



**BSR/ASHRAE/IES Addendum dn  
to ANSI/ASHRAE/IES Standard 90.1-2016**

**Public Review Draft**

# **Proposed Addendum dn to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings**

**Second Public Review (September 2018)  
(Draft Shows Proposed Changes to Current Standard)**

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at [www.ashrae.org/standards-research-technology/public-review-drafts](http://www.ashrae.org/standards-research-technology/public-review-drafts) and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at [www.ashrae.org/bookstore](http://www.ashrae.org/bookstore) or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, [www.ashrae.org](http://www.ashrae.org).

The appearance of any technical data or editorial material in this public review document does not constitute endorsement, warranty, or guaranty by ASHRAE of any product, service, process, procedure, or design, and ASHRAE expressly disclaims such.

© 2018 ASHRAE. This draft is covered under ASHRAE copyright. Permission to reproduce or redistribute all or any part of this document must be obtained from the ASHRAE Manager of Standards, 1791 Tullie Circle, NE, Atlanta, GA 30329. Phone: 404-636-8400, Ext. 1125. Fax: 404-321-5478. E-mail: [standards.section@ashrae.org](mailto:standards.section@ashrae.org).

**ASHRAE, 1791 Tullie Circle, NE, Atlanta GA 30329-2305**

© 2018 ASHRAE

*This draft is covered under ASHRAE copyright. The appearance of any technical data or editorial material in this publication document does not constitute endorsement, warranty, or guaranty by ASHRAE of any product, service, process, procedure, design or the like and ASHRAE expressly disclaims such. Permission to republish or redistribute must be obtained from the MOS.*

**(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)**

## **FOREWORD**

*This addendum revises two exceptions to requirement to use energy recovery in section 6.5.6.1.*

*One change limits the exception for solar heating to cooler climates.*

*The second clarifies the exemption for the use of “energy recovery in series with the cooling coil” by creating a new definition for series energy recovery. This definition is required because some users of the standard have confused condenser heat recovery and site-recovered energy with series energy recovery. They are quite different.*

*There is also a new definition that defines the performance of series energy recovery. The purpose is to ensure that the series energy recovery system performs well enough to justify allowing it to be used in lieu of conventional energy recovery. The format of the standard does not allow formulas to be used in a definition, so the series energy recovery ratio is described in text. For clarity, the formula is shown here:*

$$SERR = (T_L - T_C)/(T_E - T_C)$$

*Where*

*SERR = Series energy recovery ratio*

*T<sub>L</sub> = Rated dry bulb temperature of the air leaving the device.*

*T<sub>C</sub> = Dry bulb temperature of the air leaving the dehumidifying cooling coil*

*T<sub>E</sub> = Dry bulb temperature of the air entering the first step of 75 °F*

*In addition, the exemption for series energy recovery has been limited to warmer climate zones.*

***[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]***

## **Addendum DN to 90.1-2016**

---

*Modify the standard as follows (IP and SI Units)*

### 3.2 Definitions

**energy recovery, series:** A three-step process in which the first step is to remove energy from a single airstream without the use of mechanical cooling. In the second step the air stream is mechanically cooled for the purpose of dehumidification. In the third step the energy removed in step one is reintroduced to the air stream.

**energy recovery ratio, series (SERR):** The difference between the dry bulb air temperatures leaving the series energy recovery unit and leaving the dehumidifying coil divided by the difference between 75°F (24°C) and the dry bulb temperature of the air leaving the dehumidifying cooling coil.

### 3.3 Abbreviations and Acronyms

SERR series energy recovery ratio

#### 6.5.6.1 Exhaust Air Energy Recovery

Each fan system shall have an energy recovery system when the design supply fan airflow rate exceeds the value listed in Tables [6.5.6.1-1](#) and [6.5.6.1-2](#), based on the climate zone and percentage of outdoor air at design airflow conditions. Table [6.5.6.1-1](#) shall be used for all ventilation systems that operate less than 8000 hours per year, and Table [6.5.6.1-2](#) shall be used for all ventilation systems that operate 8000 or more hours per year.

