CALIFORNIA STATEWIDE
UTILITY CODES AND STANDARDS PROGRAM

2016 Title 24 Codes & Standards Enhancement (CASE) Proposal

Nonresidential HVAC Economizer Modifications

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Code Change History

2013 T-24 Requirements: HVAC Controls and Economizers

Implementation date July 1, 2014

- Economizer requirements in sections 120.2(i), 140.4(e), and NA7.5.4
  - Economizers prescriptive for units ≥ 54 kBtu/h in capacity
  - Economizer fault detection & diagnostics (FDD) mandatory
  - Performance requirements added, including leakage
  - Acceptance tests added (MECHs 5, 12, and 13)
  - Expected to affect 30% of market
- ASHRAE 90.1: Economizers prescriptive for ≥ 54 kBtu/h
- IECC 2012: Economizers prescriptive for ≥ 33 kBtu/h

Proposed Code Change Overview

NonRes HVAC Economizer Modifications

- Six (6) measures to clarify and improve economizer and economizer FDD language in the following sections of the code:
  - Section 120.2(i) – mandatory requirements
  - Section 140.4(e) – prescriptive requirements
  - NA7.5.4 – nonresidential appendices
  - JA6 – joint appendices

Proposed Code Change Overview (continued)

Economizer FDD

- Section 120.2(i):
  - Clarify that economizer FDD can be either standalone or integrated with system controller
- Section 120.2(i)3:
  - Delete refrigerant pressure sensors requirements
- Section 120.2(i)7:
  - Clarify how faults shall be reported
- Section 120.1(i)9 and Joint Appendices:
  - Integrate CEC's Economizer FDD Testing Guidance document and Declaration

Proposed Code Change Overview (continued)

Economizer Performance

- 140.4(e) and NA7.5.4:
  - Modify to reflect findings that economizer airflow is <100% design when economizer fully open
  - Modify to close loopholes for economizer leakage performance

Proposed Code Change Language

Section 120.2(i): Clarify that controls for economizer FDD can be either stand-alone or integrated into the RTU system controller.

120.2 - REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

(i) **Economizer Fault Detection and Diagnostics (FDD).** All newly installed air-cooled unitary direct-expansion units, equipped with an economizer and with mechanical cooling capacity at AHRI conditions of greater than or equal to 54,000 Btu/hr, 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)9. ~~Air-cooled unitary direct expansion units include packaged, split systems, heat pumps, and variable refrigerant flow (VRF), where the VRF capacity is defined by that of the condensing unit.~~

1. The following temperature sensors shall be permanently installed to monitor system operation: outside air, supply air, and when required for differential economizer operation, a return air sensor; and
2. Temperature sensors shall have an accuracy of ±2°F over the range of 40°F to 80°F; and
3. Refrigerant pressure sensors, if used, shall have an accuracy of ±3 percent of full scale; and
4. The controller shall have the capability of displaying the value of each sensor; and
5. The controller shall provide system status by indicating the following conditions: Free cooling available; Economizer enabled; Compressor enabled; Heating enabled; Mixed air low limit cycle active
6. The unit controller shall manually initiate each operating mode so that the operation of compressors, economizers, fans, and heating system can be independently tested and verified; and
7. Faults shall be reported to a fault management application accessible by day-to-day operating or service personnel, or annunciated locally on zone thermostats; and
8. The FDD system shall detect the following faults: A. Air temperature sensor failure/fault; B. Not economizing when it should; - C. Economizing when it should not; D. Damper not modulating; E. Excess outdoor air
9. The FDD System shall be certified by the Energy Commission as meeting requirements of Sections 120.2(i)1 through 120.2(i)8 in accordance with Section 100(h).

Proposed Code Change Language

Section 120.2(i)3: Delete refrigerant pressure sensor requirements

120.2 - REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

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9. The FDD System shall be certified by the Energy Commission as meeting requirements of Sections 120.2(i)1 through 120.2(i)8 in accordance with Section 100(h).

Proposed Code Change Language

Section 120.2(i)7: Clarify how faults shall be reported

120.2 - REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

(i) **Economizer Fault Detection and Diagnostics (FDD).** All newly installed air-cooled unitary direct-expansion units, equipped with an economizer and with mechanical cooling capacity at AHRI conditions of greater than or equal to 54,000 Btu/hr, 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)9.

[…]

~~7. Faults shall be reported to a fault management application accessible by day-to-day operating or service personnel, or annunciated locally on zone thermostats;~~ Faults shall be reported in one of the following ways:

A. To an Energy Management Control System regularly monitored by facility personnel
B. Annunciated locally on one or more zone thermostats, or on a device within five (5) feet of zone thermostat(s), clearly visible, at eye level, and meeting the requirements below:
    i. Display instructions to contact appropriate building personnel or an HVAC technician
    ii. In buildings with multiple tenants, the annunciation shall either be within property management offices, or in common space accessible by the property or building manager.
C. To a remote fault management application which automatically notifies an HVAC service provider of the fault

8. The FDD system shall detect the following faults: A. Air temperature sensor failure/fault; B. Not economizing when it should; - C. Economizing when it should not; D. Damper not modulating; E. Excess outdoor air

[…]

Proposed Code Change Language

Integrate CEC's Declaration and Economizer FDD Testing Guidance into Joint Appendix

120.2 - REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

(i) **Economizer Fault Detection and Diagnostics (FDD).**

9. The FDD System shall be certified by the Energy Commission as meeting requirements of Sections 120.2(i)1 through 120.2(i)8 and JA6.3 in accordance with Section 100(h).

