



# APPLICATION GUIDE

## California Title 24 Impact on Premier Rooftop Units

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Introduction.....	2
Ventilation Basics .....	2
Regulatory Requirements.....	2
Economizer Fault Detection and Diagnostics (FDD).....	4
Selecting a Unit in Selection Navigator to Meet Title 24.....	4
Reference Documents.....	4

## Introduction

The California Energy Commission's *2016 Building Energy Efficiency Standards for Residential and Non-Residential Buildings* is codified in the California Building Standards Commission's *2016 California Energy Code*, which is Title 24, Part 6 of the California Code of Regulations. Title 24 identifies certain requirements intended to reduce electrical energy consumption of HVAC equipment.

This Application Guide focuses on the requirements of Title 24 that affect rooftop units (RTUs), how the Johnson Controls® Premier RTUs meet those requirements, and how to select the appropriate options in the Selection Navigator tool to configure a Premier RTU to meet the 2016 Title 24 requirements. Specific requirements are referenced throughout this document using the Title 24 paragraph or section number.

One of the most significant impacts of Title 24 on RTUs is the requirement for ventilation and an associated Fault Detection and Diagnostic (FDD) system (CBSC 2016, sec. 120.1–120.2). Occupied buildings are required to provide either natural ventilation or mechanical ventilation. For a RTU, this means an economizer.

## Ventilation Basics

One common way to reduce energy cost is to use outside air that is below the required supply air temperature (SAT), called *free cooling*. Years ago, that meant opening the windows on a nice day. Today's large, sealed buildings require a more sophisticated approach, typically using an economizer to simulate the open window on a much larger scale.

An economizer is an adjustable opening on the return air side of the coil that allows outside air to enter the return air stream under certain conditions. Motorized dampers are modulated between full open and full closed by the control system based on comparative measurements of inside and outside air conditions (temperature or enthalpy) and also the need for cooling or ventilation of the occupied space. The economizer is used not only

for the free cooling aspect, but also to provide fresh air to meet ventilation requirements based on occupancy or carbon dioxide (CO<sub>2</sub>) levels. The exhaust damper (or fan) provides an outlet for the excess air to prevent over-pressurization of the building.

When the ambient air conditions are outside of the established parameters or cooling is not required, the damper closes to maintain minimum ventilation air. Title 24 requires use of a low leakage damper to prevent infiltration of outside air when the damper is fully closed. Damper leakage shall be less than 10 CFM/sq. ft. at 1.0 iwg when tested per AMCA Standard 500 (CBSC 2016, sec. 140.4(e)4C).

## Regulatory Requirements

Title 24, Part 6 is broken down into nine subchapters. Subchapter 2 defines the minimum efficiency requirements for RTUs in Table 110.2-A (CBSC 2016, sec. 110). Premier RTUs are available in 25–50 ton cooling capacities. See *Table 1 on page 3* for Energy Efficiency Ratio/Integrated Energy Efficiency Ratio (EER/IEER) ratings.

Subchapter 3 defines mandatory requirements for non-residential, high-rise residential, and hotel/motel occupancies. Pertinent requirements include:

1. If the design occupancy or maximum occupancy is 25 people/1,000 sq. ft. or more, the RTU must incorporate demand control ventilation. Exceptions exist for certain high density purposes, such as classrooms, call centers, etc. (CBSC 2016, sec. 120.1(c)3).
2. Demand control ventilation requires CO<sub>2</sub> sensors in the occupied space and an outside air CO<sub>2</sub> sensor (CBSC 2016, sec. 120.1(c)4).
3. Variable air volume (VAV) units shall include dynamic controls to maintain measured outside air ventilation rates within 10% of required outside air rates at all airflow rates (CBSC 2016, sec. 120.1(e)2). This requirement necessitates an airflow monitoring station.

**Table 1: EER/IEER Ratings**

Capacity	Efficiency	Heat Source	EER	IEER
25 Tons	Standard Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.8	14.9
		Gas/Steam/Hot Water	10.6	14.8
	Standard Capacity/High Efficiency	Cooling Only/Electric Heat	11.4	16.7
		Gas/Steam/Hot Water	11.2	16.6
	High Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.8	14.9
		Gas/Steam/Hot Water	10.6	14.8
30 Tons	Standard Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.5	14.3
		Gas/Steam/Hot Water	10.3	14.2
	Standard Capacity/High Efficiency	Cooling Only/Electric Heat	10.9	15.2
		Gas/Steam/Hot Water	10.7	15.1
	High Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.5	14.3
		Gas/Steam/Hot Water	10.3	14.2
40 Tons	Standard Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.9	14.6
		Gas/Steam/Hot Water	10.7	14.5
	Standard Capacity/High Efficiency	Cooling Only/Electric Heat	11.1	16.1
		Gas/Steam/Hot Water	10.9	16.0
	High Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.7	14.6
		Gas/Steam/Hot Water	10.5	14.5
50 Tons	Standard Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.8	15.0
		Gas/Steam/Hot Water	10.6	14.9
	Standard Capacity/High Efficiency	Cooling Only/Electric Heat	10.9	15.9
		Gas/Steam/Hot Water	10.7	15.8
	High Capacity/Standard Efficiency	Cooling Only/Electric Heat	10.5	14.8
		Gas/Steam/Hot Water	10.3	14.7

