4(r): Systems serving healthcare facilities.

SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

(b) Alterations.

2. Prescriptive approach.

C. New or Replacement Space-Conditioning Systems or Components

Exception 6 to Section 141.0(b)2C: Section 140.4(r) shall not apply to new or replacement components unless the space conditioning-systems are also new or replacements.

APPENDIX 1-A

STANDARDS AND DOCUMENTS REFERENCED IN THE ENERGY CODE

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (NATIONAL PUBLICATIONS)

ASHRAE GUIDELINE 36-2021 High-Performance Sequences of Operation for HVAC Systems (2021)

Reference Appendices

JA13.1 Guideline 36 Programming Library Certification Submittal Requirements

Title 24, Part 6, Section 140.4(r) requires that HVAC control systems use pre-programmed ASHRAE Guideline 36 (G36) libraries. Each building automation system (BAS) manufacturer or controls supplier wishing to certify that their G36 libraries conform to the G36 library requirements of Title 24, Part 6, may do so in a written declaration. This requires that a letter be sent to the California Energy Commission declaring that the G36 library conforms to Title 24, Part 6, Section XXX. The declaration at the end of this section

shall be used to submit to the California Energy Commission.

JAX.X.1 Information that shall be included with the Declaration

The BAS manufacturer or controls supplier shall provide evidence of compliance with these requirements as shown below:

Evidence: List of hardwired points and control points used in the library.

Evidence: Documentation of test plan and results, including inputs and outputs for each test.

Evidence: Documentation of programming, such as screenshots of programming function blocks or programming script.

JAX.X.2 Programming Library Requirements

Certification shall be based on one of the following two paths:

- Path A: the requirements of a third-party standardized method of test, when approved by the Energy Commission
- Path B: in accordance with the certification requirements herein. Programming library shall include complete control programming for each of logic sections from G36 listed in Table JAX.X.2-1 and shall meet the listed validation requirements.

Table JAX.X.2-1

<u>Logic Section</u>	<u>Validation Requirements</u>
<u>General (may be integrated with other library sections)</u> <u>G36 Paragraph 5.1</u>	<u>Alarms: Alarm levels, maintenance mode, exit hysteresis, latching, and suppression periods per Paragraph 5.1.12.</u>
	<u>Trim & Respond Set-Point Reset Logic: Importance-Multipliers, Request-Hours Accumulator, and Trim & Respond Variables configured in accordance with Paragraph 5.1.14.</u>
	<u>Air Economizer: Economizer high limit device types and setpoints in accordance with Paragraph 5.1.17.</u>
<u>Generic Ventilation Zones (may be integrated with other library sections)</u> <u>G36 Paragraph 5.2</u>	<u>Hierarchical alarm suppression configured per Paragraph 5.1.19.</u>
	<u>Setpoints: Zone minimum outdoor air setpoints and occupied minimum airflow determined in accordance with Paragraph 5.2.1.4.</u>
<u>Generic Thermal Zones</u>	<u>Time-averaged ventilation per Paragraph 5.2.2.</u>
	<u>Setpoints: Zone heating and cooling setpoints, demand limit setpoint adjustments, and setbacks per Paragraph 5.3.2.</u>

<u>G36 Paragraph 5.3</u>	
<u>Zone Groups</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.4</u>	
<u>VAV Terminal Unit – Cooling Only</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.5</u>	
<u>VAV Terminal Unit with Reheat</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.6</u>	
<u>Parallel Fan-Powered Terminal Unit – Constant-Volume Fan</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.7</u>	
<u>Parallel Fan-Powered Terminal Unit – Variable-Volume Fan</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.8</u>	
<u>Series Fan-Powered Terminal Unit – Constant-Volume Fan</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.9</u>	
<u>Series Fan-Powered Terminal Unit – Variable -Volume Fan</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.10</u>	
<u>Dual-Duct VAV Terminal Unit – Snap-Acting Control</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.11</u>	
<u>Dual-Duct VAV Terminal Unit – Mixing Control with Inlet Airflow Sensors</u>	<u><i>Draft Requirements to be Developed Later</i></u>
<u>G36 Paragraph 5.12</u>	

