

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.

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 $\pm 2^{\circ}\text{F}$ over the range of 40°F to 80°F

Evidence: Photocopy of sensor specification
- c. When refrigerant pressure sensors are used, they have an accuracy of ± 3 percent of full scale
Evidence: Photocopy of sensor specification
- d. The controller is capable of providing system status by indicating the following:
 - i. Free cooling available
 - ii. Economizer enabled
 - iii. Compressor enabled
 - iv. Heating enabled
 - v. Mixed air low limit cycle active
 - vi. The current value of each sensor

Evidence: Laboratory test: describe how the mode is simulated and the wording used to indicate the status.
- e. The unit controller is capable of manually initiating each operating mode so that the operation of compressors, economizers, fans, and heating system can be independently tested and verified.

Evidence: Photocopy of controller manual showing instructions for manually initiating each operating mode.

- f. The unit control is capable of reporting faults to a fault management application accessible by day-to-day operating or service personnel, or annunciated locally on zone thermostats
Evidence: Supplier’s description of how they comply, and supporting documentation such as a photocopy of controller manual or photograph of fault management application or zone thermostat, showing indication of a fault.
- g. The unit control is capable of detecting the following faults:
 - i. Air temperature sensor failure/fault
 - ii. Not economizing when it should
 - iii. Economizing when it should not
 - iv. Damper not modulating
 - v. Excess outdoor air

Guidance on Fault Detection Test Specifications

To provide evidence that the required faults are detected by the FDD functionality, the FDD Provider could perform a No-Fault and Fault test for each of the tests in Table 1. A pre-defined Test Procedure such as the one provided in the example shown in Table 2 could be used to fill out Table 1.

Table 1 – Sample of a completed fault test

Tests	Faults				
	Air temperature sensor failure/fault	Not Economizing when it should	Economizing when it Should not	Damper not modulating	Excess outdoor air
1. Damper is Stuck Open			X	X	X
2. Damper Stuck at Minimum		X		X	
3. Bad or Unplugged Actuator		X	X	X	
4. Sensor Hard Failure	X	X	X		X
5. Actuator Mechanically Disconnected		X	X	X	X

Guidance for Reporting of Test Results

The results of each test could be provided in a report with a cover letter using a standard test results reporting format that provides the following information for each test:

- a. Organization and individual conducting the test
- b. Time, Date, and Location of test
- c. Make and model of unit/control tested
- d. Range of models represented by test
- e. Test procedure used, including description of the method for imposing fault with repeatability

- f. Test driving Conditions (outdoor air temperature, return air temperature or enthalpy as required by the type of high limit control being used)
- g. Results of the test: Which alarms were generated?
- h. Provide a bill of materials for the configuration that is being certified.
- i. The FDD supplier shall describe any special field or data verifications that are required for the particular FDD analytics (beyond those included in Acceptance Test requirements).
- j. Sample of documentation that would accompany each qualifying set of FDD analytics.
- k. Name and contact information of company personnel in charge of certification
- l. A mapping from the manufacturer’s alarm description to what is required by Title 24 similar to Table 1.

Table 2 - Sample Test Procedure

Step	Description	Purpose
1	Close the economizer damper fresh air blades, then secure the blades in a manner that prevents opening.	Test alarm response when “Damper Stuck at Minimum”
2	Simulate conditions such that the damper actuator attempts to open the fresh air blades. Verify the damper blades remains secured and that the fault(s) specified in Table 1 are detected. Record the annunciated fault(s) and fault text.	
3	Release the blades and allow the economizer damper to modulate open. Verify the annunciated fault(s) have cleared.	
4	Open fully the economizer damper fresh air blades, then secure the blades in a manner that prevents closing.	Test alarm response when “Damper is Stuck Open”
5	Simulate conditions such that the damper actuator attempts to modulate the fresh air blade closed. Verify the damper remains secured and that the fault(s) specified in Table 2 are detected. Record the annunciated fault(s) and fault text.	
6	Release the blades and allow the economizer damper to modulate. Verify the annunciated fault(s) have cleared.	
7	Disconnect 1 sensor and verify the fault(s) specified in Table 1 are detected. Record the annunciated fault(s) and fault text.	Test alarm response when “Sensor Hard Failure”
8	Reconnect the sensor and verify that the annunciated fault(s) have cleared.	
9	Repeat steps 7 – 8 for each available sensor.	
10	Electrically disconnect the damper actuator and verify the fault(s) specified in Table 1 are detected. Record annunciated fault(s) and fault text.	Test alarm response when “Bad or Unplugged Actuator”
11	Reconnect the damper actuator. Verify the fault(s) have cleared and normal economizer operation has resumed.	
12	Mechanically disconnect the damper actuator from the damper blade assembly.	Test alarm response when “Actuator Disconnected”

13	Simulate conditions such that the damper actuator would be moving the damper blades. Verify the fault(s) specified in Table 2 are detected. Record annunciated fault(s) and fault text.	
14	Reconnect the damper actuator to the damper blade assembly. Verify the fault(s) have cleared and normal economizer operation has resumed.	
15	Simulate conditions necessary to generate system status of "Free cooling available". Record text of annunciated status.	Test for System Status Capability
16	Simulate system conditions necessary to generate system status of "Economizer enabled". Record text of annunciated status.	
17	Simulate system conditions necessary to generate system status of "Compressor enabled". Record text of annunciated status.	
18	Simulate system conditions necessary to generate system status of "Heating enabled". Record text of annunciated status.	
19	Simulate system conditions necessary to generate system status of "Mixed air low limit cycle active". Record text of annunciated status.	

Certification

- a. Send declarations, and on a voluntary basis evidence of functionality or test reports to:

*Attn: FDD Certification
 Building Standards Development Office
 California Energy Commission
 1516 Ninth St., MS 37
 Sacramento, CA 95814*

Consistent with the requirements of Title 24 Sections 100.0(h) and 120.2(i), companies wishing to certify to the California Energy Commission shall execute a requirement under penalty of perjury attesting that all information provided is true, complete, accurate, and in compliance with the applicable provisions of Title 6. Companies may fulfill this requirement by providing the information and signing the declaration below.

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.

Manufacturer (if different from Certifying Company)

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

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 120.2(i) of Title 24, Part 6 of the California Code of Regulations;
- (2) each Fault Detection and Diagnostic (FDD) system has been tested in accordance with all applicable requirements of Section 120.2(i)1-120.2(i)8 of Title 24, Part 6 of the California Code of Regulations;
- (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.

Certifying Company Name

Date

Name/Title (please print)

Signature