ADDENDA

ANSI/ASHRAE/IES Addendum el to
ANSI/ASHRAE/IES Standard 90.1-2013

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee on August 24, 2016; by the ASHRAE Tech Council on August 29, 2016; by the IES Board of Directors on September 26, 2016; and by the American National Standards Institute on August 30, 2016.

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FOREWORD

Addendum el adds a mandatory requirement for air-cooled direct-expansion cooling units with economizers to have basic fault detection and diagnostic (FDD) systems. These requirements have existed in the prior editions of California Title 24 and the International Energy Conservation Code. The requirements were developed in consultation with unitary system and economizer control manufacturers. As a result of these requirements, basic economizer FDD systems have become a standard option for manufacturers. The requirements in this proposal are essentially the same as the Title 24 requirements to which manufacturers have been designing equipment since 2012. The temperature sensor tolerance from Title 24 is not included here, as Standard 90.1 already includes such requirements in Section 6.5.1.1.6, Sensor Accuracy. This would be a mandatory requirement where an economizer is required to be installed, so it is included in the mandatory section of the mechanical requirements. A reference to the FDD requirements is added to Section 6.3, Simplified Approach Option for HVAC Systems.

Energy Savings: Based on a November 2011 analysis for Title 24, adjusted for current 90.1 adopted national average energy prices, average annual savings for a 54 MBH cooling unit—the smallest unit where FDD would be required—is $75 per year. The analysis used probabilities of economizer failure in various modes—based on field studies—to arrive at a conservative estimate of savings.

Cost Impact: The cost of the required fault diagnostics has reduced since the 2011 analysis that was based on separate add-on FDD. Now that manufacturers have integrated FDD into economizer controllers or unitary system controllers, the added cost is expected to range from $150 to $500 per unit.

Cost-effectiveness: A cost-effectiveness analysis using the ASHRAE SSPC 90.1 scalar methodology shows that the payback ranged from 2 to 7 years, with an average of 4 years—all of which are less than the scalar threshold of 11.3 for a 15 year measure life.

[Note: This addendum makes proposed changes to the current standard. These changes are indicated in the text by <u>underlining</u> (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes..]

Addendum el to 90.1-2013

Revise Section 6.3.2 and the Section 6.4.3 title, and add new Section 6.4.3.12 as follows (I-P and SI):

6.3.2 Criteria. The HVAC system must meet all of the following criteria:

. . .

d. The system shall have an air economizer meeting the requirements of Section<u>s</u> 6.5.1 <u>and 6.4.3.12</u>.

6.4.3 Controls <u>and Diagnostics</u>

. . .

<u>6.4.3.12 Economizer Fault Detection and Diagnostics (FDD).</u> <u>Air-cooled direct-expansion cooling units listed in Tables 6.8.1-1 and 6.8.1-2, where an air economizer is installed in accordance with Section 6.5.1, shall include a fault detection and diagnostics (FDD) system complying with the following:</u>

<u>a. The following temperature sensors shall be permanently installed to monitor system operation:</u>

<u>1. Outdoor air</u>

<u>2. Supply air</u>

<u>3. Return air, where required for economizer control</u>

<u>b. The system shall have the capability of displaying the value of each sensor.</u>

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c. The FDD system or unit controls shall be capable of and configured to provide system status by indicating the following:
   1. Free cooling available
   2. Economizer enabled
   3. Compressor enabled
   4. Heating enabled
   5. Mixed-air low-limit cycle active
d. The FDD system or unit controls shall have provisions to manually initiate each operating mode so that the operation of compressors, economizers, fans, and the heating system can be independently tested and verified.
e. The FDD system shall be capable of and configured to detect the following faults:
   1. Air temperature sensor failure/fault
   2. Not economizing when the unit should be economizing
   3. Economizing when the unit should not be economizing
   4. Damper not modulating
   5. Excess outdoor air
f. The FDD system shall be capable of and configured to report faults to a fault management application or DDC system accessible by operating or service personnel, or annunciated locally on zone thermostats.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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