<p><u>Dual-Duct VAV Terminal Unit – Mixing Control with Discharge Airflow Sensor</u></p> <p><u>G36 Paragraph 5.13</u></p>	<p><i><u>Draft Requirements to be Developed Later</u></i></p>
<p><u>Dual-Duct VAV Terminal Unit – Cold-Duct Minimum Control</u></p> <p><u>G36 Paragraph 5.14</u></p>	<p><i><u>Draft Requirements to be Developed Later</u></i></p>
<p><u>Air-Handling Unit System Modes</u></p> <p><u>G36 Paragraph 5.15</u></p>	<p><i><u>Draft Requirements to be Developed Later</u></i></p>
<p><u>Multiple-Zone VAV Air-Handling Unit</u></p> <p><u>G36 Paragraph 5.16</u></p>	<p><u>Fan Control: Fan control and duct static pressure setpoint reset using trim & respond logic per Paragraph 5.16.1.</u></p> <p><u>Supply Air Temperature Control: Supply air temperature control, setpoint reset, and air economizer high limits per 5.16.2.</u></p> <p><u>Minimum Outdoor Airflow Setpoint: System outdoor airflow requirements dynamically summed for Zone Groups in Occupied Mode per Paragraph 5.16.3.2.</u></p> <p><u>Minimum Outdoor Air Control: Outdoor air control in accordance with 5.16.4, 5.16.5, or 5.16.6.</u></p> <p><u>Relief Control: Building relief in accordance with 5.16.8 or 5.16.9.</u></p> <p><u>Return Fan Control: Return fan control in accordance with 5.16.10 or 5.16.11.</u></p> <p><u>Automatic Fault Detection and Diagnostics: Operating states, variables, and fault conditions in accordance with 5.16.14.</u></p>
<p><u>Dual-Fan Dual-Duct Heating VAV Air-Handling Unit</u></p> <p><u>G36 Paragraph 5.17</u></p>	<p><i><u>Draft Requirements to be Developed Later</u></i></p>
<p><u>Single-Zone VAV Air-Handling Unit</u></p>	<p><i><u>Draft Requirements to be Developed Later</u></i></p>

<u>G36 Paragraph 5.18</u>	
<u>General Constant Speed Exhaust Fan</u>	<u>Draft Requirements to be Developed Later</u>
<u>G36 Paragraph 5.19</u>	
<u>Fan Coil Unit</u>	<u>Draft Requirements to be Developed Later</u>
<u>G36 Paragraph 5.22</u>	

(a) JAX.X.3 Declaration

Consistent with the requirements of Title 24, Part 6, Sections 100.0(h) and XXX, companies wishing to certify to the California Energy Commission shall execute a declaration under penalty of perjury attesting that all information provided is true, complete, accurate, and in compliance with the applicable provisions of Part 6. Companies may fulfill this requirement by providing the information, signing the declaration below and submitting to the California Energy Commission as specified by the instructions in JAX.X.3.

(b) Manufacturer, Product Line, and Version Number of all libraries being certified

<u>Manufacturer</u>	<u>Product Line</u>	<u>Version Number</u>

When providing the information below, be sure to enter complete mailing addresses, including postal/zip codes.

(c) Certifying Company

<u>Contact Person Name *</u>	<u>Phone 1</u>
<u>Certifying Company Name **</u>	<u>Phone 2</u>
<u>Address</u>	<u>Fax</u>
<u>(Address)</u>	<u>E-mail</u>
<u>(Address)</u>	<u>Company Website (URL)</u>

* If the contact person named above is NOT the person whose signature is on the Declaration, then the full contact information for the person whose signature is on the Declaration must also be provided on a separate page.

** If the company named above is: A) a parent entity filing on behalf of a subsidiary entity; B) a subsidiary entity filing on behalf of a parent entity; or C) an affiliate

entity filing on behalf of an affiliate entity, the above contact information must be provided for any additional entities on a separate page.

(d) Manufacturer (if different from Certifying Company)

<u>Contact Person Name</u>	<u>Phone 1</u>
<u>Manufacturing Company Name</u>	<u>Phone 2</u>
<u>Address</u>	<u>Fax</u>
<u>(Address)</u>	<u>E-mail</u>
<u>(Address)</u>	<u>Company Website (URL)</u>

(e) Declaration

I declare under penalty of perjury under the laws of the State of California that:

- (1) All the information in this statement is true, complete, accurate, and in compliance with all applicable provisions of Section XXX of Title 24, Part 6 of the California Code of Regulations.
- (2) =
- (3) [If the party submitting this statement is a corporation, partnership, or other business entity] I am authorized to make this declaration, and to file this statement, on behalf of the company named below.

<u>Certifying Company Name</u>	<u>Date</u>
<u>Name/Title (please print)</u>	<u>Signature</u>

(f) JAX.X.4 Certification

Send declarations and evidence of functionality or test reports to the addresses below. Electronics submittals are preferred.

- (1) Electronic submittal:
Certified to CEC@energy.ca.gov Attn: G36 Libraries Certification
- (2) Mail:
Attn: G36 Libraries Certification
Building Standards
Development Office California
Energy Commission

1516 Ninth St., MS 37

Sacramento, CA 95814