Title 24, Part 6 Certification of Economizer Fault Detection and Diagnostics (FDD)

Title 24, Part 6 Section 120.2(i) requires that economizer FDD functions be installed on air-cooled unitary air conditioning systems over 4.5 tons cooling capacity, with the ability to detect the faults specified in Section 120.2(i). Each air conditioning system manufacturer, controls supplier, or FDD supplier wishing to certify that their FDD analytics conform to the FDD 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 FDD conforms to Title 24, Part 6 Section 120.2(i). The declaration at the end of this document could be used to submit to the California Energy Commission.

shall

~~Guidance on~~ information that ~~may~~ be included with the Declaration

The air conditioning system manufacturer, controls supplier, or FDD supplier provides evidence as shown below:

a. The following temperature sensors are permanently installed to monitor system operation:
   i. Outside air
   ii. Supply air
   iii. Return air, when required for differential economizer operation.

   Evidence: Photograph or schematic of all required sensors indicating their recommended mounting instructions.

b. Temperature sensors have an accuracy of ±2°F over the range of 40°F to 80°F

   Evidence: Photocopy of sensor specification

Fault Detection Diagnostic System Declaration

Consistent with the requirements of Title 24, Part 6 Sections 100.0(h) and 120.2(i), 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 electronically to CertifiedtoCEC@energy.ca.gov

Manufacturer, Model Name and Number of all devices being certified

Manufacturer	Model Name	Model Number

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

Certifying Company

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

* 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.

Available at: http://www.energy.ca.gov/title24/equipment_cert/fdd/FDD_Certification_Guidance.pdf

Proposed Code Change Language

Modify Sections 140.4(e) to clarify economizer damper fully open/closed requirement

140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

(e) **Economizers.**

1. Each cooling fan system that has a design total mechanical cooling capacity over 54,000 Btu/hr shall include either:

A. An air economizer specified by the manufacturer for the equipment on which it is installed, and capable of modulating outside-air dampers to 100 percent open and return-air dampers to ~~supply~~ 100 percent closed ~~of the design supply air quantity as outside-air~~; or

B. A water economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of […]

Proposed Code Change Language

Modify Sections 140.4(e) to clarify economizer leakage requirements

140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS
(e) **Economizers.**

4. If an economizer is required by Section 140.4(e)1, and an air economizer is used to meet the requirement, then the air economizer, and all return air dampers on any individual cooling fan system that has a total mechanical cooling capacity over 54,000 Btu/hr shall have the following features:

[…]

B. **Damper reliability testing.** Suppliers of economizers shall certify that the economizer assembly, including but not limited to outdoor air damper, return air damper, drive linkage, and actuator, have been tested and are able to open and close against the rated airflow and pressure of the system ~~after~~for 60,000 damper opening and closing cycles.

C. **Damper leakage.** Economizer and return dampers shall be certified by the manufacturer to have a maximum leakage rate of 10 cfm/sf at ~~1.0 in. w.g.~~ 250 Pascals when tested in accordance with AMCA Standard 500. The economizer leakage rate shall be certified to the Energy Commission in accordance with Section 100(h).

Proposed Code Change Language

Modify Nonresidential Appendix to clarify economizer damper fully open/closed requirement and leakage requirements

NA7.5.4 Air Economizer Controls
NA7.5.4.1 Construction Inspection
[…]

(i) Economizer reliability features are present per Standards Section 140.4(e)4.
(j) Economizer inlet damper ~~System~~ is designed to ~~provide~~ modulate up to 100 percent ~~outside air~~ open, and return air damper to 100 percent closed, without over-pressurizing the building.
(p) Provide a product specification sheet proving compliance with AMCA Standard 500 damper leakage at 10 cfm/sf at ~~1 in. w.g.~~250 Pascals, and certified to the Energy Commission in accordance with Section 100(h).

[…]

NA7.5.4.2 Functional Testing
[…]

Step 2: Enable the economizer and simulate a cooling demand large enough to drive the economizer fully open. Verify and document the following:
(a) Economizer damper is 100 percent open and return air damper is 100 percent closed.
(b) For systems that meet the criteria of §140.4(e)2.B.i, verify that the economizer is 100 percent open part of the time and the compressor cycles on and off when the cooling demand can no longer be met by the economizer alone.
[…]

Modifications Based on Stakeholder Feedback

Economizer FDD

- Fault reporting:
  - Ensured products that are compliant with 2013 requirements remain compliant
  - Added option for FDD to report fault directly to HVAC technician
- Evidence and Declaration for compliance with 120.2(i)
  - Manufacturers not liable for field installations

Modifications Based on Stakeholder Feedback

Economizer Performance

- Damper leakage
  - Modified to a declaration under penalty of perjury from third-party testing requirements
- Economizer airflow
  - Air Movement and Control Association (AMCA) to provide suggested improvements

Questions?

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