Subchapter 5 identifies prescriptive requirements for space conditioning systems. Requirements relative to RTUs include:

1. Damper Reliability Testing: Economizers shall be certified for operational life in excess of 60,000 cycles (CBSC 2016, sec. 140.4(e)4B). Premier’s ultra low leak dampers meet this requirement.
2. Damper Leakage: Title 24 requires the maximum damper leakage rate to be 10 CFM/sq. ft. at 1.0 iwg (CBSC 2016, sec. 140.4(e)4C). Our Premier economizer outside air ultra low leak dampers are certified to have a maximum leakage rate of 4 CFM/sq-ft at 1.0 iwg when tested in accordance with AMCA Standard 500.
3. Electric resistance heat shall not be used for space heating (CBSC 2016, sec. 140.4(g)).
4. Hot gas bypass is not allowed except on the lowest stage of cooling (CBSC 2016, sec. 140.4(e)5C).
5. Warranty: Economizer must have a 5-year manufacturer’s warranty (CBSC 2016, sec. 140.4(e)4A).
6. Fan Control:
  - a. Direct expansion (DX) systems greater than 65,000 Btuh that control cooling capacity directly based on space temperature shall have a minimum of two fan speeds (CBSC 2016, sec. 140.4(m)1).
  - b. VAV units shall have proportional fan control so that at 50% airflow, the fan shall draw no more than 30% of its full speed power (CBSC 2016, sec. 140.4(m)2).
  - c. Systems with an economizer shall have a minimum of two fan speeds (CBSC 2016, sec. 140.4(m)3).

## Economizer Fault Detection and Diagnostics (FDD)

When properly maintained and working correctly, economizers are an excellent way to reduce energy costs by utilizing ambient air cooling. Failure of the economizer—such as inoperable actuators, sticking damper blades, or bad sensors—can waste a large amount of energy by introducing cold air in the winter or hot, humid air in the summer. Title 24 addresses this issue by requiring a means to monitor the proper operation of the economizer.

Title 24 requires that all RTUs 4.5 tons and larger with an economizer shall have a means to monitor the system's operation and report any failures of temperature sensors, dampers, or improper operation (CBSC 2016, sec. 120.1(i)).

The FDD must provide a system status showing:

- Free cooling is available
- Economizer is enabled
- Compressor is enabled
- Heating is enabled (CBSC 2016, sec. 120.1(i)4)

Should any of the following faults occur, the FDD is designed to detect the fault and notify the operator using local annunciation and provide a fault signal via a building communication system (BACnet®):

- Air temperature sensor fault/failure
- Not economizing when required
- Economizing when not required
- Damper not modulating
- Excess outdoor air (CBSC 2016, sec. 120.1(i)7)

The FDD functionality is built into the standard software and can be enabled in the field via the unit keypad and display.

## Selecting a Unit in Selection Navigator to Meet Title 24

The California Energy Commission requires submission of equipment for listing by model number.

Visit the California Energy Commission website to download a spreadsheet that lists all certified RTU models submitted to date (California Energy Commission 2018a).

There is also a spreadsheet that lists all of the controllers that are certified to meet the Title 24 FDD requirements (California Energy Commission 2018b).

The following items must be part of the RTU to meet Title 24 requirements:

1. Cooling:
  - a. Return/Exhaust Option: Exhaust fan or gravity damper
2. Economizer:
  - a. Economizer: Full indoor air quality (IAQ) with full airflow measurement
  - b. CO<sub>2</sub> sensor (check box)
  - c. Economizer Control: Dry bulb sensor or single enthalpy sensor
  - d. Type of Damper: Ultra low leakage
3. Heating
  - a. NO electric heat

## References

1. California Energy Commission. 2018a. "Air Economizers." 2016 Manufacturer Certification for Equipment, Products and Devices. Last modified September 12, 2018. [http://www.energy.ca.gov/title24/equipment\\_cert/ae/index.html](http://www.energy.ca.gov/title24/equipment_cert/ae/index.html).
2. ———. 2018b. "Economizer Fault Detection and Diagnostics." 2016 Manufacturer Certification for Equipment, Products and Devices. Last modified February 1, 2018. [http://www.energy.ca.gov/title24/equipment\\_cert/fdd/index.html](http://www.energy.ca.gov/title24/equipment_cert/fdd/index.html).
3. CBSC (California Building Standards Commission). 2016. *California Code of Regulations*. Title 24, Part 6, 2016 *California Energy Code*. Washington D.C.: ICC (International Code Council).