Energy recovery systems required by this section shall result in an enthalpy recovery ratio of at least 50%. A 50% enthalpy recovery ratio shall mean a change in the enthalpy of the outdoor air supply equal to 50% of the difference between the outdoor air and entering exhaust air enthalpies at design conditions. Provision shall be made to bypass or control the energy recovery system to permit air economizer operation as required by Section 6.5.1.1

---

#### Exceptions to 6.5.6.1

1. Laboratory systems meeting Section [6.5.7.3](#).
  2. Systems serving spaces that are not cooled and that are heated to less than 60°F.
  3. Heating energy recovery where more than 60% of the outdoor air heating energy is provided from site-recovered energy or site-solar energy; in Climate Zones 5 through 8.
  4. Heating energy recovery in Climate Zones 0, 1, and 2.
  5. Cooling energy recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
  6. Where the sum of the airflow rates exhausted and relieved within 20 ft of each other is less than 75% of the design outdoor airflow rate, excluding exhaust air that is
    - a. used for another energy recovery system,
    - b. not allowed by ASHRAE Standard 170 for use in energy recovery systems with leakage potential, or
    - c. of Class 4 as defined in ASHRAE Standard 62.1.
  7. Systems in Climate Zones 0 through 4 requiring dehumidification that employ series energy recovery ~~recovery in series with the cooling coil.~~ and have a minimum SERR of 0.40.
  8. Systems expected to operate less than 20 hours per week at the outdoor air percentage covered by Table [6.5.6.1-1](#).
- 

#### Table 6.5.6.1.2-1 Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Less than 8000 Hours per Year

(no changes to table)

#### Table 6.5.6.1.2-2 Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Greater than or Equal to 8000 Hours per Year

(no changes to table)

*NOTE TO REVIEWER: Section 6.5.6.1 is also modified by addenda H and AM, which are approved, and in preparation for publication. The following shows how section 6.5.6.1 will appear when this addendum and addenda H and AM are combined. Additional changes needed to combine this addendum with prior addendum are shown in ~~strikeout~~ and underline. Such changes do not change the substantive nature of prior approved addenda and are not available for comment.*

#### **6.5.6.1 Exhaust Air Energy Recovery**

Each fan system shall have an *energy recovery system* when the design supply fan airflow rate exceeds the value listed in Tables [6.5.6.1-1](#) and [6.5.6.1-2](#), based on the climate zone and percentage of *outdoor air* at design airflow conditions. Table [6.5.6.1-1](#) shall be used for all *ventilation systems* that operate less than 8000 hours per year, and Table [6.5.6.1-2](#) shall be used for all *ventilation systems* that operate 8000 or more hours per year.

*Energy recovery systems* required by this section shall result in an *enthalpy recovery ratio* of at least 50%. A 50% *enthalpy recovery ratio* shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and entering exhaust air enthalpies at *design conditions*. The *energy recovery system* shall provide the required *enthalpy recovery ratio* at both heating and cooling *design conditions*, unless one mode is not required for the climate zone by the exceptions below. Provision shall be made to bypass or *control* the *energy recovery system* to permit *air economizer* operation as required by Section [6.5.1.1](#)

---

##### **Exceptions to 6.5.6.1**

1. Laboratory *systems* meeting Section [6.5.7.3](#).
  2. *Systems* serving *spaces* that are not cooled and that are heated to less than 60°F.
  3. Heating *energy recovery* where more than 60% of the *outdoor air* heating *energy* is provided from *site-recovered energy* or *site-solar energy*.
  4. Heating *energy recovery* in Climate Zones 0, 1, and 2.
  5. Cooling *energy recovery* in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
  6. Where the sum of the airflow rates exhausted and relieved within 20 ft of each other is less than 75% of the design outdoor airflow rate, excluding exhaust air that is
    - a. used for another *energy recovery system*,
    - b. not allowed by ASHRAE Standard 170 for use in *energy recovery systems* with leakage potential, or
    - c. of Class 4 as defined in ASHRAE Standard 62.1.
  7. *Systems* in Climate Zones 0 through 4 requiring dehumidification that employ *series energy recovery* and have a minimum SERR of 0.40<sub>2</sub>.
  8. *Systems* expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table [6.5.6.1-1](#).
  9. *Indoor pool dehumidifiers* meeting Section 6.5.6.4.
- 

#### **Table 6.5.6.1.2-1 Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Less than 8000 Hours per Year**

*(no changes to table)*

#### **Table 6.5.6.1.2-2 Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Greater than or Equal to 8000 Hours per Year**

*(no changes to table)*